



Winterization

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Objective

Today, we'll discuss how to prepare your fleet for winter and diminish service interruptions including

- The basics
 - Tires
 - Windshield
 - HVAC
 - Batteries
 - Engine Compartment
 - Air System
- Reminders: not to be overlooked

The Basics



- Tires
- Wipers, Washer fluid and Windshields
- HVAC
- Batteries and Electrical system
- Engine compartment / AUX Heat system
- Air system
- Operator Training

Tires

The tires are the only contact with the road. Therefore, they are one of the most important part of the coach. Properly serviced and maintained tires can make or break the safety and success of the trip. Choosing the correct tires for the conditions is also very important. Heavier lug tires on the drive axle will reduce the chance of a coach getting stuck and stranding your customers, operator and coach.

- Tread depth
- Correct inflation
- Tag unload feature operational
- Spare tire condition
- Make sure all tires have a valve stem cap installed





Windshields, Wipers, and Washer Fluid

- **Wiper blade condition**
 - No tears or blade separation.
 - Check that they correctly stay in constant contact with the windshield and clear with no holidays.
 - Are winter spec blades available?
- **Wiper arms are in good condition and operate smoothly.**
 - Make sure the arms are not worn or loose. Tighten or replace the arms as required.
- **Washer fluid system**
 - Check the freezing temp of the fluid. -0 degrees or lower.
 - Confirm the pump operates correctly (Check in as cold a temperature as possible)
 - Make sure the spray pattern covers the complete wiper area. (This was listed as 1 of the top 10 Out Of Service violations by CVSA.)
- **Windshield**
 - Replace windshield if there are any visible cracks or chips. Any issues with the condition of the windshields will be exaggerated by the large temperature swings and stress on the systems due to ice buildup.
- **Suggestions:**
 - Treat the windshield (and side drivers window) with a product like RAINX or similar.
 - Spray the arms and wiper blades with silicone. This will reduce the ability of ice and snow to adhere.

HVAC

Airflow is king!

- Flush out the condenser and heater core elements with warm, high volume – low pressure water to remove all salt and sand from the fins. Take care to check that the drains are not plugged.
- Replace the system filters in the drivers and passenger systems. Especially if you have installed a higher MERV rated filter element.
- Check the correct operation of the main heat and defroster fan assemblies. Double check the connections are tight, the amperage is correct and if installed, the brushes are serviceable.
- Make sure all heat valves are open.

Batteries and Electrical System

- Batteries:
 - Dirty or moisture covered batteries will suffer from surface discharge.
 - Cracked, bulging and distorted casings.
 - Tight corrosion free connections.
 - Correct electrolyte levels and Specific Gravity.
 - Load test
- Charging and connections
 - Check the output of the alternators
 - Check that all connections are tight and corrosion free from the alternators to the batteries
 - Perform a voltage drop check

NOTE: Alternators make horrible battery chargers!

- When a coach is running on the road, the alternators are designed to handle the electrical load of the vehicle. There is only a small percentage of power used to replenish the battery system. This will reduce at low idle speeds.
- “Jump” starting a coach should be avoided. This should only be used as a last resort. It is extremely easy to cause some very expensive electrical system damage by improperly connecting jumper cables to start a coach. **Jump starting should only be attempted from the rear jump posts in the engine compartment.** We have seen several control module failures due directly to improper jumping.

Battery Condition – Testing & Charging



Battery Condition – State of charge, clean physical appearance and terminal connections are critical before attempting to start or boost/jump start engine.

