C-255

OPERATION MAINTENANCE PARTS

ARROW ENGINE COMPANY

C255-POM-S-FEB06

In 1955 Arrow Engine Company opened for business, beginning the tradition of providing premium service and exceptional products to the oil & gas industry, as well as the industrial engine market, throughout the world.

Arrow is a part of IES Infrastructure, which operates as one of four divisions under IES Holdinps, Inc. comprised of over 8,000 employees nationwide. IES Infrastructure provides electrical and mechanical apparatus services, custom steel fabrication, and custom power solutions includinp penerator enclosures and bus systems to customers both in the United States and abroad.

With a consistent focus on our customers' needs, striving to help them grow their business, and producing the most reliable equipment and parts in the industry, Arrow has forged a 55-year tradition of excellence.

Contents

FOREWORD

GENERAL DESCRIPTION

These instructions cover the twin cylinder four stroke-cycle gas engines manufactured by Arrow Engine Company, Tulsa, Oklahoma. The engines are identified as Model C-255. They are low speed heavy duty engines that are designed to provide rotary power to equipment in oil field applications, where they are used for continuous operation. A minimum amount of maintenance is required for their continuous operation.

The C-255 normally operates in the speed range of 400 to 750 RPM and is maximum rated at 55 continuous horsepower when running at 750 RPM. Less horsepower is available when operated at a lower speed.

The C-255 is an upgraded version of the C-245 with an operating range of 400 RPM to 750 RPM. Maximum continuous horsepower for cyclical loading is 55hp.

The two cylinders are oriented horizontally and are positioned side by side. They are identical except that they operate out of phase with respect to each other. In either cylinder, the four strokes in a cycle occur during two complete crankshaft revolutions. The events that are associated with each of the four strokes are ignition and combustion (the power stroke), exhaust, intake, and compression. The power stroke in one cylinder occurs during the intake stroke of the other cylinder. For reference, the cylinder further from the power take-off is called #1 and the other closer to the power take-off is #2.

There are two flywheels in the C-255 engine. One is located internally on the end of the crankshaft closer to the power take-off and is used also to drive the belt for the cooling fan. The other, larger, flywheel is located externally on the end of the crankshaft opposite the power take-off. The engine is designed to rotate in a clockwise direction, identified by observing the end of the crankshaft opposite the power take-off.

The flywheels and an internal timing gear are physically mounted on the crankshaft and these parts all turn as a unit. A manual clutch on the power take-off end of the crankshaft can be engaged to transfer the rotary motion of the crankshaft to take-off assembly. The clutch can be disengaged manually to remove the load from the engine during starting and/or remove the driving force from the load at any time.

Low pressure carburetion is used for the C-255 engines. The carburetor can be adjusted to accommodate either natural, well head gas, or butane-propane as fuel. The fuel must be furnished through a volume-tank/scrubber to the fuel inlet of the engine, these being essential accessories as explained in Section 3, Installation.

A 12-volt DC electrical starting system is standard, powered from the electrical system of a truck or car or other portable source of DC power. Jumper cables can be used to connect the power source to the engine through the built-in Cannon receptacle on the instrument panel of the engine; the power source can be disconnected after the engine has been started. A starter switch is located on the instrument panel near the Cannon receptacle, and the C-255 normally starts after about three complete crankshaft revolutions. An optional turbine type air starter can be selected as an alternate to the 12 volt DC electrical starter system; this option is advantageous for use where a plentiful supply of high pressure gas is available to drive the turbine during starting.

The engine speed is controlled by a governor, and manual adjustment of the governor is used to set the RPM rate. As a load changes, the governor responds and adjusts the fuel flow rate so that the desired RPM rate recovers quickly and automatically. When the engine first starts, and while it is accelerating toward its normal speed, an impulse coupling retards the spark so that ignition occurs when the piston is at top dead center in the cylinder. Then, after the engine speeds up to about 150 to 175 RPM, the impulse coupling switches so that the spark is automatically adjusted to occur 17 degrees before top dead center. This timing provides the most efficient fuel economy possible.

The spark for ignition is supplied by a self-powered CD ignition system. This system consists of a high energy charging magnet, a trigger magnet, a generator coil, trigger coil, necessary wiring and sparkplugs.

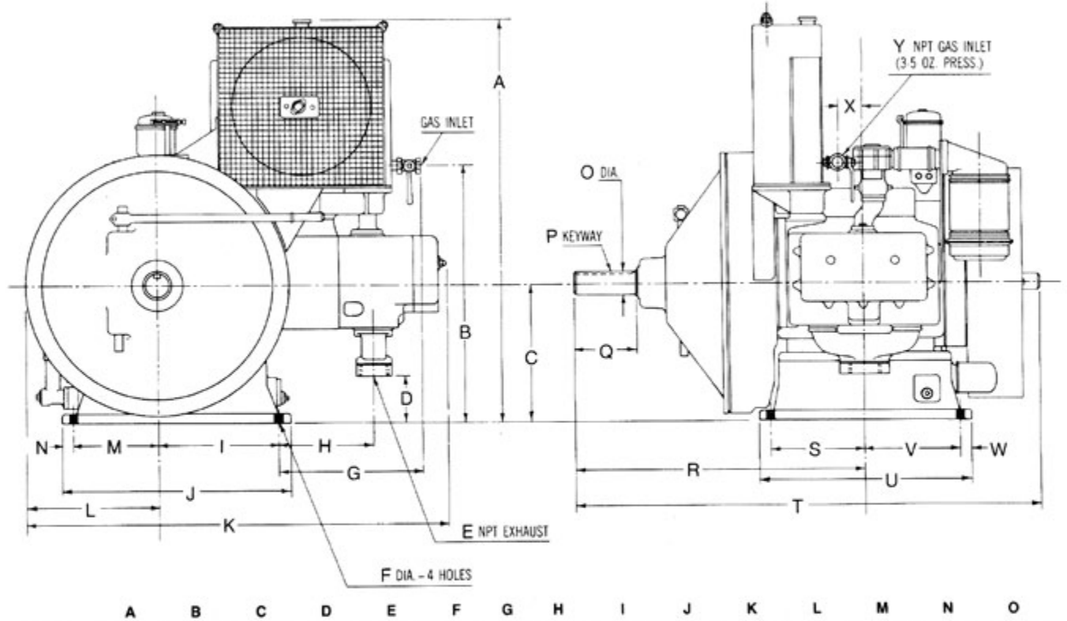
Cranking the engine for starting is aided by using a manual compression release that holds both intake valves open while the starter turns the crankshaft and the attached flywheels up to a speed from which their momentum can aid the starting process. While the valves are held open, there is no compression so the starter does not have to work as hard to turn the crankshaft. After the flywheels are turning at about 30 RPM, the manual compression release can be closed and the engine then starts to fire when the fuel-air mixture is compressed and ignited by the spark plugs.

The standard cooling system is a pressurized condensing system. This system provides for a uniform operating temperature at all ambient temperatures. By operating the engine at a high temperature, contamination and sludging of the lubricating oil is reduced. The pressurized cooling system minimizes loss of coolant through evaporation.

NOTE:
The engine will be severely damaged if it is allowed to operate without proper lubrication or adequate collant levels. If either the oil pressure or the coolant level drops below safe amount, the magneto is shorted and the engine is stopped automatically. A sight gauge is included for the coolant level and the oil level sight glass indicates crankcase oil level. The low water level gauge and the low oil pressure gauge have an automatic cut off switch that is activated if either condition is not satisfactory. Another safety feature is also included to prevent engine damage; this is a switch that is actuated if the engine should be accelerated to an overspeed condition (greater than about 800 RPM). A spring loaded pin is mounted in the larger flywheel and, under an overspeed condition, the pin triggers a latching switch to disconnect the ignition.

One of the special features of the Arrow C-255 gas

Figure 1. ARROW C-255 GAS ENGINE DIMENSIONS



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
INCHES	55 9/16	34 1/16	18 13/32	6 1/4	3	1 1/16	18 1/2	12 9/16	16 1/8	30 1/2	55 1/2	17 3/8	11 3/8	1 1/2	SEE NOTE
MM	1405	881	468	159	76	27	470	319	410	775	1409	441	289	38	

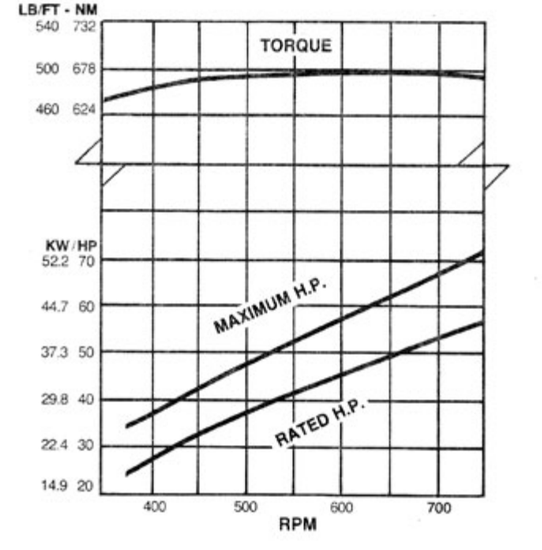
	P	Q	R	S	T	U	V	W	X	Y
INCHES	3/4 x 3/8	8 1/2	38 7/8	12 5/8	62	28 1/4	12 5/8	1 1/2	3 1/2	3/4
MM	19 x 9.5	216	987	321	1574	718	321	38	89	19

NOTE: 3.000 = 76.2 MM, 2.999 = 76 MM

engine is the full pressure lubrication system. An oil pump is driven by the crankshaft to force lubricating oil from the crankcase reservoir up to the moving parts in the engine. These include the rocker assembly and valves, the governor and the accessory drives. An oil filter is included in the system to constantly clean any foreign matter from the lubricating oil.

As a corrective maintenance aid, each valve closes against a replaceable valve seat so that the valve and seat can be replaced without requiring any machining of the cylinder head.

Specifications	English	Metric
Rated Continuous HP at 750 RPM	55	41.5 KW
Bore & Stroke	7½ x 7½ in.	190.5 x 190.5 MM
Displacement	660 C.I.	10.8 Liters
Compression Ratio	7:1	7:1
RPM Range	400-750	400-750
WR² (Torque)	1430 LB. FT.²	60.06 Kg-M²
Power Take Off Shaft Size	3"	———
Oil Capacity	25 qts.	23.7 Liters
Water Capacity	9 gal.	34.1 Liters
Spark Plug Size	18 MM	———
Exhaust Connection	2½" NPT	———
Fuel Gas Pipe Size	¾" NPT	———
No. & Size of Mounting Bolts	4-1"	———
Shipping Weight	3980 Lbs.	1805 KG
Starter	12 Volt Electric	
Safety Controls	(Water Level, O.S. & Oil Pressure Std.)	
Ignition	(Solid State Standard)	
Fuel	Gaseous	
Fuel System	Impco Carburetor	
Lubrication	Full Pressure	
Clutch	SP-114-P1	
Sheave Size	(QD, Stock Sizes)	



It is very important for the engine operator to be thoroughly familiar with the function and normal operation of all of its parts. The engine should never be started until the proper preliminary steps have been completed. Familiarity with all aspects of normal operation, coupled with the proper periodic maintenance, will ensure a long lifetime of useful service.

OPERATION

BEFORE STARTING

Before starting an Arrow C-255 Gas Engine, either in a new installation or in an existing installation in which the engine has been shut down, always check for the proper supply of coolant, lubricating oil, and fuel. Never start an engine until all three of these essentials have been provided.

COOLANT

The coolant that is used depends primarily on the ambient temperatures that are expected at the installation site. If there is no danger of freezing the coolant, a rust inhibitor solution in soft water can be used. If there is any possibility of incurring freezing temperatures, a permanent type antifreeze that includes a rust inhibitor must be mixed with clear soft water and used as the coolant.

The capacity of the cooling system is 36 quarts (34.1 liters). This amount will fill the water jacket and reservoir up to within about one inch (25.4 mm) of the top of the reservoir; the level can be seen by looking down through the filler tube on the top of the reservoir. A water level indicator and safety switch are located on the instrument panel. If the coolant should be depleted for any reason so that the level is lower than the indicator, the safety switch closes and shorts the ignition system to prevent operation of the engine. The function of the safety switch can be tested by turning the knob that extends from the front of the instrument window.

LUBRICATION

The engine is pressure lubricated with a high grade motor oil contained in a crankcase reservoir. An oil pump and filter constantly circulate the oil while the engine is running to lubricate the crankshaft and connecting rods, governor, rocker arm assembly, and valve push rods. A sight gauge on the crankcase permits observation of the oil level and of its condition at any time. This level will normally drop after the engine starts because some of the oil will then be pumped up through the moving parts that are at a level higher than the reservoir. It may be necessary to add more oil after the engine has been started so that the level in the crankcase is within the range of the sight gauge.

The oil capacity is 25 quarts (23.7 liters). Use a Supplement 1 type oil for normal operation. If the engine is to be operated on sour gas (high sulfur fuel,) use a Series 3 type oil. If there is any question regarding the proper type of oil to use, consult your oil supplier for advice.

Select a viscosity that is compatible with expected use conditions. If the engine is to be operated 12 hours per day or less or if it will be used to drive only a light load, use 30W oil. Use 40W oil for continuous duty with a normal load. Use 50W oil for continuous duty with a heavy load.

The oil pressure is indicated on the instrument panel. The pressure in an engine that is not operating is zero. It rises to 15-50 Ibs. during normal operation. A safety switch in the oil pressure indicator automatically closes and shorts the magneto if the oil pressure is too low.

There are grease fittings on the housing for the power take-off. Use a grease gun to add a good quality lubricant through each of these fittings as required.

FUEL

A vapor type gas is used for fuel. The engine is designed to operate on clean dry natural gas or properly vaporized butane-propane. A continuous supply of natural gas must be available wherever its use is selected.

Normally, the fuel from the well head or gas line should be reduced to less than 20 psi by a regulator and piped to a volume-tank/scrubber of ample size. The volume tank/scrubber will then maintain a supply of fuel at 4 to 6 ounces of pressure to the carburetor of the engine. A dial cock is installed near the carburetor in the line from the volume-tank/scrubber.

If the available natural gas is sour (containing a high concentration of sulfur), the engine will operate satisfactorily but its internal parts will be subject to more rapid deterioration than would otherwise be experienced. Thus, it, is necessary under such conditions to inspect the valves, seats, inner cylinder walls, pistons, and rings more frequently and to replace worn parts that have been damaged by the nature of the fuel.

OIL BATH AIR CLEANER

Air is drawn in to be mixed with fuel in the carburetor, after passing through the oil bath air cleaner. This filtering prevents dust particles, pollen, and other airborne contaminants from entering the internal engine components and simplifies maintenance.

A removable cup at the bottom of the air cleaner must be filled with oil before the engine is started. A ring just above the cup inside the bottom of the filter assembly holds a metal screen. All of the air that will be used in the carburetor will bubble through the oil and then pass through the metal screen before it reaches the connection to the carburetor.

To fill the air cleaner, loosen the two thumb nuts near the bottom of the air cleaner and lower the cup from the cleaner. A removable plate fits inside the cup. With the plate in position in the cup, the proper oil level is shown by a Full mark on the plate. Use 10 or 20 weight oil to fill the reservoir to this level. Then return the cup to the filter assembly and secure it with the thumb nuts.

The purpose for the removable plate inside the cup is to provide a baffle to force incoming air through the oil. The plate can be removed to permit access to the interior of the cup so that it can be wiped clean before the cup is filled with fresh oil.

FINAL INSPECTION

Before attempting to start the engine, check the following initial conditions:

1. See that the fuel valve near the carburetor is turned off and that the supply valve at the volume-tank/scrubber input is turned on. If the fuel line has not been purged, turn on the fuel valve near the carburetor to purge the line and then return the valve to off before starting the engine.

2. See that the clutch is disengaged.

3. Check to see that there are no tools or parts left lying on the engine surfaces and that there are no other impediments in the vicinity of the engine.

4. Turn the speed adjusting screw on the governor to its full counterclockwise setting to select idle.

STARTING THE ENGINE

1. Release the compression by raising the compression release lever located on the side of the valve cover; it turns about 180 degrees.

2. Check the automatic switches. The coolant level switch is open if the coolant level is sufficient. The overspeed switch must be reset manually if it has been tripped. The oil pressure switch should be reset by depressing the reset button located on the switch.

3. Connect jumper cables from the 12 volt DC source to the Cannon receptacle on the instrument panel. Polarity does not matter.

4. Press the starter switch on the instrument panel. Hold this switch while the flywheel accelerates to 30 or 40 RPM.

5. Continue to hold the starter switch engaged. Close the compression release.

6. The engine should start after several revolutions and then continue to accelerate. Release the starter switch after firing starts.

7. After the engine has accelerated to its idling speed - about 400 RPM - allow it to run at idle for several minutes. This warms the engine and permits the operator to check for normal operation.

8. Remove the jumper cable to disconnect the DC power input. This power is not required until the engine is to be started again.

9. While the engine is warming, observe the oil level in the crankcase at the sight gauge. If necessary, add oil bring the level up so that it shows in the sight gauge.

NOTE: On current production engines, a rotary type off-on start switch is used in lieu of the toggle ignition switch and push button starter switch previously used.

BRINGING THE ENGINE UP TO SPEED

After the warm up period has elapsed and the engine is operating smoothly, slowly turn the adjusting screw on the governor clockwise to accelerate to the required operating speed.

NOTE: If the engine accelerates to more than about 800 RPM, the automatic overspeed switch will be actuated by a spring-loaded pin in the flywheel and the engine will stop. Turn off the fuel valve, reset the overspeed switch, reduce the speed setting on the governor, and start the engine again.

When the engine is running smoothly at the desired speed, the clutch can be engaged to drive the load. This will always cause the engine to slow down initially, but the engine should then recover and accelerate back up to the desired speed automatically.

As long as the engine continues to operate, its speed will be set by adjustment of the speed control on the governor housing. Minor speed changes, succeeded by recovery, reflect load changes if and when they occur.

STOPPING THE ENGINE

1 . Disengage the clutch to remove the load from the power take-off.

2. Close the fuel valve near the carburetor and allow the engine to coast to a stop.

3. Set the ignition switch at OFF after the engine has come to a full stop.

EMERGENCY STOP

If the engine needs to be stopped manually for an emergency condition, set the ignition switch at OFF. If possible, protect the engine while it is coasting to a stop by turning off the fuel supply at the carburetor and by disengaging the clutch to remove the load.

INSPECTION

Thorough inspections at regular intervals will prevent minor troubles at inconvenient times and avoid costly repairs. Any new or overhauled engine should always be checked thoroughly during the first week of operation. For example, cylinder head, base pan, gear cover, and other gaskets should be examined for evidence of leaking and the bolts should be tightened as necessary.

The following is a practical inspection routine that can be adapted as needed to individual variations in operating schedules. The operator can consider the requirements of accessory maintenance and fit these details into the regular engine inspection schedules.

DAILY INSPECTION

1 . Oil level and quality - check sight gauge and add oil if necessary. Examine oil for sign of deterioration and/or contamination.

2. Coolant - check sight gauge and add coolant if necessary, using clean, soft water or anti-freeze mixed with water. Rusty, scummy or oily water may indicate the need for cleaning the cooling system or other servicing. Clean foreign objects from radiator fins. Do not open cooling system except as necessary to add water, or clean.

3. Oil pressure - check oil pressure gauge. Normal oil pressure with the engine up to operating temperature is 15-50 Ibs.

4. Air cleaner and breather - inspect for cleanliness. Under some operating conditions it may be necessary to clean each day.

5. Fuel and lubricant lines - examine for indications of leaks, damaged tubing or bad connection.

6. Check operation of safety devices.

WEEKLY INSPECTION

After finishing your Daily Inspeection...

1 . Check for any noises that may indicate need for repair or service.

2. Examine for any indications of leaking gaskets, loose cap screws, nut and engine hold down bolts. Torque nuts, in areas where leaks are indicated, to specified values. Replace gaskets and retorque evenly if leakage continues.

3. Grease power take-off but do not over grease.

4. Check fan belt for proper tension, fraying or other damage.

5. Clean the exterior of the engine.

MONTHLY INSPECTION

After finishing your Daily & Weekly Inspection...

1. Change lubricating oil when necessary.

2. Change lubricating oil filter when oil is changed.

3. Clean air filter and breather.

4. Remove, clean and regap spark plugs.

5. Adjust valve tappets.

6. Check timing and adjust carburetor.

SERVICE

LUBRICATION

CIRCULATION OF OIL

The use of a good grade of lubricating oil changed at regular intervals is important in realizing the most service from your engine. Oil performance will be reflected by conditions of engine load, temperature, fuel quality, atmospheric dirt and moisture, and maintenance. Where oil performance problems arise or are anticipated, the oil supplier should be consulted. When extended drain periods are contemplated, his analysis, or that of a reputable laboratory, should determine the suitability of oil for further service. These analyses should always be accompanied by visual inspections of the interior of the crankcase and rocker arm chamber to insure against accumulation of sludge, lacquer, etc.

In low temperatures, an oil must be used which will provide proper lubrication when the engine is hot and working. Multi-viscosity oil should be used only where cold starting conditions make it absolutely necessary. The oil supplier should assume full responsibility for satisfactory performance of the multi-viscosity oil at both low and normal engine operating temperatures. The following oil viscosities are recommended:

Intermittent duty, light load, less than 12 hrs. a day:
30W

Continuous duty, normal load, 24 hrs. a day:
40W

Continuous heavy duty, heavy load, 24 hrs. a day, high ambient temperature:
50W

OIL FILTER

To further increase the efficiency of the engine, a high grade, easily changed, full flow oil filter is a special feature. The engine, designed for long periods of operation under rugged conditions, requires an oil filter with long life, a large dirt retention capacity and effective filtration. Replacement, therefore, should be with the factory-supplied element.

It is always advisable that the element and oil be changed at the same time. However, if only the oil or the filter is to be changed, it is safer to change the filter, which will clean the dirty oil and return it to good operating condition. The practice of circulating clean oil through an unchanged dirty filter element allows previously absorbed filter contaminants to recirculate and reduce the period of acceptable oil conditions.

The oil filter is located out of the way on the base and is easily accessible. Quick removal of the oil filter, and spin-on installation of the replacement, reduces downtime to a minimum.

OIL SUMP

The engine base serves as a reservoir for the engine oil supply. The base is designed to hold a large supply of oil permitting longer intervals between oil changes.

It is recommended that the oil reservoir be drained and refilled with new, clean oil at regular intervals, because oil gradually accumulates small particles of dust, grit and corrosive material which cause unnecessary engine wear. The oil should be drained when the engine is hot, as this aids in the removal of sediment.

The formation of sludge in the oil is due in part to contamination caused by the gases, which pass by the piston rings, coming in contact with the oil and condensing. If when draining, the oil appears to be thick and congealed, the oil sump should be cleaned thoroughly. Also, remove the oil pump strainer and clean.

The oil supply should be checked regularly and replenished if necessary to maintain the level at the sight gauge. Oil may be added to the engine while running. Overfilling should be avoided.

OIL PUMP

No service of the oil pump should be necessary except during overhaul when it should be disassembled, cleaned and inspected. However, low oil pressure not due to leaks, worn bearings, or a clogged filter may be caused by worn oil pump gears. Severe sludging may require an occasional disassembly to clean the pump passages.

