

From: ppanackal@gdsmechanical.com
Sent: Wednesday, June 13, 2012 4:47 PM
To: Duffy, Daniel
Cc: Torres Rojas, Genara; Van Duyne, Sheree
Subject: Freedom of Information Online Request Form

Information:

First Name: Pramod J
Last Name: Panackal
Company: GDS Mechanical, Inc.
Mailing Address 1: 39 East Hanover Ave
Mailing Address 2: Suite B1
City: Morris Plains
State: NJ
Zip Code: 07950
Email Address: ppanackal@gdsmechanical.com
Phone: 973-993-9199
Required copies of the records: Yes

List of specific record(s):

Reference 4500062829 High Temperature Hot Water Generator, EWR. Indeck Power Equipment Company. Contract Amount 900,000.00. start date 10272011. request for 1Contract between Indeck and Port Authority NYNJ 2Plans Specifications associated with this order. 3 Copy of any status update.

THE PORT AUTHORITY OF NY & NJ

Daniel D. Duffy
FOI Administrator

August 27, 2012

Ms. Pramod J. Panackal
GDS Mechanical, Inc.
39 East Hanover Avenue, Suite B1
Morris Plains, NJ 07950

Re: Freedom of Information Reference No. 13247

Dear Ms. Panackal:

This is a response to your June 13, 2012 request, which has been processed under the Port Authority's Freedom of Information Code (the "Code") for copies of records related to the contract between Indeck and the PA - High Temperature Hot Water Generator at EWR.

Material responsive to your request and available under the Code can be found on the Port Authority's website at <http://www.panynj.gov/corporate-information/foi/13247-C.pdf>. Paper copies of the available records are available upon request.

Please refer to the above FOI reference number in any future correspondence relating to your request.

Very truly yours,



Daniel D. Duffy
FOI Administrator

THE PORT AUTHORITY OF NY & NJ

Lillian D. Valenti
Director, Procurement

VIA OVERNIGHT MAIL

January 20, 2012

Indeck Power Equipment Company
1111 Willis Avenue
Wheeling, IL 60090-5841
ATTN: David Smith

**RE: HIGH TEMPERATURE HOT WATER GENERATOR (HTHW)
SYSTEM AT NEWARK LIBERTY INTERNATIONAL AIRPORT
Purchase Order #4500062829**

Dear Mr. Smith:

The Port Authority of New York and New Jersey ("the Authority") hereby offers to enter into an agreement as hereinafter set forth ("the Agreement"), with Indeck Power Equipment Company for the purchase of the above referenced item.

The agreement between the parties shall consist of the following items:

1. This Letter of Acceptance;
2. Indeck Quotation No. QU00021439 Rev 4, dated January 10, 2012
3. Revised Technical Specification 15560 dated 12/20/11
4. PO #4500062829 dated 10/27/11 with the following changes:
 - a. Page 1 of 2 and page 2 of 2, the term "FOB" is hereby changed to "CIP" (Carriage and Insurance Paid)
 - b. Page 2 of 2, Item #6 has been deleted in its entirety

If you are in agreement with the above, please indicate such agreement by signing both copies of this letter at the lower left and returning both signed copies to the attention of Selene Ortega, Procurement Department, 2 Montgomery Street – 3rd Floor, Jersey City, NJ 07302. One fully executed original of this letter will be returned to you following execution by the Port Authority. If you have any questions, Ms. Ortega can be reached at (201) 395-3407. The contract administrator for this contract is Mr. Richard Schnurr who can be reached at (973) 961-6189.

2 Montgomery Street, 3rd Floor
Jersey City, NJ 07302
T: 201 395 7477



THE PORT AUTHORITY OF NY & NJ

Page 2

For invoicing and correspondence purposes, Purchase Order #4500062829 has been assigned to this agreement.

Sincerely,

THE PORT AUTHORITY OF NY & NJ

By: *Lillian Valenti*
Lillian Valenti
Director, Procurement Department

Date: 2/9/2012

AGREED:

INDECK POWER EQUIPMENT COMPANY:

By: *Steven Page*
(signature)

By: Steven Page
(print)

Title: Vice President

Date: 1/27/12



INDECK POWER EQUIPMENT COMPANY • 1111 SOUTH WILLIS AVENUE
WHEELING, IL 60090-5841

January 10, 2012

The Port Authority of NY & NJ
1 Madison Avenue
7th Floor
New York, NY 10010



Reference: Indeck Quotation No. QU00021439 Rev. 4
RFP No. 6000101620
Site Location: Newark Liberty International Airport

Subject: Proposal for High Temperature Hot Water Generator System

Attention: Selene Ortega/212-435-3907

Dear Ms Ortega:

Indeck is pleased to provide this firm price quotation QU00021439 to The Port Authority of NY & NJ for the Newark International Airport Project. Indeck has evaluated the information provided in the RFQ 6000101620 dated 04/19/2011 and as clarified in the subsequent meetings. The attached proposal includes the process, technical, and commercial requirements for this application.

Indeck is an industry leader in the design and manufacture of HTHW systems and is the original manufacturer of the IBW – International Boiler Works product line of the International-LaMont® HTHW Generators.

The system has been designed to provide the required high temperature hot water parameters while meeting the emission requirements set forth in the bid specification. Installation and all other equipment not specified in the proposal is not included.

We trust that we have interpreted your requirements for equipment correctly and have offered a solution that will best fit your needs. Due to commercial nature of this offering, Indeck would recommend a meeting to discuss this proposal in more detail. In the meantime, please do not hesitate to contact me if there are any questions or comments. Thank you.

David E. Smith
Phone: 847-541-8300
Fax: 847-541-9984
Email: dsmith@indeck-power.com

CC: J. Gooch, Gooch Equipment Marketing, Inc.

Indeck Power Equipment Company



Indeck Quotation No. QU00021439 Rev 4

The Port Authority of NY & NJ

Newark Liberty International Airport

Newark, NJ 07114

Package Boilers and Ancillary Equipment

January 10, 2012

CONFIDENTIAL – DO NOT DUPLICATE



CONFIDENTIAL

1. EXECUTIVE SUMMARY

1.1. INDECK GROUP OF COMPANIES

The Indeck Group of companies designs and manufactures a complete line of industrial watertube shop assembled packaged boilers and field-erected boilers. Indeck has supplied over 5,000 boiler systems in over 25 countries. Typical fuel sources utilized are Gas, Oil, Biomass, Waste Heat and Solid Fuels. Large capacity designs of up to 1,000,000 pounds per hour of steam are available.

Indeck Power Equipment Company has the largest inventory of boilers for sale, lease, or rental in the North America. Stock sizes range to over 250,000 pounds per hour of steam. A huge selection of boiler components is always available for immediate shipment.

Indeck's boiler design group, Indeck Keystone Energy has a history dating back to the 1840's as Erie City Iron Works, Zurn Energy Division, and Aalborg Industries. Indeck Keystone Energy has engineering, graphics and project management skills which are recognized as leaders in our industry.

Indeck's manufacturing group, Indeck Boiler Corporation has history dating back to the 1920's as Volcano. Indeck also has the International Boiler Works designs through our Volcano acquisition. Indeck Boiler Corporation has long been known as a source of quality manufacturing of boilers.

Indeck is the home to many of the most trusted boiler designs ever built. You can find the top industry trade names of Volcano, Erie City, Zurn, Aalborg, IBC and International Boiler Works all under one roof. Manufactured styles include "A", "O", "D", Modular "D" type boilers along with the Lamont line of High Temperature Hot Water Generators.

From concept to start-up Indeck has the design and manufacturing experience to offer steam systems that are built to your exact specification. Typical system components include boiler, fans, burner, trim, UL listed controls for burner, combustion management and feedwater control, stacks and emission reduction equipment. Our ASME certified designs and in-house quality control program are second to none.

In addition, Indeck Power Equipment Company also offers rental power plant equipment for emergencies, scheduled outages, or increased capacity requirements. Indeck Power Equipment Company also supplies mobile steam systems, trailer designed watertube boilers, diesel generators, air and water cooled chillers and emergency deaerators. Our emergency telephone line 800-446-3325 is open 24 hours per day. Be assured we are at the ready should an urgent need arise.

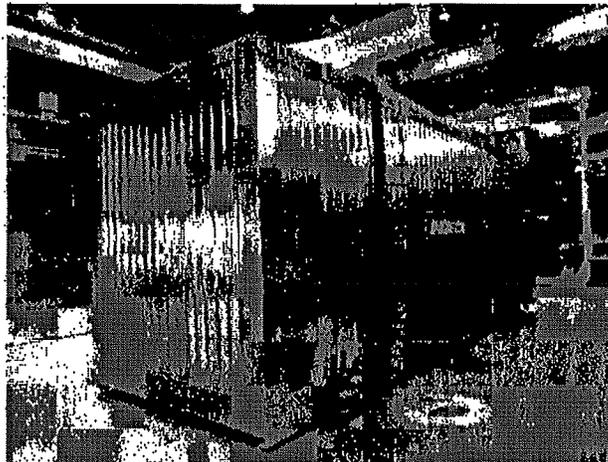
1.2. INTRODUCTION

This proposal provides the scope of supply and commercial terms for equipment and engineering services whereby Indeck proposes to design and fabricate package boiler systems for the Buyer who is defined as The Port Authority of NY & NJ for the Newark Liberty International Airport Project for the Owner who is defined as The Port Authority of NY & NJ. The proposed design of the equipment is based on the Division 15 – Section 15560 HTHW Generator, dated 3/21/11, pages 1-29.

The HTHW Generator has been designed for Natural Gas and #2 Fuel Oil backup firing and indoor placement located in the city of Newark, NJ. The scope of supply is detailed in Section 2. The general arrangement of the equipment is detailed in the drawings in Section 4. The drawings are preliminary in nature and are for reference only at this time. Actual sizing of the equipment will be provided during the design phase of the project.

The schedule provided in Section 6 defines the milestone dates for documents and equipment deliveries. Indeck would like the opportunity to discuss the schedule in more detail in an effort to ensure we meet the project delivery requirements.

With over 1,100 HTHW Generators and 5,000 watertube package boiler systems in commercial operation worldwide, Indeck utilizes our proven design standards to help lower cost while meeting the performance requirements and maintaining a high quality product. Installation, erection services and materials are not included. Exceptions and clarifications to the RFQ are specified in Section 7.





CONFIDENTIAL

1.3. BOILER DESIGN DATA

Design Conditions for the HTHW Generator is as follows:

Case	Base Offer
Boiler Type	International LaMont®
Model Nos.	TJW-C-50
Number of HTHW Generators	1
Heat Output, MMBTU/hr	50,000,000
Operating Pressure, PSIG	Per Operating Pressure Curves
HTHW Generator Design Pressure, PSIG	500
Thermal Fluid Outlet Temperature, °F	380
Thermal Fluid Inlet Temperature, °F	240
Thermal Fluid Pressure Drop (economizer), PSIG	3.0
Thermal Fluid Pressure Drop (boiler), PSIG	8.2
Ambient Temp, °F	80
HTHW Generator Location	Indoors
Boiler Turndown	10:1
Main Fuel	Natural Gas
Alternate Fuel	No. 2 Fuel Oil
NOx firing NG at Stack, ppmvd @ 3% O ₂	41
CO firing NG at Stack, ppmvd @ 3% O ₂	50
Furnace Liberation Rate, BTU/cu ft/hr	60,384
FGR (deg F at % of flue gas flow)	283F @ 30%
Air / FGR Mixture Temperature, deg F	128.6
Boiler Draft Loss at MCR, in.wc	3.2
Corrosion Allowance	-----
Tubes – HTHW Generator	0"
Tubes – Economizer	0"
Headers	0"

CONFIDENTIAL

1.4. FEATURES AND BENEFITS

Indeck is the industry leader in the design and manufacture of HTHW systems and is the original manufacturer of the IBW – International Boiler Works product line of the International-LaMont® HTHW Generators. The advantages of the International LaMont HTHW Generator include:

- **Forced Circulation**
- **Designed for High Temperature Hot Water**
- **Proprietary Design to Minimize Stresses and Fatigue Damage caused by Thermally Induced Stress Cycling**
- **Capable of High Temperature Differentials**
- **High Efficiencies**
- **Low Maintenance**
- **Completely Factory Packaged**
- **Safe Operation**
- **Compact Design**

The forced circulation, equal flow distribution of the International-LaMont® design allows the unit to have turbulent flow and higher velocities throughout the entire heating vessel and guarantees proper and efficient heat transfer with no hot spots or steaming. In addition, the International-LaMont® was specifically designed to handle large differentials between inlet and outlet temperatures. One-hundred fifty degree (150°F) differentials are common. The International-LaMont® HTHW Generator was specifically designed to maximize all factors: heat transfer, combustion and operating costs to give the end-user the most efficient unit to operate possible.

It is a forced circulation tangent tube hot water generator that was specifically designed to produce high temperature hot water. IT IS NOT A MODIFIED STEAM BOILER.

The tangential tube design and configuration is such that the unit will never experience fatigue failure caused by thermally induced stress cycling, even with large temperature differentials. The tangent tube furnace wall design and the furnace target plate will reduce down-time and operating expenses by virtually eliminating the use of refractory in the combustion chamber. The system does not require any additional blending pumps or blending stations to handle large temperature differentials.

In other manufacturers' designs, the potential for fatigue failure caused by thermally induced cyclic stresses are due to the resistance of the boiler structure to movement caused by thermal expansions and contractions within the boiler. The stresses occur every firing cycle (burner on, burner off), in varying magnitudes. Failures of this type may appear as leaks at the tube-to-tubesheet joints, cracked tubesheet ligaments, broken stays or membrane wall failures. Obviously failures of this type can be extremely serious in terms of downtime and repair costs.



CONFIDENTIAL

FEATURES AND BENEFITS (CONTINUED)

The International-LaMont® design is unmatched in its ability to produce high temperature hot water safely, because of the forced circulation watertube design and the use of inlet manifold orifices guaranteeing balanced flow distribution throughout. Additionally, the unit's compact design, requiring less floor space and lower head room, allows for better multiple unit installations and lowers operating expenses and construction costs.

The system has been designed to provide the required high temperature hot water parameters while meeting the emission requirements set forth in the bid specification. Installation and all other equipment not specified in the proposal are not included.



CONFIDENTIAL

1.5. CONTACTS

Please direct any questions concerning this proposal to:

David Smith
Sales Engineer
Indeck Power Equipment Company
1111 Willis Avenue
Wheeling, IL 60090 USA

Phone: 847-541-8300 x 3511
Fax: 847-541-9984
Email: dsmith@indeck-power.com

If the above Sales Engineer is unavailable, please feel free to contact:

Gary E. Blazek
Director of Business Development
Indeck Keystone Energy, LLC
5340 Fryling Road, Suite 200
Erie, PA 16510-4672 USA

Phone: 814-464-1203
Fax: 814-897-1089
Email: gblazek@indeck-keystone.com

The Indeck sales representative in your area is:

Jim Gooch
Gooch Equipment Marketing, Inc.
1221 Route 22 East
Lebanon, NJ 08833

Phone: 908-236-9350
Fax: 908-236-9333
Email: jimgooch@earthlink.net



CONFIDENTIAL

2. SCOPE OF SUPPLY

2.1. SCOPE SUMMARY

Indeck's proposal is based on the following division of work as defined in the following scope summary chart.

ITEM	MATERIAL			INSTALLATION BY	
	INDECK	BUYER	OPTION	INDECK	BUYER
HIGH TEMPERATURE HOT WATER GENERATOR					
HTHW GENERATOR PROPER	X				X
INTEGRAL STEEL BASE	X			X	
HEADERS	X			X	
FURNACE	X			X	
CONVECTION ZONE	X			X	
REFRACTORY SEALS	X			X	
INSULATION	X			X	
CASING AND LAGGING w/ TEMPERATURE SENSORS	X			X	
HTHW GENERATOR TRIM					
GENERAL TRIM PER ENCLOSED LIST	X			PARTIAL	X
SAFETY VALVE DISCHARGE ELBOW, PIPE		X			X
FUEL FLOW CONTROL VALVES	X			X	
BURNER SYSTEM					
WINDBOX	X			X	
BURNER	X			X	
BURNER MANagements SYSTEM (BMS)	X			X	
FUEL TRAINS – WINDBOX MOUNTED	X			X	
FUEL PRESSURE REGULATING VALVES		X			X
FUEL OIL PUMP AND POSSIBLE HEATER SETS		X			X
FUEL HANDLING SYSTEM UPSTREAM OF FUEL TRAIN		X			X
FAN SYSTEM					
F.D. FAN	X				X
F.D. FAN SILENCER	X				X
F.D. FAN INLET STEAM COIL AIRHEATER	N/A				
F.D. FAN MOTOR	X				X
F.D. FAN STEAM TURBINE DRIVE	N/A				
LUBE OIL SYSTEM	N/A				



CONFIDENTIAL

ITEM	MATERIAL			INSTALLATION BY	
	INDECK	BUYER	OPTION	INDECK	BUYER
COMBUSTION AND F.W. CONTROLS					
INSTRUMENTS	X				X
HUMAN TO MACHINE INTERFACE PANEL	X			X	
COMBUSTION CONTROL PANEL	X				X
DCS CONTROL SYSTEM		X			X
ECONOMIZER					
ECONOMIZER	X				X
ECONOMIZER FEEDWATER BY PASS SYSTEM (I.E. PIPE, TWO SHUT OFF VALVES, ONE BY PASS VALVE AND SAFETY RELIEF VALVE WITH PROPER VENTS AND DRAINS)	N/A				
DUCTS AND STACK					
COMBUSTION AIR DUCTS (SILENCER TO FD FAN MIXBOX)	X				X
AIR DUCTS (FD FAN TO BURNER WINDBOX)	N/A				
GAS DUCT (BOILER TO ECONOMIZER)	N/A				
GAS DUCTS (ECONOMIZER TO STACK)	X				X
GAS DUCTS (SCR DUCTS)	N/A				
STACK - LESS THAN 50 ft. FROM GRADE	X				X
FGR DUCT	X				X
INSULATION AND LAGGING ON WINDBOX, DUCTS & STACK		X			X
EXPANSION JOINTS					
FD FAN OUTLET	N/A				
BOILER OUTLET	N/A				
SCR OUTLET	N/A				
ECONOMIZER OUTLET	N/A				
FGR DUCT	X				X
DAMPERS					
FD FAN INLET MIX BOX	X				X
FD FAN VIV	X				X
FD FAN OUTLET (WINDBOX)	N/A				
STACK INLET	X				
FGR	X				X



CONFIDENTIAL

ITEM	MATERIAL			INSTALLATION BY	
	INDECK	BUYER	OPTION	INDECK	BUYER
WALKWAYS AND LADDERS					
PLATFORM AND LADDER AS DEFINED IN PROPOSAL	X				X
SUPPORT STRUCTURES					
FOUNDATION, SLIDE PLATES, SHIMS & ANCHOR BOLTS, NUTS, WASHERS		X			X
FD FAN INLET DUCT SUPPORT STEEL		X			X
SCR SUPPORT STEEL	N/A				
ECONOMIZER INTEGRAL BASE	X				X
ECONOMIZER SUPPORT STEEL STRUCTURE	N/A				
STACK SUPPORT STEEL STRUCTURE		X			X
PIPE SUPPORT STEEL		X			X
DUCT SUPPORT STEEL		X			X
PIPING					
INSTRUMENTATION THERMOWELLS	X			X	
INTERCONNECT (Z-PIPE) FROM ECONOMIZER TO BOILER	X				X
VENT ECON INLET 1 ST VALVE TO VENT TERMINAL POINT		X			X
VENT HTHW GENERATOR HEADERS 1 ST VALVE TO VENT TERMINAL POINT		X			X
VENT THERMAL FLUID OUTLET 1 ST VALVE TO VENT TERMINAL POINT		X			X
VENT SAFETY VALVE OUTLET TO VENT TERMINAL POINT		X			X
VENT N.G. FROM FUEL TRAIN TO VENT TERMINAL POINT		X			X
DRAINS FROM FIRST VALVE TO SITE DRAIN		X			X
ECONOMIZER DRAIN TO 1ST VALVE	X			X	
ECONOMIZER DRAIN FROM 1 ST VALVE TO SITE DRAIN		X			X
FUEL PIPE FROM FUEL SYSTEM TO FUEL TRAIN		X			X
FUEL PIPE FROM FUEL TRAIN TO BURNER	X				X
INSULATION AND LAGGING FOR PIPE		X			X
SUPPORT HANGERS AND SUPPORT STEEL FOR PIPE		X			X
AIR POLLUTION AND EMISSIONS CONTROL					
CO CATALYST	N/A				
SCR SYSTEM	N/A				
SCR AMMONIA INJECTION GRID (AIG)	N/A				



CONFIDENTIAL

ITEM	MATERIAL			INSTALLATION BY	
	INDECK	BUYER	OPTION	INDECK	BUYER
SCR PIPE FROM AIG TO AFCU	N/A				
SCR AMMONIA FLOW CONTROL UNIT (AFCU)	N/A				
SCR PIPE FROM AFCU TO STORAGE TANK & PUMP	N/A				
SCR AMMONIA STORAGE TANK AND PUMP SYSTEM	N/A				
SOOTBLOWER SYSTEM					
SOOTBLOWER PORTS	X			X	
SOOTBLOWERS	N/A				
AUXILIARY EQUIPMENT & MISC					
INTERCONNECTING WIRING, CONDUIT, RACEWAYS, TUBING AND JUNCTION BOXES		X			X
INTERCONNECTING CONTROLS COMMUNICATION CABLING SYSTEM AND ASSOCIATED ACCESORIES		X			X
COMPRESSED AIR WITH ASSOCIATED TUBING / PIPE		X			X
COMPRESSED AIR FOR ATOMIZATION AND SOOT BLOWERS		X			X
ALL POWER SUPPLIES		X			X
MOTOR STARTERS AND MCCs		X			X
EXPANSION TANK		X			X
NITROGEN PRESSURIZATION SYSTEM		X			X
HTHW GENERATOR PRIMARY PUMPS		X			X
THERMAL FLUID SYSTEM DISTRIBUTION PUMPS		X			X
CONTINUOUS EMISSIONS MONITORING SYSTEM		X			X
FINISH PAINT		X			X
SPARE PARTS	X				X
SPECIAL TOOLS - FURNACE CAMERA	X				X
SHELTER FOR FIRING FRONT OR WHOLE SYSTEM WITH ASSOCIATED BUILDING LIGHTING		X			X
FREEZE PROTECTION		X			X
FIELD SERVICE CONSULTANT (DELIVERY, INSTALLATION, START-UP, TRAINING, TEST, ETC)	X			--	--
FREIGHT	X			--	--
UNLOAD EQUIPMENT AT SITE		X		--	--
HAULING FROM TRUCK / RAIL / BARGE UNLOADING POINT TO FOUNDATION		X		--	--
SITE PREPARATION, EXCAVATION, BUILDING MODIFICATIONS, AND INSTALLATION ENGINEERING		X		--	--
PERMITS AND COMPLIANCE TESTING		X		--	--

CONFIDENTIAL**2.2. TERMINAL POINTS**

The terminal points list is intended to define the limits of the scope of supply included in this proposal. Indeck will furnish the equipment and materials inside these terminal points. Indeck scope excludes tubing and wiring unless supplied as part of a skid mounted unit.

HTHW Generator Supply Water Piping

- Water flow orifice plate installed in Buyer supplied thermal fluid piping
- Outlet of HTHW Generator Header flange (HTHW pipe and isolation valves to main header is not included)
- Outlet of safety valve flange on outlet header (vent pipe is not included)
- Outlet of vent valve on HTHW Generator header or Z-pipe (vent pipe is not included)
- Outlet of misc drain valves (drain pipe to site drain is not included)

HTHW Generator Return Water Piping

- Inlet return water to economizer flange (HTHW Return pipe from system is not included)
- Outlet of intermittent blowdown valve (drain pipe to the blowdown tank is not included)
- Outlet of economizer vent valve (vent pipe to atmosphere is not included)
- Outlet of economizer drain valve (drain pipe to site drain is not included)

Fuel

- Inlet of main and pilot gas fuel trains
- Inlet of fuel oil and air atomization trains
- Outlet of vent relief valve (pipe to safe vent location is not included)

Electrical

- Electric terminals on all field instrumentation, trim, instruments, etc
- Electric terminals on fan motors and damper actuators
- Electric terminals on skids

Air

- Inlet to forced draft fan silencer and ducting
- Instrument process connections on Indeck's individual instruments (tubing is not included)

Structural

- Foundations provided are not included.
- Anchor bolts, shims, slide plates and base plates supplied is not included.

Flue Gas

- Outlet of stack.

3. DETAILED SCOPE DESCRIPTION

3.1. WATERTUBE STEAM GENERATOR

Indeck is pleased to offer the standard design, Indeck/IBW International Lamont® High Temperature Hot Water Generator, Model **TJW-C-50**. Each HTHW Generator is a shop assembled, watertube high temperature hot water generator (HTHW) including pressure parts, casings, boiler structure, refractory and insulation. The Indeck purpose built design Hot Water Generator is constructed in accordance with the ASME Code, Section I for Power Boilers. This design is not a modified steam boiler like a bent-tube, flexible tube boiler and is not subject to fatigue failure caused by thermally induced stress cycling.

Indeck IBW International Lamont® Design Features:

Hot water forced recirculation water tube generators are specifically designed for high temperature water generation and for full utilization of maximum outlet and return water temperature differentials inherent in efficient HTW system designs.

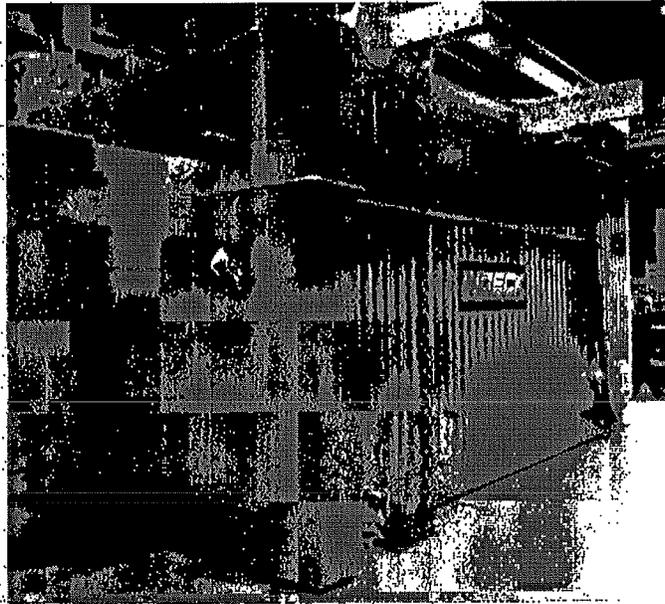
To avoid uneven heat absorption by different tubes, particularly at low loads, radiant and convective surfaces are arranged in series, not parallel. This extremely important design feature eliminates uneven heat absorption, steaming and resultant tube failure.

The Indeck/IBW International Lamont® design incorporates counterflow of water and combustion gases to provide maximum efficiency and exceptional fuel cost savings. By fully utilizing the low headroom configuration of the Indeck/IBW International Lamont® type generator, designers can realize significant savings, in both construction and on-site handling costs. Factory packaging greatly reduces field labor costs and assures proper coordination of the generator and fuel-burning equipment.

Tangent tube furnace-wall construction virtually eliminates the use of potentially troublesome refractory in the furnace area. Double casing construction, with inner casing seal-welded gas-tight, prevents furnace gases from penetrating to the insulation and outer casing. The unit is submitted to an air pressure test at the maximum furnace pressure with all seams checked with soapy water. The outer casing holds and protects the insulation which, in turn, provides safe, low exterior surface temperatures.

The Indeck/IBW International Lamont® generators are ASME Code constructed, inspected and certified by National Board Insurance and/or Provincial Authority Inspectors. All units are equipped for complete venting and draining. Two observation ports are provided for a visual check of firing conditions with one (12" X16") access door to generator interior. Sootblower(s) bearings and wallboxes are supplied. High velocity fluid circulation is controlled to avoid sedimentations in the tubes and to give extremely fast response to load changes.

CONFIDENTIAL



Technical Data:

Boiler type:	Indeck/IBW International Lamont®
Model No:	TJW-C-50
Heat medium:	High Temperature hot water
Maximum Output:	50 MMBTUh
Design pressure:	500 psig
Minimum Inlet pressure:	Per Operating Pressure Curves
Inlet Water Temperature:	260 °F
Outlet Water Temperature:	375 °F
Flow rate (Model TJW-C-50):	890 Usgpm at inlet fluid conditions
Main fuel:	Natural gas
Secondary fuel:	No. 2 Fuel Oil
Location:	Indoors

Heating surfaces:	TJW-C-50
Furnace (flat proj.): (ft ²)	679
Convection: (ft ²)	3,851
TOTAL: (ft ²)	4,530
Furnace Volume: (ft ³)	992

Furnace dimensions:	
Total Length to Bridgwall (in):	139-1/2
Total Length (in):	165-1/2
Width (in):	97-3/16
Height (in):	97-3/16



CONFIDENTIAL

Overall dimensions:

Length (casing to casing): 22' 2-1/2"
 Width: 9' 3"
 Height base to water outlet: 11' 8"

Approx. weight (w/ burner est):

Shipping (lbs): 60,500
 Operating (lbs): 68,308

Pressure Parts:	Dia.	MWT	Material
Header:			
inlet:	: 10" NPS	SCH120	SA-106B
outlet:	: 10" NPS	SCH120	SA-106B
Tubes	: 1 1/4" OD	0.095"	SA-178A-ERW
Economizer Tubes	: 2.0" OD	0.105"	SA-178A-ERW

Refractory, insulation and casings:

Front wall:
 5 in. refractory
 2 in. ceramic board
 6 in. insulating block
 3/8 in. min. gas tight outer steel casing

Rear wall:
 1 in. ceramic fibre blanket
 2 in. ceramic board
 2 in. ceramic blanket
 3/16 in. steel inner casing
 1 1/2 in blanket insulation
 Aluminium casing stucco finish

Convection side walls:
 1 1/2 in. insulation brick (lower section)
 1 1/2 in. ceramic board (upper section)
 1 1/2 in. insulation block
 1 in. ceramic blanket
 3/16 in. steel inner casing
 1 1/2 in. blanket insulation
 Aluminium casing stucco finish

Furnace side walls and roof:
 3/16 in steel inner casing
 3 in. blanket insulation
 Aluminium casing stucco finish

Headers
 2 in. blanket insulation
 Aluminium casing stucco finish

Floor
 1/4 in. min. steel inner casing
 3 in. blanket insulation

Surface preparation: SSPC-SP1 & SSPC-SP3
 Surface painting: Two coats of standard high temperature paint

The outer casing surface temperature shall not exceed an average of 50°F above ambient temperature with a surface air velocity of 100 ft/min. when the boiler is operating at maximum continuous capacity. The above specified design data may be subject to modifications after final design check.



