Rechnical report on delta steel company, ovwian aladja.

Business, Company

CHAPTER ONE INTRODUCTION 1. STUDENTS INDUSTRIAL WORK EXPERIENCE SCHEME (SIWES) The objective of the SIWES Unit is to ensure that students inScience and Technology-based disciplines are made to acquire sufficient practical knowledge so that when they get employed ongraduationthey become immediately productive with little of no further training in their fields of specialization. The SIWES Unit is responsible for the coordination of the Students Industrial Work Experience Scheme (SIWES) in the University.

The Unit accomplishes this through the placement of students who are in their penultimate year in the relevant industrial environments for on-the-job training for a minimum of six months. In collaboration with the Industrial Training Fund, the Unit monitors and controls the industrial training programme through the use of industry and institution-based Supervisors. Students, at the end of the training programme, do present reports on their practical experiences at a departmental interactive forum where faculty members jointly access individual student's performance on the programme as is required by the SIWES curriculum.

Currently, six hundred students drawn from seven colleges are participated in the 2009 SIWES programme in various industries and establishments in the country. Students in B. engr degree courses carried out their industrial trainings in various industries along with students from other SIWES – approved institutions. This is done in order not to compromise our national mandate of turning out practically sound mechanical engineering graduates that will eventually assist the country in meeting the demand for sound man power in our various energy sectors. 1. 1 DELTA STEEL COMPANY, OVWIAN ALADJA.

BRIEF INTRODUCTION The steel plant at Ovwian/Aladja (Delta Steel Company Ltd), was commissioned in 1982 and produced steel from imported iron ore and local steel scrap. It has a capacity of 1. 08 metric tones annually. DSC comprises of four major plants: * pellet plant * Direct reduction plant * Steel melting section and * Rolling mill The company also comprises of other auxiliary departments such as: - Heavy duty/internal transports department - Instrumentation and control department -Fire and safety department - Environmental control department -Central electrical maintenance department Central mechanical department and so on. I particularly worked in the heavy duty workshop/ internal transport department. The heavy duty workshop(HDW) dates as far back as Delta Steel Company itself. The heavy duty department is responsible for the up keep of both heavy duty and light vehicles, as well as maintenance of the various power plants the company depends on for its immense power supply. All vehicle damage is reported to this section for repair, also regular maintenance is carried out on the vehicles to make sure they are in good working condition. . 1. 2ORGANIZATIONAL SETUP The organizational set-up is shown below: [pic] [pic] HEAVY DUTY/ INTERNAL TRANSPORT DEPARTMENT. The heavy duty workshop focuses on repair and maintenance of vehicles (both light and heavy vehicles); they particularly specialize in repair of the companies vehicles. The workshop is divided into sections; the over-hauling section, the auto-electrical section, the vulcanizing section, the welding/fabrication section, the preventive maintenance section.

When a vehicle is brought into the workshop, the supervisors take down all complaints before sending the vehicle to the particular section where the repair will be carried. The Heavy duty Department organ gram is shown below: [pic] CHAPTER TWO 2. DETAILS OF INDUSTRIAL TRAINING. EXPERIENCE GAINED: At DELTA STEEL COMPANY PLC, i participated in motor vehicle repair and maintenance, although I was made to go through almost all the sections in the heavy duty/ internal transport department. I had the opportunity to be exposed to diesel engines, petrol engines, pneumatic systems.

All systems discussed below cover the works i carried out in this organization. 2. 1 Ignition Systems: The purpose of the ignition system is to create a spark that will ignite the fuel-air mixture in the cylinder of an engine. It must do this at exactly the right instant and do it at the rate of up to several thousand times per minute for each cylinder in the engine. Currently, there are three distinct types of ignition systems, The Mechanical Ignition System, The Electronic Ignition System and Finally, the Distributorless Ignition System.

