ABBOTT LABORATORIES

CORPORATE METROLOGY

INSTRUMENT
CALIBRATION PROCEDURE
Centrifuges
(General)

Abbott Laboratories Corporate Metrology

PROCEDURE: Centrifuges (General)

SECTION 1

INTRODUCTION AND DESCRIPTION

1.1 This is a general procedure describing the calibration of centrifuges (including temperature controlled types). The instrument being calibrated will be referred to herein as the Test Instrument (TI).

Table l. Calibration Description

Test Instrument Characteristics	Performance Specifications	Test Method
Time	Range: 0 to 120 minutes Accuracy: ±0.5% of indication *	Elapsed time interval from set point to cut-off (lamp out) is compared to elapsed time interval as measured using a standard stopwatch.
Rotational Speed	Range: 0 to 80000 RPM Accuracy: ±0.5% of indication *	The TI tachometer indication is compared to the indication of a standard tachometer or frequency counter.
Temperature	Range: -15°C to +40°C Accuracy: ±2.0°C *	The TI temperature control indication is compared to the indication of a temperature standard.

*The calibration performed using this procedure should be in accordance with the accuracy specifications under which the individual TI was procured, or in accordance with the user's requirements, whichever is appropriate. In no case should the TI temperature indicator be assigned a tolerance better than ±2.0°C.

NOTE

All measurement data shall be recorded on a Calibration/Test Record (C/TR). Tests performed to verify Test Instrument operating characteristics shall be noted on the data record by placing checks in the spaces provided.

SECTION 2

EQUIPMENT REQUIREMENTS

NOTE

Minimum use specifications are the principal parameters required for performance of the calibration, and are included to assist in the selection of alternate equipment. Satisfactory performance of alternate items shall be verified prior to use. All applicable equipment must bear evidence of current calibration.

NOTE

The instructions in this procedure relate specifically to the calibration equipment listed below. If other equipment is substituted, the instructions must be interpreted accordingly.

Table 2. Equipment Description

Item	Minimum Use Specifications	Calibration Equipment
2.1 Stopwatch	Range: 0 to 120 minutes Uncertainty: ±0.1% of indication	Cronus, Olympian
2.2 Tachometer	Range: As required to accommodate the range of the individual TI. Uncertainty: ±0.1% of indication.	Power Instruments, 1891-AM Sticht, MT-1
2.3 Frequency Counter applicable to high speed centrifuges)	Range: As required to accommodate the range of the individual TI. Uncertainty: ±0.1% of indication.	Hewlett Packard, 5316B
2.4 Temperature Meter (for temperature controlled centrifuges only)	Range: -15°C to 40°C Uncertainty: ±0.5%°C (Refer to Section 4 for limitations on sensor diameter)	Fluke, 2190A Azonix, A1011

SECTION 3

PRELIMINARY OPERATIONS

3.1 Review the entire procedure before starting the calibration process.

3.2 Determine the appropriate standards and calibration technique to be employed when performing the calibration.

3.3 Calibration Test Point Selection

NOTE

For TI's currently on the calibration program, the calibration test points will already be established and listed on the preprinted C/TR; however, if a C/TR is not available, as would be the case for an initial calibration, calibration test points should be selected as follows.

3.3.1 Time Tests - A minimum of one time testpoint should be selected in the upper portion of the TI range or at 30 minutes (whichever is less).

3.3.2 Speed Tests - For adjustable speed centrifuges, a minimum of two speed testpoints should be selected, one at approximately 10 to 30% of full scale, the other at approximately 70 to 90% of full scale. If the centrifuge uses a digital speed sensor, the higher speed testpoint may be any values greater than 30% of the centrifuge full scale capability.

3.3.3 Temperature Tests - Temperature accuracy should be tested at a minimum of three test points. The three testpoints should correspond to the low end of range, mid range, and upper range.

NOTE

Normally it is a good practice to verify sensor linearity by testing a minimum of three points across a sensor's range of use. If the centrifuge's calibrated temperature range is 0 to 25^{o}C or less, two testpoints, one at the lower end and one at the upper end of the range are acceptable. Justification for this approach is based upon the relatively narrow range of use (as compared to the usable range of an RTD, thermistor or thermocouple sensor) along with the best case tolerance of ±2^{o}C which has been established for this procedure.

3.4 Inspect the TI guard bowl and rotor for possible sample containers. Verify that the TI is clean and free of defects or materials that could impair its operation or pose a safety threat for calibration personnel.

SECTION 4

CALIBRATION PROCESS

NOTE

As desired, the time, speed and temperature tests may be completed in any order or in parallel.

NOTE

Unless otherwise specified, verify the results of each test and take corrective action after all tests are completed. All "As Found Readings" must be recorded prior to any adjustment and/or repair.

4.1 Time Accuracy Test (If applicable)

4.1.1 Set the TI timer controls as necessary to obtain the time testpoint as listed on the applicable C/TR.

4.1.2 Set the TI speed control to any arbitrary operating speed.

4.1.3 Start the TI centrifuge while simultaneously starting the standard stopwatch (Item 2.1).

4.1.4 Stop the stopwatch when zero time is reached. The TI timer will turn the centrifuge motor off and shut off the control panel lamp (if equipped).