To remove the oil pump:

1. Remove the right flywheel guard.
2. Remove the flywheel.
3. Remove the gear cover housing.
4. Remove the drive gear from the oil pump shaft.
5. Remove the oil lines from the oil pump on the inside of the engine by reaching through the hand hole on the back of the engine.
6. Remove the two cap screws from the oil pump flange and pull the oil pump out.

Reverse this procedure to install the oil pump.

Occasionally you may find the oil pump will not prime after it has been reinstalled. This could also happen on a new engine or one that has been in storage. To prime the pump remove the oil filter. Wrap a clean cloth around the spout of a pump type oiler. Insert the spout in the oil hole next to the oil filter stud. Hold the cloth tight around the hole with one hand, and pump about a cup of oil or until you can feel a back pressure. Reinstall the oil filter and crank the engine to be sure the oil pump is primed.

MAGNETO LUBRICATION

The magneto bearings are permanently lubricated during assembly, and field dismantling for lubrication is not necessary .

GOVERNOR LUBRICATION

The governor is lubricated automatically from the engine oil supply and requires no additional lubrication except an occasional drop of light oil on the throttle lever linkage to prevent binding and wear.

Periodically loosen the oil line at the top of the govemor to be sure it is being lubricated properly.

CLUTCH LUBRICATION

Throw Out Collar - Apply a small amount of lubricant, before starting, through the fitting on the tapered part of the housing.

Anti-Friction Bearings - Approximately every 3000 hours of operation, apply a small amount of lubricant to the pilot bearings through the hole in the clutch shaft and to the shaft bearings through the fitting located atthe housing hub.

Lubricant - Any high grade, soda base, short fiber grease may be used which is recommended for anti-friction bearings, having operation temperatures of 200 degrees Fahrenheit (93.33 degrees Centigrade). A multi-purpose lithium base grease for high operating temperatures is highly recommended.

FUEL SYSTEM

CARBURETOR

A design feature of the carburetor is the diaphragm operated Air-Gas Valve, the only moving part in the carburetor bowl. The Air-Gas Valve measures airflow and meters gas in proper proportions at any throttle or load condition. When the engine is stopped it provides automatic choke action for easy starting.

When connecting the gas line to the engine for the first time, turn on the gas in the line momentarily before fastening to the engine. This will clear air and any foreign matter from the gas line and provide fuel for starting.

On current production engines equipped with the Arrow #200 carburetor, fuel pressure should be 2 to 4 ozs. On older engines using the #210 carburetor, the fuel pressure should be set at 4 to 6 ozs.

To adjust the carburetor, take the following steps:

1. Open the gas regulator valve at the carburetor fuel inlet.

2. With the engine running at the desired speed and load, adjust the dial cock in the fuel line, so the engine runs the smoothest and easiest.

3. Gradually close the fuel regulating valve at the carburetor inlet to a point where the engine just begins to fluctuate. Open the regulating valve just enough to cause the engine to again run smoothly and evenly. Then open the dial cock all the way.

4. Open the throttle by hand all the way to assure the engine will pick up additional load without missing or hesitation. If it does not, open the fuel regulating valve slightly, more to a point where the engine will pick up the load without hesitation or missing.

Proper adjustment is important to assure easy starting, rated power, long valve life, and efficiency.

Cleaning or replacement of the metering assembly in the carburetor can be accomplished in a matter of minutes with just a screwdriver.

A new diaphragm may be installed in the Air-Gas Valve Assembly with no possibility of misplacing parts or wrong reassembly as the unit is riveted together and the diaphragm may be slipped on or off by removing 5 machine screws.

FUEL RATE FOR ARROW ENGINES

In our discussion of fuel usage rates for Arrow Engines, we are going to use the assumption all engines are heat engines. They use heat and not fuel. The fuel only furnishes the heat which the engine uses; hence, the heat rate of a given engine is the thing we really wish to know, since the heat rate of a given engine is the same for all fuels which that engine can burn effectively and for which it is recommended. Therefore, knowing the heat rate of an engine, we may translate that into fuel quantity for any suitable fuel whose value is known.

The heat rate of a four cycle spark ignition engine is not a fixed quantity but varies mostly with the load factor and somewhat with the speed. We have elected to eliminate the exact speed factor, since it is a minor value, by selecting a conservative value over the entire speed range of the engine for each chosen load factor. Yet, it must be clearly understood that the rated load upon which the load factor is based is not the maximum rated load, but the rated load for the speed at which the engine at the instant is operating. For example, a C-255 Engine operating at 400 RPM and 28 horsepower (20.9 KW), which is full load at that speed, would be considered as operating at full load and not at half load. It would have the same heat rate per horsepower hour as if it were operating at 55 horsepower (41.5 KW) and 750 RPM. While this is not strictly true, the conservative values chosen serve our purpose here.

With this in mind, we may now use the following tables:

TABLE 1
BTU RATE FOR ARROW ENGINES

Load Factor % Rated Load @ Operating RPM	Heat Rate BTU/ HP Hour	(KW Hour)
100%	11,000	8,203
75%	11,500	8,576
50%	12,500	9,321
25%	15,000	11,186

TABLE 2
HIGHER HEATING VALUES OF FUEL

Fuel	BTU
Refinery Natural Gas	1,100/cu. ft
Artificial Gas	600/cu. ft
Separator or Well Head Gas	Ref. to Analysis
Butane	21,000 per lb.
Propane	21,500 per lb.
Ordinary Gasoline	19,500 per lb.
Butane-Propane Gasoline	Apx. 117,000g

In the oil field operation, there are many factors which are not exactly known. For instance, the exact horsepower at the engine shaft is not known, even though the polish rod horsepower is known. There is no easy or practical method to determine the exact engine shaft horsepower. Also, exact heating value of the fuel is usually unknown. Therefore, we consider Table 2 to have an accuracy consistent with the accuracy of field measurements.

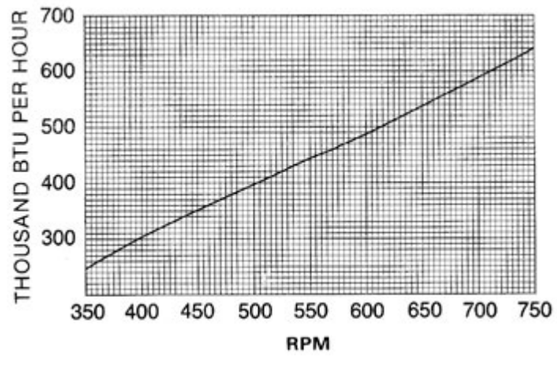
In concluding, we point out that because of the number of variables over which we have no control, we do not and cannot guarantee fuel economy except under laboratory conditions.

The Arrow engine, if properly applied on oil well pumps, can always attain much better fuel economy than 4-6 cylinder engines. The reason is that 4-6 cylinder engines cannot be applied near their full load power nor be operated at a uniform speed due to the lack of a flywheel. Usually this fuel savings is 40%. That is, the Arrow engines will not only do a better job on oil well pumping than the 4-6 cylinder engines but with 40% less fuel.

Two cycle spark ignition engines are notoriously wasteful of fuel at any other than full load.

Engines similar to Arrow design usually have simple combustion chambers without much turbulence and do not bum the fuel as effectively as Arrow engines, as has been shown by laboratory tests. Such engines have a heat rate of as much as 13,000 BTU at full load. Arrow engines do that well at half rated load. We have good reason to believe that the Arrow engines have the best fuel economy of any spark ignition engine for oil well pumping (See Table 3 for quick reference.)

TABLE 3
ARROW C-255 FUEL CONSUMPTION



AIR CLEANER

The purpose of the air cleaner is to collect dirt and grit and keep it out of the engine. To accomplish that the air cleaner itself must be kept clean. Under some extreme conditions this may mean cleaning it daily. Frequent inspections and an awareness of operating conditions will assist you to set up an adequate service program.

To clean the air cleaner, remove the lower part and flush out the oil when there is an apparent accumulation of sediment or thickening of the oil. Scrape out any accumulation, wipe clean and refill with fresh engine oil to the level indicated. If the screen appears dirty, also clean it with solvent. Reassemble the air cleaner.

Be sure all air inlet connections are tight. Dust particles are small but have the ability to do great damage. Unfiltered air through loose connections defeats the purpose of the air cleaner.

COOLING SYSTEM

The engine is cooled by a (pressurized-condenser) type system. Vapors generated in the cooling systems rise into the condenser. The fan, pulling cool air through the condenser, removes the heat and condenses the vapor. This type of system maintains a constant engine temperature through a wide ambient temperature range.

A pressure cap (4Ibs.) provides aslight pressure to seal the system and reduce coolant loss. For the first week of operation check the water level frequently to be sure there is no leak. A water level safety switch is incorporated in the system as a protection against coolant loss. If the coolant should drop to a dangerous level the safety switch will ground the magneto and stop the engine.

During the engine warm up period, air and slight amounts of vapor may be released by the pressure cap. The pressure cap prevents damaging pressure from developing, and allows air to enter the system and balance the pressure. When the engine is warmed up, check the condenser fins for dirt, bugs and debris that may be restricting the flow of air. Check the fan belt for proper tension.

When freezing temperatures prevail, a mixture of antifreeze and water must be used. A good grade of antifreeze should be mixed with water before pouring into the engine. Usually a 50-50 mix is sufficient. This will protect to 35 degrees Fahrenheit. If operating in Arctic conditions a mixture of 40% water and 60% antifreeze is permissible. However, as soon as temperatures reach a level where a 50-50 mix is adequate, the mixture should be adjusted accordingly. Never use pure antifreeze in a pressure condensing cooling system. Severe damage to the engine will result.

STARFIRE IGNITION

The Arrow Ignition SF-601 low tension magneto is of the rotating magnet design. A high energy magnet is attached to the flywheel and passes by a permanently mounted generator coil facing the flywheel. Each time the magnet passes by the face of the generator coil, a capacitor is charged to peak voltage.

A trigger magnet is also mounted on the flywheel and faces off to a trigger coil located on the engine. The trigger coil is positioned so that the magnet will pass the trigger coil and cause the SCR to discharge the storage capacitor into the ignition transformer located near the spark plug.

The Arrow Ignition SF-601 should provide long, maintenance free service because there are no moving parts. All electronic parts are encapsulated to protect against moisture and physical damage.

When spark test indicates unsatisfactory magneto performance, check the following:

1. Electrical connections – they could have become loose.
2. Air gap – the air gap between the EMG and magnet bar should be a nominal .030 inches, but no more than .080 inches.
3. Air gap – the air gap between the trigger coil and the trigger magnet bar should be a nominal .100 to .200 inches.
4. Coil – Check the coil on a reliable tester, or substitute a new identical coil in its place.

If trigger coil is moved, timing should be checked.

Start the engine. If desired, the timing may be checked with a timing light. The ignition point should be 7" before TDC. Timing can be adjusted by moving trigger coil in mounting slot.

CAUTION: Be sure proper air gap is maintained between trigger coil and trigger magnet.

IGNITION SYSTEM TROUBLESHOOTING

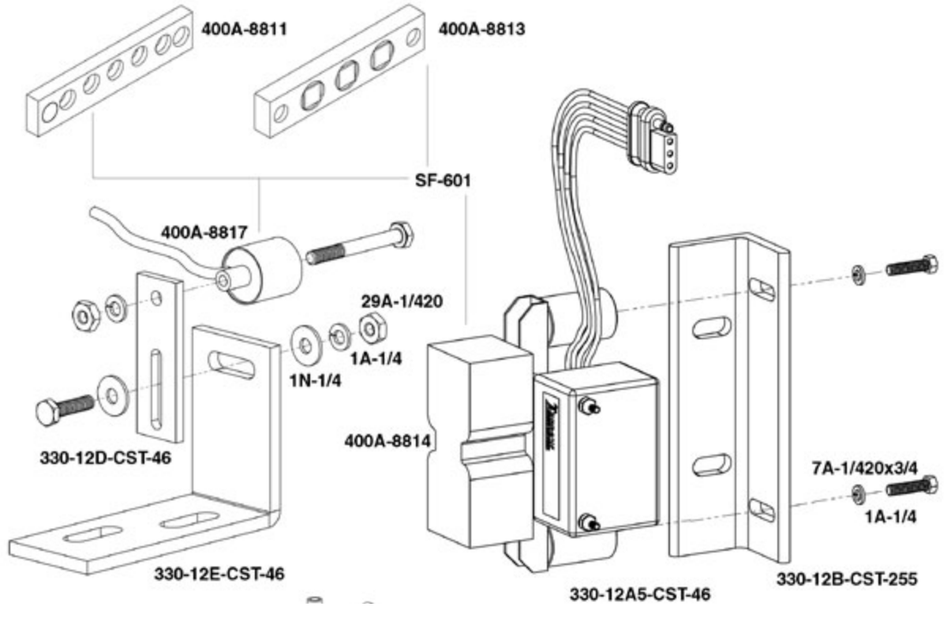
The most common ignition difficulties are as follows:

A - Improper plug gap - the specified gap should be .030-.035. I mproper gap will impede the spark and cause intermittent misfiring, particularly at low speeds.

B - Plug shorted out - this is usually caused by a cracked or dirty insulator.

C - Plug fouled - this is caused by moisture, dirt, oil, or carbon around the electrodes.

D - Misfiring - (1) this may be caused by loose or corroded cable connections, especially in the primary circuit; (2) a grounded cable will also cause misfiring.



SPARK PLUG

The spark plugs supplied with the engine have been selected according to heat range to give the longest service and the most satisfactory performance, but peculiarities of actual operation may indicate a change from the factory selection.

For protection against enforced shutdown and difficult starting due to faulty spark plugs, It is advisable to inspect, clean, file the electrodes, and regap the spark plug about every 3000 hours of operation. Reset the electrodes with a round wire gauging tool to 0.035 gap by bending the out electrode.

All spark plugs installed at the factory in Arrow Engines have stainless steel electrodes. This makes the plugs suitable for more dependable operation when using sour gas.

POWER TAKE-OFF

The clutch is a single plate dry disc type with cushion engagement and has sufficient capacity for transmitting engine power. The clutch is engaged by a hand lever which may be mounted on either side of the clutch operating shaft. The clutch housing may also be rotated to any desired position to facilitate the lever operation and service. This clutch requires very little attention except for periodic checks and lubrication.

When a new Power Take-off has been installed on an engine, rap the shaft on the end to center the pilot bearing to relieve any excessive thrust due to resistance of the pilot bearing when being pressed into the flywheel.

Care should be taken to make sure belt tension is not too tight, as this will cause severe damage to the clutch.

ADJUSTMENT

Clutch - If the clutch does not pull, heats, or operating lever jumps out, the clutch must be adjusted. With engine stopped, remove the hand hole plate in the housing and turn the clutch until the adjusting lock pin can be reached. Disengage the adjusting lock pin and tum the adjusting yoke or ring to the right, or clockwise, until the operating lever requires a distinct pressure to engage (164 Ibs. measured at handle). A new clutch generally requires several adjustments until the friction surfaces are worn in .

Bearings - Ball bearings do not require any adjustment.

LUBRICATION

Throw Out Collar - Apply a small amount of lubrication once a day, before starting, through the fitting on the tapered part of the housing.

Anti-Friction Bearings - Apply a small amount of lubricant to the pilot bearing through the hole in the clutch shaft and to the shaft bearings through the fitting located at the housing hub approximately every 3000 hours of operation.

NOTE: When a Power Take-off is being used with a direct drive through a flexible coupling, or any other means, thereby making it impossible to get at the fitting in the end of the shaft, provision should be made for cross drilling of the shaft and installing a fitting between the housing and the hub of the driven member.

Lubricant - Use any high grade, high temperature, lithium base gun lubricant for anti-friction bearings, having operating temperatures of 200 degrees Fahrenheit, minimum.

DRIVING PLATE REPLACEMENT

Common symptoms indicate the driving plate is worn out: the adjusting yoke cannot be screwed up any tighter and, in the case of riveted-on friction discs, the rivet heads are flush with the face of the disc. In the case of moulded driving plates, the entire plate must be replaced. In the case of driving plates with riveted-on friction disc, the latter may be replaced. Wherever split driving plates are used, these may be replaced by unbolting Power Take-off housing from the engine in order to permit getting at the clutch. With solid driving plates, it is necessary to further remove the clutch from the Power Take-off shaft.

ENGINE OVERHAUL

CYLINDER HEAD (Figure 2)

The cylinder head consisting of the valves and the valve operating parts serves both cylinders. Hardened replaceable valve inserts are provided for both valves in the dome type combustion chamber. This type of construction offers a maximum of efficiency and an easily serviced valve mechanism.

VALVES AND MECHANISM

During the engine's service life the valves will require grinding at certain intervals. These intervals cannot be specified exactly because a host of variable factors enter the picture, often without the engine operator's knowledge. The following have been found, to a degree, to reduce valve life:

1. Fuels that break down to form deposits that impair seat contact and prevent heat conduction and valve cooling.

2. Deposits from either fuels or oils that accumulate on the valve stems and cause sticking and burning.

3. Oil not reaching rocker arms due to clogged lines or improper fittings.

4. Shutting down a hot engine without idling for a few minutes. Exhaust valves that happen to be off their seats when the engine stops may warp so that burning occurs on restarting.

5. Improper valve clearances.

6. Lean mixtures due to improper fuel adjustment.

7. Pre-ignition due to wrong plugs or carbon deposits.

DISASSEMBLY OF CYLINDER HEAD

1. Remove cylinder head cover.

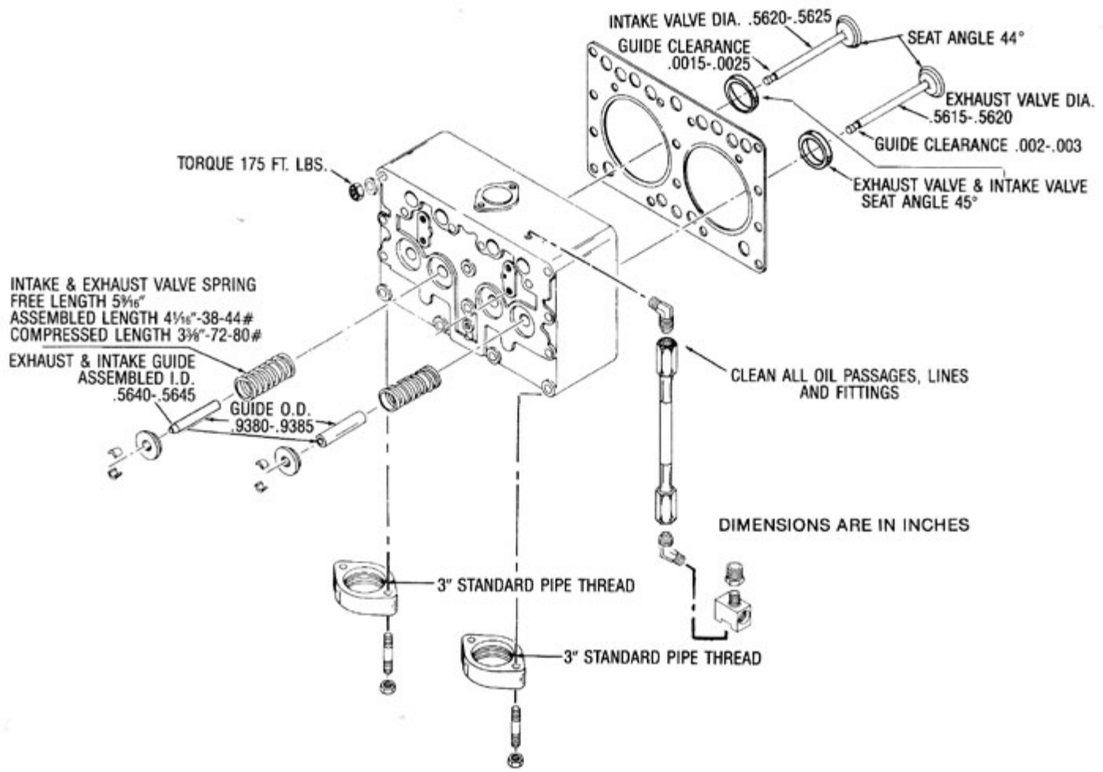
2. Remove cylinder head stud nuts and lift off the cylinder head. Place combustion chamber over a suitable block to hold valves in a closed position.

3. With suitable lever (a 318ft U-shaped rod is satisfactory) under the rocker arm, depress the valve spring to release the valve spring lock retainers. Then the valve spring washers and valve springs can be removed.

4. Clean all parts in solvent or fuel oil, remove carbon, gum, and varnish deposits. If valves or valve seats are severely burned, they should not be reground, since the metal behind the burn has probably lost its original properties. Valves that are warped or have reduced diameter at the valve stem should be discarded and replaced with new valves.

5. When refacing the valves, the maximum face runout in reference to the valve stems should not exceed 0.002 (total indicator readings), and only enough metal should be removed to produce a bright face and a continuous margin as illustrated.

Figure 2. CYLINDER HEAD



NON-SPIRAL END OF EXHAUST GUIDE AND INTAKE GUIDE GO INTO CYLINDER FIRST.

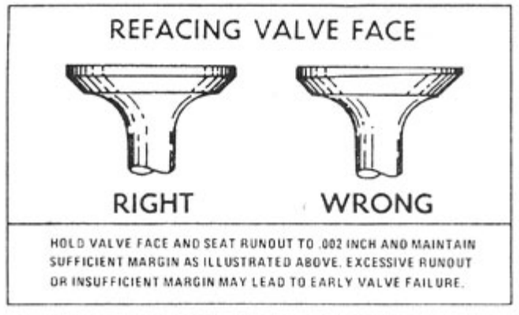
REFACING THE VALVES (Figure 3)

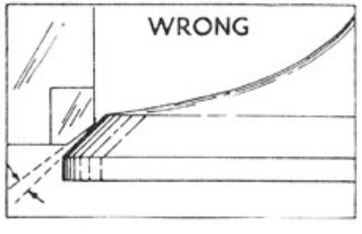
To provide a positive interference angle, the included angle of the valve face is always made greater than the seat, so as to assure valve contact at the outer edge of the valve seat. Therefore, valves should be ground to a 44 degree seat angle with one degree interference angle as illustrated in (Figure 3).

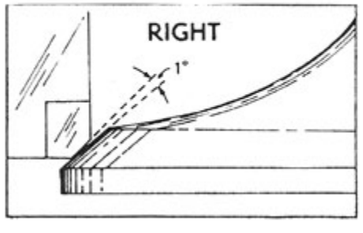
Grind the seat with a 45 degree grinding wheel. Because the valve guide is used to pilot the grinder, this procedure must be attempted only when the valve guides are clean and in good condition.

Maintain a valve seat width of 7/64" to 1/8" by grinding the outer edge of the seat on a 75 degree angle. Do not grind the seat bore to narrow the seat, as this moves the center of the seat too near the valve edge. Discard valves. that have been refaced to the point where the edge of the valves become less than 3/64".

Figure 3







REASSEMBLY OF CYLINDER HEAD (Figure 4)

1 . To reassemble the cylinder head parts, lubricate and insert valves in valve guides, and install valve springs and spring washers. Valve spring damping coils (close wound) must be placed toward the cylinder head.

2. Depress the valve spring washers and replace the valve spring lock retainers.

3. Be sure that the surfaces of the cylinder head and block are absolutely clean. Always install a new head gasket. Do not use the old head gasket over again, as more than likely it will not seal completely. Install cylinder head assembly.

