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IGNITION TIMING

593 HO and 793 Engines

Normally ignition timing adjustment should not be required. It has been set at factory and it should remain correctly adjusted since every part is fixed and not adjustable. The only time the ignition timing might have to be changed would be when removing and reinstalling the magneto housing, replacing the crankshaft, the magneto flywheel, the trigger coil or the MPEM. If the ignition timing is found incorrect, first check for proper crankshaft alignment. This might be the indication of a twisted crankshaft. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT.

The ignition timing can be checked with either the engine hot or cold. Also, the ignition timing is to be checked at 3500 RPM with a timing light.

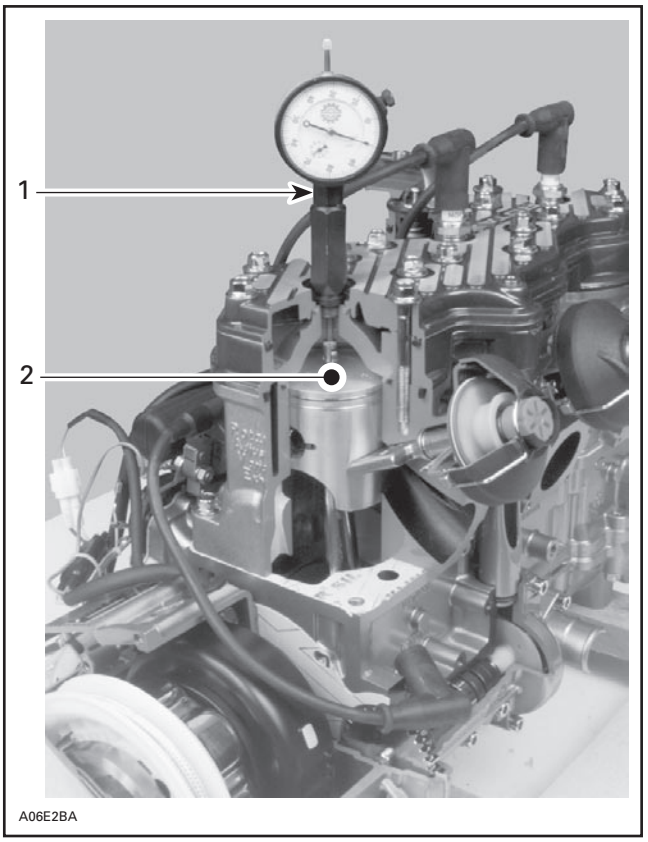
Engine break-in retard timing varies depending on engines/models for their first hour/s of operation.

ENGINE	ENGINE RETARD TIMING (°)/DURATION (h)
593 HO and 793	- 3°/1 h

NOTE: Between 3000 and 4000 RPM, the spark advance does not change. So when checking ignition timing at 3500 RPM, a change in engine speed within ± 500 RPM will not affect the timing mark when checked with the timing light.

Scribing a Timing Mark

1. Clean the area around the MAG spark plug, and remove it.
2. Install the TDC gauge in the spark plug hole, (magneto side) and adjust as follows:
   a. Position the MAG piston at approximately TDC.



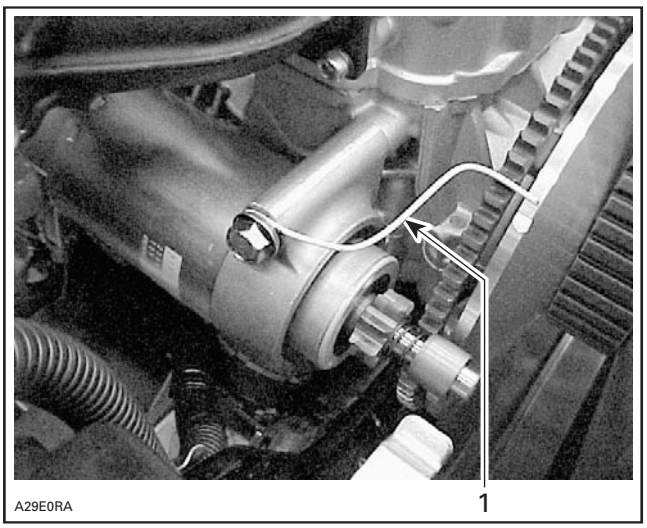
TYPICAL
1. TDC gauge on MAG side
2. MAG side piston at TDC

   b. Assemble the gauge to the adaptor and tighten the roller lock nut. Do not tighten the adaptor lock nut.
   c. Screw the adaptor into the spark plug hole and tighten to prevent movement in the plug hole.
   d. Position the dial face toward the PTO. Move the gauge down until the needle just begins to move, then move down a further 5 or 6 mm (approximately 1/4 in). Tighten adaptor lock nut by hand.
3. Locate the piston TDC position as follows:
   a. Slowly rotate the drive pulley back and forth across TDC while observing the needle. Note that the needle stops moving only as the piston is changing direction.
   b. Rotate the dial face so that "0" is in line with the needle when it stops moving.

c. Again, slowly rotate the drive pulley back and forth across TDC and adjust the dial face to "0", until the needle always stops exactly at "0" before changing direction.

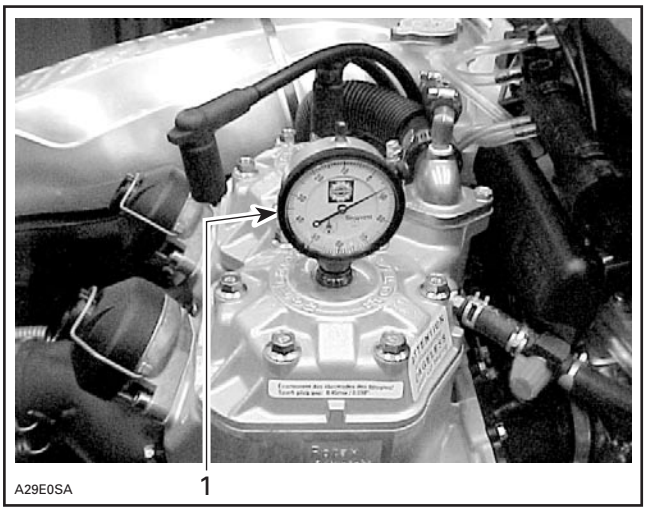
d. "0" now indicates exact TDC.

4. Rotate the drive pulley clockwise, one-quarter turn then carefully rotate it counterclockwise until the needle indicates the specified measurement, indicated in TECHNICAL DATA.
5. Twist a wire as shown and use it as a pointer. Install the wire on upper starter bolt.

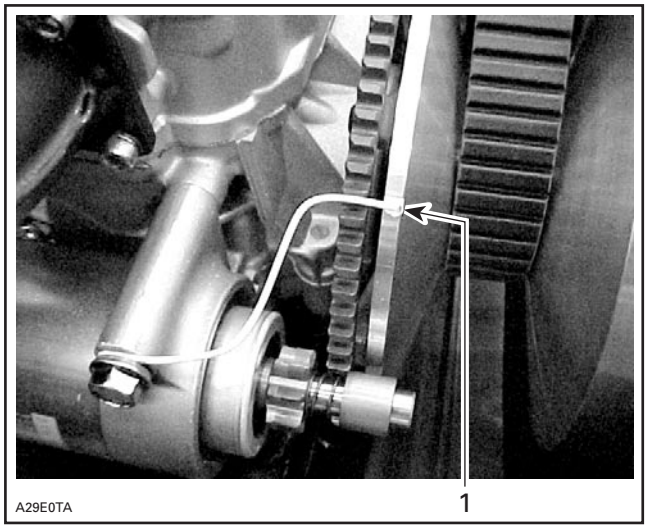


TYPICAL
1. Pointer

6. With the TDC gauge indicating specified timing, scribe a mark on drive pulley inner half in line with pointer end.



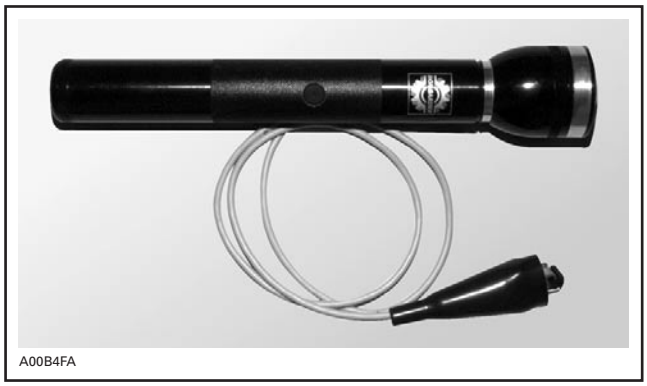
TYPICAL
1. TDC gauge indicating specified timing



TYPICAL
1. Timing mark in line with pointer end

Checking Ignition Timing

Use timing light (P/N 529 031 900).



TIMING LIGHT (P/N 529 031 900)

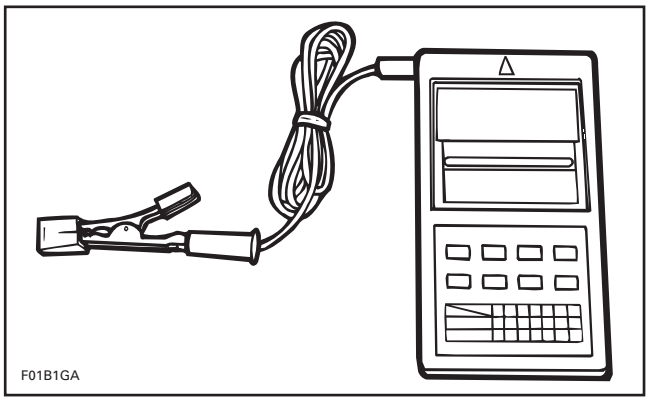
To check the ignition timing, refer to illustration and proceed as follows:

⚠ WARNING

Place ski tips against a wall, raise rear of vehicle on a stand, so that track does not contact the ground. Do not allow anyone in front of or behind the vehicle while engine is running. Keep clear of track and do not wear loose clothing which can get caught in moving parts.

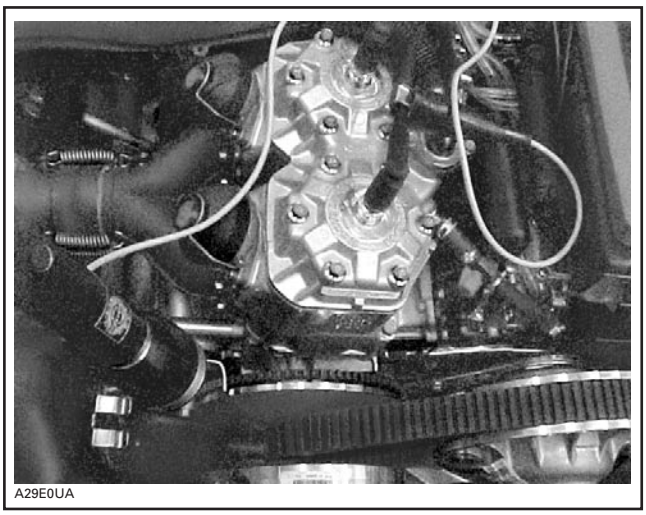
1. Connect the timing light pick-up to a spark plug cable.

Connect a digital induction type tachometer (P/N 529 014 500).



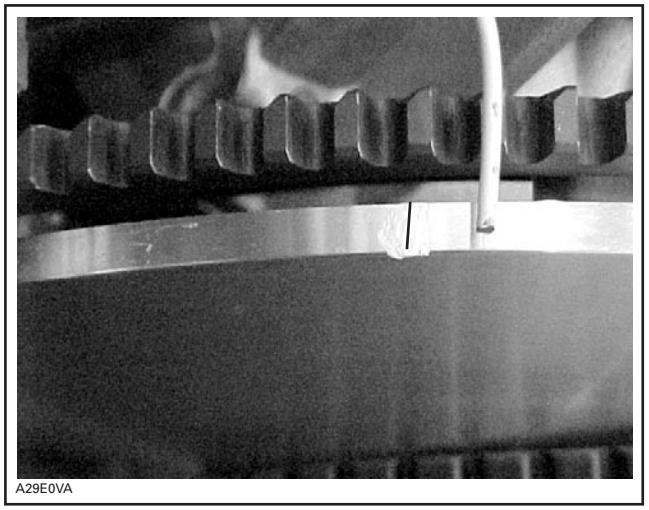
TACHOMETER (P/N 529 014 500)

2. Start the engine and point timing light on timing mark. Bring engine to 3500 RPM for a brief instant.

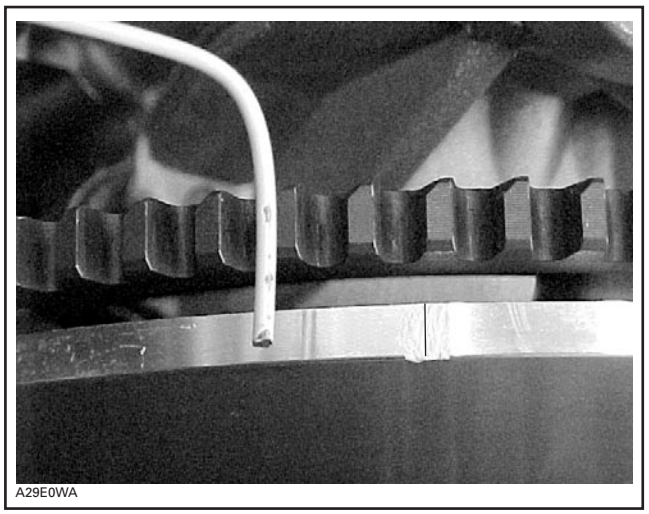


TYPICAL

The timing mark must be aligned with pointer end. If such is not the case, note if timing is retarded or advanced. Tolerance is ± 1°.



