

G3600

with ADEM™ A4

Cat® Engines for Gas Compression Applications



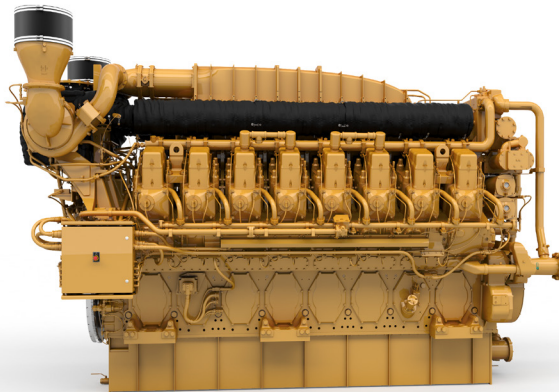
CAT® G3600 ENGINES HISTORICALLY STRONG



In 1984, Caterpillar introduced the 3600 engine family. The diesel engine quickly earned a reputation in the field as a robust performer, a reliable provider of optimized power and low maintenance in high horsepower applications.

G3600 Compression Engine

Recognizing the platform's potential for gas compression applications, Caterpillar unveiled the first G3600 engine in 1991. Over the course of the next three years, Caterpillar expanded the model to a series of four offerings including the G3606, G3608, G3612 and G3616, to account for the industry's quick acceptance of the platform.



Production History

Years in production:

- 1991 – 28 years

Field population:

- 5,400+ compression engines

Estimated total operating hours:

- 200+ million operating hours

Longest hour engine:

- Multiple major overhauls @ 100,000+ hrs

Over the past 15 years, Caterpillar has continued to innovate the platform, ever focused on customers' end needs.

The G3600 series has become synonymous with reliable performance, logging over 200 million hours in the field as a preferred solution for gas compression.

3600 Family

1975
Concept

Diesel 3600

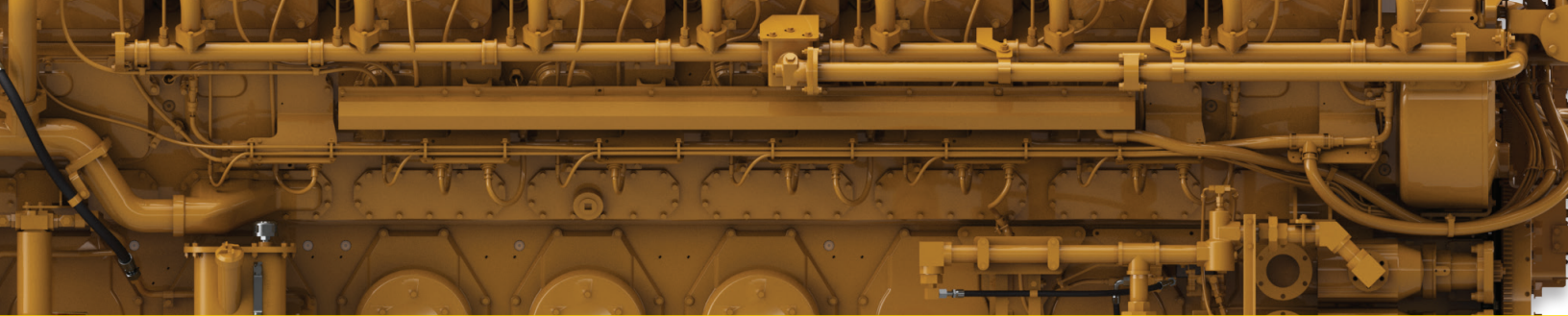
1979
Lab Test

1984
Field Test

1985
Production

Gas 3600

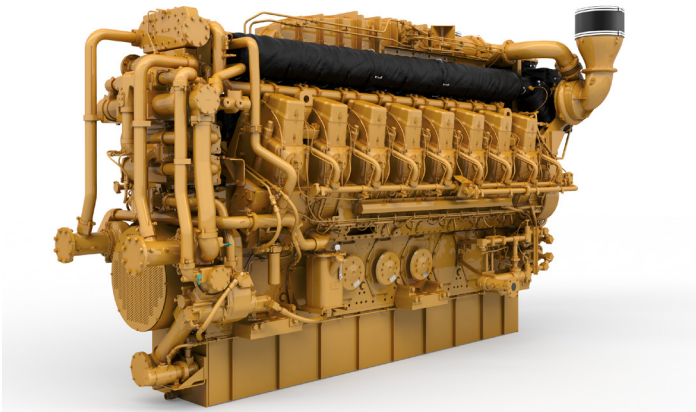
19
Lab T



Innovative Technology

In 2015, Caterpillar engineered the platform beyond expectations by drastically increasing all critical performance factors and unveiling the G3600 ADEM™ A4 engine across all four configurations.

