SECTION 17

ELECTRICAL (1)

ENGINE ELECTRICAL SYSTEM

ELECTRICAL (2)

A. Description

The electrical system of the engine can be classified into three basic groupes:

1. Ignition circuit
2. Starting circuit
3. Charging circuit

In the 360 and 400 vehicles, the motor-generator is used for starting and charging circuit, and as a result, inspection and maintenance is easy.
In the 600 vehicle, an AC generator is used for charging circuit and a starter motor for starting circuit.

Battey:

The battery supplies power to all circuit, and inspection and maintenance is necessary. When trouble shooting any circuit, inspection must start with the battery, and then proceed to the individual system.
Battery maintenance and inspection is described in the SECTION 2. ENGINE TUNE-UP and SECTION 19. PERIODIC MAINTENACE.

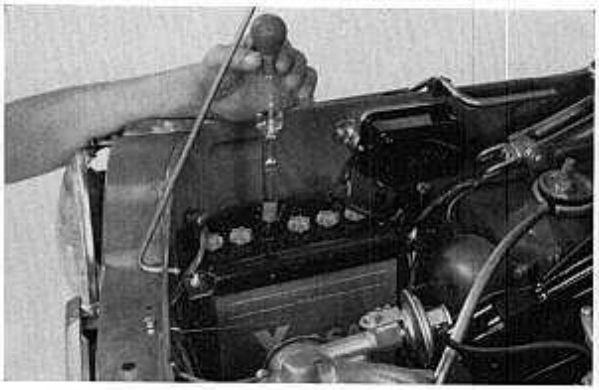


Fig. 17A-1

B. Ignition System

See SECTION 4. E. IGNITION.

C. Starting and Charging Circuit (360 and 400)

a. Description

The starting and charging circuit consists of the battery, motor-generator, ignition switch, and related wiring. These are electrically connected as shown in Fig. 17A-2 below.

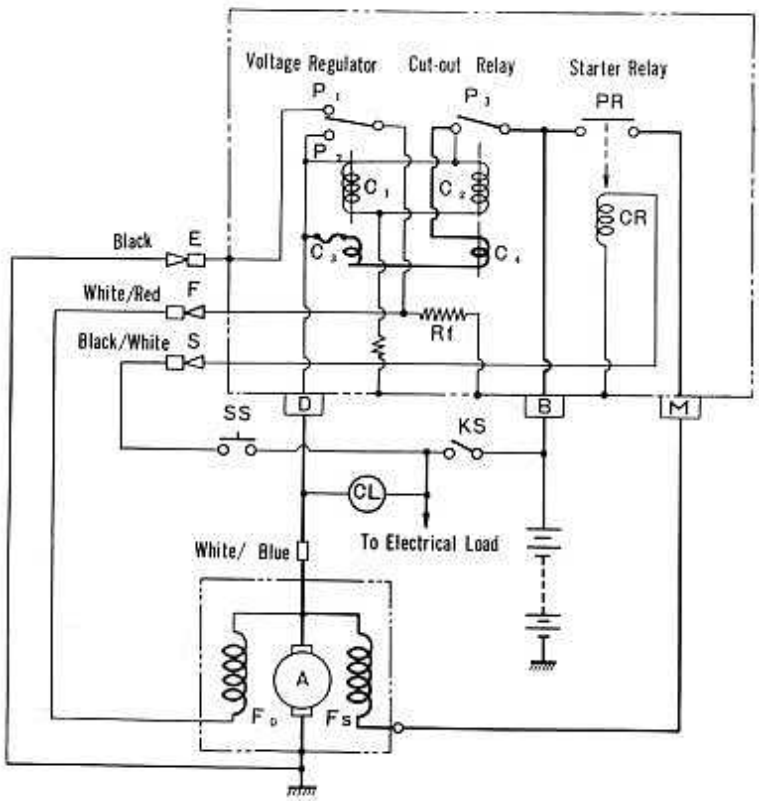


Fig. 17A-2

b. Technical Data

Motor-Generator		
Motor characteristic	Output (rated)	350W
	No-load Speed	Below 1,000 rpm
	Torque (no-load)	Over 0.5kg-m Over 350 rpm, at 10.6 V, 50A.
	Torque (locked)	Over 2.7 kg-m, Below 180A
Generator characteristic	Output (rated)	250W
	Speed (no-load)	Below 1,350 rpm at 13.5V, 25°C.
	Speed (loaded)	Below 1,700 rpm at 13.5V, 18A (cold-20 to 30°C)
Brush Length	26mm (1.02 in)	
Regulator	Adjusted voltage	14.8 to 15.8V
	Voltage (loaded)	13V or higher (with load of 8A)
	Cut-in voltage	12.5 to 13.5V
	Reverse current	4 to 12A
Starter Relay	Operating voltage	Less than 8V
	Operating current	Less than 2.5A (when operated 8V)
	Contact resistance	Less than 0.2V (100A)
	Weight	0.7 kg (1.54 lbs)

c. Maintenance

The rotor of the motor-generator is installed on the crankshaft end at the right hand side of the engine The crankshaft pulley is located at the end of the rotor. The motor-generator operates not only as a starter to start the engine but also charges the battery and supplies power to the load as a generator.

It is a DC 12V type, and compactly arranged field coils (eight) are installed on the stator.

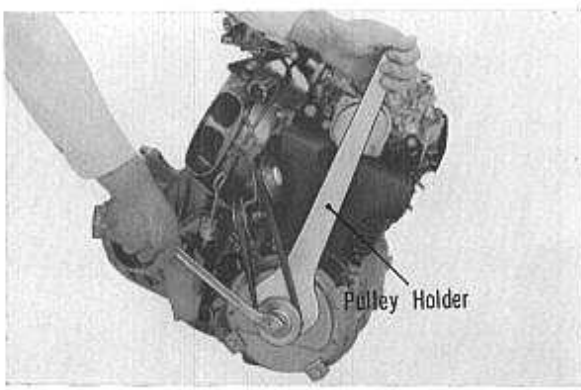


Fig. 17A-3

1. Remove battery.
2. Remove crankshaft pulley.
   The crankshaft pulley has two flat surfaces inward. The pulley holder (special tool) is inserted and forced against these surfaces to grip the pulley. The pulley bolt is loosened by using a socket wrench. **(Fig. 17A-3)**

   Note:
   This tool is not tightened but is used to grip the pulley.

3. Remove generator cover with special tool generator cover nut wrench. **(Fig. 17A-4)**

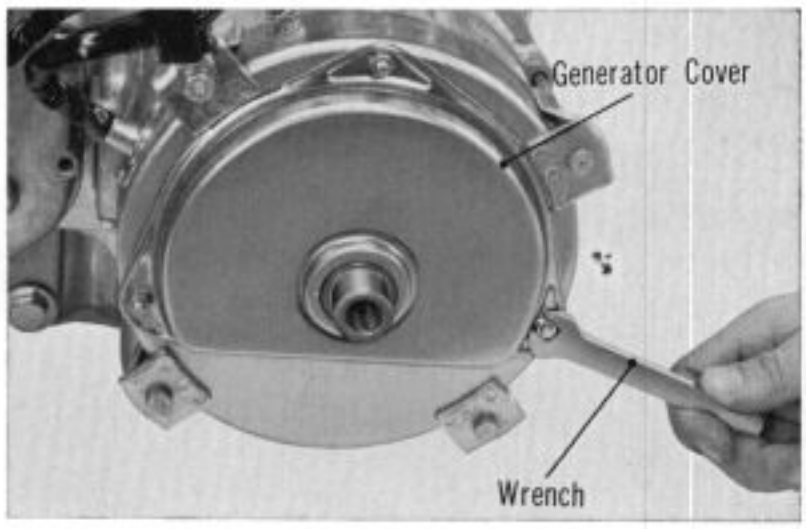


Fig. 17A-4

4. Check brush wear.

   If the length is less than 12mm (0.47 in), replace with new brushes. (Groove indicates the wear limit.)

Fig. 17A-5

5. Remove the stator.
6. Thread in the special tool rotor remover fully, and tap the remover lightly with a hammer. The rotor can then be pulled off the crankshaft.

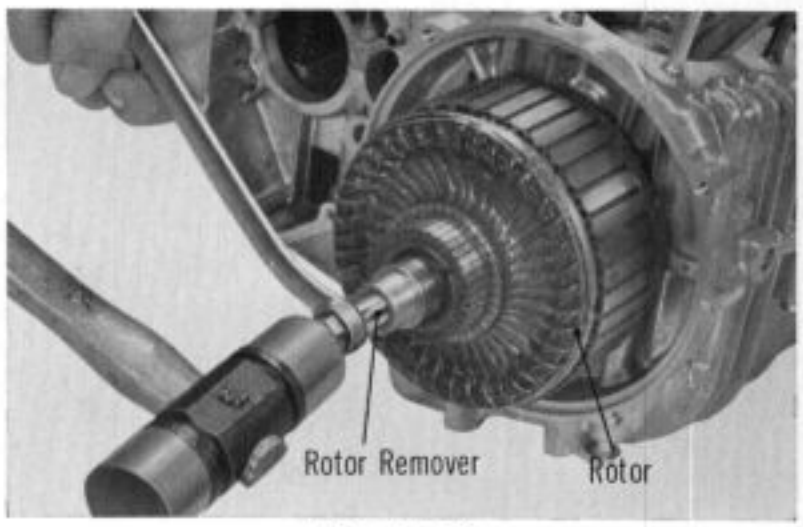


Fig. 17A-6

When reinstalling, match the crankshaft guide pin and rotor limit.

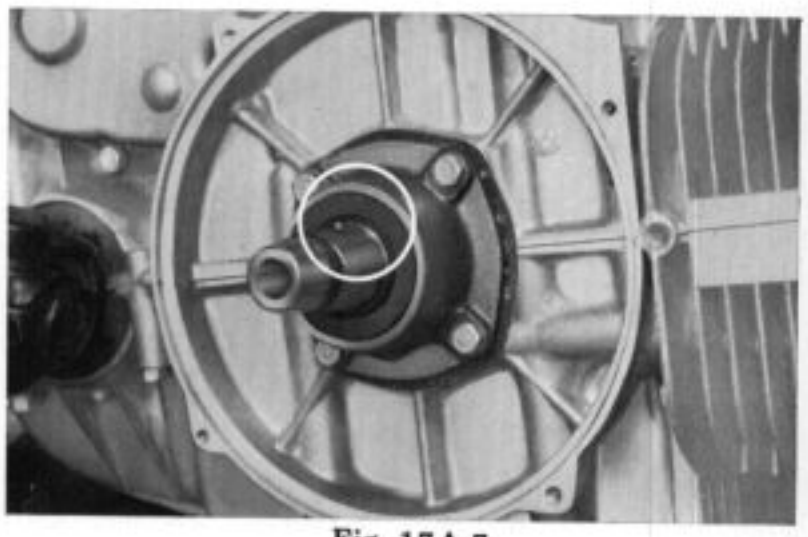


Fig. 17A-7

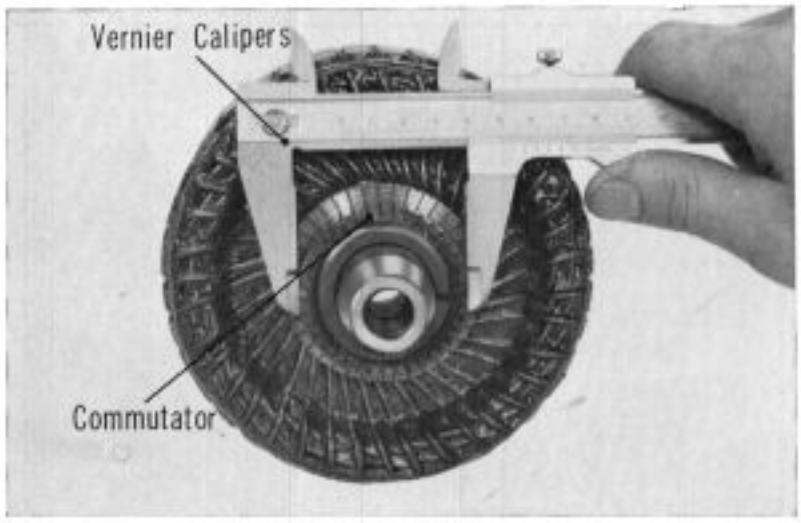


Fig. 17A-8

7. Measure commutator wear with vernier calipers.

   If the commutator outer diameter is less than 49mm (1.93 in), replace.

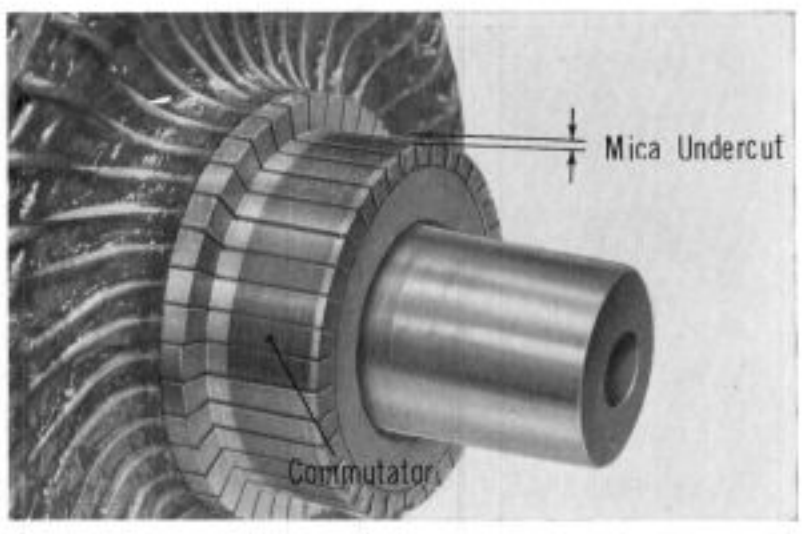


Fig. 17A-9

8. Measure the mica undercut.

   If the depth is less than 0.2mm (0.008 in), undercut to 0.5 to 0.8mm (0.020 to 0.032 in).

Fig. 17A-10

9. Measure resistance between the rotor coil and shaft. If the value is 10MΩ or more, the condition is satisfactory.

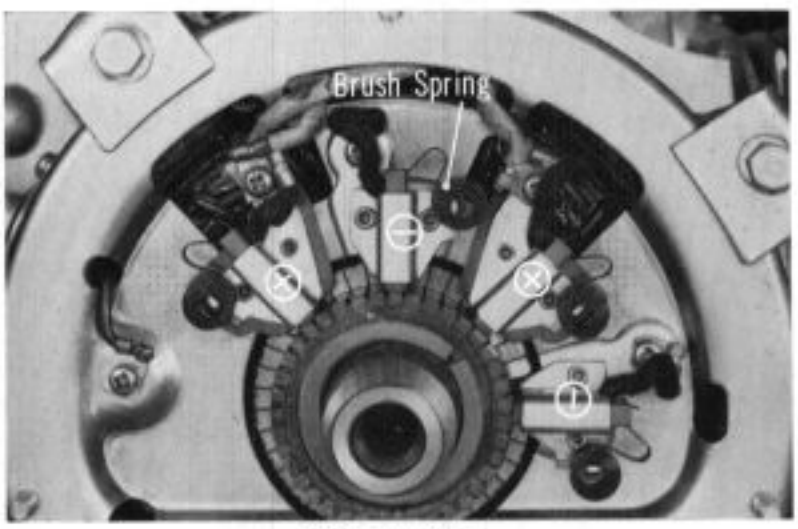


Fig. 17A-11

10. Measure brush spring tension.

    With a new brush installed, measure tension with a spring scale. If less than 500 grams (1.102 lb), replace.

11. Regulator

The regulator consists of two elements, 2-contact type voltage regulator and starter relays which function as a magnetic switch when operating as a starter. Wiring is shown in Fig. 17A-2.

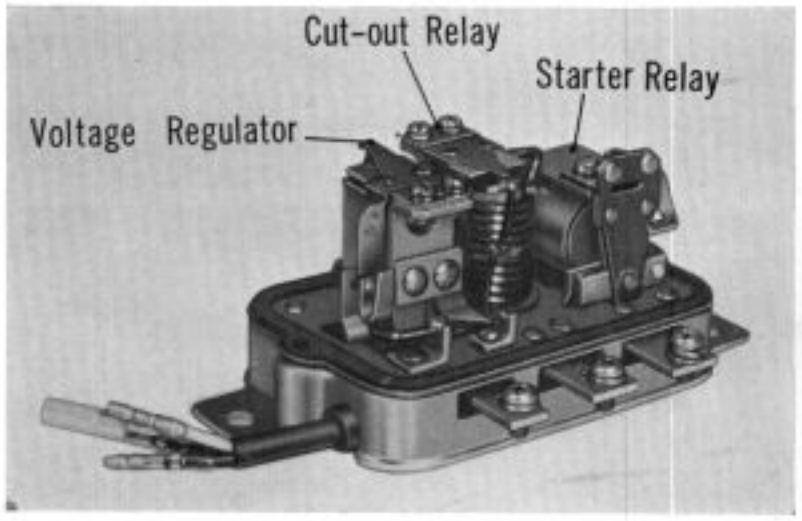


Fig. 17A-12

d. Trouble Diagnosis

1. When not charging or when charging value is low:

Disconnect connector wiring, and ground the F terminal (white/red lead) at the motor-generator for a very short period of time. Gradually reduce engine speed to 2,000 rpm. Check voltage generated at the D terminal at this time; if more than 15V, the condition is satisfactory.

Fig. 17A-13

When the voltage is below 15V, check brush and commutator contact and commutator cleanliness.

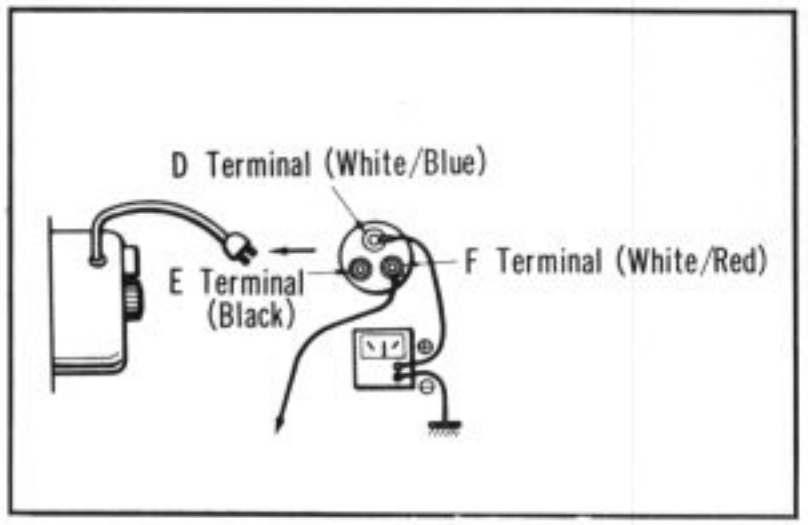


Fig. 17A-14

2. When motor-generator does not operate:

Use a completely charged battery, and apply battery voltage directly to the M terminal of the motor-generator.

If the unit does not operate, check brush and commutator contact and commutator cleanliness.

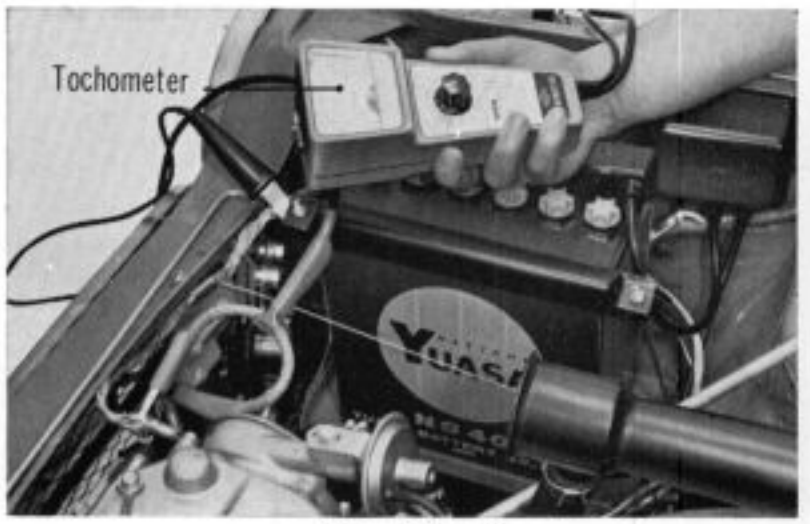


Fig. 17A-15

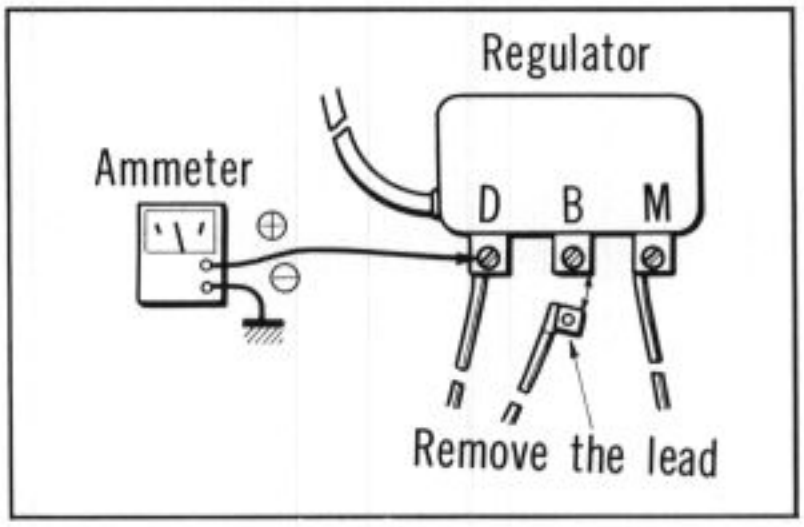


Fig. 17A-16

3. When charging is improper, check adjusted voltage of the voltage regulator. Connect a voltmeter to the D terminal of the regulator, disconnect the B terminal and observe the voltmeter as engine speed is increased to 2000 to 4000 rpm. If the voltage is in the range of 14.8 to 15.8V, the condition is normal.

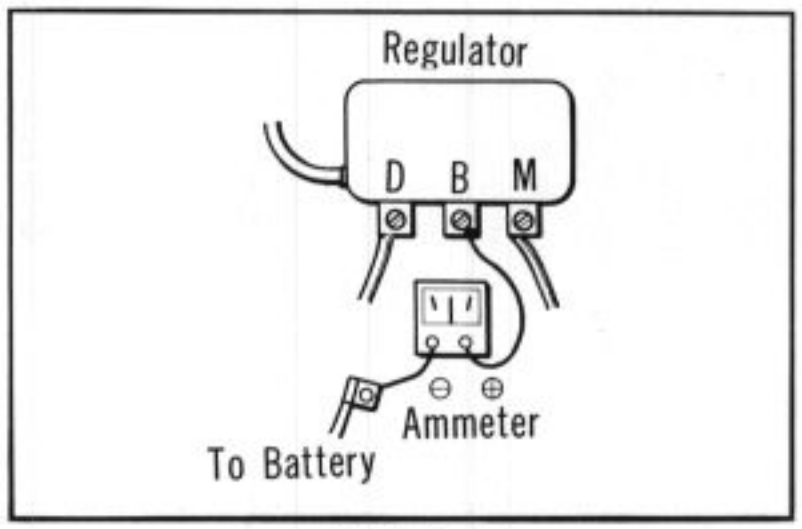


Fig. 17A-17

Connect an ammeter to the B terminal (+) of the regulator and reconnect the disconnected battery terminal (−). Check output current.

If the charging current under load (head lamps, wiper, etc.) is 10A or more, the condition is normal. Engine speed at this time is between 2000 and 3000 rpm.

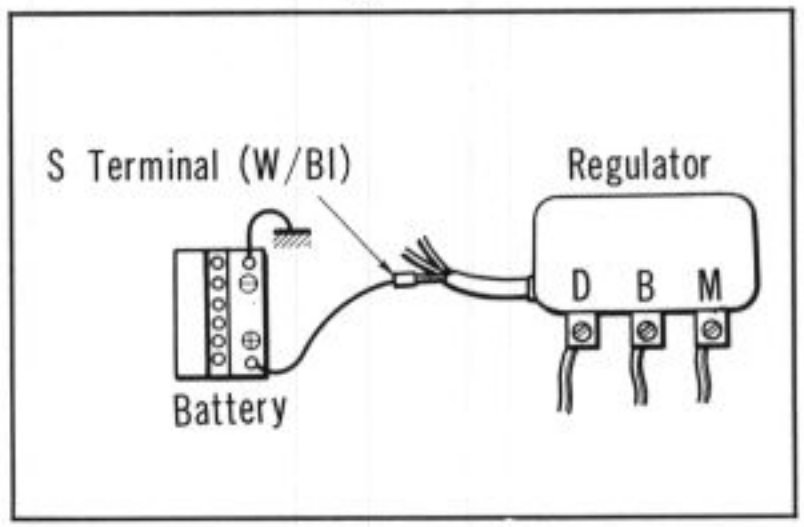


Fig. 17A-18

4. When motor-generator does not rotate:

With a separate lead, connect the battery (+) terminal to the S terminal of the regulator (white/black lead) and insure that the operating sound of the starting relay inside the regulator is normal.

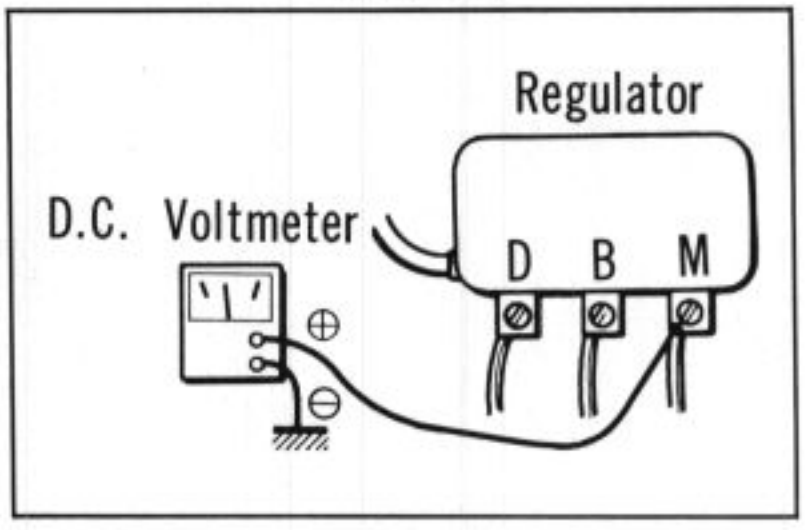


Fig. 17A-19

With the regulator connected to the motor-generator, connect a voltmeter between the M terminal of the regulator and ground. Read the voltmeter indication when the starting relay operates. If the value is 8V or more, the condition is normal.

D. Starter Motor (600 vehicle)

a. Description

Construction

The starter motor employed for 600 vehicle consists mainly of magnetic switch, motor, and pinion. The magnetic switch serves not only to engage and disengage the pinion through the shift lever by moving the plunger but also starts and stops the starting by opening and closing the main contact. Further, the magnetic switch is specially constructed to facilitate adjustment. A DC series motor with large starting torque is used. The pinion is equipped with an engine overrunning clutch which shuts off the force imposed by the engine when the engine is started.

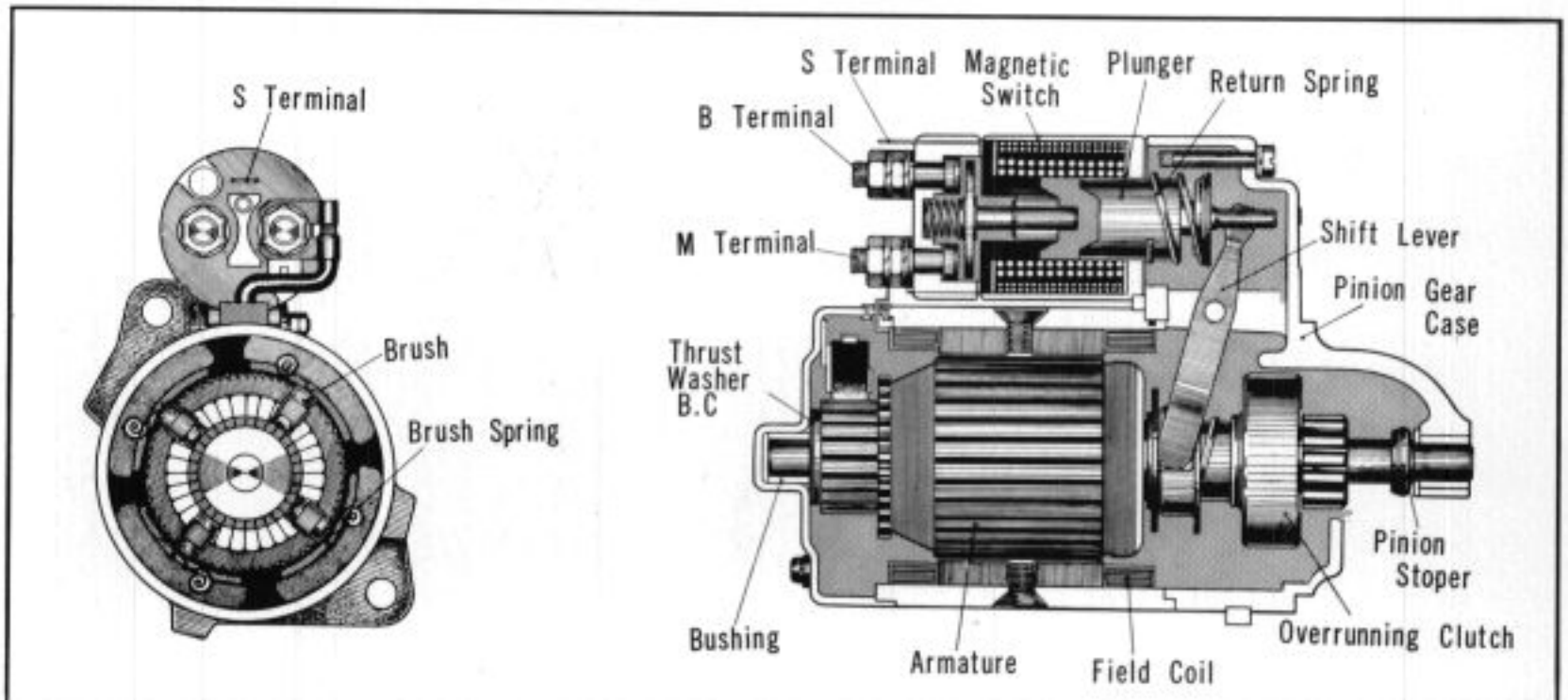


Fig. 17A-20

Overrunning clutch

The overrunning clutch is installed on the armature shaft, and is used to cut off engine torque immediately after the engine is started. This clutch consists of pinion collar, roller and clutch outer. The roller is constantly held under spring force, and its filled part of the clutch outer is tapered. (Fig. 17A-21)

The pinion and clutch outer can be idled in the rotating direction where it is positioned in the wider part of the tapered section of the clutch outer. In the rotating direction where the roller is positioned in the narrower part of the tapered section (clockwise as viewed from the pinion side or the rotating direction of the starting motor), the roller serves as a "key", transmitting rotation. (Fig. 17A-22)

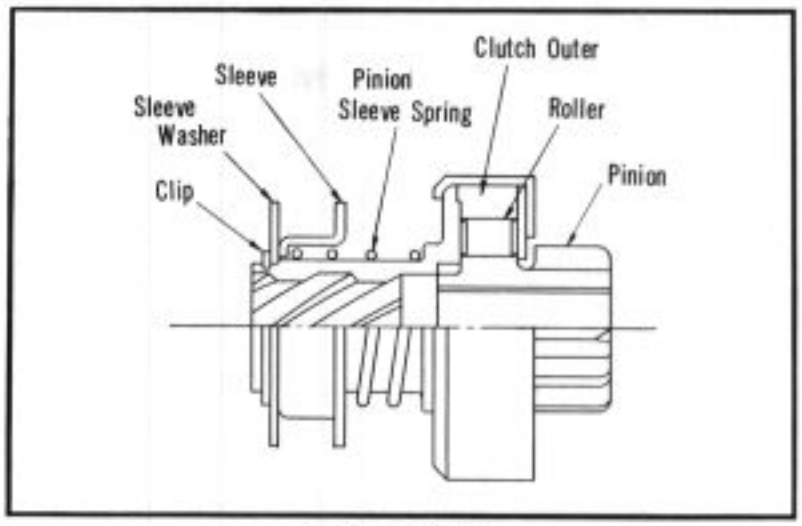


Fig. 17A-21

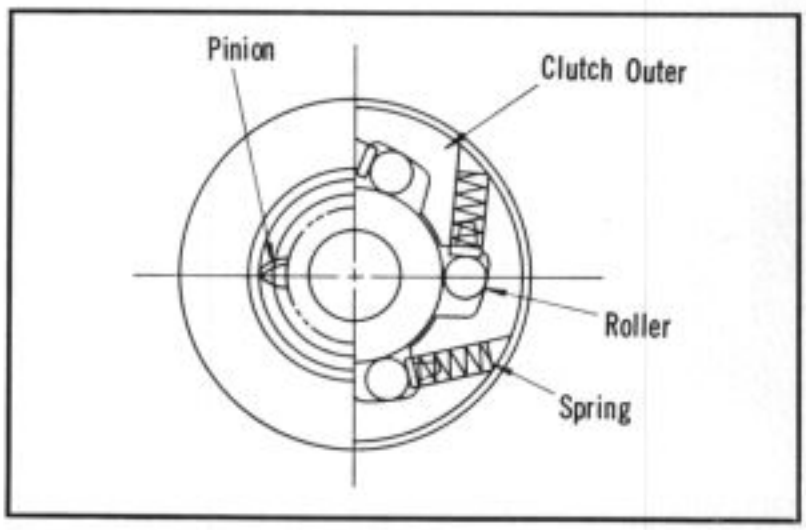


Fig. 17A-22

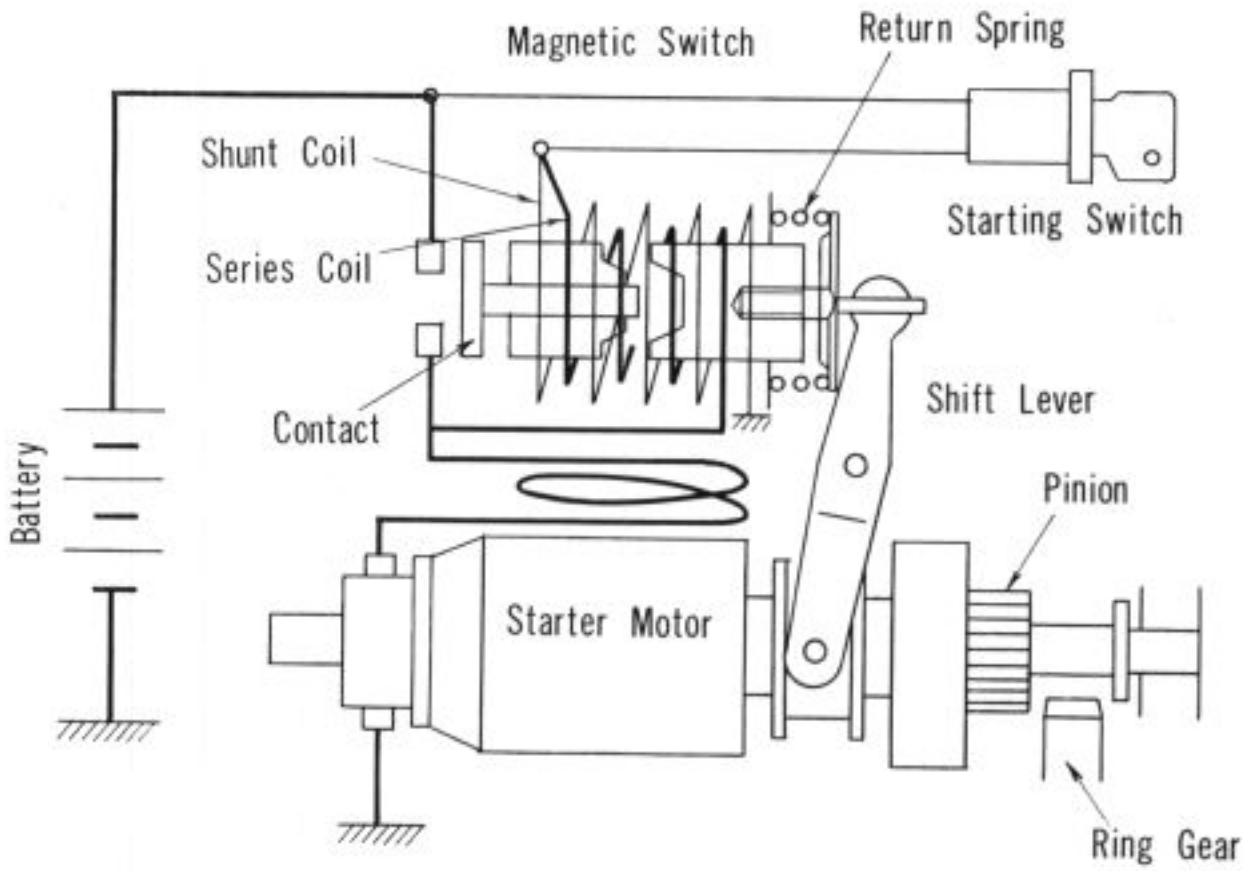


Fig. 17A-23

Principle of operation

The principle of operation is explained in sequence as follows:

(1) Turn on the starting switch.

(2) Current flows through the shunt coil and series coil of the magnetic switch. Under this condition, the plunger is attracted and the pinion is pushed out of the shift lever.

(3) At the same time, current flows through the magnetic switch series coil to the motor. As a result, the armature rotates slow rotation, thereby facilitating engagement of pinion and ring gear.

(4) When the pinion teeth and ring gear teeth are meshed, the pinion sleeve spring is compressed and the plunger moves.

(5) The contactor closes and current is directly applied to the motor by the battery. Under this condition, the armature rotates. The result is the pinion and ring gear mesh.

(6) When the pinion and ring gear mesh completely, the latter turns.

(7) The engine starts.

(8) When the engine starts, open the starting switch.

(9) The magnetic switch loses its attraction and the pinion returns to its original position through the shift lever. The pinion and ring gear then unmesh, and the motor stops.

b. Technical Data

Output	0.8kw	No-load terminal voltage	12 V	Outside dia. of armature	60mm
Rated time	30 sec.	No-load current	60A or less	No. of poles	4
Weight	5.8 kg	No-load speed	700 rpm or more	Brush material	MH-32
Rotating direction (viewed from pinion side)	Clockwise	Constrained terminal voltage	6 V	Series coil resistance	0.312Ω at 20°C
Clutch system	Overruning clutch	Constrained current	460A or less	Shunt coil resistance	0.93Ω at 20°C
		Constrained torque	1.1 kgm		
Engagement system	Magnetic shift system	Overall length of starter	220.5 mm		
		Outside diameter of yoke	90 mm		

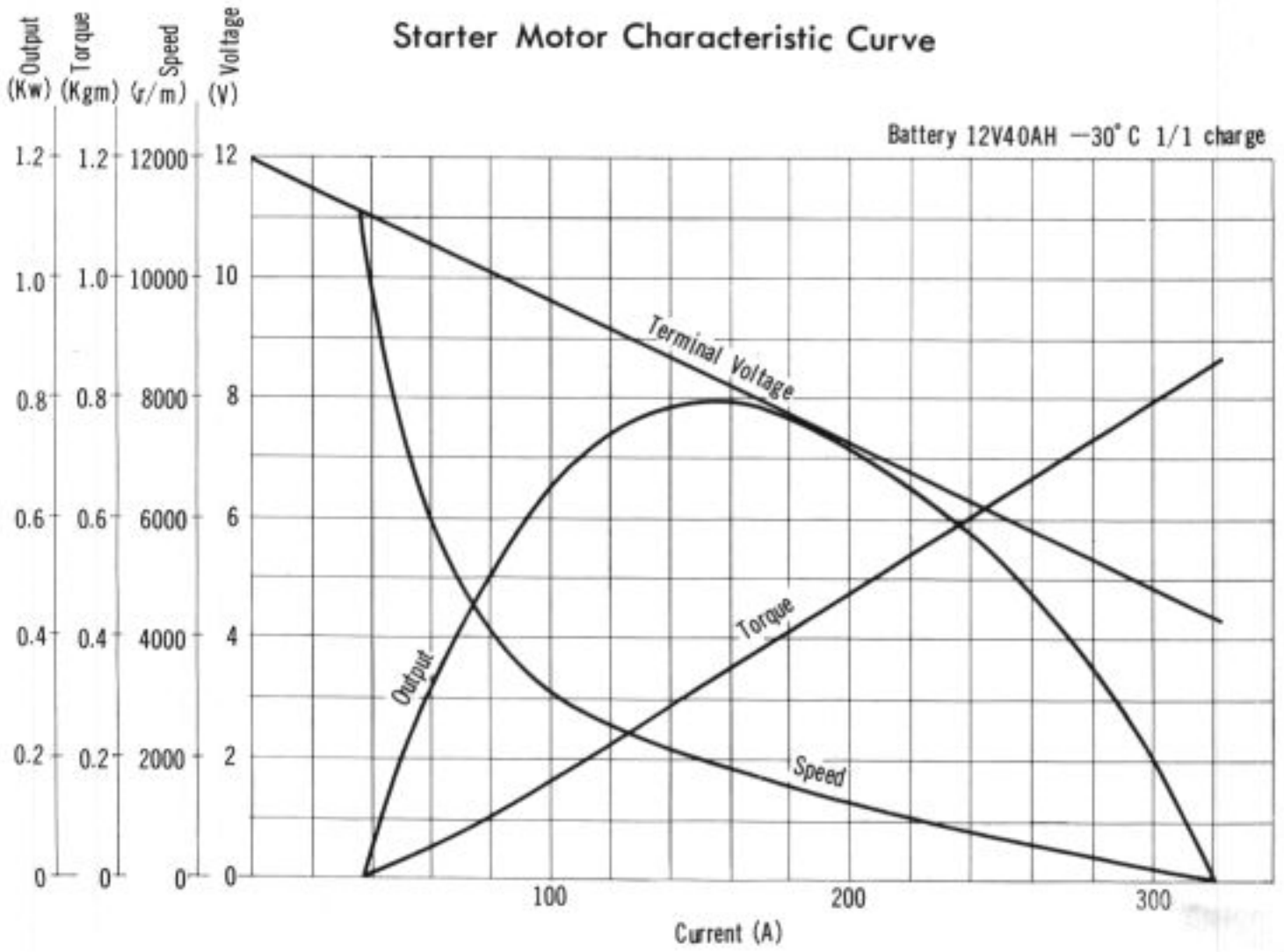


Fig. 17A-24

Maintenance Standards are shown on page 17-15.

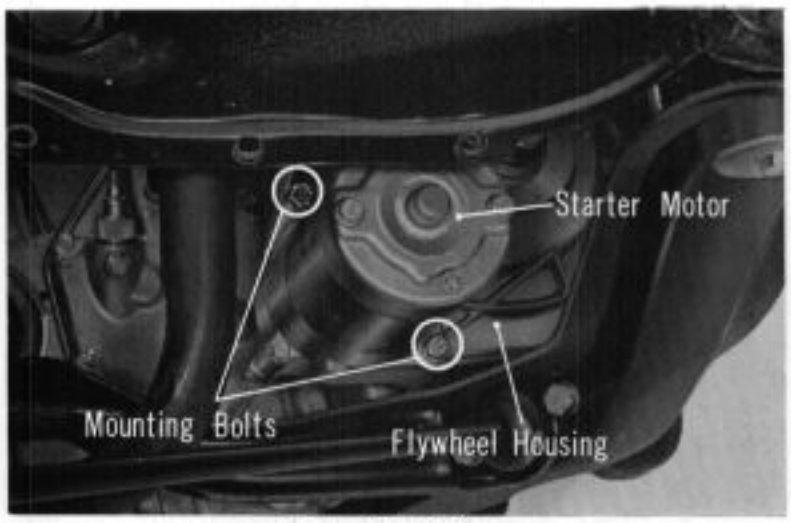


Fig. 17A-25

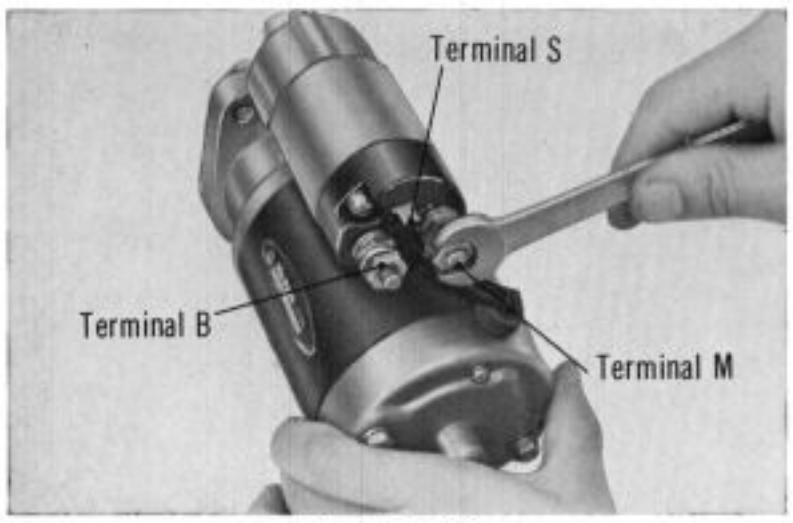


Fig. 17A-26

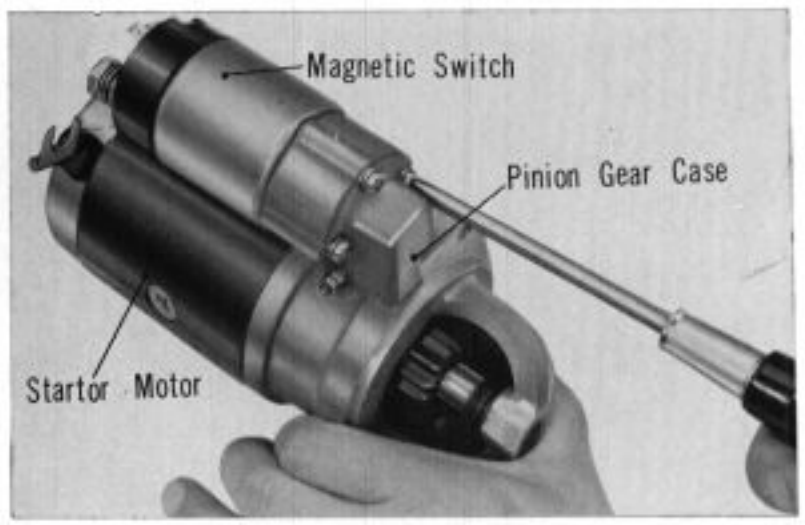


Fig. 17A-27

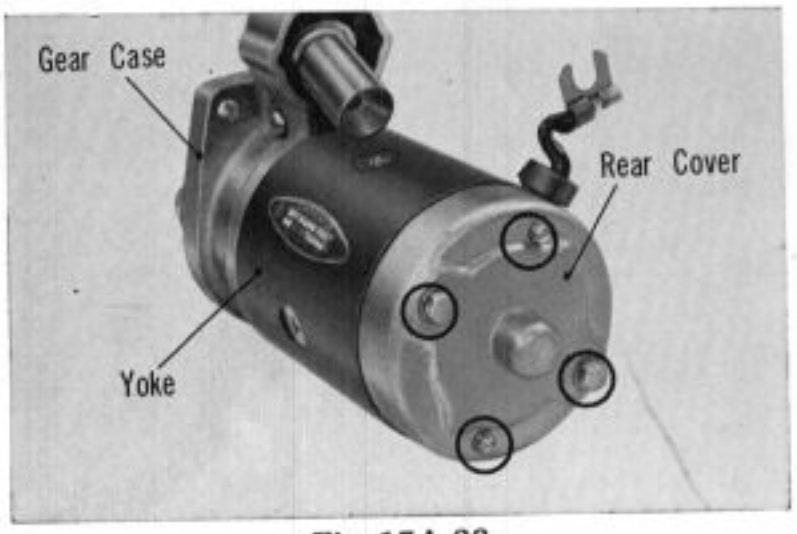


Fig. 17A-28

c. Maintenance

Removal and Disassembly

1. Remove the splash guard.
2. Remove the battery cable from the (—) terminal of the battery.
3. Remove the starter cable and the black and white lead from the B and S terminal of the magnetic switch (remove black lead then white lead).
4. Remove the two starter motor retaining bolts, and remove the starter motor from the flywheel housing.
5. Loosen the M terminal nut and remove the cable.
6. The magnetic switch is installed to the pinion gear case with three screws. Remove these screws with a screwdriver and take the magnetic switch together with the return spring **(Fig. 17A-20)** from the starter motor.
7. The two rear cover screws secure the brush holder (to the rear cover), while the rear cover bolts retain the rear cover and yoke on the pinion gearcase. Remove these bolts and screws and detach the rear cover from the yoke.

