Length (distance)

Inches (in)	x 25.4	=	Millimetres (mm)	x 0.0394	=	Inches (in)
Feet (ft)	x 0.305	=	Metres (m)	x 3.281	=	Feet (ft)
Miles	x 1.609	=	Kilometres (km)	x 0.621	=	Miles

Volume (capacity)

Cubic inches (cu in; in^3)	x 16.387	=	Cubic centimetres (cc; cm^3)	x 0.061	=	Cubic inches (cu in; in^3)
Imperial pints (Imp pt)	x 0.568	=	Litres (l)	x 1.76	=	Imperial pints (Imp pt)
Imperial quarts (Imp qt)	x 1.137	=	Litres (l)	x 0.88	=	Imperial quarts (Imp qt)
Imperial quarts (Imp qt)	x 1.201	=	US quarts (US qt)	x 0.833	=	Imperial quarts (Imp qt)
US quarts (US qt)	x 0.946	=	Litres (l)	x 1.057	=	US quarts (US qt)
Imperial gallons (Imp gal)	x 4.546	=	Litres (l)	x 0.22	=	Imperial gallons (Imp gal)
Imperial gallons (Imp gal)	x 1.201	=	US gallons (US gal)	x 0.833	=	Imperial gallons (Imp gal)
US gallons (US gal)	x 3.785	=	Litres (l)	x 0.264	=	US gallons (US gal)

Mass (weight)

Ounces (oz)	x 28.35	=	Grams (g)	x 0.035	=	Ounces (oz)
Pounds (lb)	x 0.454	=	Kilograms (kg)	x 2.205	=	Pounds (lb)

Force

Ounces-force (ozf; oz)	x 0.278	=	Newtons (N)	x 3.6	=	Ounces-force (ozf; oz)
Pounds-force (lbf; lb)	x 4.448	=	Newtons (N)	x 0.225	=	Pounds-force (lbf; lb)
Newtons (N)	x 0.1	=	Kilograms-force (kgf; kg)	x 9.81	=	Newtons (N)

Pressure

Pounds-force per square inch (psi; lbf/in^2; lb/in^2)	x 0.070	=	Kilograms-force per square centimetre (kgf/cm^2; kg/cm^2)	x 14.223	=	Pounds-force per square inch (psi; lbf/in^2; lb/in^2)
Pounds-force per square inch (psi; lbf/in^2; lb/in^2)	x 0.068	=	Atmospheres (atm)	x 14.696	=	Pounds-force per square inch (psi; lbf/in^2; lb/in^2)
Pounds-force per square inch (psi; lbf/in^2; lb/in^2)	x 0.069	=	Bars	x 14.5	=	Pounds-force per square inch (psi; lbf/in^2; lb/in^2)
Pounds-force per square inch (psi; lbf/in^2; lb/in^2)	x 6.895	=	Kilopascals (kPa)	x 0.145	=	Pounds-force per square inch (psi; lbf/in^2; lb/in^2)
Kilopascals (kPa)	x 0.01	=	Kilograms-force per square centimetre (kgf/cm^2; kg/cm^2)	x 98.1	=	Kilopascals (kPa)
Millibar (mbar)	x 100	=	Pascals (Pa)	x 0.01	=	Millibar (mbar)
Millibar (mbar)	x 0.0145	=	Pounds-force per square inch (psi; lbf/in^2; lb/in^2)	x 68.947	=	Millibar (mbar)
Millibar (mbar)	x 0.75	=	Millimetres of mercury (mmHg)	x 1.333	=	Millibar (mbar)
Millibar (mbar)	x 0.401	=	Inches of water (inH_2O)	x 2.491	=	Millibar (mbar)
Millimetres of mercury (mmHg)	x 0.535	=	Inches of water (inH_2O)	x 1.868	=	Millimetres of mercury (mmHg)
Inches of water (inH_2O)	x 0.036	=	Pounds-force per square inch (psi; lbf/in^2; lb/in^2)	x 27.68	=	Inches of water (inH_2O)

Torque (moment of force)

Pounds-force inches (lbf in; lb in)	x 1.152	=	Kilograms-force centimetre (kgf cm; kg cm)	x 0.868	=	Pounds-force inches (lbf in; lb in)
Pounds-force inches (lbf in; lb in)	x 0.113	=	Newton metres (Nm)	x 8.85	=	Pounds-force inches (lbf in; lb in)
Pounds-force inches (lbf in; lb in)	x 0.083	=	Pounds-force feet (lbf ft; lb ft)	x 12	=	Pounds-force inches (lbf in; lb in)
Pounds-force feet (lbf ft; lb ft)	x 0.138	=	Kilograms-force metres (kgf m; kg m)	x 7.233	=	Pounds-force feet (lbf ft; lb ft)
Pounds-force feet (lbf ft; lb ft)	x 1.356	=	Newton metres (Nm)	x 0.738	=	Pounds-force feet (lbf ft; lb ft)
Newton metres (Nm)	x 0.102	=	Kilograms-force metres (kgf m; kg m)	x 9.804	=	Newton metres (Nm)

Power

Horsepower (hp)	x 745.7	=	Watts (W)	x 0.0013	=	Horsepower (hp)

Velocity (speed)

Miles per hour (miles/hr; mph)	x 1.609	=	Kilometres per hour (km/hr; kph)	x 0.621	=	Miles per hour (miles/hr; mph)

Fuel consumption*

Miles per gallon (mpg)	x 0.354	=	Kilometres per litre (km/l)	x 2.825	=	Miles per gallon (mpg)

Temperature

Degrees Fahrenheit = (°C x 1.8) + 32 Degrees Celsius (Degrees Centigrade; °C) = (°F - 32) x 0.56

