BOILERWATCH® MMP-II-SSX

Acoustic Pyrometer – Biomass and W/E Applications
Simultaneous Sampling - Bidirectional - Leak Detection

Master Distributor
Greenbank Energy Solutions Inc
185 Plumpton ave
Washington Pa 15301
724-413-4021

Acoustic Pyrometer

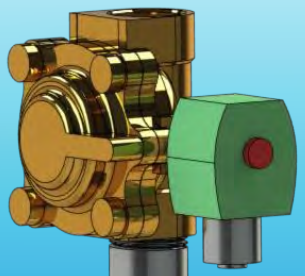
The BOILERWATCH® MMP-II-SSX acoustic pyrometer is an advanced industrial instrument that provides fully automatic measurement of high combustion-gas temperatures, permitting fuel trimming control within heaters and boilers. The system is completely non-intrusive, and operates on the principal that the speed of sound in a gas is proportional to the temperature of that gas. Acoustic transceivers are mounted on the outside of walls of the heater/boiler, and a high intensity acoustic signal is launched through the gas stream. Since the distance between the sound source and receiver is known and fixed, the average temperature of the gas along the acoustic path is computed from an accurate measurement of the sound signal's transit time.

BOILERWATCH® MMP-II SSX Provides temperature measurement in groups of 5 paths. Increases speed of processing 80%. Also reduces air consumption 80%.

BOILERWATCH® MMP-II-SSX systems are available in a variety of configurations. With up to 24 individual path temperatures available, systems may be configured for spatial 2 dimensional temperature mapping, independent temperature measurements, or a combination of both. BOILERWATCH® MMP-II-SSX systems are easy to install, commission, and operate.

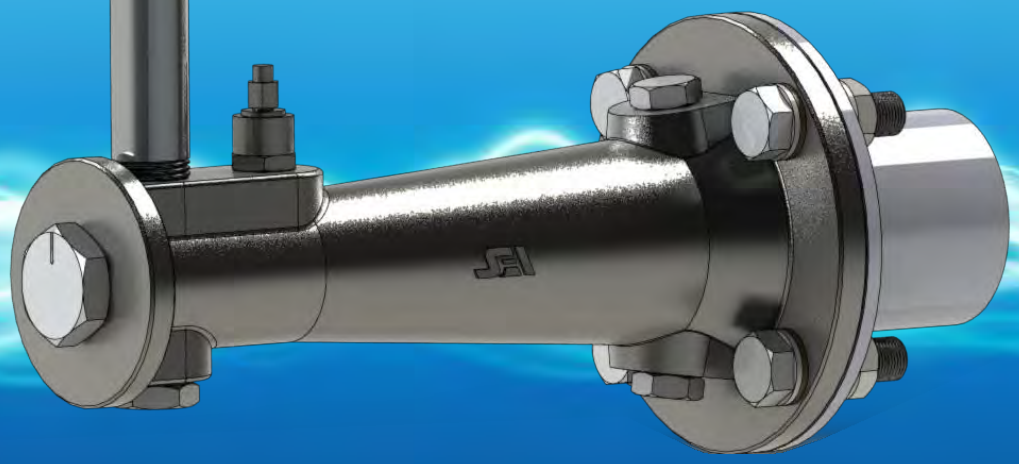
With our Acoustic Pyrometer you can measure the gas temperature in any kind of furnace or boiler and get a distribution map temperature, all in real time. The waveguide can be located in 2, 3 or 4 wall of the furnace or boiler.

Using real-time gas temperature and spatial temperature distribution profile maps from a BOILERWATCH MMP-II-SSX Acoustic Pyrometer System to reduce out-off balance gas temperature conditions within the horizontal furnace exit plane of a coal fire power boiler, provides a number of highly cost effective benefits.

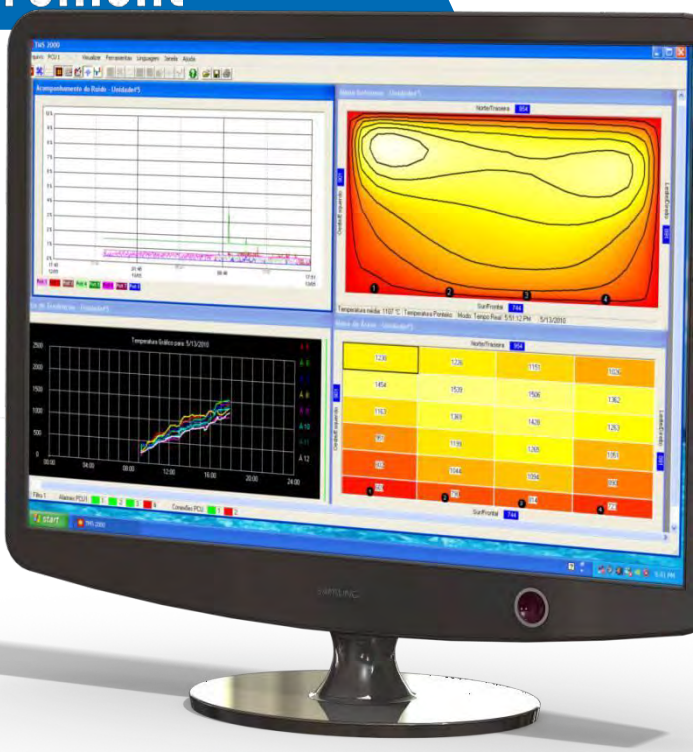


It has been shown that excess O2 can be reduced by at least 0.5%, which results in a vastly significant increase in fuel efficiency and heat rate. The cost savings from this benefit alone pays for a BOILERWATCH MMP-II-SSX system in very short time.

