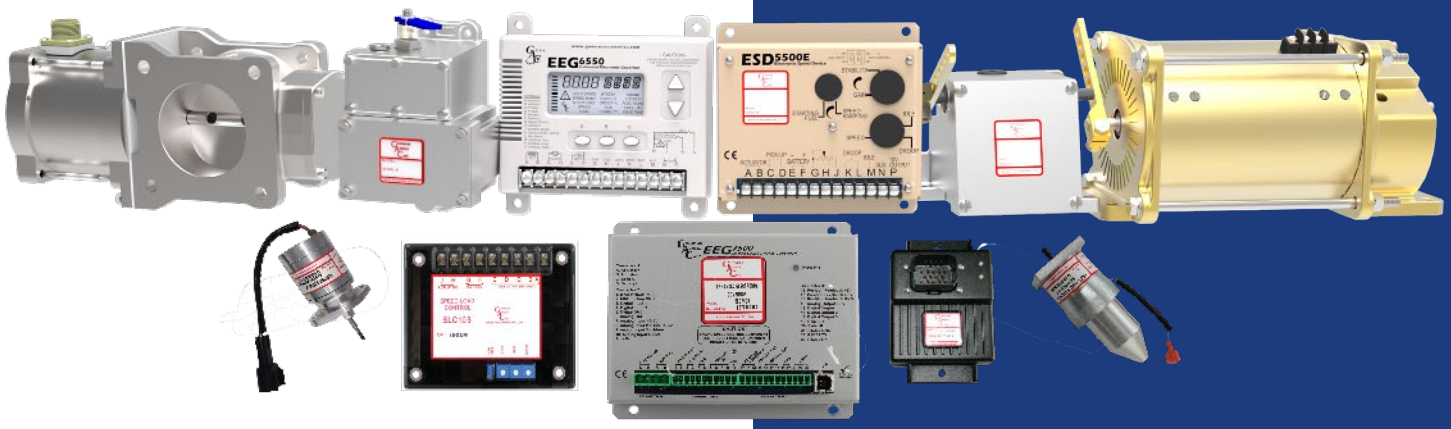
GOVERNORS AMERICA CORP.®

PROVIDING SOLUTIONS SINCE 1986

GAC PRODUCT APPLICATION GUIDE



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OVERVIEW

ABOUT THIS GUIDE

This guide is divided by engine manufacturer and engine and includes simple descriptions of solutions GAC has provided. The back of this guide details the cross-reference list of GAC products that either directly replace or can be used to replace original manufacturer equipment or other similar equipment.

ABOUT INLINE DIESEL FUEL INJECTION PUMPS

The basic types of mechanical governors used are min-max or variable speed controllers.

Min-Max Governors have mechanical limits and only govern the maximum speed and low idle speed.

Variable Speed Controllers control the engine speed at all times. (All speed controllers)

These mechanical governors are replaced with electro-magnetic proportional pump-mounted GAC Actuator.

GAC Actuator	Recommended GAC Speed Controller
175 Series	ESD5500E, 5500-II, 5511, 5550, or 2401
275 Series	ESD2210, 5500E, 5500-II, 5111, or 5550
295 Series	ESD5330, 5340, or 5500E

Rotary Fuel Pumps

Stanadyne Fuel Pumps

Three types of mechanical governors are used with Stanadyne fuel pumps, 3 to 5% droop Speed Controller for generator set application and all-speed governors on agricultural / industrial engines. Min-max Speed Controller are used on automotive applications.

The 100 Series GAC Actuator mounts directly onto the Stanadyne D Series Pump, no external mounting brackets or linkage is required.

GAC Actuator	Recommended GAC Governor
100 Series	ECC328, ESD2402, 5520, 5120, 5500-II, 5570, 2244-12/24

Note: The 100 Series GAC Actuator include Packard connectors.

Delphi DPG Fuel Pump

Delphi DPG fuel pumps have all speed mechanical governors. These are replaced by electric 103 Series GAC Actuator. The 103 Series are mounted directly onto the fuel pumps.

GAC Actuator	Recommended GAC Speed Controller
103 Series	ECC328, ESD2402, 5520, 5120, 5500-II, 5570, 2244-12/24

Engine Mounted Fuel Pumps

GAC engine mounted Actuator are designed for high temperature applications.

GAC Actuator	Recommended GAC Speed Controller
110 Series *	ECC328, ESD2244, 2402, 5120, 5520, 5570, 5500-II
180 Series**	ESD5500E, 5111, 5500-II, 5550
ALR Series	ECC328, ESD2402, 5520, 5120, 5500-II, 5570, 2244 &…

* Deutz 1011

** Deutz 1012/1013 & 2012, and Volvo 520/720

GAC GOVERNOR BASIC TERMS

Number of Teeth: Used to determine RPM and/or control frequency through the magnetic speed sensor (MSP) on Flywheel Ring Gear Teeth.

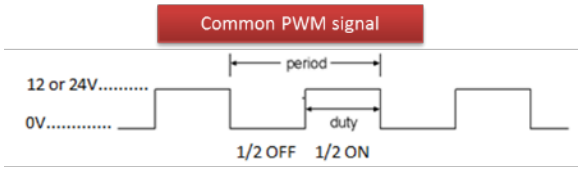
$$Frequency * 60/\#\ of\ teeth\ =\ RPM$$

Rated Speed: The operating speed of the engine.

Variable Speed: Applications that operate over a range of speeds. RPM can be set externally with either a resistive (potentiometer) or voltage input.

Crank Termination RPM: The speed at which the Speed Controller begins to regulate speed.

Pulse-Width Modulation (PWM): Equates to a percentage of battery output supplied to the actuator.



Example shows 50% Duty Cycle or ½ Battery Voltage

Overspeed: Safety parameter to turn off fuel to the engine if it reaches the defined over-speed setting.

Light Force: Speed Controller specifically designed for low current, less than 2.5 amps, fast responding, small Actuator. These governors are designed with a specific PID range, so the Actuator are precisely tuned under all speed and load conditions.

Reverse Acting: Reverse acting governors react the opposite of traditional governors by reducing actuator duty cycle to increase engine speed and increase duty cycle to bring the engine to minimum fuel.

Electronic Fuel Control (EFC): Cummins PT fuel system where actuator/valve assemblies have been optimized to work with the existing Cummins fuel system.

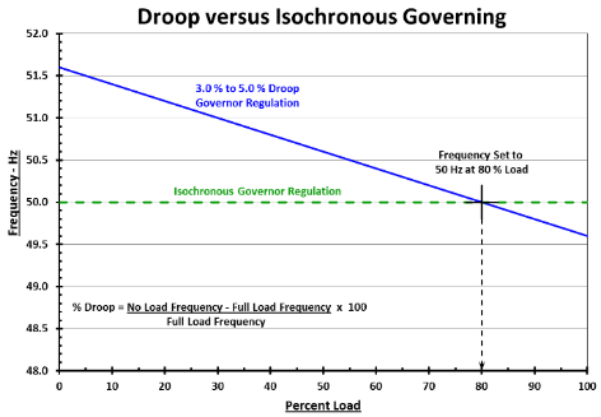
GAC GOVERNOR FEATURES

Fuel Ramp: The fuel ramp rate between the start fuel parameter and the rated speed.

Isochronous: Fixed speed control not load dependent.

Droop: governs with a decrease in speed as load increases. Without droop, the engine could be unstable. GAC governors have the option to simulate droop with dedicated input and adjustment.

- Droop %: This sets the speed decrease based on a percentage of rated speed at full engine load.
- Droop Switch: External Droop enable switch is on or off.



PID: Control loop with Proportional (P), Integral (I), and Derivative (D) terms. Measures and minimizes the error between the desired and actual speed.

Gain (P): Initial response of the control to changes in load or speed.

Stability (I): Response of the control to reach steady state also used to avoid periodic variations in speed.

Dead Time (D): Changes the transient response of the engine and affects the stability during transient load changes.

Starting Fuel: Starting fuel position sets the needed amount of fuel to start the engine easily without black exhaust smoke.

Speed Ramp: An adjustment to optimize the rate of acceleration and avoid RPM overshoot.

Idle: Speed the engine will run at if the idle select input is activated.

AUX Input: A 0-10 V reverse polarity signal used for load sharing and synchronizing multiple generators.

Speed Trim Control: The ability to use a potentiometer to vary the engine speed remotely.

Speed Switches: Relay contacts that are set to switch state at a set speed. Typically come in single, dual and/or triple element speed switches.

Soft Coupling: Averages out the engine noise/instabilities and gives better steady-state performance using a steady speed reference for the PID routine. Activating the soft coupling feature eliminates the effects of drive train resonance.

Lead Circuit: Speed anticipation which enables the Speed Controller to be more responsive and allows higher gain. This provides more active control and improves the performance of slower engines.

Dual Gain: Independent gain adjustments for idle and rated speeds.

Dead Time Compensation (DTC): GAC Speed Controllers have the ability to set various levels of DTC. Digital Speed Controller have the ability to set a full range of dead-time values based on engine speed and load.

Multi PID: Feature for digital Speed Controller allowing independent PID values to be set throughout the speed and load range.

Fuel Limit: Limit the actuator position based on speed or load.

Dither: Speed Controller commands a small variation to the actuator output to keep it constantly moving back and forth to overcome mechanical friction points at fuel systems or throttle body butterfly.
Temperature Compensated: Internal component to eliminate drift due to extreme temperature swings.

Foot Petal: Foot petal input controls mobile equipment engine over a wide range of operating speeds, used with ESD2300 Series controllers.

ARROW

ENGINE MODEL	ACTUATOR	SPEED CONTROLLER	MSP	ACCESSORIES
A32 and A42	ATB T2 45	ESD2401		
A54	ATB T2 45	ESD2401		
A90	ATB T2 45	ESD5131		

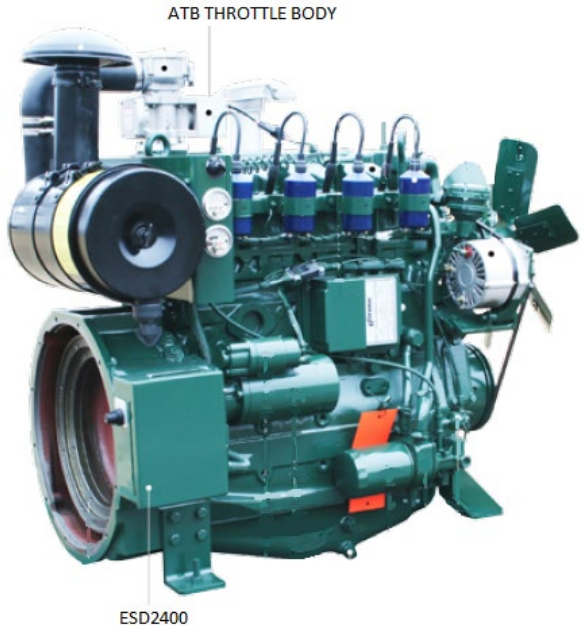
GAC APPLICATION NOTE

A-32, A-42, and A-62 GENERATOR

Customer / OEM:	**Arrow** Engine Company
Application(s):	Generator
Engine Make / Model:	A-32 3.2L A-42 4.2L A-62 6.2 L
Fuel System Type & Make / Model:	Natural Gas
Operating Speed(s):	A-32 1000-1200 RPM; 3 cylinder A-42 1000-1800 RPM; 4 cylinder A-62 1000-1800 RPM; 6 cylinder
Battery Voltage:	12 or 24 V DC
Installed Products:	• Actuator: ATB T2 Series Integral Throttle Body Actuator with optional position feedback sensor. • Speed Controller: ESD2401

Summary Arrow engines, building natural gas engine solutions, have used GAC products for over 30 years to control the flow of fuel, working in tandem with the carburetor. GAC ESD2401 speed control unit, located in an enclosed box on the side of the flywheel housing, makes it easy to update if required.

ARROW A-42 ENGINE WITH ATB T2



GAC APPLICATION NOTE

A-54 GENERATOR ENGINE

Customer / OEM:	**The Governor Shop**
Application(s):	Generator
Engine Make	Arrow A-54
Equipment Make / Model:	Oil Field
Fuel System Type & Make / Model:	Natural Gas
Operating Speed(s):	A-54 1000-1800 RPM; 6 cylinder
Battery Voltage:	12 or 24 V DC
Installed Products:	• Actuator: ATB T2 Series Integral Throttle Body Actuator 45 mm with optional position feedback sensor. • Speed Controller: EEG6550

Summary The Governor Shop in Canada modified an Arrow A54 to a gaseous generator using a GAC ATB T2 in an oil field. The engines use a process input (4-20 mA) from a Lufkin panel controlled by a GAC EEG6550.

COMPLETED PUMP WITH ATB T2

EEG6550

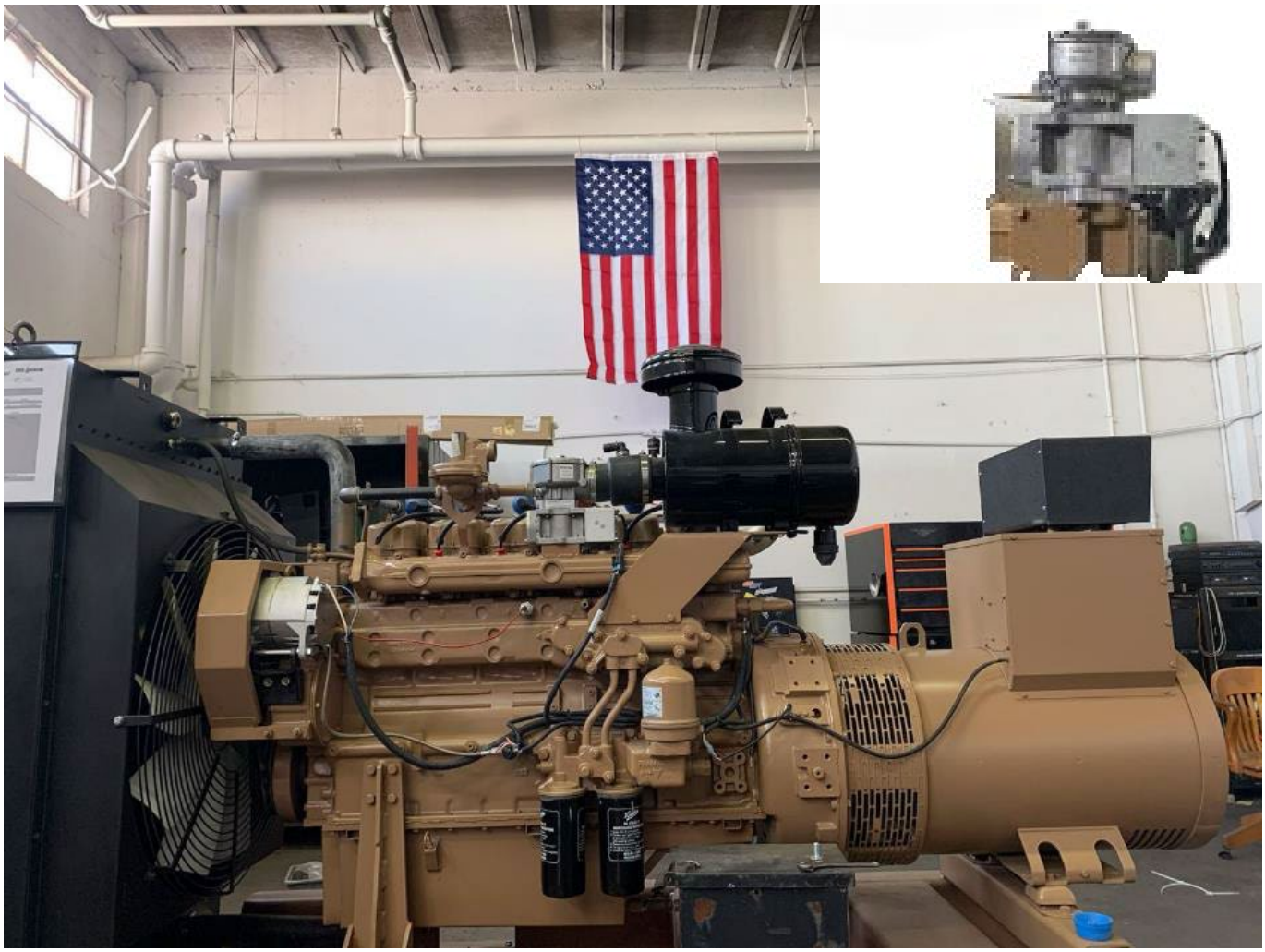
GAC APPLICATION NOTE

A-90 GENERATOR ENGINES

Customer / OEM:	**SES ARROW**
Application(s):	Custom Generators
Engine Make / Model :	Arrow A-90 1000-1800 RPM; 6 cylinder
Equipment Make / Model:	25KW
Fuel System Type & Make / Model:	Natural Gas
Battery Voltage:	12 or 24 V DC
Installed Products:	• Actuator: ATB T2 Series Integral Throttle Body Actuator (45 mm) • Speed Controller: ESD5131

Summary SES Arrow Generator builds custom generators for Oil and Gas. This 25KW unit uses a GAC throttle body controlled with the GAC ESD5131 speed controller.

ARROW A-90 WITH ATB



BEML

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
BSA6D170	ACE275K	ESD5403		

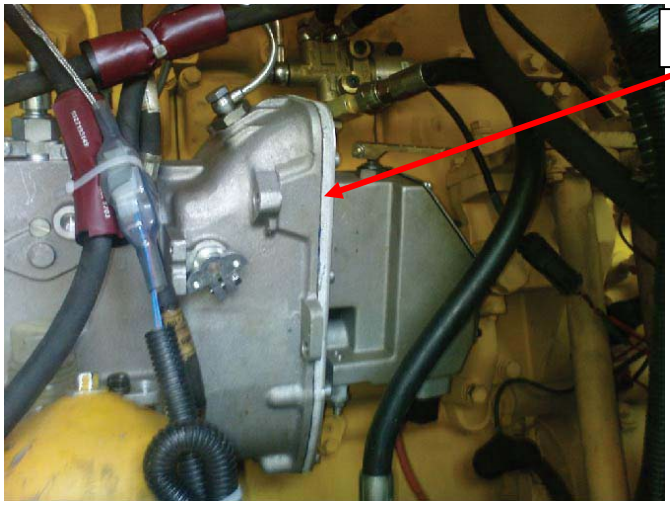
GAC APPLICATION NOTE

BSA6D170 INDUSTRIAL ENGINE

Customer / OEM:	BEML Limited
Application(s):	50 Ton Dump Truck
Engine Make / Model:	BSA6D170, 6 cylinder, 23.1L (Komatsu License)
Equipment Make / Model:	50-Ton Dumper Truck
Fuel System Type & Make / Model:	Diesel, ZEXEL Inline Fuel Pump
Operating Speed(s):	535 kW, 2100 RPM
Battery Voltage:	24 V DC
Installed Products:	• Actuator: ACE275K • Speed Controller: ESD5403 • Magnetic Speed Pickup

Summary: Conversion from mechanical to an electronic control system was performed by BEML under direction from The Indian Ministry of Defense to save fuel, improve drivability and performance. The ACE275K was selected for its heavy-duty bearings and position feedback sensor that work with the ESD5403 to achieve fuel limiting for mobile equipment.

50-TON DUMPER TRUCK



CATERPILLAR

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
3054	ADC100-24	ESD5111 or ECC328-24		
3304 and 3306	ADD225GSC-24	ESD5500E		
3406	ADD225GSC-24	ESD5500E		KT230
3406	ATB652T2N	ESD5526		EAM121
3408	ACB2001			
3408 with Natural Gas		ESD5330		ICM200-4 CL602 SPW100
3412		ESD5111 ESD5500E ESD5550		
3512 and 3516 CAT engines with Delphi DPA/DPD	ACB2001 ADD103B-12/24	ESD5330		
3516 Tugboat	ABC2001	ESD5330		
CATERPILLAR 3408	ADB225	ESD2244		

GAC APPLICATION NOTE (all of the components specified are sold separately)

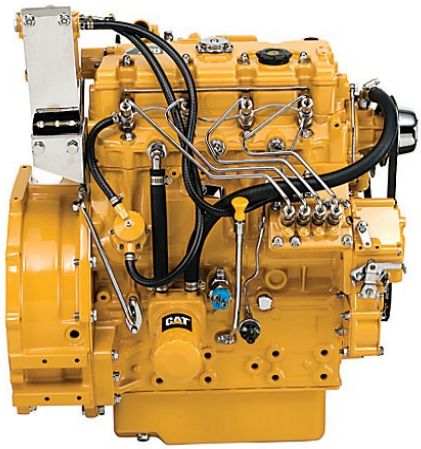
C2.2 ENGINE

Customer / OEM:	**Caterpillar**
Applications:	Water Pump Drives, Power Generation
Engine Make, Model:	Caterpillar C2.2 Engine 2.2L, 41.6 – 66.1 BHP
Fuel System:	Indirect fuel injection, Bosch PF Pump
Operating Speed(S):	Idle to 3200 rpm
Battery Voltage:	12 or 24 V DC
Installed Products:	• Actuator: ALR190-P04-12 / 24 (pull type) • Speed Controller: EEG6550 • Magnetic Speed Pickups (2): MSP6741

Summary: ALR190 Series Actuator and EEG6550 Speed Control provides a complete Electronic Governing System for a Caterpillar C2.2 engine. The EEG6550 digital governor was selected for having the most applicable combination of features. The speed ramping control significantly reduces visible exhaust smoke as the engine is accelerated under load. The Light Force governor feature scales the PID governor range of adjustment for these small, low current, actuators providing the best resolution for ease of tuning these governor response parameters.

CATERPILLAR C2.2 ENGINE BEFORE AND AFTER GAC ELECTRONIC GOVERNING SYSTEM

BEFORE



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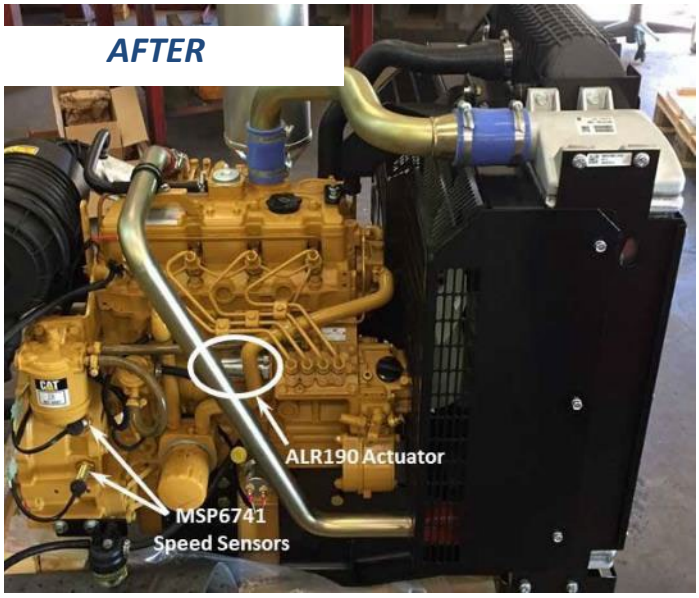


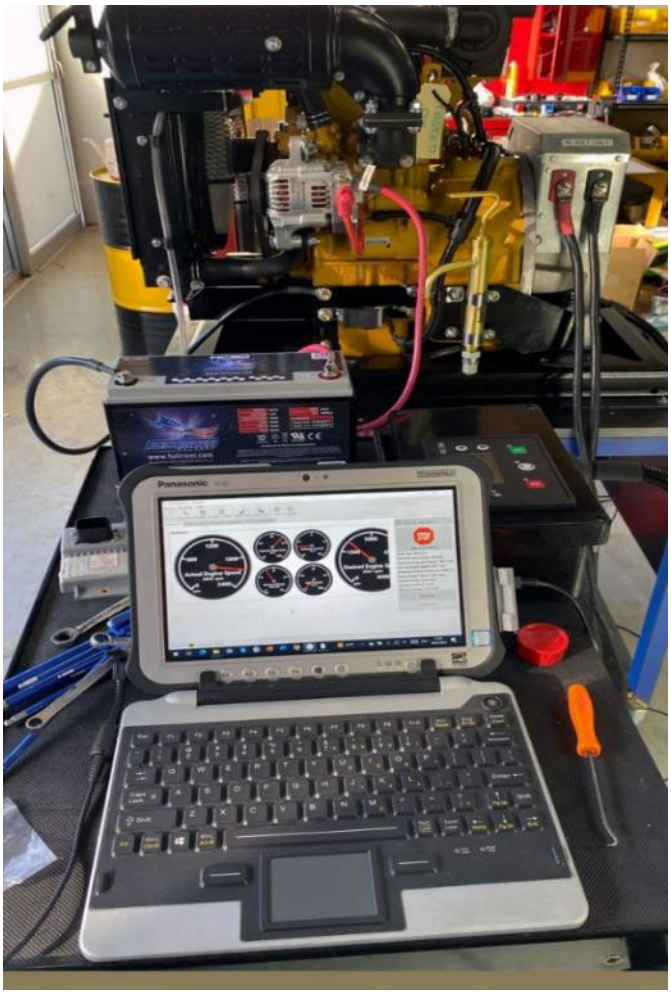
GAC APPLICATION NOTE

C0.5 ENGINE

Customer / OEM:	**Remote Energy**
Applications:	Power Generation for Battery Top Off
Engine Make, Model:	Caterpillar C0.5 11-13.7 HP U.S. EPA Tier 4 Final, EU Stage V
Fuel System:	Indirect Fuel Injection Naturally Aspirated
Operating Speed(S):	22 lb-ft @ 2600 rpm
Installed Products:	• Speed Controller: EEG7000

Summary: The HPE Mining Series is a 4kw 48V DC generator used for precision lithium battery charging. “We convert the mechanical control of the engine to electronic utilizing the EEG7000 controller and a custom-built actuator to manage the speed of the engine which includes a warm up phase before load is applied then to main RPM, which controls voltage to charge the batteries. We maintain voltage to 0.1 volts which is very precise.”

CATERPILLAR C0.5 AS HPE MINING SERIES BATTERY GENERATION SUPPORT



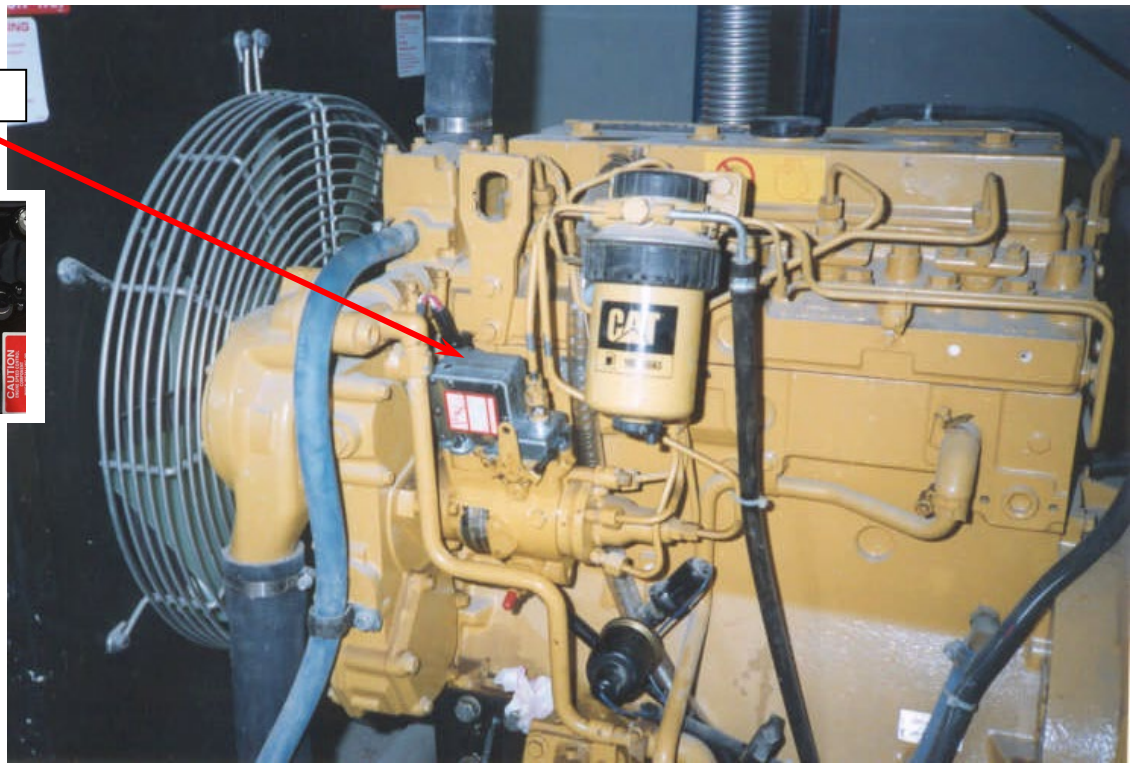
GAC APPLICATION NOTE

3054 GEN SET ENGINE

Customer / OEM:	CATERPILLAR
Application(s):	Gen-Set
Engine Make / Model:	3054, 4.4L Naturally Aspirated Inline 4 Cylinder
Fuel System Type & Make / Model:	Stanadyne Rotary Pump, Diesel
Operating Speed(s):	1500 / 1800 RPM
Battery Voltage:	24 V DC
Installed or Recommended Products:	• Actuator: ADC100 • Speed Controller: ECC328 • Magnetic Speed Pickup: No MSP required

Summary: GAC Actuator ADC100–12/24 is designed to replace the pump's governor cover and acts directly on the mechanical governor linkage arm. There are several light force speed control options available: the ECC328 Speed Controller with the input from the gen-set's electrical frequency, a magnetic pickup is not required with this controller.

ADC100-24 INSTALLED ON CATERPILLAR 3054 GEN-SET ENGINE



ECC328 Speed Controller

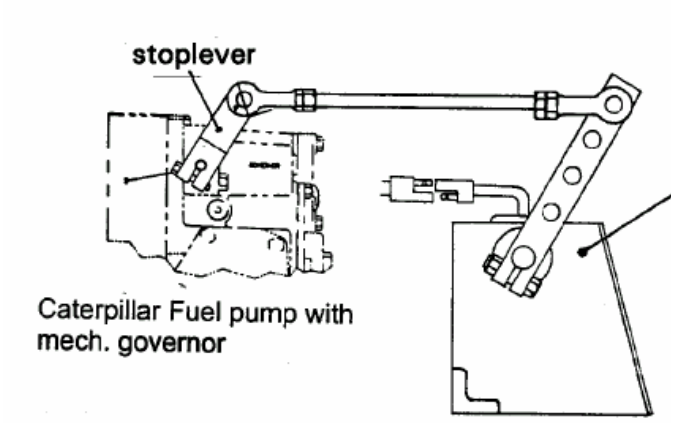
GAC APPLICATION NOTE

3304 and 3306 INDUSTRIAL ENGINES

Customer / OEM:	CATERPILLAR
Application(s):	Various
Engine Make / Model:	3304, 3306 Engines
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	218 HP @ 2000 RPM
Battery Voltage:	24 V DC
Installed Products:	• Actuator: ADD225GSC-24 w/ Packard Connector, or ADC225GS-24 w/ Commercial Connector • Controller: ESD5500E

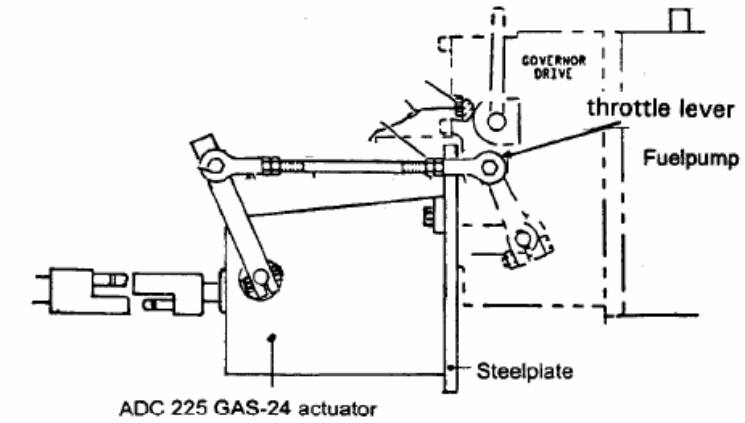
COMPLETED INSTALLATION

ENGINES WITH CATERPILLARS OWN MECHANICAL GOVERNOR



GAC actuator ADD225GSC-24 is installed on a solid bracket near the mechanical governor and linked to the stop lever. The throttle lever must be blocked in a forward position, resulting in a speed that is 200 - 300 RPM **above** the nominal operating speed.

ENGINES WITH EXTERNALLY FITTED WOODWARD PSG HYDRAULIC GOVERNOR



The PSG hydraulic governor must be removed. A steel plate must cover up the PSG drive hole. The GAC ADD225GSC-24 actuator lever is linked to the throttle lever.

GAC APPLICATION NOTE (all of the components specified are sold separately)

G3406 NATURAL GAS ENGINE UPGRADE

Customer / OEM: Caterpillar
Application(s): Industrial Natural Gas Engine
Engine Make / Model: 14.64L, 6 cylinder
Fuel System Type & Make / Model: Natural Gas
Operating Speed(s): Idle to 3600 rpm
Battery Voltage: 12/24 V DC
Installed Products:

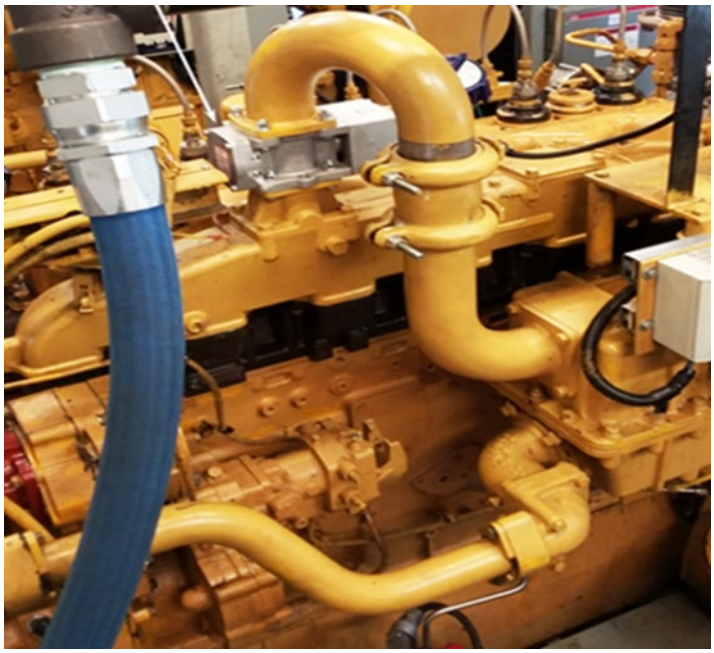
- Actuator: ATB652T2N-24
- Speed Control: ESD5526
- Interface Module: EAM121

Summary: The Governor Shop of Canada upgraded a 14.64L, 6-cylinder Caterpillar G3406 engine to a GAC control system, noting its ease of installation and superior performance. The EAM121 allows transparent compatibility with the existing controller.

BEFORE AND AFTER NATURAL GAS CONVERSION OF G3406 ENGINE

BEFORE

AFTER



ESD5526E with ANTI-WINDUP SPECIFICALLY DESIGNED FOR GASEOUS FUEL ENGINE CONTROL

ATB652T2N-24

EAM211 INTERFACE MODULE

GAC APPLICATION NOTE (all of the components specified are sold separately)

3406 INDUSTRIAL ENGINE

Customer / OEM:	CATERPILLAR
Application(S):	Industrial, Generator
Engine Make, Model:	Caterpillar 3406, Inline 6 cylinder, 14.64 L
Fuel System Type & Make, Model:	Diesel
Operating Speed(S):	472 HP @ 2100 RPM
Battery Voltage:	12 or 24 V DC
Installed Products:	• Actuator: 225 Series: ADC225GS-24 • Speed Controller: ESD5111, ESD5500E, or EEG6500 • Magnetic Speed Pickup: MSP6720 • Installation Kit: KT230 • 5K Potentiometer (optional): TP501
Summary:	Complete electronic governor replacement of an existing Caterpillar governor without removing the fuel pump. The KT230 provides the necessary bracket and hardware to install the GAC 225 series actuator. The ESD5111, ESD5550E, or EEG6500 speed control units provide precise control adjustments. Complete instructions are available on the GAC website.

GAC 225 SERIES ON CAT 3406

GAC APPLICATION NOTE

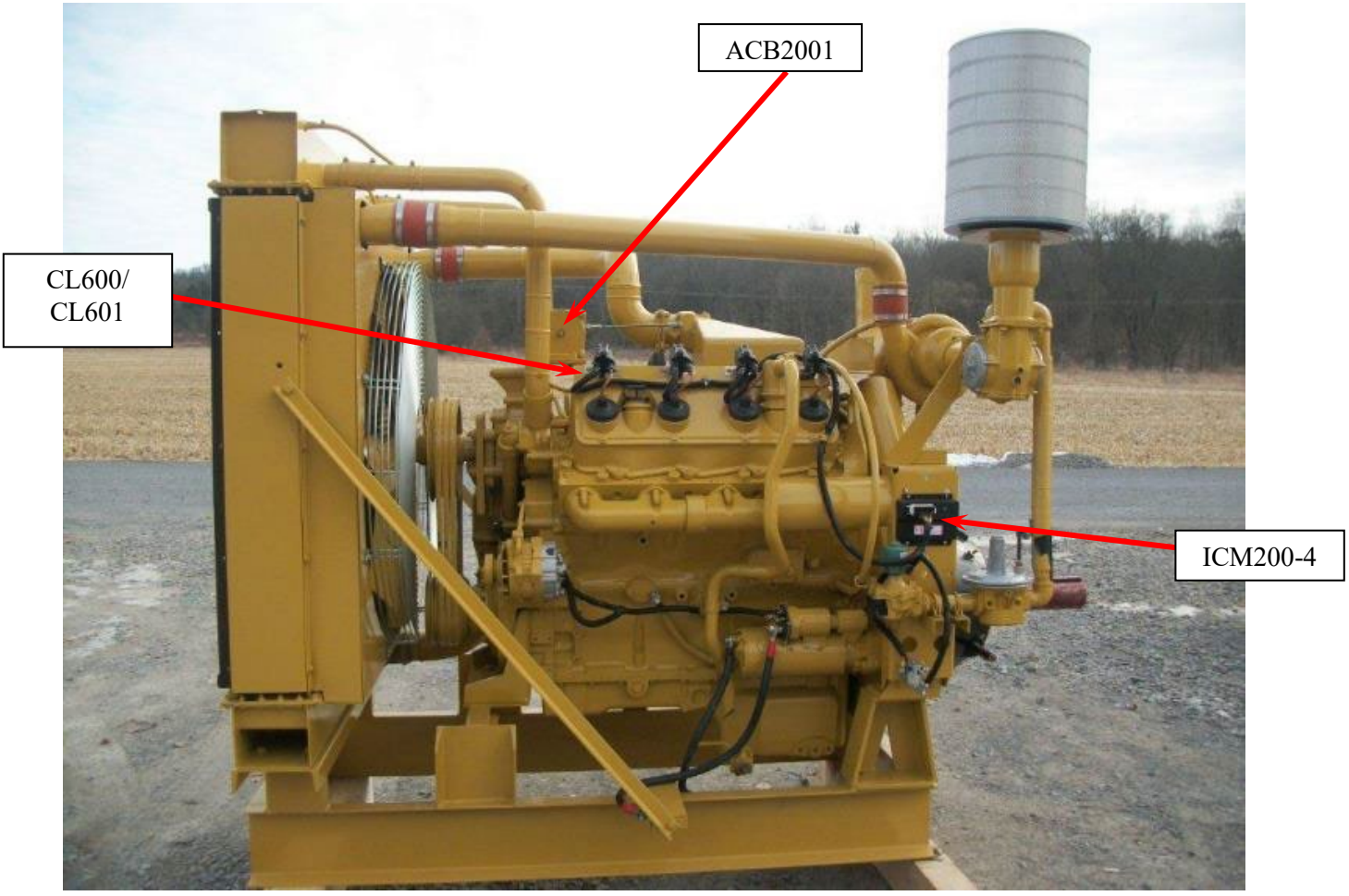
3408 NATURAL GAS GENERATOR

Customer / OEM: CATERPILLAR
Application(s): Generator
Engine Make / Model :: CAT 3408, 18 L, V-8, 136 flywheel teeth
Fuel System Type: Natural Gas
Operating Speed(s): 1500 RPM, 1800 RPM, or variable
Battery Voltage: 24 V DC
Installed Products:

- Actuator: ACB2001
- Speed Controller : ESD5330
- Ignition Control Module: ICM200-4
- Ignition Coils: CL600 for 24 V DC or CL601 for wasted spark
- Spark Plug Wires: SPW100
- Spark Plugs: SPG100-002 (Iridium Tip, Turbo Applications)

Summary: Application with GAC Ignition System running in wasted spark i.e. crankshaft triggering.

CAT 3408 WITH GAC IGNITION SYSTEM AND ACB2001



GAC APPLICATION NOTE (all of the components specified are sold separately)

3408 GOVERNOR REPLACEMENT

Customer / OEM: Fishing Vessel
Application(s): Marine
Engine Make / Model: CAT3408
Battery Voltage: 12 or 24V
Installed Products:

- Actuator: ADB225
- Speed Controller: ESD2244-24
- Magnetic Speed Pickup: MSP6723C

Summary: A fishing vessel needed a cost-effective replacement to their aging Woodward PSG but a one-for-one replacement was expensive and installation time consuming. Instead they chose GACs external mount ADB225 and the ESD2244-24, saving both downtime and money.

ESD2244-24

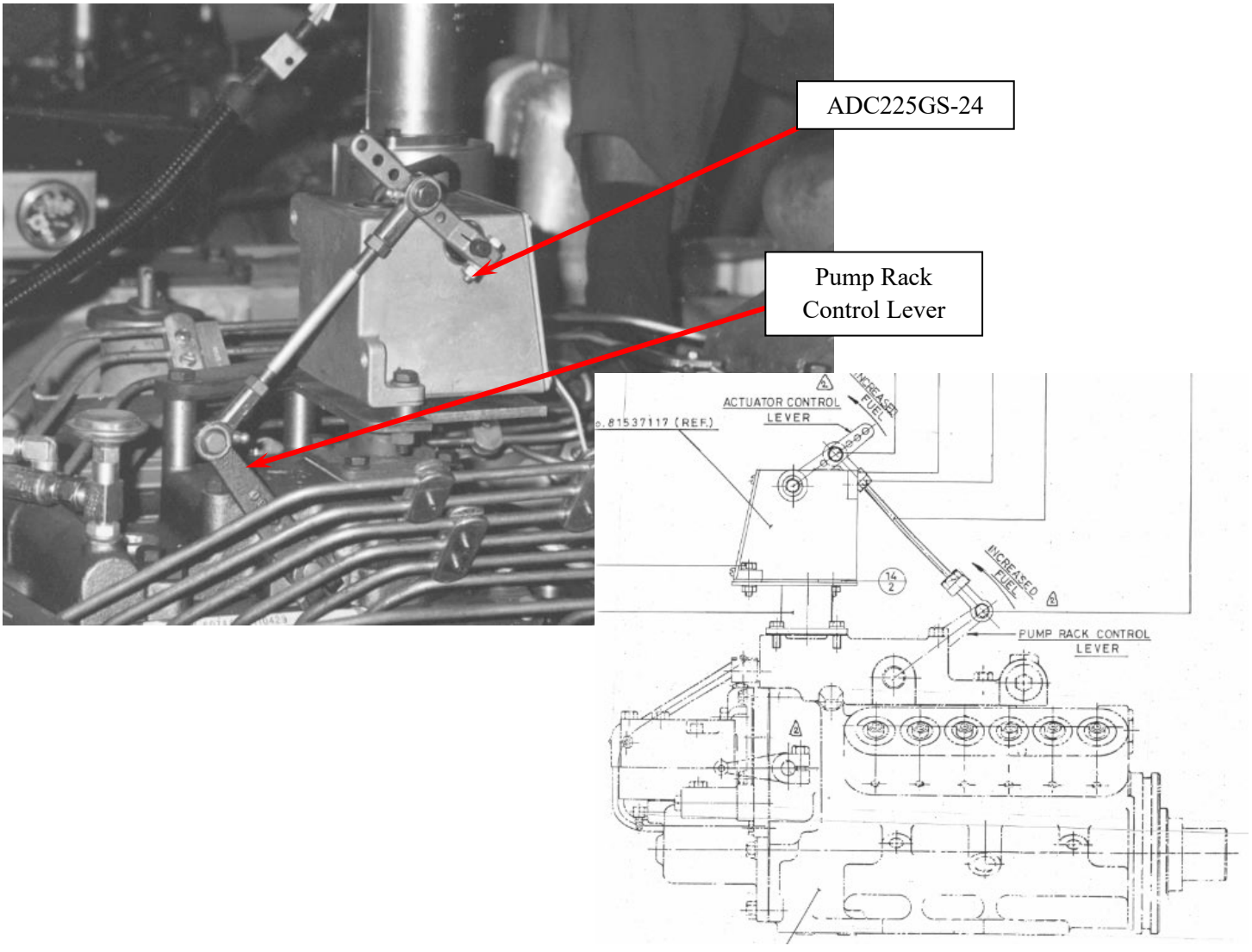
ADB225

GAC APPLICATION NOTE

3412 ENGINE

Customer / OEM:	CATERPILLAR
Application(s):	Power Generation
Engine Make / Model:	Caterpillar 3412, 27.02 L, V12
Fuel System Type & Make / Model:	Caterpillar Mechanical Governor, Diesel
Operating Speed(s):	1500/1800 RPM
Battery Voltage:	24 V DC
Installed / Recommended Products:	• Actuator: ADC225GS-24 (with lesser rate return spring) • Speed Controller: ESD5111, ESD5500E w/ start fuel and speed ramping adjustments, or ESD5550 w/ over-speed switch
Summary:	This solution replaces a PSG governor assembly only. The pump rack control lever is required for this solution. The mechanical Caterpillar Governor is not replaced.

ADC225GS-24 INSTALLED ON CATERPILLAR 3412 ENGINE

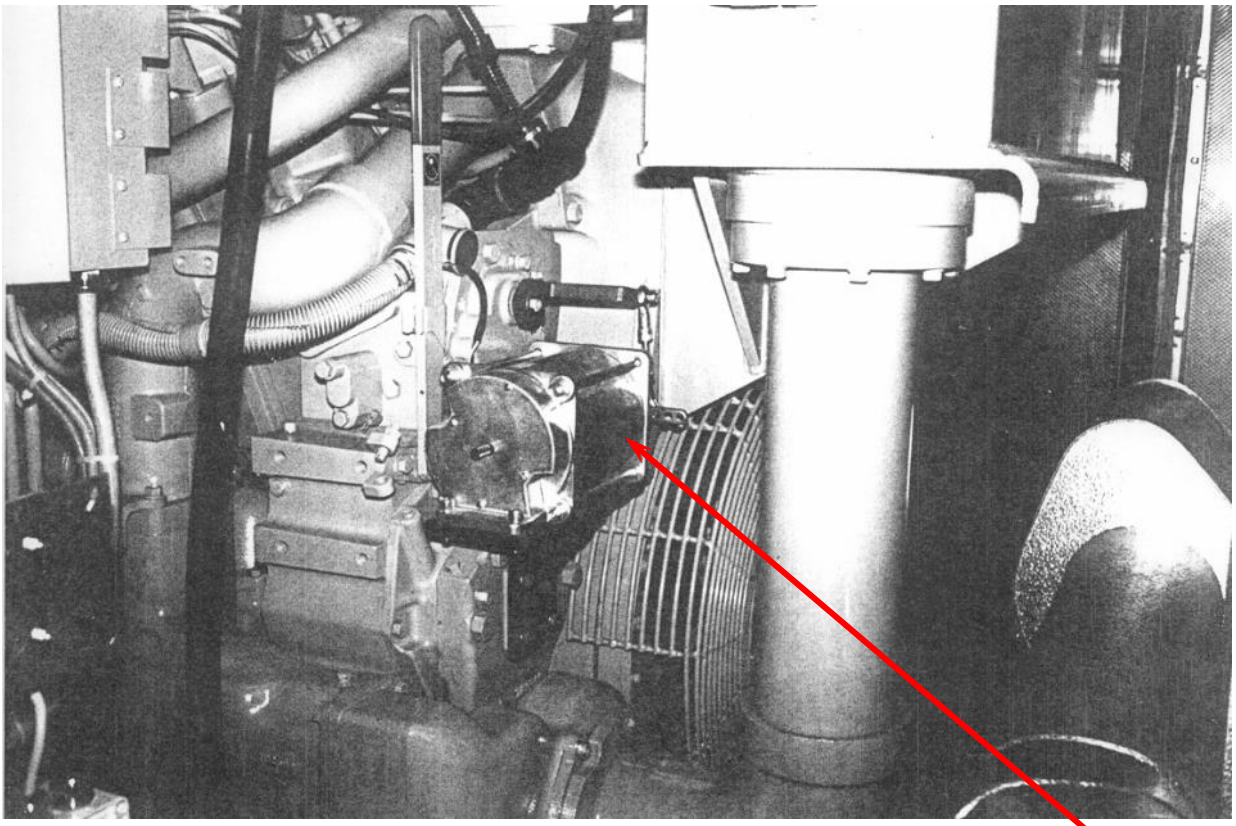


GAC APPLICATION NOTE

3512 and 3516 ENGINES

Customer / OEM:	CATERPILLAR
Application(s):	Industrial
Engine Make / Model:	Caterpillar 3512, 51.8L V-12, and 3516, 69L V-16 Engines
Fuel System Type & Make / Model:	Caterpillar Mechanical Governor, Diesel
Operating Speed(s):	Multiple
Battery Voltage:	24 V
Installed Products:	• Actuator: ACB2001 • Speed Controller: ESD5330

ACB2001 ACTUATOR ON CAT 3512 ENGINE



Note: Installed on a bracket near flywheel housing

GAC APPLICATION NOTE

DPA-DPD DELPHI DPG PUMP

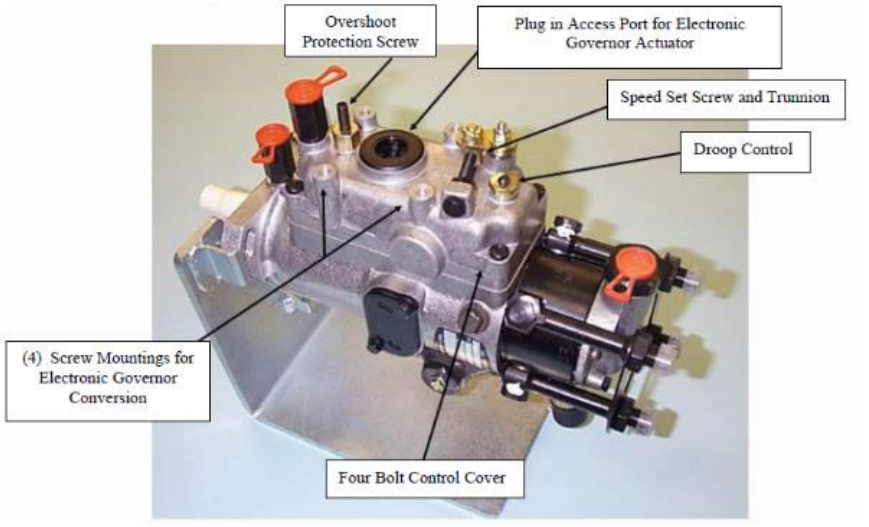
Customer / OEM:	CATERPILLAR (PERKINS)
Application(s):	Various
Engine Make / Model:	Various
Fuel System Type & Make / Model:	Diesel, Delphi DPA/DPD Pump
Operating Speed(s):	
Battery Voltage:	12 or 24 V
Installed Products:	**Actuator**: ADD103B-12/24

Summary: The 103 Series Integral Actuator is designed to mount directly to the Delphi DPA/DPD (fixed speed-versions). No external linkage or brackets are required to install this actuator. By internally moving the fuel metering valve to the no fuel position, when de-energized, the 103 Series electric actuator provides the function of fuel shutoff solenoid.

Installing the 103 Series actuator does not defeat the engine's mechanical governor operation. During the installation process, the mechanical governor is set to a higher speed than the electric governor's operating speed. In this configuration the mechanical governor acts as a speed limiter. The electromechanical design used in the 103 Series is field proven and provides a proportional actuator movement based on the actuator coil current.

INSTALLATION INSTRUCTIONS ARE AVAILABLE ON THE GAC WEBSITE.

ADD103B SERIES ACTUATOR ON DELPHI PUMP



GAC APPLICATION NOTE

DPA-DPD – DP210 ROTARY EXTERNAL PUMP REPLACEMENT

Application(s): Agricultural, Industrial and Power Generation Equipment

Engine Make / Model / Displacement / Rating: Multiple rating, with 3-, 4- , and 6-cylinder off road engines

Fuel System Type & Make / Model: Delphi DP210, DPA, DPS, DPD

Operating Speed(s): 600-3600 RPM

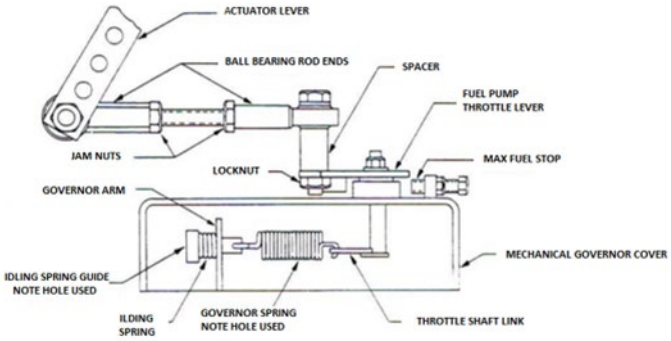
Battery Voltage: 12 or 24 V DC

Installed Products:

- Actuator: ALN050
- Speed Controller: ESD2402, ESD5120, EEG6500
- Magnetic Speed Pickup: MSP675
- Mounting Kit: BK266

Summary: Perkins, Caterpillar and other 3-, 4-, and 6-cylinder engines in off-highway applications with the DP210, DPA, or DPD pumps are mechanically governed.

They can be replaced with the GAC ALN050 or 120 Series universal actuator by mounting them to the pump's throttle lever.