8. Draw out the four brushes from the brush holder, and remove the brush holder.
9. Separate the yoke from the gear case. The yoke is provided with a hole in which the gear case lock pin is inserted. This is for yoke positioning.

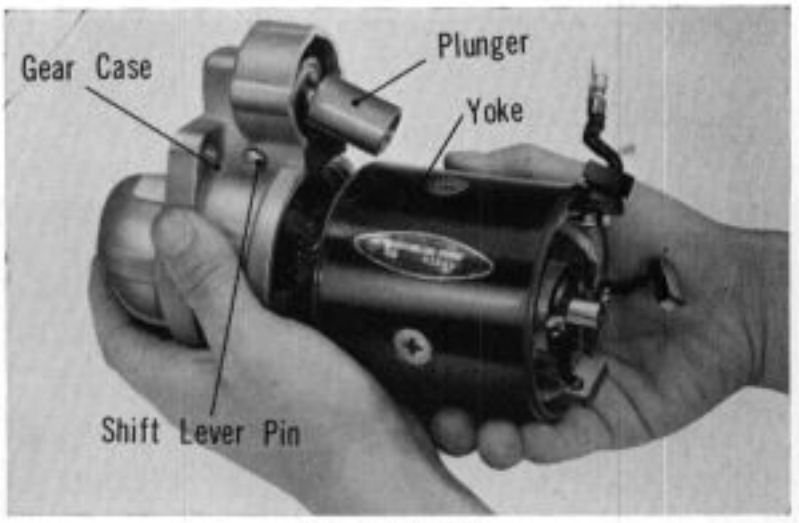


Fig. 17A-29

10. Remove the shift lever pin, and then the plunger from the shift lever. **(Fig. 17A-29)**
11. Draw out the armature from the gear case, and remove the shift lever.

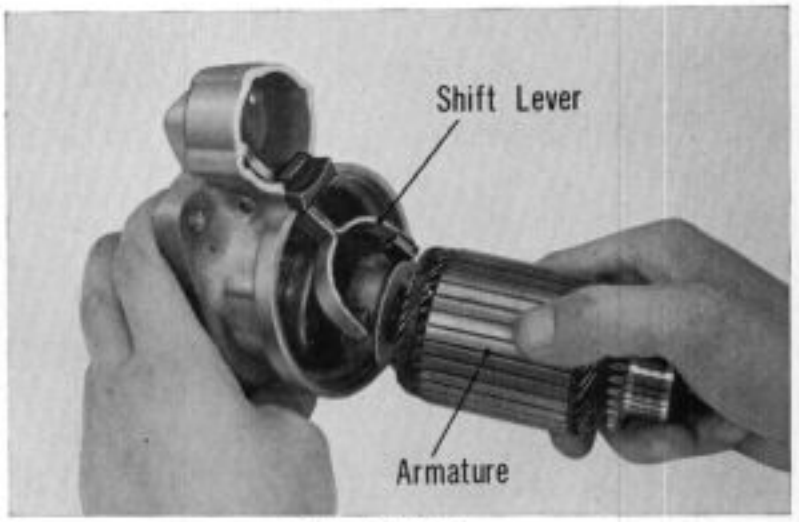


Fig. 17A-30

12. Armature Disassembly
    - (1) Thrust plate A (1.6 t)
    - (2) Pinion stopper washer
    - (3) Pinion stopper clip
    - (4) Pinion stopper
    - (5) Pinion assembly
    - (6) Shift lever
    - (7) Plunger
    - (8) Plunger return spring
    - (9) Armature
    - (10) Thrust plate B, C

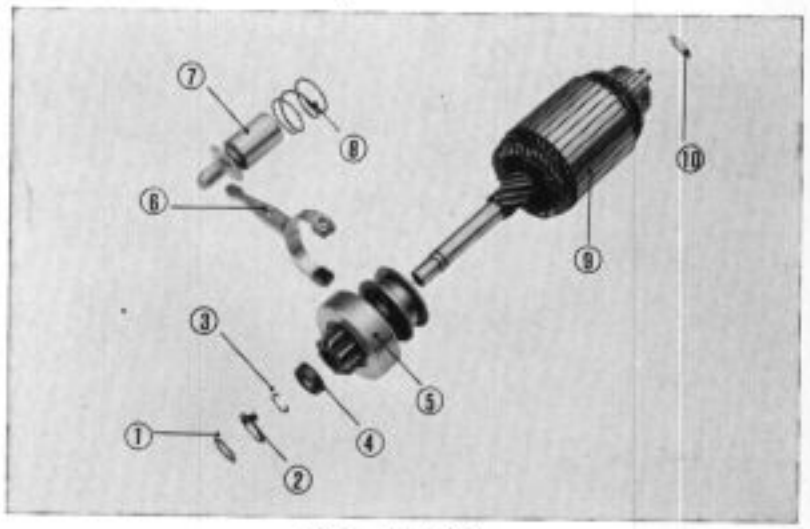


Fig. 17A-31

After removing the thrust plate A from the shaft, remove the pinion stopper washer by wrenching it out with a screwdriver. **(Fig. 17A-32)**

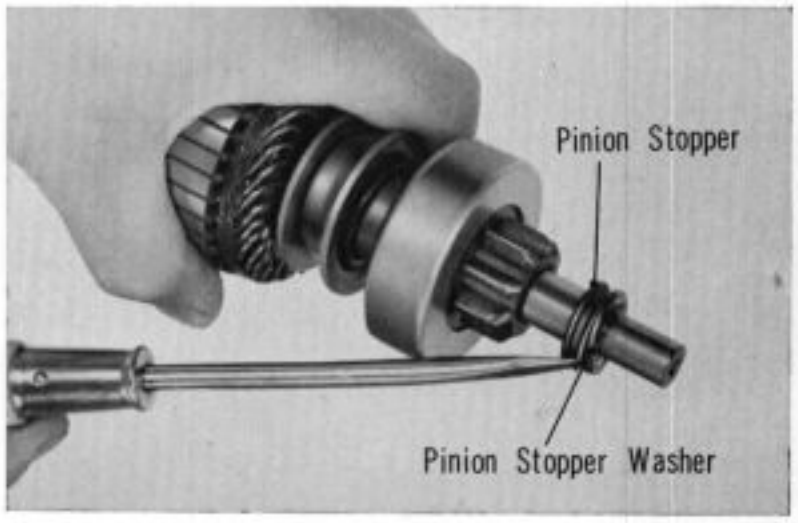


Fig. 17A-32

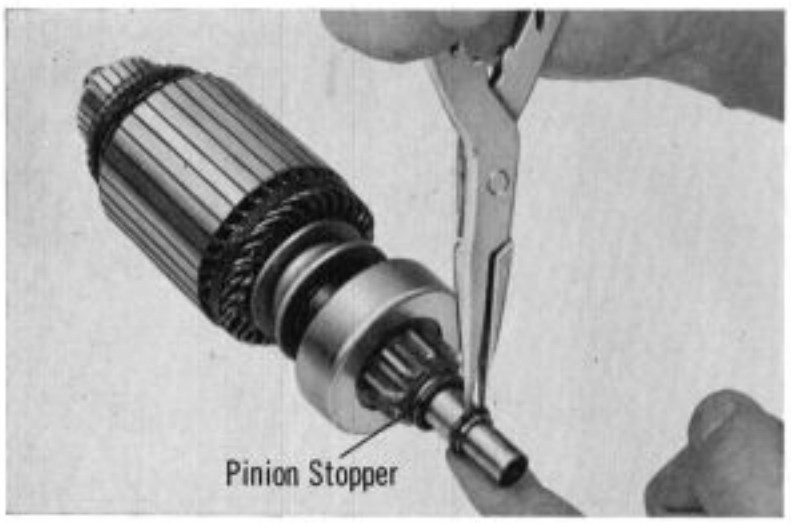


Fig. 17A-33

Next, slide the pinion stopper toward the armature and remove the pinion stopper clip with pliers. **(Fig. 17A-33)**

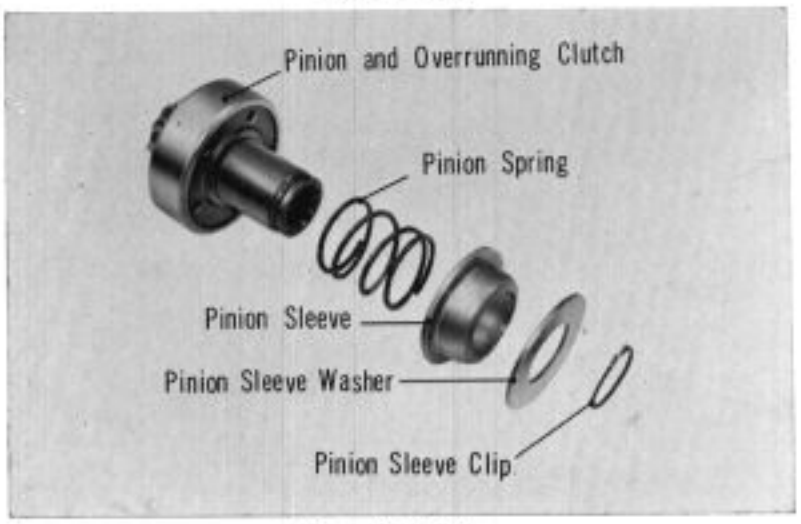


Fig. 17A-34

Remove the pinion sleeve clip, and the pinion assembly can be disassembled as illustrated in **Fig. 17A-34.**

The overrunning clutch cannot be disassembled.

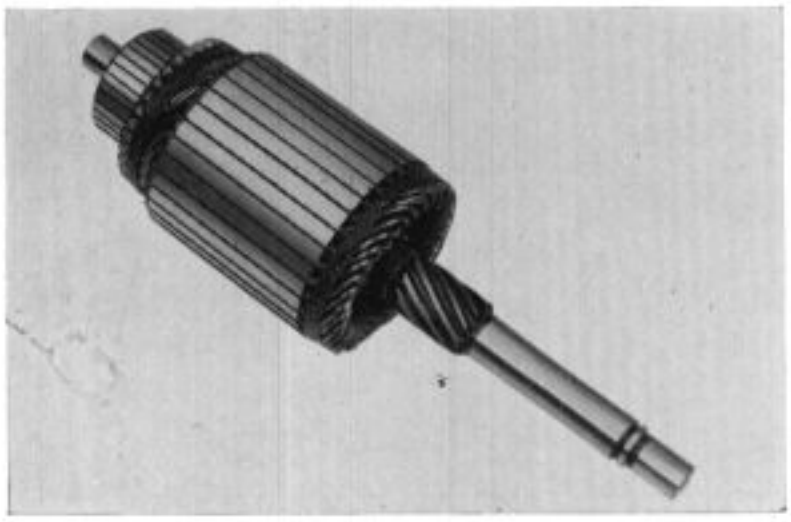


Fig. 17A-35

Inspection

1. Inspect the armature shaft for bending.
   Place both ends of the armature shaft on a center stand, attach a dial gauge to the shaft, and measure. The degree of shaft bending is one half the value indicated by the needle of the dial gauge. If bending is 0.1mm (0.004 in) or more, correct the armature shaft using a press.

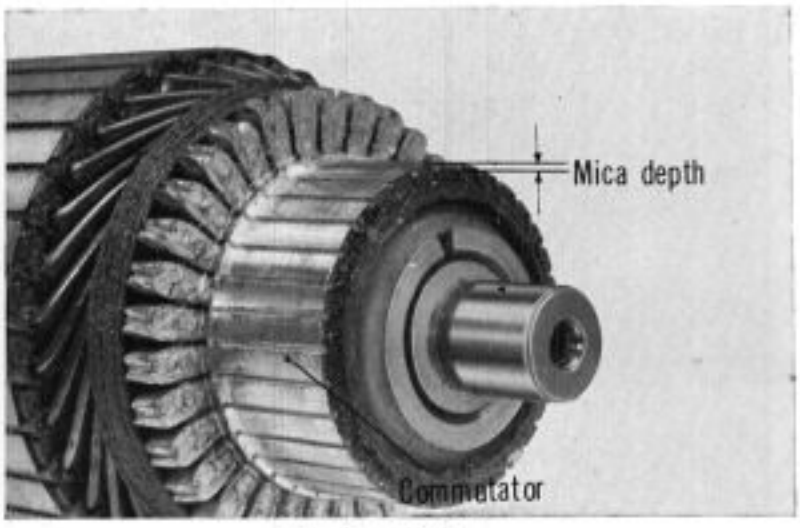


Fig. 17A-36

2. Inspect the surface of the commutator for roughness. If the commutator is not smooth, grind the surface with #500 or #600 Emery cloth. If the commutator surface is excessively rough, or if commutator deflection is 0.2mm (0.008 in) or more, correct using a lathe and finish with Emery cloth. Measure the depth of the mica between segments of the commutator. The measured value is 0.2mm (0.008 in) or less, undercut it to 0.5 to 0.8mm (0.020 to 0.032 in).

3. Check the armature coil grounding conditions with a testing device. Check continuity between the commutator and the armature shaft (or armature core). If there is continuity, the armature coil is grounded. This being the case, replace with a new armature assembly.

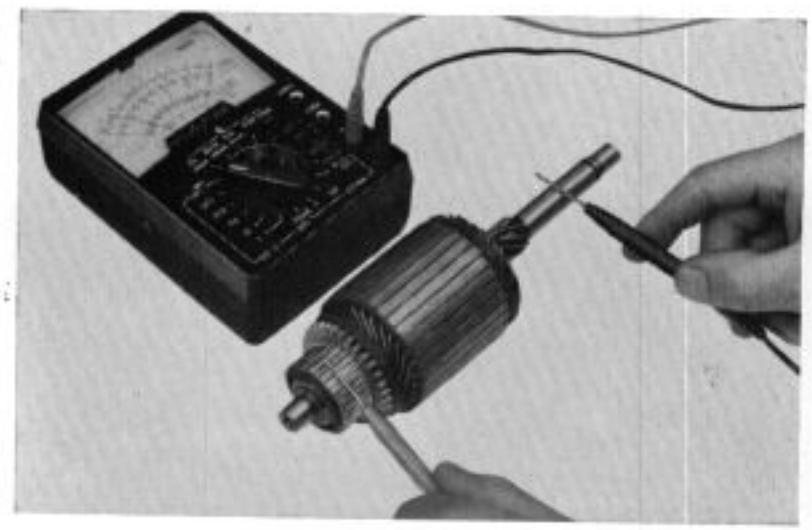


Fig. 17A-37

4. Check the armature coil for shorting with a growler tester. Mount the armature on the growler tester, and turn the armature while holding a saw piece (or piece of iron) in contact with the armature. If the saw piece or piece of iron vibrates, the coil is shorted. Replace with a new armature assembly.

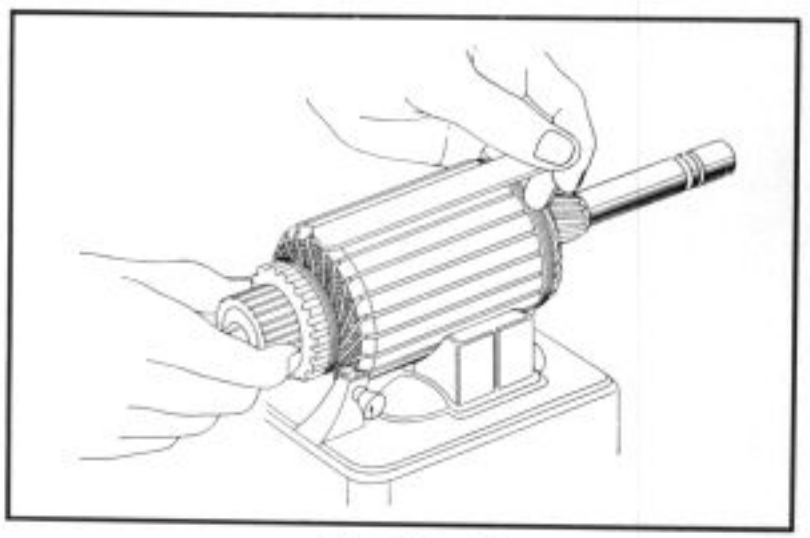


Fig. 17A-38

5. Check the field coil for disconnection using a testing device.
   Check the field coil between terminals for continuity. If there is no continuity, replace with a new field coil.
6. Check the field coil for grounding with a grounding tester. Check continuity between one side of the field coil terminal and the yoke. If there is continuity, replace with new field coil.

Fig. 17A-39

7. Check the brushes for wear.
   Measure the overall length of each brush with slide calipers, and if brush length is less than 12.5mm (0.492 in), replace the brushes with new ones.

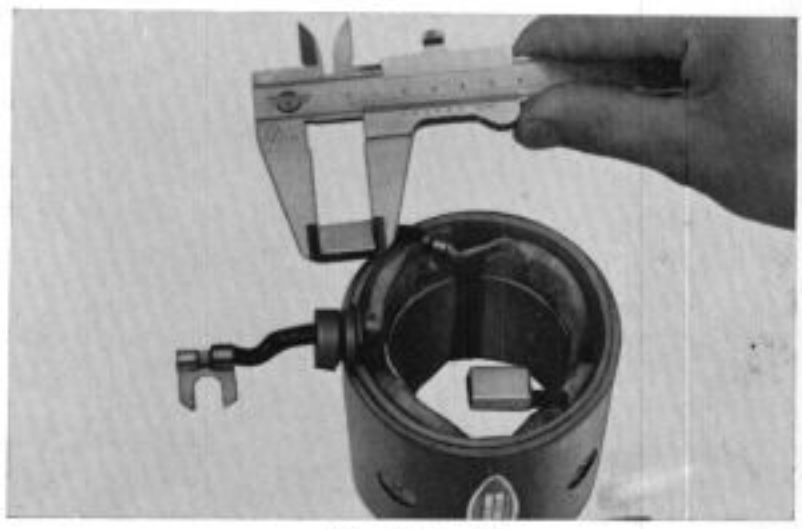


Fig. 17A-40

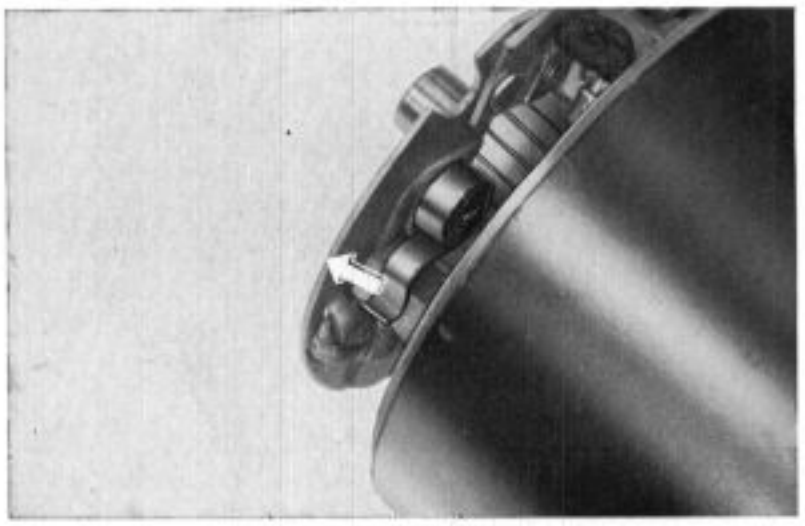


Fig. 17A-41

8. Measure the tension of the brush springs. Connect a thread to the brush processing surface of the spring and measure the tensile force of the spring. If spring tension is less than 0.7 kg (1.5 lbs), replace with new brush springs (if more than 0.9 kg (1.98 lbs), adjust to the correct value).

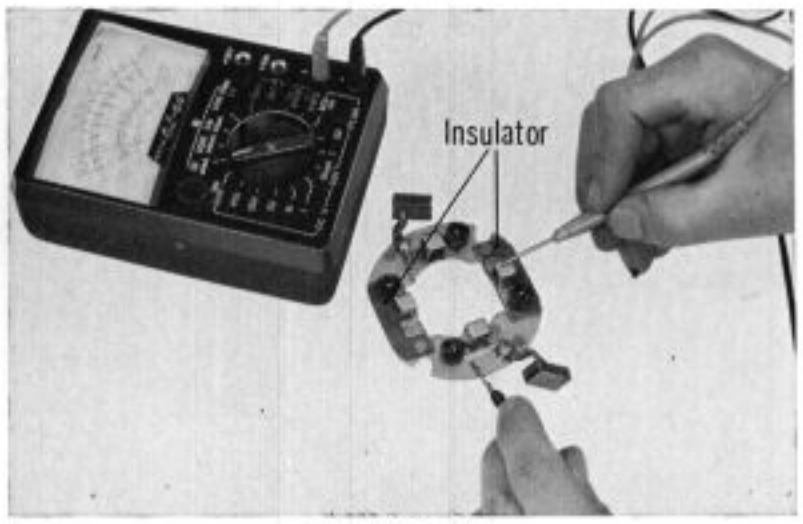


Fig. 17A-42

9. Check brush motion

   If brush movement is incorrect, check the brush holder for bending and for stained slide surfaces. Correct and clean as necessary.

10. Check the insulated brush holder for grounding with a testing device. Inspect continuity between the insulated brush holder (on the (+) side) and the brush holder assembly base (on the grounded side). If there is continuity, replace with a new brush holder.

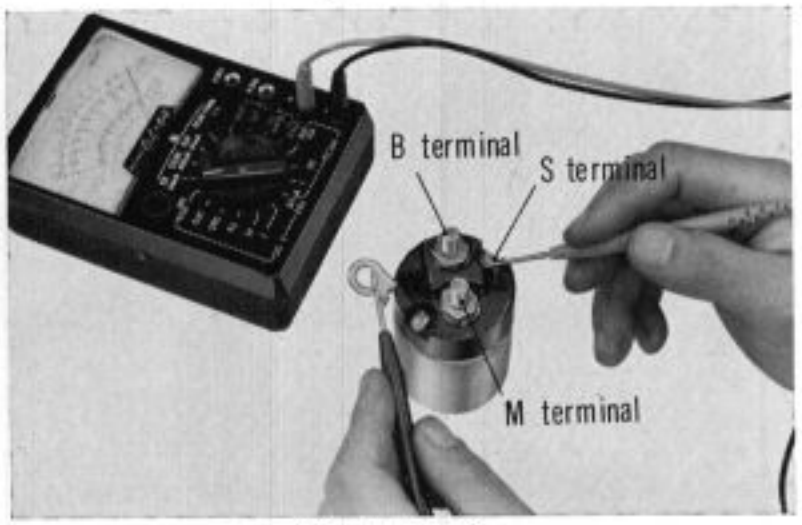


Fig. 17A-43

11. Check the magnetic switch shunt coil for disconnection. Check continuity between the S terminal of the magnetic switch and coil case (metallic part). If there is no continuity, replace.

12. Check the series coil for disconnection. Inspect continuity between the M terminal and S terminal of the magnetic switch. If there is no continuity, replace.

Fig. 17A-44

13. Inspect the pinion teeth for wear and damage. If they are defective, replace with new pinion.

14. Check the pinion spring for damage. If it is damaged, replace.

15. Check and make sure that the pinion slides smoothly. If it is scarred, split, or if it sticks, make the necessary correction.
16. If the overrunning clutch is seized or if it slips, replace with a new part.

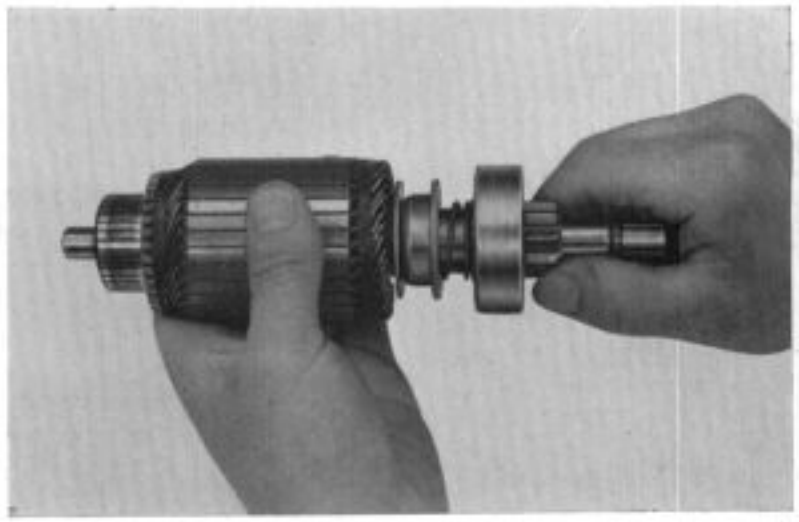


Fig. 17A-45

Table of Maintenance Standards

	Type		S114-111. 112
Brush	Material		MH-32
	Standard height		18.5mm (0.728 in)
	Serviceable limit		12.5mm (0.492 in)
Standard strength of brush spring			0.8kg (1.76 lbs)
Commutator	Outside diameter	Standard outside diameter	35mm (1.378 in)
		Serviceable limit	33mm (1.299 in)
	Difference between max. diameter and min. diameter	Serviceable limit	0.4mm (0.016 in)
		Repair precision	0.05mm (0.0020 in)
	Depth of mica between segments	Serviceable limit	0.2mm (0.008 in)
		Repair precision	0.5~0.8mm (0.020~0.032 in)
Shaft bend serviceable limit			0.08mm (0.032 in)
Standard Dimensions	Bearing on the brush side	Shaft diameter	11.450~11.468mm (0.4508~0.4515 in)
		Inside diameter	11.500~11.521mm (0.4527~0.4536 in)
	Pinion Sliding Section	Shaft diameter	12.950~12.968mm (0.5098~0.5105 in)
		Inside diameter	13.030~13.051mm (0.5130~0.5138 in)
	Bearing on the pinion side	Shaft diameter	10.950~10.968mm (0.4311~0.4318 in)
		Inside diameter	11.000~11.018mm (0.4331~0.4338 in)
Shaft and bearing gap		Serviceable limit	0.2mm (0.008 in)
		Repair precision	0.03~0.1mm (0.0012~0.0039 in)
Allowable shaft diameter underside			0.1mm (0.0039 in)
Magnetic Switch		Series coil resistance	0.312Ω
		Shunt coil resistance	0.93Ω

Lubrication

Oilless bearings are employed on the gear case side and the brush side. Whenever they are removed or disassembled, apply grease (Shell Alvania Grease No. 2) at the lubricating positions as illustrated in **Fig. 17A-46.**

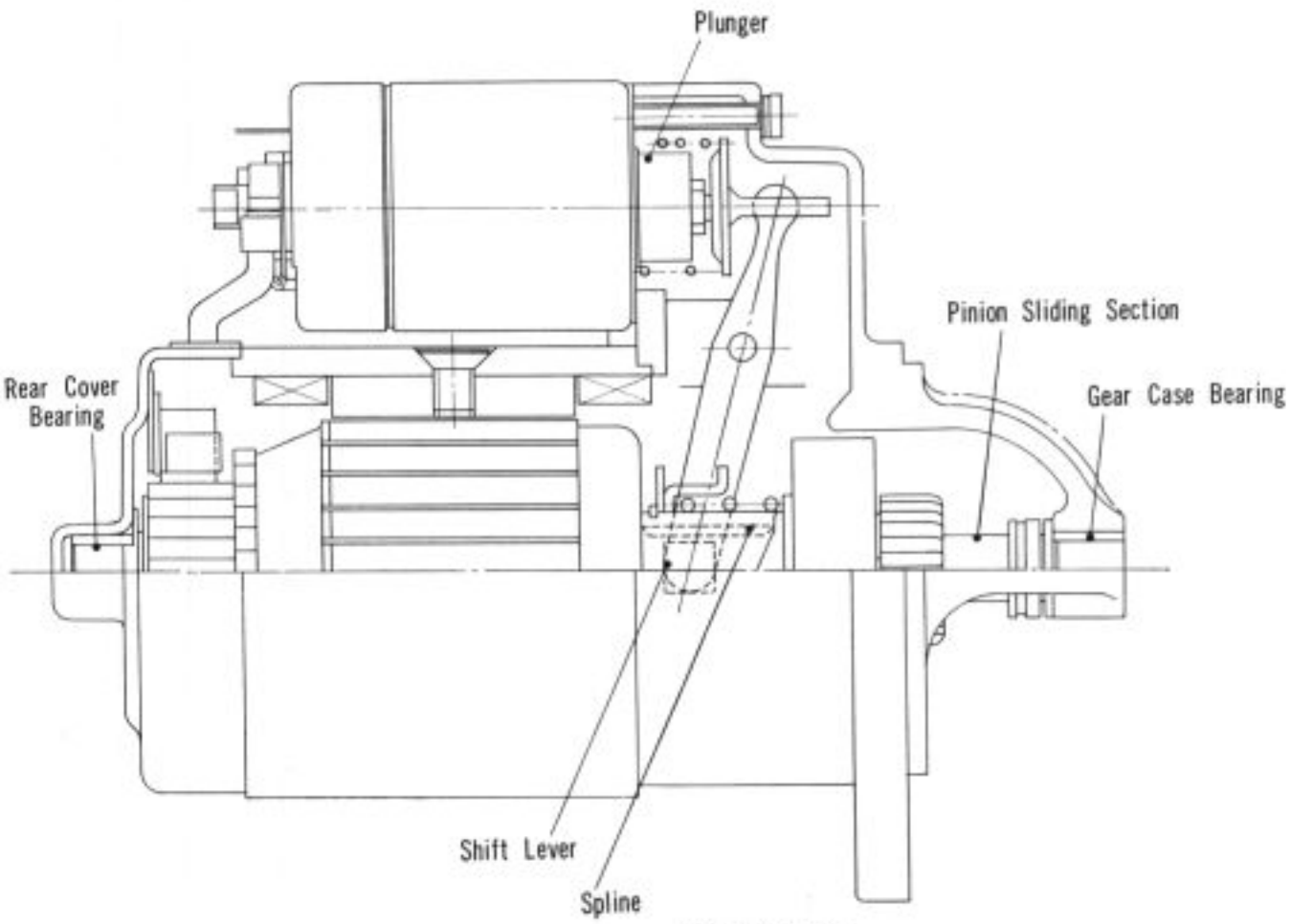


Fig. 17A-46

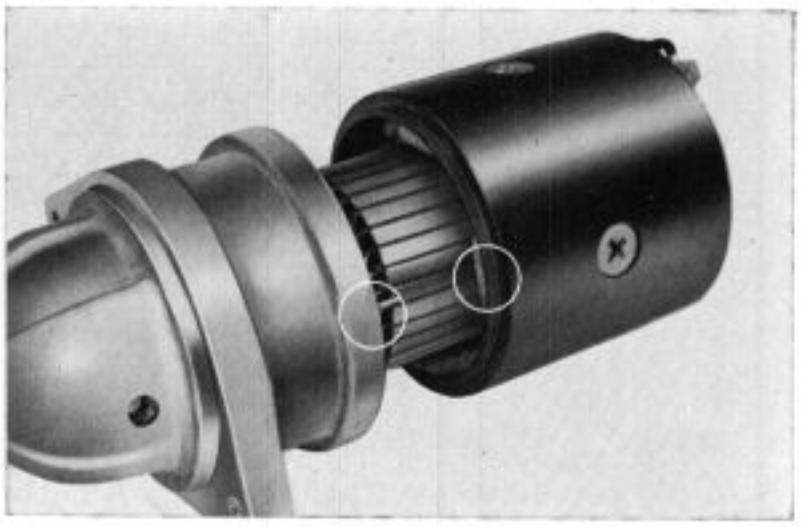


Fig. 17A-47

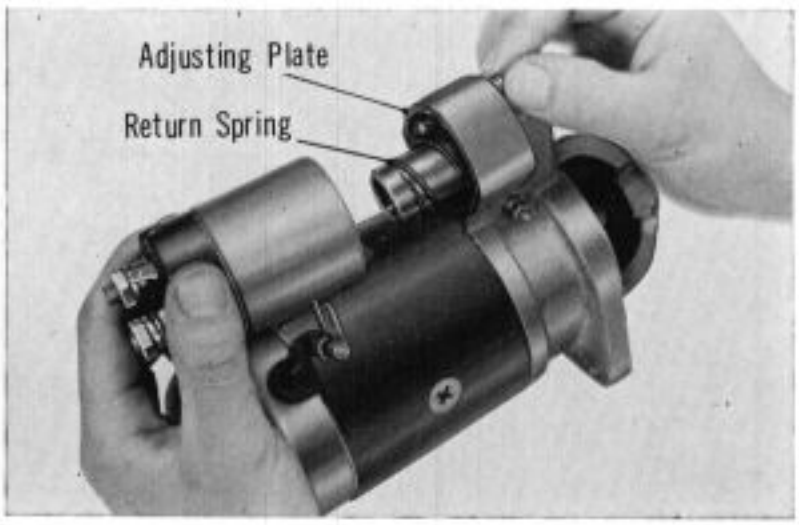


Fig. 17A-48

Adjustment and Reassembly

For reassembly and reinstallation, follow the reverse sequence of disassembly.

1. When assembling the yoke in the gear case, be sure to align the gear case dowel pin and yoke hole. **(Fig. 17A-47)**

2. When installing the magnetic switch, securely fix the return spring and adjusting plate (dust cover).

3. Pinion protruding position adjustment

   Connect the (+) to the S terminal, and the (−) to the metallic part of the magnetic switch; the pinion thus protudes as a result of plunger attraction. Push out the pinion with the finger to eliminate pinion play, and measure the distance from the pinion end to the piston stopper with a feeler gauge. The standard length is 0.3 to 1.5mm (0.012 to 0.059 in). **(Fig. 17A-49)**

   If this size is not correct, an abnormal meshing sound is produced and the service life of the pinion and ring gear is shortened. To eliminate this trouble, the size should be adjusted to the prescribed value. The size can be adjusted by changing the adjusting plate between the magnetic switch and the gear case.

   Two types of adjusting plates are available:

   0.4mm thick

   0.8mm thick

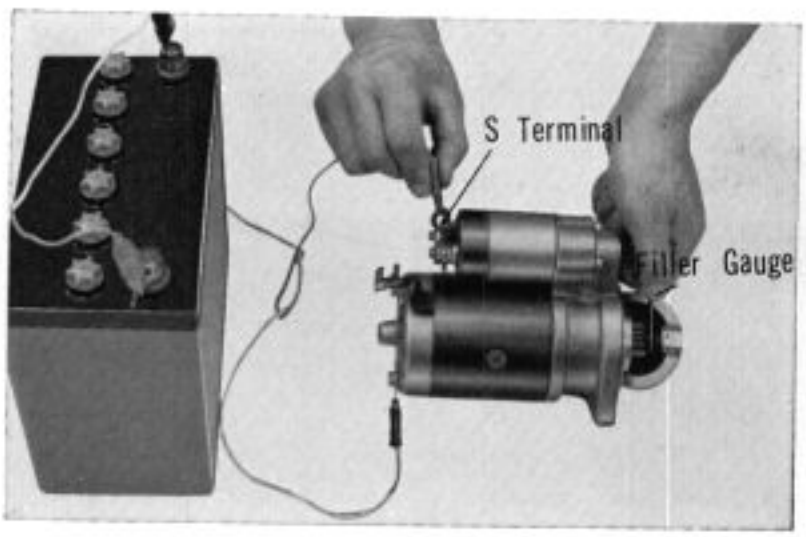


Fig. 17A-49

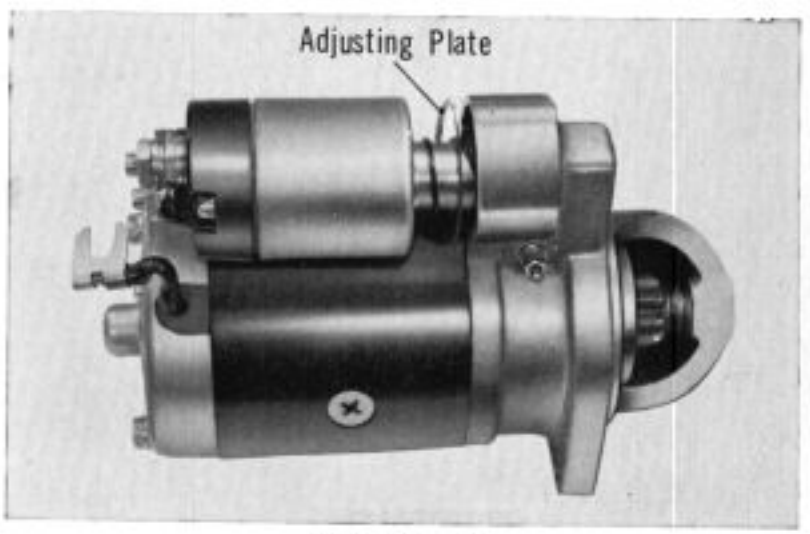


Fig. 17A-50

4. To install the starter motor, completely secure the gear case to the flywheel housing.

   Tightening torque:

   3.8~4.2 kgm (27.4~30.3 lb-ft)

   In addition, securely tighten the wiring. If it is incompletely tightened larger contact resistance may result, thus causing starting difficulty.

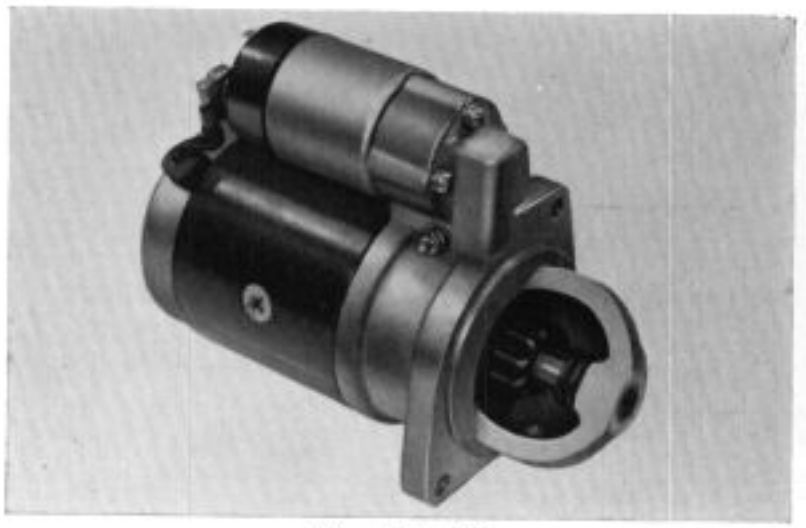


Fig. 17A-51

d. Trouble Diagnosis

(1) The pinion does not advance when the starting switch is turned on.

Faulty Part	Cause of Trouble	Corrective Action
Wiring	Disconnection, or loosened battery and switch terminals.	Repair or retighten.
Starting switch	No current flows due to improper contact.	Correct the contacting conditions or replace.

Faulty Part	Cause of Trouble	Corrective Action
Startor motor	The pinion does not move, because the thread portion engaging the armature shaft pinion section is bitten.	Repair the threaded part.
Magnetic switch	Incorrect operation of the magnetic switch plunger, or disconnected or shortened coil.	Repair or replace.

(2) Startor motor does not rotate, although pinion and ring gear mesh.

Wiring	Wiring connecting battery and magnetic switch is disconnected; or ground, magnetic switch, and motor terminal connection wires are improperly tightened.	Retighten, or replace with new wire.
Starter motor	Incorrect meshing of pinion and ring gear.	Repair the teeth.
	Improper installation.	Reinstall.
	Worn brushes, or contact of the bush spring.	Replace.
	Stained commutator.	Repair.
	Faulty armature field coil.	Repair or replace.
Magnetic switch	Field coil and bush connecting section is incompletely tightened.	Retighten.
	Improper conditions of the cantactor.	Repair.
	Roughened contact surface of the contactor.	Repair or replace.

(3) Motor attains full speed before pinion and ring gear mesh.

Startor motor	Worn pinion sleeve spring.	Replace.
Magnetic switch	Incorrect plunger dimension	Replace.

(4) Motor torque is not transmitted to the engine, although the pinion and ring gear mesh and motor rotation is normal.

Starter motor	Faulty overrunning clutch.	Replace.

(5) After starting engine, motor does not stop even when starting switch is set to OFF.

Starting switch	No current flows even when the switch is set to OFF.	Repair or replace.
Magnetic switch	The switch remains ON with the contactor displaced.	Replace.

E. Charging Circuit (600 vehicle)

a. Description

The 600 vehicle's charging circuit employs an AC generator, and the output of the generator is rectified to DC by a silicon diode. Current generated by the generator is regulated by a combination tirril regulator and AC generator. The AC generator is installed on the right side of the engine and the rotor is mounted on the right end of the crankshaft. The rectifier using silicon diodes is installed in position with the right side of the front bumber stay installing bolt and connected to the AC generator with the lead wires.

