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FPSC - COMMISSION CLERK

FLORIDA PUBLIC SERVICE COMMISSION
OFFICE OF COMMISSION CLERK

DOCUMENT NUMBER ASSIGNMENT*

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DOCUMENT NO.: 00976-2020

DOCUMENT DESCRIPTION:

CONFIDENTIAL

(CONFIDENTIAL) Hearing Exhibit No. 110 from 2/5/20 DOAH Hearing. [CLK Note: See DN 10935-2019 for Exh Nos. 1, 68-75, 80, 82, 100]

***This document number has been assigned to a confidential document.**
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DOAH CASE NO. 19-006022

COMMISSION STAFF EXHIBIT NO. 110

Excerpt from Progress Energy Florida – Mitsubishi 2008 Contract.

CONFIDENTIAL

Progress Energy

Mitsubishi Power Systems Americas, Inc.
100 Colonial Center Pkwy
Lake Mary, FL 32746

Attention: Mr. Howard Perkins, Proj. Mgr.

CONTRACT NO. 270810
AMENDMENT NO. 005
EFFECTIVE JANUARY 2, 2008

By this Amendment, Progress Energy Florida, Inc. (hereinafter "Owner" or "Buyer") offers to change the terms of the above-referenced Contract.

The Description of Work is amended at Owner's Bartow Plant, 1601 Weedon Island Dr., St. Petersburg, FL 33702 (hereinafter "Work").

The following sections of this Contract shall be replaced in their entirety.

Appendix A – Scope of Supply for Steam Turbine Generator
Appendix C – Acceptance Test Guidelines, Procedures, and Specifications
Appendix G – Drawing List
Appendix L – Inspection and Test Plan at Shop (for major components of steam turbine)
Attachment B-1 of Appendix I – Field Service Rates – Schedule of Charges

Except as modified herein, all other terms in the Contract or other Contract Amendments remain unchanged; and this Amendment is governed by those terms and conditions of the above-referenced Contract.

Progress Energy Service Company, LLC
P.O. Box 1551
Raleigh, NC 27602

Please execute this Amendment, retain an original for your file, and return the other original within ten (10) calendar days to Jenny Williams, Progress Energy Service Company, LLC, P. O. Box 1551 (PEB-8), Raleigh, NC 27602. Overnight delivery should be sent to 410 S. Wilmington Street, PEB 8, Raleigh, NC 27601. If you have any questions, please call Jenny Williams at 919-546-4090.

Sincerely,

Mark Smothers
General Manager - Construction

Accepted:

MITSUBISHI POWER SYSTEMS AMERICAS, INC.

By: _____

Name (printed): Shinichi Ueki

Title: VP, Commercial Operations

Date: January 14, 2008

Should the person's title who is executing this document not indicate that he/she is a corporate officer, an affidavit signed by a corporate officer shall be provided stating that the person whose name appears above is duly authorized to execute Contracts on behalf of the firm.

APPENDIX A
Scope of Supply for Steam Turbine Generator
(Revised January 2, 2008)

BARTOW REPOWERING PROJECT

SCOPE OF SUPPLY

FOR

STEAM TURBINE GENERATOR

T-0204-030 Rev.2

***MARCH*, 2007**

MITSUBISHI POWER SYSTEMS, INC.

CONTENTS

1. INTRODUCTION

The information included in this document has been prepared in accordance with Mitsubishi Heavy Industries, Ltd. (MHI) engineering standards and is based on experience gained by MHI during the completion of combined cycle plants throughout the world. Each project is customized in consideration of our client's specific requirements.

MHI is a leader in the power industry who has produced more than 28,000 MW of Gas turbines, 140,000 MW of steam turbines, and 550,000 tons per hour of steam generation boilers, including HRSG's.

This proposal describes the scope of supply and technical information of the equipment for the steam turbine and generator which can be used in a 4 on 1 combined cycle power plant.

Major equipment included in the proposal is as follows;

- One (1) Steam Turbine and Generator

2. DESIGN CONDITIONS

2.1 General

The equipment and systems included in this proposal are designed based on the design conditions described herein and MHI's standard design practice.

In the event the design conditions and assumptions as stated in this section. Seller reserves the right to modify the design, guarantees and/or pricing accordingly.

2. DESIGN CONDITIONS

2.2 SITE CONDITIONS

Item	Unit	Value
Atmospheric Data		
Ambient Dry Bulb Temperature		
Maximum	°F	95
Average	°F	74
Minimum	°F	35
Relative Humidity		
Average	%	80
Barometric Pressure		
Average	psia	14.69
Site Elevation	ft (AMSL)	13
Seismic Zone	UBC	*0*
Precipitation		
Annual Average in one year	inches	49
Maximum in 24-hours (100yr event)	inches	13
Ground Snow Load	pounds per square foot	0
Wind Velocity		
Design	mph(m/sec)	130(58.1)
Frost Line	inches	0

2. DESIGN CONDITIONS

2.3 Seller's Clarification / Assumption

Item	Seller's Clarification/Assumption
Steam Turbine / Generator and Accessories	The Steam Turbine / Generator and their accessories are MHI's standardized products. So, all equipment arranged around the steam turbine deck (including steam turbine) associated equipment such as lube oil system, control oil system and instrument and control system will be designed, manufactured, assembled, inspected, delivered in accordance with the MHI's standard. Therefore, please note that the specification of such components, including engineering, material selection, manufacturing and testing, can not be changed or modified in compliance with the Buyer's specific requirement. The Buyer may review and comment on Seller's documents, drawings and data sheets etc. for steam turbine and associated equipment, Seller, however, reserves all the rights of final acceptance/rejection of those comments for reasons explained above. If the modifications become mandatory by the American Law, local regulations and/or environmental impact study, then modification will be done with additional cost and change in project schedule. Environmental impact statement, Risk study, making application and taking approval of all permits shall be done by the Buyer. Seller will assist by preparing technical documents if requested by the Buyer. (Note) As explained above, this proposal is based on MHI and MHI's sub-supplier's standards. Major technical clarification and assumption are explained in the following sheets for Buyer's easy understanding.
Inland Transportation	Inland Transportation will not be included in MPS's Scope of

2. DESIGN CONDITIONS

2.3 Seller's Clarification / Assumption

Item	Seller's Clarification/Assumption
	Supply.
Witness testing of equipment in the factory	Buyer shall have the rights, at their own expense, to inspect during normal working hours, with reasonable notice, all work performed under Seller's scope of supply. With respect to any work and/ or test hereunder, Seller will perform it in accordance with manufacturer's standard procedure. Buyer shall not have any right to hold the point, to delay the manufacturing schedule to witness and to request Seller to re-perform the test by Buyer's failure to observe. Seller's inspection and test plan is to be submitted.
Noise Level	The maximum surface noise of equipment (excluding transient conditions like start up, shutdown, trip, etc. and intermittent and/or emergency use equipment such as safety valve systems etc.) at a distance of 3.3 feet (1 meter) from the source and at a height of 4 feet (1.2 meters) will not exceed 85 dB(A) with exception of ST enclosure and ST exhaust. Overall far field noise will be investigated and guaranteed by EPC Contractor. No noise restrictions are applicable to construction activities.
Freeze protection	Based on the minimum ambient temperature 35°F, freeze protection for Seller's equipment which located in ST enclosure except piping will be provided by Seller.
Manufacturer's Standard Design	Unless otherwise specified in this proposal, manufacturer's standard design, materials, sub-venders etc. will be applied to the steam turbine as much as applicable.

2. DESIGN CONDITIONS

2.3 Seller's Clarification / Assumption

Item	Seller's Clarification/Assumption
Generator kVA capacity	The kVA capacity of the generator will be based on meeting the rated output of the turbine at the specified cooling water temperature conditions and at rated generator power factor (0.90). The voltage rating of the generator will be selected based on the manufacturer's standard design criteria.
Auxiliary Cooling Water Temperature	See Utility List.
Gland Steam and Drain System	The configuration of Gland Steam System is shown in the Gland Steam and Drain Piping Diagram (T1-S5881 R3, T1-S5882 R4 and T1-S5883 R4). The design and pricing of the following equipment are related to the design of condenser, equipment layout, design of auxiliary steam system, etc. which are under EPC Contractor's responsibility. Therefore, the following equipment will not be provided by Seller and shall be provided by EPC Contractor. - Gland steam and drain piping and valves - The Gland Seal Steam Regulator consisting of gland steam header, pressure control valves, pressure transmitter and pipings. - Mist Separator - Seal Steam Desuperheater - Exhaust Hood Spray System except the Spray nozzles and thermocouples for Steam Turbine Exhaust Hood temperature measurement. - Condenser Curtain Water Spray System - Turbine Drains and Drain Receivers Seller will provide the technical data required for design of equipment under EPC Contractor's scope including flows, pressures, temperatures, control valve characteristics, etc.
Auxiliary Steam	Auxiliary Steam Requirement for ST are as follows:

2. DESIGN CONDITIONS

2.3 Seller's Clarification / Assumption

Item	Seller's Clarification/Assumption
Requirement	Minimum Pressure : 4.3 psig(0.3 kg/cm2g) (at Gland Seal Steam Regulator) Maximum Temperature: 700°F (350 °C) Maximum Flow : Approx. 8.82×10^3 lb/hr (4t/h) (For 1 ST)
Insulation procedure for ST	Insulation material and method for ST will be based on Seller's standard practice. (Refer to Insulation specification attached in section 8)
Painting	Painting specification and procedure will be as MHI's standard. Refer to STANDARD PAINTING SPECIFICATION FOR MECHANICAL EQUIPMENT attached in Section 8.
Condenser Air Extraction System	We assume that the condenser vacuum pumps will be applied for condenser air extraction system by EPC Contractor. Therefore, extraction steam for steam air ejector is not considered in Heat Balance Diagram and proposed performance.
Professional Engineers Stamp	Obtaining work of Professional Engineering Stamp is not included in this proposal.
Outdoor Installation	The equipment and systems included in this proposal are designed based on outdoor installation.
Steam Turbine Control Oil System	Steam turbine control oil system will be change from lower pressure system to higher pressure system to enhance controllability.
Oil Piping of Steam Turbine	Oil piping of the steam turbine will be specified in Section 8.25.

