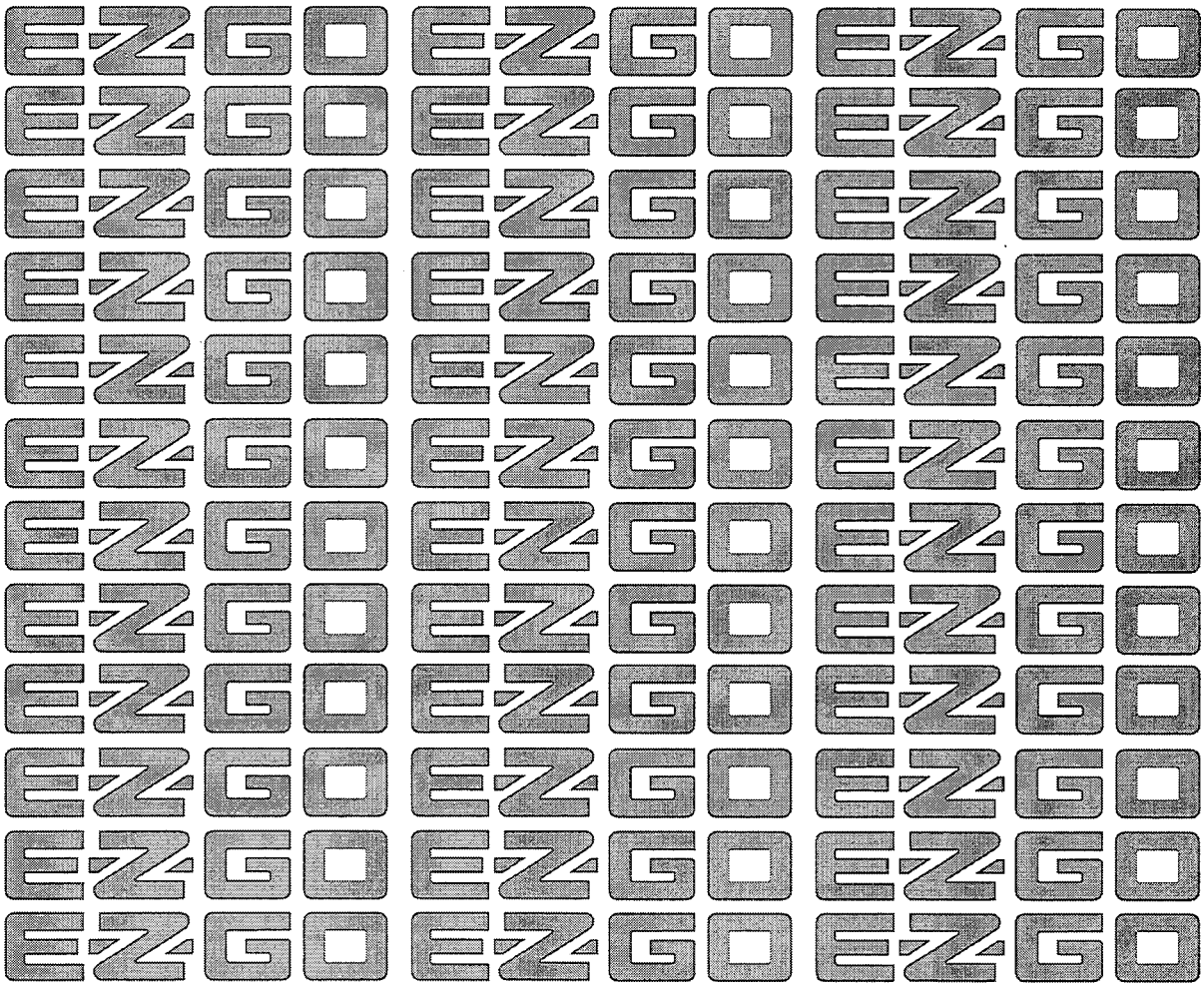
EZGO TEXTRON

ELECTRIC POWERED VEHICLES

OWNER'S OPERATION AND SERVICE MANUAL



MODEL YEARS: 89 - 96 MANUAL NO. 25122-G1 REVISED: 07/19/95

OWNER'S OPERATION AND SERVICE MANUAL

ELECTRIC POWERED VEHICLES

MODEL YEARS: 1989 - 1993

GOLFCARS

X - 440/444

X-444F (FREEDOM)

X - 444J (SPIRIT)

TRUCKS

XI - 300/500

XT - 300/500

PERSONNEL CARRIERS

PC4X

PC4XI

PC4XJ (LIBERTY)

E-Z-GO DIVISION OF TEXTRON, INC., P.O.BOX 388, AUGUSTA, GEORGIA 30903-0388

TO OBTAIN A COPY OF THE LIMITED WARRANTY THAT IS APPLICABLE TO YOUR VEHICLE, CALL OR WRITE YOUR LOCAL DISTRIBUTOR, BRANCH, OR E-Z-GO WARRANTY DEPARTMENT.

NOTE

The use of NON E-Z-GO parts may void your warranty.

Overfilling of batteries may void your warranty.

GENERAL INDEX

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This Operation and Service Manual has been designed to enable you to maintain the vehicle in accordance with procedures developed by E-Z-GO. Adherence to these procedures and trouble-shooting tips will ensure you of the best possible service from the product.

This manual is divided into individually numbered sections.

Certain illustrations and text may describe options or features that your vehicle is not equipped with; disregard these areas.

This manual is designed to cover the 1989,1990 and 1991 model years. When service procedures are different from one year to the next, it will be noted in the text or immediately following the section it is relevant to.

Throughout this manual you will find **NOTES, CAUTIONS,** and **WARNINGS** used. For the protection of all personnel and the vehicle, please observe the following:

NOTE	Indicates a condition that should be observed.
CAUTION	INDICATES A CONDITION THAT MAY RESULT IN DAMAGE TO VEHICLE.
⚠ WARNING ⚠	**INDICATES A CONDITION THAT MAY BE HAZARDOUS TO PERSONNEL AND MAY RESULT IN DAMAGE TO THE VEHICLE.**

To reduce the chance of personal injury and/or property damage, the following instructions must be carefully observed:

Proper service repair and maintenance are important to the safety of the service technician and the safe, reliable operation of all vehicles. If part replacement is necessary, the part must be replaced with the specified replacement part. Note: The use of non E-Z-GO parts will void your warranty. Do not use a replacement part of lesser quality.

The procedures recommended and described in this manual are effective methods of performing service, repair, and maintenance. Some of these procedures require the use of tools specially designed for the purpose.

Accordingly, anyone who intends to use a service procedure or tool which is not recommended by the vehicle manufacturer, must first determine that neither his safety nor the safe operation of the vehicle will be jeopardized by the service procedure or tool selected.

It is important to note that this manual contains various **NOTES, CAUTIONS,** and **WARNINGS** that must be carefully observed in order to reduce the risk of personal injury during service or repair, or the possibility that improper service or repair may damage the vehicle or render it unsafe.

To facilitate ordering parts, an illustrated parts breakdown catalogue is available from your local Distributor, Branch or the E-Z-GO Service Parts Department.

The model, serial, and manufacturing numbers are stamped on a plate on the right side of the dash housing of the vehicle. (FIG. A-1)

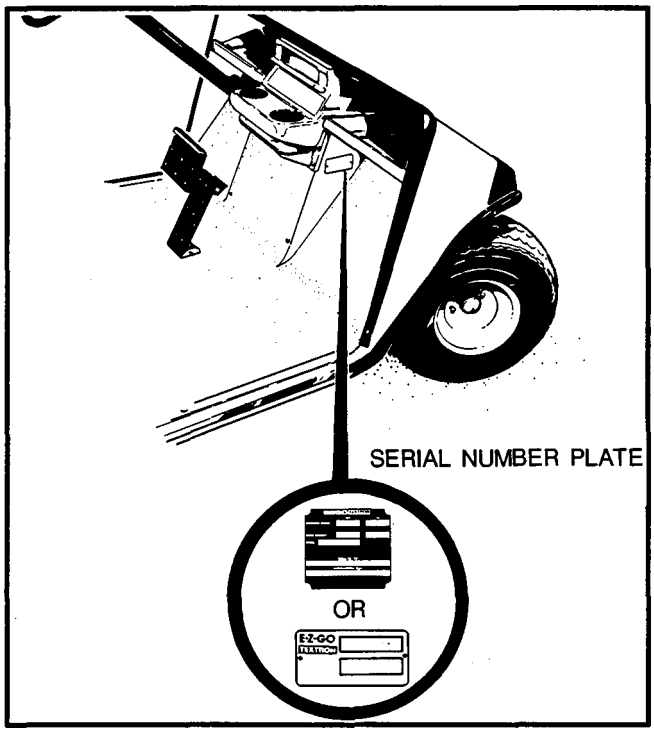


FIG. A-1 SERIAL NO., PLATE LOCATION

Always provide these numbers to the dealer when ordering parts for the vehicle.

CONTROLS

The controls of the vehicle consist of a Key Switch, Forward-Neutral-Reverse Lever, Accelerator Pedal and Combination Service Brake and parking (hill) Brake Pedal.

KEY SWITCH (FIG. A-2)

Located on the seat support panel (FIG. A-2), this switch enables the basic electrical system of the vehicle to be turned off by turning the key to the "OFF" position.

For added security, when the vehicle is left unattended the key may be removed from the "OFF" position preventing inadvertent operation of the vehicle.

NOTE

If the vehicle is equipped with E-Z-GO installed custom accessories, some accessories remain operational with the ignition switch in the "OFF" position, e.g. radio, clock, cigarette lighter.

FORWARD-NEUTRAL-REVERSE LEVER (FIG. A-2)

Located on the seat support panel adjacent to the Key Switch (FIG. A-2), this lever permits the selection of either forward, neutral or reverse. It should be left in neutral (N) when the vehicle is unattended.

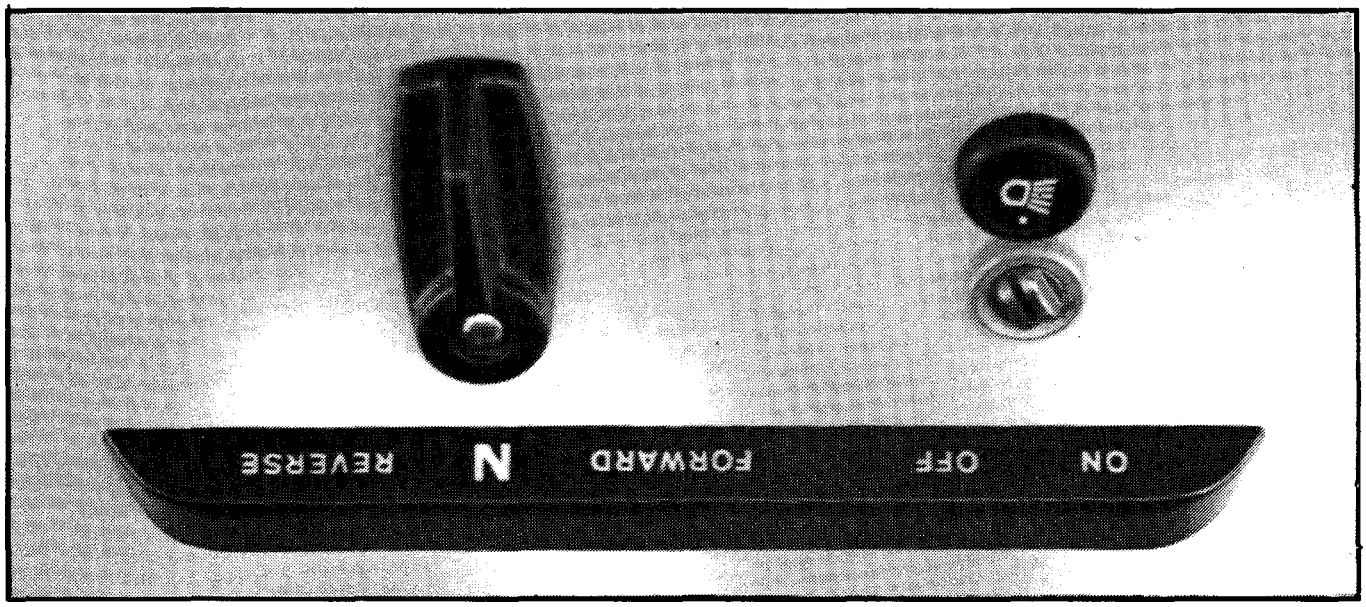


FIG. A-2 CONTROLS (PANELS MOUNTED)

CAUTION

TO AVOID COMPONENT DAMAGE, THE VEHICLE *MUST* BE BROUGHT TO A *COMPLETE* STOP BEFORE MOVING THE FORWARD-NEUTRAL-REVERSE LEVER.

ACCELERATOR PEDAL (FIG. A-3)

Depressing the accelerator (FIG. A-3) of the vehicle will release the parking (hill) brake (if engaged). This is a feature to assure that the vehicle is not driven with the parking (hill) brake engaged.

Depressing the vehicle accelerator pedal starts the motor. Each time the pedal is released, the motor will stop.

COMBINATION BRAKE AND PARKING (HILL) BRAKE PEDAL (FIG. A-3)

The brake pedal (FIG. A-3) incorporates a parking (hill) brake feature. To engage, push down on the top section of the pedal until it locks in place. The parking (hill) brake will release when the brake pedal is depressed. Use the *BOTTOM* section of the brake pedal to operate the regular brake system.

NOTE

Depressing the bottom of the brake pedal is the preferred method of releasing the parking (hill) brake to assure the longest service life of brake components.

BEFORE ENTERING VEHICLE

1. Check for correct tire inflation.
2. Inspect for fluid leaks.
3. Be certain that everything is properly stored and secured.

BEFORE STARTING

Be sure you understand the vehicle, its equipment, and how to use it safely. Although E-Z-GO vehicles have been designed to provide you with a safe and reliable vehicle, maintaining its good performance depends to a large extent on the operator.

CAUTION

IMPROPER USE OR OPERATION OF THE VEHICLE OR THE LACK OF PROPER MAINTENANCE MAY RESULT IN DECREASED PERFORMANCE OR DAMAGE TO THE VEHICLE.

BEFORE INITIAL USE, REMOVE CLEAR PLASTIC SEAT COVERINGS.

NOTE

Read and understand the following warnings before attempting to operate the vehicle.

⚠ WARNING ⚠

WHEN THE VEHICLE IS TO BE LEFT UNATTENDED, TURN KEY TO "OFF" POSITION, REMOVE KEY AND ENGAGE PARKING (HILL) BRAKE, PLACE F-N-R SWITCH IN THE NEUTRAL (N) POSITION.

FIG. A-3 ACCELERATOR AND BRAKE CONTROLS

DRIVE THE VEHICLE ONLY AS FAST AS TERRAIN AND SAFETY CONSIDERATIONS ALLOW. CONSIDER THE TERRAIN AND EXISTING TRAFFIC CONDITIONS. ALSO CONSIDER THE ENVIRONMENTAL FACTORS WHICH AFFECT THE TERRAIN AND YOUR ABILITY TO HANDLE THE VEHICLE.

AVOID DRIVING FAST DOWNHILL. SUDDEN STOPS OR CHANGE OF DIRECTION MAY RESULTS IN A LOSS OF CONTROL. USE BRAKE TO CONTROL SPEED WHEN TRAVELING DOWN AN INCLINE.

USE EXTRA CARE AND REDUCED SPEED WHEN DRIVING ON POOR SURFACES, SUCH AS LOOSE DIRT, WET GRASS, GRAVEL, ETC.

ALL TRAVEL SHOULD BE DIRECTLY UP OR DOWN HILLS.

USE EXTRA CARE WHEN DRIVING THE VEHICLE ACROSS AN INCLINE.

STAY IN DESIGNATED AREAS AND AVOID STEEP SLOPES. USE THE PARKING (HILL) BRAKE WHENEVER THE VEHICLE IS PARKED.

KEEP FEET, LEGS, HANDS, AND ARMS INSIDE THE VEHICLE AT ALL TIMES.

AVOID EXTREMELY ROUGH TERRAIN.

CHECK THE AREA BEHIND THE VEHICLE BEFORE BACKING UP.

MAKE SURE THAT FORWARD-NEUTRAL-REVERSE LEVER IS IN CORRECT POSITION BEFORE ATTEMPTING TO START VEHICLE.

ALWAYS BRING THE VEHICLE TO A COMPLETE STOP BEFORE SHIFTING THE FORWARD-NEUTRAL-REVERSE CONTROL.

SLOW DOWN BEFORE AND DURING TURNS. ALL TURNS SHOULD BE EXECUTED AT REDUCED SPEED.

STANDARD VEHICLE IS LIMITED TO 2 OCCUPANTS MAXIMUM PER SEAT.

ALWAYS REMAIN SEATED AND *HOLD ON* WHILE VEHICLE IS IN MOTION.

STARTING THE E-Z-GO ELECTRIC POWERED VEHICLE

To start the electric vehicle; apply the parking (hill) brake; place the forward-neutral-reverse lever in neutral; place the key in the ignition switch and turn to the "ON" position; move forward-neutral-reverse lever to the direction desired; release parking (hill) brake by depressing the service brake pedal; depress the accelerator pedal to start the motor.

NOTE

When the lever is in the reverse position, a warning will sound. This is a device to indicate that the vehicle is ready to start and run in reverse.

When the accelerator pedal is released, the motor stops. To stop the vehicle more quickly, depress the *BOTTOM OF THE BRAKE PEDAL*.

When leaving the vehicle unattended, engage the parking (hill) brake by depressing the *TOP* of the brake pedal until it locks in place. To release the parking (hill) brake, depress the *BOTTOM* part of the brake pedal.

CAUTION

TO AVOID COMPONENT DAMAGE, THE VEHICLE **MUST** BE BROUGHT TO A **COMPLETE** STOP BEFORE SHIFTING THE FORWARD-NEUTRAL-REVERSE LEVER.

TOWING - 1989

CAUTION

A MAXIMUM OF ONE VEHICLE MAY BE TOWED AT A TIME. (Tow bars to fit both 3 and 4 wheel vehicles are available from the E-Z-GO Service Parts Department.)

MAXIMUM TOWING SPEED IS 12 M.P.H.

TOWING - 1990 FOUR WHEEL VEHICLES

CAUTION

A MAXIMUM OF FOUR 4 WHEEL VEHICLES INCLUDING THE TOW VEHICLE MAY BE TOWED AT A TIME. (Tow bars to fit 4 wheel vehicles are available from the E-Z-GO Service Parts Department.)

MAXIMUM TOWING SPEED IS 12 M.P.H.

SERVICING A NEW ELECTRIC VEHICLE

CAUTION

IT IS IN THE BEST INTEREST OF BOTH THE VEHICLE OWNER AND SERVICING DEALER TO CAREFULLY FOLLOW THE PROCEDURES RECOMMENDED IN THIS MANUAL. ADEQUATE PREVENTATIVE MAINTENANCE, APPLIED AT REGULAR INTERVALS, IS THE BEST GUARANTEE FOR KEEPING THE E-Z-GO ELECTRIC VEHICLE BOTH DEPENDABLE AND ECONOMICAL.

Before a new vehicle is put in operation, it is recommended that the owner make a check of the items shown in the following INITIAL SERVICE CHART.

Service operations are described in pertinent sections of the Service Manual. See the index for location.

INITIAL SERVICE CHART	
Item	Service Operation
Battery	Check charge condition.
Seats	Remove protective plastic covering.
Brakes	Check operation and adjust if necessary.
Tires	Check pressure.

SEATS

PREPARATION OF SEATS FOR SERVICE

Remove protective plastic coverings from seats before placing vehicle in service. The *ONLY* function of the plastic coverings is to protect the seat bottoms and back rests during shipping. If the plastic covering is left on the seats and gets torn, dirt will get under the plastic covering and become ground into the cover material. Water getting under the plastic covering is trapped and eventually will damage the seat assembly.

TIRES

Tire condition should be inspected on a daily basis. Recommended pressure for the standard tire is listed in the Specifications Section. Inflation pressures should be checked on a weekly basis when the tires are cool.

Tire inflation should be governed by the condition of the terrain. For outdoor applications with major use on grassy areas, the following should be considered. On hard turf, it is desirable to have a slightly higher inflation pressure. On very soft turf, a lower pressure prevents tires from cutting into the turf. All tires should have the same pressure for optimum handling characteristics. Be careful not to overinflate. Due to the low volume of these small tires, overinflation can occur in a matter of seconds. Be sure to replace the valve dust cap after checking or inflation.

PREVENTATIVE MAINTENANCE

E-Z-GO suggests that preventative maintenance be performed under the following headings: Daily, Weekly, and Semi-Annually.

DAILY CHECK LIST

After the vehicle has been put into service, it is recommended that the following items be checked daily by the personnel handling the vehicles. Personnel driving vehicles to and from the storage facility can be an asset to a proper maintenance program if trained to look, listen, and feel for an unusual situation. This practice can be a great help in solving many maintenance problems in the minor stages while they can be corrected by simple adjustments.

1. Examine vehicle for damage or anything unusual to normal wear and tear.
   - Perform the **Daily Braking Performance Test**

To determine the adequacy of the vehicles brake system, the following test should be performed daily:

⚠ WARNING ⚠

ALL DRIVING BRAKE TESTS MUST BE DONE IN A SAFE LOCATION WITH REGARD FOR THE SAFETY OF ALL PERSONNEL

The recommended way of performing the daily brake test and determining any vehicles that have unacceptable braking performance is to have personnel handling the vehicles latch the hill brake at a **common point** on a paved surface while traveling at maximum governed speed. The vehicle stopping location must be observed and vehicles that stop in a significantly greater distance than other acceptable vehicles should **immediately** be removed from service and inspected by a qualified mechanic.

The mechanic should perform a "panic" stop on the suspect vehicle(s) by applying maximum force and travel to the brake pedal while traveling at full speed. He should observe if either of the rear wheels fails to "lock up". If one wheel fails to lock, it is reasonable to expect that a problem exists with the service brake system and the **6 Month Brake Maintenance** must be performed in its entirety. If both wheels lock, the parking (hill) brake must be adjusted and the vehicle re-tested per the **Daily Brake Test**.

- Torn seats.
- Damaged or missing equipment.
- Cuts in tires.
- Mechanical damage.
- Be sure that the engaged parking (hill) brake will hold on a parking (hill) and that when disengaged, does not drag or prevent the vehicle from rolling freely.
- Check the tires for wear and proper air pressure.
- Assure that all switches are operating normally.
- Listen for any noise, such as rattles due to loose hardware; scraping sounds such as brakes dragging, etc.; unusual motor noises, and be sensitive to abnormal performance.

2. Clean vehicle.

- Wipe seats.
- Clean floormat.
- Remove trash from dash tray.
- Visually check the appearance of the vehicle for dents, scratches, loose equipment.
- Wash accumulated dirt from motor compartment and underbody.

SEMI-ANNUAL MAINTENANCE (125 HRS.) (FIG. A-5)

- Perform **6 Month Brake Maintenance**.
- Check the differential oil level.
- Lubricate all moving linkages such as:

1. Accelerator rod ball joints.
2. Brake and accelerator linkage bushings.
3. Hill brake pivot pin.

⚠ WARNING ⚠

DO NOT LUBRICATE THEPARKING (HILL) BRAKE LATCH ARM OR CATCH BRACKET NOR ANY CABLE CONTROLS.

4. Steering gear and wheel bearings.

- Wash batteries, when required, using baking soda and water to remove corrosion.

PERIODIC CHECK LIST (FIG. A-6)

The following inspections should be routinely done on the schedule indicated.

STEERING

1. Gear Box - Assure that all mounting bolts are securely in place. Inspect for abnormal play in steering shaft and/or steering wheel.

   Time interval - once every 3 months (50 hours).

2. Tie rods and Pitman arms - Inspect for excessive play, bends or lose connections.

   Time interval - once every 3 months (50 hours).

3. Wheel alignment - Inspect toe-in, toe-out per specification. (See Alignment.)

   Time interval - once every 6 months (125 hours) or more often if handling is unusual or tire wear is uneven.

4. King pins - Check for excessive play.

   Time interval - every 6 months (125 hours).

BRAKES

1. Brake Pedal - Check for smooth operation of pedal.

   Time interval - once every 3 months (50 hours).

2. Hill Brake - Check for proper engagement and release, wear or damage to latch arm or catch brackets. Check for abnormal brake travel that could hinder the proper operation of parking (hill) brakes. See Brake Section for brake adjustment and operation.

   Time interval - once every 3 months (50 hours) or as needed.

3. Brake Drum, Brake Shoes, and Brake Linkages – Inspect for wear on brake shoes and brake drum and correctly functioning linkages.

   Inspect for scoring, scratches, or unusual sightings in shoes and drum (See Brake Section).

   Time interval – every 6 months (125 hours).

FRONT SUSPENSION

1. Front Axle – 3 Wheel – Inspect for smooth operation.

   Time interval – 3 months (50 hours).

2. Front axle – 4 Wheel – Inspect for damage to the axle and for loose bolts at spring mounts.

   Time interval – 3 months (50 hours).

3. Shock Absorbers – Check for oil leakage or loose connections.

   Time interval – every 3 months (50 hours).

4. Front Springs

   Leaf Spring – Check for cracks or loose connections around the spring mounting bracket and attaching bolts.

   Coil Spring – Check for cracks in springs and around shock absorber. Check for loose connections around shock mounting bolts.

   Time interval – every 3 months (50 hours).

REAR SUSPENSION AND AXLE

1. Rear Axle and Housings – Inspect for abnormal noise, loose connections at shocks and oil leakage around cover plate. Inspect rear leaf springs for damage and loose hardware.

   Time interval – every 3 months (50 hours).

WHEELS AND TIRES

1. Wheel – Inspect for proper tire pressure, abnormal wear, cracks or damage to tread area, tightness of lug nuts, dented or damaged wheel rims.

   Time interval – every 3 months (50 hours).

ELECTRICAL SYSTEM

1. Batteries – Check for low electrolyte and corrosion build-up.

   Time interval – every week.

2. Wiring – Inspect all wiring for loose connections or cracked and/or worn insulation.

   Time interval – every month (20 hours).

3. Reverse Warning – check for proper operation.

   Time interval – daily.

4. Forward–Neutral–Reverse Switch – Check for wear and lubricate.

   Time interval – semi–annually (125 hours).

5. Accelerator Switch (if applicable) – Check for wear and lubricate.

   Time interval – semi–annually (125 hours).

6. Solid State Speed Control (if applicable) – Check for dirt and corrosion

   Time Interval – every month (20 hours)

7. Solid State Speed Control – Clean terminals

   Time interval – semi–annually (125 hours)

8. Motor Brushes – Check with gauge.

   Time interval – semi–annually (125 hours).

MISCELLANEOUS

1. Inspect all lubrication areas around pedal shafts, chassis parts, etc.

   Time interval – every 3 months (50 hours).

2. Check for proper retention of all equipment.

   Time interval – daily.

CAUTION

DO NOT LUBRICATE CABLES OR PARKING (HILL) BRAKE LATCH SINCE OIL WILL CAUSE FOREIGN MATTER TO ADHERE TO THESE SURFACES WHICH WILL ACCELERATE WEAR.

CARE AND CLEANING OF THE VEHICLE

It is very important that proper techniques and cleaning materials be used.

Ordinary cleaning of vinyl seats and plastic or rubber trim requires the use of a mild soap solution applied with a sponge or soft brush and the subsequent removal of the material with a damp cloth.

Removal of oil, tar, asphalt, shoe polish, and so forth will require the use of a commercially available vinyl/rubber cleaner.

The painted surfaces of the vehicle provide attractive appearance and durable protection. Frequent washing with lukewarm or cold water is the best method or preserving those painted surfaces.

Do not use hot water, strong soap, or harsh chemical detergents.

Occasional cleaning and polishing with appropriate materials will enhance the appearance and durability of the painted surfaces.

Corrosive materials used as fertilizers or for dust control can collect on the underbody of the vehicle. These materials will accelerate corrosion of underbody parts. It is recommended that the underbody be flushed occasionally with plain water. Thoroughly clean any areas where mud or other debris can collect. Sediment packed in closed areas should be loosened to expedite their removal.

WINDSHIELD

Clean with lots of water and a clean cloth.

CAUTION

DO NOT USE ANY ABRASIVE OR VOLATILE SOLVENTS TO CLEAN PLASTIC PARTS.

TORQUE SPECIFICATIONS FOR UNSPECIFIED HARDWARE (FIG. A–4)

In general two grades of hardware are used in the vehicle. Grade 5 hardware can be identified by the 3 marks on the hexagonal head. Unmarked hardware is Grade 2.

ALL TORQUE FIGURES ARE IN FOOT POUNDS
Unless otherwise noted in the text, tighten all hardware in accordance with this chart.

Bolt size	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"	1"
Grade 2	6	11	19	30	45	66	93	150	202	300
Grade 5	9	18	31	50	75	110	150	250	378	583

FIG. A–4 TORQUE SPECIFICATIONS

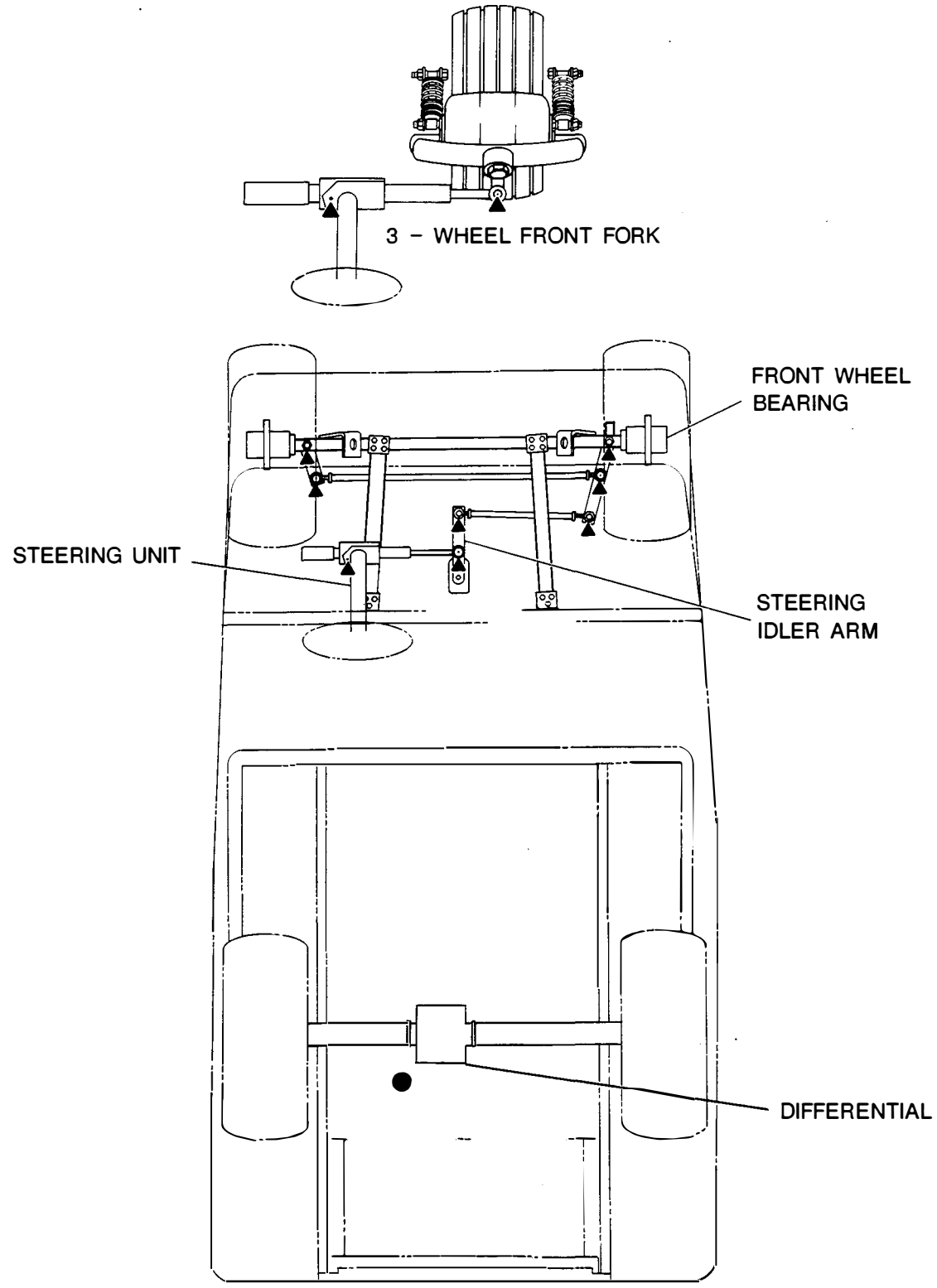


FIG. A-5 LUBRICATION CHART

SYSTEM	DAILY	WEEKLY	MONTH 20 HOURS	3 MONTH 50 HOURS	SEMIANNUAL 125 HOURS	ANNUAL 250 HOURS
BRAKES						
Pedal				• Check for smooth operation and correct free travel		
Service brake				• Check brake performance and adjust if required		
Parking brake				• Check brake performance and adjust if required		
TIRES				• Examine for cuts and excessive wear		
WHEELS				• Check for bent rims, missing/loose lug nuts		
BATTERIES						
Clean and Inspect				As required		
Charge				• Recharge to full charge state after each day's use		
Check				• Check electrolyte level – correct if required		
CONTROL LINKAGES						
Accelerator cable					• Check for smooth movement – Do not lubricate cable	
Choke cable					• Check for smooth movement and adjustment – Do not lubricate cable	
Carburetor linkage					♦ Check attachment, adjust as required	
Direction selector					♦ Check attachment, adjust as required	
STEERING ASSEMBLY					• Check for abnormal play, tightness of all hardware	
TIE RODS / LINKAGES					• Check for excessive play, bent components or loose connections	
TIRES					• Check pressure, see specifications	
WIRING					• Check all wiring for loose connections and broken/missing insulation	
FRONT AXLE						• Check for damage to axle and loose or missing hardware
FRONT SHOCK ABSORBERS						• Check for oil leakage and loose fasteners
FRONT SPRINGS						• Check for loose hardware, cracks at attachment points
FRONT WHEEL ALIGNMENT						• Check if tire wear is unusual, align per Service Manual
PARKING (HILL) BRAKE						• Check for bent / binding linkage rod and damage or wear to latch arm or catch bracket. ♦ Lubricate, use light oil. **Do not lubricate cables or brake latch**
REAR SHOCK ABSORBERS						• Check for oil leakage and loose mounting hardware
KING PINS						• Check for excessive play and tightness of retaining nuts ♦ Lubricate, use Shell Alvania EP–2
SERVICE BRAKES						♦ Clean, lubricate and adjust per Service Manual
STEERING ASSEMBLY						♦ Lubricate linkage, use Shell Alvania EP–2
TIE RODS / LINKAGES						♦ Lubricate, use Shell Alvania EP–2
FRONT WHEEL BEARINGS						♦ Adjust see Service Manual ♦ Pack, use Shell Alvania EP–2 multi–purpose grease

• Check ▲ Replace ♦ Clean, adjust etc.

FIG. F–6 PERIODIC SERVICE SCHEDULE

SYSTEM	DAILY	WEEKLY	MONTH 20 HOURS	3 MONTH 50 HOURS	SEMIANNUAL 125 HOURS	ANNUAL 250 HOURS
CHARGER AND CHARGER RECEPTACLE						CHECK AND TIGHTEN WIRE CONNECTIONS AS REQUIRED. KEEP RECEPTACLES FREE OF DIRT AND FOREIGN MATTER.
SOLID STATE SPEED CONTROL						
LEAD CONNECTIONS					♦	Tighten and clean as required
CHECK LINKAGES						• Inspect
CLEAN AND INSPECT						• Clean

• Check ▲ Replace ♦ Clean, adjust etc.

FIG. F–6 PERIODIC SERVICE SCHEDULE (CONTINUED)

SISTEMA	DIARIAMENTE	SEMANALMENTE	1 MES 20 HORAS	3 MESES 50 HORAS	SEMIANUALMENTE 125 HORAS	ANUALMENTE 250 HORAS
FRENOS						
Pedal			●			
Freno de servicio			●			
Freno de estacionamiento			●			
DISPOSITIVO DE ALARMA DE RETROCESO			●			
NEUMATICOS			●			
RUEDAS			●			
BATERIA						
Limpiar e inspeccionar			●			
Cargar			●			
Revisar			●			
CARGADOR Y RECEPTACULO DEL CARGADOR			●			
VARILLAJES DE CONTROL						
Acelerador			●			
Selector de sentido de marcha			◆			
CONTROL DE VELOCIDAD ELECTRONICO			●			
CONJUNTO DE DIRECCION			●			
BARRAS DE ACOPLAMIENTO/VARILLAJE			●			
NEUMATICOS			●			
ALAMBRADO			●			
EJE DELANTERO				●		
AMORTIGUADORES DELANTEROS				●		
RESORTES DELANTEROS				●		
ALINEAMIENTO DE LAS RUEDAS DELANTERAS				●		
SISTEMA DE COMBUSTIBLE				●		
FRENO DE ESTACIONAMIENTO (PARA PENDIENTES)				● ◆		
AMORTIGUADORES TRASEROS				●		
CARROCERIA					◆	
CONTROL ELECTRONICO DE VELOCIDAD					◆	
SELECTOR DE SENTIDO DE MARCHA					◆	

● Revisar ▲ Cambiar ◆ Limpiar, ajustar, etc.

PROGRAMA DE MANTENIMIENTO PERIODICO DEL VEHICULO ELECTRICO
(CONTINUA EN LA PAGINA SIGUIENTE)

SISTEMA	DIARIA-MENTE	SEMANAL-MENTE	1 MES 20 HORAS	3 MESES 50 HORAS	SEMIANUAL-MENTE 125 HORAS	ANUALMENTE 250 HORAS
PIVOTES DE DIRECCION					• Buscar juego excesivo y revisar el apriete de las tuercas de retención. ◆ Lubricar con Shell Alvania EP-2.	
FRENOS DE SERVICIO					◆ Limpiar, lubricar y ajustar según se indica en el Manual de servicio.	
CONJUNTO DE DIRECCION					◆ Lubricar el varillaje con Shell Alvania EP-2.	
BARRAS DE ACOPLAMIENTO/VARILLAJE					◆ Lubricar con Shell Alvania EP-2.	
COJINETES DE LAS RUEDAS DELANTERAS						◆ Ajustar; ver el Manual de servicio. ◆ Empacar con grasa universal Shell Alvania EP-2.

• Revisar ▲ Cambiar ◆ Limpiar, ajustar, etc.

PROGRAMA DE MANTENIMIENTO PERIODICO DEL VEHICULO ELECTRICO (CONTINUACION)

GENERAL

When any inspection or maintenance is performed on the vehicle it is important that care be exercised to prevent personal injury and damage to the vehicle.

NOTES, CAUTIONS AND WARNINGS

Throughout this manual you will find **NOTE, CAUTION** and **WARNING** used. For the protection of all personnel and the vehicle, please observe the following:

NOTE

Indicates a condition that should be observed.

CAUTION

INDICATES A CONDITION THAT MAY RESULT IN DAMAGE TO THE VEHICLE.

⚠ WARNING ⚠

INDICATES A CONDITION THAT MAY BE HAZARDOUS TO PERSONNEL AND MAY RESULT IN DAMAGE TO THE VEHICLE.

BEFORE WORKING ON VEHICLE

NOTE

ONLY TRAINED PERSONNEL SHOULD BE AUTHORIZED TO SERVICE E-Z-GO VEHICLES

Before inspecting or working on the vehicle observe the following warnings.

⚠ WARNING ⚠

SET THE PARKING (HILL) BRAKE.

DO NOT WORK ON THE MOTOR WHILE CONNECTED TO BATTERIES.

WHEN WORKING NEAR BATTERIES, REMOVE ANY JEWELRY, SUCH AS RINGS, WATCH, ETC.

NEVER GET UNDER A VEHICLE WHILE IT IS SUPPORTED BY A JACK. IF IT IS NECESSARY TO WORK UNDER THE VEHICLE, USE SAFETY STANDS AND TEST THE STABILITY OF THE VEHICLE ON THE STANDS.

KEEP SMOKING MATERIALS, FLAME OR SPARKS AWAY FROM THE BATTERIES.

NEVER CONNECT OR DISCONNECT EITHER THE BATTERIES OR ANY ELECTRICAL COMPONENT WHILE THE KEY IS IN THE SWITCH.

WHEN CONNECTING THE BATTERY CABLES, PAY PARTICULAR ATTENTION TO THEIR POLARITIES. NEVER CONFUSE THE POSITIVE POSTS WITH THE NEGATIVE POSTS.

BATTERY REMOVAL AND INSTALLATION

Tools Required:	Qty.
Wrench, open end, insulated, 7/16"	1
Wrench, open end, insulated, 1/2"	1
Carrier, battery	1

⚠ WARNING ⚠

USE INSULATED WRENCHES AND BE CAREFUL NOT TO ALLOW WRENCHES TO CONTACT METAL AREAS OF VEHICLE WHILE WORKING ON BATTERY TERMINALS. OBSERVE BATTERY POLARITY WHEN REINSTALLING CABLES.

Using an insulated wrench, remove all wires from the vehicle batteries. Remove the two battery hold downs by removing the hardware and lifting the plastic retainers from the threaded hold down bolts. (FIG. B-1)

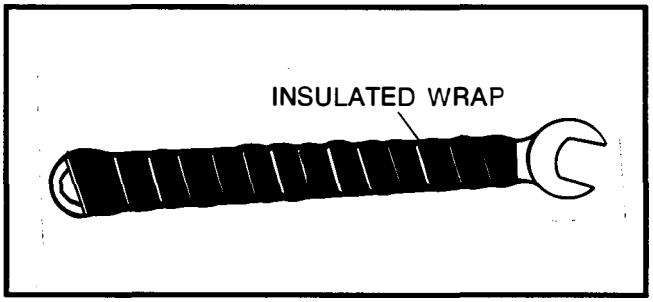


FIG. B-1 INSULATED WRENCH

Remove the batteries using a battery carrying tool. (FIG. B-2)

⚠ WARNING ⚠

BATTERIES ARE HEAVY AND CARE SHOULD BE TAKEN WHEN REMOVING THEM. BE CAREFUL TO LIFT BATTERIES WITHOUT TIPPING THEM, ELECTROLYTE MAY BE SPILLED WHICH COULD CAUSE BURNS OR DAMAGE TO VEHICLE AND CLOTHING. SHOULD ANY ELECTROLYTE BE SPILLED FLUSH THOROUGHLY WITH WATER.

Care must be taken to observe the preceding warnings when reinstalling batteries.

WEAR EYE PROTECTION

USE CARE WHEN LIFTING BATTERIES

FIG. B–2 REMOVING BATTERIES

LIFTING THE THREE WHEEL ELECTRIC POWERED VEHICLE (FIG. B–3)

Tools Required: Qty.

Chocks or wooden blocks 4
Jack, hydraulic, trolley 1
Jack stands 4

⚠ WARNING ⚠

BE SURE THAT THE VEHICLE IS ON A FIRM AND LEVEL SURFACE. NEVER GET UNDER A VEHICLE WHILE IT IS SUPPORTED BY A JACK, USE SAFETY STANDS AND TEST THE STABILITY OF THE VEHICLE ON THE STANDS. ALWAYS PLACE CHOCKS IN FRONT OF AND BEHIND THE WHEELS THAT ARE *NOT* TO BE RAISED. USE EXTREME CARE SINCE THE VEHICLE IS EXTREMELY UNSTABLE WHILE POSITIONED WITH ONE SIDE RAISED.

CAUTION

IN THE FOLLOWING OPERATION, BE CAREFUL NOT TO POSITION THE JACK IN AN AREA THAT COULD DAMAGE THE BRAKE CABLE OR HANGERS.

Place the jack under the *FRAME* at a point 4"–5" in front of the vertical seat panel. Raise the vehicle with the jack and place 1 jack stand under the most forward *FLAT* area of the frame. A second jack stand should be placed on the outboard end of the axle tube.

SLOWLY lower the jack and move it to the opposite side of the vehicle and repeat the lifting procedure described above, placing the third and fourth jack stands with corresponding position to those placed on the opposite side. Lower the jack and test the stability of the vehicle on the four jack stands.

LOWERING THE THREE WHEEL ELECTRIC POWERED VEHICLE

Lower the vehicle using the reverse procedure to the one used to raise it.

LIFTING THE FOUR WHEEL ELECTRIC POWERED VEHICLE (FIG. B–3)

Tools Required: Qty.

Jack, hydraulic, trolley 1
Jack stands 4
Chocks or wooden blocks 4

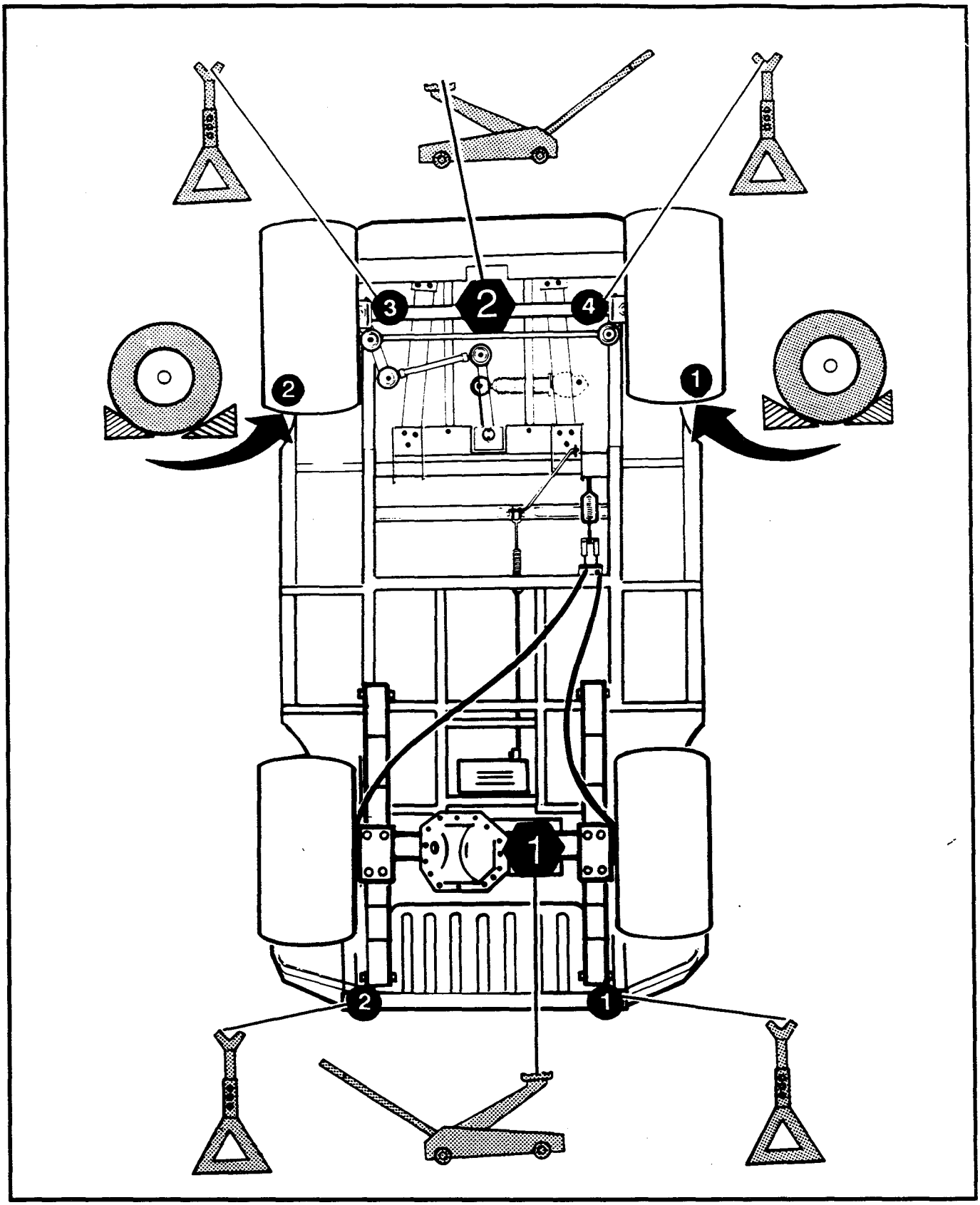


FIG. B–3 LIFTING AND JACKING POINTS

⚠ WARNING ⚠

BE SURE THAT THE VEHICLE IS ON A FIRM AND LEVEL SURFACE. NEVER GET UNDER A VEHICLE WHILE IT IS SUPPORTED BY A JACK, USE SAFETY STANDS AND TEST THE STABILITY OF THE VEHICLE ON THE STANDS. ALWAYS PLACE CHOCKS IN FRONT OF AND BEHIND THE WHEELS THAT ARE *NOT* TO BE RAISED. USE EXTREME CARE SINCE THE VEHICLE IS EXTREMELY UNSTABLE WHILE POSITIONED WITH ONE SIDE RAISED.

CAUTION

IN THE FOLLOWING OPERATION, BE CAREFUL NOT TO POSITION THE JACK IN AN AREA THAT COULD DAMAGE THE BRAKE CABLE OR HANGERS.

Place the jack under the *FRAME* at a point 4"– 5" in front of the vertical seat panel. Raise the vehicle with the jack and place 1 jack stand under the most forward *FLAT* area of the frame. A second jack stand should be placed on the outboard end of the axle tube.

SLOWLY lower the jack and move it to the opposite side of the vehicle and repeat the lifting procedure described above, placing the third and fourth jack stands with corresponding position to those placed on the opposite side. Lower the jack and test the stability of the vehicle on the four jack stands.

LOWERING THE FOUR WHEEL ELECTRIC POWERED VEHICLE

Lower the vehicle using the reverse procedure to the one used to raise it.

LIFTING PROCEDURE FOR THE FRONT OF THE THREE WHEEL ELECTRIC POWERED VEHICLE

Tools Required:	Qty.
Jack, hydraulic, trolley	1
Jack stands	2
Chocks or wooden blocks	2

⚠ WARNING ⚠

BE SURE THAT THE VEHICLE IS ON A FIRM AND LEVEL SURFACE. NEVER GET UNDER A VEHICLE WHILE IT IS SUPPORTED BY A JACK, USE SAFETY STANDS AND TEST THE STABILITY OF THE VEHICLE ON THE STANDS. ALWAYS PLACE CHOCKS IN FRONT OF AND BEHIND THE WHEELS THAT ARE *NOT* TO BE RAISED. USE EXTREME CARE SINCE THE VEHICLE IS EXTREMELY UNSTABLE WHILE POSITIONED WITH ONE SIDE RAISED.

Place chocks in front of and behind the front and rear tires. Place the jack under the left side of vehicle frame at a point 4" – 5" in front of the vertical seat support panel. Raise the side of the vehicle with the jack and place a jack stand under the most forward *flat* area of the frame. Lower the jack and repeat the procedure on the other side of the vehicle.

LIFTING PROCEDURE FOR THE REAR OF THE THREE WHEEL ELECTRIC POWERED VEHICLE

⚠ WARNING ⚠

E–Z–GO DOES NOT RECOMMEND OR ENDORSE ANY PROCEDURE THAT LIFTS THE REAR OF VEHICLE ALONE. USE PROCEDURE FOR LIFTING THE THREE WHEEL ELECTRIC POWERED VEHICLE.

WHEEL AND TIRE SERVICE

Tools Required: Qty.

Lug wrench 1
Tire tool 1
Brush, tire 1
Mallet, rubber 1

TIRE REPAIR

The vehicle is fitted with low pressure tubeless tires mounted on one piece rims. Should a tire repair be necessary, proceed as follows: If tire is flat, remove wheel and inflate tire to approximately 20 psi. Immerse tire in water to locate air leak and mark the location.

NOTE

Small holes in casing can be plugged with a standard automotive tubeless tire repair kit, available at most automotive supply outlets.

To remove tire from rim, deflate by removing valve core; separate both tire beads from rim and push bead from wide side into rim recess. Using tire tool, carefully remove the tire over the outside (valve stem side) of the wheel in the direction of the arrow shown. (FIG. C-1)

NOTE

Care must be taken to prevent damage of tire bead. When the outer bead is free of rim, insert tire tool under inner bead and pry tire off.

MOUNTING TIRE

Clean both tire beads and wheel rim bead seats with a tire brush. This is important to prevent loss of air around rim. Install tire on rim (from valve stem side) using a rubber mallet and tire tool. Remove valve core and position bead against narrow flange side. Apply air pressure through stem while pressing around center of tread. Pressure will build up and snap beads in place. Remove pressure and install valve core. Inflate to recommend pressure (see Specifications Section). *ADJUST* to desired pressure.

WHEEL INSTALLATION.

Install wheel on vehicle as shown in FIG. C-1.

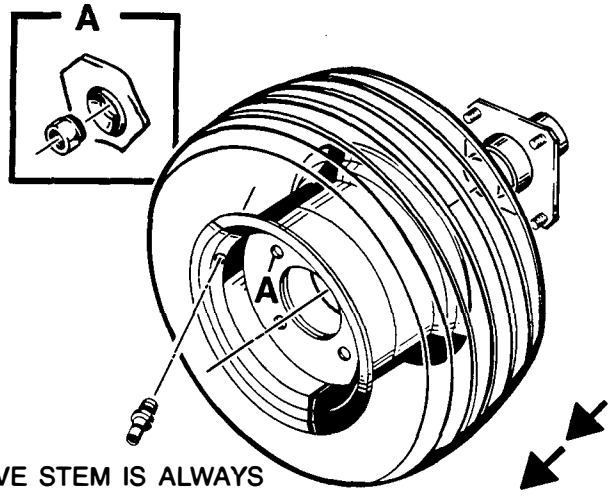


FIG. C-1 WHEELS AND TIRES

GENERAL

The steering unit is a rack and pinion type.

Tools Required:	Qty.
Screwdriver, Phillips	1
Socket, 1/2" drive, 15/16"	1
Ratchet, 1/2" drive	1
Hammer, ball pein, 2 lb.	1
Torque wrench, 1/2" drive	1
Ball joint pulling tool	1
Pliers	1
Mallet	1

STEERING ASSEMBLY REMOVAL
(FIG. D-2)

Turn the steering wheel full travel to the right to position rack end ball joint. (On four wheel vehicles it is necessary to remove the shield to provide access to the steering arm area. See section E, Suspension.)

Remove cotter pin (1) from slotted nut (2) and back nut off until it protects ball joint stud threads. Using a ball joint pulling tool as a lever, apply pressure to ball joint and tap nut with a hammer to release ball stud. Remove nut and lift stud from arm. Remove three bolts (3) and lock washers (4) securing steering box to floorboard and lift assembly out of vehicle. (FIG. D-2)

Reinstall in the reverse order of disassembly. Tighten ball joint stud slotted nut (2) to 40 ft. lbs. torque. Insert new cotter pin. (FIG. D-2)

DISASSEMBLY

STEERING WHEEL REMOVAL (FIG. D-1)

Remove two screws (1) holding the scorecard assembly (2) located on the back of the steering wheel (3). Loosen steering wheel retaining nut (4) two to three turns. Apply upwards pressure to the steering wheel (3). Place a mallet against the steering wheel nut (4) and strike mallet sharply with a hammer. The combination of upwards pressure and striking the mallet will cause the steering wheel to separate from the steering shaft.

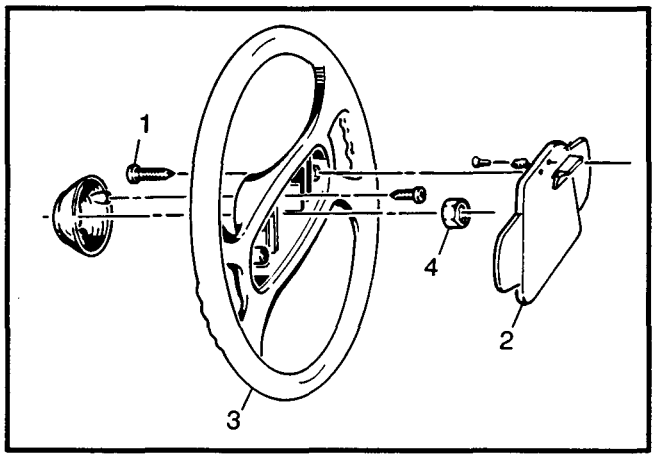


FIG. D-1 STEERING WHEEL AND SCORECARD HOLDER

CAUTION

DO NOT STRIKE THE STEERING NUT OR THE END OF THE STEERING SHAFT DIRECTLY WITH A HAMMER.

Reinstall steering wheel as follows:
Lightly coat the splines of the steering shaft with neverseize. Slide steering wheel onto steering shaft splines. Install steering nut and tighten to 10-15 ft. lbs. torque. Reinstall scorecard holder in the reverse order of disassembly.

NOTE

With the wheels in the straight ahead position, center the steering wheel before installing the steering nut and scorecard holder.

CAUTION

TIGHTEN SCORECARD ASSEMBLY SCREWS TO 6 IN. LBS. TORQUE MAXIMUM.

STEERING SHAFT REMOVAL (FIG. D-2)

Remove bolts (5) and lock washers (6) securing the column. Remove column (7) and gasket (14) and slide the shaft (9) out through flanged end of column.

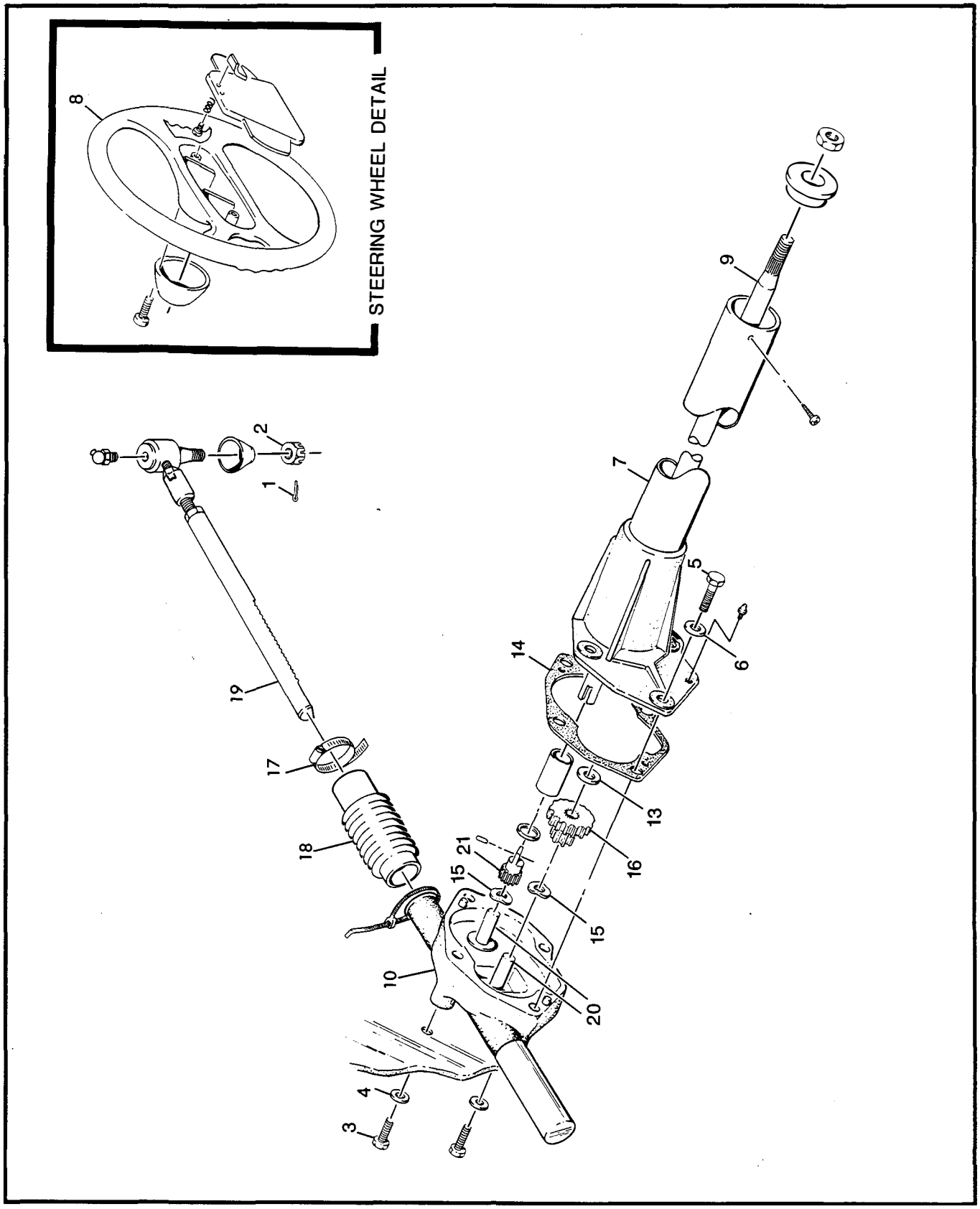


FIG. D-2 STEERING

GEAR AND RACK REMOVAL (FIG. D-2)

Remove steering column (7) from gear box. When removing gears, make note of the position of the spring washers (15), one under the pinion (21) and one under the reduction gear (16). Be sure washers are properly positioned when reassembling gears.

The flat washer (13) is placed on top of the reduction gear (16).

Loosen clamp (17) securing the bellows (18). Slide rack and rod end assembly (19) out.

NOTE

If ball joint or tie rod end is worn or damaged, the rack and rod end assembly must be replaced as a complete unit.

Clean all parts with solvent and check for wear. Replace worn or damaged parts with new parts. Repack gear box with a high quality gear grease. (E-Z-GO recommends Shell Alvania EP-2 multi purpose grease.) Apply grease liberally to gear pins, rack, and gears before reassembly.

NOTE

Pins (20) *MUST* be lubricated prior to reassembly.

Reassemble all parts in reverse order of disassembly. Be sure all hardware is tightened securely.

IDLER ARM - 4 WHEEL VEHICLES (FIG. D-3)

If the idler arm assembly (1) is worn or has excessive play, the idler arm bushings (2) must be replaced.

IDLER ARM REMOVAL (FIG. D-3)

Tools Required: ..... Qty.

Pliers 1
Wrench, open end, 11/16" 1
Socket, 3/8" drive, 15/16" 1
Torque wrench, 3/8" drive 1

To remove the idler arm, disconnect the tie rod ball joint (3) at the bottom of the idler arm and the steering gear ball joint (4) at the top of the idler arm using the procedure outlined under 'Steering Assembly Removal'.

Lift the front of the vehicle per procedures in 'Safety Procedures' Section B and remove cotter pin (5). Using a pair of pliers or vice grips, rotate idler shaft (6) back and forth while pulling downwards until the idler arm shaft is removed. After removal of the idler arm shaft, the idler arm assembly may be removed.

Before reinstalling idler arm assembly, repack with Shell Alvania EP-2 multi purpose grease. Reinstall in the reverse order of disassembly. Tighten ball joint nuts to 40 ft. lbs. torque and install new cotter pin.

TIE ROD INSPECTION

Lift front of vehicle per procedures in 'Safety Procedures' Section B and check for vertical movement of tie rod which would indicate a worn condition.

KING PIN INSPECTION

Lift front of vehicle per procedures in 'Safety Procedures' Section B. Hold top and bottom of tire and use a rocking motion to check for king pin movement which would indicate a worn condition.

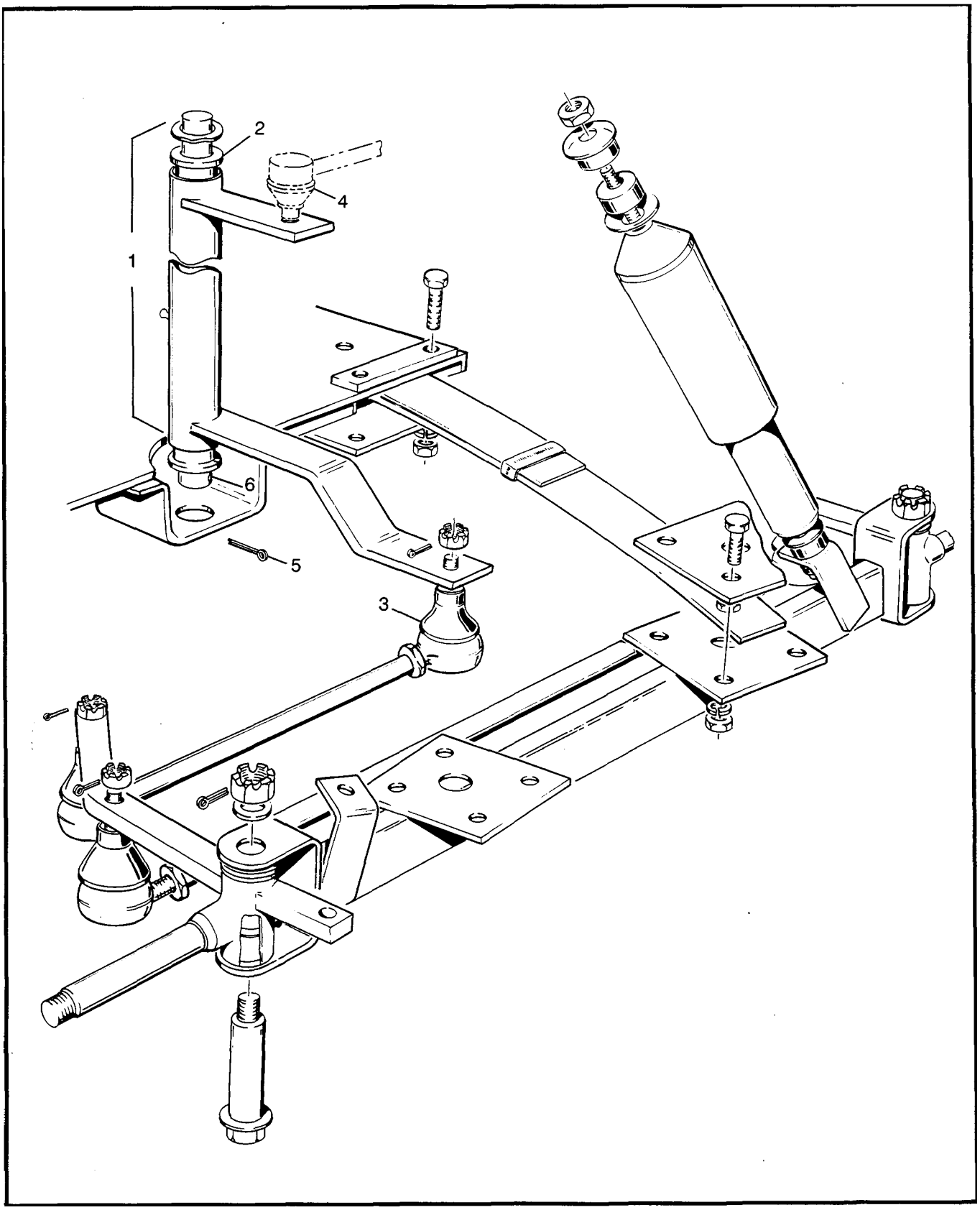


FIG. D-3 IDLER ARM REMOVAL

FRONT BUMPER REMOVAL (4 WHEEL VEHICLES) (FIG. E-1)

Tools Required: Qty.

Ratchet, 3/8" drive 1
Socket, 17/16", 3/8" drive 1
Socket, 9/16", 3/8" drive 1
Wrench, open end, 7/16" 1
Wrench, open end, 9/16" 1

FRONT SHIELD REMOVAL

Raise the front of the vehicle as detailed in section B. Remove the two bolts (1), washers (2), spacers (3) and lock nuts (4) that secure the front shield (5) to the frame.

FRONT BUMPER AND SUPPORT REMOVAL

Remove the bolts (6), lock washers (7), washers (8) and lock nuts (9) that secure the bumper (10) to the bumper rails (11). Remove the bolts (12), lock washers (13), washers (14) and lock nut (15) that secure the bumper (10) to the bumper supports (16). Remove the bolts (17), lock washers (18), and lock nuts (19) that secure the bumper rail (11) to the frame. Remove the bumper rail. Remove the bolts (20), lock washers (21), and lock nuts (22) that secure the bumper support (16) to the frame. Remove the bumper support.

Installation is in the reverse order of removal.

FRONT SUSPENSION (FOUR WHEEL VEHICLES) (FIG. E-2)

Tools Required: Qty.

Pliers 1
Pulling tool 1
Hammer, ball pein 1
Torque wrench, 1/2" drive 1
Wrench, box end, 15/16" 1
Socket, 15/16", 1/2" drive 1

FRONT SUSPENSION REMOVAL

Removal of the front suspension assembly as a unit is not required for most repair work; however, if removal is required, proceed as follows: Lift front of vehicle (see procedures in Section B) and place on jack stands. Remove the front wheels.

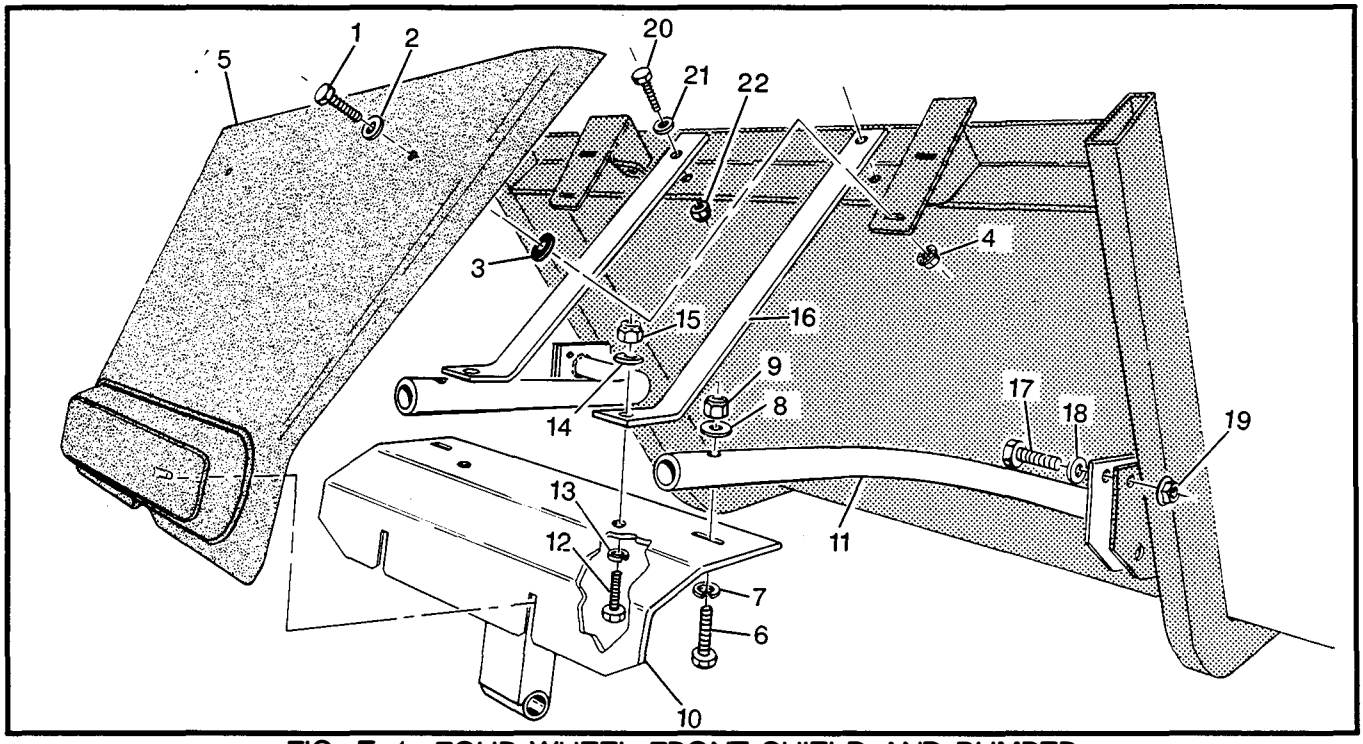


FIG. E-1 FOUR WHEEL FRONT SHIELD AND BUMPER

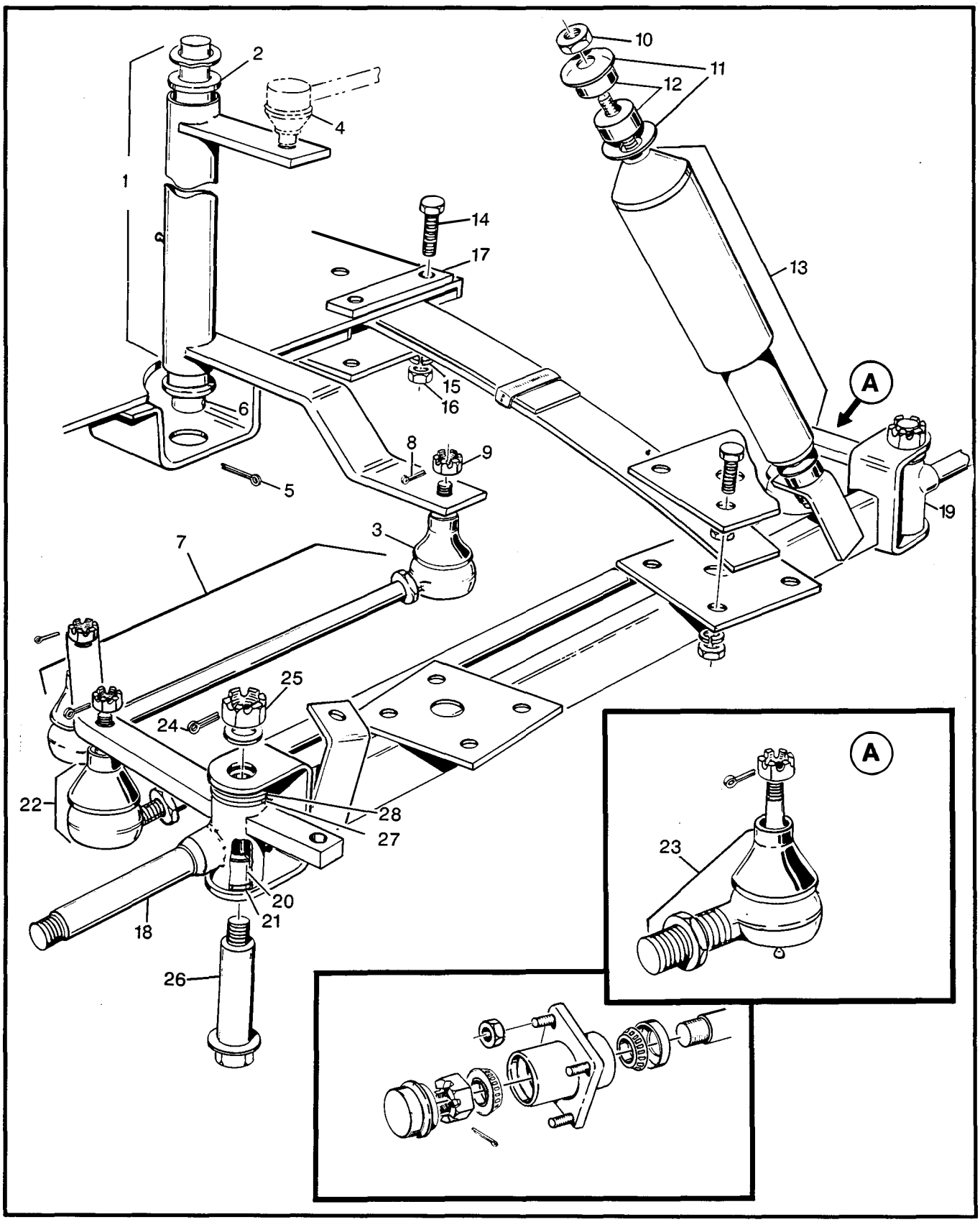


FIG. E-2 FOUR WHEEL FRONT SUSPENSION

Remove the tie rod assembly (7) from the idler arm assembly (1) as follows: Remove the cotter pin (8) from the slotted nut (9) and back it off until it protects the ball joint threads. Using a pulling tool as a lever, apply pressure to the rod end ball joint and *TAP* the nut with a hammer to loosen the ball stud. Remove the nut and lower the stud from the idler arm.

Remove the nut (10), washers (11) and bushings (12) from the top of the shock absorber (13). Collapse the shock absorbers. Remove the bolts (14), lock washers (15), nuts (16) and plate (17). Remove the front suspension assembly from the vehicle.

Replace all broken or worn parts and reinstall in reverse order of disassembly. Tighten slotted nut (9) on the rod end at idler arm to 40 ft. lbs. torque. Install a new cotter pin.

SPINDLE REPAIR (FIG. E–2)

Tools Required: Qty.

Pliers	1
Wrench, box end, 15/16"	1
Reamer, sizing , .875" dia.	1
Torque wrench, 1/2" drive	1
Socket, 15/16", 1/2" drive	1

To replace the spindles (18) and (19), king pin bushings (20) or seal (21), proceed as follows:

Remove the wheel and hub (refer to Bearing Service procedures). Disconnect the ball joint (22 or 23) from the steering arm (refer to Front Suspension Removal). Remove the cotter pin (24) and nut (25). Remove the king pin (26), taking care to note the position of the thrust bearing (27) and washers (28) at top. Remove the spindle (18) or (19). Clean the spindle with a solvent and inspect for damage or worn bushings or seals. If bushings are worn larger than .880 inch, press out and replace with new bushings. Press bushings in until flush.

NOTE

Bushing I.D. will close slightly when pressed into the housing. If a ream operation is required, use a .875 inch sizing reamer.

Reinstall in the reverse order of disassembly. Tighten the ball joint nut at the steering arm to 40 ft. lbs. torque; continue tightening to 50 ft. lbs. torque maximum to align cotter pin holes and install a new cotter pin.

BEARING ADJUSTMENT

With the front of the vehicle raised (see section B) rotate the wheel while tightening the castellated nut. Tighten the nut until the wheel becomes noticeably resistant to being turned and turn the wheel 2 – 3 full turns to displace excess grease.

MAINTENANCE ON FRONT WHEEL BEARINGS 4 WHEEL (FIG. E–3) 3 WHEEL (FIG. E–4, FIG. E–5)

When maintenance is performed on wheel bearings, they must be repacked with grease to assure proper lubrication during operation. Pack bearings as follows: Use a grease packing device or use the following manual procedure (see Periodic Service Schedule for grease specification).

Place a dab of grease in the palm of the hand. Using the other hand, take the bearing and dip the

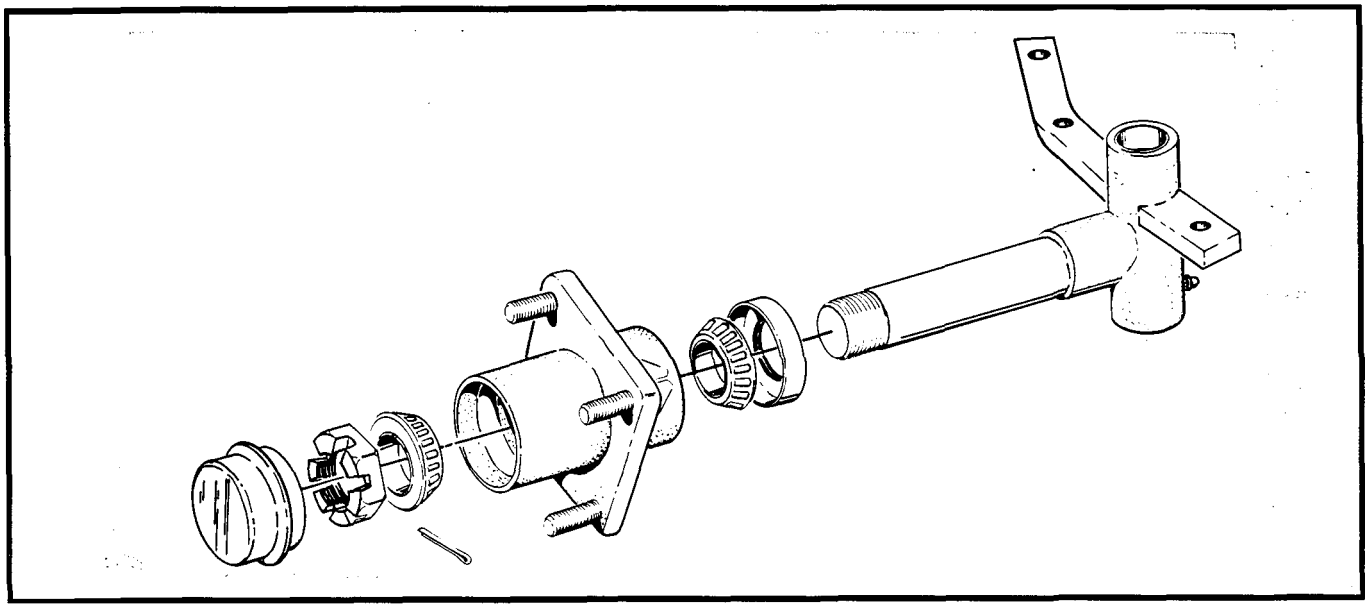


FIG. E–3 FRONT SPINDLE

bearing into the grease pushing grease up between the rollers of the bearing. This must be done around the complete bearing until all surfaces are coated with grease. Reinstall the bearings.

FORK REMOVAL AND BEARING SERVICE (FIG. E-4)

Tools Required:	Qty.
Jack stand	2
Wrench, open end, 11/16"	1
Pliers	1
Socket, 2", 1/2" drive	1
Hammer, ball pein, 2 lb.	1
Puller, slide hammer	1
Punch, long tapered	1
Bar, brass	1
Torque wrench, 1/2" drive	1

CAUTION

WHILE REMOVING NUT, SUPPORT FORK SO THAT IT WILL NOT DROP OUT AND DAMAGE THE FORK STEM AND/OR BEARINGS.

Lift the front of the vehicle (see procedures in Section B) and place on jack stands, disconnect the steering rack and ball joint. Remove the cowl center support and remove the console assembly if equipped (see Console Removal Section). Remove the dash tray liner or mat (1). Remove the stem nut (3) and washer (4) from the fork stem (5).

The lower bearing (6) will remain on the fork stem. To remove this bearing, tap lightly on the bottom surface to separate the bearing from the stem. Slide the bearing off the stem. With the fork removed from the vehicle, inspect the bearings and grease seals for damage. If the seal is damaged, the bearing and seal assembly must be replaced.

Clean the bearings with solvent and dry thoroughly. Inspect for damage or wear. Replace with new parts, if necessary. Repack the bearings with grease (see Packing procedure) making sure rollers are completely covered with grease and making sure that there is grease between the rollers and races (see Maintenance on Front Wheel Bearings).

Inspect the outer races (7) and the stem housing for pitting or other damage. If it is necessary to remove and replace the race, proceed as follows:

a) The lower race is removed using a slide hammer puller.

b) The top race is removed using a long tapered punch. Insert the punch through the bottom end of the housing and against the lower edge of the race; strike the punch with a hammer while alternately changing punch position around the edge of the race. Install a new race by tapping it *LIGHTLY* with a brass bar and hammer. Reinstall the fork and bearings in the reverse order of disassembly.

Tighten the fork stem nut until the fork is snug in the frame, then back off 1/4 turn. Reinstall the dash liner. Reinstall the cowl support and the console (if equipped).

REMOVAL OF FRONT FORK AXLE AND HUB ASSEMBLY (FIG. E-5)

Tools Required:	Qty.
Wrench, open end, 11/16"	1
Wrench, open end, 1 1/8"	2
Punch, long, tapered	1
Hammer, ball pein	1
Socket, 3/4", 1/2" Drive	1
Torque wrench, 1/2" Drive	1

Loosen the shock absorber nut (1) four to five turns. Remove the axle nut retainers (2) from the axle nuts on both sides of the fork.

Loosen the axle nut (3) to permit the flat washers (4) to separate from the axle bracket, and to permit the axle and hub assembly to drop out of the axle brackets (5 and 6). After the axle and hub assembly has been removed, remove the axle nut (3) and slide the adjuster ring (7) off the end of the axle shaft. Loosen the jam nut (8) and unscrew jam nut (9) from the axle shaft *(ONE END ONLY)*. After removing the jam nut from axle shaft, slide the spacers (10) and hub assembly from the end of the axle shaft.

To remove the bearings (11) and grease seals (12) from the hub assembly (13), insert a punch on the opposite side of the bearing to be removed, position it on the bearing cone, tap lightly around the bearing to push the bearing and grease seal out of the hub. Clean the bearings with a solvent and dry thoroughly. Check for wear round the rollers and in the races. Clean the hub assembly with solvent and dry thoroughly; check the outer races in the hub assembly for damage or wear.

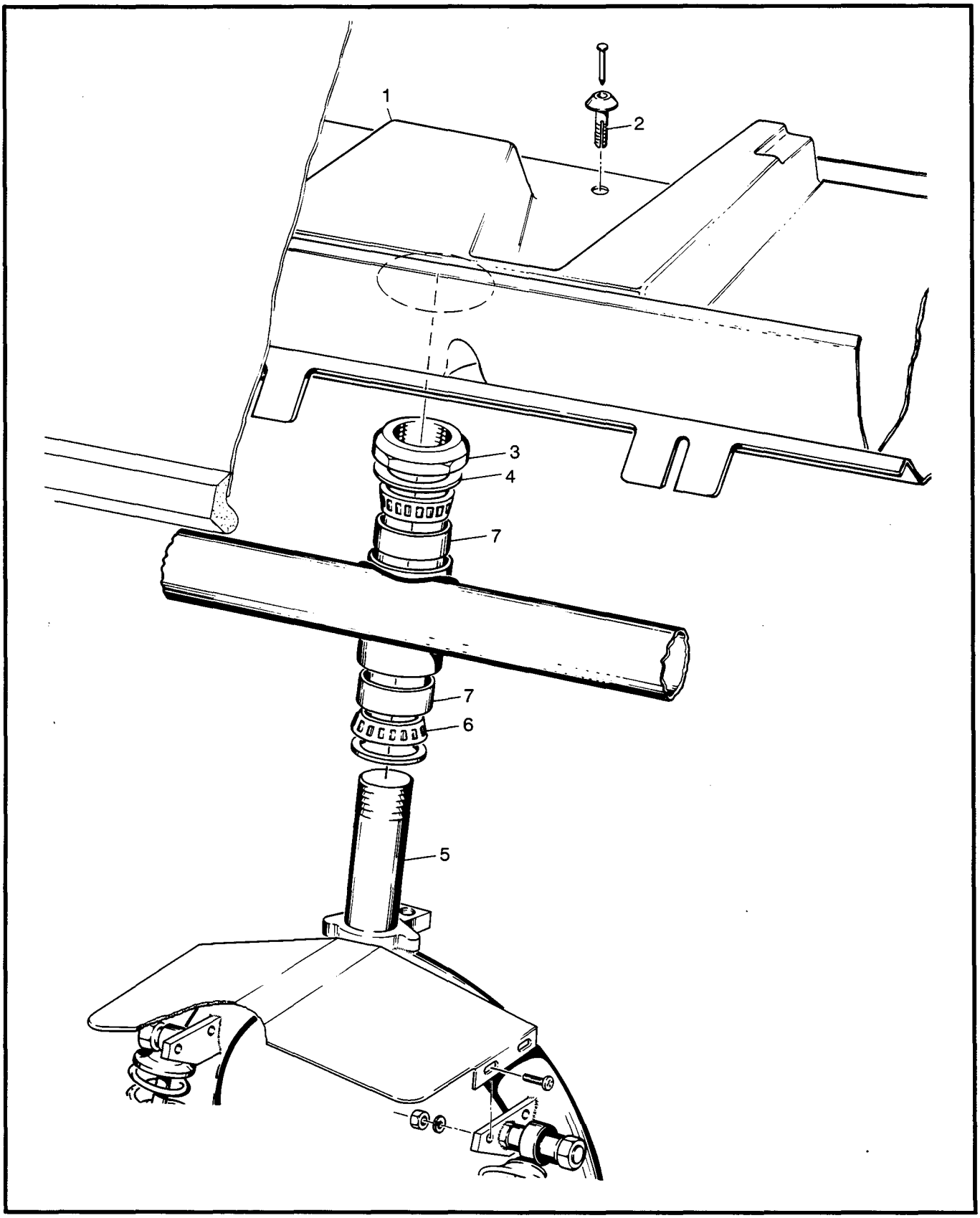


FIG. E-4 FRONT FORK REMOVAL

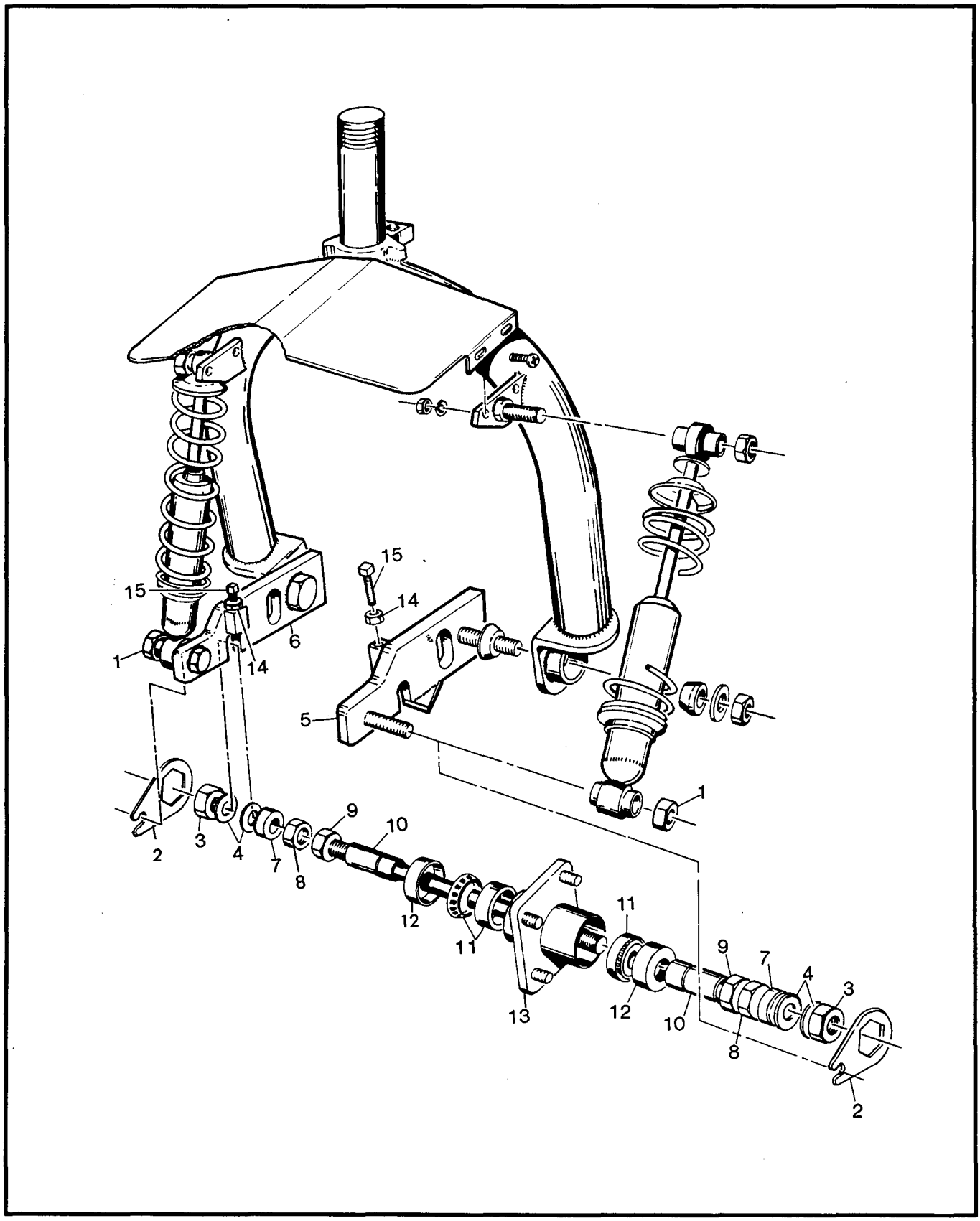


FIG. E-5 FRONT FORK ASSEMBLY

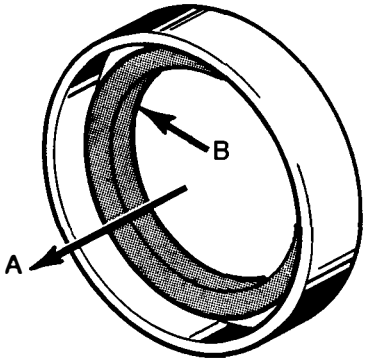
CAUTION

BE SURE THAT THE SEAL RETAINING SURFACE OF THE HUB IS CLEAN AND FREE OF GREASE. REINSTALL IN THE REVERSE ORDER OF DISASSEMBLY.

NOTE

When installing grease seals into hubs, insert the grease seals, flange side inward (FIG. E-6), and tap lightly and evenly around the seal until the seal is flush with the outer side of the hub assembly. Lubricate the seal surface with oil.

The hub assembly is reassembled to the axle assembly using the reverse procedure. When reinstalling the jam nut (9) on the axle shaft, position the inside jam nut against the spacer, tighten the nut until the hub becomes difficult to turn on the axle shaft and back off the jam nut until the hub turns freely. While holding the inner jam nut, tighten the outside jam nut to 70 - 90 ft. lbs. torque. Reinstall the tire and rim assembly on the hub and tighten the lug nuts to 50 - 60 ft. lb. torque. Install axle in fork assembly using reverse order of disassembly. Tighten outside lock nuts to 90 - 110 ft. lbs. torque.



A INSTALL THIS SIDE OF SEAL INTO HOUSING.

B LUBRICATE SEAL SURFACE.

FIG. E-6 INSTALLING GREASE SEAL

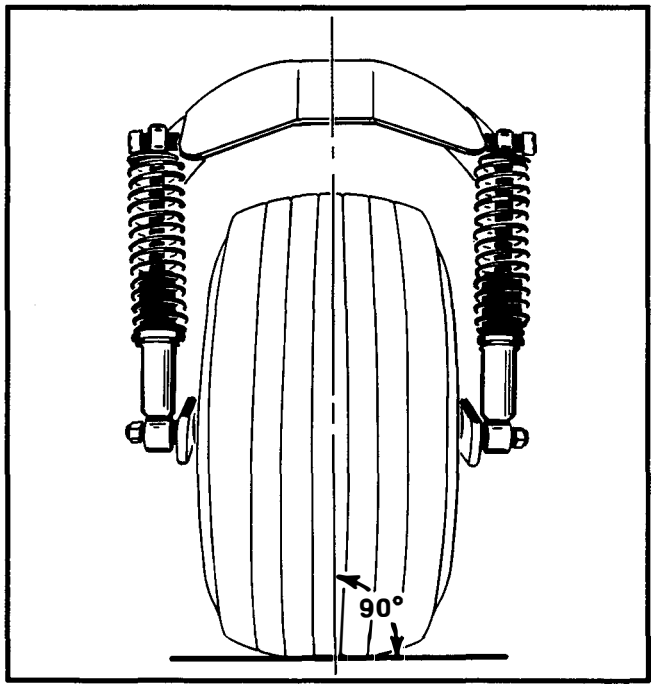


FIG. E-7 VERTICAL ALIGNMENT

FRONT WHEEL ALIGNMENT

Tools Required: Qty.

Wrench, open end, 11/16" 1
Square 1
Wrench, adjustable, 6" 1

THREE WHEEL VEHICLE

(FIG. E-5, FIG. E-7)

Should the steering tend to pull to one side, the front wheel should be aligned as follows: Position the vehicle on a flat, level surface and set the wheel in a straight ahead position. Loosen the shock absorber nut (1) four to five turns. Remove the axle retainers (2) from the axle nuts on both sides of the fork. Loosen the nut (3) at both ends of the axle (FIG. E-5).

⚠ WARNING ⚠

WHEN ADJUSTING THE FORK, ENSURE THAT A MINIMUM OF ONE FULL AXLE DIAMETER REMAINS IN THE FORK ARM SLOT.

Using a square, check the vertical alignment of the wheel/tire. Loosen the jam nuts (14) on the axle set screws (15). Adjust the set screws to position the

wheel/tire vertically (90°) to the floor. Adjust the set screws on both sides of the fork. Lower one side and raise the other to keep the axle firmly within the slot in the axle bracket. Retighten the jam nuts. Reinstall the axle nut retainers (2) and tighten nuts to 90 - 110 ft. lbs. torque.

