Lee County Board Of County Commissioners
Agenda Item Summary

Blue Sheet No. 2005 0 495

1. ACTION REQUESTED/PURPOSE:
Approve award of formal quotation (RFP B&R 2661-SM107B) and issuance of a purchase order to Mitsubishi International Corporation, the low priced proposer, meeting all specification requirements for a steam turbine and generator in the amount of $4,915,200.00.

2. WHAT ACTION ACCOMPLISHES:
Provides the necessary steam turbine and generator for the Waste To Energy Expansion Project.

3. MANAGEMENT RECOMMENDATION: Staff recommends approval of this request.

4. Departmental Category: 8 C 8a		5. Meeting Date: April 26, 2005
6. Agenda:	7. Requirement/Purpose: *(specify)*	8. Request Initiated:
X Consent	Statute	Commissioner
Administrative	Ordinance	Department: Public Works
Appeals	X Admin. Code 4-1	Division: Solid Waste
Public	Other	By: Lindsey J. Sampson
Walk-On		Lindsey J. Sampson 4/8/05

9. Background:

Sealed quotes were received by the County's design engineer, Burns & Roe, on behalf of the Solid Waste Division on February 11, 2005. On that date three (3) responses were received. On March 3, 2005, the two low proposers were asked to submit alternate pricing considering revised 'fouling factors' included in the specifications. After review, recommendation was made to award to the low-priced proposer meeting all specification requirements. Backup documentation refers to a price of $4,943,700.00 that includes $28,500.00 for the option of a performance bond. The Solid Waste Division does not want to make use of this option.

Funds are available in account string: 200923 40102.506540

Attachments: Burns & Roe bid evaluation dated 3/1105 w/ Revised Cover Letter dated 3/28/05
Tabulation sheet

10. Review for Scheduling:

Department Director	Purchasing or Contracts	Human Resources	Other	County Attorney	Budget Services (Atkins 4/14/05)				County Manager/P.W. Director
					Analyst	Risk	Grants	Mgr.	
4.11.05	N.A. per S.S. 4/8	N.A.			4/12/05	4/13/05	4/13/05		4.11.05

11. Commission Action:
____Approved
____Deferred
____Denied
____Other

Rec. by CoAtty
Date: 4/12/05
Time: 10:30
Forwarded To: B. Atkins 4/12/05

RECEIVED BY COUNTY ADMIN: 4-12-05 11:00 am
COUNTY ADMIN FORWARDED TO: 4-14-05 3pm

March 28, 2005

LEE COUNTY
WTE EXPANSION PROJECT
FORT MYERS, FLORIDA

RFP 2661-SM107B
Steam Turbine Generator

BID EVALUATION

Burns and Roe Enterprises, acting on behalf of Lee County, issued Request for Proposal No. 2661-SM 107B "Steam Turbine Generator" on December 28, 2004 to the following pre-approved bidders: General Electric Energy; Mitsubishi International Corp.; Siemens Demag Delaval Industrial Turbomachinery, Inc.; and Dresser-Rand Company. On January 11, 2005 Dresser-Rand advised they will not submit a proposal.
January 14, 2005 an email was issued to all bidders referencing Attachment A-1 of the Technical Specification and changing SYNCHRONIZING on page A1-4 from Manual to Automatic. An email issued on January 25, 2005 to all bidders, providing revised page three of the specification and revised page A1-3 of Attachment A-1. Bid due date was extended from January 28, 2005 to February 11, 2005.

On February 11, 2005 bids were received from:

-General Electric Energy, proposal number 205010

-Mitsubishi International Corporation, proposal number MPS-TS-0201

-Siemens Demag DeLaval Turbomachinery, proposal number Y041878

On Februar14 2005 the above three (3) bids were opened and base bid prices were recorded on the attached Proposal Opening Form.

RECOMMENDATION:

The recommended contract is award to Mitsubishi International Corporation. Recommended award price is:

Base Bid Price	$4,493,000
Field Technical Service	$ 117,300
Training	$ 30,000
Technical Capital Equipment Adjustment	$ 202,600
Recommended Award Price	**$4,842,900.**
Performance/Payment Bonds	$ 28,500
Recommended Award Price with Bonds	**$4,871,400**

The budget for the Steam Turbine is $3,939,781, including Field Technical Service.

BID EVALUATION 2661-SM107B "Steam Turbine Generator (cont'd...)

COMMERCIAL EVALUATION:

Attachment 5 is the bid abstract, comparing the bid prices and modification to conform bids to the RFP requirements.

Mitsubishi's evaluated bid is determined to be most economic of the three received bids.
Mitsubishi"s comments to the Contract Services/Goods Purchase Conditions are attached. Mitsubishi's comments are identified in italic. Comments are under review and required input from Covanta then Lee County for final acceptance of terms.

Mitsubishi's schedule for submittal of drawings and delivery of equipment is attached. Submittal schedule is 6-20 weeks. Mitsubishi is reviewing this schedule and will advise improvement, specifically for outline, foundation, weights and loading diagram data and information.
Mitsubishi quoted a sixteen (16) month delivery schedule has been reduced to fifteen (15) months (3/9/05 email). Based on an April 15, 2005 award, delivery is July 15, 2006.

Mitsubishi payment terms as quoted:

15% - Upon Notice to Proceed
25% - Material receipt of ST rotor material
25% - Start ST rotor assembly
25% - Completion of ST rotor assembly
10% - Ready or shipment of ST

Revised payment terms have been negotiated with Mitsubishi. They are as follows:

9% - Upon Notice to Proceed
3% - Submittal of First Package of Drawings
3% - Submittal of Second Package of Drawings
25% - Material receipt of ST rotor material
25% - Start ST rotor assembly
25% - Completion of ST rotor assembly
5% - Ready for Shipment
5% - Upon day of delivery at site
5% - Retention withheld from each invoice until Acceptance

Mitsubishi requested security, Letter of Credit equal to the contract value, to secure Lee County's payment obligation. Mitsubishi has subsequently deleted this requirement (3/8/05 email).

Mitsubishi submitted with its proposal a priced two-year operational spare parts list (copy attached). This cost is shown as an option on the bid abstract.

Due to Siemens Demag economic position after bids were equalized for scope and the technical evaluation, commercial review was not performed.

March 11, 2005

LEE COUNTY
WTE EXPANSION PROJECT
FORT MYERS, FLORIDA

RFP 2661-SM107B
Steam Turbine Generator

BID EVALUATION

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January 14, 2005 an email was issued to all bidders referencing Attachment A-1 of the Technical Specification and changing SYNCHRONIZING on page A1-4 from Manual to Automatic. An email issued on January 25, 2005 to all bidders, providing revised page three of the specification and revised page A1-3 of Attachment A-1. Bid due date was extended from January 28, 2005 to February 11, 2005.

On February 11, 2005 bids were received from:

-General Electric Energy, proposal number 205010

-Mitsubishi International Corporation, proposal number MPS-TS-0201

-Siemens Demag DeLaval Turbomachinery, proposal number Y041878

On Februar14 2005 the above three (3) bids were opened and base bid prices were recorded on the attached Proposal Opening Form.

RECOMMENDATION:

The recommended contract is award to Mitsubishi International Corporation. Recommended award price is:

Base Bid Price	$4,493,000
Field Technical Service	$ 117,300
Training	$ 30,000
Technical Capital Equipment Adjustment	$ 274,900
Recommended Award Price	**$4,921,200.**
Performance/Payment Bonds	$ 28,500
Recommended Award Price with Bonds	**$4,943,700**

The budget for the Steam Turbine is $3,939,781, including Field Technical Service.

TECHNICAL DISCUSSION,PERFORMANCE EVALUATION
AND PRICING EVALUATION

TECHNICAL BID EVALUATION
SM-107B
LEE COUNTY
STEAM TURBINE GENERATOR

Steam Turbine Generator bids were received from the following three (3) bidders:

- Mitsubishi International Corporation Proposal Number MPS-TS-0201 — Dated 2/11/05
- Siemens Demag Delaval Turbomachinery, Inc. Proposal Number Y04187 — Dated 2/11/05
- GE Energy (Thermodyn) Proposal Number 205010 — Dated 2/11/05

GE's initial bid price of $5,719,960 was significantly higher than both the Mitsubishi and Siemens bid price. Therefore, GE's proposal was not given any further consideration.

Mitsubishi has proposed a gear machine with a turbine operating speed of 4,150 rpm and a generator operating speed of 1800 rpm. Mitsubishi's guaranteed output, as measured at the generator terminals, is 18,100 KW. Mitsubishi's machine design is in accordance with Japanese Industry standards (JIS) with the turbine gear meeting AGMA requirements. All customer flanged connections will match ANSI standards. Machine performance will be to ASME standards.

Mitsubishi bid the four (4) uncontrolled extraction points as specified. They also bid the Woodward 505 governor. Mitsubishi bid a combined lube oil and control oil system. The have included a coalescence lube oil purifier in their offering. The Mitsubishi main lube oil pump is AC motor driven with a 45 KW operating load. Mitsubishi, therefore, was penalized against the Siemens shaft driven main lube oil pump.

Mitsubishi's initial generator offering did not meet the specified power factor requirements (0.85 leading and 0.85 lagging). Mitsubishi came back with a generator price adder of $150,000 to meet the power factor requirements. The Mitsubishi revised offering is acceptable to BRE. They also provided a deduct price of $18,100 for the generator protection relay and lockout relays which are not required to be furnished by them.

Mitsubishi has included a generator control panel which contains the voltage regulators and automatic synchronizer. The Mitsubishi control panel contains meters, indicating lights control switches, and pushbuttons which are usually provided on the electrical Control Panel (EPC), (separate procurement package, not part of turbine generator). During negotiations, Mitsubishi will be requested to delete their control panel and provide the regulators and synchronizer shipped loose for installation in the EPC.

Mitsubishi was given a number of I&C specifications to comply with. Mitsubishi provided a cost adder of $90,000 to comply with the specifications.

Mitsubishi did provide a list of technical exceptions, clarifications and comments to the bid specifications. These exceptions, clarifications and comments together with BRE resolutions are contained in Attachment 1.

BRE finds the Mitsubishi offering technically acceptable.

Siemens has proposed a gear machine with a turbine operating speed of 6000 rpm and a generator operating speed of 1800 rpm. Siemens guaranteed output, as measured at the generator terminals, is 18,020 KW which is 80 KW lower than the Mitsubishi machine. Siemens, therefore, was penalized +$291,366 based on a capitalized power cost of $3,642 per KW.

Siemens machine design is to DIN standards which are acceptable to BRE. The gear unit, however, will meet AGMA design requirements. All external piping flange connections will be in accordance with ANSI standards.

Siemens bid three (3) uncontrolled extractors with steam to the deaerator being provided by a letdown station off of the first extraction point. Their heat balance shows sufficient steam flow provided at the first extraction point for both air heater and deaerator steam heating.

