	DEPARTMENT KEARNY MAINTENANCE AND OPERATIONS	DIVISION ELECTRIC TRANSMISSION AND DISTRIBUTION	DOCUMENT SECURITY INTERNAL
	SUBJECT STANDARD OPERATING PRACTICES		EFFECTIVE DATE 10/15/13
TITLE WEATHER STATION INSPECTION, TESTING AND MAINTENANCE			DOCUMENT NUMBER 532.075

## 1. PURPOSE

- 1.1. This standard practice provides practical guidelines for annual inspection, testing and maintenance of SDG&E weather stations.

## 2. REFERENCE

- 2.1. SDG&E Weather Stations Calibration Check List prepared by Western Weather Group, Inc.

## 3. DEFINITIONS

- 3.1. Weather Station – Any pole-mounted or portable equipment where weather conditions and meteorological data are observed and recorded
- 3.2. Station Datalogger – An application that will display and log weather data obtained from the weather station
- 3.3. Calibration Timer – Device that tracks the amount of time since the last calibration was performed
- 3.4. Anemometer – Device that measures wind speed
- 3.5. Pyranometer – Device that measures solar irradiance (The amount of solar energy that arrives at a specific area at a specific time)
- 3.6. SCADA – Supervisory Control and Data Acquisition

## 4. GENERAL

- 4.1. Upon Arrival at Weather Station
  - 4.1.1. Check orientation of wind sensor alignment rod to true north with GPS.
  - 4.1.2. Attach keypad to station datalogger if one is not already attached.
  - 4.1.3. Set calibration timer with keypad.

#### 4.2. Air Temperature and Relative Humidity Sensor Calibration

- 4.2.1. Remove sensor from white louvered shield and place in fan aspirated shield.
- 4.2.2. Place calibrated temperature/relative humidity sensor from calibration case in fan aspirated shield.
- 4.2.3. View readings on keypads attached to station and calibration case datalogger.
- 4.2.4. Wait for the two sensors to stabilize. Note this may take 10 to 15 minutes.
- 4.2.5. Record readings from both sensors on calibration data sheet.
  - 4.2.5.1. If the temperature sensor read deviates more than 1.8°F (1°C) from the calibrated temperature, report deviation to the SCADA Construction Supervisor for corrective action.
  - 4.2.5.2. If the relative humidity sensor read deviates more than 5% (10% if dry) from the calibrated relative humidity, report deviation to the SCADA Construction Supervisor for corrective action.
  - 4.2.5.3. If the relative humidity sensor dew point read deviates more than 2.7°F (1.5°C) from the calibrated dew point value, report deviation to the SCADA Construction Supervisor for corrective action.
  - 4.2.5.4. Wash and dry temperature/humidity filter
- 4.2.6. Replace station sensor back in louvered radiation shield

#### 4.3. Wind Speed Sensor Calibration

- 4.3.1. Remove propeller from wind sensor.
- 4.3.2. Check starting torque with propeller torque disc; enter value on data sheet. 2.4 gcm max torque allowable
- 4.3.3. Attach anemometer motor drive to wind sensor.
- 4.3.4. Check wind speed output at RPM test points and enter on data sheet.
- 4.3.5. Remove anemometer motor drive.
- 4.3.6. Remove wind sensor from pole mounting post, note alignment.
- 4.3.7. Place sensor on vane angle bench stand.
- 4.3.8. Test wind direction at 24 calibration points and note values on data sheet.

- 4.3.8.1. If any of the anemometer reads deviate more than  $\pm 0.45$ mph, or cumulative errors total more than 5% of observed from the calibrated anemometer reads, report deviations to the SCADA Construction Supervisor for corrective action.
- 4.3.9. Replace sensor on pole mount and secure. Note alignment to true north.
- 4.3.10. Replace propeller, align notches on propeller with nose cone and secure propeller nut.
- 4.4. Battery Load Test
  - 4.4.1. Disconnect solar panel inputs from battery
  - 4.4.2. Attach battery load tester for thirty second test. Note value on data sheet
  - 4.4.3. Replace battery if load test value less than 10.5 volts
- 4.5. Tipping Bucket Rain Gauge Calibration
  - 4.5.1. Remove rain gauge funnel and replace with rain gauge test funnel.
  - 4.5.2. Measure proper amount of water in graduated cylinder.
  - 4.5.3. Pour water into test funnel. Note amount on data sheet once water has passed.
    - 4.5.3.1. If rain gauge sensor test result differential is greater than 5%, report deviation to SCADA Construction Supervisor for corrective action.
- 4.6. Solar Radiation Sensor (Pyranometer) Calibration
  - 4.6.1. Co-locate calibrated pyranometer next to station pyranometer. Keep both level.
  - 4.6.2. Compare readings between station and calibration sensors. Note on data sheet.
    - 4.6.2.1. If station pyranometer reading is greater than 10% of calibrated sensor reading, report deviations to the SCADA Construction Supervisor for corrective action.
- 4.7. Before Leaving Weather Station
  - 4.7.1. Set calibration timer to zero.

