Reciprocating Compression

High Speed Reciprocating Compressors (HSR)
We fuel the future. We push the boundaries of technology to bring energy to the world.

Technology Leadership
GE is there – in all the key plays in which you are working – with the field-proven components, systems and services you have relied on for nearly 200 years. From drilling to processing to industrial markets, GE is there with a broad range of products and services to address your needs.

As one of the leading worldwide providers of reciprocating compression equipment for oil and gas production, transmission, processing and independent power industries, you can count on GE for quality and reliability. We understand your need for flexible solutions that provide a lower life cycle cost and punctual delivery.

Exemplary Engineering
GE employs experienced engineers who use the latest tools and techniques to work out solutions for complex problems and bring new ideas to market.

**Application engineering** – teams of engineers develop custom solutions for specific applications, finding just the right combination of equipment and technology to meet stringent demands, including fully packaged compressors.

**Rapid prototyping and virtual testing** – using sophisticated 3D modeling software, advanced simulation software and 3D printing techniques, our engineers can perform thermal, stress, combustion and emissions analysis on parts and assemblies before a single prototype is built.

In the constant pursuit of improvement, we explore new technologies, test new designs and experiment with new ideas.

Since 1833, GE has manufactured top-quality products that have become known throughout the industries we serve. Today, our reciprocating compression products are known for their reliability and performance.
High-Speed Reciprocating Compressors (HSR)

Our HSR products range from 60 HP (45 kW) to 9000 HP (6714 kW), with a variety of piston rod load capacities and frame stroke combinations. Over 15,000 of our compressors can be found around the globe, working in fuel gas boosting, gas lift, CNG fueling, reinjection, gas gathering and vapor recovery applications – operating 24-hours a day, seven days a week.

**Economical**

GE Oil & Gas compressors are integrated into a package by a global network of authorized packagers. The compressor is matched with a driver, coolers, controls, and piping typically on a single skid. This allows the complete compressor package to be easily moved to a new location. This concept lowers your installation, site construction, and re-application costs.

Our compressors are designed to be directly connected to a variety of reciprocating natural gas engines (720 to 1,800 rpm) and electric motors (750 to 1,800 rpm). A variety of compressor frame strokes allow the compressor to be perfectly matched to the optimum driver.

**Flexible**

It is the nature of natural gas production that pressures and flows often change. Therefore, greater productivity can be attained if the compressor is easily adaptable to the new operating conditions.

Many GE Oil & Gas high-speed reciprocating compressors feature field-replaceable cylinder liners that allow the cylinder bore to be increased or decreased as operating conditions change. When the cylinder must be changed, several cylinders have identical flange connections, allowing the same piping and bottles to be used. In either case, there is no need to modify the on-skid piping and accessories, further lowering modification costs. If the cylinder bore is ever damaged, it is less expensive and less time consuming to replace a liner than a complete cylinder.

A variety of capacity-control devices are also available, including our standard variable-volume clearance pockets, featuring generous clearance volumes. These provide greater flexibility for changing operating conditions.

The modular design of our high-speed reciprocating compressors allows frames and cylinders to be easily reconfigured, offering increased flexibility with a lower cost.

**Reliable**

GE Oil & Gas API 11P high-speed reciprocating compressors are balanced opposed to minimize vibration by equalizing the opposing reciprocating forces on the crankshaft. Heavy, ribbed frames distribute reciprocating stresses evenly for greater strength and longer life. Many compressor cylinders are water jacketed to lower operating temperatures, provide thermal stability, and improve valve life.
### Reciprocating Compression Product Line