Siemens originally bid their standard control (governor) system. Siemens, however, did provide a price add of $54,500 to furnish the specified Woodward 505 Governor.

Siemens, similar to Mitsubishi, bid a combined lube oil/control oil system which is acceptable to BRE. The Siemens lube oil unit is integral to the machine and, therefore, will be located on the turbine operating deck which is also acceptable to BRE.

Siemens has included a centrifuge lube oil purifier in their offering for an additional price of $58,000. As stated above, the Siemens main oil pump is shaft driven vs AC motor driven for Mitsubishi. The specification allowed either option.

Siemens initial generator offering did not meet the specified power factor (0.85 leading and 0.85 lagging). Siemens came back with a generator price adder of $80,230 to meet the power factor requirements. The Siemens revised offering is acceptable to BRE.

Siemens did provide a list of technical exceptions, clarifications and comments to the bid specifications. These exceptions, clarifications and comments, together with BRE resolution are included in Attachment 2.

The Siemens machine requires spring mounting of the turbine and condenser since their unit requires direct coupling to the condenser. There are differences in pedestal requirements for each machine. Attachment 3 relates the cost adjustment for each of the machines. As can be seen, the Siemens TG pedestal cost is significantly more than for the Mitsubishi machine.

Both Mitsubishi and Siemens are considered technically acceptable with the addition of cost adders as shown in Attachments 1 and 2 and the bid tabulation.

Mitsubishi's total evaluated price is $5,122,415 versus $5,922,635 for Siemens as shown in the attached bid tabulation. Mitsubishi's total evaluated price is lower by almost 14%.

BRE recommends that Mitsubishi be given the STG award based on the following considerations:

1. Their evaluated price is lower by almost 14%.

2. The Mitsubishi design is a preferred design where the machine is mounted on a concrete foundation and an expansion joint is provided between the turbine exhaust and condenser connection. The Siemens machine requires spring mounting for both their machine and the condenser. This is not an optimum design arrangement since the springs will require periodic maintenance. This arrangement also complicates piping connections to the condenser where extensive expansion joints and maintenance of these expansion joints would be required. BRE has accounted for the TG pedestal difference of both Siemens and Mitsubishi in Attachment 3.

3. Since the existing Lee County machine is a Mitsubishi machine, this would facilitate any servicing and maintenance operations.

BRE, therefore, recommends the award for the STG for Lee County be given to Mitsubishi for a total price of $4,943,700 which is broken down as follows:

Base price	$4,493,000
Generator Cost Adder	$ 150,000
BN 3500 Cost Adder	$ 53,000
Deduct for generator protection relay and lockout relays	($18,100)
Erection and Startup/Commissioning Advisors	$ 117,300
Meet Covanta I&C Specifications	$ 90,000
Training	$ 30,000
Bonds	$ 28,500

SPECIFICATION SM-107B
STEAM TURBINE GENERATOR
BID TABULATION

	BIDDER		
DESCRIPTION	MITSUBISHI	SIEMENS DEMAG DELAVAL	GE THERMODYNE
Bid Price (A)	$4,493,000	$4,720,000	$5,719,960
COST ADDERS AND/OR OPTION PRICES			
Generator per Spec	+$150,000	+$80,230	
Deletion of Generator Protection Relay and Lockout Relays	($18,100)		
Automatic Synchronizing Device		$28,400	
Additional Pressure Switch for Auto Start of DC Lube Oil Pump		$3,680	
Temperature Measurement of Lube Oil After the Bearings		$3,540	

DESCRIPTION	BIDDER		
	MITSUBISHI	SIEMENS DEMAG DELAVAL	GE THERMODYNE
Lube Oil Conditioner		$58,000	
Bently Nevada 3500 Monitoring with LCD Display	$53,000	$16,340	
3500/15 Dual Power Supplies		$1,200	
3500/95 Integrated PC Display		$9,850	
Additional LCD for Local Control, door mounted		$6,200	
Removal of CT's shipped loose for installation in switchgear (deduct)		($1,300)	
Field ground detector		$10,620	
Completely Redundant AVR System		$12,210	
Atwood-Morrill Non-Return Valves with Local Test Stations		$35,400	
Baseframe Adaptation to provide Lip on Reservoir to Prevent Oil Running Down the Side of the Tank		$2,750	

	BIDDER		
DESCRIPTION	MITSUBISHI	SIEMENS DEMAG DELAVAL	GE THERMODYNE
Visual Lube Oil Level Indictor		$2,340	
Shell and Tube Oil Coolers with 85% Cleanliness Factor		$22,100	
Emerson (Rosemount) Pressure Transmitters		$29,400	
Generator Terminal Connections		$2,960	
Stainless Support Structure of the Neutral Grounding Transformer and Resistor		$1,930	
Screw Type Terminal Blocks		$1,700	
Cost of Woodward Model 505 Governor	Included in Proposal Price	$54,500	
Meet Covanta I&C Specifications	$90,000		
Total of Cost Adders and/or Option Prices (B)	$274,900	$327,550	
Total Price (A) + (B)	$4,767,900	$5,047,550	
Guaranteed Generator Output	18,100 KW	18,020 KW	18,020 KW

DESCRIPTION	BIDDER		
	MITSUBISHI	SIEMENS DEMAG DELAVAL	GE THERMODYNE
Difference in Output	Base	80 KW less than base	80 KW less than base
Capitalized power cost of output based on $3642/KW (C)	Base	+$291,360	+$291,360
Main Lube Oil Pump drive	AC Motor Driven, 45 KW	Shaft Driven	Shaft Driven
Capitalized power cost for lube oil pump (D)	$163,890	-	-
Approximate Cost Adjustment related to TG Pedestal (E) (Refer to Attachment 3 for backup data) (Estimated)	+$73,325	+$315,875	
Commissioning/Start-up spares (F)	Included in Price	Included in Price	
Erection and Start-up/Commissioning Advisors (G)	$117,300 (74 man-days and 4 round trips)	$267,850 (29 man weeks) (Includes training during erection, start-up and	
Total Evaluated Price (Sum of A,B,C,D,E,F and G)	$5,122,415	$5,922,635	

DESCRIPTION	BIDDER		
	MITSUBISHI	SIEMENS DEMAG DELAVAL	GE THERMODYNE
Delivery	16 months jobsite after NTP	13 months after Notice to Proceed (NTP)	
Type of Turbine	Single cylinder with single flow, impulse and reaction type extraction condensing turbine (with reduction gear)	Axial flow, single casing, reaction type blading.	
Lube Oil Conditioner	Included (Coalescense Type)	Included (Centrifugal Type)	Not Included
Lube Oil Reservoir Unit	Separate package, will be located at ground floor	Integral with machine, will be located on the turbine operating deck	Separate Package
Control Oil system	Combined with Lube Oil System	Combined with Lube Oil System	Separate System
Type of Generator	Revolving field, brushless, type, synchronous generator	Brushless type, synchronous generator	
Generator Cooling	TEWAC	TEWAC	
Generator Rating Capacity Power Factor	 23.5 MVA 85%	 85%	

DESCRIPTION	BIDDER		
	MITSUBISHI	SIEMENS DEMAG DELAVAL	GE THERMODYNE
Speed	1800 rpm	1800 rpm	
Number of Poles	4 pole	4 pole	
Number of Phases	3 phase	3 phase	
Frequency	60 HZ	60 HZ	
Voltage	13.8 KV	13.8 KV	
Class of Insulation	F		
Temperature Rise	B (Class F at summer peak)		
Type of Governor	Woodward Governor 505, NEMA Class "D"	Woodward Governor, 505	Woodward Governor, 505

			BIDDER		
Item	Technical Description	Specification Requirement	Mitsubishi	Siemens Demag Delaval	GE
	PERFORMANCE:				
	Turbine Speed, RPM		4,150	6,000	
	Generator Speed, RPM		1,800	1,800	
	GUARANTEED PERFORMANCE:				
A	Output Power, kW	By Bidder	18,100	18,020	
B	Throttle Conditions:				
(i)	Flow, lbs/hr (gross)	172,267	172,267	172,267	
(ii)	Pressure, Psia	865	865	865	
(iii)	Temperature, F	825	825	825	
C	First Extraction (Air Heater):	Duty 13.5 x 10^6 Btu/h			
(i)	Flow, lbs/hr (gross)		14,200	19,980	
(ii)	Pressure, Psia		155	163.9	
(iii)	Temperature, F		498	482	
D	Second Extraction (Deaerator):				
(i)	Flow, lbs/hr (gross)		7,930	NA (Steam to come from first extraction letdown station)	
(ii)	Pressure, Psia		84.8		

Item	Technical Description	Specification Requirement	BIDDER		
			Mitsubishi	Siemens Demag Delaval	GE
(iii)	Temperature, F		391		
E	Third Extraction (LP Heater #2):				
(i)	Flow, lbs/hr (gross)		5,870	12,410	
(ii)	Pressure, Psia		20.7	35.77	
(iii)	Temperature, F		231	260.6	
F	4th Extraction (LP Heater #1)				
(i)	Flow, lbs/hr (gross)		7,180	8,629	
(ii)	Pressure, Psia		8.0	8.59	
(iii)	Temperature, F		183	186.1	
G	Exhaust				
(i)	Flow, lbs/hr (gross)		137,087	130,100	
(ii)	Pressure, In. HgA		2.3	2.3	
(iii)	Temperature, F		105.6	105.6	

ATTACHMENT 1
BURNS AND ROE'S REVIEW OF MITSUBISHI'S COMMENTS, CLARIFICATIONS, DEVIATIONS TO SPECIFICATION SM-107B LEE COUNTY STEAM TURBINE GENERATOR

Item	Clause	REFERENCE	MITSUBISHI COMMENT	BURNS AND ROE'S RESPONSE OR COMMENT
1.	1.1	The generator will be directly connected to the steam turbine or will be of the geared type.	The proposed steam turbine generator unit is of geared type. So the generator speed is 1800 rpm with 4 poles.	This is acceptable to BRE
2.	1.2.2.1	The turbine and generator shall be direct coupled. This is the Purchaser's preference and shall be the BASE bid. An OPTION price for a geared unit may be submitted for consideration.		
3.	1.2.7	Piping	The interconnecting steam/oil piping between turbine skid, oil unit, gland steam condenser etc is not included	This is acceptable to BRE
4.	2.6.5	Gland Steam Seal System		
5.	2.6.6	Lubricating and Control Oil		
6.	2.6.8	Piping		
7.	1.2.12	6. Erection supervision	Technical Advisory service is offered as an option	Acceptable
8.	2.2	Reference Codes and Standards	JIS, IEC and IEEE will also be applied for the turbine and generator design and manufacturing	This is acceptable to BRE.
9.	2.2.5	Electric heaters with thermostats shall be provided to warm-up the oil and EHC fluid.	The common lubrication and control oil system is applied for this class steam turbine. So EHC fluid heater is not provided.	Acceptable
10.	2.6.1	The turbine rotor shall be tested for thermal stability.	Thermal stability test is not required for this class of steam turbine.	Acceptable
11.	2.6.4.1	4. Steam extraction pressure set point adjustment and indication.	There are no automatic controlled extractions. So we understand that this function is not required.	Accepted

