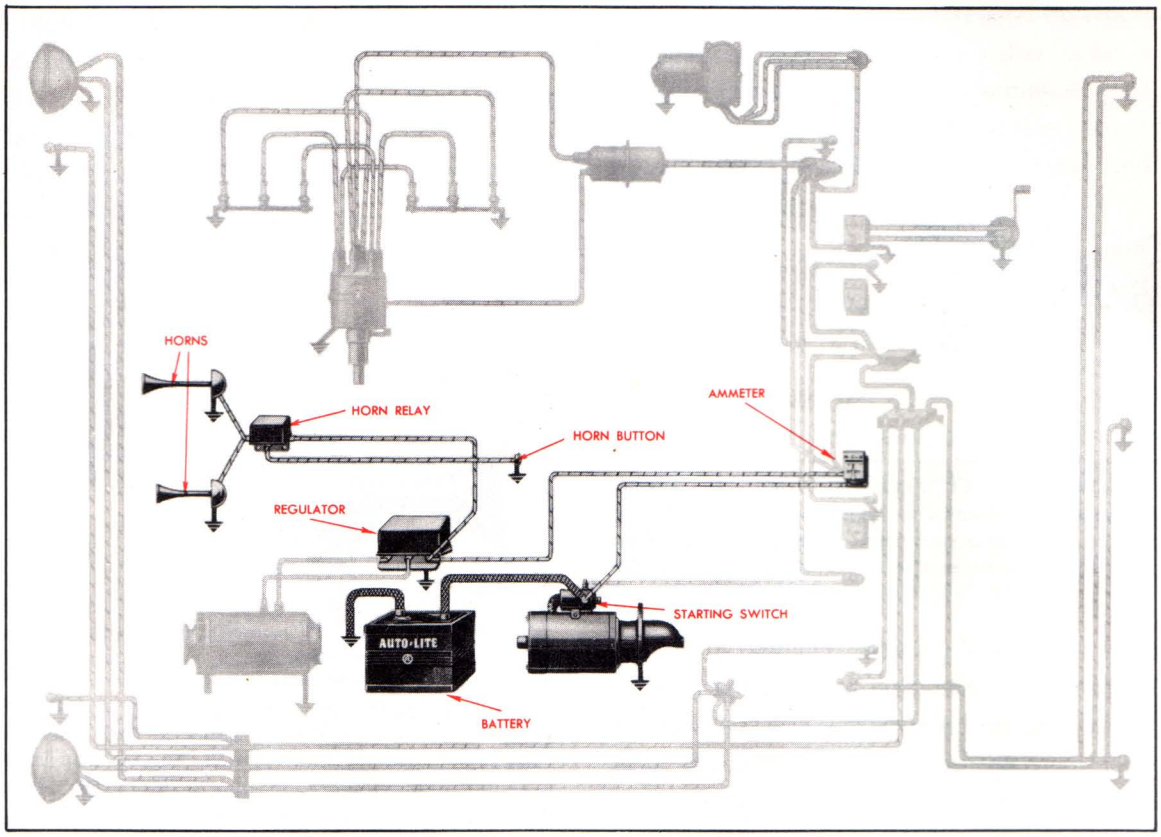

FIGURE 186—THE HORN CIRCUIT. This illustration of the horn circuit is the same as the complete car diagram shown in figure 1; however, all of the units and wiring which do not enter into the horn circuit have been subdued. While this illustration shows both the starting motor and regulator as part of the horn circuit, these units only appear because they make convenient points for connecting to the battery. For additional illustrations of the horn circuit refer to figures 187, 188 and 189.

CHAPTER 5—THE HORN CIRCUIT

The horn is an electrically operated device for making a warning sound whenever the operator depresses the horn button. The circuit may be simply from battery to horn, to horn button, to ground as illustrated in figure 187 or there may be a relay inserted between the battery and horn as illustrated in figures 186, 188 and 189. With the relay in the circuit, the button is only required to carry the relay current, and the arc formed when the button contacts open is much less than it would be if all of the horn current flowed through the button.

The horn (Figures 190, 191 and 192) consists of a diaphragm that is vibrated by an electromagnet. When the electromagnet is energized it pulls on an armature that is attached to the diaphragm. Movement of the armature flexes the diaphragm and opens a set of contacts. This opens the electromagnet circuit and the diaphragm returns to its original position, thus closing the contacts and repeating the cycle.

