ATD / ALL THE DETAILS

TRUCK & TRAILER ELECTRICAL SYSTEMS

REVISION R0.9 | PHOTO-ENHANCED EDITION

- Original 122-page R0.8 curriculum retained.
- Selected connector chapters now include photographic examples.
- New front/rear connector, adapter and wiring repair atlas appended.
- Actual ATD archive photo separated from generated reference visuals.

DOCUMENTED FINDINGS ARE NOT AUTOMATIC DIAGNOSES

A plug fitting does not establish pinout, ground, braking or pairing compatibility.
Use installed-part literature and measured function before clearing a circuit.

Stephen Guffey | All The Details | October 22, 2026

The story of every vehicle lives in the details.

ATD / ALL THE DETAILS

TRUCK & TRAILER ELECTRICAL SYSTEMS

Revision R0.8 | Dual six-way / seven-way truck sockets, adapters, trailer interfaces, and verification from source to load

THE CONNECTION CAN FIT AND STILL BE WRONG. A truck socket, its adapter and the trailer must be proven to agree on actual FUNCTIONS, brake technology, ground return and current ratings before a complete pairing is considered for service.

Why R0.8 exists

Mixed fleets may have trucks fitted with BOTH six-way and seven-way receptacles. Those sockets may have shared feeds, different controller paths, a body-builder converter, or different previous repairs. Older trailers and assorted adapters introduce additional independent variation. This revision teaches how to test each piece, compare the actual circuit maps and reach a defensible pairing decision.

The test sequence

FIRST	SECOND	THIRD	FOURTH
TRUCK Socket A (6R) & Socket B (7-way), separately	**ADAPTER** Part number, direction, contact map, correct function	**TRAILER** Plug, lamps, return, braking and breakaway	**PAIR** Qualified stationary functional test and signed disposition

Revision boundary

This is a universal training manual, not proof that any specific truck or repair shop has caused a fault. The 100-page R0.7 volume, including all 70 original R0.6 pages, is preserved unchanged inside this assembled R0.8. The new field-integration lessons are appended and separately navigable.

Prepared by Stephen Guffey | 22 October 2026 | ATD / All The Details

R0.8 / READER NAVIGATION

Jump to the right training task

The established R0.7 manual remains intact. The new D-series chapters are additions, not a replacement for the original connector plates or ground labs.

Existing manual landmarks

ORIGINAL: connector identification and four-view plates

ORIGINAL: DVOM / Power Probe / IPA / scope labs

ORIGINAL: ground return, corrosion and hardware module

R0.7 SUPPLEMENT: existing compatibility and clearance forms

New R0.8 field-integration chapters

D01-D03 Dual socket architectures, source-to-trailer chain and connector families

D04-D07 Identify equipment; test BOTH truck sockets; load-check grounds

D08-D10 Map each adapter, test trailer separately, verify brake interface

D11-D14 Hidden incompatibilities, safe pairing, decision tree, worked case

D15-D19 Matrix control and printable truck/adapter/trailer/pairing records

D20 Teach-back, sources and revision control

Reader check: A six-way and seven-way may both exist on the SAME truck. The seven-way passing does not make the six-way, its adapter, or an older trailer automatically compatible.

Use this training with the actual VIN-specific OEM instructions, connector-maker diagrams and component tester manuals. All truck-trailer pairings remain UNVERIFIED unless separately signed off using applicable procedures.

ATD / ALL THE DETAILS

TRUCK & TRAILER ELECTRICAL SYSTEMS

Universal Technician Training | Volume 01

REVISION R0.7

Compatibility, adapters and brake-system variations

Truck / trailer / adapter independent tests

Documented pairing clearance and change control

Original R0.6 - 70 pages preserved without alteration

New R0.7 navigation + additional training and field forms

Stephen Guffey | All The Details (ATD)

22 October 2026 | Controlled working edition

The story of every vehicle lives in the details.

START HERE: choose the task

Blue/red section headings are backed by clickable PDF bookmarks and navigation links.

ORIGINAL	Connector atlas: R0.6 chapters 01-05 (new PDF pp. 12-16)
ORIGINAL	DVOM, trailer tester, scope, adapter labs: original pp. 27-35
ORIGINAL	Grounding and corrosion module: original pp. 62-70
SUP 01-04	System variables, factory options and connector fingerprint
SUP 05-07	Adapters, braking technologies and one-trailer test limits
SUP 08-09	Fleet narrowing and asset IDs
SUP 10-14	Independent truck / adapter / trailer and ground testing
SUP 15-16	Paired testing, approval / HOLD criteria
SUP 17-20	Troubleshooting forks and practice cases
SUP 21-23	Shop questions, workbook, sources and revision map
FORMS	Truck / trailer / adapter / exact pairing signoff forms

READ BEFORE USING A PIN DIAGRAM

A physical connector fitting does not prove it is compatible.

Never energize an unknown brake, ABS or control-module contact.

A successful shop test with one trailer does not clear the rest of a fleet.

No real truck/trailer/adapter combination is approved by this publication.

TWO TRACKS

The main document is universal training. Individual fleet findings belong in case files.

HOW THIS EDITION WAS BUILT

PRESERVED CONTENT

All 70 original R0.6 PDF pages, photographs, source links and text are retained without changes. Their printed R0.6 page numbers are historical and remain as originally authored.

NEW R0.7 MATERIAL

Supplement chapters 01-23 and four printable forms follow the retained original. They add classification, adapter choices, independent tests, exact pairing release and repair change-control.

SOURCE BOUNDARY

The source manual demonstrates general procedures. Current manufacturer references add examples; neither is proof that an individual fleet vehicle was wired a particular way.

SAFETY / PERMISSIONS

Qualified personnel and exact vehicle/trailer/adapter manuals control safety-critical testing. No new repair authorization, Ford consultation or communication with owner/vendor occurred in preparing this document.

WORKING STATUS

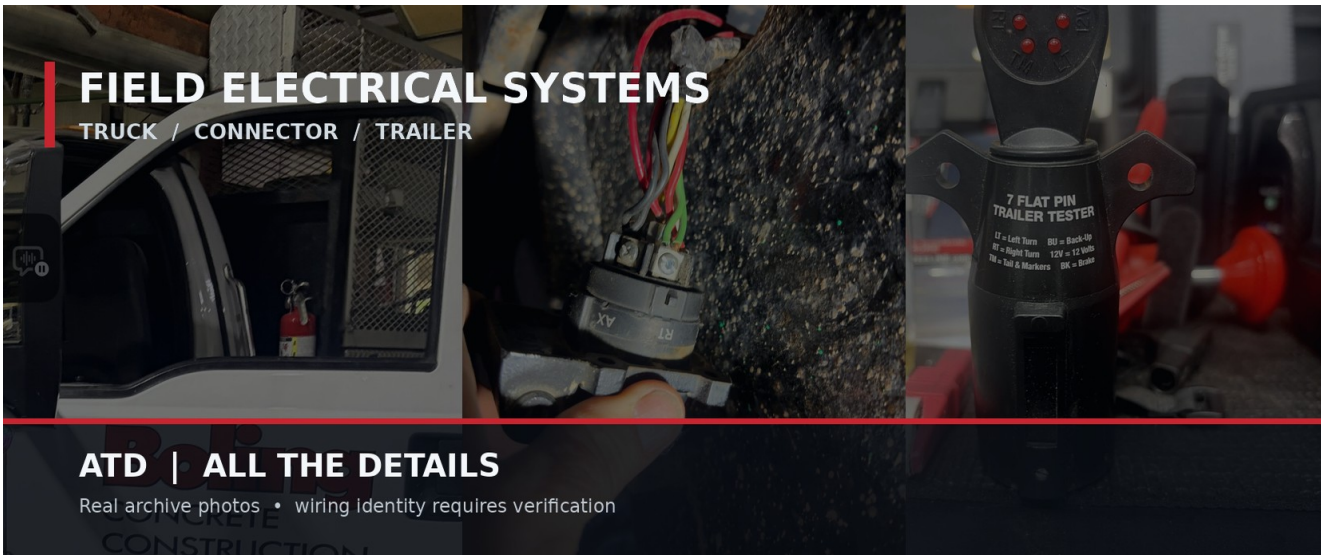
Every actual client fleet pairing remains UNVERIFIED unless its specific supporting records and safe signoff are documented. The accompanying client case supplement is a private research draft.

WORKFLOW RULE

IDENTIFY > TEST EACH ASSET > VERIFY PAIR > RECORD SIGNOFF

An unverified configuration is not a dispatch approval.

ATD / ALL THE DETAILS



UNIVERSAL TECHNICIAN TRAINING | VOLUME 01

TRUCK & TRAILER ELECTRICAL SYSTEMS

Connector identification / Wiring logic / Field diagnostics

The story of every vehicle lives in the details.

Universal reference edition | Revision R0.6 | 21 October 2026

Prepared by Stephen Guffey | All The Details (ATD)

Executive summary

Purpose, boundaries and the shortest path to useful measurements

This manual teaches the electrical fundamentals and diagnostic discipline needed to identify truck/trailer connectors, recognize circuit functions, and isolate lighting and brake-interface faults without relying on wire colors or replacing parts on speculation.

Four outcomes

- Identify 4-flat, 5-flat, 6-round, RV 7-blade and commercial SAE J560 systems, including orientation and pin assignment differences.
- Understand combined versus separate stop/turn circuits, passive adapters, powered converters, auxiliary feeds, controllers and breakaway systems.
- Use the DVOM, Power Probe Maestro, IPA MUTT, oscilloscope and scan data with clear limits, safe probe placement and repeatable command states.
- Separate tow vehicle, manufacturer body equipment, socket, adapter and trailer faults using independent, recorded testing.

How to use the training

If you are...	Start with...	Then...
New to trailer wiring	Connector recognition (01-05)	Circuit fundamentals (06-09), then Lab 0 (19)
Diagnosing a live failure	Symptom finder and quick reference	Controlled sequence (07), tool-specific labs (20-27)
Reviewing an upfitted truck	Generic case study (10), interface test (29)	Compare OEM, body/upfit, connector, adapter and trailer outputs

Critical safety and accuracy boundaries

> DO NOT INTERCHANGE Do not treat commercial SAE J560 7-round connectors as RV 7-blade connectors. Their physical contacts and functions differ. Six-round brake and auxiliary positions can vary. Identify connector family, view direction, and installed hardware before probing.

All worked examples are educational and are not verified diagnoses of the reader's vehicle. Select manufacturer-approved grounds, wiring diagrams and test limits before work.

Clickable table of contents

Tap a chapter title to jump to the section; page numbers are provided for printed use

Part I | Connector and system fundamentals

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Contents | continued

Hands-on labs, troubleshooting, quick references and appendices

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30 | Diagnostic practice: three fault patterns	38
31 | Practice answers and decision gates	39
32 | Printable field worksheet: advanced tests	40
33 | References and revision record	41

Companion reference sections

Executive summary

Grounding & corrosion | module navigator

New in R0.6 - independent ground return paths, approved attachment points, terminal hardware and galvanic corrosion. These pages are general instructions, not a substitute for a vehicle-specific ground stud or torque specification.

GROUND 01 - What ground actually means

GROUND 02 - Ground locations and attachment gates

GROUND 03 - Ring terminals, hardware and star washers

GROUND 04 - Dissimilar metals and galvanic corrosion

GROUND 05 - Weather, salt and electrical protection

GROUND 06 - Ground voltage-drop field procedure

GROUND 07 - Grounding failure worked scenarios

GROUND 08 - Ground audit and inspection worksheet

GROUND 09 - Sources, glossary and revision control

FIELD RULE: there is no universal star washer, voltage-drop limit, frame-drilling rule, or allowable material pairing for every vehicle. The installed equipment and manufacturer instructions decide the details.

Illustration index
Symptom and fault lookup
Field quick-reference
Glossary of terms
Abbreviations and circuit labels
Tool selection and safety
Competency and signoff
Revision control and source guidance
Alphabetical topic index | R0.6 photo & field annexes

Illustration index

Direct jumps to connector plates, circuit logic, and decision diagrams

Every physical contact diagram must be read with its exact view label. A truck receptacle contact face can mirror its wire-entry view; an adapter must be tested against the actual connected devices.

Open figure / drawing	What it teaches
4-flat and 5-flat: function-first drawings	Lighting and fifth-function lockout
6-round: configuration and center contact	Brake-output versus auxiliary alternatives
RV 7-way blade: colors and functions	Manufacturer conventions, not a wire-color promise
SAE J560: heavy-duty 7-round	Commercial contact assignments
Paired plug/receptacle orientation guide	Four views explained
RV 7-blade: four-view contact plate	Truck and trailer, front and rear
Six-round: four-view contact plate	Orientation and center-contact variants
J560: four-view contact plate	Commercial tractor/trailer interface
Converter signal logic	Combined stop/turn conversion pathway
Diagnostic system flow	Trace by boundary, not by insulation color
Fault isolation / abnormal left stop-turn	Find the upstream/downstream split

Symptom and fault lookup

Begin with the observation and jump to the next discriminating test

Observed problem	First discriminating action	Open
Left rear truck lamp stays on with trailer unplugged	Confirm actual illuminated filament/LED segment; compare OEM output and installed body/upfit boundary	GO TO TEST
Left turn makes right/brake lamps flash	Test isolated trailer and adapter for cross-feed, especially grounds and wrong splices	GO TO TEST
No trailer lights on one truck	Baseline connector feed and return; do not presume a failed module	GO TO TEST
Seven-way has voltage on an OFF function	Identify fuse/relay, correct terminal and matched downstream load	GO TO TEST
Brake controller says no trailer connected	Verify brake system type, load sensing, controller wiring and correct trailer	GO TO TEST
Reverse/backup indicator always energized	Trace 12 V auxiliary versus reverse contact, verify center wiring	GO TO TEST
Trailer lights dim or erratic	Load the circuit; measure feed and return voltage drop at the load	GO TO TEST
A fuse blows while moving the harness	Stop and isolate; inspect abrasion, terminal contact and cross-circuit shorts	GO TO TEST
Six-round connected through seven-blade adapter	Confirm center auxiliary/brake positions and entire contact map	GO TO TEST
Trailer breakaway not verified	Identify battery, switch, return and actual brake type before testing	GO TO TEST

IMPORTANT If there is evidence of overheated conductors, active shorting, an unknown high-current feed, or a damaged trailer brake circuit, stop testing and isolate power safely before making new connections.

Field quick-reference

A one-page start-up card before any hands-on measurement

Six diagnostic gates

Gate	Do this first	Why it matters
1 | Identify	Match truck, trailer, connector family, contact face and adapter.	The wrong pinout can produce false conclusions or damage.
2 | Preserve	Photograph as found; record VIN/trailer ID, battery state, DTCs, load, tester.	A repair that erases evidence can hide the cause.
3 | Isolate	Test truck only, trailer only, adapter only, then paired.	Identifies the fault boundary.
4 | Measure	Log OFF and commanded states; use proper load for voltage drop.	Open-circuit voltage does not prove current capacity.
5 | Compare	Compare both sides of only one verified boundary at a time.	Separates relay/OEM from upfit and downstream wiring.
6 | Confirm	Repeat under original loading and restore every safety function.	One successful light test is not a repair validation.

Connector family is not enough to choose a pinout

Family	Critical wiring issue
4-flat / 5-flat	Combined stop/turn; fifth circuit often reverse lockout, but verify.
6-round	Center and surrounding brake/auxiliary choices vary by maker.
7-way RV blade	Often combined stop/turn and electric brake output; check contact view and color system.
7-round SAE J560	Heavy-duty commercial stop, lighting and ABS power; not an RV 7-blade equivalent.

RED LINE No jumpers into an unknown relay cavity, BCM output, ABS/air-brake circuit, or electric trailer-brake output. Meter lead placement and power injection are different operations.

01 | Read a connector correctly

A wiring drawing is an address map. Use the wrong view, and every address may point across the street.

Four questions before probing

- Which connector family is actually installed?
- Is the drawing the tow-vehicle receptacle or the trailer plug?
- Am I looking into the contacts or into the rear wire-entry side?
- Where are the physical key, latch, molding marks and terminal IDs?

MIRROR IMAGE WARNING Vehicle contact-face, vehicle rear, trailer contact-face and trailer rear are different views. A diagram lacking these labels is not a safe guide to terminal placement.

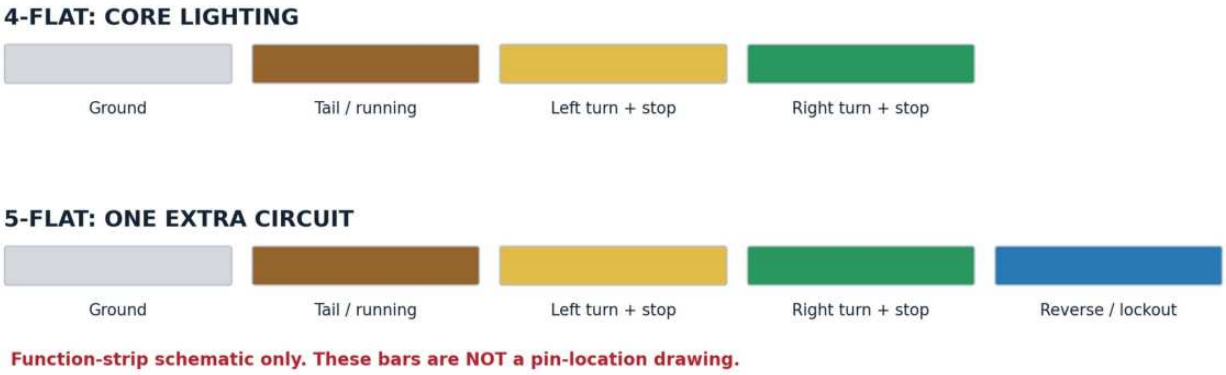
Quick connector-family recognition

Family	Typical circuits / use	Critical distinction
4-way flat	Ground; tail; L stop/turn; R stop/turn	No electric-brake feed
5-way flat	4-way plus an extra function, often reverse	Used for surge-brake reverse lockout
6-way round	Lighting, ground, brakes and 12 V	Brake and aux positions can swap
6-way square	Six contacts in a square housing	Different connector, not a 6-round pinout
7-way RV blade	Six blades plus center contact	Two published color conventions
7-round SAE J560	Commercial 7 round contacts; stop and ABS power	Not a 7-way RV blade wiring system
Other 7-round	May use reverse / electric-brake pins	Do not assume it is J560

Additional families: 4-round, 5-round and 6-flat also exist. They require their own view-specific map, not an adapted diagram. Sources: CURT, Hopkins and Phillips.

02 | 4-flat and 5-flat

FUNCTION-FIRST SCHEMATIC | NOT A PHYSICAL PIN-LOCATION DRAWING



Most 4-flat systems have three combined-lighting outputs and one ground: running lights, left turn/stop, right turn/stop, and ground. The common 5-flat adds reverse/lockout power. A fifth wire may be assigned another function, so verify the installation.

What commands should change?

Command	Expected functional behavior	Read carefully
Tail/park ON	Running-light feed active	Check both sides of trailer
Left turn	Left stop/turn pulses	Front vehicle lamp may be on a different circuit
Right turn	Right stop/turn pulses	A right flash on the left may indicate cross-feed
Service brake	Left and right stop outputs active	Combined vs separate stop/turn wiring matters
Reverse (5-flat)	Fifth feed may energize lockout	Secure vehicle; confirm installed purpose

WHY A CONVERTER EXISTS Some vehicles use separate turn and stop wiring or electronically controlled outputs. A properly selected interface can convert the truck signals to a trailer-compatible combined stop/turn system. It is not the same as a power inverter.

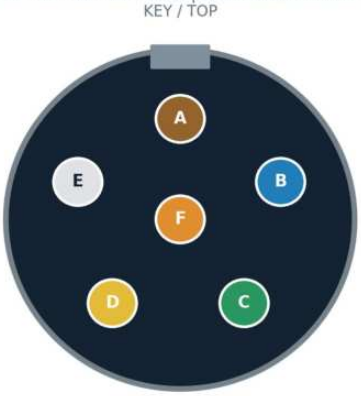
Use the exact connector installation sheet to place conductors; schematic strips above describe functions, not cavity locations. Source: CURT wiring guide and etrailer connector reference.

03 | 6-way round

THE CENTER CONTACT IS A DECISION GATE

6-WAY ROUND | STANDARD EXAMPLE

VEHICLE SIDE RECEPTACLE | REAR WIRE-ENTRY VIEW | KEY AT TOP



CONTACT KEY	FUNCTION
A	Tail / running
B	Electric brake output*
C	Right turn + stop
D	Left turn + stop
E	Ground
F	+12 V auxiliary*

TWO CONFIGURATIONS EXIST In the illustrated typical version, F (center) is auxiliary +12 V and B is electric brake output. Some six-round systems interchange these functions. Verify both vehicle and trailer, and match any 7-blade-to-6-round adapter before connection.

Verify, do not infer

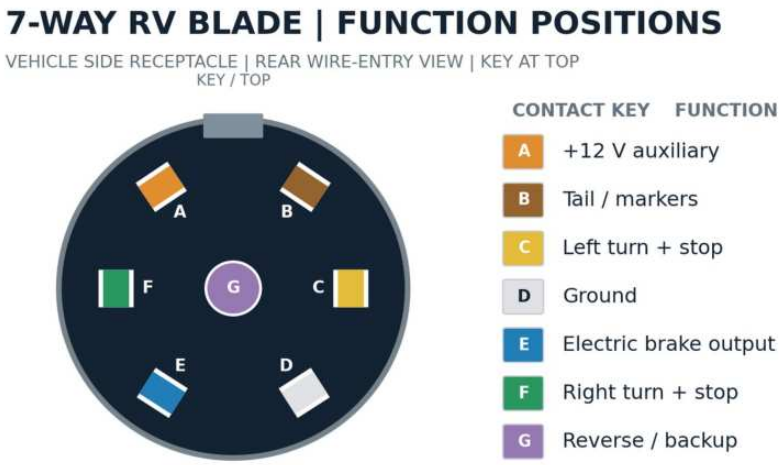
- Identify both plug and receptacle, the connector key, and the correct rear/contact face.
- Measure and document 12 V battery feed separately from proportional/pulsed brake-controller output.
- Check ground integrity under an appropriate load. A resistance beep alone does not prove a good return.
- With adapters, write down center-pin configuration before mating the trailer.

Diagram positions based on CURT representative vehicle-side rear views; center-pin interchange confirmed in Hopkins 2023 catalog. Letter keys are ATD labels, not universal molded terminal numbers.

R0.9 ILLUSTRATION / NOT TERMINAL ID

04 | 7-way RV blade

AUTOMOTIVE / RV FAMILY | SAE J2863 APPLIES TO THE CONNECTOR INTERFACE

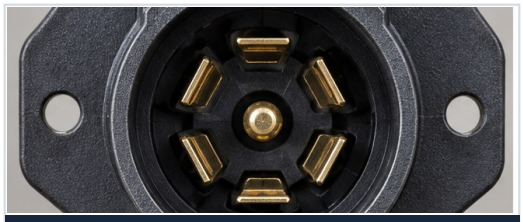


Same functions, different published wire-color conventions

Letter / function	CURT traditional color	CURT SAE J2863 color
A +12 V auxiliary	Black	Orange
B Tail / markers	Green	Brown
C Left turn + stop	Red	Yellow
D Ground	White	White
E Electric brakes	Blue	Blue
F Right turn + stop	Brown	Green
G Reverse / backup	Yellow	Grey

NOT A UNIVERSAL WIRE-COLOR PROMISE The chart reports two documented conventions. Installed OEM/upfit conductor colors may differ. Physical cavities must be matched to the actual part and verified by function. Center contact is often reverse on RV blade sockets, but this is not proof of how a particular truck has been modified.

ATD letter keys describe the drawing only. Diagram mirrors CURT rear vehicle-side reference. Sources: CURT towing electrical guide and SAE J2863_202302.



R0.9 VISUAL EXAMPLE / NOT A PINOUT

05 | SAE J560: heavy-duty 7-round

COMMERCIAL TRUCK / TRAILER | 12 V NOMINAL PRIMARY SYSTEM

This keyed, seven-round contact connection belongs to heavy-duty commercial truck/trailer systems. Its stop-light and anti-lock brake power assignments are not the RV-style electric-brake-controller pinout. Do not substitute a generic seven-round color chart.

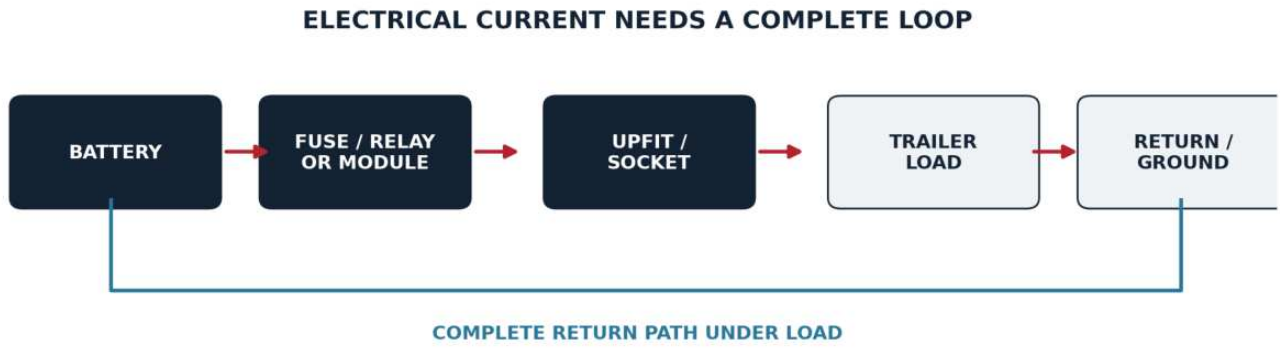
Terminal	Manufacturer-referenced function
1 White	Ground return to tow vehicle
2 Black	Clearance / identification / license
3 Yellow	Left turn / hazard
4 Red	Stop lamps / ABS secondary power
5 Green	Right turn / hazard
6 Brown	Tail / rear marker
7 Blue	ABS primary power / auxiliary

IMPORTANT An apparently similar 7-round light-duty connector may carry reverse, 12 V accessory and electric-brake output instead. Confirm it is genuinely SAE J560 before using this map.

Front-of-socket positions and functions referenced to Phillips Industries J560 catalog. SAE J560_202610 is the current listed version as of 21 October 2026; detailed applicability requires standard/manufacturer documentation.

06 | Circuit fundamentals

A CONNECTOR IS ONLY ONE STATION IN THE ELECTRICAL PATH



What can make lamps behave incorrectly?

Failure mechanism	What it changes	How to isolate it
High resistance in return	Loaded voltage rises on return side	Ground-path voltage drop
Cross-feed between circuits	One command appears on another line	Isolated function-by-function tests
Unintended battery feed	Voltage is present without requested command	Identify fuse, switch and splice path
Wrong 6-round adapter map	12 V and brake-control circuits mismatch	Verify actual center-pin mode
Module/relay/connector fault	Output missing, stuck or intermittent	Test input, command and loaded output separately

GROUND TRUTH A ground wire connected to a stud is not automatically a good ground. Test the complete path with current flowing. One low reading at one stud does not clear every conductor, terminal or connector in the return circuit.