ATTACHMENT 2
BRE REVIEW OF SIEMENS COMMENTS, CLARIFICATIONS,
DEVIATIONS TO SPECIFICATION SM-107B FOR THE
MODEL ST3 GEARED OFFERING
LEE COUNTY

Item #	Section, Paragraph, Page	Siemens Comment/Clarification	BRE Evaluation
1.	1.2.1.3 **Page 1**	**The Purchaser will furnish the expansion joint with the condenser.** To prevent origination of excessive axial forces the turbine is designed for flanged direct connection with the condenser without using an expansion joint. Thermal expansion of turbine and condenser is ensured by placing the condenser on sliding or spring supports. Therefore no expansion joint shall be used.	Siemens comment is noted.
2.	1.2.2.1 Page 1	**The turbine and generator shall be direct coupled. This is Purchaser's preference and shall be the base bid.** Offered turbine is of geared type. It allows the turbine to be fully optimized and gives the highest possible efficiency at a reasonable cost.	Acceptable
3.	1.2.3.3 Page 2	**Limit switches for main stop valve.** The steam operated Emergency Stop Valve is a special design without a spindle passing through a packing box. All moving parts are internal and not subject to oxidation or lock-ups. There are no position switches, but the status is indicated by the conditions of the Safety Oil Block, which controls the ESV.	Acceptable
4.	1.2.3.6 Page 2	**Local gage panel or instrument rack (Others will furnish ...** The steam turbine is designed for remote operation from the steam turbine operator station. During operation, the presence of an operator locally at the steam turbine is not necessary. Therefore we do not provide a local control panel, nor gauge boards with steam turbine instrumentation. The necessary local instruments are locally mounted. From the operator station it is possible to control the entire steam turbine – its accessories and the turbine itself. If required, a back-up control unit with LCD display (for control, indication and alarm annunciation e.g. in case of trouble with the main operator control station) can be offered as an option. This LCD unit would be placed in Turbine Local Cubicle on the turbine base frame.	Siemens has provided a cost add of **$28,400** for an automatic synchronizing device. BRE recommends accepting this cost adder.

Item #	Section, Paragraph, Page	Siemens Comment/Clarification	BRE Evaluation
		Please send more details about function of the synchronizing sub-panels. The synchronizing equipment including an automatic synchronizer and manual synchronizing tools, synchrocheck relay is not included in the Proposal. The Turbine Control System and Automatic Voltage Regulator-AVR (AVR is part of excitation cubicle) are designed for voltage and frequency control from synchronizing equipment delivery by others.	
5.	1.2.4.1 Page 2	**Automatic steam seal regulating valves including downstream shutoff valve.** The shut-off valve for the seal steam system is located upstream of the control valve to enable cut-off of steam flow during the steam turbine shut-down.	Upstream location of shutoff valve for seal steam system is preferred and acceptable to BRE.
6.	1.2.5 Page 2	**7. Pressure switch for auto start of auxiliary oil pump** **8. Independent pressure switch for auto start of emergency bearing oil pump** The logic for the stand-by pumps is based on analogue signals in 2 out of 3 voting. Such configuration ensures reliable and fail safe operation of the system.	Siemens is offering 2 out of 3 pressure transmitters instead of a dedicated pressure switch for these applications. This is acceptable to BRE for the auxiliary oil pump, however, an independent pressure switch is required for auto start of the emergency DC lube oil pump. Siemens has stated that the extra pressure switch can be provided for a cost adder of **$3,680**. BRE recommends the extra pressure switch and acceptance of the **$3,680** cost adder.
7.	1.2.5.10 Page 2	**Immersion heater and thermostat with self-contained oil temperature control** The oil heater element is equipped with the RTD and the control system automatically controls the heater.	Siemens is offering oil temperature control through the turbine control system rather than self-contained. This is acceptable to BRE.

Item #	Section, Paragraph, Page	Siemens Comment/Clarification	BRE Evaluation
8.	1.2.5.11 Page 2	**Lube oil conditioner system** The offered turbine oil system is designed to have high retention time. Consequently deterioration of oil is low and therefore the oil conditioning unit is not necessary/not offered for reliable operation of the turbo set. Moreover, lube oil conditioner system is totally independent on turbine systems and therefore may be purchased by Client separately later on. However, it has also been offered as an option in the Equipment and Services document of Section 2 of the proposal book dated February 11, 2004.	Lube oil conditioner is required Option price from Siemens is **$58,000**. BRE recommends acceptance of this cost adder.
9.	1.2.5.12 Page 2	**... thermometers for each bearing's lube oil drain** All bearings are equipped with one double RTD sensor placed in the bearing metal. The drain oil temperature is a function of the babbitt temperature. We feel the direct measurement of the bearing babbitt is more important for the safety of the steam turbine. For this reason no lube oil temperature after bearing measurement is necessary or included, but has been offered as an option in the Equipment and Services document of Section 2 of the proposal book dated February 11, 2004.	Siemens has furnished option pricing of **$3,540** to include the specified temperature measurement. BRE recommends acceptance of this cost adder.
10.	1.2.6.1 Page 3	**Standard supervisory instruments ....** The proposed solution uses for the vibration measurement the SKF sensors and the transmitters. The analogue signal from transmitter is then connected to the Turbine Control System. The Bently Nevada 3500 monitoring system placed in the separate cubicle has been offered as an optional price in the Equipment and Services document of Section 2 of the proposal book dated February 11, 2004. Please note that the new series monitors are multi-channel and without indicating elements.	Siemens has furnished option pricing for the BN3500 monitoring system with LCD display. Option price is **$16,340** plus **$1,200** for dual power supplies plus **$9,850** for an integrated PC Display. BRE recommends acceptance of these cost adders.
11.	1.2.6.1 Page 3	**The turbine supervisory monitors ... to the Purchaser's control panel fabricator for installation ...** Please see above comment 1.2.3.	Siemens has offered cost add of **$6,200** to provide additional LCD for local control, door mounted. BRE recommends acceptance.

Item #	Section, Paragraph, Page	Siemens Comment/Clarification	BRE Evaluation
12.	1.2.6.1.1 Page 3	**Radial x/y vibration on each turbine, generator (including exciter) and turbine reduction gear bearing.** For the light weight high speed shaft of the steam turbine we use the more sensitive x-y vibration probes. The heavier slower rotor on the generator we use seismic vibration monitors at the bearings.	Acceptable
13.	1.2.6.1.3 Page 3	**Differential expansion** The rear end steam seal is designed as a look-through type (so called – straight labyrinth). There is no danger of axial contact between rotor sealing strips and stator sealing. For this reason no rotor differential expansion measurement is necessary or included.	Acceptable
14.	1.2.6.2 Page 3	**Initiating devices for alarm, trip or status indication** The Steam Turbine control, Turloop S7, uses analogue signals in 2 out of 3 voting. These signals are used for indication, control, and alarm, as well as for trip. Such configuration ensures the reliable and fail safe operation of the system. Please, refer to the chapter 5.8.10, Turbine control system Turloop S7 to see essentials of the offered control system and trip functions.	Acceptable
15.	1.2.6.2.5 Page 3	**Turning gear engaged ...** The turning gear used is of the SSS coupling type, and is part of the gear box. A limit switch is not necessary because the turning gear will engage/disengage automatically.	Acceptable
16.	1.2.6.3.1. / 2 Page 4	**Thrust bearing front face (two duplex) / rear face (two duplex)** All bearings are equipped with one double RTD sensor embedded in the bearing metal to measure metal temperature in the hottest location. The first one is used for metal temperature measuring; the second one is a stand by.	Acceptable
17.	1.2.6.3.3 Page 4	**All turbine, generator and exciter journal bearing** Generator is designed with an overhung exciter, together with a shaft-mounted permanent magnet generator. Therefore, there are no bearings specifically for the exciter, but two radial bearings supporting the rotor only.	Acceptable

Item #	Section, Paragraph, Page	Siemens Comment/Clarification	BRE Evaluation
18.	1.2.6.4 Page 4	**Dial thermometers** **Indicating dial type of thermometers and thermowells for:** **1. Oil drains from all journal bearings** **2. Oil drain from thrust bearing** Please see above comment 1.2.5.12.	See Item 9 above
19.	1.2.6.5.7 Page 4	**Differential pressure across oil filter** The differential pressure indicator and the transmitter will be provided as a standard part of the filter.	Acceptable
20.	1.2.6.6 Page 4	**Pressure transmitters** Please, see P&ID (Section 5.12 of the proposal) for location and type of the pressure gauges. All signals from pressure measurements are led to the steam turbine control system from there the signals transferred to the DCS via MODBUS. No special transmitters are provided for connection to DCS.	Acceptable
21.	1.2.6.7.2 Page 5	**The Seller shall provide one first stage pressure tap for use as a load reference.** The turbine design does not enable provision for pressure measurement behind the first stage. Pressure measurement is provided downstream of control stage.	Siemens states that they will provide curves. This is acceptable to BRE.
22.	1.2.6.7.3 Page 5	**Digital tachometer loop consisting of dedicated probe with transducer and digital speed indicator mounted on Purchaser control room panel.** The speed is measured and processed by the steam turbine control system and displayed on the screen of the operator station. The same values are transferred to DCS.	Siemens deviation is acceptable to BRE. (Tachometer incorporated into Turbine Control System).
23.	1.2.7, Page 5	**The seller shall furnish prefabricated piping,...** Piping, which is not already fully installed and included in the scope of supply, is delivered 2D prefabricated and completed on site.	Prefabricated piping can be completed on site. This is acceptable to BRE.

Item #	Section, Paragraph, Page	Siemens Comment/Clarification	BRE Evaluation
24.	1.2.8 Page 5	**Insulation and lagging** **All thermal or noise insulation as required and aluminum jacketing for the turbine generator equipment.** The lower part of the steam turbine is clad in aluminum; the upper part is insulated by mat type thermal insulation without cladding.	Acceptable
25.	1.2.8 Page 6	**Appearance lagging** **Drawing, specification and instruments, as necessary for field application of thermal insulation and jacketing.** Scope of insulation and jacketing is described in the Section 5.1-Scope of supply. Tools for erection and maintenance of the insulation are generally available. Therefore, no tools for insulation and jacketing application are included.	Acceptable
26.	1.2.9 Page 6	**Generator system** Please see Technical specification for details of the offered scope and parameters of the generator.	Acceptable
27.	1.2.9.8 Page 6	**Type 100 OHM Pt RTDs (four per phase) in generator stator winding** The generator is designed with 6 RTD's (two per phase) according manufacturer's standard.	Acceptable
28.	1.2.10.3 Page 6	**Silicon diode bridge rectifier assembly with fuses** The fuses are not applicable for rotating diode bridge designed by SIEMENS. The diodes are oversized and fuses are not suitable for brushless rotating systems.	Acceptable
29.	1.2.10.6 Page 6	**Exciter winding automatic ground detector equipment and panel** Rotor earth-fault protection is provided by Generator protection relay.	Siemens has included a price add of **$10,620** for field ground detector. BRE recommends acceptance of this cost adder.

