

ENGINES

By Roland Taylor

Because engines are, in a majority of cases, only component part of any piece of mechanised equipment – albeit the most vital one – their importance is often taken for granted by end users.

Only when they refuse to respond to the turn of the ignition key do they come under the spotlight. The modern engine is required to produce sufficient power to drive sophisticated transmission systems, hydraulics and cutting mechanisms. Development and technology over the last two decades have produced a compact, lightweight power unit, which has a cleaner and more efficient internal combustion process than its predecessor. However, this method of producing power still has a long way to go and in the meantime will continue to be one of the top items on the environmentalists' 'clean up your act' list.

Quality standard

It was back in the seventies that we began to see changes in engine design – these were mainly in small industrial units many of which were fitted to lawn mowers. Engine manufacturers, including some UK companies, had been supplying this market for a number of years, but it was the entry of Japanese companies that was to play a major part in it at this stage. What they bought to the marketplace was not so much innovation, but quality. Using the latest in precision manufacturing they produced extremely high quality engines. As a result, other manufacturers soon realised they had to respond quickly to the situation. This meant considerable investments in engineering processes and machine tooling. Unfortunately, as with the motor cycle industry, it heralded the demise of UK small engine manufacturers. The

over all outcome was that the quality of engines, regardless of where they were produced, greatly improved.

Throughout this period an increasing number of companies began producing outdoor-power-equipment, especially grass cutting machinery. Each new product launch set the competition the challenge to improve the concept further. Engine producers were under pressure to come up with new innovations such as increasing power output, but not weight or over-all dimensions. It is during this period we see some big changes.

All-round better starting

Early two-stroke engines had been anathema in the industry. They were often inefficient, difficult to start and keep running for long periods. The development of equipment that required this type of engine such as chain saws, brushcutters and hedge trimmers demanded changes. Today, the modern two-stroke is found on a wide range of machinery and gives very few problems.

With the introduction of electronic ignition contact breaker points were eliminated and the engine's performance and starting was dramatically improved. On larger machines electric starters were soon fitted as a standard feature.

Diesel development

One of the biggest changes was on the diesel engine front, especially the single cylinder air cooled units. Up to this point they had been heavy cumbersome units that were ideal where a steady output was required. On machinery, especially rotary mowers, they failed to respond fast enough when placed under load. The advent of a small fuel injector and redesigned combustion chamber, plus the use of lightweight alloys, eventually produced an engine that was on par with its petrol cousins.

Mainly because of the savings in fuel costs, increasing numbers of commercial users were demanding diesel powered machines and twin and triple cylinder water-cooled engines began appearing on larger grass cutting equipment.

Today, turbo-charged units are begin to appear as a result of manufacturers requiring high engine output without increased weight or dimensions. A super turbo-charger can be a mechanical unit or is more likely to be driven by the exhaust gases. These pass through an impeller which drives a compressor to produce the necessary pressure that is required to deliver fuel into the combustion chamber.

Legislation calls the tune

In recent years legislation, especially in America and some countries in Europe, has meant engine designers have had to find ways of reducing exhaust emissions, noise and vibration without affecting performance. Not an easy task, as the levels of these three factors are being continually reviewed and reduced. This again has led to a host of new developments.

Design

Most single cylinder petrol engines now have overhead valves. This configuration not only reduces the over-all size of the unit, it is said to also enable the fuel/air mixture easier access to the cylinder and likewise the burnt gases can escape faster – both contributing to a more efficient performance.

Lower emissions

The combustion process in itself is very wasteful and a lot of unburned fuel is passed into the atmosphere in the form of gases. These are Carbon Monoxide (CO), Hydrocarbons and Nitric Oxides (HC+NO). Reductions in their levels will depend on:

1. The efficiency of the engine's carburettor system. Rich fuel mixtures mean higher levels of emissions. Unfortunately lean mixtures result in loss of power and starting problems, so designers have had to find a fine balance between the two on the latest models. Poorly maintained or worn engines will also be emitting high levels of emissions.
2. Fitting a catalytic converter will reduce emission levels. These are becoming more commonly available for smaller engines, but are at present a relatively expensive addition. There are a number of

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Smokeless two-stroke oil only produces water vapour and carbon dioxide. The problem of noxious oil smoke is eliminated

types available and these generally resemble either a tight coil of corrugated cardboard or a sponge. The idea is to produce the biggest surface area possible in a small space. Ceramics or stainless steel forms the base structure to which is applied a coating of precious metal. Once the catalytic converter reaches operating temperature it incinerates the emissions turning them into non-polluting compounds.