By reducing temperature imbalances and eliminating hot-spots in the FEGT plane, NOx production is cut down at the source. More uniform temperature distribution also reduces thermal stress and increases the service life of critical pressure parts including wall tubes, superheaters and reheaters.



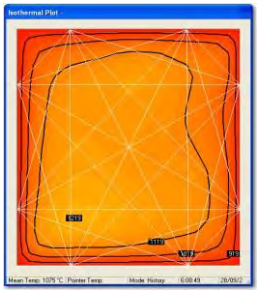
Software
Gas Temperature Measurement



TMS-2000 presents powerful visual information on real time or historical gas temperatures for temperature distribution within a furnace or combustion process. Spatial temperature distribution profiles, individual path temperatures, temperature trends, and average gas temperatures within user-defined areas are all quickly and easily available.

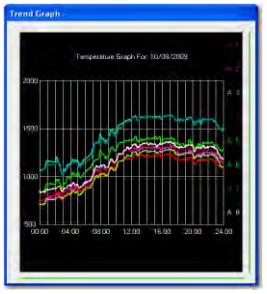
TMS-2000, like all of our software is menu driven for ease of use. In addition, it has soft key buttons to quickly move between screens, or to open and close screens.

Isothermal Map



TMS-2000 provides an accurate and clear picture of this temperature distribution profile in real time. The Isothermal Map Screen presents spatial temperature information as a series of isothermal lines and is color- coded. In addition, a digital readout of the temperature at any point on the map is obtained by simply moving the mouse cursor over the map display. For example, the screen layout below was made just by clicking on the soft key buttons.

Trend Graph

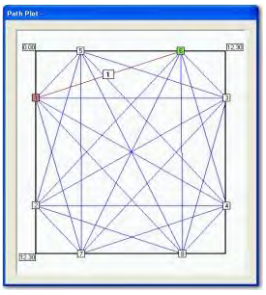


Path temperature graphs show up to 8 Areas and/or path temperature values. Both minimum and maximum temperature scale values may be selected for optimum resolution of the trace display. Time periods may be selected from the previous 24 hour periods up to 365 days. Each pen is color coded, any pen may be assigned to the first 8 paths and/or areas. The Time and Temperature are displayed by moving the mouse over the graph.

Area Map

TMS-2000's Area Map feature allows you to define up to 24 areas within the mapping plane, and automatically computes the average temperature within each area. There is considerable flexibility in defining areas, as they can be anywhere in the plane and need not be adjacent. Areas may be isolated or overlapping.

Path Plot



The path screen displays the locations of the Model 3020TR acoustic transceivers around the perimeter of the mapping plane and all of the available paths in the mapping array. Detailed information on any path, such as transmitter and receiver port numbers, path length, and other settings are available at the Tools Menu.

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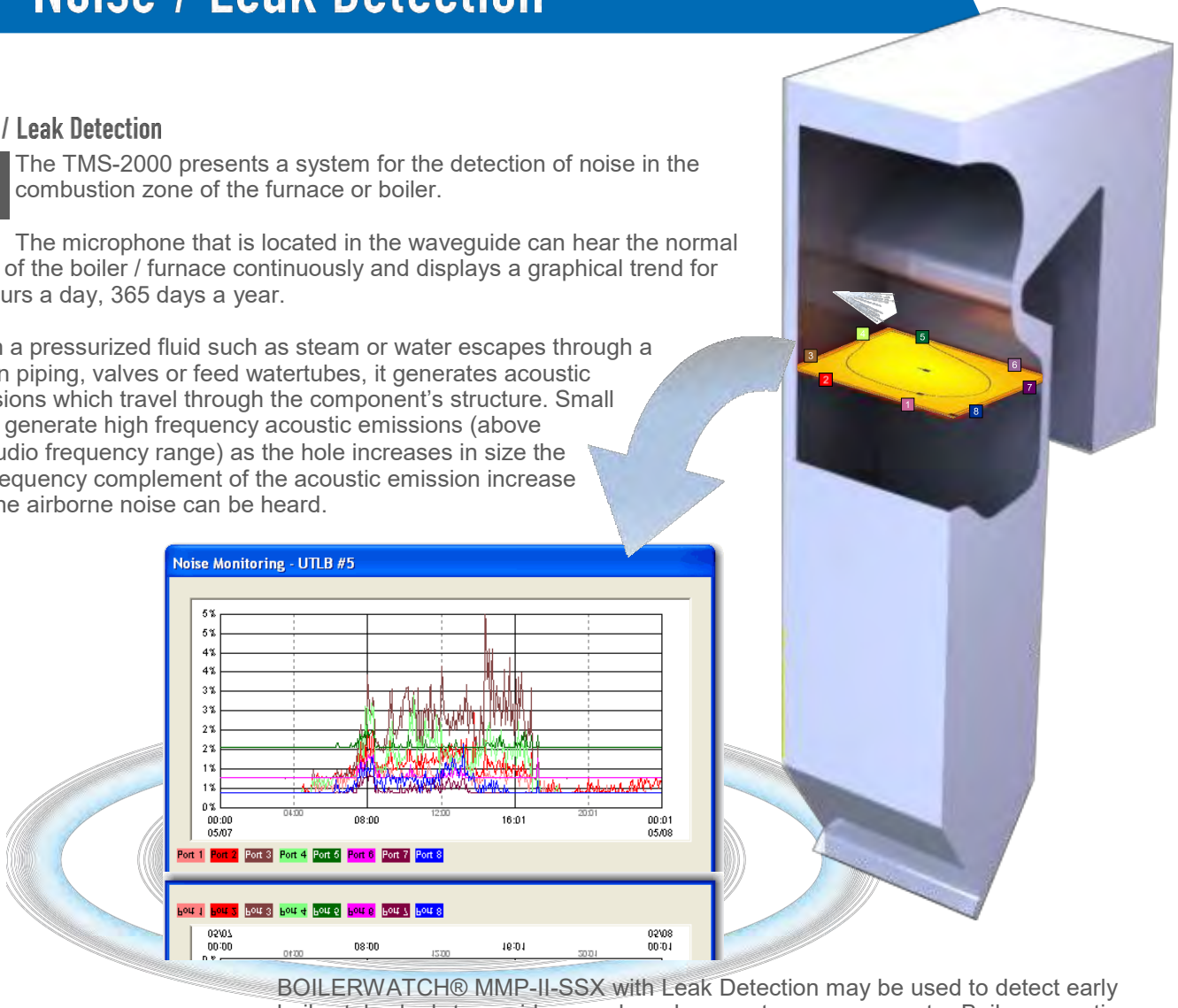
Software
Noise / Leak Detection