** It is common practice to convert from miles per gallon (mpg) to litres/100 kilometres (l/100km), where mpg x l/100 km = 282*

1 Engine doesn't start or is difficult to start

- ☐ Starter motor doesn't rotate
- ☐ Starter motor rotates but engine does not turn over
- ☐ Starter works but engine won't turn over (seized)
- ☐ No fuel flow
- ☐ Engine flooded
- ☐ No spark or weak spark
- ☐ Compression low
- ☐ Stalls after starting
- ☐ Rough idle

2 Poor running at low speed

- ☐ Spark weak
- ☐ Fuel/air mixture incorrect
- ☐ Compression low
- ☐ Poor acceleration

3 Poor running or no power at high speed

- ☐ Firing incorrect
- ☐ Fuel/air mixture incorrect
- ☐ Compression low
- ☐ Knocking or pinking
- ☐ Miscellaneous causes

4 Overheating

- ☐ Engine overheats
- ☐ Firing incorrect
- ☐ Fuel/air mixture incorrect
- ☐ Compression too high
- ☐ Engine load excessive
- ☐ Lubrication inadequate
- ☐ Miscellaneous causes

5 Transmission problems

- ☐ No drive to rear wheel
- ☐ Vibration
- ☐ Poor performance
- ☐ Clutch not disengaging completely

6 Abnormal engine noise

- ☐ Knocking or pinking
- ☐ Piston slap or rattling
- ☐ Valve noise
- ☐ Other noise

7 Abnormal frame and suspension noise

- ☐ Front end noise
- ☐ Shock absorber noise
- ☐ Brake noise

8 Excessive exhaust smoke

- ☐ White smoke (four-stroke engines)
- ☐ White/blue smoke (two-stroke engines)
- ☐ Black smoke
- ☐ Brown smoke

9 Poor handling or stability

- ☐ Handlebar hard to turn
- ☐ Handlebar shakes or vibrates excessively
- ☐ Handlebar pulls to one side
- ☐ Poor shock absorbing qualities

10 Braking problems – disc brakes

- ☐ Brakes are ineffective
- ☐ Brake lever pulsates
- ☐ Brakes drag

11 Braking problems – drum brakes

- ☐ Brakes are ineffective
- ☐ Brake lever pulsates
- ☐ Brakes drag

12 Electrical problems

- ☐ Battery dead or weak
- ☐ Battery overcharged

1 Engine doesn't start or is difficult to start

Starter motor doesn't rotate

- ☐ Fuse blown. Check fuse and starter circuit (Chapter 9).
- ☐ Battery voltage low. Check and recharge battery (Chapter 9).
- ☐ Starter motor defective. Make sure the wiring to the starter is secure. Make sure the starter relay clicks when the start button is pushed. If the relay clicks, then the fault is in the wiring or motor.
- ☐ Starter relay faulty. Check it (Chapter 9).
- ☐ Starter switch on handlebar not contacting. The contacts could be wet, corroded or dirty. Disassemble and clean the switch (Chapter 9).
- ☐ Wiring open or shorted. Check all wiring connections and harnesses to make sure that they are dry, tight and not corroded. Also check for broken or frayed wires that can cause a short to earth (see wiring diagram, Chapter 9).
- ☐ Ignition (main) switch defective. Check the switch according to the procedure in Chapter 9. Replace the switch with a new one if it is defective.

Starter motor rotates but engine does not turn over

- ☐ Starter pinion assembly defective. Inspect and repair or replace (Chapter 2).
- ☐ Damaged pinion assembly or starter gears. Inspect and replace the damaged parts (Chapter 2).

Starter works but engine won't turn over (seized)

- ☐ Seized engine caused by one or more internally damaged components. Failure due to wear, abuse or lack of lubrication. On all engines damage can include piston, cylinder, connecting rod, crankshaft, bearings and additionally on four-strokes, valves, camshaft, camchain. Refer to Chapter 2 for engine disassembly.

No fuel flow

- ☐ No fuel in tank. On Typhoon 80 and 125 models (with an auxiliary fuel tank) check that the fuel hoses are not trapped and that tank vent pipe is clear.
- ☐ Fuel tap filter clogged. Remove the tap and clean it and the filter (Chapter 4). On Hexagon models, check the in-line fuel filter.
- ☐ Fuel tap vacuum hose split or detached. Check the hose.
- ☐ Fuel tap diaphragm split. Replace the tap (Chapter 4).
- ☐ Fuel line clogged. Pull the fuel line loose and carefully blow through it.
- ☐ Float needle valve or carburettor jets clogged. The carburettor should be removed and overhauled if draining the float chamber doesn't solve the problem.

Engine flooded

- ☐ Float height too high. Check as described in Chapter 4.
- ☐ Float needle valve worn or stuck open. A piece of dirt, rust or other debris can cause the valve to seat improperly, causing excess fuel to be admitted to the float chamber. In this case, the float chamber should be cleaned and the needle valve and seat inspected. If the needle and seat are worn, then the leaking will persist and the parts should be replaced with new ones (Chapter 4).

No spark or weak spark

- ☐ Ignition switch OFF.
- ☐ Battery voltage low. Check and recharge the battery as necessary (Chapter 9).
- ☐ Spark plug dirty, defective or worn out. Locate reason for fouled plug using spark plug condition chart at the end of this manual and follow the plug maintenance procedures (Chapter 1). Condition is especially applicable to two-stroke engines due to the oily nature of their lubrication system.
- ☐ Spark plug cap or secondary (HT) wiring faulty. Check condition. Replace either or both components if cracks or deterioration are evident (Chapter 5).
- ☐ Spark plug cap not making good contact. Make sure that the plug cap fits snugly over the plug end.
- ☐ Ignition control unit defective (125 models). Check the unit, referring to Chapter 5 for details.
- ☐ Pulse generator or source coil defective. Check the unit, referring to Chapter 5 for details.
- ☐ Ignition HT coil defective. Check the coil, referring to Chapter 5.
- ☐ Ignition switch shorted. This is usually caused by water, corrosion, damage or excessive wear. The switch can be disassembled and cleaned with electrical contact cleaner. If cleaning does not help, replace the switch (Chapter 9).
- ☐ Wiring shorted or broken. Make sure that all wiring connections are clean, dry and tight. Look for chafed and broken wires (Chapters 5 and 9).