Do not confuse a scan tool showing an inactive command with proof that no electrical voltage exists on an upfitter-modified line. The meter is reporting the actual circuit; the scan tool is reporting whatever parameter its module supports.

07 | A repeatable diagnostic sequence

RECORD TRUCK, TRAILER, ADAPTER AND COMPLETE CONNECTION AS FOUR SEPARATE CONDITIONS

Gate	Setup	Question answered
1 Preserve as-found	Photos, marks, connector type, DTCs, battery state	What existed before disturbance?
2 Truck only	Trailer disconnected; command each output safely	Is fault present without trailer?
3 Trailer only	Approved isolated trailer tester and correct loads	Does trailer have load/ground/cross-feed fault?
4 Adapter only	Identify model, orientation, center-pin assignment	Does adapter remap functions correctly?
5 Pair under load	Known and controlled truck/trailer pairing	Which fault appears only when connected?
6 Verify repair	Repeat identical tests; document loaded readings	Was operation restored, repeatably?

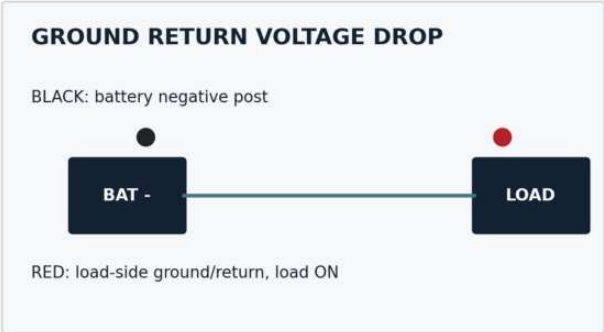
Tools do different jobs

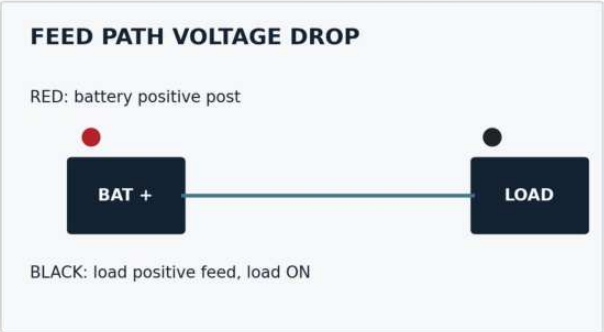
Tool	Good for	Not proof of
DVOM	DC voltage, voltage drop and continuity when de-energized	Load capacity from an open-circuit reading
Oscilloscope	Blink/PWM timing; pulse and transient shape	Circuit function unless reference known
Power Probe Maestro	Controlled electrical checking within tool ratings	Permission to energize module outputs
Trailer tester / IPA MUTT	Trailer-side independent loading and function checks	Exact wiring cause without follow-up tests
FORScan / scan tool	Commands, network status, DTC and supporting PIDs	Real voltage on unknown added harness wires

SAFETY GATE Secure vehicle and trailer independently. Power down before changing connections or pulling fuses. Do not place a person under the vehicle when commanding reverse. Never inject power into an unidentified brake, ABS or module terminal.

08 | DVOM probe placement

VOLTAGE DROP IS MEASURED WITH THE CIRCUIT LOADED





The meter measures the voltage difference between its leads. On a loaded feed path, red goes to the battery-positive post and black goes to the load feed. On a loaded ground return, red goes to the identified load ground and black goes to the battery-negative post.

Worked example (illustrative numbers, not Ford limits)

Measurement	Result	Interpretation
Battery posts, load ON	12.6 V	Reference supply
Lamp feed to battery negative	12.0 V	Feed side lost 0.6 V
Lamp return to battery negative	0.5 V	Return lost 0.5 V
Across lamp terminals	11.5 V	Actual voltage available to load
Total path loss	1.1 V	0.6 feed + 0.5 return

A READING NEEDS CONTEXT Record battery state, meter leads, exact terminals, commanded function and load type. Do not use a universal voltage-drop pass/fail threshold for every truck, cable length, ABS feed or PWM circuit; consult the applicable specification.

- Voltage checks: DVOM set to DC volts, red lead in V, black in COM.
- Continuity/ohms: de-energize and isolate the circuit first, or the reading can be misleading and unsafe.
- Sectionalize any excessive drop: post, fuse holder, relay contact, splice, connector, wire and return stud.

09 | Brakes are not one system

IDENTIFY THE BRAKE TECHNOLOGY BEFORE ASSIGNING CONTACTS

Trailer brake system	How it works	Electrical diagnostic boundary
Electric drum/disc	In-cab controller modulates brake circuit to trailer actuators	Controller output and breakaway supply must be distinguished
Hydraulic surge	Tow force compresses coupler actuator; some use reverse lockout	A reverse feed may operate lockout, not electric brakes
Air service brakes	Pneumatic service/emergency lines supply braking	SAE J560 electric connection serves lighting/ABS and auxiliaries, not pneumatic actuation
Electric-over-hydraulic	Controller commands an electric hydraulic actuator	Check actuator-specific power/ground and compatibility

Breakaway is a separate safety chain

- A breakaway switch and battery may apply trailer electric brakes if the trailer separates from the tow vehicle.
- Do not assume the 7-way auxiliary pin, brake-controller output and breakaway battery are interchangeable supplies.
- Inspect and test battery, switch, wiring and actual brake operation using the trailer and actuator manufacturer procedure; keep the trailer immobilized.

Electronic tow vehicles change the test strategy

Modern factory tow modules may monitor load, use pulse-width modulation, perform bulb diagnostics and suppress outputs until supported connection states are recognized. A small LED tester, a DVOM and a true lamp load can show different behavior. When results disagree, document tester model and use a properly rated, manufacturer-approved test method.

DO NOT BRIDGE Never jump a relay socket, trailer-controller feed or suspected network/module pin solely because a generic diagram says it should be hot. Match the Ford / vehicle wiring diagram and the installed upfit first.

10 | Case study: lamp on with trailer disconnected

SIMULATED WORKED EXAMPLE | NO VEHICLE OR ROOT CAUSE IS IDENTIFIED

A tow vehicle has an illuminated left rear lamp while the trailer is unplugged. A separate trailer socket contact also shows voltage under an OFF command. A wire found near an auxiliary fuse may or may not be related. These observations require separate tests before identifying a failed component.

What the observations establish

Observation / recorded condition	Supported conclusion	Still unknown
Left truck rear lamp stays illuminated	The trailer is not required to reproduce that lamp symptom	Which actual lamp circuit is energized and from what source
A socket indicator shows unexpected voltage	A separately identified socket circuit needs controlled loading	Contact identity, controller behavior and valid load
An added junction box is present	A body-equipment electrical boundary exists	Which inputs, outputs and modules are installed
Low voltage drop measured at one stud	That one measured segment had little loss in one condition	Complete battery-to-load return path

Controlled next-test order

- Photo-document and label socket contacts, all wires and tester model while as-found evidence exists.
- Establish lamp element and exact fuse/connector identity before interpreting readings.
- Verify truck lamp and trailer circuit as separate outputs, then locate their feed boundaries.
- Load-test the identified feed/return paths and compare repeatable command states.
- Only after exact schematic/relay identification, decide whether any module command or contact path requires deeper testing.

BOTTOM LINE A fused positive wire at a connector is a finding. It is not by itself proof that it caused the stuck lamp or that a Ford module needs programming.

TRAINING NOTE These are representative symptoms compiled to teach disciplined isolation. No actual vehicle measurement or repair outcome is claimed.

11 | Field worksheet: every connection

FILL ONE SHEET FOR EACH TRUCK / TRAILER / ADAPTER COMBINATION

Record key	Entry
Vehicle / VIN / asset ID	_____
Trailer / VIN / asset ID	_____
Adapter / tester make and model	_____
Connector family / part number	_____
View documented	[ ] Vehicle front [ ] Vehicle rear [ ] Trailer front [ ] Trailer rear
Battery / load state	_____
Date, operator, photo references	_____

Functional measurements

Function	Truck alone	Trailer alone	Paired / loaded	Notes / photo
Ground return	_____	_____	_____	_____
Tail / marker	_____	_____	_____	_____
Left stop/turn	_____	_____	_____	_____
Right stop/turn	_____	_____	_____	_____
12 V auxiliary	_____	_____	_____	_____
Electric brake output	_____	_____	_____	_____
Reverse / backup	_____	_____	_____	_____

Fault reproduced? [ ] Yes [ ] No Trailer / adapter disconnected before testing? [ ] Yes [ ] No

Next test and reason: _____

_____

Recorded evidence: _____

Record actual units and terminal IDs with every reading. N/A is more informative than a made-up number.

12 | Source index and continuation

USE MANUFACTURER PART-SPECIFIC DOCUMENTATION BEFORE DEPLOYING A PHYSICAL PINOUT

Source	What it establishes
CURT: Towing electrical wiring / Understanding Towing 6	Connector families, rear wire-entry views, traditional vs J2863 color conventions
Hopkins Towing Catalog (2023), p. 73	Two 6-way round center-pin patterns; adapter selection warning
Phillips Industries: J560 Plug & Socket Wiring	Commercial J560 socket/plug views, contact functions and representative colors
SAE J2863_202302	Automotive / RV self-draining 7-position connector interface
SAE J560_202610	Primary / auxiliary commercial truck-trailer jumper interface
generic training-case worksheet (14 Oct 2026)	Case facts and isolation strategy; not a substitute for actual truck configuration

Public source URLs

CURT Towing Electrical Wiring - reference

CURT Understanding Towing - plug and socket guide

Hopkins Towing 2023 connector catalog (PDF)

Phillips Industries commercial J560 reference

SAE J2863 (2023) automotive trailer connector reference

SAE J560 (2026) primary/auxiliary seven-conductor reference

Advanced training plates and applied laboratories follow

This edition includes full-page paired connector views and applied diagnostic laboratories. Additional fleet-specific signoffs will be developed as installed hardware is confirmed.

Reference drawings are educational. Never apply a cavity by shape, color or model year alone to an unidentified vehicle, upfit, trailer, adapter or replacement connector.

13 | Paired connector views

THE SAME CIRCUIT CAN APPEAR ON OPPOSITE SIDES OF A DRAWING

These original ATD teaching plates reconstruct representative manufacturer contact locations, not the terminal identities of an uninspected connector. Every plate holds the physical key at the top so that the viewpoint is unmistakable.

View	What you are looking toward	Why it matters
Vehicle contact face	Into the truck receptacle from outside	This is where a tester plug mates
Vehicle wire-entry / rear	At the wire terminals behind the truck socket	Usually mirrored from its contact face
Trailer contact face	Into the trailer plug contact end	Mates to the vehicle face; it is not the same drawing
Trailer wire-entry / rear	Behind the trailer plug at conductor terminations	Usually mirrored from that plug contact face

ORIENTATION RULE Always photograph the physical key/latch, connector brand, marked terminal identifiers, and BOTH views when accessible. The housing may add numbering conventions. No ATD letter key substitutes for molded terminal IDs.

Quick visual checklist

- Confirm FAMILY first: 7 RV blade, 6-round, J560, flat or another variant.
- Confirm SIDE second: vehicle or trailer.
- Confirm FACE third: contact or wire-entry.
- Confirm OPTION fourth: brake vs auxiliary contact, combined vs separate stop/turn, and any upfit module.

14 | 7-way RV blade: four views

SAE J2863-STYLE FUNCTION POSITIONS | REPRESENTATIVE MANUFACTURER VIEW

7-WAY RV BLADE

Same circuits; viewpoint changes the left-to-right picture

ATD KEYS A-G ARE TEACHING LABELS, NOT UNIVERSAL MOLDED TERMINAL NUMBERS

The color shapes use the common SAE J2863 example solely to make contact functions easy to follow. When looking into the truck socket from outside, look at the VEHICLE SOCKET / CONTACT FACE panel. When attaching conductors to the socket rear, use the VEHICLE SOCKET / WIRE-ENTRY panel.

DO NOT TRANSFER LETTERS A-G are teaching labels, not stamped terminal numbers. An OEM USCAR harness, custom flatbed interface or repaired socket can use different wire insulation colors. Use the exact plug/socket maker diagram and a functional test.

Source for positional arrangement: CURT, Understanding Towing (connector rear views), p. 16. Drawing reproduced independently in ATD notation.

R0.9 REFERENCE PHOTO / NOT MAPPED

15 | Six-round: four views

TWO RECOGNIZED BRAKE / AUXILIARY ASSIGNMENTS

6-WAY ROUND

Same circuits; viewpoint changes the left-to-right picture

ATD KEYS A-G ARE TEACHING LABELS, NOT UNIVERSAL MOLDED TERMINAL NUMBERS

Function	Illustrated example	Alternate six-round assignment
Electric brake control	B: outer contact	F: center contact
Auxiliary battery +12 V	F: center contact	B: outer contact

CENTER PIN WARNING The center is NOT automatically an electric-brake output and is NOT automatically auxiliary power. A wrong passive adapter can place full battery power on a trailer-brake circuit. Identify both ends with power OFF and verify their electrical functions before connection.

ATD letter keys are reference labels. Source: CURT connector views; Hopkins Tow Solutions, trailer wiring codes and center-pin alternative note.

R0.9 REFERENCE PHOTO / NOT MAPPED

16 | SAE J560 heavy-duty: four views

COMMERCIAL 7-ROUND | PIN 4 IS STOP / ABS SECONDARY; PIN 7 IS ABS / AUXILIARY

SAE J560 COMMERCIAL 7-ROUND

Same circuits; viewpoint changes the left-to-right picture

J560 NUMBERS 1-7 FOLLOW THE COMMERCIAL STANDARD; VERIFY CONNECTOR BRAND AND VIEW

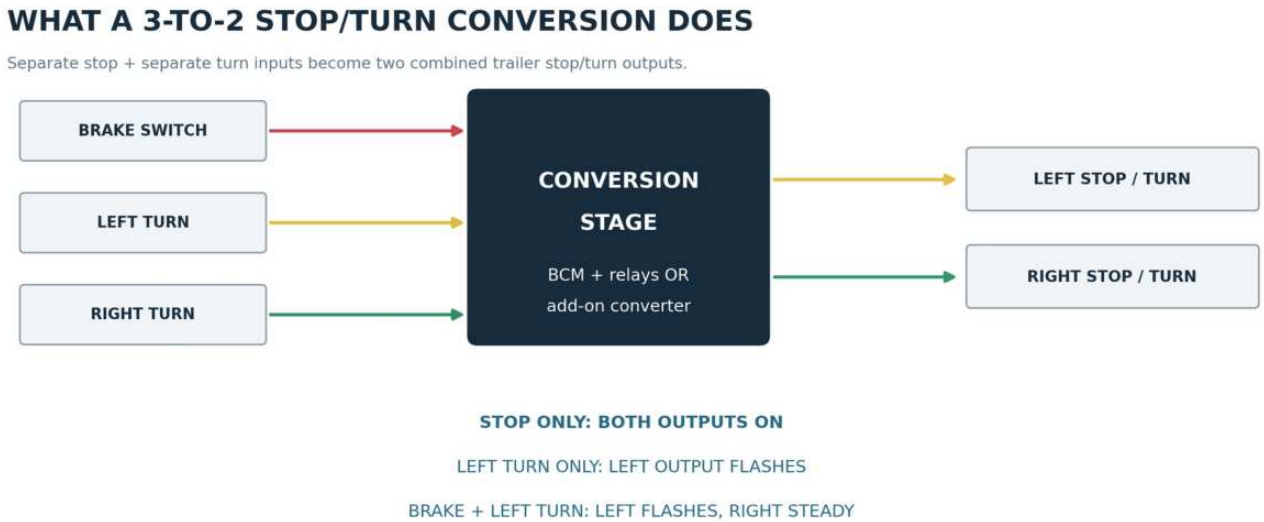
Unlike RV blade wiring, J560 uses a dedicated STOP circuit at pin 4 and separate LEFT/RIGHT turn circuits at pins 3 and 5. Pin 7 supports auxiliary/ABS primary power. The J560 connector is commonly associated with air-brake trailers, but connector type alone does not prove an entire brake configuration.

NOT A PASSIVE RV ADAPTER Physically similar seven-contact products can have different assignments. J560-to-RV conversion may need functional translation, proper electrical protection and independent brake-control support; an ordinary pin-swapping adapter cannot manufacture a missing electric-brake-controller output.

Pin definitions and face/back locations: Phillips Industries J560 Plug & Socket Wiring; Erich Jaeger SAE J560 reference.

17 | Stop / turn converter: what it really does

TWO DIFFERENT WAYS TO MAKE THE SAME OUTPUT



Do not confuse conversion behavior with a converter BOX

A truck with separate brake lamps and amber turn lamps has to deliver correctly combined left-stop/turn and right-stop/turn signals to a typical RV 7-way. Some vehicles do this in BCM-controlled outputs and dedicated relays. Other installations use a standalone powered or unpowered converter. A physical box is not required when the factory outputs already have the correct logic.

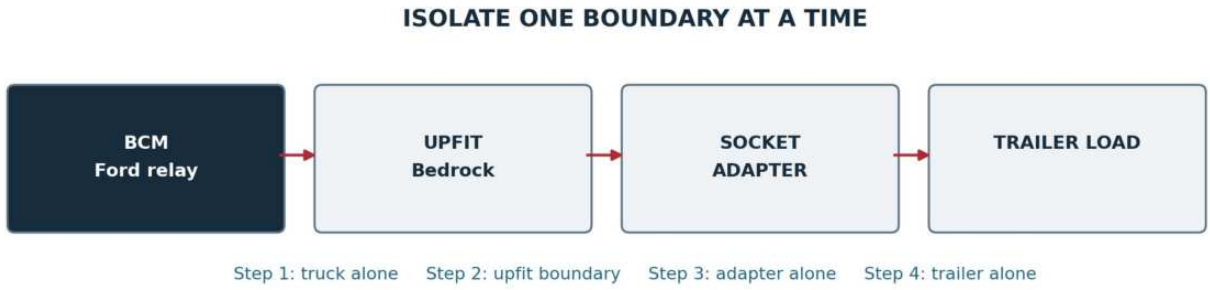
Evidence	What it proves	What it DOES NOT prove
Brake pedal activates both 7-way left and right	Output logic is combined in that test state	A standalone converter is fitted
OEM trailer outputs available	Factory may provide the required combined logic	An added upfit interface is absent
Body or upfit junction enclosure exists	Another harness boundary can be mapped	A standalone active converter is installed

CONFIGURATION EXAMPLE OEM trailer outputs may already provide the correct combined stop/turn behavior; added upfit wiring can still be present. Match model-specific schematics and verify the actual input-output boundary before diagnosing conversion hardware.

References: manufacturer electrical/body-builder manuals for the exact vehicle; CURT connector-function guidance and installed interface documentation.

18 | Follow the system, not the wire color

FACTORY ELECTRONICS -> UPFIT -> CONNECTOR -> TRAILER



A failure that appears at a trailer connector can originate upstream in relay contacts or control logic; at the altered body/upfit; inside the connector or adapter; or downstream in trailer wiring. Testing the system in one big connected state hides the boundary.

Test condition	Meaningful observation	Next logical decision
Truck alone abnormal	Trailer is not required for symptom	Trace truck/upfit/socket output path
Truck normal; trailer-alone fails	Independent trailer fault demonstrated	Trace trailer loads, ground and splices
Both alone normal; pair fails	Interaction under load, identification or feedback	Study voltage drops, adapters, controller and load
One adapter fails; other passes	Adapter likely contributes under stated conditions	End-to-end mapping and loaded connector check

EVIDENCE STANDARD Name the exact commanded state, the wiring contact and connector-side view, meter/tester used, battery voltage, load and measured result. Do not call a suspect a cause until an isolation test discriminates it from alternatives.

19 | Lab 0: preparation and safe baseline

BEGINNER PROCEDURE | NO ELECTRICAL DISCONNECTIONS UNDER LOAD

OBJECTIVE	REQUIRED SETUP	STOP / SAFETY GATE
Preserve the original state and make later comparisons meaningful.	Two wheel chocks; approved DVOM; labeled probes; camera; schematic; note sheet.	Stop for damaged insulation, heat, unsupported jack/parking or uncertain connector identity.

1. Park on level ground. Secure the truck and trailer against movement independently. Chock as appropriate. Do not rely on the hitch or parking brake alone.
2. Before moving any wire, photograph the truck socket, trailer plug, adapter, installed upfit junctions and any splices. Record connection orientation.
3. Record truck VIN/asset ID, trailer VIN/asset ID, body/upfit, fuse-box lid ID, tester name and adapter part number.
4. Identify the exact vehicle socket and trailer plug family. Use the matching manufacturer contact drawing; do not infer from shell shape.
5. Record existing warning lamps, trouble codes and driver-reported symptoms before clearing anything.
6. Inspect for exposed copper, loose rear studs, strained cables, green oxidation, water and stacked ring terminals. Do not pull on unknown wires.
7. Set the DVOM to DC V; insert black lead in COM and red lead in V. Check meter on battery posts first and record reading and engine state.
8. With lights commanded OFF, document which circuits are unexpectedly energized, using a verified pin map. Test only at accessible approved points.
9. Before unplugging a load, switching adapters or opening a fuse/relay housing, shut the load OFF and isolate power as required by the service procedure.
10. Assign a unique test ID to each change and restore the safe reference state so before/after comparisons use the same test conditions.

EXPECTED RESULT A complete baseline record, NOT a declaration that every energized terminal is faulty. Some OEM outputs pulse or self-diagnose without a trailer load.

20 | Lab 1A: DVOM circuit identification

TRUCK SOCKET ALONE | NEVER USE AN UNVERIFIED POSITIONAL MAP

OBJECTIVE	REQUIRED SETUP	STOP / SAFETY GATE
Identify each contact by function under commands.	Known-family receptacle; approved meter; safe vehicle positioning; matching OEM diagram.	Do not command reverse near anyone under/behind truck; no power-injection probes.

1. Disconnect trailer and adapter, with all lighting commands OFF. Photograph the unoccupied vehicle socket face and key.
2. Locate the verified ground contact for this EXACT socket. Verify its return to battery negative; if not confident, use battery negative as reference.
3. Connect DVOM black lead to the battery negative post or the verified ground contact; put the red lead on only ONE identified socket contact.
4. With key/engine state documented, record reading when no lamp functions are commanded. Note any pulse or unstable meter reading.
5. Command parking/marker lamps ON; record each identified contact in turn without bridging adjacent terminals.
6. Command LEFT turn; record whether the matched left output pulses. Repeat for RIGHT turn and then hazard flashers.
7. With vehicle stationary and secured, have a second operator apply SERVICE BRAKE; identify whether both left and right combined outputs activate.
8. For reverse, use the specific safe service method and spotter. No one under/behind the vehicle; do not use reverse unless practical and safe.
9. Record auxiliary feed with key ON and OFF and note whether it is constant, keyed or relay-controlled. Do not jump it.
10. If any result conflicts with the diagram, mark UNRESOLVED, stop making assumptions and verify installed harness, module, relay and upfit configuration.

EXPECTED PATTERN With combined stop/turn RV wiring, a brake-only command should activate both matched left and right stop/turn functions. With left-turn command alone, the left should pulse. An unloaded meter reading can be misleading on supervised/module-driven outputs.

21 | Lab 1B: functional command matrix

COMPLETE THIS TABLE BEFORE MAKING A WIRING CHANGE

Command	Ground	Tail/park	Left ST	Right ST	Reverse	Aux	Brake ctrl
All OFF	Return	-	-	-	-	Depends	No commanded braking
PARK ON	Return	ON	-	-	-	Depends	No commanded braking
LEFT ON	Return	-	FLASH	-	-	Depends	No commanded braking
RIGHT ON	Return	-	-	FLASH	-	Depends	No commanded braking
BRAKE only	Return	-	ON	ON	-	Depends	Controller-specific
HAZARDS	Return	-	FLASH	FLASH	-	Depends	No commanded braking
REVERSE	Return	-	-	-	ON*	Depends	No commanded braking

ST = stop/turn. This is an illustrative combined-output RV blade behavior reference, not an OEM numerical specification. * Reverse requires a safe dedicated procedure and may be absent from a given connector. A dash means normally uncommanded in the simplified example; electronic monitoring pulses may still occur.

Write measured data, not just pass/fail

Command / load	Contact ID and view	Meter / tester mode	Actual reading / behavior	Interpretation
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

WHAT CANNOT BE INFERRED A steady 12 V shown on a meter proves only voltage at that point under the recorded meter loading. It does NOT prove ability to operate a lamp, a brake magnet or trailer ABS. That requires an approved loaded test with matching limits.

22 | Lab 2: loaded voltage-drop diagnosis

FIND RESISTANCE WHILE CURRENT IS FLOWING

OBJECTIVE	REQUIRED SETUP	STOP / SAFETY GATE
Separate feed loss from ground-return loss in a functioning load path.	Identified lamp load, valid command, DVOM with long/secure reference lead.	Do not test resistance/continuity on a live circuit or bypass protective fuses.

1. Identify one normal working load, for example a running lamp. Switch it ON and leave other conditions unchanged.
2. Measure battery voltage directly at the POSTS (not clamp surfaces). Record the value with the load ON.
3. Check actual load positive to battery negative. This confirms the voltage arriving on its feed relative to battery negative.
4. For positive feed drop: RED to battery positive post; BLACK to load positive. The meter reports positive-side loss through the wiring path.
5. For return drop: RED to load return/ground wire; BLACK to battery negative post. The meter reports voltage lost on the return path.
6. Measure across load positive and load negative terminals to learn the voltage actually applied to the lamp/actuator.
7. If a drop exceeds the applicable OEM/test setup limit, move the measurement points closer: fuse holder, relay contact, splice, connector then chassis bond.
8. Repeat on the same setup after repair. Record both the before and after supply, feed loss, return loss and load current when available.

Illustrative example | no universal pass/fail limit implied

Location / relationship	Reading	Explanation
Battery at posts with lamp ON	12.6 V	Supply starting point
Feed loss: battery + to lamp +	0.6 V	Loss across feed wiring/contacts
Return loss: lamp - to battery -	0.5 V	Loss across ground path
Voltage across lamp itself	11.5 V	12.6 - 0.6 - 0.5 = 11.5 V

PWM EXCEPTION Pulse-width-modulated outputs require correct duty-cycle or waveform assessment. A simple meter average across switching and wiring does not uniquely identify resistive voltage drop.

23 | Lab 3: Power Probe Maestro

MEASUREMENT IS SAFE; ACCIDENTAL ROCKER ACTIVATION MAY NOT BE

OBJECTIVE	REQUIRED SETUP	STOP / SAFETY GATE
Use Maestro to observe supply and intermittent activity without forcing outputs.	Maestro matched to voltage rating, intact cable, approved battery source and a mapped probe point.	In VDC mode the rocker can provide battery + or - to tip. KEEP HAND CLEAR OF ROCKER.

1. Read the exact Maestro manual. Check source voltage and the device input/output ratings for this truck.
2. Connect Maestro battery clamps at proper posts as specified by Power Probe. Confirm startup display and measured supply.
3. Select VDC mode for voltage observation. The tip may read volts without any rocker activation.
4. With the circuit and probe point positively identified, touch the test point using insulated and non-spreading probing.
5. Record battery supply and probe tip voltage for all-OFF, tail, left, right and brake commands.
6. Capture MIN/MAX or glitches where useful and note command timing and any tester load.
7. Use a DVOM loaded drop or a suitable approved technique to confirm suspect high resistance; a light-load feed check alone is not a substitute.
8. Only an identified, isolated, non-module load may ever be actively powered using an approved specific procedure. Never probe-activate an unidentified BCM, brake, ABS, controller or splice.

