# Killing your engine with kindness!

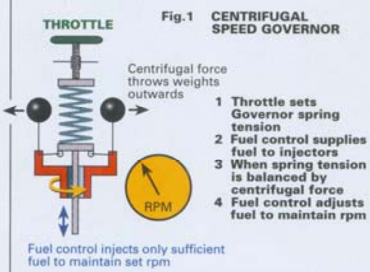
Pat and Lynette Manley explain how we may be shortening the lives of our engines.


It's the perverse nature of the wind that causes it to become light and blow from the direction of our destination at four o'clock on a Sunday afternoon. Our answer to this phenomenon is often to reach for the starter switch. Our trusty diesel engine takes us swiftly to our home mooring with our sails now full of newly found wind.

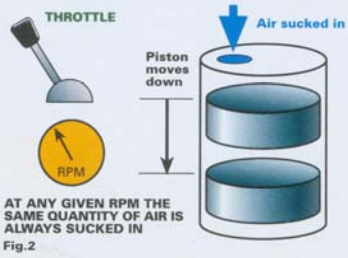
But this common action is not at all to the benefit of our diesel engine. Why not?

## The governor

The throttle on a marine diesel engine sets the speed at which the engine runs regardless of the load being experienced by the engine. To do this the throttle (or engine speed lever as it should be called) presets a centrifugal governor. (See figure. 1.)




This governor is rather like that seen on old steam engines – you may have seen them at fairgrounds on the steam-driven carousel. However in the case of a diesel engine the governor is fitted inside the fuel injection pump out of sight.



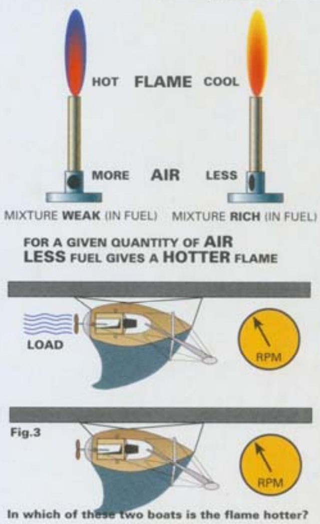

## Air intake

There's no device to control the intake of air into the engine. At any given speed the air consumed is always the same regardless of the load. Hence the air consumption at, say, 3000 RPM is twice that at 1500 RPM. (See figure 2.)

This means that at a particular engine speed the air sucked in by the engine is constant but the fuel injected varies with the load. Which is determined by the power required by the propeller to overcome the drag of the boat in the water and the air. Obviously this will vary with sea conditions and wind strength and even the cleanliness of the hull's bottom.

## Fuel to air ratio

As far as the marine diesel engine is concerned, this means that the fuel to air ratio, is variable. It follows that in a mixture of fuel and air which is burning, the more fuel relative to the amount of air, the cooler the flame temperature. Conversely, the less the amount of fuel relative to the air, the hotter the flame temperature. This is depicted by analogy to the Bunsen burner (Fig 3.)

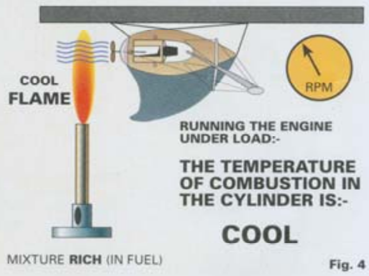



## No load – hot!

What we can see now, then, is that when there's little or no load on the engine, the mixture is weak and the flame temperature is hot. (Fig 4.)

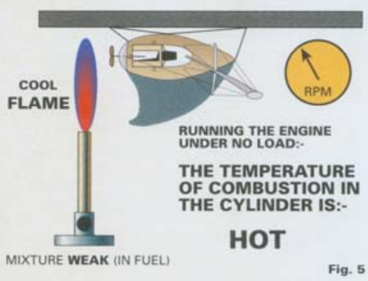
## Under load – cool!