- **Test voltage on each battery individually with multi-meter**
 - If voltage reading on each battery is 12.4 volts or higher, charge is sufficient to start engine
 - If voltage reading is less than 12.4 volts, charge or replace batteries before starting engine
 - Remember, This is only telling you part of the story.
- **Inspect physical appearance, terminal connections and securement**
 - Look for bulging sides, leaking, excessive contaminants on top
 - Battery Terminal Connections must be clean and secured properly
 - Battery hold down secured properly
 - Battery Cable connections – As a reference, there can only be a voltage drop at a single connection of 1/10th of a volt. And a voltage drop on a on an entire branch of .5 of a volt.
- **Properly test the health of the batteries**
 - Check the Electrolyte level and Specific Gravity of each Cell
 - Perform a load test

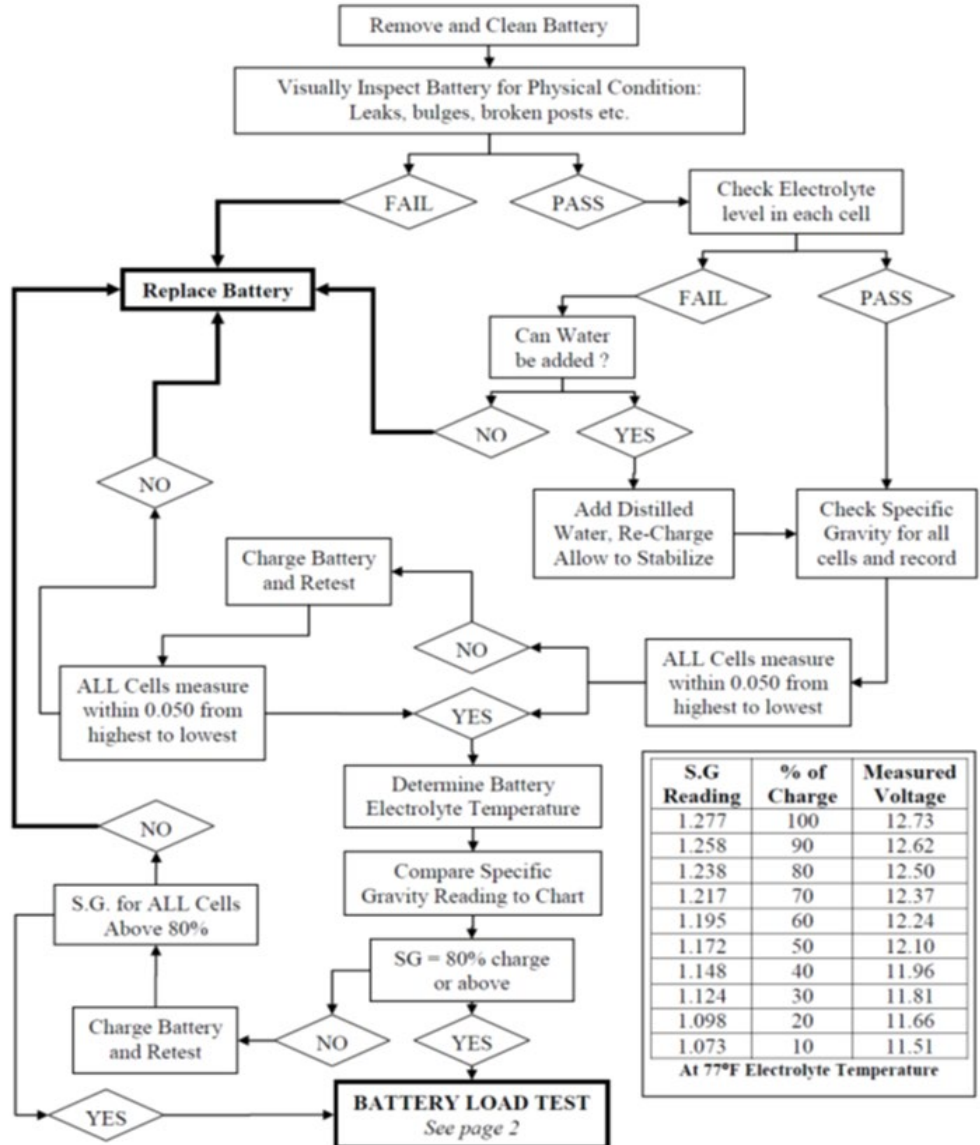
Suggestions

- Jump or boost starting should be avoided whenever possible, especially when batteries are completely depleted, i.e. below ~10.5 volts
- Alternators are designed to maintain batteries & electrical system, not charge them! Discharged batteries never fully recover and alternator life is diminished.
- **Onboard Inverter/ battery charger will not work with batteries below ~10.5 volts**