DP210 AND DPA ROTARY PUMP

ALN050 MOUNTED WITH BRACKET ON PUMP

GAC APPLICATION NOTE

3516 69L V16 MARINE

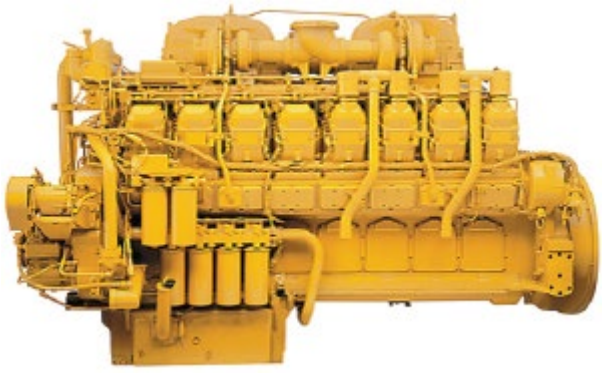
Customer / OEM:	ICELAND
Application(s):	Tugboat propulsion control
Engine Make / Model:	Caterpillar 3516, 69L V16
Installed Products:	• Actuator: ACB2001 (2) • ESD5330 (2)

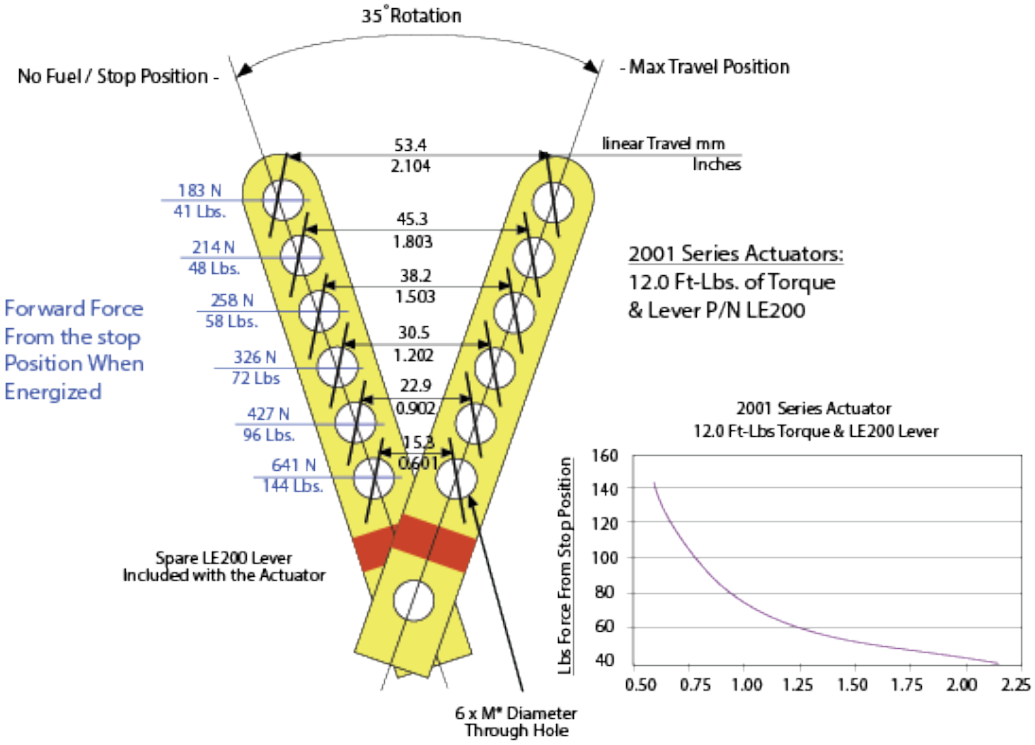
Summary: A Tugboat in Iceland replaced the main propulsion control system for its two Caterpillar 3516, 69L V16 engines, balanced the output of both engines connected to a single drive train, and controlled with a single potentiometer. The solutions uses two GAC ACB2001 actuators and two ESD5330 controllers connected with a harness that was specifically designed for the application with potentiometers to adjust and balance the engines individually and a single potentiometer to control the speed of both engines at once.

The connection to the fuel control racks were modified and each engine fitted with an ACB2001 actuator. Each of these actuators provide 12.0 Ft-Lbs. (16.3 Nm) of torque over 35° of shaft rotation.

All sea trials were successfully completed after the GAC control system was installed. The Tugboat was returned to service and continues to perform without incident and the captain reported the fastest cruising speed ever.

3516 69L V16 MARINE





CHEVROLET

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
350 natural gas or propane	ATB452T2N-12 or 24	ESD5159 ESD5526 ESD5500 EEG6500		TP501 KT1932 KT41761 EC1300
454 natural gas or propane	ATBT252	ESD5159 ESD5526 ESD5500 EEG6500	MSP6729	KT41761 KT425-T2
Combined heat and power solution using 8.1L	ATB552T2F14-12/24	EEG6500	MSP6732	

GAC APPLICATION NOTE (all of the components specified are sold separately)

350 IN³ ENGINE, NATURAL GAS OR PROPANE

ELECTRONIC GOVERNOR SOLUTION WITH GAC ATB (REF. KT350ATB)

Application(s): Power Generation, Water Pump, Forklift, others

Engine Make, Model: Chevrolet 350 in³ (5.7 L), 8 cylinders

Fuel System Type & Make, Model: Impco 225 gas carburetor mixer (customer supplied)

Operating Speed(s): Idle to 3600 RPM

Battery Voltage: 12 or 24 V DC

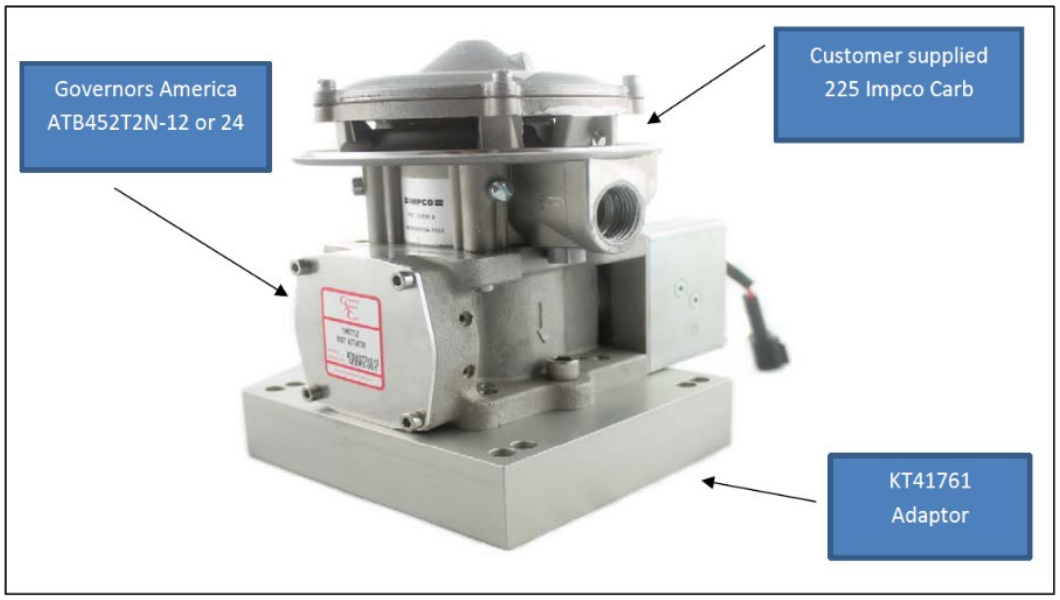
Installed Products:

- Speed Controller: ESD5159, ESD5526, ESD5500-II or EEG6500
- Throttle Body: ATB452T2N-12 or 24 V DC
- Magnetic Speed Pickup: MSP6729
- Installation Kit: KT41761
- Mating Connector: EC1300
- 5K Potentiometer (optional): TP501
- Adapter for spread bore intake manifold (if necessary): KT1932

Summary: This a complete Electronic Governing system for the natural gas or propane fueled Chevrolet 350 in³ engine using a Governors America Throttle Body with a Customer supplied Impco 225 carburetor- mixer.

INSTALLATION INSTRUCTIONS ARE AVAILABLE ON THE GAC WEBSITE

COMPLETE ELECTRONIC GOVERNING SYSTEM FOR CHEVROLET 350 IN³ NATURAL GAS OR PROPANE ENGINE



GAC APPLICATION NOTE (all of the components specified are sold separately)

454 IN³ ENGINE, NATURAL GAS or PROPANE

ELECTRONIC GOVERNOR SOLUTION WITH GAC ATB (REF. KT454ATB)

Application(s): Power Generation, Water Pump, Forklift, others

Engine Make, Model: Chevrolet 454 in³ (7.4 L), 8 cylinders

Fuel System Type & Make, Model: Impco 425 gas carburetor mixer (customer supplied)

Operating Speed(s): Idle to 3600 RPM

Battery Voltage: 12 or 24 v

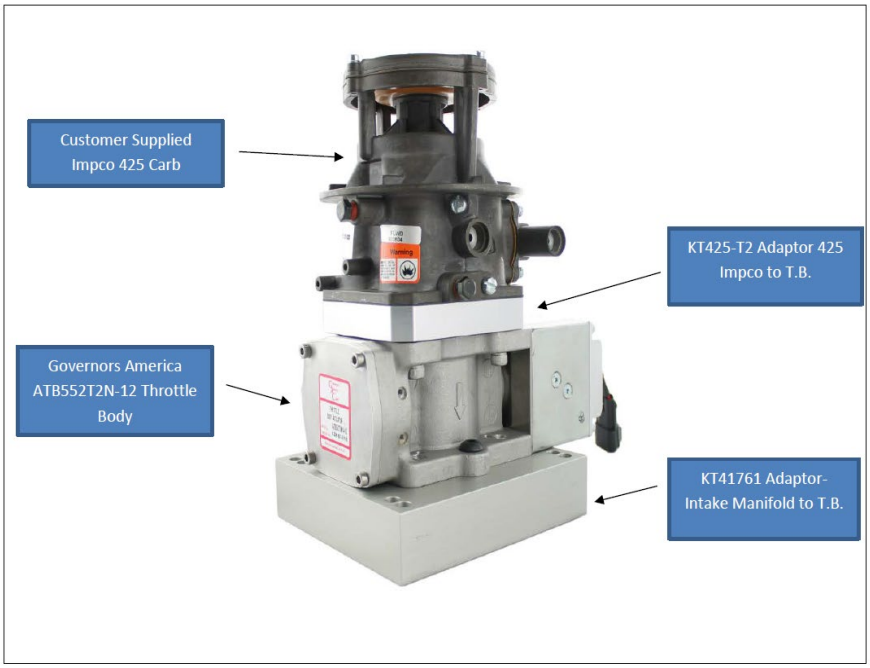
Installed Products:

- Speed Controller: ESD5159, ESD5526, ESD5500-II or EEG6500
  Throttle Body: ATB552T2N-12 or 24 (volts)
- Magnetic Speed Pickup: MSP6729
- Installation Kit: KT41761
- Installation Kit: KT425-T2
- 5K Potentiometer (optional): TP501
- Adapter for spread bore intake manifold (if necessary): KT1932

Summary: This a complete Electronic Governing system for the natural gas or propane fueled Chevrolet 454 in³ engine using a Governors America Throttle Body with a Customer supplied Impco 425 carburetor- mixer.

INSTALLATION INSTRUCTIONS ARE AVAILABLE ON THE GAC WEBSITE

COMPLETE ELECTRONIC GOVERNING SYSTEM FOR CHEVROLET 454 IN³ NATURAL GAS OR PROPANE ENGINE



GAC APPLICATION NOTE

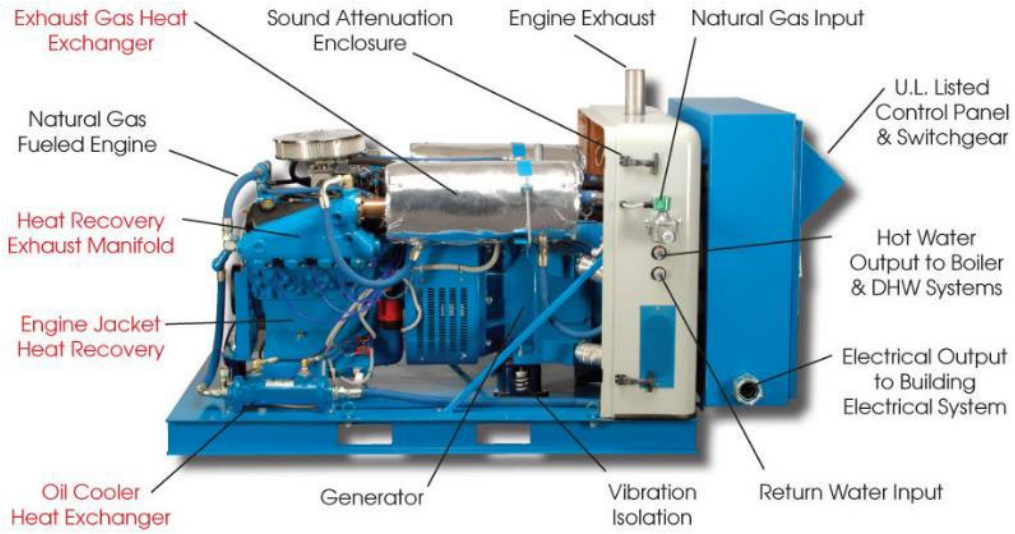
8.1L COMBINED HEAT AND POWER

Customer / OEM:	**Aegis Energy Systems**
Application(s):	Combined Heat and Power (CHP)
Engine Make / Model:	Chevrolet 8.1L
Fuel System Type & Make / Model:	Natural Gas
Operating Speed(s):	1800 RPM
Battery Voltage:	12 or 24 V DC
Installed Products:	• Speed Controller: EDG6000 , EEG6500, and ESD5111 • Actuator: ATB552T2F14-12/24 • Magnetic Speed Pickup: MSP6732

Summary: Aegis Energy Services provides turnkey installation of modular combined heat and power systems. Each cogeneration module includes a natural gas-fueled Chevrolet 8.1 L engine, induction generator, microprocessor control panel, protective switchgear, and heat recovery equipment. Each module is enclosed in a sound attenuated cover and can be installed indoors or outdoors.

The solution features the GAC an EEG6500 (Digital, Multiple PID, SmartVu, Environmentally Sealed, & Tamper Resistant) EDG6000, or ESD5111 (Analog, Isochronous, Variable, & Droop) controller and an ATB552T2F14 55 mm throttle body to provide strict performance and reliability requirements needed. The ATB552T2F14 features a position feedback sensor used by the air-fuel ratio system to determine the actual throttle position for precise control. Each module is also equipped with an MSP6723 for speed reference

COMPLETE CHP UNIT



CONTROL PANELS WITH EEG6500 AND ESD5111

TOP VIEW WITH ATB552T2

CUMMINS

A cross reference to direct replacements with Cummins part numbers to GAC part numbers is located at the end of this guide **here.**

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / OTHER
QST30G GOVERNING SYSTEM WITH BOSCH IN-LINE FUEL INJECTION PUMP	ADD175F	ESD5111or ESD5221	DDM101 KT197
NT, KT WITH EFC SYSTEM WITH PT PUMP	ADB120E4	ESD5522E	MSP6724, MSP6728C
NT, K19, K28, K38, K50 WITH EFC SYSTEM (PT-PUMP)		ESD5522E	MSP6724, MSP6728C EAM100
C WITH BOSCH INLINE AND RSV (STOP LEVER)	ADC225S ADC120, ADD175A	ESD2210, ESD5500E ESD5111	MSP6724, MSP6728C
CUMMINS B WITH CAV DPA (REAR MOUNT)/BOSCH VE STOP LEVER	ADC225S	ESD2210, ESD5111 ESD5500E	MSP6724, MSP6728C
6BT 5.9-G1 UP TO 6 CYL WITH BOSCH INLINE	ADD175A	ESD5111 , ESD2210 ESD5500E	MSP6724
4A2.0, 4A2.3, 4AT2.3	120 Series		
3A1.4 & 3A1.7	120 Series		
KTA38 37.8L	ACB2001-24	ESD5330	
4B 3.3-G1 WITH ZEXEL A	ADD175A	ESD2210, ESD5111	MSP6728C
4B 3.9, 4B 3.9-G1(2), & 6BT 5.95-G1 WITH STANADYNE PUMP	ADC100-12/24	ESD5120, ESD5522E	MSP6724, MSP6728C
8.3L and GTA855	ATB T4	ESD5526e, RSC671	
VT1710 IRRIGATION	ATB652T2F14-24	ESD5111 DDM101	STE101
KTA-50L4	ADB120E4	ESC63-17, -7, -23 SSW676, SSW675	MSP677, MSP678 ITM050, ITM051
855 NA	ATB652T2N-12 or 24	ESD5526E	5/8-18 UNF-2A
QSM111			LSM201N

GAC APPLICATION NOTE (all of the components specified are sold separately)

NT / KT with PT PUMP and EFC FUEL SYSTEM or PT PUMP WITH MECHANICAL GOVERNOR

Customer / OEM: **CUMMINS**
Applications: Diesel Engine Generators, Compressors, Marine, others
Engine Make, Model: Cummins NT and KT Series engines with EFC system with a PT pump or mechanical governor.
Fuel System: PT Pump (normally closed or normally open integrated actuators or mechanical governor).
Operating Speed(S): Full RPM range
Battery Voltage: 12 or 24 V DC
Installed Products:

- Actuator: ADB120E4-GAC (EFC system) or ADC225JS-12/24 (mechanical governor).
  - Optional Mounting Bracket for ADB120E4-GAC: BK114
  - Optional Mounting Bracket for ADC225JS-12/24
- Speed Control Options:
  - EFC (normally closed): EEG6500, ESD5522E, ESD5120
  - EFC (normally open): ESD5119, ESD5160
- Speed Controller- EEG6500, EDG6000, ESD2210, ESD5111, ESD5500E, ESD5500-II, ESD5550
- Optional EAM Module: EAM100 (interface module for Cummins EFC to GAC load sharing / synchronizing modules).
- Optional Load Sharing Modules: LSM100, 201 and 672
- Optional Auto Synchronizers: SYC6714
- Optional Throttle Linkage components:
  - Bearing Rod Ends: BR200 (1/4”-28 thread), BR300 (M5 thread), BR400 (M6 thread).
  - Threaded Rod: RD102- Zinc coated ¼”-28 thread precut to 1.0 ft. (0.3 m). RD233- Zinc coated M6 thread precut to 8.75 in. (222 mm)

SUMMARY: The ADB120E4-GAC and 225 Series for Cummins NT and KT engines provide an electromechanical actuator used for engine fuel control positioning.

The Cummins P.T. fuel system is controlled with either a mechanical governor or Normally Open or Normally Closed Electronic Fuel Control (EFC) system with its actuator integrated in the P.T. pump. GAC has actuator / governor solutions for each control system offering Isochronous, Droop and Variable Speed operation.

INSTALLATION INSTRUCTIONS ARE AVAILABLE ON THE GAC WEBSITE.

GAC APPLICATION NOTE (all of the components specified are sold separately)

220KVA GENERATOR RUNNING ON A CUMMINS 6CTAA8.3G2

Customer / OEM: **Jubilee Energy CUMMINS**

Applications: Diesel Engine Generators, Compressors, Marine, others

Engine Make, Model: Cummins 6CTAA8.3G2

Fuel System: PT Pump (normally closed or normally open integrated actuators or mechanical governor).

Operating Speed(S): Full RPM range

Battery Voltage: 12 or 24 V DC

Installed Products:

- Speed Controller: EEG7000
- Actuator: AADB175-12/24
- Magnetic Speed Pickup: MSP6732

SUMMARY: A 220kVA generator running on a Cummins 6CTAA8.3G2 needed a new speed controller to pair with the GAC 175 SERIES Actuator that was controlling fuel.

The EEG7000 was a quick replacement with no mess and no issues. Only the EEG7000 was disturbed, and it immediately connected to the DSE Control Panel.

GAC APPLICATION NOTE (all of the components specified are sold separately)

QSM11 as DUEL GENERATOR SET

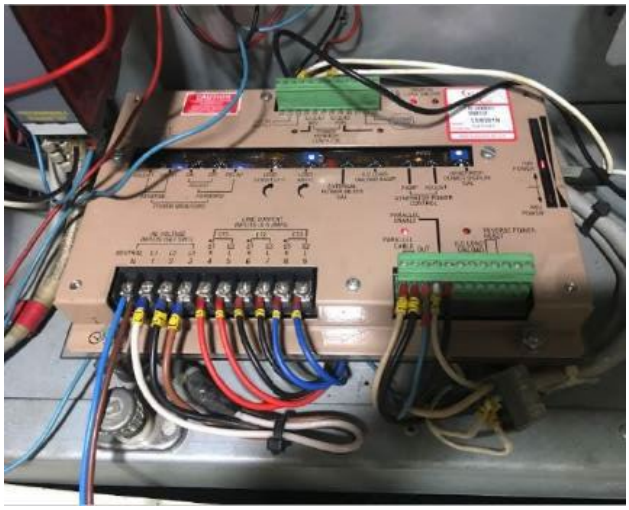
Customer / OEM: **CUMMINS**
Applications: Diesel Engine Generators, Compressors, Marine, others
Engine Make, Model: Cummins QSM11 .
Operating Speed(S): Full RPM range
Battery Voltage: 12 or 24 V DC
Installed Products:
- LSM201N

Summary: This deep water operations vessel had a question about a new piece of GAC equipment, the LSM201N load sharing module, recently added to a pair of auxiliary generators using QSM11 Cummins engines with the ISM Engine Control Module (ECM).

Balancing power distribution between engines is the primary function of the LSM. It can also provide power control through ramping and monitoring, accurately measuring true engine power.

When one of the two QSM11-DM engines reversed power it was easy to determine the cause. Out of the box the LSM201N interpreted the ECM increased voltage to be a request to decrease power. But the ECM translated increased voltage as a need to increase power. The LSM was built to allow a hardware solution of adding a jumper to change polarity, but like both GACs EEG7000 and the EEG7500 controllers, the ECM was also able to use software to match the LSMs polarity. The issue was easily resolved, and the boat was soon back in service.

LSM201N



CUMMINS QSM11

GAC APPLICATION NOTE (all of the components specified are sold separately)

QST30G GOVERNING SYSTEM CONVERSION with BOSCH IN-LINE FUEL INJECTION PUMP

Customer / OEM:	CUMMINS
Application(s):	Various
Engine Make / Model / Displacement / Rating:	Cummins QST30G / 30.5L, V121 / 760 to 1500 HP / 567 to 1119 kW
Fuel System Type & Make / Model:	Bosch in-line pump with EDC governor
Operating Speed(s):	1500, 1800 and 2100 RPM
Battery Voltage:	24 V

Installed Products:

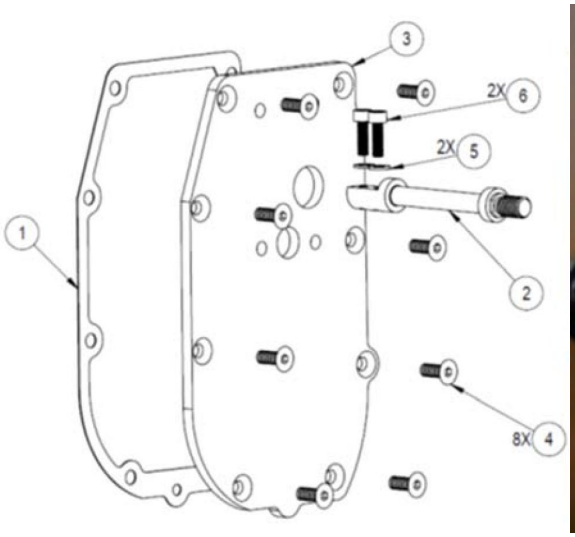
- Actuator (2 required): ADD175F
- Speed Controller (1 required): ESD5111 or ESD5221 (overspeed option)
- Dual Driver Module: DDM101
- Magnetic Speed Pickup: 5/8”, 18 thread
- Magnetic Speed Pickup Harness: CH1204
- Bosch EDC Governor Adaptor Kit (2 required): KT197
- K-Type Thermocouples (2 required): STE101
- Feedback Sensor Mating Harness (2 required): CH1243
- Actuator Harness (2 required): CH1215

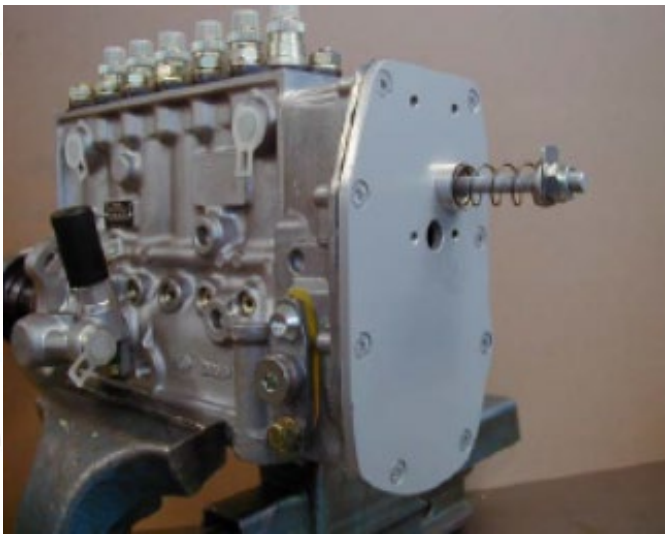
Summary: This is a GAC complete electronic governing system conversion kit for Cummins PC controller and Bosch injection pump mounted governor. The GAC parts listed are not compatible with the Cummins PCC controller or the Bosch injection pump mounted actuators. This system acts as a standalone complete dual pump governor system that does not require interaction with the Cummins controller.

Converting to the GAC system includes the installation of an ADD175F actuator on each pump with a KT197 adapter kit, installing a K-Type thermocouple in the exhaust stream of each bank and connecting the actuators, position feedback sensors and thermocouples to the DDM101 module and ESD5111 or ESD5221 governor controller. The DDM101 uses the input from the two thermocouples and two position sensors to balance and maintain an equal output from both banks of the engine while being controlled by a single governor.

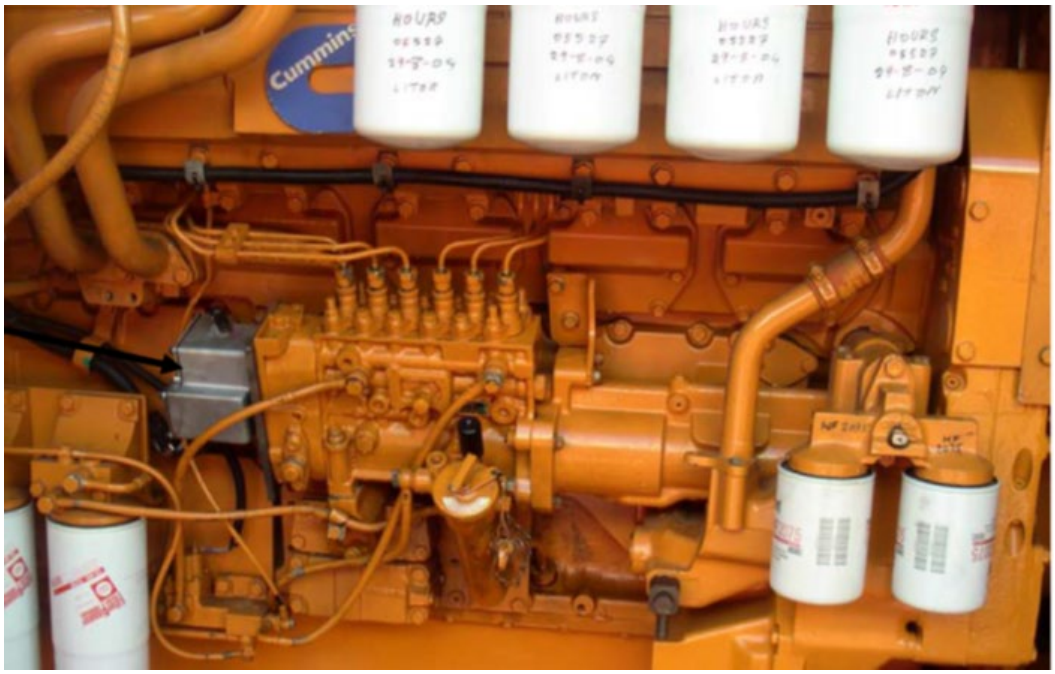
The complete conversion installation instructions are in GAC DOCUMENT CUMMINS QST30 GAC CONVERSION INSTALLATION INSTRUCTIONS PIB5119.

KT197 – ADAPTS 175 SERIES ACTUATORS TO BOSCH EDC GOVERNOR HOUSING





ADD175F ACTUATOR MOUNTED ON A QST30 FUEL INJECTION PUMP WITH KT197 INSTALLATION KIT



GAC APPLICATION NOTE

B4.5T ENGINES

Customer / OEM: Taylor Machine Works
Application(s): Forklift
Engine Make / Model: CUMMINS B4.5T-C99, 275 in^3 Displacement, 99 HP / 2200 RPM, 10 Ton Taylor Machine Works Forklift
Fuel System Type & Make / Model: Diesel
Operating Speed(s): 800 RPM idle, variable range from 800 to 2200 RPM
Battery Voltage: 12 V DC
Installed Products:
- Speed Controller : ESD2349-12
- Electronic Foot Pedal: FP100

Summary: The ESD2300 series electronic speed controller provides superior speed regulation over a variable RPM range and an immediate, precise response to transient load changes. The electronic foot pedal interface provides the load signal while a ring gear mounted magnetic Pickup provides the speed input.

- **ESD2349-12V** is specifically for off-road variable speed applications. It includes adjustable PID governor control and is compatible with foot pedal, GAC part number FP100.
- **ESD2351-12V** includes integral over-speed contacts, adjustable PID Speed Controller and is compatible with either a Williams vertically mounted foot pedal, GAC part number FP201, or horizontally mounted foot pedal GAC part number FP202.
- **ESD2352-12V** includes integral over-speed contacts, adjustable PID Speed Controller and is compatible with a Morse foot pedal.

10 TON TAYLOR MACHINE WORKS FORKLIFT

ESD2352-12 Variable Speed Controller

FP201 Vertically Mounted Foot Pedal

FP202 Horizontally Mounted Foot Pedal

GAC APPLICATION NOTE

GTA 8.8L and 855 ENGINES

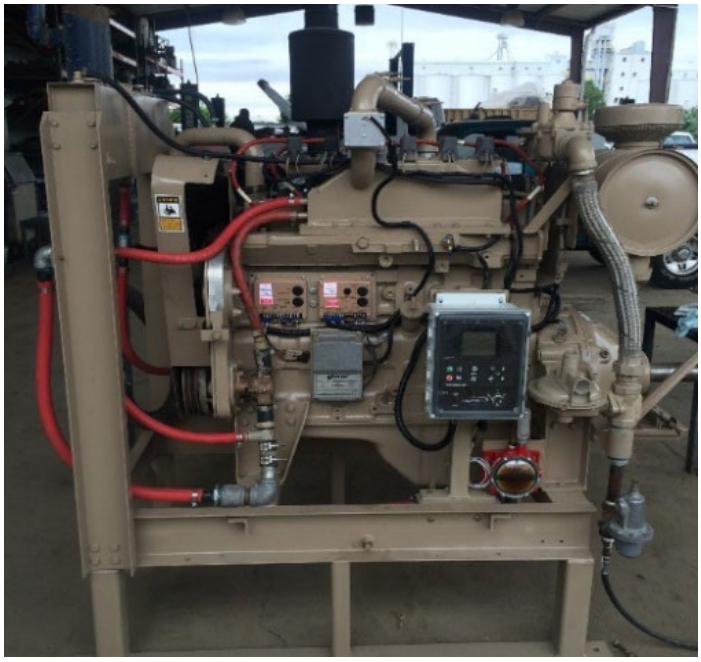
Customer / OEM: PSS Governor Services
Application(s): Irrigation
Engine Make / Model : Cummins GTA 8.3L and GTA855
Fuel System Type & Make / Model: Cummins PT Fuel System, Natural Gas
Operating Speed(s): 2100 RPM
Battery Voltage: 12 or 24 V DC
Installed Products:

- Actuator: Two ATB T2
- Speed Controller: Two ESD5221
- Speed Ramping Controller: Two RSC671's

SUMMARY PSS Governor Services (PSS) updated Cummins irrigation pump drives on 2 systems. These after market natural gas engines are now controlled by GAC integrated actuator/throttle body assemblies ATB throttle body actuators, RSC671 programmable ramp generators, and ESD5526e governor speed controllers.

GTA 8.3L

GTA855



GAC APPLICATION NOTE

KT38 ENGINES

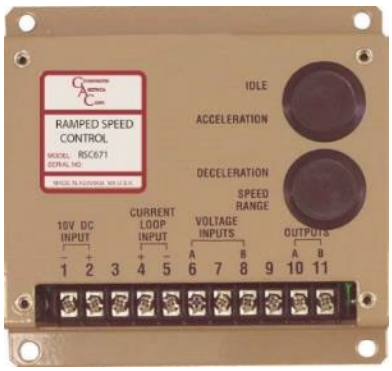
Customer / OEM:	Private
Application(s):	Tug Boat
Engine Make / Model:	Two - Cummins KT38 Engines: V12, 38L (2300 in^3) Turbocharged / After-cooled
Fuel System Type & Make / Model:	Cummins PT Fuel System
Operating Speed(s):	2100 RPM
Battery Voltage:	12 or 24 V DC
Installed Products:	• Actuator: Two ADB120E4 (Designed for Cummins PT fuel system) • Speed Controller : Two ESD5221 • Speed Ramping Controller: Two RSC671's

TUG BOAT "GLACIER WIND" IN COOK INLET, ALASKA

GAC EQUIPMENT ON CUMMINS KT38 ENGINES

ESD5221 SPEED CONTROLLER

RSC671 RAMPING SPEED



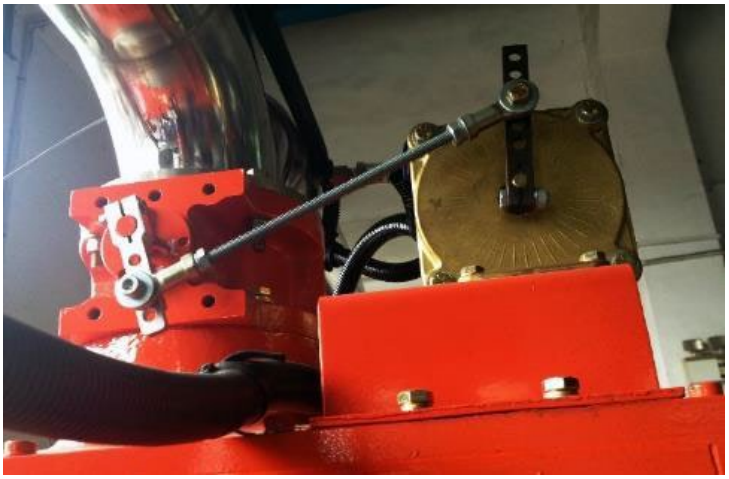
ADB120E4 ACTUATOR

GAC APPLICATION NOTE (all of the components specified are sold separately)

37.8L NATURAL GAS GEN SET 500KW

Customer / OEM	Camda
Applications:	Generator
Engine Make, Model:	Cummins
Fuel System:	Natural Gas
Operating Speed(S):	
Battery Voltage:	12 or 24 V DC
Installed Products:	• **Actuator**: ACB2001-24 • Speed Controller: ESD5330

Summary Camda New Energy Equipment Co. Ltd., a generator manufacturer, 500 kW gaseous gen-set built on the Cummins Kt38 37.8L engine uses the GAC ACB2001 controlled by the GAC ESD5330, specifically designed to run the ACB2001, ensures stability and smooth results.

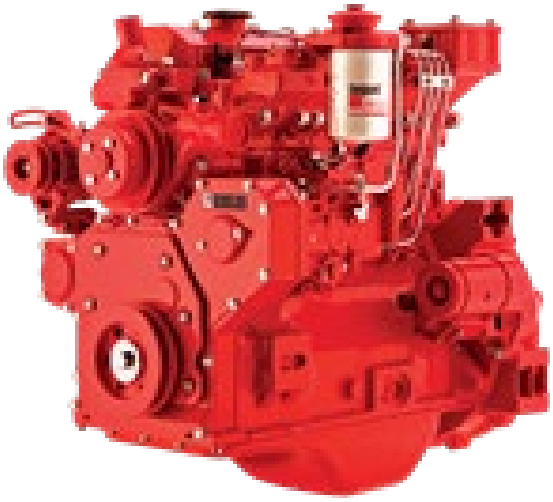


GAC APPLICATION NOTE

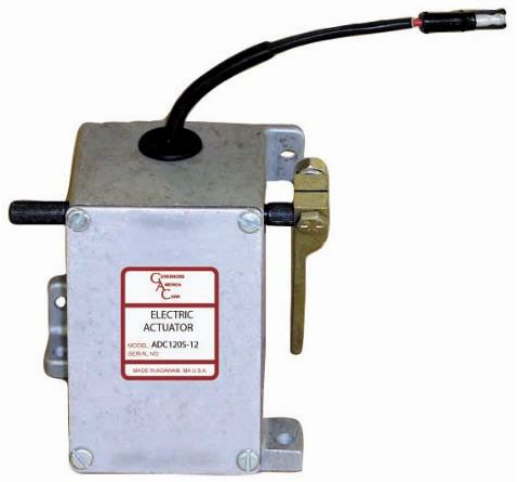
B ENGINE with CAV DPA

Customer / OEM:	CUMMINS
Application(s):	Various
Engine Make / Model:	Cummins B with CAV DPA
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	173 HP @ 2500 RPM, B5.9 99 HP @ 2500 RPM. B4.5 124 HP @ 2200 RPM, B3.9
Battery Voltage:	12, 24, or 32 V DC
Installed Products:	• Actuator: ADC120 • Speed Controller: ESD2210, ESD5111, or ESD5500E • Magnetic Speed Pickup: MSP6724 or MSP6728C

CUMMINS B SERIES ENGINE



ACTUATOR ADC120



GAC APPLICATION NOTE

C ENGINE WITH BOSCH INLINE AND RSV

Customer / OEM:	CUMMINS
Application(s):	Various
Engine Make / Model:	Cummins C with Bosch inline and RSV
Fuel System Type & Make / Model:	Bosch P-Series Inline Pump, Diesel
Operating Speed(s):	260 HP @ 2200 RPM
Battery Voltage:	12, 24, or 32 V DC
Installed Products:	• Actuator: ADC225S, ADC120, or ADD175A • Speed Controller: ESD2210, ESD5111, or ESD5500E • Magnetic Speed Pickup: MSP6724 or MSP6728C • Kits / Connectors: EC1300, KT102J, KT175-A-R, KT275 (aka KT275-3000)

CUMMINS C ENGINE AND BOSCH INLINE PUMP

B ENGINE with CAV DPA and BOSCH VE STOP LEVER

Customer / OEM:	CUMMINS
Application(s):	Agricultural and Industrial Equipment (various)
Engine Make / Model:	Cummins 4B (T) and 6B (T) Engines
Fuel System Type & Make / Model:	CAV/DPA Rotary Pumps
Operating Speed(s):	173 HP @ 2500 RPM, B5.9 99 HP @ 2500 RPM. B4.5 124 HP @ 2200 RPM, B3.9
Battery Voltage:	12 or 24 V DC
Installed Products:	• Actuator: 120 Series • Speed Controller: ESD2210, ESD5111, ESD5500E or EEG6500 (Digital) • Magnetic Speed Pickup: MSP6724, MSP6728C

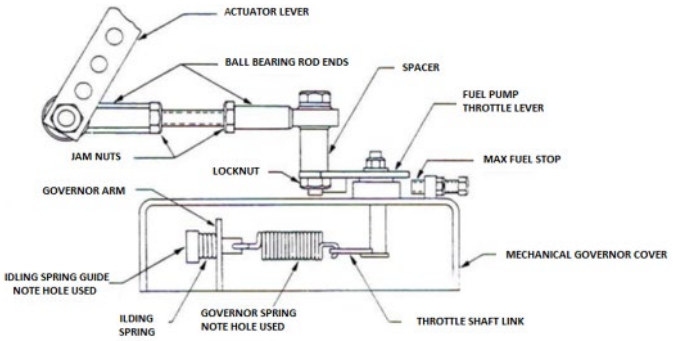
INSTALLATION INSTRUCTIONS ARE AVAILABLE ON THE GAC WEBSITE.

CUMMINS B SERIES ENGINE

GAC 120 SERIES ACTUATOR

CAV DPA ROTARY PUMP

LINKAGE



6BT ENGINE with BOSCH INLINE

Customer / OEM:	CUMMINS
Application(s):	Various
Engine Make / Model :	6BT 5.9
Fuel System Type & Make / Model:	Bosch Inline Pump, Diesel
Operating Speed(s):	173 HP @ 2500 RPM, B5.9
Battery Voltage:	12 or 24 V DC
Installed Products:	• Actuator: ADC175A • Speed Controller : ESD2210, ESD5111, or ESD5500E • Magnetic Speed Pickup: MSP6724 • Kits: EC1300, KT175-A-R or KT275

CUMMINS 6B/5.9L ENGINE WITH ADD175A ACTUATOR

GAC APPLICATION NOTE

6BTA ENGINE WITH CONTROL PANEL

Customer / OEM:	CUMMINS
Application(s):	Various
Engine Make / Model :	6BTA
Fuel System Type & Make / Model:	Bosch Inline Pump, Diesel
Operating Speed(s):	173 HP @ 2500 RPM, B5.9
Battery Voltage:	12 or 24 V DC
Installed Products:	• Actuator: Cummins • Speed Controller : ESD5500E • Cummins Power Command Panel

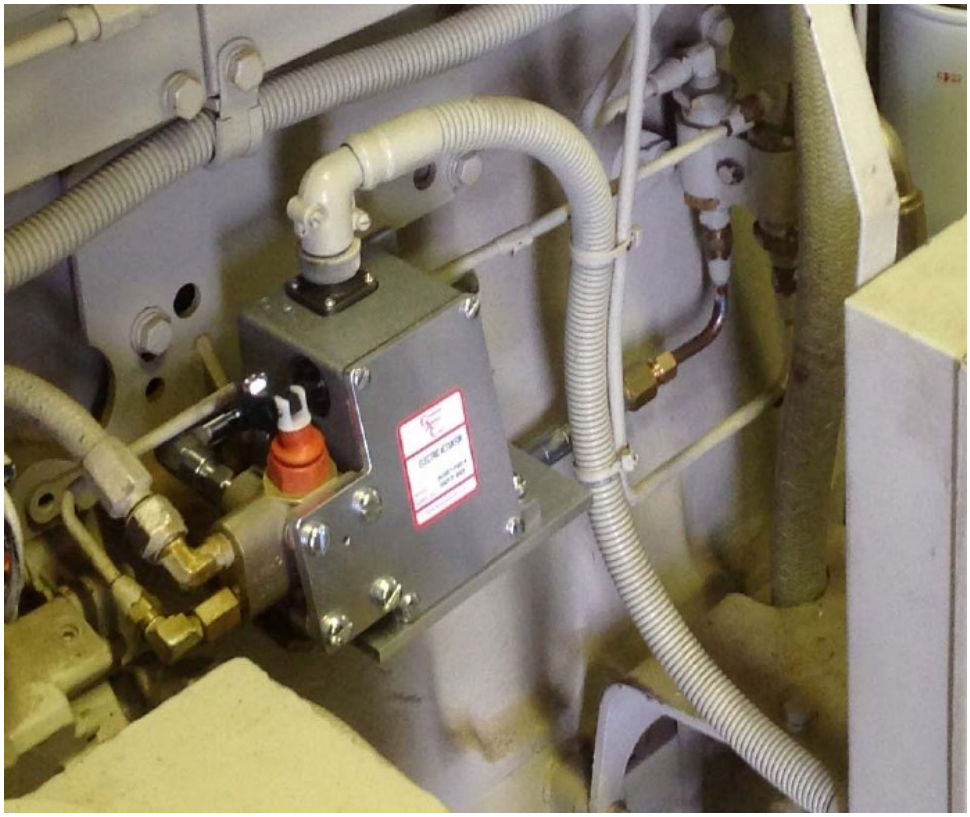
Summary: A failed Power Command panel upgraded with a new DSE panel and upgraded to the ESD5500E controller. This one was being upgraded by at a Rugby Club.

GAC APPLICATION NOTE

NT AND KT ENGINES

Customer / OEM:	Cummins
Application(s):	Various
Engine Make / Model / Displacement / Rating:	Cummins NT and KT engines with mechanical or EFC Systems
Equipment Make / Model:	
Fuel System Type & Make / Model:	Diesel, Cummins PT Fuel System
Operating Speed(s):	1800 RPM
Battery Voltage:	12, 24, or 32V
Installed Products:	• Actuator: ADB120E4 with BK115 • Speed Controller : ESD5522E • Magnetic Speed Pickup: MSP6724 or MSP6728C

CUMMINS NT855 WITH ADD120E4



GAC APPLICATION NOTE

NT, K19, K28, K38, K50 with EFC SYSTEM (PT PUMP)

Customer / OEM:	Cummins
Application(s):	Various
Engine Make / Model:	Cummins NT, K19, K28, K38, K50 with EFC System (PT pump)
Fuel System Type & Make / Model:	Diesel, Cummins PT Fuel System
Operating Speed(s):	1500 / 1800 RPM
Battery Voltage:	12 or 24 V DC
Installed Products:	• Speed Controller : ESD5522E • Interface Module: EAM100

INSTALLATION INSTRUCTIONS ARE AVAILABLE ON THE GAC WEBSITE.

CUMMINS K19, K38, AND K50 ENGINES

ESD5522E

EAM100

GAC APPLICATION NOTE (all of the components specified are sold separately)

4A2.0, 4A2.3 AND 4AT2.3 4 CYLINDER ENGINES

Applications: Generators, Compressors, Marine, others

Engine Make, Model: Cummins 4A2.0 (122 in³), 28.6 HP, 4A2.3 (140.3 in³), 33 HP and 4AT2.3 (140.3 in³) 4 cylinder in line engines

Fuel System: Indirect fuel injection

Operating Speed(S): Idle to 2800 rpm

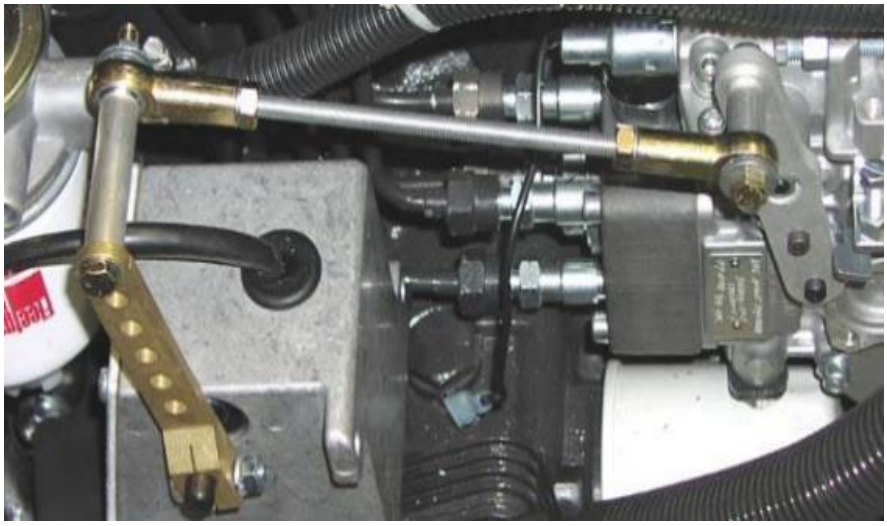
Battery Voltage: 12 or 24 V DC

Installed Products:

- **Actuator**: 120 Series-12/24 V Dc: Purchased Separately (Includes Lever Les1501)
- **Bracket** BK234: purchased separately
- **Hardware** kit KT234: purchased separately
- **Linkage** LKS234: purchased separately

Summary: DETAILED INSTALLATION INSTRUCTIONS are available on the GAC website for the 120 Series Installation Instructions and Parts List for Cummins 4A2.0, 4A2.3 and 4AT2.3 provide an electromechanical actuator used for engine fuel control positioning.

FINISHED INSTALLATION



GAC 120 SERIES

KIT

GAC APPLICATION NOTE (all of the components specified are sold separately)

3A1.4 & 3A1.7 3 CYLINDER ENGINES

Applications: Generators, Compressors, Marine, others

Engine Make, Model, Displacement: Cummins 3A1.4 (85.4 in³), 19.3 HP and 3A1.7 (103.7 in³), 41 HP, 3 cylinder in line engines

Fuel System: Indirect fuel injection

Operating Speed(S): Idle to 2800 rpm

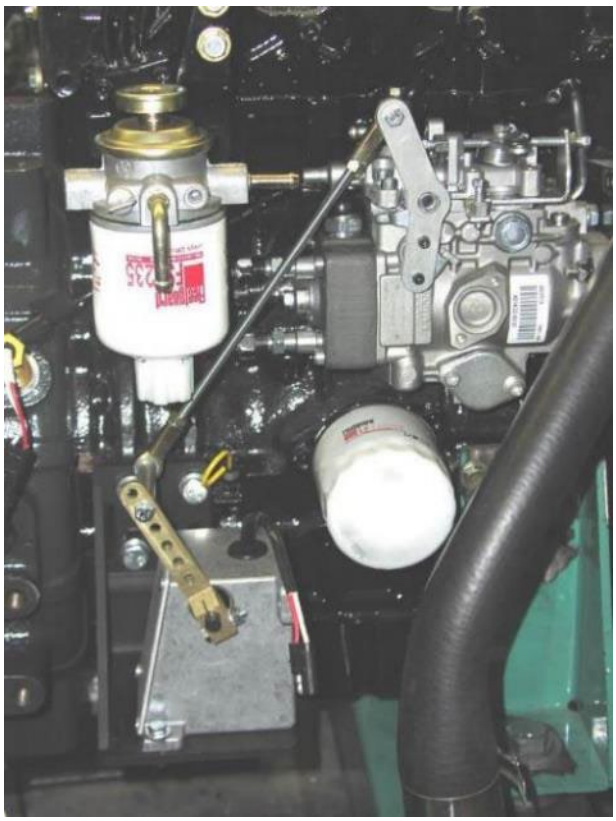
Battery Voltage: 12 or 24 V DC

Installed Products:

- Actuator: 120 Series-12/24 V Dc
- Bracket BK233: purchased separately
- Hardware KT233: purchased separately
- Linkage LKS233: purchased separately

Summary: DETAILED INSTALLATION INSTRUCTIONS are available on the GAC website FOR THE 120 Series Installation Instructions and Parts List for Cummins 3A1.4 and 3A1.7 provide an electromechanical actuator used for engine fuel control positioning.

FINISHED INSTALLATION



GAC120 WITH LEVER

BRACKET BK233, KIT KT233, LINKAGE

GAC APPLICATION NOTE

4B ENGINE with ZEXEL A

Customer / OEM:	CUMMINS
Application(s):	Various
Engine Make / Model:	4B 3.3-G1 with Zexel A
Fuel System Type & Make / Model:	Inline Diesel Pump
Operating Speed(s):	85 HP @ 2600 RPM
Battery Voltage:	12 or 24 V DC
Installed Products:	• Actuator: ADC175A with EC1300, KT175-RS-R-Zexel • Speed Controller: ESD2210 or ESD5111 • Magnetic Speed Pickup: MSP6728C

CUMMINS B3.3 ENGINE WITH ADC175A ACTUATOR

KT175-RS-R-ZEXEL INSTALLATION KIT

GAC APPLICATION NOTE (all of the components specified are sold separately)

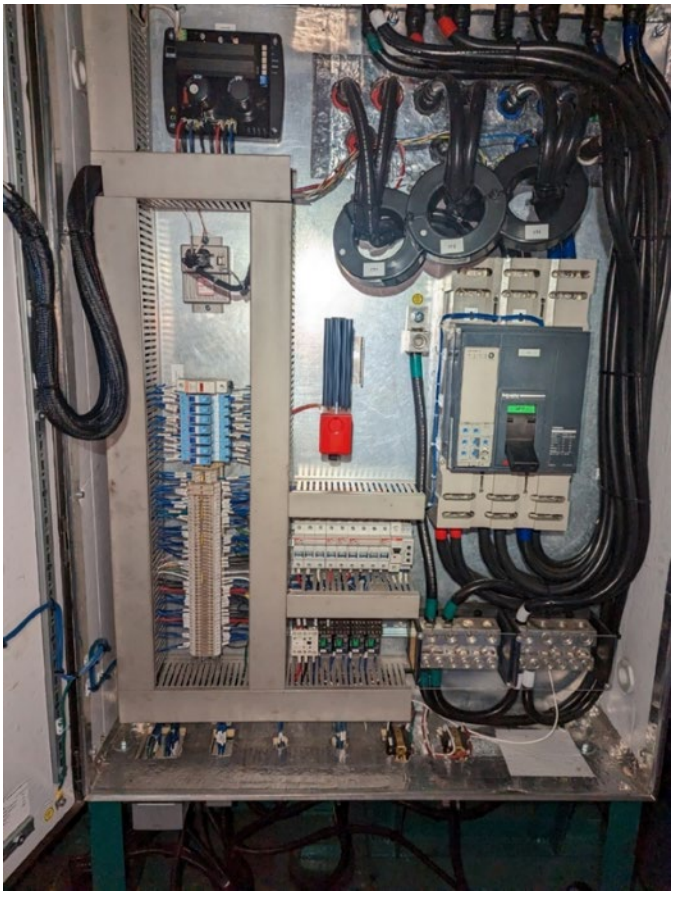
KTA19

Application(s): Container Crane, Generators
Engine Make, Model, Displacement Cummins KTA19
Fuel System Type & Make, Model: Diesel
Installed Products:
- Speed Controller: EEG7000

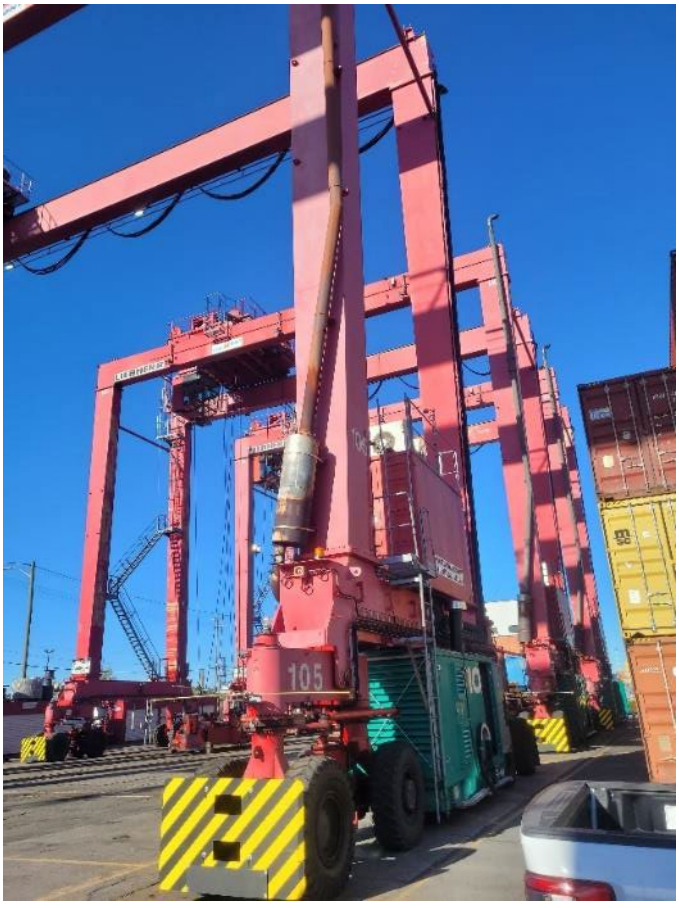
Summary: A container crane at a Canadian port asked for help fine tuning its new EEG7000. Communicating with Deep Sea DSE 7410-04 controller, the support personnel were very satisfied with the reliability and precision provided by the GAC unit.

