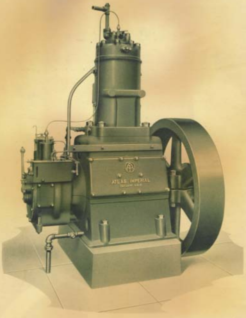
ATLAS IMPERIAL
TWO CYCLE
STATIONARY
DIESEL ENGINES

LOWER
POWER
COSTS

ATLAS IMPERIAL
TWO CYCLE
DIESEL ENGINES

Catalog No. 133-2C

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIFORNIA, U. S. A.



Front View of Single Cylinder Model

FOREWORD

IN order to supplement our line of four cycle Atlas Imperial Diesel Engines, which have for many years enjoyed an enviable reputation in the marine and portable power fields, we have designed and announced a new line of two cycle Diesel engines which is offered exclusively for stationary service.

In this catalog we have endeavored to illustrate and describe the component parts of the new Atlas Imperial Two Cycle Diesel Engines. In flexibility and efficiency these new Atlas Diesels far exceed any similar type of engine that has been offered up to this time.

These new engines are available in a wide range of horsepower in the commercial sizes and may be had in one, two, three and four cylinder models. They are especially applicable to such stationary fields as flour and feed milling, cotton ginning, ice making and refrigeration, irrigation pumping, machine shop power and electric light and power generation.

Although simplified in construction and employing another principle of operation, the Atlas Imperial Two Cycle Diesel Engines are not offered as a substitute for, nor will they in any way replace, our line of four cycle engines. Each type of engine has a very definite field of application and we offer each type for a specialized service.

The two cycle principle of operation eliminates all mechanically actuated valves, push rods and cam shafts. These engines operate quietly and with few adjustments and we recommend them for those applications where a slightly increased fuel cost is offset by a greater simplicity of operation.

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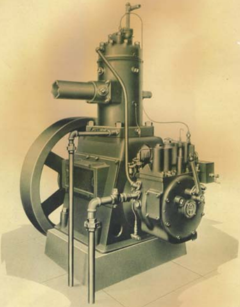


Back View, Showing Shaft Type Governor and Air Filter in Place

DIESEL ECONOMY

IN the Atlas Imperial Two Cycle Diesel Engines, illustrated and described in this catalog, we offer power users Diesel engines of heavy duty design; fully enclosed, oil tight construction; operating at medium speeds, which assures long life and low maintenance costs. They are very economical in the consumption of fuel and lubricating oil; operate quietly with a clean exhaust and afford greater flexibility than any other type of motive power. They are simple in design, construction and operation and therefore trouble free. Wearing parts are readily accessible for inspection, and pressure lubrication is employed throughout.

Since lower power cost is the motivating consideration in replacing present sources of power with modern Diesel engines, or in reaching a decision in determining the original installation, nearly every discussion of the relative advantages of the Diesel engine embraces a direct comparison with other sources of motive power.

The economy of Diesel power is predicated upon the high thermal efficiency of this type of prime mover when operating on a low priced fuel oil. By thermal efficiency we mean the percentage of potential energy, contained in fuel oil, which is actually converted into power. The measure of heat value is most commonly expressed in the British thermal unit, the amount of heat required to raise the temperature of 1 pound of pure water 1 degree at 59° F.

Bituminous coal, generally used in the firing of steam boilers, averages 12,500 B.T.U.'s per pound. Good anthracite coal averages about 13,000 B.T.U.'s per pound, while the fuel oil ordinarily employed in firing boilers and for combustion in Diesel engines averages 18,800 B.T.U.'s per pound and weighs 7½ pounds per gallon of oil having a specific gravity of 24 to 32 degrees Baumé.