The opposite is true when the engine is run under load; the flame temperature is cool. (Fig 5.) This may be the opposite of what you expect. Those with exhaust gas temperature gauges fitted to their engines may well question this statement because you generally see a rise in temperature indicated with increase of load. That's true, but it's an indication of the *average* temperature of the flame and what concerns us is the temperature of the *hottest* part of the flame.




## Diesel ignition

We must now look at the principle of the diesel engine. There's no spark to ignite



the mixture of fuel and air. Ignition is achieved by compressing the air rapidly so its temperature rises above the ignition point of the fuel, about 320°C. Fuel is then injected into the cylinder and ignition takes place. Any leakage of air past the piston will reduce the temperature rise. In a diesel engine leakage is prevented by deliberately roughening the inside surface of the cylinder by means of fine spiral grooves. (Fig 6.)

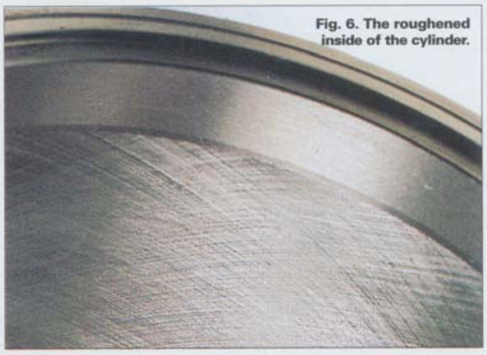


Fig. 6. The roughened inside of the cylinder.

This roughness holds lubricating oil, sprayed from below the piston, not only to reduce friction but also to prevent leakage of air past the piston rings.

And now we come to the bitter bit.

Remember we found that when we run the engine under no load, the flame temperature was high? Well this high temperature will carbonise the oil in the roughened cylinder walls and will, over a period of time, completely fill them with what looks like varnish.

## Glazing over

This is known as cylinder-bore glazing and is caused by habitually running the engine under no load. The air blowing past the pistons will slowly increase, reducing the temperature achieved by compression of the air until the engine will no longer start in the cold. Further deterioration will occur until the engine will no longer start at all. (Fig 7.)

It's often said that cylinder bore glazing is due to running the engine too cool. Provided that the engine is run for long enough for it to warm up and the thermostat in the cooling system to open, the engine won't be running too cool even under no load conditions. In fact running too cool produces problems other than cylinder bore glazing, but these occur only when we run the engine for insufficient time to let it warm up before we shut it down again. No, prevention of cylinder bore glazing is prevented by not running our engine under no load except when warming up or cooling down.

## How can we prevent it?

First let's understand that we can as easily run under no load at full engine speed as at idle. If the propeller is stationary and not moving water the engine is running under no load. It's overcoming only its own internal resistance. Engine speed is not an indication of load.

## Put the kettle on?

How often do we see a crew getting on their sailing boat and more or less immediately starting the engine to warm it up? Off come the sail covers and then maybe they prepare the lines for slipping. *"Who wants a cup of tea?"*... Twenty minutes later the engine is still running at idle. Is this a familiar picture? The engine needs only a couple of minutes at idle to warm it up sufficiently for use.

**"The engine needs only a couple of minutes at idle to warm it up sufficiently for use."**

## Charge the battery

Battery charging is often a problem with a sailing yacht and one frequently sees the engine being run for this purpose. If at all possible do this under way and under power, or, if moored to a pontoon, with the engine in gear and the propeller moving water – 1800 RPM is probably a good speed for this. Make sure that you're properly secured to the pontoon and that your propeller wash won't cause a nuisance. A 50 amp alternator is producing less than 1 horse power and with losses, will use only 2 or 3 horse power to drive it.

