



GE'S Bringing Such Low Vibrations >

Company crafts couple-free compressors

BY DJ SLATER AND MARK THAYER

GE Oil & Gas is looking to shake up the reciprocating gas compressor market with a technology designed to keep vibration to a minimum.

The company aims to do this with its CFH and CFR compressors, which feature a couple-free design to provide low mechanical vibrations, which in turn reduces fatigue and stress.

"Your primary couples are essentially zero, both horizontally and vertically," said Bhupinder Dayal, senior product manager for High-Speed Reciprocating Compression at GE Oil & Gas. "In a standard compressor, you have significant dynamic moments and couples, and that leads to higher vibration. In a couple-free compressor, you have very little vibration."

The new gas compressors are ideal for wellhead and gas-gathering applications. They can be placed on a compact ground bed instead of being grouted into a cement foundation. The low vibrations also make them particularly suitable for offshore platforms, trailer-mounted applications and mobile units, Dayal said.

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The move to design these new compressors stems from discussions with GE's customers about their "pain points," Dayal said, adding that many of their customers' challenges revolve around high vibration problems and associated costs throughout the life cycle of installed compressors. "The lower vibrations lead to much less wear and tear on compressor components," he said. "That means an end user will have lower life-cycle costs as these units operate in the field."

The couple-free technology is not the compressors' only enhancement. The crankcase has a low center of gravity and a narrow width, as well as a central cross tie bar.

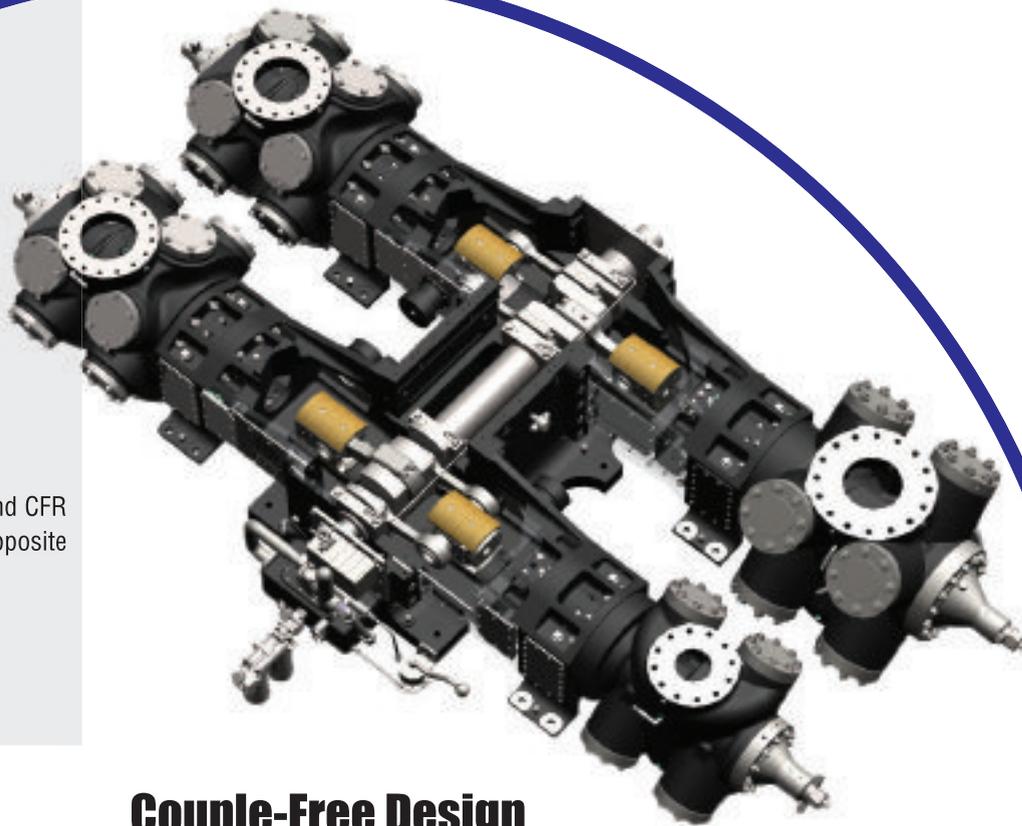
The tie-bar design uses the space between throws to increase frame stiffness to offer smooth operation, according to GE.

Additionally, the tie-bar design also enables easy maintenance of the main bearings, said Federico Pamio, GE's engineering manager for High-Speed Reciprocating Compression technology. "You don't have to remove the tie bars to access the main bearings below," he said. "This is an advantage because it reduces the amount of time you need for maintenance." The compressors also feature a lubrication system that is integrated into the frame, which reduces piping and helps avoid leaks, Pamio said.