The customer chose the EEG7000 speed controller because it allows the end user to modify or reinstall the original settings without updating the load bank; they just upload GACs free software and upload the saved configuration file and done. The EEG7000 replaced a Cummins (Onan) PCC3100 with integrated speed and voltage controller.

EEG7000



GANTRY CRANE WITH KTA19



GAC APPLICATION NOTE

KTA50-G9

Customer / OEM: Steel Mill
Application(s): Emergency Cooling System
Engine Make / Model: KTA50-G9 engine with a PT fuel system and EFC actuator
50.3 litre (3067 in.^{3})
16 cylinder
2 pump / 2 loop Cooler
Fuel System Type & Make / Model: Cummins PT™ direct injection
Operating Speed(s): 85 HP @ 2600 RPM
Battery Voltage: 24 V DC
Installed Products:

- Speed Controller: ESD5500E

Summary: DCML, a Cummins Distributor in Brazil, installed and maintains an emergency cooling water system using a KTA50-G9 engine with a PT fuel system and EFC actuator, controlled by an ESD5500E series speed control, to drive a water pump to displace 3600m3 of water per hour (over 951,000 gallons per hour). The pump runs on an automated system and comes on-line with a power failure or other interruption.

CUMMINS KTA50-G9 WITH ESD5500E

GAC APPLICATION NOTE

NA855

Customer / OEM: Johnson Irrigation
Application(s): Generator
Engine Make / Model: CUMMINS NA855
Fuel System Type & Make / Model: Natural Gas
Operating Speed(s):
Battery Voltage: 12 or 24 V DC
Installed Products:

- Actuator: ATB
- Speed Controller: EDG5500

Summary GAC worked with Johnson Irrigation, a third-generation full service engine and generator support house, to determine the optimal natural gas control system for their irrigation engines. The combination of GACs throttle body and EDG5500 speed controller provided a smooth result.

CUMMINS 855 WITH ATB ACTUATOR

ATB652T2N-24

EDG5500

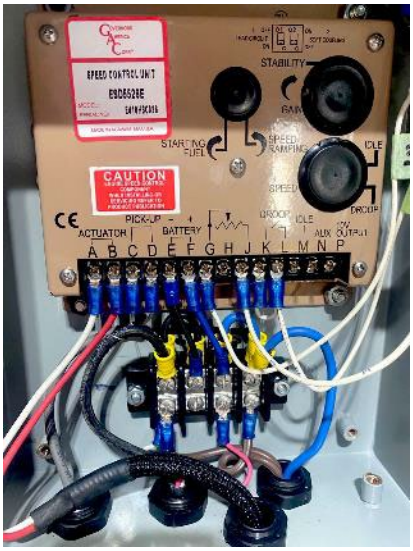
GAC APPLICATION NOTE

855

Customer / OEM:	PSS Governor Services
Application(s):	Irrigation Pump
Engine Make / Model:	CUMMINS 855
Fuel System Type & Make / Model:	Natural Gas
Operating Speed(s):	
Battery Voltage:	12 or 24 V DC
Installed Products:	• Actuator: ATB65 T2 • Speed Controller: ESD5500

Summary PSS Governor Services typically works with marine governors, but helped a local neighbor with an irrigation engine issue. The combination of GACs throttle body and ESD5500E speed controller was a quick improvement.

CUMMINS 855 WITH ATB ACTUATOR



ATB652T2N-24

ESD5500E

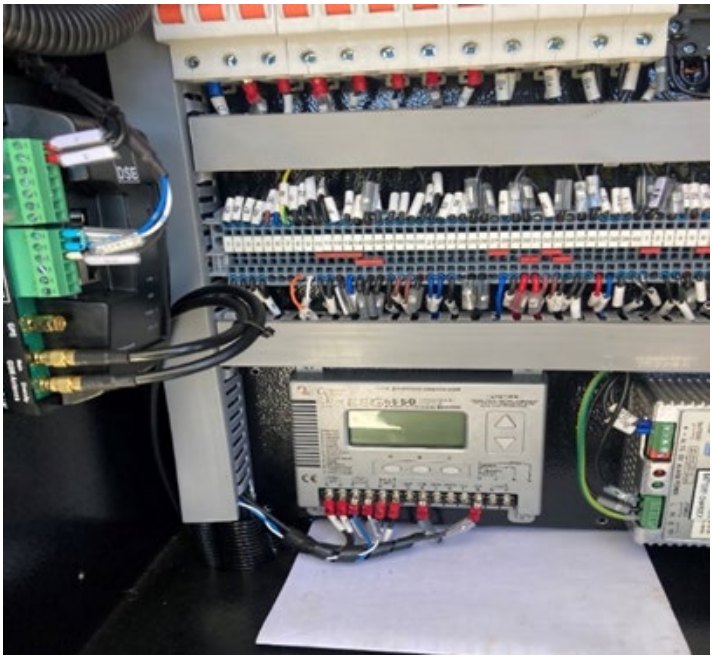
GAC APPLICATION NOTE

NTA855 DIESEL ENGINE CONVERTED TO GAS

Customer / OEM:	CUMMINS
Application(s):	Generator
Engine	NTA855
Equipment Make / Model:	
Fuel System Type & Make / Model:	Diesel
Battery Voltage:	12 or 24 V DC
Installed Products:	• Actuator: ATB652T2F14 • Speed Controller: EEG6550 in a non-synchronizing application

Summary: Jubilee built the single engine generator using the connection between the DSE generator control panel and the ESD6550 speed controller to control the fuel relay. This allows the speed controller to operate independently of the generator controller with normal shutdown and emergency shutdown removing power from the governor to stop the engine.

EEG6550



ATB652T2F14

GAC APPLICATION NOTE

C1400 DIESEL ENGINE

Customer / OEM:	CUMMINS
Application(s):	Generator
Engine	C1400
Engine Make / Model:	Cummins C1675, Cummins C1400, Cummins C825
Fuel System Type & Make / Model:	Diesel
Battery Voltage:	12 or 24 V DC
Installed Products:	• Speed Controller: ESD5520E • Stamford AVR • Control Panel: DSE

Summary This retrofit included changing out the governor and AVR and connecting into a Deep Sea DSE controller on this C1400. High end horsepower also retrofit with the same on Cummins C1675, and C825s.

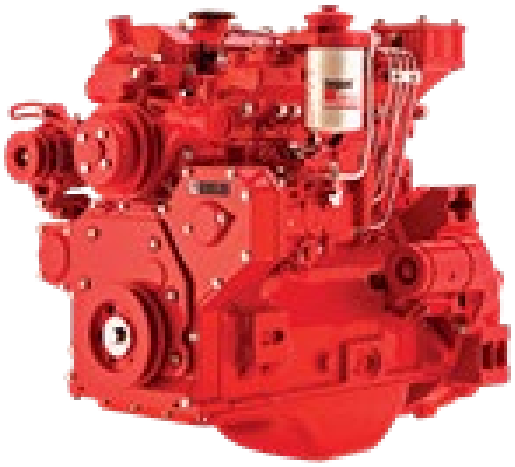
ESD5520E

GAC APPLICATION NOTE

4B AND 6BT ENGINES with STANADYNE ROTARY PUMP

Customer / OEM:	CUMMINS
Application(s):	
Engine Make / Model / Displacement / Rating:	4B 3.9, 4B 3.9-G1(2), and 6BT 5.95-G1 with Stanadyne
Equipment Make / Model:	
Fuel System Type & Make / Model:	Stanadyne Rotary Pump, Diesel
Operating Speed(s):	173 HP @ 2500 RPM, B5.9 124 HP @ 2200 RPM, B3.9
Battery Voltage:	12 or 24 V DC
Recommended Products:	• Actuator: ADC100-12/24 • Speed Controller: ESD5120 or ESD5522E • Magnetic Speed Pickup: MSP6724 or MSP6728C

CUMMINS B SERIES ENGINES



ACTUATOR ADC100

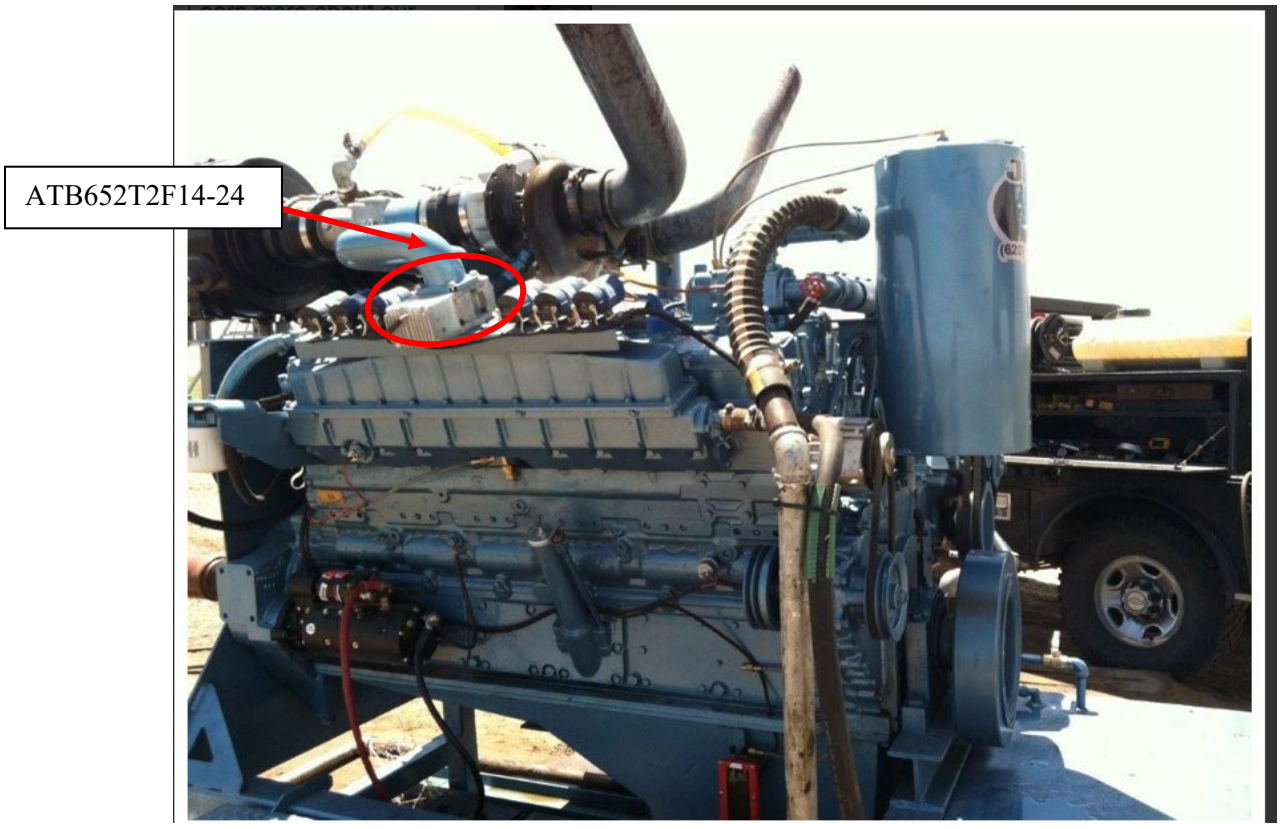
GAC APPLICATION NOTE

VT1710 ENGINE

Customer / OEM:	JIES Johnson Irrigation Engine Service
Application(s):	Irrigation
Engine Make / Model:	VT1710
Fuel System Type & Make / Model:	Natural Gas
Operating Speed(s):	685 HP @ 2100 RPM
Battery Voltage:	24 V DC
Installed Products:	• Actuator: Dual ATB652T2F14-24 • Speed Controller: ESD5111 • Dual Driver Module: DDM101-PIB4134 • Thermocouples: STE101

Summary: The Cummins VT1710 Engine requires two gaseous throttle body Actuator, each receiving equal fuel levels. The Dual Driver Module (DDM101) is used to regulate the fuel in each cylinder using its fuel and exhaust temperature balance. Using the DDM101, none, one, or two actuators can have droop. Two thermocouples measure, track, and therefore trim the balance based on exhaust temperatures.

CUMMINS VT1710 ENGINE



GAC APPLICATION NOTE

KTTA50L DIESEL ELECTRIC LOCOMOTIVE

Customer / OEM:	CUMMINS INDIA LTD.
Application(s):	Locomotive
Engine Make / Model:	Cummins KTTA50L4, 50L, 16 Cylinder, Equipped with Twin Turbo Chargers / Charge Air Cooled
Fuel System Type & Make / Model:	Cummins PT Fuel System, Diesel
Operating Speed(s):	Rated at 2000BHP @ 1900 RPM
Battery Voltage:	12, 24, or 32 V DC
Installed Products:	• Actuator: ADB120E4 • Speed Controller: LCC107B

Summary: The LCC107B Closed Loop PID Speed Control Features Overspeed Sensing, Start Fuel Adjustments, Speed Selects and Excitation Control. 16 Cylinder, 2000 BHP/1900 RPM C.I.L. Engine Installation. Twin Turbo Chargers / Charge Air Cooled

ACTUATOR - ADB120E4

C.I.L. KTTA-50-L4 ENGINE INSTALLATION

LCC107B MODULE MOUNTED IN CONTROLS CABINET

DIESEL-ELECTRIC LOCOMOTIVE

GAC APPLICATION NOTE (all of the components specified are sold separately)

855 NATURALLY ASPIRATED NATURAL GAS

Application(s): Generators, Compressors, Others
Engine Make, Model, Displacement Cummins 855 NA (14L)
Equipment Make, Model:
Fuel System Type & Make, Model: Natural Gas
Operating Speed(s): 650 to 2400 RPM
Battery Voltage: 12 or 24 V DC
Recommended Products:

- Speed Controller: ESD5526E
- Actuator: ATB652T2N-12 or 24
- Magnetic Speed Pickup: 5/8-18 UNF-2A
- Adaptor Plates: KT425, KT855

Summary: Complete Electronic Governor using GAC ATB throttle body, Speed Controller, and Customer supplied IMPCO 425 carburetor.

DETROIT ENGINES

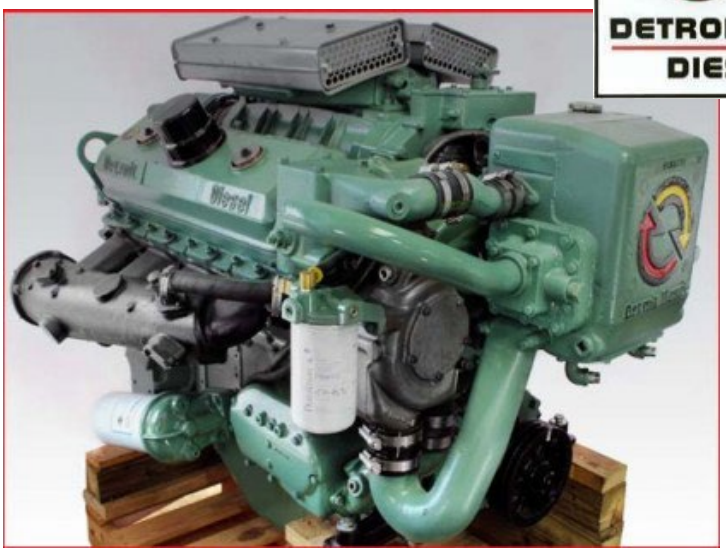
ENGINE MODEL	ACTUATOR	SPEED CONTROLLER	MSP	ACCESSORIES
3-71, 4-71 & V8-71	ADD225 ADB225 ADC225	ESD5111 ESD5500E	MSP6728C MSP679	KT170
V12-71, V8-92 & V12-92	ADB225 ADC225	ESD5111 ESD5500E	MSP6728C MSP679	
V16-71, V24-71, V16-92, V12-149 & V16-149	ACB2001 ADC225	ESD5330	MSP6728C MSP679	EAM104
DDEC Engines		EAM104		

GAC APPLICATION NOTE

3-71, 4-71, 6-71, and V8-71 ENGINES

Customer / OEM:	DETROIT DIESEL
Application(s):	Various
Engine Make / Model:	3-71, 4-71, 6-71 and V8-71
Equipment Make / Model:	
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	84 kW, 113 HP @ 2100 RPM, 3-71 116 kW, 155 HP @ 2100 RPM, 4-71 177 kW, 238 HP @ 2100 RPM, 6-71 237 kW, 318 HP @ 2100 RPM, V8-71
Battery Voltage:	12 or 24 V DC
Recommended Products:	• Actuator: ADD225, ADB225, or ADC225 with kit KT170 • Speed Controller: ESD5111 or ESD5500E • Magnetic Speed Pickup: MSP6728C or MSP679

DETROIT 3-71, 4-71, 6-71 AND V8-71 ENGINES



GAC APPLICATION NOTE

V12-71, V8-92, and V12-92 ENGINES

Customer / OEM:	DETROIT ENGINES
Application(s):	Various
Engine Make / Model:	V12-71, V8-92, V12-92
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	355 kW, 553 HP @ 2100 RPM, V12-71 321 kW, 430 HP @ 2100 RPM, V8-92 522 kW, 700 HP @ 2100 RPM, V12-92
Battery Voltage:	12 or 24 V DC
Installed Products:	• Actuator: ADC225 or ADB225 • Speed Controller: ESD5111 or ESD5500E • Magnetic Speed Pickup: MSP6728C or MSP679

DETROIT V12-71, V8-92, AND V12-92 ENGINES

GAC APPLICATION NOTE

V16-71, V24-71, V16-92, V12-149, and V16-149 ENGINES

Customer / OEM:	Detroit Engines
Application(s):	Various
Engine Make / Model:	V16-71, V24-71, V16-92, V12-149, V16-149
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	540 kW, 724 HP @ 2100 RPM, V16-71 716 kW, 960 HP @ 2100 RPM, V16-92 1007 kW, 1350 HP @ 1900 RPM, V12-149 1343 kW, 1800 HP @ 1900 RPM, V16-149
Battery Voltage:	24 V DC
Recommended Products:	• Actuator: ACB2001 or ADC225 • Speed Control: ESD5330 • Magnetic Speed Pickup: MSP6728C or MSP679

DETROIT V16-71, V16-92, V12-149 AND V16-149 ENGINES

ACTUATOR ACB2001

ESD5330

MAGNETIC SPEED PICKUPS MSP6728C AND MSP679

GAC APPLICATION NOTE

DDEC ENGINES

Customer / OEM:	Detroit Engines
Application(s):	Various
Engine Make / Model :	DDEC Engines
Fuel System Type & Make / Model:	Various
Operating Speed(s):	
Battery Voltage:	24 V DC
Recommended Products:	• Interface Module: EAM104

Summary: The GAC interface module EAM104 provides for isochronous parallel operation with GAC auto synchronizer and precision load sharing.

EAM104 INTERFACE MODULE

DEUTZ

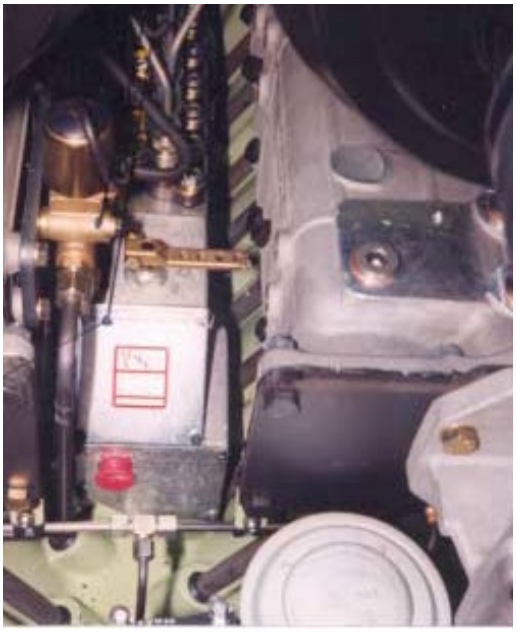
DEUTZ ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
616 Series	ACB275H-S1			
620	ACE295-24			
912 & 913	ADE176AA			
1011 & 2011	ACD110-12 / 24			
1012, 1013 & 2012	ADD180G-12/24	ESD5111 ESD5500E		KT188
1015 FIMS	ATB552T2N-12	AFR210 ICM200-6		MX60-STM SCI100, SCI103 RPR104 CL602, BK601 SPM200-1B STE101 SOX102, SPO100 STC101 GR104, 303082
1015/2015	ACE275J-24 ADD175A	ESD5500E		KT275
2008 Delphi Pump	ADD103B-12/24			
TWIN 12L513	ACE275K-24	ESD5221		RSC671
INTERFACE MODULE FOR EMR	ATB552T2F4-12 ATB401T1F4	EAM114 ESD2210-12/24 ESD5550	MSP6728C	MX60-STM SCI100, SCI103 RPR104 ICM200-6 CL602 BK601, BK604 SPM200-1B STE101, SOX102 SPO100, STC101 GR104, 303082 FIMS1500, SPM100 KT207, KT276 CH1220-L6, CH1208-L6 G 4 24V, G 4 12V CH1220, CH1230

GAC APPLICATION NOTE

MWM 616 SERIES

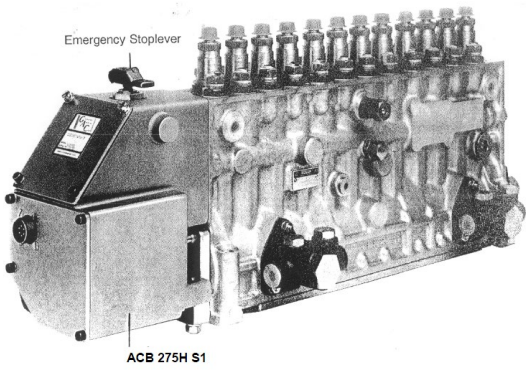
Customer / OEM:	DEUTZ MWM
Application(s):	Genset
Engine Make / Model :	616 Series Engines- TBD 616 V8/V12
Equipment Make / Model:	
Fuel System Type & Make / Model:	Diesel, Inline Pump
Operating Speed(s):	1500 / 1800 RPM
Battery Voltage:	24 V DC
Installed Products:	• Actuator: ACB275H S1 and ACB275G4-24

275 SERIES ACTUATOR ON DEUTZ MWM TBD 616 V8/V12



ACB275H S1

INTEGRAL ACTUATOR ON DEUTZ 616 SERIES ENGINE



GAC APPLICATION NOTE

MWM 620 with BOSCH P9/ P10 PUMP

Customer / OEM:	DEUTZ
Application(s):	Various
Engine Make / Model:	620 Engine
Fuel System Type & Make / Model:	Diesel, Bosch P9 and P10 Inline Pump
Operating Speed(s):	1500-1860 RPM
Battery Voltage:	24 V DC
Installed Products:	• Actuator: ACE295-24

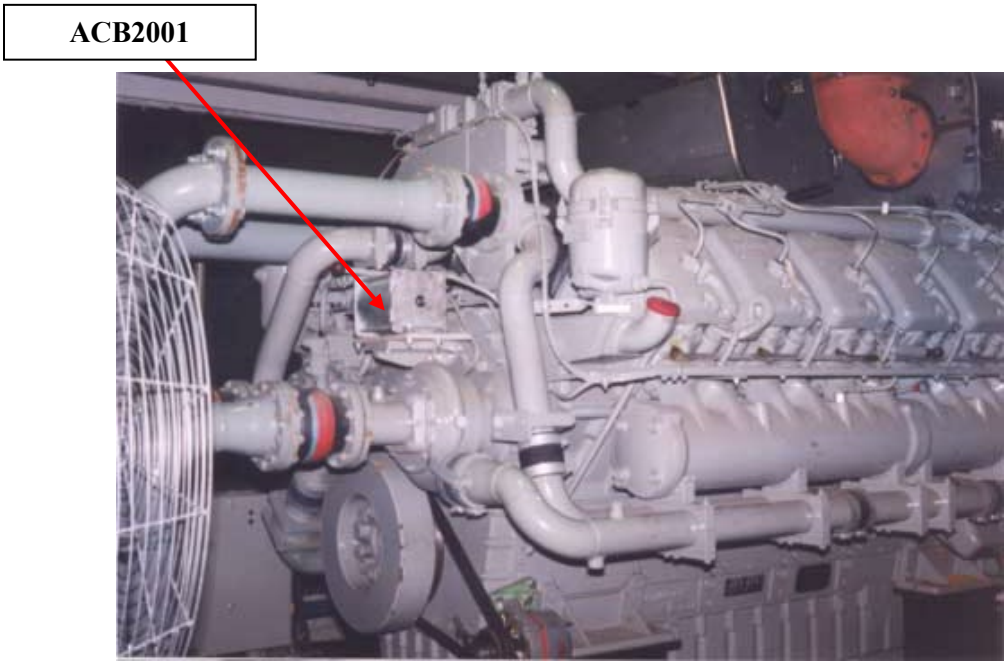
ACE295-24 ACTUATOR

GAC APPLICATION NOTE

MWM 620 V12 with BOSCH PE12/10/150/100LS54

Customer / OEM:	DEUTZ MWM
Application(s):	Industrial
Engine Make / Model:	Deutz MWM 620, V-12, 53.2 L
Fuel System Type & Make / Model:	Pump Bosch PE12/10/150/100LS54
Operating Speed(s):	Multiple
Battery Voltage:	24 V DC
Installed Products:	• Speed Controller: ESD5330 • Actuator: ACB2001

INSTALLED ACB2001



GAC APPLICATION NOTE

912/913 ENGINES

Customer / OEM:	DEUTZ
Application(s):	Various
Engine Make / Model:	912 and 913 Engine
Fuel System Type & Make / Model:	Diesel, Bosch A Inline Pump
Operating Speed(s):	
Battery Voltage:	12 or 24 V DC
Installed or Recommended Products:	Actuator: ADE176AA Series ○ 04233541-12V ○ 04233463-24V

DEUTZ 912 ENGINE

GAC APPLICATION NOTE

1011 and 2011 SERIES GEN-SETS

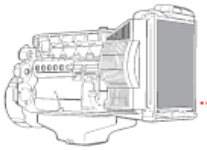
Customer / OEM:	DEUTZ
Application(s):	50 and 60 Hz Gen Drive Engines
Engine Make / Model / Displacement / Rating:	1011 and 2011 Series 2-, 3- and 4-Cylinder Engines. 0.73L/Cylinder, 1500, 1800 or 3000 RPM Applications
Equipment Make / Model:	
Fuel System Type & Make / Model:	Bosch Unit Pump, Diesel, Engine Mounted Pump
Operating Speed(s):	1500, 1800 and 3000 RPM
Battery Voltage:	12 or 24 VDC
Recommended Products:	• Actuator: ACD110-12/24

Summary: The ACD110 actuator mounts directly on the engine in place of the electric stop solenoid.

DEUTZ BF4L 1011 ENGINE

GAC EQUIPMENT ON DEUTZ 1011 SERIES ENGINES

GAC ACD110-12 = Deutz part number 0428 1525 KV-12
GAC ACD110-24 = Deutz part number 0428 1524 KV-24

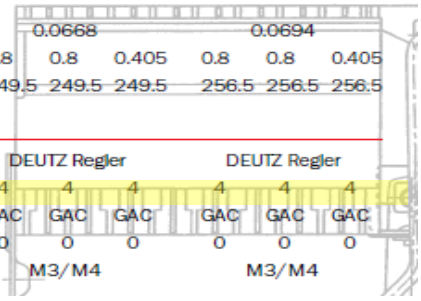


1011. Der Gen Motor.

18-60 kVA at 1500/1800/3000 min^{-1}

Technical data

Engine type		F2L 1011F	F3L 1011F			F4L 1011F			BF4L 1011F		
Speed	min^{-1}	3000	1500	1800	3000	1500	1800	3000	1500	1800	3000
Frequency	Hz	50	50	60	50	50	60	50	50	60	50
Engine/genset ratings[1]											
Continuous power, ICN (COP)[2]	kW	20.0	16.0	20.5	30.0	21.5	27.5	40.0	28.5	36.0	48.0
Prime power, ICN (PRP)[3]	kW	21.0	17.0	22.0	31.0	22.5	29.0	42.0	30.5	38.0	50.0
Limited-time running power, IFN (LTP)[4]	kW	22.0	18.0	23.0	33.0	24.0	30.5	44.0	32.0	40.0	53.0
Typical generator power output (COP)[5]	kVA	23.0	18.0	23.0	34.0	24.0	31.0	45.0	32.0	41.0	54.0
Typical generator power output (PRP)[5]	kVA	24.0	19.0	25.0	35.0	25.0	33.0	47.0	34.0	43.0	56.0
Typical generator power output (LTP)[5]	kVA	25.0	20.0	26.0	37.0	27.0	34.0	50.0	36.0	45.0	60.0
Basic engine data											
Inertia moment J											
– Engine without flywheel	kg/m^2	0.059		0.0678			0.0668			0.0694	
– Flywheel	kg/m^2	0.499	0.8	0.8	0.499	0.8	0.8	0.405	0.8	0.8	0.405
Weight, engine with radiator	kg	167	208	208	208	249.5	249.5	249.5	256.5	256.5	256.5
Governing											
Governor mechanical		DEUTZ Regler	DEUTZ Regler			DEUTZ Regler			DEUTZ Regler		
– Speed droop (static)	%	4	4	4	4	4	4	4	4	4	4
Governor electronic		GAC	GAC	GAC	GAC	GAC	GAC	GAC	GAC	GAC	GAC
– Speed droop (static, option)	%	0	0	0	0	0	0	0	0	0	0
Control quality[6]		M3/M4	M3/M4			M3/M4			M3/M4		

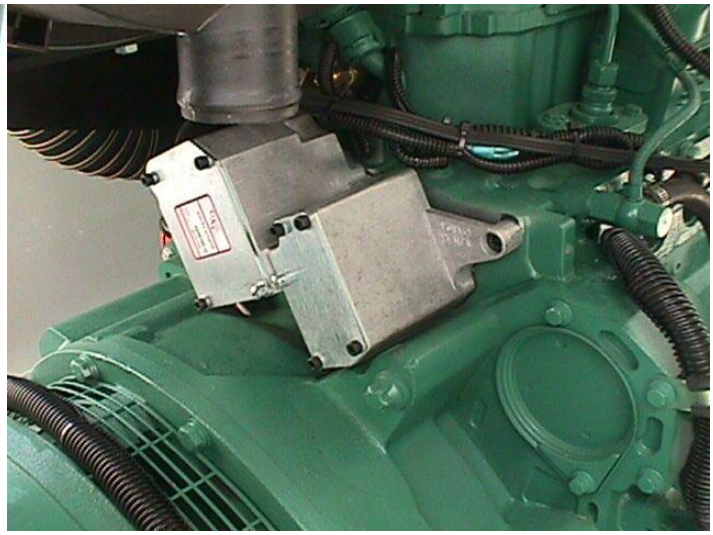


GAC APPLICATION NOTE

1012 and 1013 ENGINES

Customer / OEM:	DEUTZ / VOLVO
Application(s):	Engine
Engine Make / Model:	**Deutz:** • BF4M1012, Inline 3.19L 4 cylinder • BF6M1012, Inline 4.79L 6 cylinder • BF4M1013, Inline 4.76L 4 cylinder • BF6M1013, Inline 7.12L 6 cylinder • 2012 Engine **Volvo:** • 520 Inline 7.76L 4 cylinder • 720 Inline 7.15L 6 cylinder
Fuel System Type & Make / Model:	Diesel, Engine Mounted Pump
Operating Speed(s):	1500 / 1800 RPM
Battery Voltage:	12 or 24 V DC
Installed Products:	• Actuator: ADD180G with KT188 • Speed Controller: ESD5111 or ESD5500E

ENGINE MOUNTED ADD180G-12 OR -24 ACTUATOR



ADD180G

FREEZE PLUG INSTALLATION

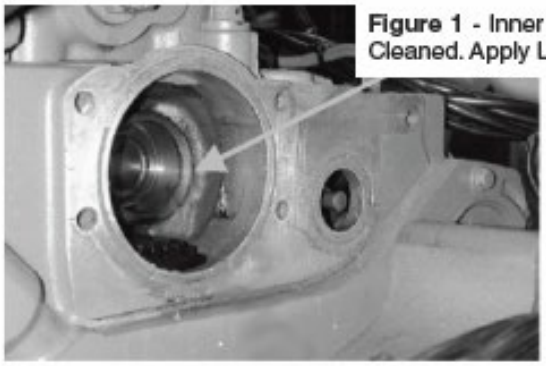


Figure 1 - Inner Bore to be Cleaned. Apply Loctite here.

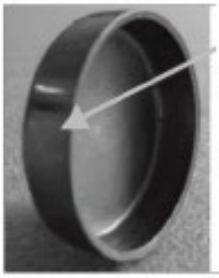


Figure 2 - Freeze Plug. Make sure this surface is clean and free of nicks or burrs. Use Loctite on outer surface.

FREEZE PLUG INSTALLATION

Figure 3 (left) & **4** (below) - Use a length of 38mm diameter steel pipe to drive the Freeze Plug into the engine's inner bore.

FREEZE PLUG INSTALLATION

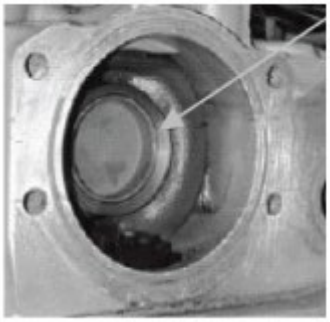


Figure 5 - Align the Freeze Plug to this edge.

GAC APPLICATION NOTE

BF6M1015GCP– FIMS

Customer / OEM: DEUTZ 1015 Series Engines
Application(s): LNG / CNG / Biogas Fueled Generator Set
Engine Make / Model: Deutz V6, 11.9L, Model #BF6M1015GCP Turbo Charged / Intercooled
Continuous Rating: 300 kW at 1500 RPM, 295 kW at 1800 RPM
Fuel System / Battery Voltage: Natural gas / 12 V DC
Operating Speed(s): 300 kW @ 1500 RPM, 295 kW @ 1800 RPM

Installed Products:

- ATB552T2N-12 55 mm Throttle Body Actuator
- AFR210 Integrated Venturi Mixer Control / Engine Speed Controller
- MX60-STM 60 mm Mixer with Stepper Motor
- SCI100 Variable Reluctance Speed Sensor
- RPR104 Zero Pressure Gas Regulator
- ICM200-6 Ignition Control Module
- CL602 Ignition Coil
- BK601 Coil Bracket, 6 Cylinder
- SPG100-002 Spark Plugs & Wires
- SPM200-1B 1 Bar MAP Sensor
- STE101 Exhaust Gas Temperature Sensor
- SOX102 O2 Sensor
- SPO100 Oil Pressure Sensor
- STC101 Coolant Temperature Sensor
- GR104 24-1, 68mm Trigger Wheel
- SCI103 Hall Effect Sensor / 90° Connector

Summary: Variations of the Deutz 6 cylinder 1015 LNG / CNG / Biogas fueled engines with GAC Fuel and Ignition Management System components are used in gen-sets, industrial and agricultural applications with wide range of power ratings.

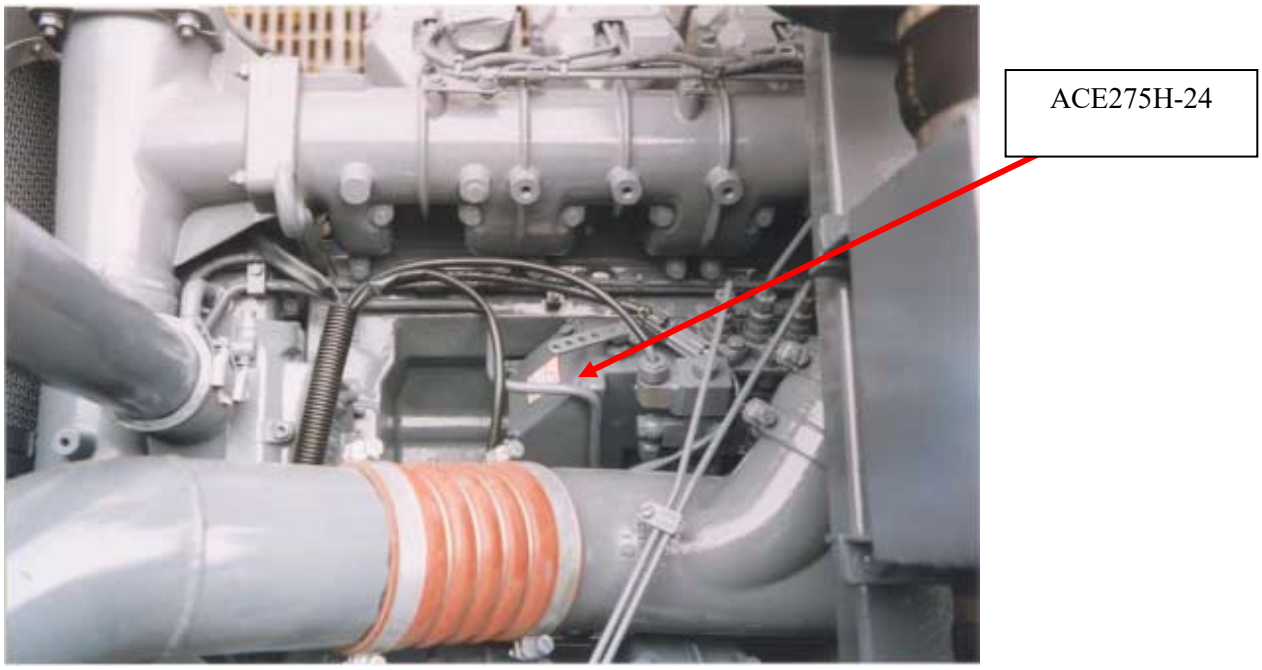
GAC FIMS SYSTEM ON DEUTZ 6 CYLINDER 1015 LNG / CNG / BIOGAS FUELED ENGINE

GAC APPLICATION NOTE

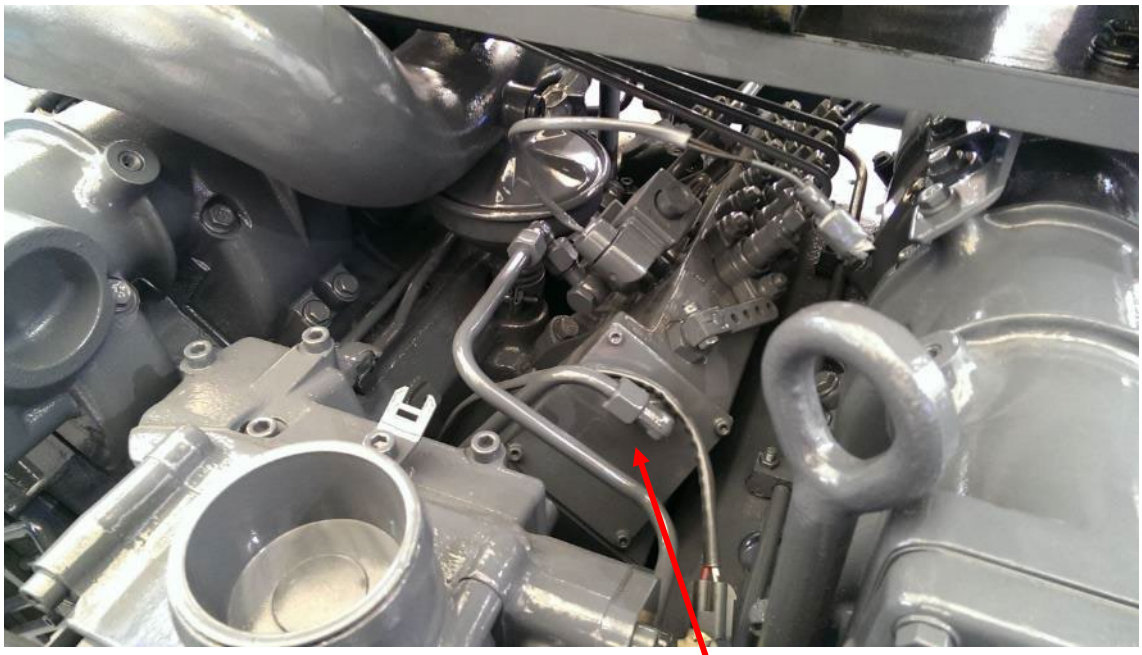
1015 ENGINES

Customer / OEM:	DEUTZ
Application(s):	Industrial, Mobile Equipment, Construction, Power Generation
Engine Make / Model:	Deutz 1015, V-8 15.87 L, or V-6 11.9L, Water Cooled, Turbocharged
Fuel System Type & Make / Model:	Diesel, Bosch Inline 6 or 8-cylinder, P3000 Series Pump
Operating Speed(s):	1500, 1800 RPM – Generator Min idle 550 RPM, maximum nominal speed 2100 RPM: mobile machinery
Battery Voltage:	24 V
Installed Products:	• Actuator: ACE275H-24 (standard unit) or ACE275J-24 (with oil drain fitting and high-torque return fitting – contact GAC for selection) • Speed Controller: ESD5500E • Mounting Kit: KT275 (P3000 Series Camshaft Bearing Retainer Kit) • EDC pump with ADD175A with KT197

ACE275H-24 ON V8 ENGINE



ACE275J-24 ON V6 ENGINE



ACE275J-24

Note: Oil drain on top cover

GAC APPLICATION NOTE

2008 ENGINE with DELPHI PUMP

Customer / OEM:	DEUTZ
Application(s):	
Engine Make / Model:	2008 Engine, Delphi Pump
Equipment Make / Model:	
Fuel System Type & Make / Model:	Diesel, Delphi DPG pump
Operating Speed(s):	36 HP @ 3000 RPM
Battery Voltage:	12 or 24 V DC
Installed Products:	• Actuator: ADD103B

ADD103 SERIES ACTUATOR

GAC APPLICATION NOTE

12L513 ENGINES

Customer / OEM: Alaska Runner Generators
Application(s): Hovercraft
Engine Make / Model: DEUTZ 12L513, V-12, 19.14 L
Equipment Make / Model: Alaskan AP188 Hovercraft Main Propellers
Fuel System Type & Make / Model: Diesel, Inline Pump
Operating Speed(s): 252-543 HP
Battery Voltage: 24 V DC
Installed Products:

- Actuator: ACE275
- Speed Controller: ESD5221
- Speed Ramping Controller: RSC671

Summary: The Alaskan AP188 Hovercraft uses two RCS671 controllers in conjunction with two ESD5221 controllers driving two ACE275 Actuator installed on the main propulsion engines, Deutz 12L513's, powering two 9 foot propellers.

ALASKAN AP188 HOVERCRAFT

GAC APPLICATION NOTE

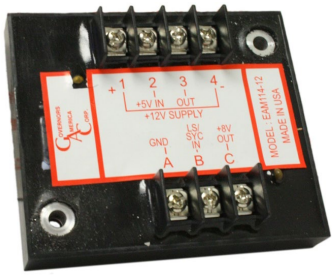
DEUTZ ENGINES with EMR INTERFACE MODULE

Application(s): Engine Control System
Engine Make / Model: DEUTZ EMR
Fuel System Type & Make / Model:
Operating Speed(s):
Battery Voltage: 12 or 24 V DC
Recommended Products:
- Interface Module: EAM114

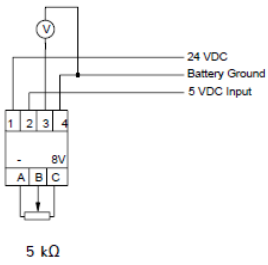
Summary: The EAM114 is an electronic interface module that provides signal conditioning to operate the DEUTZ EMR engine control system. It is typically used with a GAC auto synchronizing and load sharing system is connected to the DEUTZ EMR engine control system.

The DC supply for the interface comes from the common battery source for the Speed Controller and the accessory controls. The input to the module (Terminal B) is typically at 5.0 V DC, which represents the auto-sync and load sharing outputs analog signals. The output of the EAM114 to the EMR engine control is 2.5 V DC with the EMR 5.0 V DC reference connected to Terminal 2.

EAM114

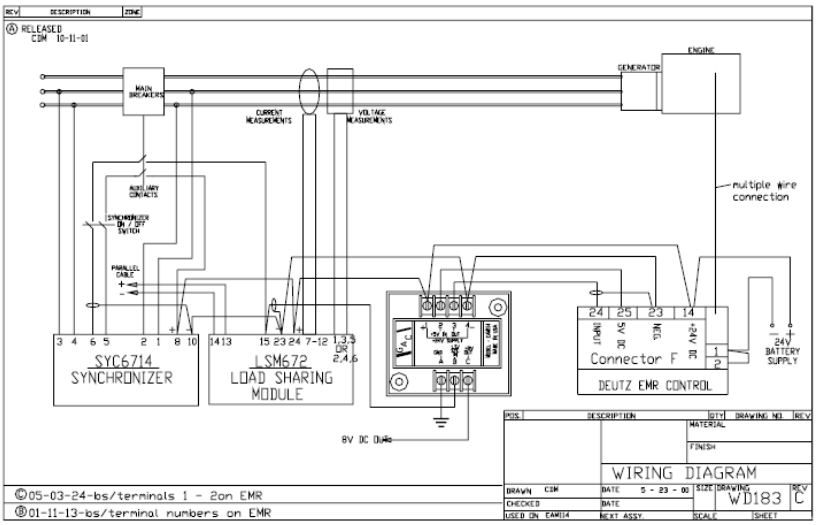


TESTING EAM114



DC Voltage Input at "B"	DC Voltage Output at "3"
0	5.7
2	5.7
3	5.7
4	4.5
5	2.5
6	0.5
7	0.45

WIRING DIAGRAM WD183C



DOOSAN

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
D1146T	ALN050	ESD5500E ESD5550 ESD5550M	MSP675	KT232R/231L JDR050

GAC APPLICATION NOTE

D1146T ENGINE

Customer / OEM:	Infracore
Application(s):	Power Generation
Engine Make / Model / Displacement / Rating:	DOOSAN D1146T 8.1L 6 Cylinder 1800 RPM 113 kW Continuous Power, 138 kW Standby 1500 RPM 97 kW Continuous Power, 118 kW Standby
Equipment Make / Model:	G-Drive
Fuel System Type & Make / Model:	Zexel In-Line "AD" Pump with RSV All Speed Governor
Operating Speed(s):	1500 / 1800 RPM
Battery Voltage:	12 or 24 V DC
Installed Products:	• Actuator: ALN050 • Speed Controller: ESD5500E • Magnetic Speed Pickup: MSP675 • Mounting Kit: KT232 mounts an ALN050 to onto a Bosch RSV governor (right side) run/stop lever. Kit KT231 is for left-side governor.

Summary: Doosan Infracore engines for power generation are built for maximum power output and durability and are installed in prime and standby generators worldwide.

DOOSAN D1146T ENGINE WITH GAC ALN050 ACTUATOR AND KT232

GAC APPLICATION NOTE

G200XF GENERATOR P086T

Customer / OEM: Emdad Energy Solutions
Application(s): Power Generation
Engine Make / Model / Rating: DOOSAN P086TI Tier 2 50Hz, 400-230 3-phaze
Fuel System Type & Make / Model: Diesel
Battery Voltage: 12 or 24 V DC
Installed Products:

- Actuator: Doosan
- Speed Controller: ESD5500E
- Control Panel: ComAp AMF8

Summary: Doosan G200XF generator with GAC ESD5500E successfully install for ComAp AMF8 for Doosan generator.

DOOSAN

FORD

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
300 natural gas or propane	ATB401T1N-12 or 24	ESD5159 ESD5526 ESD5500 EEG6500		EC1300 TP501 KT425-T2
460	ATB552T2N-12, 24	ESD5159 ESD5526 ESD5500-II EEG6500	MSP6729	KT41761 KT425-T2 TP501
460	ADC225GS -12 or 24	ESD5500E EEG6500	MSP6729	KT121M TP501

GAC APPLICATION NOTE (all of the components specified are sold separately)

460 IN^3 ENGINE, NATURAL GAS

Customer / OEM: The Governor Shop
Application(s): Generator, Power Generation,
Engine Make, Model, Displacement FORD 460 in³ with Woodward L-Series 8404-2009
Battery Voltage: 12 or 24 V DC
Installed Products:

- Speed Controller: EEG6500
- Throttle Body: ATB401T1N-12 or 24 V DC
- Magnetic Speed Pickup: MSP6729

Summary: The Governor Shop in Edmonton, Canada updated this turbocharged Ford 460 engine with a Woodward L-Series 8404-2009 to respond to load changes. It stalled for any appreciable load change. With the GAC ATB and EEG6500 installed, the engine had no trouble with turbo lag, the delay it had been experiencing during load transients caused by air-fuel ratio change needs.

FORD 460

ATB AND ESD6500 INSTALLATION

GAC APPLICATION NOTE (all of the components specified are sold separately)

300 IN³ ENGINE, NATURAL GAS or PROPANE

Customer / OEM: Electronic Governor Solution with GAC ATB (ref. KT300ATB)

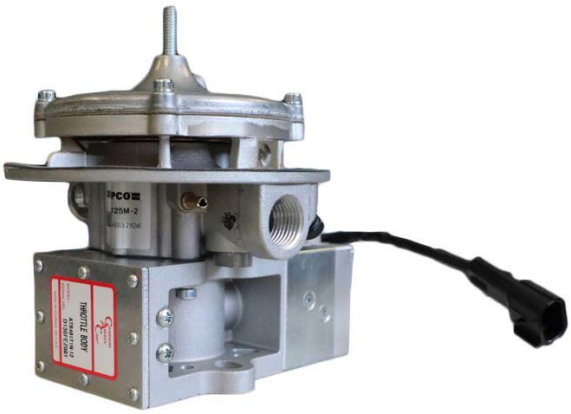
Application(s): Power Generation, Water Pump, Forklift, others
Engine Make, Model, Displacement FORD 300 in³ (4.9 L), 6 cylinders
Equipment Make / Model: Various
Fuel System Type & Make, Model: Impco 125 gas carburetor mixer (GAC part no. MX125M-2)
Operating Speed(s): Idle to 3600 RPM
Battery Voltage: 12 or 24 V DC
Installed Products:

- Speed Controller: ESD5159, ESD5526, ESD5500-II or EEG6500
- Throttle Body: ATB401T1N-12 or 24 V DC
- Magnetic Speed Pickup: MSP6729
- Mating Connector: EC1300
- 5K Potentiometer: TP501
- Air Filter (optional): AIR1-1

Summary: This a complete Electronic Governing system for the natural gas or propane fueled Ford 300 in³ engine using a Governors America Throttle Body with either a Customer or GAC supplied Impco 125 carburetor- mixer. COMPLETE INSTALLATION INSTRUCTIONS ARE AVAILABLE ON THE GAC WEBSITE.

MOUNTING MIXER-CARBURETOR ON ATB

The Impco 125 mixer carburetor can be purchased from GAC (MX125M-2) or customer supplied. Use the gaskets included with the carburetor to mount to the ATB.



OPTIONAL AIR FILTER

The optional air filter is recommended but not required.

GAC APPLICATION NOTE (all of the components specified are sold separately)

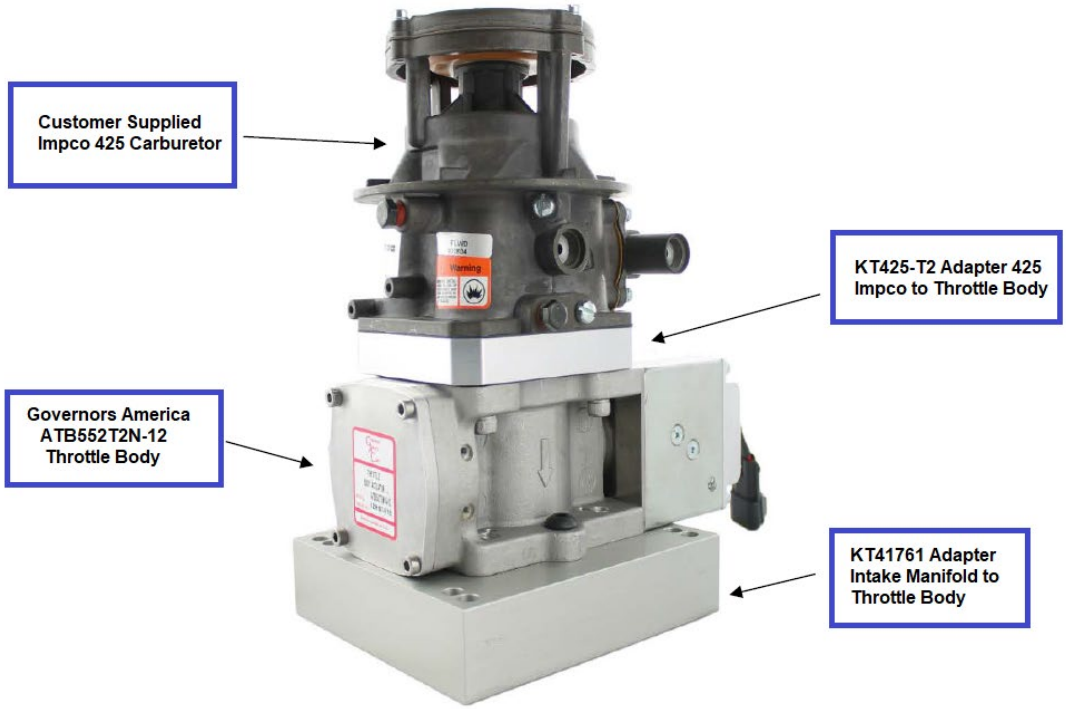
460 IN³ ENGINE, NATURAL GAS OR PROPANE

Customer / OEM: Electronic Governor Solution with GAC ATB (ref. KT460ATB)
Application(s): Power Generation, Water Pump, Forklift, others
Engine Make, Model: FORD 460 in³ (7.5 L), 8 cylinders
Fuel System Type & Make, Model: Impco 425 gas carburetor mixer (customer supplied)
Operating Speed(s): Idle to 3600 RPM
Battery Voltage: 12 or 24 V DC
Installed Products:

- Speed Controller: ESD5159, ESD5526, ESD5500-II or EEG6500
- Throttle Body: ATB552T2N-12 or 24 V DC
- Magnetic Speed Pickup: MSP6729
- Installation Kits:
  - KT41761 (intake manifold to throttle body-open square Holley Pattern)
  - KT425-T2
- 5K Potentiometer (optional): TP501

Summary: This a complete Electronic Governing system for the natural gas or propane fueled Ford 460 in³ engine using a Governors America Throttle Body with a Customer supplied Impco 425 carburetor- mixer. COMPLETE INSTALLATION INSTRUCTIONS ARE AVAILABLE ON THE GAC WEBSITE.