Efficiency of Steam Plants

In thermal efficiency, steam plants range from 5% in the small, simple, non-condensing engines to about 18% in the modern central stations employing turbines, stokers, economizers and using high pressure superheated steam. Steam plants of the very latest design have been unable to make any substantial reduction of the 82% or greater loss between the heat value of the fuel and the power actually delivered. In the modern steam plant, for each 100 B.T.U.'s supplied in the fuel, approximately 16% will be lost through the stack, and 4% through boiler radiation, leaving about 80% net steam generation. This will be further reduced by 1% radiation of engine or turbine and a condenser loss of 58%, leaving about 21% indicated horsepower. Another 3% will be lost in friction, giving a final practical horsepower of about 18%.

Thermal Efficiency of Gasoline Engines

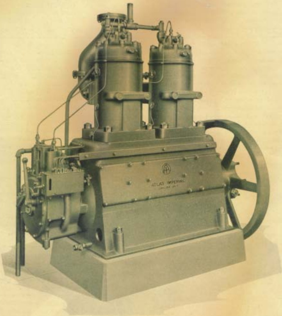
When operating under the most favorable adjustment, the thermal efficiency of the gasoline engine will average between 20% and 25%. The gasoline engine consumes approximately twice the number of gallons of fuel as a Diesel and the price of gasoline usually averages about three times the cost of Diesel fuel oil. The Diesel will therefore furnish power at approximately one-sixth the cost of the gasoline engine.

Diesel Thermal Efficiency

The modern Diesel engine has a thermal efficiency of about 35% in comparison with 18% for a modern steam plant and 25% for the gasoline engine. In the Diesel engine there is approximately 58% waste heat, 30% being dissipated in the cooling water and 28% loss in the exhaust gases. Of the 42% which goes to indicated horsepower, 7% will be absorbed by engine friction, leaving 35% for practical horsepower. Diesel engines operate on a low priced fuel oil which can be purchased in most parts of the country at prices running between 3 and 7 cents per gallon. High thermal efficiency and low priced fuel are therefore the basic factors underlying the low power cost of the Diesel engine.

Simple in Operation

Atlas Imperial Two Cycle Diesel Engines are simple in construction and operation. Since a Diesel engine does not employ a carburetor or



Front View of Two Cylinder Model with Shaft Type Governor an electrical ignition system, many of the difficulties of engine operation are immediately eliminated. Since the Diesel employs another system of ignition these engines must of necessity be much heavier in construction than the gasoline engine. They are started by compressed air and any operator who has had to rely upon storage batteries for starting power will quickly appreciate the practical infallibility of starting with compressed air.

Constant attention of an operator is not required as Atlas Diesels which run unattended can be equipped with simple and inexpensive devices which protect the engine from damage due to failure of lubricating oil or cooling water. Many Diesel installations are in operation today in which the operator puts in an appearance not more than twice a day. Except in large multiple unit installations where the variation in the load on the plant requires frequent starting and stopping of units, the operator is not required to be in constant attendance. Before starting the Diesel the operator checks up on his fuel supply, lubricating oil and cooling water, then by the manipulation of a single lever he turns on the starting air and the engine starts from stone cold and attains its full speed in less than 10 seconds. The engine assumes its full load immediately and the operator is then free to attend to other duties.

Diesel Flexibility

Many industries whose production is effected by seasonal fluctuations find in the flexibility of the Atlas Diesel another avenue of eliminating power waste. In some industries, such as ice and refrigeration, the production is in direct proportion to the speed of the machinery. Plants wishing to operate at less than full rated plant capacities can slow down the speed of the engine, which reduces the horsepower output proportionately without materially effecting the unit cost of plant production. This cannot be done in a plant operating on purchased electric power because the electric motor is a constant speed installation. Since the cost of Diesel engines runs in proportion to the rated horsepower, many plant owners prefer the flexibility and economy of a multiple engine installation in which one or more units may be shut down as the load decreases.

