

## Vista Switchgear Condition Assessment



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### 1. Scope

This work practice outlines the inspection and maintenance procedure for manual and remote supervisory (capable) S&C Electric Company Vista switches.

The inspection procedures contained herein can be performed while the switchgear is energized. Switchgear maintenance that requires de-energizing and grounding is outside the scope of this work practice.

Depending on the date of manufacture, remote supervisory (capable) switches will either have a model 5800 or 6800 automatic switch control. For our purposes, these switch control models are interchangeable.

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### 2. Application

This work practice is for qualified Seattle City Light (SCL) personnel who perform preventative maintenance on Vista Switches. Section 4 defines who is qualified to perform this work.

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### 3. Definitions

**Equipment (PS) Number** - also known as the “PS” number, it is a number that follows the prefix “PS” assigned to each switch. To help explain how this number is used, a PS number could be considered the equivalent of a person’s social security number. No matter where a person lives, their social security number remains the same. PS labels are assigned, printed, and attached to the switchgear at the warehouse prior to receiving the equipment.

**Switch (SW) Number** – also known as the System Operations Center (SOC) Switch Number, this number follows the prefix “SOC” and indicates the switch circuit location. To help explain how this number is used, an SOC number could be considered the equivalent of a street address. No matter who lives there, the address stays the same.

**Parent Facility ID No.** – this is also known as the Pad (P) Number, Underground (U) Switch Number, or the Vault (V) Number.

**Underground (U) Switch Number** – this is a switch number specifically for underground equipment. This number follows the prefix “U.”

**Pad (P) Number** – identifies the pad on which the switch is installed. The best practice is to affix the pad number to the pad itself. Labeling the switch enclosures with the pad number should be avoided.

**Vault (V) Number** – identifies the vault on which the switch is installed.

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#### 4. Safety

Vista switches shall only be maintained by qualified personnel who are knowledgeable in installation, operation, and maintenance of underground electrical power distribution equipment along with the associated hazards.

A qualified person is one who is trained and competent in:

- Distinguishing exposed live parts from non-live parts of electrical equipment.
- Determining the proper approach distances corresponding to the voltages to which the qualified person will be exposed.
- Properly using the special precautionary techniques, personal protective equipment (PPE), insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electrical equipment.
- Working in confined spaces such as vaults.
- Using an oxygen sniffer.

This work practice is intended only for such qualified personnel. The instructions in this work practice are not intended to be a substitute for adequate training and experience in safety procedures for this type of equipment.

Crews shall also familiarize themselves with and follow the safety information contained in the S&C document *Instruction Sheet 681-510*.

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#### 5. Required PPE

The following PPE is required to complete Vista switch preventive maintenance procedures:

- Flame-resistant (FR) clothing that is the appropriate class
- Safety glasses
- Gloves
- Hard hat
- Safety cones and yellow tape

## 6. Data Collection Sheet, Required Tools, and Reference Material

### 6.1 Data Collection Sheet

Personnel conducting preventative maintenance shall have on hand a blank Data Collection Sheet on which to record ratings and comments for each part of the assessment procedure. See Appendix A for an example.

### 6.2 Tools

The following tools are required to complete Vista switch preventive maintenance procedures:

- Gas detector (for vaults)
- Flashlight
- Infrared heat sensor gun
- Digital camera
- Vault key/socket
- Thermometer
- Black permanent marker
- Digital voltmeter

### 6.3 Reference Material

It is recommended that the following reference materials be on hand when conducting the condition assessment procedures:

**SCL 1167.13**; "Padmount Switch Signs and Labels"

**S&C Instruction Sheet 1045-540**; "S&C 6800 Series Automatic Switch Control Operating Instructions"

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## 7. Procedure

Follow all safety and clearance procedures before performing any work on the switch. Proper PPE is required to perform this work practice. See Section 5, "Required PPE."

### Part 1. Site and Location

Assessment	Performance Expectations
Access to site	<ul style="list-style-type: none"><li>▪ Switch is reasonably accessible to SCL operations and maintenance personnel.</li><li>▪ Accessing the site does not require a special key, permit, or prior approval for entry, as may be required for locations inside a customer building or facility.</li></ul>
Compartment access	<ul style="list-style-type: none"><li>▪ Compartments are accessible with adequate space to perform routine operations and maintenance: 10 ft in front of doors, 3 ft on sides.</li></ul>

### Part 2. Dry-Vault Style Installation Inspection

Assessment	Performance Expectations
Doors and locks	<ul style="list-style-type: none"><li>▪ Door locks work and door opens and closes properly.</li></ul>
Signs and labels	<ul style="list-style-type: none"><li>▪ Warning, Danger, and Notice signs are easily read. Switch (SOC) and Equipment (PS) numbers are assigned and easily read.</li></ul>
Water ingress	<ul style="list-style-type: none"><li>▪ No standing water.</li><li>▪ Vault is free of water damage or rust.</li></ul>
Cleanliness	<ul style="list-style-type: none"><li>▪ Vault is clean and free of debris.</li></ul>
Conduits	<ul style="list-style-type: none"><li>▪ Conduits are sealed.</li></ul>

