PIAGGIO USA, Inc.

Training Material for Vespa ET2/ET4

INDEX

FAULT FINDING

ENGINE RUNNING RICH

SYMPTOMS.

- Vehicles will not start or has cut out and will not restart - The plug is found to be very black and fouled.
- High fuel consumption - The plug is found to be very black and fouled.
- Black/badly carboned spark plug.

If you see a black plug satisfy yourself that it is due to excess fuel.

- Thick black sooty build up = excess fuel.
- Black and obviously oily = Oil pump setting.
- Black and shiny, as if it has been polished with shoe polish = weak spark.

If the plug looks wet but you cannot tell if it is gasoline or oil remember that gasoline will evaporate, oil will not.

POSSIBLE REASONS.

- Choke staying on.
- Carburetor flooding.
- Faulty vacuum tap.
- Air filter clogged.

TESTS.

Choke staying on.

Remember that the choke defaults to ON.
Refer to the information below about testing the choke to answer these questions:

1. Is the choke getting power when the engine is running?
2. Is the choke unit working?

Carburetor flooding.

Refer to the information below to understand the test for fuel level.

1. Is the fuel level reasonable with the engine idling?
2. Does the level begin to drop when the engine is run at high speed for a period?

Faulty vacuum tap.

If the diaphragm in the vacuum tap is split then fuel can be sucked down the vacuum pipe and into the manifold.
Remove the vacuum pipe from the tap. If the pipe is wet inside the tap must be faulty.

Air filter clogged.

It is unlikely that a reasonably new vehicle will have a clogged filter but is worth checking if you are running out of ideas. A high mileage vehicle may have collected a lot of dust that is clogging the element. Replacement is probably the best solution.

AUTOMATIC CHOKE OPERATION

The automatic choke units used on Vespa motor scooters are both basically the same and both work in the same way.
Remember that the choke defaults to being **ON** so it is unlikely that a cold starting problem is due to a malfunctioning choke.

OPERATION

- The choke unit has a plunger that is pushed down to close off a hole at the bottom of a drilling in the carburetor.
- A wax pellet is heated electrically and expands, as it heats up it pushes out the plunger. As the wax warms the electrical resistance measured across it increases until it becomes open circuit. In most circumstances the choke will then remain off purely by the heat of the engine.
- The time taken for the choke to turn off is controlled only by the rate at which the wax expands. The ambient temperature will affect the time taken for the choke to turn off.
- The choke is activated once the engine has started and **not** when the ignition is turned on.

Vespa ET2 50cc engine.

These motor scooters have headlights that are run from 12 volts AC.
12 volts AC is used to operate the choke. AC can only be supplied when the engine is running so the choke cannot begin to turn off until the engine is running.

Vespa ET4 150cc LEADER engine.

ET4 employs a relay so that the choke will be powered by DC but is triggered by the AC supply when the engine starts.

FAULTS

The most likely choke fault is the choke remaining ON. Symptoms will be anything that may be caused by a rich mixture.

1. High fuel consumption.
2. Black spark plug.
3. Rough running when hot. OK when ridden hard but rough and four stroking at 20 mph.
4. Fails to start. Plug is found to be black and fouled.

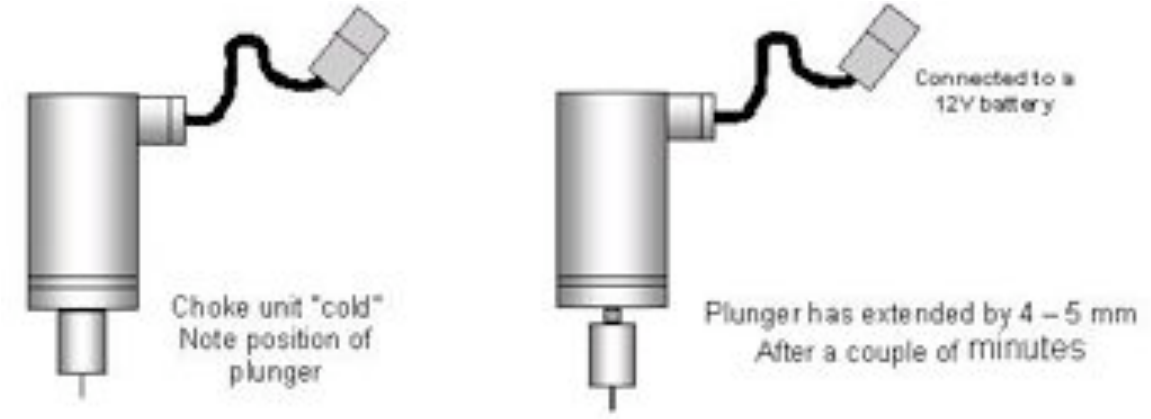
To check if the choke unit is operating.

Refer to diagram 1.

1. Remove choke unit from the carburetor.
2. Measure the distance the plunger is protruding from the body, when it is cold.
3. Attach a 12 Volt battery to the socket and leave it for two or three minutes.
4. The plunger should have extended by 4-5 mm.
5. Disconnect the battery.

The plunger should retract slowly over a couple of minutes.

Diagram 1 – Choke unit operation



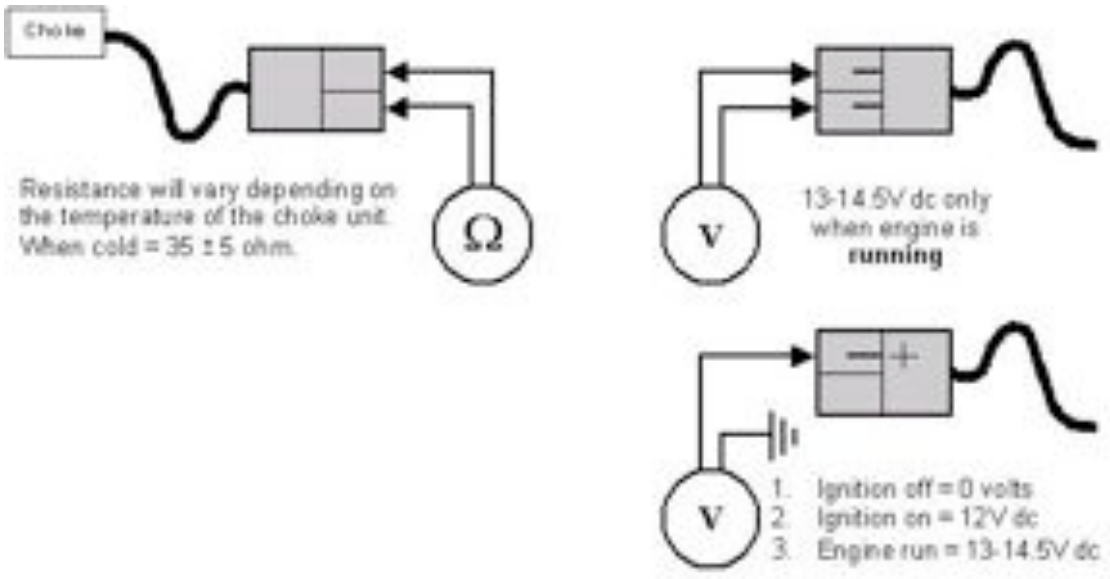
To check the choke circuit.

