International Power Technology

Cheng Low NOx (CLN) - Technical Specifications
Rolls-Royce/Allison KB5(x)

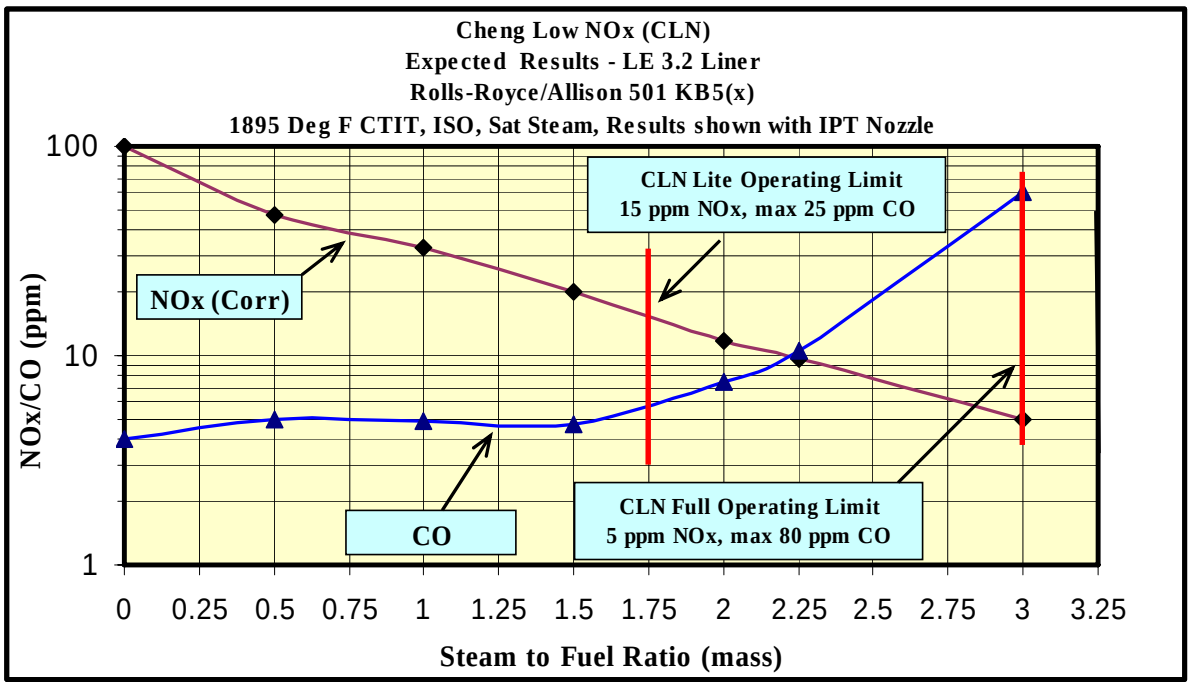
General Description: The CLN technology is an ultra-low emissions technology that has been achieved in practice and that is commercially available.

The CLN technology can best be described as a significant improvement to an existing emissions control method. Rolls-Royce/Allison has been using steam injection for power augmentation and emissions control for over 20 years and there are over 135 Allison 501KB(x) engines worldwide that use steam for emissions control. The patented CLN technology improves on the OEM's methods by mixing, off-engine, the steam and the fuel to a much higher degree of homogeneity and temperature thus achieving lower NOx while levelizing CO emissions. Simply stated, the CLN system enhances and improves on an existing turbine emissions control method that has been in operation since 1985.

For applications requiring no less than 15 ppm NOx, IPT supplies OEM hardware for all on-engine mounted components. For applications requiring between 5 and 15 ppm NOx (corrected to 15% O2), IPT will supply a set of 6 custom fuel nozzles, all other on-engine hardware is OEM.

Emissions: (nominal for LE3.2 combustion liner)

CLN Lite Package	**NOx**	Down to 15 ppm, 1.75 steam-to-fuel (sf) ratio, 1895 Deg F. CTIT, OEM Low Btu Fuel Nozzle
	CO	less than 25 ppm
CLN Full Package	**NOx**	15 to 5 ppm, 1.75/1 to 3.0/1 steam-to-fuel (sf) ratios, 1895 Deg F. CTIT, requires specialized IPT fuel nozzles.
	CO	less than 80 ppm



Benefits of CLN: Ultra-low emissions down to the 5 ppm NOx, low cost, improved turbine heat rate, lower turbine CTIT and longer combustion liner lifetimes for constant power applications, improved BOT temperature pattern, peaking power capability, low maintenance cost, part load operation, ease of installation.

Engine Performance:

Water Injection	When converting from water injection to CLN there will be a decrease in turbine heat rate and a decrease in maintenance costs. Fuel Consumption decreases by nominally 5-6% and there will be a decrease in turbine firing temperature for the same power and NOx level, resulting in improved liner durability. Additionally, CLN steam-fuel mixing results in improved BOT flame pattern.
Constant Power CLN	Decreased turbine heat rate, decreased turbine firing temperature, increased combustion liner lifetimes, improved BOT pattern, load following.
Constant CTIT CLN	Peak shaving kW capability, decreased turbine heat rate, load following.

System Requirements:

Steam	Minimum 250 psig saturated, over 600 lb. applications require silica control in feedwater. Lower steam pressures acceptable for higher NOx applications.
Fuel	Natural gas (high or low btu) only, minimum 275 psig at turbine inlet, no fuel treatment required if pipeline natural gas.
Space	Minimum space requirements inside skid for fuel heater, steam/fuel mixer, and piping and control valves.
Combustion liners	CLN can be applied to engines employing LE-2 and LE-3 combustion liners.
Installation Time	Up to 90 days for delivery and CLN systems installation, 3 day turbine downtime to interface CLN components to engine and startup.

CLN Candidates:
AQMD regulations requiring lower turbine NOx emissions
DLE to CLN conversion
Water injection to CLN nozzle steam conversion
New installations

Pricing: (budgetary per unit, turn-key, installed and guaranteed-excludes combustion liners)

CLN Components	$215,000 - $250,000
Nozzle Steam Piping	$15,000 - $55,000
Turbine Controls	$5,000 - $35,000

Contact Information:

Randy Turley – President & CEO
International Power Technology
1042 W. Hedding Street, Suite 100
San Jose, CA 95126

Phone: 408-246-9040
Web: www.intpower.com