Compression low

- ☐ Spark plug loose. Remove the plug and inspect its threads (Chapter 1).
- ☐ Cylinder head not sufficiently tightened down. If the cylinder head is suspected of being loose, then there's a chance that the gasket (4-stroke engines) or head is damaged if the problem has persisted for any length of time. The head nuts should be tightened to the proper torque in the correct sequence (Chapter 2).
- ☐ Low crankcase compression on two-stroke engines due to worn crankshaft oil seals. Condition will upset the fuel/air mixture. Renew the seals (Chapter 2A or 2B).
- ☐ Improper valve clearance (four-strokes). This means that the valve is not closing completely and compression pressure is leaking past the valve. Check and adjust the valve clearances (Chapter 1).
- ☐ Cylinder and/or piston worn. Excessive wear will cause compression pressure to leak past the rings. This is usually accompanied by worn rings as well. A top-end overhaul is necessary (Chapter 2).
- ☐ Piston rings worn, weak, broken, or sticking. Broken or sticking piston rings usually indicate a lubrication or carburation problem that causes excess carbon deposits or seizures to form on the pistons and rings. Top-end overhaul is necessary (Chapter 2).
- ☐ Piston ring-to-groove clearance excessive. This is caused by excessive wear of the piston ring lands. Piston replacement is necessary (Chapter 2).
- ☐ Cylinder head gasket damaged (4-stroke engines). If a head is allowed to become loose, or if excessive carbon build-up on the piston crown and combustion chamber causes extremely high compression, the head gasket may leak. Retorquing the head is not always sufficient to restore the seal, so gasket replacement is necessary (Chapter 2).
- ☐ Cylinder head warped. This is caused by overheating or improperly tightened head nuts. Machine shop resurfacing or head replacement is necessary (Chapter 2).
- ☐ Valve spring broken or weak (four-stroke engines). Caused by component failure or wear; the springs must be replaced (Chapter 2).
- ☐ Valve not seating properly (four-stroke engines). This is caused by a bent valve (from over-revving or improper valve adjustment), burned valve or seat (improper carburation) or an accumulation of carbon deposits on the seat (from carburation or lubrication problems). The valves must be cleaned and/or replaced and the seats serviced if possible (Chapter 2).

Stalls after starting

- ☐ Faulty automatic choke. Check connections and movement (Chapter 4).
- ☐ Ignition malfunction (Chapter 5).
- ☐ Carburettor malfunction (Chapter 4).
- ☐ Fuel contaminated. The fuel can be contaminated with either dirt or water, or can change chemically if the machine is allowed to sit for several months or more. Drain the tank and float chambers (Chapter 4).
- ☐ Inlet air leak. Check for loose carburettor-to-inlet manifold connections, loose carburettor top (Chapter 4).
- ☐ Engine idle speed incorrect. Turn idle adjusting screw until the engine idles at the specified rpm (Chapter 1).

Rough idle

- ☐ Ignition malfunction (Chapter 5).
- ☐ Idle speed incorrect (Chapter 1).
- ☐ Carburettor malfunction (Chapter 4).
- ☐ Fuel contaminated. The fuel can be contaminated with either dirt or water, or can change chemically if the machine is allowed to sit for several months or more. Drain the tank and float chambers (Chapter 4).
- ☐ Inlet air leak. Check for loose carburettor-to-inlet manifold connections, loose carburettor top (Chapter 4).
- ☐ Air filter clogged. Clean the air filter element (Chapter 1).

2 Poor running at low speeds

Spark weak

- ☐ Battery voltage low. Check and recharge battery (Chapter 9).
- ☐ Spark plug fouled, defective or worn out. Refer to Chapter 1 for spark plug maintenance.
- ☐ Spark plug cap or HT wiring defective. Refer to Chapters 1 and 5 for details on the ignition system.
- ☐ Spark plug cap not making contact.
- ☐ Incorrect spark plug. Wrong type, heat range or cap configuration. Check and install correct plug listed in Chapter 1.
- ☐ Ignition control unit defective. See Chapter 5.
- ☐ Pulse generator defective. See Chapter 5.
- ☐ Ignition HT coil defective (125 cc engines). See Chapter 5.

Fuel/air mixture incorrect

- ☐ Pilot screw out of adjustment (Chapter 4).
- ☐ Pilot jet or air passage clogged. Remove and overhaul the carburettor (Chapter 4).
- ☐ Air bleed hole clogged. Remove carburettor and blow out all passages (Chapter 4).
- ☐ Air filter clogged, poorly sealed or missing (Chapter 1).
- ☐ Air filter housing poorly sealed. Look for cracks, holes or loose screws and replace or repair defective parts.
- ☐ Fuel level too high or too low. Check the float height (Chapter 4).
- ☐ Carburettor inlet manifold loose. Check for cracks, breaks, tears or loose clamps.