TIMING RETARDED BY ABOUT 2°



TIMING ADVANCED BY ABOUT 2°

Changing Timing

VCK (Vehicle Communication Kit)

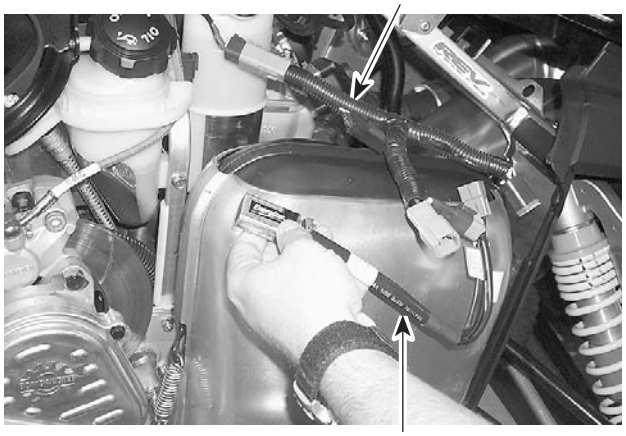
VCK (Vehicle Communication Kit) (P/N 295 035 676) can be used, with B.U.D.S. software to change the ignition timing. Look under the proper **Setting** section of the B.U.D.S. software to change the ignition timing.

Detailed information about the B.U.D.S. software and it's usage is available under it's **Help** section.

MPEM Programmer

Timing can also be changed using the MPEM programmer (P/N 529 035 878).

Connect 9-volt adaptor (P/N 529 035 675) to supply cable (P/N 529 035 869) and supply cable to diagnostic connector, located on right side of the vehicle.

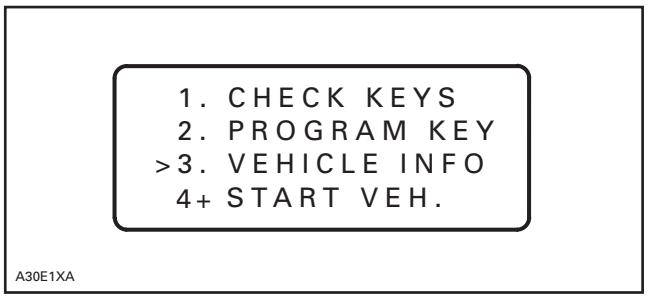


A33E0LA

Connect MPEM programmer to DESS post.

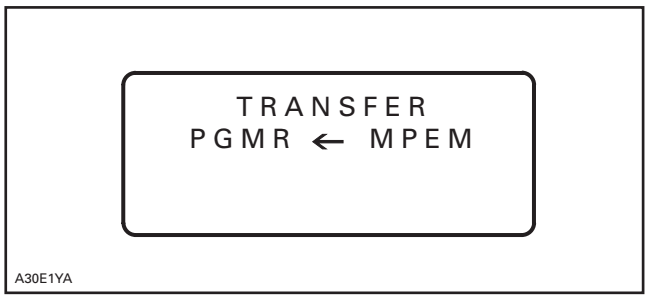
Turn on programmer then enter password.

From main menu select no. 3. INFO VEHICLE.



A30E1XA

Vehicle information is transferred from MPEM to programmer.



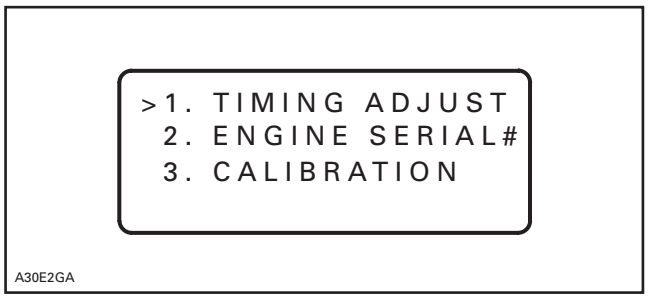
A30E1YA

NOTE: In fact the programmer takes a **copy** of all vehicle parameters scribed in MPEM. This copy will be modified within the programmer then transferred to the MPEM.

Select no. 4. ENGINE PARAMETER.

A30E1ZA

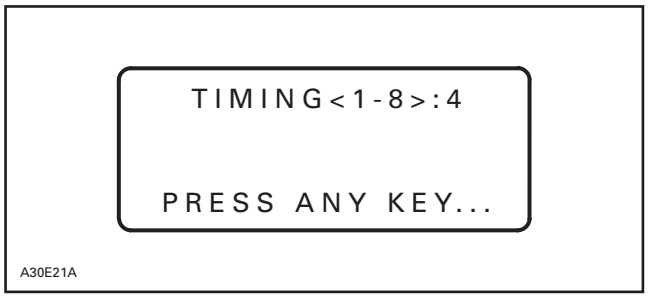
Select no. 1 TIMING ADJUSTMENT.



A30E2GA

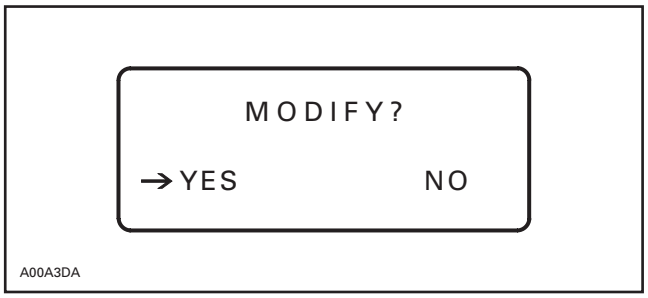
Press ENTER.

Now the display shows the engine timing correction factor that is programmed in the MPEM. In the following example timing correction factor is no. 4.



A30E21A

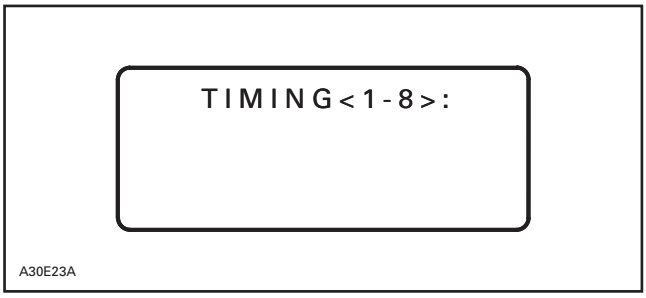
Press any key.



A00A3DA

Select YES using the key ↔.

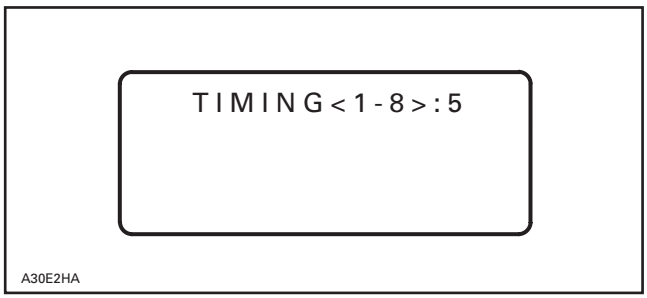
Press ENTER.



Select a timing correction factor corresponding to correction needed.

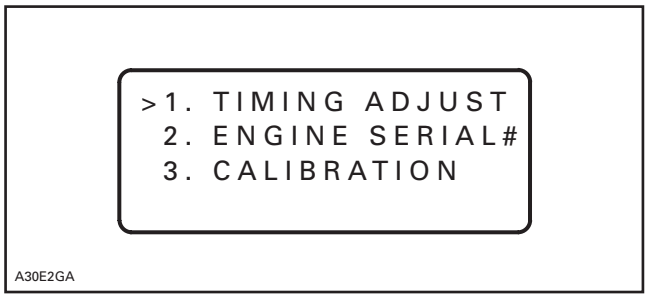
Example: Timing mark as verified with a timing light at 3500 RPM was too early by 2°. The correction factor programmed is no. 4.

Select correction factor no. 5. This will retard the timing by 2° because the difference between correction factor no. 4 and no. 5 is - 2° (passing from 1° to - 1°).

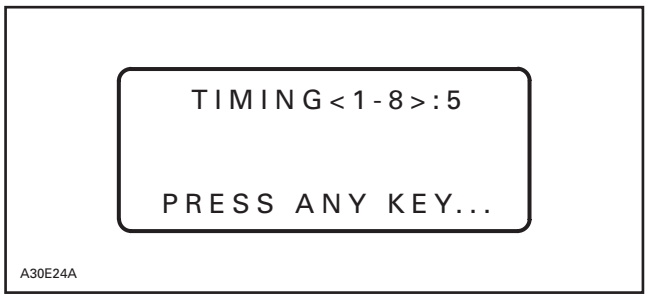


IGNITION CORRECTION FACTOR	
CORRECTION FACTOR PROGRAMMED IN MPEM	IGNITION TIMING CORRECTION
2	3°
3	2°
4	1°
1	0°
5	- 1°
6	- 2°
7	- 3°
8	- 4°

Press ENTER.

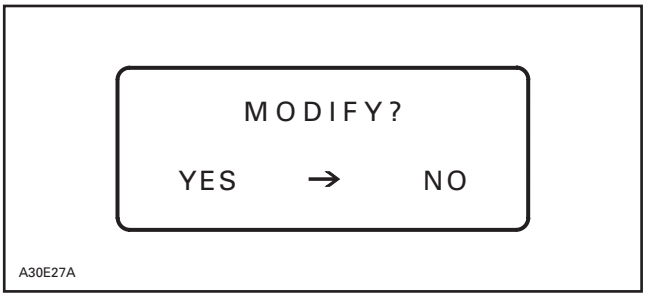


Press ENTER.

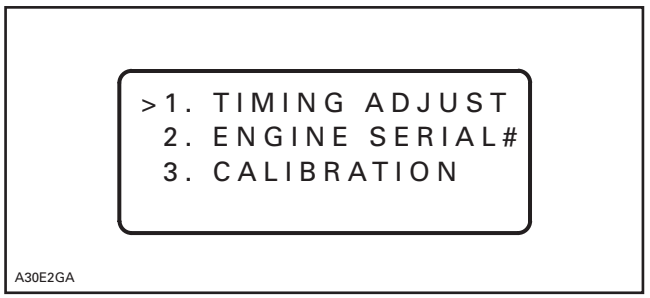


The display confirms that correction factor has been changed to no. 5.

Press any key.

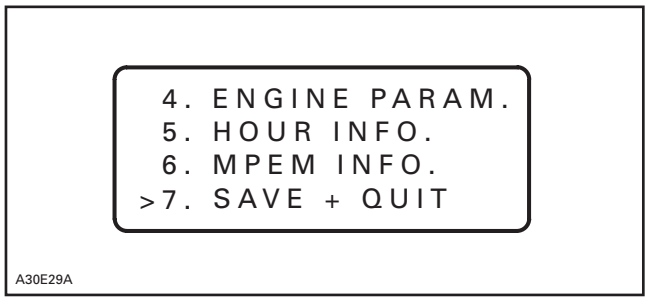


If the new correction factor selected above is the good one select NO and press ENTER. Otherwise select YES to choose an other correction factor.

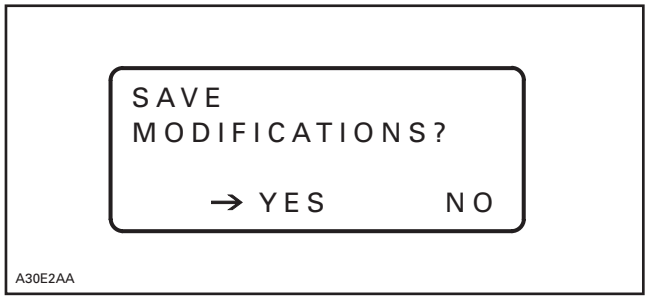


Press MENU.

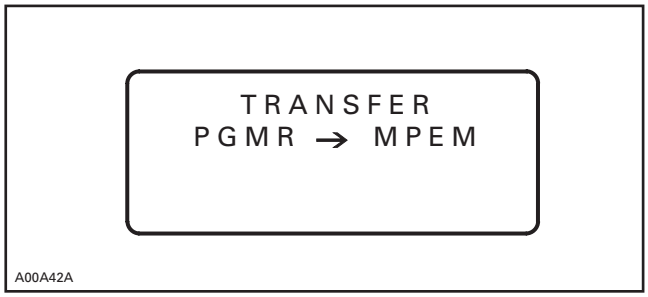
Scroll to no. 7 SAVE AND QUIT.



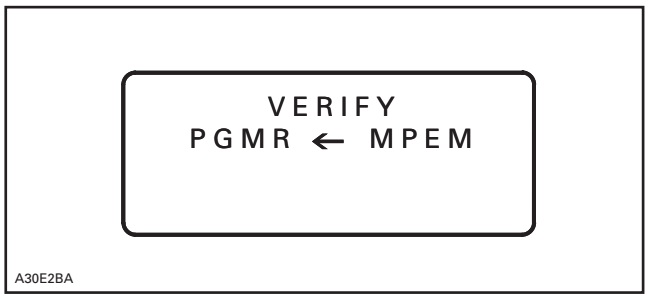
Press ENTER.



Press ENTER.

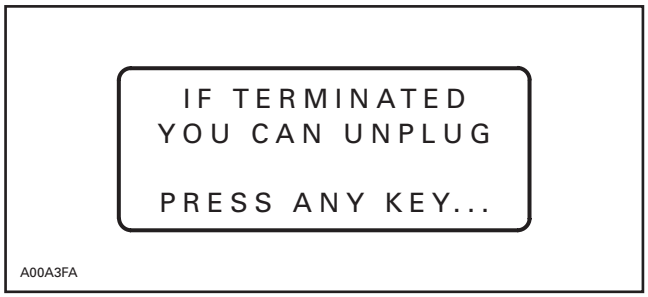


During a very short period of time the following message will appear.

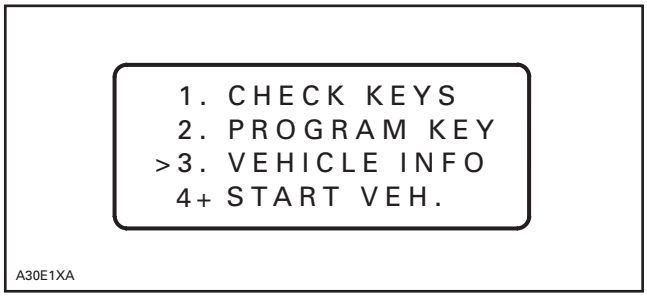


After the programmer has verified, following message will appear.