CONFIDENTIAL

3.2. TRIM
Hot Water Boiler Standard Accessories (per unit):

QTY	SERVICE DESCRIPTION	SIZE	ENDS
2	Outlet header vent valves	1/2"	SW
2	Inlet header vent valves	1/2"	SW
2	Right header vent valves	1/2"	SW
1	Inlet header thermowell for thermometer	3/4"	NPT
1	Inlet header thermometer	1-1/4"	NPT
1	Inlet header test well (capped)	1/2"	NPT
1	Inlet header pressure gauge	1/2"	NPT
1	Inlet header pressure gauge isolation valve	1/2"	NPT
1	Inlet header pressure gauge snubber	1/2"	NPT
1	Inlet header pressure test isolation valve	1/2"	NPT
1	Outlet header pressure gauge isolation valve	1/2"	NPT
1	Outlet header pressure gauge	1/2"	NPT
1	Outlet header pressure gauge snubber	1/2"	NPT
1	Outlet header pressure test isolation valve	1/2"	NPT
1	Outlet header thermowell for thermometer	1/2"	NPT
1	Outlet header thermometer	1-1/4"	NPT
1	Outlet header test well (capped)	1/2"	NPT
1	Operating temperature switch thermowell	3/4"	NPT
1	Operating temperature safety cutout switch	3/4"	NPT
1	Excess temperature switch thermowell	3/4"	NPT
1	Excess temperature safety cutout switch	3/4"	NPT
1	Boiler safety valve A	TBDX3"	FLG
1	Boiler safety valve B	TBDX3"	FLG
1	Orifice plate for pressure transmitter	TBD	-
1	Differential pressure flow switch	1/2"	FNPT
1	Flow transmitter isolation valve A	1/2"	NPT
1	Flow transmitter isolation valve B	1/2"	NPT
1	Flow transmitter three way manifold	1/2"	FNPT
2	Boiler left header drain valves	1-1/2"	SW
2	Boiler right header drain valves	1-1/2"	SW
1	Boiler high furnace pressure switch	1/4"	FNPT
3	Observation ports	2-1/2"	FNPT
1	Boiler gas outlet thermometer	1/2"	NPT
1	Boiler gas outlet thermowell	1/2"	NPT



CONFIDENTIAL

Trim items listed above are to indicate quality furnished, and Indeck reserves the right to substitute equipment of equal quality. Valves, fittings and accessories which cannot be shop mounted, due to fragility or shipping limits, will be packed separately for installation at the site by the Contractor.

3.3. BURNER SYSTEM

Number of Burners per Boiler: One (1)

Main Fuel:

Fuel Type:	Natural Gas
Heat Input:	60.15 mmbtu/hr
High Heating Value	22,699 Btu/lb
Turndown	10 to 1
Pressure at Burner	10 psig
Pressure at Fuel Train Inlet	15 psig (regulated by others)
Excess Air at MCR	15%
Flue Gas Recirculation Rate at MCR	30%

Alternate Fuel:

Fuel Type:	No. 2 Oil
Heat Input:	57.34 mmbtu/hr
High Heating Value	19,882 Btu/lb
Turndown	8 to 1
Pressure at Burner	150 psig
Pressure at Fuel Train Inlet	150 psig
Excess Air at MCR	15%
Flue Gas Recirculation Rate at MCR	30%
Atomizing Media	Air
Atomizing Media Pressure	125 psig

Pilot Fuel:

Fuel Type:	Natural Gas
Heat Input	1 mmbtu/hr
Pressure at Burner	1 psig

Miscellaneous Data:

Burner Location	Indoors, non-hazardous
Power Supply Available	120V/1Ph/60Hz 480V/3Ph/60Hz
Instrument Air Available	80 psig
Valve Train Construction	Manufacturer standard
Quality Control	Manufacturer standard

CONFIDENTIAL

Fuel Analysis

Fuel Gas Type	Natural
High Heat Value	22,699 BTU/lb
Pressure Available	14.4 psig
Pressure Available	10 psig
Ignition gas pressure	1 psig

Ultimate Analysis:	Volume
Nitrogen, N2	1.89%
Carbon Dioxide, CO2	0.55%
Methane, CH4	95.00%
Ethane, C2H6	2.30%
Propane, C3H8	0.18%
<u>n-Butane, C4H10</u>	<u>0.08%</u>
Total:	100.00%

Fuel Oil Type	#2
High Heat Value	19,882 Btu/lb
Pressure Required	150 psig

Ultimate Analysis:	Weight
Carbon, C	87.31%
Nitrogen, N2	0.03%
Hydrogen, H	12.40%
Sulfur, S	0.05%
<u>Ash</u>	<u>0.001%</u>
Total:	99.80%

CONFIDENTIAL**BURNER SYSTEM**

Low NOx Burner with windbox including wiring of air and pressure switches.

One (1) windbox will be fabricated of ASTM A-36 carbon steel plate, and complete with required structural framing, support legs, access door, lifting lugs, and baffles for balancing air flow distribution to the burner. The windbox will be provided with an inlet opening for connection to the combustion air duct. The windbox will be painted with manufacturer standard. The windbox will be seal welded to the boiler front plate.

One (1) burner, fabricated using standard stainless and mild steel components, complete with the following sub-assemblies, mounted in the windbox:

The following valve trains will include valves, piping specialties and instrumentation as specified below.

All electrical components will be wired to a NEMA 12 terminal box.

Valve trains will be fabricated using Schedule 80 ASTM A-106 Grade B seamless steel pipe and 3,000 lb. threaded fittings.

Insulation and lagging is not included.

- One (1) ignitor gas pilot train
- One (1) main gas train
- One (1) No. 2 fuel oil train
- One (1) compressed air train for No 2 fuel oil atomization

Note: Per specification requirements, Indeck is providing one (1) warehouse spare oil gun for the spare parts of this proposal.

3.4. INDUCED FLUE GAS RECIRCULATION SYSTEM

Part of the burner emission control system is an induced flue gas recirculation system. This system will use the FD inlet suction pressure to pull induce flue gas from the stack inlet to the FD fan inlet. This flue gas will then re-circulate through the HTHW Generator system to help "cool" the flame and thus lower the NOx formation. Included with the FGR system are:

The following will be shipped loose:

- 1 Lot IFGR ducting (insulation and support by others)
- 1 IFGR fabric expansion joint
- 1 IFGR Flow Control Damper, with actuator
- 1 IFGR/Air Inlet Mixing Box, for mounting on FD fan inlet

3.5. BOILER CONTROL OVERVIEW

Boiler Control System

The **INDECK** Boiler Control System (BCS) is a proven standard for the control of Indeck Boilers and Hot Water Generators. The system is built upon independent, stand-alone Allen-Bradley CompactLogix PLC processors for the Burner Management System (BMS) and the Combustion Control System (CCS) together in one independent enclosure, and one enclosure per boiler. The enclosure has an integrated Human-Machine-Interface (HMI), and audible annunciators for alarms and trips. An industrial fast-Ethernet switch is provided in the panel through which data can be shared with the plant's SCADA system (SCADA implementation by others).

INDECK HMI systems are built upon the Wonderware InTouch application on local 15" Color TFT industrial touchscreen monitors at each boiler, and a remote desktop HMI for the control-room. The remote HMI has all the capabilities of each local HMI simultaneously for each of the boilers/generators. Our experience in both equipment design and plant operation provides the basis for our efficient, operator-friendly HMI screen designs.

The enclosure is NEMA-4 and contains internal lighting and power receptacles for maintenance activities. All panels are pre-wired and tested, and include testing protocol, test results, wiring diagrams, and general-arrangement drawings. We welcome both the Owner and Purchaser to visit us for a Factory Acceptance Test before shipment.

INDECK's Control Systems are engineered, manufactured and tested in our U.L.-Listed Panel Shop and meet or exceed the requirements of NFPA-85.

INDECK uses the following instrumentation components:

- "Smart" HART-compatible 4-20mA transmitters
- Siemens Panel Lamps and Pushbuttons
- Yokogawa Oxygen Analyzers
- Durag Opacity Monitors
- Wonderware InTouch HMI Software
- VarTeck 15" Color Industrial Touchscreen Monitors
- Allen-Bradley CompactLogix family of Processors and I/O Modules
- IDEC Control Relays
- Weidmuller Terminal Systems
- Ingram Alarm Horns

CONFIDENTIAL

BURNER MANAGEMENT SYSTEM

Engineered, manufactured and tested in our U.L.-Listed Panel Shop to meet or exceed the requirements of NFPA-85, the **INDECK** Burner Management System is built on the Allen-Bradley CompactLogix platform. Our system provides First Out Indication, giving extended troubleshooting information to operators and technicians.

All system I/O is fused and can be monitored on the HMI. HMI indication includes, but is not limited to the following:

Low Gas Pressure	Low Combustion Air Flow
High Gas Pressure	FD Fan Motor Interlock
Main Gas Shutoff Valves Closure	Low Water Flow
Gas Flow Control Valve Start Position	Low Instrument Air Pressure
Low Oil Pressure	Critical Input Failure
High Oil Pressure	Critical Output Failure
Main Oil Shutoff Valves Closure	Loss of Start Limits
Oil Flow Control Valve Start Position	Low Fire Release
Low Atomizing Media Supply	High Water Temperature
Low Atomizing Media Flow	Excess Water Temperature
Select Fuel	Pilot & Main Lightoff Timing
Fuel Changeover	Flame Detector Relays
Purge Air Flow	Pilot Flame Failure
Purge Timing	Main Flame Light-off Failure
Purge Timeout	Main Flame Failure
Combustion Air Actuator Positions	

The Allen-Bradley CompactLogix PLC directs all of the BMS functions required for automatic start up, shutdown and on-line supervision of the combustion process. Logic implemented in the PLC includes: permissive supervision, furnace purge, master fuel trip, ignition fuel valve management, main fuel valve management, interlock supervision, shutdown, post-purge, critical I/O testing and watchdog timer handshaking.

INDECK's BMS includes the following safety and reliability features:

- Master Fuel Trip Relay circuitry
- Independent Watchdog Timer monitoring of PLC health
- Critical Input and Critical Output testing
- Protection from on-line editing and forced I/O
- Fused inputs and outputs
- Interposing Isolation Relays on all outputs
- "First Out " reporting of all Trip conditions
- Ethernet Communications with Plant SCADA systems

Combustion Control Systems

The **INDECK** CCS is built upon the Allen-Bradley CompactLogix controller using function-block programming. Our system is fully-metered and cross-limited with excess oxygen trim.

- ❖ Fully Metered – Characterized inputs for Fuel Flow and Air Flow provide accurate air-to-fuel ratios and precise firing control.
- ❖ Cross Limited – Air leads fuel on load increases; fuel leads air on load reductions. Air or Fuel Flow upsets override load demand to maintain safe air-to-fuel ratios.
- ❖ Excess Oxygen Trim – Continuous monitoring of stack oxygen and active PID control maintain characterized oxygen levels for increased efficiency and reduced emissions.
- ❖ Draft Control
- ❖ Plant Master / Boiler Master – Independent Boiler Master for manual, automatic, or biased Lead / Lag operation from a Plant Master. Plant Master control can be enabled from any of the Indeck boiler control panels.

All points of I/O are available to be read by the Plant's SCADA system through the provided fast-Ethernet switch to the Allen-Bradley / Rockwell Automation Ethernet/IP network.

Transmitters, Valve Manifolds, Orifice Plates, RTD's, Thermowells, etc. are provided for:

Combustion Air Flow	Econ. Flue Gas Inlet Temperature
Fuel Gas Flow	Econ. Flue Gas Outlet Temperature
Fuel Oil Flow	Water Supply Temperature
Draft Pressure	Water Return Temperature
Flue Gas Oxygen	Econ. Water Outlet Temperature
Flue Gas Opacity	Water Flow

Then end-user or their approved representative is invited to Indeck Power Equipment Company's Wheeling, Illinois facilities for a Factory Acceptance Test of the Control Systems.

CONFIDENTIAL

Human-Machine-Interfaces

INDECK HMI system is built upon the Wonderware InTouch application on a 15" Color TFT industrial touchscreen monitor local to each boiler and a remote desktop HMI for the control-room. The remote HMI has all the capabilities of each local HMI simultaneously for each of the boilers/generators. Our experience in both equipment design and plant operation provides the basis for our efficient, operator-friendly HMI screen designs.

Each HMI is identical, allowing control of any boiler from the panel of any other boiler, providing redundancy in the event of the failure of any single HMI.

Critical actions are initiated by a two-step process to avoid problems created by accidental touchscreen inputs. Help screens provide detailed information for each operator screen, a safe place to clean the touchscreen, and technician's access to PLC and communication status information. Real-time trending and historical-trending provide valuable data to operators, technicians and supervisors.

Critical touchscreen objects appear in the same location from screen to screen. Screens and information follow natural and intuitive sequences, and include such information as:

- Main Menu
- Established Limits
- Light-off Sequencing
- Process Overview
- Boiler / Burner Control
- Totalizers
- Real-Time Trending
- Historical Trending
- Shutdown
- Alarm Management
- Alarm History (including First Out Trip Annunciation and time-stamps)
- Tuning

CONFIDENTIAL

3.6. INSTRUMENTATION

Indeck has included the following instrumentation which will be shipped loose for installation in the field by Buyer:

- HTHW Generator water flow transmitter with 3 valve manifold and orifice plate (1)
- High furnace pressure switch (1)
- Fuel gas flow transmitter with 3 valve manifold and orifice plate (1)
- Fuel oil flow transmitter with 3 valve manifold and orifice plate (1)
- Air flow transmitter with 3 valve manifold (1)
- Economizer feedwater inlet temperature indicator with thermowell (1)
- Economizer feedwater inlet temperature element only with thermowell (1)
- Economizer feedwater outlet temperature indicator with thermowell (1)
- Economizer feedwater outlet temperature element only with thermowell (1)
- Economizer feedwater inlet pressure indicator with shut off valve (1)
- FD Fan inlet damper drive unit (1)
- FD Fan VIV damper drive unit (1)
- FGR damper drive unit (1)
- Pressure indicator on FD Fan outlet (1)
- Pressure indicator on windbox (1)
- Temperature element with thermowell on economizer gas inlet (1)
- Temperature element with thermowell on economizer gas outlet (1)
- Pressure transmitter on economizer gas outlet (1)
- O2 analyzer on economizer outlet (1)
- Opacity Monitor (1)
- Furnace Camera system (1) with 15" Color LCD Monitor

3.7. F.D. FAN COMPONENTS

Arrangement 4, downblast discharge, centrifugal F.D. fan complete with: 460V/3PH/60Hz TEFC inverter duty motor and VIV for flow control, fresh air/FGR mixing box with damper, inlet silencer to meet 85 DBA at 3 ft. The fan assembly will be mounted on the windbox however, shipped loose to avoid damage during transit. The fan silencer will be shipped loose and will be supported by structural steel provided by others.

3.8. ECONOMIZER

Design Pressure	500 PSIG
Tubes:	
• O.D, inches	1.5
• Material	SA-178 Grade A
• Thickness, inches	0.105
Fins:	
• Fins per inch	6
• Fin Solid or Serrated	AEROSEG
• Fin Material	Carbon Steel
• Fin Height	0.75 inch
• Fin Thickness	0.050 inch

CONFIDENTIAL

Inner Casing	Included
Insulation	Included
Outer Lagging	Included
Lifting Lugs	Included

Flue Gas Temperature, deg F

- At inlet 499
- At outlet 283

Feedwater Temperature, deg F

- At inlet 240
- At outlet 249

Included with the economizer system is the HTHW Generator interconnect "Z" piping. This piping arrangement is factory welded and designed to accept loads imposed by thermal expansion between the economizer outlet and HTHW Generator inlet flanged connections. Z-pipe offered is SA-106 Gr B material. Interconnect piping is shipped loose for installation and field fit by others. Welding required for field fit are ASME Code, Section I, required welds. Insulation of the Z-piping is provided by others.

3.9. STACK AND TRANSITION DUCTING ASSEMBLY

The stack will need a transition outlet duct from the rectangular economizer outlet to the round stack inlet. The transition ducting will be fabricated with a minimum thickness of 3/16" A-36 carbon steel plate. The transition duct includes an access door, FGR, O2 analyzer, and instrumentation connections.

The stack is a single-wall, carbon steel A-36 material to a finished elevation of not more than 50 ft from grade. Included with the stack assembly are two emissions test ports, rain cap, and an isolation damper.

Exterior insulation of these components is provided by others.

3.10. WALKWAY SYSTEM

The HTHW Generator is provided with a Platform and Ladder arrangement, shop fabricated and shipped loose for installation by others in the field. The walkway, similar to that shown on the proposal General Arrangement Drawing, will provide access to the following locations:

- Top of the HTHW Generator for access to the headers
- Safety valve access
- Economizer headers

The walkway system includes and is limited to the following areas and linear feet on a not to exceed basis. Indeck can provide additional scope upon request as a price add. This walkway system may not provide access to all required locations for start-up, testing and maintenance.

- Ladders One (1) rung type ladder approximately 15 linear feet

CONFIDENTIAL

- Walkways approximately 70 square feet
- Railing approximately 10 linear feet

3.11. SHIPPING CONFIGURATION

The following is a preliminary and approximate shipping configuration.

Component	Shipping Configuration
HTHW Generator with Burner	The HTHW Generator is a shop assembled complete with the burner windbox and burner assembly shop installed. The HTHW Generator will ship via truck.
Burner Fuel Trains	The fuel train assemblies are shop assembled and windbox mounted to the maximum extent possible. Some items are shipped loose for field installation provided by others.
Economizer	The economizer is shipped as a shop assembled module. The field installation is not included.
Platform Grating	Shipped separate from the HTHW Generator. Each piece is cut to size for specific location. Cutouts for major penetrations are made in the shop with banding. Some field cutouts and banding for field-routed pipe may be necessary. Fasteners for grating hold-down are shipped separate in boxes or cans.
Handrail	Handrails are shop fabricated into sections consisting of posts, rails and kick plate. Each post has an attachment at its base for attachment to the support steel. Actual size of the shop-fabricated sections is suitable for shipment by non-permitted trucks.
Ladders	Ladders are shop fabricated into sections consisting of side bars, rungs and cages when required. Safety gates are shipped separate.
Interconnect Z-pipe	Pipe is shipped as a welded assembly to the maximum extent possible. Fittings are shipped loose in bags or boxes. Extra length than is required is made so that the final assembly is field fit. NOTE: Field fit involves ASME Code, Section I, welding and is completed by others.
Fan	The FD fan, motor, VFD and silencer system is burner windbox mounted. Due to shipping constraints, the FD Fan assembly is shipped loose for field installation by others. Additionally, the HTHW Generator Control Panel is shipped loose. The field assembly is not included.
Stack and Rain Cap	Shipped loose for field installation and insulation by others.
Duct, Dampers, & Expansion Joints	The transition flue gas ducts will be shipped in shop assembled pieces to the maximum extent allowed by a non-permitted non-escorted truck shipment. Field installation of the transition duct is not included.
Trim	The field installation of shipped loose valves and instrumentation is not included (except for components which can be shop installed on the boiler or burner within shipping clearances).



CONFIDENTIAL

4. PROJECT MANAGEMENT AND START-UP SERVICES

4.1. PROJECT MANAGEMENT

Indeck will furnish the following support services, as required:

- A project manager will have overall responsibility for schedules, inter company coordination, customer relations, attending meetings, monitoring and reporting of project progress.
- A project engineer will coordinate the engineering efforts of the various disciplines, scheduling, distribution of vendor information and report engineering progress.
- A schedule of engineering submittals, procurement activities, and construction activities, will be updated and submitted to the customer for review.

4.2. OPERATION AND MAINTENANCE MANUALS

Indeck will furnish nine (9) hard copies and one (1) electronic copy of the Operation and Maintenance Manuals together with other documents obtained from suppliers or other sources for all equipment to be supplied.

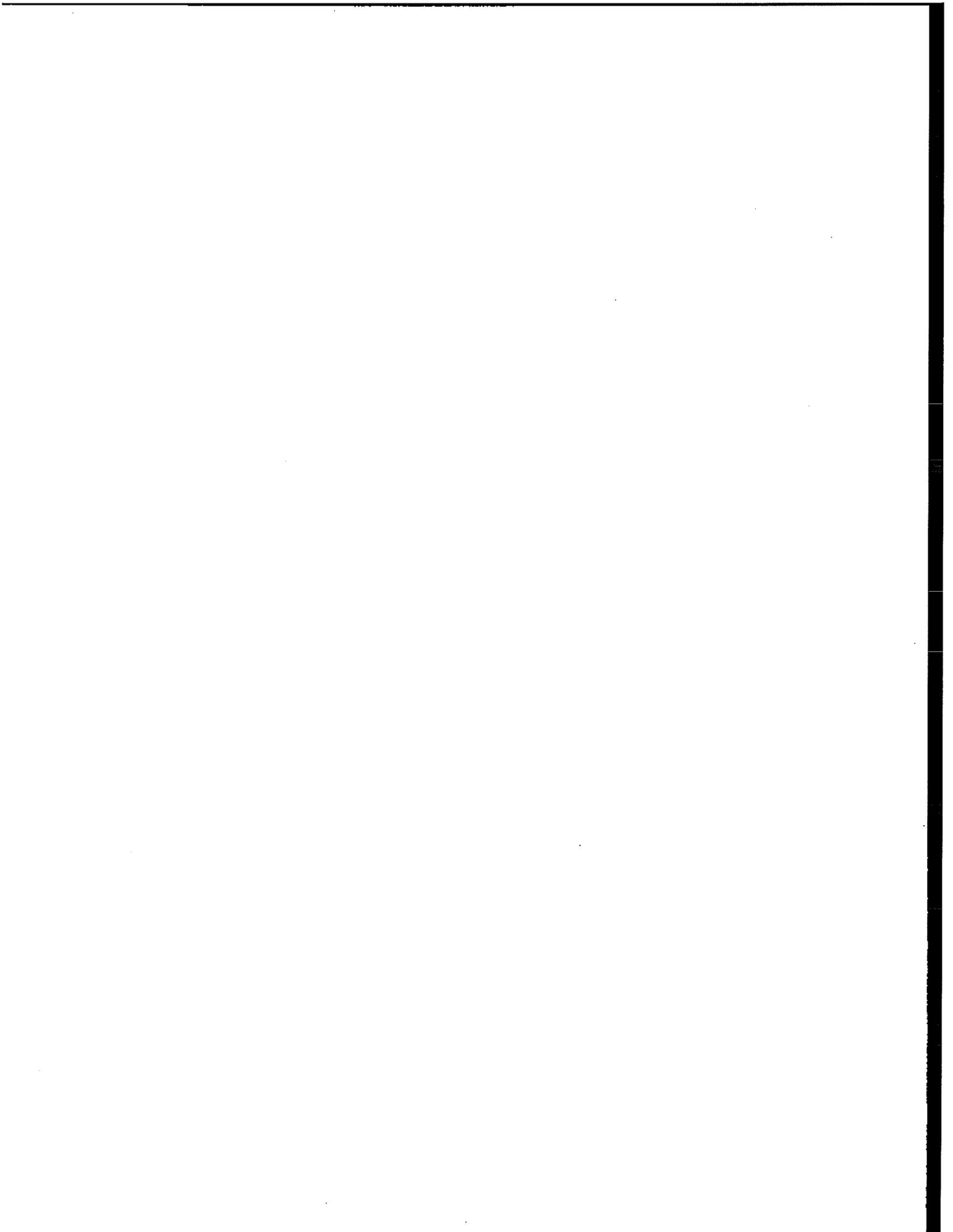
4.3. FIELD SERVICES

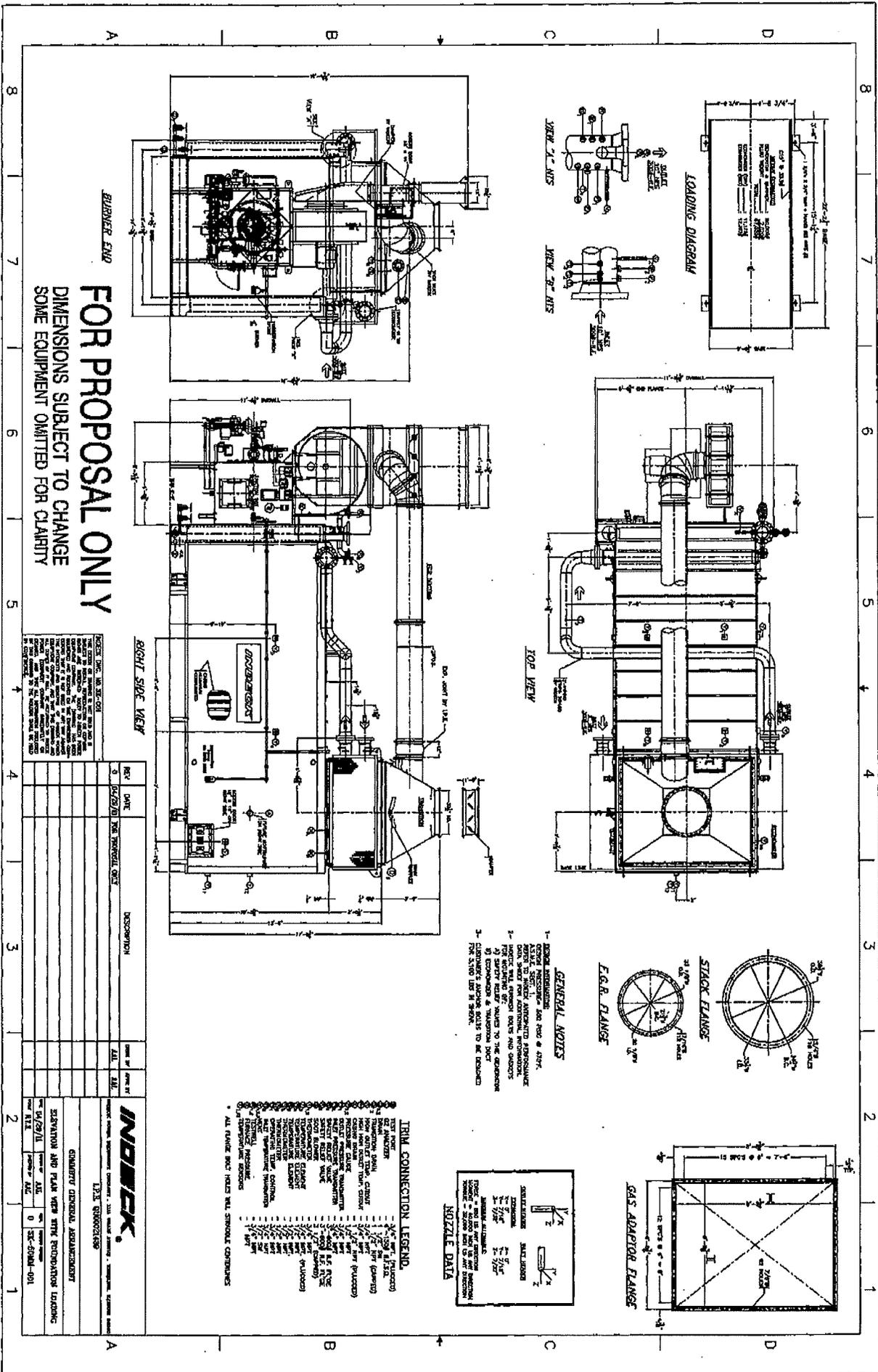
Indeck will furnish qualified field services which included: unloading equipment, construction, commissioning, and training as described on the attached Field Service Schedule for a total of 27 days of equivalent per diem time and expenses. Time and expenses required beyond that as shown on the schedule are offered on a Per Diem basis per the attached Field Service Terms.

