

# ***PROSTEAM TECHNOLOGIES***

Advanced Steam Generator System



The enhanced generator system is a complete mechanical and control package that tightly integrates fewer and much more intelligent components into an elegant package. It raises the level of steam generator efficiency, reliability, and combustion emissions.

## **System Features**

- Each generator panel has its own high performance Allen-Bradley control processor and color LCD operator interface display. Each generator is stand-alone and is fully functional and not affected by control failures in other units.
- System incorporates smart digital instrumentation and electrical actuation devices for high accuracy and reliability.
- Stable and precise control coupled with innovative passive flue-gas recirculation system enabled ultra low NOx level of less than 14 ppm.
- Sophisticated and flexible control system performs full on-line steam quality and efficiency calculations. Complete system data management is also done.
- Precise air rate control is performed using blower motor variable frequency drive and stack excess oxygen transmitter. Air rate modulation performs closed loop control of stack excess oxygen. No variable vanes or louvers are used.
- Main gas controls consisting of; safety valves of dual electro-hydraulic actuated ball valve system, FM approved for gas safety service, and normally open bleed solenoid; characterized ball valve with modulating electric actuator for rate control; and multi-variable transmitter for fully compensated orifice gas measurement.
- In the same way, the enhanced generator system can also incorporate control and metering of a waste gas stream for extra heat usage and waste disposal. The waste stream is blended and burned with the main gas stream to provide complete incineration of these components.
- Water rate controls using orifice meter with smart DP transmitter, and characterized control valve with electric modulating actuator. Water rate is modulated to provide closed loop steam quality control.
- Fuel oil rate controls using Micro-Motion coriolis meter, and characterized ball valve with electrical modulating actuator.
- Very low steam generator pressure loss and high capacity is available using optional parallel path split-flow water and steam loops.
- Full actuation and control of pilot gas assembly allows fully automatic generator startup.
- The Advanced generator system can interface to centralized feedwater pumps system or control on-board water pump.

## **Safety Features**

The solid design sets a new standard for personnel and equipment safety performance:

- Independent flame fail management using FM approved flame safety controller.
- Air flow sensing using blower VFD feedback diagnostics, purge air velocity sensor, and stack gas O2 transmitter. Pre and post purge timers are embedded in the PLC system and cannot be adjusted by the operator.
- More precise tube failure detection using water input and steam output mass balancing.
- Position feedback on safety valves assures out of position failure detection. No valves can be forced out of control during operation.
- Safety valves incorporate robust electro-hydraulic ball valve system, not guillotine valves for reliable shutoff and long life.
- Always fully automatic control at programmed setpoints for steam quality, excess O2, fuel, and gas rates.
- Detection of signal loss from all devices triggers alarm and shutdown.
- Generator controls are remotely controllable if it is desired to keep personnel away from equipment.
- The advanced generator system has full reset and restart operation. "One button start". Once commanded to start, the generator system will automatically perform all sequencing to full run operation. The unit requires no further attention.

## **Reliability Features**

- Corrosion resistant fiberglass enclosures for control and variable frequency drive equipment.
- Periodic safety testing is much faster due to fewer and smarter instruments. The full suite of safety checks for the advanced steam generator system typically take only 4 hours.
- Smart digital instrumentation hold stable calibration and have no moving parts to wear providing very long life.
- No air louvers or shutters to adjust or wear.
- All electric actuation, no pneumatic compression, drying, filtering, distribution, regulation, positioning, and actuation equipment to maintain.
- System has offline maintenance mode that allows flexible actuation of valves and blower for testing and servicing.

## Performance

The stable and precise control of the advanced steam generator design allows high steam output capacity:  
[62.4MMBtu/hr unit]

- 4,000+ BSPD steam output
- tight steam quality control
- 1,300+ MCFPD fuel gas rate
- 225 BPD fuel oil capacity
- 1% excess O2 output is typical
- 275 – 325 °F typical stack temps
- > 85 % thermal efficiency typical
- ~95% on time
- < 14 ppm NOx emissions capability with flue gas recirculation on fuel gas supply.