Refer to diagram 2 for ET2. Diagram 3 for ET4

1. Follow wire from the choke unit until you find a grey two-pin plug and socket. Unplug.
2. Resistance check will confirm continuity through the choke unit.
3. To prove the choke circuit. Connect a voltmeter across the two pins of the socket. With the engine running you should have system voltage. If no voltage then the choke will not turn off.

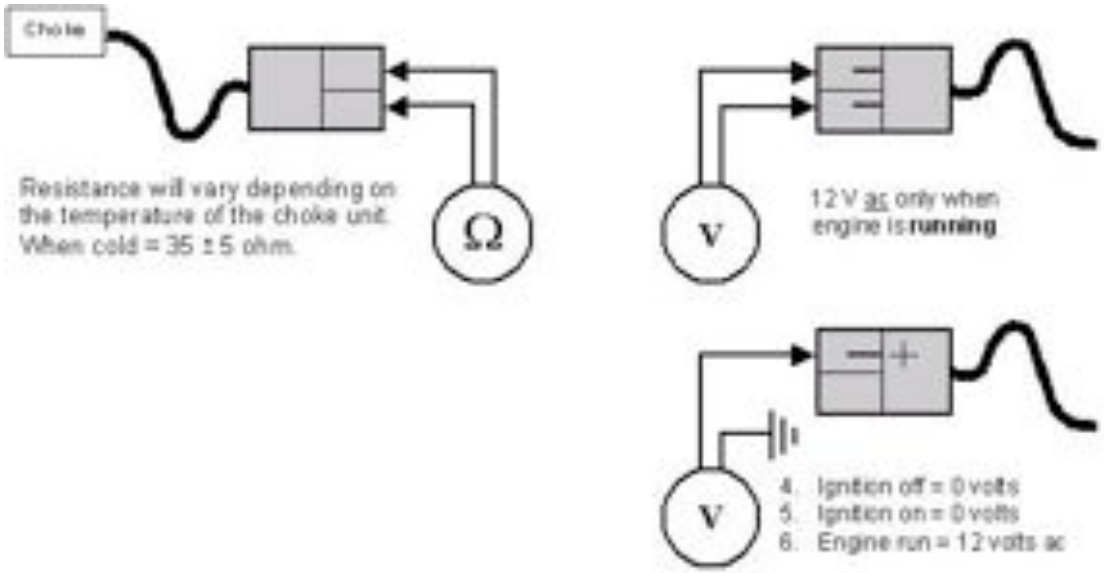
Note. Remember that the choke defaults to being ON. If the choke does not turn off the symptom will be a black and fouled plug. Or; the scooter starts and idles ok and runs at speed ok. When riding slowly (20 mph) the engine runs very roughly and four strokes badly.

Diagram 2 – Choke unit power supply. Vespa ET4



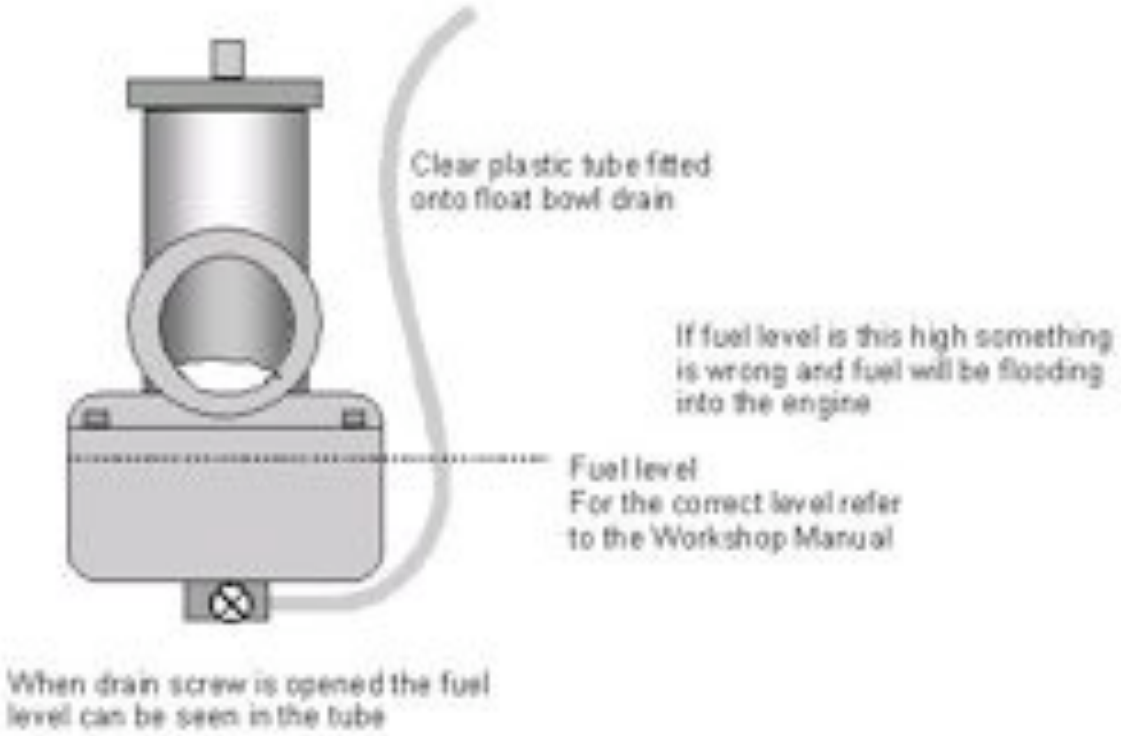
Note. Choke units all look much the same but are different and it is important to use the correct choke in the correct carburetor.

