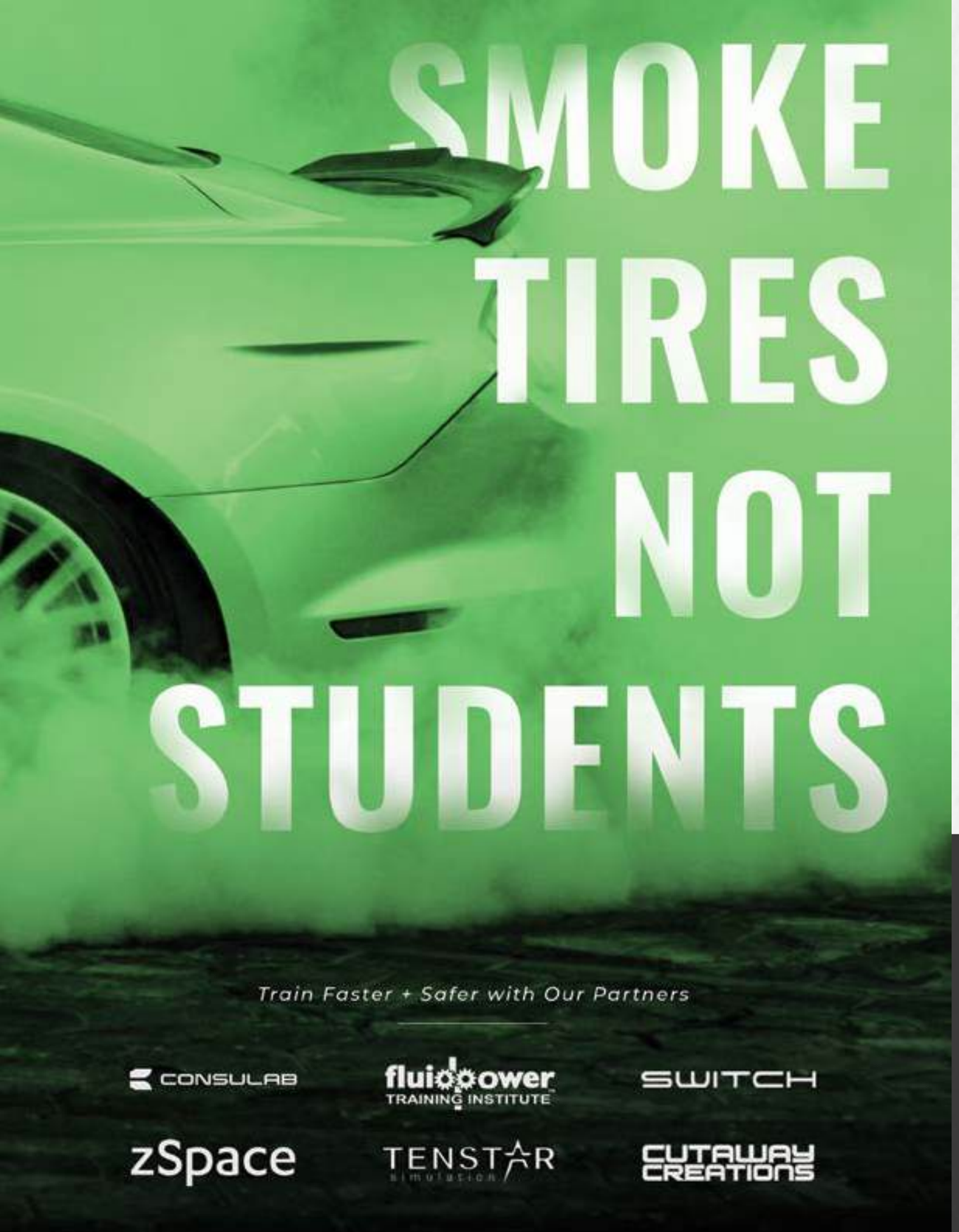
TRANSPORTATION TECH

2025 TRAINING SYSTEM CATALOG



BRINGING THE BEST TO THE WEST

For over 20 years, DAKTIC has worked with industrial training programs throughout the Western United States. We're proud to help build tomorrow's skilled workforce with the best-in-class training equipment and curriculum from our trusted partners.

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YOU NAME IT, WE'LL SOURCE IT

From **hand tools** to **power tools**, and from **diagnostic tools** to **shop equipment**, DAKTIC is your one-stop-shop for everything you need from the brands you trust. Don't waste your time scouring the internet to find what you need - just ask your local rep.

We'll find it for you and help you get it through your school's purchase order process.

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Tesla Model 3 Cutaway
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Electrical Foundations

Classroom Kits

Do your students struggle with basic electricity? Do you have challenges capturing their attention and getting them interested in how basic electricity works? Do you want to equip them with the skills and knowledge necessary to work on today's automobiles (gas-powered, hybrid and electric)? Consulab's Electrical Foundations classroom kits allow you to mix and match up to 12 of our most popular solutions for demonstrating common electrical system components, circuit operation, and diagnostic procedures. Each rolling, lockable cabinet includes storage space for consumables and manuals.

Ohm's Law + DC Circuits

CL-1919-06_053327

The Ohm's Law + DC Circuits trainer from Consulab is the ultimate workhorse for teaching basic electrical theory.

Each training unit includes:

- Digital Readout showing trainer DC voltage
- Built in Fluke meter powered with two AAA batteries
- Adjustable 2KHz pulse width modulation (0-100%)
- Comprehensive curriculum with student activities
- Curriculum covers multi-meter set-up, use and interpretation, electrical component operation and DC circuit construction and operation.

Connector Trainer + Back-probing

CL-1930_053283

Consulab has created an intuitive student-led learning system to practice proper non-destructive back-probing of connectors and components while measuring voltages, resistances, and waveform signals using both oscilloscopes and digital multimeters. A custom ECU provides activities to access and identify voltages and signals by students, and a fault box with nine instructor-led case scenarios allows students to troubleshoot abnormal conditions and identify causes. The included courseware offers up to 25+ hours of instructional time depending on individual instructor preferences.

EV High Voltage Safety

EV-400_053287

The EV-400 EV High-Voltage Safety Trainer represents a fully functional battery electric vehicle (BEV) in a compact classroom sized package. Each unit includes a fault box and a faulty component, allowing diagnostic practice of various scenarios and components in a completely safe, controlled, classroom environment. It provides an intuitive, hands-on experience for high-voltage testing, Personal Protective Equipment (PPE) use, high voltage isolation testing with a mega-ohmmeter, high voltage interlock circuits, first responders' loops, three phase motor control, high voltage power distribution, and much more. (See page 34 for more info.)

Visit **DAKTIC.COM** for pricing and details.

Cutaway Starting System
EM-200-19_052932

Key areas of this fully-functional starter have been cutaway and enclosed in plexiglass to allow safe visual observation of major components during live starter operation. Includes four faults for diagnostic exercises.

EVAP System
EM-200-22_052166

This functional evaporative emissions system shows the cause and effect of having a small and/or large system leak. Students can hookup test equipment to learn how system leaks will affect performance

Functional Cutaway Diesel Starter
EC-510HV_052964

The Consulab EC-510HV Functional Cutaway Diesel Starter Allows students to safely view all internal starter components during live starter operation.

Power Seats
EM-200-05_053246

The EM-200-05 Power Seat System Trainer includes six operational faults, wiring schematics, and student assignments to teach diagnostic exercises.

Electromagnetism Trainer
CL-1902_053242

As vehicles of all makes, models, and classes are depending more and more on electromagnetic systems, understanding the principles of electromagnetism is becoming essential for all future technicians. The CL-1902 Electromagnetism Trainer makes this invisible force visible. Visit **DAKTIC.COM** to watch the demo video.

Includes

- Ready to use in under 5 minutes
- Easy to inventory all included components
- Included courseware offers up to 50+ hours of instructional time
- All components are protected from electrical damage due to incorrect or short-circuit wiring

Classroom Kits Recommended
CL-1902-12_053286

Ask for a classroom kit to get a portable storage cabinet filled with 12 Electromagnetism Trainers. Since we recommend no more than 2 students per trainer, this is the ideal package for typical class sizes.

Visit **DAKTIC.COM** for pricing and details.

Speed + Position Sensors
EM-200-25_052984

Connect up to 18 oscilloscopes or multimeters simultaneously to the Consulab Speed + Position Sensors trainer and guide your students through a set of exercises (included) that will familiarize them with essential diagnostic skills, and demonstrate the effects of speed, sensor wheel shape, air gap, and resistance in cabling on the signal and vehicle operation. Each trainer includes a Hall sensor, two MRE sensors—one with an internal magnet and another with an external magnet—and adjustable air gaps to allow students to observe the operation, diagnosis and testing of the following:

- Crankshaft position sensors
- Camshaft position sensors
- Variable valve timing sensors
- ABS wheel speed sensors (all types)
- RPM and vehicle speed sensors

AESWave uScope Classroom Kit
AES-USCOPE-CLASS

The AES uScope is a single channel, pocket-sized, digital storage oscilloscope (DSO) that is small, quick, and powerful enough to capture the fastest signals. The Classroom Kit includes a uScope master kit for the instructor plus ten uScopes and a signal distribution harness that allows up to 10 students to connect to a single signal source simultaneously.

Advanced Electronics
MD-4000-22_053343

Part of Consulab's MD-4000 Series, the Advanced Electronics kit features 15 modules, including:

- Resistors (4)
- Capacitors (4)
- Potentiometer
- 12VDC 5-pin ISO Relay
- NCT thermistor
- Ultrasonic Sensor
- DPDT toggle switches (2)
- Fan
- Solenoid
- Diodes
- Optical sensors (3)
- Transistors

Drivability Electronics
MD-4000-23_053344

Part of Consulab's MD-4000 Series, the Drivability Electronics kit features 15 modules, including:

- 12VDC 5-pin ISO Relay
- Variable Reluctance Sensor
- MAP sensor
- TP Sensor
- Hall Effect Sensor
- ECT thermistor
- Piezo Knock Sensor
- Magnetic Resistive (2-wire ABS) Sensor
- Injector
- Optical sensors (3)

HVAC Electronics
MD-4000-24_053345

Part of Consulab's MD-4000 Series, the HVAC Electronics kit features:

- 12VDC 5-pin ISO Relay
- NCT Thermistor
- High Pressure Switch
- Sunload Sensor
- Windshield Temperature + Inside Moisture Sensor
- In-vehicle Temperature and Humidity Sensor
- PTC Thermistor
- Fan
- Air Door Actuator
- Transistors

Visit **DAKTIC.COM** for pricing and details.

Faultable Lighting + CAN Bus Trainers

1918 Series

Teach modern automotive lighting systems through student-driven learning exercises on Consulab's faultable lighting and CAN Bus trainers. Students develop their understanding of the system by wiring all circuits themselves, then they diagnose open circuits, short circuits, ground faulted circuits, and high resistance circuits that require voltage drop testing to verify. And with the included courseware, they'll learn everything from Ohm's law and basic circuits to advanced, relay controlled, power side- and ground side-controlled circuits.

Key Features

- 12 real-world faults at the push of a button
- Available as single-sided or double-sided trainers
- Plexiglass panels for OEM component visibility
- Diagnostic test terminals
- Connection points are protected against incorrect wiring
- Instrument cluster section
- Turn signal switch
- Brake switch
- Hazard switch
- Backup switch
- Headlamp switch
- SAE J1939 protocol on CAN Bus modules

Available Models

- Automotive Lighting
- Heavy Vehicle Lighting
- CAN Bus Multiplexing
- HVAC Electronics
- Drivability Electronics
- Advanced Electronics
- Any Double-Sided Combination

CAN Bus Diagnostic Trainer

MP-750_052808

Do your students have difficulty understanding the operation of Multiplex and CAN Bus systems? Do you have access to vehicles that allow you to easily teach the operation, diagnosis and repair of CAN Bus circuits? The MP-750 Multiplex Network Diagnostic Trainer was designed from the ground up to assist you with these difficult tasks. The MP-750 is a fully functional CAN Bus trainer based on a Honda vehicle platform.

Includes

- Full curriculum package with student assignments and instructors answer keys
- 12 real-world faults for diagnostic and repair exercises
- Engine systems respond to inserted faults with real world symptoms, OEM DTC's, scan tool datastream changes and check engine light operation
- DLC provides full access for scan tool and oscilloscope testing access
- Functional Multiplex & CAN Bus systems with 11 system modules
- All OEM vehicle lighting, entertainment, and accessories systems
- Functional Honda F (CAN Hi/Lo), B and K-line circuits
- Entertainment (Radio, CD/DVD, Bluetooth), Immobilizer, Alarm
- OEM Instrument panels with gauges
- Multi-Information, HVAC and Entertainment dashboard displays
- Wipers, Horn, Power Door Locks, Mirrors and Windows
- Operational vehicle doors with electrical controls
- OBDII data link connector with matching OEM terminal identification and wire colors

SRS Restraints + Air Bag Diagnostic Trainer

EM-300-07_053249

With the help of 26 system faults and inert, pre-detonated inflators, the Consulab SRS Restraints + Air Bag Diagnostic Trainer will help your students safely learn essential diagnostic skills for working with supplemental restraint systems and their related sensors. And since every OEM connector has its own test points and a connector disconnect/connect switch, it's built to withstand years of heavy use.

Key Features

- Fully-functional CAN Bus network
- The 26 insertable faults trigger OEM DTC's (diagnostic trouble codes).
- No codes, no SRS light until faults are inserted
- Diagnosed using OEM service procedures
- Simulate passenger weight to apply weight to the seat occupant sensors
- Easy removal of all impact sensors
- DLC (Diagnostic Link Connector) + breakout box with indicator lights

Comprehensive Vehicle Electrical Trainer

MF900-VETS

FPTI™ is proud to launch the most comprehensive vehicle electrical training system on the planet: the brilliant, all encompassing MF900-VETS. You would have to purchase at least five individual trainers from one, or more, suppliers to achieve the MF900's stunning capability.

System Includes

- Touchscreen computer with interactive course materials, faults, J1939 messages
- 12V starter with cold and hot start selection,
- Side panel with LED's and Incandescent Lights.
- Multi-function switch with steering wheel.
- Wiper Motor
- Automotive panel with gauges and indicators
- Power distribution module with relays and fuses
- Standard automotive switches and R-ladder switches
- Three electronics modules for the multiplexing system
- CAN bus (J1939) and OBD-II available for troubleshooting
- Magnetic and Hall effect speed sensors
- Coolant temperature and oil pressure sensors
- TPS sensor on main panel
- Battery and alternator current sensors to monitor charging and crank current

Visit **DAKTIC.COM** for pricing and details.

Next-Gen Meters
DYVO-CLASS

DYVO makes it easier and to understand and troubleshoot 12-volt automotive systems. It combines the best of a voltmeter, test light and ohmmeter, all in one easy to use device. Voltage, open circuits, short circuits, and resistance problems are just the beginning. Get a 5% volume discount when you buy a classroom package of 12 DYVO Pro Kits through DAKTIC.

Can your meter do what DYVO does?

- Loads/stresses circuits for accurate results
- Test two circuits at the same time
- Indicate circuit condition via LED color
- See voltage loss or voltage available without moving leads
- Operate with simple one-button control
- Show live battery status with warning alerts while testing
- Switch between low-impedance and high-impedance modes
- Combine multimeter and test light in one device
- Automatic voltage drop comparisons to battery

How does DYVO work?

- Connect DYVO to the vehicle's battery
- Connect DYVO to the circuits you want to test
- DYVO displays the results with LED indicators

DYVO Circuit Defect Trainer
DYVO-CDT

Demystify electrical problems and allow your students to jump right into electrical testing to build essential skills and confidence right away, rather than getting bogged down in electrical theory, formulas, laws, and rules. Plus, the 36 fault combinations built into every trainer will keep them busy troubleshooting with the included DYVO next generation meter or whatever multimeter you have on hand.

MagMat Training Systems
SBC Training

Designed to make teaching basic electrical theory and troubleshooting simple and fun, each kit includes a set of magnetized electrical/electronic modules and simplified circuits printed on magnetic mats (MagMats). Students build their circuits directly on each mat, and since each module can be faulted, each circuit can provide hours of troubleshooting practice. Order a classroom kit of 12 MagMat trainers, bug some modules, and let your students compete!

Series-Parallel Kits
MMTS-SPC

- 2 Magnetic Mats (Series Circuit/Ohm's Law, and Series Parallel Circuit)
- 2 Steel base plates
- 2 Battery Module (digital volt meter + display)
- 6 Wire Modules
- 1 Spice-LT Module
- 1 Splice-RT Modules
- 12V power supply
- 2 LEDs (19mm)
- 2 LEDs (12mm)
- 2 Latching Switches
- 2 Splice Modules
- 1 Power Supply with Magnetic Base (12V)
- 8 AA batteries
- Spare Modules Bases
- Spare Jumpers
- Pliers
- 2mm Allen Key

ECU Turn Signal Kits
MMTS-ETS

ECU Turn Signal Kits include all the modules from the Series-Parallel Circuit Trainer plus the following additional modules for teaching more advanced electrical/electronics principles:

- 1 ECU Turn Signal Wiring Diagram
- 1 ECU with Two B+ and One B- Input Driver
- 1 Fuse Block with Replaceable 5 Amp Fuse
- 1 Three-Way Switch Block

OEM Turn Signals (Optional Add-Ons)

- Tesla Model 3 Blinker Circuit (2023)
- Ford F-150 Blinker Circuit (2023)
- Honda Civic Blinker Circuit (2023)
- Chevrolet Camero 3 Blinker Circuit (2023)
- Custom Blinkers Circuits (Upon Request)

Visit **DAKTIC.COM** for pricing and details.