4.4. PROPOSAL DRAWINGS

The following drawings are preliminary proposal drawing not for final designs:

Drawing Number	Date and Revision	Description
SK-50MM-001	Revision 0, 04/29/11	General Arrangement
SK-400	Revision 0, 04/29/11	P&ID – Notes and Symbols Sheet
SK-401	Revision 0, 04/29/11	P&ID – Fuel & Air
SK-402	Revision 0, 04/29/11	P&ID – Water





FOR PROPOSAL ONLY
 DIMENSIONS SUBJECT TO CHANGE
 SOME EQUIPMENT OMITTED FOR CLARITY

REVISION HISTORY

REV	DATE	DESCRIPTION	BY	CHK
0	02/01/01	FOR PROPOSAL ONLY		

INBECK

QUALITY GENERAL MANAGEMENT

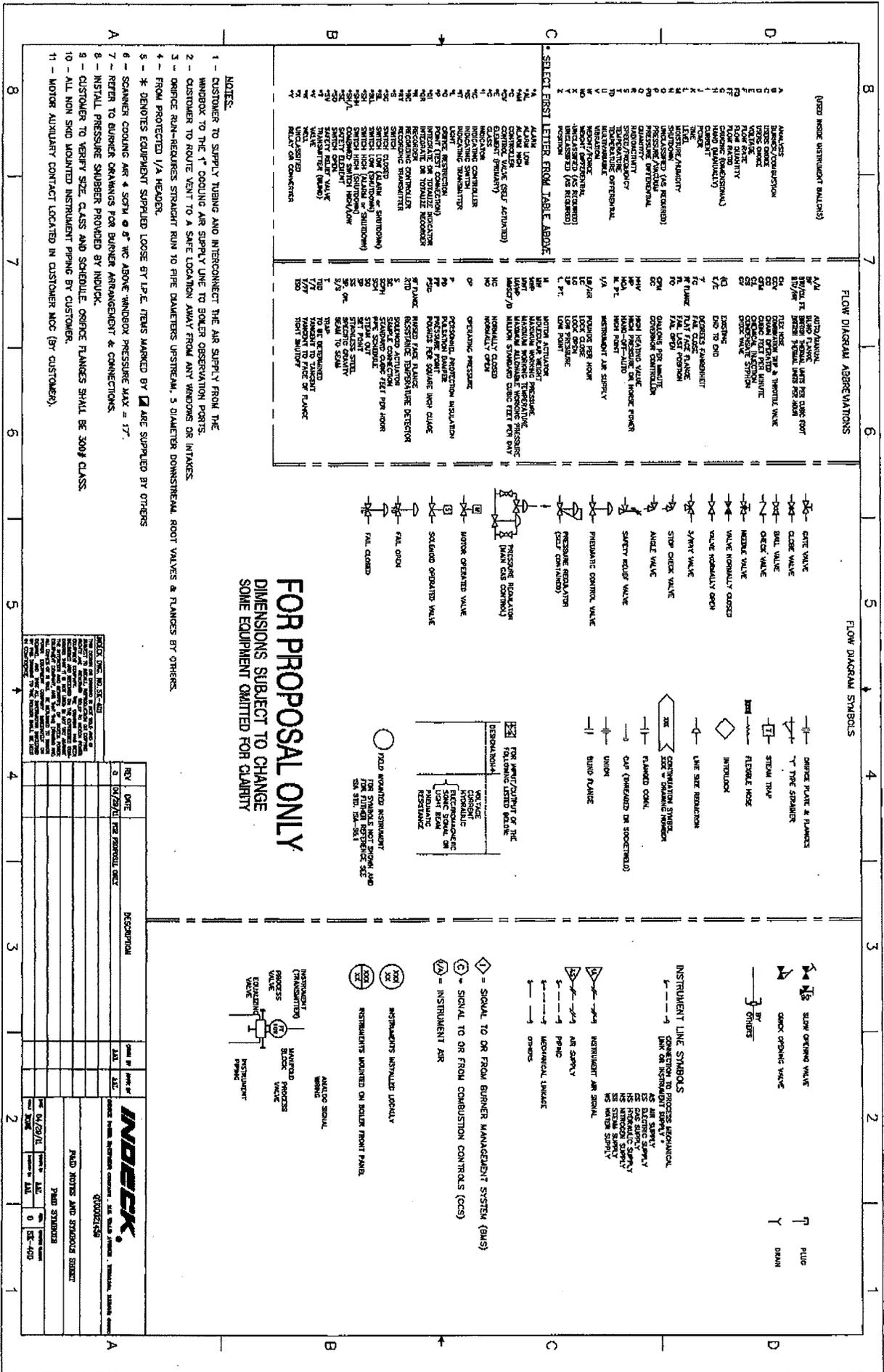
ESTIMATION AND PLAN VIEW WITH PROVISIONAL LOADING

- GENERAL NOTES**
- 1- GENERAL DIMENSIONS AND WEIGHTS ARE APPROXIMATE.
 - 2- ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.
 - 3- ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.
 - 4- ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
 - 5- ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
 - 6- ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
 - 7- ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
 - 8- ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
 - 9- ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
 - 10- ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.

NOZZLE DATA

NOZZLE TYPE	ORIFICE SIZE	ORIFICE AREA	ORIFICE PERIMETER	ORIFICE CIRCUMFERENCE
1/2"	0.1963	0.0307	0.6283	3.1416
3/8"	0.1250	0.0155	0.3927	1.5708
1/4"	0.0625	0.0039	0.1963	0.7854

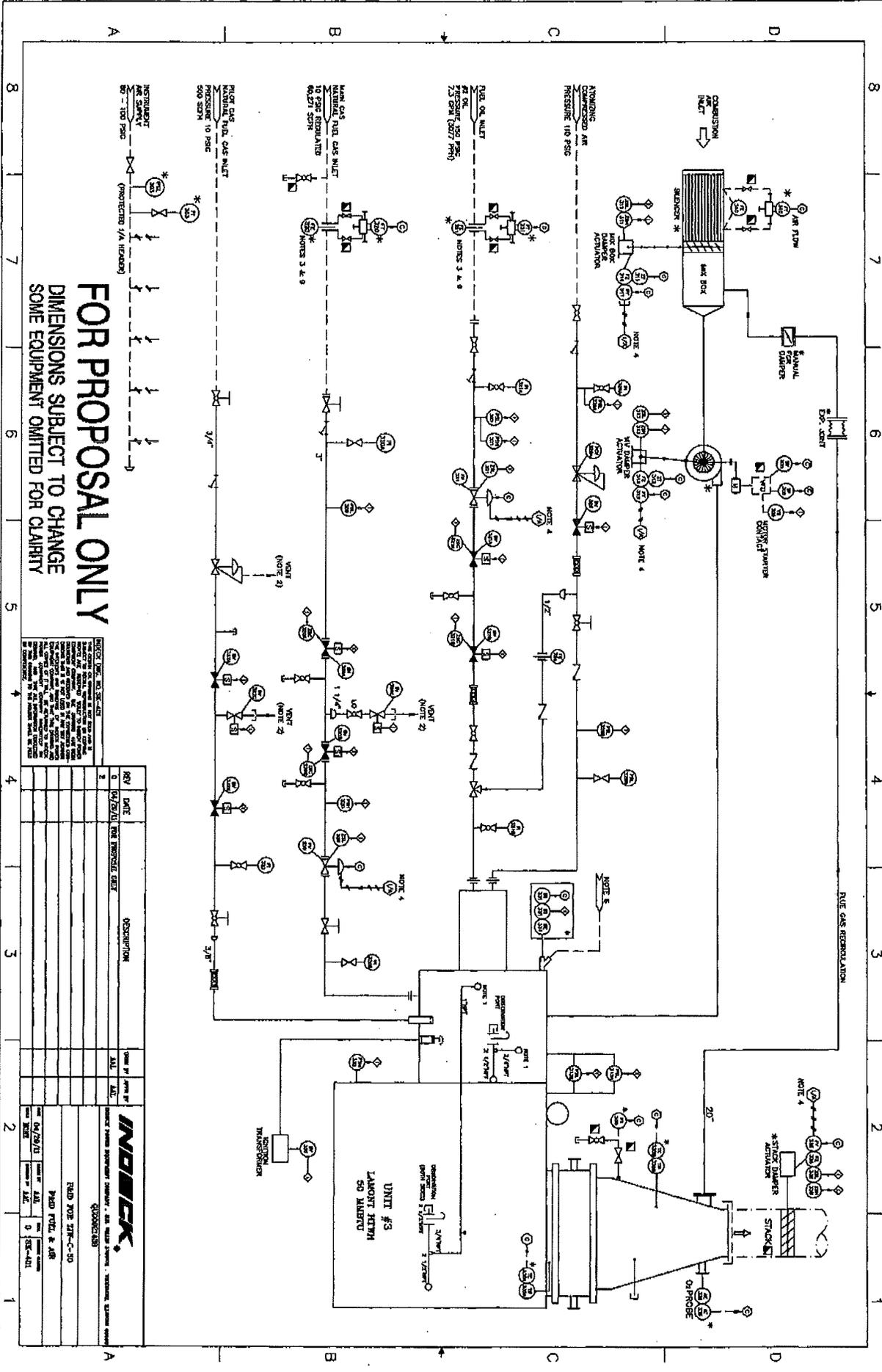
- TERM CONNECTION LEGEND**
- 1/2" (1/2")
 - 3/8" (3/8")
 - 1/4" (1/4")
 - 1/8" (1/8")
 - 1/16" (1/16")
 - 1/32" (1/32")
 - 1/64" (1/64")
 - 1/128" (1/128")
 - 1/256" (1/256")
 - 1/512" (1/512")
 - 1/1024" (1/1024")
 - 1/2048" (1/2048")
 - 1/4096" (1/4096")
 - 1/8192" (1/8192")
 - 1/16384" (1/16384")
 - 1/32768" (1/32768")
 - 1/65536" (1/65536")
 - 1/131072" (1/131072")
 - 1/262144" (1/262144")
 - 1/524288" (1/524288")
 - 1/1048576" (1/1048576")
 - 1/2097152" (1/2097152")
 - 1/4194304" (1/4194304")
 - 1/8388608" (1/8388608")
 - 1/16777216" (1/16777216")
 - 1/33554432" (1/33554432")
 - 1/67108864" (1/67108864")
 - 1/134217728" (1/134217728")
 - 1/268435456" (1/268435456")
 - 1/536870912" (1/536870912")
 - 1/1073741824" (1/1073741824")
 - 1/2147483648" (1/2147483648")
 - 1/4294967296" (1/4294967296")
 - 1/8589934592" (1/8589934592")
 - 1/17179869184" (1/17179869184")
 - 1/34359738368" (1/34359738368")
 - 1/68719476736" (1/68719476736")
 - 1/137438953472" (1/137438953472")
 - 1/274877906944" (1/274877906944")
 - 1/549755813888" (1/549755813888")
 - 1/1099511627776" (1/1099511627776")
 - 1/2199023255552" (1/2199023255552")
 - 1/4398046511104" (1/4398046511104")
 - 1/8796093022208" (1/8796093022208")
 - 1/17592186044416" (1/17592186044416")
 - 1/35184372088832" (1/35184372088832")
 - 1/70368744177664" (1/70368744177664")
 - 1/140737488355328" (1/140737488355328")
 - 1/281474976710656" (1/281474976710656")
 - 1/562949953421312" (1/562949953421312")
 - 1/1125899906842624" (1/1125899906842624")
 - 1/2251799813685248" (1/2251799813685248")
 - 1/4503599627370496" (1/4503599627370496")
 - 1/9007199254740992" (1/9007199254740992")
 - 1/18014398509481984" (1/18014398509481984")
 - 1/36028797018963968" (1/36028797018963968")
 - 1/72057594037927936" (1/72057594037927936")
 - 1/144115188075855872" (1/144115188075855872")
 - 1/288230376151711744" (1/288230376151711744")
 - 1/576460752303423488" (1/576460752303423488")
 - 1/1152921504606846976" (1/1152921504606846976")
 - 1/2305843009213693952" (1/2305843009213693952")
 - 1/4611686018427387904" (1/4611686018427387904")
 - 1/9223372036854775808" (1/9223372036854775808")
 - 1/18446744073709551616" (1/18446744073709551616")
 - 1/36893488147419103232" (1/36893488147419103232")
 - 1/73786976294838206464" (1/73786976294838206464")
 - 1/147573952589676412928" (1/147573952589676412928")
 - 1/295147905179352825856" (1/295147905179352825856")
 - 1/590295810358705651712" (1/590295810358705651712")
 - 1/1180591620717411303424" (1/1180591620717411303424")
 - 1/2361183241434822606848" (1/2361183241434822606848")
 - 1/4722366482869645213696" (1/4722366482869645213696")
 - 1/9444732965739290427392" (1/9444732965739290427392")
 - 1/18889465931478580854784" (1/18889465931478580854784")
 - 1/37778931862957161709568" (1/37778931862957161709568")
 - 1/75557863725914323419136" (1/75557863725914323419136")
 - 1/151115727451828646838272" (1/151115727451828646838272")
 - 1/302231454903657293676544" (1/302231454903657293676544")
 - 1/604462909807314587353088" (1/604462909807314587353088")
 - 1/1208925819614629174706176" (1/1208925819614629174706176")
 - 1/2417851639229258349412352" (1/2417851639229258349412352")
 - 1/4835703278458516698824704" (1/4835703278458516698824704")
 - 1/9671406556917033397649408" (1/9671406556917033397649408")
 - 1/19342813113834066795298816" (1/19342813113834066795298816")
 - 1/38685626227668133590597632" (1/38685626227668133590597632")
 - 1/77371252455336267181195264" (1/77371252455336267181195264")
 - 1/154742504910672534362390528" (1/154742504910672534362390528")
 - 1/309485009821345068724781056" (1/309485009821345068724781056")
 - 1/618970019642690137449562112" (1/618970019642690137449562112")
 - 1/1237940039285380274899124224" (1/1237940039285380274899124224")
 - 1/2475880078570760549798248448" (1/2475880078570760549798248448")
 - 1/4951760157141521099596496896" (1/4951760157141521099596496896")
 - 1/9903520314283042199192993792" (1/9903520314283042199192993792")
 - 1/19807040628566084398385987584" (1/19807040628566084398385987584")
 - 1/39614081257132168796771975168" (1/39614081257132168796771975168")
 - 1/79228162514264337593543950336" (1/79228162514264337593543950336")
 - 1/158456325028528675187087900672" (1/158456325028528675187087900672")
 - 1/316912650057057350374175801344" (1/316912650057057350374175801344")
 - 1/633825300114114700748351602688" (1/633825300114114700748351602688")
 - 1/1267650600228229401496703205376" (1/1267650600228229401496703205376")
 - 1/2535301200456458802993406410752" (1/2535301200456458802993406410752")
 - 1/5070602400912917605986812821504" (1/5070602400912917605986812821504")
 - 1/10141204801825835211973625643008" (1/10141204801825835211973625643008")
 - 1/20282409603651670423947251286016" (1/20282409603651670423947251286016")
 - 1/40564819207303340847894502572032" (1/40564819207303340847894502572032")
 - 1/81129638414606681695789005144064" (1/81129638414606681695789005144064")
 - 1/162259276832213363311578010288128" (1/162259276832213363311578010288128")
 - 1/324518553664426726623156020576256" (1/324518553664426726623156020576256")
 - 1/649037107328853453246312041152512" (1/649037107328853453246312041152512")
 - 1/1298074214577067106492640822300224" (1/1298074214577067106492640822300224")
 - 1/2596148429154134212985281644600448" (1/2596148429154134212985281644600448")
 - 1/5192296858308268425970563289200896" (1/5192296858308268425970563289200896")
 - 1/1038459371661653685194112657801792" (1/1038459371661653685194112657801792")
 - 1/2076918743323307370388225315603584" (1/2076918743323307370388225315603584")
 - 1/4153837486646614740776450631207168" (1/4153837486646614740776450631207168")
 - 1/8307674973293229481552901262414336" (1/8307674973293229481552901262414336")
 - 1/1661534994658645896305580252482872" (1/1661534994658645896305580252482872")
 - 1/3323069989317291792611160504965744" (1/3323069989317291792611160504965744")
 - 1/6646139978634583585222321009931488" (1/6646139978634583585222321009931488")
 - 1/1329227995726916771044464201986296" (1/1329227995726916771044464201986296")
 - 1/2658455991453833542088928403972592" (1/2658455991453833542088928403972592")
 - 1/5316911982907667084177856807945184" (1/5316911982907667084177856807945184")
 - 1/10633823965815334168355713615890368" (1/10633823965815334168355713615890368")
 - 1/21267647931630668336711427231780736" (1/21267647931630668336711427231780736")
 - 1/42535295863261336673422854463561472" (1/42535295863261336673422854463561472")
 - 1/85070591726522673346845708927122944" (1/85070591726522673346845708927122944")
 - 1/170141183453045346693691417854245888" (1/170141183453045346693691417854245888")
 - 1/34028236690609069338738283570849177728" (1/34028236690609069338738283570849177728")
 - 1/68056473381218138677476567141698355456" (1/68056473381218138677476567141698355456")
 - 1/1361129467624362773549531342833967111104" (1/1361129467624362773549531342833967111104")
 - 1/2722258935248725547099062685667934222208" (1/2722258935248725547099062685667934222208")
 - 1/5444517870497451094198125371335868444416" (1/5444517870497451094198125371335868444416")
 - 1/1088903574099490218839625074271736788832" (1/1088903574099490218839625074271736788832")
 - 1/2177807148198980437679250148543473577664" (1/2177807148198980437679250148543473577664")
 - 1/43556142963979608753585002970869471555296" (1/43556142963979608753585002970869471555296")
 - 1/871122859279592175071700059417389431111552" (1/871122859279592175071700059417389431111552")
 - 1/174224571855918435014340011883678886222304" (1/174224571855918435014340011883678886222304")
 - 1/34844914371183687002868002376735777244608" (1/34844914371183687002868002376735777244608")
 - 1/696898287423673740057360047534715548912" (1/696898287423673740057360047534715548912")
 - 1/1393796574847347480114720095069430977824" (1/1393796574847347480114720095069430977824")
 - 1/2787593149694694960229440190138861955456" (1/2787593149694694960229440190138861955456")
 - 1/5575186299389389920458880380277723911104" (1/5575186299389389920458880380277723911104")
 - 1/11150372598778779840917760760554467822208" (1/11150372598778779840917760760554467822208")
 - 1/22300745197557559681835521521108916444416" (1/22300745197557559681835521521108916444416")
 - 1/44601490395115119363671043042217832888832" (1/44601490395115119363671043042217832888832")
 - 1/89202980790230238727342060844355665777664" (1/89202980790230238727342060844355665777664")
 - 1/178405961580460477454684121688711315555328" (1/178405961580460477454684121688711315555328")
 - 1/3568119231609209549093682433774226311110656" (1/3568119231609209549093682433774226311110656")
 - 1/71362384632184190981873648675484526222312" (1/71362384632184190981873648675484526222312")
 - 1/14272476926436838196375129735097052444464" (1/14272476926436838196375129735097052444464")
 - 1/2854495385287367639275025847019410488928" (1/2854495385287367639275025847019410488928")
 - 1/5708990770574735278550051694038820977856" (1/5708990770574735278550051694038820977856")
 - 1/1141798154114947055710010388007741555712" (1/1141798154114947055710010388007741555712")
 - 1/22835963082298941114200207760154311114224" (1/22835963082298941114200207760154311114224")
 - 1/45671926164597882228400415520308622284448" (1/45671926164597882228400415520308622284448")
 - 1/91343852329195764456800831040617244578896" (1/91343852329195764456800831040617244578896")
 - 1/182687704658391528913601620812234489577792" (1/182687704658391528913601620812234489577792")
 - 1/365375409316783057827203241624469791555584" (1/365375409316783057827203241624469791555584")
 - 1/730750818633566115654406483248939583111168" (1/730750818633566115654406483248939583111168")
 - 1/146150163726713223130881286497879166222336" (1/146150163726713223130881286497879166222336")
 - 1/292300327453426446261765172995758332444672" (1/292300327453426446261765172995758332444672")
 - 1/58460065490685289252353034599151666488944" (1/58460065490685289252353034599151666488944")
 - 1/116920130981370578504706069198313333778888" (1/116920130981370578504706069198313333778888")
 - 1/233840261962741157009412138396626667557776" (1/233840261962741157009412138396626667557776")
 - 1/467680523925482314018824276793253335155552" (1/467680523925482314018824276793253335155552")
 - 1/9353610478509646280376485535865066703111104" (1/9353610478509646280376485535865066703111104")
 - 1/1870722095701929256075297107173013262222208" (1/1870722095701929256075297107173013262222208")
 - 1/3741444191403858512150594214346026524444416" (1/3741444191403858512150594214346026524444416")
 - 1/748288838280771702430118842869205104888892" (1/748288838280771702430118842869205104888892")
 - 1/1496577676561543404860377685738410197777664" (1/1496577676561543404860377685738410197777664")
 - 1/2993155353123086809720755371476820395555328" (1/2993155353123086809720755371476820395555328")
 - 1/5986310706246173619441510742953640711110656" (1/5986310706246173619441510742953640711110656")
 - 1/119726214124923472388830214857872814222312" (1/119726214124923472388830214857872814222312")
 - 1/239452428249846944777660429715745628444672" (1/23945242824984694477



(USED INSTRUMENT BALLINGS)

ABBREVIATION	DESCRIPTION
A	ANALYSIS
B	BURNER/COMBUSTION
C	CONTROL
D	DIAPHRAGM
E	ENGINEERING
F	FLOW
G	GENERAL
H	HAND (MANUAL)
I	INSTRUMENT
J	JUNCTION
K	KEY
L	LOCAL
M	MOTOR
N	NON-RETURN VALVE
O	ORIGINATOR
P	PROCESS
Q	QUALITY
R	REACTIVITY
S	STATUS
T	TEMPERATURE
U	UNION
V	VALVE
W	WATER
X	EXHAUST
Y	YIELD
Z	ZONE

ABBREVIATION	DESCRIPTION
AA	AUTO/AUTOMATIC
AB	BACKFLOW PREVENTER
AC	ACTUATOR
AD	ADJUSTING/ADJUSTMENT
AE	ALARM
AF	ALARM LOW
AG	ALARM HIGH
AH	ALARM
AI	ALARM
AJ	ALARM
AK	ALARM
AL	ALARM
AM	ALARM
AN	ALARM
AO	ALARM
AP	ALARM
AQ	ALARM
AR	ALARM
AS	ALARM
AT	ALARM
AV	ALARM
AW	ALARM
AX	ALARM
AY	ALARM
AZ	ALARM
BA	ALARM
BB	ALARM
BC	ALARM
BD	ALARM
BE	ALARM
BF	ALARM
BG	ALARM
BH	ALARM
BI	ALARM
BJ	ALARM
BK	ALARM
BL	ALARM
BM	ALARM
BN	ALARM
BO	ALARM
BP	ALARM
BQ	ALARM
BR	ALARM
BS	ALARM
BT	ALARM
BV	ALARM
BW	ALARM
BX	ALARM
BY	ALARM
BZ	ALARM
CA	ALARM
CB	ALARM
CC	ALARM
CD	ALARM
CE	ALARM
CF	ALARM
CG	ALARM
CH	ALARM
CI	ALARM
CJ	ALARM
CK	ALARM
CL	ALARM
CM	ALARM
CN	ALARM
CO	ALARM
CP	ALARM
CQ	ALARM
CR	ALARM
CS	ALARM
CT	ALARM
CU	ALARM
CV	ALARM
CW	ALARM
CX	ALARM
CY	ALARM
CZ	ALARM
DA	ALARM
DB	ALARM
DC	ALARM
DD	ALARM
DE	ALARM
DF	ALARM
DG	ALARM
DH	ALARM
DI	ALARM
DJ	ALARM
DK	ALARM
DL	ALARM
DM	ALARM
DN	ALARM
DO	ALARM
DP	ALARM
DQ	ALARM
DR	ALARM
DS	ALARM
DT	ALARM
DV	ALARM
DW	ALARM
DX	ALARM
DY	ALARM
DZ	ALARM
EA	ALARM
EB	ALARM
EC	ALARM
ED	ALARM
EE	ALARM
EF	ALARM
EG	ALARM
EH	ALARM
EI	ALARM
EJ	ALARM
EK	ALARM
EL	ALARM
EM	ALARM
EN	ALARM
EO	ALARM
EP	ALARM
EQ	ALARM
ER	ALARM
ES	ALARM
ET	ALARM
EU	ALARM
EV	ALARM
EW	ALARM
EX	ALARM
EY	ALARM
EZ	ALARM
FA	ALARM
FB	ALARM
FC	ALARM
FD	ALARM
FE	ALARM
FF	ALARM
FG	ALARM
FH	ALARM
FI	ALARM
FJ	ALARM
FK	ALARM
FL	ALARM
FM	ALARM
FN	ALARM
FO	ALARM
FP	ALARM
FQ	ALARM
FR	ALARM
FS	ALARM
FT	ALARM
FV	ALARM
FW	ALARM
FX	ALARM
FY	ALARM
FZ	ALARM
GA	ALARM
GB	ALARM
GC	ALARM
GD	ALARM
GE	ALARM
GF	ALARM
GG	ALARM
GH	ALARM
GI	ALARM
GJ	ALARM
GK	ALARM
GL	ALARM
GM	ALARM
GN	ALARM
GO	ALARM
GP	ALARM
GQ	ALARM
GR	ALARM
GS	ALARM
GT	ALARM
GV	ALARM
GW	ALARM
GX	ALARM
GY	ALARM
GZ	ALARM
HA	ALARM
HB	ALARM
HC	ALARM
HD	ALARM
HE	ALARM
HF	ALARM
HG	ALARM
HH	ALARM
HI	ALARM
HJ	ALARM
HK	ALARM
HL	ALARM
HM	ALARM
HN	ALARM
HO	ALARM
HP	ALARM
HQ	ALARM
HR	ALARM
HS	ALARM
HT	ALARM
HV	ALARM
HW	ALARM
HX	ALARM
HY	ALARM
HZ	ALARM
IA	ALARM
IB	ALARM
IC	ALARM
ID	ALARM
IE	ALARM
IF	ALARM
IG	ALARM
IH	ALARM
II	ALARM
IJ	ALARM
IK	ALARM
IL	ALARM
IM	ALARM
IN	ALARM
IO	ALARM
IP	ALARM
IQ	ALARM
IR	ALARM
IS	ALARM
IT	ALARM
IV	ALARM
IW	ALARM
IX	ALARM
IY	ALARM
IZ	ALARM
JA	ALARM
JB	ALARM
JC	ALARM
JD	ALARM
JE	ALARM
JF	ALARM
JG	ALARM
JH	ALARM
JI	ALARM
JJ	ALARM
JK	ALARM
JL	ALARM
JM	ALARM
JN	ALARM
JO	ALARM
JP	ALARM
JQ	ALARM
JR	ALARM
JS	ALARM
JT	ALARM
JV	ALARM
JW	ALARM
JX	ALARM
JY	ALARM
JZ	ALARM
KA	ALARM
KB	ALARM
KC	ALARM
KD	ALARM
KE	ALARM
KF	ALARM
KG	ALARM
KH	ALARM
KI	ALARM
KJ	ALARM
KL	ALARM
KM	ALARM
KN	ALARM
KO	ALARM
KP	ALARM
KQ	ALARM
KR	ALARM
KS	ALARM
KT	ALARM
KV	ALARM
KW	ALARM
KX	ALARM
KY	ALARM
KZ	ALARM
LA	ALARM
LB	ALARM
LC	ALARM
LD	ALARM
LE	ALARM
LF	ALARM
LG	ALARM
LH	ALARM
LI	ALARM
LJ	ALARM
LK	ALARM
LL	ALARM
LM	ALARM
LN	ALARM
LO	ALARM
LP	ALARM
LQ	ALARM
LR	ALARM
LS	ALARM
LT	ALARM
LV	ALARM
LW	ALARM
LX	ALARM
LY	ALARM
LZ	ALARM
MA	ALARM
MB	ALARM
MC	ALARM
MD	ALARM
ME	ALARM
MF	ALARM
MG	ALARM
MH	ALARM
MI	ALARM
MJ	ALARM
MK	ALARM
ML	ALARM
MM	ALARM
MN	ALARM
MO	ALARM
MP	ALARM
MQ	ALARM
MR	ALARM
MS	ALARM
MT	ALARM
MV	ALARM
MW	ALARM
MX	ALARM
MY	ALARM
MZ	ALARM
NA	ALARM
NB	ALARM
NC	ALARM
ND	ALARM
NE	ALARM
NF	ALARM
NG	ALARM
NH	ALARM
NI	ALARM
NJ	ALARM
NK	ALARM
NL	ALARM
NM	ALARM
NN	ALARM
NO	ALARM
NP	ALARM
NQ	ALARM
NR	ALARM
NS	ALARM
NT	ALARM
NV	ALARM
NW	ALARM
NX	ALARM
NY	ALARM
NZ	ALARM
OA	ALARM
OB	ALARM
OC	ALARM
OD	ALARM
OE	ALARM
OF	ALARM
OG	ALARM
OH	ALARM
OI	ALARM
OJ	ALARM
OK	ALARM
OL	ALARM
OM	ALARM
ON	ALARM
OO	ALARM
OP	ALARM
OQ	ALARM
OR	ALARM
OS	ALARM
OT	ALARM
OV	ALARM
OW	ALARM
OX	ALARM
OY	ALARM
OZ	ALARM
PA	ALARM
PB	ALARM
PC	ALARM
PD	ALARM
PE	ALARM
PF	ALARM
PG	ALARM
PH	ALARM
PI	ALARM
PJ	ALARM
PK	ALARM
PL	ALARM
PM	ALARM
PN	ALARM
PO	ALARM
PP	ALARM
PQ	ALARM
PR	ALARM
PS	ALARM
PT	ALARM
PV	ALARM
PW	ALARM
PX	ALARM
PY	ALARM
PZ	ALARM
QA	ALARM
QB	ALARM
QC	ALARM
QD	ALARM
QE	ALARM
QF	ALARM
QG	ALARM
QH	ALARM
QI	ALARM
QJ	ALARM
QK	ALARM
QL	ALARM
QM	ALARM
QN	ALARM
QO	ALARM
QP	ALARM
QQ	ALARM
QR	ALARM
QS	ALARM
QT	ALARM
QV	ALARM
QW	ALARM
QX	ALARM
QY	ALARM
QZ	ALARM
RA	ALARM
RB	ALARM
RC	ALARM
RD	ALARM
RE	ALARM
RF	ALARM
RG	ALARM
RH	ALARM
RI	ALARM
RJ	ALARM
RK	ALARM
RL	ALARM
RM	ALARM
RN	ALARM
RO	ALARM
RP	ALARM
RQ	ALARM
RR	ALARM
RS	ALARM
RT	ALARM
RV	ALARM
RW	ALARM
RX	ALARM
RY	ALARM
RZ	ALARM
SA	ALARM
SB	ALARM
SC	ALARM
SD	ALARM
SE	ALARM
SF	ALARM
SG	ALARM
SH	ALARM
SI	ALARM
SJ	ALARM
SK	ALARM
SL	ALARM
SM	ALARM
SN	ALARM
SO	ALARM
SP	ALARM
SQ	ALARM
SR	ALARM
SS	ALARM
ST	ALARM
SV	ALARM
SW	ALARM
SX	ALARM
SY	ALARM
SZ	ALARM
TA	ALARM
TB	ALARM
TC	ALARM
TD	ALARM
TE	ALARM
TF	ALARM
TG	ALARM
TH	ALARM
TI	ALARM
TJ	ALARM
TK	ALARM
TL	ALARM
TM	ALARM
TN	ALARM
TO	ALARM
TP	ALARM
TQ	ALARM
TR	ALARM
TS	ALARM
TV	ALARM
TW	ALARM
TX	ALARM
TY	ALARM
TZ	ALARM
UA	ALARM
UB	ALARM
UC	ALARM
UD	ALARM
UE	ALARM
UF	ALARM
UG	ALARM
UH	ALARM
UI	ALARM
UJ	ALARM
UK	ALARM
UL	ALARM
UM	ALARM
UN	ALARM
UO	ALARM
UP	ALARM
UQ	ALARM
UR	ALARM
US	ALARM
UT	ALARM
UV	ALARM
UW	ALARM
UX	ALARM
UY	ALARM
UZ	ALARM
VA	ALARM
VB	ALARM
VC	ALARM
VD	ALARM
VE	ALARM
VF	ALARM
VG	ALARM
VH	ALARM
VI	ALARM
VJ	ALARM
VK	ALARM
VL	ALARM
VM	ALARM
VN	ALARM
VO	ALARM
VP	ALARM
VQ	ALARM
VR	ALARM
VS	ALARM
VT	ALARM
VV	ALARM
VW	ALARM
VX	ALARM
VY	ALARM
VZ	ALARM
WA	ALARM
WB	ALARM
WC	ALARM
WD	ALARM
WE	ALARM
WF	ALARM
WG	ALARM
WH	ALARM
WI	ALARM
WJ	ALARM
WK	ALARM
WL	ALARM
WM	ALARM
WN	ALARM
WO	ALARM
WP	ALARM
WQ	ALARM
WR	ALARM
WS	ALARM
WT	ALARM
WV	ALARM
WW	ALARM
WX	ALARM
WY	ALARM
WZ	ALARM
XA	ALARM
XB	ALARM
XC	ALARM
XD	ALARM
XE	ALARM
XF	ALARM
XG	ALARM
XH	ALARM
XI	ALARM
XJ	ALARM
XK	ALARM
XL	ALARM
XM	ALARM
XN	ALARM
XO	ALARM
XP	ALARM
XQ	ALARM
XR	ALARM
XS	ALARM
XT	ALARM
XV	ALARM
XW	ALARM
XX	ALARM
XY	ALARM
XZ	ALARM
YA	ALARM
YB	ALARM
YC	ALARM
YD	ALARM
YE	ALARM
YF	ALARM
YG	ALARM
YH	ALARM
YI	ALARM
YJ	ALARM
YK	ALARM
YL	ALARM
YM	ALARM
YN	ALARM
YO	ALARM
YP	ALARM
YQ	ALARM
YR	ALARM
YS	ALARM
YT	ALARM
YV	ALARM
YW	ALARM
YX	ALARM
YY	ALARM
YZ	ALARM
ZA	ALARM
ZB	ALARM
ZC	ALARM
ZD	ALARM
ZE	ALARM
ZF	ALARM
ZG	ALARM
ZH	ALARM
ZI	ALARM
ZJ	ALARM
ZK	ALARM
ZL	ALARM
ZM	ALARM
ZN	ALARM
ZO	ALARM
ZP	ALARM
ZQ	ALARM
ZR	ALARM
ZS	ALARM
ZT	ALARM

