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IGNITION TIMING

377, 503 and 552 Engine Types

If for any reason, ignition timing accuracy is suspected, it can be verified as follows.

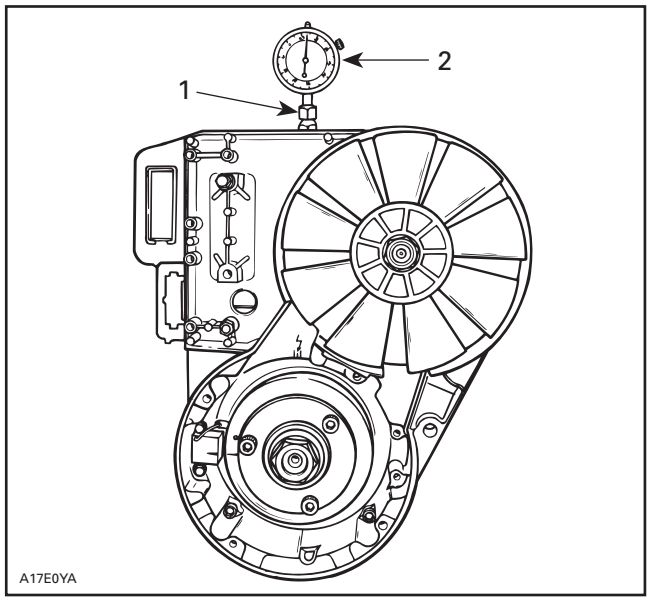
Verifying Magneto Flywheel Timing Mark Position

Prior to checking the timing, it may be necessary to verify the position of the timing mark on the magneto flywheel, for the following reasons:

1. To detect a missing or broken magneto flywheel Woodruff key which would allow a change of timing to occur, with eventual breakdown of the engine.
2. To correctly locate and mark a timing mark on a new service magneto flywheel.
3. To verify the correct location of the factory timing mark.
4. To detect a wrong magneto flywheel corresponding to a different engine type.

To verify the position of the timing mark on the magneto flywheel, proceed as follows:

1. Clean the area around the spark plugs, and remove them.
2. Remove the rewind starter from the engine.
3. Install the TDC gauge in the spark plug hole, (magneto/generator side) and adjust as follows:
   a. Position the magneto flywheel at approximately TDC.



TYPICAL — INSTALLATION OF TDC GAUGE

1. Adaptor lock nut
2. Gauge on MAG side cylinder

   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 magneto/generator. 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.
4. Locate the piston TDC position as follows:
   a. Slowly rotate the magneto flywheel 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 magneto flywheel 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.

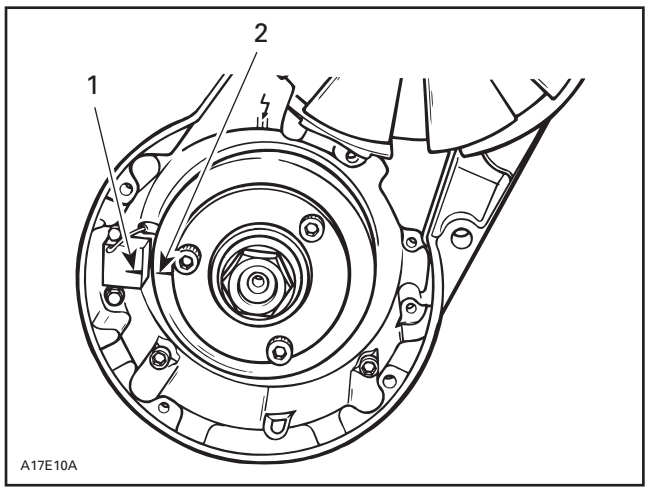
5. Verify the position of the timing mark on the magneto flywheel as follows:

NOTE: When checking timing, certain procedures require that the magneto flywheel be turned in a clockwise direction, viewed facing the magneto/generator. If it is necessary to turn back (counterclockwise) for any reason, rotate the magneto flywheel at least one-quarter turn counterclockwise, and then rotate it clockwise. The last magneto flywheel movement when making a critical check must always be in a clockwise direction, to ensure that the slack in engine moving parts is taken-up.

a. Rotate the magneto flywheel counterclockwise, one-quarter turn then carefully rotate it clockwise until the needle indicates the specified measurement. Refer to TECHNICAL DATA.

b. Verify that the magneto flywheel mark perfectly aligns with the mark on the trigger coil, refer to illustration.

c. If the marks do not align, check magneto flywheel and trigger coil part numbers and check Woodruff key condition. If all parts are the appropriate ones and if Woodruff key is in good condition, continue the procedure.



TYPICAL

1. *Trigger coil mark*
2. *Magneto flywheel mark*

NOTE: These marks cannot be used to check dynamic (with engine running) ignition timing with a timing light: a new mark must be scribed on magneto flywheel for this purpose.

6. Scribe a new mark on magneto flywheel as follows.

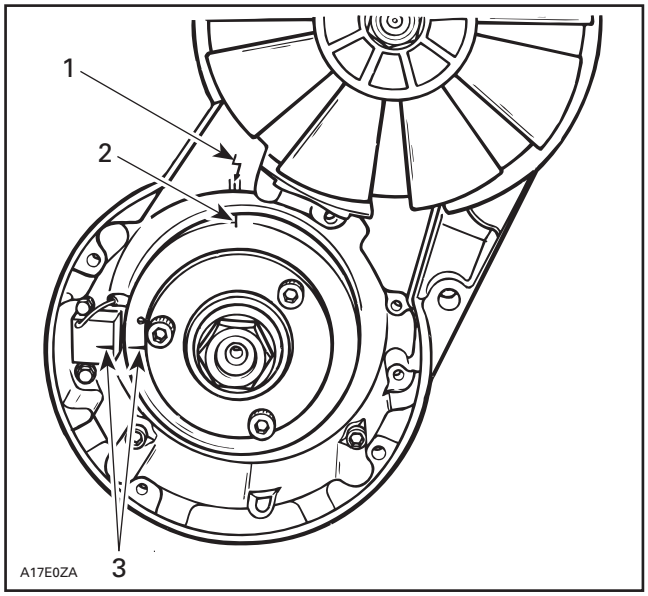
a. Remove the fan cover from the engine.

b. Maintain magneto flywheel so that previous marks remain aligned.

c. Scribe or punch a mark on magneto flywheel so that it perfectly aligns with the arrow on crankcase, refer to illustration. This new timing mark should be used for future timing checks (dynamic timing).

d. Reinstall rewind starter.

e. Check the timing with a timing light.

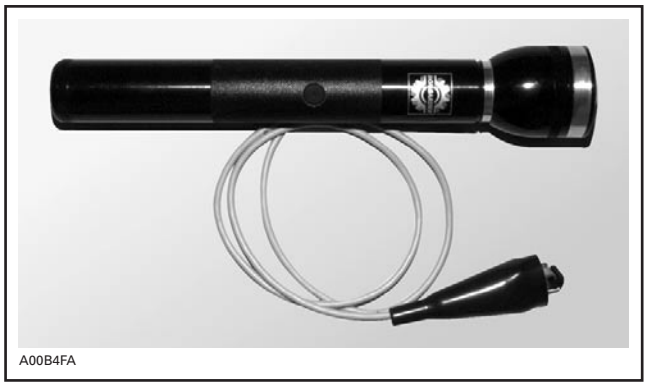


TYPICAL

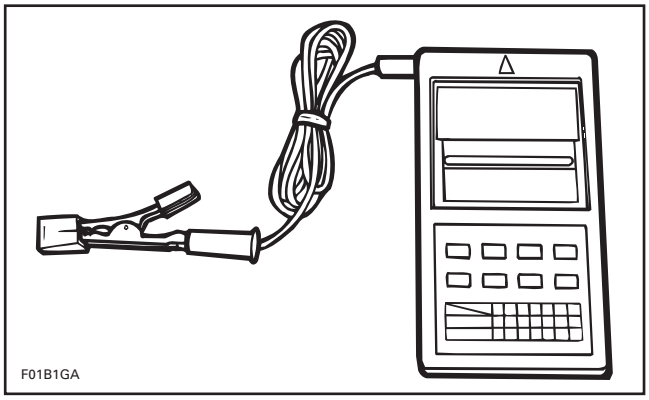
1. *Crankcase arrow*
2. *Scribe a mark here*
3. *Maintain verified timing marks aligned (static timing)*

Checking Ignition Timing

Use timing light (P/N 529 031 900) and digital induction type tachometer (P/N 529 014 500).



TIMING LIGHT (P/N 529 031 900)



TACHOMETER (P/N 529 014 500)

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.

NOTE: To avoid an incorrect reading due to parallax, view the magneto flywheel and the crankcase timing marks in a straight line.

2. Connect tachometer wire to spark plug wire or aim tachometer toward spark plug wire without using any connection wire.
3. Start the engine and raise the engine speed at least to 3500 RPM (3000 to 4000 RPM) while observing the timing marks, refer to illustration. The magneto flywheel mark scribed previously and the crankcase arrow should be perfectly aligned. If the marks do not align, a faulty trigger coil (check proper grounding of coil), a faulty flywheel, a faulty Woodruff key, a misaligned (twisted) crankshaft or a faulty CDI module could be the cause: substitute one part at a time and recheck timing marks (check connectors condition prior to substituting any part).

NOTE: Ignition timing may be verified when engine speed is anywhere within 3000 - 4000 RPM.

TYPICAL

4. Install parts which were removed.

493, 593, 693 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.

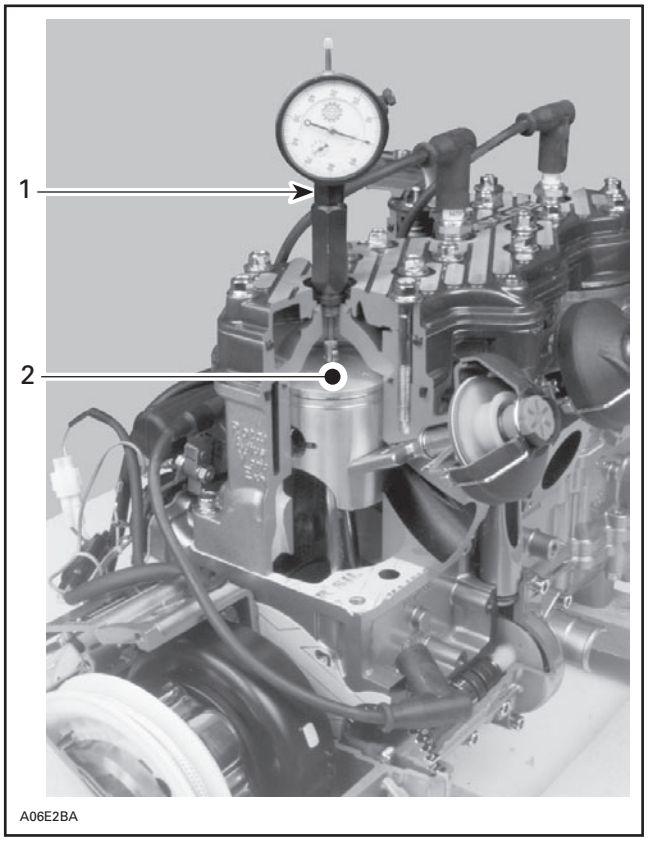
Engine retard timing varies depending on engines/models for their first hour/s of operation.

ENGINE/MODELS	ENGINE RETARD TIMING (°)/DURATION (h)
493, 593	- 3°/8 h
593 HO, 693 (except on Summit models), 793	- 3°/2 h
593 HO, 693 (on Summit models), 793 HO	- 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.

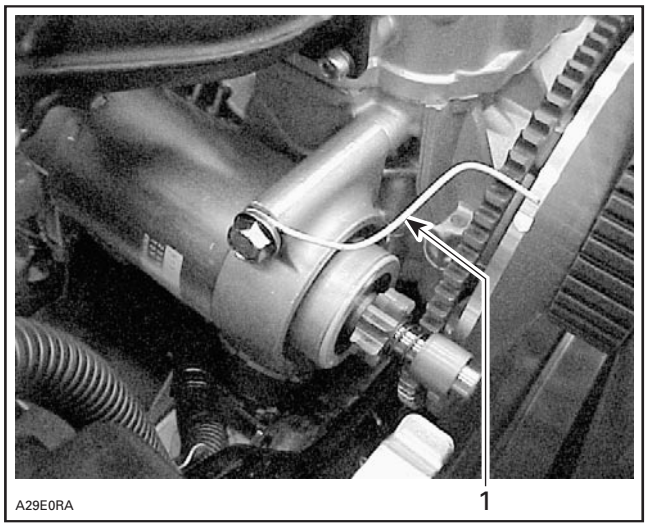
Scribing a Timing Mark

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.



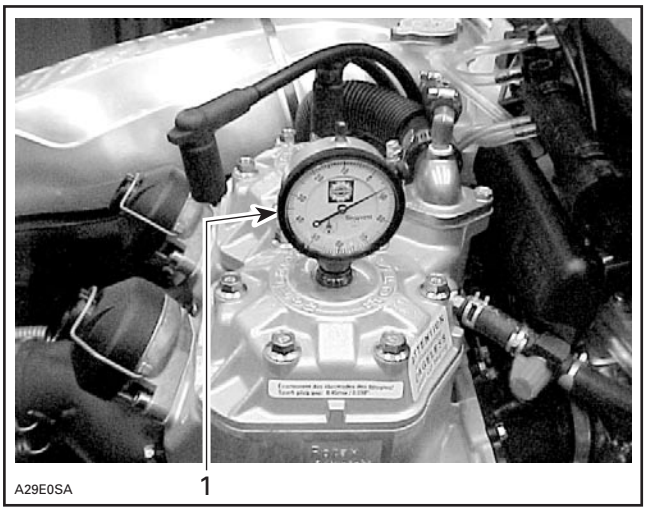
TYPICAL
1. TDC gauge on MAG side
2. MAG side piston at TDC

   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.

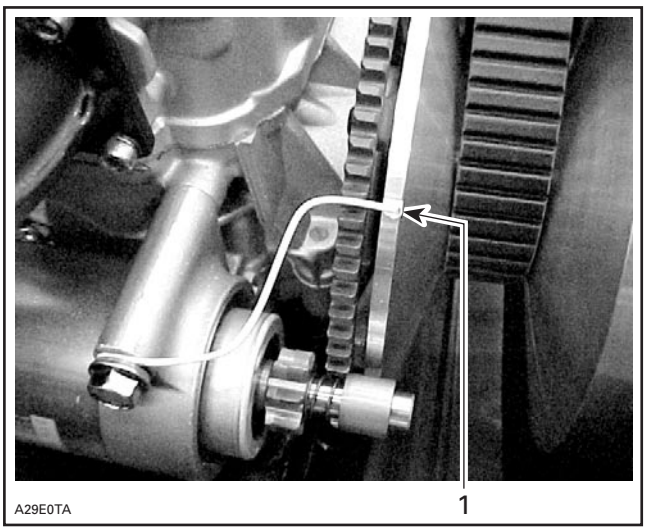


1. Pointer

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



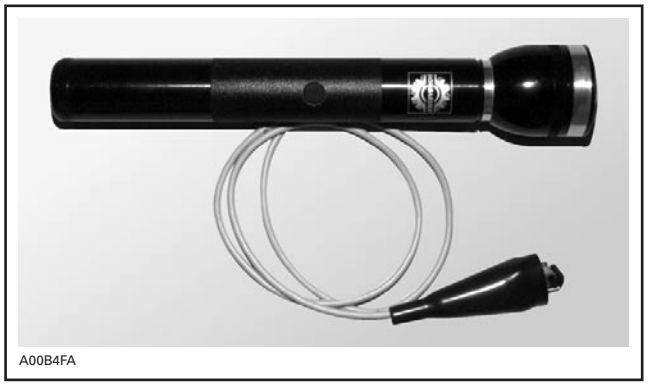
TYPICAL
1. TDC gauge indicating specified timing



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)

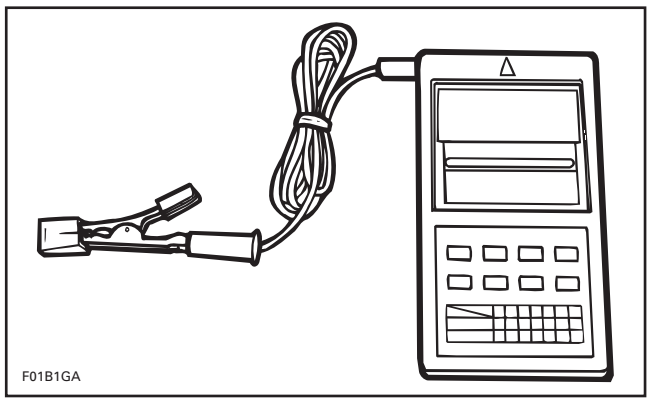
To check the ignition timing, refer to illustration and proceed as follows:

⚠ 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.