Observation	Interpretation boundary
Red/green indicator or tone	A screening indication within Maestro algorithm; not necessarily OEM pass/fail.
Voltage near battery when unloaded	Does not prove current capacity at the trailer lamp.
Transient during left-turn command	Compare to scope waveform and command state before deciding source.

Power Probe Maestro OEM instructions: VDC mode can source battery/ground through its rocker. Its feed-test mode is limited-current and should not replace a fully loaded system test.

24 | Lab 4: trailer-only tester / IPA MUTT

THE TESTER REPLACES THE TRUCK FOR CONTROLLED TRAILER-SIDE FUNCTION TESTS

OBJECTIVE	REQUIRED SETUP	STOP / SAFETY GATE
Test trailer lamps, returns and unintended cross-activation without the suspect tow vehicle.	Identify exact MUTT model, supported connector and voltage; charge battery; chock trailer.	Never attach MUTT output to an energized truck socket. No unknown adapters or mismatched 12/24 V.

1. Read the model number on the tester. Find its specific IPA manual before selecting the connector, switch settings or power source.
2. Secure the disconnected trailer independently. Inspect 7-way contacts and cable for bent metal, moisture and abrasion.
3. With tester OFF, connect correct direct cable/approved adapter to the TRAILER PLUG, not a vehicle power output.
4. Select the correct 12 V or 24 V source ONLY if that exact model supports it. Record battery reading and internal fuse rating.
5. Operate a single tail-light command. Walk the trailer; check all expected lamps and any unexpected circuits.
6. Repeat left, right, brake lamp and marker commands one at a time. Record current, warning lights and audible indications if equipped.
7. If left command illuminates right or reverse loads, document the exact coupled circuits and trace individual branches after safe shutdown.
8. Do not assume MUTT can safely power electric brake magnets or an ABS controller until manual and model-specific current limits authorize the test.
9. Turn tester OFF, disconnect, and restore connectors securely. Preserve results even if the truck tests normally later.

MODEL MATTERS IPA 9101 Ranger MUTT example is 12 V and supplies up to 10 A on a selected circuit. Other Smart/Alpha/Super MUTT units have different connectors, controls and amperage. DO NOT copy this specification to an unidentified unit.

Source: IPA MUTT official manuals index and matched model operator instructions.

25 | Lab 5: oscilloscope signals and PWM

CAPTURE THE SHAPE OF A SIGNAL, NOT JUST ITS AVERAGE

OBJECTIVE	REQUIRED SETUP	STOP / SAFETY GATE
Distinguish steady DC, signal pulses and PWM from a possible true constant feed.	Automotive-rated scope, appropriate probes, proper reference and an approved backprobe.	Never clip a common-ground bench scope lead to an unknown powered point; use proper isolation/differential setup.

1. Identify scope make/model, allowable input voltage, probe attenuation and common-ground configuration before connecting.
2. Connect channel ground only to a verified reference permitted by the scope manual, usually battery negative for isolated automotive scopes.
3. Attach probe tip to an identified lamp circuit, not a suspected data-bus or controller output without matching circuit information.
4. Start with suitable voltage range and a timebase that displays several turn cycles (for example, around 200 ms/div), then adjust.
5. Capture OFF, left turn, right turn, hazards and brake states on the same contact. Label screenshots with the actual commanded state.
6. If a faster pulse train is present, narrow the timebase gradually to reveal its period and duty cycle. Compare loaded and unloaded states.
7. Interpret duty cycle: high time divided by total cycle time. A PWM waveform can produce a misleading average DVOM reading.
8. Save the waveform and compare upstream/downstream of any suspect splice or upfit boundary with identical reference and load.

Signal seen	First interpretation	Not yet established
Flat supply-like plateau	Output may be commanded ON or stuck high	Whether current can flow through load
Slow repeated ON/OFF	Possible turn-signal operation	Correct source or connector routing
Fast repeated pulses	Possible PWM or output self-test	Wiring failure without comparison
Waveform changes at upfit boundary	Transformation or coupling possible	Exact bad part without sectional tests

26 | Lab 6: passive adapter vs converter

A SHAPE MATCH IS NOT A FUNCTION MATCH

1. Identify BOTH connector families and which is truck-side and trailer-side. Photograph key and face direction.
2. Write the required function map for every conductor: ground, tail, left/right stop-turn, aux, reverse and electric brakes.
3. With ALL SOURCES OFF and adapter fully disconnected from truck and trailer, use continuity to map each contact end-to-end.
4. Test for unintended continuity between different mapped circuits with adapter isolated. Internal electronics can invalidate ohms conclusions.
5. Verify special cases: six-round center brake vs auxiliary, 7-round J560 separate stop lamps, RV combined stop/turn and brake-control compatibility.
6. If the adapter contains electronics, identify part number and power/ground requirements; use maker testing steps rather than raw ohmmeter assumptions.
7. Connect only after correct function and voltage/current compatibility are verified. Then repeat each function under a permitted load.
8. Record a verified mapping photo rather than relying on retail packaging descriptions.

Interface	Passive adapter enough?	Critical note
7 RV blade to 4-flat lighting	Often, for the four supported lighting/ground functions	No electric-brake or charge functions carried
7 RV blade to 6-round	Only when both sides function-matched	Center brake/aux must be verified
SAE J560 7-round to RV blade	Not automatically	Different stop/turn/ABS and brake-control circuits
Separate turn + separate brake into RV	Not by pin-swapping alone	Needs combined logic from OEM or proper converter

NEVER SHORT TO TEST Do not short auxiliary +12 V to trailer brake pin or join stop and turn outputs with a splice as a substitute for conversion. Interference with ABS, BCM or trailer brake control can follow.

27 | Lab 7: trailer breakaway and auxiliary feed

THREE SEPARATE CIRCUITS: CHARGE, BRAKE OUTPUT, BREAKAWAY

Function	Typical role	Diagnostic trap
12 V auxiliary / charge	Supply/charging for trailer accessories or breakaway battery depending on installation	Assuming it must always be on
Brake-controller output	Modulated actuation signal for electric/electric-hydraulic trailer brakes	Confusing it with constant battery +12 V
Breakaway battery + switch	Independent emergency braking on trailer separation	Assuming tow socket power replaces healthy breakaway battery

1. Chock and secure trailer. Identify actual brake system and whether separate breakaway power is fitted.
2. Record breakaway battery asset ID, chemistry, state/voltage and charge condition using battery maker guidance.
3. Trace the charge/auxiliary feed to its own fuse/protection; label it separately from brake-controller output.
4. Inspect switch cable, switch housing and battery ground/positive routing. Do not bridge unidentified pins.
5. Follow the brake/actuator manufacturer breakaway functional test and permitted activation duration. Prevent uncontrolled movement.
6. After testing, reinstall breakaway pin correctly and verify brakes release, normal brake function and charger behavior.
7. Log battery and switch condition for reinspection. Keep trailer out of service if breakaway function cannot be verified safely.

CAUTION Never test electric brake assemblies by leaving them energized for an unspecified duration; magnet, controller and breakaway battery limits depend on the actual equipment. Air-brake trailer emergency systems are a different class of procedure.

28 | Fault decisions: abnormal left stop/turn

FOLLOW THE OBSERVATION TO THE NEXT DISCRIMINATING TEST

Finding	Primary boundary	What to do next safely
Left high with trailer AND adapter removed	Truck/upfit/socket	Identify correct lamp contact; compare OEM-controlled output with the body/upfit junction under one load state.
Left normal unplugged; high when trailer connected	Trailer/interconnection	Isolate trailer tester results and inspect shared ground/cross-feed
Vehicle left rear lamp also lit abnormally	Vehicle rear branch could be involved	Identify actual lamp element and shared/unshared source
Inline fuse changes backup indicator but not left	Separate battery-fed branch likely exists	Trace that branch independently; do not call it the left fault
Repaired state passes only with one tester	Tester/load dependency	Repeat under actual vehicle/trailer load and log model

Decision path for relays and electronic controls

1. Verify that the actual socket contact and wire-entry view have been identified. Confirm command OFF, battery condition and connected loads.
2. Measure abnormal contact and the same function at the next positively identified boundary toward the vehicle.
3. **At an OEM relay, first establish verified relay and socket identity from the installed box and applicable schematic.**
4. Then compare legitimate coil command, protected contact supply and loaded contact output with an approved breakout. Do not jump relay cavities.
5. **If a downstream upfit output is abnormal while a separately verified upstream OEM output is normal under the same conditions, investigate the upfit section before blaming factory electronics.**
6. Only assign cause after an intervention or sectional test reproduces and eliminates the fault without changing multiple variables.

NO SHORTCUTS High voltage alone does not identify a welded relay, a short to battery, a BCM command or a trailer-side backfeed. Prove the relevant boundary and load state first.

29 | Find the converter: OEM or aftermarket?

GENERAL PROCEDURE | THE TRUCK MAY HAVE BUILT-IN COMBINED OUTPUTS OR AN ADDED CONVERTER

A tow vehicle may produce combined stop/turn outputs directly through its OEM body controller or relays. Other vehicles require an approved standalone powered or unpowered signal converter. The correct question is not whether a black box is visible, but which component actually produces the trailer-compatible outputs.

Status	Evidence	Interpretation
OEM OPTION VERIFIED	Service literature shows appropriate combined trailer outputs	No extra converter required solely to combine brake and turn
UPFIT / ADD-ON	Labeled interface has separate input and combined output connections	Verify converter make, part number and required power/return
BRAKE-ONLY TEST	Both trailer left/right stop outputs activate as specified	Combined function proven, location still unknown
UNIDENTIFIED SPLICE	Additional wire runs / box are observed without mapping	Do not call it a converter or blame it until traced

How to determine whether a box was added

installed junction box

left OEM trailer output

3. Run a brake-only function test with a correct load. Combined trailer outputs will both activate; that proves behavior, not location of conversion.

downstream of the upfit junction

5. If a labeled add-on converter exists, document its maker/part number, fused supply, ground, signal inputs and outputs and test only to its instructions.

DIAGNOSTIC GATE A converter function can be built into OEM circuits or a standalone module. Evidence must identify which produces the final output; a module replacement or flash is not a substitute for that test.

Reference: manufacturer body-builder and wiring documentation for the specific vehicle and aftermarket converter, if fitted.

30 | Diagnostic practice: three fault patterns

DO THESE ON PAPER BEFORE LOOKING AT THE NEXT PAGE

Scenario A: two functions activate together

Trailer alone on a correctly matched MUTT: the LEFT command also illuminates the trailer backup lamps. The truck alone operates normally. Which boundary is now the strongest lead, and what is one isolation test?

Proposed boundary: _____

Next test: _____

Scenario B: good voltage, dim lamp

At battery posts during normal tail command: 12.6 V. At the lamp positive to battery negative: 12.3 V. At lamp return to battery negative: 1.8 V. What is the likely dominant path loss, and what is voltage across the lamp?

Dominant path: _____

Voltage actually across lamp: _____ V

Scenario C: brake-only stop/turn behavior

On a properly verified RV seven-blade tow socket, applying only the service brake energizes both left and right stop/turn functions. A junction enclosure contains several splices, but no identified electronics. Does that behavior alone prove a separate converter box? Explain the next test.

Answer and reasoning: _____

_____

31 | Practice answers and decision gates

THE ANSWER SHOULD REFER TO AN ISOLATED CIRCUIT, NOT AN ASSUMED PART

Case	Expected analysis	Next test
A	The trailer side is the strongest lead because it fails without the truck; one tester model and setup must be verified.	With all power OFF isolate trailer branch conductors, then repeat one controlled function test under permitted load.
B	Ground path loss dominates: feed drop 0.3 V, return drop 1.8 V; load voltage 12.3 - 1.8 = 10.5 V.	Sectionalize return path from lamp ground terminal toward battery negative under the same load.
C	No. Combined behavior may originate in OEM electronics/relays, a standalone converter or another interface.	Trace documented OEM outputs and any body/upfit interface; record actual devices by part number.

Technician signoff checklist

- [ ] I can tell an RV blade socket from an SAE J560 round socket.
- [ ] I can label the mating face and rear wire-entry side without mirroring an unknown housing.
- [ ] I can describe why a battery-fed auxiliary wire must not be confused with an electric-brake output.
- [ ] I can place a DVOM for a loaded positive feed and a loaded ground voltage drop.
- [ ] I can explain why a converter function does not prove a separate converter box.
- [ ] I can isolate truck, upfit, adapter and trailer as distinct diagnostic boundaries.

PASS CONDITION The trainee can correctly explain probe locations, safe conditions and what each result proves. Memorizing one color chart is not certification to wire a fleet trailer.

32 | Printable field worksheet: advanced tests

DUPLICATE THIS PAGE FOR EACH VEHICLE / TRAILER / ADAPTER OR INDEPENDENT REPAIR

Asset / test ID	Entry
Truck VIN / ID	_____
Trailer VIN / ID	_____
Upfit / junction model	_____
Connector and view	_____
Tester / adapter model	_____
Date, tech and photos	_____
Battery posts under load	_____ V
Selected load/current	_____ A / type _____

Function / state	Upstream V	Socket V	Trailer/load V	Return drop V	Observation
OFF / left	_____	_____	_____	_____	_____
BRAKE / left	_____	_____	_____	_____	_____
LEFT TURN	_____	_____	_____	_____	_____
RIGHT TURN	_____	_____	_____	_____	_____
PARK	_____	_____	_____	_____	_____
REVERSE (safe)	_____	_____	_____	_____	_____
AUX / CHARGE	_____	_____	_____	_____	_____

Suspect boundary: _____

Evidence that distinguishes it from other causes: _____

Follow-up required: _____

33 | References and revision record

SOURCE-BASED TRAINING | MANUFACTURER DIAGRAMS CONTROL PHYSICAL TERMINAL WORK

Reference	Use in this training
OEM body-builder / service publications	Vehicle-specific grounding locations, fuse/protection, module/relay options and specifications.
Illustrative field-case methods	Trained symptom documentation; fictionalized examples cannot certify a specific vehicle.
CURT, Understanding Towing / Plugs & Sockets p.16	Representative RV blade, 6-round and flat rear wire-entry diagrams.
CURT, Towing Electrical Wiring	Traditional vs SAE J2863 seven-blade functional color examples.
Phillips Industries, J560 Plug & Socket Wiring	Commercial J560 primary circuit names and matched front/rear drawings.
Erich Jaeger, SAE J560 technical reference	Numbered J560 primary contact role verification.
Hopkins Towing Solutions, Trailer Wiring Codes	Truck/trailer contact maps and center contact 6-round alternatives.
Power Probe, The Maestro Operator Manual	Voltage mode, rocker output, device limitations.
IPA MUTT Manuals & Training index	Model-specific trailer tester rules and capabilities.

Reference URLs

OEM Body-Builder documentation - confirm model-specific details

CURT Understanding Towing - plug and socket guide

CURT Towing Electrical Wiring - reference

Phillips Industries commercial J560 reference

Erich Jaeger SAE J560 technical reference

Hopkins Trailer Wiring Codes

Power Probe resources and Maestro documentation

IPA MUTT manuals and training index

R0.6 retains the core connector families, four-view plates, electric-brake basics and testing laboratories. All vehicle-specific examples are instructional and must be verified against the installed equipment before application.

Appendix A | Electrical glossary

Plain-English definitions used throughout the connector and diagnostic labs

Term	Practical meaning
ABS	Anti-lock braking system; commercial J560 circuits may power trailer ABS electronics.
Adapter	Device that mates different connector shapes or maps compatible circuits; a passive adapter does not create missing signal logic.
Auxiliary 12 V	Protected battery or switched feed used for supported accessories or trailer charging, separate from electric-brake actuation.
Backfeed	Voltage or current reaching a circuit from a source or direction it was not intended to use.
Battery junction box (BJB)	Vehicle power distribution assembly containing applicable fuses and relays.
Body control module (BCM)	Vehicle electronic controller that may command or monitor lighting circuits.
Brake-controller output	Variable electrical command sent to compatible electric trailer brakes; not a constant battery charging feed.
Breakaway system	Trailer emergency-brake actuation system used if the trailer separates; may include its own battery and switch.
Cavity	Specific numbered or lettered terminal position in a connector housing.
Combined stop/turn	One left circuit and one right circuit each handle brake and turn function.
Command state	Documented OFF, ON, turn, brake, hazard or reverse condition during a test.
Continuity	Electrical path present between test points; a beep alone does not prove acceptable loaded performance.
Converter	Electronic interface that changes signal logic and/or drive capability to match a trailer lighting system.
Cross-feed	An electrical path between circuits that causes one command to energize another function.
DTC	Diagnostic trouble code reported by a module or scan tool; an observation, not automatically a failed part.
Duty cycle	Percentage of a repeating waveform period that remains in its high/on state.
DVOM	Digital volt-ohm meter, used for voltage, resistance and other supported electrical measurements.
FET	Field-effect transistor; a solid-state switching device found in some module outputs.
Fuse	Sacrificial protective device that opens when excessive current flows under its operating conditions.
Ground return	Designed electrical current path back to the negative supply; may share chassis structure when specified.
Harness	Group of conductors, protection and connectors carrying electrical circuits.

Term	Practical meaning
Inline fuse	Fuse installed directly in a conductor or dedicated small fuse holder outside a main power distribution box.
Keyway	Physical orientation feature that prevents incorrect connector engagement.
KOEO	Key on, engine off; record exact ignition state because modules and circuits can behave differently.
Loaded test	A measurement made while the circuit supplies a meaningful appropriate load.
Mating face	Side of a plug or receptacle that directly connects to its counterpart.
Open circuit	Broken or disconnected electrical path that prevents intended current flow.
OEM	Original equipment manufacturer; factory routing should not be assumed unchanged after upfitting.
Pinout	Assignment of electrical functions to physical connector contacts, with stated view/orientation.
PWM	Pulse-width modulation; repeated on/off switching whose duty cycle controls an average effect.
Relay coil	Electromagnetic part of a relay used to operate its contacts; terminal numbering is not universal.
Relay contacts	Power-carrying switched path of a relay, distinct from the coil-command circuit.
Reverse lockout	Mechanism often used with surge brakes to prevent unwanted trailer braking when backing.
SAE J560	Standard family for a commercial seven-contact truck/trailer connection; not interchangeable with RV blade rules.
Separate stop/turn	System that carries independent brake and turn signal circuits rather than combined outputs.
Short to battery	Unintended connection to a positive source that can leave a circuit energized.
Short to ground	Unintended connection to return/chassis, possibly opening protection or disabling a circuit.
Upfitter	Installer or modifier adding commercial body equipment or wiring to an original vehicle.
Voltage drop	Voltage lost across part of an energized circuit due to its resistance and actual current.
Wire-entry face	Rear of connector where conductors enter; terminal locations may be mirror images of mating-face drawings.

Glossary scope: these definitions support technical training. The actual manufacturer document controls every configuration-specific pinout, safety limit and procedure.

Appendix B | Abbreviations and circuit IDs

Acronym decoder for Ford, connectors, test tools and report records

Abbreviation	Meaning or use
ABS	Anti-lock braking system
ATD	All The Details
BCM	Body control module
BJB	Battery junction box
CAT06 / CAT09	Ford wiring circuit identifiers for a documented left/right trailer branch; verify diagram applicability
CLS18 / CLS19	Ford wiring circuit identifiers on documented left/right body output branches
COM	Common/negative meter input
DTC	Diagnostic trouble code
DVOM	Digital volt-ohm meter
FET	Field-effect transistor
KOEO	Key on, engine off
MUTT	Mobile Universal Trailer Tester (product family; model-specific functions vary)
OEM	Original equipment manufacturer
PID	Parameter identification/data parameter in a scan tool
PWM	Pulse-width modulation
SAE	SAE International
TBC	Trailer brake controller (context-dependent)
VIN	Vehicle identification number
VDC	Volts direct current
J560	SAE standard designation for commercial seven-contact connectors

Vehicle circuit code

Appendix C | Tool selection and safety

Choose the tool from the question being tested, not the tool that happens to be in your hand

Tool	Use it when...	Do not conclude...
DVOM (volts)	You need a measured circuit voltage or sectional voltage drop under a valid load.	12 V open circuit means the conductor can carry load.
DVOM (ohms)	Power is off, the circuit is isolated, and you need a continuity map.	Continuity proves a good operating ground under current.
Power Probe Maestro	You need permitted voltage/ground information or manufacturer-authorized controlled load testing.	Power injection is safe on a module or unknown trailer brake contact.
IPA MUTT	You want to operate a safely disconnected trailer independent of the truck.	A tester function proves truck-side wire routing or confirms all brake electronics.
Oscilloscope	You need to distinguish steady DC, slow turn pulses, PWM and transients.	An isolated waveform identifies a failed component without boundary checks.
FORScan / scan tool	You need supported PIDs, DTCs, commands or module states.	A PID marked OFF guarantees an upfitter-modified output is at zero volts.
Test lamp / rated load	A vehicle service procedure allows a known load on a verified output.	An unknown BCM or trailer circuit is safe to load.

Before connecting any test equipment

- Match system voltage, power source, polarity, connector/adapter type, fuse protection, meter category and scope input ratings.
- Secure tow vehicle and trailer independently; no one should be below/behind the unit during commanded reverse or brake operations.
- Use the correct cable/probe ground reference, especially with grounded oscilloscopes and network-connected devices.
- Record the exact source and load state. Reconnect safety-critical systems, and retest after the final change.

Appendix D | Training competency signoff

Use this sheet with the practice cases and actual supervised field measurements

Technician: _____ Date: _____ Supervisor: _____

Mark	Task / evidence	Observed result
[ ]	Connector recognition - Identify 4-flat, 5-flat, 6-round, RV 7-blade and SAE J560 by physical features.	_____
[ ]	Face orientation - Mark truck/trailer and mating/wire-entry sides correctly on a real connector.	_____
[ ]	Function verification - Prove left, right, park, stop and reverse by command and measurement, not wire color.	_____
[ ]	Adapter mapping - Show why six-round brake/auxiliary terminals require verification.	_____
[ ]	Voltage-drop test - Place DVOM leads for positive feed and return drops under a known appropriate load.	_____
[ ]	Independent trailer test - Configure and safely operate the exact IPA MUTT model with the trailer disconnected.	_____
[ ]	Scope interpretation - Distinguish turn cycling, steady 12 V and PWM without inventing root cause.	_____
[ ]	Fault isolation - Document truck/upfit/adapter/trailer as separate boundaries.	_____
[ ]	Brake safety - Identify brake-controller output, auxiliary supply and breakaway battery as separate functions.	_____
[ ]	Documented conclusion - Present a measured finding, competing causes and a single next discriminating test.	_____

Reference exercises: Chapter 30 (scenarios) and Chapter 31 (answers). A checked box records demonstration, not independent certification or permission to perform work outside applicable safety procedures.

Reviewer: _____ Date: _____ Follow-up topics: _____

Appendix E | Revision and document controls

Publication control, source boundaries and link integrity

Field	Control
Document title	ATD Truck & Trailer Electrical Training Manual - Volume 01
Document ID	ATD-TRAILER-ELECTRICAL-TRAINING-001
Revision	R0.6 | 21 October 2026
Prepared by	Stephen Guffey | All The Details (ATD)
Audience	Technicians, fleet maintenance and supervised trainees
Source of technical procedures	Existing R0.2 training manual, cited Ford and connector maker references, and the documented Training truck case record
Validation boundary	Pinouts and wire codes are valid only where their stated connector family, viewing orientation, installation and source revision apply
Distribution	Editable Word and PDF editions; hyperlinks intended for navigation in supported viewers

Revision history

Edition	Change
R0.1	Initial connector atlas and basic tests.
R0.2	Expanded four-view connector plates, converter concepts, hands-on labs, truck case and field sheets.
R0.3	Added ATD visual treatment; some pages in that edition contained unwanted spacing.
R0.6	Rebuilt document navigation; added executive overview, linked chapter/figure/symptom references, glossary, abbreviations, tool guide, competencies, and corrected pagination, linked alphabetical index.

Source and verification policy

- Published connector-function diagrams are teaching references, not proof of which conductors were installed on a particular truck.
- Manufacturer-specific wire colors, contact views and option codes take precedence over generalized charts.

The universal converter-location question remains a diagnostic decision, not an assumption; a factory output may already contain the combined logic.

No field measurement, module programming, repair, load test or vehicle root-cause determination

- See Chapter 33 for source URLs and manufacturer documents. Verify current parts and instructions before work.

Appendix F | Alphabetical topic index

Quick alphabetic routes into the manual; use the glossary when you need a definition.

A - I	J - Z
ABS / air-brake interface	Fuse and relay outputs
Adapters	Ground return
Auxiliary 12 V feed	IPA MUTT / trailer tester
Backfeed and cross-feed	J560 commercial seven-round
Battery and breakaway	KOEO command state
Body/upfit junction box	Lighting command matrix
Brake controller	Maestro Power Probe
Combined stop/turn	Oscilloscope
Connector front/back views	PWM
Converter identification	Reverse lockout
Digital volt-ohm meter	Six-round center contact
DTCs and FORScan	Stop/turn converter
truck case study	Trailer breakaway
OEM-versus-added conversion decision	Voltage drop
Fault isolation	Wire colors

Index entries are navigation aids. Manufacturer connector drawings still govern physical terminal identification.

Appendix G | R0.6 technical validation

VERIFIED SOURCE CONVENTION IS NOT PROOF OF A PARTICULAR VEHICLE INSTALLATION

The following corrections and source checks govern the entire volume. Use the manufacturer document for the exact connector, truck option, harness, and test equipment before applying a physical pin assignment. R0.6 is a field-training edition, not an OEM-approved vehicle repair manual.

Corrected high-priority safety rule

Commercial SAE J560 seven-round PIN contacts must never be treated as RV seven-blade contacts. The physical terminal geometry, separate/combined stop-turn behavior, ABS supply, and electric-brake interface expectations differ. Do not insert a passive adapter and assume the functions are interchangeable.