ELECTRONIC GOVERNING SYSTEM FOR FORD 460 IN³ NATURAL GAS OR PROPANE ENGINE



GAC APPLICATION NOTE (all of the components specified are sold separately)

460 IN³ NA or TURBOCHARGED ENGINE

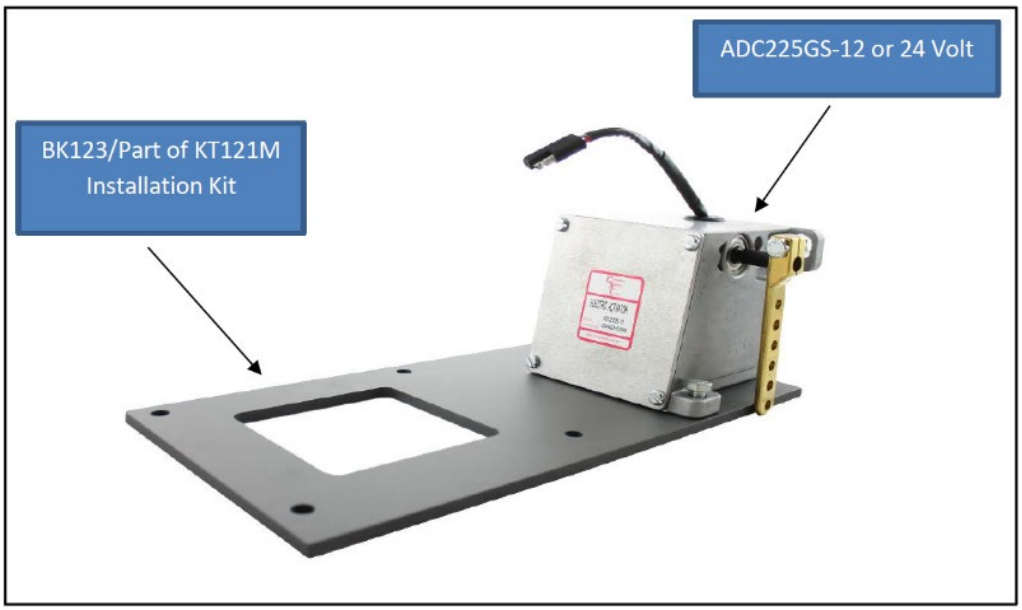
Customer / OEM:	Electronic Governor Solution with GAC 225 Series Actuator (KT460A)
Application(s):	Power Generation, Water Pump, Forklift, others
Engine Make, Model, Displacement	FORD 460 in³ (7.5 L), 8 cylinders
Equipment Make, Model:	Various
Fuel System Type & Make, Model:	Carbureted or Throttle Body
Operating Speed(s):	Idle to 3600 RPM
Battery Voltage:	12 or 24 V DC

Installed Products:

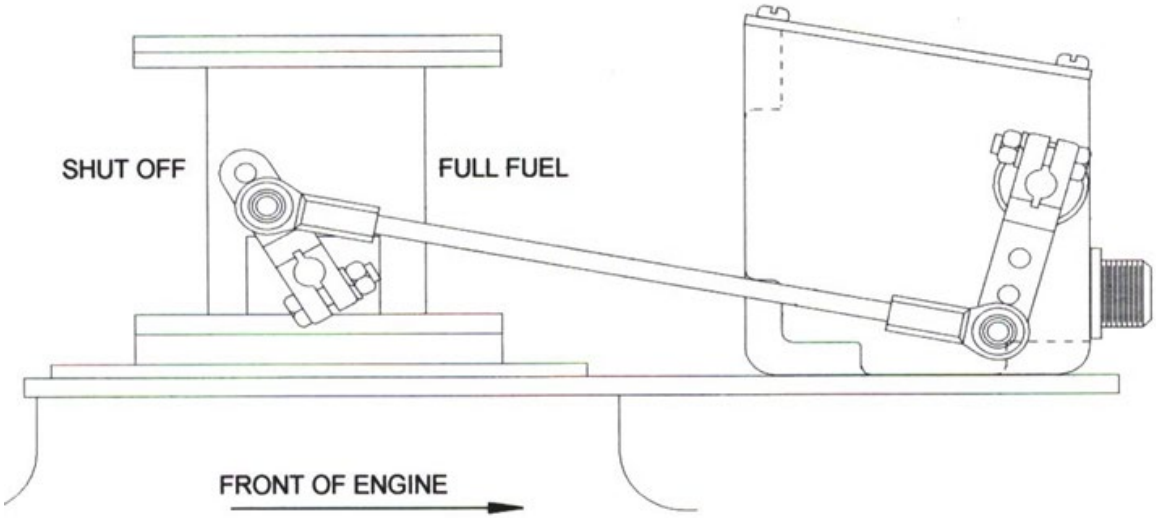
- Speed Controller: ESD5500E or EEG6500
- Actuator: ADC225GS -12 or 24 V DC
- Magnetic Speed Pickup: MSP6729
- Installation Kit : KT121M
- 5K Potentiometer (optional): TP501

Summary: This a complete Electronic Governing system for a carbureted or throttle body equipped Ford 460 in³ naturally aspirated (NA) or turbocharged engine using a Governors America 225 Series Actuator. COMPLETE INSTALLATION INSTRUCTIONS ARE AVAILABLE ON THE GAC WEBSITE.

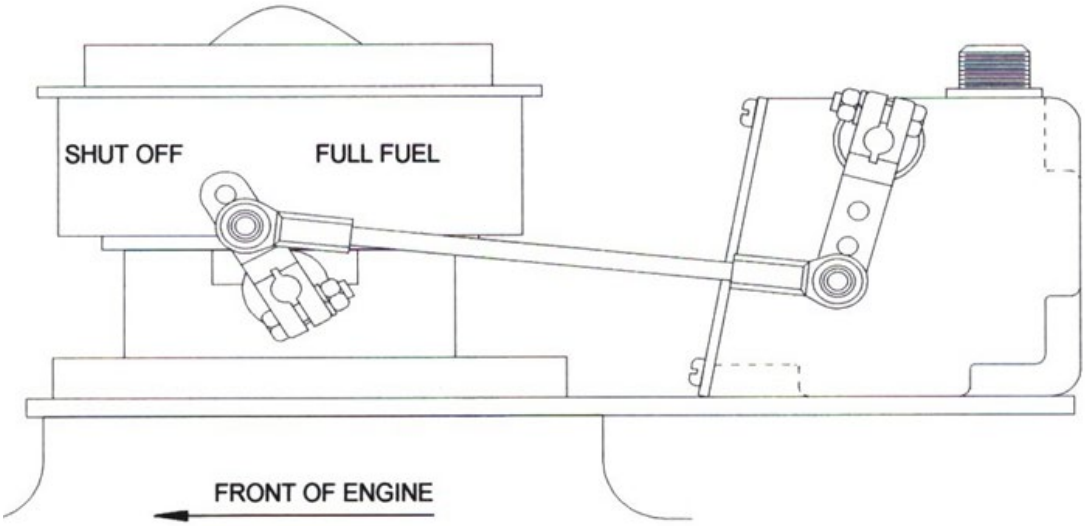
COMPLETE ELECTRONIC GOVERNING SYSTEM FOR A FORD 460 IN³ ENGINE



TURBOCHARGED



NATURALLY ASPIRATED



HATZ

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
1B Series	ADD107L01B-12/24			
35W Series	ADD107L35W-12/24		MSP6730	

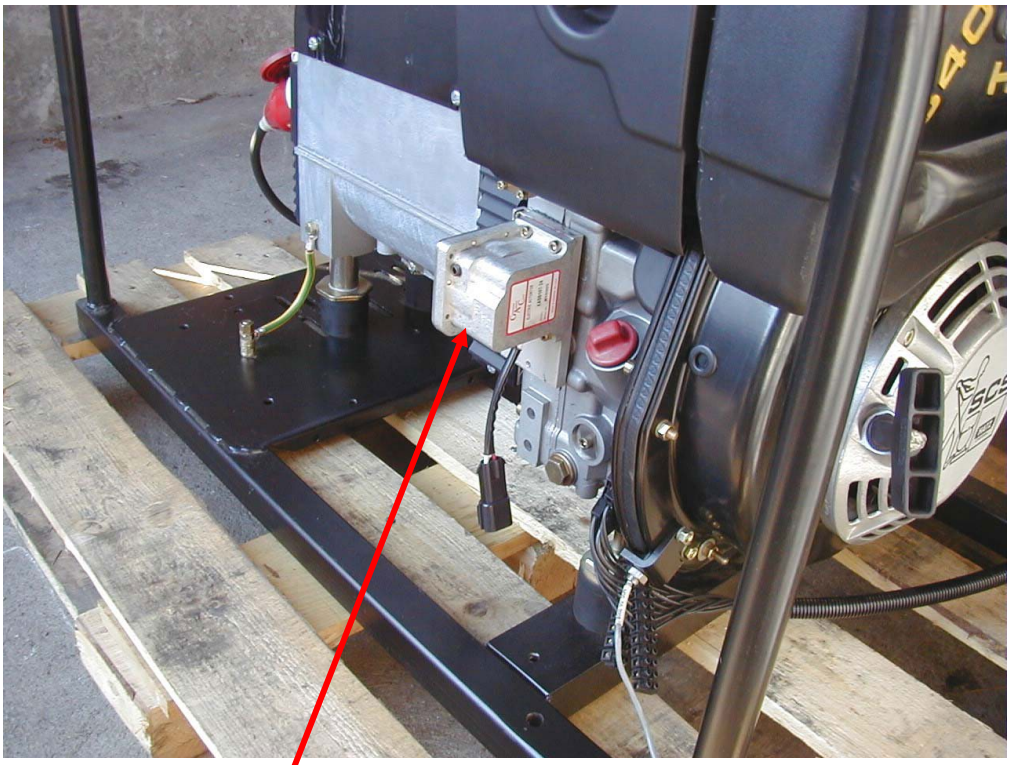
GAC APPLICATION NOTE

1B SERIES ENGINES

Customer / OEM:	Hatz
Application(s):	Various
Engine Make / Model:	1B
Equipment Make / Model:	HATZ 1B Series Engines
Fuel System Type & Make / Model:	Various
Operating Speed(s):	1.5 to 8 kW at max speed of 3600 RPM
Battery Voltage:	12 or 24 V DC
Installed Products:	• Actuator: ADD107L01B-12/24

Summary: Factory mounted, tested, and released system. (retrofit not recommended)
Isochronous and Droop operation
Works with SDG, IGC and ESD control-units

INTEGRAL ADD107 ACTUATOR ON HATZ 1B SERIES ENGINE



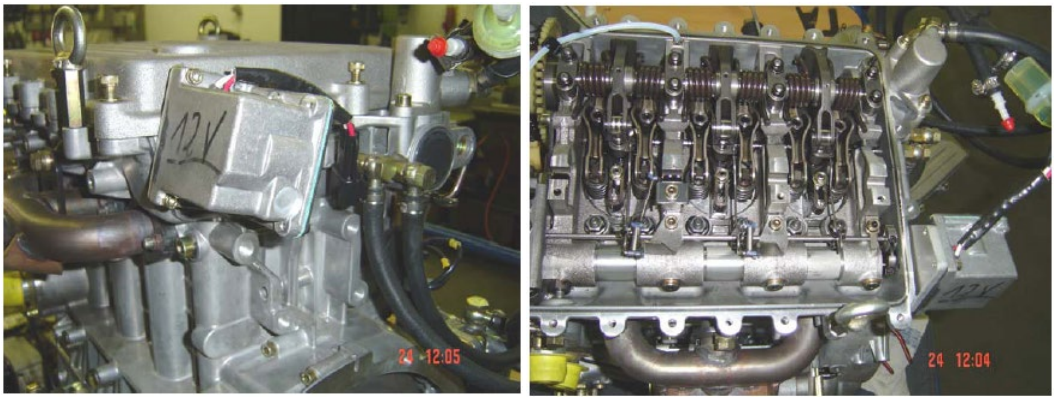
GAC APPLICATION NOTE

35W SERIES ENGINES

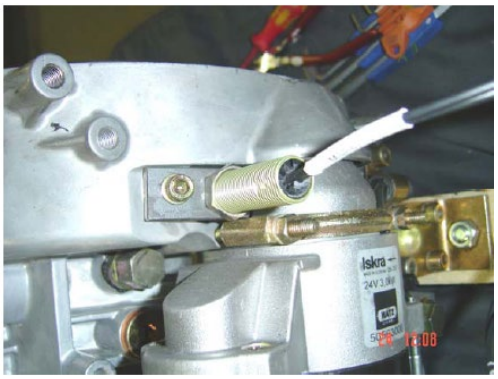
Customer / OEM:	Hatz
Application(s):	Various
Engine Make / Model :	35W
Equipment Make / Model:	HATZ 35W Series Engines
Fuel System Type:	
Battery Voltage:	12 or 24 V
Installed Products:	• Actuator: ADD107L35W-12/24 • Magnetic Speed Pickup: MSP6730

Summary: Factory mounted, tested, and released system. (retrofit not recommended)
Isochronous and Droop operation
Works with SDG, IGC, EDG and ESD control-units
Direct Link to the fuel rack

INTEGRAL ADD107 ACTUATOR ON HATZ 35W SERIES ENGINE



MSP6730 ON HATZ 35W SERIES ENGINE



JOHN DEERE

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
IRRIGATION PUMP	ADC120S-12/24	IGC745-02-04		
3029, 4045, 6068, with Stanadyne D-pump	ADC100	ECC328 (no mag pickup required) ESD22444, ESD2402 ESD5120, ESD5520 ESD5500-II	MSP 6728C	

GAC APPLICATION NOTE

JOHN DEERE DIESEL ENGINE with CAV-DPA ROTARY PUMP

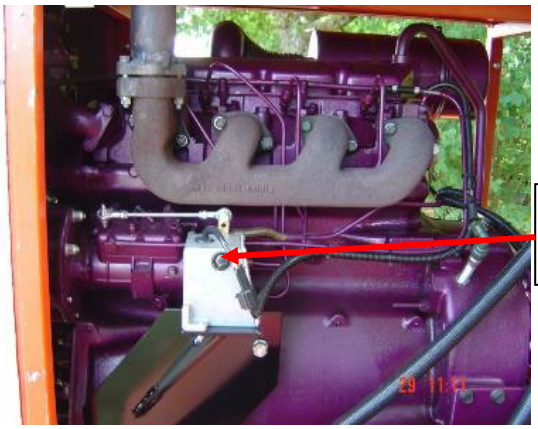
Customer / OEM:
Application(s): Irrigation Pump
Engine Make / Model : 2040, others
Equipment Make / Model: JOHN DEERE
Fuel System Type & Make / Model: Diesel, CAV-DPA Rotary Pump
Operating Speed(s):
Battery Voltage: 12 or 24 V DC
Installed Products:

- Actuator : ADC120S – 12/24
- Integrated Governor: IGC745-02-04

IRRIGATION PUMP

IGC ON IRRIGATION PUMP

ADC120S ACTUATOR ON IRRIGATION PUMP



BACK OF INTEGRATED GOVERNOR

VALVES

GAC APPLICATION NOTE

3029 / 4045 / 6068 WITH STANADYNE PUMPS

Customer / OEM: John Deere and Stanadyne

Application(s): Engine

Engine Make / Model / Displacement / Rating: JOHN DEERE 3029, Inline 3 cylinder, 2.9 L / 4045, Inline 4 cylinder, 4.4 L / 6068, Inline 6 cylinder, 6.8 L

Fuel System Type & Make / Model: Stanadyne D-series fuel injection pump

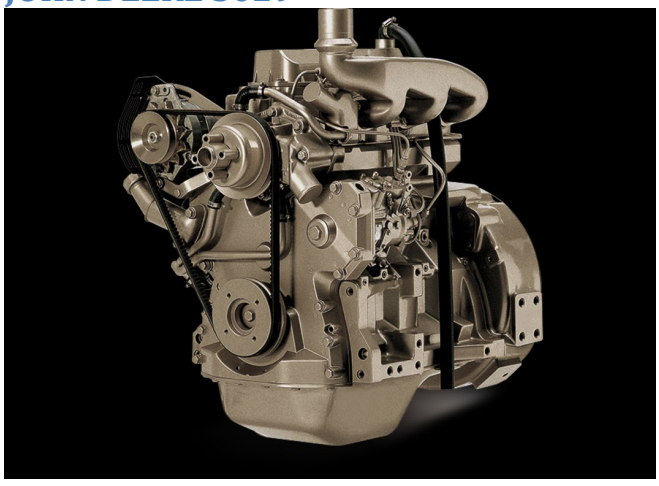
Operating Speed(s):

Battery Voltage: 12 or 24 V DC

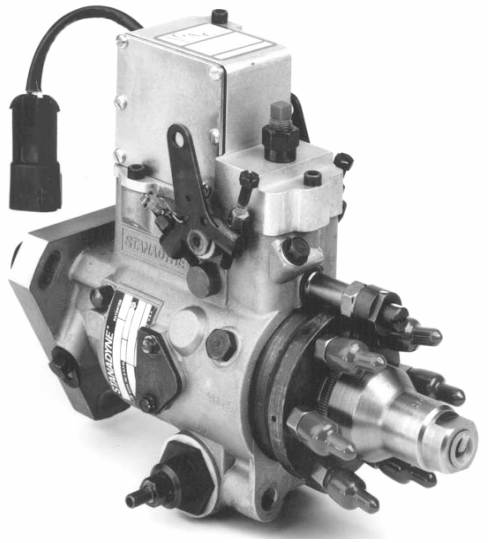
Recommended Products: Governor – light force

- ECC328 (no mag pickup required)
- ESD2244 (basic isochronous)
- ESD2402 (basic isochronous with idle and anti-windup)
- ESD5120 (isochronous, variable, and drip with no start fuel / speed ramping)
- ESD5520 (same as 5120 with start fuel and speed ramp control)
- ESD5526 (same as 5520 with anti-windup for gaseous applications)
- ESD5570 (same as 5520 with speed switch contacts)
- ESD5500-II (fusion series – all features of 5500 series)
- Actuator: ADC100-VV
- Magnetic Speed Pickup: MSP 6728C

JOHN DEERE 3029



ADC100 ON PUMP



IVECO

A cross reference a GAC replacement with an Iveco part numbers see the cross reference at the end of this guide **here.**

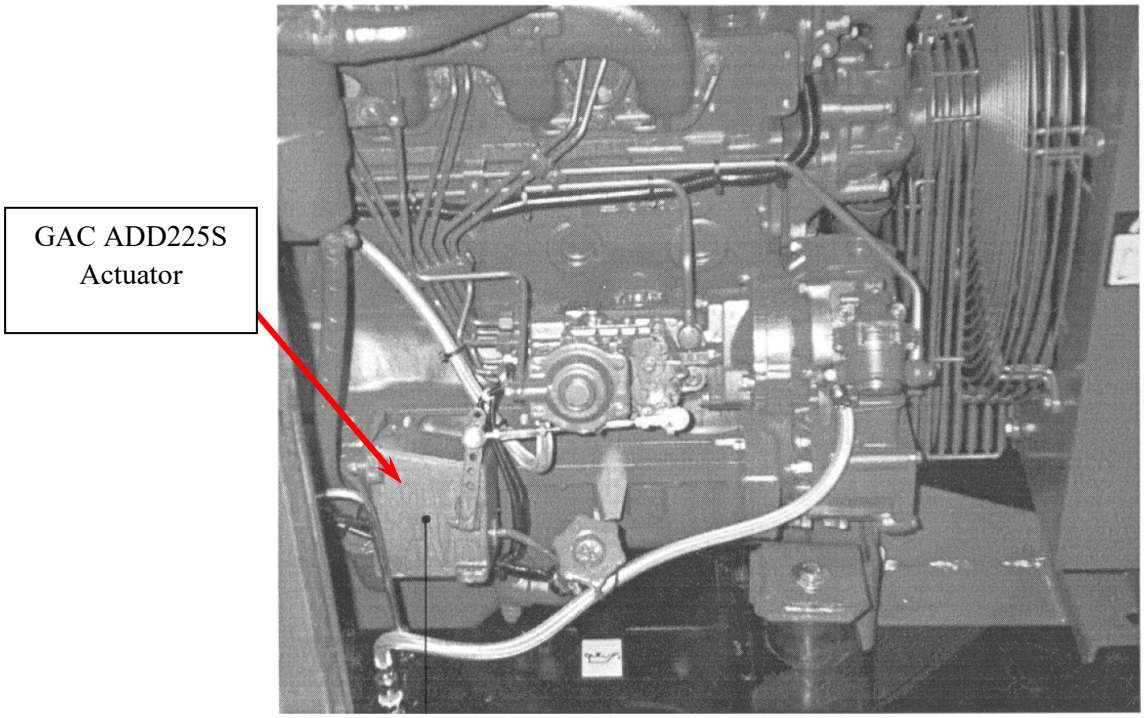
ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
7450, 7675, 8031 & 8061	ADD225S-12 ADD225S-24 ADB225F ACB2001 ACD275H ADD225SC-12, -24 ADD175A-24 ADC100-12, -24	ESD5111 ESD5500E ESD5330 EGS1013 ESD5330 SDG721 SDG725	MSP6721C MSP6728C MSP6732	KT276 KT275

GAC APPLICATION NOTE

7450, 7675, 8031, and 8061 ENGINES

Customer / OEM:	IVECO
Application(s):	Power Generation
Engine Make / Model:	IVECO 7450 Inline 4 cylinder, 5.0 L / 7675, Inline 6 cylinder, 7.5 L / 8031, Inline 3 cylinder, 2.9 L / 8061, Inline 6 cylinder, 5.9 L
Fuel System Type & Make / Model:	Diesel, Bosch VE Pump
Operating Speed(s):	1500 RPM
Battery Voltage:	12 or 24 V
Installed Products:	• Actuator: ADD225S-12/24 or ADC225S-12/24 • Speed Controller: ESD5111 or ESD5500E

ADD225S ACTUATOR ON IVECO 7450, 7675, 8031 AND 8061 ENGINES



KIRLOSKAR

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
6SL8800TA	ADC225D1S	ESD5160		
DV8, DV10 & DV12	ADD175SA-24	ESD5550		

GAC APPLICATION NOTE

6SL8800TA ENGINE with INLINE PUMP

Customer / OEM:	KIRLOSKAR Oil Engines Ltd. – Pune, India
Application(s):	Fire Pump
Engine Make / Model:	Kirloskar 6SL8800TA
Fuel System Type & Make / Model:	Diesel, Inline pump
Operating Speed(s):	355 HP @ 2100 RPM
Battery Voltage:	24 V DC
Installed Products:	• Actuator: ADC225D1S • Speed Controller: ESD5160

Summary: The **ESD5160** speed control is specifically designed for fire pump applications. It is CE certified, reverse acting and has an extended speed range. It has adjustable PID for either isochronous, variable or droop governing.
The **ADC225D1S** actuator has an extended universal through shaft and internal dual return springs for fail-safe operation.

KIRLOSKAR FIRE PUMPS

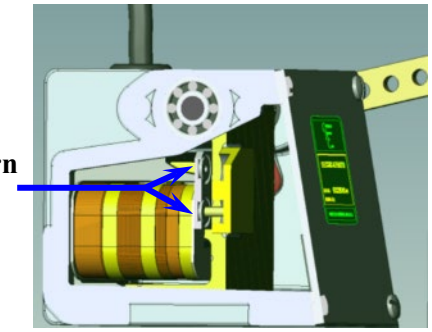
Fire Fighting Pumps - Kirloskar 6SL8800TA Engines Rated 355 HP / 2100 RPM

GAC EQUIPMENT ON KOEL FIRE PUMP APPLICATION

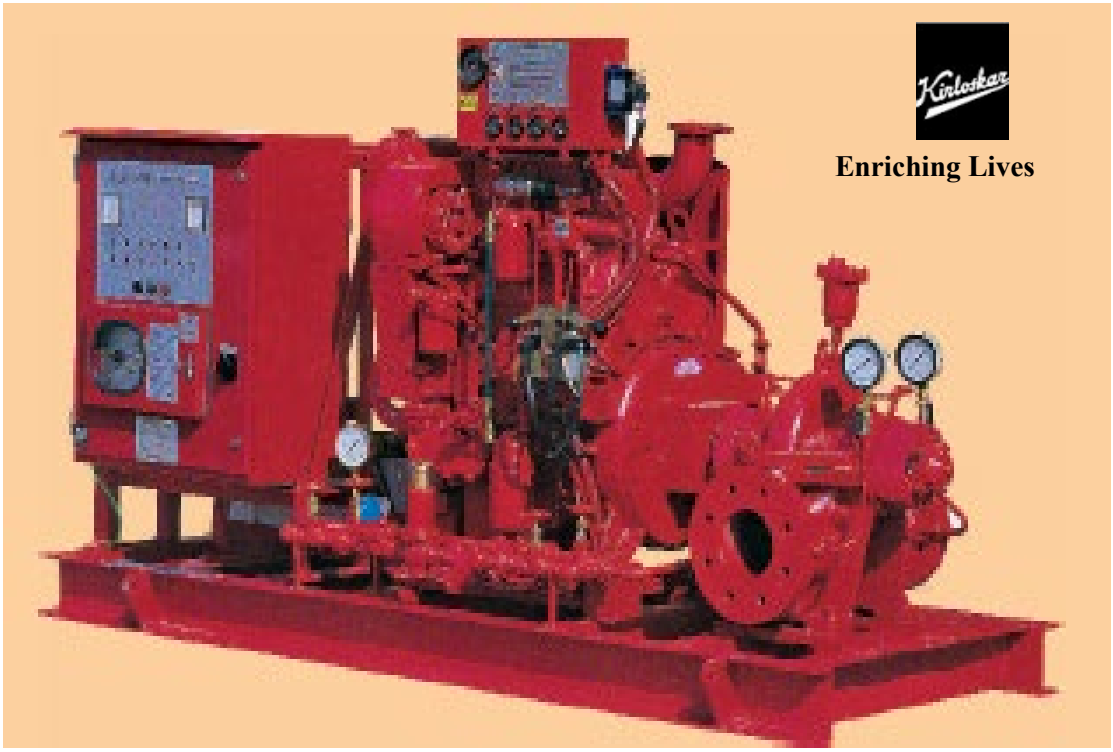
ESD5160 Speed Controller Designed for Fire-pump Applications CE Certified, Reverse Acting with Extended Speed Range, Isochronous, Variable and Droop Operation.

ADC225D1S Actuator with Dual Springs and Extended Travel

Dual Actuator Return Spring Installation



KOEL FIRE PUMP



GAC APPLICATION NOTE

DV SERIES ENGINES

Customer / OEM:	KIRLOSKAR Oil Engines Ltd – Pune, India
Application(s):	Power Generation, Fire Pumps, Hydraulic Drives
Engine Make / Model:	KOEL DV8: 15.9L, 346 kW/490 HP at 1500 RPM KOEL DV10: 19.9L, 448 kW/608 HP at 1500 RPM KOEL DV12: 23.9L, 552 kW/750 HP at 1500 RPM
Fuel System Type & Make / Model:	Diesel, Bosch inline P-Pump
Operating Speed(s):	1500 RPM operating / 800 RPM idle
Battery Voltage:	24 V DC
Recommended Products:	• Actuator: ADD175SA-24 • Speed Controller: ESD5550

Summary: The ADD175SA is designed to mount directly to fuel injection Bosch-style "P" pumps to achieve an integrated proportional fuel control package. Its control arm assembly connects directly to the fuel rack in place of a mechanical governor. The actuator includes a manual shut-off lever.

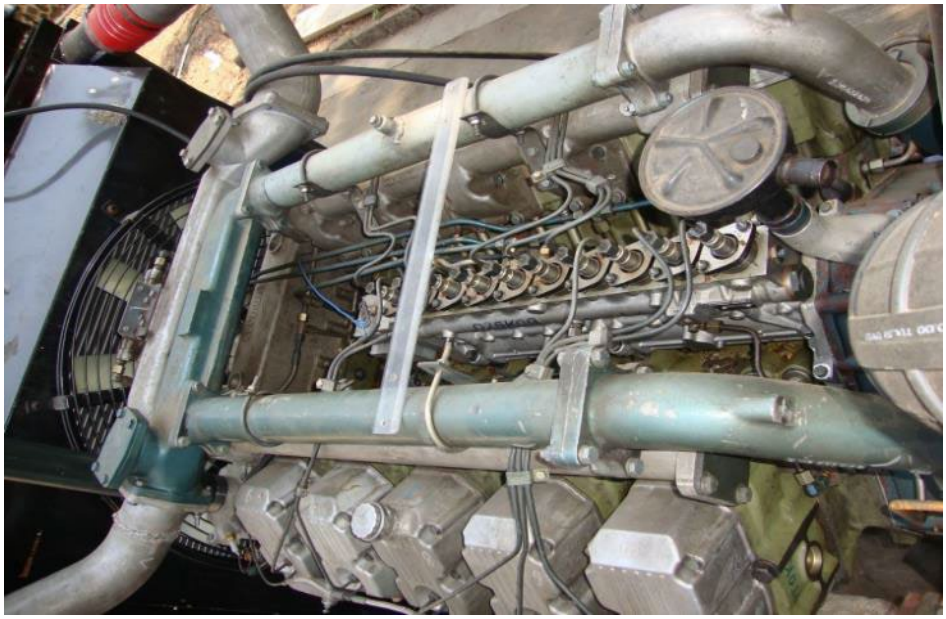
DV10 ENGINE / GEN-SET DRIVE

TEST STAND MOUNTED “P” PUMP WITH GAC ACTUATOR

ADD175SA–24 ACTUATOR ON DV10 “P” PUMP

“P” PUMP / ADD175SA-24 ACTUATOR ON DV10 ENGINE

DV10 ENGINE INSTALLATION



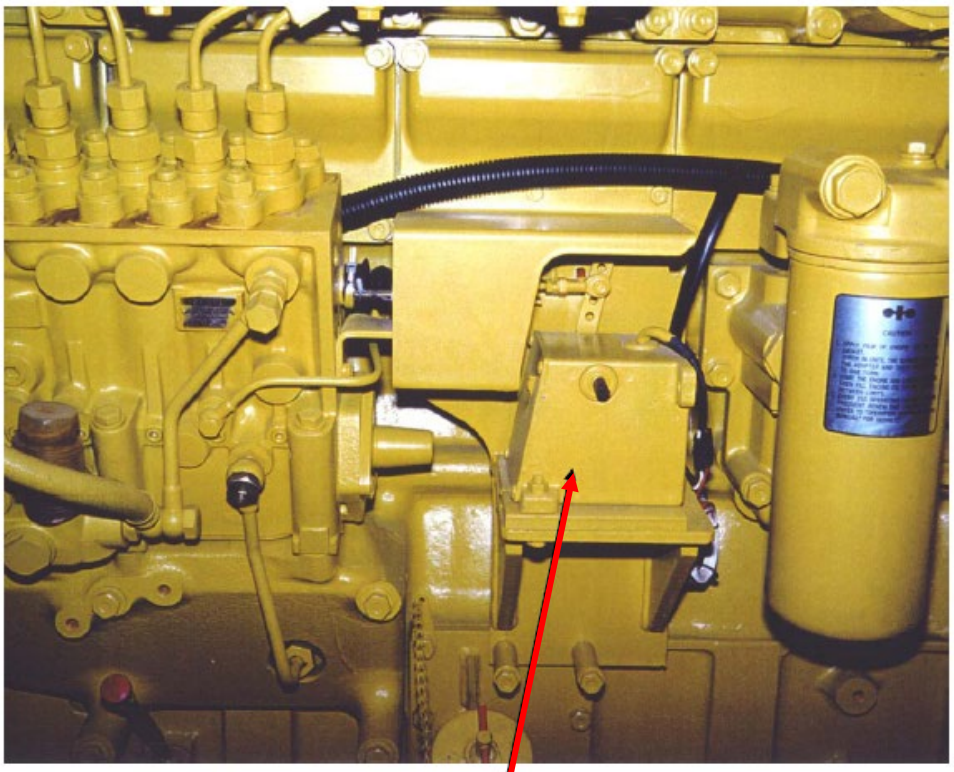
KOMATSU

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
SAA 170-G3	ADC225S-24			
GEN. SET	ADC225GAS-24			

GAC APPLICATION NOTE

SAA 170-G3 ENGINES

Customer / OEM:	KOMATSU
Application(s):	Various
Engine Make / Model:	SAA 170-G3
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	
Battery Voltage:	24 V DC
Installed Products:	• Actuator: ADC225S-24



ADC225S-24 Actuator

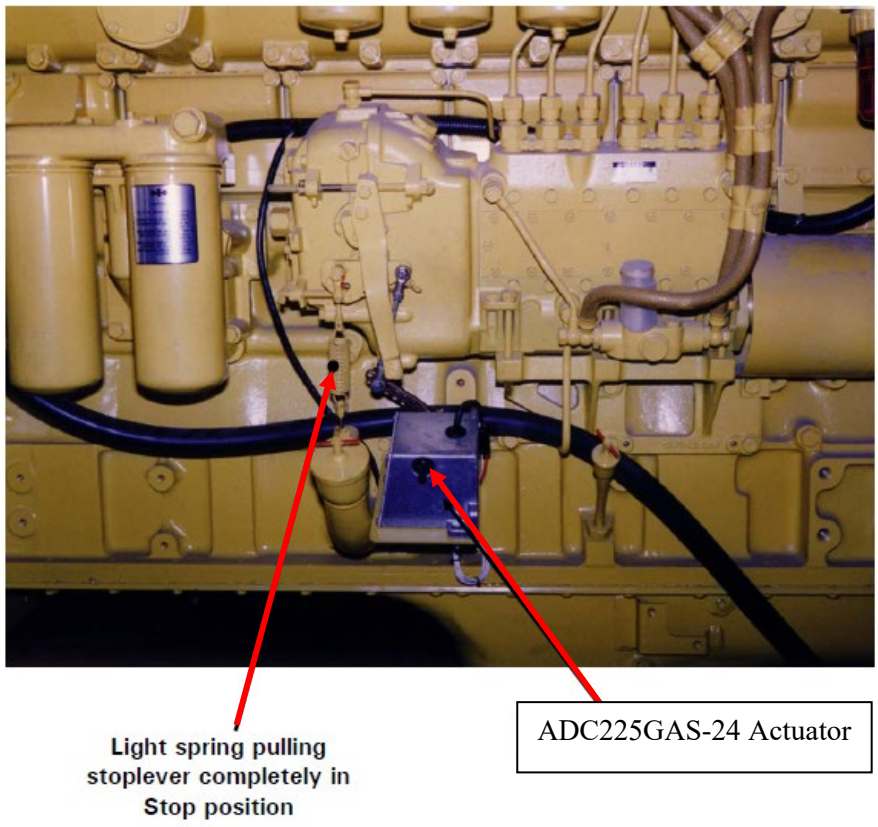
GAC APPLICATION NOTE

KOMATSU GEN SET

Customer / OEM:	KOMATSU
Application(s):	Gen.Set
Engine Make / Model:	Komatsu
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	
Battery Voltage:	24 V DC
Recommended Products:	• Actuator: ADC225GAS-24

Summary: The GAS model has a lighter spring (G), additional travel (A) and serrated shaft (S).

KOMATSU GEN SET FINISHED INSTALLATION



KUBOTA

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
D905, D1005, D1105, D1105T, V1305, V1505 & V1505-T	ALR190-K04-12/24		MSP6729	
D1503M, D1703M, D1803M, V2003M & V2403M	ALR190-KM04-12/24			
D722	ADD120S-12 ALN025-12	EEG7000		BK265
V2203	ADD120S-12			
V3300 & V3800	ALR190-K04-12/24		MSP6729	
Z482	ALN025-12	ECC328-12 ESD2402 ESD5500-II		KT130 BK265

GAC APPLICATION NOTE

VARIOUS DIESEL ENGINES

Customer / OEM: KUBOTA, Shibaura, Mitsubishi, Isuzu, Yanmar and Perkins

Application(s): Power Generation, Agricultural, Construction, Industrial, Stationary Power

Engine Make / Model: See Application Chart

Fuel System Type & Make / Model: Diesel, Inline and Unit Pumps

Operating Speed(s): 1500 / 1800 RPM operating, 600 RPM idle, variable range from 1000-2400 RPM etc…

Battery Voltage: 12 or 24 V DC

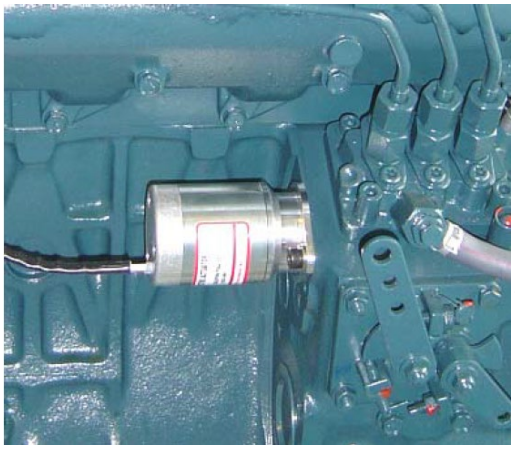
Installed Products:

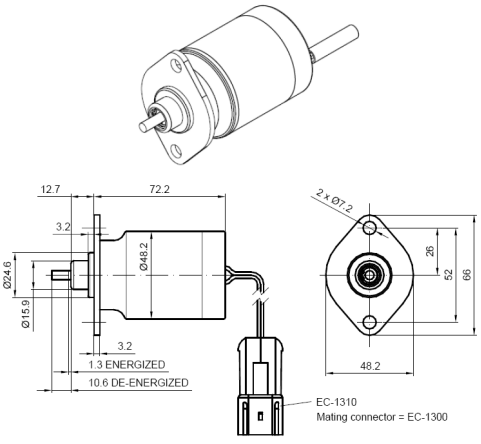
- Actuator: ALR190 Series
- Speed Controller(Light Force): ECC328, ESD2402, ESD5520E, ESD5120, ESD5500-II, ESD5570E, ESD2244-12/24 depending on features needed.
- Magnetic Speed Pickup: Various

Summary: The ALR190 Series Integral Actuator is designed to mount directly onto various injection Pumps on small engines. No external linkage or brackets are required for its installation. When de-energized the ALR190 Series actuator provides the function of a fuel shutoff solenoid. This is accomplished by a n internal spring loading the fuel-rack to the no fuel position. Installing the ALR190 Series actuator does not defeat the engine's mechanical governor operation. During the installation process, the mechanical governor is set 200-300 RPM higher than the electric Speed Controller operating speed and acts as over-speed protection and engine-power limiter within the engine manufacturers specifications.

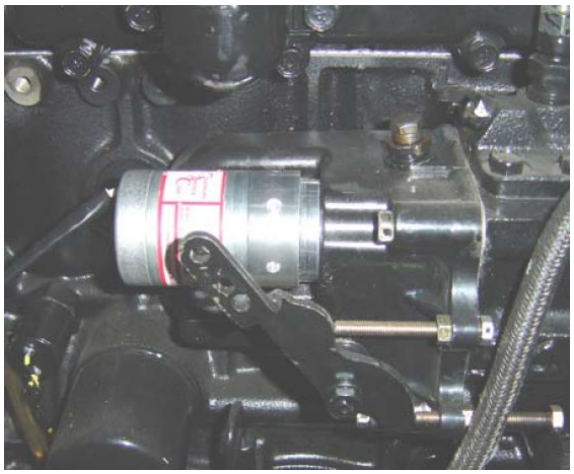
The electromechanical design used in the ALR190 Series is field proven and provides a proportional actuator movement based on the actuator coil current.

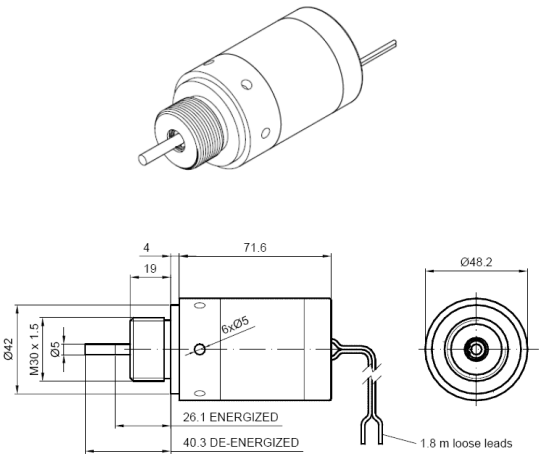
KUBOTA: ALR190-K04-XX



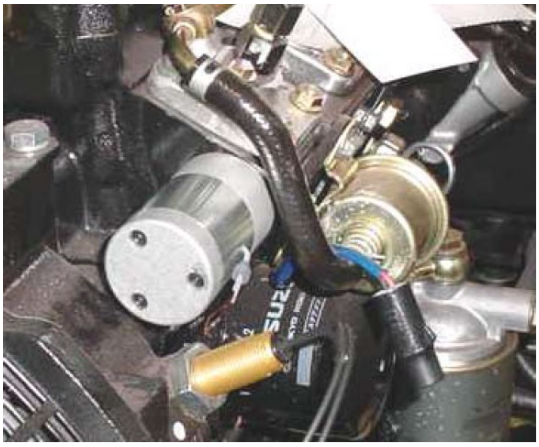


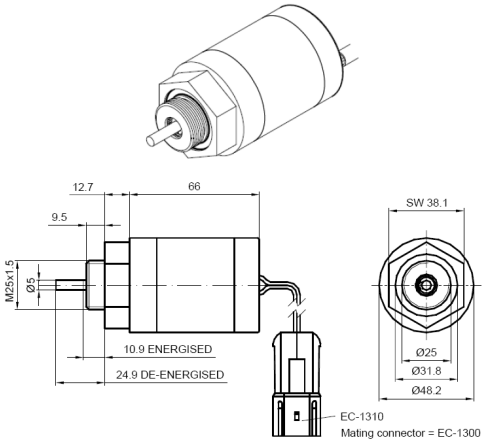
MITSUBISHI 'L' AND 'S' SERIES ENGINES: ALR190-M04-XX



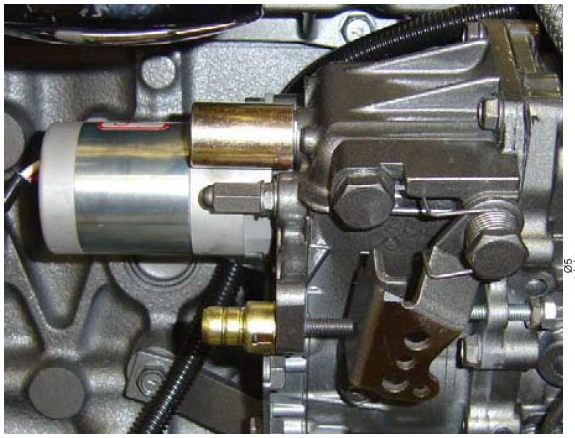


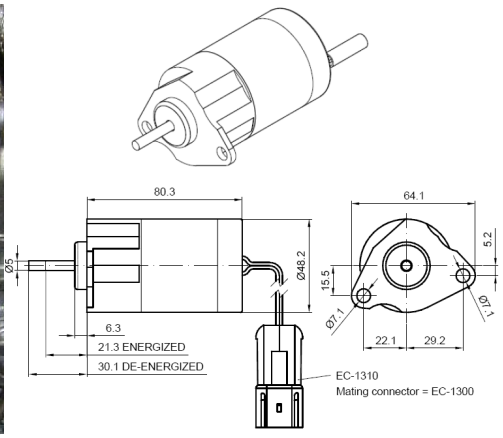
ISUZU 'C' AND 'L' SERIES ENGINES: ALR190-I03-XX



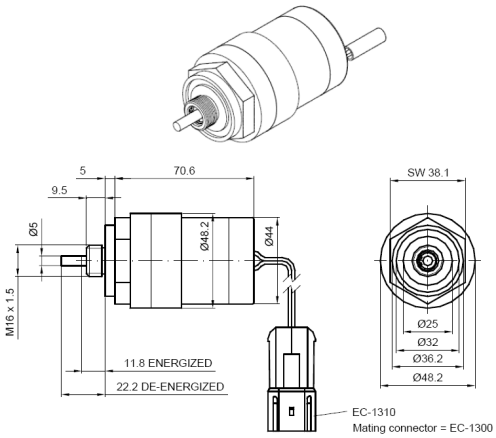


YANMAR TNV SERIES ENGINES: ALR190-Y04-XX

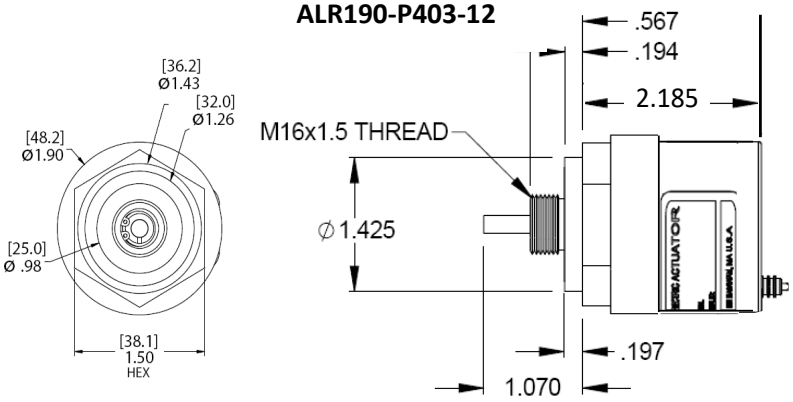




PERKINS 404 AND 403 SERIES ENGINES: ALR190-P04-XX



ALR190-P403-12



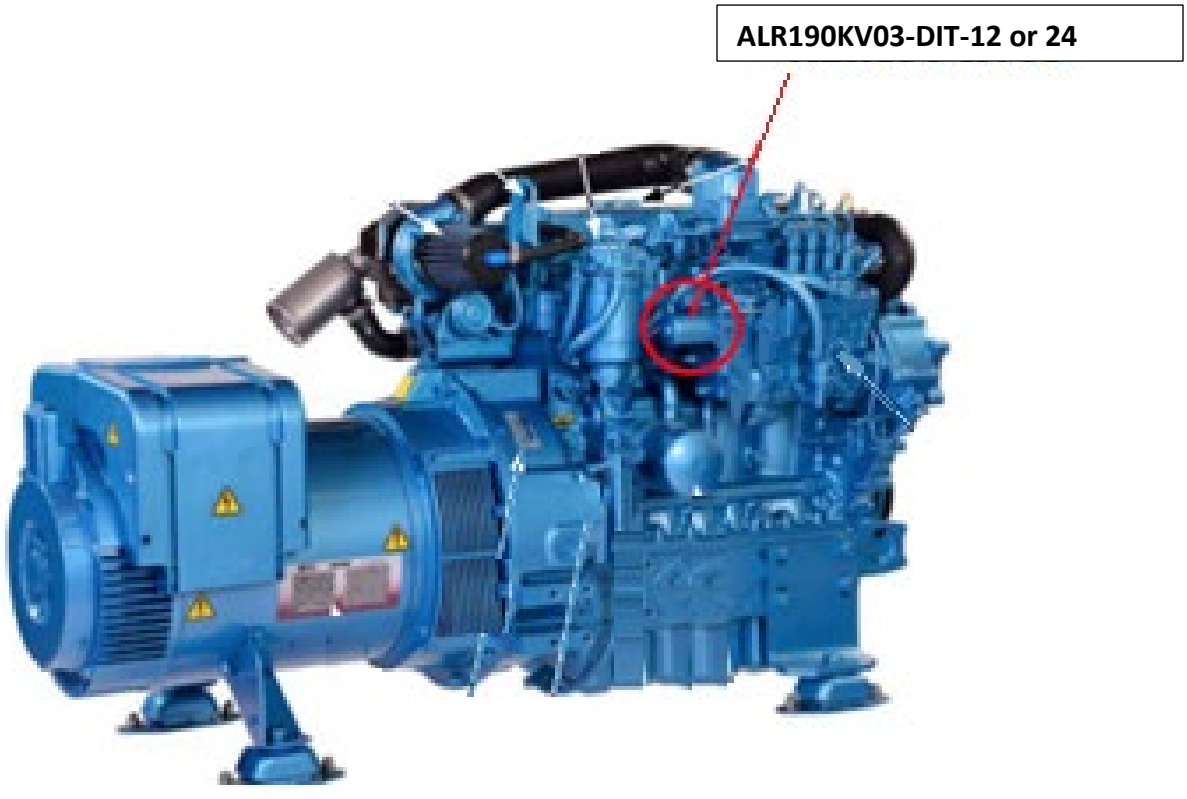
GAC APPLICATION NOTE

V3800D-IT V3800 ENGINES

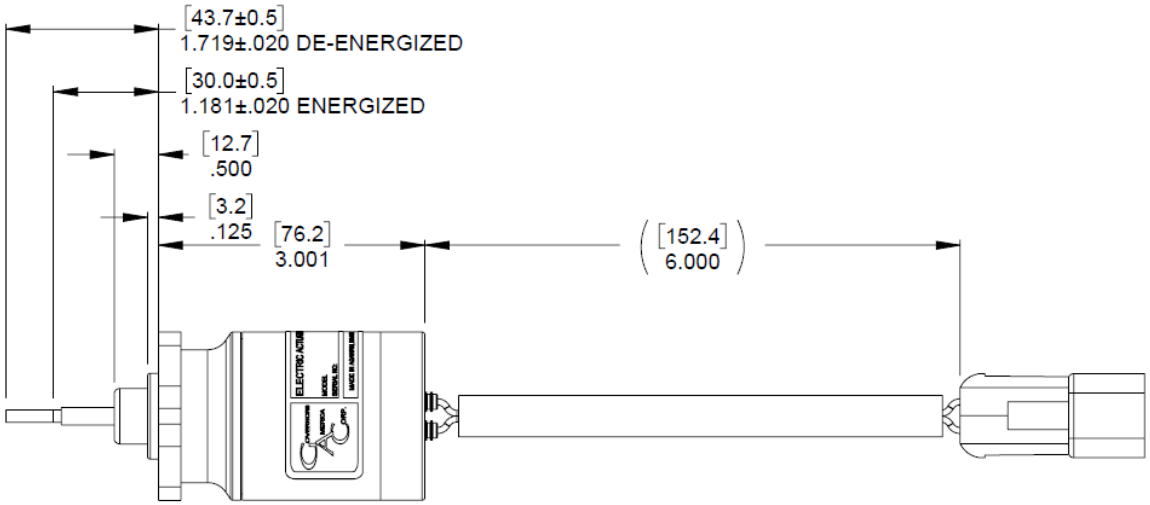
Customer / OEM:	**KUBOTA**
Application(s):	Various
Engine Make, Model, Displacement	Kubota V3800 DI-T, 4 Cylinder, 3.8L
Equipment Make, Model:	Various
Fuel System Type & Make, Model:	In Line
Operating Speed(s):	Idle to 2400 rpm
Battery Voltage:	12 or 24 V DC

Installed Products:	• Speed Controllers:
	  ○ Digital: EEG6000, EEG6500, EEG7000, EEG7500
	  ○ Analog: ESD5120, ESD5520E, ESD5500E
	• Actuator: ALR190-KV03DIT

Summary: An ALR190 actuator specifically designed for the Kubota V3800 D-IT engine.



HOW TO IDENTIFY THE ALR190-KV03DIT-12/24 ACTUATOR



APPLICATIONS CHART – ALL MODELS

NOTE Check engine dimensions before selecting or installing an ALR as alterations made to factory engines may impact ALR fit.

ENGINE FAMILY	ENGINE MODEL	ACTUATOR MODEL
CATERPILLAR		
C Series	C2.2T	ALR190-P04 -12 or -24
	C3.4	
	C1.5	ALR160-S04 -12 or -24
	C1.7	ALR190-P403 -12 or -24
PERKINS		
Perkins	404D-15 404D-22	ALR190-P04 -12 or -24 or ALR160-S04 -12 or -24
	403D-15 403D-15T	ALR190-P403 -12 or -24
SHIBAURA (PERKINS)		
Shibaura (Perkins)	N843-C, N844L-C, N844LT-C	ALR160-S04 -12 or -24 ALR190-P04 -12 or -24

ENGINE FAMILY	ENGINE MODEL	ACTUATOR MODEL
ISUZU		
C-Series	2CA 3CA 3CB 3CD 3CE	ALR190-Y04 -12 or -24
L-Series	3LB1 3LD1 3LD2 4LE1 4LE2	ALR190-I03 -12 or -24
KUBOTA		
Super 5 Series	D905	ALR190-K04 -12 or -24
	D1005	
	D1105	
	D1105-T	
	V1305	
	V1505, -T	
V3 Series	V3300 V3600 V3600T V3800	
03 Series	V2003 V2203* V2403	ALR190-KV03 -12 or -24
07 Series	V2607 V3007 V3307	ALR190-KV07 -12 or -24
DI-T	V3800DI-T	ALR190-KV03DIT -12 or -24

* IDI model only

ENGINE FAMILY	ENGINE MODEL	ACTUATOR MODEL
MITSUBISHI		
L-Series	L2E	ALR190-M04 -12
	L3E	
S3L-Series	S3L	
	S3L2	
	S4L	
	S4L2	
YANMAR		
TNV- and TNE-Series	2TNV70	ALR190-Y04 -12 or -24
	3TNV70	
	3TNV76	
	3TNV82A	
	3TNV84 3TNV84T	
	3TNV88	
	4TNV84	
	4TNV94L	
	4TNV88	
	4TNV98 4TNV98T	
	2TNE	
	3TNE	
	4TNE	

COMPATIBLE SPEED CONTROLLER MODELS

MODEL NUMBER	FEATURES
ECC328-12 or -24	Isochronous Operation / No Mag Pickup Needed Uses Genset Frequency 40-80 Hz
ESD2244-12 or -24	Isochronous Operation / Adjustable PID Functions / Speed Trim Input / Hard Potted
ESD2402-12 or -24	Isochronous Operation / Hard Potted / Idle Control / Adjustable PID Functions / Speed Trim Input /
ESD5120	Isochronous, Droop & Variable Operation / Idle Control / Speed Trim Input / Auxiliary Accessory Input & +10V Supply
ESD5520E	Isochronous, Droop & Variable Operation / Idle Control / Speed Trim Capability / Starting Fuel and Speed Ramping Adjust / Auxiliary Accessory Input & +10V Supply / Soft Coupling / Lead Circuit
ESD5500-II	Isochronous, Droop & Variable Governing / Idle Control / Aux Input & +10V Supply / Starting Fuel and Speed Ramping Adjust / Soft Coupling / Lead Circuit / Selectable Light-Force / Dither / LED Indicators
All digital speed controls are also compatible: EEG6500, EEG6550, EEG7000, EEG7500, EDG6000, SDG, etc.	