2 Poor running at low speeds (continued)

Compression low

- ☐ Spark plug loose. Remove the plug and inspect its threads (Chapter 1).
- ☐ Cylinder head not sufficiently tightened down. If the cylinder head is suspected of being loose, then there's a chance that the gasket (four-stroke engines) or head is damaged if the problem has persisted for any length of time. The head nuts should be tightened to the proper torque in the correct sequence (Chapter 2).
- ☐ Improper valve clearance (four-stroke engines). This means that the valve is not closing completely and compression pressure is leaking past the valve. Check and adjust the valve clearances (Chapter 1).
- ☐ Low crankcase compression on two-stroke engines due to worn crankshaft oil seals. Condition will upset the fuel/air mixture. Renew the seals (Chapter 2A or 2B).
- ☐ Cylinder and/or piston worn. Excessive wear will cause compression pressure to leak past the rings. This is usually accompanied by worn rings as well. A top-end overhaul is necessary (Chapter 2).
- ☐ Piston rings worn, weak, broken, or sticking. Broken or sticking piston rings usually indicate a lubrication or carburation problem that causes excess carbon deposits or seizures to form on the pistons and rings. Top-end overhaul is necessary (Chapter 2).
- ☐ Piston ring-to-groove clearance excessive. This is caused by excessive wear of the piston ring lands. Piston replacement is necessary (Chapter 2).
- ☐ Cylinder head gasket damaged (four-stroke engines). If a head is allowed to become loose, or if excessive carbon build-up on the piston crown and combustion chamber causes extremely high compression, the head gasket may leak. Retorquing the head is not always sufficient to restore the seal, so gasket replacement is necessary (Chapter 2).
- ☐ Cylinder head warped. This is caused by overheating or improperly tightened head nuts. Machine shop resurfacing or head replacement is necessary (Chapter 2).
- ☐ Valve spring broken or weak (four-stroke engines). Caused by component failure or wear; the springs must be replaced (Chapter 2).
- ☐ Valve not seating properly (four-stroke engines). This is caused by a bent valve (from over-revving or improper valve adjustment), burned valve or seat (improper carburation) or an accumulation of carbon deposits on the seat (from carburation or lubrication problems). The valves must be cleaned and/or replaced and the seats serviced if possible (Chapter 2).

Poor acceleration

- ☐ Carburettor leaking or dirty. Overhaul the carburettor (Chapter 4).
- ☐ Faulty automatic choke (Chapter4).
- ☐ Timing not advancing. The pulse generator or the ignition control unit may be defective (Chapter 5). If so, they must be replaced with new ones, as they can't be repaired.
- ☐ Engine oil viscosity too high (four-stroke engines). Using a heavier oil than that recommended in Chapter 1 can damage the oil pump or lubrication system and cause drag on the engine.
- ☐ Brakes dragging. On disc brakes, usually caused by debris which has entered the brake piston seals, or from a warped disc or bent axle, or cable out of adjustment where appropriate. On drum brakes, cable out of adjustment, shoe return spring broken. Repair as necessary (Chapter 8).
- ☐ Clutch slipping, drive belt worn, or speed governor faulty (Chapter 2G).

3 Poor running or no power at high speed

Firing incorrect

- ☐ Air filter clogged. Clean filter (Chapter 1).
- ☐ Spark plug fouled, defective or worn out. See Chapter 1 for spark plug maintenance.
- ☐ Spark plug cap or HT wiring defective. See Chapters 1 and 5 for details of the ignition system.
- ☐ Spark plug cap not in good contact (Chapter 5).
- ☐ Incorrect spark plug. Wrong type, heat range or cap configuration. Check and install correct plug listed in Chapter 1.
- ☐ Ignition control unit or HT coil defective (Chapter 5).

Fuel/air mixture incorrect

- ☐ Main jet clogged. Dirt, water or other contaminants can clog the main jet. Clean the fuel tap filter, the in-line filter (Hexagon), the float chamber area, and the jets and carburettor orifices (Chapter 4).
- ☐ Main jet wrong size. The standard jetting is for sea level atmospheric pressure and oxygen content.
- ☐ Air bleed holes clogged. Remove and overhaul carburettor (Chapter 4).
- ☐ Air filter clogged, poorly sealed, or missing (Chapter 1).
- ☐ Air filter housing or duct poorly sealed. Look for cracks, holes or loose clamps or screws, and replace or repair defective parts.
- ☐ Fuel level too high or too low. Check the float height (Chapter 4).
- ☐ Carburettor inlet manifold loose. Check for cracks, breaks, tears or loose clamps.

Compression low

- ☐ Spark plug loose. Remove the plug and inspect its threads. Reinstall and tighten to the specified torque (Chapter 1).
- ☐ Cylinder head not sufficiently tightened down. If the cylinder head is suspected of being loose, then there's a chance that the gasket (four-stroke engines) or head is damaged if the problem has persisted for any length of time. The head nuts should be tightened to the proper torque in the correct sequence (Chapter 2).
- ☐ Improper valve clearance (four-stroke engines). This means that the valve is not closing completely and compression pressure is leaking past the valve. Check and adjust the valve clearances (Chapter 1).
- ☐ Low crankcase compression on two-stroke engines due to worn crankshaft oil seals. Condition will upset the fuel/air mixture. Renew the seals (Chapter 2A or 2B).
- ☐ Cylinder and/or piston worn. Excessive wear will cause compression pressure to leak past the rings. This is usually accompanied by worn rings as well. A top-end overhaul is necessary (Chapter 2).
- ☐ Piston rings worn, weak, broken, or sticking. Broken or sticking piston rings usually indicate a lubrication or carburation problem that causes excess carbon deposits or seizures to form on the pistons and rings. Top-end overhaul is necessary (Chapter 2).
- ☐ Piston ring-to-groove clearance excessive. This is caused by excessive wear of the piston ring lands. Piston replacement is necessary (Chapter 2).