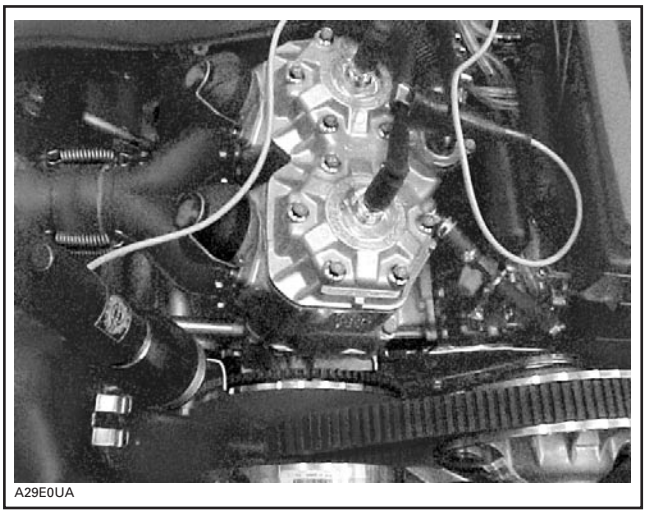
1. Connect the timing light pick-up to a spark plug cable.

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

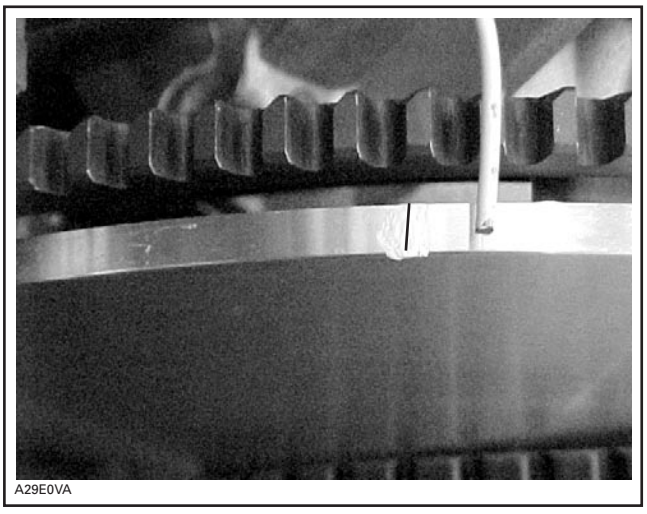


TACHOMETER (P/N 529 014 500)

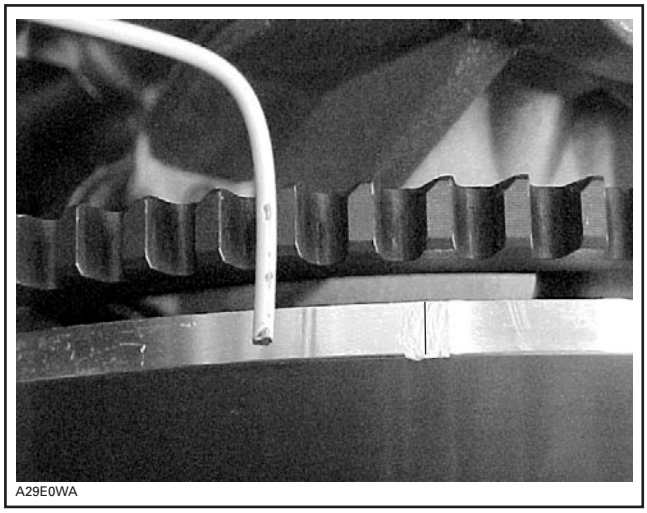
2. Start the engine and point timing light on timing mark. Bring engine to 3500 RPM for a brief instant.


A29E0UA

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°.


A29E0VA

TIMING RETARDED BY ABOUT 2°


A29E0WA

TIMING ADVANCED BY ABOUT 2°

Changing Timing

VCK (Vehicle Communication Kit)

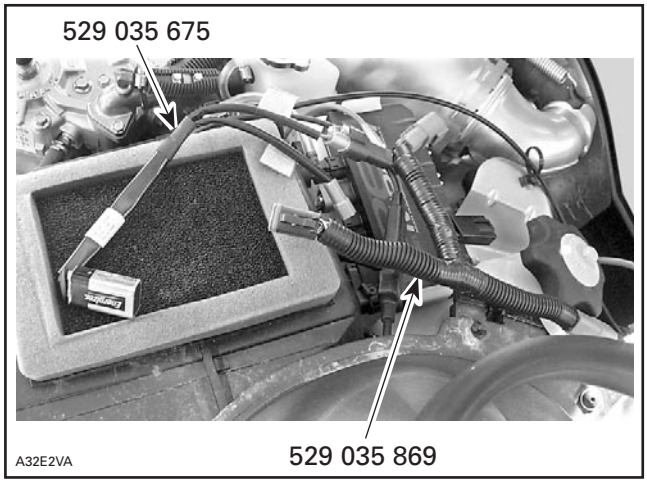
VCK (Vehicle Communication Kit) (P/N 295 035 676) can be used, with B.U.D.S. software to change the ignition timing. Look under the proper **Setting** section of the B.U.D.S. software to change the ignition timing.

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.

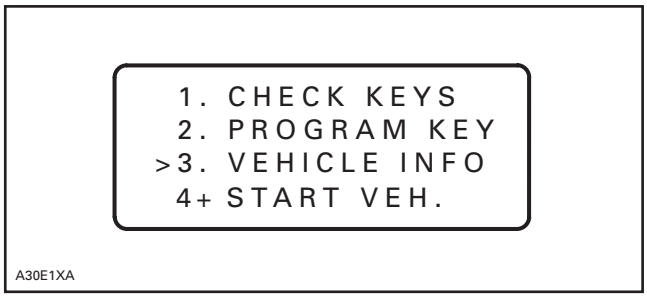


A32E2VA

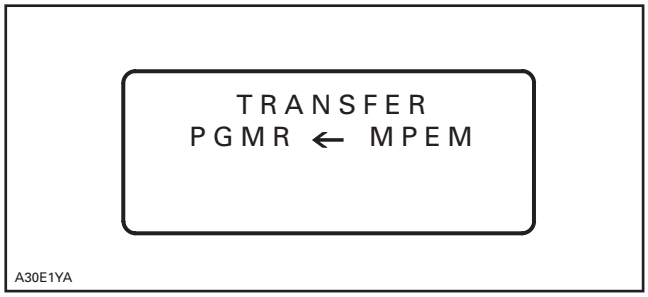
Connect MPEM programmer to DESS post.

Turn on programmer then enter password.

From main menu select no. 3. INFO VEHICLE.

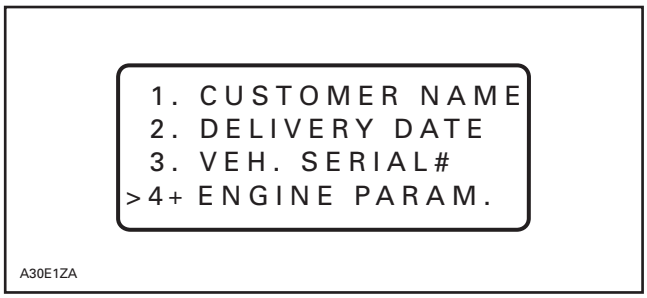


Vehicle information is transferred from MPEM to programmer.

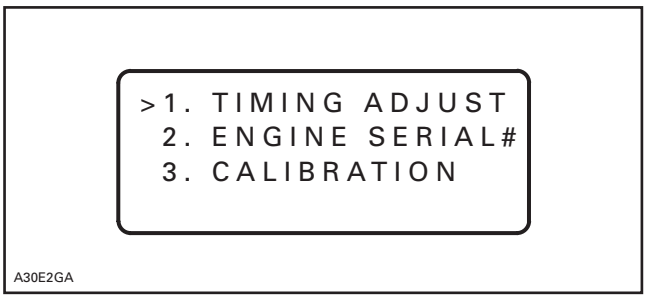


NOTE: In fact the programmer takes a copy of all vehicle parameters scribed in MPEM. This copy will be modified within the programmer then transferred to the MPEM.

Select no. 4. ENGINE PARAMETER.

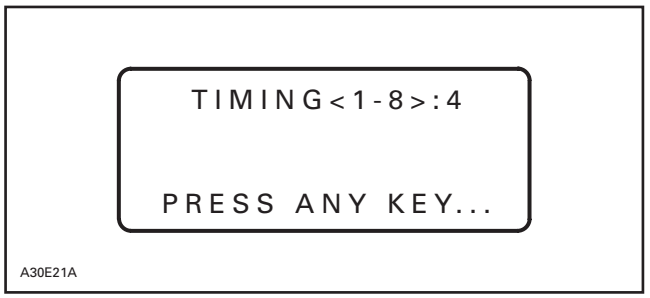


Select no. 1 TIMING ADJUSTMENT.

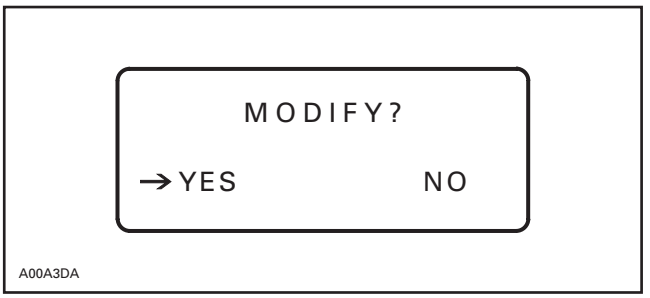


Press ENTER.

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.

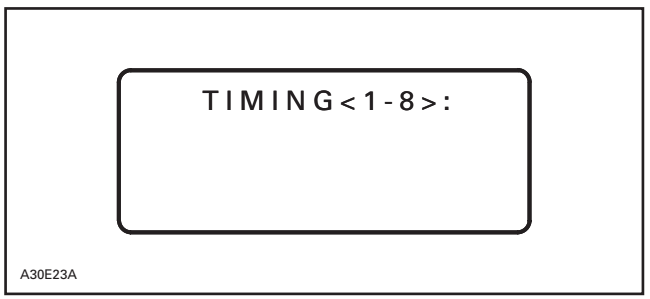


Press any key.



Select YES using the key ↔.

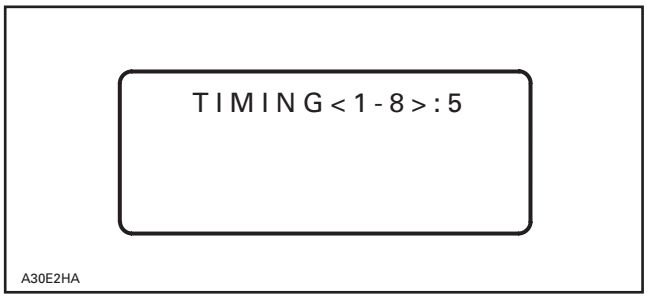
Press ENTER.



Select a timing correction factor corresponding to correction needed.

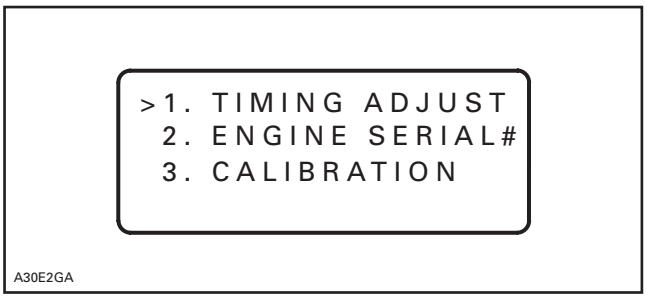
Example: Timing mark as verified with a timing light at 3500 RPM was too early by 2°. The correction factor programmed is no. 4.

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°).

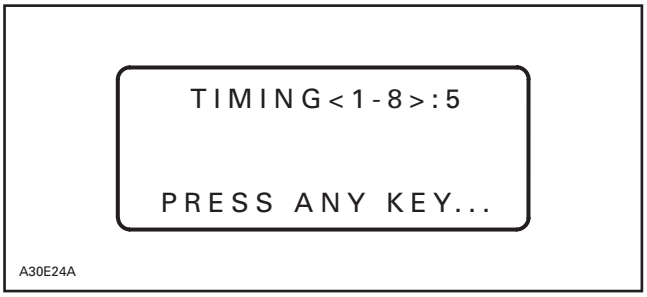


IGNITION CORRECTION FACTOR	
CORRECTION FACTOR PROGRAMMED IN MPEM	IGNITION TIMING CORRECTION
2	3°
3	2°
4	1°
1	0°
5	- 1°
6	- 2°
7	- 3°
8	- 4°

Press ENTER.

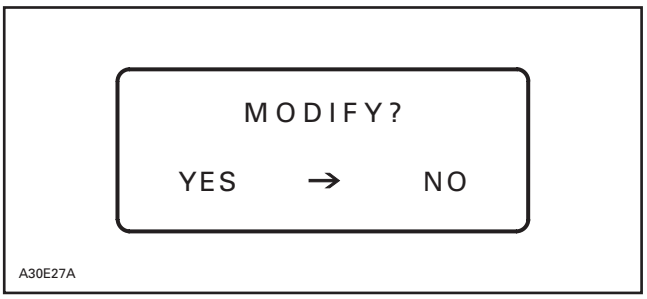


Press ENTER.

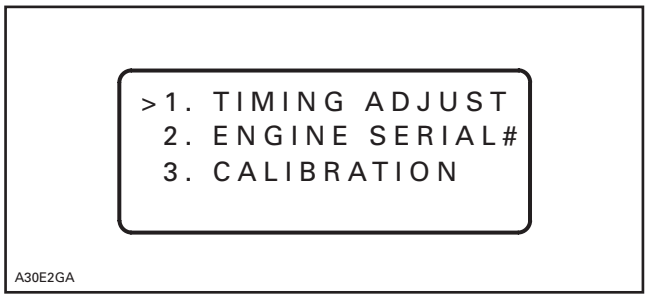


The display confirms that correction factor has been changed to no. 5.

Press any key.

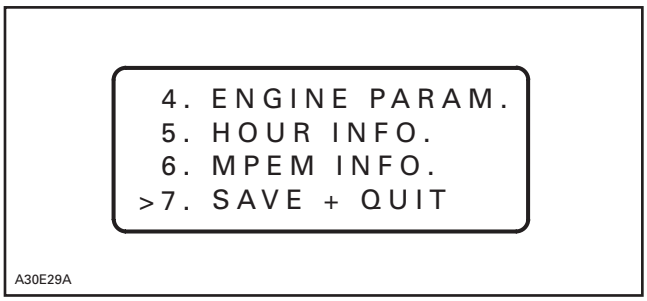


If the new correction factor selected above is the good one select NO and press ENTER. Otherwise select YES to choose an other correction factor.

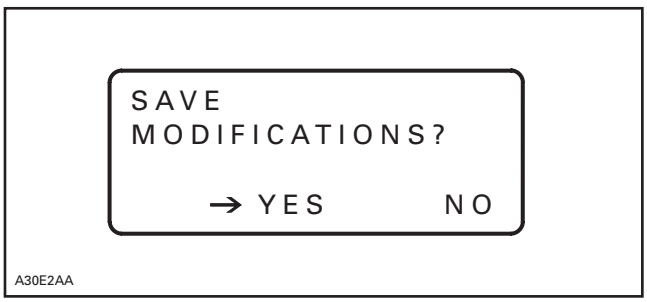


Press MENU.