## 5. ATTACHMENTS

- 5.1 Weather Station Datalogger Test Sheet

**General Information**

Station			
Station:		Latitude:	
Met Station ID:		Longitude:	
SCADA Site:		Structure ID:	
Nat Weather Service Zone:		Circuit:	
Owner:	SDGE	Calibration Date:	
Operator:		Start Time:	
Calibrator:		End Time:	
Equipment			
Datalogger:	Campbell Scientific CR800	Mounting Type:	
Communication Devices:	Raven Digital Cellular Modem	Height Above Ground Level:	Feet AGL
Temp & Relative Humidity:	Vaisala HMP45C	Power Supply:	
Wind Speed & Direction:	RM Young Wind Monitor		

**Datalogger Information**

Datalogger Battery			
Battery Voltage as Found (On Charge):		VDC	
Battery Voltage as Left (On Charge):		VDC	
Battery Load Test:			VDC
(Off Charge, 30 sec 1 Amp Load)			
SCADA Radio Battery			
Battery Voltage as Found (On Charge):		VDC	
Battery Voltage as Left (On Charge):		VDC	
Battery Load Test:			VDC
(Off Charge, 30 sec 1 Amp Load)			
Status			
OS Version:		Datalogger Clock Check:	
OS Date:		Program Errors:	
OS Signature:		Variable Out of Bounds:	
Program Signature:		Skipped Scans:	
Watchdog Errors:		Skipped System Scans:	
Lithium Battery Voltage:		Compile Results:	
Low 12 Volt Battery Count:		Scan Rate:	Sec
Low 5 Volt Battery Count:		Latest Program Revision:	

**Temperature / Relative Humidity / Dew Point Sensors**

Sensor Mfg:	Vaisala	Sensor Height AGL:	0.00	Feet					
Model #:	HMP45C	Range:	Temp:	-40 to +140 °F					
Serial #:			Relative Humidity:	0 to 100 %					
Test Results									
Test Points	Reference Data			Station Data			Differential		
Ambient	Temp °F	% RHumidity	DewPoint °F	Temp °F	% RHumidity	DewPoint °F	Temp °F	% RHumidity	DewPoint °F
Test #1									
Test #2									
Notes:									

**Rain Gauge Sensor**

Sensor Mfg:	Sierra Misco	Funnel Height AGL:		Feet
Model #:	260-2500E	Funnel Size:		Inches
Serial #:		Increments:		Inches
Test Results				Level:
Rain Gauge	Reference	Station	Differential	
Test	Data	Data		
Test #1				
Test #2				
Notes:				

**Horizontal Wind Speed Sensor**

Sensor Mfg:	RM Young	Sensor Height AGL:	0.00	Feet
Model #:	Wind Monitor AQ	Range:	0 to 100	mph
Serial #:		Starting Torque:		gm-cm (Tolerance: $\leq 2.4$ gm-cm)
Prop #:		Starting Speed:		mph (Tolerance: $\leq 1.12$ mph (0.5 m/s))

Test Results									
Test Points	RPM	mph Reference	mph Station	mph Differential	Test Points	RPM	mph Reference	mph Station	mph Differential
1	0	0.00			4	500	5.48		
2	200	2.19			5	1000	10.96		
3	300	3.29			6	5000	54.80		
					7	8000	87.68		

Notes:

**Wind Direction Sensor**

Sensor Mfg:	RM Young	Sensor Height AGL:	0.00	Feet
Model #:	Wind Monitor AQ	Range:	0 to 360	Degrees
Serial #:		Pointer Alignment - North:		
Prop #:		Vane Check Due South:		Degrees

Test Results									
Reference Direction	Rotation		WD Error		Normalized		Hysteresis	Average Error	Total Error
	CW	CCW	CW	CCW	CW	CCW			
0									
30									
60									
90									
120									
150									
180									
210									
240									
270									
300									
330									

Average error:	
Average hysteresis error	
Max hysteresis error:	0.0
Max linearity error:	0.0
Max linearity audit tolerance	3.0
Reference Direction - South	180.0
Measured Direction @ Ref:	0.0
Vane to Crossarm error (along Ref):	
Adjusted Orientation error	
Max Total Direction Error:	
Total Direction Error audit tolerance:	5.0

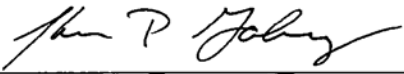

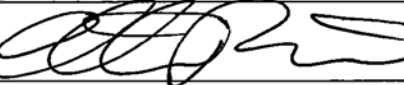

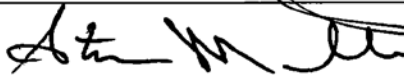
(Pointer oriented North)

Measured Direction @ Reference - Reference Direction  
Vane to Crossarm Error - Linearity Error @ Reference  
Sum of adjusted orientation error & linearity error

Notes:

## Revision History:

Effective Date	Changes Made	By
10/15/13	New	S. GAHAGAN

Titles	Name	Date
AUTHORED BY: SHAUN GAHAGAN Engineer I		10/15/2013
REVIEWED BY: CHRISTOPHER NICOLAI Team Lead		10/15/13
REVIEWED BY: CHRISTIAN BRANDT Construction Supervisor		10/15/13
APPROVED BY: TYGE LEGIER System Protection Maintenance Manager		10/15/13
ISSUED BY: STEVE MUSCARELLA Engineer I		10/15/13