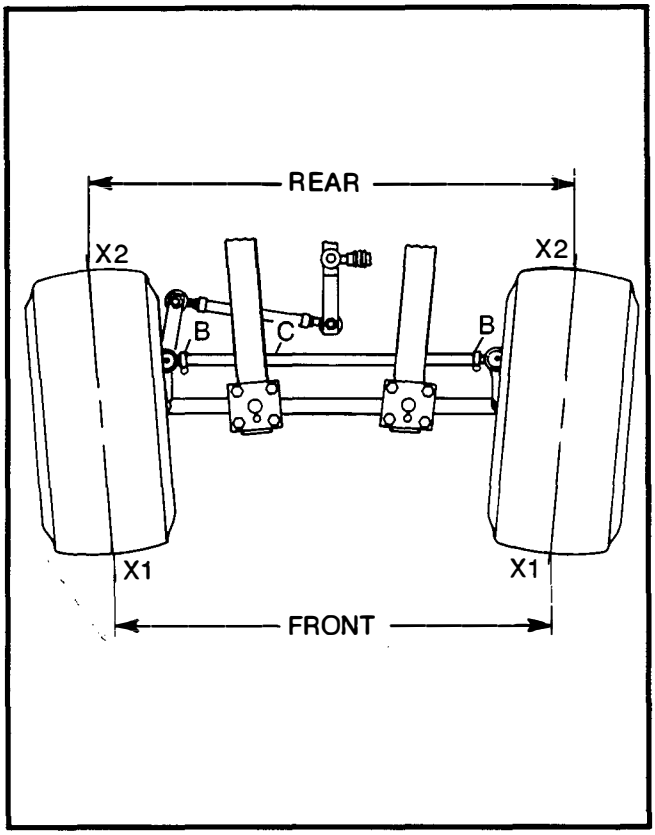


FIG. E-8 WHEEL FRONT END ALIGNMENT

FOUR WHEEL VEHICLE (FIG. E-8)

To check the front end alignment, lift the front of the vehicle (see procedures in Section B) and rotate each front, tire and scribe or chalk a line around the circumference of each tire at approximately the center of the tire. Toe-in dimensions shall be as follows: (FIG. E-8). Toe-in front dimension is to be 1/4" ± 1/16" smaller than rear dimension, when measured at points X1 to X1 and X2 to X2. If toe-in is not within the specified range, an adjustment should be made as follows: Loosen the nuts "B" on the tie rod "C" and rotate tie rod tube as required until the toe-in dimensions are within the acceptable range. Tighten nuts "B".

FRONT WHEEL BEARINGS (FOUR WHEEL VEHICLES) (FIG. E-9)

Tools Required:	Qty.
Wrench, box end, 1 1/2"	1
Jack, hydraulic, trolley	1
Jack stands	4
Pliers, needle nose	1
Pliers, channel lock	1
Punch	1
Hammer, ball pein	1
Socket, 3/4", 1/2" drive	1
Extension, 6", 1/2" drive	1
Ratchet, 1/2" drive	1

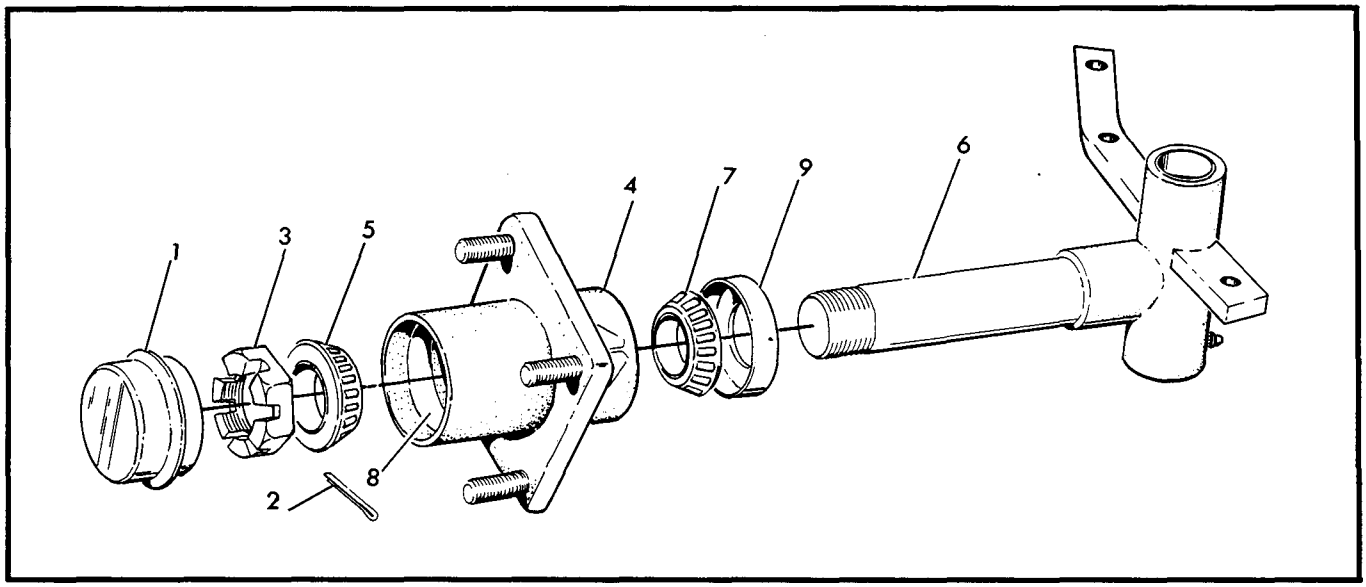


FIG. E-9 FRONT SPINDLE

Loosen the front wheel lug nuts one turn. Lift the front of vehicle (see procedures in Section B) so that wheels are off the floor and install jack stands. Remove the wheel lug nuts and remove the wheels.

Remove the dust cap (1), cotter pin (2), slotted nut (3), hub (4) and outer bearing (5) from the spindle (6). To remove the inside bearing and seal, insert a punch from the outside of the hub and lightly tap around the bearing cone (7). Clean the bearings, hub, seal and dust cap with solvent and dry thoroughly. Inspect for wear or damage.

Worn or damaged parts should be replaced. If the bearings cups (8) are worn or damaged, use a punch to remove them and press in new cups. Repack the bearings with wheel bearing grease making sure that grease is forced down between all of the rollers and race. (See Maintenance on Front Wheel Bearings 3 and 4 Wheel).

CAUTION

BE SURE THAT THE SEAL RETAINING SURFACE OF THE HUB IS CLEAN AND FREE OF GREASE.

Install seal (FIG. E–6). Lubricate the seal with oil. Reassemble using the reverse order of disassembly.

REAR SUSPENSION (3 AND 4 WHEEL VEHICLES) (FIG. E–10)

REMOVAL OF REAR SHOCK ABSORBERS

Tools Required:	Qty.
Wrench, box end, 9/16"	1
Wrench, box end, 5/16"	2
Socket, 3/4", 1/2" drive	1
Extension, 6", 1/2" drive	1
Ratchet, 1/2" drive	1
Torque wrench, 1/2" drive	1
Jack, hydraulic, trolley	1

Loosen both rear wheel and tire assemblies by loosening, but not removing, the lug nuts. Raise the vehicle (see procedures in Section B). Remove the rear wheel and tire assemblies. Use a 9/16" box end wrench on the nut (1) at the top of the shock absorber (2). Rotate the top part of the shock absorber counterclockwise. Lower the body of the shock absorber and retain all hardware. Use a 9/16" box end wrench to remove the bottom hardware. Remove the shock absorber. Reassemble using the reverse order of disassembly.

REMOVAL OF REAR LEAF SPRINGS (FIG. E–10)

Tools Required:	Qty.
Jack, hydraulic, trolley	1
Torque wrench, 1/2" drive	1
Wrench, box end, 9/16"	1
Socket, long reach, 9/16", 1/2" drive	1
Ratchet, 1/2" drive	1
Socket, 3/4", 1/2" drive	1
Pliers, needle nose	1
Screwdriver, straight blade	1
Wrench, open end, 1/2"	1

⚠ WARNING ⚠

READ REMOVING REAR AXLE ASSEMBLY FROM VEHICLE (SECTION M) BEFORE PROCEEDING.

Remove batteries (See Safety Procedures in Section B). Remove the top end of the shock absorber using previous procedures. Place a trolley jack underneath the differential housing and remove the wiring from the motor (See Electric Motor Section). Using needle nose pliers, remove the cotter pin and retaining ring from the brake assembly. Remove the pin from the brake lever. Remove the cable from the shackle. With the jack elevating the rear end, remove the 4 'U' bolts (3) from the rear end. Lower the rear end slowly. Remove the rear end from underneath the vehicle. Remove the lower nut and bolt assembly (4) from the front of the spring. Remove the nuts and hardware (5) from the shackle (6) and remove the spring (7) from the vehicle.

Install using the reverse order of disassembly.

Tighten all 'U' bolt hardware to 30–35 ft. lbs. torque. Tighten all shock absorber hardware until the bushings are compressed to the diameter of the retaining washers.

REMOVAL OF STABILIZER BAR (3 WHEEL VEHICLES ONLY) (FIG. E–10)

Use the previous procedure for removing the rear springs. Remove 'U' bolt and nut assembly from each side of the vehicle the above motor.

Remove the stabilizer bar complete with the spring retainer bracket assembly. Install using the reverse order of assembly and tighten stabilizer bar 'U' bolt hardware to 18–25 ft. lbs. torque.

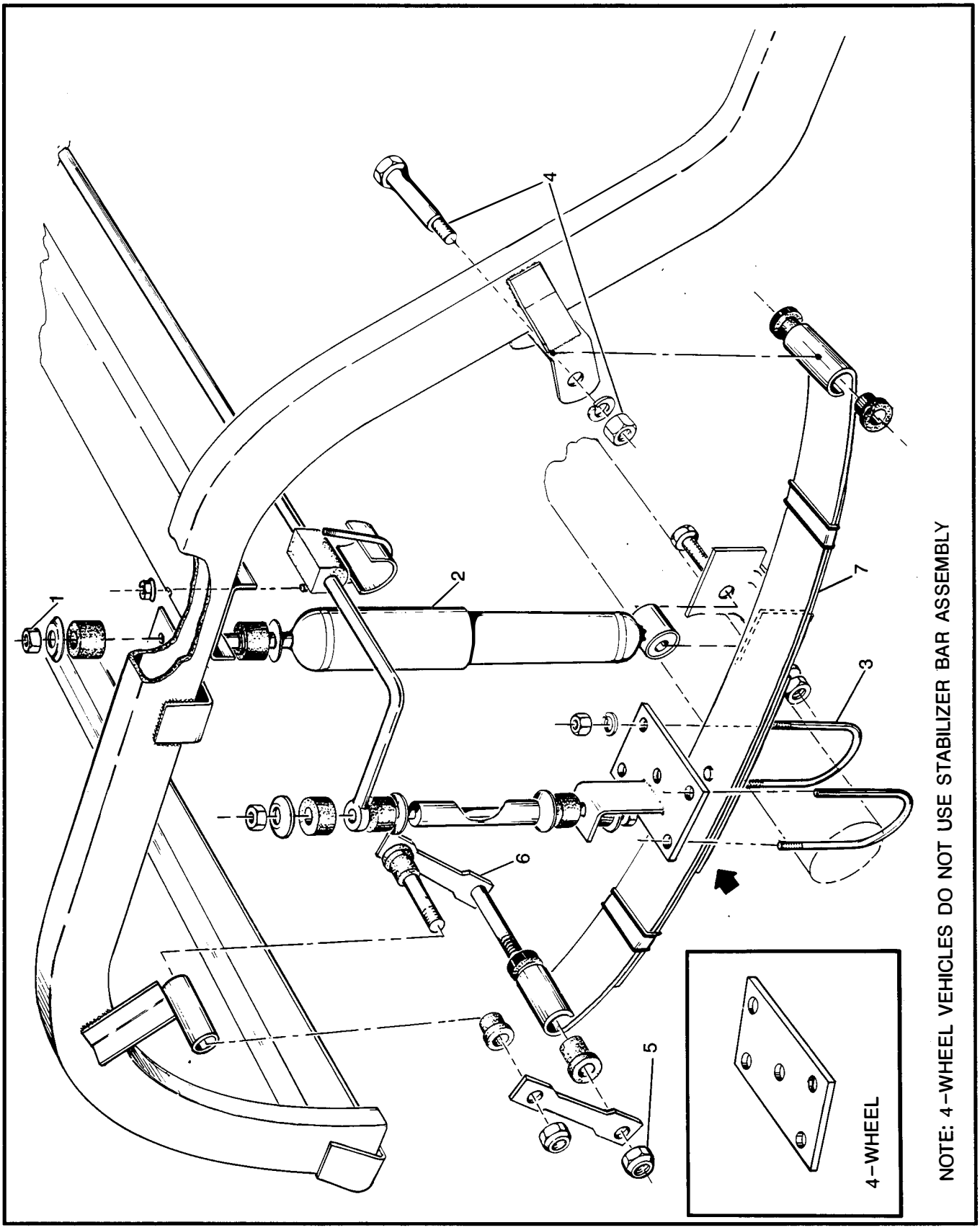


FIG. E-10 REAR SUSPENSION

FRONT SHIELD REMOVAL (FIG. E–11)

Tools Required: Qty.

Ratchet, 3/8" drive 1

Socket, 9/16", 3/8" drive 1

Wrench, open end, 7/16" 1

Wrench, open end, 9/16" 1

Raise the front of the vehicle as detailed in section B. Remove the two bolts (3), washers (4) and lock nuts (5) that secure the front shield (1) to the frame.

Pull the lower edge of the front shield (1) forward to release the spring clip from the support (9). Remove the screws (11), flat washers (12), lock washers (13) and nuts (14). Remove the support (9).

Reassemble using the reverse order of disassembly.

FRONT WHEEL ALIGNMENT, THREE WHEEL VEHICLE - OMITTED FOR 1990.

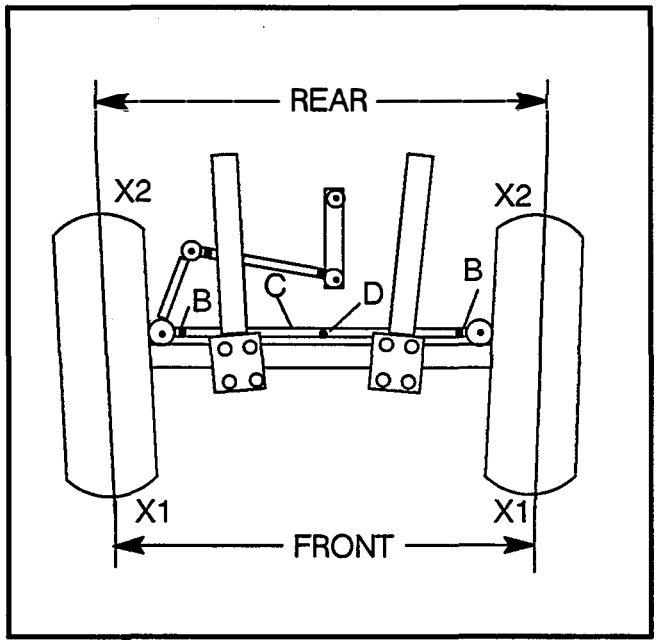


FIG. E–12 WHEEL FRONT END ALIGNMENT

Four Wheel Vehicle (FIG. E–12)

To check the front end alignment, lift the front of the vehicle (see procedures in Section B) and rotate

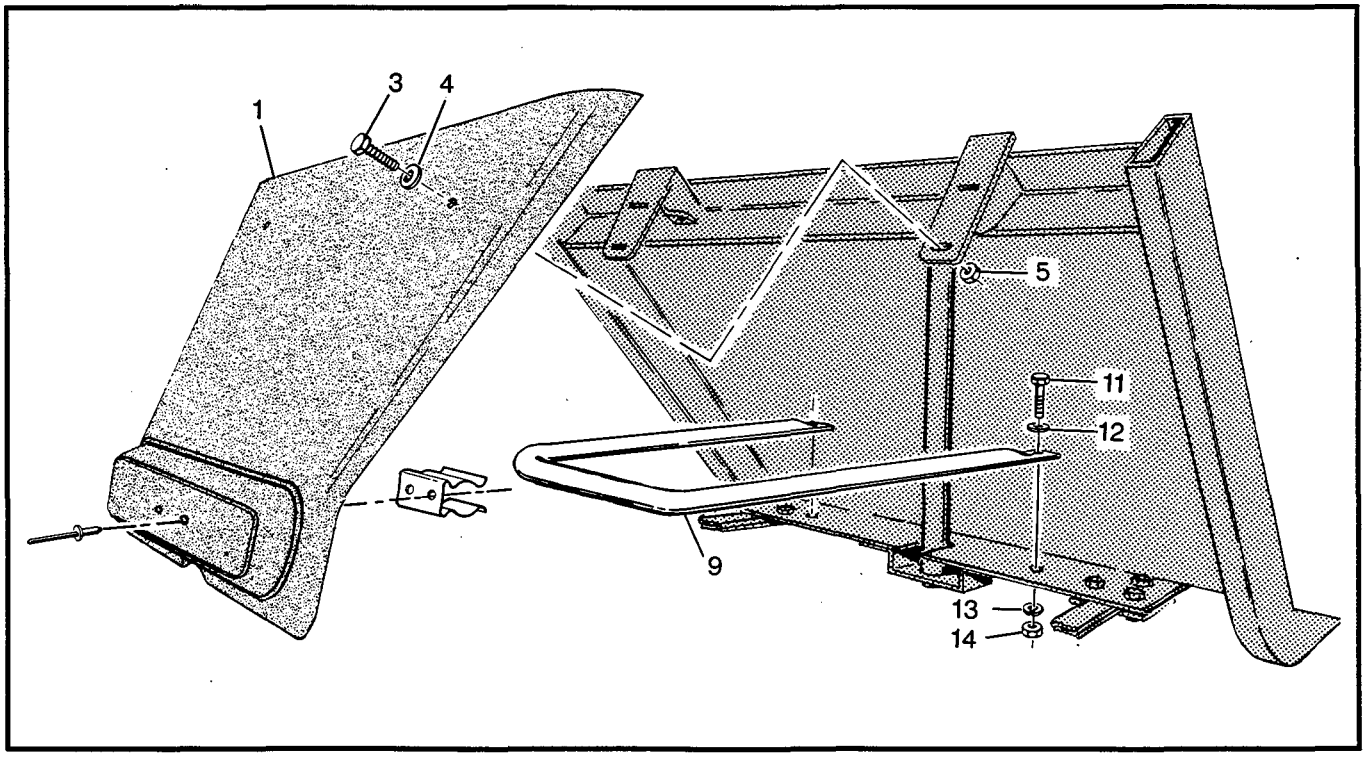


FIG. E–11 FRONT SHIELD

each front, tire and scribe or chalk a line around the circumference of each tire at approximately the center of the tire. Toe-in dimensions shall be as follows: (FIG. E-12). Toe-in front dimension is to be 1/4" ± 1/16" smaller than rear dimension, when measured at points X1, to X1, and X2 to X2. If toe-in is not within the specified range, an adjustment should be made as follows: Loosen the nuts "B" on the tie rod "C" and rotate tie rod tube as required until the toe-in dimensions are within the acceptable range. On vehicles equipped with tie rod with tow pin, be sure that tow pin "D" is vertical. Tighten nuts "B".

ACCELERATOR ADJUSTMENT (FIG. F–1) and (FIG. F–2)

Tools Required: Qty.

Pliers, needle nose 1

Wrench, open end, 1/2" 1

⚠ WARNING ⚠

DISCONNECT BATTERIES BEFORE ATTEMPTING THIS ADJUSTMENT. A COMPONENT FAILURE OR INADVERTENTLY LEAVING THE KEY IN THE "ON" POSITION COULD RESULT IN THE VEHICLE ACCELERATING OUT OF CONTROL.

To determine the need for an accelerator adjustment, observe the accelerator switch assembly (1) with the accelerator pedal (2) in the *FULLY RELEASED* position. The spring loaded brush should be located on the bottom contact stud *ONLY* and with the contact arm (4) resting against the stop (5).

Observe the accelerator switch assembly (1) with the accelerator pedal (2) in the *FULLY DEPRESSED* position. The spring loaded brush (3) should be located in *FULL* contact with the top contact stud (6) *ONLY*.

The accelerator requires adjustment if either of the above conditions are *NOT* met.

Raise the front of the vehicle (see procedures in Section B) to provide access to the underside of the accelerator linkage.

Loosen the jam nut (7) at the adjustable yoke (8). Remove the cotter pin (9) and slide the hill brake kick off rod (10) out of the adjustable yoke (8) being careful to note the position of the two flat washers (11). Inspect all parts for abnormal wear and replace if required. Separate the accelerator rod assembly (13) from the accelerator pedal and rotate the adjustable yoke (8) clockwise to shorten, or counterclockwise to lengthen the accelerator rod assembly.

The correct adjustment of the accelerator rod assembly is achieved when the above criteria are met.

Reassemble using the reverse procedure and use a new cotter pin (9) to secure the assembly. Recheck the adjustments and, with the accelerator in the *FULLY RAISED* position, bend the stop leg (17) to provide 1/32" clearance with the accelerator pedal.

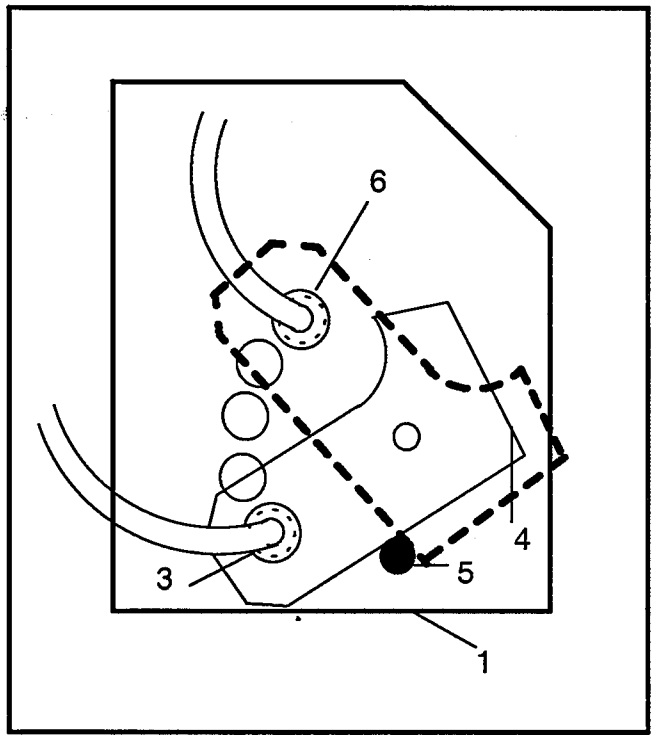


FIG. F–1 ACCELERATOR SWITCH ADJUSTMENT

ACCELERATOR LINKAGE REMOVAL (FIG. F–2)

Tools Required: Qty.

Wrench, open end, 1/2" 1

Wrench, open end, 1 1/8" 1

Long screwdriver or alignment punch 1

Hammer, ball pein 1

Remove the adjustable yoke (8) from the accelerator pedal (2) (see Accelerator Pedal Adjustment Procedure). At the accelerator switch assembly (1): Slide the barrel of the ball joint socket (14) forward and push the accelerator rod assembly (13) away from the pivot arm assembly (15). Pull the complete accelerator rod assembly through the crossmember (16) and out of the vehicle.

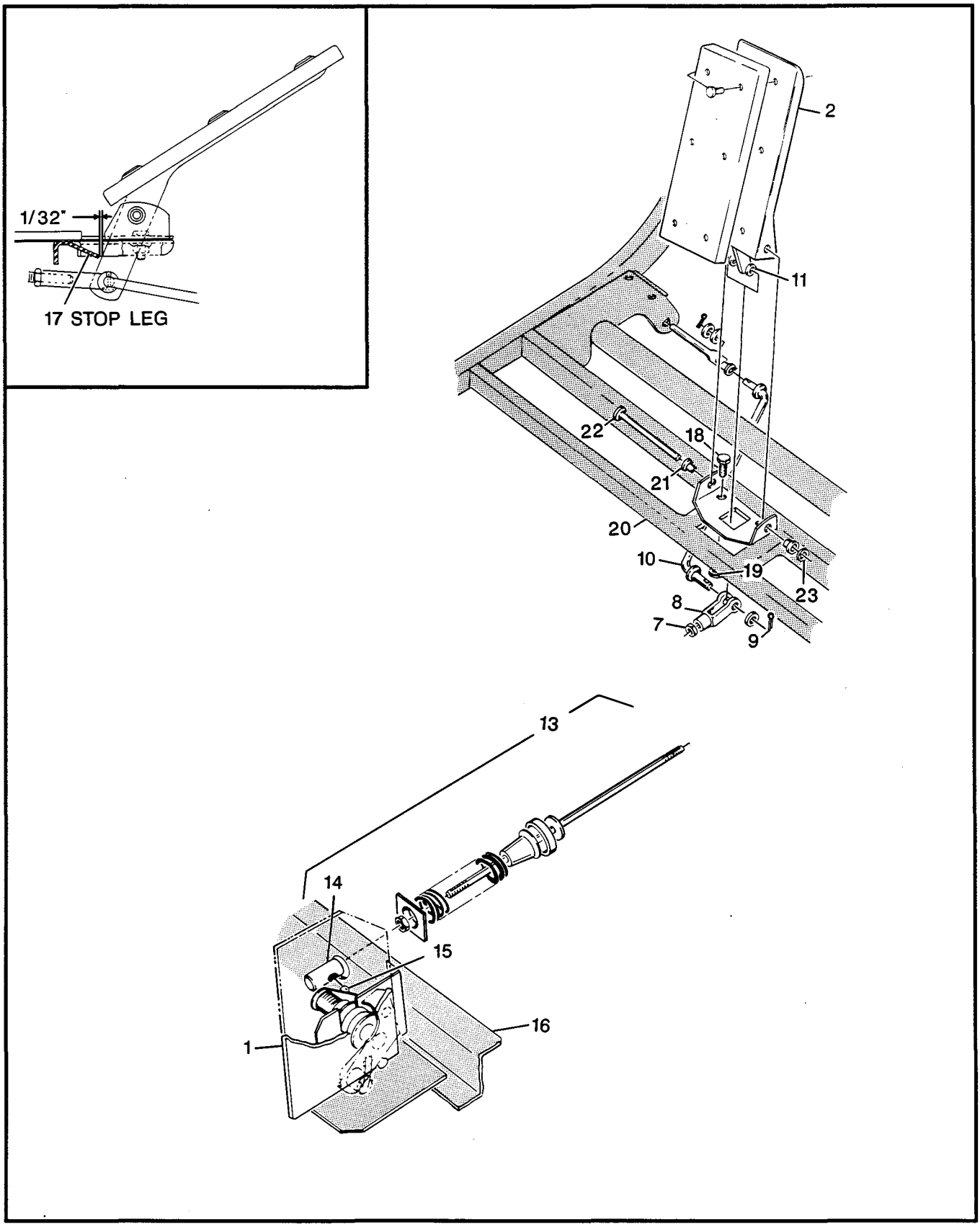


FIG. F-2 ACCELERATOR LINKAGE AND PEDAL REMOVAL

NOTE

If vehicle has been driven under adverse conditions, some difficulty may be encountered when attempting to slide the barrel of the ball joint socket (14). If such difficulty is encountered, tap the barrel using either a straight blade screwdriver or an alignment punch and a hammer.

CAUTION

TAP LIGHTLY TO PREVENT DAMAGE TO THE ACCELERATOR SWITCH ASSEMBLY.

ACCELERATOR PEDAL REMOVAL
(FIG. F-2)

Tools Required: Qty.

Wrench, box end, 7/16" 1
Pliers, needle nose 1
Wrench, open end, 1/2" 1

Remove the adjustable yoke from the accelerator pedal (see Accelerator Pedal Adjustment Procedure). Remove the two screws (18) and the two lock nuts (19) that secure the accelerator pedal assembly (2) to the frame of the vehicle (20). Lift the accelerator pedal assembly from the vehicle. Should the pivot bearings (21) need to be replaced, they may be removed by removing the pivot pin (22). A new push nut (23) will be required for reassembly.

NOTE

To assure proper braking performance, **all** periodic maintenance inspections and procedures should be performed as indicated in the schedule (Section A) i.e. Daily, Weekly, Monthly, Semi-Annually, and Annually.

GENERAL

The overall brake system consists of:

(a) self-adjusting wheel brake units which normally do not require adjustment until internal components have worn to a point of needing replacement.

(b) actuating linkages requiring periodic adjustment to compensate for normal wear of system components and/or their replacement.

NOTE

A **complete** brake system adjustment procedure **must** be performed whenever **any part of the brake system** has been replaced. (FIG. G-20)

DAILY BRAKING PERFORMANCE TEST

To determine the adequacy of the vehicles brake system, the following test should be performed daily:

⚠ WARNING ⚠

ALL DRIVING BRAKE TESTS MUST BE DONE IN A SAFE LOCATION WITH REGARD FOR THE SAFETY OF ALL PERSONNEL

The recommended way of performing the daily brake test and determining any vehicles that have unacceptable braking performance is to have personnel handling the vehicles latch the hill brake at a **common point** on a paved surface while traveling at maximum governed speed. The vehicle stopping location must be observed and vehicles that stop in a significantly greater distance than other acceptable vehicles should **immediately** be removed from service and inspected by a qualified mechanic.

The mechanic should perform a "panic" stop on the suspect vehicle(s) by applying maximum force and travel to the brake pedal while traveling at full speed. He should observe if either of the rear wheels fails to "lock up". If one wheel fails to lock, it is reasonable to expect that a problem exists with the service brake system and the **6 Month Brake Maintenance** must be performed in its entirety. If both wheels lock, the parking (hill) brake must be adjusted and the vehicle re-tested per the **Daily Brake Test**.

6 MONTH BRAKE MAINTENANCE

Raise the entire vehicle as specified in Safety Procedures Section B of the operation and service manual.

Rotate each rear wheel by hand, and feel for a dragging brake shoe that prevents smooth movement of the wheel and brake drum.

Remove the clevis pin from both cables where they attach to the wheel brake levers.

Again rotate each wheel by hand and feel for a dragging brake shoe that prevents smooth movement of the wheel and brake drum. If the wheel rotates more smoothly than with the brake cables attached, a worn or damaged brake cable is indicated and **MUST** be replaced.

Inspect the cables for abrasion to the cable housing. A kinked cable or a cable housing that has worn to the point of exposing the metal jacket will result in the cable dragging. Any worn or kinked cables **MUST** be replaced. Operate the brake pedal and observe the movement of the cables. Both should move the same amount and return fully when the brake pedal is released. If the brake pedal does not return to the full up position, excess pedal bushing friction is indicated. The bushing must be removed and lubricated or replaced. Observe the equalizer bar to see if it pivots during operation of the brake pedal. A pivoting equalizer bar, uneven movement or failure of the brake cables to return fully indicates a dragging brake cable which **MUST** be replaced.

NOTE

Gasoline powered vehicles only. When replacing the drivers side cable route the cable through the top rear saddle only.

Remove each brake drum and shoes according to procedures indicated in **BRAKE DRUM, SHOE AND BRAKE ASSEMBLY REMOVAL** section. Clean and inspect all brake parts. If there is

evidence of rust or if the adjuster does not move smoothly in the backing plate, the surfaces must be cleaned and smoothed using an emery cloth. The backing plate **MUST** be replaced if excessive wear such as gouges or galling are in evidence on the backing plate.

INSPECTION OF BRAKE SHOES

The pattern of normal brake shoe wear is shown (FIG. G-12) in quadrants A, B, C and D with quadrant 'A' showing the most wear, 'B' will show the second most wear. Quandrants B and D will always be to the rear of the vehicle.

Inspect brake shoes. Brake shoes **MUST** be replaced as a set when either shoe has a lining thickness less than .040 in. thick **AT ANY POINT** on the shoe.

After lubricating the backing plate and adjuster mechanism at the lubrication points shown in illustration (Fig G-8), re-assemble and adjust the complete brake system according to the procedures outlined in the section later in this chapter.

NOTE

A **complete** brake system adjustment procedure **must** be performed whenever **any part of the brake system** has been replaced. (FIG. G-20)

Retest according to DAILY BRAKING PERFORMANCE TEST.

HOW THE BRAKE SYSTEM WORKS

An overall view of the brake system is shown in FIG. G-13.

The brakes are the "servo acting" type.

The wheel brake is a self-adjusting unit and should not require any adjustment until internal components have worn to a point of needing replacement. Also, periodic adjustment to the actuating linkage may be required to compensate for component wear or as a result of a component replacement.

Depressing the brake pedal causes the brake cable to pull the brake actuating lever forward which in turn pushes the rear brake shoe against the brake drum. Continued movement of the brake actuating lever causes the lever slide mechanism to move which pushes the front shoe against the drum. As the shoes contact the drum "servo action" takes place. If the vehicle is moving forward the rear brake shoe moves upwards applying pressure against the upper rear portion of the brake drum. The front shoe moves downwards applying pressure against the lower front portion of the brake drum.

The action reverses when the brakes are applied with the vehicle operating in reverse.

HOW THE ADJUSTER WORKS (FIG. G-14)

The brake has an automatic adjuster mechanism that compensates for lining wear.

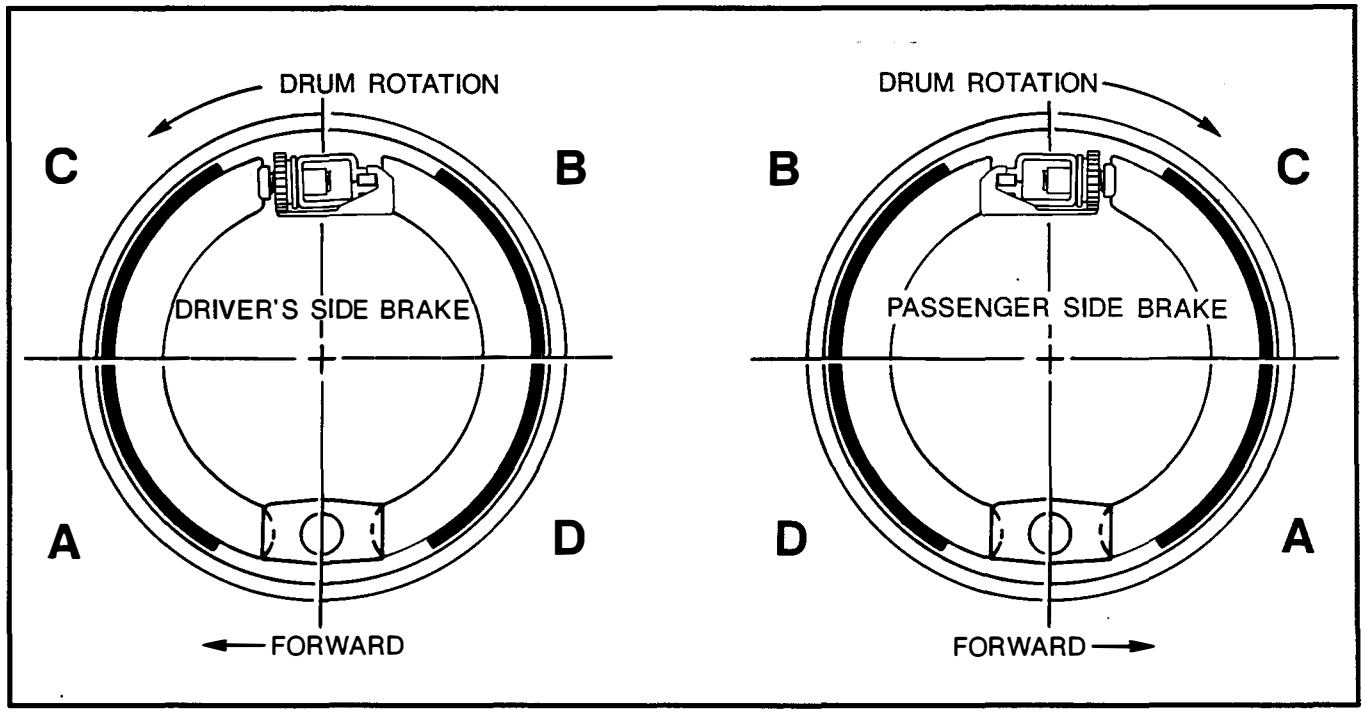


FIG. G-12 BRAKE WEAR

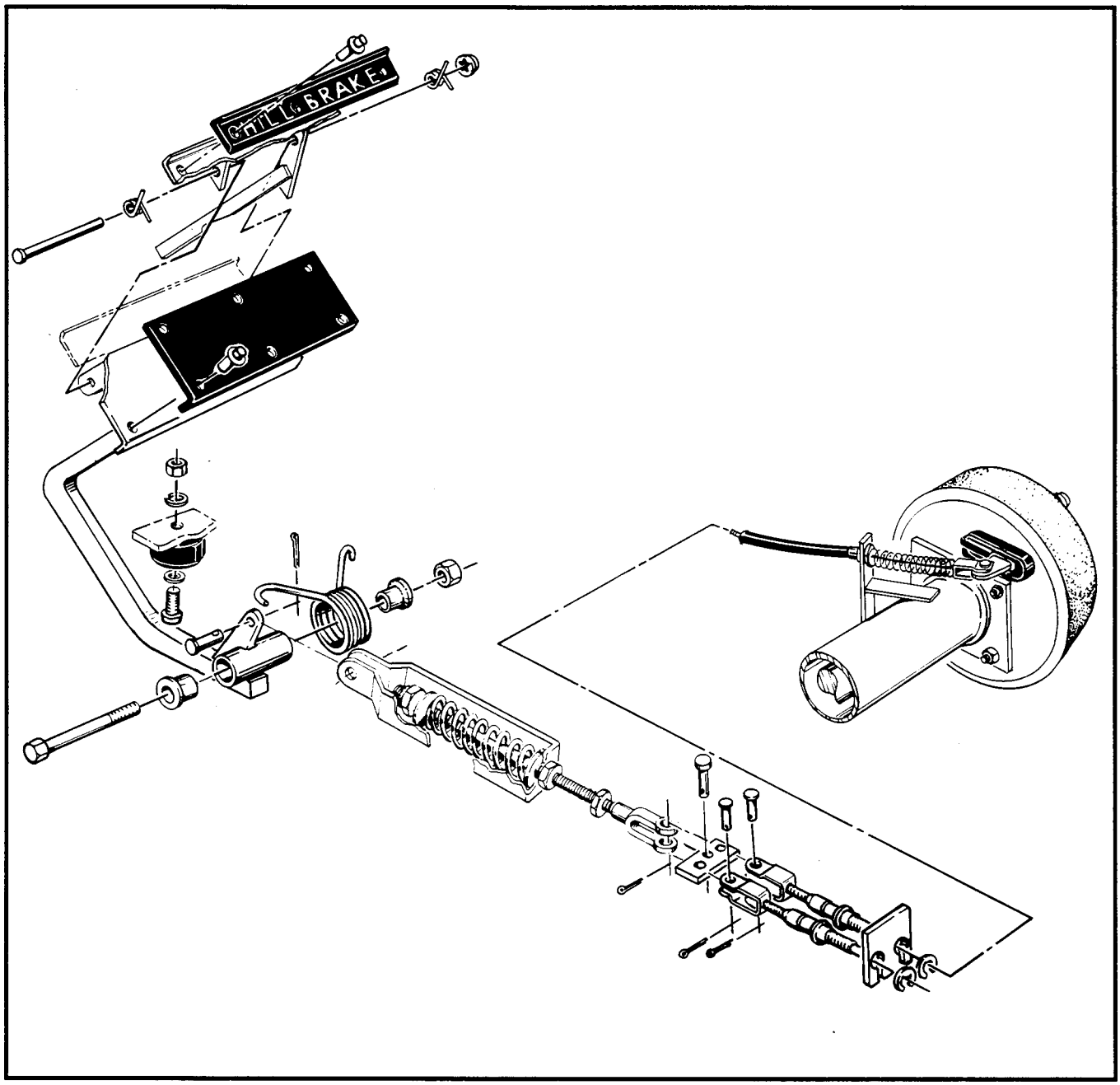
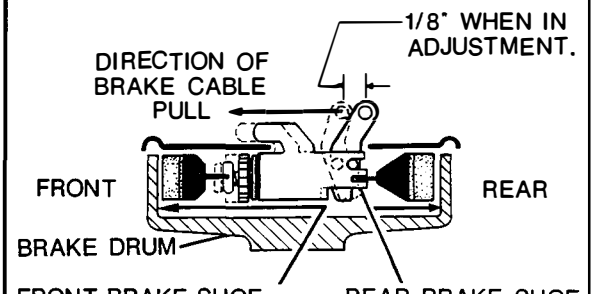


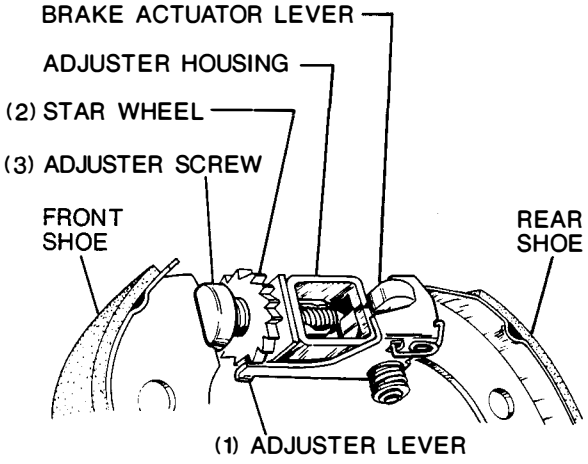
FIG. G–13 BRAKE LINKAGE

The brake adjuster is activated by movement of the lever attached to the brake cable. Movement of this lever activates the adjuster lever (1) which rotates the 'star' wheel (2). The star wheel's rotation pushes the adjuster screw (3) outwards which in turn moves the brake shoes outward. With the brake correctly adjusted, the adjuster lever does not have enough movement to rotate the star wheel since lever movement is limited to approximately 1/8". The 1/8" of movement limits the adjuster lever's motion to the flat of the tooth that it is sitting on.

As the brake shoe wears, the lever's motion increases which causes the adjuster lever to engage the next tooth of the star wheel. The star wheel is then rotated which expands the brake shoes.

ILLUSTRATIONS SHOW DRIVER'S SIDE BRAKE ONLY. PASSENGER SIDE IS MIRROR IMAGE.





NOTE: TEETH ARE NUMBERED IN ILLUSTRATION TO CLARIFY THEIR POSITIONS.

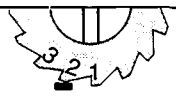
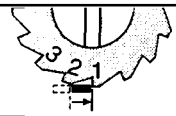
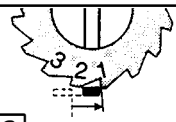
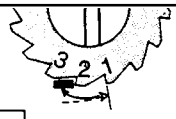
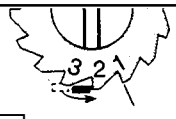
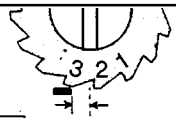
THE DISTANCE OF THE ADJUSTER LEVER TRAVEL IS REGULATED BY THE AMOUNT OF BRAKE SHOE WEAR.(A)	 A	POSITION OF ADJUSTER LEVER WITH BRAKES DISENGAGED.
WHEN BRAKE SHOE WEAR IS MINIMAL, THE DISTANCE OF ADJUSTER LEVER TRAVEL IS TOO SHORT TO FULLY RE-ADJUST BRAKES.(B)	 B	POSITION OF ADJUSTER LEVER WITH MINIMUM SHOE WEAR AND BRAKES ENGAGED.
AS SHOE WEAR INCREASES, ADJUSTER LEVER TRAVEL INCREASES, THUS TURNING THE STAR WHEEL.(C)	 C	POSITION OF ADJUSTER LEVER WITH BRAKES ENGAGED AND SHOES WORN TO POINT OF NEEDING SELF-ADJUSTMENT.
WHEN BRAKE SHOES HAVE WORN SUFFICIENTLY TO REQUIRE RE-ADJUSTMENT, THE ADJUSTER LEVER ADVANCES AND RATCHETS TO THE NEXT TOOTH WHEN BRAKES ARE RELEASED.(D)	 D	POSITION OF ADJUSTER LEVER WITH BRAKES DISENGAGED AND READY TO RESET ADJUSTER SCREW.
WHEN BRAKE IS NEXT ENGAGED, THE ADJUSTER LEVER WILL ROTATE THE STAR WHEEL FAR ENOUGH TO EXTEND THE ADJUSTER SCREW, THUS RE-SETTING THE PROPER SHOE/DRUM CLEARANCE.(E)	 E	POSITION OF ADJUSTER LEVER WITH BRAKES ENGAGED DURING RE-ADJUSTMENT OF SCREW.
WHEN THE SHOE/DRUM CLEARANCE IS RESET, LESS EFFORT IS REQUIRED TO ENGAGE THE BRAKES, THUS THE ADJUSTER LEVER TRAVEL IS ONCE AGAIN REDUCED.(F,A)	 F	POSITION OF ADJUSTER LEVER WITH BRAKES DISENGAGED AND RE-ADJUSTMENT COMPLETED. NOTE NEW POSITIONS OF TEETH.

FIG. G-14 HOW THE BRAKE ADJUSTER WORKS

DISASSEMBLY OF BRAKE PEDAL (FIG. G-15)

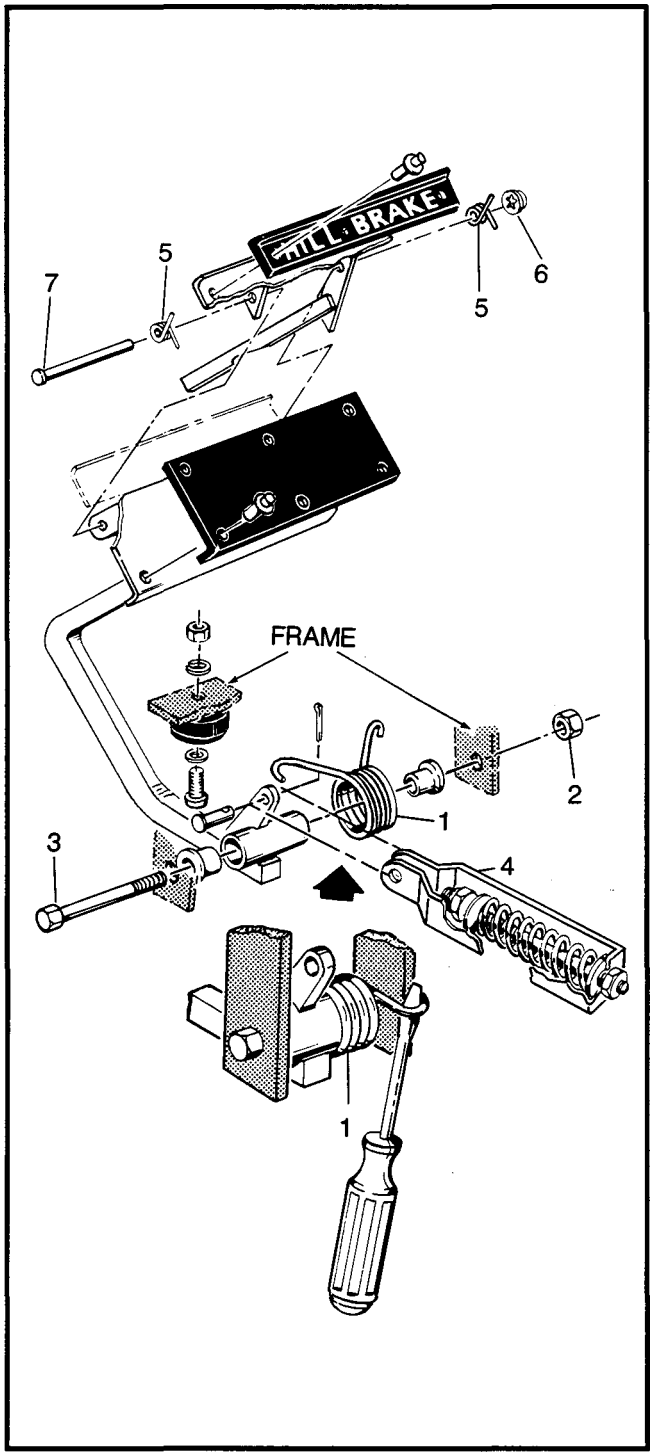


FIG. G-15 BRAKE PEDAL SPRING REMOVAL

Tools Required: Qty.

Screwdriver, straight blade 1

Pliers 1

Hammer, ball pein 1

Unhook the pedal return spring (1). (Insert a thin blade screwdriver between the small hook end and the pedal bracket, move spring back and away from the bracket.)

Remove the lock nut (2) from the pivot bolt (3) and remove the bolt. Remove the spring, disconnect the cable clevis (4) and lift the pedal out through the floorboard.

To remove the parking (hill) brake pedal, note the position of the two springs (5). Remove the "push on" retainer nut (6) (new nut required for assembly), and remove the hinge pin (7). Reassemble in the reverse order of disassembly.

REMOVAL OF PARKING (HILL) BRAKE RELEASE LINKAGE (FIG. G-16)

Tools Required: Qty.

Pliers 1

Jack, Hydraulic Trolley 1

Jack stands 1

Wrench, open end, 1/4" 1

To remove the parking (hill) brake release linkage, raise the front of vehicle (see procedure in Section B) to allow access to underside.

To remove the linkage rod (1), remove the cotter pin (2) and washers (3) and (12) from lever arm (4).

Loosen the two setscrews (5) in cam (6), and remove the pivot arm shaft (4). The cam (6) and nylon spacer (9) will come out when the pivot arm shaft is removed.

If the spacer (9) or bearings (10 and 11) are worn, replace them with new spacers or bearings.

Reassemble by reverse procedure.

NOTE

It may be necessary to remove the indentures on the shaft (4) caused by the setscrews (5).

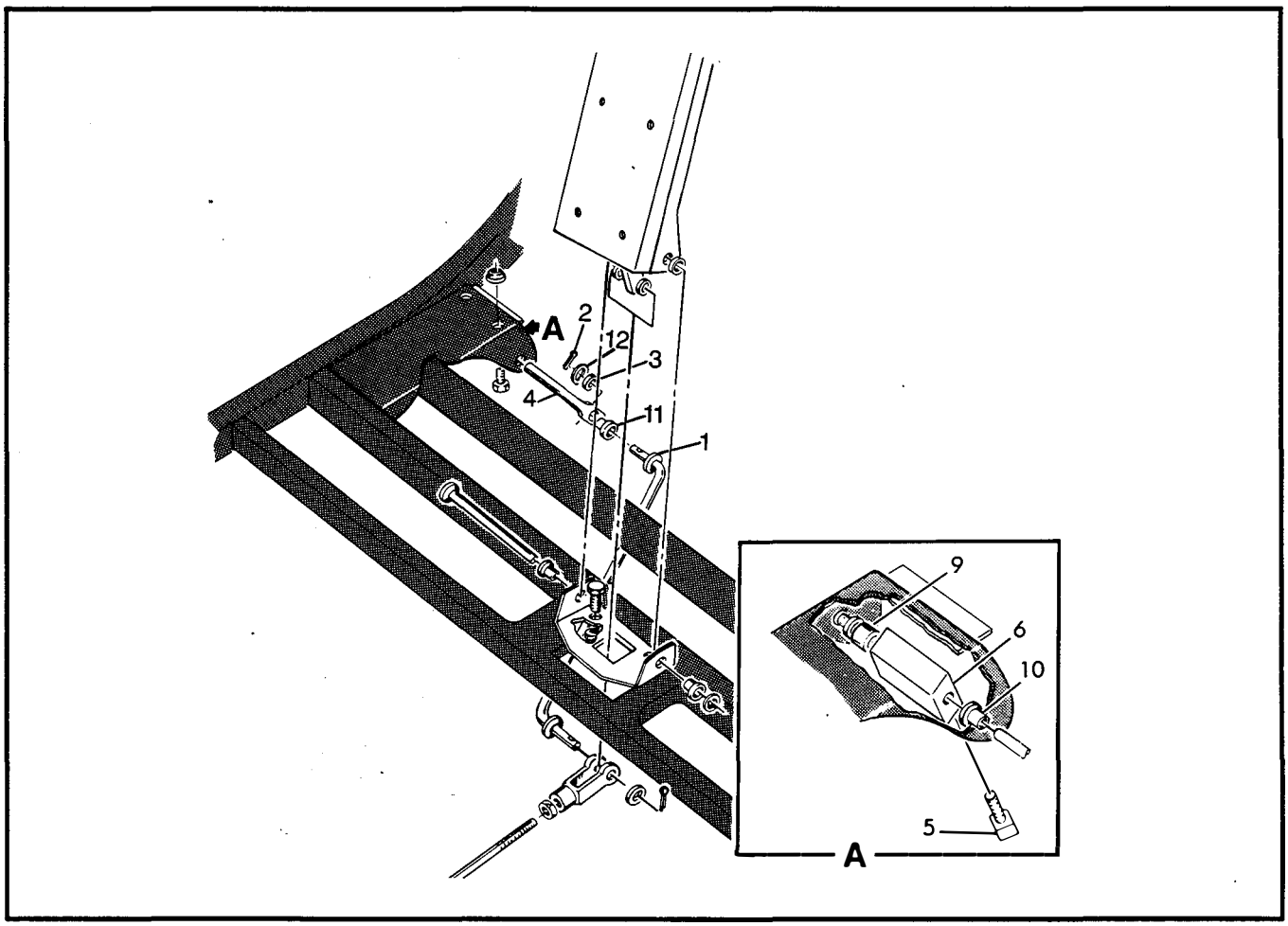


FIG. G-16 BRAKE "KICK OFF" LINKAGE

BRAKE DRUM, SHOE AND BRAKE ASSEMBLY REMOVAL (FIG. G-17, FIG. G-18)

Tools Required: Qty.

- Jack, hydraulic trolley 1
- Hammer, plastic tipped 1
- Jack stands 4
- Screwdriver, flat blade 2
- Socket, 1/2", 1/2" drive 1
- Ratchet, 1/2" 1
- Socket, 1 1/16", 1/2" drive 1
- Torque wrench, 1/2" drive 1
- Pliers 2
- Wrench, open end, 1/2" 1

DRUM REMOVAL (FIG. G-18)

Loosen lug nuts on rear wheels 1/8 to 1/4 turn. Raise the vehicle (see procedure in Section B). Remove the rear wheel(s).

Remove the cotter pin (5) and clevis pin (6) from the brake lever. Remove the cotter pin (8) from the axle nut (9) and remove the nut and washer (10). *TAP* the brake drum (11) with a plastic faced hammer to remove the drum. If the drum does not come off, it will be necessary to loosen the brake adjuster mechanism.

Rotate the brake drum until one of the holes is located over the star wheel position (11 o'clock for driver's side, 1 o'clock for passenger side).

The hole is aligned with the brake adjuster mechanism when in this position. Insert a flat blade screwdriver between the adjuster lever and the adjuster screw housing. Insert a second flat blade screwdriver and push on the bottom portion of the 'star' wheel which will loosen the adjuster screw and retract the shoes to permit the drum to be removed.

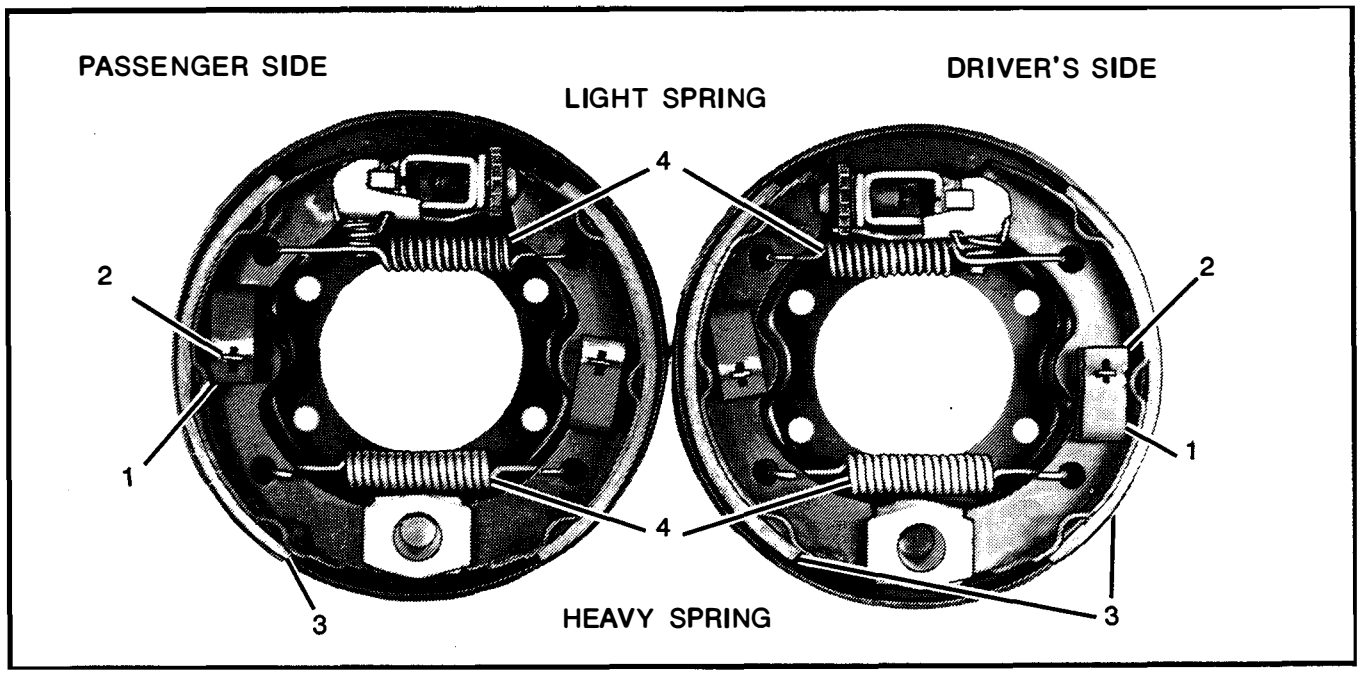


FIG. G-17 WHEEL BRAKES DRIVER'S AND PASSENGER SIDE

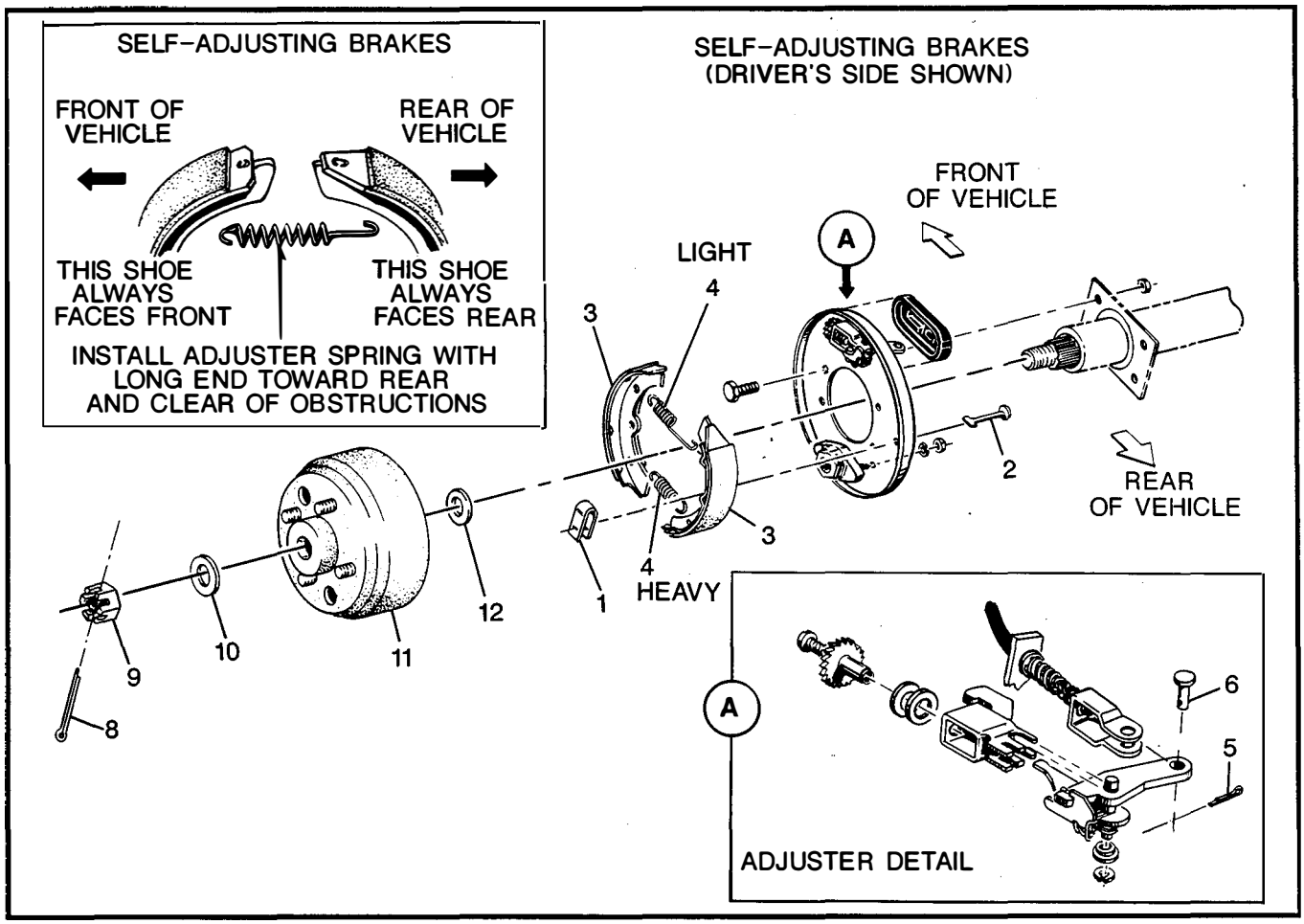


FIG. G-18 WHEEL BRAKE COMPONENTS

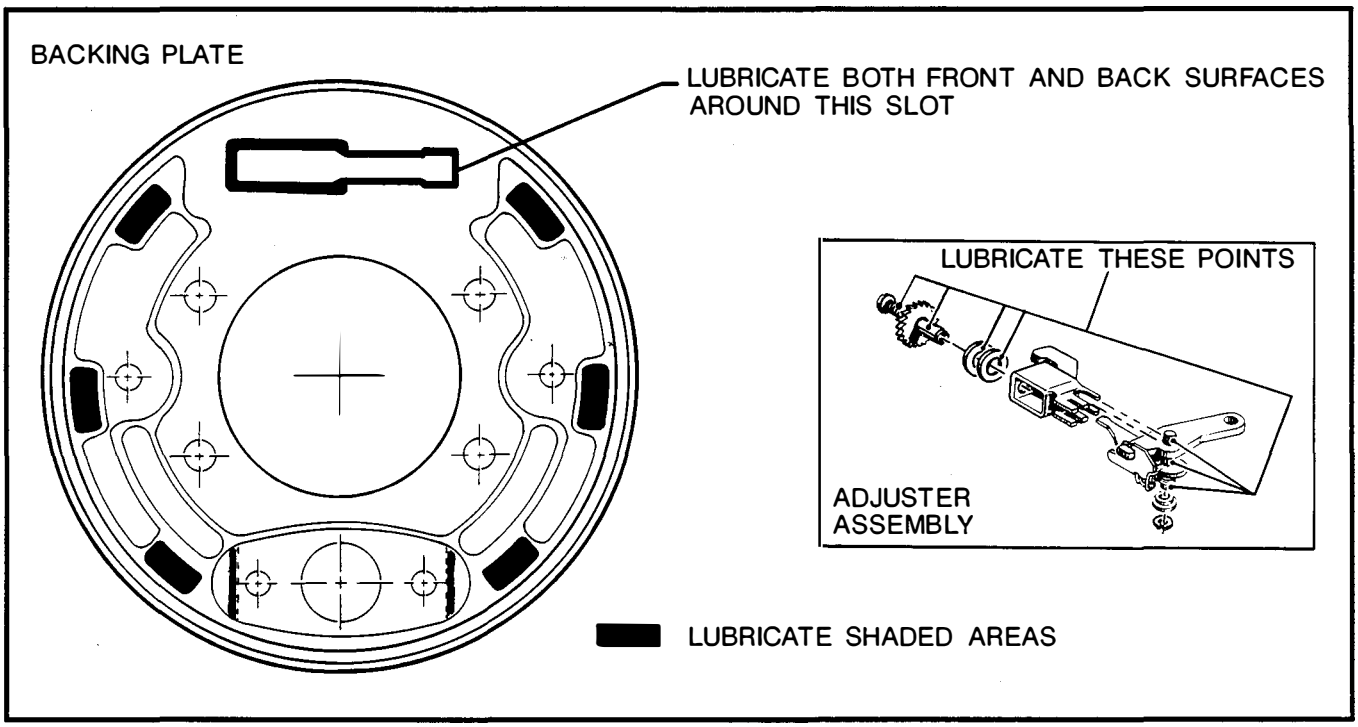


FIG. G-19 BRAKE LUBRICATION AREAS

BRAKE SHOE REMOVAL

Using a pair of pliers, compress the brake shoe retainer springs (1) at the open end of the spring.

While holding the tension pin (2) with a second set of pliers, turn the retainer spring 1/4 turn to align the slot in the spring retainer with the flats in the tension pin. Remove the brake shoe retainer springs.

Grasp the brake shoes (3) in the center and tilt them outwards and away from the back mounting plate. This will release the tension in the brake springs (4). Remove the brake springs and remove the brake shoes.

Inspect brake shoes. If a brake shoe has less than .040 lining material thickness **AT ANY POINT** on either shoe then both shoes **MUST** be replaced.

⚠ WARNING ⚠

WEAR PROTECTIVE GOGGLES AND MASK WHEN CLEANING BRAKE COMPONENTS. LUBRICATE AREAS INDICATED (FIG. G-19) **WITH COMMERCIALLY AVAILABLE BRAKE COMPONENT LUBRICANT** (available from any auto parts outlet).

Check for free lateral (front and back) movement of the adjusting mechanism and for free movement of the 'star' wheel. Remove the boot on the brake lever. Clean any accumulated brake dust from the backing plate and adjuster mechanism using a brush or air hose.

If the brake is being removed for an axle bearing and seal replacement, the four bolts and nuts securing the brake assembly to the rear axle must be removed. When reinstalling the brake mounting bolts, tighten to 23-35 ft. lbs. torque.

REPLACING BRAKE SHOES (FIG. G-17, FIG. G-18)

NOTE

The metal portion of the brake shoes differs between front and rear shoes. The identical ends of the shoes fit against the fixed anchor at the bottom of the brake. The shoe with the straight end engages in the slot in the adjusting screw, while the triangular ended shoe engages in the rear of the adjusting mechanism.

The springs must be inserted with the light spring at the top. The long hook is installed down through the rear brake shoe. The heavier bottom spring is installed with the spring hooks facing up.

Install the brake shoes using the reverse order of disassembly and secure with the brake shoe retainer springs and brake shoe return springs.

Clean the axle shaft to remove grease, dirt and all foreign matter. Apply a small amount of lubricant (Neverseize) to the spline.

Insert a straight blade screwdriver between the adjusting lever and the adjusting mechanism. Rotate the start wheel counter clockwise until the shoes have retracted sufficiently to permit the brake drum to be installed. Install washer (12), brake drum (11), washer (10), and tighten the axle nut to 70 ft. lbs. torque minimum.

If the slot in the axle nut and the hole in the axle are not in alignment, continue to tighten the axle nut until the alignment is achieved.

NOTE

Minimum torque is 70 ft. lbs. Torque readings of up to 140 ft. lbs. are satisfactory.

Install new cotter pin (8).

Move the brake lever forward and release fully, repeat until the travel of the lever is approximately 1/8". Install brake cables using clevis pin (6) and a new cotter pin (5).

COMPENSATING BRAKE LINKAGE ADJUSTMENT (FIG. G-9)

Tools Required: Qty.

Ratchet, 1/2" drive 1

Extension, 6", 1/2" drive 1

Socket, 3/4", 1/2 drive 1

Wrench, open end, 1/2" 1

Pliers 1

Hammer, ball pein 1

Raise the vehicle (see procedure in Section B)

1. Check the position of the equalizer (1) with parking (hill) brake *ENGAGED* (Detail 'A').

   a) If dimension exceeds 1/8" proceed to Step 2.

   b) If dimension is within specification proceed to Step 7.

2. Remove compensating linkage (2) from equalizer (1) by removing cotter pin (3) and clevis pin (4).

3. Remove the wheel and tire corresponding to the position of the equalizer (Detail 'A').

ADJUSTMENT OF THE WHEEL BRAKE

4. With the wheel removed, the brake lever is accessible. Push the brake lever forward and release (Detail 'B') – repeat as needed until the lever travel is approximately 1/8".

NOTE

A hammer handle works well as a tool to push the lever.

5. Reinstall wheel.

6. Reconnect compensating linkage (2).

NOTE

Always use a new cotter pin (3).

ADJUSTING COMPENSATING SPRING

7. With the parking (hill) brake *DISENGAGED*, check that the compensating spring length is between 3 7/8" and 3 15/16" (Detail C). If adjustment is required it is made at the nut (6) located in front of the spring (7) (Detail 'C').

ADJUSTING FREE PEDAL TRAVEL

8. Measure the free pedal play to determine if it is between 1" – 1 1/2". If an adjustment is required; release the jam nut (8) from the yoke (9) and adjust at the threaded rod welded nut (10) (Detail 'D').

NOTE

If the nut (6) in front of spring (7) does *NOT* rotate with the threaded rod, a second 1/2" wrench will be required. Turn both wrenches simultaneously.

Service Tip: Installing a 5/16-24 jam nut against the nut (6) and locking it in place will eliminate nut movement on the threaded rod and eliminate the need for a second wrench.

ADJUSTING THE WHEEL BRAKE AND SEATING BRAKE COMPONENTS

9. Engage the parking (hill) brake and then *RELEASE*. Repeat twenty (20) times.

NOTE

Be sure to allow the pedal to return fully after each cycle.

10. *ENGAGE* the parking (hill) brake and check for a gap of between 3/32" – 5/32" (Detail 'D'). If an adjustment is required, the adjustment is made at the welded rod adjusting nut (10).

NOTE

Be sure that the adjusting nut (6) rotates with the threaded rod. (See Service Tip).

FINAL SYSTEM CHECK

11. Remeasure the free travel (1"–1 1/2") – if an adjustment is required, the adjustment is made at the welded rod adjusting nut (10) but the gap dimension specified in Detail "D" must be maintained.
12. Tighten jam nut (8).
13. Lower vehicle.
14. Perform the "DAILY BRAKING PERFORMANCE TEST" described at the beginning of this section and return to service if the brake performance is acceptable. If performance is unacceptable, the brake shoes must be burnished to conform to the brake drum.

BURNISHING NEW BRAKE SHOES

⚠ WARNING ⚠

THIS OPERATION MUST BE DONE IN A SAFE LOCATION WITH REGARD FOR THE SAFETY OF ALL PERSONNEL

To burnish the brakes the vehicle must be operated in the forward direction at maximum governed speed and the parking (hill) brake latched. When the vehicle has stopped, the vehicle is operated in the reverse direction at maximum governed speed and the parking (hill) brake latched. This braking operation in both directions is considered as one burnishing cycle. Burnish the brakes for 15 cycles. If the brake performance is acceptable after burnishing, the vehicle may be returned to service. If the brake performance is unacceptable the 6 month maintenance **MUST** be performed again in its entirity.

PARKING (HILL) BRAKE ADJUSTMENT (FIG. G–10)

The parking (hill) brake engagement and holding force should be properly adjusted if the brakes have been adjusted per the "recommended brake adjusting procedure."

PARKING (HILL) BRAKE FUNCTION

1. To check for proper parking (hill) brake function, lift the rear of the vehicle (see procedures in Section B) so that both rear tires are clear of the ground and there are no objects near the tires.

⚠ WARNING ⚠

TO TEST FOR THE AUDIBLE "CLICK" OF THE MICRO SWITCH, THE VEHICLE FORWARD–NEUTRAL–REVERSE SWITCH MUST BE IN THE NEUTRAL POSITION OR HAVE THE REAR WHEELS RAISED TO PREVENT THE POSSIBILITY OF INJURY IF VEHICLE IS ACTIVATED.

2. Remove the seat, place the forward–neutral–reverse switch in the "forward" position, turn the ignition switch to the "on" position, and fully engage the parking (hill) brake.
3. Slowly depress the accelerator pedal until the "click" of the accelerator switch is detected (the limit switch on the accelerator switch assembly activates the solenoid). If the solenoid is activated (clicked) *AFTER* the parking (hill) brake is released, the parking (hill) brake is functioning properly.
4. If the accelerator switch solenoid is activated prior to complete parking (hill) brake disengagement, the cause may be one or a combination of the following:
   a) An improperly adjusted parking (hill) brake kick–off cam.

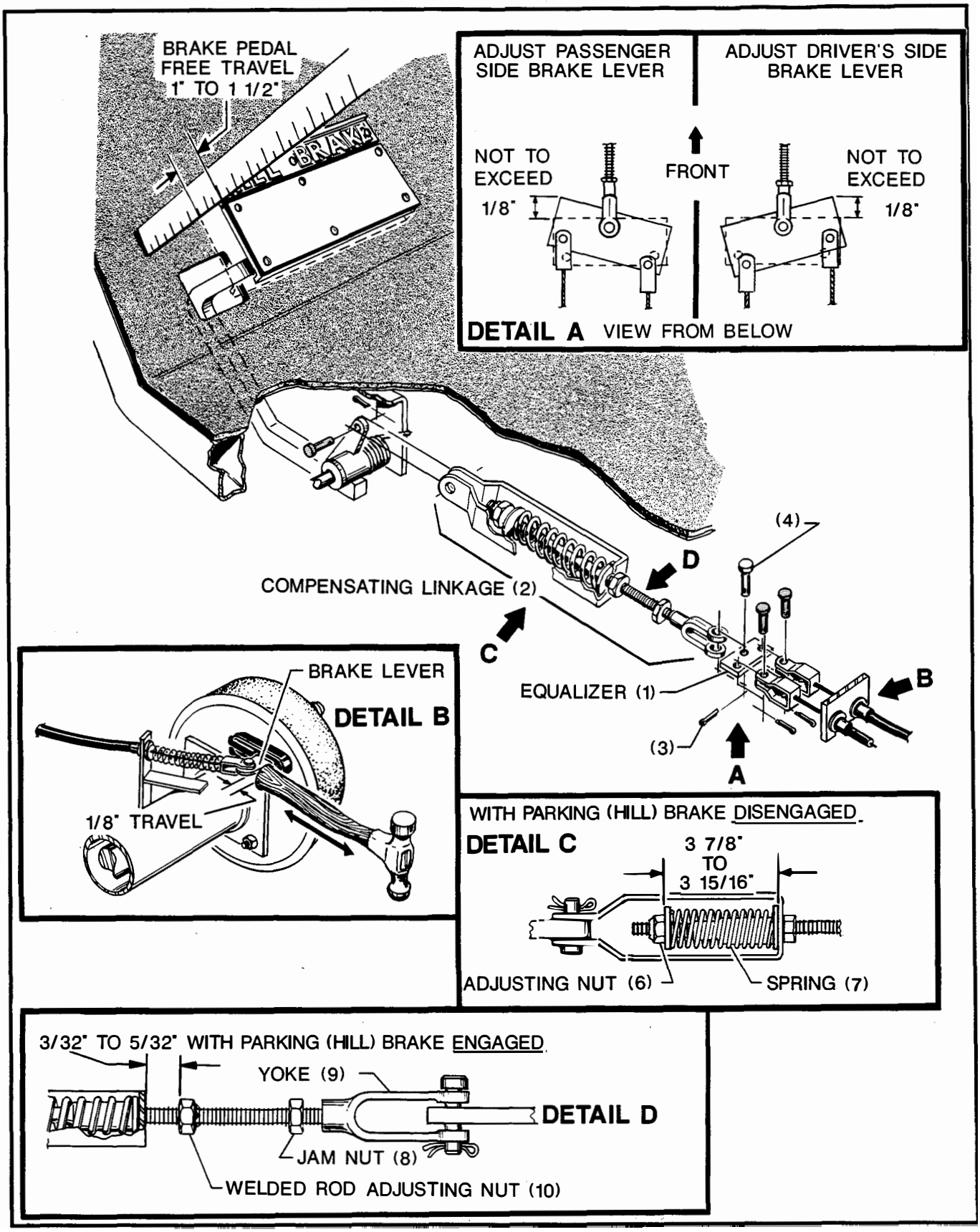


FIG. G-9 BRAKE LINKAGE ADJUSTMENT

b) The catch bracket and/or latch arm is worn or damaged.

5. To check the above items (a, b), lower the rear wheels to the ground. Lift the front of the vehicle (see procedures in Section B). If the vehicle has four wheels, remove the left front wheel (driver's side) for better access to the parking (hill) brake kick-off mechanism, and proceed as follows:

a) Inspect the catch bracket (1) and latch arm (2) for any damage or wear.

b) If the parking (hill) brake latch arm needs replacing, see section on "Disassembly of Brake Pedal".

c) If the catch bracket needs replacing, proceed as follows:

1. Be sure that the parking (hill) brake has been released.

2. Roll the floormat back from the brake area to provide access to the 1/4" catch bracket mounting nuts (5).

3. Using a 7/16" wrench, remove the 1/4" x 3/4" long bolts (3), lock washers (4), and the nuts (5) which retain the catch bracket (1) to the brake bracket.

4. Remove the catch bracket and install a new catch bracket in the reverse order of disassembly.

d) Check the cam (6) for proper adjustment. When the latch arm is engaging the catch bracket, there must *NOT* be any gap between the top of the cam and the latch arm (FIG. G-10).

e) If the cam requires adjustment, proceed as follows:

1. Engage the parking (hill) brake.

2. Loosen the two cam setscrews (7).

3. Rotate the pivot arm assembly (1, Fig. G-11) upward (clockwise when viewed from the driver's side of the vehicle) to remove the free play in the linkage.

4. Rotate the cam counterclockwise so that the top of the cam is contacting the latch arm.

5. While holding the cam and the pivot arm assembly in proper position, tighten the cam setscrews.

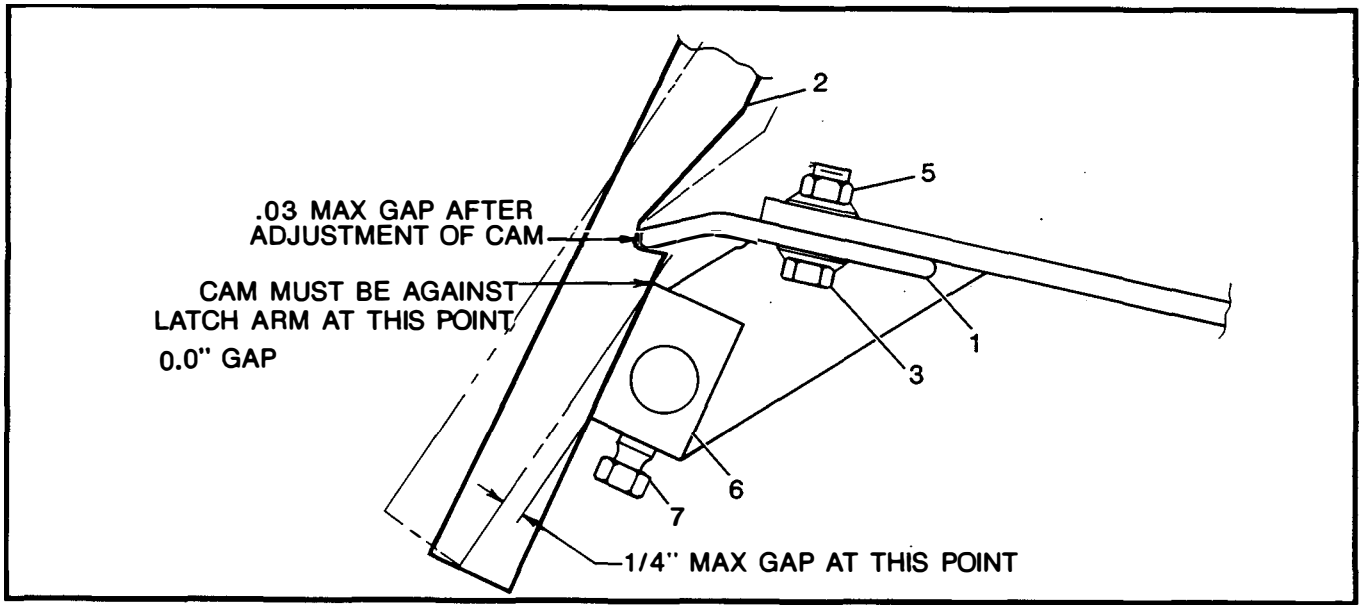


FIG. G-10 CATCH BRACKET ADJUSTMENT

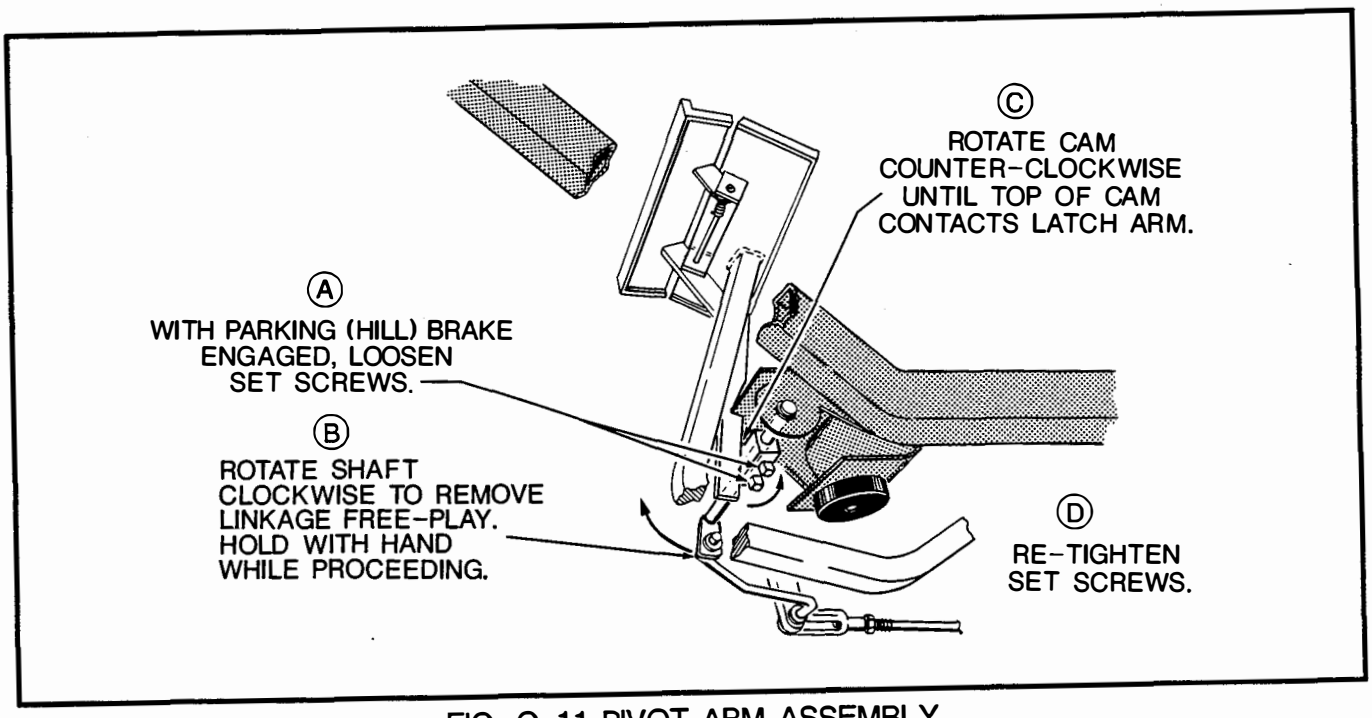


FIG. G-11 PIVOT ARM ASSEMBLY

NOTE

To assure proper braking performance, **all** periodic maintenance inspections and procedures should be performed as indicated in the schedule (Section A) i.e. Daily, Weekly, Monthly, Semi–Annually, and Annually.

GENERAL

The overall brake system consists of:

(a) self–adjusting wheel brake units which normally do not require adjustment until internal components have worn to a point of needing replacement.

(b) actuating linkages requiring periodic adjustment to compensate for normal wear of system components and/or their replacement.

NOTE

A **complete** brake system adjustment procedure **must** be performed whenever **any part of the brake system** has been replaced. (FIG. G–20)

DAILY BRAKING PERFORMANCE TEST

To determine the adequacy of the vehicles brake system, the following test should be performed daily:

⚠ **WARNING** ⚠

ALL DRIVING BRAKE TESTS MUST BE DONE IN A SAFE LOCATION WITH REGARD FOR THE SAFETY OF ALL PERSONNEL

The recommended way of performing the daily brake test and determining any vehicles that have unacceptable braking performance is to have personnel handling the vehicles latch the hill brake at a **common point** on a paved surface while traveling at maximum governed speed. The vehicle stopping location must be observed and vehicles that stop in a significantly greater distance than other acceptable vehicles should **immediately** be removed from service and inspected by a qualified mechanic.

The mechanic should perform a "panic" stop on the suspect vehicle(s) by applying maximum force and travel to the brake pedal while traveling at full speed. He should observe if either of the rear wheels fails to "lock up". If one wheel fails to lock, it is reasonable to expect that a problem exists with the service brake system and the **6 Month Brake Maintenance** must be performed in its entirety. If both wheels lock, the parking (hill) brake must be adjusted and the vehicle re–tested per the **Daily Brake Test.**

6 MONTH BRAKE MAINTENANCE

Raise the entire vehicle as specified in Safety Procedures Section B of the operation and service manual.

Rotate each rear wheel by hand, and feel for a dragging brake shoe that prevents smooth movement of the wheel and brake drum.

Remove the clevis pin from both cables where they attach to the wheel brake levers.

Again rotate each wheel by hand and feel for a dragging brake shoe that prevents smooth movement of the wheel and brake drum. If the wheel rotates more smoothly than with the brake cables attached, a worn or damaged brake cable is indicated and **MUST** be replaced.

Inspect the cables for abrasion to the cable housing. A kinked cable or a cable housing that has worn to the point of exposing the metal jacket will result in the cable dragging. Any worn or kinked cables **MUST** be replaced. Operate the brake pedal and observe the movement of the cables. Both should move the same amount and return fully when the brake pedal is released. If the brake pedal does not return to the full up position, excess pedal bushing friction is indicated. The bushing must be removed and lubricated or replaced. Observe the equalizer bar to see if it pivots during operation of the brake pedal. A pivoting equalizer bar, uneven movement or failure of the brake cables to return fully indicates a dragging brake cable which **MUST** be replaced.

Remove each brake drum and shoes according to procedures indicated in **BRAKE DRUM, SHOE AND BRAKE ASSEMBLY REMOVAL** section. Clean and inspect all brake parts. If there is evidence of rust or if the adjuster does not move smoothly in the backing plate, the surfaces must be cleaned and smoothed using an emery cloth. The backing plate **MUST** be replaced if excessive wear such as gouges or galling are in evidence on the backing plate.

INSPECTION OF BRAKE SHOES

The pattern of normal brake shoe wear is shown (FIG. G-12) in quadrants A, B, C and D with quadrant 'A' showing the most wear, 'B' will show the second most wear. Quandrants A and C will always be to the rear of the vehicle.

Inspect brake shoes. Brake shoes **MUST** be replaced as a set when either shoe has a lining thickness less than .040 in. thick **AT ANY POINT** on the shoe.

After lubricating the backing plate and adjuster mechanism at the lubrication points shown in illustration (FIG. G-19), re-assemble and adjust the complete brake system according to the procedures outlined in the section later in this chapter.

NOTE

A **complete** brake system adjustment procedure **must** be performed whenever **any part of the brake system** has been replaced. (FIG. G-20)

Retest according to DAILY BRAKING PERFORMANCE TEST.

HOW THE BRAKE SYSTEM WORKS

An overall view of the brake system is shown in FIG. G-13.

The brakes are the "servo acting" type.

The wheel brake is a self-adjusting unit and should not require any adjustment until internal components have worn to a point of needing replacement. Also, periodic adjustment to the actuating linkage may be required to compensate for component wear or as a result of a component replacement.

Depressing the brake pedal causes the brake cable to pull the brake actuating lever forward which in turn pushes the rear brake shoe against the brake drum. Continued movement of the brake actuating lever causes the lever slide mechanism to move which pushes the front shoe against the drum. As the shoes contact the drum "servo action" takes place. If the vehicle is moving forward the rear brake shoe moves upwards applying pressure against the upper rear portion of the brake drum. The front shoe moves downwards applying pressure against the lower front portion of the brake drum.

The action reverses when the brakes are applied with the vehicle operating in reverse.

HOW THE ADJUSTER WORKS (FIG. G-14)

The brake has an automatic adjuster mechanism that compensates for lining wear.

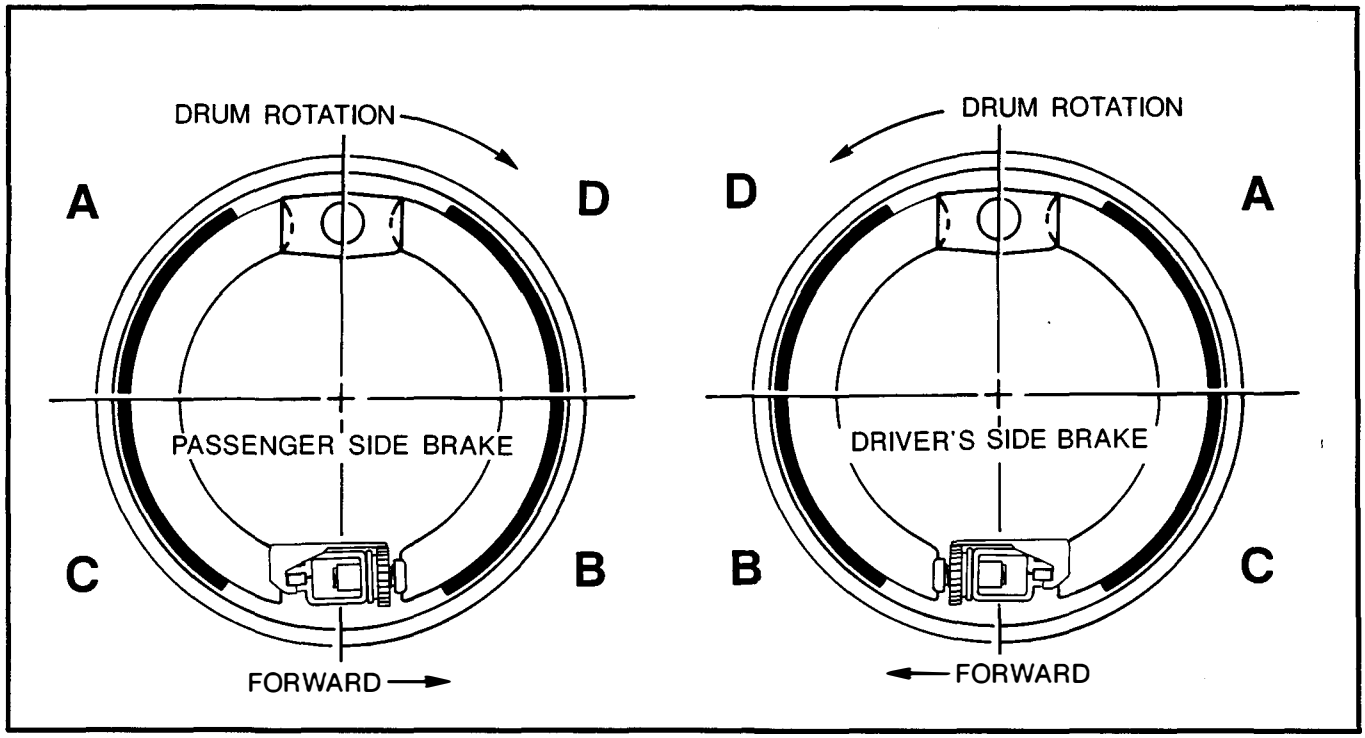


FIG. G-12 BRAKE WEAR

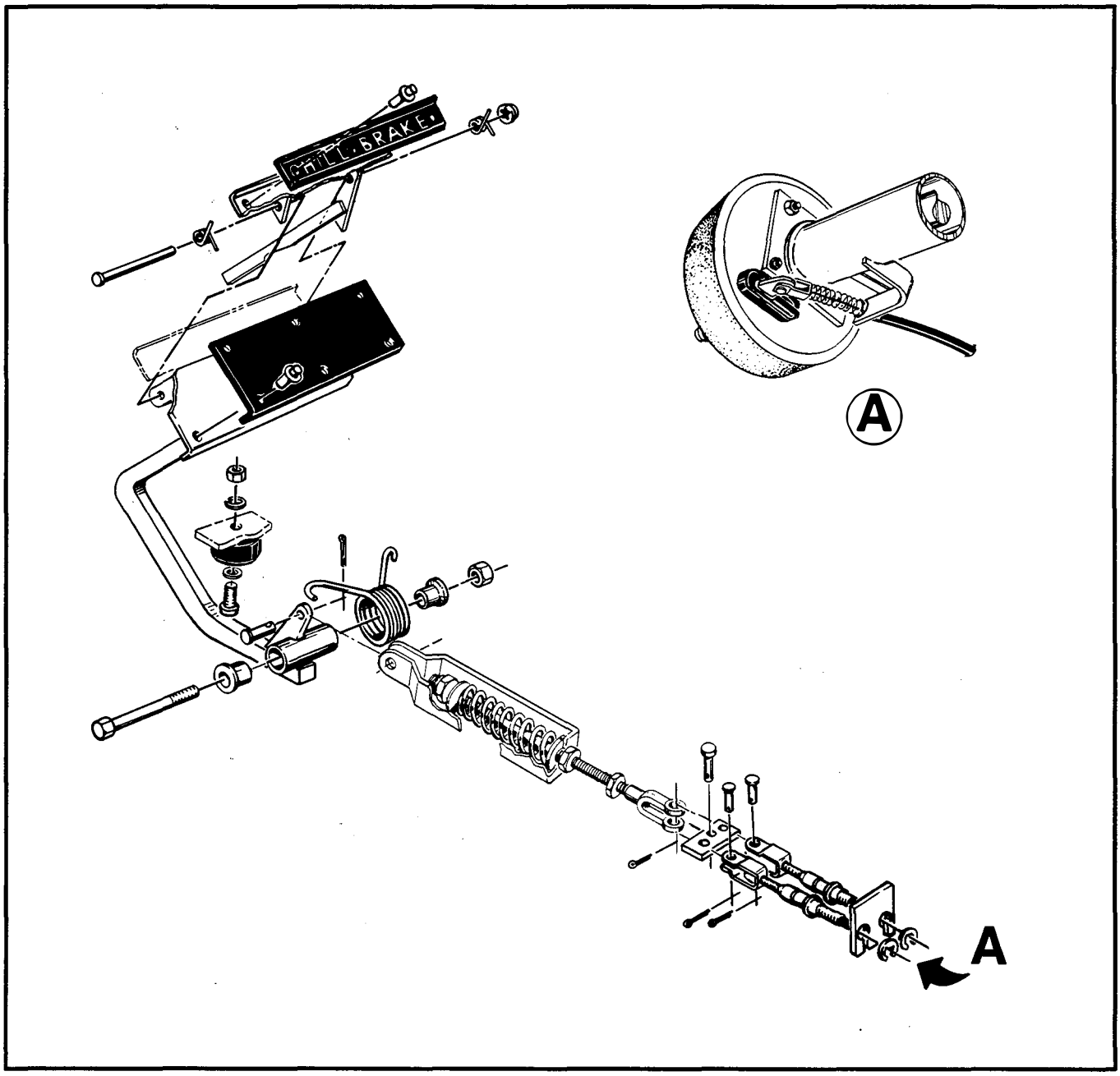
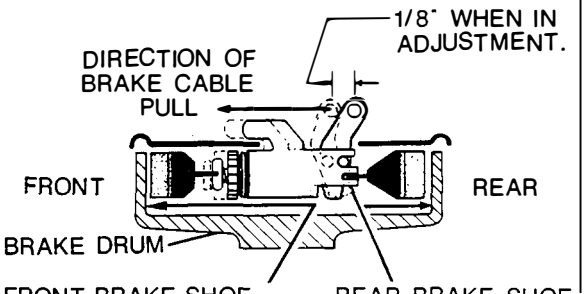


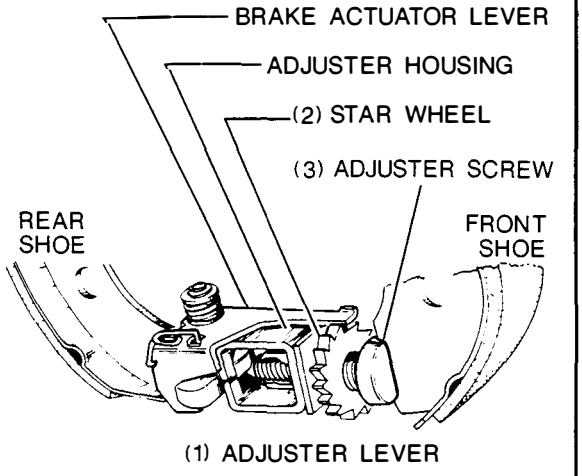
FIG. G-13 BRAKE LINKAGE

The brake adjuster is activated by movement of the lever attached to the brake cable. Movement of this lever activates the adjuster lever (1) which rotates the 'star' wheel (2). The star wheel's rotation pushes the adjuster screw (3) outwards which in turn moves the brake shoes outward. With the brake correctly adjusted, the adjuster lever does not have enough movement to rotate the star wheel since lever movement is limited to approximately 1/8". The 1/8" of movement limits the adjuster lever's motion to the flat of the tooth that it is sitting on.

As the brake shoe wears, the lever's motion increases which causes the adjuster lever to engage the next tooth of the star wheel. The star wheel is then rotated which expands the brake shoes.