The distributor is the nerve center of the mechanical ignition system and has two tasks to perform. First, it is responsible for triggering the ignition coil to generate a spark at the precise instant that it is required (which varies depending how fast the engine is turning and how much load it is under).

Second, the distributor is responsible for directing that spark to the proper cylinder (which is why it is called a distributor) The ignition switch. There are two separate circuits that go from the ignition switch to the coil.

One circuit runs through a resistor in order to step down the voltage about 15% in order to protect the points from premature wear. The other circuit sends full battery voltage to the coil. The only time this circuit is used is during cranking. Since the starter draws a considerable amount of current to crank the engine, additional voltage is needed to power the coil. So when the key is turned to the spring-loaded start position, full battery voltage is used. As soon as the engine is running, the driver releases the key to the run position which directs current through the primary resistor to the coil.

On some vehicles, the primary resistor is mounted on the firewall and is easy to replace if it fails. Ignition Coil The ignition coil is the heart of the ignition system. As current flows through the coil a strong magnetic field is built up. When the current is shut off, the collapse of this magnetic field to the secondary windings induces a high voltage which is released through the large center terminal. This voltage is then directed to the spark plugs through the distributor. Ignition Timing The timing is set by loosening a hold-down screw and rotating the body of the distributor.

Since the spark is triggered at the exact instant that the points begin to open, rotating the distributor body (which the points are mounted on) will change the relationship between the position of the points and the position of the distributor cam, which is on the shaft that is geared to the engine rotation. Ignition Wires These cables are designed to handle 20, 000 to more than 50, 000 volts. The job of the spark plug wires is to get that enormous power to the spark plug without leaking out. Spark plug wires go from the distributor cap to the spark plugs in a very specific order.

This is called the " firing order" and is part of the engine design. Each spark plug must only fire at the end of the compression stroke. Each cylinder has a compression stroke at a different time, so it is important for the individual spark plug wire to be routed to the correct cylinder. For instance, a popular V8 engine firing order is 1, 8, 4, 3, 6, 5, 7, 2. The cylinders are numbered from the front to the rear with cylinder #1 on the front-left of the engine. So the cylinders on the left side of the engine are numbered 1, 3, 5, 7 while the right side are numbered 2, 4, 6, 8.

On some engines, the right bank is 1, 2, 3, 4 while the left bank is 5, 6, 7, 8. A repair manual will tell you the correct firing order and cylinder layout for a particular engine. The next thing we need to know is what direction the distributor is rotating in, clockwise or counter-clockwise, and which terminal on the distributor cap that #1 cylinder is located. Once we have this information, we can begin routing the spark plug wires. If the wires are installed incorrectly, the engine may backfire, or at the very least, not run on all cylinders.

It is very important that the wires are installed correctly. Spark Plugs The ignition system's sole reason for being is to service the spark plug. It must provide sufficient voltage to jump the gap at the tip of the spark plug and do it at the exact right time, reliably on the order of thousands of times per minute for each spark plug in the engine. The modern spark plug is designed to last many thousands of miles before it requires replacement. These electrical wonders come in many configurations and heat ranges to work properly in a given engine.

The heat range of a spark plug dictates whether it will be hot enough to burn off any residue that collects on the tip, but not so hot that it will cause pre-ignition in the engine. Pre-ignition is caused when a spark plug is so hot, that it begins to glow and ignite the fuel-air mixture prematurely, before the spark. Most spark plugs contain a resistor to suppress radio interference. The gap on a spark plug is also important and must be set before the spark plug is installed in the engine. If the gap is too wide, there may not be enough voltage to jump the gap, causing a misfire.

If the gap is too small, the spark may be inadequate to ignite a lean fuel-air mixture, also causing a misfire. The Electronic Ignition System (from 1970's to today) In the electronic ignition system, the points and condenser were replaced by electronics. On these systems, there were several methods used to replace the points and condenser in order to trigger the coil to fire. One method used a metal wheel with teeth, usually one for each cylinder. This is called an armature or reluctor. A magnetic pickup coil senses when a tooth passes and sends a signal to the control module to fire the coil.