This is insufficient to provide a reasonable load for the engine. Larger boats should fit a diesel generating set. In this case the power of the engine is matched to that required to drive the generator. I understand that the British Steel yachts (now BT) are being re-engined and are

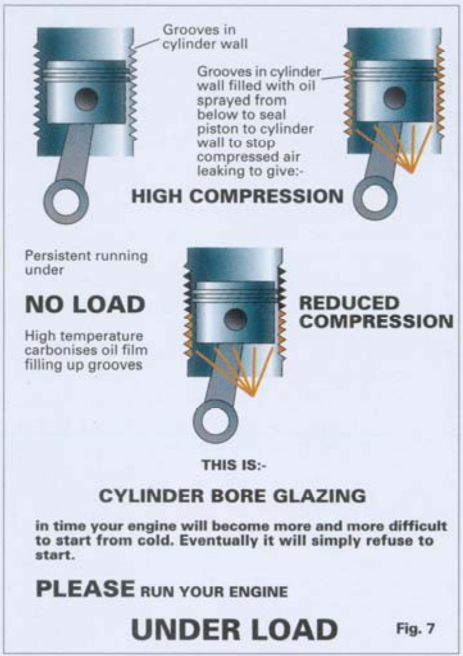


Fig. 7

being fitted with generating sets. The majority of their running time has been the daily recharging of their batteries whilst racing.

## Engine size

The yacht should be fitted with an engine of the correct size. This seems obvious but you see adverts for new boats where engines of different powers may be specified. As a guide the engine should be of a power rating such that at the boat's normal cruising speed about 70% to 75% of the engine's power is being used. This ensures there's enough power in reserve for extreme conditions but allows the engine to run under sufficient load under normal operation.

Remember that we're talking here about power and not RPM. At any RPM the fuel control system will inject sufficient fuel to deliver only enough power to overcome the load. Neither the throttle position nor the RPM are any indication of the power being developed by the engine.

## Twin engines

On a twin engine boat running at slow speed, as long as it doesn't affect the steering, you can shut down one engine. Some twin-engined boats have a power steering pump fitted to only one engine!

Don't run the engine 'just in case' in neutral, unless there really is a good reason for doing so.

## Motor sailing

And now we return to the opening paragraph. Motor sailing to windward in light airs. (Fig 8.)

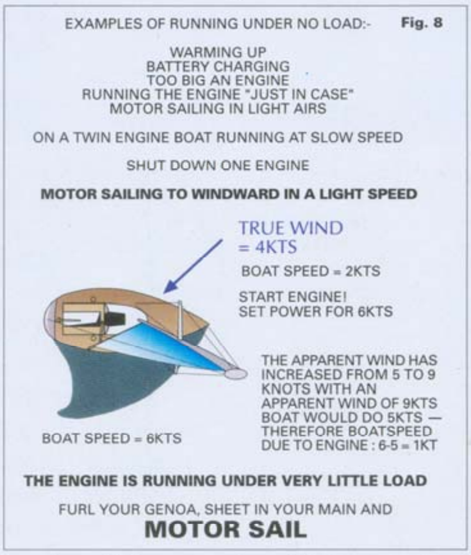
In the example shown we have a true wind of 4 knots at 45° off our bows. On the assumption that we can make 2 knots under these conditions we would experience an apparent wind of 5.5 knots. If we now start our engine and set our throttle to give 6 knots we will experience an apparent wind of 9.2 knots. This could well be sufficient to drive us at, say, 5 knots. Obviously these figures will depend on the particular boat but are not an unreasonable estimate for a modern yacht of reasonable performance under sail.

## Engine contribution

So what have we now? The yacht is making 6 knots. The new apparent wind is providing, say, 5 knots of this. Therefore the engine is contributing only 1 knot's worth of power and I suggest that, in these conditions, the engine is being run under almost no load.

I am sure there will be many who will dispute this statement, but look what happens to a yacht sailing in light airs when she encounters a puff of wind. The yacht will accelerate and when the puff passes, provided you don't mis-set the sails or are heavy handed with the helm, you'll keep on going with the new found apparent wind providing the power. Those readers who are familiar with racing dinghies will know what I'm talking about.

Fig. 8




## Conclusion

When motor-sailing in light airs get rid of the headsail, sheet in your mainsail and give the engine some 'welly'. Long may you avoid cylinder bore glazing. ●