- ☐ Cylinder head gasket damaged (four-stroke engines). If a head is allowed to become loose, or if excessive carbon build-up on the piston crown and combustion chamber causes extremely high compression, the head gasket may leak. Retorquing the head is not always sufficient to restore the seal, so gasket replacement is necessary (Chapter 2).
- ☐ Cylinder head warped. This is caused by overheating or improperly tightened head nuts. Cylinder head skimming or head replacement is necessary (Chapter 2).
- ☐ Valve spring broken or weak (four-stroke engines). Caused by component failure or wear; the springs must be replaced (Chapter 2).
- ☐ Valve not seating properly (four-stroke engines). This is caused by a bent valve (from over-revving or improper valve adjustment), burned valve or seat (improper carburation) or an accumulation of carbon deposits on the seat (from carburation or lubrication problems). The valves must be cleaned and/or replaced and the seats serviced if possible (Chapter 2).

Knocking or pinking

- ☐ Carbon build-up in combustion chamber. Use of a fuel additive that will dissolve the adhesive bonding the carbon particles to the crown and chamber is the easiest way to remove the build-up. Otherwise, the cylinder heads will have to be removed and decarbonised (Chapter 2). On two-stroke engines, the regular service interval for cylinder head decarbonisation should be adhered to.
- ☐ Incorrect or poor quality fuel. Old or improper grades of fuel can cause detonation. This causes the piston to rattle, thus the knocking or pinking sound. Drain old fuel and always use the recommended fuel grade.
- ☐ Spark plug heat range incorrect. Uncontrolled detonation indicates the plug heat range is too hot. The plug in effect becomes a glow plug, raising cylinder temperatures. Install the proper heat range plug (Chapter 1).
- ☐ Improper air/fuel mixture. This will cause the cylinders to run hot, which leads to detonation. Clogged jets or an air leak can cause this imbalance. See Chapter 4.

Miscellaneous causes

- ☐ Throttle valve doesn't open fully. Adjust the throttle grip freeplay (Chapter 1).
- ☐ Clutch slipping, drive belt worn, or speed governor faulty (Chap-ter 2G).
- ☐ Timing not advancing (Chapter 5).
- ☐ Engine oil viscosity too high. Using a heavier oil than the one recommended in Chapter 1 can damage the oil pump or lubrication system and cause drag on the engine.
- ☐ Brakes dragging. On disc brakes, usually caused by debris which has entered the brake piston seals, or from a warped disc or bent axle, or cable out of adjustment where appropriate. On drum brakes, cable out of adjustment, shoe return spring broken. Repair as necessary (Chapter 8).

4 Overheating

Engine overheats – liquid-cooled engines

- ☐ Coolant level low. Check and add coolant (Chapter 1).
- ☐ Leak in cooling system. Check cooling system hoses and radiator for leaks and other damage. Repair or replace parts as necessary (Chapter 3).
- ☐ Thermostat sticking open or closed. Check and replace as described in Chapter 3.
- ☐ Coolant passages clogged. Drain and flush the entire system, then refill with fresh coolant.
- ☐ Water pump defective. Remove the pump and check the components (Chapter 3).
- ☐ Clogged radiator fins. Clean them by blowing compressed air through the fins from the rear of the radiator.
- ☐ Cooling fan or fan switch fault (Hexagon) (Chapter 3).

Engine overheats – air-cooled engines

- ☐ Air cooling ducts blocked or incorrectly fitted.
- ☐ Problem with cooling fan.

Firing incorrect

- ☐ Spark plug fouled, defective or worn out. See Chapter 1 for spark plug maintenance.
- ☐ Incorrect spark plug.
- ☐ Ignition control unit defective (Chapter 5).
- ☐ Faulty ignition HT coil (125 cc engines) (Chapter 5).

Fuel/air mixture incorrect

- ☐ Main jet clogged. Dirt, water or other contaminants can clog the main jet. Clean the fuel tap filter, the in-line filter (Hexagon and certain LEADER engines), the float chamber area, and the jets and carburettor orifices (Chapter 4).
- ☐ Main jet wrong size. The standard jetting is for sea level atmospheric pressure and oxygen content.
- ☐ Air bleed holes clogged. Remove and overhaul carburettor (Chapter 4).
- ☐ Air filter clogged, poorly sealed, or missing (Chapter 1).
- ☐ Air filter housing or duct poorly sealed. Look for cracks, holes or loose clamps or screws, and replace or repair defective parts.
- ☐ Fuel level too high or too low. Check the float height (Chapter 4).
- ☐ Carburettor inlet manifold loose. Check for cracks, breaks, tears or loose clamps.

Compression too high

- ☐ Carbon build-up in combustion chamber. Use of a fuel additive that will dissolve the adhesive bonding the carbon particles to the piston crown and chamber is the easiest way to remove the build-up. Otherwise, the cylinder head will have to be removed and decarb-onised (Chapter 2). On two-stroke engines, the regular service interval for cylinder head decarbonisation should be adhered to.
- ☐ Improperly machined head surface or installation of incorrect size cylinder base gasket during engine assembly.

Engine load excessive

- ☐ Clutch slipping, drive belt worn, or speed governor faulty (Chap-ter 2G).
- ☐ Engine oil level too high (four-stroke engines). The addition of too much oil will cause pressurisation of the crankcase and inefficient engine operation. Check Specifications and drain to proper level (Chapter 1).
- ☐ Engine oil viscosity too high (four-stroke engines). Using a heavier oil than the one recommended in Chapter 1 can damage the oil pump or lubrication system as well as cause drag on the engine.
- ☐ Brakes dragging. On disc brakes, usually caused by debris which has entered the brake piston seals, or from a warped disc or bent axle, or cable out of adjustment where appropriate. On drum brakes, cable out of adjustment, shoe return spring broken. Repair as necessary (Chapter 8).