### Part 3. Wet-Vault Style Installation Inspection

Assessment	Performance Expectations
Doors, locks, and latches	<ul style="list-style-type: none"><li>Easy to operate, proper alignment, all latch points engage, locks and Penta head bolts are secure.</li></ul>
Signs and labels	<ul style="list-style-type: none"><li>Warning, Danger, and Notice signs are easily read. Switch (SOC) and Equipment (PS) numbers are assigned and easily read. See SCL 1167.13 for details.</li></ul>
Cleanliness	<ul style="list-style-type: none"><li>Vault is clean and free of debris.</li></ul>
Conduits	<ul style="list-style-type: none"><li>Conduits are sealed.</li></ul>

### Part 4. Padmount Style Installation Inspection

Assessment	Performance Expectations
Doors, locks and latches	<ul style="list-style-type: none"><li>Easy to operate, proper alignment, all latch points engage, locks and Penta head bolts are secure.</li></ul>
Signs and labels	<ul style="list-style-type: none"><li>Warning, danger, and notice signs are easy to read. Switch (SOC) Number and Equipment (PS) numbers are assigned and easy to read. See SCL Work Practice 1167.13 for padmount switch signs and labels.</li></ul>
Paint condition	<ul style="list-style-type: none"><li>No graffiti, only minor rust, no moss.</li></ul>
Pad	<ul style="list-style-type: none"><li>There are no major cracks; pad is reasonably level.</li></ul>
Seal	<ul style="list-style-type: none"><li>Enclosure is sealed at pad to prevent animal ingress.</li></ul>
Conduits	<ul style="list-style-type: none"><li>Conduits are sealed.</li></ul>
Water ingress	<ul style="list-style-type: none"><li>No standing water is present.</li></ul>
Condensation	<ul style="list-style-type: none"><li>Little to no condensation on roof or walls.</li></ul>
Contamination	<ul style="list-style-type: none"><li>Little to no dirt or moss on roof or walls. No signs of animal intrusion.</li></ul>

### Part 5. Heat Sensor Readings

Assessment	Performance Expectations
Ambient temperature	<ul style="list-style-type: none"><li>Measure ambient temperature.</li></ul>
Highest bushing/elbow contact temperature above ambient	<ul style="list-style-type: none"><li>Temperature is less than 10 degrees Celsius above ambient.</li><li>The difference in temperature between phase and switch is less than 5 degrees Celsius.</li></ul>

### Part 6. SF6 Gas Levels (See Appendix B for detailed instructions)

Assessment	Performance Expectations
SF6 gas level (internal gauge)	<ul style="list-style-type: none"><li>Needle location is within the "green" operating region.</li></ul>
SF6 gas level (external gauge)	<ul style="list-style-type: none"><li>Gas pressure is within the acceptable range.</li></ul>

### Part 7. Ground Connections

Assessment	Performance Expectations
Fence (padmount only)	<ul style="list-style-type: none"><li>All fences within 6 ft of the switch are grounded.</li></ul>
Enclosure (padmount only)	<ul style="list-style-type: none"><li>The enclosure is properly grounded.</li></ul>
Frame	<ul style="list-style-type: none"><li>The frame is bonded.</li></ul>
Ground rod	<ul style="list-style-type: none"><li>A ground rod is present.</li></ul>

**Part 8. Batteries (see Appendix C for detailed instructions)**

Assessment	Performance Expectations
Age of battery	<ul style="list-style-type: none"> <li>▪ Determine date of manufacture from equipment label.</li> <li>▪ Batteries that are more than 4 years old shall be replaced, regardless of physical or electrical condition.</li> </ul>
Physical condition	<ul style="list-style-type: none"> <li>▪ No damage, deformities, cracks, leaks, rust or white powder: Battery receives a condition rating of 5.</li> <li>▪ Minor damage, deformities, cracks, leaks, rust or white powder: Battery receives a condition rating of 4.</li> <li>▪ Noticeable damage, deformities, cracks, leaks, rust, or white powder: Battery receives a condition rating of 3.</li> <li>▪ Battery is in poor physical condition and replaced at the time of inspection: Battery receives a condition rating of 1.</li> </ul>
DC voltage	<ul style="list-style-type: none"> <li>▪ The open circuit voltage is greater than 32 Vdc: Battery receives a condition rating of 5.</li> <li>▪ The open circuit voltage is less than 32 Vdc and not replaced: Battery receives a condition rating of 2.</li> <li>▪ The open circuit voltage is less than 32 Vdc and is replaced.: Battery receives a condition rating of 1.</li> </ul>
Electrical condition, remote supervisory control	<ul style="list-style-type: none"> <li>▪ Battery operates supervisory control: battery receives a condition rating of 5.</li> <li>▪ Battery does not operate supervisory control and is not replaced: Battery receives a condition rating of 2.</li> <li>▪ Battery does not operate supervisory control and is replaced: Battery receives a condition rating of 1.</li> </ul>
Electrical condition, motor control battery	<ul style="list-style-type: none"> <li>▪ Battery operates motor: Battery receives a condition rating of 5.</li> <li>▪ Battery does not operate motor and is not replaced: Battery receives a condition rating of 2.</li> <li>▪ Battery does not operate motor and is replaced: Battery receives a condition rating of 1.</li> </ul>