Diagram 3 – Choke unit power supply. Vespa ET2



Note. Choke units all look much the same but are different and it is important to use the correct choke in the correct carburetor.

Diagram 4 – Checking carburetor fuel level



If you find the float bowl only half full then the engine will run weak and may be hard to start.

150cc L.E.AD.E.R. Engine

IGNITION, CHARGING & IMMOBILIZER

Use these notes in conjunction with the circuit diagram

The electrical system on the new Leader engine is very different to previous two stroke and four stroke Piaggio engines. The ignition, charging & immobilizer circuits do not function in the same way and do not share common components with previous versions.

- Ignition is now using the battery circuit. Everything shares one common supply.
- Alternator has three phase (all yellow) and ignition pick up coil (green) outputs only.
- Rectifier / Regulator is very simple. Three phase (yellow) inputs and one (red / blue) output.
- CDI unit has become more complicated. The one unit is responsible for; ignition, immobilizer, indicators & choke unit.

Ignition.

When the ignition is turned on power is supplied to the CDI via the orange wire (terminal 5).
Ignition pick up is via green wire (terminal 2).
Output to the HT coil is via purple wire (terminal 3).
The unit is earthed via black wire (terminal 8).

Immobilizer.

The wires connected to the unmarked terminals are from the antenna that is mounted around the ignition lock barrel.
The red / blue wire (terminal 4) supplies battery voltage even with ignition off.
Yellow wire (terminal 6) supplies the LED on the instrument panel. This LED should be flashing with the ignition turned off to confirm that the immobilizer system is functioning.
See the notes below about using the LED for immobilizer fault finding.

Indicators.

There is no separate indicator relay. The relay function is contained within the CDI unit,
Power to the indicator switch is via the blue / black wire (terminal 1).

Choke unit.

The choke is now controlled by the CDI (not the regulator).
Power is supplied to the choke via the orange wire when the ignition is turned on. The unit will not function until the engine is running when the CDI will complete the circuit to earth via the white / black wire (terminal 7).

Carburetor choke.

The carburettor heater will start working as soon as the ignition is turned on. Power is supplied via the orange wire.

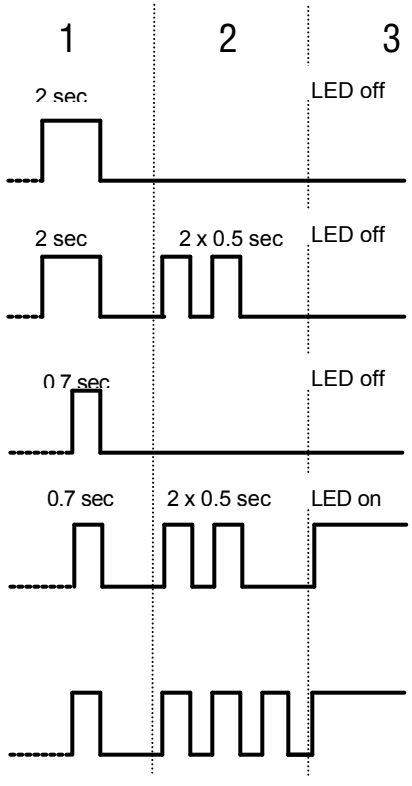
TESTING.

Immobilizer.

- Normally use the blue key for testing.
- The diagnostic test socket is on the right hand side and will be seen once the helmet storage compartment is removed. Use the exiting test box in this socket.
- Testing can be done by using the instrument panel mounted LED.
- If the system is working normally the LED will be flashing when the ignition is off and it will stop flashing when the ignition is on.
- If the immobilizer system is faulty, when the ignition is switched on there will be a series of flashes.
- The flashes hold a key to the fault.

1. The first flash will be long (2 seconds) or short (0.7 second). A Long flash means the CDI is not programmed. Short flash if the CDI is programmed.
2. Next is a series of short (0.5 second) flashes.
   1 flash = CDI not grounded
   2 flash = No transponder detected. Fault with Key or antenna.
   3 flash = Transponder detected but not recognized.
   4 flash = System not programmed.
3. The last thing to notice is whether the LED finally remains on or off.
   OFF = Ignition is possible.
   ON = Ignition is not possible.

Examples.



CDI not programmed. *Engine will run up to 2000 rpm*

CDI not programmed. Key transponder not detected.
Fault with transponder or aerial.
Engine will run up to 2000 rpm.

CDI programmed. System function normally.

CDI programmed. Key transponder not detected.
Fault with transponder or aerial.
Ignition not possible

CDI programmed.
Key transponder detected but not recognized.
Ignition not possible

Stator.

Any yellow-to-yellow should give continuity.
Yellow to ground should not give continuity.

CDI.

Note that the ET4 Leader and ET2 use <u>different</u> CDI units.

CDI Unit connections

-	Antenna
-	-
-	Antenna
6	Yellow - diagnostic LED control
1	Black / Blue - Output to indicator switch (12v switching on / off)
8	Black - Ground
3	Purple - Output to HT coil
4	Red / Blue - input. Battery voltage even with ignition switched off.
5	White/Red - input. Battery voltage only with ignition on.
7	White/Black - input from choke. To ground only when engine is running.
2	Green - input. Pulse from ignition pickup.

HT Coil.

