



Today's diesels feature DEF for NOx reduction. If you service diesels, you need a method of checking DEF quality. A refractometer designed specifically for DEF is an essential tool.

OTC DEF refractometer

Checking a customer's diesel exhaust fluid concentration

By Mike Mavrigian

Starting with 2010 models, all diesel-powered vehicles in the U.S. feature a DEF system (diesel exhaust fluid). The purpose of the DEF is to reduce NOx emissions utilizing a management-controlled mist injection of DEF into the exhaust stream. DEF is a mixture of purified urea and purified water (refer to the May/June 2013 issue of Auto Service Professional for details regarding DEF systems).

Contaminated or improper-mix DEF can cause operational problems in these systems.

In order to verify the purity of a customer's DEF supply, a simple method involves the use of a refractometer.

While this type of tool has been used for decades for testing engine coolant, OTC now offers a refractometer specifically designed for the testing of DEF, available under part number 5025.

OTC's 5025 DEF Refractometer is a portable, precision optical instrument designed to measure DEF concentration.

When a liquid sample is placed on the tool's prism, the light passing through the sample is bent (refraction). The more

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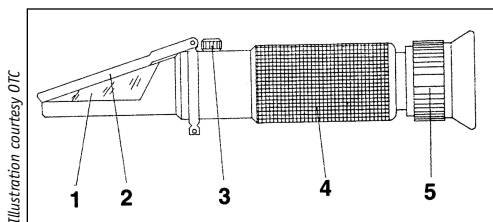
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concentrated the liquid, the more the light will bend. The refractometer features a reticle scale that is viewed by looking into the magnified eyepiece.

With no liquid on the prism, the eyepiece view will reveal a light blue background with the graduated scale. The background is an even shade of blue from top to bottom.

Once a drop of sample liquid is placed on the prism, a darker “shadow” will appear at the top of the scale.

The point at which the bottom edge of the shadow hits the scale indicates the condition of the DEF sample.



1. Prism. 2. Cover plate. 3. Correction screw. 4. Mirror tube (holds reticle scale). 5. Eyepiece (focusing ring of diopter).

Operating instructions

The refractometer must first be set up in terms of eyepiece focus and calibration.

1. With the prism aimed at bright light, and while looking through the eyepiece, adjust the focusing ring of the diopter until the reticle scale is sharp and easily viewed (just as you would adjust a rifle scope or binoculars to suit your eye).

2. Now, the refractometer must be adjusted (calibrated) to a zero point.

- Open the front plastic cover plate.
- Using the supplied cloth, clean the glass to remove any smudges, etc.
- Place one or two drops of pure distilled water onto the surface of the prism (hole the tool level to prevent the water from running off).
- Close the cover plate and press it lightly.
- While looking through the eyepiece, observe where the bottom of the shadow line rests.
- Using the small screwdriver provided with the kit, turn the adjustment screw



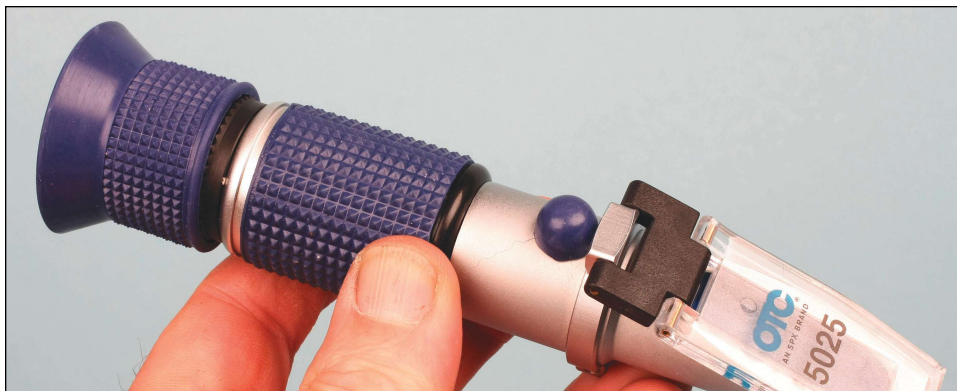
Diopter adjustment is handled by rotating the eyepiece to suit your eye.



(located on top of the tool, behind the plastic cover hinge) until the bottom of the shadow line meets the “waterline” mark at the bottom of the scale view. This establishes a reference line for pure water. The tool is now ready for DEF concentration.

3. Open the cover plate and wipe the water from the prism and the underside of the cover, using the kit’s clean cloth. The prism and cover must be clean and dry.

4. Using the plastic dropper from the kit, place one or two drops of the customer’s DEF onto the prism.



The textured surfaces on the body and eyepiece adjuster provides superior grip.

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5. Close the cover and press it lightly.
6. View the scale and note where the bottom of the shadow line intersects with the percentage scale. The ideal, or target reading is 32.5%. If under, more DEF concentration is needed. If over, the urea concentration is too high. In reality, most DEF purchases will consist of premixed containers. If the concentration level is incorrect, either the DEF was of low quality or the tank has become contaminated. The DEF tank should be drained and refilled, only with a known high quality DEF.

