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Ref. No.

Date.....

Dt. : 19th Sep. 2023

PURCHASE ORDER FOR TURBINE

**M/s I B Turbo Pvt. Ltd.,
Plot No. 21 & 22, Ecotech Extn., Ecotech-1,
Greater Noida-201308**

Purchase Order for the supply 5.0 MW Back Pressure Steam Turbine.

Dear Sir,

We are pleased to place our firm order for supply of Steam Turbine-Generator system.

Design Condition (Guarantee)

Steam to turbine	Flow	35000 Kg/Hr.
	Pressure	68 Kg/cm ² g
	Temperature	480°C.

Steam to process	Flow	35000 Kg/Hr.
through Back Pressure	Pressure	4.0 Kg/cm ² g

Power output **5000 KWh**

Low superheat Condition (Estimated)

Steam to turbine	Flow	35000 Kg/Hr.
	Pressure	68 Kg/cm ² g
	Temperature	440°C.

Steam to process	Flow	35000 Kg/Hr.
through Back Pressure	Pressure	4.0 Kg/cm ² g

Power output **4400 KWh**

UNIQUE FEATURES OF RECT-6 TURBINES

Reaction Blading

High efficiency reaction blades with 1.5x Number of stages of outdated impulse turbines mean better efficiency, leading to lower steam and fuel consumption

Electronic Speed Control

Actuation system with direct electronic output instead of Hydraulic output from converter, results in superior speed and Frequency control. No requirement for impulse oil means reduced Oil Consumption

Fly-by-Wire Actuation System

Fully electronic Actuation System ensures no springs for turbine control system.

This leads to no chance of change of spring repeatability with time and temperature. This means no periodic spring adjustment requirement for actuation

True Centre line support.

Enables equal expansion of all the components, permitting safe and quick startup. Allows precise alignment of the turbine with the driven machine.

Pressurised Lubrication

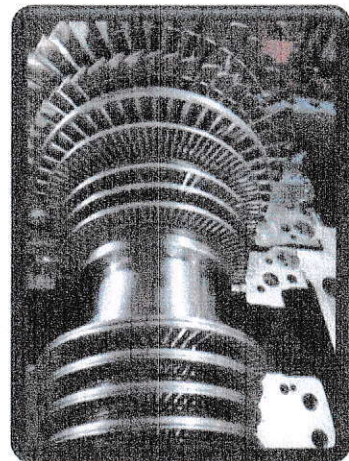
The Bearings of the Turbine and the gearbox are supplied with a Forced Lubrication and Oil Cooling system which enables the turbine to run smoothly and effortlessly.

Woodward / Voith Governor.

Standard and proven Electronic Governor for precise control over the turbine speed.

Metaflex Couplings Type

High Speed metaflex type couplings are provided between the Turbine and Gearbox, and Gearbox and Alternator. These couplings have outstanding flexibility at high speeds.



TECHNICAL SPECIFICATIONS

TURBINE

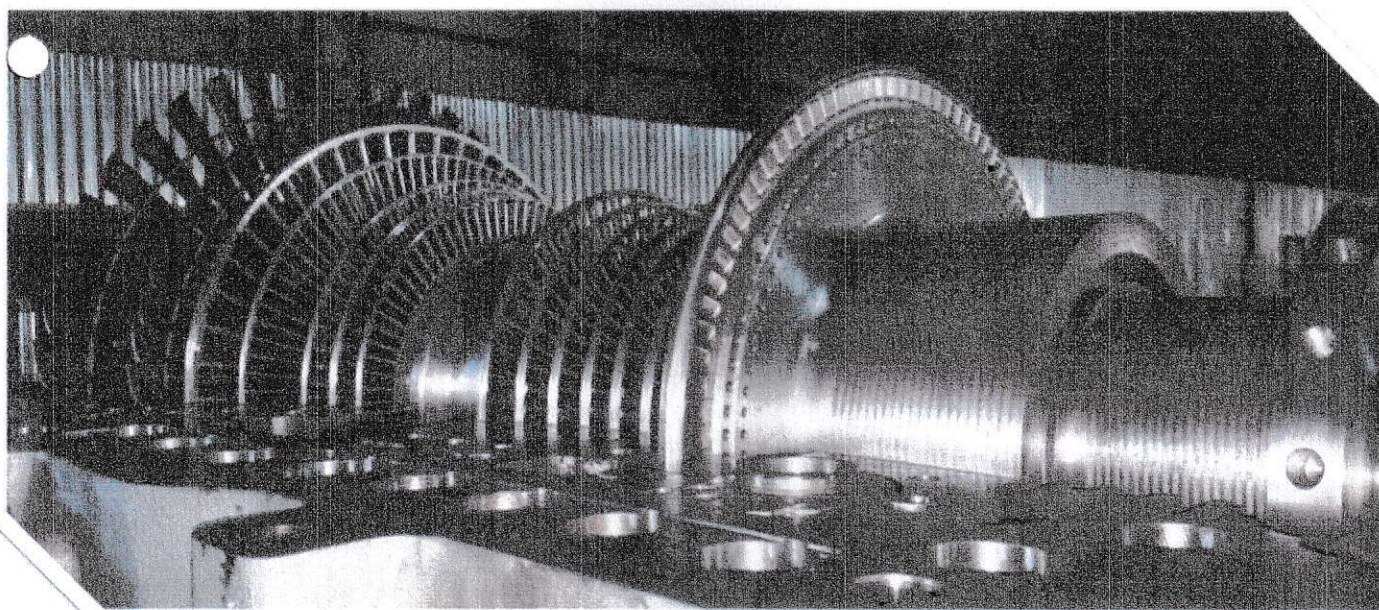
Type of Turbine	:	Back Pressure
Place of Origin	:	India
Casing	:	Horizontally Split
Nozzle Ring & Stationary Blades	:	Replaceable, Axially split.
Rotor	:	Solid Forged Rotor with Drums
CSEV Valve	:	Hydraulic Pressure Operated, with Pilot
Control system	:	Voith DTc Electronic Governor
Actuation System	:	Voith / Moog Actuators. Fly by Wire.
Bearings	:	Steel backed and white metal lined
Journal Bearing	:	Horizontally split, Tilting Pad type
Thrust Bearing	:	Horizontally split, Tilting Pad type
Thrust Collar	:	Integral
Bearing Housing	:	Horizontally split
Rating	:	5.0 MW
Drive	:	Alternator
Startup	:	Automatic
Balancing Planes	:	Min 2
Shaft End steam seals	:	Replaceable Labyrinth Strips in housing
Housing of Shaft End steam seal	:	Replaceable
Interstage steam seals	:	Replaceable Labyrinth Strips