Quality or nature of the horn signal is largely dependent upon the manner in which the diaphragm movement is utilized. Diaphragm movement of the horn shown in figure 190 is restrained by impact with the strikes screw which in turn creates a loud bell like note in the ringer disc. No such restraint exists in the horns of figures 191 and 192. In these horns the diaphragm operates essentially as a piston. Air displaced by the diaphragm movement when properly confined by a tube or projector creates a trumpet like note.

The frequency or musical note of all Auto-Lite horns is determined by the stiffness of its diaphragm and in the case of horns pictured in figures 191 and 192 it is most important that proper tube or projector length be used.

Some horns have a resistance or condenser connected in series with the magnet winding and across the contacts. This resistor or condenser is inserted to decrease arcing at the contacts and prolong contact life.

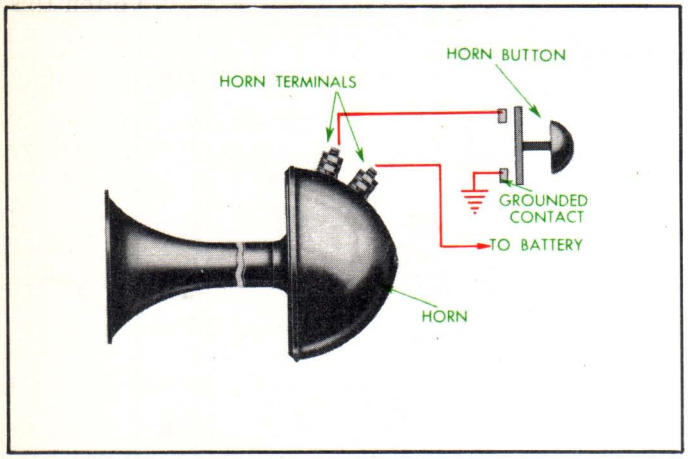

FIGURE 187—HORN CIRCUIT WITHOUT A RELAY. When a single horn having a low current draw is used, a two-wire unit is specified. One horn terminal is connected to the battery at some convenient point while the second terminal is grounded by the horn button.

The horn relay consists of an electromagnet and a set of contacts arranged so that when the magnet is energized a magnetic armature is attracted and the contacts close. A spring keeps the contacts open when the unit is at rest.

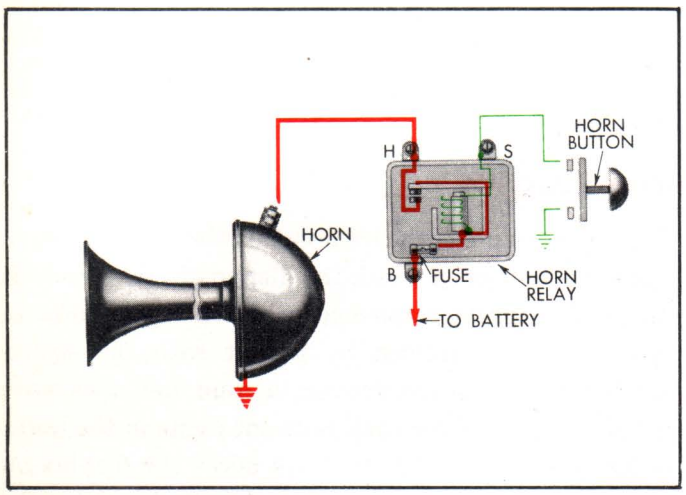

FIGURE 188—HORN CIRCUIT WITH 3 TERMINAL RELAY. This is the same circuit as is shown in figure 186 and shows the internal connections of the relay. The relay winding is connected to the battery terminal within the relay and is grounded externally by the horn button. When the button circuit is closed, the relay is energized and connects the horn to the battery. A single wire horn is used for this hook-up and the circuit is completed by a ground connection through the horn mounting.

Figures 187, 188 and 189 show the three basic horn circuits that are commonly used. It will be noted that the only difference between the circuit shown in figure 188 and that in figure 189 is that the power for the horn relay circuit is routed through the ignition switch in figure 189. The other circuit illustrated does not include a relay and is used principally with a single horn having a low current draw. A simple inspection will tell which type circuit is used on any particular installation and whether a fuse is incorporated in the horn circuit.

