MONTEREY BAY UNIFIED AIR POLLUTION CONTROL DISTRICT

STANDARD OPERATING PROCEDURES
FOR
MET ONE METEOROLOGICAL SENSOR FOR AMBIENT TEMPERATURE, MODEL 064-2

Accepted by:

Name: _____ (Supervising Air Monitoring Specialist)

Date: _____

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3.20 MET ONE METEOROLOGICAL SENSOR FOR AMBIENT TEMPERATURE, MODEL 064-2

3.20.1 GENERAL INFORMATION

3.20.1.1 Introduction

The purpose of this Standard Operating Procedure (SOP) is to document the MET One Meteorological Sensor for Ambient Temperature, Model 064-2 guidelines and follow recommended guidelines set forth by the Air Quality Surveillance Branch of the California Air Resources Board (ARB). The goal of this SOP is for the purpose of installation, configuration and operation procedures in order to ensure comparability among all MET One Meteorological Sensors for Ambient Temperature, Model 064-2. The MET One Meteorological Sensor for Ambient Temperature Model -64-2 Operation Manual contains a significant source of information pertinent to the operation, maintenance and understanding of this instrument.

3.20.1.2 Theory

The measurement of temperature for air quality applications, and generally thought of as air temperature, T, or a difference between two temperature measurements, delta T. Temperature instruments are made up of three important parts: transducers, signal conditioning, and radiation shields.

A thermistor measures ambient temperature. The resistance of the transducer varies with temperature and the variable output voltage translates into a temperature reading via the Met One Translator Module.

The effect of solar radiation and wind can severely affect the performance of temperature sensors. For this reason, a forced or convection aspiration radiation shield is essential to any temperature measurement system.

3.20.1.3 System Description

The Met One 064-2 temperature sensor is a precision, extended range thermistor. The solid-state thermistor produces a large resistance change per degree of temperature change allowing the use of normal voltage without self-heating of the sensor. When used with the Met One signal-conditioning module, the resultant output is a precise analog voltage. The sensor probe body is made of anodized aluminum with an epoxy bond for connections and cabling. The sensor is used with the Met One Translator Module.

The Met One Translator Module converts the frequency signal from the temperature sensor into a standardized voltage/current output signal.

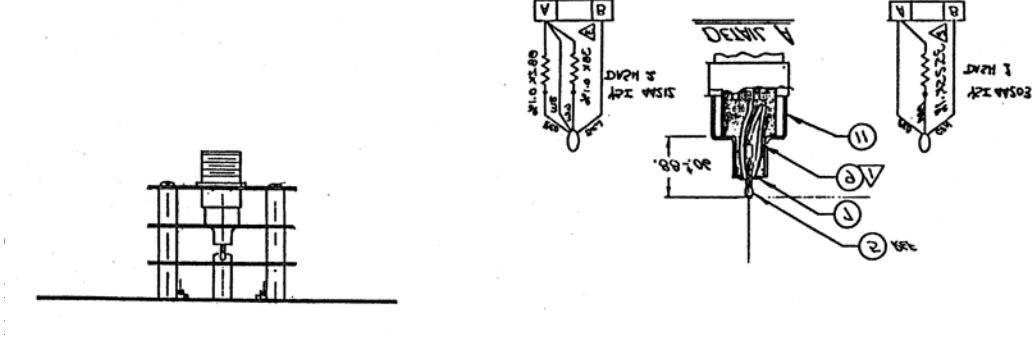

Figure 3.20.1

3.20.2 ROUTINE SERVICE CHECKS

3.20.2.1 General Information

Perform the following checks on temperature sensors at the intervals specified in the service schedule. Perform checks at the prescribed intervals, but can be performed more frequently. On the Monthly Quality Control Maintenance Check Sheet document all results and maintenance (Figure 3.20.2).

3.20.2.2 Weekly Checks

1. Review data logger and strip chart data for correct operation of the ambient temperature sensor.

2. Perform a visual inspection of the ambient temperature sensor to ensure that the radiation shield is in place and that there is no visible damage.

3. Activate built-in zero and half-scale test switches in the front of the translator module and record the data logger outputs on the Monthly Quality Control Maintenance Check Sheet (Figure 3.20.2).

3.20.2.3 Monthly Checks

1. Monthly Quality Control Maintenance Check Sheet

2. Each month, after completing the final week's checks, forward the check sheet to your supervisor and to file.

3.20.2.4 Semi-Annual Checks

1. Multipoint Sensor Calibration (Figure 3.20 .3)
Calibrate the ambient temperature sensor at least once every six months of operation, upon relocation, and after major repairs. Record the date of the most recent calibration on the Monthly Quality Control Check Sheet. See the calibration procedure in section 3.20.5.3.

3.20.2.5 Semi-Annual Preventative Maintenance

1. Inspect the sensor and cable connections. Remove any corrosion, using standard connector cleaning techniques. Replace connectors that do not clean to a shiny surface, as well as those with pitted, cracked, or broken contacts.