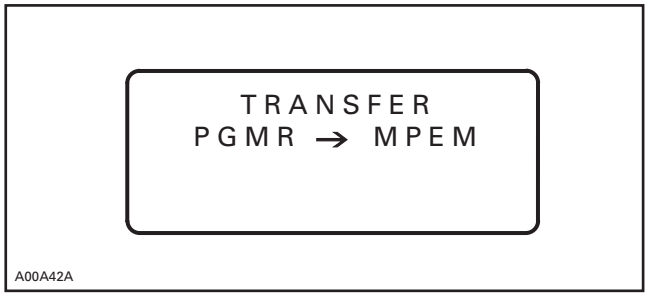
Scroll to no. 7 SAVE AND QUIT.



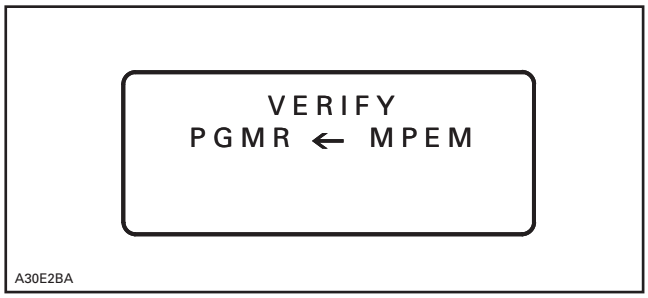
Press ENTER.



Press ENTER.

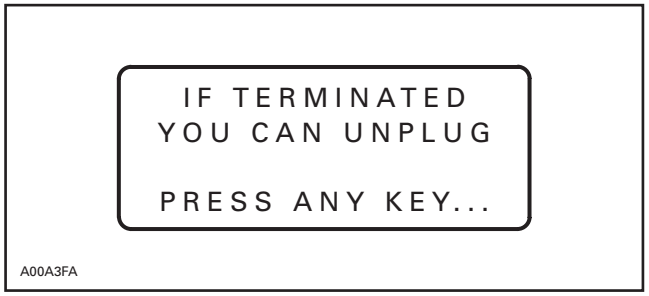


During a very short period of time the following message will appear.

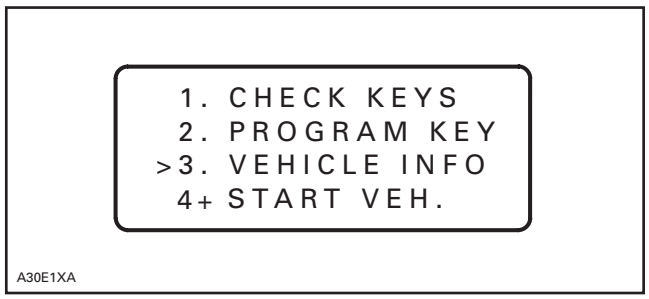


After the programmer has verified, following message will appear.

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

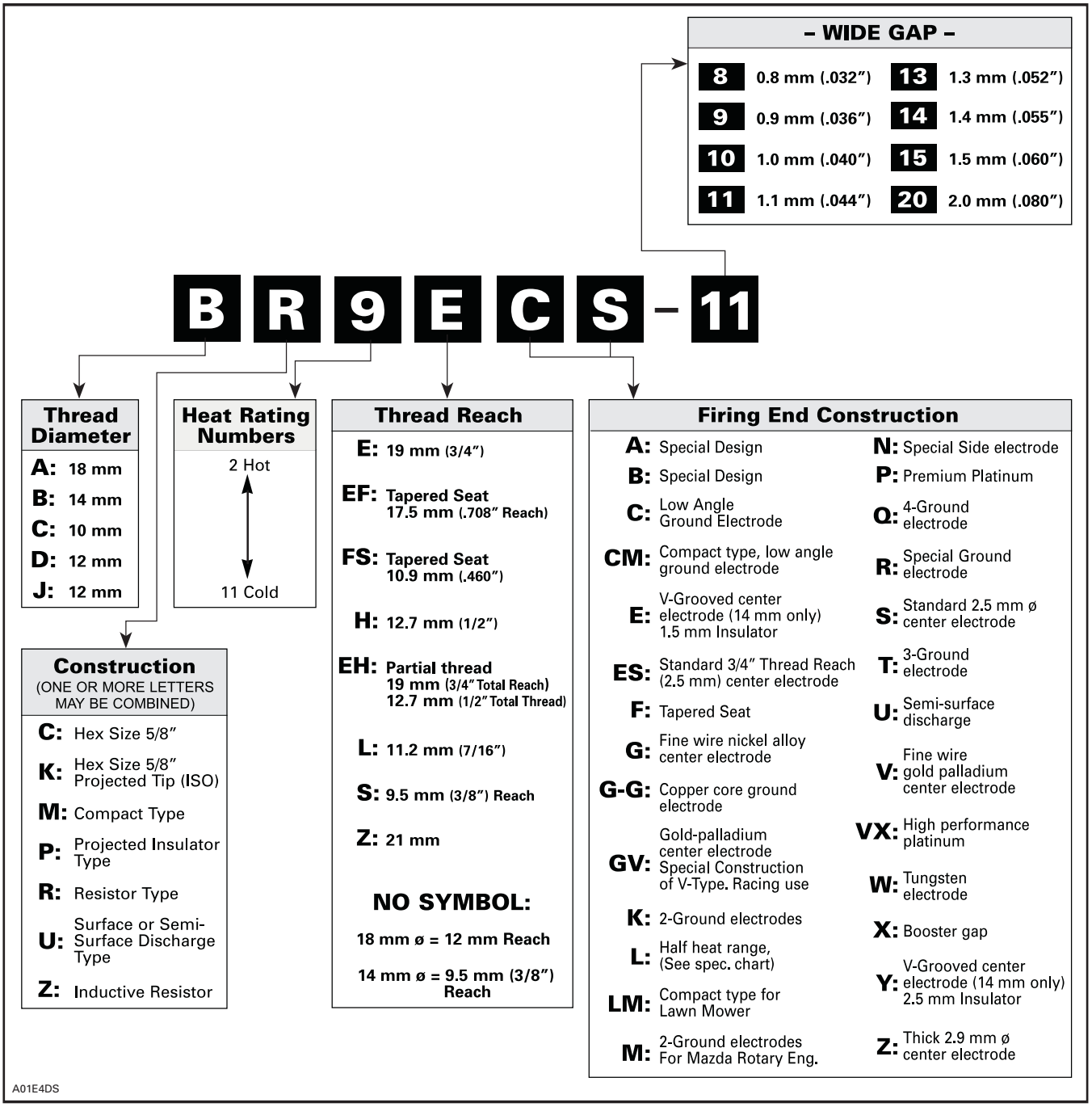
Bombardier uses NGK brand spark plugs on all its snowmobile models.

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

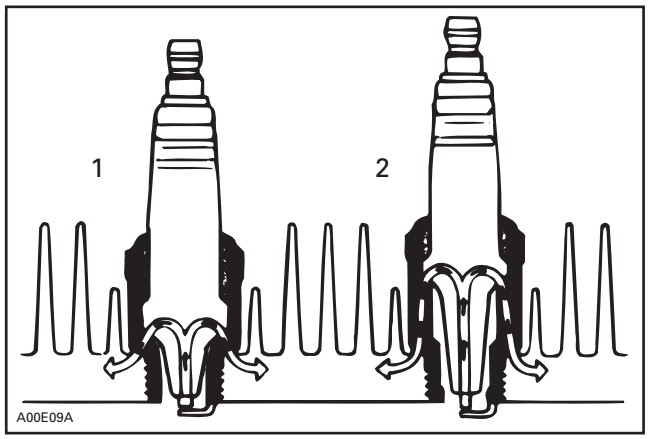
The proper operating temperature or heat range of the spark plugs is determined by the spark plug ability to dissipate the heat generated by combustion.

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 continued idle or low speed operation.



1. Cold
2. Hot

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

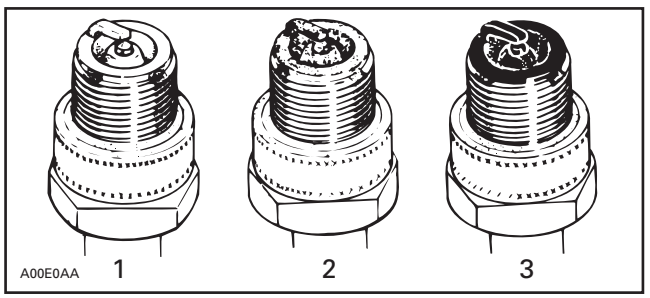
A plug that would be **too hot** will result in overheating and pre-ignition, etc.

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 pre-ignition 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 mixture too rich 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 ground.

SPARK PLUG ANALYSIS



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

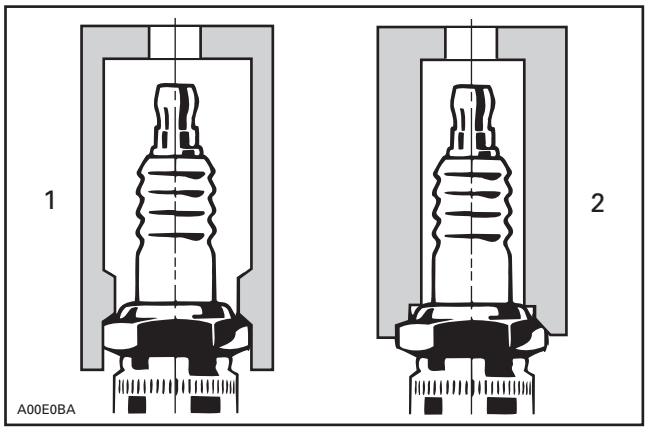
The plug electrode and piston dome reveal the condition of the engine, operating condition, method of driving and fuel mixture. For this reason it is recommended to inspect the spark plug at regular intervals, examining the plug electrode and the piston dome.

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

All Models

⚠ WARNING

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

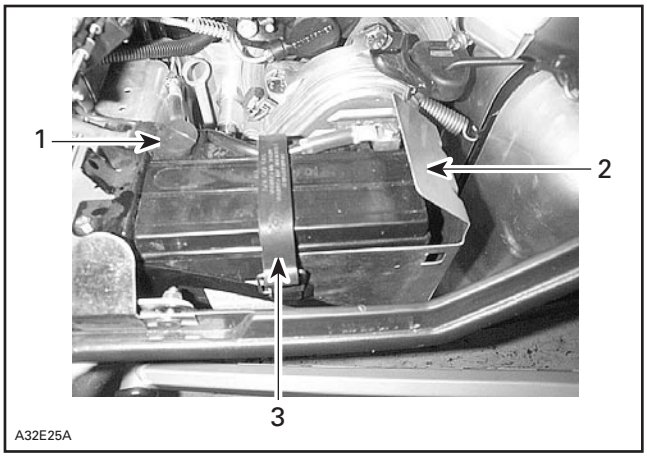
⚠ WARNING

Never charge or boost battery while installed on vehicle.

Unfasten the strap and remove battery guard.

Slide off the rubber boot from the RED cable.

Disconnect the BLACK negative cable first followed by RED cable and remove battery.



1. *Rubber boot for RED positive cable terminal*
2. *Battery guard*
3. *Strap*

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 casting 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's simplest and used most commonly.

An load test is more accurate with precise reading.

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).

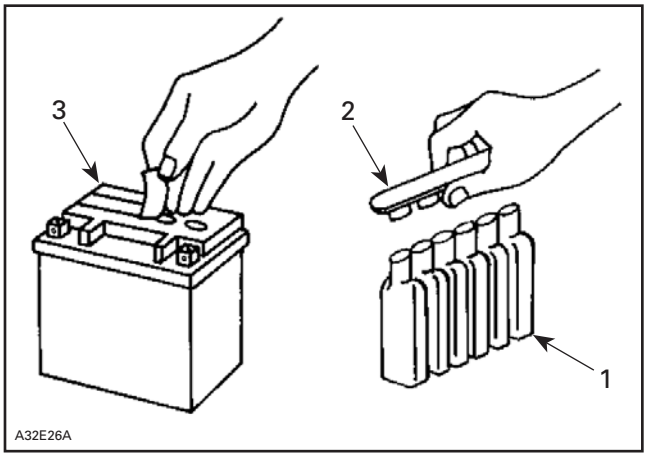
Charge the battery every two week if stored at temperature **above** 15°C (60°F).

ACTIVATION OF NEW BATTERY

⚠ WARNING

Never charge or boost battery while installed on vehicle.

Remove the aluminum sealing tape from the battery. Remove the electrolyte container from the plastic bag and detach the strip of caps. Keep the strip for battery plugs.



1. Electrolyte container
2. Strip of caps
3. Aluminum sealing tape

⚠ WARNING

Do not puncture or otherwise try to open the sealed chambers of the container.

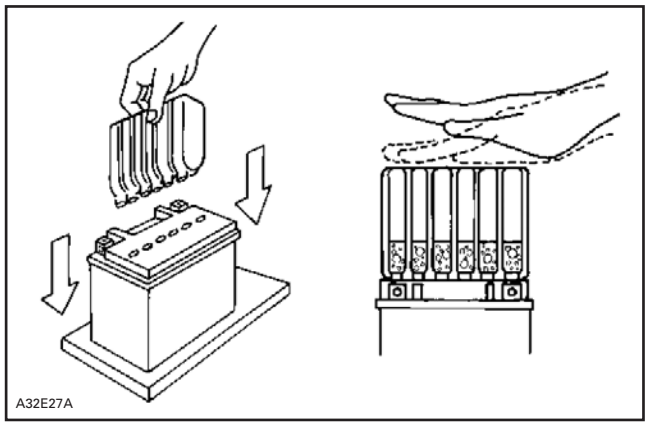
Fill the battery with electrolyte by placing the electrolyte container upside down, with the six sealed chambers in the battery's six filler pors.

Push the container down firmly enough to break the seals. The electrolyte should start to empty out.

⚠ WARNING

Do not lift or tilt the container while filling battery.

Make sure air bubbles coming up should be seen from all six filler ports. If not, tap down on the container with hand two or three times.



⚠ WARNING

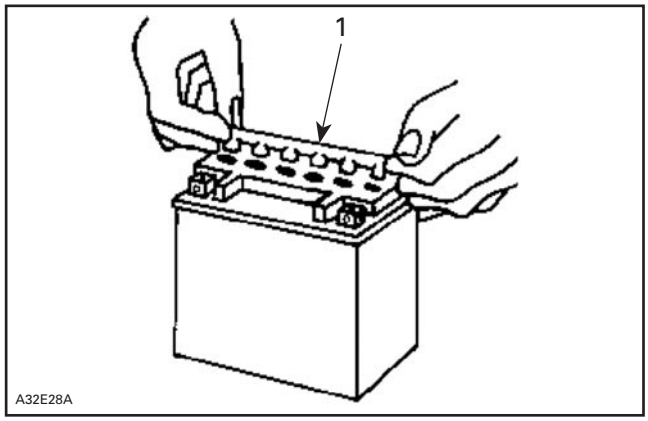
Do not squeeze the electrolyte container.

The electrolyte should completely empty in to the battery in about 20 minutes. If there is still some in the container, tap it again a few times. Remove the container. After adding electrolyte, a new battery is approximately 80% charged.

Seal filler ports with the strip of caps by pressing down with both hands until flush with battery top.

⚠ WARNING

Never topped off Absorbed Glass Mat (AGM) battery during its life. Never pry off sealing caps.



1. Strip of caps

Allow battery to stand 30 minutes to one hour maximum before charging.

⚠ WARNING

Do not open the sealed caps during charging.

Charging time of the battery is 15 hours using 1 A. charger (P/N 529 035 773) for first initial charge. Charging rate will vary depending on type of charger used.

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.

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% 75% - 100% 50% - 75% 25% - 50% 0% - 25%	None 3 - 6 5 - 11 13 - 15 20

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

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 begun.

Do not charge 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.

Time required to charge a battery will vary depending 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, 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 may be needlessly 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 term of milliamperes. It could be some time before the charging rate increases. Such low current flow may not be detectable on some charger ammeters and the battery will seem not to accept any charge.
– Only for this particular case, set the charger to a high rate.