Low Maintenance Costs

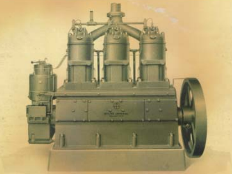
Atlas Imperial Diesel Engines are of the heavy duty type and operate at medium speeds. A study of our record of replacement parts indicates that the annual cost of maintenance is considerably under 2% of the original cost of the engine. This item depends in a large measure upon the service the engine performs and the care given to minor adjustments and adequate lubrication. The maintenance costs of Atlas Diesels must in no sense be confused with similar costs encountered in the operation of high speed gasoline or Diesel engines. Being of rugged construction and provided with ample bearing surfaces, the wear is distributed over a great many years and replacements are very infrequent. Authorities conservatively estimate the life expectancy of the heavy duty Diesel engine as 25 years. Our own records and published accounts show that engines built by us from 15 to 18 years ago are still in daily operation and the condition of these engines indicates many years of additional service.

Obsolescence

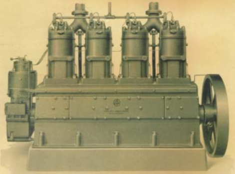
The efficiency of the modern Diesel engine so closely approaches theoretical perfection that there remains little possibility of effecting further substantial reductions in fuel consumption. In spite of all effort expended on improvement, the economy of Diesel engines has remained practically constant for the past 20 years. This gives absolute assurance that the factor of obsolescence will not in the future cause the scrapping of engines built today. Improvements made in recent years, the latest of which are exemplified in the engines illustrated in this catalog, have been mainly in balanced design and refinement. Improvement of efficiency in the future will undoubtedly be in the direction of using waste heat which is now dissipated in the cooling water and in the exhaust.

Application

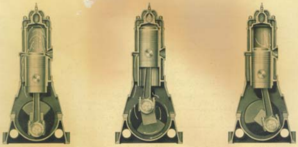
Atlas Imperial Two Cycle Diesel Engines are recommended and offered for stationary application in such fields as irrigation pumping, ice and refrigeration, cotton ginning, flour and feed milling, municipal light and power plants, sand and gravel plants, machine shop and other industrial power applications.



Front View of Three Cylinder Model with Vertical Type Governor



Front View of Four Cylinder Model with Vertical Type Governor



Scavenging *Combustion* *Exhaust*

THE TWO CYCLE PRINCIPLE

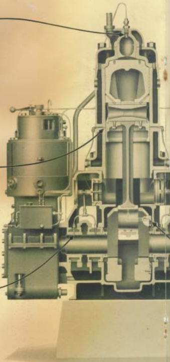
IN the Two Cycle Atlas Imperial Diesel Engine, ignition and combustion take place without explosive violence, the charge of fuel oil being ignited solely by the heat of compressed air.

On the downward or admission stroke the piston slightly compresses the air in the crankcase which has been sucked in from the atmosphere and has passed over and cooled the main bearings. This slight compression forces the air in the crankcase into the cylinder through the intake port as is indicated in the drawing at the left above. This blast of fresh air also scavenges the cylinder of the remaining burned gases which have not escaped through the exhaust port purely by expansion.

On its upward stroke, the ascending piston closes both intake and exhaust ports and compresses the entrapped air to approximately 500 pounds per square inch. The heat of this compression raises the temperature of the air to approximately 1,000 degrees Fahrenheit. This temperature is higher than the ignition point of the fuel oil which is injected in a measured amount just as the piston reaches the top of the upward stroke. This action is shown in the center illustration above.

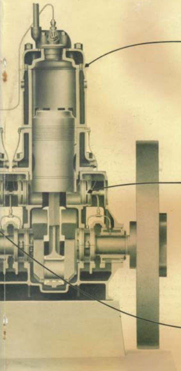
Through the proper timing of the injection of the fuel spray all explosive violence is eliminated from the combustion of the fuel charge and the burning gases produce a prolonged expansion or power stroke which is illustrated in the drawing at the right above. Just a few degrees before the full power stroke is completed the descending piston uncovers the exhaust port through which the spent gases escape to the atmosphere through an exhaust manifold. Thus it will be seen that there is absolutely no lost motion. Every downward stroke receives a power impulse which is transmitted through the crankshaft, producing an even flow of power.