3. GUARANTEES

3.1 GUARANTEES

3. GUARANTEES

3.2 GUARANTEED PERFORMANCE and other GUARANTEES for ACCEPTANCE TEST

The guaranteed performances and other guarantees for Acceptance Testing of Steam Turbine, performed in accordance with Appendix C and other test procedure which may be mutually agreed in writing, are as follows:

3.2.1. Liquidated Damage Performance Guarantees

3.2.1.1 MPS Net Steam Turbine Electrical Output	391.67 MW
3.2.1.2 MPS Net Steam Turbine Maximum Electrical Output	420.07 MW

3.2.2 Emission Guarantees

3.2.2.1 Noise Levels	[85dBA or as shown in Section 8.11 of Appendix A]

3.2.3 Demonstration Guarantees

3.2.3.1 Minimum Load at Single Gas Turbine Unit 70% Load	Stable Operation
3.2.3.2 Generator Operations (Lead Lag)	0.90 lagging, 0.95 leading
3.2.3.3 Steam Turbine Load Ramp Rate	
3.2.3.3.1 Duct firing operation	[9 MW/min]

3.2.4 Availability Guarantee

97.5%

3.2.5 Conditions to Guarantees

The following conditions are applicable to guarantees set forth in this Section 3.2:

3.2.5.1 Liquidated Damage Performance Guarantees for MPS Net Steam Turbine Electrical Output is based on conditions stated in Section 3.3 and to the following:

3. GUARANTEES

3.2 GUARANTEED PERFORMANCE and other GUARANTEES for ACCEPTANCE TEST

1.	HP Steam Flow	1,821,390 lb/h
2.	IP Steam Flow (IP Superheater Outlet)	261,726 lb/h
3.	LP Admission Steam Flow	272,337 lb/h
4.	HP Steam Pressure	1,907.7 psia at HP SV Inlet
5.	HP Steam Temperature	1,044.3°F at HP SV Inlet
6.	Reheater and Reheat Piping Pressure Drop	9.65%
7.	Reheat Steam Temperature	1,046.3 °F at IP RSV Inlet
8.	LP Admission Steam Pressure	125.8 psia at LP SV Inlet
9.	LP Admission Steam Temperature	630.2 °F
10.	LP Exhaust Pressure	2.97 inHg abs. At LP Casing Outlet
11.	Make-up Water Flow	0%
12.	Auxiliary Steam Flow except Steam Turbine Gland Seal Steam	0 lb/h

The commercial test tolerance for the MPS Net Steam Turbine Electrical Output guarantee will have a range from a minimum of 1.8% to a maximum of 2.0%. The commercial test tolerance includes measurement uncertainty and will be based on actual instruments used during the testing. If the measurement uncertainty does not exceed +/- 1.5%, 1.8% of commercial test tolerance will be applied as the commercial test tolerance. If the measurement uncertainty is between 1.5% and 1.7%, measurement uncertainty plus 0.3% will be applied as the commercial test tolerance. Buyer will prepare a list of steam turbine instruments, test instruments, and the calculated measurement uncertainty. Buyer shall implement the testing method if the calculated measurement uncertainty is equal to or less than 1.5%. If the calculated measurement uncertainty is greater than 1.7%, then the Seller shall make recommendations for testing that shall establish a new calculated measurement uncertainty which is less than 1.7%. Buyer shall then have the option to implement the new testing instrumentation recommendations for conducting the Performance Test or allowing the commercial test tolerance to exceed 2.0%.

Degradation will be considered as provided in Section 8.9.

3. GUARANTEES

3.2 GUARANTEED PERFORMANCE and other GUARANTEES for ACCEPTANCE TEST

3.2.5.2 Liquidated Damage Performance Guarantee for MPS Net Steam Turbine Maximum Electrical Output are based on conditions stated in Section 3.3 and to the following:

1.	HP Steam Flow	2,195,420 lb/h
2.	IP Steam Flow (IP Superheater Outlet)	94,940 lb/h
3.	LP Admission Steam Flow	95,916 lb/h
4.	HP Steam Pressure	2,255.6 psia at HP SV Inlet
5.	HP Steam Temperature	1,027.5 °F at HP SV Inlet
6.	Reheater and Reheat Piping Pressure Drop	14.25%
7.	Reheat Steam Temperature	1,035.0 °F at IP SV Inlet
8.	LP Admission Steam Pressure	126.2 psia at LP SV Inlet
9.	LP Admission Steam Temperature	676.5 °F
10.	LP Exhaust Pressure	2.99 inHg abs. At LP Casing Outlet
11.	Make-up Water Flow	0%
12.	Auxiliary Steam Flow except Steam Turbine Gland Seal Steam	0 lb/h

The commercial test tolerance for the MPS Net Steam Turbine Maximum Electrical Output guarantee will have a range from a minimum of 1.8% to a maximum of 2.0%. The commercial test tolerance includes measurement uncertainty and will be based on actual instruments used during the testing. If the measurement uncertainty does not exceed +/- 1.5%, 1.8% of commercial test tolerance will be applied as the commercial test tolerance. If the measurement uncertainty is between 1.5% and 1.7%, measurement uncertainty plus 0.3% will be applied as the commercial test tolerance. Buyer will prepare a list of steam turbine instruments, test instruments, and the calculated measurement uncertainty. Buyer shall implement the testing method if the calculated measurement uncertainty is equal to or less than 1.5%. If the calculated measurement uncertainty is greater than 1.7%, then the Seller shall make recommendations for testing that shall establish a new calculated measurement uncertainty which is less than 1.7%. Buyer shall then have the option to implement the new testing instrumentation recommendations for conducting the Performance Test or allowing the commercial test tolerance to exceed 2.0%.

Degradation will be considered as provided in and Section 8.9.

3. GUARANTEES

3.2 GUARANTEED PERFORMANCE and other GUARANTEES for ACCEPTANCE TEST

3.2.5.3 The conditions applicable to the Noise Levels are:

The maximum surface noise of equipment (excluding unsteady conditions like start-up, shut-down, trip, etc. and intermittent and/or emergency use equipment such as safety valve systems etc.) at a distance of 3.3 feet (1 meter) from the source and at a height of 4 feet (1.2 meters) will not exceed 85 dB(A) with exception of specific equipments listed in Section 8.11 of Appendix A. The maximum surface noise of such equipments will not exceed those sound pressure levels listed in Section 8.11 of Appendix A when measured 3.3 feet (1 meter) from the source and at a height of 3.9 feet (1.18 meters). Overall far field noise will be guaranteed separately by EPC Contractor. No noise restrictions are applicable to construction activities

3.2.5.4 The conditions applicable to the Demonstration Guarantee for Minimum Load are:

Two (2) hours demonstration test is required.

Steam Turbine Unit inlet temperature will be adjusted to the following operational limits:

1. HP Steam Temperature	960°F +0/-50°F
2. RH Steam Temperature	910°F +0/-50°F
3. Temperature Deviation between HP and RH Steam	+/-50°F
4. Backend max temp	160°F

Note:
If each steam flow rate is changed, Seller reserves the right to modify the temperature limit.

3.2.5.5 The conditions applicable to the Demonstration Guarantee for Steam Turbine Generator Operations (Lead Lag) are:

The test shall be performed under the conditions described in Section 2.2.2.

3.2.5.6 The conditions applicable to the Demonstration Guarantee for the Steam Turbine Load Ramp Rate are:

3. GUARANTEES

3.2 GUARANTEED PERFORMANCE and other GUARANTEES for ACCEPTANCE TEST

The test shall be performed under the conditions described in Section 2.2.3 of Appendix C. In case that the ramp rate of Steam Turbine Unit is limited by the other party's equipment, the Demonstration Guarantee is changed to the allowable ramp rate of power plant. The ramp rates are based on conditions stated on the following ranges:

1. HP Steam Temperature Deviation during load ramp
   +25 °F/-14 °F from initial temperature* of load ramp
2. RH Steam Temperature Deviation during load ramp
   +25 °F/-14 °F from initial temperature* of load ramp
3. LP Admission Steam Temperature Deviation during load ramp
   +25 °F/-14 °F from initial temperature of load ramp

Note*: If initial temperature exceeds 1,050.8 °F, the temperature limit of high side is 1,076 °F.

3.2.5.7 The conditions applicable to the Demonstration Guarantee for Steam Turbine Unit Trip Capability are:

The test shall be performed under the conditions described in Section 3.2.1 of Appendix-C.

Steam turbine exhaust pressure and temperature should be controlled to be less than the limitation specified in Section 5.3.

3.2.5.8 The conditions applicable to the Availability Guarantee are:

The test shall be performed under the conditions described in Section 2.3 of Appendix C.

3. GUARANTEES

3.3 BASIS FOR GUARANTEED PERFORMANCE

1. Definition of MPS Net Steam Turbine Electrical Output

   "MPS Net Steam Turbine Electrical Output" is calculated as the following conditions

   P_{NST} ; MPS Net Steam Turbine Electrical Output

   P_G ; Gross output (= Generator terminal output)

   P_{AST} ; Auxiliary Power Consumption for ST and STG's Auxiliaries. (Please refer to 4.4)

   $P_{NST} = P_G - P_{AST}$

2. The guaranteed values are based on each equipment being a new and clean conditions, not contaminated. Degradation shall be determined from Seller's degradation curve for the steam turbine equipment based on ASME PTC-6.

3. Corrections shall be applied to the test result for any deviations of the test conditions from those specified. Correction factors for deviations of the operating conditions may be in the form of curves or numerical values. Correction factors will be submitted prior to the acceptance test.

4. PERFORMANCE

4.1 PERFORMANCE DESIGN CONDITION

Steam Turbine Generator Performance Design Condition

Steam Turbine Generator performance is based on the design conditions and plant performance parameters as indicated in the Steam Turbine Performance Diagram.
If any of the equipment, arrangement, performance parameters, etc. are changed or if there is a difference in performance of the equipment under Buyer's scope, the steam turbine performance also will be changed.

These performance parameters are based on the reference Heat Balance Diagrams of Combined Cycle Operation.
The steam turbine and its generator have been designed and manufactured under the conditions of these reference Heat Balance Diagrams. Any changes and/or modifications to this proposal must be carefully studied by both the Buyer and the Seller.
Seller has a right to reject the unacceptable changes and/or modifications against these reference Heat Balance Diagrams.

4. PERFORMANCE

4.2 PERFORMANCE DATA

Steam Turbine Performance

Operating Point	Case 28	Case 48
Frequency	60Hz	
Generator Power Factor	0.90	0.949
HRSG Drum Blowdown	0%	
Duct Firing	OFF	ON
HP Steam Flow ($x10^3$lb/h)	1,821.39	2,195.42
IP Steam Flow (IP Drum Outlet) ($x10^3$lb/h)	261.726	94.94
LP Admission Steam Flow ($x10^3$lb/h)	272.337	95.916
HP Steam Pressure at HPSV Inlet (psia)	1,907.7	2,255.6
HP Steam Temperature at HPSV Inlet (°F)	1,044.3	1,027.5
Reheater and Reheat Steam Piping Pressure Drop (%)	9.65	14.25
RH Steam Temperature at RSV Inlet (°F)	1,046.3	1,035.0
LP Admission Steam Pressure at LPSV Inlet (psia)	125.8	126.2
LP Admission Steam Temperature at LPSV Inlet (°F)	630.2	676.5
Condenser Vacuum *2 [ST Back Pressure at terminal point]	2.97 inHg	2.99 inHg
Gross Steam Turbine Output (MW) *1	391.8	420.2
Auxiliary Power Consumption For ST/STG *1	130kW	130kW
Auxiliary Cooling Water Temperature (°F) *3	105	105
Remarks		

*1 : The value given are based on New and Clean condition.
*2 : ST back pressure will be measured by basket tips
*3 : The value given are based on Seller's estimation.

4. PERFORMANCE

4.3 PERFORMANCE TEST PHILOSOPHY

Steam Turbine Performance Test Philosophy

1. Introduction

This issue describes the basic items which should be agreed by both parties (the Buyer and Seller) before issuing the "Performance Test Procedure". As a rule, the procedure will be established under the concept of measuring the steam turbine guaranteed condition being not to measure the whole unit performance including the Gas Turbine and HRSG.

2. Test Code

The test will be carried out mainly based on ASME PTC-6 1996. The final procedure will be fixed with the "Performance Test Procedure" written by Seller and approved by Buyer.

