

KELSEY-HAYES COMPANY


38481 HURON RIVER DRIVE • ROMULUS, MICHIGAN



Operation and Care

OF YOUR
**TRAILER
ELECTRIC
BRAKE
SYSTEM**

OC-963

 LITHO IN U.S.A.

KELSEY-HAYES
KH ORIGINAL electric brakes

Foreword

Whether you are a "trailerite" of long standing, or a new member of this happy and growing fraternity, your new mobile home or travel trailer holds promise of many miles and many years of gracious living and interesting experiences.

The information given on these pages will show you how your Kelsey-Hayes trailer brake system operates, and enable you to keep your equipment operating at top efficiency, giving you the maximum return in pleasure, safety and dependability.

The electric brakes on your trailer are manufactured by Kelsey-Hayes Company, the world's largest maker of automotive wheels, and a leading name in the field of electric brakes and related products. You will want to complete your trailer brake system by installing a Kelsey-Hayes Automatic Controller in your car or other towing vehicle, giving you matched equipment, engineered for a completely balanced braking system.

Kelsey-Hayes manufactures all the parts you need for quiet, dependable "rolling and stopping" of your trailer or mobile home. These include wheels, hubs and drums, as well as brakes, automatic and manual controllers, and all other necessary components. They are engineered and made in a balanced combination to give you the maximum in quiet, trouble-free, long-term operation with a minimum of service and maintenance requirements. Be sure that your system is a Kelsey-Hayes system throughout.

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Romulus, Michigan

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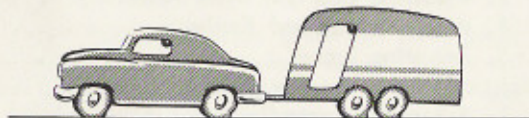
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1

HOW TO USE CAR AND TRAILER BRAKES

The best brake system is only as good as the way you use it. Here are three important rules for safe, efficient braking.

1. Always use your car and trailer brakes together.



By following this simple rule, you will get more mileage out of your tires as well as your brakes, and you will have far less fatigue in driving. You will enjoy your trailer more, too, and - most important - you will be a safer, more confident driver.

Use automatically synchronized applications of car and trailer

brakes and you can drive normally with both hands on the steering wheel. The proper brake adjustment is with a slight "lead" on the trailer brakes. Then, the car brakes stop the car, trailer brakes stop the trailer, and between them you have smooth operation with minimum stopping distances. You enjoy driving and have maximum control at all times.

2. Never use your trailer brakes alone.



Your trailer brakes have ample capacity to handle the trailer alone, but don't expect them to stop your car as well. If you do, you'll be putting excessive loads on them. This causes overheating, rapid wear, (brakes wear much more rapidly

when hot) and fade (loss of braking power). Remember that in many cases the trailer weighs much more than the car, frequently even twice as much. The trailer alone is load enough for trailer brakes.



3. Never use your car car brakes alone.



While the brakes on your car give you plenty of margin for car operation, they'll be badly overloaded if you try to make them stop your trailer too. Adding the weight of the trailer to the weight of the car may more than double their load. This overloading makes car brakes heat up, wear out faster, and makes them "fade" sooner. It makes the trailer push the car, making it hard to control, especially on slippery pavement or loose gravel, where it may jackknife.

The Kelsey-Hayes Automatic Controller makes it easy to follow these rules, even without thinking about them.

With the Kelsey-Hayes Automatic Controller properly connected into a car's hydraulic brake system, it is impossible to use the car brakes without using the trailer brakes, and you always have correct "balance" between car and trailer braking action. This is important for comfort, essential in an emergency. The controller automatically synchronizes car and trailer brakes, making them act as a single balanced brake system, all controlled by your foot on the brake pedal. You always have fully automatic control, allowing both hands to be on the steering wheel where you need them.

**BE SURE YOU HAVE BRAKES ON EVERY WHEEL.
IF YOUR TRAILER IS HEAVY ENOUGH TO NEED
4 OR 6 WHEELS, IT IS HEAVY ENOUGH TO NEED
4 OR 6 BRAKES, TOO.**

2

HOW TRAILER BRAKE SYSTEM OPERATES

First, let's get a clear idea of the overall trailer brake system.

It is basically an ELECTRICAL CIRCUIT.....This means that it must be a complete, clean, tight conductor from beginning to end, and it begins and ends at the battery. Any break or poor connection will prevent or interfere with the flow of electrical energy, which means loss of braking.

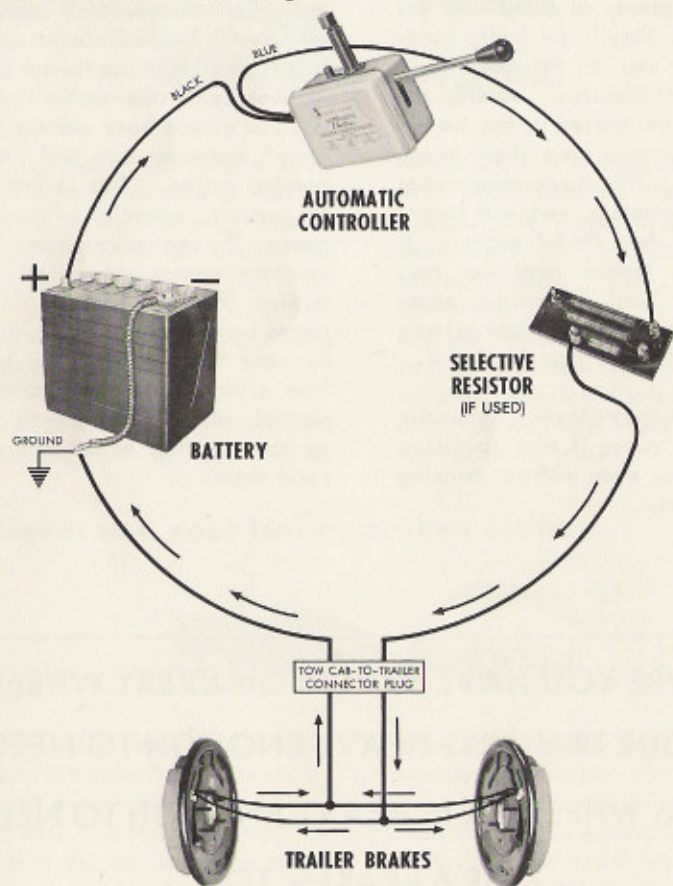


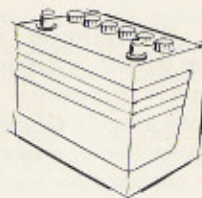
Figure 1

HOW TRAILER BRAKE SYSTEM OPERATES



1. Battery

We start with the BATTERY in your car. It may be 6-volt or 12-volt. This is the source of electrical energy which we use to operate the brakes. While we could connect directly to the positive pole on the battery, it is usually more convenient (and just as good) to make the power connection at other points.



through it. It is so constructed that you can easily control the amount of current which flows through it, and thereby controls the degree of braking action. In the Kelsey-Hayes controller this can be done automatically whenever you apply your tow car brakes, and it operates equally well with 6-volt or 12-volt systems. How the Kelsey-Hayes Automatic Controller operates is explained starting on page 10.

Vehicles with D.C. Generator

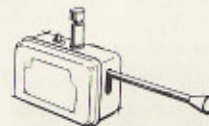
Make the power connection at (a) the "BAT" terminal on the voltage regulator or (b) the battery terminal of the starter solenoid.

Vehicles with Alternator

Make the power connection at (a) the "BAT" terminal of the starter solenoid, or (b) the positive (+) post at the battery.

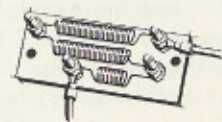
2. Controller

From the battery the circuit goes first to the CONTROLLER, which is a special type of switch. In the open or unapplied position, it breaks the circuit and prevents the flow of current to the brakes. It applies the brake by closing the circuit, allowing current to flow



3. Resistor

The brake circuit may or may not require a RESISTOR, which acts somewhat like a valve in a water line, reducing the flow of current to the

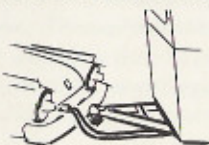


desired amount. This added resistance is needed wherever the battery output is higher than that needed for the brakes. This added resistance is needed whenever the battery output is higher than that needed for the brakes. In other words, use the Selective Resistor when the brakes have greater power than is necessary for the weight on the axle. The Kelsey-Hayes Selective Resistor provides a wide range of resistances, so you can adapt your brake system to your specific load and braking requirements, whatever they may be. It is described in detail on pages 12 and 26.



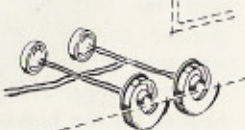
4. Tow Car-to-Trailer Connector Plug

A TOW CAR-TO-TRAILER CONNECTOR PLUG is needed so you can easily connect or disconnect the trailer from the tow car. Since corrosion or bad connections will interfere with the flow of current when needed, it is important to keep this connection clean, tight, and well protected from the weather.



5. Trailer Brakes

From the connector the circuit goes to the TRAILER BRAKES. You will notice in the diagram (Figure 1) that the complete circuit passes through each brake. This is parallel wiring, which is the only correct way to

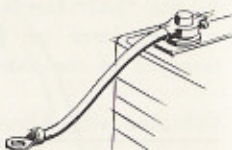


connect the brakes into the circuit. (Series wiring, in which the circuit passes first through one brake and then the other is definitely not recommended. Christmas tree lights provide a familiar comparison of parallel and series wiring; in parallel, one defective bulb has no effect on the others, but in series, one defective bulb cuts out the whole circuit. Also, in series wiring, the resistance of each element reduces the current flow to all the others.)

Kelsey-Hayes electric brakes are similar in design and construction to automotive service brakes. They provide efficient, smooth and instantaneous response to variations in current flow passing through the controller. The operation of the Kelsey-Hayes electric brake is described on Page 9.

6. Ground

The rest of the circuit is called the "GROUND". Many service problems are due to poor or defective grounding. While it may seem that, since we have reached the brakes the rest is secondary, the fact is that a poor ground circuit back to the battery will interfere with efficient brake operation just as much as a poor positive circuit to the brakes. That is why it is important to go back through the TOW CAR-TO-TRAILER CONNECTOR. Grounding through the trailer frame or at the hitch is very poor practice, and may cause a break in the circuit just when you need your brakes the most.



From the connector plug the ground wire should go to a good, clean, secure ground point on the tow car chassis or engine, preferably the same point at which the battery is grounded. Never depend on establishing a ground through the trailer hitch. If necessary, an adequate ground can be established at the rear of the tow car, if care



is used to scrape, away all paint, sealer, etc., and a secure connection is made. The ground connection completes the circuit, providing for a sure and uninterrupted electrical path through the whole

system and back to the starting point - the battery. Only a complete circuit will transmit electricity; any defect, at any point, will stop the whole system from operating.

KELSEY-HAYES ELECTRIC BRAKE

The operating parts of a typical Kelsey-Hayes Electric Brake and Drum Assembly are shown in Figure 2. While the 12" x 2" two-shoe adjustable brake is shown, the operation of all models of Kelsey-Hayes Electric Brakes is basically the same. Each brake is essentially a mechanical brake actuated by a lever and a very efficient electro-magnet which is energized by the current fed to it when you operate the controller, either automatically or manually.

When the controller, located in the towing vehicle, permits current to flow through the electro-magnet (1), the energized magnet is attracted to the armature plate (2) which rotates with the brake drum (3) and

wheel. The magnetic and frictional forces developed by the magnet operate the lever (4) in the direction in which the brake drum is rotating. The lever moves the actuating block (5) forcing the primary brake shoe (6) against the drum. An additional force created by the friction between the shoe and the drum is added to the actuating block force and is transferred by the adjustable link (7) to the secondary shoe (8). A brake that used this additional force is referred to as "self-energizing", i.e., the braking force itself is actually utilized to force the secondary shoe still tighter against the drum. The anchor (9) then acts as a stop for the "energized" secondary shoe.

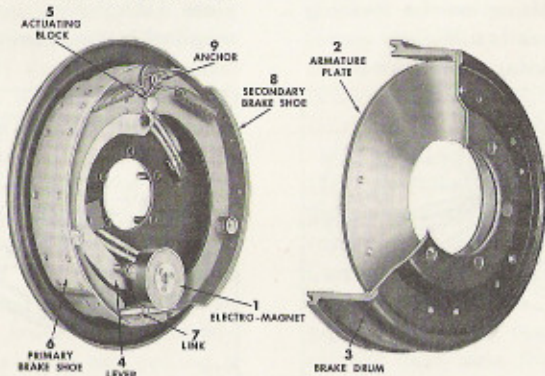


Figure 2



The amount of braking force obtained depends upon the pull exerted by the magnet, which is in turn controlled by the amount of current flowing to it. The Kelsey-Hayes Automatic Controller functions to provide a smooth, stepless control of this current either automatically, in proportion to towing vehicle braking, or manually by

movement of the controller handle. In either case, response is instantaneous, yet always smooth and controllable.

Finally, since K-H brake shoes are accurately ground and adjusted at the factory, little "wearing in" is required; maximum braking is developed with a minimum of use.