A6
ELECTRICAL + ELECTRONICS

	MAST - 1200 Hours	AST - 840 Hours	MLR - 540 Hours	CL-1919	CL-1918	CL-1930	EM-140S HY03	EM-140S GM04A	EM-200-25	EM-300-07	EV-360	MD-4000-22	MD-4000-23	MD-4000-24	MP-1918	MP-750
A. General																
1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS).	P-1	P-1	P-1				X	X								X
2. Identify electrical/electronic system components and configurations.	P-1	P-1	P-1	X	X	X	X	X	X	X		X			X	X
3. Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed.	P-1	P-1	P-1				X	X								X
4. Perform calibration/recalibration, initialization, or relearn procedures as required.	P-1	P-1	P-1	X	X		X	X	X	X		X	X	X	X	X
5. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).	P-1	P-1	P-1	X	X		X	X	X	X		X	X	X	X	X
6. Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow and resistance.	P-1	P-1	P-1	X	X	X	X	X		X		X	X	X	X	X
7. Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits.	P-1	P-1	P-1	X	X	X	X	X				X	X	X	X	
8. Describe precautions related to the use of test lights.	P-3	P-3	P-3	X	X		X	X							X	
9. Use fused jumper wires to check operation of electrical circuits per service information.	P-1	P-1	P-2	X	X		X	X	X			X	X	X	X	X
10. Use wiring diagrams during the diagnosis of electrical/electronic circuit problems.	P-1	P-1	P-2	X	X	X	X	X							X	X
11. Diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine needed action.	P-1	P-1	P-2	X	X		X	X				X	X		X	X
12. Inspect and test fusible links, circuit breakers, and fuses; determine needed action	P-1	P-1	P-2				X	X								
13. Inspect, test, repair, and/or replace components, connectors, terminals, harnesses, and wiring in electrical/electronic systems (including solder repairs); determine needed action.	P-1	P-2		X			X	X	X	X		X	X	X	X	X
14. Test and measure circuit using an oscilloscope and/or graphing multimeter (GMM); interpret results; determine needed action.	P-1	P-2		X	X	X	X	X	X			X	X	X	X	X
B. Batteries (Low Voltage)																
1. Perform battery state-of-charge test; determine needed action.	P-1	P-1	P-1				X	X								
2. Confirm proper battery capacity, size, type, and application for vehicle; perform battery capacity and load test as recommended by manufacturer; determine needed action.	P-1	P-1	P-1				X	X								
3. Maintain or restore electronic memory functions as recommended by manufacturer.	P-2	P-2	P-2													X
4. Inspect and clean battery; check battery cables, connectors, clamps, and hold-downs.	P-1	P-1	P-1				X	X								
5. Perform battery charging according to manufacturer's recommendations.	P-1	P-1	P-1				X	X								
7. Identify electrical/electronic modules, security systems, radios, and other accessories that require reinitialization or code entry after reconnecting vehicle battery.	P-2	P-2	P-2				X	X							X	X
C. Starting System (Low Voltage)																
1. Perform starter current draw test; determine needed action.	P-1	P-1	P-1				X	X								
2. Perform starter circuit voltage drop tests; determine needed action.	P-1	P-1	P-1				X	X								
3. Inspect and test starter relays and solenoids; determine needed action.	P-2	P-2	P-2				X	X								
5. Inspect and test switches, connectors, and wires of starter control circuits; determine needed action.	P-1	P-1	P-2	X			X	X								
6. Demonstrate knowledge of automatic idle-stop/start-stop system that uses a low-voltage starter to restart the engine.	P-1	P-1	P-2					X								
7. Differentiate between electrical and engine mechanical problems that cause a slow-crank or a no-crank condition.	P-1	P-2					X	X								
8. Diagnose a no-crank condition using a wiring diagram and test equipment; determine needed action.	P-1	P-2					X	X								

	MAST - 1200 Hours	AST - 840 Hours	MLR - 540 Hours	CL-1919	CL-1918	CL-1930	EM-140S HY03	EM-140S GM04A	EM-200-25	EM-300-07	EV-360	MD-4000-22	MD-4000-23	MD-4000-24	MP-1918	MP-750
D. Charging System (Low Voltage)																
1. Perform charging system output test; determine needed action.	P-1	P-1	P-1				X	X								
2. Inspect, adjust, and/or replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment; determine needed action.	P-1	P-1	P-1				X	X								
4. Perform charging circuit voltage drop tests; determine needed action.	P-1	P-1	P-2				X	X								
5. Diagnose charging system for causes of undercharge, no-charge, or overcharge conditions; determine needed action.	P-1	P-1					X	X				X				
E. Lighting Systems																
1. Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); determine needed action.	P-1	P-1	P-1	X	X							X			X	X
2. Aim headlights.	P-2	P-2	P-2													X
3. Diagnose the causes of brighter-than-normal, intermittent, dim, or no light operation; determine needed action.	P-1	P-1		X	X							X			X	X
F. Instrument Cluster and Driver Information Systems																
1. Verify operation of instrument panel gauges and warning/indicator lights; reset maintenance indicators as required.	P-1	P-1	P-1				X	X							X	X
2. Inspect and test gauges and gauge sensors/sending units for causes of abnormal readings; determine needed action.	P-1	P-2					X	X							X	X
3. Diagnose the causes of incorrect operation of warning devices and other driver information systems; determine needed action.	P-1	P-2					X	X				X				X
G. Body Electrical Systems																
1. Diagnose vehicle comfort, convenience, access, safety, and related systems operation; determine needed action	P-2	P-2	P-3									X		X		
2. Remove and reinstall door panel.	P-1	P-1	P-2													X
3. Diagnose operation of security/anti-theft systems and related circuits (such as: theft deterrent, door locks, remote keyless entry, remote start, and starter/fuel disable); determine needed action.	P-1	P-2	P-3													X
4. Describe disabling and enabling procedures for supplemental restraint system (SRS); verify indicator lamp operation.	P-1	P-1	P-2						X							X
5. Verify windshield wiper and washer operation; replace wiper blades.	P-1	P-1	P-1													
6. Diagnose operation of entertainment/infotainment systems and related circuits (such as: radio, DVD, navigation, amplifiers, speakers, antennas, and voice-activated accessories); determine needed action.	P-2	P-2						X								X
7. Diagnose operation of safety systems and related circuits (such as: horn, airbags, seat belt pretensioners, occupancy classification, wipers, and washers; determine needed action.	P-1	P-2							X							
8. Diagnose body electronic systems circuits using a scan tool; check for module communication errors (data communication bus systems); determine needed action.	P-1	P-2														X
9. Describe the process for software transfer, software updates, or reprogramming of electronic modules.	P-1	P-2					X	X								X
10. Demonstrate knowledge of advanced driver assistance systems (ADAS) and related circuits (such as: speed control/collision avoidance, heads-up display, parking assist, and back-up camera)	P-2									X						
11. Recalibrate a vehicle's advanced driver assistance system (ADAS).	P-2															
G. xEV Systems (See Hybrid/EV section of this catalog)																

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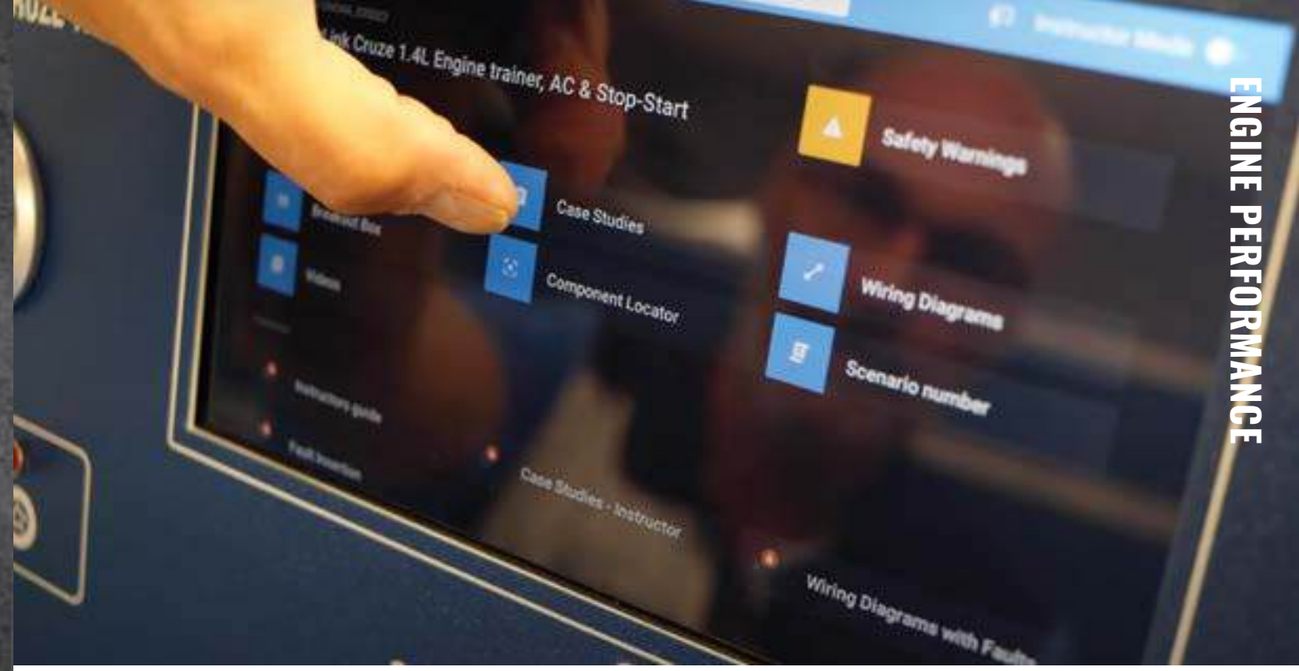
Visit **ASEEDUCATIONFOUNDATION.ORG/RESOURCES** for a complete task list.

T6
ELECTRICAL + ELECTRONICS

	IMMR	TST	MTST	CL-1902	CL-1919-06	CL-1930	EC-510HV	HV-1918	MD-4000-22	MD-4000-23	MD-4000-24	MP-1918
A. General												
1. Research vehicle service information, including vehicle service history, service precautions, and technical service bulletins.	P-1	P-1	P-1	X			X	X	X	X	X	X
2. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).	P-1	P-1	P-1	X	X		X	X	X	X	X	X
3. Demonstrate operation and proper use of digital multimeters and other test equipment when measuring source voltage, voltage drop (including grounds), current flow, continuity, and resistance.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
4. Demonstrate knowledge of the causes and effects of shorts, grounds, opens, and resistance problems in electrical/electronic circuits; identify and locate faults in electrical/electronic circuits.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
5. Use wiring diagrams during the diagnosis (troubleshooting) of electrical/electronic circuit problems.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
6. Measure parasitic (key-off) battery drain; determine needed action.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
7. Demonstrate knowledge of the function, operation, and testing of fusible links, circuit breakers, relays, solenoids, actuators, diodes, and fuses; perform inspection and testing; determine needed action.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
9. Use appropriate electronic service tool(s) and procedures to diagnose problems; check and record diagnostic codes; interpret digital multimeter (DMM) readings; clear diagnostic codes when appropriate.	P-1	P-1	P-1									X
10. Check for malfunctions caused by faults in the data bus communications network.	P-2	P-2	P-2									X
11. Identify electrical/electronic system components and configuration.	P-2	P-2	P-2	X	X	X	X	X	X	X	X	X
12. Demonstrate operation and proper use of oscilloscopes to check frequency, pulse width, and waveforms of electrical/electronic signals; interpret readings; determine needed repairs.		P-2	P-2	X	X	X	X	X	X	X	X	X
13. Demonstrate understanding of the process for software transfer, software updates, and/or reprogramming of electronic modules.			P-3									X
B. Battery System												
2. Confirm proper battery capacity for application; perform battery state-of-charge test; perform battery capacity test, determine needed action.	P-1	P-1	P-1				X					
3. Inspect and clean battery, battery cables, connectors, battery boxes, mounts, and hold-downs; service, repair, or replace as needed.	P-1	P-1	P-1				X					
C. Starting System												
1. Demonstrate understanding of starter system operation.	P-1	P-1	P-1				X					
2. Perform starter circuit cranking voltage and voltage drop tests; determine needed action.	P-1	P-1	P-1				X					
3. Inspect and test starter control circuit switches (key switch, push button, and/or magnetic switch), relays, connectors, terminals, wires, and harnesses (including over-crank protection); determine needed action.	P-1	P-1	P-1				X					
4. Diagnose causes of no-crank or slow crank condition; differentiate between electrical and engine mechanical problems; determine needed action.		P-1	P-1				X					
5. Perform starter current draw tests; determine needed action.		P-3	P-3				X					
D. Charging System												
4. Inspect cables, wires, and connectors in the charging circuit including remote sense circuit; determine needed action.	P-1	P-1	P-1				X					
5. Perform charging system voltage and amperage output tests; perform AC ripple test; determine needed action.	P-1	P-1	P-1									
6. Perform charging circuit voltage drop tests; determine needed action.		P-1	P-1				X	X	X	X	X	X
7. Remove, inspect, and/or replace generator (alternator).		P-2	P-2									
E. Lighting Systems												
1. Diagnose causes of brighter-than-normal, intermittent, dim, or no-light operation; determine needed action.	P-1	P-1	P-1	X	X	X	X	X	X	X	X	X
2. Test, replace, and aim headlights.		P-3	P-3					X				X
3. Inspect cables, wires, and connectors in the lighting systems.		P-1	P-1		X	X		X	X	X	X	X
4. Diagnose faults in tractor-to-trailer multi-wire connector(s), cables, and holders; determine needed action.		P-1	P-2					X				
5. Diagnose faults in switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, and control components/modules of exterior lighting systems; determine needed action.		P-2	P-2		X			X	X	X	X	X
6. Diagnose faults in switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, and control components/modules of interior lighting systems; determine needed action.		P-2	P-2		X			X	X	X	X	X
7. Diagnose faults in switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, and control components/modules of auxiliary lighting circuits; determine needed action.		P-2	P-2		X			X	X	X	X	X
F. Instrument Cluster and Driver Information Systems												
1. Check gauge and warning indicator operation.	P-1	P-1	P-1									X
2. Diagnose faults in the sensor/sending units, gauges, switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, printed circuits, and control components/modules of the instrument cluster, driver information systems, and warning systems; determine needed action.	P-2	P-2	P-2									X
G. Cab and Chassis Electrical Systems												
1. Diagnose operation of horn(s), wiper/washer, and occupant restraint systems.		P-1	P-1						X	X	X	
2. Demonstrate knowledge of the operation of advanced driver assistance systems (ADAS) and related circuits (such as: speed control, collision avoidance, lane departure warning and assist, and camera systems).		P-3	P-3									X
3. Demonstrate knowledge of comfort and convenience systems and related circuits (such as: power windows, power seats, power locks, remote keyless entry, steering wheel controls, and cruise control).		P-3	P-3						X	X	X	X
4. Demonstrate knowledge of entertainment systems and related circuits (such as: radio, DVD, navigation, speakers, antennas, and voice-activated accessories).		P-3	P-3									X
5. Demonstrate knowledge of power inverter, protection devices, connectors, terminals, wiring, and control components/modules of auxiliary power systems.		P-3	P-3									X
6. Demonstrate knowledge of telematics systems.		P-3	P-3									X
H. Electrified Vehicle High Voltage Safety (See Hybrid/EV section of this catalog.)												

Visit **ASEEDUCATIONFOUNDATION.ORG/RESOURCES** for a complete task list.



ENGINE PERFORMANCE

ConsuLink Faultable Engine Performance Trainers
EM-140S-GM06A_053338

Consulab engine trainers are much more than just a running engine on a stand. Every trainer allows you to insert faults into the engine performance system at the push of a button. And with the new ConsuLink™ (Patent Pending) touchscreen, students can initiate case studies that include everything they need to experience and diagnose real-world engine performance problems on modern automotive technology.

Available Models

- GM Trainer with GDI, HVAC, + Start/Stop (Pictured)
- Hyundai Trainer with GDI
- Dodge Ram/Cummins
- Cummins B6.7 EPA 2021

Student-Driven Case Studies

Simply tell your students to start a predefined case study using the touchscreen on the engine trainer dashboard, and the ConsuLink student Learning Platform will automatically insert the right set of faults into the system. The engine will produce all the engine performance symptoms associated with that fault, giving your student a chance to develop essential diagnostic skills.

Integrated Service Information

Every engine performance trainer equipped with a ConsuLink Student Learning Platform puts all the essential information your student will need to successfully complete each diagnostic case study. Safety warning, operation manuals, wiring schematics, pin numbers, breakout box pinouts, component locator diagrams, and videos on scan tool usage - it's all there at their fingertips.

Future-Proof Diagnostic Skills

In a roundtable discussion hosted by DAKTIC and Consulab, reps from Tesla, Ford, Toyota, Cummins, and Jaguar Land-Rover all agreed: developing strong diagnostic skills was crucial to success in an increasingly electrified transportation industry. While technology is changing at top speed, the skills developed with a ConsuLink engine performance trainer will only become more valuable in the years to come.

Visit **DAKTIC.COM** for pricing and details.

Engine Trainers + Electronic Programmable Fault Box

EM-140C-FD04A_035012, HV-950-QSB_035106

While the engine trainers listed below don't include the game-changing ConsuLink touchscreen, they still feature the Consulab Electronic Programmable Fault Box that so many instructors worldwide depend on. Install the free software on any PC laptop, connect it to the engine trainer Fault Box, and set your own combination of faults for student diagnostic exercises.

Automotive Models

- Ford Fusion + Optional AC
- Honda Civic + Optional AC
- Toyota Corola + Optional AC

Heavy Vehicle Models

- Cummins QSB6.7 Tier 4F
- Cummins X15 EPA 2017
- CAT C4.4 Tier 4F
- CAT C7.1 Tier 4F
- DD15/DD16 EPA 2013

Light Diesel Models

- Ford Powerstroke
- GM Duramax

Consulab Electronic Programmable Fault Boxes

EM-250-2A

Consulab trainers give you the chance to teach engine performance and current emissions technology using an Electronic Programmable Fault Box to create real-world diagnostic opportunities. Insert open, variable, and intermittent faults one at a time, or in combination with one another.

Faultable HV Components

- ECT - Engine Coolant Temp
- IAT - Intake Air Temp
- MAP - Manifold Absolute Pressure
- FTP - Fuel Tank Pressure Sensor
- INJ - Fuel Injector #1
- FP - Fuel Pump relay coil
- CKP - Crankshaft Position Sensor
- VENT - Canister close valve
- Purge - Purge control solenoid valve
- CAN - Controller Area Network High Circuit
- IAC - Idle Air Control
- CVVT - Continuously Variable Valve Timing
- TPS - Throttle Position Sensor
- HO2S 1 - Heated Oxygen Sensor 1
- HO2S 2 - Heated Oxygen Sensor 2

Faultable Automotive Components

- ECT - Engine Coolant Temp
- IAT - Intake Air Temp
- MAP - Manifold Absolute Pressure
- INJ - Fuel Injector #1
- FP - Fuel Pump relay coil
- CKP - Crankshaft Position Sensor
- CMP - Camshaft Position Sensor
- EVAP - Evap. Emission Canister Purge Solenoid
- CAN - CAN High Circuit (Select Models)
- CVVT - Continuously Variable Valve Timing
- HO2S 1 - Heated Oxygen Sensor 1
- HO2S 2 - Heated Oxygen Sensor 2

Fuel Injection + Engine Mgmt.
EM-330-1_052616

This OEM Fuel Injection + Engine Management system functions as in a real automobile, but uses non-flammable fluid instead of gasoline for safety and educational purposes. Students can adjust the sensor inputs to observe the changes in performance using DMM, Scanner or DSO.

Includes

- Adjustable sensor inputs
- OEM components, wiring, connectors + wire colors
- Most engine input sensors and output actuators
- Return type fuel system with pressure regulator
- COP (Coil-On-Plug) ignition system
- ECM breakout box with test receptacles for test equipment hookup
- OBDII data link connector

Cutaway Diesel Aftertreatment
EC-490_053131

The Consulab EC-490 helps students to visualize the inner workings of a diesel exhaust aftertreatment system, using LED's and electronic controls to help learners understand the function, and effect on, diesel engine exhaust gases following the combustion cycle. Multiple colored LED's represent the gases as they flow in the exhaust system and demonstrates the chemical reactions within each of the aftertreatment processes. Instructor can select an automatic mode which cycles through all chemical reactions or a manual mode to go through the stages step-by-step.

