Operations Procedure - Distribution System Inspection and Maintenance Plan

Subject: Distribution System Inspection and Maintenance	Procedure No. DOPS-011

I. INTRODUCTION

This distribution system inspection and maintenance plan describes CORE Electric Cooperative's (the Cooperative's) plan for maintaining the Cooperative's electrical distribution system throughout its service territory. The Cooperative's purpose in having a detailed and scheduled maintenance and inspection plan is to minimize disturbances and outages on the distribution system. The systematic inspection and maintenance program described in this plan is intended to increase the safety and reliability of the Cooperative's distribution systems and ultimately lower costs to the Cooperative and its members.

II. RESPONSIBILITY

The Distribution Operations Director, through his or her designees, shall be responsible for implementing this inspection and maintenance plan, including ensuring that timely inspections of circuits are done, that repairs or deficiencies are completed, that appropriate procedures are followed in implementing the plan, that the standards set forth in this plan are met, that records are kept for work performed, and that the plan is updated periodically to reflect changes to the Cooperative's facilities.

III. OVERHEAD DISTRIBUTION SYSTEM

A. The Cooperative's overhead distribution system consists of conductors and equipment at voltages of 34,500 volts and below that is necessary to provide electricity to the Cooperative's consumers.

B. The Cooperative's goal is to inspect and make all necessary repairs on the Cooperative's overhead distribution system.

C. Inspections and repairs shall be performed following the procedures and standards set forth by the Cooperative. Items that are to be inspected and or recorded are detailed within Appendix A to this plan. All crews performing inspections and repairs shall be provided with a copy of Appendix A and shall always keep a copy in a vehicle at the worksite.

D. The inspection process will consist of the following components:
    1. 360 - line patrol mid cycle every six (6) years per circuit all three-phase only (single phase in level 5 wildfire risk areas will be inspected every three (3) years).
    2. Drone inspections every six (6) years per circuit, bringing up to A-Z standards when repairs are needed.
    3. Regulator and sectionalizing device inspections every six (6) years per district project.
    4. UG inspections every twelve (12) years per circuit.
    5. Osmose pole inspection every twelve (12) years per circuit.
    6. Tree task work every six (6) years per circuit.
    7. Tree mid cycle work every six (6) years per circuit.

E. The 360-line patrol consists of a patrol of all distribution circuits on CORE's system. The purpose of these inspections is to look for broken or hazardous conditions that may lead to outages or damage to property or persons. Each pole will be looked at from the base of the pole with binoculars, looking for any hazards. Any hazards found will be documented, reviewed by Line Superintendent/Manager with comments added within 30 days unless it is necessary to repair sooner.

F. Drone inspections will be conducted on the entire distribution overhead system. Level 5 fire risk areas, identified on the Conditional Risk Map for Wildfire and listed on the Fire Warning Status Dashboard, and outage indices will determine the order in which circuits are inspected. These inspections are more comprehensive in that they include infrared imaging of connections and devices, as well as photos taken from above the structures that help identify issues that may include tracking insulators, damaged pole tops, and damaged crossarms.

G. When open wire secondary is found in the field by linemen, they will create the appropriate purple box in Collector. When these items are found on drone line inspections, the field personnel will add the appropriate purple box in Collector, representing open-wire secondary.
    1. When open wire secondary is less than 65 ft., CORE crews can coordinate replacement of the wire with triplex.

H. During inspections, the following recording format will be followed by the drone inspection contractor or the crews performing the 360-line patrol:

High Priority – Level 4, Red

Items flagged in this section need immediate attention. These items may present an imminent risk of failure, and a Supervisor with CORE Electric Cooperative needs to be notified so that a

crew can respond as soon as possible. Per CORE's policy, these items will need to be reviewed by a Line Superintendent/Manager with comments added and/or repaired within 30 days unless a CORE Supervisor decides it does not need to be handled immediately.

- Broken Insulator – phase on crossarm or floating
- Broken Crossarm – phases are floating or will be soon
- Tracking Insulators – burning of pole or crossarm
- Broken Pole
- Poorly Seated Hotline Clamps
- Partially Closed Switches – making contact but potentially hot and burning
- Any Tree that has Fallen into the Line
- Excessive Burning and Tracking Present on Pole or Crossarm
- Broken Jumper
- Chipped/Cracked/Broken Porcelain
- Damaged Primary Conductor – frayed or burned
- Ungrounded Equipment
- Any Thermal Imaging Anomalies
- Missing Cotter Key
- Foreign object in Line
- Blown Lightning Arrestor/Flashed Gap Arrestor
- Loose Ground Wires that Could Come in Contact with an Energized Conductor

Medium/High Priority – Level 3, Yellow

These items present the potential for an outage in the near future. The work should be scheduled as soon as reasonably possible.

