EV Charger Service & Maintenance For Community Colleges

Prepared for:

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S CURVE STRATEGIES

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Objectives

1. Master EV charger maintenance techniques

2. Understand the importance of reliable charger maintenance

3. Learn how EV charger maintenance ensures uptime and user satisfaction

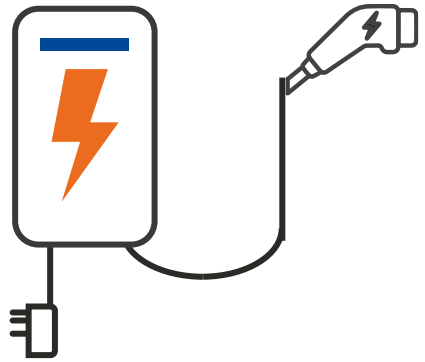
Agenda

1. Maintaining EV Chargers & Networks
2. Maintenance Overview
3. Preventive Maintenance Strategies
4. Common Repairs
5. Case Study
6. Career Pathway & Certification
7. Resources

Maintaining EV Chargers & Networks

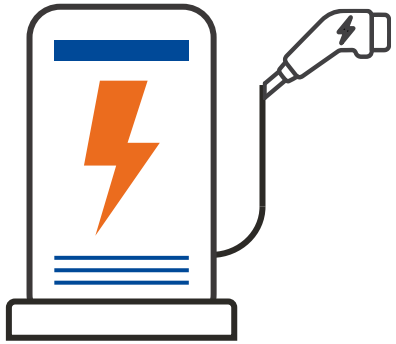
Alternating vs. Direct Current

AC and DC chargers have maintenance implications and impact thermal and wear issues in chargers in slightly different ways.



AC Level 2 Charger

208 – 240-volt AC power outlet or hard-wired (up to 19 kW)



DC Fast Charger

50 - 350 kW hard-wired DC power

DCFC maintenance challenges include more complexities, advanced power electronics, heavier charging cables, additional cooling systems and specialized training or expertise required.

Specify Charging Connectors

Maintenance of EV charging connectors is critical to maintaining station uptime.

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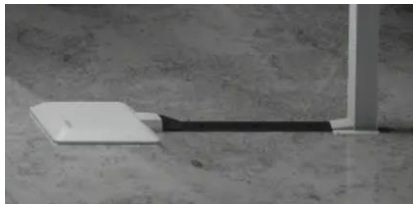


Wireless

Connector types affects maintenance schedules.

Wireless charging requires unique maintenance protocols.

Maintaining Charger Communications

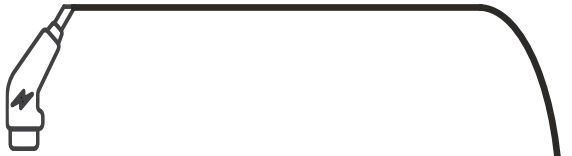
- Manage vehicle authentication via ISO 15118
- Other methods include RFID, apps, & credit cards
- The vehicle's Battery Management System (BMS) ensures safe charging via OCPP communication to the charger
- Troubleshoot communication failures
- Address cybersecurity risks: check for unsecured Wi-Fi, follow EV charging station manufacturer recommendations

Maintaining Charger Networks

- Networks connect the charger to the backend for billing and monitoring
- Networks can use cellular, ethernet or wi-fi as a communications backbone
- Network connectivity must be maintained for proper operation
- Network issues impact EV charger uptime and diagnostics

Maintenance Overview

Key Maintenance Steps



- ✅ **Conduct routine tasks:** Inspections, cleaning, functional tests
- ✅ **Perform corrective maintenance:** Software updates, vandalism repairs
- ✅ **Maximize EV charger reliability:** Increase uptime through proactive care
- ✅ **Follow manufacturer maintenance schedules:** Perform checks as recommended
- ✅ **Create preventive maintenance schedules:** Monthly, quarterly, annual

EV Charging Station Styles

The design of EV supply equipment (EVSE) impacts maintenance needs.

- **Identify styles:** Wall, pedestal, overhead, portable
- **Maintain:** screens, fans, cables and cord management components
- **Portable EVSE:** May require periodic battery charging or generator maintenance

What can go wrong?