- Purple to Black - primary winding
- HT to Black - secondary winding

WHAT TO DO IF YOU NEED TO CHANGE AN ET4 LOCK BARREL

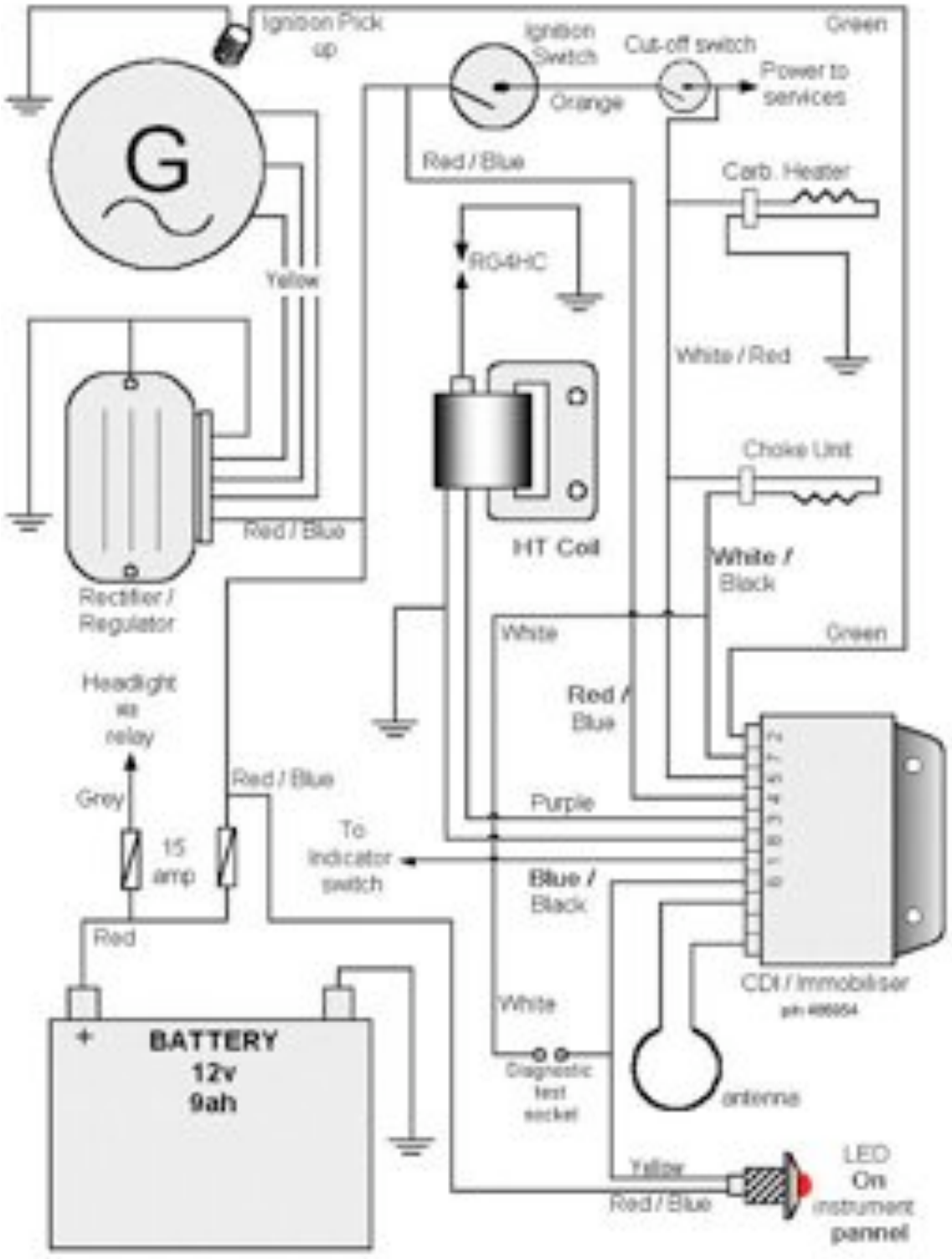
IF YOU DO NOT HAVE THE ORIGINAL RED KEY:

If you do not have the original RED key then the only solution is to change the Immobilizer and CDI unit as well.

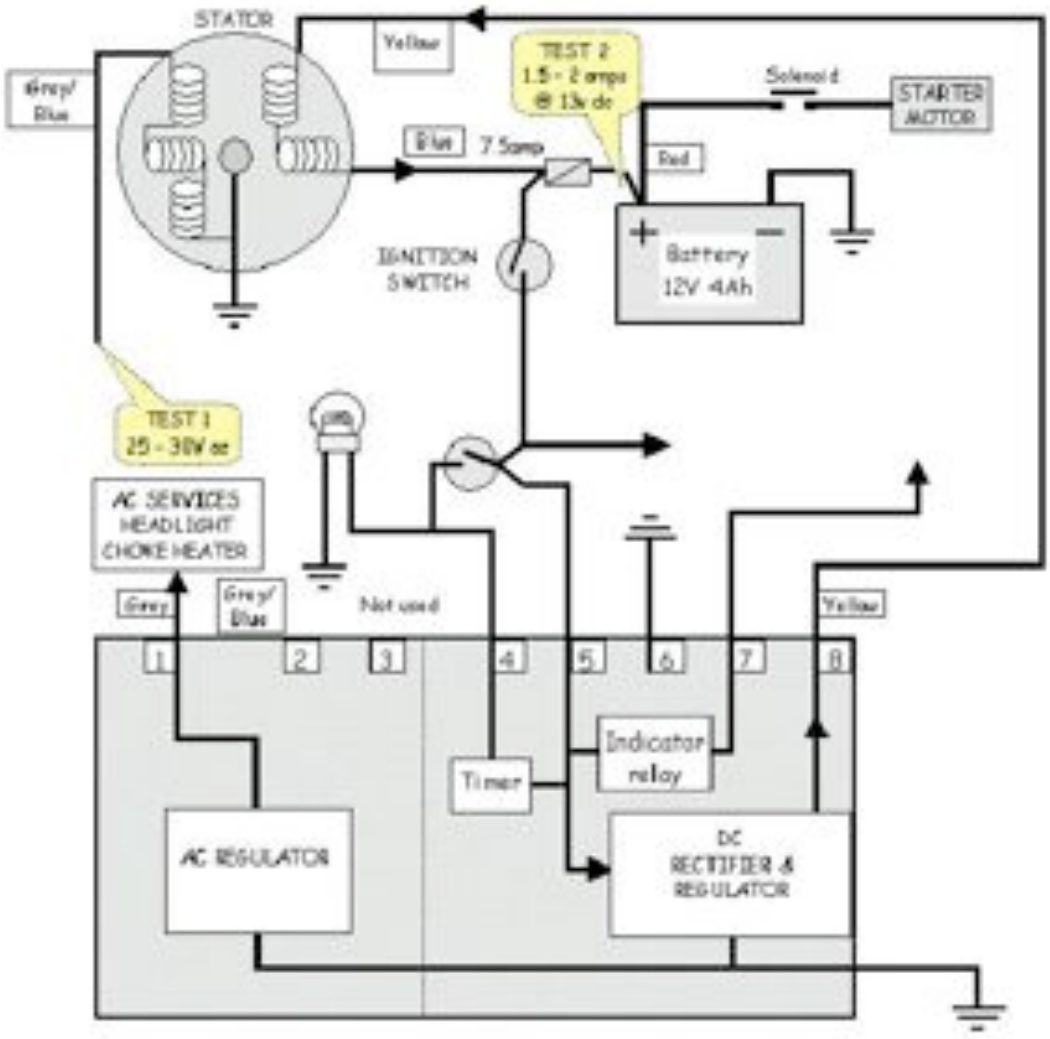
IF YOU HAVE THE ORIGINAL RED KEY:

1. Order a lock barrel set p/n: 573430. This is supplied with a pre cut RED key.
2. Order a BLUE key p/n: 573426.
3. Fit the new lock barrels.
4. Remove the flip up transponder from the OLD RED key by separating the two halves of the key slightly with a screwdriver. Do the same to the NEW RED key and then fit the OLD transponder into the NEW key. Now the immobilizer system will function as normal (It will not know anything has changed).
5. Get the new blue key cut and then program it in the normal way.

L.E.AD.E.R. 150cc IGNITION/CHARGING



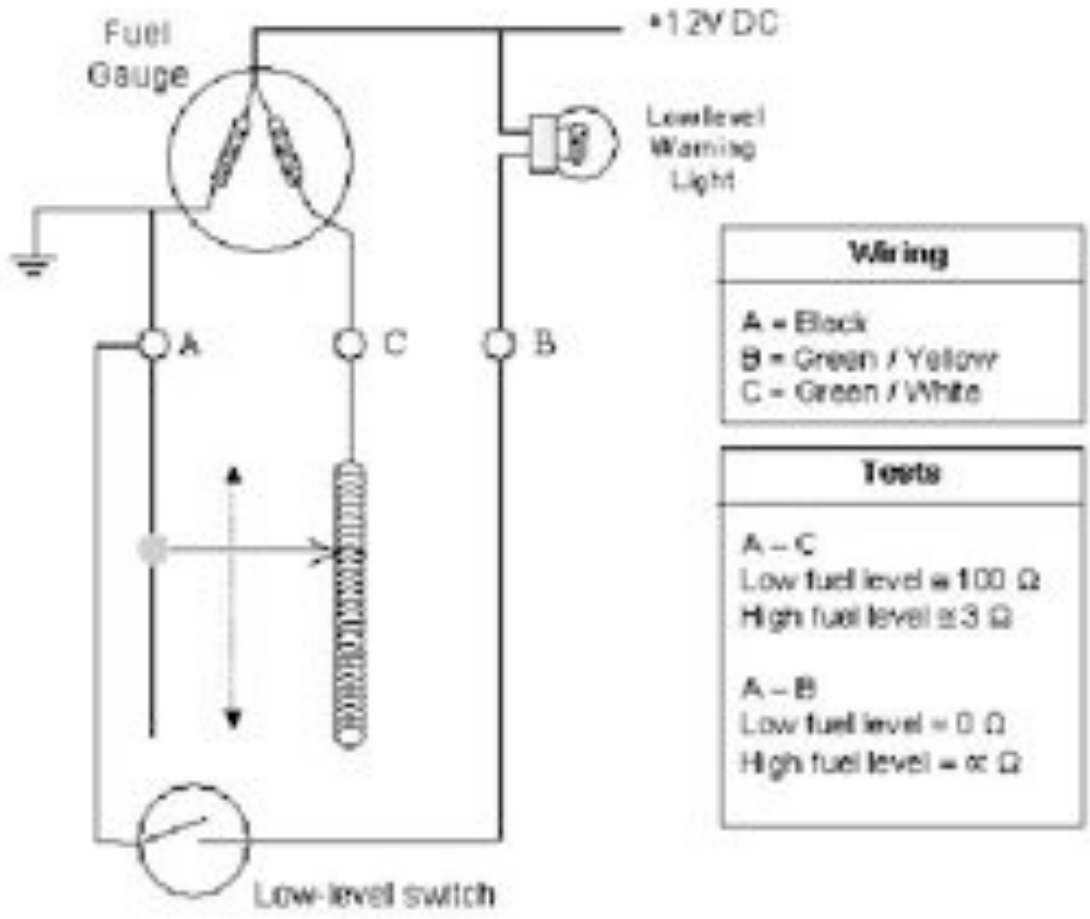
ET2 CHARGING CIRCUIT

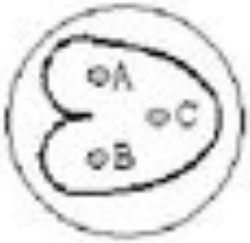


Note: oil light remains alight for 15 seconds after turning ignition on

- Alternator stator and control box both have separate components for AC and DC circuits.
- AC output is full wave and regulated.
- DC output is half wave rectified and regulated.
- DC regulation is on negative side of the alternator.
- If the voltage on terminal **5** is below 8V DC approx. (flat battery) when starting, the DC rectifier/regulator will not function so there will be no output from the alternator on the DC circuit. Connect a booster battery to raise the voltage when starting; this will make the rectifier/regulator function.
- Choke heater will only begin to operate once the engine is running. (AC circuit)
- The oil warning light will "self check". Every time the ignition is turned on the light will come on for 15 seconds.
- These vehicles do not have a separate indicator relay.
- **Tests**. 1. Blue/Grey to Ground = 25 – 30 volts AC @ 3000 rpm.
  2. Ammeter between red and battery positive = 1.5 – 2 amps with battery at 13 volts