- Porcelain Cutouts
- Porcelain Lightning Arrestors
- Poor Line Sag
- Loose Guy Wire
- Loose Hardware and Brackets
- Any Parts of Trees Encroaching within 2' of the Line.
- Broken or Poorly Tied Ties
- Lightning Damage

- Split Pole Top/Crossarms
- Bare Secondary Connections
- Missing Raptor Protection (football on primary bushing and arrestor; factory arrestor cap not sufficient)/Stinger Cover Missing/Poorly Installed/Decayed
- Jumpers Close to Grounds
- Guy Wires that are not Bonded or do not have an Insulating Link where the guy wire extends past any primary, transformers, or equipment.
- Hotline Clamp Directly on Conductor (tap rod okay)
- Loose and/or Missing Hardware
- Bird Nests
- Split Bolt Connections on Primary
- Split Bolt Connections on Secondary
- Split Bolt Connection on Neutral
- Equipment Leaking Oil
- Problems with Joint Use, Including Clearances
- Missing Guy Guards
- Auto Splice in Secondary
- R.O.W. Encroachment
- Open Wire Secondary

Low Priority – Level 2, Orange

These are poles that do not meet current specifications by CORE Electric Cooperative but do not need immediate attention.

- Unauthorized Items on CORE Poles/Equipment (such as basketball hoops, satellite dishes, and cameras, etc.)
- Abandoned/Inactive Facilities on Poles
- Shell Rot
- Inaccurate GIS Data to Include Device Labeling
- Woodpecker Holes – unless they present an issue for hardware or equipment on poles (If this is the case, they would need to be elevated to a red (4) or yellow (3) based on severity).
- Metal or Aluminum Mounting Brackets

Non-Priority Level – 1, White

These are poles that are in good condition, with no defects found, and need no attention from CORE Electric Cooperative.

I. During the 360 inspection, all Cooperative sectionalizing devices will be verified, and reclosing device counter reads will be documented in the ARC GIS Collector Application every six (6) years, along with battery replacement in Nova's and Versa Techs.

1. These devices will be inspected for loose connections and or damage.

2. The connections for these devices shall be consistent with the standards set forth by the Cooperative Standard's Committee.

3. The devices must also be installed per the Cooperative specifications. If the device is not installed per the Cooperative specifications, the inspecting crew shall create a service order to address the issue.

J. The line conductor size (phase and neutral) and material will be documented within the ARC GIS Collector Application when conducting 360 program inspections. This information will be useful for future System Improvement Projects and troubleshooting purposes.

K. Confirm phase verification with phase identifiers on taps off of three-phase to include all single-phase transformers, UG risers on main feeders, and colored phase tag on pole.

L. Any mapping / GIS discrepancies will be logged within the Collector Application using the question mark icon to get reported to the GIS department.

M. The line patrol map in Arc GIS Collector will be updated each day during patrol. The green line marking the patrolled area will indicate the area patrolled with green checkboxes, noting what repairs were made in the comment section. A green line will indicate that the line was inspected through the 360 program, a blue line will indicate that the line was inspected with the A-Z repairs, and boxes will be placed at each pole with the corresponding priority level for the drone program. Green check boxes will indicate repairs were made and must include photos and comments of what work was done in all cases.

IV. OVERHEAD DISTRIBUTION SYSTEM INSPECTION SCHEDULE

A. The Cooperative's overhead distribution system will be inspected within a six (6) year cycle. All three-phase sections are inspected on a three (3) year cycle. Single and three-phase sections downstream of the first reclosing device will be

inspected by line crews during the pole inspections.

B. The portions of the circuits listed in the GIS Fire Warning Status Dashboard as level 5 wildfire risk areas, including the single-phase identified on the Conditional Risk Map for Wildfire and three-phase taps, will be inspected every three (3) years utilizing the 360-line patrol and/or drones.

C. The main feeders, or distribution single and three-phase sections, may be inspected out of cycle after the first cycle if conditions such as significant storm damage, high fire danger, or excessive outages occur.