Press any key.



Press any key.



Unplug supply cable and 9-volt adaptor.

SPARK PLUGS

NGK SPARK PLUG

All Models

NGK SPARK PLUG NUMBERING SYSTEM

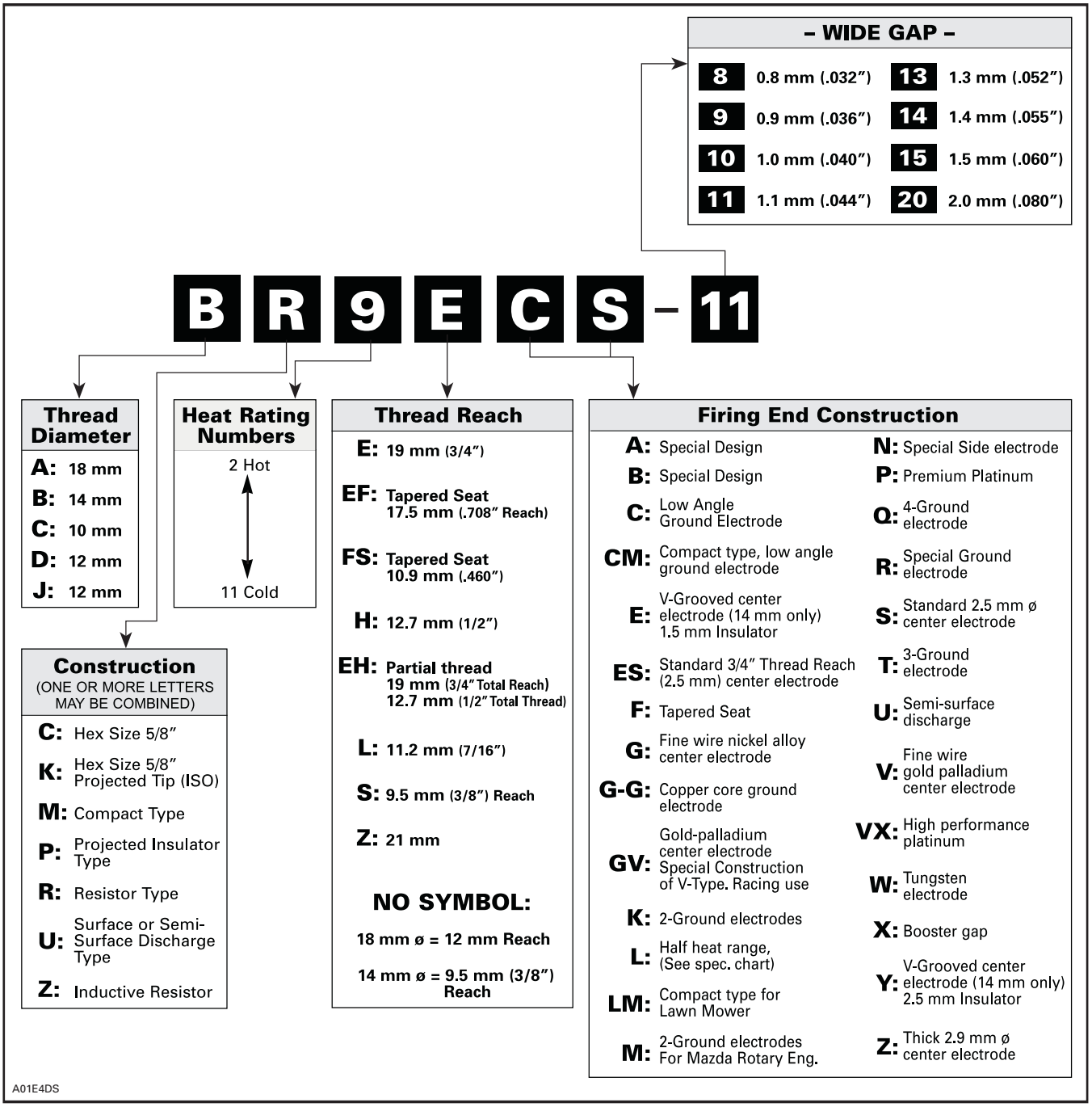
Bombardier uses NGK brand spark plugs on all its snowmobile models.

The heat range identification system is:

Low number ⟶ hot plug

High number ⟶ cold plug

DESIGN SYMBOLS USED IN NGK SPARK PLUGS



DISASSEMBLY

First unscrew the spark plug 1 turn.

Clean the spark plug and cylinder head with pressurized air, then completely unscrew.

⚠ WARNING

Whenever using compressed air, always wear protective eye wear.

HEAT RANGE

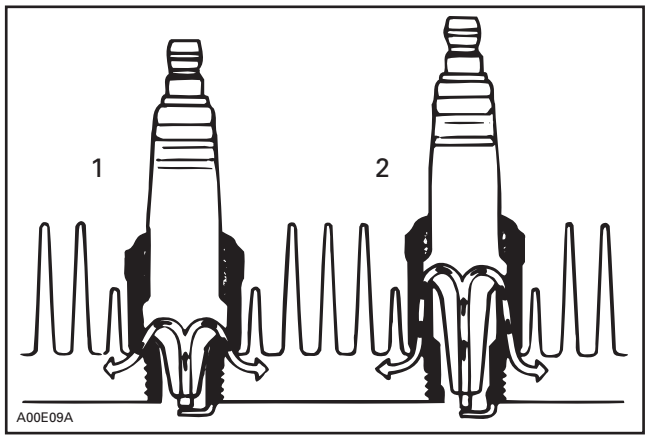
The proper operating temperature or heat range of the spark plugs is determined by the spark plug ability to dissipate the heat generated by combustion.

The longer the heat path between the electrode tip and the plug shell, the hotter the spark plug operating temperature will be — and vice-versa, the shorter the heat path, the colder the operating temperature.

A **cold** type plug has a relatively short insulator nose and transfers heat very rapidly into the cylinder head.

Such a plug is used in heavy duty or continuous high speed operation to avoid overheating.

The **hot** type plug has a longer insulator nose and transfers heat more slowly away from its firing end. It runs hotter and burns off combustion deposits which might tend to foul the plug during continuedidle or low speed operation.



1. Cold
2. Hot

CAUTION: Severe engine damage might occur if a wrong heat range plug is used.

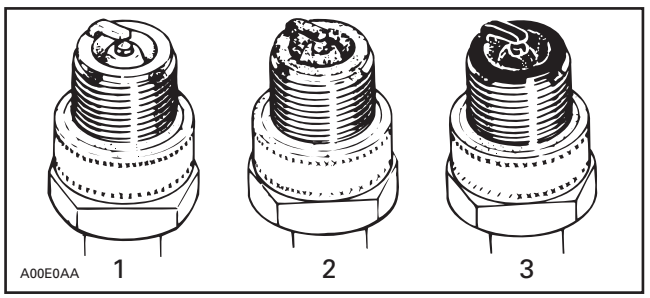
A plug that would be **too hot** will result in overheating and pre-ignition, etc.

A plug that would be **too cold** will result in fouling (shorting the spark plug) or may create carbon build up which can heat up red-hot and cause preignition or detonation.

FOULING

Fouling of the spark plug is indicated by irregular running of the engine, decreased engine speed due to misfiring, reduced performance, and increased fuel consumption. This is due to a loss of compression. Other possible causes are: prolonged idling, or running on a too rich mixture due to a faulty carburetor adjustment or incorrect fuel and/or fuel mixing. The plug face of a fouled spark plug has either a dry coating of soot or an oily, glossy coating given by an excess of oil or of oil with soot. Such coatings form a conductive connection between the center electrode and the ground.

SPARK PLUG ANALYSIS



1. Overheated (light grey)
2. Normal (brownish)
3. Fouled (black)

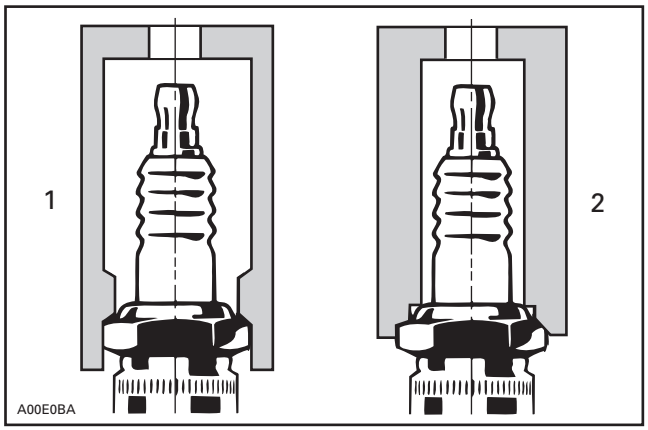
The plug electrode and piston dome reveal the condition of the engine, operating condition, method of driving and fuel mixture. For this reason it is recommended to inspect the spark plug at regular intervals, examining the plug electrode and the piston dome.

SPARK PLUG INSTALLATION

Prior to installation, make sure that contact surfaces of the cylinder head and spark plug are free of grime.

CAUTION: Do not adjust electrode gap of spark plug BR9ECS.

1. Using a wire feeler gauge, set electrode gap according to TECHNICAL DATA.
2. Apply anti-seize lubricant (P/N 293 800 070) over the spark plug threads to prevent possible seizure.
3. Hand screw spark plug into cylinder head and tighten with a torque wrench and a proper socket.



1. Proper socket
2. Improper socket

SPARK PLUG TIGHTENING TORQUE

MODELS	SPARK PLUGS	TORQUE N•m (lbf•ft)
All models	NGK	27 (20)

BATTERY

GENERAL

Absorbed Glass Mat (AGM) battery (YTX20L-BS, P/N 515 175 759) is used for the SKI-DOO snowmobiles. AGM battery is sealed, non-spillable and maintenance free.

REMOVAL

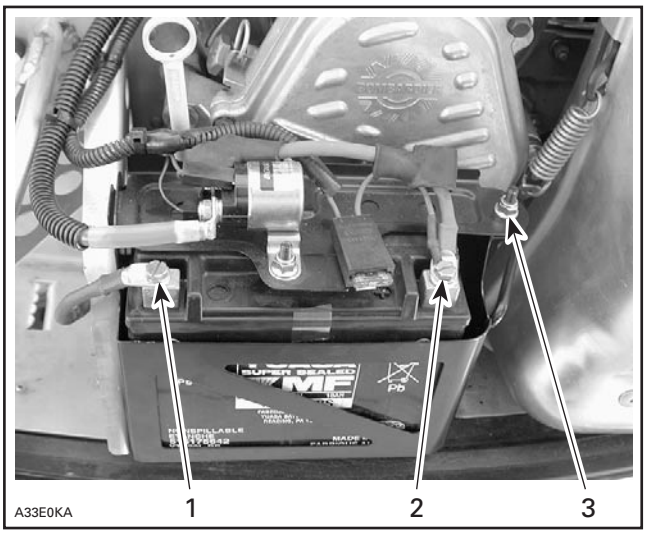
⚠ WARNING

Battery BLACK negative cable must always be disconnected first and connected last.

⚠ WARNING

Never charge or boost battery while installed on vehicle.

Open the right side panel of the vehicle.



1. *BLACK negative cable terminal*
2. *RED positive cable terminal*
3. *Bracket retaining nut*

Disconnect BLACK negative cable from the terminal.

Slide off the rubber boot from the RED cable and disconnect the RED cable.

Remove the bracket by unscrewing the bracket retaining nut.

Remove the battery.

CAUTION: Should any electrolyte spillage occur, immediately wash off with a solution of baking soda and water to prevent damage to vehicle components.

CLEANING

Clean the battery, battery casing, cables and battery posts using a solution of baking soda and water.

Remove corrosion from battery cable terminals and battery posts using a firm wire brush. Battery top should be cleaned by soft brush and any grease-cutting soap or baking soda solution.

INSPECTION

Visually inspect battery casing for cracks, leaks or other possible damage. Discoloration, warping or raised top, indicates that battery has overheated or been overcharged. If casing is damaged, replace battery and thoroughly clean battery tray and close area with water and baking soda.

⚠ WARNING

Should the battery casing be damaged, wear a suitable pair of non-absorbent gloves when removing the battery by hand.

Inspect battery posts for security of mounting.

BATTERY CHARGE TESTING

Voltmeter Test

The sealed and maintenance free battery has to be tested with a voltmeter.

Battery testing requires a voltmeter that can measure DC voltage. Connect a voltmeter parallel to the circuit being tested, observing polarity; otherwise, wrong voltmeter reading will appear.

There are two types of battery tests: unload and load.

An unload test is made on a battery without discharging current. It is the simplest and most commonly used method.

An load test is more accurate.

Unload Test

Check charge condition by using voltmeter. Voltmeter readings appear instantly to show the state of charge.

⚠ WARNING

Connect the positive lead to the battery's positive terminal, and the negative lead to the negative terminal.

STATE OF CHARGE	VOLTAGE READING
100%	12.8 - 13.0 V
75% - 100%	12.5 - 12.8 V
50% - 75%	12.0 - 12.5 V
25% - 50%	11.5 - 12.0 V
0% - 25%	11.5 V or less

Load Test

This is the best test of battery condition under a starting load. Use a load testing device that has an adjustable load.

Apply a load of 3 times the ampere-hour rating of the battery. At 14 seconds into the test, check battery voltage; if battery is in good condition, it will have at least 10.5 Vdc.

BATTERY STORAGE

Disconnect and remove battery from the vehicle.

The battery must always be stored in fully charged condition.

Clean battery terminals and cable connections using a wire brush. Apply a light coat of dielectric grease (P/N 293 550 004) or petroleum jelly on terminals.

Clean battery casing using a solution of baking soda and water. Rinse battery with clear water and dry well using a clean cloth.

Charge the battery every month if stored at temperature **below** 15°C (60°F).

Charge the battery every two week if stored at temperature **above** 15°C (60°F).

ACTIVATION OF NEW BATTERY

Refer to the instructions provided with the battery.

BATTERY CHARGING

Voltage reading should be a minimum of 12.8 - 13.0 volts after charging. If open circuit voltage reading (with voltmeter) is not 12.8 volts or more - repeat charging cycle.