The spray valve consists of a spiral grooved plug which divides the fuel and at the time of injection breaks it up into a fine spray, resulting in proper atomization and mixture with the hot compressed air. The injection orifice consists of one large hole. A spring loaded ball check valve prevents the cylinder gases from backing up into the fuel line.



In line with the piston pin and on both sides of the cylinder are the lubricating oil feed lines which supply both the piston pin and cylinder walls with lubricating oil. Directly above the piston pin on both sides is a groove which conducts the oil collected by the ring section over the slot to the pin. The piston wall is relieved at this point to give the scraper ring effect.

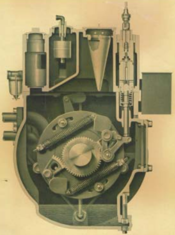
The main bearings are supplied with oil under approximately ten pounds pressure from a lubricating oil pump mounted on the governor housing. This method follows the best current engineering practice. Crank pin and cylinder lubrication is provided by a mechanical force feed lubricator.



The cylinder and combustion head are made gas tight by means of a spigot bearing on a solid copper gasket. The cooling water passes from the cylinder jacket to the head through a short pipe screwed in to the cylinder and made water tight by a rubber-asbestos grommet, preventing any water leakage into the cylinder.

The multiple disk air intake valves are self contained and easily removable units, placed directly opposite each other on the sides of the crank case. They are located above the main bearings and the large volume of air drawn into the engine for compression passes over the bearings with resultant cooling effect.

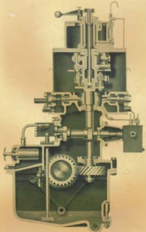
To lubricate the crank pin, oil is introduced into a banjo ring by a fitting projecting through the crank case into the open side of the oil collecting ring. A spigot, cast in one piece with the banjo ring, projects into a drilled hole in the crank pin and admits the oil. A metal bushing, driven in, prevents the loss of any lubricating oil.



THE SHAFT TYPE GOVERNOR

The shaft type governor, illustrated above, is employed on all single cylinder models and is of the variable stroke, non-reaction type. Although the stroke of the fuel pump may be changed no reaction is transmitted to the governor which lends stability to the governor, permits good regulation and prevents wear on the governor parts caused by vibration. The time of beginning of fuel injection into the combustion chamber remains constant while the duration varies in proportion to the quantity of oil injected.

The lubrication of both governor and engine cylinder and bearing is very simple and effective. A dipper on the governor body splashes oil which lubricates the governor parts. A portion of the oil splash is caught in a trough which keeps the force feed lubricator filled as long as there is any oil remaining in the sump of the governor. The cylinder, piston and main bearings are supplied with oil from the force feed lubricator. Surplus oil from the main bearings drains back into the governor sump by gravity. The surplus oil which collects in the crank pits is pumped by crankcase air pressure into the filter at the top of the fuel pump housing. This filter is made of a special grade of filter cloth which effectively strains out grit and other foreign matter. The strained clean oil then drips back into the governor sump, striking the governor parts and lubricating them in its descent.



VERTICAL TYPE GOVERNOR

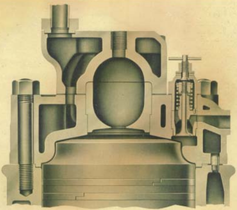
Illustrated above is the vertical type governor used on all multi-cylinder engines. The governor is entirely non-reactive, free from the effort and reaction involved in the working of the fuel pumps. The governor is quick to respond to load changes and regulates the fuel to all cylinders. The governor is direct driven from the crankshaft by oversize spiral gears.

The control lever, mounted on the top of the governor and pump unit, stops the engine and primes the spray valve tubes. The hand wheel on top of the governor shaft sets the tension on the two governor springs for synchronizing.

The individual packingless fuel pumps for each cylinder are of "Nitralloy," which is non-corrosive and extremely hard. Each pump assembly bolts to the bottom of the governor cap which is also the reservoir for the fuel oil.

