

What does 'clean' mean?

A new standard originating in the German automotive industry sets out just how clean 'clean' is. For those supplying onto the automotive industry, it will become increasingly common. *Machinery* reports

For many companies, component cleaning has generally been regarded as a necessary chore rather than a process that requires much thought or attention. Even when companies have recognised the need for specific levels of cleanliness it has been difficult for them to clearly characterise what they are trying to achieve.

All that is now changing. Companies should already be aware that EU-driven legislation on volatile organic compounds (VOCs) is in October 2007 going to outlaw what many regard as normal practice. Far fewer are likely to be aware of a new standard, VDA-19, originating in the German automotive industry, that makes it much easier for customers to specify exact cleanliness standards.

The Surface Alliance, made up of four German companies – LPW, EMO, Hoesel and Mecanolav – can offer systems for almost any cleaning requirement. It has already built up a wealth of experience in dealing with the VDA-19. In the UK, the Surface Alliance is represented by The Engineering Technology Group, Southam, Warwickshire, which represents machine tool manufacturers Chiron and Nakamura-Tome, and it has appointed industry expert Helmut T Dehnert as sales manager for these products.

Thorsten Wardin of LPW explains that VDA-19 and its international equivalent ISO – DIS 16232 grew out of the need within the automotive industry to control the levels of particulate contamination of 'function



relevant' parts.

"Particles of dirt in, for example, the fluid circuits of an engine can cause all sorts of problems: leaks, difficulties in assembly and mechanical breakdowns caused by faults such as blocked injector jets or failed oil pump bearings. But in the past there was no common way to measure or specify what a certain level of cleanliness meant," he confirmed.

SOURCES OF DIRT ARE MANY

Dirt can come from a wide variety of sources and might include chips from the machining process, oxide particles, bits of plastic, fibres from clothing and even dust from the air. Different types and sizes of particles cause different problems. A bit of fibre probably won't damage a bearing, but it could block an injector jet; so each component will have a critical level of cleanliness to function correctly. The designers of the

part will try and specify the type, size and amount of dirt that would cause a problem in, say, the oil pump – but parts don't operate in isolation. If the crankcase isn't clean to the same specification, there could be problems.

"Debris from one component could easily destroy a component in another part of the system," says Mr Wardin, "so you need to know what level of cleanliness each part can stand and to what level it has been manufactured. To do that you have to make sure that all the parties are talking about the same thing. That's why you need a standard like VDA-19 for testing and describing levels of cleanliness."

The standard has to cover a very wide range of sizes and types of components, from ball bearings to engine blocks, and also needs to allow people to characterise cleanliness by reference to a number of different parameters. For some the weight of

contamination may be the key factor, and for others it may be the maximum particle size or type, and they may want to express this per component, per unit volume or per unit surface area.

So VDA-19 doesn't offer a simple recipe but rather provides a standard 'kit of parts' for users to build up the specification that suits their needs.

The standard starts off by specifying the various ways in which the sample can be taken from the component. Options cover ultrasonic cleaning, spraying, flooding and shaking the component in the solvent. The sample is then filtered and the filter dried. The dry residue can then be weighed and examined in an optical microscope or a scanning electron microscope. The standard also gives procedures for analysing the composition of the particles on the scanning electron microscope and using an image analysing system to measure particle number and size.

The results (or a specification) can then be described in terms of the total weight and/or by particle size distribution. If it is just quoted in terms of weight, it is quoted uncodified per component, per unit area (1,000 cm²) or per unit volume (100 cm³). So a high weight – say 10 mg per part – means that the particulate residue is not that critical and a low weight – say 0.5 mg per part means that it is critical.

Alternatively, you can count the particles and produce a Component Cleanliness Code (CCC). This is specified using a combination of letter and number codes: a letter code describing whether the sample is per component, unit area or unit volume; a letter code describing each particle size range; and a numeral quantifying the number of particles in each range.

So a Component Cleanliness Code (CCC) might look something like: CCC = V (E12/F12/G8/H8/I8/J0/K00), which means a value determined with respect to unit volume (V), with no requirement to determine particle numbers below size E (50 to 100 microns) and no particles of size K

allowed (over 1,000 microns).

Incidentally, '00' means none and '0' means 0 to 1 particles allowed.

This level of detail means that it is possible for companies to be very specific about the levels of cleanliness they are asking for. But many suppliers don't really understand what this means and don't know what level of cleanliness they are currently achieving. The danger is that they may commit themselves to something that is impossible, or so expensive to achieve that they can't make a profit on the job.

This is why it pays to call in the experts, Mr Wardin says. "Ideally, companies should talk to The Surface Alliance before they have signed a contract so that we can tell them if it is possible and how it can be done. There are still some really stupid and unreasonable specifications out there because designers don't always understand the implications of what they are asking for. If we don't think it can be done economically, we will say so and they can either turn the job down or negotiate with the customer on the basis of what we think can be achieved. On the other hand, it might be that they are working to a much higher standard than the specification calls for and we can provide them with a more economical cleaning process."

"To sum up," Mr Wardin offers: "It's important in the first place that people in the UK are aware that the laws are changing as European law is applied. They won't necessarily be able to do things the way they have been doing them, and this will force them to change their existing technology. And on top of that, the more they have to do with German, or indeed international, automotive companies, then the more they will come across VDA-19 and cleanliness requirements that they might not even have heard anything about yet. This is the future and everybody will have to face it." □

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