The following table shows the charging time of the battery require.

CONSTANT CURRENT CHARGER (1.0 A)	
STATE OF CHARGE	CHARGING TIME (hours)
100%	None
75% - 100%	3 - 6
50% - 75%	5 - 11
25% - 50%	13 - 15
0% - 25%	20

BATTERY CHARGER (1.5 A) (P/N 529 035 772)	
STATE OF CHARGE	CHARGING TIME (hours)
100%	None
75% - 100%	1 - 3
50% - 75%	2 - 5
25% - 50%	5 - 10
0% - 25%	10 - 15

CAUTION: If battery gets hot to the touch, stop charging and allow it to cool before continuing.

Allow battery to rest 1 - 2 hours after charging before checking voltage reading.

TIPS FOR CHARGING A USED BATTERY

CAUTION: Prior to charging the battery, always remove it from the vehicle to prevent electrolyte spillage.

For best results, battery should be charged when the electrolyte and the plates are at room temperature. A battery that is cold may not accept current for several hours after charging began.

Do not charge a frozen battery. If the battery charge is very low, the battery may freeze. If it is suspected to be frozen, keep it in a heated area for about 2 hours before charging.

⚠ WARNING

Do not place battery near open flame.

The time required to charge a battery depends on some factors such as:

– Battery temperature: Charging time is increased as the temperature goes down. The current accepted by a cold battery will remain low. As the battery warms up, it will accept a higher rate of charge.
– Type of charger: Battery chargers vary in the amount of voltage and current that they can supply. Therefore, the time required for the battery to begin accepting measurable current will also vary.

Charging a Very Flat or Completely Discharged Battery

Unless this procedure is properly followed, a good battery could needlessly be replaced.

– Measure the voltage at the battery posts with an accurate voltmeter. If it is below 10 volts, the battery will accept current at very low rate, in terms of milliamperes. It could take some time before the charging rate increases. Such low current flow may not be detectable on some charger ammeters and the battery will seem to accept no charge.
– Only for this particular case, set the charger to a high rate.

NOTE: Some chargers have a polarity protection feature that prevents charging unless the charger leads are connected to the correct battery terminals. A completely discharged battery may not have enough voltage to activate this circuitry, even though the leads are connected properly. It will seam like the battery does not accept a charge. Follow the charger manufacturer's instructions on how to bypass or override this circuitry so that the charger will turn on and charge a low-voltage battery.

– Since the battery chargers vary in the amount of voltage and current they provide, the time required for the battery to accept measurable charger current might be up to approximately 10 hours or more.
– If the charging current is not up to a measurable amount at the end of about 10 hours, the battery should be replaced.
– If the charging current is measurable before the end or at the end of about 10 hours, the battery is good and charging should be completed in the normal manner as specified in ACTIVATION OF A NEW BATTERY.
– It is recommended that any battery recharged by this procedure be load tested prior to returning it to service.

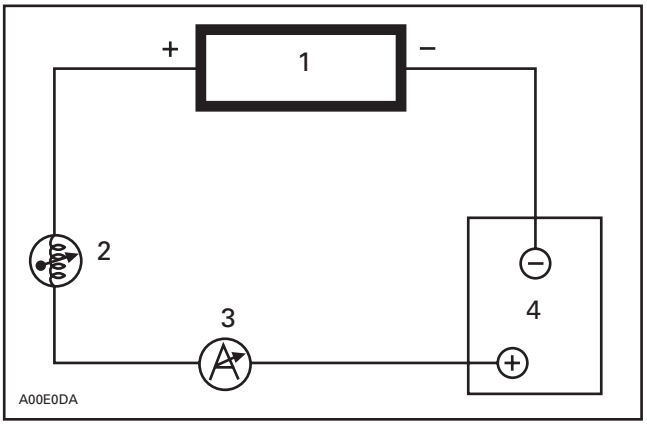
BATTERY CHARGING EQUIPMENT

The battery charger should have an adjustable charging rate. Variable adjustment is preferred, but a unit which can be adjusted in small increments is acceptable.

The battery charger must be equipped with an ammeter capable of accurately measuring current of less than one ampere.

If the present charger is not adjustable to the proper current values, a rheostat can be connected in series with the battery to provide adjustment. 12 ohm, 50 watt rheostat, such as OHMITE — 0314 or MALLORY 50K 12P, are available from electronic parts supply shops and they are suitable for use with most chargers if the peak current is to be held below 2 A.

If you need an accurate ammeter, we recommend the use of: SHURITE — 5202 (0 to 3 A) or — 5203 (0 to 5 A) available from electronic parts supply shops.



1. Charger
2. Rheostat 12 Ω 50 W
3. Ammeter
4. Battery

For a service application and a permanent installation, both ammeter and rheostat can be built into a small box adjacent to your charger.

CAUTION: Adequate ventilation MUST be provided to cool the rheostat.

INSTALLATION OF BATTERY

Install the bracket and screw the bracket retaining nut.

Connect RED positive cable it to positive battery terminal. Connect RED wire (coming from 30 A fuse).

Connect BLACK negative cable LAST.

⚠ WARNING

Battery BLACK negative cable must always be disconnected first and connected last.

⚠ WARNING

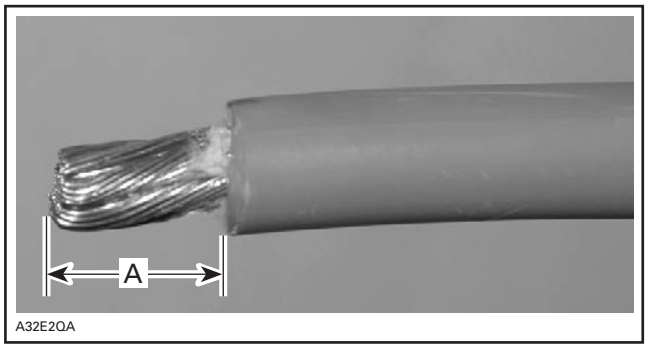
Never charge or boost battery while installed on vehicle.

Cover the RED positive terminal with rubber boot.

Apply silicone dielectric grease (P/N 293 550 004) on battery posts and connectors.

CABLE TERMINAL INSTALLATION

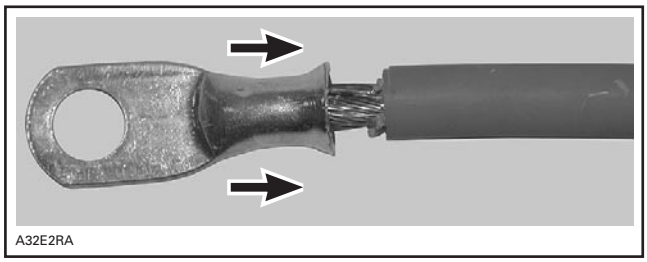
Carefully strip the wire approximately to 10 mm (1/2 in) in length, using a wire stripping tool or sharp blade/knife.



A. 10 mm

NOTE: Make sure not to cut wire strands while stripping the wire.

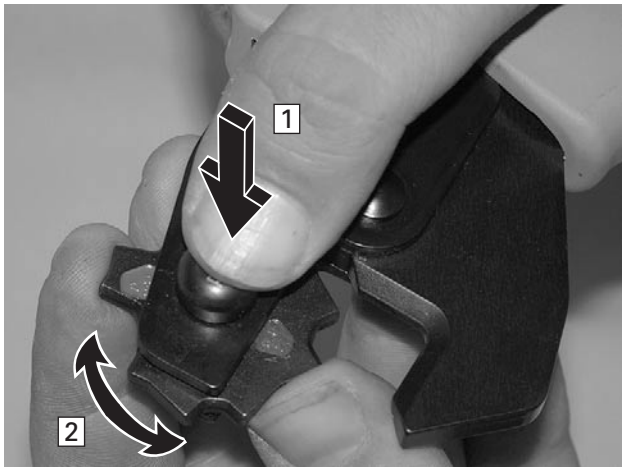
Install the appropriate terminal on the wire according to the requirement. Refer to appropriate parts catalog.



INSTALLATION OF TERMINAL

Follow the instructions provided with the crimp plier (P/N 529 035 730) to select the proper position of the tool.

NOTE: Different wires require different crimp plier settings, so make sure to follow the instruction supplied with the tool.

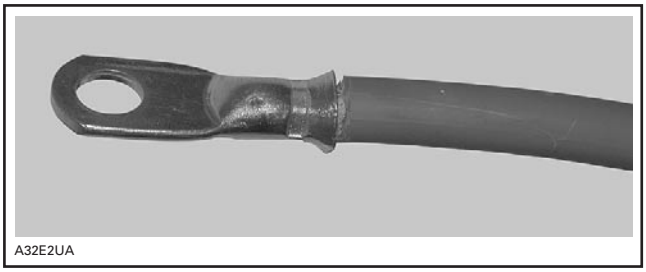


POSITIONING THE CRIMP PLIER

Step 1: Press
Step 2: Rotate

After positioning the crimp plier, crimp the terminal already installed on wire.

CRIMPING OF WIRE



PROPERLY CRIMPED WIRE

To verify, if the wire is properly crimped, hold the wire with one hand and the terminal with the other and pull with some force.

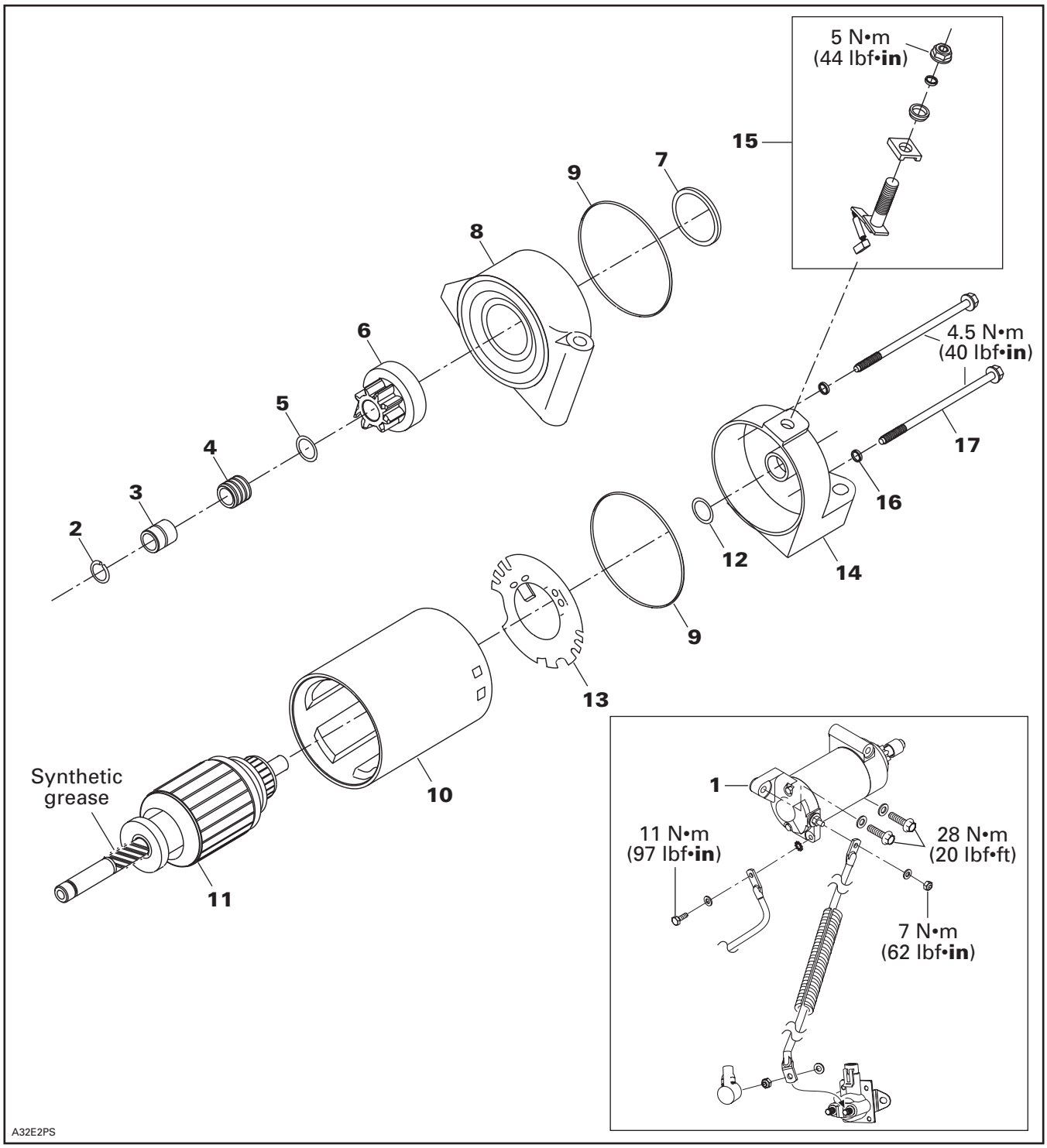
CAUTION: Never weld the wire to the terminal. Welding can change the property of the wire and it can become brittle and break.

Install the protective heat shrink rubber tube (P/N 278 001 692) on the terminal. Heat the heat shrink rubber tube using the heat gun so that it grasps the wire and the terminal.

CAUTION: Make sure that the protective heat shrink rubber tube has been properly installed and no part of wire is exposed.

ELECTRIC STARTER

REV Series Models with Electric Starting



REMOVAL

– Disconnect BLACK ground cable from battery.
– Disconnect RED positive cable from battery.

⚠ WARNING

Always disconnect ground cable first and connect last.

– Remove tuned pipe.
– Disconnect RED cable from starter.
– Disconnect ground cable from starter.
– Unbolt and remove starter from engine.

DISASSEMBLY

Before disassembling, trace index marks on starter housing **no. 10** and starter housing assembly **no. 8** to ease further assembly.