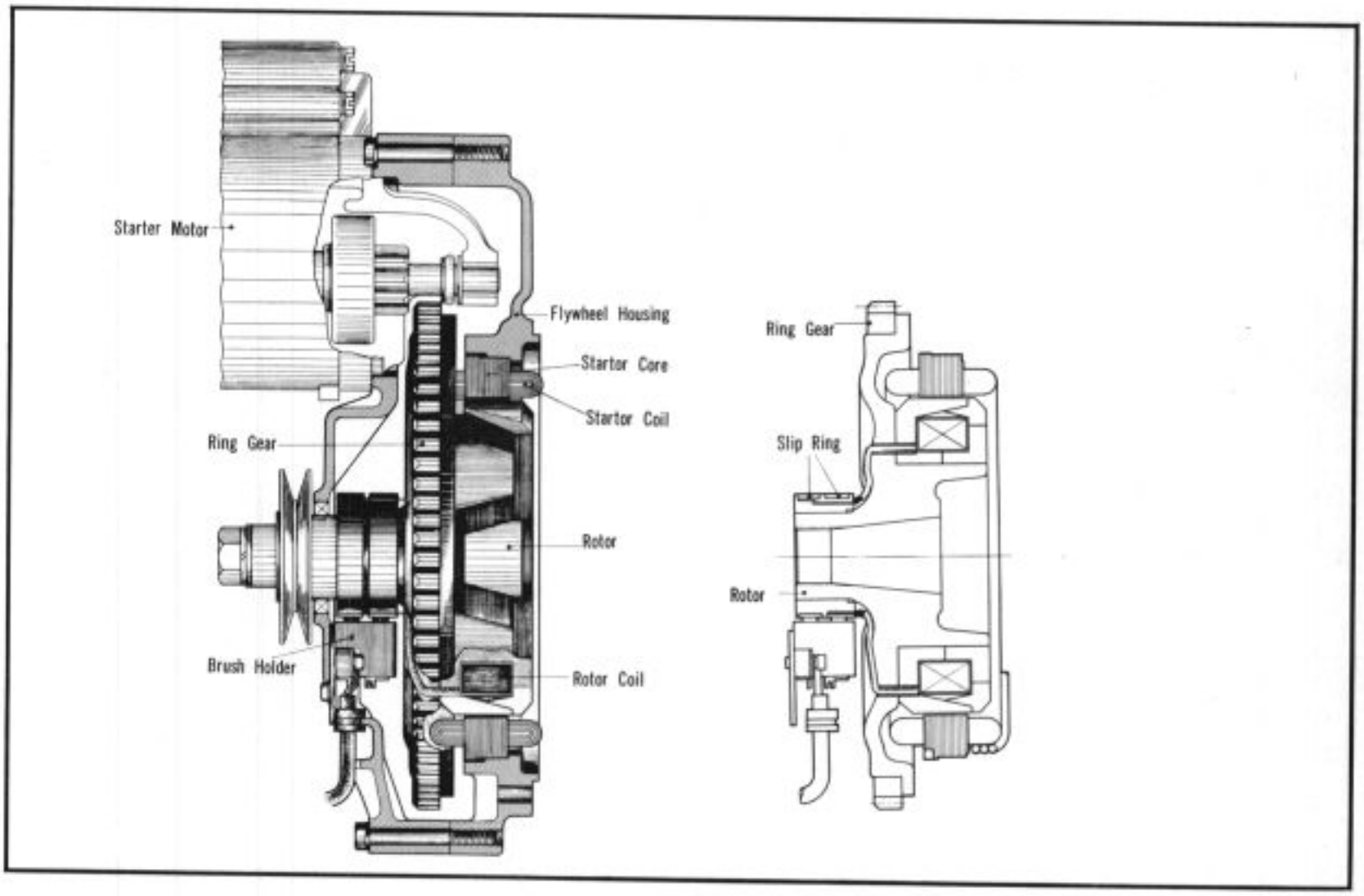


Fig. 17A-52

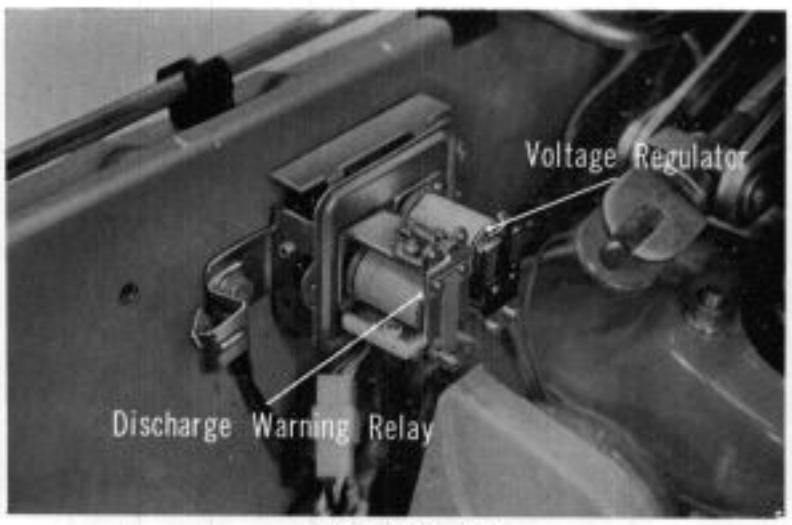


Fig. 17A-53

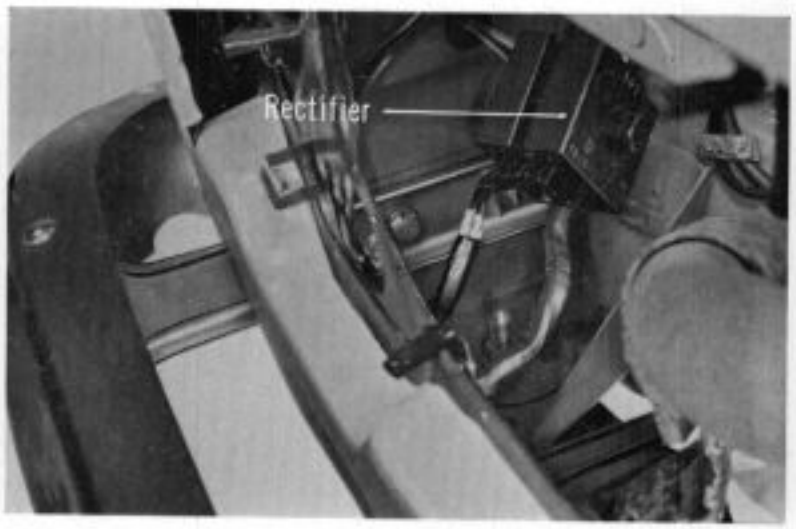


Fig. 17A-54

Connection

Electrical connection is as shown in **Fig. 17A-55**. When the exciting current flowing through the rotor coil is regulated by the voltage regulator, constant voltage is applied to the stator. The current generated by the generator runs through the silicon diode and is supplied to the battery, lamps, and other loads from the P terminal.

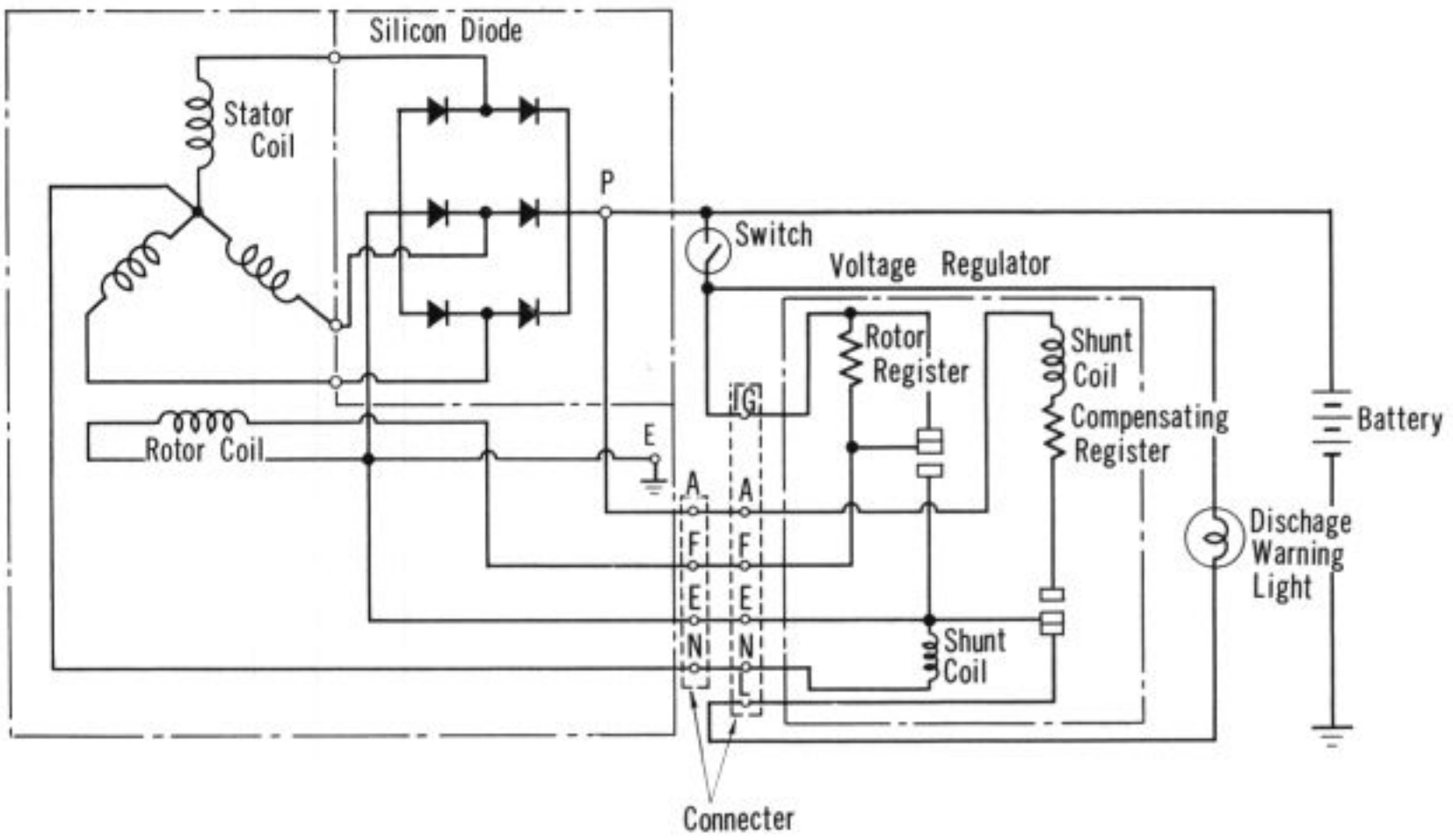


Fig. 17A-55

Principle of operation

(1) AC generator

Current flows from the battery, through the slip ring, to the rotor coil. When the rotor turns, voltage is generated in the stator coil which is secured to the stator. Further details concerning principle of operation are given below in accordance with **Fig. 17A-56.**

In the figure, when rotors N and S rotate in the direction indicated by the arrow current flows in the stator coil in the direction of a turn, the current begins to flow in the reverse direction (indicated by the dotted arrow), but this current is checked by diode D. The result is that current in one direction flows to the battery and is charged like DC. In this case, the waveform of current is as that shown in **Fig. 17A-57** (a). However, in the case of an AC generator for practical use, three-phase AC is "all-wave" with six silicon diodes and the wave form is as that shown in **Fig. 17A-57** (b).

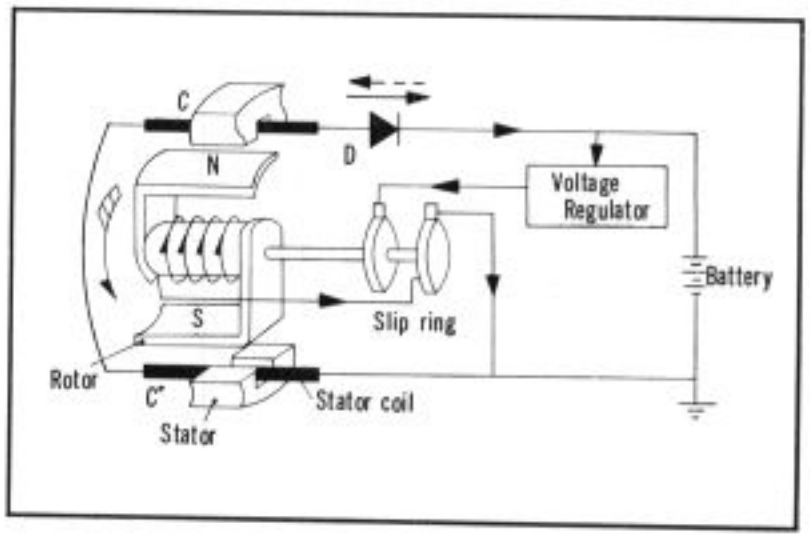


Fig. 17A-56 Principle of operation of A.C. generator

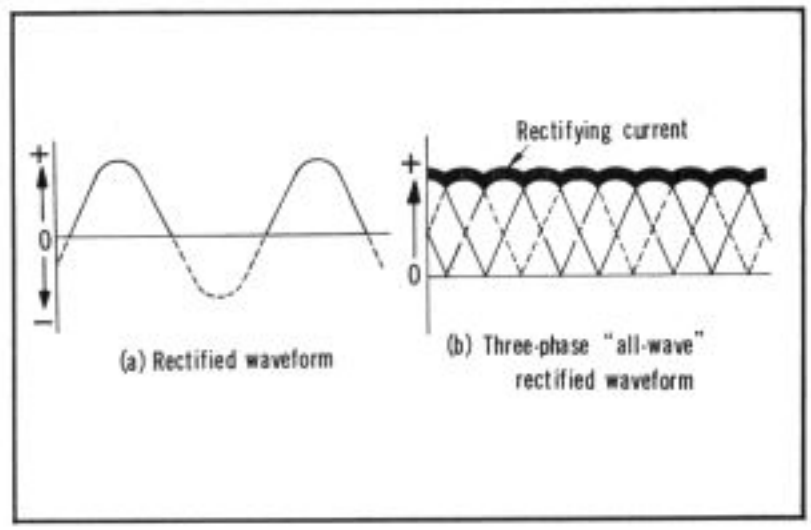


Fig. 17A-57 A.C. generator output current waveform

(2) Silicon diode

The silicon diodes allow current flow in one direction only, preventing the flow of current in the reverse direction. It works, in other words, like the conventional cut-out relay.

(3) Tirril regulator

The system of regulation has rotor resistance inserted in the rotor to maintain generator voltage constant by short circuiting. The principle of operation is explained in accordance with Fig. 17A-58

If generator speed is low, or if it is heavily loaded, the lower contact is opened and closed by the moving contact with the magnet attractive power increased and decreased proportionally with generator voltage. Under this condition, the rotor resistance RF is inserted and field current is regulated by short circuiting, thereby maintaining generetor voltage constant. If generator speed is high, of it is opened and closed. Under this condition, the rotor coil is inserted and voltage is maintained constant through short circuiting.

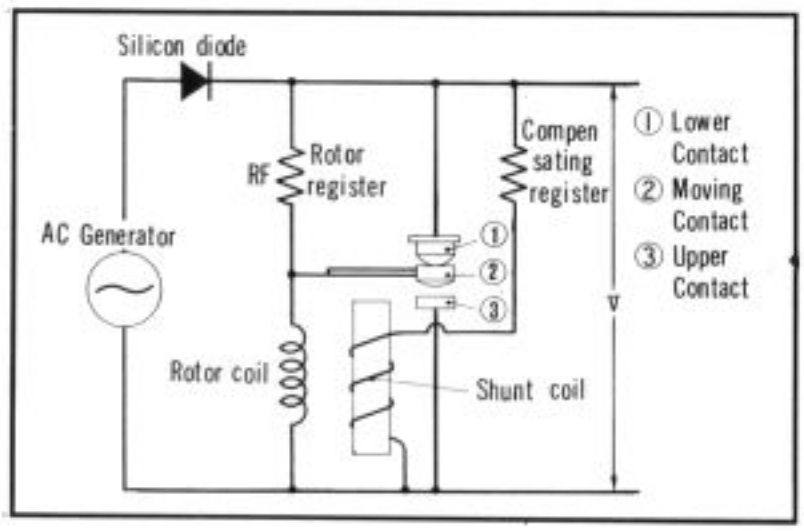


Fig. 17A-58 Two-contact type regulator operating principle

b. Technical Data

Specification

1. AC generator	
Type and Make	LD 130-01, LD 130-03 (for U.S.A.), Hitachi Ltd.
Rating	Continuous
Battery voltage	12V
Output	12V 30A, 35A (for U.S.A.)
Weight	5.99 kg, 6.15 kg (for U.S.A.)
Polarity	(−) ground
2. Rectifier	
Type and Make	SB 6B-5, SB 6B-8A (for U.S.A.) Silicon Diode Hitachi Ltd.
Battery voltage	12V
Polarity	(−) ground
Output	12V 35A, 40A (for U.S.A.)
Connection	3-phase, Bridge
Weight	0.45 kg, 0.48 kg (for U.S.A.)

3. Regulator

Type and Make	Tirril TL 1Z-33, Hitachi Ltd.
Battery voltage	12V
Polarity	(−) ground
Weight	0.35 kg

Performance

Operating speed		1,200 to 7,500 rpm
Rated speed		5,000 rpm
14V speed (normal temperature)		1,200 rpm or less
Output	Speed	5,000 rpm
	Voltage	14V
	Current	30A or more, 35 or more (for U.S.A.)

A C generator output current characteristic curve (at 14V)

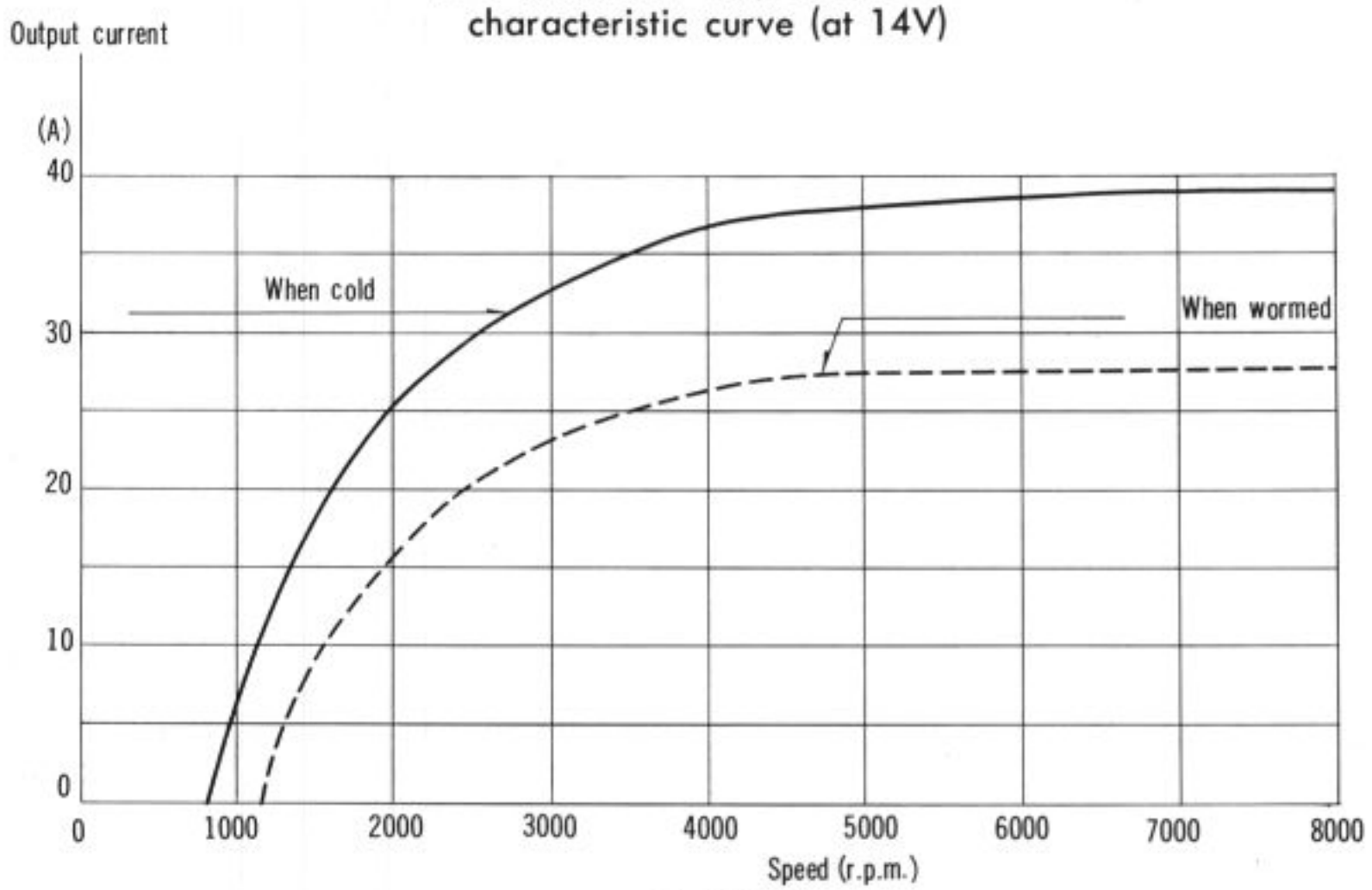


Fig. 17A-58

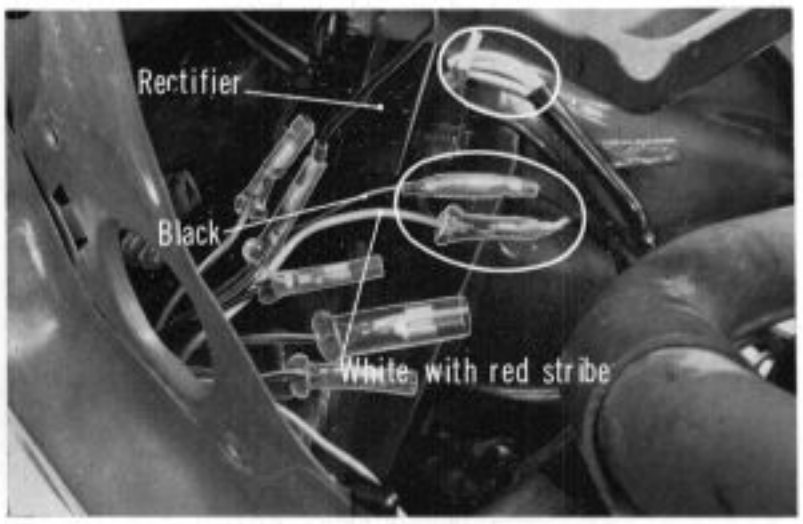


Fig. 17A59

c. Maintenance

AC Generator

Removal

1. After removing the (−) terminal of the battery, remove the four white lead wires from the rectifier.
2. Separate the white with red striped lead from the black lead, connected to the brush of the generator at the connector positions.

3. Remove the starter motor.
4. Remove the cooling fan belt from the crankshaft pulley. (Refer to SECTION 4, D.Engine Cooling.)
5. Set a 22mm wrench on the crankshaft pulley shaft to hold it securely, and remove the retaining bolts with a box wrench.

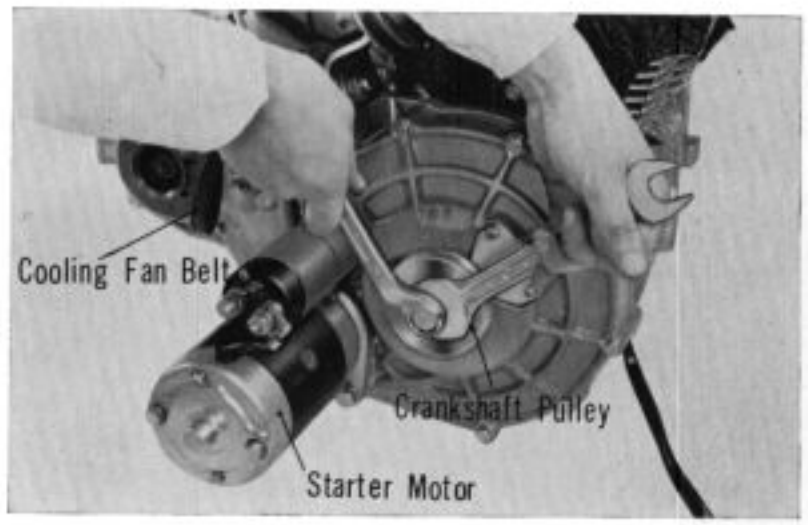


Fig. 17A-60

6. Remove the two brush holder set screws, and remove the brush holder assembly.
7. Remove the flywheel housing cover set bolts, and then the cover.

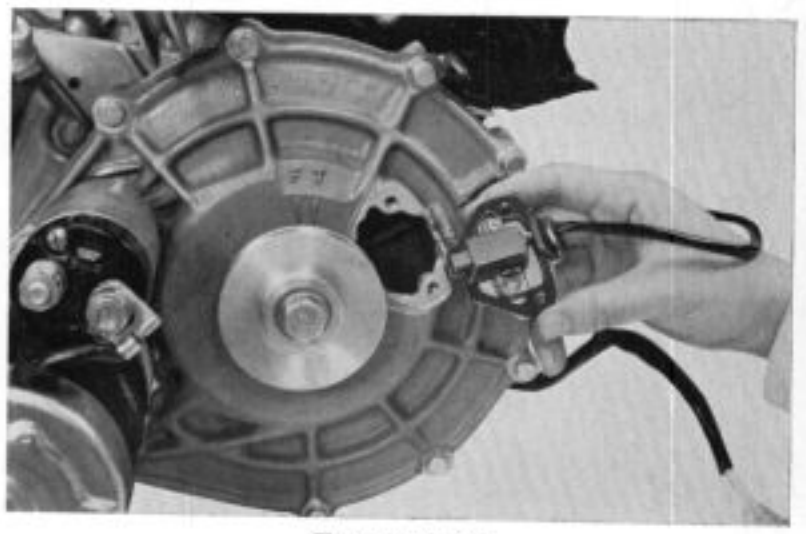


Fig. 17A-61

8. When removing the rotor, install a rotor holder (special tool) as shown in **Fig. 17A-62** with two flywheel housing installing bolts. Then fully thread in a rotor remover, and tap the rotor out while hammering the head of the rotor remover lightly. The rotor is taperfitted in the crankshaft.

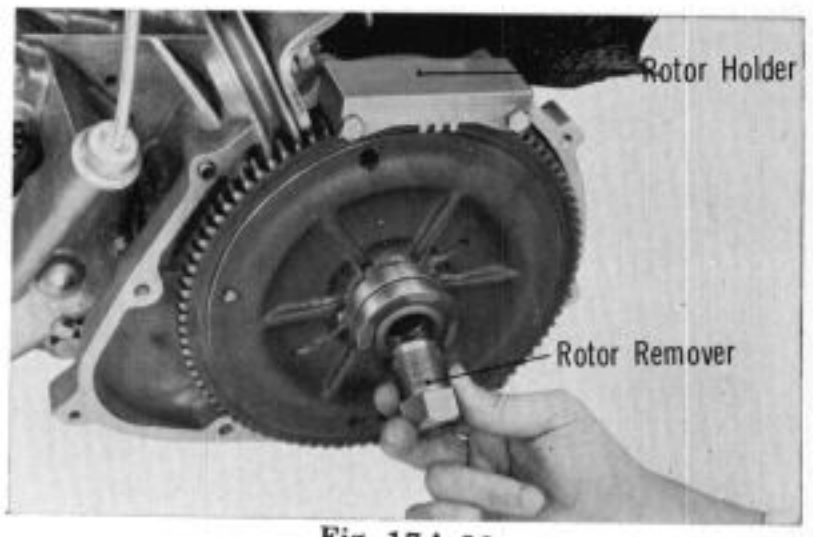


Fig. 17A-62

9. The stator is installed in the flywheel housing. Separate the flywheel housing from the engine after removing the four bolts.

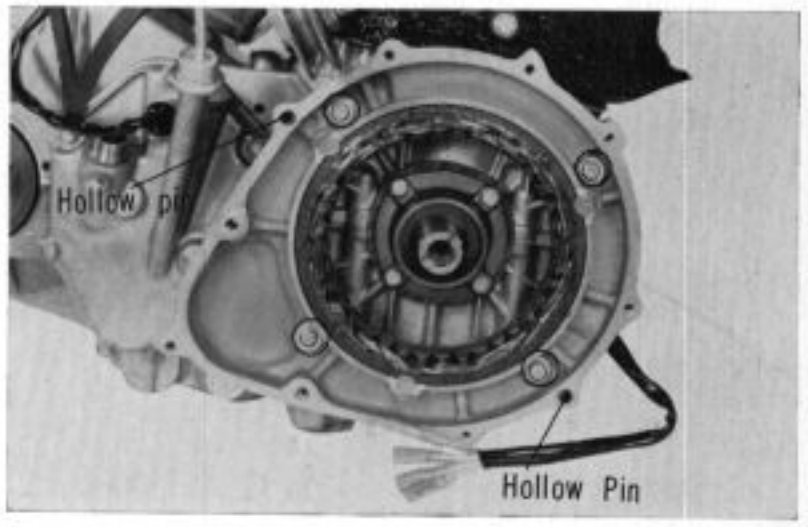


Fig. 17A-63

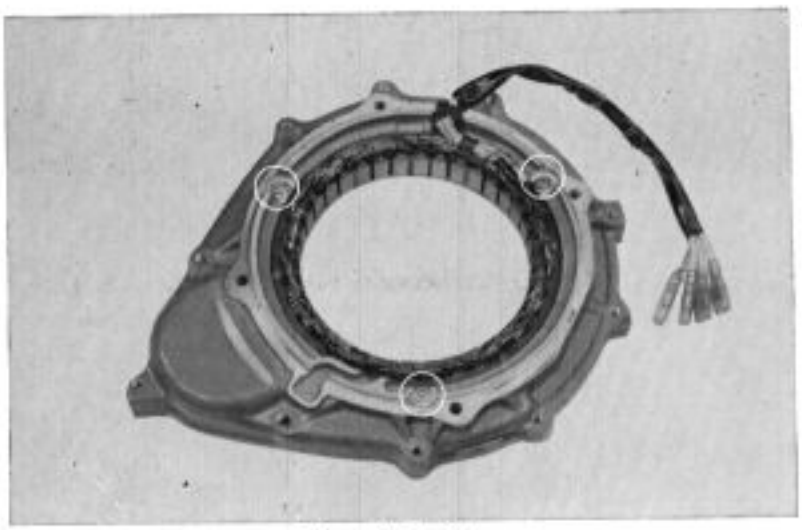


Fig. 17A-64

10. When it is necessary to replace the stator because of a disconnection, etc., remove the bolts and nuts at three different positions.

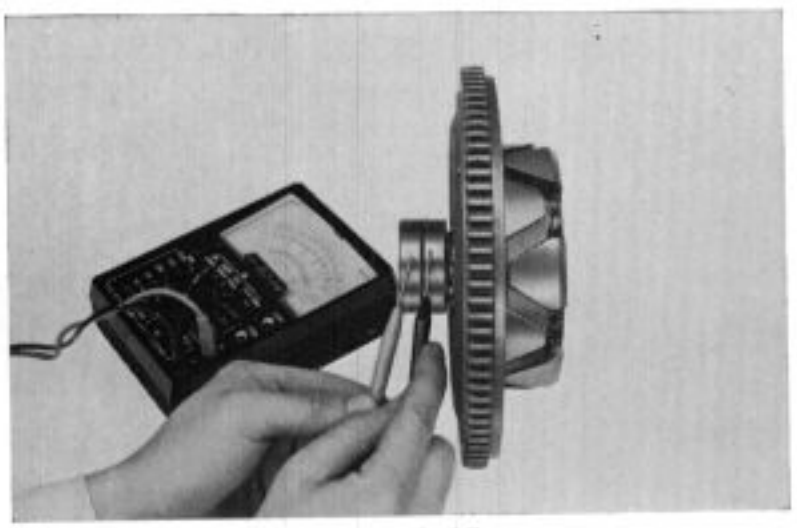


Fig. 17A-65

Inspection

1. Check the rotor coil for disconnection and condition of insulation. Inspect continuity between the two slip rings with a testing device. No continuity represents that the rotor coil is disconnected. In this case, replace the rotor assembly. If there is continuity between the slip rings and the shaft or core, the coil or the slip rings are grounded. In this case, also replace with a new part.

   Rotor coil resistance: 40A—4.05 Ω
   30A—5.19 Ω

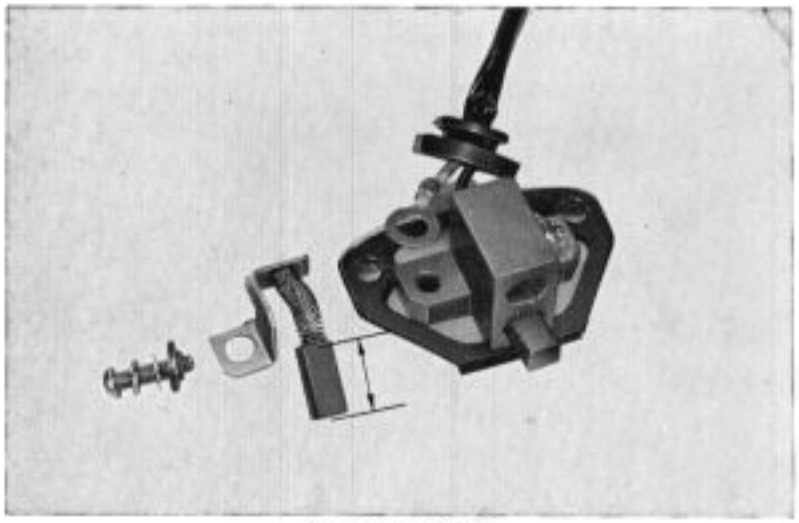


Fig. 17A-66

2. Unlike the DC generator, brush wear is extremely less. If the length of the brush is worn to 7.0mm (0.276 in) or less, replace the brush.

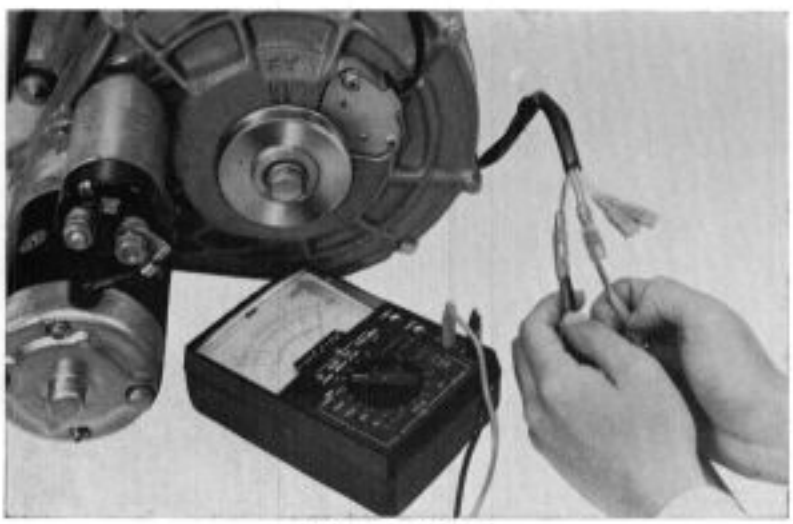


Fig. 17A-67

3. Check the stator coil for insulation and disconnection with a testing device.
   If there is no continuity between the terminals, the coil is disconnected. In this case, replace with new coil. If there is continuity between the stator coil terminals and the flywheel housing or core, it means the coil grounded. Replacement is necessary.

   Stator coil resistance: 0.115 Ω

4. Check the operation of the brush in the brush holder. With the hand press the brush end, and check the operating condition of the brush and brush spring.

   Reference: To correctly measure tension of the brush spring, push in the brush to the depth corresponding to the degree of brush wear plus 2mm. Then confirm that the tension of the spring is 0.255 to 0.345 kg. In addition, the length of a new brush is 14.5mm.

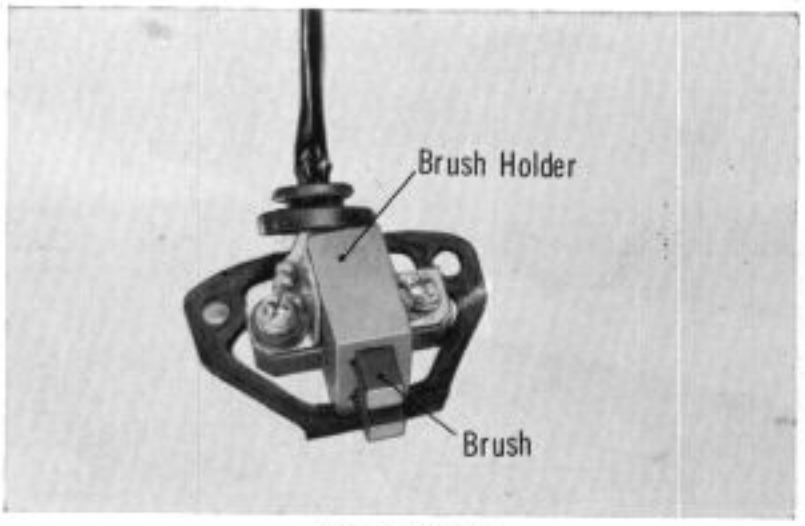


Fig. 17A-68

5. Check the rotor slip ring surface. If the surfaces are stained or rough, rework the slop rong.

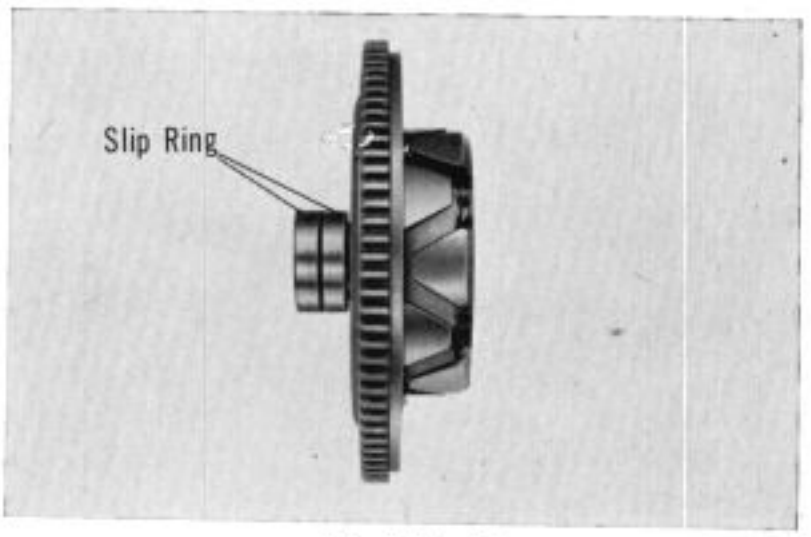


Fig. 17A-69

Installation

Installation is the reverse sequence of removal.

Note:

1. When installing the flywheel housing cover, ascertain that the flywheel housing is provided with two hollow pins. (Refer to **Fig. 17A-63**)
2. When installing the pulley, align the pulley shaft pawl with the end notch of the crankshaft. **(Fig. 17A-70)**

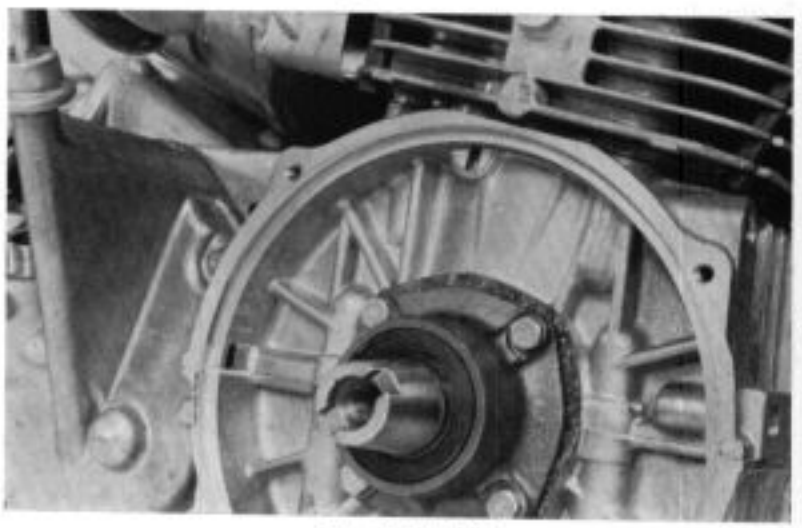


Fig. 17A-70

Voltage Regulator and Discharge Warning Relay

Removal and Installation

Remove all the regulator terminal lead wires.
Remove the right side of the headlight, hold the regulator installing nut with the hand, and remove the bolt. Then the regulator can be removed from the vehicle body.

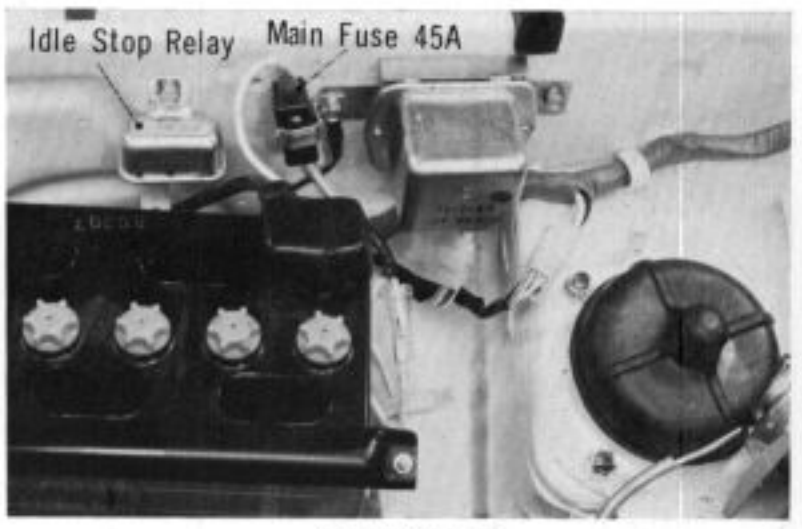


Fig. 17A-71

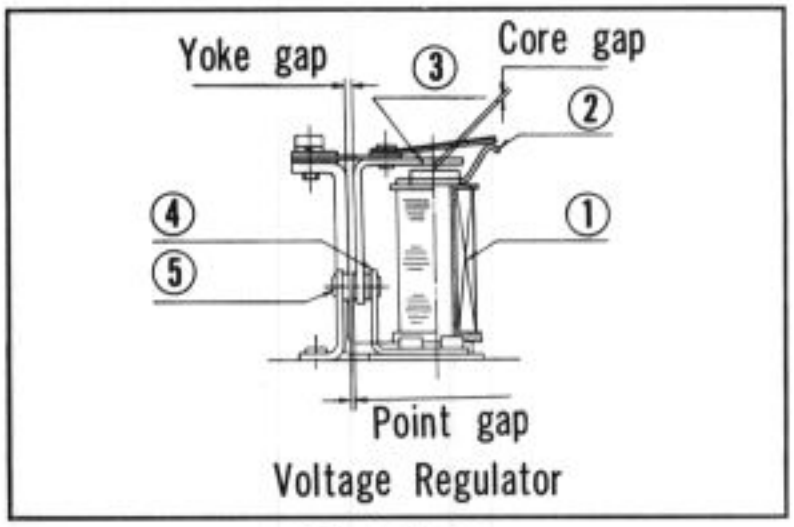


Fig. 17A-72

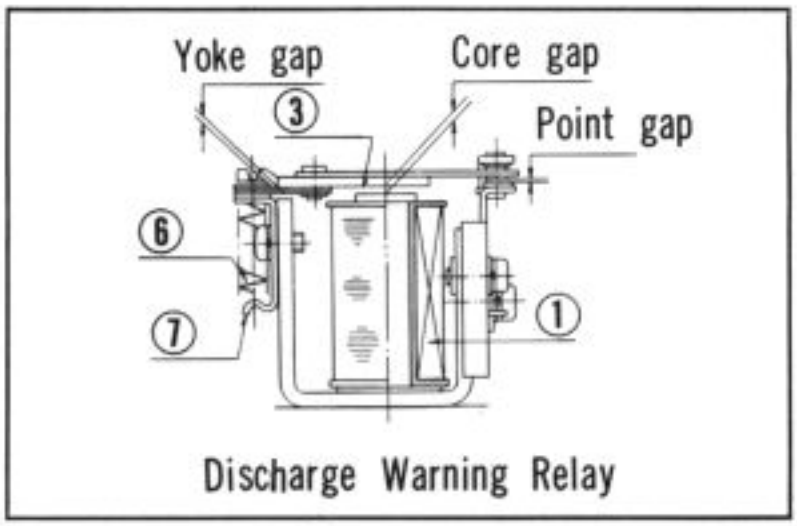


Fig. 17A-73

(Fig. 17A-72 and 17A-73)

① Voltage (shunt) coil
② Adjuster
③ Armature
④ Lower contact
⑤ Upper contact
⑥ Spring
⑦ Hanger

Inspection and Adjustment

1. Remove the regulator cap, and check the point. If the point is rough, grind it with a fine emery cloth.
2. Check the gaps in various parts and if they are not correct, adjust. **(Fig. 17A-74 to 77)**

Voltage Regulator:	
Yoke gap	0.9 to 1.0 mm (0.035 to 0.039 in)
Core gap	0.8 to 1.2 mm (0.032 to 0.047 in)
Point gap	0.4 to 0.5 mm (0.016 to 0.020 in)
Discharge Warning Relay:	
Yoke gap	0.2 mm (0.008 in)
Core gap	0.5 to 0.6 mm (0.020 to 0.024 in)
Point gap	0.4 to 0.5 mm (0.016 to 0.020 in)

Gap adjustment should be performed in the sequence of yoke gap, core gap, and point gap.