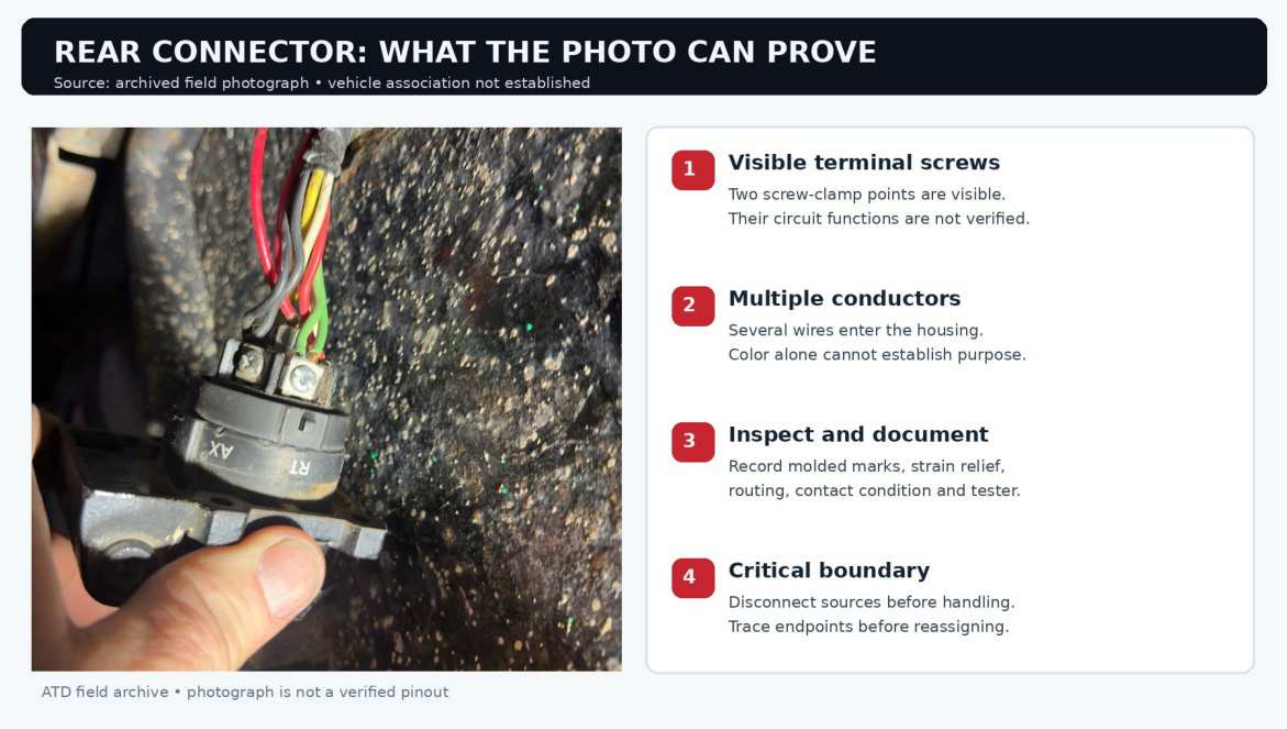
Reference / status	Verified general rule	Still a vehicle-specific question
CURT / manufacturer	Traditional and SAE J2863 RV blade families publish different wire colors.	Actual contact IDs and upfit wire colors.
Hopkins / manufacturer	Six-round center assignments can be auxiliary or electric-brake output.	Which way each individual trailer/adapter is wired.
Phillips / manufacturer	J560 uses dedicated stop and separate turn contacts; blue is auxiliary/ABS primary.	Is the installed round-pin connector truly J560?
OEM body-builder guidance	Grounds, body connections and relay functions vary by model and build option.	Consult VIN/configuration-matched service information.
Power Probe / OEM tool	Maestro can supply power or ground when the VDC rocker is actuated.	Whether the target circuit is rated and permitted for injection.
IPA / OEM tool	MUTT capability depends on exact model and connector configuration.	User-owned IPA model and procedure must be confirmed.

Evidence categories for every picture and finding

Tag	Meaning
MANUFACTURER	Published function / method for a stated connector or product option.
ARCHIVE PHOTO	Real previously supplied photo; exact truck association and circuit identification may be unverified.
OPERATOR REPORTED	Historical field claim or observation, preserved without claiming it was independently reproduced.
UNMAPPED	Contact, wire, body junction, adapter or connected trailer not fully traced.
PROPOSED TEST	A safe plan to collect discriminating evidence, not a test already performed.

Appendix H | Actual connector field photograph

ARCHIVE PHOTO • ACTUAL HARDWARE • ASSET AND CIRCUIT ID NOT VERIFIED



Learning objective: identify mechanical hardware, rear terminal access, conductor count and signs of strain or corrosion without guessing the function from color, location, or a handwritten label. A photographed wire-entry side is not the same viewpoint as a mating-face diagram.

- Before removal: take straight-on contact-face and rear wire-entry images with the keyway visible. Include the connector make/model and molded terminal legends.
- This archival photograph provides a real connector-handling example. The vehicle, exact circuit functions and manufacturer part number have not been independently established; do not assign these from image appearance alone.
- With power isolated, label individual conductors and trace each endpoint. If two wires share a terminal, record both destinations and functions before altering them.

Appendix H2 | Actual seven-way tester photograph

ARCHIVE PHOTO • THE TESTER HAS NAMED INDICATORS, NOT A TRACE OF THE WIRE ROUTE

INDICATOR TESTER: WHAT IT CAN AND CANNOT TELL

Source: archived ATD photo • function labels visible on tester

ATD field archive • photograph is not a verified pinout

1 Labels on tester
LT, RT, TM, BU, 12V and BK name displayed tester indicators.

2 What lit LEDs mean
An indicator responds electrically. It does not identify where power began.

3 Required comparison
Record the tester model and command. Repeat with a rated load, if permitted.

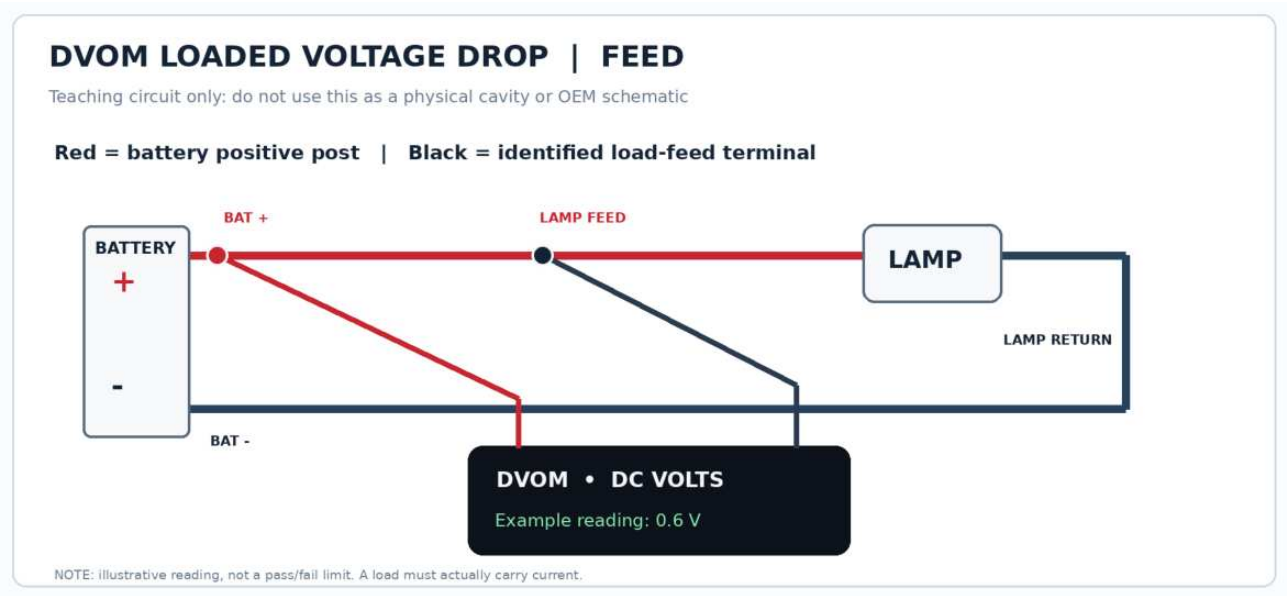
4 Circuit separation
Brake output is not charging power. BU indicator is not a circuit trace.

The tester labels are useful for observation logging. A BU LED that turns off when a particular inline fuse is removed supports a relationship to that fused feed during that condition. It does not identify the downstream wire, show that the connection is correct, or explain an independent LT indicator.

Record for every indicator	What not to infer
Command: OFF / park / left / right / brake	LED illumination alone does not establish relay or BCM failure.
Battery posts V, ignition state, tester model	No-load LED voltage does not demonstrate current delivery.
Which trailer, adapter and connector view	The test does not certify all brake/ground circuits.
Fuse boundary, before / after, same command	A changed indicator does not automatically prove root cause.

Appendix I | Probe-placement illustrations

LAB I-1 • POSITIVE FEED VOLTAGE LOSS WITH AN APPROPRIATE LOAD OPERATING

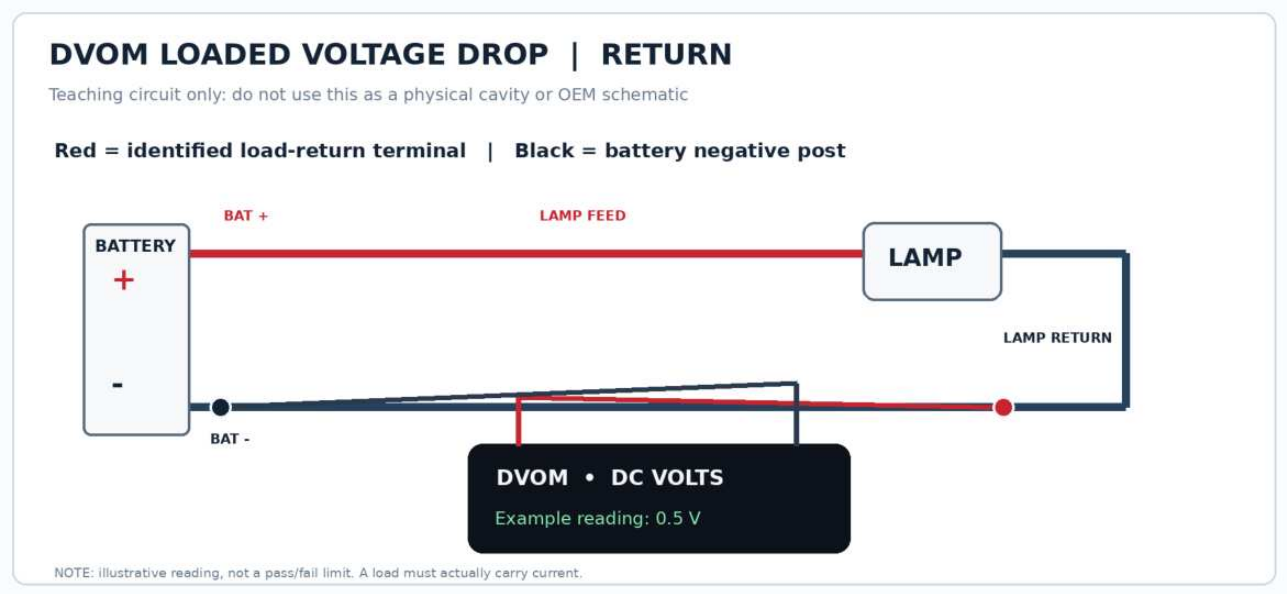


Red lead: known battery-positive POST. Black lead: positively identified supply terminal AT THE LOAD. Select DC volts, verify meter lead sockets, and operate a suitable normal load. The meter reads loss between the two points, not load voltage. Isolate sections of excess loss across connectors, fuse holders and relay contacts after confirming test conditions.

Observe	Meaning	Do not conclude
Illustrative 0.6 V difference	There is 0.6 V loss over the measured feed path under that load.	Do not call it pass/fail without vehicle/component spec.
0 V with the load OFF	No meaningful current may be flowing.	This does not prove a good conductor.
PWM/smart output	DVOM average may hide pulses.	Do not invent resistance from an unverified switched signal.

Appendix I2 | Return-path voltage loss

LAB I-2 • GROUND / RETURN VOLTAGE LOSS WITH NORMAL LOAD ON

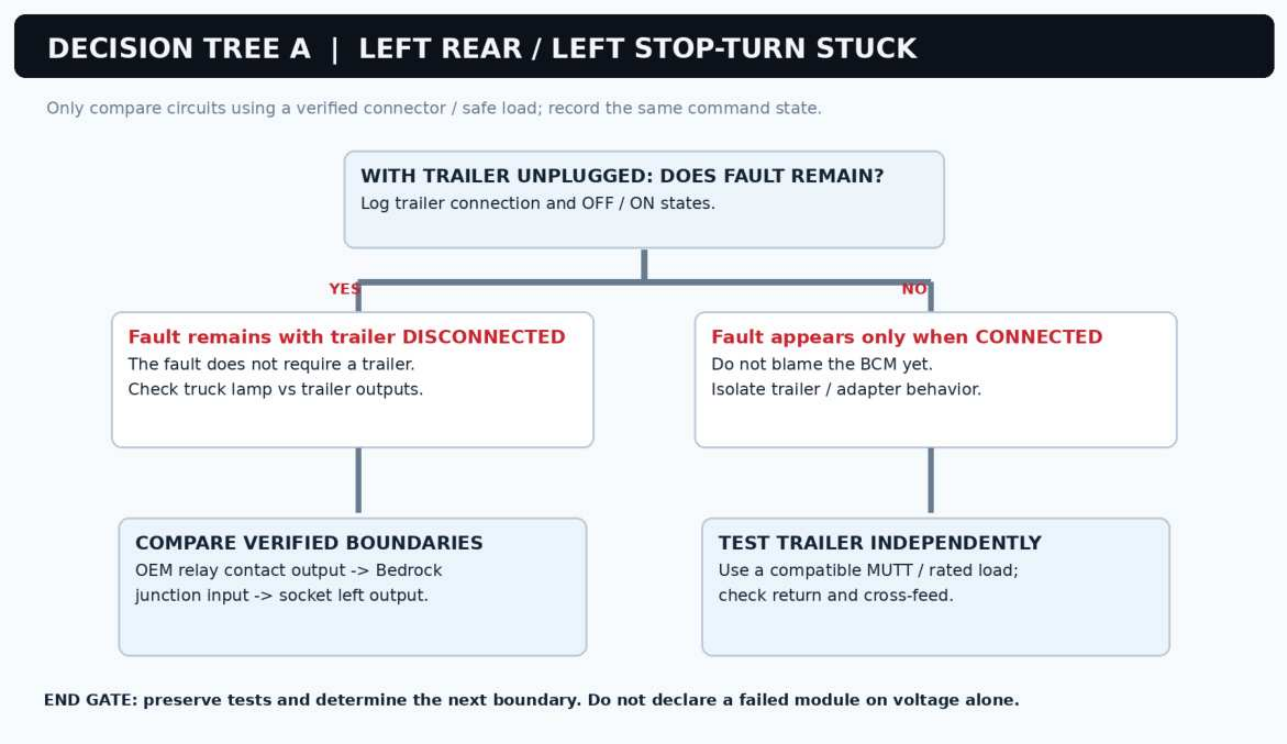


Red lead: verified LOAD RETURN terminal. Black lead: battery-negative POST. Keep the identified load commanded on. A voltage reading reflects path loss under load; take sectional measurements between connector ground, frame ring, frame metal, chassis strap and battery post if excessive by the applicable specification.

Important distinction	Instruction
Frame stud check	A small drop at one stud does not prove all return branches good.
Ohmmeter	Use only with power off and the circuit isolated; resistance in parallel paths can mislead.
Meter lead safety	Use fused leads where applicable. Avoid bridging adjacent cavities with a probe tip.
After repair	Repeat the same load and command, recheck lighting and trailer brakes.

Appendix J | Left rear lamp stays on

GENERAL DECISION TREE | LAMP STAYS ON WITH TOWED EQUIPMENT UNPLUGGED

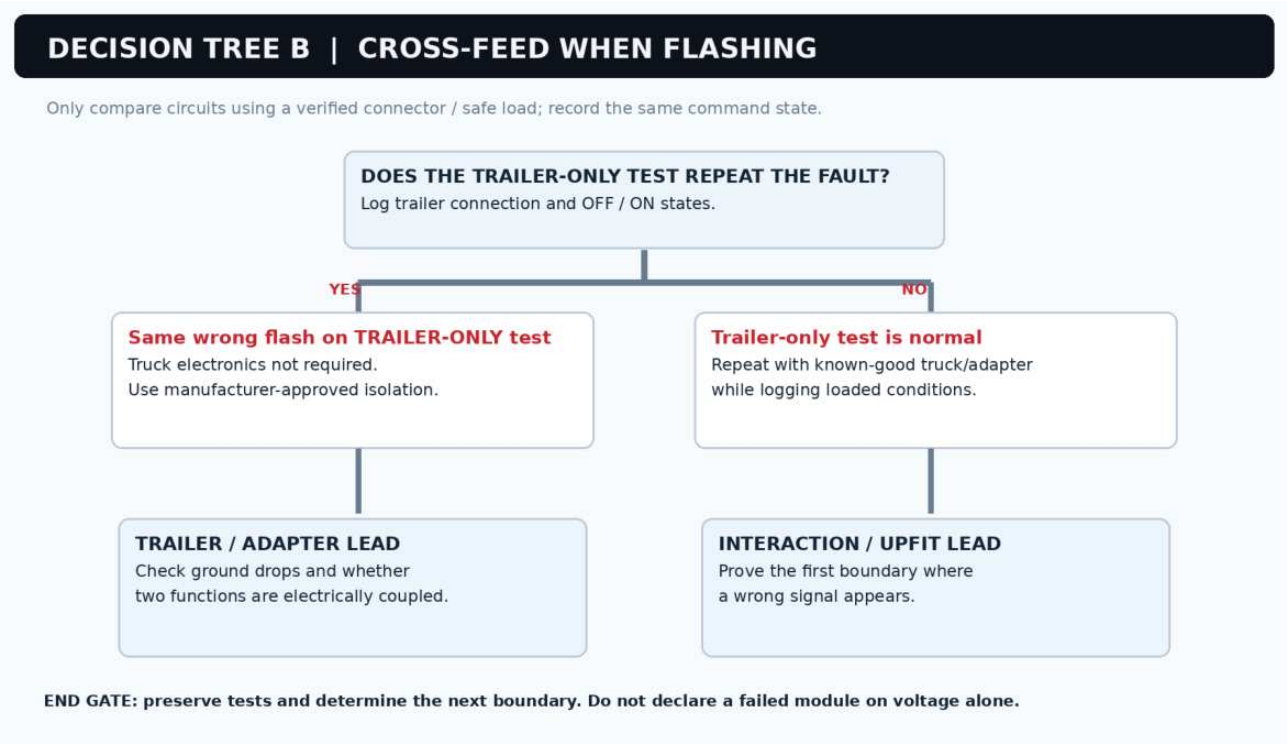


Do not make a converter or module the starting assumption. With the trailer, tester and adapter disconnected, identify the exact truck lamp segment that is illuminated and separately test the positively identified trailer-left contact. Then compare OEM and upfit boundaries under one preserved command/load state.

- Confirm the correct OEM trailer lamp fuse and relay/controller circuit from model-specific documentation. Do not jump an unidentified socket or assume its output corresponds to the truck rear lamp.
- If separate changes to different fuses affect different lamp or tester indications, record them as separate findings until an electrical connection is proven.

Appendix J2 | Cross-feed: one lamp drives another

DECISION GATE B • TURN-SIGNAL CROSS ACTIVATION ON CONNECTED TRAILERS

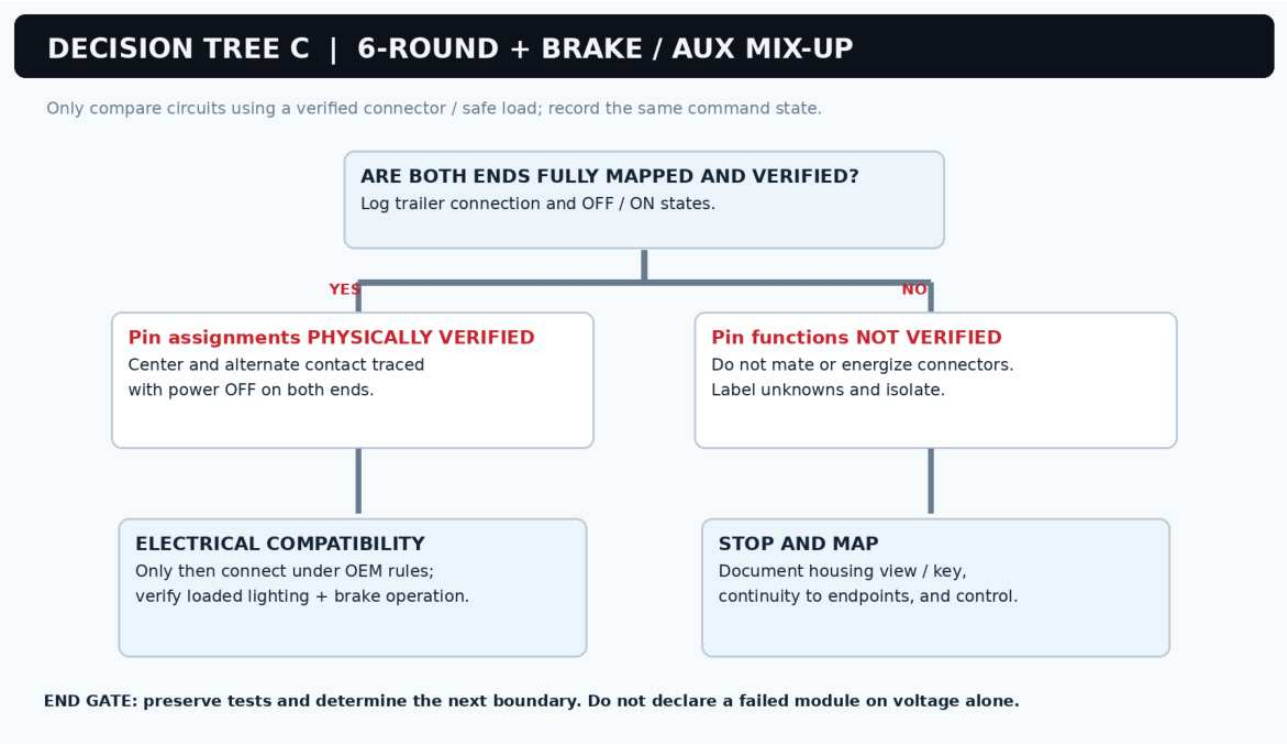


Begin with a controlled trailer-only test using the correct IPA unit and wiring adapter. If unintended functions appear while the trailer is not attached to a truck, the truck is not required to reproduce that specific symptom. Then inspect wiring/return paths with approved isolation and powered-load testing.

- A low voltage-drop reading measured only at a shared frame stud does not rule out a high-resistance terminal, disconnected return or coupling inside the trailer branch.
- If the standalone trailer operates correctly, record an identical truck-only baseline before moving to any pair test. Change only one connector/adapter/trailer variable at a time.

Appendix J3 | Six-round brake / auxiliary warning

DECISION GATE C • WRONG CENTER PIN CAN CONNECT AUXILIARY 12 V TO BRAKE OUTPUT



The six-round center position is not a universal auxiliary or brake terminal. An adapter that physically mates may map these functions differently. Never apply battery power or the Maestro rocker to discover the meaning of an unknown brake controller contact.

Before connection	Record
Physical identity	6-round plug and socket make, terminal keyway, front vs wire-entry view.
No-power continuity map	Document verified endpoints with every source disconnected; do not rely on color.
Battery vs brake functions	Confirm the supported charging feed and controller output independently.
Functional approval	Verify the exact product installation sheet, fuse/load limits and brake type.

Appendix K | Universal truck-trailer configuration register

ANY FLEET / SHOP / PRIVATE TRAILER OWNER | BLANK EXAMPLE REGISTER - NOT A VERIFIED INVENTORY

The three sample tow-vehicle slots and eighteen trailer slots are blank form rows only; duplicate or delete rows to fit the operator. Assign real asset IDs and verify every connection, brake technology, load and return path individually before approving a truck-trailer pairing.

Register ID	Vehicle / confirmed detail	Connector, brakes, upfit and current status
T-01	Unassigned fleet tow vehicle	Truck VIN _____ brake type _____ socket _____ status UNVERIFIED
T-02	Unassigned fleet tow vehicle	Truck VIN _____ brake type _____ socket _____ status UNVERIFIED
T-03	Unassigned fleet tow vehicle	Truck VIN _____ brake type _____ socket _____ status UNVERIFIED
T-04	Unassigned additional tow vehicle	VIN _____ brake type _____ socket _____ status UNVERIFIED

As-built paperwork versus current equipment

Invoices, installation diagrams and historic photographs are useful provenance, but they do not prove the current wiring after subsequent repairs, body alterations, converter swaps or connector replacements. Mark every unverified conductor, branch and interface accordingly.

Circuit or item	Present evidence status	What releases it for use
Socket contact functions	UNVERIFIED UNTIL TESTED	Front/rear photographs, molded identifiers and functional checks
Upfit junction or converter	UNVERIFIED UNTIL IDENTIFIED	Installed make/part, fused feed, return, inputs, outputs
Historical installer record	DESIGN-TIME EVIDENCE ONLY	Compare original record to current physical hardware
Ground hardware and materials	UNVERIFIED UNTIL INSPECTED	Approved location, plating, ring lugs and loaded return drop
Trailer brake / breakaway	UNVERIFIED UNTIL TESTED	Identify actual brake technology and approved functional test

Appendix K2 | Trailer roster and connector audit

BLANK REPEATABLE FORM | DUPLICATE OR DELETE ROWS TO MATCH ANY TRAILER INVENTORY

Temp ID	Trailer actual ID / VIN	Connector family / option	Brake	Verified date
TR-01	_____	6R / 7B / J560 / other: _____	_____	_____
TR-02	_____	6R / 7B / J560 / other: _____	_____	_____
TR-03	_____	6R / 7B / J560 / other: _____	_____	_____
TR-04	_____	6R / 7B / J560 / other: _____	_____	_____
TR-05	_____	6R / 7B / J560 / other: _____	_____	_____
TR-06	_____	6R / 7B / J560 / other: _____	_____	_____
TR-07	_____	6R / 7B / J560 / other: _____	_____	_____
TR-08	_____	6R / 7B / J560 / other: _____	_____	_____
TR-09	_____	6R / 7B / J560 / other: _____	_____	_____
TR-10	_____	6R / 7B / J560 / other: _____	_____	_____
TR-11	_____	6R / 7B / J560 / other: _____	_____	_____
TR-12	_____	6R / 7B / J560 / other: _____	_____	_____
TR-13	_____	6R / 7B / J560 / other: _____	_____	_____
TR-14	_____	6R / 7B / J560 / other: _____	_____	_____
TR-15	_____	6R / 7B / J560 / other: _____	_____	_____
TR-16	_____	6R / 7B / J560 / other: _____	_____	_____
TR-17	_____	6R / 7B / J560 / other: _____	_____	_____
TR-18	_____	6R / 7B / J560 / other: _____	_____	_____

Legend: 6R = six-round; 7B = RV seven-blade; J560 = commercial seven-round. These are write-in choices, not assigned classifications. Capture the actual plug's contact and rear views, brake technology, wire functions and any center-contact configuration.

Conditional connection rule

A compatible shell is a necessary but insufficient condition. Mark a truck/trailer/adapter pairing APPROVED only after every required function and voltage/load limit is identified, independent tests pass, and brake/breakaway behavior is verified by the correct manufacturer procedure.

