Model 9B
Electric Switch
Lock

Installation • Operation • Maintenance
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Installation • Operation • Maintenance

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The Model 9B electric switch lock, Figure 1, locks a lock rod, which is attached to the switch points of a hand operated switch, thus preventing unauthorized switch operation. It works in the following manner.

When a train is to leave a siding and enter the main line, the brakeman opens the door on the Model 9B lock by removing the padlock, and pulling the door handle down, and raises the operating handle to the preliminary unlock position, Figure 2a. Contacts in the lock open the circuit to the wayside signal on the main line which displays a stop indication. Other contacts start a timer (nominally, 10 minutes) which prevents further unlock operations to ensure that a train (which may have passed the signal just before it went to stop) arrives at and passes the switch location. In some installations, unlock is controlled by a dispatcher at the request of the brakeman.

Figure 1. Model 9B lock with junction box on concrete foundation.
Figure 2. Operational summary.

After the signal clears, or a train on the main line goes by, a banner indicator in the lock reads UNLOCK and the brakeman can move the operating handle all the way over, Figure 2b, which lifts a lock plunger out of the hole in the lock rod. The brakeman can now operate the hand throw switch reverse so that the train can proceed onto the mainline.

Before leaving the lock location, the brakeman returns the hand throw switch to normal, moves the lock’s operating handle to reinsert the locking plunger in the lock rod, and closes and padlocks the lock door, Figure 2c.
GENERAL DESCRIPTION

The Model 9B lock is available in two heights, high and dwarf, as shown in Figure 3. The cast iron base, Figure 4, view A, is bolted to the pedestal of a high lock or directly to the mechanism case of a dwarf lock. The base has two compartments, one for wires and the other for the locking plunger. Either a wire entrance plate, Figure 4, view C, or a junction box, Figure 5, can be bolted to the wire compartment. A pressure grease fitting is provided for lubricating the locking plunger.

Figure 3. Two heights are available: high and dwarf.

Figure 4. A — base.
B — base detail for lock rod.
C — wire entrance plate.
D — threaded end lock rod.
E — tang end lock rod.
Figure 5. The junction box, an optional feature, can be used when the lock is mounted on a concrete foundation.

Figure 6. A cast iron pedestal supports the lock, has separate compartments for wiring and operating rod.
Two types of lock rods are available, one with a threaded end, Figure 4, view D, the other with a tang end, Figure 4, view E. The tang end lock rod is for pipe connection to the switch. Lock rods are furnished drilled only for the closed point position of the switch.

The optional junction box, Figure 5, is normally used when the lock is mounted on a concrete foundation. The junction box is fastened to the base of the lock with four cap screws in place of the wire entrance plate shown in Figure 4, view C. Cable may be brought directly into the junction box through a ½ inch pipe threaded fitting. Inside the junction box are two terminal blocks with twelve terminals to a block. The junction box cover is fastened down with two cap screws, necked to prevent losing them when the cover is removed. Matching padlock holes are provided on one side of the case and cover. The cover is gasketed to provide a weathertight seal.

The cast iron pedestal, Figure 6, is divided into two compartments by a sheet metal partition. The front compartment encloses the operating rod and locking plunger; the back compartment houses the wiring from the base to the mechanism. The four smaller cap screws at the top of the pedestal are for bolting down the mechanism; the four larger cap screws are for bolting down the case which is open at the back. A separate filler bar, bolted to the rear of the pedestal, closes the gap in the case. Thus, the case may be removed to expose the entire mechanism for easy maintenance.

The cast iron case, Figure 7, has an integral partition separating the mechanism from the operating handle compartment. The indicator glass and bezel are fastened to the case partition, just below the top of the case. Hinge lugs are cast on the left-hand side of the case for the trainman’s door. The trainman’s handle is on the right-hand side. A lug is cast on top of the case for the latch strap on the maintainer’s cover.

Figure 7. The cast iron case carries the maintainer’s cover and the trainman’s door.
The banner indicator, Figure 8, is operated by the locking key through a push rod which has a spring to take up any overtravel. A collar, near the lower end of the push rod, supports the push rod free of the locking key until the locking key starts to rise. This relieves the armature of any load in the deenergized position. When the key is lifted, the push rod elevates the metal banner to show the word UNLOCKED through the window in the partition, Figure 7.