3. Role of the Parties

3.1 Evaluation

Both parties will share all data and make an evaluation. The final result will be established by mutual agreement.

3.2 Instrumentation

- Buyer will provide the special instruments, wiring and data acquisition system within the supply boundary including the feedwater condensate flow nozzle*.
- Buyer will provide the calibration record of the special instruments within the supply boundary*.
- The feedwater condensate flow nozzle, which might be installed downstream of the gland steam condenser, must be calibrated. The calibration of this flow nozzle will be done by a third party authority.*
  Also, the special care should be taken to the location, straight pipe length and the adoption of the flow straightener, etc. according to ASME PTC-6.
  The specification of the nozzle, piping routine around the nozzle and the calibration result will be reviewed by Seller.
- Seller requires to prepare the temporary PT/CT connection at Watt-Hour meter.*

4. PERFORMANCE

4.3 PERFORMANCE TEST PHILOSOPHY

· In order to obtain the main/reheat/LP steam flow, the measured flow rate of each feedwater and/or steam line will be utilized. The flow measuring instruments of these portions are subjected outside Seller's portion.

The gross flow will be measured by the feedwater condensed flow nozzle and this gross flow will be separated into the HP steam, IP steam and LP steam flow by using the flow ratio obtained through the feedwater and/or steam flow measurement results.
If a certain steam flow rate is required in order to obtain the HP/IP/LP steam flow, the steam flow measuring device will be supplied by others except for Seller. As for this steam flow measurement device, Seller will review the specification of the instrument, transmitter and data acquisition system and the accuracy ,etc. prior to the test.

· The instruments of below points are subjected to others except for Seller. Seller will review the specification of the instrument, transmitter and data acquisition system and accuracy, etc. prior to the test.
HP steam pressure and temperature
HP turbine exhaust steam pressure and temperature
RH steam pressure and temperature
LP steam pressure and temperature
Feedwater flow, pressure and temperature

· As for the LP exhaust pressure, the basket tip based on the PTC-6 will be provided by Seller and this pressure will be used.
· The electrical power will be measured by Mitsubishi Electric Corporation.

4. Corrections
The measured data will be corrected by below items.
1) HP Steam Flow
2) IP Steam Flow (IP SH Outlet)
3) LP Admission Steam Flow

4. PERFORMANCE

4.3 PERFORMANCE TEST PHILOSOPHY

4) HP Steam Pressure at HPSV inlet
5) HP Steam Temperature at HPSV inlet
6) RH Steam Temperature at RSV inlet
7) LP Steam Pressure at LPSV inlet
8) LP Steam Temperature at LPSV inlet
9) Reheater and Reheat Steam Piping Pressure Drop
10) Steam Turbine Back Pressure
11) Make-up Flow
12) Auxiliary Steam Flow
13) Generator Power Factor
14) Generator H2 Gas Pressure
15) Degradation of Steam Turbine**

* Seller can provide the feedwater condensate flow nozzle with the calibration result, Watt-Hour meter and other special instruments as an option.

**A deterioration correction will be applied if the first synchronization is not achieved within twenty-four (24) months from the shipment from Japan. The deterioration correction shall not exceed 0.1%.

If the test is not carried out within sixty(60) days after the first synchronization, then Section 8.9 Degradation Factor will be applied.

4. PERFORMANCE

4.4 AUXILIARY POWER CONSUMPTION

List of Load for Auxiliary Power Consumption for Seller's Equipment

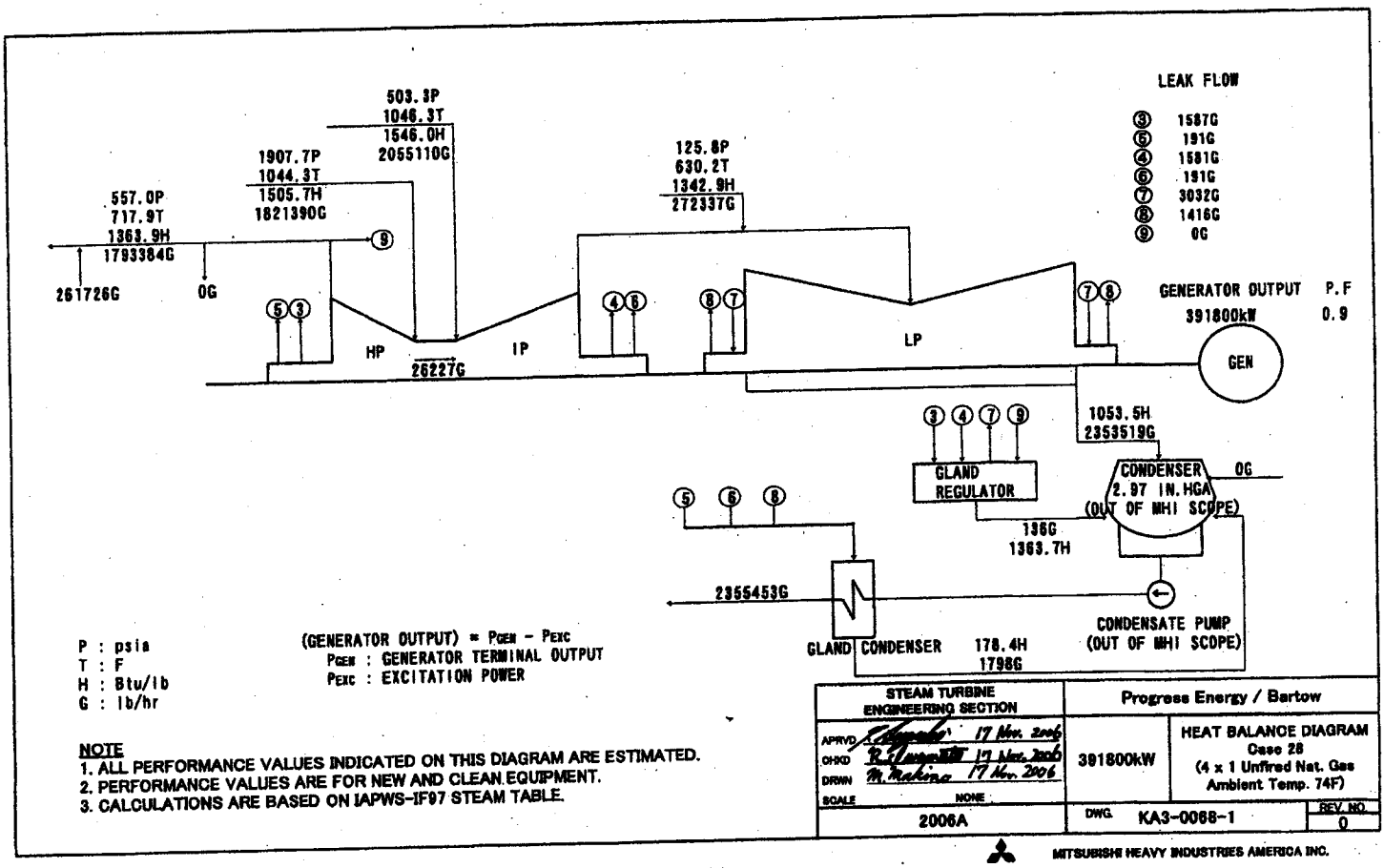
O : Included

	Equipment	
ST	Gland Condenser Exhaust Fan	O
	Lub. Oil Purifier Circulating Pump	O
	EH Control Oil Pump	O
	Vapor Extractor	O
	Control Power	O
ST GEN	Seal Oil Pump	O
	GEN Vacuum Pump	O
	Vapor Extractor	O
	Purity Meter Blower	O
	Excitation Cubicle	O
	AVR Cubicle	O
	GEN Control Panel	O
	Protection Relay Panel	O
	H2 Gas and Seal Oil Control Panel	O
	PT/SA Cubicle	O

Heat Balance Diagram

Heat Balance Diagram of Steam Turbine

Point	GT Load	Duct Firing	Cal. Point	Drawing No.	Rev. No.
Steam Turbine Generator Net Equipment Electrical Output	4 x 100%	OFF	Case28	KA3-0068-1	0
Steam Turbine Generator Net Equipment Maximum Electrical Output	3 x 100%	ON	Case48	KA3-0068-2	0
Steam Turbine Generator Net Equipment Minimum Electrical Output	1 x 70%	OFF	Case114	KA3-0068-3	0



P : psia
T : F
H : Btu/lb
G : lb/hr

(GENERATOR OUTPUT) = PGEN - PEXC
PGEN : GENERATOR TERMINAL OUTPUT
PEXC : EXCITATION POWER

NOTE
1. ALL PERFORMANCE VALUES INDICATED ON THIS DIAGRAM ARE ESTIMATED.
2. PERFORMANCE VALUES ARE FOR NEW AND CLEAN EQUIPMENT.
3. CALCULATIONS ARE BASED ON IAPWS-IF97 STEAM TABLE.

STEAM TURBINE ENGINEERING SECTION		Progress Energy / Bartow	
APRVD	17 Nov. 2006	391800kW	HEAT BALANCE DIAGRAM Case 28 (4 x 1 Unfired Nat. Gas Ambient Temp. 74F)
CHKD	17 Nov. 2006		
DRWN	M. Makino 17 Nov. 2006		
SCALE NONE		DWG. KA3-0068-1	REV. NO. 0
2006A			

MITSUBISHI HEAVY INDUSTRIES AMERICA INC.