**Part 9. Voltage Indicator**

Assessment	Performance Expectations
Display cleanliness and functionality	<ul style="list-style-type: none"> <li>▪ Display is clean and all phases function. See S&amp;C Instruction Sheet 681-510 for instructions on how to test voltage indicators.</li> </ul>

**Part 10. Portable Motor Operator (PMO) Fit Check (see Appendix D for more information)**

Assessment	Performance Expectations
Mounting	<ul style="list-style-type: none"> <li>▪ PMO is mounted properly. This is a one-time check. Do not fit check again if previously checked.</li> </ul>

**Part 11. Switch Operating Mechanism (performed only if switch is take out of service)**

Assessment	Performance Expectations
Operation	<ul style="list-style-type: none"> <li>▪ Mechanism operates smoothly.</li> <li>▪ Switch fully opens and closes.</li> </ul>

**Part 12. Overall Switch Condition Assessment Rating**

Assessment	Performance Expectations
Overall rating of the switch	<ul style="list-style-type: none"> <li>▪ Based on the above condition assessments and the expertise of the inspection team, what is an overall assessment of the complete switch?</li> </ul>

**Functional Condition Assessment Rating Guide**

- 1 – Renewal action taken by inspector, now in acceptable condition.
- 2 – Unacceptable, not fit for service, immediate corrective action required. If this rating is given, contact SOC and tag appropriately.
- 3 – Marginal condition, schedule renewal activity in the next 6 months
- 4 – Deteriorated, but acceptable condition
- 5 - Good condition

### **Part 13. Scheduling Future Off-Line Condition-Directed Renewal Tasks**

Include any out-of-service renewal tasks in this section and indicated the anticipated time frame.

### **Part 14. Comments**

Include all comments related to Parts 1-13 in this section. With each comment provided, identify which part each corresponds to.

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## **8. References**

**S&C Instruction Sheet 681-510**, "S&C Vista Underground Distribution Switchgear, UnderCover, Vault-Mounted, and Pad-Mounted Styles, Instructions for Operation," March 25, 2002

**S&C Instruction Sheet 1041-603**; "S&C Battery Chargers BC-8-24 and BC-8-36," June 6, 2016

**S&C Instruction Sheet 1045-540**, "(S&C 6800 Series Automatic Switch Control Operating Instructions," October 17, 2016

**SCL Design Standard 9202.17**; "Vista Switch Application Guide"

**SCL Work Practice 1167.13**; "Padmount Switch Signs and Labels"

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## **9. Sources**

**Shetab, Muneer**; SCL Standards Engineer, subject matter expert, and originator of 1142.23 (muneer.shetab@seattle.gov)

**S&C Data Bulletin 682-97**; "Battery Charger and Battery Pack Specifications," March 2, 2011

## Appendix A. Example of a Data Collection Sheet

Vista Switchgear Condition Assessment (For use with Work Practice 1142.23)		
Inspected By: _____	Date: _____	
Crew No: _____	Parent Facility ID No.: _____	
Switch (SW) No: _____	Equipment (PS) No.: _____	
Date of Manufacture: _____	Serial No.: _____	
Model No.: _____	Installation Type: Dry-Vault <input type="checkbox"/>	Wet-Vault <input type="checkbox"/> Padmount <input type="checkbox"/>
<b>Part 1. Site and Location</b>		
Condition Rating (1-5)	Assessment	Performance Expectations
<input type="checkbox"/>	Access to site	Switch is reasonably accessible to SCL operations and maintenance personnel. Accessing the site does not require a special key, permit, or prior approval for entry, as may be required for locations inside a customer building or facility.
<input type="checkbox"/>	Compartment access	Compartments are accessible with adequate space to perform routine operations and maintenance: 10 ft around doors, 3 ft on sides.
<b>Part 2. Dry-Vault Style Installation Inspection</b> <span style="float: right;">N/A Applicable</span>		
Condition Rating (1-5)	Assessment	Performance Expectations
<input type="checkbox"/>	Doors and locks	Door locks work and door opens and closes properly.
<input type="checkbox"/>	Signs and labels	Warning, Danger, and Notice signs are easily read. Switch (SOC) and Equipment (PS) numbers are assigned and easily read.
<input type="checkbox"/>	Water ingress	No standing water. Vault is free of water damage or rust.
<input type="checkbox"/>	Cleanliness	Vault is clean and free of debris.
<input type="checkbox"/>	Conduits	Sealed
<b>Part 3. Wet-vault Style Installation Inspection</b> <span style="float: right;">N/A Applicable</span>		
Condition Rating (1-5)	Assessment	Performance Expectations
<input type="checkbox"/>	Doors, Locks, and latches	Easy to operate, proper alignment, all latch points engage, locks and Penta head bolts are secure.
<input type="checkbox"/>	Signs and labels	Warning, Danger, and Notice signs are easily read. Switch (SOC) and Equipment (PS) numbers are assigned and easily read.
<input type="checkbox"/>	Cleanliness	Vault is clean and free of debris.
<input type="checkbox"/>	Conduits	Conduits are sealed.
<b>Part 4. Padmount-Vault Style Installation Inspection</b> <span style="float: right;">N/A Applicable</span>		
Condition Rating (1-5)	Assessment	Performance Expectations
<input type="checkbox"/>	Doors, Locks, and latches	Easy to operate, proper alignment, all latch points engage, locks and Penta head bolts are secure.
<input type="checkbox"/>	Signs and labels	Warning, Danger, and Notice signs are easily read. Switch (SOC) and Equipment (PS) numbers are assigned and easily read. See SCL Work Practice 1167.13 for padmount switch signs and labels.
<input type="checkbox"/>	Paint condition	No graffiti, only minor rust, no moss.
<input type="checkbox"/>	Pad	There are no major cracks; pad is reasonably level.
<input type="checkbox"/>	Seal	Enclosure is sealed at pad to prevent animal ingress.
<input type="checkbox"/>	Conduits	Conduits are sealed.
<input type="checkbox"/>	Water ingress	No standing water is present.
<input type="checkbox"/>	Condensation	Little to no condensation on roof or walls.
<input type="checkbox"/>	Contamination	Little to no dirt or moss on roof or walls. No signs of animal intrusion.