Item #	Section, Paragraph, Page	Siemens Comment/Clarification	BRE Evaluation
30.	1.2.10.10 Page 6	**Two (2) static type automatic voltage regulator (AVR) including required reference and sensing circuit (complete with current and voltage transformer).** Two channel system is included in the Proposal, First channel (automatic channel) is equipped with automatic voltage regulator (AVR) and second channel is equipped with excitation current regulator (ECR). Both channels will be controlled from the operator station or control room. There is a function "Follow-up Control" for switching between channels. A completely redundant AVR system has been offered as an option in the Equipment and Services document of Section 2 of the proposal book dated February 11, 2004.	Completely redundant and functionally identical automatic voltage regulators are required. The extra price from Siemens for the complete redundant system (two transistor choppers and two AVR) is **$12,210**. BRE recommends acceptance of this cost adder.
31.	1.2.11.3 Page 7	**Control devices, wiring and cabinets** MCC, wires and cabinets are not included in the scope of supply and shall be delivered by others.	Acceptable
32.	1.2.11.6 Page 7	**All turbine–generator mounted devices and instruments shall be wired to terminal boxes furnished by the Seller.** Terminal points for all electrical motors are in their terminal boxes, instrumentation cabling for TG set is wired to junction boxes located on the base frame. Instruments located off-skid are connected straight to the instrument.	Acceptable
33.	1.2.11.7 Page 7	**Surge protection equipment** Surge arresters and capacitors located in the Main Terminal Box (MTB) are included in the Proposal. Other surge protection equipment is not included. There it mentions that the arresters and capacitors will be delivered by others.	Acceptable
34.	1.2.12.1 Page 7	**Turbine-generator Performance Thermal Kit (see Performance Curves Attachment 2).** Please specify more in detail, the Performance Curves Attachment are not attached.	Thermal Kit is required at completion
35.	1.2.12.2. Page 7	**Cleaning and painting (see Section 4.4)** Surface preparation and protection of the steam turbine and accessories in the scope of supply is offered according to well proven Siemens' guidelines, which fulfils international standards.	Siemens comment relative to cleaning and painting is acceptable.

Item #	Section, Paragraph, Page	Siemens Comment/Clarification	BRE Evaluation
36	2.2 Page 9	**Referenced Codes, Standards and Other Documents.** The offered steam turbine and accessories are designed, manufactured and delivered according to the standards stated in the Section 5.4-Standards and codes and are according to the well proven internal procedures and practices.	The Siemens machine is built to Western European Codes and Standards including DIN standards. Terminal flanges will be ANSI rated. The above is acceptable to BRE.
37.	2.3.3.5 Page 12	**The performance calculations shall include the effect of all leak off steam.** The performance calculations include leak-off steam flows as shown in the HBDs attached in the Section 5.12-Enclosures	Acceptable
38.	2.3.3.6 Page 12	**The performance calculations shall include effect of all mechanical and electrical losses.** The performance calculations include mechanical and electrical losses of steam turbine, gearbox and generator. No losses of any other kind were included into calculation.	Acceptable
39.	2.4.1.1 Page 12	**The turbine is to be capable of continuous operation with the valves wide open (VWO) flow and minimum operating back pressure stated in Attachment 1 for the 30 years service life.** The steam turbine is designed for operation life of 200,000 operation hours.	Siemens ST 13 machine is designed for approximately 25 year life. This is acceptable for an industrial type steam turbine.
40.	2.4.1.2.b Page 13	**T-G load shedding – upon loss of utility tie, T-G runs back to maintain house load – most of the main steam is bypassed to an air cooled condenser or a bypass condenser.** The steam turbine is allowed to operate up to a maximum exhaust pressure allowed for respective load.	Acceptable
41.	2.4.2 Page 12	**Pressure and temperature variations** The steam turbine is designed for continuous operation at design conditions, with variations according to IEC 45-1. If there are load points with inlet steam parameters likely exceeding those defined in the above mentioned standard, they shall be investigated in detail, parameters and duration of operation agreed and operation procedures specified.	Comment is Acceptable

Item #	Section, Paragraph, Page	Siemens Comment/Clarification	BRE Evaluation
42.	2.4.4 Page14	**Hydrostatic test of the main steam piping system** **… . It is intended that the turbine main steam stop valves be used to close off the pipe at the turbine end during hydrostatic test of the main steam system and, therefore, shall be designed accordingly. …** The main steam piping shall be disconnected from the emergency stop valve during hydrostatic test to avoid any damage of the turbine casing during the test. Therefore the valve can not be used as a closure for the piping.	Acceptable
43.	2.5.1 Page 14	**Each part shall be fabricated of materials best suited for the service which it performs.** The materials used in design of the steam turbine and accessories are chosen according to European standards as stated in Section 5.4-standards and codes. The materials ensure trouble free and safe operation of the turboset and accessories. **… .These items shall be shipped by the Seller to destinations designated by the Purchaser.** All the deliveries are offered DDP Jobsite, but only the jobsite that will be specified in the contract. Multiple locations should be defined in advance of the contract and any cost impact evaluated. **All flanges shall be manufactured in accordance with the latest edition of ANSI B16.5.** Internal flanges of the turbogenerator test shall be designed and delivered according to the DIN, external flanges are per ANSI.	Acceptable
44.	2.5.2 Page 15	**Wind and seismic design shall be in accordance with applicable national and state codes.** National standards are not available. Therefore, no modifications to turbine design were applied.	Acceptable

Item #	Section, Paragraph, Page	Siemens Comment/Clarification	BRE Evaluation
45.	2.5.5 Page15	**Electric oil heaters shall have low heat output of 20 watt per square inch or less to prevent oil carbonization.** The oil heater is designed to safely and reliably heat oil content without causing oil carbonization. Therefore, well proved standard solution has been kept.	Siemens has stated their density is 6.45 watts/sq in. which is acceptable to BRE.
46.	2.5.6 Page 16	**Vibration** Please, see Section 5.8.11-Field instrumentation for details on type and location of vibration sensors. The tests carried out are specified in Section 5.5 Inspection and test program.	Siemens explanation of vibration is acceptable.
47.	2.6.1 Page 17	**Control for the spray nozzle shall be suitable for the following type of operation...** Because this is a downward exhaust, an exhaust spray water system is not required.	Acceptable
48.	2.6.2 Page 18	**Corrosion-Erosion resistance** **The contaminants In the main steam under average conditions are expected to be as shown on Attachment 1 Design Data.** Values of conductivity in the Attachment 1 exceeds limiting value for steam turbine operation stated in Section 5.10 Steam quality requirements, which enables the steam turbine to operate safely, but with likely increase of built-up of blade deposits having impact to turbine performance. However, the other contaminants values shall be defined in mg/kg to enable proper evaluation, since the ppb units may be confusing.	Numbers provided in specification are representative numbers and will be firmed up later. The intent is that the steam will be of sufficient quality to meet the vendor's requirements.
49.	2.6.3 Page 18	**Turning gear** **The turning gear shall be AC motor operated ... and arranged for local engagement and start.** The turning gear used is of the SSS coupling type, and is part of the gear box. The turning gear will engage/disengage automatically, therefore a lever and limit switch is not necessary. The design of this turning gear does not allow jogging of rotor (to control turning gear at very slow rpm). For the inspections or emergency cases the hand turning wheel will be used. Therefore local control facility for rotor turning gear is not recommended.	Acceptable

Item #	Section, Paragraph, Page	Siemens Comment/Clarification	BRE Evaluation
50.	2.6.3.3 Page 18	**Start-up time required after shutdown without turning gear available, and no hand turning of rotor.** Shutdown without turning gear on or hand turning is not allowed. Such situation may result in bending of the rotor with consequent damage of the blading and long term overhaul.	Acceptable
51.	2.6.4.1 Page 18	**The governor shall be Woodward Model 505 or ...** The proposed governor is based on PLC Simatic S-300, the Woodward 505 can be proposed as an option.	Siemens has offered the Woodward Governor for an additional price adder of **$54,500**. BRE recommends that this price adder be accepted.
52.	2.6.4.1 Page 18	**Seller shall supply an insert with dedicated hardwired hardware ...** Please see above comment 1.2.3.6	See Item 11
53.	2.6.4.1.5 Page 19	**Turbine exhaust casing high temperature trip** There is not any danger to the turbine/blading due to high exhaust temperature therefore the trip is not provided.	Acceptable
54.	2.6.4.1 Page 19	**All trips shall have a separate set of contacts .... shall have instrumentation to provide a prediction alarm** Please see above comment 1.2.6.2	Acceptable
55.	2.6.4.2.4 Page 20	**The control system shall be furnished with its own dedicated KW transducer ...** The additional transducer can be provided for extra price.	
56.	2.6.4.3 Page 21, 22	**The design pressure and temperature of the T&T valve shall meet the requirements of the ANSI B31.1 Code.** The steam turbine is designed according to European standard as stated in Section 5.4 Standards and Codes. **The T&T valves or valves shall be equipped with position switches having pilot duty contact ratings..... . The governing control valves shall be provided with continuous position indication in the control room.** The steam operated Emergency Stop Valve is Vendor's special design without	

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		position transmitter and limit switches, because all the moving parts are inside of ESV body. A pressure measurement of the output lines of the Safety Oil Block, which is part of the safety device of the ESV, indicates the position. There is no position measurement available for the control valves, the feedback is done mechanically, and the position indication is derived from the actuating signal from the governor. **Seller shall provide differential pressure taps across strainer, for monitoring pressure drop during start-up.** The strainer is built-in in the emergency stop valve body, which design does not allow incorporation of the differential pressure measurement.	
57.	2.6.4.4 Page 22	**... . The Seller's air relay pilot device, operated by hydraulic oil pressure, shall relieve the air pressure when the unit trips. ...** The power assisted non-return valves are designed with air piston. The air release from the piston shall be controlled by relay pilot valve operated by solenoid valve based on electrical signal from the control system. **Each non-return valve shall be provided with a local test station.** Local test stations for non-return valves can be offered for extra price. **Seller's base bid shall include Atwood-Morrill non-return valves.** The non-return valves used in the offer are selected from the list of Seller's sub-supplier's, an optional price for the Atwood-Morrill non-return valves has been offered in the Equipment and Services document of Section 2 of the proposal book dated February 11, 2004.	Acceptable Siemens has offered option pricing to provide the specified A&M Valve with local test stations. This cost adder is **$35,400**. BRE recommends this cost option.
58.	2.6.5 Page 22	**Gland steam seal system** **The blower shall be designed for 1.0 psig discharge pressure.** The blower suction and discharge pressures are designed according to internal guidelines to ensure proper operation of the gland steam system.	Acceptable
59.	2.6.6 Page 22	**Lubricating and control oil system** **Lubricating oil reservoir will be located on the ground floor.** Common lubricating and control oil tank is built-in to the steam turbine base frame.	Acceptable

