

**Shelburne Falls Trolley Museum**

**Trolley Car No. 10**

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# Shelburne Falls Trolley Museum

## Trolley Car No. 10

### Introduction

The Shelburne Falls Trolley Museum's Trolley Car No. 10 was manufactured by the Wason Manufacturing Co. of Springfield, Massachusetts in 1896. Car No. 10 permanently berths in the museum's all-metal car barn. Like all trolley cars, it operates using electric traction power. Car No. 10 was originally equipped with four traction motors, one for each of its four axles. Two motors are currently mounted because using just two improves the museum's operations. Car No. 10 was designed to operate on 600 volt DC electricity; however the museum operates the car using 300 volts which matches its needs at the museum perfectly.

The "**Trolley Power Substation**", located in the car barn, converts standard 240 volt utility-supplied AC electricity into 300 volt DC electricity for Car No. 10. Two power switches de-energize and isolate the power substation and these are kept turned OFF except when the trolley is in use.

DC electricity is delivered to trolley cars via an overhead wire known as the "**Trolley Wire**". Trolley cars can move under their own power only on tracks equipped with a trolley wire. These tracks are known as "**Tracks Under Wire**". The track itself serves as part of the electrical circuit; however, it does not represent a shock hazard since the track is electrically grounded and therefore safe to touch. The trolley wire, on the other hand, will provide a severe electrical shock if touched and therefore represents a danger to avoid.

Trolley Car No. 10 has two interior compartments. The "**Passenger Compartment**" has bench seating along the sidewalls with electric heaters below to provide comfort in the cold weather. The "**Freight Compartment**" is without seating or any other contents (other than those intentionally placed there) and includes large sliding doors on each side for moving cargo in and out. Since these compartments allow Car No. 10 to provide combined freight and passenger service, it is known as a "**Combination Car**", or simply a "**Combine**". The two ends of the car are referred to as the "**Passenger End**" and the "**Freight End**". The museum utilizes the freight compartment doors together with loading platforms to minimize physical barriers for boarding passengers.

### Safety Equipment

1. First Aid Kit – A first aid kit is located inside the freight compartment on the end wall to the right of the vestibule door. It is behind the cotton bale.
2. Fire Extinguishers – There is a fire extinguisher in each of the two vestibules.
3. Canopy Switch – This large red-handled switch is located inside the freight vestibule directly above the end door. This switch disconnects the traction motors, either when operated manually or automatically when there is an overload.
4. Electrical Fuses – Large fuses on the end wall inside the passenger vestibule protect the lighting and heating circuits.

## Hazards

The most immediate hazards on Car No. 10 are those related to electricity. Under normal circumstances, passengers and crew are not exposed to any electrical hazards. It is under unusual circumstances that attention must be paid to the potential for the following electrical hazards:

1. Controller Cabinets – The two motor controllers, located in each vestibule, are used by motormen to control Car No.10's movement. The controllers are electrically grounded and enclosed by a wooden cabinet and therefore safe to touch when the cabinets are closed. However, when these cabinets are open, electrical contacts which may be energized are exposed. These cabinets must be kept closed to avoid electrical shock hazards.
2. Canopy Switch – The canopy switch, located above then end door in the freight vestibule, is enclosed by an insulated metal case. The operating red handle is insulated and therefore safe to touch. The metal enclosure can be opened for inspection and is held closed by a fastening wing-nut. If the enclosure is open, electrical contacts will be exposed which may be energized. The canopy switch must be kept closed to avoid electrical shock hazards.
3. Defective Wire Insulation – All of the wiring within Car No. 10 is covered with black rubber insulation which makes the wires appear similar to rubber hoses of various sizes. Most of the wiring is either hidden inside Car No. 10 or located below the floor. In some cases, groups of wires are harnessed together within lengths of used fire hose. Great care is taken to protect wires from moving parts which might rub away insulation. If insulation is rubbed away, the silver or copper colored metal conductor within will be exposed. Metal conductors may also be exposed where insulating electrical tape falls away. Any exposed metal conductors are electrical shock hazards. Immediate steps must be taken to keep everyone away from exposed conductors and the insulation repaired before the car is used.
4. Derailment – Should Car No. 10 come off the track, a dangerous shock hazard exists because the car is no longer electrically grounded. Passengers and crew on board a derailed trolley car are perfectly safe while remaining onboard; however, a shock hazard exists for those stepping off the car onto the ground. Touching both the trolley car and the ground is dangerous under these conditions. A derailed trolley car can only be safely exited with a jump until the trolley car is disconnected from the 300 volt DC electricity.