Four handle-operated adjustable contacts, Figure 22, can be adjusted to make or break in any position of the 180-degree throw of the operating handle. Usually, they are adjusted so that two are closed in the normal position of the handle and the other two are closed at the intermediate position of the handle. The commutators are molded with a circle of rectangular openings 12 degrees apart on one side only, as shown in Figures 8 and 22. A studded washer, placed between each two commutators, has a key which fits into a keyway in the shaft. Because the commutators are engaged on the studs of this washer, they are turned by the movement of the shaft.

A door-operated circuit controller, Figure 9, view A, is mounted on the case partition. The controller has two independent normally open and two independent normally closed relay-type contacts. The lever-operated emergency release of the latch-out type, Figure 9, view B, fits on the left-hand side of the frame near the force-down lever. The release is equipped with one normally closed contact and is sealed with a wire seal.
OPERATION

Starting with the switch locked in its normal position the following text and Figures 10 through 16 describe, step by step, the operation of the lock and the resulting action of the mechanism. See Figure 24 for references to the various parts of the mechanism.

Preliminary Unlock

The padlock is removed and the trainman’s handle is operated to open the door. A heavy flat spring, Figure 24, view C, holds the door closed tightly, since it engages the door lug when the trainman’s handle is in its upright position. As the trainman’s handle is swung forward and down, Figure 10, the spring is released and the cam forces the door open, even if it should be frozen shut. The operating handle, Figure 24, view A, is then raised to the intermediate position. A spring-loaded catch on the indexing bracket engages a detent on the locking dog at the intermediate position, thus holding the handle and locking dog in this position.

The initial movement of the operating handle moves the handle operated shaft, Figure 24, view A, and its associated commutators 42 degrees. The commutators may be set to break the signal circuits taken through them so that the preliminary movement of the operating handle sets the signals to stop.

Further movement of the operating handle much beyond the detent position is prevented because the notch in the locking dog would engage the locking key. The detent holds the locking dog free of actual contact with the locking key so that the locking lever with key is free to pick up whenever the coils are energized. See Figure 24, view B.

The banner indicator in its down position shows LOCKED through the indicator window. A collar on the push rod rests on the base of the indicator frame.

Figure 10. Pulling handle down to open door.
Unlock Position

With the operating handle in the intermediate position, Figure 11, the lock is still effective because the locking key rests in the notch, thus preventing further movement of the operating handle.

When the control circuit is energized, the armature, Figure 24, view B, is attracted to the pole pieces and raises its attached locking lever and key to clear the notch on the locking dog. As the locking key raises, it comes up under the push rod which actuates the banner indicator. Any overtravel by the push rod is taken up by a coil spring underneath the banner indicator. Thus when the locking key picks up, the banner indicator moves to show the word UNLOCKED through the indicator window. With the interlocking dog thus unlocked it is free to be rotated further by the operating handle, Figure 12.

As the operating handle is rotated to the reverse position, it carries with it the locking dog to which is attached the operating rod through the crank pin. In the normal position of the operating handle, the locking dog is at rest with its yoke or offset portion, Figure 24, view B, at its lowest point.

The operating rod is fastened to the locking dog by a pin, so when the handle moves, the operating rod moves also. As the operating handle is rotated from the normal to the reverse position, the operating rod raises, bringing the plunger with it. When the operating handle reaches the reverse position, the plunger is completely withdrawn from its hole in the lock rod, thus permitting the switch to be thrown.

Relock Position

Before the mechanism can be rellocked, it is necessary to restore the switch to its normal position. Otherwise the hole in lock rod will not align with the plunger, thus making it impossible to restore the operating handle to its normal position.
A semi-circular lug, cast on the inside of the trainman’s door, Figure 11, prevents the door from being closed until the operating handle is in the normal position. Only then can the door be latched and the padlock applied, Figures 13 and 14.

As the operating handle is returned to normal, the locking dog and commutators are rotated through 180 degrees. When the locking dog reaches the intermediate position, the locking key is free to drop into the notch on the locking dog. At this point the lock is again effective unless energy is holding up the armature. When the locking key drops into the notch, the banner indicator drops to show the word LOCKED through the indicator window. During the travel of the operating handle from the intermediate position to the normal position, the force-down lever comes into play to ensure that the locking key is forced down into its notch on the locking dog.