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		Therefore the oil tank will be located on the turbine foundation. **All openings on the top shall be raised a minimum of one inch above the tank surface and gasketed.** The base frame design features do not allow for these adaptations without substantial design modifications. **If equipment is located on the tank, the top of the reservoir shall have a half inch high lip around its perimeter with drain to grade, to prevent oil from running down the side of the tank.** The base frame is designed to prevent oil leakage during normal operation. The modification of the base frame has not been included; however it can be done for extra price. **Connections shall be provided on the reservoir for the Purchaser's supply and return lines from the Seller's lube oil conditioner.** The offered turbine oil system is designed to have high retention time. Consequently deterioration of oil is low and therefore the oil conditioning unit is not necessary/not offered for reliable operation of the turbo set. Moreover, lube oil conditioner system is totally independent on turbine systems and therefore may be purchased by Client separately later on. However, the connection for purifier will be provided. The purifier can also be offered as an option. **A visual level indicator ...** Because of the remote operation design the local indicator is not provided. The local level indicator has been offered as an option in the Equipment and Services document of Section 2 of the proposal book dated February 11, 2004. **An AC motor driven vapor exhauster shall be provided of sufficient capacity to ventilate the air space within the reservoir to the turbine room roof while maintaining a vacuum of 1 inch of water at the bearing houses. An alternate for an additional high grade demister on the exhauster discharge may be provided.** The oil vapor exhauster is designed according to the internal standards to maintain sufficient pressure in the oil system for trouble free operation. The scope of supply for oil system equipment included in the scope of supply is shown in the P&ID Lube oil.	Siemens has provided a cost adder of **$2,750** to provide the lip. Siemens has provided a cost adder of **$2,340** to provide the indicator Acceptable

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		Lube oil. **An independent supply line and filter shall be provided between the DC pump and the bearing oil header.** The independent pipeline from DC pump to header will be provided. However, the filter is connected at the suction of the pump.	Acceptable
60.	2.6.6 Page 24	**Pressure switches shall be provided for automatic starting of the pumps ...for remotely testing ... (by simulating a low pressure ...)** The logic the stand-by pumps is based on analogue signals in 2 out of 3 voting. Such configuration ensures the reliable and fail safe operation of the system without additional testing. **Positive displacement pumps shall have separate external safety relief valve arranged to avoid pressure built-up due to excess temperature as a result of oil recirculation. A check valve shall be provided at each pump discharge.** A common relief valve is used to make the oil header safe. Check valves are provided at the discharge of the of main and auxiliary oil pumps. The DC pump discharge is not provided with check valve. **Two, full size, tube and shell oil coolers shall be provided.** The steam turbine is equipped with two plate type coolers. Tube and shell oil coolers has been offered as an option in the Equipment and Services document of Section 2 of the proposal book dated February 11, 2004. **Exchanger surface area shall be based upon a cleanliness factor not to exceed 85%.** The coolers are designed with features according to internal practices and standards to ensure proper function. **Expansion heads of coolers shall be so designed that leakage between oil and water passages, due to pressure differences, cannot occur. .... The heads, tube sheets and supports shall be designed so the water side of the cooler can be cleaned while the unit is on turning gear.** The coolers are plate type, so the design, maintenance and safety features are accordant with the type of the cooler.	Refer to Item 6 Acceptable Siemens has furnished a price adder of **$22,100** to furnish the two (2) shell and tube heat exchangers as specified. BRE recommends that this cost adder be accepted.

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		The coolers shall be suitable for operation as a heater during oil flushing with hot water admitted to the water side at no higher than 200°F (93°C). The oil system is equipped with immersion heaters, which heating capacity is sufficient to heat up oil content during flushing.	
61.	2.6.7 Page 25	**All electronic transmitters shall be as Rosemount, or ...** For your convenience we have enclosed our standard Subsupplier list in Section 5.14 of the Proposal Book. The Emerson (Rosemount) transmitters have been proposed as an option in the Equipment and Services document of Section 2 of the proposal book dated February 11, 2004.	Siemens has furnished a price adder of **$29,400** to furnish the Rosemount transmitters. BRE recommends that this cost adder be accepted.
62.	2.6.7 Page 25	**Seller shall not supply loose instruments ... in local instrument rack ...** The pressure and temperature transmitters will be delivered loose for the inlet steam piping.	Acceptable
63.	2.6.7 Page 25	**All thermocouples shall be ... Type E** The K type thermocouples will be provided.	Acceptable
64	2.6.7 Page 25	**The electrical digital indicating tachometers ...** Please see above comment 1.2.6.7.3	See Item 22
65	2.6.7 Page 26	**All transmitters and switches furnished shall not be shipped loose ...** The live steam piping is excluded from Siemens' scope of supply, therefore the necessary instruments for steam turbine operation will be delivered loose. This includes one pressure transmitter and one temperature detector. The tap points (including firs isolating valve) will be delivered by others. **Transmitters and switches shall be installed on the local gauge board.** **The steam turbine is designed for remote control. Therefore local gauge pane is not part of scope of supply.**	Acceptable
66.	2.6.7 Page 26	**All devices that initiate a turbine or a generator trip shall be furnished with at least one (1) additional contact for Purchaser's use.** All provided sensors will be connected only to the delivered control system and then the signals will be sent per serial link to Purchaser's DCS. Note also that the turbine trip signals are derived from the analogue transmitters.	Acceptable

Item #	Section, Paragraph, Page	Siemens Comment/Clarification	BRE Evaluation
67.	2.6.7 Page 26	**The Seller's various instrumentation sub-vendors or suppliers shall conform to the Purchaser's master vendor list.** For the proposed Sub-suppliers please see Section 5.14 of the Proposal book.	Acceptable
68.	2.6.8 Page 26	**Piping** **All piping shall be in accordance with ANSI B31.1 and weld end preparation shall be in accordance with ANSI B16.25.** The piping and internal connections in the scope of supply are designed, manufactured and delivered according to European standards. Interfaces to Client are provided with flanges according to ANSI. **The Seller shall furnish all piping 2" in diameter and smaller as schedule 80 minimum.** Piping in the scope of supply is designed according to the international standards and Seller practice. **The piping shall be neatly arranged to be as inconspicuous as possible and offer no obstruction to the operators.** The turbine is arranged to fulfill operation, maintenance and safety regulations and to fulfill operation requirements, which limits modification of outward form of the machine. No special adaptations (covers, insulation, routing of piping, etc.) shall be applied to improve appearance of the machine.	The listed piping deviations/clarifications are acceptable to BRE
69.	2.6.8 Page 26	**All drains shall be 1" (inside diameter minimum)per ASME TDP-1** All internal piping is designed, manufactured and delivered according to European standards, external connections are per ANSI. **All piping for steam, oil and water shall be seamless steel,.....result of physical damage or piping failures.** The design, manufacture, surface preparation, etc. shall be carried out according to European standards and Seller's practices to ensure proper function of the piping systems.	Acceptable

Item #	Section, Paragraph, Page	Siemens Comment/Clarification	BRE Evaluation
70.	2.6.9 Page 26	**Insulation and lagging** **Insulation and lagging shall be prefabricated by the Seller.** **All insulation shall allow for easy removal and re-installation during normal maintenance activities, without physical damage to the insulating properties.** Insulation of the turbine lower part as well as piping is lined by permanent aluminum cladding can not be removed. The upper part is insulated by removable mat type insulation. **Insulation shall be applied where necessary such that the surface temperature at any point at any time does not exceed 130°F (54°C) with stagnant ambient air at 80°F (27°C).....** The surface temperature of the thermal insulation shall not be measured in the surroundings of the openings and lead-through and it is measured at 1 meter's distance from the insulation surface. The thermal insulation will be designed and delivered according to the Seller internal guidelines. The bottom of the turbine and piping is insulated by non-removable insulation with aluminum cladding; the upper part of the turbine is insulated by mat-type insulation without cladding. Modification of the insulation material type or its design would have a cost impact. No housing on the inlet part of the turbine shall be delivered.	Acceptable
71.	2.7 Page 28	**Stator and rotor winding insulation and associated supporting materials shall be Class F limited to a Class B temperature rise during operation within a 40°C ambient and shall be capable of withstanding temperatures specified in ANSI C50.13 and dielectric test specified in ANSI C50.10.** Class B temperature rise shall be allowed during operation with VWO as well.	Acceptable
72.	2.7 Page 28	**Phase and neutral terminals....** The generator is designed for cable connection with the Main Terminal Box. There are not neutral and line side copper bars for non-segregated phase bus. The Main Terminal Box (MTB) will be located next to the Generator The cables for connection with MTB are part of Generator delivery. The MTB is designed for cable connection with high voltage switchgear from the bottom.	Generator main terminal box must be configured for connection to non-segregated phase bus duct. Extra price from Siemens for equipment is **$2,960.** BRE recommends acceptance of this cost adder.