Noise / Leak Detection

The TMS-2000 presents a system for the detection of noise in the combustion zone of the furnace or boiler.

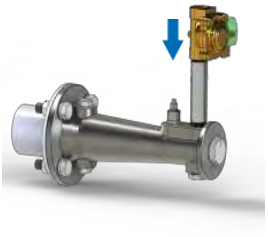
The microphone that is located in the waveguide can hear the normal noise of the boiler / furnace continuously and displays a graphical trend for 24 hours a day, 365 days a year.

When a pressurized fluid such as steam or water escapes through a leak in piping, valves or feed watertubes, it generates acoustic emissions which travel through the component's structure. Small holes generate high frequency acoustic emissions (above the audio frequency range) as the hole increases in size the low frequency complement of the acoustic emission increase and the airborne noise can be heard.



BOILERWATCH® MMP-II-SSX with Leak Detection may be used to detect early boiler tube leak to avoid secondary damage to pressure parts. Boiler acoustic tube leak detection system must be used as it prevents damage to costly boiler parts and it is very much cost effective.

Microphone



Traditional leak detection system such hearing hissing sound by ear or monitoring feed water flow or furnace vacuum is not much reliable because it cannot detect small leak so damage to vital costly equipment of boiler may not be avoided. Operators noticed many instances where thermal power plants boiler allowed to run for long time due to confusion which caused permanent damage to many boiler tubes, refractory and boiler structures. Hence importance of acoustic monitoring leak detection systems sincerely felt.

Early detection by BOILERWATCH® MMP-II-SSX with Leak Detection results in substantial reduction of repair times and costs with a consequent increase in plant availability and profits. The early detection of a boiler tube leak will give financial savings which will easily exceed the initial capital cost of the detection system even at the very first event.

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Components

1 3020TR-SSL Transceiver Unit · Wave Guide and Preamplifier

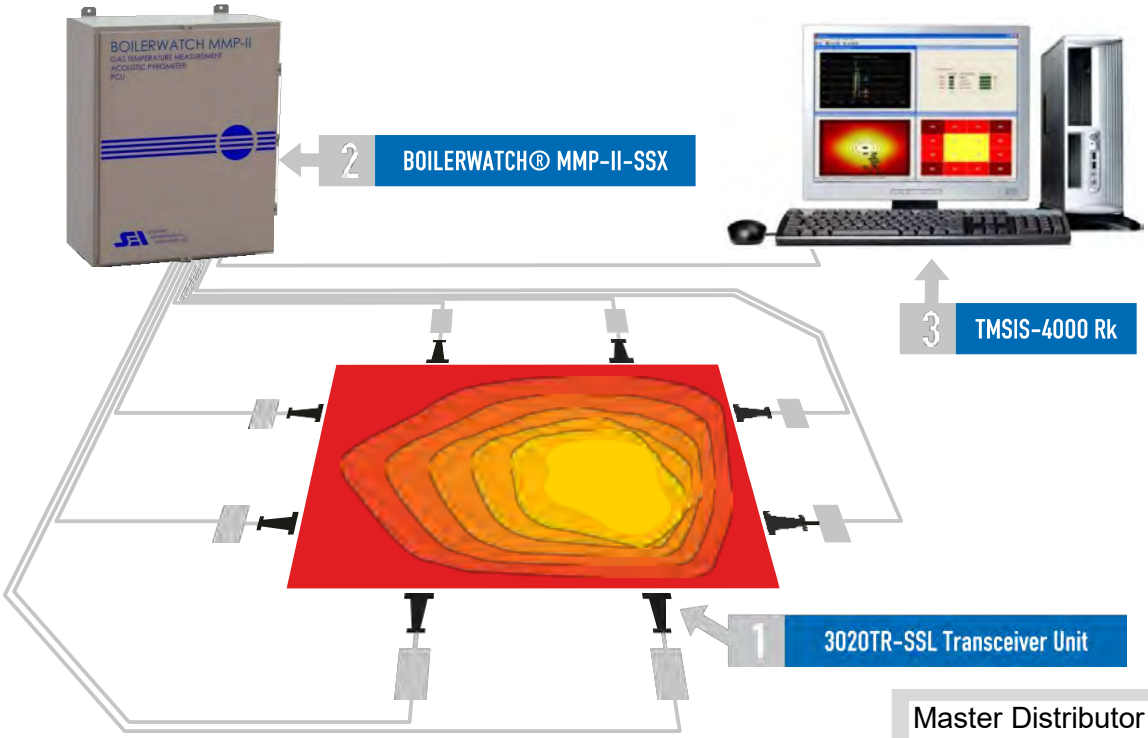
Pneumatically driven acoustic sound source and receiver. Mounts on exterior furnace heater wall/observation door, and provides acoustic transmitter and receiver functions for balanced-draft furnace applications.