ET2 & ET4 FUEL GAUGE SENDER AND CIRCUIT

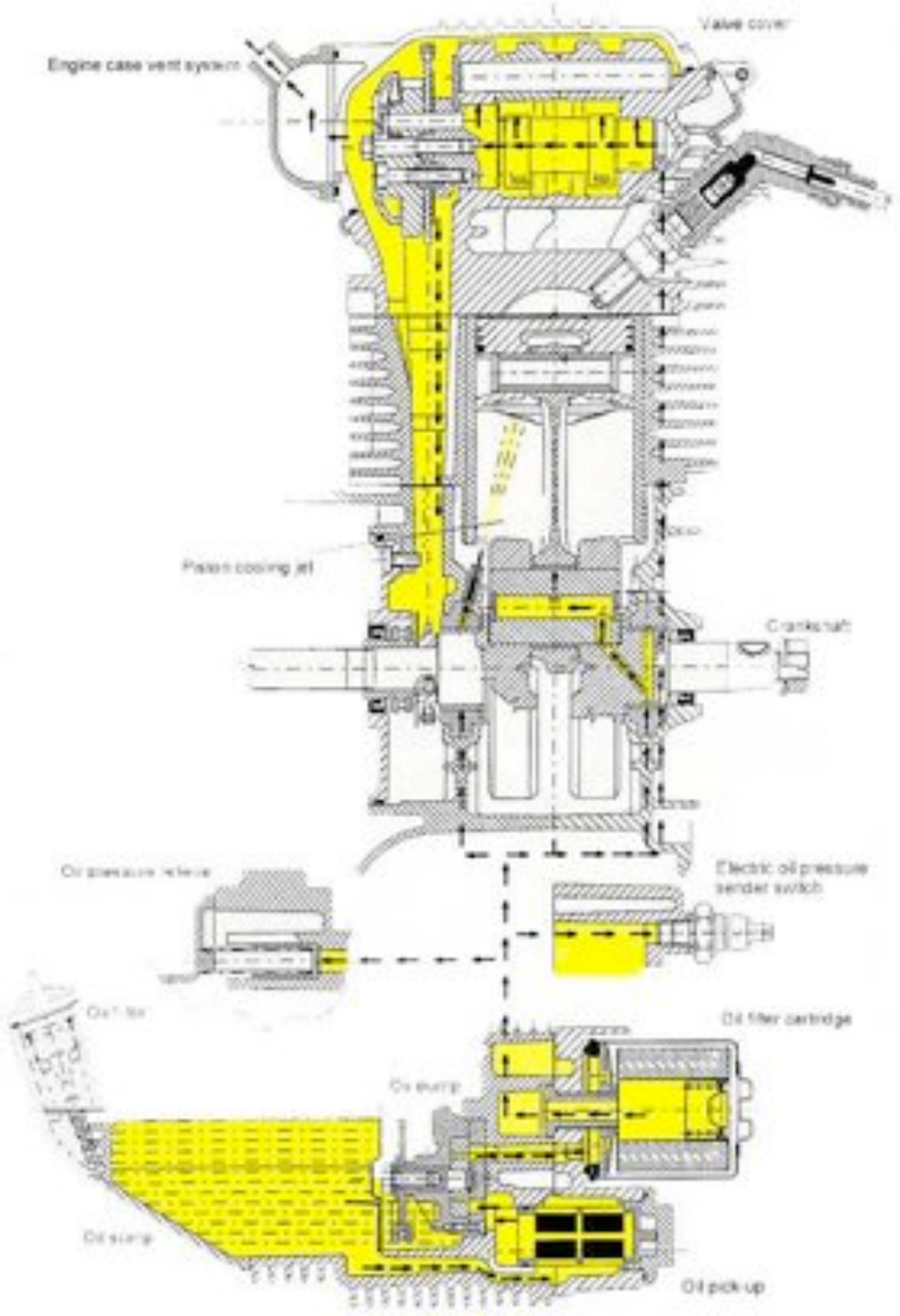




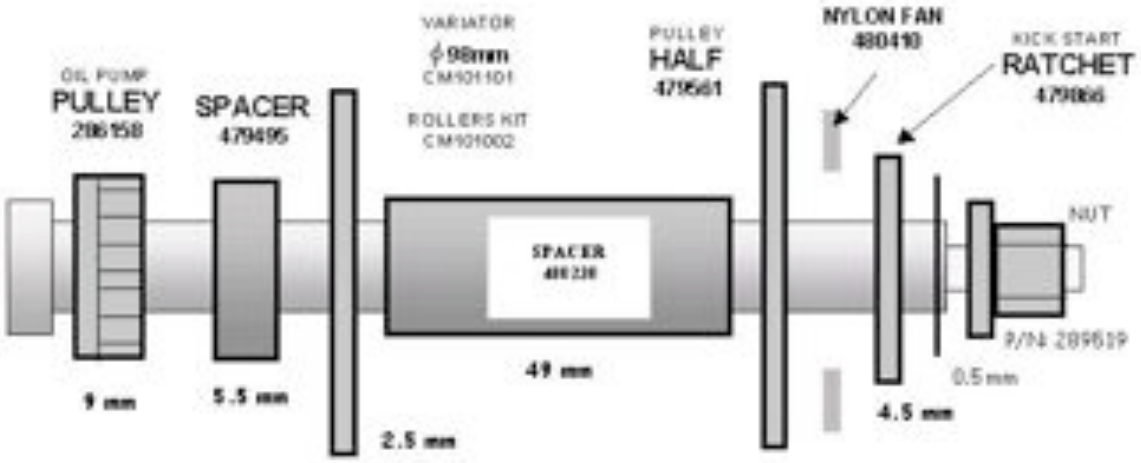
Top view of the fuel sender unit

The fuel sender units used on the automatic scooters may look different but the circuit and method of operation is always basically the same.
Vehicles without a fuel gauge have the low fuel warning light and will have a two pin wiring connector. The wiring logic will still be as above.