#### Frame (by stroke) HP and compression rod load at max RPM

<table>
<thead>
<tr>
<th>Frame</th>
<th>No. of Throws</th>
<th>Stroke (Inches)</th>
<th>Max. Speed (RPM)</th>
<th>Power/Throw (HP/Throw)</th>
<th>Rod Load (lbf)</th>
<th>Max. Pressure (psig)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>1-2</td>
<td>3</td>
<td>1800</td>
<td>60</td>
<td>6,000</td>
<td>6,000</td>
</tr>
<tr>
<td>H</td>
<td>1-2-4</td>
<td>3</td>
<td>1800</td>
<td>100</td>
<td>10,000</td>
<td>6,000</td>
</tr>
<tr>
<td>CFA</td>
<td>2-4</td>
<td>3</td>
<td>1800</td>
<td>145</td>
<td>11,000</td>
<td>5,280</td>
</tr>
<tr>
<td>A</td>
<td>1-2-4</td>
<td>3.5</td>
<td>1800</td>
<td>200</td>
<td>12,500</td>
<td>6,000</td>
</tr>
<tr>
<td>RAM</td>
<td>2-4</td>
<td>5</td>
<td>1500</td>
<td>594</td>
<td>35,000</td>
<td>2,000</td>
</tr>
<tr>
<td>MH</td>
<td>2-4-6</td>
<td>6</td>
<td>1200</td>
<td>900</td>
<td>42,000</td>
<td>6,000</td>
</tr>
<tr>
<td>CFR</td>
<td>2-4</td>
<td>5</td>
<td>1500</td>
<td>850</td>
<td>48,000</td>
<td>2,000</td>
</tr>
<tr>
<td>CFH</td>
<td>2-4</td>
<td>6</td>
<td>1200</td>
<td>680</td>
<td>52,000</td>
<td>6,000</td>
</tr>
<tr>
<td>WH</td>
<td>2-4-6</td>
<td>6</td>
<td>1200</td>
<td>900</td>
<td>55,000</td>
<td>6,500</td>
</tr>
<tr>
<td>WH</td>
<td>2-4-6</td>
<td>7</td>
<td>1000</td>
<td>850</td>
<td>55,000</td>
<td>6,500</td>
</tr>
<tr>
<td>WG</td>
<td>2-4-6</td>
<td>6</td>
<td>1200</td>
<td>1,500</td>
<td>70,000</td>
<td>6,500</td>
</tr>
<tr>
<td>WG</td>
<td>2-4-6</td>
<td>7</td>
<td>1000</td>
<td>1,250</td>
<td>70,000</td>
<td>6,500</td>
</tr>
</tbody>
</table>

Note: RPMs and HP displayed are max.
Cylinders Selection

Large availability of cylinders, for any application

**Air cooled/Water cooled cylinders**
- Air cooled for standard applications – newly expanded portfolio
- Designed per API-618 requirements
- Available on CFH, MH, WH and WG frames
- Water cooled upon request

**FlexFlow cylinders**
- Optimize equipment for varying operating conditions – aimed at gas gathering & transmission applications
- FlexFlow technology includes removable liners and piston rod assemblies that can be easily replaced, decreasing inventory and labor when compared to substituting cylinder bodies
Specialized Services

COMPRESSION SPECIALTIES (CSI)
Large-bore engine and compressor parts, repairs and service
Founded in 1918 as an automobile repair shop, our compression service business has grown to become one of the nation’s leading manufacturers of aftermarket parts for large industrial engines and compression equipment. The company also has become a trusted repair and field service provider for a wide range of equipment brands, including Caterpillar™, Waukesha®, Clark™, Worthington™, Ingersoll Rand™ and others. In addition to new parts manufacturing, supply and repairs, we provide the standard for power cylinder reining. Utilizing a plasma-port cutting process that improves quality, production and delivery times, we have become an industry leader for large-bore cylinder relines.

TURBINE SPECIALTIES (TSI)
Complete turbocharger manufacturing and repair
For more than 40 years, our team in Salina, Kansas, has been cultivating expertise in everything to do with turbochargers and has an enviable reputation for quality work. Today, GE Oil & Gas offers comprehensive parts, repair, new and remanufactured turbochargers, retrofit packages, testing, upgrade/re-aero services, training & unit exchange for Clark™, ABB™, Napier™, MAN™ and EMD™. We are the only OEM for Cooper-Bessemer*, Delaval™ and Elliott™ equipment.