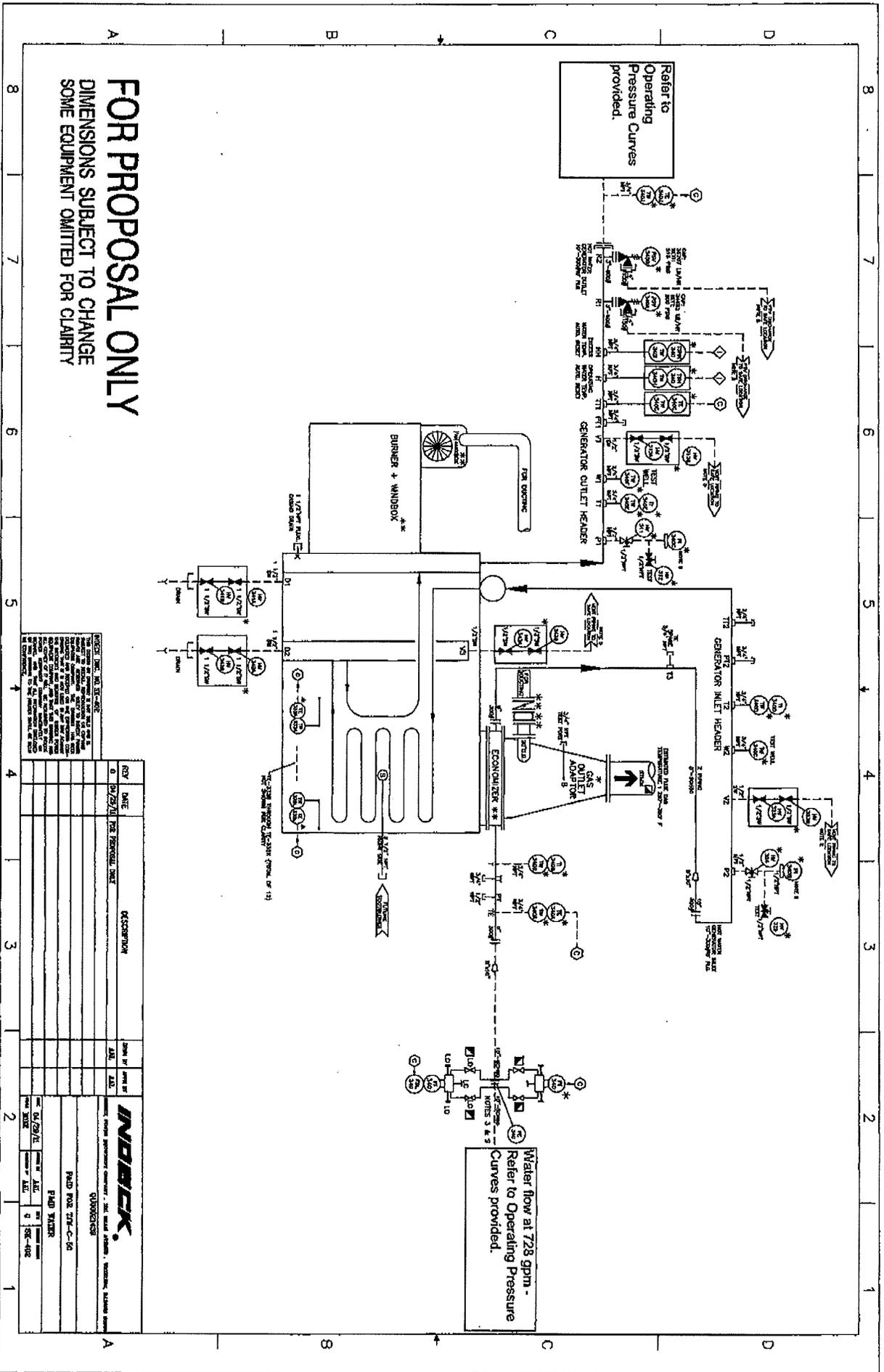


FOR PROPOSAL ONLY
 DIMENSIONS SUBJECT TO CHANGE
 SOME EQUIPMENT OMITTED FOR CLARITY

NOTE: THE UNIT IS TO BE USED FOR THE PURPOSES OF THE PROPOSAL ONLY. THE UNIT IS NOT TO BE USED FOR ANY OTHER PURPOSES. THE UNIT IS TO BE USED FOR THE PURPOSES OF THE PROPOSAL ONLY. THE UNIT IS NOT TO BE USED FOR ANY OTHER PURPOSES.

REV	DATE	DESCRIPTION	DESIGNED BY	CHECKED BY
0	04/29/11	PRELIMINARY DESIGN	ALL	ALL
1				
2				

INNOVICK PROJECT: GASEOUS PHASE REACTOR SYSTEM - SEE RELATED DRAWINGS FOR COMPLETE SYSTEM DETAILS Q100002138	
READ JOB 21W-C-30 PART: LAB. # 418 UNIT: 3 REV: 0 DATE: 04/29/11	UNIT #3 LABORATORY 50 HOURS



FOR PROPOSAL ONLY
 DIMENSIONS SUBJECT TO CHANGE
 SOME EQUIPMENT OMITTED FOR CLARITY

NOTE: THE USER SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND APPROVALS FROM THE LOCAL, STATE, AND FEDERAL AUTHORITIES. THE USER SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND APPROVALS FROM THE LOCAL, STATE, AND FEDERAL AUTHORITIES. THE USER SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND APPROVALS FROM THE LOCAL, STATE, AND FEDERAL AUTHORITIES.

REV	DATE	DESCRIPTION	BY	CHK
0	02/25/11	FOR PROPOSAL ONLY		

INBRICK 020002125 PAID FOR TTR-C-50 PAID WATER		DATE: 02/25/11 BY: JAC CHK: JAC REV: 0 REC: 492
--	--	---

CONFIDENTIAL

5. PERFORMANCE

5.1. PERFORMANCE

The performance for each Watertube Package Boiler is as detailed below for steady state conditions:

- A. Heat Output - The maximum continuous rating (MCR) will be 50.00 MMBTU/hr at the system terminal point firing natural gas and No. 2 fuel oil.
- B. Efficiency – The thermal efficiency of the system will not be less than 82% at 100% MCR firing natural gas and 85% at 100% MCR firing No. 2 fuel oil (based on HHV of the respective fuel).
- C. Water Temperature - The thermal fluid outlet temperature leaving the HTHW Generator at 100% MCR will be 380 deg F firing natural gas or No. 2 fuel oil.
- E. Emissions – The following performance will be extended from twenty-five (25) to one hundred (100) percent of boiler load, provided that the system is operated at steady state conditions.

Maximum emission levels firing natural gas with all concentrations corrected to 3% oxygen, on a dry basis is as follows:

NOx 0.05 lb/mmbtu (41 ppm)
CO 50 ppm (0.037 lb/mmbtu)
VOC 10 ppm (0.004 lb/mmbtu)
PM/PM10 0.005 lb/mmbtu
Opacity 5%, 6 minute time average

Maximum emission levels firing No. 2 fuel oil with all concentrations corrected to 3% oxygen, on a dry basis is as follows:

NOx 0.08 lb/mmbtu (64 ppm)
CO 50 ppm (0.037 lb/mmbtu)
VOC 10 ppm (0.004 lb/mmbtu)
SOx 0.052 lb/mmbtu
PM/PM10 0.03 lb/mmbtu



CONFIDENTIAL

5.2. BASIS OF THE PERFORMANCE

The above performance values are based upon the following conditions:

1. Operating pressure of the system is 223 psig at the HTHW Generator inlet.
2. Thermal fluid inlet temperature entering economizer is 240°F.
3. Ambient air temperature of 80°F.
4. Relative humidity of 60% at 80°F.
5. System is located at an elevation of less than 10 feet above sea level.
6. The fuel fired shall have an analysis as defined above under burner specifications and included in the attached performance reports 5-Jul-2011.
7. Fuels will be supplied at the required pressures and temperatures.
8. The boiler is designed for indoor installation.
9. This boiler system performance is based on the attached performance reports dated 5-Jul-2011 at steady state conditions.
10. Testing shall be in accordance with "General Performance & Technical Conditions".
11. The boiler water quality shall be per the attached Indeck Recommended Water Quality Limits for Hot Water Boilers.



INDECK

Anticipated Performances Data For "International-Lamont" Hot Fluid Boiler

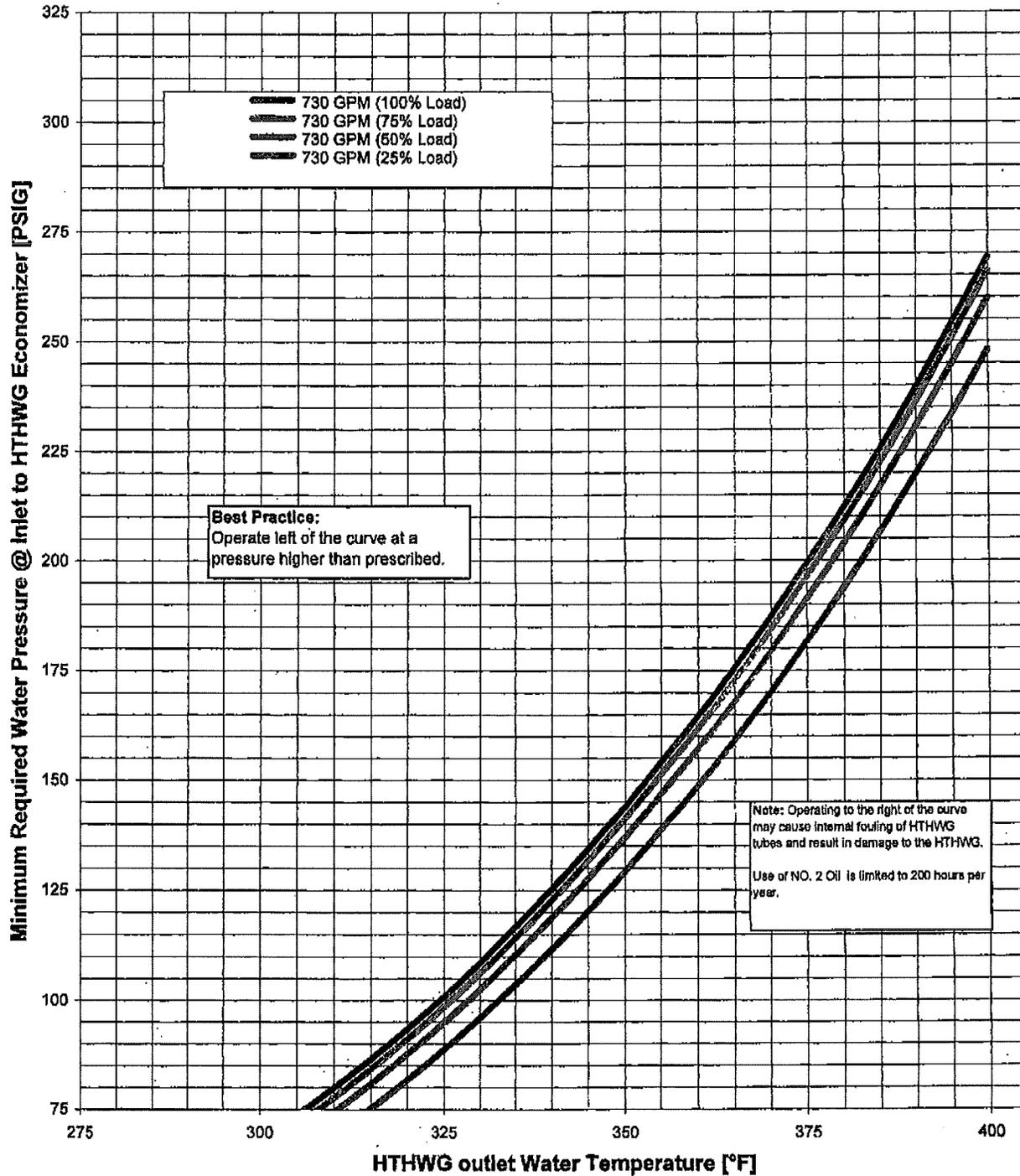
Project name: Newark Airport		Customer name: NY / NJ Port Authority		Ref #	QU-21439
Design conditions					
Lamont size:	50	Min Pressure in/out:	223.2 / 212.0 psig	Thermal Fluid Used:	Water
Fuel Fired:	Std Natural Gas	Fuel HHV:	22,699 BTU/lb	Site Elevation:	10 FASL
				Ambient Air Temp:	80 F
With economizer		Firing Rate			
		100%	75%	50%	25%
Heat Output	MMBTU/hr	50.00	37.50	25.00	12.50
Heat Input	MMBTU/hr	59.80	45.20	30.51	15.81
Boiler Efficiency (HHV) (5)	%	83.5%	83.0%	81.9%	79.1%
Boiler Efficiency (LHV) (5)	%	93.7%	93.2%	92.2%	89.3%
Thermal Fluid Flow (1)(2)	USgpm	728 at inlet fluid conditions			
	lb/hr	345,162	339,292	332,839	325,782
Thermal Fluid Outlet Temperature (3)	deg.F	380.0			
Thermal Fluid Inlet Temperature	deg.F	240.0	269.5	304.9	341.6
Thermal Fluid Pressure Drop in economizer	PSI	3.0	3.0	3.0	3.0
Thermal Fluid Pressure Drop in boiler (7)	PSI	8.2	7.9	7.6	7.3
Excess air	%	15%	15%	15%	25%
Flue gas recirculation (FGR)	%	30%	30%	30%	30%
Ambient air & FGR flow	lb/hr	67,789	51,148	34,533	19,432
Combustion air temperature	deg.F	128.6	131.0	136.0	143.7
Boiler draft loss	in.wc	3.2	1.8	0.8	0.3
Econ draft loss	in.wc	0.4	0.2	0.1	0.0
Fuel flow	lb/hr	2,639	1,991	1,344	697
Estimated Flue gas temp (vg Generator)(6)	deg.F	499	456	417	389
Estimated Flue gas temp at econ outlet(6)	deg.F	283	283	314	347
Flue gas flow	lb/hr	54,175	40,876	27,598	15,483
Furnace Heat Release	BTU/hr ft2	88,219	68,563	44,940	23,287
Furnace Liberation Rate	BTU/hr ft3	60,384	45,561	30,781	15,939
Physicals Data			Heating Surface		
Design pressure	Psig	500	Projected Radiant Furnace Surface		ft2
Boiler headers / Z-Pipe & Inlet Piping	NPS	10 / 8	Convective		ft2
Flooded Content	US gallon	936.0	Total Generator		ft2
Unit Dry Weight	lb	60,500	Furnace Volume		ft3
Thermal Fluid Weight At Ambient T	lb	7,808	Convection tube velocity		ft/s
Flooded Total Weight At Ambient T	lb	68,308	Furnace tube velocity		ft/s
Orifices quantity and diameter (in)	76	9/16			
Refractory floor	%	0%			
NOTES:					
(1) Low flow outout switch to be set at 655 USgpm (90% of Design Water Flow Rate as measured by inlet water flow meter).					
(2) Fluid properties based on inlet water temperature to system.					
(3) Maximum Manufacturer's recommended temperature is N/A F.					
(4) Ambient air at 60% relative humidity.					
(5) Includes 1.0 % manufacturer's margin, A.B.M.A. radiation losses and 0.0 % unaccounted loss.					
(6) Flue gases dew point temperature is 142 F					
(7) Does not include equipment losses for flow meter, valves, bypass station, or piping unless explicitly stated.					
By: A. Morian	Version: 2.3.8	Rev 0	Date:	5-Jul-2011	



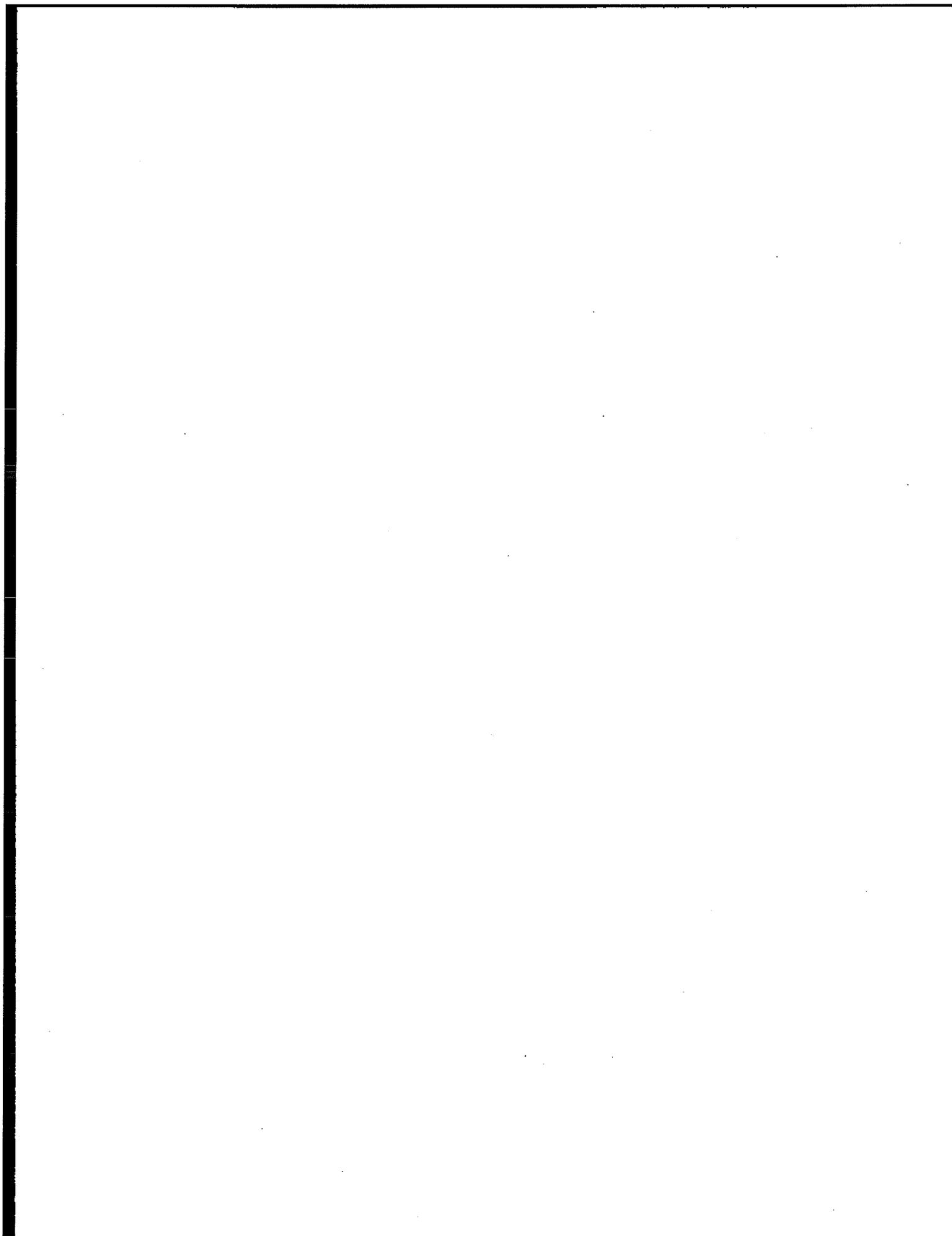
Anticipated Performances Data For "International-Lamont" Hot Fluid Boiler

Project name: Newark Airport		Customer name: NY / NJ Port Authority		Ref #	QU-21439
Design conditions					
Lamont size:	60	Min Pressure in/out:	223.2 / 212.0 psig	Thermal Fluid Used:	Water
Fuel Fired:	Std #2 Oil	Fuel HHV:	19,882 BTU/lb	Site Elevation:	10 FASL Ambient Air Temp: 80 F
With economizer		Firing Rate			
		100%	75%	50%	25%
Heat Output	MMBTU/hr	50.00	37.50	25.00	12.50
Heat Input	MMBTU/hr	57.10	43.07	29.06	15.03
Boiler Efficiency (HHV) (5)	%	87.8%	87.1%	86.0%	83.2%
Boiler Efficiency (LHV) (5)	%	93.6%	93.2%	92.2%	89.3%
Thermal Fluid Flow (1)(2)	USgpm	728 at inlet fluid conditions			
	lb/hr	345,162	339,292	332,839	326,782
Thermal Fluid Outlet Temperature (3)	deg.F	380.0			
Thermal Fluid Inlet Temperature	deg.F	240.0	269.5	304.9	341.6
Thermal Fluid Pressure Drop in economizer	PSI	3.0	3.0	3.0	3.0
Thermal Fluid Pressure Drop in boiler (7)	PSI	8.2	7.9	7.6	7.3
Excess air	%	16%	15%	15%	25%
Flue gas recirculation (FGR)	%	30%	30%	30%	30%
Ambient air & FGR flow	lb/hr	64,523	48,666	32,831	18,434
Combustion air temperature	deg.F	128.9	131.2	136.3	144.1
Boiler draft loss	in.wc	2.8	1.6	0.7	0.2
Econ draft loss	in.wc	0.3	0.2	0.1	0.0
Fuel flow	lb/hr	2,872	2,166	1,461	756
Estimated Flue gas temp lvg Generator(6)	deg.F	516	470	427	393
Estimated Flue gas temp at econ outlet(6)	deg.F	283	292	314	347
Flue gas flow	lb/hr	51,842	39,101	26,379	14,761
Furnace Heat Release	BTU/hr ft2	84,099	63,431	42,792	22,129
Furnace Liberation Rate	BTU/hr ft3	67,664	43,417	29,290	15,146
Physicals Data			Heating Surface		
Design pressure	Psig	500	Projected Radiant Furnace Surface		ft2 679.0
Boiler headers / Z-Pipe & Inlet Piping	NPS	10 / 8	Convective		ft2 3851.0
Flooded Content	US gallon	836.0	Total Generator		ft2 4530.0
Unit Dry Weight	lb	60,500	Furnace Volume		ft3 992.0
Thermal Fluid Weight At Ambient T	lb	7,808	Convection tube velocity		ft/s 3.7
Flooded Total Weight At Ambient T	lb	68,308	Furnace tube velocity		ft/s 3.6
Orifices quantity and diameter (in)	76	9/16			
Refractory floor	%	0%			
NOTES:					
(1) Low flow cutout switch to be set at 655 USgpm (90% of Design Water Flow Rate as measured by inlet water flow meter).					
(2) Fluid properties based on inlet water temperature to system.					
(3) Maximum Manufacturer's recommended temperature is N/A F.					
(4) Ambient air at 60% relative humidity.					
(5) Includes 1.0 % manufacturer's margin, A.B.M.A. radiation losses and 0.0 % unaccounted loss.					
(6) Flue gases dew point temperature is 130 F					
(7) Does not include equipment losses for flow meter, valves, bypass station, or piping unless explicitly stated.					
Use of No. 2 Oil is limited to 200 hours per year.					
By: A. Morian		Version: 2.3.8		Rev 0 Date: 6-Jul-2011	

INDECK QU-21439
Operating Pressure Curve Guideline For Std Natural Gas Firing
(TJW-C-50 With Economizer)



- Notes:**
1. Curves are Based on 60 MMSTU/HR heat output.
 2. Do not operate at pressures below curve @ 100% load!
 3. Pressure at inlet is located between the flow meter and the economizer.





CONFIDENTIAL

5.3. GENERAL PERFORMANCE & TECHNICAL CONDITONS

I. Conditions

The performance data is based on the conditions as stated in the following paragraphs:

- A. The equipment shall have been erected in accordance with the Indeck's plans and specifications, properly maintained and operated by the Buyer and /or Owner, and shall be in operating condition satisfactory to Indeck. The heat absorbing surfaces shall be clean inside and out.
- B. For HTHW Generators, the allowable concentration in the HTHW Generator water shall not exceed ABMA TABLE 4 HTHW Generator Water Limits and Water Quality Limits Adapted from ASME 1979 Consensus for HTHW Generator water quality, feedwater and attemperation water. For hot water generators, the allowable water quality shall meet the Indeck Recommended Water Quality Limits for Hot Water Generators. Refer to the following charts which state these limits. Chemicals used for internal treatment should be supplied to the HTHW Generator preferably through a separate HTHW Generator connection, used exclusively for that purpose, and in such a manner so as to prevent deposits on drum and tube internal surfaces which would interfere with proper operation. The allowable concentrations above are minimal for the HTHW Generator or hot water generator water control and in no way shall be construed as the controlling criteria for any specific installation. Feedwater and HTHW Generator water control for any specific installation shall be the responsibility of the equipment operator and /or Buyer's / Owner's feedwater consultant. Treatment should be such as to prevent deposits on the heating surfaces of the HTHW Generator or hot water generator as well as the drum internals (if applicable).
- C. Samples of water for testing shall be taken from the continuous blowdown, if installed, otherwise through a suitable located sampling pipe. Samples shall be taken through a cooling coil to prevent flashing. Sampling of HTHW Generator or hot water generator water shall be done as specified by the methods prescribed in ASTM Publications D1192, "Standard Specification for Equipment for Sampling Water, and Steam", and D3370 "Standard Specification for Equipment for Sampling Water". The determination of the concentrations within the HTHW Generator or hot water generator water shall be made in accordance with the proper ASTM Standards.

II. Tests

- A. Performance test if required by Buyer shall be run within thirty (30) days after the first fire not to exceed seven (7) months from offer to ship, it being understood that Indeck will require preliminary tests. Tests shall be conducted on one representative unit mutually agreed upon by the Buyer and Indeck. The Buyer, at Buyer's expense, shall make all preparations to furnish all operating and testing personnel and incur all expenses connected with such test, and shall give to Indeck at least fifteen (15) days notice of the date or dates on which tests will be made.
- B. Material, labor, fuel, utilities, temporary test equipment, electronic data logger /recorder, and supervision to conduct performance test shall be furnished by Buyer.
- C. Indeck's representative shall have access to the records at all times, and the test shall be conducted in a manner to satisfy Indeck that the specified performance conditions are being maintained. A complete copy of test data and results shall be furnished to Indeck in electronic and / or paper format as would be suitable for subsequent analysis and calculations.