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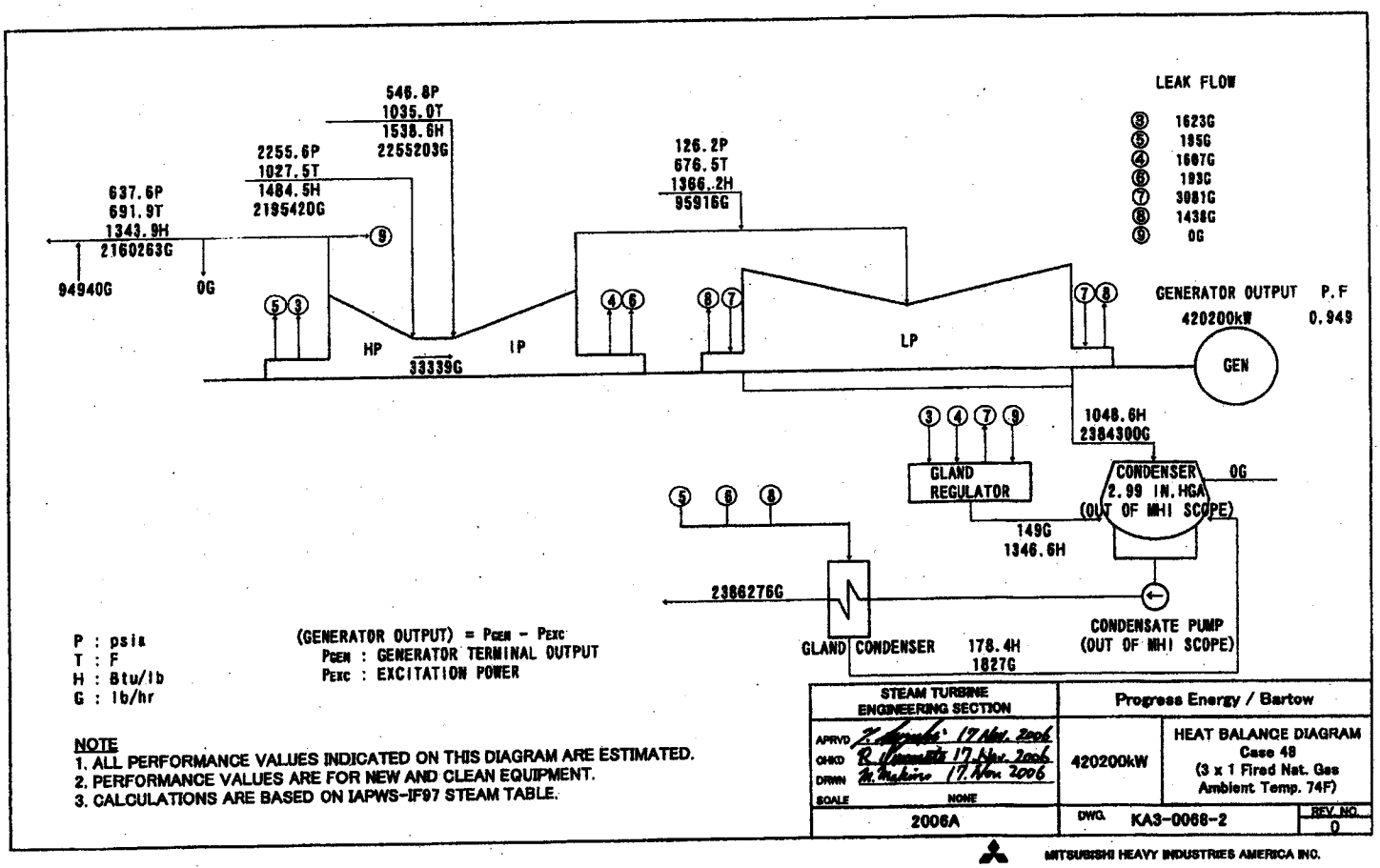
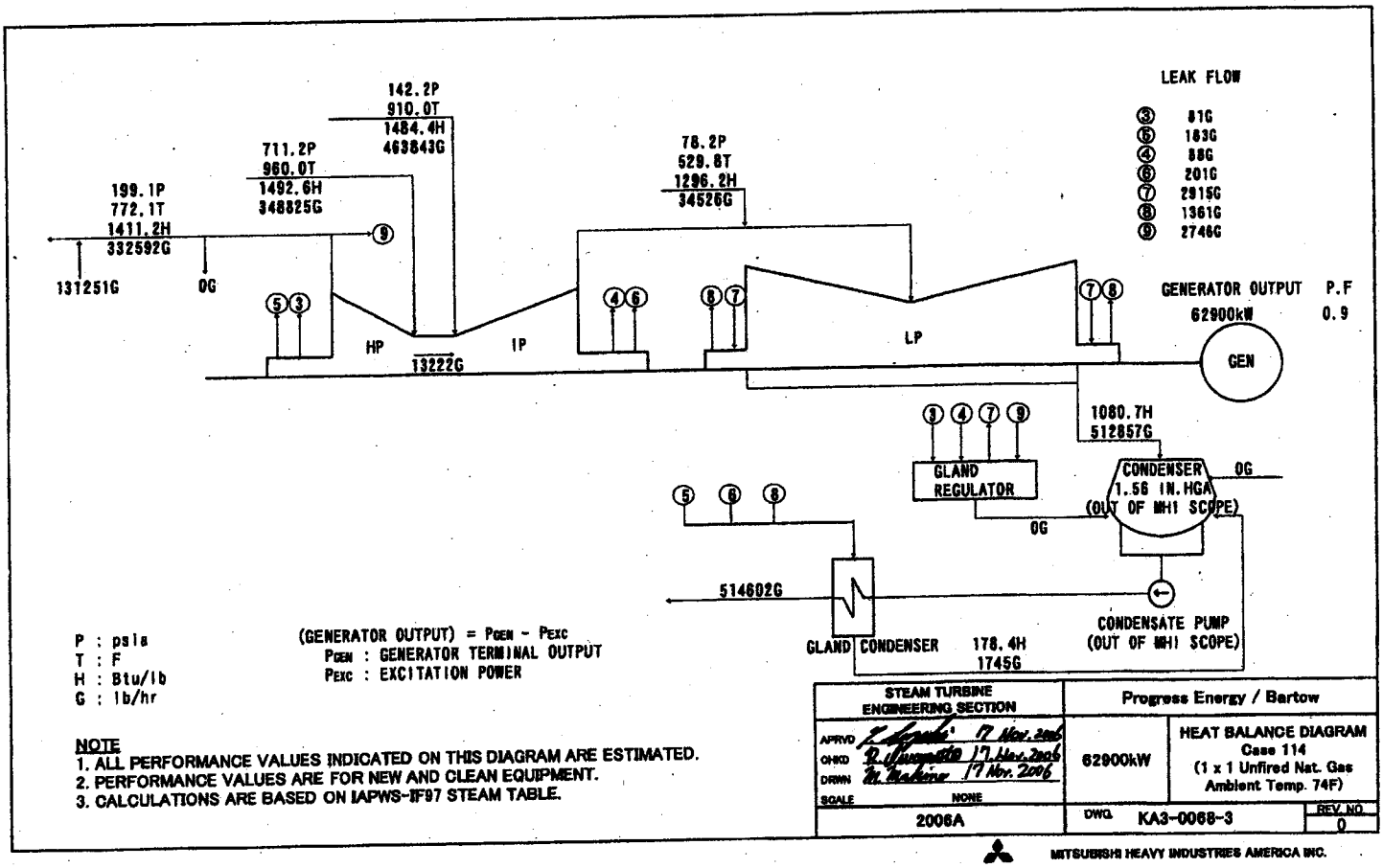


DEF-19FL-FUEL-012446


142.2P
910.0T
1484.4H
463843G
711.2P
960.0T
1492.6H
348825G
199.1P
772.1T
1411.2H
332592G
131251G
0G
78.2P
529.8T
1296.2H
34526G
LEAK FLOW
③ 81G
⑤ 183G
④ 88G
⑥ 201G
⑦ 2915G
⑧ 1361G
⑨ 2746G
GENERATOR OUTPUT P.F
62900kW 0.9
GEN
HP
IP
LP
13222G
1080.7H
512857G
GLAND REGULATOR
CONDENSER
1.56 IN.HGA
(OUT OF MHI SCOPE)
0G
514602G
GLAND CONDENSER
178.4H
1745G
CONDENSATE PUMP
(OUT OF MHI SCOPE)
P : psia
T : F
H : Btu/lb
G : lb/hr
(GENERATOR OUTPUT) = PGEN - PEXC
PGEN : GENERATOR TERMINAL OUTPUT
PEXC : EXCITATION POWER
NOTE
1. ALL PERFORMANCE VALUES INDICATED ON THIS DIAGRAM ARE ESTIMATED.
2. PERFORMANCE VALUES ARE FOR NEW AND CLEAN EQUIPMENT.
3. CALCULATIONS ARE BASED ON IAPWS-IF97 STEAM TABLE.
STEAM TURBINE ENGINEERING SECTION
Progress Energy / Bartow
APRVD 17 Nov. 2006
CHKD 17 Nov. 2006
DRWN 17 Nov. 2006
SCALE NONE
62900kW
HEAT BALANCE DIAGRAM
Case 114
(1 x 1 Unfired Nat. Gas
Ambient Temp. 74F)
2006A
DWG. KA3-0068-3
REV. NO. 0
MITSUBISHI HEAVY INDUSTRIES AMERICA INC.

4. PERFORMANCE

4.5 HEAT BALANCE DIAGRAM

Heat Balance Diagram of Steam Turbine

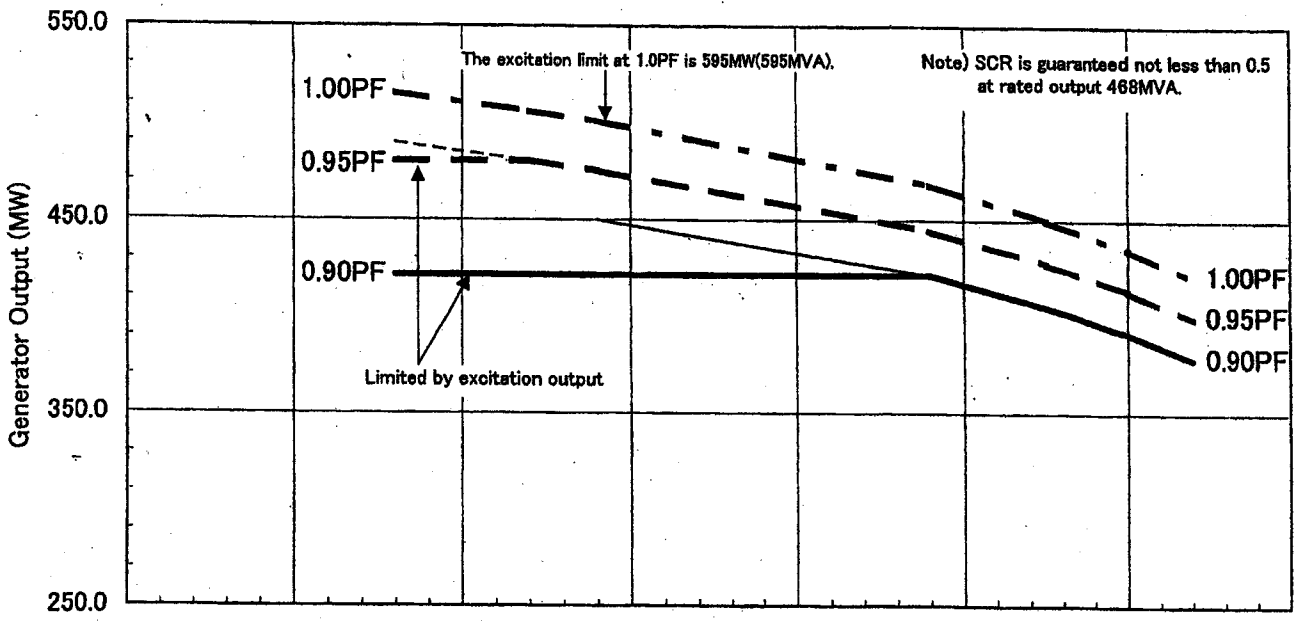
Refer to the drawing KA3-0068-1 Rev.0, KA3-0068-2 Rev.0 and KA3-0068-3 Rev.0.

CONFIDENTIAL

KC917171

Bartow Repoweing Project [B]

COOLING WATER TEMPERATURE VERSUS GENERATOR OUTPUT CURVE
(According to ANSI B temperature rise, Hydrogen gas pressure:0.50MPa-g)



APPROVED	H. Ohashi
CHECKED	J. Kanda
DESIGNED	02-4/8 N. Arikawa S. Nomura
Rev.A We amended note.	S. Nomura 06-4/6 T. Nishida
Rev.B We amended [B] name.	S. Nomura 09-2/6 T. Nishida

The generator output curve shows only limitted by ANSI B temperature rise. The generator output may be also limitted by another functions. (i.e. SCR, cooling water condition, and so on.)

