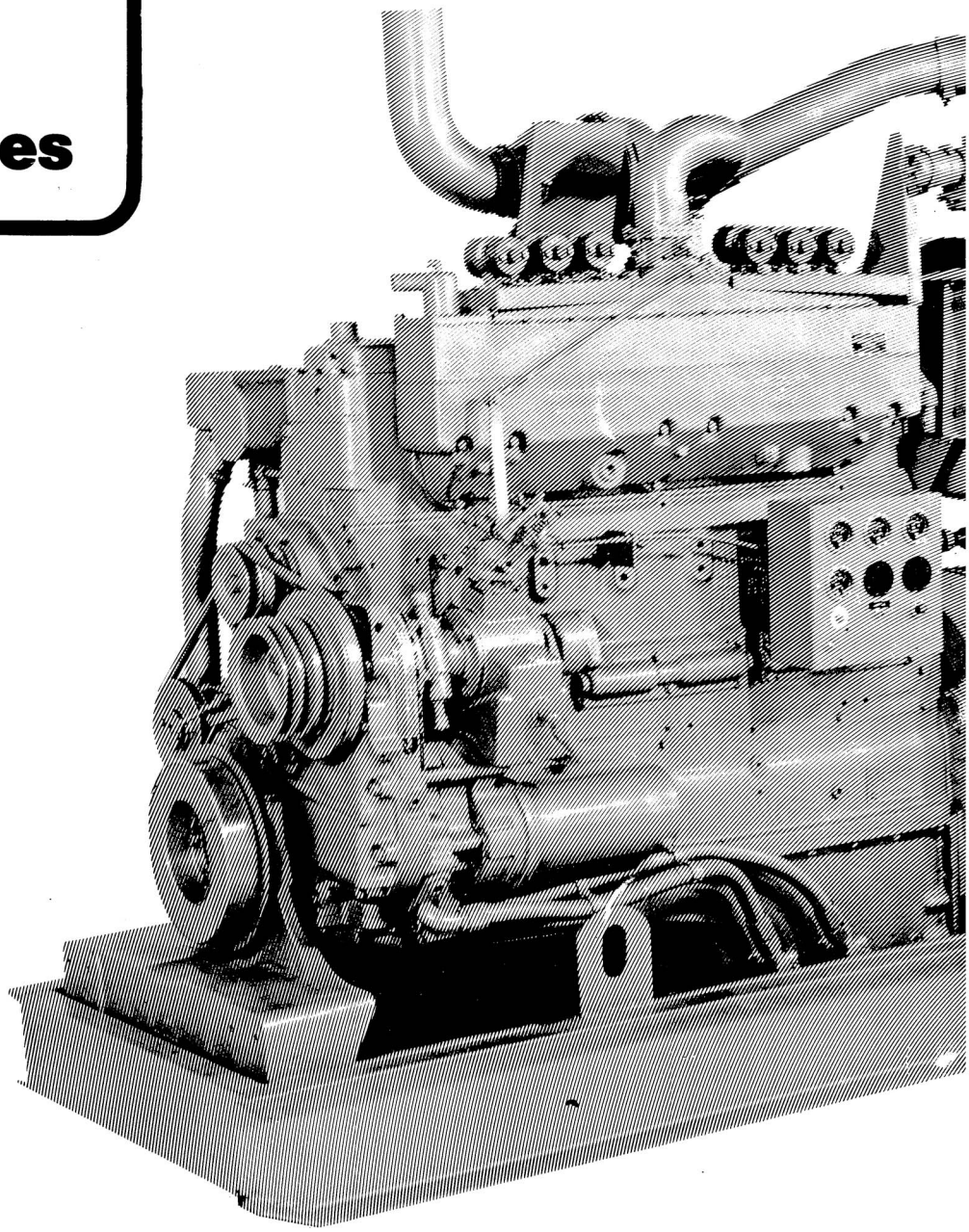
Bulletin 830120

Cummins

Gas Engines

G-495
G-743
G-855
GTA-743A
GTA-743B
GTA-855
G-1710
GTA-1710

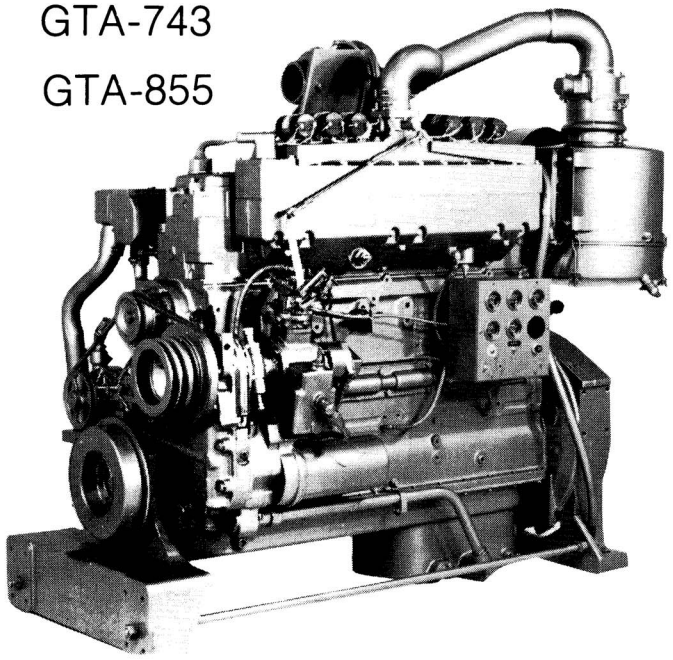


Cummins Gas Engine Operation & Maintenance Manual

Table of Contents

GTA-743

GTA-855



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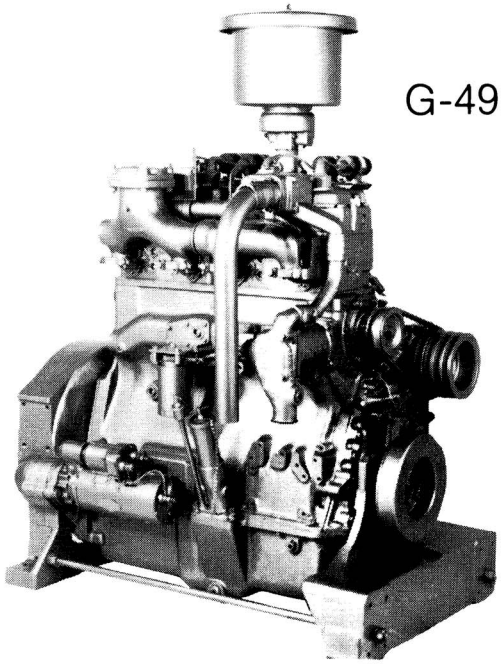