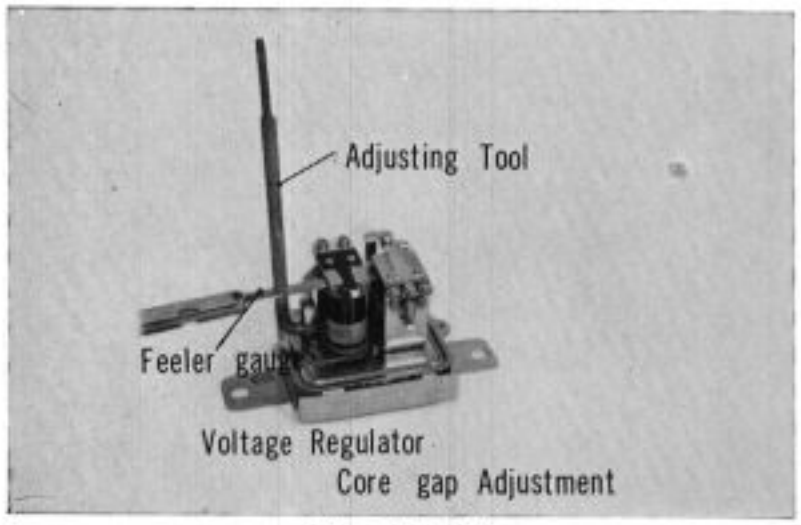


Fig. 17A-74

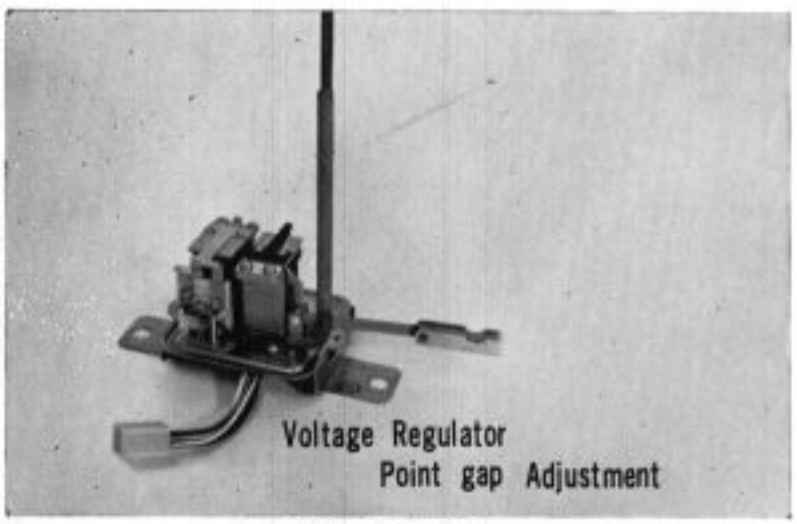


Fig. 17A-75

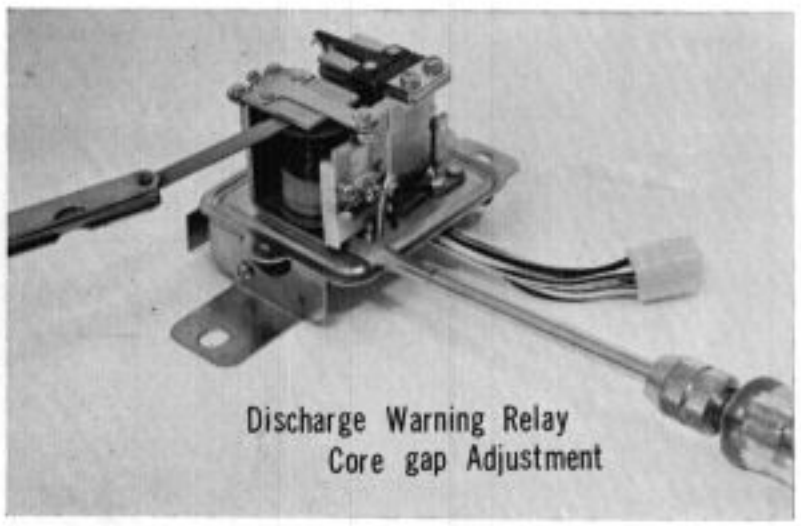


Fig. 17A-76

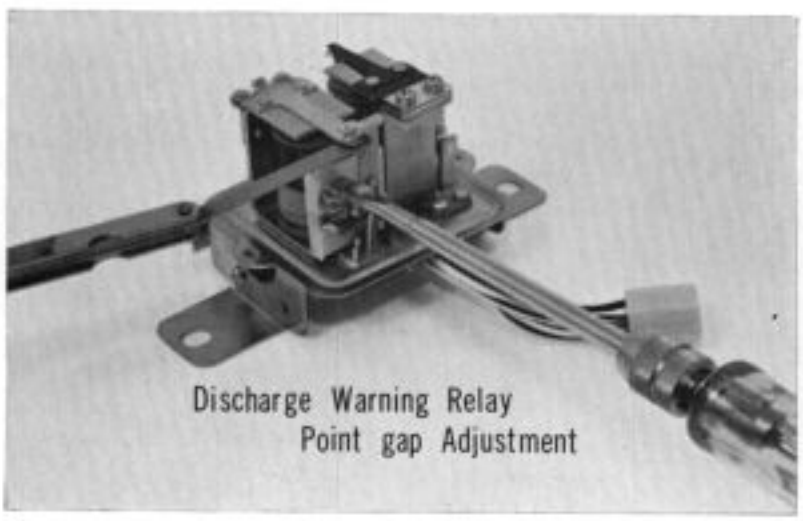


Fig. 17A-77

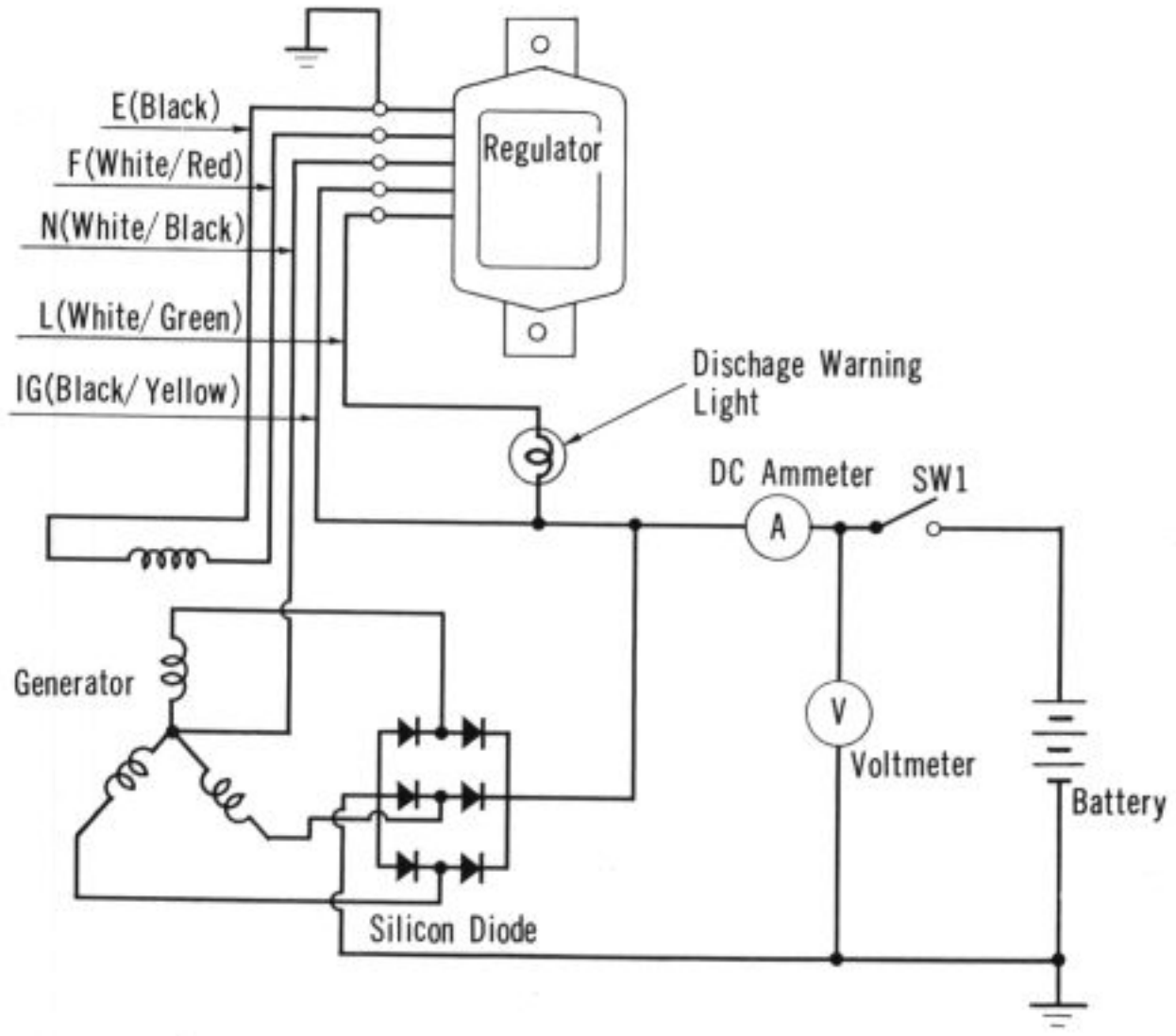


Fig. 17A-78

3. Prepare a DC voltmeter, ammeter, and contact them as illustrated in Fig. 17A-78
4. When regulating no-load voltage, close the switch SW1 thereby allowing exciting current to flow from the battery to the generator rotor coil. After generator speed is raised (approximately 800 rpm), set the switch SW1 OFF.

   Note:
   In the case of a DC generator, when a regulator is combined with the generator to increase generator speed, voltage rises. In the case of an AC generator, however, voltage is not generated as prescribed unless the rotor is initially excited with the DC current flowing into the rotor coil from the battery. When speeding up the generator after stopping it once, set switch SW1 ON and let current flow from the battery. When voltage is generated, set the switch OFF, and check no-load voltage.
5. Raise generator speed to the rated value of 5,000 rpm, and regulate no-load voltage with the regulator.
6. If no-load voltage is lower than the rated voltage (13.5V), bend the adjuster upward and regulate it to the rated value. (Fig. 17A-79)

   ⬅ : Lower the voltage
   ⇦ : Raise the voltage
7. If no-load voltage is higher than the rated voltage of 14.5V, conversely, lower the adjuster and regulate it to the rated value. (Fig. 17A-79)
8. Now, voltage regulator adjustment has been completed. For confirmation of adjustment has been completed. For confirmation of adjustment results, stop the generator and raise generator speed to 5,000 rpm and ascertain that voltage is as rated.

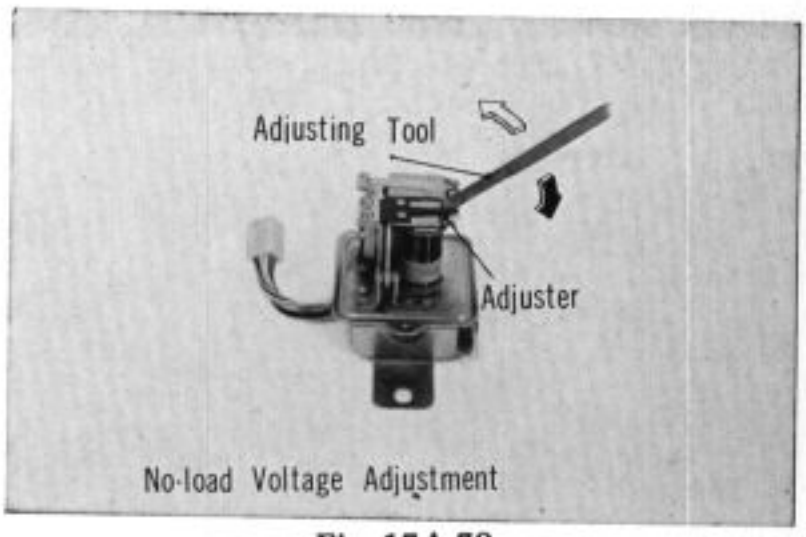


Fig. 17A-79

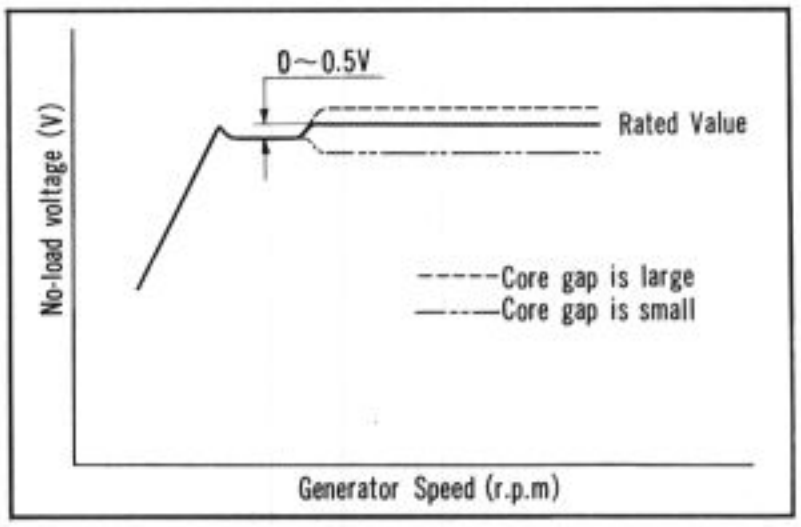


Fig. 17A-80

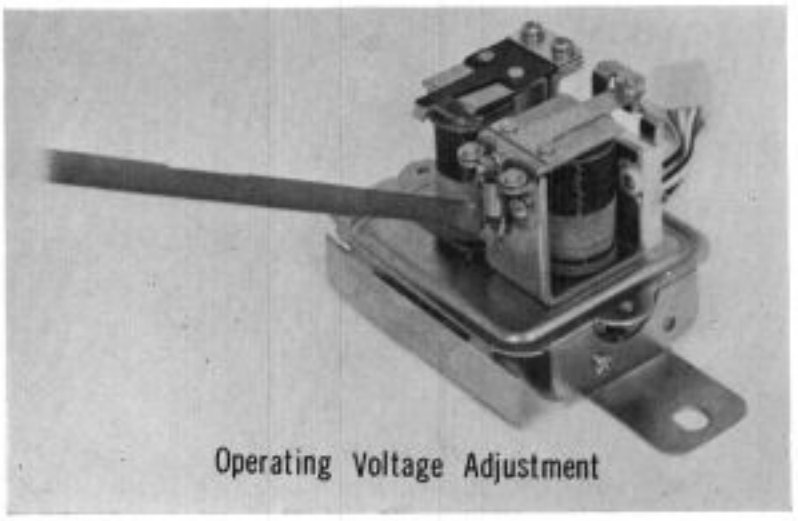


Fig. 17A-81

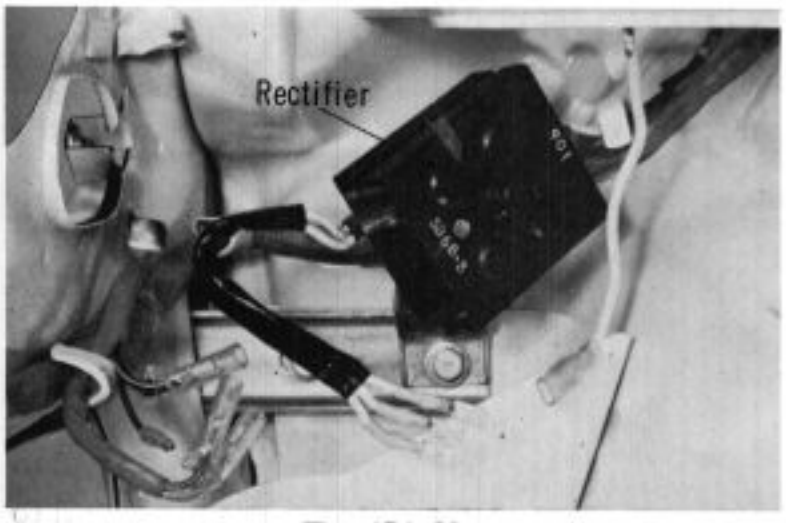


Fig. 17A-82

9. Generator voltage after completing adjustment is as shown in **Fig. 17A-80.**

   When generator operation is changed from low speed (with the lower contact actuated) to high speed (with the upper contact actuated), there is a voltage fluctuation. This voltage change does not matter. Approximately 0.5V voltage rise is desirable in the adjustment.

10. If there is voltage change exceeding 0.5V, or if there is voltage drop when generator operation is changed to high speed, inspect the core gap again. If core gap is too large, voltage rises and if too small, voltage drops.

11. Discharge Warning Relay
    When adjusting the operating (cut-in) voltage of the discharge warning relay, raise generator speed, as prescribed 4 and 5 above, check the operating (cut-in) voltage.

    Operating voltage:
    8 to 10V at P terminal

OperatingVoltage	Tensile force of coil spring	Adjustment
High	Strong	Put hanger upward
Low	Weak	Lower hanger

To judge the functional quality of the silicon diode, disconnect the AC generator stator coil and silicon diode, and check the characteristics of the silicon diode in the normal direction and the reverse direction with an appropriate testing device. If there is continuity only in the normal direction, the silicon diode is defectless. If there is continuity in both directions, or if there is continuity in neither direction, the silicon diode is defective. In this case, replace the silicon diode.

Note:
Do not use a megger. If a megger is used for continuity testing, the silicon diode is damaged by the high voltage.

Handling Precautions

1. Connect silicon diode correctly to the battery while paying attention to battery polarity. If the silicon diode is misconnected, the battery is shorted with the silicon diode. Under this condition, over current flows, thus resulting in damaged silicon diode or seized wire harnes..
2. Connect the terminals correctly.
3. Do not turn the generator at high speed with the silicon diode P terminal circuit disconnected. If this precaution is not observed, high voltage is generated and the silicon diode is sometimes damaged.
4. When charging the battery from outside, such as quick charging disconnect the silicon diode P terminal.

Table of Maintenance Standards

AC Generator		
Register		
Stator coil		0.115Ω
Rotor coil		5.19Ω
Regulator	Shunt coil	10.5Ω
	Rotor register	10Ω
	Compensating register	25Ω
Discharge warning relay shunt coil		33.2Ω
Brush		
Standard length		14.5 mm
Serviceable limit		7.0 mm
Spring tension		0.3 kg
Regulator		
Yoke gap		0.9 to 1.0 mm
Core gap		0.8 to 1.2 mm
Point gap		0.4 to 0.5 mm
Discharge warning relay		
Yoke gap		0.2 mm
Core gap		0.5 to 0.6 mm
Point gap		0.4 to 0.5 mm
Operating voltage		8 to 10V at P terminal

d. Trouble Diagnosis

(1) Battery is not charged.

Faulty Part	Cause of Trouble	Corrective Action
Wiring and ammeter	Disconnection, short circuit, or displaced connector.	Repair or replace.
Generator	1. Disconnected coils, grounding, or short circuit.	Replace.
	2. Faulty silicon diode.	Replace.
Regulator	1. Lead wire, short or disconnection.	Repair or replace.
	2. No-load voltage is lower than the rated voltage.	Readjust.

(2) Battery is discharged due to insufficient charge.

Wiring	Early stage of disconnection and short circuit, or loosened connected part.	Repair or retighten.
Generator	1. Rotor coil lay er short circuit.	Replace.
	2. Stator coil layer hort circuit.	Replace
	3. Stator coil one phase disconnected.	Replace
	4. Stained slip rings.	Clean
	5. Improper contact of brush.	Correct.
	6. Faulty silicon diode.	Replace.

(3) Battery is overcharged due to excessive charging.

Wiring	The A terminal circuit and F terminal are shortened to be a shunt generator.	Repair.
Battery	Interior short circuit.	Replace.
Regulator	1. Abnormal rise in the no-load voltage.	Repair.
	2. Defective regulator grounding.	Correct grounding.
	3. Disconnected coil lead wire.	Repair or replace.

(4) Unstable charging current.

Wiring	As the vehicle body vibrates, the part of the wire with the broken shield is shortened or the lead wire is disconnected. This disconnected lead wire sometimes contacts.	Repair or replace.

BODY ELECTRICAL SYSTEM

Electrical System, N600

① Battery ② Ignition Coil ③ Spark Plug ④ A.C. Generator
⑤ Starter Motor ⑥ Voltage Regulator ⑦ Rectifier ⑧ Horn ⑨ Fuel Pump
⑩ Fuse Box ⑪ Wiper Motor ⑫ Turn Signal Relay ⑬ Stop Light Switch
⑭ Ignition Switch ⑮ Door Switch ⑯ Head Light ⑰ Front Turn Signal Light
⑱ Rear Combination Light ⑲ Back-up Light ⑳ License Plate Light
㉑ Interior Light ㉒ Idle Stop Relay

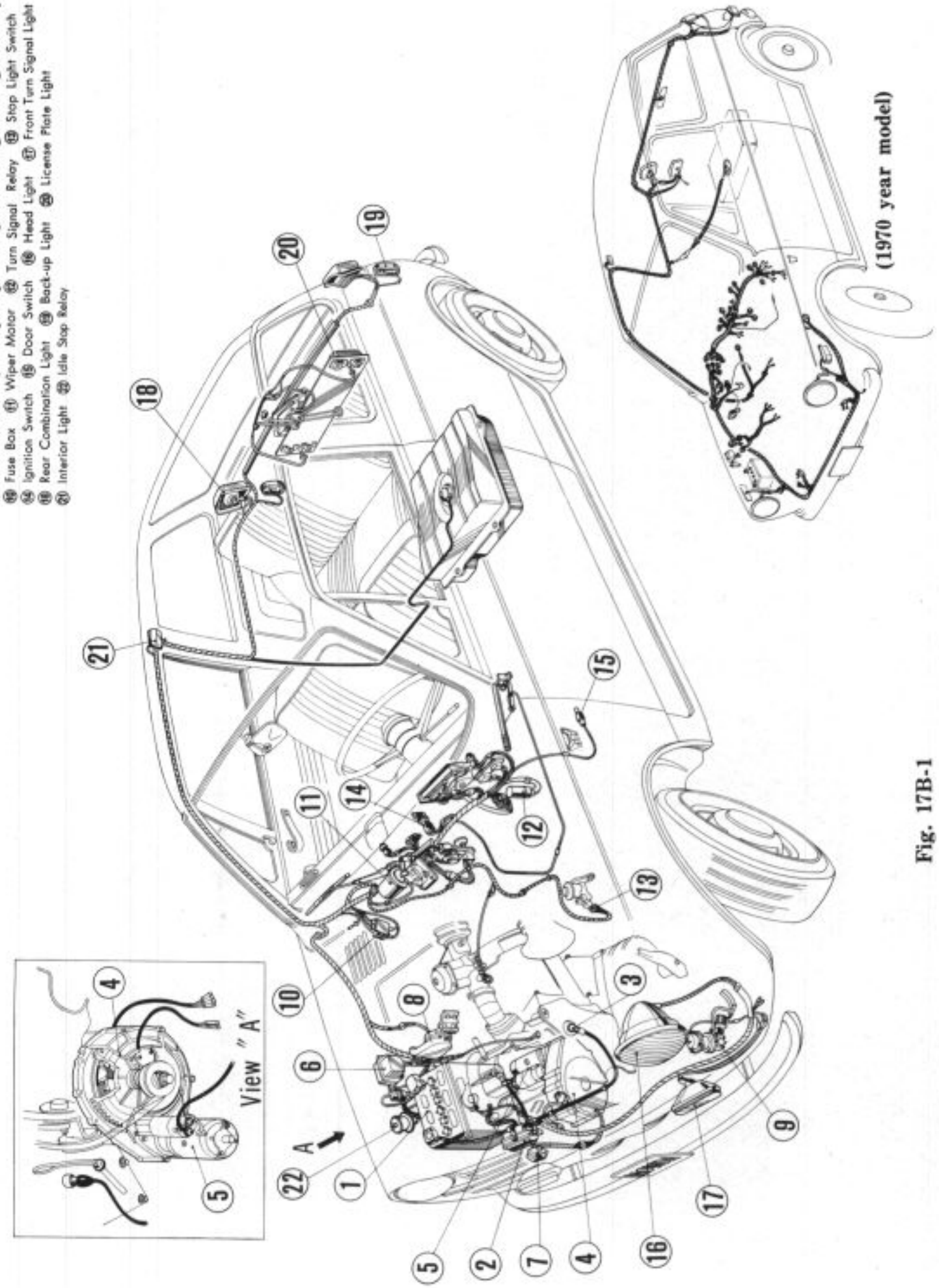


Fig. 17B-1

Instrument Panel Wiring (Vehicles delivered to U.S.A., Canada, and etc.)

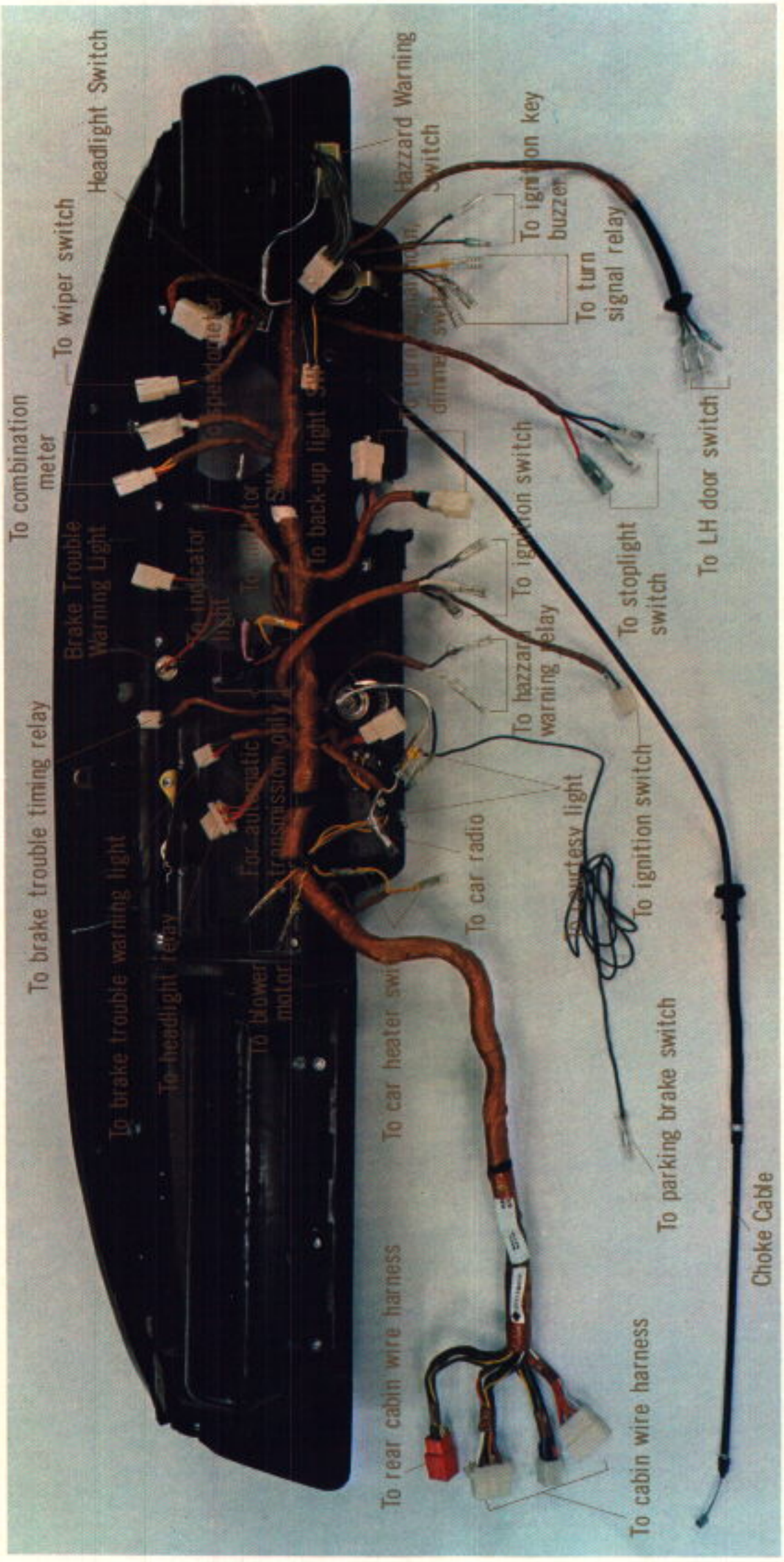


Fig. 17B-1a

Fig. 17B-1b

A. Fuse Box

The fuese box is located on the upper dashboard in the engine compartment (Fig. 17B-3) or in front of the ventilator lid at the right corner of the cabin (Fig. 17B-2).

Vehicles delivered to the following countries have the fuse box on the upper dashboard of the engine compartment and 12P fuse box (See Fig. 17B-5), while other vehicles have it in the cabin and 3P fuse box (See Fig. 17B-6).

Germany, France, Italy, Portugal, Denmark, Belgium, Netherlands, Luxemburg Finland, Switzerland, Norway, and Sweden.

From the following "Body applicable serial number", the vehicle for the above countries have 8P fuse box shown in Fig. 17B-4.

N360-1253455, LN360-1014822, N400-1000013, N600-1085151

Vehicles delivered to U.S.A.,Canada,etc incorporate 4P fuse box (Fig. 17B-6a)

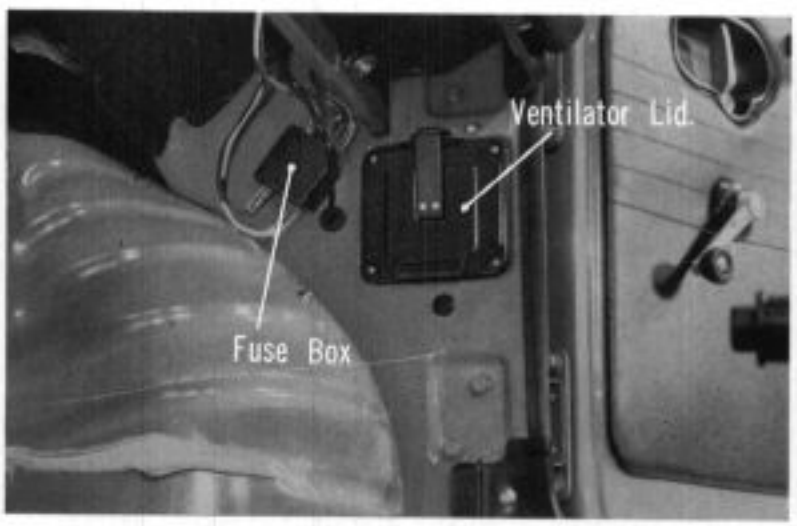


Fig. 17B-2

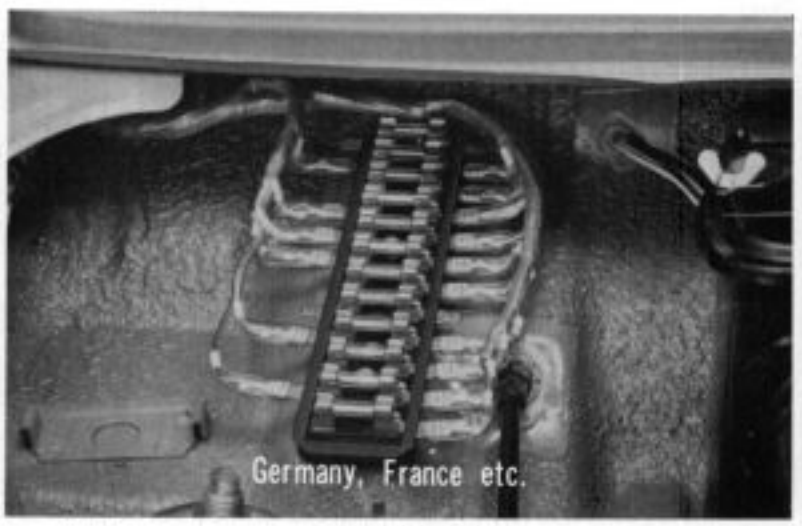


Fig. 17B-3

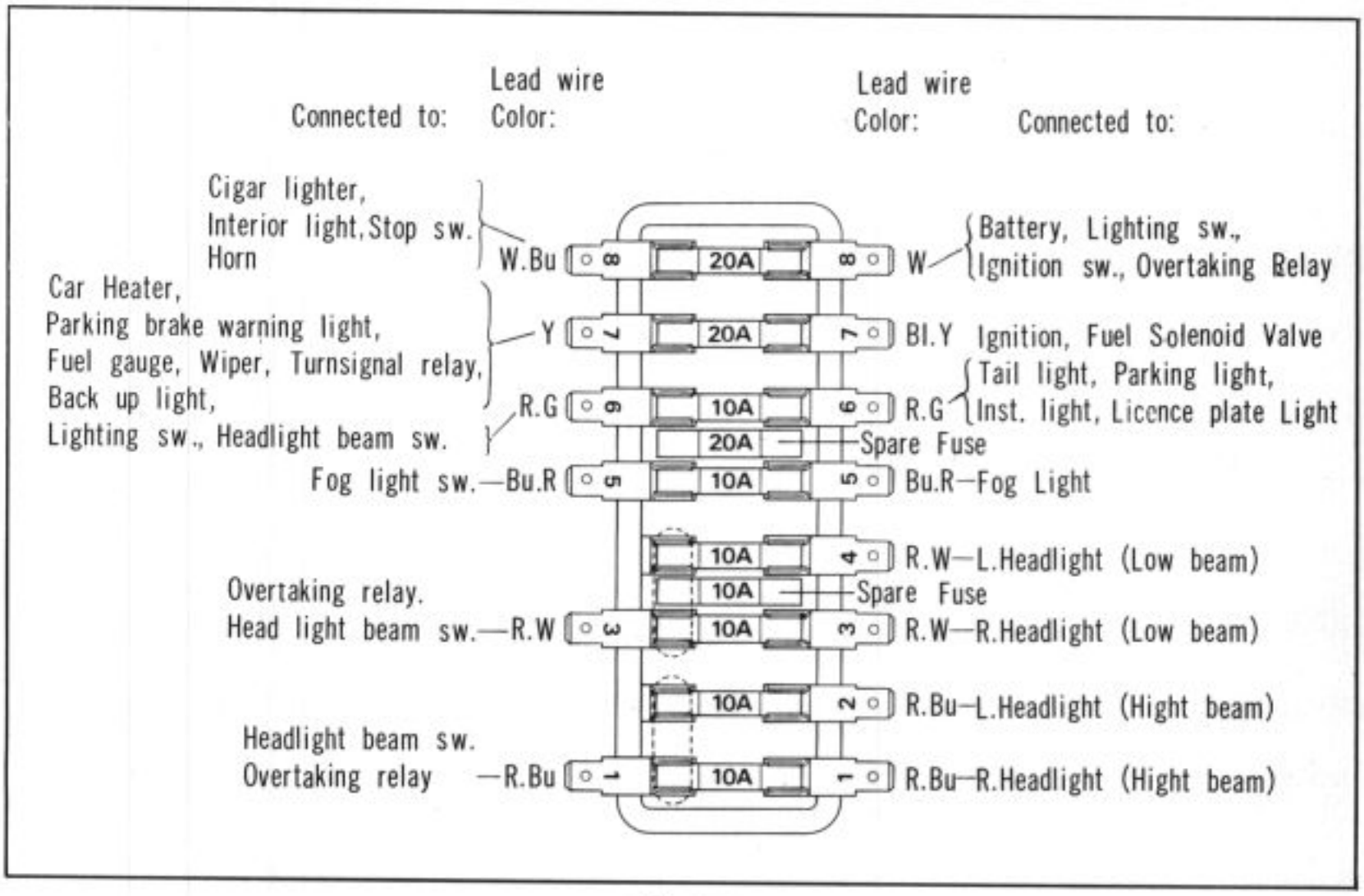


Fig. 17B-4

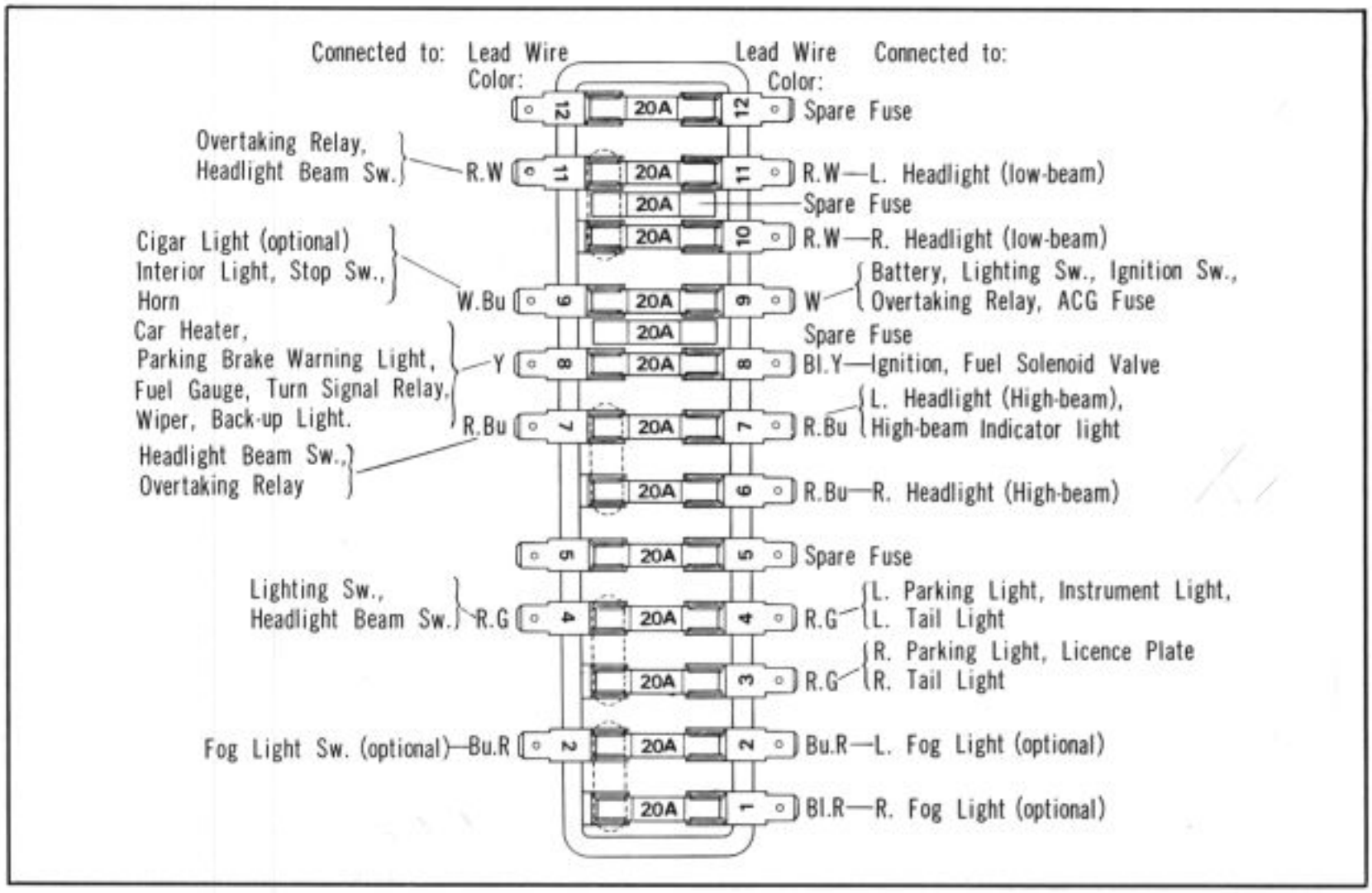


Fig. 17B-5

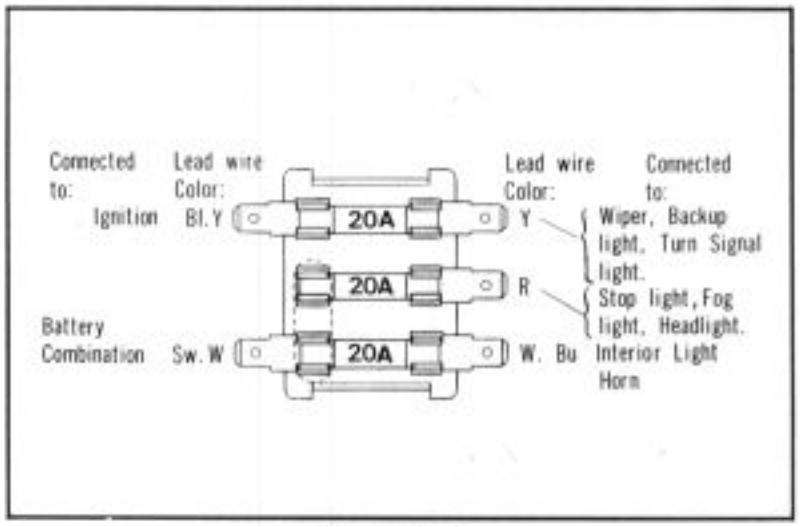


Fig. 17B-6

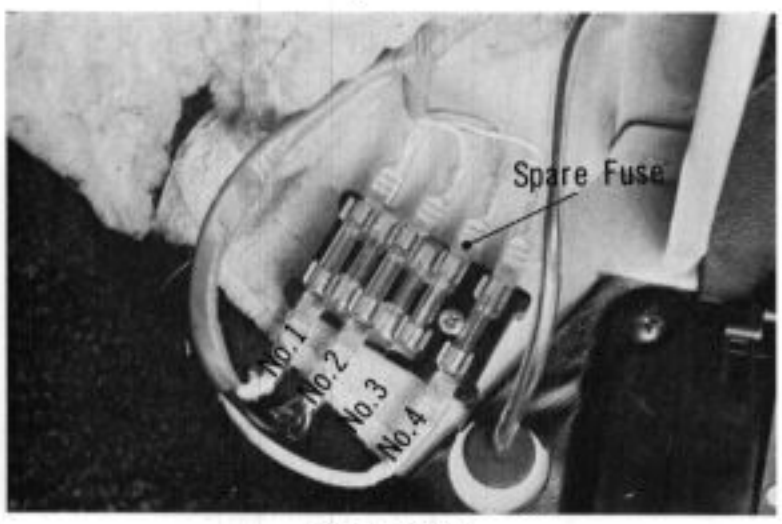


Fig. 17B-6a

R.W . . . . . .Red with White stripe
W.Ru . . . . . .White with Blue stripe
W . . . . . .White
Bl.Y . . . . . .Black with Yellow stripe
Y . . . . . .Yellow
R.Bu . . . . . .Red with Blue stripe
R.G . . . . . .Red with Green stripe
Bu.R . . . . . .Blue with Red stripe
Bl.R . . . . . .Black with Red stripe
R . . . . . .Red

(Fuse Box for U.S.A.)
No. 1 . . . . . .15A
Car Heater Blower Motor
No. 2 . . . . . .15A
Back-up Light
Turn Signal Light
Wiper Motor
Fuel Gauge
No. 3 . . . . . .20A
Side Marker Light
Tail Light
Licence Light
Stop Light
Headlight
No. 4 . . . . . .20A
Horn
Cigar Lighter
Interior Light
Radio
Hazard Warning Light

B. Lighting Circuit

a. Headlight

There are four types of headlights classified according to countries to which vehicles are exported. Their disassembled views are given in Fig. 17B-7, 8, 9 and 10 respectively.

(1) Standard . . . . . Fig. 17B-7
(2) Germany, Denmark, Switzerland, Norway, Sweden and Finland . . . . . Fig. 17B-8
(3) France, Belgium, Italy, Portugal, Netherland, Luxemburg . . . . . Fig. 17B-9
(4) USA . . . . . Fig. 17B-10

The headlights delivered to countries (3) self-contain parking lights (4W).

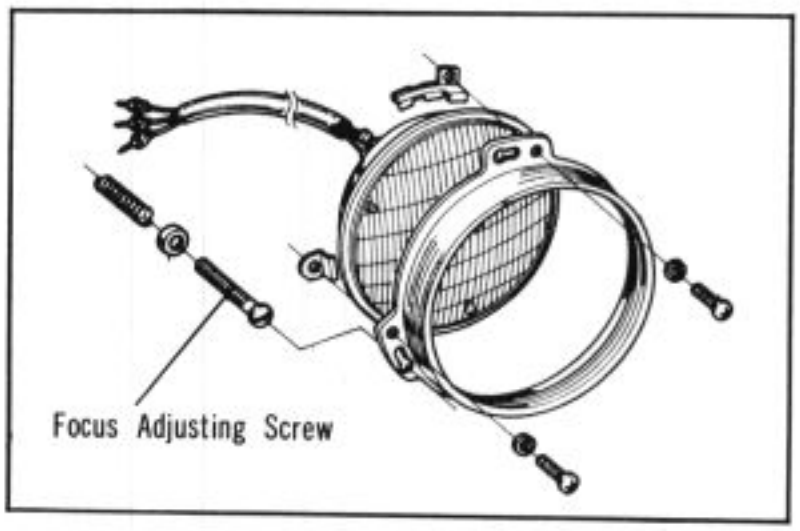


Fig. 17B-7

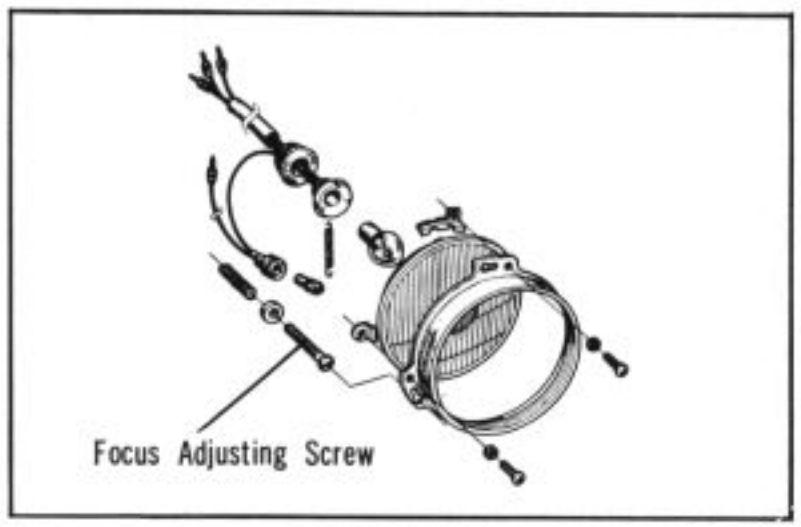


Fig. 17B-8

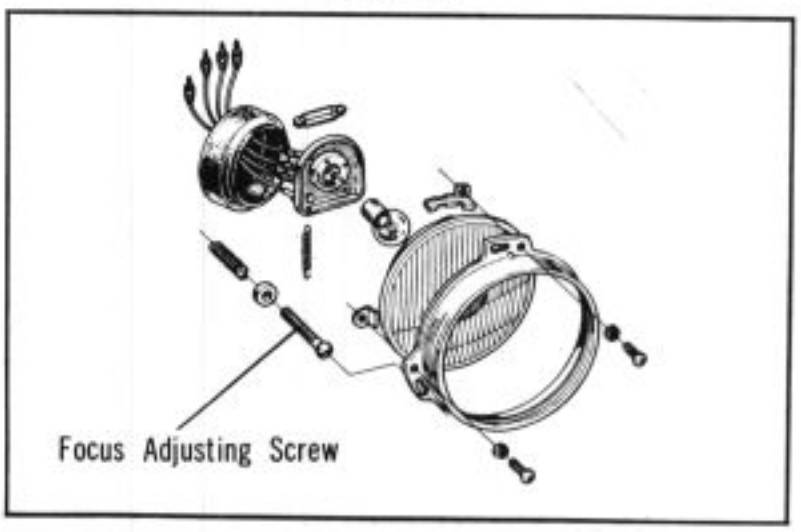


Fig. 17B-9

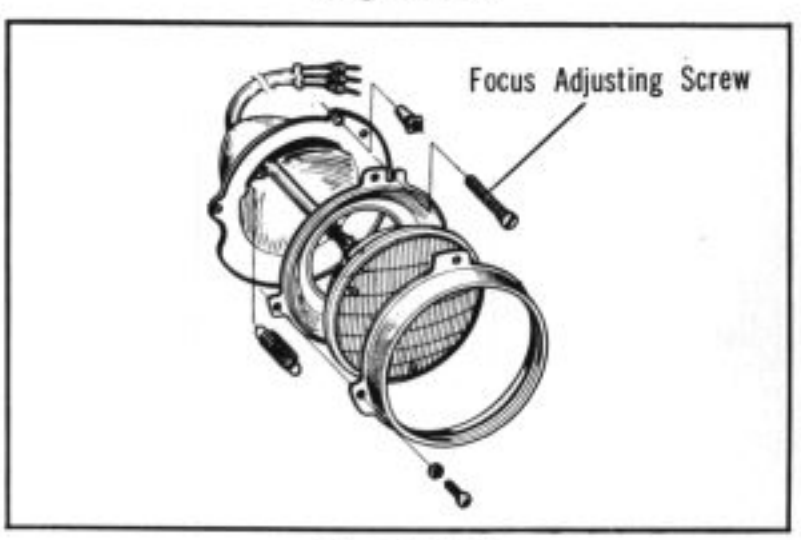


Fig. 17B-10

The disassembly and reassembly of the headlights are described in the following taking the headlight delivered to USA as an example.