[B]

SCR defined in MHI (MELCO) doc (ABF-A632-048)
Tabulated data in MHI (MELCO) doc (ABF-A632-048)

KC917171 Rev.B

DEF-19FL-FUEL-012473

CONFIDENTIAL

DOAH CASE NO. 19-006022

COMMISSION STAFF EXHIBIT NO. 110

Excerpt from Progress Energy Florida – Mitsubishi 2008 Contract.

CONFIDENTIAL

Progress Energy

Mitsubishi Power Systems Americas, Inc.
100 Colonial Center Pkwy
Lake Mary, FL 32746

Attention: Mr. Howard Perkins, Proj. Mgr.

CONTRACT NO. 270810
AMENDMENT NO. 005
EFFECTIVE JANUARY 2, 2008

By this Amendment, Progress Energy Florida, Inc. (hereinafter "Owner" or "Buyer") offers to change the terms of the above-referenced Contract.

The Description of Work is amended at Owner's Bartow Plant, 1601 Weedon Island Dr., St. Petersburg, FL 33702 (hereinafter "Work").

The following sections of this Contract shall be replaced in their entirety.

Appendix A – Scope of Supply for Steam Turbine Generator
Appendix C – Acceptance Test Guidelines, Procedures, and Specifications
Appendix G – Drawing List
Appendix L – Inspection and Test Plan at Shop (for major components of steam turbine)
Attachment B-1 of Appendix I – Field Service Rates – Schedule of Charges

Except as modified herein, all other terms in the Contract or other Contract Amendments remain unchanged; and this Amendment is governed by those terms and conditions of the above-referenced Contract.

Progress Energy Service Company, LLC
P.O. Box 1551
Raleigh, NC 27602

Please execute this Amendment, retain an original for your file, and return the other original within ten (10) calendar days to Jenny Williams, Progress Energy Service Company, LLC, P. O. Box 1551 (PEB-8), Raleigh, NC 27602. Overnight delivery should be sent to 410 S. Wilmington Street, PEB 8, Raleigh, NC 27601. If you have any questions, please call Jenny Williams at 919-546-4090.

Sincerely,

Mark Smothers
General Manager - Construction

Accepted:

MITSUBISHI POWER SYSTEMS AMERICAS, INC.

By: _____

Name (printed): Shinichi Ueki

Title: VP, Commercial Operations

Date: January 14, 2008

Should the person's title who is executing this document not indicate that he/she is a corporate officer, an affidavit signed by a corporate officer shall be provided stating that the person whose name appears above is duly authorized to execute Contracts on behalf of the firm.

APPENDIX A
Scope of Supply for Steam Turbine Generator
(Revised January 2, 2008)

BARTOW REPOWERING PROJECT

SCOPE OF SUPPLY

FOR

STEAM TURBINE GENERATOR

T-0204-030 Rev.2

***MARCH*, 2007**

MITSUBISHI POWER SYSTEMS, INC.

CONTENTS

1. INTRODUCTION

The information included in this document has been prepared in accordance with Mitsubishi Heavy Industries, Ltd. (MHI) engineering standards and is based on experience gained by MHI during the completion of combined cycle plants throughout the world. Each project is customized in consideration of our client's specific requirements.

MHI is a leader in the power industry who has produced more than 28,000 MW of Gas turbines, 140,000 MW of steam turbines, and 550,000 tons per hour of steam generation boilers, including HRSG's.

This proposal describes the scope of supply and technical information of the equipment for the steam turbine and generator which can be used in a 4 on 1 combined cycle power plant.

Major equipment included in the proposal is as follows;

- One (1) Steam Turbine and Generator

2. DESIGN CONDITIONS

2.1 General

The equipment and systems included in this proposal are designed based on the design conditions described herein and MHI's standard design practice.

In the event the design conditions and assumptions as stated in this section. Seller reserves the right to modify the design, guarantees and/or pricing accordingly.

2. DESIGN CONDITIONS

2.2 SITE CONDITIONS

Item	Unit	Value
Atmospheric Data		
Ambient Dry Bulb Temperature		
Maximum	°F	95
Average	°F	74
Minimum	°F	35
Relative Humidity		
Average	%	80
Barometric Pressure		
Average	psia	14.69
Site Elevation	ft (AMSL)	13
Seismic Zone	UBC	*0*
Precipitation		
Annual Average in one year	inches	49
Maximum in 24-hours (100yr event)	inches	13
Ground Snow Load	pounds per square foot	0
Wind Velocity		
Design	mph(m/sec)	130(58.1)
Frost Line	inches	0

2. DESIGN CONDITIONS

2.3 Seller's Clarification / Assumption

Item	Seller's Clarification/Assumption
Steam Turbine / Generator and Accessories	The Steam Turbine / Generator and their accessories are MHI's standardized products. So, all equipment arranged around the steam turbine deck (including steam turbine) associated equipment such as lube oil system, control oil system and instrument and control system will be designed, manufactured, assembled, inspected, delivered in accordance with the MHI's standard. Therefore, please note that the specification of such components, including engineering, material selection, manufacturing and testing, can not be changed or modified in compliance with the Buyer's specific requirement. The Buyer may review and comment on Seller's documents, drawings and data sheets etc. for steam turbine and associated equipment, Seller, however, reserves all the rights of final acceptance/rejection of those comments for reasons explained above. If the modifications become mandatory by the American Law, local regulations and/or environmental impact study, then modification will be done with additional cost and change in project schedule. Environmental impact statement, Risk study, making application and taking approval of all permits shall be done by the Buyer. Seller will assist by preparing technical documents if requested by the Buyer. (Note) As explained above, this proposal is based on MHI and MHI's sub-supplier's standards. Major technical clarification and assumption are explained in the following sheets for Buyer's easy understanding.
Inland Transportation	Inland Transportation will not be included in MPS's Scope of

2. DESIGN CONDITIONS

2.3 Seller's Clarification / Assumption

Item	Seller's Clarification/Assumption
	Supply.
Witness testing of equipment in the factory	Buyer shall have the rights, at their own expense, to inspect during normal working hours, with reasonable notice, all work performed under Seller's scope of supply. With respect to any work and/ or test hereunder, Seller will perform it in accordance with manufacturer's standard procedure. Buyer shall not have any right to hold the point, to delay the manufacturing schedule to witness and to request Seller to re-perform the test by Buyer's failure to observe. Seller's inspection and test plan is to be submitted.
Noise Level	The maximum surface noise of equipment (excluding transient conditions like start up, shutdown, trip, etc. and intermittent and/or emergency use equipment such as safety valve systems etc.) at a distance of 3.3 feet (1 meter) from the source and at a height of 4 feet (1.2 meters) will not exceed 85 dB(A) with exception of ST enclosure and ST exhaust. Overall far field noise will be investigated and guaranteed by EPC Contractor. No noise restrictions are applicable to construction activities.
Freeze protection	Based on the minimum ambient temperature 35°F, freeze protection for Seller's equipment which located in ST enclosure except piping will be provided by Seller.
Manufacturer's Standard Design	Unless otherwise specified in this proposal, manufacturer's standard design, materials, sub-venders etc. will be applied to the steam turbine as much as applicable.

2. DESIGN CONDITIONS

2.3 Seller's Clarification / Assumption

Item	Seller's Clarification/Assumption
Generator kVA capacity	The kVA capacity of the generator will be based on meeting the rated output of the turbine at the specified cooling water temperature conditions and at rated generator power factor (0.90). The voltage rating of the generator will be selected based on the manufacturer's standard design criteria.
Auxiliary Cooling Water Temperature	See Utility List.
Gland Steam and Drain System	The configuration of Gland Steam System is shown in the Gland Steam and Drain Piping Diagram (T1-S5881 R3, T1-S5882 R4 and T1-S5883 R4). The design and pricing of the following equipment are related to the design of condenser, equipment layout, design of auxiliary steam system, etc. which are under EPC Contractor's responsibility. Therefore, the following equipment will not be provided by Seller and shall be provided by EPC Contractor. - Gland steam and drain piping and valves - The Gland Seal Steam Regulator consisting of gland steam header, pressure control valves, pressure transmitter and pipings. - Mist Separator - Seal Steam Desuperheater - Exhaust Hood Spray System except the Spray nozzles and thermocouples for Steam Turbine Exhaust Hood temperature measurement. - Condenser Curtain Water Spray System - Turbine Drains and Drain Receivers Seller will provide the technical data required for design of equipment under EPC Contractor's scope including flows, pressures, temperatures, control valve characteristics, etc.
Auxiliary Steam	Auxiliary Steam Requirement for ST are as follows:

2. DESIGN CONDITIONS

2.3 Seller's Clarification / Assumption

Item	Seller's Clarification/Assumption
Requirement	Minimum Pressure : 4.3 psig(0.3 kg/cm2g) (at Gland Seal Steam Regulator) Maximum Temperature: 700°F (350 °C) Maximum Flow : Approx. 8.82×10^3 lb/hr (4t/h) (For 1 ST)
Insulation procedure for ST	Insulation material and method for ST will be based on Seller's standard practice. (Refer to Insulation specification attached in section 8)
Painting	Painting specification and procedure will be as MHI's standard. Refer to STANDARD PAINTING SPECIFICATION FOR MECHANICAL EQUIPMENT attached in Section 8.
Condenser Air Extraction System	We assume that the condenser vacuum pumps will be applied for condenser air extraction system by EPC Contractor. Therefore, extraction steam for steam air ejector is not considered in Heat Balance Diagram and proposed performance.
Professional Engineers Stamp	Obtaining work of Professional Engineering Stamp is not included in this proposal.
Outdoor Installation	The equipment and systems included in this proposal are designed based on outdoor installation.
Steam Turbine Control Oil System	Steam turbine control oil system will be change from lower pressure system to higher pressure system to enhance controllability.
Oil Piping of Steam Turbine	Oil piping of the steam turbine will be specified in Section 8.25.