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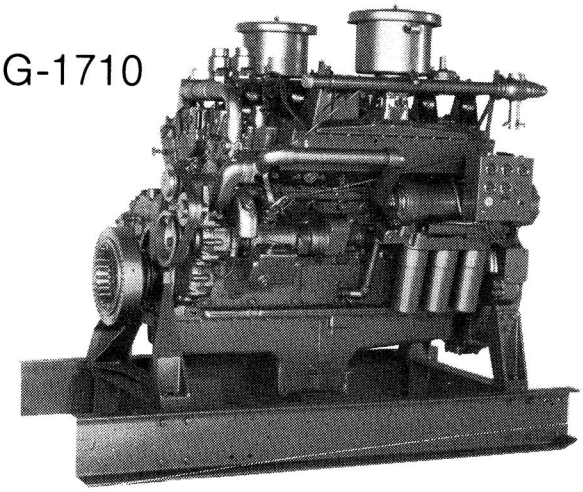
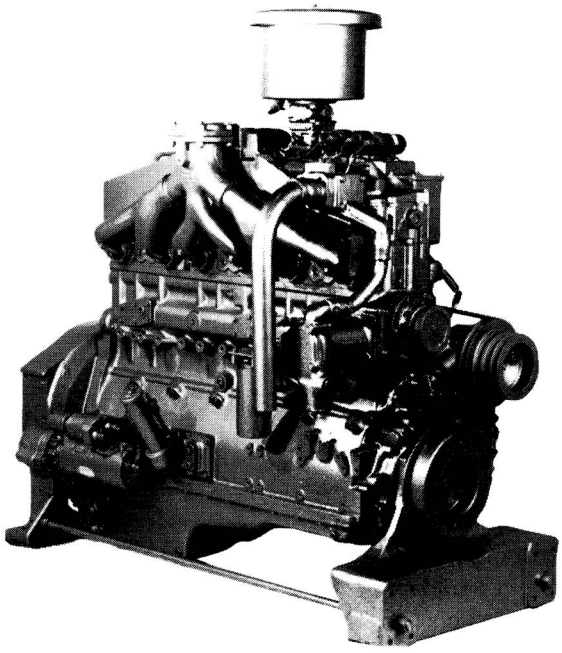
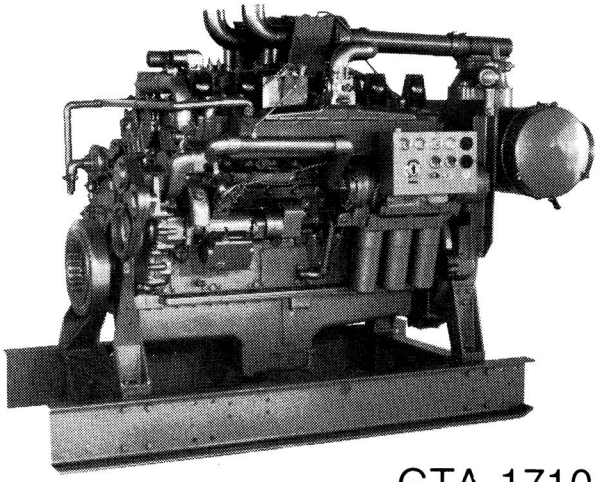




G-743

G-855



GTA-1710

Operating Principles

The most satisfactory service can be expected from a Cummins Gas Engine when the operation procedures are based upon a clear understanding of the engine working principles. Each part of the engine affects the operation of every other working part and of the engine as a whole.

The Cummins Gas Engine

Cummins Gas Engines described in this manual are four-stroke spark-ignited engines that burn a controlled mixture of natural gas and air. Horsepower ratings and other engine specifications are tabulated in Table 1 below.

Models	Displacement* Cubic Inches	Horsepower** Application Range		
G-495	495N	70	to	110
G-743	743N	100	to	165
G-855	855N	150	to	200
G-1710	1710N	300	to	400
GTA-743	743TA	190	to	250
GTA-855	855TA	240	to	300
GTA-1710	1710TA	400	to	600

* N - Naturally aspirated
TA - Turbocharged/Aftercooled

** Continuous horsepower is based on operation at 4000 feet altitude and 100°F air temperature.

Cummins Natural Gas Cycle

It is easier to understand the function of the engine parts if it is known what happens in the combustion chamber during each of the four piston strokes of the cycle. The four strokes and the order in which they occur are: Intake Stroke, Compression Stroke, Power Stroke and Exhaust Stroke.

Intake Stroke

During the intake stroke, the piston travels downward permitting air and fuel mixture from the carburetor to enter the combustion chamber through the open intake valves.

Compression Stroke

At the end of the intake stroke, the intake valves close and the piston starts upward on the compression stroke. The exhaust valves remain closed.

At the end of the compression stroke, the air and fuel mixture in the combustion chamber has been forced by the piston to occupy a space about one-twelfth as great in volume as it occupied at the beginning of the stroke. Thus, we say the compression ratio is 12:1. Near the end of the compression stroke, the mixture is ignited by the spark plug.

Power Stroke

During the power stroke with both the intake and exhaust valves closed, the burning fuel causes an increase in pressure above the piston which pushes the piston downward and adds impetus to the crankshaft rotation.

Exhaust Stroke

During the exhaust stroke, the exhaust valves are open, the intake valves are closed, and the piston is on its upstroke.