**Force-Down Operation**

The "forced drop" feature consists of a pivoted, goose-necked force-down lever, Figure 24, view A. A roller on the goosenecked end of the lever engages a cam on the face of the locking dog. Until the handle is in the intermediate position, a pin on the left side of the locking dog prevents the lever from rising to allow the locking key to lift out of the notch. As the operating handle is raised to the intermediate position, the roller on the force-down lever engages the cam on the face of the locking dog and lifts enough to allow the locking key to clear the notch in the dog. At the same time, the pin on the left face of the locking dog moves down to clear the tapered portion of the force-down lever, thus releasing it just before the roller engages the cam and starts to lift the lever. When the armature is pulled up by the magnetic force of the energized coils, the force-down lever is already up to allow the key to be raised out of the notch.
Figure 15. To use emergency release, operate handle to intermediate position, remove seal, hold down emergency release lever, and move operating handle to unlock position.

Figure 16. To reset emergency release, pull reset lever forward as shown.

Operation of Emergency Release

Assuming that the normal control circuit does not respond and that the switch must be unlocked and operated for emergency reasons, the emergency release is used. See Figure 9, view B, and Figure 15.

The operation of the switch lock is the same as previously described except that the unlock is not obtained electrically with the operating handle at the intermediate position.

First, the seal on the emergency release is broken. The sealing strap under the emergency release lever must be pulled forward out of the way before the emergency release lever can be pushed down to release the locking key via a cross-connecting arm.

Now the lock is operated in the normal manner except that the emergency release lever is held down until the operating handle is turned a few degrees beyond the intermediate position.

The emergency release, being of the latch-out type, cannot be reset except as illustrated in Figure 16. When the emergency release lever is pressed down, the reset lever, which is spring loaded, snaps its notched portion over the tapered end of the emergency release lever and holds the lever down until it is reset. The emergency release contact opens when the reset lever snaps its notch over the end of the emergency release lever. The contact does not close until the release is reset. The emergency release lever cannot be resealed until it is reset.
Figure 17. Typical switch-lock control circuit with emergency release and normally deenergized approach relays. Broken lines show optional supervisory control.

Figure 18. Typical switch-lock control circuit with time release and normally deenergized approach relays. Broken lines show optional supervisory control. Preliminary movement of crank will slot signals.

CIRCUITS

Figure 17 shows an arrangement with normally deenergized AR relays. This circuit is suitable for use on a two-, three-, or four-wire signal system (2-wire shown) with or without supervisory control. Since AR relays are connected to the line through back contacts on the NWPR relay, the signal circuits are opened by the preliminary movement of the operating handle. When supervisory control is used, the signal circuits cannot be opened unless the supervisory control relay (WLZR) is energized and the operating handle is moved to the intermediate position. The circuit as shown uses the mechanical emergency release. A short track circuit is used to release the lock for a train leaving the main line. An indication, if required, may be taken from the NWPR relay.

Figure 18 shows an arrangement with normally deenergized AR relays. This circuit is suitable for use on a two-, three-, or four-wire signal system (3-wire shown). The preliminary movement of the crank opens the signal controls, releasing the NWPR relay. The circuit can be used either with or without supervisory control. The circuit is shown with an automatic electrical time release. A short track circuit is used to release the lock for a train leaving the main line. An indication, if required, may be taken from the NWPR relay. The mechanical emergency release can be used in addition, if desired.
INSTALLATION

The Model 9B switch lock may be installed on wooden ties or bolted to a concrete foundation. Figure 19 shows a typical installation on two ties, together with a switch circuit controller and a GRS hinged front rod. The lock may be placed on either side of the switch and located on the ties at the proper "A" dimension so that there is unrestricted movement of the lock rod. Check that the locking plunger drops freely into the hole in the lock rod when the lock is positioned on the ties with the switch in its normal position. Locate and drill mounting holes and fasten the lock to the ties.

Figure 20 shows the Model 9B lock mounted on a concrete foundation. There is ample clearance in the 5-inch square slot for the base lug. The steel tie straps between the concrete foundation and the ties hold the distance from lock to rail constant. The attached junction box is recommended where the lock is mounted on a concrete foundation. Construct the concrete foundation following the dimensions given in Figure 20. Insert the hook bolts before the concrete is poured. Position the foundation so that there will be unrestricted movement of the lock rod in its slot and the clearance dimensions agree with railroad requirements. See that the locking plunger drops freely into the hole in the lock rod when the lock is positioned on the foundation with the switch in its normal position.