AUTOMATIC CONTROLLER

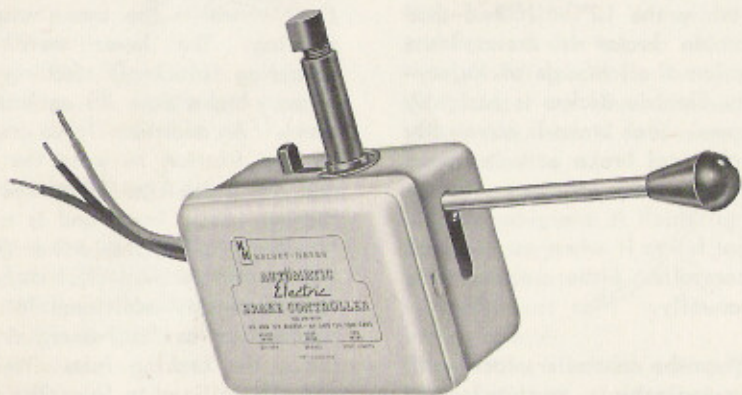


Figure 3

The Kelsey-Hayes Automatic Controller synchronizes car and trailer brakes automatically. It may be mounted either on the steering column (if there is sufficient space) or nearby under the instrument

panel in such a position that the handle is within easy reach of the driver. See Figures 4 and 5. Complete installation instructions are supplied in the Controller Kit (Kit No. 39743).

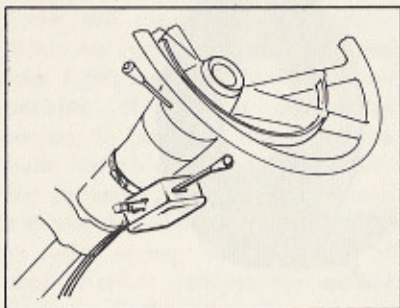


Figure 4

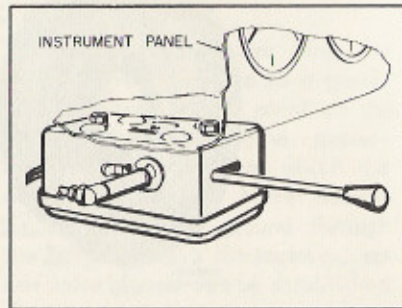


Figure 5

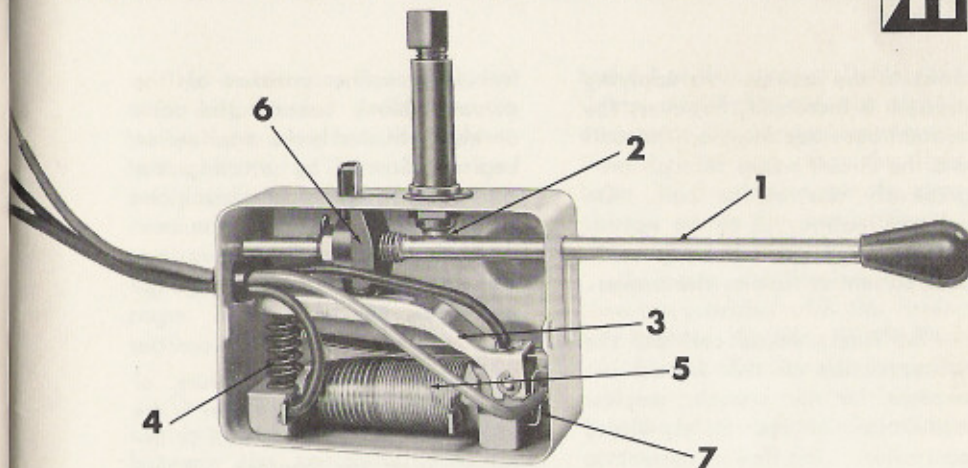


Figure 6

The controller should be installed and connected into the brake system as described in detail in the Installation Instruction supplied with Controller Kit No. 39743, (Form EC-1160).

To provide automatic actuation of the trailer brakes, the controller is also connected into the hydraulic brake system of the towing vehicle, of the hydraulic connection.

In the normal position the controller is "unapplied", and the control lever (1) is up as in Figure 6. Application of the tow car brakes will cause the hydraulic piston (2) to depress the control lever automatically and apply the trailer brakes in proportion to the tow car brake application. The control lever will always move with each application of the tow car brakes and return to the "off" position whenever the brakes are released, whether or not you are pulling a trailer. However, with the trailer disconnected from the tow car the

brake circuit is opened, so of course no electrical current flows. The K-H controller is engineered so that it can be operated year around, for many years. Therefore, it is not necessary to "shut it off" with a valve, etc. inserted in the hydraulic line. On the contrary, this year around operation will help to keep the cylinder from leaking by keeping the synthetic piston cup "alive", and the bore of the cylinder clean and free from corrosion. The controller can be applied manually at any time by simply depressing the control lever. In operation the electrical supply is connected to a rocker-type contact bar (3) which is held in the "off" position by its return spring (4). As brake application begins, the contact bar is brought into contact with the resistor coil (5). Current flows through the coil and to the brakes. At the beginning of brake application, the current must pass through a large segment of the resistor coil, so that only a small amount of current



flows to the brakes. As applying pressure is increased, however, the contact bar rides down on the coil and the circuit passes through progressively less of the coil. On full application, all of the resistor coil is by-passed, allowing maximum current to flow to the brakes.

The finely wound coil and the rocker action of the contact bar account for the smooth, stepless modulation of the Kelsey-Hayes controller. The flow of current to the brakes, and therefore the degree of trailer brake application, is always directly proportional to the applying pressure imposed on the control lever.

Notice that the applying pressure of the control lever is imposed on the contact bar through the actuator block (6), which is mounted on a threaded section of the con-

trol lever. The position of the actuator block controls the point at which trailer brake application begins. Simply by rotating the control lever the actuator block can be positioned to provide the most desirable "balance" between car and trailer brakes. (See page 25 and figure 25).

Another important feature of your Kelsey-Hayes Controller is the stop light switch (7) which is integral with the contact bar but independent of the resistor coil. As brake application begins, the movement of the contact bar causes this stop light circuit to close, illuminating the trailer stop lights. Since the stop light current does not pass through the resistor coil, full-brightness stop lights are afforded without imposing any load on the coil. See page 25 to adjust the stop light switch.

SELECTIVE RESISTOR

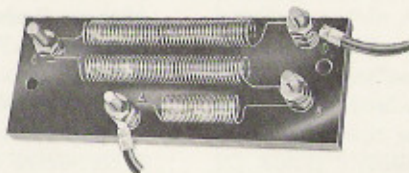


Figure 7

The Kelsey-Hayes Selective Resistor is necessary whenever brake capacity exceeds the trailer braking requirements. All properly engineered brakes are designed to provide fully adequate braking power at rated axle load. (See page 43) Since many well designed trailers

weigh less than the rated axle load, the braking power should be adjusted to avoid undesirable premature wheel skid or "grabby" braking when the controller is fully applied. This adjusting can be effectively accomplished by the use of a Kelsey-Hayes Selective Resistor.



The resistor has been designed with 8 graduated resistances to handle all trailers from the lightest to the heaviest. The operator can easily secure the necessary amount of current to the brakes for his particular needs, simply by selecting the correct terminals. See pages 26 and 27 for suggested settings.

The K-H Selective Resistor is connected only in the brake circuit between the controller and the

brakes* so that running lights, tail lights, stop lights and turn signals operate on the standard car circuit. However, be sure that the light bulbs in the trailer are the same voltage as the tow car battery.

Complete installation instructions are provided with the Selective Resistor Kit No. 41149 (Form No. SR-860-2). See also page 26.

* In the blue wire on Kelsey-Hayes controllers.

BREAK-AWAY SWITCH

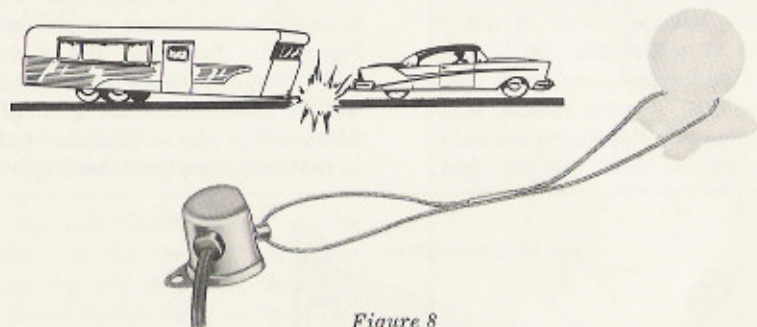


Figure 8

This device maintains control over the brakes on your mobile home or other trailer even after you have lost control through a break-away. Its simple fool-proof design and rugged construction are your assurance that if your car and trailer should ever "part company" on the highway, the trailer brakes are automatically being applied to prevent its running wild. No other part of your trailer electric brake system is more important than this dependable protection against serious break-away damage.

The very instant a break-away occurs, the pull-pin, which is linked to the tow car, is pulled from the switch. The two contacts automatically close to complete the electrical circuit and apply the trailer brakes. In most cases the trailer actually comes to stop before the driver can stop his tow car. The switch is mounted at the front of the trailer, together with a suitable battery. Installation takes only a short time but pays great dividends in safety and peace of mind on the highway. See also page 26 and page 28.

3

INSTALLATION AND ADJUSTMENT OF TRAILER BRAKE SYSTEM COMPONENTS

BRAKE INSTALLATION

1. Mounting Flange

An axle flange which is square and concentric with the spindle and is securely welded in place is the foundation of any good brake. A mounting flange which is out of square or mislocated will cause erratic performance and poor brake service life. For this reason, when the flange is welded onto the axle, it is important to do the job right.

This is the right way:

Use a Kelsey-Hayes flange welding fixture, and bolt the flange securely to the fixture as shown in Figure 9. Assemble the fixture (with flange) onto the axle spindle and draw the spindle nut up snugly. Be sure that the wide-spaced holes in the flange are positioned so that

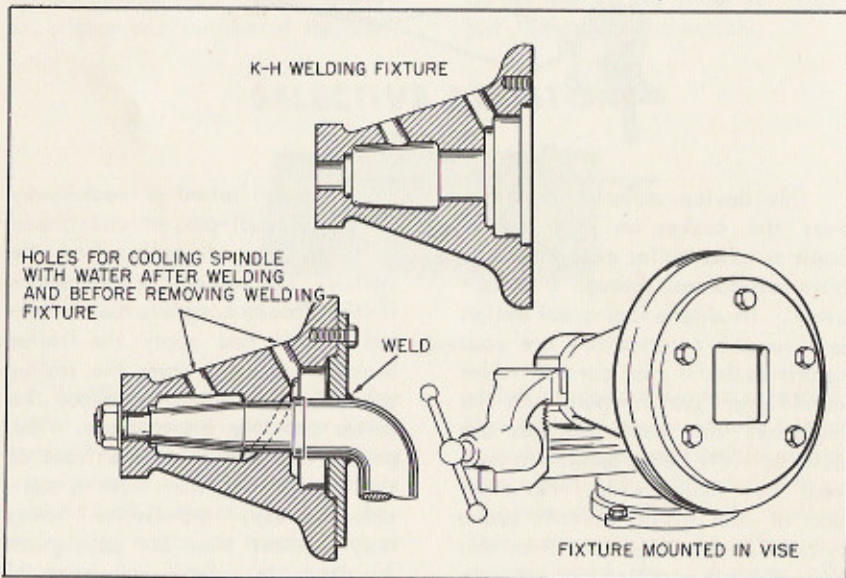


Figure 9

INSTALLATION AND ADJUSTMENT



they will be at the bottom of the axle when installed on the vehicle.

Do not make a continuous weld around the flange. Follow this welding procedure (refer to Figure 10).

1. "Tack" at the center of what will be the bottom of the flange (when on the trailer).

2. "Tack" each side of the axle near the top.

3. Weld first one side, then the other, starting at the bottom and welding up to the location of the "tack".

4. Weld across the top of the axle only if you feel that this is needed for a heavily loaded axle to withstand the brake torque.

The side welds should not be started at the "tacked" weld because this will soften the centering weld and permit the axle to deflect from the welding heat, pulling the flange off-center as it cools.

There should be no weld (other than the centering tack weld) on the bottom of the axle as that is the location of the maximum stresses in this area. Considerable strength is obtained from the "mechanical working" in rolling the steel in forging (and bending if a "drop center" or "offset axle"). The heating from a continuous weld will reduce the maximum tensile strength of the bottom weld.

The axle spindle will have absorbed more heat from the weld than the fixture and must be cooled before removal.

The welding fixture contains two cooling holes which are joined by a water passage. Water may be forced into one hole and out the other for best results. See Figure 9.

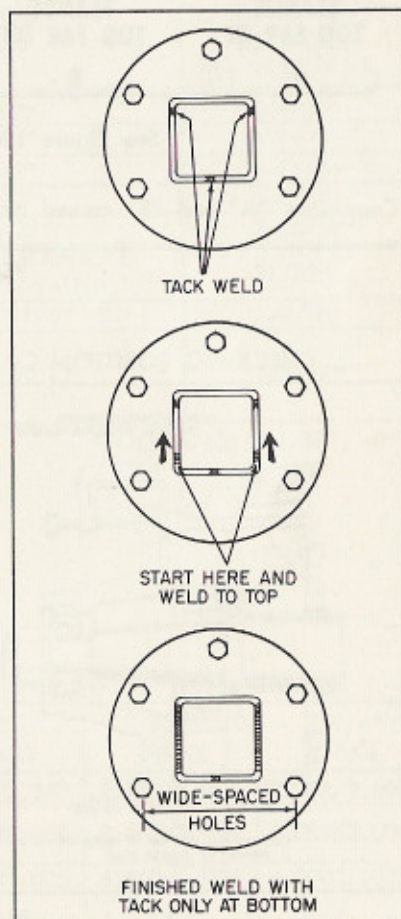


Figure 10



The results of an improperly positioned brake flange are shown in these sketches.