All electrical hazards can be eliminated from Car No. 10 when needed for inspection, repair, or emergencies. Refer to following procedures for details.

It must be stressed that anyone going under Car No. 10, or standing close to Car No. 10, is taking an unnecessary risk. It is never safe to be under Car No. 10 except under carefully controlled conditions. It also unsafe to stand close to Car No. 10 where crewmembers may not be aware someone is present.

The remaining hazards associated with Car No. 10 are related to physical injury such as falling or being pinched, crushed, or hit. These hazards exist when there is an unexpected movement of either Car No. 10 or one of its doors or windows. Following the operating procedures outlined in the Operating Rules, wearing appropriate clothing, and maintaining mindfulness are the best protections against such hazards.

## General Equipment

Trolley Car No. 10 is doubled ended, with a “**Vestibule**” enclosing motorman controls at each end. Each vestibule is equipped with an “**End Door**” which separates the vestibule from the interior compartment and two “**Side Doors**” where passengers can enter from outside.

Car No. 10 rides on two double axel assemblies called “**Trucks**”. Each truck has four wheels and a suspension system of springs to cushion the ride. Trucks may be equipped with one or two traction motors, each driving one axle. Wooden wedges called “**Trigs**” hang from chains near each truck at the center of Car No. 10 on one side. These trigs can be wedged between a wheel and the rail to prevent the car from moving.

A single “**Trolley Pole**” is located on the roof of Car No. 10. The pole makes contact with the trolley wire and supplies electrical power to the car. Car No. 10’s pole can be rotated and swung into position at either end of the car. The pole is spring tensioned so it wants to move upward toward the wire. The pole is lowered by pulling down on the “**Pole Rope**” which is tied to the end of the pole. The lower end of the pole rope is wound onto a pulley inside the “**Retriever**” which is clipped to the face of the car. The retriever contains a powerful spring which quickly pulls down the pole when conditions cause the pole to come free of the wire. A “**Trolley Wheel**” is at the tip of Car No. 10’s trolley pole. This pulley contacts the trolley wire and conducts the electricity to the car while reducing friction and wear.

Car No. 10’s passenger compartment and both vestibules are equipped with “**Sash Windows**” which can be opened. These windows are not counterweighted and are therefore heavy. The sash windows can cause injury if slammed shut unexpectedly. The windows in the passenger compartment are held open by catches on the right side of each lower sash. Care must be taken to ensure the catches are secure when the windows are left open. The sash windows ventilating the vestibules must be held open with prop-sticks. The prop-sticks are stored on the window sills when the windows are closed.

Both interior compartments have “**Clerestory Windows**” just below the ceiling. These small windows which are mostly original to Car No. 10 can be louvered open to provide excellent yet unobtrusive ventilation in most weather.

Car No. 10’s two interior end doors, its door separating the two internal compartments, and the two large freight doors, are all “**Sliding Doors**”. The two freight doors can be latched closed or simply left open depending on operating conditions. The three smaller interior doors are typically left open. To ensure these doors don’t close unexpectedly, prop-sticks are placed on the slide track above each door opening. These sticks must be removed before these doors can be closed.

Trolley Car No. 10 is equipped with conductor “**Bells and Pull Cords**”. There is a bell in each vestibule. Pull cords, one on each side of the interior, run the full length of the car. Each cord connects with one of the bells. The conductor uses the appropriate bell, depending on the motorman’s location, to signal directions to the motorman. Car No. 10 is also equipped with two “**Gongs**” located at each end directly below the vestibule floor. The gongs are used by the motorman to give warning of the trolley’s approach.

Car No. 10 is equipped with interior “**Cabin Lights and Heat**”, as well as two exterior “**Headlights**”, one at each end.

## Operator Controls

A “**Brake Wheel**” is located in each vestibule on the right-hand side. Car No. 10’s brakes, which squeeze against the treads of each of the car’s eight wheels, can be applied from either brake wheel at any time. The brakes are applied by rotating the brake wheel in the clockwise direction until a resistance is felt, then rotating the wheel further against this resistance to regulate the braking force. The brake wheel can be locked in position at any desired braking force by engaging a foot-operated catch on the floor in a ratchet gear. The brakes are released from the catch by rotating the brake wheel further clockwise, disengaging the locking catch with your foot after it is free, and allowing the brake wheel to gently spin free in the counterclockwise direction. The brakes will only release when neither brake wheel is set to apply the brakes.