Includes

- Catalysts, filters, dosing valve and sensors
- Adjustable speed progression of LED's allows for customization to your student exercises
- Compact design fits all classrooms and labs
- Clear protective cover over the system to prevent contact with catalyst materials

Cutaway Starting System
EM-200-19_052932

Key areas of this fully-functional starter have been cutaway and enclosed in plexiglass to allow safe visual observation of major components during live starter operation. Includes four faults for diagnostic exercises.

EVAP System
EM-200-22_052166

This functional evaporative emissions system shows the cause and effect of having a small and/or large system leak. Students can hookup test equipment to learn how system leaks will affect performance.

Connector Trainer + Backprobing
CL-1930_053283

Teach non-destructive back-probing of connectors and components with the CL-1930. A custom ECU allows students to identify voltages and signals, and a fault box with nine scenarios allows students to troubleshoot abnormal conditions and identify causes. Curriculum offers up to 25+ hours of instructional time depending on instructor preferences.

Custom Cutaways
Cutaway Creations

Looking for a cutaway to help you teach engine performance? DAKTIC has partnered with Cutaway Creations to create showroom-quality cutaways built to your specifications. Visit **daktic.com/cutaway-creations** to learn more.

Visit **DAKTIC.COM** for pricing and details.

Faultable Starting Stations + Swivel Stands

EM-145S-GM05_053331

Rebuild a set of matching engines on a swivel stand that attaches to a faultable starting station from Consulab. These packages are so efficient that you only need one starting station for every five engines and swivel stands. And once you've confirmed the engine was reassembled correctly, you can use the included Electronic Programmable Fault Box for engine performance diagnostic exercises as well.

Key Features

- Matching Engines Included
- Test Start Rebuilt Engines
- Swap out up to 5 Engines per Starting Station

Diesel Repair Trainer - Kubota 2-Cylinder

HV-145S-KB02_053277

Teach the fundamentals of diesel engines by rebuilding a set of matching Kubota 2-cylinder engines on a swivel stand that can be easily attached to a Consulab starting station. These packages are so efficient that you only need one starting station for every five engines and swivel stands.

Exercises Include

- Engine Identification
- Cylinder Head Removal
- Cylinder Head Inspection
- Valve Train Inspection
- Cylinder Block Inspection
- Piston Removal, Inspection and Measurement
- Crankshaft Removal, Inspection and Measurement
- Crankshaft Inspection, Measurement and Installation
- Piston Cleaning, Lubrication and Installation
- Cylinder Head Installation

Visit **DAKTIC.COM** for pricing and details.

Mechanical Faults Trainer

EM-141S-TY01_053234

Have you ever wanted a running engine with repeatable mechanical faults that all of your students could diagnose? Would you like an engine system that has internal mechanical faults not requiring you to reinsert and repair them after each student use? The EM-141S-TY01 does exactly that.

Key Features

- Engine, transmission and complete assembly of components
- Functional Electronic Throttle Control, Catalytic Converter and Variable Valve Timing systems
- Full curriculum package with student assignments + instructor answer keys

Cutaway Starting System

EM-200-19_052932

Key areas of this fully-functional starter have been cutaway and enclosed in plexiglass to allow safe visual observation of major components during live starter operation. Includes four faults for diagnostic exercises.

DAKTIC Universal Run Stand

DAK-URS

The DAKTIC Universal Run Stand was developed with the help of Cutaway Creations. We worked together to ask our customers what they were looking for in an run stand, and then build something that captures all of the most popular features in an American-made run stand that can be adapted to fit most any internal combustion engine.

The standard configuration will fit **any Chevrolet big block (as shown BBC w 6L90), small block, LS, LT** as well as many others that take the cross bolt style front mount, and the threaded uprights allow you to build your own for future engines that have different configuration. But if you believe you need further customizations, contact us at sales@daktic.com and we'll work with you to deliver a stand that fits your engine combination at the time of delivery.

Key Features

- Fabricated, Wired, and Assembled in the U.S.A.
- Adjustable Rear Bell Housing Mount System (Pre Drilled for GM on one side of each bracket, others available)
- Adaptable to All American V8 Engines
- Adaptable to most Light and Medium-Duty Diesel Engines
- Custom Brackets for Other Engines Available
- Test run and or heat cycle most auto and diesel engines with or without transmission attached (Depending on length)

Multi-Position Dash Panel

- Tachometer
- Coolant Temp Gauge with sender
- Oil Pressure Gauge with sender
- Vacuum/Boost Gauge Mechanical
- Voltmeter
- Throttle Lever
- Accy Switch
- Fan Switch
- Keyed Ignition
- Emergency Stop

Visit **DAKTIC.COM** for pricing and details.

A8
ENGINE PERFORMANCE

	MAST - 1200 Hours	AST - 840 Hours	MLR - 540 Hours	CL-1930	EM-140C ALL	EM-140S-HY04	EM-140S-GM06A	EM-141S + EM-145S	EM-200-14	EM-200-22	EM-200-25	EM-330-1
A. General												
1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS).	P-1	P-1	P-1		X	X	X	X	X	X		X
2. Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed.	P-1	P-1	P-1		X	X	X	X				X
3. Verify proper engine cooling system operation; determine needed action.	P-1	P-1	P-1		X	X	X	X				
4. Verify correct camshaft timing including engines equipped with variable valve timing (VVT) systems; determine needed action.	P-1	P-1	P-1		X	X	X	X				
5. Identify and interpret engine performance concerns; determine needed action.	P-1	P-1			X	X	X	X				
6. Diagnose abnormal engine noises or vibration concerns; determine needed action.	P-2	P-3			X	X	X	X				
7. Diagnose the cause of excessive oil consumption, coolant consumption, unusual exhaust color, odor, and sound; determine needed action.	P-2	P-2						X				
8. Perform engine manifold pressure tests (vacuum/boost); determine needed action.	P-1	P-1			X	X	X	X				
9. Perform cylinder power balance test; determine needed action.	P-1	P-2			X	X	X	X				
10. Perform cylinder cranking and running compression tests; determine needed action.	P-1	P-1			X	X	X	X				
11. Perform cylinder leakage test; determine needed action.	P-1	P-1			X	X	X	X				
B. Computerized Controls												
1. Identify computerized control system components and configurations.	P-1	P-1	P-1		X	X	X	X	X			X
2. Access and use service information to perform step-by-step (troubleshooting) diagnosis.	P-1	P-1			X	X	X	X	X	X		X
3. Perform active tests of actuators using a scan tool; determine needed action.	P-1	P-1			X	X	X	X				
4. Demonstrate knowledge of OBD readiness flags, monitors, and drive cycle for repair verification.	P-1	P-1			X	X	X	X		X		
5. Inspect and test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, and circuits using a graphing multimeter (GMM), digital storage oscilloscope (DSO), and/or scan tool; determine needed action.	P-1	P-2		X	X	X	X	X	X		X	X
6. Describe the process for reprogramming or recalibrating the powertrain/engine control module (PCM/ECM).	P-1	P-1			X	X	X	X				
7. Diagnose the causes of emissions or driveability concerns with stored or active diagnostic trouble codes (DTC); obtain, graph, and interpret scan tool data.	P-1				X	X	X	X				X
8. Diagnose emissions or driveability concerns without stored or active diagnostic trouble codes; determine needed action.	P-1				X	X	X	X				
9. Diagnose driveability and emissions problems resulting from malfunctions of interrelated systems (cruise control, security alarms, suspension controls, traction controls, HVAC, automatic transmissions, non-OEM installed accessories, or similar systems); determine needed action.	P-2						X					
C. Ignition System												
1. Identify ignition system components and configurations.	P-1	P-1	P-1		X	X	X	X	X			X
2. Remove and replace spark plugs; inspect secondary ignition components for wear and damage; determine needed action.	P-1	P-1	P-2		X	X	X	X				
3. Diagnose no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns related to ignition system problems; determine needed action.	P-1	P-2			X	X	X	X	X		X	X
4. Inspect and test crankshaft and camshaft position sensor(s); determine needed action.	P-1	P-2			X	X	X	X	X		X	X
5. Inspect, test, and/or replace ignition control module and/or powertrain/engine control module; reprogram/initialize as needed.	P-2	P-2			X	X	X					
D. Fuel, Air Induction, and Exhaust Systems												
1. Identify fuel, air induction, and exhaust system components and configurations.	P-1	P-1	P-1		X	X	X	X				X
2. Replace fuel filter(s) where applicable.	P-3	P-3	P-3									
3. Inspect, service, or replace air filters, filter housings, and intake duct work.	P-1	P-1	P-1		X	X	X	X				
4. Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields for leaks and unmetered air; determine needed action.	P-1	P-1	P-1		X	X	X	X				
5. Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; determine needed action.	P-1	P-1	P-1		X	X	X	X				
6. Check and refill diesel exhaust fluid (DEF).	P-3	P-3	P-3									
7. Check fuel for quality, composition, and contamination; determine needed action.	P-1	P-2			X	X	X	X				
8. Inspect and test fuel pump(s) and pump control system for pressure, regulation, and volume; determine needed action.	P-1	P-1			X	X	X	X				
9. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.	P-1	P-1			X	X	X	X				
10. Inspect, test, and/or replace fuel injectors on low- and high-pressure systems.	P-1	P-2				X	X	X				X
11. Verify proper idle speed; determine needed action.	P-1	P-1			X	X	X	X				X
12. Perform exhaust system back-pressure test; determine needed action.	P-2	P-2			X	X	X	X				
13. Demonstrate knowledge of the operation of turbocharger/supercharger systems.	P-2	P-2			X	X	X	X				X
14. Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, engine run-on, and emissions problems related to fuel, air induction, and exhaust system problems; determine needed action.	P-2						X					
E. Emissions Control Systems												
1. Identify emission control system components and configurations.	P-1	P-1	P-1		X	X	X	X		X		
2. Inspect, test, service, and/or replace positive crankcase ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses; determine needed action.	P-2	P-2	P-2		X	X	X	X				
3. Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilation (PCV) system; determine needed action.	P-2	P-2			X	X	X	X				
4. Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; inspect, test, service and/or replace electrical/electronic sensors, controls, wiring, tubing, exhaust passages, coolers, vacuum/pressure controls, filters, and hoses of exhaust gas recirculation (EGR) system; determine needed action.	P-1	P-2			X	X		X				
6. Diagnose emission and driveability concerns caused by catalytic converter system; determine needed action.	P-1	P-1			X	X	X	X				
7. Diagnose emissions and driveability concerns caused by the evaporative emissions control (EVAP) system; determine needed action.	P-1	P-1			X	X	X	X		X		

Visit **ASEEDUCATIONFOUNDATION.ORG/RESOURCES** for a complete task list.

A1
ENGINE REPAIR

	MAST - 1200 Hours	AST - 840 Hours	MLR - 540 Hours	EM-140C ALL	EM-141S-TY01	EM-145S-GM05
A. General						
1. Research vehicle service information such as fluid type, internal combustion engine operation, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS).	P-1	P-1	P-1	X	X	X
2. Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed.	P-1	P-1	P-1	X	X	X
3. Verify operation of the instrument panel engine warning indicators.	P-1	P-1	P-1	X	X	X
4. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine needed action.	P-1	P-1	P-1	X	X	X
5. Install engine covers using gaskets, seals, and sealers as required.	P-1	P-1	P-2		X	X
6. Verify engine mechanical timing.	P-1	P-1	P-2		X	X
7. Inspect, remove, and/or replace engine mounts.	P-2	P-2	P-2		X	X
8. Identify service precautions related to service of the internal combustion engine of an xEV.	P-1	P-1	P-2		X	X
9. Remove and reinstall engine on a vehicle equipped with OBDII; reconnect all attaching components and restore the vehicle to running condition.	P-3					X
B. Cylinder Head and Valve Train						
1. Identify cylinder head and valve train components and configurations.	P-1	P-1	P-1		X	X
2. Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specification and procedure.	P-1	P-1				X
3. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition.	P-1	P-2				X
4. Inspect valve actuating mechanisms for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine needed action.	P-1	P-2				X
5. Adjust valves (mechanical or hydraulic lifters).	P-2	P-2			X	X
6. Inspect and replace camshaft and drive belt/chain; includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and valve timing components; verify correct camshaft timing.	P-1	P-1			X	X
7. Inspect valve springs for squareness and free height comparison; determine needed action.	P-3				X	X
8. Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks/keepers, and valve lock/keeper grooves; determine needed action.	P-3				X	X
9. Inspect valve guides for wear; check valve stem-to-guide clearance; determine needed action.	P-3				X	X
10. Inspect valves and valve seats; determine needed action.	P-3				X	X
11. Check valve spring assembled height and valve stem height; determine needed action.	P-3				X	X
12. Inspect valve lifters and hydraulic lash adjusters; determine needed action.	P-2				X	X
13. Inspect and/or measure camshaft for runout, journal wear and lobe wear.	P-3					X
14. Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine needed action.	P-3					X
C. Engine Block Assembly						
1. Identify engine block assembly components and configurations.	P-1	P-1	P-1			X
2. Remove, inspect, and/or replace crankshaft vibration damper (harmonic balancer).	P-1	P-2			X	X
3. Disassemble engine block; clean and prepare components for inspection and reassembly.	P-2					X
4. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine needed action.	P-2					X
5. Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine needed action.	P-2					X
6. Perform deglazing and cleaning of cylinder walls.	P-2					X
7. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine needed action.	P-2					
8. Inspect crankshaft for straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure end play and journal wear; check crankshaft position sensor reluctor ring (where applicable); determine needed action.	P-2					X
9. Inspect main and connecting rod bearings for damage and wear; determine needed action.	P-2					X
10. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine needed action.	P-2					X
11. Inspect and measure piston skirts and ring lands; determine needed action.	P-2					X
12. Determine piston-to-bore clearance.	P-2					X
13. Inspect, measure, and install piston rings.	P-2					X
15. Assemble engine block.	P-1					X
D. Lubrication and Cooling Systems						
1. Identify lubrication and cooling system components and configurations	P-1	P-1	P-1			X
2. Perform engine oil and filter change; use proper fluid type per manufacturer specification; reset maintenance reminder as required.	P-1	P-1	P-1		X	X
3. Perform cooling system pressure and dye tests to identify leaks; check coolant condition and level; inspect and test radiator, pressure cap, coolant recovery tank, heater core, and galley plugs; determine needed action.	P-1	P-1	P-1		X	X
4. Identify causes of engine overheating.	P-1	P-1	P-2		X	X
5. Inspect, replace, and/or adjust drive belts, tensioners, and pulleys; check pulley and belt alignment.	P-1	P-1	P-1	X	X	X
6. Inspect and test coolant; drain and recover coolant; flush and/or refill cooling system; use proper fluid type per manufacturer specification; bleed air as required.	P-1	P-1	P-1		X	X
7. Identify different types of water/coolant pumps (belt driven, chain driven, and electric).	P-1	P-1	P-2			X
8. Remove, inspect, and replace thermostat and gasket/seal.	P-1	P-1	P-1			X
9. Inspect, remove, and replace water/coolant pumps.	P-2	P-2			X	X
10. Remove and replace radiator.	P-2	P-2			X	X
11. Inspect and test fan(s), fan clutch (electrical and/or mechanical), fan shroud, and air dams/shutters;determine needed action.	P-1	P-1			X	X
13. Inspect auxiliary coolers; determine needed action.	P-2	P-2			X	X
14. Inspect, test, and replace oil temperature and pressure switches and sensors.	P-1	P-2				X

Visit **ASEEDUCATIONFOUNDATION.ORG/RESOURCES** for a complete task list.

