

Substation Supplemental Inspection Program

SUMMARY

This utility standard defines the scope and process to use for the substation supplemental inspection program.

TARGET AUDIENCE

Utility personnel who are involved in the substation supplemental inspection program.

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REQUIREMENTS

1 General Information

- 1.1 Substation equipment maintenance requirements use a combined time-based and condition-based maintenance (CBM) approach. These practices are described in [Utility Standard TD-3322S, "Substation Equipment Maintenance Requirements."](#)
- 1.2 Protective equipment maintenance requirements use a combined time-based, trouble-based, or CBM approach. These practices are described in [Utility Standard TD-3323S, "Protective Equipment Maintenance Requirements."](#)
- 1.3 The two standards (listed above) and their described maintenance practices promote safe and reliable electrical service within PG&E's service territory. It also ensures compliance with various regulatory bodies, such as the California Independent System Operator (CAISO), the North American Electric Reliability Corporation (NERC), the Western Electricity Coordinating Council (WECC), the California Public Utilities Commission (CPUC), and, where applicable, the regulations of other agencies.
- 1.4 Routine substation equipment maintenance and protective equipment maintenance includes many activities including visual inspections, infrared inspections, preventative maintenance, corrective maintenance, and equipment testing.

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2 Supplemental Inspection Program Development

- 2.1 To further minimize the risk of substation equipment failure causing a public or employee safety or system reliability concern (e.g., spreading a fire outside of the substation), PG&E has developed a program for performing supplemental inspections on selected facilities, based on risk assessment.
- 2.2 The supplemental inspection program is designed to target specific inspection points based on potential failure modes and risks that could result in fire ignition.
 1. There are differences in the inspection points captured during routine inspections compared to those captured during supplemental inspections.
- 2.3 These supplemental inspections are performed in addition to the routine inspections that are part of the maintenance practices described in [Utility Standard TD-3322S](#) and [Utility Standard TD-3323S](#).
- 2.4 To develop this supplemental inspection program, a failure modes and effects analysis (FMEA) has been performed on substation equipment. The scope and results of this analysis are available as a reference in [TD-8123M, *Electric System Inspections and Preventative Maintenance Manual*](#), and [“Failure Mode and Effect Analysis \(FMEA\) for Substations”](#) (in Section 3 of TD-8123M).
- 2.5 Should an update be warranted, perform a FMEA as follows:
 1. Develop a FMEA for substation asset components to identify critical components that constitute single points of failure.
 - a. Determine the ways an asset and components might fail (i.e., failure modes).
 - b. Determine the probability of failure (i.e., occurrence probability).
 - c. Determine the severity of consequence (i.e., severity rating).
 2. Evaluate each component for applicable failure modes.
- 2.6 Provide inspection techniques based on primary detection methods (i.e., visual, drone, infrared) for identifying those failure modes.
- 2.7 Use the FMEA to develop the supplemental inspection program for substations.
 1. The supplemental inspection program includes the following three methods:
 - Drone-based aerial inspection
 - Ground-based visual inspection
 - Infrared inspection

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2.7 (continued)

2. Inspect all the critical components identified in the FMEA that can be assessed using these methods.
3. Perform the supplemental inspections in PG&E-owned substations and switchyards based on the following risk factors:
 - High Fire Threat Districts (HFTDs)
 - High Fire Risk Areas (HFRAs)
 - Wildfire risk and consequence modeling
4. [Utility Standard TD-3328S, Attachment 1, "Substation Supplemental Inspection Criteria,"](#) classifies substations and switchyards into different wildfire risk tiers and sets the inspection frequency for each of the classifications.

3 Supplemental Inspection Requirements

3.1 All substations and switchyards (including power generation facilities) that meet the following criteria are included in the program:

1. Facilities containing "inspectable assets" owned or maintained by electric operations.
2. Facilities that are considered in-service, are energized, are designated spares, or are expected to be energized within the inspection year.

3.2 Inspection types may be omitted for facilities where that type of an inspection is not possible.

EXAMPLE: It is not possible to perform an effective aerial inspection on an indoor substation; therefore, an aerial inspection is not required for that location.

3.3 Types of inspections are as follow.

1. Aerial Inspection
 - a. Perform aerial inspections in accordance with [Attachment 2, "Aerial Inspection Approval Workflow,"](#) and [Utility Procedure TD-3328P-02, "Substation Aerial Inspection Procedure."](#) (This procedure is scheduled for publication in the 1st quarter of 2022.)
 - b. Focus: Aerial inspections focus on substation outdoor equipment and the surrounding defensible space.

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3.3.1.b (continued)

- (1) The drones fly a pre-determined path over the facility and record images at specific points in the flight path.
- (2) The images are reviewed by the aerial inspection review team (AIR+).

2. Ground-Based Visual Inspection

- a. Perform this inspection in accordance with the steps shown in [Attachment 3, "Ground Inspection Approval Workflow,"](#) and [Utility Procedure TD-3328P-03, "Substation Ground Inspection Procedure."](#) (This procedure is scheduled for publication in the 1st quarter of 2022.)
- b. Focus: Ground-based visual inspections focus on all substation equipment, as well as identifying defensible space and combustible material in and around the facility.

3. Infrared Inspection

- a. Perform infrared inspections in accordance with [Manual TD-3322M, Infrared Inspections,](#) and in conjunction with the ground-based visual inspection.