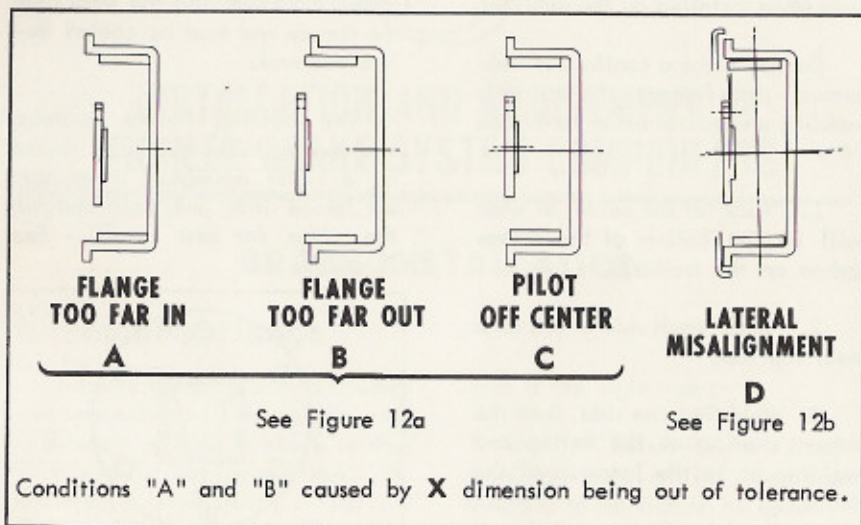


Figure 11

CHECKING POSITION OF BRAKE MOUNTING FLANGE

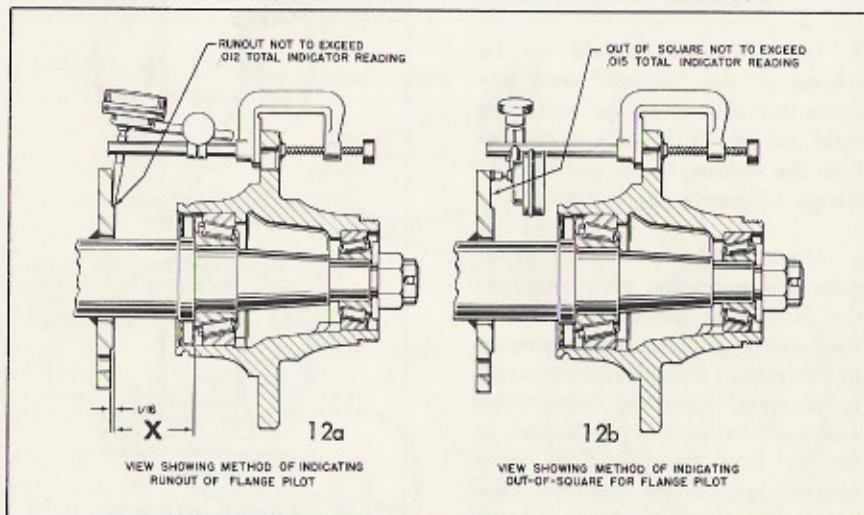


Figure 12



BRAKE MOUNTING FLANGE DIMENSIONS

FLANGE LOCATION CHART		
HUB AND DRUM GROUP NO.	BRAKE USED	X-FLANGE LOCATION * SEE FIGURE 12a
7 & 7-F	12"	2-1/32"
10	10"	4-19/32"
13	12"	1-15/16"
13-A	12"	1-7/8"
13-HR, 13HCS	12"	2-25/32"
55-A	9" MECHANICAL 9" HYDRAULIC	31/32"
4408	7-1/4"	1-9/16"
445F, 445UF, 445UG, 545U, 550U, 555U, 655U, & 5475U	10" & 12"	1-9/32"

*TOLERANCE: +1/16", -0"

BRAKE MOUNTING DATA

	12" BRAKE	10" BRAKE	7-1/4" BRAKE
AXLE FLANGE PILOT DIA.	3.244/3.249	2.998/3.000	2.998/3.000
BACKING PLATE MOUNTING HOLE	3.252/3.254	3.002/3.004	3.002/3.004
BOLT CIRCLE DIAMETER	3.875 ± .005	4.000 ± .005	4.000 ± .005
NUMBER OF MOUNTING BOLTS	5	4	4
MOUNTING BOLT SIZE	3/8	7/16	7/16



2. Installing Brakes & Armature Plates

Kelsey-Hayes Electric Brakes are supplied in Kit form. Each Kit includes one set of brakes (one right-hand, and one left-hand) together with two armature plates, necessary attaching bolts, and sufficient wire and terminals for the normal installation.

Three flat head screws, lock-washers and hex nuts are used to attach each armature plate to the inside of a brake drum. Be sure that the armature plate is squarely and securely mounted, with the nuts drawn up tight. Use the three countersunk holes in the armature plate, passing the screws through from the inside of the drum, and assembling the lockwashers and hex nuts to them on the outside of the

drum, as shown in Figure 13. (Armature plates assembled at the factory are normally riveted to the drum).

Mounting studs for attaching the brake to the mounting flange are a part of each brake assembly. Nuts and lockwashers are supplied in the Kit. In mounting the brake, be sure that the anchor pin is at the top, the magnet is at the bottom, and the actuating lever is toward the front of the trailer. (Figure 14). Also, the connecting terminals should be to the rear of the trailer. Install lockwashers and hex nuts and draw up tight.

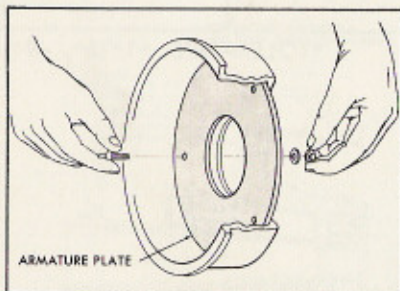


Figure 13

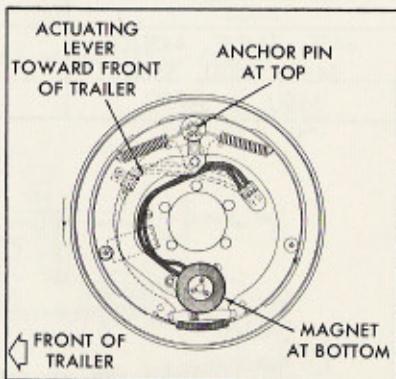


Figure 14

3. Installing Hub & Drum Assemblies

The difference between the right-hand and left-hand brake assemblies can be seen by noting the position of the actuating lever. The right-hand brake is installed on the right side of the trailer,

and the left-hand brake on the left side of the trailer.

After the brakes have been assembled to the axle flanges and the armature plates have been as-



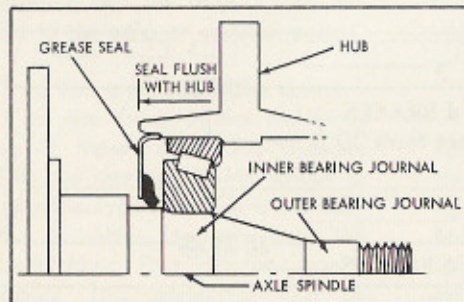
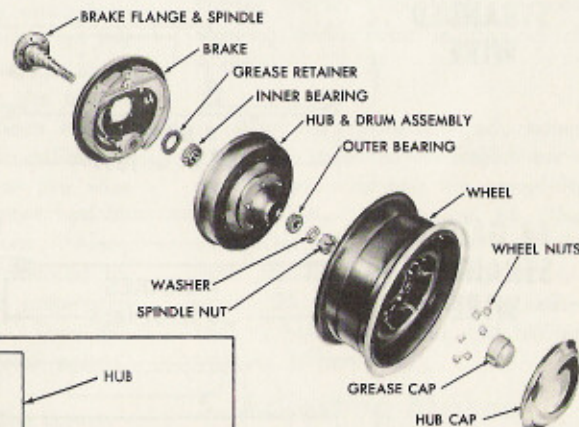
sembled to the drums, the hub and drum assemblies may be installed on the axle spindle. Refer to the wheel group exploded view (Figure 15) for the correct order of installation.

Pack the inner bearing assembly with a good grade of grease, being sure that grease is forced into the cage and around all bearings. Install the bearing assembly into the bearing cup in the I.D. of the hub, then install the grease seal, tapping it into place with a soft hammer until its outer surface is flush with the inner face of the hub. Wipe free of grease.

Mount the hub and drum assembly onto the spindle, pushing it by

hand against the inner bearing surface of the spindle. Pack the outer bearing with grease, and insert it into the hub, around the spindle end. Next, install the washer and spindle nut. Rotate the hub and drum assembly while tightening the spindle nut. When the bearings start to bind, back the nut off one castellation (about one-sixth of a turn) and install a cotter pin through the spindle and nut. Bend one end of the pin up over the end of the spindle, and cut the other end off. Install the grease cap.

The wheels may now be mounted onto the hubs in the same manner as wheels are mounted onto your automobile. Wheel nuts should be checked periodically to be sure they are tight.



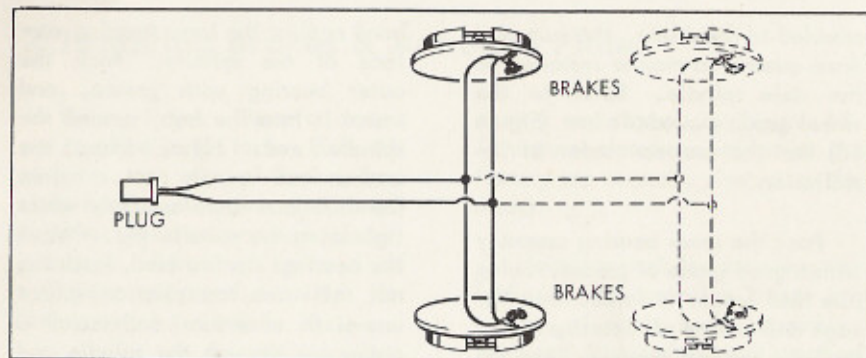


Figure 16

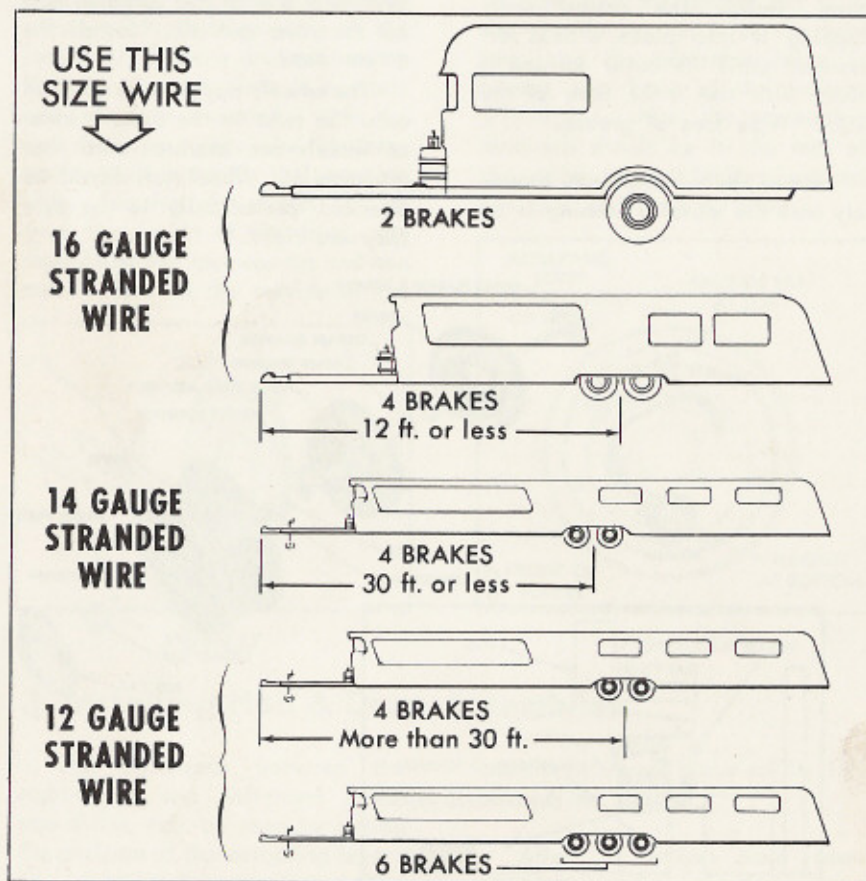


Figure 17

4. Wiring Brakes & Trailer

Figure 16 shows the recommended wiring arrangement for single axle and multiple axle trailers. Note that parallel wiring is indicated; the trailer brakes should not be wired in series.

The following procedure is recommended.

1. First select the proper wire gauge from diagram, Figure 17. The proper wire gauge selection is based chiefly on resistance but also on current carrying capacity. Excessive wire resistance can cause "weak" brakes. Be sure to use a good grade of moisture proof automotive STRANDED WIRE.