CONFIDENTIAL

GENERAL PERFORMANCE & TECHNICAL CONDITIONS

- D. The equipment shall be considered as accepted if tests show that the performance guarantees, if made, have been fulfilled or if the Buyer fails to have said equipment tested within period mentioned. In case of failure to meet performance guarantees, if made, Indeck reserves the right to change, repair or replace the equipment furnished so that required performance guarantees will be obtained. Upon satisfactory completion of performance test, Indeck's responsibility shall be limited to the material and workmanship warranty.
- E. Performance tests and analysis (if required) for steaming capacity, operating pressure, steam temperature, and efficiency shall be in accordance with the applicable Performance Test Code (PTC).

For fired HTHW Generator systems, Indeck will use ASME PTC 4-1998 Fired Steam Generators. The steam flow shall be measured using a calibrated feedwater flow element with blowdown isolated during the test. The desuperheater flow will be accounted for via a Heat Balance if not measured with a calibrated flow element. The efficiency shall be calculated using the Energy Balance Method limiting the losses to the following items: Dry Gas, Hydrogen and Moisture in Fuel, Moisture in Air, Unburned Combustibles, Radiation and Manufacturer's Margin. The radiation loss shall be per ABMA Standard Radiation Loss Chart. Under no conditions shall the Manufacturer's Margin be used in a punitive manner against Indeck in any acceptance testing or analysis thereof.

For Gas Turbine Heat Recovery Steam Generators, the steam flow shall be confirmed by using the ASME PTC 4.4-1981 (Reaffirmed in 2003) input-output method to verify compliance with any guarantees.

For Waste Heat HTHW Generators, the steam flow shall be confirmed by using the concepts of ASME PTC 4.4-1981 (Reaffirmed in 2003) input-output method to verify compliance with any guarantees. Indeck will provide a method of determining the mass flow through the unit for the specific application.

For hot water generator systems, the heat output and efficiency shall be confirmed by using the PTC 4.1-1964 (reaffirmed in 1991). The abbreviated heat loss method will be used to determine efficiency.

Tests will be conducted using installed plant instrumentation. Any temporary instrumentation required for the test shall be supplied by the Buyer. Calibration of all instruments necessary for testing is the responsibility of Buyer. Calibration records shall be submitted to Indeck prior to testing for use in determining the overall uncertainty of each performance measurement. Measurement uncertainty shall be used as a tolerance in proving compliance with performance guarantees. The performance test shall have a four (4) hour duration with critical measurements taken at mutually agreed upon intervals.



CONFIDENTIAL

GENERAL PERFORMANCE & TECHNICAL CONDITIONS

- F. Emission test (not included by Indeck) shall be performed in accordance with the Federal EPA Code of Federal Regulations (CFR 40 Part 60 Appendix A) which states the following test methods: NOx = Method 7, CO = Method 10, VOC / UBHC = Method 25, Particulate = Method 5. If a local governing authority has different testing criteria, it shall be provided to Indeck for review and comment.
 - G. Performance calculations shall be based on the steam tables in latest edition of the latest edition of the "ASME Steam Tables."
 - H. The determination of the fuel or fuels high heating value must be made in accordance with the applicable ASTM Standard.
 - I. The Unaccounted for Loss and Manufacturer's Margin are applied in order to counter conditions beyond the control of the Manufacturer. This value is a combination of the Manufacturer's Margin (1% for liquid or gaseous) and Unmeasured Losses.
 - J. Upon completion of all performance tests, all parties shall recognize limits of probable measurement error efficiency.
 - K. If local union rules require standby labor during these tests, it shall be furnished by the Buyer at no charge to Indeck.
 - L. Equipment must be in like-new condition at the time of the test. If equipment is not in like new condition, corrections and cleanings are to Buyer's account. Indeck shall be afforded reasonable access to perform preliminary testing with balance of plant available to support operation of the equipment over varying capacities.
- III. Responsibility**
- A. The treatment of feedwater and the conditioning of HTHW Generator water are beyond the control of Indeck. Indeck shall not be responsible for damage due to the presence of oil, grease, scale, or deposits on the internal surfaces of the Equipment, or for damage resulting from foaming caused by chemical conditions of the water or for damage resulting from corrosion or caustic embrittlement.
 - B. Indeck is not responsible for corrosion, erosion, catalyst poisons or fouling due to corrosive agents or non-combustion residue (ash) in the fuels and flue gas entering the HTHW Generator or hot water generator or maintenance resulting from combustion of the fuel. Indeck is not responsible for catalyst plugging or clogging for any reason, or increased catalyst draft loss. The Buyer should exercise diligence in this regard, checking fuel analysis with supplier, investigating possibility of using helpful additives, and operating soot blowing equipment if required for the time periods as outlined in the maintenance manual or dictated by operation. Indeck shall not be responsible for damage resulting from conditions of heat transfer medium such as, deposits on internal and external surface, thermal shock, water hammer and explosion.
 - C. The Buyer and /or Owner shall provide, when applicable, all fluid and gaseous fuels clean and free from debris and foreign matter at point of connection to burner piping.
 - D. The Buyer and /or Owner shall provide a constant, uniform quantity of fuel flow, without segregation, to the firing equipment and with sizing and quality of solid fuel for all testing as outlined in this proposal.
 - E. Indeck or its representative will not be responsible for operation or maintenance of the equipment provided under this contract at any time including prior to or during acceptance testing.

CONFIDENTIAL**GENERAL PERFORMANCE & TECHNICAL CONDITIONS****IV. Test Procedures for Solids in Steam and Water**

- A. There are two commonly accepted methods for the determination of solids in steam, which are:
- Electrical conductivity method for dissolved solids.
 - Gravimetric method for total solids.
- B. Because of the normally small difference in the total and dissolved solids and the complexity, time, and degree of skill involved in the gravimetric determination, it is usual to accept the electrical conductivity method of testing.
- C. The electrical conductivity determination of dissolved solids in the condensed steam shall be made in accordance with ASTM D-1125-50T, Tentative Method on Electrical Conductivity of Water. Remove dissolved gases from the sample with any added material which will increase its conductivity. The conductivity shall be corrected to compensate for residual ammonia, carbon dioxide, or other gases remaining in the sample, and the dissolved solids shall be calculated from this corrected conductivity. For measuring performance by the electrical conductivity method, the average of ten determinations made at regular intervals throughout the test period shall be used. The sodium Flame Photometer (Gravimetric) method is recommended for measuring the maximum solids carryover in the steam.
- D. The gravimetric determination of total solids in the condensed steam may be made in accordance with Method A of the latest edition of ASTM D-1069 entitled "Test for Suspended and Dissolved Solids in Industrial Waters" or a similar method embodying the essential principles of that specification. For measuring performance by the gravimetric method, the results shall be expressed as the average of three determinations made upon a composite sample which shall be taken throughout the entire test period.

V. General Performance

- A. It is recognized that the performance of the equipment covered in this proposal cannot be exactly predicted for every possible operating condition. In consequence, any predicted performance data submitted are intended to show probable operating results which may be closely approximated but which cannot be guaranteed except as expressly stated in the performance guarantee, if made, clause or clauses in this proposal. Any performance curves submitted are for the Buyer's convenience and the performance indicated thereon is not offered by the Indeck, nor to be construed by the Buyer, as a proposal of contract obligation. Heating surfaces and tube thickness shown in the proposal are preliminary information and will be verified during contract execution.
- B. The HTHW Generator saturated pressure parts are constructed in accordance with the requirements in A.S.M.E. Code, Section I for stationary HTHW Generators in effect at the date of the purchase order. A hydrostatic test of the saturated pressure parts will be performed at one and one half times the design pressure of the HTHW Generator per ASME Code requirements.
- C. If the HTHW Generator proper is shop assembled, the flue gas side will receive our standard shop soap bubble test.
- D. The latest edition of the following codes and standards shall be used for the subject offering: ABMA, AISC, AWS, ANSI B31.1, ASTM, SSPC, NEMA, UL, OSHA, NFPA, ISA. Please note applicable components shall be UL & FM approved; however, the system is not UL & FM approved.
- E. Basis: wind ASCE 7-2010 90 MPH exposure C and I = 1.0, seismic ICC Building Code - 2009 Zone 2B and I = 1.0.



CONFIDENTIAL

GENERAL PERFORMANCE & TECHNICAL CONDITIONS

ABMA TABLE 4 HTHW GENERATOR WATER LIMITS AND
ESTIMATES OF CARRYOVER LIMITS THAT CAN BE ACHIEVED FOR STEAM
HTHW GENERATORS

CONDITIONS FOR WHICH FRACTIONAL CARRYOVER IS VALID					
Drum Pressure Psig	Maximum HTHW Generator Water Solids ppm	Steam TDS Corresponding to Max. BW TDS ppm	Maximum Total Alkalinity ppm as CaCO ₃	Maximum Suspended Solids ppm	Maximum FCO, Fractional Carryover (Note 2)
0 - 300	3500	1.0	(Note 1)	15	0.0003
301 - 450	3000	1.0	"	10	0.0003
451 - 600	2500	1.0	"	8	0.0004
601 - 750	1000	0.5	"	3	0.0005
751 - 900	750	0.5	"	2	0.0006
901 - 1000	625	0.5	"	1	0.0007
1001 - 1800	100	0.1*	Not Applicable*	1	0.001
1801 - 2350	50	0.1*	"	1	0.002
2351 - 2600	25	0.05*	"	1	0.002
2601 - 2900	15	0.05*	"	1	0.003

(Note 1) 20% of Actual HTHW Generator Water Solids. For TDS ≤ 100 ppm, the total alkalinity is dictated by the HTHW Generator water treatment.

(Note 2) Does not include vaporous silica carryover



CONFIDENTIAL

GENERAL PERFORMANCE & TECHNICAL CONDITIONS

Water Quality Limits

[Adapted From ASME 1979 Consensus]

HTHW Generator Type: Industrial watertube, high duty, primary fuel fired, drum type steam HTHW Generators

Makeup Water Percentage: Up to 100% of feedwater

Conditions: Includes superheater, turbine drives, or process restriction on steam purity

Saturated Steam Purity Target ⁽⁹⁾

Drum Operating Pressure ⁽¹⁾	MPa (psig)	0-2.07 (0-300)	2.08-2.10 (301-450)	3.11-4.14 (451-600)	4.15-5.17 (601-750)	6.18-6.21 (751-900)	6.22-6.89 (901-1000)	8.90-10.34 (1001-1500)	10.35-13.79 (1501-2000)
Feedwater ⁽²⁾									
Dissolved oxygen (mg/1 O ₂) Measured before oxygen Scavenger addition ⁽³⁾		<0.04	<0.04	<0.007	0.007	<0.007	<0.007	<0.007	<0.007
Total Iron (mg/1 Fe)		≤0.100	≤0.050	≤0.030	≤0.025	≤0.020	≤0.020	≤0.010	≤0.010
Total copper (mg/1 Cu)		≤0.050	≤0.025	<0.020	≤0.020	≤0.015	≤0.015	≤0.010	≤0.010
Total hardness (mg/1 CaCO ₃)		≤0.300	≤0.300	≤0.200	≤0.200	≤0.100	≤0.050	—Not detectable—	
pH range @ 25°C		7.6-10.0	7.6-10.0	7.6-10.0	7.6-10.0	7.5-10.0	8.5-9.5	9.0-9.6	9.0-9.6
Chemicals for preHTHW Generator System protection							Use only volatile alkaline materials		
Nonvolatile TOC *mg/1 c)(8)		<1	<1	<0.5	<0.5	<0.5	—As low as possible, <0.2—		
Oily matter (mg/1)		<1	<1	<0.5	<0.5	<0.5	—As low as possible, <0.2—		
HTHW Generator Water Silica (mg/1 SiO ₂)		≤150	≤80	≤40	≤30	≤20	≤8	≤2	≤1
Total alkalinity (mg/1 CaCO ₃)		<350 ⁽⁵⁾	<300 ⁽⁵⁾	<250 ⁽⁵⁾	<200 ⁽⁵⁾	<150 ⁽⁵⁾	<100 ⁽⁵⁾	—Not specified ⁽⁵⁾ —	
Free hydroxide alkalinity (mg/1 CaCO ₃) ⁽²⁾		—Not specified—					—Not detectable ⁽⁴⁾ —		
Specific conductance (µmho/cm) @ 25°C without neutralization		<3500 ⁽⁶⁾	<3000 ⁽⁶⁾	2500 ⁽⁶⁾	<2000 ⁽⁶⁾	<1500 ⁽⁶⁾	<1000 ⁽⁶⁾	≤150	≤100

Notes for Table

- With local heat fluxes >473.2 kW/m² (>150,000 Btu/hr/ft²), use values for the next higher pressure range.
- Minimal level of OH- alkalinity in HTHW Generators below 6.21 MPa (900 psig) must be individually specified with regard to silica solubility and other components of internal treatment.
- Maximum total alkalinity consistent with acceptable steam purity. If necessary, should override conductance as blowdown control parameter. If makeup is demineralized water at 4.14 MPa (600 psig) to 6.89 MPa (1000 psig), HTHW Generator water alkalinity and conductance should be that in table for 6.90 to 10.34 MPa (1001 to 1500 psig) range.
- Not detectable in these cases refers to free sodium or potassium hydroxide alkalinity. Some small variable amount of total alkalinity will be present and measurable with the assumed congruent or coordinated phosphate-pH control or volatile treatment employed at these high pressure ranges.
- Maximum values often not achievable without exceeding suggested maximum total alkalinity values, especially in HTHW Generators below 6.21MPa (900 psig) with >20% makeup of water whose total alkalinity is >20% of TDS naturally or after pretreatment steam purity must be established for each case by careful steam purity measurements. Relationship between conductance and steam purity is affected by too many variables to allow its reduction to a simple list of tabulated values.
- Nonvolatile TOC is that organic carbon not intentionally added as part of the water treatment regime.
- HTHW Generators below 6.21 MPa (900 psig) with large furnaces, large steam release space and internal chelant, polymer, and/or antifoam treatment can sometimes tolerate higher levels of feedwater impurities that those in the table and still achieve adequate deposition control and steam purity. Removal of these impurities by external pretreatment is always a more positive solution. Alternatives must be evaluated as to practicality and economics in each individual case.
- Values in table assume existence of deaerator.
- No values given because steam purity achievable depends upon many variables, including HTHW Generator water total alkalinity and specific conductance as well as design of HTHW Generator, steam drum internals, and operating conditions (note 5). Since HTHW Generators in this category require a relatively high degree of steam purity, other operating parameters must be set as low as necessary to achieve this high purity for protection of the superheaters and turbines and/or avoid process contamination.



CONFIDENTIAL

GENERAL PERFORMANCE & TECHNICAL CONDITIONS

Indeck Required Water Quality Limits for Hot Water Generators *

Hardness as ppm CaCO3 (Note 1)	PH	Residual Sulphite as ppm Na2SO3	P- Alkalinity as ppm CaCO3 (Note 2)	M- Alkalinity as ppm CaCO3 (Note 3)	Chlorides ppm NaCl (Note 4)	Ammonia as ppm NH3 (Note 5)
<5	9.5 - 10.0	15 to 30	as req'd	100 to 400	<100	<7

Conductivity μ S/cm at 25deg.C	Suspended Solids (ppm)	Oily and Greasy Matter (ppm)	Copper (ppm)	Iron (ppm)	Zinc (ppm)	Total Bacteria Count (cells/ml) (Note 6)
<2000	20 to 40	10 to 20	<0.02	<0.02	0	100 to 1000

* Limits represent reasonably achievable levels to limit water side corrosion and surface deposits. Indeck equipment warranty excludes claims resulting from corrosion and/or deposits. It is owner/operators responsibility in conjunction with a qualified water treatment specialist to maintain appropriate water chemistry in the unit at all times.

1. Initial system fill should utilize softened water with a hardness <2 ppm with sufficient TDS to buffer solution against PH change. To control oxygen concentrations in the circulating water a sodium sulfite solution (NaSO3) should be added as an oxygen scavenger until a residual of 30 ppm is maintained. As system is heated, additional sodium sulphite additions will be required due to its reaction with oxygen.

2. P-Alkalinity should be adjusted to maintain the PH within target range. Its concentration will normally be approximately 10% of the total alkalinity level.

3. This "total" alkalinity will reach equilibrium when the required PH range is reached.

4. Excessive chloride ions are potentially corrosive and may indicate a malfunction of the softener system.

5. Ammonia is a byproduct of bacterial activity and any increase in this level may require the addition of a biocide to prevent fouling of the system.

6. Elimination of dead pockets, maintaining system PH at 9.0, and water temperature above 160 deg.F will inhibit bacterial growth.



CONFIDENTIAL

6. SCHEDULE

6.1. DOCUMENTATION SCHEDULE

Indeck will prepare boiler performance calculations, system and component general arrangements, design drawings, flow diagrams and equipment specifications which will properly establish the system design and equipment supply. Indeck will provide informational drawings for the following items. This schedule is based on weeks after both the Buyer and Indeck signing off on a Full Notice to Proceed (FNTP) Purchase Order.

Item	Document Description	Weeks After FNTP
1	Foundation Load Drawing	3-5
2	General Arrangement Drawing	3-5
3	Piping and Instrumentation Diagram	3-5
4	Design Performance Summary Sheet	6-8
5	Trim List - Steam / Water	10
6	Burner Arrangement Drawings	12
7	Burner Fuel Piping Drawings	12
8	Wiring Schematic	18
9	Duct Drawing	18
10	Panel Layout Drawings	18
11	Trim List - Burner	20
12	BMS Sequence of Operation/Logic Diagram	20
13	Piping - Large Bore Arrangement Drawing	20
14	Control Panel Diagram / Block Diagram	22
15	Piping - Small Bore Arrangement Drawing	24
16	O&M Manuals (9 copies)	At Shipment
17	ASME Data Report	At Shipment



CONFIDENTIAL

6.2. EQUIPMENT DELIVERY SCHEDULE

Indeck will begin work with a Full Notice-to-Proceed (FNTP) Purchase Order mutually accepted and signed by Buyer and Indeck and the initial deposit payment must be received by Indeck. If the full release to begin work is delayed beyond the stated FNTP date, the scheduled deliveries will be delayed. The delay shall be determined based upon the Indeck schedule at the time of release.

Engineering and delivery of the equipment will be scheduled to afford an efficient processing of the project. Indeck schedule is predicated on a "no holds" contract basis. Indeck will immediately start engineering and work to release orders for major work long lead items; tubing, headers, economizer, burner, and FD Fan once an acceptable Order is received by Indeck along with the initial deposit payment. This will limit Buyer's ability to make fundamental changes to major equipment being furnished. Indeck is willing to review these unknown comments on drawings which Indeck may receive at a later date and provide our comments related to our compliance; however, material changes to the information which impact design, material, and labor will be subject to a price and schedule adjustments to be determined at a later date. Factory Hydrostatic and Casing Pressure tests may elect to be witnessed by Buyer but are not considered hold points. Indeck will provide five (5) days advance notice to Buyer for the tests that would like to be witnessed.

Indeck requires an early delivery window for all of the equipment furnished. The delivery at the end point shall have an allowable early delivery window of three (3) to five (5) weeks before the stated delivery dates. The Buyer / site personnel are required to off-load the equipment and properly store the equipment at the Buyer's expense.

The schedule is subject to current project engineering workload, shop workload, shop shutdown/holiday schedules, and review at time of contract award.

Based on both the Buyer and Indeck signing off on a Full Notice to Proceed (FNTP) Purchase Order and Indeck receiving the initial deposit payment by the stated FNTP date below, the equipment will be ready to ship from the point of manufacture as follows:

Equipment	Ship Date -- Unit #1
Full Notice to Proceed	01/11/2012
Boiler	05/20/2012



CONFIDENTIAL

7. TECHNICAL COMMENTS, CLARIFICATIONS AND EXCEPTIONS

The following comments, clarifications and exceptions form a part of Indeck's proposal. Indeck requests an opportunity to discuss these in more detail during your evaluation of this offer. Additional comments may follow. If a purchase order is released, these comments shall supersede the request for quote specifications.

Request for Quotation dated 4/22/2011 – Division 15 Section 15560 pages 1-29:

- 1.01.A -(Manufacturer to provide technical assistance for windbox removal). Indeck clarifies that the technical assistance time as shown in this proposal is included with the price quoted. Additional time required beyond that shown reverts to per diem rates. Furthermore, for this project, windbox removal is not required.
- 1.01.B -"The manufacturer shall furnish all materials and equipment..." This paragraph is unclear in its meaning. Indeck clarifies that the equipment and services provided are as described in this proposal. Furthermore, there should only be one paragraph labeled 1.01.B
- 1.03.B - Indeck clarifies that, as referenced in NFPA 85, burner valve trains and piping are designed in accordance with NFPA 54 and NFPA 31, not ANSI B31.1 code and not ASME B31.1 code.
- 2.02.A.4.a -Indeck clarifies that based on 14.4 psig gas pressure available in the plant, it is assumed that the gas supply pressure at the fuel train interface for the main gas train is 10 psig, regulated by others.
- 2.02.A.6 - Indeck clarifies that 'readily installed appurtenances' also include FGR Ducts, Gas Ducts, Air Ducts, Dampers, actuators, gauges, thermocouples, transmitters, stack, and flow meter...etc. Any additional structural steel required for the stack assembly is by others. These items are to be listed as 'Shipped Separately' and will be further defined in the Engineering Submittals. A sample P&ID is included with this proposal for consideration of the 'shipped loose items'.
- 2.02.B.1 and 2 - Indeck clarifies that proprietary calculations will not be made available.
- 2.02.B.3 - Submit letter from instrumentation supplier that combustion controls are compatible and matched with burner and generator for proper operation. Indeck clarifies that Factory Acceptance Testing is welcome to the Buyer and is provided for controls simulations as described in this proposal. A letter from each instrumentation supplier is unreasonable.
- 2.02.B.4- Indeck clarifies that a letter from burner manufacturer stating that burners are able to fire natural gas and No. 2 Oil at emission rates that are lower than the regulated emission limits is unnecessary as the Engineering Design Datasheets are submitted to Buyer for approval prior to manufacturing release.
- 2.03.H - At the Owner's request, Indeck has provided performance data at the 50,000,000 BTU duty given 380 degrees F supply and 240 degrees F return conditions.
- 2.03.D - Indeck clarifies that Emissions are as limited to those described in Section 4 of this proposal.
- 2.03.H - Maximum Water Pressure Drop. Indeck clarifies that economizer and generator allowable pressure drop does not include pressure drop incurred by the water flow meter.
- 2.03.H SO2 Emission Requirements - Indeck takes exception to this requirement as there is a discrepancy in the SOX emissions and the Sulfur content in the fuel. Indeck's proposal is based on #2 oil as having 0.05% wt Sulfur. The specification has SOX emissions based on fuel having 0.2% Sulfur! The specified sulfur is 4 times higher than that assumed by the Indeck for the emission performance.
- 2.03.J.3.(e) - Indeck clarifies that when operating at 30% FGR, burner draft loss at 100% load is expected to be approximately 8.5 in wg on gas and oil firing.
- 2.03.J.5.(c) - Indeck clarifies that equipment will be shop assembled to the maximum extent possible with burner mounted in the windbox and valve trains mounted and wired on the windbox. Any breakdown required for installation is not included in this offering, and shall be provided by others. Shipped loose items will be denoted on final Engineering Submittals.
- 2.03.J.5.(e)(1) - Indeck clarifies that the oil gun mixes fuel oil and compressed air in the oil nozzle. Compressed air provided by others.
- 2.03.K.1.f - Indeck clarifies that no air pre-heater or option for an air pre-heater is offered. The proposed design does not require an air pre-heater for the HTHW Generator system to operate. Furthermore, no heat source has been identified in the specification. If an air preheater is determined to be needed by the Buyer, additional information will be required in order to define the design requirements before equipment can be offered. Price and delivery will be affected.
- 2.03.M.2 - Indeck clarifies that pipe stress analysis information is included on the Engineering Submittals for Buyer approval prior to fabrication.
- 3.02.D - Indeck clarifies that the fan performance for this product has been previously tested. Fan curve, efficiency, power usage shall be provided on the fan vendor performance curve and provided with Engineering Submittals. Specific performance testing for the fans manufactured for this project is not included.
- 3.04.C.1.g) - Indeck clarifies that all required testing equipment is provided by others as Third Party Testing for performance and emissions are not in the Manufacturer's Scope.
- 3.04.C.1.k) - Indeck clarifies that the performance for complete combustion tests @ 10%,25%,50%,75%,100%, will be recorded by the Indeck Service Technician. Performance testing at various load points is contingent upon the end user's ability to create heat demand at the time of the performance test
- 3.09 - Indeck clarifies that the standard manufacturer's warranty applies to all items except for those described in the Indeck Power Equipment Company 5-Year Limited Pressure Vessel Special Warranty as described in this proposal. Furthermore, start date of the warranty as described in the specification is open and ambiguous. Indeck clarifies that the start date for the warranty is upon successful performance testing by the Indeck Service Technician.



CONFIDENTIAL

8. FREIGHT

The equipment will be shipped per Incoterms 2000 CIP – Newark Liberty International Airport, Newark, NJ. Freight expenses are included in the proposed pricing.

Truck Shipments

Truck shipments of the HTHW Generator and auxiliary equipment are subject to route survey and permit approval, and changes in routing required by State and Provincial Transportation Agencies. All of the foregoing may require a price and schedule adjustment.

Off loading of the components is the responsibility of the Buyer, two (2) hours of free time for unloading has been provided. Additional time is subject to demurrage.

General

Indeck reserves the right to select a carrier of our choice. This offer is subject to verification of truck clearances based on the actual site location. Other than listed within Pricing Summary, all other shipments will be via un-escorted trucks. The HTHW Generator size and shipping clearances will dictate what accessories will be shipped mounted on the unit. Freight pricing is based on current value for the following items and are subject to change based on market price at the time of shipment: prevailing tariffs, duties, fuel costs. Any non-normal routing and extra escorts which result in special costs associated with a road closure, road bans, bridge closure, bridge bans, construction, or permit rejection are subject to a price adjustment. Any utilities, wire lifting, or police escorts if required, will be billed as per outlay. Suitable ground conditions on site and in all work areas are the responsibility of others. If additional towing or pushing of transportation equipment is required because of site conditions, any costs incurred will be a price adjustment. Any damages incurred to property or equipment (including transportation equipment) as a result of towing or pushing will be a price adjustment. Cargo insurance is not included, but is available upon request. Any charges arising from customs inspections or other delays beyond the control of freight forwarder will be a price adjustment. For water transportation to the site, the move from the Port of Import to the site is not included. Indeck request the equipment to be shipped below deck.



CONFIDENTIAL

9. PRICING

9.1. BASE OFFER

Your net price for the above described boiler is defined on the attached Price Summary form. Pricing is valid for 30 days.

9.2. OPTIONAL OFFERS

The optional offers are as defined in the attached Price Summary form. Pricing is valid for 30 days

9.3. PAYMENT TERMS

The Indeck payment terms are defined in the attached Terms and Conditions of Sale and as listed below:

5% At confirmation of order. Net 0

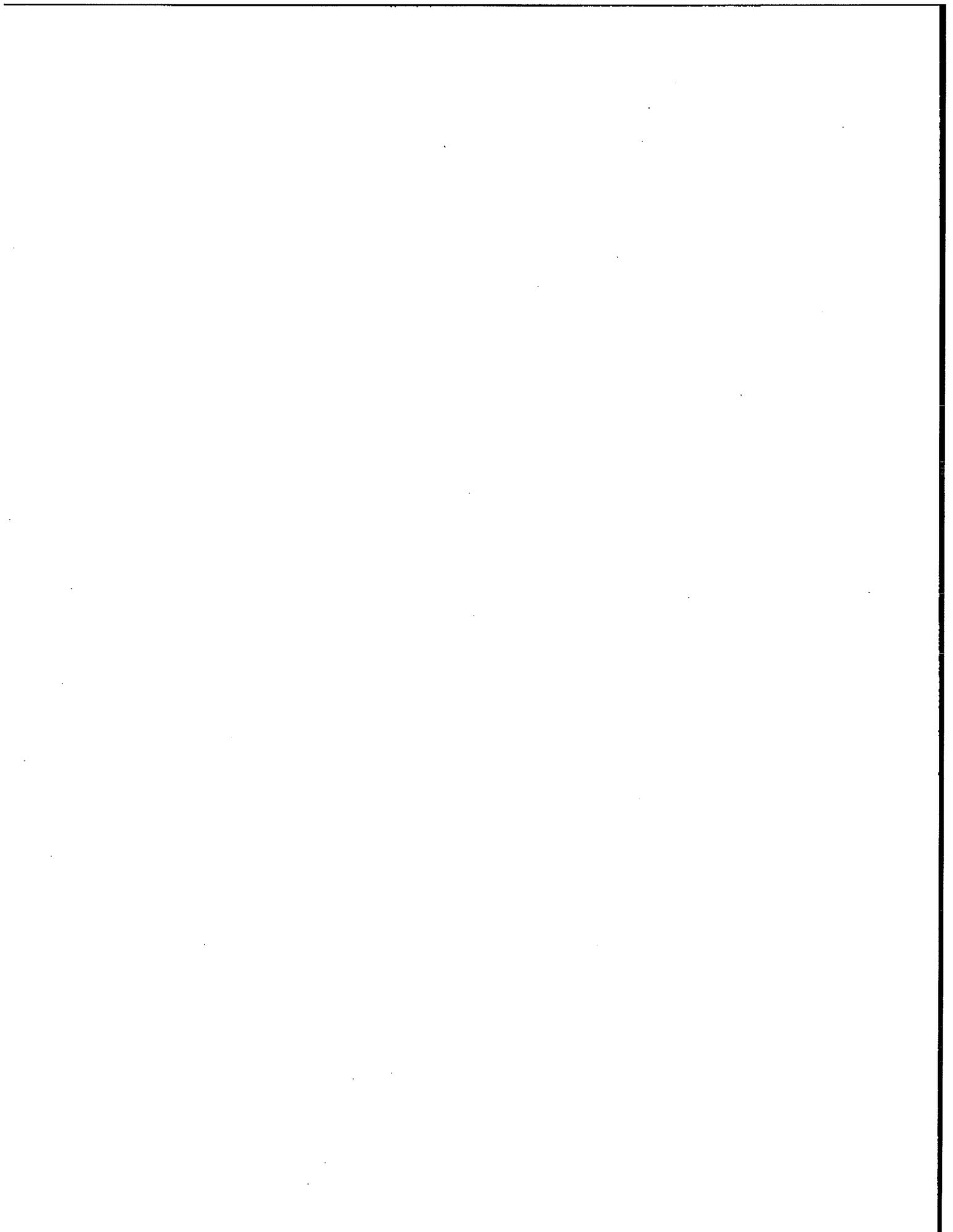
20% Upon order placement for major material (HTHW Generator headers and tubes). Net 0

15% Upon receipt of major materials as defined above. Net 0

20% Upon completion of bending half the HTHW Generator tubes. Net 0

20% Upon successful HTHW Generator hydrotest. Net 0

20% After shipment or offer to ship. Net 30





CONFIDENTIAL

10. GENERAL AND COMMERCIAL

10.1. GENERAL

After the equipment has been properly installed and is ready for operation, we do require that an Indeck Service Technician supervise the initial start-up by your operators and train your operating personnel. Please see attached our Field Service Rate Sheets. At sometime during the start-up, the burner manufacturer may be required on site for adjusting the burner. This would be billed at cost plus 15% handling charge.