2 BOILERWATCH® MMP-II-SSX · Processor Control Unit (PCU)

Sound spectrum used for reliable detection is from 500 Hz to 3,500 Hz. Simultaneous detection is available to sample all paths in less than 15 seconds. Provides temperature measurement capacity for up to eight (8) independent paths (requires 2 model 3020TR Transceiver units per path), or up to a twenty-four (24) path array for spatial temperature distribution mapping (using up to 8 model 3020TR Transceivers).

3 TMSIS-4000 Rk

The TMSIS-4000 utilizes the TMS-2000 software to convert path temperature data provided by the BOILERWATCH® PCU into area data for planar temperature distribution mapping applications. The spatial temperature gradients are displayed in the form of an isothermal map and accurately represent a planar temperature gradients. Additionally, the complete two-dimensional (2-D) (planar) isothermal map is sectioned into 24 areas forming an array of area temperatures, which constitute a single spatial temperature plane. The area temperature data is then fed directly into the plant Distributed Control System (DCS), Data Acquisition System (DAS), for data presentation and archiving.



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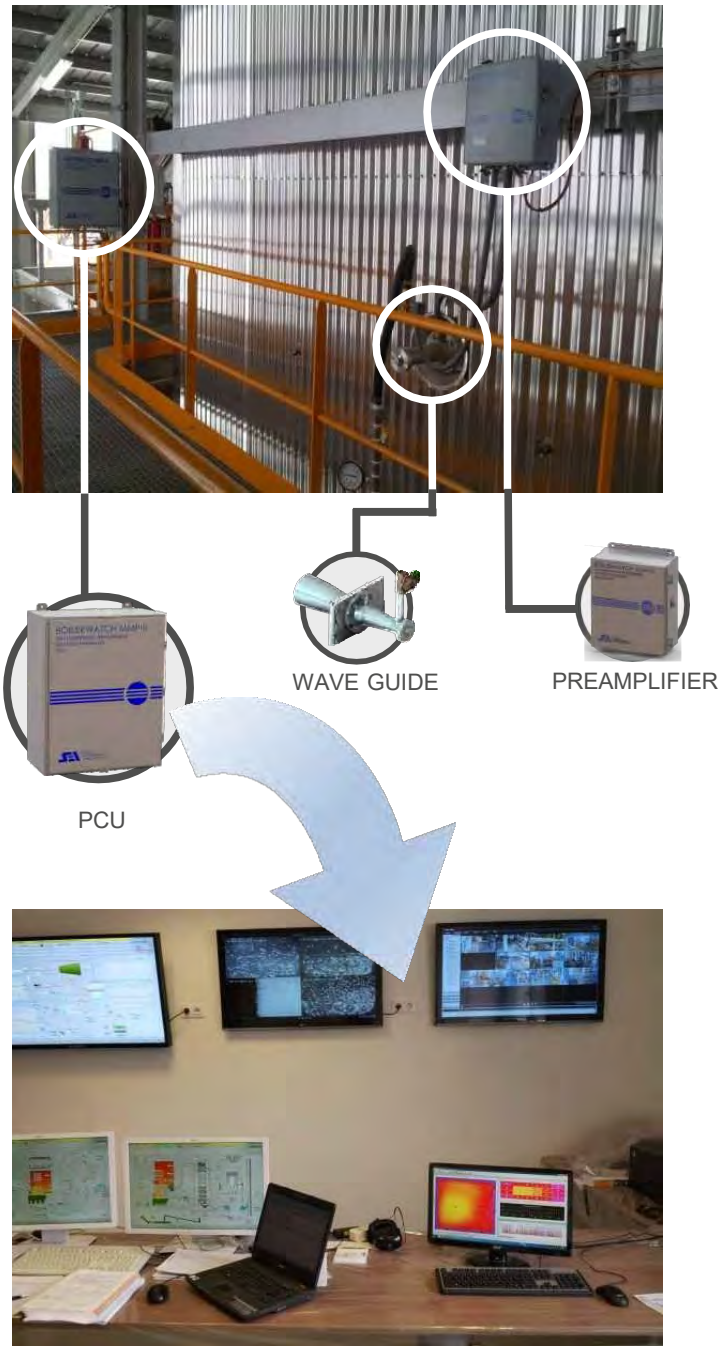
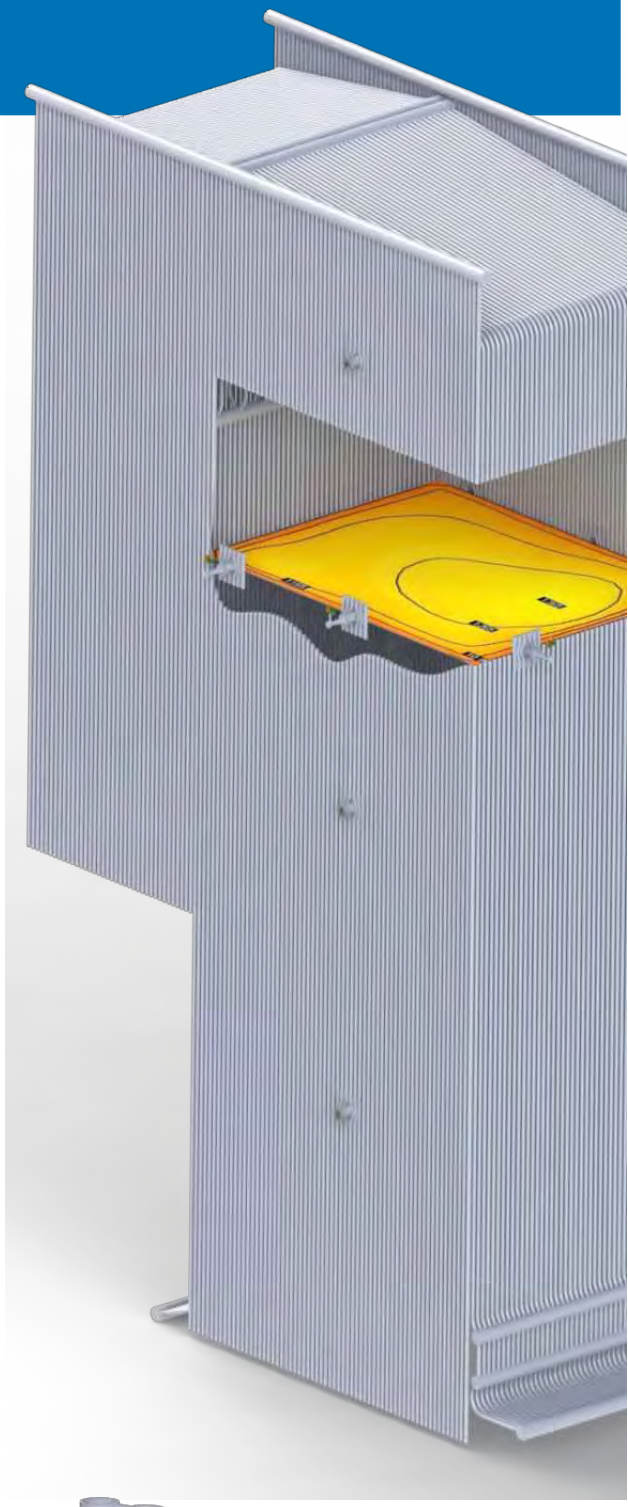
GESTAMP BIOMASS