2. Cut 2 single wires or one 2-conductor wire long enough to reach between the brakes on the same axle, allowing enough extra length to fasten under the rubber covered "J" clips on each brake. These clips act as strain reliefs so that any pulls or jerks on the wire will not have to be absorbed by the electrical connections. Also, extra wire should be allowed for the movement between suspension springing and the axle. Tape the wire to the axle at several points.

3. Run a wire from the connector at the front of the trailer to one of these two brake-to-brake wires and connect, using solder or a pressure type closed-end connector. If solder is used, tape the connection. This is the power supply. This connection can be made at the center of the axle

wire or at either brake.

4. Run a second wire from the connector at the front of the trailer to the other brake-to-brake wire, and connect in the same manner. This is the ground wire. This wire also can be connected at the center of the axle or at either brake.

5. If brakes are used on more than one axle, continue the two lead wires from the connector to each of the pairs of brake-to-brake wires, and connect in the same manner.

6. Be sure that all connections are clean and tight, then tape wires at convenient intervals to the trailer frame. This will prevent sagging and excessive flexing of wires.

After the trailer is wired, complete the tow car-to-trailer connection and road test the complete installation. Adjustment at the controller and selective resistor (if used) can be made as described on pages 25 and 26, until a satisfactory balance of car and trailer braking is achieved.

5. Adjusting Brakes

While the trailer is still jacked up, with the wheels off the ground, the brakes should be adjusted. Kelsey-Hayes two-shoe electric brakes are an automotive type brake, and the method of adjustment is the same as on most automobile brakes.

The brake adjusting screw is at the bottom of the brake, and is accessible through an opening in the backing plate, which is sealed with a plug. After removing the plug the adjusting screw may be turned in either direction with the blade of a screwdriver or with a

standard brake adjusting tool, see Figure 18. While spinning the wheel, turn the adjusting screw until the wheel has a heavy drag, then back off only until the wheel turns freely. Replace the plug to keep out dirt and moisture.

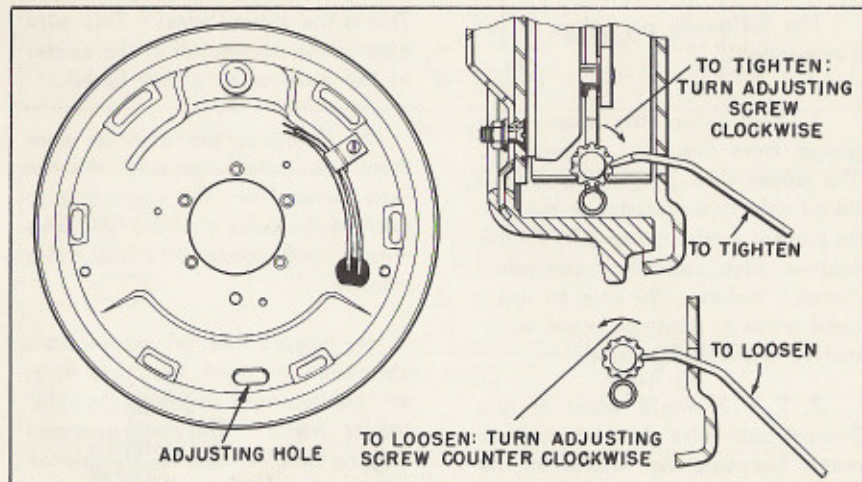


Figure 18

CONTROL SYSTEM INSTALLATION and WIRING

1. Automatic Controller

The Automatic Controller Kit (No. 39743) includes complete instructions for mounting the controller, and making the hydraulic and electrical connections. All materials necessary for the installation are included in the Kit. Briefly stated, the following steps are necessary.

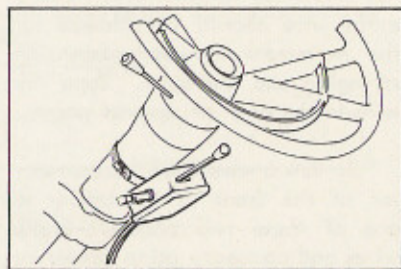


Figure 19

MOUNTING. As shown in Figure 19, the standard location for the controller is on the left side of the steering column, within

easy reach of the driver. A wrap-around clamp is used for this purpose. On cars in which mounting in this position is impractical, the

controller may be mounted on the under side of the instrument panel in a convenient location. To mount in this manner it is necessary to drill two (2) $3/16$ " holes $3-1/4$ " apart, and use two (2) $3/16$ " screws and lock nuts to complete the mounting. See Figure 20.

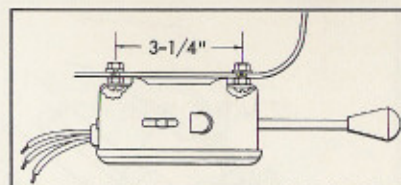


Figure 20

HYDRAULIC CONNECTION. This feature provides automatic operation of the trailer brakes whenever the tow car hydraulic brakes are applied. As shown in Figure 21, this connection is made between the output side of the master cylinder and the hydraulic connection on the controller. It is important to be sure that all hydraulic connections are tight, to prevent loss of fluid from the brake system. After these connections are made, it is usually necessary to bleed the hydraulic system to remove any air which may have entered the brake lines during installation.

BLEEDING. Be sure the master cylinder reservoir is filled, then bleed the controller line as shown in Figure 22 until clear fluid flows continuously. Tighten the tube nut while still pressing on the brake pedal. Remove all traces of brake fluid from painted surfaces to avoid damage to paint. After bleeding wipe all connections dry, press hard on the brake pedal for 10 seconds, then inspect for leakage. Correct if necessary. Refill master cylinder reservoir.

NOTE: If brake pedal is spongy after bleeding at controller, it may be necessary to bleed the system at the wheel cylinders.

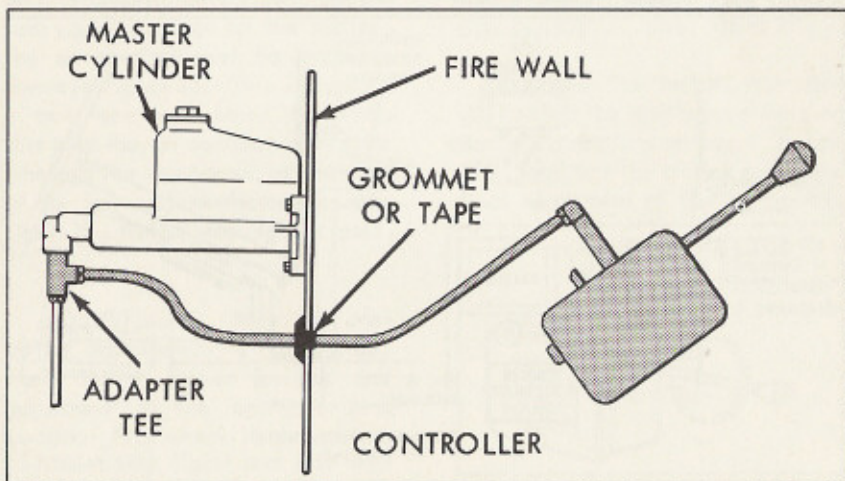


Figure 21

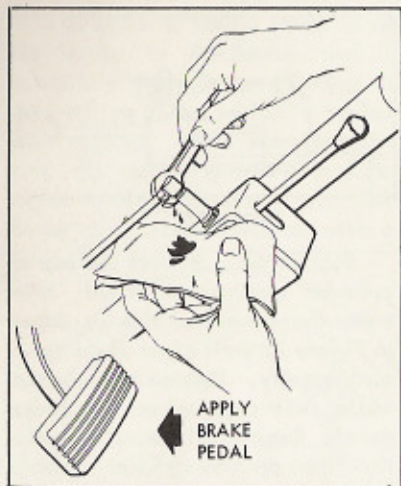


Figure 22

WIRING. There are three electrical connections for the controller. See Figure 23. The black wire is connected to a convenient power supply point; normally the BATTERY post on the voltage regulator or the starter solenoid. This carries the electrical current to the controller. The blue wire carries the current to the brakes

when the controller is applied. It is connected to the trailer brakes through the connector at the rear of the towing vehicle.

NOTE: If a Selective Resistor is used, it is connected into this blue wire connection. The K-H Selective Resistor Settings chart (Form SR-860-3) should be consulted to determine whether a resistor is needed. (See page 26).

The third connection is the ground wire which is very important. It is installed between the connector at the rear of the towing vehicle and a good ground point on the car. The best ground point is where the car battery is grounded. However, if necessary an adequate ground at the rear of the towing vehicle can be made if care is used to scrape away all paint, grease, etc., and to make the connection secure. In any event, never attempt to establish a ground through the trailer hitch.

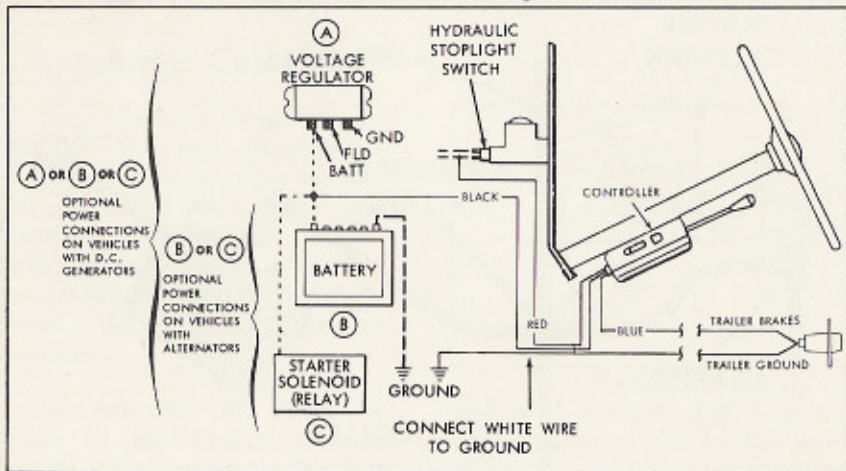


Figure 23

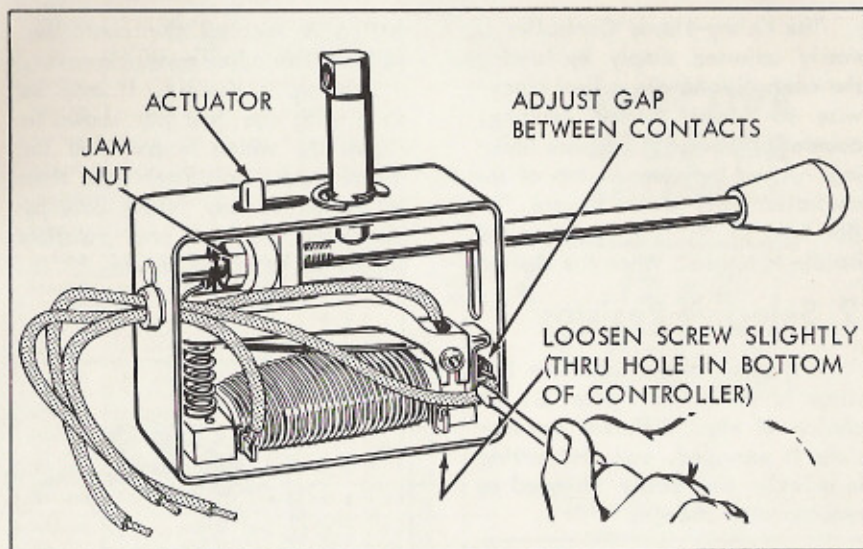


Figure 24

A trailer stop light connection (red wire) is provided on the controller. The stop light switch in the controller is independent of the controller rheostat, so full trailer stop light current is provided throughout brake application. If an interrupted stop light circuit (for turn signals) is used on the trailer, the connection must be made as shown in Figure 23. This is typical of most late model cars. However, this wire may be connected directly (through the connector at the rear of the tow car) to the trailer stop light, if a trailer stop light is used.

no brakes applied, remove the controller cover and check for gap in stoplight contactor points. If the gap has been inadvertently disturbed during installation, it may be adjusted by loosening the screw through the hole in the bottom of the controller case. The proper gap is .020". (See Figure 24)

If a selective resistor has been used adjust the resistance according to the instructions on pages 26 and 27. Road test the trailer and make final adjustment of the controller.

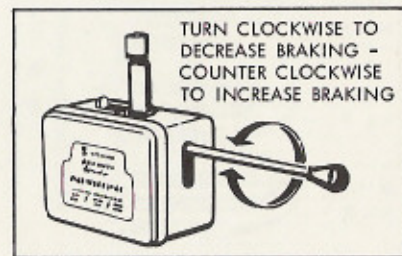


Figure 25

ADJUSTMENT. When the controller installation is completed, hook up the trailer for test and adjustment of the controller and circuit. First check the operation of trailer stop lights and turn signals. If the stop lights are lit with



The Kelsey-Hayes Controller is easily adjusted simply by turning the controller handle. Turn clockwise to lessen trailer braking, counter clockwise to increase braking. A red indicator on top of the controller will move toward "L" (for low) or "H" (for high) as the handle is turned. When the desired

2. Selective Resistor

A diagram of the Selective Resistor is shown in Figure 26. A choice of eight different connections is provided, and the setting is quickly and easily changed as requirements change.

setting is reached the controller will hold this adjustment. However, if locking is desired, it may be done with the jam nut shown in Figure 24 which is provided for this purpose. Adjustment may then be varied at any future date by loosening jam nut and rotating handle as described above.

