

# High Rate of Precision

## A sharp pair of eyes quantifies potentially harmful deposits

A small team of SwRI technicians uses a unique instrument to rate precise gradations of surface distress and to quantify potentially harmful deposits left on engine parts. Team members use these unique instruments daily, train continually and, to maintain international acceptance, must “recalibrate” annually during mandatory industry workshops.

The instrument? The highly evolved human eye. So far, the best machines developed can’t do this job any better than the eight human raters of the Fuels and Lubricants Research Department of SwRI’s Automotive Products and Emissions Research Division.

At least for now, “the eye is better than a machine,” said George Castillo, an SwRI rater for the past 21 years.

Raters not only detect deposits such as varnish and sludge on auto parts, they must also assign a numeric value to their intensity. To do that, they compare the deposit on the part with a standard rating scale developed by the Coordinating Research Council (CRC). This scale, which resembles something a homeowner might use to select wall paint, depicts 10 shades of color, ranging from lighter to darker shades, which the rater must match to the deposits on the part being rated. The intensity of these shades of color is evaluated, not the color itself, since varnish deposits, for example, take on various hues. Using this 0 to 10 merit scale, a 10 represents a part devoid of deposits, while a lower number represents increasing levels of deposits.

But rating isn’t as easy as matching the closest shade of color. The technician also must mentally divide each shade on the scale into 10 more increments to obtain the finest possible match to the deposit on the part.

In many cases the difference between an acceptable deposit level and an unacceptable one is a matter of a few tenths of a unit. One of the ironies of the fuels and lubricants testing business is the fact that literally millions of dollars are spent on high-technology testing with state-of-the-art control and data acquisition equipment, yet the final determination of acceptability is the subjective rating applied by these experts.

Not everyone has the ability to be a rater, and those who accept the challenge require up to six months of training on a single test type before producing reliable and acceptable ratings.

However, raters must be proficient at more than just one test.

“I guess we could probably name a minimum of 75 different types of tests that we rate,” said Garland Tschirhart, a rater with 32 years’ experience. “Field ratings (examinations conducted outside the laboratory) add to the list.”

When one considers such a variety of tests — with subjective ratings required on parts that include pistons, gears and oil pans, from engines that power everything from weed-whackers to locomotives, Castillo and Tschirhart estimated that a realistic training period for all-around proficiency might be more like three years. Included in this training is attendance at workshops, where industry raters are refocused to consensus opinion. This allows for reproducible ratings among laboratories and the continued evaluation and modification, if necessary, of the CRC rating scales.



Most rating follows a breakdown examination method in which the part is broken down or divided into sections for careful examination of each individual section.

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SwRI’s eight raters (Pat Garcia, George Castillo, Jesse Rodriguez, Frank Lopez, Art Sanchez, Robert Elizardo, Ralph Viera, and Garland Tschirhart) have a combined experience of more than 120 years and routinely perform more ratings than any other fuels and lubricants research organization in the world. Regardless of the vast experience of these raters, there are continuing internal quality checks, including re-examination of the raters’ own work from months or years past.

Most rating is done in a laboratory setting under strictly controlled conditions of light and temperature to ensure uniformity. However, this is not always the case, as a client’s call for a field rating of engine or equipment parts can bring the need for a quick temporary relocation thousands of miles away to a remote mine, an airport hangar or the engine room of a giant ocean freighter.

During the past 40 years, there have been several attempts to develop electronics using concepts such as machine vision and robotic applications to replace the human rater. Some limited success has been achieved in bench tests, but none has succeeded in providing the flexibility, reliability, accuracy and adaptiveness of the trained human eye.

With the current move to globalize the use of CRC rating techniques into fuels and lubricant test procedures used in other parts of the world, it would appear that the extremely specialized and important talents demonstrated by raters of SwRI will continue to be needed far into the future. ❖

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