3. GUARANTEES

3.1 GUARANTEES

3. GUARANTEES

3.2 GUARANTEED PERFORMANCE and other GUARANTEES for ACCEPTANCE TEST

The guaranteed performances and other guarantees for Acceptance Testing of Steam Turbine, performed in accordance with Appendix C and other test procedure which may be mutually agreed in writing, are as follows:

3.2.1. Liquidated Damage Performance Guarantees

3.2.1.1 MPS Net Steam Turbine Electrical Output	391.67 MW
3.2.1.2 MPS Net Steam Turbine Maximum Electrical Output	420.07 MW

3.2.2 Emission Guarantees

3.2.2.1 Noise Levels	[85dBA or as shown in Section 8.11 of Appendix A]

3.2.3 Demonstration Guarantees

3.2.3.1 Minimum Load at Single Gas Turbine Unit 70% Load	Stable Operation
3.2.3.2 Generator Operations (Lead Lag)	0.90 lagging, 0.95 leading
3.2.3.3 Steam Turbine Load Ramp Rate	
3.2.3.3.1 Duct firing operation	[9 MW/min]

3.2.4 Availability Guarantee

97.5%

3.2.5 Conditions to Guarantees

The following conditions are applicable to guarantees set forth in this Section 3.2:

3.2.5.1 Liquidated Damage Performance Guarantees for MPS Net Steam Turbine Electrical Output is based on conditions stated in Section 3.3 and to the following:

3. GUARANTEES

3.2 GUARANTEED PERFORMANCE and other GUARANTEES for ACCEPTANCE TEST

1.	HP Steam Flow	1,821,390 lb/h
2.	IP Steam Flow (IP Superheater Outlet)	261,726 lb/h
3.	LP Admission Steam Flow	272,337 lb/h
4.	HP Steam Pressure	1,907.7 psia at HP SV Inlet
5.	HP Steam Temperature	1,044.3°F at HP SV Inlet
6.	Reheater and Reheat Piping Pressure Drop	9.65%
7.	Reheat Steam Temperature	1,046.3 °F at IP RSV Inlet
8.	LP Admission Steam Pressure	125.8 psia at LP SV Inlet
9.	LP Admission Steam Temperature	630.2 °F
10.	LP Exhaust Pressure	2.97 inHg abs. At LP Casing Outlet
11.	Make-up Water Flow	0%
12.	Auxiliary Steam Flow except Steam Turbine Gland Seal Steam	0 lb/h

The commercial test tolerance for the MPS Net Steam Turbine Electrical Output guarantee will have a range from a minimum of 1.8% to a maximum of 2.0%. The commercial test tolerance includes measurement uncertainty and will be based on actual instruments used during the testing. If the measurement uncertainty does not exceed +/- 1.5%, 1.8% of commercial test tolerance will be applied as the commercial test tolerance. If the measurement uncertainty is between 1.5% and 1.7%, measurement uncertainty plus 0.3% will be applied as the commercial test tolerance. Buyer will prepare a list of steam turbine instruments, test instruments, and the calculated measurement uncertainty. Buyer shall implement the testing method if the calculated measurement uncertainty is equal to or less than 1.5%. If the calculated measurement uncertainty is greater than 1.7%, then the Seller shall make recommendations for testing that shall establish a new calculated measurement uncertainty which is less than 1.7%. Buyer shall then have the option to implement the new testing instrumentation recommendations for conducting the Performance Test or allowing the commercial test tolerance to exceed 2.0%.

Degradation will be considered as provided in Section 8.9.

3. GUARANTEES

3.2 GUARANTEED PERFORMANCE and other GUARANTEES for ACCEPTANCE TEST

3.2.5.2 Liquidated Damage Performance Guarantee for MPS Net Steam Turbine Maximum Electrical Output are based on conditions stated in Section 3.3 and to the following:

1.	HP Steam Flow	2,195,420 lb/h
2.	IP Steam Flow (IP Superheater Outlet)	94,940 lb/h
3.	LP Admission Steam Flow	95,916 lb/h
4.	HP Steam Pressure	2,255.6 psia at HP SV Inlet
5.	HP Steam Temperature	1,027.5 °F at HP SV Inlet
6.	Reheater and Reheat Piping Pressure Drop	14.25%
7.	Reheat Steam Temperature	1,035.0 °F at IP SV Inlet
8.	LP Admission Steam Pressure	126.2 psia at LP SV Inlet
9.	LP Admission Steam Temperature	676.5 °F
10.	LP Exhaust Pressure	2.99 inHg abs. At LP Casing Outlet
11.	Make-up Water Flow	0%
12.	Auxiliary Steam Flow except Steam Turbine Gland Seal Steam	0 lb/h

The commercial test tolerance for the MPS Net Steam Turbine Maximum Electrical Output guarantee will have a range from a minimum of 1.8% to a maximum of 2.0%. The commercial test tolerance includes measurement uncertainty and will be based on actual instruments used during the testing. If the measurement uncertainty does not exceed +/- 1.5%, 1.8% of commercial test tolerance will be applied as the commercial test tolerance. If the measurement uncertainty is between 1.5% and 1.7%, measurement uncertainty plus 0.3% will be applied as the commercial test tolerance. Buyer will prepare a list of steam turbine instruments, test instruments, and the calculated measurement uncertainty. Buyer shall implement the testing method if the calculated measurement uncertainty is equal to or less than 1.5%. If the calculated measurement uncertainty is greater than 1.7%, then the Seller shall make recommendations for testing that shall establish a new calculated measurement uncertainty which is less than 1.7%. Buyer shall then have the option to implement the new testing instrumentation recommendations for conducting the Performance Test or allowing the commercial test tolerance to exceed 2.0%.

Degradation will be considered as provided in and Section 8.9.

3. GUARANTEES

3.2 GUARANTEED PERFORMANCE and other GUARANTEES for ACCEPTANCE TEST

3.2.5.3 The conditions applicable to the Noise Levels are:

The maximum surface noise of equipment (excluding unsteady conditions like start-up, shut-down, trip, etc. and intermittent and/or emergency use equipment such as safety valve systems etc.) at a distance of 3.3 feet (1 meter) from the source and at a height of 4 feet (1.2 meters) will not exceed 85 dB(A) with exception of specific equipments listed in Section 8.11 of Appendix A. The maximum surface noise of such equipments will not exceed those sound pressure levels listed in Section 8.11 of Appendix A when measured 3.3 feet (1 meter) from the source and at a height of 3.9 feet (1.18 meters). Overall far field noise will be guaranteed separately by EPC Contractor. No noise restrictions are applicable to construction activities

3.2.5.4 The conditions applicable to the Demonstration Guarantee for Minimum Load are:

Two (2) hours demonstration test is required.

Steam Turbine Unit inlet temperature will be adjusted to the following operational limits:

1. HP Steam Temperature	960°F +0/-50°F
2. RH Steam Temperature	910°F +0/-50°F
3. Temperature Deviation between HP and RH Steam	+/-50°F
4. Backend max temp	160°F

Note:
If each steam flow rate is changed, Seller reserves the right to modify the temperature limit.

3.2.5.5 The conditions applicable to the Demonstration Guarantee for Steam Turbine Generator Operations (Lead Lag) are:

The test shall be performed under the conditions described in Section 2.2.2.

3.2.5.6 The conditions applicable to the Demonstration Guarantee for the Steam Turbine Load Ramp Rate are:

3. GUARANTEES

3.2 GUARANTEED PERFORMANCE and other GUARANTEES for ACCEPTANCE TEST

The test shall be performed under the conditions described in Section 2.2.3 of Appendix C. In case that the ramp rate of Steam Turbine Unit is limited by the other party's equipment, the Demonstration Guarantee is changed to the allowable ramp rate of power plant. The ramp rates are based on conditions stated on the following ranges:

1. HP Steam Temperature Deviation during load ramp
   +25 °F/-14 °F from initial temperature* of load ramp
2. RH Steam Temperature Deviation during load ramp
   +25 °F/-14 °F from initial temperature* of load ramp
3. LP Admission Steam Temperature Deviation during load ramp
   +25 °F/-14 °F from initial temperature of load ramp

Note*: If initial temperature exceeds 1,050.8 °F, the temperature limit of high side is 1,076 °F.

3.2.5.7 The conditions applicable to the Demonstration Guarantee for Steam Turbine Unit Trip Capability are:

The test shall be performed under the conditions described in Section 3.2.1 of Appendix-C.

Steam turbine exhaust pressure and temperature should be controlled to be less than the limitation specified in Section 5.3.

3.2.5.8 The conditions applicable to the Availability Guarantee are:

The test shall be performed under the conditions described in Section 2.3 of Appendix C.

3. GUARANTEES

3.3 BASIS FOR GUARANTEED PERFORMANCE

1. Definition of MPS Net Steam Turbine Electrical Output

   "MPS Net Steam Turbine Electrical Output" is calculated as the following conditions

   P_{NST} ; MPS Net Steam Turbine Electrical Output

   P_G ; Gross output (= Generator terminal output)

   P_{AST} ; Auxiliary Power Consumption for ST and STG's Auxiliaries. (Please refer to 4.4)

   $P_{NST} = P_G - P_{AST}$

2. The guaranteed values are based on each equipment being a new and clean conditions, not contaminated. Degradation shall be determined from Seller's degradation curve for the steam turbine equipment based on ASME PTC-6.

3. Corrections shall be applied to the test result for any deviations of the test conditions from those specified. Correction factors for deviations of the operating conditions may be in the form of curves or numerical values. Correction factors will be submitted prior to the acceptance test.

4. PERFORMANCE

4.1 PERFORMANCE DESIGN CONDITION

Steam Turbine Generator Performance Design Condition

Steam Turbine Generator performance is based on the design conditions and plant performance parameters as indicated in the Steam Turbine Performance Diagram.
If any of the equipment, arrangement, performance parameters, etc. are changed or if there is a difference in performance of the equipment under Buyer's scope, the steam turbine performance also will be changed.

These performance parameters are based on the reference Heat Balance Diagrams of Combined Cycle Operation.
The steam turbine and its generator have been designed and manufactured under the conditions of these reference Heat Balance Diagrams. Any changes and/or modifications to this proposal must be carefully studied by both the Buyer and the Seller.
Seller has a right to reject the unacceptable changes and/or modifications against these reference Heat Balance Diagrams.

4. PERFORMANCE

4.2 PERFORMANCE DATA

Steam Turbine Performance

Operating Point	Case 28	Case 48
Frequency	60Hz	
Generator Power Factor	0.90	0.949
HRSG Drum Blowdown	0%	
Duct Firing	OFF	ON
HP Steam Flow ($x10^3$lb/h)	1,821.39	2,195.42
IP Steam Flow (IP Drum Outlet) ($x10^3$lb/h)	261.726	94.94
LP Admission Steam Flow ($x10^3$lb/h)	272.337	95.916
HP Steam Pressure at HPSV Inlet (psia)	1,907.7	2,255.6
HP Steam Temperature at HPSV Inlet (°F)	1,044.3	1,027.5
Reheater and Reheat Steam Piping Pressure Drop (%)	9.65	14.25
RH Steam Temperature at RSV Inlet (°F)	1,046.3	1,035.0
LP Admission Steam Pressure at LPSV Inlet (psia)	125.8	126.2
LP Admission Steam Temperature at LPSV Inlet (°F)	630.2	676.5
Condenser Vacuum *2 [ST Back Pressure at terminal point]	2.97 inHg	2.99 inHg
Gross Steam Turbine Output (MW) *1	391.8	420.2
Auxiliary Power Consumption For ST/STG *1	130kW	130kW
Auxiliary Cooling Water Temperature (°F) *3	105	105
Remarks		

*1 : The value given are based on New and Clean condition.
*2 : ST back pressure will be measured by basket tips
*3 : The value given are based on Seller's estimation.

4. PERFORMANCE

4.3 PERFORMANCE TEST PHILOSOPHY

Steam Turbine Performance Test Philosophy

1. Introduction

This issue describes the basic items which should be agreed by both parties (the Buyer and Seller) before issuing the "Performance Test Procedure". As a rule, the procedure will be established under the concept of measuring the steam turbine guaranteed condition being not to measure the whole unit performance including the Gas Turbine and HRSG.

2. Test Code

The test will be carried out mainly based on ASME PTC-6 1996. The final procedure will be fixed with the "Performance Test Procedure" written by Seller and approved by Buyer.

3. Role of the Parties

3.1 Evaluation

Both parties will share all data and make an evaluation. The final result will be established by mutual agreement.