## Data Management / Diagnostics

- Accumulates daily efficiency, water, gas, fuel, and steam quality performance. Stores the last 30 days and monthly totals for retrieval and remote telemetry.
- Calculates 10 minute and daily averages for all process measurements.
- Captures the last 30 special operating events such as alarm shutdown conditions, resets, restarts, etc. Records all process conditions at the instant of the event. These stored events, with all operating parameters, replayed from the control panel screen in chronological order provide a valuable diagnostics function.

## Other

- Communications - the advanced steam generator design uses Allen-Bradley PLC equipment with integrated Ethernet communications for high speed networking. Other networks are available.
- Generator system is also fully remotely controllable.
- All current operating conditions, stored totals, and diagnostic event data is retrievable remotely.
- Full digital color operator interface display panel on each generator.
- Solid and mature design. Well proven in multiple installations with several years of runtime in California and Russia.

## Options

The above describes the characteristics of the basic advanced steam generator system. Additional features and enhancements can be initially requested, added by ProSteam Technologies, or by the customer after installation. Some typical options are:

- Engineering and construction services for complete multi-generator steam plant
- Steam SpliTigator™ quality control and measurement manifolds
- Complete system design including remote data communications, central graphics monitoring, control, and integration with legacy systems
- Centralized feedwater pumping systems
- Feedwater treatment facilities
- Custom user requirements

## Typical Steam Generator Views

Blower and Burner Area



Typical High Flue Gas Rate Flame



Fuel Gas Train



**Sample Control Panel Display Screens**

21NW-G04 Main Screen

Gas Press	42	PSI	Stack Oxygen	0.91	%O2
Gas Flow	1197	MCFPD	Steam Press	774	PSI
Waste Gas	382	MCFPD	Steam Quality	67	%
Water Flow	3961	BPD	Air/FGR Ratio	19.4	%
Water Press	1477	PSI	Efficiency	86	%
Can Pump Suction Press	118	PSI			

Generator Start Time - 2/02/2001 8:16  
 Total Run Time - 94.2 HRS

Restart Locked Out

**Generator Full Run**

F1 GEN STOP	F2 Process	F3 Maint Screen	F5 Alarms
F6 Gen Start	F7 Setpoint	F9 Step Hold	F10 Menu Screen

F1 F2 F3 F4 F5  
 F6 F7 F8 F9 F10

21NW-G04 Event History

Event - Generator Stop Command  
 Step - Full Run Step  
 Date - 1/30/2001 10:27

Step Time -	87.2	FGR (%) -	19.7
Gas Press (psi) -	38	Efficiency (%) -	85
Gas Flow (mcfpd) -	1184	Steam DP (" wc) -	1014
Waste Gas (mcfpd) -	326	Ambient Temp -	58
Water Flow (bpd) -	3897	Mix Temp -	89
Water Press (psi) -	1420	Recirc Temp -	243
CP Suct Press -	105	Water Valve Pos -	66
Stack O2 (%) -	0.97	Gas Valve Pos -	56
Steam Press (psi) -	741	Waste Gas Ulv Pos -	32
Steam Quality (%) -	67.4	Blower Speed -	1855

F1 GEN STOP	F3 Sel Value 18	F4 Next Value	F5 Run Screen
		F9 Prev Value	F10 Menu Screen

F1 F2 F3 F4 F5  
 F6 F7 F8 F9 F10

**21NW-G04 Daily Average History**

Date	Selected This Month	Last Month
	2/5/2001	2/2001
Gas Rate (mofd)	1182	1204
Waste Gas (mofd)	357	369
Water Rate (bpd)	3882	3912
Stack O2 (%)	0.96	0.98
Steam Quality (%)	67	66
Heat Rate (mmbtu/d)	1267	1302
Run Time (%)	100	98.6
Gas Total (mof)	1182	7628
Waste Gas (mof)	351	2189
Water Total (bbbls)	3848	24627
Heat Total (mmbtu)	1254	8026
Run Time (hrs)	24	153

F1 GEN STOP
F3 Sel Value 26
F4 Next Value
F5 Run Screen

F9 Prev Value
F10 Menu Screen

**F1** **F2** **F3** **F4** **F5**  
**F6** **F7** **F8** **F9** **F10**

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