4 Overheating (continued)

Lubrication inadequate

- ☐ Engine oil level too low (four-stroke engines). Friction caused by intermittent lack of lubrication or from oil that is overworked can cause overheating. The oil provides a definite cooling function in the engine. Check the oil level (Chapter 1).
- ☐ Oil pump out of adjustment (two-stroke engines). Adjust pump cable (Chapter 1).
- ☐ Poor quality oil or incorrect viscosity or type. Oil is rated not only according to viscosity but also according to type. Some oils are not rated high enough for use in this engine. Check the Specifications section and change to the correct oil (Chapter 1). On two-stroke engines, make sure that you use a two-stroke oil which is suitable for oil injection engines.

Miscellaneous causes

- ☐ Modification to exhaust system. Most aftermarket exhaust systems cause the engine to run leaner, which make them run hotter. When installing an accessory exhaust system, always obtain advice on rejetting the carburettor.

5 Transmission problems

No drive to rear wheel

- ☐ Drive belt broken (Chapter 2G).
- ☐ Clutch not engaging (Chapter 2G).
- ☐ Clutch or drum excessively worn (Chapter 2G).

Transmission noise or vibration

- ☐ Bearings worn. Also includes the possibility that the shafts are worn. Overhaul the transmission (Chapter 2G).
- ☐ Gears worn or chipped (Chapter 2G).
- ☐ Clutch drum worn unevenly (Chapter 2G).
- ☐ Worn bearings or bent shaft (Chapter 2G).
- ☐ Loose clutch nut or drum nut (Chapter 2G).

Poor performance

- ☐ Speed governor worn or insufficiently greased (Chapter 2G).
- ☐ Weak or broken driven pulley spring (Chapter 2G).
- ☐ Clutch or drum excessively worn (Chapter 2G).
- ☐ Grease on clutch friction material (Chapter 2G).
- ☐ Drive belt excessively worn (Chapter 2G).

Clutch not disengaging completely

- ☐ Weak or broken clutch springs (Chapter 2G).
- ☐ Engine idle speed too high (Chapter 1).

6 Abnormal engine noise

Knocking or pinking

- ☐ Carbon build-up in combustion chamber. Use of a fuel additive that will dissolve the adhesive bonding the carbon particles to the piston crown and chamber is the easiest way to remove the build-up. Otherwise, the cylinder head will have to be removed and decarbonised (Chapter 2). On two-stroke engines, always decarbonise the cylinder head and piston crown at the recommended service interval (Chapter 1).
- ☐ Incorrect or poor quality fuel. Old or improper fuel can cause detonation. This causes the pistons to rattle, thus the knocking or pinking sound. Drain the old fuel and always use the recommended grade fuel (Chapter 4).
- ☐ Spark plug heat range incorrect. Uncontrolled detonation indicates that the plug heat range is too hot. The plug in effect becomes a glow plug, raising cylinder temperatures. Install the proper heat range plug (Chapter 1).
- ☐ Improper air/fuel mixture. This will cause the cylinder to run hot and lead to detonation. Clogged jets or an air leak can cause this imbalance. See Chapter 4.

Piston slap or rattling

- ☐ Cylinder-to-piston clearance excessive. Caused by improper assembly. Inspect and overhaul top-end parts (Chapter 2).
- ☐ Connecting rod bent. Caused by over-revving, trying to start a badly flooded engine or from ingesting a foreign object into the combustion chamber. Replace the damaged parts (Chapter 2).
- ☐ Piston pin or piston pin bore worn or seized from wear or lack of lubrication. Replace damaged parts (Chapter 2).
- ☐ Piston ring(s) worn, broken or sticking. Overhaul the top-end (Chapter 2).
- ☐ Piston seizure damage. Usually from lack of lubrication or overheating. Replace the piston and where possible, rebore the cylinder, as necessary (Chapter 2). On two-stroke engines, check that the oil pump is correctly adjusted.
- ☐ Connecting rod upper or lower end clearance excessive. Caused by excessive wear or lack of lubrication. Replace worn parts.

Valve noise – four-stroke engines

- ☐ Incorrect valve clearances. Adjust the clearances by referring to Chapter 1.
- ☐ Valve spring broken or weak. Check and replace weak valve springs (Chapter 2).
- ☐ Camshaft bearings worn or damaged. Lack of lubrication at high rpm is usually the cause of damage. Insufficient oil or failure to change the oil at the recommended intervals are the chief causes. (Chapter 2).

Other noise

- ☐ Exhaust pipe leaking at cylinder head connection. Caused by improper fit of pipe or loose exhaust flange. All exhaust fasteners should be tightened evenly and carefully. Failure to do this will lead to a leak.
- ☐ Crankshaft runout excessive. Caused by a bent crankshaft (from over-revving) or damage from an upper cylinder component failure.
- ☐ Engine mounting bolts loose. Tighten all engine mount bolts (Chapter 2).
- ☐ Crankshaft bearings worn (Chapter 2).
- ☐ Camshaft drive gear assembly defective (four-stroke engines). Replace according to the procedure in Chapter 2.

7 Abnormal frame and suspension noise

Front end noise

- ☐ Steering head bearings loose or damaged. Clicks when braking. Check and adjust or replace as necessary (Chapters 1 and 6).
- ☐ Bolts loose. Make sure all bolts are tightened to the specified torque (Chapter 6).
- ☐ Fork tube bent. Good possibility if machine has been dropped. Replace tube with a new one (Chapter 6).
- ☐ Front axle nut loose. Tighten to the specified torque (Chapter 8).
- ☐ Loose or worn wheel or hub bearings. Check and replace as needed (Chapter 8).