Other systems used an electric eye with a shutter wheel to send a signal to the electronics that it was time to trigger the coil to fire. These systems still need to have the initial timing adjusted by rotating the distributor housing. The advantage of this system, aside from the fact that it is maintenance free, is that the control module can handle much higher primary voltage than the mechanical points. Voltage can even be stepped up before sending it to the coil, so the coil can create a much hotter spark, on the order of 50, 000 volts instead of 20, 000 volts that is common with the mechanical systems.

These systems only have a single wire from the ignition switch to the coil since a primary resistor is no longer needed. On some vehicles, this control module was mounted inside the distributor where the points used to be mounted. On other designs, the control module was mounted outside the distributor with external wiring to connect it to the pickup coil. On many General Motors engines, the control module was inside the distributor and the coil was mounted on top of the distributor for a one piece unitized ignition system. GM called it High Energy Ignition or HEI for short.

The higher voltage that these systems provided allow the use of a much wider gap on the spark plugs for a longer, fatter spark. This larger spark also allowed a leaner mixture for better fuel economy and still insure a smooth running engine. The early electronic systems had limited or no computing power, so timing still had to be set manually and there was still a centrifugal and vacuum advance built into the distributor. On some of the later systems, the inside of the distributor is empty and all triggering is performed by a sensor that watches a notched wheel connected to either the crankshaft or the camshaft.

These devices are called Crankshaft Position Sensor or Camshaft Position Sensor. In these systems, the job of the distributor is solely to distribute the spark to the correct cylinder through the distributor cap and rotor. The computer handles the timing and any timing advance necessary for the smooth running of the engine. The Distributorless Ignition system (from 1980's to today) Newer automobiles have evolved from a mechanical system (distributor) to a completely solid state electronic system with no moving parts. These systems are completely controlled by the on-board computer.

In place of the distributor, there are multiple coils that each serve one or two spark plugs. A typical 6 cylinder engine has 3 coils that are mounted together in a coil " pack". A spark plug wire comes out of each side of the individual coil and goes to the appropriate spark plug. The coil fires both spark plugs at the same time. One spark plug fires on the compression stroke igniting the fuel-air mixture to produce power, while the other spark plug fires on the exhaust stroke and does nothing. On some vehicles, there is an individual coil for each cylinder mounted directly on top of the spark plug.

This design completely eliminates the high tension spark plug wires for even better reliability. Most of these systems use spark plugs that are designed to last over 100, 000 miles, which cuts down on maintenance costs. 2. 2 TRANSMISSION SYSTEMS The transmission is a device that is connected to the back of the engine and sends the power from the engine to the drive wheels. An automobile engine runs at its best at a certain RPM (Revolutions Per Minute) range and it is the transmission's job to make sure that the power is delivered to the wheels while keeping the engine within that range.

Transmission Components : The modern automatic transmission consists of many components and systems that are designed to work together in a symphony of clever mechanical, hydraulic and electricaltechnologythat has evolved over the years into what many mechanically inclined individuals consider to be an art form. The main components that make up an automatic transmission include: •Planetary Gear Sets which are the mechanical systems that provide the various forward gear ratios as well as reverse. The Hydraulic System which uses a special transmission fluid sent under pressure by an Oil Pump through the Valve Body to control the Clutches and the Bands in order to control the planetary gear sets. •Seals and Gaskets are used to keep the oil where it is supposed to be and prevent it from leaking out. •The Torque Converter which acts like a clutch to allow the vehicle to come to a stop in gear while the engine is still running. •The Governor and the Modulator or Throttle Cable that monitor speed and throttle position in order to determine when to shift. On newer vehicles, shift points are controlled by Computer which directs electrical solenoids to shift oil flow to the appropriate component at the right instant. 2. 3 The Cooling System: The cooling system is made up of the passages inside the engine block and heads, a water pump to circulate the coolant, a thermostat to control the temperature of the coolant, a radiator to cool the coolant, a radiator cap to control the pressure in the system, and some plumbing consisting of interconnecting hoses to transfer the coolant from the engine to the radiator.