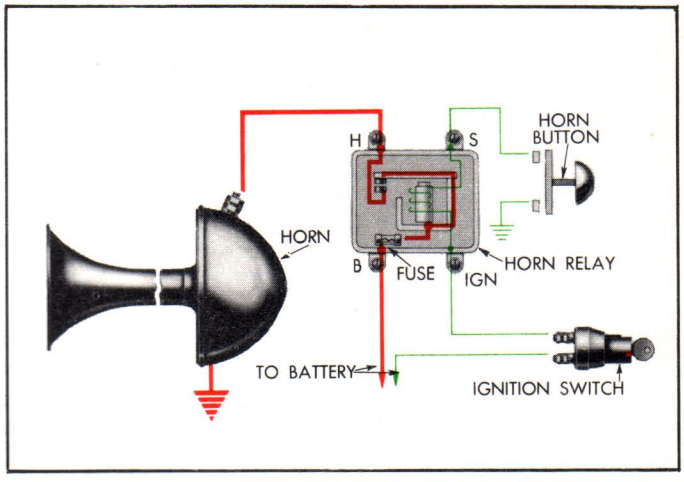

FIGURE 189—HORN CIRCUIT WITH 4 TERMINAL RELAY. This circuit is basically the same as that shown in figure 188; however, both ends of the relay winding are brought out to terminals and the relay circuit connection to the battery is made at some other point, usually the ignition switch. This makes the horn inoperative except when the ignition is turned on.

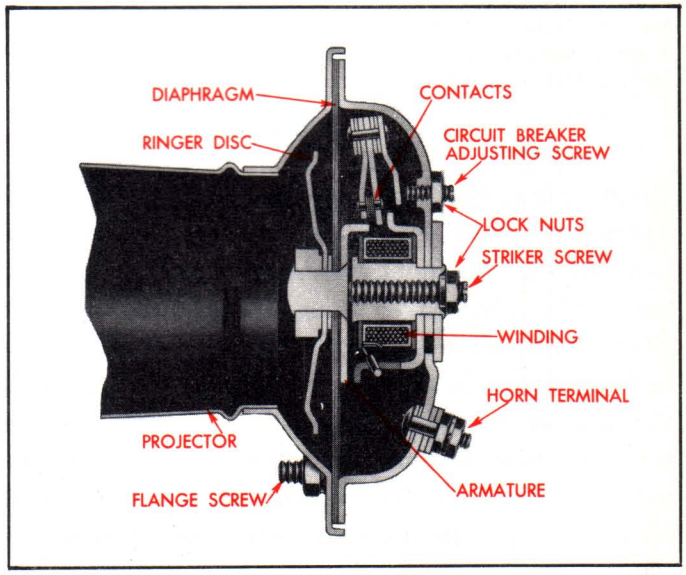

FIGURE 190—HORN ADJUSTMENTS (TYPES HA, HD, AND HK). To adjust these horns tighten all of the flange screws and back out the striker screw until it no longer contacts the diaphragm assembly.

Connect an ammeter, variable resistance and battery in series with the horn terminals and connect a voltmeter to the horn terminals. Adjust the voltage to the specified value then adjust the current to the specifications for the circuit breaker draw by turning the adjusting screw. Tighten the circuit breaker lock nut then adjust the striker screw and its lock nut to give the correct final setting.

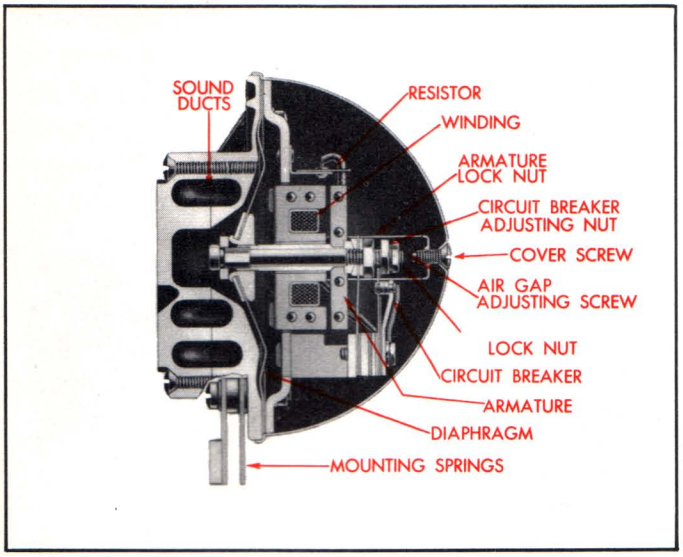

FIGURE 191—HORN ADJUSTMENTS (TYPES HB, HC, HF, AND HG). Adjustment of the armature air gap is made by loosening the lock nut and turning the adjusting bolt. The current draw is adjusted by loosening the lock nut and turning the large adjusting nut.