The “**Canopy Switch**” is located inside Car No. 10’s freight vestibule on the end wall above the door. This switch is left in the OFF position when the car is not in use. When OFF, this switch disconnects the traction motors but leaves the lights and heaters circuits active. Once placed in the ON position, the switch normally does not need to be operated until the car is no longer being used. In the unlikely event of an electrical overload, the switch will automatically disconnect the motors.

The “**Reverser Key**” is a removable metal handle that is inserted into the motor controller in order to select the direction of travel and activate the motors. The motorman maintains possession of the reverser key at all times and must remove the key from the controller when not moving a trolley. This prevents anyone else from unexpectedly operating the motors.

The “**Power Handle**” is part of the motor controller which the motorman uses to regulate the electrical power for the motors. It has eight operating positions and an OFF position. When starting the car from a stop, the motors cannot suddenly be given full electrical power. This would be jarring for the passengers and harmful to the motors. Instead, the electrical power must be applied gradually, as the car builds up speed. As the handle is advanced through operating positions 1 through 8 (these operating positions are called “**Notches**”), more power is applied to the motors causing the car to increase speed. The handle must be left in each position long enough for Car No. 10 to build up speed before advancing it to the next position.

When a decrease in speed is desired, the power handle cannot simply be moved to a lower notch. Instead, the handle must first be moved to the OFF position, then to the desired operating position. Since Car No. 10 will be coasting, the handle can be moved directly to the new position from OFF. This procedure engages features of the controller to eliminate sparks which would otherwise wear away its electrical contacts.

Car No. 10’s two traction motors share the electrical power provided to them. There are two different ways for these motors to share power. When the motors are connected in “**Series**”, they share the electricity in a way that makes them stronger at slow speeds. This is particularly helpful when starting the car. When the motors are connected in “**Parallel**”, they share the electricity in a way that makes them run faster. This helps when the car is already moving along and needs to gain more speed. Power handle notches 1 through 5 use the series connection while notches 6 through 8 use the parallel connection. Switching between series and parallel is called “**Transitioning**”. This happens automatically when the handle is moved between notch 5 and 6.

There is a **Headlight Power Switch** on the end wall in each of Car No. 10's vestibules which controls the headlight for that vestibule's end of the car. Both headlight power switches are normally left ON. Headlights must be seen in working order at all times. If a headlight burns out, its power switch must be immediately turned OFF until the bulb is replaced. This is a precaution that is peculiar to certain DC lighting circuits because DC electricity arcs more easily than AC.

There is a **Heater Power Switch** and an **Interior Light Switch** on the end wall of Car No. 10's passenger vestibule. The heater power switch is normally left OFF. The interior light switch is normally left ON. If the interior lights fail to work, the interior light switch must immediately be turned OFF. The heaters may be used anytime passengers would benefit, however the heaters rapidly consume electricity and should not be ON unless needed. The heat and lighting circuit fuses are located on the end wall inside the passenger vestibule. Seek assistance in the event of an apparent bulb or fuse failure.

# Procedures

## Testing Brakes

Car No. 10's brakes must be checked each time the car begins service after being berthed in the car barn. When berthed, Car No. 10's brakes are left released after the car has been immobilized with trigs. Releasing the brakes at the end of an operating period takes the stress off the brake rigging and reduces the likelihood that brake shoes will stick to their wheels after sitting still for a period of time and rusting.

The first step to be taken as part of a brake test is to make sure that no brake shoe is stuck to its wheel. Each brake shoe can be pressed upon with a foot to see if it moves or is stuck. If stuck, it must be carefully knocked free in a way that does not harm either the wheel or the brake shoe.

Next, use a brake wheel to apply the brakes. Repeat the above process of checking the brake shoes, only this time check that each brake shoe is pressed firmly against its wheel. Once the brakes are observed to be applied, the trigs may be removed if the car is to be moved. Finally, when the car is ready to run, soon after the car has started to move slowly, apply the brakes and check that Car No. 10 stops with ease.

## Trolley Wire Power Substation Operation

The electricity for the trolley wire is converted to 300 Volt DC by the power substation in the car barn. The power substation has two switches, one to control the AC utility power connection and one to control the DC trolley wire connection. Both of these switches are left in the OFF position except when a trolley requires power.