GAC APPLICATION NOTE

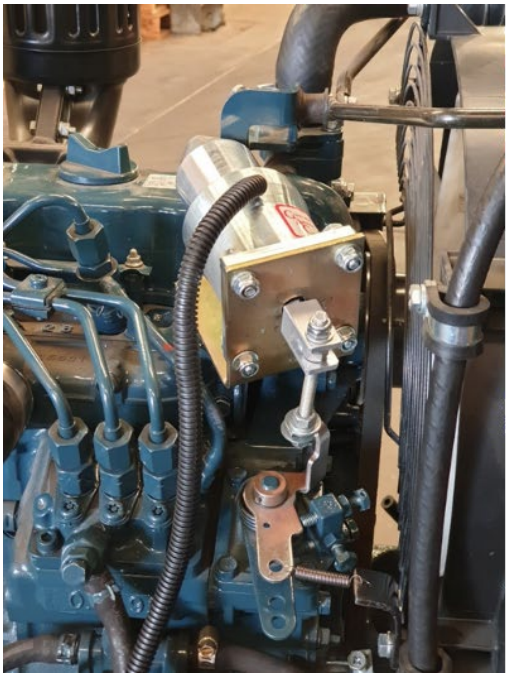
D722 VARIABLE SPEED ENGINE

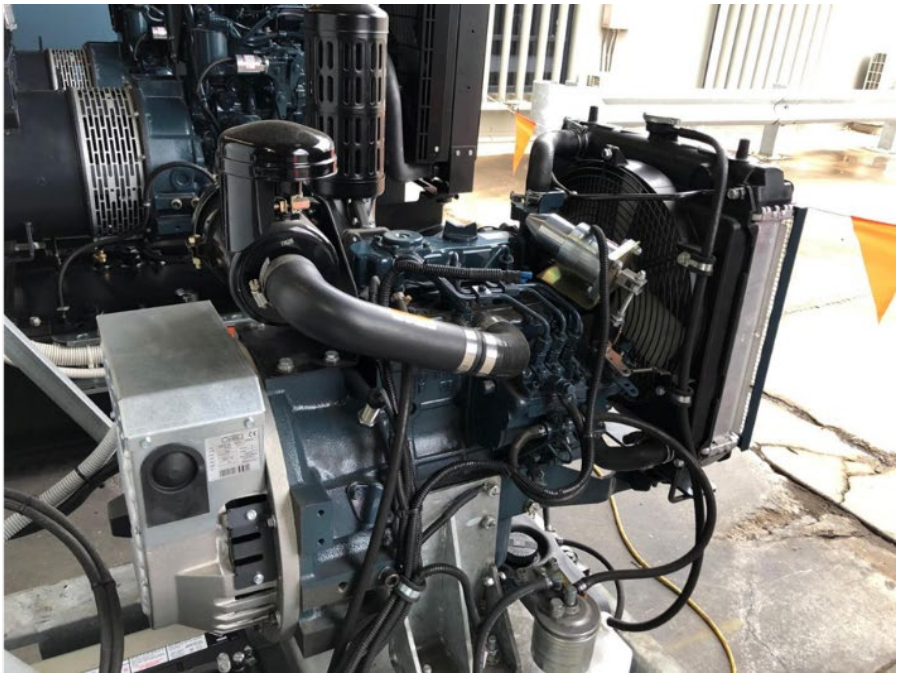
Customer / OEM: KUBOTA
Application(s): Mecc Alte Generator Drive, Variable DC
Engine Make / Model: Kubota D722 Diesel 0.719 L, 3 Cylinder, 14.9 kW (20.0 HP) at 3600 RPM, 12V
Fuel System: Diesel
Operating Speed(s): 14.9 kW @ 3600 RPM
Battery Voltage: 12 V DC
Installed Products:

- **Alternator** (MECC ALTE) : PM5G 48VDC
- **Actuator** (GAC): ALN025 with BK265 and KT130 clevis kit
- **Speed Controller** (GAC): EEG7000

Summary: By pairing Mecc Alte's Permanent Magnet Generator (PMG) with a GAC actuator and speed controller, the team developed a variable speed generator solution that varies a generator's engine speed based on load. This solution, based on a Kubota D722 Diesel 3-cyl engine, can optimize and match the output power with demand and reduce fuel consumption by at least 25%. The result allowed the customer to charge a battery bank while maintaining voltage and maximizing the battery life..

ACTUATOR ALN025-12 AND EEG7000





D722 VARIABLE SPEED ENGINE

EEG7000 ENHANCED ELECTRONIC DIGITAL SPEED CONTROLLER

- Mini-ECU, J1939 TSC1 Control Capable with Diagnostic Messages (DM).
- Isochronous, Variable, or Customizable Droop Governing.
- 3 Fixed Speeds or Variable Speed with Direct 0-5V, 5kΩ, or 4-20mA Input.
- Built-in USB Port for Easy Configuration with Free Software.
- Black-Smoke Reduction, Speed Ramp Control, Load Sharing / Synchronizing Option, and Cummins EFC Capable.
- Built-in Speed Switch Output for Crank or Overspeed.
- Engine Hour Meter and Service Timer.
- Fully Sealed, IP-67.

EEG7000 ACCESSORIES

GAC PART NUMBER	DESCRIPTION
EC1502	EEG7000 14 Pin AMPSEAL mating connector
CH1520	EEG7000 Cable Harness Assembly

ALN025 / ALN050 ACTUATOR AND ACCESSORIES

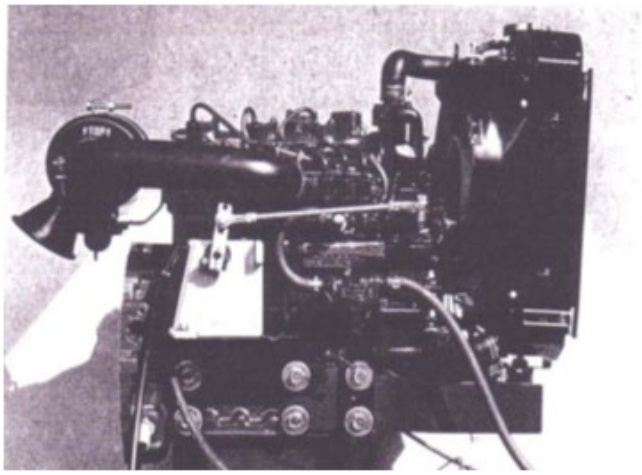
GAC's ALN linear actuators provide highly accurate precise positioning for closed-loop control with a minimum number of moving parts, prolonging the life of the actuator. With no sliding parts and sealed, reliability is outstanding, and no maintenance is necessary.

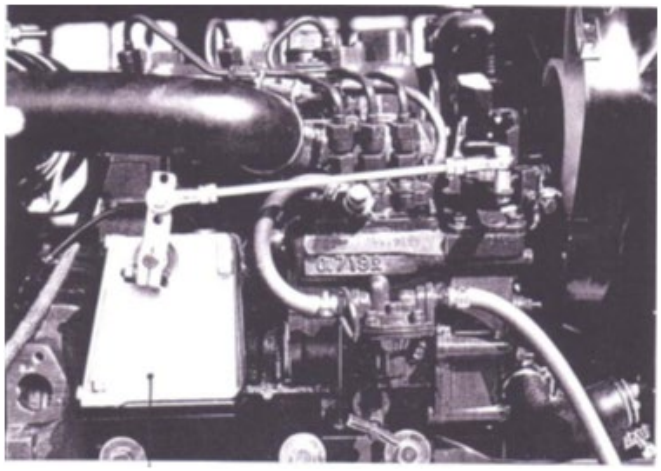
GAC APPLICATION NOTE

D722 DIESEL ENGINES

Customer / OEM:	KUBOTA
Application(s):	Various
Engine Make / Model:	D722
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	14.9 kW @ 3600 RPM
Battery Voltage:	12 V DC
Installed Products:	• Actuator: ADD120S-12 or ADC120S-12

ACTUATOR ADD120S-12 AND ADC120S-12



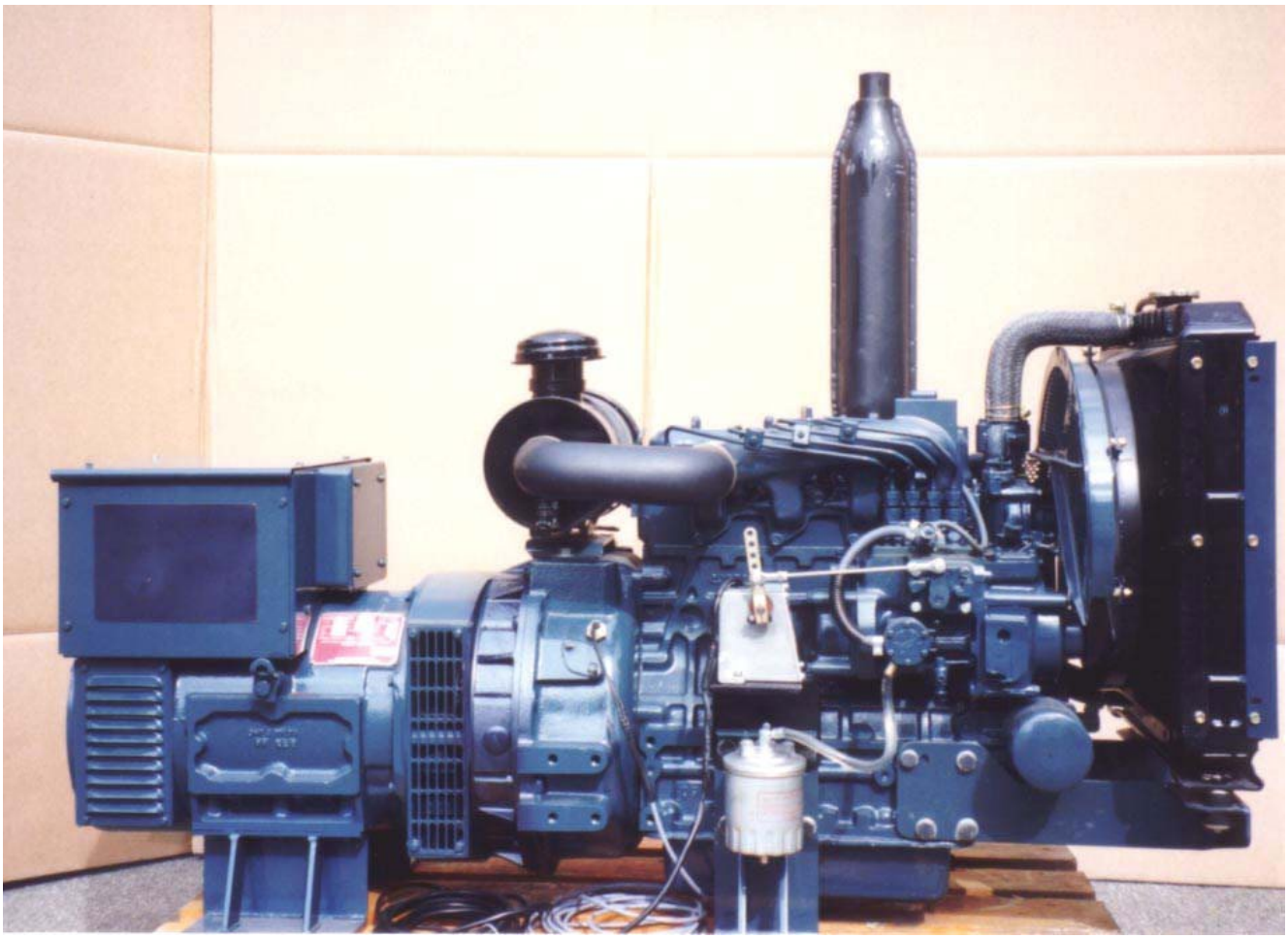


GAC APPLICATION NOTE

V2203 ENGINES

Customer / OEM:	KUBOTA
Application(s):	Various
Engine Make / Model / Displacement / Rating:	V2203 Engine
Equipment Make / Model:	
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	35.9 kW @ 2800 RPM
Battery Voltage:	12 V DC
Installed Products:	Actuator: ADD120S-12

ADD120S-12 ACTUATOR ON KUBOTA V2203



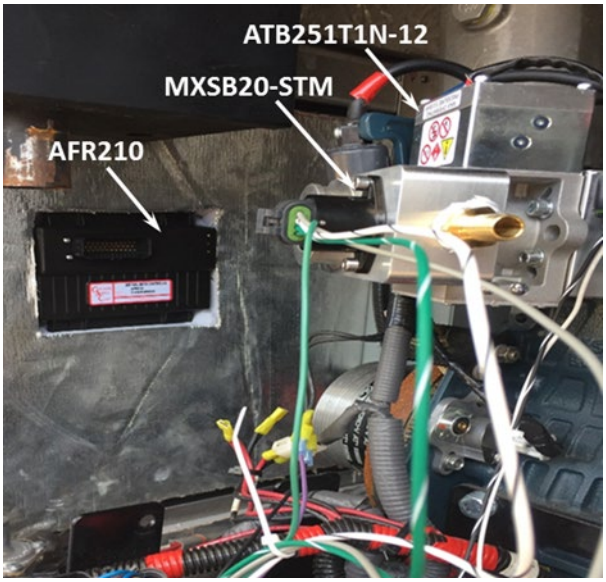
GAC APPLICATION NOTE

WG752 3-CYLINDER, 0.74L ENGINE

Customer / OEM:	KUBOTA
Application(s):	Various
Engine Make / Model	WG752
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	35.9 kW @ 2800 RPM
Battery Voltage:	12 V DC
Products Used:	• AFR210 • ATB251T1N1-12 • MSP6827C • MXB20-STM

Summary GAC's AFR210 offers an 'Anti-Wind-Up' PID feature that minimizes RPM over-shoot and/or under-shoot to support this combined heat and power (CHP) solution.

GASEOUS CO-GEN CHP POWER



GAC APPLICATION NOTE (all of the components specified are sold separately)

Z482 ENGINE USING ALN025 SERIES ACTUATOR AND SPEED CONTROLLER OPTIONS

Customer / OEM:	Multiple
Application(s):	Universal small engine
Engine Make / Model / Displacement / Rating:	KUBOTA Z482 / 479cc / 10.9 HP
Equipment Make / Model:	Multiple
Fuel System Type & Make / Model:	Bosch MD Type mini pump
Operating Speed(s):	2400 – 3200 RPM operating, 3600 RPM Max Speed
Battery Voltage:	12 V DC

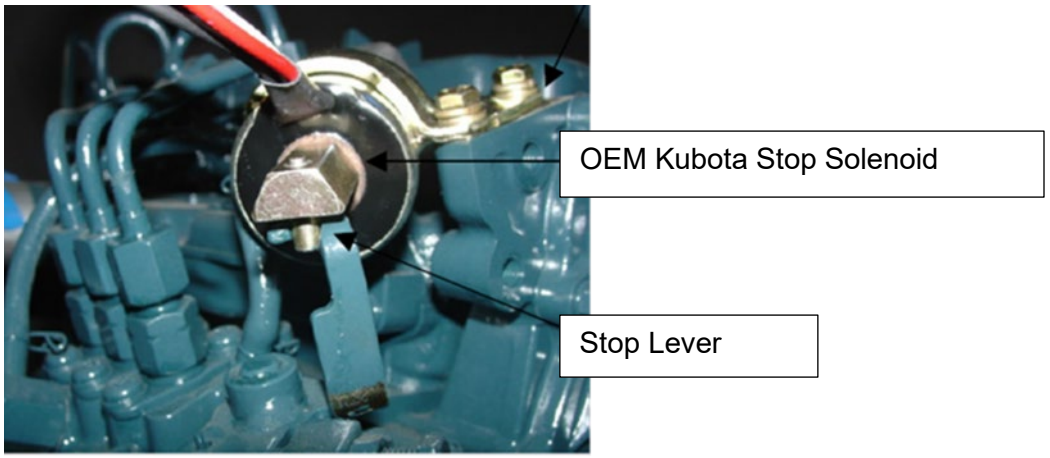
Installed Products:

- Actuator: ALN025-12
- Speed Controller Options (Analog):
  - ECC328-12 No speed sensor – Uses generator frequency, Fixed Speed, No Idle (Only for AC Generator Application). No speed sensor necessary.
  - ESD2402-12 Idle function, fixed speed
  - ESD5120 Idle function, fixed or variable speed, load share/sync
  - ESD5500-II Idle function, fixed or variable speed, load share/sync, starting fuel, speed ramping
- Speed Controller Options (Digital):
  - EEG6500, EEG7000 or EEG7500
- Optional Starter Mounting Bracket: BK265
- Optional Clevis Kit: KT130
- Optional Threaded Rod: RD102 (1/4”-28) or RD233 (M6 x 1.5mm)

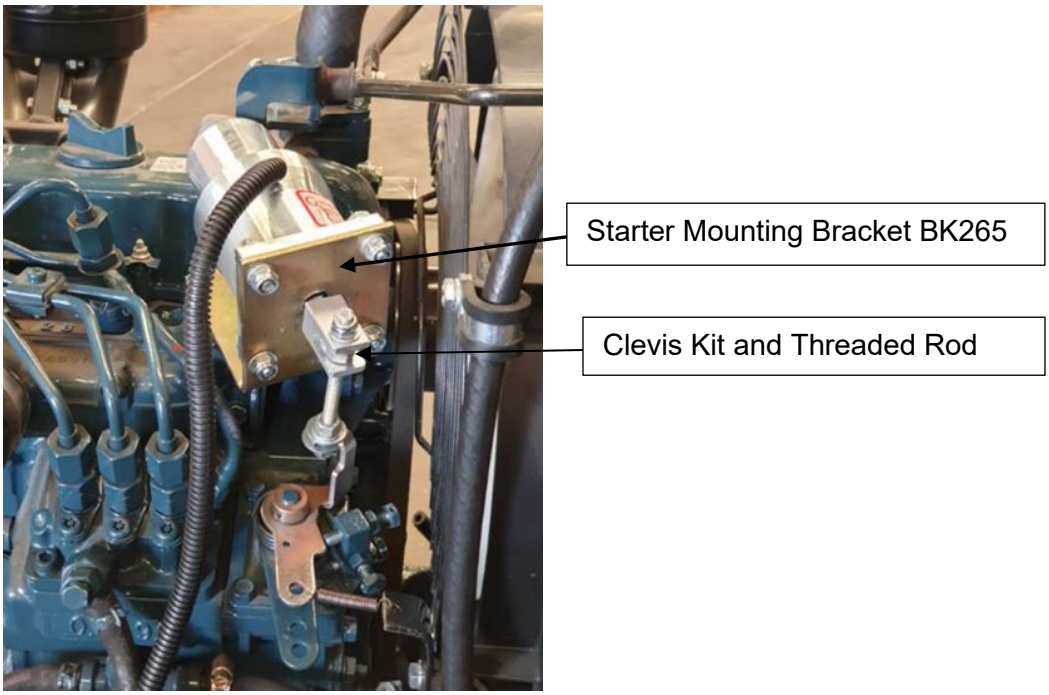
Summary: ALN025-12 actuator is to be mounted in place of the original fuel shut-off solenoid. The ALN025-12 serves as both the actuator and a fail-safe fuel shut-off.

ALN025-12

ORIGINAL STOP SOLENOID MOUNTED ON KUBOTA Z482



FINISHED INSTALLATION: ALN025-12 MOUNTED ON KUBOTA Z482



LIMMAT

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
12 CYLINDER	ADB225	ESD5500E	RSC671	SSW675

GAC APPLICATION NOTE

12 CYLINDER MARINE ENGINE

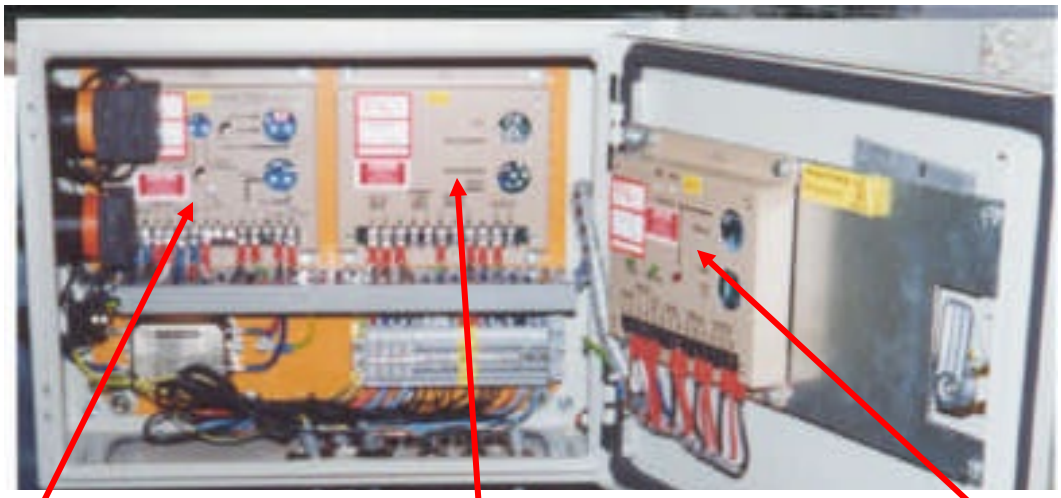
Customer / OEM: Lake Boat
Application(s): Marine Control
Engine Make / Model: LINMAT 12 Cylinder
Fuel System Type & Make / Model: Diesel, Mechanical Governor, Inline Pump
Operating Speed(s): Variable
Battery Voltage: 24 V DC
Installed Products:

- Actuator: ADB225
- Speed Controller: ESD5500E
- Speed Ramping Controller: RSC671
- Accessories: SSW675

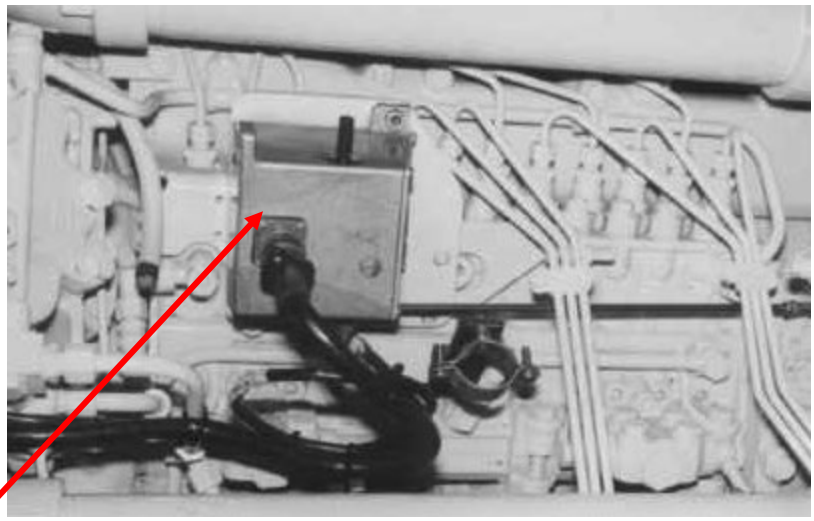
Summary: The ESD5500E works in harmony with the RSC671 for precise acceleration / deceleration control. The SSW675 provides crank / over speed switching capability.

PASSENGER BOAT WITH VARIABLE PITCH PROPELLER

MARINE CONTROLS



ADB225 ACTUATOR



LOMBARDINI

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
KDW1003	ADC120	ESD5500E, EEG6500 or EEG7000	MSP6729	KT130
LDW 2004	ADC120S-12			

GAC APPLICATION NOTE (all of the components specified are sold separately)

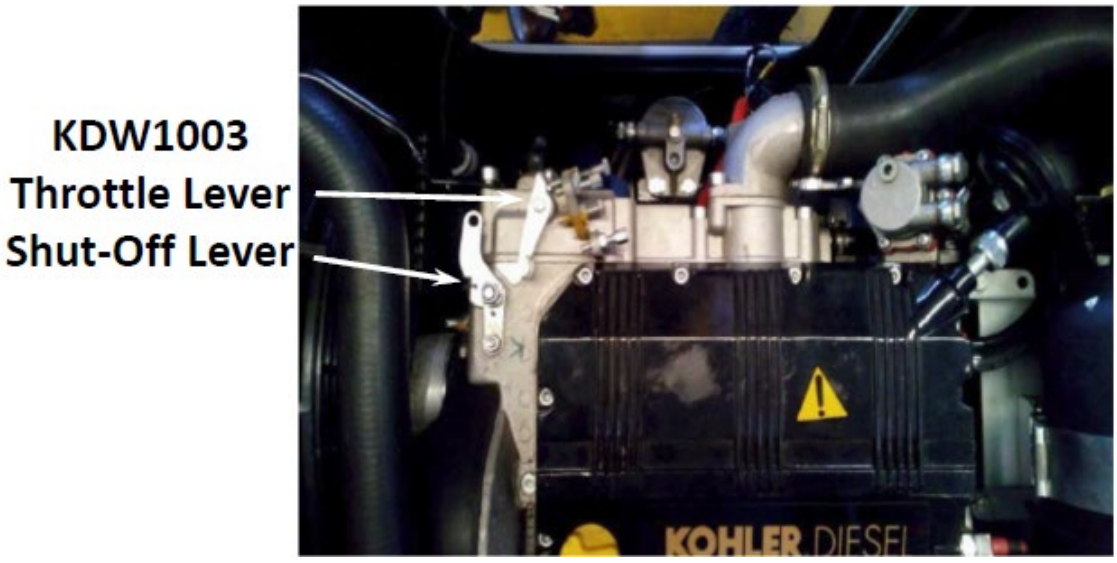
KOHLER (LOMBARDINI) KDW1003 DIESEL ENGINE

Customer / OEM:	Electronic Governor Solution with GAC ALN025: 12 or 24 V DC Linear Actuator or 120 Series: 12 or 24 V DC Actuator
Application(s):	Refrigeration Groups, Excavators, Tractors, Compressors, others
Engine Make, Model, Displacement	KOHLER KDW1003, 62.7 in³ (17.5 kW), 3 cylinders
Equipment Make, Model:	Various
Fuel System Type & Make, Model:	Indirect injection
Operating Speed(s):	Idle to 3600 RPM
Battery Voltage:	12 or 24 V DC

Installed Products:	• Speed Controller: ESD5500E, EEG6500 or EEG7000
	• Actuator: ALN025 -12/24 (V DC) or 120 Series-12/24 (V DC)
	• Magnetic Speed Pickup: MSP6729
	• Hardware for ALN025 installation only:
	  ○ Clevis Kit: KT130
	  ○ Bearing Rod Ends: BR200 (¼”-24), BR300 (M5), BR400 (M6) or BR500 (M8)
	  ○ Threaded Rods : RD102 (¼”-28) or RD233 (M6)
	  ○ Mounting Plate (starter): BK265

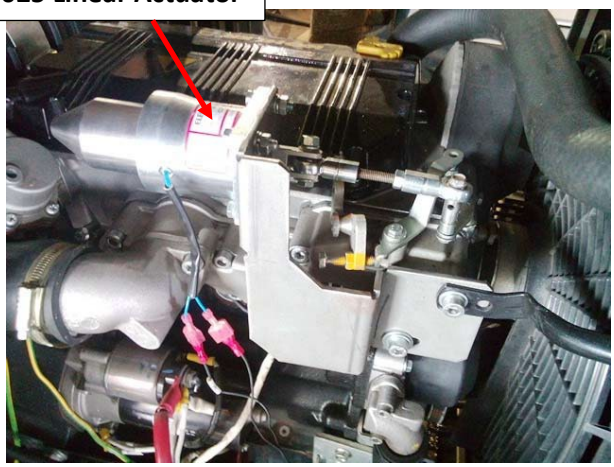
Summary:	This a complete Electronic Governing system for a Kohler (Lombardini) KDW1003 3 Cylinder Diesel Engine

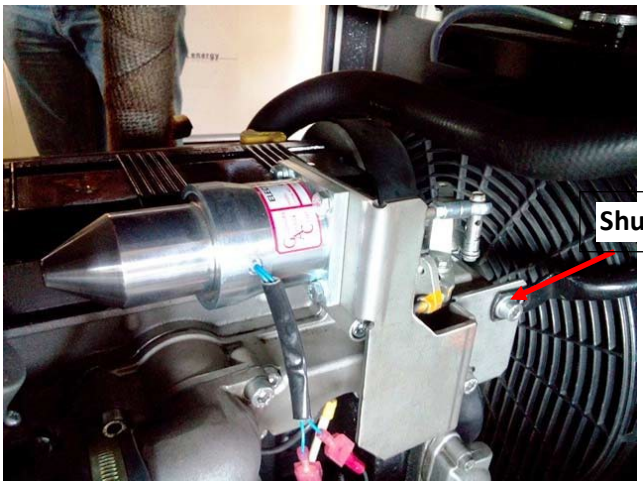
BASIC FUEL PUMP AND GOVERNOR SETUP ON KDW3000 ENGINE



COMPLETE ELECTRONIC GOVERNING SYSTEM FOR A KOHLER (LOMBARDINI) ENGINE ALN025 CONFIGURATION

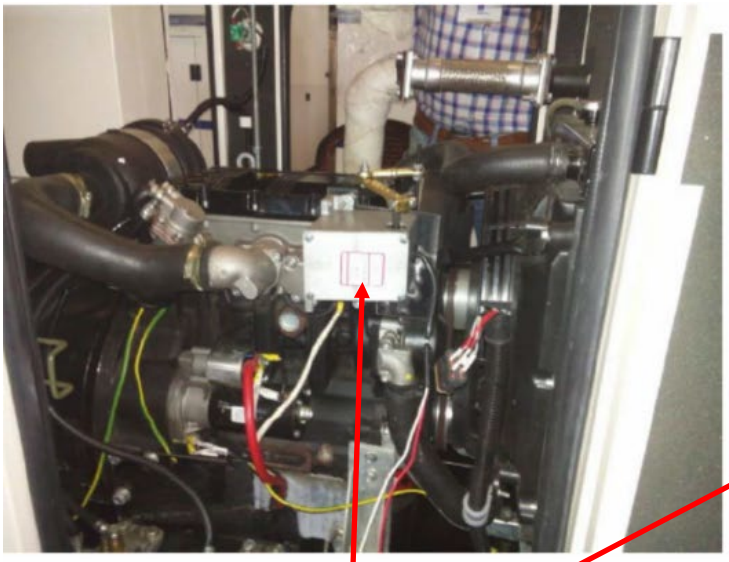
ALN025 Linear Actuator

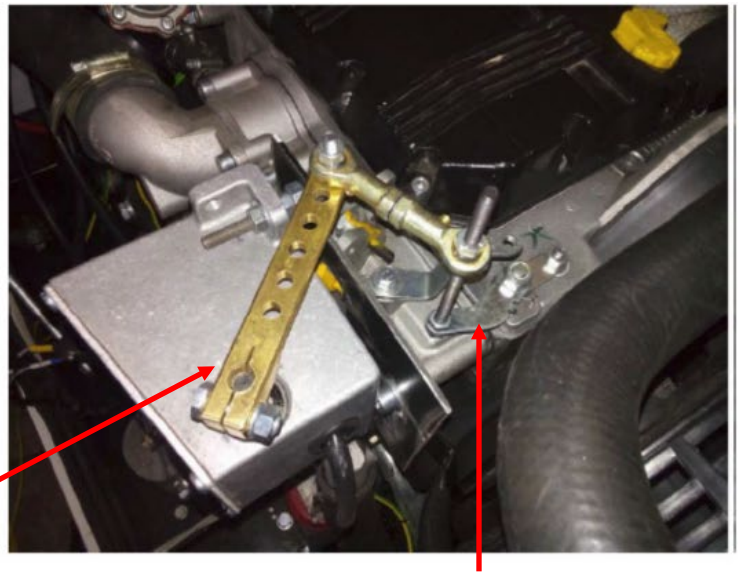




Shut Off Lever

COMPLETE ELECTRONIC GOVERNING SYSTEM FOR A KOHLER (LOMBARDINI) ENGINE 120 SERIES CONFIGURATION





ADC120 SERIES ACTUATOR (INCLUDES LE1400-2LEVER)

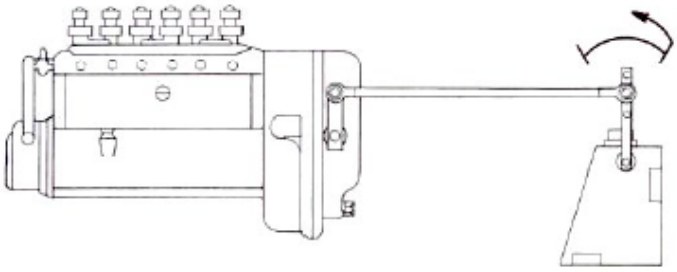
Shut Off Lever

ALN025 ACTUATOR AND RELATED PARTS

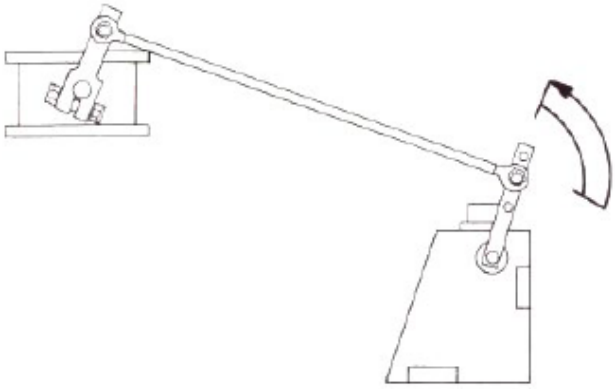
ADC120 ACTUATOR WITH LEVER

FOR DETAILED INSTALLATION INSTRUCTIONS SEE EACH PRODUCTS INSTALLATION MANUAL

FUEL LEVER AT MID FUEL POSITION DIAGRAM



FUEL LEVER AT FULL FUEL POSITION DIAGRAM



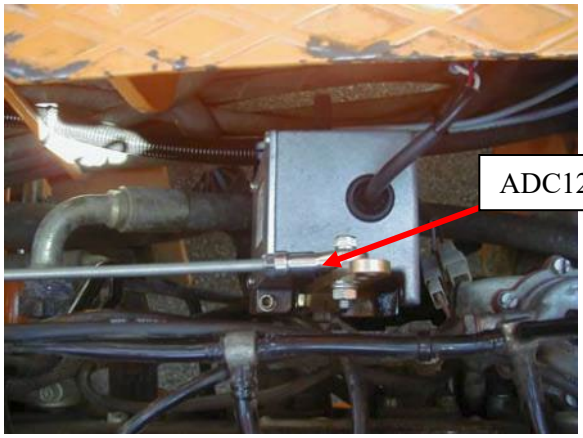
GAC APPLICATION NOTE

LDW 2004 ENGINE

Customer / OEM:	Witschi
Application(s):	CMT Mobile Loader
Engine Make / Model:	LOMBARDINI LDW 2004, 4 cylinder, 2.1L
Equipment Make / Model:	Witschi CMT Loader
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	35kW @ 3000 RPM
Battery Voltage:	12 V DC
Installed Products:	• Actuator: ADC120S-12

CMT LOADER

ADC120S-12



LOADER DASHBOARD

LOADER ELECTRIC FOOT PEDAL

LOVOL

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
1003, 1004, 1006, 1106	ADD175A-12/24	ESD5500E		

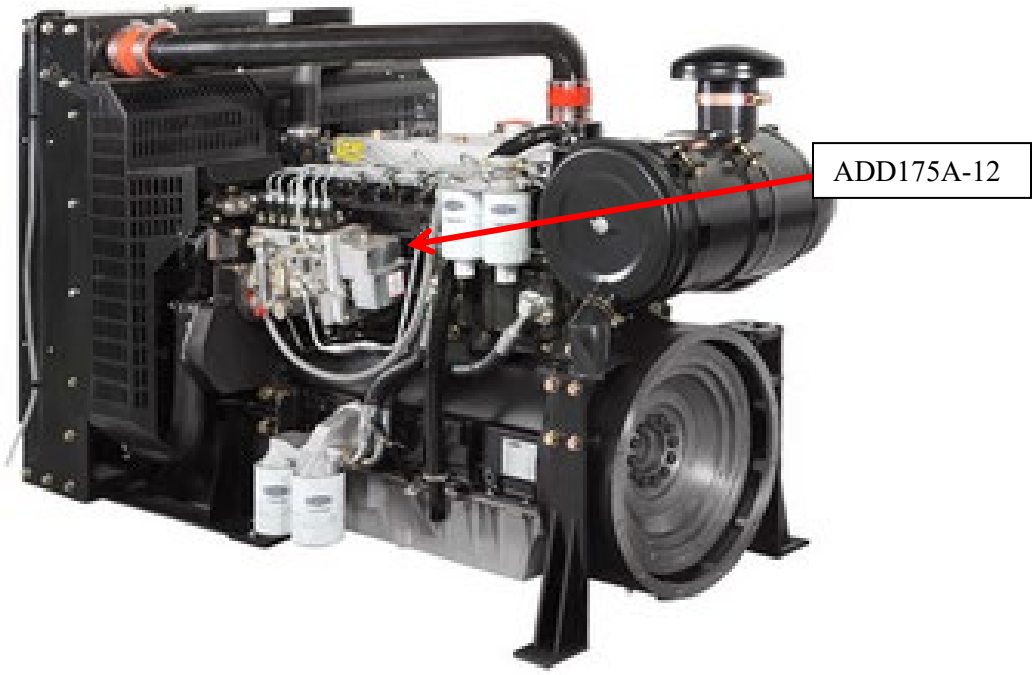
GAC APPLICATION NOTE

LOVOL DIESEL GEN SET ENGINES

Customer / OEM:	Foton Lovol International Heavy Industry Co., Ltd.
Application(s):	Power Generation
Engine Make / Model:	Lovol 1003 series, 2.99L, NA/Turbo, 26 / 38 kW Lovol 1004 series, 3.99L, NA/Turbo, 40 / 60 kW Lovol 1006 series, 5.98L, Turbo/Water-cooled, 90 / 110 kW Lovol 1106 series, 5.98L, Turbo Air-cooled, 130-158.4 kW (1500RPM)
Fuel System Type & Make / Model:	Diesel, Asimco-Tianwei (BYC), PB Pump (1003, 1004, 1006), P7100 (1106)
Operating Speed(s):	1500 / 1800 RPM rated
Battery Voltage:	12 or 24 V DC
Installed Products:	• Speed Controller: ESD5500E (Lovol T63201004) • Actuator: ADD175A-12/24 (Lovol T73201202 for 12V, T73201203 for 24V)

Summary: The ESD5500E controller was selected for its ruggedness, reliability and ease of operation, as well as its many essential features, perfect for the China gen set market. It is also a good choice for exporting Chinese-made engines because GAC has world-wide recognition. The ADD175A-12 is a perfect fit for BYC's PB and P7100 pumps as it was designed specifically to fit Bosch and BYC pumps.

LOVOL 1006TAG



MAN

A cross reference to MAN part numbers to GAC part numbers is at the end of this guide here.

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
D2842	ACE275HD-24	ESD5330 RSC671		
0824 & 0826	ADD120S-24			
2876	ATB652T2F14-24	SDG	MSP6723C	
E3268	ADB335-24 ADC225-24	EEG6550	MSP6723C	

GAC APPLICATION NOTE

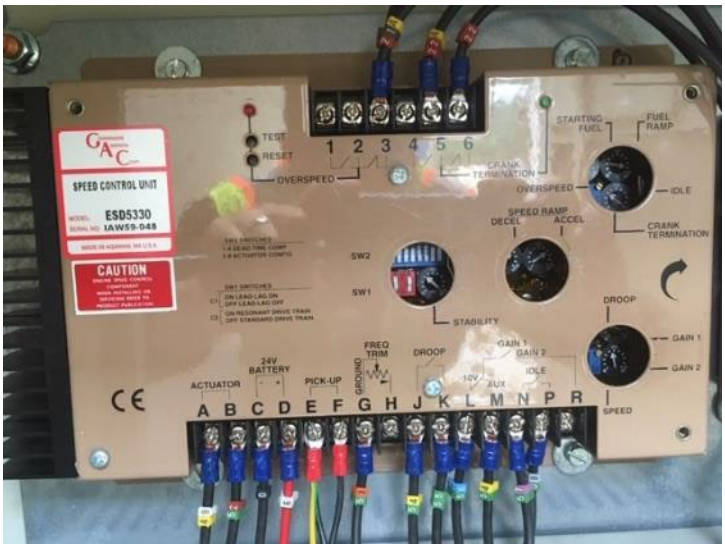
D2842LE201 with ACE275HD-24 ACTUATOR

Customer / OEM:	MAN Engines /Trevicos Corp.
Application:	High Pressure Soil Pump – Pile Driver (Model 7T800)
Engine Make / Model	MAN D2842 LE 201 / 610KW / V12
Equipment Make / Model:	Soilmec 7T800
Fuel System :	Diesel, Inline Pump
Operating Speed(s):	1500 / 1800 RPM, 750bar 614 liters-per-minute
Battery Voltage:	24 V DC
Installed Products:	• Actuator: ACE275HD-24 • Speed Controller: ESD5330 • Controller: RSC671

Summary This Soilmec 7T800 pump uses a 21.93L diesel MAN D2842 LE 201 engine to power this 614 liter/min workhorse. The engine is equipped with a GAC ACE275HD actuator (MAN PN 51.11610.6028) with heavy duty bearings to provide the strength and durability this application needs. The GAC ESD5330 works with our RSC671 controller to ensure precise control.

COMPLETED PROJECT

ESD5330 WITH RSC671



ACE275HD-24 MOUNTED ON DIESEL PUMP

MAN 12 CYLINDER ENGINE M/N D2842LE 201

GAC APPLICATION NOTE

2876 COMBINED HEAT AND POWER AMERIGEN 150

Customer / OEM: **Co Energy America**
Application(s): Combined Heat and Power (CHP)
Engine Make / Model / 150 MAN 2876
Fuel System Type & Make / Model: Natural Gas
Products in Solution: **Actuator**: Throttle Body, 65 mm Bore, Feedback HT Sealed
Speed Controller: GAC Smart Digital Governors
Other: Magnetic Speed Pickup

Summary:

Co Energy America has included GAC ATBs in their 150K W Amerigen 1150 CHP solution for over 20 years. Although the engines originally included a control, they needed more precise consistent results, and chose GAC ATBs for that reason.

Co Energy America has placed the Amerigen 150 across New England including Gillette Stadium, Whole Foods, Mass College of Pharmacy, and various Health care facilities.

COMPLETED CHP UNIT

SDG514

ATB652T2F14-24

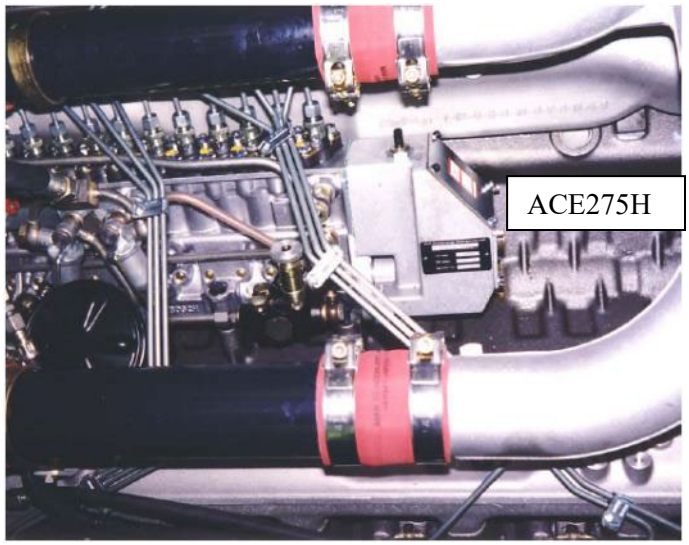
GAC APPLICATION NOTE

2842 AND 2866 ENGINES

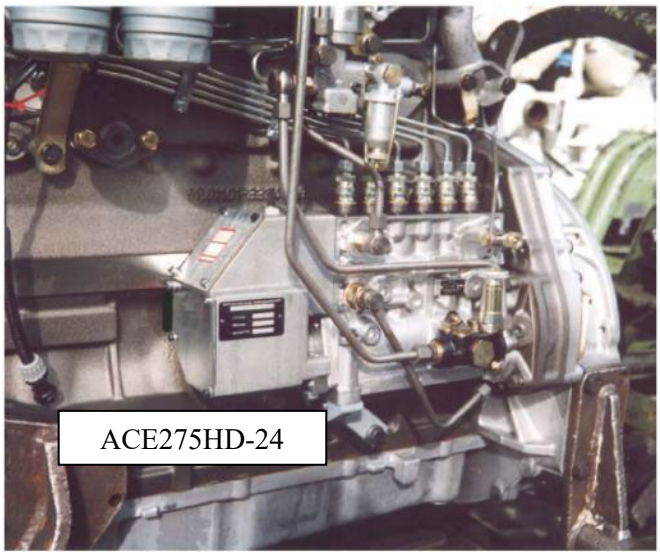
Customer / OEM: MAN
Application(s): Various
Engine Make / Model: MAN 2842, 2866 and 2876 Engines
Fuel System Type : Diesel, Inline Pump
Operating Speed(s): 1500 / 1800 RPM
Battery Voltage: 24 V DC
Installed Products:
- Actuator: ACE275HD-24

Summary: HD Version includes heavy duty bearings received by MAN for durability.

ACE275HD-24 ACTUATOR ON MAN 2842



ACE275HD-24 ACTUATOR ON MAN 2866



GAC APPLICATION NOTE

MAN E3268 COMBINED HEAT AND POWER

Customer / OEM: **HATRACO**
Application(s): Combined Heat and Power
Engine Make / Model: E3268 LE212 and MAN E2876 LE302
Equipment Make / Model: V8
Fuel System Type & Make / Model: Gasoline
Operating Speed(s): 350 kW
Battery Voltage: 24 V DC
Installed Products:

- Actuator: ADC225-24 or ADB335-24
- Speed Controller: EEG6550
- Other: MSP6723C

Summary CHP based on the gas engine MAN E2876 LE302 with GAC ADC225-24 or ADB335-24, controlled with EEG6500 and MSP6723C.

FINISHED CHP

ENGINE WITH GAC ADC225-24

ENGINE WITH GAC ADB335-24

GAC APPLICATION NOTE

MAN 9L20 MARINE GEN SET

Customer / OEM: **Research Vessel**
Application(s): Marine Gen Set
Engine Make / Model: MAN 9L20
Fuel System Type & Make / Model: Diesel
Operating Speed(s): 900 kW
Battery Voltage: 24 V DC
Installed Products:
- EEG6500

Summary The ARA PUERTO DESEADO oceanographic research vessel needed an overhaul before it returned to work studying the continental shelf as far south as Antarctica. Powered by 2 MAN 9L20 / 27 900 KW diesel engines and 2 ABB 380V, 120 kW AC electric motors for auxiliary propulsion the EEG6500 was used to update speed control of its power plant, replacing the original system

RESEARCH VESSEL

EEG6500 INSTALLATION

ENGINE ROOM

MILITARY

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
John Deere 40457F151 & 6068TF151	ADC101-24	ESD5551	MSP6735 MSP6728	AVR100, AVR400 LSS100, LSS400 TCM100, TCM102 TCM400 PCI102 CH113, CH114

GAC APPLICATION NOTE

JOHN DEERE 40457F151 and 6068TF151 GENERATOR

Customer / OEM: Army Mobile Electrical Power

Application(s): Power Generation

Engine Make / Model : 30 kW: JOHN DEERE 40457F151, 4 cycle, 4 cylinder, 3.9 L
60 kW: JOHN DEERE 6068TF151, 4 cycle, 6 cylinder, 5.9 L

Equipment Make / Model: L-3 Westwood / Cherokee Nation Generator

MEP Part Number	NSN	Description
806B	6115-01-462-0291	60 kW; 50/60 Hz
816B	6115-01-462-0292	60 kW; 400 Hz
805B	6115-01-461-9335	30 kW; 50/60 Hz
815B	6115-01-462-0290	30 kW; 400 Hz

Fuel System Type & Make / Model: Diesel, Engine Mounted Pump, JP-8

Operating Speed(s): 400 Hz – 2000 RPM
50/60 Hz – 1800 RPM

Battery Voltage: 24 V DC Input

Installed Products:

- Speed Controller — ESD5551
- Actuator, D-Series — ADC101-24 (96-23538)
- Voltage Regulator (50/60 Hz) — AVR100
- Voltage Regulator (400 Hz) — AVR400
- Load Sharing (50/60 Hz) — LSS100
- Load Sharing (400 Hz) — LSS400
- I/O Interface (50/60 Hz) — TCM100
- Main Backplane Interconnect — TCM102
- I/O Interface (400 Hz) — TCM400
- Power Supply — PCI102
- Magnetic Speed Pickup — MSP6735, MSP6728
- Cable Harness — CH113 (96-23665) CH114 (96-23664)

Summary: The 60 kW is called MEP 806B for 50/60 Hz applications and MEP 816B for 400 Hz applications. The 30 kW model is called MEP 805B for 50/60 Hz applications and MEP 815B for 400 Hz applications. Skid and trailer mount configurations are available.

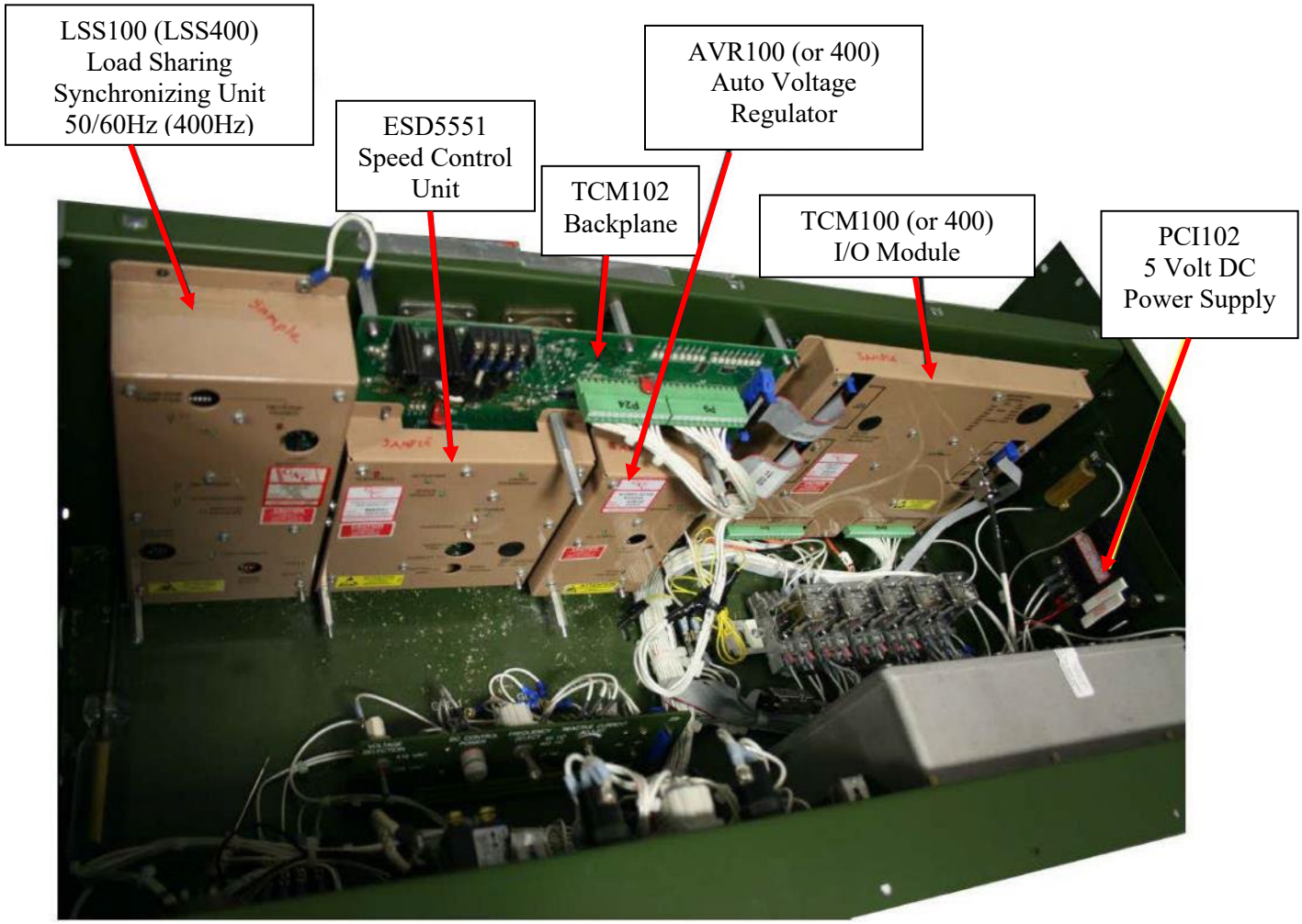
30 kW 50/60 Hz: The 30kW TQG Generator Set, MEP-805B, is a fully enclosed, self-contained, skid-mounted, portable unit. It is equipped with controls, instruments, and accessories necessary for operation as single unit or in parallel with another unit of the same class and mode. The generator set includes a diesel engine, brushless generator, cooling system, excitation system, governing system, fuel system, 24 VDC starting system, DCS, and fault system. The generator set is designed to be used with any piece of equipment requiring a medium source of AC power and operates in a “Hot and Basic” climatic condition range of -25°F to +120°F. This generator set is mobile and requires forklift support.

30 kW 400 Hz: The 30kW TQG Generator Set, MEP-815B, is a fully enclosed, self-contained, skid-mounted, portable unit. It is equipped with controls, instruments, and accessories necessary for operation as a single unit or in parallel with another unit of the same class and mode. The generator set includes a diesel engine, brushless generator, cooling system, excitation system, governing system, fuel system, and 24 V DCDC starting system, DCS, and fault system. The generator set is designed to be used with any piece of equipment requiring a medium source of AC power and operates in a “Hot and Basic” climatic condition range of -25°F to +120°F. This generator set is mobile and requires forklift support.

60 kW 50/60 Hz: The 60kW TQG Generator Set, MEP-806B, is a fully enclosed, self-contained, skid-mounted, portable unit. It is equipped with controls, instruments, and accessories necessary for operation as a single unit or in parallel with another unit of the same class and mode. The generator set includes a diesel engine, brushless generator, cooling system, excitation system, governing system, fuel system, 24 VDC starting system DCS, and fault system. The generator set is designed to be used with any piece of equipment requiring a medium source of AC power and operates in a “Hot and Basic” climatic condition range of -25°F to +120°F. This generator set is mobile and requires forklift support.

60 kW 400 Hz: The 60kW TQG Generator Set, MEP-816B, is a fully enclosed, self-contained, skid-mounted, portable unit. It is equipped with controls, instruments, and accessories necessary for operation as a single unit or in parallel with another unit of the same class and mode. The generator set includes a diesel engine, brushless generator, cooling system, excitation system, governing system, fuel system, 24 V DCDC starting system, DCS, and fault system. The generator set is designed to be used with any piece of equipment requiring a medium source of AC power and operates in a “Hot and Basic” climatic condition range of -25°F to +120°F. This generator set is mobile and requires forklift support.