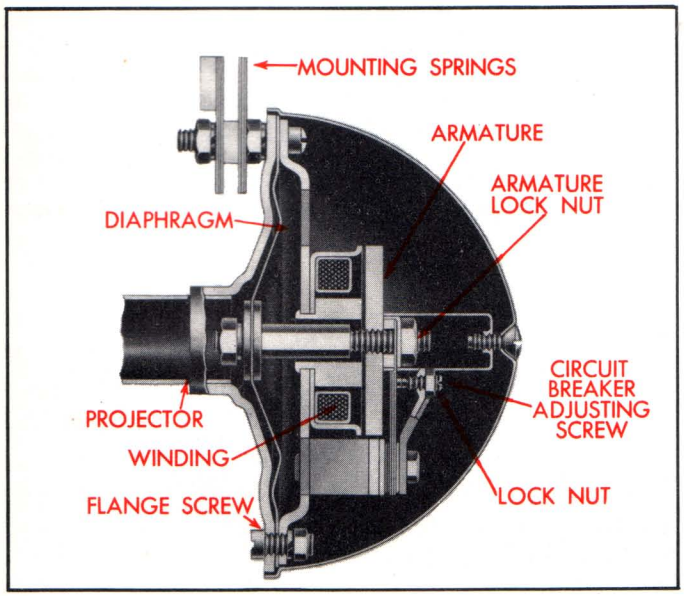

FIGURE 192—HORN ADJUSTMENTS (TYPES HAA, HH, HJ, HL, HM, HO, HP, HT, HU, AND HW). The armature air gap is adjusted by screwing the round armature in or out as needed as illustrated in figure 193. The current draw is adjusted by loosening the lock nut and turning the contact screw to give the exact voltage and current specified.

HORN WIRING MAINTENANCE

Inspect the wiring between the horn, button, relay and battery for loose connections, chafed insulation, corroded terminals and for partial breaks—especially where the wires enter a conduit or are clamped by a terminal. The power or battery wire to the horn or relay may be connected directly to the battery, but more often this connection is made at some other point such as the starting switch, ammeter, regulator, or ignition switch. For a complete check, the inspection should follow this circuit all the way back to the battery and should include the battery ground strap.

If a fuse is incorporated in one of the wires or is mounted on the relay terminal, the fuse should be removed and inspected and the holder should be cleaned.

If the horn does not operate when the button is depressed, check for opens in the horn button circuit by grounding the relay or horn terminal which is connected to the button. If the horn operates it indicates proper operation of the horn and relay, and the horn button and lead should be carefully and thoroughly inspected.

The usual cause of continuous operation of the horn is a ground in the horn button wiring. To check, disconnect the horn button wire from the horn or relay. If this stops the horn operation, inspect the wire for grounds especially where it enters the steering column. If the horn does not stop when this wire is removed disconnect the other wires and inspect the horn and relay. When replacing the horn wiring use size No. 12 wire or larger for the load circuit.

HORN MAINTENANCE

The horn should be periodically inspected. Wipe the dirt from the outside of the horn and remove any debris from the projector. If the horn is rusted or corroded it should be removed for an overhaul. If the horn mounting is cracked or loose proper repairs should be made.

Before condemning a horn for inoperation, be sure to check the fuse and wiring as previously described as most horn failures can be traced to a blown fuse or faulty wiring.

To test whether the horn is inoperative, connect a jumper lead from the battery (the starting switch battery terminal is usually most convenient) to the horn terminal. Single wire horns should operate with this wire in place; however, if they do not, ground the horn frame to the chassis to check the horn ground connection. If the horn now operates it indicates the ground connec-

tion is at fault and that the horn should be removed and the mounting surfaces cleaned. Two wire horns will not operate with only the battery jumper lead in place, but require connecting a second wire from the other horn terminal to a ground on the frame. If the horn or horns operate with these tests it indicates that the cause of the inoperation will be found in the wiring, relay or button. To test which side of the circuit is at fault disconnect the test wires one at a time and operate the horn button.