NOTE: Some chargers have a polarity protection feature which 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. This will make it appear that the battery will not accept a charge. Follow the charger manufacturer's instruction telling 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.

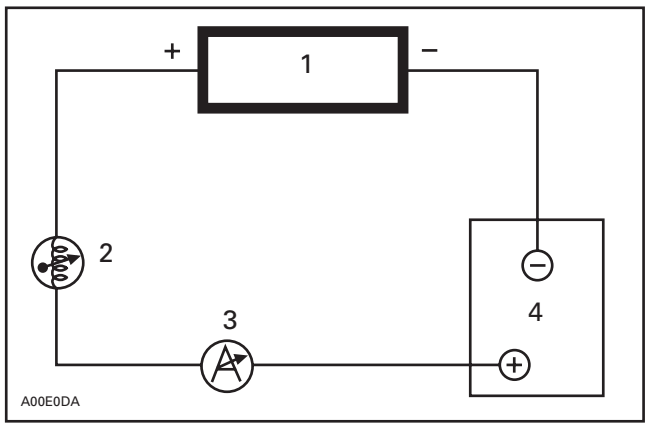
BATTERY CHARGING EQUIPMENT

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

All Models

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.

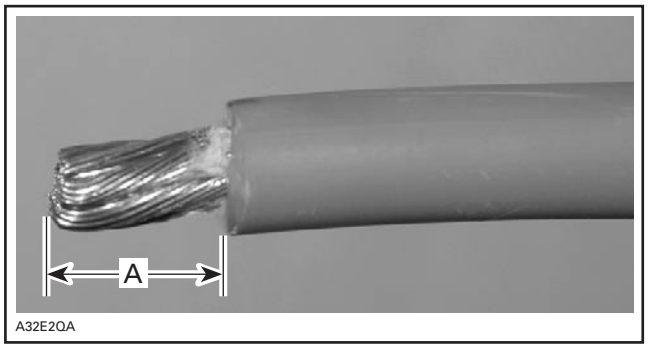
Cover the RED positive terminal with rubber boot.

Put the battery guard and fasten the strap.

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

CABLE TERMINAL INSTALLATION

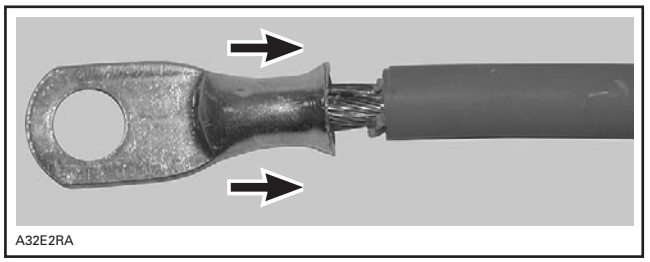
Carefully strip the wire approximately to 10 mm (1/2 in) in length, using a wire stripping tool or sharp blade/knife.



A. 10 mm

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

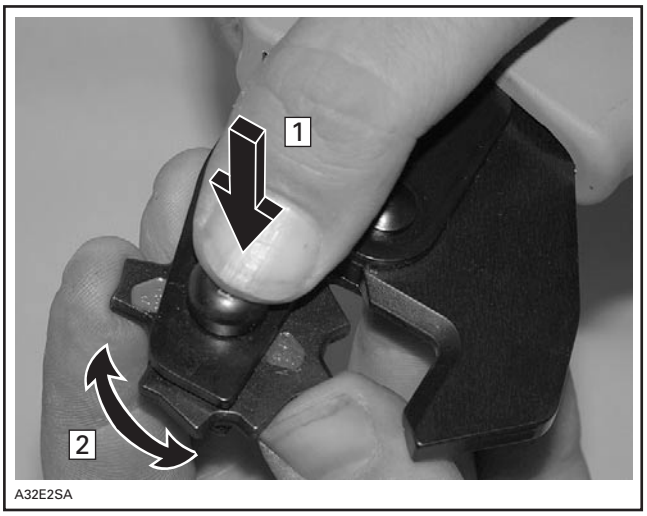
Install the appropriate terminal on the wire according to the requirement. Refer to appropriate parts catalog.



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.

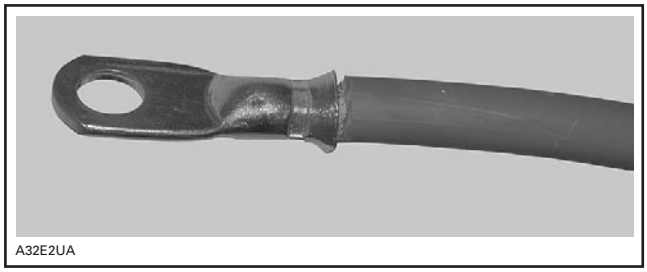


POSITIONING THE CRIMP PLIER

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, apply some pulling force on wire and the terminal at the same time from both directions.

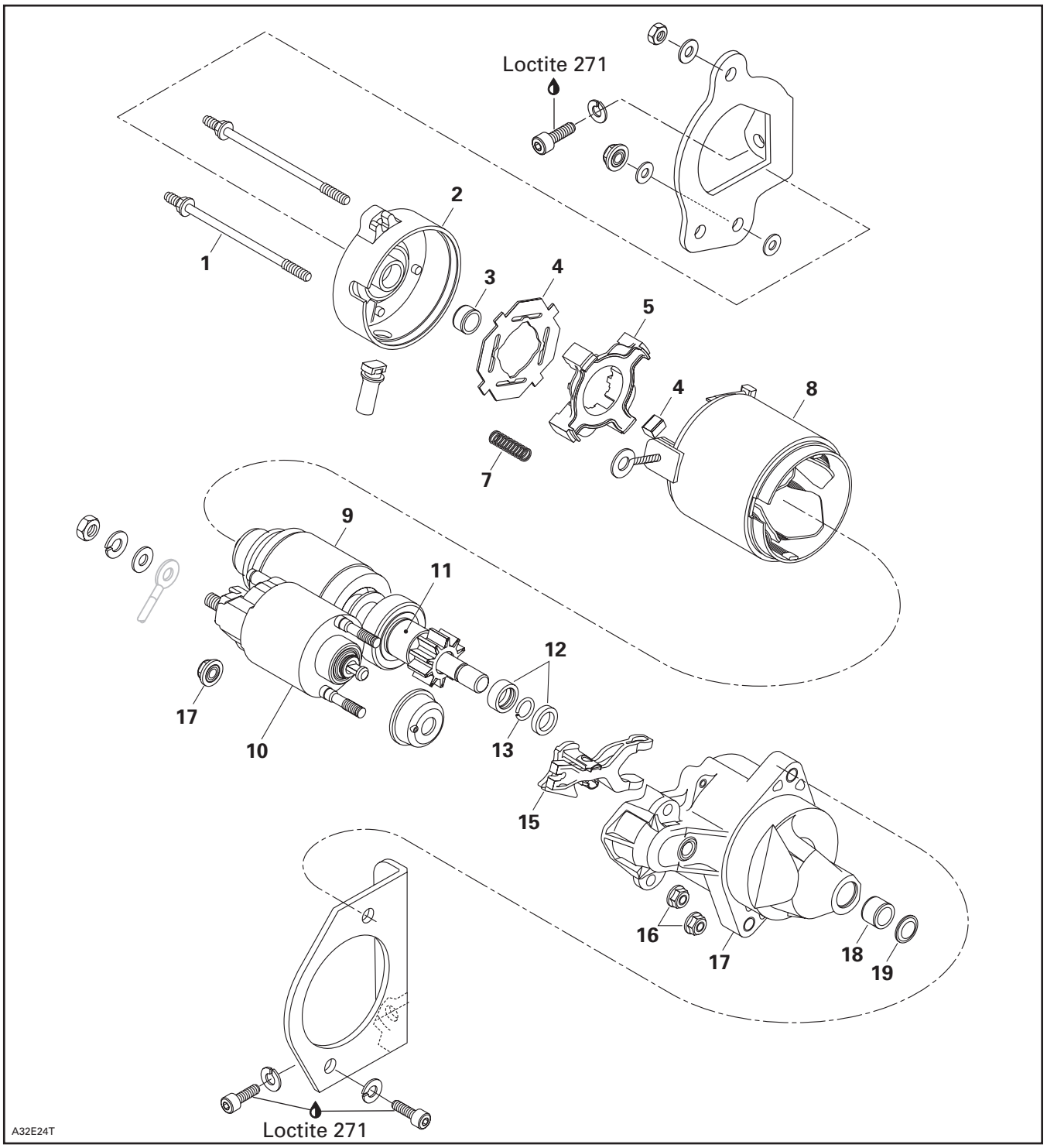
CAUTION: Never weld the wire to the terminal. Welding can change the property of the wire and it can become brittle and break.

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.

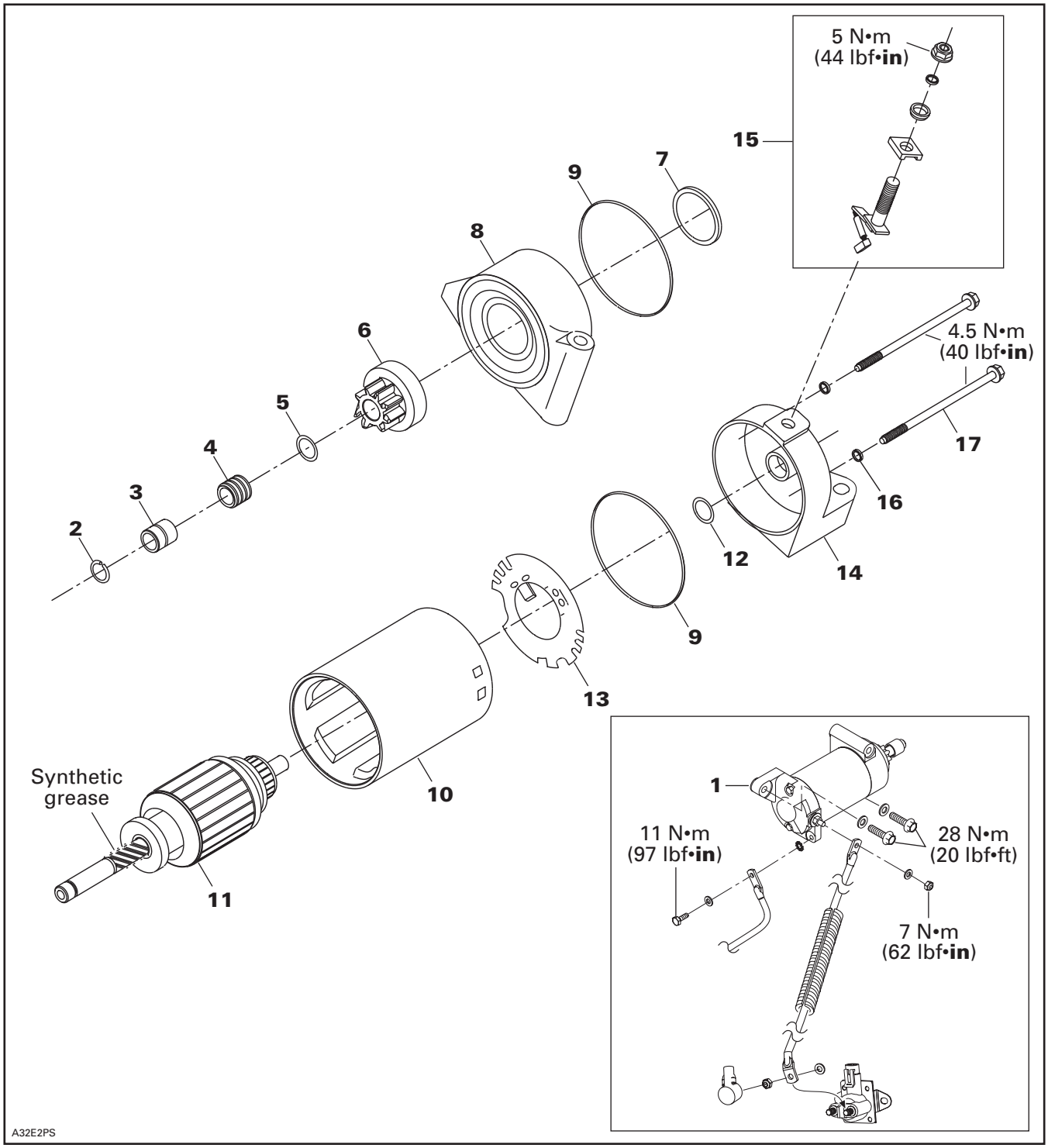
CAUTION: Make sure that the protective heat shrink rubber tube has been properly installed and no part of wire is exposed.

ELECTRIC STARTER

Fan Cooled ZX Series with Electric Starting



Liquid Cooled ZX Series with Electric Starting



REMOVAL

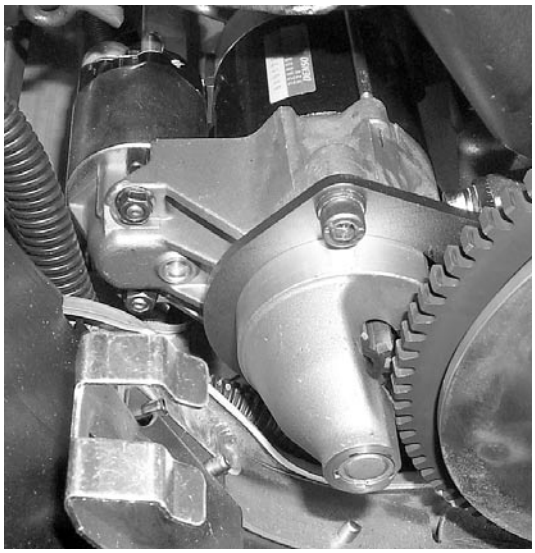
Fan Cooled ZX Series Starter

– 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 and RED/GREEN wire from starter relay.
– Disconnect ground cable from MAG side bracket.
– Unbolt starter from PTO side bracket.
– Unbolt MAG side bracket from engine.
– Remove starter from engine.


A32E29A

TYPICAL

Liquid Cooled ZX Series

– 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

Fan Cooled ZX Series

Disconnect bare wire linking starter and relay.

Remove nuts **no. 16** then relay **no. 10** by lifting and pulling to disengage from drive lever **no. 15**.

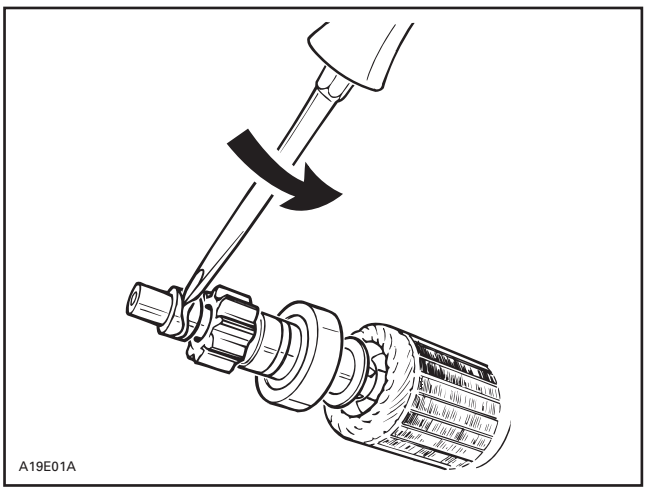
Unscrew starter screws (long) **no. 1** then pull yoke **no. 8** with end frame **no. 2** to separate from drive housing **no. 17**.

Pull armature **no. 9** with drive lever **no. 15**.

Remove insulator **no. 4** then brush springs **no. 7** being careful not to lose them since they will be projected out.

Pull brush holder **no. 5** from yoke **no. 8**.

Insert blade of a small screwdriver between stop collars.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TYPICAL

Twist screwdriver to separate stop collars **no. 12** thus giving access to circlip **no. 13**.