Shock absorber noise

- ☐ Fluid level incorrect. Indicates a leak caused by defective seal. Shock will be covered with oil. Replace shock or seek advice on repair from a Piaggio dealer (Chapter 6).
- ☐ Defective shock absorber with internal damage. This is in the body of the shock and can't be remedied. The shock must be replaced with a new one (Chapter 6).
- ☐ Bent or damaged shock body. Replace the shock with a new one (Chapter 6).
- ☐ Loose or worn suspension linkage components. Check and replace as necessary (Chapter 6).

Brake noise

- ☐ Squeal caused by dust on brake pads or shoes. Usually found in combination with glazed pads or shoes. Clean using brake cleaning solvent (Chapter 8).
- ☐ Contamination of brake pads or shoes. Oil, brake fluid or dirt causing brake to chatter or squeal. Clean or replace pads or shoes (Chapter 8).
- ☐ Pads or shoes glazed. Caused by excessive heat from prolonged use or from contamination. Do not use sandpaper, emery cloth, carborundum cloth or any other abrasive to roughen the pad surfaces as abrasives will stay in the pad material and damage the disc or drum. A very fine flat file can be used, but pad or shoe replacement is advised (Chapter 8).
- ☐ Disc or drum warped. Can cause a chattering, clicking or intermittent squeal. Usually accompanied by a pulsating lever and uneven braking. Check the disc runout and the drum ovality (Chapter 8).
- ☐ Loose or worn wheel (front) for transmission (rear) bearings. Check and replace as needed (Chapters 8 or 2G).

8 Excessive exhaust smoke

White smoke – four-stroke engines (oil burning)

- ☐ Piston oil ring worn. The ring may be broken or damaged, causing oil from the crankcase to be pulled past the piston into the combustion chamber. Replace the rings with new ones (Chapter 2).
- ☐ Cylinder worn, cracked, or scored. Caused by overheating or oil starvation. The cylinder will have to be rebored and an oversize piston installed (Chapter 2).
- ☐ Valve oil seal damaged or worn. Replace oil seal with new ones (Chapter 2).
- ☐ Valve guide worn. Measure the valve guides and if worn seek the advice of a Piaggio dealer (Chapter 2).
- ☐ Engine oil level too high, which causes the oil to be forced past the rings. Drain oil to the proper level (Daily (pre-ride) checks).
- ☐ Head gasket broken between oil return and cylinder. Causes oil to be pulled into the combustion chamber. Replace the head gasket and check the head for warpage (Chapter 2).
- ☐ Abnormal crankcase pressurisation, which forces oil past the rings.

White/blue smoke – two-stroke engines (oil burning)

- ☐ Oil pump cable adjustment incorrect. Check throttle cable/oil pump cable adjustment (Chapter 1).
- ☐ Accumulated oil deposits in the exhaust system. If the scooter is used for short journeys only, the oil residue from the exhaust gases will condense in the cool silencer. Take the scooter for a long run in hot weather to burn off the accumulated oil residue.

Black smoke (over-rich mixture)

- ☐ Air filter clogged. Clean the element (Chapter 1).
- ☐ Main jet too large or loose. Compare the jet size to the Specifications (Chapter 4).
- ☐ Automatic choke faulty (Chapter 4).
- ☐ Fuel level too high. Check and adjust the float height as necessary (Chapter 4).
- ☐ Float needle valve held off needle seat. Clean the float chamber and fuel line and replace the needle and seat if necessary (Chap-ter 4).

Brown smoke (lean mixture)

- ☐ Main jet too small or clogged. Lean condition caused by wrong size main jet or by a restricted orifice. Clean float chambers and jets and compare jet size to Specifications (Chapter 4).
- ☐ Fuel flow insufficient. Float needle valve stuck closed due to chemical reaction with old fuel. Float height incorrect. Restricted fuel line. Clean line and float chamber and adjust floats if necessary.
- ☐ Carburettor inlet manifold clamps loose (Chapter 4).
- ☐ Air filter poorly sealed or not installed (Chapter 1).
- ☐ Ignition timing incorrect (Chapter 5).

9 Poor handling or stability

Handlebar hard to turn

- ☐ Steering head bearing adjuster nut too tight. Check adjustment as described in Chapter 1.
- ☐ Bearings damaged. Roughness can be felt as the bars are turned from side-to-side. Replace bearings and races (Chapter 6).
- ☐ Races dented or worn. Denting results from wear in only one position (eg, straight ahead), from a collision or hitting a pothole or from dropping the machine. Replace races and bearings (Chapter 6).
- ☐ Steering stem lubrication inadequate. Causes are grease getting hard from age or being washed out by high pressure car washes. Disassemble steering head and repack bearings (Chapter 6).
- ☐ Steering stem bent. Caused by a collision, hitting a pothole or by dropping the machine. Replace damaged part. Don't try to straighten the steering stem (Chapter 6).
- ☐ Front tyre air pressure too low (Daily (pre-ride) checks).

Handlebar shakes or vibrates excessively

- ☐ Tyres worn (Chapter 8).
- ☐ Swingarm pivots worn. Replace worn components (Chapter 6).
- ☐ Wheel rim(s) warped or damaged. Inspect wheels for runout (Chapter 8).
- ☐ Wheel bearings worn. Worn wheel bearings (front) or transmission bearings (rear) can cause poor tracking. Worn front bearings will cause wobble (Chapter 8).
- ☐ Handlebar mountings loose (Chapter 6).
- ☐ Front suspension bolts loose. Tighten them to the specified torque (Chapter 6).
- ☐ Engine mounting bolts loose. Will cause excessive vibration with increased engine rpm (Chapter 2).