L.E.AD.E.R. 150cc ENGINE SECTION



VESPA ET2 CRANKSHAFT COMPONENTS (Range 3.9)



- Crankshaft spline length from shoulder at main bearing to the end is always 72.5 mm.
- The component stack as shown above must be 74.0 mm
- Important. The nut must not bottom on the crankshaft shoulder.
- Assemble all the components on the shaft without the fan. Check that the splines end 1 mm below the face of the kick-start plate.
- **DO NOT** grease variator rollers.
- Always use a new nut. Use Locktite 242F or similar and torque to 40-44 N.M. by means of the specific half pulley holding tool P/N 020165Y

ET2/4 SPECS. CHART

	ET2	ET4
Cost:	2,950 USD	3,950 USD
Made in:	Pontedera, Italy	Pontedera, Italy
Frame:	Pressed steel monocoque type	
Engine type:	Single cylinder, ottocycle 2-stroke	Single cylinder, ottocycle 4-stroke
Engine power:	5.1 bhp	11.26 bhp
Bore:	1.8 in. (46 mm)	2.6 in. (52.6 mm)
Stroke:	1.5 in. (39.3 mm)	1.9 in. (48.6 mm)
Compression ratio:	10.2:1	Ranging from 10.1 to 11.1:1
Engine size (Displacement):	3 cu.in. (49.4 cc.)	9.1 cu.in. (149.56 cc.)
Lubrication:	Separate with automatic oil pump	Chain-driven lobe pump
Oil:	2-stroke full synthetic oil (Selenia oil is recommended)	4-stroke synthetic oil (Selenia oil is recommended)
Fuel:	Unleaded, 92 octane minumum	
Fuel capacity:	2.4 gal (9 l)	
Mileage:	Approx. 95 MPG	Approx. 40 MPG
Induction:	Reed valve in crankcase	SOHC (Single Over Head Camshaft)
Ignition:	Electronic CDI (note: the letter "E" in ET stands for electronic ignition)	Electronic CDI and variable timing (note: the letter "E" in ET stands for electronic ignition)
Starter:	Electric and kickstart	
Engine cooling:	Forced air	
Weight (curbside):	216 lbs. (98 kg)	236 lbs. (107 kg)
Length:	69.3 in. (1,760 mm)	
Width:	26.4 in. (670 mm)	
Wheel base:	50.4 in. (1,280 mm)	
Seat height:	31.7 in. (805 mm)	
Top speed:	48 mph (88 km/h)	61 mph (98 km/h)
Wheels:	Aluminum alloy:	Aluminum alloy:
	Front 2.50 x 10"	Front 2.50 x 10"
	Rear 3.00 x 10"	Rear 3.00 x 10"
Front tire:	100/80-10" Pirelli SL38	100/80-10" Pirelli SL38
Rear tire:	120/80-10" Pirelli SL38	120/80-10" Pirelli SL38
Transmission:	CVT (Continuous Variable Transmission)	
Clutch:	Automatic, centrifugal type	
Front suspension:	Swinging arm (semioleodynamic type) with helicoidal spring and hydraulic double effect damper. This type of suspension has been adopted on all Vespa models since 1946.	
Rear suspension:	Helicoidal spring and hydraulic double effect damper	Helicoidal adjustable spring and hydraulic double effect damper
Front brake:	Disc brake (diameter 7.9 in./200 mm) with hydraulic linkage (r.h. brake lever) and dual piston hydraulic caliper	
Rear brake:	Drum brake (diameter 4.3 in./110 mm) with mechanical linkage (l.h. brake lever)	
Warranty:	1 year, unlimited miles	
Colors:	Black (Nero) Cobalt Blue (Blu Cobalto) Dragon Red (Rosso Dragone) Ivory (Bianco Capodimonte) Light Blue (Celo) Light Green (Verde Carducci) Pearl (Perla) Platinum (Platino)	Black (Nero) Cobalt Blue (Blu Cobalto) Dragon Red (Rosso Dragone) Ivory (Bianco Capodimonte) Light Blue (Celo) Light Green (Verde Carducci) Pearl (Perla) Platinum (Platino)

ASSISTENZA TECHNICAL INFORMATION BULLETINS

NUMBER 001, OCTOBER 2001

Vespa ET4 sealed battery

It has come to our attention that there were a number of Vespa ET4 scooters that were fitted with acid type batteries from the factory. If you receive a Vespa with the wrong battery fitted please remove the battery and place the VIN # of the vehicle it came out of on it. Please return any wrong batteries that you have collected at the end of the month and bill Piaggio USA for the shipping. Please order a replacement battery on a Pre-Sales order form and fax it to (310) 604-3989 and we will send the replacement battery to you second day shipment. All Vespa ET4's shipped after the August 19 will arrive fitted with the proper battery. We at Piaggio would like to apologize for this problem and any inconvenience that it may have caused.

Correct battery

12V-10A maintenance-free type

Incorrect Battery

12V-12A Acid type

NUMBER 002, OCTOBER 2001

Vespa ET2 & ET4 carburetors

We have noticed an increasing number of carburetor change outs in the Warranty claims. Piaggio USA will not honor the warranty replacement of complete carburetors unless there is a broken part or a manufacturer's defect. All carburetors that are not functioning properly must be disassembled and properly cleaned and reinstalled before approval to replace the carburetor will be given by the Vespa Assistenza Department. Please see Technical notes below on the symptoms and causes and repair of the ET2 and ET4 carburetors.

ET2 Carburetor Problems

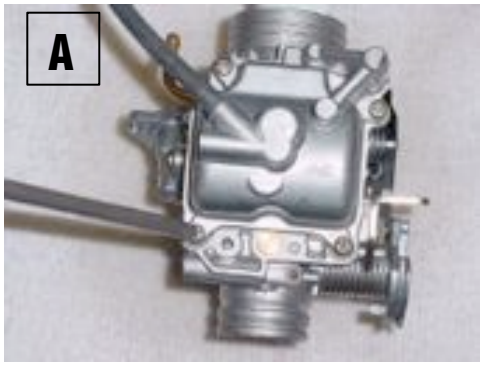
Symptoms: After PDI the Vespa will not start and gas overflows from the carburetor.

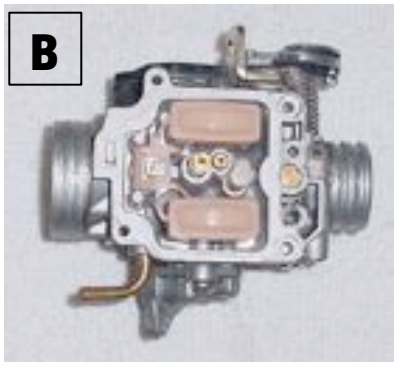
Action: In this case the float needle is most likely stuck to the seat in the carburetor (please see picture below). To fix this problem you can remove the float bowl and gently pull the float up in order to release the needle from the seat. Another option is to remove the fuel line to the carburetor and gently blow compressed air into the line thus causing the needle to push away from the seat. If done properly, once the needle is separated from the seat and gasoline is able to pass through the seat the problem should not reoccur.