4.1.5 Record the TI calibration set-point in the "TI" column of the C/TR. Read the stopwatch indication and record this value in the "STD" column of the C/TR. Verify that the recorded value is within the specified tolerance limits.

4.2 Speed Accuracy Test - Using a Standard Tachometer

4.2.1 If the TI rotor is not accessible for use as a speed reference, remove the front panel of the TI so as to expose the bottom of the TI guard bowl and spindle (shaft).

4.2.2 In a clearly visible area, mark an alignment point on the TI spindle (or the top of the rotor) using a white crayon, luminous or reflective tape.

4.2.3 If equipped, set TI timer to any value past 15 minutes. Start the TI centrifuge.

4.2.4 Set the speed control to the first calibration point as specified on the C/TR.

4.2.5 If the TI is equipped with a built-in tachometer, allow the built-in tachometer to stabilize. Record the TI tachometer reading in the "TI" column of the C/TR. (If the TI is not equipped with a tachometer, record the speed setpoint value).

4.2.6 Using the standard tachometer (Item 2.2) take a standard tachometer reading by pointing the standard toward and near the TI alignment mark. Allow the standard to stabilize. Record the standard tachometer in the "STD" column of the C/TR and verify that the recorded value is within the specified tolerance limits.

4.2.7 Repeat steps 4.2.4 through 4.2.6 for each additional speed testpoint.

4.3 Speed Accuracy Test - Using a Standard Frequency Counter

NOTE

The technique of using a frequency counter to perform the speed calibration enables 'closed case' calibration and thereby eliminates exposure to moving parts. The technique is applicable to any centrifuge which uses an electronic pick up (inductive or capacitive proximity switch, photo-detector, etc.) for speed sensing.

4.3.1 If the TI is being calibrated for the first time, physically examine the speed sensing equipment and determine the ratio of input pulses to shaft revolutions. For TI's currently on the calibration program, the pulse/revolution ratio will be documented on the C/TR.

4.3.2 Connect the standard frequency counter (Item 2.3) to the pulse output of the electronic speed pickup.

4.3.3 Configure the frequency counter to measure frequency in Hz.

4.3.4 Set the TI timer to any value past 15 minutes and start the TI.

4.3.5 Set the TI centrifuge speed control to the first calibration point as specified on the C/TR.

4.3.6 Record the TI tachometer reading in the "TI" column of the C/TR. (If the TI is not equipped with a tachometer, record the speed setpoint value).

4.3.7 Read the frequency counter indication and divide this value by the pulse/revolution ratio to calculate revolutions/second. Multiply by 60 seconds/minute to calculate RPM.

4.3.8 Record the standard RPM value in the "STD" column of the C/TR and verify that the recorded value is within the specified tolerance limits.

4.3.9 Repeat steps 4.3.5 through 4.3.8 for each additional speed testpoint.

4.4 Temperature Accuracy Test (Temperature Controlled Centrifuges Only)

4.4.1 Fill two centrifuge tubes with water (mineral oil or silicone oil is also acceptable) and place in opposite sides of the rotor. If possible, use centrifuge tubes with a volume of at least 15 mL.

4.4.2 Verify that the standard temperature sensor (Item 2.4) satisfies the following criteria:

Centrifuge Tube Volume	Temperature Sensor Maximum Diameter
≥ 15 mL	1/8" sheath probe, or 16 gauge T/C wire
< 15 mL	1/16" sheath probe, or 20 gauge T/C wire

4.4.3 Set the TI temperature control to the temperature set point as specified on the C/TR.

4.4.4 Start the TI centrifuge and set to an arbitrary operating speed.

4.4.5 If the centrifuge is equipped with a temperature indicator (as opposed to only a setpoint display) wait until the setpoint temperature has been reached, then allow an additional 10 minutes stabilization time. If the centrifuge is not equipped with a temperature indicator, allow a minimum of 30 minutes stabilization time.

4.4.6 Read and record the TI temperature indication. (If the TI is not equipped with a temperature meter, record the temperature setpoint value).

NOTE

The temperature control on some centrifuges cycles on and off around the temperature setpoint (analog proportional control is not used). If the TI temperature indication shows temperature cycling, record the average of the high and low values.

4.4.7 Stop the TI centrifuge.

4.4.8 Using a two step method, place the standard temperature sensor into the liquid media in one of the centrifuge tubes for approximately 5 seconds. Quickly move the standard temperature sensor to the liquid media in the opposite centrifuge tube. Read and record the standard temperature indication when the reading stabilizes or reaches its extrema (minimum or maximum value).

4.4.9 Repeat steps 4.4.3 through 4.4.8 for each additional temperature testpoint.

4.4.10 If no other measurements are to be made, disconnect the test equipment and return the TI to its normal configuration.

Summary of Change

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