NOTE: To ensure consistent readings, the refractometer should be zeroed with pure water and DEF-tested at the same ambient temperature.

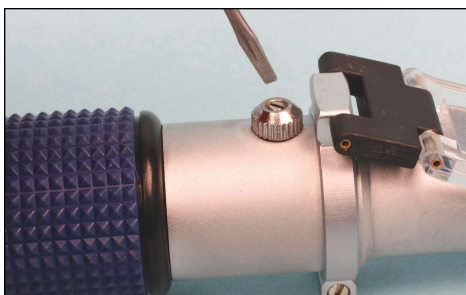
The OTC 5025 kit includes:

- A plastic storage case with form-cut foam.
- Refractometer (range of 15% to 40%; resolution of 0.5%).
- Soft cloth.
- Long-neck dropper.
- Screw driver (for calibration adjustment).
- Small plastic bottle for pure water.
- Pointer.

After unpacking our sample tool kit, I checked to make sure that the prism was clean. I aimed the refractometer at a bright light and looked through the eyepiece, only to see a big fuzzy blue blur. As I rotated the eyepiece (diopter adjustment), the scale began to be discernable, and within a few gradual turns, the black reticle scale was very sharp and easy to read against a light blue background.

The body (and eyepiece barrel) is coated with a textured material (rubber or elastomer) that provides excellent non-slip grip. The eyepiece is clear, and the eyepiece shade cup nestles comfortably against your eye socket to eliminate stray light while viewing.

The adjustment screw (to be rotated while zeroing the pure water reference calibration) is protected by a soft blue rubber cap. Simply pop the cap off for screw access. I suggest replacing the cap after adjustment,



After popping off the rubber cap, use the supplied screwdriver to adjust the scale for zero calibration to pure water.

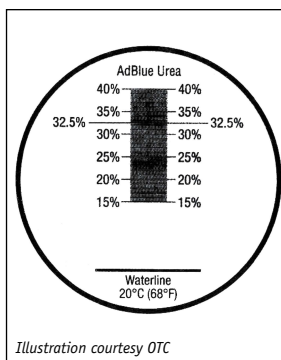


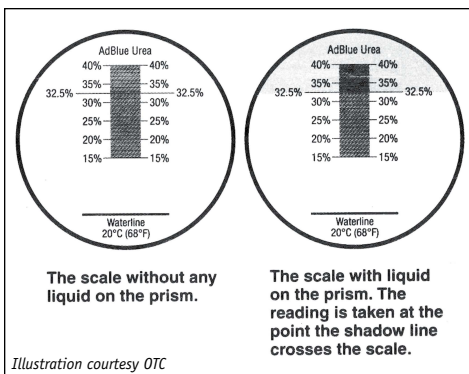
Illustration courtesy OTC

After placing one or two pure distilled water onto the prism, close the cover and turn the adjuster screw until the bottom of the shadow line meets the water line (zero) mark at the bottom of the scale.

simply to protect the small slotted screw from dust and contamination during handling and storage (don't toss the cap).

Setting zero calibration was easy. I applied two drops of pure distilled water onto the prism, closed the plastic cover and pressed it gently, and while looking through the optical viewer, rotated the adjuster screw until the shadow line met the lower water line mark on the scale screen. This was easy to view and was a no-brainer. The viewing area is very clear and easy to view, with no bothersome "black-out" that would require nudging it around your eye to obtain a clear view. I experienced a clear view of the background and scale at all times, once I had adjusted the diopter to suit my eye. NOTE: It's important to use only pure distilled water to set your zero calibration. Tap water, and even spring water can contain chemicals that may result in incorrect calibration.

After wiping the prism and the underside of the plastic cover with the kit's soft cloth, I applied two drops of a quality brand of DEF



After wiping and drying the prism and underside of the plastic cover plate to remove the water used during calibration, apply one or two drops of DEF onto the prism. Close and press the cover plate. Properly concentrated DEF should result in the bottom of the shadow line to read 32.5%. Be sure to clean the prism and cover plate after your reading, wiping with clean distilled water and drying to remove any traces of the DEF before storing.

to the prism, closed and pressed the cover and read the scale. The shadow line was easy to see, and hit the 32.5% mark (this verified

that the DEF I purchased does indeed have the proper concentration as required).

Granted, high-tech digital DEF meters are also available that may be quicker to use, but they cost several hundreds of dollars and require batteries. The simple OTC DEF refractometer needs no batteries, and costs a bit over \$100 or so (depending on where you buy it, of course).

NOTE: As simple as it may appear, a quality refractometer is a precision instrument and should be treated accordingly. Once your check has been completed, clean and dry the prism, and pack it away in the storage case, along with the dropper, water bottle and cloth. If the tool breaks or malfunctions, it will only be due to mishandling or improper storage. ●

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