INLET STEAM CONDITIONS

Inlet Steam Pressure : 68 Kg/cm²g
Inlet Steam Temperature : 480 °C
Inlet Steam Flow : 35 TPH

BACK PRESSURE STEAM

Flow : 35 TPH
Pressure : 4.0 Kg/cm²g



GEARBOX

Quantity : One No.
Type : Parallel Shaft, Double Helical
Output Speed : 1500 RPM
Rated Power : 5500 KW
Service Factor : 1.4 Minimum
Standard : AGMA 421.06

ALTERNATOR

Quantity	:	One No.
Rating	:	6000 KVA
Frequency	:	50 Hz
Voltage	:	11 kV
Mounting	:	Horizontal Foot Mounting
Type	:	Water Cooled
Duty	:	Continuous
Pole	:	4
Power Factor	:	0.8 Lagging
No. of Phases	:	3
No. of Terminals	:	3 Phase + 3 Neutral
Type of Bearings	:	Steel Backed, Babbitt lined
Mounting	:	End shield Mounted
DE Bearing	:	Non-Insulated
NDE Bearing	:	Insulated
Noise level	:	90 dB @ 1m distance
Type of Winding	:	Lap winding
Voltage Variation	:	+/- 10%
Frequency Variation	:	50 Hz +/- 1 %
Combined Variation of Volt & Freq:	:	+/- 10%
Connection	:	Star
Generator Enclosure Protection	:	IP 54
Exciter Enclosure Protection	:	IP 54
Terminal Box Enclosure Protection: (Line and Neutral)	:	IP 54
No of coolers	:	2 x 66% Duty

Cooler Location	:	Top /Side
Insulation Class Main Stator	:	`F'
Insulation Class Main Rotor	:	`F'
Insulation Class Exciter Armature	:	`F'
Insulation Class Exciter Field	:	`F'
Stator Insulation Method	:	GVPI
Rotor Insulation Method	:	GVPI
Specification	:	BS 4999 / IEC 34
Harmonic loading	:	As per IEEE 519
Excitation	:	Brushless Excitation System.
Exciter type	:	Excitation Transformer
Ambient Temperature for Design	:	40 Deg C
Temperature rise at rated condition: (Stator)		Limited to 'B' rise
Temperature rise at rated V/ F variation: (Stator)		Limited to 'B' rise
Temperature rise at rated condition: (Main Rotor)		Limited to 'B' rise
Temperature rise at rated condition: (Exciter Armature)		Limited to 'B' rise
Temperature rise at rated condition: (Exciter Field)		Limited to 'B' rise
Short Circuit Ratio	:	> 0.5
AVR	:	ABB 1010 (1A + 1M)
Space Heaters	:	Two for Alternator + One for Exciter
Fault Level	:	26.3 kA for 3 second

Exhaust Expansion Bellow

Type	:	Corrugated
MOC of bellows	:	SS 304
MOC of Flange	:	MS fabricated

Gland Steam Condenser

Type	:	Shell and tube
Tube material	:	Admiralty brass
Shell & end cover material	:	Carbon Steel
Tube sheet material	:	IS-2062
Accessory	:	Motor driven centrifugal air blower
Driver for air blower	:	AC motor

FORCED LUBRICATION SYSTEM

With all internal piping including SS piping after Lube oil and Control oil filters, as per ASME standards.