GAC PRODUCTS IN GENERATOR CONTROL CABINET



END PRODUCT

30 KW, 50/60 HZ GENERATOR EXAMPLE

30 KW, 400 HZ GENERATOR EXAMPLE

60 KW, 50/60 HZ GENERATOR EXAMPLE

30 KW 50/60 HZ SPECS

Technical Description

Generator Set		**Fuel**	
Manufacturer:	MCII	Fuel Capacity (Gal):	23
Model:	MEP-805B	Fuel Consumption (GPH):	2.60
Voltage (Volts):	120/208/240/416	Fuel Requirement:	Diesel/JP-8
Frequency (Hz):	50/60		
Speed (RPM):	1800	**Dimensions**	
Phase:	3	Length (in):	79.7
		Width (in):	35.7
Engine		Height (in):	55
Manufacturer:	John Deere	Weight (lbs):	
Model:	4045TF151	Dry:	2732
Type:	4 Cycle	Wet (coolant & POLs):	2931
Cylinders:	4	Volume (ft^3):	90.56
Displacement:	239 in^3 (3.9L)		
		Aural Signature	
		Audio Rating:	70dBA @ 7 meters

Replaced Items	MEP-005A, MEP-805A.
Transportability	All variants of the USMC M353 trailer.

30 KW 400 HZ SPECS

Technical Description

Generator Set		**Fuel**	
Manufacturer:	MCII	Fuel Capacity (Gal):	23
Model:	MEP-815B	Fuel Consumption (GPH):	2.75
Voltage (Volts):	120/208/240/416	Fuel Requirement:	Diesel/JP-8
Frequency (Hz):	400		
Speed (RPM):	2000	**Dimensions**	
Phase:	3	Length (in):	79.7
		Width (in):	35.7
Engine		Height (in):	55
Manufacturer:	John Deere	Weight (lbs):	
Model:	4045TF151	Dry:	2732
Type:	4 Cycle	Wet (coolant & POLs):	2931
Cylinders:	4	Volume (ft^3):	90.56
Displacement:	239 in^3 (3.9L)		
		Aural Signature	
		Audio Rating:	71dBA @ 7 meters

Replaced Items MEP-114A, MEP-815A.

Transportability All variants of the USMC M353 trailer.

60 KW 50/60 HZ SPECS

Technical Description

Generator Set		**Fuel**	
Manufacturer:	MCII	Fuel Capacity (Gal):	43
Model:	MEP-806B	Fuel Consumption (GPH):	5.06
Voltage (Volts):	120/208/240/416	Fuel Requirement:	Diesel/JP-8
Frequency (Hz):	50/60		
Speed (RPM):	1800	**Dimensions**	
Phase:	3	Length (in):	87
		Width (in):	35.7
Engine		Height (in):	59
Manufacturer:	John Deere	Weight (lbs):	
Model:	6068TF151	Dry:	3556
Type:	4 Cycle	Wet (coolant & POLs):	3992
Cylinders:	6	Volume (ft^3):	106
Displacement:	359 in^3 (5.9L)		
		Aural Signature	
		Audio Rating:	70dBA @ 7 meters

Replaced Items MEP-006A, MEP-806A.

Transportability All variants of the USMC M353 trailer.

60 KW 400 HZ SPECS

Technical Description

Generator Set

Manufacturer:	MCII
Model:	MEP-816B
Voltage (Volts):	120/208/240/416
Frequency (Hz):	400
Speed (RPM):	2000
Phase:	3

Engine

Manufacturer:	John Deere
Model:	6068TF151
Type:	4 Cycle
Cylinders:	6
Displacement:	359 in^3 (5.9L)

Fuel

Fuel Capacity (Gal):	43
Fuel Consumption (GPH):	5.37
Fuel Requirement:	Diesel/JP-8

Dimensions

Length (in):	87
Width (in):	35.7
Height (in):	59
Weight (lbs):	
Dry:	3603
Wet (coolant & POLs):	4042
Volume (ft^3):	103

Aural Signature

Audio Rating:	72dBA @ 7 meters

Replaced Items MEP-115A, MEP-816A.

Transportability All variants of the USMC M353 trailer.

MITSUBISHI

The following engine application solutions are described in this section. Links to details on the products are located in this table. Links to details of many of the installation steps described are in the corresponding application note.

Mitsubishi part numbers that cross reference to GAC part numbers are referenced in the MITSUBISHI cross-reference table at the end of this guide.

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
L3E-V363JGH		EDG6000		EAM208
S4L2	ALR190-M04-12	SDG514-02-02	MSP6738	

GAC APPLICATION NOTE

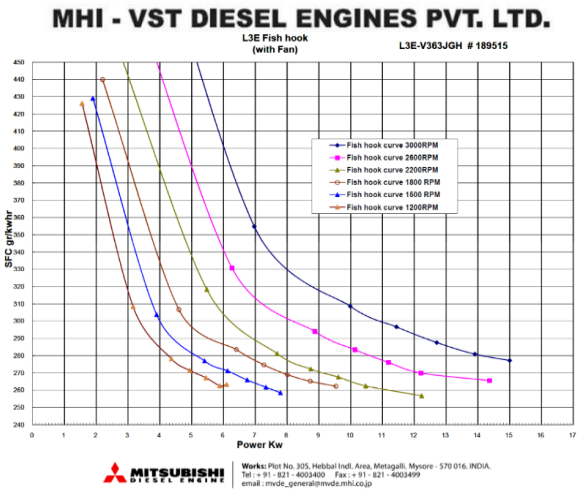
L3E ENGINE

Application(s): Power Generation
Engine Make / Model : MITSUBISHI L3E-V363JGH
Fuel System Type & Make / Model: Diesel
Operating Speed(s): Variable Range from 1200-3000 RPM
Battery Voltage: 12 or 24 V DC
Installed / Recommended Products:
- Speed Controller: EDG6000
- Interface Module: EAM208

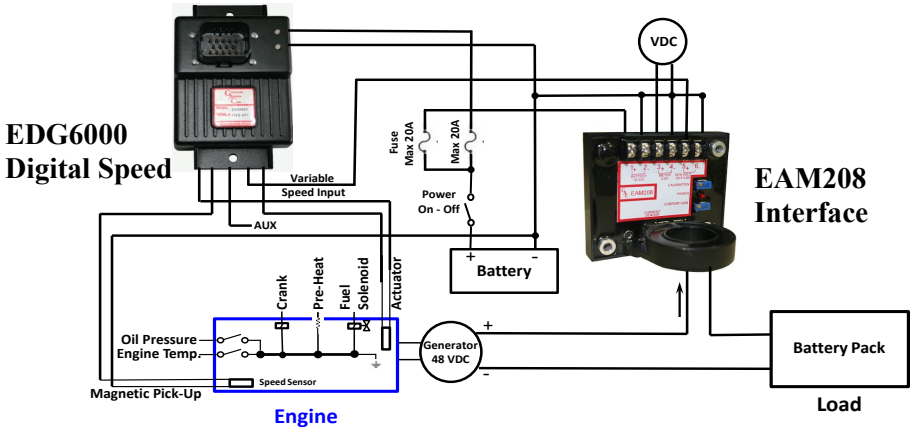
Summary: The **EAM208** accessory module provides an output proportional to power based on the current input from the variable speed DC generator. The **EDG6000** is a digital Speed Controller designed for industrial engine applications from generator sets, and mechanical drives, to pumps or compressors.

MITSUBISHI L3E GEN-DRIVE ENGINE

MITSUBISHI L3E: SFC -G/KW-HR



EXAMPLE: VARIABLE SPEED DC GENERATOR SCHEMATIC



GAC APPLICATION NOTE

S4L2 POWERING MILLER WELDER

Customer / OEM:	Miller Electric Manufacturing Company
Application(s):	Diesel Welder
Engine Make / Model :	MITSUBISHI S4L2, 1.8L, 4-cylinder In-line, Water-cooled
Equipment Make / Model:	Miller Big Blue Series
Fuel System Type & Make / Model:	Diesel, Bosch-type inline
Operating Speed(s):	1800 RPM
Battery Voltage:	12 V DC
Installed Products:	• Actuator: ALR190-M05-12 • Speed Controller: SDG514-02-02 • Magnetic Speed Pickup: MSP6738

Summary: The SDG514-02-02 digital speed control is used with the ALR190-M05-12 integrated linear actuator mounted on a Mitsubishi S4L2 engine with Bosch-type pump along with an MSP6738 for speed reference. These are used in a series of compact diesel welders to precisely control engine speed in all load conditions. The ALR190-M05-12 (reverse acting, pull actuator) connects directly to the fuel pump in place of the stop solenoid for seamless integration and incredible transient response. The SDG514-02-02 is a powerful, compact, and tamper-proof Speed Controller with a customer-specific calibration so that every engine off the line performs the same. These generators are used by construction contractors, independent rig owners and fleet managers.

COMPLETED WELDER

ALR CLOSE-UP VIEW

SIDE VIEW OF WELDER

SDG INSTALLED

MITSUBISHI HEAVY INDUSTRY

The following engine application solutions are described in this section. Links to details on the products are located in this table. Links to details of many of the installation steps described are in the corresponding application note.

Mitsubishi part numbers that cross reference to GAC part numbers are referenced in the MITSUBISHI cross-reference table at the end of this guide.

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
MHI S6R2 Series	ADC225S-24	ESD5500E	MSP6728C	KT193
S4S & S6S	ADD225S-12/24 ADD175A-12/24	ESD5111 ESD5221 ESD5550	MSP6722C MSP6728C	KT175-AR KT175-RS-R KT289
S4S Injection Pump	ADD175A	ESD5221		KT175-RS-R KT289
S12A2, S12R & S16R	ACB2001	ESD5330 ESD5340	MSP6728C	
L Series & K Series	ADD225S-12/24	ESD2210-12/24	MSP6728C	
S6A3, S6B3, S6R	ADD225S-12/24	ESD5500E	MSP6728C	

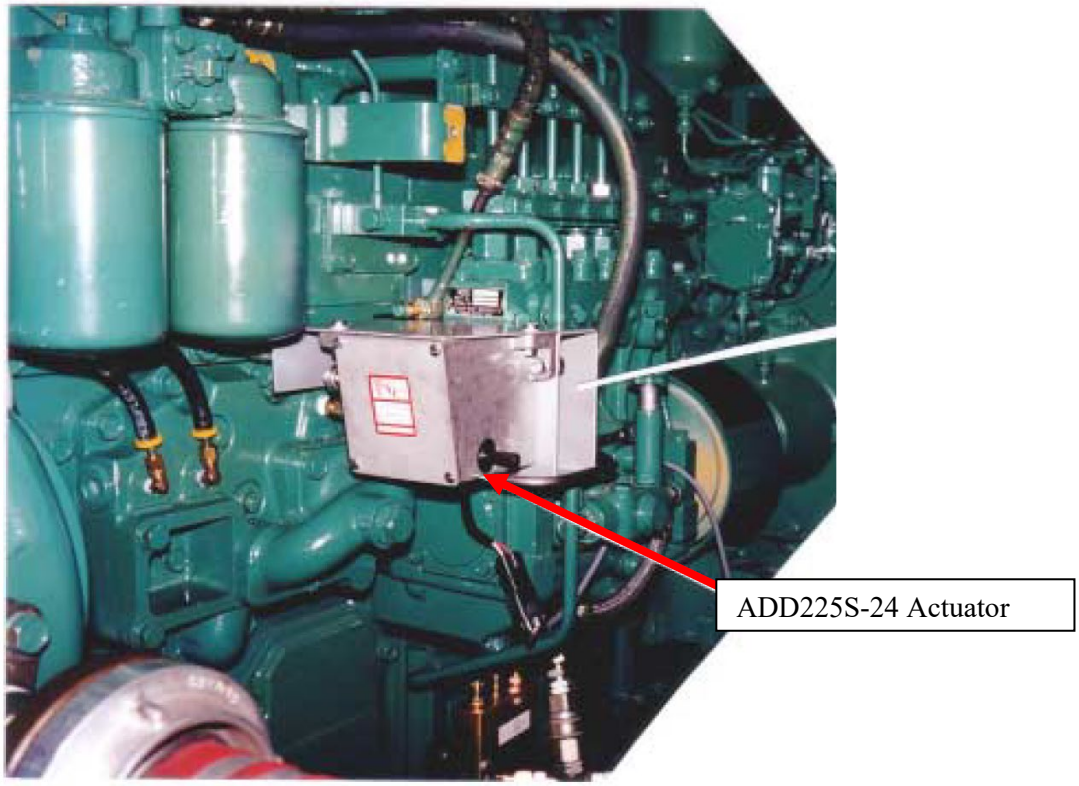
GAC APPLICATION NOTE

MHI S6R2 (VOLVO D30) ENGINES

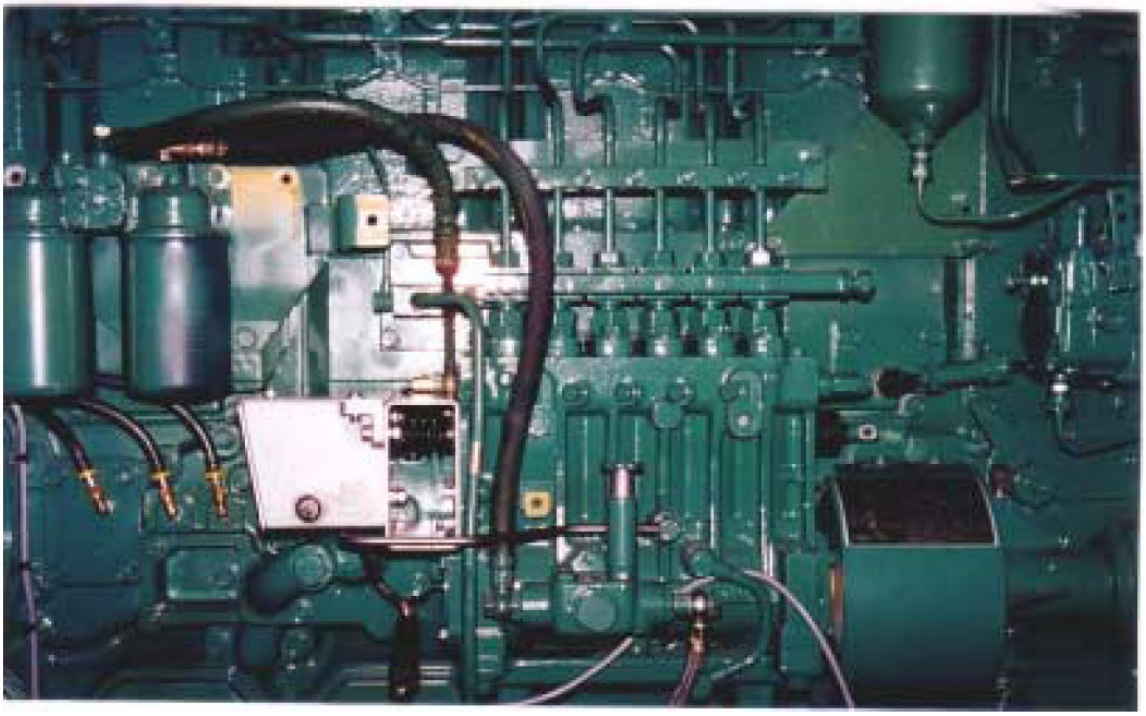
Customer / OEM:	Volvo Penta
Application(s):	Marine Propulsion / Generator Drive
Engine Make / Model:	MITSUBISHI S6R2, 24.5L In-Line 6 Cylinder Power Ratings Range from 480 to 759 kW at 1500 RPM
Fuel System Type & Make / Model:	Diesel, In-line
Operating Speed(s):	1500 / 1800 RPM and Variable Speed
Battery Voltage:	24 V DC
Installed Products:	• Actuator: ADC225S-24 (Volvo Part Number 3838271) • Speed Controller: ESD5500E (Volvo Part Number 3817999) • Magnetic Speed Sensor: MSP6827C

Summary: The MHI S6R2 engine series fit with a GAC electronic governor systems for superior speed control serves in gen-sets and marine propulsion applications.

VOLVO D30 (MHI S6R2) ENGINE WITH GAC GOVERNOR SYSTEM ON PS6-48 270 PUMP



VOLVO D30 (MHI S6R2) ENGINE WITH GAC GOVERNOR SYSTEM ON PS6-48 270 PUMP



GAC GOVERNOR SYSTEMS ON VOLVO-MHI ENGINES FOR RETROFIT APPLICATIONS

ENGINE	ACTUATOR	SPEED CONTROLLER	MSP
D25A	ADD225S-24	ESD5500E	MSP6728C
D30A	ADD225S-24	ESD5500E	MSP6728C
D34A	ACB2001	ESD5330	MSP6728C
D49A	ACB2001	ESD5330	MSP6728C
D65A	ACB2001	ESD5330	MSP6728C

GAC APPLICATION NOTE

S4S and S6S MHI ENGINES

Customer / OEM:	MITSUBISHI Heavy Ind.
Application(s):	50 Hz Gen. Set 42 HP at 1500 RPM
Engine Make / Model :	S4S 4 cyl. 3.31L and S6S
Fuel System Type & Make / Model:	Diesel, Zexel Inline Injection Pump
Operating Speed(s):	1500 / 1800 RPM
Battery Voltage:	12 or 24 V DC
Installed or Recommended Products:	• Actuator: ADD225, or ADD175A-12/24 • Speed Controller: ESD5111, ESD5221 or ESD5550 • Magnetic Speed Pickup: MSP6722C or MSP6728C • Mounting Kit; KT175-RS-R, or KT289 (included with actuator)

S4S ENGINE

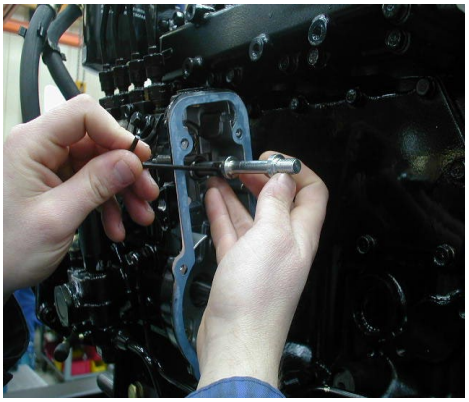
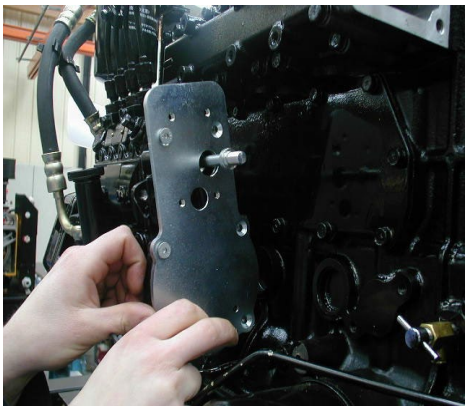
GAC APPLICATION NOTE

MHI S4S INJECTION PUMP INSTALLATION

Customer / OEM:	MITSUBISHI Heavy Ind.
Application(s):	50 Hz Gen. Set 42 HP at 1500 RPM
Engine Make / Model:	S4S 4 cyl. 3.31L
Fuel System Type & Make / Model:	Zexel In-Line Injection Pump
Operating Speed(s):	1500 / 1800 RPM
Battery Voltage:	
Installed Products:	• Actuator: ADD175A • Mounting Kits: KT175-RS-R and KT289

Summary: Pump replacement.

MOUNTING KIT KT175-RS-R

Connect the link rack to the fuel rack. The gasket and adaptor plate are then screwed into the mechanical governor housing.

INSTALLATION INSTRUCTIONS ARE AVAILABLE ON THE GAC WEBSITE

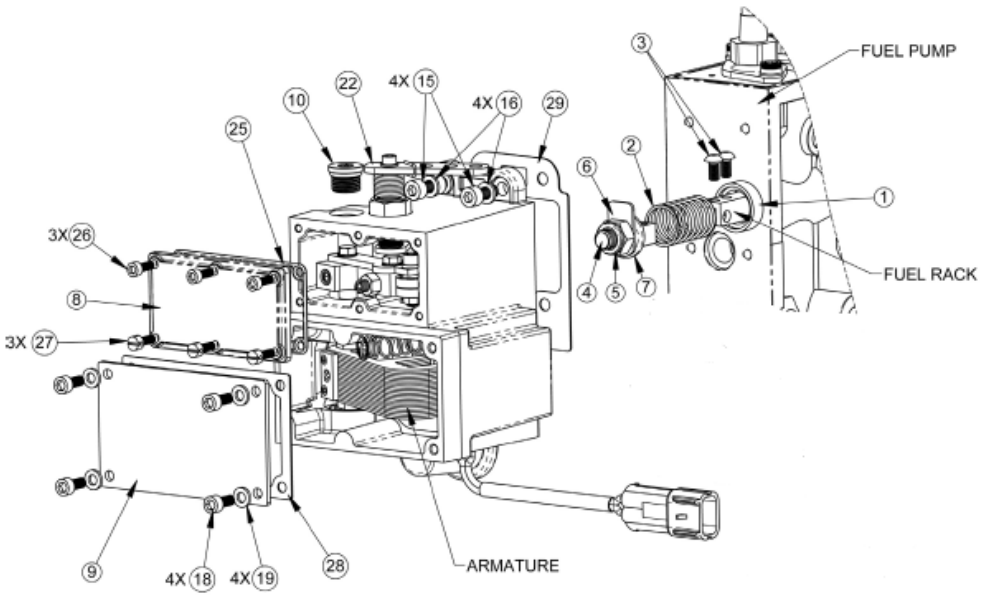


FIGURE 1-1

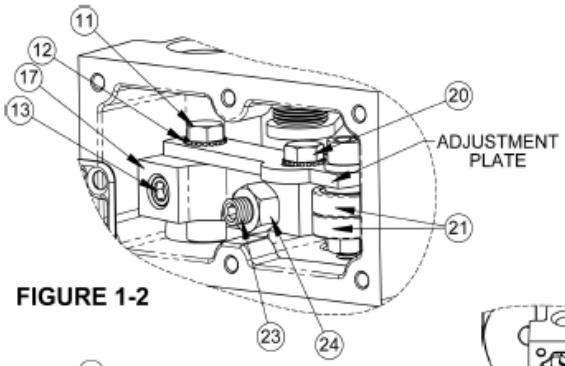
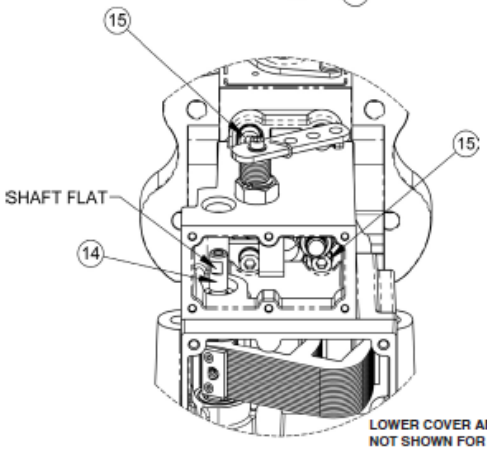


FIGURE 1-2



LOWER COVER AND LEVER ASSEMBLY NOT SHOWN FOR CLARITY

FIGURE 1-3

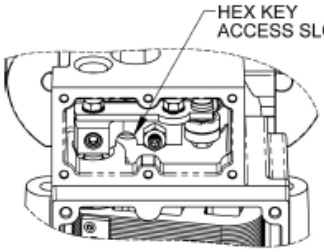
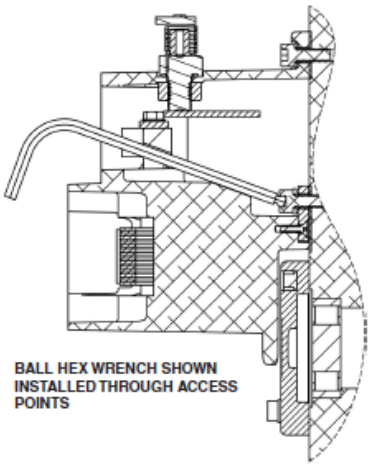


FIGURE 1-5



BALL HEX WRENCH SHOWN INSTALLED THROUGH ACCESS POINTS

GAC APPLICATION NOTE

S12A2, S12R, and S16R MHI ENGINES

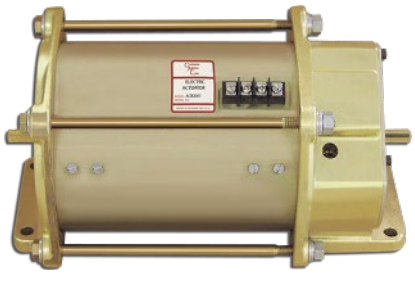
Customer / OEM:	MITSUBISHI Heavy Ind.
Application(s):	Gen-Set, Industrial and Marine
Engine Make / Model / Displacement / Rating:	S12R 2992 in^3 / 49L V12 S16R 3989 in^3 / 65.37L V16
Equipment Make / Model:	
Fuel System Type & Make / Model:	Diesel, In-Line
Operating Speed(s):	1500 RPM, 1800 RPM. 2200 RPM Over-speed
Battery Voltage:	24 V DC
Installed Products:	• Actuator: ACB2001 • Speed Controller: ESD5340 • Magnetic Speed Pickup: MSP6728C

Summary: The ESD5340 Speed Controller offers superior full fuel control from rated operating speed to low idle due to its unique combination of features like dual gain adjustment, one for idle and one for operating speed, with independently adjustable acceleration and deceleration speed ramping controls. The ESD5340 also includes:

- A Two Element Speed Switch
- Dual Speed Ramping from Idle to Operating Speed, with Acceleration and Deceleration Adjustments
- Wide Range Speed Control Compatible
- Start Fuel Control for Lower Exhaust Emissions
- Enhanced Start Circuit for Large Bore Engines
- Variable Speed Governing
- Accessory Inputs for Load Sharing
- High Current Controlled Output, Designed for the ACB2001
- Dual Gain, One at Idle & One at Operating Speed
- Adjustable Chop Frequency for Added Stability

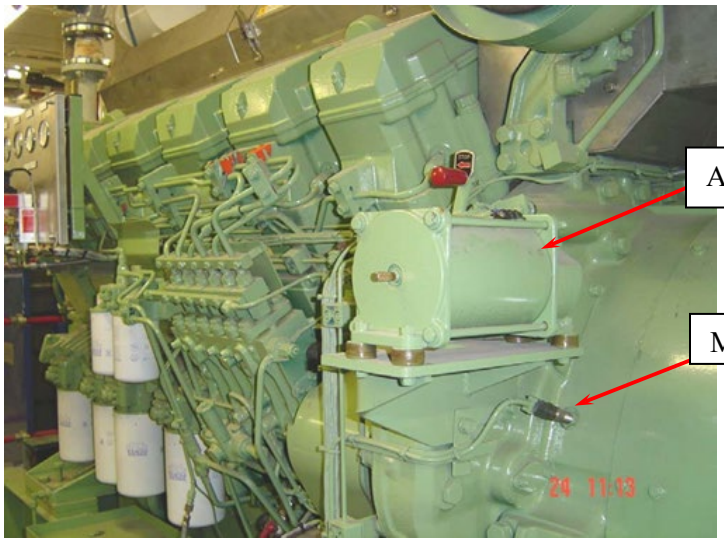
ESD5340

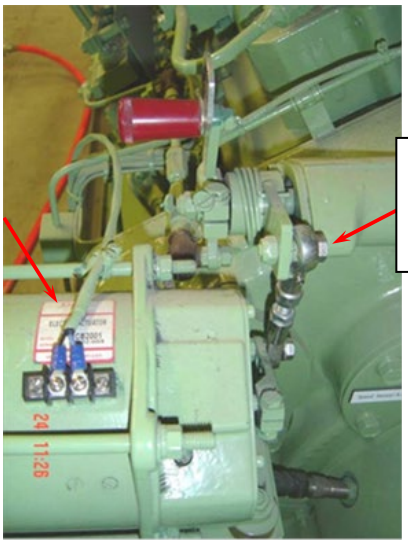
ACB2001 ACTUATOR



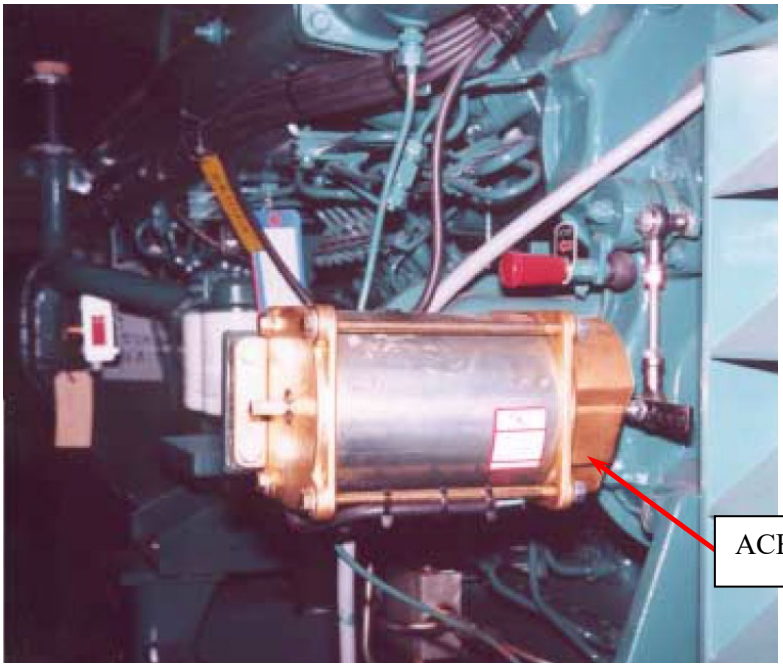
SPEED SENSOR

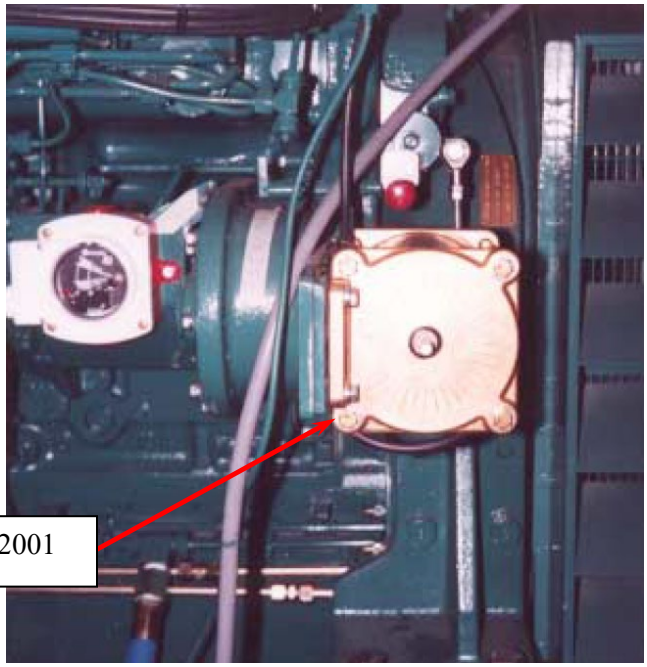
ACB2001 ACTUATOR ON MHI S12R V12 ENGINE (VOLVO PENTA D49)





ACB2001 ACTUATOR ON MHI S12A2 V12 ENGINE (VOLVO PENTA D34)





MHI - S12R: 2,992 CUBIC INCH / 49L DISPLACEMENT V12

MHI S16R-PTA; 3,989 CUBIC INCH / 65.37L DISPLACEMENT V16

GAC APPLICATION NOTE

L-SERIES and K-SERIES ENGINES

Customer / OEM:	MITSUBISHI Heavy Ind.
Application(s):	Various
Engine Make / Model :	L-Series and K-Series
Equipment Make / Model:	
Fuel System Type:	Diesel
Operating Speed(s):	5.4 to 20.4 HP, 1500 – 3600 RPM, L- Series
Battery Voltage:	12 or 24 V DC
Installed or Recommended Products:	• Actuator: ADD225S-12/24 • Speed Controller: ESD2210-12/24 • Magnetic Speed Pickup: MSP6728C

MITSUBISHI L AND K SERIES ENGINES

GAC APPLICATION NOTE

S6A3, S6B3, and S6R MHI ENGINES

Customer / OEM:	MITSUBISHI Heavy Ind.
Application(s):	Various
Engine Make / Model:	S6A3, S6B3, and S6R
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	583 HP @ 1960 RPM, S6A3 429 HP @ 2000 RPM, S6B3 835 HP prime power @ 1800 RPM, S6R
Battery Voltage:	24 V DC
Installed and Recommended Products:	• Actuator: ADD225S-24 • Speed Controller: ESD5500E • Magnetic Speed Pickup: MSP6728C

S6A3, S6B3, AND S6R ENGINES

MTU

The following engine application solutions are described in this section. Links to details on the products are located in this table. Links to details of many of the installation steps described are in the corresponding application note.

MTU part numbers that cross reference to GAC part numbers are referenced in the MTU cross-reference table at the end of this guide.

MTU ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
183 Locomotive	ACB275C		RSC671	LCC109B
447 & 440 HP	ADC225S-24 ACB275C	ESD5221 ESD5550 LSM201	MSP677	KT276, KT275 PCA157, PCA155 PCA162, PCA156 MRM100 KT6731
183 Generator Marine	ACE275H	EGS104B SYC6714		

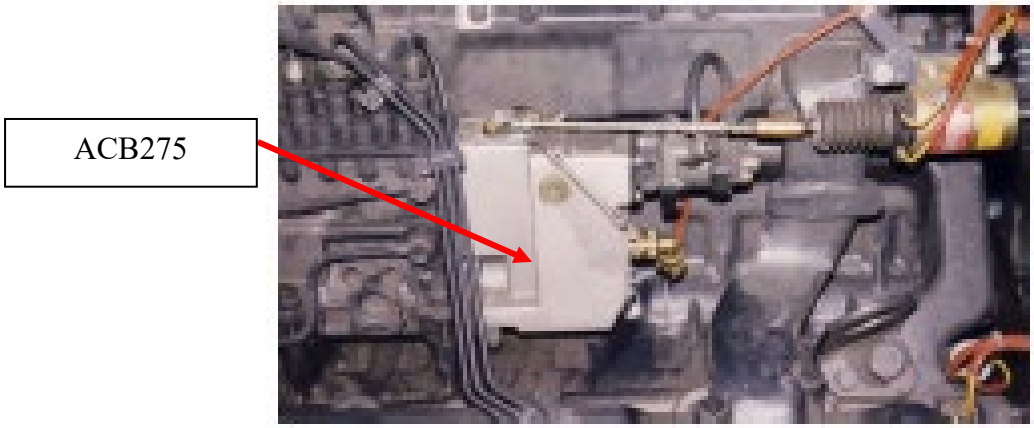
GAC APPLICATION NOTE

MTU 183 DIESEL-ELECTRIC LOCOMOTIVE

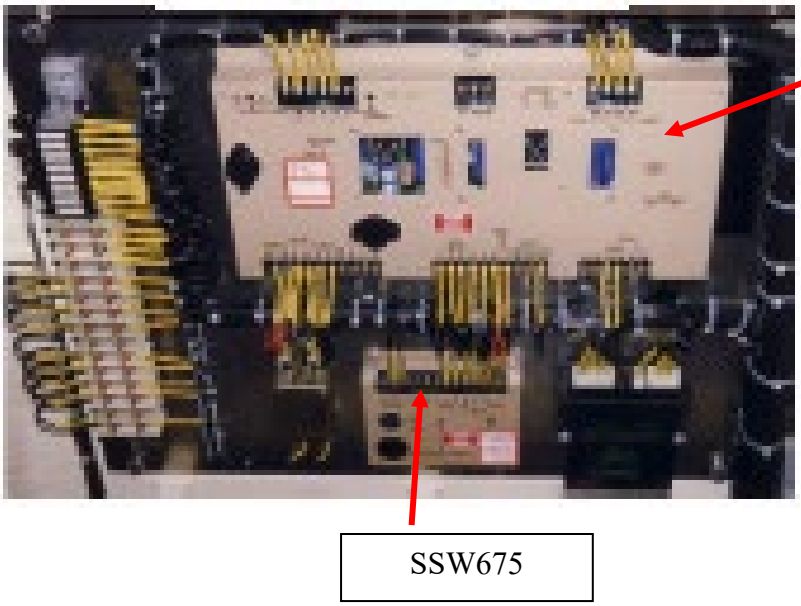
Customer / OEM:	Zermatt-Bahn Cog Railway
Application(s):	Locomotive
Engine Make / Model:	MTU 183, V-12, 21.93 L
Fuel System Type & Make / Model:	Diesel, Inline Pump
Operating Speed(s):	Variable
Battery Voltage:	24 V DC
Installed Products:	• Actuator: ACB275H • Speed Switch: SSW675 • Accessories: LCC109B

LOCOMOTIVE

ACB275H

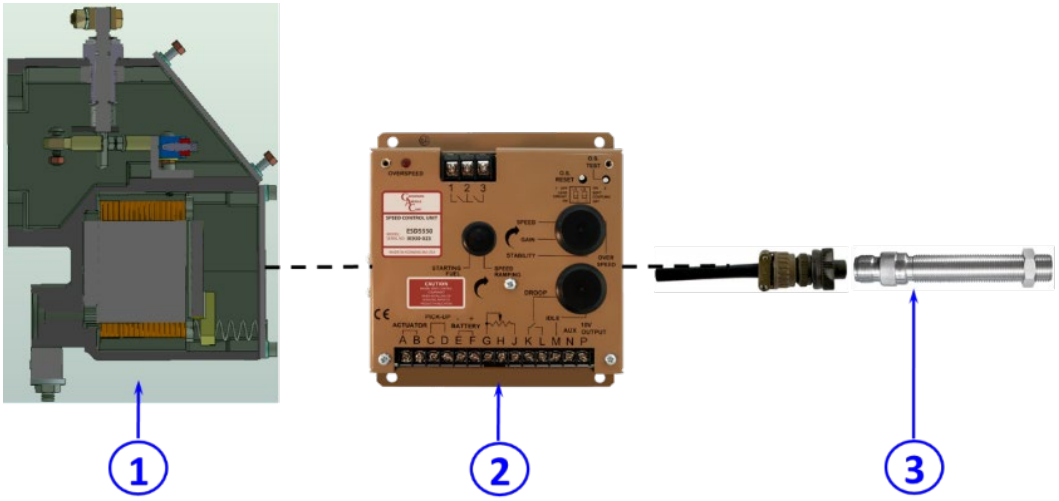


LCC109B AND SSW675



GAC ELECTRONIC GOVERNOR SOLUTIONS FOR MTU ENGINES

MTU 183 SERIES ENGINES WITH INTEGRAL ACTUATOR

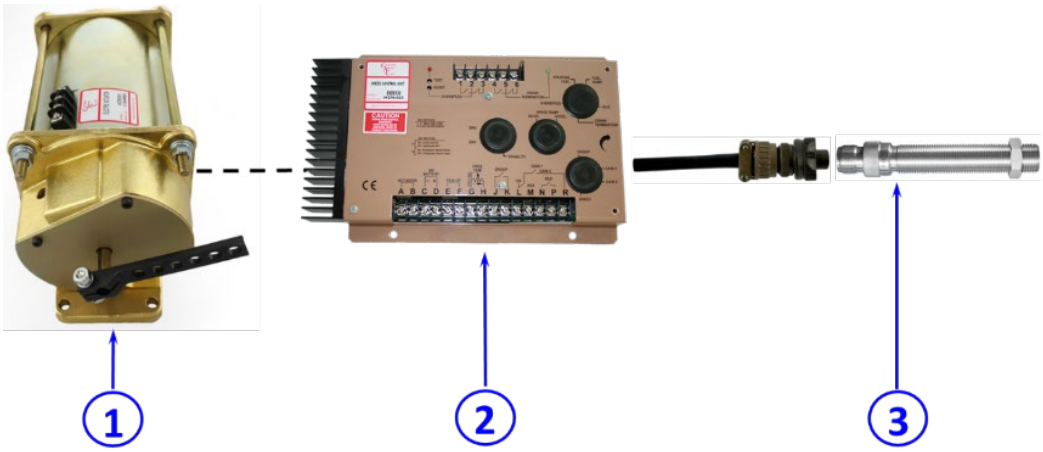


1. Actuator
   ACB275 C

2. Speed Controller
   ESD5221
   ESD5330
   ESD5550

3. Magnetic Speed Sensor
   MSP677
   Mating Connector
   EC1100

MTU 396 SERIES ENGINES WITH EXTERNAL ACTUATOR



1. Actuator
   ACB2001

2. Speed Controller
   ESD5330

3. Magnetic Speed Sensor
   MSP677
   Mating Connector
   EC1100

GAC APPLICATION NOTE

MTU 447 WOOD CHIPPER

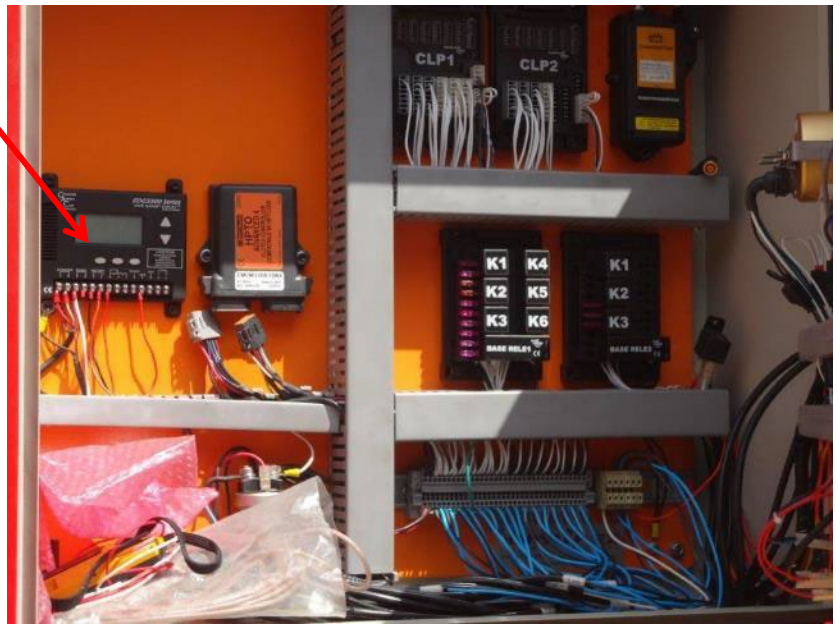
Customer / OEM:	LiPPEL: Brazil
Application(s):	Wood Chipper
Engine Make / Model :	MTU 447, 440HP
Equipment Make / Model:	Forestry Drum Wood Chipper PTML 350/550 x 800
Fuel System Type & Make / Model:	Diesel, Bosch Inline Fuel Pump
Operating Speed(s):	1800 RPM
Battery Voltage:	24 V DC
Installed Products:	• Actuator: ADC225S-24 • Speed Controller: EDG5500

Summary: Forestry Drum Wood Chipper in Brazil.

COMPLETE WOOD CHIPPER

EDG5500

EDG5500



ADC225S-24, FUEL PUMP SIDE VIEW

ADC225S-24

GAC APPLICATION NOTE

MTU 183 MARINE PROPULSION / GENERATOR DRIVE

Customer / OEM: SES Yacht

Application(s): Marine

Engine Make: 2 MTU 183, 150KW each, Diesel

Battery Voltage: 24 V DC

Installed Products:

- Speed Controller: EGS104B
- Supporting Modules: 2 LSM201 load share modules
- Supporting Modules: 2 SYC6714 synchronizers
- Actuator: ACE275H

Summary: The EGS104B speed controller uses the actuators and synchronizers on each engine to share information and provide a smooth transition between the engines.

NOELL

NOELL ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
6 CYL.	ADD175	ESD5550	RSC671	

GAC APPLICATION NOTE

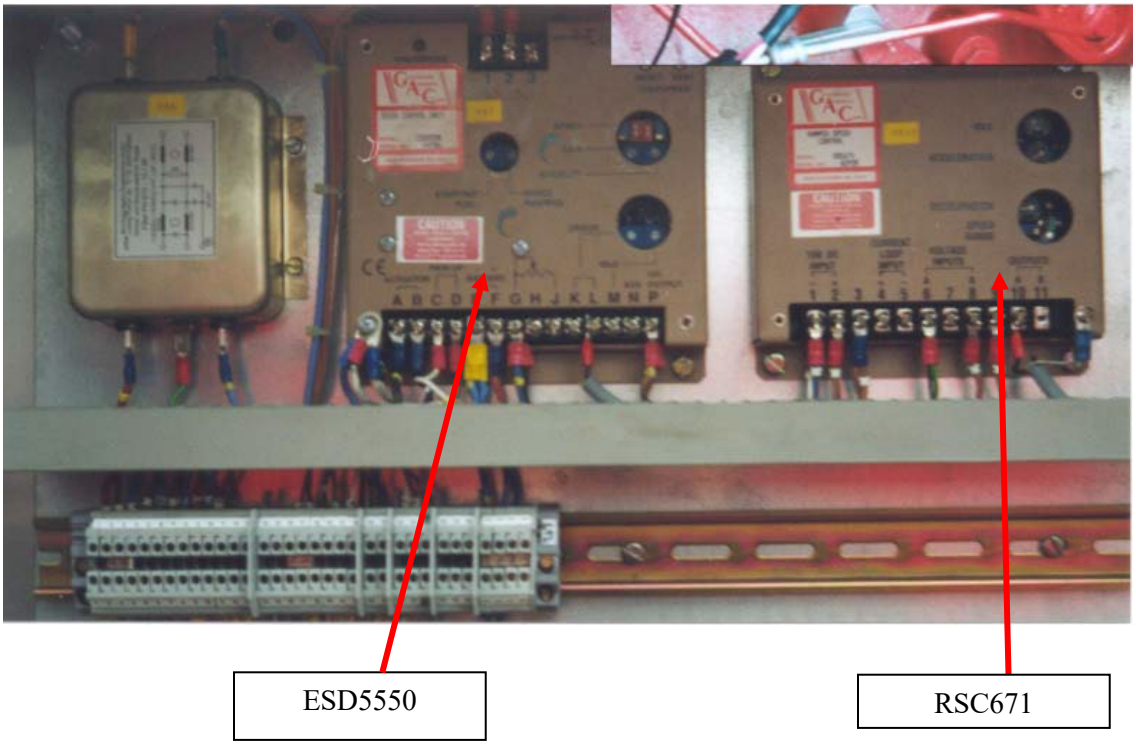
6 CYLINDER CRANE

Customer / OEM:	NOELL Crane Systems
Application:	Crane
Engine Make / Model:	6 Cylinder Scania
Equipment Make / Model:	Container Crane
Fuel System Type & Make / Model:	Diesel, Bosch Inline Pump
Operating Speed(s):	
Battery Voltage:	12 or 24 V DC
Installed Products:	• Actuator: ADD175-24 • Speed Controller: ESD5550 • Speed Ramping Module: RSC671

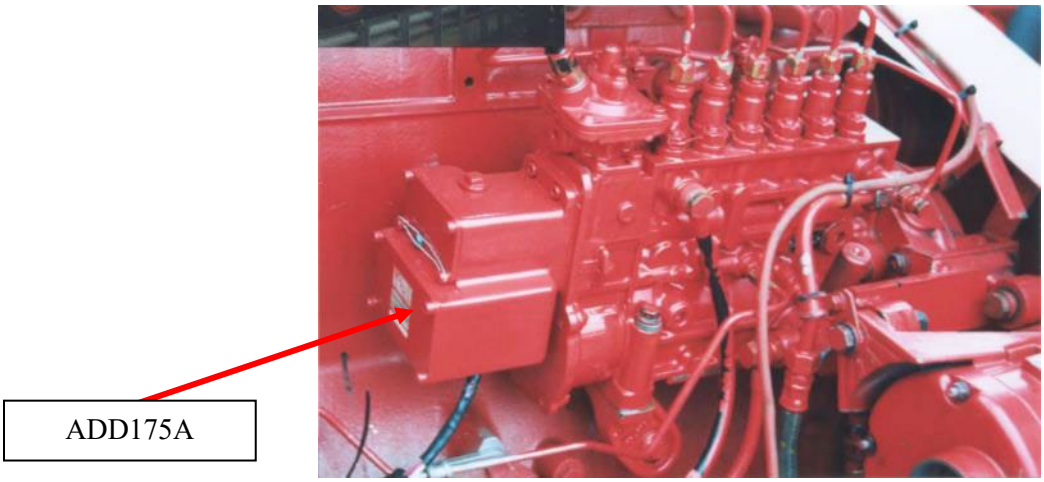
Summary: Dock container crane looking for engine stability chose GAC.

CONTAINER CRANE

GAC CONTROLS



ACTUATOR on PUMP



PERKINS

The following engine application solutions are described in this section. Links to details on the products are located in this table. Links to details of many of the installation steps described are in the corresponding application note.

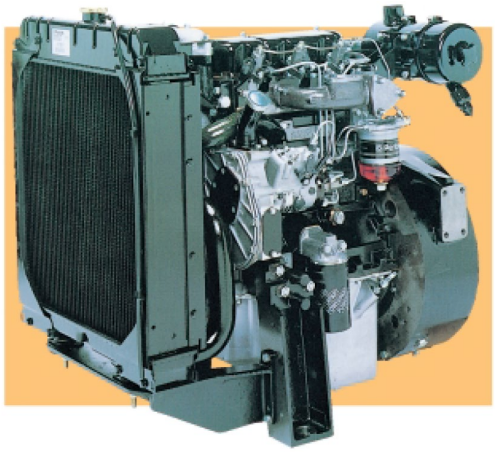
PERKINS ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
3.1524	ADC100	ESD2244 ESD5120 ESD5522E, ESD5570	MSP6728C	EC1350
4.236	ADC100 ADD120S	ESD2244 ESD5120 ESD5522E, ESD5570	MSP6728C	KT190 EC1350
403D	ALR190	EEG6500		
1004-4	ADC100	ESD2244, ESD5120 ESD5522E, ESD5570	MSP6723C, MSP6728C	EC1350
1006-6	ADC100	ESD2244, ESD5120 ESD5522E, ESD5570	MSP6723C MSP6728C	KT190 EC1350
1300 SERIES				EAM115
1306 (TAG)	ADD175A		MSP6724	KT275
2006	ACE275HD-24		MSP6728C	KT275
2800 SERIES				EAM113
3008 (TA)	ACE275HD-24 ADD175A			KT275
3012 SERIES	ADD225S		MSP6728C	
4006, 4008 & 4016	ATB552T2N2-24 ATB652T2N2-24 ATB753T3N14-24	AFR210		RPR102 MXSB44-STM ICM200-6/8 STE101 SOX103 CL600, GR104 SPW100 SCI101
4006 TAG2 ENGINE	ACB2001	ESD5330, ESD5340		
Vista A	ADD103B-12/24			

GAC APPLICATION NOTE

3.1524 ENGINE with STANADYNE

Customer / OEM:	PERKINS
Application(s):	Various
Engine Make / Model:	3.1524 (T) with Stanadyne 3 cylinder, 2.5 liter
Fuel System Type & Make / Model:	Diesel, Stanadyne Rotary Pump
Operating Speed(s):	1500 / 1800 RPM
Battery Voltage:	12 or 24 V DC
Installed or Recommended Products:	• Actuator: ADC100 • Speed Controllers: ESD2244, ESD5120, ESD5522E, or ESD5570 • Magnetic Speed Pickup: MSP6728C and EC1350
Summary:	Mounted directly on the rotary pump

PERKINS 3.1524 ENGINE WITH STANADYNE ROTARY PUMP



1- PERKINS 3.1524 ENGINE RATINGS

Engine Speed rev/min	Type of Operation	Typical Generator Output (Net) kVA	kWe	Engine Power Gross kWm	bhp	Net kWm	bhp
1500	Prime power	**27.5**	**22.0**	25.0	33.5	24.5	33.0
	Standby power	**30.0**	**24.0**	27.5	37.0	27.0	36.0
1800	Prime power	**30.5**	**24.5**	28.0	37.5	27.5	37.0
	Standby power	**34.0**	**27.0**	31.0	42.0	30.5	41.0

GAC APPLICATION NOTE

4.236 ENGINE with STANADYNE CAV

Customer / OEM:	Perkins
Application(s):	Various
Engine Make / Model:	4.236 (T) with Stanadyne CAV
Fuel System Type & Make / Model:	Diesel, Stanadyne Rotary Pump
Operating Speed(s):	84 HP @ 2800 RPM
Battery Voltage:	12, 24 or 32 V DC
Installed or Recommended Products:	• Actuator: ADC100 or ADD120S • Speed Controllers: ESD2244, ESD5120, ESD5522E, or ESD5570 • Magnetic Speed Pickup: MSP6728C and EC1350 • Mounting Kit: KT190

PERKINS 4.236 ENGINE

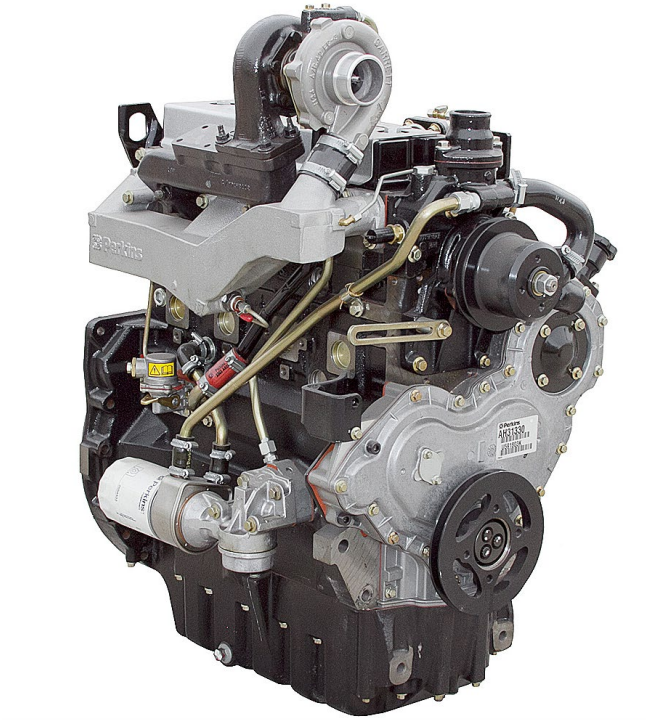
GAC ACTUATOR ON STANADYNE ROTARY PUMP

GAC APPLICATION NOTE

1004 ENGINE with STANADYNE ROTARY PUMP

Customer / OEM:	Perkins
Application(s):	Various
Engine Make / Model:	1004-4 (TW) with Stanadyne
Fuel System Type & Make / Model:	Diesel, Stanadyne Rotary Pump
Operating Speed(s):	85.5 BHP @ 2600 RPM
Battery Voltage:	12 or 24 V DC
Installed or Recommended Products:	• Actuator: ADC100 • Speed Controller: ESD2244, ESD5120, ESD5522E, or ESD5570 • Magnetic Speed Pickup: MSP6728C, EC1350, or MSP6723C with M16x1.5 thread
Summary:	Mounted directly on pump

PERKINS 1004-4 ENGINE WITH STANADYNE ROTARY PUMP AND ADC100 ACTUATOR



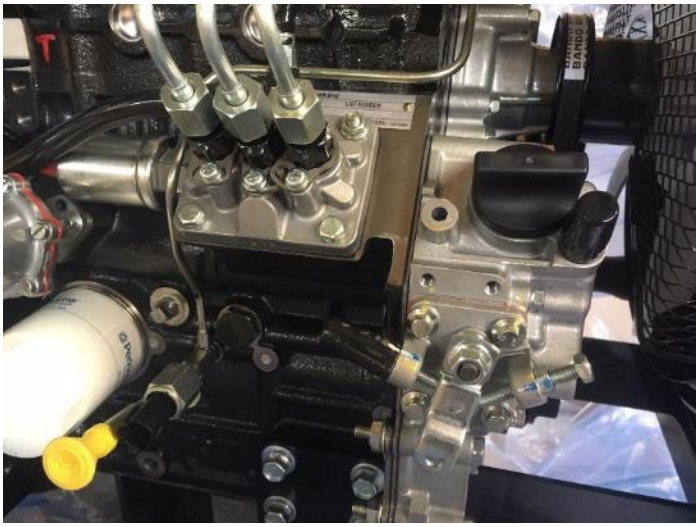
GAC APPLICATION NOTE (all of the components specified are sold separately)

CATERPILLAR C1.7 and PERKINS 403D ENGINES

Customer / OEM:	Perkins / Caterpillar
Application(s):	Industrial Diesel Engines
Engine Make / Model:	403D-07 / 3 cyl /.76L/9-15.3 kW / 2800-3600 rpm 403D-15 / 18.4-25.1 kW / 2200-3000 rpm 403D-15T / 23.1-30 kW / 2200-3000 rpm CAT C1.7 / 23.6 & 26.1 kW / 2400-2600 rpm
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	2200 to 3600 RPM
Battery Voltage:	12/24 VDC
Installed Products:	• Actuator: ALR190-P403-12/24 • Speed Controls: EEG6500 (digital), ESD5111 or ESD5500E (analog)

Summary: ALR actuator easily replaces the Electronic Fuel Stop Solenoid in the Perkins and Caterpillar engines.