D. Regulators will be inspected for damage and loose connections and operated to ensure they are stepping correctly every six (6) years. Regulators that are found to have been in service for a period of twenty (20) years will be scheduled to be changed out. When inspecting, field personnel will take note of the make, year, counter, min/max positions, if the control panel is on regulator or pole, and time delay settings. Regulator bypass switches will be lubricated with approved products that are safe to use on energized equipment following manufacturer guidelines for bypass switch lubrication and operation.

E. During power restoration efforts, field personnel should make a conscious effort to inspect and record any major deficiencies or safety-sensitive issues on the section of line being patrolled. The section of line patrolled will not be recorded as patrolled during a power restoration.

V. UNDERGROUND DISTRIBUTION SYSTEM

A. The Cooperative's underground distribution system consists of conductors and equipment at voltages of 12,470 volts and below that is necessary to provide electricity to the Cooperative's members.

B. Inspections and repairs shall be performed following the procedures and standards set forth by the Cooperative.

C. During inspection, the items highlighted in Appendix C need to be documented in the ARC GIS Collector Application.

D. Any necessary repairs will be completed immediately if safety sensitive. All other repairs will be reviewed by the Line Superintendent/Manager within thirty (30) business days of discovery and scheduled to be repaired

VI. UNDERGROUND DISTRIBUTION SYSTEM INSPECTION SCHEDULE

A. The Cooperative's underground all primary distribution system will be inspected every twelve (12) years.

B. During power restoration efforts, field personnel should make a conscious effort to inspect and record any major deficiencies or safety-sensitive issues on the section of line being patrolled. The section of line patrolled will not be recorded as patrolled during a power restoration.

C. In the event there is an underground primary failure, field personnel will install a marker ball on the primary splice location and a splice location will be marked on the map using the Splice Location Symbol.

D. Complete inspections will be conducted only during non-power restoration efforts and only during routine maintenance and construction. Items inspected shall be documented in GIS patrol maps with the appropriate symbols and pictures added at all inspection points. Photos should include serial number(s) and inside/outside conditions. Thermal camera may be used to check termination points.

E. The underground distribution system's oil switchgear will be replaced at a rate determined by the Operations and Engineering departments. This type of work requires extensive switching and isolation practices. During these operations, the loops affecting the switch will be considered inspected.

VII. STREETLIGHT INSPECTION AND MAINTENANCE

A. Street light inspection and maintenance will be conducted on a six (6) year cycle starting in 2027.

B. Field personnel will note the following upon their inspection/maintenance:
   1. Streetlight numbered tag
   2. Type of pole (aluminum, fiberglass, or wood)
   3. Height of pole
   4. Type of light (LED colonial or shoebox – 2 bar or 3 bar)
   5. Condition of pole (frayed, broke, holes, etc.)
   6. Single or double head

VIII. SAFETY AND REGULATIONS

A. The Cooperative and Contractors performing work for the Cooperative shall comply with all governmental safety requirements and regulations and the safety and health provisions of their company. A partial list of applicable standards and regulations follows:

1. OSHA Requirements (1910.269)
2. National Electric Safety Code (NESC)
3. State of Colorado Requirement – Colorado Revised Statutes Title 9 Safety - Industrial and Commercial, Article 2.5 – High Voltage Power Lines – Safety Requirements.
4. Cooperative Switching and Clearance Procedure 700.09
5. Cooperative crews shall comply with the Cooperative Safety Manual.

IX. QUALIFICATIONS AND TRAINING

A. The distribution system inspections will be conducted by personnel qualified by the Cooperative under OSHA Requirement 1910.269.

B. Repairs of equipment over a 600-volt rating will be completed by Cooperative linemen or contractors qualified to perform live line repairs.

C. Repairs on equipment rated at 600 volts and less will be completed by personnel qualified by the Cooperative under OSHA Requirement 1910.269.

X. RECORD-KEEPING

A. ARC GIS Collector will be used for record-keeping. The crew lead will update the line patrol map each day with a green line representing the area patrolled and a green checkbox indicating repairs made in the comments section. Red checkboxes will indicate work still needing completion and that work shall be reviewed by Line Superintendent/Manager with comments added within 30 days unless it is necessary to repair sooner. Photos and comments will be added to all checkboxes created.

B. All records relating to inspection and maintenance of the distribution system will be retained within the GIS platform.

XI. REPORTING

A. The Distribution Operations Director will report on the progress and status of the plan to the Chief Operating Officer monthly.