2. Remove the three stainless steel screws that attach the sensor to the radiation shield.

3. Remove any dust, spider webs, or insects, which can accumulate on the sensor. Inspect sensor for cracks and for exposed/broken wires on the thermistor.

4. Remove any dust, spider webs, or insects which will accumulate in the intake orifice of the radiation shield.

5. Re-attach sensor to radiation shield.

FILE#_____

MONTEREY BAY UNIFIED AIR POLLUTION CONTROL DISTRICT
MONTHLY QUALITY CONTROL MAINTENANCE CHECK SHEET

MET ONE METEOROLOGICAL INSTRUMENT

LOCATION: _____ MONTH/YEAR: _____
STATION AIRS NUMBER: _____ TECHNICIAN: _____
ANALYZER ID# _____

DATE	VISUAL	WIND SPEED		WIND DIRECTION		AMBIENT TEMPERATURE	
		ZERO	SPAN	ZERO	SPAN	ZERO	SPAN

1. DAILY VISUAL (RECORD WEEKLY) CHECK DAS
2. WEEKLY PERFORM ELECTRONIC CHECKS AND RECORD RESULTS
3. SEMI ANNUALLY:

Date last calibrated _____ Next calibration due _____ 6 Months

TYPE	ID#
WIND SPEED	
WIND DIRECTION	
AMBIENT TEMPERATURE	

DATE	COMMENTS OR MAINTENANCE PERFORMED

REVIEWED BY _____ DATE _____

Form #508 rev. 08/08/11 (word)

Figure 3.20.2

FILE#_____

MONTEREY BAY UNIFIED AIR POLLUTION CONTROL DISTRICT
METEOROLOGICAL SENSOR CALIBRATION FORM

ASIS _____ FINAL _____

LOCATION: _____ DATE: _____
STATION AIRS NUMBER: _____
TRANSLATOR ID# _____ LAST CALIBRATION DATE: _____

PARAMETER	UNITS	SOURCE VALUE	DATA LOGGER RESPONSE	
			READING	ERROR
WIND DIRECTION TORQUE _____g <7.5g	0 - 360 DEGREES <5.0 E combined accuracy and orientation error	0		E
		90		E
		180		E
		270		E
WIND SPEED TORQUE _____g <0.35g	0 - 50 MILES PER HOUR <0.6 MPH			MPH
				MPH
				MPH
AMBIENT TEMPERATURE	0 - 100 DEGREES F +/- 0 .9 EF			EF
				EF
				EF

CALIBRATION STANDARDS USED

Wind Direction	CROSS ARM ORIENT. DEGREES_____DECLINATION_____ TS 529 TRANSIT MODEL # 40-1400 WARREN-KNIGHT FORESTER COMPASS
TS 239 WS 300 RPM	SYNCHRONOUS MOTOR ID # 049C-1 SN # J9093-300 CALIB. DATE:
TS 240 WS 600 RPM	SYNCHRONOUS MOTOR ID # 049C-2 SN # J9094-600 CALIB. DATE:
TEMPERATURE	ID# MODEL # SERIAL# CALIB. Date

MET ONE METEOROLOGICAL SENSOR MODEL AND SERIAL NUMBERS

WD	ID#	MODEL #	SERIAL #
WS	ID#	MODEL #	SERIAL #
ATM	ID#	MODEL #	SERIAL #

Comments:

_____
_____
_____

CALIBRATED BY_____
REVIEWED BY_____DATE_____

Form #517 rev. 08/08/11 (word)

Figure 3.20.3

FILE# _____

MONTEREY BAY UNIFIED AIR POLLUTION CONTROL DISTRICT

STM STATION TEMPERATURE MONITOR CALIBRATION FORM
ASIS _____ FINAL _____

LOCATION: _____ DATE: _____

STATION AIRS NUMBER: _____

STM ID# _____ S/N# _____
LAST CALIBRATION DATE: _____

PARAMETER	UNITS	SOURCE VALUE	DATA LOGGER RESPONSE	
			READING	ERROR
STATION TEMPERATURE	0 - 50 DEGREES C <0.5 °C			°C

CALIBRATION STANDARDS USED

TEMPERATURE	ID#	MODEL#	SERIAL#	CALIB. DATE:

COMMENTS: _____

_____

_____

CALIBRATED BY _____

REVIEWED BY _____ DATE _____

Form #566 rev. 08/01/2002

Figure 3.20.4

3.20.3 DETAILED MAINTENANCE AND ALIGNMENT PROCEDURES

3.20.3.1 The Met One 064-2 Ambient Temperature Sensor's design provides years of service. Constructed of noncorrosive materials it requires little maintenance. Provided below are general maintenance requirements. Refer to the sensor operating manua1 for detailed instructions on maintenance procedures.