Users are responsible for:

- A. Returning defective part(s) within 30 days of shipment of warranty part(s).
- B. Indeck requires that ABMA guidelines are maintained within the steam drum of our boilers.
- C. Proper care and maintenance of the equipment.
- D. Providing competent operators.

This quotation is based upon Indeck's standard "General Conditions of Sale". In addition, please note that the price does include shipping charges to job site but does not include any taxes, duties, permits, fees, export documentation or preparation, etc. which may be applicable. This proposal is subject to management review and shop loading at the time of the purchase order. Oversea jobsites have parts only warranties with field labor and freight is not included. Shop inspections do not include radiography, magnetic particle inspection and hardness tests.

The technical constructability information contained in this proposal and any supporting documents from Indeck is provided solely for informational purposes only. Indeck makes no further guarantees, warranties, or representations beyond those contained in this proposal about the accuracy of this constructability information provided including, but not limited to, information relating to equipment design, weights, quantities, and sizes. By using this information, Buyer agrees to and accepts this disclaimer.

All documents, attachments, and/or information submitted herein is the intellectual and confidential property of Indeck and, as such, it is to be held in strict confidence and is not to be forwarded to other parties, be used to compete against Indeck, or be reproduced in any form without the expressed written permission of Indeck. Use of this information shall in no way alter or expand Indeck's liability. Recipient shall return to Indeck all documents, attachments, and /or information upon demand. This submittal, including any attachments, is intended solely for the addressees and for the purposes described herein. All rights with respect to privileged, intellectual, and/or confidential information and in all events are reserved. The obligations under this paragraph shall survive the expiration or termination of any agreement and shall extend to and be binding upon the respective successors and assigns of the parties hereto. Persons receiving this submittal by mistake should return it to the sender and destroy any copies.



CONFIDENTIAL

10.2.GENERAL CONDITIONS OF SALE

1. **CONTRACT AND ACCEPTANCE** - The terms and conditions of sale set forth herein, and all drawings, specifications, descriptions, and other documents attached hereto and incorporated herein by reference constitute the entire agreement between INDECK (SELLER) and _____ ("Buyer"). **SELLER'S ACCEPTANCE OF THIS ORDER IS EXPRESSLY CONDITIONED BY BUYER'S ASSENT TO THE TERMS CONTAINED HEREIN.** The terms and conditions of Seller's proposal (if any) and acknowledgment shall prevail over any conflicting or different terms in Buyer's order unless Buyer notifies Seller in writing of its objections thereto within seven (7) days from receipt of Seller's acknowledgment. The failure of Seller to object to any provision in conflict herewith whether contained on Buyer's purchase order or otherwise, shall not be construed as a waiver of the provisions hereof nor as an acceptance thereof. Seller's proposal is only preliminary unless it is otherwise confirmed. If any of the terms and conditions of Seller's proposal conflict with these general conditions of sale, those contained in the proposal shall prevail.
2. **PRICES AND PAYMENT.**
 - a. Prices set forth in this Agreement will not include crating costs, and delivery of the Product will be Ex Works (as defined in INCOTERMS 2000). Crating costs will be charged to Buyer without markup and such crating will not be returnable or refundable. Unless otherwise agreed by Buyer and Seller in writing, payment will be payable in cash at Seller's place of business without any deductions and in accordance with the Payment Terms section of this Agreement.
 - b. Seller reserves the right to change the terms of payment if, in Seller's sole judgment, the financial condition of Buyer has changed prior to or at the time of any shipment.
 - c. If final completion of the Product or shipment of the completed Product is delayed due to Buyer's failure to (i) promptly inspect such Product, (ii) give shipping instructions or (iii) discharge any duty necessary for delivery, payment will become due as if shipment had been made. In any such case, Buyer will pay reasonable storage charges in addition to the purchase price. Risk of loss during storage will be borne by Buyer.
 - d. Payments due will accrue interest from the date that a payment is due at a rate that is the lesser of (i) 1.5% per month or (ii) the maximum interest rate permitted by law. If a dispute arises between Buyer and Seller, no deduction will be made from any payment owed by Buyer without Seller's written acceptance of the same. If such dispute concerns an amount payable by Buyer, then Buyer will be permitted to withhold only the disputed amount and will pay all other amounts as they become due.
 - e. If termination of this Agreement (following acceptance of the Purchase Order (pursuant to the Acknowledgement)) is agreed upon by Buyer and Seller in writing, full payment by Buyer will be due on the date of termination and only with deduction of the Product, or parts thereof, which has not yet been purchased and produced.

CONFIDENTIAL

3. **SHIPPING SCHEDULE AND DELIVERY** - Seller will establish shipping schedules as close as practicable to Buyer's requested delivery date. However, Seller will not be responsible for deviations in meeting shipping schedules nor for any losses or damages to Buyer (or any third person) occasioned by deviations in the performance or the non-performance of any Seller's obligations under this contract or by loss of or damage to the product when caused directly or indirectly by or in any manner arising from any force majeure event such as, but not limited to, fires, floods, thefts, accidents, embargoes, war or other outbreak of hostilities, acts of government, acts of God, acts of the public enemy, unusually severe weather, delay of carriers or suppliers, governmental acts or regulations, casualty, riots, acts of Buyer, strikes or other labor difficulties, shortages of labor, supplies, and transportation facilities or any other similar or different cause or causes beyond its control or the control of its suppliers or subcontractors. In the event of any such delay, (1) the time for performance shall be reasonably extended including any additional recovery time for design, manufacture, and shipment, (2) Seller and Buyer shall take reasonable steps to re-establish the time table set out in the Contract, (3) an adjustment shall be made for additional costs to Seller. If the cause results in Contract termination, Buyer shall reimburse Seller for its costs plus Contract profit for all work performed. Seller reserves the right to ship in advance of any Buyer request dates, except those dates stipulated, not before. Seller reserves the right to make delivery in lots. Upon delivery of each product lot, Seller shall have the right to immediately invoice an appropriate portion of the total purchase price. Should shipment be held beyond scheduled date for the convenience of Buyer, the Seller reserves the right to bill immediately for the goods and to charge Buyer for warehousing insurance, trucking charges and all other expenses incident to such delay.
4. **CLAIMS FOR SHIPMENT OR SHORTAGES** - Any claim for loss, breakage, or any other damage (obvious or concealed) resulting or arising from the shipment of the products are Buyer's responsibility and should be made to the carrier. Seller will render Buyer reasonable assistance in securing satisfactory adjustment of such claims. Any notices of shortages or other errors must be made in writing to Seller within 15 days after receipt of shipment. Failure to give such notice shall constitute unqualified acceptance and a waiver of all claims by Buyer.
5. **TRANSPORTATION CHARGES AND ALLOWANCES** - No freight is allowed unless stated in Seller's proposal (if any). If Seller's proposal stated that freight (if any) is allowed, all prices are F.O.B. Seller's shipping point with most economical surface transportation allowed. If the quoted price includes transportation, Seller reserves the right to designate the common carrier and to ship in the manner it deems most economical. Added costs due to special routing requested by the Buyer are chargeable to the Buyer. Under no circumstances is any freight allowance which is absorbed by the Seller to be deducted from the selling price. If the quoted price includes transportation, no reduction will be made in lieu thereof whether Buyer accepts shipment at factory, warehouse, freight station, or otherwise supplies its own transportation. Seller does not warrant that clearance is available to ship the product by any specific mode of transportation. Seller shall, under no circumstances, be responsible for performance hereunder if any delays are the result of a force majeure event which is beyond the reasonable control of Seller.

CONFIDENTIAL

6. **RISK OF LOSS AND TITLE** – Unless otherwise agreed to in writing by Seller, regardless of who pays shipping costs or arranges for shipment, delivery of the product will be F.O.B. factory or Seller's facility with all title, ownership, and risk of loss or damages will completely transfer to Buyer upon Seller making the product available for shipment F.O.B. Seller's factory, plant, or other point of shipment, or upon transfer to a transport carrier.

7. **TAXES** - All applicable international, federal, state, and local taxes including fees, duties, or other charges are for Buyer's account and are in addition to the prices quoted by Seller in its proposal. Seller's prices do not include any applicable sales, excise or similar taxes and duty. If under law or governmental regulation now or hereafter in effect, the Seller is required to pay or collect any tax, fees, duties, or other charges upon products included in this order or predicated upon, measured by or arising from the sale, transportation, delivery, use or consumption of said products whether directly or indirectly, the price to be paid by the Buyer hereunder shall be increased by the amount of any such tax. Buyer agrees to pay such tax as part of the purchase price.

8. **PRODUCT** - The Seller agrees to supply the Buyer with equipment and components from Seller's standard product unless otherwise mutually agreed upon by Buyer and Seller. Upon request of Buyer, Seller shall reasonably cooperate with Buyer with respect to Buyer's responsibility for compliance with specified federal, state or local laws or requirements of authorities and other state and federal requirements; however, Buyer shall be solely responsible for such compliance, and Seller will incur no liability on account of any failure of Buyer to comply with any such laws or requirements. Buyer hereby agrees to indemnify, defend and hold harmless Seller from any costs, damages, fines and expenses (including, but not limited to, reasonable attorneys' fees) incurred by Seller resulting from Buyer's failure to comply with such laws and requirements. Any application or permit required for erection, installation, or operation of the products shall be the sole responsibility of the Buyer and shall be obtained by the Buyer. Any alteration or modification necessary to the building/foundation upon which Seller's products are erected and any liability arising therefrom will be the sole responsibility of the Buyer.

Supporting steel furnished by Seller shall be designed to support the product proposed to be furnished by Seller and shall be designed in accordance with the latest Rules of the American Institute of Steel Construction. If Seller is required to increase the size or weight of its supporting structures to conform to additional rules or additional loadings imposed by Buyer, Buyer shall reimburse Seller for the additional steel required.

Seller shall provide Buyer with drawings showing the foundation loading due to the product and the required anchor bolt location. Seller is not responsible for excavation, grouting, concrete work, depth of footings, size or adequacy of the foundations. Seller bears no responsibility for damage caused by settlement of the foundation.

9. **INSTALLATION** - If Seller has agreed to install the product, Seller warrants that such installation will be performed in a workmanlike manner. Buyer shall pay all costs of installation, including the cost of any modifications to Buyer's plant and product which



CONFIDENTIAL

are necessary to accommodate Seller's product. Seller specifically does not warrant that such modifications will not be necessary.

10. **MATERIAL AND WORKMANSHIP WARRANTY -**

Sole Express Warranty - The Seller warrants that the products sold hereunder conform to any applicable drawings and specifications delivered by Seller and accepted in writing by Buyer and will be free from defects in material and workmanship which became apparent under normal use, and of which Buyer gives written notice to Seller within a period of 12 months from the date of the scheduled first fire or flue gas in the boiler or 18 months from the date of shipment or offer to ship, whichever period expires first. Refractory or insulation furnished by Seller is warranted for ninety (90) days from the date of initial first fire or flue gas in the boiler or 12 months from date of shipment or offer to ship, whichever happens first, and excludes faulty installation by others. Any express or implied reference to plans and specifications outside of the specific scope of the product furnished or repaired hereunder shall not in any way alter or enlarge Seller's responsibility under the contract. Product or services supplied by other vendors are excluded from Seller's warranty and only carry such warranty as provided by those vendors. Seller agrees to act as liaison for Buyer with those vendors.

Exclusive Remedy - Should a defect in material provided by Seller be found at first fire or flue gas in the boiler while the Seller Service Technician is on site, Seller will pay for the removal of the old part, installation of the new or repaired part, labor and freight (excluding any modifications required to access Seller's part which was not provided by Seller to Seller). Should the Buyer not use an Seller Service Technician or after first fire or flue gas by an Seller Service Technician within that period, the Seller receives from Buyer written notice within ten (10) days of Buyer's discovery of any alleged defect in or non-conformance of any product and if, in Seller's sole judgment, the product does not conform or is found to be defective in material or workmanship, then Buyer shall, at Seller's request, return the part or product F.O.B. Seller's shipping point and Seller, at Seller's option and expenses, shall repair or replace the defective part or product or repay the Buyer the full price paid for such part or product by Buyer. Dismounting of defective or non-conforming parts and reinstallation of repaired or replaced parts is done at Buyer's expense. Warranty for delivery of spare parts or replacement of non-conforming parts expires when warranty established at sale for original product expires and does not alter or extend limits on liability. If Seller fails to so repair or replace, Seller's liability shall not exceed the contract price of the specific defective goods. Buyer and Seller agree there is no failure of essential purpose of this warranty so long as Seller is willing and able to repair and replace defective goods. Any repayment of purchase price shall be without interest. Seller's sole responsibility, and Buyer's exclusive remedy hereunder shall be limited to such repair, replacement, or repayment of the purchase price as above provided. The foregoing warranty is in lieu of all tort liability and all other warranties, representations, or rights of rejections, express or implied.

NO IMPLIED WARRANTIES - THERE ARE NO OTHER WARRANTIES, EXPRESSED, STATUTORY OR IMPLIED, INCLUDING OF MERCHANTABILITY, QUALITY OR FITNESS FOR PURPOSE, NOR ANY AFFIRMATION OF FACT OR REPRESENTATION WHICH EXTENDS BEYOND THE DESCRIPTION OF THE FACE HEREOF.

CONFIDENTIAL

Conditions of Warranty and Exclusions – Seller's warranty is contingent upon proper operation and maintenance by Buyer. The warranties of Seller do not cover and Seller makes no warranty with respect to: (a) failures not reported to Seller within ten (10) days of Buyer's discovery of when failure occurs during the warranty period specified above; (b) failure to give Seller prompt and reasonable opportunity to inspect the product; (c) normal wear and tear or other results of product operation including, but not limited to, damage resulting from the improper management of chemicals, treatment of feedwater and/or the conditioning of boiler water, such as damage due to the presence of oil, grease, scale or deposits, damage resulting from foaming caused by chemical conditions of the water, or damage resulting from water side, steam side, or flue gas side corrosion or erosion, or caustic embrittlement, or failure or damage due to misapplication, abuse, improper installation or abnormal conditions of temperature, dirt, erosion, or corrosive matter, fouling, any chemical elements that reduce or eliminate the effectiveness of a catalyst when an SCR/CO system is included or other factors which may be due to corrosive agents, combustible residues, ash, or other constituents of the fuel, damage to paint or painted surfaces, or the workmanship, materials, or adequacy of the foundation; (d) failure to keep adequate logs and records to establish proper product operation; (e) failures due to operation, either intentional or otherwise, above rated capacities or in an otherwise improper manner; (f) products which have been in any way tampered with or altered by anyone other than an authorized representative of Seller (g) products damaged in shipment or otherwise without fault of Seller; (h) expenses incurred by Buyer in an attempt to repair or rework any alleged defective product; and (i) defects in material and workmanship which are attributable to drawings and specifications provided by Buyer. Failure to properly operate this product voids this warranty. Buyer bears responsibility for verifying the fuel analysis, utilizing fuel additives where necessary and properly operating soot blowing product.

Backcharges – The parties agree that Buyer's remedies for warranty claims are set forth above and that Buyer will not be permitted to backcharge Seller in connection with any such claim.

F. Subvendor Repair Warranty - Product manufactured by others but repaired by Seller is subject to Seller's warranty and limitations set forth herein and the warranties and limitations of the subvendors and such product is limited by design factors beyond the control of Seller.

G. Cost of Removal for Access – The cost of removal or replacement of product furnished by parties other than Seller to provide access to the defect will be to the Buyer's account.

H. Servicing Warranty Claims – During the warranty period set forth herein, Seller shall repair or replace within a reasonable time of inspecting the product and reviewing necessary operational or test data in order to determine that a defect exists. Seller shall be fully compensated for the expenses and travel and job time (at the then prevailing per diem rates) of its service representatives who inspect non-warranty claims. Seller shall also be compensated for the time and expenses of its service representatives who travel to a jobsite and are denied necessary access to the product for any reason or are delayed at the jobsite while waiting for product availability.

11. **PERFORMANCE GUARANTEE AND TESTING**

- A. Successful performance tests satisfy Seller's Contract obligation regarding product operation. Performance tests shall be run as soon as possible after initial scheduled



CONFIDENTIAL

start-up (defined as first fire or flue gas in the boiler), not to exceed thirty (30) days. If the performance test is not completed within thirty (30) days after notice of initial scheduled start-up of the boiler, then the performance test shall be deemed satisfactorily performed for any and all purposes. Said tests shall be made in accordance with Seller's Operating and Maintenance Manual, Seller's General Performance & Technical Conditions in Seller's proposal, and with the applicable test procedures of the latest edition of ASME Power Test Code for stationary steam generating units. The tests shall be conducted at the Contract specification load or, if Buyer can not conduct at the specification load, then at any lesser load as agreed upon by Buyer and Seller. Once the product has achieved performance requirements at the Contract specification load or the agreed lesser load, all Contract specifications and guarantees regarding performance of the product are satisfied. Upon satisfactory completion of performance tests, Seller's responsibility shall be limited to the material and workmanship warranty established under this Contract.

- B. All labor costs including, but not limited to, stand-by labor required by local unions and material costs associated with initial scheduled start-up and satisfactory completion of performance tests, shall be for Buyer's account and shall be in addition to the Contract price. Any overtime during initial scheduled start-up and/or performance testing shall be for Buyer's account.
12. **PATENT INDEMNITY** - Seller agrees that it will indemnify Buyer for all damages or costs resulting from any suit or demand alleging infringement of any patent relating to the structure of the apparatus or any part thereof furnished by Seller hereunder, if Seller is notified promptly in writing of such suit or demand and given adequate authority, information and assistance for the defense of same. Seller shall have no obligation to assume defense of any such claim, but in the event that it does exercise such right, Seller at its own option and expenses shall have the right to settle such suit or demand by procuring for the Buyer the right to continue using the apparatus or part thereof furnished by Seller. Alternatively, Seller may, at its expense, replace the apparatus or part thereof with non-infringing apparatus, or may modify same so that it becomes non-infringing, or may remove the alleged infringing apparatus and refund the purchase price. On any apparatus or part thereof made to the buyer's design or the design of which has been modified by the Buyer, this indemnification clause shall not apply. Seller's sole responsibility and the Buyer's exclusive remedy for any such suit or demand shall be set forth in this paragraph, and in no event shall Seller's liability under this paragraph exceed the purchase price paid by the Buyer for the products.
13. **SELLER'S RIGHT TO MANUFACTURE** - Seller in its sole discretion shall have the right to manufacture the products provided hereunder as far in advance of its estimated shipping schedule as it seems appropriate.
14. **LIMITATION ON LIABILITY** - Seller's sole responsibility and Buyer's sole and exclusive remedy with respect to any breach of warranty or guarantee under this agreement shall be limited to repair, replacement or repayment of the purchase price at Seller's sole option. Seller's total responsibility and liability for any and all claims, damages of any nature, losses, liabilities or costs of corrective efforts, including but not limited to those relating to any warranty or guarantee arising out of or related to performance of this agreement or the products covered hereunder or the performance



CONFIDENTIAL

thereof shall not exceed the purchase price. In no event shall Seller be liable for any special, indirect, incidental or consequential damages of any character; including but not limited to, loss of use of productive facilities or product, lost profits, property damage, expenses incurred in reliance on Seller's performance hereunder, or lost production, whether suffered by Buyer or any third party. Seller disclaims all liability for any and all cost, claims, demands, charges, expenses or other damages, either direct or indirect, incident to all property damages arising out of any cause of action based on strict liability. Seller's limit of liability associated with the performance and emission guarantees shall be limited to ten (10) percent of the contract price.

15. **INDEMNITY** - Buyer hereby agrees to defend, indemnify and hold harmless Seller, its employees, officers, agents, affiliates, and representatives for or from any damage to property of Buyer or third parties or injury to or deaths of persons including without limitation employees, officers, agents, or representatives of Buyer or Seller and third parties and for any and all claims, costs, expenses (including attorneys' and experts' fees) suits, demands, damages, and liabilities while engaged in activities relating to this Agreement or arising out of Buyers' ownership or use of the product.
16. **MODIFICATION, RESCISSION AND WAIVER** - This contract may not be modified or rescinded nor any of its provisions waived unless such modifications, rescission or waiver is in writing and signed by an authorized employee of Seller at its office.
17. **SECURITY INTEREST** - In order to secure the obligations of Buyer under this Purchase Order ("Obligations"), Buyer hereby grants to Seller a security interest in the items set forth on this Purchase Order (hereinafter is referred to collectively as the "Collateral") and being shipped to the Buyer hereunder. Buyer shall maintain the Collateral in such condition and repair and not permit its value to be impaired, in all events consistent with Buyer's past practices in the ordinary course of its business until the Obligations are repaid. The security interest of Seller in the Collateral shall be superior and prior to all other liens as a purchase money security interest, and Buyer shall not, incur, assume or suffer to exist any lien upon any of the Collateral other than the lien hereby granted. Buyer shall pay all expenses and, upon request, execute and deliver any commercially reasonable documents and take any further actions not inconsistent with the terms of this Purchase Order reasonably deemed advisable by Seller to establish, determine priority of, perfect, continue perfected, or terminate the security interests granted to Seller under this Purchase Order. Buyer authorizes Seller to prepare and file financing statements or fixture filings describing the Collateral in such jurisdictions as Seller deems appropriate. If Buyer fails to remit payment pursuant to the terms of this Purchase Order or any related documents, Seller may enter into premises where any Collateral may be located, and may take possession of Collateral, all without notice or hearing, provided that such entry into the premises is accomplished in a lawful manner. Seller may also require Buyer to assemble the Collateral and to make it available to Seller at any convenient place designated by Seller. It is agreed that Seller will not have an adequate remedy at law if this obligation is breached, and accordingly that Buyer's obligation to assemble Collateral shall be specifically enforceable. Seller may sell the Collateral removed from Buyer's premises or collected from such Buyer pursuant to the laws of the State of Illinois. Seller shall release any liens upon the Collateral upon repayment in full of the Obligations.



CONFIDENTIAL

18. **CANCELLATION** - This order is non-cancelable.
19. **COSTS AND EXPENSES** - Buyer agrees to pay Seller all costs and expenses, including reasonable attorney's fees (including those on appeal) incurred by Seller in exercising any of its rights and remedies, hereunder, including specifically the collection of any outstanding balance owed to Seller by Buyer.
20. **MISCELLANEOUS** - Seller reserves the right to furnish substitutes for materials which cannot be reasonably obtained because of any restrictions, voluntarily or compulsorily established by or in connection with any governmental authority or program. Seller may during any periods of shortage due to causes beyond the control of Seller or its suppliers, prorate its supply of products among all of its Buyers in such manner as may be deemed equitable in the sole judgment of Seller.

Seller shall not incur any liability to Buyer because of any pro-ration hereunder.

All orders must be accepted by an authorized employee of Seller at its office.

The rights and duties of the parties and construction and effect of all provisions hereof shall be governed by and construed according to the law of the Illinois, except as otherwise provided herein. Any legal action relating to, arising from or brought to interpret these terms and conditions of sale, must be initiated in a federal or state court of competent jurisdiction for Cook County, Illinois.

Failure of Seller to insist in any one or more instances upon the performance of any of the terms and conditions of this contract or the failure of Seller to exercise any of its rights hereunder shall not be construed as a waiver of relinquishment of any such term, conditions, or right thereunder, and shall not affect Seller's right to insist upon strict performance and compliance with regard to any unexecuted portions of this contract or future performance of these terms and conditions.

21. **LIMITED LIABILITY OF SELLER FOR FIELD WORK**
- A. At all times during which Seller's agents, laborers, engineers, or service technicians (representatives) perform service at the job site, including, but not limited to, installation, start-up first fire or flue gas in the boiler, testing, or product repairs, Buyer shall provide a supervisor to whom the representatives shall report. Such supervisor shall direct the work of the representatives and shall be responsible for the operation of all product and appurtenances in the work area for the safety of all persons, and for the protection of property in the work area. No representative of Seller may operate the product.
- B. In the event Seller field erects the product utilizing its own field labor, Seller shall provide a supervisor to direct only the work of Seller's erection personnel. This supervisor shall report to and be directed by Buyer's project engineer, or comparable individual, at the job site.
22. **RESPONSIBILITY OF BUYER FOR OPERATION OF EQUIPMENTS** - With respect to all product operation, including, but not limited to, preliminary operations,

CONFIDENTIAL

demonstrations of capacity, and performance testing, Seller's representatives are authorized only to advise and consult with Buyer or its representatives and no representative of Seller is licensed to operate the product.

23. **COMPLIANCE AT THE JOB SITE** – Seller does not warrant that the product complies with laws, ordinances, regulations or insurance requirements in effect at the job site. Modifications to the product which are required in order to comply with the same are at Buyer's expense. Seller accepts no responsibility for penalties or citations levied against Buyer by local, state, or federal authorities.
24. **CONFIDENTIAL INFORMATION OF SELLER** - All documents, information, intellectual property, or proprietary information received from Seller (including, but not limited to proposals, samples, designs, concepts and drawings), herein defined as Confidential Information, remains the intellectual and confidential property of Seller. Buyer shall maintain as secret and treat as confidential all Confidential Information supplied by Seller. Buyer may not use any Confidential Information received from Seller in performing other work for itself or any third party at any time and Seller's Confidential Information may not be used by Buyer to compete against Seller or be disclosed or reproduced in any form to a third party without Seller's expressed written prior consent. Use of this Confidential Information shall in no way alter or expand Seller's liability. Confidential Information shall not include that which is previously known by Buyer, public information, or information received from a third party under no obligation to Seller to hold the information as confidential. Buyer shall return to Seller all Confidential Information upon demand and in no event later than the completion of the work under the Contract. Drawings supplied to Buyer for maintenance and installation purposes need not be returned to Seller at Contract completion. All rights with respect to privileged, intellectual, and/or Confidential Information and in all events are reserved by Seller. The obligations under this paragraph shall survive the expiration or termination of any agreement and shall extend to and be binding upon the respective successors and assigns of the parties hereto.
25. **SHOP INSPECTIONS AND TESTING** - Seller is responsible only for those routine tests and inspections, which it performs on its own premises during the manufacturing process. Any further tests or inspections required by Buyer shall be at Buyer's expense.
26. **MANUALS AND WARNINGS** - Buyer accepts complete responsibility for ensuring that Seller's instruction manuals, and those of Seller's vendors, are distributed to and utilized by the product operators and that said individuals are properly trained to safely and competently operate the product. Buyer agrees to indemnify and hold harmless Seller from any and all claims, losses, damages, or expenses arising from or in any way connected with Buyer's responsibility hereunder.
27. **SET-OFF** - This Contract is not subject to a right of setoff by Buyer and Buyer agrees that any other debt Seller, whether disputed or not, cannot be set off against any payment owed by Buyer to Seller under this Contract.



CONFIDENTIAL

28. **CLEARANCES AND INTERFERENCES** - The Buyer recognizes that Seller's product to be incorporated into Buyer/Owner's facility requires careful planning and calculation of clearances from other product and structures in the facility. Buyer's information including drawings, product layout and other structural dimensions identified in Buyer's specification and bid invitation are relied upon by Seller for their accuracy and completeness in order for Seller to supply product clear of costly interferences. All costs and expenses related to an interference or clearance requirement which was not completely and accurately identified to Seller prior to submittal of Seller's General Arrangement Drawings shall be paid by Buyer. An interference or clearance deficiency is that which causes Seller to redesign, modify or relocate Seller's product or cause the modification or relocation of structures, material or product of the Buyer, Owner or other contractors and suppliers.
29. **MATERIAL ESCALATION** - The price owed to Seller under this agreement is a fixed price, except with respect to the cost of materials used to produce the goods and equipment contemplated under this agreement. The purchase price with respect to materials is included in the purchase price agreed to herein, however Seller shall be entitled to an increase in the purchase price for materials in the event the cost incurred for such materials increases during Seller's performance of the manufacturing of the equipment being supplied under this agreement. Any increase in the purchase price shall be based on the actual increased cost of materials incurred by Seller from vendor proposal date to date of purchase order from Seller to vendor plus an added mark-up equal to the original margin included in the purchase price.
- CURRENCY** - The prices are quoted in USA dollars. Currency fluctuations from USA dollar to Canadian dollar or USA to Korean Won will be adjusted for at time of invoice.
- FUEL** - A fuel surcharge will be charged dependent upon actual fuel costs incurred.