Appendix K3 | Truck–trailer pairing sheet

UNIVERSAL PAIRING RECORD | RECHECK AFTER ELECTRICAL CHANGES OR ADAPTER SWAPS

Pair	Truck asset	Trailer asset	Adapter ID / center option	Independent tests	Paired test result
1	_____	_____	_____	T:___ R:___ A:___	_____
2	_____	_____	_____	T:___ R:___ A:___	_____
3	_____	_____	_____	T:___ R:___ A:___	_____
4	_____	_____	_____	T:___ R:___ A:___	_____
5	_____	_____	_____	T:___ R:___ A:___	_____
6	_____	_____	_____	T:___ R:___ A:___	_____
7	_____	_____	_____	T:___ R:___ A:___	_____
8	_____	_____	_____	T:___ R:___ A:___	_____
9	_____	_____	_____	T:___ R:___ A:___	_____

Pairing disposition

Status	Required evidence
HOLD	Unknown physical connector/contact assignment, short, overheated lead, breakaway fault or incompatible brake/ABS system.
CONDITIONAL	Identities are confirmed, but a specified diagnostic load test or adapter proof is pending; no towing authorization.
VERIFIED FOR THIS CONFIGURATION	Recorded truck/trailer/adapter IDs, date, approved functional tests, brake system and operating conditions.
RETEST REQUIRED	Connector replaced, module flashed, trailer re-wired, battery changed or harness work alters electrical state.

A VERIFIED pairing is not permanent: harness alterations, adapter swaps, charging modifications, battery work, or new module software require a new baseline. Record every paired outcome in the local maintenance or fleet record where available.

Appendix L | Photographic capture and field QA

REPRODUCIBLE PHOTO EVIDENCE • CAPTURE BOTH CONDUCTOR ENDPOINTS AND TEST CONDITIONS

Image	Required frame	Why
P1 overview	Whole rear truck bed/body/junction/connector, with vehicle ID.	Associates evidence with the correct asset.
P2 face	Straight into socket, lid/keyway/terminal labels legible.	Eliminates mirrored pinout confusion.
P3 rear	Wire-entry side, strain relief, conductor count/colors.	Shows splices and multi-wire terminals.
P4 junction	Body/upfit junction enclosure, wide view and close-up; all legends.	Locates input versus output paths.
P5 protection	Inline fuse holder, battery feed, factory box lid and label.	Establishes source and protection boundary.
P6 returns	Ground rings, bare/painted interface, corrosion and routing.	Documents current return connections.
P7 tester	Tester make/model and indicator state with command recorded.	Makes the observation reproducible.
P8 post-repair	Same viewpoints with wire labels visible.	Shows what changed and supports verification.

File naming and minimum data

ATD_ASSET01_20261021_P2_SOCKET_FACE.jpg

One-minute evidence gate

- Asset/trailer/adapter identities confirmed or explicitly UNVERIFIED.
- Photo orientation labels included on connector figures.
- No electrical assignment asserted from wire color alone.
- Every test states ON/OFF command, connected configuration and meter placement.
- Before/after evidence and brake restoration recorded.

Appendix M | Sources, signoff and R0.6 controls

SOURCE LINKS ARE EDUCATIONAL REFERENCES; VERIFY THE ACTUAL PART AND CURRENT PROCEDURE BEFORE TESTING

CURT | Towing electrical wiring

CURT | Plugs and socket rear-view PDF

Hopkins | Wiring code variants

Hopkins 2023 | Center-pin adapter options

Phillips Industries | J560 catalog

Ford Pro | commercial vehicle body-builder publicationsFord Pro | Upfitter / body-builder publications

Power Probe | Maestro

IPA | MUTT manuals by model

Universal-source and configuration status

Part	Status
Connector family conventions	Cross-checked with published CURT/Hopkins/Phillips examples.
Ground location and hardware rules	Vary by OEM model; GM/Ford body-builder guidance controls for those vehicles.
Maestro and IPA limitations	Checked against manufacturer capability/manual indexes.
Real connector and tester photos	Retrieved from the ATD archive. Not all images are tied to a specific fleet asset.
2019 historic body installer invoice	ATD archived photo establishes historic invoice items only.
Vehicle-specific wiring, Ford pin cavities, actual field measurements	NOT independently verified by producing this manual.
Published booklet / verification	R0.6 is training-controlled; technician must sign field deployment and specific setup gates.

Document: ATD-TRAILER-ELECTRICAL-TRAINING-001 | Universal edition R0.6 | 21 October 2026 | Stephen Guffey

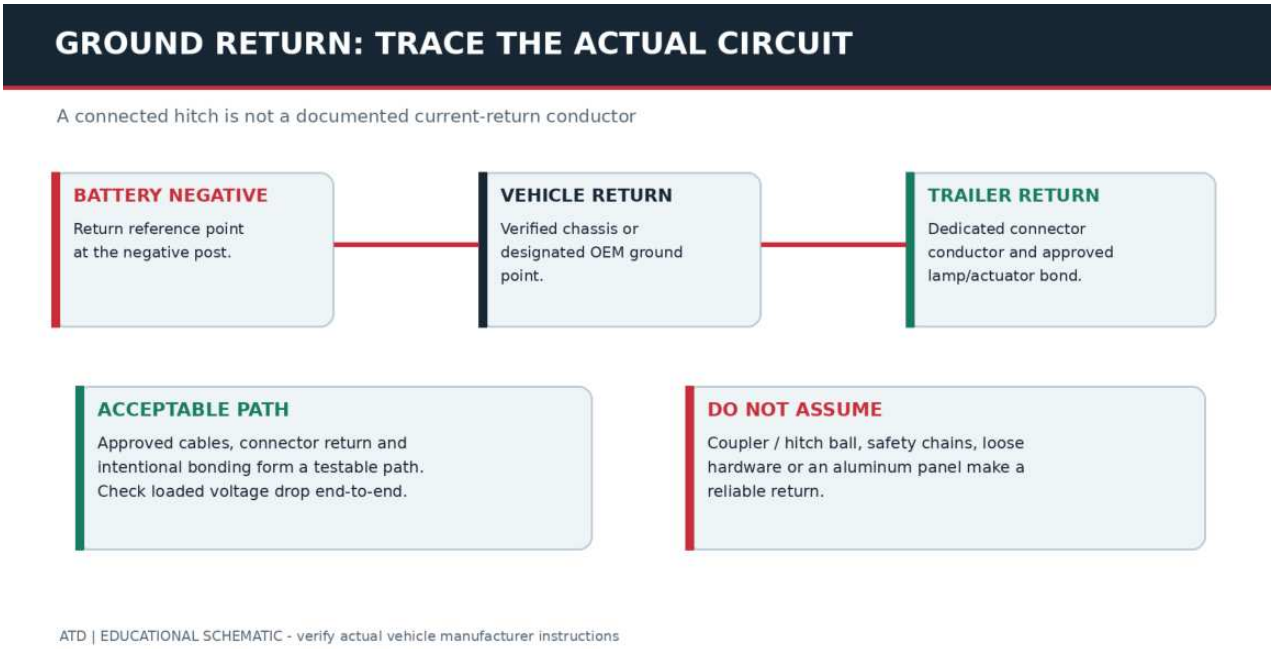
TECHNICAL SIGNOFF Reviewer: _____ Date: _____ Installed vehicle/connector variant: _____

The story of every vehicle lives in the details.

GROUND 01 | The return path is a complete circuit

VEHICLE-NEUTRAL ELECTRICAL FUNDAMENTALS | WHAT IS A GROUND, BOND AND CURRENT RETURN?

A ground is not simply "something made of metal." Every electrical load needs a designed return path back to its supply. Some vehicle systems use the chassis as part of the return. Others require an insulated return conductor and approved frame/body bonds. A mechanical mounting bolt or hitch may conduct at one moment and fail under vibration, corrosion or loading.



Separate these three jobs

Circuit	Job	Diagnostic danger
Current return	Carry operating current from a lighting or accessory load back to source	A frame bond is assumed without tracing/measurement
Structural bond	Connect body, chassis or equipment structures electrically where engineered	A loose or isolated body can seek another unintended path
Clean signal reference	Provide the specific electronics reference specified by OEM	Sharing high-current lamp/motor returns can inject noise into sensors or networks

A trailer ground contact must use the assigned connector return path with an adequately sized conductor. Do not depend on the hitch ball or safety chains as the electrical return. Confirm with loaded voltage-drop testing across the truck and trailer combination.

GROUND 02 | Choosing a proper ground location

START WITH THE ACTUAL OEM / UPFITTER GUIDE | NOT A RANDOM FRAME BOLT

Preferred evidence	Avoid without explicit approval
Named OEM ground stud or designated accessory ground connector	Factory sensor/ECU return splice or battery current sensor bypass
Documented chassis bonding location with approved stud/fastener	Fuel/brake/steering fasteners, suspension members, thin unsupported panels
Clean, service-accessible, corrosion-resistant connection	Self-tapping sheet metal screws or blind frame drilling
Correctly rated ground bus / designed jumper strap	Stacking arbitrary terminals at existing grounds

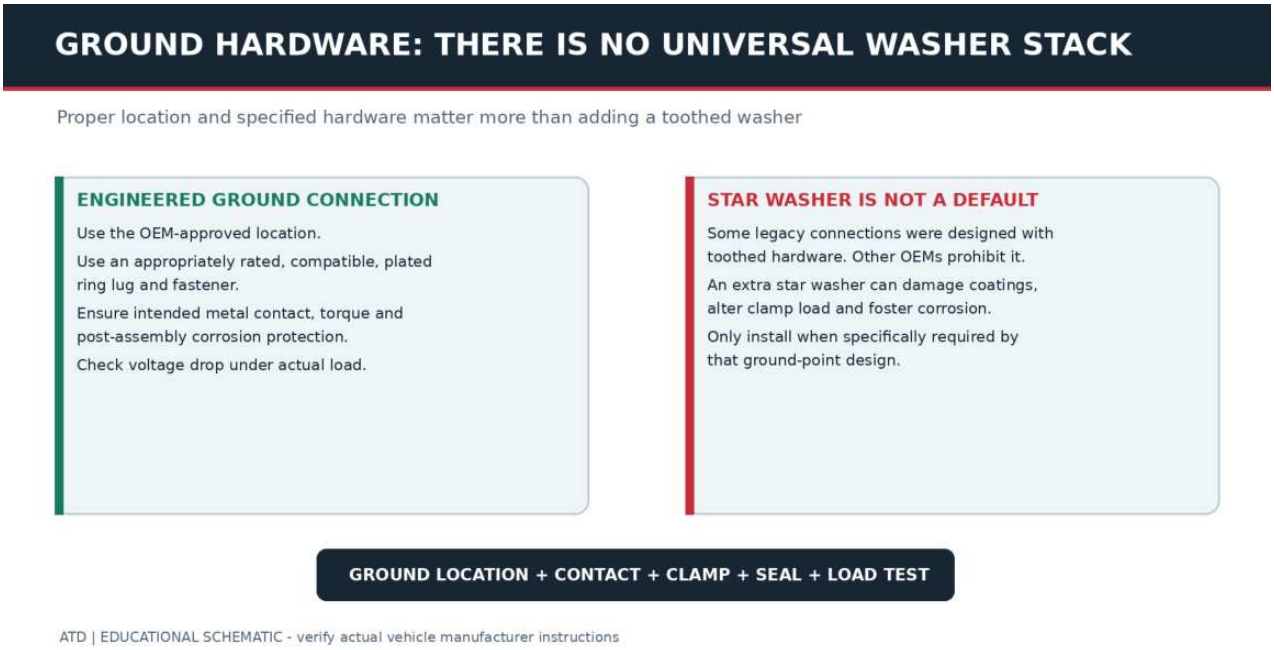
A location checklist that works across makes

- Confirm model, build year, body material and equipment manuals before selecting the site.
- Determine whether an approved ground stud exists; where a new ground is permitted, follow documented frame-zone restrictions.
- Locate ground and related feed together on the electrical drawing; do not alter module/sensor references.
- Account for moisture, coating, road salt, service access, frame/body flex and strain relief.
- Check clamp hardware, substrate metal, corrosion protection and torque specification before installation.
- Verify return voltage drop at the actual load, not just continuity at the stud.

Published example, not a universal instruction: a Ford 2025 body-builder guide advises grounding additional accessories to the sides of approved frame rails and avoiding aluminum sheet metal; GM electrical best practices favor designated ground studs and compatible plated fasteners. These statements apply only where their respective OEM manuals apply.

GROUND 03 | Ring lugs, stacking and star washers

CONTACT PRESSURE + COMPATIBLE HARDWARE + ENVIRONMENTAL PROTECTION



The star-washer misconception

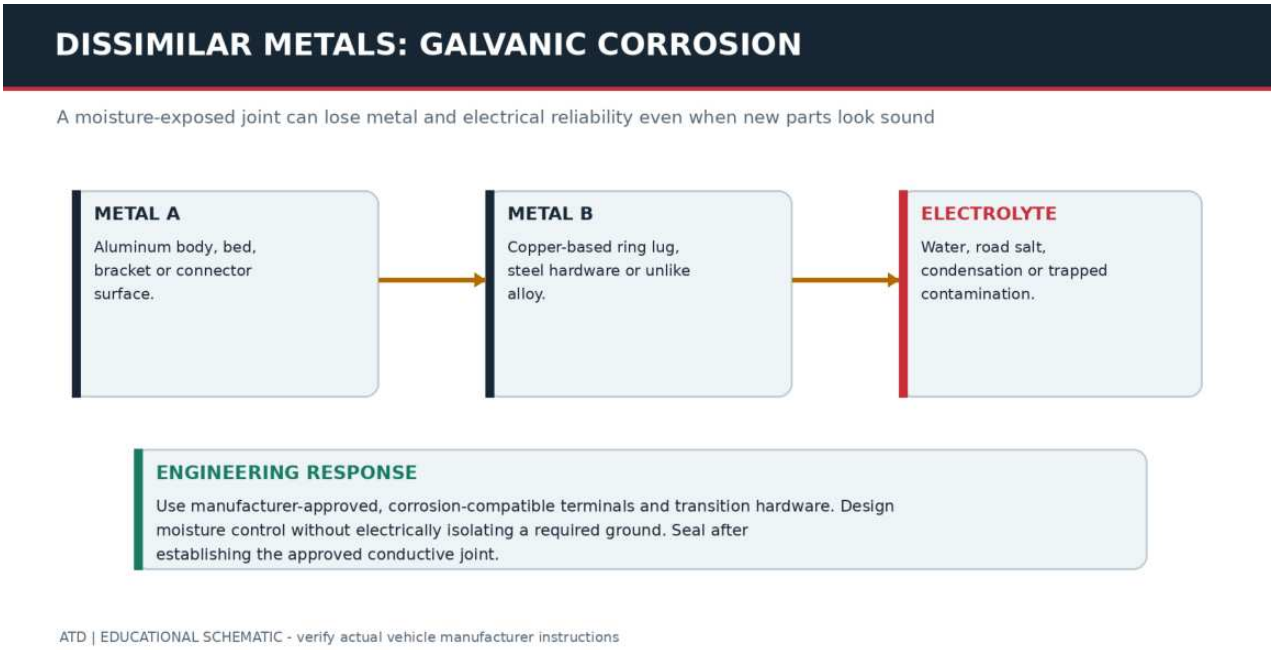
A toothed or star washer is sometimes specified in a particular ground assembly, but it is not universally beneficial. A GM service communication for specified older vehicles cautioned against adding star washers to body/chassis grounds because of corrosion and torque concerns. Follow the actual manufacturer-approved fastener/washer arrangement. Never add a washer merely to "bite through" an unknown coating.

Ring terminal and stud workmanship

- Use the correct conductor cross-section, approved crimp tool/terminal, plating, stud diameter and current rating.
- Seat the lug on the engineered conductive surface; do not blindly strip factory coatings outside an authorized ground zone.
- Use a supported anti-rotation terminal or intended retention arrangement and manufacturer torque. A tight-looking nut is not proof of proper clamp force.
- Avoid stacks: each extra terminal creates another interface. GM best practices discourage stacking and specify no more than two ring terminals when unavoidable; this is GM guidance, not a universal fastener limit.
- Do not use rivets or sheet-metal screws for a new ground where the maker forbids them. Support cable routing and strain relief.
- After the approved connection is complete and measured, restore protective sealing/coating as specified without insulating the contact surface.

GROUND 04 | Dissimilar metals and corrosion

GALVANIC EFFECTS / ELECTROLYTE / ALUMINUM / COPPER / STEEL



Galvanic corrosion occurs when unlike electrically connected metals share an electrolyte such as road water and de-icing salt. An aluminum-to-copper interface is especially important to engineer: aluminum develops an insulating oxide film, and an unprotected joint can experience metal loss and increased resistance. The severity depends on materials, plating, environment, area ratio and protection.

Example risk pairings

Combination	Why it deserves special attention	Practical response
Copper lug at aluminum panel	Electrochemical potential and aluminum oxide	Use the specific approved transition/ground design; do not improvise a bare copper-to-aluminum joint.
Steel or stainless hardware at aluminum body	Moisture can accelerate galvanic attack; stainless is not automatically safer	Follow body manufacturer fastener plating and isolation requirements.
Copper lug on coated steel frame	Paint/rust can interrupt the intended path; water can attack exposed metal	Use an approved conductive stud location and reseal per instructions.
Multiple plated ring terminals on a bolt	Different plating/pressure and trapped moisture create multiple loss points	Minimize stacks and use approved bus or distribution hardware.

A subtle but critical distinction: an isolating washer may properly separate a steel attachment from an aluminum panel, while electrically insulating that same joint would defeat a required ground. Never copy a corrosion-isolation construction detail into a current-return joint unless the OEM designed an alternate conductive path.

GROUND 05 | Preventing moisture and salt failures

SEAL / DRAIN / ROUTE / SUPPORT / INSPECT

How a good connection deteriorates

Mechanism	Typical warning	Preventive measure
Road salt & water	Green/white build-up, pin pitting, unexpected lamp cross-feed	Weather-tight connector, manufacturer-approved cleaning and dielectric protection
Wire wicking	Corrosion under insulation beyond a repaired terminal	Replace to sound conductor; use appropriate sealed crimp repair
Mixed-metal fastener	Pitting/white oxide under ring lug or at aluminum structure	Approved compatible plated/bimetallic hardware, moisture control
Vibration / unsupported wire	Loose terminal, cracked insulation, intermittent return	Proper clamp/strain relief, correct lug and torque
Paint/coating change	Paint underneath an intended ground pad or bare unprotected repair	Document approved contact prep and restore required protection

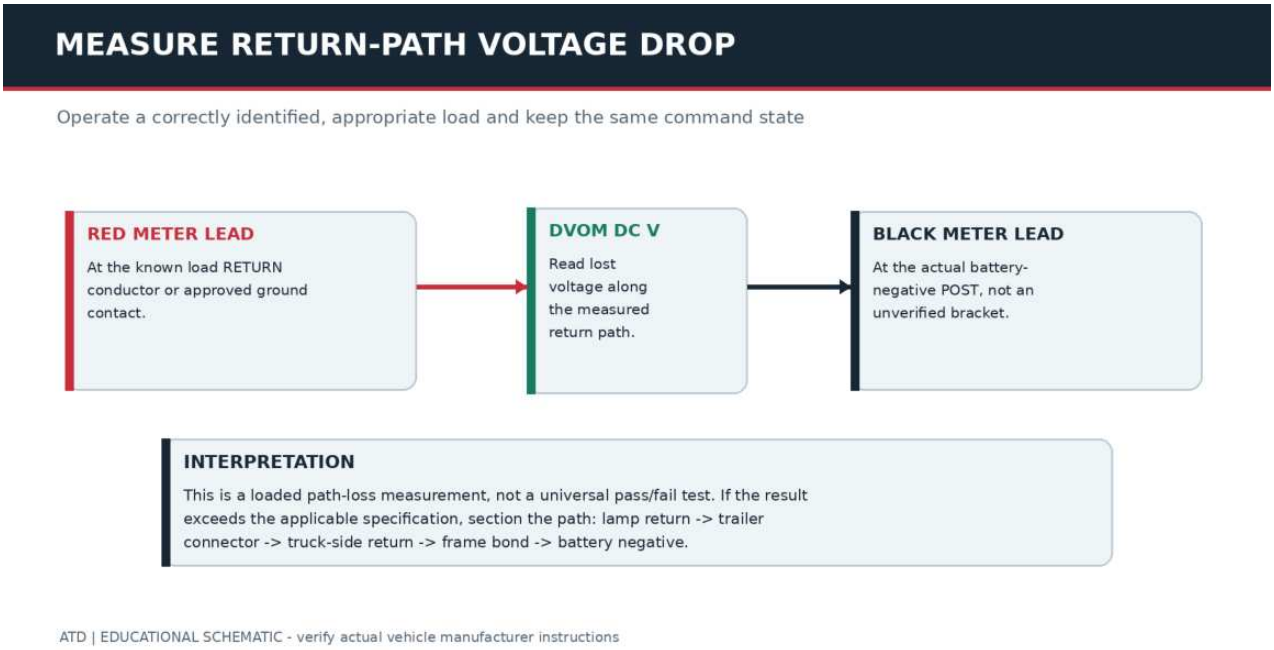
The grease distinction

Phillips and Truck-Lite recommend dielectric protection for applicable trailer plug/socket systems, but nonconductive dielectric grease is not automatically the right product or placement for every ring-lug/frame contact. Follow the component instructions, especially for contacts that rely on precisely specified surface preparation. Prevent moisture entry and seal exposed hardware after correct electrical contact and clamp load have been established.

- Inspect both sides of 7-way sockets/plugs and terminal seals, not only the visible mating face.
- Look for cable rub, missing grommets, unsupported splices and water traps along frame rails.
- Record annual or exposure-based maintenance; severe road-salt, saltwater and washdown usage may require shorter intervals.
- Replace terminals with significant pitting, loss of spring tension, broken seals or overheated plastic rather than scraping endlessly.

GROUND 06 | Measure the actual return under load

DVOM LAB | VERIFIED POSITIVE LOAD, METER LEADS IN VOLTS/COM, KNOWN LOAD OPERATING



The voltage difference between the identified load return and the battery-negative post is the loss across those points while the load operates. Verify lead sockets and safe vehicle positioning. A reading made with the load OFF often misses a high-resistance fault. Test approved lighting loads first; safety-critical brake/ABS and electronic grounds require the appropriate OEM procedure.

A repeatable sequence

- Identify the operating circuit and read the vehicle/trailer wiring diagram. Confirm truck and trailer secured and no person at a moving load.
- Record battery-post voltage, ignition state, light/actuator command, connector family and actual load current when supported.
- Put RED voltmeter lead on the verified load-return terminal; BLACK on the battery-negative POST. Do not probe an unknown cavity.
- Operate the load under a permitted normal condition; record the voltage loss and applicable vehicle/component limit.
- If excessive, section the return: lamp pigtail -> trailer frame bond -> trailer connector ground -> truck-side return -> frame/battery strap -> negative post.
- Record each segment with identical load/current and power state. Clean, repair and retest using approved materials and hardware.
- Validate tail, turn, brake, reverse and breakaway systems as applicable after repair.

Test point	With load ON	Interpretation
Lamp return -> trailer frame stud	_____ V	Only this local conductor/terminal segment.
Trailer ground contact -> truck-side ground contact	_____ V	Connector/adapter return interface.
Frame/body bond -> battery negative post	_____ V	Truck return/bond cable and contact segments.
Lamp return -> battery negative post	_____ V	Total return loss along that verified test span.

GROUND 07 | Diagnostic scenarios and answer gates

WORKED EXAMPLES | DECIDE BY MEASUREMENT, NOT BY THE HARDWARE YOU EXPECT TO FIND

Case A - left turn also illuminates right/stop lamp

The misbehavior occurs only with a trailer connected. A continuity beep between two random frame points seems normal. The next step is to test the trailer alone using a compatible tester, then load-measure the shared return and isolated left/right functions. A common return problem or a cross-circuit splice remains possible; the beep cannot distinguish them.

Case B - star washer added; symptom returns after winter

A newly installed star washer initially improves a lamp contact, but later the joint exhibits corrosion and drop under load. Investigate approved location, exposed plating/coating, terminal compatibility, contact pressure and water entry. Do not conclude a star washer is required; it may be part of the failure mechanism.

Case C - aluminum body with copper lug

A copper-based lug fastened directly to an aluminum body in road-salt exposure has oxidation and intermittent lighting. Confirm whether that panel was ever an approved ground. If not, restore the manufacturer-designed ground through a compatible conductor/termination and approved chassis point. Do not isolate the required return without providing the specified conductive alternative.

Case D - low measured drop at one frame stud

A stud reads 0.015 V under one light load, but the far-left trailer lamp still dims when multiple lamps are lit. Check the complete return at the lamp, the connector ground contact and the truck negative post under the combined load. The earlier stud reading proved only the specific segment and state.

Case	Best discriminating test	Premature conclusion to avoid
A	Trailer-only test + loaded return drop	"The BCM must be damaged"
B	Verify OEM washer/hardware and corrosion state	"Every ground needs a star washer"
C	Confirm approved ground site and bimetallic connection	"Any clean aluminum panel is a ground"
D	Total path and individual segments under same load	"0.015 V at one stud clears the ground"

GROUND 08 | Universal ground inspection worksheet

PRINT OR DUPLICATE | COMPLETE ONE SHEET PER VEHICLE / TRAILER / GROUND ASSEMBLY

Field	Record
Vehicle / trailer / asset ID	_____
Date / technician / weather / road salt	_____
Ground point ID / sketch or photo reference	_____
OEM document / exact page / approved location	_____
Substrate metal / body material	Steel [ ] Aluminum [ ] Other [ ] Details: _____
Lug and fastener plating / washer design	_____
Number and order of terminal lugs	_____
Conductor gauge / current / circuit	_____
Corrosion, paint, seal or damage	_____
Battery post V / load / command	_____
Return-path drop measured / acceptance spec	Measured _____ V Applicable spec _____ V
Repair authorized, parts and protective finish	_____
Loaded retest / result	_____
Review / technician signature / next inspection	_____

Status: [ ] VERIFIED TO APPLICABLE SPEC [ ] REQUIRES REPAIR [ ] NOT TESTED [ ] OEM PROCEDURE NEEDED

Do not mark a ground verified from a continuity tone, clean-looking bolt, isolated unloaded voltage measurement or non-specific torque estimate.

GROUND 09 | Definitions, sources and publication control

TECHNICAL REFERENCES SUPPORT GENERAL PRINCIPLES. VEHICLE-SPECIFIC REPAIR RULES TAKE PRECEDENCE.

Term	Meaning in this manual
Return conductor	Intended electrical route from a load back to its source.
Bonding strap	Designed electrical conductor connecting structural elements where specified.
Galvanic corrosion	Electrochemical deterioration of dissimilar metals coupled in an electrolyte.
Electrolyte	Water or conductive contamination, often accelerated by de-icing salts.
Star/serrated washer	Toothed hardware used only where specified by a particular engineered joint.
Clean / dirty grounds	OEM separation of low-noise electronic references from higher-current/noisier loads.
Contact plating	Protective or functional metal finish selected for an electrical interface.
Loaded voltage drop	Electrical loss measured across a path when a defined current flows.
Bimetallic termination	Engineered transition suited to otherwise problematic metal pairings.

Primary documents and technical references

GM Upfitter Integration | Electrical Best Practices

Ford Pro | Upfit Publications (model-specific)

Ford Pro | 2025 General BBLB (grounding / aluminum)

Grote Industries | Trailer Wiring Data

Truck-Lite | Lighting User Guide (internal grounds, corrosion)

Phillips Industries | Prevent Damage Caused by Corrosion

TE Connectivity | LITEALUM / aluminum contacts

Archived GM service communication | star washer caution

Revision R0.6: converted the fleet-specific training draft into a vehicle-neutral instructional edition, generalized worked examples and compatibility forms, and added the nine-part Grounding & Bonding module. The former R0.5 remains a separate historical ATD edition containing the original fleet case notes.