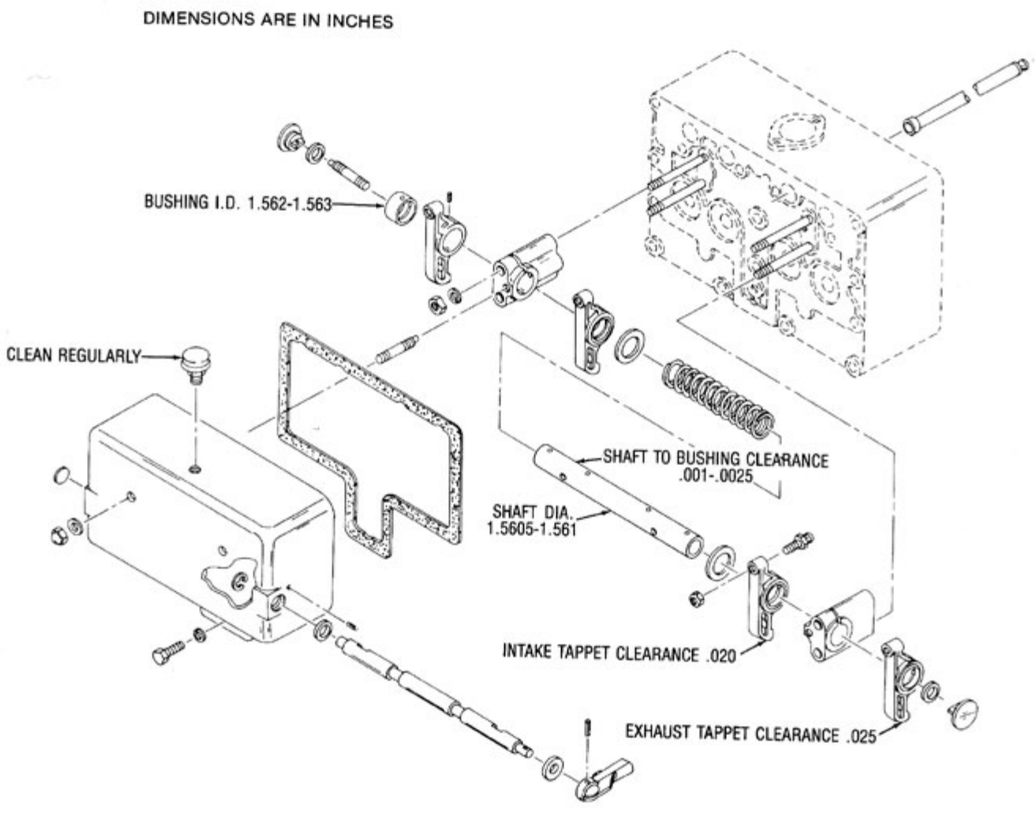
4. Snug cylinder head studs evenly, and then tighten alternately with a torque wrench to 175 ft. Ibs.

5. Crank the engine to bring each piston in turn to top dead center of its compression stroke and replace the push rods.

6. Loosen the lock nut on the rocker arm adjusting screw. Turn the adjusting screw until proper clearance is obtained and tighten the lock nut without further movement of the screw. Proper clearance is 0.020" on the intake valve and 0.025" on the exhaust valve.

7. Reassemble the cylinder head cover and run the engine until it is at normal operating temperature. Retorque the cylinder head stud nuts and while the engine is still warm reset the tappet clearance.

Figure 4. ROCKER ARM CHAMBER



CYLINDER SLEEVE (Figure 5)

The cylinder sleeves are mounted in a removable cylinder block. Replacing the sleeves can be accomplished without removing the cylinder block, by using a block of wood between the crankshaft throw and the sleeve and bumping the block by turning the flywheel. When the sleeve and piston are worn excessively, replace with new parts.

Be cautious when installing the cylinder sleeve in the cylinder block. The lower end of the sleeve has three grooves into which sealing rings are inserted. These grooves must be thoroughly cleaned before the sealing rings can be installed. Scrape the sealing area in the cylinder block free of scale and lime deposits. If necessary, smooth any rough spots and sharp edges with an emery cloth. It is very important to have the sealing area and the chamber on the sealing area clean and free of any sharp edges.

Making sure the grooves are clean, slip the sealing rings in place and work out all twists. Coat the bore of the cylinder block and the outside surface of the cylinder sleeve and sealing rings with non-caustic liquid soap and immediately install the sleeve before the soap dries.

Place the sleeve in the cylinder block and push it straight in by hand. The cylinder head may be used as a battering ram by slipping it over the cylinder head studs and driving the sleeve to a fully seated position. The top of the sleeve should project about 0.005" out of the block to insure a tight seal with the cylinder head gasket.

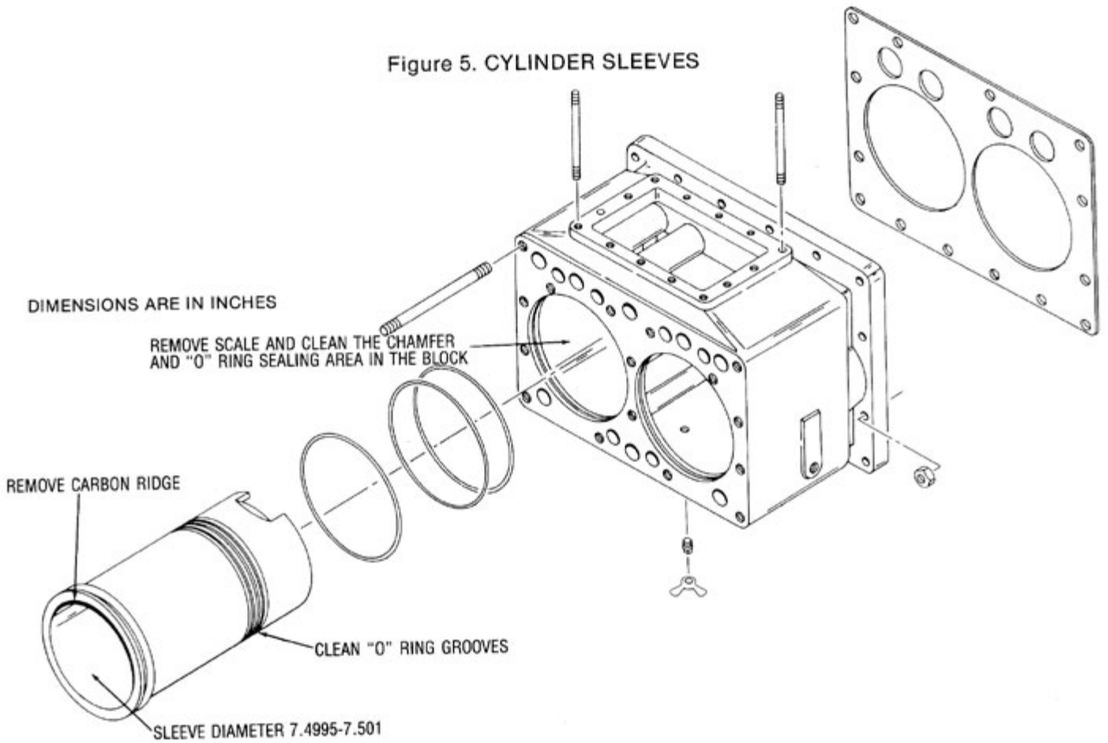
PISTON AND CONNECTING ROD (Figure 6)

Aluminum alloy pistons with two compression rings, one scraper ring and one oil control ring are used in this engine. The piston pin is semi-floating in that it has a tight fit in the piston and loose on the connecting rod.

Proper clearance and tolerances are very important on engine performance. Loose pistons will be noisy, have excessive blowby, high oil consumption and sluggish power characteristics. Overly tight pistons may be even more dangerous as they could cause severe damage to cylinder walls and other running parts.

To remove the connecting rod and piston, drain the engine jacket water and remove the cylinder head and crankcase hand hole cover. You may find it more to your convenience to also remove the hand hole cover on top of the crankcase. Remove the rod bearing cap and bearing. Push the rod away from the crankshaft just far enough to roll out the other half of the rod bearing.

Figure 5. CYLINDER SLEEVES



Remove the carbon ridge at the outer portion of the cylinder sleeve. If this cleaning is not done, it could damage the piston and removal will be difficult trying to force the rings past the ridge.

Push the connecting rod and piston out of the bore. Remove the piston pin snap rings and put the piston in a bucket of hot water. The piston should be heated to about 165 degrees Fahrenheit (74 degrees Centigrade) to be able to push the pin out of the piston. Never try to heat the piston with a flame.

Remove and discard the piston rings. Thoroughly wash the piston in solvent and clean the ring grooves, oil return holes in the oil ring groove and the outside surfaces of the piston. Reassemble the piston and connecting rod by reheating the piston and pushing the piston pin in by hand.

Be sure to install the piston rings in the right grooves. The compression rings are in the top two grooves. The oil scraper goes in the third groove. The oil control ring goes in the fourth groove.

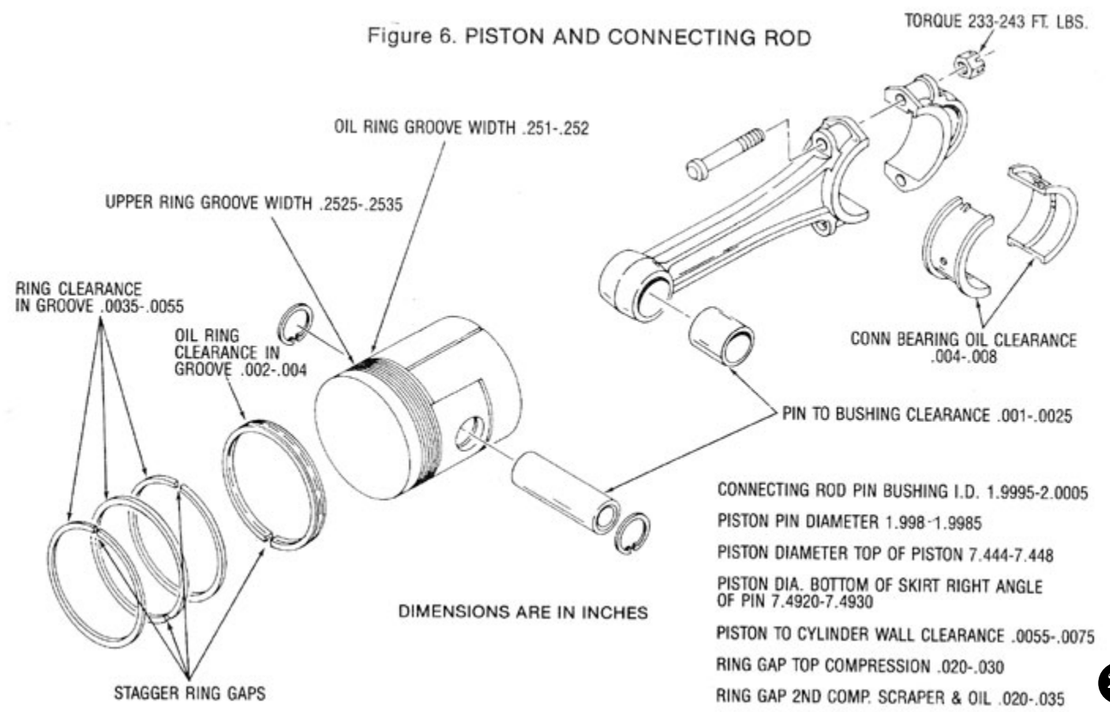
To fit the piston rings place ring in the cylinder sleeve and square up by inserting the piston and moving the ring slightly. Measure the gap with a feeler gauge. If the gap is less than specified, remove the ring and dress the ends with a fine file until proper clearance is obtained. Rings with insufficient clearance will butt the ends from expansion resulting in warped rings and scored cylinders.

Oil the rings generously when installing and be careful not to distort the rings. The oil control rings (slotted) is installed in the bottom groove, which has the oil drain holes in it. The scraper ring is installed, with the undercut towards the bottom of the piston, in the third groove. Lubricate the rings and piston liberally again and install with the slotted side of the piston up.

The connecting rod is machined to accommodate precision bearings. The bearing shells are positively located in the connecting rod by tangs that fit into the reliefs in the cap and rod at the parting joint.

When installing bearings be sure the backs of the bearings and the rod bore surface are absolutely clean. Lubricate the bearing face and crank journal before assembling the rod to the crankshaft. DO NOT file bearing liner edges or connecting rod mating faces.

Figure 6. PISTON AND CONNECTING ROD



CAMSHAFT (Figure 7)

After long service the camshaft and camshaft gear may wear to a point where they will require replacement. Inspection is recommended during overhaul.

To remove the camshaft:

1. Remove the flywheel guard opposite the PTO.

2. To remove flywheel, first remove the four nuts from the camshaft studs. Place a small spacer such as a 3/4" nut between the flywheel retaining plate and the end of the crankshaft and insert two 1/2-13 cap screws through outer holes of plate into flywheel. Tighten these cap screws tightly and smartly rap hand crank spud.

3. Remove the gear covering housing.

4. Remove the camshaft gear with gear puller.

5. Remove the two cap screws from the camshaft thrust plate.

6. Remove cylinder head cover from crankcase and push lifters towards the cylinder head.

7. Remove top cover from crankcase and push lifters toward the cylinder head.

8. Pull camshaft out and remove lifters.

To install the camshaft and retime the magneto reverse procedure. Timing the camshaft is an important consideration In servicing the engine. Timing marks are provided on both the crankshaft gear and camshaft gear. Mesh the gears so that the two "X's" on the camshaft gear straddle the "X. on the crankshaft gear.

CRANKSHAFT (Figure 7)

The crankshaft is supported by three precision main bearings. Shaft end play is absorbed by two thrust washer halves on the power take-off side of the crankcase. The designed ruggedness of the crankshaft and the large main bearings offer considerable trouble free service.

Removal of the crankshaft can be made after disconnecting the connecting rods, removing flywheels, PTO, gear cover, flywheel housing and main bearing caps. Cut off short pieces of hose and slip them over the studs to protect the threads. Insert two long bolts in the crankshaft flange to aid in handling.

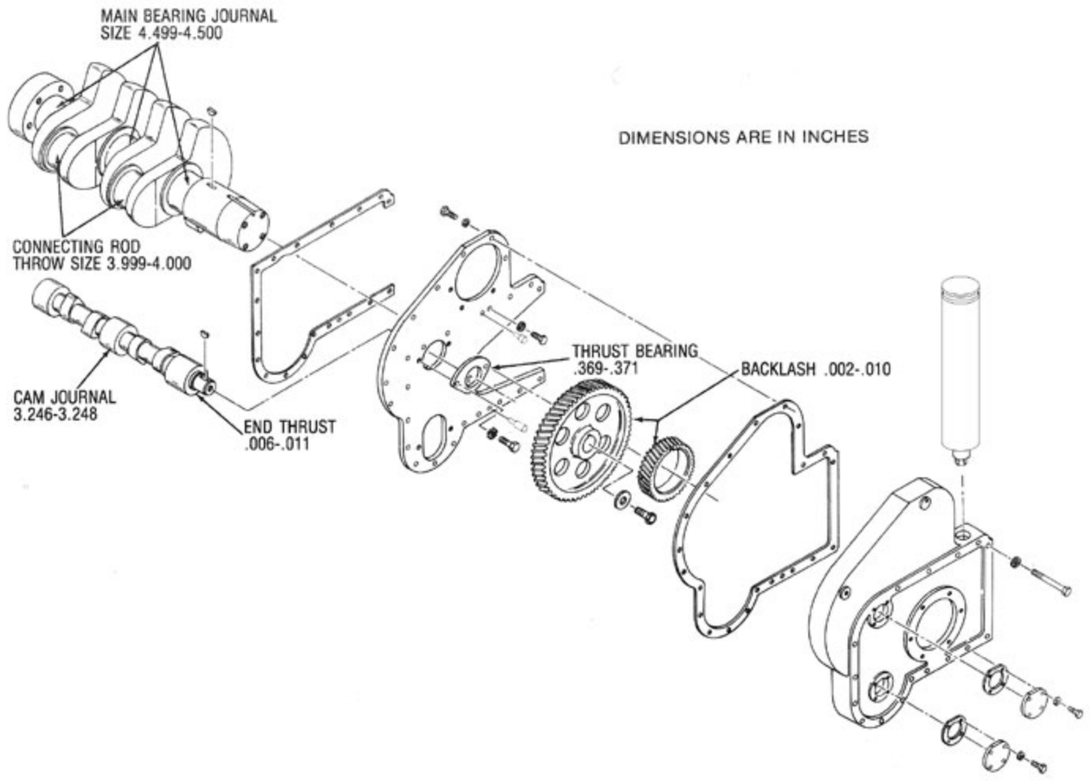
Roll the crankshaft over until the counterweights are towards the cylinder head end. Using a hoist, to keep from dropping the crank, pull the crank out as far as it will go.

Using the bolts in the crank flange turn the crank until the tips of the counterweights are sticking up through the top hand hole. Raise the crank slowly until the lower end of the countersights clear the crankcase.

Ease the crankshaft out by pulling and turning the lower end of the counterweights out at the same time.

To reinstall, line the crankshaft up with the crankcase. Turn the crankshaft to start the counterweights in at the top and reverse the procedure.

Figure 7. CAMSHAFT AND CRANKSHAFT



OIL PUMP (Figure 8)

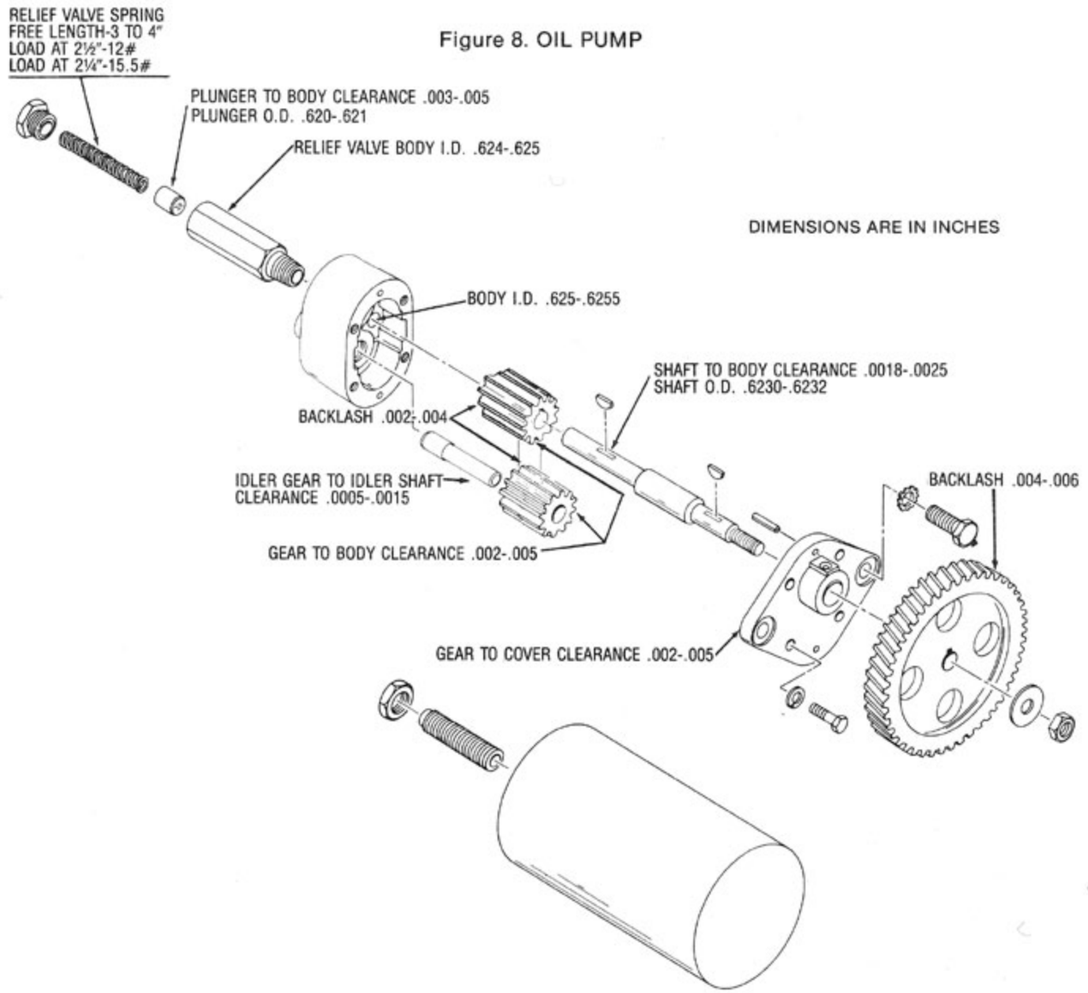
It should not be necessary to service the oil pump except during overhaul, when it should be disassembled, cleaned and inspected. However, worn oil pump gears can cause problems such as low oil pressure (not due to leaks), worn bearings, or a clogged filter. Severe sludging may require an occasional disassembly to clean the pump passages.

To remove the oil pump:

1. Remove the right flywheel guard.
2. Remove the flywheel.
3. Remove the gear cover housing.
4. Remove the drive gear from the oil pump shaft.
5. Remove the oil lines from the oil pump on the inside of the engine.
6. Remove the two cap screws from the oil pump flange and pull pump out.

Reverse this procedure to install the oil pump.

Figure 8. OIL PUMP



GOVERNOR (Figure 9)

If the governor does not perform properly it should be removed, cleaned and inspected for repair. Because the govemor automatically maintains the engine at a constant speed under varying loads, and protects against dangerous overspeeding, it should always be operated in first class condition.

Governor repair is fairly simple as there is very little trouble that cannot be remedied by replacing worn parts. Keeping the governor clean and free from any worn parts that are causing a sticking or binding action is about all the maintenance that is required.

SPEED ADJUSTMENT

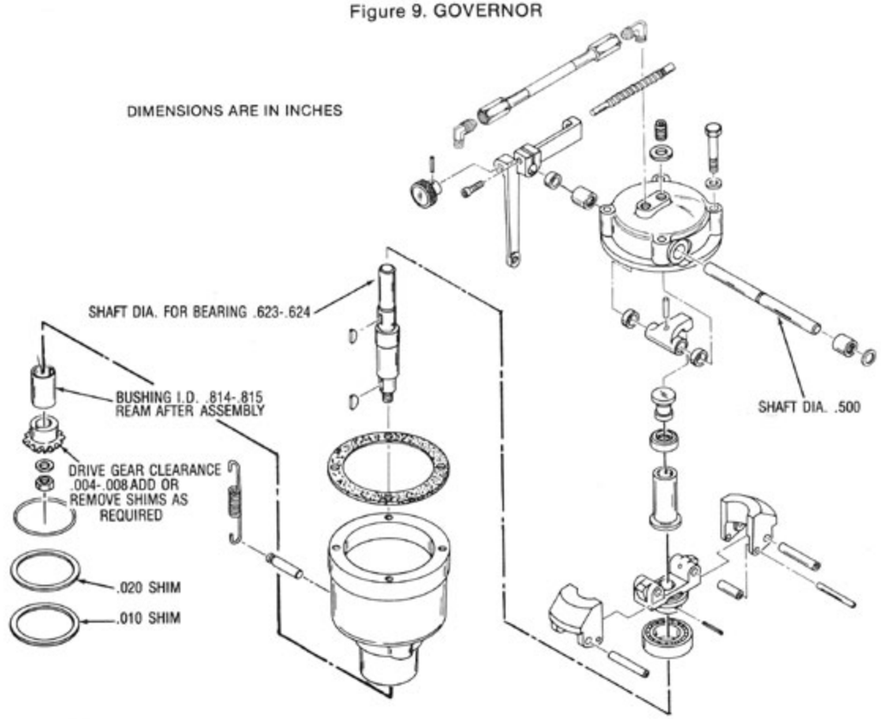
Speed adjustments for this engine can be made by adjusting the knob on the governor terminal lever. Accurate settings can be made with tachometer readings taken at the flywheel end of the crankshaft.