CONFIDENTIAL

Indeck Power Equipment Company 5-Year Limited Pressure Vessel Special Warranty

Indeck (the Company) warrants that at the time of shipment the pressure vessel, limited to hot water generator headers, tubes, burner windbox and register assembly for the Indeck Boiler Model, TJW-C-50 high temperature hot water generator will be free from defects and materials and workmanship for a period of five (5) years from the date of shipment.

The foregoing is in lieu of all other warranties, oral or express or implied, including any warranties that extend beyond the description of the equipment or the parts or the services, there are no express warranties other than those stated herein, and to the extent permitted by law, there are no implied warranties of marketability or fitness for a particular purpose. The provisions of the special warranty as to duration, warranty adjustment and limitation of liability shall be the same for both implied warranties (if any) and express warranties.

This special pressure vessel warranty is solely as stated above and does not apply (a) when alternations or repairs are provided by persons not expressly approved by the Company; or (b) the materials used are not of the Company's specification and manufacture; or (c) abuse or misuse of the equipment is evident, including boilers subjected to cyclic thermal fatigue conditions; or (d) insulative or corrosive substances such as scale and improper chemical balance are involved and/or witnessed; or (e) if the unit identified in the proposal is not inspected annually by an authorized Company representative (which such annual inspection shall include viewing of both the waterside and fireside surfaces).

Owner must make claim of any breach of this Special Warranty by written notice to the Company's home office within ten (10) days of discovering any defect. The Company agrees, as its sole option, replace, but not install, such parts or pressure vessel components as it deems necessary ("Warranty Adjustment"). Any Warranty Adjustment(s) made by the Company shall not extend the warranty period set forth above.

The above Warranty Adjustment sets forth buyer's exclusive remedy and the extent of the Company's liability for breach of implied (if any) and express warranties, representations, instructions or defects from any cause in connection with the sale or use of equipment. The Company shall not be liable for any special, indirect or consequential damages or for loss, damage or expense, directly or indirectly arising from the use of the equipment or from any other cause whether based on warranty (expressed or implied) or tort or contract, and regardless of any advice or recommendations that may have been rendered concerning the purchase, installation or use of the equipment.



CONFIDENTIAL

**10.3. DOMESTIC FIELD SERVICE RATE SHEET
WITH STANDARD TERMS AND CONDITIONS, Effective July 2, 2003**

Indeck Field Service includes consultation, inspection, trouble-shooting, technical direction of installation, maintenance or repair (labor by others), start-up, initial adjustment, tests and instruction of plant personnel.

Indeck service is performed only by Indeck trained, duly qualified Service Technicians or Representatives from other companies hired by Indeck to perform a specific task. Such service does not include the supply of any parts. Indeck service is performed only on the basis of a bona fide purchase order for field service issued by the ultimate customer or his authorized representative, covering the specific service desired.

RATE CATEGORY	Rate Per Man/Day
A) Standard Boiler Systems & Auxiliaries up to 300 BHP Saturated Steam.	\$ 800.00
B) Standard Boiler Systems & Auxiliaries above 300 BHP up to 75,000 PPH Saturated Steam, Generators and Chillers.	\$ 900.00
C) Custom Boiler Systems, Custom Instrumentation and Controls, Superheated Boiler Systems and Standard Boiler Systems above 75,000 PPH	\$1,200.00
D) If an outside contractor, approved by INDECK is required and their rates for service are higher than the rates of INDECK, the customer will be charged the contractor rates that apply, plus 15%. If a technician from INDECK is also required to assist, the charges for the INDECK technician will be the same as rate category A, B, or C, with all standard terms and conditions to apply.	

Billings will be based on rates in effect at the time service is rendered. Rates apply within the continental United States and Canada only (U.S. Dollars).

WORK HOURS AND WORK DAYS

A "man hour day" is eight (8) hours time, per man during normal day shift working hours. Normal working hours will be considered as 7:00 A.M. to 3:00 P.M., Monday through Friday, except for legal holidays, and includes 1-hour for lunch.

OVERTIME

Overtime applies to work performed before 7:00 a.m. and after 3:00 p.m., Monday through Friday, all time on Saturday and will be billed at one and one-half (1-1/2) times the regular rate. Any time on Sundays and holidays recognized by Indeck will be billed at two (2) times the regular rate.



CONFIDENTIAL

DOMESTIC FIELD SERVICE (cont'd)

TRAVEL TIME

All Field Service Consultant travel time is chargeable at the standard rates that apply during the time traveled. Travel time is the actual time spent in travel between Wheeling, Illinois, the Field Service Consultant's home, or other assignment and the job site and from living quarters to job site and return. Travel time from job to job will be charged pro-rata.

MINIMUM BILLING

Service performed for less than four (4) hours will be invoiced at one-half (1/2) day; service in excess of four (4) hours, but less than eight (8) hours, will be invoiced as one (1) day.

TOOLS (All freight charges for tools will be for Customers' account).

Flue Gas Analyzer

\$ 50.00/Day For Days Used

Boroscope

\$250.00/Day For Days Used

EXPENSES

Travel and living expenses will be invoiced at actual, and supported by third party receipts, while meals will be billed at \$30.00 per day.

- A. Travel expenses include, but are not limited to, plane, train, private or rental automobile charges from the point of regularly assigned location of the Field Service Consultant, return, plus any required local travel. Company and private automobile charges are charged at the rate of \$.75 per mile or \$35.00 per day, whichever is greater. Taxi, gas, tolls, and parking fees are additional.
- B. Living expenses include, but not limited to, lodging, meals, laundry, phone/fax, and incidental costs.

DELAYS

Field Service Consultant's time will be charged at the applicable rate when the Field Service Consultant is at the job site, but is unable to perform services requested because necessary equipment, utilities or support is not available.

STANDBY

On-Site Standby Time: If the Field Service Consultant is asked to remain on-site in a standby capacity, this time will be chargeable at the applicable rate of the day.

Off-Site Standby Time: If the Field Service Consultant is asked to be available on an "on call" basis while off-site, this availability will be chargeable at the applicable rate of the day.

DURATION

For service visits which extend beyond two (2) weeks, the Field Service Consultant will be allowed to travel home on the second weekend with time and expenses chargeable at the applicable rate.



CONFIDENTIAL

DOMESTIC FIELD SERVICE (cont'd)

SCHEDULING

Indeck will attempt to schedule a Field Service Consultant visit per the customer's request when given as much advance notice as possible. Usually two (2) weeks notice is adequate. To arrange service, call Indeck Service Department. Phone: (847-541-8300, Fax: (847) 541-9372.

SUPPORT LABOR

All labor including, but not limited to, standby labor, initial check-out, start-up, and testing required to assist the Field Service Consultant at any time, shall be supplied by the Customer at no cost to Indeck.

PRICING

Purchase orders are subject to review and acceptance by Indeck. The total service amount specified in the customer's purchase order is provisional and subject to alteration. The final amount is to be calculated based on actual hours worked/traveled and actual expenses incurred.

FOREIGN SERVICE

Foreign service is available only upon application and acceptance by Indeck.

TERMS OF PAYMENT

Payment of charges shall be made in full within fifteen (15) days of receipt of invoice. Indeck reserves the right to charge interest of 2% per month on past due balances.

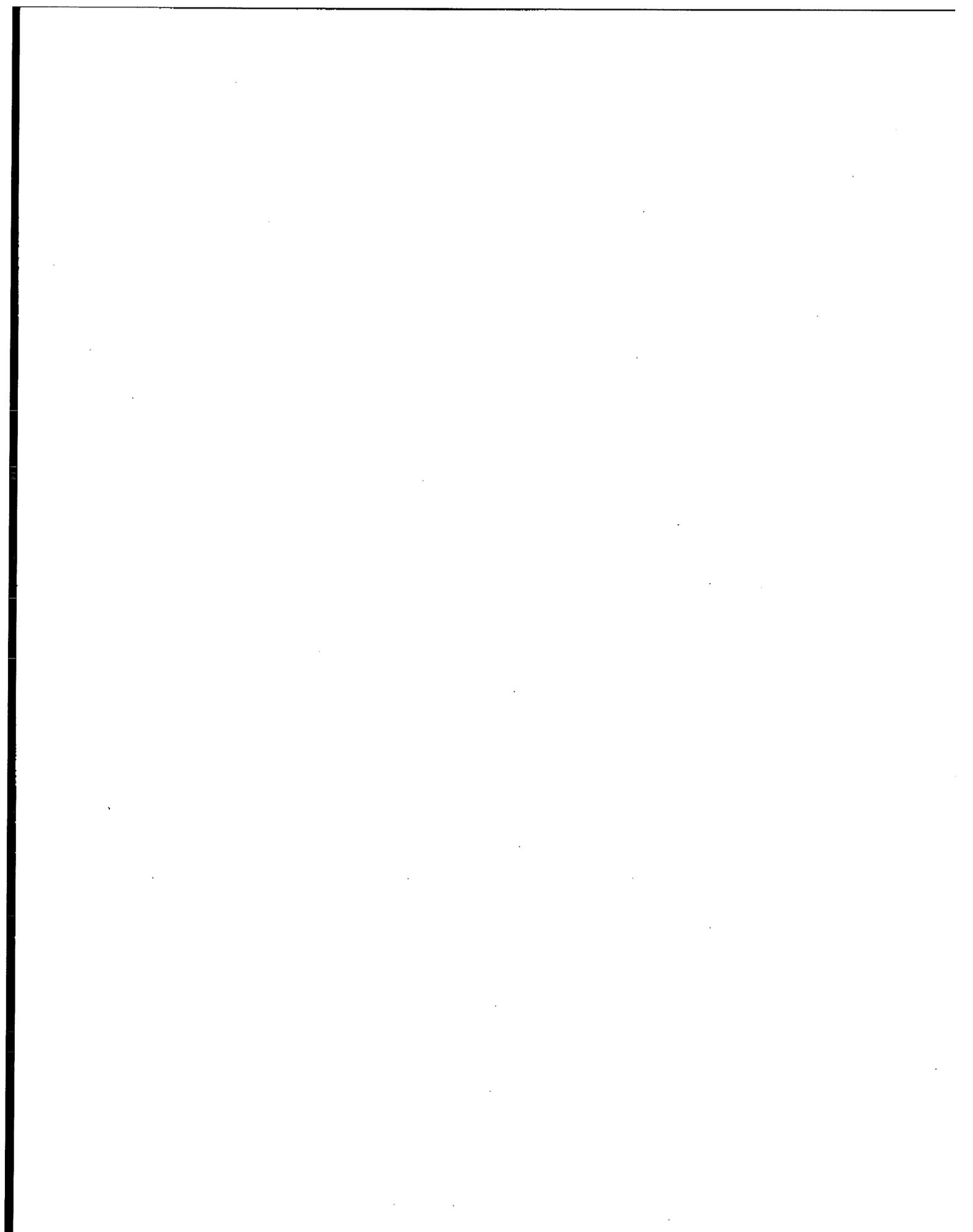
LIMITATIONS ON CONTRACT

These field service terms and conditions are expressly limited to these terms and conditions and shall govern the contract by which Indeck agrees to provide a Field Service Consultant. Indeck's acceptance of customer's purchase order is conditional on customer's assent to these terms and conditions. No other terms and conditions shall be binding on Indeck unless expressly agreed to in writing.

RESPONSIBILITY

Indeck's Field Service Consultants are authorized only to advise and consult with the customer or his representative and are not authorized nor licensed to operate the equipment. It shall be understood that responsibility for operation rests solely with the customer's operators and Indeck assumes no responsibility for the customer's personnel or representatives failure to properly perform their respective duties, and the presence of an Indeck Field Service Consultant at the customer's plant in no way relieves the customer's personnel or representatives of any of their responsibilities.

Indeck shall not be liable for any claims, losses, labor, expenses or damages, direct or consequential, resulting directly or indirectly from the service performed or for consequential loss or damage of any nature arising from any cause.



DIVISION 15

SECTION 15560

HIGH TEMPERATURE HOT WATER GENERATOR

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for fabrication, delivery, consulting of rigging and installation, start-up and testing of a high temperature hot water (HTHW) generators at Newark International Airport Central Heating and Refrigeration Plant (CHRP).

- A. The unit shall be shipped with windbox and burner installed. It may be necessary to remove windbox and burner during relocation (Manufacturer to provide technical assistance for windbox removal). All warranties shall be as specified below.
- B. The manufacturer shall furnish all materials and equipment, other than items specifically listed as provided by others listed within this specification including any and all equipment, materials and labor not within the HTHW generator manufacturer's scope.
- B. Provide one (1) Indeck/IBW International-LaMont® High Temperature Hot Water Generator for temporary use, Model type TJW-C-50, with an output capacity of 50 MMBH per this specification.
- C. The generator shall be equipped with dual fuel burners capable of burning natural gas and No. 2 oil and meet required emissions per this specification.
- D. The generator shall be equipped with an economizer as required to achieve the efficiencies specified in Part 2 of this specification.
- E. The generator shall be equipped with its own combustion control and burner management control panel with master control feature built in.
- F. Arrange for the HTHW generator to be completely integrated by the generator manufacturer at the manufacturer's facility. All components shall be shop assembled except for the economizer, forced draft fan and any other items listed as "shipped Separately", which shall be mounted in the field. The package unit shall include all components and accessories as specified here in for a complete installation.
- G. The HTHW generator economizer and forced draft fan shall be shipped loose and assembled in the field by qualified others and supervised by manufacturer's trained technicians. Hours to be identified in manufacturer's proposal.
- H. Provide manufacturer's standard spare parts to be identified in manufacturer's proposal.

1.02 REFERENCES

New Jersey Department of Environmental Protection – Port Authority Newark International Airport Central Heating Plant Site Specific Requirements (See Sections 2.03 H)

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Design and performance of components and methods specified herein shall comply with all Federal, State and Local laws, ordinances, regulations and codes that would apply if the Authority were a private corporation and with the latest industry standards, including, but not limited to those of the entities listed below.

American Gas Association (AGA)

American National Standards Institute (ANSI)

American Society of Mechanical Engineers (ASME): Boiler and Pressure Vessel Code

American Society of Mechanical Engineers (ASME): Code for Pressure Piping

American Society for Testing and Materials (ASTM)

National Board of Boiler and Pressure Vessel Inspectors

National Fire Prevention Association (NFPA 85, 2011)

National Electrical Manufacturers Association (NEMA)

New Jersey Administrative Code - Title 7 (7:27-19.7)

New Jersey Department of Environmental Protection (NJDEP)

New Jersey Uniform Construction Code

Occupational Safety and Health Administration (OSHA)

Underwriters Laboratories Inc. (UL)

United States Environmental Protection Agency (USEPA)

Design and performance requirements of the high temperature hot water generator system shall be as specified herein.

- B. HTHW general design standards are as follows:

Factory Hydrostatic Test Pressure	750 psi
Design Code	ASME NFPA 31, 54 & 85
HTHW Piping Design Code	ANSI B31.1

1.04 QUALITY ASSURANCE

- A. Workmanship and Materials
1. Workmanship and materials shall in every respect be free from defects of any kind and shall be in accordance with the best modern practice and whenever the Contract Drawings, Specifications or directions of the Authority admit of a doubt as to what is permissible or fail to note the quality of any construction the interpretation which calls for the best quality is to be followed. Workmanship shall conform to applicable Specifications, manufacturer's instructions and recommendations for installation of products for the applications shown on the Contract Drawings.
 2. Materials and equipment incorporated into the work shall be new. No used or remanufactured parts or equipment shall be permitted.

3. Reference to standards of any society, institution, association or governmental authority in the Specifications or on the Contract Drawings, whether explicit or implied, shall mean to the latest edition in effect at the time of purchase upon the present Contract unless specifically stated otherwise.
4. If required by the Authority, furnish satisfactory evidence as to the kind and quality of materials and equipment to be employed by the manufacturer in performing the Work. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the approved instructions of the applicable supplier.
5. Develop and maintain a quality control system which will establish that all code and standard requirements including material, design, fabrication, examination and inspection will be met. Make available to the Authority certification that the welding procedure and the welders are qualified in accordance with the requirements of Section IX of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, B31.1 Power Piping Code. Such certification shall have been obtained a maximum of one year prior to the performance of Work under this Contract. Only recognized testing agencies, as approved by the Authority, will be acceptable for certification. Make welder's certificate available to the Authority upon his request.
6. Make available to the Authority a copy of Welding Procedure Specifications with proof of welder's qualifications.
7. Verify that piping and appurtenances, of types and sizes required, have been satisfactorily used for purposes similar to those intended herein for not less than three years.

B. Design

1. Equipment and appurtenances shall be of rugged construction and of sufficient strength to withstand normal stresses which may occur during fabrication, testing, transportation, installation and all normal conditions of operation.
2. Furnish and install adequate stays, braces and anchors. Ensure that all bearings and moving parts are adequately protected against wear by bushings or other approved means and are able to be fully lubricated by readily accessible devices.

1.05 SUBMITTALS

Refer to Appendix A.

PART 2. PRODUCTS

2.01 ACCEPTABLE HTHW GENERATOR MANUFACTURERS

A. High Temperature Hot Water Generator:

Subject to compliance with requirements of this Section, furnish and install Indeck/IBW International-LaMont® High Temperature Hot Water Generator, Model type TJW-C-50, no substitution allowed.

B. Duel Fuel Burner:

Subject to compliance with requirements of this Specification, furnish and install a duel fuel, low NOx burner, windbox, fully metered fuel train and combustion control system.

2.02 REQUIREMENTS

A. General

1. Arrange for HTHW generator to be subjected to factory pressure vessel tests to check construction, as specified herein. Transmit to Authority manufacturer's certifications that the tests have been conducted and passed for the completed unit.
2. HTHW generator shall be constructed in accordance with ASME Boiler Code. Submit a copy of manufacturer's data report to the Authority
3. Type and Arrangement: The HTHW generator shall be of the factory-assembled, bottom-supported, bent tube, pressurized furnace, controlled forced circulation type. The high temperature hot water generator shall be specifically designed for high temperature hot water applications and designed for firing natural gas and No. 2 fuel oil.
4. Generator Fuels: The HTHW generator shall be designed for use with natural gas and No. 2 fuel oil. Performance parameters associated with various fuels shall take into consideration the following fuel data:
 - a. Natural Gas:
 - (1) Higher Heating Value: 1,000 Btu/ft³
 - (2) Density: Approximately 0.046 lb/ft³
 - (3) Main gas pressure at plant interface: approximately 25-30 psig
 - (4) Main gas pressure at the inlet to existing fuel train: 14.4 psig adjustable
 - (5) Ignition gas pressure at ignitor: 1 psig
 - b. No. 2 Fuel Oil:
 - (1) Higher Heating Value: 138,000 Btu/gal
 - (2) Density: Approximately 7.15 lb/gallon
 - (3) Percent Nitrogen by Weight: 0.01 to 0.03
 - (4) Percent Sulfur by Weight: 0.05
5. Electrical connections shall be as follows:
 - a. Main Power:
 - (1) Voltage: 460 Volts
 - (2) Phase: 3
 - (3) Frequency: 60 hz
 - b. Control Power:
 - (1) Voltage: 115 Volts
 - (2) Phase: 1
 - (3) Frequency: 60 hz
6. The unit shall be factory-wired and assembled except for such readily installed appurtenances as safety valves, pressure gages, forced draft fan, economizer and any other items listed as "Shipped Separately". These items may be removed prior to shipment to prevent damage, reduce cubage or meet shipping dimension restrictions.

In other respects, the unit shall be complete and ready for operation when connected to water, fuel and electrical supplies.

7. The HTHW generator shall, as a minimum, be in accordance with the requirements of this Section. Unless otherwise authorized by the Authority, the HTHW generator shall be provided with the features indicated herein. Additional or better features which are not specifically prohibited by this Section but which are a part of the manufacturer's standard commercial product shall be included in the unit being furnished.
8. Furnish fully integrated HTHW generator system consisting of a HTHW generator, burner, FD fan, economizer, dampers and instrumentation. All components of the HTHW generator system shall be matched for compatibility and performance.
9. HTHW generator including related components of such equipment, shall conform to (1) latest version, including all addenda, supplements and interpretations, of all codes, regulations and publications listed in Section 1.03 and (2) all referenced standards including all requirements of State and local agencies that would have jurisdiction if the Authority were a private corporation.
10. Materials used shall be free from defects which might adversely affect the performance or maintainability of individual components or of the overall assembly. Materials not specified herein shall be of the same quality used for the intended purpose in commercial practice. Unless otherwise specified herein, all equipment, material and articles incorporated in the work covered by this specification shall be in new condition.
11. HTHW generator and economizer to be furnished with one coat of rust-resistant, high temperature primer unless corrosion resistant materials are required. All other materials shall be coated to prevent corrosion.
12. All motors shall be TEFC, high efficiency type motors with a minimum service factor of 1.15.
13. HTHW generator and supporting equipment shall bear the ASME symbol as well as the National Board Registration Numbers.
14. All equipment provided with an alarm shall have spare contacts for remote alarm wiring.
15. The use of asbestos insulation, on any equipment, IS PROHIBITED.

B. Certification

1. Make available calculation for the generator that each system component is correctly sized and selected for use with all other components.
2. Make available calculation and computer simulations from the burner manufacturer that each burner component is correctly sized and selected for use with all other components.
3. Submit a letter from instrumentation supplier that combustion controls are compatible and matched with burner and generator for proper operation.
4. Submit a letter from the burner manufacturer stating that the burners are able to burn natural gas and #2 oil at emissions rates that are lower than the regulated emissions limits.

2.03 HIGH TEMPERATURE HOT WATER GENERATOR

- A. The HTHW generator shall be designed in accordance with applicable sections of the ASME Boiler and Pressure Vessel Code and any additional requirements specified herein.
- B. Arrange for HTHW generator to receive authorized ASME Code inspection prior to shipment from factory. The Authority reserves the right to have an independent National Board of Boiler and Pressure Vessel or ASME Pressure Vessel Inspector witness generator fabrication and testing at the cost of the Authority.
- C. Submit to the Authority copies of all protocols and inspection reports.
- D. Submit documents verifying that HTHW generator emissions are certified to meet the latest testing and operating requirements of the New Jersey Department of Environmental Protection (NJDEP) and U.S. Environmental Protection Agency (US EPA). See Section 2.03 Part H of this Specification.
- E. HTHW generator shall be capable of firing with smoke level not to exceed 5% opacity as indicated by the calibrated opacity monitor, over a 6 minute rolling average. 5% or less opacity is defined as no visible smoke by the naked eye.
- F. Transmit to the Authority combustion and performance data for all fuels at 100%, 75%, 50% and 25%.
- G. All furnace walls other than front wall shall be 100% water-cooled.
- H. HTHW Generator Design Parameters.

Output _____ 50,000,000 btu/hr
Design Pressure _____ 500 psig @ 470°F
Operating Pressure _____ Minimum inlet pressure shall be by manufacturer. Submit curve of minimum inlet pressure based on outlet temperature and load through full range of turndown.

Primary Condition (full load):

Outlet Water Temperature _____ 380°F
Inlet Flow Rate _____ 730 GPM
Total Heat Output _____ 50 MMBTUH.

Maximum Water Pressure Drop -

Generator _____ 26 ft. of H₂O
Economizer _____ 7 ft. of H₂O.

Minimum Efficiency at Full Load -

No. 2 Oil _____ 85 %
Natural Gas _____ 82 %

NOx Emissions Requirements -

Natural Gas _____ 0.05 lb/MMbtu
No. 2 Oil _____ 0.08 lb/MMbtu

PM-10 Emissions Requirements -

Natural Gas _____ 0.625 lb/hr (Based on the AP-42 emissions factor 7.6 lb/MMSCF)
No. 2 Oil _____ 2.0 lb/hr

TSP Emissions Requirements –

Natural Gas _____ 0.625 lb/hr (Based on the AP-42
emissions factor 7.6 lb/MMSCF)
No. 2 Oil _____ 0.72 lb/hr

Total VOC Emissions Requirements –

By Calculations -

Natural Gas _____ 0.3125 lb/hr
No. 2 Oil _____ 0.625 lb/hr

Stack Monitored -

Natural Gas & No. 2 Oil _____ 50 ppmvd @7% O₂

CO Emissions Requirements –

Stack Monitored -

Natural Gas _____ 3.125 lb/hr
No. 2 Oil _____ 6.25 lb/hr

Stack Monitored _____ 100 ppmvd @7% O₂

SO₂ Emissions Requirements –

Natural Gas _____ 0.0625 lb/hr (Based on the AP-42
emissions factor 0.6 lb/MMSCF)
No. 2 Oil _____ 12.5 lb/hr (Based on the AP-42
emissions factor 28.4 lb/MGAL)

Sulfur Content in Fuel < 0.2 %

I. HTHW Generator Construction

1. General: Lugs shall be provided on the high temperature hot water generator and accessory equipment for unloading, lifting and/or skidding. Show lug lifting and pulling points on the general arrangement drawings.
2. Enclosure: The high temperature hot water generator shall be constructed to form a pressure-tight envelope from the combustion air inlet to the combustion gas outlet at the stack. Record gastight pressure characteristics of the enclosure or casing arrangement, have them verified and certified at the factory prior to delivery and submit to the Authority.
3. Furnace: The furnace of the high temperature hot water generator shall be sized to ensure complete combustion of the fuel within the furnace proper and without flame impingement on walls or tubes. Ensure that refractory is provided where necessary to protect the tubes and to obtain proper burner operation. Design shall prevent the short circulating of furnace gases to the flue gas outlet.
4. Tubes: Tubes shall be of the material and thickness required for the service and shall be in accordance with the ASME code. Tubes shall be designed for divided process water flow through individual tubes or groups of tubes corresponding directly to the heat-absorbing capacity of the associated surface area in the radiant and convective sections of the generator and to prevent hot spots under all specified operating conditions.

5. **Flow Distribution:** The high temperature hot water generator tube arrangement and circulation design shall ensure that water will be distributed to the heating surfaces in proportion to the heat absorbing capacities of the surfaces to avoid uneven heat absorption over the full range of high temperature water generator operation.
6. **Supports:** Generator and firing equipment shall be supported from the foundations with structural steel. Generator supports shall permit free expansion and contraction of each portion of the generator without placing undue stress on any part of the generator or setting.
7. **Access and Observation Provisions:** Furnish the generator complete with all required access and observation openings. Furnish access and cleanout doors to permit access to the furnace and any other areas requiring access. Doors in high temperature areas shall be refractory lined. An access way shall be provided for access into the furnace without requiring burner removal. A total of three (3) conveniently located observation ports shall be furnished including ports for viewing the burner and igniter. Observation ports shall be of the air-cooled glass window type designed to permit replacement of the glass while the unit is in operation. One of the ports shall be fitted with a factory installed camera for remote monitoring in the control room. Camera shall be similar to FPS or Lenox.
8. **Generator Wall Casing:** Walls shall have casing constructed of not lighter than 10 gauge black steel sheets, either bolted or welded. Casing shall be gastight and shall be reinforced with structural steel to achieve rigidity and prevent buckling. Furnish and install insulation between the refractory backup and steel casing or between an inner and outer casing; insulation shall be of sufficient thickness to ensure a maximum casing temperature of 50°F above ambient external temperature. Furnish and install a minimum of 12 temperature sensors to monitor inner casing temperature, 3 on each side wall, 2 on the back wall and 4 on the roof of the furnace. Each sensor shall indicate through the control system any overheating of the casing.
9. **Miscellaneous:** Pipe connections shall be provided for, but not limited to, connections for high temperature water supply and return, safety valves, maintenance drains, drainage vents and instrument connections. None of the piping connections shall be made through the manhole covers or access panels. No piping shall be routed near these entry points which would require removal to allow easy access to the HTHW generator. Drains and vents shall be a minimum of 1".

J. **Burner**

1. Burner type shall be forced draft, low NOx arranged for automatic ring type natural gas and air atomizing No. 2 fuel oil firing.
2. The burner shall be compatible with the HTHW generator and furnace volume and dimensions.
3. Burner design parameters:
 - (a) Combustion air temperature: 80°F at 50% Relative Humidity

- (b) Plant elevation: 10 ft. above sea level
- (c) Generator stack height above HTHW generator base: Approximately 50 ft.
- (d) Instrument air supply pressure: 90-100 psig, clean, dry and oil free
- (e) Maximum pressure drop at full load:

Gas 6.3 in. W.C.

Oil 6.8 in. W.C.

- (f) Excess air: 15%
- (g) Gas turndown ratio: 10:1
- (h) Oil turndown ratio: 8:1

4. Windbox Construction

- (a) Material: Carbon Steel
- (b) Side thickness: .25 in
- (c) Front plate: .25 in

5. Gas Burner Construction

- (a) Type: Multiple Poker
- (b) Furnish and install stainless steel spuds around periphery to uniformly distribute gas to entire burner cross section. Provide slip fit design with set screwed connection to facilitate adjustment.
- (c) Fuel trains shall be windbox mounted to the maximum extent possible. Remaining pieces shall be shipped loose for field mounting by contractor.
- (d) Gas burner trim as follows:
 - (1) Two (2) Safety shut off valves with SPDT switches, cast iron body similar to Maxon or approved equal.
 - (2) Vent valve with aluminum body similar to ASCO or approved equal
 - (3) Manual shut off valve with semi-steel flange similar to Homestead or approved equal.
 - (4) Gas flow control valve with positioner and electrically interruptible pilot similar to Fisher or approved equal.
 - (5) Ignition gas pressure regulator with aluminum body.
 - (6) Ignition gas safety shut off valves, two (2) with brass bodies and vent connection.