Oil Tank

Type	:	Reservoir
Location	:	Separate Oil Console
Oil reservoir capacity	:	3000 Liters
First Fill of Lub Oil	:	2400 Liters
No. of Oil strainer	:	Two
No. of Air Breather	:	Four
No. of Vapour Exhaust fans	:	One

Main Oil Pump

Type	:	Gear/Screw type, Rotary
Driven	:	Thru Gearbox low speed shaft, at NDE.
Normal Discharge Oil Pressure	:	5.0 Kg/cm ² g
Operating Speed	:	1500 rpm

Auxiliary Oil Pump

Type	:	Gear type
Driven	:	Electrically (A.C) Motor
Rating	:	12 KW
Voltage	:	415 V
Operating Speed	:	1500 rpm
Discharge Oil Pressure	:	5.0 Kg/cm ² g

Emergency Oil Pump

Type	:	Gear type
Driven	:	DC Motor
Operating Speed	:	1500 rpm
Discharge	:	
Oil Pressure	:	1.2 Kg/cm ² g
Capacity	:	110 LPM
Power	:	2.2 KW

Control Oil Pumps

Type	:	Screw type
No. of Screws	:	3
Quantity	:	2 Nos (1W + 1S)
Driven	:	Electrically (A.C)
Motor rating	:	12 kW
Operating Speed	:	1500 rpm
Discharge Oil Pressure	:	25.0 Kg/cm ² g
Mounting	:	Skid

Lube Oil Filters

Type	:	Basket type
Qty	:	2 Nos (One as Standby)
Differential pressure	:	0.5 kg/cm ² g
Pressure Transmitter	:	Differential Pressure sensing
Mesh Size	:	25 microns
Mounting	:	Foot
Oil flow capacity	:	400 lpm

Control Oil Filters

Type	:	Basket type
Qty	:	2 Nos (One as Standby)
Differential pressure	:	0.5 kg/cm ² g
Pressure Transmitter	:	Differential Pressure sensing
Mesh Size	:	10 micron
Mounting	:	Skid
Oil flow capacity	:	- lpm

Lube Oil Coolers

Design code	:	HEI / TEMA
Plate material	:	SA 240 Gr.316
Type	:	Shell & Tube
No. of Coolers	:	2 *100 % with online changeover
Cooling Water Inlet pressure	:	3 kg/cm ² g
Design pressure of Tube side	:	6 kg/cm ² g
Design pressure of Shell side	:	6 kg/cm ² g
Hydraulic test pressure	:	9 kg/cm ² g
Oil inlet temperature	:	55 °C

Oil outlet temperature	:	44 °C
Cooling Water inlet temperature	:	32 °C
Cooling Water outlet temperature	:	40 °C
Cleanliness Factor	:	0.85
Oil flow capacity	:	400 lpm
Cleanliness factor	:	0.85
Mounting	:	Saddle support

Control Oil Coolers

Design code	:	HEI / TEMA
Plate material	:	SA 240 Gr.316
Type	:	Shell & Tube
No. of Coolers	:	2
Cooling Water Inlet pressure	:	3 kg/cm ² g
Design pressure of Tube side	:	6 kg/cm ² g
Design pressure of Shell side	:	25 kg/cm ² g
Hydraulic test pressure	:	37.5 kg/cm ² g
Oil inlet temperature	:	55 °C
Oil outlet temperature	:	44 °C
Cooling Water inlet temperature	:	32 °C
Cooling Water outlet temperature	:	40 °C
Cleanliness Factor	:	0.85
Oil flow capacity	:	- lpm
Cleanliness factor	:	0.85
Mounting	:	Saddle support

Oil Vapour extraction Fan

Quantity	:	One No.
Voltage	:	415 V
Frequency	:	50 Hz
Motor Rating	:	1 KW
Mounting	:	Oil tank
Type of connection	:	Flanged

Above data is preliminary and may change after detailed engineering

SCOPE OF SUPPLY STEAM TURBINE GENERATOR SET

One Number Steam Turbine Generator Set and Auxiliaries. The scope of supply comprises:

Steam turbine

Reaction Blading.

Turbine bottom exhaust.

Gearbox and Alternator placed directly on the foundation.

Combined stop and emergency trip valve and multiple inlet control valves.

Internal steam pipes for leak steam.

Drain connections from emergency valve steam chest, exhaust branch and gland leading to a common manifold terminating at the base plate level.

Steam Strainer will be installed at Turbine inlet within ESV.

Reduction Gearbox

4 nos. RTD's for bearing temperature (duplex).

Flanges for coupling guard on pinion.

Design Code AGMA 6011 I03 with Service Factor 1.4

Oil System

Lube oil tank fabricated from Mild Steel. The tank is installed at ground level.

1 x 100% Gear Box low speed shaft driven Main Oil Pump.

1 x 100% Auxiliary oil pump with AC motor.

1 x 30% Emergency oil pump auxiliary DC Motor driven.

2 x 100% Control Oil Pumps.

1 number Oil Vapour exhaustor fan with motor.

Stainless Steel piping after Lube Oil and Control Oil filters.

2 x 100 % Lube oil coolers.

2 x 100 % Control oil cooler.

2 x 100 % Control oil filters of 10 microns.

2 x 100% Lube oil filters of 25 microns.

Sight flow glass for Lube Oil Drain lines.

Couplings

Flexible Coupling between turbine and gear box and between gear box and generator.

Fully enclosed Coupling guard for high-speed Coupling.

Semi enclosed Coupling guard for low-speed Coupling.

Couplings will be lubrication free.

Oil leak off will be provided in high-speed coupling guard.

Turbine Hub will have integral flanged shaft end, with future possibility of installation of Hydraulic fitted shrink fit hub after machining and balancing.