Software/Network Issues

OCPP timeout errors, firmware bugs (~30%)

Overheating

High loads, poor ventilation (~20%)

User Error

Improper connector handling (~25%)

Aging Hardware

Relay/capacitor failures after 10,000 cycles, screens, cables, electronics (~25%)

Physical Charger Issues

Cut or Damaged Cables

Insulation faults from vehicle impact

Failed Circuit Breakers

Tripped or degraded (e.g., 40A breaker)

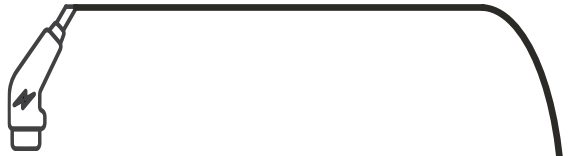
Connector Damage

Worn pins, cracked housings

Vandalism

Damaged screens, enclosures, cables

Solving Physical Issues



- ✅ **Replacing cables:** Per NEC Article 625.23 (e.g., use proper EV cables)
- ✅ **Reset/replace breakers:** Test with multimeter (e.g., Klein CL220 or Extech CT70)
- ✅ **Repair/replace connectors:** Per manufacturer specs
- ✅ **Reinforce enclosures:** With tamper-resistant bolts

NEC Article 625 is your roadmap to safe, compliant EV charger installations.

Preventive Maintenance Strategies

Preventive Maintenance

- **Monitor software:** Check logs for any communications or connectivity errors
- **Clean EV chargers:** Remove dirt and dust from vents, filters and connectors
- **Educate users:** On connector handling to reduce wear
- **Schedule hardware replacements:** Relays after 10,000 cycles, cables and connectors, cable cooling hardware and coolant, screens, etc.

Tools for Maintenance

- **Basic tools:** Ratchets, sockets, screwdrivers, nut drivers, wire strippers, allen wrenches, torque wrenches and meters
- **Working with metric/SAE fasteners:** Per charger specs (with metric being more common)
- **Maintain toolkit:** Cable cutters, crimpers, pliers and wire nuts
- **Follow manufacturer's tool recommendations:** As outlined in their service manuals

Investing in a set of high quality tools is an investment in your future.

Test Equipment for Diagnostics

- **Fluke FEV100 EVSE Test Adapter:** Simulates EV to car connection
- **Multimeters (e.g., Klein CL220 or Extech CT70):** Diagnose voltage/current/breakers
- **Cellular signal meters:** Verify 4G/5G connectivity
- **Charger diagnostic tools and apps:** Manufacturer-specific
- **On-line Tools:** Cloud-based remote monitoring dashboards are now more common

Documentation & Reporting

- **Maintain service logs:** Record faults, repairs, tests, parts replacements
- **Submit warranty claims:** Always with error codes and as much info as possible
- **Document for Certification:** Include maintenance hours for EV Infrastructure Training Program
- **Use apps:** For real-time reporting of issues
- **Demonstrate:** Use warranty claim workflows and OEM contact protocols

Software & Firmware Updates

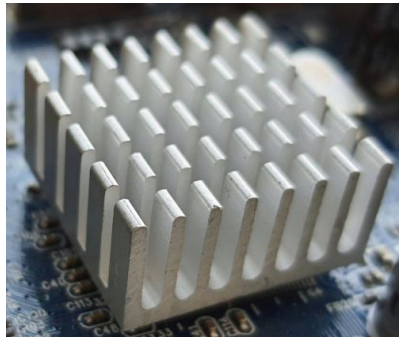
- Apply firmware updates over the air via network connection or locally via USB
- Verify update compatibility (e.g., make sure that the update in question is made for your particular model of charging station)
- Troubleshoot update failures: Reboot, check connectivity
- Schedule updates and other maintenance activities to minimize downtime

Advanced Diagnostics – Error Codes

- **Interpret error codes:** E.g., “OCPP 1.6 Timeout,” “Ground Fault” in service manuals or on OEM website
- **Use diagnostic apps:** Access logs via portals
- **Test power delivery:** Measure voltage drop (<5%)
- **Document:** Findings for warranty claims and other techs

