

# Vacuum Cleaners

## V1 General Information

Vacuum cleaner consist of a series motor (F5) connected to a centrifugal fan. The air is sucked up from the carpet through a dust bag to collect the dirt (or through a cyclone for bagless vacs) by the vacuum cleaner motor and the air is expelled into the room. The air flow through the vacuum cleaner flows through the motor cooling it. However if the dust bag has a whole in it then the dust flows through the motor causing problems with the motor brushes and bearings. Most vacuum cleaner have two more secondary filters, a motor filter after the dust bag to keep dust out of the motor. Other filter is a exit filter, to clean the air before it enters the room, which is important if you suffer form asthma or have dust allergy. This filter is sometimes called a HEPA filter. High Efficiency Particle Arrestance, it removes 99.97% of particles larger than 0.3µm. Both these filters need to be cleaned and replaced at regular intervals.

Some vacuum cleaner motors are “by-pass” motors where the air does not flow through the motor, but these are only found on commercial vacuum cleaners.

Air suction reductions is done by two methods, a air bleed in the handle/hose or by reducing the power of the motor by using a Triac circuit.

### Types of Vacuum Cleaners

#### Upright Vacuum Cleaners

These have rotating brushes or beaters to help remove dirt from the carpet. The beaters can be driven by a separate series motor by a small belt or directly from the vacuum motor with a belt. Some upright vacuum cleaners have a detachable hose to use like a barrel vacuum cleaner, giving it the advantage of a barrel cleaner. These tend to have longer internal pipe and bend that can cause blockage. Upright vacuum cleaner tend to cleaner better than barrel vacuum cleaners.

#### Barrel Vacuum Cleaners

The vacuum cleaner is on wheels and the is pulled along. To improve cleaning power heads can be used. These have a small series motor driving beaters by a belt. The hose has two wires attached to it to power the motor. An alternative is the turbo head where the air flow drives the beaters, however the suction is reduced and performance is generally about the same as a barrel cleaner.

#### Wet and Dry Vacuum Cleaners

These are barrel cleaners with a float valve to stop the overflowing holding tank water entering the motor. Only some commercial wet and dry Vacuum cleaners have by-pass motors.

#### Back Pack Vacuum Cleaners

These are commercial barrel vacuum cleaner carried on the back of the operator.

## V2 Access

Pulling apart a vacuum cleaner can be difficult, particularly domestic cleaners as manufactures like to hide screw heads. Screws can be hidden under switch covers, which are held on by plastic clips. Do not force too hard as plastic casing can break! Getting them back together can also be difficult as many different parts need to be aligned for assemble.

Commercial vacuum cleaners are usually easier to pull apart and put back together.

## V3 Faults and Repairs

### V3.0 Testing a Vacuum Cleaner

Use an in-line ammeter (Appendix 1) with a safety switch and operate the vacuum cleaner. Doing this increases your safety when doing repairs. The vacuum cleaner will use about 4-5A of electrical current, depending on the power (Wattage) of the motor. When the air flow is cut off the

motor current will drop to about 3.5A. The vacuum cleaner is not moving any air and the load on the motor decreases.

### V3.1 Block Hoses and Internal Pipes

Hose can be blown out backwards blockage removed with stick or even with a garden hose with water, allow to dry before using. Internal piping will require some disassemble to get access.

### V3.2 Mains Lead Failure

The mains lead where it enters the vacuum cleaner will flex and the wires can break under the insulation without any visual sign. Plug the vacuum cleaner in and operate it. Flex the mains lead and if the motor stops and starts a wire is broken. Sometimes a small hole burns through the PVC insulation. The same can happen at the three pin mains plug.

Vacuum cleaners with cord rewinders the wires can break just where the last of the cord goes inside the reel. If the reel comes apart it can be difficult to reassemble.

**Repair.** Pull the vacuum cleaner apart and replace the lead or cut  $\frac{1}{2}$  m from the cord and rejoin. The cord is clamped to the vacuum cleaner body to prevent any force being passed onto the electrical connections.