1. Since this is a sealed beam type, the headlight can be disassembled as illustrated in Fig. 17B-11 by removing two screws from the retaining ring and the connector from the lamp.

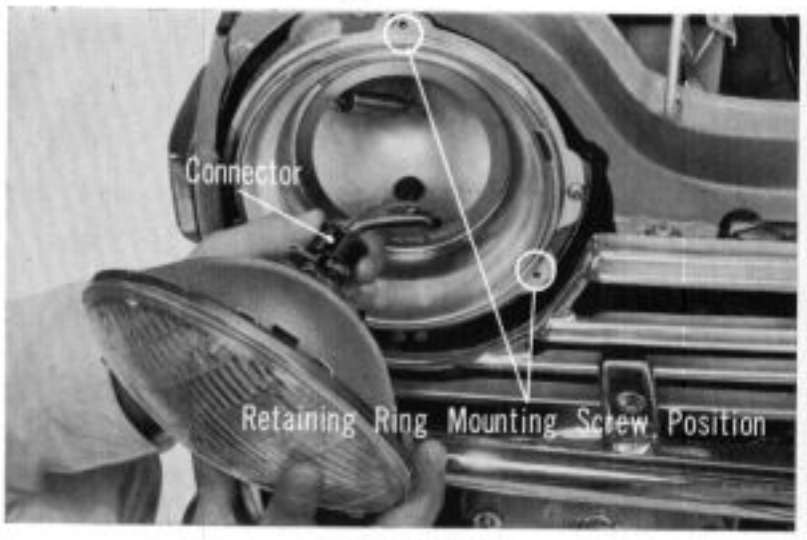


Fig. 17B-11

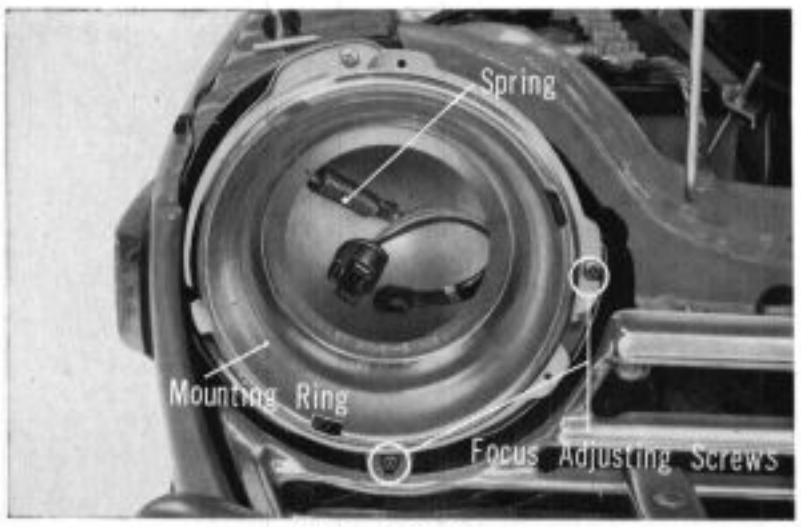


Fig. 17B-12

2. The mounting ring can be removed by removing the spring and two focus adjusting screws. **(Fig. 17B-12)**

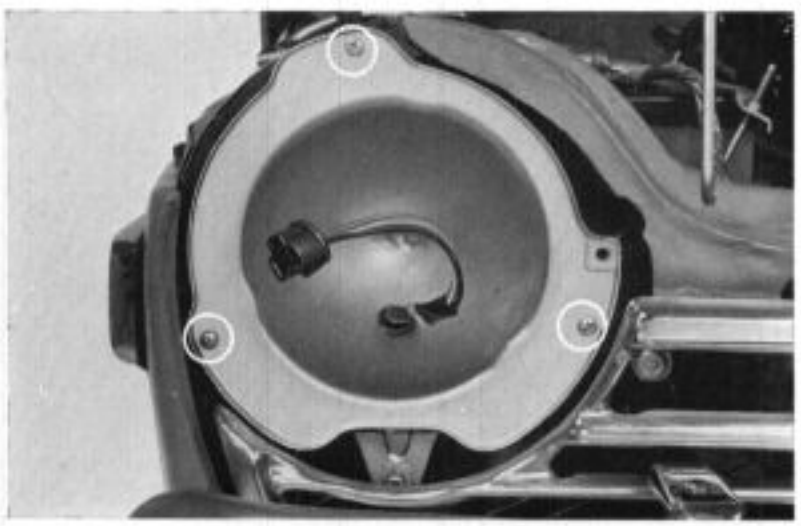


Fig. 17B-13

3. Then remove the three screws from the headlight housing. **(Fig. 17B-13)**

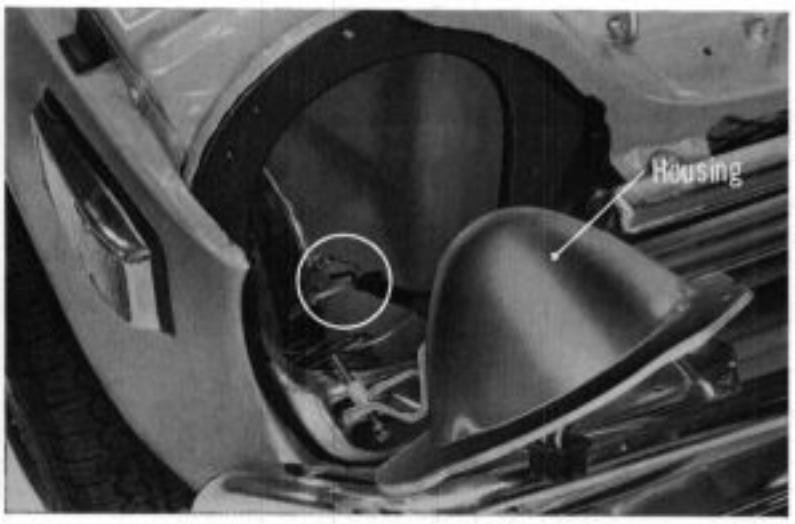


Fig. 17B-14

4. The housing can be separated from the vehicle by unhooking the connector from the wire harness. Match the colors of the wire harness when reconnecting it. **(Fig. 17B-14)**

5. The focus can be adjusted right and left by means of the screw on the right, and up and down by means of the screw at the bottom. **(See Fig. 17B-12.)**

Headlight Alignment

Headlight alignment may differ among the countries due to their own regulations. Vehicles delivered to U.S.A., Canada, etc are adjusted as follows.
Park the car in front of the wall screen with 7.62 m (25 ft) dislance from the screen. Then level the car by bouncing both the front and the rear. Note the headlight alignment test is conducted with 10 literes fuel (less than a half-full) in the tank, with a driver seated in the car, the car unloaded except for the spare tire and tools. Ensure that the tires have the correct inflation pressure.

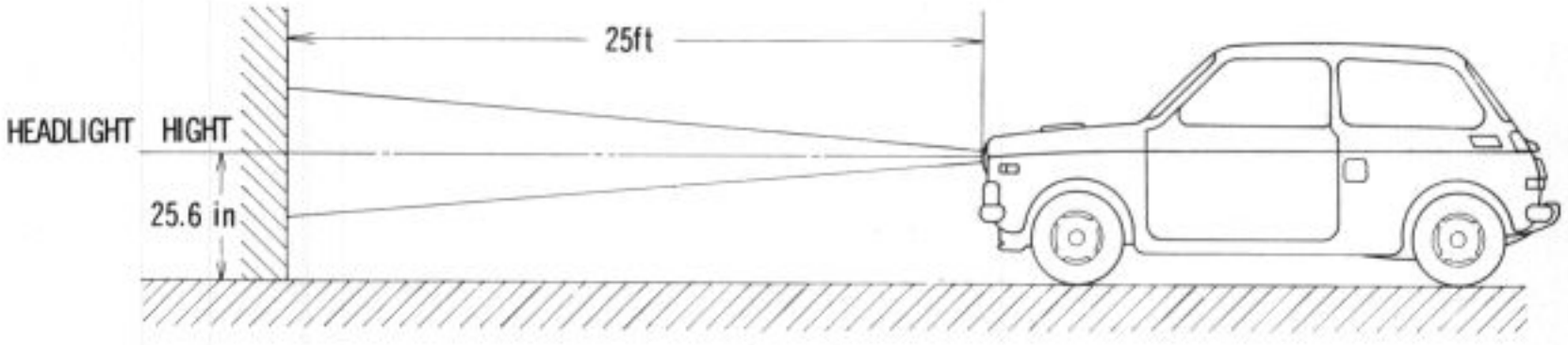


Fig. 17B-14a

Alight the headlights as shown in the picture. Each headlight can be adjusted by means of screws located under the headlight trim ring. (Fig. 17B-13)

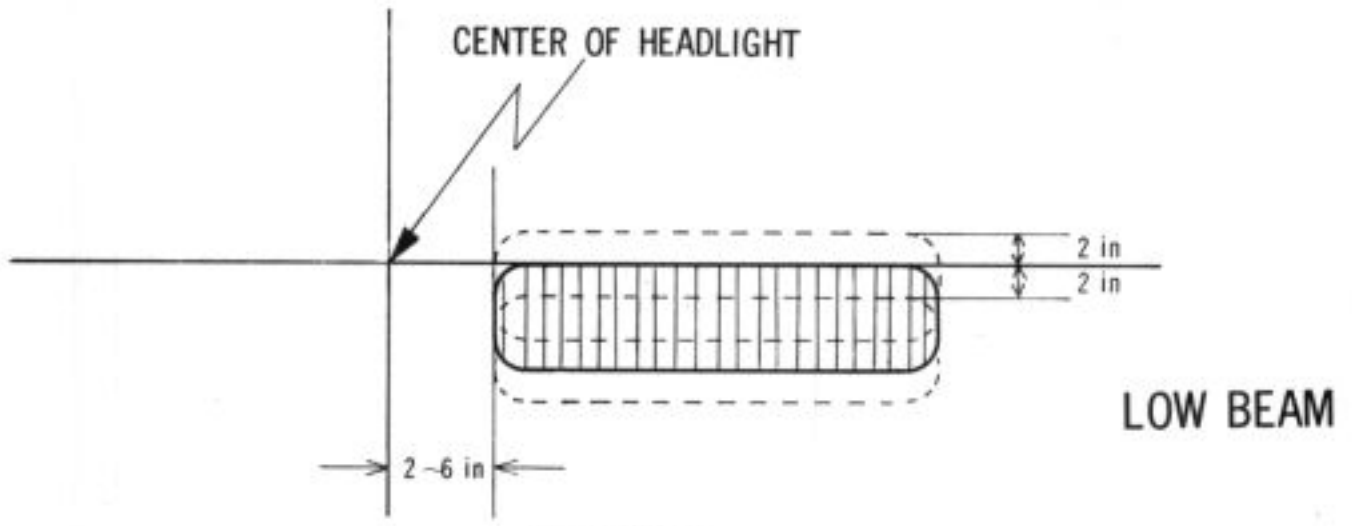


Fig. 17B-14b

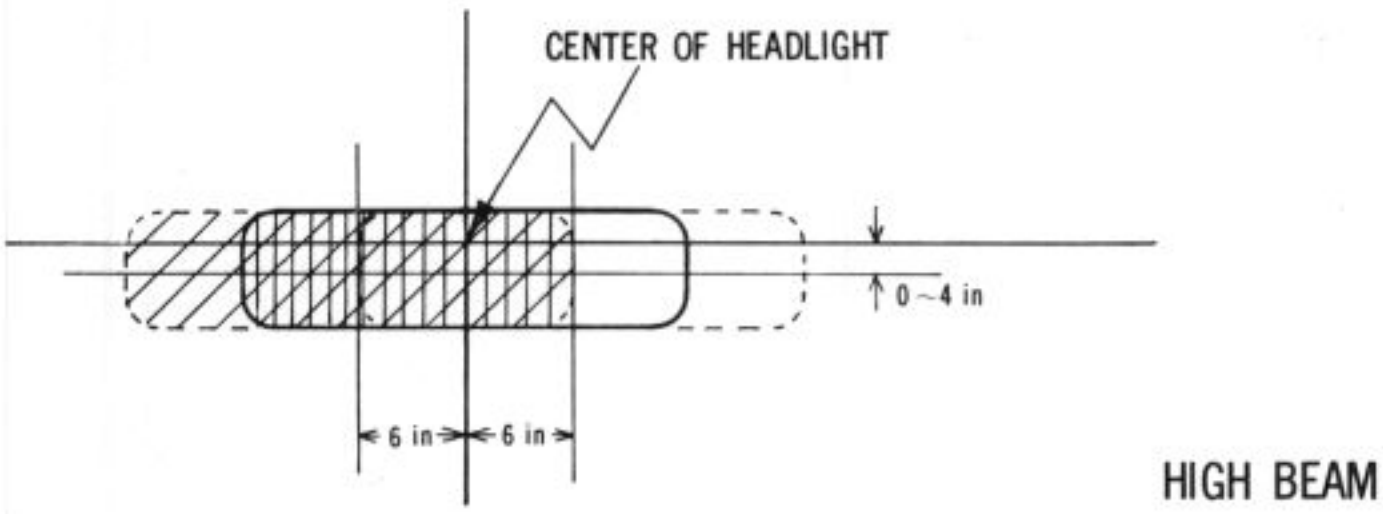


Fig. 17B-14c

b. Rear Combination Light

Standard

To inspect and replace the bulb, open the rear compartment lid, remove the two installing bolts in the rear compartment, and separate the rear combination light from the vehicle body. Since the bulb socket is inserted in the light body, the bulb socket can be removed by pulling. The bulb uses a combined filament, and therefore must be installed in the correct direction. The metallic part of the bulb has differently stepped pawls. Set the bulb in the socket by aligning the pawls with the socket grooves.

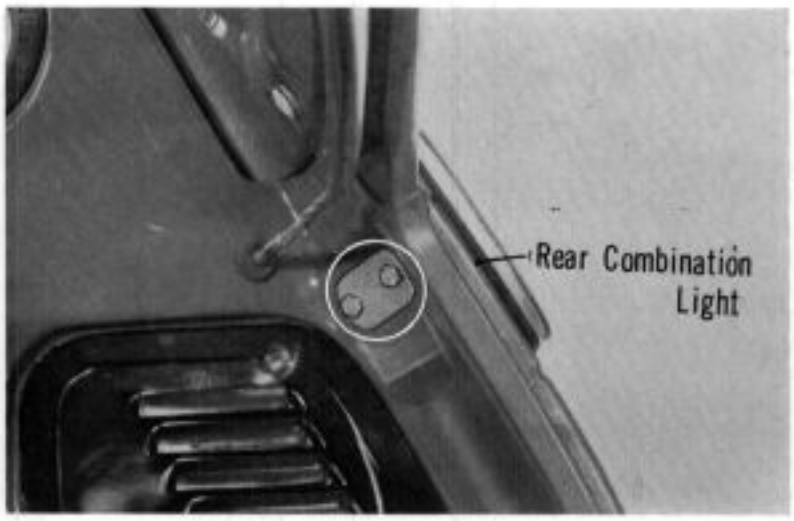


Fig. 17B-15

Fig. 17B-16

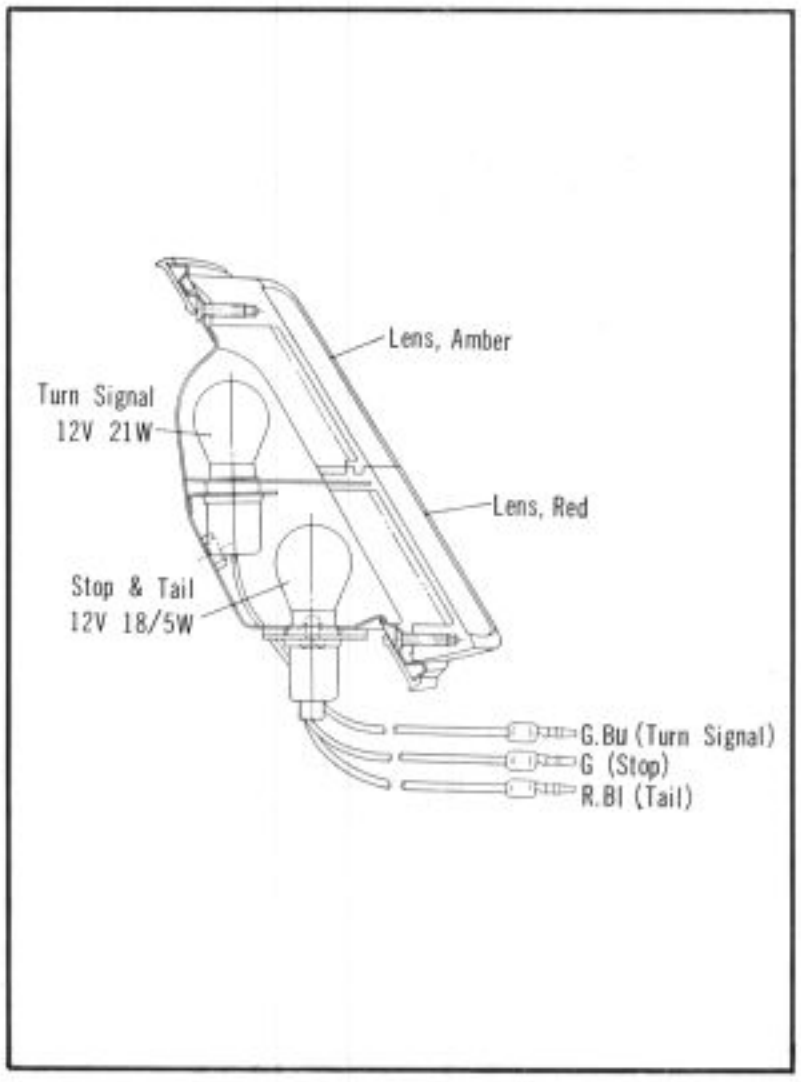


Fig. 17B-17

Vehicles delivered to England and Ireland

The turn signal lights are on top, and the stop and tail lights are at the bottom. These bulbs can be replaced or inspected in the same manner as those that are standard. (Fig. 17B-17)

c. Front Turn-signal Light

Remove the front turn signal light lens, and remove the bulb from the socket by turning it counterclockwise. When installing the bulb in the socket, pay attention to the bulb pawls to be aligned with the socket grooves.

Turn signal 25W
Parking light 8W

Fig. 17B-18

Check for the installation direction of the rubber seal when fitting the lens. The rubber seal has a groove to drain water contained in the light. Install the rubber seal with the groove facing downward. **(Fig. 17B-19)**

Bulbs except for those delivered to France and Belgium contain two filaments in the same envelope; one for turn signaling and the other for parking.

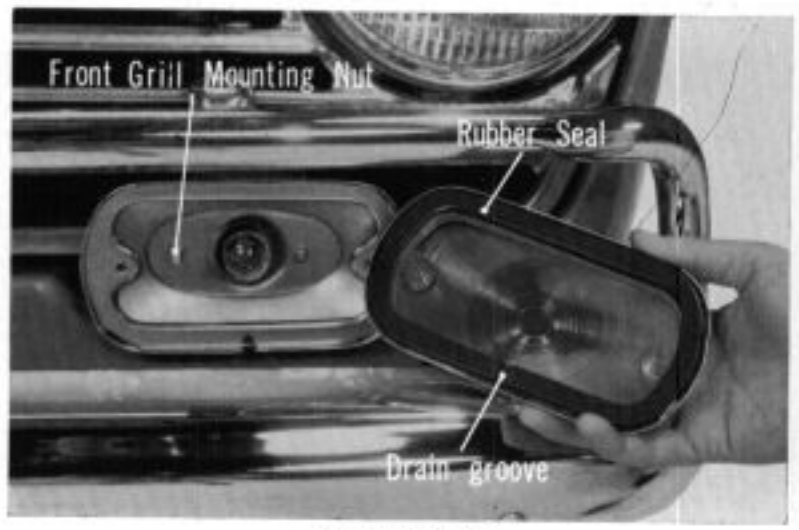


Fig. 17B-19

d. Back-up Light

Remove the two screws. Then, the lens and light assembly can be separated from the vehicle body.

Back-up light 10W

Fig. 17B-20

e. Front Side Marker Light (Only for the U.S.A.)

The front side marker lights are equipped on the right and left front fenders. The lens are a reflex reflector type.

Bulb 12V 4cp

1. Remove the lens.
2. Then, remove the screw from the socket mounting. (For replacement and inspection of the bulb) **(Fig. 17B-21)**

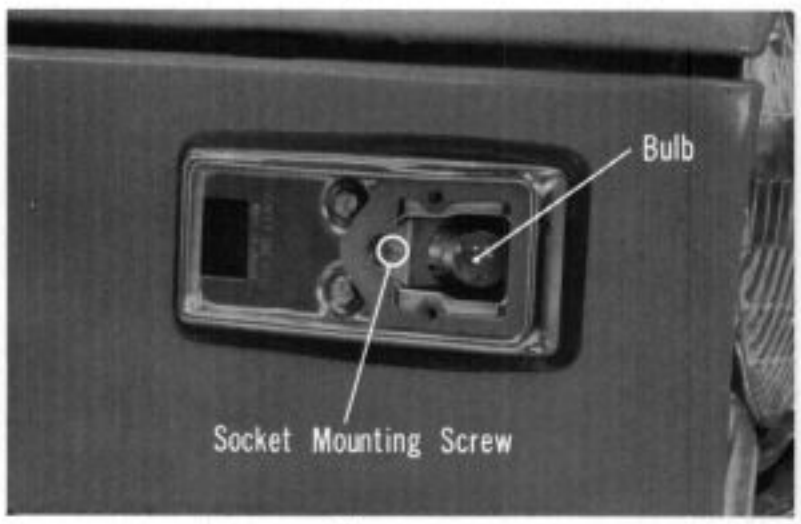


Fig. 17B-21

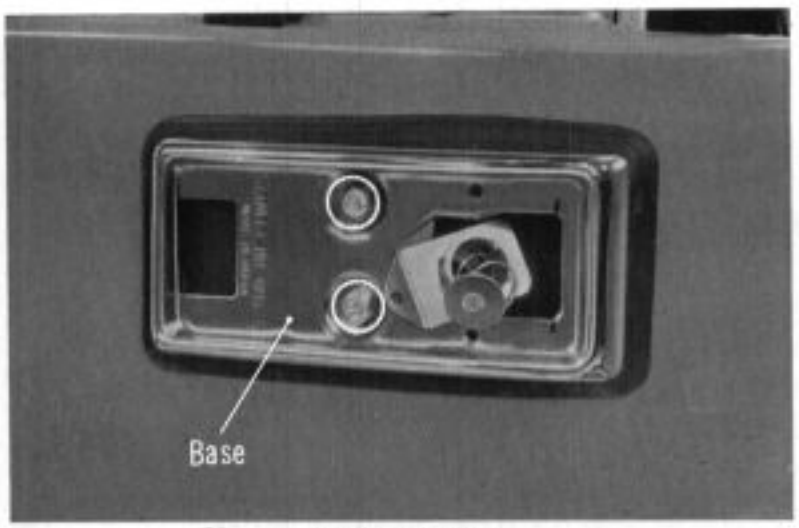


Fig. 17B-22

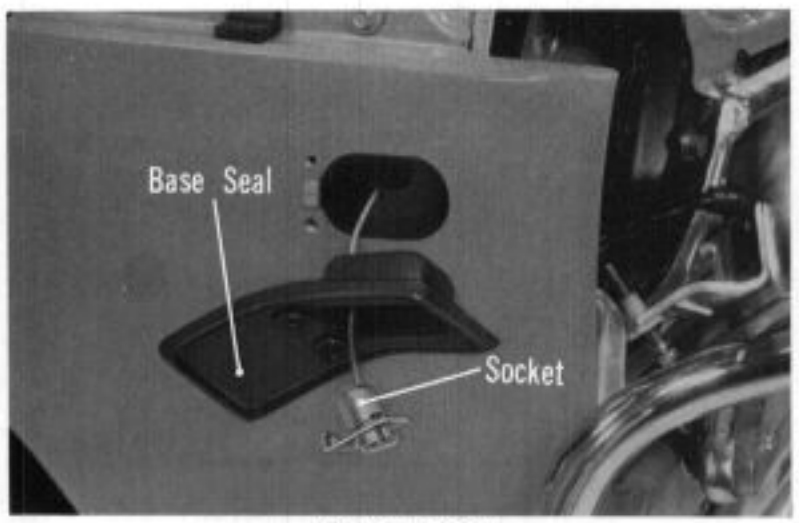


Fig. 17B-23

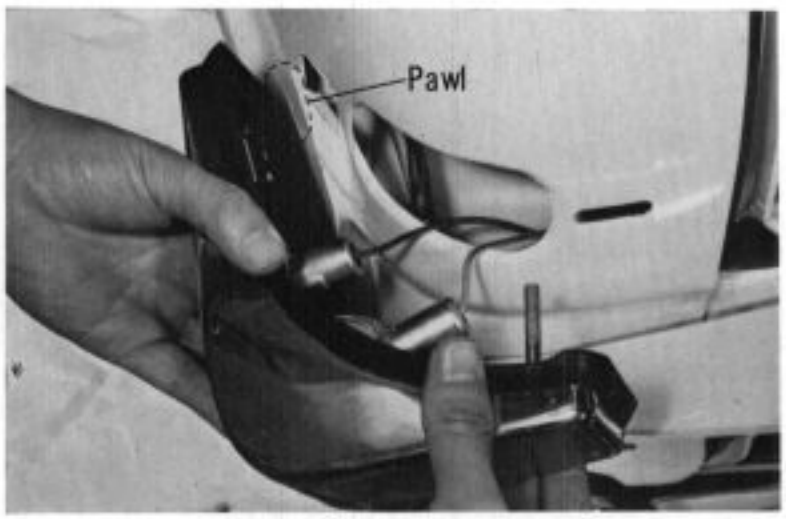


Fig. 17B-24

Fig. 17B-25

3. The light base is fixed to the fender with two bolts. **(Fig. 17B-22)**

4. Before replacing the base seal or the socket, remove the headlight and disconnect the connector from the wire harness. **(Fig. 17B-23)**

f. Rear Side Marker Light and Back-up Light (Only for USA)

Model 600 to be delivered to USA have rear side marker light and back-up light beside the rear combination light.

1. Remove the lens to replace the bulbs.

Side marker light	12V 4cp
Back-up light	12V 15cp

2. The rear side marker light is mounted by means of a pawl at the front and a nut at the rear

g. Licence Plate Light

The side licence plate light is installed on the base of the licence plate (except for models to be shipped to France and Belgium, and the standard model). To replace the bulb, remove the lens. **(Fig. 17B-26)** To replace the licence plate light (installed at the base of the licence plate), open the rear compartment lid and remove the screw on the reverse side of the lid.

C. Windshield Wiper

a. Description

- The wiper assembly incorporates a stable ferrite-magnet motor as the power source whose speed is reduced by a speed reduction gear (worm gear) to the required speed, at which the output shaft of the wiper motor turns to swing the wiper shafts (the shafts on which the blade arms are attached) by means of links and rods so as to wipe off water and dirt from the surface of the windshield.
- In the case of the two-speed reduction system, employed by vehicles to be shipped to the USA, the motor has an additional brush besides the two ordinary brushes and the speed is changed by alternating these brushes electrically by means of the wiper switch at the driver seat position. The motor has no field winding since a permanent magnet is used.
- Automatic wiper stopping is performed by a dynamo brake, which will neither have electrical troubles nor change its stopping position.
- Since the link mechanism and the arm blades have elasticity and sufficient strength and the arm pressure, arm blade dimensions, and wiping angle are made appropriate, the wiping performance is quite reliable under all rainy conditions. The water sealing is trouble-free.

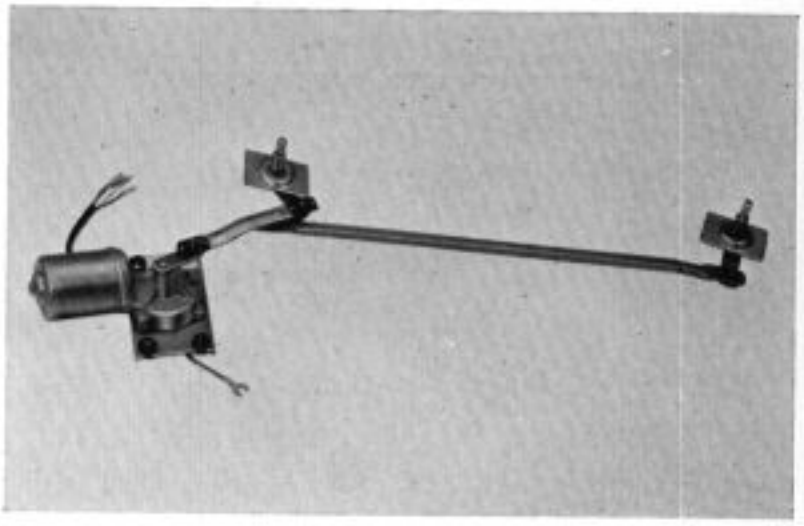


Fig. 17B-27

b. Specifications

Motor		Arm	
Rated voltage	12V	Blade pressure	450±30g
No-load speed	60 rpm	Linkage	By M5° bolts
No-load current	Less than 1.5A		
Reaction torque	Greater than 100kg-cm	Blade	
Current under load	Less than 17A	Type	Designed for use with curved Surface of glass
Link			
Wiping angle (When wet)	88° on the driver seat side 101° on the assistant seat side	Length	NWB 300mm
		Linkage	7.2mm (width) Bayonet type
Arm shaft diameter	8ϕ		

c. Speed Switch and Auto-stop Mechanism

1. When the wiper is inoperative.

   Fig. 17B-28 shows the state in which the wiper is inoperative. Since no voltage is applied to the (+) brushes (connected to terminals L and H) in this state, no current flows in the motor.

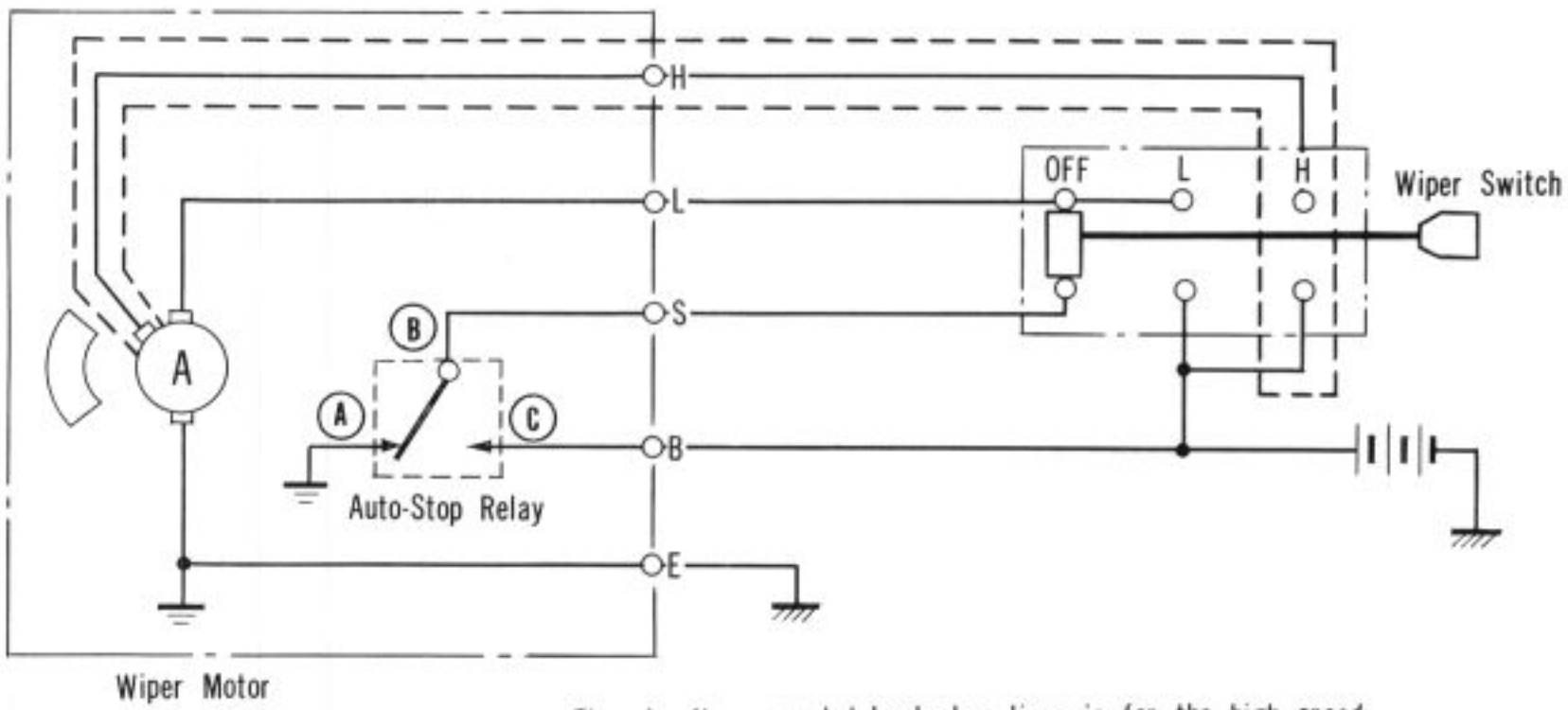


Fig. 17B-28

2. At the low wiper speed.

   Fig. 17B-29 is the state in which the wiper is operating at low speed. In this state battery terminal (+) and terminal L is connected by the wiper switch. Current flows in the order of battery (+), the switch, terminal L, the rotor, terminal E, and battery (−) regardless of the position of the auto-stop relay, and the motor turns.

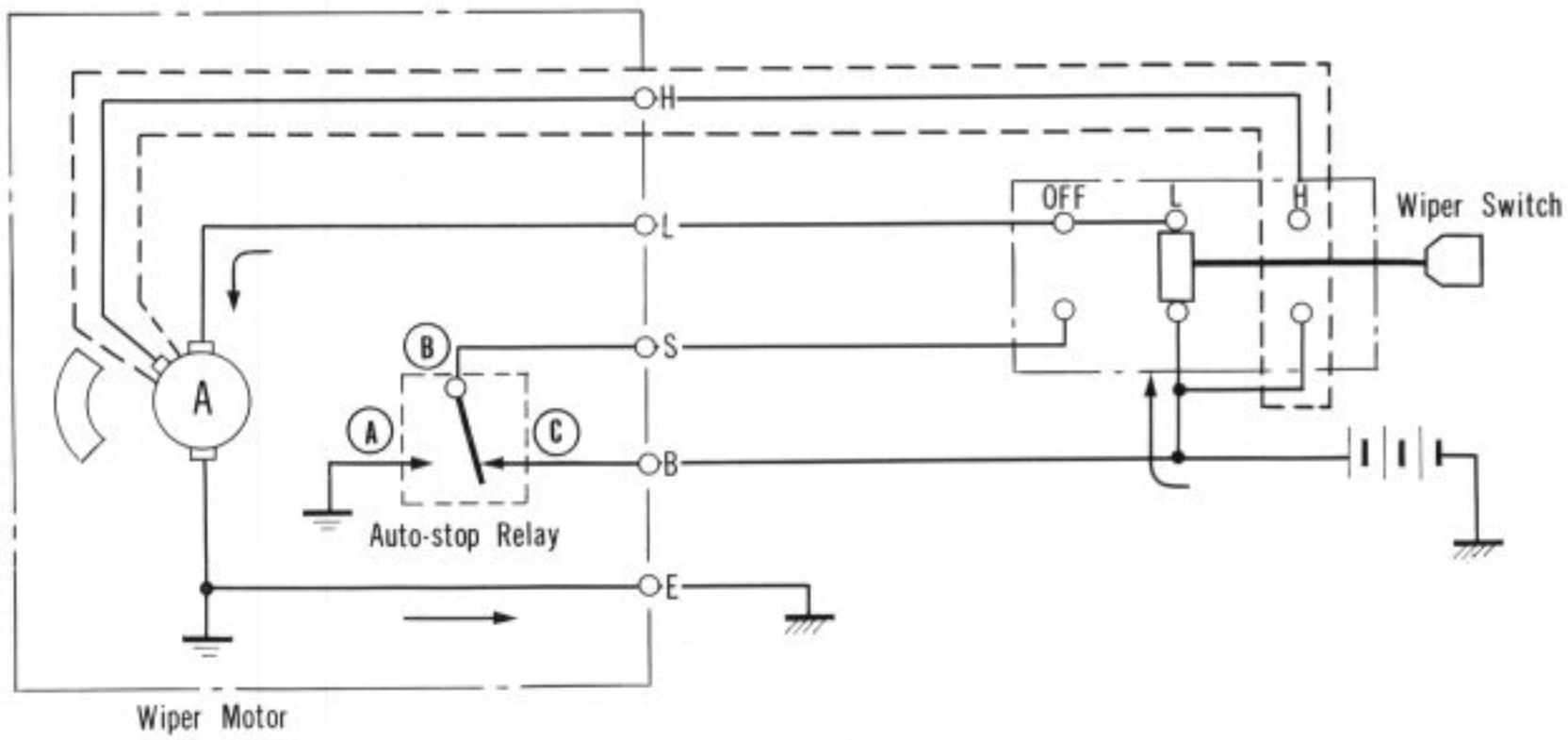
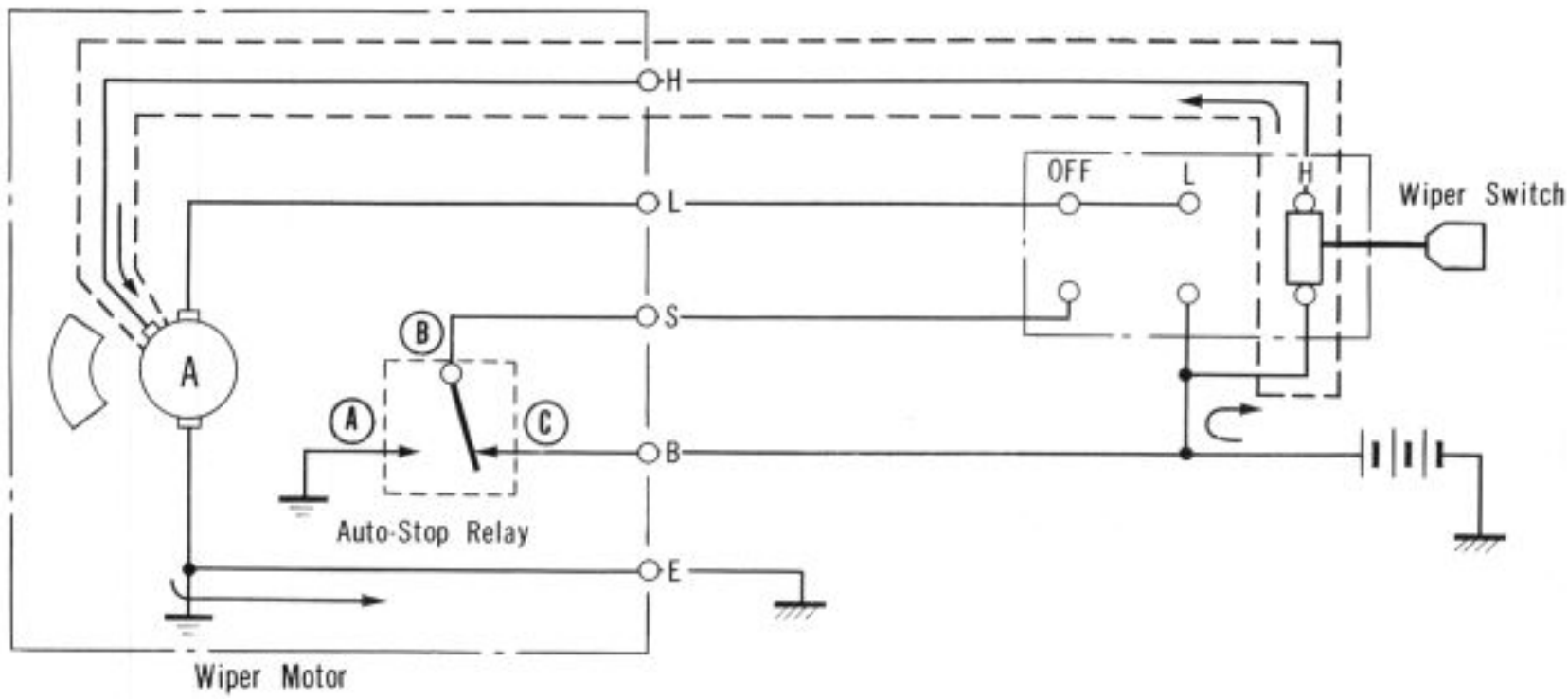


Fig. 17B-29

3. At high wiper speed (in the case of two-speed operation).

   When the wiper switch is set to high speed as shown in Fig. 17B-30, current flows through the third brush as indicated by the arrow, part of the magnetic flux is not used, and the wiper turns at the high speed. Also at this high speed, the position of the auto-stop relay has nothing to do with the motor operation.

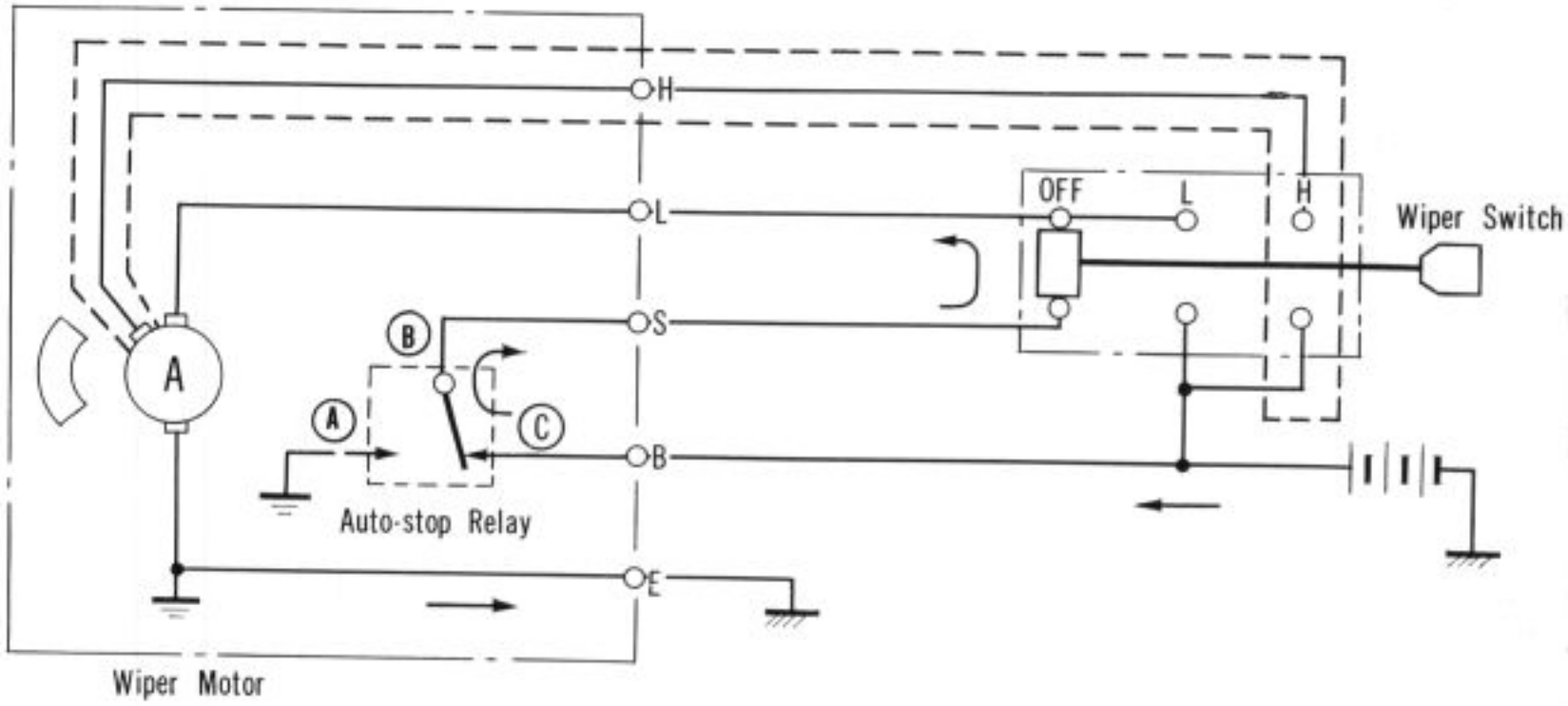


The circuit surrounded by broken lines is for the high speed.