T2
DIESEL ENGINES

	IMMR	TST	MTST	EC-490	EC-510HV	HV-145S-KB02	HV-950 (ALL)
A. General							
1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins.	P-1	P-1	P-1	X		X	X
2. Inspect level and condition of fuel, oil, diesel exhaust fluid (DEF), and coolant.	P-1	P-1	P-1			X	X
3. Inspect engine assembly for fuel, oil, coolant, air, and other leaks; determine needed action.	P-1	P-1	P-1			X	X
4. Identify system components, configurations, and types of the following: cylinder head(s), valve train, engine block, engine lubrication, engine cooling, air induction, exhaust, fuel, and engine braking.	P-1	P-1	P-1			X	X
B. Cylinder Head and Valve Train							
1. Inspect electronic wiring harness and brackets for wear, bending, cracks, and proper securement; determine needed action.	P-2	P-1	P-1				X
2. Inspect valve train components; determine needed action.		P-2	P-2		X	X	X
3. Adjust valve bridges (crossheads); adjust valve clearances and injector settings.		P-1	P-1		X	X	X
4. Inspect, measure, and replace/reinstall camshaft; measure end play and backlash; determine needed action.			P-3			X	
C. Engine Block							
1. Inspect crankshaft vibration damper; inspect engine mounts; determine needed action.	P-2	P-1	P-1			X	X
2. Remove, inspect, service, and install pans, covers, gaskets, seals, wear rings, and crankcase ventilation components; determine needed action.	P-3	P-1	P-1			X	
3. Install and align flywheel housing; inspect flywheel housing(s) to transmission housing/engine mating surface(s); measure flywheel housing face and bore runout; determine needed action.		P-2	P-2			X	X
4. Inspect flywheel/flexplate (including ring gear) and mounting surfaces for cracks and wear; measure runout; determine needed action.		P-2	P-2		X	X	X
5. Disassemble and clean engine block; inspect engine block for cracks/damage; measure mating surfaces for warpage; check condition of passages, core/expansion plugs, and gallery plugs; inspect threaded holes, studs, dowel pins, and bolts for serviceability; determine needed action.			P-3			X	
6. Inspect cylinder sleeve counter bore and lower bore; check bore distortion; determine needed action.			P-3			X	
7. Clean, inspect, and measure cylinder walls or liners for wear and damage; determine needed action.			P-3			X	
8. Replace/reinstall cylinder liners and seals; check and adjust liner height (protrusion).			P-3			X	
9. Inspect camshaft bearings for wear and damage; determine needed action.			P-3			X	
10. Inspect, measure, and replace/reinstall camshaft; measure end play and backlash; determine needed action.			P-3			X	
11. Clean and inspect crankshaft for surface cracks and journal damage; check condition of oil passages; check passage plugs; measure journal diameter; determine needed action.			P-3			X	
12. Inspect main bearings for wear patterns and damage; replace as needed; check bearing clearances; check and correct crankshaft end play.			P-3			X	
13. Inspect, install, and time gear train; measure gear backlash; determine needed action.			P-3			X	
14. Inspect connecting rod and bearings for wear patterns; measure pistons, pins, retainers, and bushings; determine needed action.			P-3			X	
15. Determine piston-to-cylinder wall clearance; check ring-to-groove fit and end gap; install rings on pistons.			P-3			X	
16. Assemble pistons and connecting rods; install in block; install rod bearings and check clearances.			P-3			X	
17. Check condition of piston cooling jets (nozzles); determine needed action.			P-3			X	
D. Lubrication Systems							
1. Test engine oil pressure; check operation of pressure sensor, gauge, and/or sending unit; test engine oil temperature; check operation of temperature sensor; determine needed action.	P-2	P-1	P-1			X	X
2. Check engine oil level, condition, and consumption; take engine oil sample; determine needed action.	P-1	P-1	P-1		X	X	X
3. Determine proper lubricant; perform oil and filter service.	P-1	P-1	P-1			X	X
4. Inspect, clean, and test oil cooler and components; determine needed action.		P-2	P-2			X	X
5. Inspect turbocharger lubrication systems; determine needed action.		P-2	P-2				X
6. Inspect and measure oil pump, drives, inlet pipes, and pick-up screens; check drive gear clearances; determine needed action.			P-3			X	
7. Inspect oil pressure regulator valve(s), by-pass and pressure relief valve(s), oil thermostat, and filters; determine needed action.			P-3			X	X
E. Cooling System							
1. Check engine coolant type, level, and condition; test coolant for freeze protection and additive package concentration.	P-1	P-1	P-1			X	X
2. Test coolant temperature; test operation of temperature and level sensors, gauge, and/or sending unit; determine needed action.	P-1	P-1	P-1			X	X
3. Inspect and reinstall/replace pulleys, tensioners and drive belts; adjust drive belts and check alignment.	P-1	P-1	P-1			X	X
4. Recover coolant; flush and refill with recommended coolant/additive package; bleed cooling system.	P-2	P-1	P-1			X	X
5. Inspect coolant conditioner/filter assembly for leaks; inspect valves, lines, and fittings; replace as needed.	P-2	P-1	P-1				X
6. Inspect water pump, hoses, and clamps; determine needed action.	P-1	P-1	P-1			X	X
7. Inspect and pressure test cooling system(s); pressure test cap, tank(s), and recovery systems; inspect radiator and mountings; determine needed action.	P-1	P-1	P-1			X	X
8. Inspect thermostatic cooling fan system (hydraulic, pneumatic, and electronic) and fan shroud; determine needed action.	P-1	P-1	P-1			X	X
9. Identify engine block heater(s).	P-2	P-2	P-2				X
10. Diagnose engine coolant consumption; determine needed action.		P-1	P-2			X	X
11. Inspect thermostat(s), by-passes, housing(s), and seals; replace as needed.		P-1	P-1			X	X
F. Air Induction and Exhaust Systems							
1. Inspect turbocharger(s), wastegate(s), and piping systems; determine needed action	P-2	P-2	P-2				X
2. Check air induction system including: cooler assembly, piping, hoses, clamps, and mountings; replace air filter as needed; reset restriction indicator (if applicable).	P-1	P-1	P-1			X	X
3. Inspect intake manifold, gaskets, and connections; determine needed action.	P-1	P-1	P-1			X	X
4. Perform air intake system restriction and leakage tests; determine needed action.		P-1	P-1			X	X
5. Check exhaust back pressure.	P-2	P-3	P-3			X	X
6. Inspect variable ratio geometry turbocharger (VGT), controls, and actuators (pneumatic, hydraulic, and electronic).		P-2	P-2				X
7. Demonstrate knowledge of charge air cooler operation and testing.		P-1	P-1			X	X
8. Diagnose preheater/inlet air heater or glow plug system and controls: determine needed action.		P-3	P-3				X
G. Fuel System							
1. Check fuel level and condition; determine needed action.	P-1	P-1	P-1			X	X
2. Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, hoses, lines, and fittings; determine needed action.	P-1	P-1	P-1			X	X

Visit **ASEEDUCATIONFOUNDATION.ORG/RESOURCES** for a complete task list.

T2
DIESEL ENGINES

	IMMR	TST	MTST	EC-490	EC-510HV	HV-145S-KB02	HV-950 (ALL)
3. Inspect low pressure fuel system components (fuel pump, pump drives, screens, fuel/water separators/indicators, hoses, lines, filters, heaters, coolers, ECM cooling plates, check valves, pressure regulator valves, restrictive fittings, and mounting hardware); determine needed action.	P-1	P-1	P-1			X	X
4. Replace fuel filter; prime and bleed fuel system.	P-1	P-1	P-1			X	X
5. Inspect high pressure fuel system components (fuel pump, pump drives, hoses, injection lines, filters, hold-downs, fittings, seals, and mounting hardware).	P-1	P-1	P-1			X	X
6. Demonstrate knowledge and understanding of the different types of fuel systems.		P-1	P-1			X	X
7. Perform fuel supply and return system tests; determine needed action.		P-1	P-1			X	X
H. Engine Brakes							
1. Demonstrate knowledge of engine compression and/or exhaust brake operation.	P-1	P-1	P-1				X
2. Inspect and adjust engine compression and/or exhaust brake systems; determine needed action.		P-3	P-3				X
3. Inspect, test, and adjust engine compression and/or exhaust brake control circuits, switches, and solenoids; determine needed action.		P-3	P-3				X
I. Emission Controls							
1. Inspect engine exhaust system, exhaust gas recirculation (EGR) system, and exhaust aftertreatment system for leaks, mounting, proper routing, and damaged or missing components; determine needed action.	P-1	P-1	P-1				X
2. Demonstrate knowledge of exhaust gas recirculation (EGR) system operation including: EGR valve, cooler, piping, electronic sensors, controls, and wiring; determine needed action.	P-2	P-1	P-1			X	X
3. Inspect and test exhaust aftertreatment system components and controls including diesel oxidation catalyst (DOC), selective catalytic reduction (SCR), diesel exhaust fluid (DEF), diesel particulate filter (DPF), and sensors; check regeneration system operation; determine needed action.	P-2	P-1	P-1	X			X
4. Identify emission control system components and configurations.		P-1	P-1	X			X
5. Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; inspect, test, service and/or replace electrical/electronic sensors, controls, wiring, tubing, exhaust passages, cooler(s), and hoses of exhaust gas recirculation (EGR) system; determine needed action.		P-3	P-1			X	X
6. Using manufacturers'/service information, interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine needed action.		P-1	P-1	X			X
J. Driveability and Electronic Engine Controls							
1. Check engine operation (starting and running) including: noise, vibration, smoke, etc.; determine needed action.	P-2	P-2	P-2		X	X	X
2. Perform cylinder contribution test using electronic service tool(s).	P-3	P-1	P-1				X
3. Demonstrate knowledge of computerized control system components and configurations.	P-1	P-1	P-1		X		X
4. Use appropriate electronic service tool(s) to check and record diagnostic codes; check and record trip/operational data; reset maintenance monitor (if applicable, clear diagnostic codes when appropriate.	P-1	P-1	P-1				X
5. Access and use service information to perform step-by-step (troubleshooting) diagnosis.	P-1	P-1	P-1	X		X	X
6. Diagnose engine no-crank, cranks but fails to start, hard starting, and starts but does not continue to run problems; determine needed action.		P-2	P-1		X	X	X
7. Diagnose engine surging, rough operation, misfiring, low power, slow deceleration, slow acceleration, and/or shut down problems; determine needed action.		P-2	P-1			X	X
8. Perform intake manifold pressure (boost) test; determine needed action.		P-2	P-2				X
9. Use diagnostic tool, digital multimeter (DMM), and digital storage oscilloscope (DSO) to inspect or test computerized engine control system sensors, actuators, circuits, and electronic control modules (ECM); determine needed actions.		P-1	P-1				X
10. Demonstrate knowledge of the process for reprogramming or recalibrating the engine control module.		P-2	P-2				X
11. Diagnose drivability and emissions problems resulting from malfunctions of interrelated systems (ADAS, HVAC, automatic transmissions, auxiliary power units (APU), non-OEM installed accessories, or similar systems); determine needed action.		P-2	P-2				X
12. Diagnose failures in the data communications bus networks; determine needed action.		P-2	P-2				X
13. Demonstrate knowledge of setting performance parameters using electronic service tools and service information system access.			P-3				X

from classroom to Showroom

with Cutaway Creations

DAKTIC is proud to be your local sole-source partner for custom, showroom-quality training solutions from Cutaway Creations.

MODEL 3 CUTAWAY

Interactive Demonstrative EV
EV-601-TS_053322

Consulab's EV-601 showcases the best-selling, cutting-edge technology of the Tesla Model 3, cutaway for maximum visibility and enhanced for training purposes. Give your students hands-on training with the interactive display and protected high voltage test points as they learn the inner workings of the drive, charging, thermal, and battery systems without the risk associated with high voltage.

Emergency Response

Location of security loops for emergency response personnel.

Animated LED Strips

LED strips indicate paths of electrical energy and coolant flow throughout the vehicle.

Interactive Touchscreen

An interactive touchscreen activates LED strips to highlight the flow of coolant and electrical energy in each operational state.

Every Tesla training system comes with complete curriculum and over **40 hours of student activities.**

Cutaway Components

Motor/inverter cutaways showing 3-phase power into the motor, cooling passages, rotor,stator, and inverter.

Plexiglas

Penthouse cover removed/ cutaway and protected by Plexiglas.

Infotainment Screen

Fully operational infotainment screen, CAN Bus communication, ADAS, and low-voltage system

Rebuildable EV Kit Car + Full-Semester EV Curriculum

The Switch Lab

Switch Vehicles are designed to be built, tested, driven, and then disassembled for the next class to use—each semester, and year after year—and comes with all the courseware you need to run a 17-week class, an 8-week after-school club project, or a 2-week summer workshop. And with Switch vehicles safely and successfully built by students in over 150 programs nationwide, ranging from colleges and universities down to junior high school, the Switch Lab has proven to be an exceptionally effective way to teach EV technology to any audience.

Featured Models

- Lead-Acid, PM Drive
- Lithium Ion, PM Drive

Recommended Add-Ons

- Custom powder coating
- Expanded seating (third or bench)
- Relay lab kit with ferrule connectors

EV Training Workshops

SL-WS/4.5

Every Switch Lab comes with 4.5 days of instructor training where you'll build the Switch EV with a team and receive instruction on design and construction, EV components, basic electricity, wiring, and mechanics. These workshops are often attended by EV enthusiasts and technicians hoping to expand their skill set, and tuition can be purchased separately.

Switch EV Trainer

SL-EVT

The Switch EV Trainer includes all of the components of a modern EV drivetrain on a compact (2.5'x3'x3.2'), insulated, mobile platform. It arrives fully assembled, and rolls into any workspace for immediate use. The trainer's configurable battery management system and motor controller provide a tailored learning experience, while real-time data interpretation from the integrated CAN network enriches the educational process. The Hyper 9 motor with controller, regenerative braking capability, and the Orion2 Battery Management System further enhance the trainer's capabilities.

Training Topics

- Identify EV components
- Fundamentals of electricity
- Low & high voltage wiring
- Reading wiring diagrams
- Proper connection & termination
- Understand relays & fuses
- Exam prep for ASE xEV level 1 & 2
- Motor controller & BMS Configuration
- Troubleshooting

Safety + Diagnostic Tools

SL-C-IN-TOOLS

To ensure you have everything you need to hit the ground running with your new Switch electric vehicle, every Switch Lab comes with essential safety and diagnostic tools.

Relay Lab Kits

SL-RLK

This hands-on learning tool is ideal as a stand-alone product, or an add-on to your Switch Lab. Students learn the functions and wiring of relays, switches, and lights using a kit similar to the Switch EV dashboard.

Visit **DAKTIC.COM** for pricing and details.

EV High Voltage Safety Trainer

EV-400_053287

The EV-400 EV High-Voltage Safety Trainer represents a fully functional battery electric vehicle (BEV) in a compact classroom sized package. Each unit includes a fault box and a faulty component, allowing diagnostic practice of various scenarios and components in a completely safe, controlled, classroom environment. It provides an intuitive, hands-on experience for high-voltage testing, Personal Protective Equipment (PPE) use, high voltage isolation testing with a mega-ohmmeter, high voltage interlock circuits, first responders' loops, three phase motor control, high voltage power distribution, and much more.

Key Features

- Measurable 400V DC and 3 phase motor signals. Real-world EV voltage, completely safeguarded for student interaction
- Comprehensive Simulation: From start to drive motor, the EV-400 replicates the full functionality of an EV, providing an immersive learning experience.
- Understanding & Usage of Personal Protection Equipment (PPE)
- Identification of High-Voltage Components
- High-Voltage Measurements Verification
- Circuit Insulation + Isolation Testing
- Lockout/Tagout with Faraday Cage
- 3-Phase Motor Functionality via Oscilloscope
- Fault box with 10 faults + 1 faulty component
- 4 different fault indicator lights (12v, high voltage, isolation, interlock)
- Live loss of isolation (LOI) detection
- Includes High Voltage gloves and PICO Insulation Tester

Ohm's Law + DC Circuits

CL-1919-06_053327

The Ohm's Law + DC Circuits trainer from Consulab is the ultimate workhorse for teaching basic electrical theory. Each training unit includes:

- Digital Readout showing trainer DC voltage
- Built in Fluke meter powered with two AAA batteries
- Adjustable 2KHz pulse width modulation (0-100%)
- Comprehensive curriculum with student activities
- Curriculum covers multi-meter set-up, use and interpretation, electrical component operation and DC circuit construction and operation.

Connector Trainer + Back-probing

CL-1930_053283

Consulab has created an intuitive student-led learning system to practice proper non-destructive back-probing of connectors and components while measuring voltages, resistances, and waveform signals using both oscilloscopes and digital multimeters. A custom ECU provides activities to access and identify voltages and signals by students, and a fault box with nine instructor-led case scenarios allows students to troubleshoot abnormal conditions and identify causes. The included courseware offers up to 25+ hours of instructional time depending on individual instructor preferences.

EV Pathway Classroom Kit

CL-1919-EVP

Before your students can run with high voltage, they need to learn how to crawl. That's why we've created the EV Pathway Classroom, which includes 4x Ohm's Law + DC Circuits Trainers for the basics, 4x Connector Trainers for teaching non-destructive back-probing, and 4x EV High Voltage Safety Trainers in a lockable, rolling cabinet.

Visit **DAKTIC.COM** for pricing and details.

Cutaway Prius Drivetrain

EC-140H_052944

The EC-140H Cutaway Toyota Prius Hybrid Drivetrain allows you to take your entire class on a road test where they can observe the inner workings of a hybrid drivetrain as it runs through all eight drive modes in slow motion. And since some drive modes only occur for short durations, Consulab has included a steady state switch which allows you to extend the duration of any drive mode you need more time to explain to your students.

Includes

- ICE (internal combustion engine)
- Torque damper assembly
- MG1 (motor/generator #1)
- Planetary gearset (power split device)
- MG2 (motor/generator #2)
- Transaxle
- Inverter
- HV (high voltage) battery (non-functional

Demonstrates the Following Driving Modes:

- Reverse
- Engine start
- Low speed and low acceleration (stealth)
- Normal drive (cruise)
- High speed and full-throttle acceleration
- High speed energy recirculation
- Coasting
- Regenerative braking)

Electromagnetism Trainer

CL-1902_053242

As vehicles of all makes, models, and classes are depending more and more on electromagnetic systems, understanding the principles of electromagnetism is becoming essential for all future technicians. The CL-1902 Electromagnetism Trainer makes this invisible force visible. Available in a Classroom Kit, which includes 12 trainers in a lockable rolling cabinet.

Hybrid Planetary Gearset Trainer

EM-200-29_053137

The counter-intuitive principles of hybrid vehicle drivetrains suddenly make sense as your students manually rotate, hold, and release cranks to simulate the interaction between the ICE, MG1, MG2, and drive wheels.

zSpace Alt. Fuels Bundle

AR/VR Simulated Labs

zSpace delivers a stunning augmented/virtual reality that allows students to safely and efficiently practice a wide range of diagnostic exercises on hybrid/electric vehicles. And most importantly, after practicing with zSpace, your students will tackle the real thing in the shop more quickly and safely.

Cutaway Hybrid Scroll-Type A/C Compressor

EC-2001-07_053156

The EC-2001-07 allows students to see the internal operation of the electrically driven hybrid scroll type A/C compressor. The 3-phase electric motor that drives the compressor can be rotated using a hand crank.

Visit **DAKTIC.COM** for pricing and details.

L3 HYBRID/EV

	IMMR	TST	MTST	Switch EV (Kit Car)	Switch EV Trainer	EV-601-TS_053322	EV-400_053287	EC-140H	EC-2001-07	EM-200-29	CL-1930_053283	EV-360_053325	CL-1919-06_053327	CL-1902_053242
A. BATTERY SYSTEMS (11 questions)														
1. Perform high-voltage (HV) system de-energize/disable procedure; energize/enable high-voltage system	P-1	P-1	P-1	X	X		X							
2. Identify, inspect, and use proper personal protective equipment (PPE).	P-1	P-1	P-1	X	X	X	X	X						
3. Identify, validate, and use proper electrical testing equipment and leads.	P-1	P-1	P-1	X	X	X	X							
4. Retrieve and diagnose DTCs; determine needed repairs.	P-1	P-1	P-1	X	X	X								
5. Diagnose problems caused by damaged or failed harnesses, connectors, terminals and fuses.	P-1	P-1	P-1	X	X						X			
6. Diagnose high voltage (HV) battery pack malfunctions.		P-3	P-2	X	X									
7. Remove and install high voltage battery pack.		P-3	P-2	X	X									
8. Test, diagnose and repair high voltage leaks/loss of isolation.		P-3	P-2	X	X	X	X							
9. Test, diagnose and repair high voltage battery pack heating and cooling systems.		P-3	P-2	X	X									
10. Test, diagnose, repair or replace high voltage battery pack internal components.		P-3	P-2	X	X									
B. INTERNAL COMBUSTION ENGINE (6 questions)														
3. Differentiate between driveability problems caused by the internal combustion engine and/or hybrid drive system.								X						
4. Perform internal combustion engine cranking compression test; interpret results.										X				
10. Service engine cooling system.								X						
C. DRIVE SYSTEMS (9 questions)														
1. Perform high-voltage (HV) system de-energize/disable procedure; energize/enable high-voltage system.				X	X									
2. Identify, inspect, and use proper personal protective equipment (PPE).				X	X									
3. Identify, validate, and use proper electrical testing equipment and leads.				X	X	X		X						
4. Retrieve and diagnose driveline DTCs; determine needed repairs.				X	X	X								
5. Diagnose problems caused by damaged or failed harnesses, connectors, terminals, and fuses.				X	X	X					X			
6. Test, diagnose and repair high voltage leaks/loss of isolation.				X	X									
D. POWER ELECTRONICS (13 questions)														
1. Perform high-voltage (HV) system de-energize/disable procedure; energize/enable high-voltage system.				X	X									
2. Identify, inspect, and use proper personal protective equipment (PPE).				X	X									
3. Identify, validate, and use proper electrical testing equipment and leads.				X	X	X								
4. Retrieve and diagnose DTCs; determine needed repairs.				X	X	X								
5. Diagnose problems caused by damaged or failed harnesses, connectors, terminals, and fuses.				X	X	X					X			
6. Identify procedures necessary to establish the proper vehicle operational power mode during service (OFF, ACCESSORY, POWER ON, READY TO DRIVE).				X	X									
7. Diagnose the cause of a hybrid system warning displayed on the instrument panel and/or a driveability complaint.						X		X						

	IMMR	TST	MTST	Switch EV (Kit Car)	Switch EV Trainer	EV-601-TS_053322	EV-400_053287	EC-140H	EC-2001-07	EM-200-29	CL-1930_053283	EV-360_053325	CL-1919-06_053327	CL-1902_053242
8. Diagnose AC/DC inverter faults; perform needed repair.				X	X	X								
9. Remove and install AC/DC inverter.				X	X									
13. Diagnose DC/DC converter system; perform needed repair.				X	X									
14. Remove and install DC/DC converter.				X	X									
15. Inspect high-voltage cable condition; test for loss of isolation.				X	X									
16. Perform testing of low-voltage battery.				X	X	X								
17. Diagnose high-voltage contactor faults; perform needed repair.						X								
19. Diagnose high-voltage DC charging faults; perform needed repair.				X	X									
20. Diagnose failures in data communication bus network; determine needed repair.				X	X									
E. HYBRID SUPPORTING SYSTEMS (6 questions)														
1. Perform high-voltage (HV) system de-energize/disable procedure; energize/enable high-voltage system.				X	X									
2. Identify, inspect, and use proper personal protective equipment (PPE).				X	X									
3. Identify, validate, and use proper electrical testing equipment and leads.				X	X									
4. Retrieve and diagnose DTCs; determine needed repairs.				X	X									
5. Diagnose problems caused by damaged or failed harnesses, connectors, terminals, and fuses.				X	X						X			
9. Remove and install high voltage air conditioning compressor; identify and select proper system oil.								X						
10.Differentiate between brake hydraulic system and regenerative braking faults; determine needed repairs and procedures.				X	X									

Visit **ASEEDUCATIONFOUNDATION.ORG/RESOURCES** for a complete task list.