3.2 Instrumentation

- Buyer will provide the special instruments, wiring and data acquisition system within the supply boundary including the feedwater condensate flow nozzle*.
- Buyer will provide the calibration record of the special instruments within the supply boundary*.
- The feedwater condensate flow nozzle, which might be installed downstream of the gland steam condenser, must be calibrated. The calibration of this flow nozzle will be done by a third party authority.*
  Also, the special care should be taken to the location, straight pipe length and the adoption of the flow straightener, etc. according to ASME PTC-6.
  The specification of the nozzle, piping routine around the nozzle and the calibration result will be reviewed by Seller.
- Seller requires to prepare the temporary PT/CT connection at Watt-Hour meter.*

4. PERFORMANCE

4.3 PERFORMANCE TEST PHILOSOPHY

· In order to obtain the main/reheat/LP steam flow, the measured flow rate of each feedwater and/or steam line will be utilized. The flow measuring instruments of these portions are subjected outside Seller's portion.

The gross flow will be measured by the feedwater condensed flow nozzle and this gross flow will be separated into the HP steam, IP steam and LP steam flow by using the flow ratio obtained through the feedwater and/or steam flow measurement results.
If a certain steam flow rate is required in order to obtain the HP/IP/LP steam flow, the steam flow measuring device will be supplied by others except for Seller. As for this steam flow measurement device, Seller will review the specification of the instrument, transmitter and data acquisition system and the accuracy ,etc. prior to the test.

· The instruments of below points are subjected to others except for Seller. Seller will review the specification of the instrument, transmitter and data acquisition system and accuracy, etc. prior to the test.
HP steam pressure and temperature
HP turbine exhaust steam pressure and temperature
RH steam pressure and temperature
LP steam pressure and temperature
Feedwater flow, pressure and temperature

· As for the LP exhaust pressure, the basket tip based on the PTC-6 will be provided by Seller and this pressure will be used.
· The electrical power will be measured by Mitsubishi Electric Corporation.

4. Corrections
The measured data will be corrected by below items.
1) HP Steam Flow
2) IP Steam Flow (IP SH Outlet)
3) LP Admission Steam Flow

4. PERFORMANCE

4.3 PERFORMANCE TEST PHILOSOPHY

4) HP Steam Pressure at HPSV inlet
5) HP Steam Temperature at HPSV inlet
6) RH Steam Temperature at RSV inlet
7) LP Steam Pressure at LPSV inlet
8) LP Steam Temperature at LPSV inlet
9) Reheater and Reheat Steam Piping Pressure Drop
10) Steam Turbine Back Pressure
11) Make-up Flow
12) Auxiliary Steam Flow
13) Generator Power Factor
14) Generator H2 Gas Pressure
15) Degradation of Steam Turbine**

* Seller can provide the feedwater condensate flow nozzle with the calibration result, Watt-Hour meter and other special instruments as an option.

** A deterioration correction will be applied if the first synchronization is not achieved within twenty-four (24) months from the shipment from Japan. The deterioration correction shall not exceed 0.1%.

If the test is not carried out within sixty(60) days after the first synchronization, then Section 8.9 Degradation Factor will be applied.

4. PERFORMANCE

4.4 AUXILIARY POWER CONSUMPTION

List of Load for Auxiliary Power Consumption for Seller's Equipment

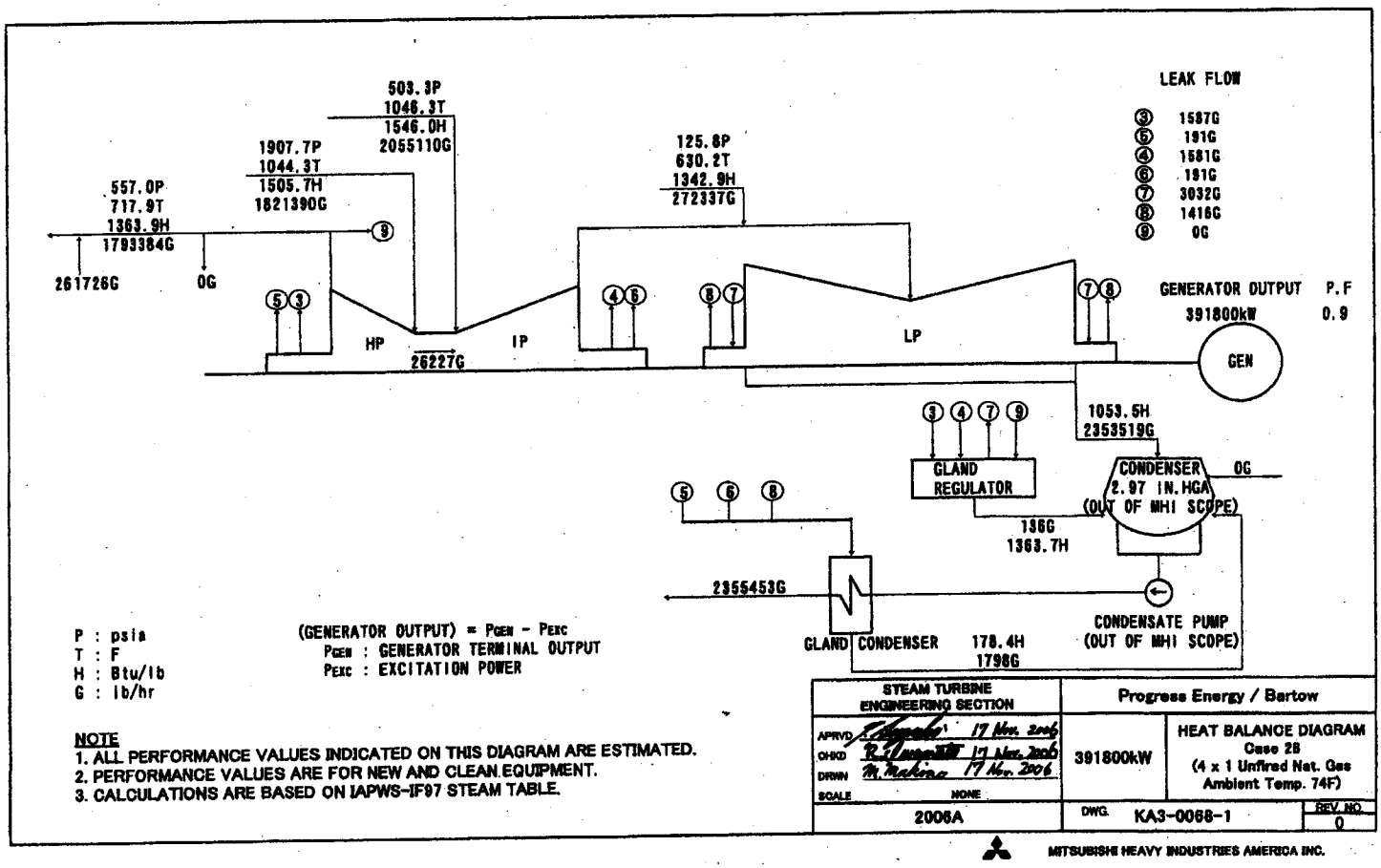
O : Included

	Equipment	
ST	Gland Condenser Exhaust Fan	O
	Lub. Oil Purifier Circulating Pump	O
	EH Control Oil Pump	O
	Vapor Extractor	O
	Control Power	O
ST GEN	Seal Oil Pump	O
	GEN Vacuum Pump	O
	Vapor Extractor	O
	Purity Meter Blower	O
	Excitation Cubicle	O
	AVR Cubicle	O
	GEN Control Panel	O
	Protection Relay Panel	O
	H2 Gas and Seal Oil Control Panel	O
	PT/SA Cubicle	O

Heat Balance Diagram

Heat Balance Diagram of Steam Turbine

Point	GT Load	Duct Firing	Cal. Point	Drawing No.	Rev. No.
Steam Turbine Generator Net Equipment Electrical Output	4 x 100%	OFF	Case28	KA3-0068-1	0
Steam Turbine Generator Net Equipment Maximum Electrical Output	3 x 100%	ON	Case48	KA3-0068-2	0
Steam Turbine Generator Net Equipment Minimum Electrical Output	1 x 70%	OFF	Case114	KA3-0068-3	0



P : psia
T : F
H : Btu/lb
G : lb/hr

(GENERATOR OUTPUT) = PGEN - PEXC
PGEN : GENERATOR TERMINAL OUTPUT
PEXC : EXCITATION POWER

NOTE
1. ALL PERFORMANCE VALUES INDICATED ON THIS DIAGRAM ARE ESTIMATED.
2. PERFORMANCE VALUES ARE FOR NEW AND CLEAN EQUIPMENT.
3. CALCULATIONS ARE BASED ON IAPWS-IF97 STEAM TABLE.

STEAM TURBINE ENGINEERING SECTION		Progress Energy / Bartow	
APRVD	17 Nov. 2006	391800kW	HEAT BALANCE DIAGRAM Case 28 (4 x 1 Unfired Nat. Gas Ambient Temp. 74F)
CHKD	17 Nov. 2006		
DRWN	17 Nov. 2006		
SCALE NONE		DWG. KA3-0068-1	REV. NO. 0
2006A			

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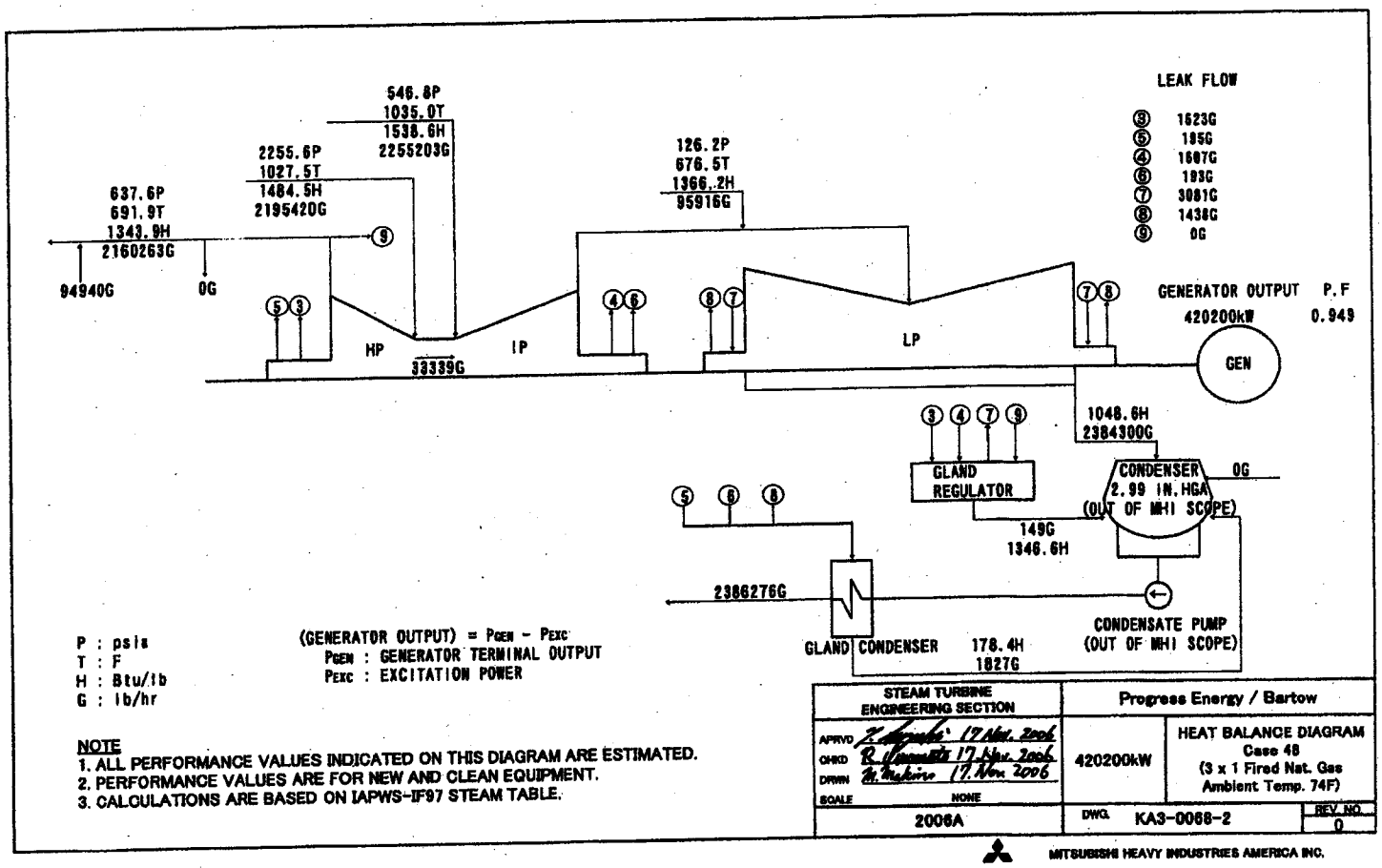