If the horn is inoperative or does not have a clear, steady tone it should be removed, cleaned and disassembled. Inspect the diaphragm for cracks and distortion and inspect the winding and connections for opens, faulty insulation and grounds. Check the resistor, if used, with an ohmmeter or by the volt-ammeter method. Check the condenser for capacity, grounds and leaks with a condenser tester.

Inspect the contacts. Do not force the contacts apart as this would bend the contact spring and change the contact pressure. If contacts are rough or burned, clean and polish with crocus cloth and carbon tetrachloride. If contacts are burned excessively or are fused they should be replaced. On some types this necessitates the replacement of the complete back assembly while others can be replaced by installing new contact spring and contact screw assemblies.

Assemble the horn, leaving the horn dome and dome bracket off until after the horn is adjusted. Be sure all gaskets are in place and thoroughly tighten the flange screws and circuit breaker mounting screws. Also be sure the nut, when used on the projector side of the diaphragm, is tight with the proper size lockwasher in place. Solder all connections within the horn to make strong low resistance joints. Inspect to see that the circuit breaker contacts are aligned and that the contact spring does not rub against the armature stud.

On horns having an adjustable armature, measure the gap between the armature and field cup with two flat feeler gauges. Adjust the gap on all sides to the specified value by loosening the armature lock nut and turning the slotted armature stud. Round armatures do not have a slotted stud, but are adjusted by turning the armature to screw it in or out as shown in figure 193. It is sometimes necessary to tap the armature lock spring lightly with a screw driver to free it before the armature can be turned. Tighten the lock nut and check the gap.

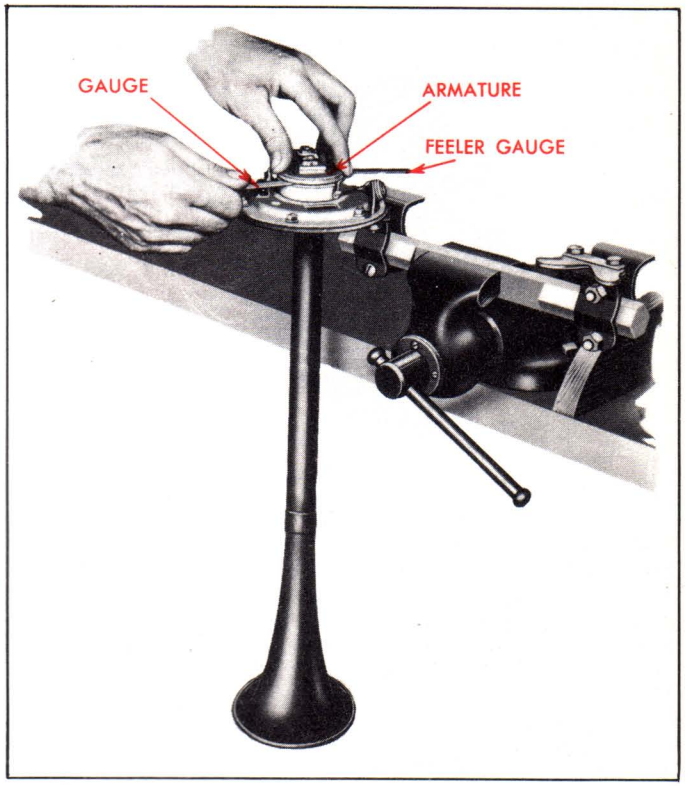

FIGURE 193—ADJUSTING THE ARMATURE AIR GAP. On this type horn, the air gap is adjusted by inserting two feeler gauges of the proper thickness and turning the armature until the gauges are a snug fit. It is usually necessary to loosen the armature lock nut and tap the spring plate lightly to free the armature and allow it to be turned.

Connect an ammeter and variable resistance in series with one horn terminal and a battery of the horn rated voltage. Connect the other horn terminal (horn base if single wire unit) to the second battery terminal and connect a voltmeter across the horn terminals.
When tuning a set of horns, each horn should be connected and adjusted separately then checked for tone by operating as a pair.

NOTE: Do not stuff rags or other material in the projector to muffle the sound as this changes the vibration frequency and would give a false current setting. Also do not clamp the flange in a vise as the pressure may cause a tension on the diaphragm and result in breakage. The horn tone depends to a great extent on the type of mounting and for best results a special test fixture should be used.