A6 xEV SYSTEMS

	MAST - 1200 Hours	AST - 840 Hours	MLR - 540 Hours	CL-1919	CL-1918	CL-1930	EM-140S HY03	EM-140S GM04A	EM-200-25	EM-300-07	EV-360	MD-4000-22	MD-4000-23	MD-4000-24	MP-1918	MP-750
A. General																
1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS).	P-1	P-1	P-1				X	X								X
2. Identify electrical/electronic system components and configurations.	P-1	P-1	P-1	X	X	X	X	X	X	X		X			X	X
3. Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed.	P-1	P-1	P-1				X	X								X
4. Perform calibration/recalibration, initialization, or relearn procedures as required.	P-1	P-1	P-1	X	X		X	X	X	X		X	X	X	X	X
5. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).	P-1	P-1	P-1	X	X		X	X	X	X		X	X	X	X	X
6. Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow and resistance.	P-1	P-1	P-1	X	X	X	X	X		X		X	X	X	X	X
7. Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits.	P-1	P-1	P-1	X	X	X	X	X				X	X	X	X	
8. Describe precautions related to the use of test lights.	P-3	P-3	P-3	X	X		X	X							X	
9. Use fused jumper wires to check operation of electrical circuits per service information.	P-1	P-1	P-2	X	X		X	X	X			X	X	X	X	X
10. Use wiring diagrams during the diagnosis of electrical/electronic circuit problems.	P-1	P-1	P-2	X	X	X	X	X							X	X
11. Diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine needed action.	P-1	P-1	P-2	X	X		X	X				X	X		X	X
12. Inspect and test fusible links, circuit breakers, and fuses; determine needed action	P-1	P-1	P-2				X	X								
13. Inspect, test, repair, and/or replace components, connectors, terminals, harnesses, and wiring in electrical/electronic systems (including solder repairs); determine needed action.	P-1	P-2		X			X	X	X	X		X	X	X	X	X
14. Test and measure circuit using an oscilloscope and/or graphing multimeter (GMM); interpret results; determine needed action.	P-1	P-2		X	X	X	X	X	X			X	X	X	X	X
B. Batteries (Low Voltage)																
1. Perform battery state-of-charge test; determine needed action.	P-1	P-1	P-1				X	X								
2. Confirm proper battery capacity, size, type, and application for vehicle; perform battery capacity and load test as recommended by manufacturer; determine needed action.	P-1	P-1	P-1				X	X								
3. Maintain or restore electronic memory functions as recommended by manufacturer.	P-2	P-2	P-2													X
4. Inspect and clean battery; check battery cables, connectors, clamps, and hold-downs.	P-1	P-1	P-1				X	X								
5. Perform battery charging according to manufacturer's recommendations.	P-1	P-1	P-1				X	X								
7. Identify electrical/electronic modules, security systems, radios, and other accessories that require reinitialization or code entry after reconnecting vehicle battery.	P-2	P-2	P-2				X	X							X	X
C. Starting System (Low Voltage)																
1. Perform starter current draw test; determine needed action.	P-1	P-1	P-1				X	X								
2. Perform starter circuit voltage drop tests; determine needed action.	P-1	P-1	P-1				X	X								
3. Inspect and test starter relays and solenoids; determine needed action.	P-2	P-2	P-2				X	X								
5. Inspect and test switches, connectors, and wires of starter control circuits; determine needed action.	P-1	P-1	P-2	X			X	X								
6. Demonstrate knowledge of automatic idle-stop/start-stop system that uses a low-voltage starter to restart the engine.	P-1	P-1	P-2					X								
7. Differentiate between electrical and engine mechanical problems that cause a slow-crank or a no-crank condition.	P-1	P-2					X	X								
8. Diagnose a no-crank condition using a wiring diagram and test equipment; determine needed action.	P-1	P-2					X	X								

	MAST - 1200 Hours	AST - 840 Hours	MLR - 540 Hours	CL-1919	CL-1918	CL-1930	EM-140S HY03	EM-140S GM04A	EM-200-25	EM-300-07	EV-360	MD-4000-22	MD-4000-23	MD-4000-24	MP-1918	MP-750
D. Charging System (Low Voltage)																
1. Perform charging system output test; determine needed action.	P-1	P-1	P-1				X	X								
2. Inspect, adjust, and/or replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment; determine needed action.	P-1	P-1	P-1				X	X								
4. Perform charging circuit voltage drop tests; determine needed action.	P-1	P-1	P-2				X	X								
5. Diagnose charging system for causes of undercharge, no-charge, or overcharge conditions; determine needed action.	P-1	P-1					X	X				X				
E. Lighting Systems																
1. Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); determine needed action.	P-1	P-1	P-1	X	X							X			X	X
2. Aim headlights.	P-2	P-2	P-2													X
3. Diagnose the causes of brighter-than-normal, intermittent, dim, or no light operation; determine needed action.	P-1	P-1		X	X							X			X	X
F. Instrument Cluster and Driver Information Systems																
1. Verify operation of instrument panel gauges and warning/indicator lights; reset maintenance indicators as required.	P-1	P-1	P-1				X	X							X	X
2. Inspect and test gauges and gauge sensors/sending units for causes of abnormal readings; determine needed action.	P-1	P-2					X	X							X	X
3. Diagnose the causes of incorrect operation of warning devices and other driver information systems; determine needed action.	P-1	P-2					X	X				X				X
G. Body Electrical Systems																
1. Diagnose vehicle comfort, convenience, access, safety, and related systems operation; determine needed action	P-2	P-2	P-3									X		X		
2. Remove and reinstall door panel.	P-1	P-1	P-2													X
3. Diagnose operation of security/anti-theft systems and related circuits (such as: theft deterrent, door locks, remote keyless entry, remote start, and starter/fuel disable); determine needed action.	P-1	P-2	P-3													X
4. Describe disabling and enabling procedures for supplemental restraint system (SRS); verify indicator lamp operation.	P-1	P-1	P-2						X							X
5. Verify windshield wiper and washer operation; replace wiper blades.	P-1	P-1	P-1													
6. Diagnose operation of entertainment/infotainment systems and related circuits (such as: radio, DVD, navigation, amplifiers, speakers, antennas, and voice-activated accessories); determine needed action.	P-2	P-2						X								X
7. Diagnose operation of safety systems and related circuits (such as: horn, airbags, seat belt pretensioners, occupancy classification, wipers, and washers; determine needed action.	P-1	P-2							X							
8. Diagnose body electronic systems circuits using a scan tool; check for module communication errors (data communication bus systems); determine needed action.	P-1	P-2														X
9. Describe the process for software transfer, software updates, or reprogramming of electronic modules.	P-1	P-2					X	X								X
10. Demonstrate knowledge of advanced driver assistance systems (ADAS) and related circuits (such as: speed control/collision avoidance, heads-up display, parking assist, and back-up camera)	P-2									X						
11. Recalibrate a vehicle's advanced driver assistance system (ADAS).	P-2															

Visit **ASEEDUCATIONFOUNDATION.ORG/RESOURCES** for a complete task list.

T6
HIGH VOLTAGE SAFETY

	IMMR	TST	MTST	CL-1902	CL-1919-06	CL-1930	EC-510HV	HV-1918	MD-4000-22	MD-4000-23	MD-4000-24	MP-1918
A. General												
1. Research vehicle service information, including vehicle service history, service precautions, and technical service bulletins.	P-1	P-1	P-1	X			X	X	X	X	X	X
2. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).	P-1	P-1	P-1	X	X		X	X	X	X	X	X
3. Demonstrate operation and proper use of digital multimeters and other test equipment when measuring source voltage, voltage drop (including grounds), current flow, continuity, and resistance.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
4. Demonstrate knowledge of the causes and effects of shorts, grounds, opens, and resistance problems in electrical/electronic circuits; identify and locate faults in electrical/electronic circuits.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
5. Use wiring diagrams during the diagnosis (troubleshooting) of electrical/electronic circuit problems.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
6. Measure parasitic (key-off) battery drain; determine needed action.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
7. Demonstrate knowledge of the function, operation, and testing of fusible links, circuit breakers, relays, solenoids, actuators, diodes, and fuses; perform inspection and testing; determine needed action.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
9. Use appropriate electronic service tool(s) and procedures to diagnose problems; check and record diagnostic codes; interpret digital multimeter (DMM) readings; clear diagnostic codes when appropriate.	P-1	P-1	P-1									X
10. Check for malfunctions caused by faults in the data bus communications network.	P-2	P-2	P-2									X
11. Identify electrical/electronic system components and configuration.	P-2	P-2	P-2	X	X	X	X	X	X	X	X	X
12. Demonstrate operation and proper use of oscilloscopes to check frequency, pulse width, and waveforms of electrical/electronic signals; interpret readings; determine needed repairs.		P-2	P-2	X	X	X	X	X	X	X	X	X
13. Demonstrate understanding of the process for software transfer, software updates, and/or reprogramming of electronic modules.			P-3									X
B. Battery System												
2. Confirm proper battery capacity for application; perform battery state-of-charge test; perform battery capacity test, determine needed action.	P-1	P-1	P-1				X					
3. Inspect and clean battery, battery cables, connectors, battery boxes, mounts, and hold-downs; service, repair, or replace as needed.	P-1	P-1	P-1				X					
C. Starting System												
1. Demonstrate understanding of starter system operation.	P-1	P-1	P-1				X					
2. Perform starter circuit cranking voltage and voltage drop tests; determine needed action.	P-1	P-1	P-1				X					
3. Inspect and test starter control circuit switches (key switch, push button, and/or magnetic switch), relays, connectors, terminals, wires, and harnesses (including over-crank protection); determine needed action.	P-1	P-1	P-1				X					
4. Diagnose causes of no-crank or slow crank condition; differentiate between electrical and engine mechanical problems; determine needed action.		P-1	P-1				X					
5. Perform starter current draw tests; determine needed action.		P-3	P-3				X					
D. Charging System												
4. Inspect cables, wires, and connectors in the charging circuit including remote sense circuit; determine needed action.	P-1	P-1	P-1				X					
5. Perform charging system voltage and amperage output tests; perform AC ripple test; determine needed action.	P-1	P-1	P-1									
6. Perform charging circuit voltage drop tests; determine needed action.		P-1	P-1				X	X	X	X	X	X
7. Remove, inspect, and/or replace generator (alternator).		P-2	P-2									
E. Lighting Systems												
1. Diagnose causes of brighter-than-normal, intermittent, dim, or no-light operation; determine needed action.	P-1	P-1	P-1	X	X	X	X	X	X	X	X	X
2. Test, replace, and aim headlights.		P-3	P-3					X				X

	IMMR	TST	MTST	CL-1902	CL-1919-06	CL-1930	EC-510HV	HV-1918	MD-4000-22	MD-4000-23	MD-4000-24	MP-1918
3. Inspect cables, wires, and connectors in the lighting systems.		P-1	P-1		X	X		X	X	X	X	X
4. Diagnose faults in tractor-to-trailer multi-wire connector(s), cables, and holders; determine needed action.		P-1	P-2					X				
5. Diagnose faults in switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, and control components/modules of exterior lighting systems; determine needed action.		P-2	P-2		X			X	X	X	X	X
6. Diagnose faults in switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, and control components/modules of interior lighting systems; determine needed action.		P-2	P-2		X			X	X	X	X	X
7. Diagnose faults in switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, and control components/modules of auxiliary lighting circuits; determine needed action.		P-2	P-2		X			X	X	X	X	X
F. Instrument Cluster and Driver Information Systems												
1. Check gauge and warning indicator operation.	P-1	P-1	P-1									X
2. Diagnose faults in the sensor/sending units, gauges, switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, printed circuits, and control components/modules of the instrument cluster, driver information systems, and warning systems; determine needed action.	P-2	P-2	P-2									X
G. Cab and Chassis Electrical Systems												
1. Diagnose operation of horn(s), wiper/washer, and occupant restraint systems.		P-1	P-1						X	X	X	
2. Demonstrate knowledge of the operation of advanced driver assistance systems (ADAS) and related circuits (such as: speed control, collision avoidance, lane departure warning and assist, and camera systems).		P-3	P-3									X
3. Demonstrate knowledge of comfort and convenience systems and related circuits (such as: power windows, power seats, power locks, remote keyless entry, steering wheel controls, and cruise control).		P-3	P-3						X	X	X	X
4. Demonstrate knowledge of entertainment systems and related circuits (such as: radio, DVD, navigation, speakers, antennas, and voice-activated accessories).		P-3	P-3									X
5. Demonstrate knowledge of power inverter, protection devices, connectors, terminals, wiring, and control components/modules of auxiliary power systems.		P-3	P-3									X
6. Demonstrate knowledge of telematics systems.		P-3	P-3									X

Visit **ASEEDUCATIONFOUNDATION.ORG/RESOURCES** for a complete task list.

Functional Heavy Vehicle Transmission Cutaways

EC-1108_053155 (Eaton), EC-1106-03_052742 (Allison 3000)

Why settle for a cutaway transmission that doesn't move? Help your students see exactly what's going on inside with a functional transmission cutaway from Consulab. Each cutaway demonstrates gear changes, planetary gear sets, clutches, bands, and more.
Consulab's functional transmissions have been strategically sectioned and cutaway to show the internal transmission functions in action. Whether you go with a fully automatic Allison transmission, or an Eaton manual transmission, you'll see how gear changes work using regulated air pressure, a hand crank, and the integrated control panel.

Available Models

- Eaton Manual Transmission
- Allison 1000 Series (Automatic)
- Allison 3000 Series (Automatic)

Key Features

- Driven by 120VAC electric motor
- Manual gear changes made using OEM shifter
- Automatic gear changes can be made using an electronic speed selector with lamps to show the applied and released clutches and bands
- Transfer case can be shifted electronically
- Complete hydraulic clutch system with master/slave cylinders and clutch pedal (manual trans)
- Enclosed in protective PETG cover

Cutaway Differential

EC-431_053112

The Consulab EC-431 Cutaway Differential is driven by a hand crank to allow the visualization of the internal function of each component. Screws easily adjust the pinion depth and backlash for quick pattern demonstrations.

Cutaway Hydraulic Clutch

EC-1120_053185

Take the mystery out of clutch operation with the new EC-1120, which gives you total visibility of all hydraulic clutch components without the limitations of working under a vehicle.

Driveshaft Working Angle Trainer

EM-200-28_053054

The Consulab EM-200-28 demonstrates the acceleration and deceleration phenomenon that often occurs in revolving universal joints and driveshafts. Turn on the motor and hold a plastic card against the toothed wheels to show how various working angles create this phenomenon.

Custom Functional Cutaways

Cutaway Creations

Need something we don't currently offer in our catalog? Our partners at Cutaway Creations can create a visually intriguing cutaway display that will reveal the inner workings of any mechanical or electromechanical product you request.
Contact us at **sales@daktic.com** and we'll make it happen together.

Visit **DAKTIC.COM** for pricing and details.