Part 5. Heat Sensor Readings		
Condition Rating (1-5)	Assessment	Performance Expectations
	____ °C Ambient temperature	Measure ambient temperature.
Way 1 <input type="checkbox"/>	____ °C Highest bushing/elbow temperature above ambient	Less than 10 degrees centigrade above ambient. Between phase and switch the difference shall be less than 5 degrees centigrade.
Way 2 <input type="checkbox"/>	____ °C Highest bushing/elbow temperature above ambient	Less than 10 degrees centigrade above ambient. Between phase and switch the difference shall be less than 5 degrees centigrade.
Way 3 <input type="checkbox"/>	____ °C Highest bushing/elbow temperature above ambient	Less than 10 degrees centigrade above ambient. Between phase and switch the difference shall be less than 5 degrees centigrade.
Way 4 <input type="checkbox"/>	____ °C Highest bushing/elbow temperature above ambient	Less than 10 degrees centigrade above ambient. Between phase and switch the difference shall be less than 5 degrees centigrade.
Way 5 <input type="checkbox"/>	____ °C Highest bushing/elbow temperature above ambient	Less than 10 degrees centigrade above ambient. Between phase and switch the difference shall be less than 5 degrees centigrade.
Way 6 <input type="checkbox"/>	____ °C Highest bushing/elbow temperature above ambient	Less than 10 degrees centigrade above ambient. Between phase and switch the difference shall be less than 5 degrees centigrade.
Part 6. SF6 Gas Levels		
		<input type="checkbox"/> Internal Gauge <input type="checkbox"/> External Gauge
Condition Rating (1-5)	Assessment	Performance Expectations
<input type="checkbox"/>	SF6 gas level (Internal Gauge)	Needle location is within the "green" operating region. Call S&C at 1-888-762-1100 or 1-855-381-8800 if needle is within the "Green with Yellow Stripes" region. A condition rating of 2 should also result in an overall switch rating of 2.
<input type="checkbox"/>	SF6 gas level (External Gauge)	Gas pressure is within the acceptable range. See "Acceptable (Pass) Range for SF6 Gas Pressure in External Gauges" graph in Work Practice 1142.23. Call S&C at 1-888-762-1100 or 1-855-381-8800 if the acceptable range is questionable. A condition rating of 2 should also result in an overall switch rating of 2.
Part 7. Ground Connections		
Condition Rating (1-5)	Assessment	Performance Expectations
<input type="checkbox"/>	Fence (Padmount Only)	All fences within 6 ft of the switch are grounded. See SCL Construction Standard U10-1.2, Section A-A.
<input type="checkbox"/>	Enclosure (Padmount Only)	The enclosure is properly grounded. See SCL Construction Guideline U10-5, Figures 1 and 3.
<input type="checkbox"/>	Frame	The frame is bonded.
<input type="checkbox"/>	Ground rod	A ground rod is present.
Part 8. Batteries		
	Switch has batteries? <input type="checkbox"/> Yes <input type="checkbox"/> No	MFR. Date: Supervisory <input type="checkbox"/> Motor Cont. <input type="checkbox"/>
Condition Rating (1-5)	Assessment	Performance Expectations
<input type="checkbox"/>	Age of battery	Determine date of manufacture from equipment label. Replace batteries that are more than 4 years old regardless of physical or electrical condition. Battery is more than 4 years old: Battery receives a condition rating of 1.
<input type="checkbox"/>	Physical condition	No damage, deformities, cracks, leaks, rust or white powder: Battery receives a condition rating of 5. Minor damage, deformities, cracks, leaks, rust or white powder: Battery receives a condition rating of 4. Noticeable damage, deformities, cracks, leaks, rust, or white powder: Battery receives a condition rating of 3. Battery is in poor physical condition and replaced at the time of inspection: Battery receives a condition rating of 1.
<input type="checkbox"/>	DC voltage	The open circuit voltage is greater than 32 Vdc: Battery receives a condition rating of 5. The open circuit voltage is less than 32 Vdc and not replaced: Battery receives a condition rating of 2. The open circuit voltage is less than 32 Vdc and is replaced: Battery receives a condition rating of 1.
<input type="checkbox"/>	Electrical condition Remote supervisory control	Battery operates supervisory control: battery receives a condition rating of 5. Battery does not operate supervisory control and is not replaced: Battery receives a condition rating of 2. Battery does not operate supervisory control and is replaced: Battery receives a condition rating of 1.
<input type="checkbox"/>	Electrical condition Motor control battery	Battery operates motor: Battery receives a condition rating of 5. Battery does not operate motor and is not replaced: Battery receives a condition rating of 2. Battery does not operate motor and is replaced: Battery receives a condition rating of 1. Check battery indicator LED lights on the Vista Battery Charger. Replace battery if "Battery Low" LED light is on continuously. Investigate if "Overvoltage" LED light is continuously on.
Part 9. Voltage Indicator		
Condition Rating (1-5)	Assessment	Performance Expectations
<input type="checkbox"/>	Display cleanliness and functionality	Display is clean and all phases function. See Instruction Sheet 681-510 for instructions on how to test voltage indicators.