ILLUSTRATIONS SHOW PASSENGER SIDE BRAKE ONLY. DRIVER'S SIDE IS MIRROR IMAGE.





NOTE: TEETH ARE NUMBERED IN ILLUSTRATION TO CLARIFY THEIR POSITIONS.

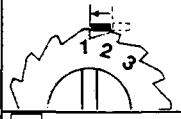
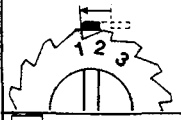
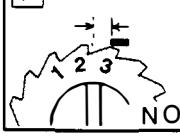
THE DISTANCE OF THE ADJUSTER LEVER TRAVEL IS REGULATED BY THE AMOUNT OF BRAKE SHOE WEAR.(A)	A 	POSITION OF ADJUSTER LEVER WITH BRAKES DISENGAGED.
WHEN BRAKE SHOE WEAR IS MINIMAL, THE DISTANCE OF ADJUSTER LEVER TRAVEL IS TOO SHORT TO FULLY RE-ADJUST BRAKES.(B)	B 	POSITION OF ADJUSTER LEVER WITH MINIMUM SHOE WEAR AND BRAKES ENGAGED.
AS SHOE WEAR INCREASES, ADJUSTER LEVER TRAVEL INCREASES, THUS TURNING THE STAR WHEEL.(C)	C 	POSITION OF ADJUSTER LEVER WITH BRAKES ENGAGED AND SHOES WORN TO POINT OF NEEDING SELF-ADJUSTMENT.
WHEN BRAKE SHOES HAVE WORN SUFFICIENTLY TO REQUIRE RE-ADJUSTMENT, THE ADJUSTER LEVER ADVANCES AND RATCHETS TO THE NEXT TOOTH WHEN BRAKES ARE RELEASED.(D)	D 	POSITION OF ADJUSTER LEVER WITH BRAKES DISENGAGED AND READY TO RESET ADJUSTER SCREW.
WHEN BRAKE IS NEXT ENGAGED, THE ADJUSTER LEVER WILL ROTATE THE STAR WHEEL FAR ENOUGH TO EXTEND THE ADJUSTER SCREW, THUS RE-SETTING THE PROPER SHOE/DRUM CLEARANCE.(E)	E 	POSITION OF ADJUSTER LEVER WITH BRAKES ENGAGED DURING RE-ADJUSTMENT OF SCREW.
WHEN THE SHOE/DRUM CLEARANCE IS RESET, LESS EFFORT IS REQUIRED TO ENGAGE THE BRAKES, THUS THE ADJUSTER LEVER TRAVEL IS ONCE AGAIN REDUCED.(F,A)	F 	POSITION OF ADJUSTER LEVER WITH BRAKES DISENGAGED AND RE-ADJUSTMENT COMPLETED. NOTE NEW POSITIONS OF TEETH.

FIG. G-14 HOW THE BRAKE ADJUSTER WORKS

DISASSEMBLY OF BRAKE PEDAL (FIG. G-15)

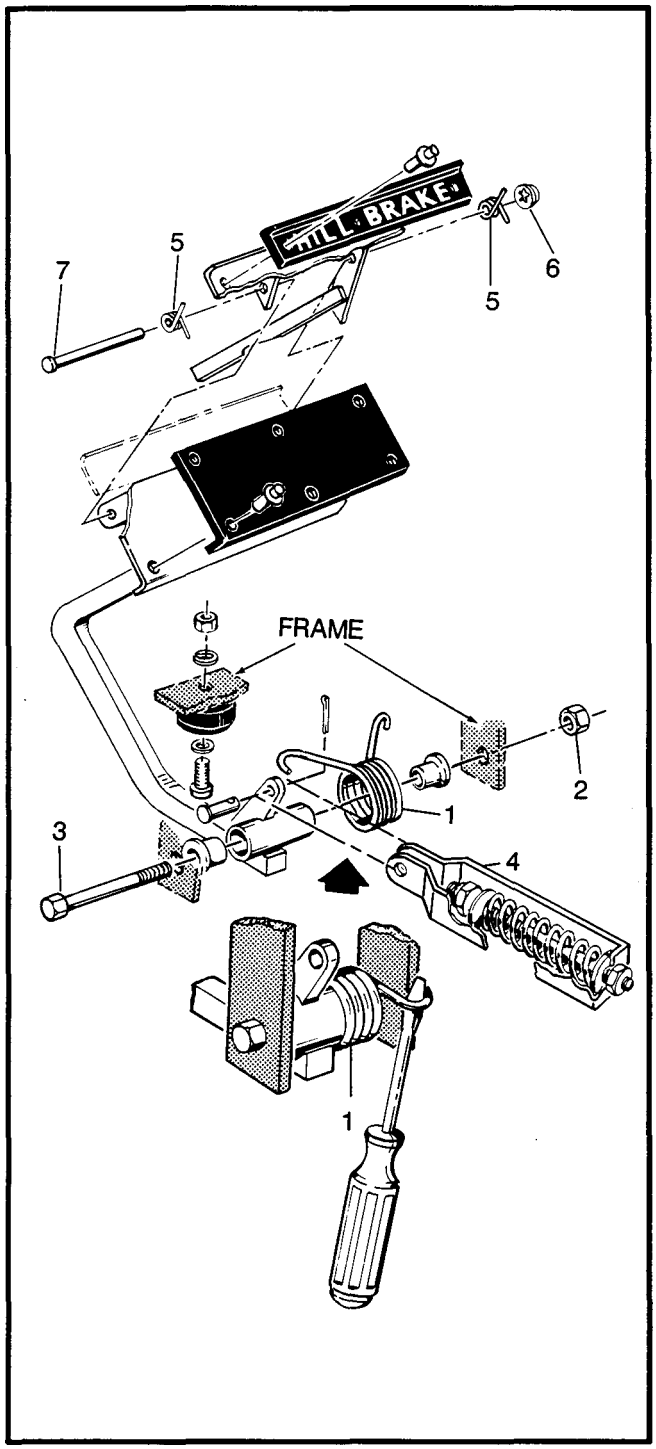


FIG. G-15 BRAKE PEDAL SPRING REMOVAL

Tools Required: Qty.

Screwdriver, straight blade 1

Pliers 1

Hammer, ball pein 1

Unhook the pedal return spring (1). (Insert a thin blade screwdriver between the small hook end and the pedal bracket, move spring back and away from the bracket.)

Remove the lock nut (2) from the pivot bolt (3) and remove the bolt. Remove the spring, disconnect the cable clevis (4) and lift the pedal out through the floorboard.

To remove the parking (hill) brake pedal, note the position of the two springs (5). Remove the "push on" retainer nut (6) (new nut required for assembly), and remove the hinge pin (7). Reassemble in the reverse order of disassembly.

REMOVAL OF PARKING (HILL) BRAKE RELEASE LINKAGE (FIG. G-16)

Tools Required: Qty.

Pliers 1

Jack, Hydraulic Trolley 1

Jack stands 1

Wrench, open end, 1/4" 1

To remove the parking (hill) brake release linkage, raise the front of vehicle (see procedure in Section B) to allow access to underside.

To remove the linkage rod (1), remove the cotter pin (2) and washers (3) and (12) from lever arm (4).

Loosen the two setscrews (5) in cam (6), and remove the pivot arm shaft (4). The cam (6) and nylon spacer (9) will come out when the pivot arm shaft is removed.

If the spacer (9) or bearings (10 and 11) are worn, replace them with new spacers or bearings.

Reassemble by reverse procedure.

NOTE

It may be necessary to remove the indentures on the shaft (4) caused by the setscrews (5).

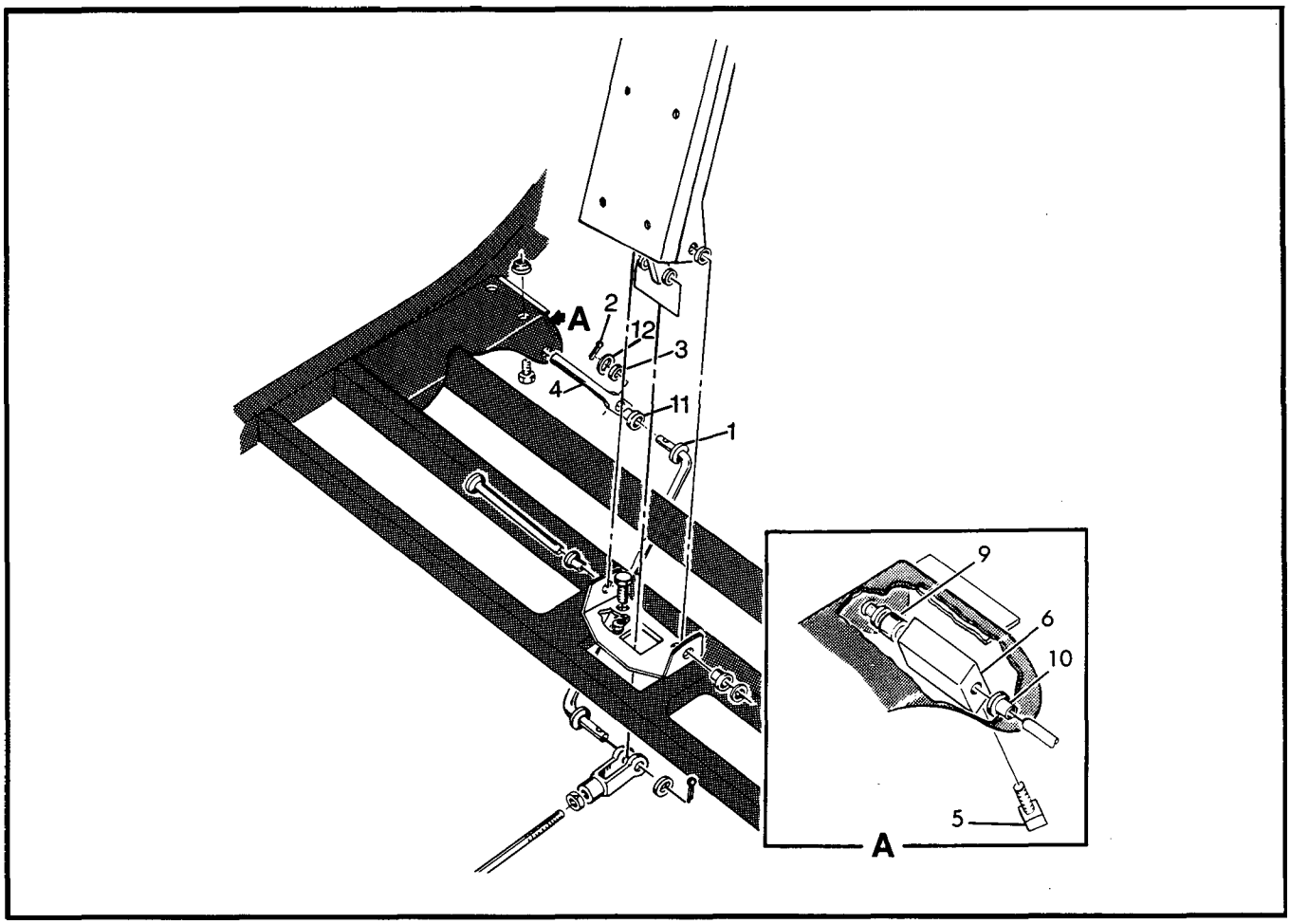


FIG. G-16 BRAKE "KICK OFF" LINKAGE

BRAKE DRUM, SHOE AND BRAKE ASSEMBLY REMOVAL (FIG. G-17, FIG. G-18)

Tools Required: Qty.

- Jack, hydraulic trolley 1
- Hammer, plastic tipped 1
- Jack stands 4
- Screwdriver, flat blade 2
- Socket, 1/2", 1/2" drive 1
- Ratchet, 1/2" 1
- Socket, 1 1/16", 1/2" drive 1
- Torque wrench, 1/2" drive 1
- Pliers 2
- Wrench, open end, 1/2" 1

DRUM REMOVAL (FIG. G-18)

Loosen lug nuts on rear wheels 1/8 to 1/4 turn. Raise the vehicle (see procedure in Section B). Remove the rear wheel(s).

Remove the cotter pin (5) and clevis pin (6) from the brake lever. Remove the cotter pin (8) from the axle nut (9) and remove the nut and washer (10). *TAP* the brake drum (11) with a plastic faced hammer to remove the drum. If the drum does not come off, it will be necessary to loosen the brake adjuster mechanism.

Rotate the brake drum until one of the holes is located over the star wheel position (7 o'clock for driver's side, 5 o'clock for passenger side).

The hole is aligned with the brake adjuster mechanism when in this position. Insert a flat blade screwdriver between the adjuster lever and the adjuster screw housing. Insert a second flat blade screwdriver and push on the top portion of the 'star' wheel which will loosen the adjuster screw and retract the shoes to permit the drum to be removed.

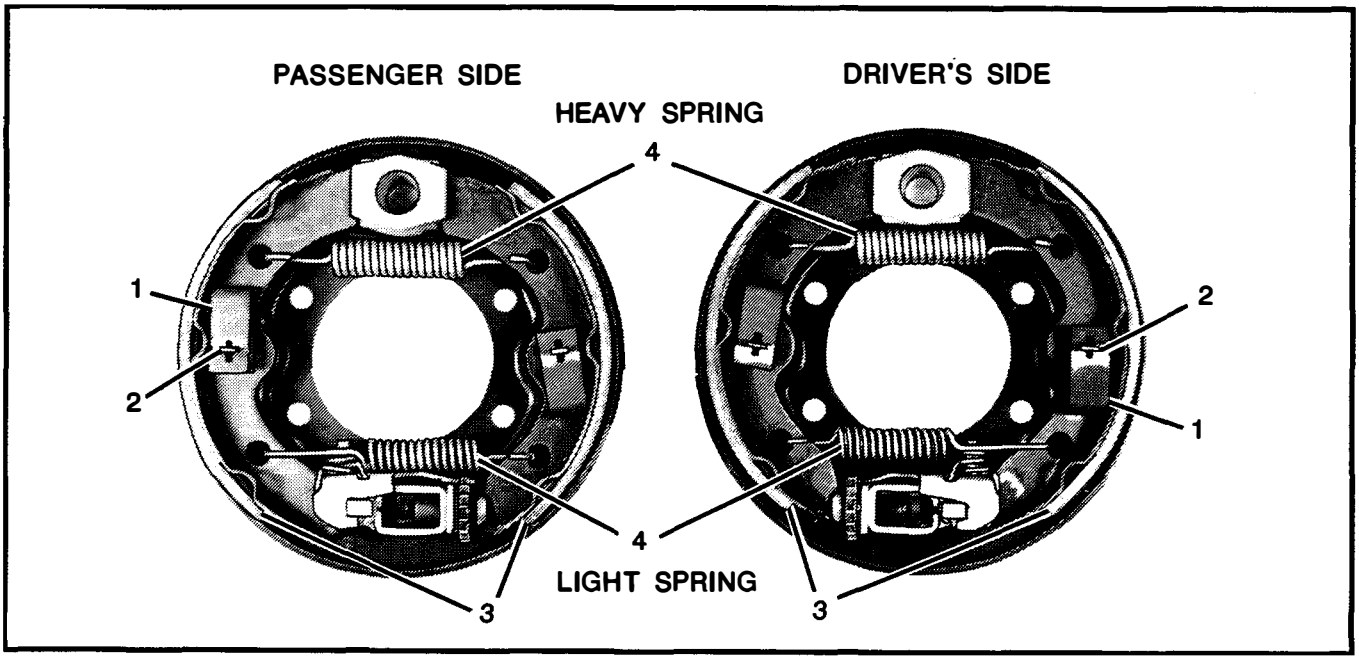


FIG. G-17 WHEEL BRAKES DRIVER'S AND PASSENGER SIDE

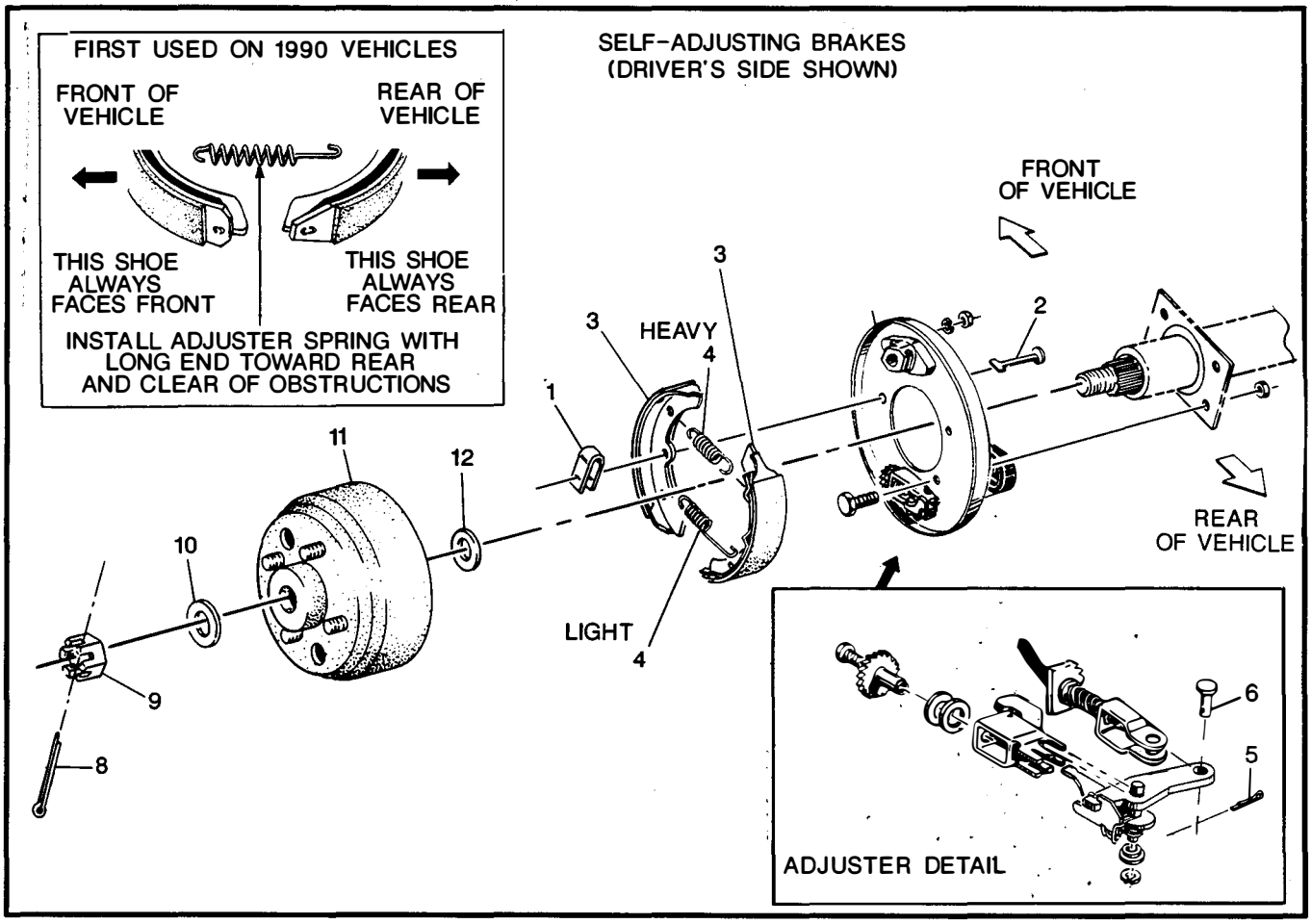


FIG. G-18 WHEEL BRAKE COMPONENTS

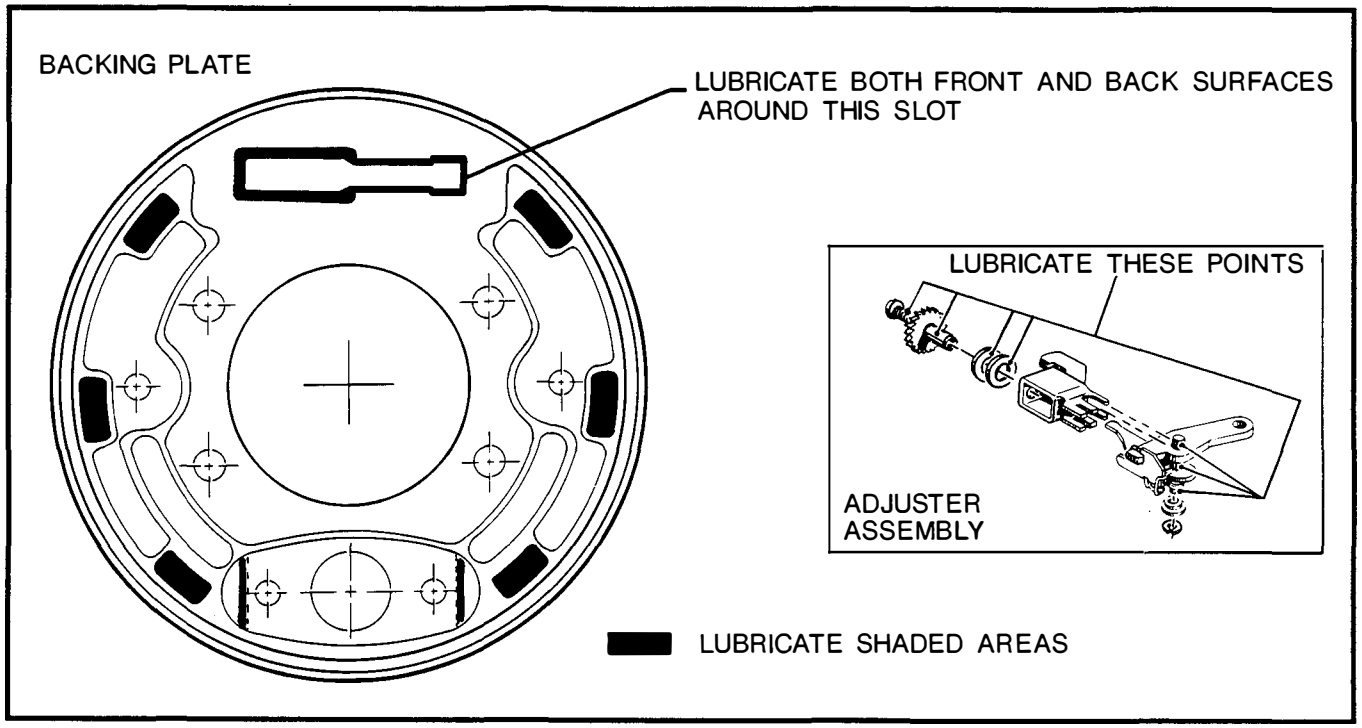


FIG. G-8 BRAKE LUBRICATION AREAS

BRAKE SHOE REMOVAL

Using a pair of pliers, compress the brake shoe retainer springs (1) at the open end of the spring.

While holding the tension pin (2) with a second set of pliers, turn the retainer spring 1/4 turn to align the slot in the spring retainer with the flats in the tension pin. Remove the brake shoe retainer springs.

Grasp the brake shoes (3) in the center and tilt them outwards and away from the back mounting plate. This will release the tension in the brake springs (4). Remove the brake springs and remove the brake shoes.

Inspect brake shoes. If a brake shoe has less than .040 lining material thickness **AT ANY POINT** on either shoe then both shoes **MUST** be replaced.

⚠ WARNING ⚠

WEAR PROTECTIVE GOGGLES AND MASK WHEN CLEANING BRAKE COMPONENTS. LUBRICATE AREAS INDICATED (FIG. G-8) **WITH COMMERCIALLY AVAILABLE BRAKE COMPONENT LUBRICANT** (available from any auto parts outlet).

Check for free lateral (front and back) movement of the adjusting mechanism and for free movement of the 'star' wheel. Remove the boot on the brake lever. Clean any accumulated brake dust from the backing plate and adjuster mechanism using a brush or air hose.

If the brake is being removed for an axle bearing and seal replacement, the four bolts and nuts securing the brake assembly to the rear axle must be removed. When reinstalling the brake mounting bolts, tighten to 23-35 ft. lbs. torque.

REPLACING BRAKE SHOES (FIG. G-6, FIG. G-7)

NOTE

The metal portion of the brake shoes differs between front and rear shoes. The identical ends of the shoes fit against the fixed anchor at the top of the brake. The shoe with the straight end engages in the slot in the adjusting screw, while the triangular ended shoe engages in the rear of the adjusting mechanism.

The springs must be inserted with the light spring at the bottom. The long hook is installed down through the rear brake shoe. The heavier top spring is installed with the spring hooks facing up.

Install the brake shoes using the reverse order of disassembly and secure with the brake shoe retainer springs and brake shoe return springs.

Clean the axle shaft to remove grease, dirt and all foreign matter. Apply a small amount of lubricant (Neverseize) to the spline.

Insert a straight blade screwdriver between the adjusting lever and the adjusting mechanism. Rotate the start wheel counter clockwise until the shoes have retracted sufficiently to permit the brake drum to be installed. Install washer (12), brake drum (11), washer (10), and tighten the axle nut to 70 ft. lbs. torque minimum.

If the slot in the axle nut and the hole in the axle are not in alignment, continue to tighten the axle nut until the alignment is achieved.

NOTE

Minimum torque is 70 ft. lbs. Torque readings of up to 140 ft. lbs. are satisfactory.

Install new cotter pin (8).

Move the brake lever forward and release fully, repeat until the travel of the lever is approximately 1/8". Install brake cables using clevis pin (6) and a new cotter pin (5).

COMPENSATING BRAKE LINKAGE ADJUSTMENT (FIG. G–20)

Tools Required: Qty.

Ratchet, 1/2" drive 1

Extension, 6", 1/2" drive 1

Socket, 3/4", 1/2 drive 1

Wrench, open end, 1/2" 1

Pliers 1

Hammer, ball pein 1

Raise the vehicle (see procedure in Section B)

1. Check the position of the equalizer (1) with parking (hill) brake *ENGAGED* (Detail 'A').

   a) If dimension exceeds 1/8" proceed to Step 2.

   b) If dimension is within specification proceed to Step 7.

2. Remove compensating linkage (2) from equalizer (1) by removing cotter pin (3) and clevis pin (4).

3. Remove the wheel and tire corresponding to the position of the equalizer (Detail 'A').

ADJUSTMENT OF THE WHEEL BRAKE

4. With the wheel removed, the brake lever is accessible. Push the brake lever forward and release (Detail 'B') – repeat as needed until the lever travel is approximately 1/8".

NOTE

A hammer handle works well as a tool to push the lever.

5. Reinstall wheel.

6. Reconnect compensating linkage (2).

NOTE

Always use a new cotter pin (3).

ADJUSTING COMPENSATING SPRING

7. With the parking (hill) brake *DISENGAGED*, check that the compensating spring length is 3 15/16" (Detail C). If adjustment is required it is made at the nut (6) located in front of the spring (7) (Detail 'C').

ADJUSTING FREE PEDAL TRAVEL

8. Measure the free pedal play to determine if it is between 1" – 1 1/2". If an adjustment is required; release the jam nut (8) from the yoke (9) and adjust at the threaded rod welded nut (10) (Detail 'D').

NOTE

If the nut (6) in front of spring (7) does *NOT* rotate with the threaded rod, a second 1/2" wrench will be required. Turn both wrenches simultaneously.

Service Tip: Installing a 5/16–24 jam nut against the nut (6) and locking it in place will eliminate nut movement on the threaded rod and eliminate the need for a second wrench.

ADJUSTING THE WHEEL BRAKE AND SEATING BRAKE COMPONENTS

9. Engage the parking (hill) brake and then *RELEASE*. Repeat twenty (20) times.

NOTE

Be sure to allow the pedal to return fully after each cycle.

10. *ENGAGE* the parking (hill) brake and check for a gap of 3/32" (Detail 'D'). If an adjustment is required, the adjustment is made at the welded rod adjusting nut (10).

NOTE

Be sure that the adjusting nut (6) rotates with the threaded rod. (See Service Tip).

FINAL SYSTEM CHECK

11. Remeasure the free travel (1"-1 1/2") - if an adjustment is required, the adjustment is made at the welded rod adjusting nut (10) but the gap dimension specified in Detail "D" must be maintained.
12. Tighten jam nut (8).
13. Lower vehicle.
14. Perform the "DAILY BRAKING PERFORMANCE TEST" described at the beginning of this section and return to service if the brake performance is acceptable. If performance is unacceptable, the brake shoes must be burnished to conform to the brake drum.

BURNISHING NEW BRAKE SHOES

⚠ WARNING ⚠

THIS OPERATION MUST BE DONE IN A SAFE LOCATION WITH REGARD FOR THE SAFETY OF ALL PERSONNEL

To burnish the brakes the vehicle must be operated in the forward direction at maximum governed speed and the parking (hill) brake latched. When the vehicle has stopped, the vehicle is operated in the reverse direction at maximum governed speed and the parking (hill) brake latched. This braking operation in both directions is considered as one burnishing cycle. Burnish the brakes for 15 cycles. If the brake performance is acceptable after burnishing, the vehicle may be returned to service. If the brake performance is unacceptable the 6 month maintenance **MUST** be performed again in its entirety.

PARKING (HILL) BRAKE ADJUSTMENT (FIG. G-10)

The parking (hill) brake engagement and holding force should be properly adjusted if the brakes have been adjusted per the "recommended brake adjusting procedure."

PARKING (HILL) BRAKE FUNCTION

1. To check for proper parking (hill) brake function, lift the rear of the vehicle (see procedures in Section B) so that both rear tires are clear of the ground and there are no objects near the tires.

⚠ WARNING ⚠

TO TEST FOR THE AUDIBLE "CLICK" OF THE MICRO SWITCH, THE VEHICLE FORWARD-NEUTRAL-REVERSE SWITCH MUST BE IN THE NEUTRAL POSITION OR HAVE THE REAR WHEELS RAISED TO PREVENT THE POSSIBILITY OF INJURY IF VEHICLE IS ACTIVATED.

2. Remove the seat, place the forward-neutral-reverse switch in the "forward" position, turn the ignition switch to the "on" position, and fully engage the parking (hill) brake.
3. Slowly depress the accelerator pedal until the "click" of the accelerator switch is detected (the limit switch on the accelerator switch assembly activates the solenoid). If the solenoid is activated (clicked) *AFTER* the parking (hill) brake is released, the parking (hill) brake is functioning properly.
4. If the accelerator switch solenoid is activated prior to complete parking (hill) brake disengagement, the cause may be one or a combination of the following:
   a) An improperly adjusted parking (hill) brake kick-off cam.

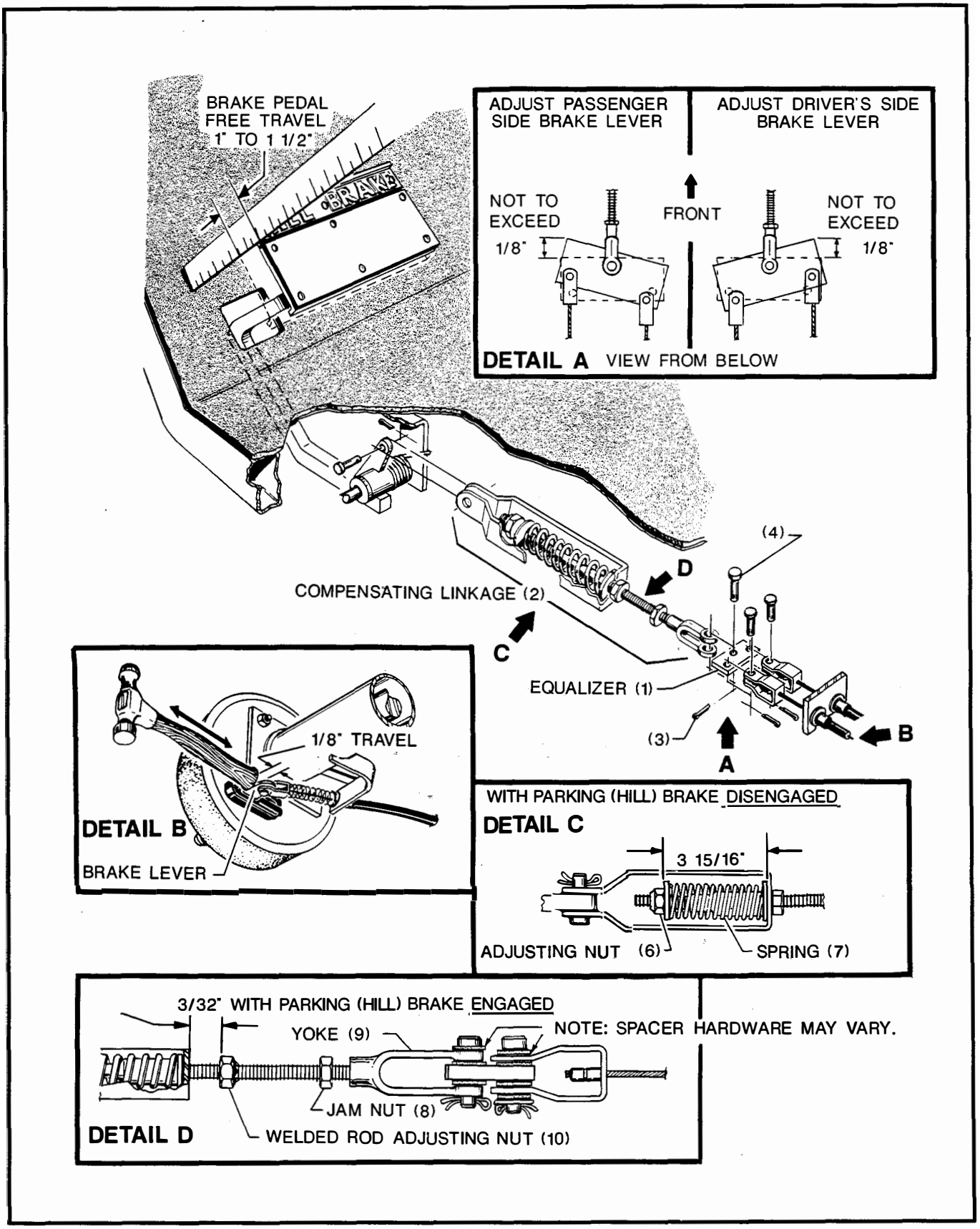


FIG. G-9 BRAKE LINKAGE ADJUSTMENT

b) The catch bracket and/or latch arm is worn or damaged.

5. To check the above items (a, b), lower the rear wheels to the ground. Lift the front of the vehicle (see procedures in Section B). If the vehicle has four wheels, remove the left front wheel (driver's side) for better access to the parking (hill) brake kick-off mechanism, and proceed as follows:

a) Inspect the catch bracket (1) and latch arm (2) for any damage or wear.

b) If the parking (hill) brake latch arm needs replacing, see section on "Disassembly of Brake Pedal".

c) If the catch bracket needs replacing, proceed as follows:

1. Be sure that the parking (hill) brake has been released.

2. Roll the floormat back from the brake area to provide access to the 1/4" catch bracket mounting nuts (5).

3. Using a 7/16" wrench, remove the 1/4" x 3/4" long bolts (3), lock washers (4), and the nuts (5) which retain the catch bracket (1) to the brake bracket.

4. Remove the catch bracket and install a new catch bracket in the reverse order of disassembly.

d) Check the cam (6) for proper adjustment. When the latch arm is engaging the catch bracket, there must *NOT* be any gap between the top of the cam and the latch arm (FIG. G-10).

e) If the cam requires adjustment, proceed as follows:

1. Engage the parking (hill) brake.

2. Loosen the two cam setscrews (7).

3. Rotate the pivot arm assembly (1, Fig. G-11) upward (clockwise when viewed from the driver's side of the vehicle) to remove the free play in the linkage.

4. Rotate the cam counterclockwise so that the top of the cam is contacting the latch arm.

5. While holding the cam and the pivot arm assembly in proper position, tighten the cam setscrews.

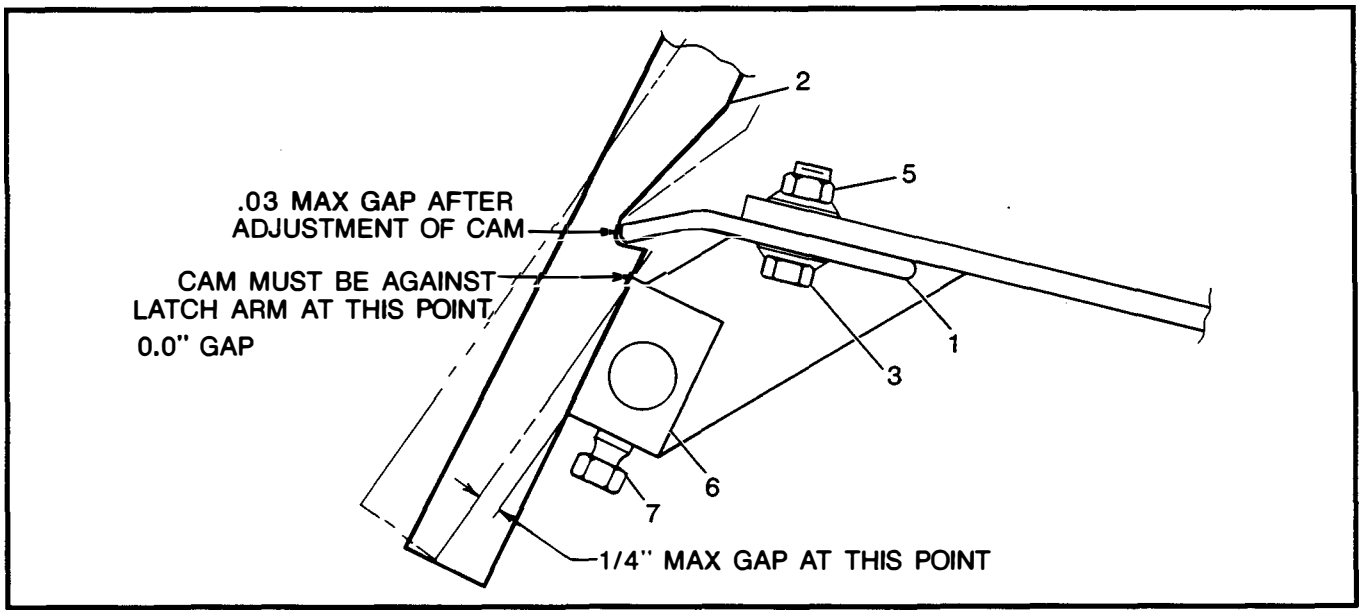


FIG. G-10 CATCH BRACKET ADJUSTMENT

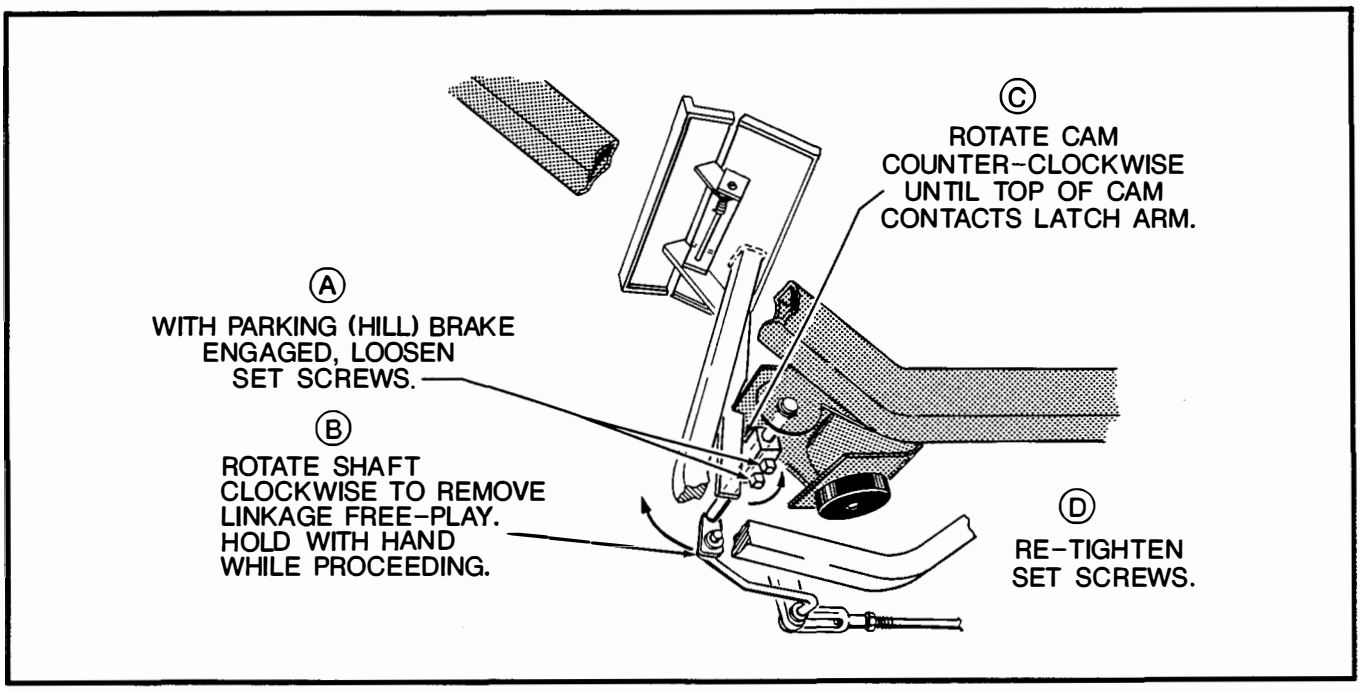


FIG. G-11 PIVOT ARM ASSEMBLY

NOTE

To assure correct braking performance, all periodic maintenance, inspections and procedures must be performed as indicated in the Periodic Service Schedule in Section 'A' of this manual. ***It is most important that a Daily Brake Performance Test be performed and the entire brake system be serviced in accordance with the Periodic Service Schedule.***

GENERAL

(See Fig. G-1 "Brake System" on page G-30)

The brake system is mechanical and consists of actuating linkages and self adjusting wheel brake assemblies. The actuating linkages require periodic adjustment to compensate for the normal wear of system components. Replacement of any linkage components will also require a linkage adjustment.

The wheel brake units are self adjusting which automatically adjust to compensate for brake shoe wear. The brake **does** require routine inspection and lubrication (see Periodic Service Schedule in Section 'A' of this manual) of the backing plate and adjuster mechanism.

NOTE

If ***any*** *brake system component is replaced, the* ***entire*** *brake system must be adjusted.*

To determine the adequacy of the vehicles brake system, a brake performance test should be performed daily.

DAILY BRAKE PERFORMANCE TEST

⚠ WARNING ⚠

ALL BRAKE TESTS MUST BE DONE IN A SAFE LOCATION WITH REGARD FOR THE SAFETY OF ALL PERSONNEL.

General

Since weather conditions and terrain frequently vary, no specific braking distance can be specified. The test is intended to compare similar vehicles by applying the parking brake (to eliminate different pedal pressures) at a common point to determine if any vehicle shows significantly different braking characteristics from other vehicles being tested.

Since loss of braking performance can deteriorate over a prolonged period, brake performance characteristics should also be compared to the performance of a new vehicle.

Test Method

On a dry paved surface that is free of gravel, sand, etc., approach a marker at governed speed. Engage and latch the parking (Park) brake at the marker and observe the stopping distance of the vehicle. Any vehicle that stops in a significantly greater distance than an acceptable vehicle should be tested again. If it again fails to stop in an acceptable distance, it should be immediately removed from service and inspected by a qualified mechanic.

The mechanic should sit in the center of the seat to equalize weight distribution and perform a 'panic stop' by applying maximum force and travel to the service brake pedal while moving at full governed speed. If both wheels lock as the result of the panic stop, it is reasonable to assume that the problem originates in the parking brake system and the parking brake should be adjusted. If one wheel fails to lock, it is reasonable to suspect the service brake system and a complete brake maintenance (described elsewhere in this section) must be performed.

Test the vehicle before returning it to service.

HOW THE BRAKE SYSTEM WORKS

Wheel Brake Servo Action

(See Fig. G-2 "Brake Wear" on page G-31)

NOTE

The wheel brakes are 'servo acting' and should not require any adjustment for brake shoe wear. Periodic inspection and lubrication of the wheel brake is required as part of the routine brake maintenance procedure.
The actuating linkage may require periodic adjustment to compensate for normal component wear or the replacement of individual components.

With the vehicle moving forwards, depressing the brake pedal pulls the brake cables. The brake cable pulls the wheel brake actuating lever which pushes the rear brake shoe against the brake drum. Continuing pressure causes the actuating lever to move which pushes the front shoe against the brake drum. As both shoes contact the drum, 'servo action' takes place which causes the rear brake shoe to move upwards and apply pressure to the upper rear portion of the brake drum. The front shoe moves downwards and applies pressure to the lower front portion of the brake drum. The action reverses when the vehicle is operating in reverse.

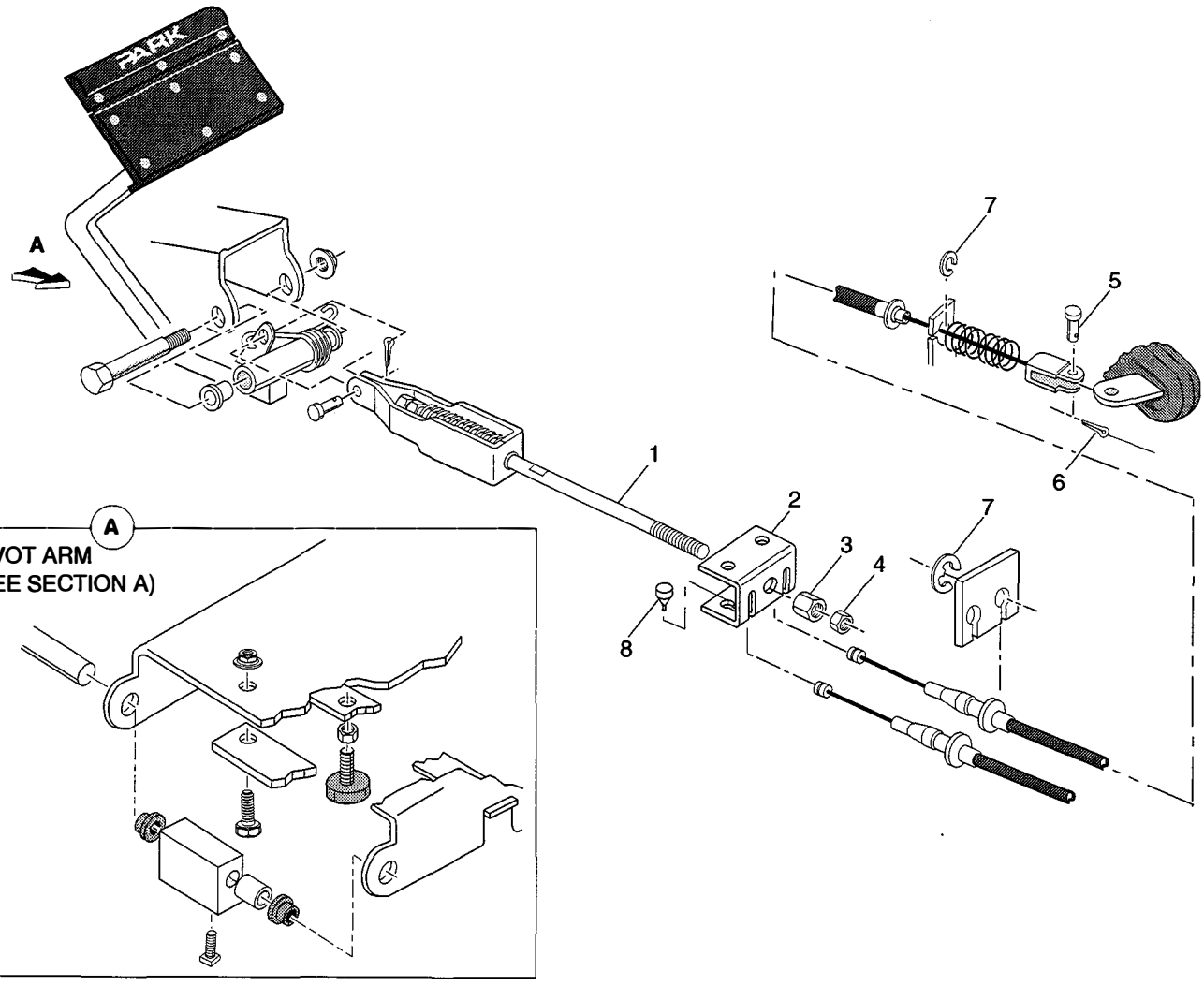


Fig. G-1 Brake System

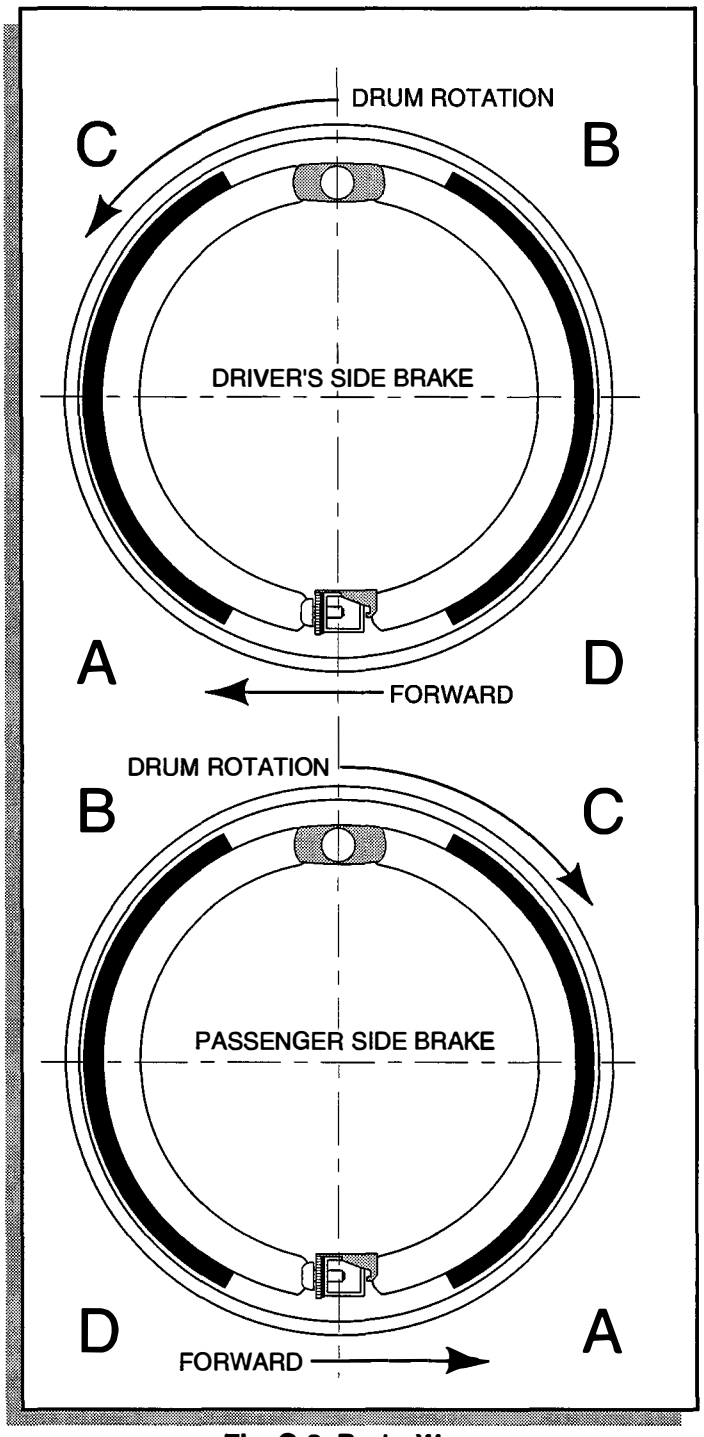


Fig. G-2 Brake Wear

Wheel Brake Adjuster

(See Fig. G-3 "How the Brake Adjuster Works" on page G-32)

The wheel brakes are equipped with an automatic adjuster mechanism that is designed to compensate for brake shoe wear and eliminate the need for brake shoe adjustment.

In the initial break in period, the brake shoes wear at a more rapid rate than normal. This is the result of the shoes burnishing (seating) to the contour of the brake drum. Until the high spots have been worn away, automatic brake adjustment will be more frequent than that of a seated brake shoe. As the brake shoe becomes seated to the brake drum, the shoe cures and becomes harder.

The adjusting mechanism is activated by movement of the brake lever that is attached to the brake cable. The movement of this lever activates the brake adjuster lever (1). If adjustment is required, the brake adjuster lever engages and rotates the 'star wheel' (2). Rotation of the star wheel causes the threaded adjuster screw (3) to move outwards against the brake shoes which moves the brake shoes into correct adjustment.

With the brake shoes in correct adjustment, the adjusting levers motion is limited to approximately 1/8" and cannot move enough to engage the next tooth on the star wheel. The adjuster lever moves on top of the flat of the star wheel tooth and no rotation of the star wheel takes place. As the brake shoes wear, the motion of the adjusting lever increases until it reaches the point that it engages the next tooth of the star wheel and rotates it to expand the adjuster screw and the brake shoes. The process is then repeated as the shoes continue to wear.

Brake Pedal and Linkage

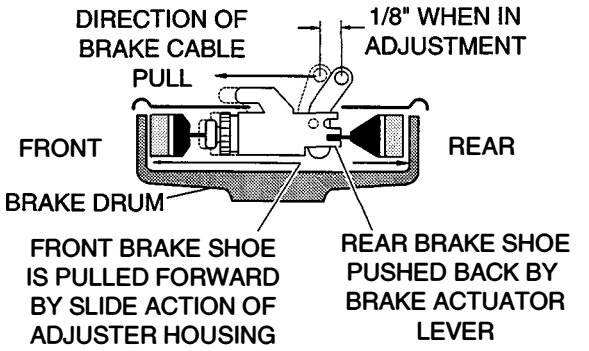
(See Fig. G-4 "Compensator and Equalizer" on page G-33)

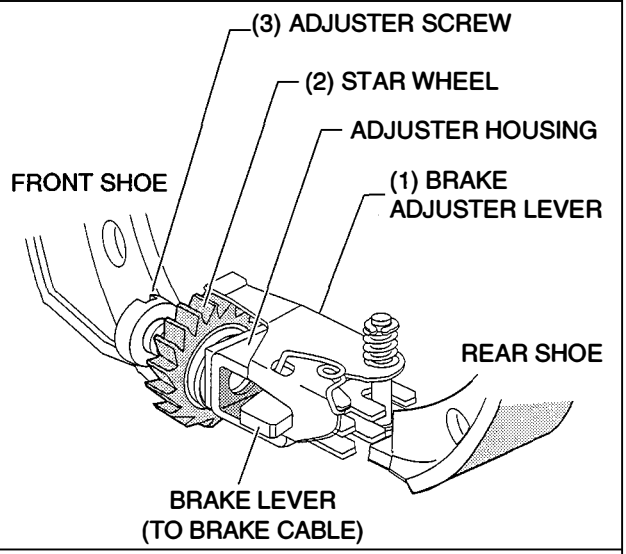
The brake pedal provides a mechanical advantage which is a relationship between the length of the brake pedal and the length of the arm that the brake cables and compensator are attached to.

The brake compensator assembly applies a preload to the system that insures that the parking brake remains under tension whenever it is engaged. As the service brake pedal is engaged the spring within the compensator linkage is compressed until the linkage engages the tube within the spring and becomes solid. The linkage between brake pedal and wheel brake transfers foot pressure to the wheel brake.

The left and right brake cables are joined to the compensator linkage with an equalizer link. Due to variations in individual wheel brake adjustment and friction within the driver's and passenger side brake cables, the equalizer may be slightly misaligned. This misalignment is normal, however misalignment that exceeds 1/8" per side (1/4") total is an indication of a damaged brake cable or a wheel brake that is not adjusting correctly. The routine brake inspection will identify the suspect component(s)

ILLUSTRATIONS SHOW PASSENGER SIDE ONLY. DRIVER'S SIDE IS MIRROR IMAGE.





NOTE: TEETH ARE NUMBERED IN ILLUSTRATION TO CLARIFY THEIR POSITIONS.

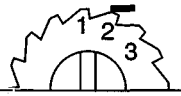
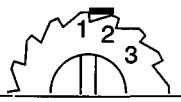
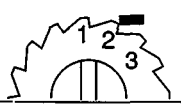
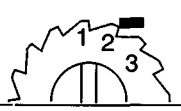
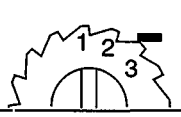
THE DISTANCE OF THE ADJUSTER LEVER TRAVEL IS REGULATED BY THE AMOUNT OF BRAKE SHOE WEAR. (A)		POSITION OF ADJUSTER LEVER WITH BRAKES DISENGAGED.
WHEN BRAKE SHOE WEAR IS MINIMAL, THE DISTANCE OF ADJUSTER LEVER TRAVEL IS TOO SHORT TO FULLY RE-ADJUST BRAKES. (B)		POSITION OF ADJUSTER LEVER WITH MINIMUM SHOE WEAR AND BRAKES ENGAGED.
AS SHOE WEAR INCREASES, ADJUSTER LEVER TRAVEL INCREASES, THUS TURNING THE STAR WHEEL. (C)		POSITION OF ADJUSTER LEVER WITH BRAKES ENGAGED AND SHOE WORN TO POINT OF NEEDING SELF-ADJUSTMENT
WHEN BRAKE SHOES HAVE WORN SUFFICIENTLY TO REQUIRE RE-ADJUSTMENT, THE ADJUSTER LEVER ADVANCES AND RATCHETS TO THE NEXT TOOTH WHEN BRAKES ARE RELEASED. (D)		POSITION OF ADJUSTER LEVER WITH BRAKES DIS-ENGAGED AND READY TO RESET ADJUSTER SCREW.
WHEN BRAKE IS NEXT ENGAGED, THE ADJUSTER LEVER WILL ROTATE THE STAR WHEEL FAR ENOUGH TO EXTEND THE ADJUSTER SCREW, THUS RESETTING THE PROPER SHOE/DRUM CLEARANCE. (E)		POSITION OF ADJUSTER LEVER WITH BRAKES ENGAGED DURING RE-ADJUSTMENT OF SCREW.
WHEN THE SHOE/DRUM CLEARANCE IS RESET, LESS EFFORT IS REQUIRED TO ENGAGE THE BRAKES, THUS THE ADJUSTER LEVER TRAVEL IS ONCE AGAIN REDUCED. (F, A)		POSITION OF ADJUSTER LEVER WITH BRAKES DISENGAGED AND RE-ADJUSTMENT COMPLETED. NOTE: POSITION OF TEETH

Fig. G-3 How the Brake Adjuster Works

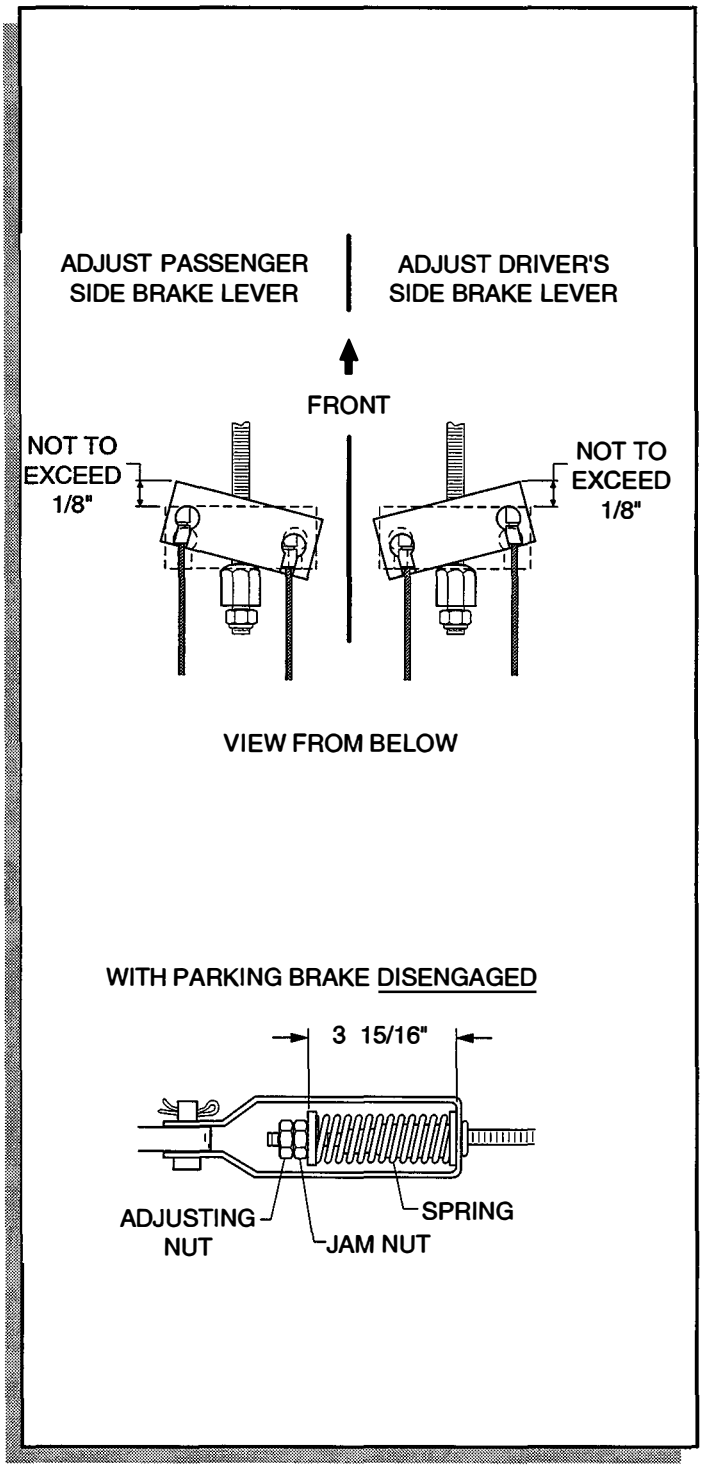


Fig. G-4 Compensator and Equalizer

NOTE

Brake Maintenance should include the inspection and adjustment of all brake components. The following tool list includes the tools required to perform all maintenance.

BRAKE MAINTENANCE

Tool List	Qty. Required
Jack, floor, hydraulic	1
Jack stands	4
Chocks	4
Socket, 1/2", 1/2" drive	1
Socket, 3/4", 1/2" drive	1
Socket, 11/16", 1/2" drive	1
Socket, 1/4", 3/8" drive	1
Torque wrench, 1/2" drive ft. lbs.	1
Torque wrench, 3/8" drive, in. lbs.	1
Extension, 6", 1/2" drive	1
Ratchet, 1/2" drive	1
Wrench, open end, 1/4"	1
Wrench, open end, 1/2"	1
Screwdriver, straight blade	1
Screwdriver, straight blade, narrow	1
Pliers	1
Hammer, ball pein	1
Hammer, plastic tipped	1
Puller (E-Z-GO P/N 15947-G1)	1
Emery cloth	AR
Pry bar	1

New Vehicles

(See Fig. G-1 "Brake System" on page G-30)

NOTE

A brake problem that occurs before the routine maintenance should be carefully evaluated. A component change or repair may be in order, however if the routine maintenance time is imminent, it is recommended that the entire maintenance be performed.

A new vehicle will undergo an initial break in of components that will include brake cables and the seating of the brake shoes. In this initial break in period, the brake shoes wear at a more rapid rate than normal. This is the result of the shoes burnishing (seating) to the contour of the brake drum. Until the high spots have been worn away, automatic brake adjustment will be more frequent than the wear of a seated brake shoe. As the brake shoe becomes seated to the brake drum, the shoe cures and becomes harder.

In this break in period it is not uncommon for the brake pedal free travel to be diminished and the effort required to latch the parking brake may rise to an unacceptable level. The timing of this situation varies due to the terrain that the vehicle is used on and the driving habits of the operator(s). If this occurs **before the first routine service**, the brake linkage should be adjusted. The adjustment is made at the compensating rod (1) **at the equalizer (2) end only.** Adjust the spherical nut (3) until the brake pedal free play meets specification. Tighten the jam nut (4) to 10 - 11 ft. lbs torque. Inspect both wheel brake actuating levers to determine if the levers are returning fully with the brake pedal released. If the operation is satisfactory, return the vehicle to service.

Troubleshooting Brake Problems

⚠ WARNING ⚠

EACH OF THE PROCEEDING PROBLEMS MAY BE INDIVIDUALLY CORRECTED, HOWEVER THE DAILY BRAKE PERFORMANCE TEST MUST BE PERFORMED TO DETERMINE THAT THE BRAKING SYSTEM HAS BEEN RETURNED TO AN ACCEPTABLE CONDITION.

SATISFACTORY BRAKE PERFORMANCE DOES NOT ELIMINATE THE NEED FOR ROUTINE BRAKE MAINTENANCE AS DESCRIBED IN THE PERIODIC MAINTENANCE SCHEDULE.

1. Hard pedal (No free play)
   - Linkage Adjustment or improper wheel brake actuator motion
2. Spongy pedal (Too much free play)
   - Linkage adjustment or wheel brake adjuster not functioning correctly
3. Dragging brake
   - Brake shoe not retracting or brake cable not returning
4. Inadequate braking (One wheel will not lock)
   - Wheel brake adjuster not functioning correctly or brake lever not returning
5. Inadequate braking (general)
   - Requires total periodic maintenance
6. Parking brake hard to latch
   - Adjust pedal free play and check that wheel brake actuators are returning fully
7. Parking brake will not stay latched
   - Worn latch mechanism, no preload (adjust linkage) or incorrectly adjusted accelerator kick off cam
8. Parking brake will not hold on grade (normal braking O.K.)
   - Adjust linkage

Periodic Brake Maintenance

(See Fig. G-1 "Brake System" on page G-30)

(See Fig. G-6 "Brake Pedal 'Free Travel'" on page G-35)

⚠ WARNING ⚠

IT IS IMPORTANT TO PERFORM THE FOLLOWING BRAKE MAINTENANCE IN THE SEQUENCE DESCRIBED.

FAILURE TO FOLLOW THE PRESCRIBED SEQUENCE COULD RESULT IN IMPROPER BRAKE OPERATION THAT COULD CAUSE SEVERE INJURY.

Refer to Periodic Service Schedule for service interval (perform more frequently under severe conditions).

1. Raise the entire vehicle as specified in the Safety Procedures in Section 'B' of this manual.
2. Determine that the free pedal travel is within specification (1" to 1 1/2" of movement at the brake pedal before any movement of the brake levers takes place). Adjust if required per 'New Vehicles' elsewhere in this section.
3. Rotate each rear wheel by hand and feel for smooth rotation of the wheel and brake drum. Any roughness indicates a dragging brake shoe which will require correction.
4. Remove the clevis pin from both brake cables where they attach to the wheel brake levers.
5. Rotate the wheel by hand and compare the motion with step # 3.
   - If there is no drag in either step 3 or 5, the brake shoes are not dragging and the brake cables are not binding.
   - If the brake dragged in step 3, but does not drag when the brake cable is disconnected, the brake cable **must** be replaced. Brake cable replacement consists of removing the retaining rings (7) at

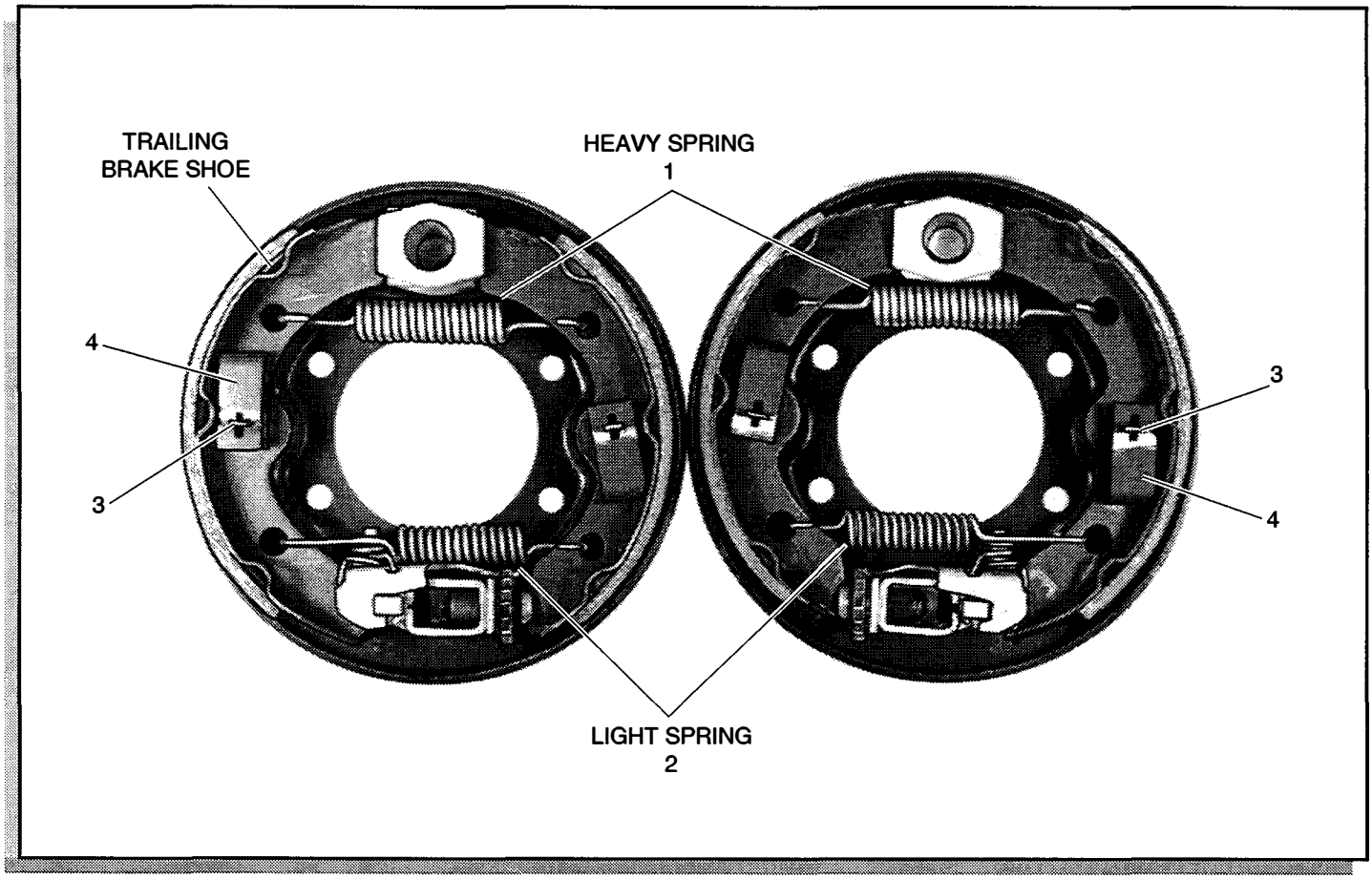


Fig. G-5 Wheel Brake Driver's and Passenger Side

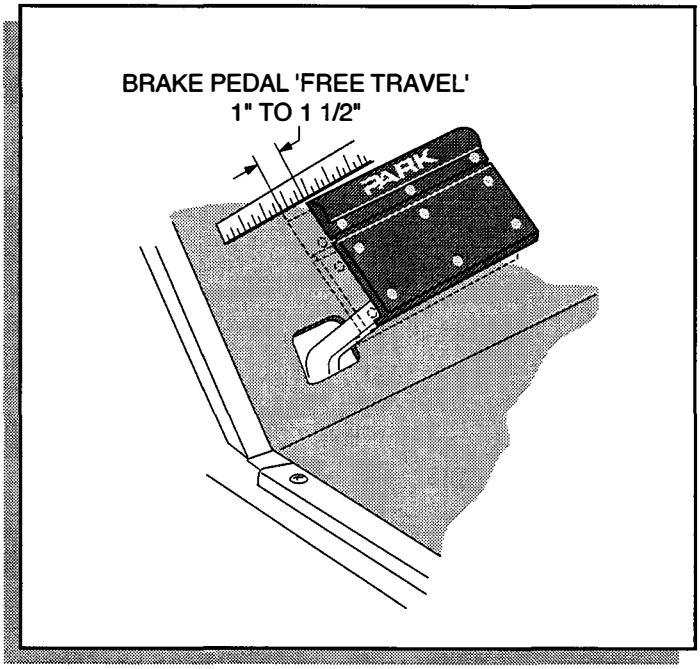


Fig. G-6 Brake Pedal 'Free Travel'

either end of the outer brake cable and removing the rubber plug (8) at the equalizer (2). The cable can then be removed and a new one installed. Do not connect to the brake until the wheel brake has been disassembled and serviced. (Ref. Fig. G-1)

- If the brake dragged in step 3, and continues to drag with the brake cable disconnected, the wheel brake is the cause.

Brake Drum Removal

(See Fig. G-7 "Wheel Brake" on page G-36)

(See Fig. G-8 "Removing Castellated Nut" on page G-36)

Remove the dust cap (1) to gain access to the castellated nut (2) and the cotter pin (3). Remove the cotter pin and remove the castellated nut as shown. **Do not apply the brake** when removing nut. (Ref. Fig. G-8) Remove the washer (4) and adapter (5).

Slide the hub and drum (6) off the axle shaft. Tap the drum with a plastic hammer to loosen it from the axle shaft or use drum puller (E-Z-GO P/N 15947-G1).

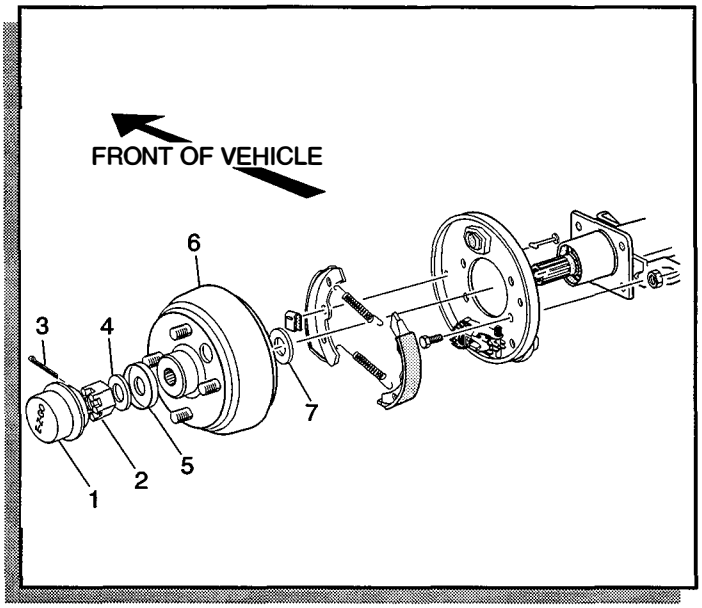


Fig. G-7 Wheel Brake

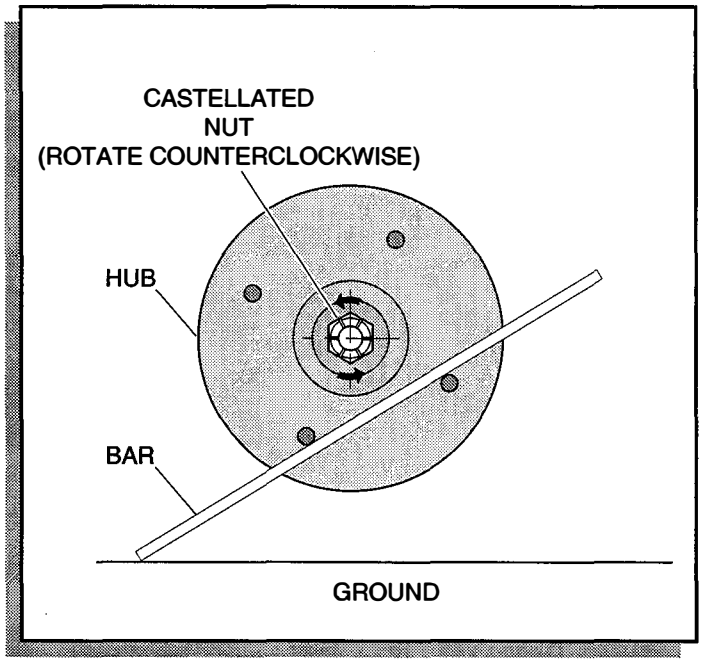


Fig. G-8 Removing Castellated Nut

NOTE

If the hub and drum does not slide from the brake assembly, the brake shoes must be retracted. Rotate the hub so that the approximately 1" hole is in the six o'clock position which is directly over the brake mechanism. Use two small straight blade screwdrivers to move the adjusting lever free from the adjusting wheel while rotating the star wheel upwards.

Note the location of the washer (7) which may be on the axle shaft or attached to the rear of the hub and drum.

Brake Shoe Removal/Inspection

(See Fig. G-5 "Wheel Brake Driver's and Passenger Side" on page G-35)

(See Fig. G-9 "Brake Shoe Wear" on page G-36)

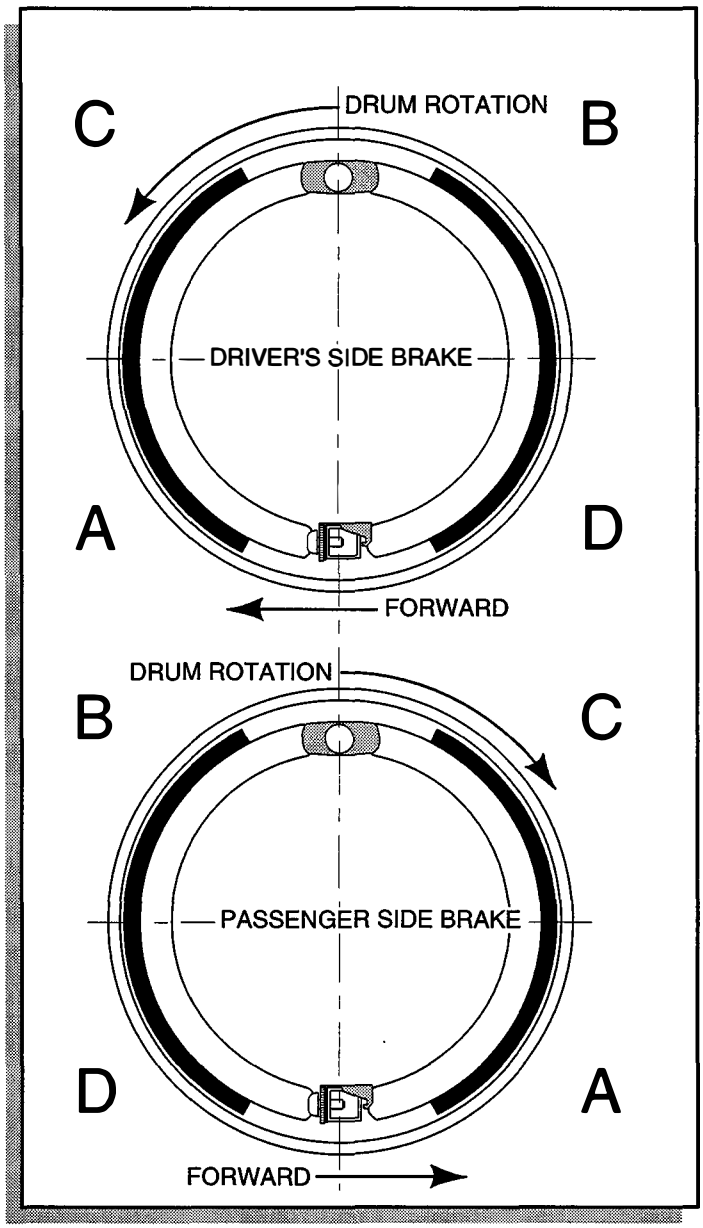


Fig. G-9 Brake Shoe Wear

The pattern of normal brake shoe wear is shown in quadrant 'A', 'B', 'C' & 'D' with quadrant 'A' showing the most wear. Quadrant 'B' will show the second most wear. Quadrant 'A' and 'B' will always show the most wear.

Remove the two brake shoe springs (1,2) being sure to note the location of the heavy spring. Hold the shoe clamp pin (3) and compress and rotate the shoe clamp

(4) 90 degrees to release it from the shoe clamp pin. Remove the brake shoes.

Measure the brake shoe thickness at the most worn area. Brake shoe thickness **must never be less than .040** at any point on the shoe. If the brake shoe thickness is approaching the .040 dimension, it would be prudent to replace the shoes at this time.

Backing Plate Inspection/Lubrication

(See Fig. G-10 "Lubricating Backing Plate and Adjuster" on page G-37)

⚠ WARNING ⚠

A BACKING PLATE ASSEMBLY THAT SHOWS ANY INDICATION OF GALLING OR GOUGING IS NOT REPAIRABLE AND MUST BE REPLACED

WEAR EYE PROTECTION AND A MASK WHEN CLEANING BRAKE COMPONENTS.

Operate the brake lever to check for free motion. Remove the rubber boot that covers the adjuster and clean any accumulated brake dust. Check that the star wheel moves freely and clean and lubricate the adjuster mechanism. Clean any accumulated brake dust from the backing plate. If the shoes are to be replaced, the adjuster should be returned to minimum extension. Operate the sliding portion of the adjuster against the backing plate and check for free movement. The backing plate may be smoothed in this area using emery cloth to remove any rust or other corrosion, but a backing plate that has excessive wear such as gouges or galling **must** be replaced. Lubricate the backing plate with a commercially available brake component lubricant in the areas indicated being careful to lubricate the slider completely and the friction surfaces for the brake shoes.

CAUTION

IT IS IMPORTANT THAT THE FRICTION AREAS BETWEEN THE BACKING PLATE AND THE BRAKE SHOES BE LUBRICATED. BE CAREFUL NOT TO ALLOW LUBRICANT TO CONTACT THE BRAKING PORTION OF THE BRAKE SHOES OR THE FRICTION SURFACE OF THE BRAKE DRUM

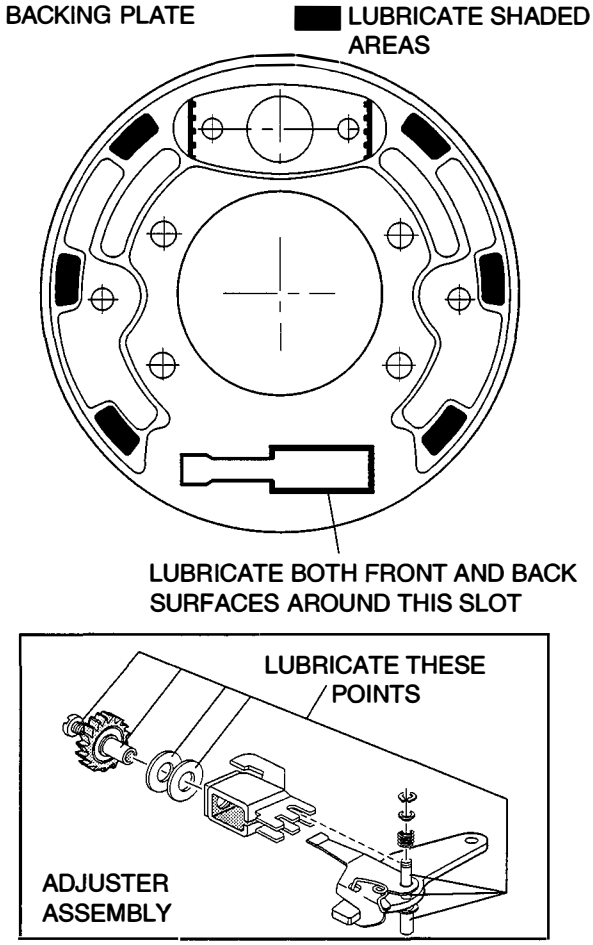


Fig. G-10 Lubricating Backing Plate and Adjuster

Backing Plate Installation

(See Fig. G-11 "Backing Plate Installation" on page G-38)

If the backing plate has been removed for replacement or as part of an axle bearing or seal replacement, the hardware (1,2) should be tightened to 23 - 35 ft. lbs torque.

Brake Shoe Installation

(See Fig. G-12 "Brake Shoe Installation" on page G-38)

NOTE

The metal frame of the brake shoes differs between the front and rear shoes. The shoe with the straight end engages in the slot in the adjusting screw. The identical end of the shoes engage with the fixed anchor. The shoe with the triangular end engages with the rear of the adjuster mechanism.

The brake springs must be installed with the light spring closest to the adjuster with the long hook installed down

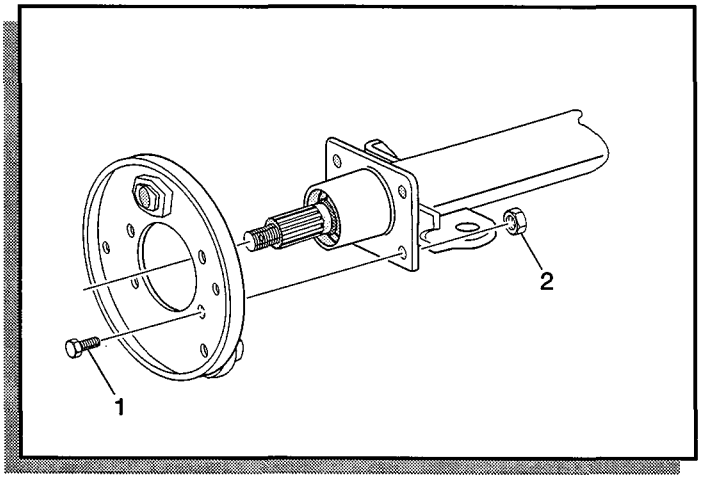


Fig. G-11 Backing Plate Installation

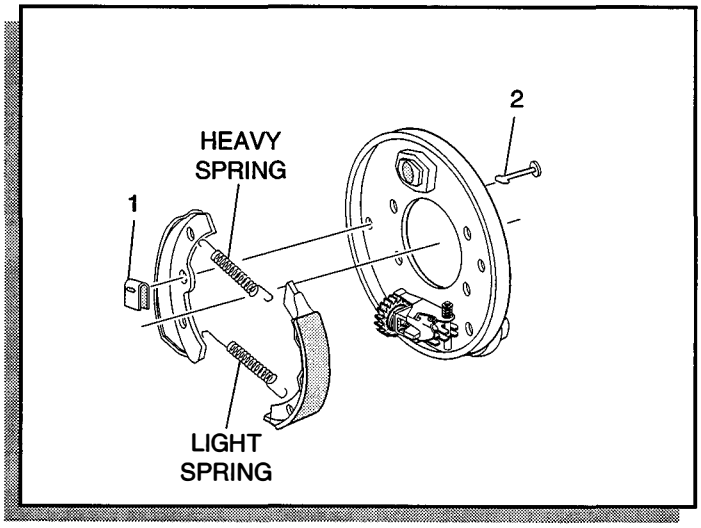


Fig. G-12 Brake Shoe Installation

through the rear brake shoe. The heavy top spring is installed with the spring hooks facing out.

Install the shoes as indicated in the note on the previous page and install the shoe clamp (1) over the shoe clamp pin (2) and rotate 90 degrees to lock them in place.

Brake Drum Replacement

(See Fig. G-7 "Wheel Brake" on page G-36)

(See Fig. G-13 "Brake Drum Installation" on page G-38)

(See Fig. G-14 "Wheel Brake Lever Adjustment" on page G-38)

Clean the axle shaft to remove dirt, grease and any foreign matter. Apply a small amount of anti-seize compound to the spline. Retract the brake shoes enough to permit the brake drum to be installed. Install the thin washer (7) and slide the brake drum (6) into place. Install the remaining hardware and tighten the nut to a **minimum** of 70 ft. lbs. torque. **Do not apply** the brake when installing nut. (Ref. Fig. G-13) **Continue to tighten** until

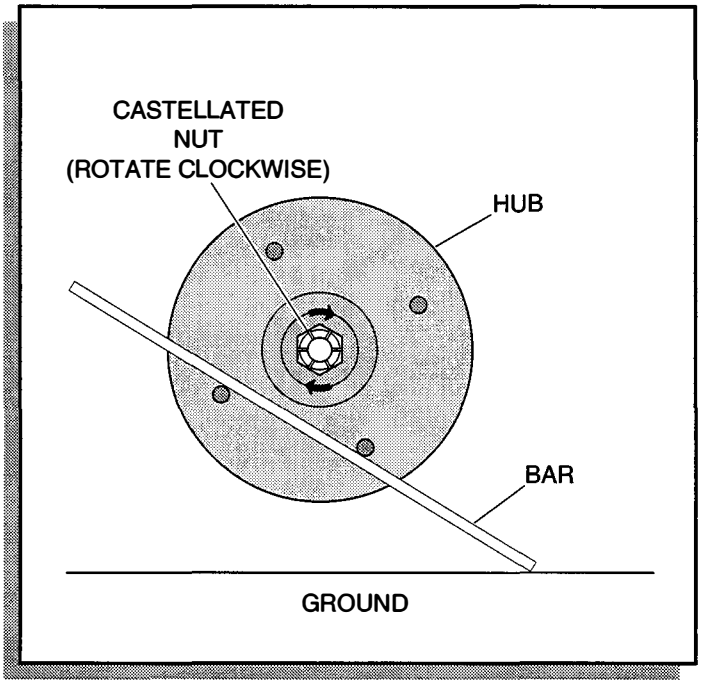


Fig. G-13 Brake Drum Installation

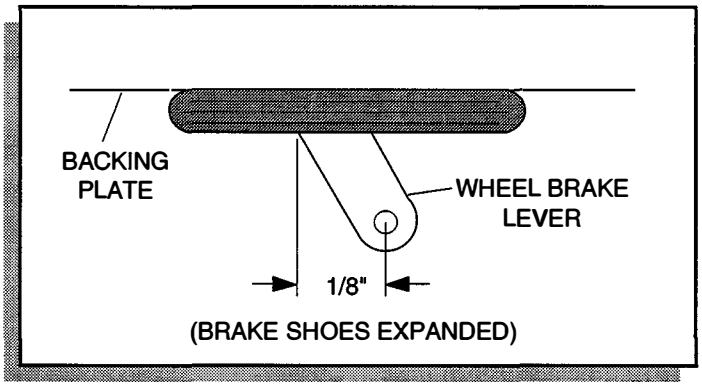


Fig. G-14 Wheel Brake Lever Adjustment

a cotter pin can be installed through the castellated nut and the hole in the axle. Maximum torque is 140 ft. lbs. Install a new cotter pin.

Using a suitable tool such as a hammer handle, actuate the wheel brake lever and release fully. Repeat the process until the brake lever travel is approximately 1/8" which indicates that the brake shoes have adjusted to their correct position. Install the brake cables using clevis pin and a new cotter pin.

Compensating Link Adjustment

(See Fig. G-15 "Equalizer Position" on page G-39)

(See Fig. G-1 "Brake System" on page G-30)

1. (Ref. Fig. G-15) Check the position of the equalizer with the parking brake engaged.

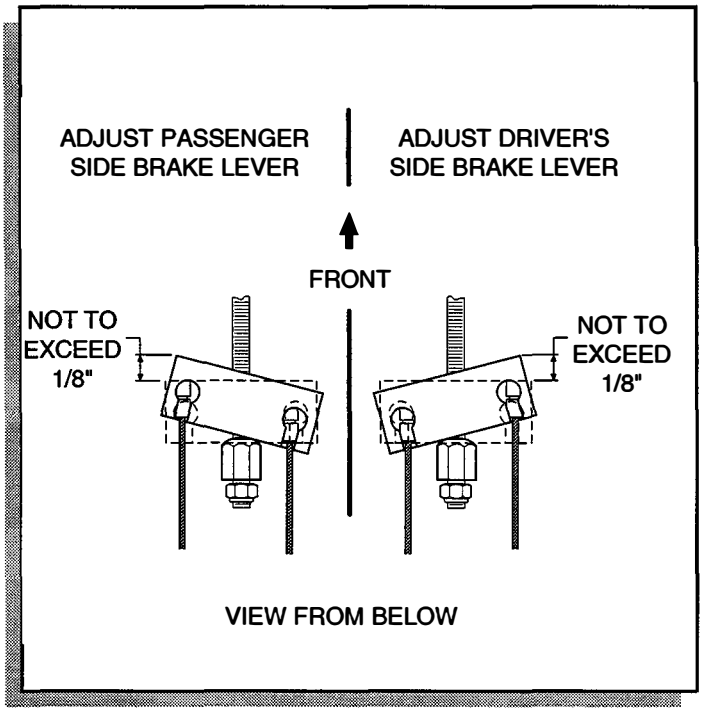


Fig. G-15 Equalizer Position

- If the dimension exceeds 1/8" go to step 2.
- If dimension is less than 1/8" go to "Adjusting the Compensating Spring" on page H-11.

2. (Ref. Fig. G-1) Release the parking brake and remove the wheel indicated by the equalizer position. Remove the clevis pin (5) and cotter pin (6) from the wheel brake lever.
3. Using a suitable tool such as a hammer handle, actuate the wheel brake lever and release fully. Repeat the process until the brake lever travel becomes approximately 1/8" which indicates that the brake shoes have adjusted to their correct position.
4. Install the brake cable using clevis pin (5) and a new cotter pin (6).

Adjusting the Compensating Spring

(See Fig. G-16 "Compensating Spring Adjustment" on page G-39)

In general, no adjustment will need to be made since the spring is factory calibrated. With the parking brake **DISENGAGED** check that the compensating spring length is 3 15/16" If an adjustment is required it is made at the nuts at the spring facing the front of the vehicle. Tighten the jam nut firmly after adjusting.

Adjusting Brake Pedal 'Free Travel'

(See Fig. G-17 "Brake Pedal 'Free Travel'" on page G-39)

Measure the free play of the pedal and determine if it is between 1" to 1 1/2". If an adjustment is required, it must be made at the spherical nut (1) behind the equalizer. Release the jam nut (2) and adjust the spherical nut to achieve the correct pedal free play. Tighten the jam nut to 10 - 11 ft. lbs. torque.

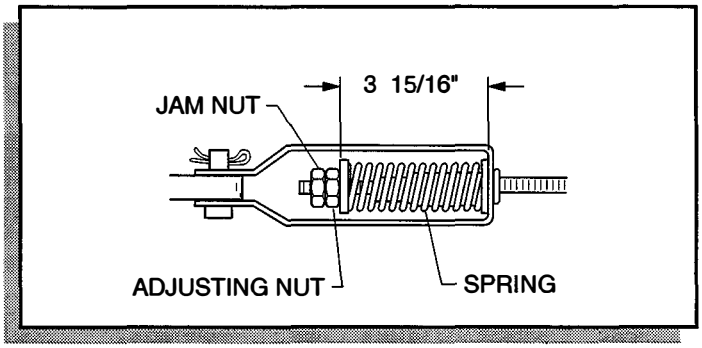


Fig. G-16 Compensating Spring Adjustment

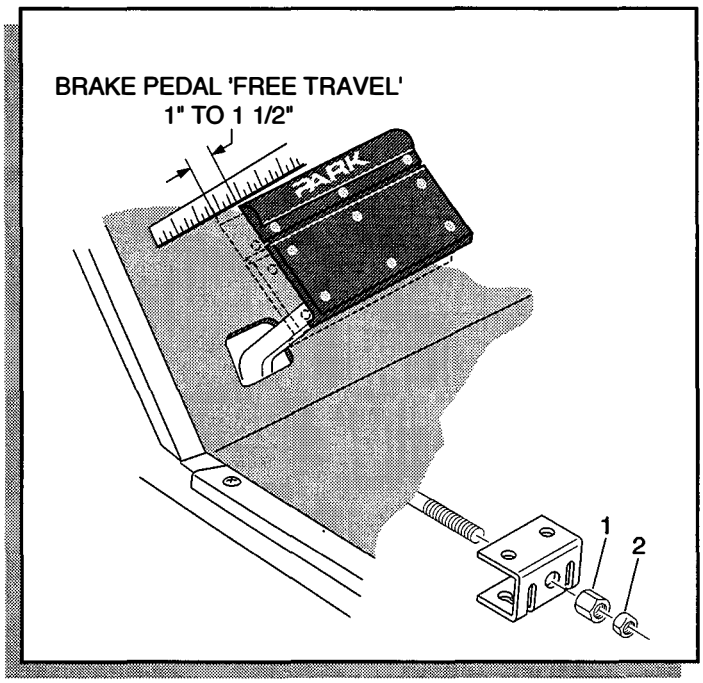


Fig. G-17 Brake Pedal 'Free Travel'

Checking for 'Free Travel' Movement

(See Fig. G-18 "Removing the Brake Pedal" on page G-40)

Check that the brake pedal returns against the pedal bumper when released. If the pedal does not release fully or is sluggish, the brake pedal should be inspected. Check that the torsion spring (4) is hooked around the pedal and the frame. If the spring is correctly installed and the pedal does not return satisfactorily, the pedal will need to be removed.

