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REGULAR 91 PETROL — WILL IT AFFECT CHAINSAWS?

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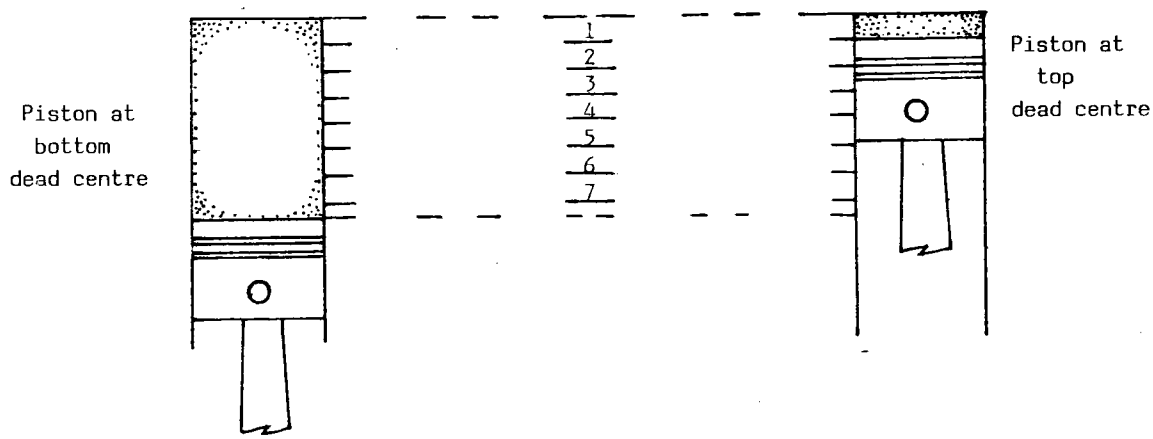
INTRODUCTION

A new regular fuel with an octane rating of 91 was introduced on 1 October, 1983. It replaced the previous regular (83 octane) which is no longer available. Regular 91 was introduced to improve efficiencies. Many engines do not need 96 octane, but 83 octane is too low. Regular 91 is a good compromise.

What are the consequences of this change for small engines such as those used in chainsaws? Before examining the meaning of the octane number, it is appropriate to review two features of internal combustion engines : "compression ratio" and "knock".

WHAT IS COMPRESSION RATIO?

This is the relation between the total volume inside the engine cylinder when the piston is at its greatest distance from the cylinder head (bottom dead centre, BDC), compared with the volume when the piston has travelled closest to the cylinder head (top dead centre, TDC).



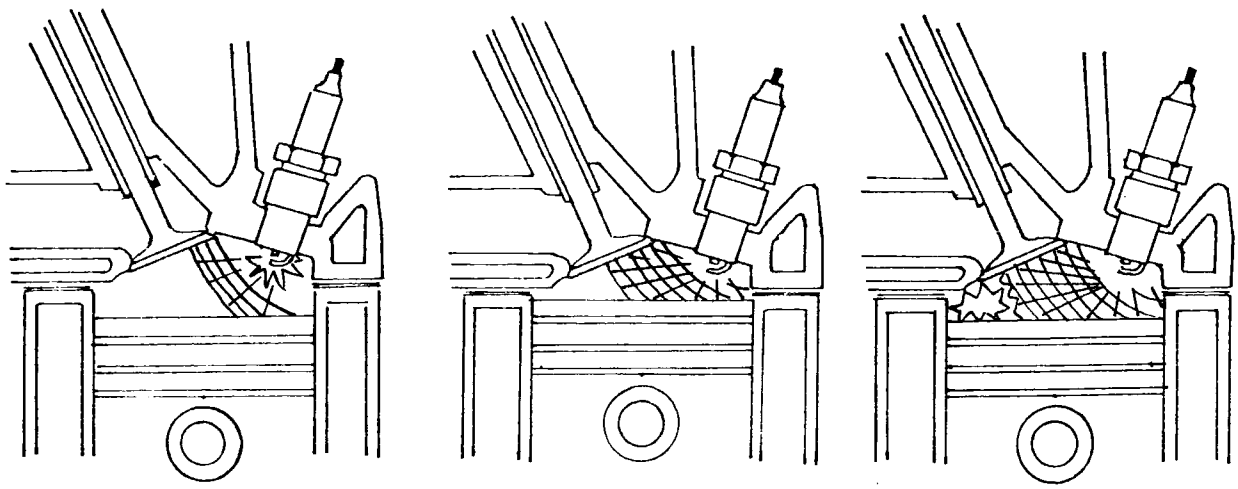
A compression ratio of 7.5 : 1

The higher the compression ratio, the more the fuel-air mixture is compressed and the higher the pressure inside the cylinder before the fuel burns. If the fuel burns properly, higher compression increases the power output of the engine because more of the fuel energy is converted into useful power.