Test and tagging requires that the outer sheath not be cut exposing the insulated wires. Tape or heat shrink tubing etc. is not allowed. Vacuum cleaners use about 4-5A and the cords can get warm due to the long time operating and heat damage can also occur. Replacement leads can be made from new extension cords, cut off the socket, strip the insulation and do not use the earth wire on double insulated cleaners.

Some commercial vacuum cleaners leads only last 6 to 12 months, they have a hard life!

### V3.3 Switch Failures

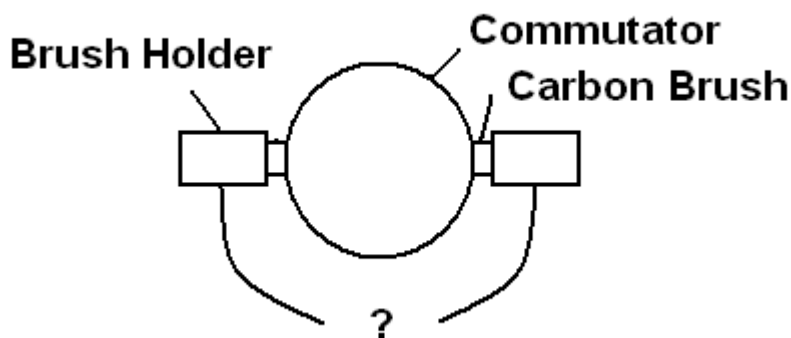
Remove some of the casing of the vacuum cleaner and circuit trace using Voltmeter or ohmmeter. (D3). Danger!

**!** Danger! Read section on electrical safety before attempting this. See section A1.1 and A1.2 for safety rules for testing live equipment.

Check the switch and motor and thermal overload thermostat. Replace the faulty component. Always replace the switch with an all plastic switch to keep the double insulated (C5) status of the vacuum cleaner. The vacuum cleaner uses 4-5A of electrical current, so the switch needs to exceed this rating. Also see V3.4.

### V3.4 Motor Replacement

Test with an in-line ammeter for excessive current, arcing of brushes or noisy bearings (dust has entered the bearings). If the motor does not operate, circuit trace as in V3.3. Worn brushes will create an open circuit between the two brushes. Measure the resistance between the carbon brushes, it should be low (about  $4\Omega$ ), if it is high ( $+1M\Omega$ ) then the brushes are worn. Also check the



*Illustration 1: Measure Resistance*

resistance while rotating the commutator.

**Motor Repairs:** Most motor are now riveted together, making repairs very difficult. New motor can be purchased. Alternative repairs may be done.

**Motor brushes** may be able to be replaced. If they are held on by small bolts, replacement is easy. If they are riveted on drill out the rivets and replace with small bolts if there is enough metal for it. Alternative is to bend the brass at the end of the holder to remove the old brush and fit the new one in. Solder the wire tail to the brass holder. Source replacement brushes before starting.

**Motor bearing** may replaced See F3, Cheap motor may use bush bearings while other ones use ball bearings (608ZZ), see F3 about advice on replacement.. Usually the back bearing gets noisy with dust. Remove the motor end casting (picture F5.1) with the brushes, refit a new bearing and reassemble (hold the brushes in when reassembling).

The front bearing with the fan does not dust in it and is usually OK. To replace hold the motor by its field windings and tap off the first Aluminium cover with a hammer and punch, it is only a slide fit. Undo the nut holding the fan and remove, repeat for the second cover, noting the order of the parts.

## V4 Model Information

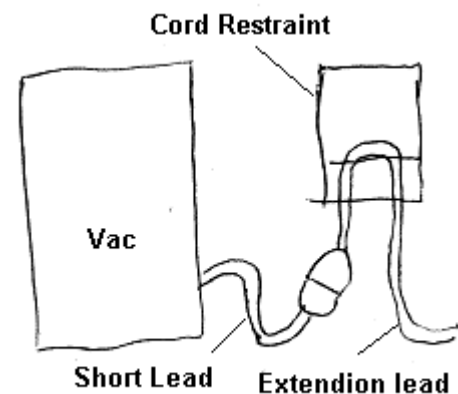
### V4.1 Ducted System

A vacuum unit located in the garage and pipes go to different parts of the house with outlets. If the pipe become blocked try blowing back through the system with a blowing vacuum cleaner. Also try using plumber pipe unblocking cables. If all else fails the pipes may need to be cut to clear the blockage, then repaired.