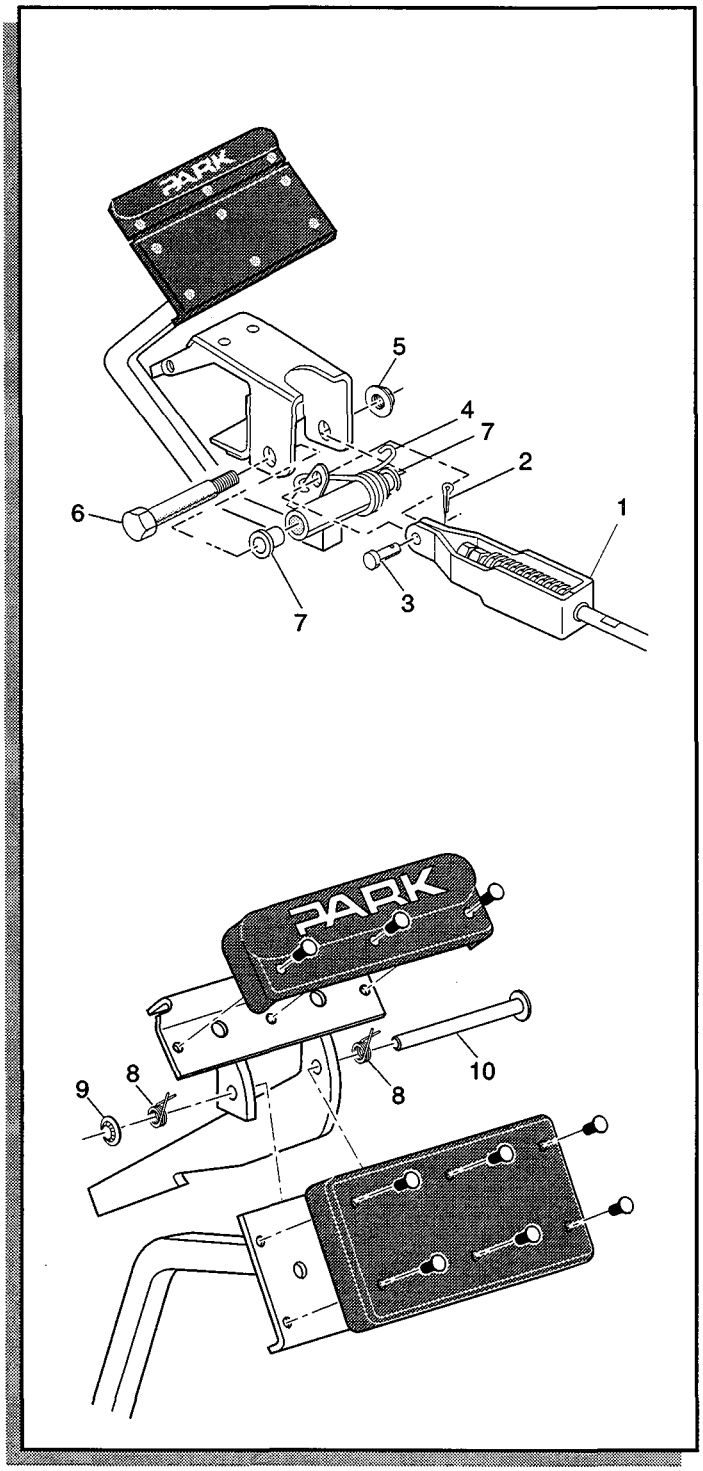


Fig. G-18 Removing the Brake Pedal

Brake Pedal Removal

(See Fig. G-18 "Removing the Brake Pedal" on page G-40)

1. Remove the compensator spring assembly (1) by removing the cotter pin (2) and the clevis pin (3). Unplug the wiring harness on Freedom models.
2. Unhook the torsion spring (4) by inserting a thin blade screwdriver between the small hook and the bracket. Move the hook back and to the side to release the torsion spring (4).
3. Remove the lock nut (5) and the shoulder bolt (6) and remove the brake pedal. Inspect the shoulder bolt for signs of corrosion that could bind with the bushings (7). This is a plated bolt, therefore it must be replaced with a new one if corrosion is found. Inspect the bushings (7) for signs of wear resulting from corrosion to the bolt. If any damage is found, replace the bushings.

Parking Brake Pedal Removal

(See Fig. G-18 "Removing the Brake Pedal" on page G-40)

Note the location of the two torsion springs (8). Remove the push nut (9) and remove the pin (10).

Parking Brake Pedal Installation

(See Fig. G-18 "Removing the Brake Pedal" on page G-40)

Installation is in the reverse order of disassembly. Use a new push nut.

Brake Pedal Installation

(See Fig. G-18 "Removing the Brake Pedal" on page G-40)

Brake pedal installation is in the reverse order of disassembly. Tighten the nut (5) to 25 - 29 ft. lbs. torque and use a new cotter pin when installing the compensator linkage.

Adjusting the Pedal Bumper

(See Fig. G-19 "Pedal Bumper Adjustment" on page G-41)

When the brake pedal is released it will contact the pedal bumper. The dimension from the top of the pedal arm to the setscrew heads in the kick off cam should be approximately 1/4". If an adjustment to the pedal bumper is required, the bumper lock nut should be loosened and the bumper adjusted by rotating it. Tighten the lock nut to 12 - 14 ft. lbs.

Adjusting and Seating Brake Components

(See Fig. G-20 "Checking Accelerator Rod Adjustment" on page G-41)

1. Engage and release the parking brake 20 times, being sure to release the pedal and allow it to return each time.
2. Engage the parking brake and check that the dimension behind the compensator linkage frame and the flange on the rod is 3/32". If the dimension is incorrect, the free travel must be readjusted until the correct dimension is achieved.

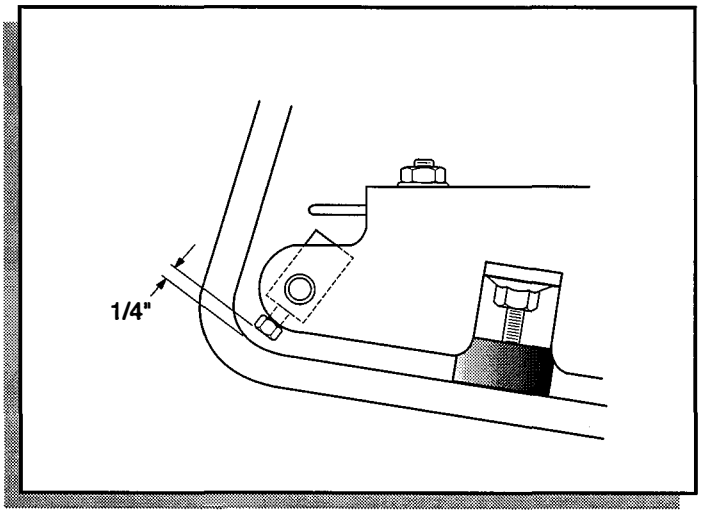


Fig. G-19 Pedal Bumper Adjustment

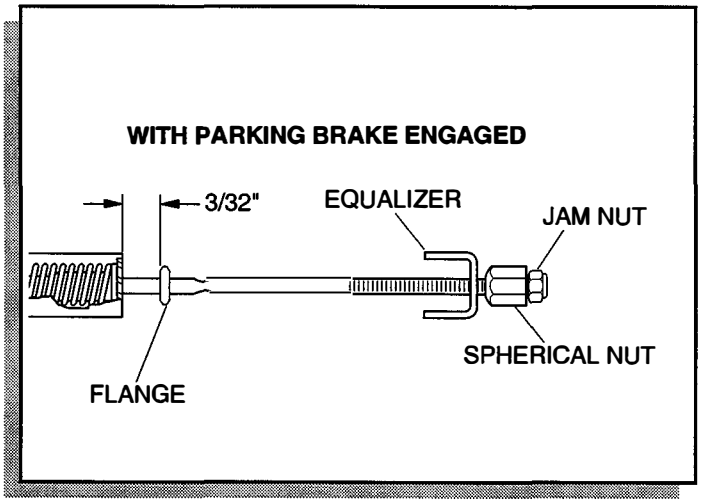


Fig. G-20 Checking Accelerator Rod Adjustment

Parking Brake Adjustment

1. The parking brake must be adjusted after the service brake has been adjusted.

⚠ WARNING ⚠

TO PREVENT INADVERTENT VEHICLE MOVEMENT, BE SURE THAT BOTH REAR WHEELS ARE RAISED BEFORE PERFORMING THIS TEST.

2. Remove the seat and place the direction selector in the 'F' position. Engage the parking brake and turn the key switch 'ON'.
3. Slowly depress the accelerator pedal until the 'click' of the solenoid is heard. If the solenoid is activated **after** the parking brake has released, the parking brake is functioning correctly. If the solenoid is activated before the parking brake is released, the following must be inspected:
   - An improperly adjusted parking brake kick off cam.
   - The catch bracket or latch arm are worn or damaged.

Latch Pedal and Latch Arm Inspection/ Replacement

(See Fig. G-21 "Catch Bracket Adjustment" on page G-43)

1. Remove the drivers side front wheel to gain improved access to the brake pedal release mechanism.

⚠ WARNING ⚠

WORN LATCH ARMS AND CATCH BRACKETS ARE HARDENED PARTS. DO NOT GRIND OR FILE THEM. NEW PARTS MUST BE USED.

2. Inspect the latch bracket and pedal latch arm for signs of wear or damage. If the latch arm requires replacement, refer to "Brake Pedal Removal" page H-12.
3. If the catch bracket requires replacement remove the two bolts (1) and nuts (2) which secure the catch bracket. Replace the catch bracket with a new one and tighten the hardware to 85 - 95 in. lbs. torque
4. Inspect the kick off cam (3) for correct adjustment. With the parking brake engaged and fully latched, there must be no gap between the top of the cam and the latch arm.
5. To adjust the kick off cam (3), engage the parking brake and loosen the two cam set screws (4) and rotate the cam until it contacts the latch arm. Tighten the set screws to 45-55 in. lbs. torque.

Parking Brake Release Linkage Removal

(See Fig. G-2 "Brake Wear" on page G-31)

1. To remove the linkage rod (1), remove the cotter pin (2), washers (3) and bushings (4) from linkage rod.
2. Loosen the two setscrews (5) from the cam (6) and remove the cam pivot (7), cam (6) and spacer (8).
3. Inspect the bushings (9,10) and spacer (8). If they are worn replace them with new ones.

Parking Brake Release Linkage Installation

(See Fig. G-21 "Catch Bracket Adjustment" on page G-43)

(See Fig. G-22 "Parking Brake Release Linkage" on page G-43)

Installation is in the reverse order of disassembly. Adjust the cam as detailed in Parking Brake Release Linkage Removal

Final Test

Lower the vehicle and perform the daily braking test. If the test indicates inadequate brake performance, the brake shoes must be burnished to conform to the brake drum.

Burnishing Brake Shoes

⚠ WARNING ⚠

ALL BRAKE TESTS MUST BE DONE IN A SAFE LOCATION WITH REGARD FOR THE SAFETY OF ALL PERSONNEL.

To burnish the brakes, the vehicle must be operated in the forward direction at maximum governed speed and the brakes applied as hard as possible without locking the wheel(s). When the vehicle has come to a full stop, the vehicle should be operated at maximum speed in reverse and the brakes applied as hard as possible without locking the wheel(s). This braking operation in both directions is considered as one burnishing cycle. Repeat the cycle a minimum of 50 times for complete seating of brake shoes. If the brake performance is satisfactory after burnishing, the vehicle may be returned to service. If the performance is not satisfactory, there is a problem with the maintenance and it **must** be performed again in its entirety.

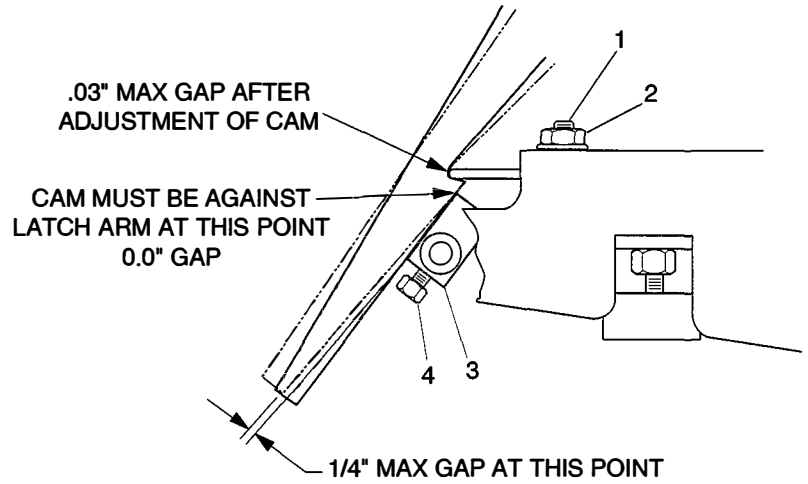


Fig. G-21 Catch Bracket Adjustment

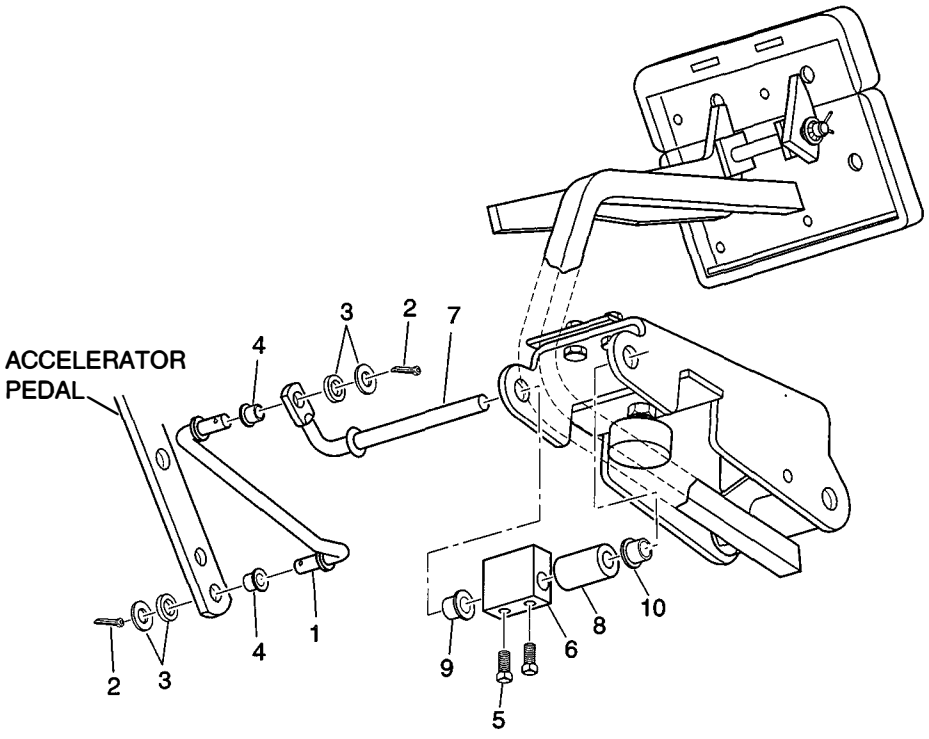


Fig. G-22 Parking Brake Release Linkage

Notes:

GENERAL

Electric vehicle batteries require CAREFUL maintenance to maximize their useful service life.

CAUTION

OVERFILLING OF THE BATTERIES WILL VOID THE WARRANTY. E-Z-GO SUGGESTS THE USE OF AN AUTOMATIC WATERING DEVICE THAT IS AVAILABLE FROM YOUR BATTERY DISTRIBUTOR.

⚠ WARNING ⚠

THE ELECTROLYTE IN A STORAGE BATTERY IS A DILUTE ACID WHICH CAN CAUSE SEVERE BURNS. ALWAYS WEAR SAFETY GOGGLES WHEN ADDING WATER, CHARGING BATTERIES, OR CLEANING BATTERIES. TREAT ALL ELECTROLYTE SPILLS BY EXTENDED FLUSHING WITH CLEAR WATER.

HYDROGEN GAS IS FORMED WHEN CHARGING BATTERIES. DO NOT CHARGE BATTERIES WITHOUT ADEQUATE VENTILATION. DO NOT SMOKE IN AN AREA BEING USED FOR CHARGING BATTERIES. CONCENTRATIONS OF 4% HYDROGEN GAS OR MORE IS EXPLOSIVE.

PREVENTATIVE MAINTENANCE

- Check the electrolyte level at *LEAST* once a week.
- Inspect all wiring for breaks or deterioration of the insulation.
- Before charging batteries, inspect all terminations for frayed conductors and loose or damaged connectors.
- Before charging batteries, inspect all terminations to assure that they are both clean (corrosion free) and securely fastened to battery posts.
- When adding water, do not overfill (FIG. H-1). Overfilling will cause a loss of acid from the electrolyte. Use distilled water when adding water to batteries. E-Z-GO strongly recommends that other water sources *NOT* be used since impurities can reduce the useful life of the batteries. If it is suspected that a suitable water source other than distilled be available, a water analysis and a consultation with your local representative will indicate if the water is detrimental to battery operation. You may also consult your local telephone company to determine if they use the local water. (The telephone company is a major user of battery powered systems.)

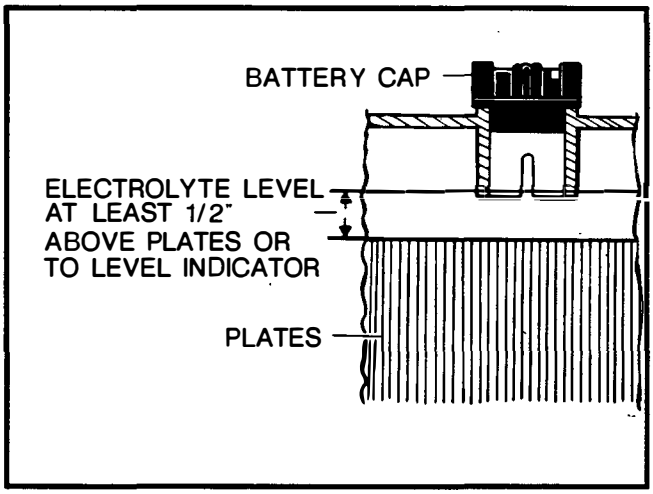


FIG. H-1 BATTERY ELECTROLYTE LEVEL

- Batteries should be recharged after each day's use. Golf car batteries should be charged between rounds if possible.

CAUTION

DO NOT SEND A VEHICLE OUT UNLESS ITS BATTERIES ARE IN A GOOD STATE OF CHARGE. DISCHARGING A BATTERY COMPLETELY BEFORE RECHARGING (DEEP CYCLING) IS DETRIMENTAL TO BATTERY LIFE.

⚠ WARNING ⚠

WEAR GLOVES AND EYE PROTECTION WHEN WORKING WITH BATTERIES. ACID IN THE ELECTROLYTE CAN CAUSE BURNS TO THE EYES, SKIN AND CLOTHING.

- Keep batteries clean. Wash batteries with a stiff bristle brush using water and bicarbonate of soda. Rinse with water after cleaning.

- Batteries should be checked frequently to be sure that they are in a good state of charge. Full charge for a new battery should yield a hydrometer reading of 1.260 –1.280 specific gravity while an older battery may give a reading of 1.250 specific gravity and still be fully charged.
- In the "off season", the batteries should be *FULLY CHARGED* and stored in an unheated covered area. Check the batteries during the "off season" at thirty day intervals and recharge if a hydrometer shows a reading of less than 1.220 specific gravity.
- Before returning batteries to service, perform all of the preceding preventative maintenance.
- To prevent unnecessary drag on the vehicle which will result in poor performance and a higher amperage draw, inspect for improperly adjusted wheel bearings, dragging brakes, and underinflated tires.

BATTERY INSTALLATION

⚠ WARNING ⚠

BEFORE PROCEEDING, REMOVE ALL JEWELRY, RINGS, WATCHES, ETC., AND WRAP ALL WRENCHES IN VINYL INSULATING TAPE (FIG. H–2) TO ELIMINATE THE POSSIBILITY OF A SHORT CIRCUIT SHOULD THE OPPOSING TERMINALS BE "SHORTED OUT" OR CONTACTED TO THE FRAME. A SHORT CIRCUIT COULD RESULT IN AN EXPLOSION AND SEVERE PERSONAL INJURY.

BE SURE THAT THE FORWARD–NEUTRAL–REVERSE SWITCH IS IN THE NEUTRAL POSITION AND THE KEY SWITCH IS IN THE "OFF" POSITION.

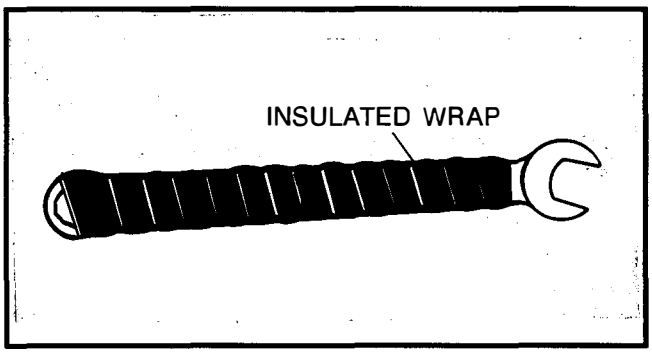


FIG. H–2 INSULATED WRENCH

See Safety Procedures in Section B. Carefully note the manner in which the old set of batteries were installed. Pay particular attention to the polarity of the wiring (FIG. H–3).

Remove the wiring from each battery using an *INSULATED WRENCH* (FIG. H–2) and remove the two battery hold downs. Remove the batteries using a battery removal tool.

⚠ WARNING ⚠

BATTERIES ARE HEAVY AND CARE SHOULD BE TAKEN WHEN REMOVING THEM. BE CAREFUL TO LIFT BATTERIES WITHOUT TIPPING THEM, ELECTROLYTE MAY BE SPILLED WHICH COULD CAUSE BURNS OR DAMAGE TO VEHICLE AND CLOTHING. SHOULD ANY ELECTROLYTE BE SPILLED, FLUSH THOROUGHLY WITH WATER.

Inspect the battery racks for corrosion and clean if required using a putty knife and a wire brush. Remove *ALL* corrosion before priming and painting with a corrosion resistant paint.

Inspect all batteries visually for damaged containers, covers or terminals that may have been damaged or broken during transit. Inspect each cell (a dry cell could indicate a possible crack in the battery case).

Inspect all cables and terminations for any defects and replace as required. If they are to be reused, clean in a solution of water and bicarbonate of soda (1 bucket water to 1 cup of bicarbonate of soda). Rinse thoroughly and clean and dry. Remove any remaining corrosion from the wire terminations using a wire brush. Clean the battery terminals with a wire brush until all corrosion is removed.

Install the batteries and the battery hold downs. Tighten the hold down hardware snugly (25–30 in. lbs.) to prevent battery bounce but do not overtighten since the battery case could be distorted.

Use an insulated wrench to install the battery wiring and tighten nuts to provide a tight connection between the wire terminations and the battery posts.

Apply a coat of petroleum jelly to the outside of the connection to retard corrosion of the joint.

Before the vehicle is put into service for the first time with new batteries, a 12 hours charge is required to charge all batteries to a common level of charge.

When electric golf cars (or other vehicles) are used for 36 holes (70–80 minutes) or more, the batteries become deeply discharged, which is reflected in a

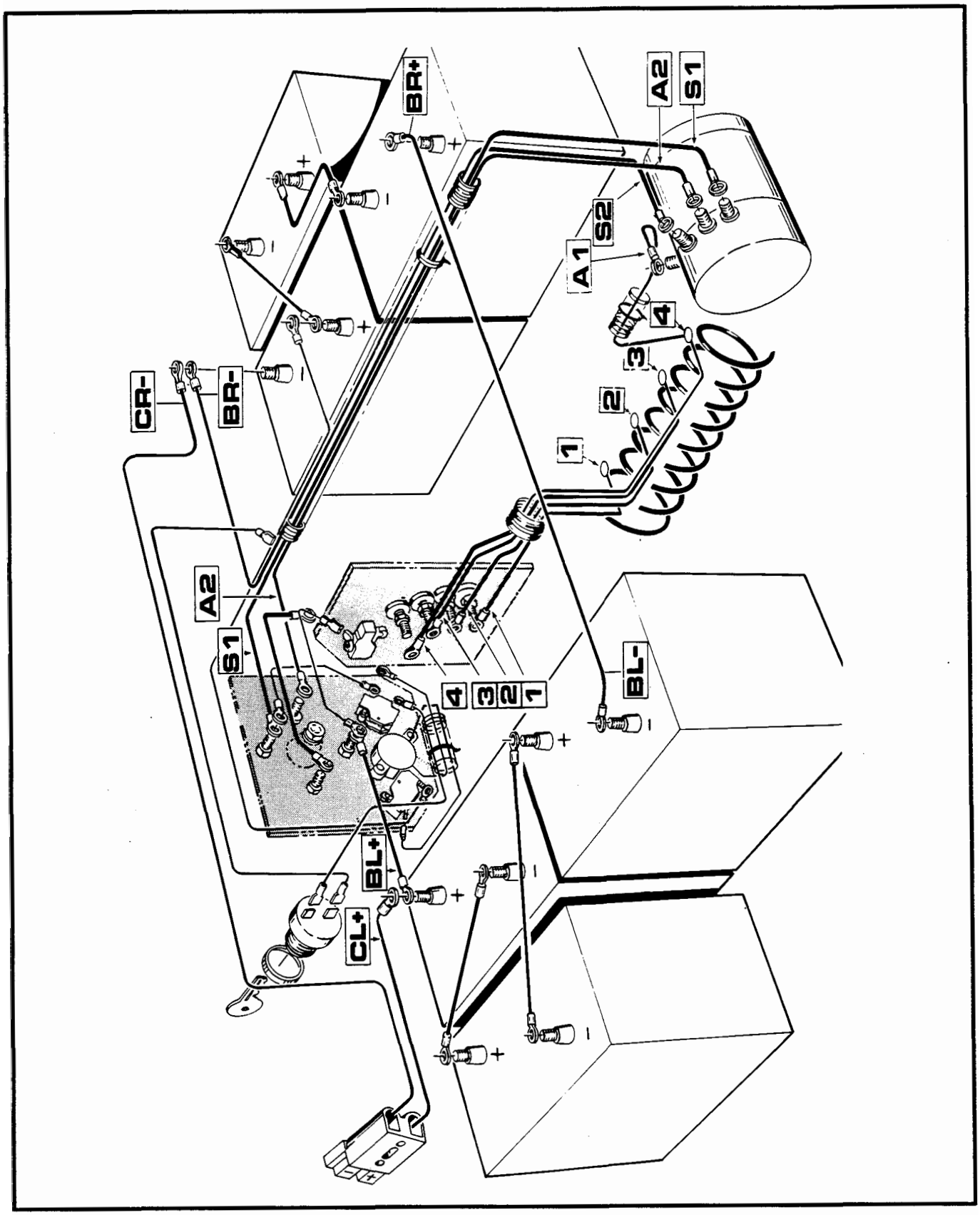


FIG. H-3 POWER WIRING DIAGRAM

low specific gravity reading. Batteries in this state of discharge require longer charge cycles to restore their full capacity.

If this lengthy charge time is prematurely terminated because the car/vehicle is returned to service, the balance of the charge should be made up. This make up or catch up charge should be accomplished at the earliest possible time.

If the recharge is not made up, the batteries become more and more discharged as they are used. When batteries are allowed to remain deeply discharged, their life is shortened.

CHARGING (FIG. H-4)

It is most important to follow the following steps when charging batteries.

- Check that electrolyte covers the plates in ALL cells.
- Charging must be performed in a well ventilated area.
- Inspect the charger D.C. plug for loose, bent, arced or dirty contacts.
- Inspect the vehicle receptacle for loose wires or damage.
- Insert plug fully into receptacle and check that the connection is tight.
- Be careful not to pull on the D.C. cord or place it in a position where it can be driven over or present a hazard to personnel working the area.

⚠ WARNING ⚠

WHEN CONNECTING OR DISCONNECTING THE CHARGER TO A VEHICLE, ALWAYS MAKE SURE THAT THE TIMER, ELAPSED TIME INDICATOR, OR POWER SWITCH IS SET IN THE OFF POSITION. IF IT IS NOT, AN ELECTRICAL ARC WILL OCCUR AND MAY CAUSE AN EXPLOSION OR FIRE.

Observe the ambient temperature in the charging area. A battery requires a longer charge time than normal when the ambient temperature falls below 60° F. The time required increases as the ambient temperature decreases.

A.C. LINE VOLTAGE

The battery charger's initial output is directly proportional to the input voltage. If a problem is encountered with several vehicles that indicates an insufficient initial (start) charge, it is suggested that the batteries be tested, and if found satisfactory, then the input A.C. voltage should be checked by the power company and their recommendations be followed. For additional information pertaining to the battery charger, see the'Battery Charger Section' in this manual.

ROTATING VEHICLES

It is important to charge each vehicle fully after each day of use. With this in mind, the fleet should be "rotated" such that the first vehicle charge should be the first vehicle to be used the following day. In this way, batteries will receive the maximum charge available and the wear on the vehicles will be evenly distributed.

ADDING WATER

The electrolyte in the vehicle's batteries is a solution of sulfuric acid and water. Some of the water portion of this solution evaporates or is lost in the charging cycle but the acid is retained. In the life of a battery, it is only necessary to replenish water and not the acid.

⚠ WARNING ⚠

IF A CONSIDERABLE AMOUNT OF BATTERY ELECTROLYTE IS SPILLED, IT MAY BE REPLACED. BE SURE TO OBSERVE ALL PROCEDURES, CAUTIONS, AND WARNINGS PROVIDED BY THE ELECTROLYTE MANUFACTURER.

When replenishing water, use only distilled water.

In the life of an average battery, the water usage will be approximately 2 1/2 times the original electrolyte quantity, or approximately 16 quarts.

CAUTION

USE OF *NON* DISTILLED WATER CONTAINING VARIOUS MINERALS BECOMES SIGNIFICANT IN THIS QUANTITY AND WILL HAVE A DETRIMENTAL EFFECT ON THE LIFE OF THE BATTERY.

WATER LEVEL (FIG. H-5)

CAUTION

OVERFILLING OF THE BATTERIES WILL VOID THE WARRANTY. E-Z-GO SUGGESTS THE USE OF AN AUTOMATIC WATERING DEVICE THAT IS AVAILABLE FROM YOUR BATTERY DISTRIBUTOR.

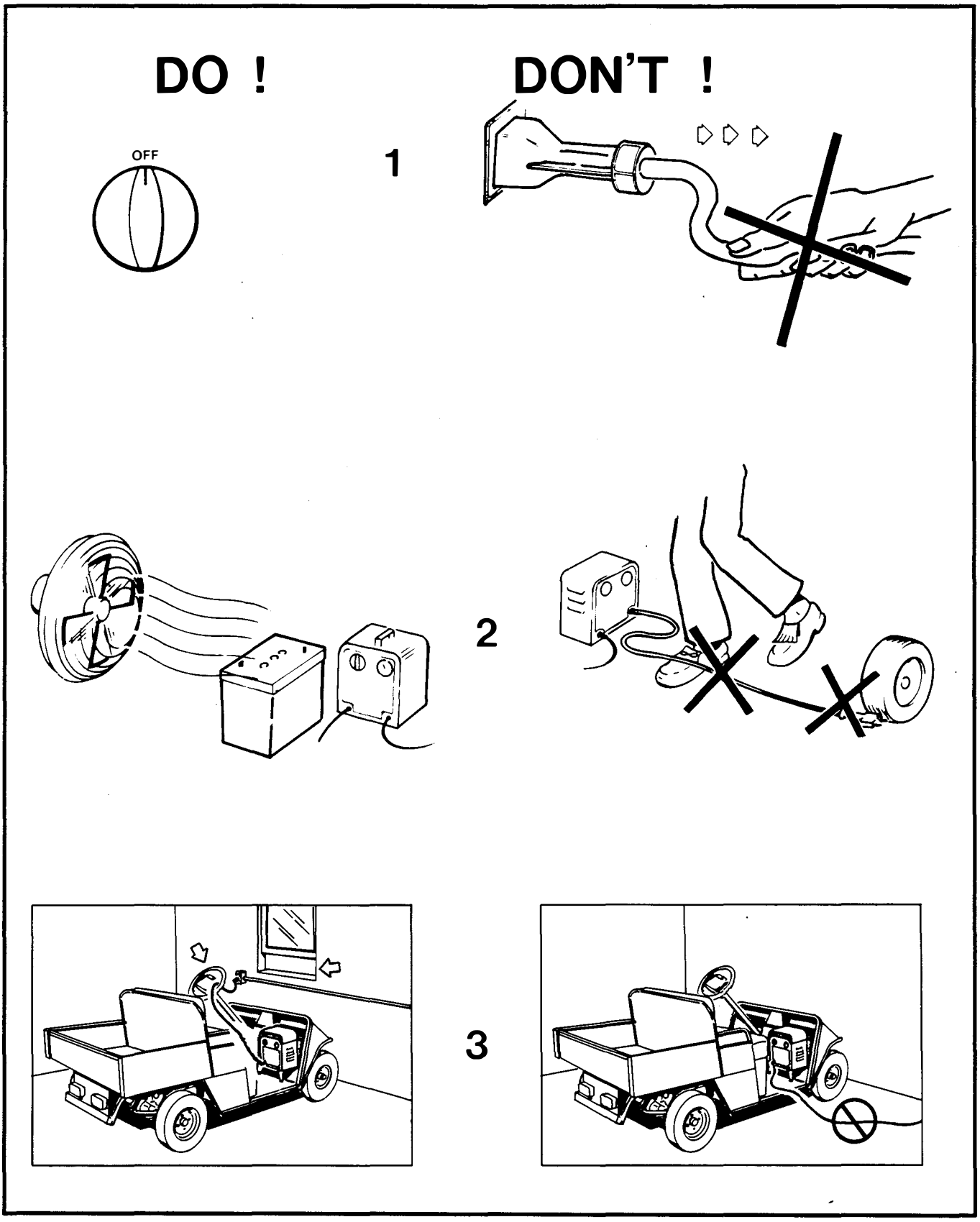


FIG. H-4 CHARGING BATTERIES

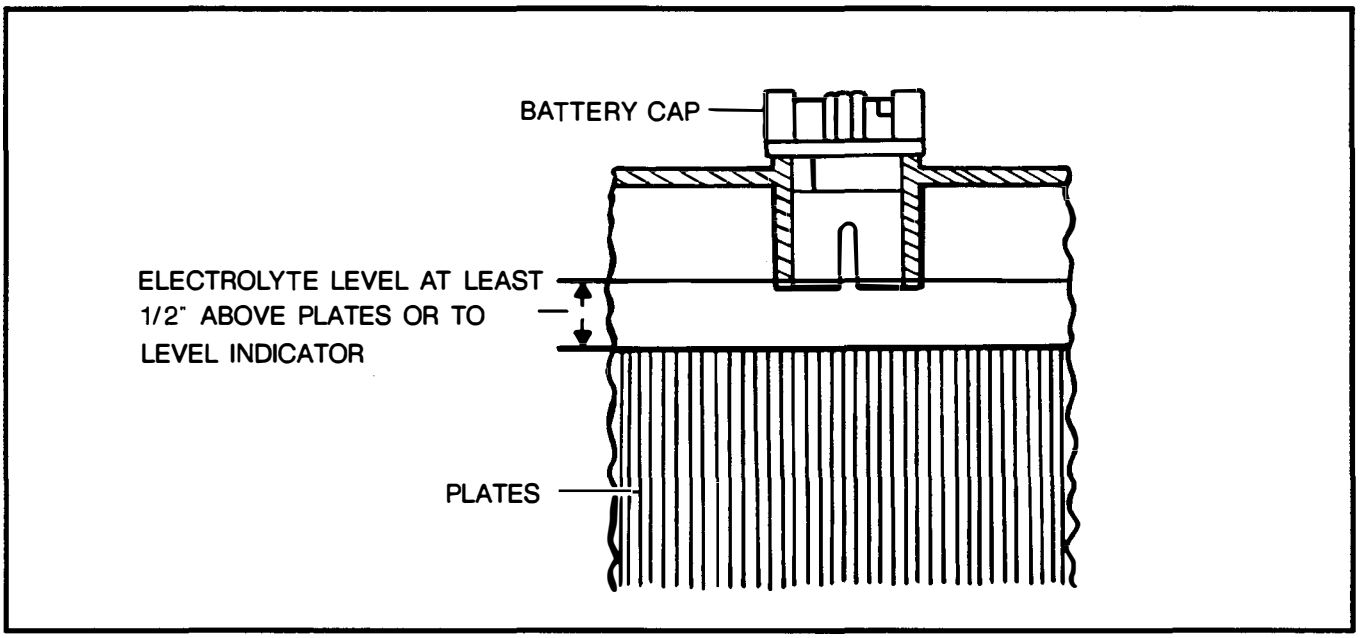


FIG. H-5 BATTERY ELECTROLYTE LEVEL

Add water to the indicator ring if equipped or to 1/2" above the top of the separators. Filling above this level will cause the loss of electrolyte during the charging cycle. The charging cycle causes bubbles to occur which will cause the electrolyte to fill the cavity above the plates. If the electrolyte is overfilled the gassing will force a portion of the electrolyte out through the vent holes in the vent caps. The result of this electrolyte loss will additionally result in corrosion of the wire and connections and the corrosion of the battery support members.

CAUTION

BEFORE CHARGING, BE SURE THAT ELECTROLYTE IS ABOVE THE SEPARATORS. NEVER ALLOW THE ELECTROLYTE TO FALL BELOW THE TOP OF THE PLATES SINCE PERMANENT DAMAGE CAN RESULT TO THE UNCOVERED PORTION OF THE PLATES.

NOTE

It is recommended that any additional water required be added at the end of the charging cycle.

E-Z-GO recommends that all vent caps be removed and immersed in a clean container of water while watering the batteries. This will prevent loss of the caps and dilute any acid residue that could result in burned fingers. After replacing vent caps, rinse off batteries with a hose to eliminate any spilled electrolyte that may have been splashed during the watering operation.

CLEANING

A coating of acid impregnated dirt on the top surface of a battery will create an electrical path between the terminals of the battery. This electrical path will cause a "current leakage" which will both reduce the operating efficiency of the battery and reduce its useful life.

CAUTION

BE SURE ALL VENT CAPS ARE SECURELY IN PLACE BEFORE CLEANING BATTERIES. THIS WILL PREVENT CONTAMINANTS FROM ENTERING BATTERIES.

⚠ WARNING ⚠

USE EYE PROTECTION AND GLOVES DURING THE FOLLOWING CLEANING OPERATION.

Wash with a hose and remove any remaining foreign matter using a stiff bristle brush and a solution of water and bicarbonate of soda (1 cup of bicarbonate of soda to 1 bucket, approximately 8 quarts of water). Hose off batteries after cleaning.

TESTING BATTERIES

WHAT TO CHECK: If a vehicle fails to perform satisfactorily and it is suspected there is a battery

failure, each battery should first be checked individually and then all batteries in the vehicle should be checked as a set.

TEST WITH HYDROMETER: Using a battery hydrometer, test each battery individually, comparing the three cell readings of each battery. If the variation between the highest and lowest cell readings in any one battery is .050 (50 gravity points) or more, there is reason to suspect a weak or failing cell. This test is best accomplished with the batteries in a *PARTIALLY* discharged state; after the car has been used for at least 9 holes of golf.

INSTRUCTIONS FOR USING HYDROMETER: (FIG. H-6)

1. Draw the minimum of electrolyte into the test tube to permit the float to float freely without contacting the top or bottom of the test tube.
2. Hold hydrometer in a vertical position and take a reading at your eye level.
3. Always correct hydrometer Specific Gravity reading to 80° F. For each ten degrees temperature above 80° F, add 4 points to reading. Example: 90° F 1.250 Sp. Gr. = 1.254. For each ten degrees below 80° F, subtract 4 points from reading. Example: 70° F 1.250 Sp. Gr. = 1.246.
4. Test each cell, record readings (corrected to 80° F). A variation of 50 points between any two cell readings (example 1.250 – 1.200) indicates a defect in the low reading cells.

VOLTMETER CHECK

If the voltage of *EACH* cell cannot be measured, test the terminal voltage of each battery (if a set of batteries is being checked). Compare the voltage of the batteries against one another. If the battery voltage readings vary by 0.5 volts or more, there is probably a weak or failing battery. As stated under "Hydrometer Check", the voltmeter check is more effective if the batteries are partially charged.

If the batteries in the vehicle have been on charge and are to be tested with a voltmeter, drive the vehicle around for approximately 30 seconds, then let it stand idle for three or more minutes before testing. This stabilizes the voltage. In this instance, it removes a "surface charge" from the plates which would give a false high voltage reading.

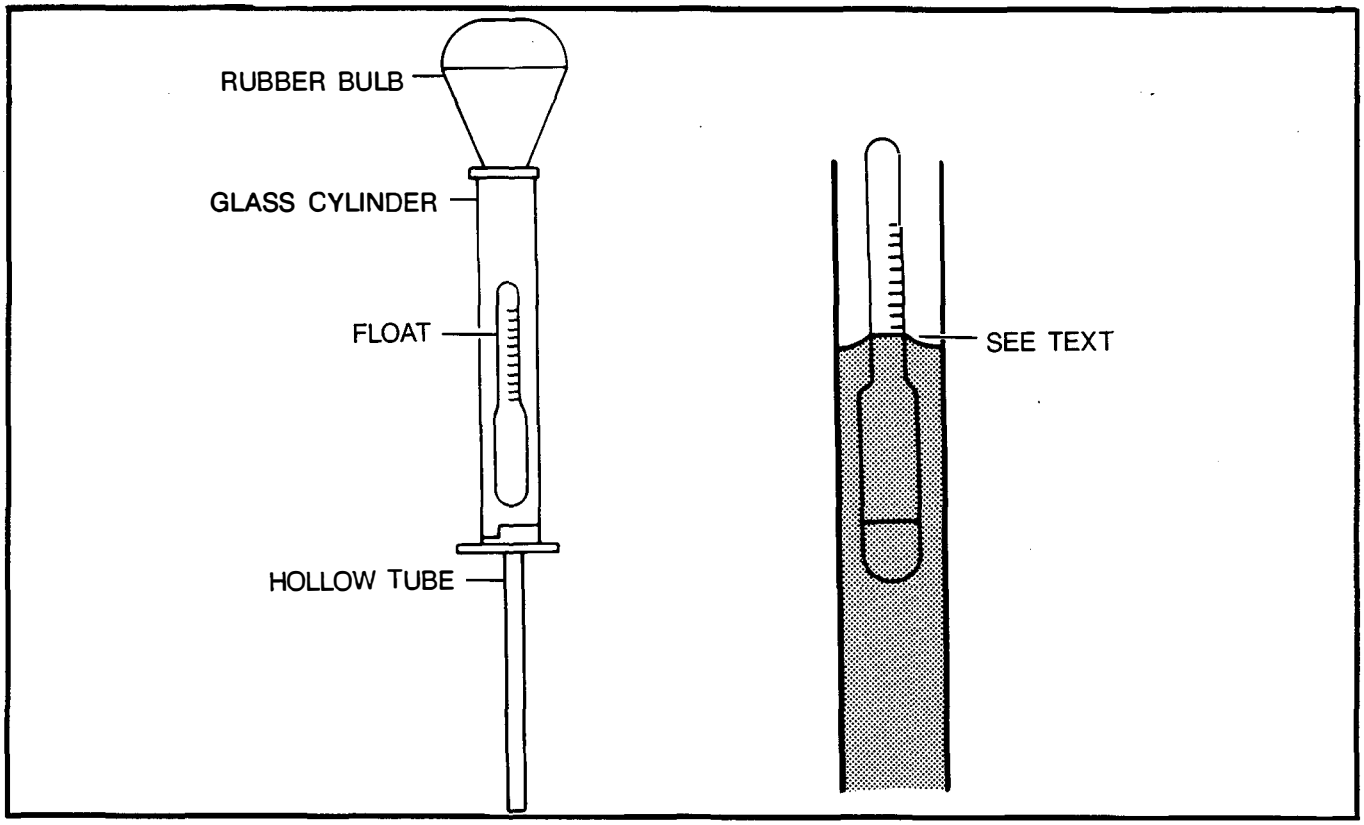


FIG. H-6 USING HYDROMETER

LOAD TEST

This test is designed to simulate the demands imposed on batteries supplying power to electric vehicles.

Batteries fully charged and with the electrolyte temperature @ 80° F ±5° F (26.7° C ±3° C) are discharged at the constant rate specified for the type battery being tested to a terminal voltage equivalent of 1.75 volts per cell. The discharge time in minutes is the battery capacity. The full charge electrolyte specific gravity is to be the same as specified by the battery manufacturer.

Golf car batteries shall be tested as indicated above at a rate of 75 ±1 ampere. There are load testers on the market that are capable of testing batteries in the vehicle.

If the hydrometer or voltmeter check indicates a battery, or one battery in a set of batteries, is failing, fully charge it and conduct the above load test. Record the discharge time in minutes for the battery voltage to reach 5.25 volts. A battery which delivers 50% or less of its rated capacity in minutes should be replaced.

BATTERY LIFE

The life of an electric vehicle battery is determined not only by the number of cycles (a discharge and a recharge) it receives but also by the'depth' of each cycle. Suppose batteries are used to operate a golf car for 18 holes per day. Let us call that one life cycle. If they are used for 36 holes, this is a much deeper discharge and would be equivalent to approximately three life cycles. A battery used 36 holes per day will have a life span approximately one-third that of one used 18 holes per day.

OPERATION AND SERVICE MANUAL

SECTION: BATTERY CHARGER, TOTAL CHARGE®

J

DESCRIPTION

The E–Z–GO battery charger is semi–automatic and is designed specifically for charging electric vehicle batteries.

The charger type is known as a ferroresonant. The term ferroresonant is applied to a charger that starts the charge at a relatively high rate of charge and continuously reduces the rate as the battery or batteries become nearer the full charge condition.

CHARGER INSTALLATION (FIG. J–1)

GROUNDING

⚠ WARNING ⚠

IT IS IMPORTANT THAT A GOOD GROUND BE PROVIDED IN ORDER TO ADEQUATELY PROTECT PERSONNEL AND EQUIPMENT. REFER TO SPECIFICATION GS–726–006 (Pg.T–1)

Each charger requires an input of a dedicated 110–120 Volt A.C. 60 cycle 15 Amp circuit with a standard three prong, NEMA 15–5R receptacle.

⚠ WARNING ⚠

PORTABLE CHARGERS SHOULD BE MOUNTED ON A PLATFORM ABOVE THE GROUND, OR IN SUCH A MANNER AS TO PERMIT THE MAXIMUM AIR FLOW UNDERNEATH AND AROUND THE CHARGER. IF THE CHARGER IS MOUNTED SUCH THAT SUFFICIENT AIR FLOW IS PREVENTED FROM ENTERING THE LOUVERS, OVERHEATING MAY RESULT WHICH COULD CAUSE SERIOUS DAMAGE TO THE CHARGER AND THE POTENTIAL FOR FIRE.

If the charger is operated in an outdoor location, rain and sun protection must be provided.

See paragraph in the BATTERIES AND CHARGING section 'H' of this manual for symptoms that may indicate a low input voltage (A.C.) condition.

The charging (D.C.) cord is equipped with a polarized connector which fits into a matching receptacle on the vehicle.

The power (A.C.) cord is equipped with a standard three prong U.L. listed grounded type plug. Electrical outlet receptacles installed for use at the battery charging locations must be of the three prong grounded type (NEMA 15–5R), which will ground the charger to eliminate any electrical hazard.

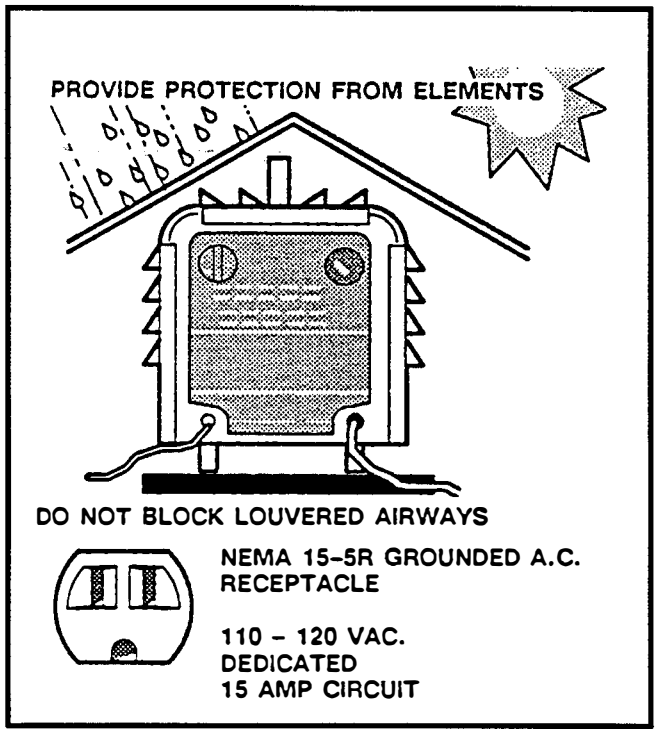


FIG. J–1 CHARGER INSTALLATION

⚠ WARNING ⚠

AN UNGROUNDED ELECTRICAL DEVICE MAY BECOME A PHYSICAL HAZARD THAT COULD RESULT IN AN ELECTRICAL SHOCK OR ELECTROCUTION.

WHEN CONNECTING OR DISCONNECTING THE CHARGER TO A VEHICLE, ALWAYS MAKE SURE THAT THE TIMER, ELAPSED TIME INDICATOR, OR THE POWER SWITCH IS SET IN THE 'OFF' POSITION. IF IT IS NOT, AN ELECTRICAL ARC WILL OCCUR AND MAY CAUSE AN EXPLOSION OR FIRE.

GENERAL

The Total Charge® charger can be connected to a vehicle that has been driven any distance and will charge the batteries fully before shutting itself off.

The electronics module within the charger samples the battery voltage during the charging period. If the module senses that the battery voltage has risen, it continues the charge. If the module senses no change, it determines that the batteries are fully charged and shuts the charger off.

There are two electronic modules in use and each has slightly different characteristics.

UNDERSTANDING YOUR TOTAL CHARGE® CHARGER

The Total Charge® charger reacts to unusual situations in various ways.

A. PENTA MODULE

1. If the charger was disconnected from the vehicle during the charge cycle, it will shut off immediately.
2. If the charger was disconnected from the vehicle during the charge cycle and the elapsed timer not set to "off", the following will result when it is reconnected:
   a. The charger will continue to charge the batteries as soon as reconnection takes place. If, however, the batteries require a charge greater than time remaining on the timer, the battery will obtain a full charge.
3. If the A.C. power was interrupted, the charge cycle will continue normally for the remainder of the cycle when the power is restored.
4. If the elapsed time indicator shows that the charger has run for 12 hours, check to confirm that the timer is in the "off" position and not between 11 and 12 hours (a detent can be felt in the 12 hour or "off" position). The charger can charge for a maximum of 12 hours when set in the "start" position, 11 hours maximum when set at "1", 10 hours maximum when set at "2", and so forth. If there is reason to believe that the batteries were not fully charged, the following situations may apply:
   a. The elapsed timer may not have been reset to "start" position or was set at "1", "2", etc.
   b. The batteries may be deeply discharged and require a longer charge time.
   c. There may be a weak cell in one or more batteries.
   d. the automatic module may have failed.
5. If the batteries become fully charged in a short period of time (1 hour), the charger will shut off. If the open circuit battery voltage drops to 36.7–37.3 volts and the elapsed time indicator has time remaining, the charger will turn itself on until the batteries are fully charged or the elapsed time indicator shuts the charger off.

B. AVEX MODULE

1. If the charger is disconnected from the vehicle during the charge cycle the charger will shut off immediately.
2. If the charger was disconnected from the vehicle during the charge cycle and the elapsed timer not set to "off", the following situations will result when it is reconnected:
   a. The charger will continue to charge the batteries as soon as a reconnection takes place. If, however, the batteries require a charge period of from 10 to 12 hours, then the remaining charge period will be reduced by the time that the charger was disconnected.
3. If the A.C. power was interrupted, the charge cycle will continue normally for the remainder of the cycle when the power is restored.
4. If the elapsed time indicator shows that the charger has run for 12 hours, check to confirm that the timer is in the "off" position and not between 11 and 12 hours (a detent can be felt in the 12 hour or "off" position). The charger can charge for a maximum of 12 hours when set in the "start" position, 11 hours maximum when set at "1", 10 hours maximum when set at "2", and so forth. If there is reason to believe that the batteries were not fully charged, the following situations may apply:
   a. The elapsed timer may not have been reset to "start" position or was set at "1", "2", etc.
   b. The batteries may be deeply discharged and require a longer charge time.
   c. There may be a weak cell in one or more batteries.

d. The automatic module may have failed.

5. If the batteries become fully charged in a short period of time (30 minutes), the charger will shut off. If the open circuit battery voltage drops to 36.7–37.3 volts and the elapsed time indicator has time remaining, the charger will turn itself on until the batteries are fully charged or the elapsed time indicator shuts the charger off.

TROUBLE–SHOOTING

CHARGER TROUBLE–SHOOTING (FIG. J–2, FIG. J–3, FIG. J–4, FIG. J–5, and FIG. J–6)

A simple but effective method of trouble–shooting a battery charger that does not operate is as follows. Use FIG. J–2, FIG. J–5, and FIG. J–6 for reference. Follow the sequenced procedures.

⚠ WARNING ⚠

DISCONNECT THE BATTERY CHARGER FROM BOTH THE A.C. POWER AND THE BATTERIES BEFORE PROCEEDING.

CHECK FOR A.C. POWER

1. Remove the top cover (1) by removing the Phillips head screws (2) from the flanges. Set VOM meter to the X1 ohms scale. Examine the D.C. plug (3) that connects to the vehicle carefully for loose terminals or broken wires. If everything is in good condition, use the Ohm Meter. Touch the red probe to the tip in the D.C. plug on the positive side (4), touch the black probe to the heat sink (5). The ohm meter's needle should deflect. If the needle does not move, there is an open circuit between the D.C. plug and the heat sink which indicates a break in the white wire or a bad circuit breaker.

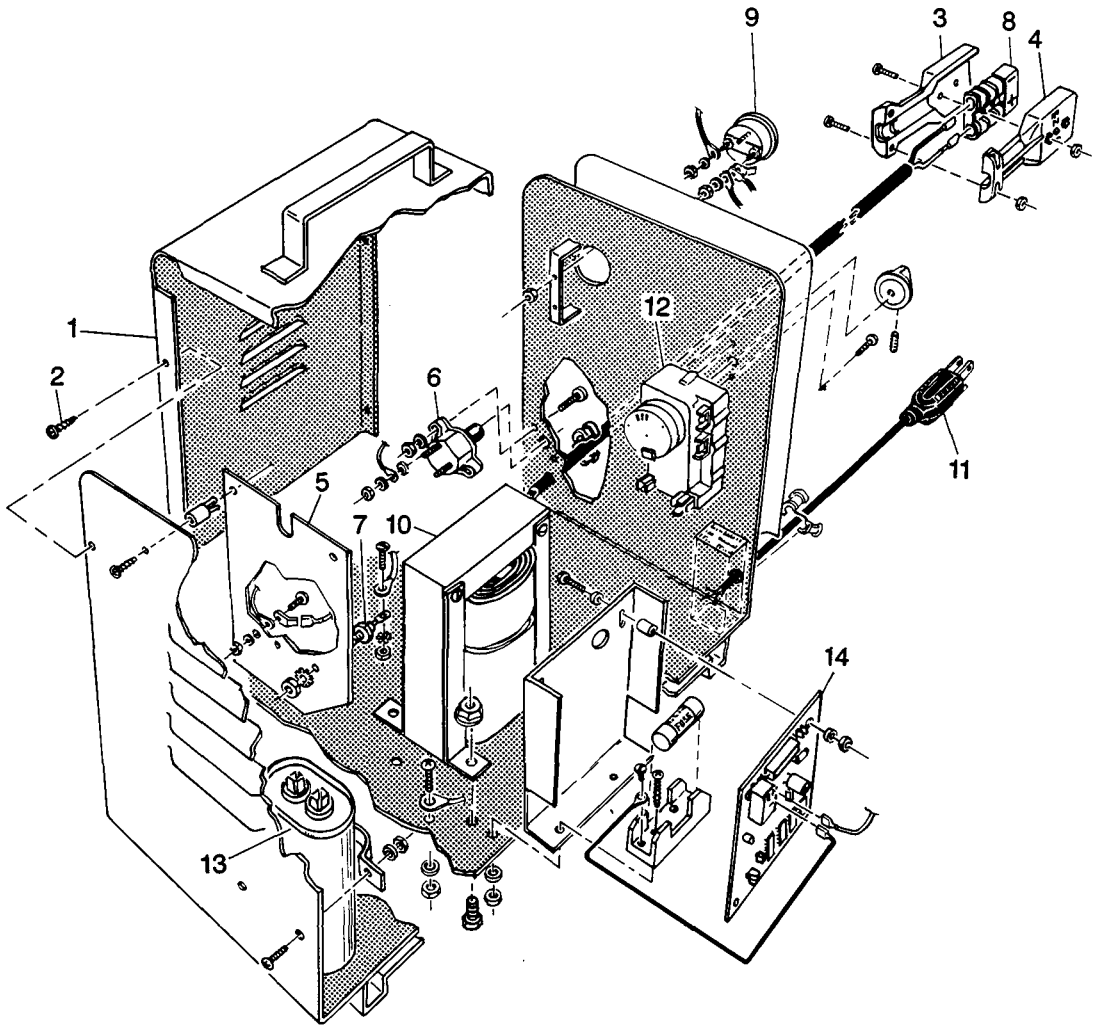
   a. On–Board Models Only: On–board models are equipped with a relay which prevents the electronics module from drawing power from the batteries when the vehicle is NOT plugged in to an A.C. power supply. To test the relay: plug charger into an A.C. supply and turn timer 'ON'. Check for 36 V.D.C. between the diode heat sink and the positive D.C. terminal at the printed circuit board. Replace relay if 36 V.D.C. is not present.

2. To test the circuit breaker (6), place a probe on one side of the circuit breaker and the other probe on the other side of the circuit breaker; the needle should deflect on the ohm meter. If it does not move, a bad circuit breaker is indicated.

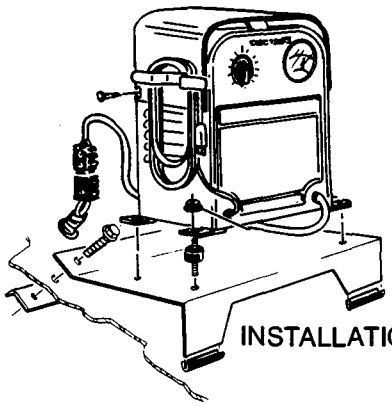
3. Disconnect the red wire at the heat sink. Touch the red (+) probe to the heat sink (5) and the black (–) probe to the joint of the wire and silicon diode (7). If the needle moves, it indicates a bad diode. If the needle does not move, reverse the leads, touch the black (–) probe on the heat sink and the red (+) probe on the joint, the needle of the ohm meter should deflect. If it does not move, a bad diode is indicated (7). Conformance to this procedure indicates that all circuitry between the tip of the positive wire at the D.C. plug to the joint at the wires coming from the diodes is functioning correctly. Reattach red wire.

4. To test the negative side of the D.C.. cord, touch either probe to the tip of the negative wire (8) at the D.C. plug and the other to the terminal on the ammeter (9) which has 2 wires that connect to the transformer (10). If a full needle deflection does *NOT* take place, an open circuit somewhere in the negative or black wire is indicated. This may be a broken wire, a loose terminal, or a defective ammeter. If the needle does not deflect, probe each component in the circuit until the open circuit is found. When the probe crosses the "open", it will deflect full scale.

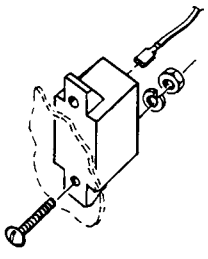
5. Touch the red (+) probe to one blade of the A.C. plug (11) (not the ground pin) and the black (–) probe to the black wire from the A.C. cord to the timer (12). If the needle of the Ohm Meter does not deflect, switch the red (+) probe to the other blade of the A.C. plug. It should deflect to indicate a complete circuit. If the needle does not deflect, it indicates a defective fuse or a broken A.C. input wire. If fuse is suspect, replace with a new one,. If the black wire is sound, repeat the same test



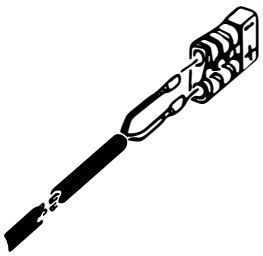
DETAILS (ON-BOARD CHARGER ONLY)



INSTALLATION



RELAY



36V D.C. CORD

FIG. J-2 BATTERY CHARGER

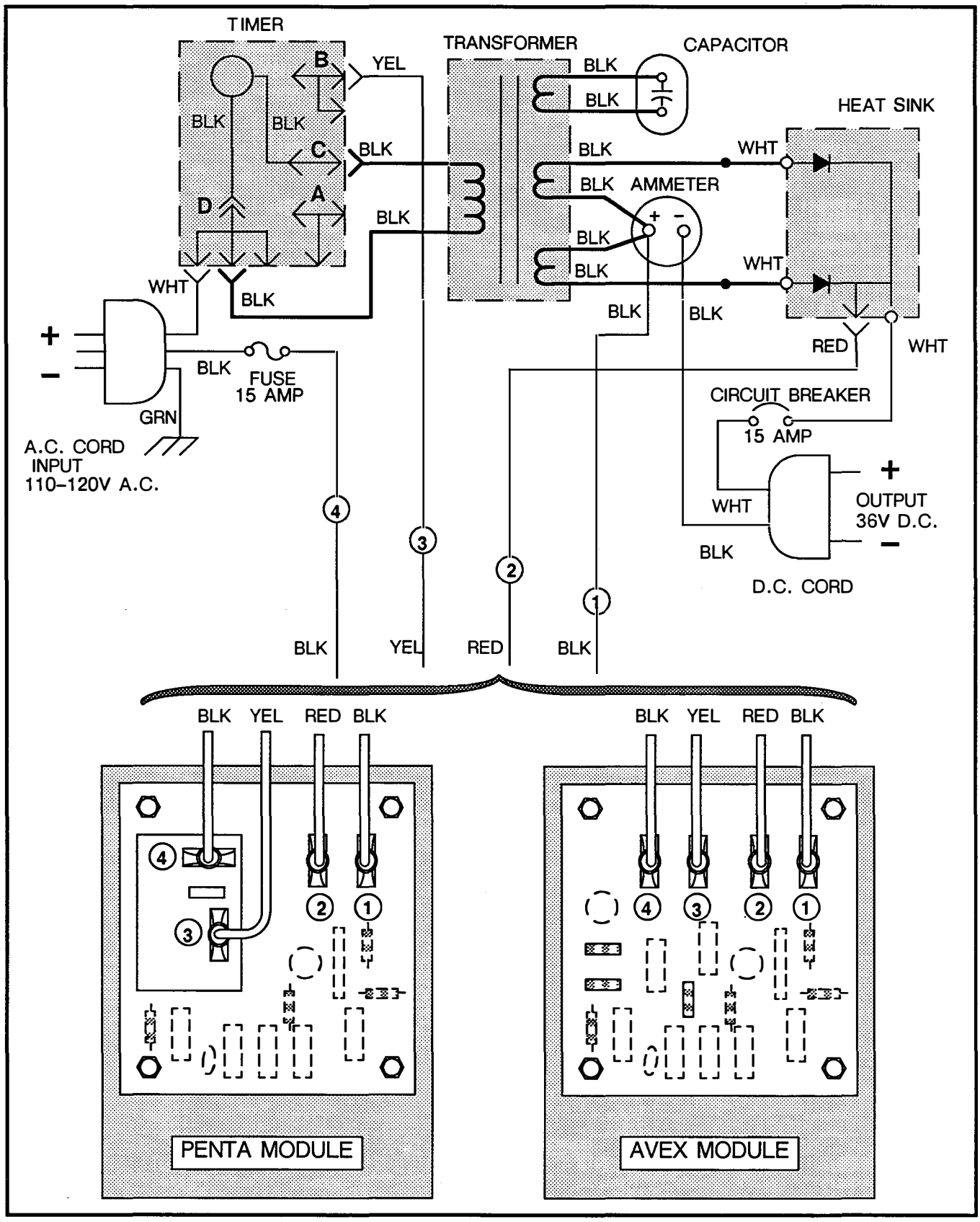


FIG. J-3 SCHEMATIC DIAGRAM (PORTABLE TOTAL CHARGE®)

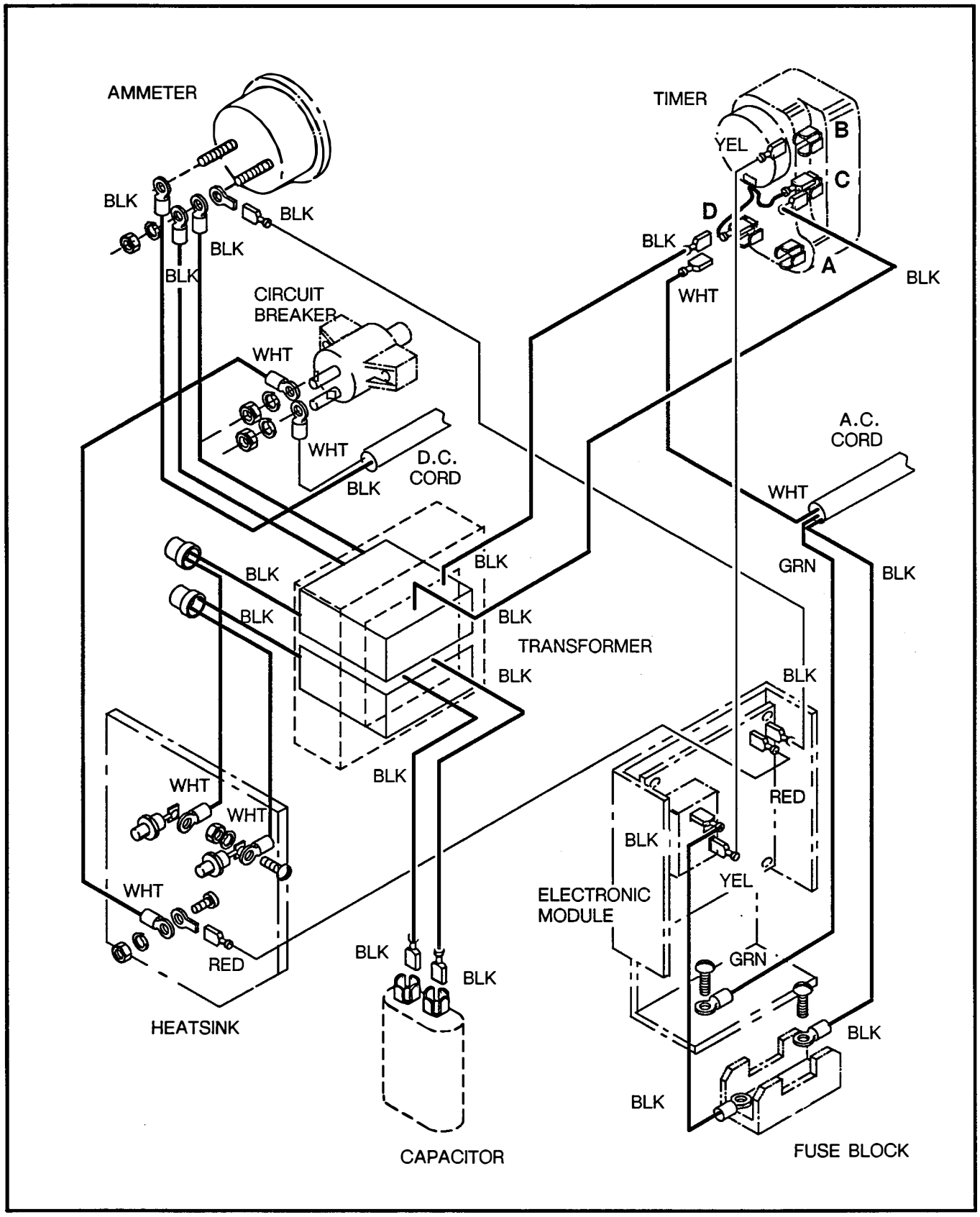


FIG. J-4 WIRING DIAGRAM (PORTABLE TOTAL CHARGE®)

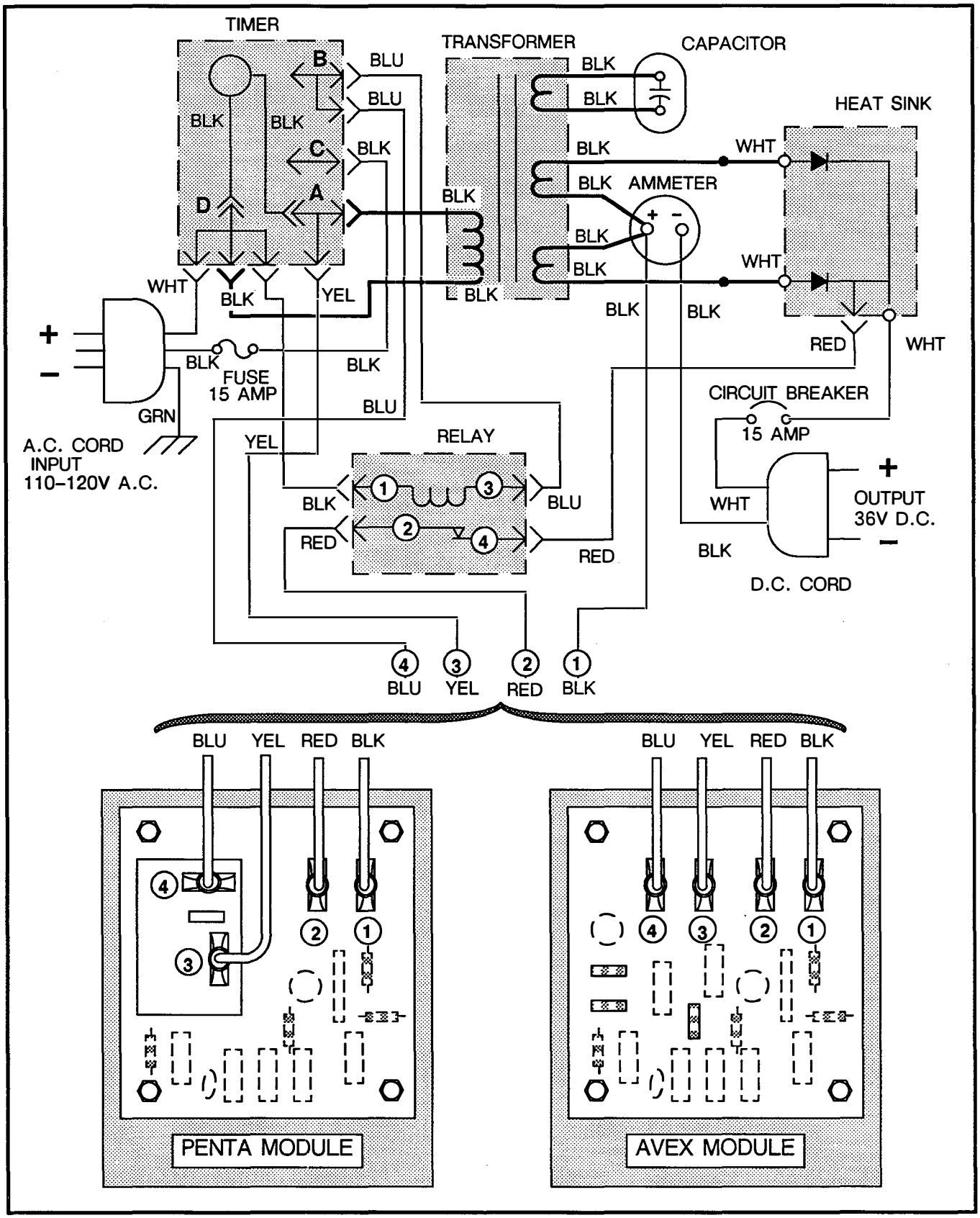


FIG. J-5 SCHEMATIC DIAGRAM (ON BOARD TOTAL CHARGE®)

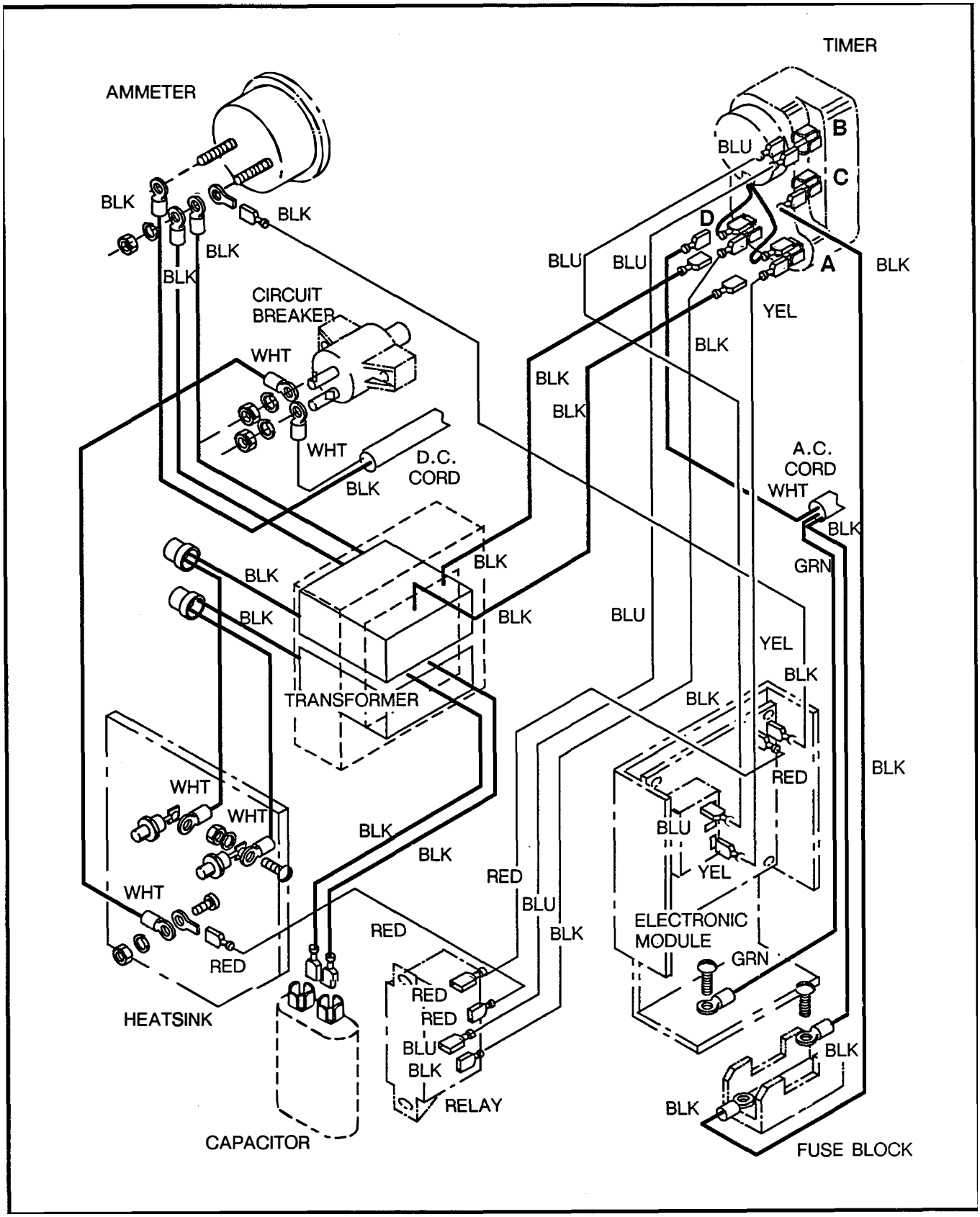


FIG. J-6 WIRING DIAGRAM (ON BOARD TOTAL CHARGE®)

to the white wire and the other blade of the A.C. plug.

6. Locate the wires at the top contact that join the timer motor and the transformer (terminal C). Touch the red (+) probe to terminal C and touch the black (–) probe to terminal B. Turn the timer on. The Ohm Meter needle should deflect indicating a good timer. All circuitry from the A.C. plug to the primary winding of the transformer is functioning. The ohm meter will check the transformer correctly only for an open circuit or shorted winding to ground. Disconnect the primary winding transformer lead from terminal C on the timer. Touch one probe to the transformer lead and touch the other probe to the terminal D on the timer. The meter will deflect if the primary winding is complete. Touch one probe to the + terminal on the ammeter and touch the other probe to each wire at the diodes.

7. The meter will deflect each time if the secondary winding is complete. Touch one probe to the transformer laminations and touch the other probe to one primary transformer lead wire. If the meter deflects, the primary winding is shored to ground. Remove the probe from the primary transformer lead wire and touch it to each diode wire. If the meter deflects either time, the secondary winding is shorted to ground. Remove the probe from the diode lead wire and touch it to one disconnected capacitor lead wire. If the meter deflects, the ferroresonant winding is shorted to ground.

⚠ WARNING ⚠

BE SURE TO DISCHARGE THE CAPACITOR (13) BEFORE TOUCHING EITHER WIRE OR TERMINAL. THIS IS DONE BY SHORTING OR TOUCHING BOTH CAPACITOR WIRES OR TERMINALS WITH AN INSULATED SCREWDRIVER WHILE HOLDING THE INSULATED HANDLE.

8. Set the Ohm Meter to 1K ohms. Touch one probe to each terminal of the capacitor, reverse the probes. The needles should deflect and then return to neutral. Repeat this procedure; as the capacitor charges and discharges, the needle will deflect and return each time the probes are reversed. If the needle does not deflect at all, it indicates an open circuit.

If the needle deflects full scale and remains at full scale with the probes in either position, the capacitor is shorted.

An ohm meter is unable to test for a transformer with a short circuit. Should the charger fail to work after the above tests have been completed, the transformer should be exchanged for one that is known to be good.

With one wire removed from the capacitor, touch one probe to the wire connected to the capacitor and touch the other probe to the wire removed. The meter will deflect if the ferroresonant winding is complete.

9. (FIG. J–6) Remove the black wire joining the module and fuse at the module connection and reconnect to contact B of the timer. Turn the timer on. If the charger does not operate, check that there is an A.C. input line voltage to the battery charger. If the charger operates, the automatic shut–off electronic module is defective.

COMPONENT REPLACEMENT

The automatic shut–off module is a non–repairable component and must be removed and *REPLACED.*

CAUTION

CARE MUST BE TAKEN WHEN DISCONNECTING OR CONNECTING THE WIRES ON THE AUTOMATIC SHUT–OFF MODULE TO PREVENT BREAKAGE OF THE TERMINALS.

In general, component replacement within the battery charger requires no explanation; however, diode replacement must be done with extreme care.

CAUTION

TO PREVENT DAMAGE AND PREMATURE FAILURE OF DIODES, THE FOLLOWING PROCEDURES MUST BE FOLLOWED.

Before installing the diode to the heat sink, clean the heat sink and apply a thin layer of heat sink compound (available at any electronics supply house) between the body of the diode and the heat sink. Tighten the diode hardware to 15–20 in. lbs. torque. Remove any excess heat sink compound.

DESCRIPTION

The E–Z–GOTotal Charge® III and Total Charge® IV battery chargers are automatic and is designed specifically for charging electric vehicle batteries.

The charger type is known as a ferroresonant. The term ferroresonant is applied to a charger that starts the charge at a relatively high rate of charge and continuously reduces the rate as the battery or batteries become nearer the full charge condition.

CHARGER INSTALLATION (FIG. J–7)

GROUNDING

⚠ WARNING ⚠

IT IS IMPORTANT THAT A GOOD GROUND BE PROVIDED IN ORDER TO ADEQUATELY PROTECT PERSONNEL AND EQUIPMENT. REFER TO SPECIFICATION GS–726–006 (PG. T–1)

Each charger requires an input of a dedicated 110–120 Volt A.C. 60 cycle 15 Amp circuit with a standard three prong, NEMA 15–5R receptacle.

⚠ WARNING ⚠

PORTABLE CHARGERS SHOULD BE MOUNTED ON A PLATFORM ABOVE THE GROUND, OR IN SUCH A MANNER AS TO PERMIT MAXIMUM AIR FLOW UNDERNEATH AND AROUND THE CHARGER. IF THE CHARGER IS MOUNTED SUCH THAT SUFFICIENT AIR FLOW DOES NOT ENTER THE LOUVERS, OVERHEATING MAY RESULT WHICH COULD CAUSE SERIOUS DAMAGE TO THE CHARGER AND THE POTENTIAL FOR FIRE.

If the charger is operated in an outdoor location, rain and sun protection must be provided.

See paragraph in the BATTERIES AND CHARGING section of this manual for symptoms that may indicate a low input voltage (A.C.) condition.

The charging (D.C.) cord is equipped with a polarized connector which fits into a matching receptacle on the vehicle.

The power (A.C.) cord is equipped with a standard three prong U.L. listed grounded type plug. Electrical outlet receptacles installed for use at the battery charging locations must be of the three prong grounded type (NEMA 15–5R), which will ground the charger to eliminate any electrical hazard.

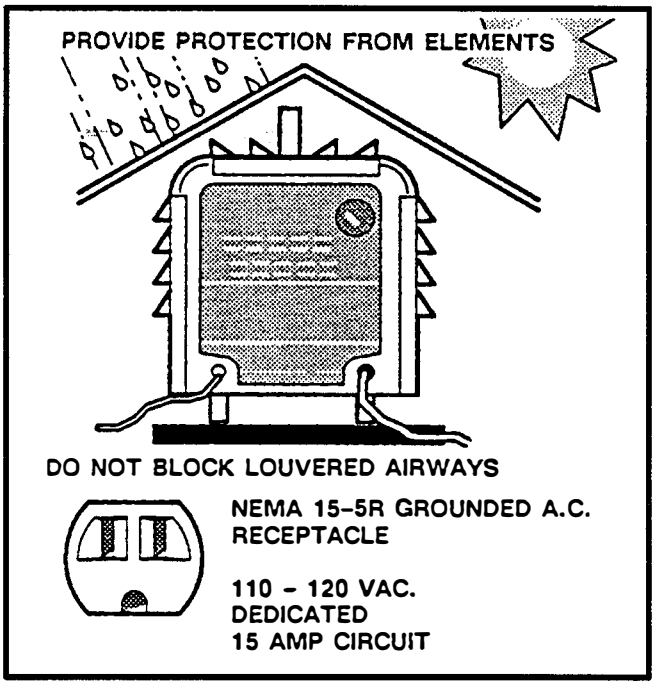


FIG. J–7 CHARGER INSTALLATION

⚠ WARNING ⚠

AN UNGROUNDED ELECTRICAL DEVICE MAY BECOME A PHYSICAL HAZARD THAT COULD RESULT IN AN ELECTRICAL SHOCK OR ELECTROCUTION.

GENERAL

The Total Charge® charger can be connected to a vehicle that has been driven any distance and will charge the batteries fully before shutting itself off.

The electronics module within the charger samples the battery voltage during the charging period. If the module senses that the battery voltage has risen, it continues the charge. If the module senses no change, it determines that the batteries are fully charged and shuts the charger off.

There are two electronic modules in use and each has slightly different characteristics.

UNDERSTANDING YOUR TOTAL CHARGE® III AND IV CHARGERS

The Total Charge® charger reacts to unusual situations in various ways.

1. PENTA MODULE / POTTER AND BRUMFIELD
   1. If the charger is disconnected from the vehicle during the charge cycle, it will shut off immediately.
   2. If the A.C. power is interrupted, the charge cycle will continue normally for the remainder of the cycle when the power is restored.
   3. If the batteries become fully charged in a short period of time (1 hour), the charger will shut off. If the open circuit battery voltage drops to 36.7–37.3 volts the charger will turn itself on until the batteries are fully charged.

TROUBLE–SHOOTING

CHARGER TROUBLE–SHOOTING (FIG. J–8 THRU FIG. J–16)

A simple but effective method of trouble–shooting a battery charger that does not operate is as follows. Follow the sequenced procedures.

⚠ WARNING ⚠

DISCONNECT THE BATTERY CHARGER FROM BOTH THE A.C. POWER AND THE BATTERIES BEFORE PROCEEDING.

CHECKING FOR A.C. POWER WHEN #1 WHEN IS ON D.C. SIDE

Perform a continuity check on all components from the A.C. cord to the D.C. plug. If you are unfamiliar with how to perform this check, consult the following trouble–shooting sequence.

1. Remove the top cover (1) by removing the Phillips head screws (2) from the flanges. Set an analog VOM meter to the X1 ohms scale, or a digital VOM to continuity. Examine the D.C. plug (3) that connects to the vehicle carefully for loose terminals or broken wires. If everything is in good condition, use the Ohm Meter. Touch the red probe to the tip in the D.C. plug on the positive side (4), touch the black probe to the heat sink (5). The ohm meter's needle should deflect. If the needle does not move, there is an open circuit between the D.C. plug and the heat sink which indicates a break in the white wire or a bad circuit breaker.

   a. On–Board Models Only: On–board models are equipped with a relay which prevents the electronic module from drawing power from the batteries when the vehicle is NOT plugged into an A.C. power supply. To test the relay: plug charger into an A.C. power supply. Check for 36 V.D.C. between the diode heat sink and the positive D.C. terminal at the printed circuit board. Replace the relay if 36 V.D.C. is not present.

2. To test the circuit breaker (6), place a probe on one side of the circuit breaker and the other probe on the other side of the circuit breaker; the needle should deflect on the ohm meter. If it does not move, a bad circuit breaker is indicated.

3. Disconnect the red wire at the heat sink. Touch the red (+) probe to the heat sink (5) and the black (–) probe to the joint of the wire and silicon diode (7). If the needle moves or reads "0", this indicates a bad diode. If the needle does not move, reverse the leads, touch the black (–) probe on the heat sink and the red (+) probe on the joint, the needle of the ohm meter should deflect. If it does not move, a bad diode is indicated (7). Conformance to this procedure indicates that all circuitry between the tip of the positive wire at the D.C. plug to the joint at the wires coming from the diodes is functioning correctly. Reattach red wire.

4. To test the negative side of the D.C.. cord, touch either probe to the tip of the negative wire (8) at the D.C. plug and the other to the terminal on the ammeter (9) which has 2 wires that connect to the transformer (10). If a full needle deflection does *NOT* take place, an open circuit somewhere in the negative or black wire is indicated. This may be a broken wire, a loose terminal, or a defective ammeter. If the needle does not deflect, probe each component in the circuit until the open circuit is found. When the probe crosses the "open", the needle will deflect full scale.