Battery Testing

BATTERY TESTING CHART



S.G Reading	% of Charge	Measured Voltage
1.277	100	12.73
1.258	90	12.62
1.238	80	12.50
1.217	70	12.37
1.195	60	12.24
1.172	50	12.10
1.148	40	11.96
1.124	30	11.81
1.098	20	11.66
1.073	10	11.51

At 77°F Electrolyte Temperature

3-Minute Battery Test



- Battery is disconnected or removed from the coach
- Inspect battery
 - **PASS**, is ready / capable of charging
- Connect charger
- Set to @ 30 Amp rating
- Allow battery charge rate (amp meter) to stabilize for approximately 3 minutes
- Check voltage **WHILE** charging
- If more than 15 volts are required to charge @30 Amps INTO battery cells, battery has excessive internal resistance – the battery has '**SULFATED**' plates
- Your done, that battery will never be dependable

Engine Compartment

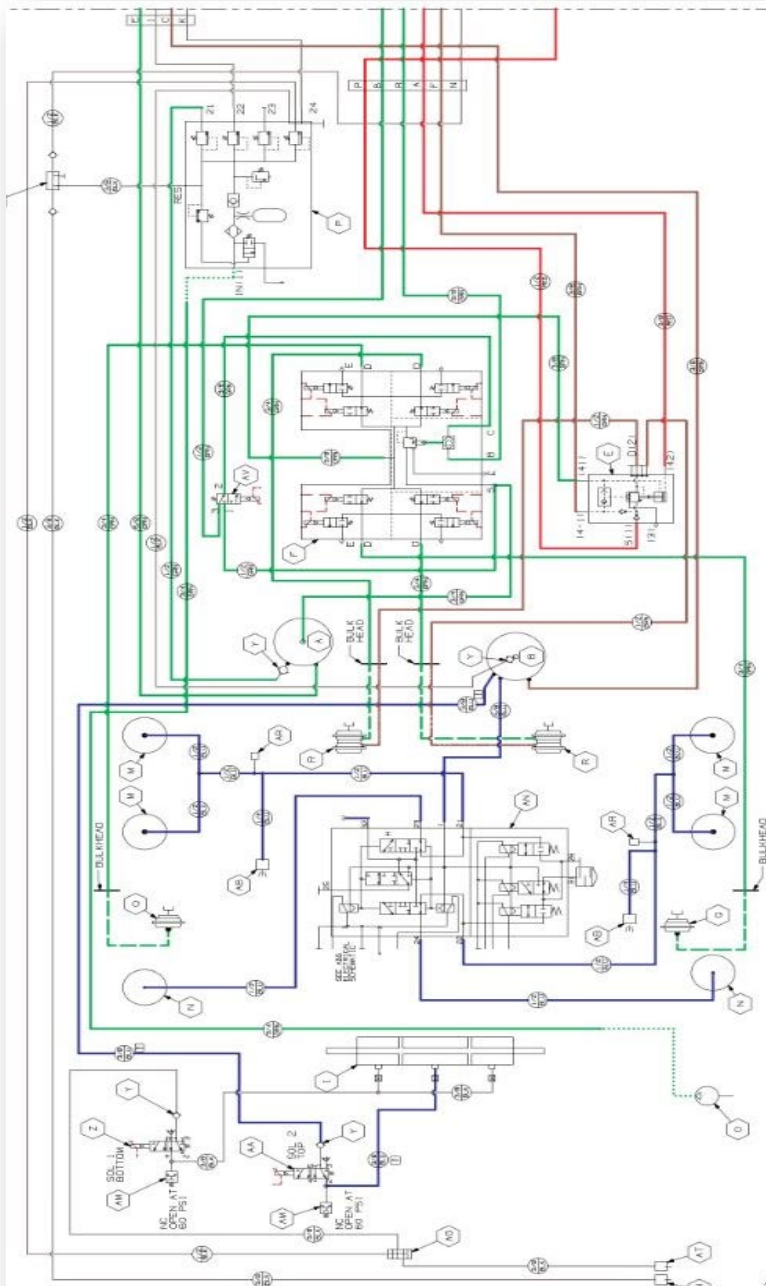
- Engine Coolant
 - Test that the coolant is properly rated for PH and mixture strength.
 - Ensure the coolant is at the correct level
 - Inspect the hoses for any signs of leaks, cracking or blisters.
- Belt condition
 - Inspect the belts for the correct routing and condition
 - Ensure that the correct spare belt sizes are in the spare belt kit
 - Inspect the idler pulleys spin freely
- Radiator and Charge Air Cooler
 - Rinse the RAD and CAC with high volume / low pressure water removing salt and contaminants from the fin areas.
 - Inspect the cooling fan operation
- Lavatory
 - Make sure the lavatory main tank as well as the overflow tank are serviced with fluid with a low temperature rating. A frozen lavatory tank could cause tank damage.
- AUX Heater
 - This is a very important system for operating a modern diesel engine. This system helps keep the engine in the correct operating temperature to complete the regen process. This system will also make sure that the engine is properly preheated on initial start up.
 - Follow the OEM information for proper service and system operating guidelines.
- DEF Fluid
 - Test to make sure your DEF fluid is rated for the lower temperatures.