Another feature is FlexFlow technology, which allows operators to quickly adjust cylinder bore sizes through the use of

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■ Pistons on the CFH and CFR are positioned directly opposite each other.



Couple-Free Design

GE's pair of new compressor models features a couple-free design. In mechanical engineering, a *couple* is a pair of equal and parallel forces offset by a distance and acting in opposite direction. In a typical reciprocating compressor, a couple is formed where two pistons move in opposite directions in parallel planes as their connecting rods are pushed and pulled back and forth by the rotation of the crankshaft.

A couple produces a *moment*, sometimes called a torque, or twisting motion on the body it acts on. In a typical reciprocating compressor, the moment is perpendicular to the length of the crankshaft. The crankshaft takes the brunt of the twisting force

and passes those forces to the bearings, frame, foundation, cylinders and piping. Over time, the resulting vibration causes damaging wear and tear on the machine.

The couple-free design eliminates the couples by positioning the cylinders exactly opposite each other along the crankshaft, so that the reciprocating pistons are moving along the same axis without any offset. To make that possible, one of the pistons is connected to the crankshaft using one thicker connecting rod, while the other piston is connected by two thinner connecting rods positioned on the crankshaft outside of the thicker opposing rod. The result is much less mechanical vibration.



■ The new compressors from GE Oil & Gas are available with two or four throws with a 5 or 6 in. (127 or 152 mm) stroke.

	CFH		CFR	
	CFH 62	CFH 64	CFR 52	CFR 54
No. Of Cylinder Throws	2	4	2	4
Maximum speed (RPM)	1200	1200	1500	1500
Maximum Power	1360 hp (1014 kW)	2720 hp (2028 kW)	1700 hp (1268 kW)	1700 hp (1268 kW)
Rated Power Per Throw	680 hp (507 kW)	680 hp (507 kW)	850 hp (634 kW)	850 hp (634 kW)
Stroke	6 in. (152 mm)	6 in. (152 mm)	5 in. (127 mm)	5 in. (127 mm)
Piston Rod Diameter	2.5 in. (63.5 mm)	2.5 in. (63.5 mm)	2.25 in. (57.1 mm)	2.25 in. (57.1 mm)
Piston Speed At Max RPM	1200 fpm (6.1 m/s)	1200 fpm (6.1 m/s)	1250 fpm (6.35 m/s)	1250 fpm (6.35 m/s)
Maximum Internal Gas Rod Loads				
Tension (MGRT)	55,000 lb.ft. (245,000 N)	55,000 lb.ft. (245,000 N)	55,000 lb.ft. (245,000 N)	55,000 lb.ft. (245,000 N)
Compression (MGRC)	55,000 lb.ft. (245,000 N)	55,000 lb.ft. (245,000 N)	55,000 lb.ft. (245,000 N)	55,000 lb.ft. (245,000 N)
Total Peak To Peak	110,000 lb.ft. (489,000 N)	110,000 lb.ft. (489,000 N)	110,000 lb.ft. (489,000 N)	110,000 lb.ft. (489,000 N)
Net Road Load Allowed Max	52,000 lb.ft. (231,000 N)	52,000 lb.ft. (231,000 N)	48,000 lb.ft. (214,000 N)	48,000 lb.ft. (214,000 N)
Frame Weight	6500 lbs (2948 kg)	13,500 lbs (6124 kg)	6500 lbs (2948 kg)	13,500 lbs (6124 kg)
Dimensions				
Width	73 in. (185 cm)			
Length	55.6 in. (141 cm)	99.6 in. (253 cm)	55.6 in. (141 cm)	99.6 in. (253 cm)
Height	30 in. (76 cm)			
Spacing Between Throws		44 in. (112 cm)		44 in. (112 cm)

liners in order to maintain the engine at its full horsepower as the field conditions or flow requirements change. “If you have to install new cylinders on a compressor, it takes a long time,” Dayal said. “With FlexFlow cylinders, all you have to do is add or remove the liners and replace piston rod assemblies. That’s eight hours versus two days to change complete cylinders.”

GE Oil & Gas has been offering an API 618 5900 hp (4400 kW) fully balanced or couple-free compressor, model SHMB, since 1991. These compressors are deployed in offshore applications. Cameron has been shipping couple-free compressor model CFA (150 to 650 hp or 112 to 485 kw) since 2001 after

it acquired Griffin Compressors Inc. (See January-February 2001 *COMPRESSORtech2*, p62.)

Cameron was developing a larger couple-free compressor in 2014, the same time GE Oil & Gas acquired its reciprocating compression business. GE continued developing the CFH and CFR compressors, quadrupling the investment in the reciprocating business a year later, according to Dairmaid Mulholland, president of GE’s Reciprocating Compression. The product team was then able to leverage GE’s research and development resources to mold the technology into what it is today. CT2