Handlebar pulls to one side

- ☐ Frame bent. Definitely suspect this if the machine has been dropped. May or may not be accompanied by cracking near the bend. Replace the frame (Chapter 6).
- ☐ Wheels out of alignment. Caused by improper location of axle spacers or from bent steering stem or frame (Chapter 6 or 8).
- ☐ Steering stem bent. Caused by impact damage or by dropping the machine. Replace the steering stem (Chapter 6).
- ☐ Fork tube bent (telescopic fork models). Disassemble the forks and replace the damaged parts (Chapter 6).

Poor shock absorbing qualities

Too hard:

a) Fork grease or oil quantity excessive (Chapter 6).
b) Fork grease or oil viscosity too high. Use the correct grade (see the Specifications in Chapter 1).
c) Suspension bent. Causes a harsh, sticking feeling (Chapter 6).
d) Fork internal damage (Chapter 6).
e) Shock internal damage (Chapter 6).
f) Tyre pressure too high (Chapter 1).

Too soft:

a) Fork grease or oil viscosity too light. Use the correct grade (see the Specifications in Chapter 1).
b) Fork or shock spring(s) weak or broken (Chapter 6).
c) Shock internal damage or leakage (Chapter 6).

10 Braking problems – disc brakes

Brakes are ineffective

- ☐ Air in brake line. Caused by inattention to master cylinder fluid level or by leakage. Locate problem and bleed brake (Chapter 8).
- ☐ Pads or disc worn (Chapters 1 and 8).
- ☐ Brake fluid leak. Locate problem and rectify (Chapter 8).
- ☐ Contaminated pads. Caused by contamination with oil, grease, brake fluid, etc. Clean or replace pads. Clean disc thoroughly with brake cleaner (Chapter 8).
- ☐ Brake fluid deteriorated. Fluid is old or contaminated. Drain system, replenish with new fluid and bleed the system (Chapter 8).
- ☐ Master cylinder internal parts worn or damaged causing fluid to bypass (Chapter 8).
- ☐ Master cylinder bore scratched by foreign material or broken spring. Repair or replace master cylinder (Chapter 8).
- ☐ Disc warped. Replace disc (Chapter 8).
- ☐ On models where the master cylinder is operated by a short cable from the handlebar lever, check that the cable is correctly adjusted and moves freely (Chapter 8).

Brake lever pulsates

- ☐ Disc warped. Replace disc (Chapter 8).
- ☐ Axle bent. Replace axle (Chapter 8).
- ☐ Brake caliper bolts loose (Chapter 8).
- ☐ Wheel warped or otherwise damaged (Chapter 8).
- ☐ Wheel or hub bearings damaged or worn (Chapter 8).

Brakes drag

- ☐ Master cylinder piston seized. Caused by wear or damage to piston or cylinder bore (Chapter 8).
- ☐ Lever balky or stuck. Check pivot and lubricate (Chapter 8).
- ☐ Brake caliper piston seized in bore. Caused by wear or ingestion of dirt past deteriorated seal (Chapter 8).
- ☐ Brake pads damaged. Pad material separated from backing plate. Usually caused by faulty manufacturing process or from contact with chemicals. Replace pads (Chapter 8).
- ☐ Pads improperly installed (Chapter 8).

11 Braking problems – drum brakes

Brakes are ineffective

- ☐ Cable incorrectly adjusted. Check cable (Chapter 1).
- ☐ Shoes or drum worn (Chapters 1 and 8).
- ☐ Contaminated shoes. Caused by contamination with oil, grease, brake fluid, etc. Clean or replace shoes. Clean drum thoroughly with brake cleaner (Chapter 8).
- ☐ Brake lever arm incorrectly positioned, or cam excessively worn (Chapter 8).

Brake lever pulsates

- ☐ Drum warped. Replace drum (Chapter 8).
- ☐ Axle bent. Replace axle (Chapter 8).
- ☐ Wheel warped or otherwise damaged (Chapter 8).
- ☐ Wheel/hub bearings (front) or transmission bearings (rear) damaged or worn (Chapter 8).

Brakes drag

- ☐ Cable incorrectly adjusted or requires lubrication. Check cable (Chapter 1).
- ☐ Shoe return springs broken (Chapter 8).
- ☐ Lever balky or stuck. Check pivot and lubricate (Chapter 8).
- ☐ Lever arm or cam binds. Caused by inadequate lubrication or damage (Chapter 8).
- ☐ Brake shoe damaged. Friction material separated from shoe. Usually caused by faulty manufacturing process or from contact with chemicals. Replace shoes (Chapter 8).
- ☐ Shoes improperly installed (Chapter 8).

12 Electrical problems

Battery dead or weak

- ☐ Battery faulty. Caused by sulphated plates which are shorted through sedimentation. Also, broken battery terminal making only occasional contact (Chapter 9).
- ☐ Battery cables making poor contact (Chapter 9).
- ☐ Load excessive. Caused by addition of high wattage lights or other electrical accessories.
- ☐ Ignition (main) switch defective. Switch either earths internally or fails to shut off system. Replace the switch (Chapter 9).
- ☐ Regulator/rectifier defective (Chapter 9).
- ☐ Alternator stator coil open or shorted (Chapter 9).
- ☐ Wiring faulty. Wiring either shorted to earth or connections loose in ignition, charging or lighting circuits (Chapter 9).

Battery overcharged

- ☐ Regulator/rectifier defective. Overcharging is noticed when battery gets excessively warm (Chapter 9).
- ☐ Battery defective. Replace battery with a new one (Chapter 9).
- ☐ Battery amperage too low, wrong type or size. Install manufacturer's specified amp-hour battery to handle charging load (Chapter 9).

Note: References throughout this index are in the form - "*Chapter number*" • "*Page number*"

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