A cooling system works by sending a liquid coolant through passages in the engine block and heads. As the coolant flows through these passages, it picks up heat from the engine. The heated fluid then makes its way through a rubber hose to the radiator in the front of the car. As it flows through the thin tubes in the radiator, the hot liquid is cooled by the air stream entering the engine compartment from the grill in front of the car. Once the fluid is cooled, it returns to the engine to absorb more heat. The water pump has the job of keeping the fluid moving through this system of plumbing and hidden passages. pic] A thermostat is placed between the engine and the radiator to make sure that the coolant stays above a certain preset temperature. If the coolant temperature falls below this temperature, the thermostat blocks the coolant flow to the radiator, forcing the fluid instead through a bypass directly back to the engine. The coolant will continue to circulate like this until it reaches the design temperature, at which point, the thermostat will open a valve and allow the coolant back through the radiator. In order to prevent the coolant from boiling, the cooling system is designed to be pressurized.

Under pressure, the boiling point of the coolant is raised considerably. However, too much pressure will cause hoses and other parts to burst, so a system is needed to relieve pressure if it exceeds a certain point. The job of maintaining the pressure in the cooling system belongs to the radiator cap. The cap is designed to release pressure if it reaches the specified upper limit that the system was designed to handle. Prior to the '70s, the cap would release this extra pressure to the pavement. Since then, a system was added to capture any released fluid and store it temporarily in a reserve tank.

This fluid would then return to the cooling system after the engine cooled down. This is what is called a closed cooling system. Circulation The coolant follows a path that takes it from the water pump, through passages inside the engine block where it collects the heat produced by the cylinders. It then flows up to the cylinder head (or heads in a V type engine) where it collects more heat from the combustion chambers. It then flows out past the thermostat (if the thermostat is opened to allow the fluid to pass), through the upper radiator hose and into the radiator.

The coolant flows through the thin flattened tubes that make up the core of the radiator and is cooled by the air flow through the radiator. From there, it flows out of the radiator, through the lower radiator hose and back to the water pump. By this time, the coolant is cooled off and ready to collect more heat from the engine. The Components of a Cooling System • The Radiator • Radiator Cooling Fans • Pressure Cap & Reserve Tank • Water Pump • Thermostat • Bypass System • Head Gaskets & Intake Manifold Gaskets • Hoses

The Radiator The radiator core is usually made of flattened aluminum tubes with aluminum strips that zigzag between the tubes. These fins transfer the heat in the tubes into the air stream to be carried away from the vehicle. On each end of the radiator core is a tank, usually made of plastic that covers the ends of the radiator, Radiator Fans Mounted on the back of the radiator on the side closest to the engine is one or two electric fans inside a housing that is designed to protect fingers and to direct the air flow.

These fans are there to keep the air flow going through the radiator while the vehicle is going slow or is stopped with the engine running. Water Pump: The water pump is made up of a housing, usually made of cast iron or cast aluminum and an impeller mounted on a spinning shaft with a pulley attached to the shaft on the outside of the pump body. A seal keeps fluid from leaking out of the pump housing past the spinning shaft. The impeller uses centrifugal force to draw the coolant in from the lower radiator hose and send it under pressure into the engine block.

There is a gasket to seal the water pump to the engine block and prevent the flowing coolant from leaking out where the pump is attached to the block.. Thermostat The thermostat is simply a valve that measures the temperature of the coolant and, if it is hot enough, opens to allow the coolant to flow through the radiator. If the coolant is not hot enough, the flow to the radiator is blocked and fluid is directed to a bypass system that allows the coolant to return directly back to the engine. The heart of a thermostat is a sealed copper cup that contains wax and a metal pellet.

