

Application Brief

EGauge Model 4590

Soil Density Gauge

July 2015

Introduction

The new generation of Troxler nuclear gauges is now available! The new EGauge, Model 4590, offers reliable, precise soil density measurements without the hassles of maintaining a radioactive materials license, training operators, wearing monitoring badges and dealing with regulatory paperwork. The source activity in the Model 4590 is approximately 100 times less than a typical 3400 series nuclear density gauge. This gauge does not fall into the category of a "Specifically Licensed" gauge, as the nuclear gauges historically have. The exposure rate to the operator from this model is also 100 times lower than experienced with other nuclear gauges. The EGauge still uses the nuclear technology which has proven to be a reliable method for soil density quality control measurements over more than 40 years of use around the world!

Traditional Methods

The nuclear gauges have been the industry standard for density testing and moisture testing in construction for many years. For the past fifteen years, non-nuclear gauges have been introduced and available; however, these gauges have not been in wide use. The nuclear gauges have proven to have the highest accuracy. Additionally, many agencies and states have adopted the nuclear gauge as their standard.

The original Troxler 3400 series nuclear gauges, in use today, have provided for many years a reliable and safe method for measuring the density of compacted construction materials in the field. However, the 8 mCi Cesium 137 source and the 40 mCi Americium 241 source contained in the traditional gauges used to measure soil density and moisture, cause these gauges to fall into the category of a "Specifically Licensed" product in the United States. The specific license issued by the Nuclear Regulatory Commission or an Agreement State agency requires safety training for all gauge operators, several documents to be kept on file, strict storage requirements and may require TLD badge monitoring service for all operators. The EGauge Model 4590 is exempt from nuclear regulatory licensing in the United States; therefore, these restrictions no longer apply to this gauge.

Troxler Technology

The Troxler EGauge, nuclear density gauge utilizes a low activity gamma ray source to perform the density measurements in much the same manner that we have been doing for over 45 years. The Cesium 137

source and the sensitive detector work together to provide reliable density readings which are as good as the nuclear gauge the market has historically relied upon.

The operation of the Model 4590 is similar to that of the traditional Troxler nuclear density gauges and therefore, the experienced operator can use the gauge with little additional training. A standard count is performed allowing the gauge to account for background radiation and source decay. Unlike previous gauges, the standard count does not require the use of a polyethylene block. The user simply performs the standard count right on the soil after preparing a predrilled hole in the soil at least 2 inches deep. When performing a measurement, a 15 second stabilization count occurs. After lowering the rod to the appropriate depth for the measurement, a two minute density reading is performed followed by a 1 minute background measurement. All of the gauge menus are very simple to follow, resembling the traditional Troxler 3400 series gauge menus.

Due to the very low source activity it is necessary to closely monitor background radiation. Anytime the material measured changes or when moving to a new jobsite, it is necessary to perform a background count at the measurement location over the prepared hole. It is also critical that any known sources of radioactive material be kept at least 30 feet (10 meters) away during standard counts, background counts and measurement counts (for example: other nuclear gauges). Density measurements can be performed between 2 inches (5 cm) and 8 inches (20 cm) in depth, there is not a backscatter measurement position. The EGauge is currently offered as an 8 inch capable density gauge for soil density measurement with a non-nuclear moisture probe accessory which measures moisture at a depth of 4-5 inches.

Moisture Probe Accessory

The Troxler Model 6760 Moisture Probe is provided with each EGauge. The probe measures the moisture of the soil in the same prepared hole as used for the density measurement. The moisture measurement method uses electromagnetic technology which has been used for moisture measurements for several decades. The probe is inserted into the prepared hole. This measurement can be done before or after the density measurement, the operator selects the order in the software. The moisture probe communicates with the EGauge using a cable or a Bluetooth connection (if the gauge is equipped with the Bluetooth adapter). If no moisture measurement is to be performed, this option can be deactivated. Also if the operator wishes to use another method to determine moisture, this value can be entered using the keypad rather than measured by the probe.

User Interface, Data Storage and Output

Through the Model 4590 gauge keypad, the operator can easily access any of the gauge's many options. The control panel consists of 30 keys with user friendly menus allowing almost all functions to be accessed with one or two keystrokes. A "beep" verifies that the keystroke was received by the gauge. A twenty character Liquid Crystal Display (LCD) screen located above the keypad allows for descriptive menus and easy viewing from a standing position.

The Model 4590 gauge can store up to 1000 test readings for later recall or downloading to a printer or computer. For transfer of data to your computer, the 4590 provides the option of outputting stored data to a printer via the USB drive or to a removable storage ("thumb drive"). Measurements are stored under specific project numbers by pressing the STORE key after a measurement or by enabling the Auto Store option. The *Auto-Store* function, when enabled, automatically stores sample data upon completion of a measurement. The data is stored under the active project, using a sequential sample ID number.