Gearbox Pinion, gear wheel and Alternator will have Hydraulic fitted shrink fit coupling

Generator

Generator automatic voltage control with one auto and one manual channel

Brushless excitation system through Excitation transformer
Alternator Data sheet
Power Capability Curve of Alternator
Performance Curve of Alternator

Features

Auto PF controller
Remote voltage control
Auto-Manual follow-up
Under frequency protection
Field flashing provision
AVR cum excitation panel shall be complete with generator voltmeter, field voltmeter, field ammeter, PF meter, Auto/Manual selector switch, AC supply & DC supply on /off control switches, indicating lamps and space heater with thermostat

Generator Air Cooler

Inlet & Outlet flanges with matching flanges along with hardware.
2 Nos. RTD type + 2 Nos. Dial type Temperature Gauges for Air Inlet.
2 Nos. RTD type + 2 Nos. Dial type Temperature Gauges for Air Outlet.
Water leakage detectors – 2 Nos.

Generator Bearings

Oil Inlet & Outlet flanges with matching flanges along with hardware.
RTD type BTM – 1 No./ Bearing (Duplex type).
Dial type BTM – 1 No./ Bearing (Duplex type).
Pressure gauges at Inlet.
Temperature Gauges at Outlet.

Generator Winding

Duplex type RTD's – 2 Nos. /Phase.

Generator Space Heater

Two for Generator & One for Exciter (Suitably rated).

Control System

IBT shall provide turbine supervisory panel comprising Electronic governor.
Electronic Direct Actuation system for Speed Control
Governor will Handle speed control from slow roll speed (10% of rated speed) to 110% of Rated speed.
It will consider input from 2 sensors and provide an indication in case of failure of any 1 probe. System will continue to work even with a single functioning probe.
In case Governor feedback signal does not confirm zero travel, PLC Interlock will prevent ESV from opening.
Governor will also provide trip command in case of overspeed, working on 1 out of 2 logic.

Low Speed RPM will be measured by Proximity Sensor.
All Tripping will be actuated by Solenoid valves.
All solenoid valves will work on the basis of de-energise to trip.
Manual Push tripping will be provided in Turbine Oil line, which will cut off oil supply

to ESV and Actuators.

PLC based system will control

1. Control Oil System interlocks
2. Lube Oil System interlocks
3. RPM Redundant overspeed tripping
4. Turbine Cold, warm and hot start interlocks.
5. ESV Solenoid Valve interlocks
6. Electronic tripping redundant interlocks
7. All Motor startup in remote mode.
8. Shift wise, Daily, Yearly, lifetime running and power generation statistics.
9. Axial Displacement and Vibration Monitoring.
10. All setpoints, alarm and trips
11. Trend monitoring for all digitally monitored parameters.
12. Communication with Generator Protection Relay.
13. Communication with CV Actuators

One Number Axial Probe shall be provided at Turbine end and shall be directly connected to the Turbine PLC Panel.

Casing Vibration Monitoring system for

1. Turbine Steam End Journal Bearing
2. Turbine Exhaust End Journal Bearing
3. Gearbox Pinion Driven End Journal Bearing
4. Gearbox Pinion Non-Driven End Journal Bearing.

Monitoring will be done by Loop powered sensors providing 4 - 20 mA output.
Monitor & Protection for STG Set & auxiliaries shall be through Turbine PLC.

Relay Panel:

Generator Protection Device (SYMAP BC) incorporating-
Over current relay Over voltage protection.

Generator Master trip protection

Turbine Master trip protection

Stator Earth fault protection

Rotor Earth fault protection

Negative sequence protection

Loss of excitation protection

Under frequency protection with df/dt feature

Metering Panel:

Voltage Current Frequency

kW (Active Power)

PF (Power factor)

kWh (Energy)

Push Buttons / Switches

Breaker control	1 no.
Generator voltage Raise/Lower	2 nos.
Governor Raise/Lower	2 nos.
Annunciators Test/Accept/Reset	3 nos.
AC aux. supply ON/OFF	1 no.
Generator space heater ON/OFF	1 no.
Set of test terminal blocks	1 set
Emergency trip push button	1 no.

Lamps

Incoming live RYB	3 nos.
Bus live RYB	3 nos.
Generator CB Open/Closed	2 nos.
Breaker spring charged	1 no.
Breaker auto trip	1 no.
AC aux. supply ON	1 no.
Generator Space heater ON	1 no.

Neutral grounding resistor panel

Free standing sheet steel cubicle connected to the neutral bus from the top and comprising of Resistance Banks.

Lightning Arrestor, surge capacitor & potential transformer panel

This panel shall be a free-standing sheet steel cubicle connected to cables.

Potential Transformers for Generator Protection, for metering and for AVR sensing