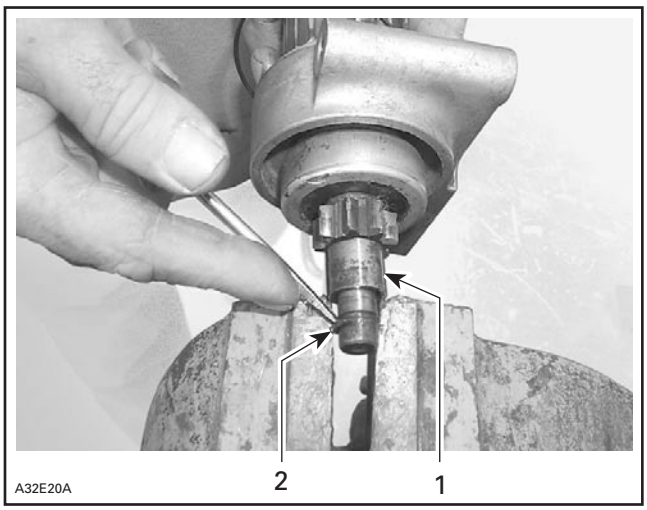
Remove starter through bolts **no. 17**. Separate end frame housing **no. 14** from starter housing **no. 10**. Withdraw starter housing from armature **no. 11**.

Brush holder **no. 13** can be removed from end frame housing **no. 14** by disconnecting the end frame attached brush from brush holder **no. 13**.

Check the radial play between the armature shaft and end frame bearing. Replace the end frame bearing or replace starter. If parts are in good condition, coat with synthetic grease (P/N 413 711 500) before reinstalling them.

Push back the collar **no. 3** using a screwdriver.

Remove snap ring **no. 2**. Remove collar **no. 3** and spring **no. 4**.



1. Collar
2. Snap ring

Turn starter clutch **no. 6** clockwise to remove it from armature assembly **no. 11**.

Pull housing from armature.

CLEANING AND INSPECTION

CLEANING

CAUTION: Yoke ass'y and drive unit assembly must not be immersed in cleaning solvent.

Clean brushes and holders with a clean cloth soaked in solvent. Brushes must be dried thoroughly with a clean cloth.

Blow brush holders clean using compressed air.

⚠ WARNING

Always wear safety glasses when using compressed air.

Remove dirt, oil or grease from commutator using a clean cloth soaked in suitable solvent. Dry well using a clean and dry cloth.

Clean engine ring gear teeth and drive unit (clutch).

NOTE: Bushings or bearings must not be cleaned with grease dissolving agents.

Immerse all metal components in cleaning solution. Dry using a clean and dry cloth.

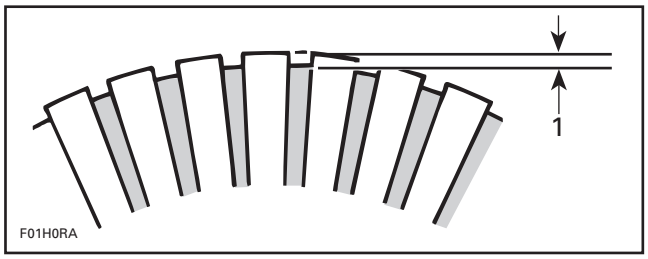
INSPECTION

Armature

NOTE: An ohmmeter may be used for the following testing procedures, except for the one concerning the shorted windings in the armature.

Check the commutator for roughness, burnt or scored surface. If necessary, turn the commutator on a lathe, just enough to remove grime.

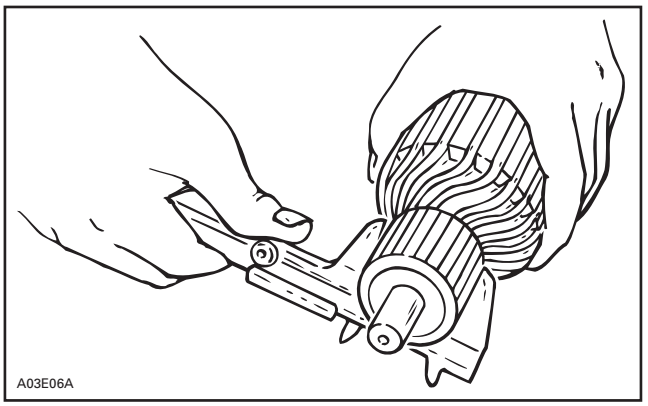
Check the commutator for mica depth. If the depth is less than 0.20 mm (.008 in), undercut the mica. Be sure no burrs are left and no copper dust remains between the segments.



1. Commutator undercut 0.20 mm (.008 in)

Check the commutator out-of-round condition with V Blocks and an indicator. If the commutator out-of-round is more than 0.40 mm (.016 in), the commutator should be turned on a lathe.

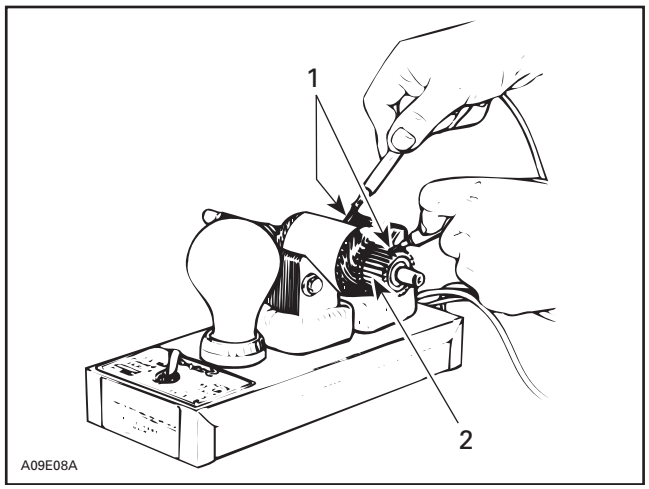
Check commutator outer diameter. If less than specified value, replace.



MODEL	WEAR LIMIT
ALL	27 mm (1.063 in)

Test for Ground Circuit in the Armature

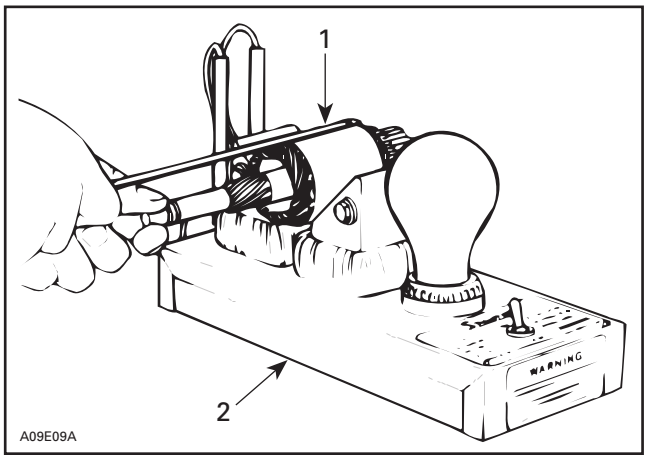
Use growler test probes. Check between armature core and the commutator bars. If growler lamp turns on, bars are grounded. If so, replace armature.



1. Test probes
2. Commutator bars

Test Armature for Shorted Winding

When the armature is rotated in the growler with a steel strip (hacksaw blade) held above it, the strip will vibrate over that area of the armature which has short circuit. Replace armature if so.



1. Steel strip (hack-saw blade)
2. Growler

Test the Armature for Open Circuit

Use growler test probes. Place one test probe on a commutator bar and the other test probe on the neighboring bar. Repeat this operation for all bars, moving one test probe at a time. If the growler lamp does not turn on, the armature circuit between these 2 bars is opened. The armature should be replaced or repaired; open circuits most often occur at the commutator riser where coils are soldered. (Burnt commutator bars are usually an indication of an open-circuit armature coil).

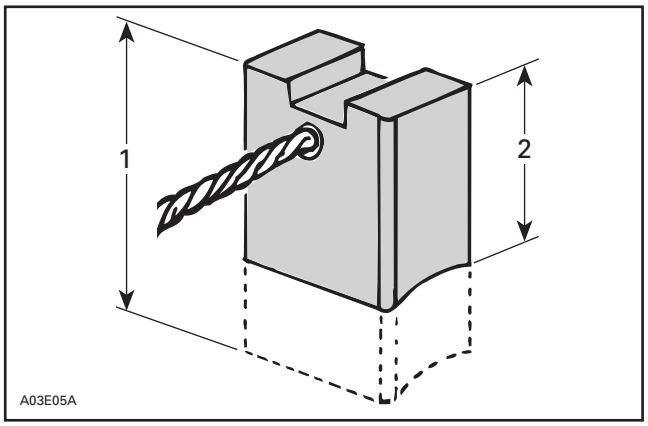
Brush Holder

Check the brush holder for insulation using growler test probes. Place one test probe on the insulated brush holder and the other test probe on the brush holder plate. If the growler lamp turns on, the brush holder has to be repaired or replaced.

Brush Length

Measure brush length. If less than the specified value, replace them.

MODEL	LENGTH	
	NEW	WEAR LIMIT
ALL	10 mm (.400 in)	6 mm (.236 in)



TYPICAL
1. New
2. Wear limit

Overrunning Clutch

The pinion of the overrunning clutch should turn smoothly in a clockwise direction, and should not slip in a counterclockwise direction. If defective, replace.

Check the pinion teeth for wear and damage. If defective, replace.

RELAY

Inspect connections and clean as necessary. Relay condition can be checked with an ohmmeter. Install test probes on **large** connectors of relay when it is activated (+ on RED/GREEN wire and – on the BLACK wire).

IMPORTANT: No current must be present on large cables when using ohmmeter, otherwise meter could be damaged.

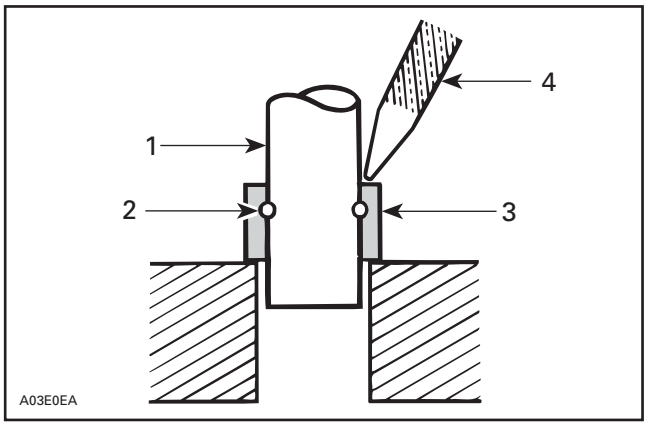
ASSEMBLY

Reverse the order of disassembly to reassemble starter. However, attention should be paid to the following operations.

Prior to assembling, coat sliding surfaces on armature shaft splines, overrunning clutch and bushing with synthetic grease (P/N 413 711 500).

After placing collar **no. 3** on armature shaft **no. 11**, fit new snap ring **no. 2** on armature shaft, then make sure that it is properly secured.

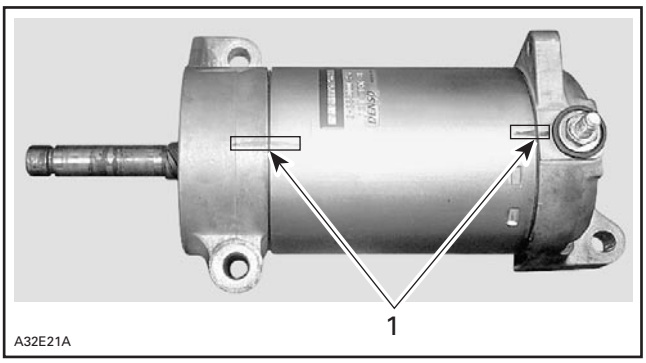
Slide collar **no. 3** over snap ring **no. 2** and secure in place by punching it in two or three places.



1. *Armature shaft*
2. *Snap ring*
3. *Collar*
4. *Punch*

Starter Housing Assembly and Starter Housing

Align previously traced indexing marks.

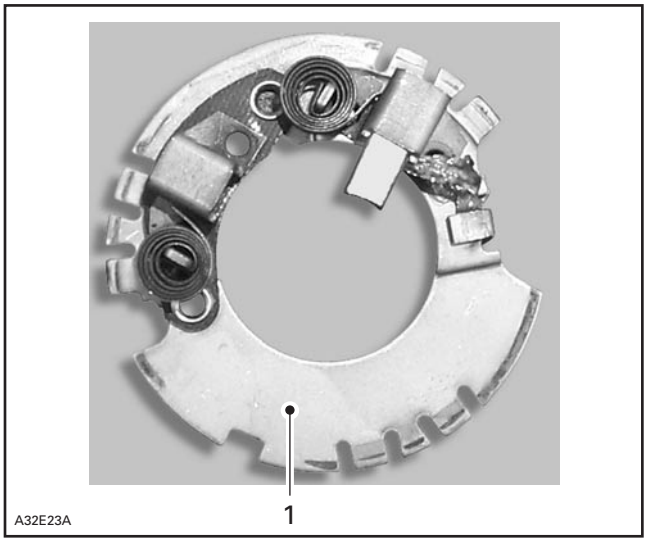


TYPICAL

1. *Aligned indexing marks*

Open brushes and slide over commutator.

Align end frame locating notch with yoke locating protrusion and properly sit brush holder **no. 13** into housing **no. 14**.



1. *Brush holder*

To ease end frame installation, retain brush holder with a small screwdriver while installing armature assembly.

CAUTION: Make sure to place two end housings on a flat surface before tightening the through bolts.

CAUTION: Make sure end frame fits perfectly on yoke.