Part 10. Portable Motor Operator (PMO) Fit Check		Previously checked?		
		<input checked="" type="checkbox"/> <b>Y</b> <input type="checkbox"/> <b>N</b>		
Condition Rating (1-5)	Assessment	Performance Expectations		
<input type="checkbox"/>	Mounting	PMO mounts properly. This is a one-time check. Mark the the above boxes accordingly. Do not fit check again if previously checked.		
Part 11. Switch Operating Mechanism (performed only if switch is taken out of service)				
Condition Rating (1-5)	Assessment	Performance Expectations		
<input type="checkbox"/>	Operation	Mechanism operates smoothly. Switch fully opens and closes.		
Part 12. Overall Switch Condition Assessment Rating				
Condition Rating (1-5)	Assessment	Performance Expectations		
<input type="checkbox"/>	Overall rating of the switch	Based on the above condition assessments and the expertise of the inspection team what is an overall assessment of the complete switch? Contact S&C Technical Support Hotline at 1-888-762-1100 or 855-381-8800 prior to recommending an unacceptable rating. Contact SOC. If this rating is given, contact SOC and tag appropriately.		
Part 13. Scheduling Future Off-line Condition Directed Renewal Tasks				
Anticipated Time Frame (Months)				
0-3	3-12	12-24	Beyond 24	Renewal Task
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vault cleaning
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Painting
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Contact and hinge lubrication with NYE Rheolube 368
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Attach safety signs and labels
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other(s)
Part 14. Comments (Include comments for Parts 1-13. With each comment provided, identify which part each corresponds to)				

## Appendix B. SF6 Gauge Assessment Details

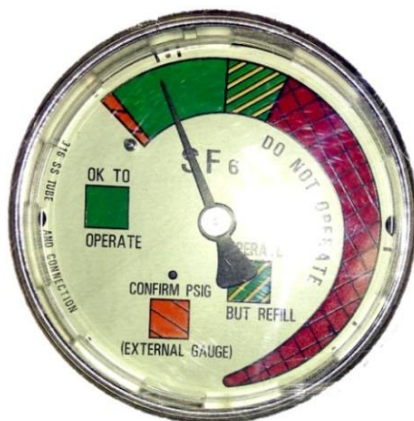
This information corresponds to Part 6 of the Vista Switchgear Condition Assessment Checklist.

Each Vista switch is equipped with one SF6 gas pressure gauge. The gauge will be one of three styles:

### INTERNAL

Internal style pressure gauges are temperature compensated.

**Figure B1. New SF6 gauge. Used on switches purchased after 2011.**



**Figure B2. Old SF6 Gauge. Used on switches purchased before 2011.**



### EXTERNAL

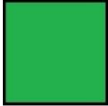



External style pressure gauges are not temperature compensated.