WHAT IS "KNOCK"?

Each fuel has a limit on how much it can be compressed and still burn properly, when ignited in a spark-ignition engine.

For example, regular petrol may burn evenly in an engine with a compression ratio of 7 : 1 and supply a smooth flow of power. If it is used in an engine with a compression ratio of 10 : 1, it may burn unevenly and cause the engine to "knock". During "knock", fuel ignites next to the spark plug and pressure builds up on the unburned fuel as shown. This pressure then causes a spontaneous combustion of the unburned fuel, causing a small explosion or "knock". Fuel "knock" is a serious problem because it is hard on pistons, rings and bearings and results in a loss of power.



(1) Spark ignites fuel-air mixture

(2) Flame advances smoothly, compressing further the end-charge

(3) End-charge ignites violently producing a "knock"

OCTANE NUMBER

The basis for selection of a fuel with adequate antiknock is the octane number. The owner's manual for any spark-ignited engine should specify the minimum octane number that can be used.

The octane number is a method of comparing the antiknock qualities of fuels with standard test fuels. Fuels with less tendency to "knock" have higher octane numbers, with some, such as LPG, being higher than 100.

DIFFERENT OCTANE NUMBERS

There are in fact two octane numbers used :

Research = R

Motor = M

The numbers are used in many ways in different countries. Some use R or M only, some $\frac{R + M}{2}$, some $\frac{2R + 3M}{5}$, etc. The research and motor octane numbers are derived from different test methods; the same fuel gives different R and M numbers. Octane numbers quoted in New Zealand are research octane numbers.

Fuel octane numbers themselves vary from country to country, oil company to oil company, area to area and time to time. New Zealand is unusual in that there is no variation (other than slight production variation within specification).

CHAINSAW REQUIREMENTS

A review of a range of chainsaw handbooks has shown that most specify "regular" or "standard" fuel. Only one, Jonsereds, has been found to specify a recommended octane number ("approx. 85"). None recommended "super". All such handbooks have been printed overseas and do not apply specifically to the New Zealand situation. The terms "regular", "standard" or "low octane" are ill defined but for the northern hemisphere would usually mean something under 92 whereas "super", "premium" or "high octane" are over 92.

Each engine is designed for a minimum octane number. Anything over that does not improve its performance or detract from it. With wear, as the machine ages, its minimum octane number requirement does increase but the manufacturers' octane specifications would take account of normal wear over the life of the engine. Thus, where regular has been used in the past, a change can confidently be made to Regular 91.

ADDITIVES

In at least one instance, a European chainsaw handbook has suggested that high octane fuels should not be used as they are more likely to lead to damage to the carburettor gaskets. In Europe, alcohols or other chemcials are often used to raise the octane number, and this is why the fuel may affect gaskets. This is not a problem in New Zealand at present. Any changes, such as methanol addition, would be decided and publicly announced by the Ministry of Energy.

Some New Zealand operators who have run their chainsaws on super report more fouling of the spark plugs, particularly if the saw runs for long periods at idling or low speeds. The experience of several operators suggests that a little experimentation between different types of spark plugs can overcome this difficulty.

The new Regular 91 has the same lead content as super to improve octane number.

CHAINSAW COMPRESSION RATIOS

It was stated earlier when discussing "knock" that if regular is used in an engine with a compression ratio of 10 : 1, it may cause "knock". Many chainsaws now have compression ratios of 10 : 1 or more and yet the manufacturers still recommend regular - why is this ?

In a 2 stroke engine, the compression stroke of the piston starts below the ports. This allows some of the fuel-air mixture to escape which reduces the effective compression ratio to such an extent that the lower octane fuels can be used. The high power output of these small engines is achieved by high speed. The gas escape is the reason for reduced fuel efficiency in 2 stroke engines.

CONCLUSION

The main point concerning octane numbers is that"knock" damages engines and reduces efficiency. This is why it is important that the correct fuel be used. The logging industry need not be concerned about the introduction of Regular 91. For any chainsaw or other machine where Regular 83 has been used in the past, a change can confidently be made to Regular 91. Where super has been necessary in the past, the octane number requirement for that machine should be checked. Some engines do not require 96 octane fuel and can change to Regular 91 with no drop in performance.

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