INSTALLATION

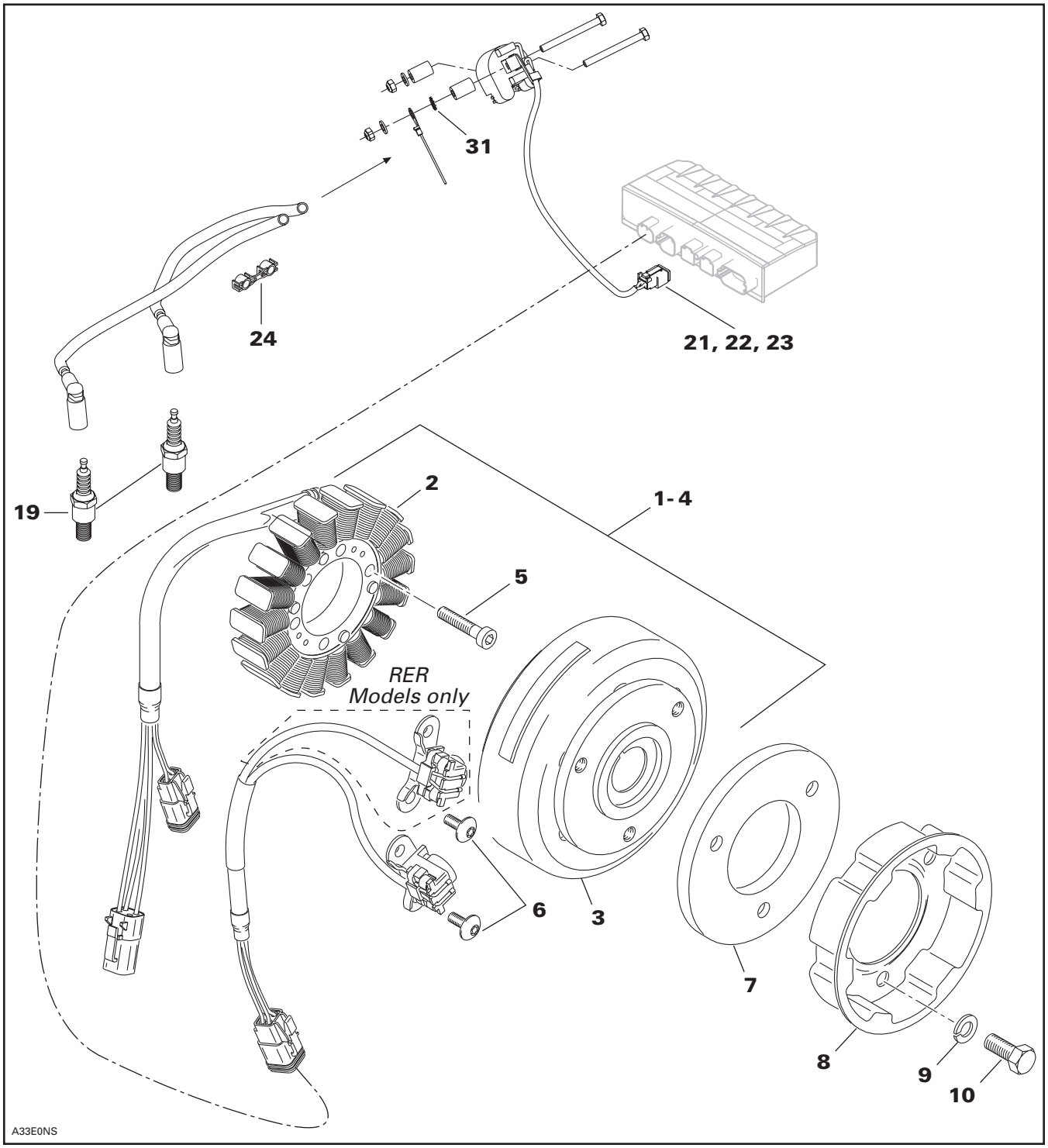
– Use new teflon washers on the 3 bolts retaining starter to engine.
– Torque the bolts to 28 ± 1N•m (20 ± 1 lbf•ft).
– Make sure that starter and engine mating surfaces are free of grime. Serious trouble may arise if starter is not properly aligned.
– Connect the RED battery cable and the RED wire to the large terminal of the starter.
– Torque large terminal nut to 7 N•m (62 lbf•**in**).

⚠ WARNING

Always disconnect ground cable first and connect last.

– Connect ground cable to the starter with star washer in between.
– Torque ground cable connecting bolt to 11 N•m (97 lbf•**in**).

TESTING PROCEDURE

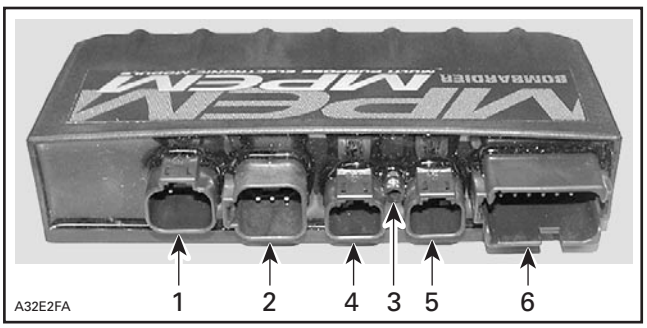


GENERAL

The following chart gives the engine types with their implemented system.

MODEL	IGNITION SYSTEM	CHARGING SYSTEM OUTPUT
REV series	BOMBARDIER DC 360 W	360

Multi-Purpose Electronic Module (MPEM) Connections



BOMBARDIER 360 W MPEM

1. *Trigger coil and RER trigger coil if so equipped, 11-DE housing*
2. *DPM solenoid and engine temp. sensor if so equipped, 11-DD housing*
3. *Atmospheric pressure nipple if so equipped*
4. *High tension coil, 11-DC housing*
5. *Air temperature sensor if so equipped, 11-DB housing*
6. *DESS, ignition and engine stop switches, DESS pilot lamp and reverse alarm if so equipped, 11-DA housing*

CHECKING CALIBRATION PROGRAM

Using VCK (Vehicle Communication Kit)

The VCK (P/N 295 035 676) can be used with the B.U.D.S. software to check the calibration. Detailed information about the B.U.D.S. software and its usage is available under its **Help** section.

Using MPEM Programmer

Calibration can also be checked using the MPEM programmer (P/N 529 035 878).

CAUTION: Do not interchange MPEM from one model to another. Even if the P/N stamped on the MPEM is the same, calibration program may be different. When ordering a new MPEM always refer to appropriate model parts catalog. The service P/N published in parts catalogs are the ones with the good calibration program according to model.

With Engine Running

If the below mentioned tool is not available start engine. Turn on programmer then enter password.

Increase engine speed to 2000 - 2500 RPM then follow the same procedure as WITH ENGINE STOPPED.

CAUTION: Engine must run till the end of the procedure.

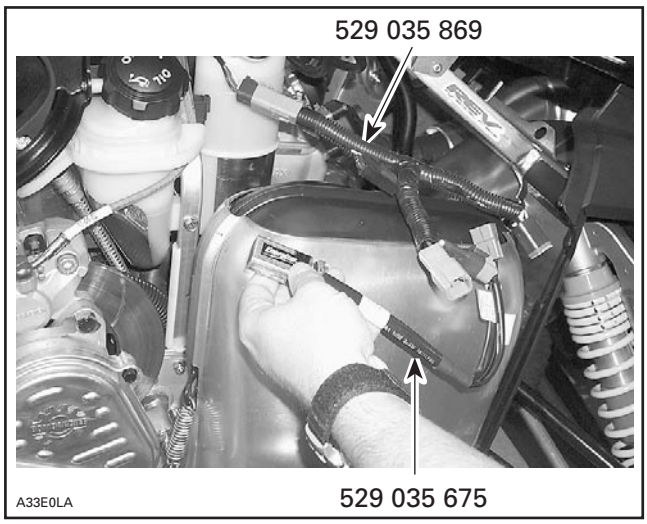
When data are being transferred, you must rev the engine at 2000 - 2500 RPM and make sure connection between programmer and vehicle is good.

IMPORTANT: In following procedure each time **←Trs** symbol appears, make sure to rev engine between 2000 and 2500 RPM.

Engine will misfire while vehicle information is being transferred from MPEM to programmer. If engine stalls, restart it, keep engine speed at 2000 - 2500 RPM and select no. 3 VEHICLE INFO again.

With Engine Stopped

Connect 9-volt adaptor (P/N 529 035 675) to supply cable (P/N 529 035 869) and supply cable to diagnostic connector, located on right side of the vehicle.



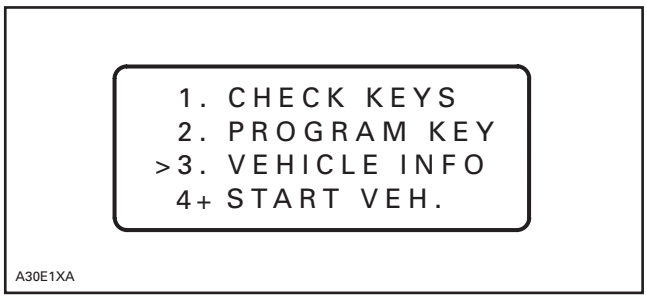
When cables are connected a beeping signal from the reverse buzzer will be heard (if vehicle is so equipped). This indicates that the MPEM is now ready to transfer programming operations.

Once MPEM calibration program checking is done, unplug 9 volt adaptor and supply cable.

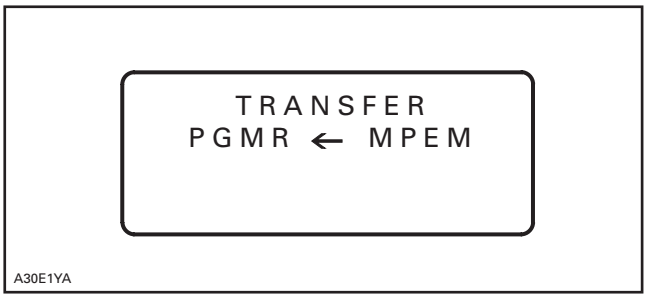
PROCEDURE

Turn on programmer then enter password.

From main menu select no. 3. VEHICLE INFO; ←**Trs**.

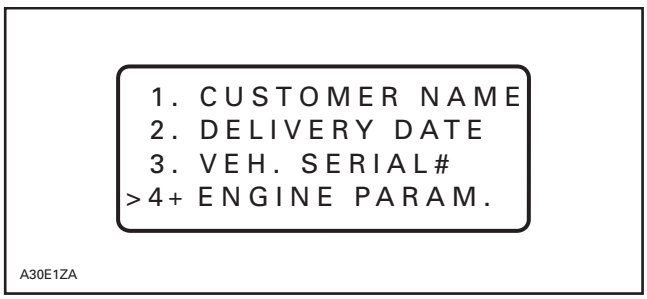


Vehicle information is transferred from MPEM to programmer.

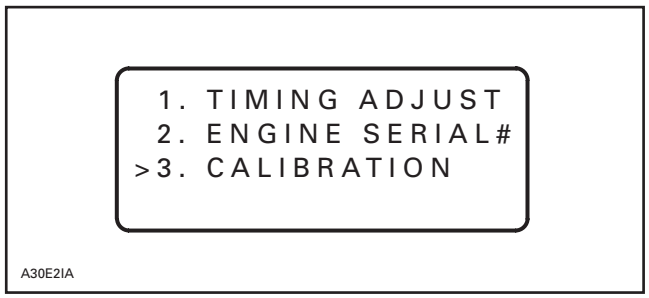


NOTE: In fact the programmer takes a **copy** of all vehicle parameters scribed in MPEM. This copy will be modified within the programmer then transferred to the MPEM.

Select no. 4. ENGINE PARAMETER.

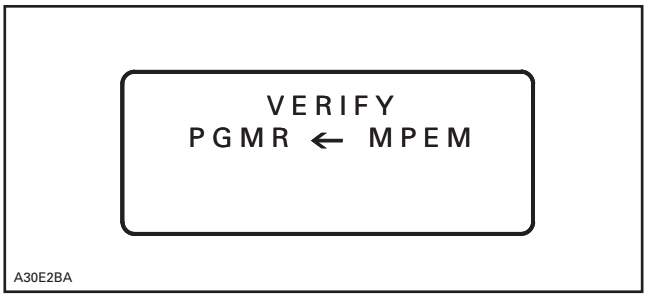


Select no. 3 CALIBRATION.

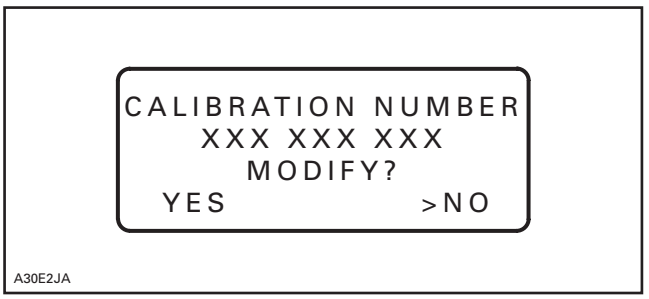


Press ENTER ←**Trs**.

Following screen appears temporarily:



And then following screen showing the actual calibration number in the MPEM.



Check for proper calibration number. See table below.

Select NO and press ENTER.

Press MENU twice; ←**Trs** then turn off programmer, unplug it from MPEM. Remove 9-volt adaptor.

Stop engine when using WITH ENGINE RUNNING procedure.

MODEL	ENGINE	CALIBRATED MPEM P/N	CALIBRATION P/N	MPEM P/N
MX Z Sport 600	593 HO	512 059 702	512 059 703	512 059 760
MX Z Sport 600 R	593 HO	512 059 704	512 059 703	512 059 761
MX Z Sport 600 R DPM	593 HO	512 059 705	512 059 703	512 059 762
MX Z X 600 R	593 HO	512 059 705	512 059 703	512 059 762
MX Z Sport 800	793	512 059 706	512 059 707	512 059 760
MX Z Sport 800 R	793	512 059 708	512 059 707	512 059 761
MX Z Sport 800 R DPM	793	512 059 709	512 059 707	512 059 762
MX Z X 800	793	512 059 709	512 059 707	512 059 762

CHANGING MPEM CALIBRATION PROGRAM

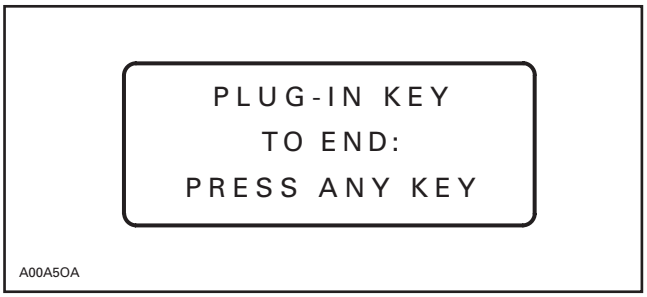
Using VCK (Vehicle Communication Kit)

The VCK (P/N 295 035 676) can be used with the B.U.D.S. software to change the MPEM calibration. Detailed information about the B.U.D.S. software and its usage is available under its **Help** section.