Wire is brought in through a cable entrance adapter screwed into the 1½" pipe threads on the wire entrance plate or on the optional junction box. Wires are run up that part of the pedestal which is closer to the wire entrance and directly under the circuit controller. Wires may be run without removing the case, or the case can be removed without disturbing the mechanism. Divide the wires so that those for attaching to left-hand terminal posts come up that side of the pedestal, etc.
MAINTENANCE

Operating Values

Voltage, operating ............ 8 to 12 volts d-c
Working current, maximum .... 31.5 ma.
Saturation current ............. 64 ma.
Dropaway current, minimum ... 2.85 ma.
Resistance, nominal .......... 200 ohms

Lubrication

Lubricate the lock plunger with grease through the pressure fitting in the base. Other bearings do not require lubrication.

Armature (Figure 21)

Armature end play should not be less than 0.010” nor more than 0.020”. Make this adjustment so that the locking load on the locking key is not transmitted to the armature trunnions.

Adjust and lock the residual stop screw for a 0.015” parallel armature air gap.

When the locking key is in the full released position (picked up), check that it clears the top of the dog on the operating shaft by at least 0.010”.

Figure 20. Concrete foundation mounting.

Figure 21. Parts of mechanism cut away to show armature assembly and related parts.
Figure 22. Exploded view of commutator assembly.

Commottors (Figure 22)

Commottors are adjusted so contacts make and break as required. Adjust each of the three tips on the contact spring so as to make contact for as much of its full width as practical and check that they exert a pressure of 5 to 9 ounces against the contact band on the commutator as measured as near the point of contact as possible. The variation in this pressure must not exceed 2 ounces between tips on the same contact spring. Check that the contact spring does not overhang the bands on the commutators by more than 1/32 inch.

Contact adjustment is made by loosening the nut at the end of the commutator shaft and sliding the bushings back enough to disengage the commutator from the studded washer. Shift the commutators to the desired position and put them back in contact with the studded washers. Do this two at a time, starting from the back. Replace the outside washer and bushings. Tighten the nut until the whole assembly is snug, then replace the cotter pin.

Banner Indicator (Figures 8 and 21)

Check that all moving parts operate freely. When the operating handle is in its full normal position, the banner arm must rest on the stop pin. When the operating handle is in the full reverse position and the locking key is in the full released position, the banner arm must rest against the top of the mounting bracket. Check that the banner clears the bezel and drive screws for the bezel by at least 1/32 inch.
Emergency Release (Figure 9, view B)

1. With the operating handle in the normal position and the emergency release lever in the notch, tripped and with the contact opened, adjust the stud so that the cross-connecting arm just clears the end of locking lever.

2. With the operating handle and emergency release lever both in the normal position, check that the clearance between the cross-connecting arm and the end of locking lever is not less than 3/16 inch.

3. With the operating handle in the intermediate position and the emergency release lever held all the way down, check that the locking key raises far enough to release the lock.

4. With the lock energized and with the conditions as in paragraph (3) above, check that there is a clearance between the cross-connecting arm and the end of the locking finger.

5. Check that the emergency release lever does not bind against any part of the lock case.

6. With the sealing strap on the case in position for sealing, check that the emergency release lever cannot be operated far enough to open the contact.

Door-Operated Circuit Controller (Figure 9, view A)

Check that the contact opening is not less than 0.050 inch, that the contact pressure is from 8 to 16 ounces, and that the contact finger is from 0.010 to 0.015 inch away from its stop with the contact closed.

Cover (Figure 23)

The cover fit can be adjusted as follows: Remove the cotter pin in the hinge pin on the cover and remove the cover from the lock. Loosen the jam nuts at the bottom of the eyebolts and screw the eyebolts in until the cover can be closed with even pressure all around. Adjust each eyebolt the same. Hold them straight and tighten the jam nuts. Reinstall the cover and replace the cotter pin. Make sure the eyebolts do not put excessive pressure on the hinge pins.

Removing Mechanism (Figure 8)

1. Remove the case as follows:
   a. Drive out the roll pin holding the operating handle to the shaft.
   b. Remove the operating handle and felt washers from the shaft.
   c. Remove the four cap screws and lift off the case.

2. Remove the cotter key holding the crank pin in the operating rod and locking dog.

3. Remove the crank pin holding the operating rod in the yoke section of the locking dog.

4. Remove the four cap screws and lift out the mechanism.
Figure 24. Operating parts of Model 9B switch lock shown locked in normal position.