Burned gases are forced out of the combustion chamber through the open exhaust valve ports by the upward travel of the piston.

The Fuel System

Fuel must be clean, free of acids, sulphur compounds, water, pipe scale and other foreign materials which could cause corrosion or abrasion of cylinder liners, bearings, and internal engine parts. Dry processed natural gases for pipeline transmission usually have the liquids removed and contain primarily methane and a small percent of ethane gases. This gas is generally 1000 BTU/cu.ft. H.H.V. and can be used in all Cummins Natural Gas Engines. The application of engines on non-processed gas requires careful study for proper compression ratio selection. Check with your dealer for proper compression ratio and power ratings for individual applications.

Located between the gas supply line and the engine intake manifold are the following units which make up the fuel system:

1. Line Pressure Regulator
2. Gas Filter
3. Pressure Reduction Valve or Thermac
4. Carburetor

Line Pressure Regulator

The gas pressure should be reduced to 5.8-11.6 ounces (10-20 inches H_2O) per square inch before entering the pressure reduction valve.

Note: Contact gas company for gas main pressure in your area.

Gas Filter

The filter removes particulate matter from the gas down to .0004". It is a pleated paper type filter and the element must be inspected regularly and replaced when necessary.

Pressure Reduction Valve (Thermac)

Pressure reduction valves must be used when gas pressure cannot be reduced and maintained by the line pressure regulator at a steady 2.9 ounces per square inch (5 inches H_2O) for 1000 BTU gas at the carburetor inlet, or when more pressure must be used to overcome line loss due to small pipe, elbows, or line length.

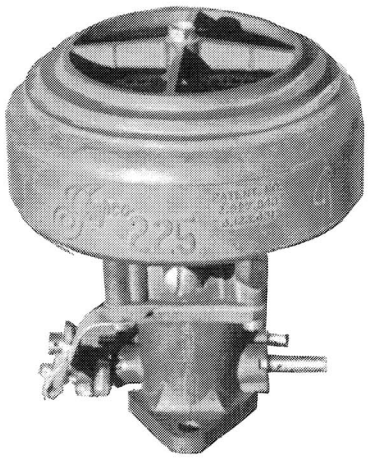
The pressure reduction valve of Thermac is used to fine tune and adjust the gas pressure reaching the carburetor. With this valve it is possible to maintain the 5 inches of H_2O gas pressure to the carburetor.

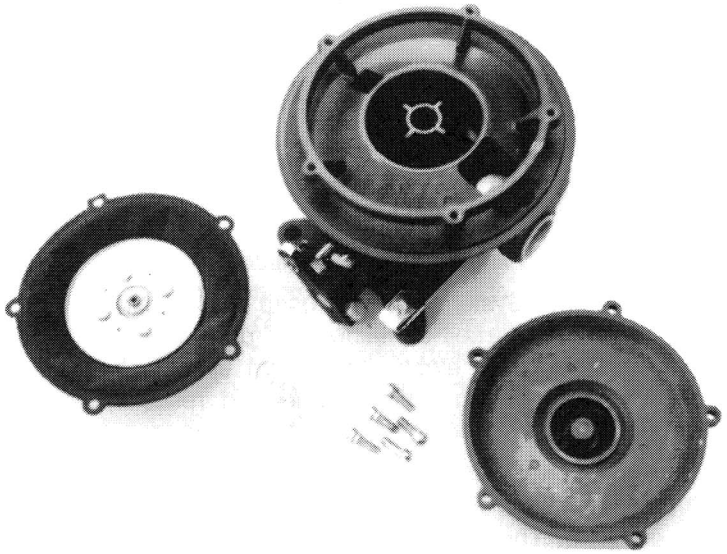
Carburetor

The air-gas mixture through the carburetor is controlled by an air gas valve. The air gas valve meters both air and gas in proper proportions at any throttle setting. It also seals off gas flow when the engine is shut down and provides automatic choke action for starting. The flow of air through the carburetor is controlled by the butterfly valve in the carburetor throat. This flow is measured by the air measuring valve mounted on a diaphragm. The greater the air flow, the higher the air measuring valve rises. The gas metering valve is connected directly to the air valve so that it rises exactly the same amount. The gas valve is shaped to admit the correct amount of gas at any height to which the air measuring valve rises. The natural gas pressure to the carburetor inlet should not exceed 5 inches of water with the engine under full load. This allows a very high metering force up to the fuel entering the carburetor at low engine speeds and allows easy starting without priming, with excellent low speed torque.