The governor is properly set at the factory for speed range. Should it become necessary to reset the governor, a definite procedure should be followed:

1. Disconnect the control rod from the carburetor.
2. Unhook the spring from the pin in the base of the governor, and with the governor lever all the way forward toward the carburetor. measure the distance from the center of the hole in the governor lever to the center of the spring pin. This distance should be exactly 211/16". If the distance is not as specified above, loosen the allen head clamp bolt in the governor lever and set the lever for the correct distance specified. Tighten the clamp bolt securely.
3. Adjust the length of the control rod so that the butterfly valve is all the way open but not against the stop and the governor lever is in the full open position. Next, pull the governor rod back to the position where the butterfly valve is just closed, but not jammed tight against the sides of the venturi. Then adjust the allen screw on top of the governor so the butterfly valve cannot close any farther. Start the engine and with the governor in the extreme low speed setting, obtain the desired idle speed by adjusting the same allen screw. When the desired idle speed is reached, lock the allen screw with the jam nut. If these adjustments are properly made, the maximum no load speed will be 4% to 5% above the speed shown in the specifications. It is advisable to frequently check the operating speed of the engine with a tachometer.

For best results and optimum performance, Arrow Engine Company recommends that engines be operated at 75% or more of the maximum rated RPM. This will result in smoother operation with less carboning, and less crankcase contamination.

Figure 9. GOVERNOR



POWER TAKE-OFF REMOVAL AND DISASSEMBLY (Figure 10)

1 . Remove all attached parts from the output end of the clutch shaft (21). Remove the key (20) and grease fitting (19) from the output end of the clutch shaft.

2. Remove the twelve hex-cap screws that secure the clutch housing (17) to the flywheel housing. Use two 7/16-14 pusher screws in the tapped holes of the clutch housing flange, and remove the power take-off from the engine.

3. Remove the eight hex-head cap screws that secure the driving ring (1) to the engine flywheel. Remove the driving ring.

4. Support the clutch housing with wooden blocks on a work bench with the clutch end up.

5. Use a standard bearing puller, and remove the pilot bearing (2) from the clutch shaft.

6. Remove the jam nut (9) and lock washer (8) from the hose fitting (6c) located in the clutch housing. Push the grease fitting, hose fitting, and hose into the clutch housing.

7. Straighten the bent portion of the hub nut lock washer (4) from the hub nut (3). Remove the hub nut and the lock washer (4) from the clutch shaft. Discard the hub nut lock washer.

8. Use a gear-and-bearing puller with two legs, threaded for 5/8-11 NC, to remove the clutch assembly (5). Attach the puller so the jack screw is against the pilot bearing end of the clutch shaft, while the threaded legs are screwed into the two holes provided in the hub-and-back plate. Tap the jack screw sharply with tension on the puller to unseat the tapers. Remove the clutch assembly (5) and the hub key (22) from the clutch shaft.

9. Set the clutch assembly on a bench with the sliding sleeve and collar facing upward. Remove the flexible hose assembly (6) from the collar (5D(5)). Remove the hose fitting (6a) from the hose (6b). Remove the grease fitting (10) from the hose fitting (6c), and remove the hose fitting (6c), from the hose.

10. Straighten and remove the four cotter pins (5c(3)) from the lever headed pins (5c(1)). Remove the headed pins (5c(1)), and remove the levers, sliding sleeve, and collar groups as an assembly from the adjusting ring and floating plate. Remove the eight spring washers (5c(2)) which are located adjacent to each lever in the mounting lugs of the floating plate.

11. Remove the two hex nuts and hex-head cap screws (5d(5)(c)) and (5d(5)(a)) which retain the split collar and shims to the sliding sleeve. Remove the collar (5d(5)(d)) and shims (5d(5)(b)) from the sliding sleeve.

12. Straighten and remove the eight cotter pins (5d(3)) from the headed pins (5d(1)) which retain the levers and lever links to the sliding sleeve. Remove the headed pins (5d(1)), levers (5c(4)), and lever links (5d(2)) from the sliding sleeve.

13. Unscrew and remove the adjusting ring (5e) while depressing the adjusting ring lock pin with a screw-driver. Remove the adjusting ring lock pin (Sf) and spring (59) from the floating plate.

14. Remove the floating plate (5h) and the driving plate (5b) from the hub-and-back plate.

15. Remove the cap screw (11), lock washer (12), and lock (13) which secure the bearing retainer (7) to the housing (17). Remove the bearing retainer (7) from the housing.

16. Use a soft steel bar and tap or press the clutch shaft (21) from the clutch housing (17). The forward bearing cup (23) will remove with the clutch shaft and bearing cones (23). Two holes are provided at the rear of the housing through which a straight punch can be used to remove the rear bearing cup when required.

17. Remove the external snap ring (24) from the clutch shaft (21). Press or pull the bearing cones (23) from the shaft. The cones remove from rear toward front.

18. Remove the pipe plug (14) from the grease passage drilling in the housing only if replacement of the part is necessary.

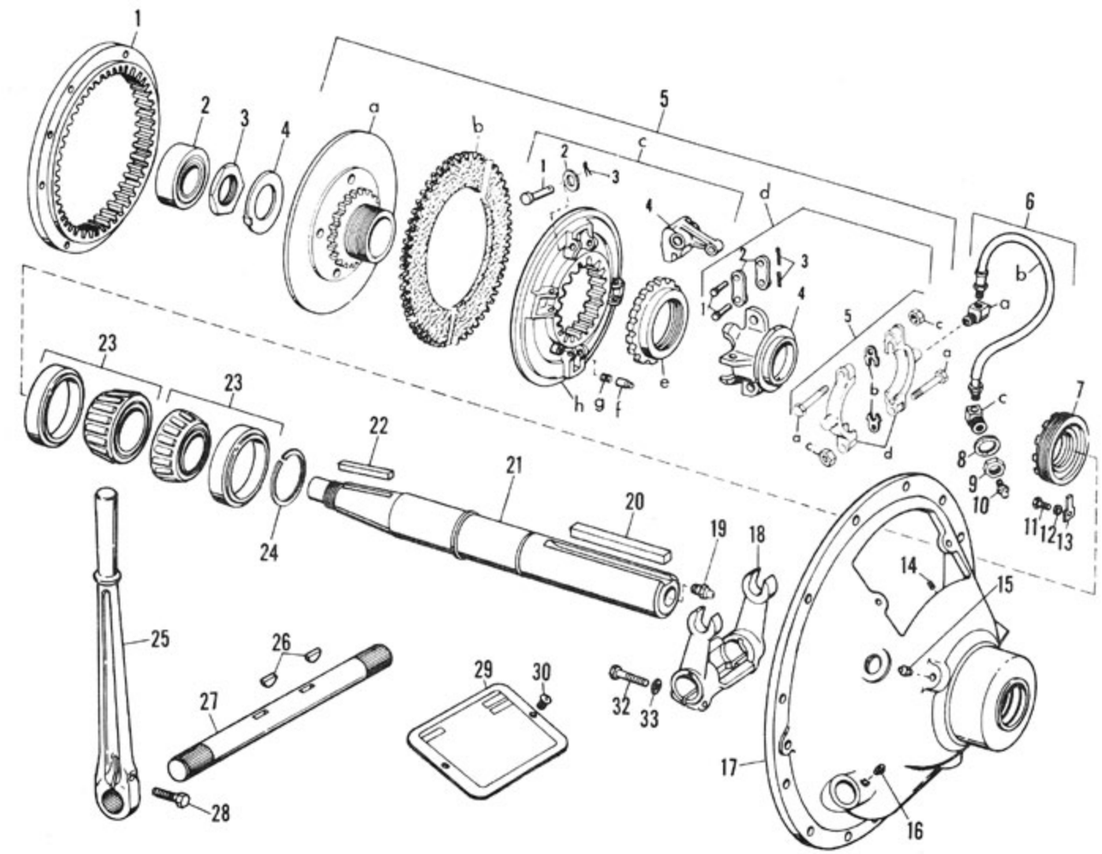
19. Remove the hex-head cap screw (28) from the hand lever (25). Remove the hand lever from the operating shaft.

20. Remove the two hex-head cap screws (32) and lock washers (33) from the throw out yoke (18). Tap one end of the operating shaft exposing one of the woodruff keys. Remove the key (26) and tap the operating shaft further to remove the other key. Remove the throw out yoke (18) and operating shaft (27) from the housing.

21. Remove the two round-head machine screws (30) from the instruction plate cover (29), and remove the cover (29) and gasket (31) from the housing (17). Discard the flat gasket (31).

22. Remove the hydraulic (grease) fitting (15) and remove the two hydraulic (grease) fittings (16) from the clutch housing only if replacement of the parts is necessary.

Figure 10. POWER TAKE-OFF ASSEMBLY



POWER TAKE-OFF ASSEMBLY AND INSTALLATION (Figure 10)

1. Install the 1/8 inch hydraulic (grease) fitting (15) and two 1/4 inch hydraulic (grease) fittings (16) into the clutch housing.

2. Install the operating shaft (27) halfway into the clutch housing. Slip the throw out yoke (18) onto the operating shaft and push the shaft through the opening on the other side of the clutch housing. Install one woodruff key (26) in the operating shaft. Slightly move the throw out yoke on the operating shaft and install the other key. Install the two hex-head cap screws (32) 3/8-16 x 1 1/2 and lock washer (33) 3/8 inch into the throw out yoke. Center the yoke on the woodruff keys and tighten the cap screws to 38 ft.lbs. torque.

3. Install and secure the hand lever (25) to the operating shaft with one hex-head cap screw (28) 1/2-13 x 1 3/4. Tighten the cap screw to 85 ft. Ibs. torque.

4. Use an arbor press and press the clutch shaft into the bearing cones (23). The cones should be positioned back-to-back. Retain the bearing cones on the clutch shaft with an external snap ring (24).

5. Support the clutch housing on the bench with wooden blocks with the clutch end up.

6. Use a piece of steel tubing about 14 inches long and slightly smaller in diameter than the 0.0. (outside diameter) of the bearing cup (23). Tap or press the bearing cup into its bore with its wider section (back face) toward the rear. Tap or press the cup to bottom.

7. Install the clutch shaft (21) into the clutch housing (17). Use the piece of steel tubing previously referred to above to press or tap forward bearing cup (23) into the bearing bore. Install the bearing retainer (7) and adjust the bearing end play in accordance with the procedure outlined under, "Adjustment." After adjustment, install the lock (13), lock washer (12), and hex-head cap screw (11) 5/16-18 x 5/8. Tighten the cap screw to 21 ft. Ibs. torque.

8. Set the hub and back plate (5a) on the work bench with the threaded hub up. Install the driving plate (5b) onto the hub and back plate. Install the floating plate (5h) onto the driving plate indexing the splines on the hub and back plate with those in the floating plate hub. Install the adjusting lock spring (5g) and adjusting lock pin (5f) into the hole provided in the floating plate (5h). Depress the lock pin spring with a screwdriver held on the lock pin, and install the adjusting ring (5e) onto the threaded hub of the hub and back plate. Screw the adjusting ring (5e) about half way down the threads on hub. Release the lock pin into a notch of the ring.

9. Install the eight headed pins (5d(1)), four clutch levers (5c(4)), and eight lever links (5d(2)) to the sliding sleeve. Retain the headed pins with eight cotter pins(5d(3)). Spread the ends of the cotter pins.

10. Install the collar halves (5d(5)(d)) and two shims (5d(5)(b)) to the sliding sleeve (5d(4)). Secure the collar to the sleeve with the two hex-head cap screws (5d(5)(a)) 3/8-24 x 2 1/4 and two hex nuts (5d(5)(c)). Tighten the nuts to 30 ft. Ibs. torque.

11. Set the levers, sliding sleeve, and the collar groups onto the adjusting ring and floating plate as an assembly. Engage the levers with the ring and locate the levers in their mounting lugs.

12. Place eight spring washers (5c(2)) adjacent to the levers (one on each side) in the mounting lugs of the floating plate. Secure the four levers with four headed pins (5c(1)) installed through the lugs, washers and levers. Retain the headed pins with four cotter pins (5c(3)). Spread the ends of the cotter pins.

13. Install the hose assembly (6) onto the collar assembly (5d(5)). Install the hose fitting (6a) into the split collar (5d(5)(d)). Install the hose (6b) onto the hose fitting (6a). Install the hose fitting (6c) onto the hose (6b). Install the hydraulic (grease) fitting (10) into the hose fitting (6c).

14. Install the pipe plug (14) into the housing (17) if removed previously.

15. Install the clutch assembly (5) over the clutch shaft and into the housing. Engage the throw out yoke with the trunnions on the split collar assembly. Align the keyway in the clutch shaft with the keyway in the hub and back plate (5a). Install the key (22). Install the hub nut lock washer (4). Install the hub nut (3). Tighten the hub nut against the lock washer and hub and back plate to remove clearances. Turn the nut an additional 1 /6 turn and bend the lock washer (4) over a flat on the nut.

16. Route the hose assembly (6) to clear all moving parts and push the hose fitting (6c) through the hole provided in the clutch housing. Install the lock washer (8) over the fitting (6c), and install the nut (9) on the fitting to secure the fitting to the housing.

17. Tap or press the pilot bearing (2) onto the end of the clutch shaft (17). Use the force on the bearing inner race. Leave a space of 0.12 inch between the end of the shaft and forward face of the bearing inner race. (See sketch.)

18. Adjust the clutch assembly by the following procedure:
(a) With the clutch disengaged, turn the clutch assembly (5) until the adjusting lock pin can be reached through the hand (instruction plate cover) hole. Depress the adjusting ring lock pin to free the adjusting ring (5e).
(b) Turn the adjusting ring one or two adjusting notch degrees of rotation in a clockwise direction, or until the hand lever requires a distinct pressure.
(c) Release the adjusting ring lock pin and move the ring to lock the pin in the nearest locking pressure.
(d) Engage and disengage the clutch a number of times to make certain the clutch is functioning properly. If proper adjustment has not been accomplished, repeat steps (a) through (c) until proper engagement and disengagement is obtained.

19. Place a new instruction plate cover gasket (31) and plate cover (29) in position on the housing (17). Secure the plate and gasket on the housing with two round-head machine screws (30) 1/4-20 x 1/2. Tighten the screws to 11 ft. Ibs. torque.

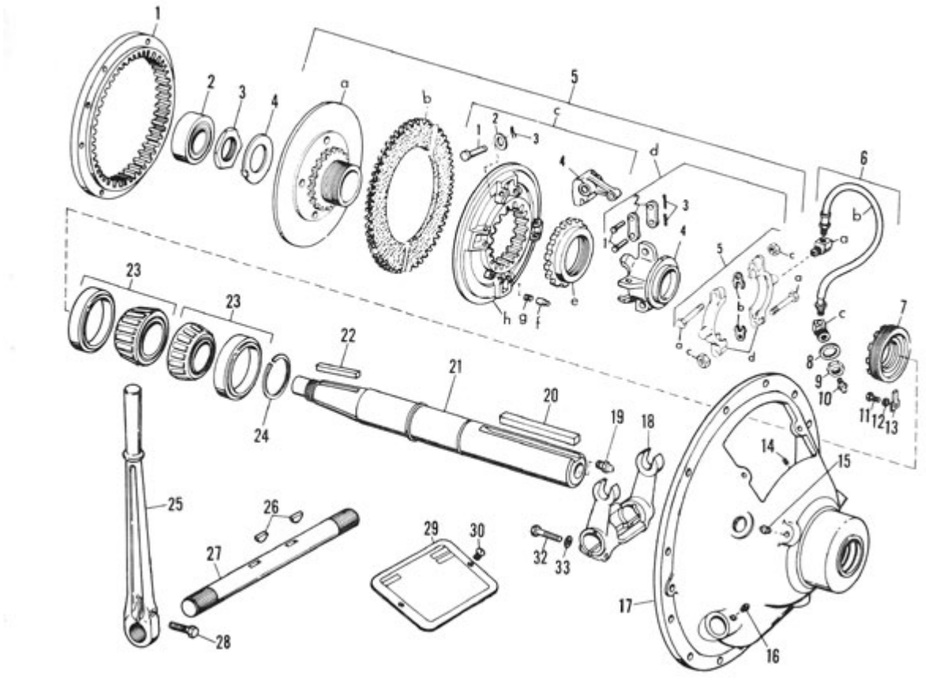
20. Position the driving ring (1) against the engine flywheel and secure it with eight hex-head cap screws.

21. Position the clutch housing (17) against the flywheel housing, carefully aligning the pilot bearing (2) with the flywheel pilot and the clutch driving plate (5b) with the driving ring. Secure the clutch housing to the flywheel housing with twelve hex-head cap screws. Rap the output end of the shaft with a soft hammer to relieve any preloading on the bearings.

22. Install a 1/4 inch grease fitting (19) and 3/4 x 3/4 x 71/4 inch key (20) in the output end of the clutch shaft. Attach all the parts previously removed to the output end of the clutch shaft.

23. Remove 1/8 inch grease fitting and replace (34) with flush mounted plug (PF18-1/8).

Figure 10. POWER TAKE-OFF ASSEMBLY



Engine Data

Displacement	660 cubic inches
Bore and Stroke	7 1/2" x 7 1/2"
Maximum Possible Speed	750 RPM
Compression Ratio	7.0:1
Maximum Rating for Pumping	55hp
Total WR2 of Engine	1430 feet lbs.
Oil Capacity	25 quarts
Coolant Capacity	36 quarts
Flywheel Housing	SAE Number 00
Suspension	Base Mounted
Overall Length	56 3/8"
Overall Width	62"
Overall Height	58 1/8"
Approximate Weight	3,980 pounds
Firing Order	1-0-2-0

Wrench Torques

Cylinder Head Nut	175 ft. lbs.
Connecting Rod Nut	243 ft. lbs.
Main Bearing Nut	275 ft. lbs.
Flywheel Nut	243 ft. lbs.

Oil Type

Normal Operation	Supplement 1
High Sulphur Fuel	Series 3

Oil Viscosity

Intermittent Duty Light Load Less Than (>) 12 Hours a Day	30W
Continuous Duty Normal Load 24 Hour Day	40W
Continuous Heavy Duty Heavy Load 24 Hour Day	50W

Exhaust System

Flange	3" N.P.T.
Minimum Permissible Exhaust Pipe Dia.	< 20' long - 3" dia. 20'-30' long - 4" dia.

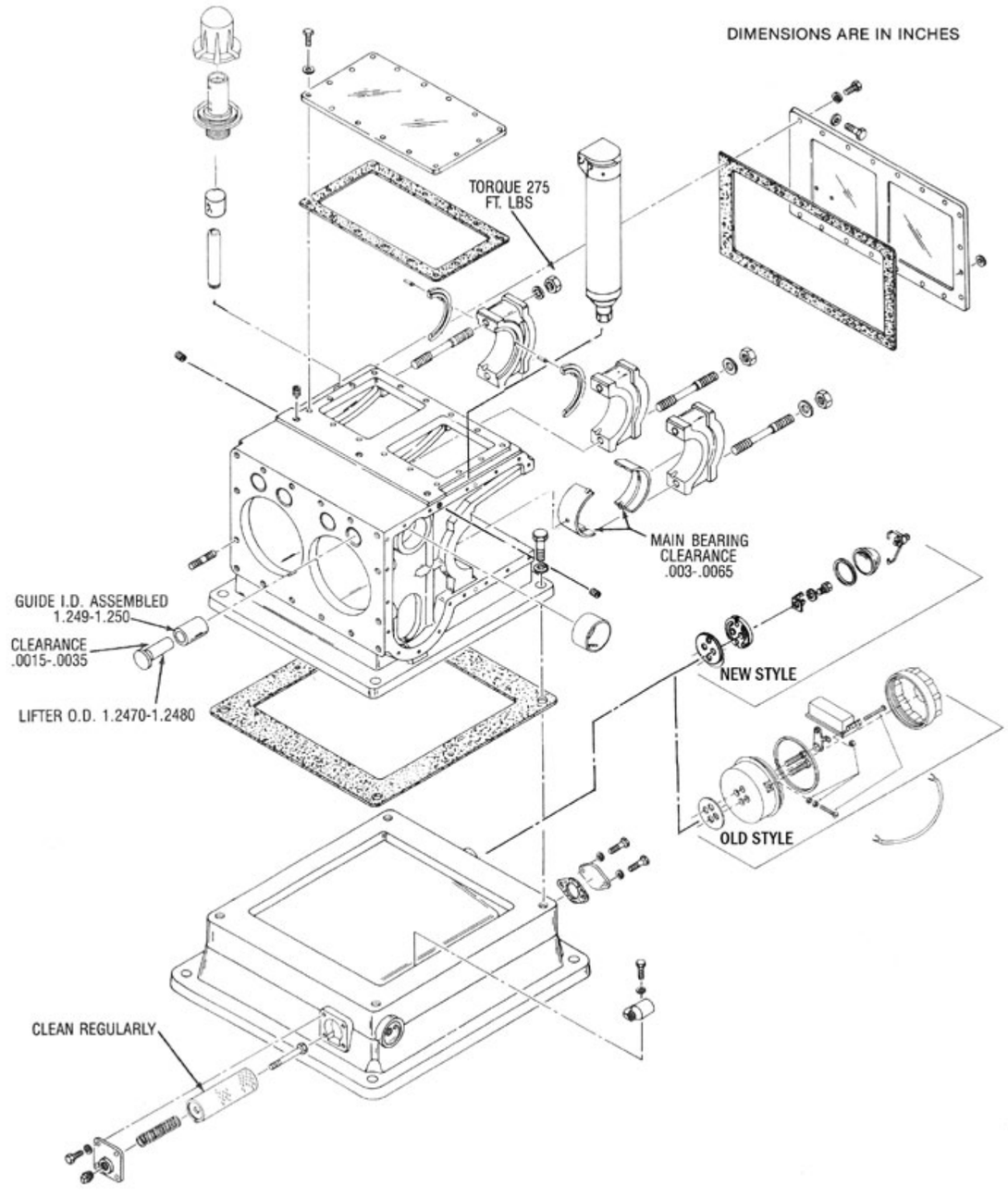
HORSEPOWER DERATES

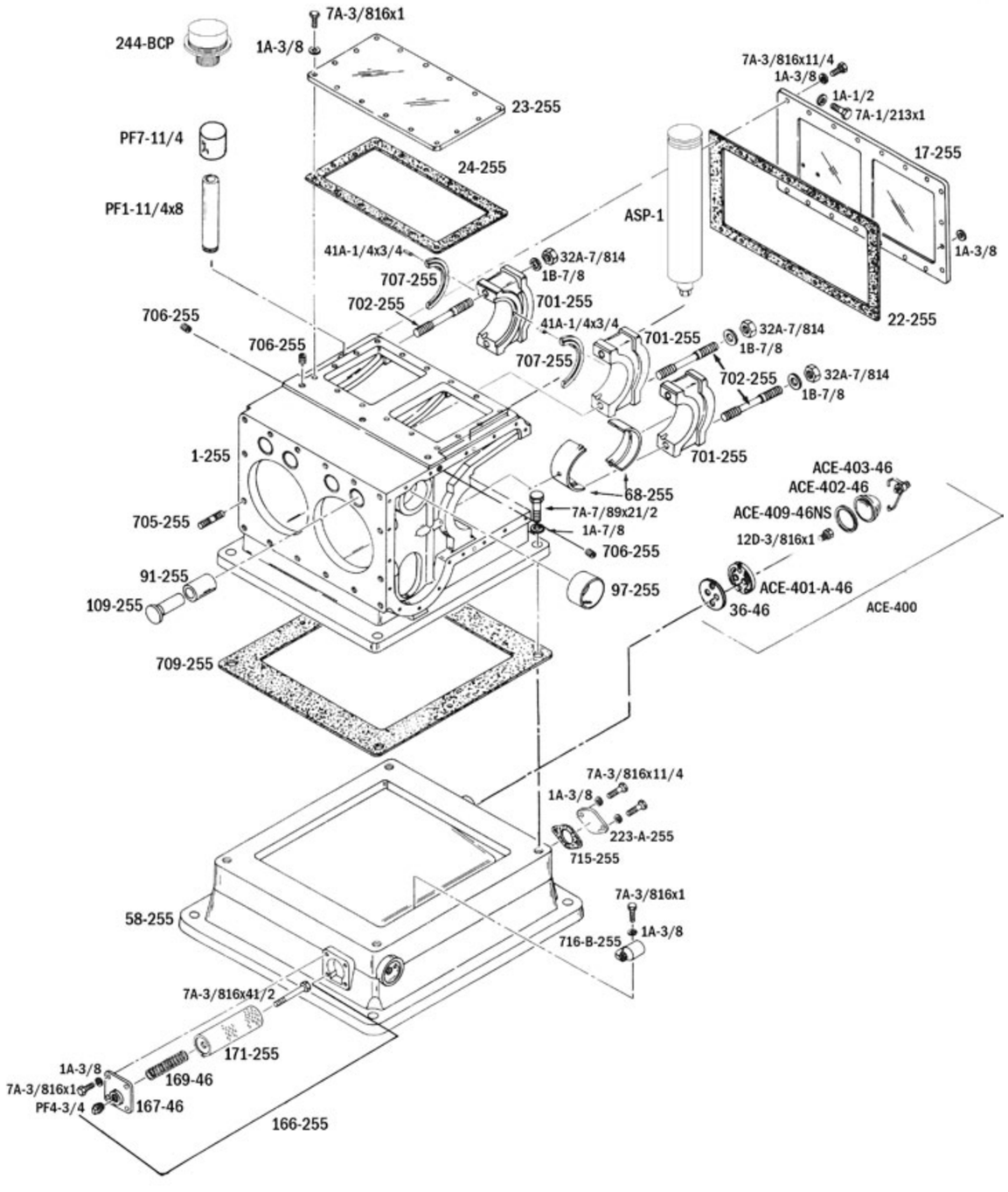
Condition	Continuous Duty	Intermittent Duty
Altitude Naturally Aspirated	Deduct 3% for each 1,000' above 1,500'	Deduct 3% for each 1,000' above 500'
	Deduct 3% for each 305m above 457m	Deduct 3% for each 305m above 152m
Altitude Turbo Charged	Deduct 3% for each 1,000' above 3,000'	Deduct 3% for each 1,000' above 1,500'
	Deduct 3% for each 305m above 914m	Deduct 3% for each 305m above 457m
Temperature	Deduct 1% for every 10°F above 100°F	Deduct 1% for every 10°F above 85°F
	Deduct 1% for every 5.5°C above 38°C	Deduct 1% for every 5.5°C above 29°C
Duty Ratings & Standards	The load and speed that can be applied without interruption except for normal maintenance.	The highest load and speed that can be applied under specific conditions of varying load and/or speed.