BEFORE AND AFTER INSTALLATION OF THE ALR190-P403-12/24 ACTUATOR



GAC APPLICATION NOTE

1006 ENGINE with STANADYNE CAV

Customer / OEM:	Perkins
Application(s):	Various
Engine Make / Model :	1006-6 (TW) with Stanadyne CAV 6 cylinder in-line
Fuel System Type & Make / Model:	Diesel, Stanadyne Rotary Pump
Operating Speed(s):	182.5 BHP @ 2600 RPM
Battery Voltage:	12, 24, or 32 V DC
Installed or Recommended Products:	• Actuator: ADC100 or ADD120S • Speed Controllers: ESD2244, ESD5120, ESD5522E, or ESD5570 • Magnetic Speed Pickup: MSP6728C, EC1350, or MSP6723C with M16x1.5 thread • Mounting Kit: KT190
Summary:	Mounted directly on pump

PERKINS 1006-6 ENGINE AND STANADYNE PUMP WITH ADC100 ACTUATOR

ENGINE RATINGS

Performance Data	Gross Intermittent*	Speed rev/min	Net Intermittent	Speed rev/min
Power Output (kW)	119	2600	107	2600
Power Output (bhp)	159	2600	143.5	2600
Peak Torque (Nm)	577	1600	516	1600
Peak Torque (lbf ft)	425	1600	380	1600

Power output for a run-in engine after 60 hours.
*Rating Standard ISO (TR) 14396

GAC APPLICATION NOTE

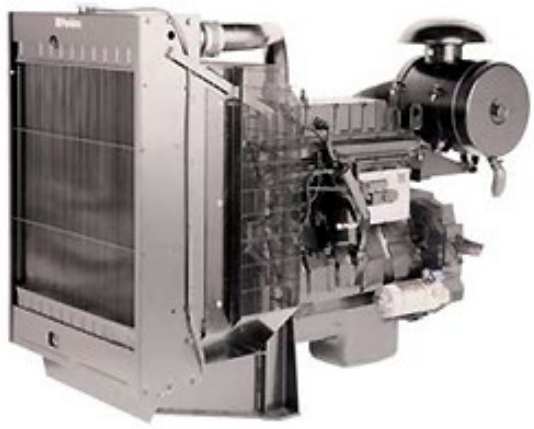
1300 SERIES with INTERFACE MODULE

Customer / OEM: Perkins
Application(s): Engine Control System
Engine Make / Model: 1300 series
Fuel System Type & Make / Model:
Operating Speed(s): 174-350 BHP
Battery Voltage: 12 or 24 V
Recommended Products:
- Interface Module: EAM115

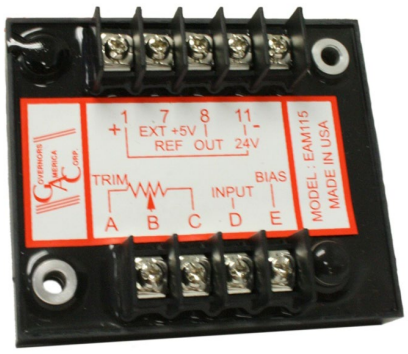
Summary: The EAM115 is an interface module that provides conditioned electrical signals for Perkins1300 Series engine/genset applications (Edi 6e gen set). A typical application is where a GAC load sharing/ synchronization system is to be connected to such a Perkins engine control system.

The DC supply for the interface comes from the common battery source for the engine control and the accessory controls. The input to the module (Terminal D) is typically 5.0 V DC, which represents the load sharing, and synchronization signals. The output of the EAM115 to the Perkins control is a 2.5 V DC signal based on the Perkins 5.0 V DC reference signal.

PERKINS 1300 SERIES ENGINE



EAM115 INTERFACE MODULE

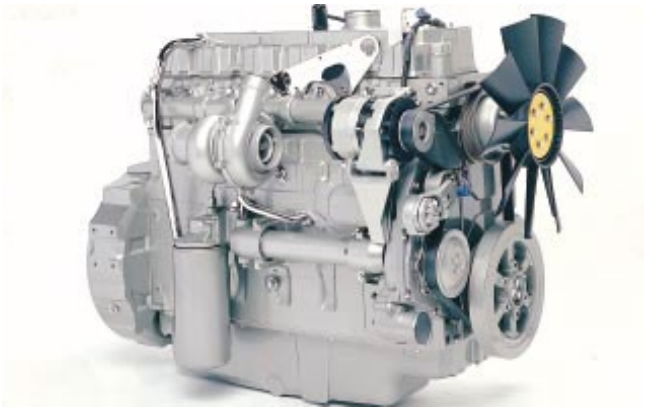


GAC APPLICATION NOTE

1306 ENGINE with BOSCH "P" PUMP

Customer / OEM:	Perkins
Application(s):	Gen. Set
Engine Make / Model:	1306 (TAG)
Fuel System Type & Make / Model:	Diesel, Bosch "P" Inline Pump
Operating Speed(s):	246 kW, 330 HP @ 1500 RPM 261 kW, 350 HP @ 1800 RPM
Battery Voltage:	12 or 24 V DC
Installed or Recommended Products:	• Actuator : ADD175A • Magnetic Speed Pickup: MSP6724 with ¾-16 UNF • Mounting Kit: KT275

PERKINS 1306 ENGINE



MSP6724

1300 Series EDi Gen Set Power		
	Gross Engine Output kWm (hp)	
	@1500 rev/min	@1800 rev/min
1306-E87T	149.0 (200)	171.5 (230)
	160.0 (215)	- -
1306-E87TA	186.5 (250)	201.5 (270)
	205.0 (270)	227.5 (305)
	223.0 (300)	242.5 (325)
	231.0 (310)	--
	246.0 (330)	261.0 (350)

GAC APPLICATION NOTE

2006 ENGINE with BOSCH "P" PUMP

Customer / OEM:	Perkins
Application(s):	Gen. Set
Engine Make / Model:	2006 (TA)
Fuel System Type & Make / Model:	Diesel, Bosch "P" Inline Pump
Operating Speed(s):	364 kW @ 1500 RPM 368 kW @ 1800 RPM
Battery Voltage:	24 V DC
Recommended Products:	• Actuator: ACE275HD-24 • Magnetic Speed Pickup: MSP6728 with 5/8-18 UNF • Mounting Kit: KT275

PERKINS 2006 ENGINE AND BOSCH "P" PUMP

GAC APPLICATION NOTE

2800 SERIES ENGINE

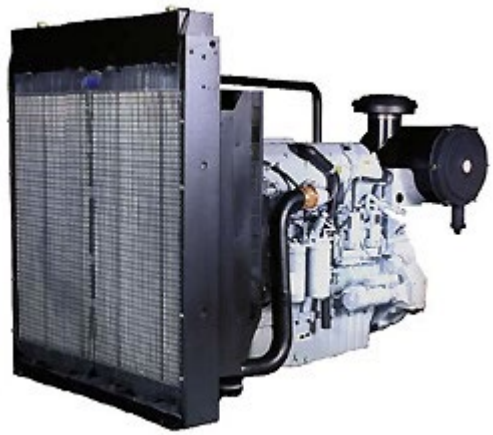
Customer / OEM:	Perkins
Application(s):	Engine Control System
Engine Make / Model :	2800 Series
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	514-652 kW
Battery Voltage:	24 V DC
Recommended Products:	• Interface Module: EAM113

Summary: The EAM113 interface module is designed to be used between the PERKINS 2800 series engine control and an external control such as a variable speed input or a Load sharing and Synchronizing system. The output of the EAM113 is a current sinking PWM signal that controls the PERKINS engine control.

The EAM113 has two inputs, a 4-20 mA input as well as a 5.0V DC input. The 4-20 mA input serves to provide a wide range of PWM for maximum changes at the PERKINS control. The 5.0 V DC input is a limited range PWM output around 50% duty cycle for trimming of the speed for such usages as GAC load sharing and synchronizing.

A single potentiometer adjustment allows the range of the input signal's effect on the PERKINS control to be limited from maximum to minimum PWM duty cycle. The PWM frequency is fixed at 500 Hz. Supply voltage for the interface is the same 24 V DC battery that supplies the PERKINS system.

PERKINS 2800 SERIES ENGINE



EAM113 INTERFACE MODULE

GAC APPLICATION NOTE

3008 ENGINE with BOSCH "P" PUMP

Customer / OEM:	Perkins
Application(s):	Various
Engine Make / Model / Displacement / Rating:	3008 (TA) with Bosch "P"
Fuel System Type & Make / Model:	Diesel, Bosch "P" Inline Pump
Operating Speed(s):	468 kW, 628 BHP @ 1500 RPM
Battery Voltage:	24 V DC
Recommended Products:	• Actuator: ACE275HD-24 or ADD175A-24 • Mounting Kit: KT275

PERKINS 3008 ENGINE AND BOSCH "P" PUMP

ENGINE RATINGS

Engine Speed rev/min	Type of Operation	Typical Generator Output (Net) kVA	kWe	Engine Power Gross kW	bhp	Net kW	bhp
1500	Continuous Baseload	–	–	–	–	–	–
	Prime Power	500	400	438	587	426	571
	Standby (Maximum)	550	440	480	644	468	628
1800	Continuous Baseload	–	–	–	–	–	–
	Prime Power	–	–	–	–	–	–
	Standby (Maximum)	–	–	–	–	–	–

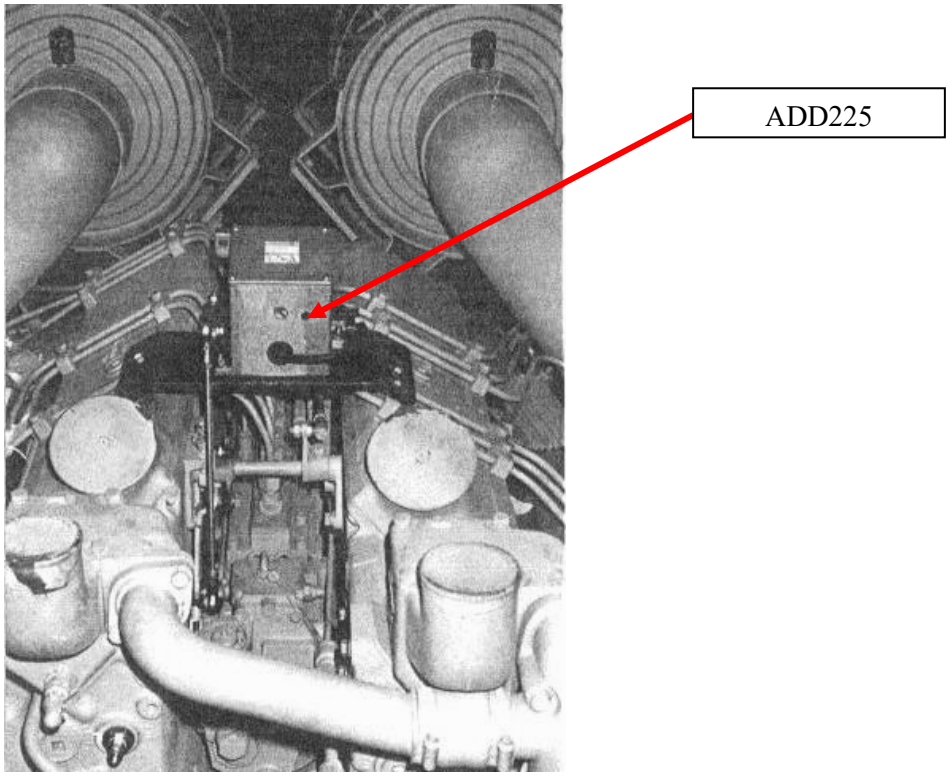
GAC APPLICATION NOTE

3012 SERIES ENGINES

Customer / OEM:	Perkins
Application(s):	Power Generation
Engine Make / Model:	3012 26.1L V-12
Fuel System Type & Make / Model:	Diesel, CAV Maximec
Operating Speed(s):	550 kW, 738 BHP @ 1800 RPM
Battery Voltage:	24 V DC
Recommended Products:	• Actuator: ADD225S-24 • Magnetic Speed Sensor: MSP6728C

Summary: Engine with CAV Maximec fuel pump (to stop lever)

ACTUATOR AND INSTALLATION KIT



GAC APPLICATION NOTE

4000 SERIES METHANE POWER GENERATION

Customer / OEM:	Mayphil – Gas Centre of Excellence for Perkins 4000 Series Engines
Application(s):	Power Generation, mining
Engine Make / Model / Displacement / Rating:	Perkins 22.9L (1398 in^3) 4006 in-line 6 cylinder series Perkins 30.6L (1865 in^3) 4008 in-line 8 cylinder series Perkins 61.1L (3729 in^3) 4016 V-16 cylinder series gas engines
Fuel System Type & Make / Model:	Air/Fuel mixer with zero pressure regulator and mixture adjustment Actuator throttle body, Ignition system with individual cylinder ignition coils, spark plugs and electronic engine Governor -
Operating Speed(s):	1500 / 1800 RPM 384 kW @ 1200 RPM, 415 kW @ 1500 RPM, 4008 inline 912 kW @ 1500 RPM, 4016 V-16
Battery Voltage:	24 V DC
Recommended Products:	• Zero pressure gas regulator GAC RPR102 • Venturi mixer and fuel control valve assembly GAC MXSB44-STM • Actuator throttle body GAC ATB552T2N2-24, ATB652T2N2-24 and ATB753T3N214-24 • Venturi mixer-control / engine speed controller GAC AFR210 • Oxygen Sensor GAC SOX103 • Exhaust gas temperature sensor GAC STE101 • Ignition Control Module GAC ICM200-6/8 • Ignition Coils GAC CL600 • Spark Plug Wires GAC SPW100 • Camshaft trigger wheel GAC GR104 • Camshaft sensor GAC SCI101

Summary: From their UK headquarters in South Wales, Mayphil and their regional facilities have been appointed Perkins 4000 Series Centre of Excellence for engines capable of operating on a wide range of methane based gases: landfill gas, digester gas biogas and coal bed mine gas.

MAYPHIL / PERKINS 4000 SERIES GAS ENGINES

4006 SERIES

4008 SERIES

4016 SERIES

GAC ESD5500 SERIES AND ACTUATOR THROTTLE BODY

On Mayphil / Perkins 4006 Engine prepared for shipment

GAC APPLICATION NOTE

N844 4 CYLINDER ENGINE

Customer / OEM: Private
Application(s): Power Generation
Engine Make / Model: N844
Fuel System Type & Make / Model: Diesel
Battery Voltage:
Recommended Products:

- Actuator: ALR160-S04
- Speed Controller: SDG725

Summary: The Puma Ocean Racing Team installed a Perkins N844 four-cylinder engine to adjust the keel on one of their sailboats. GACs ALR160-S04 actuator and SDG725 Smart Digital Governor supports the application which required a fast, compact, flexible variable speed system that can be controlled from above or below deck. The ALR160 actuator replaced the shut off solenoid in the PF pump housing, acting directly on the fuel control rack.

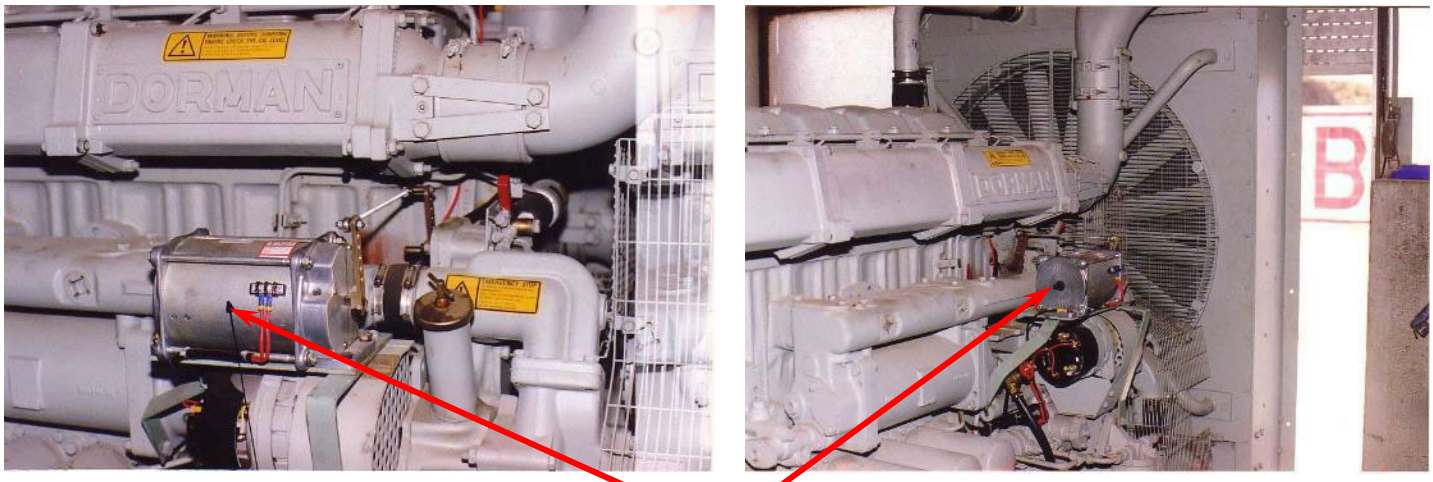
FINISHED INSTALLATION

GAC APPLICATION NOTE

DORMAN 6 SETCA 2 / PERKINS 4006 TAG2 ENGINE

Customer / OEM:	Perkins / Dorman
Application(s):	Industrial, Gen-set Engine
Engine Make / Model :	4006 TAG2 6 Cylinder 22.9L, 587 kW at 1500 RPM
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	1500 RPM
Battery Voltage:	24 V DC
Installed or Recommended Products:	• Actuator: ACB2001 • Speed Controllers: ESD5330 (Standard) or ESD5340 (Full Fuel at Start-up)
Summary:	The Perkins Engine Company Limited acquired Dorman Diesels of Stafford; they incorporated the SE engines into the Perkins system as the 4000 Series.

DORMAN 6 SETCA 2 / PERKINS 4006 TAG2 ENGINE



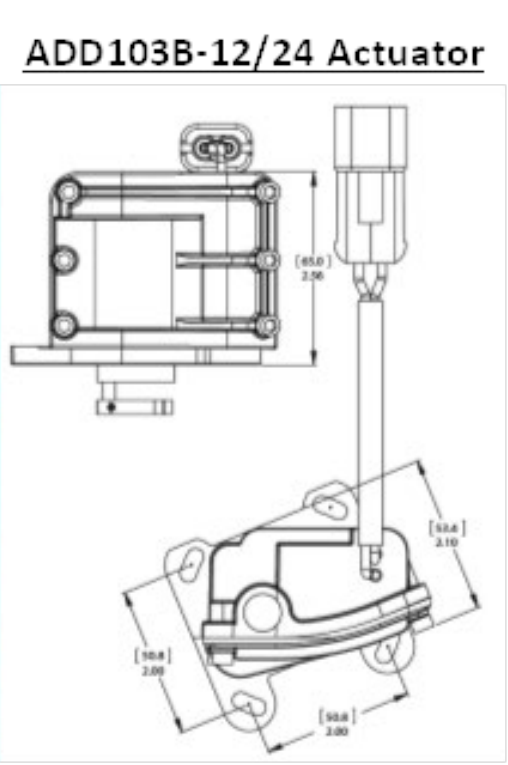
GAC - ACB2001
Actuator

GAC APPLICATION NOTE

VISTA A with DELPHI DPA

Customer / OEM: Perkins
Application(s): Various
Engine Make / Model: Vista A 1453
Fuel System Type & Make / Model: Diesel, Delphi DPG Pump
Operating Speed(s):
Battery Voltage: 12 or 24 V DC
Installed Products:
- Actuator: ADD103B-12/24

Summary: 3230F570T Perkins Vista A 30 KVA Delphi DPA Fuel Pump



SCANIA

SCANIA ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
D9, D11, DSC 14 & DSI 14	ADC225S-24	ESD5131 ESD5500E	MSP675	
Scania DSC 1000	ACE275K-24			DSC1004
Scania 12L	ATB652T2N1-24V			
Scania S6				EAM127
Sanfirden SGI-12-ST	ATB652T2N1-24 ACB275H	ESD5526E RSC671	MSP677	EC1100 CH1204-L3 CH1206-S PCI105 KT276 CH1203-B CH1206A-L6 CH1208-6 DSC1002 DSC1002C

GAC APPLICATION NOTE

DC13 072A ENGINES

Customer / OEM:	Scania
Application(s):	Generator
Engine Make / Model:	DC13 072A
Equipment Make / Model:	6 Cylinder, 12.7L
Fuel System Type & Make / Model:	Natural Gas
Operating Speed(s):	326-406 kW
Battery Voltage:	24 V DC
Installed Products:	• Actuator: ATB752T2N-24 • Speed Controller: AFR201 • MLXB75

Summary: Two Scania DC13 072A engines and GAC AFR solution supports three water pumps in a Brazilian town. The GAC ATB driven by an AFR keeps the engine running for this town. Running in a lean mixture the AFR allows for updates using the free GAC configuration software.

DUAL SCANIA DC13 FOR PUMP SUPPORT

GAC APPLICATION NOTE

D9, D11, DSC 14, and DSI 14 ENGINES

Customer / OEM:	Scania
Application(s):	Various
Engine Make / Model / Displacement / Rating:	D9, D11, DSC 14, DSI 14
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	700 RPM low idle, variable range from 700-2200 RPM
Battery Voltage:	24 V DC
Recommended Products:	• Actuator: ADC225S-24 • Speed Controllers: ESD5131 or ESD5500E • Magnetic Speed Pickup: MSP675

SCANIA D9

1 Actuator

ADC225S-24

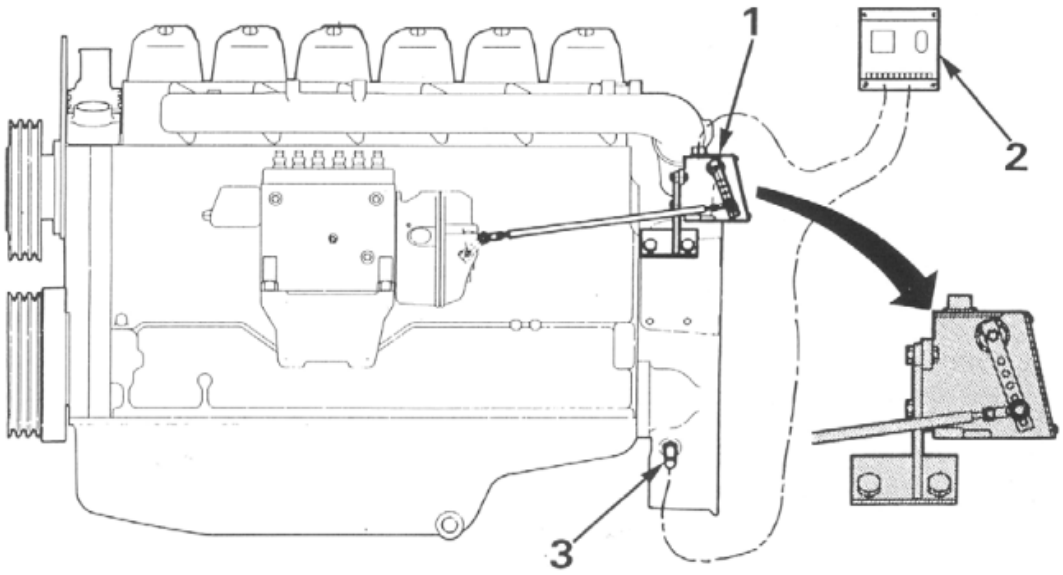
2 Control Unit

ESD5131 or

ESD5500E

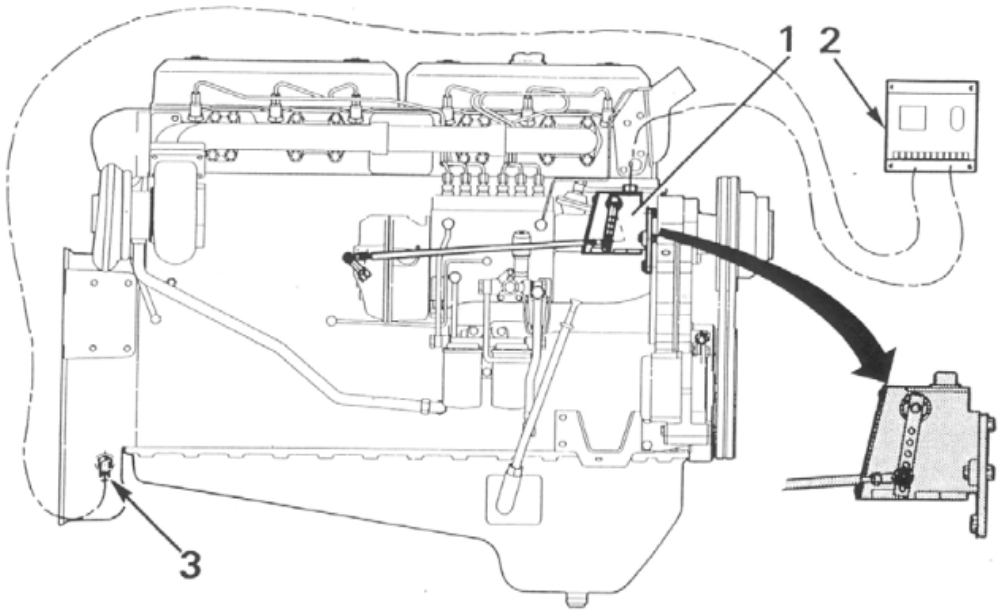
3 Speed Sensor

MSP675



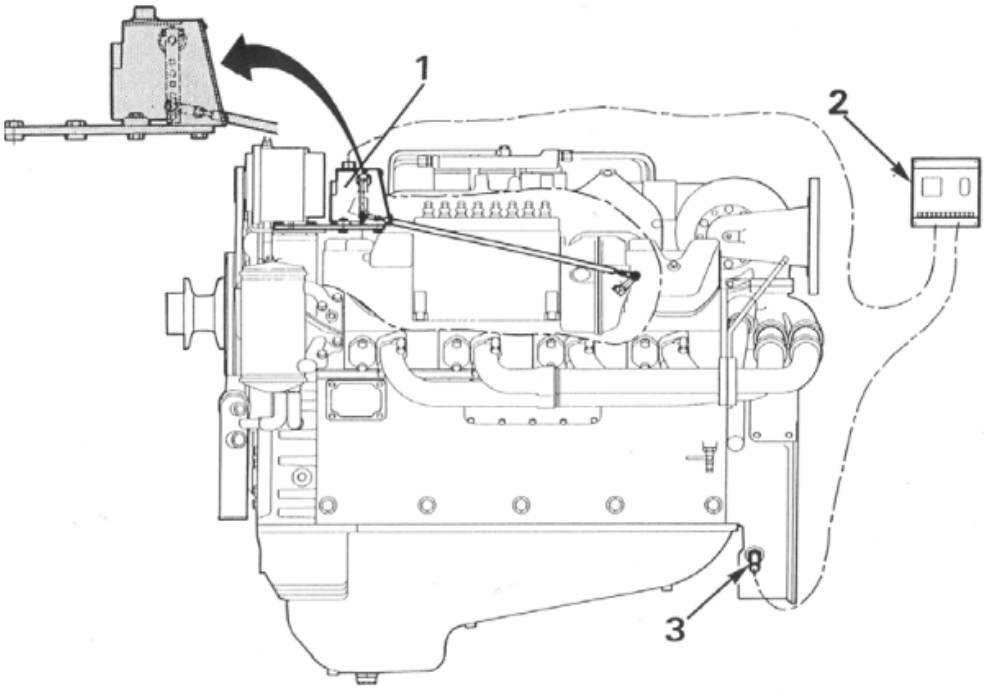
SCANIA D11

1 Actuator
ADC225S-24
2 Control Unit
ESD5131 or
ESD5500E
3 Speed Sensor
MSP675



SCANIA DSC 14

1 Actuator
ADC225S-24
2 Control Unit
ESD5131
3 Speed Sensor
MSP675



SCANIA DSI 14

1 Actuator

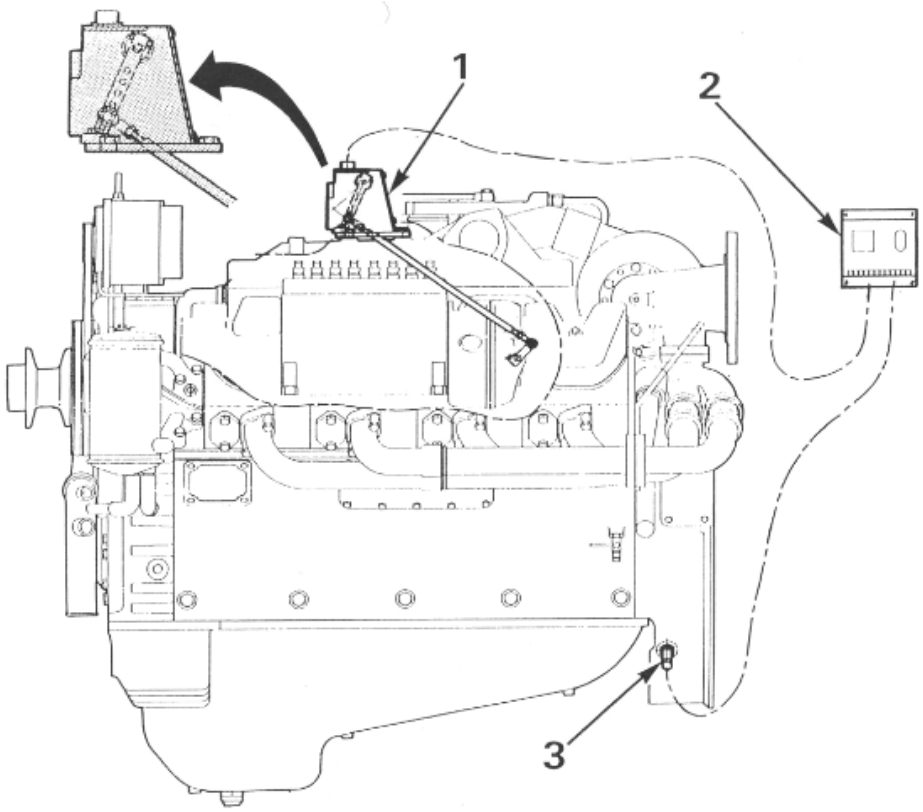
ADC225S-24

2 Control Unit

ESD5131

3 Speed Sensor

MSP675



GAC APPLICATION NOTE

DSC1000 SERIES ENGINE CONTROL SYSTEM

Customer / OEM: Scania, Deutz, MWM, BEML…
Application(s): Marine, Power Generation, Off Road Mobile Equipment
Fuel System Type & Make / Model: Diesel, Bosch Inline P-Pump
Operating Speed(s): 800 RPM idle, variable range from 1000-2400 RPM
Battery Voltage: 24 V DC
Installed Products: Actuator: **ACE275K-24**

- Position Feedback Sensor
- Heavy Duty Bearings
- Manual Shut-Off

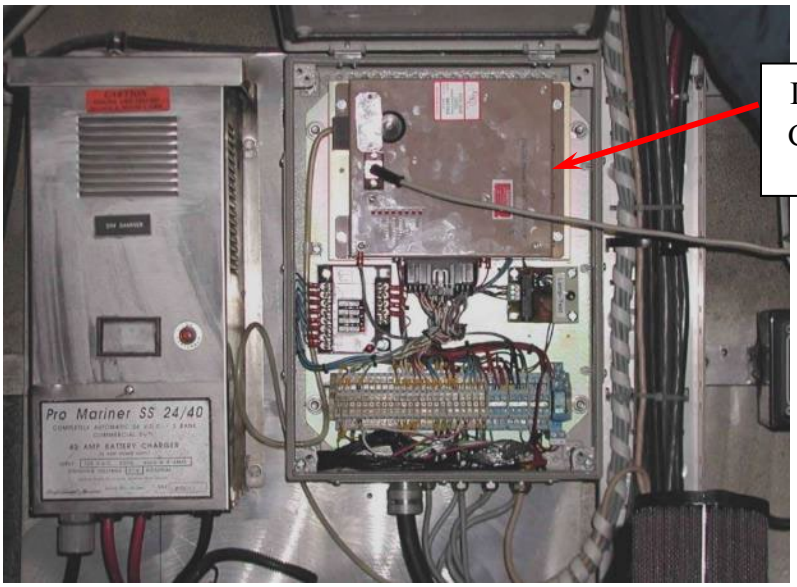
Speed Controller: **DSC1004**

- Cranking Fuel and Crank Termination Adjustments
- Speed Ramping
- Fully Programmable – GDS Software
- Fuel Mapping Based On RPM and Boost Pressure / Boost Limits
- Temperature Dependent Start Fuel
- Temperature dependent Torque Curve (De-Rated Temp. Control)
- Fault Codes / Fault Logging / MIL w/ Flash Codes
- Load Sharing / Synchronizer Input
- Droop or Isochronous Selection
- Oil, Air and Exhaust Temp. Measurement w/ Adjustable Thresholds

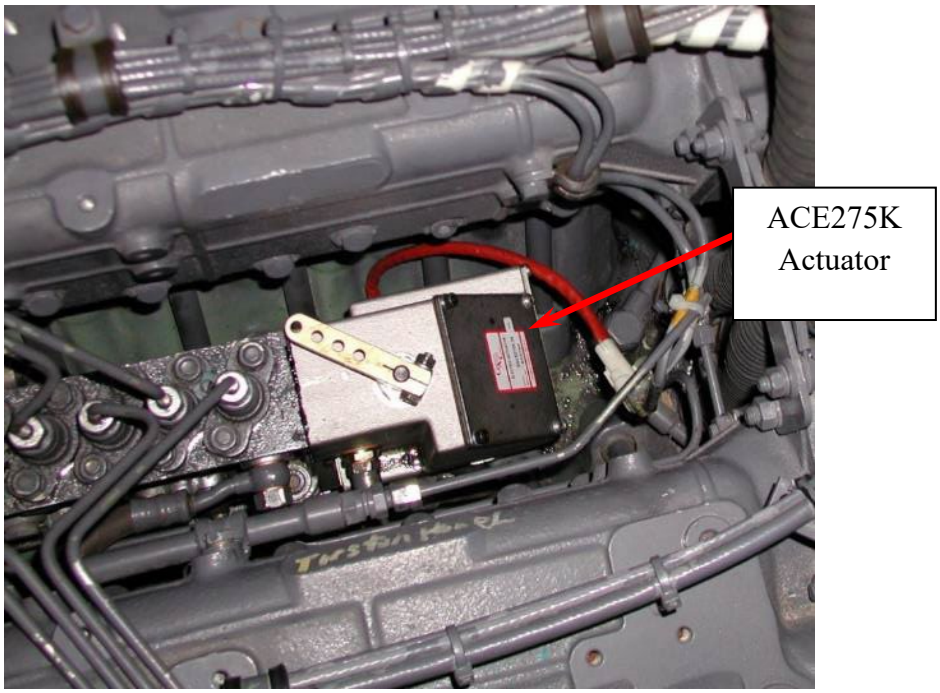
Summary: Marine Installation on water taxi.

THE MONMOUTH OUT OF WEEHAKEN, N.J.

DSC1004 CONTROLLER PANEL INSTALLATION



ACE275K ACTUATOR MOUNTED ON BOSCH "P" PUMP



GAC APPLICATION NOTE

12 LITER GAS ENGINE

Customer / OEM:	Scania
Application(s):	Various Gen Set
Engine Make / Model:	12L Gas Engine
Fuel System Type & Make / Model:	Natural Gas
Operating Speed(s):	
Battery Voltage:	24V
Recommended Products:	Actuator: ATB652T3N1-24

Summary: SCANIA 12-liter gas engine with GAC electronic governor using an ATB652T3N1-24 V DC Integral electric throttle

GAC APPLICATION NOTE

S6 ENGINE

Customer / OEM:	SCANIA
Application(s):	Engine Control
Engine Make / Model:	S6
Operating Speed(s):	
Battery Voltage:	24 V DC
Recommended Products:	• Interface Module: EAM127

Summary: The EAM127 is an electronic interface module designed for use with the SCANIA S6 engine control system. The module accepts a nominal 5 VDC input signal and converts this signal to a 1.589 V DC analog signal for the S6 control across a galvanic isolated barrier. Typical usage is as a signal conditioner between a GAC auto-synchronizer / load sharing system and the S6 engine control. The power to operate the interface comes from the 24 V DC on the COO module.

EAM127 INTERFACE MODULE

GAC APPLICATION NOTE

SANFIRDEN BIO GAS ENGINE - SCANIA SGI-12-ST

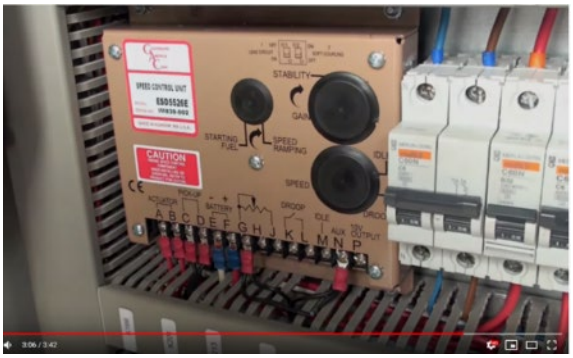
Customer / OEM:	SANFIRDEN / SCANIA
Application(s):	Gen-Set
Engine Make / Model :	Scania 12L SGI-12-ST / 205 kW at 50 Hz and 220 kW at 60 Hz
Fuel System Type & Make / Model:	LNG, CNG, LBG, Natural Gas. 45% to 60% Methane
Operating Speed(s):	1500 / 1800 RPM
Battery Voltage:	12 or 24 V DC

Installed or Recommended Products:	• Actuator: ATB T2 - 65mm Bore Diameter, High Temperature / Sealed with optional positions feedback sensor
	• Speed Controller: ESD5526E
	  • Anti-Wind-Up Circuit (for use with ATB gas applications)
	  • Switchable Droop Control, Start Fuel Control
	  • Speed Ramping, Soft Coupling, Over-speed Control Switch

Summary:	See **http://www.youtube.com/watch?v=sszuUNz5ltU** for a live demonstration**.**

COMPLETED SCANIA SGI-12-ST BIO-GAS FUELED ENGINE

GAC ESD5526 AND ATBT2 ACTUATOR



VOLVO

The following engine application solutions are described in this section. Links to details on the products are located in this table. Links to details of many of the installation steps described are in the corresponding application note.

Volvo part numbers that cross reference to GAC part numbers are referenced in the VOLVO cross-reference table at the end of this guide.

VOLVO ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
D5A, D7A, TD 420, TAD 420, TAD 520, TAD 531, TAD 720 & TAD 731	ADD180G-12/24	ESD5500E ESD5111 ESD5500-II ESD5550		
D25A &D30A	ADD225S-24		MSP6728C	
D34A, D49A & D65A	ACB2001	ESD5330	MSP6728C	
TD610, TWD610, TD710, TWD710, TAD721, TAD730, TD740, TD741, TD1010, TAD1030, TAD1031, TAD1032, TWD1211, TAD1230, TAD1231 & TAD1233	ACB275H-24 ADD175A-24	ESD5500E	MSP6728C	KT275 KT276
TAD 520 & TAD 720	ADD225S-24	ESD5500E		

GAC APPLICATION NOTE

TD 420, TAD 420, TAD 520, TAD 531, TAD 720 AND TAD 731 ENGINES

Customer / OEM: VOLVO / DEUTZ

Application(s): Marine Gen-set and Industrial Applications

Engine Make / Model: Volvo Industrial: 4.76L 4 Cylinder and 7.15L 6 Cylinder
TD 420, TAD 420, TAD 520, TAD 531, TAD 720 and TAD 731
Volvo Marine Gen-Set: D5A and D7A
Deutz: 1012, 1013 and 2012

Equipment Make / Model: Marine Gen-set and Industrial Applications

Fuel System Type & Make / Model: Diesel, Engine Mounted Pump

Operating Speed(s): 1500 / 1800 RPM

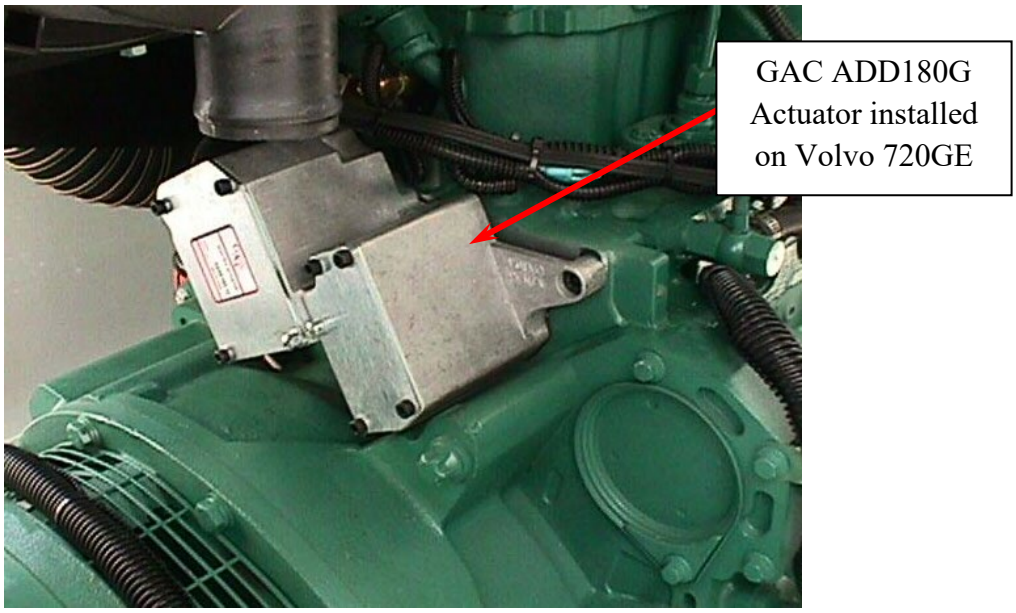
Battery Voltage: 12 or 24 V DC

Installed Products:

- Actuator: ADD180G-12/24
- Speed Controller: ESD5500E, ESD5111, ESD5500-II, or ESD5550

Summary: The 180 SERIES Integral Actuator is designed to mount directly to Deutz 1013/2012 and Volvo 520/720 engines. The existing mechanical governor is removed from the engine and the 180 SERIES integral actuator is mounted in its place.

ADD180G INSTALLED ON A VOLVO ENGINE



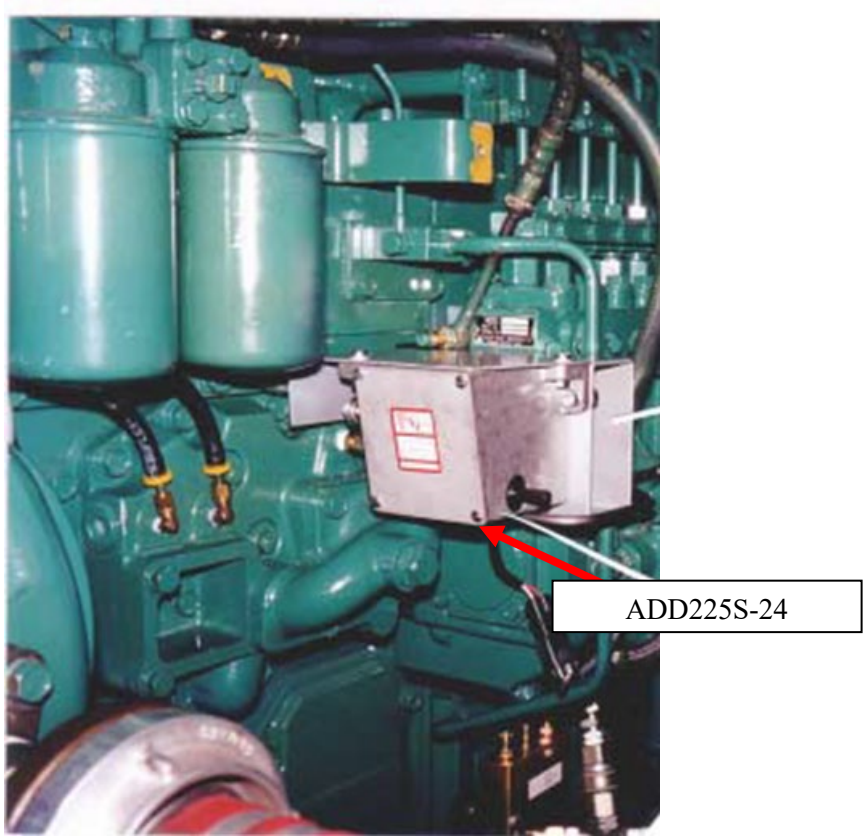
GAC APPLICATION NOTE

VOLVO D30 (MHI S6R2) ENGINES

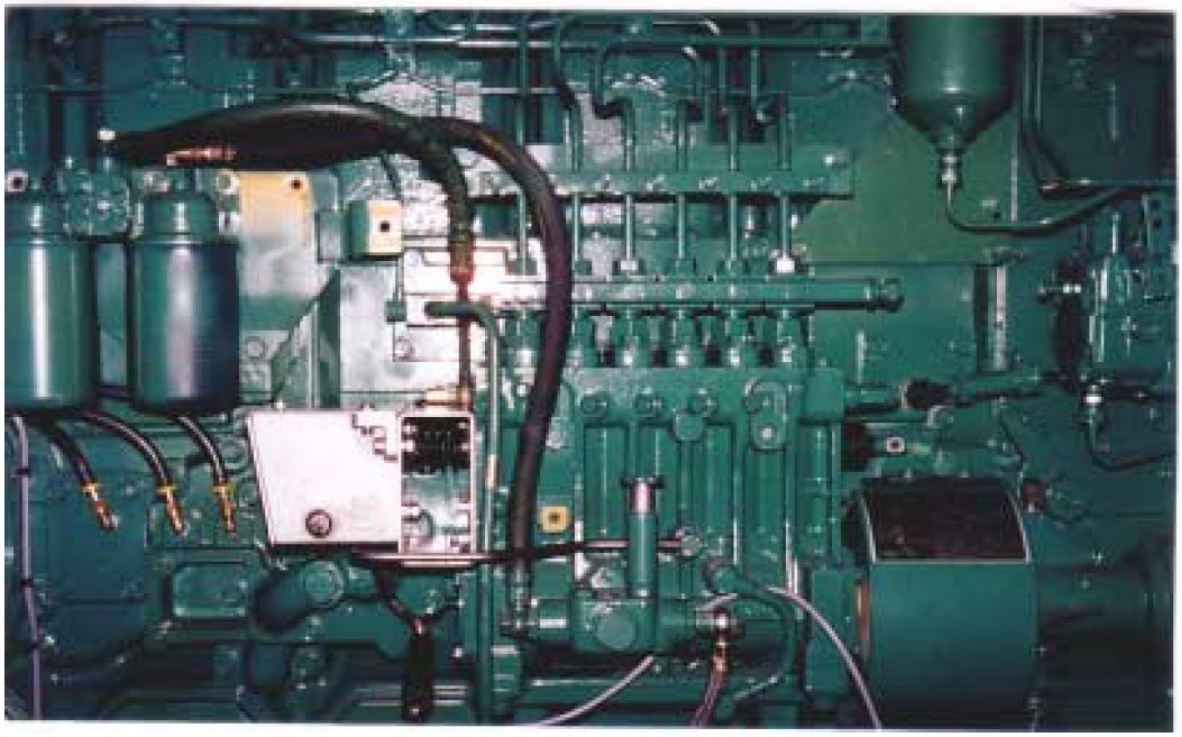
Customer / OEM:	VOLVO PENTA
Application(s):	Marine Propulsion / Generator Drive
Engine Make / Model:	Mitsubishi S6R2, 24.5L In-Line 6 Cylinder Power Ratings Range from 480 to 759 kW at 1500 RPM
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	1500 / 1800 RPM and Variable Speed
Battery Voltage:	24 V DC
Installed Products:	• Actuator : ADC225S-24 (Volvo Part Number 3838271) • Speed Controllers: ESD5500E (Volvo Part Number 3817999) • Magnetic Speed Pickup: MSP6827C

Summary: The MHI S6R2 engine series fit with a GAC electronic governor systems for superior speed control serves in gen-sets and marine propulsion applications.

VOLVO D30 (MHI S6R2) ENGINE WITH GAC SPEED CONTROLLER AND ACTUATOR ON PS6-48 270 PUMP



VOLVO D30 (MHI S6R2) ENGINE WITH GAC SPEED CONTROLLER AND ACTUATOR ON PS6-48 270 PUMP



GAC GOVERNOR SOLUTIONS ON VOLVO-MHI ENGINES FOR RETROFIT APPLICATIONS

Engine	Actuator	Speed Controller	MSP
D25A	ADD225S-24	ESD5500E	MSP6728C
D30A	ADD225S-24	ESD5500E	MSP6728C
D34A	ACB2001	ESD5330	MSP6728C
D49A	ACB2001	ESD5330	MSP6728C
D65A	ACB2001	ESD5330	MSP6728C

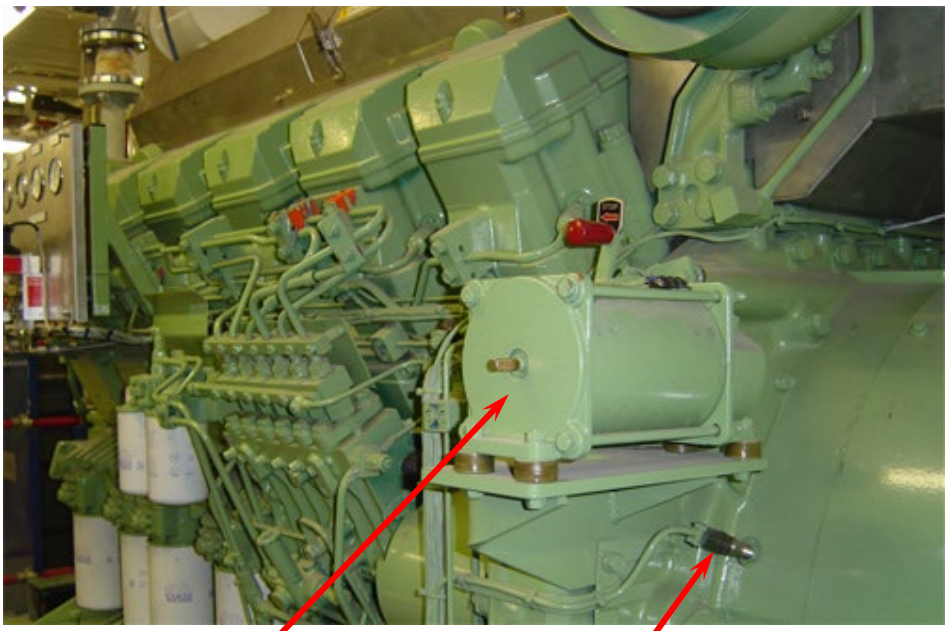
GAC APPLICATION NOTE

D34A, D49A, and D65A ENGINES for MARINE APPLICATIONS

Customer / OEM:	VOLVO
Application(s):	Marine Main Propulsion and Generator Drive
Engine Make / Model :	D34A – V12, 33.9L, 964 HP at 1500 RPM and 1126 HP at 1800 RPM D49A – V12, 49L, 1319 HP at 1650 RPM D65A – V16, 65.4L, 2190 HP at 1800RPM
Equipment Make / Model:	Multiple Vessel Manufacturers
Fuel System Type & Make / Model:	Diesel, In-line Injection Pump
Operating Speed(s):	1500 / 1800 RPM operating, variable range from 900-1800 RPM
Battery Voltage:	24 V DC
Installed Products:	• Actuator: ACB2001 • Speed Controller: ESD5330 • Magnetic Speed Pickup: MSP6728C

Summary The actuator is mounted on stiff rubber elements (shore 60) and connected to the original MHI linkage with 2-SF8 ball-links, with a manual stop lever.