As the thermostat heats up, the hot wax expands, pushing a piston against spring pressure to open the valve and allow coolant to circulate. Bypass System This is a passage that allows the coolant to bypass the radiator and return directly back to the engine. Some engines use a rubber hose, or a fixed steel tube. In other engines, there is a cast in passage built into the water pump or front housing. Head Gaskets and Intake Manifold Gaskets All internal combustion engines have an engine block and one or two cylinder heads. The mating surfaces where the block and head meet are machined flat or a close, precision fit, but no amount of careful machining will allow them to be completely water tight or be able to hold back combustion gases from escaping past the mating surfaces. In order to seal the block to the heads, we use a head gasket. The head gasket has several things it needs to seal against. The main thing is the combustion pressure on each cylinder. Oil and coolant must easily flow between block and head and it is the job of the head gasket to keep these fluids from leaking out or into the combustion chamber, or each other for that matter.

A typical head gasket is usually made of soft sheet metal that is stamped with ridges that surround all leak points. When the head is placed on the block, the head gasket is sandwiched between them. Many bolts, called head bolts are screwed in and tightened down causing the head gasket to crush and form a tight seal between the block and head. Head gaskets usually fail if the engine overheats for a sustained period of time causing the cylinder head to warp and release pressure on the head gasket.

This is most common on engines with cast aluminum heads, which are now on just about all modern engines. Hoses There are several rubber hoses that make up the plumbing to connect the components of the cooling system. These hoses are designed to withstand the pressure inside the cooling system. Because of this, they are subject to wear and tear and eventually may require replacing as part of routine maintenance. If the rubber is beginning to look dry and cracked, or becomes soft and spongy, or you notice some ballooning at the ends, it is time to replace them.

The main radiator hoses are usually molded to a shape that is designed to rout the hose around obstacles without kinking. 2. 4 ENGINES (INTERNAL COMBUSTION ENGINES) PETROL ENGINES: Internal combustion gasoline engines run on a mixture of gasoline and air. The ideal mixture is 14. 7 parts of air to one part of gasoline (by weight.) Since gas weighs much more than air, we are talking about a whole lot of air and a tiny bit of gas. One part of gas that is completely vaporized into 14. 7 parts of air can produce tremendous power when ignited inside an engine.

Air enters the engine through the air cleaner and proceeds to the throttle plate. You control the amount of air that passes through the throttle plate and into the engine with the gas pedal. It is then distributed through a series of passages called the intake manifold, to each cylinder. At some point after the air cleaner, depending on the engine, fuel is added to the air-stream by either a fuel injection system or, in older vehicles, by the carburetor. Once the fuel is vaporized into the air stream, the mixture is drawn into each cylinder as that cylinder begins its intake stroke.

When the piston reaches the bottom of the cylinder, the intake valve closes and the piston begins moving up in the cylinder compressing the charge. When the piston reaches the top, the spark plug ignites the fuel-air mixture causing a powerful expansion of the gas, which pushes the piston back down with great force against the crankshaft. Engine Types The majority of engines in motor vehicles today are four-stroke, spark-ignition internal combustion engines. The exceptions like the diesel and rotary engines will not be covered in this article.

There are several engine types which are identified by the number of cylinders and the way the cylinders are laid out. Motor vehicles will have from 3 to 12 cylinders which are arranged in the engine block in several configurations. The most popular of them are shown on the left. In-line engines have their cylinders arranged in a row. 3, 4, 5 and 6 cylinder engines commonly use this arrangement. The " V" arrangement uses two banks of cylinders side-by-side and is commonly used in V-6, V-8, V-10 and V-12 configurations. Flat engines use two opposing banks of cylinders and are less common than the other two designs.