TEXCENTRIC
New and reconditioned compressor valves
GE produces TEXCENTRIC valves, assemblies and parts for virtually any type of air, gas or process/petrochemical compressor – including replacement parts, plus in-house engineering and manufacturing of poppet valves, plate valves and plug-type unloaders.

ENGINE UPGRADES
Technologies to improve emissions, efficiency and performance
Using the best of technology, engineering services and project management, GE Oil & Gas offers comprehensive upgrades for large-bore engines, including Cooper-Bessemer and non-OEM equipment like Clark™, Worthington™, and Ingersoll Rand™. Engine upgrades reduce engine emissions, increase horsepower and improve efficiencies and reliability.

The Learning Center
Educating customers, operators and maintenance personnel
The Learning Center is GE’s dedicated reciprocating engine and compression training resource for your employees. Staff well-trained in equipment operation and maintenance is one of your best tools for improving performance, reducing downtime and overall operating costs and maintaining a safe operation. For more information, contact us at tlc@ge.com or 1.713.354.1296.
Reciprocating Compression Services

24/7 Service Assistance with 844-RECIP-GE
Our global service number, 1-844-RECIP-GE, gives customers throughout the world a single source for the technical support and troubleshooting expertise needed in today’s fast-paced compression industry.

Engine Upgrades and Overhauls: Superior*, Cooper-Bessemer*, Enterprise*
The team at GE Oil & Gas has been providing technology and engineering services for engine upgrades for decades. With our advanced technologies, expertise and project management experience, we will reduce engine emissions, increase horsepower and improve efficiencies and reliability of your engines. GE Oil & Gas has the ideal combination of products and services required to upgrade your engine to meet or exceed the emissions and performance levels you need.

- **OEM solutions** – We can provide comprehensive product and service offerings for almost any product on the market.
- **Experience** – We have completed more than 450 engine upgrades.
- **Flexibility** – Our team of engineers and project managers will work with you to find the best solution for your unique needs, regardless of your make or model of engine-compressor.
- **Accountability** – We guarantee performance and stand behind our work.

Field Services
The services network of experienced GE Oil & Gas representatives and technicians provides quick response to your service needs – anytime, anywhere. Field services include:

- **Installation** – Service representatives assist with equipment installation and commissioning, and also provide training to operating personnel, ensuring the equipment operates within specified parameters.
- **Overhauls** – Service technicians are available for teardown, inspection and rebuild services for engines and compressors. During overhaul periods, new retrofits and safety upgrades can be installed to further improve operating efficiency.
- **General services** – We’re here to serve you. Call our services team at 1-844-RECIP-GE for grout services, equipment relocation and reapplication, engineered solutions, alignment services, predictive emissions monitoring, compressor resizing and contract maintenance.
- **Field machining** – Our field machining services saves time and money, providing a cost-effective alternative to equipment removal. Our experienced service technicians can perform multiple machining tasks on site, including base and frame laser alignment, wireline, line bore machining, metal spray, compressor liner replacement and more.
Replacement Parts and Exchange

Our 60,000-sq-ft (5574-sq-m) central parts warehouse stocks a full range of replacement parts for GE and non-GE built engines, compressors and power generation equipment, including AJAX, Caterpillar™, Clark™, Cooper-Bessemer™, Enterprise™, Ingersoll Rand™, Superior™, Waukesha™ and Worthington™. All replacement parts are built to OEM or aftermarket specifications to ensure reliability, lower maintenance and long-term savings.

An economical alternative to new parts replacement, our parts exchange program allows operators to trade worn parts for used or factory-reconditioned components and assemblies. Our growing list of parts includes power cylinders, power cylinder heads, pumps, camshafts, and others for a wide range of engines, compressors, turbochargers, control units and more.

Reconditioning/Retrofits/Upgrades

Our aftermarket services team can recondition or remanufacture any make of reciprocating engine, compressor or turbocharger, offering an attractive, economical solution based on your particular situation.

Reconditioning restores equipment to like-new condition in accordance with OEM specifications. Remanufacturing involves restoring equipment to a given set of specifications, based on a particular application.