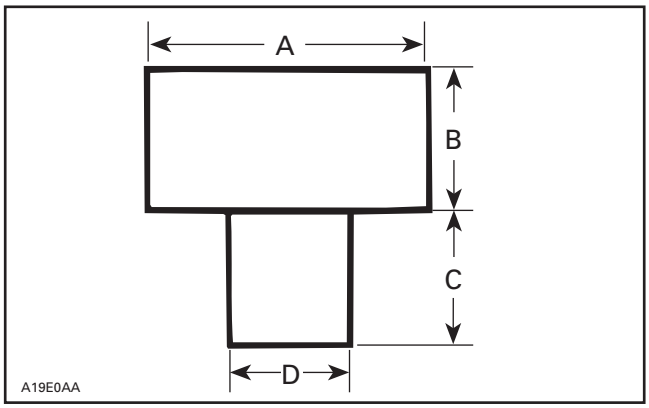
Remove outer collar, circlip then inner collar.

Remove overrunning clutch **no. 11**.

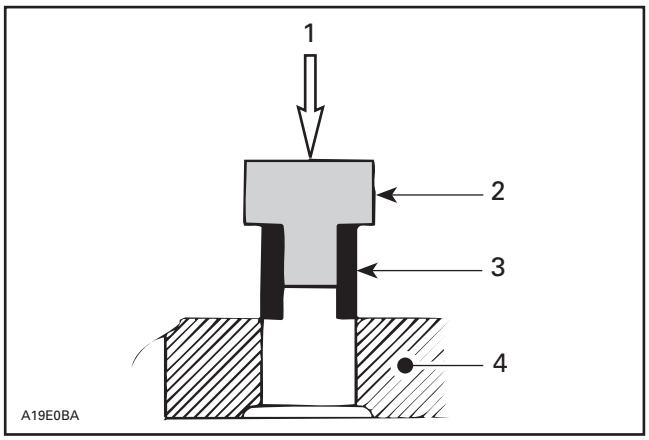
Check the wear on bushing **no. 18** by measuring the amount of radial play between the armature shaft and the bushing.

The radial play should not exceed 0.20 mm (.008 in). If greater, replace the bushing. To replace, press out the old one toward bushing cover and press in a new one with a bushing pusher. The correct size of the bushing pusher to use is given on next illustration.

CAUTION: Support drive housing adequately to prevent damage when pressing bushing.

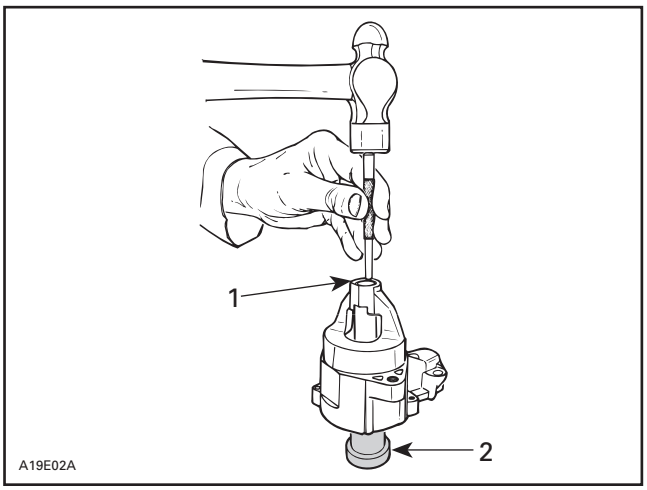


BUSHING PUSHER
A. 16 mm (5/8 in) diameter
B. 13 mm (1/2 in)
C. 11 mm (7/16 in)
D. 11.0 mm (.433 in)



1. Press-in
2. Bushing pusher
3. Bushing
4. Drive housing

Install bushing cover **no. 19** then, using a punch, stake bushing cover in place.



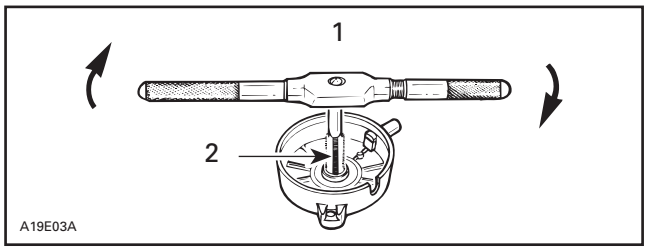
1. Stake bushing cover
2. Support

3, Bushing (end frame)

Check the wear on bushing **no. 3** by measuring the amount of radial play between the armature shaft and the bushing.

The radial play should not exceed 0.20 mm (.008 in). If greater, replace bushing as follows:

Using a 12 mm tap, cut threads into bushing so that the tap contacts the end frame. Continue to rotate tap until the bushing comes free.



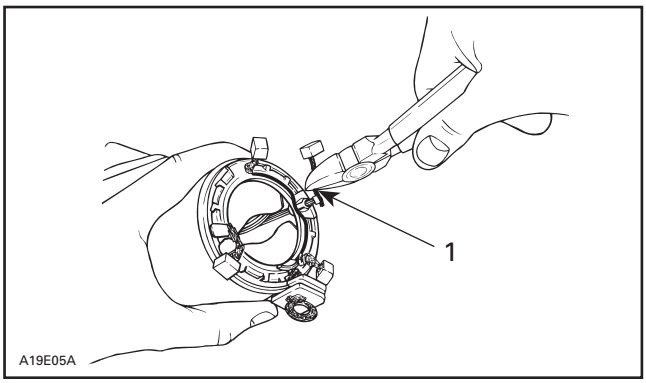
1. Turn until bushing goes out
2. 12 mm tap

To install new bushing, use the same bushing pusher as for drive housing bushing installation.

6, Brush

To replace brush **no. 6**, proceed as follows:

Cut brush wire close to connector at the welded portion.



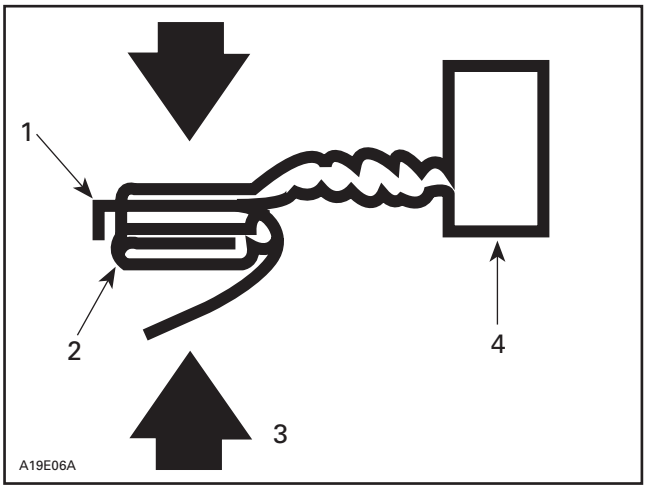
1. Cut close to connector

Remove burrs with a file on the remaining welded portion.

CAUTION: Be careful not to damage plastic portion of yoke.

Place spare brush plate edge against yoke connector edge (welded portion).

Crimp plate over yoke connector with a pair of pliers.



1. Plate edge
2. Yoke connector
3. Crimp
4. Spare brush

Solder the crimped portion.

CAUTION: Do not overheat and quickly perform soldering to prevent solder from flowing to the brush through the wire. Preferably use a heat sink.

Liquid Cooled ZX Series

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

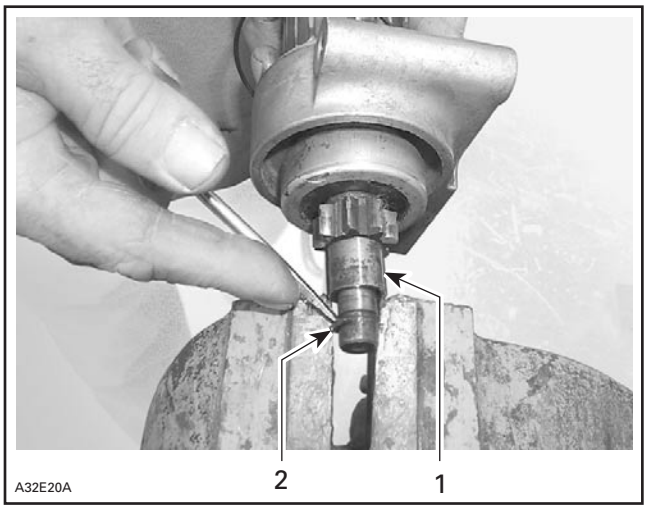
Remove starter through bolts **no. 17**. Separate end frame housing **no. 14** from starter housing **no. 10**. Withdraw starter housing from armature **no. 11**.

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 then 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

All Models

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

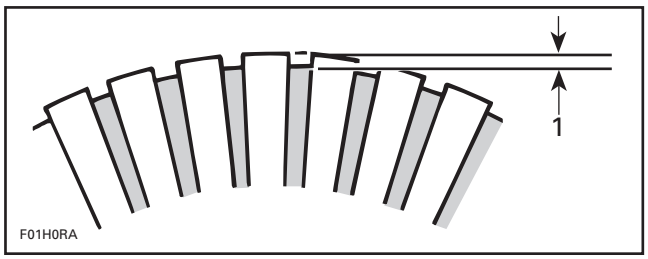
All Models

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, enough to remove grime only.

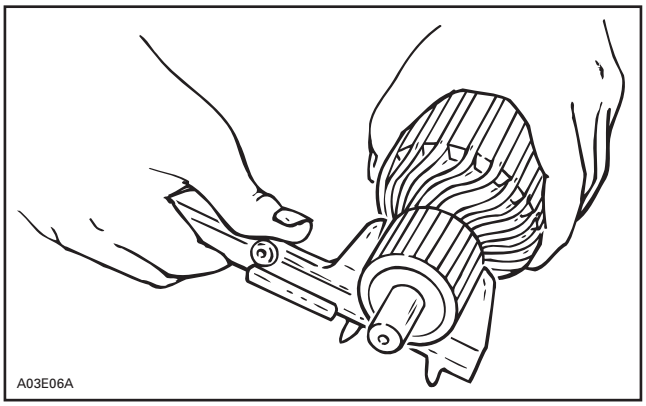
Check the commutator for mica depth. If the depth is less than 0.20 mm (.008 in), undercut the mica. Be sure that no burrs are left and no copper dust remains between the segments after the undercutting operation is completed.



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.

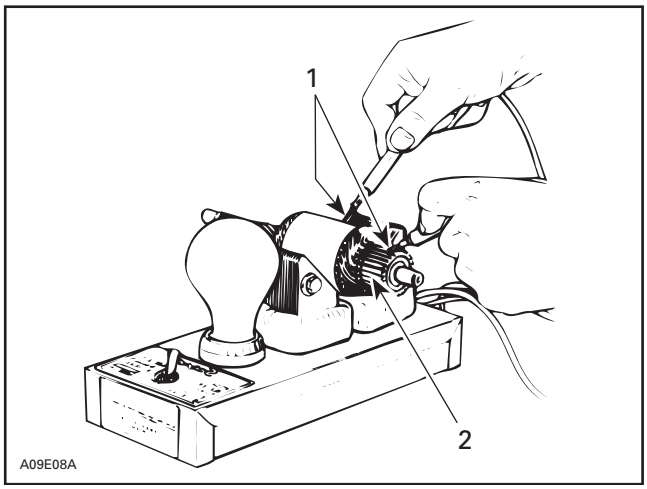
Check commutator outer diameter. If less than specified value, replace.



MODEL	WEAR LIMIT
ZX SERIES	27 mm (1.063 in)

Test for Ground Circuit in the Armature

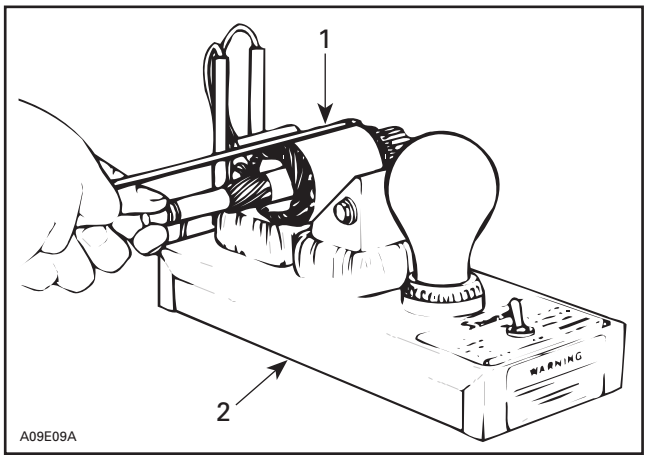
Use growler test probes. Check between armature core and the commutator bars. If growler lamp turns on, bars are grounded. If so, replace armature.



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

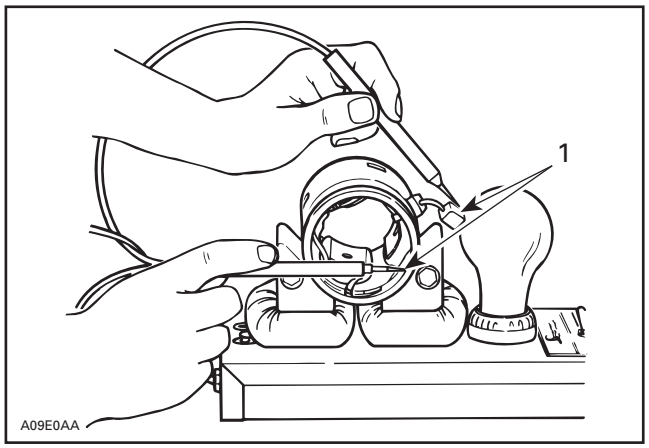
Use growler test probes. Place one test probe on a commutator bar and the other test probe on the neighboring bar. Repeat this operation for all bars, moving one test probe at a time. If the growler lamp does not turn on, the armature circuit between these 2 bars is opened. The armature should be replaced 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).

Field Windings and Brushes

Fan Cooled ZX Series

Test the Field Winding for Open Circuit

Use growler test probes. Place one test probe on the negative brush and the other test probe on the yoke. If growler lamp does not turn on, the field winding has an open-circuit. The yoke has to be repaired or replaced.



1. Test probes

Check the dynamic brake winding for open circuit by placing one test probe on the positive brush and the other probe on the negative brush.

If growler lamp does not turn on, the winding circuit is open-circuit and the yoke has to be repaired or replaced.

Brush Holder

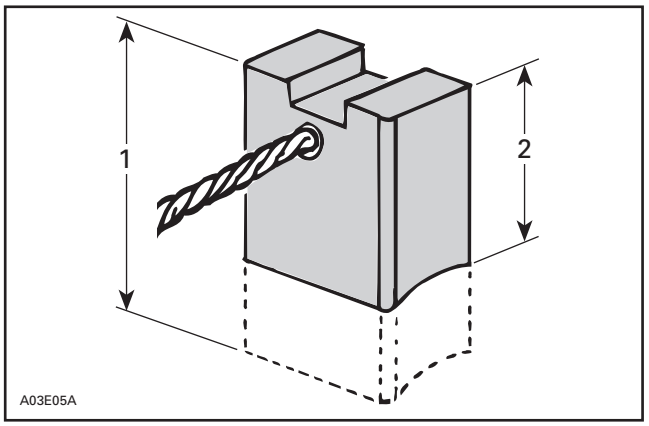
All Models

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
ZX SERIES	10 mm (.400 in)	6 mm (.236 in)

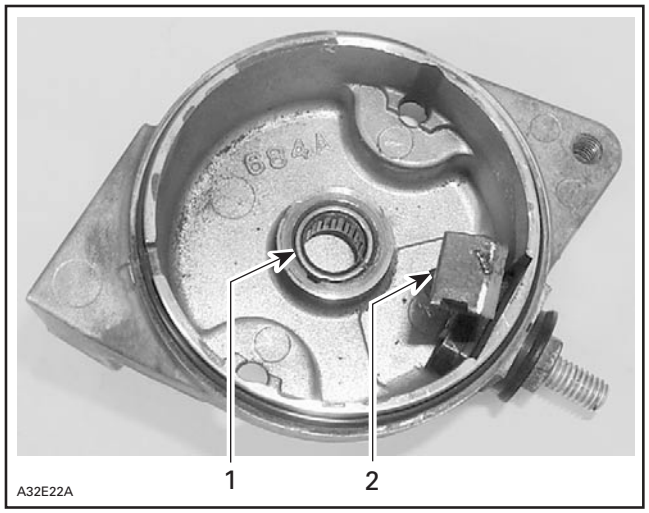


TYPICAL
1. *New*
2. *Wear limit*

End Housing

Liquid Cooled ZX Series

Check the mica insulation of the positive brush and also the roller bearing condition. Replace, if necessary.