### V4.2 VacPac Commercial Vacuum Cleaner.

These are easy repaired. The base comes off with several screws for switch or cord replacement. Undo more screws at the middle join to replace the motor. Note the rubber sealing rings position and it important to assemble them correctly to hold the motor preventing it from rotating in use. Replace the motor filter with the new paper or cone filter to protect the motor.

The have a short cord and a long extension lead. It is important that the extension lead is anchored by the cord restraint so the the short lead does not flex in operation.



### V4.3 Nilfish A300AU/NZ

Barrel vacuum cleaner. To pull apart for repairs:

*Illustration 2: Cord Restraint*

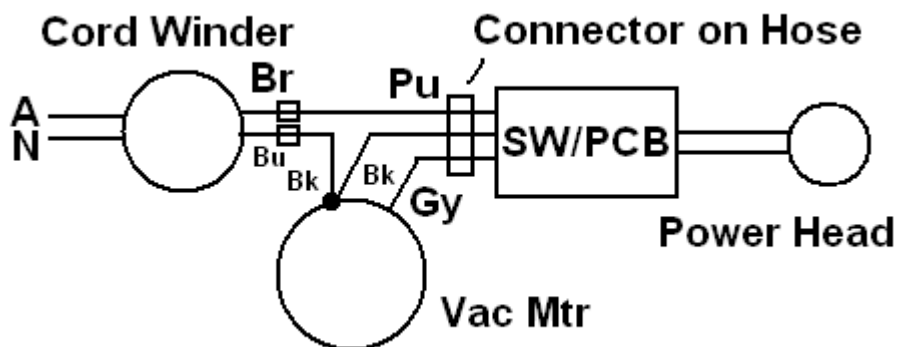
1. Remove dust bag cover, spring hinge with screw driver to remove hinge from body.
2. Undo three screws holding top on.
3. Spring off the off/on switch cover and the cord rewind button.
4. Undo six screws holding the handle on and remove.
5. Loft off the top cover.
6. Remove the cord rewind mechanism from the vacuum cleaner body.
7. The cord rewind mechanism comes apart for cord replacement by undoing the screw in the centre hollow post. With care it can be reassembled.

#### V4.4 Dyson DC05/079AU

The Dyson vacuum cleaner consists of an odd shaped barrel cleaner with a cyclone instead of a dust bag. The secondary filters are foam and Dyson instruction book recommends washing them in water. It also has a power head driven by a series motor. An internet search for this vacuum cleaner found [www.grosse-is-a-geek.com/diydco5.html](http://www.grosse-is-a-geek.com/diydco5.html). This site gives the instruction on pulling the vacuum cleaner apart and putting it back together. It has many colour pictures. Basically the wheels clip off using a screw driver, exposing some screws. I will not repeat it again. With the odd shapes it can be a bit tricky.

##### Switches in the Hose Assemble

A switch on a circuit board controls the vacuum motor and the power head motor. These can fail and Dyson sell the hose assembly as a complete unit. It can be repaired with a bit of skill. If replacing the switch use plastic switches, see note V3.3.



*Illustration 3: Dyson Hose SW*

#### V4.5 Dyson DC01

This is an upright vacuum cleaner with a grey body with yellow plastic bits. It has a Vacuum motor in the base driving the beaters with a flat rubber belt from the end of the motor. It has a cyclone instead of bags and two filters, a motor filter, and an exit filter.

The air flow through the vacuum cleaner through “pipes” and has a hose for corners and other bits. These can block so clean them if the suction is poor.

##### Access to the motor

This can be a bit tricky.

1. Remove the bottom beater cover (4 screws) and the belt.
2. Remove the wheel on the belt end. Yellow plastic covers the axle. Spring these off. Remove the 'E' clip and the wheel.
3. Remove the top cover from the beaters, by springing off the “rotating hinge” at the other end off the motor (opposite the belt) and rotating down.
4. Remove the second plastic bit.
5. Undo the 6 screws ( T15) holding the bottom motor cover and remove the cover. Take note about the rubber flap valve.
6. This gives access to the vacuum motor, noise capacitor, and thermal overload.