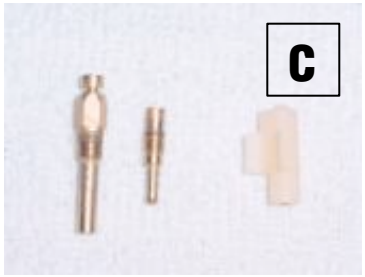
ET4 Carburetor Problems

Symptoms: Vespa will start and idle but dies as soon as the accelerator is turned. This symptom is very similar to the CDI not being programmed but it will not gain slightly in rpm's when the throttle is turned, as it will do if the CDI is not programmed.

Action: In this case the problem is usually a clogged pilot jet. The idle circuit is running off of the choke jet and this is allowing the scooter to start and idle but as soon as you turn the throttle there is no transition from the pilot circuit to the main jet and the scooter will die. Turn the carburetor over and remove the four float bowl screws (A). Remove the jets (B) as pictured below and clean the carburetor and the jets thoroughly with carburetor cleaner and a jet pick. Please be careful not to get carburetor cleaner on any of the other engine components as it may ruin surface finishes. After the carburetor and jets have been thoroughly cleaned and the carburetor refitted (c) the running problem should be solved.







Warning:

When working with gasoline or other harmful chemicals, please be sure to use gloves and proper eye protection and always work in a well-ventilated area and do not work near an open flame or hot surfaces.

Programming ET4 immobilizer system

We have had a few questions lately on how to properly program keys for the ET4. Review the instructions and pictures below to help you program new keys. The red key opens and closes the circuit. All of the un-programmed blue keys should be introduced in between the red keys. You can program up to seven blue keys.

1. Separate the keys and remove all key chains.

2. Put the red key in the ignition.

3. Turn the key to the "on" position.

4. Turn the key "Off" when the LED comes on.

5. Remove the red key.

6. Place the blue key in the ignition within 6 seconds.

7. Turn the key to the “On” position.

8. Turn the key “Off’ when the LED comes on.

9. Remove the blue key.
(Repeat steps 6 -9 for additional blue keys)

10. Put the red key in the ignition within 6 seconds.

11. Turn the key to the “On” position.

12. Turn the key “Off” before the LED comes on.

13. Remove the red key to close the circuit.

NUMBER 004, DICEMBER 2001

Vespa ET2 spare parts catalog update

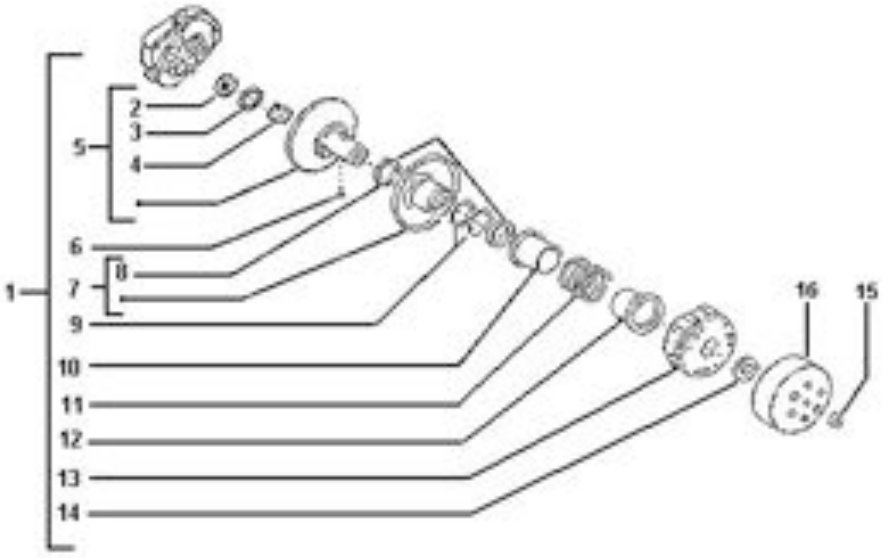
On page 28, table 7 has been updated to reflect proper part descriptions and part numbers for the items shown within the graph. Please open the document title Table 7 and add a copy to all of your ET2 Parts Books.

PIAGGIO

PULEGGIA CONDOTTA
POULIE ENTRAINEE
DRIVEN PULLEY
GETRIESENE RIEMENSCHEIBEN
POLEA CONDUCIDA

T. 7

ZAPC 1600



Pos. Pos. Loc. Pos. Pos.	Numero Numéro Number Nummer Número	Q.tà Q.té Q.ty M.ge Cant	Nota Nota Note Anm. Nota	Denominazione	Designation	Decription	Beschreibung	Descripción
1	CM1001015	1		Puleggia	Poulie	Pulley	Riemenscheibe	Polea
2	289953	1		Cuscinetto	Roulement	Bearing	Lager	Cojinete
3	006824	1		Anello	Circlips	Ring	Ring	Anillo
4	289952	1		Astuccio a rulli	Cage á roul.	Roller cage	Rolleniagerkafig	Jaula rodillos
5	4795526	1		Semipuleggia	Demi poulie	Pully, half	Riemenscheibenhälfte	Semipolea
6	482766	3		Perno	Pivot	Pin	Zapfen	Perno
7	436785	1		Semipuleggia	Demi Poulie	Pully, half	Riemenscheibenhälfte	Semipolea
8	289950	1		Anello	Circlips	Ring	Ring	Anillo
9	289840	2		Guarnizione	Joint	Packing	Dichtung	Junta
10	483443	1		Scodellino	Rondelle d'ar	Sleave	Federaufnahme	Platillo
11	479028	1		Molla	Ressort	Spring	Feder	Muelle
12	487935	1		Scodellino	Rondelle d'ar	Sleave	Federaufnahme	Platillo
13	CM1002015	1		Gr.frizione	Gr.embrayage	Clutch assy	Kupplungbacken	Gr.embrague
14	289955	1		Ghiera	Douille	Ring nut	Gewindeerring	Casquillo
15	289519	1		Dado	Ecrou	Nut	Mutter	Tuerca
16	289933	1		Tamburo Frizione	Tambour d'embr	Clutch drum	kupplungstrommel	Tambor de embr.

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