3.4 All inspection results are reviewed by the centralized inspection review team (CIRT).

1. During this review, each abnormality is validated, a priority is assigned, and a SAP work management (WM) notification is created per [Utility Standard TD-3328S, Attachment 2, "Aerial Inspection Approval Workflow,"](#) and [Utility Standard TD-3328S, Attachment 3, "Ground Inspection Approval Workflow."](#)
 - a. See [Utility Procedure TD-3328P-04, "Substation Inspection – Centralized Inspection Review Procedure."](#) (This procedure is scheduled for publication in the 1st quarter of 2022.)

4 Record Keeping

- 4.1 The results of all inspections must be recorded in an electronic format using a PG&E-approved application and stored in an approved system of record in accordance with [Corporation Standard GOV-7101S, "Enterprise Records and Information Management Standard."](#)
- 4.2 Identify each abnormal condition, provide any comments, and attach pictures to the inspection results.

END of Requirements

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DEFINITIONS AND ACRONYMS

AIR+: Aerial inspection review team.

CIRT: Centralized inspection review team.

Defensible space: The area within the perimeter of a parcel where basic wildfire protection practices are implemented. It provides the key point of defense from an approaching wildfire or escaping fire.

FMEA: Failure modes and effects analysis.

HFRA: PG&E-defined high fire risk area.

HFTD: CPUC-defined High Fire Threat District.

Inspectable asset: Equipment or component for which the primary means of detection of failure modes (identified in the FMEA) are visual or infrared inspection.

Inspection: A detailed visual observation of a facility looking for abnormalities or circumstances that may have a negative impact on safety, reliability, or asset life.

SAP WM: SAP work management system.

IMPLEMENTATION RESPONSIBILITIES

The director in charge of standards and work methods must communicate the publication of Revision 2 of this standard to electric asset strategy and system inspections employees and issue a general notification regarding the publication of this revision.

GOVERNING DOCUMENT

NA

COMPLIANCE REQUIREMENT / REGULATORY COMMITMENT

- [CAISO Amended and Restated Transmission Control Agreement, Appendix C, "CAISO Maintenance Standards"](#)
- [CPUC General Order 174, "Rules for Electric Utility Substations"](#)
- [NERC FAC-501-WECC-2, "Transmission Maintenance"](#)
- [NERC PRC-005-6, "Protection System, Automatic Reclosing, and Sudden Pressure Relaying Maintenance"](#)

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Compliance Requirement / Regulatory Commitment (continued)

Records and Information Management:

PG&E records are company assets that must be managed with integrity to ensure authenticity and reliability. Each line of business (LOB) must manage records and information in accordance with the Enterprise Records and Information (ERIM) policy, standards, and Enterprise Records Retention Schedule (ERRS). Each LOB is also responsible for ensuring records are complete, accurate, verifiable, and can be retrieved on request. Either refer to [GOV-7101S, "Enterprise Records and Information Management Standard,"](#) for further records management guidance or contact ERIM at Enterprise_RIM@pge.com.

REFERENCE DOCUMENTS

Developmental References:

- [Corporation Standard GOV-1038S, "Inspection and Corrective Maintenance Governance"](#)
- [Utility Standard TD-8123S, "Electric System \(T/S/D\) Patrol, Inspection, and Maintenance Program"](#)

Supplemental References:

- [TD-8123M, "Electric System Inspections and Preventative Maintenance Manual"](#)
- [TD-3322M, "Substation Maintenance and Construction Manual", Infrared Inspections](#)
- [Utility Procedure TD-3328P-01, "Substation Supplemental Inspection Program"](#) (to be published 1st quarter 2022)
- [Utility Procedure TD-3328P-02, "Substation Aerial Inspection Procedure"](#) (to be published 1st quarter 2022)
- [Utility Procedure TD-3328P-03, "Substation Ground Inspection Procedure"](#) (to be published 1st quarter 2022)
- [Utility Procedure TD-3328P-04, "Substation Inspection – Centralized Inspection Review Procedure"](#) (to be published 1st quarter 2022)
- [Utility Standard TD-3322S, "Substation Equipment Maintenance Requirements"](#)
- [Utility Standard TD-3323S, "Protective Equipment Maintenance Requirements"](#)

APPENDICES

NA

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ATTACHMENTS

[Utility Standard TD-3328S, Attachment 1, "Substation Supplemental Inspection Criteria"](#)

[Utility Standard TD-3328S, Attachment 2, "Aerial Inspection Approval Workflow"](#)

[Utility Standard TD-3328S, Attachment 3, "Ground Inspection Approval Workflow"](#)

DOCUMENT REVISION

This procedure cancels and supersedes Utility Procedure TD-3328S, "Substation Supplemental Inspection Program, Rev. 1, dated 06/11/2021.

DOCUMENT APPROVER

██████████ Director, Standards and Work Methods

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REVISION NOTES

Where?	What Changed?
2.2	Added to differentiate inspection points captured from routine inspections compared to supplemental inspections.
2.4.1	Removed items “d” and “e”.
2.4.3	Changed section formatting.
2.4.4	Removed section.
2.5.3	Added High Fire Risk Areas (HFRAs).
2.5.4	Relocated section 3.3.4 to section 2.5.4.
Entire document	<p>Update scheduled publication dates for new future procedures TD-3328P-02, TD-3328P-03, and TD-3328P-04 from 4th quarter of 2021, to 1st quarter of 2022.</p> <p>Added reference TD-3328P-01, “Substation Supplemental Inspection Program” (to be published 1st quarter of 2022).</p>