5. Touch the red (+) probe to one blade of the A.C. plug (11) (not the ground pin) and the black (–) probe to the yellow wire on the module. If the needle of the Ohm meter does not deflect, switch the red (+) probe to the other blade of the A.C. plug. It should deflect to indicate a complete circuit. If the needle does not deflect, it indicates a defective fuse or a broken A.C. input wire. If fuse is suspect, replace with a new one. If the black wire is sound, switch the red (+) probe to the white

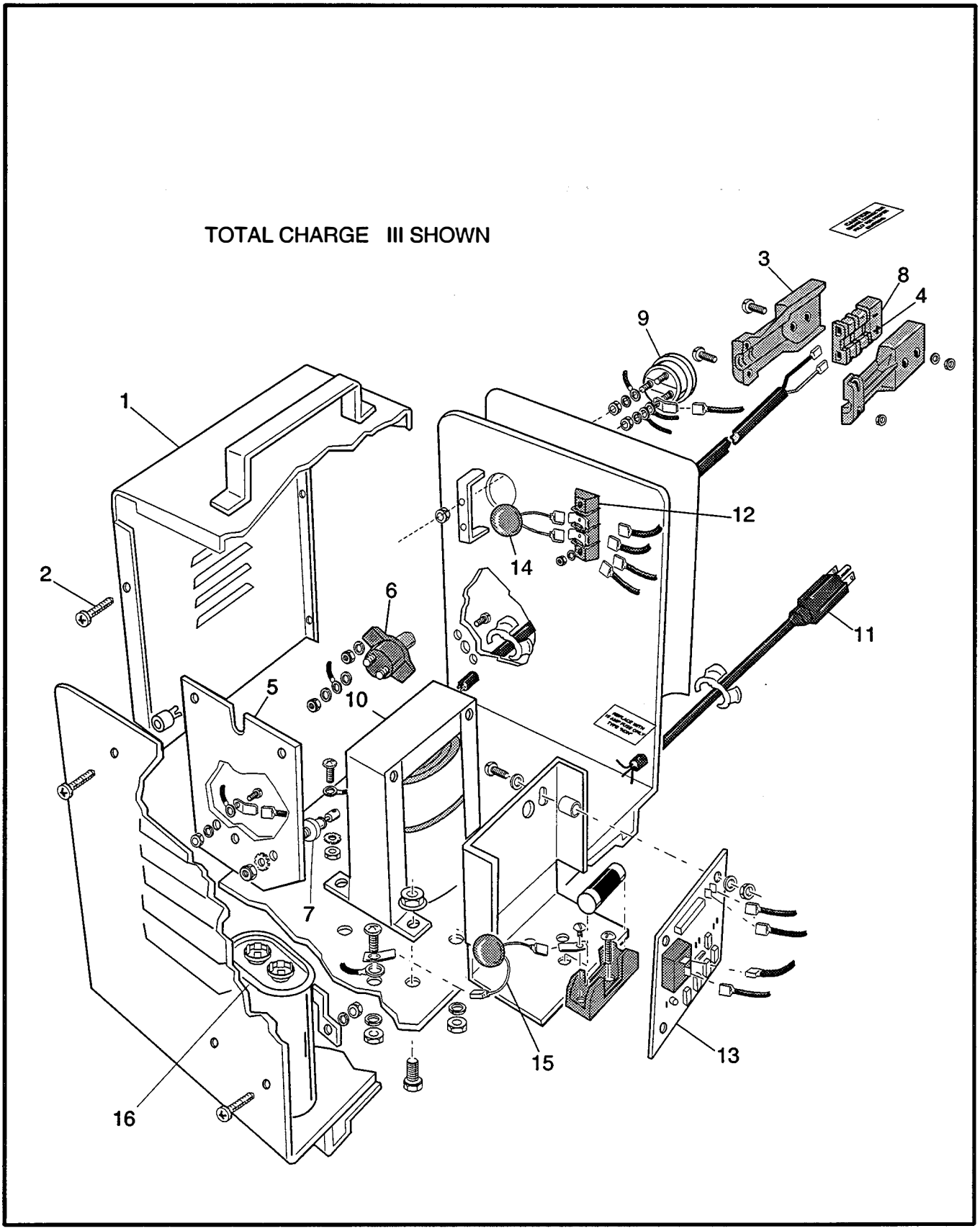


FIG. J–8 BATTERY CHARGER

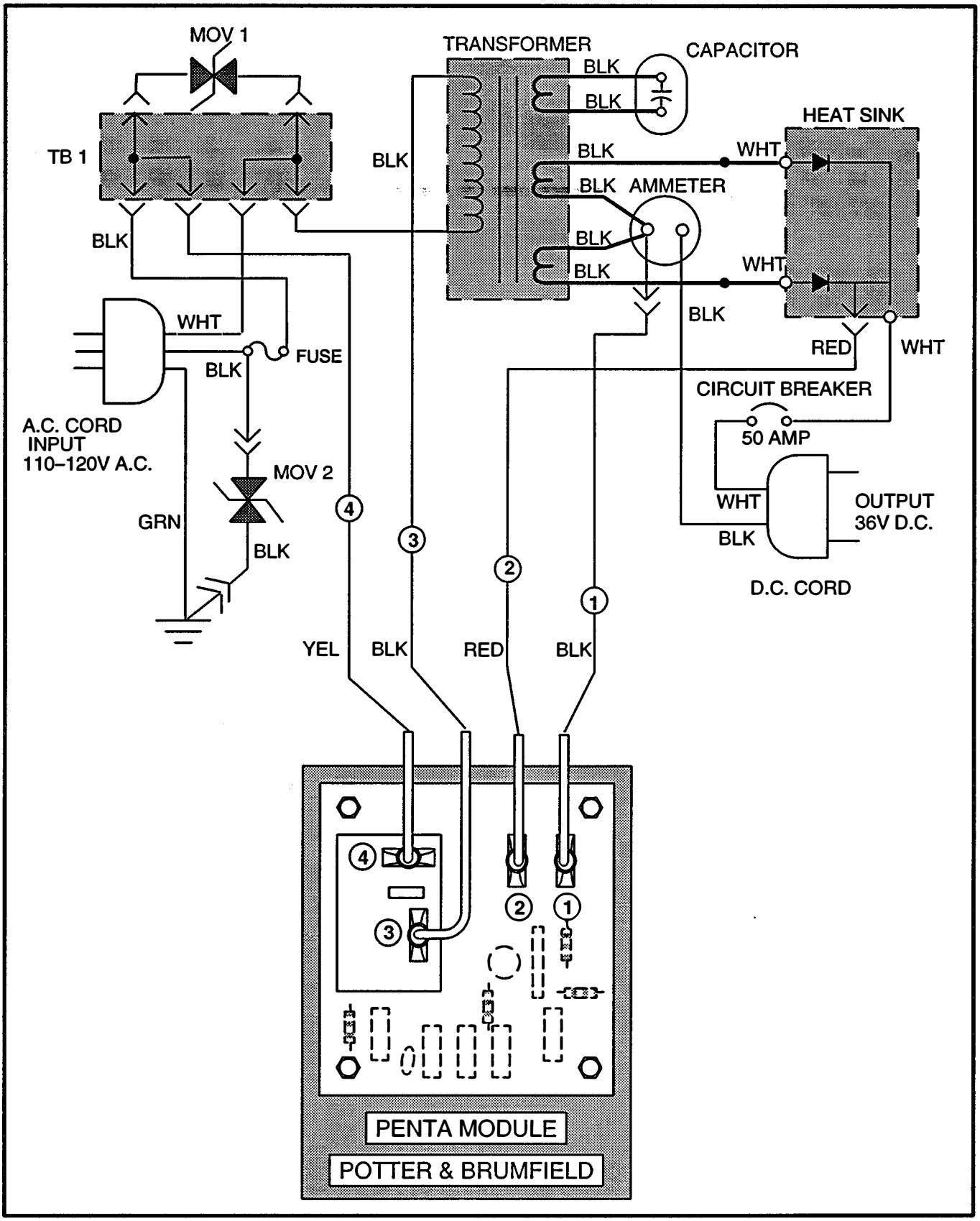


FIG. J–9 SCHEMATIC DIAGRAM (PORTABLE TOTAL CHARGE® III CHARGER)

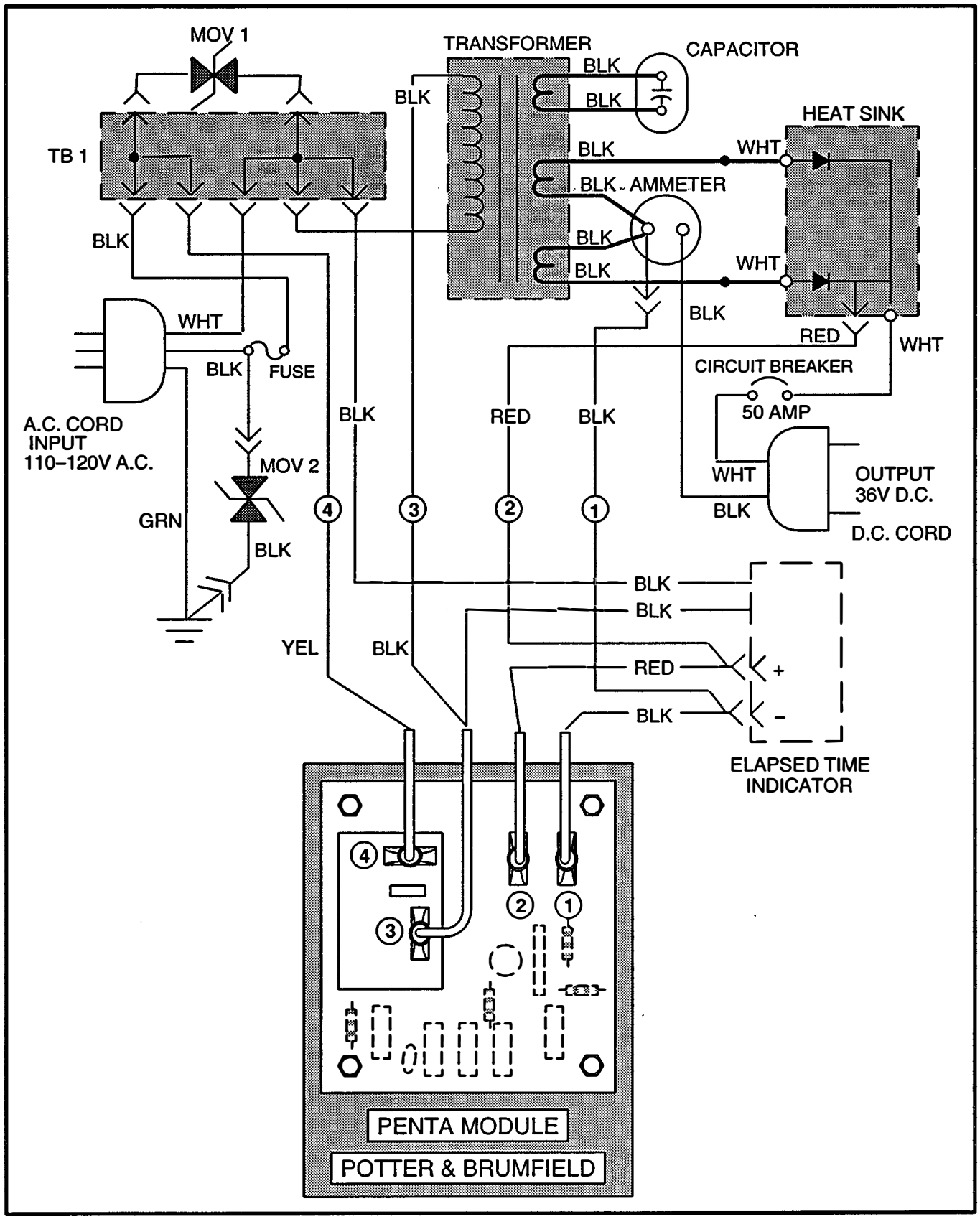


FIG. J–10 SCHEMATIC DIAGRAM (PORTABLE TOTAL CHARGE® IV CHARGER)

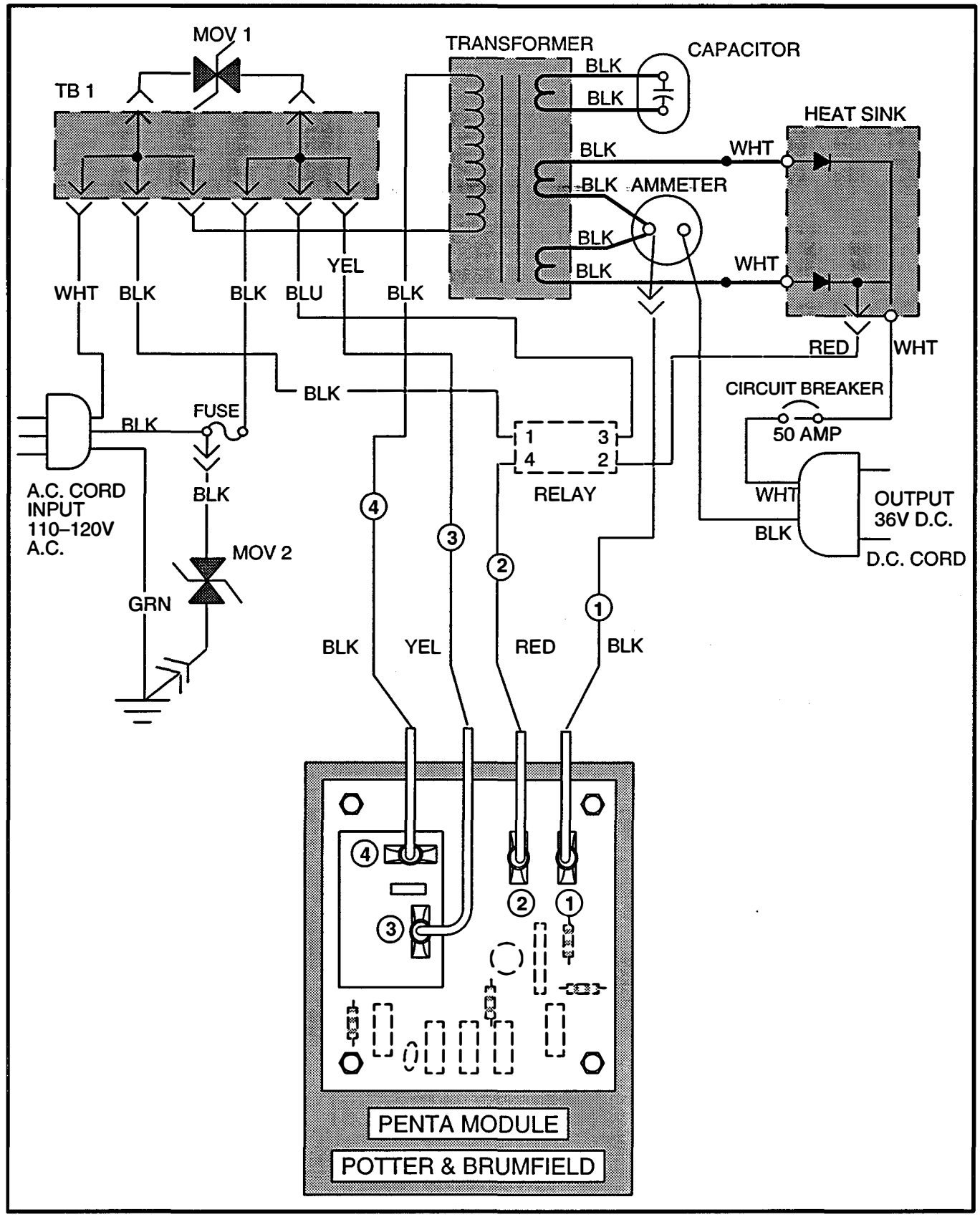


FIG. J–11 SCHEMATIC DIAGRAM (ON BOARD TOTAL CHARGE® III CHARGER)

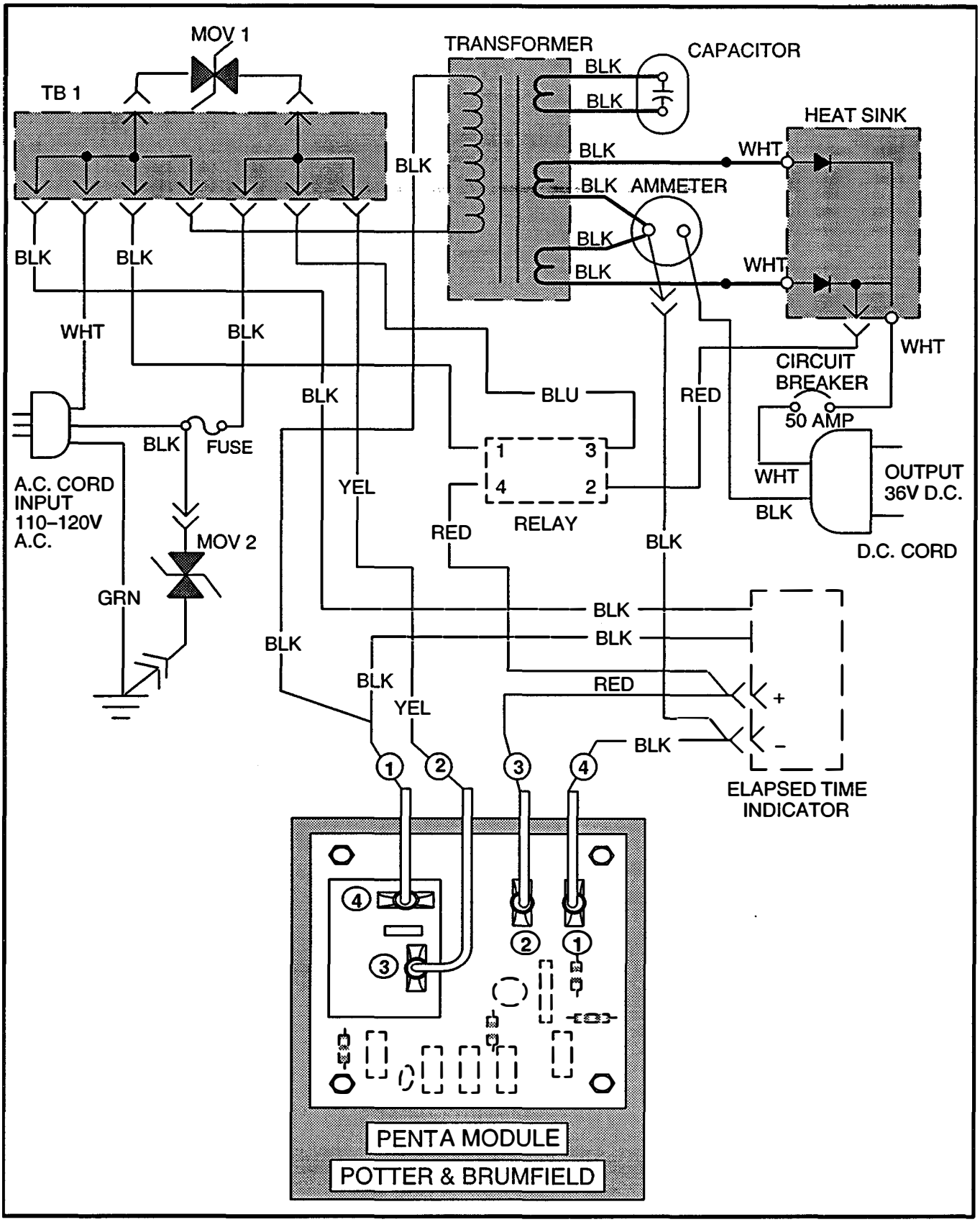


FIG. J–12 SCHEMATIC DIAGRAM (ON BOARD TOTAL CHARGE® IV CHARGER)

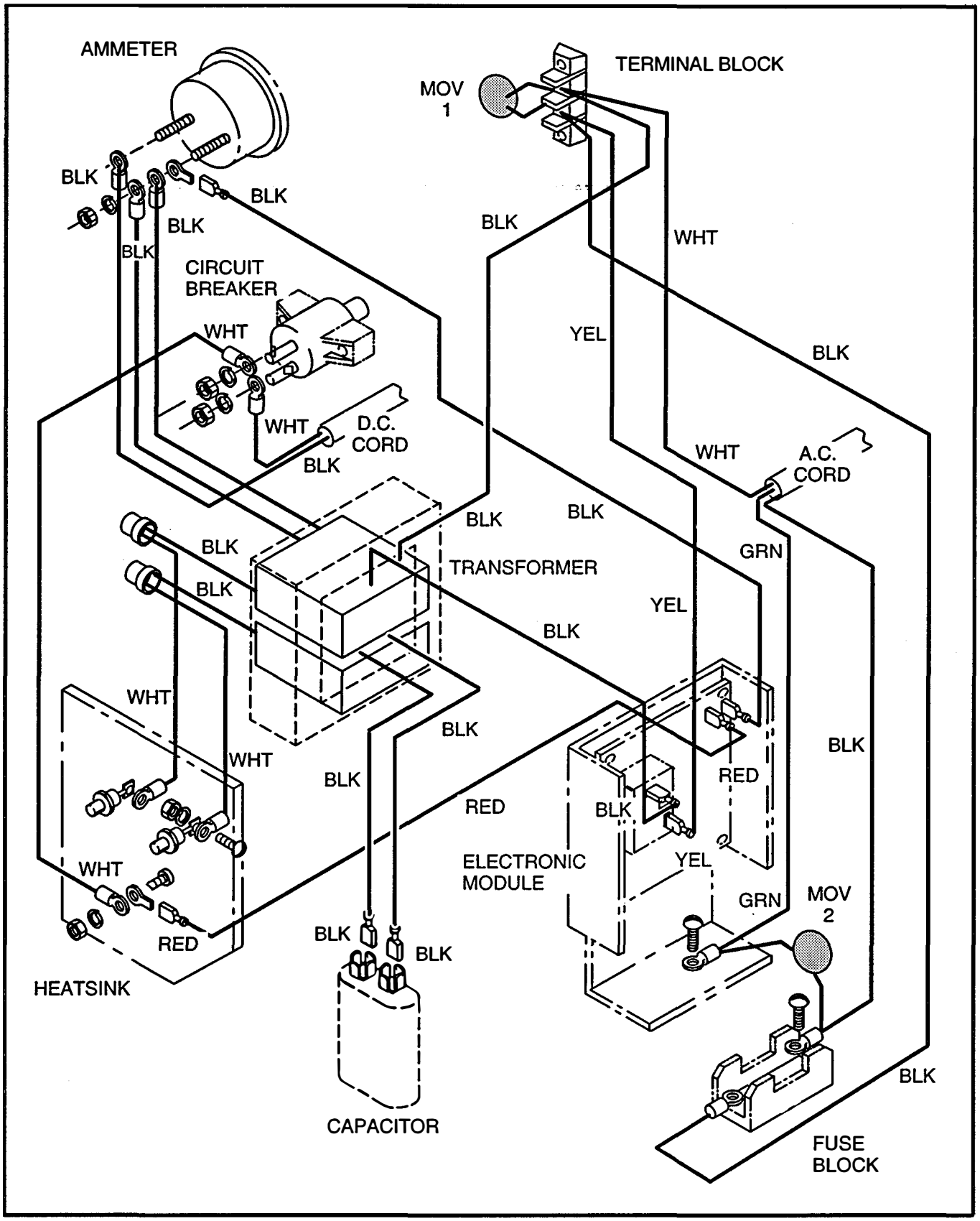


FIG. J–13 WIRING DIAGRAM (PORTABLE TOTAL CHARGE® III CHARGER)

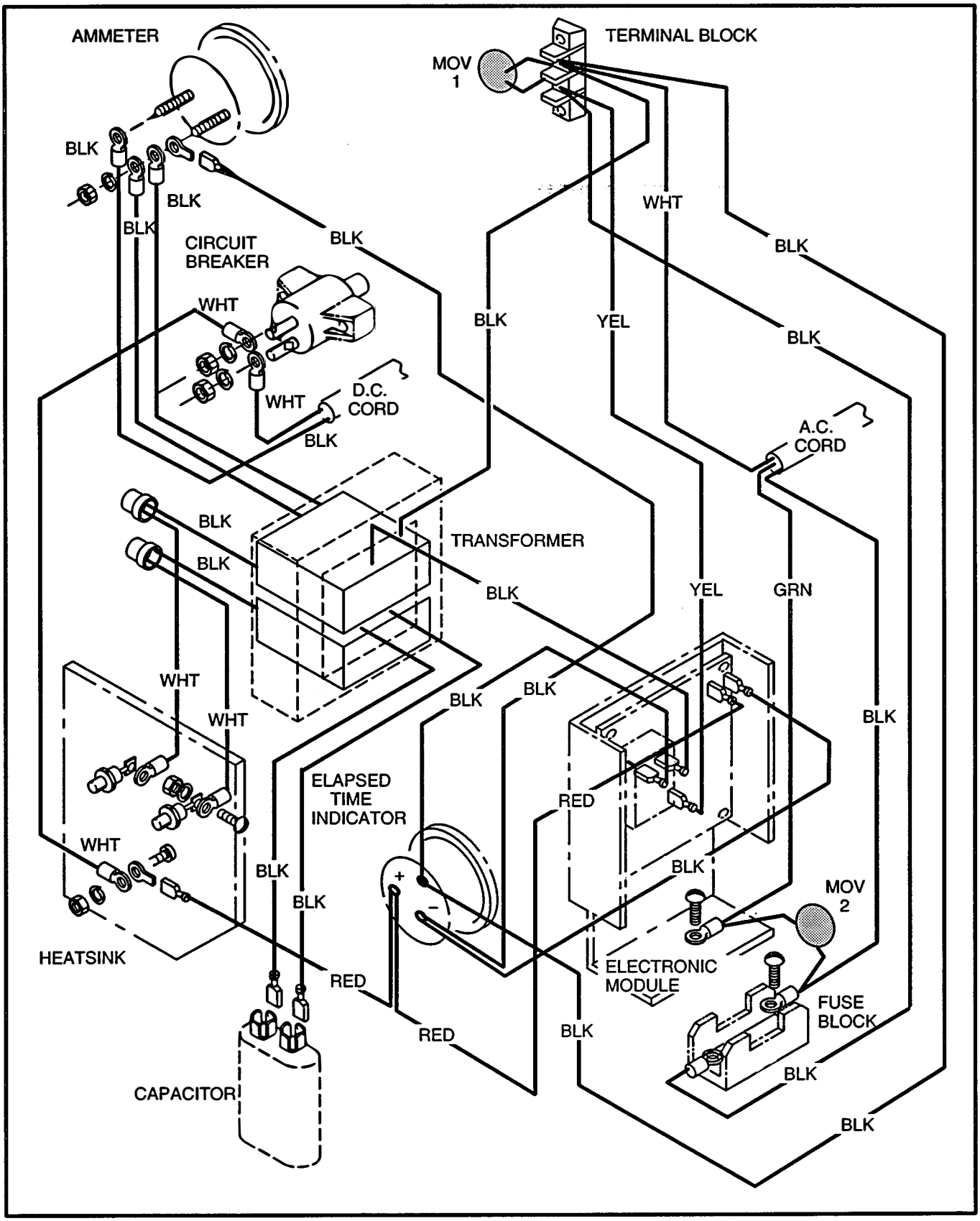


FIG. J–14 WIRING DIAGRAM (PORTABLE TOTAL CHARGE® IV CHARGER)

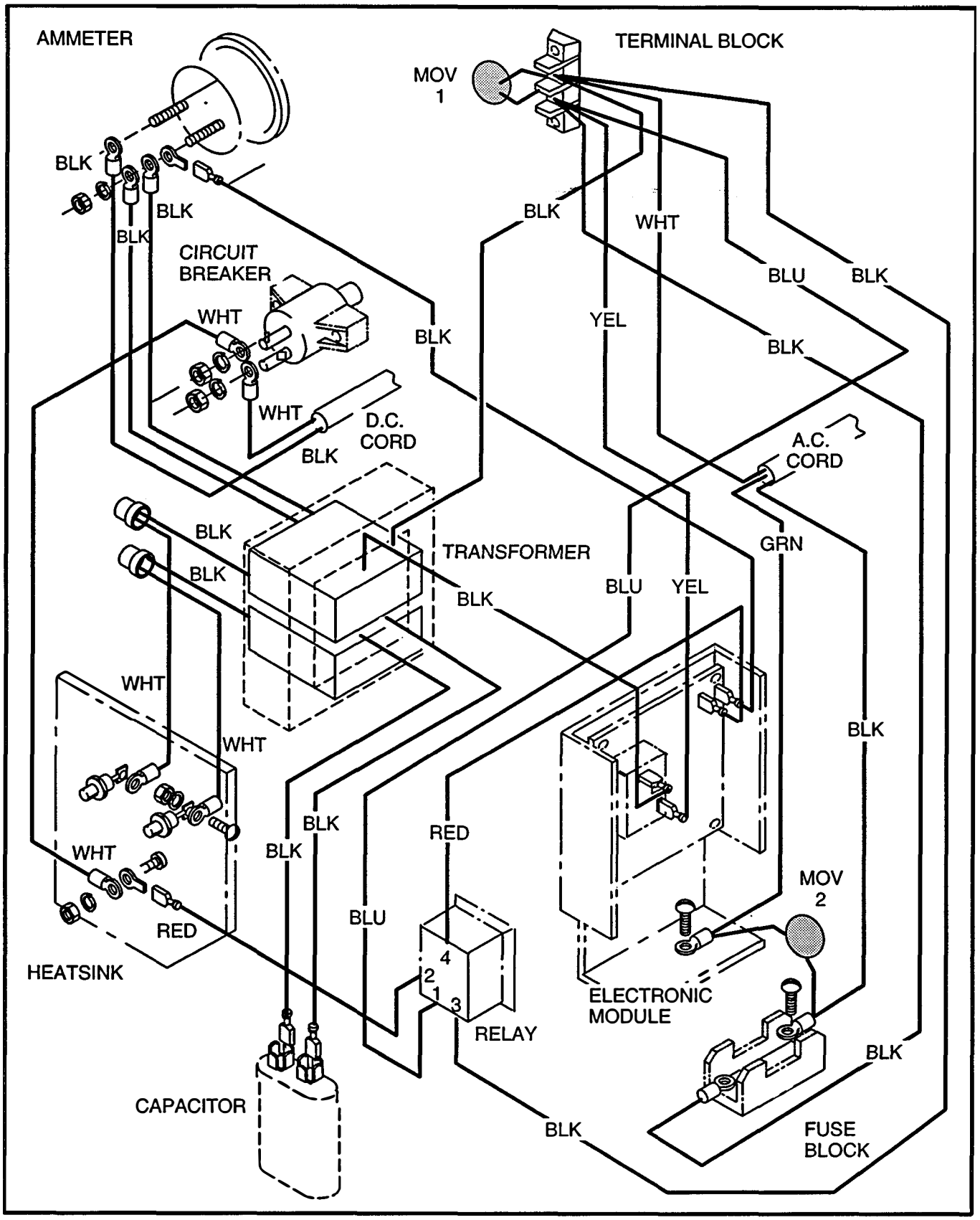


FIG. J–15 WIRING DIAGRAM (ON BOARD TOTAL CHARGE® III CHARGER)

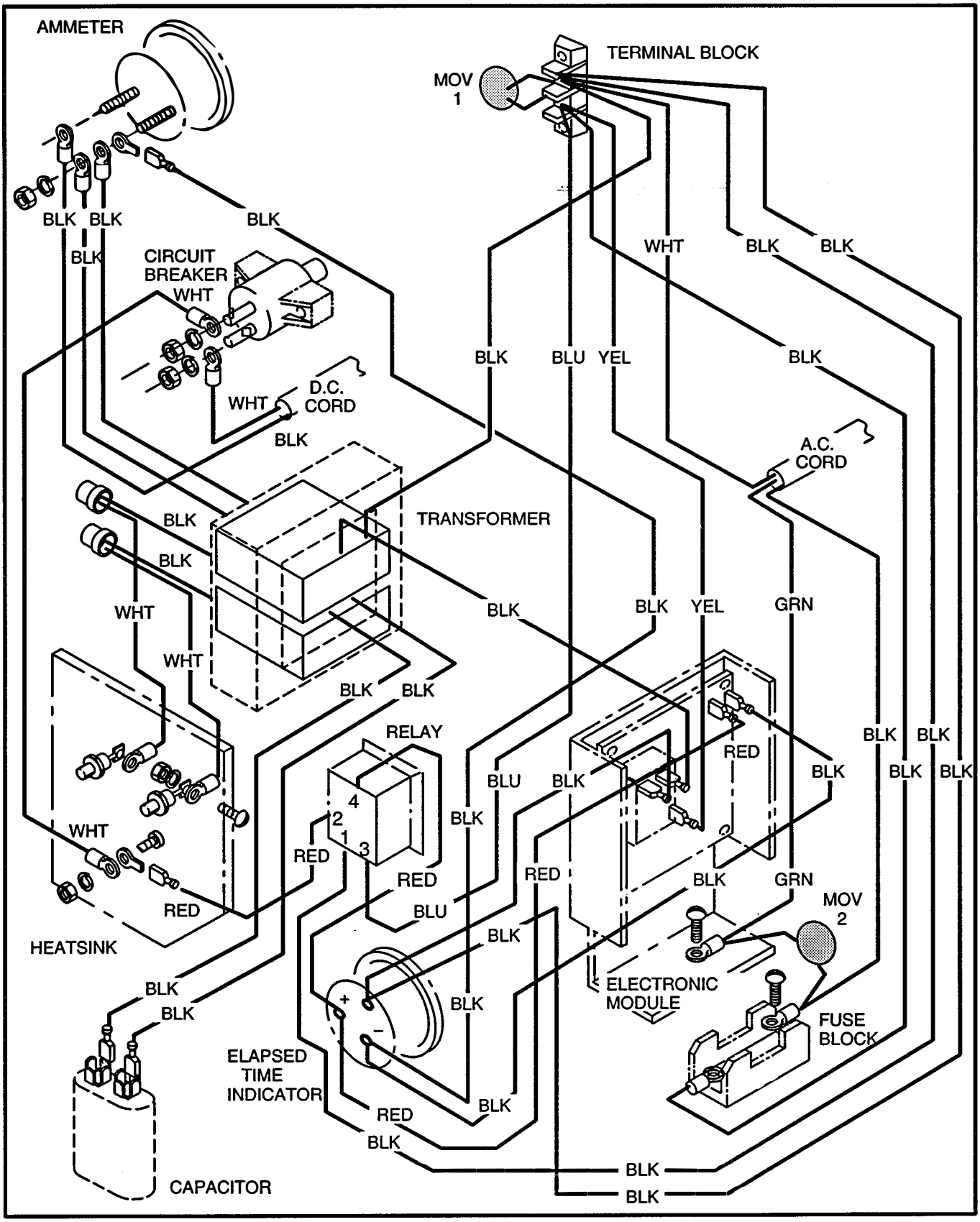


FIG. J–16 WIRING DIAGRAM (ON BOARD TOTAL CHARGE® IV CHARGER)

wire at terminal block 1 (TB 1) (12). It should deflect to indicate a complete circuit.

An ohm meter is unable to test for a transformer with a short circuit. Should the charger fail to work after the above tests have been completed, the transformer should be exchanged for one that is known to be good.

⚠ WARNING ⚠

BE SURE TO DISCHARGE THE CAPACITOR (16) BEFORE TOUCHING EITHER WIRE OR TERMINAL. THIS IS DONE BY SHORTING OR TOUCHING BOTH CAPACITOR WIRES OR TERMINALS WITH AN INSULATED SCREWDRIVER WHILE HOLDING THE INSULATED HANDLE.

6. Before checking the capacitor, disconnect one lead. When left connected, a reading through the transformer is obtained. Set the Ohm Meter to 1K ohms. Touch one probe to each terminal of the capacitor, reverse the probes. The needle should deflect and then return to neutral. Repeat this procedure; as the capacitor charges and discharges, the needle will deflect and return each time the probes are reversed. If the needle does not deflect at all, this indicates an open circuit.

If the needle deflects full scale and remains at full scale with the probes in either position, the capacitor is shorted.

With one wire removed from the capacitor, touch one probe to the wire connected to the capacitor and touch the other probe to the wire removed. The meter will deflect if the ferroresonant winding is complete.

CAUTION

CARE MUST BE TAKEN WHEN CHECKING MODULE, LETHAL VOLTAGES ARE APPLIED.

7. To check the module, remove the black transformer wire from the module. Reconnect to the terminal block 1 (TB 1) in place of the yellow wire. Plug the A.C. cord into a 120 volt A.C. source. The charger should come on indicating a defective electronic control module.

8. To check the primary wiring of the transformer, touch the red (+) probe to the black transformer wire at the terminal block 1 (TB 1), and the black (–) probe to the black transformer wire at the control module (13). The ohmmeter needle should deflect indicating completeness of the primary winding.

9. If either MOV1 (14) or MOV2 (15) shows the effects of having sustained a powerline disturbance (burnt, discolored or physical damage) they must be replaced. The MOV's can be checked with an ohmmeter for a shorted condition. Disconnect one end of the MOV that is being checked. Set the ohmmeter to RX1000 ohms. Place the probes across the MOV. The needle of the ohmmeter should not deflect. If the needle does deflect, the MOV is defective.

ELAPSED CHARGE TIME INDICATOR (APPLICABLE TO TOTAL CHARGE® IV MODEL ONLY)

The elapsed charge time indicator is powered by the D.C. voltage from the battery. Counting starts when the charger is turned "ON". A '.1' reading on the counter equals 6 minutes.

COMPONENT REPLACEMENT

The automatic shut–off module is a non–repairable component and must be removed and *REPLACED.*

CAUTION

CARE MUST BE TAKEN WHEN DISCONNECTING OR CONNECTING THE WIRES ON THE AUTOMATIC SHUT–OFF MODULE TO PREVENT BREAKAGE OF THE TERMINALS.

In general, component replacement within the battery charger requires no explanation; however, diode replacement must be done with extreme care.

CAUTION

TO PREVENT DAMAGE AND PREMATURE FAILURE OF DIODES, THE FOLLOWING PROCEDURES MUST BE FOLLOWED.

Before installing the diode to the heat sink, clean the heat sink and apply a thin layer of heat sink compound (available at any electronics supply house) between the body of the diode and the heat sink. Tighten the diode hardware to 15–20 in. lbs. torque. Remove any excess heat sink compound.

GENERAL (FIG. K–1)

There are two distinct circuits used in the operation of an electric vehicle. These circuits are the *CONTROL* and the *POWER* circuits.

The control circuits may be identified by the light gauge wire used. The control circuit components consist of the key switch, the solenoid, a reverse warning device and two micro switches. Micro switch MS–2 is actuated by the forward–neutral–reverse switch, and micro switch MS–3 is actuated by the accelerator switch.

CONTROL CIRCUIT

FORWARD OPERATION

With the key switch in the "ON" position and the forward–neutral–reverse switch in the "FORWARD" (F) position, micro switch MS–2 is closed which provides an electrical path to the solenoid. Depressing the accelerator pedal moves the "wiper" side of the accelerator switch from the "OFF" position (0) to the (1) position, and also activates micro switch MS–3. The closure of MS–3 completes the control circuit and activates the coil of the solenoid which causes the solenoid contacts to close which in turn activates the power circuit.

REVERSE OPERATION

The reverse operation is identical to forward operation except that a reverse warning device is activated by the forward–neutral–reverse switch that is placed in the "REVERSE" (R) position. This warning device is in continuous operation while the forward–neutral–reverse switch is in the "REVERSE" (R) position.

POWER CIRCUIT

With the control circuit activated, the solenoid contacts are closed. Power is applied to the power circuit. Depressing the accelerator pedal moves the "wiper" side of the accelerator switch from the "OFF" position (0) to the (1) position. Power now flows through the resistor R1, R2, and R3, through the forward–neutral–reverse switch which directs power in the correct orientation through the armature and field windings of the motor.

As the accelerator pedal is depressed further, the wiper advances to position (2) which bypasses resistor R1. Position (3) bypasses resistors R1 and R2. The final position (4) bypasses all resistors and unrestricted battery power is transmitted to the motor which yields the maximum speed and power.

CIRCUIT TESTING (FIG. K–2, FIG. K–3, FIG. K–4)

Tools Required: Qty.

V.O.M. 1

If the car fails to operate or operates poorly, the following test sequence should be followed.

⚠ WARNING ⚠

TO PREVENT THE VEHICLE FROM INADVERTENTLY ACCELERATING, WHICH COULD CAUSE BODILY INJURY, THE VEHICLE MUST BE LIFTED TO RAISE BOTH DRIVE WHEELS ABOVE THE GROUND.

Raise the vehicle (see safety procedures in Section B) before proceeding.

To test the control circuit, turn the key switch (1) to the "ON" position. Set the volt meter to the 50 VDC range. Touch the black probe to the negative (–) contact of the vehicle D.C. receptacle and the red (+) probe to the positive (+) contact of the vehicle D.C. receptacle. (FIG. K–3)

A meter reading of 36 VDC ±5V indicates the batteries are satisfactory. A reading of below 36 VDC ±5V indicates that one or all batteries are defective or are in need of charging (see Batteries Section for testing procedures). No reading indicates an "open" condition and the power transmission circuit should be inspected for a broken or disconnected conductor.

With the forward–neutral–reverse switch in the forward position, remove the red (+) probe from the positive contact of the receptacle and relocate it to the positive (+) terminal of the solenoid (2). The positive terminal may be identified by the heavy gauge wire that is attached to the F–N–R switch. A meter reading of 36 VDC ±5V will indicate that the heavy gauge wire (BR+) and terminations between

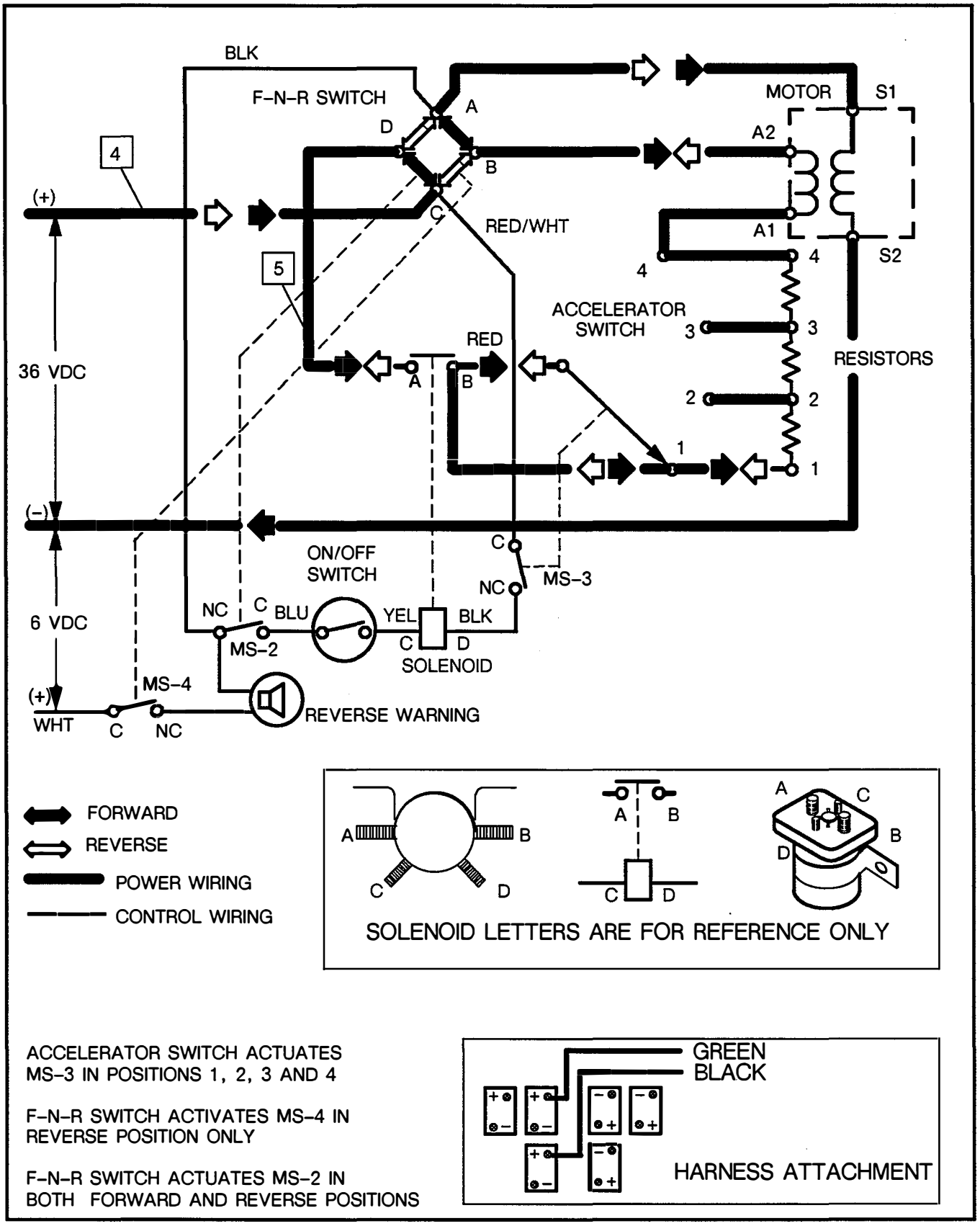


FIG. K-1 ELECTRIC VEHICLE WIRING DIAGRAM

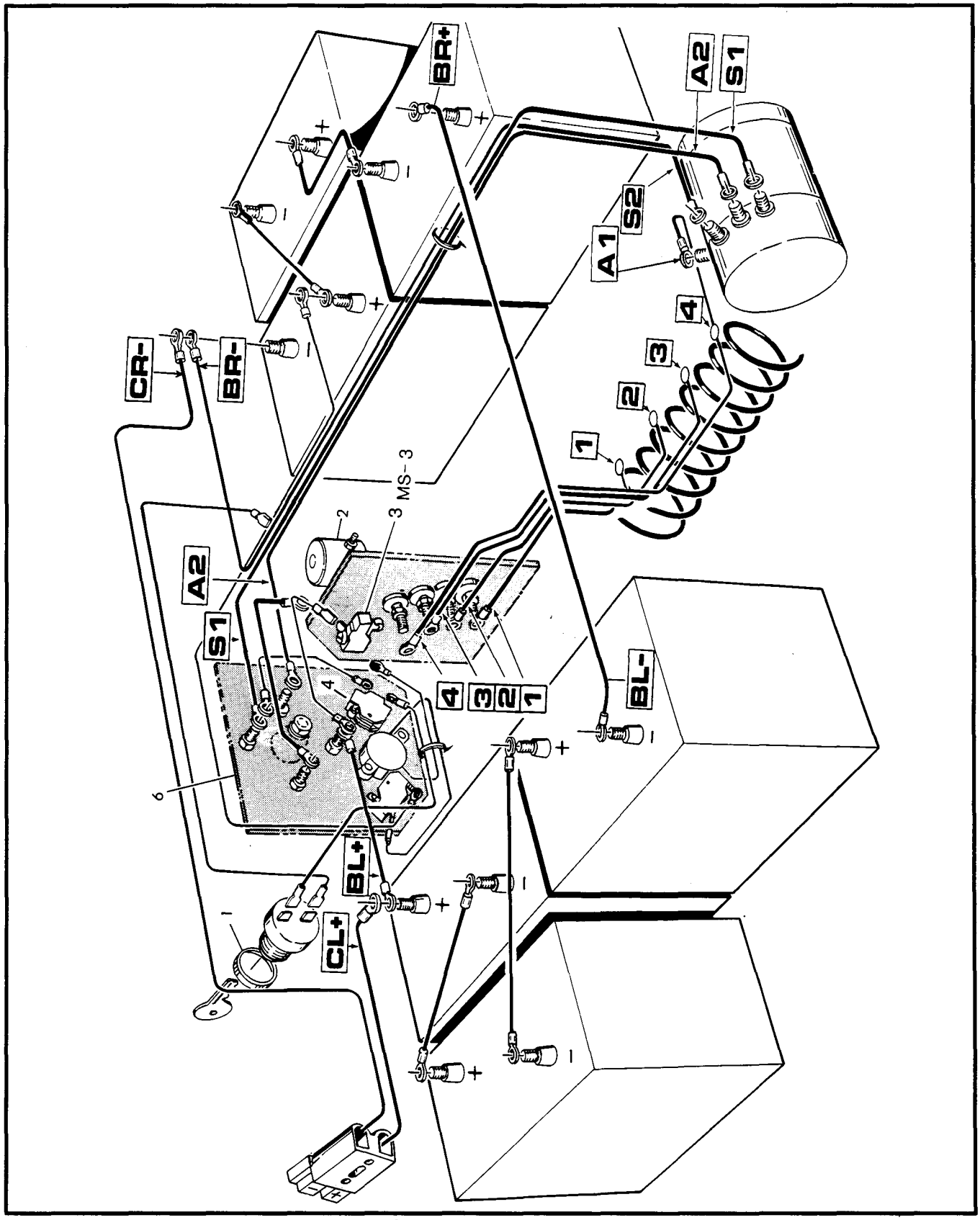


FIG. K-2 POWER WIRING DIAGRAM

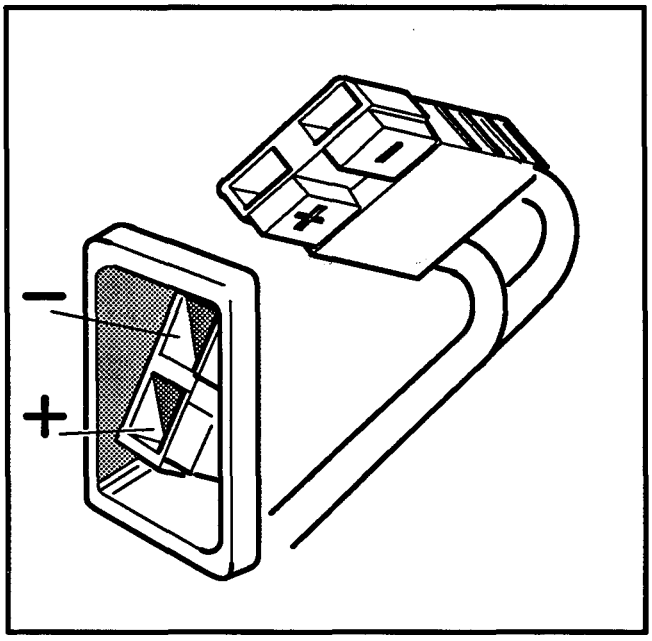


FIG. K-3 CHARGING RECEPTACLE
(VIEWED FROM FRONT)

the battery and solenoid positive (+) terminal are in good condition.

With the forward-neutral-reverse switch in the neutral position, locate the red (+) probe on the common terminal (3) of MS-3 (located on the accelerator switch). The common terminal may be identified by the RED/WHITE wire attached to it. A meter reading of 36 VDC ±5V indicates that the RED/WHITE wire and termination between the micro switch MS-3 and the forward-neutral-reverse switch are in good condition.

DEPRESS the accelerator pedal. Locate the red (+) probe on the normally closed (NC) terminal of micro switch MS-3. This terminal may be identified by the black wire attached between it and the solenoid. A meter reading of 36 VDC ±5V indicates that the micro switch is functioning. If the meter fails to move from the "0" position, check that the accelerator pedal is depressed, if it is and there is no reading, the micro switch MS-3 must be replaced.

DEPRESS the accelerator pedal. Locate the red (+) probe on the small terminal of the solenoid (2) with the black wire attached. A meter reading of 36 VDC ±5V indicates that the black wire from the solenoid to MS-3 is in good condition. Move the red (+) probe to the other small terminal located on the solenoid. If the meter needle deflects, the solenoid coil is working. A meter reading of "0" indicates that the solenoid should be replaced.

Locate the red (+) probe to the key switch (1), terminal 4. A meter reading of 36 VDC ±5V indicates that the yellow wire from the solenoid to the key switch is in good condition. Locate the red (+) probe to the key switch, terminal 3. *TURN KEY ON*. A meter reading of 36 VDC ±3V indicates that the key switch is in satisfactory condition. No reading indicates that the key switch should be replaced.

Locate the red (+) probe on the common (c) terminal of micro switch (4) MS-2 situated on the forward-neutral-reverse switch assembly (6). The terminal may be identified by the blue wire attached to it. A meter reading of 36 VDC ±5V will indicate that the wire from the key switch to micro switch MS-2 is in good condition.

Place the red (+) probe to the positive (+) contact of the vehicle receptacle. Locate the black (-) probe to the normally closed (NC) position of micro switch MS-2. This terminal may be identified by the black wire attached to it. A meter reading of 36 VDC ±5V will indicate that the micro switch (4) is in good condition.

The completion of this test procedure will have checked all wiring and components in the control circuit.

The reverse warning device does not affect the operation of the vehicle, however, E-Z-GO strongly recommends that its operation be checked and maintained since the correct functioning of this safety device may prevent an accident.

The warning device (1) (FIG. K-4) should sound whenever the forward-neutral-reverse switch is in the "REVERSE" (R) position. Should the warning device fail to sound, the following procedure should be used to trouble-shoot the circuit.

Set the volt meter to the 15 VDC range, check that the key switch in "ON" and the forward-neutral-reverse switch is in the "REVERSE" (R) position. Locate the black probe (-) in the negative side of the vehicle receptacle (FIG. K-3) and place the red (+) probe to the terminal on MS-4 with the black wire. A meter reading of 6 VDC indicates that the black wire between the positive (+) terminal of the front right battery and the micro switch MS-4 is in good condition.

Locate the red (+) probe on the other terminal of micro switch MS-4. A meter reading of 6 VDC will indicate that the micro switch MS-4 is in good condition and that the warning device must be replaced.

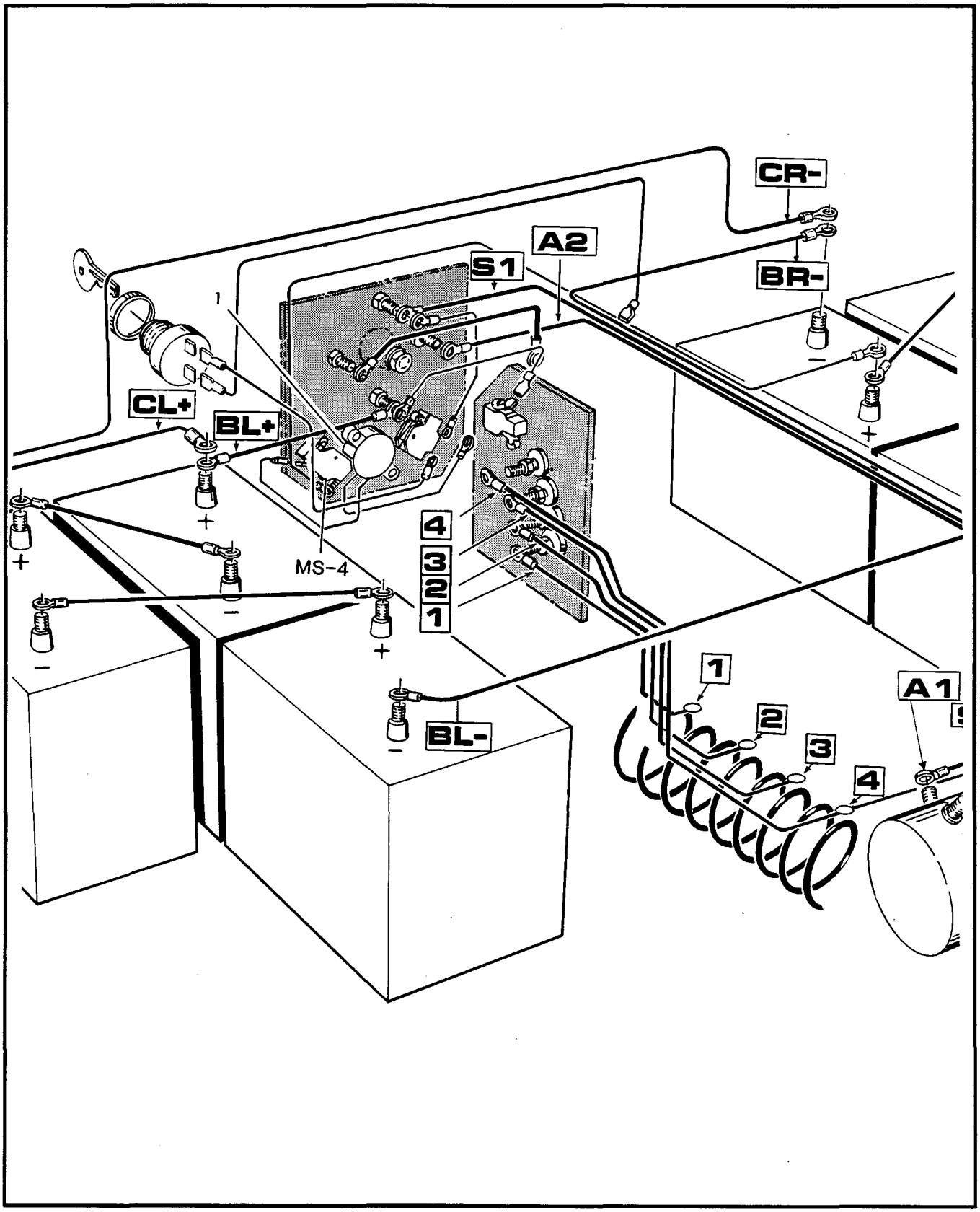


FIG. K-4 WARNING DEVICE

POWER CIRCUIT (FIG. K-5)

Tools Required: Qty.

V.O.M. 1

IF THE VEHICLE DOES NOT RUN:

⚠ WARNING ⚠

TO PREVENT THE VEHICLE FROM INADVERTENTLY ACCELERATING, WHICH COULD CAUSE BODILY INJURY, THE VEHICLE MUST BE LIFTED TO RAISE BOTH DRIVE WHEELS ABOVE THE GROUND.

Raise the vehicle (see safety procedures in Section B) before proceeding.

Place key switch (1) in the "ON" position and the forward-neutral-reverse switch (6) to the forward 'F' position.

Set the volt meter to the 50 VDC range. Touch the black (-) probe to the negative (-) contact of the vehicle D.C. receptacle and the red (+) probe to the positive (+) contact of the vehicle D.C. receptacle (FIG. K-3, FIG. K-5)

A meter reading of 36 VDC ±5 VDC indicates that the batteries are satisfactory. A reading below 36 VDC ±5V indicates that one or all batteries are defective or are in need of charging. (See Batteries Section for testing procedures.) No reading indicates an "open" condition and the following procedure should be followed.

Locate the red (+) probe on the positive (+) post of the battery (7) that has two heavy gauge wires attached to it. Locate the black (-) probe on motor (8) terminal S2. A meter reading of 36 VDC ±5 VDC indicates that the wire joining the motors (S2) and the battery (BR-) is satisfactory.

A reading of less than 36 VDC ±5V indicates a broken wire, a poor connection, or corrosion at either the battery or motor termination.

Locate the black (-) probe to the motor (8) terminal S1. A reading of 36 VDC ±5 VDC indicates that the field coils are satisfactory. A meter reading of 0 VDC indicates that the field coil is "open", which will require the repair or replacement of the motor. Locate the black (-) probe to the motor (8) terminal A1. A meter reading of 36 VDC ±5 VDC indicates that the armature is satisfactory. Locate the black (-) probe on each of the four motor (8) terminals and the number 1 contact of the accelerator switch (5). A reading of 36 VDC ±5 VDC at each terminal will indicate that the wiring and resistors are good. A reading of 0 VDC indicates an "open" condition that may be located by visual inspection, or using an ohm meter, perform a "continuity" test between the terminals of each wire.

CAUTION

REMOVE BATTERY (+) CONNECTIONS BEFORE USING OHM METER. (SEE SAFETY PROCEDURES IN SECTION B.)

No reading indicates a broken wire, a poor connection, or corrosion at either of the wire terminations.

IF THE VEHICLE RUNS BUT PERFORMS ERRATICALLY:

⚠ WARNING ⚠

TO PREVENT THE VEHICLE FROM INADVERTENTLY ACCELERATING, WHICH COULD CAUSE BODILY INJURY, THE VEHICLE MUST BE LIFTED TO RAISE BOTH DRIVE WHEELS ABOVE THE GROUND.

Raise the vehicle (see safety procedures in Section B) before proceeding.

Place key switch (1) in the "ON" position and the forward-neutral-reverse switch (6) to the forward 'F' position.

Visually inspect all components for burned or broken wires, loose connections at each of the accelerator switch (5) contacts, resistor coils (9) and the forward-neutral-reverse switch. Inspect all terminals for corrosion hand clean if required. If a visual inspection fails to yield the cause of the problem, an ohm meter may be used to perform a "continuity" test at each component.

CAUTION

REMOVE BATTERY (+) CONNECTIONS BEFORE USING OHM METER. (SEE SAFETY PROCEDURES IN SECTION B.)

NOTE

A test light may be substituted for an ohm meter.

If the vehicle continues to run with the accelerator switch (5) in the released position, either the accel-

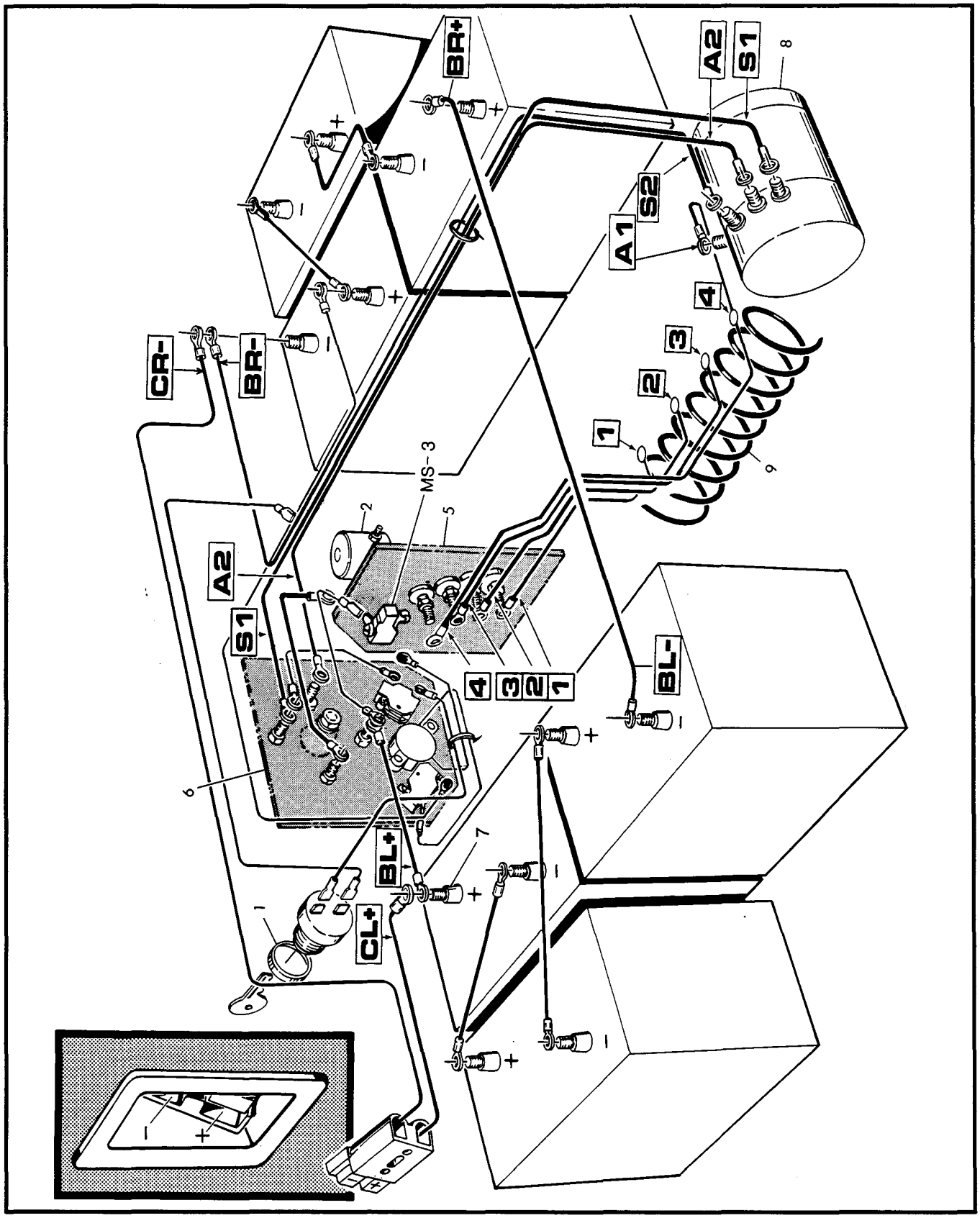


FIG. K-5 POWER WIRING DIAGRAM

erator linkage is out of adjustment (see Accelerator Adjustment in Section F) or the solenoid (2) contacts are stuck in the 'ON' position. If the vehicle continues to operate after determining that the accelerator linkage is in correct adjustment, the solenoid (2) must be replaced.

TESTING THE MOTOR (FIG. K–5)

NOTE

This test is valid only after the control and power wiring has been inspected as detailed in the preceding procedures.

Tools Required: Qty.

V.O.M. 1

⚠ WARNING ⚠

TO PREVENT THE VEHICLE FROM INADVERTENTLY ACCELERATING, WHICH COULD CAUSE BODILY INJURY, THE VEHICLE MUST BE LIFTED TO RAISE BOTH DRIVE WHEELS ABOVE THE GROUND.

Raise the vehicle (see safety procedures in Section B) before proceeding.

Place key switch (1) in the 'ON' position and the forward–neutral–reverse switch (6) to the forward 'F' position.

NOTE

Use the following test *ONLY IF THE MOTOR WILL NOT RUN*.

This check is for open circuits in field coils, brushes, or brush rigging. To check for a short circuit, refer to the Motor Section.

Set the volt meter to the 50 VDC range.

Locate the black (–) probe to the negative (–) contact of the vehicle D.C. receptacle and the red (+) probe to the motor terminal S2. A meter reading of 0 VDC indicates a good condition. Locate the red (+) probe on the motor (8) terminal S1. A meter reading of 0 VDC indicates that the field coils are satisfactory. A meter reading of 36 VDC ±5 VDC indicates that the field coils are open and the motor must be repaired or replaced.

Locate the red (+) probe on the motor terminal A2. A reading other than 0 VDC indicates that the power wiring should be rechecked. Locate the red (+) probe to the motor terminal A1. A meter reading of 0 VDC indicates that the brushes, brush holder, and all connections are satisfactory. A meter reading of 36 VDC ±5 VDC indicates a problem with the brushes, brush holder, or connections.

The following tests may be performed with an ohm meter or test light.

⚠ WARNING ⚠

REMOVE BATTERY (+) CONNECTIONS BEFORE CONTINUING WITH THIS TEST. SHORTING OF MOTOR WIRES COULD RESULT IN AN EXPLOSION.

Remove wires from motor terminals A1 and S2. Set the ohm meter to the RX1 scale. Using the ohm meter, place probes on motor terminals S1 and S2. A meter reading of "0" indicates a satisfactory condition at the field coils. No needle deflection indicates an "open" condition that will require the motor to be repaired or replaced.

Place the probes on motor terminals A1 and A2. A meter reading of "0" indicates a satisfactory condition at the brushes and rigging. No needle deflection indicates a condition that will require the motor to be repaired or replaced.

Check for continuity between each of the motor terminals and the motor shell. Continuity between terminals S1 and S2 to the motor shell indicates a short circuit between the field coils and the case. Continuity between terminals A1 or A2 to the motor shell indicates a short circuit in the armature. Both of the preceding conditions will require the motor to be repaired or replaced.

Retighten all motor terminal connections to 35–40 in. lbs. torque.

FORWARD–NEUTRAL–REVERSE SWITCH (FIG. K–6)

The forward–neutral–reverse switch operation is described in Power Circuit at the beginning of this section.

SWITCH LUBRICATION

During the servicing of the vehicle, the forward–neutral–reverse switch shaft should be removed, cleaned, and lubricated with bearing grease. The contact surfaces may also be lubricated with a thin coat of petroleum jelly to permit smooth operation of the switch.

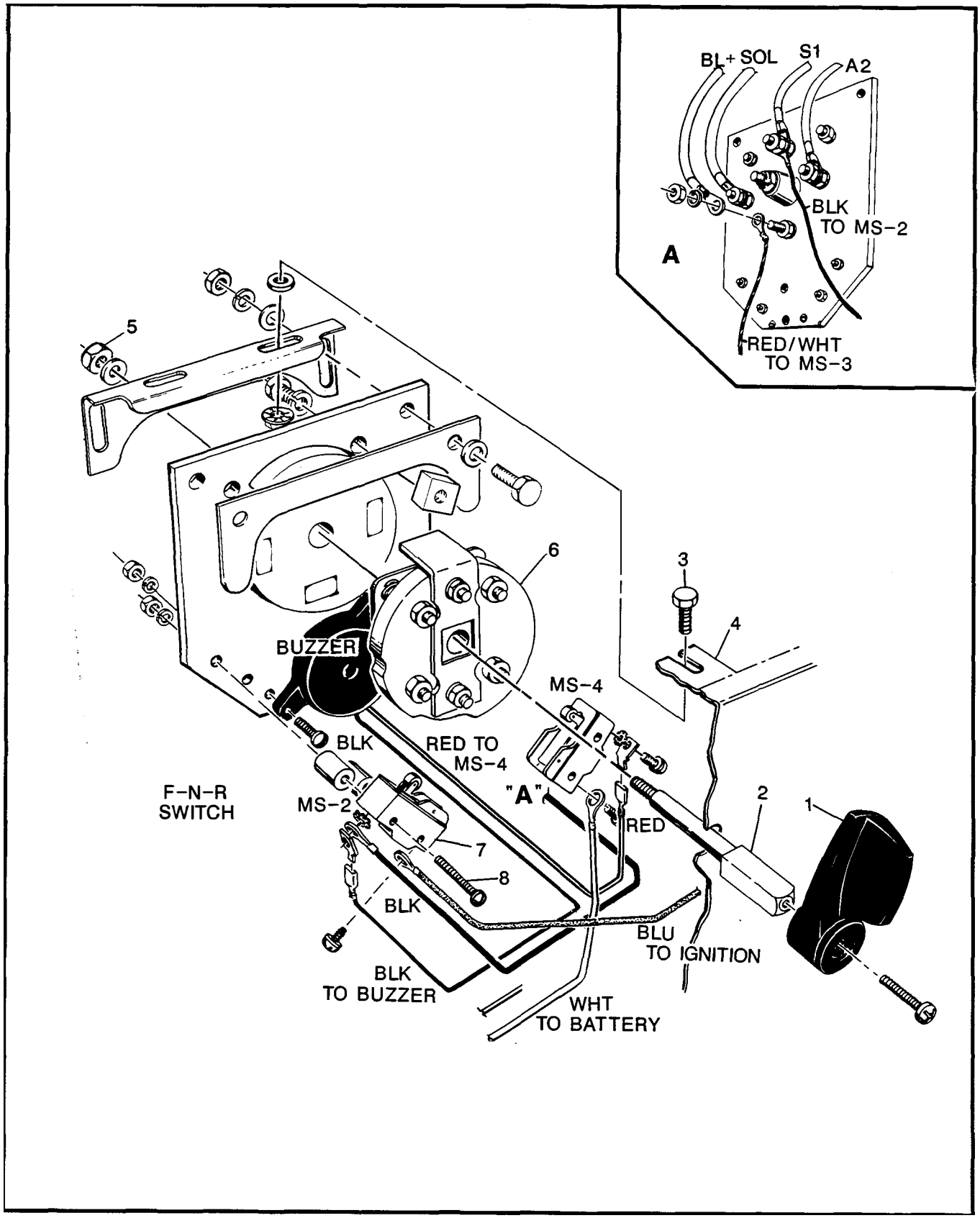


FIG. K-6 FORWARD-NEUTRAL-REVERSE SWITCH ASSEMBLY

FORWARD-NEUTRAL-REVERSE SWITCH INSPECTION AND REPAIR:

⚠ WARNING ⚠

DISCONNECT THE BATTERY LEAD (#4) (FIG. K-1) FROM THE BATTERY BEFORE ATTEMPTING SERVICE OF THE FORWARD-NEUTRAL-REVERSE SWITCH.

Periodic inspection of the switch should include the following:

1. Check that all wire connections are tight and free of corrosion.
2. Check the contacts for abnormal wear. The contacts in the movable cam portion of the switch are spring loaded and the cam assembly must be replaced when worn sufficiently to cause a loss of spring pressure.
3. Rotate the switch lever from "stop to stop" to check for smooth operation. If the switch is excessively hard to operate, inspect for rough contact surfaces and replace if required. If the contact surfaces are good, the stationary contact surfaces may be lubricated, if required, with a very thin coat of petroleum jelly.

If the switch is abnormally loose, check the shaft nut and tighten if required. Inspect for abnormally worn spring loaded contacts.

Inspect the micro switch for adjustment and dirt that might inhibit its operation.

Reassemble in the reverse order of disassembly.

FORWARD-NEUTRAL-REVERSE SWITCH REMOVAL AND DISASSEMBLY (FIG. K-6)

Tools Required: Qty.

Wrench, box end combination, 7/16"-1/2" 1

Wrench, box end, 9/16" 1

Screwdriver, Phillips 1

Remove lever (1) from shaft (2).

Disconnect the wiring connections on the rear of the switch, disconnect one push-on connection from the solenoid and one from the warning device. Disconnect the wire from the micro switch to the key switch at the key switch.

Loosen the two screws (3) which secure the switch bracket to the seat support frame (4) and slide the switch assembly from the slotted bracket.

Remove the nut (5) from the switch shaft (2), remove the cam (6) complete with the shaft (2) from the bushing, and remove the shaft (2) from the cam assembly (6).

Reassemble the switch in the reverse order of disassembly. Rotate the cam from stop to stop and check the operation of the micro switch (7) rollers.

Reinstall the forward-neutral-reverse switch in the vehicle and adjust the switch to align with the hole in the vertical support panel. Tighten the hardware that secured the forward-neutral-reverse switch to the vehicle to 10-12 ft. lbs. torque.

ACCELERATOR SWITCH (FIG. K-7)

The accelerator switch is a rheostat type, mechanically controlled by a push-rod linkage connected to the accelerator foot pedal. Switch operation is described in the Power circuit, Forward Operation, at the beginning of this section.

SWITCH LUBRICATION

DO NOT lubricate the five copper contact studs or the spring loaded brush contact.

The contact arm shaft (2) is the only part on the switch assembly (1) requiring lubrication. This part should be removed (semi-annually), cleaned and lubricated with wheel bearing grease.

SWITCH INSPECTION AND REPAIR (FIG. K-7)

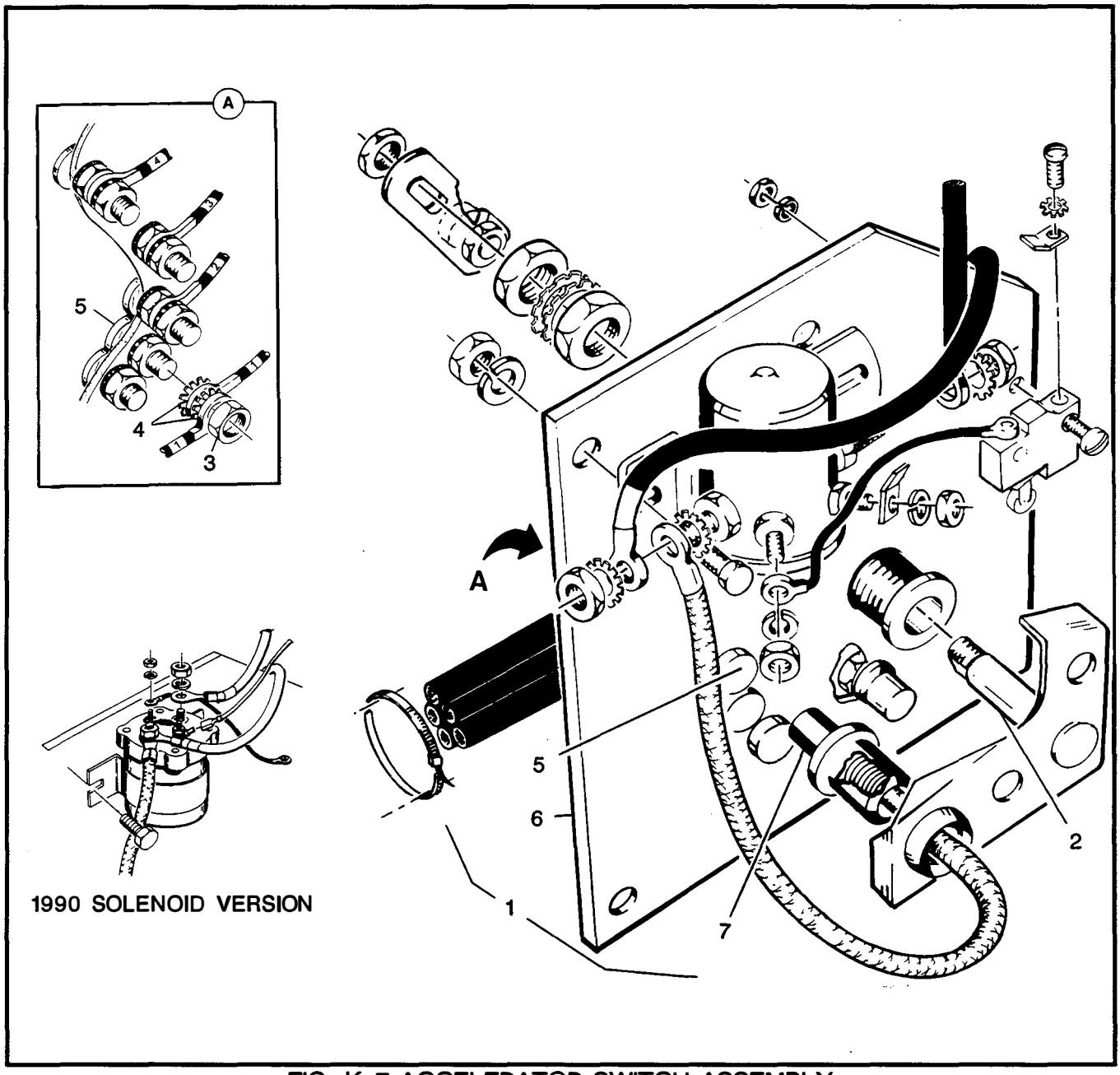
⚠ WARNING ⚠

DISCONNECT THE BATTERY LEAD (#4) (FIG. K-1) FROM THE BATTERY BEFORE PROCEEDING WITH INSPECTION.

NOTE

To assure efficient operation, the accelerator switch must be kept in good repair. Periodic inspection of wiring harness connections, board mounted contact studs, and the spring loaded sliding brush contact should be made as follows:

1. Inspect and tighten (if required) the nuts (3), lock washers (4), securing wires to the contact studs (5) to 70-80 in. lbs. torque.



1990 SOLENOID VERSION

FIG. K-7 ACCELERATOR SWITCH ASSEMBLY

2. Observe badly pitted or worn contact studs (5). If a contact is burned or melted (resulting from a stuck or misadjusted accelerator linkage), the contact board assembly (6) (includes contacts and hardware) must be replaced.

3. Inspect the spring loaded brush contact (7) for firm spring pressure and a free action in the bushing.

4. Inspect the brush (7) for a burned tip and abnormal wear. When the brush is worn to approximately 1/2" in length, the brush must be replaced. To check the length, remove the brush by removing the shaft and arm assembly (2) and sliding the brush from its carrier.

ACCELERATOR SWITCH REMOVAL (FIG. K-8)

Tools Required: Qty.

Wrench, open end, 1 1/8" 1
Screwdriver, long standard blade 1
Hammer, small, ball pein 1
Wrench, box end, 1/2" 1

To remove the accelerator switch assembly (1) from the vehicle, disconnect the wire #4 (FIG. K-9) at the batteries. (See Safety Procedures in Section B.)

Disconnect the wire #5 (FIG. K-9) at the forward-neutral-reverse switch.

Disconnect the red/white wire at the micro switch, the yellow wire at the solenoid and the wire from motor terminal A1 (FIG. K-9). Disconnect the accelerator linkage (2) from the accelerator switch arm (3) (See Section F). Loosen nut (4) and lift assembly (1) to gain access to hardware (5 and 6) securing power wiring to the switch. Remove wiring.

RESISTOR REPLACEMENT (FIG. K-10)

Tools Required: Qty.

Wrench, box end, 1/2" 1
Wrench, box end, 7/16" 1
Ratchet, 3/8 drive 1
Socket, 7/16", 3/8 drive 1

⚠ WARNING ⚠

TO PREVENT THE VEHICLE FROM INADVERTENTLY ACCELERATING, WHICH COULD CAUSE BODILY INJURY, THE VEHICLE MUST BE LIFTED TO RAISE BOTH DRIVE WHEELS ABOVE THE GROUND.

REMOVE BATTERY (+) CONNECTIONS BEFORE PROCEEDING.

Raise the vehicle (see safety procedures in Section B).

Remove the four nuts (1) and lock washers (2) that secure the wiring to the four bolts (3) located in the center of the resistor assembly (4). Remove the hardware (20) securing the resistor assembly to the battery racks and lift the entire unit from the vehicle.

Visually inspect the resistor coils for breaks or burns.

If it is determined that a defective resistor coil exists, the inner heat shield (5) must be removed by removing the four nuts (6) and lock washers (7) that secure the inner heat shield to the outer shield (8). The resistor board (9) may then be separated from the inner heat shield by removing the remaining nuts (10) lock washers (11), and metal strips (12).

Remove the lock washer (13), large flat washer (14) and the nut (15) from either end of the defective resistor. This will allow the resistors to be separated from the resistor board. Remove the large flat washer (16), nut (17), lock washer (18) and flat washer (19) from the ends of the defective resistor. Replace the defective resistor and reinstall, carefully replacing the hardware back in the order it was disassembled.

Tighten nuts (17) attaching resistors to 15-18 ft. lbs. torque.

Tighten the nuts (15) attaching resistors to resistor board to 10-12 ft. lbs torque.

Reinstall resistor board assembly to inner heat shield and tighten nuts (10) to 6 ft. lbs. torque.

Reinstall inner heat shield to outer shield and tighten nuts (6) to 5-6 ft. lbs. torque.

Reinstall the resistor assembly to the battery racks and tighten the bolt (20) to 5-6 ft. lbs. torque.

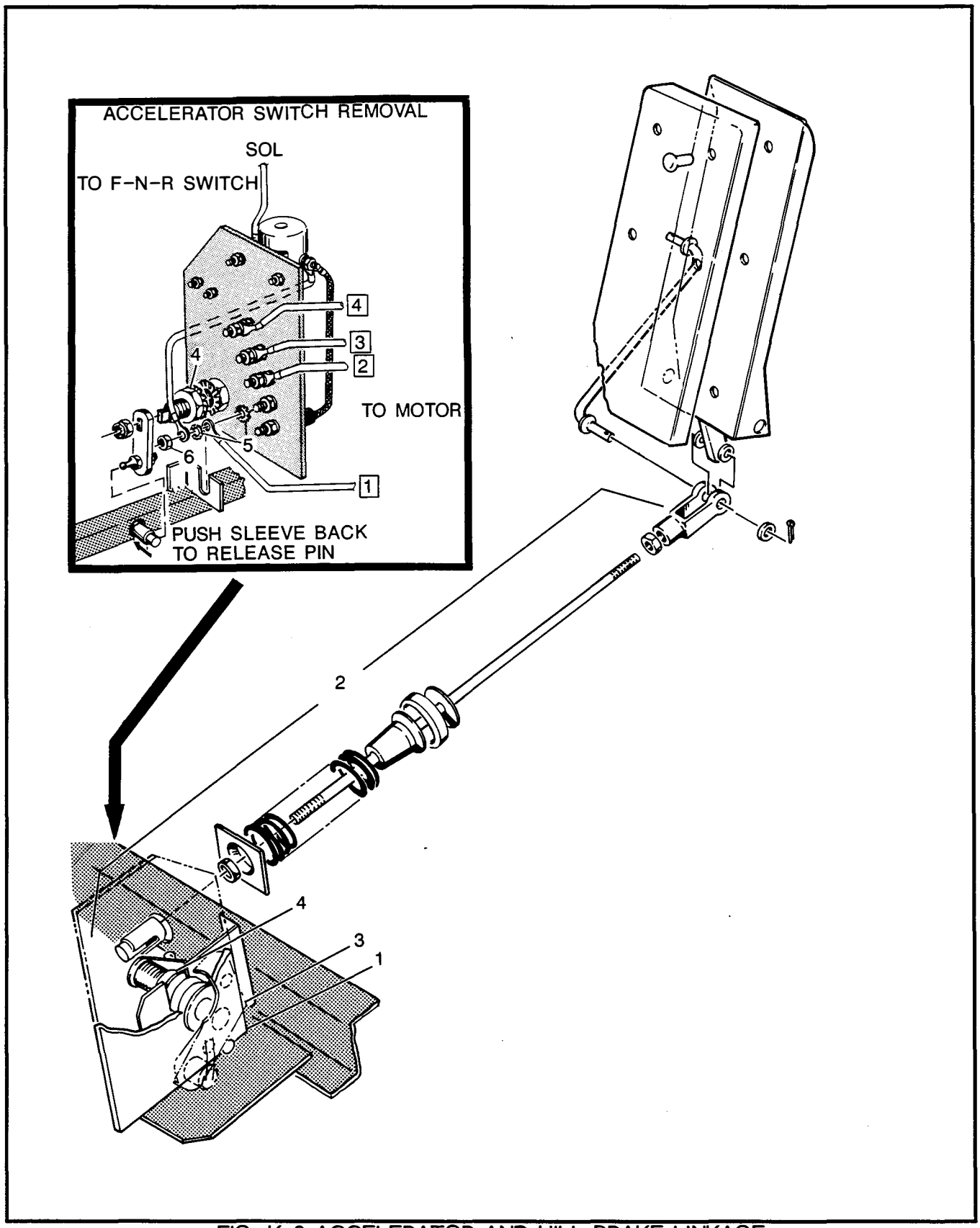


FIG. K-8 ACCELERATOR AND HILL BRAKE LINKAGE

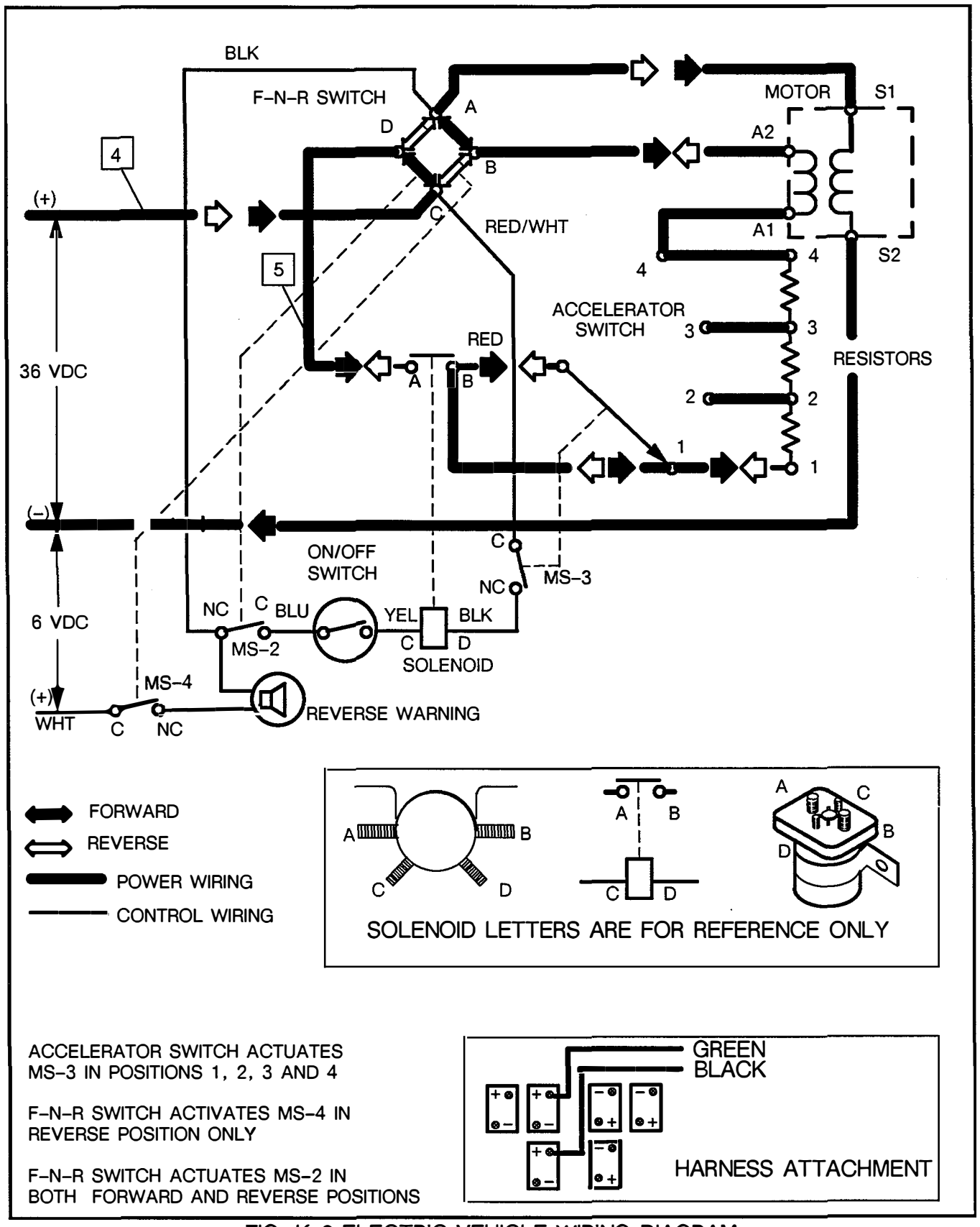


FIG. K-9 ELECTRIC VEHICLE WIRING DIAGRAM

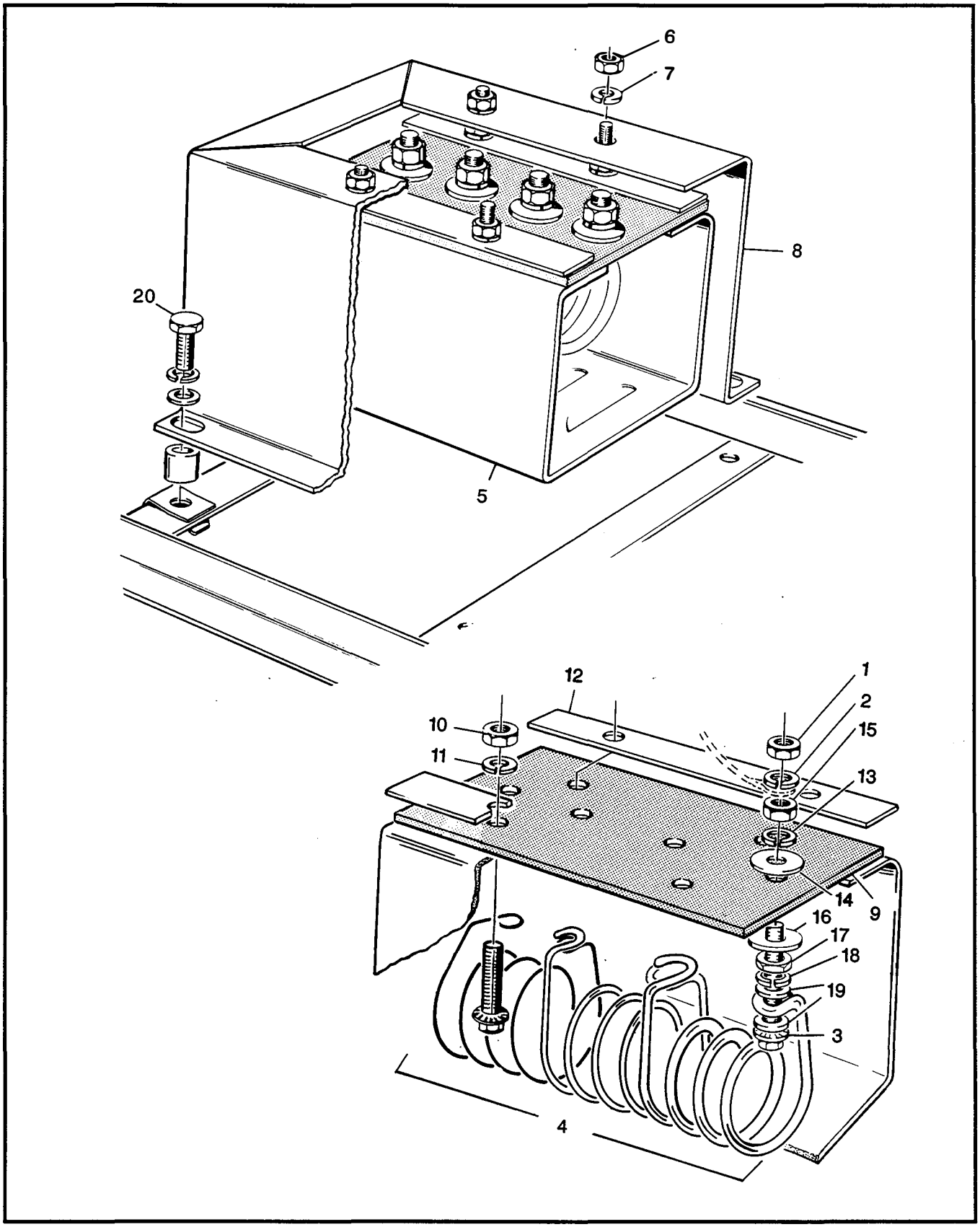


FIG. K-10 RESISTOR ASSEMBLY

MOTOR REMOVAL AND DISASSEMBLY (FIG. L–1, FIG. L–2)

Tools Required: Qty.

Wrench, box end, 1/2" 1
Wrench, box end, 7/16" 1

⚠ WARNING ⚠

REMOVE BATTERY (+) CONNECTION BEFORE PROCEEDING (SEE SAFETY PROCEDURES IN SECTION B). SHORTING OF MOTOR WIRES COULD RESULT IN AN EXPLOSION.

Remove all wires from motor (FIG. L–1). Mark the motor/axle housing at one of the bolts to ensure correct alignment when reinstalling the motor (FIG. L–1). Remove the 3 bolts and washers that secure the motor to the axle housing (FIG. L–1). Slide the motor out from the axle housing (FIG. L–1).

CAUTION

CARE MUST BE TAKEN IN HANDLING MOTOR TO PREVENT DAMAGE TO AXLE AND MOTOR SPLINES.

Loosen the nuts (1) that attach the terminals S1 and S2. Remove the two clamp bolts (2) that secure the commutator end shield (3) to the motor frame (4).

Slide the commutator end shield (3) and the armature (5) out of the motor frame. Remove the brushes (6) (See Brush Spring Measurement). Reassemble in reverse order of disassembly and tighten end shield hardware to 100–120 in lb. torque.

ELECTRIC MOTOR REPAIR (FIG. L–2)

Tools Required: Qty.

Gauge, E–Z–GO P/N 17219–G1 1
Ohm meter 1

MAJOR motor repair should *NOT* be attempted by non–specialized staff. There are some maintenance and repair procedures which do not require specialized tools or knowledge that may be attempted. Replacement of brushes and field coils may be attempted; however, major repairs, such as armature turning or bearing replacement, should only be attempted by a qualified motor technician.

VOLTAGE AND RESISTANCE MEASUREMENT

The following tests may be performed with an ohm meter or test light.

⚠ WARNING ⚠

REMOVE BATTERY (+) CONNECTIONS BEFORE CONTINUING WITH THIS TEST. SHORTING OF MOTOR WIRES COULD RESULT IN AN EXPLOSION.

Remove wires from motor terminals A1 and S2. Set the ohm meter to the RX1 scale. Using the ohm meter, place probes on motor terminals S1 and S2. A meter reading of "0" indicates a satisfactory condition at the field coils. No needle deflection indicates an "open" condition that will require the motor to be repaired or replaced.

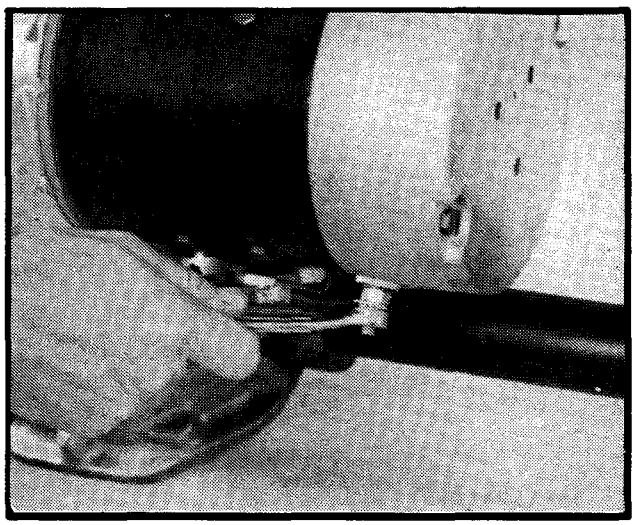
Place the probes on motor terminals A1 and A2. A meter reading of "0" indicates a satisfactory condition at the brushes and rigging. No needle deflection indicates a condition that will require the motor to be repaired or replaced.

Set the Ohm meter to the RX 100 scale then check for continuity between each of the motor terminals and the motor shell. Continuity between terminals S1 and S2 to the motor shell indicates a short circuit between the field coils and the case. Continuity between terminals A1 or A2 to the motor shell indicates a short circuit in the armature. Both of the preceding conditions will require the motor to be repaired or replaced.

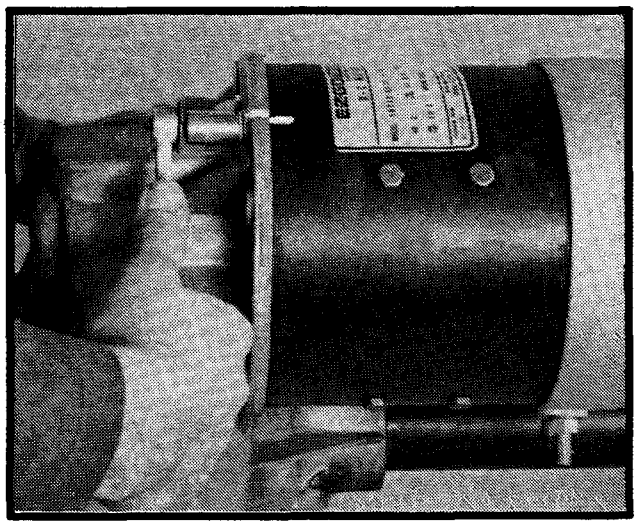
Tighten all motor terminal connections to 35–40 in. lbs. torque.

ROUTINE EXAMINATION AND BRUSH REPLACEMENT (FIG. L–3)

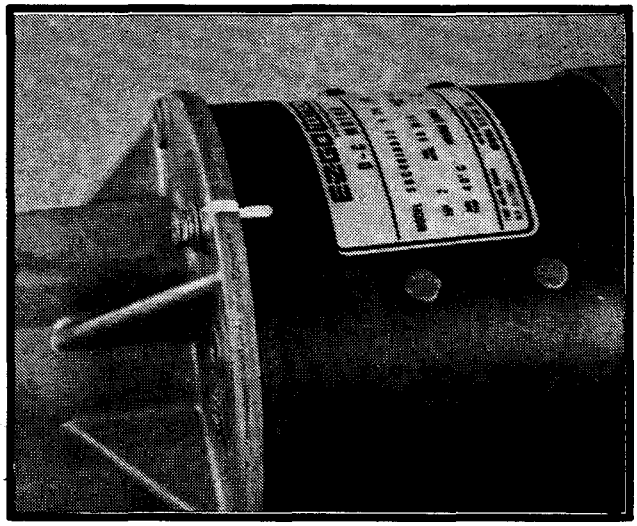
1. The motor is totally enclosed and brush wear is determined by use of an E–Z–GO gauge inserted in a hole in the end shield as shown.



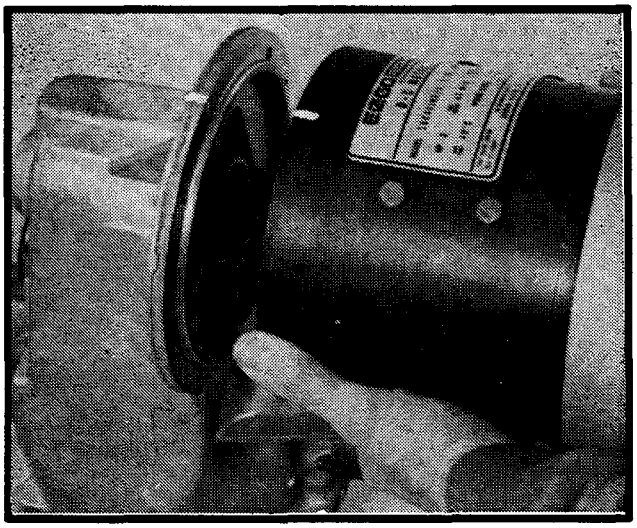
REMOVE ALL WIRES



REMOVE BOLTS/WASHERS



MARK MOTOR/AXLE HOUSING



SLIDE MOTOR OUT

FIG. L-1 MOTOR REMOVAL

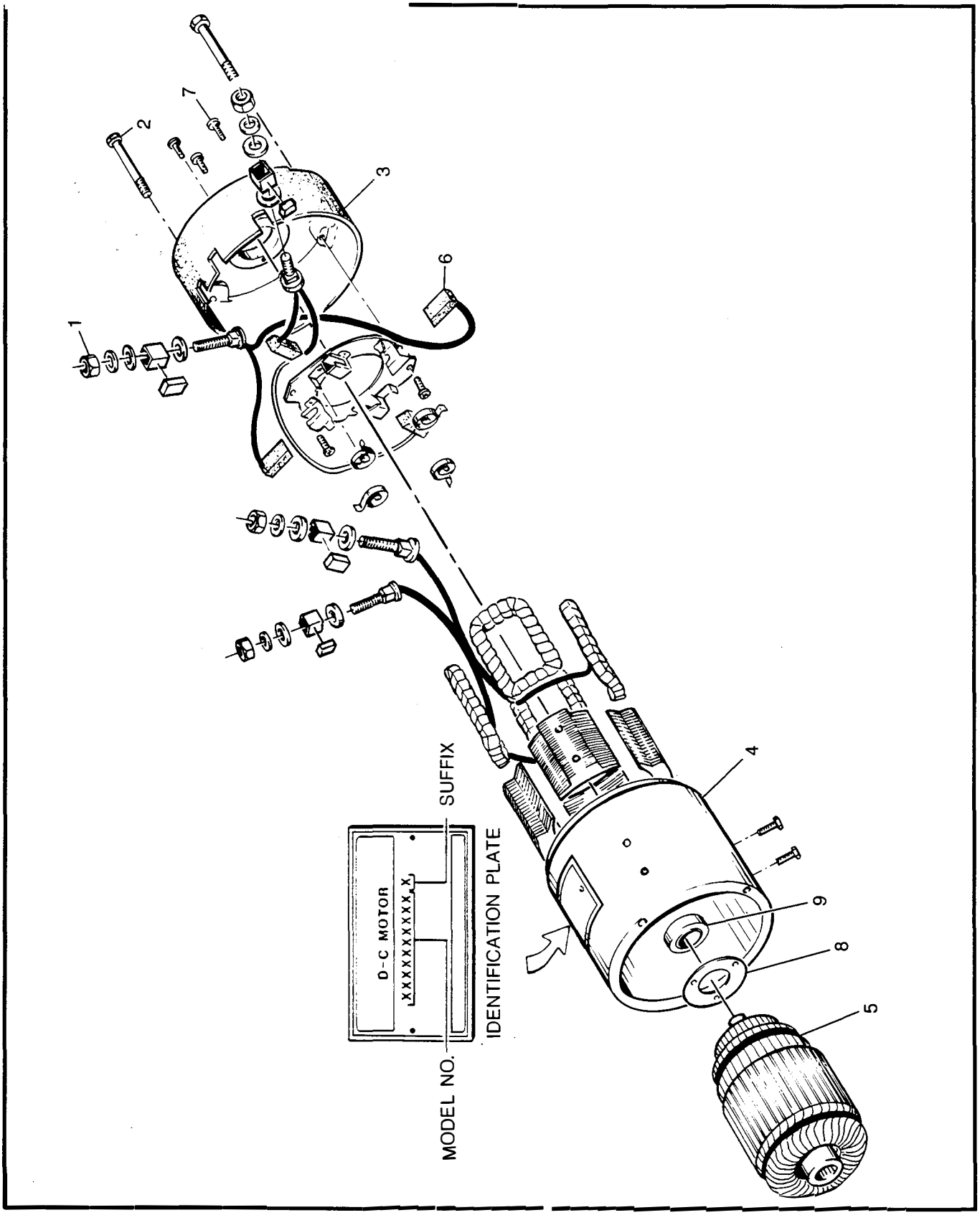


FIG. L-2 ELECTRIC MOTOR

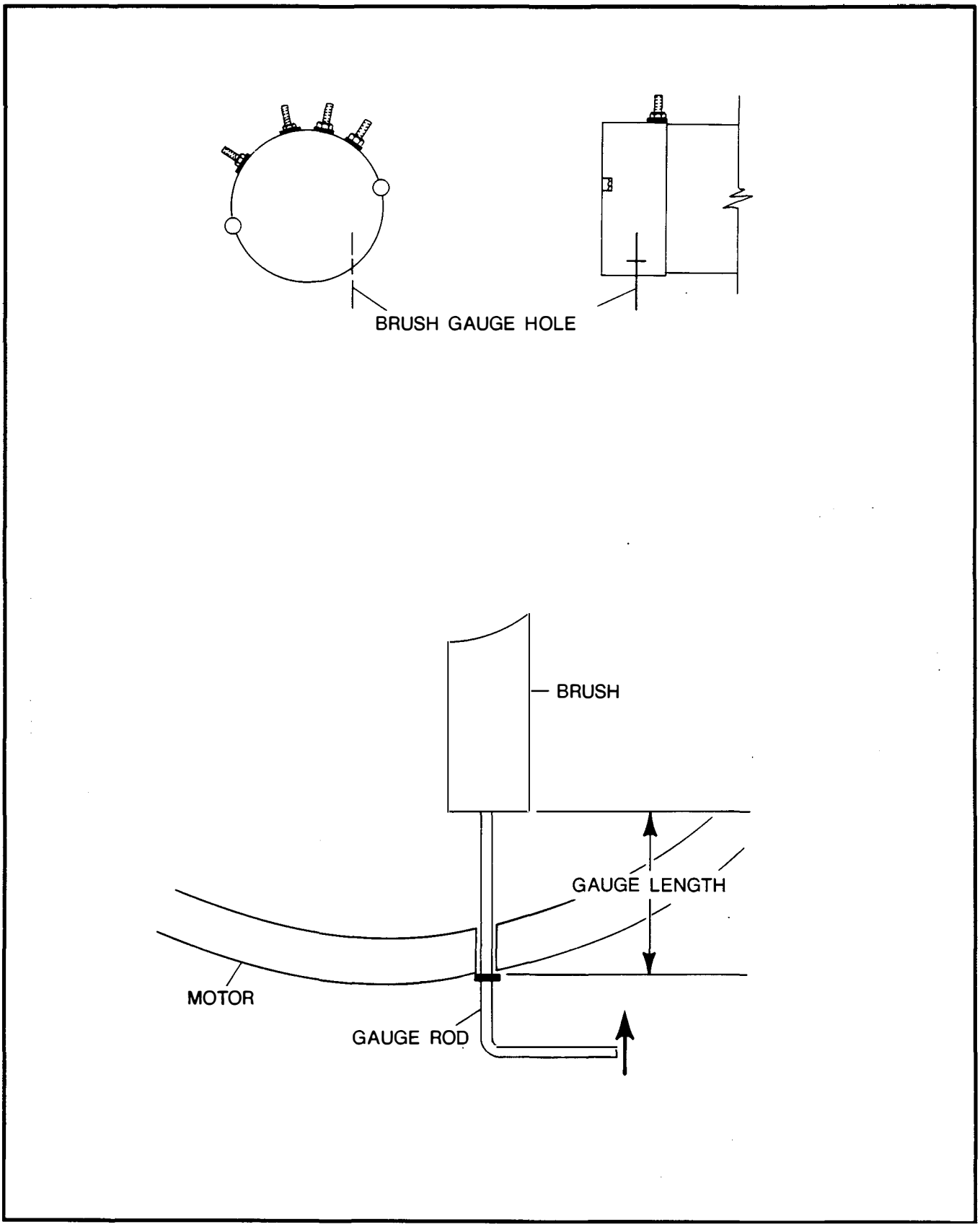


FIG. L-3 BRUSH WEAR MEASUREMENT

NOTE

With new brushes, the gauge rod can be inserted approximately .78" into brush measurement holes. Brushes should be replaced when rod can be inserted 1.56" into hole. This leaves approximately 1/8" allowable wear remaining.

a) If brush is worn to a condition requiring replacement, the motor must be disassembled. [See Disassembly (After Removal From Rear Axle Assembly)].

b) Check each brush for free movement in its holder and examine it for wear and general condition. If brush is broken, cracked, severely chipped, or worn to a length of less than 5/8 inch measured on the short side of the brush, replace it (FIG. L-4). Whenever any brushes are replaced, it is good practice to replace all of them. Keep extra brushes on hand.

c) Examine the condition of the brush springs. Make sure the spring coils are uniform and the springs do not appear discolored which could indicate heating that has caused loss of spring quality. If these or other signs of spring damage are evident, replace the spring or use a small spring scale (FIG. L-5) to see if the spring requires one pound or more force to lift it at the point of contact with the worn brush.

d) Observe the condition of the commutator and the armature coils which may be visible. Refer to Armature/Commutator Test procedures for details to look for during this inspection.