- (7) The system shall have the capability to be easily modified to allow connection of a propane cylinder. The ignition system shall be capable of igniting the main burner using the propane cylinder gas at supply pressures of 10 PSI.
 - (8) Ignition transformer (10,000 Volts), 120/6000 V similar to Dongan or approved equal.
- (e) Oil burner trim as follows:
- (1) Gun – internal mixing with air atomization. Piping arrangement shall be cross connected to permit air purging through oil passages of gun for removal without leaking or dripping of oil.
 - (2) Oil burner shall have integral oil hose and air hose and shall come with a vise/wrench set for nozzle removal.
 - (3) (1) Spare air atomizing oil burner gun shall be provided.
 - (4) Atomizing air and fuel oil train shall be factory assembled and mounted and shall include a safety shut off valve similar to Maxon or approved equal.
 - (5) Fuel flow shall be controlled through a flow control valve with positioner similar to Fisher 667EZ or approved equal. Valve shall have a mechanical stop and normally closed action. Valve shall fail in closed position.

K. Forced Draft Fan

1. Forced draft fan design parameters:

(a) Main Power:

- (1) Voltage: 460 Volts
- (2) Phase: 3
- (3) Frequency: 60 hz
- (4) Motor Type: TEFC
- (5) NOISE LEVEL: 85 DBA @ 5 Ft
- (6) Manufacturer: Chicago Blower or aproved equal

(b) Variable Frequency Drive:

- (1) Capable of speed control within the operating range of the burner management system.
- (2) Capable of manual frequency control override at local panel as well as at combustion control panel.
- (3) Voltage: 460 Volts
- (4) Phase: 3
- (5) Frequency: 60 hz

(c) NEMA class rating: NEMA 3R

(d) Code requirements: NFPA 85

(e) Location: Indoor, temporary enclosure above 40 F.

(f) Air Preheater (Provide Add/Alternate Price): Provide air preheater for temporary use only. Air preheater shall be connected to the HTHW system locally at the generator and sufficiently sized to provide full load combustion air to the forced draft fan at a temperature of 80 degree F from an ambient temperature of 20 degree F.

2. Fan Wheel and Housing – Backward inclined airfoil with screened inlet. Housing shall be mounted on the windbox and directly connected to the windbox through the housing discharge.
3. The fan shall be of sufficient horsepower to provide sufficient air flow at sufficient static pressure for combustion at 100% of generator rated capacity.

L. Flue Gas Recirculation

1. Size flue gas recirculation as governed by emissions requirements. Furnish and install butterfly valve in duct from HTHW generator exhaust stack to mixing chamber at fan suction. Duct to be carbon steel.

M. Economizer

1. The economizer shall be complete with HTHW feed piping between the economizer and the HTHW generator and shall require minimum field assembly.
2. Piping shall conform to B31.1. Make available pipe stress calculation for review by the Authority.
3. The economizer shall be equipped with an outlet temperature element to indicate low flue gas temperature.
4. The economizer shall be designed and constructed in accordance with ASME Boiler and Pressure Vessel Code, Section I. Materials used in construction shall withstand the temperature and pressures prevailing under maximum load conditions.

N. HTHW Generator Accessories

1. General: This section defines the accessories or trim items which shall be provided with the generator. Include valves, fittings and accessories not identified below but required by code or recommended by generator manufacturer for convenient and efficient generator operation. Install accessories and trim items in factory. Ship loose only as required to facilitate ease of transportation and rigging.
2. Safety Valves: Furnish and install safety valves in accordance with the ASME Boiler and Pressure Vessel Code. The set pressure selection of the safety relief valves shall take into consideration the maximum normal system pressurization and the generator circulating pump shutoff head, shall not create inefficient system operation and shall minimize the

number of times the safety valves lift as a function of specified system characteristics. Relief valves shall be hydrostatically tested by the contractor with cold water for set point verification.

3. Drain Valves: Furnish and install double block drain valves at each maintenance drain as recommended.
4. Vent Valves: Furnish and install double block vent valves at each maintenance vent as recommended.
5. Test Wells: Furnish and install a minimum of one test well with cap and chain as recommended.
6. Pressure Gauges: Furnish and install two 6 inch dial pressure gauges with snubbers for local indication of water inlet and outlet pressures.
7. Thermometers: Furnish and install two 9 inch scale adjustable angle thermometers with separable wells for local indication of water inlet and outlet temperatures, as well as for flue gas temperature.
8. Outlet Damper
 - a. Carbon steel construction suitable for the flue gas temperature and pressure.
 - b. Furnish pneumatic actuator for modulating operation under the control of HTHW generator control system located external to enclosure.
9. Inlet Damper
 - a. Construction suitable for open/close operation.
 - b. Furnish pneumatic actuator for modulating operation under the control of the HTHW generator control system.
10. Equip generator with soot blower ports. Do not install soot blowers.

2.04 BOILER CONTROL SYSTEM

- A. The Boiler Control System (BCS) shall be built upon independent, stand-alone Allen-Bradley CompactLogix PLC processors for the Burner Management System (BMS) and the Combustion Control System (CCS) together in one independent enclosure, and one enclosure per boiler. The enclosure shall have an integrated Human-Machine-Interface (HMI), and audible annunciators for alarms and trips. Furnish and install an industrial fast-Ethernet switch in the panel through which data can be shared with the plant's SCADA system (SCADA implementation by others).
- B. The HMI systems shall be built upon the Wonderware InTouch application on local 15" Color TFT industrial touchscreen monitors at each boiler, and a remote desktop HMI for the control-room. The remote HMI shall have all the capabilities of each local HMI simultaneously for each of the boilers/generators. The HMI screen designs shall be efficient and operator-friendly.

- C. The enclosure shall be NEMA-4 and shall contain internal lighting and power receptacles for maintenance activities. All panels shall be pre-wired and tested, and shall include testing protocol, test results, wiring diagrams, and general-arrangement drawings.
- D. The Control Systems shall be engineered, manufactured and factory tested and shall meet or exceed the requirements of NFPA-85.
- E. The following instrumentation components shall be used:
 1. "Smart" HART-compatible 4-20mA transmitters
 2. Siemens Panel Lamps and Pushbuttons
 3. Yokogawa Oxygen Analyzers
 4. Durag Opacity Monitors
 5. Wonderware InTouch HMI Software
 6. VarTeck 15" Color Industrial Touchscreen Monitors
 7. Allen-Bradley CompactLogix family of Processors and I/O Modules
 8. IDEC Control Relays
 9. Weidmuller Terminal Systems
 10. Ingram Alarm Horns

2.05 BURNER MANAGEMENT SYSTEMS

- A. The Burner Management Systems (BMS) shall be engineered, manufactured and factory tested and shall meet or exceed the requirements of NFPA-85.
- B. The BMS shall provide First Out Indication, giving troubleshooting information to operators and technicians.
- C. All system I/O shall be fused and shall be able to be monitored on the HMI. HMI indication includes, but is not limited to the following:

Low Gas Pressure	Low Combustion Air Flow
High Gas Pressure	FD Fan Motor Interlock
Main Gas Shutoff Valves Closure	Low Water Flow
Gas Flow Control Valve Start Position	Low Instrument Air Pressure
Low Oil Pressure	Critical Input Failure
High Oil Pressure	Critical Output Failure
Main Oil Shutoff Valves Closure	Loss of Start Limits

Oil Flow Control Valve Start Position	Low Fire Release
Low Atomizing Media Supply	High Water Temperature
Low Atomizing Media Flow	Excess Water Temperature
Select Fuel	Pilot & Main Lightoff Timing
Fuel Changeover	Flame Detector Relays
Purge Air Flow	Pilot Flame Failure
Purge Timing	Main Flame Light-off Failure
Purge Timeout	Main Flame Failure
Combustion Air Actuator Positions	

D. The Allen-Bradley CompactLogix PLC shall direct all of the BMS functions required for automatic start up, shutdown and on-line supervision of the combustion process. Logic implemented in the PLC shall include:

1. Permissive supervision
2. Furnace purge
3. Master fuel trip
4. Ignition fuel valve management
5. Main fuel valve management
6. Interlock supervision
7. Shutdown
8. Post-purge
9. Critical I/O testing
10. Watchdog timer handshaking.

E. The BMS shall include the following safety and reliability features:

1. Master Fuel Trip Relay circuitry
2. Independent Watchdog Timer monitoring of PLC health
3. Critical Input and Critical Output testing
4. Protection from on-line editing and forced I/O
5. Fused inputs and outputs

6. Interposing Isolation Relays on all outputs
7. "First Out " reporting of all Trip conditions
8. Ethernet Communications with Plant SCADA systems

2.06 COMBUSTION CONTROL SYSTEMS

- A. The combustion control system (CCS) shall be built upon the Allen-Bradley CompactLogix controller using function-block programming. The system shall be fully-metered and cross-limited with excess oxygen trim.
 1. Fully Metered – Characterized inputs for Fuel Flow and Air Flow provide accurate air-to-fuel ratios and precise firing control.
 2. Cross Limited – Air leads fuel on load increases; fuel leads air on load reductions. Air or Fuel Flow upsets override load demand to maintain safe air-to-fuel ratios.
 3. Excess Oxygen Trim – Continuous monitoring of stack oxygen and active PID control maintain characterized oxygen levels for increased efficiency and reduced emissions.
 4. Draft Control
 5. Plant Master / Boiler Master – Independent Boiler Master for manual, automatic, or biased Lead / Lag operation from a Plant Master. Plant Master control can be enabled from any of the Indeck boiler control panels.
- B. All points of I/O shall be available to be read by the Plant's SCADA system through a manufacturer provided fast-Ethernet switch to the Allen-Bradley / Rockwell Automation Ethernet/IP network.
- C. Furnish and install transmitters, valve manifolds, orifice plates, RTD's, thermowells, etc. for:

Combustion Air Flow	Econ. Flue Gas Inlet Temperature
Fuel Gas Flow	Econ. Flue Gas Outlet Temperature
Fuel Oil Flow	Water Supply Temperature
Draft Pressure	Water Return Temperature
Flue Gas Oxygen	Econ. Water Outlet Temperature
Flue Gas Opacity	Water Flow
VFD Speed	

2.07 HUMAN-MACHINE-INTERFACES

- A. The HMI system shall be built upon the Wonderware InTouch application on a 15" Color TFT industrial touchscreen monitor local to each boiler and a remote desktop HMI for the control-room. The remote HMI shall have all the capabilities of each local HMI simultaneously for each of the boilers/generators. The HMI screen designs shall be efficient and operator-friendly.
- B. Each HMI shall be identical, allowing control of any boiler from the panel of any other boiler, providing redundancy in the event of the failure of any single HMI.
- C. Critical actions shall be initiated by a two-step process to avoid problems created by accidental touchscreen inputs. Help screens shall provide detailed information for each operator screen, a safe place to clean the touchscreen, and technician's access to PLC and communication status information.
- D. Provide real-time trending and historical-trending.
- E. Critical touchscreen objects shall appear in the same location from screen to screen. Screens and information shall follow natural and intuitive sequences, and include such information as:
 - 1. Main Menu
 - 2. Established Limits
 - 3. Light-off Sequencing
 - 4. Process Overview
 - 5. Boiler / Burner Control
 - 6. Totalizers
 - 7. Real-Time Trending
 - 8. Historical Trending
 - 9. Shutdown
 - 10. Alarm Management
 - 11. Alarm History (including First Out Trip Annunciation and time-stamps)
 - 12. Tuning

2.08 PERFORMANCE GUARANTEE

- A. Perform a computational fluid dynamic analysis (CFD) to verify the full range and efficiency of the burner/HTHW generator combination.

- B. Obtain from the burner manufacturer for the Authority's benefit a written guarantee that NOx emissions on natural gas firing will not exceed 0.05 LB/MMBTU, with the use of induced flue gas recirculation and that NOx emissions on No. 2 oil firing will not exceed 0.08 LB/MMBTU, with the use of induced flue gas recirculation.
- C. When the installation is completed, conduct a performance test. Arrange for the burner and combustion controls to be put into operation by an Indeck Field Service Consultant authorized by the manufacturer. Submit to the Authority a detailed written record of the startup performance, including burner setting at 10 points over the load range, before the service engineer is released. At each of the 10 load points, record the NOx emissions, gas burner pressure, windbox air pressure, furnace pressure, gas supply pressure, gas flow, percent oxygen, stack temperature, atomizing air pressure, oil flow, oil pressure and register positions.

2.09 VALVES

- A. All valves furnished shall be rated for connected operating pressure and temperature.
- B. All controls valves furnished shall have renewable stainless steel seats and disks.
- C. All valves of similar type shall be from the same manufacturer.

2.10 SPARE PARTS

A. GENERAL

1. Furnish spare parts and consumables identified on the Spare Parts List contained in this Section.
2. Spare parts shall be identical to the parts actually furnished on the equipment.
3. All spare parts shipments shall be delivered in properly and clearly labeled containers prepared for one year of storage. Each container label shall be indelibly marked with complete descriptive information including manufacturer's part number, part name and equipment for which the part is to be used.
4. Deliver all required spare parts for each piece of equipment prior to the start-up of that piece of equipment. Certificate of Final Completion will not be issued until all spare parts have been received by the Authority.
5. Maintain each piece of equipment as directed by the warranty section of this specification and do not use any of the stored spare parts during the warranty period.
6. The Authority will count items delivered and will inspect for damage. This will be done immediately upon receipt of spare parts shipments.
7. Upon completion verification, the Authority will sign the manufacturer's submitted inventory listing spare parts.
8. The inventory listing shall identify each spare part as follows:
 - a. Equipment name or description; i.e., forced draft blower motor, VFD, etc.
 - b. Schedule Tag Number
 - c. Spare Part Name; impeller, wearing ring, relay, gauge, float assembly, etc.
 - d. Manufacturer's Part Number and CAGE Code Number
 - e. Federal Stock Number (if available)
 - f. Quantity

9. The following definitions apply:

Set - The total number required to completely replace at one time all such items on or for the piece of equipment or for the total system.

Complete Assembly - The total scope of components and integral sub-components necessary to replace the stated item with minimum disconnection of attachments, electrical leads, piping, etc.

Complete Unit - A fully integral replacement of the stated piece of equipment or component inclusive of its foundation, base mount, coupling, linkages and attachments, requiring only the disconnection of either its electrical power supply leads or external (non-integral) piping or both, for replacement/change-out.

W/ - Means with and inclusive of.

B. PRODUCTS

1. General

Provide spare parts as indicated in the Spare Parts list which follows.

2. Spare Parts List

Component	Quantity
Pilot Electrode (complete assembly)	2
Ignition Transformer	1
Flame Scanner (complete assembly)	1
Air Switch	1
Indicator Lamps (complete assembly)	1 set
Fuses (all sizes)	1 set
Burner Management Controller (Flame scanner with accessory boards and enunciator)	1
HTHW generator Gaskets	2 sets
Fuel Oil Pump Gaskets	2 sets
Oil Burner Gun/Atomizer (complete assembly)	1
Oil Atomizer Nozzles, each type and size	1 set
Gauges	1 set
Pilot Gas Manifold Pilot Gas Manifold with Transformer, Regulator, Solenoid and Pilot	
Cock (complete)	2 sets
Ultraviolet Scanner	1

PART 3. EXECUTION

3.01 CONSTRUCTION

A. Field Service

1. Dispatch factory-trained technicians to start-up and service the equipment. The technicians may be in the direct employ of the HTHW generator manufacturer or the contractor's own direct employee for all field services. Make prior arrangements to have supporting equipment manufacturer's technicians readily available to support his field technicians. The Authority is to be so informed.
2. All field service shall be supported by a fully qualified field service department. The field service department shall be fully staffed with at least six full time employees, all of whom are factory-trained for the equipment supplied under this specification.
3. An Indeck Field Service Consultant shall be within a two hour drive from the site.
4. An Indeck Field Service Consultant shall have spare parts readily available.
5. In addition to standard start-up and field services, respond to system failures within 4 hours of the Authority's report.

B. HTHW Generator

1. **Pressure Testing of Generator Casing**
Prior to application of insulation to the inner casing, the generator shall be pressure tested for air tightness. The test shall be conducted by temporarily sealing all openings to the inner casing and applying a minimum of 10 inches W.C. to the interior of the HTHW generator. The air pressure drop shall not exceed two inches W.C. after a period of 20 minutes.
2. **Hydrostatic Testing**
The HTHW generator shall be hydrostatically tested before applying any refractories or casing materials. Perform a hydrostatic test in the presence of the Authority and an inspector having a National Board Commission. In addition to the ASME symbol, each HTHW generator shall bear a National Board Registration Number.

C. Equipment Field Services

1. Submit written certification to the Authority that all the equipment has been properly installed and tested to safely, properly and continuously operate at all rated capacities and performances as specified.

3.02 FACTORY TESTS

A. General

1. **Scheduling and Reports**
 - a. Submit HTHW generator and supporting equipment manufacturer's factory test reports at least ten days prior to shipment. Submit for review seven hard copies and one electronic copy unless the Authority requires only an electronic copy.
 - b. Factory test reports shall be signed by the manufacturer and the Boiler Inspector as required.

- c. Arrange for the factory to perform two specific tests to be witnessed by the Authority: (1) hydrotest of the the waterside prior to installation of the casing and (2) smoke test of the casing after the unit is completed.
 - d. Three weeks prior to factory testing of each piece of equipment, notify the Authority of the testing to be conducted. The Authority reserves the right to witness one or all of the factory tests. Submit to the Authority a preliminary factory test schedule prior to start of construction to allow sufficient time for the Authority to coordinate travel and accommodations.
2. Documentation to the Authority
- a. For the HTHW generator, supply Authority with seven legible copies and one electronic copy (unless the Authority requires only an electronic copy) of:
 - (1) Manufacturer's ASME Data Report P-3.
 - (2) Manufacturer's partial ASME Data Report P-4.
 - (3) Manufacturer's data report for fabricated piping.
 - (4) All material certifications.
 - (5) Welding procedure specification.
 - (6) Welding procedure qualification records.
 - (7) Welding procedure qualifications record of testing.
 - (8) Generator detail drawings of all tubes, drums and headers.
 - (9) Assembly drawings.
 - b. Submit code stamp and report to the Authority.
- B. Shop Hydro Test: The shop-assembled pressure parts of the HTHW generator shall be hydrostatically tested in the manufacturer's shop at a pressure equal to 1-1/2 times the design pressure. Submit manufacturer's certificate of compliance with ASME code requirements to the Authority.
- C. Shop Casing Test: Before the application of insulation, the inner casing of the HTHW generator shall be given an enclosure airtightness test. The test pressure shall be 2 inches W.C. above the predicted maximum furnace operating pressure. Air shall be admitted to the units until the test pressure is reached; then the unit shall be sealed. If the pressure drop does not exceed 0.5 inches wg in 15 minutes, the units shall be considered satisfactorily tight. Compliance with these test requirements does not relieve the generator manufacturer of responsibility for other HTHW generator performance guarantees.
- D. Forced Draft Fan Performance Test
 Prior to shipment, submit the certified forced draft fan performance report for its rated capacity and related static pressure to the Authority. The report shall include the fan curve indicating the design and actual conditions plotted. The report curve shall provide static pressure inches W.C., shaft horsepower & mechanical efficiency versus fan CFM capacity.
- 3.03 FINAL INSPECTION AND TESTING
- A. Upon completion of the work, all equipment will be subjected to final field performance tests to demonstrate that the equipment is properly installed, meets its operating cycles and is free from defects such as overheating, overloading, undue vibration and other deleterious effects. The final field tests shall be witnessed by the Authority and the

manufacturer's representative. The installation contractor shall furnish all labor, lubricants, materials, equipment and instruments necessary for the tests. Until final field tests are accepted by the Authority, the installation contractor shall make all necessary changes, adjustments and replacements at no additional cost to the Authority.

3.04 FIELD PERFORMANCE TEST

- A. A factory trained manufacturer's representative shall be present at the site to witness the field performance tests and to perform any equipment adjustments required.
- B. Submit certification from each component manufacturer (including HTHW generator, burner, economizer, forced draft fan and controls manufacturers) that each furnished item has been properly installed in compliance with its recommendations and is suitable for operation and field testing.
- C. Field tests shall demonstrate that the HTHW generator system meets the performance/capacities specified in this Specification and guaranteed in the manufacturer's technical submission.

1. HTHW Generators Related Control Systems

- a. Have representative to be present on site to conduct equipment pre-startup tests as well as HTHW generator combustion and emissions testing.
- b. Provide all necessary special equipment and other items necessary for equipment field tests and for generator combustion and emissions testing.
- c. Perform combustion testing on each generator prior to beneficial use and/or acceptance.
- d. Conduct combustion testing in accordance with the ASME Test Code for Stationary Steam Generating Units (applies to HTHW generators as well), modified for HTHW unit, except that no weighing of fuel and water will be required. Submit proposed test modifications for Authority's approval. The combustion testing shall utilize the data and calculation procedures in the ASME Test Report for Simplified Efficiency Test all in accordance with the ASME Power Test Code PTC 4.1.
- e. Test all generator and burner interlocks, actuators, valves, controllers, gauges, thermometers, pilot lights, switches, etc. prior to combustion testing. Replace any malfunctioning or out-of-specification component at no additional cost to the Authority. Submit to the Authority an itemized data record sheet of this component testing.
- f. Make all required adjustments to HTHW generator, burner and HTHW generator control system in preparation for and in performance of combustion testing. Conduct all combustion tests.
- g. Provide all required testing equipment, including gauges, thermometers, calorimeter, Orsat apparatus, thermocouple pyrometer, gas meter, water meter, and other necessary test equipment. Permanent gauges, meters, instruments, etc. installed for permanent use with the HTHW generator may be used if properly calibrated and approved by the Authority. Calibrate all test instruments. Submit final calibration reports to the Authority for record.
- h. Prior to performing any combustion testing, obtain and coordinate the services of a qualified HTHW generator operator to operate the HTHW generator and all supporting equipment/appurtenances.

- i. The manufacturer's factory trained technician shall be responsible for the HTHW generator control system and that all appurtenances are calibrated to ensure the specified performance. The fuel burner, forced draft fan, controls, etc. shall be fully coordinated, manually capable and automatically controllable, to hold the required settings. The generator fuel burning systems shall be continuously variable throughout the specified operating range without manual adjustment of burner, register or nozzle and they shall achieve turndown without manual adjustment. Run each test until two Orsat samples and flue temperatures are constant.
- j. Set up, calibrate, test and make ready for use all testing apparatus prior to final combustion testing. Submit calibration certificates for all test instruments with test data. Conduct combustion testing for a period of at least eight hours, at variable loads as requested by the Authority or until sufficient data has been obtained to extrapolate the results for loads not available during the test period.
- k. Adjust all HTHW generator components and systems to achieve the specified performance and perform complete combustion tests on each generator at loads of 10%, 25%, 50%, 75% and 100% of generator capacity. Conduct performance tests with the burner operating on natural gas and also on No. 2 fuel oil. Record and analyze test data to demonstrate the following at the specified loads:
 - (1) Generator water flow in GPM.
 - (2) HTHW supply and return temperatures in °F.
 - (3) Heat generation in MMBTU/hr. rates.
 - (4) Fuel oil flow to burner, GPH.
 - (5) Natural gas flow to burner, CFH.
 - (6) Burner firing lbs./hr. and MMBTU/hr. rates.
 - (7) HTHW generator room ambient temperature in °F.
 - (8) Generator combustion air flow lbs./hr. and lbs./MMBTU rates.
 - (9) Generator outlet flue gas temperature.
 - (10) Lbs./MMBTU and percent of carbon monoxide in flue gas.
 - (11) Lbs./MMBTU and percent of carbon dioxide in flue gas.
 - (12) Lbs./MMBTU and percent of oxygen in flue gas.
 - (13) Lbs./MMBTU and percent excess air in combustion air.
 - (14) Lbs./MMBTU and percent of sulfur dioxide in flue gas.
 - (15) Lbs./MMBTU and percent of nitrous oxides in flue gas.
 - (16) Fuel pressure at burner.
 - (17) Generator windbox pressure.
 - (18) Generator furnace pressure.
 - (19) Natural gas pressure at burner, PSIG.
 - (20) Generator flue outlet pressure.
 - (21) Burner air register position.
 - (22) Burner diffuser position.
 - (23) Combustion air flow/oxygen trim controller output signal.
 - (24) Gas flow controller output signal.
 - (25) Generator water flow totalizer reading.

- (26) Burner fuel flow totalizer reading.
 - (27) Smoke level test.
 - (28) Atomizing air supply pressure, PSIG.
 - (29) Atomizing air pressure at burner, PSIG.
 - (30) Atomizing air flow, SCFM.
 - (31) Percent of oxygen for plant air.
 - (32) Percent of oxygen for analyzer.
- l. Present test data graphically at the tested loads. The graphs shall include, but not be limited to:
 - (1) Percent of windbox oxygen versus percent of generator demand.
 - (2) Lbs./MMBTU NO_x versus percent of generator demand.
 - (3) Percent of oxygen for analyzer versus percent of generator demand.

Additionally, fine tune equipment to provide a smooth curve from one load point to another for each fuel (natural gas and No. 2 oil).
 - m. The Authority will compare fuel consumption data at each loading from the performance tests against the requirements of this specification.
 - n. Submit a performance test report documenting the data collection and the system performance.

3.05 TRAINING

- A. Provide factory trained representatives of the HTHW generator and burner manufacturer at the site to provide operating instructions and maintenance procedures training to the Authority's operating and maintenance personnel, in accordance with the Schedule project schedule.
- B. For each specified piece of equipment, provide factory trained representatives to provide operating instructions and maintenance procedures training to the Authority's operating and maintenance personnel, in accordance with the Schedule that follows.
- C. Conduct operating instructions and equipment "hands-on" training in a classroom setting. Schedule and develop the instructions and training program and submit to the Authority for his review and approval. All training sessions shall be video taped with three (3) copies of the tapes delivered to the Authority.
- D. Operating instructions and maintenance procedures training shall commence only after the Authority's concurrence that all adjustments, field testing, combustion testing, emissions testing, hydrostatic testing, etc., and all other specified duties have been completed for each specific equipment item and prior to the time that each equipment item is placed into continuous operation.
- E. Coordinate the scheduling of training sessions with the supporting equipment manufacturer's training representatives so that cohesive training with proper sequencing of topics may be implemented.
- F. Instructors shall utilize equipment manufacturer's operation and maintenance manuals as bases for instruction. Review contents of each manual with the Authority's personnel in detail to explain all aspects of operation and maintenance.

- G. Demonstrations shall include, but not be limited to, start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, shutdown and emergency operation of the equipment on location.
- H. All times shown in the following Training Schedule are exclusive of any travel time.
- I. Submit to the Authority for his review and approval four copies of the Training Schedule indicating times and dates.
- J. Training Schedule
 - 1. Training shall be done in three (3) equal phases: at start up, at mid operation and follow up.
 - 1. HTHW Generator
 - a. Operations Training (Each Phase)
Two (2) consecutive days for one (1), eight (8) hour shift (total 16 hours).
 - b. Maintenance Training (Each Phase)
Two (2), eight (8) hour shifts equally divided for classroom and "hands-on" training (total 16 hours).
 - 2. Operations Review Training
Conduct two (2), eight (8) hour training shifts six months after commissioning and acceptance of the HTHW generator to review the Authority's operating experience and resolve any outstanding operating problems.

3.06 PAINTING

Factory Coating: Equipment and component items, when fabricated from ferrous metal, shall be factory-finished with the manufacturer's standard finish.

3.07 MANUALS AND "AS BUILT" DRAWINGS

- A. Drawings
 - 1. Submit to the Authority nine (9) hard copies and one (1) electronic copy of completed non-proprietary drawings of equipment and systems including, but not limited to, the following:
 - a. HTHW generator
 - b. HTHW generator P&IDs
 - c. Burners
 - d. Combustion and burner management control panels
 - e. Electrical schematics
 - f. Field instruments
 - g. Piping diagrams
 - h. Burner fuel trains
 - i. Fuel requirements
 - j. Compressed air requirements

- k. Breeching and stack requirements
- l. Sizing of headers
- 2. Drawings shall include:
 - a. Dimensional drawings drawn to scale for plan and section views of equipment.
 - b. System schematics clearly indicating and identifying components, supporting utility connections, instrumentation, controls, piping and wiring.
 - c. Equipment specifications and descriptive literature.
 - d. Weights of equipment.
 - e. Rigging instructions.
 - f. Individual system components as called for in the Specification Schedules.
- B. Operation and Maintenance Manuals
 - 1. Submit four preliminary copies of operating and maintenance manuals for review by the Authority.
 - 2. Upon approval by the Authority submit nine (9) hard copies and nine (9) electronic copies of completely bound sets of instructions for operating and maintaining HTHW generator and equipment. Hard copies binders shall be 3-ring looseleaf type with title on front cover and binding. Electronic copies shall be on CDR or DVD. Complete and submit manuals prior to training.
 - 3. Manuals shall include:
 - a. Table of Contents and Index with binder page numbers.
 - b. Summarization table briefly describing all specified equipment items and related capacities.
 - c. HTHW generator and supporting equipment manufacturer's name and address and telephone number of local service representative.
 - d. Provide tabs for each item section in binder.
 - e. Each item section shall include the following:
 - (1) Brief description of each system and equipment sub-components.
 - (2) Basic operating features.
 - (3) Performance limiting conditions.
 - (4) Equipment start-up instructions.
 - (5) Equipment shutdown instructions.
 - (6) Safety considerations.
 - (7) Emergency procedures.
 - (8) Complete lubrication instructions and schedule (may be included in preventive maintenance schedule section). Separate listing of lubricants required for all components including recommended domestic manufacturers and specific grades with "equivalent" cross-referencing.
 - (9) Complete preventive maintenance schedule including instructions and recommended intervals for both normal and severe operating conditions with statements clearly defining conditions which may be considered "severe".
 - (10) Complete guide to troubleshooting including list of symptoms and instructions for corrective action.
 - (11) Electrical motor data (separate section).