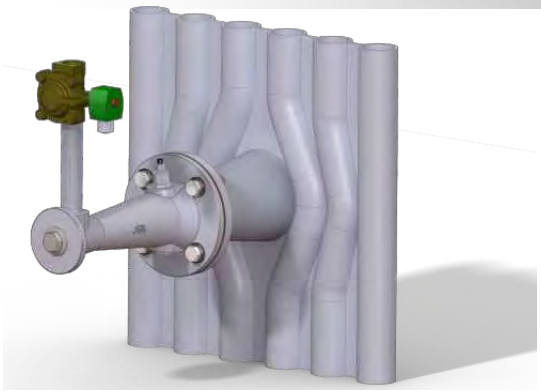


TMSIS-4000
CONTROL ROOM



Configuration:

6 Sensors 3020TR (2 on side walls and 2 on front wall) to obtain 12 trajectories per map.



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Location:	Spain
Power:	16.8 MWe
Fuel:	Forest
Energy Generation per Year:	130.000 MWhe
Tons of CO2 avoided:	100.000tons

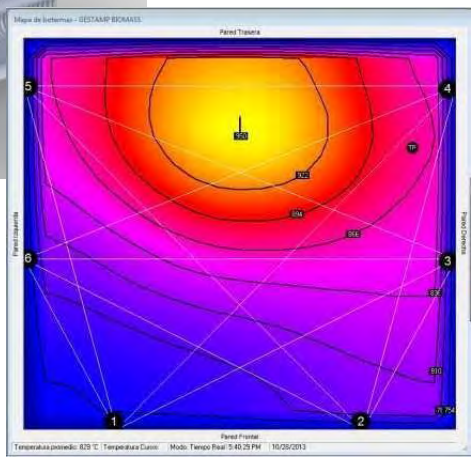
Optimize Availability

The main objective of the boiler design is to obtain high availability in operating hours. For this, the **BOILERWATCH MMP-II-SSX** Acoustic Pyrometry system has been installed to obtain a gas temperature distribution map throughout the boiler that avoids reaching the plastic temperature of the ashes and thus avoid adhesions and fouling. In turn, this temperature map is compatible with working outside the chlorine corrosion parameters in superheater banks.

The boiler is water-tube and will generate superheated steam from the combustion of forest residues and the recovery of heat from the gases. It is a radiant type boiler and in it all the evaporation takes place by means of heat transfer by radiation and convection on its membrane walls. These cavities are formed by a main hearth and a convective passage. This design reduces fouling of the boiler by minimizing the number of tube bundles inside.

The superheater bundle section is made up of tube banks with a spray-type intermediate tempering stage, to keep the temperature of the turbine superheated steam constant.