Using MPEM Programmer

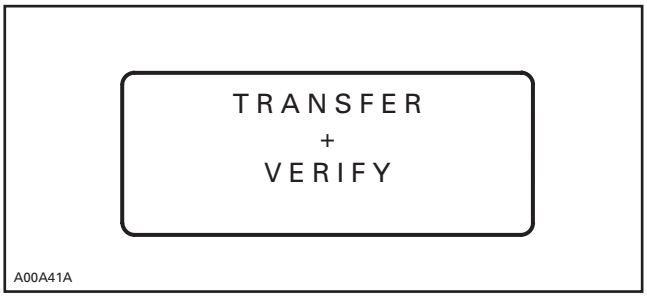
Proceed the same as for checking MPEM calibration but select YES to MODIFY? and press ENTER. The following screen is displayed:

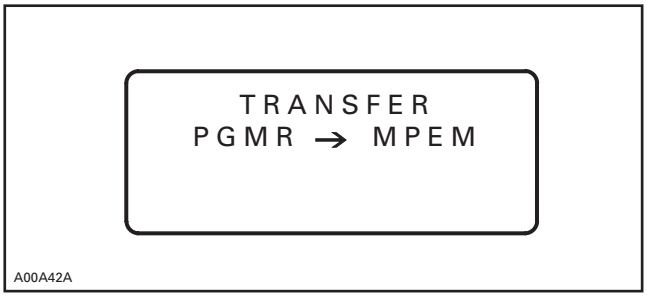
Enter new calibration number and press ENTER. The following screen is displayed:

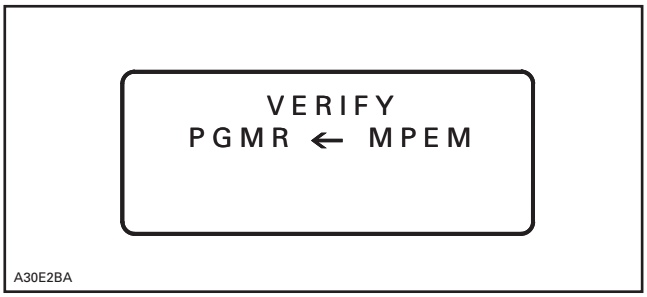


Simultaneously with the following operation a transfer will occur; ←**Trs**. At this point, be ready to rev the engine so it won't fall below the 2000 RPM mark when not using 9-volt adaptor.

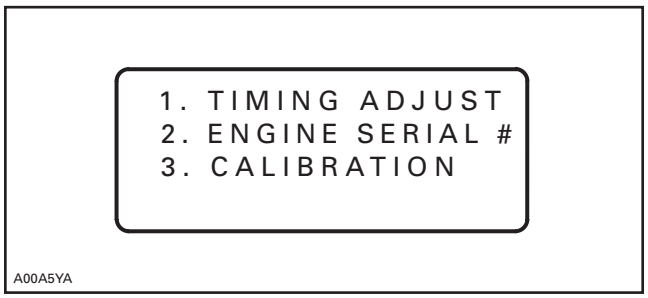
Plug-in the desired calibration cartridge (special red key) onto the programmer post, the following screens will be temporarily displayed:



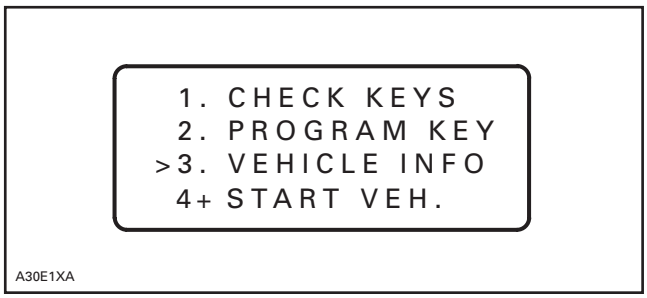




Press any key, the following screen will be displayed:



Press MENU twice, the following screen will be displayed:



After procedure is completed, make sure the engine idle speed is 1800 - 2000 RPM when engine is hot.

Stop the engine.

SYSTEM TESTING

IGNITION SYSTEM TESTING SEQUENCE

In case of ignition problems, check the following in the prescribed order until the problem can be solved.

1. Sparking/spark plug condition.
2. Electrical connectors.
3. DESS switch-and engine cut-out switch.
4. Generator coil.
5. Trigger coil(s).
6. MPEM voltage.
7. High voltage coil.
8. Buzzer testing.

LIGHTING SYSTEM TESTING SEQUENCE

1. Electrical connectors.
2. Magneto output (lighting generator coil).

Testing Conditions

Voltage measurements are always taken upon vehicle starting. Readings when the engine is running will be higher than indicated range. Part temperature must be approximately 20°C (68°F) (room temperature), otherwise readings could be distorted.

Analysis of Readings

Voltage Readings

When testing the different magneto components, it is important to take into consideration that readings vary according to the force applied onto the manual starter. It is therefore important to employ enough force upon each trial.

The reading must be 3 times within or above the range indicated in the corresponding table. If the reading is too low, the part is considered to be defective and must be replaced.

Resistance Readings

Place multimeter selector switch to Ω in order to measure resistance. Readings must be within the indicated range. Otherwise, the part is considered to be defective and must be replaced.

CAUTION: When taking measurements, it is useless to try to start the vehicle since readings would then be distorted.

Intermittent Ignition Problems

It is difficult to make a diagnostic in the case of intermittent ignition problems. Thus, problems occurring only when the engine operating temperature is normal must be checked in similar conditions.

In most cases when problems are caused by temperature or vibrations, these can only be solved by replacing parts. Most problems cannot be detected when the engine is stopped.

Multiple Problems

As a matter of fact, more that one component can be defective. As a result, if the problem remains although a part was replaced, start over the whole verification from the beginning in order to identify the other defective component.

1. SPARKING

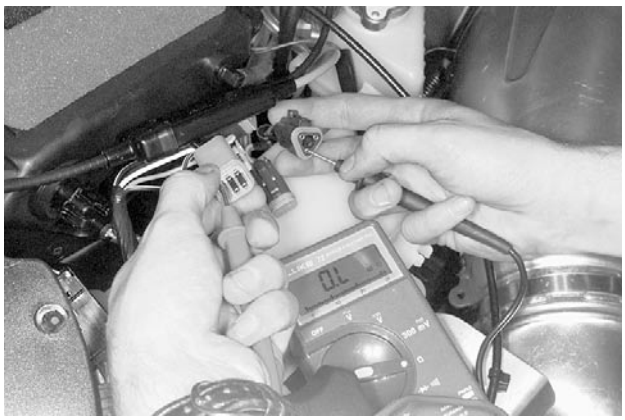
During this operation, it is important to use the snowmobile spark plug and not a new one. Bring the plug in contact with the engine. Pull rewind starter. If no spark is produced, replace the spark plug with a new one and do the test again.

2. ELECTRICAL CONNECTOR TESTING

Make sure that none of the connectors are disconnected.

3. DESS SWITCH AND ENGINE CUT-OUT SWITCH TESTING

Disconnect connector housings and check resistance as indicated in IGNITION table.


A32E0XA

If readings are acceptable, go on to next step.

If readings are inadequate, individually check each switch as follows.

DESS Switch

Tether Cord Switch

Using a multimeter check by connecting probes to BLACK/GREEN and BLACK/WHITE wires. The multimeter should indicate a closed circuit (0 $_{\Omega}$) in operating position and a open circuit (0.L $_{M\Omega}$) in off position.

DESS Switch Wire

Check continuity (null resistance) between switch center terminal and WHITE/GRAY wire connector.

Check continuity (null resistance) between switch side ring and BLACK/GREEN wire connector.

If readings do not correspond to the above mentioned indications, replace switch.

If none of these verifications are conclusive, the problem finds its source in the main wiring harness. Proceed as follows:

Engine Cut-Out Switch

Unplug switch block connected to main wiring harness. Check using a multimeter by connecting probes to appropriate wires. Refer to corresponding IGNITION AND ELECTRICAL SYSTEM TESTING table in this subsection. The multimeter should indicate an open circuit (0.L $_{M\Omega}$) in operating position and if the circuit is closed (0 $_{\Omega}$) in off position.

NOTE: For the next step, no switch must be connected to the main wiring harness.

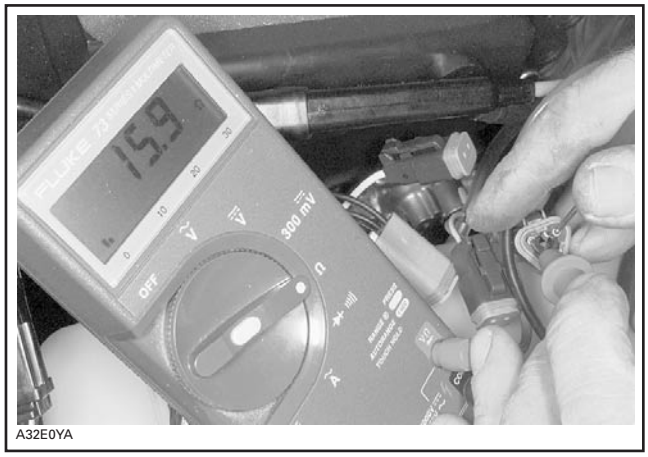
Disconnect all switches from the main wiring harness and check the continuity of each wire by connecting probes to the end of wires of the same color. Repeat with all other wires. It is important to mention that all wires of the same color within a given harness are connected together. These wires should therefore have a closed circuit. On the other hand, BLACK and BLACK/YELLOW wires must have an open circuit (0.L $_{M\Omega}$).

Repair or replace if necessary.

4. GENERATOR COIL TESTING

Resistance Testing

1. Disconnect housing between the magneto and the MPEM.
2. Connect multimeter probes to appropriate wires and measure resistance. Refer to corresponding IGNITION AND ELECTRICAL SYSTEM TESTING table in this subsection.



A32E0YA

3. Compare readings with those appearing in the IGNITION table.

Voltage Testing

When manually starting the engine while the spark plug is installed, the engine will tend to accelerate beyond the compression point. This will result in higher magneto output power.

1. Disconnect housing between the magneto and the MPEM.
2. Connect multimeter probes to appropriate wires. Refer to corresponding ignition and electrical system testing table in this subsection. Bring the selector switch to Ṽ and the scale to 00.0 Vac.
3. Activate the manual starter and check values indicated by the multimeter.
4. Repeat operation 3 times.
5. Compare readings with those appearing in the IGNITION table.

5. TRIGGER COIL TESTING

Resistance Testing

1. Connect probes to appropriate wires from trigger coil housing. Refer to corresponding IGNITION AND ELECTRICAL SYSTEM TESTING table in this subsection.

A32E10A

2. Compare readings with those appearing in the IGNITION table.

Voltage Testing

1. Connect probes to appropriate wires from trigger coil housing. Refer to corresponding IGNITION AND ELECTRICAL SYSTEM TESTING table in this subsection.
2. Activate the manual starter and check values indicated by the multimeter.
3. Repeat operation 3 times.
4. Compare readings with those appearing in the IGNITION table.

6. MPEM VOLTAGE TESTING

1. Disconnect the housing between module and high voltage coil.
2. Connect multimeter probes to WHITE/BLUE and BLACK wires coming out from module. Place the selector switch to Ṽ and the scale to 00.0 Vac.

A32E0ZA

TYPICAL

3. Activate the manual starter and check values indicated by the multimeter.
4. Repeat operation 3 times.
5. Compare readings with those appearing in the IGNITION table.

7. HIGH VOLTAGE COIL TESTING

Resistance Testing

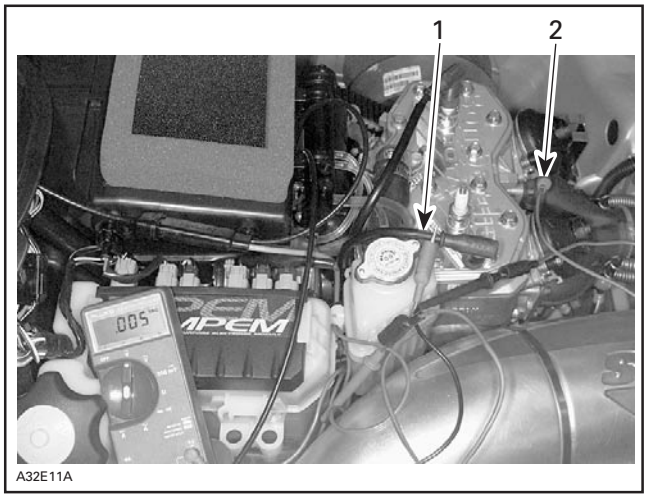
1. Unplug housing between high tension coil and MPEM.
2. Connect multimeter probes to WHITE/BLUE and BLACK wires and measure resistance.

A32E12A

3. Compare readings with those appearing in the IGNITION table.

Voltage Testing

1. Disconnect spark plug cap from spark plug.
2. Fasten alligator clip to spark plug cable, near the spark plug.
3. Connect other multimeter wire to engine (ground), then place selector switch to $\tilde{V}$ and scale to 0.00 Vac.