Thermal Management Maintenance

- **Inspect cooling systems:** Fans, heatsinks, coolant levels
- **Monitor temperatures:** Max 140°F per UL 2202
- **Clean vents:** To prevent thermal shutdowns
- **Replace faulty fans:** Per manufacturer specs
- Discuss battery thermal events and fire response planning



EV Battery Thermal Events & Fire Response Planning

Battery Thermal Runaway

Uncontrolled increase in battery temperature causing fire/explosion

Triggers: Overcharging, physical damage, manufacturing defects, extreme heat

Warning Signs: Unusual heat, smoke, hissing sounds, chemical odors

Progression: Can spread from one cell to entire battery pack

Toxic Gases: Hydrogen fluoride, carbon monoxide, other hazardous vapors

Immediate Response Protocol

- **EVACUATE:** Clear 50-foot radius minimum
- **CALL 911:** Specify "EV battery fire"
- **DE-ENERGIZE:** Shut off power at main breaker
- **VENTILATE:** Open doors/windows if safe
- **STAY UPWIND:** Avoid toxic smoke inhalation
- **DO NOT approach:** Let the professionals handle it

Prevention & Safety

- **Regular Inspections:** Check for physical damage, corrosion, unusual heat
- **Temperature Monitoring:** Install thermal sensors on DCFC systems
- **Proper Installation:** Follow NEC 625 grounding and overcurrent protection
- **Fire Suppression:** Class D extinguishers for lithium batteries
- **Water Cooling:** Massive water application (1,000+ gallons) to cool batteries
- **Site Planning:** Locate charging away from structures when possible

Environmental Impacts on Maintenance

- **Address corrosion:** Coastal areas (e.g., salt spray)
- **Mitigate UV degradation:** Connector plastics
- **Protect against dust ingress:** IP54-rated enclosures
- **Adjust maintenance frequency:** For harsh climates
- **NEMA Enclosure Ratings:** Verify that the proper NEMA enclosure ratings (3R or 4) were installed

Commissioning & Troubleshooting

- **Follow manufacturer commissioning:** Voltage checks (e.g. 240V ± 5%)
- **Inspect breakers/cables/connectors:** Test continuity with multimeter
- Use troubleshooting software
- Repair, test, and return charger to service as quickly as possible
- If possible, include interoperability testing with different EV models