One hardened cam, keyed to the governor drive shaft, gives the pump plungers a full stroke at all times, irrespective of the load on the engine. Two additional cams, one keyed to the drive shaft, and the other free, control the closing of the suction valve and thus the beginning of injection. The free cam is linked to the governor weights and its movement relative to the fixed cam varies the point of closing of the suction valve and therefore the amount of fuel discharged through the spray valve into the combustion chamber.

A cross shaft driven by spiral gears from the governor shaft operates the mechanical force feed lubricator which supplies oil to the cylinders and crank pins. The fuel and lubricating oil pumps, both of the gear type, are driven from the opposite side.



THE COMBUSTION CHAMBER

So much of the successful operation of a Diesel engine depends upon the perfect combustion of the fuel and the complete scavenging of the cylinders of burned gases and refilling with fresh air that this phase of the design of the Atlas Imperial Two Cycle Diesel has been given more than ordinary study and attention.

Control of the flow of air through the cylinder to accomplish this, as shown in the drawings on page 9, requires the scientific design of ports and passages and these forms must be checked and proved experimentally. The air starting check valve is mounted in a cage for easy removal and cannot fall into the cylinder in case of breakage because it is securely pocketed as an added factor of safety.

As the piston rises on the compression stroke, air is compressed into the upper or "pre-combustion" chamber. Just before the piston reaches top center, and while the air is still flowing through the neck, the injection of fuel begins. The fuel spray travels in the opposite direction to the incoming air, with the result that the fuel and air becomes thoroughly mixed while ignition takes place. Injection of fuel continues after ignition begins and any pressure rise drives the gas again through the neck toward the piston until the pressure on both sides of the neck is equalized.

In this manner the neck controls the rate of combustion and the flow of gas back and forth through the neck creates turbulence which causes thorough mixing of fuel and air. As the piston begins to move downward gas is drawn out of the upper chamber, but any combustion taking place below the neck equalizes the pressure and stops the flow. Thus the back and forth flow continues until the fuel is completely burned.

The connecting rod is made of high grade heat treated steel. Its one piece construction inherently assures the alignment of the crank-pin bearing shell. The upper shell of this, which receives the piston load, is lined with a high grade babbitt metal.

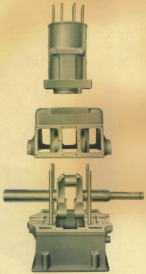
THE CYLINDER

The cylinder is a simple, one piece casting, of high grade iron, usually known as "semi-steel." It is of ample strength, and has liberally proportioned water jackets, extending practically its full length. Cooling water is admitted near the upper end of the cylinder where the temperature is higher. The water in the lower part of the jacket has only natural, or thermosyphon circulation, and keeps this portion of the cylinder warm, thus avoiding excessive difference in expansion between the upper and lower portions of the cylinder barrel. A large cleanout opening is provided at the bottom of the jacket.

PISTON AND CONNECTING ROD ASSEMBLY

The piston is a high grade iron casting properly proportioned for the duty it has to perform. It has five rings above and one below the piston pin. The piston lubricating fitting is so positioned that the oil is at all times between the upper and lower rings, thus assuring adequate lubrication of the piston thrust surface. Oil scrapers located in each side of the piston direct oil to the piston pin.

This piston pin is made from "Nitralloy," an alloy steel with an exceptionally hard surface, providing a bearing with exceptional wearing qualities. The pin is fastened in the rod by a heavy clamping bolt. Removable bronze piston pin bushings are located in the pistons.



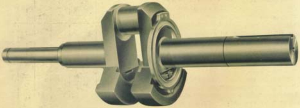
Base, Frame and Cylinder

FRAME CONSTRUCTION

Two castings, each extending the full length of the engine, constitute the main frame. The individual crank cases are formed by two solid partitions which cross both the upper and lower castings directly under each cylinder. Besides bolting these castings together most rigidly they have also been fitted with two keys running the full length of the joint both front and rear. This not only assures an oil tight joint but also affords perfect alignment and a joint that will never warp or distort. Four heavy alloy steel bolts from each cylinder extend through the centerframe and are studded into the base, making a strong, rigid and inflexible framework, the bolts relieving the frame of all cylinder tension.