Lightning Arrestor

11 kV grade Gapless type

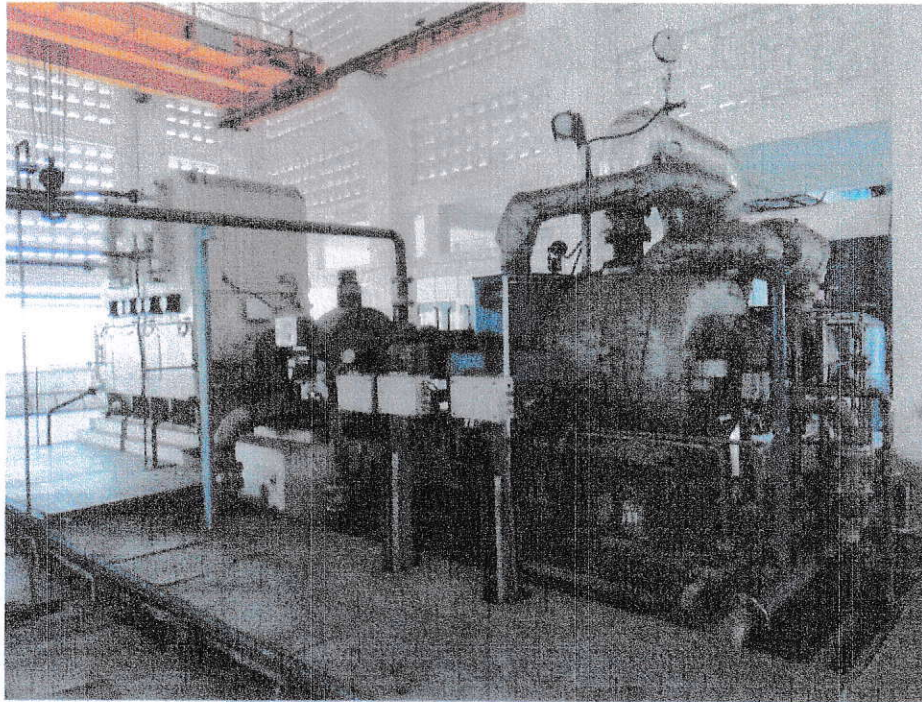
Surge capacitors

11 kV grade, 0.25 mF rated

Potential Transformer Panel

11 kV rated

**Sole Plate
Foundation Bolts
O & M manuals (2 sets)**



INSTRUMENT LIST

STEAM PATH

Live steam pressure gauge mounted on main steam pipe line
Live steam temperature gauge mounted on main steam pipe line
Live steam pressure transmitter before ESV
Live steam temp element before ESV
Nozzle box pressure transmitters -2
Control stage pressure transmitter
Exhaust steam pressure gauge mounted on main steam pipe line
Exhaust steam temperature gauge mounted on main steam pipe line
Exhaust steam pressure transmitter
Exhaust steam temp element
Gland steam condenser pressure gauge

Local Gauge board will be provided for monitoring turbine steam and oil Parameters.

LUBE OIL SYSTEM

Level gauge in main Oil Tank
Bearing temperature gauges for gear box and alternator – 6 no. Total.
Lube oil pressure gauge at bearing inlet of turbine, gear box and alternator
Bearing temperature RTD (duplex) for turbine, gear box and alternator
Alternator Hot air and cold air temp gauge
Alternator Hot air and Cold air temp RTD (duplex)
Alternator winding temperature 6 RTD (duplex)
Temperature gauge before cooler on oil side
Temperature gauge after cooler on oil side
Temperature Element after cooler
Control oil header discharge pressure transmitter
DPT for control oil filter.
Lube oil header discharge pressure gauge
DPT for Lube oil filter.
Lube oil header discharge pressure transmitter (2 out of 3 logic) with -
- Lube oil low alarm & auto start of Auxiliary oil pump.
- Lube oil pr. Low low & auto start of Emergency Oil Pump

Plant Electricals

Instrument/signal cabling from local instruments to local junction boxes.

Turbine nameplate will be provided, with mention of 1st and 2nd critical speeds, and having Maximum parameters mentioned in SI Units.

TESTING

Stage Testing

Stage Testing of Turbine

Steam Casing Ultrasonic Testing will be conducted.

Die penetration test for Pre machined Rotor shaft will be conducted.

Hydrostatic test for Turbine casing will be conducted at 150% of Max rated pressure.

Hydrostatic test for Inlet valve body will be conducted at 150% of Max pressure.

Casing Joint leakage test will be conducted.

Stage Testing of Alternator

Stator and Rotor Core Assembly

Copper for Stator and Rotor Coils

Stator Winding after VPI

Rotor Shaft

Rotor Winding

Rotor Balancing at Reduced Speed

Cooler Pressure Test

AVR

Routine test of Alternator will be conducted at Alternator manufacturer's works.

Duration of trial will be 4 hours at Rated RPM.

Overspeed trial Will at 120% of Rated speed for 2 minutes.

Measurement of Winding Resistance.

Measurement of Insulation Resistance.

High Voltage test.

Phase sequence test.

Open circuit and short circuit characteristics.

Voltage balance test.

Shaft voltage measurement.

Inherent Regulation test.

Vibration Measurement.

Noise level measurement.

Polarisation Index test.

Efficiency Test.

Recommended Spares (Typical) (Extra Cost)

Sl. No	Item Description	Qty
1	Turbine Bearing Pads -Thrust & Journal	01 Set
2	Filter Element- Control Oil Main	02 No
3	Oil Tank Strainer Element	01 No
4	Filter Element-Lube Oil	01 No
5	Pump Coupling - MOP	01 No
6	Control Oil Pump	01 No
7	Auxiliary Oil Pump	01 No
8	Gland (Front, Rear & Balance Piston)	01 Set
9	High Speed Coupling Unit	01 Set
10	Attachment bolts of High-Speed Coupling	01 Set
11	Low Speed Coupling Unit	01 Set
12	Attachment Bolts of Low Speed Coupling	01 Set
13	Pinion Bearing of Gear Box	01 Set
14	Bearings of Barring Gear	01 Set
15	Pressure Transmitter for Steam & Oil Line	01 Set
16	RTD for Bearings	01 Set
17	Vibration Probe for Turbine, Gear Box	02 No
18	Magnetic Pick up Unit	01 No
19	Oil Seal for Front & Rear Bearings	01 Set
20	2/2 Way Solenoid	01 No
21	3/2 Way Solenoid	01 No
22	Pressure Relieve Valve – Lube and Control Oil	01 No
23	Rupture Disc	01 No
24	DC EOP Motor	01 No
25	Expansion Bellow on Back Pressure Line	01 No
26	Expansion Bellow at Extraction	01 No
27	Strips for Rotor Steam Seals	01 No
28	Needle Bearings for Extraction Grid Valve	01 Set
29	Pinion Shaft	01 No
30	Glass cover for Sight Glass	01 Set

BATTERY LIMITS

The following define the limits of IB Turbo and the Purchaser.