A2
AUTOMATIC TRANS

	EV-601-TS_053322	EV-400_053287	EC-140H	EC-2001-07	EM-200-29	CL-1930_053283	EV-360_053325	CL-1919-06_053327	CL-1902_053242
A. General									
1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and/or vehicles equipped with advanced driver assistance systems (ADAS).	P-1	P-1	P-1		X	X	X		
2. Identify automatic transmission and transaxle components and configurations, including torque converter automatic, dual-clutch automatic (DCT), CVT, and xEV drive.	P-1	P-1	P-1		X	X	X	X	X
3. Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed.	P-1	P-1	P-1			X			
4. Inspect transmission fluid condition; check fluid level; inspect for leaks on transmission or transaxle equipped with a dipstick.	P-1	P-1	P-1			X			
5. Demonstrate knowledge of procedures to check transmission fluid condition and level on transmission or transaxle not equipped with a dipstick.	P-1	P-1	P-1			X			
6. Demonstrate knowledge of transmission/transaxle gear reduction/multiplication operation using driving, driven, and held member (power flow) principles.	P-1	P-1	P-3		X			X	
7. Demonstrate knowledge of hydraulic principles (Pascal's Law) in a transmission/transaxle.	P-1	P-2	P-3		X				
8. Identify and interpret transmission/transaxle concerns, differentiate between engine performance and transmission/transaxle concerns; determine needed action.	P-1	P-1				X			
12. Perform pressure tests on transmissions/transaxles equipped with electronic pressure control; determine needed action.	P-1	P-2				X			
13. Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information.	P-1	P-1				X			
14. Diagnose noise and vibration concerns; determine needed action.	P-2						X		
B. In-Vehicle Transmission/Transaxle									
3. Demonstrate knowledge of relearn procedures.	P-2	P-2	P-2			X			
4. Inspect, replace/or and align powertrain mounts.	P-1	P-1	P-3			X			
C. Off-Vehicle Transmission and Transaxle									
2. Describe the operational characteristics of a hybrid vehicle drive train.	P-2	P-2	P-3	X				X	X

A3
MANUAL TRANS

	MAST - 1200 Hours	AST - 840 Hours	MLR - 540 Hours	EC-431	EC-1120	EM-200-28
A. General						
2. Identify manual drive train and axles components and configurations.	P-1	P-1	P-1	X	X	X
6. Diagnose drive train concerns; determine needed action.	P-2	P-2				X
B. Clutch						
1. Check and adjust clutch master cylinder fluid level; check for leaks; use proper fluid type per manufacturer specification.	P-2	P-2	P-3		X	
2. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine needed action.	P-3	P-3			X	
3. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; determine needed action.	P-3	P-3			X	
4. Inspect clutch pressure plate assembly, clutch disc, release (throw-out) bearing, linkage, and pilot bearing/bushing (as applicable).	P-2	P-2			X	
5. Bleed clutch hydraulic system.	P-2	P-2			X	
F. Four-wheel Drive/All-wheel Drive						
5. Diagnose noise, vibration, and unusual steering concerns; determine needed action.	P-2					X

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T3 DRIVETRAIN

	IMMR	TST	MTST	EC-431	EC-1106-01	EC-1106-03	EC-1108	EC-1120	EM-200-28	EM-1100
A. General										
1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins.	P-1	P-1	P-1	X	X	X	X	X	X	
2. Identify drive train components, transmission type, and configuration.	P-1	P-1	P-1	X	X	X	X	X	X	X
B. Clutch										
1. Inspect and adjust clutch, clutch brake, linkage, cables, levers, brackets, bushings, pivots, springs, and clutch safety switch (includes push-type and pull-type); check pedal height and travel; determine needed action.	P-1	P-1	P-1					X		
2. Inspect clutch master cylinder fluid level; check clutch master cylinder, slave cylinder, lines, and hoses for leaks and damage; determine needed action.	P-1	P-1	P-1					X		
3. Inspect, lubricate, or replace release (throw-out) bearing, sleeve, bushings, springs, housing, levers, release fork, fork pads, rollers, shafts, and seals.	P-1	P-1	P-1					X		
4. Inspect, repair, and/or replace hydraulic clutch slave and master cylinders, lines, and hoses; bleed system.		P-2	P-2					X		
5. Inspect and/or replace single-disc clutch pressure plate and clutch disc.		P-1	P-1					X		
10. Identify causes of clutch noise, binding, slippage, pulsation, vibration, grabbing, dragging, and chatter problems; determine needed action.			P-1					X		
C. Transmission										
1. Inspect transmission shifter and linkage; inspect and/or replace transmission mounts, insulators, and mounting bolts.	P-1	P-1	P-1				X			
9. Identify causes of transmission noise, shifting concerns, lockup, jumping out-of-gear, overheating, and vibration problems; determine needed repairs.		P-1	P-1	X	X	X	X	X	X	X
10. Inspect, test, repair, and/or replace air/electric shift controls, lines, hoses, valves, regulators, filters, and cylinder assemblies.		P-2	P-2				X			
15. Inspect and test operation of automatic transmission, components, and controls; diagnose automatic transmission system problems; determine needed action.		P-2	P-2		X	X				
D. Driveshaft and Universal Joints										
1. Inspect, service, and/or replace driveshafts, slip joints, yokes, drive flanges, support bearings, universal joints, boots, seals, and retaining/mounting hardware; check phasing of all shafts.	P-1	P-1	P-1						X	
2. Identify causes of driveshaft and universal joint noise and vibration problems; determine needed action.		P-1	P-1						X	
E. Drive Axles										
11. Inspect and/or replace components of differential case assembly including spider gears, cross shaft, side gears, thrust washers, case halves, and bearings.			P-3	X						
12. Inspect and replace components of locking differential case assembly.			P-3							
13. Inspect differential carrier housing and caps, side bearing bores, and pilot (spigot, pocket) bearing bore; determine needed action.			P-3	X						
14. Inspect and replace ring and drive pinion gears, spacers, sleeves, bearing cages, and bearings.			P-3	X						
15. Measure ring gear runout; determine needed action.			P-3	X						
16. Measure and adjust drive pinion bearing preload.			P-3	X						
17. Measure and adjust drive pinion depth.			P-3	X						
18. Measure and adjust side bearing preload and ring gear backlash.			P-3	X						
19. Check and interpret ring gear and pinion tooth contact pattern; determine needed action.			P-3	X						
20. Inspect, adjust, or replace ring gear thrust block/screw.			P-3	X						

THE WORLD'S MOST VERSATILE
DRIVING SIMULATOR

Opperate **over 25 vehicles** on a single Tenstar simulator, all from the safety of your classroom.

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ADAS (Advanced Driver Assist Systems) Trainer
EV-360_053325

This exciting new trainer is for teaching the concepts of autonomous vehicle systems & Advanced Driver Assist Systems (ADAS). The EV-360 was designed to demonstrate the fundamental concepts and technologies currently incorporated in today's advanced vehicles. This trainer allows a student to visualize sensor readings and results, literally locating where the components are on a vehicle and compares the strengths and weaknesses of the various sensors and technologies to one another. This trainer is a scale model, providing visual cues to help students recognize design function and orientation.

Key Features

- Student to visualize sensor readings and results
- Demonstrates ADAS component locations
- Compares the strengths and weaknesses of the various sensors and technologies.
- Student becomes the processor of all the sensor inputs

SRS Restraints + Air Bag Diagnostics
EM-300-07_053249

With the help of 26 system faults and inert, pre-detonated inflators, the Consulab SRS Restraints + Air Bag Diagnostic Trainer will help your students safely learn essential diagnostic skills for working with supplemental restraint systems and their related sensors. And since every OEM connector has its own test points and a connector disconnect/ connect switch, it's built to withstand years of heavy use.

Automotive Steering + Suspension System
EM-130_052793

The Automotive Suspension + Steering trainer is equipped with two movable turntables and a magnetic alignment measuring gauge to assist students in observing actual measurement and changes in alignment angles.

Key Features

- Accomplish 14 required MLR tasks
- No electricity, air or hydraulics required
- Demonstrate tasks in the classroom
- See a full range of motion of all suspension components at any angle
- Visually identify components of a MacPherson strut suspension system and rack & pinion system
- Change, measure and observe results to caster, camber and toe
- Unit comes with a sway and stabilizer bar that can easily be disconnected for routine service

Heavy Truck Steering System
HV-130_053243

Consulab's Heavy Truck Steering system features a fully operational steering gear that operates from stop-to-stop to show the full action of the steering components without the hazard of hydraulic power steering. Demonstrate basic alignment geometry and the function of steering components and allow students to practice adjusting the components.

Key Features

- No access limits from hood, radiator, engine, etc.
- Rolls into any classroom with standard size doors
- Axle covers a broad range of front axle types
- Show, caster, camber, toe, king pin inclination, toe-out on turns, Ackerman angle, steering stops, poppets, and steering geometry
- Steering gear is fully operational, without hydraulic power, and operates from stop-to-stop to show full steering action.
- Easily measures camber, caster and set toe
- Included student assignments follow manufacturer service info and procedures

A4
SUSPENSION + STEERING AUTOMOTIVE

	MAST - 1200 Hours	AST - 840 Hours	MLR - 540 Hours	EM-130	EM-300-07
A. General					
1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS).	P-1	P-1	P-1	X	X
2. Identify suspension and steering system components and configurations.	P-1	P-1	P-1	X	
4. Disable, enable, and properly handle SRS/airbag system components during vehicle service following manufactures' procedures.	P-1	P-1	P-2		X
5. Identify and interpret suspension and steering system concerns; determine needed action.	P-1	P-1		X	
B. Steering Systems					
1. Inspect rack and pinion steering gear tie rod ends (sockets) and bellows boots; repair or replace as needed.	P-1	P-1	P-1	X	
8. Inspect, replace, and/or adjust tie rod ends (sockets), tie rod sleeves, and clamps (non-rack and pinion).	P-3	P-3	P-3	X	
14. Inspect steering shaft universal joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; determine needed action.	P-2	P-2		X	
15. Remove and replace rack and pinion steering gear; inspect mounting bushings and brackets.	P-2	P-2		X	
C. Suspension Systems					
7. Inspect, remove, and/or replace front/rear stabilizer bar (sway bar) bushings, brackets, and links.	P-2	P-2	P-2	X	
12. Diagnose suspension system noises, body sway, and uneven ride height concerns; determine needed action	P-1	P-1		X	
E. Wheel Alignment					
1. Perform pre-alignment inspection; measure vehicle ride height; determine needed action.	P-1	P-1	P-1	X	
4. Prepare vehicle for wheel alignment on alignment machine; perform four-wheel alignment by checking and adjusting front caster, front and rear camber, and toe as required; center steering wheel.	P-1	P-1		X	
5. Check toe-out-on-turns (turning radius); determine needed action.	P-1	P-1		X	
8. Check for front wheel setback; determine needed action.	P-1	P-1		X	
F. Wheels and Tires					
1. Inspect tire condition/age; identify tire wear patterns; check for correct tire size, application (service-class, load, and speed ratings), and air pressure as listed on the tire information placard/label.	P-1	P-1	P-1	X	

T5
SUSPENSION + STEERING AUTOMOTIVE

	IMMR	TST	MTST	HV-130
B. Steering Column				
1. Check steering wheel for free play, binding, and proper centering; inspect and service steering shaft U-joint(s), slip joint(s), bearings, bushings, and seals; phase steering shaft.	P-1	P-1	P-1	X
2. Identify causes of fixed and driver adjustable steering column and shaft noise, looseness, and binding problems.	P-1	P-1	P-1	X
4. Remove the steering wheel (includes steering wheels equipped with electrical/electronic controls and components); install and center the steering wheel.		P-2	P-2	X
C. Steering Pump and Gear Units				
3. Inspect and/or replace power steering gear(s) (single and/or dual) and mountings; adjust or set poppet valves as required.	P-3	P-2	P-2	X
4. Identify causes of power steering system noise, binding, darting/oversteer, reduced wheel cut, steering wheel kick, pulling, non-recovery, turning effort, looseness, hard steering, overheating, fluid leakage, and fluid aeration problems.		P-1	P-1	X
D. Steering Linkage				
1. Inspect, service, repair, and/or replace tie rod ends, ball joints, kingpins, pitman arms, idler arms, and other steering linkage components.	P-1	P-1	P-1	X
E. Suspension Systems				
1. Inspect, service, repair, and/or replace shock absorbers, bushings, brackets, and mounts.	P-1	P-1	P-1	X
2. Inspect, repair, and/or replace leaf springs, center bolts, clips, pins, bushings, shackles, U-bolts, insulators, brackets, and mounts.	P-1	P-1	P-1	X
3. Inspect, repair, and/or replace axle and axle aligning devices such as: radius rods, track bars, stabilizer bars, and torque arms; inspect related bushings, mounts, shims and attaching hardware; determine needed action.	P-1	P-1	P-1	X
7. Measure, record and adjust ride height; determine needed action.	P-2	P-1	P-1	X
8. Inspect and service kingpins, steering knuckle bushings, locks, bearings, seals, and covers.		P-1	P-1	X
9. Diagnose rough ride problems; determine needed action.		P-3	P-3	X
F. Wheel Alignment Diagnosis and Repair				
1. Demonstrate understanding of alignment angles.	P-3	P-1	P-1	X
2. Diagnose causes of vehicle wandering, pulling, shimmy, hard steering, and off-center steering wheel problems.		P-1	P-1	X
3. Check, record, and adjust camber.		P-2	P-2	X
4. Check, record, and adjust caster.		P-2	P-2	X
5. Check, record, and adjust toe settings.		P-1	P-1	X
6. Check rear axle(s) alignment (thrustline/centerline) and tracking.		P-2	P-2	X
7. Identify turning/Ackerman angle (toe-out-on-turns) problems.		P-3	P-3	X
8. Check front axle alignment (centerline).		P-2	P-2	X
G. Wheels and Tires				
1. Inspect tire condition; identify tire wear patterns; measure tread depth; verify tire matching (diameter and tread); inspect valve stem and cap; set tire pressure; verify tire pressure monitoring system (TPMS) operation (if applicable); determine needed action.		P-1	P-1	X
2. Diagnose wheel/tire vibration, shimmy, pounding, and hop (tramp) problems; determine needed action.		P-2	P-2	X
3. Check wheel mounting hardware; check wheel condition; remove and install wheel/tire assemblies (steering and drive axle); torque fasteners to manufacturer's specification using torque wrench.		P-1	P-1	X
4. Demonstrate knowledge of DOT tire identification numbers/markings for new and retread/recap tires; inspect tire and wheel for proper application (size, load range, position, and tread design); determine needed action.		P-2	P-2	X

Visit **ASEEDUCATIONFOUNDATION.ORG/RESOURCES** for a complete task list.

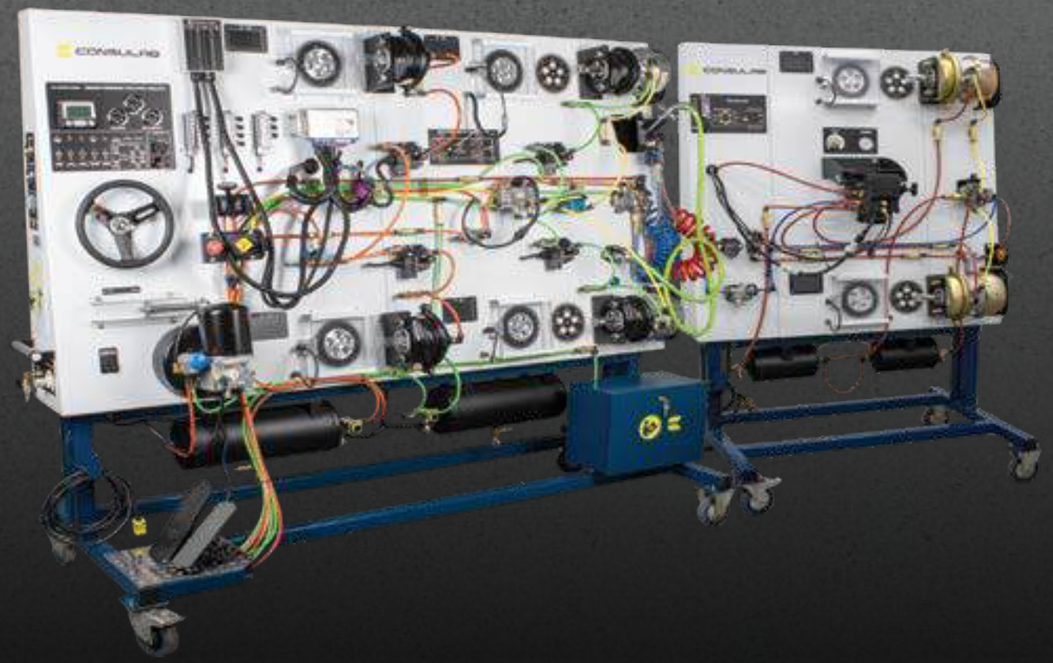
AIR BRAKE DRIVING SIMULATOR

Air Brake Driving Simulator
HV-125-BWP_053334

Consulab has created the only air brake trainer that allows you to take the entire class on a "road test" to watch live data on a scan tool. Simulate a drive on an icy road and start to lose control, and you will get to demonstrate how the ABS and ESP functions. Students get to hear, feel and see how all the electronic control valves react during these ABS, ESP, and ATC events. You can demonstrate trailer sway, you can demonstrate traction control events.

Available Models

- Complete Driving Simulator (Below)
- Transit Bus Driving Simulator
- Foundation Air Brakes for Drivers



Front Trailer Drum without Spring Brake
HV-124-FDM_053321

Give your students full view of an operating truck steering axle drum brake with service brake by connecting this optional add-on to your Air Brake Driving Simulator.

Trailer Disc with Spring Brake
HV-124-DC_053319

Connect this trailer axle disc brake with parking and service brakes to your Air Brake Driving Simulator to demonstrate mechanical actuation with the cutaway view of the caliper.

Trailer Drum with Spring Brake
HV-124-DM_053320

Demonstrate foundation brake actuation by connecting this optional trailer axle drum brake module to your Air Brake Driving Simulator. Includes parking and service brakes.

Advanced Troubleshooting Sets
30255-7, 30256, 93788

Optional add-ons include a removable breakout box for sets of T-harnesses that allow non-invasive electrical component testing (30255-7), a set of defective components (30256), and a NEXIQ USB link 2 communication interface (93788).

Visit **DAKTIC.COM** for pricing and details.

ABS Brake Trainer with Mechanical Faults
EM-122-HN02_052621

This Consulab brake trainer includes mechanical faults in the friction components designed to be diagnosed by students while performing a brake inspection, plus six electronic faults that can be inserted with the push of a button. The trainer is built with OEM components from the 2006-2010 Honda Civic platform, and all routine brake service procedures can be performed, including component replacement, adjustments and hydraulic bleeding.

Includes

- OEM instrument panel with indicator lamps
- DLC for scan tool data stream hookup
- Hydraulic pressure gauges at each wheel
- ABS Control Unit breakout box for DVOM and Oscilloscope

Disc + Drum Trainer with Mechanical Faults
EM-123-4HN02_052746

Consulab's Disc + Drum Brake Trainer with Faults includes four permanent, mechanical, real-world faults and allows students to practice all routine brake service procedures. The platform is built using recycled OEM component and brand new discs, pads, drums, and shoes. Plus, thanks to an extremely small footprint, it can fit through any standard doorway and into classroom.

Faults Include

- Waved disc
- Out of spec disc
- Out of spec drum
- Out of spec pads

Two-Wheel Brake System (Non-ABS)
EM-123-2_053251

Struggling with training bottlenecks? Several Consulab brake trainers fit in a single bay, allowing students to practice all routine brake service procedures simultaneously. Built with OEM components from the non-ABS Honda Civic platform, this trainer is also perfect for classroom demonstrations.

Cutaway Active Brake Booster + Master Cylinder
EC-122_052992

The Consulab EC-122 cutaway demonstrates the operation and internal parts of a vacuum brake booster and master cylinder. The trainer is equipped with a braking handle that simulates the brake pedal for educational purposes.

AR/VR Brake Replacements
zSpace Automotive Bundle

Let your students practice on virtual brakes over and over to make their time in the shop more efficient with the zSpace Automotive Bundle. See page 8 for more info on the zSpace Inspire Learning Platform.

Air Drum Wheel End Training System with Cutaways
HV-126-DM_052960

Using shop air (90 psi minimum) the service and parking brakes can be applied, the brake system can be dismantled, adjusted and the brakes can be measured. The trainer includes cutaways showing the s-cam, the slack adjuster and the bearing races.

Air Disc Wheel End Training System with Cutaways
HV-126-DC_052960

Using shop air (90 psi minimum) the service and parking brakes can be applied, the brake system can be dismantled, adjusted and the brakes can be measured. The trainer includes cutaways showing the caliper, the s-cam and the bearing races.

Cutaway 30/30 Air Brake Chamber
EC-127_053145

The EC-127 Cutaway 30/30 Air Brake Chamber is partly cut away so that a trainee can observe the internal elements housed within the chamber.