Finally, in the low gas temperature part, there is the economizer and air preheater bundle. The latter has a bypass on the air side to control the combustion air temperature.



Combustion

The combustion system is made up of a feeding silo with an anti-vault system, three high-capacity, low-speed extractor screws, three spreader-type biomass feeders and an air-cooled vibrating grill.

It has a complete primary and secondary air system with independent fans and regulation. It also has a gas recirculation system with which a high control of combustion and CO and NOx emissions is achieved. All these fans are driven by frequency inverters, which optimizes both their working point and the installation's self-consumption.

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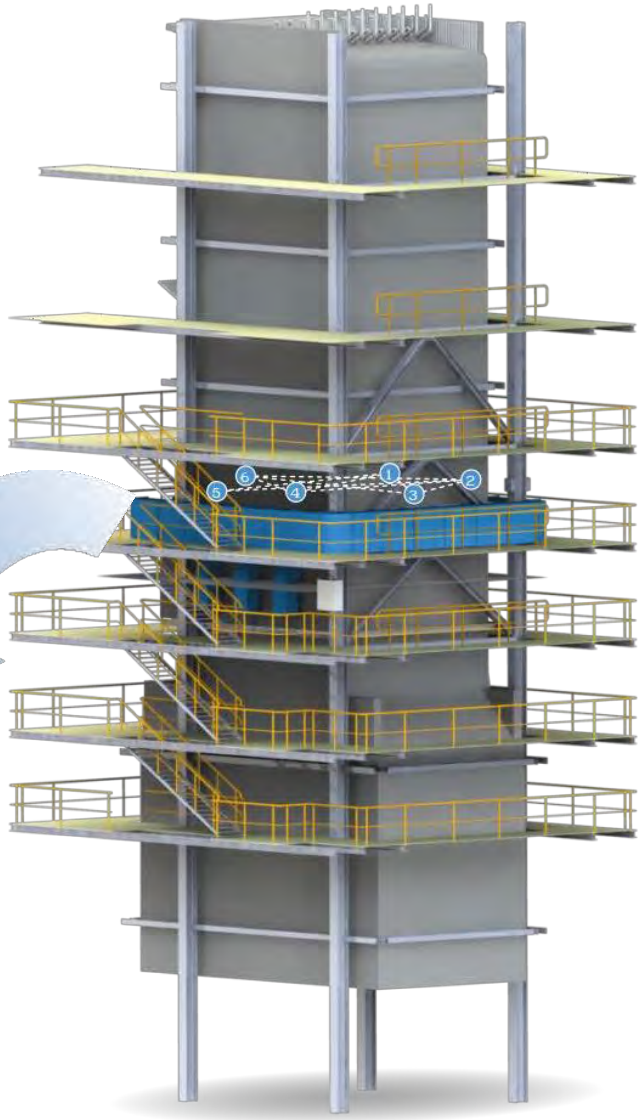
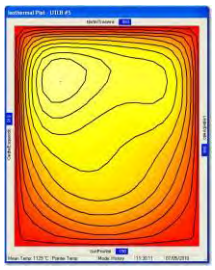
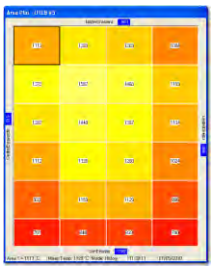
ENCE-Spain

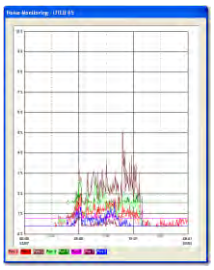
Client: ENCE
Location: Huelva, España
Boiler: HU-41
Fuel: Forest-Biomass.
Capacity: 41 MW

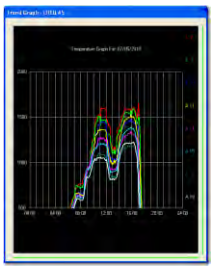


In the boiler startup, the system shown on the screen an isothermal maps, Area Graph Temperature and Noise Graphs Monitoring inside the boiler.
Our system detects a noise inside the boiler at increase the load and pressure of steam. The operator determines that it is a leak and the boiler must stop for inspection, verifying the leakage between port 3 and 4.









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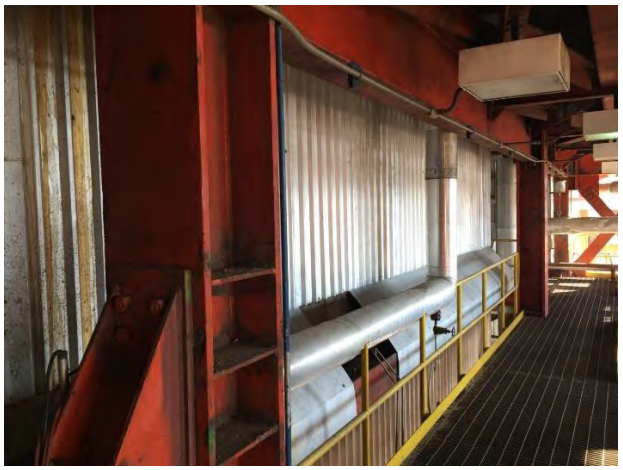
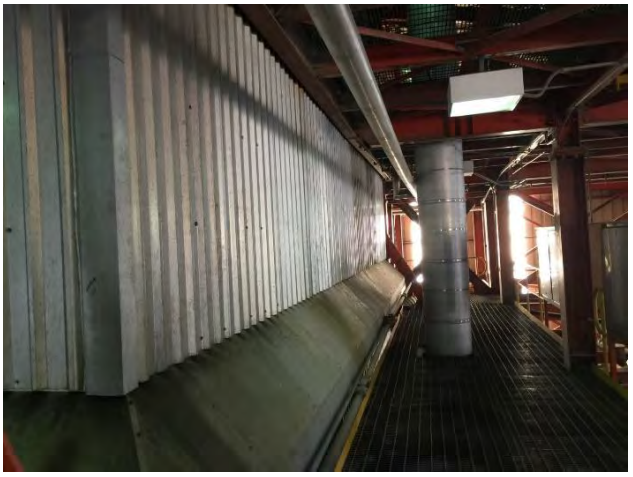
Furnace Walkdown