Technical signoff: reviewer _____ date _____ document ATD-TRAILER-ELECTRICAL-TRAINING-001

ATD - ALL THE DETAILS | The story of every vehicle lives in the details.

SUP 01 | What is compatibility?

A connector can physically fit while its electrical or braking functions are incompatible. Keep function, equipment capability and test evidence separate.

FOUNDATION: Use the full chain - factory truck controls > body/upfit wiring > truck connector > adapter/converter > trailer plug > trailer wiring/load > ground return. Braking, coupler and ratings are additional independent gates.

The five layers

Layer	What must match	What appearance cannot prove
Mechanical interface	Connector shell, contact gender/key, locking, cable condition	Electrical function or safe current
Circuit function	Every contact maps to expected trailer function	Wire color or center-contact meaning
Control and power	Combined/separate stop-turn, controller output, power/ground, ABS	Whether a lamp-test LED is a valid load
Brake system	Trailer actuation technology, compatible controls, breakaway/emergency	That the same plug means same brake system
Whole connection	Wiring ratings, coupling, loads, protection, paired function tests	That another trailer passing clears this trailer

Distinguish four words

- **Possible** means an engineering mechanism exists; it is not proof the mechanism occurs on this equipment.
- **Observed** means somebody saw a symptom under stated conditions; its cause remains open.
- **Verified** means a named test with identified asset, command, measuring point and result supports a limited conclusion.
- **Approved** means the required independent AND paired safety/functional gates are recorded for one exact configuration.

Current status: this module is instruction and proposed verification. No fleet compatibility has been certified by producing the document.

SUP 02 | Where variables enter

Do not reduce a fleet to six pins and seven pins. The truck, adapter and trailer each has a configuration history.

What varies	Examples	Evidence to collect
Truck year/series	F-350 vs F-650; generation, factory tow option, electronics	VIN, build sheet, diagram revision
Truck service brakes	Hydraulic or pneumatic on equipped chassis	Build record + physical verification
Trailer brakes	Electric, EOH, surge, pneumatic	Axles, actuators, lines, controller
Lights	Combined left/right stop-turn vs independent stop/turn	Brake-only and turn-only loaded behavior
Connector	6-round center brake/aux; 7 RV blade; J560; others	Photos, molded marks, correct view
Adapter	Passive pin map, active converter, loss of function	Individual ID, part number, full map
Upfitter	Relays, splice blocks, signal converters, brake controller	As-built versus as-found drawings
Age/service history	Water, corrosion, cut wires, replacement sockets	As-found photos, change log, loaded tests

Why dates matter

An eight-year service history provides many opportunities for change, but time alone is not evidence of a fault. Assign each actual modification a date, installer, part, wiring change, and as-left test whenever records exist.

> **One model year is only a research starting point. It is not a complete description of an individual truck after body conversion, repairs or software changes.**

SUP 03 | 2019 F-650: what four choices mean

A concrete illustration of configuration branching; it is NOT four verified physical pinouts and not a statement about any particular fleet truck.

Illustrative factory category	Vehicle service brakes	Trailer stop/turn logic
A - code 152 (ATD research lead)	Hydraulic	Combined
B - code 154 (ATD research lead)	Hydraulic	Separate
C - code 159 (ATD research lead)	Air	Combined
D - code 157 (ATD research lead)	Air	Separate

Ford published 2019 F-650/F-750 literature showing hydraulic and air-brake equipment and both combined and separate trailer-connection arrangements. This 2 x 2 illustrates **four configuration categories**, not four independently proven terminal layouts. An optional pneumatic trailer air-brake package is an additional system, not an electrical pin assignment. Option numbers 152/154/159/157 are carried from earlier ATD order-guide research as verification leads, not independently authenticated factory build records in this edition. Prior ATD research also lists 158 as an air-trailer package lead. Confirm all codes and VIN eligibility in the correct Ford order/build guide.

What changes the testing?

- A separate stop lamp and separate turn-signal arrangement cannot be blindly treated as combined RV stop-turn logic.
- An air-service trailer requires compatible pneumatic equipment. A seven-way electrical socket cannot provide air actuation.
- A later six-way installation on a 2019 factory seven-way truck requires its own traced modification and circuit map.
- A dash scan PID, fuse legend or truck series alone does not validate the wiring at a modified rear socket.

NUMBER RULE: Two common six-round center-contact choices do not imply a 50/50 probability. Four factory categories do not imply four unique seven-way pinouts.

SUP 04 | Connector fingerprint: not a wire color chart

Every connector receives an orientation-aware function record. Never substitute visual similarity for an identified pin map.

Connector family	Usual interface pattern	Special verification
4-flat / 5-flat	Combined lamp functions; 5th commonly reverse/lockout	Fifth contact function varies
6-round	Lighting, ground, aux and brake functions	Center may be AUX or BRAKE; check matching outer position
7 RV blade (J2863 style)	Combined stop/turn, ground, aux, electric brake, backup	Physical cavity and color conventions are distinct matters
SAE J560 7-round	Separate turn, stop lamps, auxiliary/ABS feed	Not equivalent to RV electric-brake interface
Other 6/7	Special-purpose or legacy arrangement	Manufacturer-specific drawing is mandatory

Record four views

- Tow-vehicle socket looking into mating face
- Tow-vehicle socket looking at rear terminals
- Trailer plug looking into mating face
- Trailer plug looking at wire entry.

Put the latch/key at 12 o'clock in each photo when practicable. Mark VEHICLE/TRAILER and FACE/REAR in every drawing. Front and rear can appear mirrored. Use molded terminal markings and actual tests.

Never connect a partly mapped adapter or trailer just to discover the center contact. An auxiliary-to-brake mismatch can result in unexpected brake actuation.

SUP 05 | The adapter decision tree

Adapters are not one-size-fits-all. A device that changes shell shape, one that remaps pins, and a powered signal converter do different jobs.

Known condition	Potential remedy	When it is NOT enough
RV blade to six-round: matching circuit functions	Correct documented passive adapter	Brake/aux center positions not matched
Brake and auxiliary swapped on six-round	Correct verified remapping adapter	Unknown trailer brake/load or overheated wiring
Separate stop/turn to combined stop/turn	Correct OEM logic or approved active converter	Passive wires cannot merge switching logic
Electric brakes without compatible controller	Manufacturer-approved controller/interface installation	A passive adapter cannot create a missing control signal
Trailer needs air service/emergency controls	Compatible certified pneumatic tractor/trailer system	Electrical adapter cannot supply air pressure
Poor return, short, corroded pin, broken wire	Repair verified fault and retest	Adapter does not repair compromised conductor

How to screen an adapter before purchase

1. Identify exact truck SOCKET type, trailer PLUG type and both required functions.
2. Determine passive map vs active conversion, voltage and current ratings, proper ground, mounting and fuse/protection.
3. Obtain exact manufacturer part number, installation sheet and supported equipment list.
4. Trace and record the adapter itself (see SUP 11) before authorizing any pairing.
5. Assign an asset label (AD-###) and restrict it to named approved pairings.

An adapter choice is a compatibility decision, not an experiment. Do not daisy-chain unknown adapters or use a generic converter to compensate for damaged wiring.

SUP 06 | Truck brakes are not trailer brakes

Keep the truck service-brake architecture, trailer actuator technology and electrical connector records in three different fields.

System	How trailer brakes operate	What must be present and verified
Electric drum/disc	Controller sends electrical command to magnets	Compatible TBC, load, wiring, return, breakaway
Electric over hydraulic	Electrical command operates hydraulic trailer actuator	Approved actuator/controller compatibility, charge/power, breakaway
Surge hydraulic	Trailer coupler compresses actuator	Correct mechanical/hydraulic components, possible reverse lockout
Pneumatic air	Air service/emergency hoses and valves actuate trailer system	Compatible air equipment and trained air-brake inspection; J560 often powers ABS/lights

Air-service trailer critical warning

The 7-contact SAE J560 electrical connector is separate from pneumatic service and emergency lines. A truck's own air brakes do not necessarily prove it has a complete air-trailer connection package. Similarly, a hydraulically braked truck may tow appropriate electric-brake trailers if properly equipped, but that does not give it air-trailer actuation.

- Confirm actual gladhand/line configuration, compatible valves, couplings, trailer emergency operation and air system inspection by a qualified technician.
- Never interchange service/emergency hoses or use the first hookup as a brake-function test.
- Record tow ratings, coupler, safety chains, breakaway and legal inspection as separate release gates.

DO NOT RELEASE a pairing on the basis of connector pinouts alone. A working set of tail lamps says nothing definitive about service-brake compatibility.

SUP 07 | Why a one-trailer test is limited

A newer trailer can be a helpful controlled load. It is not a representative certificate for a mixed older fleet.

Test finding	Supports	Does NOT establish
Truck output passes using tester	Truck output under named tester, load and command	Behavior with every real trailer load
Truck + new trailer passes	Specified functions with that trailer, adapter and date	Every old trailer or different adapter is compatible
Only lamps verified	Observed lighting behaviors	Brake, breakaway, ABS or ground current capacity
Shop reports repair done	Claimed repair activity	Proof of cause, pre/post values or no recurrence

Minimum shop return for a requested trailer

- Exact truck VIN/ID, trailer ID and age/configuration; adapter ID if used.
- Which circuit functions were measured, how loaded, what commands, what readings and pass basis.
- Was trailer-only testing performed? Was brake technology and breakaway tested or outside scope?
- What part of the original fault was reproduced, isolated, corrected and verified?
- What older fleet trailers and adapters remain UNTESTED?

A good result is still useful. Its conclusion must be no broader than the asset combination, conditions, and actual functions tested.

SUP 08 | How to narrow the fleet quickly

Create an electrical/brake fingerprint for each component BEFORE multiplying full pairing combinations.

Phase A: first-pass inventory - no disconnections required

1. Assign TRK-###, TLR-### and AD-### labels; record VIN/serial, age and location.
2. Photograph each connection and note actual 4/5/6/7 family, rear terminals, signs of custom wiring and brake equipment.
3. Collect available factory build, body/upfit, prior shop and controller instructions.
4. Group visually similar candidate configurations as research groups only, not approved groups.

Phase B: engineering classification

Fingerprint axis	Field
Truck	Year / family / factory trailer logic / current socket / ground / controller / air package
Trailer	Actual plug / required signal logic / brake tech / breakaway / aux needs / ABS
Adapter	Input face / output face / center mode / passive-active / current limit
Evidence quality	Document / measured / observed / inferred / unknown
Version	Last wiring or module change date / person / record

Phase C: screen out impossible or suspect connections

A first-pass automated matrix may mark a mismatch as HOLD, or a potential compatible route as CANDIDATE. It must never automatically APPROVE an untested pairing. One qualified test plan can cover a validated configuration family, but each real asset requires documented inspection, and every released combination must meet the applicable operational gates.

> **With 3 trucks and 18 to 30 trailers, there are 54 to 90 direct theoretical truck/trailer pairings. Adding adapters increases equipment choices, not automatically verified pairings.**

SUP 09 | Asset IDs and the four record types

Use one sheet/table per asset, with stable IDs even after equipment moves to another truck or trailer.

Record	Required information	Never substitute
TRUCK	VIN confirmed by photo; make/year; GVWR; service brake type; OEM tow option; upfit; socket face/back; TBC; power/ground; diagram	Model name for VIN/build option
TRAILER	ID/VIN; brake type; axles; plug; breakaway; battery; loads; ground; ABS; service history	A successful hookup elsewhere
ADAPTER	Brand/part; serial/QR; plug/socket; active/passive; verified function-to-function map; ratings; custody	Unlabeled loose adapter
PAIRING	Truck + trailer + adapter IDs; test conditions; evidence; loads; brake proof; approval and expiry/recheck trigger	Generic compatible label

What to photograph

Use a consistent eight-photo series: P1 truck/trailer overview; P2 connector face; P3 back/wire entry; P4 junction/upfit; P5 protection; P6 returns; P7 tester display plus command; P8 after any repair. Name by stable asset ID and date; never infer unseen destinations from a photo.

Suggested evidence status codes

Code	Meaning
M	Manufacturer statement for named component / revision
O	Operator-reported observation
T	Direct measured test with record and setup
U	Unknown/untraced
P	Proposed test not yet conducted

The R5 master Excel matrix can store these records. A spreadsheet cell marked PASS is not a safety clearance until the required signed evidence gates exist.

SUP 10 | Truck-only test: technician procedure

Begin with the suspect trailer and all adapters disconnected; no unknown jumping, bypasses or power injection.

Setup and identification

1. Park level, secure truck, keep all loads OFF; record engine/ignition state, battery voltage and VIN.
2. Photograph truck socket mating face and rear entry, key/latch, terminal marks, damage, strain, junctions and grounds.
3. Obtain matching Ford/OEM plus upfit/connector documentation; label every cavity by verified function, not wire color.
4. Inspect overheat, exposed copper, pin tension, corrosion, two conductors on one terminal and any unknown fused branch; HOLD damaged equipment before energizing.
5. With DVOM set to DC VOLTS, leads in COM/V, check at battery posts; use battery negative or approved identified return as reference.

Functional commands

1. At one positively identified pin at a time, record ALL OFF, key ON/OFF, PARK, LEFT, RIGHT, HAZARD and service BRAKE behavior.
2. When safe and supported, record reverse and auxiliary supply separately; note 12 V source may be constant or keyed.
3. For electronic PWM/bulb-detection outputs, use OEM-authorized loads or scope so unloaded tester LEDs are not mistaken for usable output.
4. Measure feed and return drop under appropriate normal lamp load; record exact points, load/current and OEM limits.
5. Compare OEM-controlled input/output, upfit junction, relay, and connector output only at verified circuit boundaries. Save findings and unresolved contacts.

STOP if connector family/pin not mapped, ground path unidentified, active shorting, brake/ABS outputs involved or tool ratings uncertain. Escalate to correct OEM procedures. See original R0.6 Chapters 19-23, 25 and GROUND 06.

SUP 11 | Adapter-only test: technician procedure

An adapter is a separate electrical asset, not simply the space between two plugs.

Passive adapter: isolated continuity map

1. Remove adapter from truck and trailer. Shut down all connected sources and verify the adapter is de-energized.
2. Record AD ID, exact model, brand, contact view on both ends, intended input side and intended output side.
3. From manufacturer diagram, list intended functions for every contact and confirm whether center pin BRAKE or AUX.
4. Set DVOM to continuity/ohms ONLY when isolated; map each expected input contact to the intended output contact, one at a time.
5. Check for unexpected continuity between unrelated circuits using the part maker's constraints; electronics/diodes may invalidate ohmmeter findings.
6. Inspect contact wear, melted plastic, corrosion, loose terminals, polarity and rating; photograph and log.
7. If the adapter contains electronics, STOP using generic continuity interpretation and follow active converter power/ground and functional test instructions.
8. Mark the adapter PASS MAPPED, HOLD DEFECT or UNVERIFIED. Pairing approval is a different test.

Sample function-to-function map

Input identified contact	Expected output function	Actual result
Ground/return	Ground/return	_____
Tail/marker	Tail/marker	_____
Left stop/turn	Left (or converter input)	_____
Right stop/turn	Right (or converter input)	_____
Brake controller	Electric brake as applicable	_____
Auxiliary power	Auxiliary/charge as applicable	_____
Reverse/lockout	Only if supported	_____

Never swap two power/brake conductors live to see which one works. Never use an unevaluated generic J560-to-RV adapter as a substitute for missing brake control.

SUP 12 | Trailer-only test: technician procedure

Use a correct isolated trailer-side tester; this is different from an indicator placed in the truck socket.

1. Chock and immobilize trailer independently, disconnect truck and adapter and identify plug family, voltage, brake type and breakaway.
2. Photograph plug face, rear terminations, corrosion, strain and exposed wires. Identify the assigned return contact and safe supply sources.
3. Match an IPA MUTT/Smart MUTT or equivalent model to plug, system voltage and test functions. Obtain exact operator manual and fuse/current ratings.
4. With tester OFF, attach approved connector only to the trailer plug. Do not connect trailer-powering tester to live truck socket.
5. Individually energize supported marker, left, right, brake lamp and other permitted lighting functions. Note expected lamps, unintended lamps and tester current.
6. Add permitted combined functions such as brake + left, tail + brake, hazards + marker and measure ground return under the correct load.
7. Identify trailer auxiliary/battery and electric controller/breakaway circuits separately; do not use lamp tester to improvise actuator power.
8. Have a qualified technician test mechanical/air/electric brake application, release and breakaway per axle/actuator maker.
9. Record tester model, mode, battery state, current, actual observations, photos, defects and trailer-alone disposition.

Signs that should stop testing

- Uncommanded trailer brake current or unexpectedly hot brake magnet/wiring
- Overheated terminal, sparking, blowout, smoke or damaged isolation
- Unexpected coupled lamp functions or return voltage loss outside applicable spec
- Unknown trailer brake technology, air-line state or breakaway integrity

Tester model matters: a truck-side 7-way indicator plug does not prove a disconnected trailer passed. Likewise a trailer tester does not prove Ford BCM wiring or all brake/ABS capabilities.

SUP 13 | Ground and loaded voltage-drop tests

A continuity beep or good-looking stacked ground bolt cannot establish a satisfactory current-return path.

Basic DVOM setup for a verified lighting load

1. Confirm DC voltage measurement, BLACK lead in COM, RED lead in V; first measure battery post-to-post voltage with the known load ON.
2. To measure feed path drop: RED at source positive post, BLACK at load-positive terminal, with the same approved load operating.
3. To measure return path drop: RED at positively identified load-return terminal, BLACK at source negative post; maintain identical load.
4. Measure voltage ACROSS the load terminals. Save command state, battery voltage, load current if known, and actual readings.
5. If out of maker limit, section the path: source > fuse/relay > body splice > socket > adapter > trailer connector > lamp; then return through bonds/negative.
6. Correct approved damaged parts and retest with same load, circuit state and connection, including other interacting lamps.

Worked example only - no universal limit

Measurement	Example
Battery posts with lamp ON	12.6 V
Feed loss	0.6 V
Return loss	0.5 V
Voltage actually across lamp	11.5 V = 12.6 - 0.6 - 0.5

An actual pass/fail requires the applicable wire/load/maker specification, test method and current. PWM outputs can require scope/waveform analysis instead of interpreting a meter average.

Trailer return must be through its intended contact/conductor and approved bonding. Hitch ball, chains, rusted sheet metal or frame contact are not substitute design assumptions. See R0.6 GROUND 01-09.

SUP 14 | Individual circuit function grid

Use actual measured values with terminal IDs; never substitute an ON/OFF checkmark for measurements where voltage drop or current matters.

Test state	Expected function for an identified combined-stop/turn RV output	Record abnormal coupling
All OFF	Stop-turn outputs uncommanded; aux may be active per design	Any lit/energized output vs OEM behavior
Park/marker ON	Marker feed active	Left/right or backup erroneously lighting
Left turn	Left combined stop/turn flashes	Right/stop/aux coupling
Right turn	Right combined stop/turn flashes	Left/stop/aux coupling
Service brake only	Left and right combined outputs ON	One output absent or wrong logic
Brake + left turn	Left flashes; right brake steady in typical combined system	Unexpected simultaneous/weak output
Brake + right turn	Right flashes; left brake steady	Unexpected simultaneous/weak output
Reverse (safe)	Backup/lockout only if equipped	Unknown high-current activation
Controller / breakaway	Separate maker-approved brake test	Not a steady +12 V lamp feed

For each record write these eight fields

Asset + date | contact ID + viewing side | meter/tester model | probe reference | actual voltage/current/waveform | command/key/load | applicable spec | result and evidence file.

This table is an electrical functional teaching reference, not universal pin locations and not the expected behavior of SAE J560 independent STOP contacts.

SUP 15 | Pairing test: controlled final gate

Only combine assets that have already passed independent inspection, mapping and applicable safety-critical checks.

1. Select one truck ID, one trailer ID, and precisely one adapter ID if required. Log all three.
2. Confirm connector function map, operating voltage, current capacity, required brake controller/air system, coupler/tow ratings and ground path.
3. Require prior truck-only, trailer-only and adapter-only evidence with no unresolved cross-feeds or safety faults.
4. With equipment secured, commands OFF and correct procedure, mate only the verified hardware. Observe for sparks, unexpected actuation or warning.
5. Check identified tail, left, right, stop, hazards, and permissible combined lamps one function at a time, then under combined normal load.
6. Under load, measure both feed and return at the actual trailer load; use appropriate meter or scope for supervised circuits.
7. Qualified personnel check normal service-brake application/release and breakaway/emergency function by equipment-specific procedure.
8. Record paired warnings, trailer-recognition messages, air pressure (where applicable), controller/ABS diagnostics and final results.
9. Do NOT use a public-road towing attempt to discover a suspected brake/connector mismatch. Release only after full required clearance.
10. Save signed pairing record, date, as-left configuration version, tests, and specific adapter requirement.

Any change in truck wiring, trailer wiring, adapter, brake controller, software, breaks/grounds or brake hardware triggers a review and retest before the pairing is considered current.

SUP 16 | Clearance: four statuses and no shortcuts

The compatibility matrix is a safety-and-evidence workflow; it is not a scorecard that turns unknown data into a PASS.

Disposition	Exactly what it means	Dispatch assumption
APPROVED - DIRECT	Independent and paired functions documented with no adapter	Only for named configuration and conditions
APPROVED - ADAPTER ID	Same full evidence with a specific rated, tested AD ID	Swapping adapter voids this approval
HOLD - DO NOT CONNECT	Known incompatibility, fault, overheated parts, brake concern or unsafe condition	Repair, inspect and retest before release
UNVERIFIED	Identity, mapping, ground, brake or necessary paired evidence missing	Not an approval to tow

Evidence required before an approval

- Exact truck/trailer/adapter IDs and currently installed configurations.
- Connector make, view, contact function map, tested voltage and expected loads.
- Independently passed truck, trailer and adapter tests with photos and measured results.
- Brake type and appropriate controller/air system, trailer breakaway/ABS and safe mechanical coupling verified.
- Paired loaded function and proper ground verification under supported conditions.
- Competent reviewer signoff and next retest trigger / exception record.

Safety logic: a calculator or spreadsheet may flag candidates, but cannot approve a truck-trailer system it has never actually tested.

SUP 17 | If a test fails, locate the fault boundary

Treat a symptom as an observation; one changed boundary at a time produces an interpretable next test.

Actual symptom	First discriminating test	Premature conclusion to avoid
Left truck lamp ON with trailer unplugged	Truck/upfit/connector paths, lamp element, fuse and relay per exact diagram	"Trailer caused it" or "BCM failed"
Truck socket indication ON at no command	Identify cavity, source, load, key/PWM state and separate fused branches	"12 V on LED = active functional output"
Trailer right flashes with left	Trailer-only cross-feed and loaded return test	"Bad trailer module"
Truck normal, trailer-alone fails	Trailer circuits / ground / brake system	"All trucks need programming"
Truck+trailer fails, both pass alone	Adapter function map, interaction under normal load, control compatibility	"Just swap the adapter live"
Brake drag or reduced towing performance	Brake-control current/air application and separately PCM codes	"Engine limp mode caused by trailer"

Finding, hypothesis, next test

Finding: One actual terminal was energized with brake switch OFF at the specified time and load. **Hypotheses:** wrong feed, backfeed, relay, converter, BCM output, ground return. **Next test:** compare the immediately upstream verified boundary under identical conditions. Do not assign a failed component until the test distinguishes it from alternatives.

> **When using scan data, distinguish command/input PIDs from the physical voltage of the relevant output. An inactive switch PID does not prove a rear lamp driver was commanded OFF.**

SUP 18 | Worked exercise A: six-round center mix-up

Fictional exercise. The purpose is to teach why two legitimate adapter conventions are not interchangeable.

A truck carries a seven-way RV blade socket. A trailer has a six-round plug. An unidentified adapter mates both physically. The trailer lamps appear normal until an auxiliary feed is enabled, at which point the electric-brake circuit may receive voltage unexpectedly.

Do not connect until all of these are known

- Truck-side function of the RV blade contacts.
- Trailer-side center contact intended function and the corresponding alternative outer contact.
- Exact passive adapter input-to-output map and manufacturer part number.
- Presence and rating of a compatible brake controller and proper trailer brake/breakaway equipment.

Expected diagnostic sequence

1. Isolate all three components and label as-found hardware.
2. Record each physical view and manufacturer function chart; draw a full contact map.
3. Map the passive adapter without power. Identify whether it routes the trailer center to brake output or auxiliary source.
4. Correct the configuration using a suitable documented adapter only if all other functions and limits match.
5. Repeat permitted independent and coupled function and brake verification with qualified technician.

> **No percentage can be assigned to the two common six-round center conventions without inventory data. "Two common possibilities" is not "a 50/50 chance."**

SUP 19 | Worked exercise B: changing one variable

Fictional exercise. A successful pairing today can fail after someone replaces the adapter or connector next month.

Truck TRK-02 and trailer TLR-05 have a documented approved configuration with adapter AD-03. An operator substitutes an unnumbered look-alike adapter. The lights illuminate but brake behavior has not been checked.

Question	Answer from controlled evidence
Can the prior record still be used?	No. It approved AD-03 under recorded conditions; it cannot approve a different, unverified adapter.
Can an installer assume wire colors?	No. Installed function-to-function mapping must be traced and verified.
What is the immediate disposition?	UNVERIFIED or HOLD if an observed safety defect exists. Do not dispatch based on visual similarity.
What releases this new pairing?	Identify/map new adapter; repeat required functions and brakes under load; record new ID and signature.

Change control event log

Date/time | truck ID | trailer ID | old/new adapter ID | reason for substitution | new part number | circuit map version | physical photos | tests repeated | signoff.

A driver QR scan can prompt a compatibility check, but only after the underlying data has been validated and the record is current.

SUP 20 | Worked exercise C: truck lamp with no trailer

Fictionalized instructional pattern; do not turn a recorded symptom into a premature Ford BCM diagnosis.

A left rear truck lamp remains illuminated with the trailer disconnected. A passenger-compartment left stop/turn fuse change extinguishes the lamp. A truck-side tester separately shows a backup indicator changed by an inline fused wire, while another indicator remains active.

What the observations permit

- The trailer does not need to be present for this specific truck-lamp symptom.
- The observed fuse is part of the affected power path in that test condition, but this alone does not identify the origin.
- The changed backup indication supports a relationship to the inline fuse branch; it does not automatically explain a separate left indication.
- Exposed wires or unidentified grounds are reasons for circuit tracing, not proof of which module is bad.

What discriminates a module from the wiring?

1. Confirm actual illuminated lamp segment, key state and exact truck versus trailer-output identity.
2. Obtain vehicle/option matched wiring; record the applicable fuses, relays, BCM outputs and upfit junctions.
3. Under the same command and permissible load, compare source/output voltages at verified OEM and upfit boundaries.
4. Identify any alternate fused supply, backfeed, open return, damaged connector or relay before condemning a module.
5. Preserve as-found photos, measurements and programming/repair logs.

R0.6 original reference: Chapter 10, Chapter 28 and Appendix J. Original examples remain instructional. The case-specific operator notes are maintained in a separate private companion.