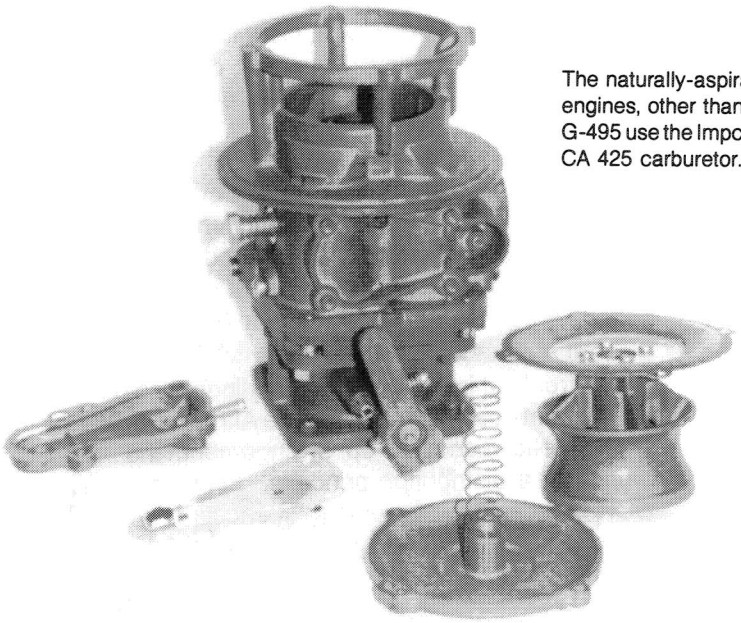
Gas Shut-Off Valve

A gas shut-off valve may be mounted between the line pressure regulator and the pressure reduction valve to assure a positive gas shut-off. The valve may be operated manually, electrically, or actuated from ignition system or oil pressure as a safety system.