Identify location for measurement and then identify the walls for mounting. Keep sensors 3 feet from corners. Solenoid valve and preamplifier boxes can be remote mounted 20 feet from sensors.

Identify fuel intake chutes. Are there any adjustments possible for modulation?

Existing observation doors can be used. We supply hinged adaptors to maintain their use.

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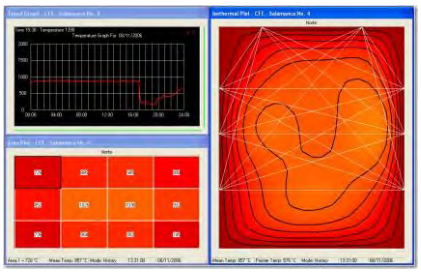
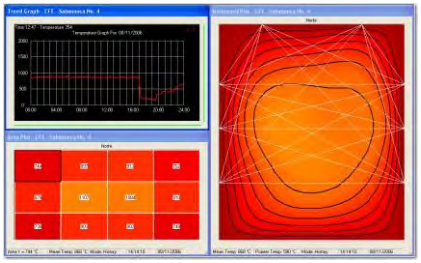
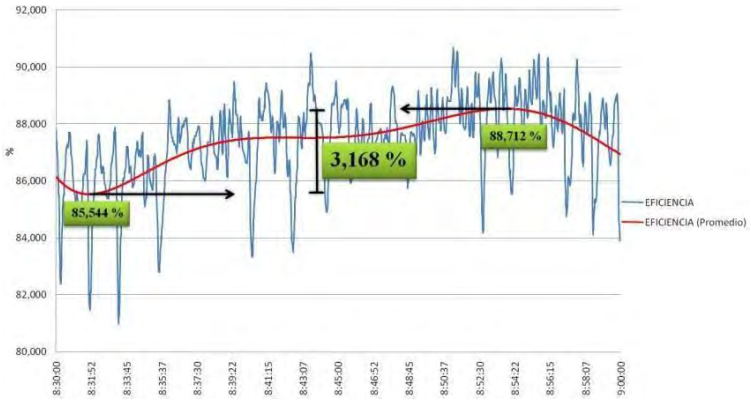
CFE Salamanca - Mexico



