

## COMBUSTION TECHNOLOGY

Solar Turbines has a long history of installing gas turbines around the world using a broad range of gaseous and liquid fuels while at the same time reducing emissions.

As the world's energy demands expand, concerns about gas turbine emissions and fuel consumption have grown. Maintaining its industry leadership position, Solar continues to improve its conventional and SoLoNOx™ dry low emissions combustion system – developing new products and adapting new systems to utilize a broader range of fuels and operate more efficiently while minimizing emissions.

### Benefits

- Reduced Emissions
- Enhanced Operational Flexibility
- Broad Fuel Range Adaptability

### Technology Advancements for Cleaner Combustion

Solar has developed a robust set of emission control tools that enable its gas turbines to operate more cleanly. NOx emissions as low as 9 ppm are available on many SoLoNOx equipped packages.

### Augmented Backside-Cooled Liner

The augmented backside-cooled liner is a feature of Solar's gas turbines that is designed to reduce emissions. With backside cooling, the cooling air does not mix with the combusting mixture in the combustor primary zone. This eliminates a significant amount of quenching which results in lower CO emissions. This allows the combustor to be designed for a cooler flame that reduces NOx emissions as well.

### Enhanced Fuel Control

The engine fuel delivery system has been enhanced to provide more accurate and precise control of pilot fuel flow which is key to achieving consistently low emissions.

These enhancements also allow for higher pressure drop in the pilot circuit, improving fuel distribution and resulting in improved emissions and stability

Electronic actuators provide fast, accurate and repeatable response of the compressor inlet variable guide vanes, bleed valve and fuel valves to better control emission levels over the operating range.

### Burner Acoustic Monitor

Solar developed the burner acoustic monitor (BAM) that utilizes a dynamic pressure sensor to measure combustor pressure oscillations. Results are displayed and recorded by the human machine interface (HMI) display for analysis and troubleshooting. BAM is available as a retrofit kit and is standard on SoLoNOx shipments. The latest version uses a high temperature sensor that mounts directly to the torch, eliminating the semi-infinite coil. Along with this improvement, active control for engine protection is now standard.

### Emissions Control

Enhanced emissions control (EEC) eliminates the abrupt transition into and out of SoLoNOx mode by maintaining temperature control throughout the entire engine operating range. This is accomplished via bleed valve modulation (two shaft) or IGV modulation (one shaft). Additionally, pilot fuel flow is controlled to a minimum schedule throughout the same engine load range.

EEC is standard for the following products booked with a  $\geq 15$  ppm NOx warranty:

- Titan™ 250 (30000S, 31900S)
- Titan™ 130 (20501S, 23001S, 23502S)
- Mars® 100 (16002S)
- Taurus™ 70 (11101S, 10801S, 10802S)

Availability on other products is currently in work. For more information on this and enhanced emissions control, please contact Solar.

# Solar<sup>®</sup> Turbines

A Caterpillar Company

Powering the Future Through Sustainable, Innovative Energy Solutions

## Lower Emissions at Lower Ambient Temperatures

SoLoNOx low emissions range has been expanded to -20°F (-29°C) on most products at a tiered NOx guarantee level from 0°F to -20°F (-17°C to 29°C) on approved projects.

## Using Alternate Gaseous Fuels

Conventional combustion gas turbines can use a broad range of gaseous fuels including gases associated with oil production, biogas, coke oven gas, natural gas liquid and liquefied petroleum gas. SoLoNOx system qualification continues for a broader range of fuels, including higher BTU associated gases and lower BTU landfill and digester gases.

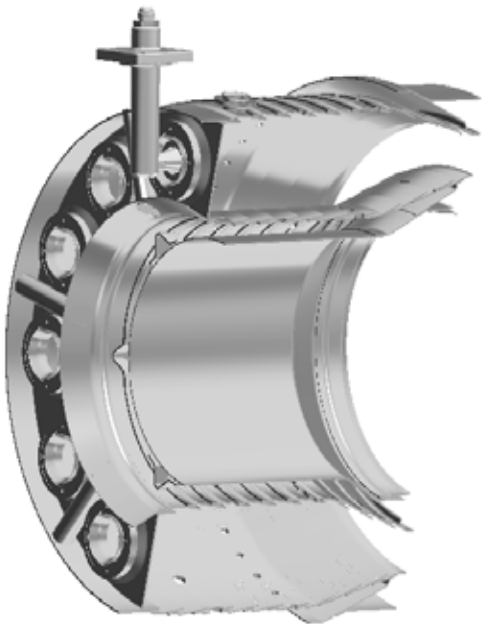
## Liquid Fuel System

Solar's liquid-fueled systems provide cleaner, more efficient solutions.

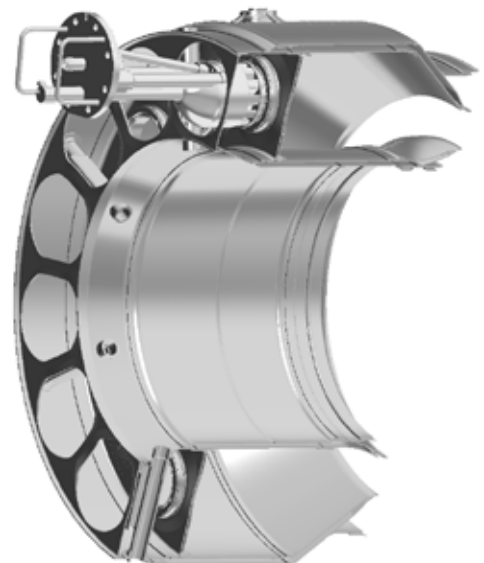
- Improvements to reduce coking of SoLoNOx dual fuel injectors and inhibit cross talk between fuel circuits
- The purge system has been improved to ensure that all liquid fuel is removed on shutdowns and fuel transfers to prevent injector coking

## More Versatile Combustion

Several conversions are possible to upgrade your existing Solar<sup>®</sup> gas turbine packages to SoLoNOx or dual fuel capabilities, or to improve your existing SoLoNOx system. Consult with your local sales representative for options.



Conventional Combustor Liner  
and Fuel Injector



SoLoNOx Combustor Liner  
and Fuel Injector

### Additional Information

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