On HA, HD and HK type horns back out the striker screw in the center of the horn back so that it is clear and does not touch the diaphragm assembly. Loosen the lock nut on the circuit breaker screw and adjust the

screw and variable resistance to give the correct humming voltage and current. See figure 190. Tighten the lock nut and check the humming draw. Turn the striker screw in until it touches the diaphragm and adjust the screw and resistance to give the correct voltage and current. Tighten the lock nut. Vary the voltage slightly above and below the adjustment figure to make sure the horn will operate under varying conditions. Also check the horn operation by opening and closing the circuit a few times.

On types HB, HC, HF and HG horns loosen the small lock nut (see figure 191) on the contact adjustment. Adjust the variable resistance and the large brass nut to give the exact voltage and current setting then tighten the lock nut and recheck the setting. Vary the voltage slightly above and below the specified figure and open and close the circuit a few times to check the horn operation. Install the dome bracket and dome, then recheck the operation and tone.

On the horns not included in the above descriptions the horn is adjusted by loosening the lock nut and turning the circuit breaker contact screw. See figure 192. Hold the voltage at the specified value and turn the contact screw to give the correct current draw. Tighten the lock nut and check the voltage and current. Install the dome.

HORN RELAY MAINTENANCE

Many horn relays have a fuse incorporated in the horn circuit to prevent damage when short circuits occur. This fuse is located in a holder mounted on the relay "battery" terminal. The fuse is removed for inspection and replacement by pressing in slightly and turning the top part of the holder. Inspect to see that the fuse is not blown and that both the fuse and holder are clean and bright. Sometimes the lower fuse holder contact becomes corroded and does not make contact. If the lower end of the fuse is corroded or dirty also clean the spring contact. A small piece of very fine sandpaper can be used to clean this contact.

To check the relay operation ground the control terminal. This terminal is usually marked "S" and is connected to the horn button. Relays having 4 terminals receive their operating current through the ignition switch or some other control which must be turned on to make the relay operate. If the relay does not close with the "S" terminal grounded, check the wiring as described earlier in this Chapter and remove the horn and relay for a complete test.

Remove the relay cover and fuse. Inspect for dirty or burned contacts and damaged insulation. File the contacts with a No. 6 American Swiss cut equalling file until they are clean and bright. Clean all dirt from the contacts with a strip of clean lintless tape and carbon tetrachloride. Thoroughly clean the fuse, fuse contacts and holder and inspect the fuse insulation. Make sure the armature operates easily, without interference and tighten the nut on the bottom of the magnet core.

Place a feeler gauge between the core and armature and hold the contacts closed. Have spring tension on the armature, but do not seal armature against the yoke. Adjust the height of the stationary contact to give the exact armature air gap specified. Keep the contacts aligned.

Measure the contact gap or the armature air gap with the contacts open, whichever is specified. Adjust to the specified value by bending the armature stop. Be sure stop does not interfere with armature movement.

Connect a variable resistance in series between a battery and one of the relay control terminals. Connect the other control terminal to the second battery terminal. On some relays both ends of the winding are brought out to external terminals and the load circuit is completely separate from the control circuit. On other relays one end of the winding is connected to the "Battery" terminal and the other end is connected to the control switch terminal. An inspection will easily determine which terminals are connected to the winding. Connect a voltmeter to the relay control terminals.

Increase the voltage slowly and note the voltage at which the contacts close. If the contact is mounted on a spring arm, increase the voltage until the armature seals against the yoke. Reduce the voltage and note the voltage at which the contacts open. To indicate when the contacts are open and closed, connect a test lamp in series with the battery and the relay load terminals. The lamp will light when the contacts close. Adjust the contact closing and opening voltage by changing the armature spring tension by bending the lower spring hanger or, if no spring is used, by bending the hinge ears keeping the ears aligned.

Be sure cover gasket is in good condition and properly installed then clinch the cover tightly in place.