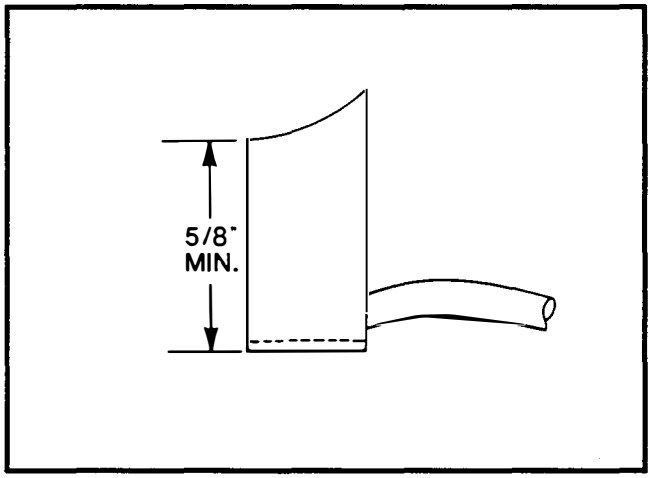


FIG. L-4 MINIMUM BRUSH LENGTH

DISASSEMBLY (AFTER MOTOR REMOVAL FROM REAR AXLE ASSEMBLY)

1. Smooth away any signs of roughness or burrs from the shaft.
2. Mark the exact relationship between the motor housing and end shield by marking with a chisel or marker (FIG. L-1).
3. Remove the clamp screws at the commutator end of the motor which hold the close fit rabbeted end shield to the motor housing.
4. If upon inspection, the armature or field coils appear oily, a faulty oil seal or "O" ring in the rear axle is suspect, allowing the rear axle lubricant to pass into the motor. Oil on a commutator will cause sparking, resulting in both rapid commutator and brush wear.
5. Disassemble the motor (See Motor Removal and Disassembly). Clean armature and/or field coils by wiping with a clean cloth and contact cleaner or alcohol.
6. Remove the three screws (7) that retain the bearing retainer (8). Remove the bearing retainer and inspect the bearing (9) for wear or damage.
7. Lightly lubricate the bearing with motor oil and press into place. Reinstall bearing retainer. Reinstall retaining screws and "snug" into place.
8. Remove the motor housing assembly. When necessary, the field coils can be removed by removing the terminal screws, nuts, and the pole piece screws from the motor housing.

   A. Remove the armature.

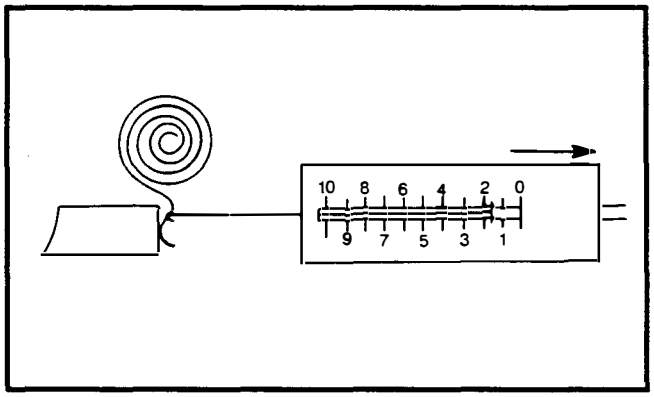


FIG. L-5 BRUSH SPRING TENSION

B. When necessary, the commutator end shield may be further disassembled to change brushes, brush rigging, and cross-over leads by removing the appropriate and obvious screws. This should be done if the brush holders or insulation plate appear burned, warped or have loosened rivets.

INSPECTION OF ARMATURE

NOTE

Replacement is suggested as the best means for maintaining the integrity of these heavy duty motors.

1. If deep burned sections are evident on the commutator bars, this is a symptom of an open circuit in the armature winding. If such evidence is noted, measure the armature resistance by selecting at random any two bars of the commutator with a bar span given in the Motor Reference Data. If this measurements does not meet the value given, the armature should not be used.

NOTE

This condition could be caused by an undetected fault of manufacture appearing early in normal field service conditions, or it could be caused by overloading of the motor causing high temperature failure of connections. The resulting high resistance in a joint could cause this symptom appearance. Evidence of general overheating accompanying flat spots would tend to indicate overworking of the motor.

2. If one or more armature conductors are abnormally black or appear burned compared with the other armature conductors, this is an indication of shorted armature winding. If such evidence is detected, a dirty armature should first be blown off to clean it and then checked with a growler. If the short circuit is not confirmed by this indication, check resistances and apply a high potential test not exceeding 600 volts AC for 1 minute. If the armature does not pass these tests, it should not be used.

HIGH POTENTIAL LAMP TEST ARMATURE AND FIELD.

Construct a test fixture as per (FIG. L-6).

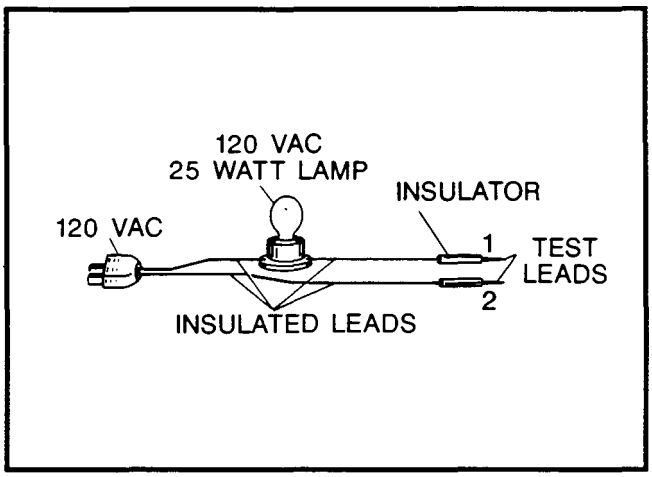


FIG. L-6 HIGH POTENTIAL LAMP TEST FIXTURE

⚠ WARNING ⚠

TEST FIXTURE TO BE CONSTRUCTED AND OPERATED BY QUALIFIED ELECTRICAL SERVICE PERSONNEL. SEVERE ELECTRICAL SHOCK OR ELECTROCUTION MAY RESULT.

ARMATURE/COMMUTATOR

1. **Grounded Commutator Segment to Armature Test**
   a) Attach test lamp lead #1 to armature shaft.
   b) Touch test lamp lead #2 to each segment of the commutator.
   c) If test lamp illuminates, a short is present between armature shaft and the commutator segment.
   d) If test lamp does not illuminate, the test is satisfactory.
2. **Open Commutator Segments Test**
   a) Touch test lamp leads 1 and 2 between opposite segments of the commutator.
   b) If test lamp illuminates, the segment is satisfactory.
   c) If test lamp does not illuminate, the segment is open.
3. **Shorted Commutator Segments Test**
   a) Touch test lamp lead #1 to A segment.
   b) Touch test lamp lead #2 to each segment in turn.

c) If test lamp lights at other than the opposite segment of commutator, the commutator winding is shorted.

FIELD COILS

1. **Grounded Field Coils Test**

   a) Attach test lamp lead #1 to motor housing.

   b) Touch test lamp lead #2 to terminals S1 and S2 on housing.

   c) Test lamp should not illuminate. If test lamp illuminates, the field coils are shorted to motor housing.

2. **Open Field Coil Test**

   a) Attach test lamp lead #1 to terminal.

   b) Attach test lamp lead #2 to terminal.

   c) Test lamp should illuminate. If test lamp does not illuminate, the field coils are open.

THE FOLLOWING TESTS ARE TO BE COMPLETED AFTER MOTOR REPAIR AND BEFORE INSTALLATION IN VEHICLE. (MOTOR REASSEMBLED)

1. **Armature To Field Coil Short Test**

   a) Attach test lead #1 to terminal A1.

   b) Attach test lead #2 to terminal F1.

   c) Test lamp should not illuminate. If test lamp illuminates, motor should be disassembled to locate source of problem.

2. **Armature To Motor Case Short Test**

   a) Attach test lamp #1 to terminal A1.

   b) Attach test lead #2 to terminal A1 (lamp should light), then A2.

   c) Test lamp should not illuminate. If test lamp illuminates, the motor should be disassembled to locate source of problem.

3. **Field Coil To Case Test**

NOTE

Short circuited coils can be caused by several things, as well as an undetected manufacturing fault which most likely would show up early in normal service.

   a) If a generally heat discolored appearance uniformly over the commutator or windings is observed, it is usually a sign of overloading of the vehicle or motor. This should be corrected or the symptoms will be repetitive and motors will be burned out frequently.

   b) Bubbled insulation and individual brush burn marks on the commutator is a typical example of a motor armature which has been loaded to stall with power applied. It overheated and its elements boiled to failure.

COMMUTATOR INSPECTION AND CARE

NOTE

The following operations should only be performed by an experienced and competent electric motor shop.

1. Inspect the commutator during each brush inspection.

2. Commutator bars should not be pitted, burned or grooved in the brush track. If found in this condition, the surface should be refinished in a lathe, limiting the depth of cut to .005 inch or less on a side and repeat until smooth.

3. Before a final cut, the mica insulation between commutator bars should be undercut, .032 inch and no mica slivers should be left along the side of the bars above the undercut.

4. Next, dynamic balance the armature to within .0015 inch amplitude at 3000 RPM. After this, the final finish cut should be made with a diamond tool to obtain a surface finish of 8 to 16 micro inch. The armature should not be put back in service with a diameter of less than 2.625 inches.

5. After refinishing a commutator, check it for eccentricity. It should not exceed .001 inch total

indicator reading for the entire diameter and with a .002 inch maximum bar-to-bar difference.

INSPECTION OF FIELD WINDINGS

If upon inspection, the insulation on the field coils appears blackened or charred, the serviceability of the coils is questionable. Burned or scorched coil insulation is a symptom of coil overheating due to overloads, grounded or short circuited windings.

To check the windings electrically for grounds or open circuits, a continuity tester, ground tester, and ohm meter are required.

To check for a grounded field connect the tester between terminal studs S1 to ground and S2 to ground.

To check for an open or shorted winding: Connect the ohm meter between S2 and S1. The resistance should conform to the value in the Motor Reference Data.

BEARING INSPECTION AND CARE

1. The bearing is prelubricated with Chevron SR1-2 high temperature grease or equivalent, sufficient for the life of the bearing.

NOTE

Do not use silicone grease in a DC motor.

2. Check the bearing by turning it with your fingers. Feel for bindings or gritty effects and for excessive looseness or wobble. If any defect is apparent or if there is any doubt at all as to serviceability of the bearing, replace it with a new one.

3. Remove the old bearing by using a suitable bearing puller. Press new bearing into place by means of an arbor press that exerts pressure on the inner ring.

CAUTION

DO NOT USE A HAMMER FOR BEARING REPLACEMENT. IT WILL DAMAGE THE BEARING.

REASSEMBLY

1. Install the bearing and retainer in the end shield.
2. Set commutator end shield in place on bench with the brush rigging facing upward. Push each brush back up into brush holder until its end would permit commutator to pass under without hitting. Adjust end of spring so that it is against side of brush and holds brush in "cocked" position.
3. Set armature into place in the end shield.
4. Push on end of each brush to release onto the commutator. Observe that all brushes seat on commutator properly and that end of springs ride on brush tops in line with brush holder grooves. Make sure that the brush spring will travel down the holder slot as the brush wears.
5. Position the motor housing over the armature and position it exactly with mark on end shield. Gently seat on rabbet.
6. Gently fit the motor over the rear axle input spline. Line up marks and secure the motor to the rear axle with the existing hardware.
7. Be sure the end shield is a snug fit in the stator rabbet, then replace the clamp screws. Check to determine that armature is free to turn. If it will not turn, check the assembly.
8. Make a high potential test (up to a maximum of 600 volts AC for 1 minute) to assure motor has been properly reassembled.

PARTS IDENTIFICATION

1. The motor model number identifies every part of the motor.
2. When ordering, always describe the particular part and refer to the motor model number.

GENERAL

The vehicle's rear axle is a high efficiency unit featuring a matched set of low friction helical cut gears. The vehicle is equipped with expanding shoe drum brakes on the rear wheels. Brake service instructions are covered in the Brake Section of this manual.

DIFFERENTIAL LUBRICATION

Tools Required: Qty.

Screwdriver, Phillips, large 1

Wrench, open end, 7/8" 1

Dipstick, service E-Z-GO # 24710-G1 1

The lubricant level should be checked in accordance with the Periodic Service Schedule contained in Section 'A' of this manual. With the vehicle parked on a level surface, the parking (hill) brake set, the key in the 'OFF' position and the F-N-R switch in the 'N' position, remove the trunk lid. If the vehicle is not equipped with a cover plate with a check/fill plug, remove the vent plug from the axle and use a service dipstick to determine the fluid level. If lubricant is in the 'ADD' range add lubricant as required to bring to the acceptable level (see Periodic Service Schedule for recommended lubricant). The axle contains 8-10 oz. of lubricant when in the acceptable range. Remove the dipstick and replace the vent plug being careful not to kink the vinyl tubing. Reinstall the trunk lid.

If the vehicle is equipped with a check/fill plug in the cover plate, remove the plug and feel for the level of lubricant, if the lubricant cannot be felt add until lubricant can be felt or pours out of the plug hole.

NOTE

If there is evidence of accumulated greasy dirt around the rear axle cover, axle shafts or input shaft, the lubricant level should be checked immediately. Low lubricant level is an indication of a leak which should be identified and corrected.

The axle shaft wheel bearings are lubricated and sealed at the factory and do *NOT* receive any lubrication from the rear axle.

AXLE ADJUSTMENTS

The helical axle has no external or internal adjustments or shims; therefore, no disassembly is required except to replace worn or defective components caused by conditions beyond normal control.

REMOVING THE REAR AXLE FROM THE VEHICLE (FIG. M-1)

Tools Required: Qty.

Pliers, needle nose 1

Wrench, open end, 1/2" 1

Wrench, open end, 9/16" 1

Jack stands 2

Jack, hydraulic, trolley 1

Disconnect the batteries (See procedures in section B). Remove the wiring from the motor (See Motor Removal and Disassembly).

Loosen both rear wheel and tire assemblies by loosening each lug nut approximately one turn. Raise the vehicle (see procedure in Section B). Remove both rear wheel and tire assemblies. Place a jack under the center of the rear bumper and elevate until the rear axle is clear of the jack stands. Remove the jack stands and relocate them under the outboard ends of the rear bumper. Lower the vehicle onto the jack stands that are adjusted such that the rear axle assembly is as low as possible while still being clear of the shop floor.

⚠ WARNING ⚠

BEFORE PROCEEDING, BE SURE THAT THE VEHICLE IS SECURELY SUPPORTED ON THE JACK STANDS.

Remove the trunk lid (See body and Trim Section) to gain access to the upper mounting hardware of the rear shock absorbers. (1), (2), (3) Remove the upper mounting hardware of the rear shock absorbers.

If required the adjusting yoke may be loosened to remove tension from the brake cables. (Refer to the Brake section for readjustment procedures).

NOTE

It is suggested that an additional person support the motor during the following procedure.

Use the jack to support the motor and axle assembly before removing the nuts (4) and washers (5) from the four 'U' bolts (6).

⚠ WARNING ⚠

DUE TO THE WEIGHT AND LOCATION OF THE MOTOR, CARE MUST BE TAKEN NOT TO ALLOW THE AXLE ASSEMBLY TO ROTATE OR FALL DURING THE FOLLOWING OPERATION.

CARE MUST BE TAKEN WHEN REMOVING THE AXLE FROM THE VEHICLE. DO NOT ALLOW THE UNIT TO STRIKE THE JACK STANDS SUPPORTING THE VEHICLE.

Slowly lower the jack and pull the complete motor and axle through the vehicle's wheel well.

INSTALLING THE REAR AXLE(FIG. M-1)

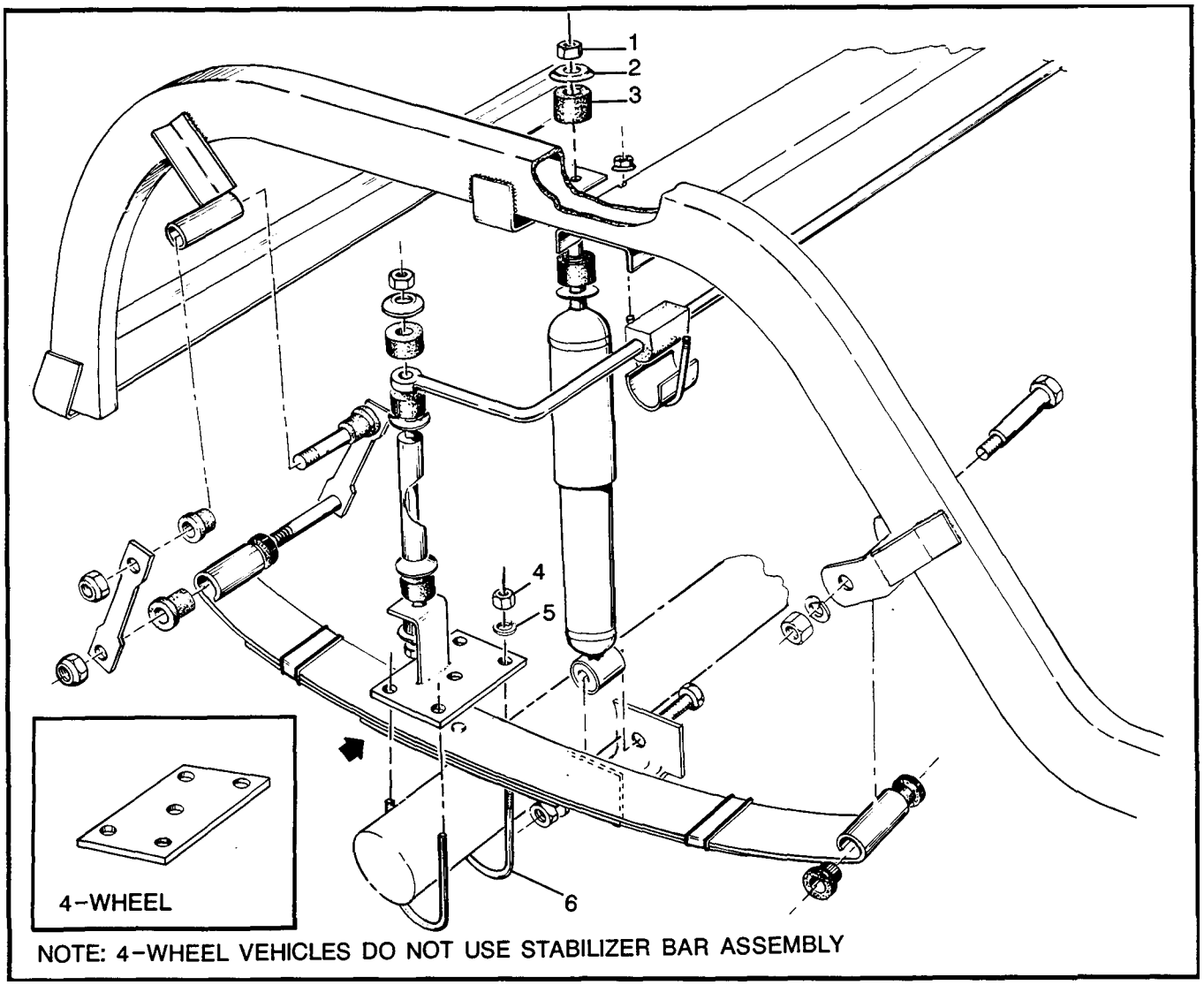
Reassemble the axle assembly using the reverse order of disassembly.

Tighten the nuts (4) fastening the 'U' bolts (6) to 30-35 ft. lbs. torque. Tighten the nuts (1) retaining the shock absorber until the top rubber bushing (3) is compressed to the same diameter as the washer (2).

Tighten the nuts fastening the motor wire terminals to 35-40 in. lbs. torque.

NOTE

For motor removal, see Section L.



NOTE: 4-WHEEL VEHICLES DO NOT USE STABILIZER BAR ASSEMBLY

FIG. M-1

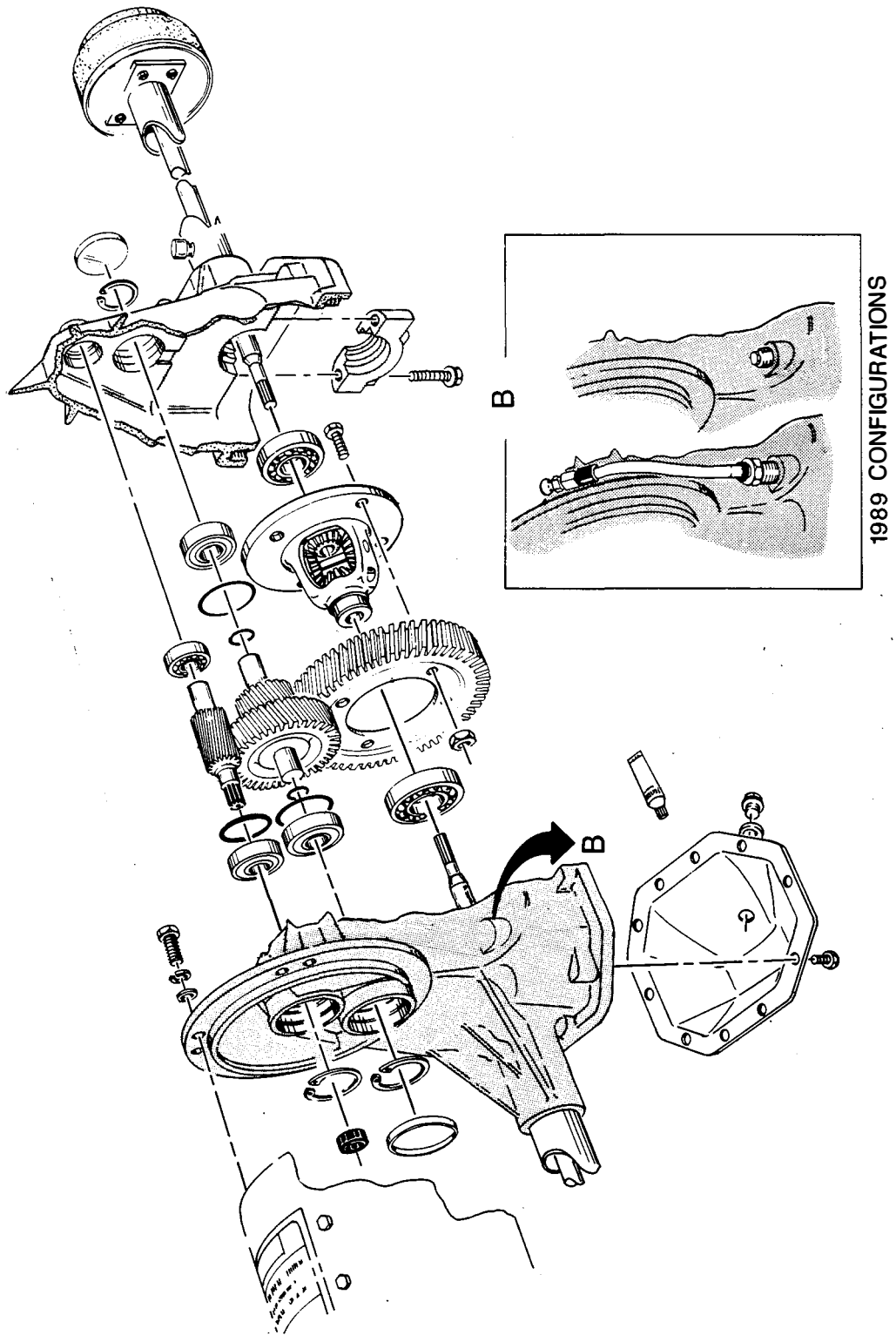


FIG. M-2

REAR AXLE DISASSEMBLY (FIG. M-2)

CAUTION

THE REAR AXLE/MOTOR IS A PRECISION ASSEMBLY, AND AS SUCH ANY REPAIR OR REPLACEMENT OF PARTS MUST BE DONE WITH GREAT CARE IN A CLEAN ENVIRONMENT. BEFORE ATTEMPTING TO PERFORM ANY SERVICE ON THE AXLE, READ AND UNDERSTAND *ALL* OF THE FOLLOWING TEXT AND PHOTOGRAPHS BEFORE ADJUSTING OR DISASSEMBLING THE UNIT.

HANDLE ALL GEARS WITH EXTREME CARE SINCE EACH IS PART OF A MATCHED SET. DAMAGE TO ONE WILL REQUIRE REPLACEMENT OF THE ENTIRE SET OR RESULT IN AN UNACCEPTABLY HIGH NOISE LEVEL.

SNAP RINGS MUST BE REMOVED/INSTALLED WITH CARE TO PREVENT DAMAGE TO BEARINGS, SEALS AND BEARING BORES.

NOTE

It is recommended that whenever a bearing, seal or 'O' ring is removed, it be replaced with a new one regardless of mileage. Always wipe the seals and 'O' rings with a light oil before installing.

Removal of the brake assemblies are not required for the disassembly of the rear axle.

BRAKE DRUM AND HUB DISASSEMBLY/ASSEMBLY

Tools Required: Qty.

Pliers, needle nose 1
Ratchet or pull handle, 1/2" drive 1
Socket, 1 1/16", hex, 1/2" drive 1
Jack, hydraulic, trolley 1

NOTE

The following procedure does not require the removal of the rear axle from the vehicle.

Loosen the rear wheel lug nuts approximately one turn. Raise the vehicle and support on jack stands (see procedures in section B). Remove the rear wheels.

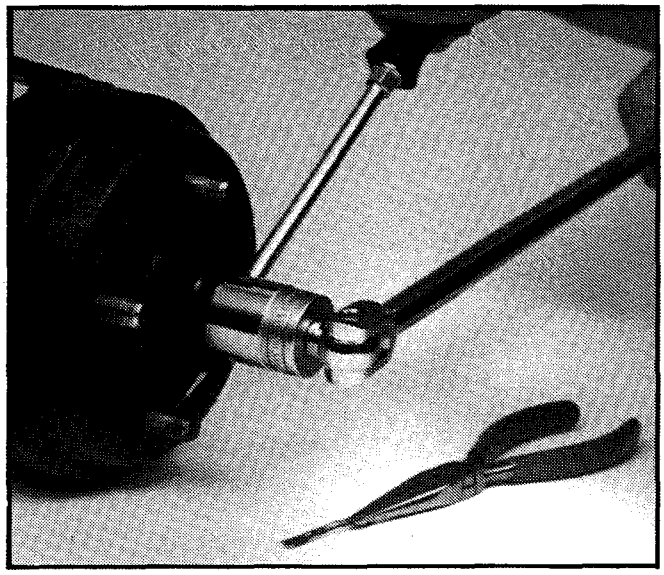


FIG. M-3

Remove the cotter pin, axle nut, washer, and the spindle cap adapter, if equipped. (FIG. M-3) and (FIG. M-9)

Remove the brake drum and washer (1).

AXLE SHAFT REMOVAL AND DISASSEMBLY

Tools Required: Qty.

Arbor press 1
Pliers, needle nose 1
Pliers, snap ring, internal 1
Slide hammer, E-Z-GO P/N 18753-G1 1

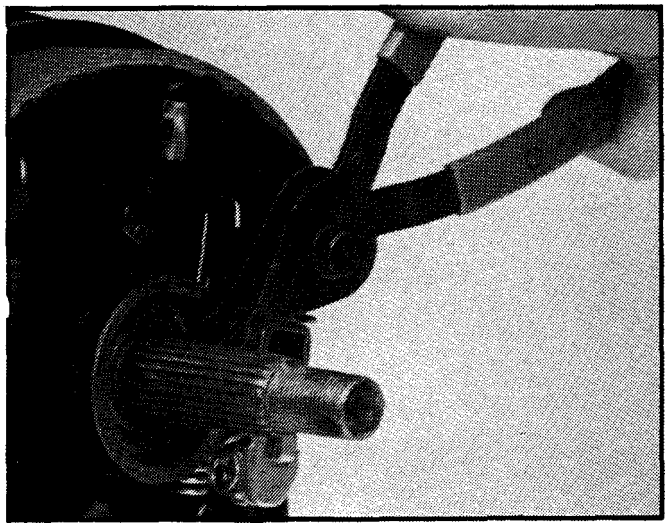


FIG. M-4

Remove the outer snap ring (2) from the axle tube. (FIG. M-4) and (FIG. M-9)

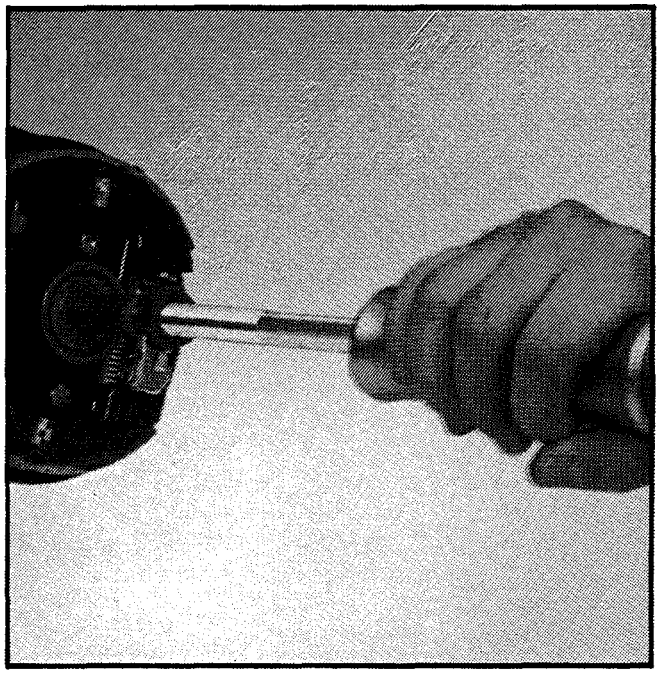


FIG. M-5

Attach a slide hammer to the axle shaft thread and remove the axle and bearing from the axle tube. (FIG. M-5)

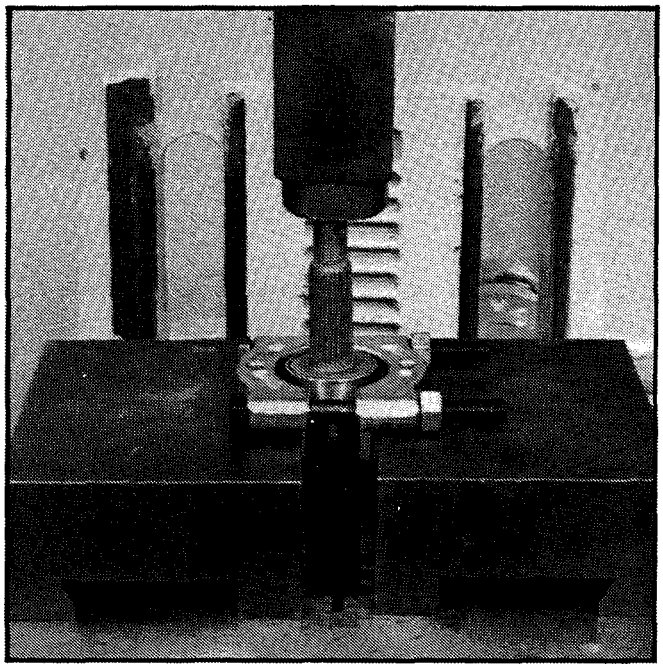


FIG. M-6

Remove the bearing by supporting the inner race of the bearing on an arbor press bed and apply pressure to the threaded end of the axle shaft. (FIG. M-6)

AXLE SHAFT SEAL REMOVAL AND REPLACEMENT

Tools Required: Qty.

Pliers, snap ring, internal 1

Puller, seal 1

Seal installer, E-Z-GO P/N 18739-G1 1

Hammer, ball pein 1

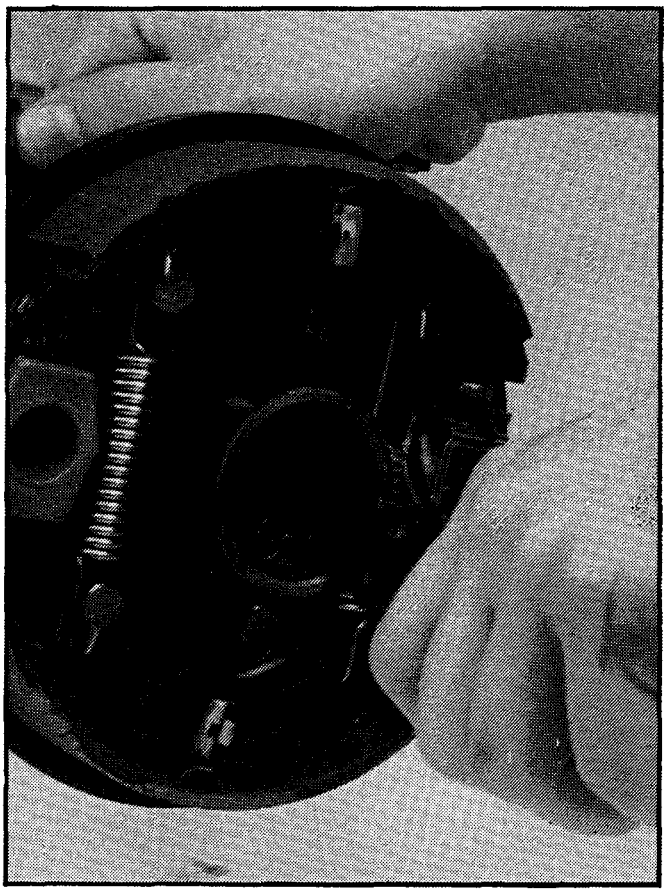


FIG. M-7

Remove the inner snap ring (3). (FIG. M-7) and (FIG. M-9)

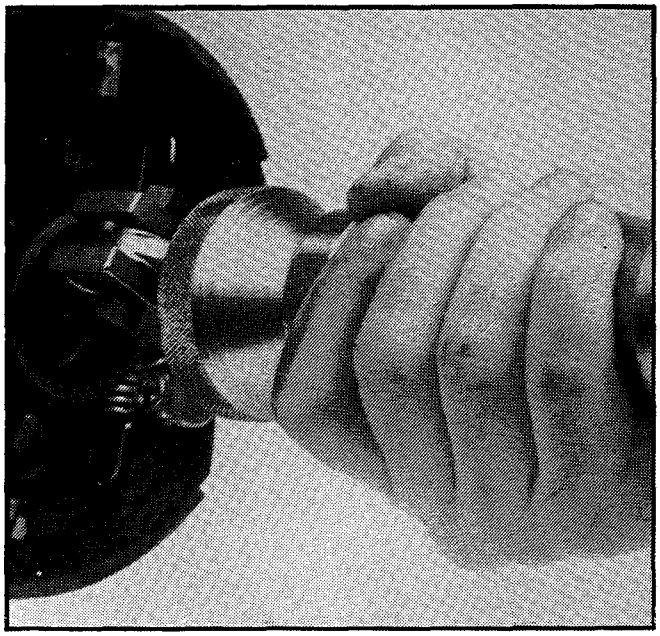


FIG. M-8

Use a puller to remove the seal (4). (FIG. M-8) and (FIG. M-9)

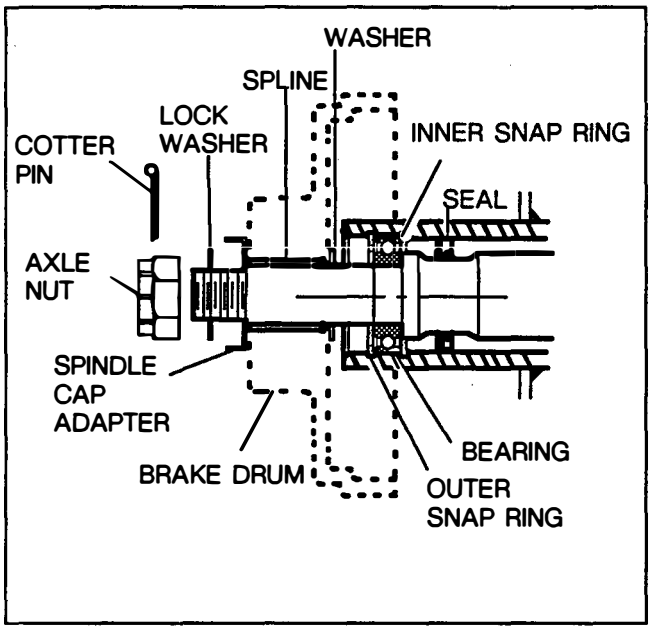


FIG. M-9

CAUTION

USE CARE TO PREVENT DAMAGE TO THE INNER SURFACE OF THE AXLE TUBE AT THE SEALING AREA.

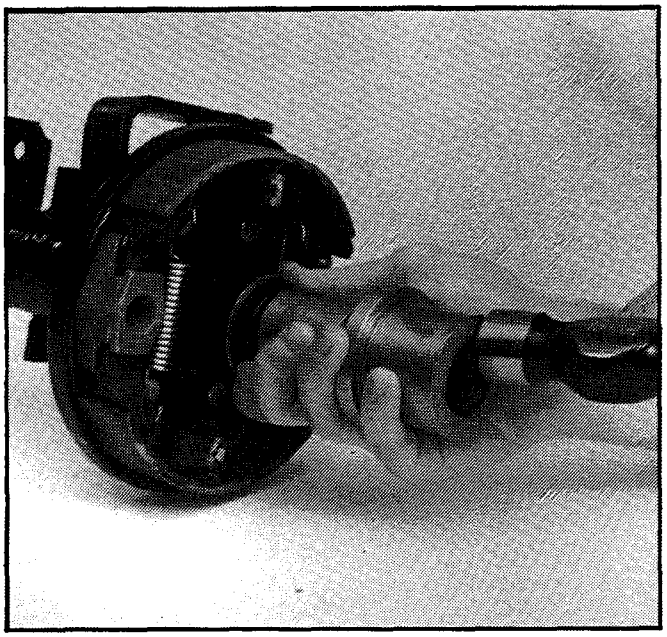


FIG. M-10

To install the seal use the special E-Z-GO seal installer to drive the seal into its correct position. (FIG. M-9) and (FIG. M-10)

Install the inner snap ring. (FIG. M-9)

CAUTION

TO PREVENT SEAL DAMAGE, LIGHTLY COAT THE AXLE SHAFT WITH BEARING GREASE AND SUPPORT THE SHAFT DURING INSTALLATION.

AXLE SHAFT REPLACEMENT

Carefully insert the axle shaft and bearing through the oil seal. Rotate the shaft until the spline engages with the differential side gears. Install the outer snap ring (2). (FIG. M-7)

Coat the outboard spline of the axle with an anti-seize compound. Install the brake hub and drum, thrust washer, nut, and a new cotter pin.

NOTE

Tighten the axle nut to 70 ft. lbs. torque minimum/140 ft. lbs. torque maximum. Continue to tighten until the slot in the nut aligns with the cotter pin hole.

DIFFERENTIAL REMOVAL

Tools Required:	Qty.
Ratchet, 3/8" drive	1
Socket, 1/2", 3/8" drive	1
Putty knife	1
Pan, oil drain	1
Sealant, Permatex 20536-G1	1
Drain pan	1

AXLE SHAFT REMOVAL AND DISASSEMBLY

CAUTION

THE REAR AXLE/MOTOR IS A PRECISION ASSEMBLY, AND AS SUCH ANY REPAIR OR REPLACEMENT OF PARTS MUST BE DONE WITH GREAT CARE IN A CLEAN ENVIRONMENT. BEFORE ATTEMPTING TO PERFORM ANY SERVICE ON THE AXLE, READ AND UNDERSTAND *ALL* OF THE FOLLOWING TEXT AND PHOTOGRAPHS BEFORE ADJUSTING OR DISASSEMBLING THE UNIT.

HANDLE ALL GEARS WITH EXTREME CARE SINCE EACH IS PART OF A MATCHED SET. DAMAGE TO ONE WILL REQUIRE REPLACEMENT OF THE ENTIRE SET OR RESULT IN AN UNACCEPTABLY HIGH NOISE LEVEL.

Remove the left and right axle assemblies as detailed elsewhere in this section.

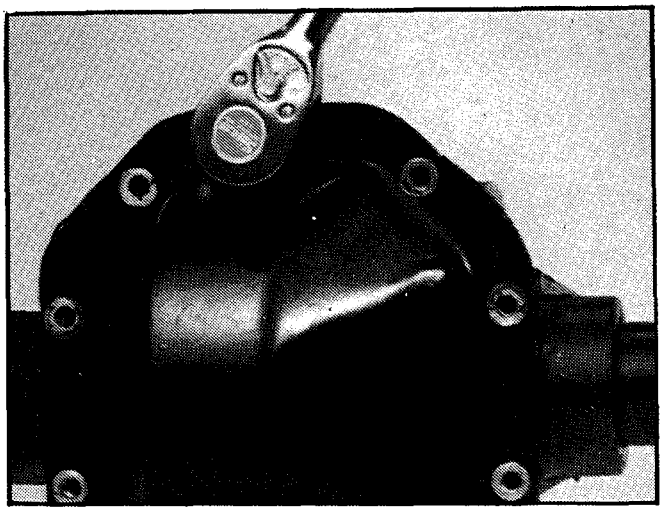


FIG. M-11

Remove the ten cover plate bolts and remove the cover plate. Drain the lubricant into a drain pan. (FIG. M-11)

NOTE

Late 1989 models and on have a cover plate with a check/fill plug.

CAUTION

USE CARE NOT TO DAMAGE THE SEALING SURFACES.

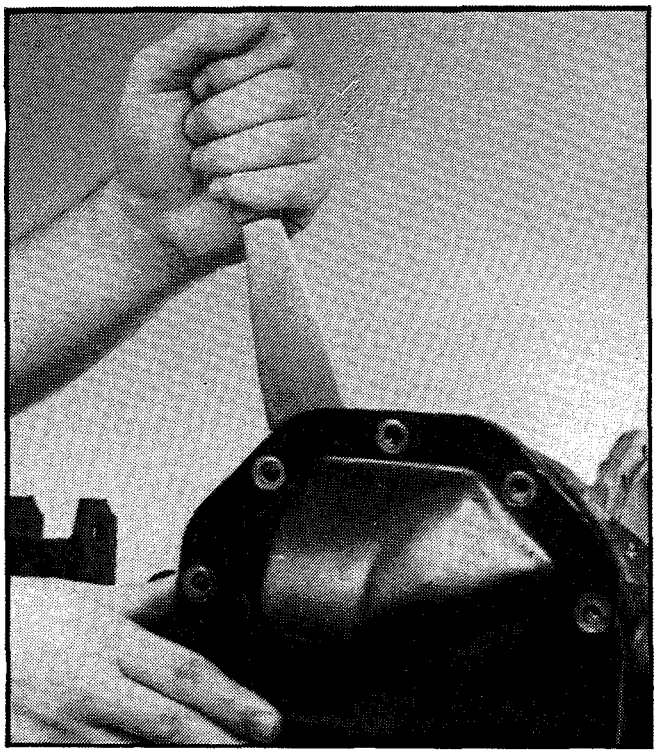


FIG. M-12

A putty knife may be required to separate the cover plate from the housing. (FIG. M-12)

All sealant must be removed from both the cover plate and the housing sealing surfaces.

NOTE

The bearing caps are marked for identification. They *MUST* be reassembled in their original position.

CAUTION

DO NOT DAMAGE THE MACHINED SURFACES OF THE BEARING CAPS.

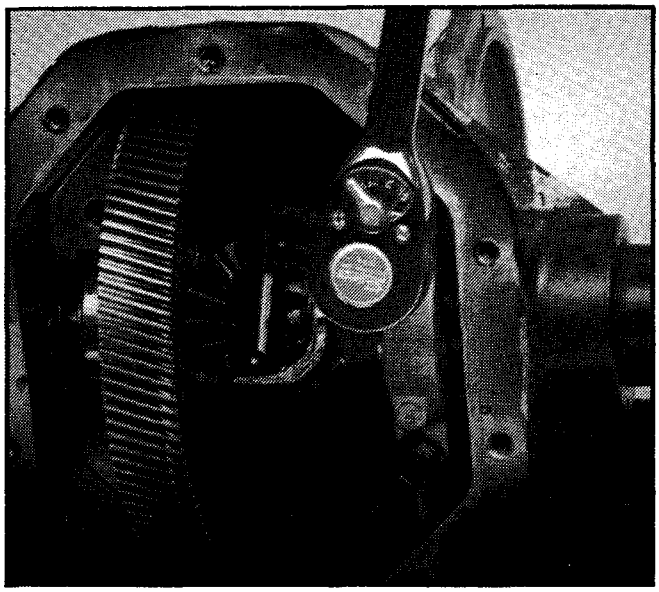


FIG. M–13

Remove the four cap screws and remove the bearing caps. (FIG. M–13)

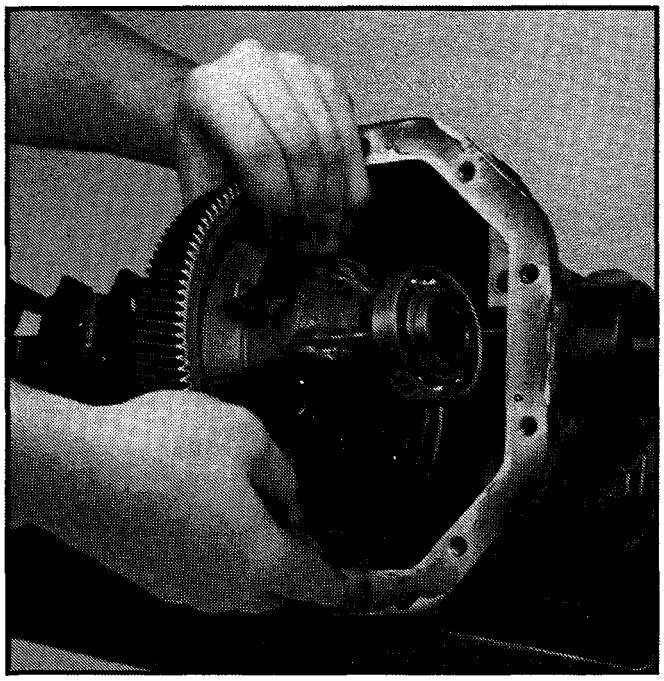


FIG. M–14

Remove the differential case from the housing. (FIG. M–14)

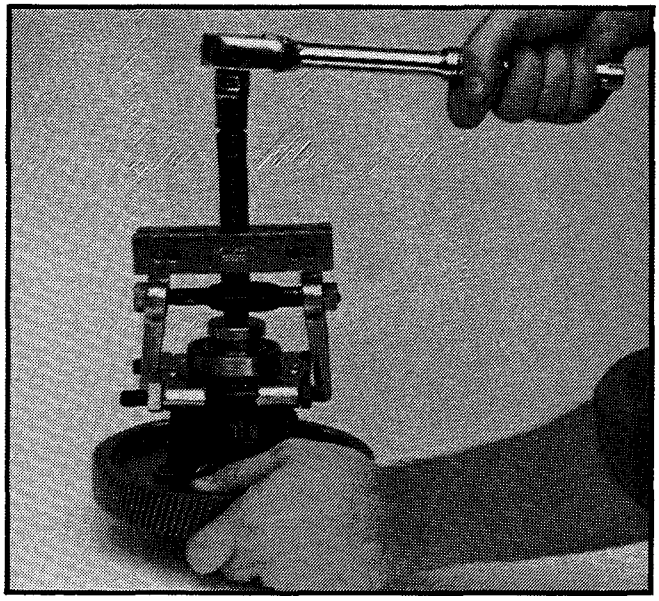


FIG. M–15

Do not remove the bearing from the differential case unless a bearing failure is evident. If a bearing failure has occurred, remove it using a bearing puller and replace with new bearings. (FIG. M–15)

DIFFERENTIAL INSTALLATION

Installation is in the reverse order of removal. Use Permatex sealant as required between the housing and the cover plate.

INTERMEDIATE GEAR REMOVAL

Tools Required:	Qty.
Pliers, snap ring, internal	1
Drift, brass	1
Puller, bearing, inner diameter	1
Puller, bearing, jaw type	1
Screwdriver, Phillips	1
Drill, 3/8", electric or air	1
Drill bit, 1/8"	1
Punch, center	1
Hammer, ball pein	1

CAUTION

HANDLE ALL GEARS WITH EXTREME CARE SINCE EACH IS PART OF A MATCHED SET. DAMAGE TO ONE WILL REQUIRE REPLACEMENT OF THE ENTIRE SET OR RESULT IN AN UNACCEPTABLY HIGH NOISE LEVEL.

NOTE

The intermediate gear shaft is located behind the metal plugs, and is recessed within the bearing bore. Each end of the shaft is countersunk which provides adequate clearance to drill out the metal plugs.

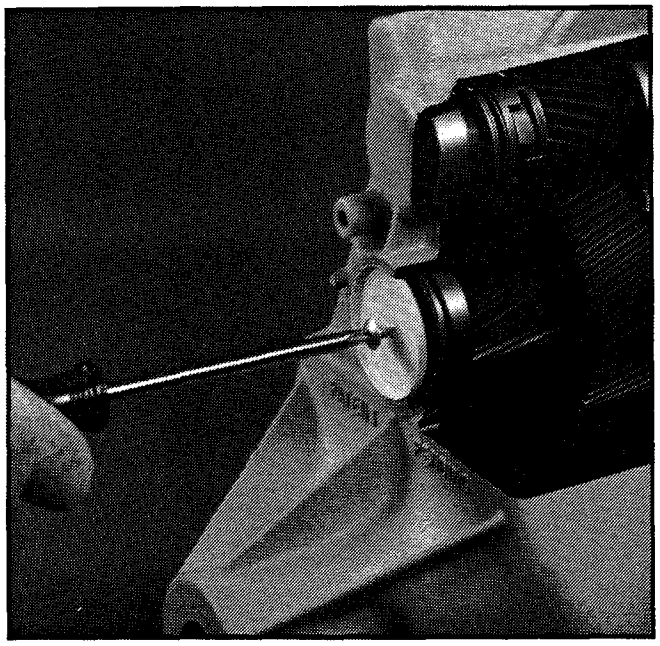


FIG. M–16

Lightly punch the center of the intermediate gear shaft plugs. Drill through each plug using a 1/8" diameter drill being careful not to drill into the shaft below the plug. Insert a suitable Phillips head sheet metal screw into the drilled hole and screw in until the metal plug is forced out of the bearing bore. (FIG. M–16)

Clean any remaining sealant from the bore before proceeding, using care not to damage the housing bore.

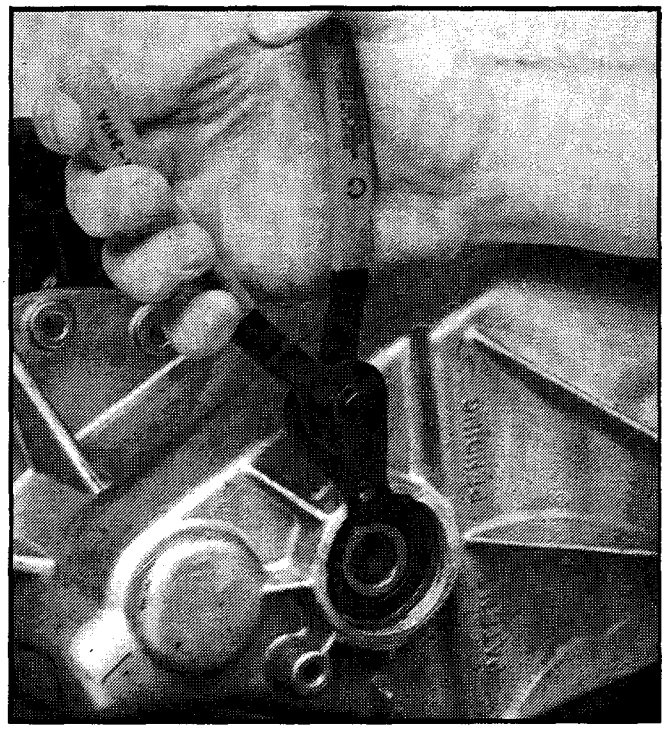


FIG. M–17

Remove the snap ring from each side of the housing. (FIG. M–17)

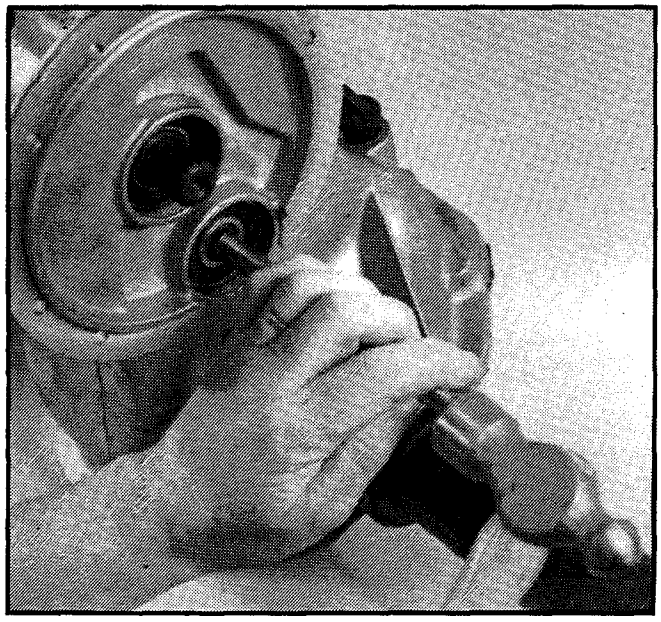


FIG. M–18

Use a brass drift to drive the intermediate gear away from the flanged side of the axle housing. (FIG. M–18)

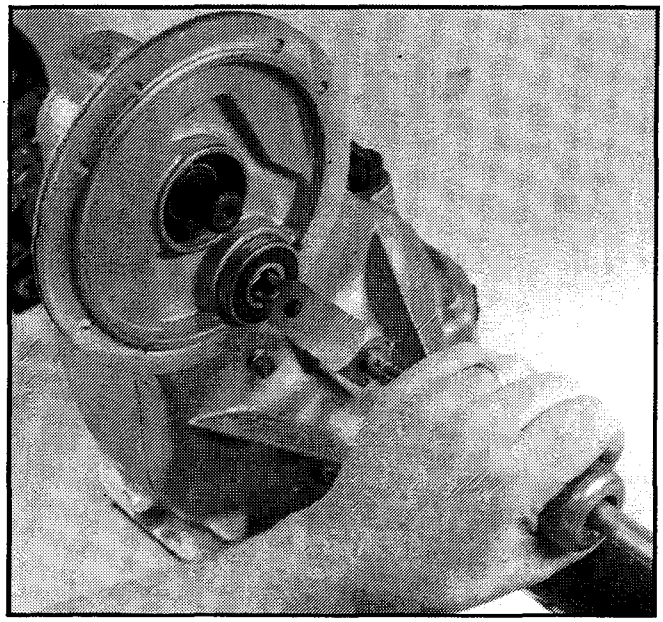


FIG. M–19

Use an inner diameter bearing puller attached to a slide hammer to remove the bearing from the *FLANGED* side of the housing. (FIG. M–19)

NOTE

If the bearing does not remain in the housing bore, it may be separated from the gear using two wooden wedges. (FIG. M–20)

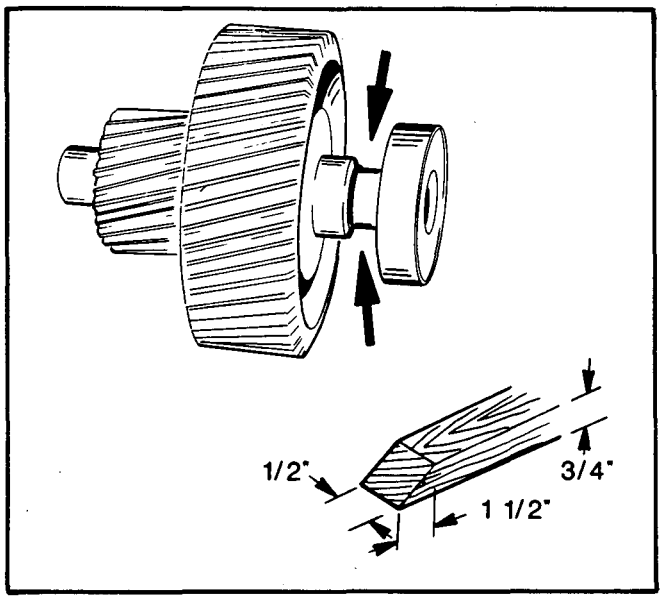


FIG. M–20

Remove the bearing opposite the flanged side of the housing by driving the intermediate gear and bearing towards the non–flanged side of the housing until the bearing is fully exposed.

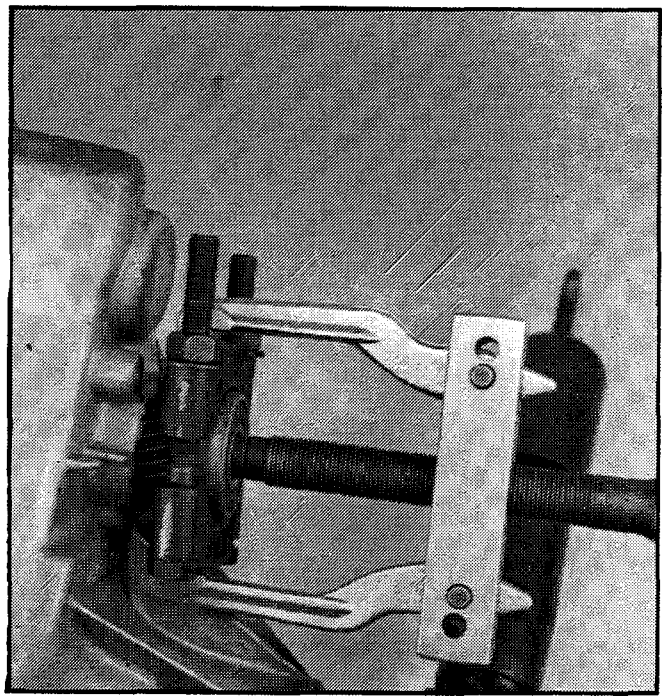


FIG. M–21

Use a bearing puller to remove the bearing from the intermediate gear. (FIG. M–21)

CAUTION

HANDLE ALL GEARS WITH EXTREME CARE SINCE EACH IS PART OF A MATCHED SET. DAMAGE TO ONE WILL REQUIRE REPLACEMENT OF THE ENTIRE SET OR RESULT IN AN UNACCEPTABLY HIGH NOISE LEVEL.

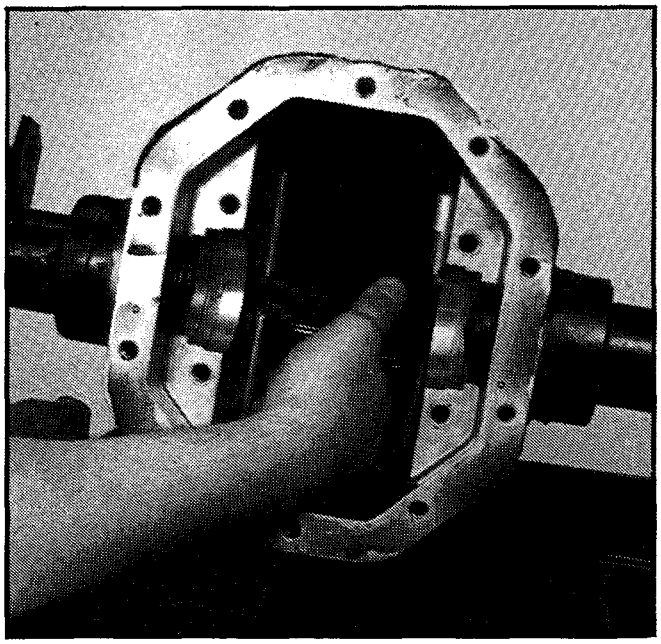


FIG. M-22

Tilt the small diameter end of the intermediate gear towards the opening in the bottom of the housing and remove. (FIG. M-22)

Remove the old 'O' rings and replace with new ones.

INTERMEDIATE GEAR INSTALLATION

Install new 'O' rings on each end of the intermediate gear shaft. Place the intermediate gear into position within the housing. Push the bearings onto the shoulders of the shaft to assure a correct fit. Install the outer snap rings. Coat the edges of the metal plugs with sealant and tap into place using a socket and a hammer.

INPUT GEAR REMOVAL

Tools Required: ..... Qty.

Pliers, snap ring, internal 1

Slide hammer 1

Arbor press 1

Remove the snap ring. (FIG. M-23)

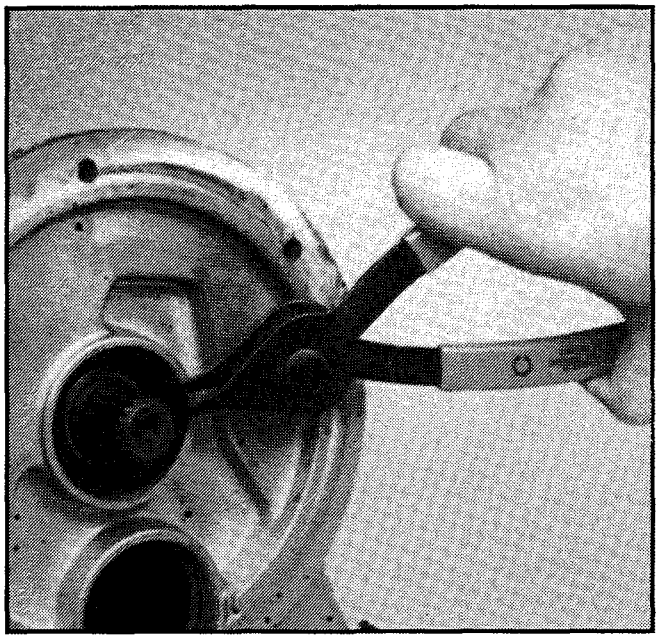


FIG. M-23

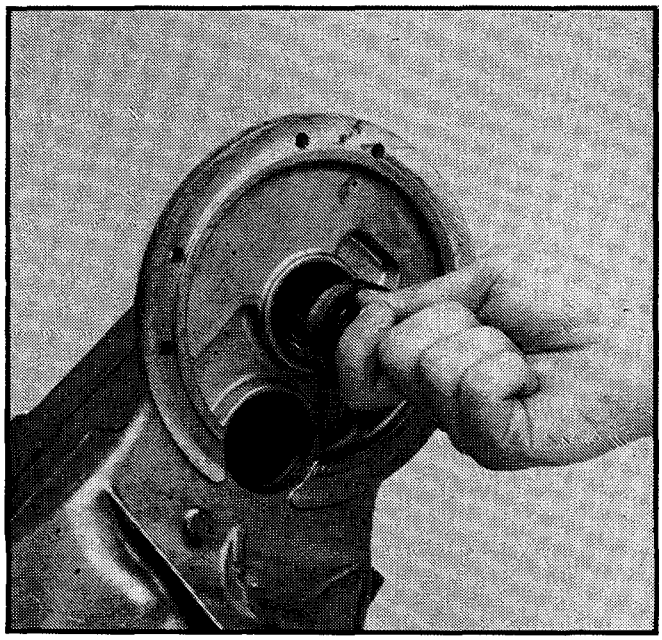


FIG. M-24

Pull the input gear from the axle housing. (FIG. M-24)

NOTE

The gear and bearings should slide out from the housing easily. If undue resistance is encountered, a slide hammer may be required to remove the assembly.

DIFFERENTIAL DISASSEMBLY

NOTE

The differential assembly is available *ONLY* as a complete assembly.

DIFFERENTIAL GEAR REMOVAL

Tools Required: Qty.

Wrench, 9/16" box end 1

Socket, 9/16", 1/2 drive 1

Ratchet, 1/2" drive 1

Hammer, plastic tipped 1

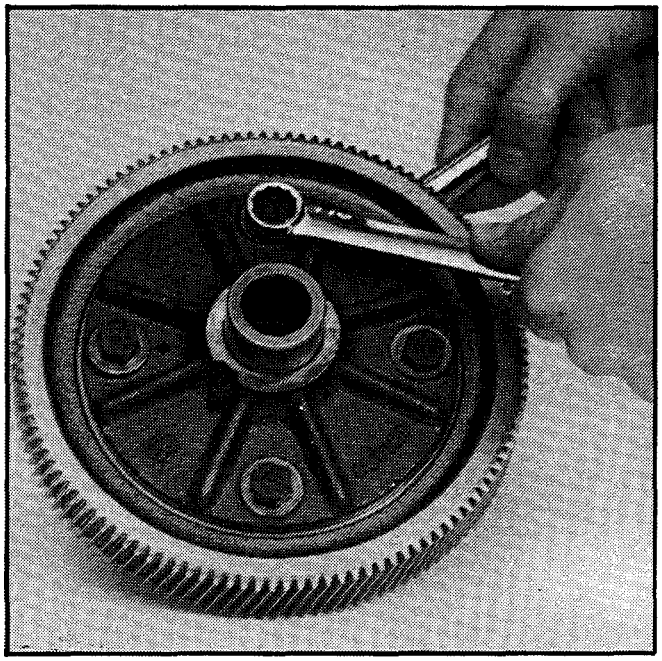


FIG. M-25

Remove the four bolts and nuts that secure the large output gear to the differential case. (FIG. M-25)

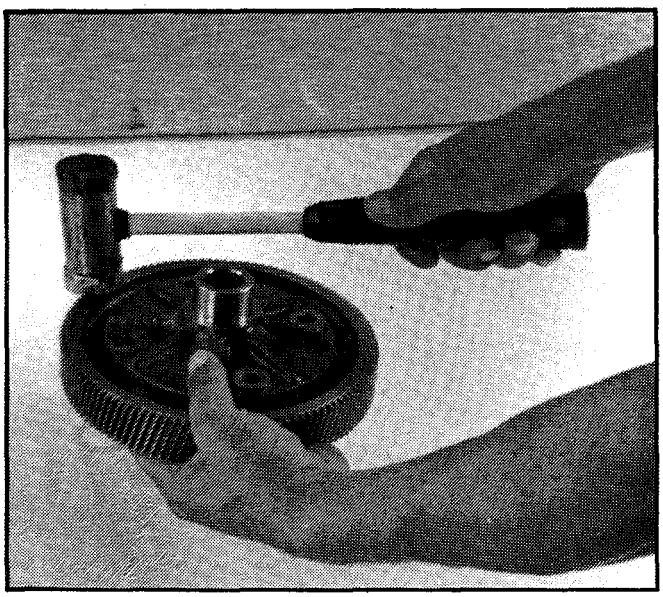


FIG. M-26

If the large output gear does not separate easily from the differential case, it may require the use of a plastic tipped hammer to remove it. (FIG. M-26)

Reassemble in the reverse order of disassembly.

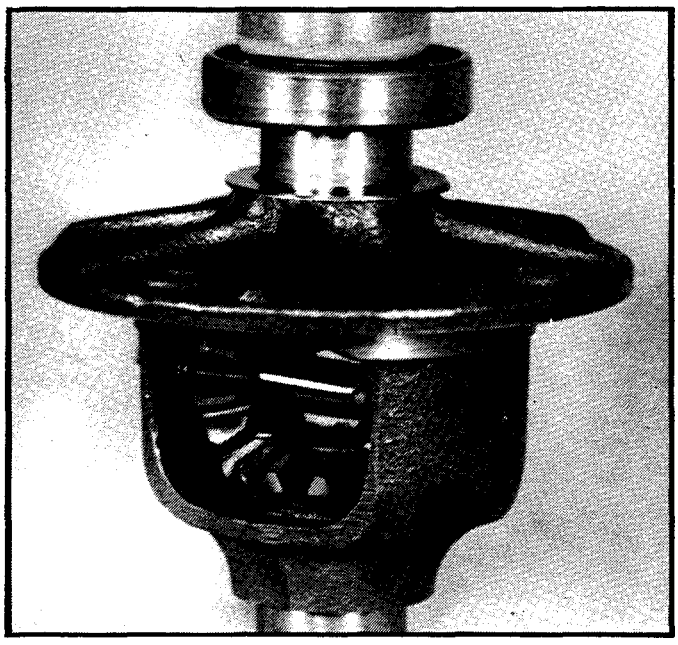


FIG. M-27

Press new bearings onto differential assembly. (FIG. M-27).

CAUTION

THE HEAD OF THE BOLT MUST BE AGAINST THE DIFFERENTIAL CASE AND THE NUT AGAINST THE LARGE OUTPUT GEAR. FAILURE TO FOLLOW THIS CAUTION WILL RESULT IN SERIOUS DAMAGE TO THE OTHER COMPONENTS.

Position the ring gear on the differential case and start the drive gear bolts into the gear.

Tighten the bolts, alternating back and forth across the gear until the gear is pulled evenly into place. Tighten the bolts to 45 - 65 ft. lbs. torque (FIG. M-28).

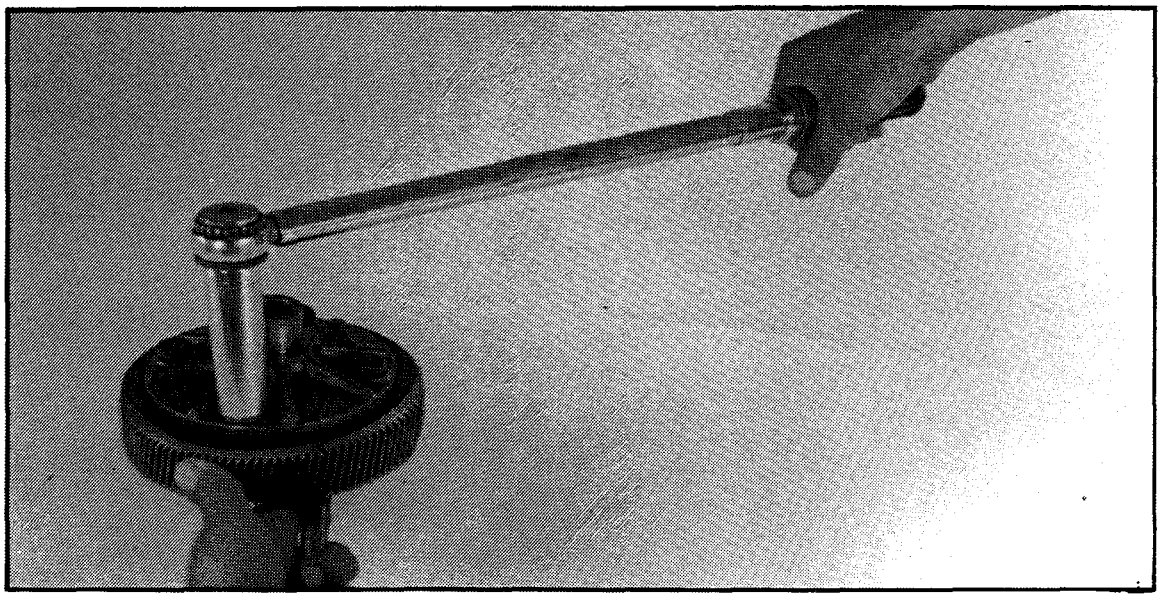


FIG. M-28

GENERAL (FIG. N–1)

⚠ WARNING ⚠

IT IS IMPORTANT THAT A GOOD GROUND BE PROVIDED IN ORDER TO ADEQUATELY PROTECT PERSONNEL AND EQUIPMENT. REFER TO SPECIFICATION GS–726–006 (Pg. T–1).

There are two distinct circuits used in the operation of an electric vehicle. These circuits are the *CONTROL* and the *POWER* circuits.

The control circuits may be identified by the light gauge wire used. The control circuit components consist of the key switch, the solenoid, a reverse warning device and two micro switches. Micro switch MS–2 is actuated by the forward–neutral–reverse switch, and micro switch MS–3 is actuated by . . movement of the potentiometer lever which is moved by the accelerator linkage.

CONTROL CIRCUIT

FORWARD OPERATION

With the key switch in the 'ON' position and the forward–neutral–reverse switch in the 'FORWARD' position, micro switch MS–2 is closed which provides an electrical path to the solenoid. Depressing the accelerator pedal moves the lever of the potentiometer from the "OFF" position and also activates micro switch MS–3. The closure of MS–3 completes the control circuit and activates the coil of the solenoid which causes the solenoid contacts to close which in turn activates the power circuit.

REVERSE OPERATION

The reverse operation is identical to forward operation except that the second pole of the double micro switch activates a circuit that lowers the resistance within the potentiometer resulting in a reduced maximum reverse speed. Additionally a reverse warning device is activated by the forward–neutral–reverse switch that is placed in the 'REVERSE' position which activates micro switch MS–4. This warning device is in continuous operation while the forward–neutral–reverse switch is in the 'REVERSE' position.

POWER CIRCUIT

With the control circuit activated, the solenoid contacts are closed. Power is applied to the power circuit. Depressing the accelerator pedal moves the lever of the potentiometer which increases the resistance from 0 – 5000 ohms. The control module uses solid state circuitry to supply power through the forward–neutral–reverse switch which directs power in the correct orientation through the armature and field windings of the motor.

FEATURES AND BENEFITS OF THE SOLID STATE SPEED CONTROL

SMOOTH STEPLESS OPERATION

1. The E–Z–GO Solid State speed controllers give electric vehicles new and improved driving characteristics by allowing superior operator control of vehicle's drive motor speed. This is possible through the use of electronic control techniques by which the power delivered to the motor can be smoothly varied from fully off to fully on. There are no speed steps or increments.

   A high power semiconductor switch consisting of an array of paralleled power MOSFET transistors, controls the current in the motor windings. The transistors are connected in series with the battery and the motor. The transistors are turned on and off at the rate of 15,000 times per second by the control circuitry, while the ratio of the on and off times is varied in response to the input demanded by the throttle. This technique is called pulse width modulation. When the transistors are on, the current through the motor builds up, storing energy in the motor's magnetic field. When the transistors turn off, this stored energy causes the motor current to continue to flow through the free wheel diode. The motor current ramps up and down as the switch turns on and off, the average current (which determines the motor torque) being controlled by the ratio of the on and off times. In this way, smooth, stepless control of the power delivered to the motor is achieved with very low power loss in the control components.

CURRENT MULTIPLICATION

2. One of the most intriguing features and benefits of the E–Z–GO Solid State speed controller is the fact

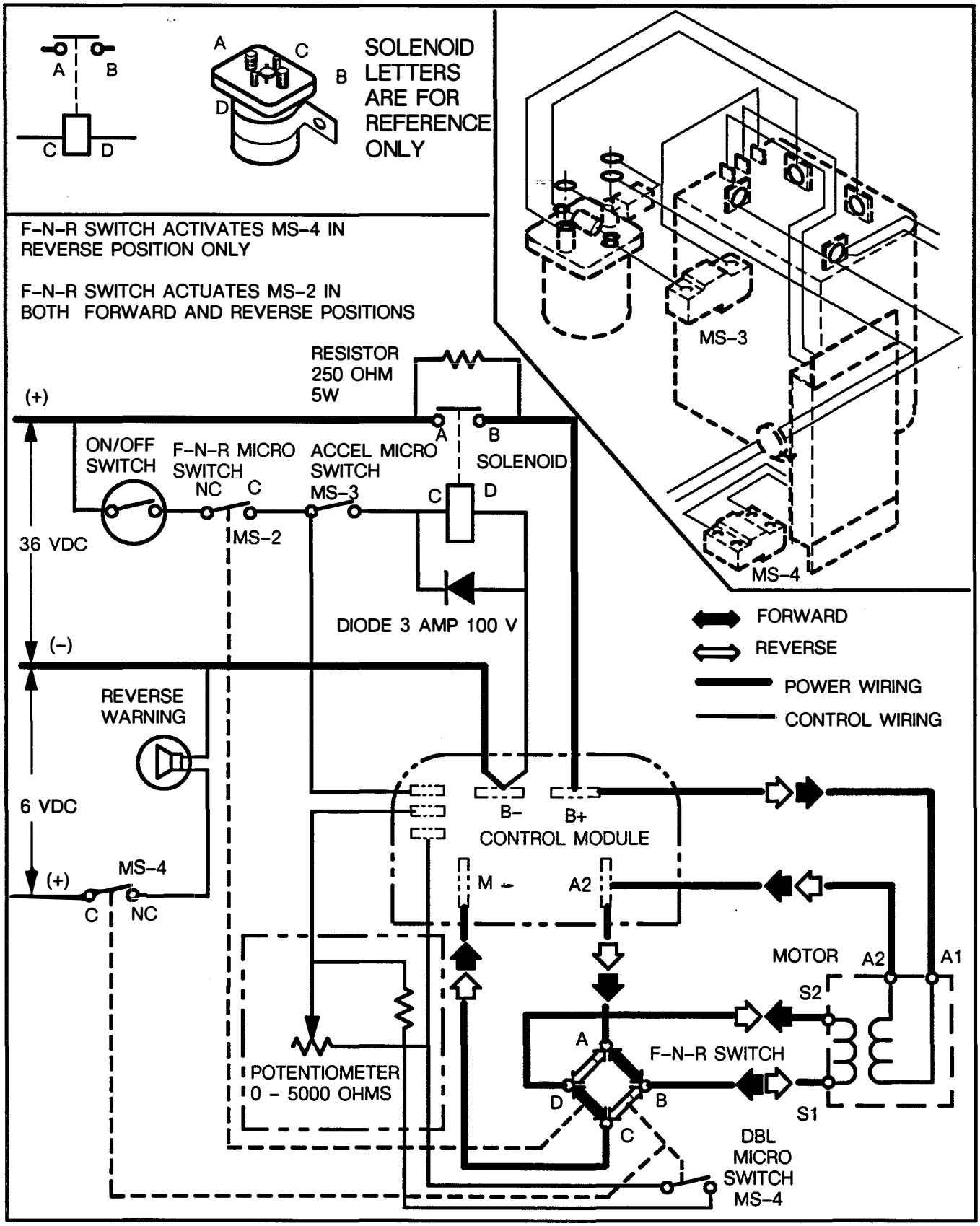


FIG. N-1 CONTROL AND POWER CIRCUITS

that during acceleration, or reduced speed operation, it allows more current to flow into the motor than flows out of the battery. This is possible because the controller acts like a D.C. transformer, i.e., it takes in high voltage(the full battery voltage) and low current, and puts out low voltage and high current. Thus for these conditions the battery only has to supply a fraction of the current required by a resistor type controller in which the battery current and motor current are always equal. The result is a dramatic improvement in the vehicle's efficiency; this gives greater driving range per battery charge.

CURRENT LIMITING

3. Another feature of E–Z–GO Solid State controllers is their ability to limit the motor current to a preset maximum. This current limit feature protects the controller from damage which might result if the current were limited only by the motor demand. The current limit feature is also very important to the rest of the system because it reduces the stresses placed on the motor, drive train, and batteries. Motor and battery efficiency and service life are both improved by eliminating high current surges during vehicle acceleration. This also saves wear and tear on vehicle transmissions and drive trains and in some cases, the terrain that the vehicle rides on (e.g., fairways and greens).

UNDER VOLTAGE CUTBACK

4. The controller must have a means of preventing operation at very low battery voltages. This is because the control circuitry requires some minimum voltage to function properly. For this reason, the controller is designed so that its output is gradually reduced if the battery voltage falls below a certain level; for the standard 36 volt models this happens at 16 volts. By reducing the output to the motor, the battery voltage can recover and an equilibrium is established in which the battery is allowed to supply as much current as it can without falling below 16 volts.

THERMAL PROTECTION

5. The design of these transistorized motor controllers has placed a great deal of emphasis on thermal management and in normal operation they barely get warm. If, however, the controller is undersized for its application or otherwise overloaded, overheating may occur. If the internal temperature of the controller exceeds 165 degrees Fahrenheit, the current limit will be reduced to approximately one half of its rated value. This will generally allow vehicle operation at a reduced performance level, to allow maneuvering out of the way and stopping in a good place. When the controller cools down, full current limit and performance will automatically return.

RUNAWAY PROTECTION

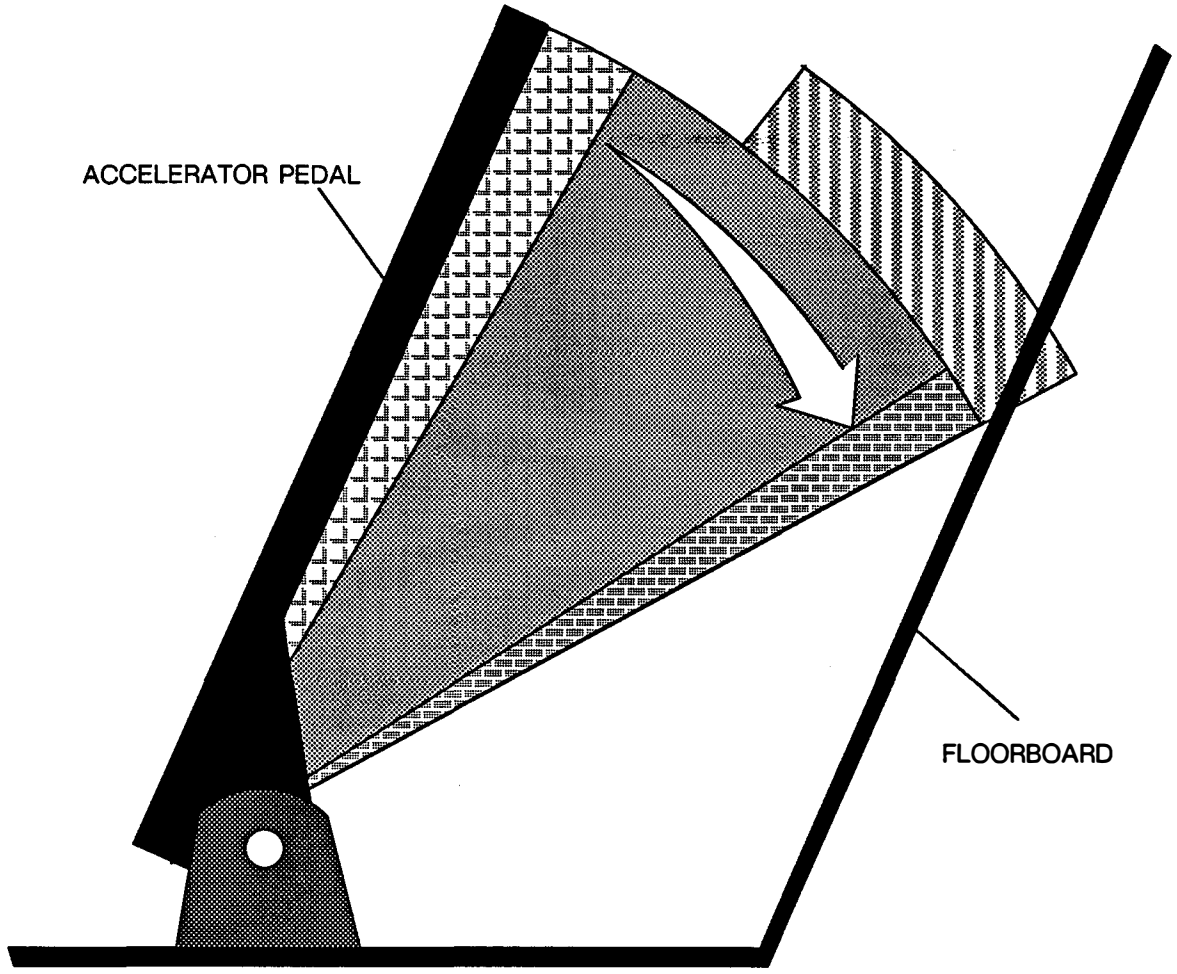
6. These controllers have a feature which shuts off the output in the event of an open circuit fault in the potentiometer or its wiring which could otherwise result in uncontrolled full speed operation. The standard throttle configuration is a 5000 ± 10% ohm, 2 wire potentiometer going from zero ohms for full off to 5000 ohms for full on. Broken potentiometer wiring, connectors or potentiometers which fail open would normally give a full on signal. The controller detects any throttle inputs of more than 7000 ohms as a fault and shuts off the output preventing a runaway. The controller will return to normal operation when the fault is repaired.

HIGH PEDAL PROTECTION (FIG. N–2)

7. The E–Z–GO Solid State controller has circuitry to sense a "high" (depressed) accelerator pedal at the time the controller is turned on and inhibit the output until the pedal is released and re–applied. This safety feature (also called Neutral Start or High Pedal Disable) prevents the vehicle from being turned on with the throttle depressed, requiring the operator to start smoothly from zero throttle. It also protects against sudden starts caused by problems in the throttle linkage (e.g., bent parts, broken return spring, etc.) which might give a partial or full throttle signal to the controller even with the pedal released.

SERVICEABILITY

8. The design philosophy of the E–Z–GO Solid State controllers has been to make simple, easily installed controllers requiring no user adjustments or modifications. Experience has shown that the electronic components are very reliable and that many problems are caused by the effects of contamination (especially water and battery acid). Accordingly, these units are sealed into an electrically isolated aluminum extrusion and are not field serviceable. The controllers are, however, rebuildable at the factory.



ACCELERATOR PEDAL AT REST

HILL (PARKING) BRAKE RELEASE ZONE

0 - 5000 OHMS (OPERATING RANGE IN FORWARD)

PEDAL OVER TRAVEL (FULL SPEED TO PEDAL STOP)

70 - 5000 OHMS (VEHICLE WILL NOT START IF FORWARD OR REVERSE IS SELECTED WITH THE PEDAL IN THIS POSITION)

FIG. N-2 ACCELERATOR POSITIONS

REDUCED SPEED REVERSE

9. The vehicle is equipped with a feature that limits the maximum reverse speed. The reverse speed limiting circuit restricts the vehicles reverse top speed without affecting the lower speeds, by reducing the resistance of the potentiometer. Since the circuit reduces power to the motor, some difficulty in climbing steep grades in reverse may be anticipated.

GENERAL

The following procedures will assist in the trouble-shooting and repair or adjustment of the E-Z-GO solid state speed controllers in an efficient and timely manner.

No procedure can cover every situation, therefore this procedure should be used as a guide in conjunction with good repair practices.

⚠ WARNING ⚠

BEFORE ATTEMPTING TO TROUBLE-SHOOT OR REPAIR THE EQUIPMENT BE SURE THAT THOSE WORKING ON OR AROUND THE EQUIPMENT CANNOT BE INJURED. REFER TO THE APPROPRIATE PARAGRAPHS IN SECTION 'B' FOR THE CORRECT PROCEDURE FOR RAISING BOTH OF THE VEHICLES DRIVE WHEELS. OBSERVE ALL WARNINGS PERTAINING TO SAFE PRACTICES WHEN WORKING ON AN ELECTRIC VEHICLE. ALWAYS WEAR APPROVED EYE PROTECTION.

Tools Required:	Qty.
Volt ohm meter	1
Wrench, open end, 7/16"	1
Wrench, open end, 1/2"	1
Wrench, open end, 3/8"	1

No special tools are required to install, remove or adjust the unit. Good quality tools are required and vice grips, pliers or adjustable wrenches should **not** be used.

The use of a Volt Ohm Meter (VOM) is **mandatory** to perform trouble-shooting on the solid state speed controller. When selecting a VOM, either an analog (needle type) or a digital type is acceptable, although it is easier to determine small voltage and resistance changes with a digital meter. You do not need to purchase the most expensive available but it should be capable of accurately measuring both voltage and resistance. If an analog meter is selected it should have a scale that is large enough to be easily and accurately read. The meter will be reading voltages from 1 to 50 and resistances from 0 to 10,000 ohms. Look at the the DC voltage selector and select a meter that permits voltage selection that is most applicable to your needs. Remember that reading 6 volts on a 50 volt meter scale would be difficult. The same problem exists when reading resistance (ohms). Select a meter with scales that are appropriate for the readings required. A meter that can easily be misinterpreted can cost many hours of wasted time looking for problems that do not exist or overlooking genuine problems. It doesn't matter if you choose analog or digital, just be sure that the meter is reliable and accurate. Most important however is to be sure that you know how to use it efficiently.

TROUBLE-SHOOTING VEHICLE WIRING

(FIG. N-3), (FIG. N-4), (FIG. N-6)

Tools Required:	Qty.
V.O.M.	1

If the car fails to operate or operates poorly, the following test sequence should be followed.

⚠ WARNING ⚠

TO PREVENT THE VEHICLE FROM INADVERTENTLY ACCELERATING, WHICH COULD CAUSE BODILY INJURY, THE VEHICLE MUST BE LIFTED TO RAISE BOTH DRIVE WHEELS ABOVE THE GROUND.

Raise the vehicle (see safety procedures in Section B) before proceeding.

Remove the cover of the solid state speed control by loosening the bolt that secures the cover. Lift off the cover. Examine all of the wiring to assure that all wires are without physical damage or corrosion. Check the routing of all wiring and the tightness of each connection. Repair or replace any suspect wires or connections.

To test the control circuit, turn the key switch to the 'ON' position. Set the volt meter to the 50 VDC range. Touch the black probe to the negative (-) contact of the vehicle D.C. receptacle and the red (+) probe to the positive (+) contact of the vehicle D.C. receptacle. (FIG. N-4)

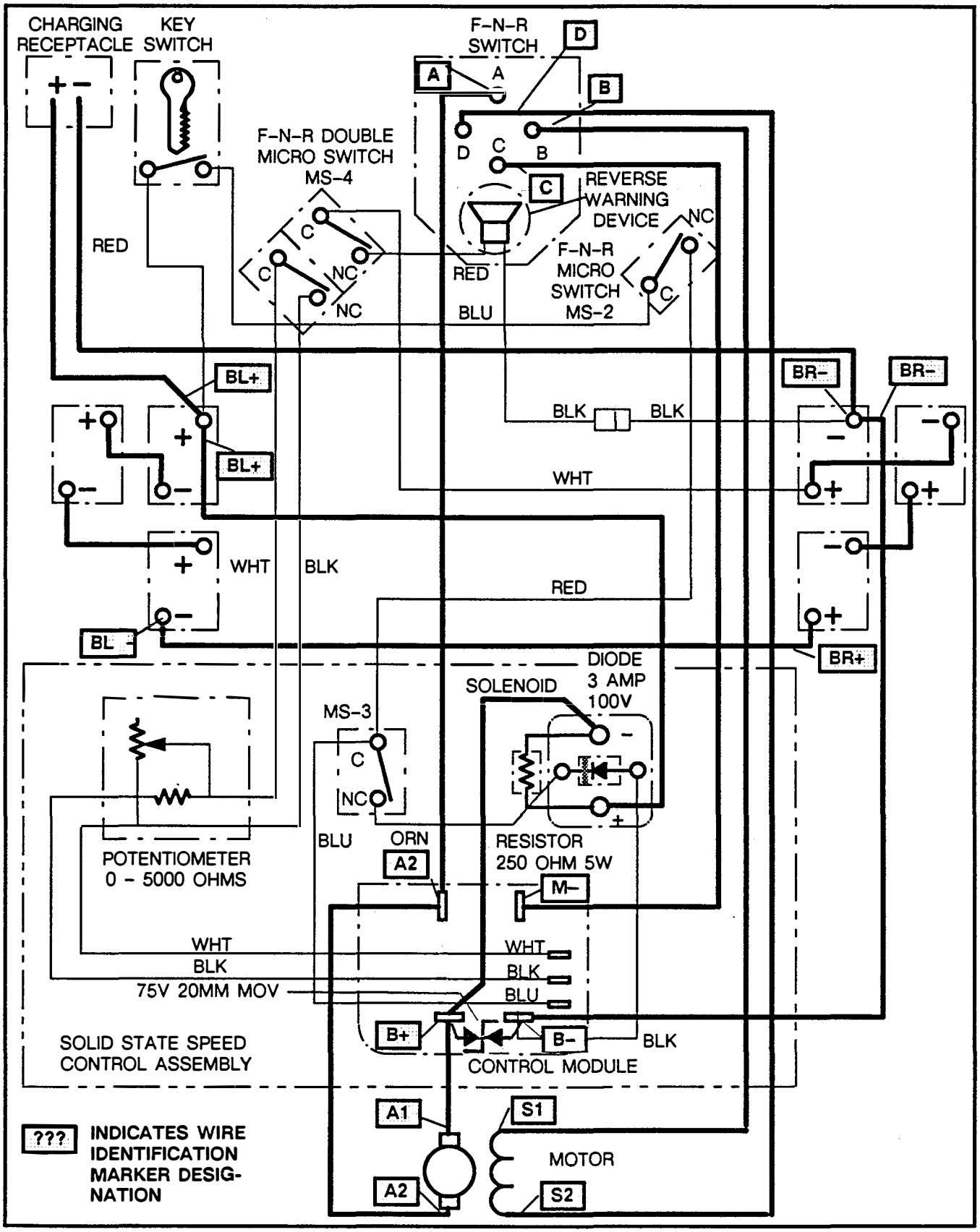


FIG. N-3 POWER WIRING DIAGRAM

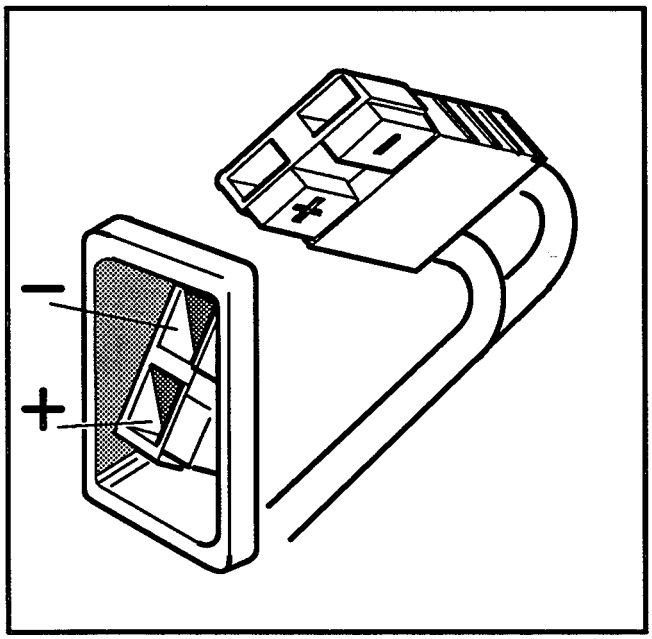


FIG. N-4 CHARGING RECEPTACLE
(VIEWED FROM FRONT)

A meter reading of 36 VDC ±5V indicates the batteries are satisfactory. A reading of below 36 VDC ±5V indicates that one or all batteries are defective or are in need of charging (see Batteries Section for testing procedures). No reading indicates an 'open' condition and the power transmission circuit should be inspected for a broken or disconnected conductor.

With the forward-neutral-reverse switch in the forward position, remove the red (+) probe from the positive contact of the receptacle and relocate it to the positive (+) terminal of the solenoid. A meter reading of 36 VDC ±5V will indicate that the heavy gauge wire (BL+) and terminations between the battery and solenoid positive (+) terminal are in good condition.

TROUBLE-SHOOTING SOLID STATE SPEED CONTROLLER (FIG. N-1), (FIG. N-5), (FIG. N-6)

GENERAL

The following procedures will assist in the trouble-shooting and repair or adjustment of the E-Z-GO solid state speed controllers in an efficient and timely manner.

⚠ WARNING ⚠

BEFORE ATTEMPTING TO TROUBLE-SHOOT OR REPAIR THE EQUIPMENT BE SURE THAT THOSE WORKING ON OR AROUND THE EQUIPMENT CANNOT BE INJURED. REFER TO THE APPROPRIATE PARAGRAPHS IN SECTION 'B' FOR THE CORRECT PROCEDURE FOR RAISING BOTH OF THE VEHICLES DRIVE WHEELS. OBSERVE ALL WARNINGS PERTAINING TO SAFE PRACTICES WHEN WORKING ON AN ELECTRIC VEHICLE. ALWAYS WEAR APPROVED EYE PROTECTION.