**Figure B3. Replacement SF6 Gauge. Used on some Vista switches to replace defective internal gauges. Mounted on the SF6 fill port.**



**To check an internal gauge:**

**Needle Location on the SF6 Pressure Gauge**

				
<b>Color</b>	Green	Green with yellow stripes	Orange with black stripes	Red with black stripes
<b>Result</b>	Pass	Pass	Fail	Fail
<b>Action</b>	None	Call S&C	Call S&C	Call S&C

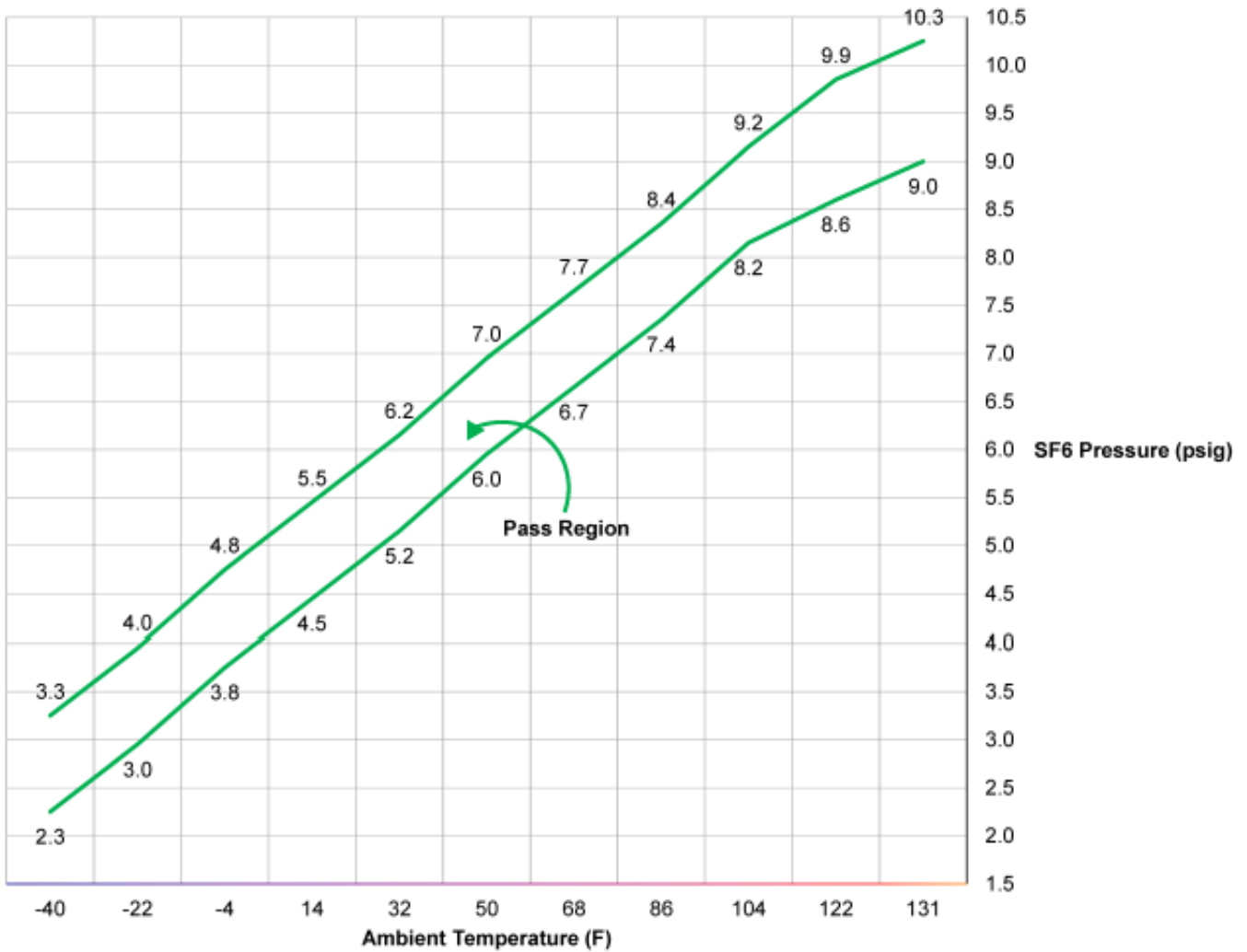
The needle location shall be within the “green” operating region. Call S&C at 1-888-762-1100 or 1-855-381-8800 if the needle is outside the “green” operating zone. A condition rating of 1 should also result in an overall switch rating of 1.

**To check an external gauge:**

1. Determine the ambient temperature.
2. Read the psig from the gauge.
3. Use Figure 6e and Table 6 to determine whether that number falls in the pass range (shown in green). For example, the pass range for 68°F is between 6.7 and 7.7 psig.

Call S&C at 1-888-762-1100 or 1-855-381-8800 if the needle is outside the pass range. A condition rating of 1 should also result in an overall switch rating of 1.

**Figure B4. Acceptable (Pass) Range for SF6 Gas Pressure in External Gauges**



**Table B1. Acceptable (Pass) Range for SF6 Gas Pressure in External Gauges**

Ambient Temperature (F)	Normal Pressure (psig)	Pass Range (psig)
131	9.8	9.0 - 10.3
122	9.4	8.6 - 9.9
104	8.65	8.2 - 9.2
86	7.85	7.4 - 8.4
68	7.15	6.7 - 7.7
50	6.45	6.0 - 7.0
32	5.65	5.2 - 6.2
14	4.95	4.5 - 5.5
-4	4.25	3.8 - 4.8
-22	3.5	3.0 - 4.0
-40	2.8	2.3 - 3.3

## Appendix C. Battery Inspection and Replacement

This information corresponds to Part 8 of the Vista Switchgear Condition Assessment Checklist.