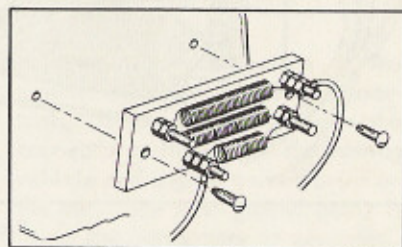


Figure 27

MOUNTING. Using the resistor as a template, mark and drill two (2) 3/16" holes on the engine side of the fire wall, and mount, using two screws. (See Figure 27)

CONNECTING. Consult the K-H Selective Resistor settings chart (Form SR-860-3), page 27, and connect the resistor into the line that leads from the blue wire on the controller to the brakes.

ADJUSTING. Check the initial trailer brake application with the controller fully applied. If the setting is correct, the controller full "on" position should provide firm braking action just short of skidding on dry pavement. Follow the chart and change the setting to achieve greater or less braking, as required.

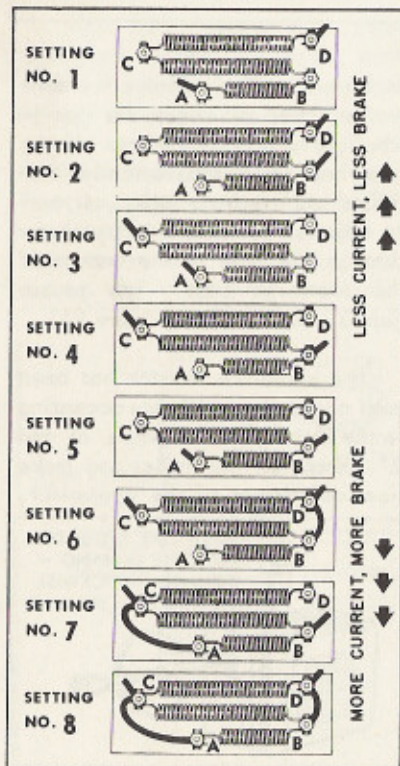


Figure 26



SELECTIVE RESISTOR SETTINGS

12 x 2

KELSEY-HAYES ELECTRIC BRAKES

NOTE

Selective Resistor is not required for Kelsey-Hayes 7-1/4" brakes.

TOTAL * TRAILER WEIGHT LBS.	12V TOW CAR				6V TOW CAR	
	6V BRAKES		12V BRAKES		6V BRAKES	
	1 AXLE 2 BRAKES	2 AXLE 4 BRAKES	1 AXLE 2 BRAKES	2 AXLE 4 BRAKES	1 AXLE 2 BRAKES	2 AXLE 4 BRAKES
500-1000	NO. 1	NO. 1	NO. 1	NO. 1	NO. 3	NO. 3
1000-1500	NO. 2	NO. 2	NO. 2	NO. 2	NO. 5	NO. 4
1500-2000	NO. 2	NO. 3	NO. 2	NO. 3	NO. 6	NO. 5
2000-2500	NO. 4	NO. 4	NO. 4	NO. 4	NO. 7	NO. 6
2500-3000	NO. 4	NO. 4	NO. 5	NO. 4	NO. 8	NO. 7
3000-3500	NO. 5	NO. 4	NO. 6	NO. 4	NONE REQ'D	NO. 8
3500-4000	NO. 6	NO. 5	NO. 7	NO. 5		NO. 8
4000-4500	NO. 7	NO. 5	NONE REQ'D	NO. 5		NONE REQ'D
4500-5200	NO. 8	NO. 6		NO. 6		
5200-5500		NO. 6		NO. 7		
5500-6000		NO. 7		NO. 7		
6000-6500		NO. 7		NO. 8		
6500-7000		NO. 8		NO. 8		
7000-7500		NO. 8		NO. 8		
7500-8000		NO. 8		NO. 8		
8000-8500		NO. 8		NONE REQ'D		
8500-9000		NO. 8				
9000-9500		NO. 8				
9500-10400		NO. 8				

SELECTIVE RESISTOR SETTINGS

10 x 2.25

KELSEY-HAYES ELECTRIC BRAKES

TOTAL * TRAILER WEIGHT LBS.	12V TOW CAR				6V TOW CAR	
	6V BRAKES		12V BRAKES		6V BRAKES	
	1 AXLE 2 BRAKES	2 AXLE 4 BRAKES	1 AXLE 2 BRAKES	2 AXLE 4 BRAKES	1 AXLE 2 BRAKES	2 AXLE 4 BRAKES
500-1000	NO. 1	NO. 1	NO. 1	NO. 3	NO. 3	NO. 3
1000-1500	NO. 3	NO. 3	NO. 3	NO. 3	NO. 6	NO. 5
1500-2000	NO. 4	NO. 4	NO. 5	NO. 4	NO. 8	NO. 6
2000-2500	NO. 5	NO. 4	NO. 7	NO. 4	NONE REQ'D	NO. 7
2500-3000	NO. 7	NO. 5	NONE REQ'D	NO. 5		NO. 8
3000-3500	NO. 8	NO. 6		NO. 6		NONE REQ'D
3500-4000	NO. 8	NO. 7		NO. 7		
4000-4500		NO. 7		NO. 8		
4500-5200		NO. 8		NO. 8		
5200-5500		NO. 8		NONE REQ'D		
5500-6000		NO. 8				
6000-6500		NO. 8				
6500-7000		NO. 8				
7000-7500		NO. 8				
7500-8000		NO. 8				
8000-8500						
8500-9000						
9000-9500						
9500-10400						

* WHEN CONSIDERING THREE AXLE TRAILERS WITH FOUR BRAKES OR TWO AXLE TRAILERS WITH TWO BRAKES, CONSIDER ONLY THE WEIGHT ON THE BRAKING AXLES WHEN REFERRING TO THE CHART.

3. Break-Away Switch

A standby battery mounted on the trailer is used to supply the electrical power to apply the brakes in the event of a break-away. An automotive wet cell battery of proper voltage to match the trailer brakes is recommended. However, one or two 6-volt "hot shot" batteries may be used. The break-away switch holds this power in reserve, and closes to apply the brakes, if a break-away occurs.

MOUNTING. The break-away switch should be mounted on the trailer hitch in such a position that it will not interfere with cramping the trailer either way, and will be close enough to the front to permit looping the pull-pin wire over the hitch ball on the tow car. To mount the switch it is necessary to drill only one hole and fasten with a screw, lockwasher and nut. The standby battery should be installed at any convenient and protected point near the front of the trailer.

WIRING. Figure 29 shows how the break-away switch and battery are connected into the trailer brake circuit. One switch lead is con-

nected to one brake wire. The other switch lead is connected to the positive (+) battery terminal. The other battery terminal is then connected to the second brake wire. Solder and tape these connections.

When the trailer is connected to the tow car, the break-away switch loop should be placed over the hitch ball before the hitch is lowered into position. When disconnecting trailer from tow car, remove wire loop from the hitch ball; do not remove pull-pin from switch, because this will apply the trailer brakes.

CAUTION: Trailer brakes will be applied whenever the pull-pin is removed from the switch. The pull-pin should be removed only in an emergency. Otherwise the standby battery on the trailer will be discharged. Check the battery periodically to make certain that sufficient current is always available to apply and hold the trailer brakes in an emergency.

No adjustment is required on the break-away switch.

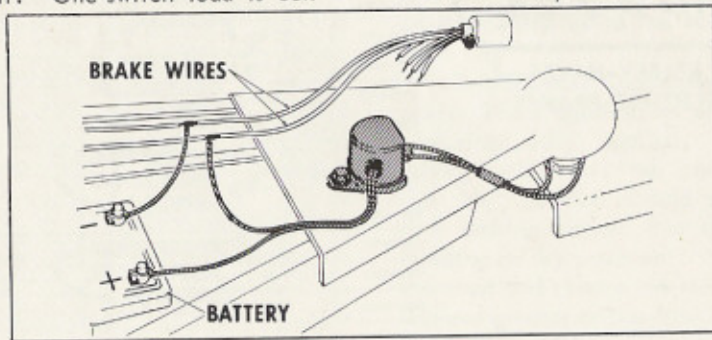


Figure 28

CHECKING THE ELECTRICAL CIRCUIT

1. Test Instrument

In order to properly check the electrical circuit and components, a D.C. ammeter should be used (0-15 amps for 2 to 4 brakes, and



Figure 29

0-25 amps for 6 brakes). However, in an emergency an automotive lamp may be used as a test bulb as shown in Figure 30. Be sure to use an automotive light bulb of the same voltage (6-volt or 12-volt) as your trailer brakes.

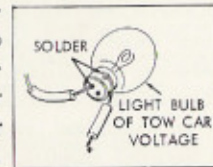


Figure 30

The test bulb is made by soldering a convenient length of wire (about 4 to 6 inches) to each of the two terminals of the bulb. (Note: In many such bulbs, grounding is through the base, so one wire is soldered to the base as shown.)

2. Testing the Circuit

First check the continuity of the system. To do this connect the trailer to the towing vehicle, then place the ammeter or test bulb in the circuit as shown in Figure 31.

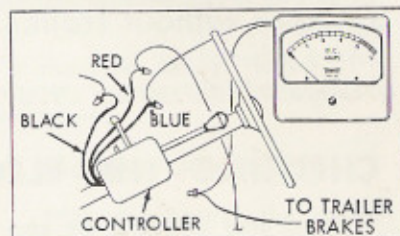


Figure 31

NOTE: Whenever connecting the ammeter, you can avoid possible damage to the ammeter by connecting one lead then just touching the other lead quickly. If the needle goes the wrong way you have reversed the polarity. To correct, simply reverse the leads, then complete the connection. Now operate the controller slowly. The cut-in or lowest current should read from 1 to 1-3/4 amps. The reading will vary, depending on the voltage and the number of brakes in the system. Consult the ammeter value table (page 36) for the correct reading for your brake system. If the ammeter registers the correct high and low readings and shows smooth current modulation you may assume that the controller is functioning properly. If you do not show the correct high and low or the modulation is poor, check the following electrical circuit problems.

If you are using a test light instead of an ammeter, the bulb should be "out" when the controller is "off", burn dimly as controller application starts, and gradually

burn more brightly as the controller handle is moved toward "on". In full "on" position, the bulb should burn with maximum brightness.

3. Check without Trailer

If trailer is not available a quick check of the tow car circuit

CHECKING THE ELECTRICAL COMPONENTS

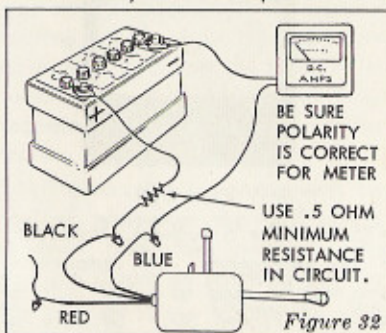
When, after checking the circuit, the trouble is located in a specific component (such as the controller or a brake magnet) it is advisable to remove this component and check it on the bench.

1. Automatic Controller Bench Check

To bench check the controller, connect to ammeter or test light as shown in Figure 34. The ammeter or test light should vary smoothly from "off" to "on". If it does not vary smoothly or shows no current when the controller is at full "on", remove the controller cover and inspect the resistor coil. If the coil is burned out, it must be replaced. A burned out coil can be

may be made by inserting the test bulb at the tow car connector plug. Have someone operate the controller slowly. If, as the controller handle is moved toward "on", the light goes from dim to bright or the ammeter shows a gradual rise, the tow car circuit is probably all right.

detected by visual inspection.



CAUTION: The resistor coil should last indefinitely under normal operating conditions. If the coil is burned out, carefully check the entire electrical system for a short circuited condition. A short circuit can damage any electric brake controller. See page 29 et seq.

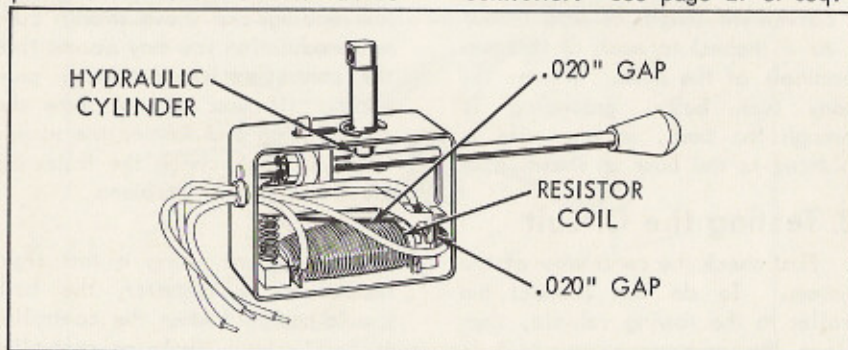


Figure 33

After replacing the coil be sure there is at least .020" clearance between the contactor strip and the coil when the controller handle is unapplied. See Figure 33.

2. Stop Light Switch

All K-H controllers are now equipped with a separate stop light switch which allows full current to flow to the trailer stop lights throughout brake application. It should be at .020" gap when the controller handle is unapplied. This gap can be adjusted by loosening one screw through an access hole in the bottom of the controller case, as shown in Figure 24, page 25.