The new platform is a game-changer for the industry, incorporating the most substantial updates made to the gas compression platform in its noted history.



						Year																												
						91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
						Ignition/Control System	ADEM™ A3																			ADEM™ A4								
	Serial Number Prefix	Engine Controls	Engine Arr.	NOx Levels (g/hp-hr)	Range of Ratings (bhp)	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
G3606	3XF	ESS	7C4106	0.7	1500-1666																													
				0.7	1666-1765																													
				0.7	1666																													
	4ZS	ADEM™ A3	1763606	0.7	1666-1765																													
				0.7	1500-1765																													
				0.5,0.7	1775-1900																													
JFE	ADEM™ A4	4191870	0.3, 0.5	1875-2010																														
G3608	4WF	ESS	7C4108	0.7	2222																													
				0.7	2117-2352																													
				0.7	1960-2222																													
	BEN	ADEM™ A3	1763608	0.7	2144-2400																													
				0.7	2225-2520																													
				0.7	2012-2370																													
	XH7	ADEM™ A4	4375913	0.5,0.7	2482																													
			2286944	0.3, 0.5	2370-2520																													
			4375913	0.3, 0.5	2500-2675																													
G3612	1YG	ESS	7C4112	0.7	3335																													
				0.7	3100-3550																													
				0.5*,0.7	3100-3550																													
	BKE	ADEM™ A3	1973916	0.7	2000-3670																													
				0.7	3127-3785																													
				0.5,0.7	3750-4000																													
	BB2	ADEM™ A4	4414758	0.3, 0.5	4325-5045																													
			1763612	0.7	3200-5147																													
			4414758	0.5*,0.7	4445-4735																													
G3616	4CG	ESS	7C4116	0.7	4735																													
	BLB	ADEM™ A3	1763616	0.7	4735																													
				0.5,0.7	4705-5045																													
				0.3, 0.5	5000-5350																													

85
Test

1990
Field Test

1991
Production

2002
ADEM A3

2015
ADEM A4

CAT® G3600 ENGINES

FIELD PROVEN

“

For years, Kodiak has benefited from the unparalleled reliability of Caterpillar's 3600 line of natural gas engines. The 3606 A4 is no different. 3600's make up 22% of Kodiak's fleet; with A4's being the vast majority. The A4's versatility, in terms of the range of fuel it can handle, makes it a perfect fit for a variety of applications (e.g. gas lift, gathering, plants, etc.). The upgraded user interface on the ECM reduces Kodiak's labor costs by decreasing the time spent training new technicians.

”

Craig Collins, EVP & General Counsel
Kodiak Gas Services LLC

Mechanical Reliability (Runtime %)

Pegasus Optimization Managers LLC

Engine	Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	Jun 2018	Jul 2018	Aug 2018	Sep 2018	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	YR Avg
Bronco #1	100	100	100	99.25	100	99.62	99.85	100	99.45	100	98.36	99.11	98.85	100	99.61
Bronco #2	99.67	100	100	100	100	99.73	100	100	97.81	100	100	99.04	99.66	100	99.71
Bronco #3	100	99.86	99.81	99.73	100	100	99.73	100	99.49	100	99.73	100	99.80	99.66	99.84
Bronco #4	99.71	99.93	100	100	100	100	99.32	100	99.86	99.86	99.59	99.87	98.99	98.82	99.71
Bronco #5	99.80	100	100	100	100	100	99.66	100	100	100	99.39	98.84	100.00	99.11	99.77
Bronco #6	99.35	100	100	100	99.49	99.76	99.19	100	99.38	99.45	99.07	99.64	99.78	100	99.65
Bronco #7	100	99.78	100	98.80	100	100	99.52	99.93	100	99.98	98.46	98.93	100	100	99.67
Bronco #8	100	100	100	99.97	99.63	98.95	99.59	98.77	99.25	99.19	97.90	99.96	98.50	99.52	99.37



“

The engines are more powerful, produce lower emissions, and operate within a wider range of fuel gas conditions...

The reliability of Caterpillar's products is unrivaled. Our compressors may remain in service for 30 years or more.

”

Shane Estes, Vice President
Pegasus Optimization Managers LLC
In reference to ADEM™ A4

CONFIDENCE IN THE FIELD

Mechanical Reliability (Runtime %)

Kodiak Gas Services LLC

Engine	Application	Frame	Average-Load	Mechanical Availability	Date of Installation	Hours Accumulated through 5/1/2019
G3606	Gas Lift	JGD4	79%	99.85%	9/8/2017	13,292

Energy Transfer Partners

Engine	Application	Driven Equipment	Average Uptime	Mechanical Availability	Date of Installation
G3606	Gas Gathering	Reciprocating Comp	97.74%	99%	9/1/2017
G3606	Gas Gathering	Reciprocating Comp	98.1%	99%	10/20/2017
G3606	Gas Gathering	Reciprocating Comp	96.75%	99%	10/3/2017