### C.1. Battery Date of Manufacture

Individual 6 V and 12 V EnerSys cells shown in figures C.2d and C.2e of this appendix are re-packaged together by S&C Electric Company to form 36 V Remote Supervisory and Motor Control battery packs.

The Remote Supervisory Battery Packs have a sticker on them like the one shown in Figure C.1a. In this example, "DATE 1126" means the battery was packaged together on the 26<sup>th</sup> week of 2011. The date corresponding to the 26<sup>th</sup> week of 2011 is June 27 to July 3, 2011. Use June 27, 2011 as the date of manufacture.

The Motor Control Battery Packs have two stickers on them like the one shown in Figure C.1b. In this example, the two stickers are "Place in operation or charge batteries in this equipment before: 4-6-2010" and "Battery charged on 8-6-09." Use August 6, 2009 as the date of manufacture.

**Figure C.1a. Remote Supervisory Battery Pack**



**Figure C.1b. Motor Control Battery Pack**

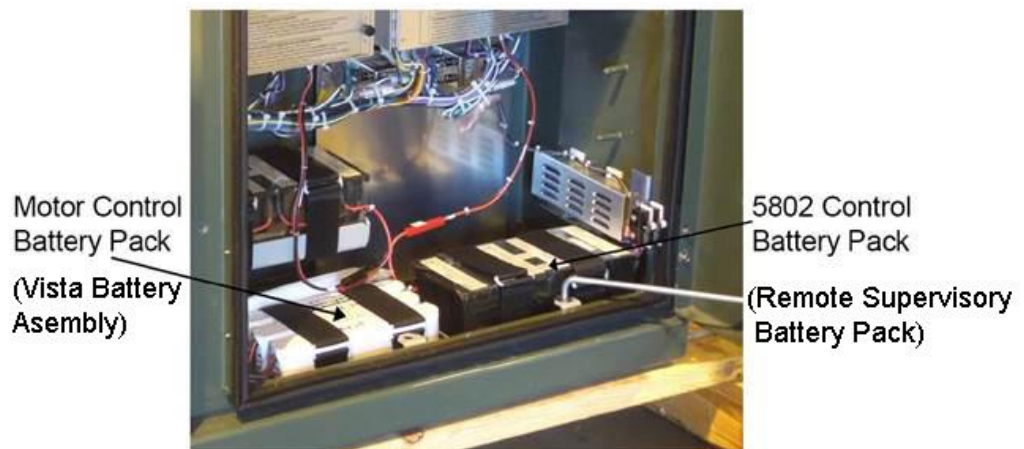


## C.2. Battery Testing and Replacement

This information applies only to Vista switches that have motor control or remote supervisory control battery packs, or both. There are separate test procedures for the 6800 Control Battery Pack and the Motor Control Battery Pack.

The 6800 Control Battery Pack, also known as Remote Supervisory Battery Pack has a black case as shown in Figure C.2a.

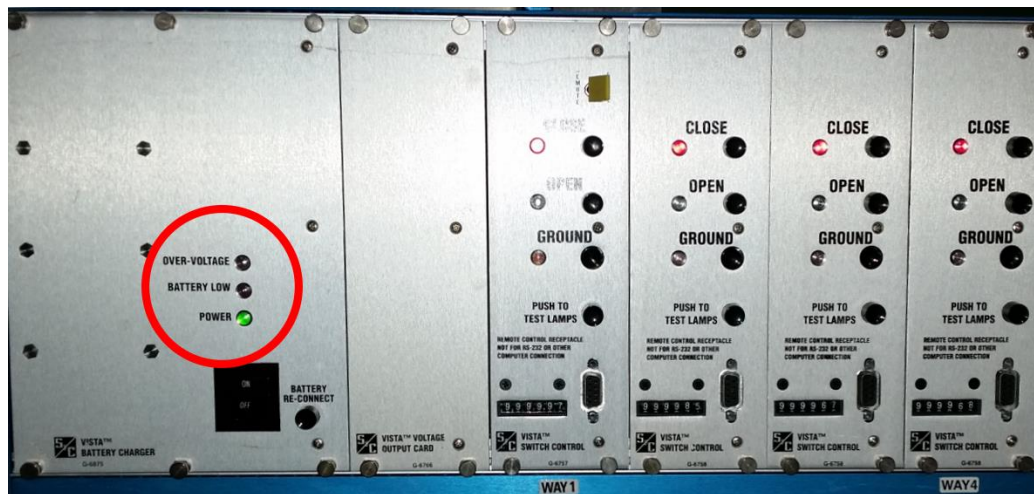
**Figure C.2a. 6800 Control Battery Pack, SCL Stock No. 013744; S&C Electric Company Catalog No. 591-000190-02**



### 6800 Control Battery Pack Test

1. Inspect batteries for physical damage like deformities, cracks, leaks, rust, or white powder.
2. Use the "Battery Test/Lamp Test" toggle switch to test the battery condition. See the S&C document *Instruction Sheet 1045-540* for testing requirements.
3. Toggle the switch UP to start a battery test. The test lasts approximately 30 seconds if the control is operating on battery power or approximately 3 minutes if the control is operating on AC power. The "Battery Low" LED blinks during the test. See Figure 6g.
4. If the "Battery Low" or "Battery Bad" LED light appears, the battery failed the test. Replace the battery. Otherwise, the battery passed the test.