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73.	2.7 Page 28	**The generator neutral shall be high resistance...stainless steel resistor.** The resistor is designed according manufacturer standard and will be located in to the MTB. There is not a stainless steel resistor.	Neutral grounding transformer AND resistor are required per the specification. Extra price from Siemens for equipment is **$1,930.** BRE recommends acceptance of this cost adder
74.	2.7.1 Page 29	**Generator Accessories** Please see SIEMENS scope of supply of the line and neutral side equipment located in the MTB, Section 5.1 (Scope of Supply and Services)	Acceptable
75.	2.9.1 Page 31	**All motors shall meet the applicable requirements of NEMA MG-1.** Mechanical part of electrical motors is designed according to IEC, electrical part according to NEMA.	Acceptable
76.	2.9.4 2.9.5 Page 33	**Wiring ...** For space reasons and construction requirements all cables in the turbine area must be designed in accordance with the Vendor standard. Cables are made from copper according to IEC 228 class 5 with increased mechanical sturdiness, flame retardant insulation electric proof 300/500V, 0,5 mm^2, suitable for ambient temperature –30 ... + 70°C, armored hose with PVC coat protect the cables. The cables are led in zinc coated cable trays. The cable trays are fixed without mechanical stress. **Barrier type terminal blocks ...** The terminals are of screw-less spring type.	Siemens has provided a cost adder to comply with specification requirements. The cost adder is **$1700.** BRE recommends acceptance.
77.	2.10 Page 34	**Oil conditioner** The offered turbine oil system is designed to have high retention time. Consequently deterioration of oil is low and therefore the oil conditioning unit is not necessary/not offered for reliable operation of the turbo set, therefore this section is not applicable. Moreover, lube oil conditioner system is totally independent on turbine systems and therefore may be purchased by Client separately later on. However, this has been offered as an option in the Equipment and Services document of Section 2 of the proposal book dated February 11, 2004	See Item 8 above
78	2.11	**Turbine reduction gears**	Acceptable

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	Page 36	Turbine reduction gear is bought-out product, which is of well proven design according to manufacturer's standards and procedures. Required technical features changes may have influence to reliability of the equipment design and consequently price and delivery time. Therefore, required changes were not taken into consideration. **The Seller shall provide for the mounting of vibration probes. Probes shall be supplied at each bearing to detect radial and axial movements of the gear and pinion shafts. The peak-to-peak vibration amplitude of the gear shaft and pinion shaft shall not exceed 1 mil at full load.** The vibration monitoring probes shall be supplied as mentioned in Section 5.1-Scope of supply. Vibration limiting values are as stated in Section 5.11.3 Vibration guarantee. **The shop test shall consist of a no-load, full speed, spin test.** Please, see Section 5.5 Inspection and test program to see scope of tests and inspections included into Sellers scope of supply. The testing, measurements, cleaning, marking and preparation for operation is carried out according to the Seller's and manufacturer's standards and procedures.	
79.	2.12 Page 37	**Air assisted non-return valves** The offered non-return flaps are designed, manufactured and delivered according to the European standards. They are of required type (spring to close, air cylinder operator); however the design features (packing type, accessibility options, number of operators, etc) are according to manufacturer's practice.	See Item 57 above
80.	3.2 Page 39	**Examination and tests** **Seller shall furnish 5 copies of all of the test reports, whether witnessed or not.** The scope of supply includes 1 set of test report to be handed over for the Purchaser. Additional sets can be provided for extra price.	Acceptable
81.	3.2.1 Page 39	**Turbine generator shop test.** Tests included into scope of supply are specified in Chapter 5.5 Inspection and test program	Acceptable

Item #	Section, Paragraph, Page	Siemens Comment/Clarification	BRE Evaluation
		test program.	
82.	3.2.2 Page 40	**Turbine generator acceptance test** The steam turbine is designed and equipped for performance test as described in Chapter 5.11 Performance Guarantees. Adaptation for the test according to ASME PTC6 can be offered for extra price. Instrumentation for the test and execution of the test shall be responsibility of the Purchaser, the Seller's scope of supply includes supervision of test only.	Acceptable
83.	4.1 Page 40	**Tools** Please, see Section 5.1 Scope of supply for the list of special tools.	Acceptable
84.	4.3 Page 41	**Advisers for erection and start-up.** Please, see commercial part of the offer for the details on advisory services.	Acceptable
85.	4.4 Page 41	**Surface preparation and painting** Surface preparation and painting was offered according to the internal procedures of the Seller and its sub-suppliers.	Acceptable
86.	4.6 Page 43	**Data and drawings** **Drawings** Drawings included into scope of supply and its delivery time and conditions are stated in the list of drawings, Section 5.6 Documentation.	Acceptable

Document: Attachment 1

Item No.	Section, Paragraph, Page	Document requirement Comments/Deviations/Clarifications/Reference/cost Impact	
89.	2. Page A1-2	**Turbine performance required** **Seller is requested to provide an exhaust pressure correction curve for case II with his proposal. See Attachment 2 for other required correction curves** Correction curves shall be prepared during final turbine design, i.e. after contract signing or during later stages of the project. **Turbine generator shall be capable of operating with VWO steam flow and 1.5" HgA exhaust pressure.** The turbine generator is capable to operate at the above mentioned parameters. However, the generator insulation rise may reach Class F values depending on cooling water temperature and other external influence	Acceptable
	3. Page A1-3	**Additional design requirements** **Stop valve pressure during piping hydrostatic test** The main steam piping shall be disconnected from the emergency stop valve during hydrostatic test to avoid any damage of the turbine casing during the test. The turbine casing, the ESV and control valves body are subject of hydrostatic test on level of 1.5 times operation pressure in respective part without correction on temperature. **Maximum initial pressure** Maximum exhaust pressure for turbine exhaust is 3.63 PSI (7.39 HgA) as defined in Section 5.9.1 Technical data of turbine of the Siemens' specification. The steam turbine is designed for continuous operation at design conditions, with variations according to IEC 45-1. If there are load points with inlet steam parameters likely exceeding those defined in the above mentioned standard, they shall be investigated in detail, parameters and duration of operation agreed and operation procedures specified.	Acceptable

Item No.	Section, Paragraph, Page	Document requirement Comments/Deviations/Clarifications/Reference/cost Impact	
90.	4. Page 1-3	**Generator performance required** **Minimum rating kVA** **NAMEPLATE** The generator is designed for maximum operational power output and power factor 0.85, i.e. 23770 kVA. The exceptional load points when the power exceeds the above, the insulation class of the generation shall shift to class F. **Speed, rpm** **3600** Speed of the generator shall be 1800 rpm, because the turbogenerator set is designed using a geared. **Current transformers 12 required, 2 CT's on each bushing** This paragraph is not in compliance with paragraph 2.7.1 "Generator Accessories" page no.29. Please see SIEMENS scope of supply of the line and neutral side equipment located in the MTB, chapter 5.1 (Scope of Supply and Services) **Synchronising manual and automatic** Synchronizing equipment is not included in the Proposal, but has been offered as an option in the Equipment and Services document of Section 2 of the proposal book dated February 11, 2004. **Notes: 2. Seller shall furnish IRIS Engineering...** These are currently not included. **Generator main lead and neutral terminal boxes bottom mounted** The generator is designed for cable connection with the Main Terminal Box. There are not neutral and line side copper bars for non-segregated phase bus. The Main Terminal Box (MTB) will be located next to the Generator The cables for connection with MTB are part of Generator delivery. The MTB is designed for cable connection with high voltage switchgear from the bottom. ****Minimum operating back pressure (per Section 2.4.1)** Section 2.4.1 of the Technical specification makes reference back to Attachment 1, which creates circular reference. Therefore, values stated in the Vendor's offer take precedence.	Generator Speed of 1800 rpm is acceptable to BRE. Siemens cost adder to include automatic synchronizing device has been provided.

Item No.	Section, Paragraph, Page	Document requirement Comments/Deviations/Clarifications/Reference/cost Impact	
91.	6. Page A1-5	**Main steam contaminants and feed water treatment** Please, see Section 5.10-Steam quality requirements defining quality of the steam suitable for turbine operation and reflected into the offer. If those values are exceeded, proper evaluation and impact into turbine operation shall be identified and the offer modified accordingly	See Item #49
92.	8. Page A1-5	**Guidelines for heat and material balances** The complete plant set up is responsibility of the Purchaser. Therefore, complete plant HBD is also responsibility of the Purchaser. Parameters of steam at the turbine flanges are decisive for performance calculation. If there is any variation from the Purchaser's definitions of other parameters it shall be rectified later on. However, it may result in change of the turbine and its accessories parameters and of performance and price as well.	Acceptable
93.	10. Page A1-7	**Project specific requirements** **10.2 In addition to the curves identified in Attachment 2, Seller shall supply the following curves...** Correction curves shall be prepared during final turbine design, i.e. during later stages of offer or after contract signing. In addition, the scope and delivery times shall be discussed.	Acceptable

Turbine Generator Bid Evaluation					ATTACHMENT 3
Estimated Approximate Cost Adjustment related to T/G Pedestal					
1. Siemens					
Item	Unit	Unit Cost	Quantity	Total Cost	Remarks
1. Springs for Turbine Generator-Add	LS	LS	-	$150,000	Including Installation
2. Spring for Condenser-Add	LS	LS	-	$150,000	Including Installation
3. Smaller Pedestal (41'x15') compare to Mitshubishi 46'X20'	CY	$400	-125	($50,000)	(Deck+Mat=11'); (920-615)x11/27
4. Added Floor Area (920-615)=305SF					
a. Steel 305x30 lb/SF	Ton	$4,000	4.6	$18,400	
b. Floor Deck	SF	$5	305	$1,525	
c. Operating Floor Slab (305X4.5")	CY	$500	4.3	$2,150	
d. Ground Floor Slab (305x8")	CY	$500	7.6	$3,800	
5. Delete Expansion Joint Bet Condenser and Turbine	LS	10,000	-1	-10,000	
6. Expansion Joint/Flexibility for all piping connected to Condenser				25,000	
7. Additional Engineering for Piping Design				25,000	
			Total	$315,875	
2. Mitsubishi					
1. Larger Pedestal	CY	$400	125	$50,000	
2. Thicker Top Deck for Stiffer Pedestal 920x2'	CY	$400	68	$27,200	
3. Higher Generator Pad (18x20x2.25)	CY	$400	30	$12,000	
4. Deduct for less floor area					
a. Steel 305x30 lb/SF	Ton	$4,000	-4.6	($18,400)	
b. Floor Deck	SF	$5	-305	($1,525)	
c. Operating Floor Slab (305X4.5")	CY	$500	-4.3	($2,150)	
d. Ground Floor Slab (305x8")	CY	$500	-7.6	($3,800)	
5 Expansion Joint	LS	$10,000	1	$10,000	
Total				$73,325	

ATTACHMENT 4

SUBMITTED TECHNICAL DATA COMPARISON

SPECIFICATION SM-107B

STEAM TURBINE GENERATOR

BURNS AND ROE ENTERPRISES, INC.