THE CRANKSHAFT

The crankshaft is a one piece forging, of high carbon steel, heat-treated, and manufactured and machined according to the best approved practice. It is conservatively designed and of ample proportions for the work to be performed. Each crank throw is counterweighted and each crankpin is drilled to conduct the oil to the crankpin bearing. Oil is fed into a banjo ring on the crankshaft from a tube supplied from the force feed lubricator. The oil is collected in this ring and passed into the drilled crankpin through a spigot requiring no packing. A dam prevents the oil from being thrown out of the crankpin and causes it to pass into the crankpin bearing.



The Crankshaft

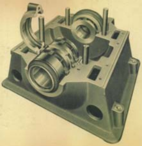
THE MAIN BEARINGS

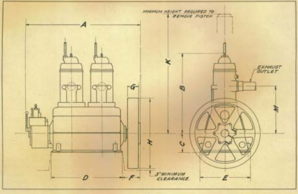
The main bearings each consist of two cast steel shells of equal size, shown in the illustration above as "A" and "B." Each shell is lined with babbitt and the heavy flanged ends are so designed and machined as to rest securely in the bore of the frame. A thrust spacer, "B," separates and positively locates the bearing shells when they are assembled on the crankshaft. The thrust spacer is tongued into the base and projecting lugs on the upper shells prevent rotation of the bearings in their housings. All set screws are eliminated. The outer flanges of the bearings are fitted snugly into the cross walls of the frame and a heavy cap is bolted over the thrust spacer and the inner flanges of the upper bearing shells. A split, air sealing thrust collar, "E," bears against the outer ground ends of the bearing shells under spring pressure and not against the frame casting. The wear on this part is taken by an easily removable, special composition thrust ring, "D," shown above.

Proper lubrication of bearings is of prime importance in any engine and this cannot be accomplished with a sparse oil supply. The unusual construction employed in the main bearing assembly of this engine permits lubricating oil to be supplied under pressure. This insures an abundant supply of lubricating oil to the bearing surfaces at all times, thereby reducing wear to an absolute minimum. This is a most desirable feature since it permits of engine operation with long periods between bearing inspection and adjustment.

BASE CONSTRUCTION

The main base is a heavy single piece casting well ribbed to give the desired rigidity. It is bored to receive the concentric main bearing shells thus insuring absolute alignment of all bearings. The base is machined on top to receive the main frame. Locating keys are provided in the base to locate the frame in proper alignment. Heavy tie rods are threaded into the base to fasten the base and frame securely together. These tie rods also serve to hold the cylinder in place, thus relieving the cast frame of stresses due to gas pressure in the cylinder. Foundation bolt bosses of generous proportions are provided on each side of the base.

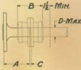




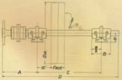
APPROXIMATE DIMENSIONS

ENGINE SIZE					DIMENSIONS IN INCHES									
HP	No. CYLS	RPM	BORE	STROKE	A	B	C	D	E	F	G	H	K	M
15	1	720	6	8	47⅛	37¾	11½	22½	25¼	8⅝	5	32	55	21 3/16
20	1		7		47⅛			22½						
30	2		6		63¾			37¾						
40	2		7		63¾			37¾						
40	1	450	10½	12	56¾	55	13	28	34½	12⅞	6	51	82	32¼
80	2				77½			43¾			5¼	51		
50	1	360	12¼	13½	61⅞	58⅝	14	30⅞	37¼	12¾	6⅞	58	86	33
100	2				88			54⅝			6	51		
150	3				111¾			78⅝			6	51		
200	4				135½			102⅜			5¼	51		