3. Hydraulic Cylinder Leakage

When checking the electrical circuit of the controller, it is advisable to check its hydraulic cylinder at the same time, to be sure it is tight and free of leakage.

The hydraulic cylinder assembly is built to the same high standard of quality as other K-H hydraulic brake components. However, if leakage does occur it is recommended that the complete hydraulic cylinder assembly be replaced. When reconnecting the controller into the hydraulic system of the tow car, bleed and check connections as described on page 23.

4. Break-Away Switch

The break-away switch can be checked simply by placing an ammeter or test light in the circuit

between the break-away switch and the brakes, then pulling out the break-away pin. If no current flows to the brakes, check to be sure the break-away switch contacts are clean. If the contacts are clean, check the batteries for full charge. Replace batteries if necessary.

5. Magnet Assembly

Without removing the magnet assembly from the brake, inspect the magnet for wear and flatness.

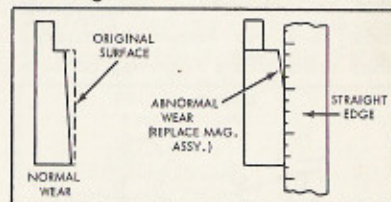


Figure 34

If the magnet rubbing surface is flat it need not be replaced until the friction element shows signs of wearing through. A magnet that is not wearing flat must be replaced since it cannot function efficiently. To check the wearing surface for flatness, lay a scale or straight-edge on the magnet as shown in Figure 34

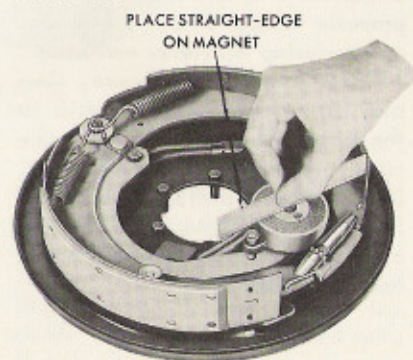


Figure 35

Before replacing with a new magnet determine the cause of the improper wear. First check the magnet lever pivot. A worn pivot bushing can cause the magnet lever to cock, thus allowing the magnet to tip against the armature plate. If this condition exists, the lever assembly should be replaced. Also, if the magnet has a washer in front of the spring (necessary on some earlier magnets), this washer should be removed. (See Figure 36). Current magnet replacement assemblies do not contain this washer since it is no longer necessary. When reinstalling magnets, be sure

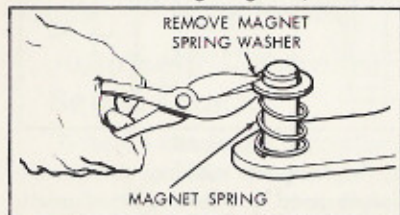


Figure 36

to install the loom (lead wires) properly, avoiding kinks and allowing ample clearance for the lever to move through its full travel. Operate the lever in both directions to be sure the loom moves properly without binding, kinking, or interfering with lever movement. NOTE: In the 7-1/4" brake, special attention should be paid to the proper lubrication of the brake magnet lever pivot since this brake, used on boat trailers, may often be immersed in water. Be sure the pivot is free from corrosion and is operating smoothly.

6. Magnet Bench Check

To check electrically, remove the magnet for bench test. To check for a possible coil-to-case short, connect the magnet in series with the ammeter (or suitable test bulb) as shown in Figure 38. Since the short may be intermittent, move the leads and rap the magnet while checking. If the ammeter shows current or the test bulb lights, a short is present. Replace with a new magnet assembly.

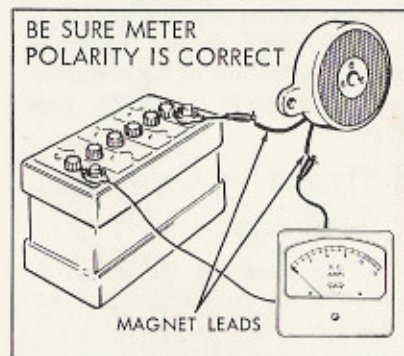


Figure 37

To check for possible shorts within the magnet coil, connect as shown in Figure 37. Check current

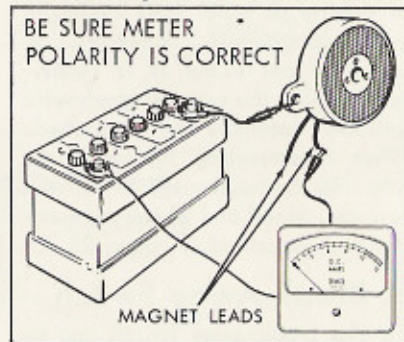


Figure 38

and refer to Table 1, page 36, for proper amperage values. If the proper current value does not register on the ammeter, the magnet must be replaced.

NOTE: Earlier model 6-volt magnets on Kelsey-Hayes 10" and 12"

brakes have yellow terminal insulators. Later model magnet assemblies have yellow leads. Similarly, earlier 12-volt magnets had green terminal insulators, while later magnet assemblies have green leads. All 7-1/4" brakes have 12-volt magnets.

CHECKING THE MECHANICAL COMPONENTS

1. Bearings and Seals

Remove the hub, drum and armature plate assembly. Inspect the bearing cups and cones for wear or damage. If damaged replace

with new bearing cups and cones. ALWAYS replace cups and cones in sets. Inspect seals for damage; replace if necessary.

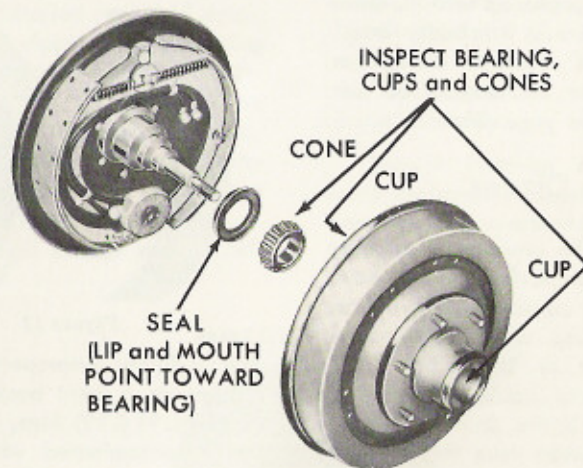


Figure 39

2. Armature Plates

Inspect the armature plates. Under normal conditions the Kelsey-Hayes Tufftrided armature plate should last indefinitely. However, if an armature plate shows excessive galling due to severe contamination (mud, small stones, etc.) it

can easily be replaced. Replacement armature plates are supplied with the necessary screws, nuts and lockwashers (three required). If the original plate is riveted in, rivets may easily be drilled out. If only one plate is damaged, only

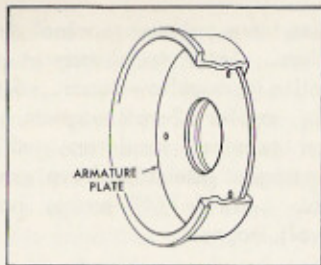


Figure 40

the damaged plate needs to be

NOTE: Always inspect the magnet assembly when replacing an armature plate since the same condition which caused damage to it may also have caused magnet damage. If the magnet is wearing flat it need not be replaced with the armature plate unless it is badly worn. However, if it shows uneven or angular wear, it should be replaced. See page 31.

3. Brake Drums

Inspect the brake drum rubbing surface. This surface should have a dull grey appearance free from heavy scoring and/or excessive wear. One or two light score marks are not cause for reboring the drum. If the drum has heavy scoring, is worn more than .020" oversized, or has more than .015" runout, the drum should be rebored. A standard drum lathe may be used, taking care not to remove more than .060" from the original drum diameter (.030" per side). The drum should be discarded if it must be bored more than .060" over its original diameter to clean up the surface.

NOTE: Since K-H brakes are adjustable, they do not require spacers between the shoe and lining when the drum is rebored. However, if a drum is bored out as much as .060" on the diameter, be sure the brake shoes and linings are ground to match the new drum inside diameter.

4. Brake Lining

First inspect the brake linings for wear. If a lining is worn to the rivets it should be replaced. Inspect for uneven lining wear patterns such as shown in Figure 43, and replace if this condition exists. Wear patterns such as this

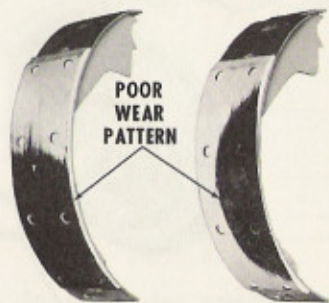


Figure 41

may indicate improperly located flanges or a bent backing plate. (See Figs. 11 & 12) Also, if lining is badly contaminated with grease, oil, etc., it must be replaced, since contamination of this type cannot be sanded or dissolved out.

IMPORTANT: Always replace brake linings in sets - on both brakes on the same axle.

If the lining is worn to the rivets without evidence of uneven wear, simply replace with new

Kelsey-Hayes factory ground shoe and lining assemblies. Shoes may also be relined with the proper friction material, supplied by Kelsey-Hayes, chamfered and ready for riveting to the shoe. Rivet securely and grind approximately .030" under drum diameter.

To remove brake shoes, first remove the brake shoe return springs. Then remove the shoes, adjuster assembly and adjuster springs as an assembly, Figure 42. Remove adjuster assembly and spring from the brake shoes. Before replacing shoes carefully inspect all springs. If springs appear stretched or otherwise deformed, new springs should be installed to avoid dragging brakes. Apply a light coating of lubricant to the adjuster assembly and to the six points on the backing plate where the shoes rest. Reinstall the brake shoes, reversing the removal sequence. See page 22 for adjustment procedure.

NOTE: On all except the 7-1/4"

x 1-1/4" brake, be sure to install the shoe with the short (primary) lining in the front or forward position. The 7-1/4" x 1-1/4" linings are both the same length and material, and are interchangeable.

5. Boat Trailer Brakes

Special attention should be given to boat trailer brakes which are subjected to immersion during boat launchings. When the boating season is over and before the trailer is stored, remove the brake drums and inspect the brake assembly. Be sure all parts are dry and free from corrosion. If necessary, disassemble the brake, clean the shoes, backing plate, etc. then lightly lubricate the anchor, magnet pivot, shoe contact points on the backing plates, and the adjuster assembly.

Inspect bearings and bearing seals; replace if necessary. Repack bearings and reassemble drum and wheel assembly.

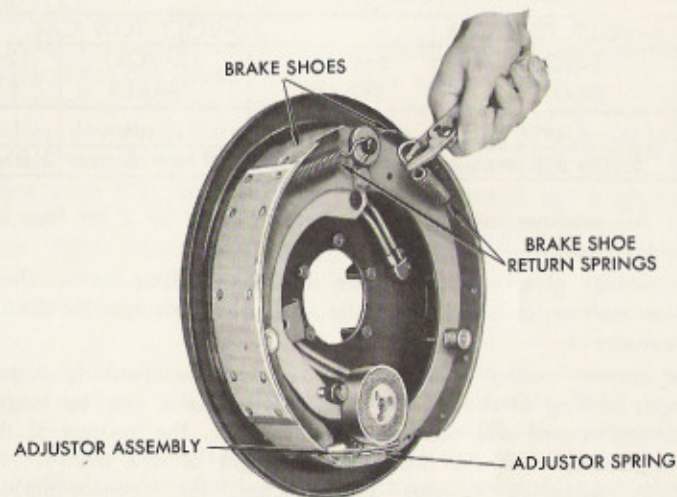


Figure 42

5

TROUBLE SHOOTING

ELECTRICAL CIRCUIT TROUBLE SHOOTING

TABLE 1

CORRECT CURRENT READINGS FOR SINGLE MAGNETS ATTACHED MATCHING BATTERY SOURCE

10" & 12" 6-volt	10" & 12" 12-volt	7-1/4" 12-volt
2.7 to 3.2 amps	3.0 to 3.5 amps	1.7 to 2.2 amps

TABLE 2

CORRECT MINIMUM & MAXIMUM CURRENT VALUES AT CONTROLLER FOR VARIOUS TRAILER BRAKE COMBINATIONS †

	10" AND 12" BRAKES			7-1/4" BRAKES
	6-VOLT TOW CAR	12-VOLT TOW CAR		12-VOLT BRAKES
	6-VOLT BRAKES	6-VOLT BRAKES	12-VOLT BRAKES	
MIN.	.7 amp	1.3 amps	1.2 amps	1.0 amp
MAX.	5.0 to 5.5 amps	10 to 12 amps	6.0 to 6.5 amps	3.8 to 4.4 amps

NOTE: All readings are for two brakes; multiply by 2 for four brakes and 3 for six brakes.

† The values given are without a selective resistor in the circuit. If a selective resistor is used, put both wires on a common terminal to check these values.

The current values given are to be used for checking purposes only. For proper braking of the trailer a selective resistor may be required. This depends on the size and number of brakes used, the voltage of the towing vehicle, voltage of the brake, and weight of the trailer. See Form SR-860-3, Selective Resistor Setting Card, for recommendations on the resistor.



1. No Current Flow Apparent

(Will result in no brakes)

1. Check for proper wiring of the circuit. See tow car trailer wiring instructions, page 21, and note the full circuit. Note particularly the ground wire instructions.

