

I read on many forums about 0w and 5w oils being too thin. I will try to explain it without getting over technical and we'll go from there.

0w-40, 5w-40, 10w-40 and 15w-40 are all the same thickness (14cst) at 100degC.

Centistokes (cst) is the measure of a fluid's resistance to flow (viscosity). It is calculated in terms of the time required for a standard quantity of fluid at a certain temperature to flow through a standard orifice. The higher the value, the more viscous the fluid.

As viscosity varies with temperature, the value is meaningless unless accompanied by the temperature at which it is measured. In the case of oils, viscosity is generally reported in centistokes (cst) and usually measured at 40degC and 100degC.

So, all oils that end in 40 (sae 40) are around 14cst thickness at 100degC.

This applies to all oils that end in the same number, all oils that end in 50 (sae 50) are around 18.5cst at 100degC and all oils that end in 60 (sae 60) are around 24cst at 100degC.

With me so far?

Great!

Now, ALL oils are thicker when cold. Confused? It's true and here is a table to illustrate this.

SAE 40 (straight 40)

Temp degC.....Viscosity (thickness)

0.....	2579cst
20.....	473cst
40.....	135cst
60.....	52.2cs t
100.....	14cst
120.....	8.8cst

As you will see, there is plenty of viscosity at 0degC, in fact many times more than at 100degC and this is the problem especially in cold weather, can the **oil** flow quick enough to protect vital engine parts at start up. Not really!

So, given that an sae 40 is 14cst at 100degC which is adequate viscosity to protect the engine, and much thicker when cold, how can a 0w **oil** be too thin?

Well, it can't is the truth.

The clever part (thanks to synthetics) is that thin base oils can be used so that start up viscosity (on say a 5w-40 at 0degC) is reduced to around 800cst and this obviously gives much better flow than a monograde sae 40 (2579cst as quoted above).

So, how does this happen, well as explained at the beginning, it's all about temperature, yes a thin base **oil** is still thicker when cold than at 100degC but the clever stuff (due to synthetics again) is that the chemists are able to build these oils out of molecules that do not thin to less than 14cst at 100degC!

What are the parameters for our recommendations?

Well, we always talk about good cold start protection, by this we mean flow so a 5w will flow better than a 10w and so on. This is why we recommend 5w or 10w as the thickest you want to use except in exceptional circumstances. Flow is critical to protect the engine from wear!

We also talk about **oil** temps, mods and what the car is used for. This is related to the second number xw-(XX) as there may be issues with **oil** temperatures causing the **oil** to be too thin and therefore the possibility of metal to metal contact.

This is difficult to explain but, if for example your **oil** temp does not exceed 120degC at any time then a good "shear stable" sae 40 is perfectly capable of giving protection.

"Shear stability" is important here because if the **oil** shears it thins and that's not good!

However, if you are seeing temperatures in excess of 120degC due to mods and track use etc then there is a strong argument to using an sae 50 as it will have more viscosity at these excessive temperatures.

There are trade offs here. Thicker oils cause more friction and therefore more heat and they waste power and affect fuel consumption so it's always best to use the thinnest **oil** (i.e. second number) that you can get away with and still maintain **oil** pressure.

There is more but this post is too long already so lets keep it to basics.

Cheers  
Simon

Here are the figures for viscosity in cst (centistokes) and temperature for different oils.

The first numbers are sae numbers for straight 30,40,50 and 60. The second set of numbers is for various multigrades as they are obviously thinner when cold than straight oils due to lighter viscosity basestocks being used.

#### Monogrades

DegC.....	0.....	20.....	40.....	60.....	100.....	120
Sae 30....	1600....	315.....	95.....	39.....	11.....	7...
Sae 40....	2579....	473.....	135.....	52.....	14.....	9....
Sae 50....	4592....	771.....	205.....	75.....	18.....	11..
Sae 60....	7865...1218...	303.....	105.....	24.....	14..	

#### Multigrades

DegC.....	0.....	10.....	40.....	100
0W/20.....	329.....	181.....	46.....	9..
5W/40.....	811.....	421.....	92.....	14..
10W/50.....	1039.....	539.....	117.....	18..
15W/50.....	1376.....	675.....	130.....	18..
20W/50.....	2305.....	1015.....	148.....	18..

These two graphs demonstrate the fact that a monograde is the same thickness at 100degC as a multigrade of the same sae number but the distinct benefits that a multigrade brings at lower temperatures. This is obviously benefits cold crank wear as the rate of flow of multigrades is much better at lower temps.

There is no temperature where oil suddenly starts to flow better. A 10W/40 for example will flow between -25C and 100C or more, but there is a big difference in the rate of flow (True viscosity at -25C is about 7000 Centistoke(cSt) units, dropping to 14 at 100C. 'Viscosity' is just another name for 'rate of flow'.

The question is, at what (sump) temperature is the oil at a viscosity that suits a modern high-RPM engine.

Present day designs seem happy on an oil viscosity of 10 to 15 cSt. (But many are OK on less than 10.) 30cSt is too high at high RPM. It can lead to foaming, air entrainment and cavitation.

.....Temp. for 30cSt (Deg. C).....Temp. for 15cSt.....Temp. for 10cSt

5W/40.....	71.....	90.....	117.....
10W/40.....	70.....	99.....	118.....
10W/50.....	80.....	109.....	130.....
10W/60.....	89.....	119.....	142.....

This shows that a 5W/40 or a 10W/40 is perfectly adequate for all engines except those that run an unusually high temperatures.

Also, a thick oil can lead to trouble unless properly warmed up before high RPM is used.

I hope that these figures at least give some insight to what actually happens to the oil inside your engine at different temperatures.

Cheers  
Simon