Virtual Labs by zSpace

zSpace delivers a stunning augmented/virtual reality that allows students to safely and efficiently practice a wide range of educational, mechanical, and diagnostic exercises on most automotive systems, including hybrid/electric vehicles. And most importantly, after practicing with zSpace, your students will tackle the real thing in the shop more quickly and safely.

Alt. Fuels Bundle

Automotive Bundle

Fluid Power Bundle

SALES + SUPPORT
801 210 1303
DAKTIC
YOUR LOCAL PARTNER
CONTACT@DAKTIC.COM

Visit **daktic.com/zspace** for details and pricing.

A5 BRAKES

	MAST - 1200 Hours	AST - 840 Hours	MLR - 540 Hours	EM-122-HN02	EM-123-2	EM-123-4HN02	EM-123-TY05 (Coming Soon)	EM-200-25	EV-601-TS
A. General									
1. Research vehicle service information such as fluid type, system design (hydraulic, electronic, etc.), vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS).	P-1	P-1	P-1	X	X	X			
2. Identify brake system components and configurations.	P-1	P-1	P-1	X	X	X	X		
5. Perform calibration/recalibration, initialization, or relearn procedures as required.	P-1	P-1	P-1			X			
6. Describe procedure for performing a road test to check brake system operation, including an anti-lock brake system (ABS).		P-1		X		X			
B. Hydraulic System									
1. Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law).	P-1	P-1	P-1	X	X	X	X		
2. Measure brake pedal height, travel, and free play (as applicable); determine needed action.	P-1	P-1	P-1				X		
3. Check master cylinder for internal/external leaks and proper operation; determine needed action.	P-1	P-1	P-1	X	X	X	X		
4. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear, and loose fittings/supports; determine needed action.	P-1	P-1	P-1	X	X	X	X		
5. Select, handle, store, and fill brake fluids to proper level; use proper fluid type per manufacturer specification.	P-1	P-1	P-1	X	X	X	X		
6. Bleed and/or replace fluid in the brake system.	P-3	P-2	P-3	X	X	X			
7. Test brake fluid for contamination.	P-2	P-2	P-2	X	X	X	X		
8. Identify, inspect, test, and replace components of brake warning light system.	P-2	P-2	P-2	X	X	X			
9. Remove, bench bleed, and reinstall master cylinder.	P-1	P-1		X	X	X	X		
10. Diagnose poor stopping, pulling, or dragging concerns caused by malfunctions in the hydraulic system; determine needed action.	P-1	P-2		X		X	X		
11. Replace brake lines, hoses, fittings, and supports.	P-2	P-2		X	X	X			
12. Fabricate brake lines using proper material and flaring procedures.	P-2	P-2		X	X	X			
C. Drum Brakes									
1. Remove, clean, and inspect brake drum; measure brake drum diameter; determine serviceability.	P-2	P-2	P-2	X	X	X	X		
2. Refinish brake drum and measure final drum diameter; compare with specification.	P-2	P-2	P-3	X	X	X	X		
3. Remove, clean, inspect, and/or replace brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble.	P-2	P-2	P-3	X	X	X	X		
4. Inspect wheel cylinders for leaks and proper operation; remove and replace as needed.	P-2	P-2	P-3	X	X	X	X		
5. Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; perform final checks and adjustments.	P-2	P-2	P-3	X	X	X			
6. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pedal pulsation concerns; determine needed action.	P-2	P-2		X		X	X		
D. Disc Brakes									
1. Remove and clean caliper assembly; inspect for leaks, damage, and wear; determine needed action.	P-1	P-1	P-1	X	X	X	X		
2. Inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine needed action	P-1	P-1	P-1	X	X	X	X		
3. Remove, inspect, and/or replace brake pads and retaining hardware; determine needed action.	P-1	P-1	P-1	X	X	X	X		
4. Lubricate and reinstall caliper, brake pads, and related hardware; seat brake pads against rotor; inspect for leaks.	P-1	P-1	P-1	X	X	X	X		
5. Clean and inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action.	P-1	P-1	P-1	X	X	X	X		
6. Remove and reinstall/replace rotor.	P-1	P-1	P-1	X	X	X	X		
7. Refinish rotor on vehicle; measure final rotor thickness and compare with specification.	P-1	P-2	P-3	X		X	X		
8. Refinish rotor off vehicle; measure final rotor thickness and compare with specification.	P-2	P-2	P-3	X	X	X	X		
10. Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendation.	P-1	P-1	P-1	X	X	X			
11. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine needed action.	P-1	P-1		X		X	X		
E. Power-Assist Units									
1. Check brake pedal travel with and without engine running to verify proper power booster operation.	P-2	P-2	P-2	X*	X*	X*	X		
2. Identify components of the brake power assist system (vacuum/ hydraulic/electric).	P-2	P-2	P-2	X	X	X	X		
3. Inspect vacuum-type power booster unit for leaks; inspect the check-valve for proper operation; check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster determine needed action.	P-2	P-2		X*	X*	X*	X		
F. Related Systems (i.e., Wheel Bearings, Parking Brakes, Electrical)									
2. Check parking brake system components for wear, binding, and corrosion; clean, lubricate, adjust and/or replace as needed.	P-2	P-2	P-2	X	X	X			
3. Check parking brake operation (including electric parking brakes); check parking brake indicator light system operation; determine needed action.	P-2	P-2	P-2	X	X	X			
4. Check operation of brake stop light system.	P-1	P-1	P-1						
5. Inspect and replace wheel studs.	P-2	P-2	P-2	X	X	X	X		
G. Electronic Brake Control Systems: Antilock Brake (ABS), Traction Control (TCS), and Electronic Stability Control (ESC) Systems									
1. Identify and inspect electronic brake control system components and describe function (ABS, TCS, ESC); determine needed action.	P-2	P-1	P-2	X					
2. Describe the operation of a regenerative braking system.	P-2	P-2	P-3						X
4. Diagnose poor stopping, wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system; determine needed action.	P-2			X					
6. Depressurize high-pressure components of an electronic brake control system.	P-2			X					
7. Test, diagnose, and service electronic brake control system speed sensors (digital and analog), toothed ring (tone wheel), and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO) (includes output signal, resistance, shorts to voltage/ground, and frequency data).	P-2			X				X	

Visit **ASEEDUCATIONFOUNDATION.ORG/RESOURCES** for a complete task list.

T4 BRAKES

	IMMR	TST	MTST	EC-127	HV-120	HV-125-BUS	HV-125-BWP	HV-126-DC	HV-126-DM
A. General									
1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins.	P-1	P-1	P-1		X	X	X	X	X
2. Identify brake system components and configurations (including air and hydraulic systems, parking brake, power assist, and vehicle dynamic brake systems).	P-1	P-1	P-1	X	X	X	X	X	X
3. Identify brake performance problems caused by the mechanical/foundation brake system (air and hydraulic).	P-1	P-1	P-1	X	X	X	X	X	X
4. Use appropriate electronic service tool(s) and procedures to diagnose problems; check and record diagnostic codes; interpret digital multimeter (DMM) readings; clear diagnostic codes when appropriate.	P-1	P-1	P-1			X	X		
B. Air Brakes: Air Supply and Service Systems									
1. Inspect, test, repair, and/or replace air supply system components such as compressor, governor, air drier, tanks, and lines; inspect service system components such as lines, fittings, mountings, and valves (hand brake/trailer control, brake relay, quick release, tractor protection, emergency/spring brake control/modulator, pressure relief/safety); determine needed action.	P-1	P-1	P-1		X	X	X		
2. Test gauge operation and readings; test low pressure warning alarm operation; perform air supply system tests such as pressure build-up, governor settings, and leakage; drain air tanks and check for contamination; determine needed action.	P-1	P-1	P-1		X	X	X		
3. Demonstrate knowledge and understanding of air supply and service system components and operations.	P-1	P-1	P-1	X	X	X	X	X	X
4. Inspect air compressor inlet; inspect oil supply and coolant lines, fittings, and mounting brackets; repair or replace as needed.	P-1	P-1	P-1						
5. Inspect and test one-way (single) check valves, two-way (double) check valves, manual and automatic drain valves; determine needed action.	P-1	P-1	P-1		X		X		
6. Inspect and service air drier systems, filters, valves, heaters, wiring, and connectors; determine needed action.	P-1	P-1	P-1		X	X	X		
7. Inspect and test brake application (foot/treadle) valve, fittings, and mounts; check pedal operation; determine needed action.	P-1	P-1	P-1		X	X	X		
8. Inspect air compressor drive gear components (gears, belts, tensioners, and/or couplings); determine needed action.	P-1	P-3	P-3		X	X	X		
C. Air Brakes: Mechanical/Foundation Brake System									
1. Inspect, test, repair, and/or replace service brake chambers, diaphragms, clamps, springs, pushrods, clevises, and mounting brackets; determine needed action.	P-1	P-1	P-1	X				X	X
2. Identify slack adjuster/brake adjuster type; check free stroke and applied stroke; inspect and lubricate slack adjusters/brake adjusters; perform needed action.	P-1	P-1	P-1					X	X
3. Inspect and lubricate camshafts (S-cams), tubes, rollers, bushings, seals, spacers, retainers, brake spiders, shields, anchor pins, and springs; perform needed action.	P-1	P-1	P-1					X	X
4. Remove brake drum; clean and inspect brake drum and mounting surface; measure brake drum diameter; measure brake lining thickness; inspect brake lining condition; determine needed action.	P-1	P-1	P-1						X
5. Inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action.	P-1	P-1	P-1					X	
6. Inspect, clean, and adjust air disc brake caliper assemblies; inspect and measure disc brake pads; inspect mounting hardware; perform needed action.	P-1	P-1	P-1					X	
7. Identify concerns related to the mechanical/foundation brake system including poor stopping, brake noise, premature wear, pulling, grabbing, or dragging; determine needed action.		P-1	P-1	X	X	X	X	X	X
D. Air brakes: Parking Brake System									
1. Inspect, test, and/or replace parking (spring) brake chamber.	P-1	P-1	P-1	X	X	X	X	X	X
2. Inspect, test, and/or replace parking (spring) brake check valves, lines, hoses, and fittings.	P-1	P-1	P-1		X	X	X	X	X
4. Manually release (cage) and reset (uncage) parking (spring) brakes.	P-2	P-2	P-2	X	X	X	X	X	X
5. Identify and test anti-compounding brake function; determine needed action.	P-3	P-2	P-2		X	X	X		
I. Vehicle Dynamic Brake Systems (Air and Hydraulic): Antilock Brake System (ABS), Automatic Traction Control (ATC) System, and Electronic Stability Control (ESC) System, Automatic Emergency Braking (AEB) System									
1. Observe antilock brake system (ABS) warning light operation including trailer and dash mounted trailer ABS warning light; determine needed action.	P-1	P-1	P-1			X	X		
2. Observe automatic traction control (ATC) and electronic stability control (ETC) warning light operation; determine needed action.	P-1	P-1	P-1			X	X		
3. Test vehicle/wheel speed sensors and circuits; adjust, repair, and/or replace as needed.	P-3	P-1	P-1			X	X		

	IMMR	TST	MTST	EC-127	HV-120	HV-125-BUS	HV-125-BWP	HV-126-DC	HV-126-DM
4. Demonstrate knowledge of Automatic Emergency Braking (AEB) systems.	P-3	P-3	P-3			X	X		
5. Identify stopping concerns related to the vehicle dynamic brake systems: ABS, ATC, and ESC; determine needed action.		P-2	P-2			X	X		
6. Diagnose problems in the vehicle dynamic brake control systems: ABS, ATC, and ESC; determine needed action.		P-3	P-2			X	X		
7. Check and test operation of vehicle dynamic brake system (air and hydraulic) mechanical and electrical components; determine needed action.		P-1	P-1			X	X		
8. Bleed ABS hydraulic circuits.		P-2	P-2						
9. Verify power line carrier (PLC) operation.		P-3	P-3			X	X		
J. Wheel Bearings									
1. Clean, inspect, lubricate, and/or replace wheel bearings and races/cups; replace seals and wear rings; inspect spindle/tube; inspect and replace retaining hardware; adjust wheel bearings; check hub assembly fluid level and condition; verify end play with dial indicator method.	P-1	P-1	P-1					X	X
2. Identify, inspect, and/or replace unitized/preset hub bearing assemblies.	P-1	P-1	P-1					X	X

Visit **ASEEDUCATIONFOUNDATION.ORG/RESOURCES** for a complete task list.

Consulab A/C Trainers
EM-2000-HB_053094

The Consulab EM-2000-HB Air Conditioning trainer is a complete A/C system with unique features designed to enhance the instruction of air conditioning physics. The trainer uses the H-Block TXV design of refrigerant flow control. The trainer uses common automotive components and can be used in both classroom and shop environments. The trainer utilizes a hermetically sealed and internally protected compressor. Operates on 120V 15A 60Hz circuit.

Available Models

- H-Block TXV System (Pictured)
- TXV System
- Orifice Tube System
- R1234YF System

Robinair Add-Ons Available
Bundle any Consulab A/C trainer with a Robinair machine to get what you need with less paperwork.

Heavy Vehicle HVAC Trainer - M2
HV-101_052948

Based on a Freightliner Business Class M2 commercial truck, the HV-101 trainer features the ability to insert faults creating real-world abnormal operating conditions for student diagnostic training. The refrigerant in this stand-alone system can be recovered, evacuated and recharged using service equipment with trainers OEM service ports.

HVAC Electronics
MD-4000-24_053345

The Consulab MD-4000-24 is a versatile and adaptable electrical/electronic training can be used for teaching basic Ohm's law or circuits used in common HVAC systems, including many tasks in area A6 and others of the ASE Education Foundation (NATEF).

Cutaway Hybrid Scroll Type Compressor
EC-2001-07_053156

The EC-2001-07 allows students to see the internal operation of the electrically driven hybrid scroll type A/C compressor The 3-phase electric motor that drives the compressor can be rotated using a hand crank.

Cutaway TXV H-Block
EC-2100_053053

The Consulab EC-2100 cutaway trainer is designed to demonstrate the internal operation of a typical TXV H-block used to control refrigerant flow in today's HVAC systems.

Visit **DAKTIC.COM** for pricing and details.

A7 HVAC

	MAST - 1200 Hours	AST - 840 Hours	MLR - 540 Hours	EM-1405 WITH A/C	EM-2000 (ALL)
A. General					
2. Identify heating, ventilation, and air conditioning (HVAC) components and configurations.	P-1	P-1	P-1	X	X
3. Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed.	P-1	P-1	P-1	X	
4. Perform A/C system performance test; interpret results; determine needed action.	P-1	P-1	P-2	X	X
5. Identify abnormal operating noises in the A/C system; determine needed action.	P-2	P-2	P-3	X	X
6. Leak test A/C system; determine needed action.	P-1	P-1	P-1	X	X
7. Verify and interpret heating and air conditioning concerns; determine needed action.	P-1	P-1	P-1	X	X
8. Place a vehicle in service mode as needed before servicing and diagnosing the HVAC system.	P-1	P-1	P-1	X	X
9. Identify refrigerant type; test for sealant/contaminant; select and connect proper gauge set/test equipment; record temperature and pressure readings.	P-1	P-1		X	X
10. Inspect condition/quantity of refrigerant oil removed from A/C system; determine needed action.	P-1	P-1		X	X
B. Refrigeration System Components					
2. Inspect for proper A/C condenser airflow; determine needed action.	P-1	P-1	P-2	X	X
3. Inspect evaporator housing condensation drain; determine needed action.	P-1	P-1	P-1	X	X
4. Inspect, test, and/or service A/C compressor clutch components and/or assembly; determine needed action.	P-2	P-2		X	
9. Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and/or control module) to interrupt system operation; determine needed action.	P-1	P-2		X	X
10. Determine procedure to remove and reinstall evaporator; determine required oil type and quantity.	P-2	P-2		X	
C. Heating, Ventilation, and Engine Cooling Systems					
1. Inspect engine cooling and heater systems hoses and pipes; determine needed action.	P-1	P-1	P-1	X	
2. Inspect and test heater control valve(s); determine needed action	P-2	P-2		X	
3. Diagnose temperature control problems in the HVAC system related to the engine cooling system, including electric heating; determine needed action.	P-2	P-3		X	
D. Operating Systems and Related Controls					
1. Inspect HVAC system ducts, doors, hoses, cabin filters, and outlets; determine needed action.	P-1	P-1	P-1	X	
3. Inspect and test HVAC system blower motors, resistors, switches, relays, wiring, and protection devices; determine needed action.	P-1	P-1		X	
4. Diagnose A/C compressor control systems; determine needed action.	P-1	P-2		X	
5. Diagnose malfunctions in the vacuum, mechanical, and/or electrical components and controls of the HVAC system; determine needed action.	P-2	P-2		X	
7. Check operation of automatic HVAC control systems; determine needed action.	P-2	P-2		X	
E. Refrigerant Recovery, Recycling, and Handling					
1. Demonstrate knowledge of the requirement to recover, recycle, and handle refrigerants using proper equipment and procedures.	P-1	P-1	P-1	X	X
2. Use and maintain refrigerant handling equipment according to equipment manufacturer's standards.	P-1	P-1		X	X
3. Identify A/C system refrigerant; test for sealants/contaminants; recover, evacuate, and charge A/C system; add refrigerant oil as required.	P-1	P-1		X	X
4. Recycle, label, and store refrigerant.	P-1	P-1		X	X

T7 HVAC

	IMMR	TST	MTST	EM-2000-HB	EM-2000-OT	EM-2000-TXV	EM-2000-YF	HV-101
A. General								
1. Research vehicle service information, including refrigerant/oil type, vehicle service history, service precautions, and technical service bulletins.	P-1	P-1	P-1	X	X	X	X	X
2. Identify heating, ventilation, and air conditioning (HVAC) components and configuration.	P-1	P-1	P-1	X	X	X	X	X
3. Use appropriate electronic service tool(s) and procedures to diagnose problems; check and record diagnostic codes; interpret digital multimeter (DMM) readings; clear diagnostic codes when appropriate.	P-1	P-1	P-1					
4. Diagnose heating and air conditioning problems; determine needed action.		P-1	P-1	X	X	X	X	X
5. Identify refrigerant type; test for contamination; select and connect proper gauge set/test equipment; record temperature and pressure readings.		P-1	P-1	X	X	X	X	X
6. Demonstrate knowledge of A/C system performance test.		P-1	P-1	X	X	X	X	X
7. Demonstrate knowledge of A/C system leak test.		P-1	P-1	X	X	X	X	X
8. Inspect condition of refrigerant oil removed from A/C system; determine needed action.		P-1	P-1	X	X	X	X	X
9. Determine oil and oil capacity for system application and/or component replacement.		P-1	P-1	X	X	X	X	X
B. Refrigeration System Components								
1. Inspect, remove, and replace A/C compressor drive belts, pulleys, and tensioners; verify proper belt alignment.	P-1	P-1	P-1					
2. Check A/C system operation including system pressures; visually inspect A/C components for signs of leaks; check A/C monitoring system (if applicable).	P-1	P-1	P-1	X	X	X	X	X
3. Inspect A/C condenser for airflow restrictions; determine needed action.	P-1	P-1	P-1	X	X	X	X	X
4. Inspect evaporator housing water drain; perform needed action.	P-1	P-1	P-1	X	X	X	X	X
5. Inspect A/C compressor assembly; check compressor clutch air gap; determine needed action.		P-1	P-1					X
6. Inspect AC system hoses, lines, fittings, O-rings, seals, and service valves; determine needed action.		P-1	P-1	X	X	X	X	X
7. Inspect receiver/drier or accumulator/drier; determine needed action.		P-1	P-1	X	X	X	X	
8. Inspect expansion valve or orifice (expansion) tube; determine needed action.		P-1	P-1	X	X			X
9. Demonstrate knowledge of A/C system conditions that cause the protection devices (pressure, thermal, and/or control module) to interrupt system operation.		P-2	P-2	X	X	X	X	X
10. Demonstrate knowledge of procedure to remove and reinstall evaporator.		P-3	P-2					X
11. Demonstrate knowledge of procedure to inspect and/or replace condenser.		P-3	P-2					X
C. Heating, Ventilation, and Engine Cooling Systems								
1. Inspect engine cooling system and heater system hoses and pipes; determine needed action.	P-1	P-1	P-1					X
2. Inspect HVAC system heater ducts, doors, hoses, cabin filters, and outlets; determine needed action.	P-1	P-1	P-1					X
3. Identify the source of A/C system odors; determine needed action.	P-2	P-2	P-1	X	X	X	X	X
4. Identify temperature control problems in the HVAC system; determine needed action.		P-2	P-2	X	X	X	X	X
5. Demonstrate knowledge of the procedures to remove, inspect, reinstall, and/or replace engine coolant and heater system components.		P-3	P-2					X
D. Operating Systems and Related Controls								
1. Verify HVAC system blower motor operation; confirm proper air distribution; confirm proper temperature control; determine needed action.	P-1	P-1	P-1	X	X	X	X	X
2. Inspect and test HVAC system blower motors, resistors, switches, relays, wiring, and protection devices; determine needed action.		P-1	P-1	X	X	X	X	X

Visit **ASEEDUCATIONFOUNDATION.ORG/RESOURCES** for a complete task list.