1. Inspect and lubricate the sensor cable connections with silicon-based grease, as necessary.

2. Keep set screws lubricated with anti-seize compound for easy removal.

3. Record any maintenance, malfunctions, repairs, and actions taken to prevent recurrences of malfunction on the Monthly Quality Control Maintenance Check sheet and in the Meteorological Sensor Instrument Log.

3.20.4 TROUBLESHOOTING

3.20.4.1 General Information
Troubleshooting should attempt to isolate the source of the malfunction and reduce maintenance time. If a problem exists check the following items.

3.20.4.2 Troubleshooting Guide

1. Visually inspect the ambient temperature sensor, checking for signs of damage.

2. Check for loss of voltage supply.

3. Verify that the cable connections are secure.

4. Measure the outputs from the ambient temperature sensor and/or translator using the voltmeter.

5. Verify proper data logger initialization.

3.20.5 CALIBRATION PROCEDURE

Perform inside and outside air temperature sensor accuracy calibrations to determine the station temperature sensors correctly convert temperature to resistance. The sensor's translator converts the resistance to a representative voltage. The data logger displays the Voltage in degrees Fahrenheit/Celsius.

Outside temperature sensors are calibrated once every six (6) months, or more frequently in corrosive environments. Perform calibrations to assure that the sensor's accuracy is still within PSD guidelines.

During the wind direction calibration, look for problems which could effect the operation of the sensor such as, dirty components, and loose, worn, or broken parts. Document any noted problems on the Meteorological Sensor Calibration Datasheet (Figure 3.20.3). If a sensor should fail any section of the following calibrations, complete the other calibration procedures if possible.

This "AS-IS" condition will provide information to verify data validity between calibration periods. Complete an "AS-IS" Meteorological Sensor Calibration Datasheet when an "AS-IS" calibration is performed. A "FINAL" calibration form is also required if the sensor is repaired or changed.

3.20.5.1 Apparatus:

1. Handheld digital thermometer or National Institute Standards and Technology (NIST) glass thermometer (hereafter referred to as traceable thermometer)

2. Wide mouth thermoses or Dewar flasks for thermal water baths

3. Crushed ice, ambient temperature water, and hot water for the thermal baths

4. Calibration report forms (Figure 3.20.3)

3.20.5.2 "As Is" Calibration

OTHER THAN ROUTINE CHECKS, ANALYZER REPAIRS OR ADJUSTMENTS SHOULD NOT BE MADE PRIOR TO THE "As Is" CALIBRATION.

1. Ice Bath

   a. Prepare the ice bath by filling the wide mouth thermos or Dewar flask with crushed ice and then filling with water. Allow the ice bath temperature to equilibrate.

   b. Remove the station outside temperature sensor from the radiation shield. Immerse the station temperature sensor and the traceable thermometer into the ice bath. The station temperature sensor and the traceable thermometer should be within one inch of each other in the water bath.

   c. When readings from the station sensor and traceable thermometer are stable, record the temperatures on the Meteorological Sensor Calibration

Datasheet. Correct the digital traceable thermometer readings for slope and intercept.

2. Ambient Bath

   a. Prepare the ambient bath by filling the wide mouth thermos or Dewar flask with room temperature water. The temperature should be near 77° F (25°C). Add a little hot or cold water to obtain a temperature of approximately 77° F (25°C).

   b. Immerse the station temperature sensor and the traceable thermometer into the ice bath. The station temperature sensor and the traceable thermometer should be within one inch of each other in the water bath.

   c. When readings from the station sensor and traceable thermometer are stable, record the temperatures on the Meteorological Sensor Calibration Datasheet. Correct the digital traceable thermometer readings for slope and intercept.

3. Hot Bath

   a. Prepare the hot bath by filling the wide mouth thermos or Dewar flask with heated water. The temperature should be near 100° F (38°C). Add a little hot or cold water to obtain a temperature of approximately 100° F (38°C).

   b. Immerse the station temperature sensor and the traceable thermometer into the ice bath. The station temperature sensor and the traceable thermometer should be within one inch of each other in the water bath.

   c. When readings from the station sensor and traceable thermometer are stable, record the temperatures on the Meteorological Sensor Calibration Datasheet. Correct the digital traceable thermometer readings for slope and intercept.

5. If there is a difference of greater than +/-0.5°C between the station sensor and the correct traceable thermometer readings, repair or replace the station sensor and/or the translator card.

6. Following the procedures detailed above for “Ambient Bath”, calibrate the inside station temperature sensor. Record the data logger and traceable thermometer temperatures on the Inside Temperature Sensor Calibration Datasheet (Figure 3.20.4).

7. If there is a difference of greater than +/-1.0°C between the inside station sensor and the correct traceable thermometer readings, adjust, repair or replace the inside station temperature sensor.

3.20.5.3 "Final Calibration"

If any part of the "As Is" Calibration fails to meet specifications, repair or replace the sensor, and perform a "Final Calibration' using the steps defined above, for the Meteorological Sensor Calibration.

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