SUP 21 | Shop evidence and programming questions

Good diagnostic reconciliation asks for records, not blame. Keep Ford contact history and shop claims separate from verified work.

Six direct questions (draft, not transmitted)

1. What specific complaint was reproduced, and which pinpoint tests and measurements established the cause?
2. If a BCM or other module was condemned, what actual command-versus-loaded-output test separated internal failure from external wiring?
3. Were seven-way, six-way, grounds, added rear wiring, junctions, relays and alternate power feeds inspected or ruled out? What results?
4. What modules, hardware IDs or configurations were replaced, programmed, reset or reflashed? Provide session and before/after records if available.
5. What Ford contact or technical support advice actually occurred, and what reference/date documents it?
6. Which exact truck + trailer + adapter was tested; were lamps, ground under load, controller, brakes and breakaway checked; what final results and itemized charges exist?

Recordkeeping boundaries

Time parked at a service facility is not billed labor. A programming-access requirement is not proof a module was flashed. A shop saying a repair was complete is not the same as a measured as-left test. Request documents and allow "not performed / record unavailable" as an honest answer.

Private draft only. No communication to any owner, dealer, Ford employee or repair facility is authorized or implied by inclusion in this manual.

SUP 22 | Fleet matrix: how to use the 14 logs

The compatibility workbook is a structured evidence store. Enter data once per asset and link it to each verification session.

Workbook area	Core purpose	Audit guardrail
Asset roster	Identify truck, trailer and adapter	Stable IDs; do not reuse after scrapping
Connector register	Identify front/rear and physical terminals	Record manufacturer drawing revision
Contact map	Each cavity to actual function	Source of assignment and result
Wiring route / upfit	OEM outputs to junction/socket, ground and protection	As-built vs as-modified separately
Circuit tests	Load, command, probe points, measurements	Units and real values; no imagined specs
Brake/breakaway	Actuator/controller/air and emergency systems	Qualified inspection and source
Adapter map	Part number, end-to-end mapping	Isolated vs active electronic method
Pairings/approvals	Three asset IDs + results + reviewer	UNVERIFIED default; no auto-pass
Change & exceptions	Every modification, fail, repair and retest	Do not overwrite failed history

Practical first pilot

1. Select one available truck, two different-age trailers and every adapter relevant to those two trailers.
2. Complete four individual fingerprints; record unknowns openly.
3. Use the lab/worksheet procedure; get qualified brake and air checks as applicable.
4. Approve only fully verified combination(s), then demonstrate the test record and change log to the owner.

> **A reusable configuration signature reduces duplicated research. It never replaces per-asset condition checks or required final pair testing.**

FORM T | Truck independent verification record

Fill with actual readings. Blank means unverified; do not infer a PASS from an empty field.

Record / evidence	Enter
Truck asset ID / VIN / year	_____
Factory service brakes / installed tow package	_____
Body/upfit, rear junction, converter, controller	_____
Socket family / make / part	_____
Socket FACE photo / REAR photo IDs	_____
Wiring diagram revision / reference	_____
Ground contact ID / tested return path	_____
Battery post voltage / engine state	_____
DVOM / tester make model	_____
Date / technician / observation status	_____

Command / test	Cavity / view / reference	Actual reading / load / spec
All OFF	_____	_____
Park/marker	_____	_____
Left turn	_____	_____
Right turn	_____	_____
Brake only	_____	_____
Brake + turn	_____	_____
Reverse if supported	_____	_____
Aux if supported	_____	_____
Ground return loaded	_____	_____

Defect / hold reason: _____

Evidence files / next test: _____

Signoff: _____ Status: UNVERIFIED / HOLD / INDIVIDUAL TEST PASSED

FORM L | Trailer independent verification record

A trailer-only lighting test is not a complete braking-system certification.

Record / evidence	Enter
Trailer asset ID / VIN / age	_____
Plug family / maker / part / front view	_____
Wire entry / ground photos	_____
Trailer brakes: electric / EOH / surge / air	_____
Controller compatibility requirement	_____
Breakaway device / battery asset / air emergency	_____
Axle / brake maker and service procedure	_____
Trailer-only tester / supply voltage	_____
Date / technician / photo record	_____

Function	Result / actual voltage or current / load
Tail/marker	_____
Left turn	_____
Right turn	_____
Stop lamps	_____
Turn + stop combined	_____
Ground loaded drop	_____
Aux / reverse	_____
Brakes / ABS (qualified)	_____
Breakaway / emergency (qualified)	_____

Unexpected circuit or fault: _____

Reviewer: _____ Status: UNVERIFIED / HOLD / INDIVIDUAL TEST PASSED

FORM A | Adapter isolated mapping record

Isolated continuity mapping applies only to a passive adapter without active electronics.

Record / evidence	Enter
Adapter ID / brand / manufacturer part	_____
Input family / side / mating face	_____
Output family / side / mating face	_____
Center pin: BRAKE / AUX / not applicable	_____
Passive vs active / manufacturer test method	_____
Voltage / current limit / fuse and ground	_____
Photo / drawing source and revision	_____

Input physical cavity	Required function	Output physical cavity	Measured result
_____	Ground	_____	_____
_____	Tail	_____	_____
_____	Left / brake	_____	_____
_____	Right / brake	_____	_____
_____	Electric brake	_____	_____
_____	Auxiliary	_____	_____
_____	Reverse / optional	_____	_____

Other unintended cross-contact test (with sources isolated): _____

Active converter functional test per maker (if applicable): _____

Inspector: _____ Status: MAPPED / UNVERIFIED / HOLD Date: _____

Mapping one adapter does not automatically clear a connected truck and trailer. Each installed pairing requires its own final clearance.

FORM P | Truck + trailer + adapter release record

This is the only form that can evidence an approved combination, after the required separate tests exist.

Field	Write the verified data
Pairing record / date / inspector	_____
Truck ID + current wiring version	_____
Trailer ID + current wiring version	_____
Adapter ID + mapping version (or NONE)	_____
Truck individual test ID and result	_____
Trailer individual test ID and result	_____
Adapter individual test ID and result	_____
Electric control / air service compatibility	_____
Brakes / breakaway / ABS / coupler verified	_____
Loaded ground and wiring test evidence	_____
Paired stop/turn/park/aux/reverse results	_____
Open defects / exceptions / evidence path	_____

Disposition	Select EXACTLY ONE / sign
APPROVED - DIRECT	[ ] all required proofs on file and no adapter
APPROVED - ADAPTER ID	[ ] specific ID mapped and tested: _____
HOLD - DO NOT CONNECT	[ ] reason: _____
UNVERIFIED - NOT APPROVED	[ ] evidence still missing: _____

Reviewer name / signature: _____ Conditions / expiration or retest trigger: _____

RETEST: wiring/connector replacement; adapter substitution; trailer brake changes; module/firmware or protection changes; damage or abnormal behavior. Approval is configuration-specific.

SUP 23 | Source notes and revision crosswalk

R0.7 supplements the original R0.6 training edition. Sources establish general methods, not individual asset condition.

Original R0.6 section	New R0.7 addition
Chapters 01-05 (connector recognition)	SUP 03-05, FORM A: industry variants and adapter verification
Chapters 06-09 (circuits and brakes)	SUP 01-02, 06, 13-14: fleet-level variables and scope
Chapters 10-18 (cases, views, interfaces)	SUP 07-09, 17-20: fault boundaries, one-trailer limit, fingerprints
Chapters 19-27 (field labs)	SUP 10-16, FORMS T/L/A/P: release-capable testing path
Chapters 28-33, appendices and GROUND 01-09	SUP 17, 21-22: evidence and change-control audit

External manufacturer references for the new material

Ford 2019 F-650/F-750 Tow Guide: Ford towing and brake systems (PDF).

Ford 2019 F-650/F-750 Owner Manual: owner manual (PDF), fuse/relay examples on printed pp. 175-177.

CURT manufacturer adapter #57660: center-brake arrangement; Lippert/CURT #57260: center auxiliary arrangement. Check current actual install sheet.

Phillips Industries J560 catalog: J560 wiring reference.

Controlled version facts

Document ID ATD-TRAILER-ELECTRICAL-TRAINING-001 | R0.7 consolidation dated 22 October 2026. R0.6 original pages preserved unaltered, with their printed R0.6 headers/footers and internal links. New pages explicitly identified as R0.7 SUP or FORM. All described client/vendor case facts live in a separate private companion and remain unverified unless named evidence is supplied.

ATD / ALL THE DETAILS - The story of every vehicle lives in the details.

R0.8 FIELD INTEGRATION / D01

The two-socket truck: six-way AND seven-way

A truck fitted with both six-round and seven-contact receptacles is NOT proven to have two equivalent outputs. A connector is the final interface, not an electrical schematic.

FIELD RULE: TWO SOCKETS DO NOT MEAN TWO IDENTICAL SYSTEMS. Verify each socket separately and trace where it obtains power, control signals and return current.

Four upstream arrangements that might exist

Possible arrangement	What it would mean	What must be verified
Shared feeds	Six-way and seven-way tap some of the same lighting, auxiliary or ground circuits.	Separate harness branches, branch protection and load rating.
Separate output paths	One socket uses OEM trailer outputs while another uses relays, a controller or upfit junction.	Source, commanded behavior and correct circuit assignment for EACH.
Converter/adapter branch	One socket has combined stop/turn logic while another depends on a separate converter.	Input/output behavior, part number and protected power/ground.
Later modifications	Either socket or its wiring may have been repaired, bypassed or replaced over time.	As-found photos, continuity mapping and measured operation, not factory age alone.

Important distinction

- The truck service brakes (hydraulic or air) and the trailer brake actuation type (electric, electric-over-hydraulic, surge or pneumatic) must be recorded separately.
- A six-way and a seven-way might share a chassis or harness ground, but a return path has not been established until the actual contact and conductor are identified and tested under load.
- An unused second socket may still connect into a modified harness; removing a trailer does not necessarily isolate every truck-side branch.

Training question: If the seven-way socket works, does that verify the six-way? **No.** It establishes only the outputs tested on the seven-way under the recorded commands and loads.

R0.8 FIELD INTEGRATION / D02

The complete chain to verify

A matching plug proves mechanical fit only. Electrical function, voltage, load, braking technology and protection are separate requirements.

Follow the truck to the trailer, not the connector color

Boundary	Variables that can differ or fail
1 Truck factory circuits	Year, model, factory options, BCM/relay outputs, fuse protections, separate versus combined stop/turn.
2 Body / upfitter	Junction boxes, added relays, dual sockets, trailer-brake controller, converter, fused auxiliary supply, splices.
3 Truck socket A (6R)	Exact contact-view orientation; electric-brake versus auxiliary assignment; return path; condition.
4 Truck socket B (7-way)	7 RV blade versus 7 round/J560; actual wiring, molded IDs, auxiliary/ABS/lighting roles.
5 Adapter / extension	Input and output connector families; orientation; every contact map; passive versus active; rating.
6 Trailer plug and harness	Age, contact map, splices, grounds, wire gauge, frame bonds, insulation and previous repairs.
7 Trailer loads / brakes	Lamp types, controller demand, brake technology, breakaway and battery/charge/ABS requirements.

Verify every boundary as FOUND today. A Ford build record or upfitter invoice tells you what was originally ordered or installed; it cannot alone certify a plug repaired or rewired years later.

R0.8 FIELD INTEGRATION / D03

Recognize connectors before assigning functions

Do not count pinouts from connector shape alone. Two common six-way center-contact choices are not a 50/50 probability, and they do not describe all possible installed variations.

Connector / family	Main training distinction	Typical special concern
Six-round (6R)	Two widely encountered center-contact assignments: brake-control output OR 12-volt auxiliary; the other role moves to another contact.	A mismatched adapter can misroute auxiliary supply to trailer brake actuation.
Seven-way RV blade (7B)	Distinct blade layout, typically combined stop/turn, electric brake, auxiliary and reverse.	Wire-color charts vary; identify real cavities/commands.
Commercial 7-round SAE J560	Separate stop and turn functions plus an ABS/auxiliary power role; not the RV blade system.	Requires special treatment: pin swapping alone may not translate signals or supply trailer electric brakes.
Other six/seven-contact parts	Some other round, square or specialty housings exist.	Do not apply another family pin map.
Adapter or Y/harness	May simply map compatible signals, convert logic, or omit functions.	Every input-to-output contact and rating requires documentation.

The 2019 Ford example, correctly interpreted

A documented Ford 2019 medium-duty order guide describes hydraulic/air vehicle brakes crossed with combined/separate trailer lighting arrangements. That illustrates **four option categories, not four proven seven-way physical pinouts**. The original truck configuration is not necessarily its current installed upfit configuration.

Do not label all six-way and seven-way sockets as universally wired, and do not assign equal probabilities to center-contact variants.

R0.8 FIELD INTEGRATION / D04

Preserve and identify before testing

Beginner field sequence, with the vehicle stationary and secured. This phase should not energize unknown circuits or require rewiring.

- **1.** Assign unique asset identifiers to the truck, EACH installed socket, the trailer and EACH adapter or extension; avoid identifying every connector as simply "the seven-way."
- **2.** Photograph truck VIN/certification label, rear body, socket A and B mating faces, lids/keys/marks, and wire-entry faces when safely accessible.
- **3.** Record year/model, factory service brakes, trailer brake controller, upfitter identification and the make/model of every installed interface.
- **4.** Record connector type, exact molded terminal numbering, view direction (truck front/rear; trailer front/rear), conductor count and wire colors as observations only.
- **5.** Check for exposed copper, touching studs, oxidation, melted insulation, loose stacked terminals, missing seals and unsupported harnesses. Photograph before any correction.
- **6.** Locate approved fuse/relay and OEM/upfitter schematics by truck VIN and options. Mark unknown splices and feeds UNMAPPED.
- **7.** Identify any breakaway battery and trailer brake technology without applying power.
- **8.** Stop for evidence of current arcing, overheated brake wires, unverified power feeds or unsafe braking hardware.

Evidence label to use

Label	Meaning
Observed	What the operator saw or measured under stated conditions, not a universally established cause.
Verified	Supported by matched OEM/component documents and reproducible specified testing.
Unmapped	Connection, ground or splice has not been fully traced.
Suspected	Possible mechanism requiring a discriminating test.
Not tested	No evidence supporting approval; do not treat as passed.

R0.8 FIELD INTEGRATION / D05

Truck-only test: BOTH sockets, independently

Use the exact connector-family reference and the truck manufacturer's authorized service methods. Tests described below begin with trailer and adapters fully disconnected.

Procedure for socket A (example: six-round)

- **1.** Record truck asset, socket ID, source battery voltage at posts, ignition/engine state and tester model.
- **2.** Identify a correct reference point and the socket's intended return contact by exact part drawing; note "ground UNVERIFIED" until loaded test.
- **3.** With all lighting commands OFF, measure only approved identified terminals using insulated probe tips; note any supervisory pulses.
- **4.** Command PARK, LEFT TURN, RIGHT TURN, HAZARD and SERVICE BRAKE separately, plus BRAKE+LEFT and BRAKE+RIGHT. Log actual response and cross-activation.
- **5.** Evaluate reverse only using the OEM safe stationary procedure; no person behind or under equipment.
- **6.** Distinguish auxiliary power from modulated brake-controller output using matched instructions. Never apply battery positive to an unknown brake or BCM terminal.
- **7.** Use manufacturer-permitted loads to confirm current delivery and loaded ground/positive voltage drop where appropriate.
- **8.** Leave the socket in safe restored state, disconnected from test gear, and repeat as a NEW test record for socket B.

Socket B (example: seven-way) gets its own complete result

Do not copy socket A readings into B. Record both connector contact maps, whether outputs match the correct signal conventions, and whether the circuit shares an OEM/upfit boundary. A pass on one socket is not approval of the other.

STOP: If both sockets do not identify clearly, if brake/aux functions are uncertain, or if a current path overheats, do not connect a trailer to discover what happens.

R0.8 FIELD INTEGRATION / D06

Function-command matrix for dual sockets

Create one filled table for socket A and another for socket B. The pattern below is illustrative for a COMBINED stop/turn arrangement only, never a substitute for the actual truck diagram.

Command	Typical combined stop/turn	Things a basic tester might miss
All OFF	No intended lighting feed; auxiliary behavior depends on design.	Low-current diagnostic pulses, backfeed and ignition-dependent auxiliary voltage.
Park/marker ON	Correct marker feed active.	Dim lamp caused by voltage drop or overloaded ground.
Left turn	Left stop/turn output pulses.	Right lamp or brake feed also pulses due to crossfeed.
Right turn	Right stop/turn output pulses.	Left or reverse feed cross-activation.
Service brake	Both combined stop/turn outputs active.	Separate-stop/turn architecture needing a correct interface.
Brake + left	Left flashes while right stop remains active.	Combined/turn-logic failure not caught in left-only test.
Brake + right	Right flashes while left stop remains active.	Converter or spliced wiring conflict.
Hazards	Both side signals pulse.	Unexpected brake-controller feed or unusual lamp response.
Aux/key variations	Document OFF, KOEO and engine state if supported.	Charging feed appears only after engine run; brake-vs-aux mismatch.
Electric brake	Follow exact controller manual and safe simulated/test load.	Controller may require recognition/load; DVOM averages PWM.
Reverse	Only if equipped and tested with safe OEM procedure.	Reverse contact absent, reassigned or fed from an added source.

Measurement line: command ____ socket A contact/view ____ A measured ____ V ____ A socket B contact/view ____ B measured ____ V ____ A load ____ ground drop ____ V technician/date ____

R0.8 FIELD INTEGRATION / D07

Verify grounds while a correct load operates

A continuity tone or a ground-looking wire does not establish a valid return. This point is particularly important when a six-way and seven-way are both fitted to the same truck.

Task	Safe measurement / interpretation
Identify	Trace the intended ground contact from each socket to the approved truck/upfit return. No dedicated ground IDENTIFIED is different from proving the ground is absent.
Load	Use one verified, rated lighting load. Record battery voltage at the posts with that load ON.
Meter placement	For return-path drop, set DVOM to DC volts: RED on identified load return, BLACK on battery-negative post; record the loss under that load.
Section	If excessive relative to the correct design limit, measure successive return segments across connector, adapter, ring terminal, strap or bonding point.
Compare	Repeat each socket separately and with relevant supported combinations of lighting loads. One good stud reading does not clear every branch.
Repair	Use OEM-approved material, attachment point and torque; restore protection; document before/after under identical loads.

Why dual sockets complicate a ground

Both receptacles may connect to the same chassis return, to separate insulated returns, or to later-added body grounds. A lighting fault on one branch can use another conductor as an unintended return. Do not infer the complete route from a stud or hitch connection.

Never make a trailer hitch ball or safety chains the planned operating ground. Manufacturer-specific voltage-drop limits and connection details control.

R0.8 FIELD INTEGRATION / D08

Adapter-only test: a third independent asset

Identify an adapter by its EXACT make/part number, direction and contact map. A shape-changing connector cannot create a missing electric-brake controller or air-brake system.

- **1.** Label adapter with a unique ID and photograph both mating ends, rear markings and cable/strain relief.
- **2.** Record incoming family, outgoing family, actual orientation, and whether it is passive, a powered converter, or unknown.
- **3.** Obtain the maker's installation/function chart and document whether six-way CENTER is intended as auxiliary or brake-control signal.
- **4.** For a passive adapter ONLY, disconnect from ALL sources/loads, confirm de-energized, then map each input contact to its intended output by continuity. No connected truck or trailer.
- **5.** Test for unwanted inter-contact continuity in the isolated adapter. Internal electronics can give misleading resistance readings; follow maker instructions for active units.
- **6.** Verify conductor ratings, protective device, environmental condition, correct signal logic and all required functions. Do not approve an adapter that silently drops required brakes, ABS, ground or auxiliary capability.
- **7.** Active converters require the manufacturer-approved powered bench/interface test. Identify dedicated power, ground, signal inputs and outputs; do not use bare wire swapping as a conversion substitute.
- **8.** Mark ADAPTER VERIFIED as a component only after its map is documented. It still needs a separate final approval for each permitted truck/trailer pairing.

Useful concrete example

CURT documents distinct 7-way RV blade to 6-round adapters with different six-way center functions (e.g., **#57260 center auxiliary** and **#57660 center-brake variant**). The listing is proof that alternative products exist, **not** proof that any unit on a given fleet uses either one correctly. Confirm the entire contact map, including the exact maker meaning of any "brake" label.

DO NOT find an adapter's assignment by applying full battery voltage to an unknown six-way center contact. That contact might lead to trailer brakes.

R0.8 FIELD INTEGRATION / D09

Trailer-only verification: independent from truck

One new trailer passing a test establishes only the tested trailer, functions, tester and conditions. Older trailers may use different arrangements, previous modifications and different brake systems.

- **1.** Chock and secure trailer independently. Record asset/serial, connector family, view orientation, actual brakes and breakaway design.
- **2.** Inspect plug face and wire entry, cable jacket, junction, lamps, grounding conductor, axle/brake wiring and breakaway hardware; preserve photos.
- **3.** Use a trailer-side tester or IPA MUTT that MATCHES the connector family, voltage and ratings; it supplies the trailer independently of the truck.
- **4.** With permitted testing configuration, command tail/markers, left, right, brake lamps and supported reverse/aux as separate functions. Walk the trailer: note every expected and unexpected light.
- **5.** Repeat supported combined command/load cases, checking for dimming and crossfeeds. Trace suspicious grounds under an appropriate operating load.
- **6.** Electric/EOH brake-controller and breakaway tests follow matched component procedures and permitted activation duration; do not assume lighting tester verifies braking.
- **7.** Pneumatic supply/service/emergency equipment must be inspected by qualified air-brake personnel under applicable procedures, never with a general-purpose electrical tester.
- **8.** Record trailer-only results with pass/fail/unverified by function, not one whole-trailer "good" stamp.

Trailer electric-brake magnet or trailer ABS actuation cannot be certified merely because a seven-way tester shows its stop/turn indicators.

R0.8 FIELD INTEGRATION / D10

Brake-interface matching is separate from lighting

A truck with hydraulic service brakes can be equipped to operate some electric-brake trailers. A truck with air brakes does NOT necessarily have the pneumatic trailer interfaces required for an air-brake trailer.

Trailer brake equipment	What must exist on the tow vehicle / interface	What an adapter cannot supply
Electric drum/disc	Compatible brake controller/output, protected supply/return, breakaway system and rating.	No passive adapter can produce a missing correct controller signal.
Electric-over-hydraulic	Compatible actuator/controller signal, supply, ground and required breakaway arrangement.	An adapter cannot guarantee controller/actuator compatibility.
Hydraulic surge	Correct physical coupler and if equipped reverse lockout feed/logic; applicable towing and mechanical ratings.	A simple contact remap cannot replace mechanical compatibility.
Pneumatic air service/emergency	Proper supply and service pneumatic plumbing, valves, controls, breakaway/emergency functions, and separate electrical lighting/ABS interface.	An electrical six-to-seven adapter cannot provide air lines or air brake control.

Safety distinction

If air-brake combinations are involved, qualified personnel must verify service and emergency line routing, air integrity, release/application and ABS/electrical expectations. Do not open air lines or attempt unfamiliar pneumatic procedures as an electrical-lab exercise.

References: FMCSA 49 CFR 393.43 / 393.45 and the relevant vehicle/trailer brake manuals.

R0.8 FIELD INTEGRATION / D11

Faults that may hide behind a plug that fits

Treat the scenarios as possibilities, not diagnoses of any particular truck. A basic tester lighting up all its lamps is not complete compatibility certification.

Possible mismatch or fault	Why it could be missed	Discriminating evidence
Six-round brake/aux reversal	Trailer running lights may look normal; unexpected brake drag may start only when AUX becomes live.	Isolated adapter/trailer map plus rated controller/aux checks; never energize unknown contact.
Separate vs combined stop/turn	Left-only and right-only tests pass, but brake+turn has wrong logic.	Brake-only and brake+turn combined command grid; verify converter interface.
Poor return path	Unloaded DVOM reads 12V and lamps may appear normal one at a time.	Loaded ground voltage-drop with individual AND combined lighting loads.
One socket modified, one not	Seven-way looks correct while six-way feeds are spliced differently.	Independent A/B socket maps and command results; trace source-to-connector.
Converter power or ground missing	Some indicators work but controller drops out under real trailer load.	Document exact part and verify matched input/output and supply.
Unprotected auxiliary backfeed	A lamp or tester shows an unexpected energized contact when ignition changes.	Fuse/protection/source trace, meter under specified loads, no guessing by color.
Trailer-side old splice	New trailer passes; older trailer fails only under simultaneous functions.	Trailer-only tests for every trailer and evidence of end-to-end wiring.
Missing pneumatic interface	Electrical lights work while trailer air brake system cannot function correctly.	Independent qualified pneumatic brake verification, not adapter selection.
Unrecognized trailer/controller load	Some electronic truck outputs pulse, inhibit or show abnormal unloaded readings.	OEM test loads and supported scan-tool data; compare real current and actual output.

R0.8 FIELD INTEGRATION / D12

Control the first truck + adapter + trailer test

Only perform paired testing after every component is individually identified, the map is compatible, grounds are verified and braking systems are confirmed. Qualified personnel control safety-critical operations.

- **1.** Identify the EXACT intended triple: Truck T, truck socket A or B, Adapter AD-x or NONE, Trailer R-y. Photograph this pairing.
- **2.** Compare contact-by-contact function mappings and voltage/ground/load requirements. Confirm separate vs combined logic and controller compatibility.
- **3.** Confirm mechanical towing ratings, physical coupler, air-service interface if any, brake/ABS and breakaway readiness. Stop on ANY mismatch.
- **4.** With vehicle secured, commands OFF, use only a verified matching adapter and join equipment per manufacturer instructions.
- **5.** Observe any unexpected immediate brake actuation, smoke, electrical heat, blown protection or warning; stop and isolate safely if detected.
- **6.** Perform PARK, LEFT, RIGHT, BRAKE, HAZARD, BRAKE+LEFT and BRAKE+RIGHT; record truck and trailer lamp behavior.
- **7.** Perform permitted key-state auxiliary and brake-controller tests using approved procedure and ratings; do not use a public-road test to discover brake lockup.
- **8.** Where safe and authorized, compare loaded feed and return loss across the exact connected system, including adapter contacts.
- **9.** Record the tests that passed, did not pass, were omitted, and any unit-specific restrictions. Only a qualified reviewer can approve service.
- **10.** When the adapter or trailer changes, treat it as a NEW combination; previous approval does not automatically transfer.

A successful test with a newly purchased trailer DOES NOT certify a different older trailer, another adapter, the other socket, or a different truck.

R0.8 FIELD INTEGRATION / D13

Diagnose one boundary at a time

This is the decision approach when different trucks or different sockets behave differently. Always preserve the unchanged conditions and results.