HORN SPECIFICATIONS

HORN TYPE	PITCH	RATED VOLTS	ARMATURE AIR GAP	CIRCUIT BREAKER Volts	CIRCUIT BREAKER Amps.	STRIKER Volts	STRIKER Amps.
HA	Low	6	—	6.0	4.4	6.0	5.2
HA	High	6	—	6.0	4.4	6.0	5.2
HAA	Low	12	.0495"	12.0	9.5	—	—
HAA	High	12	.040"	12.0	9.5	—	—
HB	Low	6	.027"	6.2	7.5	—	—
HB	High	6	.027"	6.2	7.5	—	—
HC	Low	6	.042"	6.2	11.0	—	—
HC	High	6	.038"	6.2	11.0	—	—
HD	Low	12	—	12.0	3.4	12.0	4.5
HD	High	12	—	12.0	3.4	12.0	4.5
HF	Low	12	.042"	12.0	9.5	—	—
HF	High	12	.038"	12.0	9.5	—	—
HG	Low	12	.026"	12.0	7.0	—	—
HG	High	12	.026"	12.0	7.0	—	—
HH	Low	6	.040"	6.2	14.5	—	—
HH	High	6	.040"	6.2	14.5	—	—
HJ	Low	12	.040"	12.0	9.5	—	—
HJ	High	12	.040"	12.0	9.5	—	—
HK	Low	24	—	24.0	1.5	24.0	2.2
HK	High	24	—	24.0	1.5	24.0	2.2
HL	Low	6	.040"	6.2	14.5	—	—
HL	High	6	.040"	6.2	14.5	—	—
HM	Low	12	.040"	12.0	9.5	—	—
HM	High	12	.040"	12.0	9.5	—	—
HO	Low	6	.052"	6.2	15.0	—	—
HO	High	6	.042"	6.2	15.0	—	—
HP	Low	12	.052"	12.0	9.5	—	—
HP	High	12	.042"	12.0	9.5	—	—
HT	Low	6	.052"	6.2	15.0	—	—
HT	High	6	.042"	6.2	15.0	—	—
HU	Low	12	.052"	12.0	9.5	—	—
HU	High	12	.042"	12.0	9.5	—	—
HW	Low	6	.0495"	6.2	15.0	—	—
HW	High	6	.040"	6.2	15.0	—	—

HORN RELAY SPECIFICATIONS

Part No.	Rated Volts	Fuse	Wiring Diagram	Armature Air Gap (Inches)	Contact Point Gap (Inches)	Contacts Close (Volts)	Contacts Open (Volts)
HR-4001, S	6 or 12	None	Fig. 188	.012-.017*	.026†	3.0-4.0‡	1.5-2.5‡
HR-4002, S	6 or 12	30 amp.	Fig. 188	.012-.017*	.026†	3.0-4.0‡	1.5-2.5‡
HR-4101, S	6 or 12	30 amp.	Fig. 188	.012-.017*	.026†	2.5-3.5†	—
HRB-4201	6	14 amp.	Fig. 189	.012-.017*	.026†	3.25-4.0‡	—
HRB-4202, A	6	20 amp.	Fig. 189	.012-.017*	.026†	3.25-4.0‡	—
HRB-4301	6	20 amp.	Fig. 189	.012-.017*	**	2.8-3.6‡	—
HRC-4001	6 or 12	None	Fig. 188	.016-.020§	.026†	1.5-3.0‡‡	0.5 min.‡‡
HRL-4001	6 or 12	None	Fig. 189	.016-.020§	.026†	1.5-3.0‡‡	0.5 min.‡‡
HRL-4101	6 or 12	None	Fig. 189	.016-.020§	.026†	1.5-3.0‡‡	0.5 min.‡‡
HRL-4102	6 or 12	None	Fig. 188	.016-.020§	.026†	1.5-3.0‡‡	0.5 min.‡‡
HRL-4103	6 or 12	None	Fig. 189	.016-.020§	.026†	1.5-3.0‡‡	0.5 min.‡‡
HRL-4104	6 or 12	None	Fig. 189	.016-.020§	.026†	1.5-3.0‡‡	0.5 min.‡‡
HRM-4103	6	30 amp.	Fig. 189	.031-.036††	.015 min.§§	4.5 max.‡	1.0 min.§§

* Have contacts closed and adjust by varying height of stationary contact.

† Adjust by bending armature stop.

‡ Adjust by bending lower spring hanger.

§ Have contacts closed but not sealed and adjust by varying height of stationary contact.

** Adjust armature air gap with contacts open to .034"-.038" by bending armature stop.

‡‡ Armature seals at 4.0 volts maximum. Adjust by bending hinge ears keeping both ears in line.

†† Have contacts open and adjust by bending armature stop.

§§ Adjust by varying height of stationary contact.