Live Steam	Connection to turbine ESV by purchaser.
Exhaust Steam	At Turbine Exhaust flange. Nozzle by supplier.
Bleed Line	At Turbine Bleed Nozzle by supplier (CV loose supply)
Extraction Line to Deaerator & Process	At Turbine Extraction Nozzle by supplier
Drains & Vents	<p>All equipment drains (including Turbine drains) shall be terminated at the base of respective equipment by Supplier. Further Piping by purchaser.</p> <p>All the vents shall be terminated at equipment nozzle; further piping shall be by purchaser.</p>
Auxiliary Cooling Water (Inlet / Outlet)	Connection to Inlet / Outlet Flanges of consumers, i.e. Lube Oil Coolers, Main Steam Condensers, Gland Steam Condensers, Generator Air Coolers by Purchaser
Generated Power	At Generator terminals.
Auxiliary Power & Control cables	At the motor/consumer terminals by purchaser
415 V AC	At the inlet of consumer terminals by purchaser
230V AC	At the inlet of consumer terminals by purchaser.
Instrument cabling	Up to field / local junction boxes. Further cabling by Purchaser.
Instrument and service air	Connection to consumers.
Earthing	At respective equipment earth stubs by Purchaser.
Foundations	Lower end of skids/ base plates of respective equipment/ structures

EXCLUSIONS

The following equipment / services are not included in our scope

- All Steam Piping & permissions including -
 - Main Steam stop valve at inlet, exhaust, NRV and Pneumatic ISV.
 - Steam turbine by-pass system along with its related piping, PRDS system, steam flow meter, necessary valves, and accessories.
- All Electrical and Control cabling, Bus Duct, Capacitor Bank, Earthing, transformer.
- Turbine Insulation
- Flushing and First Fill of Oil.
- All Civil works.
- Erection, assembly on the site and commissioning
- Cooling Water Piping and Cooling Tower.
- Emergency Power Supply.
- Lube Oil Centrifuge.
- Overhead Crane.
- Spares
- Battery, Battery Charger and DCDB - 110 V DC, Min 200 Ah, Ni-Cd, with FCBC charging

Any equipment, materials, services not specifically mentioned as being included in this offer.

SCOPE OF WORK/SERVICES TO BE PROVIDED BY PURCHASER

The following shall be provided by the Purchaser free of cost to the Supplier / his Sub-suppliers:

All necessary tools, tackles, consumables, skilled and unskilled manpower as specified by the Supplier for erection of the TG set.

Adequate access / approach roads upto place of storage and erection for free movement of equipment and suitable for transportation of heavy equipment / materials.

Uninterrupted supply of service water, potable water, electricity and compressed air at convenient points for construction purpose at Plant area and at labour colony.

Continuous availability of all utilities as required in sufficient quantities during testing, commissioning and performance testing.

All Statutory clearances.

Necessary overall watch and security personnel for safety of the materials at site.

Medical facilities at site for Supplier/ Sub-supplier's personnel free of charge.

P&T and telefax services as available with the Purchaser free of cost basis.

Steam blowing shall be carried by Purchaser before start-up of turbine as per procedure.

TECHNICAL DETAILS

Machine noise

The machine noise level shall be determined according to DIN 45 635 and evaluated according to ISO/TC43. The plant quoted will not exceed a noise level of 90 ± 2 dB(A) above the turbine table slab in any octave band without noise hood.

The noise level under floor will not exceed 90 dB(A) provided that the influence of the ambient noise is less than 3 dB(A).

The measurements shall be taken at a distance of 1 m maximum from the machine surface of the turbo-set above the foundation table slab. The influence of extraneous noises and acoustic reflections of the room shall be taken into consideration when evaluating the measured values.

Vibrations

As per ISO 7919, Part 3 – “Mechanical vibration of non-reciprocating machines – Measurements on rotating shafts and evaluation criteria”, Zone A = Normal, Zone B = Acceptable and Zone C = High.

Calculations

Lateral Analysis Report of the train will be provided. The rotor will be modeled as elements comprising of small elements. The undamped critical speeds, undamped mode shapes and unbalance response due to API 612 calculations will be carried out.

The lateral natural frequencies and mode shapes obtained will also be provided.

Torsional Analysis Report of the train will be provided. The rotor will be modeled as elements comprising of small elements. The undamped critical speeds, undamped mode shapes and unbalance response due to API 612 calculations will be carried out.

The torsional natural frequencies and mode shapes obtained will also be provided.

Critical Speed Map will be provided.