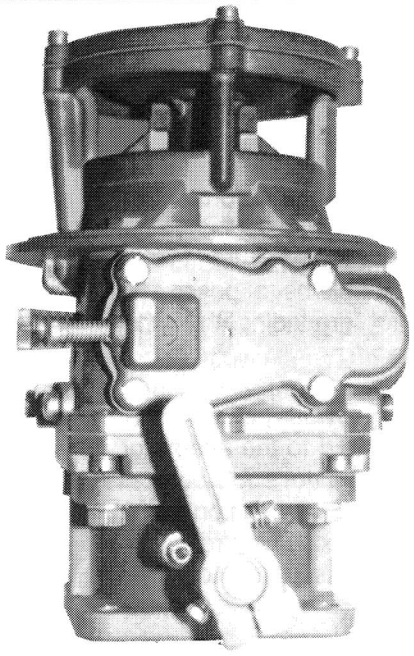


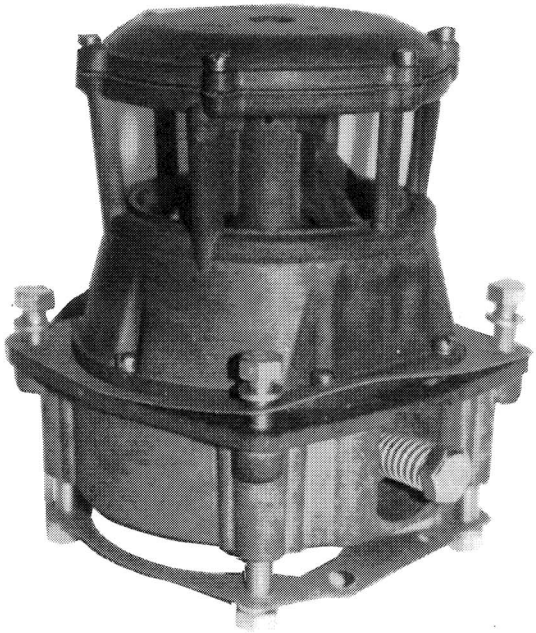


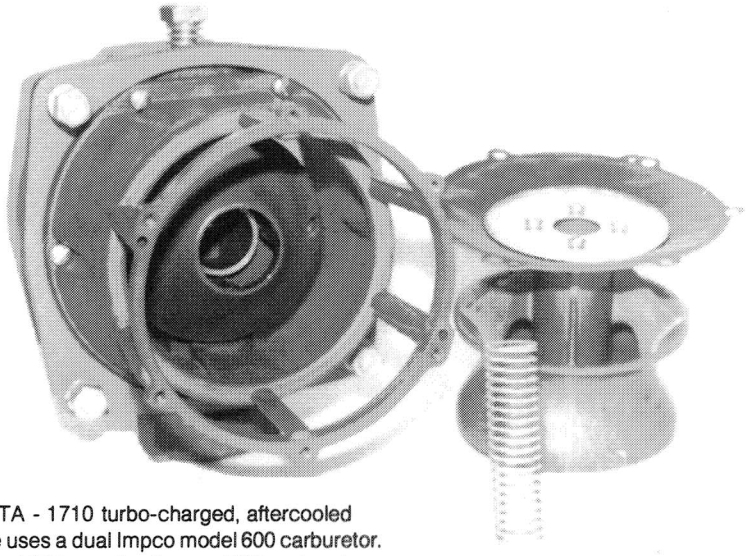
The G-495 uses an Impco model 225 carburetor.



The naturally-aspirated engines, other than the G-495 use the Impco model CA 425 carburetor.







The GTA - 1710 turbo-charged, aftercooled engine uses a dual Impco model 600 carburetor. The G - 1710 uses two Impco 4250 carburetors.

The Ignition System

The Altronic Ignition System currently used on Cummins Natural Gas Engines is a self-contained, self-powered, low tension, low fire-hazard, electronic system specifically designed to meet the ignition demand and reliability requirements of high speed spark-ignited engines.

The Altronic I-6 ignition system is used on the four and six cylinder engines. The system consists of a permanent magnet alternator unit, wiring harness, four or six ignition coils, three magnets in an aluminum disc (two on 4 cylinder engines) and an associated pick-up module. The self-powered Altronic I-6 requires no external voltage.

Note: External voltage applied to the ignition system or any grounding to the Altronic box may cause permanent damage to the system.

The system contains a positive output lead (white or lettered P) for grounding the ignition and shutting the engine down.

The alternator provides power to charge an energy storage capacitor mounted to the alternator. The electronic box rectifies the alternator's AC output to DC and stores the energy. When the magnets on the aluminum disc pass the pick-up coil, a Silicone Controlled Rectifier (SCR) switch is triggered to release the stored energy to the ignition transformers.

The coils (transformers) are mounted remotely and connected to its spark plugs through high voltage leads. The capacitor discharge principle produces a rapid, powerful spark. The short duration of the spark reduces electrode erosion. The transformer is designed to produce a very high rate of voltage rise, approximately 25 kilovolts. All electronic box parts are encased in epoxy and are immovable.

The alternator performs no timing function and can be either belt or coupling driven. Coupling driven alternators mount to the engine's governor drive. Belt driven alternators usually mount in place of 12 volt automotive type alternators.

Adequate output is available at low cranking RPM. The capacitor will store peak voltage generated during the fastest cranking speed to insure a good spark at the lowest speed. Timing is set only once, after which it remains constant.

The Altronic III is used on the 12 cylinder engines. It works on the same basic principle as the Altronic I-6. Rather than a magnetic disc/pick-up arrangement, the Altronic III works on a distribution principle. Firing is controlled by SCR alternator switches in sequence. The Altronic III is timed to the engine and must be retimed when removed and refitted.