1. *Roller bearing*
2. *Positive brush*

Overrunning Clutch

All Models

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 relay body for the fan cooled models and – on the BLACK wire for liquid cooled models).

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

ASSEMBLY

Fan Cooled ZX Series

Prior to assembling, coat sliding surfaces and moving parts on armature shaft splines, overrunning clutch, relay plunger, drive lever and bushings with synthetic grease (P/N 413 711 500).

Proceed as follows for assembling.

Secure drive housing in a vise.

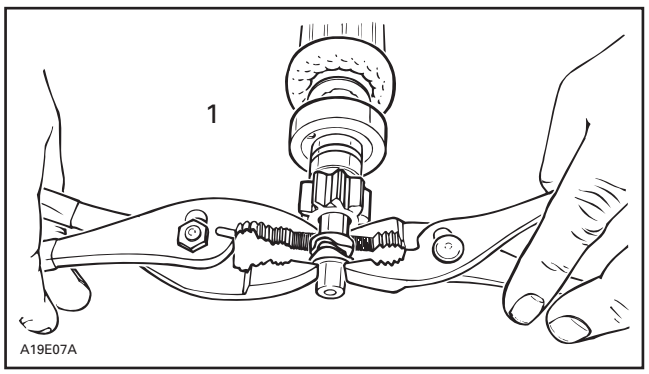
CAUTION: Do not overtighten since housing might be damaged.

Install overrunning clutch onto armature shaft. Insert **inner** collar onto shaft. Install a new circlip.

CAUTION: Always install a new circlip when servicing.

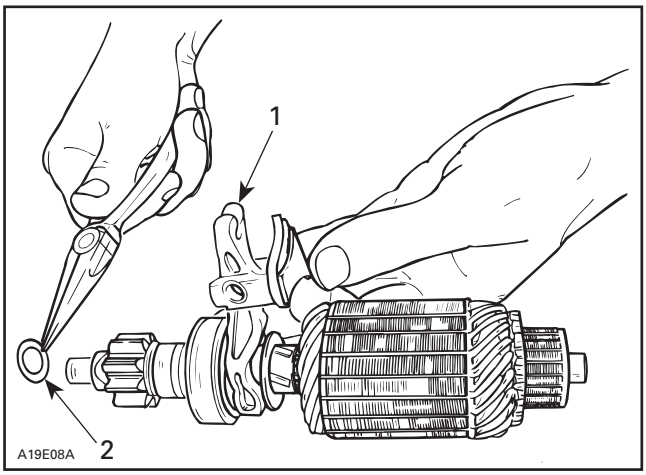
Insert **outer** collar being careful to match protrusions with notches of collars.

Using a pair of pliers on each side of stop collars, squeeze evenly until collars sit over circlip.



1. *Squeeze evenly*

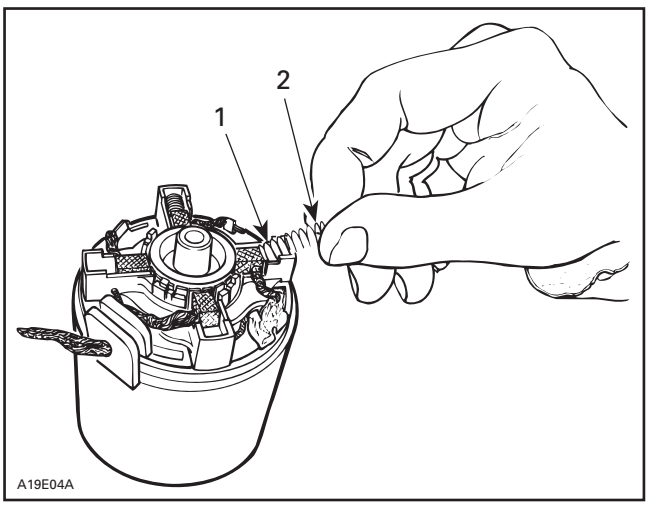
Install thrust washer against outer stop collar. Place drive lever onto overrunning clutch then insert into drive housing.



1. Install on overrunning clutch
2. Install thrust washer

Slide yoke over armature.

Install brush holder then brushes in their housings. Insert springs as follows: place one end of spring against brush, compress, then push the other end of spring onto its housing. Repeat for remaining springs.



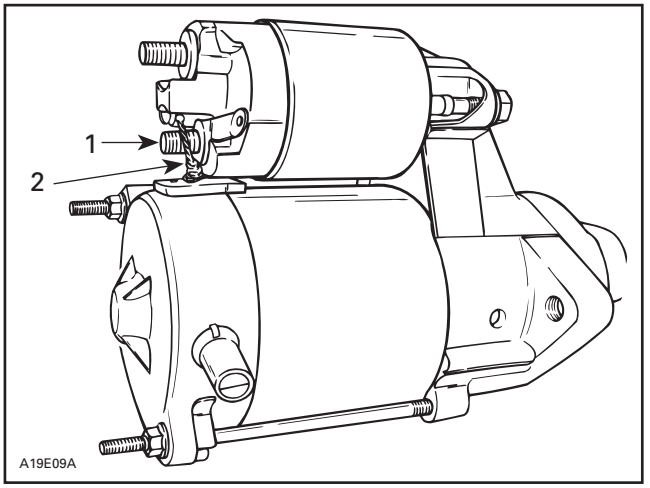
1. This end first
2. Push this end to complete

Secure insulator over brushes and springs. Properly install end frame and tighten screws.

Insert relay plunger inside of drive lever fork and secure to drive housing.

Connect starter bare wire to relay.

NOTE: Connect this wire on the **shorter** relay stud.



TYPICAL
1. Shorter stud
2. Bare wire

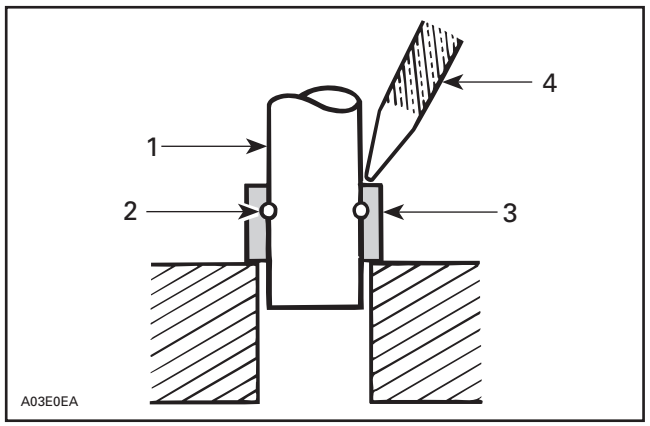
Liquid Cooled ZX Series

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.

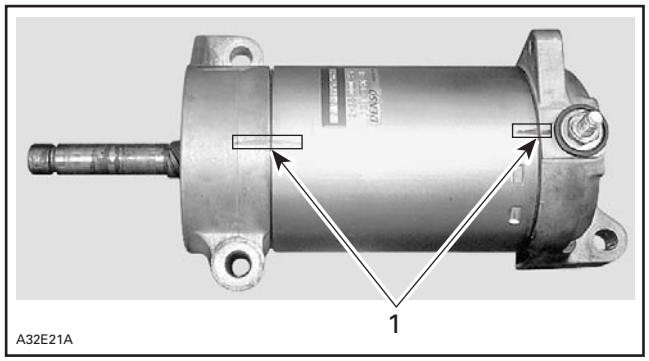
Slide collar **no. 3** over snap ring **no. 2** and secure in place by punching it at two or three places.



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

Starter Housing Assembly and Starter Housing

Align previously traced indexing marks.

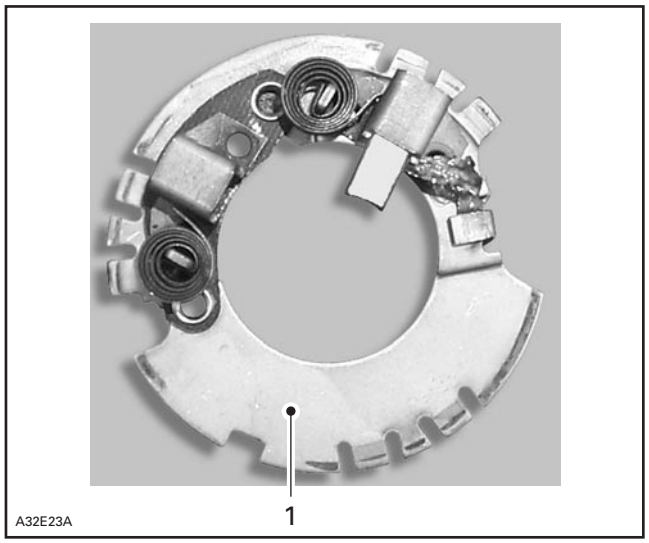


TYPICAL

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.

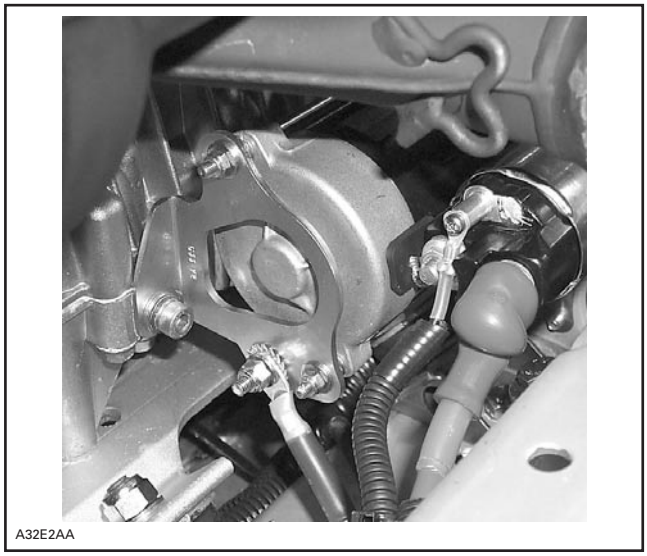
CAUTION: Make sure to place two end housings on a flat surface before tightening the through bolts.

CAUTION: Make sure end frame fits perfectly on yoke.

INSTALLATION

Fan Cooled ZX Series

Install carriage bolt in MAG side bracket before installing starter.



Make sure that starter and engine mating surfaces are free of grime. Serious trouble may arise if starter is not properly aligned.

CAUTION: Make sure that both starter brackets are well seated against engine crankcase and starter before torquing all retaining bolts.

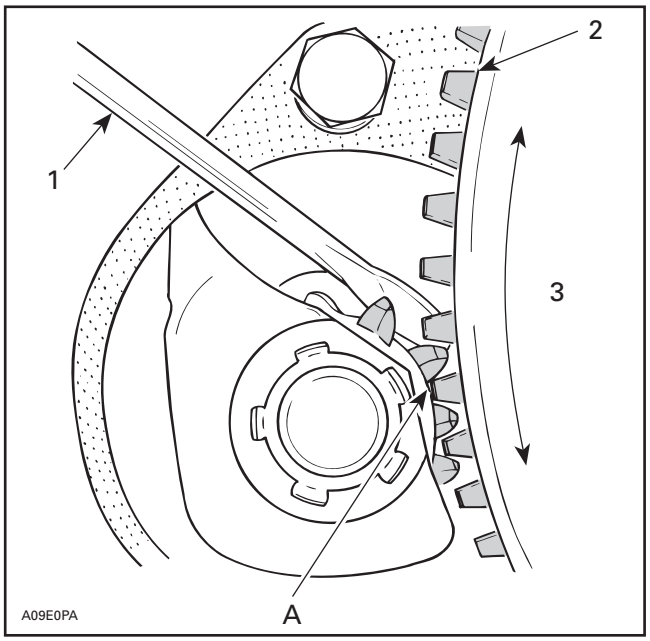
Torque all M8 bolts to 24 ± 4 N•m (17 ± 3 lbf•ft).

Torque all M5 bolts to 5 ± 0.5 N•m (44 ± 5 lbf•**in**).

CAUTION: Before checking engaging depth of starter pinon teeth, make sure that battery cables are disconnected.

NOTE: Check proper engaging depth of starter pinion teeth to ring gear teeth (see illustration). Install hardened washers (P/N 503 007 900) between engine and starter supports accordingly.

CAUTION: Always install new self-locking fasteners.



1. Screwdriver pulling starter pinion
2. Ring gear
3. No excessive backlash
A. 0.5 to 1.5 mm (.020 to .060 in)

Connect the RED battery cable and the RED wire to the large terminal of the relay. Connect RED/GREEN wire to small terminal of relay.

Liquid Cooled ZX Series

– 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.

MODELS	IGNITION SYSTEM	CHARGING SYSTEM OUTPUT
ZX fan cooled models with 503 engine	① RER dual trigger coil CDI (twin cylinder)	300
ZX fan cooled models with 552 and 377 engines	① RER dual trigger coil CDI (twin cylinder)	340
ZX liquid cooled	② BOMBARDIER DC 360 W	360

① RER Dual Trigger Coil CDI (twin cylinder)

The RER dual trigger coil CDI system has an ignition coil integrated to the MPEM which is mounted on oil reservoir.

MPEM is connected to a single ignition generator coil via a 3-connector housing (BLACK and RED wires).

MPEM is programmed to recognize a signal sent by the switch located on snowmobile console.

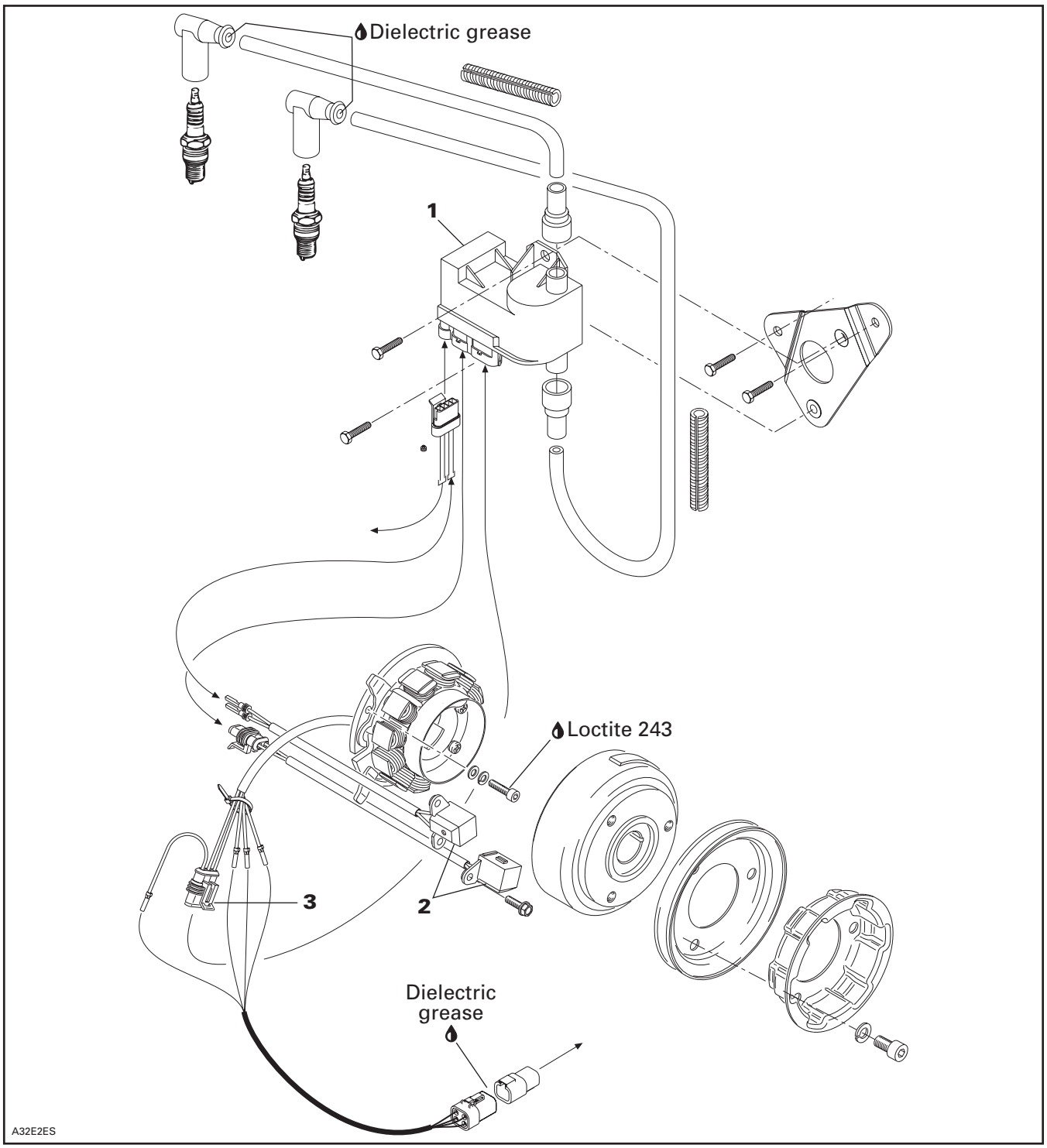
When switch is activated, MPEM cuts off ignition and engine rev drops at approximately 450 RPM.