CODES & STANDARDS	
Steam turbine	IEC Standard.
Gear Box	AGMA.
A.C Generator	IEC 60034-1 or Equivalent
Lube oil System	IBT Standard
Oil System Component	IBT Standard

Motors	IEC Standard.
Connection Flanges	As per required class rating
Instruments	IBT Standard
Cables	IS 694
Painting	IBT Standard

Couplings

a. High Speed Coupling		
Type	Flexible Membrane	
Lubrication	Not required	
Service Factor	1.6 Minimum	
b. Low Speed Coupling		
Type	Flexible Membrane	
Speed	1500 RPM	
Lubrication	Not required	
Service factor	1.6 Minimum	
Coupling Misalignment		
	Continuous	Transient
Axial (mm)	1.5	2.25
Radial (mm)	1.8	1.8
Angular (Deg)	0.5	0.5
Torsional Stiffness based- on 1/3 rd shaft Penetration		
Turbine Hub	MNM / RAD	8.43
Gearbox Hub	MNM / RAD	8.43

Transmission Unit	MNM / RAD	0.8
Total Assembly	MNM / RAD	0.62

CODES & STANDARDS

Steam turbine	IEC Standard.
Gear Box	AGMA.
A.C Generator	IEC 60034-1 or Equivalent
Lube oil System	IBT Standard
Oil System Component	IBT Standard
Motors	IEC Standard.
Connection Flanges	As per required class rating
Instruments	IBT Standard
Cables	IS 694
Painting	IBT Standard

Make of Bought Out Items

MECHANICAL

Gear Box	Triveni / Precise / Entellcad / equi
Coupling	Euro flex / Unique / Cubic / equi
Control & On Off Valves (Pneumatic)	Mil Controls / RK / Chemtrol / equi
Valves – Above Class 600 (Manual/ Motorised)	KSB / Steel Strong / Audco / Weir BDK / equi
Valves – Upto And Inclusive Of Class 600. (Manual/ Motorised)	KSB / Steel Strong / Weir BDK / Bonetti / equi
Pneumatic Quick Closing NRV	Weir / Armatury / Adams / Bonetti / equi
Flow Elements / Orifice Plate Ball / Needle Valve	Micro Precision/ GIC / BDK / L & T/ equi MH Valves / Fluidline / equi
Butterfly Valve	Inter Valve / Weir BDK/ equi
Relief Valves equi	Fainger Lesser / Darling Muesco / Tyco Sanmar/
Steam Traps	Spirax-Marshall / Pennant/ equi
Thermal Insulation	Baroda Insulation / Atharva Insulation / equi

ELECTRICAL

Alternator	HT- TDPS / WEG / Crompton / BHEL / Kirloskar LT – Leroy Somer / Stamford / TDPS / BHEL
Condenser	Chem Process / GE Godavari / New Field / equi
AVR	ABB / Sanelec / equi
Panels	Tycon Automation / equi
Instrument Transformers (Ct's & Pt's)	Pragati / Instrans / Kappa / equi
Rotor Earth Fault Relay	Woodward /Dief / Symap / equi
Master Trip Relay	ABB /Alstom / equi

Meters	Schneider / Conzerve / Secure / equi
Transducer	Secure / Rishabh / Masibus / equi
Trivector Meter	L & T (Er300p) / Secure (Premier) / equi
Ac Motors	ABB / Siemens / equi
Actuator - Mov	Auma / Rotork / equi
Selector Switches	Kaycee / Salzer / equi
Push Buttons	Teknic / equi
MCB / Contactors	ABB / Siemens / Equi
Terminal Block	Wago / Elmex / equi

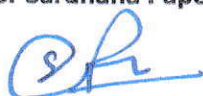
INSTRUMENTATION

Governor	Woodward / Voith
Control Actuators	Voith / Moog / equi
Vibration (Probes)	Provibtech / Shinkawa / IRD / Bently Nevada / equi
Panels	Tycon / equi
Pressure/Differential Pressure Transmitters	ABB / Siemens / Emerson / Keller / Yashtec / equi
Temperature Transmitters	P&F / ABB / Emerson / Siemens / equi
Rtd, Thermocouple	Masibus / GIC / Techno / equi
Pressure & Temperature Gauges	Wika / GIC / equi
Pressure/ Diff Press Switches	Switzer / Sanmur / equi
Level Measurement	V-Automat / Chemtrol / equi
Solenoid Valves	Rotex / Aquila / equi
Air Filter Regulators	Placka / Shavo-Norgren / equi
Temperature Scanner	Masibus / equi
Annunciators	Intelec / Instra Alarm / Proton / equi

PRICE BID

Sr. No.	Description	Price
1.0	SUPPLY OF UNITS	
1.1	Design, manufacture and Supply on Ex-works basis of 1 x 5.0 MW STG Set along with Auxiliaries as per our offer.	Rs 3,21,00,000/-
2.0	SERVICES – Supervision of Erection & Commissioning	
2.1	Supervision of Erection & Commissioning of IB Turbo Supplied unit	At Actuals
2.2	Freight	At actual and to the SPPL account
2.3	Insurance (including Transit, storage, Erection or any other handling & Comprehensive Risk Insurances)	At actual and to the SPPL account
2.4	GST	Extra as Applicable

For Sardhana Papers Pvt. Ltd.



Director

GENERAL TERMS & CONDITIONS

PRICE : The prices quoted are Ex-works Greater Noida. Packing, Forwarding, Loading, Insurance, Freight charges are extra. Besides All taxes, GST and bank charges will also be payable by you.