2. Be sure all connections are clean, dry and tight - especially at tow car-to-trailer connector plug.

3. Check the controller resistor coil.

2. Minimum and Maximum Readings Too High

(Will result in excessive and grabby brakes - possible controller burnout)

1. 6-volt Brakes with 12-volt Tow Car - A selective resistor is required for 6-volt brakes used with 12-volt tow car. Install selective resistor. See page 26.

2. Short in wiring. Carefully check circuit for frayed insulation etc.

3. Short in brakes. Remove the magnet terminal components from the brake backing plates and inspect for evidence of shorting. Remove magnet assemblies and check for worn leads. Bench check for internal shorts. (See page 32) Replace if necessary.

4. Stop lights connected in brake circuit. See controller installation instructions, page 22.

3. Minimum and Maximum Readings Too Low

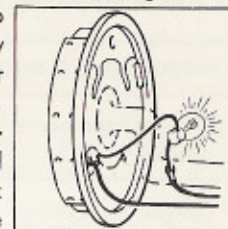
(Will result in insufficient brakes)

1. Poor circuit connections or inadequate ground. See wiring in-

structions, page 21, and check brake circuit. Pay particular attention to good grounding of the system.

2. Open circuit in at least one magnet. Check the current flow in each brake as shown in Figure 43.

If there is no current flow through either of the magnets, check the magnet leads and bench check magnet. See



page 32.

Figure 43

3. Brakes wired in series. Re-check tow car circuit. See page 21 for correct circuit wiring.

4. No Modulation - Only

Maximum Current Available

(Will result in grabby brakes)

Check for burned out controller resistor coil.

5. Intermittent Current Flow

(Will cause intermittent or possibly surging brakes)

Intermittent current flow is usually caused by attempts to ground through the trailer hitch. It may also be caused by a magnet lead which is partially severed, causing intermittent contact with every wheel revolution. Another cause may be a broken or frayed wire at any point in the system.

To locate the cause of this intermittent current flow you may have to install your ammeter or test light at the controller and have an assistant observe under actual driving conditions.

**MECHANICAL COMPONENTS TROUBLE SHOOTING****PROBLEM: GRABBY OR LOCKING BRAKES**

PROBABLE CAUSE	REMEDY
Flanges Improperly Installed	Check flange location - replace if necessary*. See page 14.
Grease on Lining	Check for contamination. Replace seals and lining. See page 34.
Controller not Modulating	1. Disconnect red wire on controller. Road test for braking modulation. If modulation is O.K., check red wire, page 24. 2. Bench check controller - replace if necessary. See page 30.
Improper Lining	Be sure replacement lining is genuine K-H lining. Replace, if necessary. See page 34.
No Selective Resistor	A selective resistor is required when brakes have greater power than is necessary for the weight on the axle. Install selective resistor when necessary. See page 26.
Loose Parts in Brakes	Check for loose rivets, broken springs etc. jammed in brakes.
Rust in Armature Plate and/or Brake Drums	Caused by non-use. Usually corrected by normal continued use.

*Correcting this condition is normally a garage operation, requiring equipment which the individual trailer owner is not likely to have. See your nearest Kelsey-Hayes Electric Brake Service Station to have the axle flange correctly mounted.

A list of Kelsey-Hayes distributors and service stations is available on request.

**PROBLEM: WEAK BRAKES**

PROBABLE CAUSE	REMEDY
Poor Connections	Check that all connections are clean and tight.
Poor Ground	Do not depend upon grounding through the trailer hitch. See page 24 for proper grounding instructions.
Short Circuit	Check electrical circuit. See checking electrical circuit, page 29.
Selective Resistor Setting Incorrect	Check for proper setting to avoid too much resistance. See page 27.
Worn or Defective Magnets	Replace magnets. See page 31.
Poor Brake Adjustment	Adjust brakes. See page 22.
Backing Plates Bent or Misaligned	Check backing plate and flanges. See page 14. Correct if necessary.
Greasy Lining	Check for worn or damaged grease seals. Replace if necessary. Make sure bearings are packed with high grade bearing grease, not cup grease or chassis lubricant.
12-volt Brakes used with 6-volt Tow Car	Install new 6-volt magnet assemblies.
Excessive Load on Trailer	Check to be sure your trailer is not under-braked. Too much weight will result in lack of torque, fade, poor performance. Also, be sure to have brakes on every axle - one set of brakes cannot be expected to handle the weight on two axles.
Using Trailer Brakes only	Use of trailer brakes only, can cause early fade or loss of friction due to excessive heat. See operating tips, page 4.
Inadequate Gauge of Wire	See wiring recommendations. Figure 17, page 20.

**PROBLEM: NO BRAKES**

PROBABLE CAUSE	REMEDY
Open Circuit	Check for broken wires, loose connections, improper grounding, faulty connector plug between car and trailer, etc.
Improperly Wired or Inoperative Controller	Rewire controller. See page 24. Check controller operation. See page 25.
Poor Brake Adjustment	Adjust brakes. See page 22.
Selective Resistor Defective	Check resistor for loose connections.
Worn or Defective Magnets	Replace magnets. See page 31.
Short Circuit	Check electrical circuit. See checking electrical circuit, page 29.

PROBLEM: INTERMITTENT OR SURGING BRAKES

PROBABLE CAUSE	REMEDY
Out of Round Drums	Rebore drums if more than .015 out of round. See page 34.
Inadequate Trailer Ground	Check for proper grounding. See page 24. (Note: A ground through trailer hitch is inadequate.)
Broken Magnet Lead Wires	Bench check magnets. See page 31. Replace if necessary.
Loose Wheel Bearings	Check and adjust bearings. See page 35.

**PROBLEM: DRAGGING BRAKES**

PROBABLE CAUSE	REMEDY
Brakes Adjusted Incorrectly	Check brake adjustment. See page 22.
Electrical Defect in Controller	Insufficient gap between controller contactor strip and coil may cause brakes to be on continuously. Correct condition. See page 30.
Hydraulic Defect in Controller	Too high a residual pressure in the tow car hydraulic system or a "gummed up" controller cylinder may cause the controller to be held "on" slightly. Check and repair. See Figure 6, page 11.
Flanges Improperly Installed	Check and reweld. See page 14. Also check for bent backing plates. Replace if necessary.
Badly Corroded Brake Assemblies	Check brake assemblies for severe corrosion. Check to be sure magnet levers operate freely. Clean and lubricate brake assemblies. See special instructions for boat trailer brakes, page 35.
Weak or Broken Shoe Return Springs	Check and replace if necessary.

**PROBLEM: NOISY BRAKES**

PROBABLE CAUSE	REMEDY
Lining Worn to Rivets	Check and reline linings. See page 34.
Loose Parts - Rivets, Broken Springs, etc.	Check and repair.
Flange Improperly Located, Bent Backing Plate	Check and repair if necessary. See page 14.
Grease on Lining	Check and reline if necessary. See page 34.
Improper Bearing Adjustment	Check and adjust bearings. Check for worn or damaged bearings. Replace if necessary. See page 33.
Poor adjustment	A certain amount of noise is normal when the brake releases. Proper adjustment will minimize this noise. See Page 32.

NOTE: Kelsey-Hayes brakes are noted for quietness of operation. When properly installed, brake noise should not be evident. Consequently it is wise to have your brakes checked if a noise does develop.

PROBLEM: STOP LIGHTS OR TURN-SIGNALS INOPERATIVE

PROBABLE CAUSE	REMEDY
Incorrectly Wired	See instructions, page 24. Rewire if necessary.
Controller Stop Light Switch Improperly Adjusted	Adjust controller stop light switch. See page 25.

BRAKE PARTS IDENTIFICATION CHART

Brake Identification

SINGLE BAND TYPE HIGH ANCHOR TYPE LOW ANCHOR TYPE

Magnet Identification

L.H. MAGNET R.H. MAGNET

MAGNET DIAMETERS	
Brake Size	Diameter of Magnet Face 10"
7 1/2" Electric	2"
10" Electric (Standard)	2-3/4"
10" Electric (Universal)	2-3/8"
12" Electric	2-3/4"

Color Coding of 6-Volt and 12-Volt Magnets

NEW STYLE	OLD STYLE
6-Volt - Yellow Loom	6-Volt - Yellow Terminal
12-Volt - Green Loom	12-Volt - Green Terminal

Primary-Secondary Identification

PRIMARY PRIMARY

SECONDARY

L.H. BRAKE R.H. BRAKE

Using the Adaptor

No. 49789

ADAPTORS INSTALLED ON EARLIER 12" BRAKES ADAPTORS INSTALLED ON EARLIER 10" BRAKES

On 10" brakes, install the adaptors as shown at right. Because the basic magnet lead length is not changed on this brake, the adaptors should be doubled back as shown, so that when the installation is completed the magnet lead terminals are about even with the terminal posts.

ELECTRIC BRAKE SERVICE PARTS

DESCRIPTION	12" ELECTRIC								12" ELECTRIC COMBIN-	MECHANICAL ACTION	10" ELECTRIC (STD) ◇ (2-3/4" Magnet)				10" ELECTRIC UNIVERSAL ◇ (2-3/8" Magnet)				7/4" ELECTRIC
	SINGLE BAND	2-SHOE LOW ANCHOR 12x2	2-SHOE HIGH ANCHOR 12x2				2-SHOE		12x2	2-SHOE 10x2 1/4	2-SHOE 10x2 1/4				2-SHOE 10x2 1/4	2-SHOE 7/4x1 1/4			
			6-VOLT w/POST TYPE* TERMINALS	12-VOLT w/POST TYPE* TERMINALS	6-VOLT w/PLUG TYPE TERMINALS	12-VOLT w/PLUG TYPE TERMINALS	6-VOLT w/POST TYPE* TERMINALS	12-VOLT w/POST TYPE* TERMINALS			6-VOLT w/POST TYPE* TERMINALS	12-VOLT w/POST TYPE* TERMINALS	6-VOLT w/PLUG TYPE TERMINALS	12-VOLT w/PLUG TYPE TERMINALS			6-VOLT w/POST TYPE* TERMINALS	12-VOLT w/POST TYPE* TERMINALS	6-VOLT w/PLUG TYPE TERMINALS
Brake Assembly	30851-2	39463-4	46650-1	45400-1	48962-3	48960-1	40060-1	46650-1	48964-7	48964-5	40700-1	46662-3	48970-1	48968-9	42668-9	46666-7	48974-5	48972-3	46125-6
Armature Plate	30944	30944	30944	30944	30944	30944	30944	30944	30944	30944	40727	40727	40727	40727	42693	42693	42693	42693	46619
Washer	30805	30805	30805	30805	30805	30805	30805	30805	30805	30805	30805	30805	30805	30805	30805	30805	30805	30805	46842
Nut	30807	30807	30807	30807	30807	30807	30807	30807	30807	30807	30807	30807	30807	30807	30807	30807	30807	30807	46841
Screw	39419	39419	39419	39419	39419	39419	39419	39419	39419	39419	39419	39419	39419	39419	39419	39419	39419	39419	46841
Magnet Assembly	39486-7	39486-7	39486-7	46359-60	48774-5	48762-3	39486-7	46359-60	48774-5	48762-3	40993-4	46634-5	48847-8	48841-2	42683-4	46643-4	48858-9	48853-4	46141-2
Retaining Ring	43747	43747	43747	43747	43747	43747	43747	43747	43747	43747	43747	43747	43747	43747	43747	43747	43747	43747	43747
Terminal (6-V Yellow)	30850	30850	30850	-	-	-	30850	-	-	-	30850	-	-	-	30850	-	-	-	-
Terminal (12-V Green)	-	-	-	46730	-	-	-	46730	-	-	-	46730	-	-	-	46730	-	-	47138
Terminal Butt Connector	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Terminal Insulation (Red)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	47139
Magnet Spring	46264	46264	46264	46264	46264	46264	46264	46264	46264	46264	46264	46264	46264	46264	46264	46264	46264	46264	46150
Cable Clip	33332	39497	45413	45413	-	-	39497	39497	-	-	42692	42692	42692	42692	42692	42692	42692	42692	45780
Lever	30862-3	40907-8	45416-7	45416-7	45416-7	45416-7	40907-8	40907-8	40907-8	40907-8	40718-9	40718-9	48647-8	48647-8	42678-9	42678-9	48601-2	48601-2	46135-6
Lever Retaining Rings	-	-	-	-	-	-	-	-	-	-	40724	40724	40724	40724	40724	40724	40724	40724	46151
Shoe & Lining Assy. Pri.	□	39693	46397	46397	46397	46397	40107†	40107†	40107†	40107†	47071	47071	47071	47071	47071	47071	47071	47071	46327
Shoe & Lining Assy. Sec.	□	39693	46398	46398	46398	46398	40108†	40108†	40108†	40108†	47073	47073	47073	47073	47073	47073	47073	47073	46327
Lining Primary	30873	39696	46374	46374	46374	46374	46399	46399	46399	46399	47072	47072	47072	47072	47072	47072	47072	47072	46156
Lining Secondary	30873	39696	46399	46399	46399	46399	46399	46399	46399	46399	47074	47074	47074	47074	47074	47074	47074	47074	46156
Rivets	21211	21211	21211	21211	21211	21211	21211	21211	21211	21211	31716	31716	31716	31716	31716	31716	31716	31716	31716
Hold Down Pin	-	30687	30687	30687	30687	30687	30687	30687	30687	30687	30687	30687	30687	30687	30687	30687	30687	30687	46159
Hold Down Spring	-	30688	30688	30688	30688	30688	30688	30688	30688	30688	30688	30688	30688	30688	30688	30688	30688	30688	-
Hold Down Cup	-	30690	30690	30690	30690	30690	30690	30690	30690	30690	30690	30690	30690	30690	30690	30690	30690	30690	-
Hold Down Spring Clip	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	46160
Washer Retaining Ring	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	46158
Adjusting Screw Assy.	-	39474	46115	46115	46115	46115	46115	46115	46115	46115	46115	46115	46115	46115	46115	46115	46115	46115	45781
Adjusting Screw Spring	-	41013	44934	44934	44934	44934	44934	44934	44934	44934	44935	44935	44935	44935	44935	44935	44935	44935	46161
Retractor Spring	**	39499	45424	45424	45424	45424	40112	40112	40112	40112	30677	30677	30677	30677	30677	30677	30677	30677	47323
Brake Mounting Stud	30810	30810	30810	30810	30810	30810	30810	30810	30810	30810	40712	40712	40712	40712	40712	40712	40712	40712	40712
Brake Mounting Washer	22548	22548	22548	22548	22548	22548	22548	22548	22548	22548	26441	26441	26441	26441	26441	26441	26441	26441	26441
Brake Mounting Nut	44448	44448	44448	44448	44448	44448	44448	44448	44448	44448	24074	24074	24074	24074	24074	24074	24074	24074	24074
Brake Adj. Hole Cover	-	47564	47564	47564	47564	47564	47564	47564	47564	47564	47564	47564	47564	47564	47564	47564	47564	47564	32764

* No Longer Manufactured - Service Parts Available ** 32037 1/2"x4" 33097 7/16"x2-3/4"

□ Brake Band and Lining Assy is 32642RH & 32643LH Retractor Springs are included.