3. In the case of two-stroke engines there are now available smokeless oils. These are produced from a gas. When the oil/petrol mixture is burnt in the combustion chamber it reverts back to its original form and is emitted from the engine as water vapour and carbon dioxide.

Noise

Improved exhaust systems, sound proofing materials and engine speed have a bearing on the amount of noise produced. Many manufacturers are now putting larger power units on machines so that even when under load the engine is working well within its capacity, thus keeping the noise emitted to a minimum. Incidentally this can also affect the amount of vibration produced.

Vibration

Synchronised balanced engine

components plus specialist mountings reduce the levels of vibration from an engine. On small power units fitted to chain saws, brushcutters and hedge trimmers, improved damping systems provide extra operator comfort.

All this mainly applies to new engines and equipment so what about all those machines that are already in operation?

There are a number of things that greenkeepers can do that will not only contribute towards a cleaner environment but help towards getting the optimum performance from their equipment with the minimum of engine downtime.

Re-powering equipment

The engine's performance is at the heart of any piece of equipment's performance. When this starts to deteriorate it can have the following affects:

- There is marked difference in the quality of finish
- Operations take longer
- Starting becomes difficult
- Fuel and oil consumption increase
- Emission levels rise
- More pressure is placed on the machine's other components
- The risk of a breakdown at a critical time is greatly increased
- Costs rise, frustration increases and efficiency declines.

At this stage there a probably

two courses of action that could be considered. Firstly the machine is replaced with the latest version, but funds may not be available for this solution. An alternative answer is to fit a new engine, but before taking this route there are a number of factors that need to be considered.

What is the condition of the rest of the machine? It is pointless to replace the power unit then find other components, transmission drives or cutting mechanism breakdown because they too are worn out.

The unit you are considering using will need to fit into the existing engine compartment without major modifications. Engine suppliers usually have list of suitable replacement power units plus any modification kits that may be necessary.

The advantages of taking this course of action are:

1. The latest model of engine is installed with all the latest benefits. It will carry a warranty.
2. Compared with replacing the whole machine it will be a very much less costly exercise.
3. The efficiency and performance of the machine is greatly improved.
4. The chances of any downtime are reduced.

Anyone contemplating fitting a new power unit should consult their local engine supplier who

can not only advise on the best course of action but also may have some attractive packages to offer.

Other environmentally friendly actions

- Maintaining equipment, especially engines, to the highest of standards will always pay dividends.

- Air filters. A dirty or blocked air filter makes the mixture richer and as a result exhaust emission rises dramatically. Fuel consumption rises and starting becomes difficult whilst performance deteriorates. Therefore, clean air filters regularly, especially in dry dusty conditions.

- Fuel. Use the correct two-stroke mixture. Clear up any spillage immediately as these are one of the worst forms of atmosphere pollution. Ensure carburettor settings are regularly checked as these are vital to maintaining the lowest levels of pollution possible.

- Oil. Keep at the correct level and change at the recommended intervals. Oil contributes towards keeping the engine running at the correct temperature. Use a smokeless oil in two-stroke mixtures.

- Cooling systems. On air-cooled engines the fins around the cylinder head need to be kept free of debris as blockages in these cause the engine to run hot and produce more pollution. Units, especially diesel, are generally water-cooled and the radiators on these need to be kept free of grass clippings and dirt.

- General. Regularly attend to any components that require greasing, oiling or adjustment. It reduces any strain placed on the power unit. In addition to reducing pollution, this is good machinery management and makes for a more efficient and productive operation.

The race is on to find an alternative to the internal combustion engine, but in the foreseeable future it is likely to continue as the major source of power for most professional amenity equipment. However, whilst the basic principle is unlikely to change, man's ingenuity will continue to find ways of refining the process and design of engines to meet the demands and requirements of both the legislators and users.