W.O. No. 2661.001 Date 03/01/05 Book No. _____ Page No. _____
Drawing No. _____ Calc. No. _____ Sheet 1 Cont. on Sheet 2
By R N RAMIREZ Checked _____ Approved _____
Title TECHNICAL COMPARISON

SIEMENS

GENERAL INFORMATION

Equipment	Steam Turbine Generator
Project	Lee County
Purchaser	Lee County
Based on Specification No.	Rev. 2 Date 12-22-04
Data Submitted By: Company	Siemens
Signed By	
Title	
Date	

TURBINE PERFORMANCE DATA (Data marked with an asterisk (*) are guaranteed) Per ASME PTC-6 Full Scale test)

	Guaranteed Performance Condition	VWO
Net Generation, kW	18020 *	21090
Throttle Conditions:		
Flow, lb/hr	171110	190950
Pressure, psia	865	865
Temperature, °F	825	825
Maximum Net Export Steam, lb/hr	41020	33578
Exhaust Pressure, inch Hg abs	2.3	2.3
Makeup, %		
Final Feed Water Temperature, °F	298	298
Heat Loss to Oil Coolers, Btu/hr		

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Form BR 8002-2A (1/86)

ATTACHMENT 4

MITSUBISHI

GENERAL INFORMATION

Equipment	Steam Turbine Generator
Project	Lee County Wte. Facility Expansion
Purchaser	
Based on Specification No.	Rev. 0 Date 2/11
Data Submitted By: Company	Mitsubishi Power Systems
Signed By	Y. TAKAGAKI
Title	
Date	2/11/2005

TURBINE PERFORMANCE DATA (Data marked with an asterisk (*) are guaranteed)

	Guaranteed Performance Condition	VWO
Net Generation, kW	17,850 *	19,700
Throttle Conditions:		
Flow, lb/hr	172,267	192,102
Pressure, psia	865	865
Temperature, °F	825	825
Maximum Net Export Steam, lb/hr	—	—
Exhaust Pressure, inch Hg abs	2.3	2.3
Makeup, %	0	0
Final Feed Water Temperature, °F		
Heat Loss to Oil Coolers, Btu/hr		

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Drawing No. _____ Calc. No. _____ Sheet 2 Cont. on Sheet 3
By MX Checked _____ Approved _____
Title TECHNICAL COMPARISON

SIEMENS

	Guaranteed Performance Condition	VWO
Heat Loss to Air Coolers, Btu/hr		
TAUXP (Auxiliary power chargeable to turbine generator, kW)	20	20
Heat Balance Number	I	III
Minimum continuous allowable back pressure at stated flow, inch Hg abs	1,5	1,5
No Load Steam Flow at Guaranteed Steam Conditions, lb/hr	AFTER ORDER	AFTER ORDER

Performance Curves

The following curves shall be provided four months after Release for Engineering. (Release of approved heat balance)

Title	Curve No.
Expansion lines on Mollier Diagram at required heat balances	
Fixed losses	
Exhaust loss vs. annulus velocity or volumetric flow	
Gland leakages and enthalpies vs. throttle flow or normal predicted parameters	
Throttle pressure correction to load (MW)	
Throttle temperature correction to load (MW)	
Exhaust pressure correction to load (MW)	
Generator loss curve vs. generator output in MVA	
Air cooler water flow vs. load	
Lubricating oil cooler water flow vs. load	

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Form DR 8002-2A (1/86)

MITSUBISHI

	Guaranteed Performance Condition	VWO
Heat Loss to Air Coolers, Btu/hr		
TAUXP (Auxiliary power chargeable to turbine generator, kW)		
Heat Balance Number	MPS-05-023	MPS-05-025
Minimum continuous allowable back pressure at stated flow, inch Hg abs	N.A.	N.A.
No Load Steam Flow at Guaranteed Steam Conditions, lb/hr	approx. 22000	approx. 21000

Performance Curves

The following curves shall be provided four months after Release for Engineering. (Release of approved heat balance)

Title	Curve No.
Expansion lines on Mollier Diagram at required heat balances	later
Fixed losses	later
Exhaust loss vs. annulus velocity or volumetric flow	later
Gland leakages and enthalpies vs. throttle flow or normal predicted parameters	later
Throttle pressure correction to load (MW)	later
Throttle temperature correction to load (MW)	later
Exhaust pressure correction to load (MW)	later
Generator loss curve vs. generator output in MVA	later
Air cooler water flow vs. load	later
Lubricating oil cooler water flow vs. load	later

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W.O. No. 2661.001 Date 03/01/05 Book No. _____ Page No. _____

Drawing No. _____ Calc. No. _____ Sheet 3 Cont. on Sheet 4

By RMR Checked _____ Approved _____

Title TECHNICAL COMPARISON

SIEMENS

Title	Curve No.
First stage pressure and enthalpy vs. throttle flow or normal predicted parameter	

Seller is to include any other normal thermal kit performance curves and/or information that the Seller normally furnishes.

All turbine performance curves and data shall be a function of a turbine parameter.

Seller is to provide appropriate curves for the automatic extraction condition.

PHYSICAL DATA

Critical Speeds (rpm)	Combined
First critical	540
Second critical	20060 (N/A)
Weights, lb	
Unit shipped in one piece (yes/no)	No
Generator rotor shipped in stator (yes/no)	Yes
Total shipping weight of complete unit	312750
Finished weight of complete unit	283000
Turbine rotor	7500
Generator rotor	285000
Generator stator	498000
Heaviest piece during erection	Turbine on baseframe 160000
Second heaviest piece during erection	Generator 123000
Heaviest piece to be lifted after erection	Generator Rotor 285000

MITSUBISHI

Title	Curve No.
First stage pressure and enthalpy vs. throttle flow or normal predicted parameter	Curve

Seller is to include any other normal thermal kit performance curves and/or information that the Seller normally furnishes.

All turbine performance curves and data shall be a function of a turbine parameter.

Seller is to provide appropriate curves for the automatic extraction condition.

PHYSICAL DATA

Critical Speeds (rpm)	Combined
First critical	approx. 2600
Second critical	approx. 8700
Weights, lb	
Unit shipped in one piece (yes/no)	No
Generator rotor shipped in stator (yes/no)	Yes
Total shipping weight of complete unit (ST + gen + bed)	approx. 130,000 lb
Finished weight of complete unit	N/A
Turbine rotor	approx. 16,400 lb
Generator rotor	
Generator stator	
Heaviest piece during erection	approx. 100,000 lb
Second heaviest piece during erection	
Heaviest piece to be lifted after erection	

BURNS AND ROE ENTERPRISES, INC.

W.O. No. 2661.001 Date 03/01/05 Book No. Page No.
Drawing No. Calc. No. Sheet 4 Cont. on Sheet 5
By RMR Checked Approved
Title TECHNICAL COMPARISON

SIEMENS

Dimensions

Length of unit overall, ft-in.	91.6 Ft
Width of unit overall, ft-in.	13 FE
Height of unit above floor, ft-in.	13.2 ft
Space required to remove generator rotor	
Straight, ft-in.	16.6 Ft
Skewed, ft-in.	
Maximum vertical lift required to disassemble unit, ft-in.	determined after layout clarification
Piece requiring maximum vertical lift	Turbine casing / Generator coolers

Shaft Vibration, Mils Double Amplitude

	Shop Test (Max. Acceptable)	Field Operation Test (Max. Acceptable)
Turbine rotor	2.29	2.29
Generator rotor	1.91	1.91
Exciter rotor (but the bearing vibration sensors will be installed)	NA	NA
Alarm		3.29
Trip		4.30

TURBINE DETAILS

Blading

Number of rows	CS + 19
Material (ASTM No.)	
Inlet end/rows	AFTER ORDER
Exhaust end/rows	-11-

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Form BR 8002-2A (1/86)

MITSUBISHI

Dimensions

Length of unit overall, ft-in.	approx 46'
Width of unit overall, ft-in.	approx 17'
Height of unit above floor, ft-in.	approx 12'-6" (3800mm)
Space required to remove generator rotor	
Straight, ft-in.	Later
Skewed, ft-in.	Later
Maximum vertical lift required to disassemble unit, ft-in.	approx. 26ft (from bottom of operating floor)
Piece requiring maximum vertical lift	Turbine upper casing

Shaft Vibration, Mils Double Amplitude

	Shop Test (Max. Acceptable)	Field Operation Test (Max. Acceptable)
Turbine rotor	1.0	2.0
Generator rotor	2.0	2.5
Exciter rotor		
Alarm	3.0	3.0
Trip	4.8	4.8

TURBINE DETAILS

Blading

Number of rows	11
Material (ASTM No.)	
Inlet end/rows	12% Cr steel
Exhaust end/rows	12% Cr steel

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Drawing No. ____ Calc. No. ____ Sheet 5 Cont. on Sheet 6
By RMK Checked ____ Approved ____
Title TECHNICAL COMPARISON

SIEMENS

Last row blades

Blade length, inch	-11-
Effective blade length, inch	14
Tip speed, ft/sec.	AFTER ORDER
Flow area, sq. ft.	-11-

Nozzles

Material (ASTM NO.)	
Inlet end	-11-
Exhaust end	-11-
First Stage (Nozzle Control) Curtis or Rateau	-11-

Rotor

Type of construction	Forged
Thrust bearing type	Tilt pad
Journal bearing type	Tilt pad
Rotor span	~ 103 inch

Back pressure

Allowable for continuous operation, inch Hg abs

	High	Low
Maximum load (VWO)	5	1.5
Minimum load	AFTER	ORDER
No load	-11-	

MITSUBISHI

Last row blades

Blade length, inch	15.7"
Effective blade length, inch	15.7"
Tip speed, ft/sec.	1252.3
Flow area, sq. ft.	12.4

Nozzles

Material (ASTM NO.)	
Inlet end	12% Cr Steel
Exhaust end	12% Cr Steel
First Stage (Nozzle Control) Curtis or Rateau	Rateau

Rotor

Type of construction	Forged
Thrust bearing type	Tilting Pads (Cricket type)
Journal bearing type	Tilting Pads
Rotor span	120in

Back pressure

Allowable for continuous operation, inch Hg abs

	High	Low
Maximum load (VWO)	14	N.A.
Minimum load	14	N.A.
No load	14	N.A.

BURNS AND ROE ENTERPRISES, INC.

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Drawing No. _____ Calc. No. _____ Sheet 12 Cont. on Sheet 7
By RMR Checked _____ Approved _____
Title TECHNICAL COMPARISON

SIEMENS

	High	Low
Recommended setting, in. Hg abs		
Alarm	7.4	N/A
Trip	12	N/A
Max. allowable for short duration in. Hg abs - hrs.	AFTER ORDER	

GENERAL TURBINE DATA

Turbine Speed: 6800 rpm

Connections - Size and Material

	Size, Inch	Wall Thickness, Inch	Material (ASTM No.)	Maximum Allowable Distance to Non-Return Valve
Steam inlet to stop valves	10		AFTER ORDER	
Auto. controlled extraction	N/A			
First extraction point ____ stage	4		-11-	
Second extraction point ____ stage	6		-11-	
Third extraction point ____ stage	10		-11-	
Fourth extraction point ____ stage	N/A			
Exhaust connection	72x50		-11-	

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Form BR 8002-2A (1/86)

MITSUBISHI

	High	Low
Recommended setting, in. Hg abs		
Alarm	14	N.A.
Trip	22	N.A.
Max. allowable for short duration in. Hg abs - hrs.	18	N.A.