XII. PROCEDURE APPROVALS

	Date	Name	Title
Approved	1/30/2020	Alex J. Mendez	Distribution Operations Director
Approved	8/27/2020	Alex J. Mendez	Distribution Operations Director
Approved	9/13/2022	Alex J. Mendez	Distribution Operations Director
Approved	8/12/2024	Robert Kiess	Interim Distribution Operations Director

XIII. PROCEDURE REVISION HISTORY

Effective Date	Revision Number	Revised By:	Revision History
1/30/2020	1	Alex J. Mendez	Updated for fire mitigation plan; added revision history.
8/27/2020	2	T.J. Havens	Updated Section III (L); Updated Section IX (A)
9/13/2022	3	Alex J. Mendez, T.J. Havens, Mike McCorkell, Sam Morris, Damon Darling	Updated Section III; revised and updated Section V and VI.
8/12/2024	4	Robert Kiess, Brian Hinks, T.J. Havens, Mike McCorkell, Jordan Ambrogi	Edits to Section III; Minor edits to High Priority – Level 4, Red; Updates to Medium/High Priority – Level – 3, Yellow and Non-Priority Level – 1, White; Edits to Section IV and VI; Addition of Section VII Streetlight Inspection and Maintenance; Minor edits to Section X. Record-Keeping and Section XI Reporting; Edits to Appendix A and C.

APPENDIX A

OVERHEAD INSPECTION ITEMS

- LOOSE HARDWARE AND BRACKETS – TIGHTEN ALL HARDWARE WHEN SET UP ON A POLE.
- BROKEN TIES
- WHEN SET UP ON A POLE, CHANGE ALL PORCELAIN DEAD-END INSULATORS WITH A DIAMETER OF 7 INCHES OR LESS TO POLYMER.
- TRACKING/CRACKED INSULATORS WILL BE CHANGED TO POLYMER.
- LINE SAG
- ENSURE ALL POLE GROUNDS ARE IN GOOD CONDITION AND REPAIR AS NEEDED
- REMOVE ANY SIGNAGE FROM POLES.
- LIGHTNING DAMAGE
- CHANGE PORCELAIN CUT-OUTS AND INSTALL FIBERGLASS CUTOUT/ARRESTER BRACKETS IF MOUNTED DIRECTLY TO POLE OR IF ANY TYPE OF METAL BRACKETS ARE BEING USED.
- ARRESTER CONDITION – ELIMINATE ALL PORCELAIN, INCLUDING GAP ARRESTERS ON TRANSFORMERS/REPLACE WITH POLYMER ARRESTER KITS.
- CONDITION OF CONNECTIONS/ELIMINATE ALL SPLIT BOLT CONNECTORS, INCLUDING NEUTRAL CONNECTIONS.
- TAPS ON BASKET WITH APPROVED HOT LINE CLAMP/UNLESS TAP ROD WAS RECENTLY INSTALLED AND AN APPROVED HL CLAMP IS USED AND VERIFIED TIGHT.
    - REMOVE ANY UNIVERSAL BAIL/STIRRUP WITH DAMAGE OR WITH ONLY ONE H CRIMP AND REPLACE WITH WEDGE STYLE.
    - IF BAIL HAS 2 H-CRIMPS, OKAY UNLESS DAMAGE OR SIGNS OF ARCING.
- RAPTOR PROTECTION/STINGER COVER – REMOVE AND REPLACE ANY WILDLIFE PROTECTION THAT HAS ANY MARKINGS OF BURNS/BLACK MARKS. REPLACE ALL JUMPERS WITH INSULATED HENDRIX WIRE OF THE CORRECT SIZE.
- UG RISER CONDITION
    - DEVICE NUMBER
    - RAPTOR PROTECTION
    - REMOVE AND REPLACE ANY METAL-TYPE MOUNTING BRACKETS AND REPLACE WITH FIBERGLASS.
- GUY WIRE
    - PROPERLY GROUNDED OR INSULATED LINK - INSTALL INSULATED LINK OR LINKS ON ALL DOWN GUYS WHERE THE GUY WIRE EXTENDS PAST ANY PRIMARY, TRANSFORMERS, OR EQUIPMENT.
    - PROPER TENSION
    - GUY GUARD – ENSURE/INSTALL GUY GUARDS ON ALL DOWN GUYS AND REPLACE ANY BROKEN/DAMAGED GUY GUARDS.
- ANCHOR CONDITION – ENSURE NO SIGNS OF EROSION/DECAY
- EQUIPMENT CONDITION