They are used in engines from Subaru and Porsche in 4 and 6 cylinder arrangements as well as in the old VW beetles with 4 cylinders. Flat engines are also used in some Ferraris with 12 cylinders Most engine blocks are made of cast iron or cast aluminum.. Each cylinder contains a piston that travels up and down inside the cylinder bore. All the pistons in the engine are connected through individual connecting rods to a common crankshaft. The crankshaft is located below the cylinders on an in-line engine, at the base of the V on a V-type engine and between the cylinder banks on a flat engine.

As the pistons move up and down, they turn the crankshaft just like a bicycle riders legs will pump up and down to turn the crank that is connected to the pedals of a bicycle. A cylinder head is bolted to the top of each bank of cylinders to seal the individual cylinders and contain the combustion process that takes place inside the cylinder. Most cylinder heads are made of cast aluminum or cast iron. The cylinder head contains at least one intake valve and one exhaust valve for each cylinder. This allows the air-fuel mixture to enter the cylinder and the burned exhaust gas to exit the cylinder.

Engines have at least two valves per cylinder, one intake valve and one exhaust valve. Many newer engines are using multiple intake and exhaust valves per cylinder for increased engine power and efficiency. These engines are sometimes named for the number of valves that they have such as " 24 Valve V6" which indicates a V-6 engine with four valves per cylinder. Modern engine designs can use anywhere from 2 to 5 valves per cylinder. The valves are opened and closed by means of a camshaft. A camshaft is a rotating shaft that has individual lobes for each valve.

The lobe is a " bump" on one side of the shaft that pushes against a valve lifter moving it up and down. When the lobe pushes against the lifter, the lifter in turn pushes the valve open. When the lobe rotates away from the lifter, the valve is closed by a spring that is attached to the valve. A common configuration is to have one camshaft located in the engine block with the lifters connecting to the valves through a series of linkages. The camshaft must be synchronized with the crankshaft so that the camshaft makes one revolution for every two revolutions of the crankshaft.

In most engines, this is done by a " Timing Chain" (similar to a bicycle chain) that connects the camshaft with the crankshaft. Newer engines have the camshaft located in the cylinder head directly over the valves. This design is more efficient but it is more costly to manufacture and requires multiple camshafts on Flat and V-type engines. It also requires much longer timing chains or timing belts which are prone to wear. Some engines have two camshafts on each head, one for the intake valves and one for the exhaust valves. These engines are called Double Overhead Camshaft (D. O. H. C. Engines while the other type is called Single Overhead Camshaft (S. O. H. C.) Engines. Engines with the camshaft in the block are called Overhead Valve (O. H. V) Engines. How an Engine Works The four strokes are Intake, Compression, Power and Exhaust. The piston travels down on the Intake stroke, up on the Compression stroke, down on the Power stroke and up on the Exhaust stroke. •Intake As the piston starts down on the Intake stroke, the intake valve opens and the fuel-air mixture is drawn into the cylinder (similar to drawing back the plunger on a hypodermic needle to allow fluid to be drawn into the chamber. When the piston reaches the bottom of the intake stroke, the intake valve closes, trapping the air-fuel mixture in the cylinder. •Compression The piston moves up and compresses the trapped air fuel mixture that was brought in by the intake stroke. The amount that the mixture is compressed is determined by the compression ratio of the engine. The compression ratio on the average engine is in the range of 8: 1 to 10: 1. This means that when the piston reaches the top of the cylinder, the air-fuel mixture is squeezed to about one tenth of its original volume. •Power

The spark plug fires, igniting the compressed air-fuel mixture which produces a powerful expansion of the vapor. The combustion process pushes the piston down the cylinder with great force turning the crankshaft to provide the power to propel the vehicle. Each piston fires at a different time, determined by the engine firing order. By the time the crankshaft completes two revolutions, each cylinder in the engine will have gone through one power stroke. •Exhaust With the piston at the bottom of the cylinder, the exhaust valve opens to allow the burned exhaust gas to be expelled to the exhaust system.