Tools Required:	Qty.
Volt ohm meter	1
Wrench, open end, 7/16"	1
Wrench, open end, 1/2"	1
Wrench, open end, 3/8"	1

No special tools are required to install, remove or adjust the unit. Good quality tools are required and vice grips, pliers or adjustable wrenches should not be used.

The use of a Volt Ohm Meter (VOM) is **mandatory** to perform trouble-shooting on the solid state speed controller. When selecting a VOM, either an analog (needle type) or a digital type is acceptable, although it is easier to determine small voltage and resistance changes with a digital meter. You do not need to purchase the most expensive available but it should be capable of accurately measuring both voltage and resistance. If an analog meter is selected it should have a scale that is large enough to be easily and accurately read. The meter will be reading voltages from 1 to 50 and resistances from 0 to 10,000 ohms. Look at the the DC voltage selector and select a meter that permits voltage selection that is most applicable to your needs. Remember that reading 6 volts on a 50 volt meter scale would be difficult. The same problem exists when reading resistance (ohms). Select a meter with scales that are appropriate for the readings required. A meter that can easily be misinterpreted can cost many hours of wasted time looking for problems that do not exist or overlooking genuine problems. It doesn't matter if you choose analog or digital, just be sure that the meter is reliable and accurate. Most important however is to be sure that you know how to use it efficiently.

TROUBLE-SHOOTING (FIG. N-1), (FIG. N-2), (FIG. N-5), (FIG. N-6)

Use common sense and and the following step by step chart when trouble-shooting the entire accelerator and solid state controller system.

Verify that adequate battery voltage is present to operate the vehicle. Battery voltage should be 36VDC ±5V after the surface charge is removed.

1. Remove the cover by removing the screw that secures the cover. Lift off the cover. Examine all of the wiring to assure that all wires are without physical damage or corrosion. Check the routing of all wiring and the tightness of each connection. Repair or replace any suspect wires or connections. (FIG. N-6)

2. Inspect the male 'push on' contacts at the control unit and be sure that they and the areas around them are free of corrosion. (FIG. N-1)

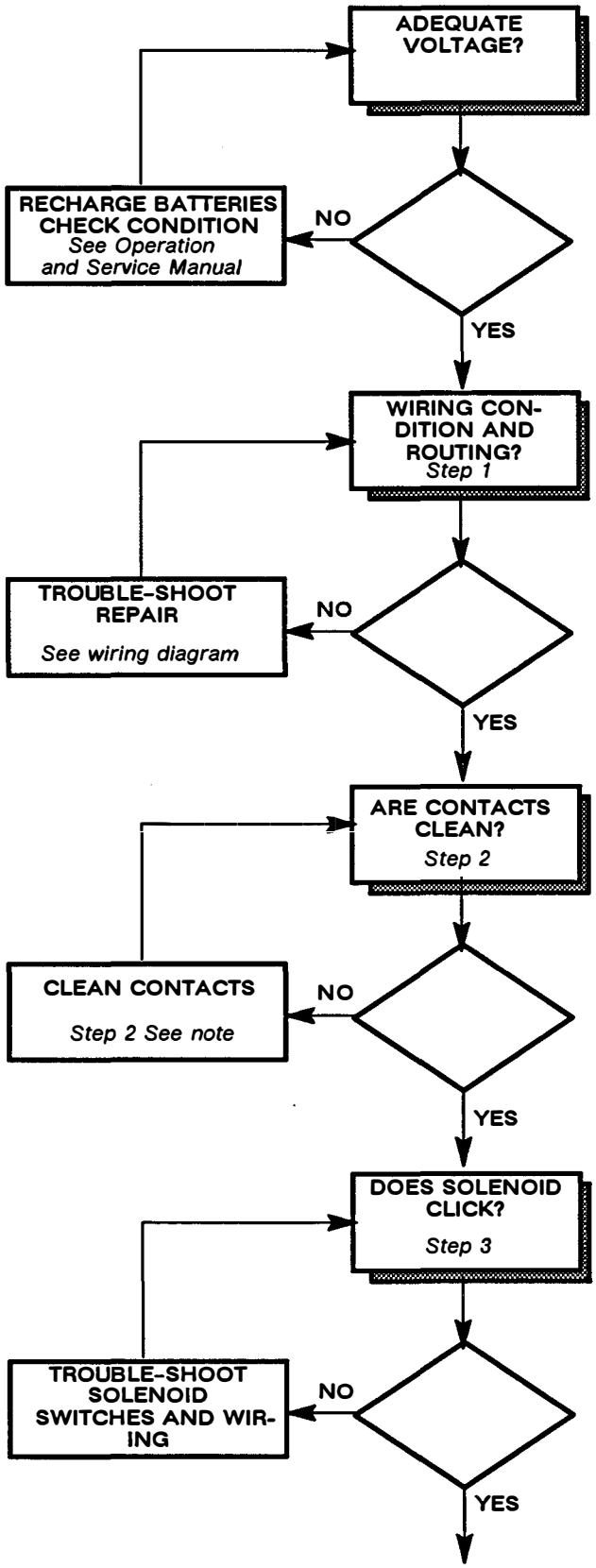
NOTE

Use radio and TV tuner cleaner applied with a 'Q tip' or a small brush. **Do not use solvents that could attack the plastic sealant.** Mild soap and water applied with a soft brush (tooth brush) rinsed with clear water and thoroughly dried is very effective.

3. Remove the 'push on' connection from the top of the control unit (blue wire from the micro switch to the control unit). Place the F-N-R switch in the 'FORWARD' position, turn the key switch to 'ON' and slowly depress the accelerator pedal. The solenoid should make an audible 'click'. If there is an audible 'click' go to step 4. If there is no 'click' the fault is in the solenoid coil, micro switches, key switch or wiring.

4. With the VOM (volt ohm meter) adjusted to the correct scale, connect the (-) probe to the B- terminal at the battery set. Connect the (+) probe to the female contact of the wire that was removed in step 2. With the key switch in the 'ON' position and the accelerator pedal in the fully depressed position battery voltage should be indicated. If battery voltage is not indicated move the (+) probe to each component working towards the positive side of the battery until the defective component is found. Example: From wire to accelerator micro switch to key switch to + terminal of battery. If battery voltage is present at the female connection of the wire removed in step 2 and the solenoid does not

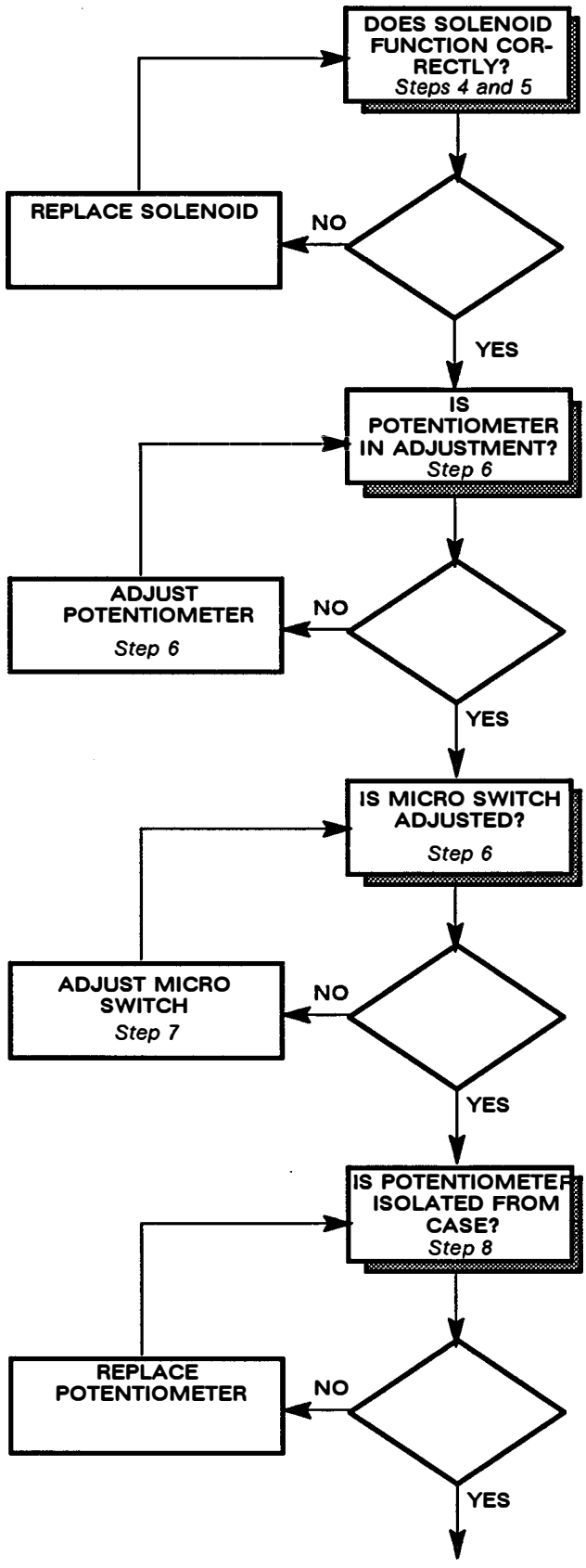
VEHICLE WILL NOT RUN OR IS ERRATIC



'click' the fault is in the solenoid coil windings and the solenoid must be replaced

5. With the VOM meter adjusted to the correct scale and with the top 'push on' connector removed, place the F–N–R switch in the 'F' position. Connect the (–) probe to the B– terminal at the battery set. Connect the (+) probe to the large solenoid contact connected to the positive side of the battery set and verify that battery voltage is present. Move the (+) probe to the other large contact, the meter should indicate 1V less than battery voltage indicating that the resistor is in good condition. No voltage drop indicates a welded solenoid that must be replaced. A higher than 0 volt drop indicates a poor resistor that must be replaced. Depress the accelerator pedal several times to activate the solenoid and observe the meter. No meter movement or erratic movement indicates poor or defective solenoid which must be replaced. Full battery voltage indicates that the system is functioning properly.

6. At the control unit remove, the two wires with female 'push on' connectors coming from the potentiometer. With the VOM adjusted to the correct ohms scale attach each probe to the two wires from the potentiometer. With the accelerator pedal in the released position the meter must indicate 0 ohms and continue to indicate 0 through at least 1/2" of downward pedal movement. slowly depress the accelerator pedal and observe the meter. The meter should rise smoothly to 5000 ohms. When the meter indicates 5000 ohms the pedal should not be fully depressed. (Approximately 1/2" of pedal travel should remain after the 5000 ohm reading). If correct readings are not achieved, check the potentiometers activating linkage. With the accelerator in the released position insert a spacer (dime) between the arm and the top stop (FIG. N–5).The potentiometer activating lever should **just** retain the dime (FIG. N–5). Should the potentiometer activating lever not properly contact the top stop remove the connecting linkage and adjust by lengthening or shortening the linkage (FIG. N–5). With the accelerator in the released position the potentiometer activating lever should just contact the upper stop with a spacer (dime) installed.



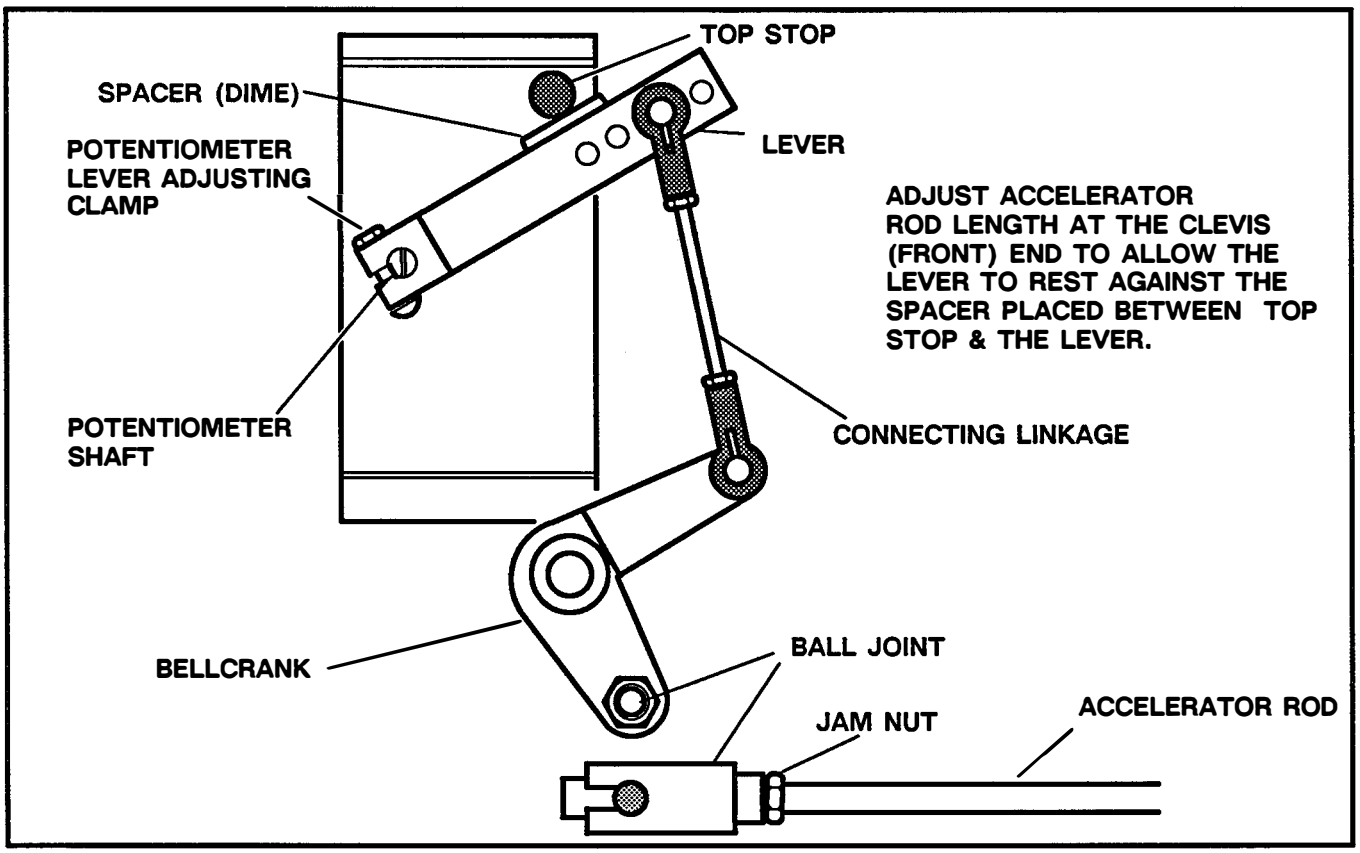


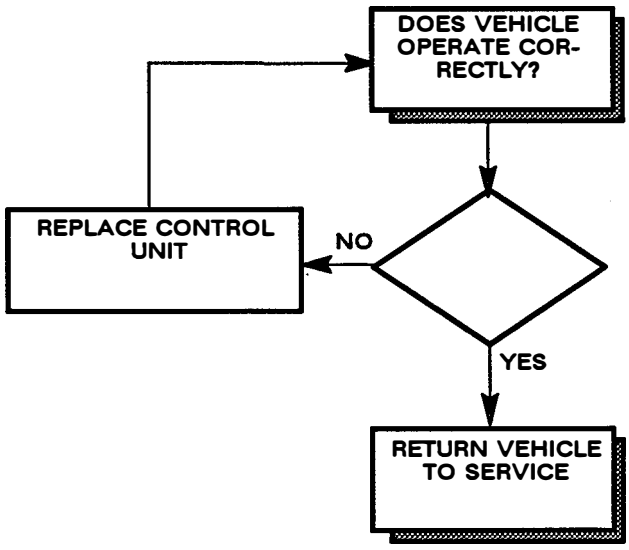
FIG. N-5 ACCELERATOR ADJUSTMENTS

7. Depress the accelerator pedal. The micro switch attached to the potentiometer should activate as near to the 0 ohms position as possible.

NOTE

If the micro switch activation takes place at 50 ohms or higher the high pedal protection circuit will be activated which will cause the unit to malfunction.

8. Remove one of the VOM probes and touch to the metal housing of the potentiometer. The meter should read infinity, if it does not, replace the potentiometer.
9. Reconnect the wiring. If the vehicle does not operate correctly check the F-N-R switch, the motor and use a Volt meter wired between B + and M - which should indicate between 0 and battery voltage when the accelerator pedal is operated. If all of the previous checks indicate that the vehicle is in good operating condition,the control module must be replaced with a new one that is known to be good.



REDUCED SPEED REVERSE (FIG. N-7),

The vehicle is designed to operate in reverse at a substantially reduced speed. If the vehicle runs in reverse at a speed similar to that in forward the reverse system must be checked.

1. Verify that adequate battery voltage is present to operate the vehicle. Battery voltage should be 36 VDC±5V after surface charge is removed.

2. Remove the cover by loosening the screw that secures the cover. Lift off the cover. Examine all of the wiring to assure that all wires are without physical damage or corrosion. Check the routing of all wiring and the tightness of each connection. Repair or replace any suspect wires or connections.

3. Inspect the male 'push on' contacts at the control unit and be sure that they and the areas around them are free of corrosion.

NOTE

Use radio and TV tuner cleaner applied with a 'Q tip' or a small brush. **Do not use solvents that could attack the plastic sealant.** Mild soap and water applied with a soft brush (tooth brush) rinsed with clear water and thoroughly dried is very effective.

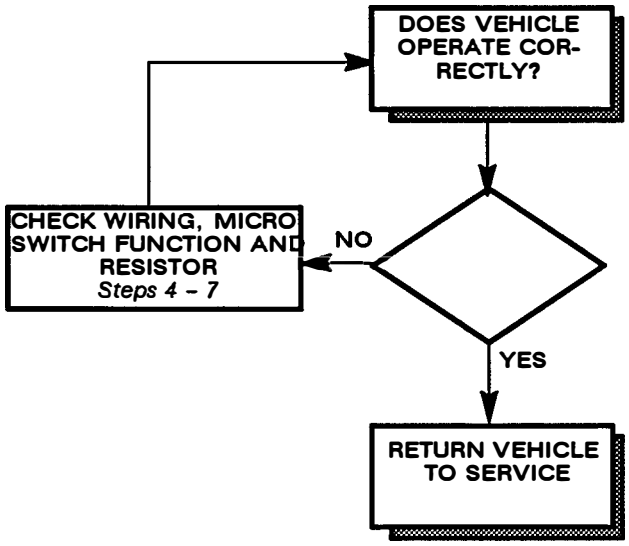
4. . Inspect the wiring to the double micro switch from the potentiometer.

5. . Check the function of the micro switch switch by checking for continuity when the F-N-R switch is placed in the reverse position. Replace the micro switch if defective.

6. . Remove the two rear 'push on' connections from the top of the control unit. With the VOM set to the correct scale attach a probe to each of the wires removed from the control unit.

7. . Place the F-N-R switch in the reverse position, fully depress the accelerator pedal and observe the meter. A reading of 2500 ohms will indicate that the internal resistor in the potentiometer is in good condition. Readings significantly higher indicates a defective resistor and the potentiometer must be replaced.

VEHICLE RUNS TOO FAST IN REVERSE



REVERSE WARNING DEVICE (FIG. N-7)

The completion of the preceding trouble-shooting procedure will have checked all wiring and components in the control circuit.

The reverse warning device does not affect the operation of the vehicle, however, E-Z-GO strongly recommends that its operation be checked and maintained since the correct functioning of this safety device may prevent an accident.

The warning device (FIG. N-7) should sound whenever the forward-neutral-reverse switch is in the 'REVERSE' position. Should the warning device fail to sound, the following procedure should be used to trouble-shoot the circuit.

Set the volt meter to the 15 VDC range, check that the key switch is 'ON' and the forward-neutral-reverse switch is in the 'REVERSE' position. Locate the black probe (-) in the negative side of the vehicle receptacle (FIG. N-3) and place the red (+) probe to the terminal on MS-4 with the white wire closest to the F-N-R switch. A meter reading of 6 VDC indicates that the white wire between the positive (+) terminal of the front right battery and the micro switch MS-4 is in good condition.

Seperate the connection in the black wire from the warning device to the battery. Place the red probe (+) on the terminal of the black wire attached to the

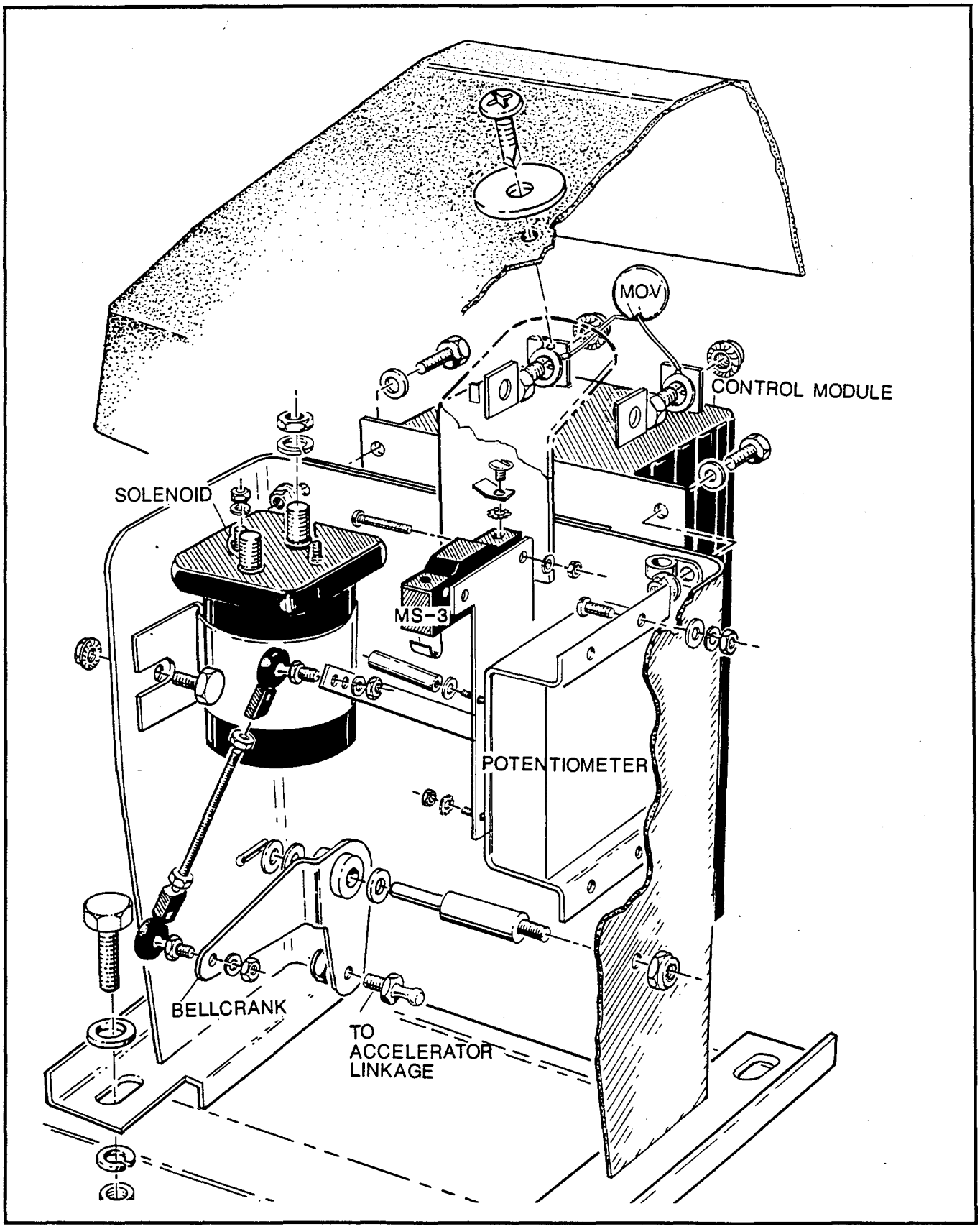


FIG. N-6 COMPONENT ARRANGEMENT

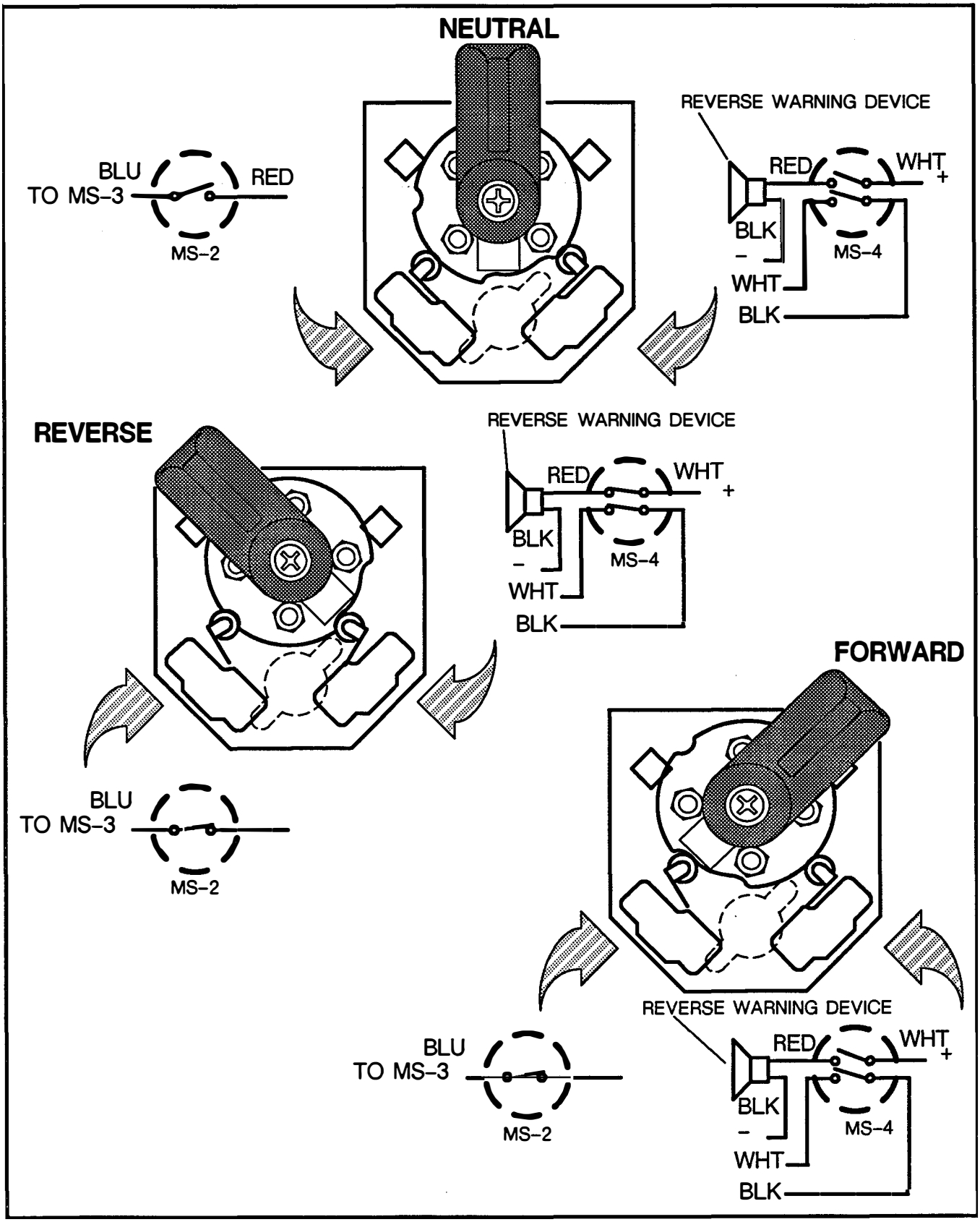


FIG. N-7 F-N-R MICRO SWITCHES AND REVERSE WARNING DEVICE

battery. A meter reading of 6 volts indicates that the black wire from the battery is in good condition. Re-connect the connection.

Locate the red (+) probe on the other terminal of micro switch MS-4. A meter reading of 6 VDC will indicate that the micro switch MS-4 is in good condition and that the warning device must be replaced.

POWER CIRCUIT (FIG. N-8)

Tools Required: Qty.

V.O.M. 1

IF THE VEHICLE DOES NOT RUN:

NOTE

Before proceeding refer to speed control module troubleshooting. (Page N-7)

⚠ WARNING ⚠

TO PREVENT THE VEHICLE FROM INADVERTENTLY ACCELERATING, WHICH COULD CAUSE BODILY INJURY, THE VEHICLE MUST BE LIFTED TO RAISE BOTH DRIVE WHEELS ABOVE THE GROUND.

Raise the vehicle (see safety procedures in Section B) before proceeding.

Place key switch in the 'ON' position and the forward-neutral-reverse switch to the forward position.

Set the volt meter to the 50 VDC range. Touch the black (-) probe to the negative (-) contact of the vehicle D.C. receptacle and the red (+) probe to the positive (+) contact of the vehicle D.C. receptacle (FIG. N-4, FIG. N-8)

A meter reading of 36 VDC ±5 VDC indicates that the batteries are satisfactory. A reading below 36 VDC ±5V indicates that one or all batteries are defective or are in need of charging. (See Batteries Section for testing procedures.) No reading indicates an 'open' condition and the following procedure should be followed.

Locate the black (-) probe on the negative (-) post of the battery that has two heavy gauge wires attached to it. Locate the red (+) probe to the positive side of the solenoid. A meter reading of 36VDC ±5 V indicates that the wire joining (BL+) to solenoid is satisfactory.
A reading of less than 32 VDC ±5 V indicates a broken wire, a poor connection, or corrosion at either the battery or motor termination.

Locate the black (-) probe on the negative (-) post of the battery that has two heavy gauge wires attached to it. Locate the positive probe on the negative (-) side of the solenoid. A meter reading of 32 VDC ±4 V indicates that the resistor on the solenoid is satisfactory. A meter reading OF '0' VDC indicates that the solenoid is 'open' which requires replacement.

NOTE

When testing for voltage from the negative side of the solenoid a meter reading of 32 VDC ±4 V indicates a satisfactory condition. Reduced voltage is observed due to the resistor located on the solenoid.

Locate the red (+) probe to the motor terminal A1. A meter reading of 32 VDC ±4 V indicates continuity between the solenoid and A1 on motor. A reading of '0' VDC indicates an 'open' circuit and should be repaired.

Locate the red (+) probe on (B+) terminal on the controller. A reading of 32 VDC ±4 V indicates that the solenoid wire to (B+) on controller is satisfactory. A reading of '0' VDC indicates an 'open' condition that should be repaired.

Locate the red (+) probe on motor terminal to A2. A reading of 32 VDC ±4 V indicates that the armature and the motor is satisfactory. A meter reading of '0' VDC requires repair or replacement of the motor.

Locate the red (+) probe on the A2 lead of the controller. A reading of 32 VDC ±4 V indicates that the wire between A2 on the motor and the controller is satisfactory. A reading of '0' VDC indicates an 'open' circuit and the wire should be repaired or replaced.

Locate the red (+) probe on A contact of the F-N-R switch. A reading of 32 VDC ±4 V indicates that the wire between A2 on the controller and A contact on the F-N-R switch is satisfactory. A reading of '0' VDC indicates an 'open' circuit and the wire should be repaired or replaced.

Locate the red (+) probe on B contact of the F-N-R switch. A reading of 32 VDC ±4 V indicates satisfac-

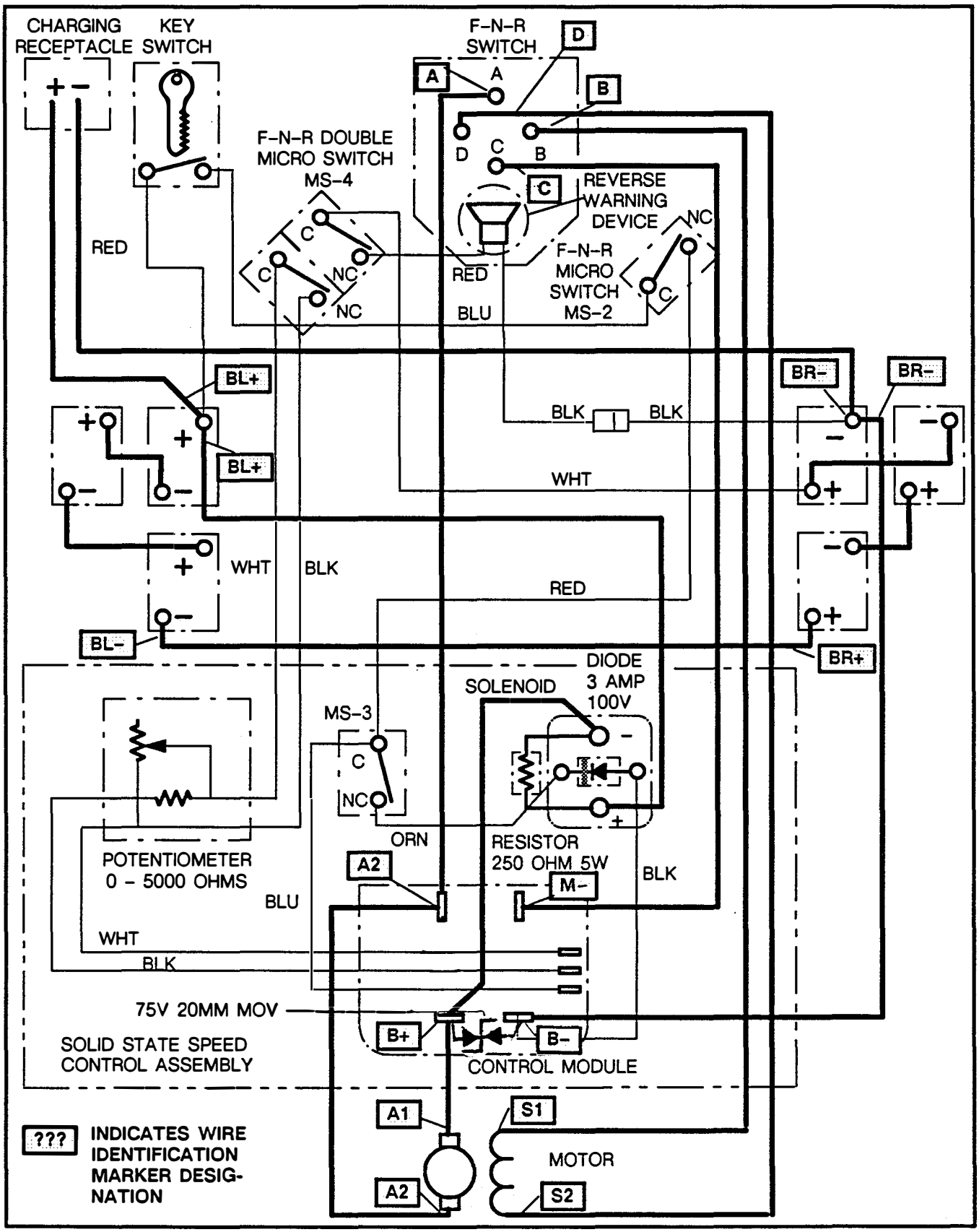


FIG. N-8 POWER WIRING DIAGRAM

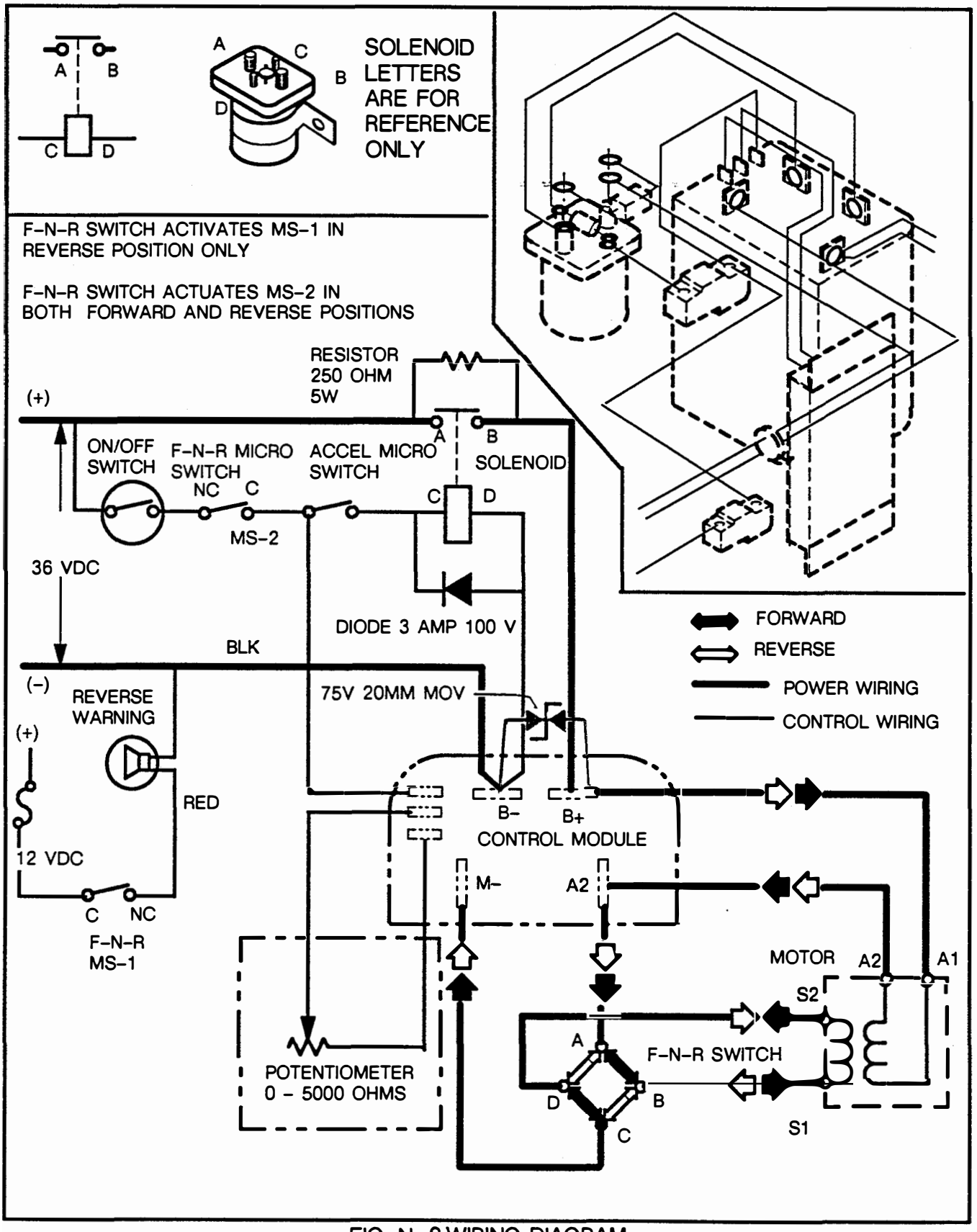


FIG. N-9 WIRING DIAGRAM

tory connection between A and B terminals of the F-N-R switch. A reading of '0' VDC indicates an 'open' circuit and the F-N-R switch should be repaired or replaced.

Locate the red (+) probe to the S1 terminal on the motor. A meter reading of 32 VDC ±4 V indicates satisfactory connection between S1 on motor and B on F-N-R. A reading of '0' VDC indicates an 'open' circuit and the wire between B on F-N-R and S1 on motor should be repaired or replaced.

Locate the red (+) probe on S2 terminal on the motor. A meter reading of 32 VDC ±4 V indicates that the field coil is satisfactory. A meter reading of '0' VDC indicates an 'open' circuit which would require the repair or replacement of the motor.

Locate the red (+) probe on the D contact of the F-N-R switch. A meter reading of 32 VDC ±4 V indicates that the wire between S2 on the motor and D on the F-N-R switch is satisfactory. A meter reading of '0' VDC indicates an 'open' circuit and the wire between S2 on motor and D on F-N-R should be repaired or replaced.

Locate the red (+) probe on C contact of the F-N-R switch. A meter reading of 32 VDC ±4 V indicates satisfactory connection between D and C terminals of the F-N-R switch. A meter reading of '0' VDC indicates an 'open' circuit and the F-N-R switch should be repaired or replaced.

Locate the red (+) probe on M- of the controller. A meter reading of 32 VDC ±4 V indicates satisfactory connection between C terminal of F-N-R switch and M- on controller. A reading of '0' VDC indicates an 'open' circuit and the wire between C terminal on F-N-R and M- on controller should be repaired or replaced.

⚠ WARNING ⚠

TO PREVENT THE VEHICLE FROM INADVERTENTLY ACCELERATING, WHICH COULD CAUSE BODILY INJURY, THE VEHICLE MUST BE LIFTED TO RAISE BOTH DRIVE WHEELS ABOVE THE GROUND.

Raise the vehicle (see safety procedures in Section B) before proceeding.

Place key switch in the 'ON' position and the forward-neutral-reverse switch to the forward position.

Visually inspect all components for burned or broken wires or loose connections . Inspect all terminals for corrosion, and clean if required. If a visual inspection fails to yield the cause of the problem, an ohm meter may be used to perform a "continuity" test at each component.

CHECKING FOR CONTINUITY

The ohmmeter can be very useful in testing for continuity. A wire conductor that is continuous without a break has partically zero ohms of resistance. When testing for continuity, be sure that the ohmmeter is set to the lowest ohms range.

There are many applications. Because of the insulated cover, a wire conductor can have an internal break which is not visible, or the wire can have a bad connection at the terminal.

When testing for continuity, check for zero ohms between any two points along the conductor. A break in the conducting path is evident from a reading of infinite resistance (∞) showing an open circuit.

CAUTION

REMOVE BATTERY (+) CONNECTIONS BEFORE USING OHM METER. (SEE SAFETY PROCEDURES IN SECTION B.)

NOTE

A test light may be substituted for an ohm meter.

If the vehicle continues to run with the accelerator pedal in the released position, either the accelerator linkage is out of adjustment (see Accelerator Adjustment in Section F).

TESTING THE MOTOR (FIG. N-8)

NOTE

This test is valid only after the control and power wiring has been inspected as detailed in the preceding procedures.

Tools Required: Qty.

V.O.M. 1

⚠ WARNING ⚠

TO PREVENT THE VEHICLE FROM INADVERTENTLY ACCELERATING, WHICH COULD CAUSE BODILY INJURY, THE VEHICLE MUST BE LIFTED TO RAISE BOTH DRIVE WHEELS ABOVE THE GROUND.

Raise the vehicle (see safety procedures in Section B) before proceeding.

Place key switch in the 'ON' position and the forward–neutral–reverse switch to the forward position.

NOTE

Use the following test *ONLY IF THE MOTOR WILL NOT RUN*.

This check is for open circuits in field coils, brushes, or brush rigging. To check for a short circuit, refer to the Motor Section.

Set the volt meter to the 50 VDC range.

Locate the black (–) probe to the negative (–) contact of the vehicle D.C. receptacle and the red (+) probe to the motor terminal S2. Depress the Accelerator pedal. A meter reading of 0 VDC indicates a good condition. Locate the red (+) probe on the motor terminal S1. A meter reading of 0 VDC indicates that the field coils are satisfactory. A meter reading of 36 VDC ±5 VDC indicates that the field coils are open and the motor must be repaired or replaced.

Locate the red (+) probe on the motor terminal A2. A reading other than 0 VDC indicates that the power wiring should be rechecked. Locate the red (+) probe to the motor terminal A1. A meter reading of 0 VDC indicates that the brushes, brush holder, and all connections are satisfactory. A meter reading of 36 VDC ±5 VDC indicates a problem with the brushes, brush holder, or connections.

The following tests may be performed with an ohm meter or test light.

⚠ WARNING ⚠

REMOVE BATTERY (+) CONNECTIONS BEFORE CONTINUING WITH THIS TEST. SHORTING OF MOTOR WIRES COULD RESULT IN AN EXPLOSION.

Remove wires from motor terminals A1 and S2. Set the ohm meter to the RX1 scale. Using the ohm meter, place probes on motor terminals S1 and S2. A meter reading of "0" indicates a satisfactory condition at the field coils. No needle deflection indicates an 'open' condition that will require the motor to be repaired or replaced.

Place the probes on motor terminals A1 and A2. A meter reading of "0" indicates a satisfactory condition at the brushes and rigging. No needle deflection indicates a condition that will require the motor to be repaired or replaced.

Check for continuity between each of the motor terminals and the motor shell. Continuity between terminals S1 and S2 to the motor shell indicates a short circuit between the field coils and the case. Continuity between terminals A1 or A2 to the motor shell indicates a short circuit in the armature. Both of the preceding conditions will require the motor to be repaired or replaced.

Tighten all motor terminal connections to 35–40 in. lbs. torque.

FORWARD–NEUTRAL–REVERSE SWITCH (FIG. N–9)

The forward–neutral–reverse switch operation is described in Power Circuit at the beginning of this section.

SWITCH LUBRICATION

During the servicing of the vehicle, the forward–neutral–reverse switch shaft should be removed, cleaned, and lubricated with bearing grease. The contact surfaces may also be lubricated with a thin coat of petroleum jelly to permit smooth operation of the switch.

FORWARD–NEUTRAL–REVERSE SWITCH INSPECTION AND REPAIR:

⚠ WARNING ⚠

DISCONNECT THE BATTERY LEAD (BL+) FROM THE BATTERY BEFORE ATTEMPTING SERVICE OF THE FORWARD–NEUTRAL–REVERSE SWITCH.

Periodic inspection of the switch should include the following:

1. Check that all wire connections are tight and free of corrosion.
2. Check the contacts for abnormal wear. The contacts in the movable cam portion of the switch are spring loaded and the cam assembly

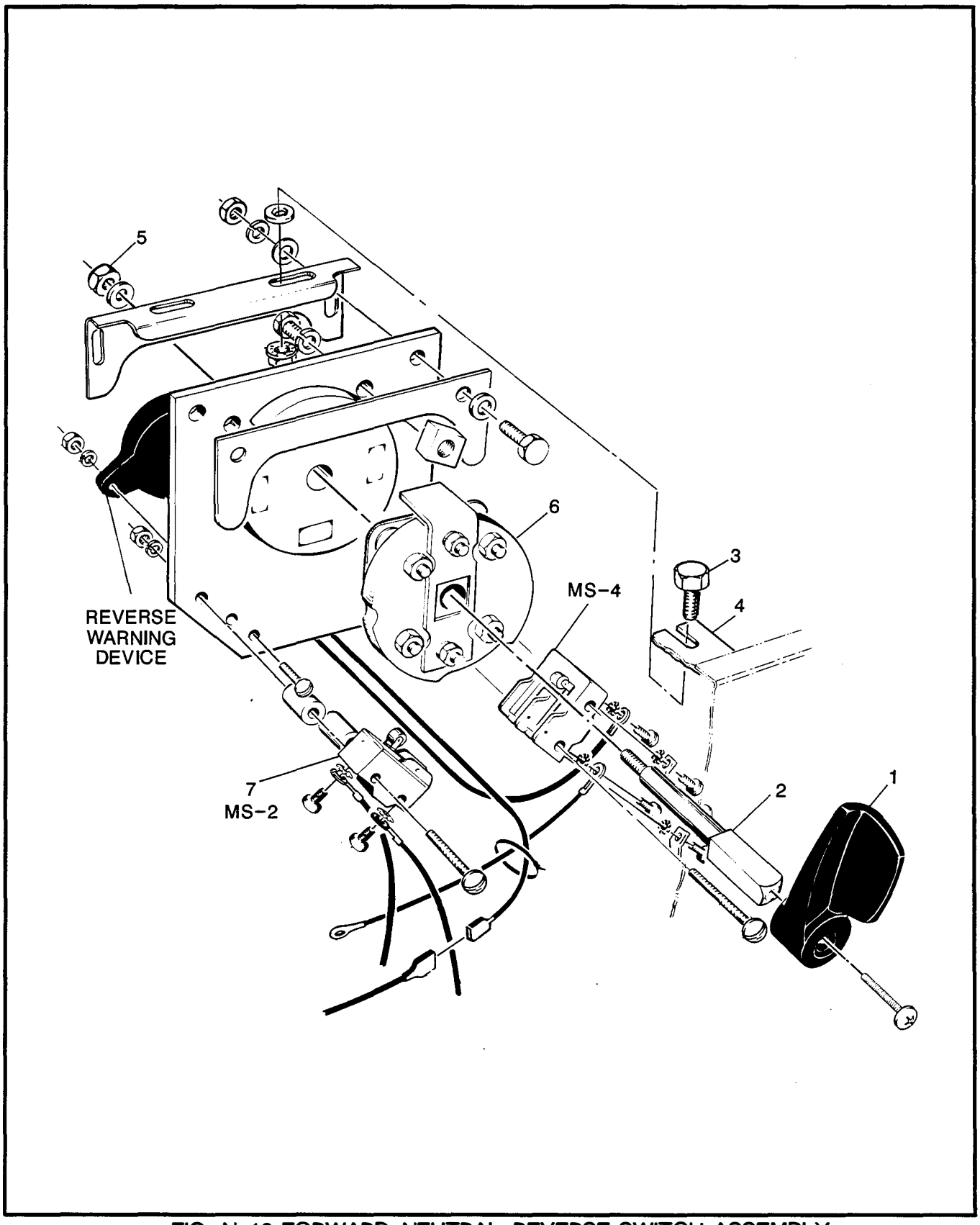


FIG. N-10 FORWARD-NEUTRAL-REVERSE SWITCH ASSEMBLY

must be replaced when worn sufficiently to cause a loss of spring pressure.

3. Rotate the switch lever from 'stop to stop' to check for smooth operation. If the switch is excessively hard to operate, inspect for rough contact surfaces and replace if required. If the contact surfaces are good, the stationary contact surfaces may be lubricated, if required, with a very thin coat of petroleum jelly.

If the switch is abnormally loose, check the shaft nut and tighten if required. Inspect for abnormally worn spring loaded contacts.

Inspect the micro switches for operation and dirt that might inhibit its operation.

Reassemble in the reverse order of disassembly.

FORWARD-NEUTRAL-REVERSE SWITCH REMOVAL AND DISASSEMBLY (FIG. N-9)

Tools Required: Qty.

Wrench, box end combination, 7/16"-1/2" 1
Wrench, box end, 9/16" 1
Screwdriver, Phillips 1

Remove lever (1) from shaft (2).

Disconnect all of the wiring connections from the rear of the switch, disconnect push-on connections and any other connections securing the switch to the vehicle electrical system. Disconnect the wire from the micro switch to the key switch at the key switch.

Loosen the two screws (3) which secure the switch bracket to the seat support frame (4) and slide the switch assembly from the slotted bracket.

Remove the nut (5) from the switch shaft (2), remove the cam (6) complete with the shaft (2) from the bushing, and remove the shaft (2) from the cam assembly (6).

Reassemble the switch in the reverse order of disassembly. Rotate the cam from stop to stop and check the operation of the micro switch (7) rollers.

Reinstall the forward-neutral-reverse switch in the vehicle and adjust the switch to align with the hole in the vertical support panel. Tighten the hardware that secures the forward-neutral-reverse switch to the vehicle to 10-12 ft. lbs. torque.

HORN CIRCUIT (IF EQUIPPED)

The horn circuit is a 12 volt system and consists of a horn switch, fuse block, fuse, horn, and central wiring harness.

HORN

When the horn switch is depressed, the horn circuit is completed permitting current to flow from the battery to the fuse and through the horn causing it to sound. The horn will operate if the vehicle is in either the *ON* or *OFF* position.

TESTING THE HORN CIRCUIT (FIG. O–1, FIG. O–2)

Tools Required: Qty.

V.O.M. 1

IF THE VEHICLE RUNS BUT THE HORN IS INOPERATIVE:

1. Check for loose wires at each terminal connection and for worn insulation or bare wires touching the frame. *BARE WIRES MAY CAUSE A SHORT CIRCUIT.* (Refer to FIG. O–1 for meter set–up).
2. Check for adequate battery volts (nominal 12 VDC) by setting VOM to 12 VDC range and place the red probe (+) on the battery post with the green wire attached. Place the black probe (–) on the battery post with the black wire attached. A reading of 11 VDC or better indicates adequate battery condition. No reading indicates (a) a poor connection between the probes and the battery terminals; (b) a defective VOM. A voltage reading below 11 volts indicates poor battery condition and the vehicle should be recharged before proceeding with the test.

NOTE

Due to the resistance of the wires involved within the harness, voltage readings may be somewhat lower

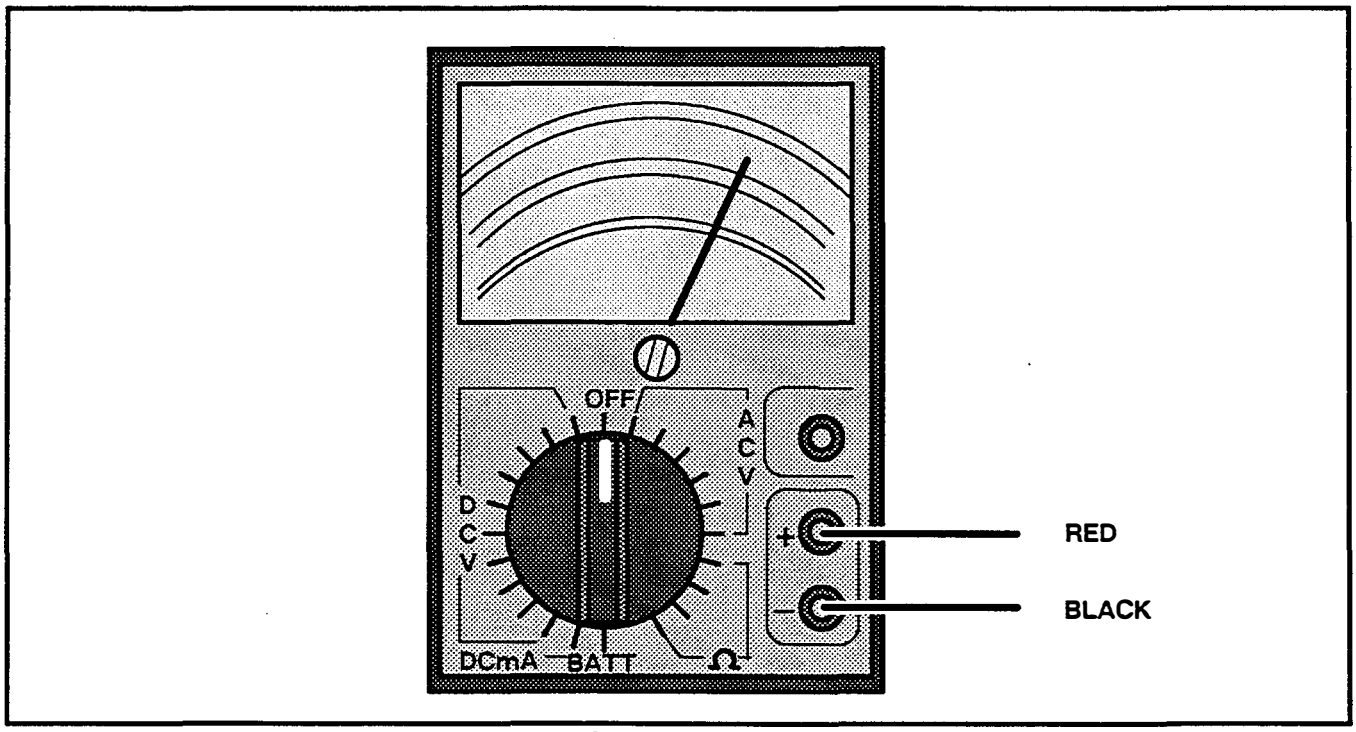


FIG. O–1 VOM SET UP

than battery voltage. A reading of 1 volt below battery voltage is acceptable.

3. Firmly attach the black probe (–) to the battery post with the black wire attached and the red probe (+) to the green terminal at the fuse block. A reading of battery voltage indicates that the green wire is in good condition.

NOTE

Green wire supplies power to the entire fuse block.

4. Place the red probe (+) to the orange/white wire terminal on the fuse block. A reading of battery voltage indicates that the fuse is in good condition. No reading indicates a defective fuse; replace with a good 15 amp fuse.

5. Place the red probe (+) to the yellow connection at the horn switch. A reading of battery voltage indicates that the yellow wire supplying power to the switch is in good condition. If no reading is indicated, move the probe to the other yellow wire terminal at the horn switch and repeat test.

6. Place the red probe (+) to the other horn switch terminal (yellow wire) and depress horn switch button. A reading of battery voltage indicates a good horn switch. No reading indicates a defective switch; replace it with a good horn switch.

7. Place the red probe (+) to the horn terminal with the yellow wire. Depress horn button. A reading of battery voltage indicates a good yellow wire.

8. Remove the black wire from the horn. Select ohms x 1 (continuity) position on the VOM. Place the red probe (+) to the terminal of the black wire. A reading of .00 on a digital VOM or less than 5 ohms on a needle type meter indicates that the black wire is in good condition. All wiring has now been checked; therefore, the horn is defective. Replace with a good horn.

NOTE

If any VOM readings indicate a defective wire, it is recommended that the condition of the terminals and wire junction be examined. A defective wire should be replaced with one of the same gauge and color and wired between the correct components and wire tied to the harness bundle. The defective wire should be cut back close to the harness and the ends protected with vinyl electrical tape.

HEADLIGHT AND TAILLIGHT CIRCUIT (IF EQUIPPED)

The headlight and taillight circuit is a 12 volt system and consists of a light switch, fuse block, fuse, headlights, taillights, and central wiring harness.

HEADLIGHTS AND TAILLIGHTS

When the headlight/taillight switch is pulled to the *'ON'* position, the circuit is completed permitting current to flow from the battery to the fuse and through the lights causing them to illuminate. The headlights/taillights will operate if the vehicle keyswitch is in either the *ON* or *OFF* position.

TESTING THE HEADLIGHTS AND TAILLIGHTS CIRCUIT (FIG. O–1, FIG. O–3, FIG. O–4, FIG. O–5)

Tools Required: Qty.

V.O.M. 1

If the vehicle runs but the headlights and taillights are inoperative: Proceed to Step 1. If any lights are functional proceed to Step 7.

1. Check for loose wires at each terminal connection and for worn insulation or bare wires touching the frame. *BARE WIRES MAY CAUSE A SHORT CIRCUIT.* Refer to (FIG. O–1) for meter set–up.

2. Check for adequate battery volts (nominal 12 VDC) by setting VOM to the 12 VDC range and place the red probe (+) on the battery post with the green wire attached. Place the black probe (–) on the battery post with the black wire attached. A reading of 11 VDC or better indicates adequate battery condition. No reading indicates (a) a poor connection between the

probes and the battery terminals; (b) a defective VOM. A voltage reading below 11 volts indicates poor battery condition and the vehicle should be recharged before proceeding with the test.

NOTE

Due to the resistance of the wires involved within the harness, voltage readings may be somewhat lower than battery voltage. A reading of 1 volt below battery voltage is acceptable.

3. Firmly attach the black probe (–) to the battery post with the black wire attached to perform Steps 3 through 4 and the red probe (+) to the green terminal at the fuse block. A reading of battery voltage indicates that the green wire is in good condition.

NOTE

This wire supplies power to the entire fuse block.

4. Place the red probe (+) to the blue/white wire terminal on the fuse block. A reading of battery voltage indicates that the fuse is in good condition. No reading indicates a defective fuse, replace with a good 15 amp fuse.

5. Place the red probe (+) to the blue/white connection at the light switch. A reading of battery voltage indicates that the blue/white wire is in good condition.

6. Disconnect both wires from the light switch. Select ohms x 1 (continuity) position on the VOM. Place the red probe (+) to one terminal and the black probe (–) to the other. Pull out switch button. A reading of .00 on a digital VOM or less than 5 ohms on a needle type meter indicates that the switch is in good condition. A reading of infinity indicates a defective switch. Replace with a good switch and reconnect the wiring.

7. *IF ONE OR MORE LIGHTS ARE OPERATIONAL*, check for defective wiring or a defective bulb or module (rear light). Check for voltage to headlights. Pull out light switch and disconnect blue/white wire at the defective headlight. Set the VOM to 12 VDC range, place the red probe (+) to the blue/white wire terminal and the black probe (–) to the ring terminal with the black wire that is attached to the headlight mounting bolts. A reading of battery voltage indicates that either the socket is corroded or defective, or that the bulb is defective. Replace the bulb after inspecting the socket and reconnect the wiring.

8. At taillights, repeat the process except that the black harness wire should be disconnected from the black light module wire and the black probe (–) should be placed on the black wire terminal.

TWO TAILLIGHTS SYSTEMS ARE IN USE

1. Multiple taillights are made up of individual lamp modules. To replace a rear lamp module, gently pry the lamp module from its retaining bezel using a straight blade screwdriver. (Use caution to prevent breakage). Unplug the lamp module from the plug and replace by snapping into the bezel. Replace all wires disconnected in the test.

2. The single taillight is a conventional single bulb, two filament type that may be accessed by removing the two screws in the lens.

NOTE

If any VOM readings indicate a defective wire, it is recommended that the condition of the terminals and wire junction be examined. A defective wire should be replaced with one of the same gauge and color and wired between the correct components and wire tied to the harness bundle. The defective wire should be cut back close to the harness and the ends protected with vinyl electrical tape.

BRAKE LIGHT CIRCUIT (IF EQUIPPED) (FIG. O–1, FIG. O–6, FIG. O–7)

The brake circuit is a 12 volt system and consists of a brake pedal operated micro switch, a fuse block, fuse, brake lights, and a central wiring harness.

When the service brake pedal is depressed, a micro switch is closed which completes the brake light circuit which permits current to flow to the brake lights. The brake lights will operate if the vehicle is in either the *ON* or *OFF* position.

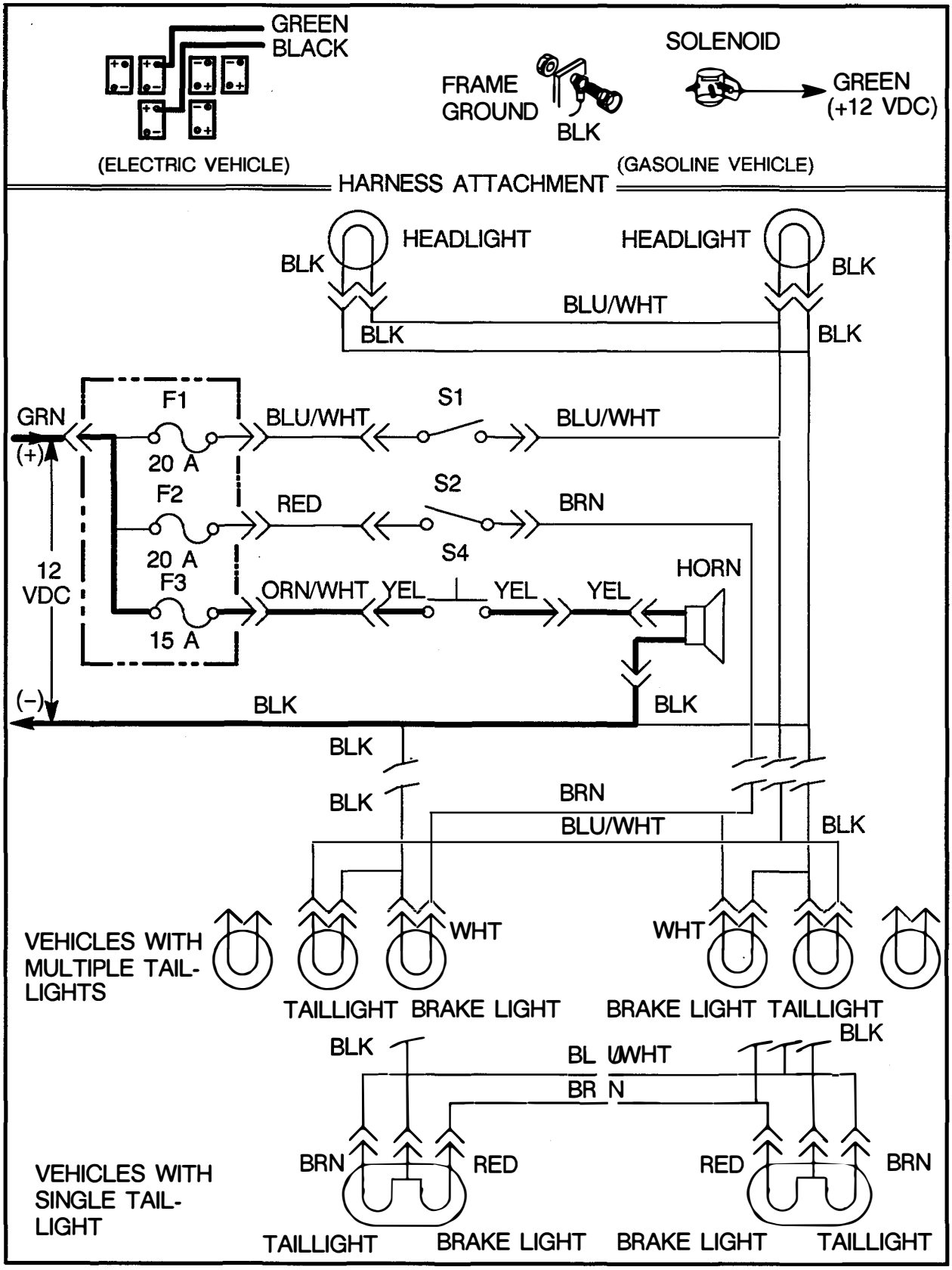


FIG. O-2 HORN CIRCUIT

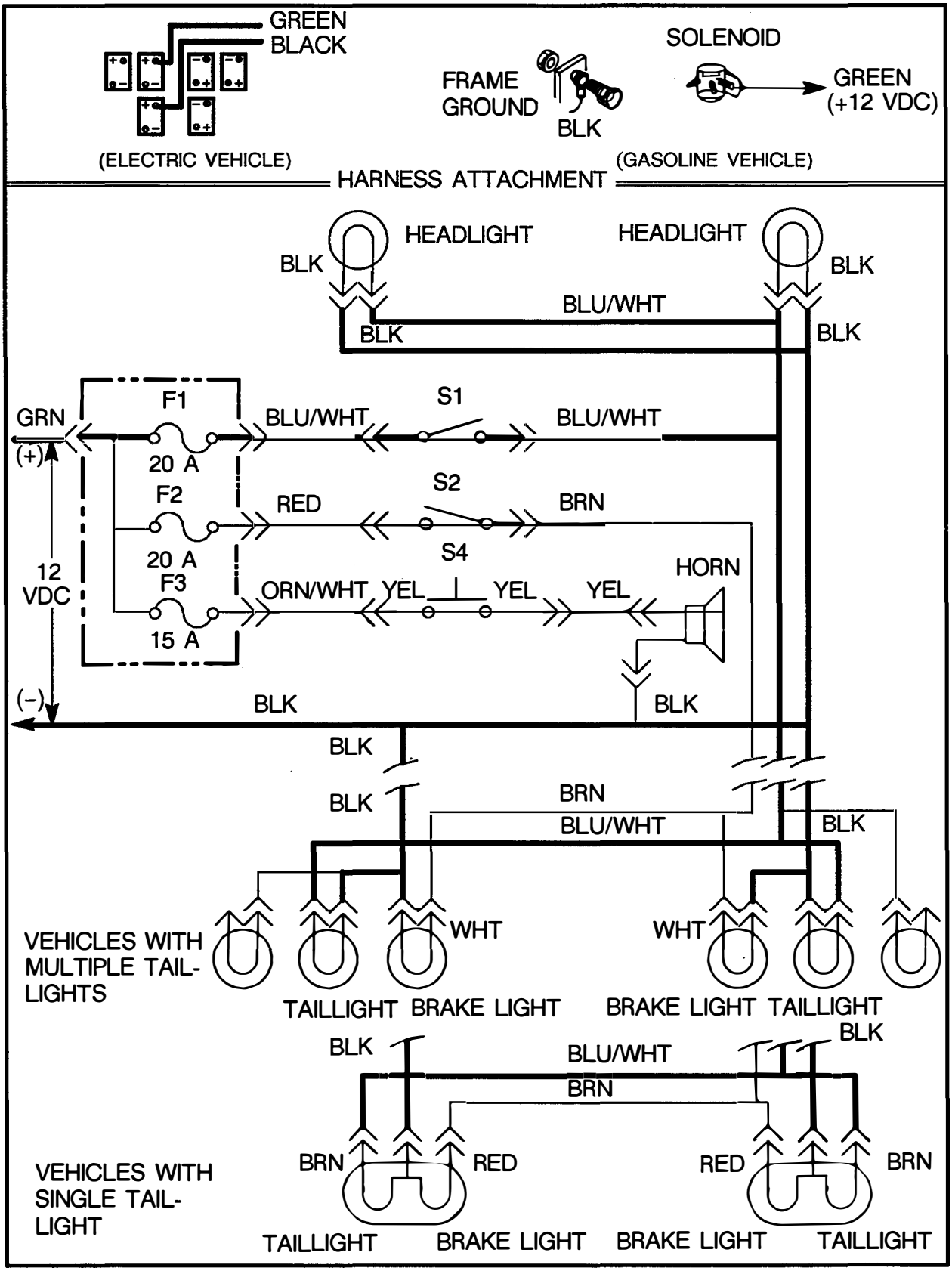


FIG. O-3 HEADLIGHT AND TAILLIGHT CIRCUIT

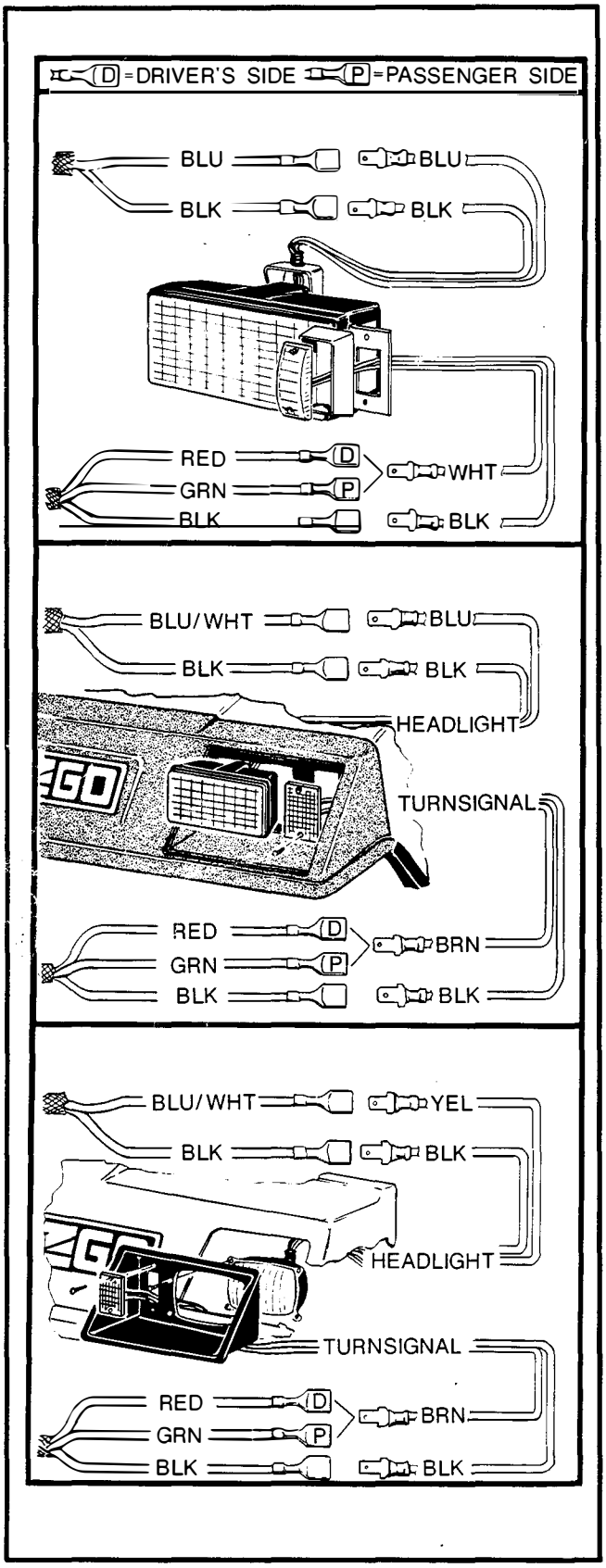


FIG. O-4 HEADLIGHT INSTALLATION WITHOUT TURNSIGNAL SWITCH

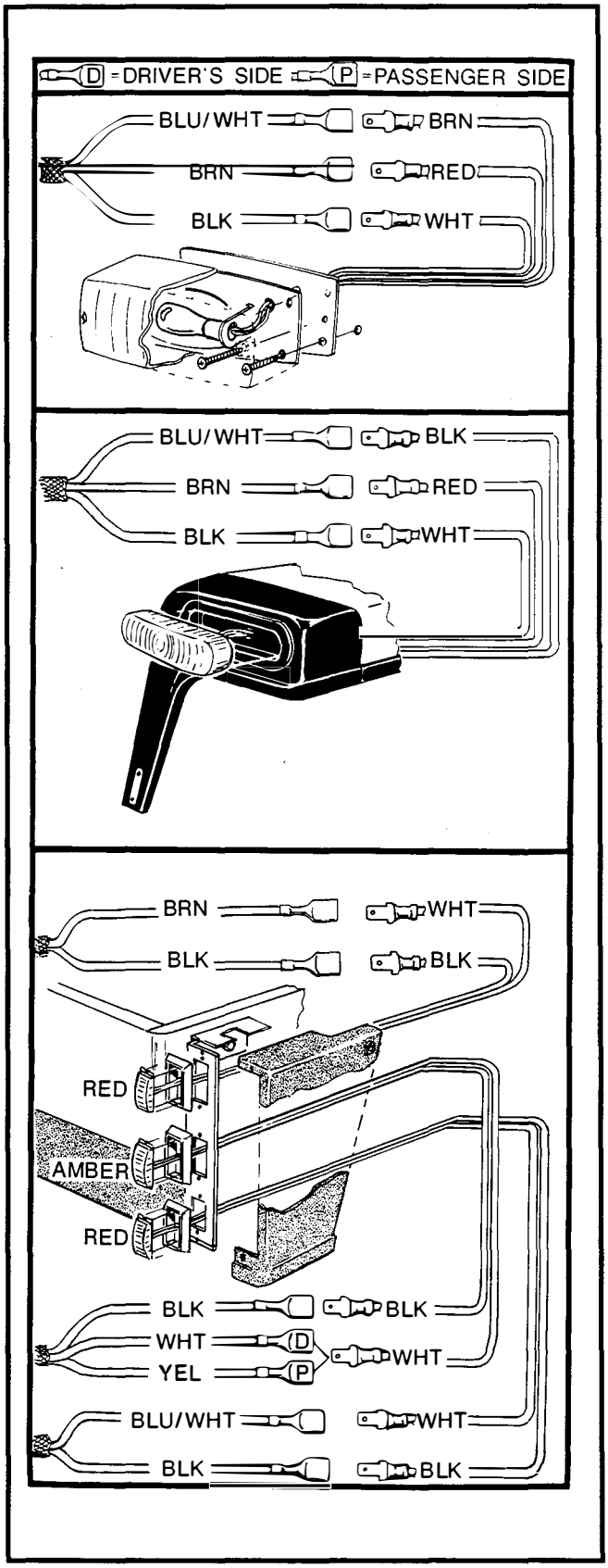


FIG. O-5 TAILLIGHT INSTALLATION WITHOUT TURNSIGNAL SWITCH

TESTING THE BRAKE LIGHT CIRCUIT

Tools Required: Qty.

V.O.M. 1

1. BRAKE LIGHTS (FIG. O–1, FIG. O–6, FIG. O–7)

   a) *IF ONLY ONE BRAKE LIGHT IS INOPERATIVE,* the overall system is functional; therefore, the following steps should be followed: If no brake lights are functional proceed to Step 1b. Assure that the brown wire from the harness is attached to the white wire from the inoperative lamp module plug. If the lamp still fails to light when the brake pedal is depressed, proceed as follows. Separate the brown harness wire from the white lamp module wire. Select the 12 VDC range of the VOM. Place the red probe (+) to the brown wire and the black probe (+) to the black wire connection at the battery. Depress the brake pedal. A reading of 12 VDC volt indicates that the brown wire is in good condition and that the lamp module is defective. The taillights are made up of individual lamp modules. To replace a rear lamp module, gently pry the lamp module from its retaining bezel using a straight blade screwdriver. (Use caution to prevent breakage). Unplug the lamp module from the plug and replace by snapping into the bezel. Replace all wires disconnected in the test.

   b) *IF BOTH BRAKE LIGHTS ARE INOPERATIVE AND THE VEHICLE RUNS.* Visually check for disconnected wires under the floorboard, at the micro switch and at the rear lights.

2. Check for loose wires at the terminal–connections and for worn insulation or bare wires touching the frame. *BARE WIRES MAY CAUSE A SHORT CIRCUIT.*

3. Check for adequate battery volts (nominal 12 VDC) by setting VOM to 12 VDC range and place the red probe (+) on the battery post with the green wire attached. Place the black probe (–) on the battery post with the black wire attached. A reading of 11 VDC or better indicates adequate battery condition. No reading indicates (a) a poor connection between the probes and the battery terminals; (b) a defective VOM. A voltage reading below 11 volts indicates poor battery condition and the vehicle should be recharged before proceeding with the test.

NOTE

Due to the resistance of the wires involved within the harness, voltage readings may be somewhat lower than battery voltage. A reading of 1 volt below battery voltage is acceptable.

4. Firmly attach the black probe (–) to the battery post with the black wire attached and the red probe (+) to the green wire terminal at the fuse block. A reading of battery voltage indicates that the green wire is in good condition.

NOTE

This wire supplies power to the entire fuse block.

5. Place the red probe (+) to the red wire terminal on the fuse block. A reading of battery voltage indicates that the fuse is in good condition. No reading indicates a defective fuse, replace with a good 20 amp fuse.

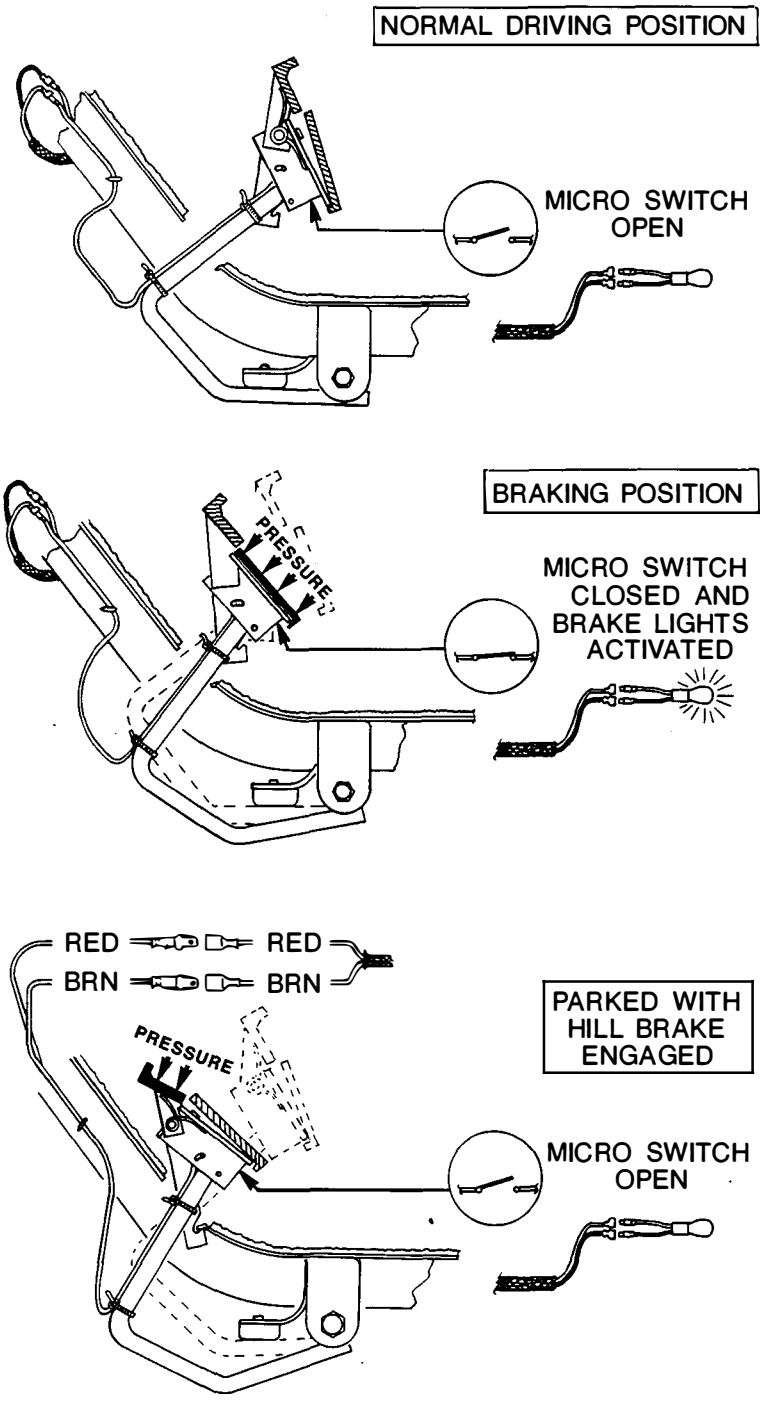
Check for correct operation and function of brake pedal actuated micro switch.

6. Raise the front of vehicle (see Safety Procedures in Section B).

7. Depress service brake pedal and listen for audible click from micro switch. Release pedal and listen for an audible click.

An audible click in both the up and down pedal positions indicates a correct micro switch adjustment.

If the switch is not activated and released correctly, it may be adjusted by loosening the two bolts that secure the micro switch and moving the switch until



NOTE: AUDIBLE CLICK WHILE APPLYING AND RELEASING BRAKES INDICATES PROPER SWITCH ADJUSTMENT.

FIG. O-6 BRAKE SYSTEM MICRO SWITCH

the appropriate adjustment is achieved. If the switch is in correct adjustment and the brake lights are not activated, it is necessary to check for defective wiring or components.

Set the VOM to the 12 VDC range and attach the black probe (–) to the negative battery post with the black wire attached. Place the red probe (+) to the micro switch terminal with the brown wire attached. Depress the brake pedal. A reading of battery voltage indicates that the service brake micro switch is operating correctly. If no voltage is indicated, the micro switch must be tested.

8. Move the red probe (+) to the service brake micro switch terminal with the red wire attached. A reading of battery voltage indicates that the red wire is in good condition. Move the red probe (+) to the other terminal of the service brake micro switch and manually activate the switch by pressing the roller of the actuating arm toward the switch until an audible click is heard. A reading of battery voltage indicates that the switch is in good condition. No reading indicates that the micro switch needs replacement.

9. Move to the rear of the vehicle, and access the lights. Move the red probe (+) to the brake light at the brown wire. Depress the service brake. A reading of battery voltage indicates that the brown wire is in good condition.

10. Disconnect the connector from the light module and move the red probe (+) to the white terminal. Depress the service brake. A reading of battery voltage indicates that the connector wiring is in good condition.

NOTE

If any VOM readings indicate a defective wire, it is recommended that the condition of the terminals and wire junction be examined. A defective wire should be replaced with one of the same gauge and color and wired between the correct components and wire tied to the harness bundle. The defective wire should be cut back close to the harness and the ends protected with vinyl electrical tape.

When replacing micro switches, be sure to check the switch adjustment.

NOTE

Due to the resistance of the wires involved within the harness, voltage readings may be somewhat lower than battery voltage. A reading of 1 volt below battery voltage is acceptable.

TURN SIGNALS AND FLASHER CIRCUIT (IF EQUIPPED)

The turn signal and flasher is a 12 volt system and consists of a turn signal/flasher switch, fuse block, fuse, front and rear lamps, and central wiring harness.

TURN SIGNALS AND FLASHER

When the turn signal/flasher switch is activated, the circuit is completed permitting current to flow from the battery to the fuse and through the flasher causing the appropriate lights to flash. The turn signal/flasher will operate if the vehicle is in either the *ON* or *OFF* position.

TESTING THE TURN SIGNAL/FLASHER CIRCUIT (FIG. O–1, FIG. O–8, FIG. O–9)

The test procedure for this test is the same for both the single and multiple unit taillight vehicles. A difference *DOES* exist in the turn signal switch wiring (brown wire). *BOTH CIRCUIT DIAGRAMS ARE PROVIDED FOR REFERENCE.*

Tools Required: Qty.

V.O.M. 1

IF THE VEHICLE RUNS BUT ALL TURN SIGNALS AND FLASHER ARE INOPERATIVE:

1. Check for loose wires at each terminal connection and for worn insulation or bare wires touching the frame. *BARE WIRES MAY CAUSE A SHORT CIRCUIT.*

2. Check for adequate battery volts (nominal 12 VDC) by setting VOM to 12 VDC range and place the red probe (+) on the battery post with the green wire attached. Place the black probe (–) on the battery post with the black wire attached. A reading of 11 VDC or better indi-

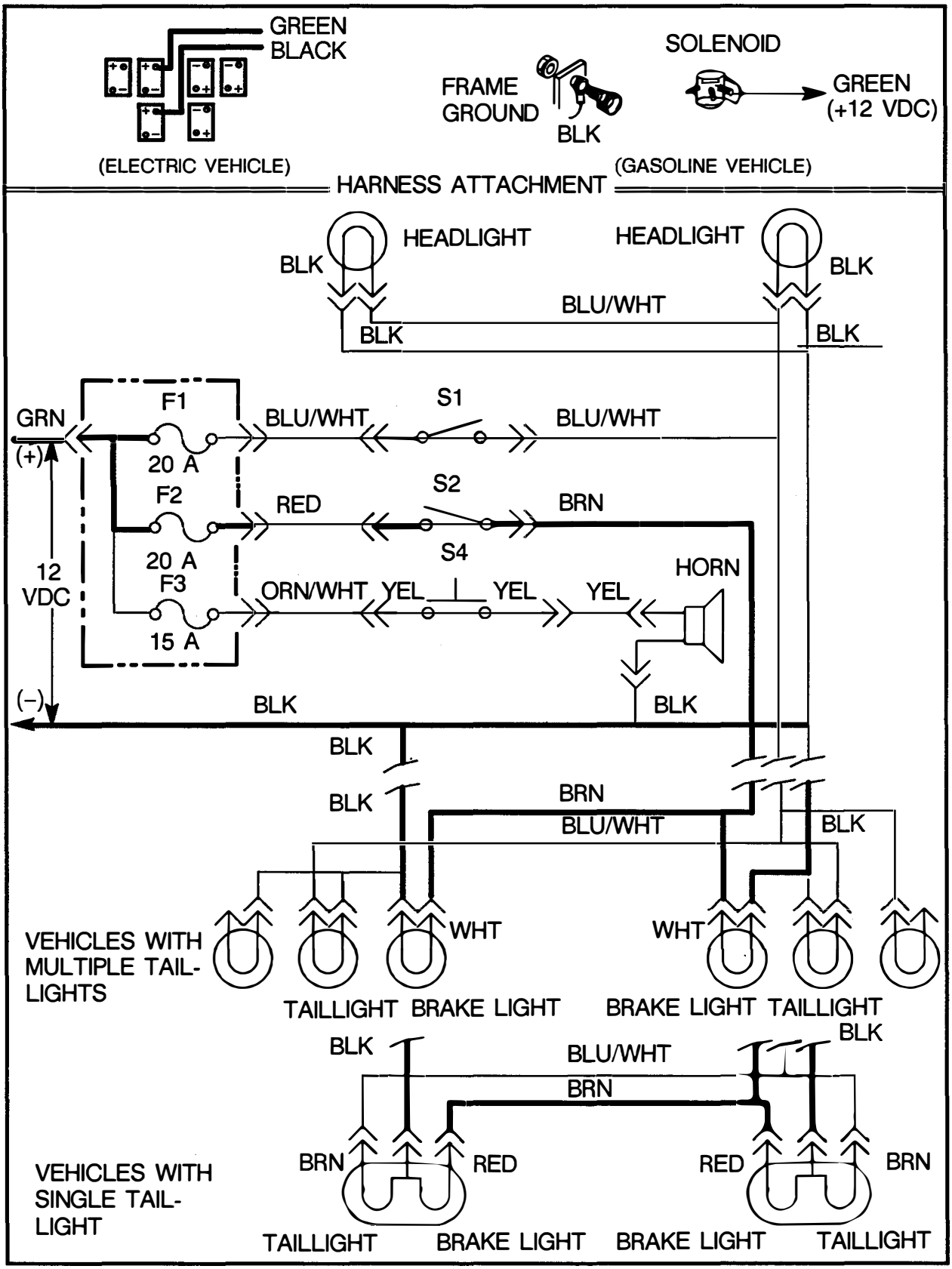


FIG. O-7 BRAKE LIGHT CIRCUIT

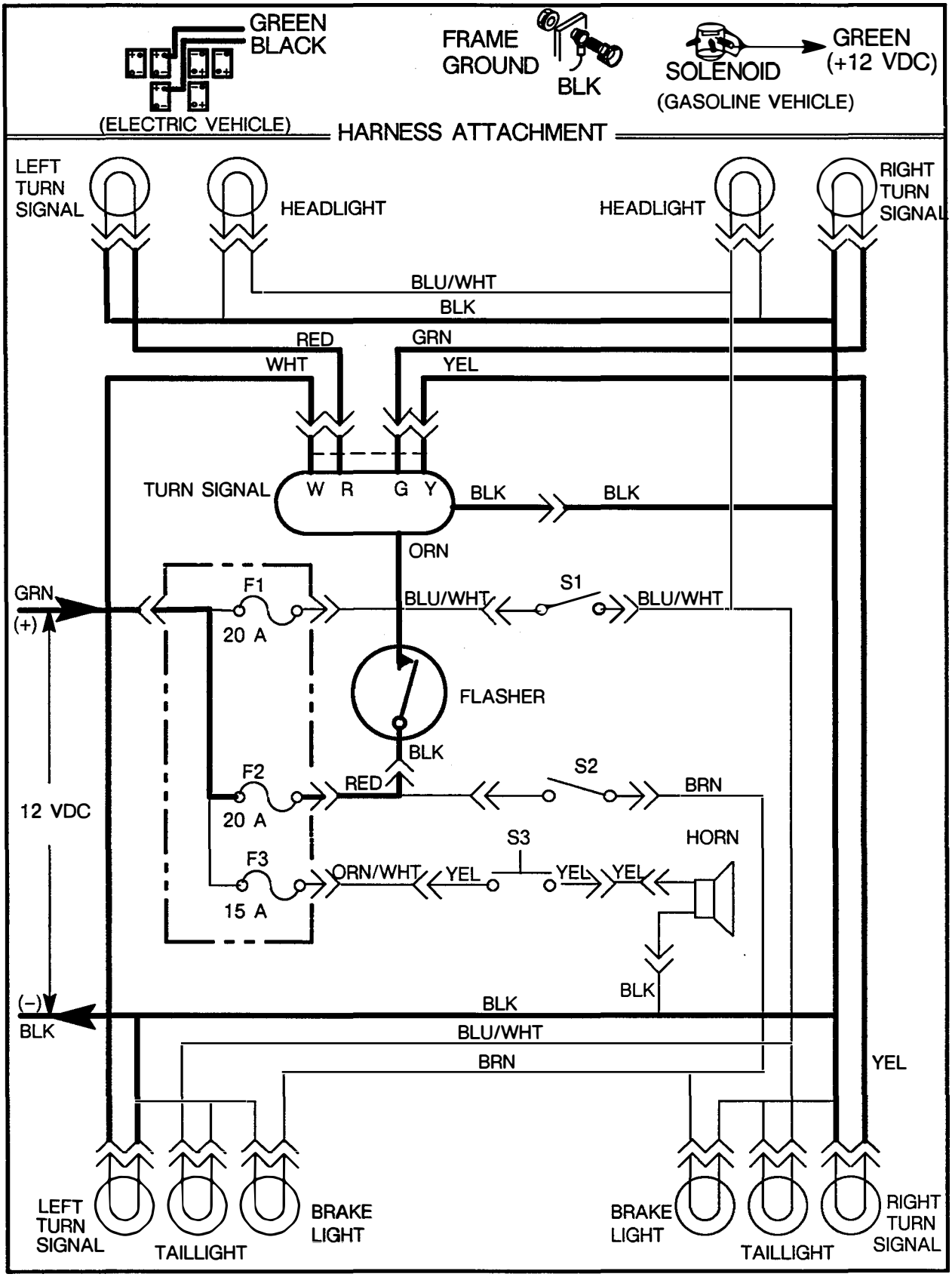


FIG. O–8 TURN SIGNAL/FLASHER CIRCUIT (MULTIPLE TAILLIGHT VEHICLES)

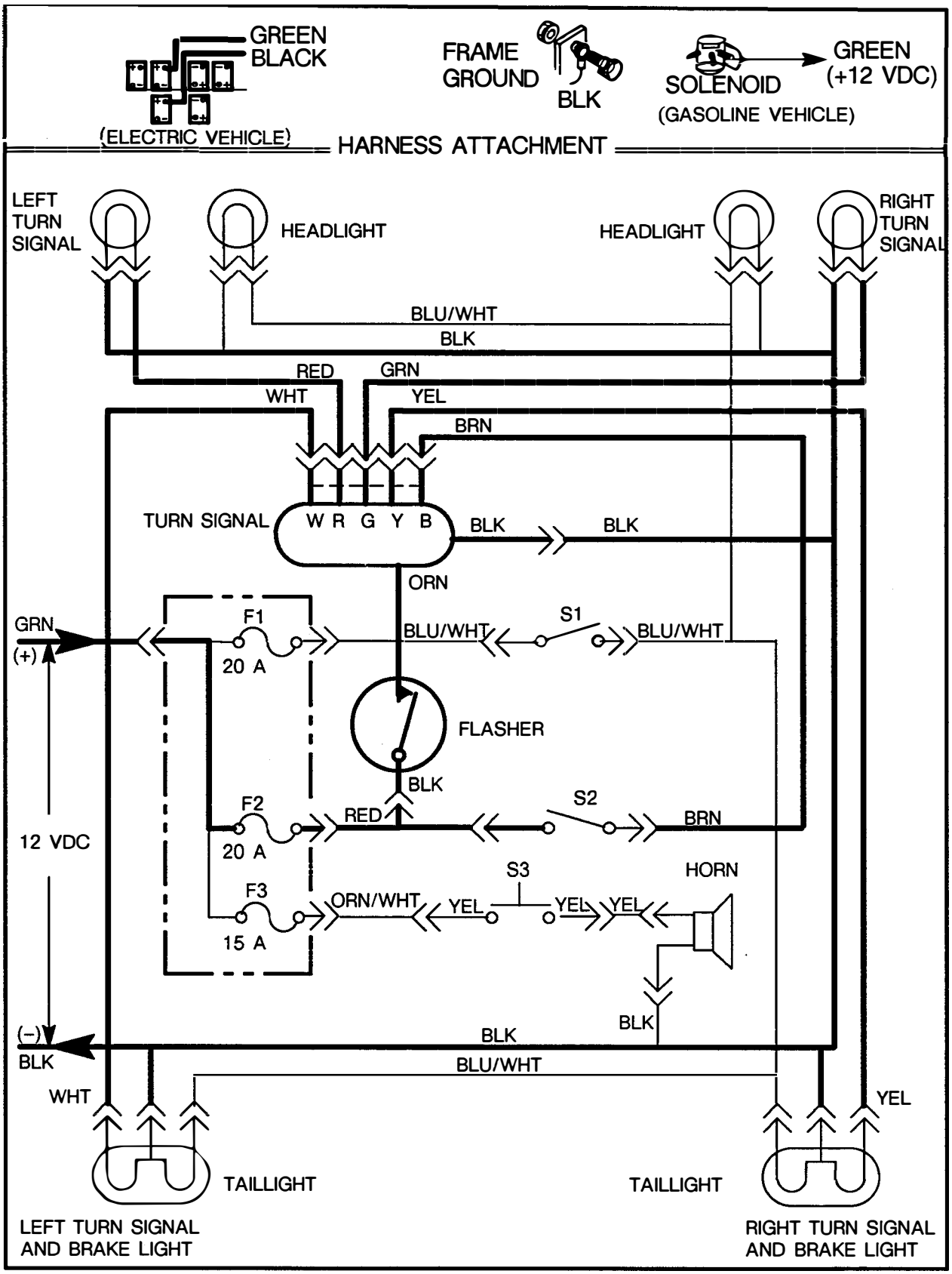


FIG. O-9 TURN SIGNAL/FLASHER CIRCUIT (SINGLE UNIT TAILLIGHT VEHICLES)

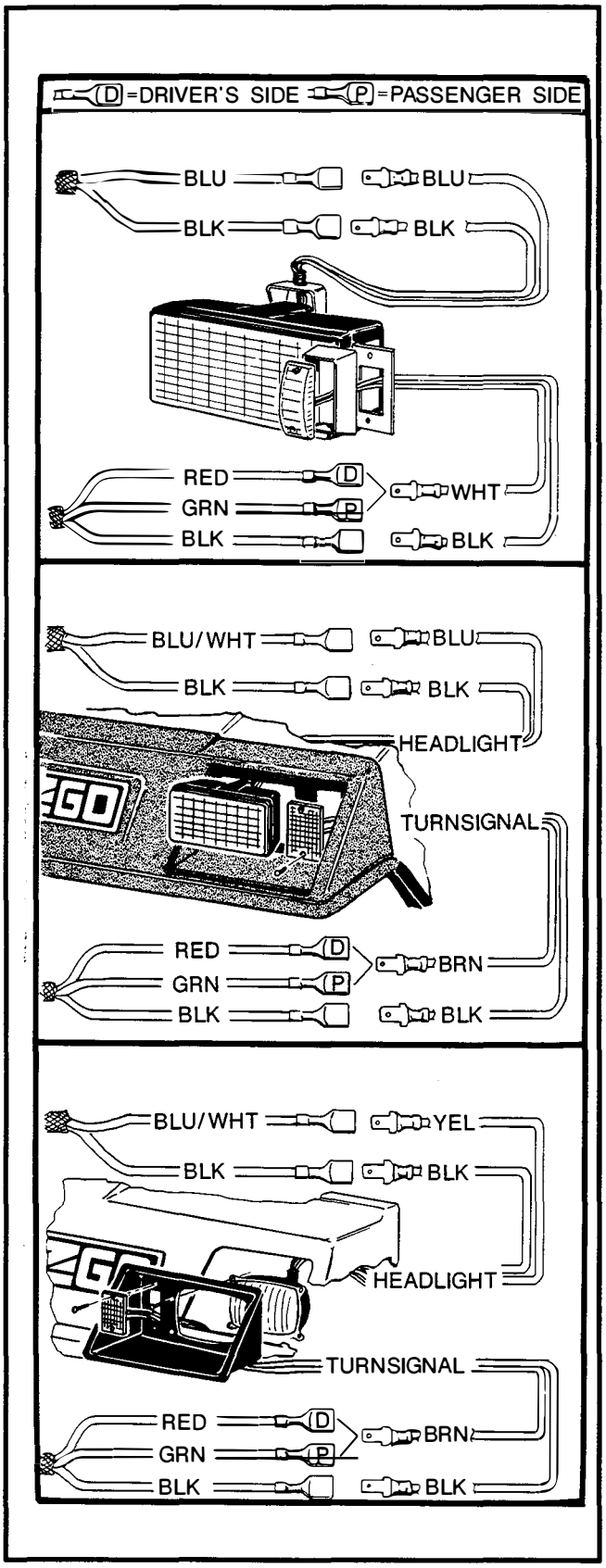


FIG. O-10 HEADLIGHT INSTALLATION WITH TURNSIGNAL SWITCH

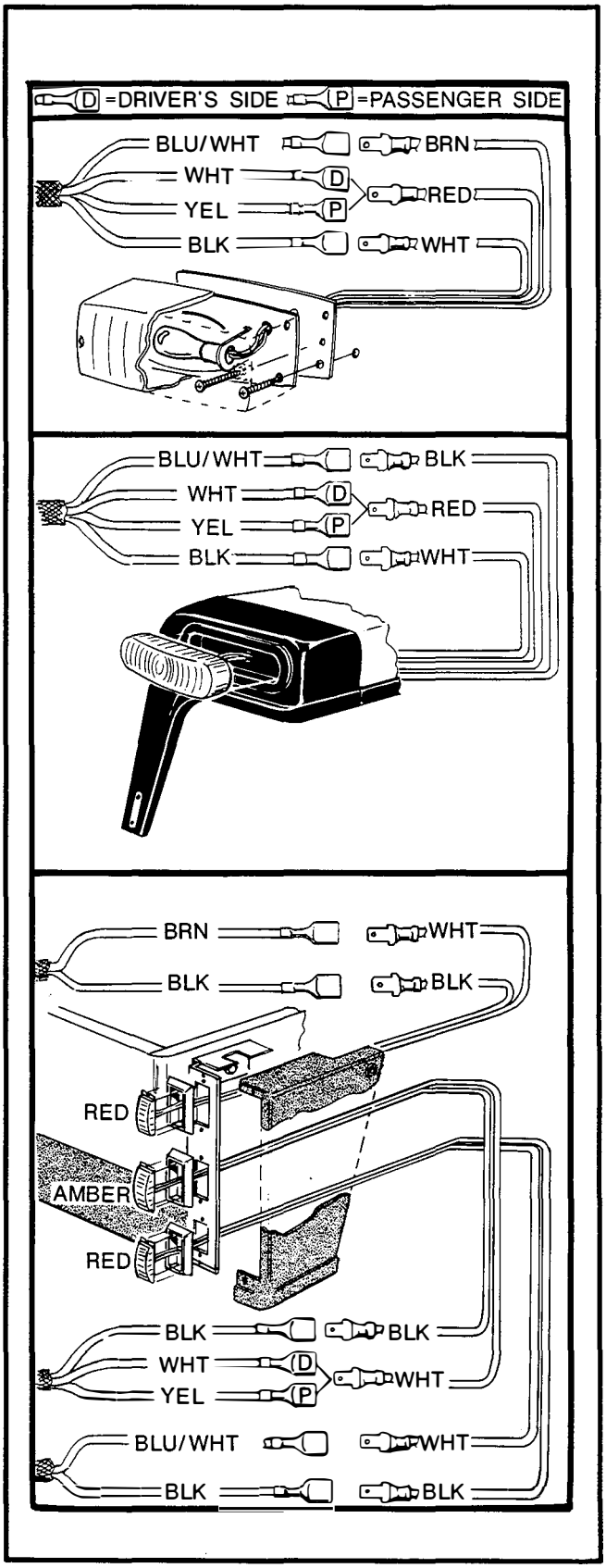


FIG. O-11 TAILLIGHT INSTALLATION WITH TURNSIGNAL SWITCH

cates adequate battery condition. No reading indicates (a) a poor connection between the probes and the battery terminals; (b) a defective VOM. A voltage reading below 11 volts indicates poor battery condition and the vehicle should be recharged before proceeding with the test.