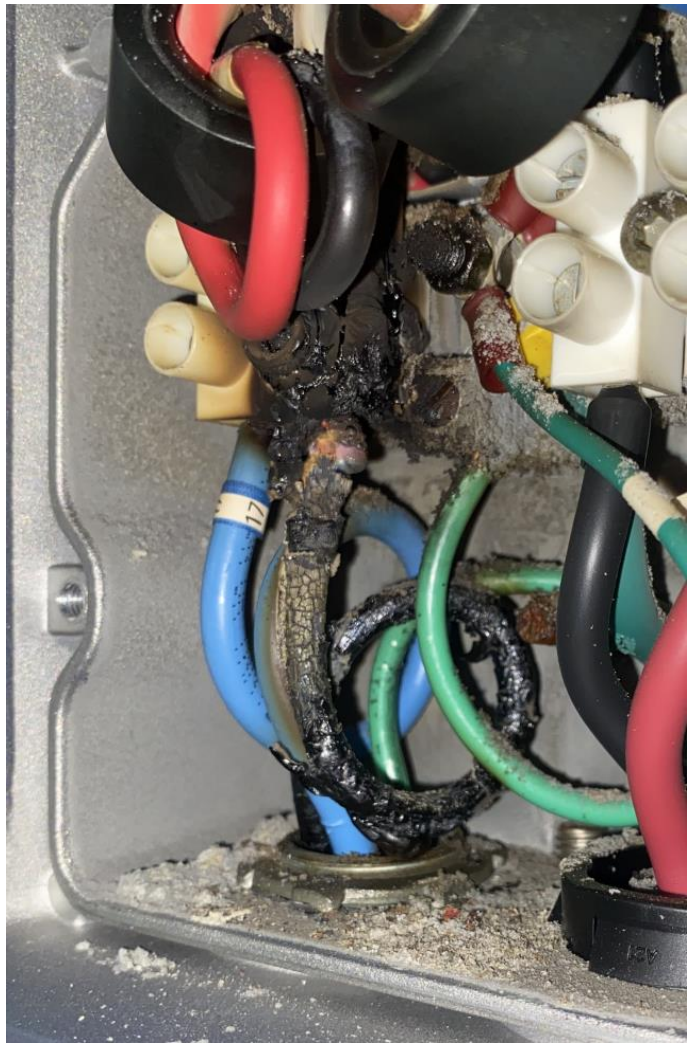
Sample EV Charger Diagnostic Workflow

STEP	CHECKPOINT	WHAT TO LOOK FOR	NEXT ACTION
1	Visual Inspection	Physical damage to charger, conduit, cable, connectors, loose mounting hardware	If damaged, DO NOT ENERGIZE. Report and replace parts.
2	Power Supply	Use multimeter to confirm voltage at breaker and EVSE terminals (208 or 240V)	If no power or incorrect voltage, inspect breaker panel and service feed.
3	Breaker & Panel	Breaker amperage matches charger spec (e.g., 40A for 32A output)	Replace or adjust breaker if incorrectly sized or faulty.
4	Grounding & Bonding	Confirm ground connection and proper bonding of metallic parts	Correct grounding faults or bonding issues before proceeding.
5	Connectivity / Networking	For networked chargers: verify Wi-Fi, Ethernet, or cellular signal strength and OCPP communication	Reposition antenna, reconfigure network, or install repeater if necessary.
6	EVSE LEDs / Display Status	Read status lights or error codes (e.g., blinking red = fault)	Refer to manufacturer error code guide for interpretation and action.
7	EV Connector Test	Plug into a known working EV and observe response	If no charge, test another charger or connector cable—could be relay or contactor.
8	Software Commissioning / App Setup	Ensure charger has been registered and activated in backend system	Reboot and reinitialize with correct credentials and site configuration.
9	Pilot Signal Check	Confirm presence of 1kHz Pulse-Width-Modulated pilot signal from EV charger to EV (use charger tester)	If missing, charger controller board may be faulty. Replace or escalate.
10	Test with EVSE Diagnostic Tool	Use Level 2 tester to simulate vehicle and check sequencing	Identify if issue is vehicle-side or charger-side.
11	Environmental Conditions	Extreme temps, moisture, blocked vents, or overheating	Install shade or ventilation as needed; clear debris.
12	Call Support / Submit RMA	If above steps fail, contact manufacturer tech support with serial number and logs	Begin Return Material Authorization (RMA) process or dispatch higher-tier tech.