T7 HVAC

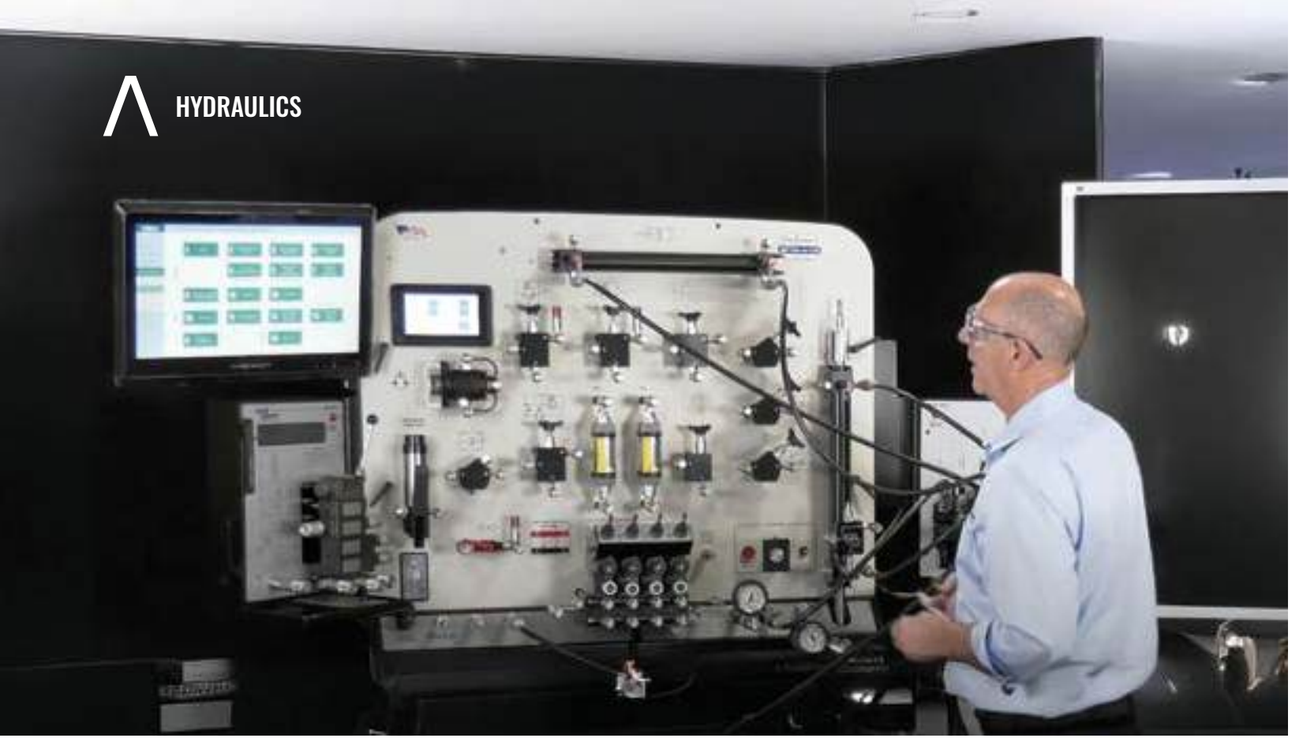
	IMMR	TST	MTST	EM-2000-HB	EM-2000-OT	EM-2000-TXV	EM-2000-YF	HV-101
4. Diagnose malfunctions in the vacuum, mechanical, and electrical components and controls of the HVAC system; determine needed action.		P-2	P-3					X
E. Refrigerant Recovery, Recycling, and Handling								
1. Demonstrate knowledge of correct use and maintenance of refrigerant handling equipment.		P-1	P-1	X	X	X	X	X
2. Demonstrate knowledge of how to identify A/C system refrigerant; test for sealants; recover, evacuate, and charge A/C system; add refrigerant oil as required.		P-1	P-1	X	X	X	X	X
3. Demonstrate knowledge of how to recover, recycle, label, and store refrigerant in accordance with EPA Section 609 guidelines.		P-1	P-1	X	X	X	X	X

BEYOND THE GARAGE

TELL YOUR FRIENDS ACROSS CAMPUS

While DAKTIC specializes in automotive and heavy vehicle training solutions, we've been serving CTE programs of all kinds for over 20 years. Visit **daktic.com** to discover how we can help teach electric power technology, renewable energy, industrial maintenance, process control, robotics, automation, Industry 4.0, and more.

DAKTIC



Basic through Advanced Hydraulics

MF102 Series

The flagship training system from the Fluid Power Training Institute offers up to 80-hours of training in hydraulic systems and troubleshooting, depending on the configuration you choose. Every MF102 training system features unparalleled craftsmanship, proudly designed and built in the United States, and is available as either a single-sided or double-sided trainer.

Key Features

- All models available as single- or double-sided trainers
- Base models can be used to teach 40+ hours of practical hydraulics
- Troubleshooting models offer an additional 40+ hours of training
- Zero-leak fittings ensure a cleaner, safer training lab
- Designed by world-renowned instructor, Rory McLaren

Available Plug-and-Play Modules

- Accumulator w/ Differential Pressure Unloading Valve Module
- Proportional Flow & Directional Control Valve
- Stacked Valve Module
- Stacked valve module w/ diagnostic package
- Mobile directional control valve module
- Mobile directional control valve module w/ diagnostics
- Load-sense mobile directional control valve
- Load-sense mobile directional control valve w/ diagnostics

Practical Hydraulics

MF102-H

The MF102-H base system includes everything you need to build and demonstrate hydraulic circuits, teaching basic through advanced theory through hands-on exercises.

Troubleshooting

MF102-H-TS

The MF102-H-TS includes all the features and benefits of the MF102-H and adds the ability to create diagnostic exercises at the push of a button. The panel-mounted touchscreen makes it possible for almost every component on the simulator to automatically “wear out.”

Troubleshooting + Student Tacking

MF102-H-TSE

On FPTI’s flagship hydraulics trainer, an integrated touchscreen computer comes with all the same exercises as the MF102-H-TS, plus a selection of Advanced Competency Testing Activities that allow you to record and review each student’s troubleshooting performance.

Flex Plate Modules

DAK-FP-FLEX

The Flex Plate mounting system allows you expand any MF102 in seconds with almost limitless possibilities. Visit **DAKTIC.COM/fpti** for a complete list of 29 available Flex Plate modules, or contact **sales@daktic.com** and request an estimate to create your own custom module.

Visit **DAKTIC.COM** for pricing and details.

HYDROSTATIC TRANSMISSIONS

Hydrostatic Transmissions
MF500E-HT-TSE

The MF500 is designed for instructors who want to teach hydrostatic transmission and steering systems from basic concepts to advanced applications and troubleshooting with the same components found in popular front-end loaders, but without the safety hazards and physical limitations of operating a faulty skid-steer in a shop full of students. And the simulation software on the integrated touchscreen allows students to gather around to experience real-time symptoms of faults as you drive the simulator through a variety of scenarios over video-game style graphic terrain.

Available Options (Shown Above)

- Hydraulic Implement with Articulated Steering
- Hydraulic Cylinder Rebuild Station

Learning Activities

- Pump and/or motor installation procedures
- Pump and/or motor pre-start checks and adjustments
- Pump and/or motor start-up checks and adjustments
- Set charge pressure relief valves on systems with and without hot oil shuttle valves
- Set main pressure relief valves and pressure over-ride valves
- Perform null adjustments on electronic displacement control valves
- How and where to check pump and motor case pressures
- Perform mechanical adjustments on electronic and mechanical displacement control valves
- Perform diagnostic procedures on a hydrostatic transmission system

Cavitation Trainer
MF200-CAV

You can spend hours trying to explain to students what cavitation is and when you're done they'll still probably be doubtful, or you can turn on the totally transparent MF200-CAV and erase all doubt. Wouldn't it be satisfying to know that when the cavitation lesson is over, your students will KNOW, and more importantly UNDERSTAND, everything that is good and bad about the operation at the inlet side of a pump?

Includes

- Transparent oil reservoir, pump inlet, transmission line; and pump outlet transmission line
- Backlighting on all transparent components to increase visual effects
- Adjustable pump inlet restrictor valve, air inlet valve, pressure control valve, and pump inlet opening in reservoir
- Diagnostic instruments

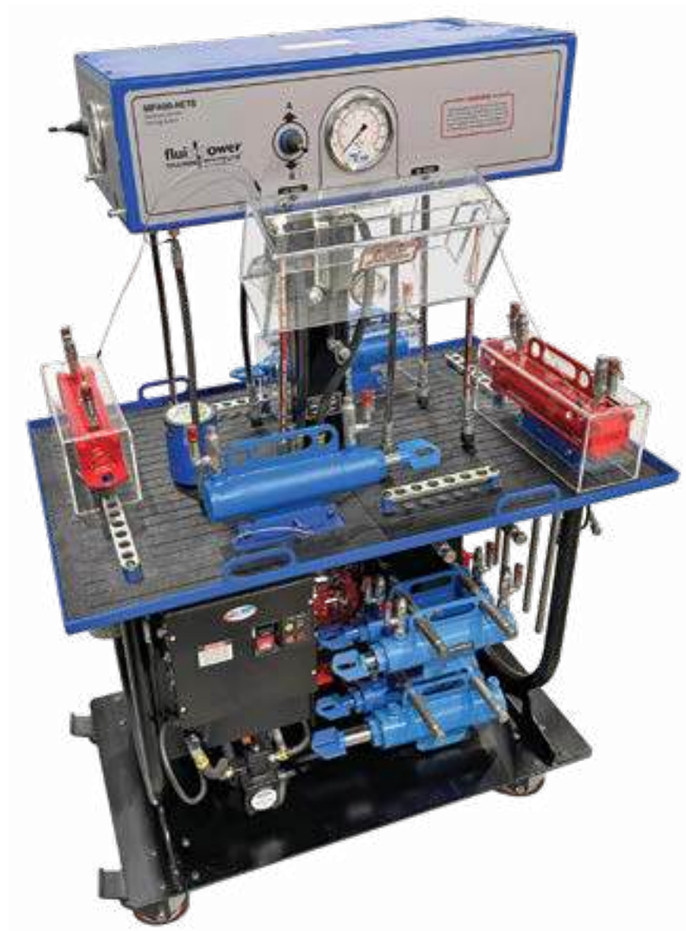
Hydrostatic Principles
MF300-VCLS-TS

The MF300-VCLS is an extremely versatile 2-in-1 training system designed for teaching and learning hydraulic steering and hydrostatic transmissions. The optional troubleshooting package makes it possible, at the flick-of-a-switch, to fault the pump in the transmission system, or everything in the steering system. And like most FPTI training systems, every MF300-VCLS simulator comes with a complete curriculum and student exercises.

Available Models

- Practical Hydrostatics Package (MF300-VCLS)
- Troubleshooting Package (MF300-VCLS-TS)

Visit **DAKTIC.COM** for pricing and details.

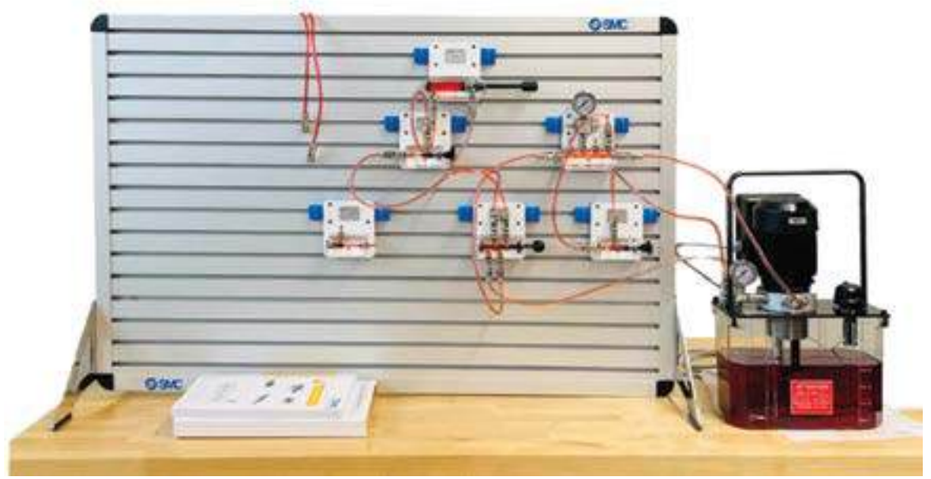


Hydraulic Cylinder Training System
MF400-HCTS

The MF400-HCTS teaches students, in addition to proper and safe cylinder overhaul procedures, how to correctly analyze the most common types of cylinder failures – in real time. Built for safety and efficiency, each four-station mobile training system comes equipped with swivel-lock casters, welded steel anchors and cradles with mechanical locks to secure each cylinder, storage for up to eighteen round weld and/or tie-rod type hydraulic cylinders, and clear acrylic safety covers to protect students from oil spray in the event they did not reassemble the cylinder or install the seals correctly.

Possible Exercises

- Overhaul a hydraulic cylinder
- Identify and use the tools needed to overhaul a hydraulic cylinder
- Inspect the components in a hydraulic cylinder to determine root cause of failure
- Replace piston and gland seals
- Test a hydraulic cylinder
- Air bleed a hydraulic cylinder



Transparent Hydraulic Systems
HYDROMODEL-200

SMC makes the inner workings of hydraulic systems visible while in operation. Each hydraulic component is housed in a transparent methacrylate body, allowing students to easily see for themselves how they work. The hoses, as well as the different devices, are connected to each other with a system of quick-fit self-sealing connectors with zero leakage.

Hydraulic + Pneumatic VR/AR Labs
zSpace AR/VR Platform

The hydraulics and pneumatics content, created for zSpace by Fun2, utilizes 3D model components, animations and system building to help students understand the structural relationships and working principles of fluid power components and systems.

Hydraulic Cutaways
FPTI

Every FPTI cutaway model is a handcrafted work of art that will make your classroom look professional and, more importantly, insure that every effort is made to help students fully understand how components work. Visit **daktic.com** to see all available models.

SRS Restraints + Air Bag Diagnostic Trainer
EM-300-07_053249

With the help of 26 system faults and inert, pre-detonated inflators, the Consulab SRS Restraints + Air Bag Diagnostic Trainer will help your students safely learn essential diagnostic skills for working with supplemental restraint systems and their related sensors. And since every OEM connector has its own test points and a connector disconnect/connect switch, it's built to withstand years of heavy use.

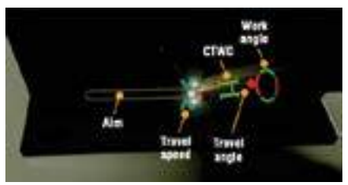
Key Features

- Fully-functional CAN Bus network
- The 26 insertable faults trigger OEM DTC's (diagnostic trouble codes)
- No codes, no SRS light until faults are inserted
- Diagnosed using OEM service procedures
- Simulate passenger weight to apply weight to the seat occupant sensors
- Easy removal of all impact sensors
- DLC (Diagnostic Link Connector) + breakout box with indicator lights

MobileArc Welding Simulator
907817

Miller Electric, the most trusted name in welding, has made introducing students to MIG welding easier, more affordable, and more efficient than ever with their new MobileArc welding simulator. Ideal for auto collision programs, a classroom set of MobileArc simulators will minimize materials costs while maximizing the number of correct real-world welds they achieve in the shop after practicing their technique in a simulated environment.

MobileArc Display
Insert the mobile device screen into the helmet or attach it to the welding gun and watch the plastic work piece become steel with the magic of augmented reality simulation technology.



Instant Performance Feedback
As soon as they begin welding, MobileArc visual guides coach your students in real-time, helping them develop muscle memory for the correct work angle, travel angle, speed, and stick-out.

Post-Weld Feedback
Student performance is scored, graphed and recorded so you can replay them, offer your own in-depth feedback, assign a grade, and assess whether they're ready to move on to the real thing.

Visit **DAKTIC.COM** for pricing and details.

CONSULTATION NOTES

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Join Our Growing Community

Every January, DAKTIC sponsors two days of technical training for automotive, heavy vehicle, and ag mechanic instructors in the Western United States. Visit **daktic.com/wwc** to sign up for news about this exciting event and become a part of our growing community.

DAKTIC | TRANSPORTATION TECH
INTEGRATED TRAINING SYSTEMS

WHAT'S ON YOUR WISHLIST?

Instructors who plan early are most likely to get the funding they need to build their program. That's why **DAKTIC honors quotes for up to one year** on most of the training products we carry. And whether you give us your wishlist in person, over the phone, via email, or using the quote request tool at **DAKTIC.COM,** we'll work hard to get you pricing in 24-hours or less.

Visit **DAKTIC.COM** and submit your wishlist today.