Fig. 17B-30

4. When the wiper switch is at STOP.

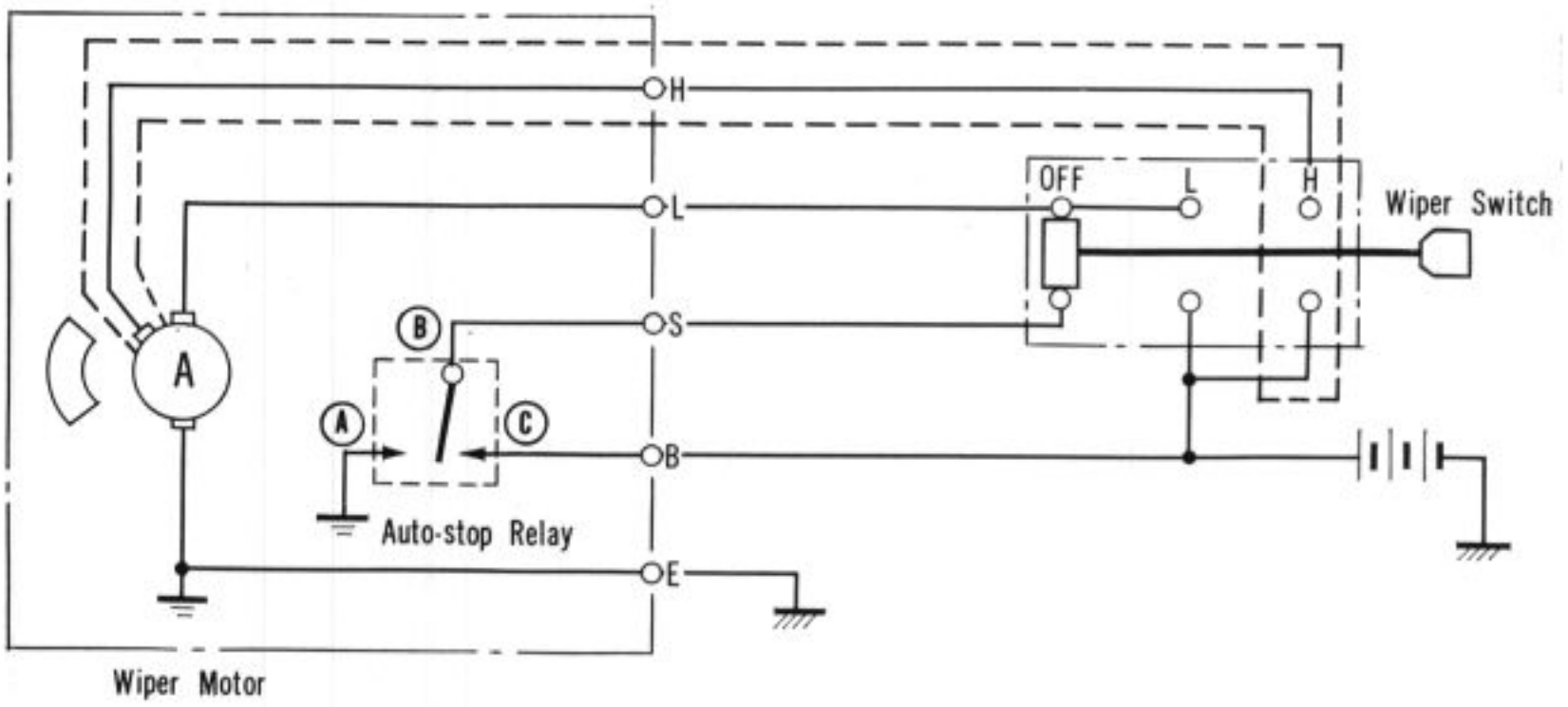
   (a) When contact Ⓑ and contact Ⓒ are closed by the auto-stop relay current flows as shown in Fig. 17B-31 and the wiper operates at a low speed.



The circuit surrounded by broken lines is for high speed.

Fig. 17B-31

   (b) When contact Ⓑ is connected to neither contact Ⓐ nor contact Ⓒ of the auto-stop relay, no current flows in the motor and the wiper keeps turning by inertia. (Fig. 17B-32)



The circuit surrounded by broken lines is for high speed.

Fig. 17B-32

(c) If contact Ⓑ is connected to contact Ⓐ of the auto-stop relay, a closed circuit is established by the rotor, resistor, terminal S, switch, and the rotor as whon in **Fig. 17B-33**. In this state, the rotor turning in the magnetic field acts as a generator, and current flows in the above closed circuit due to the voltage generated by the rotor. That is, current must be supplied to keept the rotor turning or otherwise the inertia force of the motor is rapidly consumed and the rotor is stopped. Thus, the stopping mentioned in 1 is brought about.

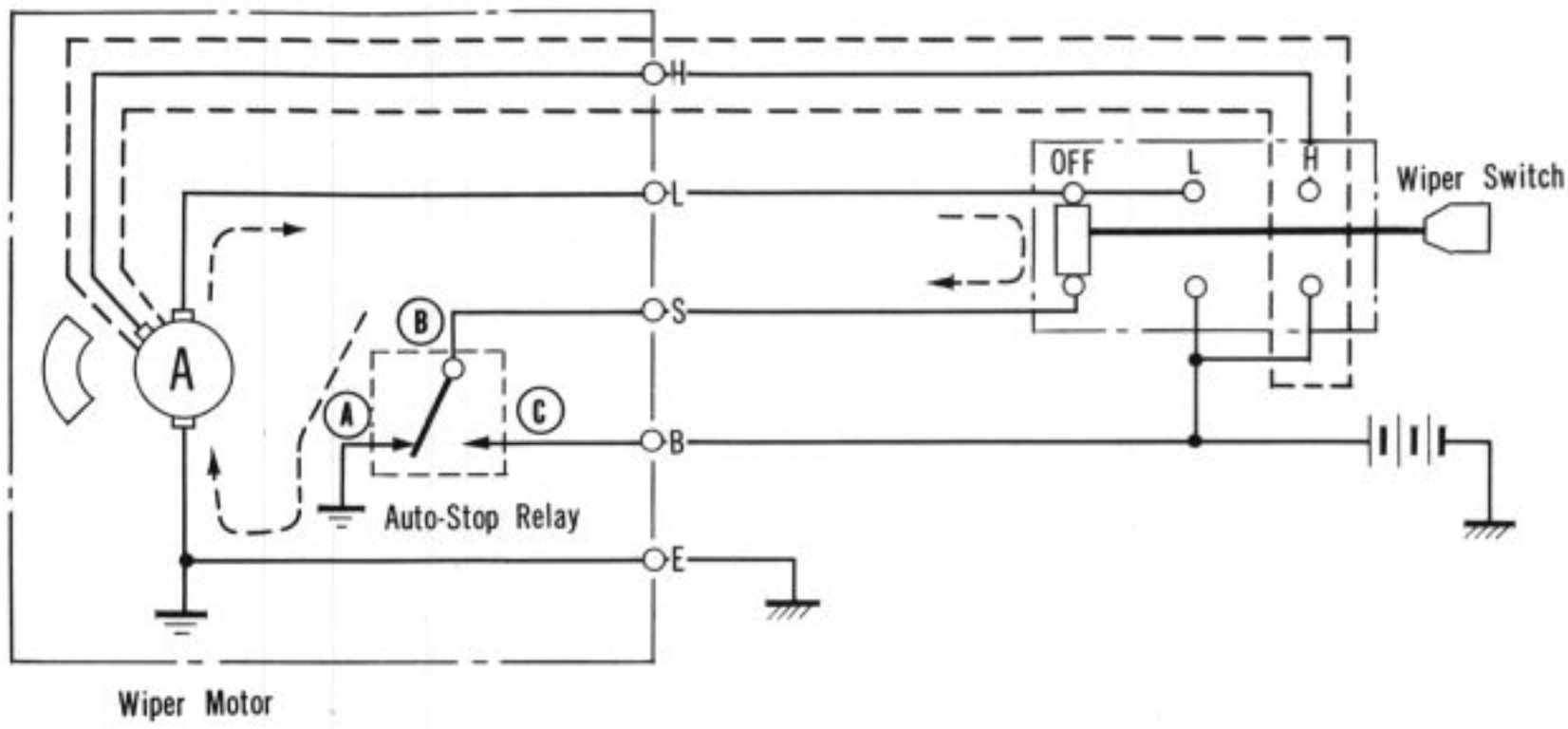


Fig. 17B-33

Auto-stop relay

A relay plate having a shape shown in **Fig. 17B-34** is fitted in the driven gear or the worm wheel, in the gear box. In **Fig. 17B-34**, the inner and outer areas (parts A) are conductors, the intermediate portion (part B) is insulator, and the two dotted circles are the tracks which conductor pieces are in contant while the relay plate is turning. Leads are connected to these circular conductors through conductor pieces.

The outer conductor piece (connected directly to the power source) only contacts the outer conductor of the relay plate, and the inner conductor piece contacts the outer conductor of the relay plate → the insulator → the inner conductor → the insulator → the outer conductor. The inner conductor of the relay plate is grounded to the body of the motor. In **Fig. 17B-35** (a), the inner conductor piece is in contact with the outer conductor.

When inner conductor piece is on the insulator, the relay takes the position shown in **Fig. 17B-35** (b). And the relay with the inner conductor piece being in contact with the inner conductor is shown in **Fig. 17B-35** (c). **Fig. 17B-35** (a) though **17B-35** (c) correspond to **Figs. 17B-31** and **17B-33** in effecting the auto-stop.

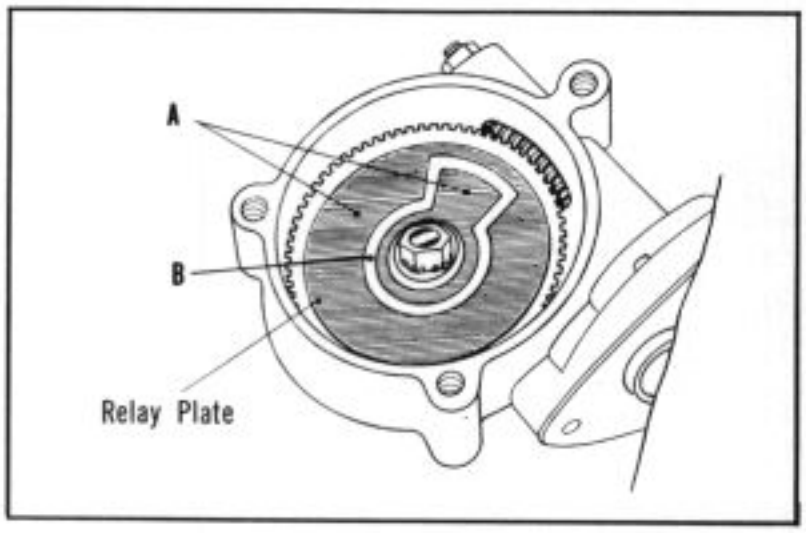


Fig. 17B-34

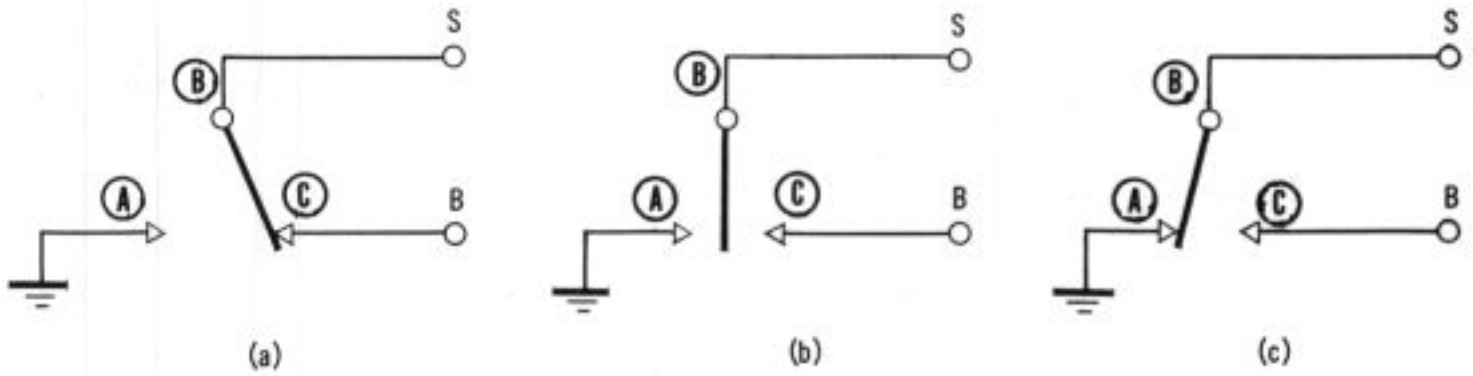


Fig. 17B-35

d. Suggestions Concerning the Wiper

- Avoid removal and disassembling of the motor, link, and arms. Particularly, the motor will be difficult to disassemble and reassemble without special jigs.
- The wiper blades should be replaced when the rubber is so worn that they do not wipe satisfactorily.
- When installing the wiper arm, confirm that the motor automatically stops at the correct position by turning the motor, and then align the blades so that they are parallel to the bottom edge of the glass before securing them with bolts. (Tightening torque of 40 to 50 kg-cm is preferable.)
- During cleaning of inspection of the vehicles avoid opening the engine compartment lid with the blades set up from the glass surface, or the arm blades would be damaged.
- Rewiring of the motor leads after disconnection should be made with the colors matched, or erroneous connections would damage the motor or result in the blown fuse.
- A large volume of snow accumulated over the glass may make it impossible to operate the wiper. If this is the case, remove the snow.
- The blades may be frozed fast to the glass under cold weathers. Melt the ice before turning on the wiper switch.
- Turning on the wiper switch when the wiper cannot operate due to snow or freezing can result in motor damages.
- When the wiper stops due to heavy snow or freezing, the large current will be retained in the motor circuit by the automatic mechanism even after the wiper switch is turned off. This can result in motor damages. Always turn off the wiper switch while normally operating the wiper by setting up the blades from the glass, and stop the wiper at its auto-stop position.

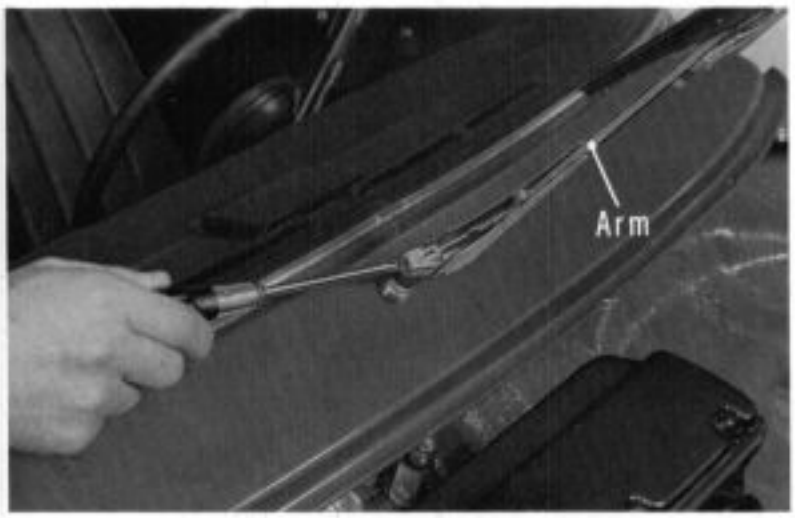


Fig. 17B-36

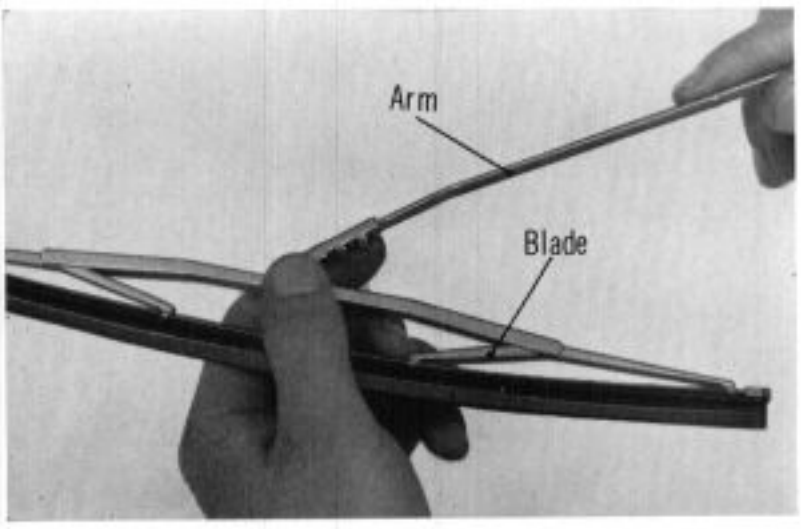


Fig. 17B-37

e. Maintenance

1. Inspect blade rubber for deterioration, hardening cracks, and lack of arm contact pressure against windshield.
2. When replacing the wiper arm, remove the lock bolt which secures the arm **(Fig. 17B-36)**

   Tightening torque:
   40~50 kg-cm (2.9~3.6 lb-ft)
3. The wiper blade can be removed by depressing the arm link where the blade is connected to the arm, and pulling it out. When inserting, depress until the arm locks.

4. Remove the cotter pin, separate the link from the motor, and try to operate without a load. If the motor speed is 45~55 rpm, the motor is normal. If the motor does not rotate, a defective switch or wiring is most probable. Inspect the motor unit first.

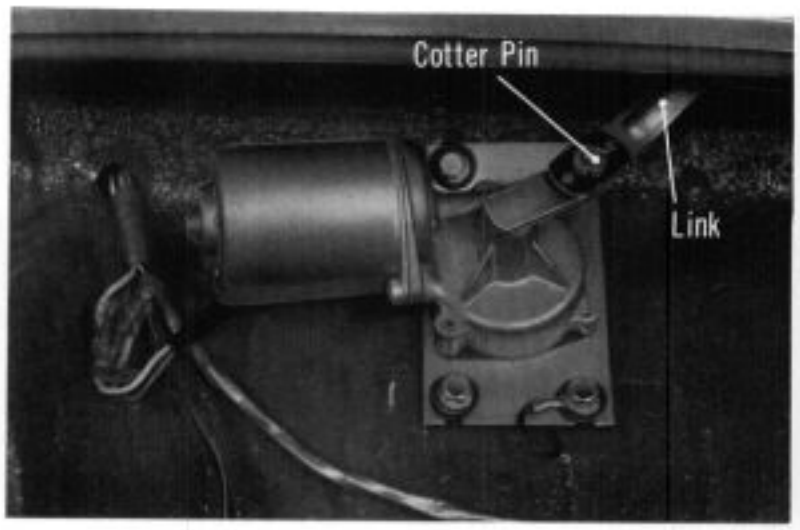


Fig. 17B-38

5. Check the stop position

   Short the motor S1 terminal and S2 terminal with a separate lead as shown in figure, and operate the motor at low speed. In addition, connect the B terminal and battery (+) terminal, and disconnect the S2 terminal and battery (+) terminal connection. Make this test several times, If the motor clamp plate stops at a fixed position, the condition is satisfactory.

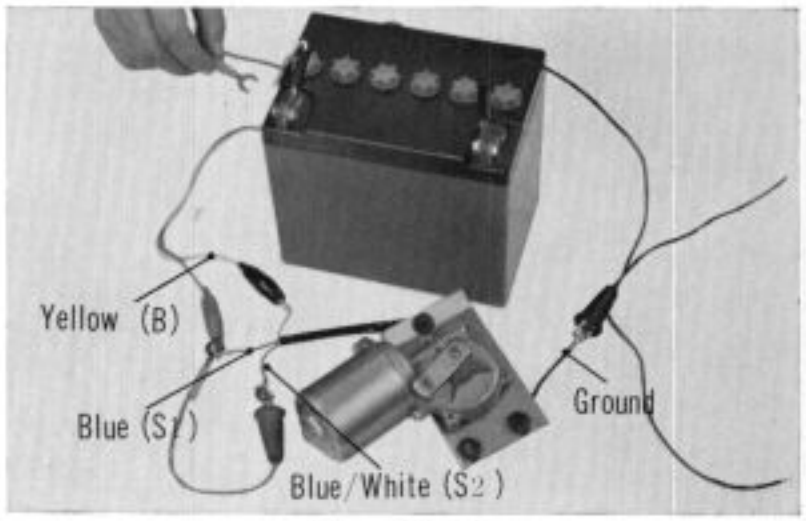


Fig. 17B-39

6. Trouble shooting.

   When the wiper motor becomes unoperatable, first insure that the fuse is not blown. If the fuse is normal, check voltage between the wiper motor blue cable and ground. If the value is between 10 and 12V, the condition is normal. Check continuity and insure that no open line exists.

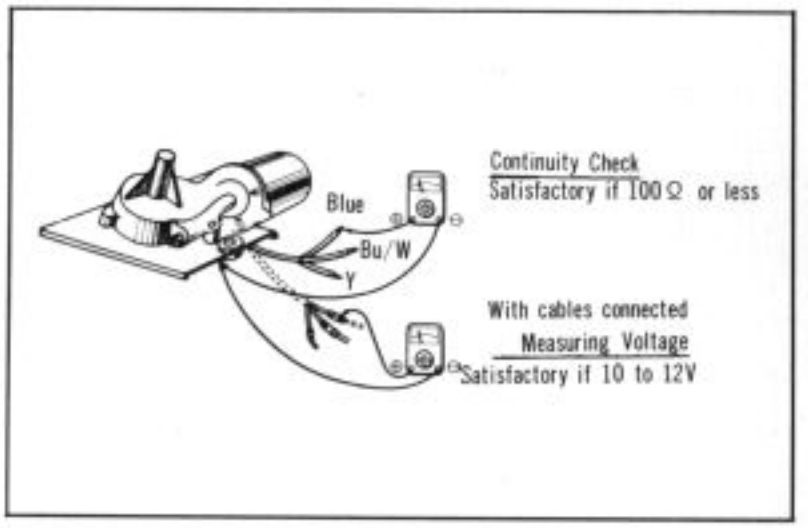


Fig. 17B-40

D. Horn

a. Ratings

Model	Voltage (V)		Current (A)	Sound magnitude (dB)	Frequency (C/S)
	Rated voltage	Operating range			
UH-2D	12	9 — 15	Less than 3.5	98 — 108	440 ± 30
UL-2D	12	9 — 15	Less than 3.5	98 — 108	520 ± 30

b. Construction

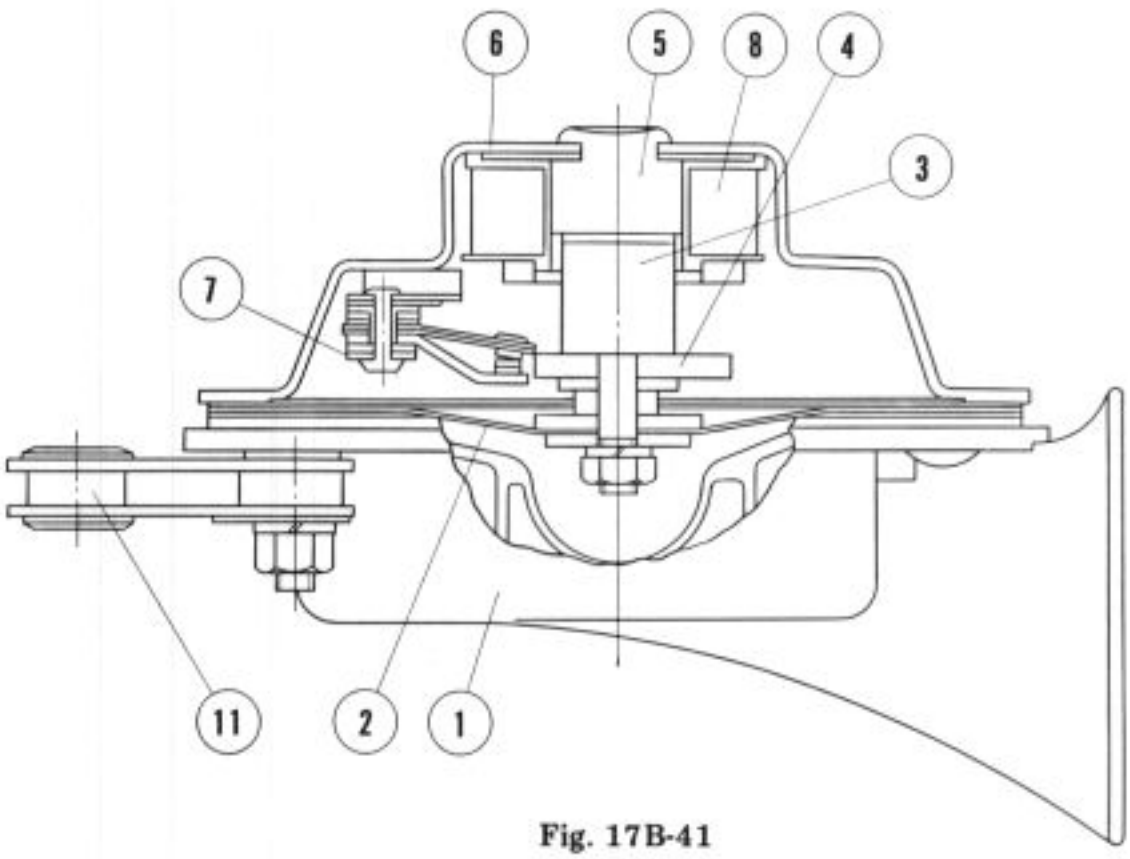


Fig. 17B-41

(1)	Car ring horn	Acoustic amplification and radiation
(2)	Diaphragm	Vibratory element (Sound source)
(3)	Pole B	Linkage between the armature and the vibratory element, and magnetic field.
(4)	Armature	Magnetic field (Sound source).
(5)	Pole A	Magnetic field.
(6)	Case	Mounting base, magnetic field, and protection for internal parts.
(7)	Contact assembly	Current switching for vibration.
(8)	Coil	Serves to magnetize the poles and armature (Source of the attractive force).
(9)	Cord A	Lead for electrical connection. (Fig. 17B-43)
(10)	Cord B	Lead for electrical connection. (Fig. 17B-43)
(11)	Clamp unit	Mounting fixture (incorporates spring to prevent acoustic interference between the horn and the body of the vehicle)

c. Electrical Connection

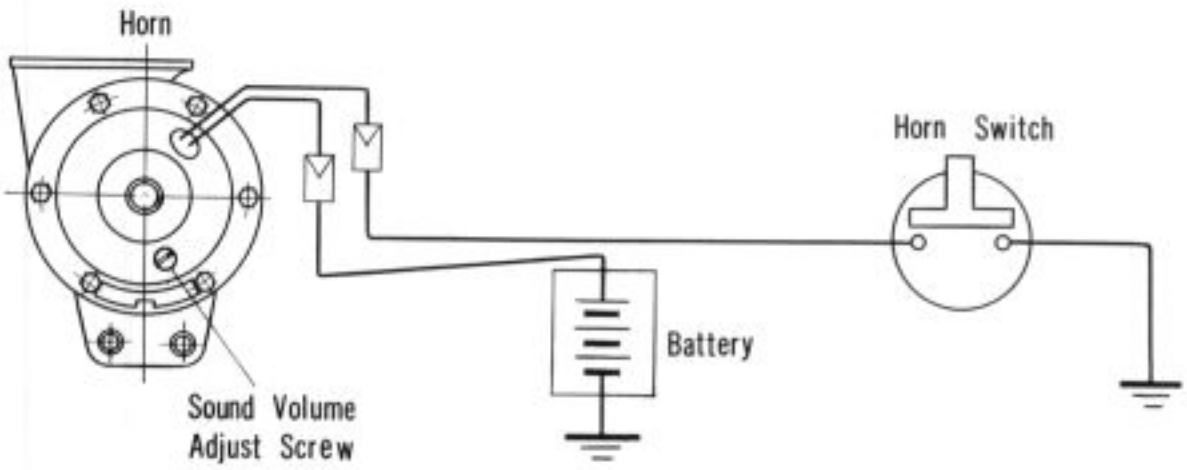


Fig. 17B-42

d. Operating Principle

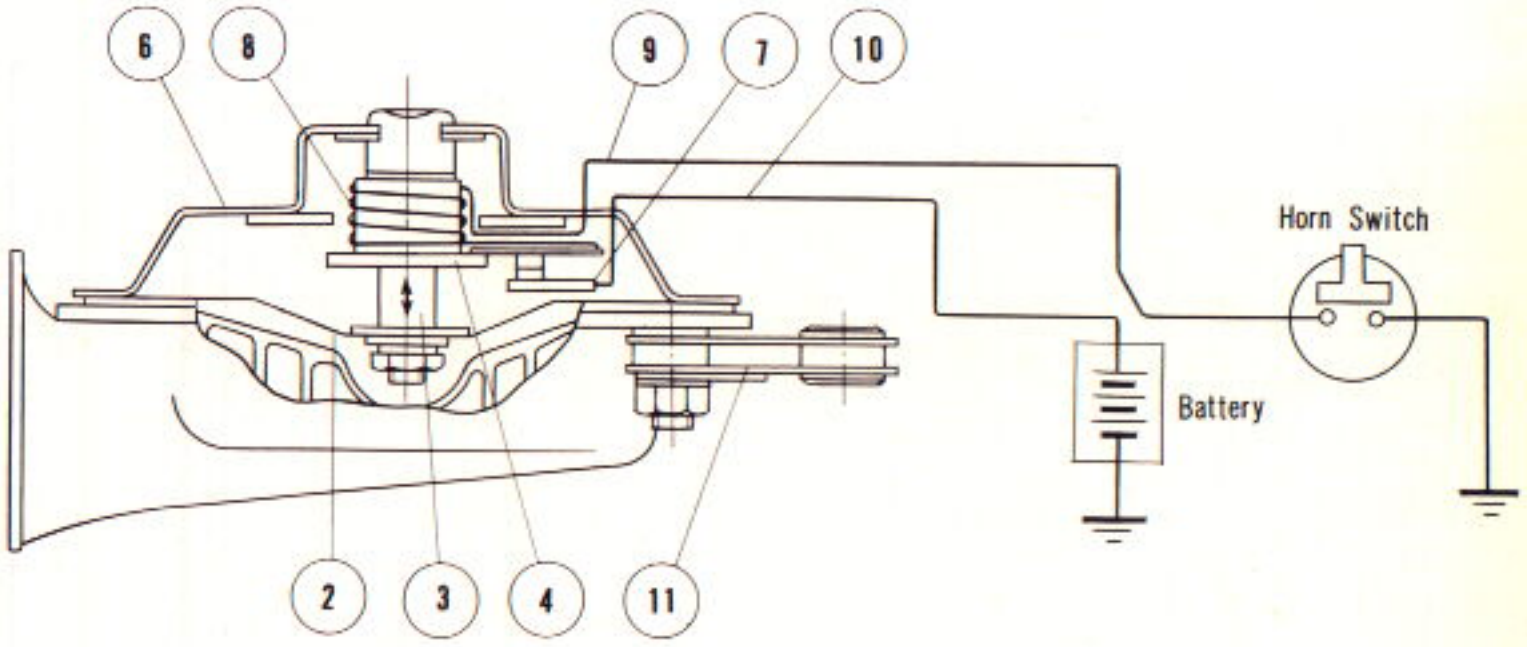


Fig. 17B-43

When the switch is closed, current flows from cord A ⑨, to coil ⑧, contact assembly ⑨, (contact plate B, point, contact plate A, and contact stay), cord B ⑩ , and to the battery.

This current sets up the electromagnetic field to attract the armature. When the attracted armature reaches the cylinder in the core, the contacts of the contact assembly open to remove the current, and thus the core no longer holds the armature but the armature is returned by the replusive force of the vibrating element connected to the armature by pole B. When the armature returns, the contacts again, close to allow the current to flow from cord A to the coil, and to the contact assembly (contact plate B, point, contact plate A) and to magnetize the core which attachs the armature. This series of action is repeated while the horn switch is closed; the vibrating element makes regular vibrations to produce sounds which is amplified by the spiral horn to effect the sound into the atmosphere.

e. Operational Suggestions

(A) Avoid disassembling the horn since the mechanism is carefully adjusted with instruments.

(B) Water entering the horn will be trapped in the vibrating element chamber, rendering it impossible to operate the horn. Caution is required during washing the car.

(C) When the necessity of adjusting the sound volume arises, turn the sound volume adjust screw on the point assembly gradually while listening to the sound. To increase the sound volume, turn the screw to the right; and to reduce it, to the left.

f. Trouble Shooting and Repair

In case the horn delivers a reduced sound volume, poor tone quality, or does not operate at all, check for the causes as follows.

Trouble						Trouble shooting		Corrective action
Trouble other than in the horn itself	Low battery vbltage or overcharge					Check the battery voltage with a multimeter		Charge the battery
	Loose electrical connection, open circuit, or the mounting fixture is not grounded electrically.					Check for open wires, loose bolts, and especially conditions in the junctions.		Resolder or retighten the bolts.
	Defective horn switch					Check the contact of the horn switch with a multimeter, and also check the grounding.		Polish the contact or replace the horn switch (*)
Defective horn	Directly connect the horn to the battery with a lead	When it does not operate at all		When the armature is not attached (examine from the operating sound)		Open coil or lead wire		Resolder or replace the coil (This should be made at the workshop)
						Lost point or excessive wear		Replace the contact assembly (*)
				When the armature is attached (examine from the operating sound)		Worn contact (Increased contact resistance)		Replace the contact assembly (*)
						Close contacts		Sound adjust screw (Note)
		The horn operated but with a reduced sound volume				Worn contact (increased contact resistance)		Replace the contact assembly (*)
						Insufficient current due to inappropriate adjustment		Adjust with the sound volume adjust screw (*)
		Poor sound quality	Hissy and broken sound			Too high current due to inappropriate adjustment		Adjust with the sound volume adjust screw (*)
						Insufficient gap between the armature and the core		Adjust the gap (*)
			Poor and hollow sound			Cracked vibratory element		Replace the vibrating element (*)

Note: Since troubles marked (*) will be difficult, have the workshop repair them.

E. Fuel Gauge and Unit

When the tank is filled with fuel and the gauge does not indicate, check in accordance with the following instructions:

1. Pull out the gauge unit lead from the rear wheel housing, connect a new unit, and move the flat vertically. If the new gauge operates, check the old gauge.

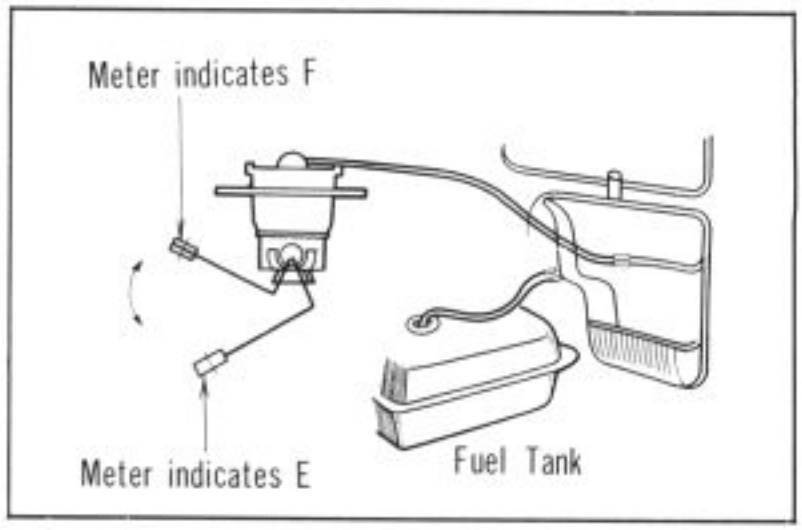


Fig. 17B-44

2. Measure resistance by using an ohmmeter. Rated resistance is 30 to 34Ω.

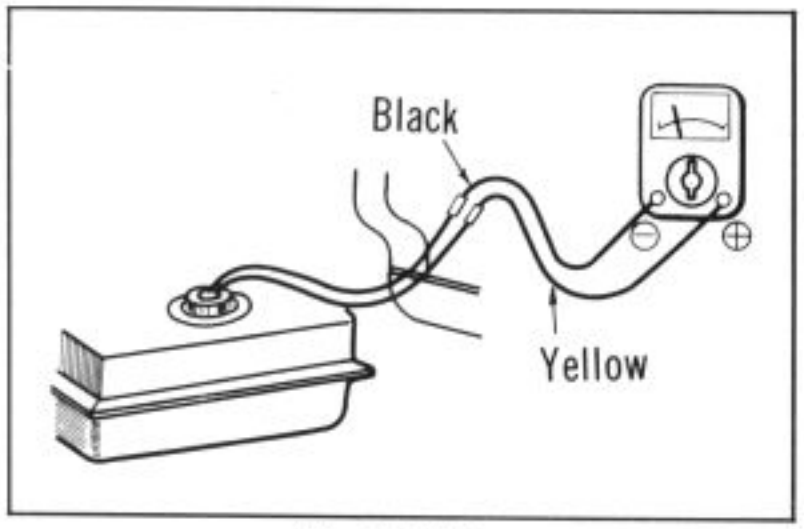


Fig. 17B-45

3. Make sure that the gauge unit is not coming in contact with the separator in the fuel tank.

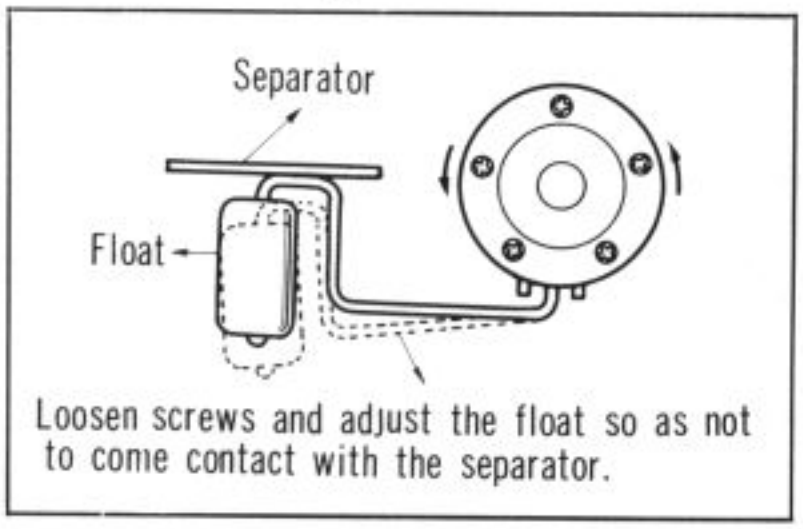


Fig. 17B-46

4. When the gauge does not operate under the arrangement indicated in "1" above, measure resistance between the gauge terminals with ohmmeter. (Disconnect wiring to the gauge unit beforehand.) If resistance is less than 100Ω, the condition is normal. If resistance exceeds 100Ω, replace the gauge. **(Fig. 17B-47)** **(Fig. 17B-48)**

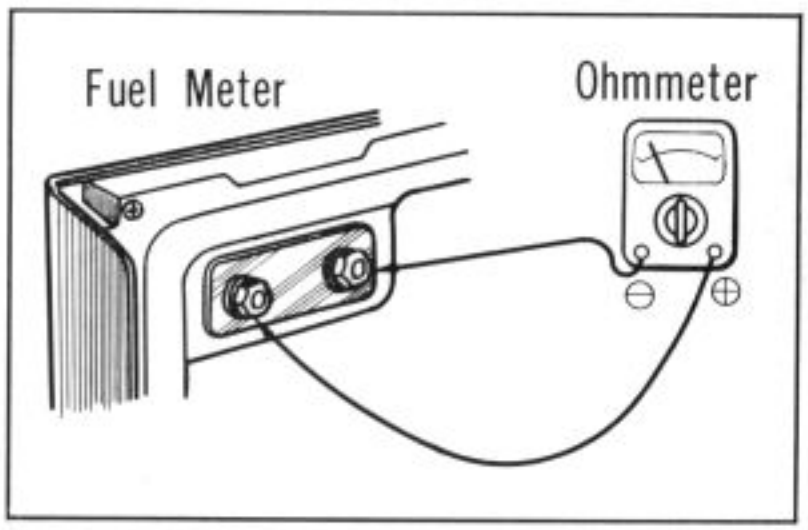


Fig. 17B-47

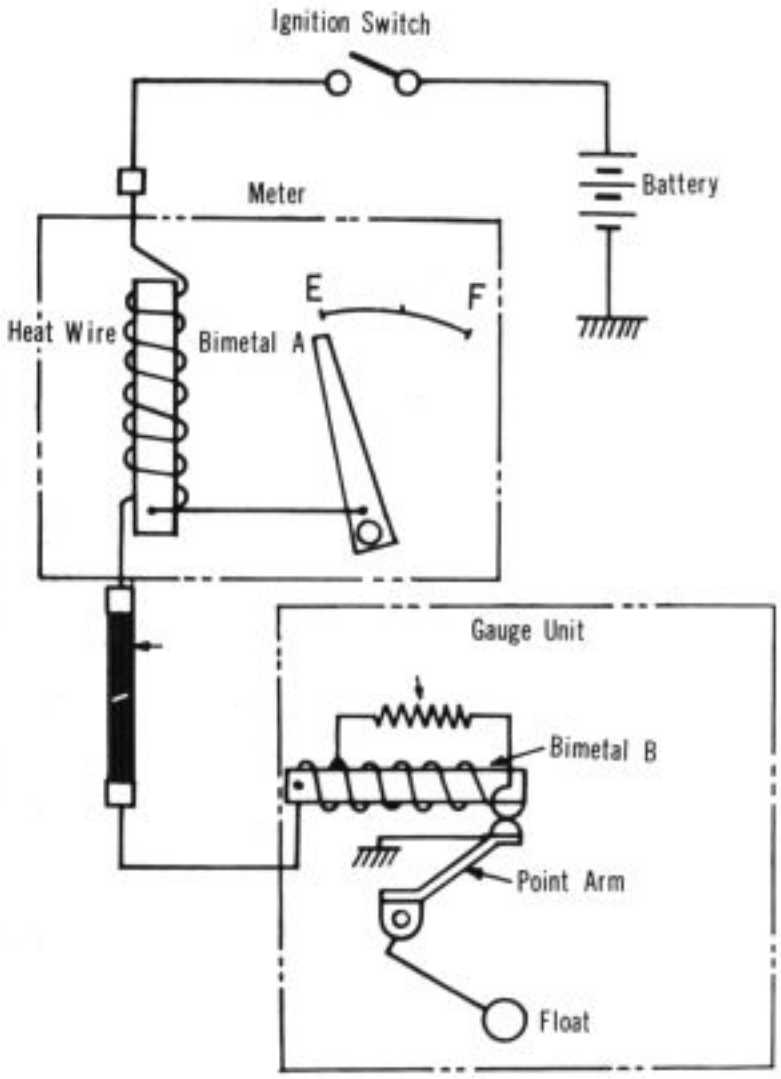
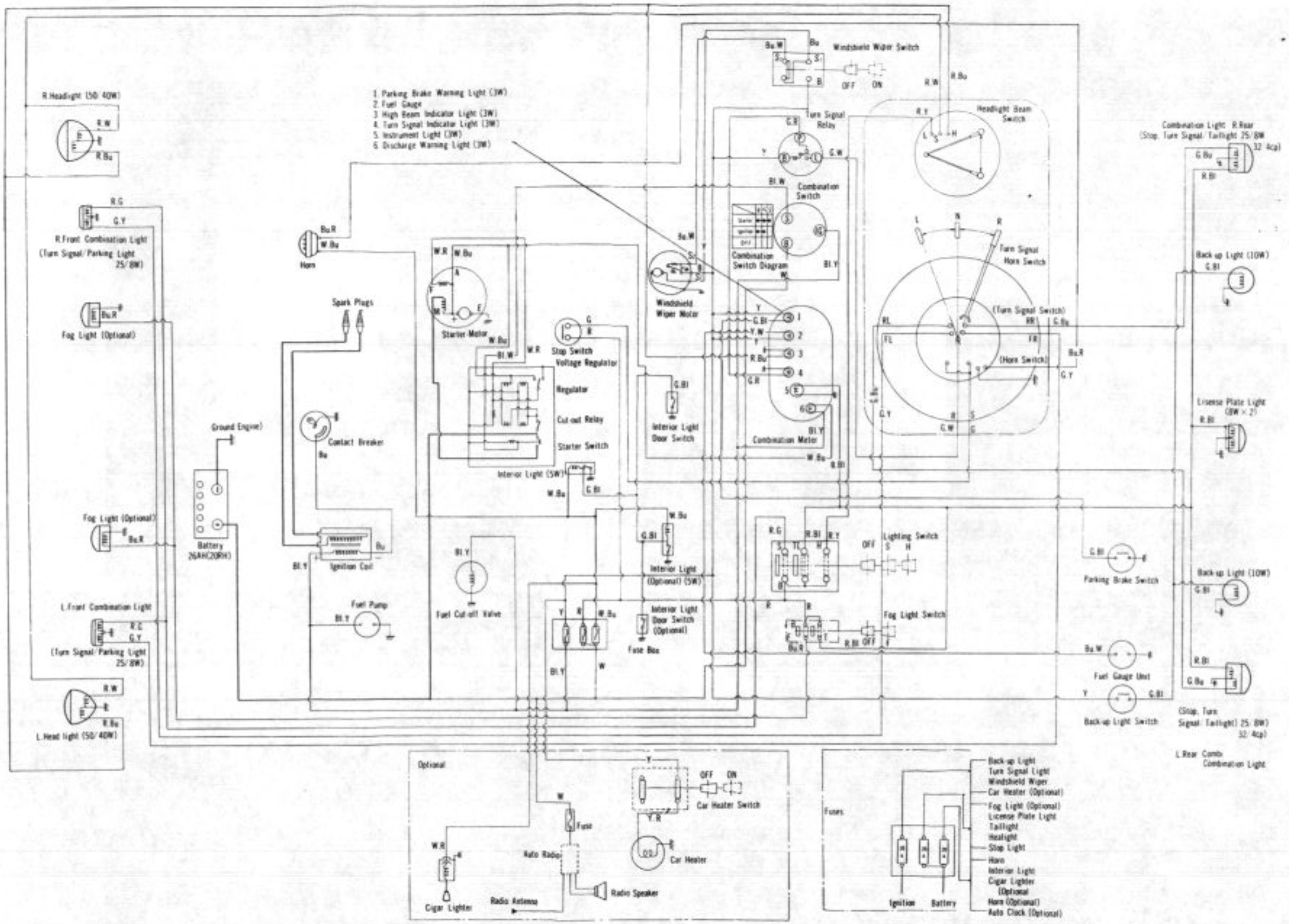

Ignition Switch
Battery
Meter
E
F
Heat Wire
Bimetal A
Gauge Unit
Bimetal B
Point Arm
Float

