43676 Progress Way
Chilliwack, BC, Canada V2R 0C3
Phone: 604.795.9491
Fax: 949.724.1397

www.CleanEnergyFuels.com

CleanCNG™ Fact Sheet

What is the CleanCNG™?

- A highly versatile non-lubricated Natural Gas compressor capable of serving the majority global market's requirements and across a range of applications.

What are Common Applications of the CleanCNG™ Compressor?

- CleanCNG™ scales with multiple units to support any application for compressed gas from compressing gas for fast-fill vehicle fueling, taxis, shuttles and delivery trucks to time-fill applications for overnight filling for transit buses, and refuse vehicles.
- CleanCNG™ is also used for trailer fueling component of Clean Energy Compression's 'virtual pipeline' solutions – delivering bulk natural gas up to 500 km beyond pipeline for industrial, resource extraction, commercial and residential use.

Why is Low Vibration Important in Natural Gas Compressors?

- Lower vibration improves overall service life as parts are not worn or damaged.
- The lowered requirement for maintenance and monitoring intervals also reduces costs significantly.
- Significant reduction in noise.

How Low is Low Vibration?

- Clean Energy Compression's CleanCNG™ natural gas compressor delivers industry leading, ultra-low system vibration that exceeds API 618 standards.
- CleanCNG™ runs so smoothly that a Canadian one dollar coin can be balanced on a 250 HP, unanchored compressor running on a gravel pad. The Canadian one dollar coin was chosen not only because of Clean Energy Compression's Canadian engineering and manufacturing, but because the coin itself is unstable – with a ratio of almost 14:1 diameter-to-width (26.5 mm in diameter and only 1.95 mm thick). This is similar to a United States Quarter and significantly less stable than the 10:1 ratio for a one Euro coin (23.25 diameter X 2.33 mm thickness).

Why is Reduced Noise Important?

CEC's CleanCNG™ natural gas compressor's system and enclosure design deliver some of the lowest noise readings in the industry with recorded levels at less than 75dba at only three meters.

- Reducing noise below 75dba @ 3 meters (10 feet) ensures that compressors easily meet requirements in most stringent jurisdictions – station owners will be able to get approvals.
- No additional procurement of noise absorption panels or walls required.
- Reduced site footprint requirement – real estate often the biggest investment for station owners.
- Improved site layout flexibility – staff and fueling can operate in closer proximity to compressors without discomfort.
- As a point of reference, 75dba @ 3 meters is about the same as operating a household vacuum cleaner.

What Engineering Approach was Employed to Achieve Low Vibration and Noise? Was it Unique?

- Typically CNG compressors are built by assembling components around the compressor block on a skid, this means that the vibration of the block is amplified through the piping and other sub-components.
- The CleanCNG™ unit has an innovative monocoque approach consisting of individually built, highly rigid sub-assemblies that when combined make an extremely rigid unit.
- Clean Energy Compression is the only major CNG compressor company in the world whose compressors are constructed in this fashion.

Why is the Serviceability of a Compressor Important?

The CleanCNG™ includes industry unique serviceability improvement features and elements specifically designed to significantly reduce annual service time and cost, increase uptime, improve worker safety, and increase the likelihood and regularity of preventative maintenance.

- Estimates show that improved efficiencies could reduce time (and related costs) by as much as 13,000 hours over the lifetime of a CleanCNG™ compressor.
- Every major component on the compressor is serviceable without obstruction – something virtually unheard of in the industry. Additionally, advanced remote monitoring, and detailed on-site diagnostics ensure that no extraneous investigations need to be conducted to resolve any performance issues.

Why is Incorporating Scalability Important for Compressor Design?

- All station networks will face changes in their needs. For most owners, this means custom engineering work to build a new compressor to meet exact site specifications and more engineering work to plan out connections between compressors, site control panels etc. and finally extensive site preparation for hook-up. This adds up to significant capital cost and lead-time to add capacity or redundancy.
- Most compressors also require additional space between units to ensure heat-flow is dissipated and not recirculated. Despite this, heat may still be recirculated causing additional energy cost as cooling system will be less efficient.
- Clean Energy Compression is the only company that offers standard pre-engineered units that do not require significant engineering or site work to increase capacity – adding capacity literally means connecting another compressor to pre-established connections – like building blocks.

How Scalable is the CleanCNG™ compared to other compressors?

Clean Energy Compression's CleanCNG™ is the only natural gas compressor where control systems, assembly, and enclosure are all purpose-built to be mated together in a building-block expandable manner so that customers get redundancy and scale without excess cost:

- Capacity can be expanded with little or no additional engineering – 2, 3, 4 or more compressors can be connected to provide scalable, incremental flow expansion as the site demand increases.
- Control units are engineered to connect to master controller and literally supply gas as requested with no additional programming for additional compressors.
- Piping is pre-configured in the skid for each unit so they can literally be placed and connected like building blocks.
- Special heat-flow design that allows units to literally be connected with no excess site footprint utilization while maintaining cooling performance and cost-efficiency.

Why is the Unit Called the CleanCNG™? What is a non-lubricated compressor?

Clean Energy Compression's exclusive dedication to a non-lubricated natural gas compression with advancements in ring and block design utilizing Teflon materials eliminates the requirement for oil lubrication within the compressor cylinders.

- As a non-lubricated compressor, the pistons in the compressor are protected from wear with use of special patented Teflon rings where lubricated compressors use added oil – lots of it.

- Non-lubricated compressors deliver far cleaner CNG than trying to remove heavy vaporized oil from a hot gas stream using filters which have varying effectiveness and must then, themselves, be safely disposed of.
- Most competitors offer oil-based compressor block lubrication; in this case, unlike in a combustion engine, oil in a compressor is not burned, but is actually "carried over" as an unwanted contaminant vapor in the compressed natural gas fuel.
- Reducing oil carryover reduces costs of maintenance caused by the contamination of vehicle fuel systems and expensive virtual pipeline infrastructure. In the case of vehicles, contamination can lead to sub-optimal performance and even breakdowns due to fouling of fuel systems or sensors within engine blocks.
- Clean Energy Compression is the world's only exclusive manufacturer of non-lubricated natural gas compressors. With performance of less than 5 ppm, a CleanCNG™ offers as much as 20 X less oil carryover than an oil based compressor.

What Makes the CleanCNG™ the 'Most Versatile Compressor'?

- The CleanCNG™ "W" compressor block is configurable to meet the largest specification spectrum of any system in the world.
- Similar to airlines that make huge gains from choosing one airplane for their major routes, natural gas station owners, deploying multiple sites, have the advantage of only needing to service one main compressor block design. The result is less training costs, greater and deeper technical competence, and reduced spare parts inventory requirements.