NOTE

Due to the resistance of the wires involved within the harness, voltage readings may be somewhat lower than battery voltage. A reading of 1 volt below battery voltage is acceptable.

3. Firmly attach the black probe (–) to the battery post with the black wire attached and the red probe (+) to the green terminal of the fuse block. A reading of battery voltage indicates that the green wire is in good condition.

NOTE

This green wire supplies power to the entire fuse block.

4. Place the red probe (+) to the red wire terminal on the fuse block. A reading of battery voltage indicates that the fuse is in good condition. No reading indicates a defective fuse, replace with a good 20 amp fuse.

5. Remove the flasher from its socket. Select ohms x 1 (continuity) position on the VOM. Place the red probe (+) on one of the flasher terminals and the black probe (–) on the other flasher terminal. A reading of .00 on a digital VOM or less than 5 ohms on a needle type meter indicates that the flasher is in good condition.

6. Inspect the flasher socket for corrosion before replacing the flasher.

7. Separate the harness to turn signal connector and inspect for corrosion and correct placement of pins and sockets in the connector housings.

8. Check that the black wire from the flasher socket is attached to the red wire from the harness and that the black wire from the turn signal is attached to the black wire from the harness, and the black wire from the flasher is firmly attached to the orange wire from the turn signal.

9. If the system does not function after the above check, the turn signal switch and harness assembly must be replaced.

If the left, right, or emergency flasher works, the flasher unit is satisfactory and a defective bulb or wiring should be suspected.

10. Select the 12 VDC range of the VOM. Place the red probe (+) to:

    Left Front ..... Red Wire
    Left Rear ..... White Wire
    Right Front ..... Green Wire
    Right Rear ..... Yellow Wire

    and the black probe (–) to the black wire connection at the negative post of the battery. Turn on the appropriate turn signal. A pulsating reading of 12 VDC indicates that power is available to the light, therefore, the light module is defective. If no voltage is present a defective wire is indicated.

    To replace a front lamp module, gently pry lamp module from its retaining bezel using a straight blade screwdriver. (Use caution to prevent breakage.) Unplug the lamp module from the plug and replace by snapping into the bezel. Replace all wires disconnected in test.

NOTE

If any VOM readings indicate a defective wire, it is recommended that the condition of the terminals and wire junction be examined. A defective wire should be replaced with one of the same gauge and color and wired between the correct components and wire tied to the harness bundle. The defective wire should be cut back close to the harness and the ends protected with vinyl electrical tape.

HOUR METER CIRCUIT (IF EQUIPPED)

The hour meter circuit is a 36 volt system for electric vehicles and a 12 volt system for gasoline vehicles. Both consists of a hour meter and central wiring harness.

HOUR METER

The hour meter is wired to the vehicle's batteries and indicates the number of hours that the vehicle has operated. The hour meter will operate only when the vehicle is running.

TESTING HOUR METER CIRCUIT - Electric Vehicle Only (FIG. O-1, FIG. O-12)

Tools Required: Qty.

V.O.M. 1

If the vehicle runs but the hour meter is inoperative:

1. Check for loose wires at the terminal connections and for worn insulation or bare wires touching the frame. *BARE WIRES MAY CAUSE A SHORT CIRCUIT.*
2. Raise vehicle (see safety procedures in Section B).

⚠ WARNING ⚠

THIS TEST WILL CAUSE VEHICLE WHEELS TO TURN. BE SURE THAT VEHICLE IS ADEQUATELY SUPPORTED WITH BOTH REAR WHEELS CLEAR OF FLOOR. KEEP CLEAR OF ROTATING WHEELS. CLOTHING BECOMING TRAPPED BY WHEEL COULD CAUSE SERIOUS PERSONAL INJURY.

3. Check for adequate battery volts (nominal 36 VDC) by setting VOM to 36 VDC range, unplug the yellow and gray wires from the rear of the hour meter. Place the black probe (-) on the gray wire terminal. Place the red probe (+) on the yellow wire terminal. Turn key switch to *ON* and depress accelerator pedal. A reading of 31.5 VDC or better indicates adequate battery condition. No reading indicates (a) a poor connection between the probes and the terminals; (b) a defective VOM. A voltage reading below 31.5 volts indicates poor battery charge and the vehicle should be recharged before proceeding with the test.
4. If battery voltage is in excess of 31.5 VDC and the hour meter does not function, the hour meter should be replaced being careful to rewire with gray to the negative terminal (-) and yellow to the positive terminal (+).

TESTING HOUR METER CIRCUIT - Gasoline Vehicle Only (FIG. O-1, FIG. O-13)

Tools Required: Qty.

V.O.M. 1

If the vehicle runs but the hour meter is inoperative:

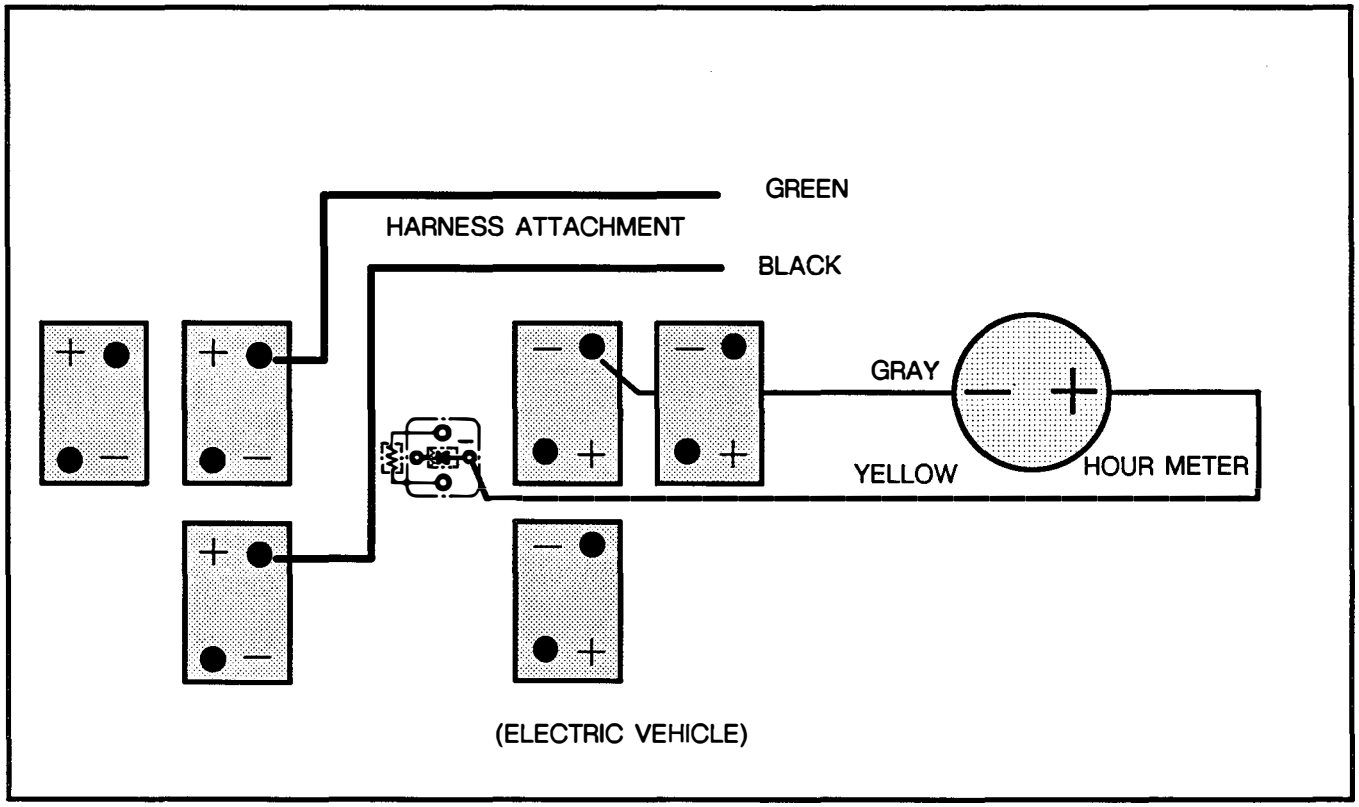


FIG. O-12 HOUR METER CIRCUIT - ELECTRIC VEHICLE ONLY

1. Check for loose wires at the terminal connections and for worn insulation or bare wires touching the frame. *BARE WIRES MAY CAUSE A SHORT CIRCUIT.*

2. Raise vehicle (see procedures in Section B).

⚠ WARNING ⚠

THIS TEST WILL CAUSE VEHICLE WHEELS TO TURN. BE SURE THAT VEHICLE IS ADEQUATELY SUPPORTED WITH BOTH REAR WHEELS CLEAR OF FLOOR. KEEP CLEAR OF ROTATING WHEELS. CLOTHING BECOMING TRAPPED BY WHEEL COULD CAUSE SERIOUS PERSONAL INJURY.

3. Check for adequate battery volts (nominal 12 VDC) by setting VOM to 12 VDC range, unplug the yellow and gray wires from the rear of the hour meter. Place the black probe (–) on the gray wire terminal. Place the red probe (+) on the yellow wire terminal. Turn key switch to *ON* and depress accelerator pedal. A reading of 11 VDC or better indicates adequate battery condition. No reading indicates (a) a poor connection between the probes and the terminals; (b) a defective VOM. A voltage reading below 11 volts indicates poor battery charge and the vehicle should be recharged before proceeding with the test.

4. If battery voltage is in excess of 11 VDC and the hour meter does not function, the hour meter should be replaced being careful to rewire with gray to the negative terminal (–) and yellow to the positive terminal (+).

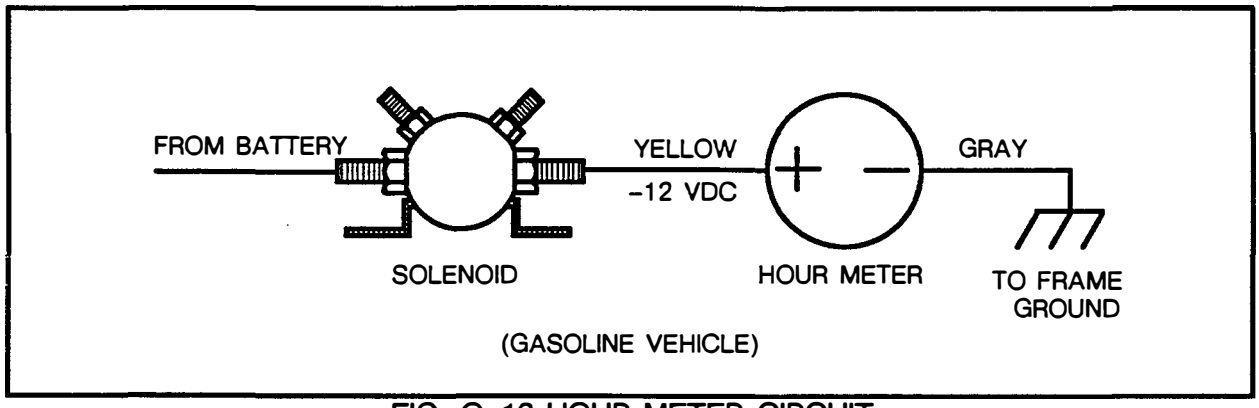


FIG. O–13 HOUR METER CIRCUIT

STATE OF CHARGE METER (IF EQUIPPED) – Electric Vehicle Only

The state of charge circuit is a 36 volt system and consists of a state of charge meter and central wiring harness.

STATE OF CHARGE METER

The state of charge meter is wired to the 36 volt battery set of the vehicle and indicates the charge condition of the battery set. The state of charge meter will operate if the vehicle is in either the ON or OFF position.

TESTING STATE OF CHARGE METER CIRCUIT (FIG. O–1 , FIG. O–14)

Tools Required: Qty.

V.O.M. 1

If the vehicle runs but the state of charge meter is inoperative:

1. Check for loose wires at the terminals–connections and for worn insulation or bare wires touching the frame. *BARE WIRES MAY CAUSE A SHORT CIRCUIT.*

2. Check for adequate battery volts (Nominal 36 VDC) by setting VOM to 36 VDC range, unplug the green and gray wires from the rear of the

state of charge meter. Place the red probe (+) on the green wire terminal. Place the black probe (–) on the gray wire terminal. A reading of 36 VDC ±5V or better indicates adequate battery condition. No reading indicates (a) a poor connection between the probes and the battery terminals; (b) a defective VOM. A voltage reading below 32 volts indicates poor battery charge and the vehicle should be recharged before proceeding with the test.

3. If battery voltage meets the criteria specified and the state of charge meter does not function, the state of charge meter should be replaced being careful to rewire with gray to the negative (–) terminal and green to the positive (+) terminal.

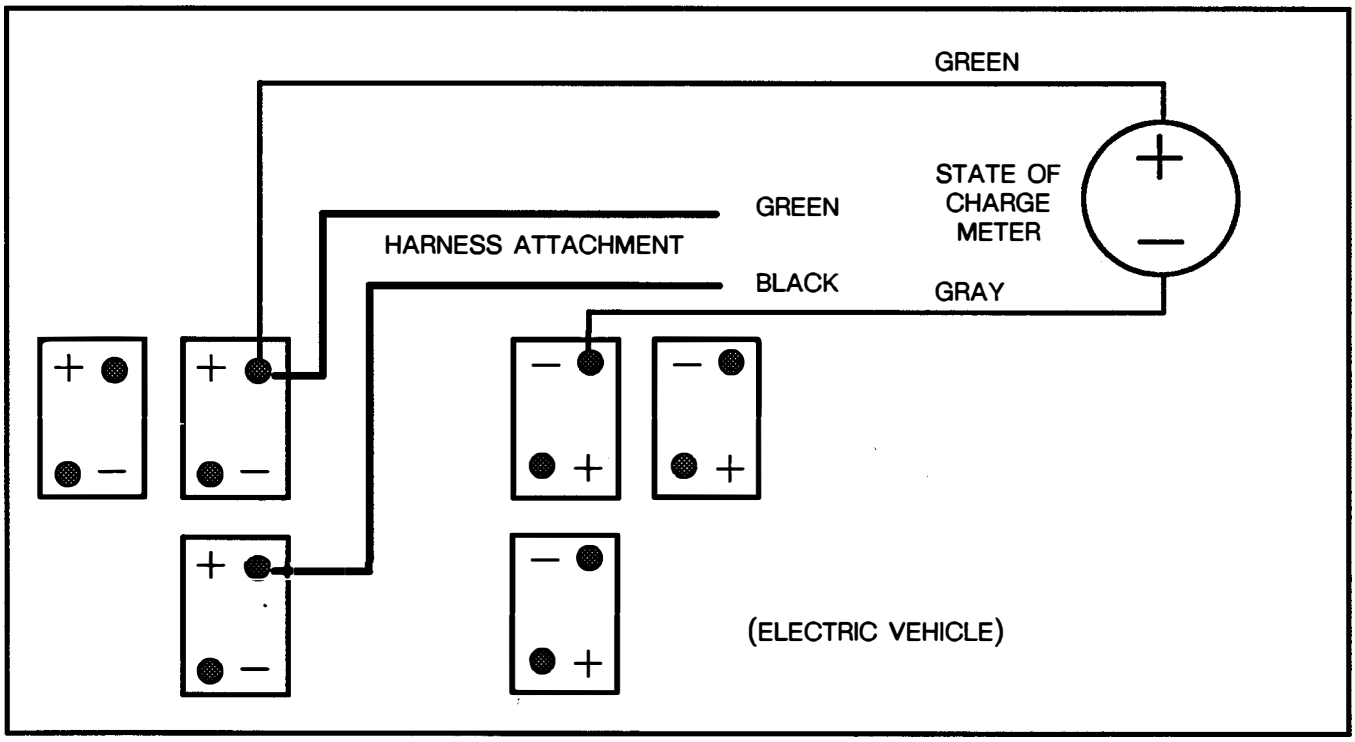


FIG. O–14 STATE OF CHARGE METER CIRCUIT

GENERAL

The following five pages describe the general assembly methods used in securing body and trim components to the vehicle. Refer to the *body and associated parts* pages of the *service parts manual* for construction details. By referring to the service parts pages the general construction methods may be determined while these general assembly methods indicate the disassembly and assembly methods required.

TRIM

Trim consists of a vinyl extrusion that is installed around the outside edges of the body panels and the rear edge of the dash tray. The ends of the trim (except for the rear of the dash tray) are secured to the vehicle with a pop rivet.

TRIM REMOVAL (FIG. P-1)

Use either an air or electric powered drill with a 1/4" drill bit to drill out the rivet head. Using an awl or other suitable punch, push out the remainder of the rivet. Grasp the loose end of the trim and pull down and away from the body panel. The removal of the trim running along the edge of the floormat on either side of the vehicle varies with the model of the vehicle.

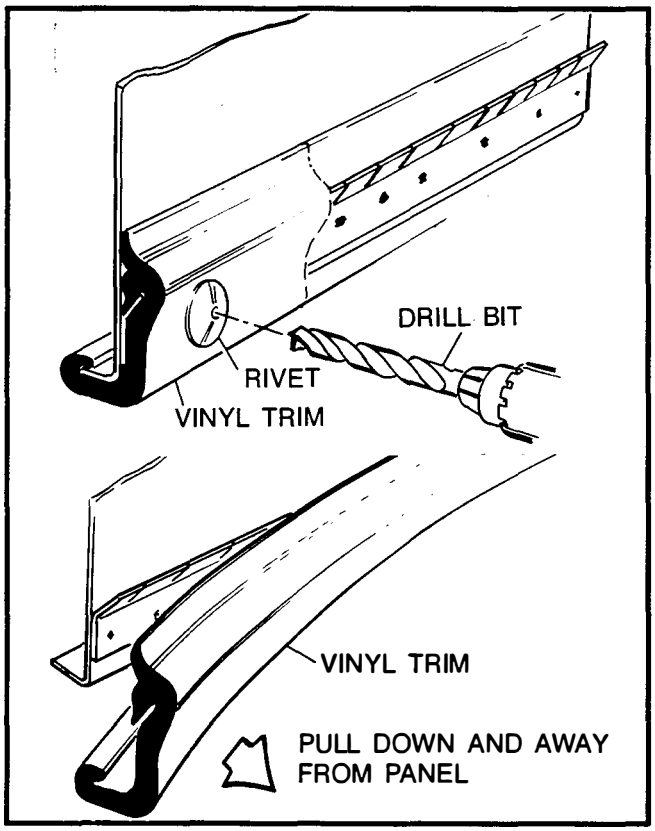


FIG. P-1 TRIM REMOVAL

VEHICLES EQUIPPED WITH ONE PIECE ROCKER PANEL (FIG. P-2)

The removal of the vinyl trim running along the floorboard will require that the stainless steel rocker panel be removed. The rocker panel is retained by two stainless steel truss head screws, washers and lock nuts. Care must be used when tightening the hardware not to over tighten the hardware which would distort the rocker panel.

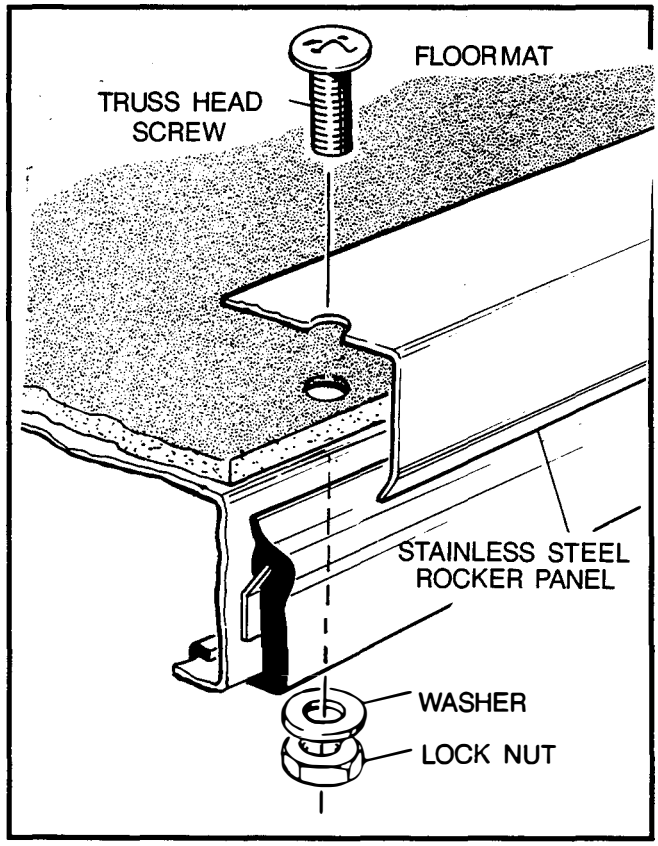


FIG. P-2 ROCKER PANEL REMOVAL STAINLESS STEEL

VEHICLES EQUIPPED WITH TWO PIECE ROCKER PANELS (FIG. P-3)

Remove the stainless steel portion of the rocker panel by removing the two stainless steel carriage bolts and lock nuts. The stainless steel portion of the rocker panel can then be removed from the plastic portion by tilting out and then lifting straight up. Removal of the plastic section must be done with care to prevent damage to the attached fasteners. Grasp the front of the plastic rocker panel and pull it out and down. Move rearwards pulling out and down at each fastener until the rocker panel has been removed. When installing the rocker panel be sure that the slots in the body panels are not distorted. Install the rocker panel by carefully aligning the front fastener with the front slot and tapping home using a rubber mallet. Repeat the operation with each adjacent fastener until the rocker panel is installed.

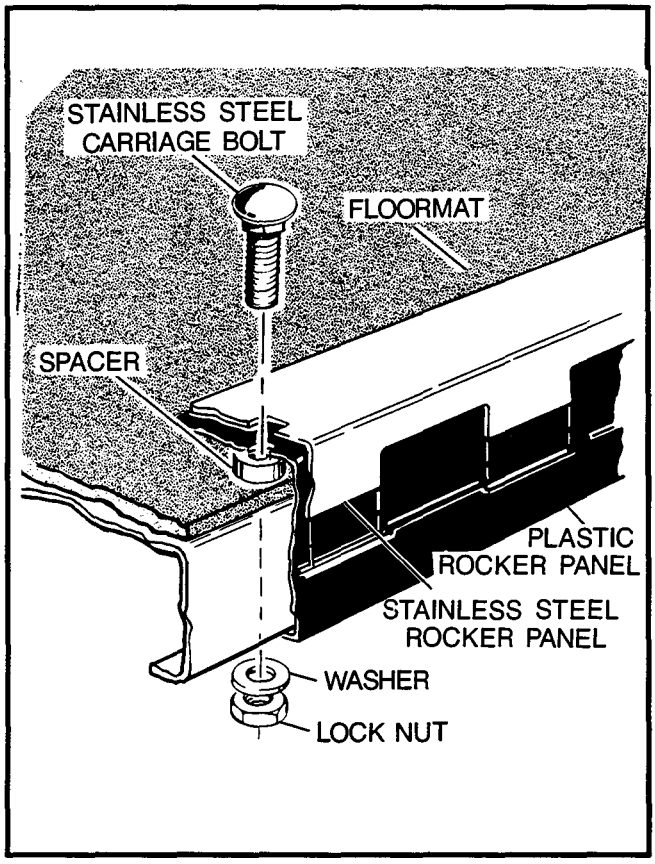


FIG. P-3 ROCKER PANEL REMOVAL, STAINLESS STEEL AND PLASTIC

TRIM INSTALLATION (FIG. P-4, FIG. P-5, FIG. P-6)

In order to make the vinyl trim flexible and pliable it should first be heated. Under field conditions, this can best be accomplished by immersing the trim in a container of hot water (110° to 120°) for approximately ten minutes. Hook the trim over the flange on the outside of the panel and press down while pushing the lower edge over the flange at the outside of the panel.

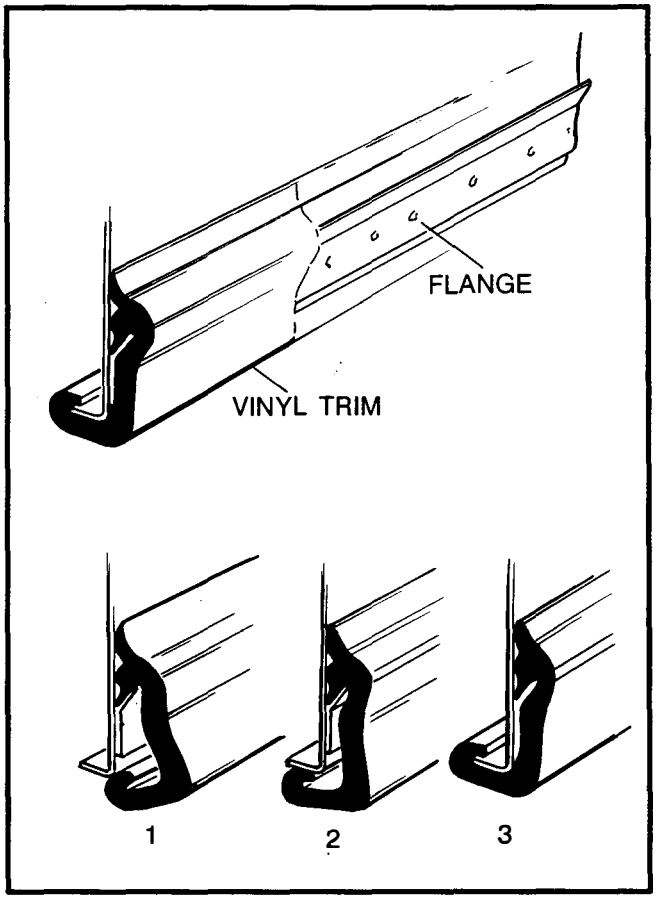


FIG. P-4 TRIM INSTALLATION

Service tip: Short sections of trim that have been pulled loose, can be replaced by heating with a heat gun or hair dryer to improve the trim flexibility. The section can then be pressed into place using the same technique as indicated above.

After the trim is installed it is secured with a rivet. Use an awl inserted through the rivet hole in the body panel and forced through the trim to locate the hole. Drill through the vinyl trim and install the rivet.

Use a sharp utility knife and a straight edge to cut the excess trim to the correct contour.

CAUTION

TO PREVENT CUTTING THROUGH THE PAINT AND BODY PANEL PROTECTIVE COATING, EXTREME CARE SHOULD BE USED WHEN CUTTING THE TRIM. ALWAYS USE A STRAIGHT EDGE AND A SHARP KNIFE TO PROVIDE A PROFESSIONAL APPEARANCE.

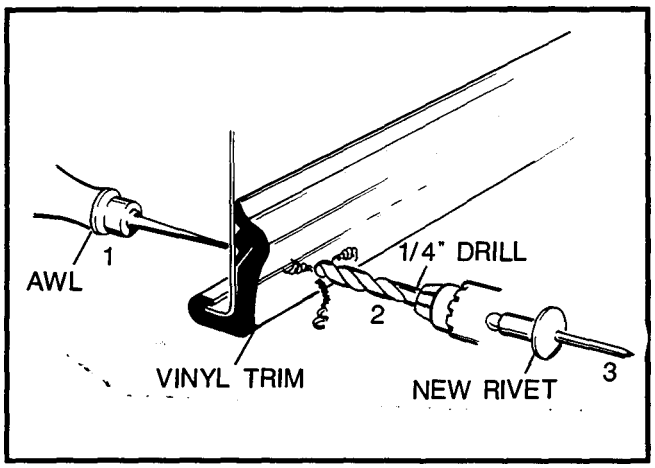


FIG. P-5 INSTALLING RIVETS

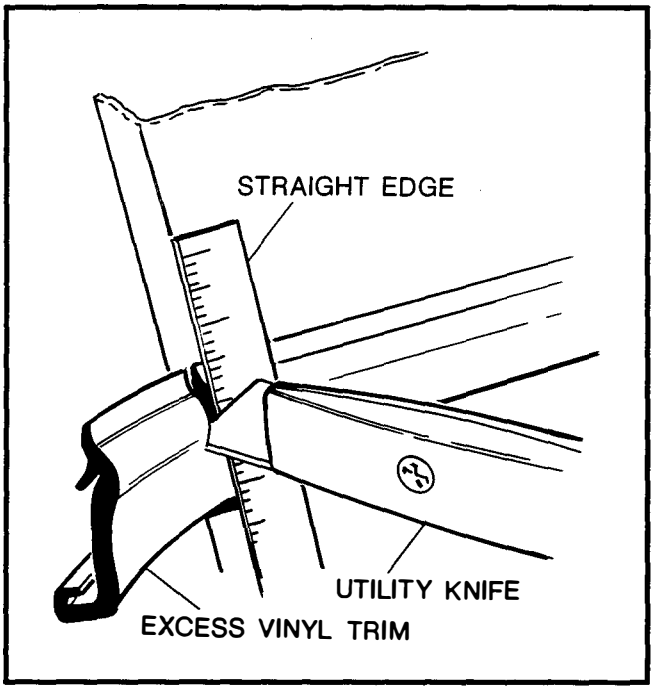


FIG. P-6 FINISHING TRIM

BODY COMPONENTS

⚠ WARNING ⚠

DISCONNECT OR REMOVE BATTERIES BEFORE PROCEEDING. OBSERVE THE PROCEDURES IN SECTION B (SAFETY PROCEDURES).

A variety of methods are used to attach body components and each has a recommended method of removal and installation.

SPOT WELDS (FIG. P-7)

⚠ WARNING ⚠

USE EYE AND EAR PROTECTION WHEN USING EITHER A HAMMER OR AN AIR POWERED CHISEL.

USE EYE PROTECTION WHEN USING ANY POWER TOOLS.

NOTE

The welds can be broken using a hammer and chisel; however, an air powered chisel is recommended.

Many sheet metal components have been secured using spot welds. The components can be removed by breaking each weld; this is accomplished by driving a 5/8" chisel through each weld. (FIG. P-7)

In the field sheet metal service components are secured to the vehicle with self-drilling and tapping screws or with nuts attached to studs that are attached to the replacement component.

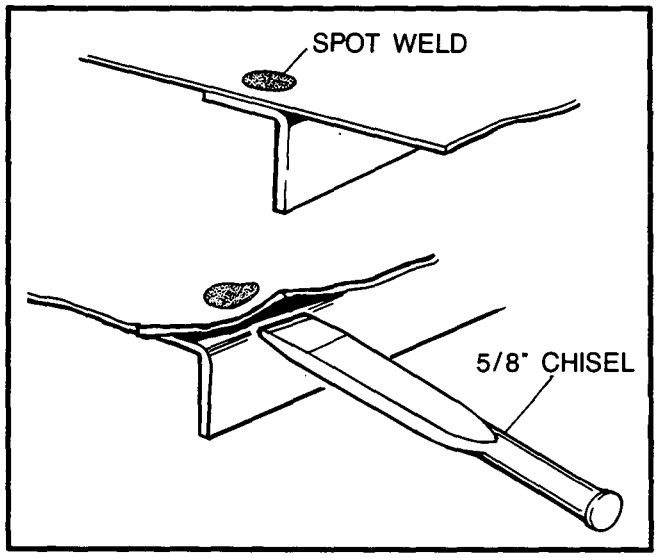


FIG. P-7 BREAKING SPOT WELDS

METAL RIVETS (FIG. P-8)

⚠ WARNING ⚠

USE EYE PROTECTION WHEN USING ANY POWER TOOLS.

CAUTION

WHEN DRILLING OUT RIVETS, DRILL OUT RIVET HEAD ONLY. BE CAREFUL NOT TO DRILL INTO BODY PANELS

Metal rivets are removed by drilling into the head with a drill bit that is larger than the shank. Drill until the rivet head separates from the shank. Use a punch to drive out the remains of the rivet. Replace rivet with a new one.

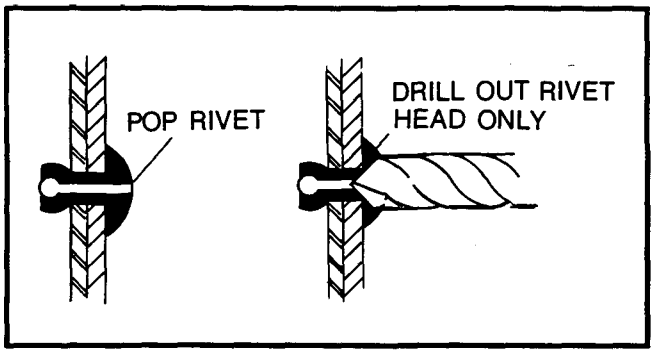


FIG. P-8 REMOVAL OF METAL RIVETS

PLASTIC RIVETS (FIG. P-9)

Plastic rivets may be removed and reused by pushing out the pin from the rear of the rivet using a straight blade screwdriver. Remove the pin from the rivet, and remove the rivet from the body panels. The rivet may be reused by inserting it firmly into place and pressing the rivet pin flush with the head of the rivet with the flat portion of a screwdriver.

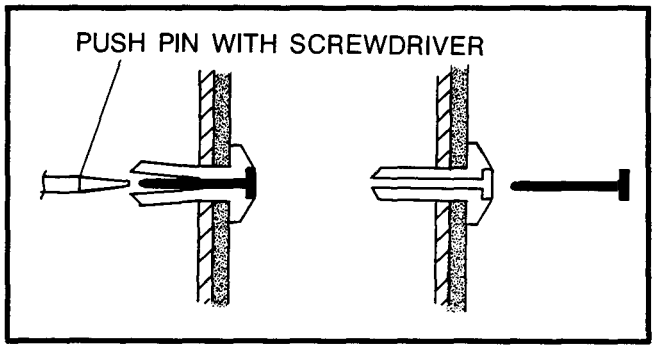


FIG. P-9 REMOVAL OF PLASTIC RIVETS

PLASTIC *CHRISTMAS TREE* FASTENERS (FIG. P-10)

Plastic *CHRISTMAS TREE* fasteners are removed by prying out of the body panel. In general, this is best accomplished by prying away the material being attached as close to the fastener as possible.

In many cases the fastener can be reused; however, excessive distortion or tearing of the holding tabs will require the use of a new fastener.

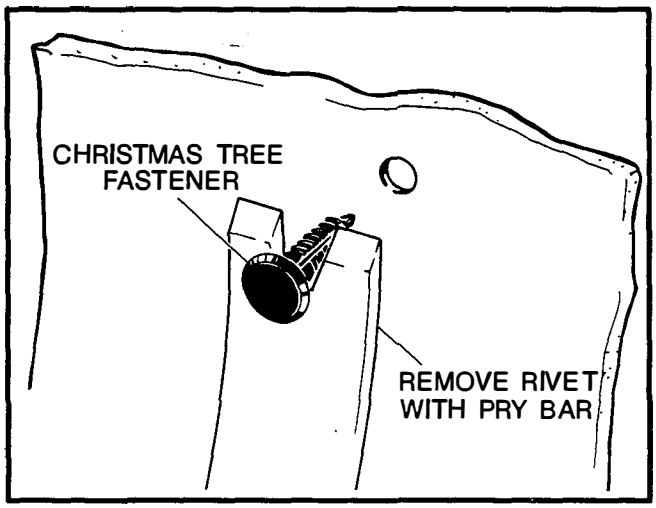


FIG. P-10 CHRISTMAS TREE FASTENER REMOVAL

SELF-DRILLING AND TAPPING SCREWS (FIG. P-11)

⚠ WARNING ⚠

USE EYE PROTECTION WHEN USING ANY POWER TOOLS.

Self-drilling and tapping screws can be removed with a suitably sized Phillips screwdriver; however, due to the self-tapping feature this is frequently impractical. Removal of these screws is best accomplished with the use of an impact driver with a suitably sized Phillips bit.

Installation requires an electric or air powered hand drill and a suitably sized Phillips bit. The screw will drill and tap its own hole.

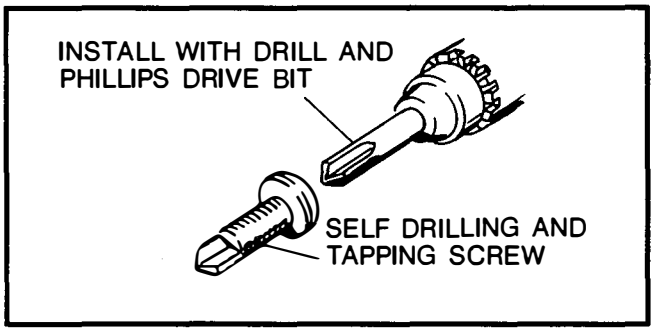


FIG. P-11 SELF-DRILLING AND TAPPING SCREW INSTALLATION

WELD STUDS (FIG. P-12)

Weld studs are attached to many production and service parts that are attached to frame members with lock nuts.

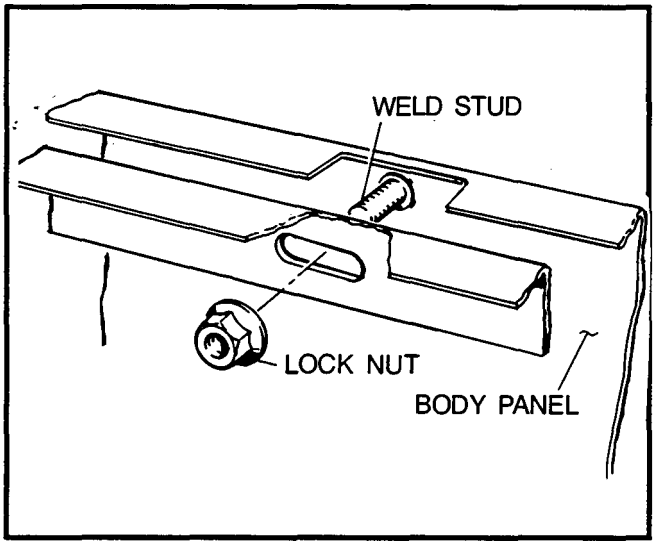


FIG. P-12 WELD STUDS

"U" NUTS (FIG. P-13)

Several types of "U" nuts are used in the vehicle and may be removed from body panels by spreading gently with a flat bladed screwdriver and sliding from the panel. Unless the nut is distorted or otherwise damaged, it may be reused on new panels.

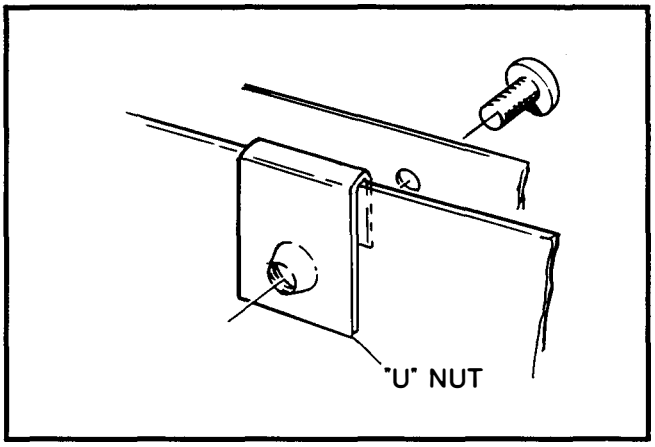


FIG. P-13 REMOVAL OF "U" NUTS

PAINT SYSTEM CONTRAST

E-Z-GO uses high solids paints in its production facility for two reasons: Firstly, the paint provides a high quality finish and excellent color retention. Secondly, as a continuous high volume painting facility we are required to use this system to permit us to conform with E.P.A. regulations. Note that in our system we have the facilities for baking the paint.

There are significant problems involved with using high solids Polane paint in a low volume body shop environment. Primer and top paint mixing is more complicated than when using the old polane and the mixed primer and paint has a shorter pot life (2 hours).

Some minor difference in luster may be determined between side by side panels painted with the two systems however and the old polane may fade somewhat faster with extended U.V. exposure.

Panels that are to be touched up, should be painted in their entirety to assure accurate color match. Spray cans are not available in high solids paints but are compatible with high solids paints. Spray cans are only recommended for touching up a minor imperfection.

POLANE REPAINTING INSTRUCTIONS

Step 1 - Lightly sand with water using #320 paper until all gloss is removed and the desired finish obtained. Do not remove the galvanneal surface from the metal. Silver chips in the sanding dust will indicate galvanneal removal.

Step 2 - Clean surface with solvent - mineral spirits or naptha.

Step 3 - Mix Polane catalyst #V66-V29 at a ratio of 1 to 8 (16 oz. per gallon of paint). Reduce with thinner #R7K212 to a viscosity of 24-26 Saybolt Universal Seconds. Add retarder R7K6251 as necessary to slow drying time.

NOTE

Viscosity should be measured by standard cup such as a Zahn or Ford. The cup can be purchased at most paint supply outlets. A cup filled with paint mixture should flow through the bottom orifice at the above time frame.

Step 4 - Apply paint spray in a light tack coat followed by the heavier coat until a thickness of one mil is obtained.

NOTE

A one mil thickness is the normal coverage required to hide primer or bare metal.

Step 5 - Allow 4-6 hours drying time for finished coat. Most topcoats have small transparent bubbles at initial application. Most will disappear after a cure of 2-3 days.

HIGH SOLIDS REPAINTING INSTRUCTIONS

Step 1 - Lightly sand with water using #320 paper until all gloss is removed and the desired finish obtained. Do not remove the galvanneal surface from the metal. Silver chips in the sanding dust will indicate galvanneal removal.

Step 2 - Clean surface with solvent - mineral spirits or naptha.

Step 3 - Mix Polane catalyst #V66-V29 at a ratio of 1 to 4 (32 oz. per gallon of paint). Reduce with thinner #R7K6204 to a viscosity of 24-26 Saybolt Universal Seconds. Add retarder R7K6208 as necessary to slow drying time.

NOTE

Viscosity should be measured by standard cup such as a Zahn or Ford. The cup can be purchased at most paint supply outlets. A cup filled with paint mixture should flow through the bottom orifice at the above time frame.

Step 4 - Apply paint spray in a light tack coat followed by the heavier coat until a thickness of one mil is obtained.

NOTE

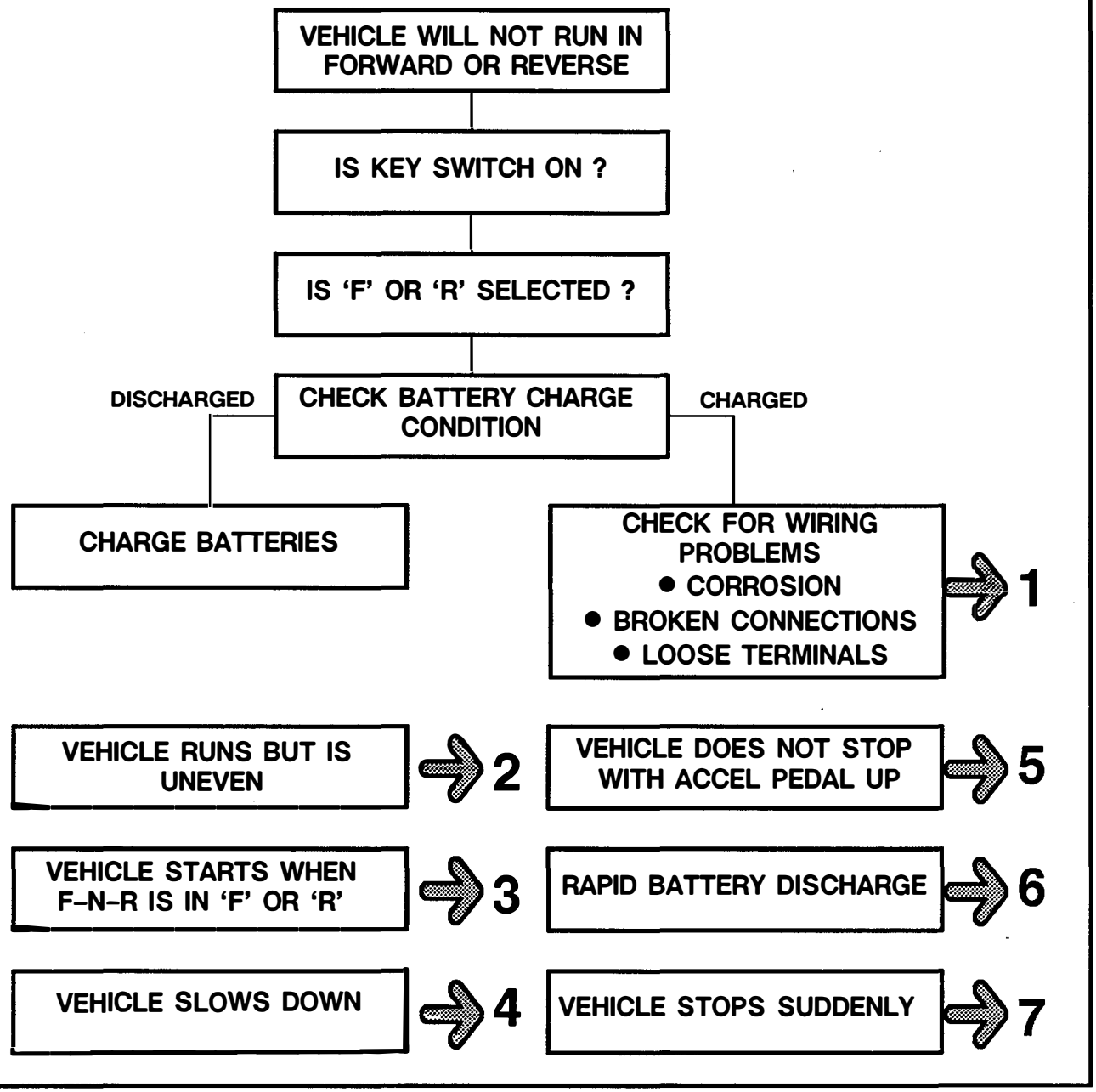
A one mil thickness is the normal coverage required to hide primer or bare metal.

Step 5 - Allow 4-6 hours drying time for finished coat. Most topcoats have small transparent bubbles at initial application. Most will disappear after a cure of 2-3 days.

⚠ WARNING ⚠

NEVER ATTEMPT ANY TROUBLE-SHOOTING WITHOUT TAKING MEASURES TO PROTECT YOURSELF AND OTHERS IF THE VEHICLE WAS TO INADVERTENTLY START. REFER TO WARNINGS IN SECTION 'A' AND SAFETY PROCEDURES IN SECTION 'B'.

MOTOR DRIVE AND ELECTRICAL SYSTEM



THE FOLLOWING IS AN ALPHABETICAL LISTING OF COMPONENT TOPICS COVERED IN THE MOTOR DRIVE AND ELECTRICAL SECTION OF THIS TROUBLE-SHOOTING SECTION.

SECTION '1' (MOTOR DOES NOT ROTATE)

GENERAL TROUBLESHOOTING (VEHICLES EQUIPPED WITH RESISTOR SYSTEM; FOR VEHICLES EQUIPPED WITH SOLID STATE SPEED CONTROL SEE SECTION N)

⚠ WARNING ⚠

OBSERVE ALL SAFETY CONSIDERATIONS WHEN PERFORMING THE FOLLOWING TESTS. VEHICLE COULD MOVE WITHOUT WARNING CAUSING INJURY TO PERSONS IN THE AREA.

- Raise the rear wheels of the vehicle. (See safety Procedures in section B)
- Turn key switch to 'ON'.
- Move F-N-R switch to 'F'.
- Slowly press the accelerator switch and listen for a 'click' from the solenoid.

SOLENOID DOES NOT CLICK

- Check the connections to and the function of: key switch, accelerator micro switch, F-N-R micro switch and solenoid. Repair or replace.

SOLENOID CLICKS

NOTE

It is possible for the solenoid to click but not make an adequate electrical connection. If the following checks do not indicate a problem, the solenoid should be considered suspect and checked with a VOM.

- Check the wiring to the accelerator switch, resistors and motor for loose or broken connections. Tighten or replace.
- Check the accelerator switch for worn contacts and correct operation. Replace.
- Check motor as described in the Motor section 'L' of this manual.

SECTION '2' (ACCELERATION IS ROUGH AND UNEVEN)(VEHICLES EQUIPPED WITH RESISTOR SYSTEM; FOR VEHICLES EQUIPPED WITH SOLID STATE SPEED CONTROL SEE SECTION N)

- Check for loose or broken connections between the accelerator switch and the resistors. Tighten or replace.
- Check the accelerator switch for dirty, burned, corroded, shorted or worn contact points. Replace accelerator contact board and moveable wiper contact.
- Check the resistors for damage. Repair or replace.

- Check for loose terminals. Tighten.

SECTION '3' (VEHICLE STARTS IMMEDIATELY WHEN THE F-N-R SWITCH IS IN THE 'F' OR 'R' POSITION)(VEHICLES EQUIPPED WITH RESISTOR SYSTEM; FOR VEHICLES EQUIPPED WITH SOLID STATE SPEED CONTROL SEE SECTION N)

- Check the accelerator linkage adjustment. Adjust.
- Check the accelerator switch for jammed contact points. Replace accelerator contact board and moveable wiper contact.
- Check for a jammed accelerator pedal. Repair or replace
- Check for stuck solenoid contacts. Replace.

SECTION '4' (VEHICLE SPEED SLOWS)(VEHICLES EQUIPPED WITH RESISTOR SYSTEM; FOR VEHICLES EQUIPPED WITH SOLID STATE SPEED CONTROL SEE SECTION N)

- Check the condition of charge and the electrolyte level in each battery. Recharge and add distilled water as required.
- Check the batteries, accelerator switch, resistors and motor for loose connections. Tighten.
- Check the accelerator switch for dirty or worn contact points, paying extra attention to the upper contact points. If the accelerator switch contacts are burned abnormally be sure that the wiper (accelerator arm) contact is in contact with the fixed contacts and be sure to check for loose connections at the resistors. Check for shorted or broken wires at each connection and for full accelerator arm travel. Repair or replace.
- Inspect the motor for worn or damaged brushes or a dirty commutator. Replace or clean.

SECTION '5' (VEHICLE DOES NOT STOP WHEN ACCELERATOR IS RELEASED)(VEHICLES EQUIPPED WITH RESISTOR SYSTEM; FOR VEHICLES EQUIPPED WITH SOLID STATE SPEED CONTROL SEE SECTION N)

- If the motor stops when the F-N-R switch is placed in the 'N' position.
- Check the function of the accelerator switch micro switch. Replace.
- Check the solenoid for stuck contacts. Replace.
- Check for correctly adjusted accelerator linkage. Adjust.

SECTION '6' (BATTERIES DISCHARGE FASTER THAN NORMAL AFTER A FULL CHARGE)(VEHICLES EQUIPPED WITH RESISTOR SYSTEM; FOR VEHICLES EQUIPPED WITH SOLID STATE SPEED CONTROL SEE SECTION N)

- Check battery for loose or corroded terminals. Tighten or clean.
- Check battery electrolyte level. Add distilled water as required.
- Check the specific gravity level of each battery. See Batteries and Charging section 'H of this manual'
- Inspect each battery case for damage. Replace.
- Check the charging circuit for loose connections or broken wires. Tighten or replace.
- Check the A.C. voltage at the battery charger A.C. plug receptacle. 115 Volts, 15 Amps.
- Check that the battery charger A.C. plug is firmly connected to its receptacle. Connect.
- Inspect the D.C. plug and cord for damage.
- Check all wiring in the power transmission and motor circuit for loose connections (accelerator switch, solenoid and motor). Tighten.
- Check the accelerator switch for dirty, burned or worn contacts. Replace.

- Check for full accelerator arm travel. Adjust.
- Inspect the motor for worn or damaged brushes or a dirty commutator. Replace or clean.
- Check for dragging brakes, tire pressure, alignment, excessive wheel bearing drag. Repair.
- Check rear axle function and for signs of axle leakage. Repair.

SECTION '7' (VEHICLE STOPS SUDDENLY)

- Refer to Section '1' and Section '6'

DEAD BATTERY

- Recharge or Replace.

F-N-R SWITCH

- Check function and clean or replace if required.

KEY SWITCH

- Check function and replace if required.

ELECTRICAL SYSTEM

- Trouble-shoot per the Electrical section 'K' (vehicles equipped with resistor system; for vehicles equipped with solid state speed control see section 'N') of this manual. Repair or replace as required.
- F-N-R switch contacts are dirty or pitted. Clean or replace.
- Corrosion at wire connections. Clean or replace.
- Disconnected connection. Connect.
- Broken wire. Repair or replace.
- Open circuit. Trouble-shoot per Electrical section 'K' or 'N' of this manual and repair or replace as required.
- Short circuit. Trouble-shoot per Electrical section 'K' or 'N' of this manual and repair or replace as required.
- Poor connection at terminals. Clean, repair or tighten.

BATTERY

- Check batteries as described in Batteries and Charging section 'H' of this manual.

F-N-R SWITCH

- Check for pitted or arced contacts. Replace components as required.
- Using a VOM, and with F-N-R switch in the'F' position check for continuity between 'A' to 'B' contacts and 'C' to 'D' contacts. Repair or replace switch if '0' is not indicated.
- Using a VOM, and with F-N-R switch in the 'R' position check for continuity between 'A' to 'D' contacts and 'B' to 'C' contacts. Repair or replace switch if '0' is not indicated.

KEY SWITCH

- Use a VOM to check continuity when KEY is in the 'ON' position. Replace switch if reading does not indicate .00 (digital meter) or under 5 ohms (analog meter).
- Resistance should read 'Infinity' when key is in the 'OFF' position. Replace switch if reading does not indicate 'infinity'.

ELECTRIC MOTOR

MOTOR DOES NOT TURN

- Brushes are not contacting the commutator. Check for free movement of brushes.
- Motor terminals are loose or corroded. Tighten or clean.
- Power transmission wires are broken. Check for breaks at joints. Replace.
- Field coil is 'open'. Repair or replace.
- Armature is broken. Repair or replace.

MOTOR TURNS SLOWLY

- Check for poor or inadequate length brushes. Replace.
- Terminals are loose or corroded. Tighten or clean.
- Wires are deffective or have faulty connections. Replace.
- Accelerator wiper motion is incomplete. Adjust.
- Batteries require charging. Charge.

NOISY MOTOR

- Loose mounting bolts. Tighten.
- Foreign matter inside motor. Clean interior of motor.
- Bearing is dirty or defective. Replace.

BEARING OVERHEATING

- Defective bearing. Replace.
- Improper installation of bearing. Adjust or replace.

ERRATIC OPERATION

- Load exceeds specification. Reduce load to specified limits.
- Commutator out of round. Repair or replace. See Electric motor section 'L'of this manual.
- Brushes worn beyond specification. Replace brushes.
- Commutator is excessively rough. Smooth with sandpaper. See Electric motor section 'L' of this manual.
- High mica at commutator. Recondition. See Electric motor section 'L' of this manual.
- Commutator dirty. Clean with an electrical cleaner and dry throughly.
- Armature coil is shorted or broken. Replace.

VIBRATION

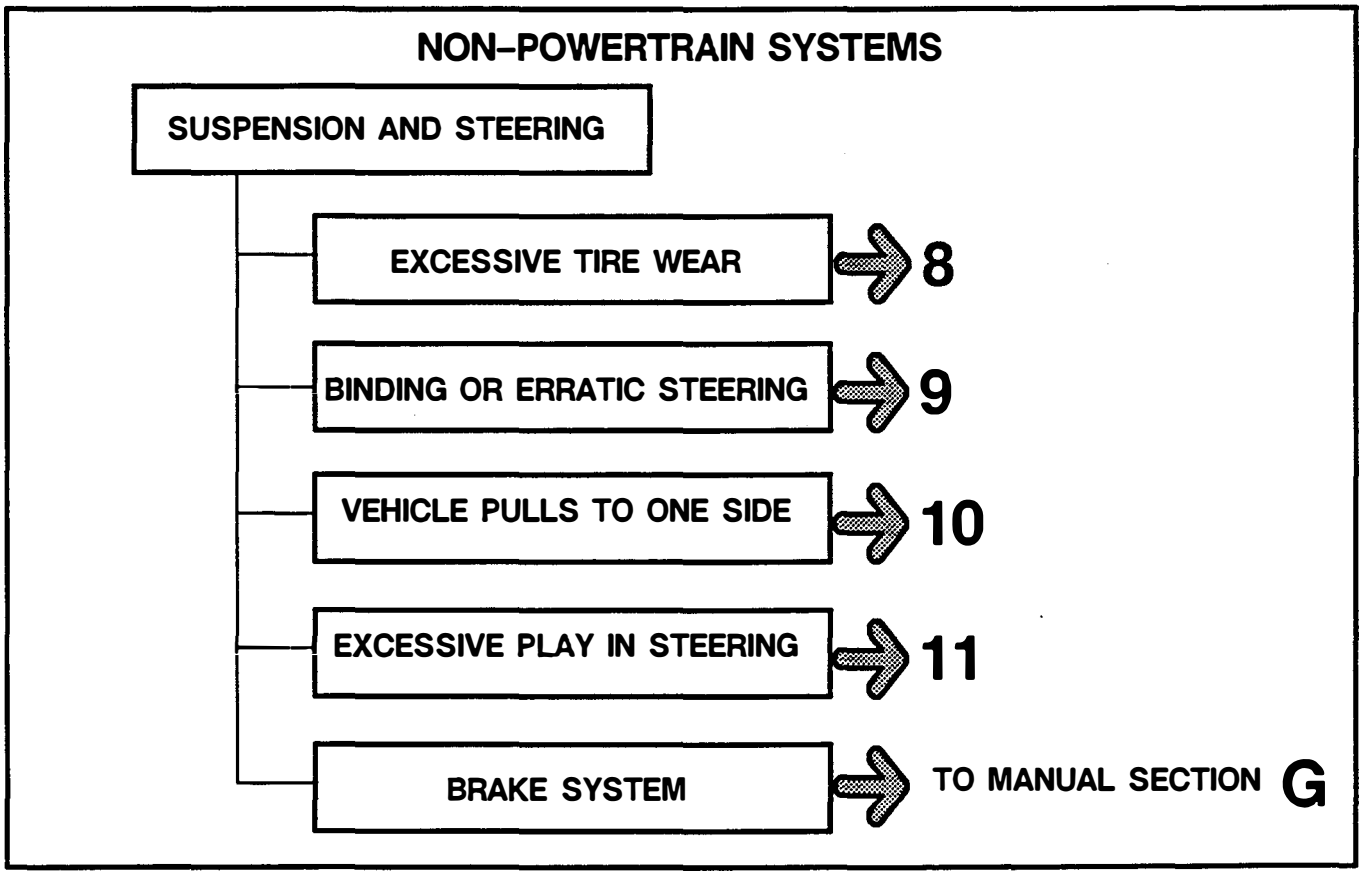
- Motor loose. Tighten.
- Motor turns erratically. Repair or replace.

MOTOR OPERATES AT EXCESSIVE SPEED

- Field coil winding is shorted within motor. Repair or replace field coils. See Electric motor section 'L' of this manual.

SOLENOID (VEHICLES EQUIPPED WITH RESISTOR SYSTEM; FOR VEHICLES EQUIPPED WITH SOLID STATE SPEED CONTROL SEE SECTION N)

- Using a VOM, and with the solenoid in the unenergized position, check for continuity between the small terminals. Replace solenoid if no continuity is indicated.
- Using a VOM, and with the solenoid in the energized position disconnect the 6 gauge wire (solenoid to battery), check for continuity between the large terminals. Replace solenoid if no continuity is indicated.
- Using a VOM, and with the solenoid in the unenergized position, check that resistance between the large terminals indicates infinity. Replace solenoid if value is incorrect.



SECTION '8' (EXCESSIVE TIRE WEAR)

TIRES

- Incorrect tire pressure. Inflate to specified pressure.

WHEEL

- Bent wheel rim. Replace.

WHEEL ALIGNMENT

- Check Alignment. Adjust.
- Spring and suspension component deterioration. Repair.

WHEEL BRAKE

- Dragging wheel brake. Adjust.

SECTION '9' (VEHICLE PULLS TO ONE SIDE)

WHEEL

- Incorrect tire pressure. Inflate to specified pressure.
- Mismatched tires on same axle. Replace with same type tire.
- Bent wheel rim. Replace.

WHEEL ALIGNMENT

- Check alignment. Adjust.
- Spring and suspension component deterioration. Repair.

WHEEL BRAKE

- Dragging wheel brake. Adjust.

FRONT FORK

- Fork bent. Replace.

SECTION '10' (BINDING OR ERRATIC STEERING)

TIRES

- Incorrect tire pressure. Inflate to specified pressure.

WHEEL ALIGNMENT

- Check alignment. Adjust.
- Spring and suspension component deterioration. Repair.

SUSPENSION AND STEERING COMPONENTS

- Dry lubrication joints. Lubricate or replace and lubricate joints.

STEERING BOX

- Damaged steering box components. Repair or replace.

SECTION '11' (EXCESSIVE PLAY IN STEERING)

SUSPENSION COMPONENTS

- Worn suspension components. Repair.

STEERING WHEEL

- Cracked steering wheel insert (hub). Remove steering wheel and inspect. Replace steering wheel if cracked.
- Damaged or stripped splines in steering wheel insert (hub). Remove steering wheel and inspect. Replace steering wheel if damaged. (Do not exceed specified torque).

- Damaged or stripped splines on steering shaft. Remove steering wheel and inspect. Replace steering shaft if damaged.
- Loose steering wheel nut. Tighten to specified torque. (Do not exceed specified torque).
- Worn reduction gear. Replace.
- Worn pinion gear. Replace.
- Worn rack and rod assembly. Replace

STEERING BOX

- Loose steering box. Tighten.

IDLER ARM

- Worn idler arm bushing. Replace.

WHEEL BEARINGS

- Loose wheel bearings. Inspect, repack and tighten or pack and replace.

WHEEL BRAKE

- Wheel brake and entire brake system adjustment and repair is covered under the Brakes section 'G' of this manual.

GOLF CARS (X–440/X–444)

WEIGHT (WITHOUT BATTERIES)	521 POUNDS (3 WHEEL) 565 POUNDS (4 WHEEL)
LENGTH	88 1/2 INCHES (3 WHEEL) 93 INCHES (4 WHEEL)
WIDTH (AT REAR WHEELS)	48 INCHES
TREAD (REAR WHEELS)	39 INCHES
WHEEL BASE	60 INCHES (3 WHEEL) 66 INCHES (4 WHEEL)
HEIGHT AT STEERING WHEEL	48 5/8 INCHES
HEIGHT AT FLOOR	11 INCHES
GROUND CLEARANCE (AT DIFFERENTIAL)	5 INCHES
SEAT HEIGHT	29 INCHES
CLEARANCE CIRCLE	17 FEET 6 INCHES (3 WHEEL) 19 FEET 6 INCHES (4 WHEEL)
LOAD CAPACITY (INCLUDING OPERATOR PASSENGER(S) AND ACCESSORIES)	800 POUNDS
BRAKES	DRUM, MECHANICAL, AUTO–ADJUSTING (REAR WHEELS)
PARKING (HILL) BRAKE	MECHANICAL, AUTOMATIC RELEASE, SELF–COMPENSATING
TIRES	18 X 8.50 X 8, 4 PLY RATED (3 WHEEL) 18 X 8.50 X 8, POWER RIB, (4 WHEEL)
TIRE PRESSURE	18–22 PSI.
ELECTRICAL SYSTEM	36 VOLT D.C., 6 VOLT, DEEP CYCLE LEAD ACID BATTERIES (6)
ACCELERATOR SWITCH	SOLID STATE CONTINUOUSLY VARIABLE SPEED CONTROLLER
DRIVE TRAIN	DIRECT MOTOR SHAFT CONNECTED TO TRANSAXLE PINION SHAFT

GENERAL SPECIFICATIONS

TRANSAXLE	DOUBLE REDUCTION HELICAL GEARING WITH AUTOMOTIVE TYPE DIFFERENTIAL. 12.55:1 RATIO
DIFFERENTIAL LUBRICATION	SAE–80–90 WEIGHT OIL, 8–10 OZ.
SPEED	12 M.P.H.
FRONT SUSPENSION	COIL SPRINGS AND SHOCK ABSORBERS (3 WHEEL) LEAF SPRINGS AND SHOCK ABSORBERS (4 WHEEL)
REAR SUSPENSION	LEAF SPRINGS AND SHOCK ABSORBERS
STEERING	RACK AND PINION
HILL CLIMBING	40% GRADE
BODY	ALL REPLACEABLE STEEL BODY COMPONENTS
.CHASSIS	RECTANGULAR STEEL TUBING
CHARGER	TOTAL CHARGER® III 110–120 VOLTS, 60 CYCLE A.C. INPUT, 21 AMP D.C. 36 VOLTS OUTPUT U.L. AND C.S.A. LISTED

SPIRIT (X–444J)

WEIGHT (WITHOUT BATTERIES)	565 POUNDS
LENGTH	94 INCHES
WIDTH (AT REAR WHEELS)	48 INCHES
TREAD (REAR WHEELS)	39 INCHES
WHEEL BASE	66 INCHES
HEIGHT AT STEERING WHEEL	48 5/8 INCHES
HEIGHT AT FLOOR	11 INCHES
GROUND CLEARANCE (AT DIFFERENTIAL)	5 INCHES
SEAT HEIGHT	29 INCHES
CLEARANCE CIRCLE	19 FEET 6 INCHES
LOAD CAPACITY (INCLUDING OPERATOR PASSENGER(S) AND ACCESSORIES)	800 POUNDS
BRAKES	DRUM, MECHANICAL, AUTO–ADJUSTING (REAR WHEELS)
PARKING (HILL) BRAKE	MECHANICAL, AUTOMATIC RELEASE, SELF–COMPENSATING
TIRES	18 X 8.50 X 8, 4 PLY RATED
TIRE PRESSURE	18–22 PSI.
ELECTRICAL SYSTEM	36 VOLT D.C., 6 VOLT, DEEP CYCLE LEAD ACID BATTERIES (6)
ACCELERATOR SWITCH	SOLID STATE CONTINUOUSLY VARIABLE SPEED CONTROLLER
DRIVE TRAIN	DIRECT, MOTOR SHAFT CONNECTED TO TRANSAXLE PINION SHAFT
TRANSAXLE	DOUBLE REDUCTION HELICAL GEARING WITH AUTOMOTIVE TYPE DIFFERENTIAL. 12.55:1 RATIO
DIFFERENTIAL LUBRICATION	SAE–80–90 WEIGHT OIL, 8–10 OZ.
SPEED	12 M.P.H.
FRONT SUSPENSION	LEAF SPRINGS AND SHOCK ABSORBERS
REAR SUSPENSION	LEAF SPRINGS AND SHOCK ABSORBERS
STEERING	RACK AND PINION

GENERAL SPECIFICATIONS

HILL CLIMBING	40% GRADE
BODY	ALL REPLACEABLE PLASTIC AND STEEL BODY COMPONENTS
CHASSIS	RECTANGULAR STEEL TUBING
CHARGER	TOTAL CHARGER® 110–120 VOLTS, 60 CYCLE A.C. INPUT, 21 AMP D.C. 36 VOLT OUTPUT, U.L. AND C.S.A. LISTED
LIGHTING	DUAL HALOGEN HEADLIGHTS, TAILLIGHTS AND BRAKE LIGHTS. OPTIONAL FRONT AND REAR TURN SIGNAL SWITCH/INDICATOR.
HORN	ELECTRIC

FREEDOM (X–444F)

WEIGHT (WITHOUT BATTERIES)	565 POUNDS
LENGTH	93 INCHES
WIDTH (AT REAR WHEELS)	48 INCHES
TREAD (REAR WHEELS)	39 INCHES
WHEEL BASE	66 INCHES
HEIGHT AT STEERING WHEEL	48 5/8 INCHES
HEIGHT AT FLOOR	11 INCHES
GROUND CLEARANCE (AT DIFFERENTIAL)	5 INCHES
SEAT HEIGHT	29 INCHES
CLEARANCE CIRCLE	19 FEET 6 INCHES
LOAD CAPACITY (INCLUDING OPERATOR PASSENGER(S) AND ACCESSORIES)	800 POUNDS
BRAKES	DRUM, MECHANICAL, AUTO–ADJUSTING (REAR WHEELS)
PARKING (HILL) BRAKE	MECHANICAL, AUTOMATIC RELEASE, SELF–COMPENSATING
TIRES	18 X 8.50 X 8, POWER RIB, 4 PLY RATED
TIRE PRESSURE	18–22 PSI.
ELECTRICAL SYSTEM	36 VOLT D.C., 6 VOLT, DEEP CYCLE LEAD ACID BATTERIES (6)
ACCELERATOR SWITCH	SOLID STATE CONTINUOUSLY VARIABLE SPEED CONTROLLER
DRIVE TRAIN	DIRECT, MOTOR SHAFT CONNECTED TO TRANS-AXLE PINION SHAFT
TRANSAXLE	DOUBLE REDUCTION HELICAL GEARING WITH AUTOMOTIVE TYPE DIFFERENTIAL. 12.55:1 RATIO
DIFFERENTIAL LUBRICATION	SAE–80–90 WEIGHT OIL, 8–10 OZ.
SPEED	12 M.P.H.
FRONT SUSPENSION	LEAF SPRINGS AND SHOCK ABSORBERS
REAR SUSPENSION	LEAF SPRINGS AND SHOCK ABSORBERS
STEERING	RACK AND PINION

GENERAL SPECIFICATIONS

HILL CLIMBING	40% GRADE
BODY	ALL REPLACEABLE STEEL BODY COMPONENTS
CHASSIS	RECTANGULAR STEEL TUBING
CHARGER	TOTAL CHARGER® III 110–120 VOLTS, 60 CYCLE A.C. INPUT, 21 AMP D.C. 36 VOLT OUTPUT, U.L. AND C.S.A. LISTED
LIGHTING	DUAL HALOGEN HEADLIGHTS, TAILLIGHTS AND BRAKE LIGHTS. OPTIONAL FRONT AND REAR TURN SIGNAL SWITCH/INDICATOR.
HORN	ELECTRIC

PERSONNEL CARRIER (PC4X)

WEIGHT (WITHOUT BATTERIES)	666 POUNDS
LENGTH (INCLUDING FOOT REST)	106 INCHES
WIDTH (AT REAR WHEELS)	48 INCHES
TREAD (REAR WHEELS)	39 INCHES
WHEEL BASE	66 INCHES
HEIGHT AT STEERING WHEEL	48 5/8 INCHES
HEIGHT AT FLOOR	11 INCHES
GROUND CLEARANCE (AT DIFFERENTIAL)	5 INCHES
SEAT HEIGHT	29 INCHES
INTERSECTING AISLE CLEARANCE	75 INCHES
CLEARANCE CIRCLE	19 FEET 6 INCHES
LOAD CAPACITY (INCLUDING OPERATOR PASSENGER(S) AND ACCESSORIES)	800 POUNDS
BRAKES	DRUM, MECHANICAL, AUTO–ADJUSTING (REAR WHEELS)
PARKING (HILL) BRAKE	MECHANICAL, AUTOMATIC RELEASE, SELF–COMPENSATING
TIRES	18.5 X 8.50 X 8, POWER CUSHION, 6 PLY RATED
TIRE PRESSURE	18–22 PSI.
ELECTRICAL SYSTEM	36 VOLT D.C., 6 VOLT, DEEP CYCLE LEAD ACID BATTERIES (6)
ACCELERATOR SWITCH	FOUR SPEED, SINGLE SOLENOID, SELF–ADJUSTING WIPER ARM CONTACT
DRIVE TRAIN	DIRECT, MOTOR SHAFT CONNECTED TO TRANS-AXLE PINION SHAFT
TRANSAXLE	DOUBLE REDUCTION HELICAL GEARING WITH AUTOMOTIVE TYPE DIFFERENTIAL. 12.45:1 RATIO
DIFFERENTIAL LUBRICATION	SAE–80–90 WEIGHT OIL, 8–10 OZ.
SPEED	12 M.P.H.
FRONT SUSPENSION	HEAVY DUTY LEAF SPRINGS AND SHOCK ABSORBERS

GENERAL SPECIFICATIONS

REAR SUSPENSION	HEAVY DUTY LEAF SPRINGS AND SHOCK ABSORBERS
STEERING	RACK AND PINION
HILL CLIMBING	40% GRADE
BODY	ALL REPLACEABLE STEEL BODY COMPONENTS
CHASSIS	RECTANGULAR STEEL TUBING
CHARGER	TOTAL CHARGER® III 110–120 VOLTS, 60 CYCLE A.C. INPUT, 21 AMP D.C. 36 VOLT OUTPUT, U.L. AND C.S.A. LISTED
LIGHTING	DUAL HALOGEN HEADLIGHTS, TAILLIGHTS AND BRAKE LIGHTS. OPTIONAL FRONT AND REAR TURN SIGNAL SWITCH/INDICATOR.
HORN	ELECTRIC

LIBERTY (PC4XJ) – 1989 ONLY

WEIGHT (WITHOUT BATTERIES)	668 POUNDS
LENGTH (INCLUDING FOOT REST)	107 INCHES
WIDTH (AT REAR WHEELS)	48 INCHES
TREAD (REAR WHEELS)	39 INCHES
WHEEL BASE	66 INCHES
HEIGHT AT STEERING WHEEL	48 5/8 INCHES
HEIGHT AT FLOOR	11 INCHES
GROUND CLEARANCE (AT DIFFERENTIAL)	5 INCHES
SEAT HEIGHT	29 INCHES
CLEARANCE CIRCLE	18 FEET 6 INCHES
LOAD CAPACITY (INCLUDING OPERATOR PASSENGER(S) AND ACCESSORIES)	800 POUNDS
BRAKES	DRUM, MECHANICAL, AUTO–ADJUSTING (REAR WHEELS)
PARKING (HILL) BRAKE	MECHANICAL, AUTOMATIC RELEASE, SELF–COMPENSATING
TIRES	18.5 X 8.50 X 8, 6 PLY RATED
TIRE PRESSURE	18–22 PSI.
ELECTRICAL SYSTEM	36 VOLT D.C., 6 VOLT, DEEP CYCLE LEAD ACID BATTERIES (6)
ACCELERATOR SWITCH	FOUR SPEED, SINGLE SOLENOID, SELF–ADJUSTING WIPER ARM CONTACT
DRIVE TRAIN	DIRECT, MOTOR SHAFT CONNECTED TO TRANS-AXLE PINION SHAFT
TRANSAXLE	DOUBLE REDUCTION HELICAL GEARING WITH AUTOMOTIVE TYPE DIFFERENTIAL. 12.55:1 RATIO
DIFFERENTIAL LUBRICATION	SAE–80–90 WEIGHT OIL, 8–10 OZ.
SPEED	12 M.P.H.
FRONT SUSPENSION	HEAVY DUTY LEAF SPRINGS AND SHOCK ABSORBERS
REAR SUSPENSION	HEAVY DUTY LEAF SPRINGS AND SHOCK ABSORBERS

GENERAL SPECIFICATIONS

STEERING	RACK AND PINION
HILL CLIMBING	40% GRADE
BODY	ALL REPLACEABLE PLASTIC AND STEEL BODY COMPONENTS
CHASSIS	RECTANGULAR STEEL TUBING
CHARGER	TOTAL CHARGER® 110–120 VOLTS, 60 CYCLE A.C. INPUT, 21 AMP D.C. 36 VOLT OUTPUT, U.L. AND C.S.A. LISTED
LIGHTING	DUAL HALOGEN HEADLIGHTS, TAILLIGHTS AND BRAKE LIGHTS. OPTIONAL FRONT AND REAR TURN SIGNAL SWITCH/INDICATOR.
HORN	ELECTRIC

INDUSTRIAL PERSONNEL CARRIER (PC4XI)

WEIGHT (WITHOUT BATTERIES)	667 POUNDS
LENGTH (INCLUDING FOOT REST)	106 INCHES
WIDTH (AT REAR WHEELS)	48 INCHES
TREAD (REAR WHEELS)	39 INCHES
WHEEL BASE	66 INCHES
HEIGHT AT STEERING WHEEL	48 5/8 INCHES
HEIGHT AT FLOOR	11 INCHES
GROUND CLEARANCE (AT DIFFERENTIAL)	5 INCHES
SEAT HEIGHT	29 INCHES
INTERSECTING AISLE CLEARANCE	75 INCHES
CLEARANCE CIRCLE	19 FEET 6 INCHES
LOAD CAPACITY (INCLUDING OPERATOR PASSENGER(S) AND ACCESSORIES)	800 POUNDS
BRAKES	DRUM, MECHANICAL, AUTO ADJUSTING (REAR WHEELS)
PARKING (HILL) BRAKE	MECHANICAL, AUTOMATIC RELEASE, SELF–COMPENSATING
TIRES	5.70 X 8, INDUSTRIAL TYPE, 6 PLY RATED
TIRE PRESSURE	50–60 PSI.
ELECTRICAL SYSTEM	36 VOLT D.C., 6 VOLT, DEEP CYCLE LEAD ACID BATTERIES (6)
ACCELERATOR SWITCH	FOUR SPEED, SINGLE SOLENOID, SELF–ADJUSTING WIPER ARM CONTACT
DRIVE TRAIN	DIRECT, MOTOR SHAFT CONNECTED TO TRANS-AXLE PINION SHAFT
TRANSAXLE	DOUBLE REDUCTION HELICAL GEARING WITH AUTOMOTIVE TYPE DIFFERENTIAL. 12.45:1 RATIO
DIFFERENTIAL LUBRICATION	SAE–80–90 WEIGHT OIL, 8–10 OZ.
SPEED	12 M.P.H.
FRONT SUSPENSION	HEAVY DUTY LEAF SPRINGS AND SHOCK ABSORBERS

REAR SUSPENSION	HEAVY DUTY LEAF SPRINGS AND SHOCK ABSORBERS
STEERING	RACK AND PINION
HILL CLIMBING	40% GRADE
BODY	ALL REPLACEABLE STEEL BODY COMPONENTS
CHASSIS	RECTANGULAR STEEL TUBING
CHARGER	TOTAL CHARGER® III 110–120 VOLTS, 60 CYCLE A.C. INPUT, 21 AMP D.C. 36 VOLT OUTPUT, U.L. AND C.S.A. LISTED
LIGHTING	DUAL HALOGEN HEADLIGHTS, TAILLIGHTS AND BRAKE LIGHTS. OPTIONAL FRONT AND REAR TURN SIGNAL SWITCH/INDICATOR.
HORN	ELECTRIC

TURF TRUCK (XT–300/500)

WEIGHT (WITHOUT BATTERIES)	640 POUNDS (3 WHEEL) 715 POUNDS (4 WHEEL)
LENGTH	92 INCHES (3 WHEEL) 96 INCHES (4 WHEEL)
WIDTH (AT REAR WHEELS)	48 INCHES
TREAD (REAR WHEELS)	39 INCHES
WHEEL BASE	60 INCHES (3 WHEEL) 66 INCHES (4 WHEEL)
HEIGHT AT STEERING WHEEL	48 5/8 INCHES
HEIGHT AT FLOOR	11 INCHES
GROUND CLEARANCE (AT DIFFERENTIAL)	5 INCHES
SEAT HEIGHT	29 INCHES
CLEARANCE CIRCLE	17 FEET 6 INCHES (3 WHEEL) 19 FEET 6 INCHES (4 WHEEL)
LOAD CAPACITY (INCLUDING OPERATOR PASSENGER(S) AND ACCESSORIES)	1000 POUNDS
LOAD BED SIZE	44 INCHES WIDE, 40 INCHES LONG, 8 INCHES DEEP
LOAD BED HEIGHT	24 INCHES
BRAKES	DRUM, MECHANICAL, AUTO–ADJUSTING (REAR WHEELS)
PARKING (HILL) BRAKE	MECHANICAL, AUTOMATIC RELEASE, SELF–COMPENSATING
TIRES	18 X 8.50 X 8, POWER RIB, 4 PLY RATED
TIRE PRESSURE	18–22 PSI.
ELECTRICAL SYSTEM	36 VOLT D.C., 6 VOLT, DEEP CYCLE LEAD ACID BATTERIES (6)
ACCELERATOR SWITCH	FOUR SPEED, SINGLE SOLENOID, SELF–ADJUSTING WIPER ARM CONTACT
DRIVE TRAIN	DIRECT, MOTOR SHAFT CONNECTED TO TRANS-AXLE PINION SHAFT
TRANSAXLE	DOUBLE REDUCTION HELICAL GEARING WITH AUTOMOTIVE TYPE DIFFERENTIAL. 12.45:1 RATIO

DIFFERENTIAL LUBRICATION	SAE–80–90 WEIGHT OIL, 8–10 OZ.
SPEED	12 M.P.H.
FRONT SUSPENSION	HEAVY DUTY COIL SPRINGS AND SHOCK ABSORBERS (3 WHEEL) HEAVY DUTY LEAF SPRINGS AND SHOCK ABSORBERS (4 WHEEL)
REAR SUSPENSION	HEAVY DUTY LEAF SPRINGS AND SHOCK ABSORBERS
STEERING	RACK AND PINION
HILL CLIMBING	40% GRADE
BODY	ALL REPLACEABLE STEEL BODY COMPONENTS
CHASSIS	RECTANGULAR STEEL TUBING
CHARGER	TOTAL CHARGER® III 110–120 VOLTS, 60 CYCLE A.C. INPUT, 21 AMP D.C. 36 VOLT OUTPUT, U.L. AND C.S.A. LISTED
HORN	ELECTRIC

INDUSTRIAL TRUCK (XI–300/500)

WEIGHT (WITHOUT BATTERIES)	680 POUNDS (3 WHEEL) 755 POUNDS (4 WHEEL)
LENGTH	92 INCHES (3 WHEEL) 96 INCHES (4 WHEEL)
WIDTH (AT REAR WHEELS)	48 INCHES
TREAD (REAR WHEELS)	39 INCHES
WHEEL BASE	60 INCHES (3 WHEEL) 66 INCHES (4 WHEEL)
HEIGHT AT STEERING WHEEL	48 5/8 INCHES
HEIGHT AT FLOOR	11 INCHES
GROUND CLEARANCE (AT DIFFERENTIAL)	5 INCHES
SEAT HEIGHT	29 INCHES
CLEARANCE CIRCLE	17.6 FEET (3 WHEEL) 18.6 FEET (4 WHEEL)
INTERSECTING AISLE CLEARANCE	72 INCHES (3 WHEEL) 75 INCHES (4 WHEEL)
LOAD CAPACITY (INCLUDING OPERATOR PASSENGER(S) AND ACCESSORIES)	1000 POUNDS
LOAD BED SIZE	44 INCHES WIDE, 28 INCHES LONG, 8 INCHES DEEP
LOAD BED HEIGHT	24 INCHES
BRAKES	DRUM, MECHANICAL, AUTO–ADJUSTING (REAR WHEELS)
PARKING (HILL) BRAKE	MECHANICAL, AUTOMATIC RELEASE, SELF–COMPENSATING
TIRES	5.70 X 8, INDUSTRIAL TYPE, 4 PLY RATED
TIRE PRESSURE	50–60 PSI.
ELECTRICAL SYSTEM	36 VOLT D.C., 6 VOLT, DEEP CYCLE LEAD ACID BATTERIES (6)
ACCELERATOR SWITCH	FOUR SPEED, SINGLE SOLENOID, SELF–ADJUSTING WIPER ARM CONTACT

GENERAL SPECIFICATIONS

DRIVE TRAIN	DIRECT, MOTOR SHAFT CONNECTED TO TRANS-AXLE PINION SHAFT
TRANSAXLE	DOUBLE REDUCTION HELICAL GEARING WITH AUTOMOTIVE TYPE DIFFERENTIAL. 14.78:1 RATIO
DIFFERENTIAL LUBRICATION	SAE–80–90 WEIGHT OIL, 8–10 OZ.
SPEED	12 M.P.H.
FRONT SUSPENSION	HEAVY DUTY COIL SPRINGS AND SHOCK ABSORBERS (3 WHEEL) HEAVY DUTY LEAF SPRINGS AND SHOCK ABSORBERS (4 WHEEL)
REAR SUSPENSION	HEAVY DUTY LEAF SPRINGS AND SHOCK ABSORBERS
STEERING	RACK AND PINION
HILL CLIMBING	40% GRADE
BODY	ALL REPLACEABLE STEEL BODY COMPONENTS
CHASSIS	RECTANGULAR STEEL TUBING
CHARGER	TOTAL CHARGER® III (ON BOARD) 110–120 VOLTS, 60 CYCLE A.C. INPUT, 21 AMP D.C. 36 VOLT OUTPUT, U.L. AND C.S.A. LISTED
LIGHTING	DUAL HALOGEN HEADLIGHTS, TAILLIGHTS AND BRAKE LIGHTS.
HORN	ELECTRIC

GS–726–006	REVISION: – – –	TITLE: General Specification: Lightning Protection And Grounding
EFFECTIVE: 10/19/92	SUPERCEDES:	

1. Grounding Requirements

For the purpose of this specification, building ground systems should serve two primary functions: personal safety and equipment protection. In order to be effective, all elements and functions of building ground system must receive equal consideration in design and installation. Once installed, it is up to the owner to adequately maintain the system by implementing periodic inspections and ground tests in order to determine its effectiveness.

2. Ground Systems

All electronic equipment is inherently related to earth by capacitive coupling, accidental or incidental contact and intentional connection. The earth forms a natural readily available form of common potential reference for all electrical circuits. For maximum effectiveness, grounding must be looked at from a total system viewpoint, with various sub–systems comprising the total facility ground system. The interconnection of the various sub–systems into a building ground system will provide a direct path, of known low impedance, between earth and the various electrical and other equipment. This effectively extends an approximation of ground reference throughout the building. The total building ground system is composed of an earth electrode system, a lightning protection system and an equipment fault protective system.

Resistance To Earth: The resistance to earth of the ground system should not exceed 10 ohms. Where the resistance of 10 ohms cannot be obtained due to high soil resistivity, rock formations or other abnormal conditions, alternate methods of reducing the resistance to earth must be considered.

Chemical Treatments: No salt, coke or other chemicals may be used to treat the soil in order to obtain the required ground resistance readings. Approved methods of enhancement are bentonite clay or the GEM product for ground enhancement as manufactured by Erico Products of Solon, Ohio.

Ground Tests: The resistance to earth of the ground system shall be measured by the "Fall of Potential Method". Acceptable resistance meters/testers are those manufactured by Biddle or AEMC.

3. Lightning Protection Requirements

The external lightning protection system shall be designed and installed by a contractor who specializes in the lightning protection field. The contractor must be listed with Underwriters Laboratories Inc. and be in good standing. All work shall be under the direct supervision of a Certified Master Installer with current credentials from the Lightning Protection Institute.

The materials and design for the structure will comply with the most recent edition of the National Fire Protection Association Lightning Protection Code, NFPA 780 and the Materials Standard for Safety from Underwriters Laboratories UL96. Materials for this project may be those of Harger Lightning Protection, 1066 Campus Drive, Mundelein, Illinois (800–842–7437).

Upon completion of the project, the contractor will supply to the owner the Master Label issued by Underwriters Laboratories.

4. Equipment Fault And Personal Safety System

   The standard method of providing an equipment fault protection ground network is to run a good ground conductor (green wire) through the conduit together with the AC distribution system. This method is required for all types of conduit, including metallic.

5. Ground Network Requirements

   Install the conduit in accordance with local regulations or as prescribed by the National Electrical Code.

6. External Grounding Requirements

   For optimum results, earth electrode installation must be accomplished early in the construction of a new site. The earth electrode system should be established at the same time utilities are installed to insure proper interconnection of all utility grounds/systems.

   For existing sites, the earth electrode installation shall be constructed using the most economical means possible in order to meet the intent of this specification.

   Prior to the installation or design of the ground system, a survey should be taken in order to determine the earth resistivity, types of soil or any manmade features that may have significant effect upon the efficiency of the grounding system. Based on the information gathered, deviations from this specification (Exceeding normal requirements) may be necessary in order to achieve desired results.

7. Materials

   Ground Rod Electrodes: Ground rod electrodes shall have a minimum diameter of 5/8" and be no less than 10'–0" in length. Rods may be copper, copper–clad steel or stainless steel. Galvanized steel rods are not permitted unless it is determined that the galvanized rod will have a longer life expectancy due to soil conditions.

   Ground Rod Spacing: Ground rods shall not be spaced at intervals exceeding 60'–0" around the perimeter of the structure.

   Ground Loop Conductor: In no case shall the ground loop conductor be smaller than a 2/0 AWG bare, stranded, soft drawn copper wire. The ground loop must be installed at least 24" below grade and be at least 24" away from the structure. All bends in the conductor shall have a minimum radius of 8" and be no less than 90 degrees.

   Ground Mats: In areas where electrodes cannot be driven, a ground mat consisting of a #6 solid copper or a copper–copper clad steel mesh, utilizing a 12" x 12" cross pattern may be used. All inter–connections in the mesh shall be brazed or silver soldered.

   Ground Plates: Ground plates if utilized shall be 24" x 24" x .032 thick solid copper. Ground plates should only be used if a ground rod cannot be driven.

Ground Connections: Unless otherwise specified or approved by the owner, all connections below grade shall be by exothermic weld (Cadweld). Where exothermic welds may not be practical, UL approved grounding clamps that utilize two bolts for pressure may be used. NOTE: Prior approval must be obtained in order to use mechanical connection below grade.

8. Earth Electrode System

The earth electrode system consists of a network of earth electrode rods, plates, mats or grids and their interconnecting conductors. The extensions into the building are used as the principle grounding point for connecting to the ground system serving the building. Ground potential is established by electrodes in the earth.

An electrode may be a metallic water pipe that has no isolation joints, a system of buried, driven rods interconnected with a bare wire that normally forms a ring around the building or a ground plane of horizontal buried wires. Depending upon soil conditions, building design and the existing water pipe networks, an electrode may be a combination of any of the above mentioned systems.

9. Lightning Protection System

The lightning protection system provides a non–destructive path to ground for lightning energy contacting or induced onto or in a building. To effectively protect from lightning damage, air terminals are installed according to the National Fire Protection Association Lightning Protection Code (NFPA 780). Air terminals will intercept the discharge to keep it from penetrating or structurally damaging the building. This is done by providing a low impedance path from the air terminals to the earth electrode system.

10. Equipment Fault And Personal Safety System

The equipment fault protective system ensures that personnel are protected from shock hazard and equipment is protected from damage or destruction resulting from faults (lightning induced surges) that may develop in the electrical system. Deliberately engineered ground conductors (green wire safety ground) shall be provided throughout the AC distribution system to afford electrical paths of sufficient capacity, so that protective devices can operate promptly and efficiently. The use of conduit for grounding in lieu of a dedicated green wire is unacceptable.

Install the green wire ground (#6 stranded) with the AC power distribution conductors. There shall be no green wires spliced within the conduit. All splices shall be performed at the appropriate junction boxes.

Bond the ground conductor to all pull boxes, junction boxes and power panels.

In existing facilities where an existing conduit is not large enough to accommodate an additional ground conductor, or where a conduit section is insulated from other conduit sections, an external ground conductor may be installed to maintain continuity. All mounting hardware and connectors shall be UL approved.

All DC chargers are to be grounded to the green wire ground using UL approved connectors. At no point should the chargers be isolated from the grounding system.

All interior grounding should return to a single ground point. From this location it is then connected to the exterior ground system.

Optional Interior Ground Halo: If an interior ground halo is to be installed around the inside perimeter of the structure, this conductor (#2/0 green insulated minimum) shall be securely fastened to the structure. All connections to the halo shall be made using UL listed connectors.

Transient Voltage Surge Suppression: TVSS shall be provided at the main electrical service entrance panel. Protection at this point shall be as follows:

UL 1449 Listed device
25,000 ampere surge capacity with maximum 495 volt clamping voltage
Protection should be Line to Ground, Neutral to Ground and Line To Neutral
Internally fused for safety
Failure mode indicator lights

Suppression may be as the 14000 series of Harger Lightning Protection, Inc., 1066 Campus Drive, Mundelein, IL (800–842–7437), or MBP 120EFI series from EFI Electronics Corporation, 2415 South 2300 West, Salt Lake City, UT (801–977–9009).

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