MPEM fires a spark at a great advance creating a thrust which reverses engine rotation.

Second trigger coil located on crankcase takes over to produce spark in reverse rotation.

A safety device is incorporated to MPEM preventing it from reading any signal coming from reverse switch at following engine revs.

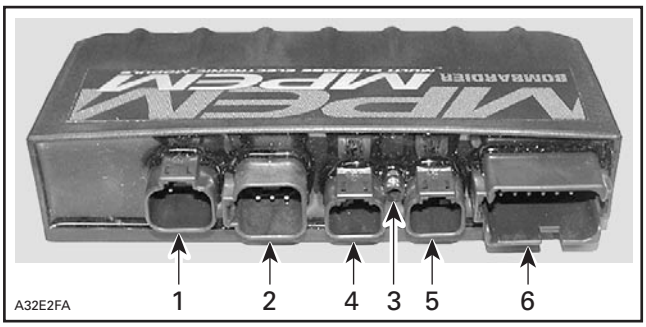
Below 1000 RPM and above 3500 RPM = No reverse signal.



① *RER DUAL TRIGGER COIL CDI SYSTEM (TWIN CYLINDER)*

1. *MPEM*
2. *Trigger coils*
3. *11-DC housing (BLACK and RED wires)*

Multi-Purpose Electronic Module (MPEM) Connections



② *BOMBARDIER 360 W MPEM*

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

Liquid Cooled Models

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 a model to an other. 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.

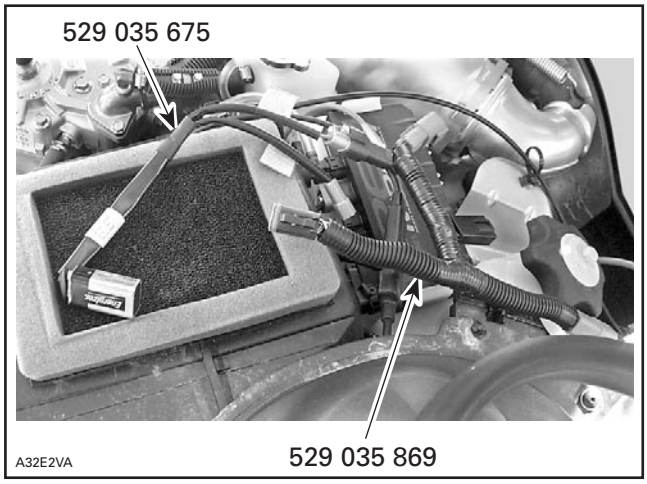
When data are being transferred, you must rev the engine at 2000 - 2500 RPM and make sure connection between programmer and vehicle is good.

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.

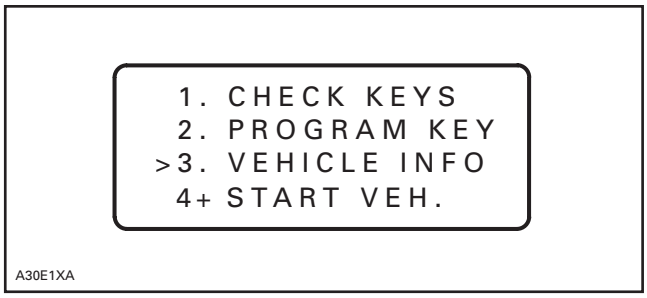


When cables are connected a beeping signal from the reverse buzzer will be heard (if vehicle is so equipped). This indicates that the MPEM is now ready to transfer programming operations.

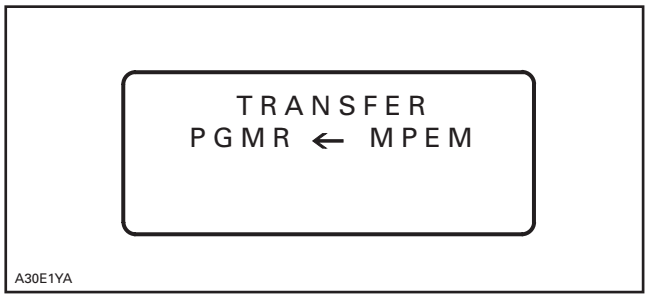
Once MPEM calibration program checking is done, unplug 9 volt adaptor and supply cable.

Turn on programmer then enter password.

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

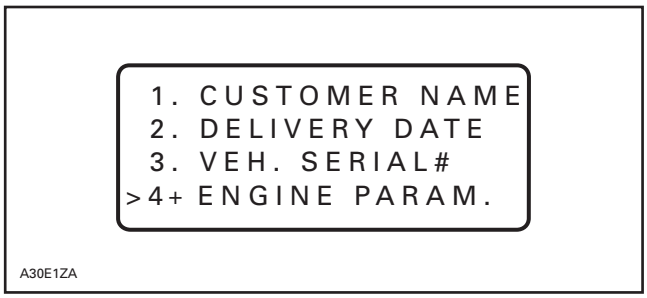


Vehicle information is transferred from MPEM to programmer.

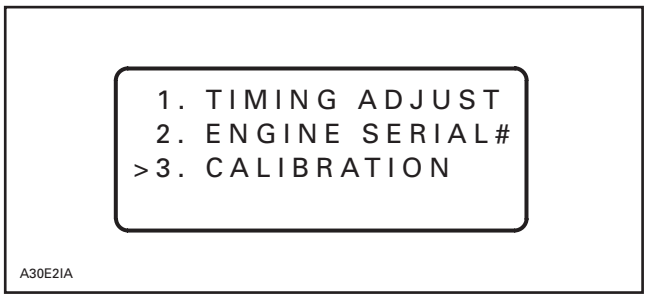


NOTE: In fact the programmer takes a **copy** of all vehicle parameters scribed in MPEM. This copy will be modified within the programmer then transferred to the MPEM.

Select no. 4. ENGINE PARAMETER.

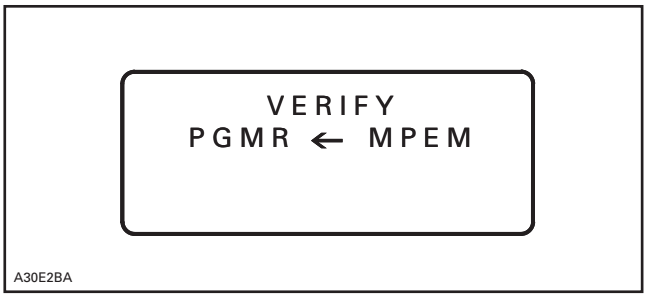


Select no. 3 CALIBRATION.

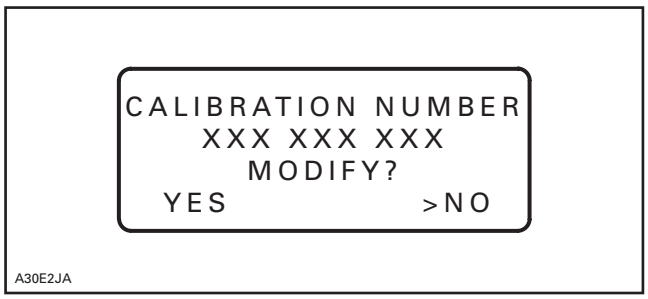


Press ENTER ←**Trs**.

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
Mach Z Tech Plus	809	512 059 292	512 059 293	512 059 294
MX Z Trail 500	493	512 059 636	512 059 637	512 059 581
MX Z Trail 500 R	493	512 059 638	512 059 637	512 059 582
MX Z Adrenaline 500	493	512 059 636	512 059 637	512 059 581
MX Z Adrenaline 500 R	493	512 059 638	512 059 637	512 059 582
Legend Sport 500	493	512 059 638	512 059 637	512 059 582
Grand Touring Sport 500	493	512 059 638	512 059 637	512 059 582
MX Z Trail 600	593	512 059 639	512 059 640	512 059 581
MX Z Trail 600 R	593	512 059 641	512 059 640	512 059 582
Legend Sport 600	593	512 059 641	512 059 640	512 059 582
Legend SE 600	593	512 059 653	512 059 640	512 059 752
Grand Touring Sport 600	593	512 059 641	512 059 640	512 059 582
Grand Touring SE 600	593	512 059 653	512 059 640	512 059 752
MX Z Adrenaline 600	593 HO	512 059 642	512 059 643	512 059 583
MX Z Adrenaline 600 R	593 HO	512 059 644	512 059 643	512 059 752
MX Z Renegade 600	593 HO	512 059 642	512 059 643	512 059 583
MX Z Renegade 600 R	593 HO	512 059 644	512 059 643	512 059 752
Summit Adrenaline 600	593 HO	512 059 656	512 059 657	512 059 583
Summit Adrenaline 600 R	593 HO	512 059 658	512 059 657	512 059 752
MX Z Adrenaline 700	693	512 059 649	512 059 646	512 059 583
MX Z Adrenaline 700 R	693	512 059 645	512 059 646	512 059 752
Legend Sport 700	693	512 059 654	512 059 646	512 059 582
Legend SE 700	693	512 059 652	512 059 646	512 059 752
Grand Touring Sport 700	693	512 059 654	512 059 646	512 059 582

MODEL	ENGINE	CALIBRATED MPEM P/N	CALIBRATION P/N	MPEM P/N
Grand Touring SE 700	693	512 059 652	512 059 646	512 059 752
Summit Adrenaline 700	693	512059 663	512059 660	512 059 583
Summit Adrenaline 700 R	693	512 059 659	512059 660	512 059 752
Summit H.M. 700	693	512059 663	512059 660	512 059 583
Summit H.M. 700 R	693	512 059 659	512059 660	512 059 752
Summit X 700	693	512059 663	512059 660	512 059 583
Summit X 700 R	693	512 059 659	512059 660	512 059 752
MX Z Adrenaline 800	793	512 059 650	512 059 648	512 059 583
MX Z Adrenaline 800 R	793	512 059 647	512 059 648	512 059 752
MX Z Renegade 800	793	512 059 650	512 059 648	512 059 583
MX Z Renegade 800 R	793	512 059 647	512 059 648	512 059 752
Summit Adrenaline 800	793 HO	512 059 664	512 059 662	512 059 583
Summit Adrenaline 800 R	793 HO	512 059 661	512 059 662	512 059 752
Summit X 800	793 HO	512 059 664	512 059 662	512 059 583
Summit X 800 R	793 HO	512 059 661	512 059 662	512 059 752
Summit H.M. 800	793 HO	512 059 664	512 059 662	512 059 583
Summit H.M. 800 R	793 HO	512 059 661	512 059 662	512 059 752
Summit H.M. X 800	793 HO	512 059 664	512 059 662	512 059 583
Summit H.M. X 800 R	793 HO	512 059 661	512 059 662	512 059 752
MX Z 380 F	377	512 059 518	512 059 521	512 058 941
Legend 380 F	377	512 059 518	512 059 521	512 058 941
Grand Touring 380 F	377	512 059 518	512 059 521	512 058 941
Skandic Sport	503	512 059 519	512 059 522	512 058 941
MX Z 550 F	552	512 059 626	512 059 627	512 058 941
Summit 550 F	552	512 059 628	512 059 627	512 059 337
Legend 550 F	552	512 059 626	512 059 627	512 058 941
Grand Touring 550 F	552	512 059 626	512 059 627	512 058 941

CHANGING MPEM CALIBRATION PROGRAM

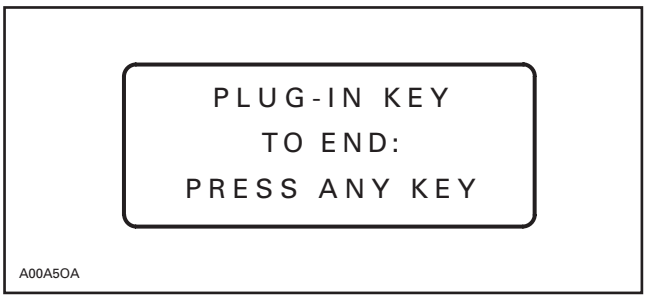
Using VCK (Vehicle Communication Kit)

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

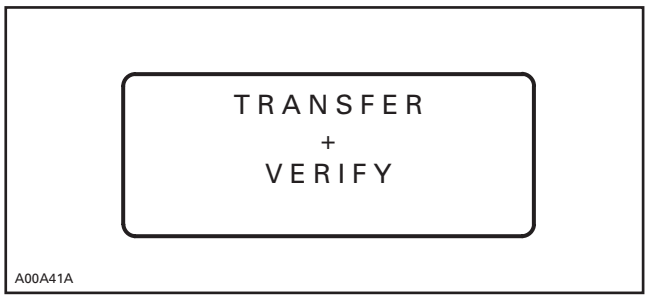
Proceed the same as for checking MPEM calibration but select YES to MODIFY? and press ENTER following screen appears:

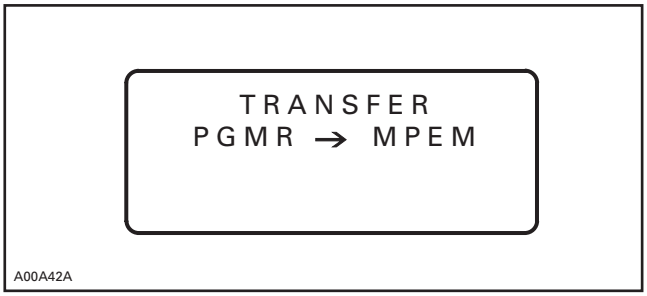
Enter new calibration number and press ENTER, following screen appears:

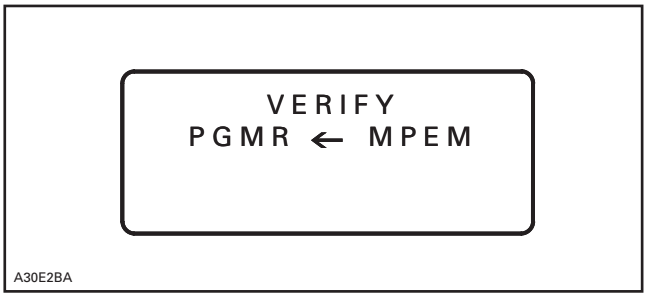


Simultaneously with the following operation a transfer will occur; **←Trs**. At this point, be ready to rev the engine so it won't fall below the 2000 RPM mark when not using 9-volt adaptor.