P : psia
T : F
H : Btu/lb
G : lb/hr

(GENERATOR OUTPUT) = PGEN - PEXC
PGEN : GENERATOR TERMINAL OUTPUT
PEXC : EXCITATION POWER

NOTE
1. ALL PERFORMANCE VALUES INDICATED ON THIS DIAGRAM ARE ESTIMATED.
2. PERFORMANCE VALUES ARE FOR NEW AND CLEAN EQUIPMENT.
3. CALCULATIONS ARE BASED ON IAPWS-IF97 STEAM TABLE.

STEAM TURBINE ENGINEERING SECTION		Progress Energy / Bartow	
APRVD	K. Miyaoka 17 Nov. 2006	420200kW	HEAT BALANCE DIAGRAM Case 48 (3 x 1 Fired Nat. Gas Ambient Temp. 74F)
CHKD	R. Yamamoto 17 Nov. 2006		
DRWN	H. Makino 17 Nov. 2006		
SCALE	NONE		
2006A		DWG. KA3-0068-2	REV. NO. 0

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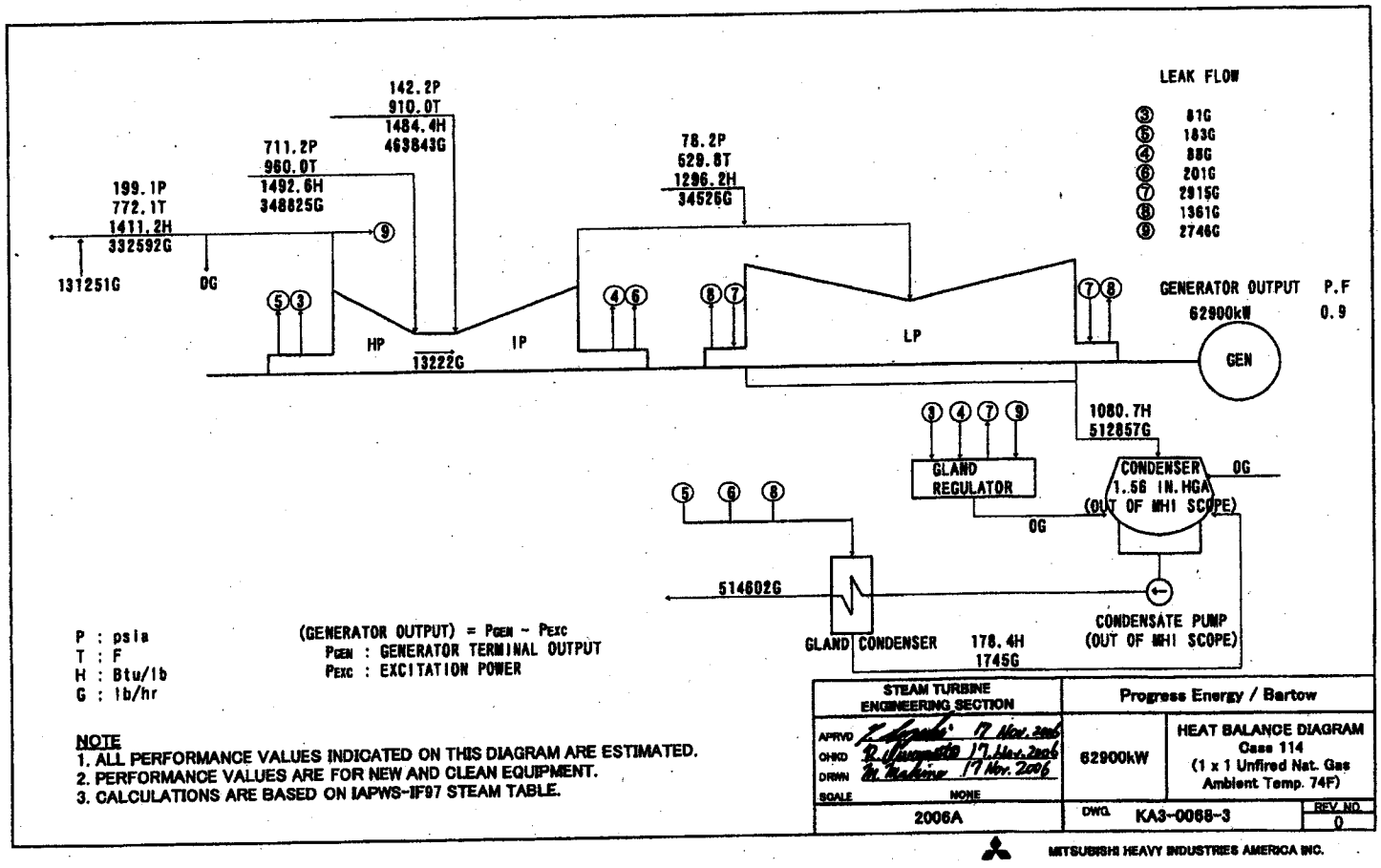

NOTE
1. ALL PERFORMANCE VALUES INDICATED ON THIS DIAGRAM ARE ESTIMATED.
2. PERFORMANCE VALUES ARE FOR NEW AND CLEAN EQUIPMENT.
3. CALCULATIONS ARE BASED ON IAPWS-IF97 STEAM TABLE.

STEAM TURBINE ENGINEERING SECTION	Progress Energy / Bartow	
APRVD 17 Nov. 2006	62900kW	HEAT BALANCE DIAGRAM Case 114 (1 x 1 Unfired Nat. Gas Ambient Temp. 74F)
CHKD 17 Nov. 2006		
DRWN 17 Nov. 2006		
SCALE NONE	DWG. KA3-0068-3	REV. NO. 0
2006A		

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4. PERFORMANCE

4.5 HEAT BALANCE DIAGRAM

Heat Balance Diagram of Steam Turbine

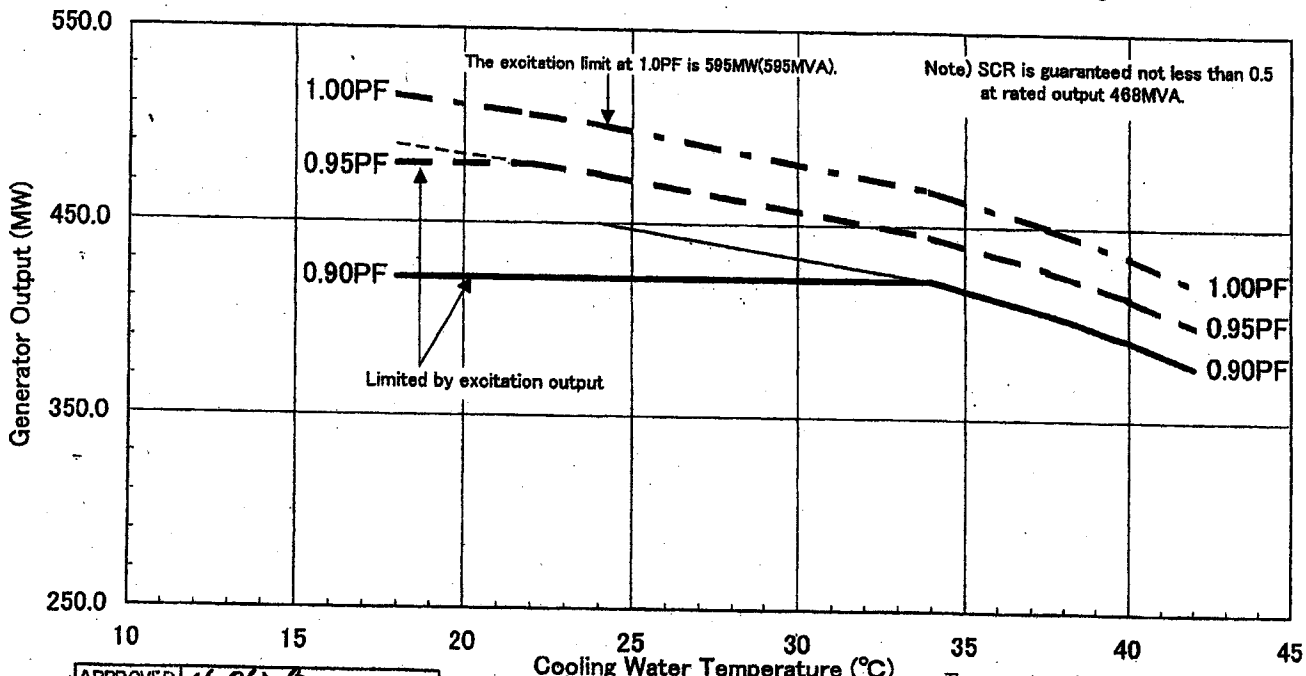
Refer to the drawing KA3-0068-1 Rev.0, KA3-0068-2 Rev.0 and KA3-0068-3 Rev.0.

CONFIDENTIAL

KC917171

Bartow Repoweing Project [B]

COOLING WATER TEMPERATURE VERSUS GENERATOR OUTPUT CURVE
(According to ANSI B temperature rise, Hydrogen gas pressure:0.50MPa-g)



APPROVED	H. Ohashi
CHECKED	T. Kawata
DESIGNED	'02-4/18 N. Arikawa S. Iwata
Rev.A We amended note.	S. Iwata '05-4/6 T. Nishida
Rev.B We amended [illegible] name.	S. Iwata '07-2/6 T. Nishida

The generator output curve shows only limitted by ANSI B temperature rise. The generator output may be also limitted by another functions. (i.e. SCR, cooling water condition, and so on.) [B]

SCR defined in MHI (MELCO) doc (ABF-A632-048)
Tabulated data in MHI (MELCO) doc (ABF-A632-048)

KC917171 Rev.A/B

DEF-19FL-FUEL-012473