All ratings are corrected to 500' (152m) altitude, 29.38Hg (746mm), and a temperature of 85°F (29°C).

Natural Gas ratings are based on the use of 900 BTU (33.5 J/cm3) LHV gas. Propane ratings are based on the use of 2335 BTU HD-5 propane.

Figure 11. BASE ASSEMBLY





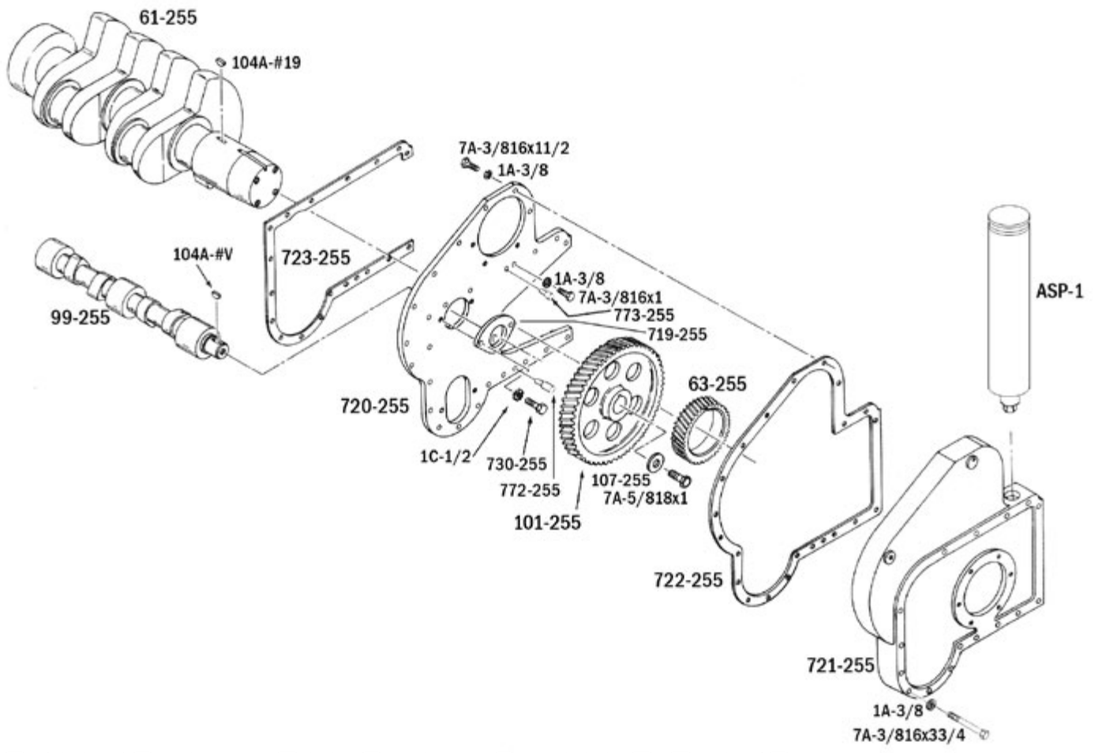
CRANKCASE AND BASE

Part No.	Description	Qty.
1-255	Crankcase	1
109-255	Valve Lifter	4
12D-3/816x1	Flat Socket Machine Screw	1
166-255	Oil Strainer Assembly	1
167-46	Oil Strainer Cover	1
169-46	Compression Spring	1
17-255	Front Plate	1
171-255	Oil Intake Screen	1
1A-1/2	Plated Lockwasher	1
1A-3/8	Plated Lockwasher	41
1A-7/8	Plated Lockwasher	7
222-255	Complete Cylinder Head Assy	
22-255	Plate Gasket	1
223-A-255	Cover Plate	1
23-255	Top Cover	1
244-BCP	Breather Filter	2
24-255	Top Cover Gasket	1
32A-7/814	Flexlock Locknut	3
36-46	Gasket	1
41A-1/4x3/4	Roll Pin	2
58-255	Base	1
68-255	Main Bearing, Pair	3
701-255	Main Bearing Thrust Cap	1
702-255	Bearing Cap Stud	12
705-255	Cylinder Block Stud	16

Part No.	Description	Qty.
706-255	7/8" Taper Plug	3
707-255	Thrust Washer, Pair	2
709-255	Base Gasket	1
715-255	Body Gasket	1
716-B-255	Oil Strainer Bracket	1
751-255	Crankcase Assembly	1
7A-1/213x1	Hex Head Capscrew	1
7A-3/816x1	Hex Head Capscrew	21
7A-3/816x11/4	Hex Head Capscrew	20
7A-3/816x3/4	Hex Head Capscrew	
7A-3/816x41/2	Hex Head Capscrew	1
7A-7/89x21/2	Hex Head Capscrew	4
91-255	Lifter Guide	4
97-255	Camshaft Bearing	3
ACE-400	Oil Level Indicator	1
ACE-401-A-46	Oil Level Indicator Body	1
ACE-402-46	Sediment Bowl	1
ACE-403-46	Bail Assembly	1
ACE-409-46NS	Gasket	1
ASP-1	Oil Filler	1
PF1-11/4x8	Pipe Nipple	2
PF4-3/4	Square Head Plated Pipe Plug	1
PF7-11/4	Coupling	2

Drawing Notes:

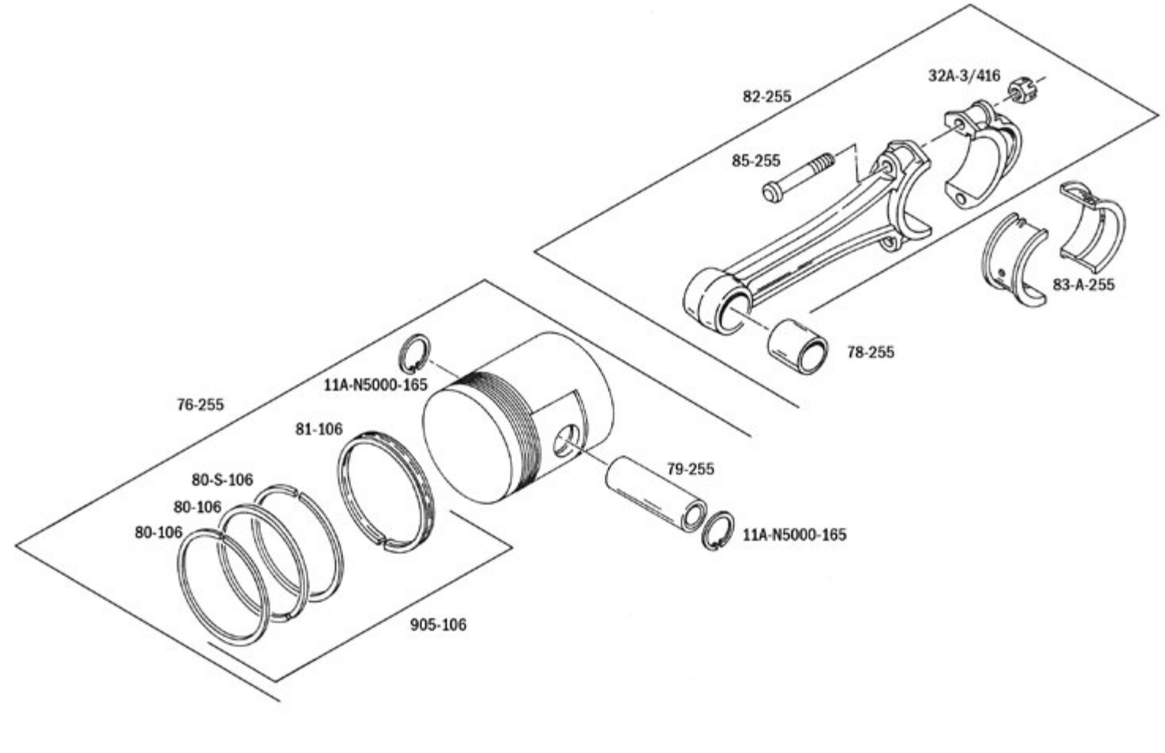
ASP-1 Mounts to the back of the 17-255. The 244-BCP, PF711/4 and the PF1-11/4x8 are also put on the same spot on the opposite side of the crankcase.



CRANKSHAFT, CAMSHAFT & TIMING GEARS

Part No.	Description	Qty.
104A-#19	Woodruff Key	1
104A-#V	Woodruff Key	1
101-255	Camshaft Gear	1
107-255	5/8" Flat Washer	1
1A-3/8	Plated Lockwasher	39
1C-1/2	External Lockwasher	2
61-255	Crankshaft Assembly	1
63-255	Crankshaft Timing Gear	1
719-255	Thrust Plate	1
720-255	Crankcase Side Plate	1
721-255	Timing Gear Cover	1

Part No.	Description	Qty.
722-255	Cover To Side Plate Gasket	1
723-255	Gasket	1
730-255	Capscrew	2
772-255	Crankcase Dowel	1
773-255	Crankcase Gear Dowel	1
7A-3/816x1	Hex Head Capscrew	1
7A-3/816x11/2	Hex Head Capscrew	22
7A-3/816x33/4	Hex Head Capscrew	16
7A-5/818x1	Hex Head Capscrew	1
99-255	Camshaft	1
ASP-1	Oil Filler	1



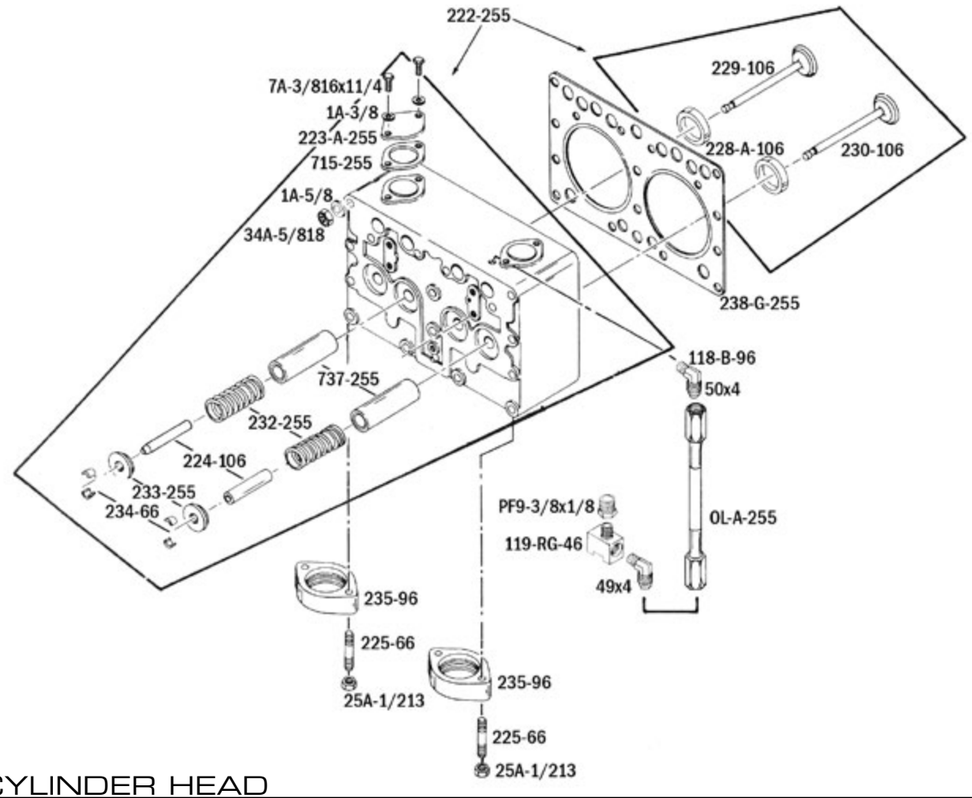
PISTON & CONNECTING ROD

Part No.	Description	Qty.
11A-N5000-165	Retaining Ring	4
32A-3/416	Flexlock Locknut	2
76-255	Piston With Pin And Rings	2
78-255	Connecting Rod Bushing	2
79-255	Piston Pin	2
80-106	Compression Ring	6
81-106	Piston Oil Ring	2
82-255	Connecting Rod Assembly	2
83-A-255	Connecting Rod Bearing, Pair	2
85-255	Connecting Rod Bolt	2
905-106	Ring Set	2

DUAL EXHAUST STADARD

FLEXIBLE OIL LINES STANDARD ON ALL C-255

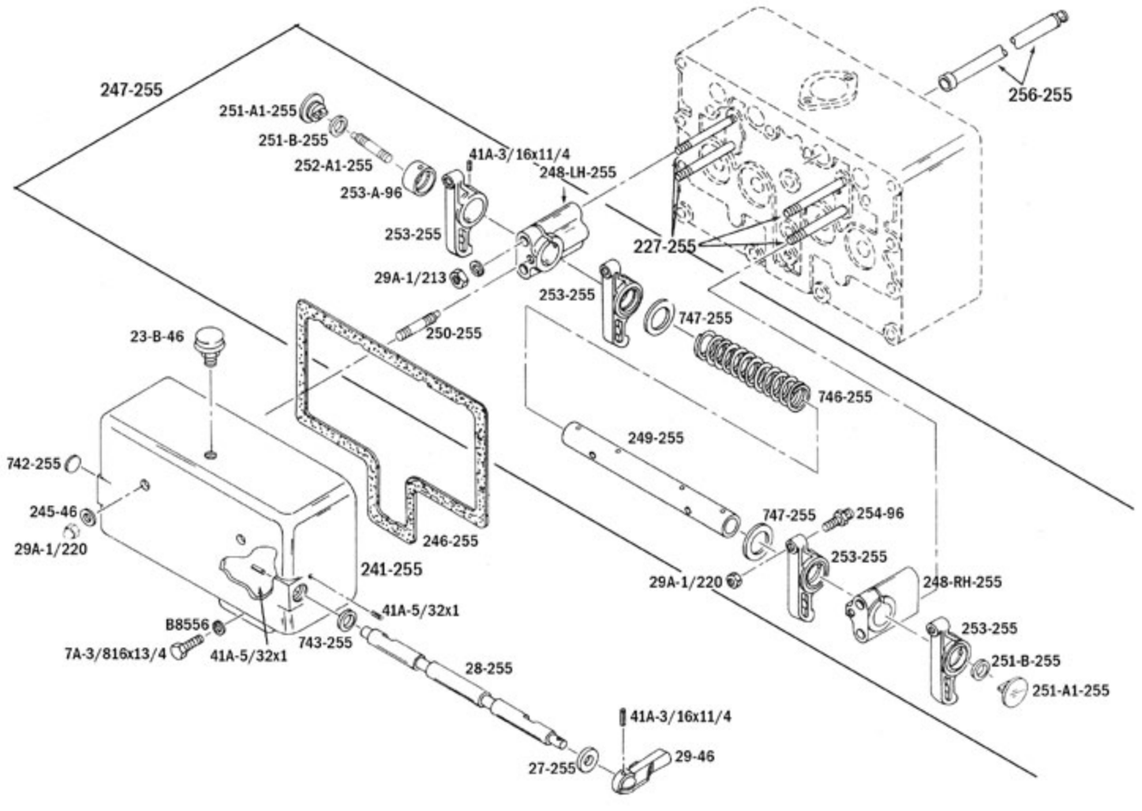
FLEXIBLE OIL LINES STANDARD ON C-245 BEGINING WITH SERIAL NUMBER 500426



CYLINDER HEAD

Part No.	Description	Qty.
118-B-96	Brass Pipe Nipple	1
119-RG-46	1/8" Male Branch Tee	1
1A-3/8	Plated Lockwasher	6
1A-5/8	Plated Lockwasher	16
222-255	Complete Cylinder Head Assy	1
222-RK-255	Cylinder Head Repair Kit	1
223-A-255	Cover Plate	2
224-106	Exhaust Valve Stem Guide	4
225-66	Exhaust Flange Stud	4
228-A-106	Exhaust Valve Seat Insert	4
229-106	Inlet Valve	2
230-106	Exhaust Valve	2
232-255	Valve Spring	4

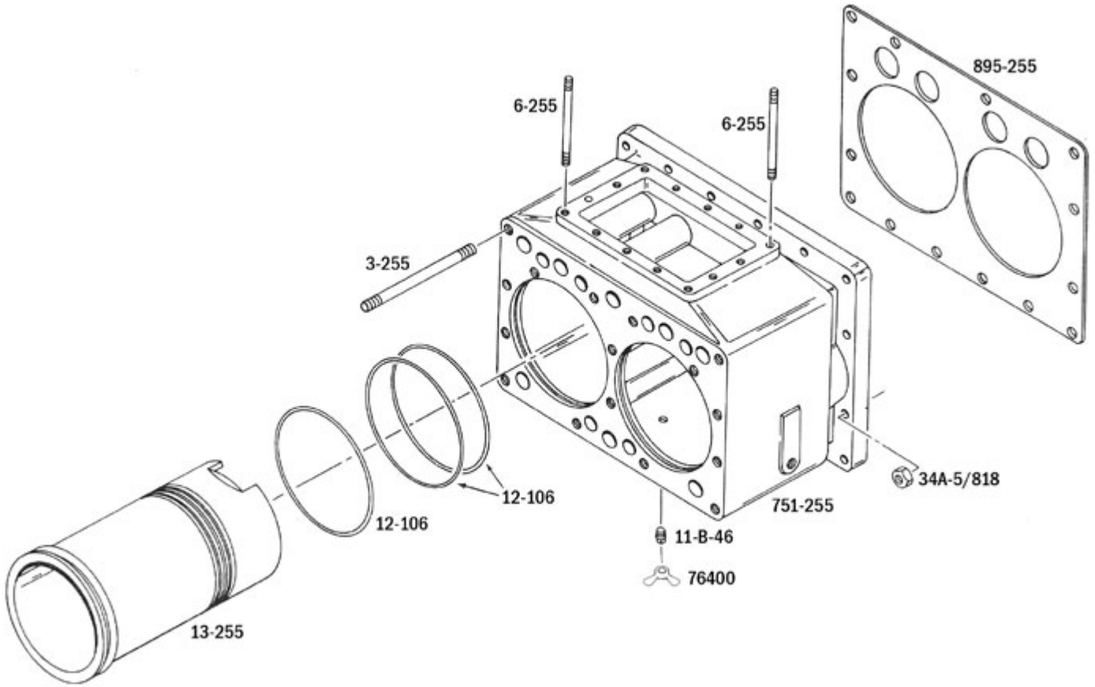
Part No.	Description	Qty.
233-255	Spring Retainer	4
234-66	Valve Retainer Lock, Pair	4
235-96	Exhaust Flange	2
238-G-255	Grafoil Head Gasket	2
25A-1/213	Heavy Hex Nut	4
34A-5/818	High Grade Nut	16
49x4	90 ° Elbow	1
50x4	Female 90 ° Elbow	1
715-255	Body Gasket	3
737-255	Oil Deflector	2
7A-3/816x11/4	Hex Head Capscrew	6
OL-A-255	Crankcase Tee Rocker	1
PF9-3/8x1/8	Pipe Bushing	1