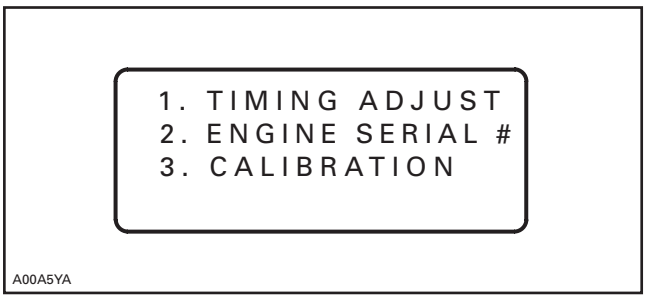
Plug-in the desired calibration cartridge (special red key) onto the programmer post, the following screens will appear temporarily:



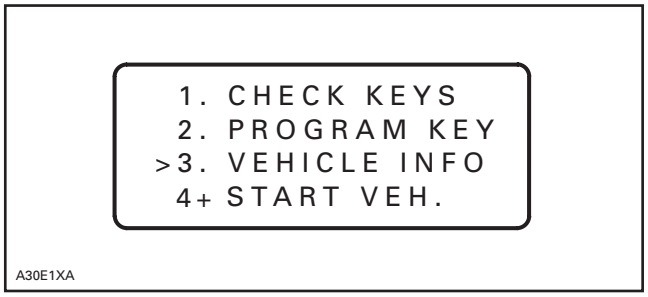




Press any key, display will show followed by next screen:



Press MENU twice, following screen will show:



After procedure is completed, ensure engine idle speed with engine hot is 1800 - 2000 RPM.

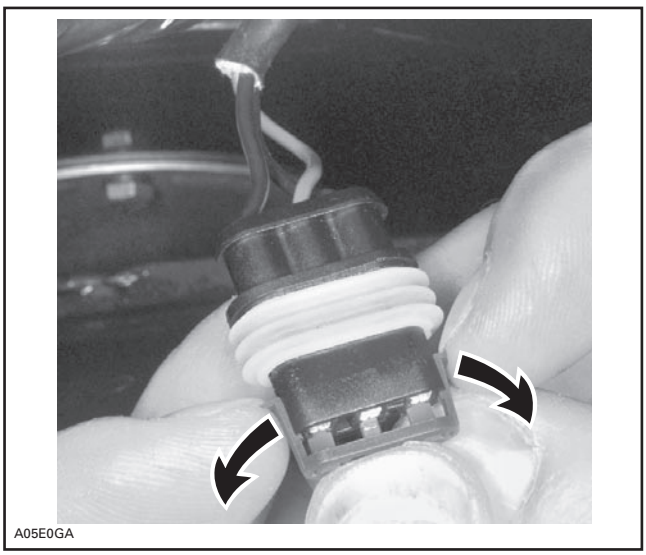
Stop the engine.

ACCESS TO MPEM CONNECTORS

Fan Cooled Models

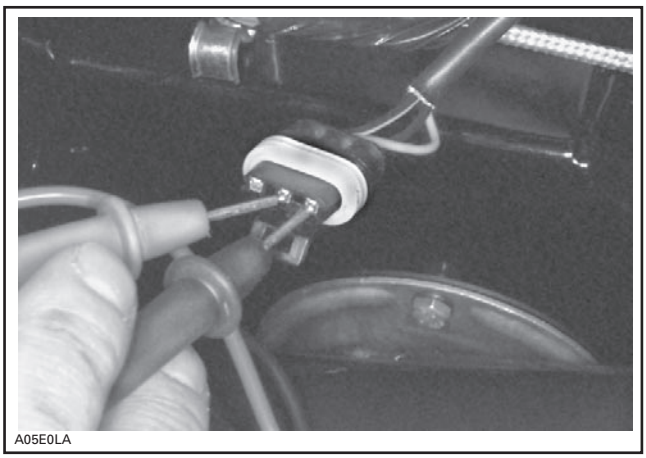
To ease electrical readings on MPEM connectors, connector cap must be removed.

Hold connector in hands then lift both tabs to remove connector cap.



LIFT TABS TO REMOVE CAP

Insert multimeter probes into connector.



TEST USING MULTIMETER PROBES

SYSTEM TESTING

IGNITION SYSTEM TESTING SEQUENCE

In the 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. Ignition switch, DESS switch or tether cut-out switch and engine cut-out switch.
4. Ignition generator coil.
5. Trigger coil.
6. MPEM voltage (liquid cooled models only).
7. High voltage coil (liquid cooled models only).
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

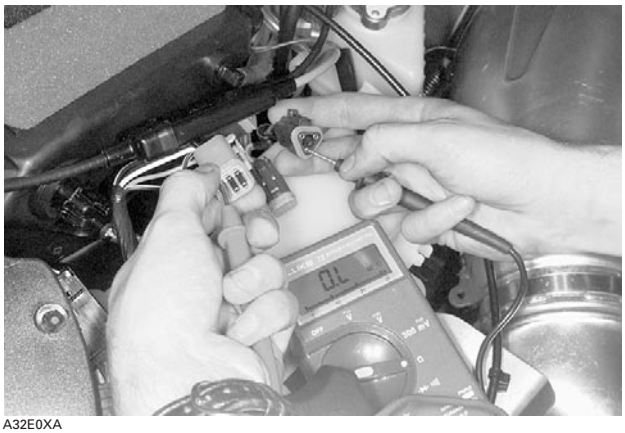
During this operation, it is important to use the snowmobile spark plug and not a new one. Bring the plug in contact with the engine. Pull rewind starter. If no spark is produced, replace the spark plug with a new one and do the test again.

2. ELECTRICAL CONNECTOR TESTING

Make sure that none of the connectors are disconnected.

3. IGNITION SWITCH, TETHER CORD 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

Liquid Cooled Models Only

Tether Cord Switch

Check using a multimeter 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/GREY 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:

Fan Cooled Models Only

Tether Cord 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.

Ignition Switch (key, if equipped)

Disconnect switch housing. Using a multimeter, check between MAG and GRD terminals if the circuit is open (0.L $_{M\Omega}$) in operating position and if the circuit is closed (0 $_{\Omega}$) in off position.

Engine Cut-Out Switch

All Models

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. IGNITION 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

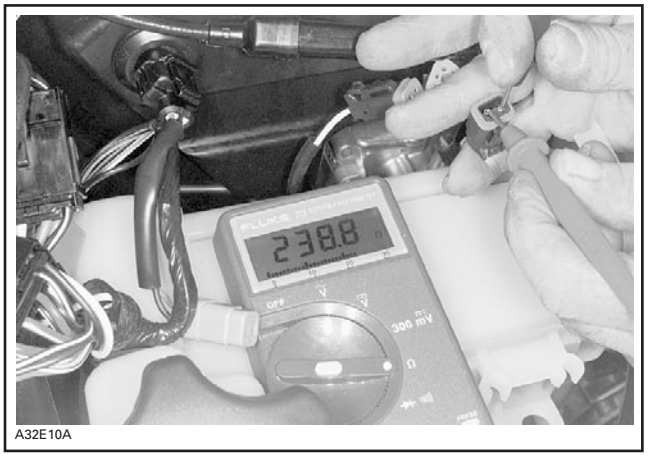
When manually starting the engine while the spark plug is installed, the engine will tend to accelerate beyond the compression point. This will result in higher magneto output power.

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 $\tilde{V}$ 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

Liquid Cooled Models Only

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 $\tilde{V}$ 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

Liquid Cooled Models Only

Resistance Testing

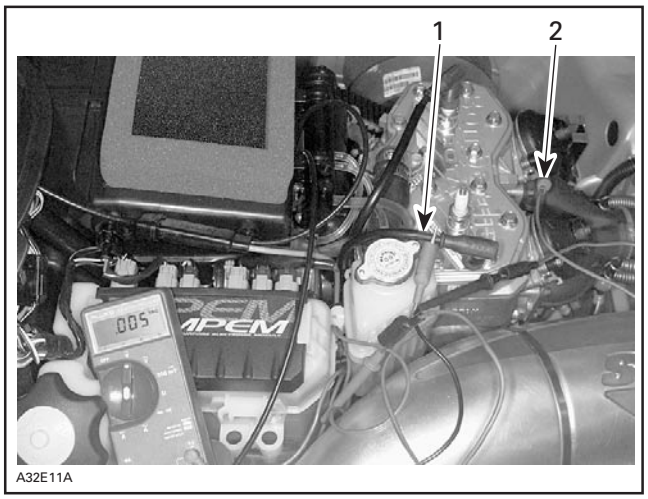
1. Unplug housing between high tension coil and MPEM.
2. Connect multimeter probes to WHITE/BLUE and BLACK wires and measure resistance.


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

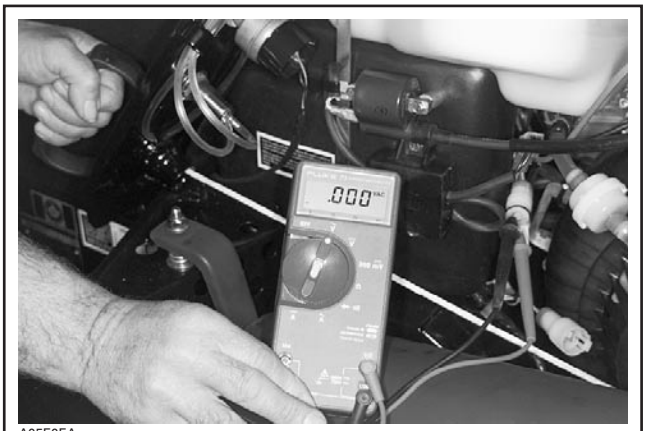
CONCLUSION

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 wires).
2. Connect multimeter probes to YELLOW wires, then 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.



A05E0EA

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.

IGNITION AND LIGHTING SYSTEM TESTING (ZX Fan Series with RER 300 W/340 W)							
PART	TEST TO BE PERFORMED	WIRE COLOR	RESISTANCE Ω		VOLTAGE V		NOTE
			VALUE (ohms)	MULTIMETER SCALE	VALUE (volts)	MULTIMETER SCALE	
Stop switch	Running insulation	BK BK/YL	0.L	00.0 MΩ	—	—	All switches must be in run position.
	Continuity in STOP position	BK BK/YL	00.0 - 00.5	00.0 Ω	—	—	Only one stop switch must be in stop position. Test them one after the other.
Ignition generator coil	Output	RD BK	4.5 - 6.5	00.0 Ω	7.0 - 15.0	00.0 Vac	—
	Ground continuity	BK engine	00.0 - 00.5	00.0 Ω	—	—	The term "engine" refers to the engine metal parts connected to the magneto housing.
Front trigger coil	Resistance and output	WH/YL BL/YL	160 -180	00.0 Ω	.150 - .350	.000 Vac	—
Rear trigger coil	Resistance and output	WH/YL BL/YL	160 -180	00.0 Ω	.150 - .350	.000 Vac	—
MPEM and high voltage coil	Secondary winding resistance with caps	Spark plug cap Spark plug cap	8.90 K - 13.1 K	00.0 KΩ	**CAUTION:** Do not measure high voltage coil output voltage.		
	Secondary winding resistance without caps	BK BK	0.90 K - 1.10 K	00.0 KΩ			
	Secondary winding voltage	BK engine	—	—	.100 - .250	0.00 Vac	The measurement must be taken on the spark plug cable (without the spark plug).
Spark plug cap	Cap resistance	—	4.0 K - 6.0 K	00.0 KΩ	—	—	—
Lighting generator coil	Power	YL YL/BK	00.0 - 00.6	00.0 Ω	3.0 - 7.0	00.0 Vac	—
	Insulation	YL engine	0.L	00.0 MΩ	—	—	The term "engine" refers to the engine metal parts connected to the magneto housing.
	Ground continuity	BK engine	00.0 - 00.5	00.0 Ω	—	—	

NOTE: Engine stop switches include the ignition switch, the tether cord switch and the engine cut-out switch.

It is important to take note that voltage measurements must be taken while starting the vehicle using the manual starter.

Voltages obtained upon starting are proportional to the force applied onto the manual starter. A low voltage is therefore normal under a low cranking force.

Perform testing in the prescribed order and replace any parts not performing according to specifications.

It is important to resume all tests when replacing a component.

If not specified, the probe connecting sequence is not important.

360 W ZX LC 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 ZX LC 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 AC CIRCUIT INSULATION

Fan Cooled Electric Start Models

If AC circuit is not insulated from frame, headlamp beam will weaken.

INSPECTION

Disconnect regulator/rectifier.

Connect one digital ohmmeter probe (needle ohmmeter will not offer enough precision) to frame and other probe to YELLOW wire (2-MO).

Measured resistance must be infinite. If such is not the case, it means there is a connection between AC circuit and frame.

Disconnect one accessory at the time to identify the faulty circuit.

INSPECTION OF HEATING ELEMENTS

All Models

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

Throttle Lever Heating Element

Current Measurement

HIGH INTENSITY	BROWN wire	0.23 A minimum
LOW INTENSITY	BROWN/YELLOW wire	0.13 A minimum

Handlebar Grip Heating Element

Resistance Measurement

300 W, 340 W and 360 W Models

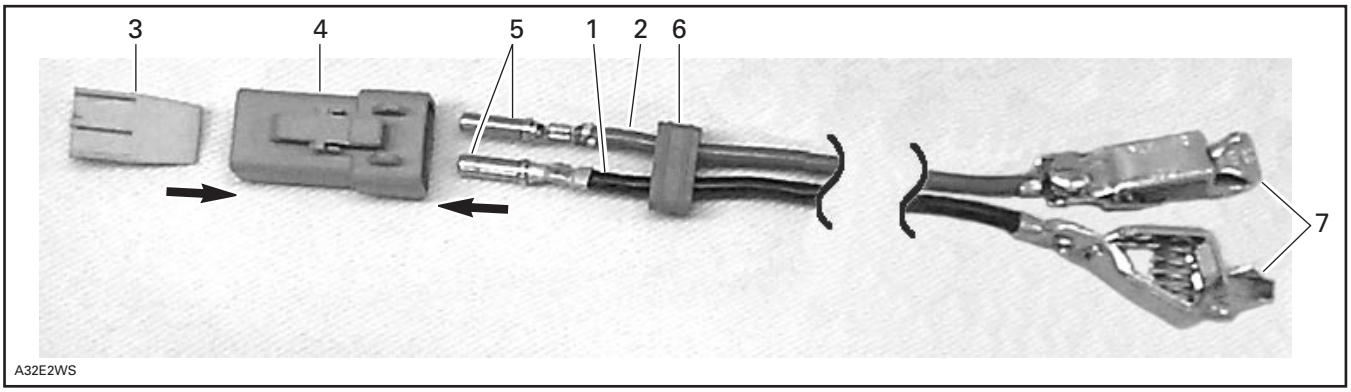
LOW INTENSITY	YELLOW/BLACK wire ORANGE/VIOLET wire	10.9 to ① 13.4 ohms
HIGH INTENSITY	YELLOW/BLACK wire ORANGE wire	5.5 to ① 6.8 ohms

① When measuring resistance at terminals the actual value will be half the measurement in table. The reason for that is the elements are connected in parallel. Therefore the total resistance is half the resistance of one element.

HEADLIGHT AND ACCESSORIES SYSTEM TESTING

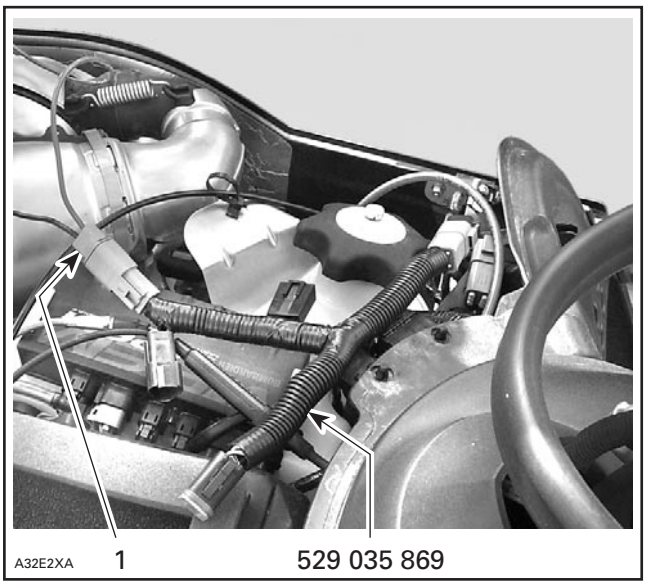
360 W Models Only

Make an homemade adaptor as shown below.



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

Connect 12-Volt supply to the 2 position housing of the supply cable (P/N 529 035 869). Respect polarity by connecting 12V to RED wire and ground to BLACK wire.



1. *Homemade adaptor*

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

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 headlight system testing is done, disconnect supply cable from vehicle and then 12-Volt supply from the supply cable.