**Fig. C.2b. Vista Battery Charger**



### Motor Control Battery Pack Test

The battery charger performs an automatic monthly interval impedance test to determine the condition of the battery. There is no toggle switch to test the condition of the battery. The LED lights on the battery charger show the test results. Replace the battery when the “Battery Low” LED light appears. See Figure C3.

**Figure C.2c. Battery Indicator LED Lights**



### Battery Pack Replacement

This procedure is applicable to both remote supervisory and motor control battery packs.

1. Measure the open circuit voltage of the replacement battery. It must have an output voltage of at least 32.0 Vdc. Batteries with less than 32 Vdc open circuit voltage are considered bad and should not be used.
2. If the remote supervisory battery has failed, indicate the switch way to which the battery corresponds.

### 6800 Control Battery Pack

Also known as a Remote Supervisory Battery Pack, it consists of six (6) 6V 0859-0012, 8.0 Ah (ampere-hour) EnerSys Cyclon batteries connected in series. The combined voltage of this battery pack is 36Vdc. The S&C Part No. for the 36 V battery pack is 591-000190-02. These batteries are typically shipped from Alameda, California.

The quantity of control battery packs required by a remote supervisory (capable) Vista switch varies with the number of ways and whether the switch is purchased with SCADA-capable electronics. See SCL 9202.17.

**Figure C.2d. 6800 Control Battery Pack**



**CYCLON 6 Volt Monoblocs**

Product Number	Description	Length in. (mm)	Width in. (mm)	Height in. (mm)	Weight lbs. (kg)
0819-0012	6V, 2.5Ah Monobloc	4.48 (113.8)	1.81 (46.0)	2.75 (69.9)	1.15 (.52)
0809-0012	6V, 5.0Ah Monobloc	5.48 (139.2)	2.12 (53.8)	3.02 (76.7)	2.16 (.98)
0859-0012	6V, 8.0Ah Monobloc	5.48 (139.2)	2.13 (54.1)	4.00 (101.6)	3.15 (1.43)

**Motor Control Battery Pack**

Also known as a Vista Battery Assembly, it consists of three (3) 12V 0808-0109, 5.0 Ah, Energys Cyclon batteries connected in series. The combined voltage of this battery pack is 36 Vdc. The S&C Part No. stamped on the 36V battery pack is 9931-073. The S&C Part No. for ordering is QCUA-5601-3. These batteries are typically shipped from Chicago, Illinois.

A remote supervisory (capable) Vista switch will have one motor control battery pack.

**Figure C.2e. Motor Control Battery Pack**



**CYCLON 12 Volt 1x6 Shrink Wrap**

Product Number	Description	Length in. (mm)	Width in. (mm)	Height in. (mm)	Weight lbs. (kg)	Leads
0810-0108	2.5Ah D Dbl. Slot	8.08 (205.2)	1.48 (37.6)	2.66 (67.6)	2.49 (1.13)	No
0810-0109	2.5Ah D	8.08 (205.2)	1.48 (37.6)	2.66 (67.6)	2.52 (1.14)	Yes
0860-0108	4.5Ah DT Dbl. Slot	8.08 (205.2)	1.48 (37.6)	4.03 (102.4)	3.88 (1.76)	No
0860-0109	4.5Ah DT	8.08 (205.2)	1.48 (37.6)	4.03 (102.4)	3.91 (1.77)	Yes
0800-0108	5.0Ah X Dbl. Slot	10.48 (266.2)	1.87 (47.5)	3.12 (79.2)	4.99 (2.27)	No
0800-0109	5.0Ah X	10.48 (266.2)	1.87 (47.5)	3.12 (79.2)	5.03 (2.28)	Yes
0850-0108	8.0Ah E Dbl. Slot	10.48 (266.2)	1.87 (47.5)	4.19 (106.4)	6.73 (3.05)	No
0850-0109	8.0Ah E	10.48 (266.2)	1.87 (47.5)	4.19 (106.4)	6.77 (3.07)	Yes



## Appendix D. Portable Motor Operator

This information corresponds to Part 10 of the Vista Switchgear Condition Assessment Checklist.

The purpose of this procedure is to confirm whether a Portable Motor Operator (PMO) mounts properly on a manual Vista switch. The PMO cannot be used with switches equipped with a permanent motor operator, that is, those that are remote supervisory controlled (capable).

1. DO NOT operate the switch with the PMO.
2. Make sure the hooks on each end of the PMO properly fit inside the holes on either side of the PMO mounting bracket on the Vista switch. See Figure D1.
3. Repeat step 2 for each way of the Vista switch.

**Figure D1. Portable Motor Operator Mounting**