A32E11A

1. MAG side spark plug cable
2. Connected to ground

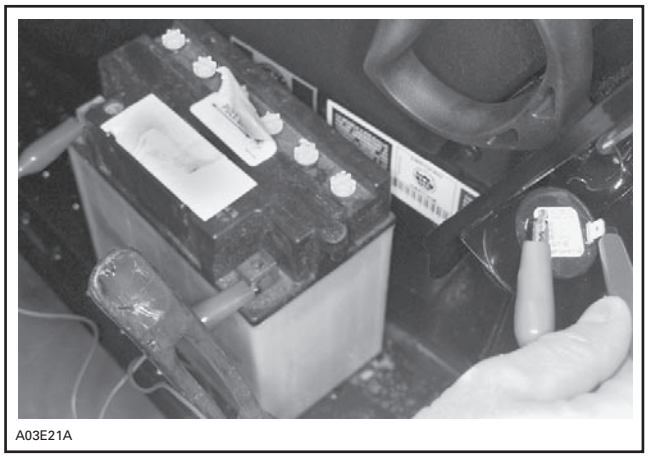
4. Activate the manual starter and check values indicated by the multimeter.
5. Repeat operation 3 times.
6. Compare readings with those appearing in the IGNITION table.

8. BUZZER TESTING

Using jumper wires, connect battery positive post to buzzer positive tab.

Connect battery negative post to buzzer negative tab. See next photo.

CAUTION: To avoid buzzer damage, ensure that polarity is respected.


A03E21A

TYPICAL — 12-VOLT BATTERY PLUGGED TO BUZZER

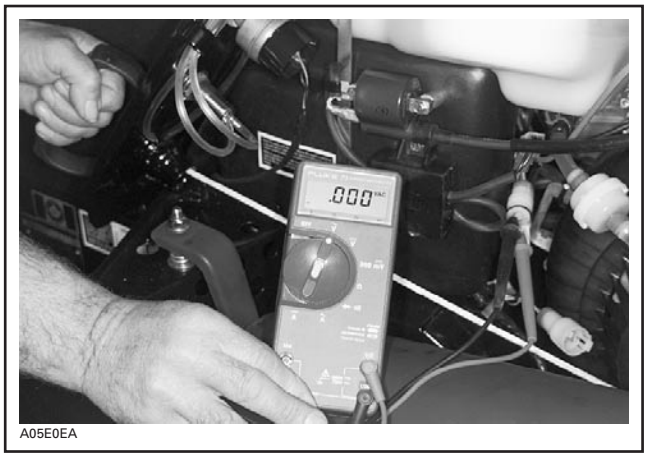
CONCLUSION

If none of the above testing operations produced valid results, it is strongly recommended to keep on testing according to the list appearing in the Resistance column of the IGNITION table.

Set the multimeter as indicated.

LIGHTING GENERATOR COIL VOLTAGE TESTING

1. Disconnect housing from engine (YELLOW and GREEN wires).
2. Connect multimeter probes to YELLOW and GREEN wires as described in following table. Place selector switch to Ṽ and scale to 0.00 Vac.
3. Activate the manual starter and check values indicated by the multimeter.
4. Repeat operation 3 times.



TYPICAL

5. Compare readings with those appearing in the LIGHTING table.

CONCLUSION

If none of the above testing operations produced valid results, it is strongly recommended to keep on testing according to the list appearing in the Resistance column of the LIGHTING table.

Set the multimeter as indicated.

360 W REV IGNITION AND ELECTRICAL SYSTEM TESTING

360 W REV IGNITION AND ELECTRICAL SYSTEM TESTING								
PART	TEST TO BE PERFORMED	WIRE COLOR	MULTIMETER PROBE CONNECTION	RESISTANCE Ω		VOLTAGE		NOTE
				MULTIMETER SCALE	VALUE (ohms)	MULTIMETER SCALE	VALUE (volts)	
Engine stop switches	Running insulation	BK and BK/YL	11-DA-3-F 11-DA-6-F	00.0 Ω or auto range	0.L	—	—	Engine stop switches must be in run Position.
	Continuity in stop position	BK and BK/YL	11-DB-3-F 11-DA-6-F	00.0 Ω or auto range	00.0 to 00.5	—	—	Engine stop switches must be in stop Position.
DESS switch	Insulation with DESS removed	BK/WH and BK/GN	11-DA-4-F 11-DA-5-F	00.0 Ω or auto range	0.L	—	—	Tether cap must be removed.
	Continuity with DESS in run position	BK/WH and BK/GN	11-DA-4-F 11-DA-5-F	00.0 Ω or auto range	00.0 to 00.5	—	—	Tether cap must be in place.
MPEM	Ground connection	BK and negative battery terminal or body	11-DA-3-F	00.0 Ω or auto range	00.0 to 00.5	—	—	—
MPEM power (with battery)	Power from battery	RD/GY and BK	11-DA-12-F 11-DA-3-F	—	—	00.0 Vdc	Same as battery voltage	Voltage always present.
	Power from regulator	RD/BR and BK	11-DA-1-F 11-DA-3-F	—	—	00.0 Vdc	1 to 2 volts	While cranking engine.
MPEM power (without battery)	Power from regulator	RD/BU and BK	11-DA-2-F 11-DA-3-F	—	—	00.0 Vdc	3 to 5 volts	While cranking engine.
Trigger coil no. 1	Resistance and output	BU/YL and WH/YL	11-DE-4-F 11-DE 1-F	00.0 Ω or auto range	190 to 300	00.0 Vdc	.200-.350	While cranking engine.
Trigger coil no. 2 (RER only)	Resistance and output	GN/YL and GY/YL	11-DE-3-F 11-DE-2-F	00.0 Ω or auto range	190 to 300	00.0 Vdc	.200-.350	While cranking engine.
MPEM output voltage	Voltage to ignition coil	WH/BU and BK	Wires from primary of high voltage coil	—	—	00.0 Vdc	225.0 to 275.0	With tether cap in place and Engine stop switches in run Position. While cranking engine.
High voltage coil	Primary winding resistance	WH/BU and BK	11-DC-2-F 11-DC-1-F	00.0 Ω or auto range	00.2 to 00.5	—	—	Disconnect the ignition coil from the MPEM.
	Secondary winding resistance spark plug wires and caps included	Between both spark plug caps	Between both spark plug caps	00.0 Ω	14.5 k to 23.5 k	—	—	Do not attemp to remove spark plugs caps from the wires.
	Secondary winding resistance spark plug wires removed	Male terminal to male terminal	On male terminals of high voltage coil	00.0 Ω	9.6 k to 14.4 k	—	—	With spark plug wires removed from high voltage coil.
	Secondary winding voltage	BK and engine	On spark plug wire insulation and on engine	—	—	00.0 Vdc	1.5 to 2.5	Do not probe into spark plug cap with spark plug wires removed from spark plug.
Start/ RER switch (with battery)	Start/RER signal at MPEM	BE and BK	11-DA-7-F 11-DA-3-F	—	—	00.0 Vdc	Battery voltage	When Start/RER button is activated in all conditions.
	Battery voltage to switch from 5 A fuse	RD/GY and negative battery terminal	12-HG-5 and negative battery terminal	—	—	00.0 Vdc	Battery voltage	The 5 A fuse is located on the electrical config harness.

360 W REV IGNITION AND ELECTRICAL SYSTEM TESTING								
PART	TEST TO BE PERFORMED	WIRE COLOR	MULTIMETER PROBE CONNECTION	RESISTANCE Ω		VOLTAGE		NOTE
				MULTIMETER SCALE	VALUE (ohms)	MULTIMETER SCALE	VALUE (volts)	
RER switch (without battery)	RER signal at MPEM	BE and BK	11-DA-7-F 11-DA-3-F	—	—	00.0 Vdc	11 V to 13 V	When RER button is activated when engine is running.
Start/ RER switch (All)	Continuity from Start/RER switch to MPEM	BE and BE	12-HG-8-M 11-DA-7-F	00.0 Ω or auto range	1.0 Ω	—	—	—
	Voltage supply from regulator	RD/BU and negative battery terminal	5-RR-87-F and negative battery terminal	—	—	Above battery voltage below 15 volts	00.0 Vdc	—
Charging current	Current to battery	RD and RD/WH	6-FA-A-F 6-FA-B-F	—	—	10 A Scale	2-4 A	Engine @ 5000 RPM with fully charged battery. With 30 A fuse removed and Ammeter in series.
Lighting generator coil	Output	YL and YL and GN	2-MO-(1,2,3)-F	00.0 Ω or auto range	00.0 to 00.5 3 times	00.0 Vac	3.5 to 5.5 3 times	Do the test between A and B, A and C and B and C using manual starter.
	Coil insulation	YL and engine	2-MO-(1,2,3)-F and engine	00.0 MΩ or auto range	O.L.	—	—	The term engine refers to the metal parts connected to the magneto housing.
Relay (with battery)	Coil	WH/GN and BK	5-RC-85-F 5-RC-86-F	—	—	00.0 Vdc	10.5 to 13.5	Engine Idling (1500 to 1800 RPM)
	Contacts	RD/WH and RD/BR	5-RC-87-F 5-RC-30-F	—	—	00.0 Vdc	0.00 to 0.10	Engine Idling (1500 to 1800 RPM)
Relay (without battery)	Coil	WH/GN and BK	5-RC-85-F 5-RC-86-F	—	—	00.0 Vdc	10.5 to 13.6	Engine Idling (1500 to 1800 RPM)
	Contacts	RD/BU and RD/BR	5-RC-87-F 5-RC-30-F	—	—	00.0 Vdc	0.00 to 0.11	Engine Idling (1500 to 1800 RPM)

NOTE: If voltage is present at the coil and contact, replace the relay.

An approved automotive spark plug tester is preferred for testing the secondary winding voltage.

All cranking tests are performed with the manual starter. Faster cranking speeds may produce higher voltages.

Ignition and electric starter will not work if the Engine stop switches is in the kill position.

Charging system test should be performed if a no spark condition is encountered on this vehicle.

INSPECTION OF HEATING ELEMENTS

All measurements must be performed at 21°C (70°F).

Throttle Lever Element

Current Measurement

HIGH INTENSITY	BROWN wire BLACK wire	0.83 A minimum
LOW INTENSITY	BROWN/YELLOW wire BLACK wire	0.64 A minimum

Handlebar Grip Heating Element

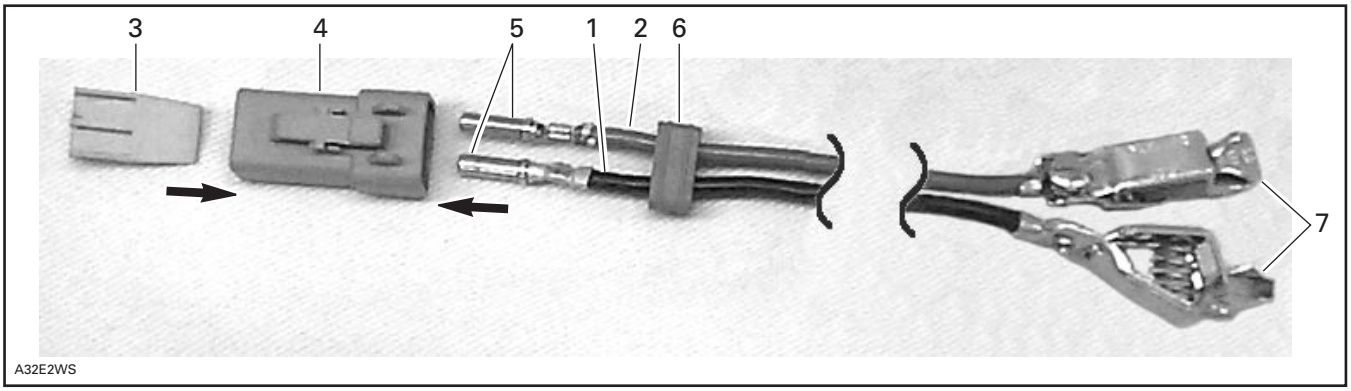
Resistance Measurement

LOW INTENSITY	YELLOW/BLACK wire ORANGE/VIOLET wire	17.1to 20.9 ohms
HIGH INTENSITY	YELLOW/BLACK wire ORANGE wire	8.7 to 10.5 ohms

HEADLIGHT AND ACCESSORIES SYSTEMS TESTING

360 W Models Only

Make an homemade adaptor as shown below.

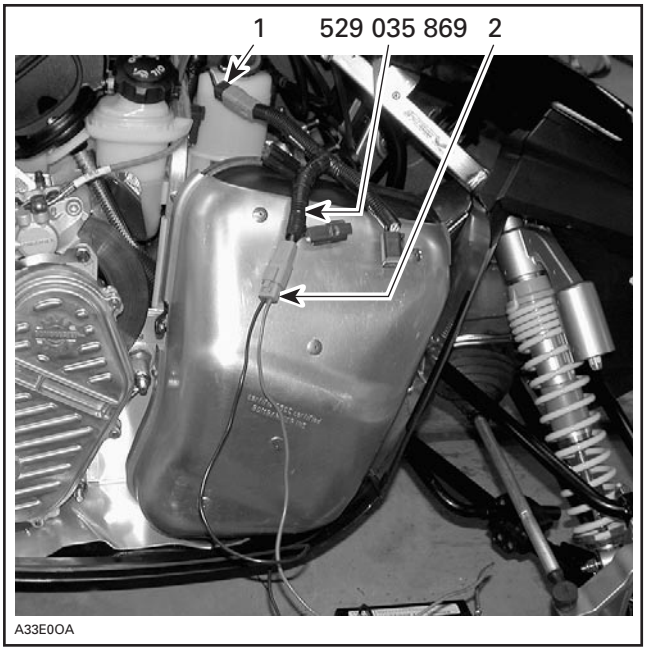


1. *Black wire in position no.1*
2. *Red wire in position no. 2*
3. *Lock P/N 278 001 671*
4. *Female terminal housing (2 circuits) P/N 278 001 673*
5. *Female terminal P/N 515 175 567 (2)*
6. *Seal (included with housing)*
7. *Alligator clips*

Connect supply cable (P/N 529 035 869) to diagnostic connector, located on right side of the vehicle.

Connect the homemade adaptor to the supply cable (P/N 529 035 869).

Connect the homemade adaptor to a 12 volt battery. Respect polarity.



1. *Diagnostic connector*
2. *Homemade adaptor*

Now the headlight and accessories systems are supplied with 12 volts. Refer to appropriate wiring diagram in wiring diagram section to troubleshoot headlight system.

Once testing is done, disconnect homemade adaptor from battery and supply cable from vehicle.