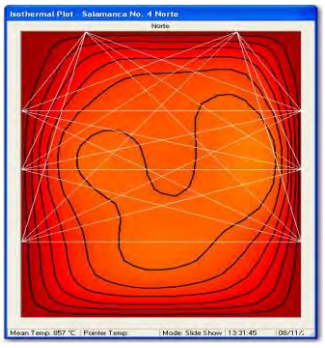
UNBALANCED

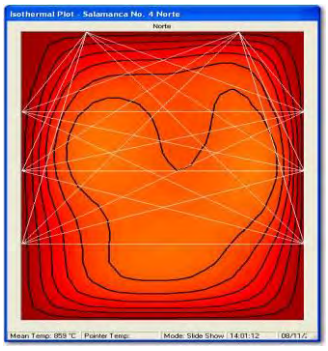


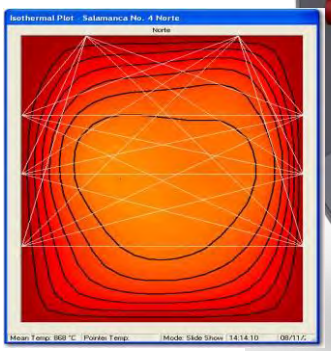
BALANCED



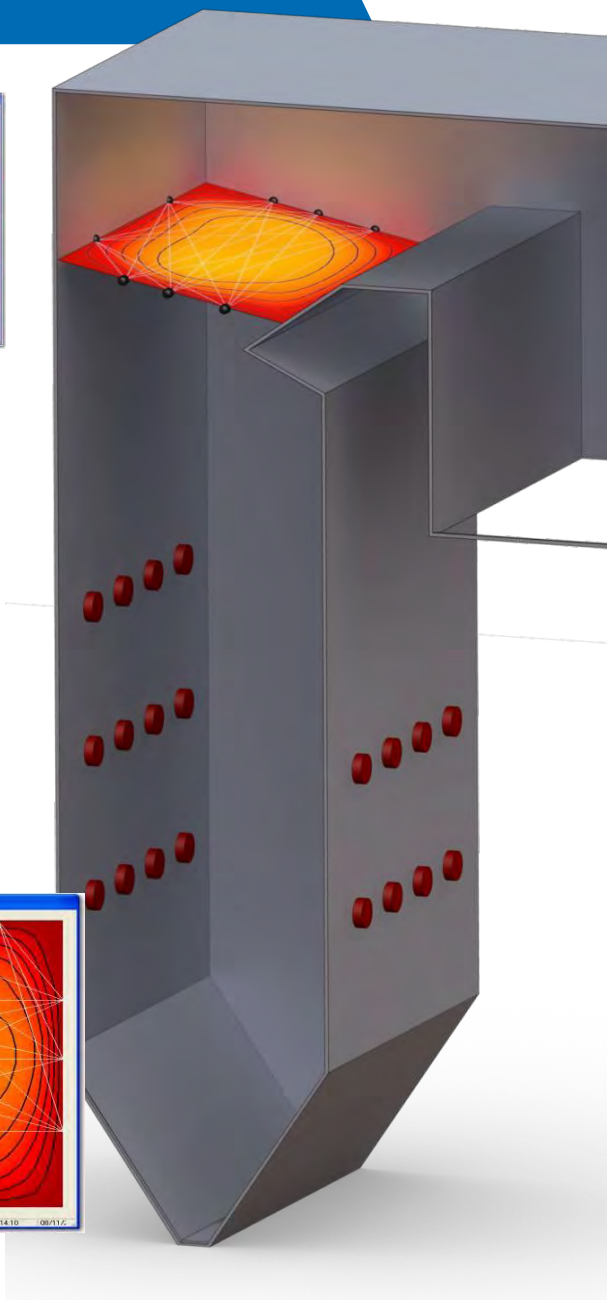
EFFICIENCY INCREASE







COMBUSTION PROGRESS



Combustion Control and Efficiency Increase

* Reduction of fuel consumption by improving Boiler Thermal Efficiency (3.9 %).
- Thermal Stress Reduction in the Pipe Walls and overall internal components of the boiler, due to displaying Hot Point development in Real-Time.
* Emissions Reduction/Combustion Quality.
- In the data compiled during the tests it was observed that manipulating the air flow and watching the display of a homogeneous isothermal chart it was possible to improve the emission of polluting agents.
* Improvement of the availability for service.
- By having control of the thermal distribution of temperatures, the production of hot points is not allowed, avoiding unforeseen needs to place the unit out of service, and therefore increasing the operating time of such unit.

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Specifications

1 3020TR-SSL Transceiver Unit · Wave Guide and Preamplifier

Wave Guide

Material:	Stainless Steel 316L
Dimensions:	200mm flange diameter, 325mm length
Flange:	In accordance with ASTM standard 3-inch 150 lb. pipe flange
Weight:	26 lb. (11.8 Kg.)
Temperature Environment:	Flange: +450ºF (+232ºC) max.; Ambient Air: +130ºF (+54ºC) max.
Noise generated:	Inside: 126dB.
Air Pressure to Sound Source	Air Service. 80 - 120 psig (5.0 - 8.3 Bar).
Air consumption	5 bar = 2.26 m3/min (No Constant)

Preamplifier

Ambient Air Temperature:	+ 140 ºF (60ºC) maximum, No solar loading on cabinet
Enclosure:	343H x 288W x 130D mm
Weight:	14 lb (6,4 Kg)
Industrial Standards:	NEMA/EEMAC Type 4. IEC 60529, IP66

2 BOILERWATCH® MMP-II-SSX · Processor Control Unit (PCU)

Ambient Air Temperature:	+ 130 ºF (54ºC) maximum, No solar loading on cabinet
Enclosure:	762H x 610W x 356Dmm
Weight:	110 lb (50Kg)
Industrial Standards:	NEMA/EEMAC Type 4. IEC 60529, IP66

3 TMSIS-4000 Rk

Number of Ports:	Two minimum and up to sixteen maximum
Number of Paths:	Up to twenty-four (24) paths
Warranty:	Two (2) years.

TMS-2000 Software

Measurement Range:	32ºF to 3500 ºF (0ºC to 1927 ºC)
Temperature Units:	English or Metric (ºF or ºC)
Accuracy:	Better than 0.5%
Measurement Acquisition Time:	Less than 30 Sec.
Data Output:	OPC/Ethernet
Data Saved:	Unlimited (Isothermal Map, Trend Graph and Noise Detection).
Remote Connection:	VPN or Remote IP.

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Benefits

Startup Temperature:

Monitor flue gas temperature ramp from Ambient Temperature for boiler startup preventing overfiring that could damage superheat tubes, or underfiring that could potentially send wet steam to the steam turbine damaging buckets.

Soot Blower Control:

Record time vs. temperature histories to improve boiler performance and control of soot blower operation and duration. Monitor thermal transients during cleaning to improve heat transfer on boiler tubes from under cleaning which could lead to slagging conditions. Monitor boiler gas temperature for comparison to steam outlet temperature for determining soot blower activation.

Reduce Slagging / Ash Fusion:

Monitor maximum allowable temperature in the boiler superheat/reheat section for ash fusion alarm point annunciation.

Low NOx Applications:

Sense temperature set points between 1,600°F and 2,100°F for the injection of low NOx enhancers with urea or ammonia in Selective Noncatalytic Reduction Systems.

FEGT High Temperature:

Monitor highest temperature and maximum load condition for most efficient operation and prevent boiler waterwall, reheat and superheat tube failure.

Reduce Fuel Consumption on Startup:

Monitor fuel changeover based on temperature rather than load, thereby reducing startup time by hours.

Fluidized Bed Boilers:

Determine optimal temperature for pulverized limestone injection on flue gas desulfurization systems and general operating conditions. Measure bed temperature for optimal operating efficiency.

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