DELIVERY : The delivery will be **8 - 10 months** from the date of receipt of your technically and commercially clear order accompanied by necessary advance. We are not responsible for any delay caused by extraneous circumstances or Acts of God beyond our control and cannot pay any damages or penalties on this account. The equipment ordered may be dispatched in 1,2 or more lots.

If required we can undertake the dispatch of the equipment on behalf of the buyer by road transport only to any destination given by the buyer on freight To Pay basis, on the clear understanding that we will not be liable for any damages whatsoever. The freight charges contracted by us on behalf of the buyer will be deemed as negotiated under the buyer's authority and therefore it shall be binding on the Buyer to make full payment.

WARRANTY : Our Products are Warranted for a period of ONE YEAR from the date of dispatch, against any manufacturing defect or faulty workmanship reported in writing during the Warranty period. The warranty does not extend to consequential damages or losses. The Warranty is NULL & VOID if repairs and/or replacements are carried out without our consent in writing. For bought-out items the warranty of the supplier is passed on to the purchaser.

CONFIDENTIALITY : The Client shall treat all quotations, drawings, data, technical information etc., received from IBT, as strictly confidential and shall take all precautions necessary to prevent the unauthorised disclosure in part or parcel of any of the above mentioned, to any third party.

ARBITRATION : All disputes or differences whatsoever arising to the construction, meaning and operation or effect of this contract or the breach thereof shall be settled by arbitration in accordance with the rules of arbitration of the Indian Council of Arbitration and the award made in pursuance thereof shall be binding on the parties.

PLACE OF JURISDICTION : In the event of any dispute arising as a result of contracting to supply, against this offer and quotation, the place of JURISDICTION will be GREATER BOMBAY and no other place.

TERMS OF PAYMENT :

- a) First advance of 40% along with the technically and commercially clear order.
- b) A interim advance of 20% after 60 Days.
- c) Balance full payment along with taxes against our proforma invoice. You may inspect the material at our works before dispatch.

PERFORMANCE TRIAL : IBT will conduct a Performance guarantee (PG) test at guaranteed point as mentioned under the guarantee schedule of the Technical offer within 15 days of successful commissioning of the unit. Performance test readings shall be taken during a period of 4 hours duration. PG test shall be carried out at guarantee point or at maximum available load. The duration of the performance test during the trial period shall be sufficient to obtain the requisite number of readings. The duration considered suitable is 4 hours. In case the UNIT is not able to achieve full load due to reasons not attributable to Supplier, then the test would be carried out at the maximum possible load with calculated correction curves. Purchaser has to provide shutdown if required by Supplier during trial period to make necessary adjustments.

Any stoppages during this period shall not be counted as a break in the 72 hours trial run to demonstrate the performance. Cumulative 72 hours run shall be counted disregarding the stoppages due to sources outside the TG.

The UNIT shall be taken over by PURCHASER upon completion of the PG test and PURCHASER shall issue a taking over certificate to the Supplier. Such a certificate shall not unreasonably be withheld nor be delayed by PURCHASER on account of minor omissions or defects, which do not affect the commercial use of the UNIT. Purchaser has to adhere to Supplier PG test procedure. Purchaser needs to furnish preliminary readings at rated load to Supplier for reference. All readings shall be collected from Supplier instrument as per approved PID.

In case the Performance test is not carried out, within 30 days after the commissioning or within 120 days from the date of Last Major Supply (i.e. of turbine, whichever is later) due to no fault of Supplier or if the UNIT is put to commercial use (other than for commissioning and testing) or if the Supplier is prevented from carrying out the test on completion due to reasons not attributable to the Supplier, whichever is earlier then the Performance test will be deemed successfully completed and the UNIT will be deemed taken over by Purchaser.

All consumables, electricity, fuel, water, labour, etc at Site shall be arranged and made available free of cost by the Purchaser.

Successful commissioning refers to the taking the UNIT on full load. If however, the

load is not available due to constraints on part of Purchaser, loading the UNIT to the available load would be considered as Successful Commissioning.

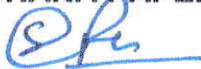
FORCE MAJEURE : All our offers are subject to force majeure, by which is meant causes beyond our control, such as war, invasion, civil disobedience, government orders directives or restrictions, strikes, lockouts, riots, fire, earthquakes, floods, accidents, delay or inability to obtain labour, raw material, railway wagon, shipping space or any such and similar causes whatsoever.

All orders will only be accepted after the realisation of the agreed advance which shall not be subject to any interest under any circumstances whatsoever. We however reserve the right to adjust such advance against any payments which might fall due because of delay in lifting of the ordered equipment or on account of incidental expenses incurred on buyer's behalf. An order placed with us cannot be cancelled for any reason whatsoever without our consent in writing. Any cancellation of order without our consent will result in the forfeiture of Advance, without prejudice to our claim for compensation and other legal remedies.

Before effecting dispatch, your sales tax registration numbers both state and central are to be intimated to us. It is to be clearly understood that for interstate dispatches central sales tax declaration form should be handed over to us at the time of taking delivery of the boiler. If you fail to do so, sales tax charges in full will be payable to us.

Any condition/matters relating to this offer not expressly stipulated in the above will be a matter of mutual discussion and agreement at the time of accepting the order. If this order is accepted and order placed all the above conditions of sale will automatically stand accepted by the buyer.

SARDHANA PAPERS PVT. LTD.,



DIRECTOR