    - (TRANSFORMER, RECLOSER, SWITCH, REGULATOR, CAPACITOR, ECT.)
    - DEVICE NUMBER
    - RECLOSER SIZE – CONFIRM RECLOSER SIZE MATCHES COLLECTOR IN GIS.
    - OIL LEAKS – REPLACE ANY LEAKING EQUIPMENT.
    - BUSHING CONDITION – REPLACE ANY BUSHINGS THAT ARE CRACKED OR CHIPPED.
    - PROPER JUMPER CONNECTION (SIZE OF HOTLINE CLAMP AND BAIL) – INSTALL #4 HENDRIX JUMPER ON ALL TRANSFORMERS AND CORRECT SIZE OF INSULATED HENDRIX ON ALL OTHER EQUIPMENT, IF SET UP ON POLE.
    - PROPERLY GROUNDED – ALL CSP TRANSFORMERS SHALL HAVE LOOP GROUNDING.
- POLE CONDITION
    - VISIBLE INSPECTION – LIGHTNING DAMAGE, SHELL ROT, EXCESSIVE SPLITTING. REPAIR OR CHANGE AS NEEDED.
- CONDUCTOR JUMPER CONDITION/TIGHT AND INSTALLED WITH APPROVED CONNECTOR – REPLACE ALL PRIMARY JUMPERS WITH PROPERLY SIZED INSULATED HENDRIX WIRE.
    - THE EXCEPTION FOR LIGHTNING ARRESTER IS #6 COPPER BUT MUST HAVE STINGER COVER INSTALLED OR REPLACED WITH #4 INSULATED HENDRIX.
    - MINIMUM SIZE FOR PRIMARY JUMPERS 1/0 OR LESS IS #2 COPPER INSULATED HENDRIX.
    - ANYTHING LARGER THAN 1/0, SEE SPECS FOR CORRECT SIZE OF INSULATED JUMPER.
- CONDUCTOR TYPE
    - UPDATE SIZE AND TYPE OF CONDUCTOR ON COLLECTOR.

APPENDIX C

UNDERGROUND INSPECTION ITEMS

- SIGNAGE/ PLACARDS
  - NORMAL OPEN, DOOR CLEARANCE, HIGH VOLTAGE, EQUIPMENT NUMBER
  - REPLACE IREA STICKERS WITH CORE STICKERS
  - CLEARANCE/NOTICE TAGS (IF FOUND NOTED IN GIS)
- EQUIPMENT (TRANSFORMER, SWITCHGEAR, CUBICLE, REGULATOR)
  - EQUIPMENT SERIAL NUMBER
  - VERIFY PHASING TAGS
  - VERIFY TRANSFORMER NUMBER
  - EQUIPMENT SIZE KVA
  - PHASING
    - SINGLE, THREE PHASE
    - A,B,C
  - PAINT, RUST, AND CORROSION
  - OIL LEAKS
  - EQUIPMENT LEVEL
    - EXCESSIVE SETTLING/LEANING OF EQUIPMENT
  - FAULT INDICATORS INSTALL AS NEEDED
  - EQUIPMENT ACCESS
  - LOCKING MECHANISM
    - PADLOCKS/PENTA-HEAD BOLT
  - DOOR AND HINGE CONDITION
  - PRIMARY AND SECONDARY BUSHING CONDITION
  - SECONDARY BAR TYPE
  - CONDITION OF CABLES/CONDUCTORS (PRIMARY AND SECONDARY)
    - TAGS - PHASE COLOR, EQUIPMENT, CONDITION
    - ELBOWS (OVERALL CONDITION, SWOLLEN?), TO INCLUDE INJECTED CABLES.
    - ADEQUATE SLACK
    - SIZE
    - RISER CABLE TERMINATIONS (PORCELAIN OR POLYMER)
  - GROUND AND BONDING CONNECTIONS
  - ARRESTER
  - CONDITION OF PAD
    - FIBERGLASS VAULTS IN GOOD CONDITION AND UNDAMAGED
  - UNDERGROUND RISER
  - ARRESTER AND SWITCH CUTOUT CONDITION
  - CROSSARM AND OR BRACKET CONDITIONS
  - HARDWARE
  - CONDITION OF RISER PIPE
  - CONDUIT CHECKED FOR SHARP EDGES
  - CLEARANCE

- VEGETATION ISSUES
- INTERFERING STRUCTURE ISSUES