Air System

A properly serviced air system is extremely important when operating in winter conditions. The air dryer system should be on your normal preventative maintenance schedule; however, intermediate checks may indicate that the system is allowing moisture to enter the system and may need to be serviced more frequently.

- Drain all air tanks of water. Note any excess of oil as this will be an indication of possible compressor failure.
- Service and replace the desiccant cartridge in the air dryer.
- Confirm the correct operation of the air dryer system paying close attention to the purge valve and heater operation.
- Inspect air lines for any wear or cracking. Most air lines are rated to -35 degrees.



Be Prepared



- At least 2 gallons of windshield washer fluid. (Lowest temp possible)
- 100-foot 12ga extension cord. Make sure it is a heavy enough gauge to handle the loads and winter environments.
- 1-2 gallons Concentrated coolant
- Spare belts
- Long handled push broom (for removing snow)
- Snow shovel
- Spare fuses and light bulbs
- Lavatory concentrate
- Gloves and safety vest

Training and Safety Reminders

The most prepared coach needs a skilled and focused operator to make sure passengers arrive at their destination safely. Here are a few employee training suggestions and reminders.

OPERATIONS:

- Know the weather, both en-route and at your destination. Being prepared to say the weather is just too bad might be the difference between success and failure.
- What are the optional routes to take if needed.
- Have we provided everything we can to our operator for his success on this trip.

OPERATOR:

- Proper jump start procedures. Each OEM publishes the correct procedures for their coaches in the maintenance manuals. Print and review with your operators.
- How to properly remove ice build-up on the windshield wipers and windows.
- Proper use of the Tag Axle unloading system. This could save a tow and keep the trip on schedule.
- How to remove snow build-up on the roof of the coach. Not removing this snow is a violation, many states have laws in place that mandate the removal of all snow and ice from the roof. (NH – Jessica's Law) It doesn't take much snow on the roof to change the handling characteristics of the coach.
- Slow down and **DO NOT USE CRUISE CONTROL.**
- Drive within your capabilities. Know your limitations. If your concerned, so are your passengers.
- Keep the dash area clear of anything not required to operate the coach. The airflow from the defrosters has been engineered to be the most effective. If you have tissue boxes and tour brochures restricting the airflow the defrosters will not be effective.
- When to plug in the battery charger and engine block heater.



Questions



