



UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION



USBR 1020-89

PROCEDURE FOR CALIBRATING OVENS

INTRODUCTION

This procedure is under the jurisdiction of the Geotechnical Services Branch, code D-3760, Research and Laboratory Services Division, Denver Office, Denver, Colorado. The procedure is issued under the fixed designation USBR 1020. The number immediately following the designation indicates the year of acceptance or the year of last revision.

1. Scope

1.1 This designation outlines the procedure for calibrating ovens used for standard laboratory testing. This calibration procedure is limited to ovens operating to a maximum temperature of 300 °C. Ovens operating at higher temperatures require special handling and, therefore, should be periodically checked by the manufacturer.

1.2 This procedure is to be used for periodic checks of laboratory ovens. If stringent calibration tolerances are required, this procedure should not be used and ASTM designation: E 145 is to be consulted.

2. Applicable Documents

2.1 *ASTM Standard:*

E 1 ASTM Thermometers

E 145 Specification for Gravity-Convection and Forced-Ventilation Ovens

3. Summary of Method

3.1 A thermometer is placed in an oven which is set at the desired operating temperature. The temperature reading of the thermometer is compared to the oven thermostat reading. The appropriate thermostat adjustment is determined.

4. Significance and Use

4.1 Accurate temperature control is important for many soil testing procedures in order to obtain accurate results.

4.2 Ovens are used primarily for determination of moisture content in soils. The ovens should have minimum inside dimensions of 3 feet wide by 2 feet deep by 2 feet high. For most soils laboratory application ovens should be thermostatically controlled at 110 ± 5 °C. Since it is necessary that a uniform temperature be maintained throughout the oven, the mechanical convection or forced-draft ovens are recommended.

NOTE 1.—Ovens slightly smaller than the recommended size may be used, but oven temperature varies significantly when the door is opened, and calibration will be more difficult.

4.3 This calibration procedure is to be performed upon receipt of the oven and annually thereafter.

5. Apparatus

5.1 *Oven.*—An oven, thermostatically controlled, forced-draft or mechanical convection, horizontal air flow type.

5.2 *Thermometer.*—Etched stem glass thermometer with eye-hook at the end for hanging, 0 to 300 °C, 2 °C divisions, mercury filled, conforming to the requirements of ASTM E 1.

5.3 *Gloves.*—Asbestos, 1 pair, to be used whenever handling equipment heated to elevated temperatures.

6. Precautions

6.1 *Safety Precautions:*

6.1.1 All electrical wires and cords are to be checked for damage. If any damage is observed, it is to be repaired before attempting to use the oven.

6.1.2 Care should be exercised in handling any equipment that is heated to elevated temperatures. Gloves are to be worn whenever handling such equipment or materials.

7. Calibration and Standardization

7.1 Verify that the thermometer to be used for this procedure has a certificate of inspection or calibration verification from the manufacturer. If there is doubt as to the accuracy of the thermometer, it should not be used for this procedure; a thermometer with a verifiable accuracy is to be obtained and used.

8. Conditioning

8.1 During the calibration procedure, the room temperature should not vary more than ± 10 °C.

9. Procedure

9.1 All data are to be recorded on the "Oven Calibration" form as shown on figure 1.

9.2 Locate and record the serial number, or any other identifying markings, of the oven to be calibrated.

9.3 Remove any material (sample containers, pans, etc.) from the oven.

9.4 Carefully hang the thermometer by its eye-hook with a piece of wire as close to the center of the oven chamber as possible. Make sure that the thermometer hangs freely.

9.5 Determine the applicable temperature at which the oven will be calibrated and set the thermostat of the oven to that temperature.

NOTE 2.—For most geotechnical purposes, the oven will be calibrated at 110 °C. If calibration is desired at another temperature, the procedure is similar. If a range of calibrated temperatures is desired, the calibration should be performed in intervals of 5 °C over the desired range of temperatures.

9.6 Allow sufficient time for the oven temperature to stabilize and record the oven thermostat reading.

9.7 Determine the thermometer reading and record the value.

NOTE 3.—The oven temperature will drop drastically when the oven door is opened. The thermometer reading should be taken as quickly as possible once the door is opened.

9.9 Calculate the thermostat correction and record the value.

9.10 If the thermometer reading is within ± 5 °C of the thermostat reading, the calibration procedure is completed. If the thermometer reading differs from the thermostat reading by more than 5 °C, or if a more stringent calibration is desired, see subparagraph 1.2.

9.11 Adjust the thermostat by the amount of the thermostat correction.

9.12 Repeat subparagraphs 9.6 through 9.11 until the desired calibration accuracy has been achieved.

10. Calculations

10.1 Calculate the thermostat correction using the following expression:

$$\text{Thermostat correction} = (1) - (2)$$

where:

(1) = oven thermostat reading

(2) = thermometer reading

11. Report

11.1 The report is to consist of a completed and checked "Oven Calibration" form (fig. 1).

11.2 All calculations are to show a checkmark.