Finding	Interpretation supported	Next useful test
Truck rear lamp stays on with trailer disconnected	A trailer is not required to reproduce the symptom at that moment.	Identify actual lamp segment and fuse; compare OEM/upfit outputs under identical command state.
Seven-way output looks correct; six-way differs	Both socket outputs are not proven equivalent.	Compare socket A/B with same commands; trace source and converter branch.
Truck sockets pass alone, trailer fails MUTT	Truck not needed for that independent trailer failure.	Trace trailer ground, connectors, splices and affected load.
Truck + trailer fail only with adapter	Adapter or its interaction becomes lead; not proof the adapter alone is defective.	Isolated part-number/continuity map and test same approved paired functions.
One new trailer passes, older one fails	Successful result is specific to new trailer and tested pairing.	Test older trailer independently, then matched combinations if safe.
Only brake+left has wrong result	Possible conversion or crossfeed under simultaneous loads.	Brake+turn truth table; loaded return/stop-turn boundary.
Scan input PID inactive; rear lamp energized	The input PID is not an actual output terminal measurement.	Synchronous OEM output and upfit feed/ground measurements.

Separate unrelated diagnostic lanes

A trailer brake drag may mimic low power without a PCM torque limit. Engine P0402/P00BC/P132B/P2209 or similar DTCs still require independent air-management/aftertreatment diagnosis. Do not claim one wiring fault explains everything without synchronized evidence.

R0.8 FIELD INTEGRATION / D14

A teaching exercise from a mixed work-truck fleet

An operator observed unusual rear-light behavior on multiple vehicles. One truck had exposed strands touching in a seven-way, a six-way not yet inspected, and a ground path not positively identified. A service shop later asked to test a newer trailer.

What these facts DO and DO NOT establish

Reported observation	Supported conclusion	Still unknown
Exposed conductors made contact at seven-way terminals; contact was corrected.	Electrical work was warranted on that connector; as-found photographs matter.	Whether this contact caused all recorded truck lamp behavior or previous damage.
Dedicated connector ground was not positively identified.	The return path remained UNVERIFIED.	Whether a valid ground existed elsewhere or operated acceptably under load.
Six-way connector was not examined.	It remains a distinct untested electrical boundary.	Its pinout, condition and source path.
Left rear truck lamp remained lit with no trailer connected.	Trailer connection not required to reproduce this truck-side symptom then.	OEM vs upfit vs relay/BCM actual feed origin.
Newer trailer was supplied for a shop test.	Only a documented set of tests on that exact configuration can establish specific function results.	What was tested and whether any older trailer or adapter was compatible.

Five tests to distinguish cause, not assign blame

- Preserve as-found data and exact wiring/photo/repair timing before testing.
- Trace the vehicle lamp itself versus the separate trailer output; do not combine them into one circuit just because both are labeled left.
- Measure six-way and seven-way outputs separately under the same command and matched test load.
- Identify actual return paths and loaded voltage drop to battery negative.
- Request prior shop test records, Ford procedural references and after-repair verification; a module failure remains unproven until supported.

Case classification: OPERATOR REPORTED / TRAINING SCENARIO. Not an independent certification, proof of shop fault, or universal F-650 diagnosis.

R0.8 FIELD INTEGRATION / D15

The real purpose of the compatibility matrix

Reduce a fleet of connections to known electrical/brake configurations without pretending that similar assets are interchangeable.

Record	Minimum fields	Clearance role
Truck T / socket A / socket B	VIN, year/options, actual 6R/7B/J560 part, each contact function, source path, brake equipment, load/ground tests.	Truck + each socket verified independently.
Adapter AD	ID, maker/model, in/out family, six-way center mapping, passive/active, ratings, continuity/functional tests.	Adapter component function verified, not automatically approved for any trailer.
Trailer R	VIN/ID, plug map, brake/breakaway type, lamp function/grid, ground drop, actuator/ABS verification.	Trailer independently verified.
Pair P	T and socket, AD or none, R, actual functions, brake review, test date, technician, evidence IDs.	Specific triple is approved, held, or unverified.

Possible statuses

Status	Required meaning
DIRECT VERIFIED	The precise no-adapter pairing has complete compatible mapping and signed functional / brake verification.
ADAPTER VERIFIED	Only the named adapter ID, direction, version and specific pairing are approved.
HOLD / DO NOT CONNECT	Identified damage, miswire, current or brake incompatibility, or failed required safety test.
UNVERIFIED	A test, map, document or signature is absent; it is not approved simply because the plug fits.
RETEST REQUIRED	Any change to socket, adapter, wiring, module, brake controller, repair or relevant equipment affects previous approval.

Use configuration grouping for planning only. If three trucks and 18-30 trailers are in service, 54-90 DIRECT pairs are theoretically possible before adapters. Grouping reduces repeated investigative effort but does not erase configuration-specific release gates.

R0.8 FIELD INTEGRATION / D16

Field form T: two-socket truck fingerprint

Complete an independent page for each vehicle before attempting any trailer pairing. Blank does not mean PASS.

Field	Record
Truck asset, VIN, year, model	_____
Body / upfitter / controller	_____
Truck service brakes; trailer-control equipment	_____
Socket A identity / maker / face drawing	_____
Socket B identity / maker / face drawing	_____
Shared OEM/upfit junction proved?	YES / NO / UNVERIFIED | evidence _____
A six-round center role mapped?	BRAKE / AUX / OTHER / UNVERIFIED | evidence _____
A identified ground and loaded drop	Contact ____ source ____ load ____ measured ____ V limit ____
B identified ground and loaded drop	Contact ____ source ____ load ____ measured ____ V limit ____
Lighting commands on A; evidence ID	OFF ____ PARK ____ L ____ R ____ BRAKE ____ B+L ____ B+R ____
Lighting commands on B; evidence ID	OFF ____ PARK ____ L ____ R ____ BRAKE ____ B+L ____ B+R ____
Aux / brake signal by state, A vs B	_____
Wire repair/ground/modification needed?	_____
Inspector, date, preliminary disposition	_____

Notes / pin contact sketch / tool and rating / source schematic:

_____

_____

_____

R0.8 FIELD INTEGRATION / D17

Field form A: adapter fingerprint

Complete this page for every adapter, extension, Y-harness or converter. A passive adapter must be fully disconnected and de-energized for continuity mapping.

Field	Record
Adapter ID / manufacturer / part number	_____
Input family + VIEW / marked IDs	_____
Output family + VIEW / marked IDs	_____
PASSIVE / ACTIVE / UNKNOWN	_____
Center-pin assignment where six-round fitted	BRAKE / AUX / UNKNOWN evidence _____
Ground in -> out	From contact ____ To contact ____ Test / continuity _____
Tail in -> out	From contact ____ To contact ____ Test / continuity _____
Left in -> out	From contact ____ To contact ____ Test / continuity _____
Right in -> out	From contact ____ To contact ____ Test / continuity _____
Brake lamps / brake control input -> output	From contact ____ To contact ____ Test / continuity _____
Auxiliary power in -> out	From contact ____ To contact ____ Test / continuity _____
Reverse / ABS / other in -> out	From contact ____ To contact ____ Test / continuity _____
Unintended connection / resistance?	_____
Power / current / converter specifications	_____
Inspector / date / evidence	_____
Disposition	COMPONENT VERIFIED / HOLD / UNVERIFIED

A correct continuity map is NOT sufficient to approve a powered converter or certify operation under load. Adapter output must also be matched to the actual trailer.

R0.8 FIELD INTEGRATION / D18

Field form R: trailer independent fingerprint

The trailer receives a separate record, even if an owner says it has always worked with another truck.

Field	Record
Trailer ID / VIN / year / use	_____
Plug family / maker / molded terminal IDs	_____
Contact FACE and wire-entry photo IDs	_____
Actual contact functions mapped?	GROUND ____ TAIL ____ L ____ R ____ BRAKE CTRL ____ AUX ____
Brake technology and manufacturer	ELECTRIC / EOH / SURGE / AIR / OTHER _____
Breakaway system / battery / ABS	_____
Tester make/model / power rating	_____
Lighting grid verified	PARK ____ LEFT ____ RIGHT ____ BRAKE ____ B+L ____ B+R ____
Backup / auxiliary when applicable	_____
Ground return loaded drop	Load ____ battery V ____ drop ____ V limit ____
Brake and breakaway function proof	Procedure ID ____ result ____ qualified reviewer _____
Repair / unsafe condition / limitation	_____
Reviewer, date, record ID	_____
Disposition	VERIFIED / HOLD / UNVERIFIED

Unexpected lamps / changed conditions / next discriminating test:

_____

_____

_____

R0.8 FIELD INTEGRATION / D19

Field form P: final pairing release

This is the only form that authorizes a specific pairing in the ATD training workflow; approval still requires a qualified and authorized human reviewer and all applicable legal inspections.

Gate	Document evidence / result
Truck ID and chosen socket ID	_____
Adapter ID, model, direction or NONE	_____
Trailer ID	_____
Truck socket independently tested?	PASS / FAIL / UNVERIFIED record ID _____
Trailer independently tested?	PASS / FAIL / UNVERIFIED record ID _____
Adapter independently tested?	PASS / FAIL / N/A / UNVERIFIED record ID _____
Electrical mapping and ratings compatible?	YES / NO / UNVERIFIED evidence _____
Brake / emergency / breakaway interface verified?	YES / NO / UNVERIFIED reviewer _____
Stationary combined functional test complete?	YES / NO / UNVERIFIED test record _____
Tail/left/right/stop/turn combinations pass?	YES / NO / UNVERIFIED notes _____
Power, loaded return, charge and ABS as applicable?	YES / NO / UNVERIFIED notes _____
Faults corrected and identical retest passed?	YES / NO / N/A repair record _____
Decision and restrictions	DIRECT VERIFIED / ADAPTER VERIFIED / HOLD / UNVERIFIED
Reviewer + date + next periodic check	_____

DO NOT CLEAR when any required map, brake test, return path, protective feature or qualified signoff is missing. Any later adapter swap, wiring change or software/configuration change triggers a new review.

R0.8 FIELD INTEGRATION / D20

Instructor review, source notes and revision control

End the exercise with explanations, not a memorized wire-color chart. The original R0.6 / R0.7 chapters and illustrations remain authoritative within their stated scope.

Five teach-back questions

- The truck's seven-way passes on a tester. Can a six-way on the same truck be marked VERIFIED without testing? Explain why not.
- One six-round center pin carries auxiliary 12V and an adapter routes it to a trailer brake conductor. What is the required safety action?
- A new trailer passes with one truck. Does that prove 20 older trailers fit every truck in the yard? Name the missing evidence.
- A connected trailer's brake lamps work normally but the truck service brakes are hydraulic and the trailer requires air. Why is electrical success not towing approval?
- The operator cannot identify a dedicated ground wire in the seven-way. Does that prove no ground exists? Name the next two tests.

Source controls and published references

Reference	General topic supported
https://www.curtmfg.com/part/57660	Six-way center-brake variant of 7 RV-blade to six-round adapter.
https://www.lippert.com/curt-adapter-7-way-rv-blade-to-6-way-round-trailer-center-pin-auxiliary-57260-2020103568	Six-way center-auxiliary variant; illustrates alternatives exist.
https://www.etrailer.com/faq-wiring.aspx	Connector families, variation of brake and charge assignments.
https://phillipsind.com/wp-content/uploads/2024/04/BOC-Mini-Catalog.pdf	SAE J560 seven-round contact roles and distinct front/back views.
https://www.fordpro.com/en-us/upfit/publications/	Locate exact model-year vehicle/body-builder documentation.
https://www.law.cornell.edu/cfr/text/49/393.43	Air brake, breakaway and air-line safety requirements; consult current regulation.

R0.8 revision statement

Preserved: All 100 pages of the R0.7 updated manual remain part of the assembled volume, including the original 70-page R0.6 edition. **Added:** D01-D20 dual-socket, adapter, trailer, isolated testing and verification casebook. **Status:** Training reference only; no fleet truck , trailer, adapter, Ford module or repair action has been independently certified by publication of this manual.

Prepared by Stephen Guffey | ATD / All The Details | 22 October 2026

CONNECTORS, PHOTO EVIDENCE & SEALED WIRING REPAIRS

Truck + Trailer Electrical Training / Photo Edition R0.9

The story of every vehicle lives in the details.

Prepared by Stephen Guffey | All The Details | October 22, 2026

PRIVATE WORKING EDITION / TRAINING REFERENCE / NOT A VEHICLE CERTIFICATION

PHOTO + FIELD REPAIR ATLAS

Four views. Four different questions.

A correct test begins by identifying the exact object, not counting contacts in a photograph. A plug and socket are mating halves. Each has a front contact face and a rear wire-entry view.

1 VEHICLE SOCKET / FRONT

2 VEHICLE SOCKET / REAR

3 TRAILER PLUG / FRONT

4 TRAILER PLUG / REAR

Orientation rule: Rear views may be mirrored relative to the mating face. Stock-style images show physical construction only. Use a product-specific manufacturer diagram, molded contact legends and confirmed live/de-energized measurements for every actual pin assignment.

PHOTO + FIELD REPAIR ATLAS

6-way round | front and termination side

Vehicle socket / mating face
ILLUSTRATIVE, NOT A PINOUT

Vehicle socket / illustrative rear
ILLUSTRATIVE, NOT A PINOUT

CRITICAL: CENTER PIN IS NOT UNIVERSAL

Two common 6-round configurations interchange the electric-brake output and 12 V auxiliary supply. A plug can mate physically even when these functions do not match. Wire insulation color is not a reliable substitute for functional identification.

Beginner field check

1. Photograph lid/keyway and contact face. 2. De-energize and document the rear terminals without disturbing strands. 3. Trace the designed ground return. 4. Verify all six functions by approved tests. 5. Stop if brake and auxiliary positions remain uncertain.

> Never perform the identification by sending battery power into an unknown contact. A brake/auxiliary reversal can energize a trailer-brake circuit unintentionally.

PHOTO + FIELD REPAIR ATLAS

7-way RV blade | front and termination side

Vehicle socket / front

Vehicle socket / rear

Trailer plug / front

Trailer plug / rear

Photographs show geometry, not circuit assignments. RV 7-blade and heavy-duty SAE J560 7-round are different interfaces. A rear view is not a front-view pinout. A previous installer may also have changed conductor assignments.

PHOTO + FIELD REPAIR ATLAS

One truck, two sockets | two separate tests

WHAT MUST NOT BE ASSUMED

The presence of both sockets does not prove they share the same power feeds, ground path, stop/turn logic, fuse protection, brake-controller source or modification history. Each socket is its own diagnostic boundary until traced.

Independent verification order

A. Identify and test six-way alone. B. Identify and test seven-way alone. C. Compare each back to the documented OEM/upfit junctions. D. Test adapters separately. E. Test trailer alone. F. Evaluate only verified pairings with brakes and loads included.

> Teaching example, not a fleet inspection result: The photograph represents a dual-connector installation. An apparently normal light check at one socket does not clear the other socket or the trailer-brake path.

PHOTO + FIELD REPAIR ATLAS

Adapters | physical fit is not compatibility

AN ADAPTER CAN CHANGE THE ELECTRICAL MAP

A passive adapter connects existing functions to different contact shapes or positions. An active converter may alter separate-versus-combined stop/turn signals. Neither creates a missing pneumatic brake system or a compatible electric-brake controller.

Record every adapter as an asset

Adapter ID / manufacturer / part number / socket family / plug family / contact-face view / measured end-to-end function map / permitted voltage and current / approved truck-trailer pairing / date and technician.

> Release gate: Unknown adapters stay out of service. After a correct unpowered mapping, an appropriate controlled loaded test must still demonstrate correct lighting, return path, trailer braking and auxiliary functions.

PHOTO + FIELD REPAIR ATLAS

Seven round + braking | two separate systems

ELECTRICAL CONNECTOR != MECHANICAL BRAKE CAPABILITY

A commercial SAE J560 connection typically carries separate stop/turn lighting and trailer ABS/auxiliary feeds, not a generic RV electric-brake-controller output. Air service/emergency hoses and valves are additional systems that need their own checks.

Electric-actuated	Verify controller compatibility, approved current/load and breakaway system.
Electric-over-hydraulic	Verify actuator/control strategy, independent power and breakaway.
Hydraulic surge	Verify mechanical coupler/braking system and reverse lockout if provided.
Pneumatic air	Verify tractor/trailer air equipment, service/emergency circuits and air-brake procedures.

Safety stop: Do not road-test a suspected brake compatibility problem as a way to discover its behavior. Brake and pneumatic verification requires qualified personnel and the equipment-specific procedure.

PHOTO + FIELD REPAIR ATLAS

Actual archive photo | rear connector condition

REAL ATD ARCHIVE IMAGE

VISIBLE IN THE PHOTOGRAPH

Rear-terminal access, exposed conductor ends, multiple wires entering a small housing, and fastening hardware. These are inspection leads, not proof of which electrical function was present on each screw.

REPORTED SEPARATELY

During inspection, exposed wires were reported touching adjacent terminals. A dedicated connector ground path had not yet been verified. The other six-way connection was not fully inspected.

PROVENANCE AND LIMITS

This is an existing ATD archival image reproduced from the prior manual. Its exact vehicle association and wire functions cannot be independently authenticated from this cropped photograph alone. Link it to the original field image, timestamp, asset ID, and repair log before treating it as case-specific proof.

> Do not conclude: "The BCM failed," "the six-way was defective," or "the ground was missing" from this photo. The photograph supports a justified request for mapping, inspection, loaded-ground testing, and documentation.

PHOTO + FIELD REPAIR ATLAS

As-found versus target workmanship

ARCHIVE / AS-FOUND
REAL IMAGE; WIRING AND CIRCUITS UNVERIFIED

CONCEPT / CLEAN REAR
GENERATED IMAGE; NOT THE SAME CONNECTOR

WHAT CHANGES BETWEEN THOSE VIEWS?

The goal is not to make a repair look neat. A safe repair must preserve the correct conductor-to-terminal assignment, eliminate exposed or stray strands, use terminals compatible with the actual connector, retain strain relief, seal the enclosure, and pass functional and loaded measurements.

> Document before AND after: include a wide view showing the truck or trailer, a straight-on mating face, rear terminal close-up, wire identification, ground conductor route, any junction/adapter, and loaded post-repair readings.

Two images side by side do not prove this repair was performed on the same asset.

PHOTO + FIELD REPAIR ATLAS

Select the repair | connector, splice, or junction

The proper repair is determined by where the damage is and what the component manufacturer permits. Different connection styles require different terminals and tools. A marine-grade component alone does not establish suitability in an automotive circuit.

Damaged / overheated housing

Replace connector or OEM-approved pigtail; preserve terminal mapping and seal.

Serviceable screw terminal

Use maker-approved wire termination and clamping method; secure strain relief.

Cut or corroded harness wire

Replace damaged length with same or approved gauge; use specified sealed splice.

Branching / two wires at one screw

Use manufacturer-approved multi-conductor terminal or rated junction arrangement.

Unknown or unverified ground

Identify designed return and verify under load; never improvise a random bolt.

Module, ABS, twisted pair or shield

Consult vehicle/OEM service method; some circuits require specialized repairs.

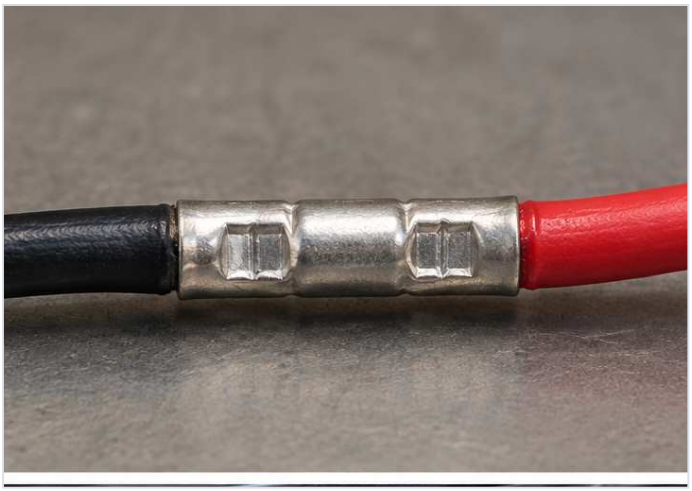
> Do not repair by twisting wires together and wrapping them with tape alone. Avoid unapproved tap splices, uninsulated barrels, unsupported free-hanging joints, and joining two separately controlled lamp outputs into one circuit.

PHOTO + FIELD REPAIR ATLAS

Sealed crimp splice | preparation to protection

1 PREPARE

Power off, confirm circuit ID, sound copper, matching gauge and approved barrel.



2 CRIMP

Insert fully, select maker-specified die/tool, make each required crimp; inspect.

3 SEAL

Apply sized adhesive-lined heat shrink and shielded heat until specified seal forms.

4 ROUTE

Stagger multiple splices, restore conduit, clamps and bend/abrasion protection.

Ford/Motorcraft source: Published wire-splice kits specify correct-size crimp barrels and adhesive-lined heat shrink. Always confirm the repair method permitted for the actual Ford chassis, upfit harness, circuit type, and wire gauge. The photos are conceptual training illustrations.

PHOTO + FIELD REPAIR ATLAS

The failure points | what to catch before release

01 Stray copper or wires touching terminals

Inspect every rear contact with good light; restore separation and appropriate insulation.

02 Loose screw / incorrect terminal style

Use housing/terminal-approved method and installation torque; do not crush strands.

03 Mixed wires under one unlisted terminal

Trace both endpoints, then move any branch to an approved junction/terminal.

04 Corrosion extending under insulation

Replace conductor to sound copper; inspect for wicking and moisture source.

05 No verified trailer ground return

Trace assigned ground through connector and measure return voltage loss under load.

06 Wrong adapter brake/aux mapping

Power off; map both sides before any powered paired test.

07 Splice against sharp metal or moving bed

Support, loom, grommet and separate from hot, moving or abrasive surfaces.

> No part is cleared because it merely looks clean. Verify the exact repaired circuit under its expected command and load. Perform related-function checks to catch cross-feed, backfeed, brake or ground interactions.

PHOTO + FIELD REPAIR ATLAS

After the repair | prove the complete function

Record actual measurements before saying a repair is complete. These steps teach workflow; exact permissible voltage/current levels and brake tests come from the relevant manufacturer.

01 **AS-LEFT PHOTO**
Connector face and rear, grounded routing, correct wire ID and restored seals.

02 **TRUCK 6-WAY ALONE**
Left/right, stop, tail, auxiliary, controller, and loaded return as applicable.

03 **TRUCK 7-WAY ALONE**
Repeat independently; do not copy readings or assume shared relays/ground.

04 **ADAPTER ISOLATED**
Manufacturer/part ID, de-energized map, unintended cross-connection check.

05 **TRAILER INDEPENDENTLY**
Matched tester; lamp functions, appropriate brake/breakaway/ABS verification.

06 **PAIRING UNDER CONTROL**
Secure stationary load checks by qualified personnel; no road-based discovery.

07 **REPEAT UNDER CONDITIONS**
Brake+turn, markers+turn, key states, loaded grounds, interlocks as equipped.

08 **RELEASE / HOLD**
Date, measurements, operator, photo/tester IDs, exact approved pairing and adapters.

> Not verified = not approved. Each modified connector or adapter requires a new baseline. Never equate one trailer test with approval for all interchangeable fleet equipment.

PHOTO + FIELD REPAIR ATLAS

Field photo requests | replace concepts with evidence

These are the exact photos that will strengthen the next edition. Use the original phone files at full resolution, not screenshots of screenshots. Show asset ID/date and a measuring scale where safe.

P1 — **TRUCK OVERVIEW**
Rear bed/hitch with BOTH sockets visible; plate/asset number nearby.

P2 — **6-WAY CONTACT FACE**
Straight-on photo with latch/key at top; macro focus; light off.

P3 — **6-WAY WIRE-ENTRY**
Cover safely removed by technician; all terminal labels and wires in one frame.

P4 — **7-WAY CONTACT FACE**
Straight-on photo of same truck socket; molded marks readable.

P5 — **7-WAY WIRE-ENTRY**
Both before repair and after repair; show screw/strand condition.

P6 — **ADAPTER TWO ENDS**
Face of both connector ends plus manufacturer part number and switch setting.

P7 — **GROUND / JUNCTION**
Assigned return conductor, approved stud, loom, fuses and body junction.

P8 — **GOOD SPLICE EXAMPLE**
Crimp barrel before sealing; finished shrink; supported harness routing.

P9 — **TRAILER CONNECTION**
Trailer ID/plug, back of plug, brake type and breakaway/air hardware.

> How to file: ATD_[asset ID]_[YYYYMMDD]_P5_7WAY_REAR_ASFOUND.jpg. Preserve originals and create a separate edited markup copy. No need to take unnecessary risks to access a rear socket: secure power, vehicle and trailer first.

PHOTO + FIELD REPAIR ATLAS

Sources, photography and publication controls

Technical statements here are training guidance only. Model year and connector shape do not authorize a vehicle-specific wiring, splicing, brake or ground repair. Confirm the current OEM service publications and the installed connector maker before electrical work.

SOURCE REGISTER

FORD / MOTORCRAFT, 2020 wiring pigtail & wire splice kit

Manufacturer source. Applies only within its stated product, vehicle and procedure scope. Reference for training, not proof of an as-installed client circuit.

OPEN MANUFACTURER REFERENCE

FORD, 2021 modifier guide, electrical splices and repairs

Manufacturer source. Applies only within its stated product, vehicle and procedure scope. Reference for training, not proof of an as-installed client circuit.

OPEN MANUFACTURER REFERENCE

CURT, Understanding Towing: connector front/rear references

Manufacturer source. Applies only within its stated product, vehicle and procedure scope. Reference for training, not proof of an as-installed client circuit.

OPEN MANUFACTURER REFERENCE

TE Connectivity, automotive heat shrink and splice sealing

Manufacturer source. Applies only within its stated product, vehicle and procedure scope. Reference for training, not proof of an as-installed client circuit.

OPEN MANUFACTURER REFERENCE

IMAGE PROVENANCE

Reference photos: generated stock-style illustrations by ATD/AI; for appearance only. They may contain simplifications or contact-count errors and must never be used to assign terminals. Field photo: cropped from user-supplied ATD manual archival image; asset and wire function remain unverified. Do not pass reference images off as photographs of the fleet trucks.

> Revision R0.9: This atlas adds photo-forward connector identification, actual as-found evidence, terminal/splice workmanship, and post-repair validation. Existing R0.8 manual contents and electrical safety limitations are retained; no field test or approved compatibility conclusion is created by this publication.

Help improve this manual

This separately versioned review draft preserves all 138 pages of the supplied R0.9 public web derivative and adds this page. Technical content has not been recertified. Do not use illustrative connector drawings to assign physical contacts.

Report an error or suggest an improvement

Email stephenguffey1969@gmail.com with subject ATD TECHNICAL CORRECTION. Include edition, exact filename, page/section/figure, category (safety, technical, clarity, accessibility or addition), supporting source or measured evidence, and proposed correction. Contact details are optional. Do not send private customer records.

Safety-related concern

Put SAFETY in the subject. Stop relying on the disputed instruction until applicable manufacturer information and a qualified reviewer resolve it. Email is not an emergency service and no immediate reply is promised.

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Visit https://v05-review.atd-training-staging.pages.dev/training/#verify and select the downloaded file. SHA-256 and SHA-512 are calculated locally in your browser; the file is not uploaded. Both values must match the separate release manifest. A match proves byte consistency with that manifest, not technical correctness, publisher identity or authenticity.

Revision control

R0.9 remains available unchanged. This R0.9.2 draft is a publication-feedback update only. See the version archive and correction log at https://v05-review.atd-training-staging.pages.dev/training/versions/. Release date: 2026-10-23. No manufacturer endorsement or certification is claimed.