Common Repairs

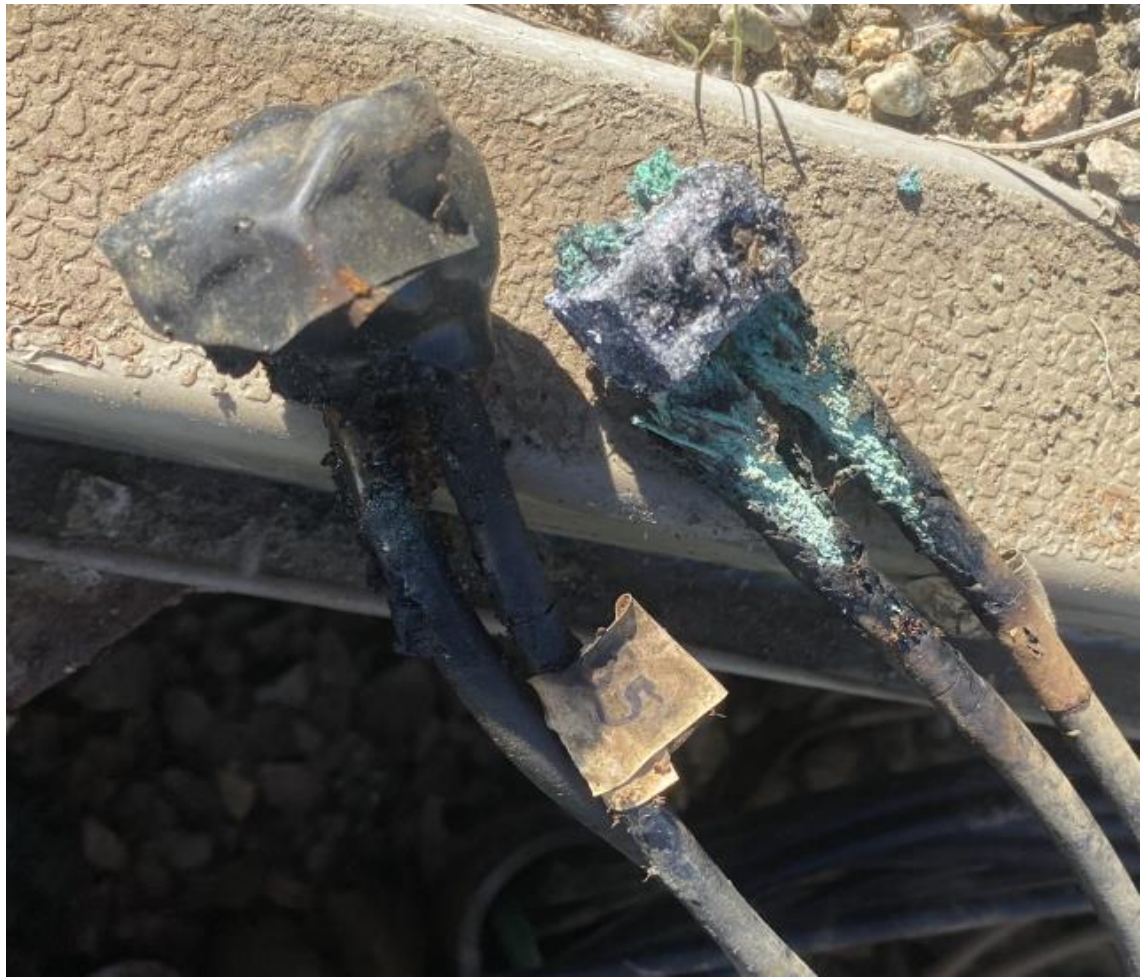
EV Charging Maintenance Challenges

Blackened Terminal Block



EV Charging Maintenance Challenges

Corroded Wire Splices

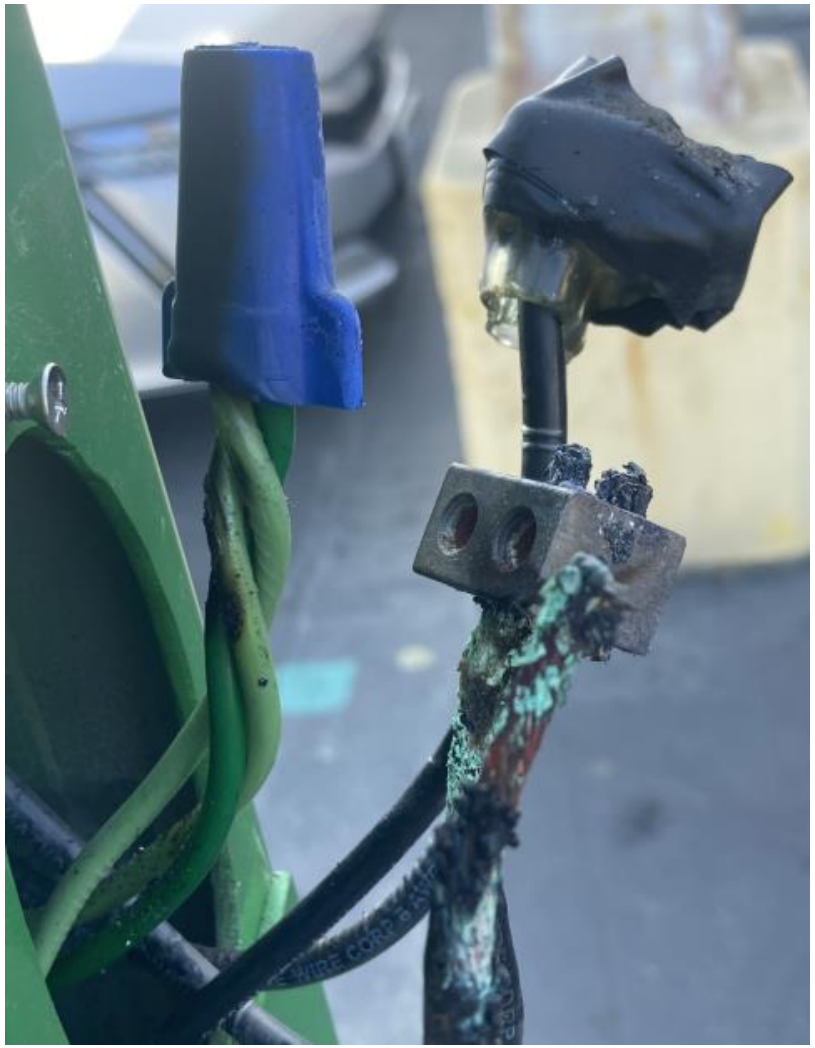


EV Charging Maintenance Challenges

Corroded Charger Base

EV Charging Maintenance Challenges

Corroded Splice in Charger Pedestal



Case Study

Case Study:

Charging Station Repair

Commercial Site:

- Repair high-powered EV charger that won't charge cars.

Challenge:

- Use the 12-step workflow to determine what the problem is with the charger

Solution:

- Cable insulation fault found on right-hand cable
- Voltages checked out, error message in log about fault
- Disassemble the cabinet
- Remove old cable
- Replace old cable with "Type EV" new cable
- Re-assemble charger
- Test: Verify charger is working and will charge vehicles

Career Pathways & Certifications

EV Charger Installer Career Pathways

ENTRY ROLE (APPRENTICE TO JUNIOR TECHNICIAN)	TYPICAL TITLES	KEY RESPONSIBILITIES	ESSENTIAL SKILLS / CERTIFICATIONS
Electrical Apprentice	Apprentice Electrician, EV Installer Helper	• Assist with wiring, conduit, and mounting hardware • Site cleanup and materials handling • Learn safety and NEC code basics	• OSHA 10 • Basic hand/power tool proficiency • Math skills • Enrolled in electrician apprenticeship
Junior EV Installer	EVSE Technician I, Installer Trainee	• Support charger mounting and wiring • Pull wire, install conduit • Assist with commissioning and testing	• Basic electrical knowledge • Ability to read site plans • Good communication and teamwork

MID-LEVEL ROLES (TECHNICIAN TO CREW LEAD)	TYPICAL TITLES	KEY RESPONSIBILITIES	ESSENTIAL SKILLS / CERTIFICATIONS