Since the cylinder contains so much pressure, when the valve opens, the gas is expelled with a violent force (that is why a vehicle without a muffler sounds so loud.) The piston travels up to the top of the cylinder pushing all the exhaust out before closing the exhaust valve in preparation for starting the four stroke process over again. Oiling System Oil is the life-blood of the engine. Oil is pumped under pressure to all the moving parts of the engine by an oil pump. The oil pump is mounted at the bottom of the engine in the oil pan and is connected by a gear to either the crankshaft or the camshaft.

This way, when the engine is turning, the oil pump is pumping. Engine Balance The Flywheel for a four cylinder engine produces a power stroke every half crankshaft revolution, an eight cylinder, every quarter revolution. This means that a V8 will be smother running than a four cylinder engine. To keep the combustion pulses from generating a vibration, a flywheel is attached to the back of the crankshaft. The flywheel is a disk that is about 12 to 15 inches in diameter. On a standard transmission car, the flywheel is a heavy iron disk that doubles as part of the clutch system. The flywheel uses inertia to smooth out the normal engine pulses.

DIESEL ENGINES[pic] A diesel engine is an internal combustion engine that uses the heat of compression to initiate ignition to burn the fuel, which is injected into the combustion chamber during the final stage of compression. This is in contrast to a petrol engine (known as a gasoline engine in North America) or gas engine (using a gaseous fuel, not gasoline), which uses the Otto cycle, in which an air-fuel mixture is ignited by a spark plug. The diesel cycle was invented by German engineer Rudolf Diesel and it has the highest thermal efficiency of any regular internal or external combustion engine due to its very high compression ratio.

Low-speed diesel engines (as used in ships and other applications where overall engine weight is relatively unimportant) often have a thermal efficiency which exceeds 50 percent. Diesel engines are manufactured in two stroke and four stroke versions. They were originally used as a more efficient replacement for stationary steam engines. The diesel internal combustion engine differs from the gasoline powered Otto cycle by using highly compressed, hot air to ignite the fuel rather than using a spark plug (compression ignition rather than spark ignition).

In the true diesel engine, only air is initially introduced into the combustion chamber. The air is then compressed with a compression ratio typically between 15 and 22 resulting into a 40-bar (4. 0 MPa; 580 psi) pressure compared to 8 to 14 bars (0. 80 to 1. 4 MPa) (about 200 psi) in the petrol engine. This high compression heats the air to 550 °C (1, 022 °F). At about this moment, fuel is injected directly into the compressed air in the combustion chamber. This may be into a (typically toroidal) void in the top of the piston or a pre-chamber depending upon the design of the engine.

The fuel injector ensures that the fuel is broken down into small droplets, and that the fuel is distributed evenly. The heat of the compressed air vaporizes fuel from the surface of the droplets. The vapour is then ignited by the heat from the compressed air in the combustion chamber, the droplets continue to vaporise from their surfaces and burn, getting smaller, until all the fuel in the droplets has been burnt. The start of vaporisation causes a delay period during ignition, and the characteristic diesel knocking sound as the vapor reaches ignition temperature and causes an abrupt increase in pressure above the piston.

The rapid expansion of combustion gases then drives the piston downward, supplying power to the crankshaft. Major advantages Diesel engines have several advantages over other internal combustion engines: • They burn less fuel than a petrol engine performing the same work, due to the engine's higher temperature of combustion and greater expansion ratio. Gasoline engines are typically 25 percent efficient while diesel engines can convert over 30 percent of the fuel energy into mechanical energy. • They have no high-tension electrical ignition system to attend to, resulting in high reliability and easy adaptation to damp environments.

The absence of coils, spark plug wires, etc. , also eliminates a source of radio frequency emissions which can interfere with navigation andcommunicationequipment, which is especially important in marine and aircraft applications. • They can deliver much more of their rated power on a continuous basis than a petrol engine. • The life of a diesel engine is generally about twice as long as that of a petrol engine due to the increased strength of parts used, also because diesel fuel has better lubrication properties than petrol. • Diesel fuel is considered safer than petrol in many applications.