ROCKER ARM & COVER

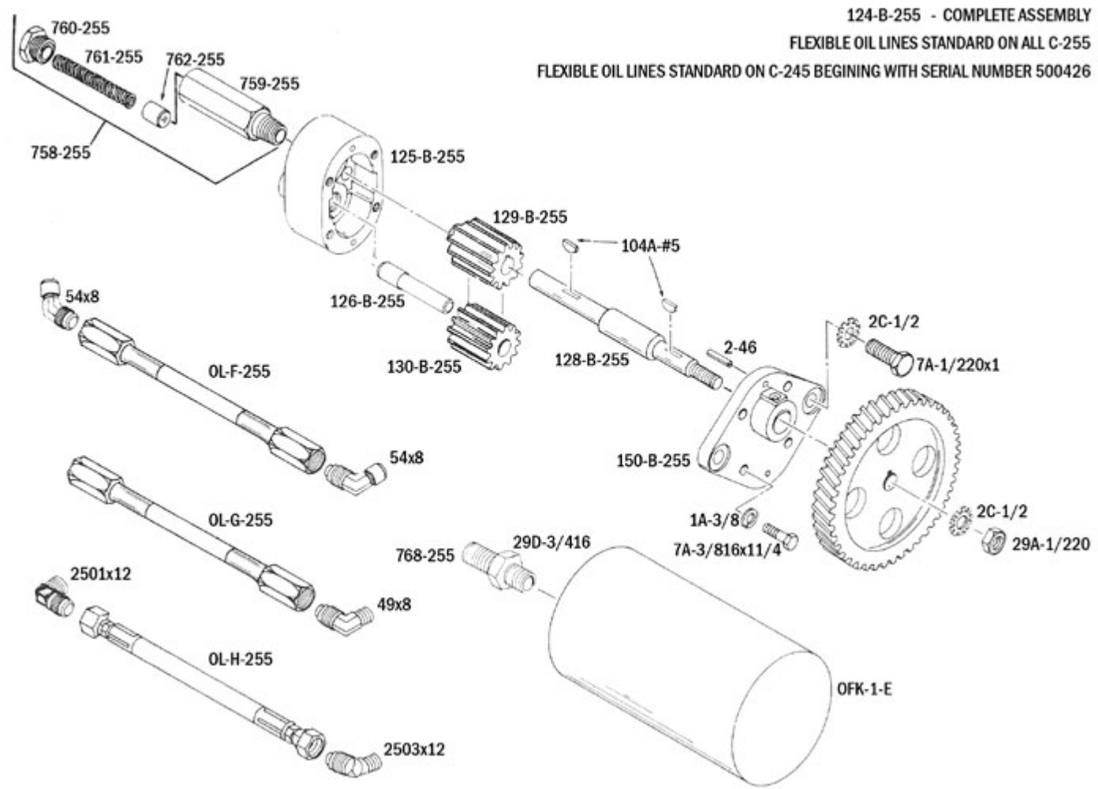
Part No.	Description	Qty.
227-255	Rocker Arm Stud	4
23-B-46	Breather Filter	1
241-255	Valve Cover Assembly	1
245-46	Copper Washer	2
246-255	Valve Cover Gasket	1
247-255	Rocker Arm Bracket Assy	1
248-LH-255	Left Hand Bracket Shaft	1
248-RH-255	Right Hand Bracket Shaft	1
249-255	Shaft	1
250-255	Valve Cover Stud	2
251-A1-255	Rocker Shaft Plug	1
251-B-255	Rocker Arm Shaft O Ring	1
252-A1-255	Rocker Arm Plug Stud	1
253-255	Rocker Arm	4
253-A-96	Rocker Arm Bushing	1
254-96	Valve Adjusting Screw	4

Part No.	Description	Qty.
256-255	Push Rod	4
27-255	Spacer	1
28-255	Shaft	1
29-46	Intake Valve Lever	1
29A-1/213	Finished Hex Nut	4
29A-1/220	Finished Hex Nut	6
41A-3/16x11/4	Roll Pin	5
41A-5/32x1	Roll Pin	1
742-255	Plug	1
743-255	Valve Cover Seal	1
746-255	Outer Spring	1
747-255	Washer	1
7A-3/816x13/4	Hex Head Capscrew	1
B8556	Copper Washer 13/32x3/4x1/16	1



CYLINDER BLOCK

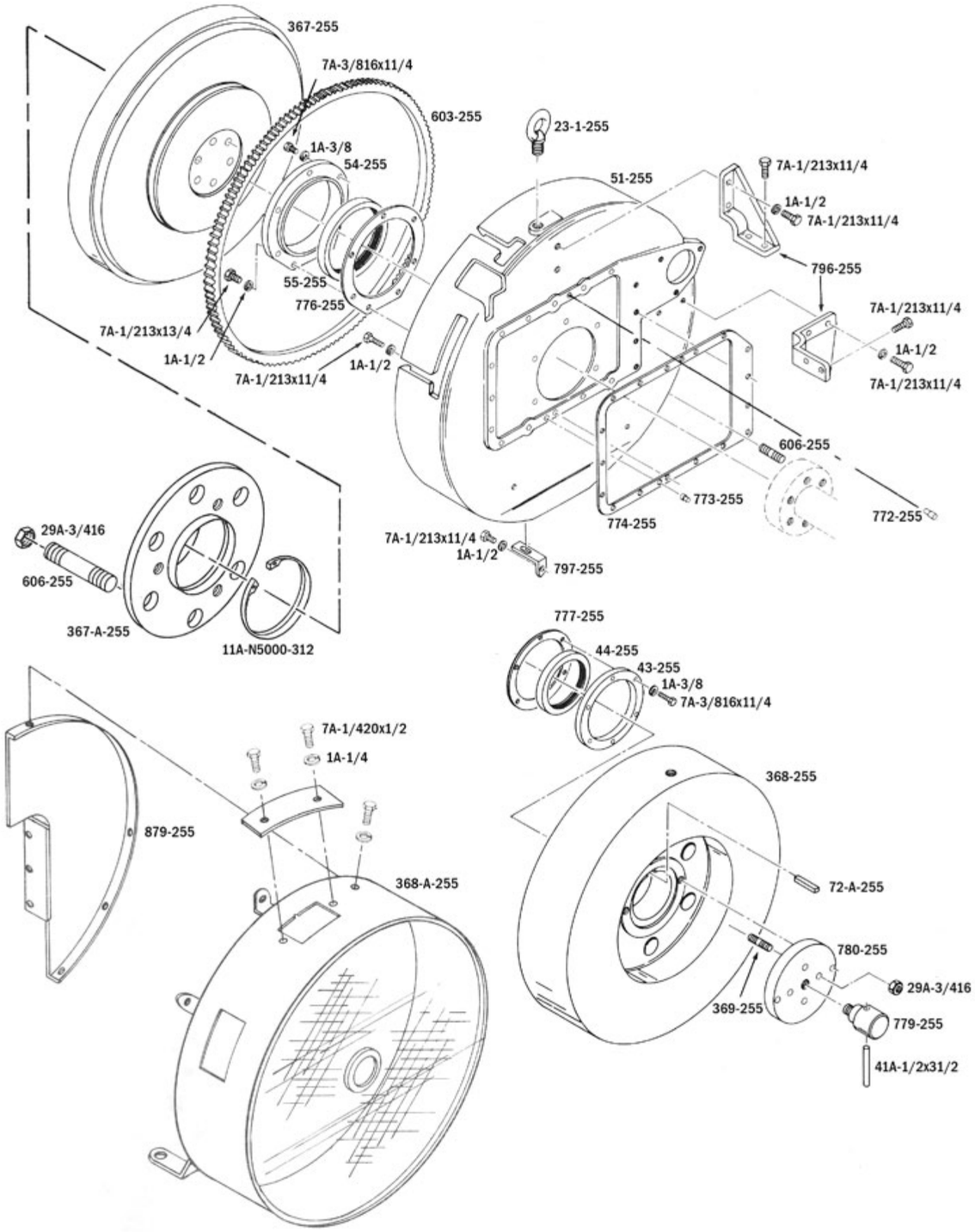
Part No.	Description	Qty.
11-B-46	3220x8x4 Bushing	1
12-106	Cylinder Sleeve Gasket	6
13-255	Cylinder Sleeve	2
3-255	Cylinder Head Stud	16
34A-5/818	High Grade Nut	16
6-255	Rad Tank Stud, Long	14
751-255	Cylinder Block	1
76400	.25 Drain Cock	1
895-255	Cylinder Block Gasket	1



OIL PUMP AND FILTER

Part No.	Description	Qty.
104A-#5	Woodruff Key	2
125-B-255	Oil Pump Housing	1
126-B-255	Oil Pump Idler Shaft	1
128-B-255	Oil Pump Drive Shaft	1
129-B-255	Oil Pump Drive Gear	1
130-B-255	Oil Pump Idler Gear	1
150-B-255	Body Cover	1
1A-3/8	Plated Lockwasher	4
2-46	Dowel Pin	2
2501x12	90° Elbow, 3/4" Npt	1
2503x12	45° Elbow, 3/4" Npt	1
29A-1/220	Finished Hex Nut	1
29D-3/416	Finished Hex Jam Nut	1
2C-1/2	Internal Lockwasher	3

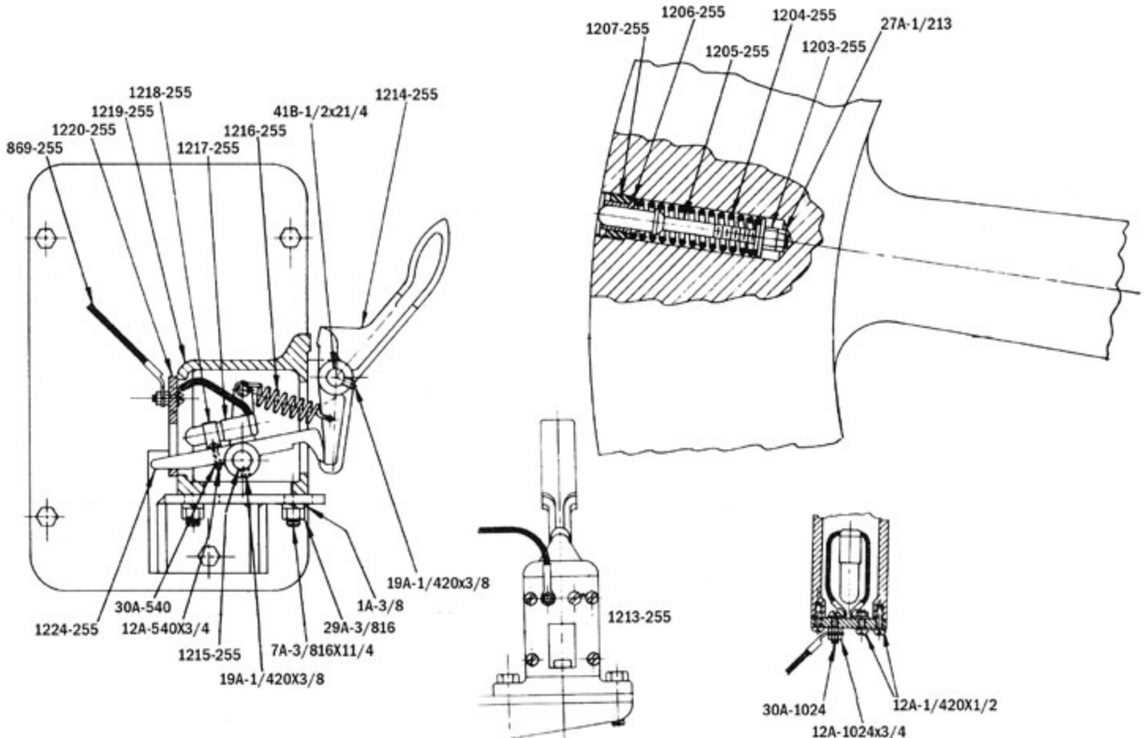
Part No.	Description	Qty.
49x8	90° Elbow, 8 Jic 3/8"npt	1
54x8	45° Elbow, 3/8"npt	2
758-255	Relief Valve Assembly	1
759-255	Body	1
760-255	Relief Valve Nut	1
761-255	Spring	1
762-255	Plunger	1
768-255	Male Connector	1
7A-1/200x1	Hex Head Capscrew	2
7A-3/816x11/4	Hex Head Capscrew	4
OFK-1-E	Oil Filter Element	1
OL-F-255	Oil Filter To Relief Valve Line	1
OL-G-255	Oil Filter To Crankcase Line	1
OL-H-255	Suction Oil Line	1



FLYWHEEL & HOUSING

Part No.	Description	Qty.
11A-N5000-312	Retaining Ring	1
1A-1/2	Plated Lockwasher	17
1A-1/4	Plated Lockwasher	3
1A-3/8	Plated Lockwasher	11
23-1-255	1" #10 Eye Bolt	1
29A-3/416	Finished Hex Nut	8
367-255	Small Flywheel	1
367-A-255	Pilot Bearing Housing	1
368-255	Large Flywheel	1
368-A-255	Metal Flywheel Guard	1
369-255	Flywheel Stud	2
41A-1/2x31/2	Roll Pin	1
43-255	Retaining Seal	1
44-255	Timing Gear Seal, Side	1
51-255	Flywheel Housing	1
54-255	Retaining Seal	1
55-255	Flywheel Seal	1

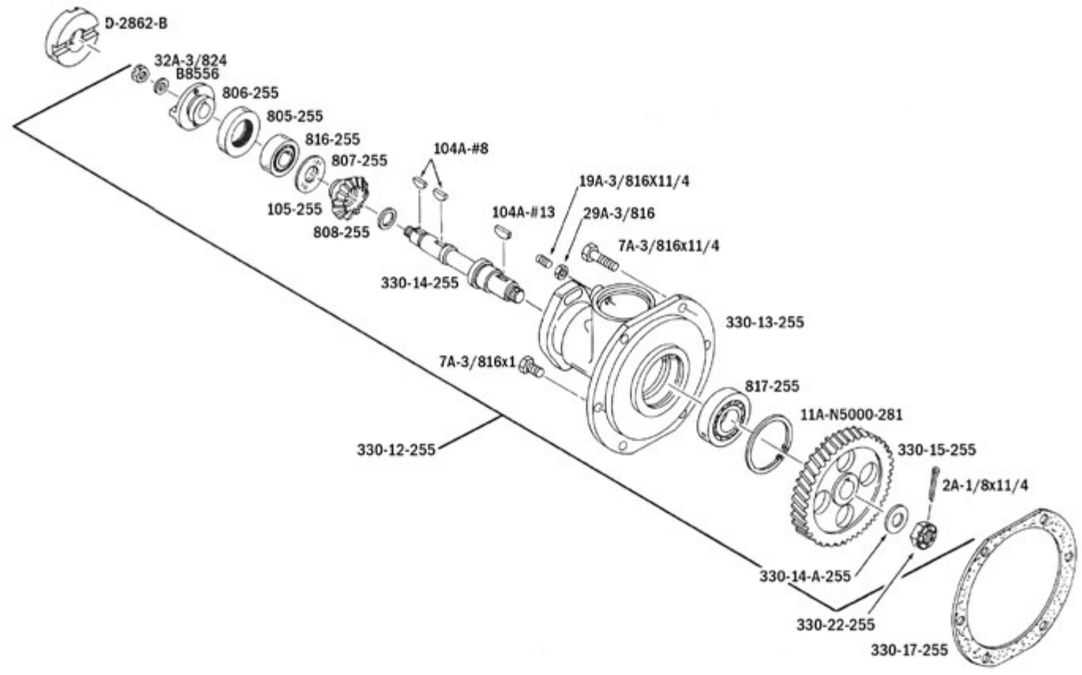
Part No.	Description	Qty.
603-255	Ring Gear	1
606-255	Flywheel Stud	6
7A-1/213x11/4	Hex Head Capscrew	15
7A-1/213x13/4	Hex Head Capscrew	2
7A-1/420x1/2	Hex head Capscrew	3
7A-3/816x11/4	Hex Head Capscrew	11
72-A-255	Flywheel Key	1
772-255	Crankcase Housing Dowel	1
773-255	Crankcase Gear Dowel	1
774-255	Gasket Housing	1
776-255	Retainer Gasket	1
777-255	Reatiner Gasket	1
779-255	Stub Shaft	1
780-255	Stub Shaft Plate	1
796-255	Brace	1
797-255	Brace	1
879-255	Intermediate Guard	1



OVERSPEED CONTROLER

Part No.	Description	Qty.
1203-255	Spring Bolt Nut	1
1204-255	Spring	1
1205-255	Bolt	1
1206-255	Bushing	1
1207-255	Spring Retaining Nut	1
1213-255	Overspeed Trip Assembly	1
1214-255	Trip Lever	1
1215-255	Overspeed Pin	2
1216-255	Spring	1
1217-255	Merc Switch	1
1218-255	Clip	1
1219-255	Housing	1
1220-255	Insulation Plate	1

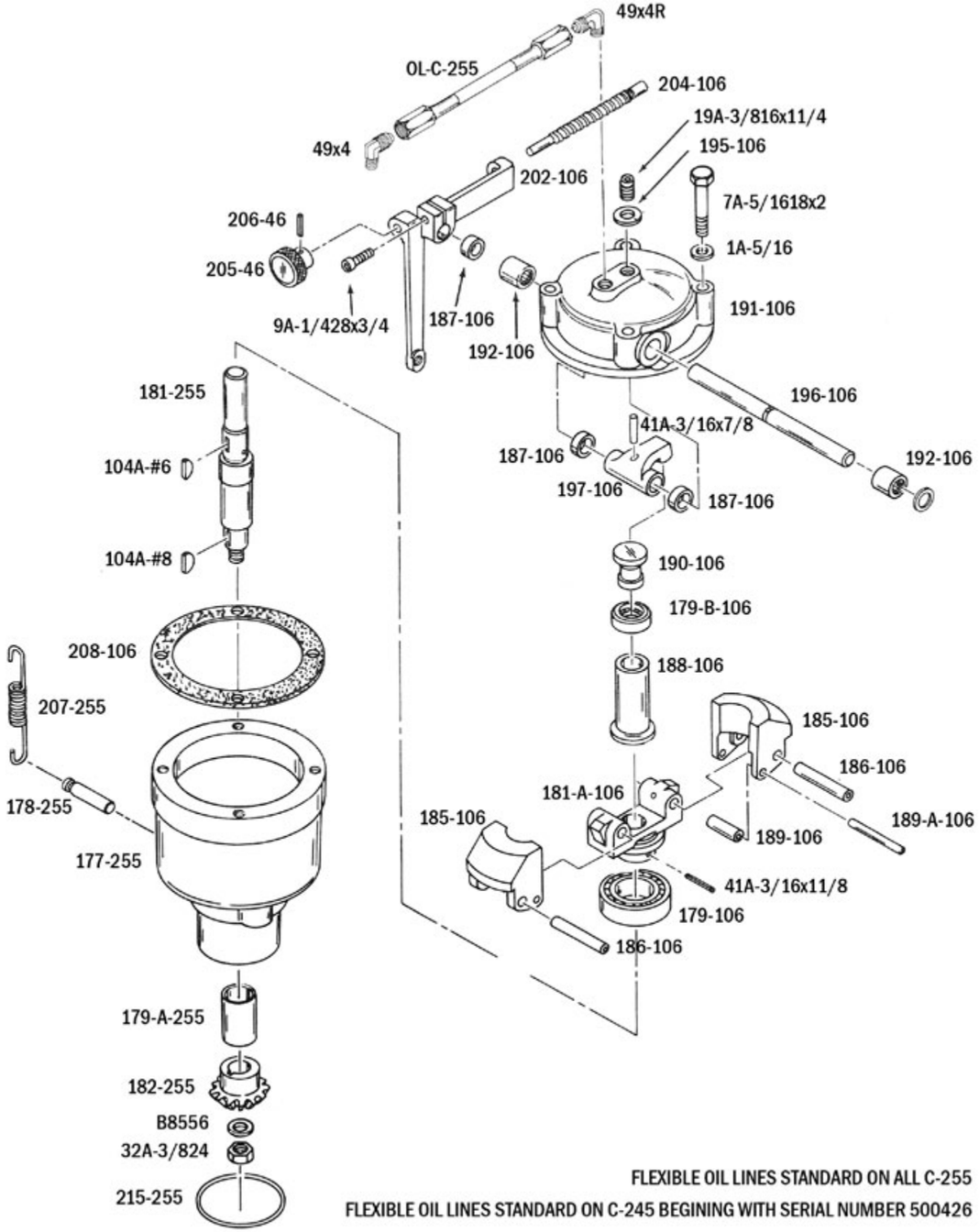
Part No.	Description	Qty.
1224-255	Lever Switch	1
12A-1/420x1/2	Round Head Machine Screw	2
12A-1024x3/4	Round Head Machine Screw	1
12A-540x3/4	Round Head Machine Screw	1
19A-1/420x3/8	Socket Head Setscrew	1
1A-3/8	Plated Lockwasher	4
27A-1/213	Heavyduty Hex Head Jam Nut	1
29A-3/816	Finished Hex Nut	4
30A-1024	Machine Screw Nut	1
30A-540	Machine Screw Nut	1
7A-3/816x11/4	Hex Head Capscrew	4
869-255	Switch Wire Assembly	1



MAGNETO & GOVERNOR DRIVE

Part No.	Description	Qty.
104A-#13	Woodruff Key	1
104A-#8	Woodruff Key	2
105-255	Governor Drive Gear	1
11A-N5000-281	Retaining Ring	1
19A-3/816x11/4	Socket Head Setscrew	1
29A-3/816	Finished Hex Nut	1
2A-1/8x11/4	Cotter Pin	1
32A-3/824	Flexlock Locknut	1
330-12-255	Magneto & Governor Drive Assy	1
330-13-255	Magneto Housing	1
330-14-255	Shaft	1
330-14-A-255	Washer	1
330-15-255	Drive Shaft Gear	1

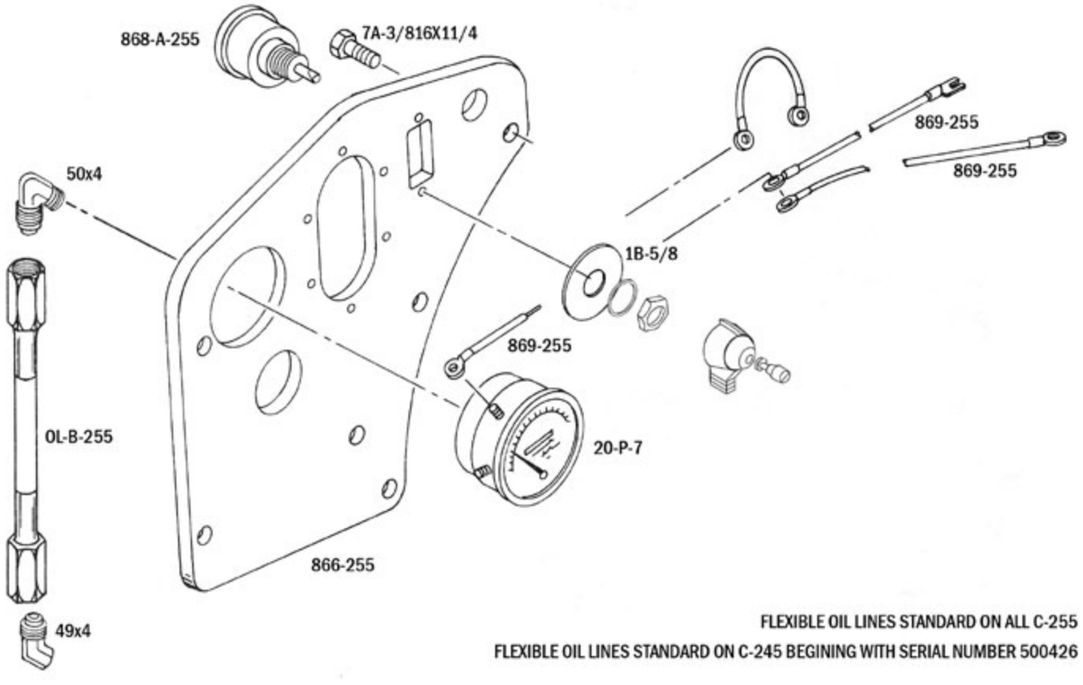
Part No.	Description	Qty.
330-17-255	Gasket	1
330-22-255	Slotted Hex Head Jam Nut	1
7A-3/816x1	Hex Head Capscrew	3
7A-3/816x11/4	Hex Head Capscerw	3
805-255	Bearing Housing Oil Seal	1
806-255	Magneto Coupling	1
807-255	Slinger	1
808-255	Shim	1
816-255	Magneto Drive Bearing	1
817-255	Magneto & Governor Drive Bearing	1
B8556	Copper Washer	1
D-2862-B	Coupling Disc - Obsolete	1