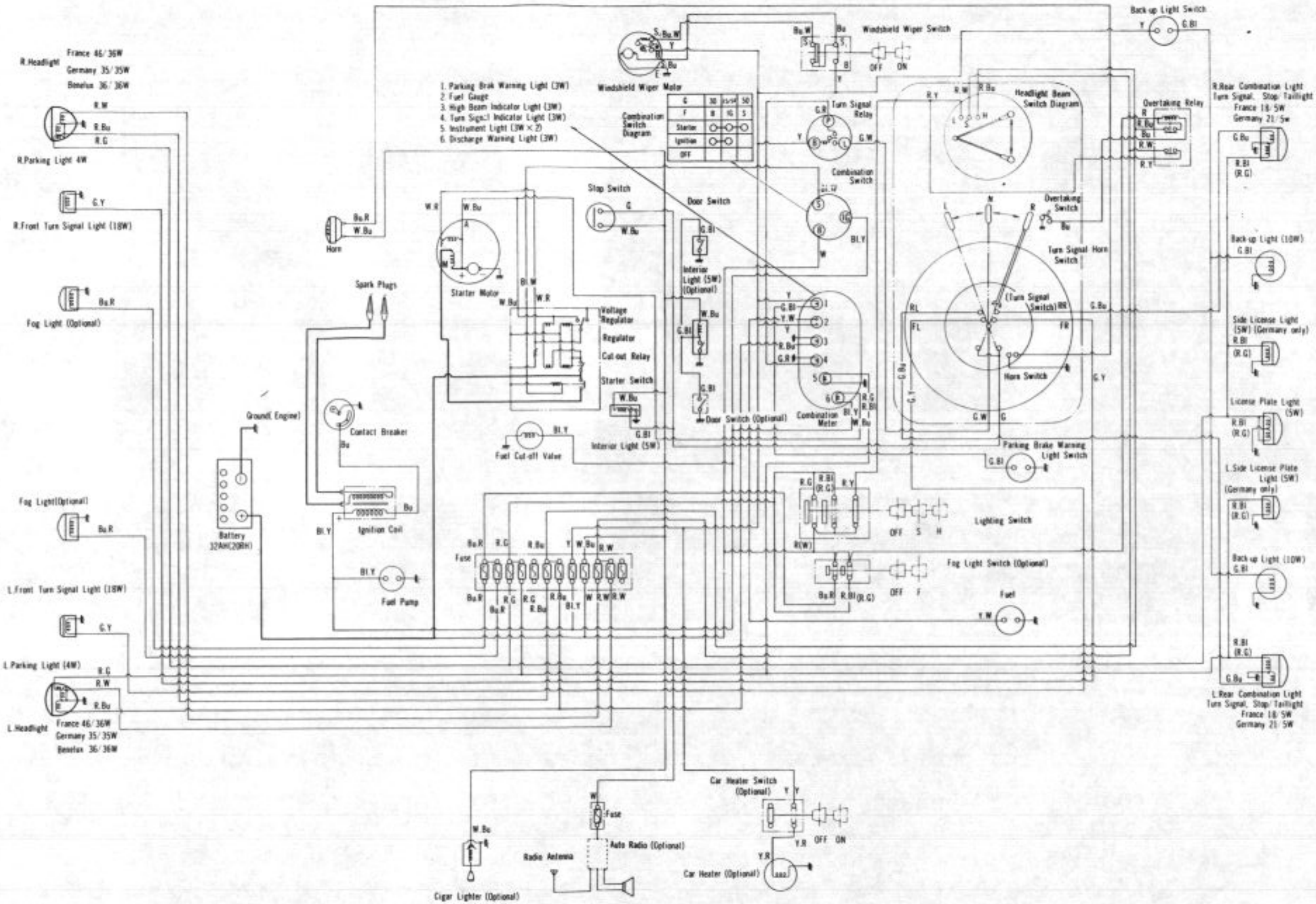
Fig. 17B-48

1. N360 ; Standard



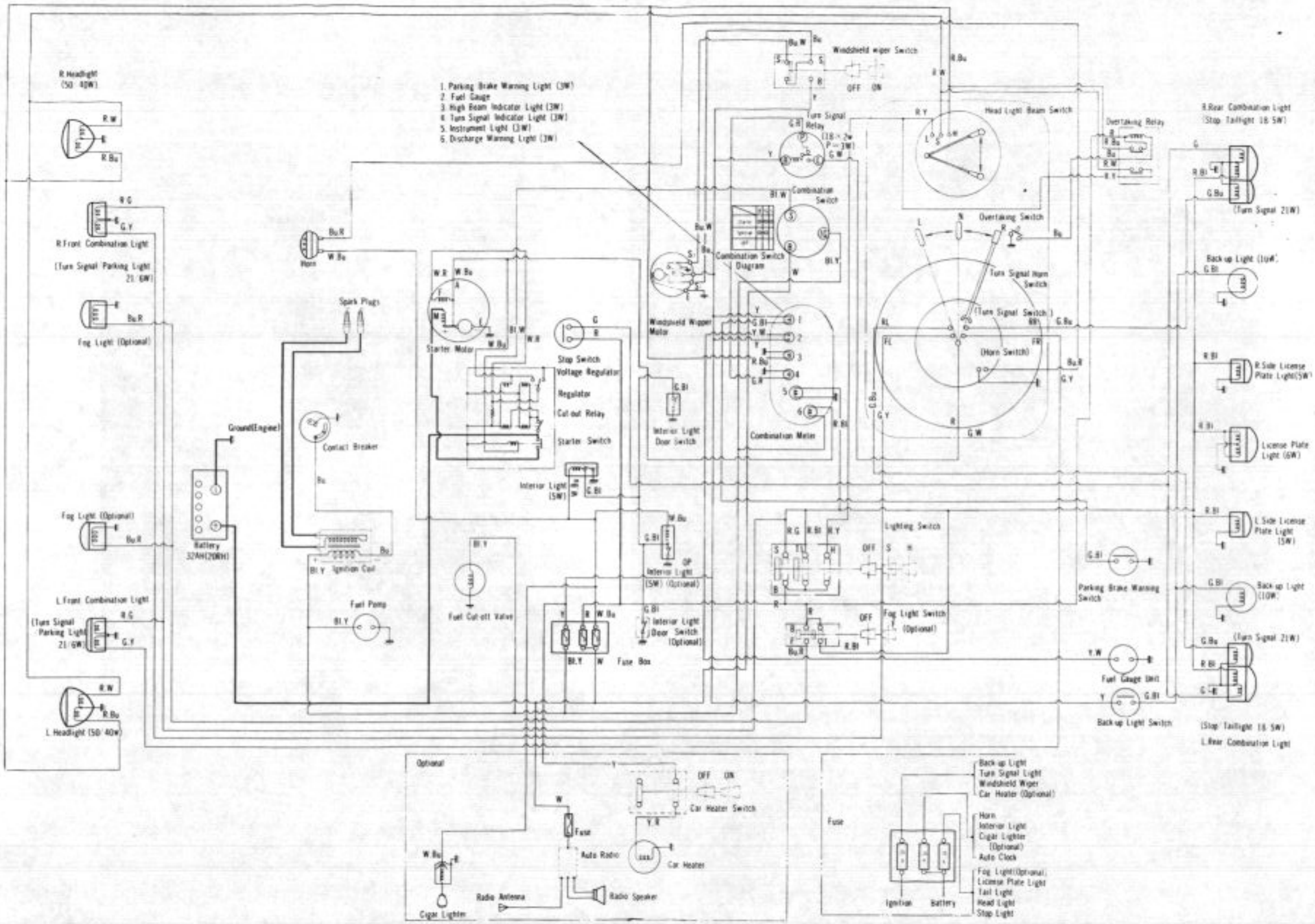
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

2. N360; Europe Continent



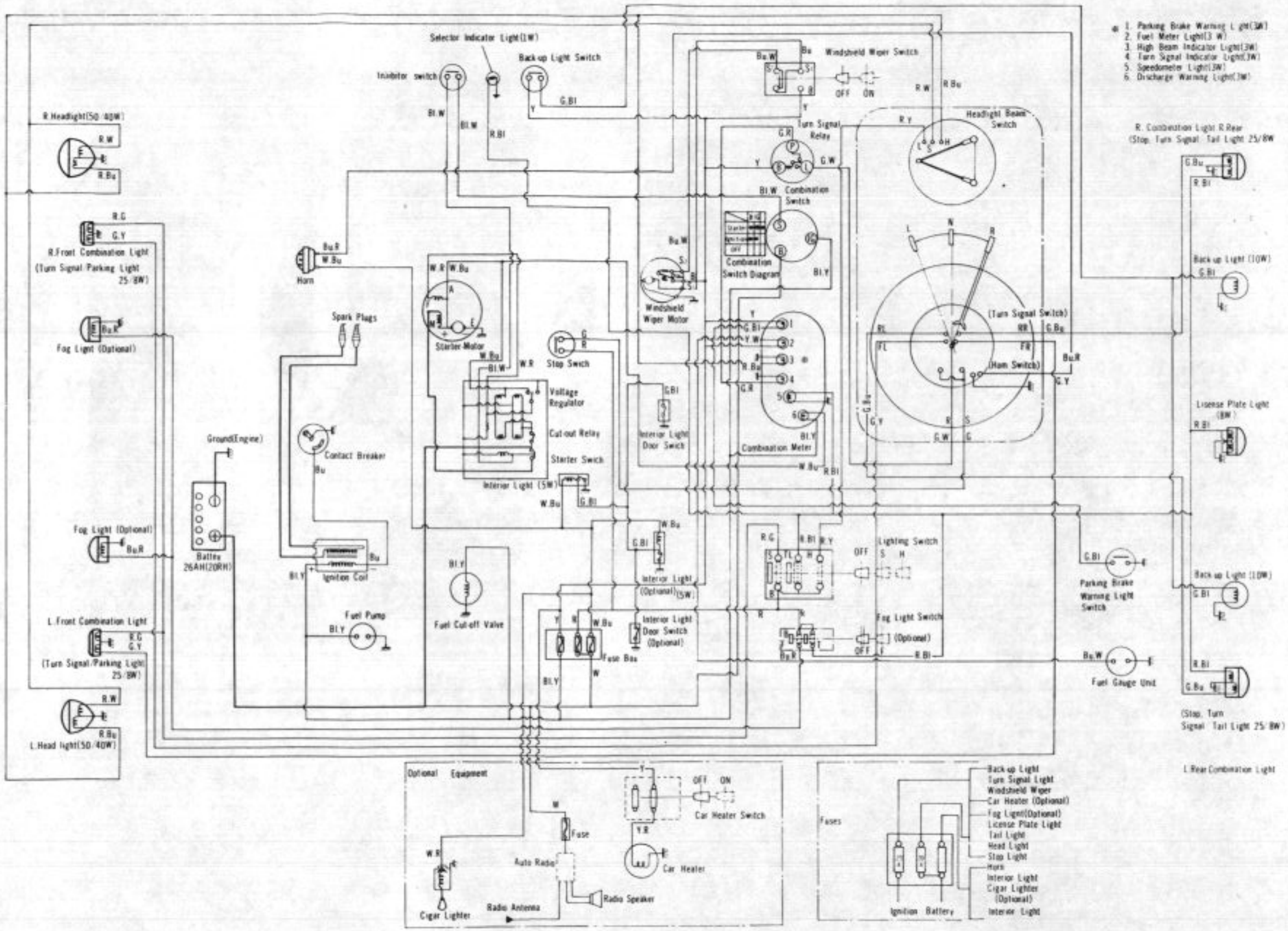
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

3. N360; U.K. and Australia



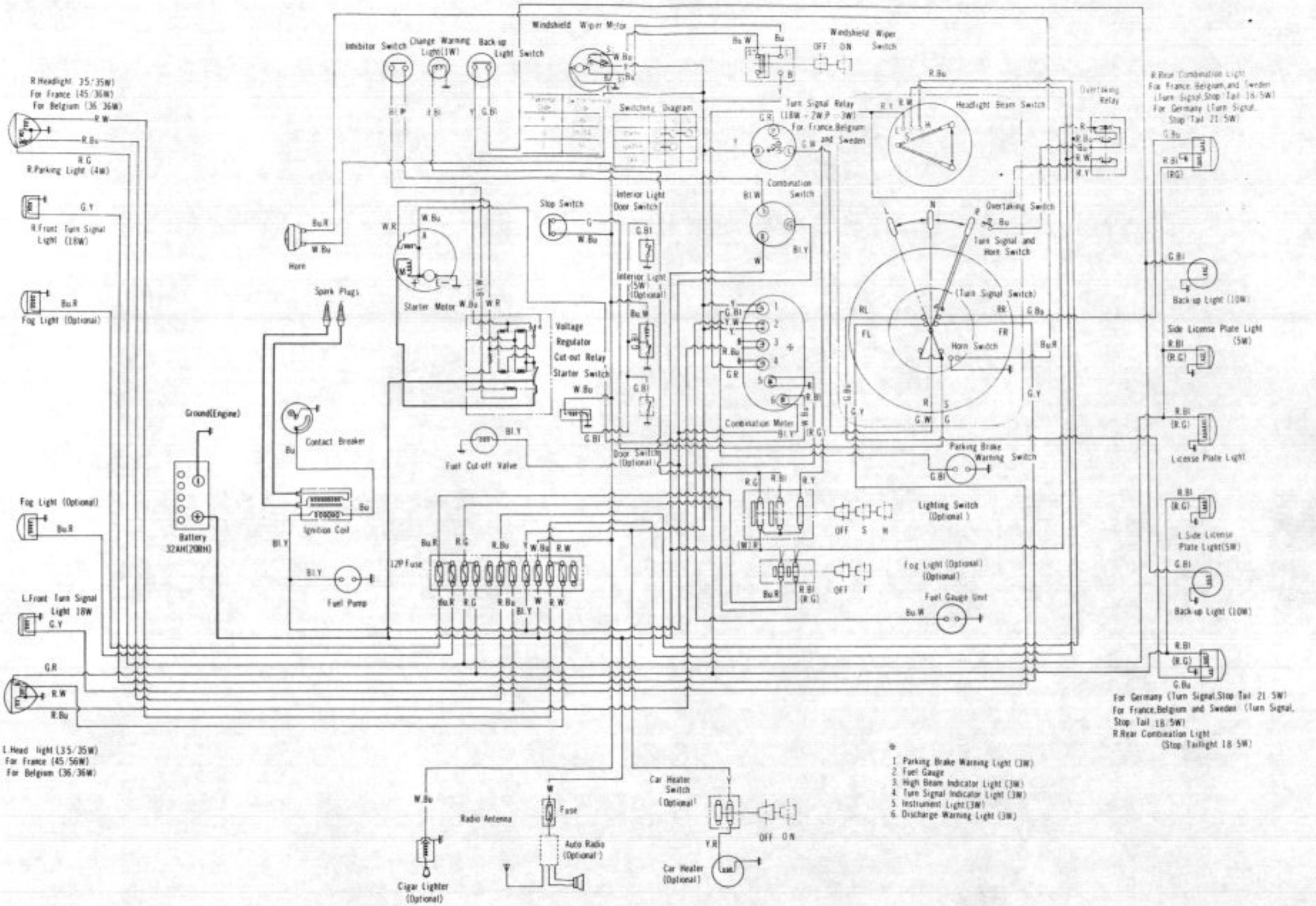
R. ·····Red	R.Y ·····Red/yellow stripe	G.W ·····Green/white stripe	Bu.Y ·····Blue/yellow stripe	Y.R ·····Yellow/red stripe	W.R ·····White/red stripe
R.Bl ·····Red/black stripe	G ·····Green	G.Y ·····Green/yellow stripe	Bl ·····Black	Y.W ·····Yellow/white stripe	W.Y ·····White/yellow stripe
R.Bu ·····Red/blue stripe	G.Bl ·····Green/black stripe	Bu ·····Blue	Bl.W ·····Black/white stripe	W ·····White	
R.G ·····Red/green stripe	G.Bu ·····Green/blue stripe	Bu.R ·····Blue/red stripe	Bl.Y ·····Black/yellow stripe	W.Bu ·····White/blue stripe	
R.W ·····Red/white stripe	G.R ·····Green/red stripe	Bu.W ·····Blue/white stripe	Y ·····Yellow	W.G ·····White/green stripe	

4. A360 ; Standard



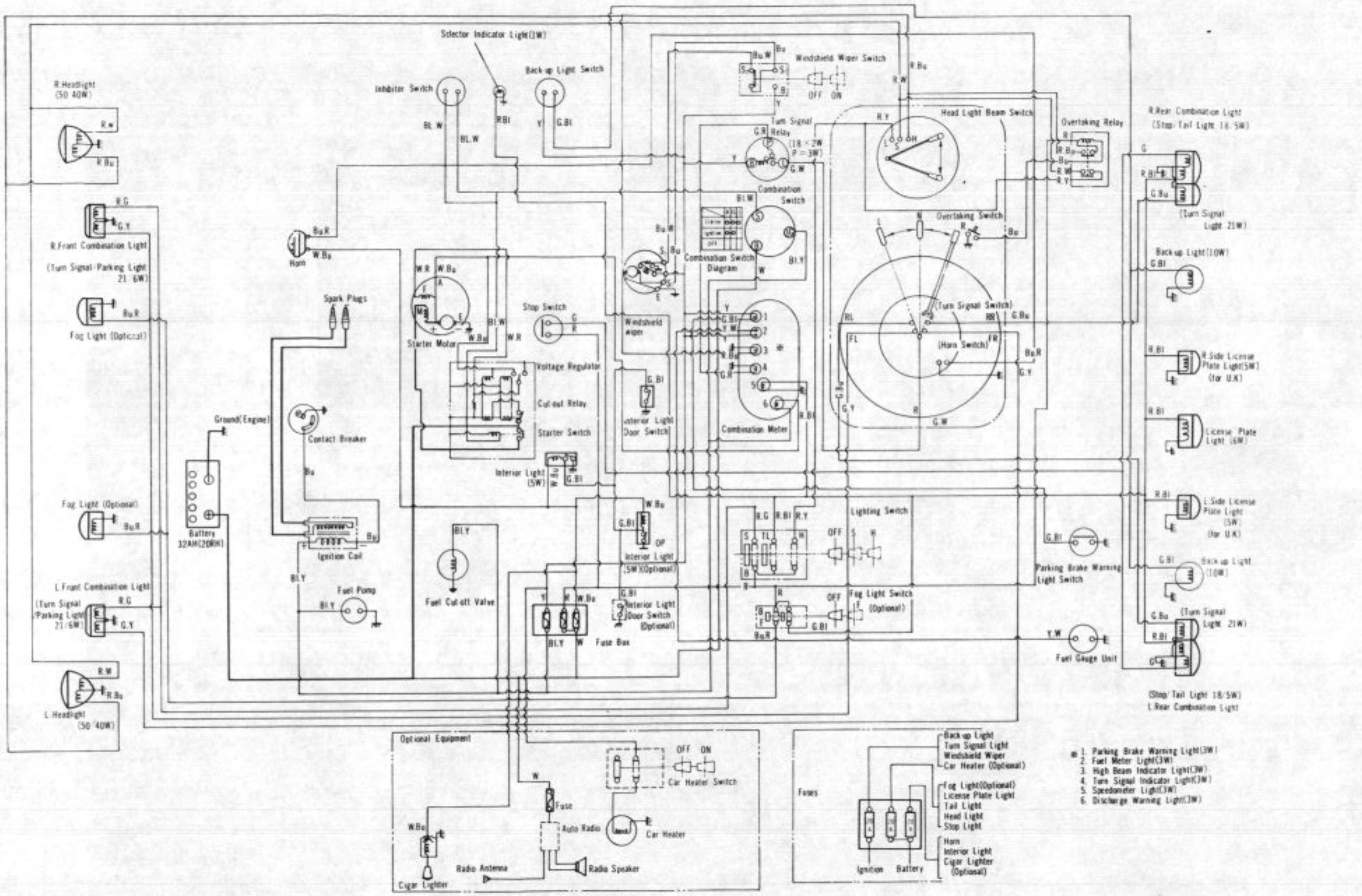
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

5. A360; Germany, France and Belgium



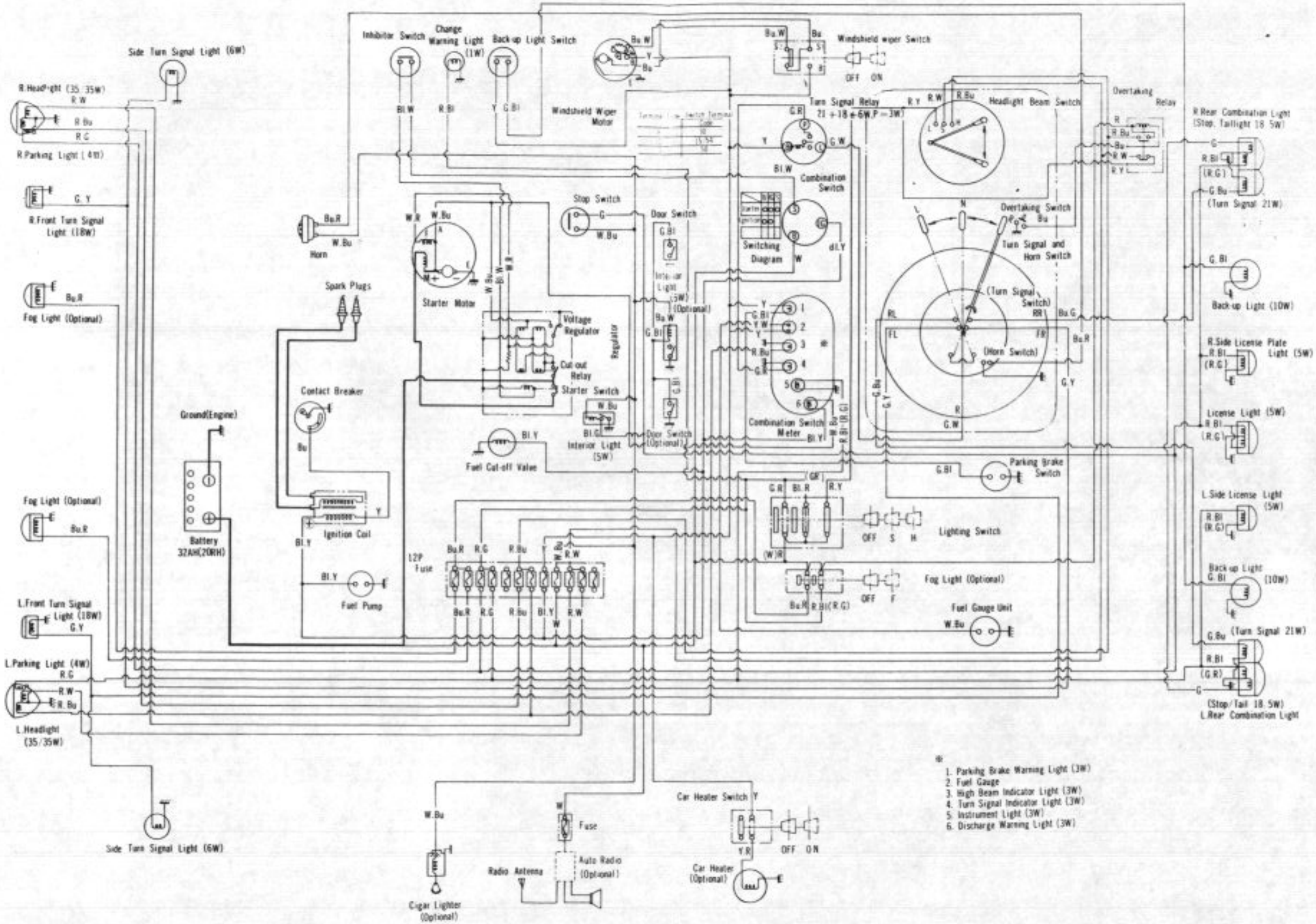
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

6. A360; U.K. and Australia



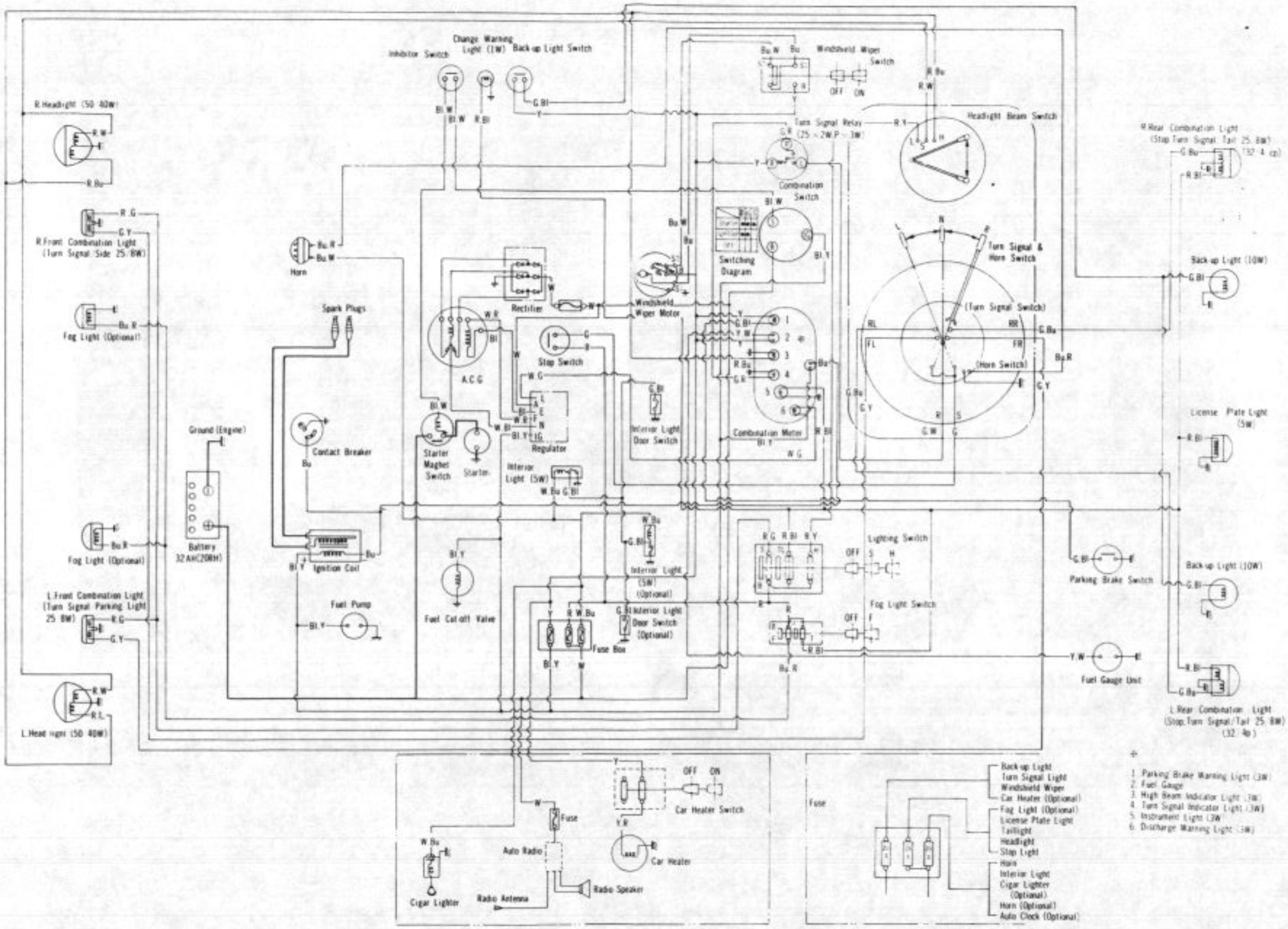
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

7. A360 ; Denmark



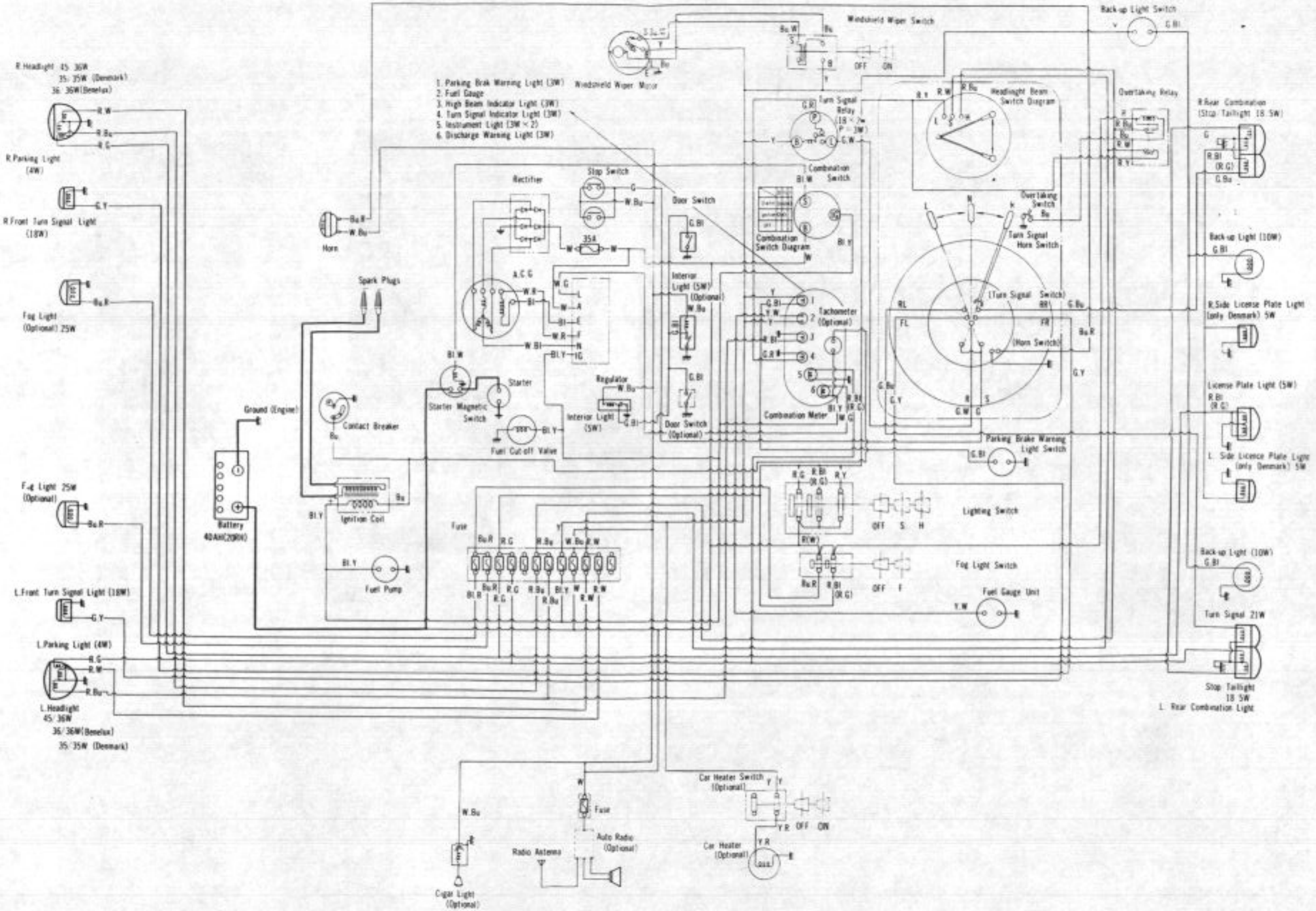
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

8. N600; Standard



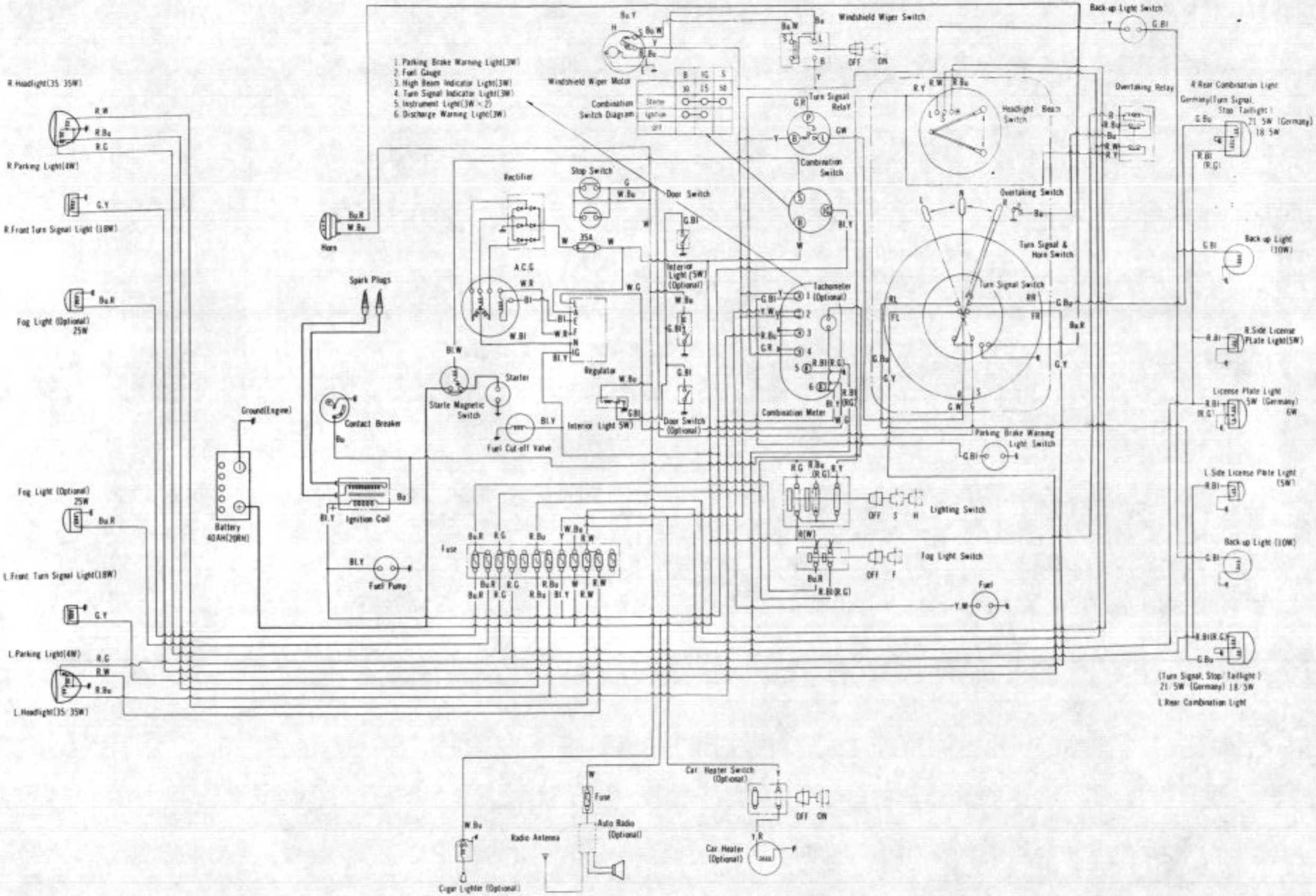
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

9. N600; France, Italy, Portugal, Denmark and Benelux



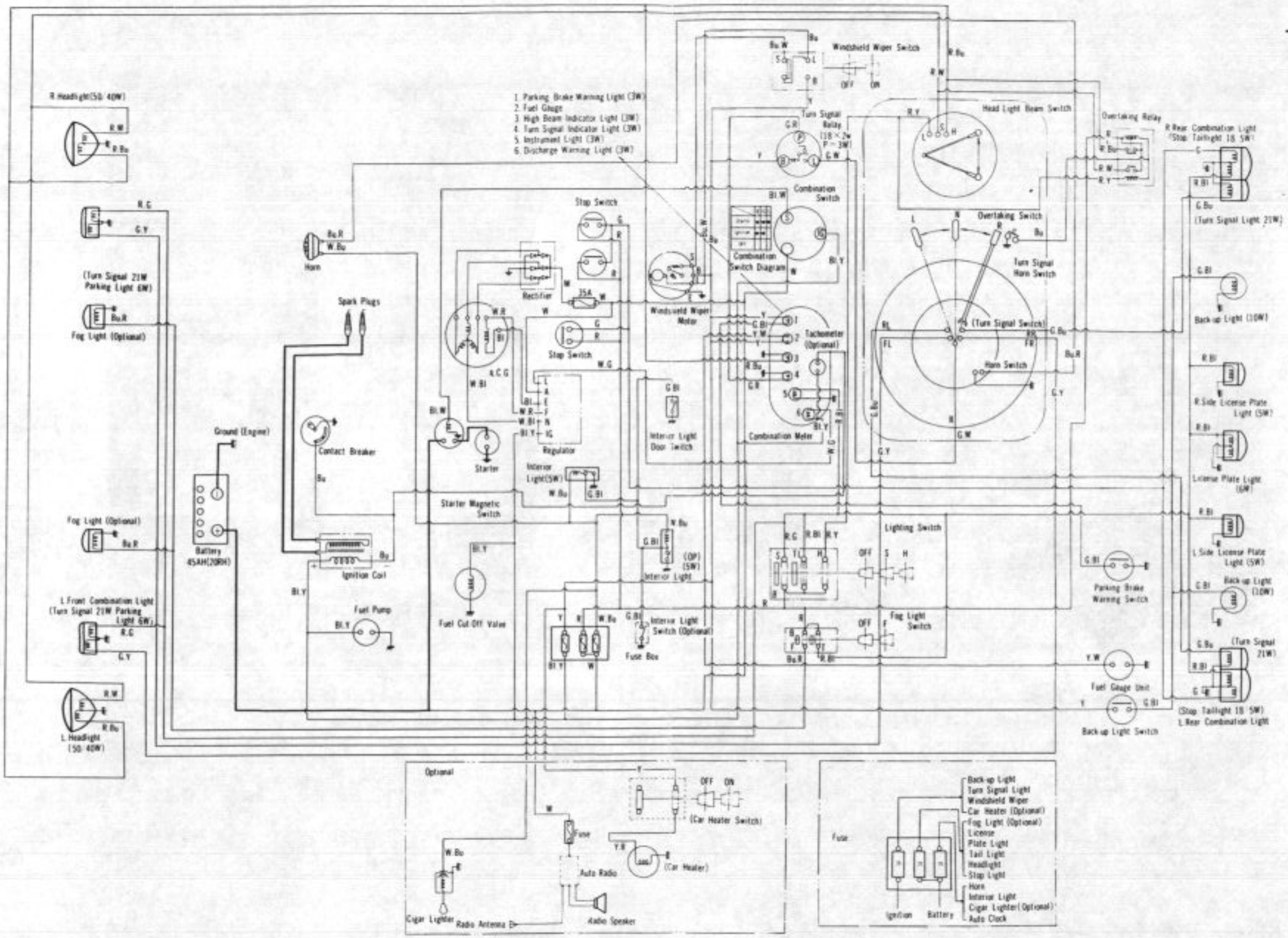
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

10. N600; Germany, Finland, Switzerland, Norway and Sweden

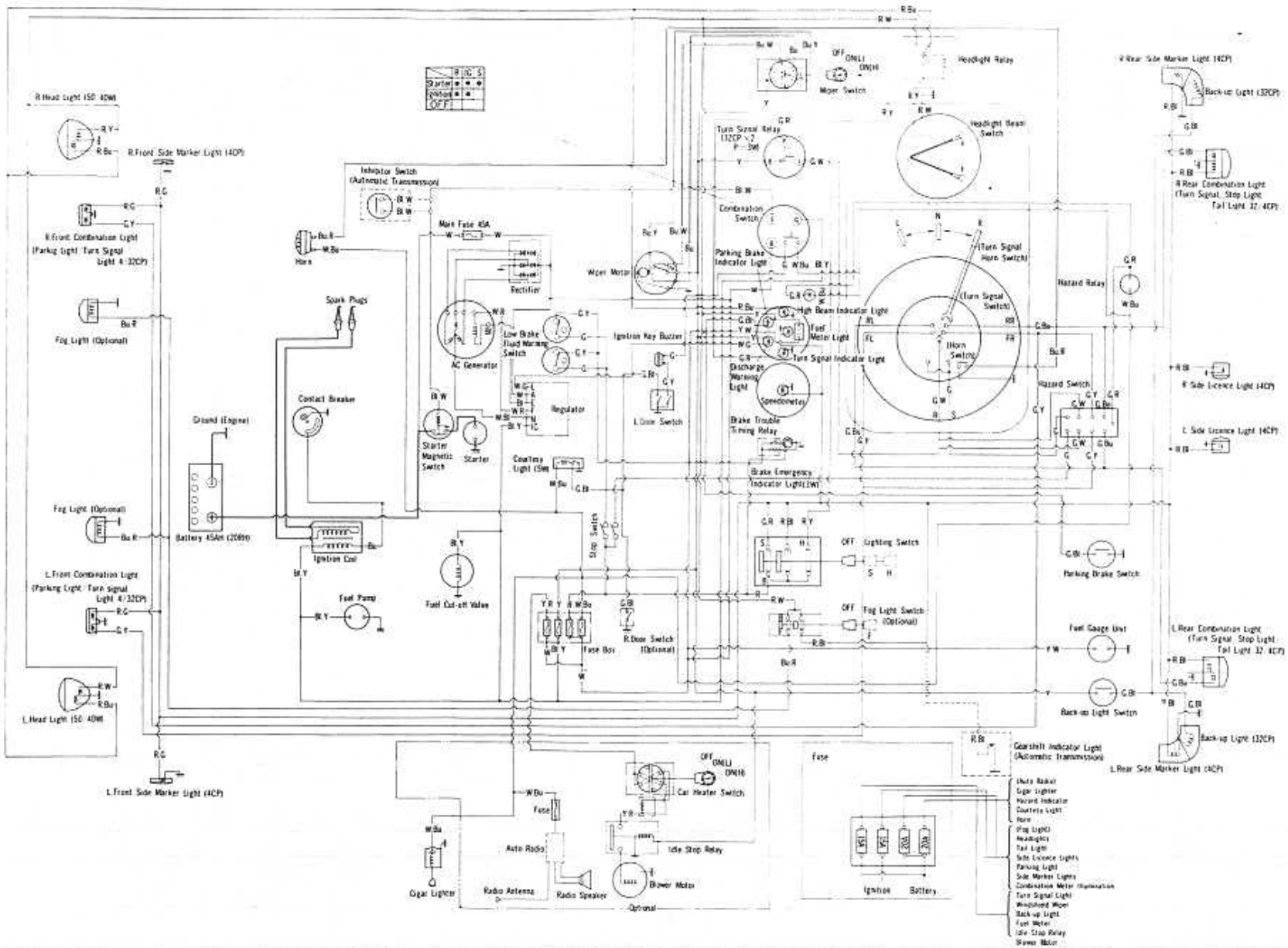


R	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

11. N600; U.K. and Australia

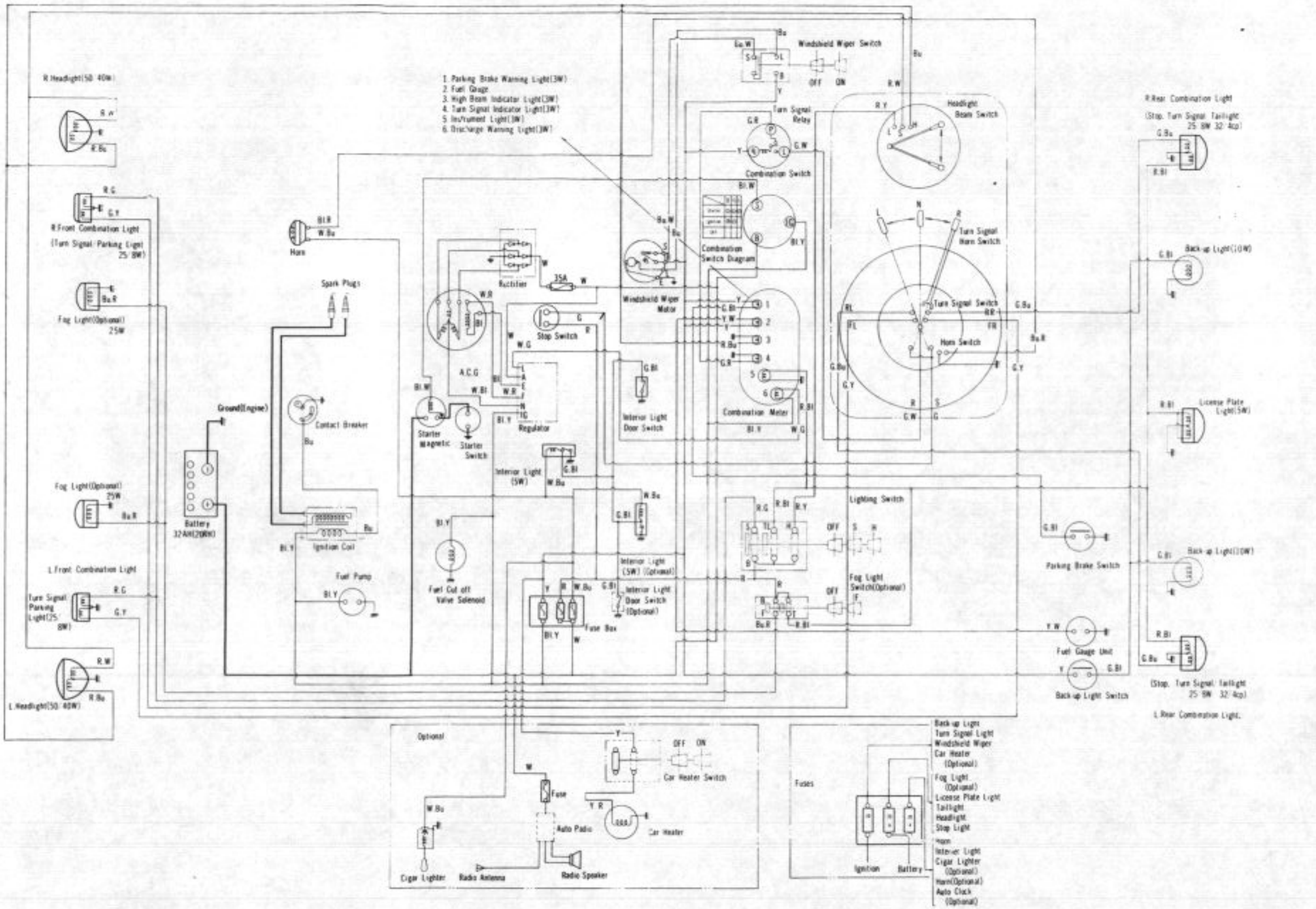


R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		



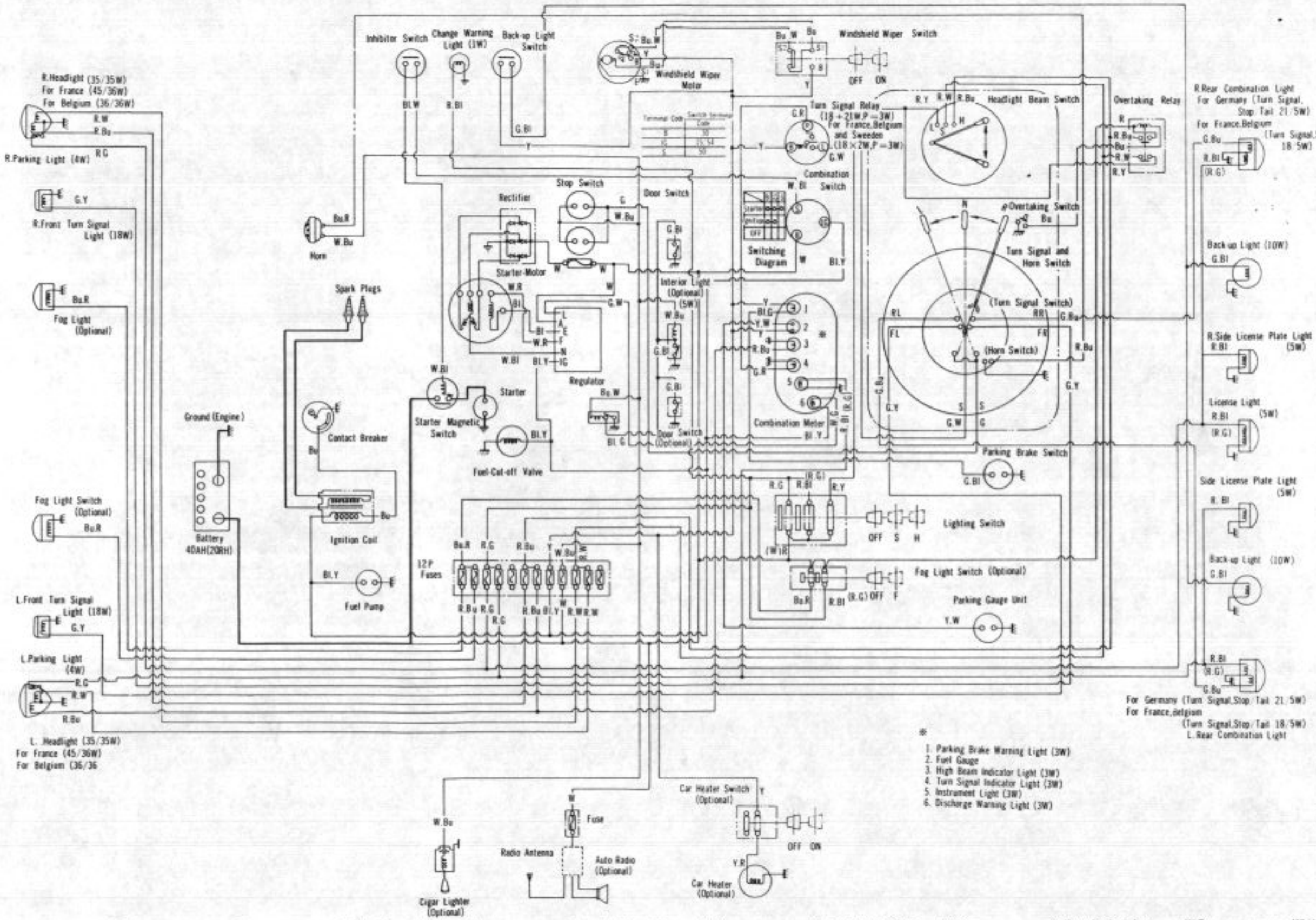
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