ACB2001 ON VOLVO PENTA D49 V12 MHI S12R-MPTK ENGINE



ACB2001 Actuator

GAC MSP6728C Magnetic Speed Sensor

Magnetic Speed Sensor

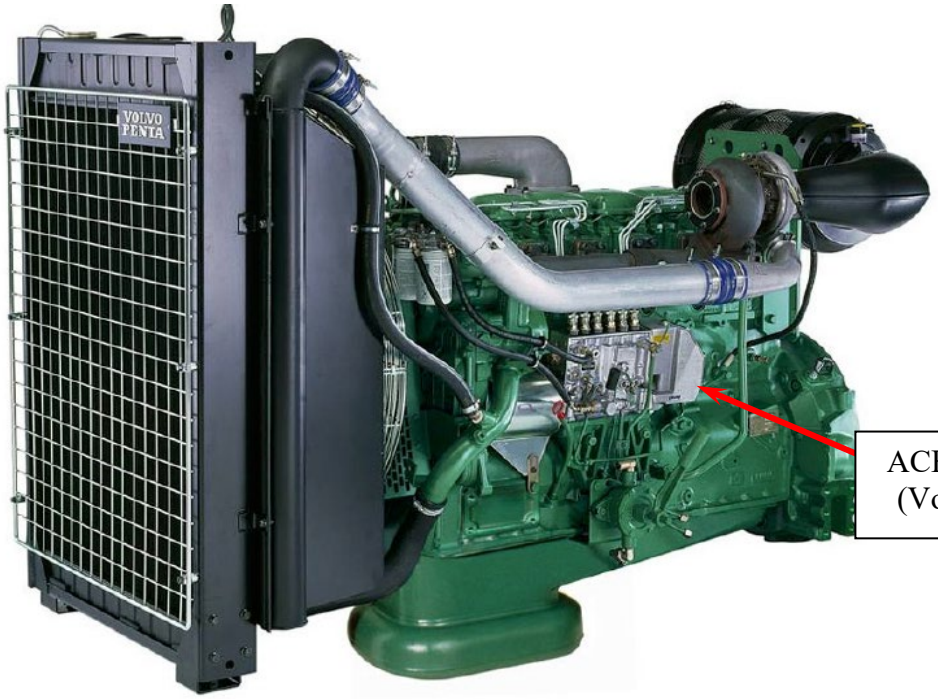
GAC APPLICATION NOTE

TD/TWD610, TD/TWD710, TAD721, 730, 740, TD1010, and TD1030 ENGINES

Customer / OEM:	VOLVO
Application(s):	Industrial, Gen-Set, Marine
Engine Make / Model:	TD/TWD610-5.5L 6 Cylinder TD/TWD710- 6.7L 6 Cylinder TAD721, 730 and 740-7.3L 6 Cylinder TD1010, 1030, 1031 and 1032-9.6L 6 Cylinder
Equipment Make / Model:	Multiple applications
Fuel System Type & Make / Model:	Diesel, MW Pump, Bosch P3000 and P7000 Inline Pumps
Operating Speed(s):	1500 / 1800 RPM operating, 600 RPM idle, variable range from 1000-2400 RPM
Battery Voltage:	24 V DC
Installed Products:	• Actuator: ADD175A-24 or ACB275H-24 • Speed Controller: ESD5500E • Magnetic Speed Pickup: MSP6728C • Mounting Kit: KT275 or KT276

VOLVO TAD1032 ENGINE: 397 HP AT 1500 RPM / 390 HP AT 1800 RPM

VOLVO PENTA GENSET ENGINE

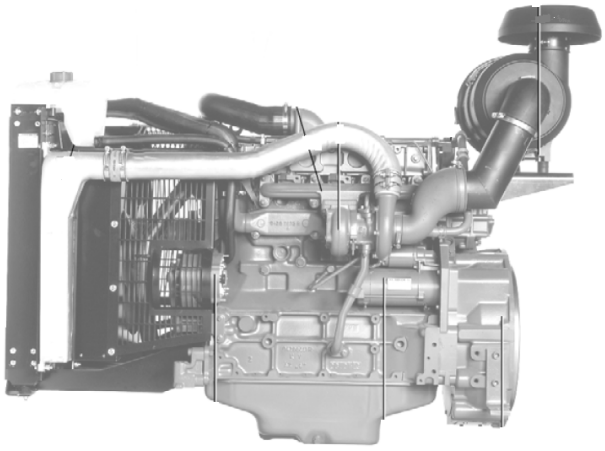


GAC APPLICATION NOTE

TAD 520/720 ENGINES

Customer / OEM:	DEUTZ / VOLVO
Application(s):	Engine
Engine Make / Model:	Volvo TAD 520/720
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	102 kW, 139 HP @ 1500 RPM, 110 kW, 150 HP @ 1800 RPM, TAD520 153 kW, 209 HP @ 1500 RPM, 163 kW, 222 HP @ 1800 RPM, TAD720
Battery Voltage:	24 V DC
Recommended Products:	• Actuator: ADD225

VOLVO TAD 520 AND TAD 720 ENGINES



WANCO

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
Wanco				TCM050

GAC APPLICATION NOTE

WANCO LIGHT TOWER

Customer / OEM:	WANCO
Application(s):	Light Towers
Engine Make / Model ::	Multiple Engines
Fuel System Type & Make / Model:	Diesel
Operating Speed(s):	1800 RPM
Battery Voltage:	12 V DC
Installed Products:	• EAM / Other: TCM050

Summary: Wanco purchased the TCM050, which is produced and programmed at GAC, and enclosed it in their own rugged exterior for use on their light towers. Features include:

- Fully integrated display and configuration, non-volatile memory for fast recording and real-time clock.
- Relays – starter, pre-heat, fuel, fault
- Warnings - start, ready-to-load, load energized, crank, fault, and LEDs
- I/O Low fuel warning, auxiliary shutdown, remote start, magnetic speed pickup

WANCO LIGHT TOWER

INSTALLATION LOCATION

TCM050

TCM050 IN CASE

WISCONSIN MOTORS

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
TM27	ATB401T1N-12	AFR201 JDR100	MSP6729	SDU1100 or SDU1101 ICM200-4 CL602 MXSB26-STM RPR102 SOX102 SPM201-2B SPW100

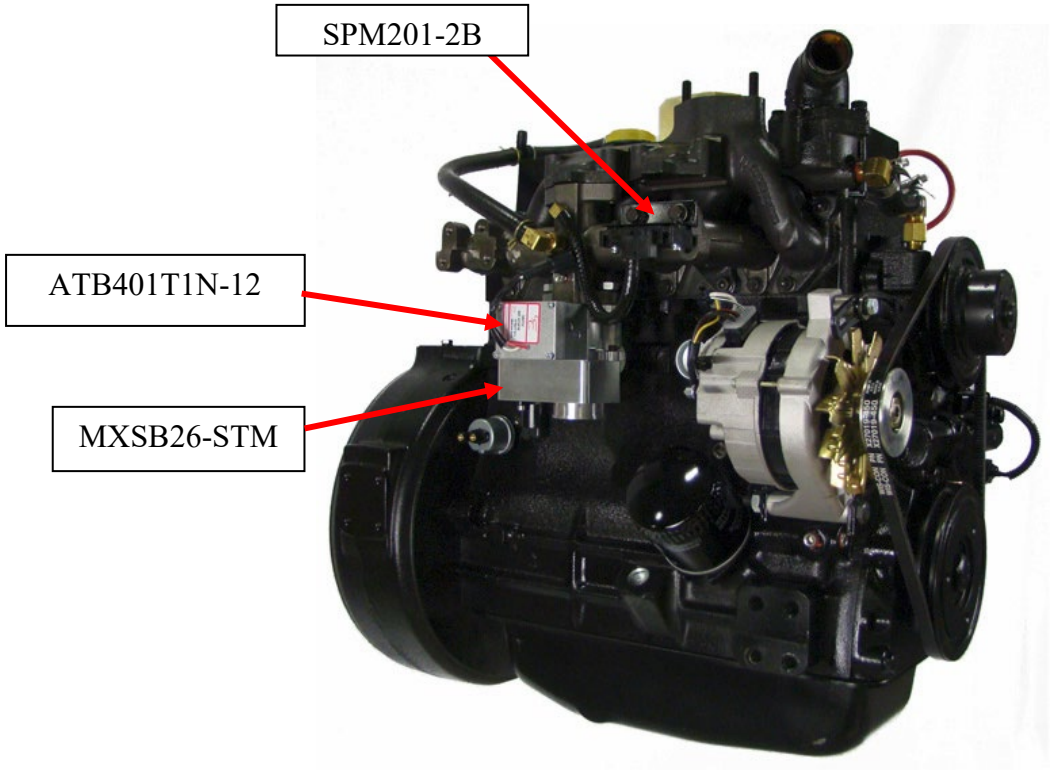
GAC APPLICATION NOTE

TM27 ENGINES

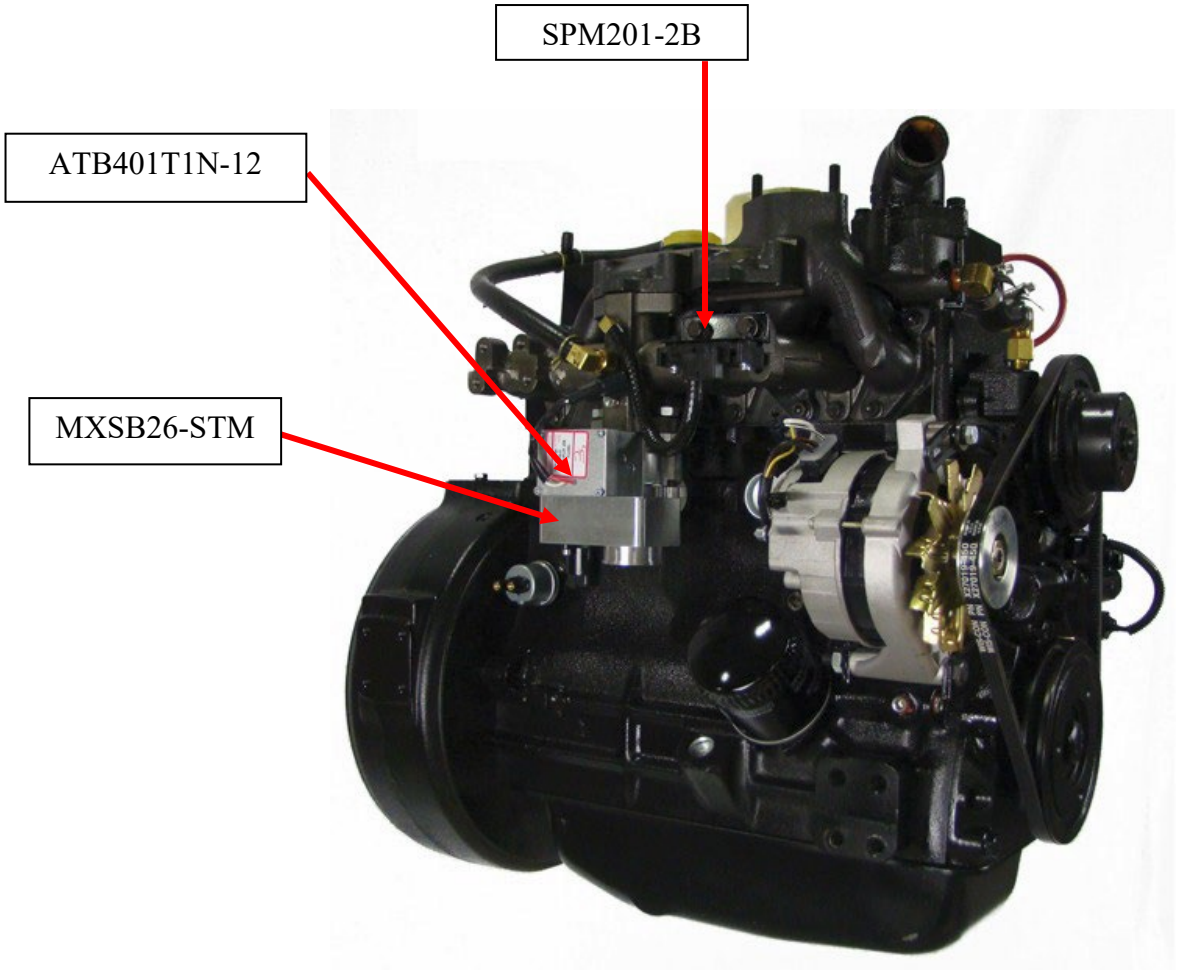
Customer / OEM:	WISCONSIN Motors
Application(s):	Power Generation, Compression
Engine Make / Model :	Wisconsin Motors TM27, 4-cylinder, 2.7 L
Fuel System:	LP or Natural Gas
Operating Speed(s):	52 HP, 1500, 1800, 2000-2400 RPM
Battery Voltage:	12 V DC
Installed Products:	• Actuator: ATB401T1N-12 • Magnetic Speed Pickup: MSP 6729 • FIMS: AFR201, ICM200-4, CL602, MXS B26-STM, RPR102, SOX102, SPM201-2B, SPW100, JDR100 (Part of panel SDU1100 or SDU1101)

Summary: GAC's FIMS500 fuel management system led the engine to be EPA certified to run up to 60% methane content in the fuel.

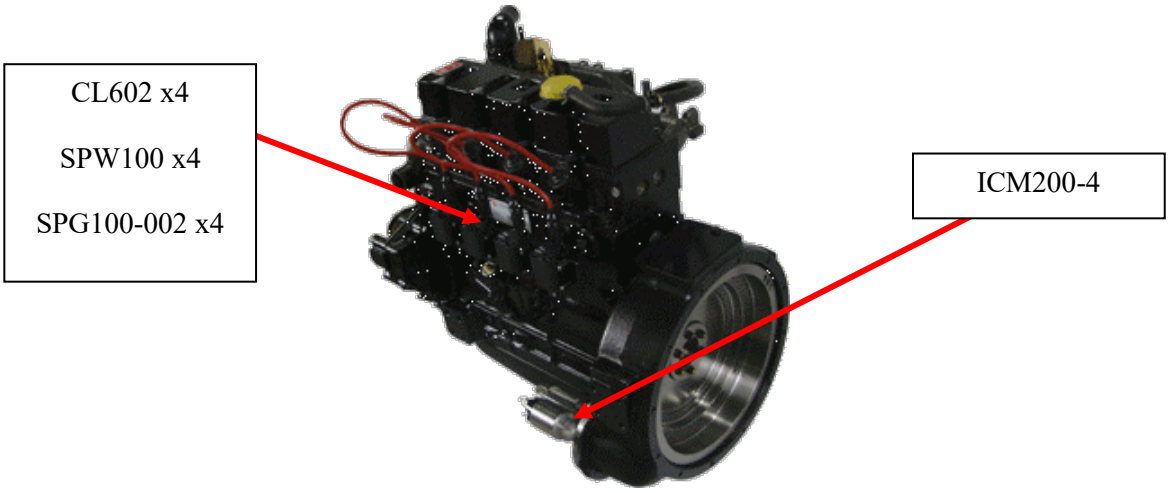
NATURAL GAS CONFIGURATION – VARIABLE SPEED



CONSTANT SPEED ENGINE



INSTALLED IGNITION SYSTEM



EPA CERTIFICATE

	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY **2013 MODEL YEAR** **CERTIFICATE OF CONFORMITY** **WITH THE CLEAN AIR ACT OF 1990**	**OFFICE OF TRANSPORTATION AND AIR QUALITY** **ANN ARBOR, MICHIGAN 48105**

Certificate Issued To: Wisconsin Motors, LLC. (U.S. Manufacturer or Importer) **Certificate Number:** DWMLB02.7TM2-004	**Effective Date:** 09/25/2013 **Expiration Date:** 12/31/2013	Byron J. Bunker, Division Director Compliance Division	**Issue Date:** 09/25/2013 **Revision Date:** N/A

Manufacturer: Wisconsin Motors, LLC.
Engine Family: DWMLB02.7TM2
Certificate Number: DWMLB02.7TM2-004
Certification Type: Stationary (Part 60)
Fuel : Natural Gas (CNG/LNG)
Emission Standards : HC + NOx (g/kW-hr) : 2.7
CO (g/kW-hr) : 4.4
NMHC + NOx (g/kW-hr) : 2.7
Emergency Use Only : N

Pursuant to Section 213 of the Clean Air Act (42 U.S.C. section 7547) and 40 CFR Part 60, 1065, 1068, and 60 (stationary only and combined stationary and mobile) and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engines which have been found to conform to applicable requirements and which represent the following nonroad engines, by engine family, more fully described in the documentation required by 40 CFR Part 60 and produced in the stated model year.

This certificate of conformity covers only those new nonroad spark-ignition engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Part 60 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 60. This certificate of conformity does not cover nonroad engines imported prior to the effective date of the certificate.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 1068.20 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR Part 60. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void *ab initio* for other reasons specified in 40 CFR Part 60.

This certificate does not cover large nonroad engines sold, offered for sale, or introduced, or delivered for introduction, into commerce in the U.S. prior to the effective date of the certificate.

WISCONSIN MOTORS

Your Heavy-Duty Power Source

CONTINENTAL ADVANTAGE

EPA and CARB Certified for stationary applications

Four Cylinder OHV

Liquid-Cooled

Stellite exhaust valves

Drive-by-wire throttle control

On-Board electronic Engine management and Diagnositcs

Precise engine speed control

Optional control center is available

Leading the way in industrial engine innovation

Continental TM27

52 HP Natural Gas Configuration

Your Heavy-Duty Power Source

WORLDWIDE PARTS AND SERVICE

We back our engines with a world wide service network. Experienced Continental representatives are always ready to meet your needs.

Industrial by Design

EPA and CARB certified engines

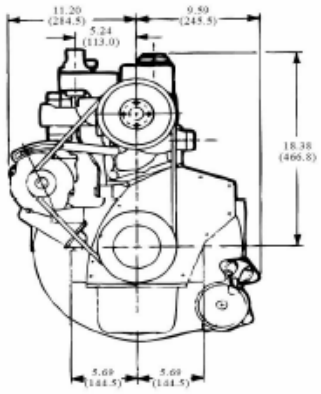
WISCONSIN MOTORS

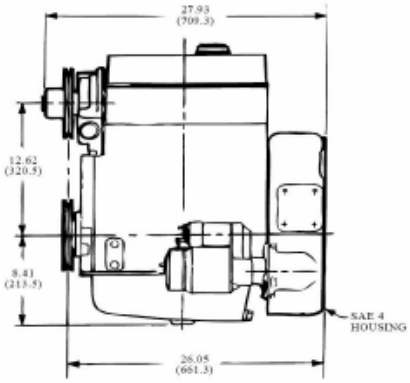
Your Heavy-Duty Power Source

Continental TM27
Performance Specifications

Standard Features

- Four cylinder OHV
- Liquid-cooled
- Heavy-duty cast iron block & cylinder head
- Five main bearings
- Stellite exhaust valves
- Closed-loop air/fuel ratio control
- Precise engine speed Control
- On-board electronic engine management and diagnostics
- Post-catalyst O_2 sensor based diagnostics
- Low oil pressure & high High coolant temp. shutdown protection
- SAE #4 flywheel housing (Standard)
- High volume oil pump
- Full-flow oil filter
- 63 amp. alternator with internal regulator





Power Output : Natural Gas				
Power			Torque	
RPM	HP	KW	Ft.lbs	Kg-M
2200	44.8	33.4	117.6	16.3
2400	51.7	38.5	113.0	15.6

Bore — 3.58 in. (91 mm)
Stroke — 4.06 in. (103.2 mm)
Piston Displacement—164.7 cu. in.

POWER OUTPUT

Maximum dynamometer gross brake horse-power of the basic engine corrected to a pressure reading of 29.3 in. Hg (99 kPa) dry barometer and temperature of 77°F(25°C) when tested in accordance with SAE Test Code J1995 (June 95). Engine output can be demonstrated within 5% at the factory under standard rating conditions. Power will decrease 3% for each 1,000 ft.(305 m) above 500 feet (152.4 m) and 1% for each 10°F (12.2°C) above standard temperature of 77°F (25° C). For continuous operation, applications should be limited to 80% of power shown.

EPA and CARB certified

The Continental TM27 is EPA and CARB certified. Wisconsin Motors is committed to a cleaner tomorrow beginning today.

Wisconsin Motors, LLC
2021 MacArthur Road
Waukesha, WI 53188
1-800-932-2858
www.wisconsinmotors.com

WM10323

XINCHAI

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
YANXU-FORKLIFT				DPG100-VS FP201

GAC APPLICATION NOTE

VARIABLE SPEED FORKLIFT with DPG100-VS

Customer / OEM: XINCHAI
Application(s): Forklift
Engine Make / Model: 45kW / 2500 RPM
Fuel System Type & Make / Model: Shandong Kangda BQ Diesel Fuel Injection System
Operating Speed(s): 600 RPM to 2500 RPM
Battery Voltage:
Installed Products:

- Pump Mounted, integrated actuator/digital governor: DPG100-VS
- Other: Dual trace electric foot pedal FP201

Summary: The DPG mounts directly onto the Kangda BQ injection pump and offers superior speed regulation over a variable RPM range. The controller includes torque limiting flexibility and a fully programmable speed/load matrix for customized throttle response / throttle progressions. Its electronic foot peal interface provides the load signal while a ring gear mounted magnetic pickup provides speed signal. The DPG's actuator mechanism includes a rack position feedback sensor for precise, closed-loop control of the fuel system.

XINCHAI - PUMP / DPG AND FOOT PEDAL INSTALLATION

DUAL TRACE ELECTRIC FOOT PEDAL KT-FP201

DPG100-VS ON KANGDA BQ INJECTION PUMP

XICHAI FORKLIFT

DPG100-VS PUMP MOUNTED, INTEGRATED VARIABLE SPEED DIGITAL GOVERNOR / ACTUATOR ASSEMBLY

YANMAR

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
6CXBM	ACB2001			

GAC APPLICATION NOTE

6CXBM MARINE PROPULSION / GEN SET

Customer / OEM: New Zealand Coast Guard

Application(s): Marine

Engine Make: 2 - YANMAR 500 HP 6CXBM, Diesel

Battery Voltage: 24 V DC

Installed Products:

- Actuators: 2 - ACB2001

Summary: This NZ Coast Guard vessel needed reliable throttle control with high torque during tight maneuvers. By combining two GAC ACB2001 actuators with an AXIOMATIC AX100310 Unidirectional Digital Control one of Coastguard Bluff's rescue vessels has a reliable solution to a throttle speed control issue.

THROTTLE CONTROL SOLUTION

VARIOUS

ENGINE MODEL	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP	GAC ACCESSORIES
VARIABLE SPEED RSC671	GAC ACTUATOR	ESD5100 ESD5200 ESD5500E	RSC671	
175 Series Actuator	175 Series Actuator			KT175-RS-R-Zexel

GAC APPLICATION NOTE

VARIABLE SPEED RSC671 AND ESD SERIES WIRING AND ADJUSTMENT

Customer / OEM: Various

Application(s): Marine, Industrial, Agricultural

Engine Make / Model: Various

Fuel System Type & Make / Model:

Operating Speed(s): Variable Speed

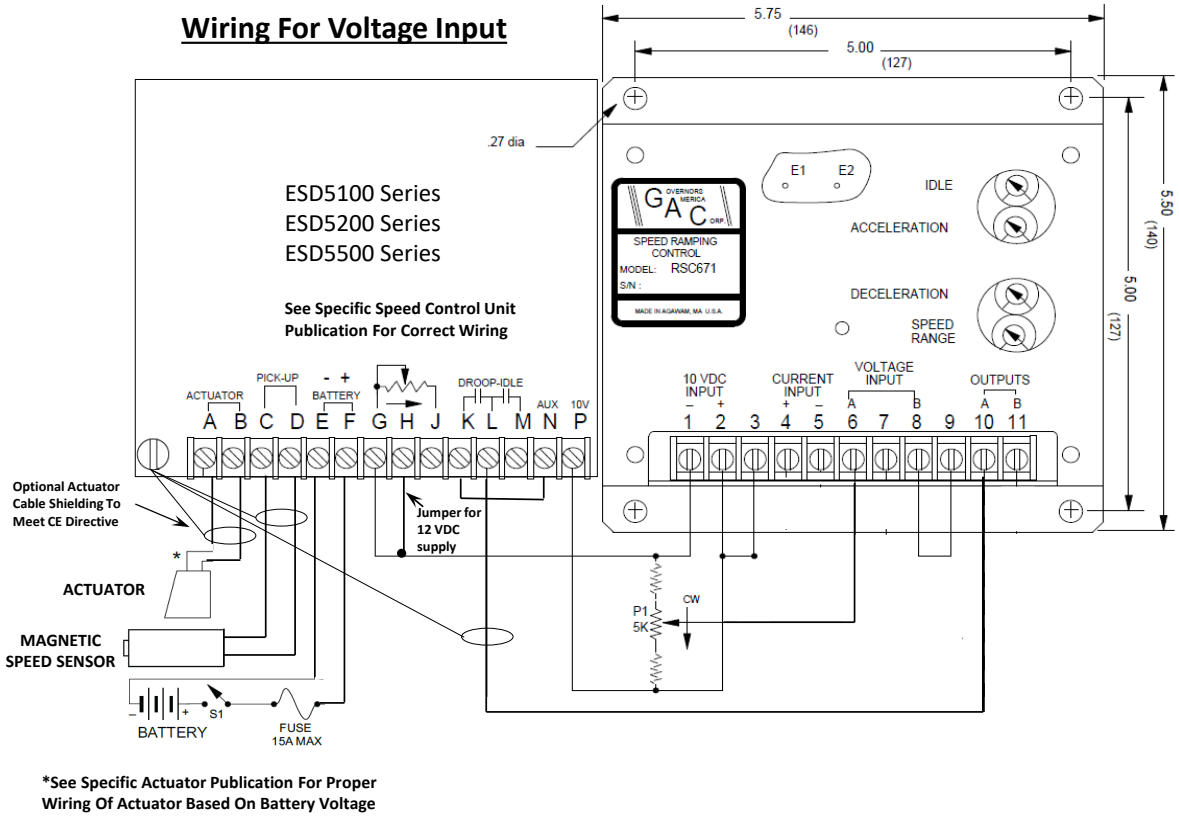
Battery Voltage: 12 or 24 V DC

Installed or Recommended Products:

- Actuator: All Compatible GAC Actuator
- Speed Controllers : ESD5100, ESD5200, or ESD5500E Series
- Speed Ramping Control: RSC671

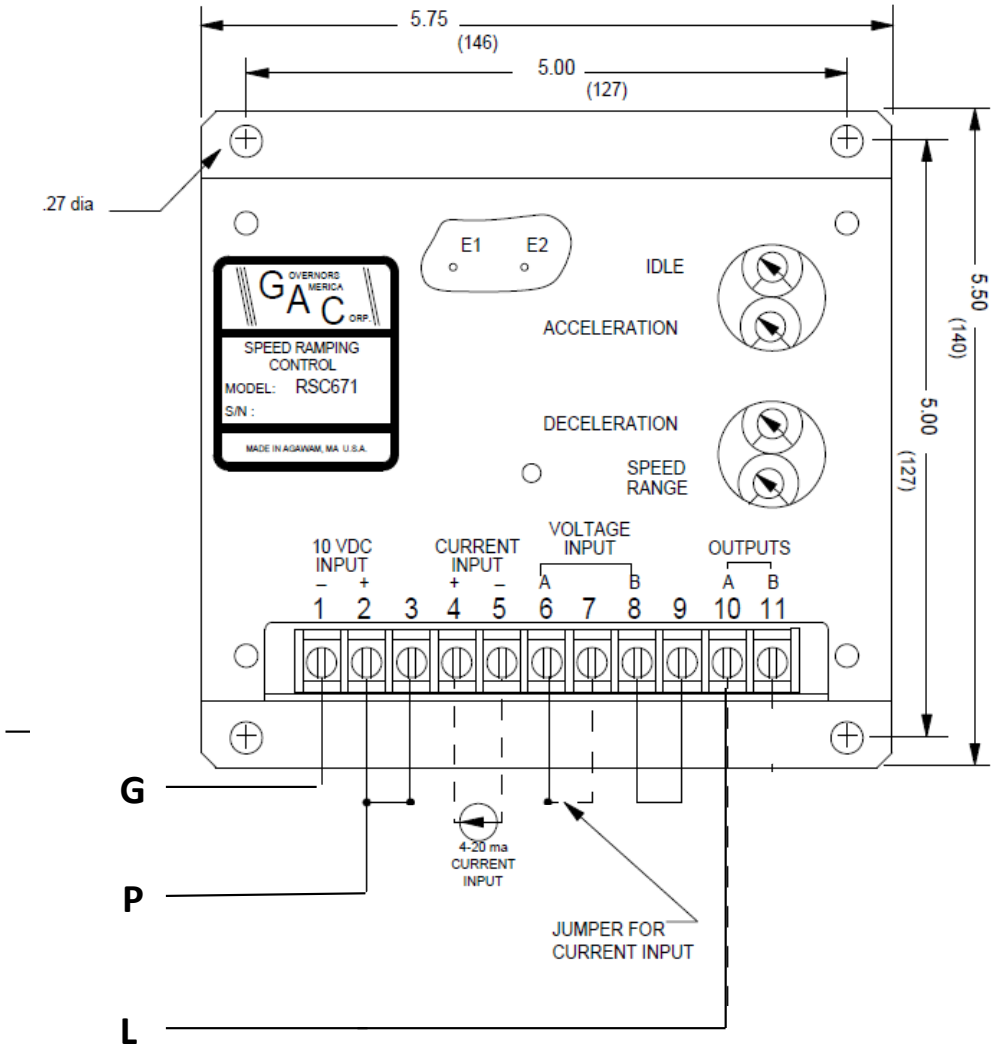
Summary: With a 0-10 V DC or a 4-20 mA input to the RSC 671 module a wide range speed control is possible.

WIRING FOR VOLTAGE INPUT



WIRING FOR CURRENT INPUT ONLY

Wiring For Current Input Only



Wiring:

- Connect terminals K and N on ESD if DROOP is required
- Connect terminals 2 and 3 on RSC if **voltage** input is used.
- Connect terminals 2 and 3, also 6 and 7 on RSC if **current** input is used.
- **Important:** Ground potential of current input (terminal 5 on RSC671) must be equal to terminal E on the ESD (battery -)

GAC APPLICATION NOTE

GAC 175 SERIES ACTUATOR INSTALLATION ON DENSO / BOSCH PUMP

Customer / OEM: Denso / ZEXEL / Bosch

Application(s): Gen-Set, Agricultural, Industrial, Marine

Engine Make / Model : Various

Fuel System Type & Make / Model: In-Line 'P' type pump, constant or variable speed

Operating Speed(s): Specific to Individual Engine Application

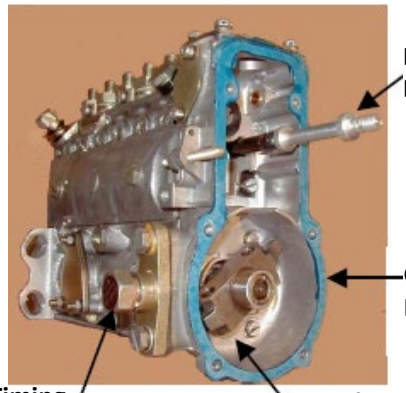
Battery Voltage: 12 or 24 VDC

Installed Products:

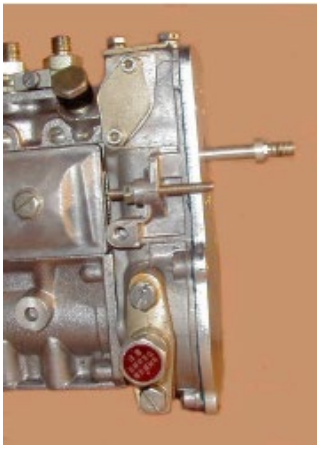
- Mounting Kit: KT175RS-R-ZEXEL
- 175 Series Actuator Mounted on RSV Governor housing

GAC 175 SERIES ACTUATOR ON DENSO / ZEXEL / BOSCH PUMP

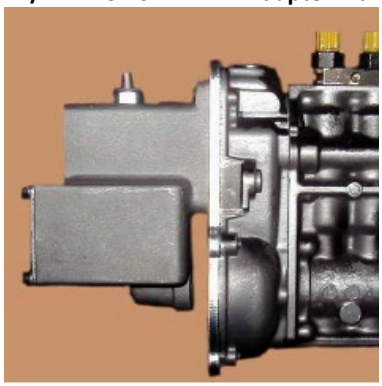
Pump with Existing Governor Housing. Rack Extension Installed



Adapter Plate From KT 175 RS-R ZEXEL Installation Kit Installed on Governor Housing



175 Series Actuator Installed on 'A' Size Pump with RSV Governor w/ KT 175 RS-R ZEXEL Adapter Kit



KT175-WRS-R-ZEXEL Installation Kit

CROSS REFERENCES and GAC REPLACEMENTS

VARIOUS MANUFACTURERS

ENGINE MANUFACTURER	GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	MFR PART NUMBER
AGREKKO		ESD5520E		311025A
DAEWOO		ESD5550		65.11220-7009
DENYO			JDR050	Y0602120691
HOBART	ACB120			404113-0
	ACB225			404113-1
	ACB225			482335
		ESC61C-7		404112-0
		ESC63C-7		404112-1
	ADC120			M20577-2
LINCOLN		SDG		M20577-1
			MSP6722	M20577-3
			MSP Bushing	M20577-6
LOVOL	ADD175A-12			T73201202
	ADD175A-24			T73201203
		ESD5500E		T63201004
			EC1300	T63274315
MACK BORING	ALN050-12			010-MACK1340
REGAL BELOIT			CVR63-4R	761594-01
				761684-01

AMBAC CROSS REFERENCES & REPLACEMENTS

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	AMBAC PART NUMBER	NOTES
ACE120			AGB130D5	
ACB225			AGB200A1	
			AGB200A2	Rotary, .2 Joule, 12-32V w.7.1" Lever
ACB225			AGB200A3	
			AGB200A4	Rotary, .2 Joule, 12-32V w.7.1" Lever
ACB225			AGB200A5	
ACB225			AGB200A6	
ACB275H			AGB270A1	
ACB275H			AGB270B1	
ACB275H			AGB280A1	
ACB275H			AGB280B1	
ADB120E4			AGD130E4	
ADB120E4			AGD130E5	
ADB120E4			AGD200E6	
			AGK1600A1	
ACB2001			AGK2200A1	
			AGK505A4	
			AGK505A5	
			AGK525A4	
			AGK525A5	
			AGL101A1	Linear, Nippondenso PFR Pump Mounted, 12V (Perkins 100 Series)
			AGL120A1	Linear, Actuator, .05 Joules, Pedestal Mount, 12V DC
			AGL121A1	Linear, Nippondenso PFR Pump Mounted, 24 V DC (Perkins 100 Series)
			AGL202A1	Lucas (CAV) DPA/DPS Pumps with Fixed Timing 12V
			AGL202A2	Lucas (CAV) DPA/DPS Pumps with Fixed Timing 12V
			AGL222A1	Lucas (CAV) DPA/DPS Pumps with Fixed Timing 24 V DC
ADC100-12			AGS50A1	
ADC100-12			AGS50A4	
ADC100-24			AGS50A2	
ADC100-24			AGS52A4	
			AL3000-12	Linear, 4 LB. Pull, .8" Stroke, 12V (Supersedes AGL301)
			AL3000-24	Linear, 4 LB. Pull, .8" Stroke, 24 V DC (Supersedes AGL321)
			AL3001-12	Linear, 4 LB. Pull , 12v
			AL3001-24	Linear, 4 LB. Pull , 24 V DC
ADC100-12			AR3100-12	

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	AMBAC PART NUMBER	NOTES
ADC100-24			AR3100-24	
ACB275H			AR3200	
	ESC61C-17		CU671C-17	
	ESC61C-7		CU671C-7	
	ESC63C-23		CU673C-23	
			CU673C-26	Replaced by CW673C-30U
			CW673C-17	Replaced by CW673C-30U
			CW673C-7	Replaced by CW673C-30U
			CW673C-30U	Replaced by CW673C-30U
				High Current Output for AGK1600/2200 Actuator, High Resolution
			EC50	Remote Speed Trim, integral Idle/Run Feature Terminal Strip,12-32V
			EC50F-1	Superseded by EC5100
			EC5000	Superseded by EC5100 (but available while supplies last)
				For All Actuator (Cummins, AMBAC, etc.), Switchable Current
			EC501	Levels, Fuel Limiting, Speed Ramping, ISO/Droop, Idle/Run, 12-32V
			EC5010	Superseded by EC5010
				Fuel Limiting, Speed Ramping, ISO/Droop, Idle/Run, 12-32V
			EC51E1	(Supersedes EC501)
			EC5100	Superseded by EC5100 (but available while supplies last)
			EC5111	ISO/Droop, Remote Speed, 12V-32V (Superseded EC50 & EC51.)
			EC60A-3	ISO/Droop, Load Sharing, Run/Idle, 12-32V (Supersedes ECD67-5111)
			EC60A4	12V, 50/60 Hz Unit
			EC60B-3	24V, 50/60 Hz Unit
			EC60B-4	12V, 400 Hz Unit
	ESD2110		ECD67-2110	24V, 400 Hz Unit
	ESD2110		ECD67-2112	
	ESD5111		ECD67-5111	
	ESD5221		ECD67-5221	
			ECD67-7000	Speed Control Unit - P.C. Plug In
			KT67-5221	Speed Control Unit - P.C. Plug In
				EC-5111B With Adj. Single Set Point Speed Switch, SWA674 12-32V
		LS671	LS671A	
		LSM672N	LS672A	
		LSM675	LS7010	Superseded By LS7010
			LS7000	

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	AMBAC PART NUMBER	NOTES
				Load Share Unit, Load Ramping, Power Monitors, Compatible With
			CU6714D	Barber-Colman and Cummins Speed Controls
		SYC6714	SY6000	Superseded by SY6000
				Supersedes CU6714D
			SYN671(A)	
			SYN401415	Auto-Synchronizer with Master/Slave Feature (Order As New Part Number SYN401415)
		RSC671	RGC671	Auto-Synchronizer with Master/Slave Feature
			BP401397	
		SSW674	SWA674A	Adjustable Speed Switch
			SWA675A-1	
		SSW675	SWA675A-2	2 Element Speed Switch-Latching (Superseded to SWA675D1)
		SSW675	SWA675D1	
		SSW676	SWA676B	
			MP414045	
			MP6710A	4.5 Inch Body Length, Bendix Connector MS3106A
			MP6712	5 Inch Body Length, MIL Connector, With Mating Connector
		MSP675	MP675	3 Inch Body Length, 72 Inch Leads
		MSP676	MP676	
		MSP677	MP677	
		MSP6721C	MP6775	
		MSP678	MP678	
		MSP679	MP679A	
			MP6750	
		MSP6723C	MP6716	2-3/8 Inch Body Length, 8 Inch Leads
		TP502	TP671A	
		TP503	TP672A	description based I think that is right
		TP501	CU6710A	
			CU6711A	
			CU6721A	1 Turn, 50K OHMS, With Knob, Switch
				10 Turn, 5K OHMS, Remote Droop Pot
			KT410046	
			KT410632	Converts AGD130 to AGD200
			KT410633	Installation Kit; AGB Actuator, Includes 6 Pin Connector Rod End Bearings, Threaded Rod, Actuator Lever and Magnetic Pickup
		KT275	KT413882	Installation Kit; AGK Actuator, Includes Rod End Bearings, Threaded Rad, Actuator Lever and Magnetic Pickup

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	AMBAC PART NUMBER	NOTES
		KT276	KT413883	
			KT6722	
			KT6723	Idle/Run Module (CU Controllers)
			KT6724	AGD130E Service Kit
			KT6737	AGD130E Plunger Assembly
			KT6738	AGB270A1 and GAB270B1 Bearing Cover Kit AGB280A1 and GAB280B1 Bearing Cover Kit
		FU411368		Fuse and Holder, 10 A Fast Acting (Most 12V Systems)
		FU411369		Fuse and Holder, 15 A Fast Acting (Most 24 V Systems)
		CH1203	CB6712A	
		CH1204	CB401428	
			(CB6715A)	
			EC1248-3	Connector (all AGJ Type Actuator)
				Connector (all AGJ Type Actuator)
			LE6713A	
		LE1400-1	LE673-1A	Lever AGD Type Actuator
		LE1400-2	LE673-2A	
			LE673-3A	
			BG403040	7.1 Inch Length With 3/16 Inch Diameter Holes
		BR200	BG671	Rod End Bearing, Male 3/16 Inch ID, 10-32 Thread AGB250
			BG672	
				Rod End Bearing, female 3 /16 Inch ID, 10-32 Thread
		BR100	BG403039	(Order As New Part Number BG403039)
		EC1200	EC1248-6	
		EC1000	EC1249-2	
		EC1100	EC1267-1	
		EC1010	EC412902	
			BK410043	
		BK114	BK6726	Mounting Bracket for AGK505/525, AR3500 Series

BARBER COLMAN CROSS REFERENCES & REPLACEMENTS

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	BARBER COLMAN PART NUMBER	NOTES
ATB301T1N-12			PF31-12	
ATB401T1N-12			PF38-12	
ATB402T2N-12			PF42-12	
ATB452T2N-12			PF50-12	
ATB552T2N-12			PF60-12	
ALN025-12/24			DYNC-10202-12/24	
ALN050-12/24			DYNC-10502-12/24	
ADB225F-12/24			DYNC-11000-XXX-X-XX	
ADC225GS-12/24			DYNC-11020-12/24	
ADC225S-24			DYNC-12000-24	
			DYNC-14000-XXX-X-XX	
ACB2001			DYNC-12000-24	
ADC100-12			DYNC-70025-12	
	ESD2402-12/24		DPG2100	
	ESD1100 or ESD2210 or ESD2402		DPG-2101-001	
	ESD2210-12/24		DPG-2102	
	ESD2402-12/24		DPG-2103	
	ESD5120		DPG-2104	
	ESD2402-12/24		DPG-2105	
			DPG-2145-55	NO DIRECT REPLACEMENT
	ESD2410-24 or ESD1000-24		DYNC-10744	
	SDG700/800		DPG-2201	
	SDG700/800		DPG-2223	
	SDG700/800		DPG-2401	
	SDG700/800		DPG-2300	
			DYN10024/25/26/31/10502/503504/506/10652/53/54/56	NO DIRECT REPLACEMENT
	ESD5330		DPG-2201	
	ESD5500E		DPG-2201	
	ESD5330		DPG-2201	
	ESD2401-12/24		DYN1 10701-000-0-12/24	
	ESD5131			
	ESD5520E		DYNA1 10752-000-0-12/24	
		EAM103	DYNA1 10753,4,6	
	ESD2402-12/24		DYN1 10784-000-0-12/24	
	ESD5520			
	ESD5120		DYN1 10794-000-0-12/24	
	ESD2402-12/24			

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	BARBER COLMAN PART NUMBER	NOTES
	ESD2244-12/24			
		LAM100	DYN2 500004	
	SSW675		DYNZ 60010, 60013	
		MSP674 to 6732C	DYNT-10100 to 10600	
		MSP6724 to 6744	DYNT-13200 to 13300	
		MSP6714 to 6723C	DYNT-11100 to 11600	
			DYNS 10000, -1	

CUMMINS CROSS REFERENCES & REPLACEMENTS

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	CUMMINS PART NUMBER	NOTES
ADB120E4			3019635 3001817	
ACD120			3019635/3001817	
	ESD5111		3020987	Replacement for
	ESD5119 (reversing action)		3052504 3052505 3052506 3052507 3052508 3052509 3037359 3032733	Normally open
	ESD5120		3063504 3063505 3044189 3044196	Normally closed
	EEG6500		3081313	
	ESC63-17		3005810	
	ESC63-7		3014107	
	ESC63-23		3014195	
	SSW676		3039571	
	SSW675		8836	Not a direct replacement
		MSP677	213272	
		CH1205	213273	
		MSP678	3003916	
		CH1203B	3005811	
		LCC200	3008316	
		TP503	3015105	
		MSP676	3017418	
		MSP678	3628381	
		ITM050	ITM050	
		ITM051	ITM051	

DEUTZ CROSS REFERENCES & REPLACEMENTS

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	DEUTZ PART NUMBER
ACB275H-S1			1231 4175
ACB275CF			1231 4288
ACE295-24			1230 7878
ADE176AA-12			0423 3541, 04233456
ADE176AA-24			0423 3463
ACD110-12			0428 1525 KV-12
ACD110-24			0428 1524 KV-24
ADD180G-12			02113598
ADD180G-24			0421 26060
ATB552T2N-12 (Rev H)			301622
ATB552T2F4-12			302990
ATB401T1F-12			302991
ACE275H-24			0422 3844
ACE275CF-24			1231 6257
ACE275J-24			0422 6301
ACD176A-24			0423 3140 replaced by 0423 3463
ACD176A-12, ADE176A-12			0423 3456
ADD176AA-24			0423 3463
ADE176AA-24			0423 3464
ADE176AA-12			0423 3541
AXX110-24			0427 1898
ACB2001			1230 5436
ACB2000CF			1230 4578
	DSC1004B-KPL		1502 2476
	DSC1004		1232 0916
	PCI105		1509 8057
	EAM125		1509 6247
	ESD5550		1232 0621
	RSC671		1509 6246
	ESD2210-12		0427 1795
	ESD5550		0419 1545
	ESD2210-24		0427 1897
	ESD5221		0422 3457
	ESD5500E		0422 3846
		KT207	303089
		KT276	0422 3959
		KT209	302979
		KT214	302981
		KT275	1231 4423
		KT278	1231 6259

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	DEUTZ PART NUMBER
		KT 1611	1231 6113
		MX60-STM	302972
		MX30-STM	302987
		FIMS1500 6 Cyl	302583
		FIMS1500 4 Cyl	302997
		FIMS1500 6 Cyl. Turbo	302938
		SOX100	302977
		SOX102	302978
		CL601	302664
		ECM64A	302969
		SPG100-001	302973
		SPG100-002	303082
		SPM100	30301
		SPM101	302974
		SAI100	302976
		STE100	302982
		CH1220-L03	0423 3576
		CH1230-L03	0424 3577
		CH1240 CE-L02	0427 1793
		CH1231	302983
		CH1232	302984
		CH1234	302985
		CH1204-L6	1232 0622
		CH1203A-L6	1232 0623
		CH1225L03	04233807
		CH1301-L10	1232 0914
		CH1220-L6	0422 4032
		CH1208-L6	0422 4035
		CH1208AM-L6	0422 4956
		CH1208AM-L2	0427 1801
		CH1203A-L10	1509 8058
		CH1204A-L10	1509 8059
		CH1220-L10	1232 3417
		CH1204-L15	1232 3419
		MSP6728C	0423 3161
		MSP6714	1232 0620
		MSP6732	0419 1541
		DSC1004B-KPL	1232 2066
		DC 22321	1203 6768
		MTC6C-4320 LC	1215 3968
		EC1110	1215 3968
		EC1110	1215 7759
		GA 270	1221 3833
		GA 7000	1221 3883

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	DEUTZ PART NUMBER
		GA 277	1221 3885
		G4-24V	1231 4176, was 04323142
		FN670-10/06	1232 0983
		BK601	302970
		BK604	302994

DOOSAN / GHANA CONTROLS CROSS REFERENCES & REPLACEMENTS

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	DOOSAN / GHANA PART NUMBER
	ESD5550		65.11220-7009
	ESD5550M		65.11220-7008 / DWC-2000
			65.11220-7011 / DGC-2007
			300611-00633A / DGC-2013
			GNSA-2002
ACE275H-24			65.11101-8008B 65.11501-7006 DWA-2000 65.11501.7008 65.11501.7009
		MSP675	46492583

HEINZMANN CROSS REFERENCES & REPLACEMENTS

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	HEINZMANN PART NUMBER
	ESD5400		KG1/2
	ESD5221		KG6/10
	ESD5221		KG16/30/40
	ESD5330		KG64/90
	ESD5221		KG2000
	ESD5400		AC3
	EDG5500 or ESD5500E		DC2 / DC6
	EDG6000		DC8
	SDG500 / SDG700		DC8
	EDG5500 or ESD5500E		DC9
	EDG6000		DC12
	SDG500 / SDG700		DC12
ADC100			StG 4002
ADD175A			StG 2005 DP
ADD176A			StG 2005 DP
ACE275H			StG 2005 DP
ACE295			StG 2040 DP
ACB120			StG 1/ StG 2
ADB335			StG 6-01 (Gears)
ADB445			StG 6-02V (Gears)
ACB2001			StG 10 (Gears)
ACB2001			StG 16 (Gears) / StG 2080
ACB120			StG 2005
ACB225			StG 2010
ADB445			StG 2040
ACB120			StG 3005 / StG 3010
ALN025			LA 25 / LA 30
ALN050			LA 35

IVECO CROSS REFERENCES & REPLACEMENTS

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	IVECO PART NUMBER
ADD225S-12			8018971
ADD225S-24			8021744
ADB225F			8015587
ACB2001			8018556
ACB275H			8018674
ACE275H-24			8029133
ADD225S-12			8078971
ADD225S-24			8021744
ADD175A-24			8037141
ADC100-12			8045581
ADC100-24			8045582
ALN025-12			5802139004
ADD103B-12			5801383709
ADD103B-24			5801407573
	ESD5111		8017472
	ESD5500E		8018675
	ESD5330		8018557
	EGS1013		8023045
	ESD5330		8030357
	SDG721 or 725		87974507
	ESD5111		8017472
	ESD5500E		8018675
	ECC328-12		5802139002
		MSP6721C	8014335
		MSP6728C	8018673
		MSP6732	8030061
		KT276	8018343
		KT275	8018386

MAN CROSS REFERENCES & REPLACEMENTS

GAC ACTUATOR	GAC SPEED CONTROLLER	MSP / ACCESSORIES	MAN PART NUMBER
ADD120S-12			51.11610-6026
ADD120S-24			51.11610-6025
ACE275HD-24			51.11610-6028
	ESD2210		51.11610-7131
	ESD2335		51.11610-7159
	ESD5131		51.11610-7132
	ESD5221		51.11610-7133
	ESD5305		51.11610-7134
	ESD5550		51.11610-7135
	SDG		51.11610-1023
		MSP6723C	51.27120-7032
		LE1400	99.25413-6117
		EC1000	51.25435-7007
		EC1300	51.25435-6010
		EC1310	51.25435-6011
		KT278-1	E 51.11610-6029
		LE1400-4	E 51.11605-0199
		LK275	E 51.11610-6017
		SP202	E 51.97601-0286

MITSUBISHI / MITSUBISHI HEAVY IND CROSS REFERENCES & REPLACEMENTS

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	MITSUBISHI PART NUMBER
ALR190-M04-12 ALR160-S03-12			242538
ADC225S-24			3838271
	SDG514-02-02		242295
	ESD5500E		3817999
		MSP6738	242537

MTU CROSS REFERENCES & REPLACEMENTS

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	MTU PART NUMBER	NOTES
ACB275C			001-061-23-00	
	ESD5221A		000-538-32-60	
	EGS104B		000-538-55-60	Caseless
	EGS104B		000-538-56-60	
	PCA156		001-530-16-12	
	PCA157		000-532-01-10	
	PCA155		000-532-50-64	
	PCA162		000-533-29-88	Filter Board for EGS104B
		KT275	001-061-09-03	
		KT275	001-061-10-03	
		KT276	000-061-10-03	
		MSP677	000-535-62-33	
		MRM100	000-538-57-60	
		MRM100A	003-531-86-18	
		DP3	003-531-76-18	
		MPP 4102 G2S	003-531-84-18	

SCANIA CROSS REFERENCES & REPLACEMENTS

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC / MSP ACCESSORIES	SCANIA PART NUMBER
ADC225S-24			1349 380
ACB275H			1359 295
	RSC671		1359 400
	ESD5131		1349 569
	ESD5500E		1373 879
		MSP675	1373 881
		MSP677	1300 298
		CH1204-L3	1300 300
		CH1206-S	1349 570
		PCI105	1359 216
		KT276	1359 296
		CH1203-B	1359 299
		CH1206A-L6	1359 403
		CH1208-6	1359 404
		DSC1002	1412 222
		DSC1002C	1412 223
		DSC1002	1423 086
		DSC1002	1432 252
		DSC1002	1432 254
		DSC1002C	1480 890
		DSC1002	1480 891
		DSC1002C	1534601
		DSC1002C	1534603

SDMO CROSS REFERENCES & REPLACEMENTS

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	SDMO PART NUMBER
ADD175A-12			30604011001
ADD175A-24			30604011201
ADC100-12			30604020701
	ESD2210-12		30604020901
	ESD5111		30604015401
	ESD5131		30604007101
		KT175-RS-R	30604012201
		KT276	30604021001
		MSP6724C	30604020801
		MSP6728C	30604005401
		MSP6729	31101043101
		EC1350	31613096301
		EGS276-12	30604020011NE

VOLVO CROSS REFERENCES & REPLACEMENTS

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	VOLVO PART NUMBER
ADD180G-12/24			358 9408
ADD225S-24			383 8271
ADD175-24			382 7267
ADD175A-24			383 4900
ACB225			863 616
ACB275D			866 167
ACB275H			383 7082
ACE275K-24			358 6281
ACE275H-24			382 5454
	EGS222-12		881 676
	EGS222-24		881 677
	ESD5500E		881 616 (873 979, 873 738, 873 747)
	ESD5330		881 665
	ESD5131		865 414 and 873738
	ESD5111		863 617
	LSM672N		873 796
	LSM201N		873 797
	SYC6714		873 798
		KT166	382 6107
		KT286 with Gasket	383 9296
		KT276	865 233
		KT275	866 169
		KT278	382 5233
		MSP6732C	358 9140
		MSP679	863 618
		MSP6728C	382 5810
		LE1400-2	862 207
		LE160	866 812
		LE161	382 5151
		TP502	874 370
		EC1310	358 6975
		EC1301	358 6282
		MPP4102-G2-24V	358 6789
		EC1300	383 4933

WOODWARD CROSS REFERENCES & REPLACEMENTS

GAC ACTUATOR	GAC SPEED CONTROLLER	GAC MSP / ACCESSORIES	WOODWARD PART NUMBER
	ESD5526E		8290-051, -052
	ESD5131		8290-038, -046, -054, -060, -061,-067, -071, -075
	ESD5500E		8290-138-140, -172, -175, -184, -186,-189, -190
	ESD5500E		8290-044, -069, -073, -077
	ESD5526E		8290-039, -041, -045, -047, -057, -058, -059 ,-064, -068, -072, -076,
	ESD5526E		8290-070, -074, -045, -078, -185, -187
	ESD5528E		8290-139, -141, -174, -185,-187
	ESD5330		8290—016, -017, -021, -142,-118, -158, 8256-016, -021, -022
	EDG5500 or ESD5500E		2301A
	EDG5500 or ESD5500E		DPG2100
	EDG6000		DPG2200
	EDG5500 or ESD5500E		EPG512/EPG524
	EDG5500 or ESD5500E		EPG1712/EPG1714
ADD104-12			DYNC 70000-001-0-12 (CW)
ADC100			Dyna 70025
ADD175A (12 or 24)			Kit: A459 8
ADD176A (12 or 24)			Actuator SA-4506-24 (24VDC)
ACE275H-24 (24)			Actuator SA-4506-24 (24VDC)
ADC225 (12 or 24)			Dyna8000, Models DC11020-000-012 Through DC11028-300-024
ADB335-24 (24VDC Only)			Dyna8200, Models DC12000-000-012 Through DC12003-000-024
ADB335F-24			8405-089
ADB445-24 (24VDC Only)			DynaPlus4
ACB2001-24 (24VDC Only)			DynaPlus8, UG8 – UG40
ALN025			ProAct Model I
ALN050			ProAct Model II
		LSM100	LSM
ATB T1 Series			L-Series ITB
ATB T2 Series			F-Series ITB
ATB T3 Series			Flo-Tech ITB
ATB T4 Series			ProAct ITB – Large Bores