The AC power switch is enclosed within a large grey fuse box located next to the car barn exterior wall adjacent to Car No. 10's passenger vestibule when the car is berthed. The red rubber-covered operating handle is secured with a key-lock in the OFF position. This prevents the power substation from producing any DC.

The DC power switch is mounted on the power substation opposite the AC power switch. It's identical to Car No. 10's canopy switch. Its white plastic operating handle is not locked but is left in the OFF position when no trolley power is needed. This provides extra protection for the power substation should lightning strike the wire (which is also equipped with lightning arresters). The DC power switch will automatically disconnect the trolley wire from the power substation when an overload occurs.

When possible, make a visual inspection of the trolley wire before energizing it. Look for any problems with trees or failed support structures which may have caused the wire to loosen or fall. Both the AC and the DC switches must be ON to energize the trolley wire. The DC switch is turned ON first, while the AC switch is still OFF. The AC switch will normally be locked in the OFF position with a Yellow-Lock, which all crewmembers can unlock when needed. It should not be locked in the ON position, but the key-lock should be kept nearby.

Sets of three indicator lights mounted at three locations and connected to the trolley wire, illuminate when the wire is energized and ready to power trolley cars. These lights are mounted near the trolley wire where the wire enters the car barn and also the shed. The third indicator light set is near the far end of the trolley wire.

When trolley power is no longer needed, the above process is reversed, so that both power substation switches are OFF. The AC switch is turned OFF first, and also locked. The DC switch is turned OFF last.

When necessary to keep the trolley wire power OFF for safety reasons, the AC switch will be locked with a Blue-Lock. A Blue-Lock may not be removed by anyone other than the person who locked it in place, or by someone acting under their orders. If a Blue-Lock is securing the AC switch, do not attempt to unlock it since it is not safe to energize the trolley wire until the person locking the switch has determined it's again safe. Review the Operating Rules for more information on Blue Signal protection.

## **Placing the Car's Pole on the Trolley Wire**

When berthed, Car No. 10's trolley pole is removed from the trolley wire and placed in contact with the metal frame of the car barn. This electrically grounds the trolley pole and removes electrical hazards from the car. It also provides the car with extra lightning protection while berthed.

A crewmember placing Car No. 10's pole on the wire will necessarily be standing between the rails and close to the car. Since an unexpected movement of the car at this time threatens the safety of a crewmember in this position, that person takes precautions to ensure no movement occurs. The crewmember takes the following steps:

1. Immobilize the car with trigs or brakes.
2. Confirm the canopy switch is OFF.
3. Take possession of the reverser key.

When preparing Car No. 10 for use, a crewmember may first need to rotate the pole to the freight end. In this case, the pole rope is pulled to lower the pole away from the ceiling and then tied to the retriever. The retriever is then detached from the car's passenger end and walked to the freight end where it is attached to the car again. Care must be taken while rotating the pole inside the car barn to avoid striking overhead lights and other obstructions.



Once the retriever is mounted on Car No. 10's freight end, the pole rope is handheld while being untied from the retriever. The pole rope is then slowly let out, allowing the pole to approach but not touch the wire. Once close, the trolley wheel is allowed to touch the wire briefly, and then pulled away. Car No. 10's interior lights should briefly illuminate and the car should remain still. Upon confirming this response to the brief touch of the wire, the trolley wheel may be placed to rest on the trolley wire and the pole rope allowed to wind into the retriever. The pole rope is then gently pulled out of the retriever and allowed to wind back in, confirming that the rope is free to move in and out of the retriever as the pole moves up and down.

When Car No. 10 has been put in service and is operating normally, it will be necessary to frequently move the pole from one end of the car to the other. In this case, the canopy switch is left ON while the pole is placed on the wire, however, the crewmember placing the pole must be in possession of the reverser key and the brakes must be set.

### **Conductor's Readiness Check**

Before accepting passengers to Car No. 10, the conductor must ensure the car is in a condition ready for service. The conductor checks the following items:

1. The first aid kit and fire extinguishers are on board and in good condition.
2. All interior lights are working and the heaters are in use only if needed.
3. All open sash windows are properly secured with latches or prop-sticks.
4. All interior sliding doors are held open by sticks on the door tracks.
5. The floor is free of tripping hazards and is clean.
6. The seating is properly positioned.
7. All garbage is removed.
8. A rulebook is onboard.