In addition to the measurement information, project number and station number, the gauge can store additional notes. For each measurement, the gauge can store a location description of up to 12 characters, as well as a note of up to 15 characters.

Batteries and Power Consumption

This gauge runs on a rechargeable nickel metal hydride (NiMH) battery or AA Alkaline batteries. Under normal conditions a fully charged battery remains operational for approximately 1 to 2 weeks (of standard use). When the "BATTERY LOW" warning appears, approximately 2-3 hours remain before the battery must be recharged. A full charge (approx. 2.5 hrs.) is recommended at that time; however, a 30-minute recharge can provide several hours of use if necessary. Two power adapters are included as standard accessories with this gauge: a 115 / 230 VAC (50 / 60 Hz) and a 12 VDC charger. On-board alkaline batteries can be used in the event that recharging is not an option. These batteries can provide additional 10 to 12 hours of use when recharging is not an option. It is recommended that users replace these alkaline batteries annually to ensure that they are ready when you need them.

Additional Features and Options

A number of other features are offered by the Model 4590 gauge to provide ease of operation and to ensure that the gauge is performing properly.

Easy to Read Display

The Model 4590 offers an enlarged 4 line by 20 character LCD (Liquid Crystal Display) screen with 8 mm tall characters. An illuminated display screen is standard on the Model 4590 gauges allowing for ease of viewing measurement results on night work from dusk to dawn.

Automatic Depth Mode

The Model 4590 offers the automatic depth mode using updated technology which proves to be very durable. The automatic depth mode reads the depth that the source rod is lowered to when a measurement is performed. The gauge determines the source depth; therefore the operator is not required to program in the depth of each test. The Model 4590 has a new feature that allows the operator to start a measurement from a small keypad on the top of the source rod near the handle. On this "remote" keypad there is a Start button and an ESC (Escape) button.

Optional Global Positioning System

The optional Global Positioning System (GPS) can be included on the 4590 gauge. Precise GPS coordinates are stored with each measurement record when the GPS is installed and enabled. The GPS receiver used in the Model 4590 has Wide Area Augmentation System (WAAS) capabilities which improve the location accuracy.

12 Month Limited Warranty

A 12 month limited warranty is provided with the new Troxler Model 4590 nuclear density gauge. In addition, an annual calibration and preventative maintenance plan from Troxler ensures the gauge is always in top condition.

Diagnostic Features

Correct gauge operation is supported by some diagnostic features. A STAT (statistical stability) test may be performed by the operator to validate the normal operation of the gauge. After a STAT test, a Drift test can check the long term drift of the gauge if a problem is suspected. Standard count comparison, validation and storage are also done by the Model 4590. The last 4 standard counts are stored in the gauge's memory and the average is compared to the new standard count to verify that it is within the specified limits. Several types of offsets can be enabled to temporarily "recalibrate" the gauge for use in measuring particular materials that do not fall within the range of a normal calibration.

Summary

The Troxler EGauge is the only soil density gauge offered which uses the proven Troxler nuclear technology to perform density measurements and is exempt from the radioactive materials license in the United States. This is very exciting for those customers who have been asking for a "non-nuclear" solution to soil density testing. Additionally, the moisture probe supplied with the EGauge is non-nuclear and can be used on most soils reliably with the proper offset. The proven nuclear density measurement technology is now available without the hassles of the regulatory requirements.

Troxler, the industry leader in nuclear density gauges, now offers a license *exempt* option for soil quality control testing!

Specifications

Measurement Specifications

6 inch (15 mm) Depth	Measurement Time = 2 min;
135 lb/ft ³ (2163 kg/m ³) Sample Density	Background Time = 1 min

Precision

Repeatability (1-standard deviation)	0.3 lb/ft ³ (4.8 kg/m ³)
Reproducibility (1-standard deviation)	0.5 lb/ft ³ (8.0 kg/m ³) ¹
Composition Error	0 lb/ft ³ (0 kg/m ³)

Mechanical Specifications

EGauge Size (HxLxW)	24.6" x 15.4" x 9.2" 625mm x 391mm x 234mm
Moisture Probe Size (HxLxW)	8.2" x 13.6" x 5.6" 208mm x 346mm x 142mm
Case Dimensions (HxLxW)	31.3" x 20.4" x 15.5" 795mm x 518mm x 393mm
Weight	35 lbs (13.8 kgb)
Shipping Weight	83.0 lbs (37.6 kg)
Storage Temperature	-67 – 185° F (-55 to 85° C)
Operating temperature	41 – 128° F (-5 to 70° C)

Electrical Specifications

Power Source	
Main	NiMH rechargeable batteries
Backup	5 AA alkaline batteries
Charge Source	12 V dc, 2A
Battery Recharge Time	3 hours maximum, (may be charged incrementally without damaging the batteries)
Time Before Automatic Shutdown	5 hours of inactivity

¹ Reproducibility as measured is consistent with that stated in ASTM-D6938-10