GOVERNOR

Part No.	Description	Qty.
104A-#6	Woodruff Key	1
104A-#8	Woodruff Key	1
176-255	Complete Governor	1
176-RK-255	Governor Repair Kit	n/a
177-255	Lower Housing For Governor	1
178-255	Spring Pin	1
179-106	Ball Bearing	1
179-A-255	Bushing	1
179-B-106	Thrust Bearing	1
181-255	Shaft	1
181-A-106	Governor Head	1
182-255	Governor Gear	1
185-106	Governor Weight	2
186-106	Pin	2
187-106	Spacer	3
188-106	Governor Sleeve	1
189-106	Sleeve	2
189-A-106	Pin	2
190-106	Thrust Plate	1
191-106	Governor Housing + Bushing	1
192-106	Bearing	2

Part No.	Description	Qty.
195-106	3/8" Copper Washer	1
196-106	Governor Operating Rod	1
197-106	Governor Rod Lever, Inner	1
19A-3/816x11/4	Socket Head Setscrew	1
1A-5/16	Plated Lockwasher	4
202-106	Governor Rod Lever Assy	1
204-106	Governor Adjusting Screw	1
205-46	Governor Adjustment Rod	1
206-46	Pin	1
207-255	Brown Governor Spring	1
208-106	Governor Housing Gasket	1
215-255	Governor Buna O Ring	1
32A-3/824	Flexlock Locknut	1
41A-3/16x11/8	Roll Pin	1
41A-3/16x7/8	Roll Pin	1
49x4	90° Elbow	1
49x4R	Restricted Elbow	1
7A-5/1618x2	Hex Head Capscrew	4
9A-1/428x3/4	Socket Head Capscrew	1
B8556	Copper Washer	1
OL-C-255	Governor - Crankcase Oil Line	1

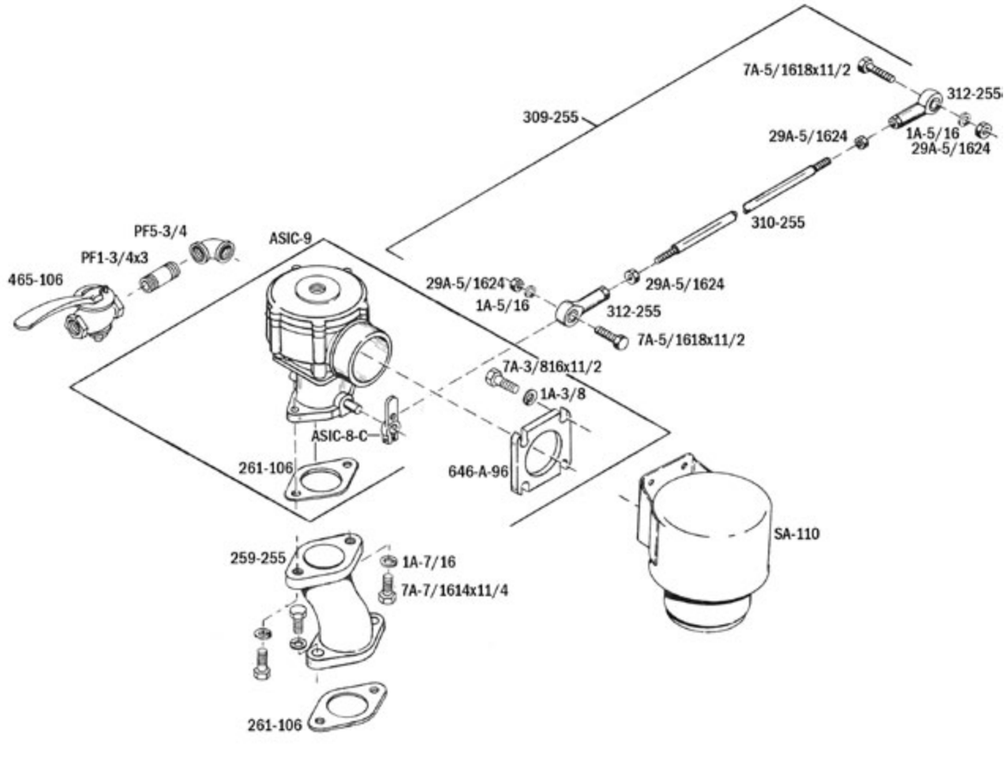


FLEXIBLE OIL LINES STANDARD ON ALL C-255

FLEXIBLE OIL LINES STANDARD ON C-245 BEGINING WITH SERIAL NUMBER 500426

INSTRUMENT PANEL

Part No.	Description	Qty.
1B-5/8	Flat Washer	1
20-P-7	Safety Switch	1
49x4	90° Elbow	1
50x4	Female 90° Elbow	1
7A-3/816x11/4	Hex Head Capscrew	6
866-255	Instument Panel	1
868-A-255	Rotary Switch	1
869-255	Switch Wire Assembly	3
OL-B-255	Oil Guage - Cranckcase Oil Line	1

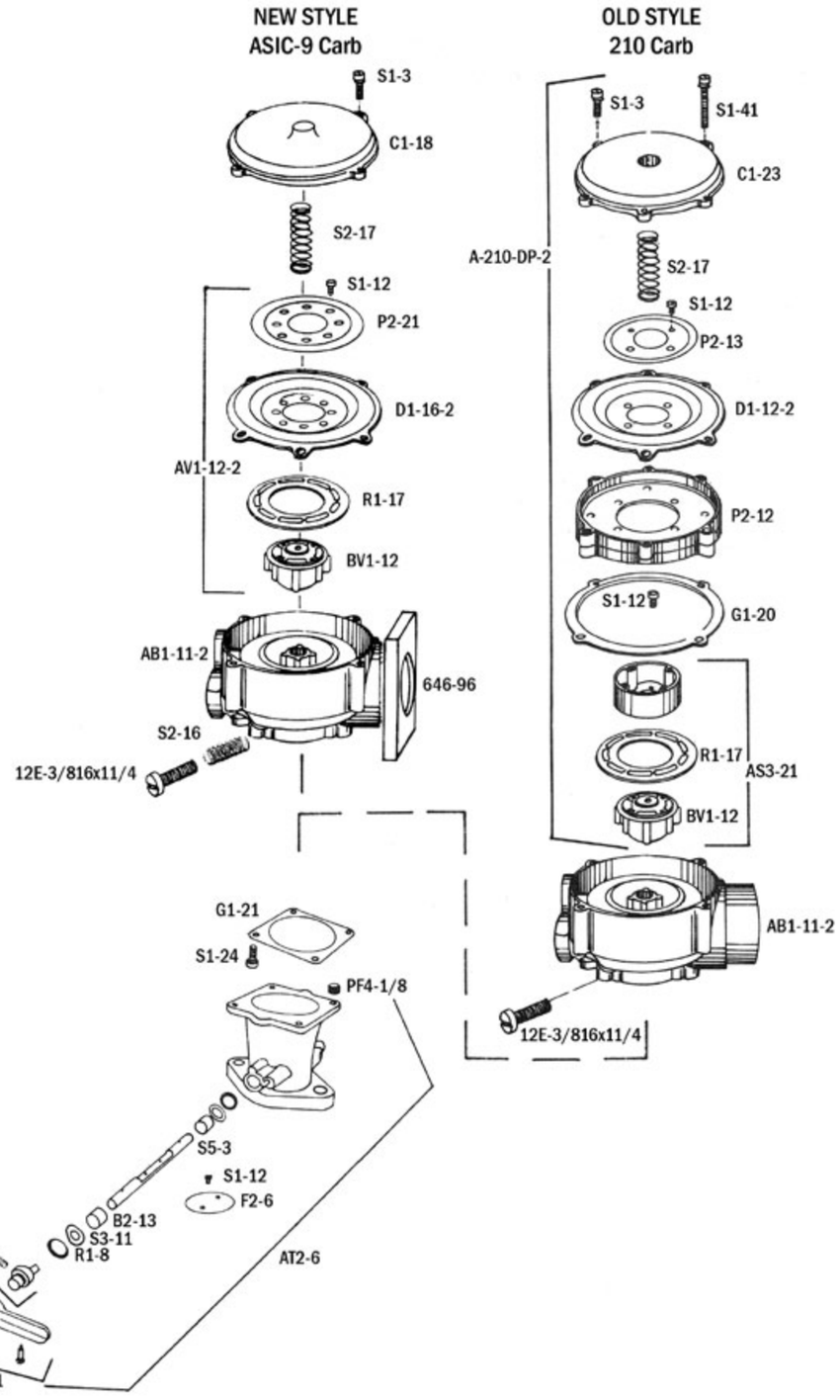


CARBURETOR & AIR CLEANER

	Part No.	Description	Qty.
	1A-3/8	Plated Lockwasher	4
	1A-5/16	Plated Lockwasher	2
	1A-7/16	Plated Lockwasher	4
	259-255	Adaptor	1
	261-106	Carburetor To Elbow Gasket	2
	29A-5/1624	Finished Hex Nut	4
	309-255	Throttle Control Rod Assembly	1
	310-255	Control Rod	1
	312-255	Ball Joint Rod End	2
*	465-106	3/4 Valve Throttle Valve	1

Part No.	Description	Qty.
646-A-96	Vortox Adaptor	1
7A-3/816x11/21	Hex Head Capscrew	4
7A-5/1618x11/2	Hex Head Capscrew	2
7A7/1614x11/4	Hex Head Capscrew	4
ASIC-8-C	200 Carburetor	1
ASIC-9	200 Carburetor Assembly	1
PF1-3/4x3	Nipple Pipe	1
PF5-3/4	90° Street Elbow	1
SA-110	Air Cleaner	1

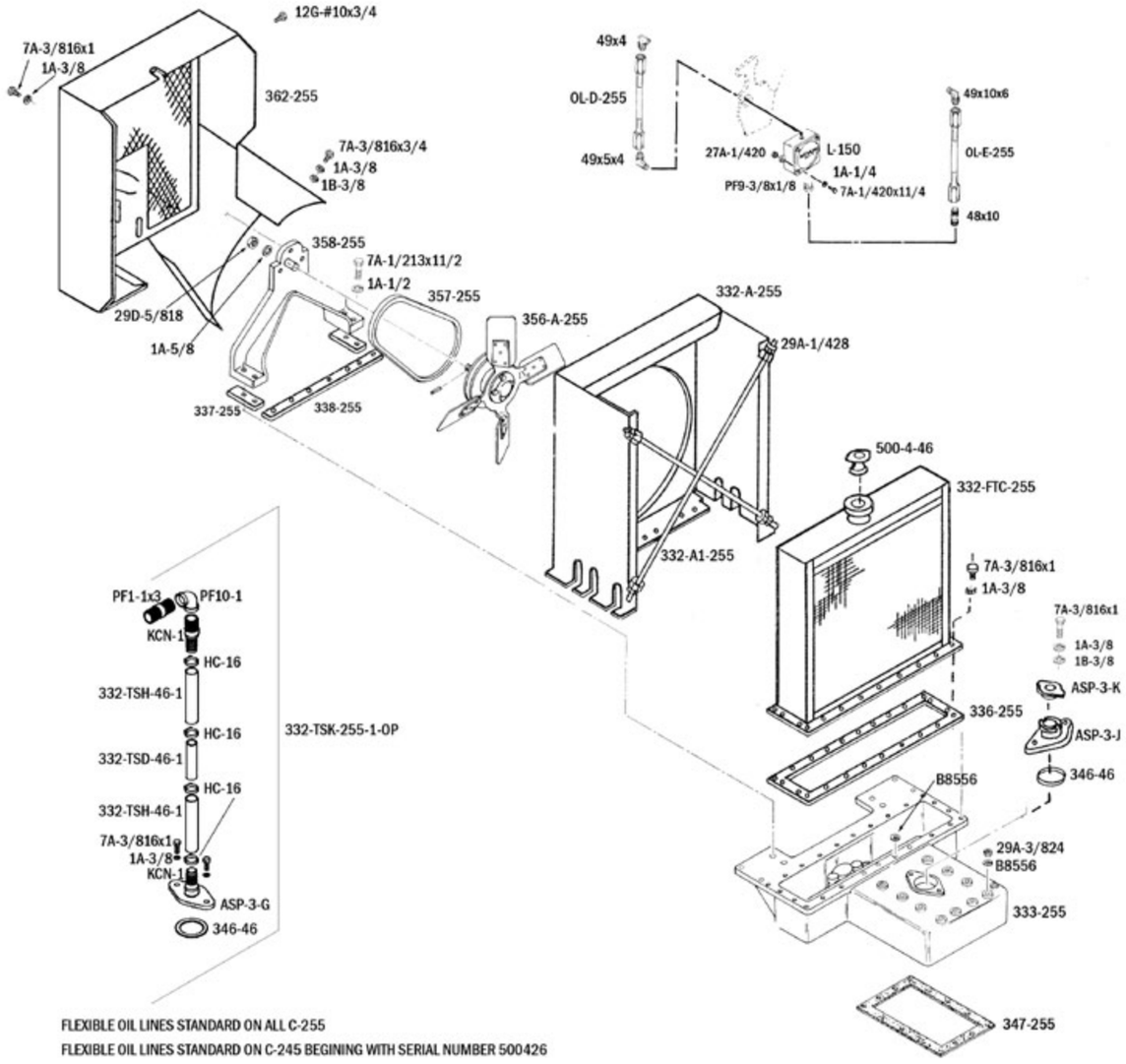
* Not included on new engines.



CARBURETOR COMPONENTS

Part No.	Description	Qty.
12E-3/816x11/4	Fillister Machine Screw	1
646-A-96	Vortox Adaptor	1
A-210-DP-2	Dash Pot Assembly	1
AB1-11-2	Body Assembly	1
AL1-10	3/8” Throttle Stop Assembly	1
AS3-21	Valve & Spacer Assembly	1
AL1-9-1	Throttle Lever	1
AT2-6	Throttle Body Assembly	1
AV1-12-2	Valve Diaphram	1
B2-13	3/8” Bearing	2
BV1-12	Valve	1
C1-18	Carburetor Cover	1
C1-23	Carburator Cover	1
D1-12-2	.210 Diaphram	1
D1-16-2	.200 Diaphram	1
F2-6	2” Butterfly	1
G1-20	Plate To Body Gasket	1

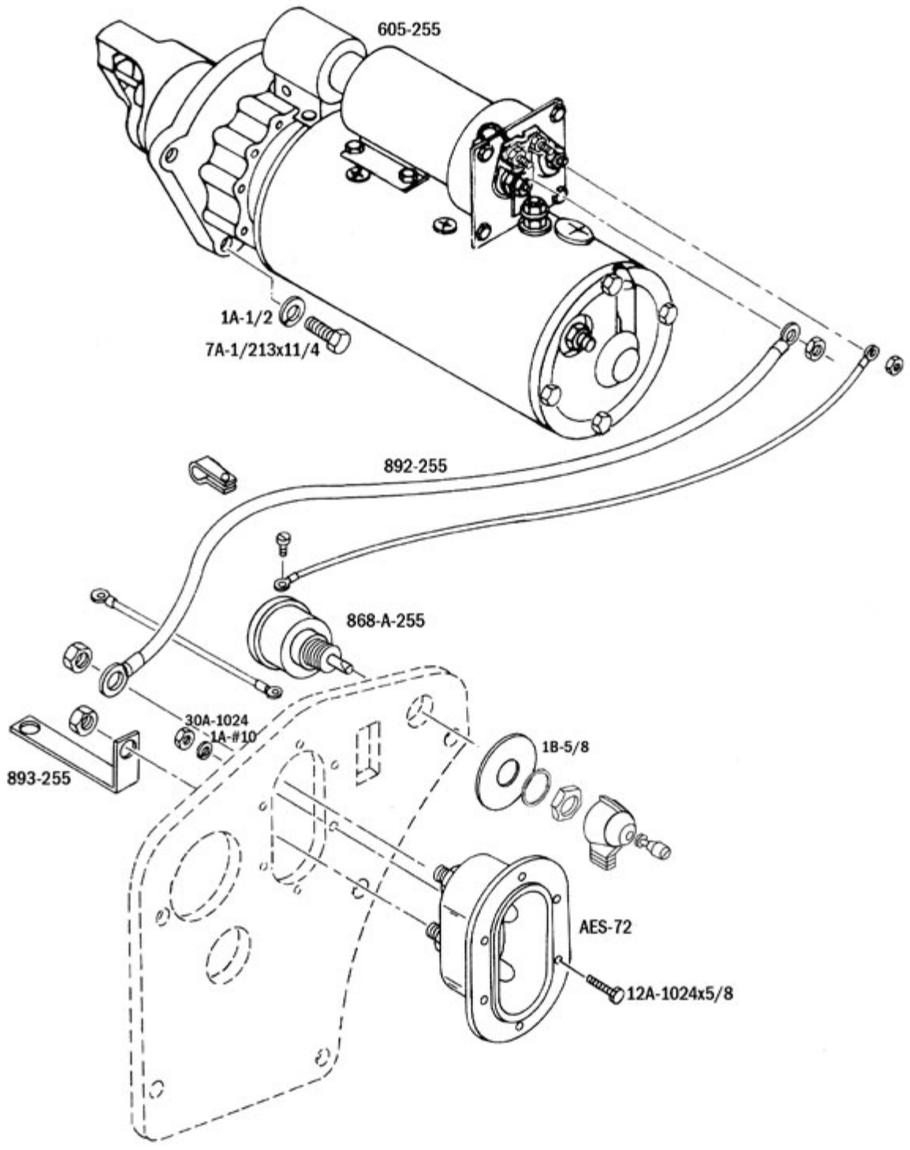
Part No.	Description	Qty.
G1-21	Throttle To Body Gasket	1
P2-12	Plate Divider	1
P2-13	Backup Plate	1
P2-21	Backup Plate	1
PF4-1/8	Square Head Pipe Plug	1
R1-17	Air Valve Ring	1
R1-8	O-ring	2
S1-12	Screw	10
S1-24	Screw	4
S1-26	Screw	1
S1-3	Screw	4
S1-41	Screw	3
S2-16	Idle Screw Spring	1
S2-17	Spring	1
S3-11	Shaft Screw	2
S5-3	3/8 Butterfly Shaft	1



RADIATOR

Part No.	Description	Qty.
12G-#10x3/4	Self Drill & Tap Screw	9
1A-1/2	Plated Lockwasher	4
1A-1/4	Plated Lockwasher	1
1A-3/8	Plated Lockwasher	27
1A-5/8	Plated Lockwasher	1
1B-3/8	Flat Lockwasher	1
27A-1/420	Heavyduty Hex Head Jam Nut	1
29A-1/428	Finished Hex Head Nut	4
29A-3/824	Finished Hex Head Nut	10
29D-5/818	Finished Hex Head Jam Nut	1
332-A-255	Radiator Shell With Support Rod	1
332-A1-255	Radiator Shell Support Rod	2
332-FTC-255	Radiator With Gasket	1
332-TSD-46-1	Glass Sight, 1”	1
332-TSH-46	Heater Hose, 2” x 12 1/2”	1
332-TSK-255-1-OP	Thermosiphon Kit	1
333-255	Water Hopper	1
336-255	Radiator Core Gasket	1
346-46	Water Filler Gasket	1
347-255	Tank To Block Gasket	1
356-A-255	Fan Assembly-special Build Only	1
357-255	Fan Belt	1

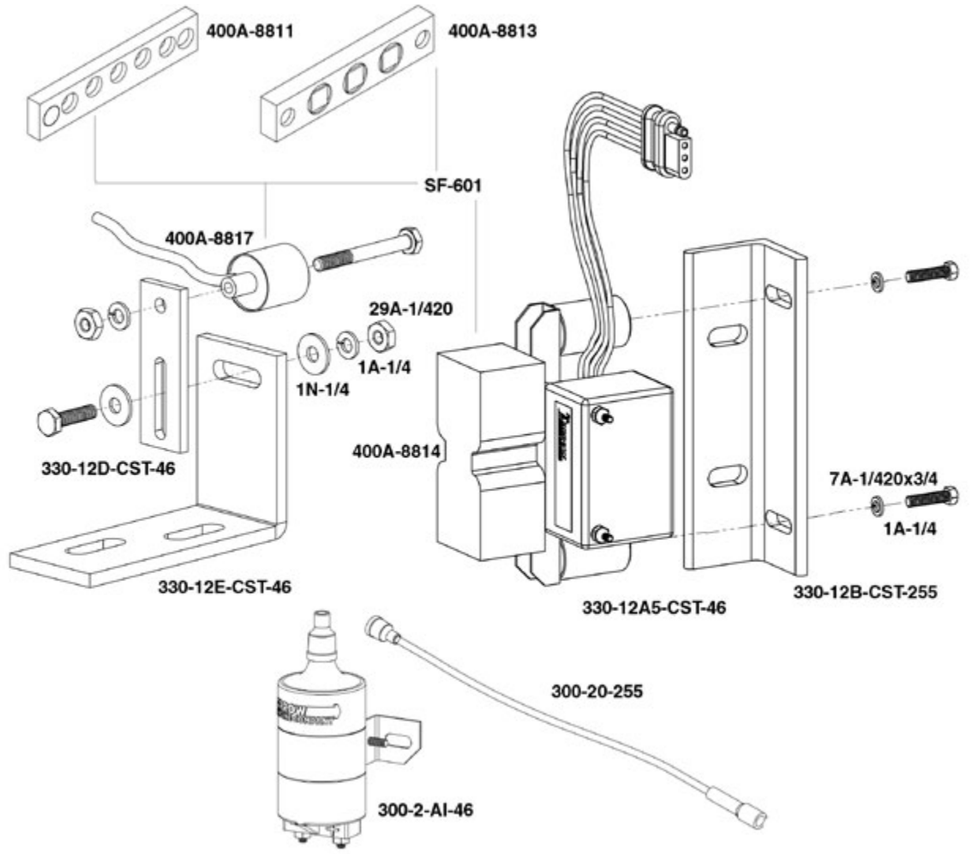
Part No.	Description	Qty.
358-255	Fan Bracket	1
362-255	Fan Belt Guard Assembly	1
48x10	Straight Fitting	1
49x10x6	90° Elbow	1
49x4	90° Elbow	1
49x5x4	90° Elbow	1
500-4-46	Radiator Cap	1
7A-1/213x11/2	Hex Head Capscrew	4
7A-1/420x11/4	Hex Head Capscrew	1
7A-3/816x1	Hex Head Capscrew	3
7A-3/816x3/4	Hex Head Capscrew	26
ASP-3-G	Thermo Siphon Adaptor	1
ASP-3-J	Water Filler Body	1
ASP-3-K	Press Cap	1
B8556	Copper Washer	35
HC-16	Hose Clamp	4
KCN-1	Nipple, 1”	2
L-150	Low Water Level Switch	1
OL-D-255	Water Guage To Hopper	1
OL-E-255	Water Guage To Cylinder	1
PF10-1	90° Elbow	1
PF1-1x3	Pipe Nipple	1
PF9-3/8x1/8	Pipe Bushing	1



ELECTRIC STARTER

Part No.	Description	Qty.
12A-1024x5/8	Round Head Machine Screw	6
1A-#10	Plated Lockwasher	6
1A-1/2	Plated Lockwasher	4
1B-5/8	Flat Washer	1
30A-1024	Machine Screw Nut	6
605-255	Starter	1