† 40107 RH Prim. & LH Sec. 40108 LH Prim. & RH Sec.

◇ Caution: Check Magnet Size to identify Brake for Service Parts.

K-H ELECTRIC BRAKES

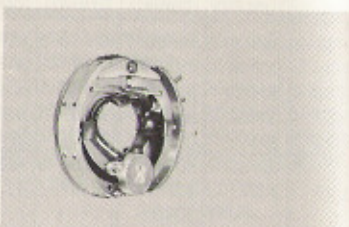
Kelsey-Hayes is one of the world's largest producers of hydraulic and electric brakes for the automotive, mobile home and trailer industries.

10 MODELS

cover the complete range of braking requirements from the smallest boat trailer to the largest mobile home.

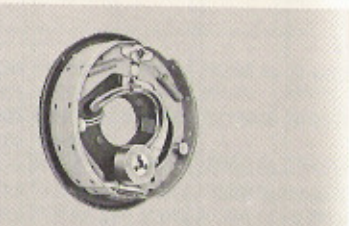
7.25 X 1.25 TWO-SHOE ADJUSTABLE 12-VOLT ONLY

Automotive type brake designed especially for boat trailers, light campers and light utility trailers, with axle loads up to 1500#. Will fit 8" & 12" wheels.



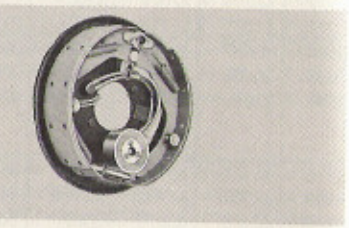
10 X 2.25 TWO-SHOE ADJUSTABLE (FOR "UNIVERSAL" GROUP) 6-VOLT AND 12-VOLT MODELS

Automotive type brake for light and medium travel trailers, and utility trailers up to 3300# axle loads.



10 X 2.25 TWO-SHOE ADJUSTABLE (FOR GROUP 10) 6-VOLT AND 12-VOLT MODELS

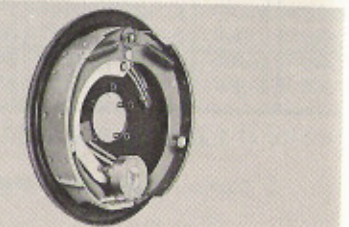
Automotive type brake for light and medium travel trailers, horse trailers, utility trailers up to 4000# axle loads. Widely used on trailers requiring a low platform. Takes a 10" wheel.



12 X 2 TWO-SHOE, ADJUSTABLE 6-VOLT AND 12-VOLT MODELS

Automotive type brake for mobile homes, large travel and utility trailers, and other heavy applications up to 5200# axle loads.

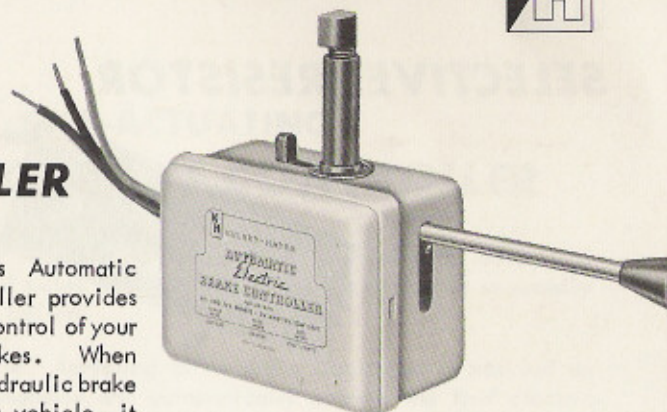
Also available in mechanical and electric-mechanical models, 6 volt and 12 volt.



Use these Kelsey-Hayes products for a fully engineered electric brake system



BRAKE CONTROLLER



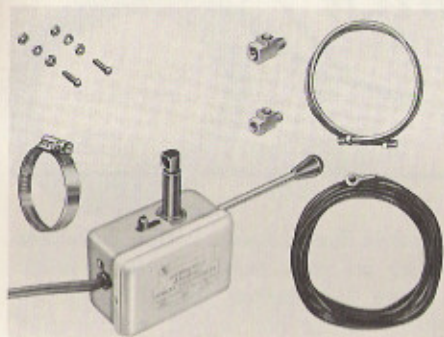
The Kelsey-Hayes Automatic Electric Brake Controller provides smoothly modulated control of your electric trailer brakes. When connected into the hydraulic brake system of the towing vehicle, it operates automatically to synchronize the braking of both car and trailer, whenever the tow-car brakes are applied. It is fully and easily adjustable for varying load conditions, and assures smooth brake application from gradual deceleration to full emergency stopping.

Only the KELSEY-HAYES AUTOMATIC CONTROLLER gives you the best in all these

IMPORTANT FEATURES

to make your trailer braking smooth, safe, and fully modulated.

- ▲ ACCURATE FINGERTIP ADJUSTMENT
- ▲ AUTOMATIC TRAILER STOP LIGHT
- ▲ COMPLETE HYDRAULIC BRAKE CONTROL
- ▲ STEPLESS MODULATION



COMPLETE KIT SIMPLE INSTALLATION

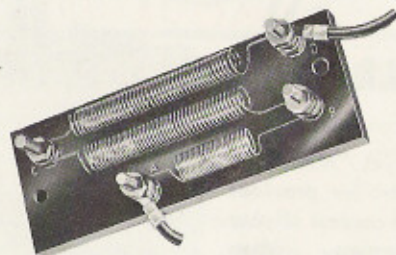
The Automatic Controller Kit includes all wire, tubing and fittings necessary for the complete installation, together with easy-to-follow instructions for installing and connecting into the hydraulic brake system on your car.

The Kelsey-Hayes Automatic Controller is the only controller on the market that is engineered for use with either 6-volt or 12-volt cars and 6-volt or 12-volt brakes.

Use these Kelsey-Hayes products for a fully engineered electric brake system



SELECTIVE RESISTOR

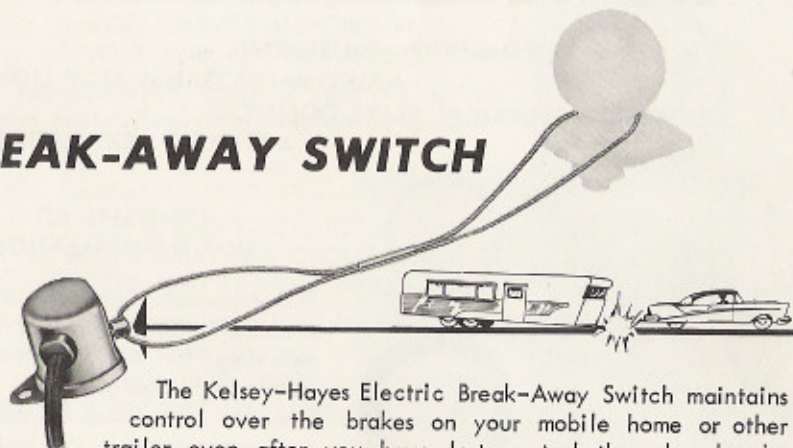


The Kelsey-Hayes Resistor is necessary whenever brake capacity exceeds the trailer braking requirements.

Braking power can be adjusted to avoid undesirable premature wheel skid when the controller is fully applied.

The Resistor has 8 graduated resistances to handle all trailers from the lightest to the heaviest. It is connected in the brake circuit between the controller and the brakes so that running lights, tail lights, stop lights and turn signals operate on the standard car circuit.

BREAK-AWAY SWITCH



The Kelsey-Hayes Electric Break-Away Switch maintains control over the brakes on your mobile home or other trailer even after you have lost control through a break-away. Its simple, fool-proof design and rugged construction are your assurance that if your car and trailer should ever "part company" on the highway, the trailer brakes are automatically being applied to prevent its running wild. No other part of your trailer electric brake system is more important than this dependable protection against serious break-away damage.

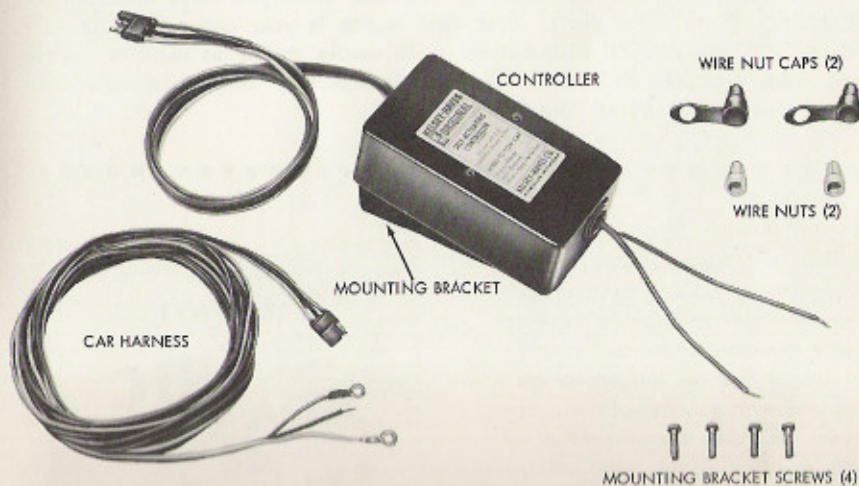
Use these Kelsey-Hayes products for a fully engineered electric brake system



SELF-ACTUATING ELECTRIC BRAKE CONTROLLER

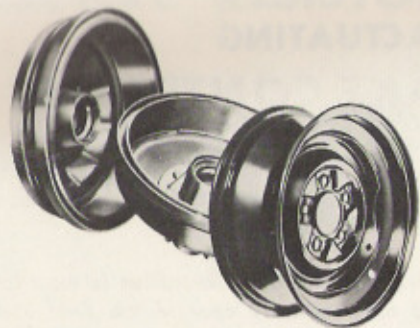
Quickly and easily installed, and designed specifically for occasional or temporary use. Well suited for use on rental trailers as well as seasonally used boat and utility trailers.

The Kelsey-Hayes Self Actuating (S/A) Brake Controller is mounted on the trailer tongue to smoothly and automatically operate the K-H electric brakes (two or four). The controller is engineered to provide four stages of braking (light, medium, heavy or emergency braking). It senses the amount of tow car braking and instantly applies the electric trailer brakes proportionately. To compensate for varying trailer loads, four load control adjustments are built into the controller.



KIT NO. 49469 (BLACK CASE) USED FOR **K-H 7-1/4 x 1-1/4** ELECTRIC BRAKES
KIT NO. 49942 (TAN CASE) USED FOR **K-H 10 x 2-1/4** ELECTRIC BRAKES

Use these Kelsey-Hayes products for a fully engineered electric brake system



- **WHEELS**
- **HUBS**
- **DRUMS**

Kelsey-Hayes is the world's largest manufacturer of wheels, hubs and brake drums for the automotive and mobile home industries. K-H development and experience in wheel, hub and drum production, which goes back over half a century, is assurance for you that when you need replacement of any of these vital parts, your best source is your authorized Kelsey-Hayes distributor. K-H distributors, with ample stocks on hand to supply your needs promptly and efficiently, are strategically located in more than fifty cities in the United States and Canada.



Use a Kelsey-Hayes system throughout. You will have smooth operation and dependable braking with the most modern and reliable equipment that the industry offers. And wherever you travel, you are never far from competent, efficient service if the need arises. Kelsey-Hayes equipment is maintained and serviced by hundreds of authorized Kelsey-Hayes brake service stations, from coast to coast. Look for this sign



Your assurance of the best in service for the best of equipment—that's Kelsey-Hayes.