EVSE Technician	Installer II, Journeyman Electrician (EVSE)	• Install and troubleshoot Level 2 & DCFC chargers • Interpret electrical diagrams • Configure network connectivity	• Journeyman electrician license • EVSE brand certifications (e.g., ChargePoint, BTC) • OCPP/network basics
Crew Lead / Foreman	EV Installation Supervisor, Field Lead	• Oversee install crew • Coordinate with site host, utility, and AHJ • Ensure safety, quality control, and code compliance	• Strong project coordination • NEC and ADA knowledge • OSHA 30 • Time management & troubleshooting skills

EV Charger Installer Career Pathways

ADVANCED ROLES (OPTIONAL PATHWAYS)	POTENTIAL TITLES	KEY RESPONSIBILITIES	ADVANCED SKILLS / TRAINING
Commissioning Specialist	EVSE Start-Up Tech, Test & Commissioning Tech	• Perform final system testing • Configure network/software settings • Interface with utility & software providers	• Networking protocols • IT/software familiarity • Diagnostic tools
Project Manager (EVSE)	EVSE Project Coordinator, Site Development Lead	• Manage install timelines & budgets • Coordinate permitting, utility approvals • Supervise field teams	• Construction management • Permitting & utility process • Communication & documentation
Electrical Engineer (EVSE)	Design Engineer, EV Infrastructure Engineer	• Design electrical plans for charging sites • Calculate load & service capacity • Work with AHJs and utilities	• PE license (optional) • AutoCAD • Load calcs, NEC, Title 24

Pathway to EVITP Certification

- Gain 8,000 hours electrical experience or licensure
- Take electrical fundamentals courses for maintenance knowledge
- Join an apprenticeship for hands-on skills
- Enroll in EVITP 20-hour course, pass exam