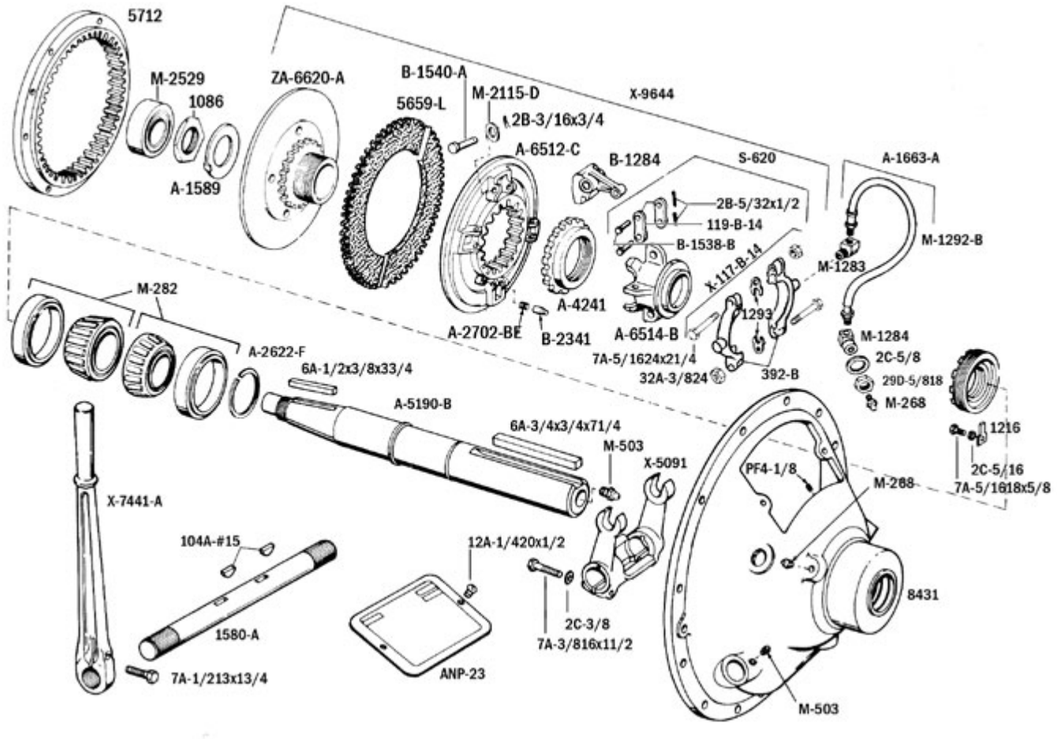
Part No.	Description	Qty.
7A-1/213x11/4	Hex Head Capscrew	4
868-A-255	Rotary Switch	1
892-255	Starter Cable	1
893-255	Ground Strap	1
AES-72	Cannon Receptecle	1



ARROW IGNITION SYSTEM

Part No.	Description	Qty.
73905	Spark Plug Terminal	2
161900	Spark Plug Cover	2
100 10 W	Star Fire Resistor	1
14 AWG THHN-B	Black Wire	7
14 AWG THHN-W	14 Gage White Wire	5
14 AWG THHN-Y	Yellow Wire	5
16-14 MALE PUSH	Red Male Push On	3
16-14 PUSH ON	Blue Female Push On	3
1A-1/4	Plated Lockwasher	3
1A-3/8	Plated Lockwasher	4
1B-3/8	Standard Flat Washer	4
1N-1/4	Sae Plated Flat Washer	6
29A-1/420	Finished Hex Nut	1
330-12A5-CST-46	Spacer	2
330-12B-CST-255	Charging Gen. Bracket	1
330-12D-CST-46	Trigger Coil Adj Bracket	1

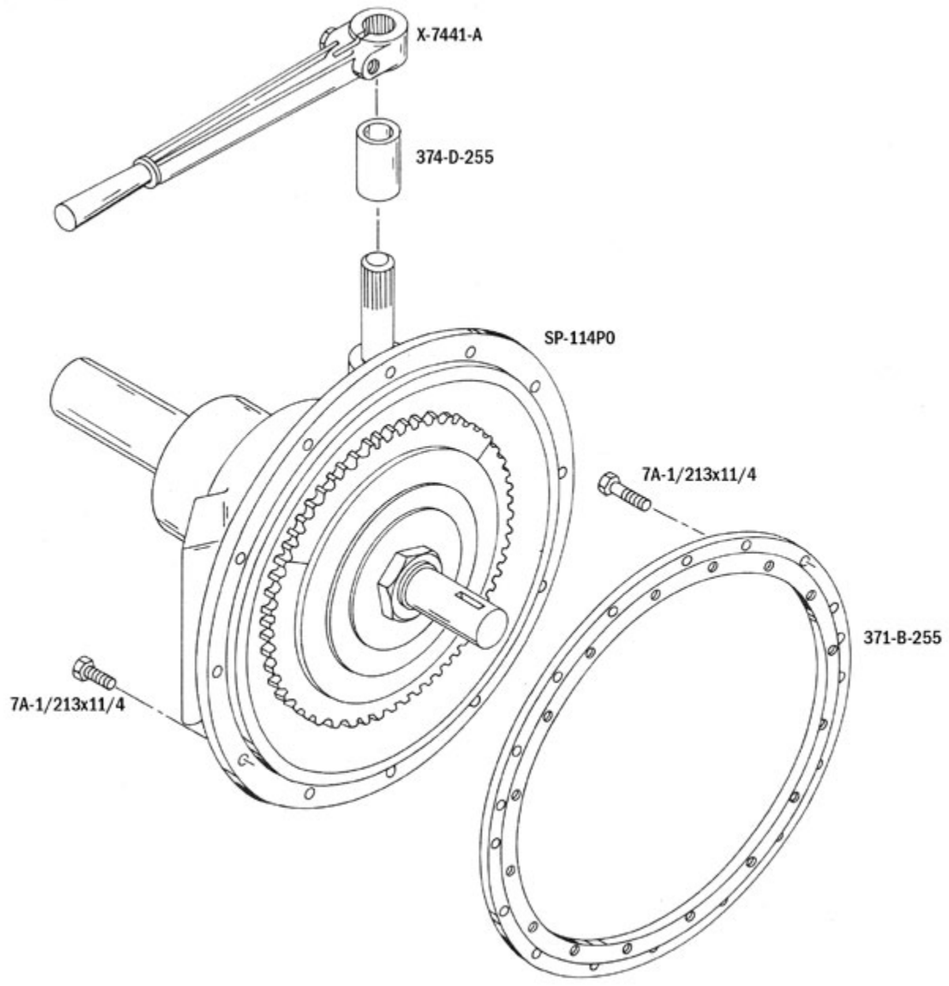
Part No.	Description	Qty.
330-12E-CST-46	Trigger Coil Bracket	1
330-13C-255	Magneto Housing Cover Plate	1
330-17-46	Gasket	1
330-20-255	Spark Plug Cable	2
330-2-AI-46	Ignition Coil	2
330-5-AI-255	Magneto Pick Up Bracket	1
7A-1/420x3/4	Hex Head Capscrew	3
400A-8811	Trigger Magnet Bar	1
400A-8813	Charging Magnet Bar	1
400A-8814	Electric Ignition Module	1
400A-8817	Trigger Coil Assembly	1
7A-3/816x11/2	Hex Head Capscrew	4
AES-65	Large Hole Eyelet	1
AES-66	Small Hole Eyelet	6
SF-601	Arrow Ignition	1



14" POWER TAKE OFF COMPONENTS

Part No.	Description	Qty.
104A-#15	Woodruff Key	2
1086	Hub Nut	1
119-B-14	Link Lever	2
1216	Retainer Bearing Clip Lock	1
12A-1/420x1/2	Round Head Machine Screw	2
1580-A	Operating Shaft	1
29D-5/818	Finished Hex Head Jam Nut	1
2B-3/16x3/4	Cotter Pin	1
2B-5/32x1/2	Tee Head Cotter Pin	2
2C-3/8	Internal Lockwasher	2
2C-5/16	Internal Lockwasher	1
2C-5/8	Internal Lockwasher	1
32A-3/824	Flexlock Locknut	2
5659-L	Three Piece Drive Plate	1
5712	Drive Ring	1
6A-1/2x3/8x33/4	Square End Key	1
6A-3/4x3/4x71/4	Square End Key	1
7A-1/213x13/4	Hex Head Capscrew	1
7A-3/816x11/2	Hex Head Capscrew	2
7A-5/1618x5/8	Hex Head Capscrew	2
7A-5/1624x21/4	Hex Head Capscrew	2
8431 OR 8431	Housing	1
A-1589	Lockwasher	1
A-1663-A	11" Hose Assembly	1
A-2622-F	Snap Ring	1

Part No.	Description	Qty.
A-2702-BE	Adjustable Lock Spring Pin	1
A-4241	Adjustable Ring	1
A-5190-B	Clutch Shaft	1
A-6512-C	Drive Plate	1
A-6514-B	Sliding Sleeve	1
ANP-23	9"x6" Nameplate	1
B-1284	Finger Lever	1
B-1538-B	Link Lever Pin	2
B-1540-A	Lever Pin	4
B-2341	Adjustable Lock Pin	1
M-1283	Fitting	1
M-1284	Fitting	1
M-1292-B	14" Flex Hose	1
M-2115-D	Spring Washer	4
M-2529	2 Peice Easy Slip Bearing	1
M-268	Male Lube Fitting	2
M-282	Roller Bearing	2
M-503	Shaft Fitting	1
PF4-1/8	Square Head Pipe Plug	1
S-620	Sliding Sleeve Assembly	1
X-117-B-14	Collar Assembly	1
X-5091	Throwout Yoke	1
X-7441-A	Hand Lever	1
X-9644	Clutch Pack	1
ZA-6620-A	Tapered Back Hub Plate	1

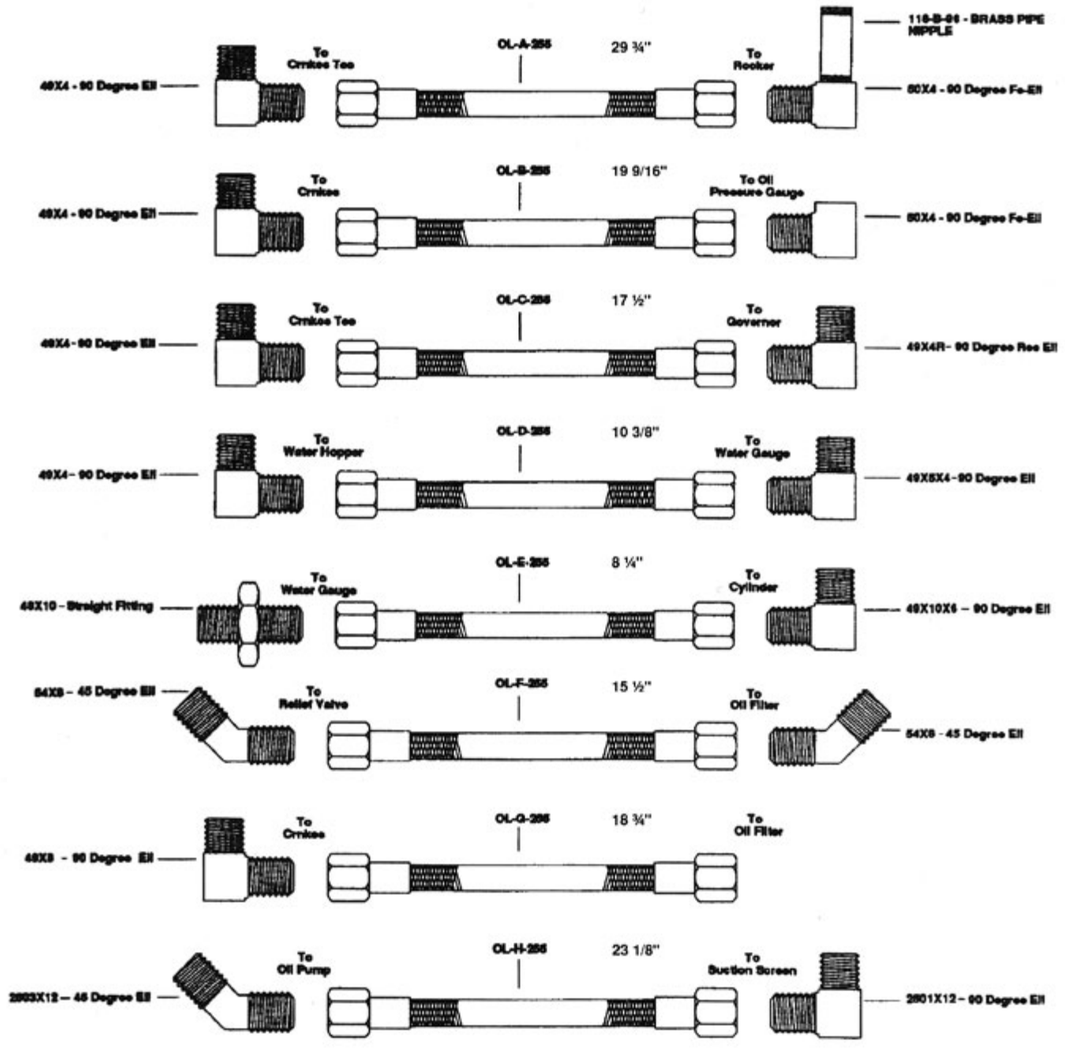


POWER TAKE OFF

	Part No.	Description	Qty.
*	371-B-255	Ring Adaptor	1
	374-D-255	Lever Spacer	1
	7A-1/213x11/4	Hex Head Capscrew	30
	SP-114-PO	Clutch	1
	X-7441-A	Hand Lever	1

* Not sold seperately.

COMPLETE OIL LINE KIT - OLK-U-255

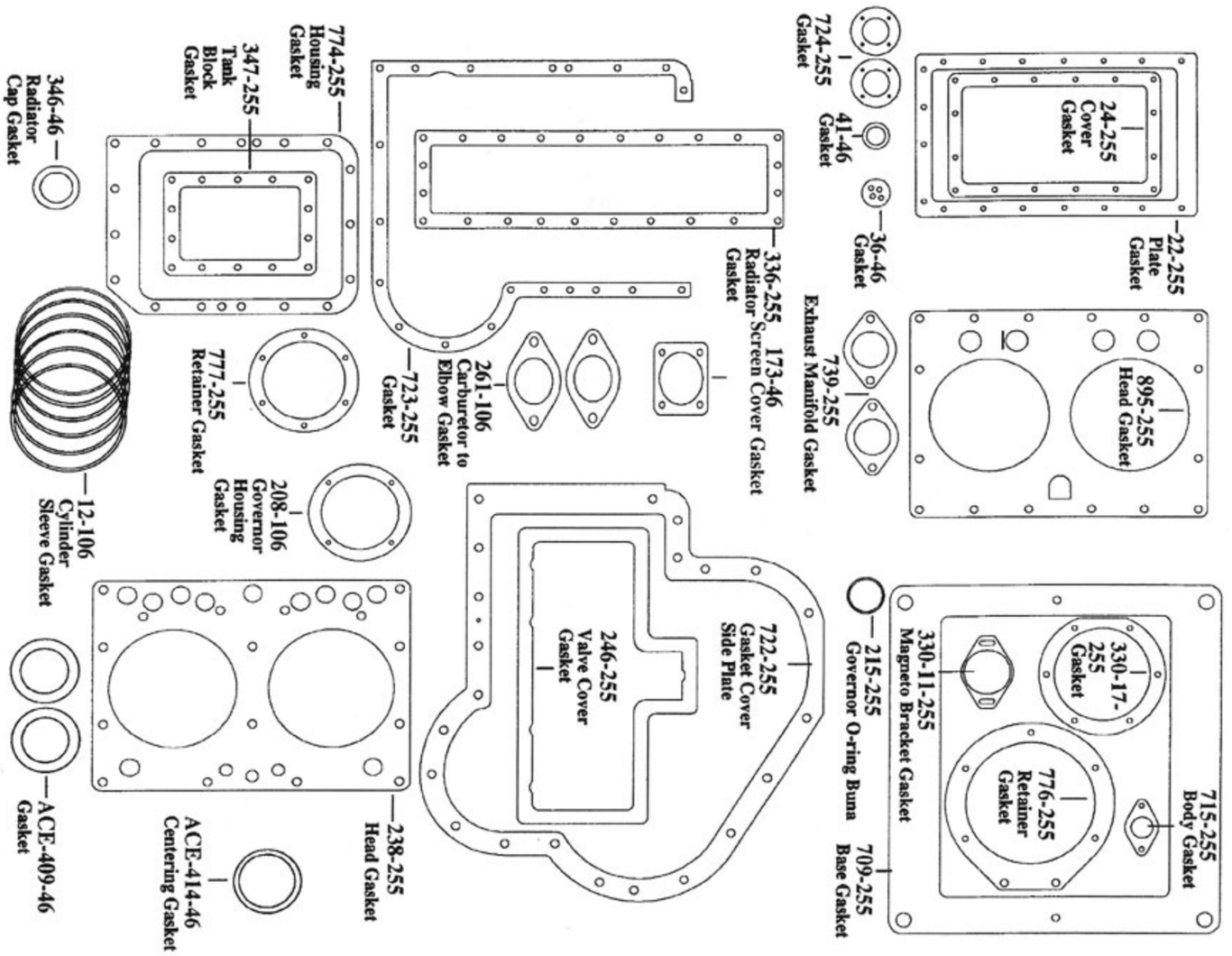


INSTALLATION OF OIL LINES

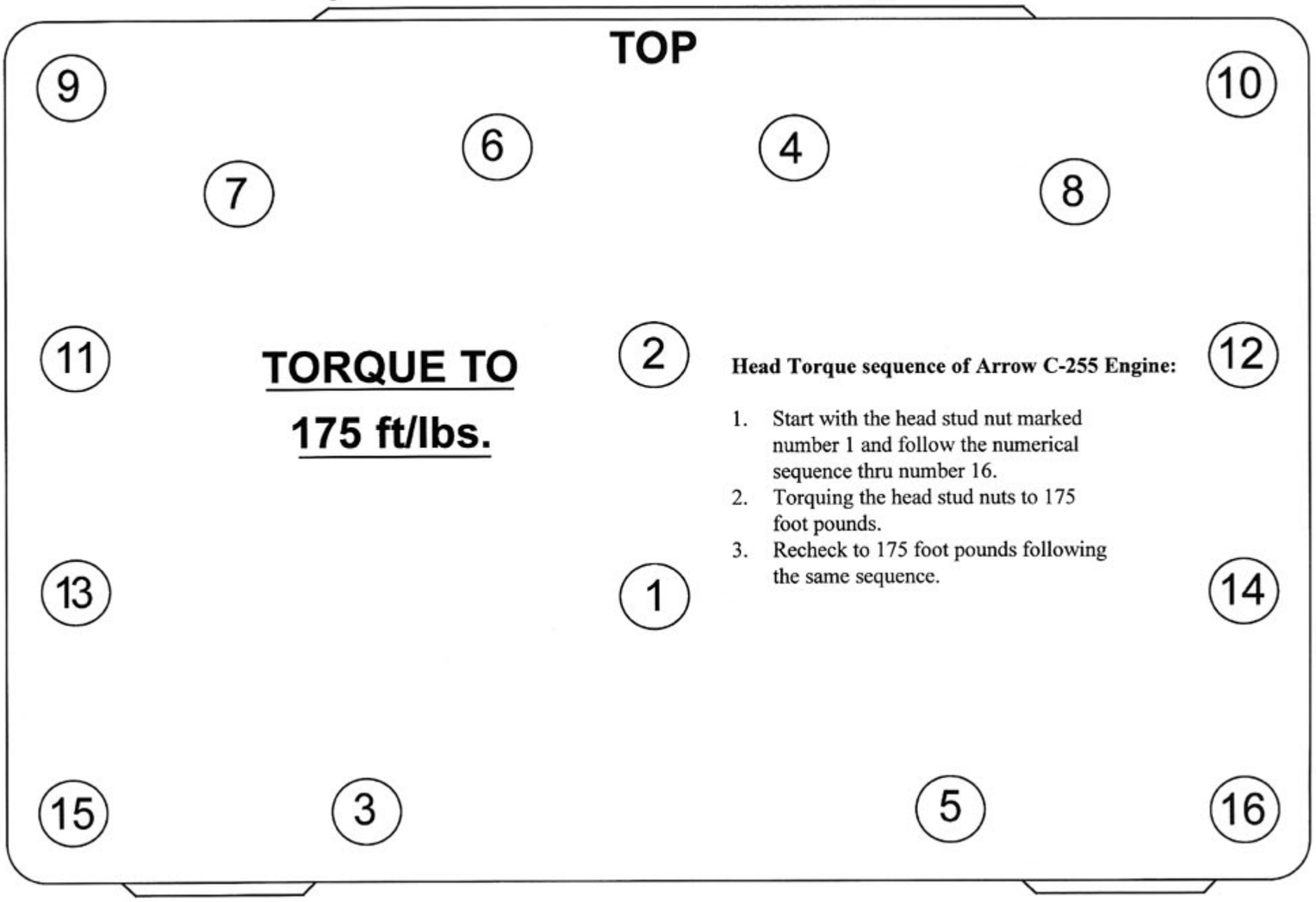
To identify each hose, the female fitting of the hose will be marked with a letter and a number of two digits. Reference this sheet to identify the proper location to install each hose. For example - the line for assembly OL-A-255 will be marked A5.

CAUTION: Position hoses to be free of sharp bends so that lines will not kink and stop oil flow or crack the teflon lines.

CAUTION: Be sure the hoses have ample clearance from all moving engine parts.



C-255 Cylinder Head Torquing Sequence:



Head Torque sequence of Arrow C-255 Engine:

1. Start with the head stud nut marked number 1 and follow the numerical sequence thru number 16.
2. Torquing the head stud nuts to 175 foot pounds.
3. Recheck to 175 foot pounds following the same sequence.

ARROW MANUFACTURED

REPLACEMENT PARTS

Caterpillar® Engines

G379
G398
G3304
G3306
G399

Waukesha® Engines

F2895
F3521
F5108
L5790
P9390
145G/F817
140G/F554
WAK/1197
L7042

Fairbanks Morse® Engines

ZC-118
ZC-208
ZC-503
ZC-739
ZC-346

Ajax® Engines

5 x 6½
EA-22, 6½ x 8 CMA
EA-30, 7¼ x 8 CMA
E-30, 7½ x 10 CMA
E-42, 8½ x 10 CMA
DP-60, 9½ x 10 CMA
DP-70/80/160, 11 x 14 CMA
DP-115/230, 13¼ x 16

Piston & Rod Assemblies
180
360
600
800

OEM

C-Series

*C-46
*C-66
*C-106
*C-96
*C-101
*C-255

VR-Series

VR-155
VR-220
VR-232
*VR-260
VR-283
VR-310
*VR-330
*VR-330CF
VR-265
*VR-380

A-Series

*A42
*A54
*A62

K6 Slow Speed Engine

*

Lufkin Engines

L-333
*L-795
L-1770
L-2165

Witte Engines

98
B12
E15
E20
F32
F42

Arrow Chemical Pumps

*10 Series (beam operated)
*12 & 13 Series (pneumatic)
*430 Series (electric)
*500 & 510 Series (pneumatic)
*Solar Chempump

Gas Compressors

**VRC-2
*VRC-CNG

Gas Products

*Volume Tanks
*Vertical & Horizontal Separators
*Suction Scrubbers
*Meter Runs
*Coalescers
*Skids

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