USA Compression Partners, LP

Engine	Application	Driven Equipment	Average-Load	Mechanical Availability	Date of Installation	Hours Accumulated through 5/1/2019
G3606	Well Head Booster	Ariel JGD/4	95%	99%	9/24/2013	33,008
G3606	Well Head Booster	Ariel JGD/4	95%	99%	9/24/2013	31,471
G3606	Well Head Booster	Ariel JGC/4	90%	99%	4/30/2014	42,394



Compressor Station - USA Compression Partners, LP
Powered by G3608 A4 engines

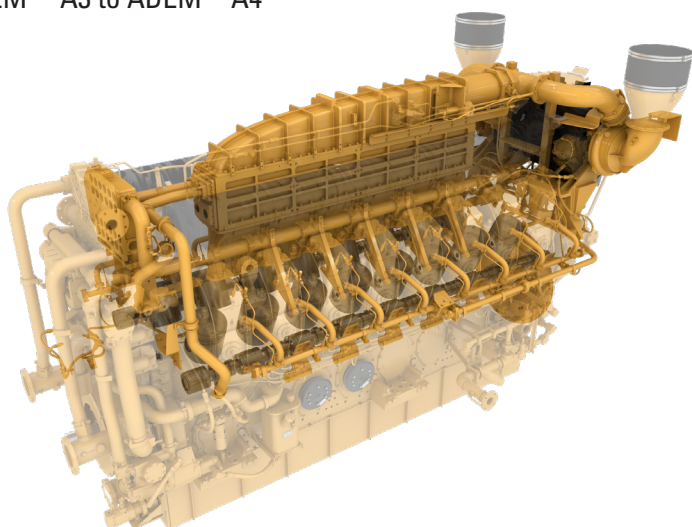
CAT® G3600 ENGINES TECHNOLOGY

The G3600 engine leverages the latest technology updating from the ADEM™ A3 to ADEM™ A4 ECM while simultaneously building upon the solid reputation of the 3600 series of engines. At the foundation are the same proven block and crankshaft design that embody the 3600 with its proven reliability and durability. The G3600 series engines with ADEM™ A4 ECM technology offer increased power, better altitude capability, improved fuel tolerance, and lower emissions, while making it easier to package with on engine thermostats and a single exhaust connection point.

Versatile combustion technology, optimized turbocharger design, and enhanced software enables the G3600 with ADEM™ A4 to run on a wide variety of fuels virtually anywhere in the world.

TECHNOLOGY ROADMAP

ADEM™ A3 to ADEM™ A4



Improved Intake Air System

Optimized turbocharger trim and two-stage aftercooler design provide:

- Denser, cooler intake air
- Greater altitude & ambient temperature capability
- Improved fuel tolerance
- Greater power density

ADEM A4 ECM

- Enhanced engine software with direct NOx control feedback optimizes engine control strategy
- Increased engine stability during load changes improve fuel tolerance and fluctuation capability

Superior Camshaft design

Optimized cam events utilizing the Miller Cycle

- Extends the improvement in fuel capability
- Enhances fuel consumption efficiency
- Generates more power from less fuel

Enhanced Piston Design

Improved piston design with an optimized swirl ratio

- Provides a cleaner burn
- Reduces NOx emissions up to 40%
- Increases onsite power potential

AFRC Improvements

- Direct NOx control feedback
- Engine mounted NOx sensor
- Improved emissions tracking during load changes

Lower Compression Ratio

- Greatly expands fuel tolerance range
- Improved emissions via optimized combustion recipe

ADEM™A3



ADEM™A4



G3600 RATINGS



Waha Compressor Station - Energy Transfer
Powered by G3616 A4 engines

G3600 ENGINE RATINGS

Engine	bkW	bhp	rpm	SCAC
G3606	1398	1875	1000	54°C (130°F)
	1454	1950	1000	43°C (110°F)
	1499	2010	1000	32°C (90°F)
G3608	1864	2500	1000	54°C (130°F)
	1931	2590	1000	43°C (110°F)
	1995	2675	1000	32°C (90°F)
G3612	2796	3750	1000	54°C (130°F)
	2890	3875	1000	43°C (110°F)
	2983	4000	1000	32°C (90°F)
G3616	3729	5000	1000	54°C (130°F)
	3859	5175	1000	43°C (110°F)
	3990	5350	1000	32°C (90°F)





Power You Can Rely On

For your most rigorous work, you need dependable power. Cat engines have been tested and proven for decades to give you just that. And the global Cat dealer network is ready to help, wherever you are, whenever you need them. We're built to keep you up and running.

To learn more about Cat engines for gas compression, call your local Cat dealer or visit www.catoilandgasinfo.com.

LET'S DO THE WORK.™

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