GENERAL TURBINE DATA

Turbine Speed: 4566 STD

Connections - Size and Material

	Size, Inch	Wall Thickness, Inch	Material (ASTM No.)	Maximum Allowable Distance to Non-Return Valve
Steam inlet to stop valves			A217-WC9	
Auto. controlled extraction	N.A.	N.A.	N.A.	N.A.
First extraction point 3 stage outlet			A217-WC9	Later
Second extraction point 4 stage outlet			A217-WC9	Later
Third extraction point 6 stage outlet			A217-WC9	Later
Fourth extraction point 7 stage outlet			A217-Gr.70-36 eq.	Later
Exhaust connection	80 eq.	N.A.	A217-Gr.70-36 eq.	

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Drawing No. ____ Calc. No. ____ Sheet 7 Cont. on Sheet 8
By RMB Checked ____ Approved ____
Title TECHNICAL COMPARISON

SIEMENS

Connections - Allowable Loading

X axis is parallel to the turbine shaft
Y axis is vertical
Z axis is perpendicular to the X and Y axis
R is vector sum of the components

	Allowable Force (Kips)				Allowable Moment (Ft-Kips)			
	X	Y	Z	R	Z	Y	Z	R
Steam inlet to stop valve	AFTER ORDER				—	—	—	—

Turning Gear

Type	AC MOTOR DRIVEN
Turbine rotor speed, rpm	190
At turning gear engagement	0 / 190
At turning gear operation	190
At turning gear throw-out	>190

LUBRICATING OIL SYSTEM

Lube Oil Reservoir

Capacity, gallons	
Normal operating level	2642
Runback at shutdown	
Total system operating	
Maximum reservoir storage	
Reservoir lining or protective coating	Coating
Retention time at normal operation (minutes)	8

MITSUBISHI

Connections - Allowable Loading

X axis is parallel to the turbine shaft
Y axis is vertical
Z axis is perpendicular to the X and Y axis
R is vector sum of the components

	Allowable Force (Kips)				Allowable Moment (Ft-Kips)			
	X	Y	Z	R	Z	Y	Z	R
Steam inlet to stop valve	—	—	—	—	—	—	—	—

to be informed later. main steam pipe size is required.

Turning Gear

Type	
Turbine rotor speed, rpm	
At turning gear engagement	approx. 10 rpm
At turning gear operation	approx. 10 rpm
At turning gear throw-out	max less 10 rpm

LUBRICATING OIL SYSTEM

Lube Oil Reservoir

Capacity, gallons	
Normal operating level	132 / (500 liter)
Runback at shutdown	depends on G.A.
Total system operating	132 / ____
Maximum reservoir storage	132 / ____
Reservoir lining or protective coating	Yes
Retention time at normal operation (minutes)	5 MIN.

BURNS AND ROE ENTERPRISES, INC.

W.O. No. 2661.001 Date 12/01/04 Book No. _____ Page No. _____
Drawing No. _____ Calc. No. _____ Sheet 8 Cont. on Sheet 9
By RMR Checked _____ Approved _____
Title TECHNICAL COMPARISON

SIEMENS

Lube Oil Pumps

Main pump:

Shaft or motor driven	Shaft
Capacity, gpm	317
Head, ft	AFTER ORDER
Motor Hp (if applicable)	N/A

Auxiliary pump (AC)

Capacity, gpm	317
Head, ft	AFTER ORDER
Motor size, Hp	60

Emergency DC pump

Capacity, gpm	97
Head, ft	AFTER ORDER
Motor size, Hp	6
Minimum required run time on loss of both AC oil pumps, minutes	AFTER ORDER

LUBE OIL CONDITIONER (OPTIONAL)

Conditioner

Manufacturer Model No.	Alfa Laval - centrifugal
Capacity, gph	53
Total holding capacity, gallons	
Overall length, ft/in.	40
Overall width, ft/in.	40
Overall height, ft/in.	52

Form BR 8002-2A (1/81)

MITSUBISHI

Lube Oil Pumps

Main pump:

Shaft or motor driven	AC motor
Capacity, gpm	264.2 (1000 l/min)
Head, ft	170.7 m (12 kg/cm²)
Motor Hp (if applicable)	45 kW

Auxiliary pump (AC)

Capacity, gpm	264.2 (1000 l/min)
Head, ft	170.7 m (12 kg/cm²)
Motor size, Hp	45 kW

Emergency DC pump

Capacity, gpm	92.5 (350 l/min)
Head, ft	28.4 (2.0 kg/cm²)
Motor size, Hp	3.7 kW
Minimum required run time on loss of both AC oil pumps, minutes	60 min

LUBE OIL CONDITIONER

Conditioner

Manufacturer Model No.	Cartridge type
Capacity, gph	Later
Total holding capacity, gallons	
Overall length, ft/in.	
Overall width, ft/in.	
Overall height, ft/in.	

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W.O. No. 2661-001 Date 03/01/05 Book No. ____ Page No. ____
Drawing No. ____ Calc. No. ____ Sheet 9 Cont. on Sheet 10
By RMR Checked ____ Approved ____
Title TECHNICAL COMPARISON

SIEMENS

Weight empty, lb	710
Weight, full to operating level, lb	800
EHC FLUID SYSTEM (if required)	
System capacity, gallons	Common w/lube oil system
Fluid type designation	____
STEAM SEAL SYSTEM	
Gland Sealing System Requirements	Normal Operating
Quantity normal, lb/hr	556
Quantity design, lb/hr	600
Pressure, psig	870
Temperature, °F	824
EHC GOVERNING AND PROTECTIVE SYSTEMS	
Valve gear type	E/H
No. of valve	3
Speed Governor and Speed/Load Changer	
Full load to half load regulation, percent of speed	AFTER ORDER
Maximum over speed following full load rejection at VWO with normal control settings	10%
Steady state speed regulation, percent	
Normal setting	____
Adjustable range	____
Minimum load change sensitivity, kW	____

Form BR 8002-2A (1/86)

MITSUBISHI

Weight empty, lb	Later
Weight, full to operating level, lb	Later
EHC FLUID SYSTEM (if required)	
System capacity, gallons	N.A.
Fluid type designation	N.A.
STEAM SEAL SYSTEM	
Gland Sealing System Requirements	Normal Operating
Quantity normal, lb/hr	0
Quantity design, lb/hr	approx. 800
Pressure, psig	Later
Temperature, °F	Later
EHC GOVERNING AND PROTECTIVE SYSTEMS	
Valve gear type	Hydraulic
No. of valve	4 or 6
Speed Governor and Speed/Load Changer	
Full load to half load regulation, percent of speed	1800 → 1836 (2%)
Maximum over speed following full load rejection at VWO with normal control settings	less than 107% of rated speed
Steady state speed regulation, percent	
Normal setting	4%
Adjustable range	2-10%
Minimum load change sensitivity, kW	Later

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W.O. No. 2661001 Date 03/01/05 Book No. _____ Page No. _____
Drawing No. _____ Calc. No. _____ Sheet 10 Cont. on Sheet 11
By RMR Checked _____ Approved _____
Title TECHNICAL COMPARISON

SIEMENS

Automatic governor runback actuation			_____
Over Speed Trip System			
Primary mechanical trip settings, percent of rated speed			N/A
Backup trip setting, percent of rated speed			110%
Maximum expected over speed following full load rejection at VWO, assuming failure of turbine speed control system, percent of rated speed			110%
Turbine and generator rotor over speed test at factory, percent of rated speed			120%
Valve Stroking Times			
Stroking time, sec.	Closing Emergency	Normal	Opening Normal
Stop	AFTER ORDER		_____
Control	"		_____

GENERATOR PERFORMANCE DATA

Performance	100% Cooling	Max. Cap.
Kilovolt-amperes continuous	23770	_____ *
Power factor (lagging)	0.85	_____ *
Volts	13800	_____ *
Amperes per phase	994	_____ *
Short circuit ratio	63%	_____ *
Phase	3	3
Hertz	60	60
Speed, rpm	1800	1800

MITSUBISHI

Automatic governor runback actuation			_____
Over Speed Trip System			
Primary mechanical trip settings, percent of rated speed			110%
Backup trip setting, percent of rated speed			112%
Maximum expected over speed following full load rejection at VWO, assuming failure of turbine speed control system, percent of rated speed			Less than 109%
Turbine and generator rotor over speed test at factory, percent of rated speed			120%
Valve Stroking Times			
Stroking time, sec.	Closing Emergency	Normal	Opening Normal
Stop	100%/sec	100%/min	100%/min
Control	100%/sec	100%/min	100%/min

GENERATOR PERFORMANCE DATA

Performance	100% Cooling	Max. Cap.
Kilovolt-amperes continuous	_____	_____ *
Power factor (lagging)	0.85	0.85 *
Volts	13800	13800 *
Amperes per phase	_____	_____ *
Short circuit ratio	_____	_____ *
Phase	3	3
Hertz	60	60
Speed, rpm	1800	1800

Generator data will be finalized after the final selection of Generator manufacturer.

BURNS AND ROE ENTERPRISES, INC.

W.O. No. 2661.001 Date 02/01/05 Book No. ___ Page No. ___

Drawing No. ___ Calc. No. ___ Sheet 11 Cont. on Sheet 12

By RMR Checked ___ Approved ___

Title TECHNICAL COMPARISON

SIEMENS

Temperature, °C

Rotor:	Gas to air	AFTER ORDER
	Rise by resistance	-11- *
Stator:	Cold liquid to air	-11- *
	Rise by RTD	-11- *

*Guaranteed Items

The generator shall operate successfully at maximum [illegible]VA given above with rated frequency and power factor, at any given voltage not more than 5 percent above or below rated voltage, but not necessarily with the standards of performance established for operation at rated voltage.

Losses

The calculated losses at [illegible]VA 0.85 PF, at rated voltage are:

Generator fan and windage, kW	83
Open circuit core loss, kW	87
Load loss, kW	27
I^2R of armature at 75°C, kW	64
I^2R of field at 75°C, kW	
Margin on above, kW	N/K
Exciter, kW	N/K
Miscellaneous, shaft seals, coupling windage, kW	N/K
Total, kW	361
Bearings, generator only and shaft seals, kW	25
Total losses, kW	
3 phase motoring real power losses, kW	N/K

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MITSUBISHI

Temperature, °C

Rotor:	Gas to air	*
	Rise by resistance	*
Stator:	Cold liquid to air	*
	Rise by RTD	*

*Guaranteed Items

The generator shall operate successfully at maximum _____kVA given above with rated frequency and power factor, at any given voltage not more than 5 percent above or below rated voltage, but not necessarily with the standards of performance established for operation at rated voltage.

Losses

The calculated losses at _____ kVA _____ PF, at rated voltage are:

Generator fan and windage, kW	
Open circuit core loss, kW	
Load loss, kW	
I^2R of armature at 75°C, kW	
I^2R of field at 75°C, kW	
Margin on above, kW	
Exciter, kW	
Miscellaneous, shaft seals, coupling windage, kW	
Total, kW	
Bearings, generator only and shaft seals, kW	
Total losses, kW	
3 phase motoring real power losses, kW	

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