13. A600; Standard



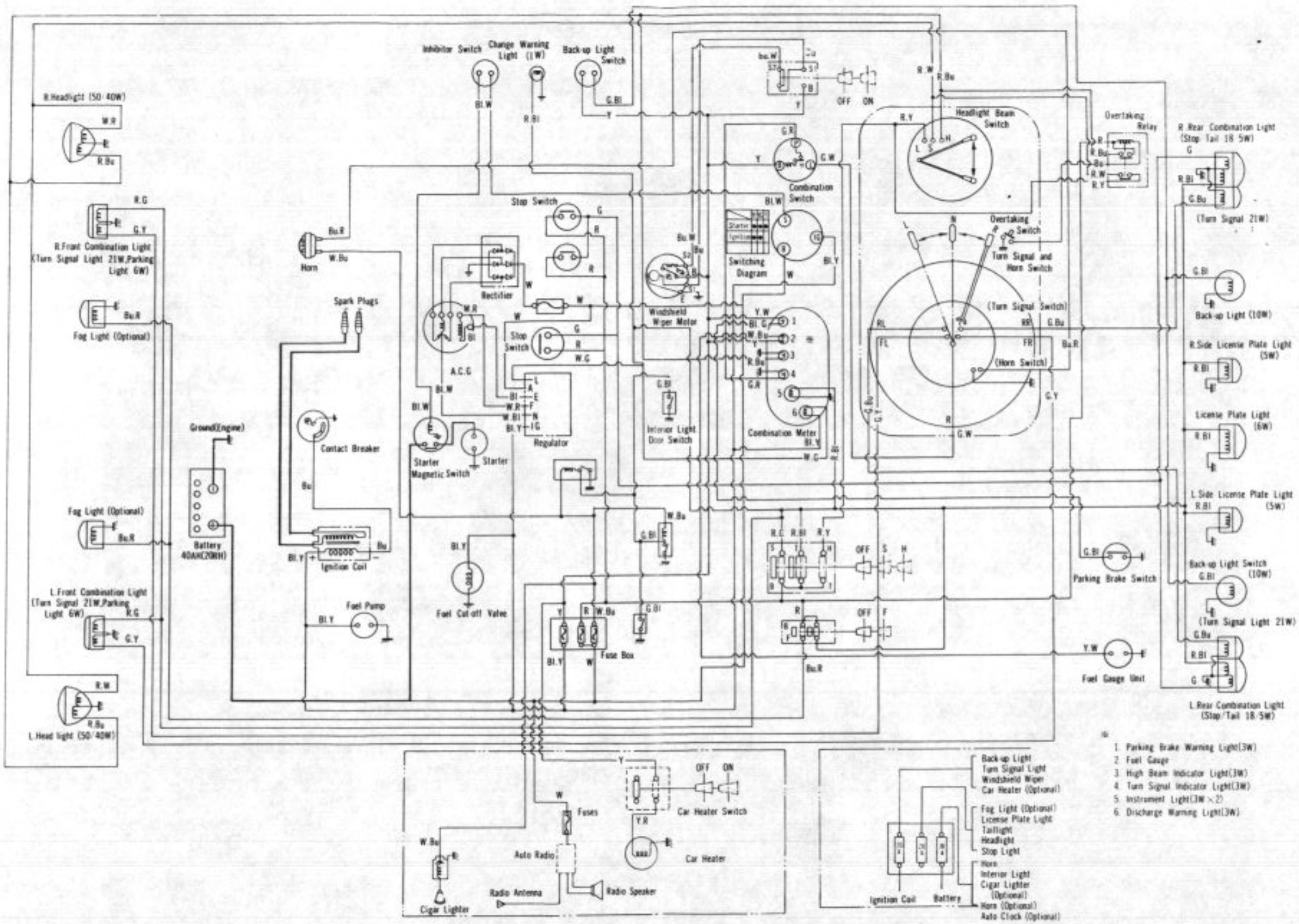
R ---------- Red	R.Y ---------- Red/yellow stripe	G.W ---------- Green/white stripe	Bu.Y ---------- Blue/yellow stripe	Y.R ---------- Yellow/red stripe	W.R ---------- White/red stripe
R.Bl ---------- Red/black stripe	G ---------- Green	G.Y ---------- Green/yellow stripe	Bl ---------- Black	Y.W ---------- Yellow/white stripe	W.Y ---------- White/yellow stripe
R.Bu ---------- Red/blue stripe	G.Bl ---------- Green/black stripe	Bu ---------- Blue	Bl.W ---------- Black/white stripe	W ---------- White	
R.G ---------- Red/green stripe	G.Bu ---------- Green/blue stripe	Bu.R ---------- Blue/red stripe	Bl.Y ---------- Black/yellow stripe	W.Bu ---------- White/blue stripe	
R.W ---------- Red/white stripe	G.R ---------- Green/red stripe	Bu.W ---------- Blue/white stripe	Y ---------- Yellow	W.G ---------- White/green stripe	

14. A600; Germany, France and Belgium



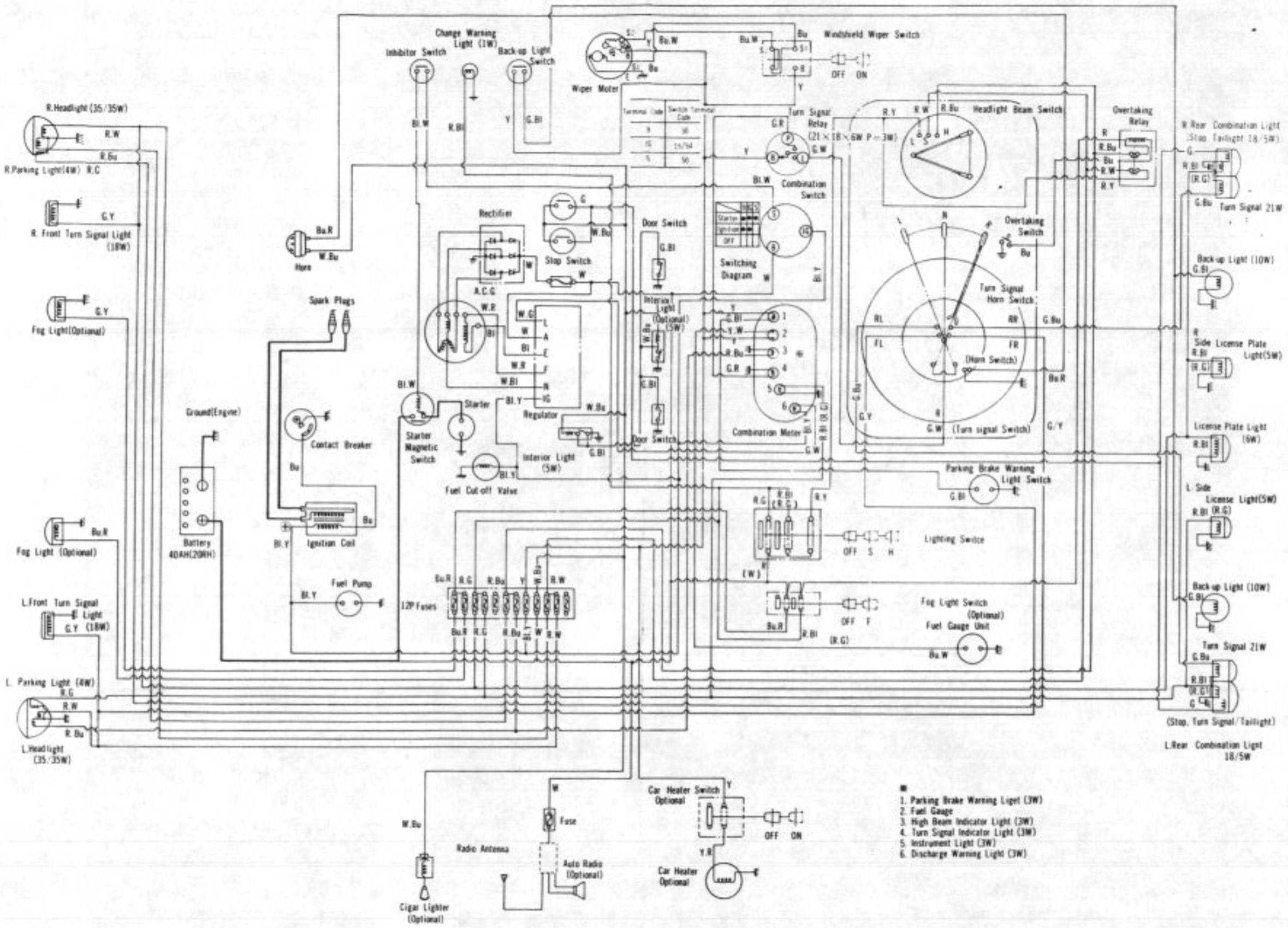
R. ..... Red	R.Y ..... Red/yellow stripe	G.W ..... Green/white stripe	Bu.Y ..... Blue/yellow stripe	Y.R ..... Yellow/red stripe	W.R ..... White/red stripe
R.Bl ..... Red/black stripe	G ..... Green	G.Y ..... Green/yellow stripe	Bl ..... Black	Y.W ..... Yellow/white stripe	W.Y ..... White/yellow stripe
R.Bu ..... Red/blue stripe	G.Bl ..... Green/black stripe	Bu ..... Blue	Bl.W ..... Black/white stripe	W ..... White	
R.G ..... Red/green stripe	G.Bu ..... Green/blue stripe	Bu.R ..... Blue/red stripe	Bl.Y ..... Black/yellow stripe	W.Bu ..... White/blue stripe	
R.W ..... Red/white stripe	G.R ..... Green/red stripe	Bu.W ..... Blue/white stripe	Y ..... Yellow	W.G ..... White/green stripe	

15. A600; U.K. and Australia



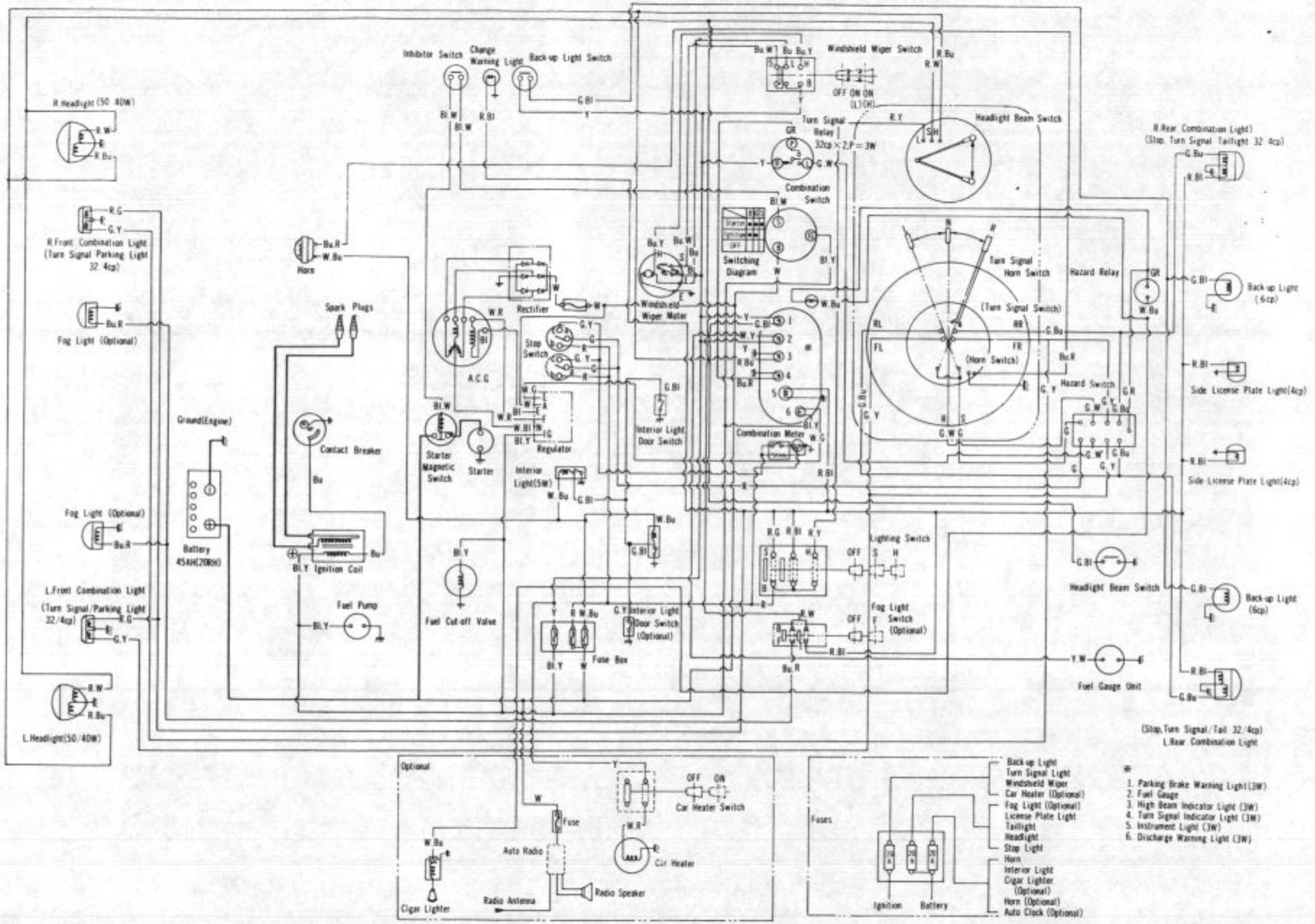
R. ····· Red	R.Y ····· Red/yellow stripe	G.W ····· Green/white stripe	Bu.Y ····· Blue/yellow stripe	Y.R ····· Yellow/red stripe	W.R ····· White/red stripe
R.Bl ····· Red/black stripe	G ····· Green	G.Y ····· Green/yellow stripe	Bl ····· Black	Y.W ····· Yellow/white stripe	W.Y ····· White/yellow stripe
R.Bu ····· Red/blue stripe	G.Bl ····· Green/black stripe	Bu ····· Blue	Bl.W ····· Black/white stripe	W ····· White	
R.G ····· Red/green stripe	G.Bu ····· Green/blue stripe	Bu.R ····· Blue/red stripe	Bl.Y ····· Black/yellow stripe	W.Bu ····· White/blue stripe	
R.W ····· Red/white stripe	G.R ····· Green/red stripe	Bu.W ····· Blue/white stripe	Y ····· Yellow	W.G ····· White/green stripe	

16. A600; Denmark



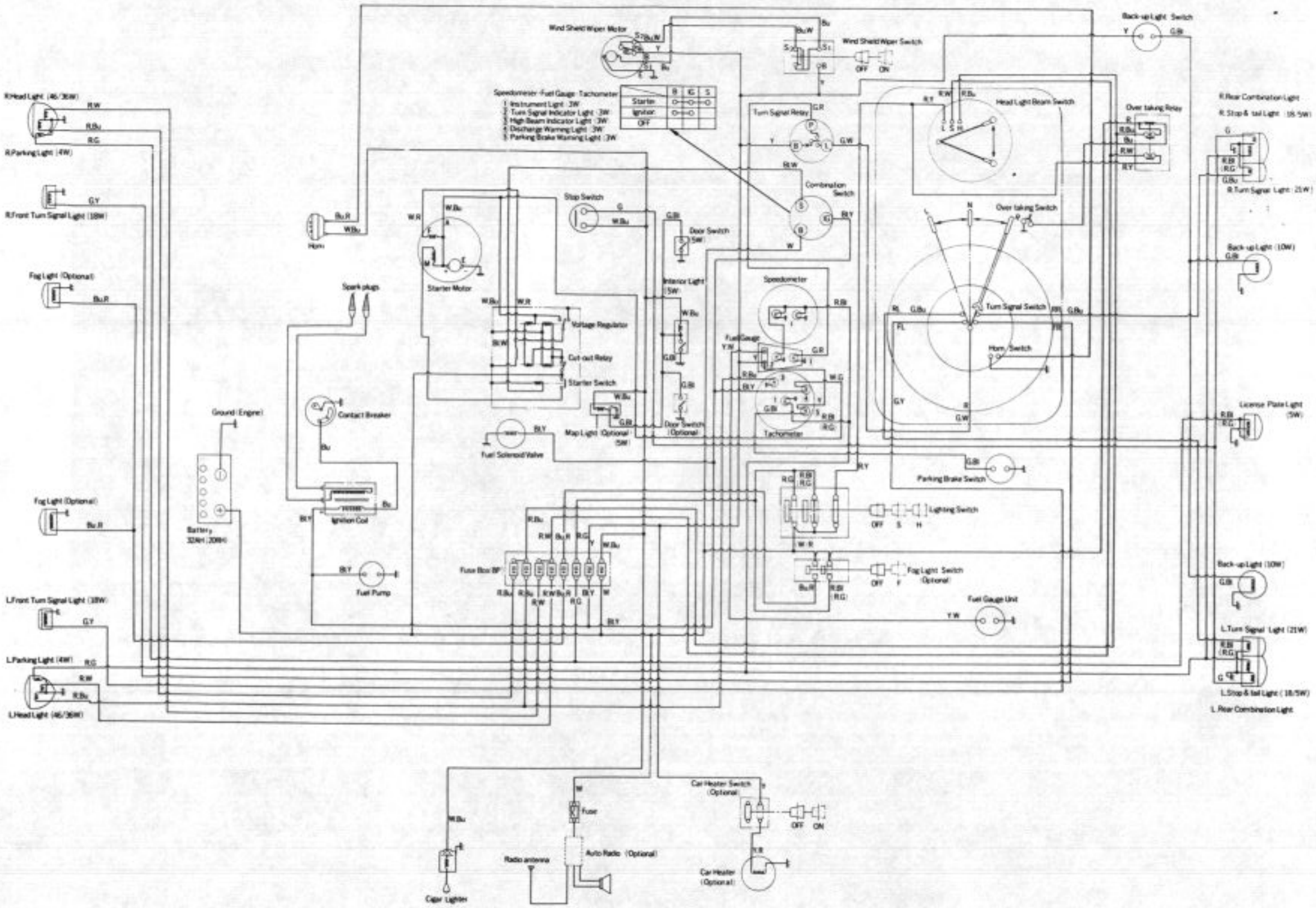
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

17. AA600; U.S.A. and Canada



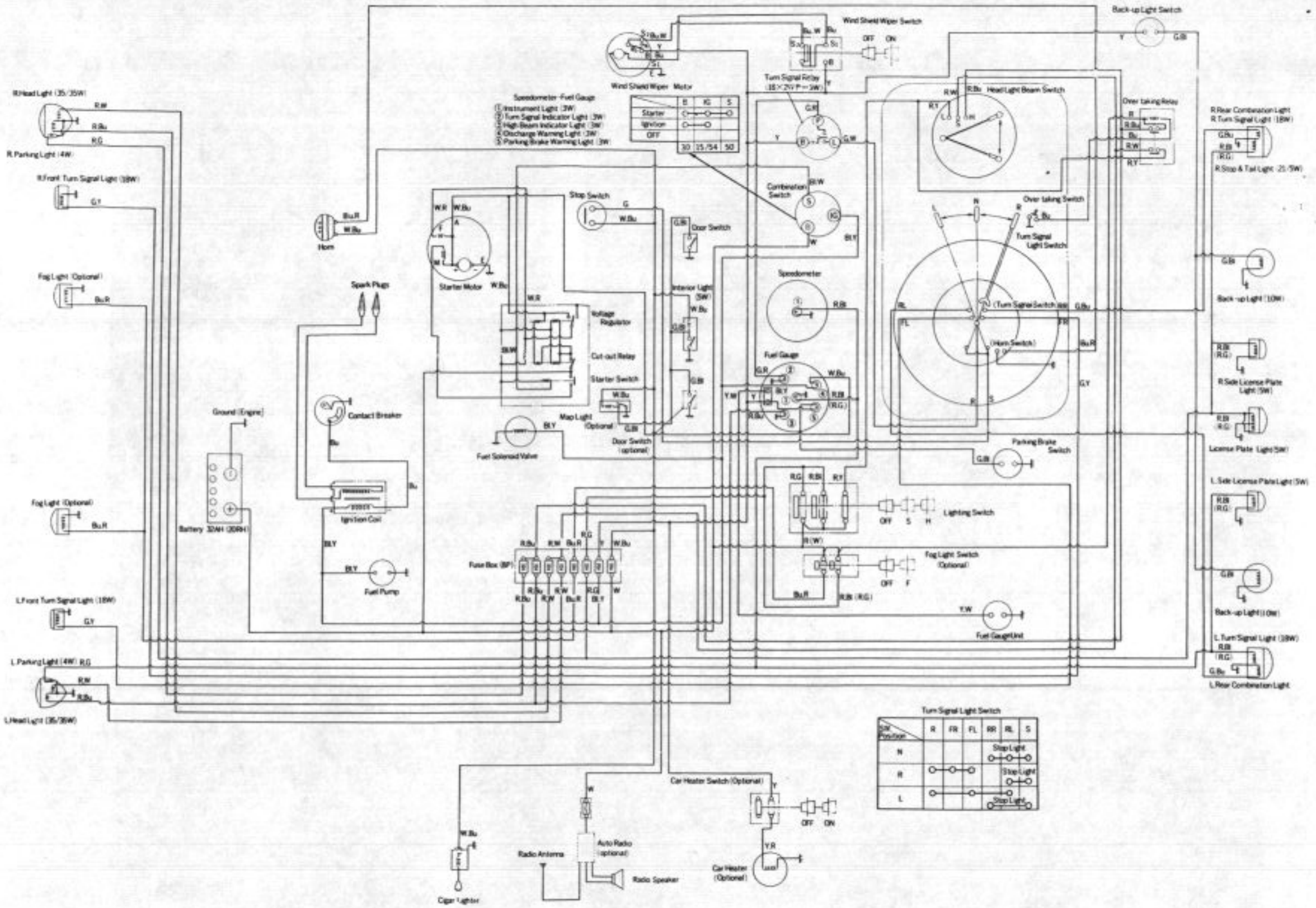
R. ····· Red	R.Y ····· Red/yellow stripe	G.W ····· Green/white stripe	Bu.Y ····· Blue/yellow stripe	Y.R ····· Yellow/red stripe	W.R ····· White/red stripe
R.Bl ····· Red/black stripe	G ····· Green	G.Y ····· Green/yellow stripe	Bl ····· Black	Y.W ····· Yellow/white stripe	W.Y ····· White/yellow stripe
R.Bu ····· Red/blue stripe	G.Bl ····· Green/black stripe	Bu ····· Blue	Bl.W ····· Black/white stripe	W ····· White	
R.G ····· Red/green stripe	G.Bu ····· Green/blue stripe	Bu.R ····· Blue/red stripe	Bl.Y ····· Black/yellow stripe	W.Bu ····· White/blue stripe	
R.W ····· Red/white stripe	G.R ····· Green/red stripe	Bu.W ····· Blue/white stripe	Y ····· Yellow	W.G ····· White/green stripe	

18. N400 ; France



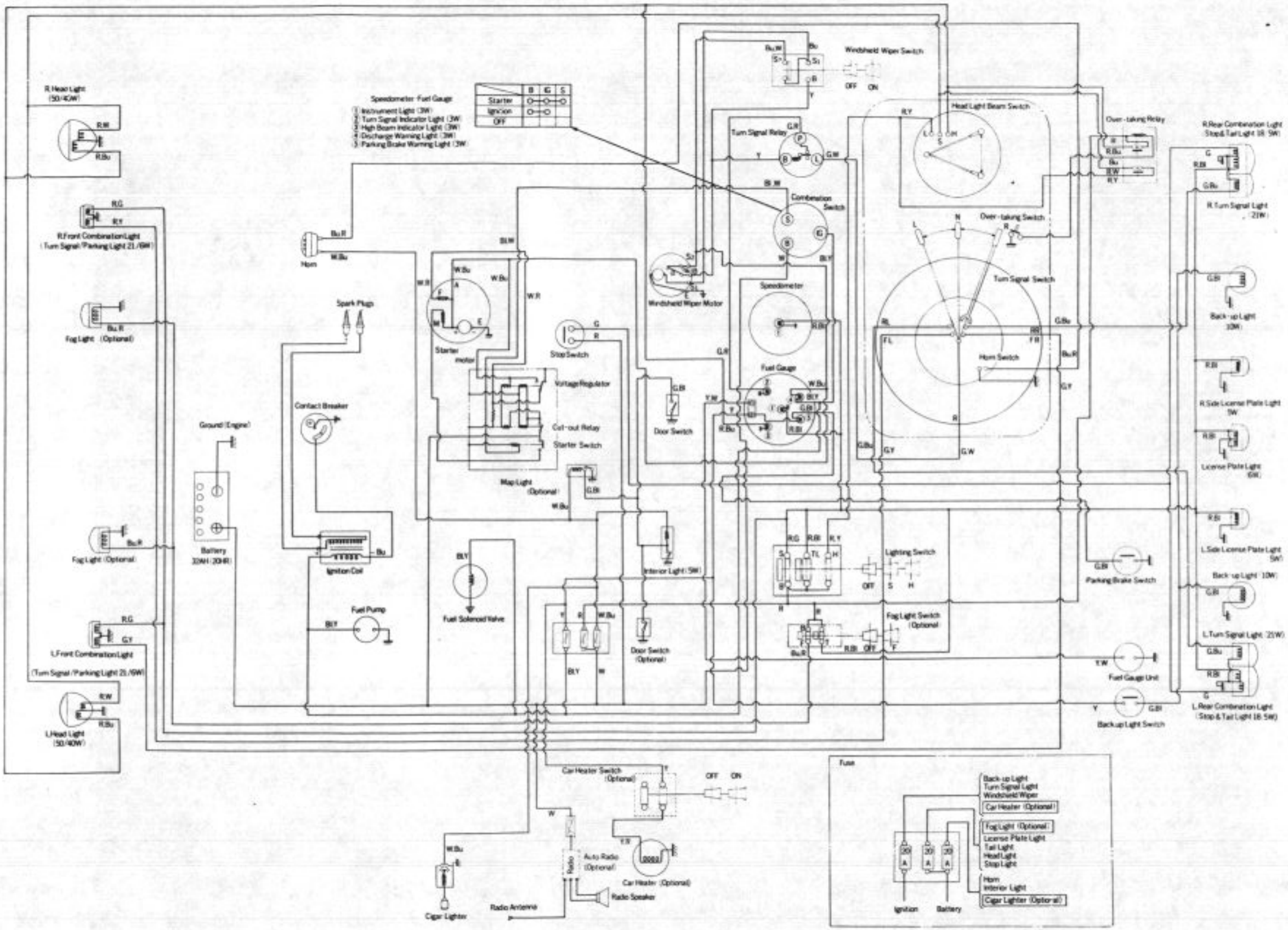
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

19. N400; Germany



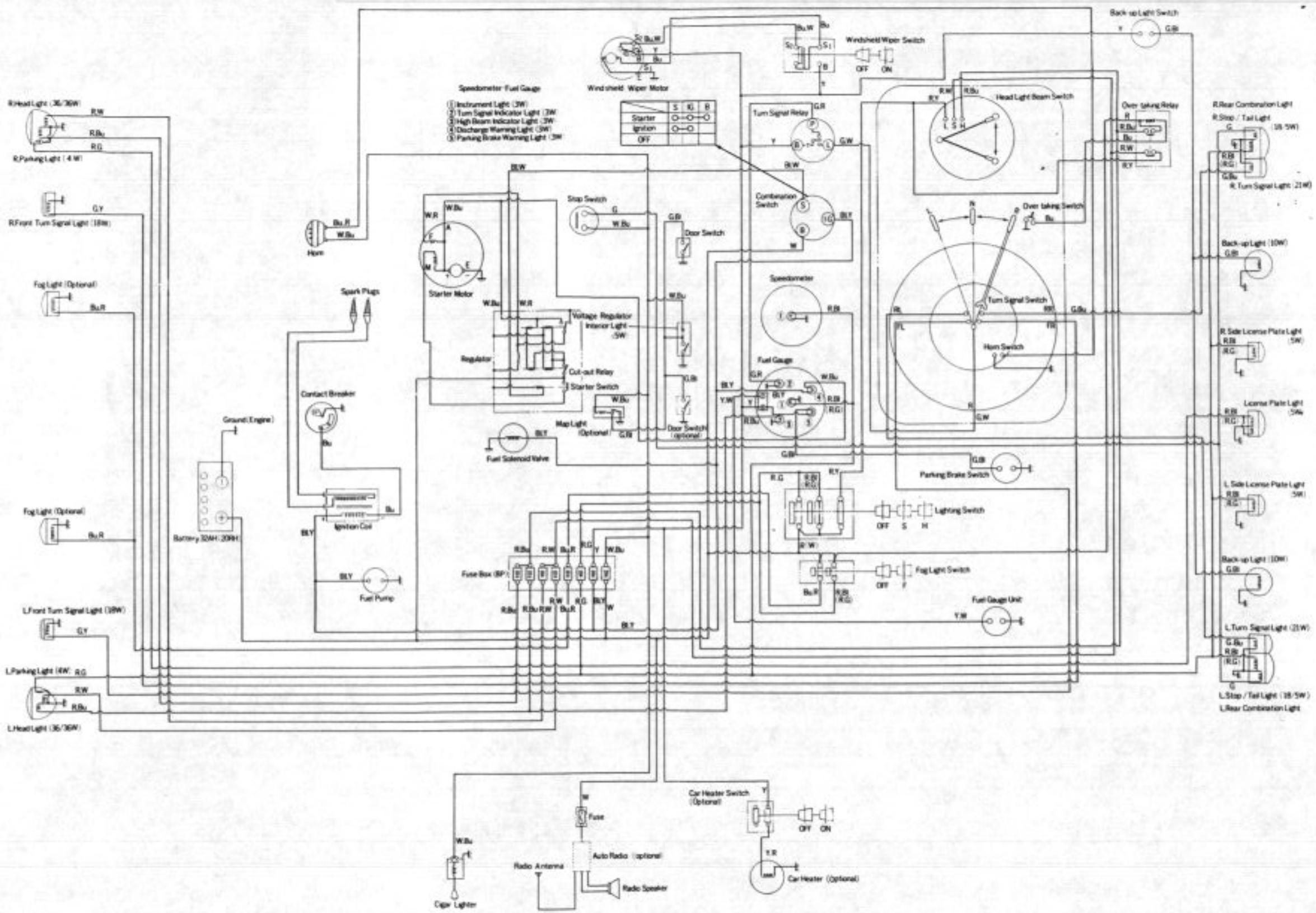
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

20. N400; U.K.



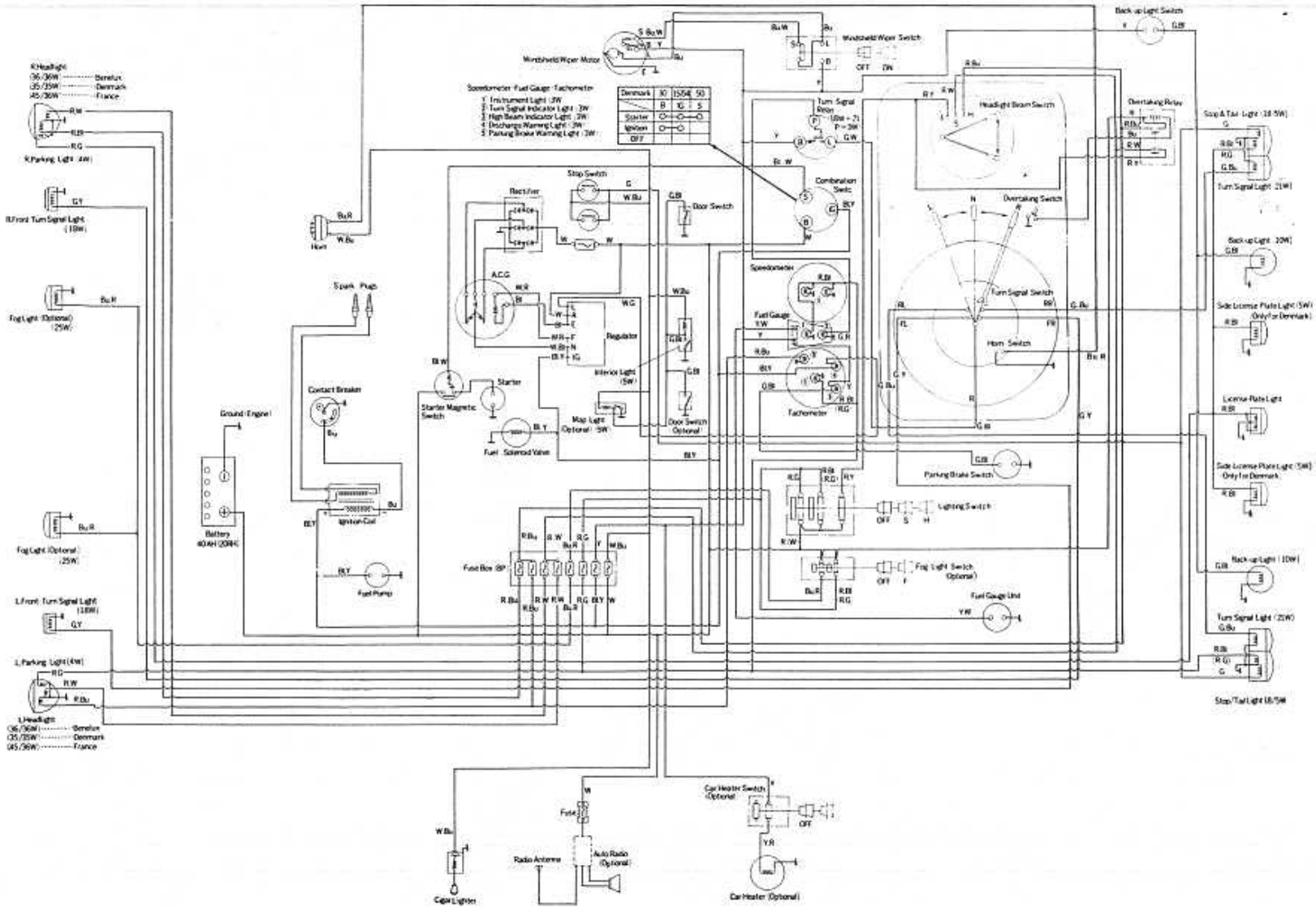
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

21. N400 ; Belgium



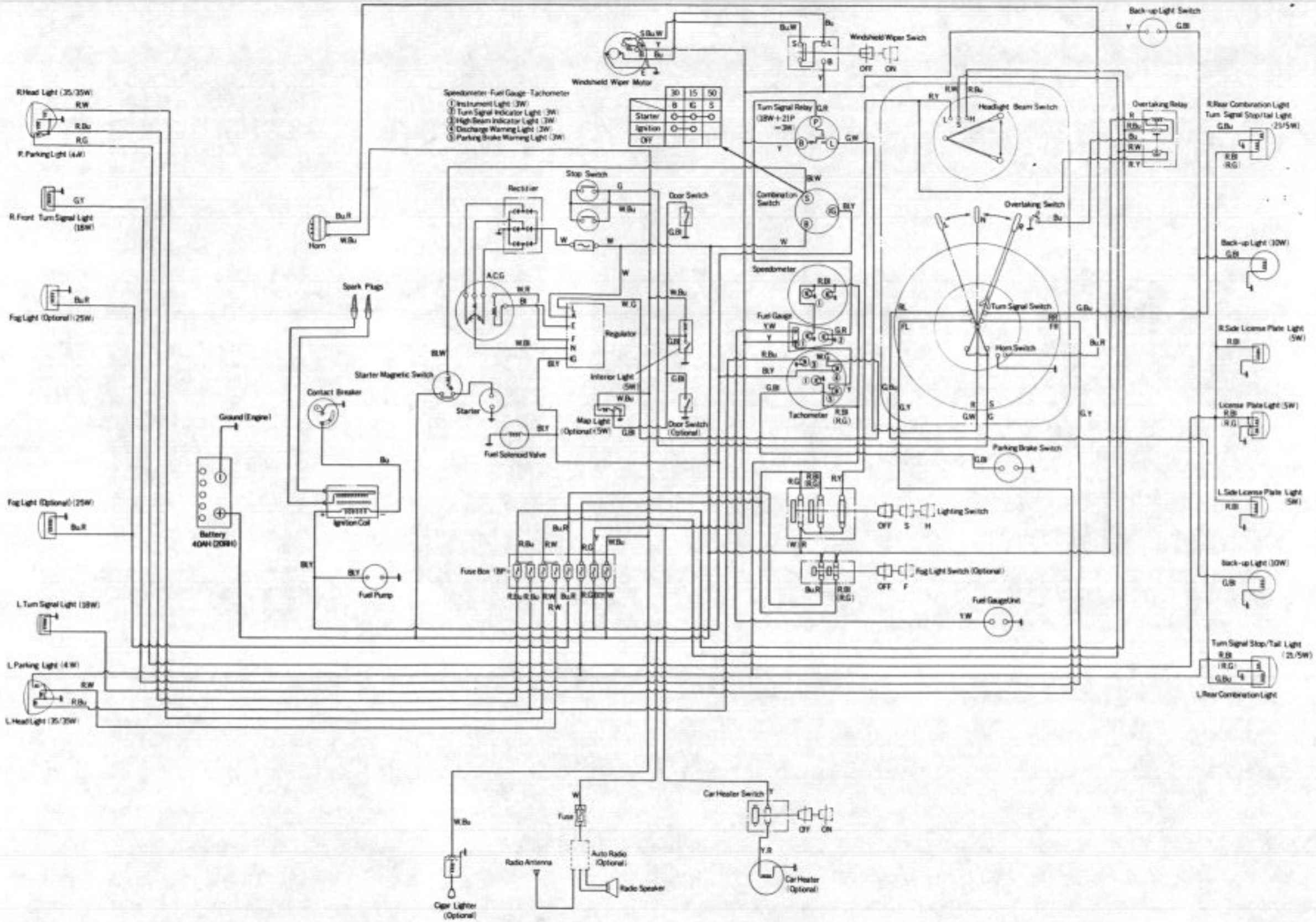
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

22. N600G; France, Belgium and Denmark



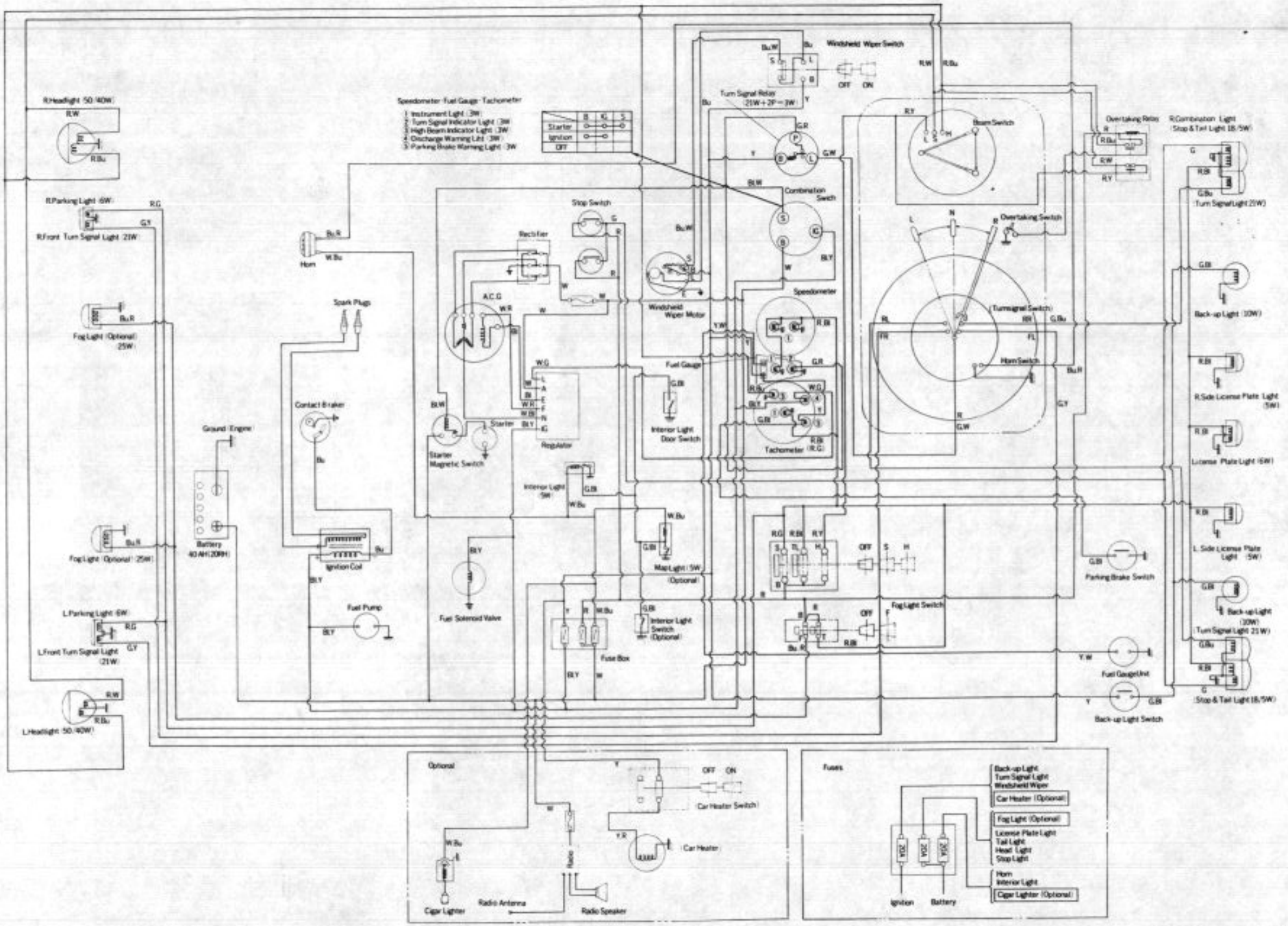
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

23. N600G ; Germany



R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

24. N600G ; U.K.



R. ---------- Red	R.Y ---------- Red/yellow stripe	G.W ---------- Green/white stripe	Bu.Y ---------- Blue/yellow stripe	Y.R ---------- Yellow/red stripe	W.R ---------- White/red stripe
R.Bl ---------- Red/black stripe	G ---------- Green	G.Y ---------- Green/yellow stripe	Bl ---------- Black	Y.W ---------- Yellow/white stripe	W.Y ---------- White/yellow stripe
R.Bu ---------- Red/blue stripe	G.Bl ---------- Green/black stripe	Bu ---------- Blue	Bl.W ---------- Black/white stripe	W ---------- White	
R.G ---------- Red/green stripe	G.Bu ---------- Green/blue stripe	Bu.R ---------- Blue/red stripe	Bl.Y ---------- Black/yellow stripe	W.Bu ---------- White/blue stripe	
R.W ---------- Red/white stripe	G.R ---------- Green/red stripe	Bu.W ---------- Blue/white stripe	Y ---------- Yellow	W.G ---------- White/green stripe	