Although diesel fuel will burn in open air using a wick, it will not explode and does not release a large amount of flammable vapor. The low vapor pressure of diesel is especially advantageous in marine applications, where the accumulation of explosive fuel-air mixtures is a particular hazard. For the same reason, diesel engines are immune to vapor locking. • For any given partial load the fuel efficiency (mass burned per energy produced) of a diesel engine remains nearly constant, as opposed to petrol and turbine engines which use proportionally more fuel with partial power outputs. They generate less waste heat in cooling and exhaust. As with petrol engines, there are two classes of diesel engines in current use: two-stroke and four-stroke. The four-stroke type is the " classic" version, tracing its lineage back to Rudolf Diesel's prototype. It is also the most commonly used form, being the preferred power source for many motor vehicles, especially buses and trucks. Much larger engines, such as used for railroad locomotion and marine propulsion, are often two-stroke units, offering a more favourable power-to-weight ratio, as well as better fuel economy.

The most powerful engines in the world are two-stroke diesels of mammoth dimensions. Two-stroke diesel operation is similar to that of petrol counterparts, except that fuel is not mixed with air before induction, and the crankcase does not take an active role in the cycle. Normally, the number of cylinders are used in multiples of two, although any number of cylinders can be used as long as the load on the crankshaft is counterbalanced to prevent excessive vibration. The inline-six cylinder design is the most prolific in light to medium-duty engines, though small V8 and larger inline-four displacement engines are also common.

Five cylinder diesel engines have also been produced, being a compromise between the smooth running of the six cylinder and the space-efficient dimensions of the four cylinder. CHAPTER THREE 3. 0 PROBLEMS ENCOUNTERED Below are some of the problems I encountered in the course of my industrial attachment: - initial difficulty in carrying out certain laborious jobs, such as tightening/ loosening of nuts and bolts - lack of technical know how on what to do without close supervision, during the first few weeks of attachment. Restricted relations with staffs, during my first few weeks of attachment, due to unfamiliarity - . initial difficulty in fitting into the workshops practices, and - Initial difficulty in navigating the workshop. 3. 1 CONCLUSION/ RECOMMENDATION Haven fully participated in the Students' Industrial Work Experience scheme(SIWES) programme, which allowed me to experience and practice first hand, the practical aspects of my chosen field of study; I wish to make the following recommendations; 1.

That the authorities' in-charge should ensure better welfare for students carrying out the SIWES programme. 2. The Industrial Training Fund officials and university based supervisors should be encouraged to pay more visits to thier students on attachment, so as to cut down cases of students refusing to participate in the training. 3. The various companies students are attached to should ensure better welfare for students attached to their various organizations. 4. The safety of students in the SIWES programme should be uppermost in the minds of managers in the various companies students in this programme are attached.

Hence safety gadgets/wears/equipments should be provided for students at places of attachment as this would reduce the risk of accidents. 5. The organizations should ensure that the students attached to their respective firms are properly motivated. 3. 2 REFERENCE - TECHNICAL KNOW HOW: A MANUAL FOR DELTA STEEL COMPANY TRANEES(1989) - WIKIPEDIA - APPLIED THERMODYNAMICS, BY MACKONKEY. (1990) ----------------------- Figure 1: Organizational Set-up for delta steel company Nigeria Limited Monitoring Unit Rolling mill

Board of Directors General Manager Audit Unit Legal Services/Company Secretary Assistant General Manager Purchasing Statistics/Planning S. M. S Administrative/FinancePellet plant Supporting Staff Preventive maitainance Over hauling workshop Welding/Fabrication vulcanizing Billing Cashier Packing Officer Accountant Cashier I Managing Director Workshop Supervisor Admin. Manager Purchasing/Supply Security Stores Secretary Supply Stores Officer Clerks Auto electrical Figure 3: Organ gram for the heavy duty department.