Our services team provides retrofit services to enhance engine performance and meet new emissions requirements. Available for CleanBurn™ and other engine emission technologies, retrofits can be specified to meet minimum, moderate or maximum NOx and CO reduction. Current technology provides low-pressure electronic fuel injection, high-performance turbochargers, as well as LE kits and HCR pistons for AJAX units. Engine efficiency upgrades also can be performed to help improve fuel efficiency, engine performance and reliability. Upgrades can include Jet Cell™ conversions, air/fuel ratio improvements, blower/turbocharger and ignition system upgrades, and electronic control panels.

Repair and Unit Exchange

The services network at GE Oil & Gas operates numerous service locations worldwide; each staffed by experienced personnel and equipped to restore most makes of equipment to OEM specifications. Services include valve reconditioning, camshaft relobing, head and cylinder reconditioning, water pump repair, performance monitoring, turbocharger repair and much more.

When you can’t afford a shutdown during an engine overhaul, our services unit exchange program offers a number of benefits. Fully certified exchange units are delivered to your site before any work begins, ensuring any necessary downtime is reduced. Exchange equipment keeps your operation running smoothly for as long as your equipment is out of service.
Partnering with you to Optimize your Equipment

Whether you’ve got an installed base of 1 or 1,000, we’ve spent over 180 years partnering with customers like you to bring out the best in your equipment. Our team of experts can help you keep your machine running more efficiently, decrease your maintenance costs, and meet emissions requirements.

Upgrades available across our product lines, including our large-bore engines and our non-OEM equipment:
- Cooper-Bessemer® (OEM)
- Clark™
- Worthington™
- Ingersoll Rand™

Selected Examples of our Upgrades

Transmission Compressor Cylinders

Proven Performance and Reliability

**CCGT-20**
MWP: 1450 psig
Liner Dia. Range: 13” to 16”
(330 mm to 406 mm)

**CDGTA-20**
MWP: 1450 psig
Liner Dia. Range: 16” to 19”
(406 mm to 483 mm)

**CEGTA-20**
MWP: 1350 psig
Liner Dia. Range: 19” to 23”
(483 mm to 584 mm)

New Pre-Combustion Chamber and ePCC

Improved Control and Reduced Maintenance

- Improved stability and reliability
- Precise control of the pre-chamber air/fuel ratio
- Reduced volume/PCC NOx contribution
- Eliminates PCC check valve cleaning

New Head Design

Optimized Combustion

- Single center-mounted PCC
- PCC indirectly cooled
- Side-mounted sparkplug
- Better flame propagation
- Reduced crevice volume

Electronic Controls

Fewer Operational Excursions

- TER based air/fuel ratio
- Wider operating range
- Turbocharger monitoring
- Data trending
GE Oil & Gas moves natural gas to fuel the future for a cleaner energy world.

GE works with our global customers and partners to deliver reciprocating compression innovation and technology that optimizes the production and distribution of natural gas. We put our expertise to work—through our R&D, engineering, financing, global infrastructure, and 24/7 service. GE delivers reliability and availability for end-users everywhere, every day.

NORTH AND SOUTH AMERICA
16250 Port Northwest Drive
Houston, TX 77041
USA
Tel 1 844-RECIP-GE (U.S./Canada)

EUROPE, AFRICA, CASPIAN AND RUSSIA
Via Cantú 8/10
20092 Cinisello Balsamo (MI)
Milan, Italy
Tel 1 713-354-1299 (International)

ASIA PACIFIC AND MIDDLE EAST
No. 2 Gul Circle
Jurong Industrial Est.
Singapore 629560
Republic of Singapore
Tel 1 713-354-1299 (International)

GE Oil & Gas
16250 Port Northwest
Houston TX 77041
+1 866 754 3562
www.geoilandgas.com

©2016 General Electric Company. All rights reserved.

*Denotes a trademark of the General Electric Company. Other company names and products names in this document are the registered trademark or trademarks of their respective owners.

GEA31391A 05/2016