Certified drawings will be furnished for construction purposes



Type "A" Drive



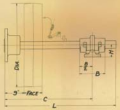
Type "B" Drive

STUB SHAFT AND FLEXIBLE COUPLING

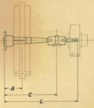
HP	CYLS	RPM	A	B	C	D
15 20 30 40	1 1 2 2	720	5¾	4¾ 4¾ 5½ 5½	⅛	1½ 1½ 2 2
40 80	1 2	450	7⅛ 7⅛	6¾ 6¾	3/16 3/16	2½ 2⅜
50 100 150 200	1 2 3 4	360	7½ 7⅛ 9 9	6¾ 6¾ 8¼ 9¾	3/16 3/16 3/16 ¼	2½ 2⅜ 3 3½

EXTENSION SHAFT WITH FLEXIBLE COUPLING

			Plain Pulley				Clutch Pulley		
HP	CYLS	RPM	A	B	C	D	C	D	H
15 20 30 40	1 1 2 2	720	18	11	21	41	41	61	4⅝
40 80	1 2	450	22	14	28 34	50 55	43 51	65 72	5¾
50 100 150 200	1 2 3 4	360	22 22 25¼ 25¼	14 14 16 16	30 38 48 54	52 59 74 80	48 57 68 72	70 78 94 98	5⅝ 5⅝ 6 7/16 6 7/16



Type "C" Drive



Type "D" Drive

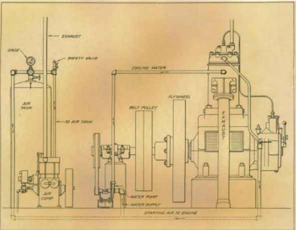
PLAIN EXTENSION SHAFTS

			Plain Pulley			Clutch Pulley		
HP	CYLS	RPM	B	C	L	C	L	H
15 20 30 40	1 1 2 2	720	11	24½	34	40	50	4⅝
40 80	1 2	450	14	27 33	38 42	42 50½	52 61¼	5¾ 5¾
50 100 150 200	1 2 3 4	360	14 14 16 16	27 37 46 52	40 48 58 64	47½ 56⅝ 67 71½	58 67¾ 79 83¼	5¾ 5¾ 6 7/16 6 7/16

SHAFT FOR DIRECT ENGINE DRIVEN GENERATOR

HP	CYLS	RPM	A	C	L
15 20 30 40	1 1 2 2	720	Shaft is part of the generator. Requires coupling only.		
40 80	1 2	450	12 15½	42¾ 49⅝	60 65½
50 100 150 200	1 2 3 4	360	12 15½ 16½ 16½	42¾ 51⅝ 54¼ 54¼	60 70⅝ 73⅝ 75⅝

All approximate Dimensions shown on this page are in inches. Certified drawings will be furnished for construction purposes.



THE AIR STARTING SYSTEM

The Atlas Imperial Two Cycle Diesel Engine is started by compressed air which is furnished by a small auxiliary gasoline operated air compressor and is stored in an air receiver placed adjacent to the engine, as is shown in the installation diagram above.

Before starting the Diesel in the morning the operator starts the small auxiliary compressor, unless the gage shows sufficient air pressure from the previous day. He then opens the air valve and through the manipulation of a single lever starts the Diesel. The small compressor remains in operation until the pressure in the air receiver is again sufficient for starting, after which the operator stops the compressor and closes the air valve.

The air starting timing valve is located in the governor housing and is actuated by a cam mounted on the crankshaft in the case of the shaft type governor, and on the vertical drive shaft of the vertical type governor. Both types of governors are illustrated and described on pages 12 and 13.

The starting valve is normally held from engagement with the cam by a spring. Upon opening the air supply to start the engine, the air pushes the starting valve stem in engagement with the cam, thus timing and controlling the admission of air to the power cylinders for starting.

In the multi-cylinder engines air for starting is admitted to one cylinder in the two cylinder model, and to two cylinders in the three and four cylinder engines. From the governor housing the air is conducted to the cylinders through seamless steel tubing as shown in the diagram above. An automatic check valve, located in the cylinder head, prevents the back flow of the products of combustion into the starting air pipe. This prevents the building up of dangerous pressures in the air starting system.

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