Key Takeaways

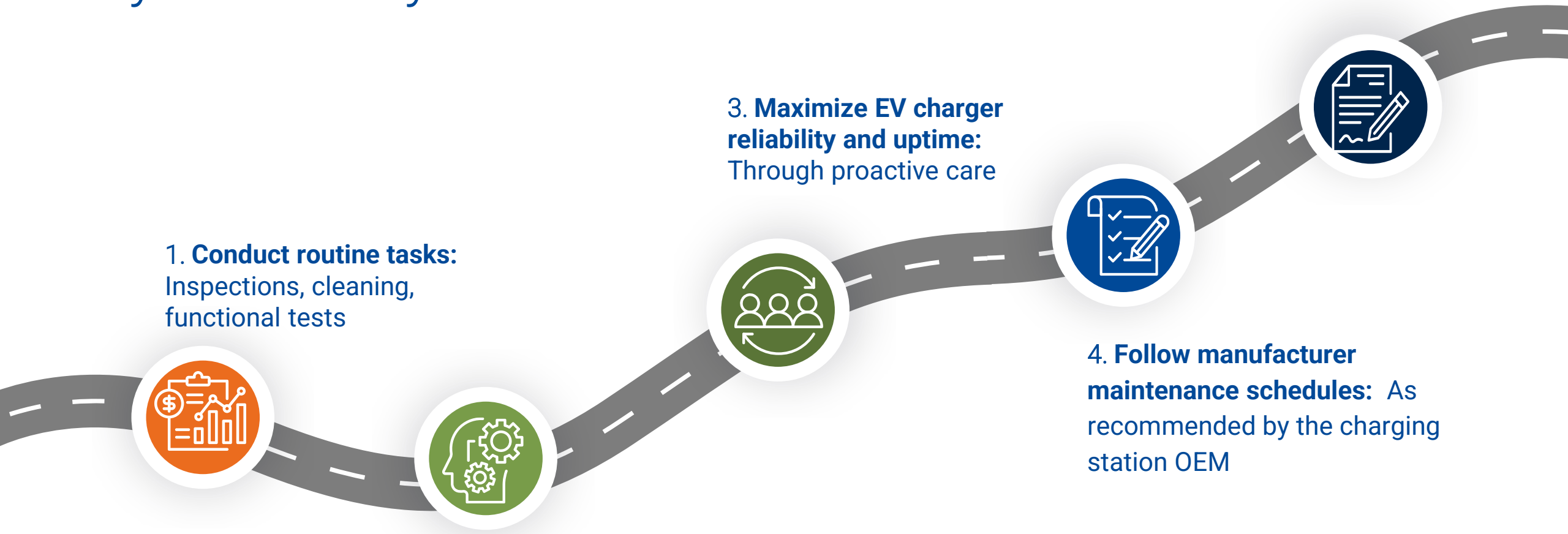
1. **Conduct routine tasks:** Inspections, cleaning, functional tests

2. **Perform corrective maintenance:** Software updates, vandalism, repairs

3. **Maximize EV charger reliability and uptime:** Through proactive care

4. **Follow manufacturer maintenance schedules:** As recommended by the charging station OEM

5. **Create sample preventive maintenance schedules:** Monthly, quarterly, annual



Resources

Resources

5 Part EV Charger Site Selection Best Practices Series

LA County Training https://isd.lacounty.gov/electric-vehicles-and-charging-stations/

Installation and Maintenance Training

Cerritos College: Advanced Transportation and Logistics Program https://www.cerritos.edu/atte/

Electric Vehicle Infrastructure Training Program https://evitp.org

International Brotherhood of Electrical Workers (IBEW) https://www.ibew.org

Safety and Standards

Underwriters Laboratories (UL): https://www.ul.com

SAE International: https://www.sae.org

Occupational Safety and Health Administration (OSHA): https://oshacommunity.com/ehs/osha-standards-for-electric-vehicle-charging-stations/

Charger Networks

Many charging companies offer training for their own charger installations:

- ChargePoint: https://www.chargepoint.com
- EVgo: https://www.evgo.com
- Electrify America: https://www.electrifyamerica.com/getting-started/
- Tesla: https://www.tesla.com/support/charging/supercharger
- Blink Charging: https://blinkcharging.com/products/commercial-products

Thank You!

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