

# **Equipment Maintenance and Repairs**

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## INTRODUCTION

Broke down? Equipment failure? Can't get parts? Unhappy customer? Must finish job by tonight? How many times have you been in this position? We as cleaning and restoration contractors need to consider and analyze this question and put it at the top of our list along with accounts receivable problems, how to increase productivity, etc. We are so concerned with the business operation at hand that we fail to remember that the tools that make our business possible require attention also. The term I would like to stress throughout this presentation is "preventive maintenance." If nothing else is retained please remember these two words. Lets remember that suppliers furnish us with manuals on service for a reason, just as we advise our customers on how to maintain their carpeting, etc.

## IMPORTANCE

Equipment is not indistructable, even though many of us treat it like it was. Steel, iron, copper, oil, rubber, aluminum, etc. all wear out and break down in time. Especially if they are not protected with lubrication, adjustment, proper operation, etc. Labor cost is one of our biggest expenses, but have you thought about the price of replacing equipment lately? In this age of high technology we must remember that equipment may take the place of one to three men and justifies our careful attention. Therefore, cost of equipment is a small price to pay for increased production and maintaining an edge on competition, resulting in increased profits. But why replacement? If you would have treated it properly, replacement may not have been required. Look at your profit and loss sheet, then substract equipment replacement. Profit down the drain. When we are competing with people who do not look down the road, we must use every precaution possible to keep expenses at a minimum.

## RESPONSIBILITY AND TRAINING

Your first question I'm sure is: How do I go about this? To answer this question, you have some important decisions to make. Should we attempt to maintain our own equipment or enlist outside help. If you will carry this out to its logical conclusion some observations will be made: We know more about our specialized equipment than anyone else. When equipment needs attention it needs it now, not tomorrow or next week. Repairs at outside shops are inconvenient and expensive. Who has the parts for maintaining our equipment? The answers are obvious: You should look in your organization and find a person who enjoys repair and maintenance. Make him responsible for maintaining your equipment and give him the authority. Then provide him with the schooling and training to carry out his position. Here again I must stress the fact that money spent in this area is as important as training your employees to perform certain cleaning and restoration tasks. When your maintenance man tells you that certain procedures need to be done, LISTEN. He is trying to save you valuable time and money later.

## MAINTAIN PARTS INVENTORY

Now you have the man who will be responsible for maintenance and repair, but how can he function without proper equipment and replacement parts. I realize that all items are impossible to stock but your person responsible knows what he needs to lubricate and maintain certain crucial pieces of inventory. Also he knows what parts are needed to be kept in ready for replacement when a break down occurs. Let him have this inventory or of what value is he to you? It's not a matter of can we, it is a matter of we must, so our operation can go on without costly interruptions. When parts are not available be sure to know your suppliers. Trust him for quick and convenient service. He owes it to you.

## TECHNICAL INFORMATION AND PROCEDURES TO FOLLOW

We shall attempt to cover basic areas of equipment in this section. Not all specific pieces of equipment will be mentioned but certain maintenance procedures apply to a wide variety of cleaning machines. How many of your machines have electric motors or gasoline engines? Almost all equipment has one or the other except for manual equipment such as hand pumps and other hand operated items.

### ELECTRIC MOTOR MAINTENANCE:

#### TO CLEAN A MOTOR

1. Be sure that the motor is completely disconnected from the circuit. Detach the cord or disconnect the wires from the motor.
2. Remove the belt or otherwise disconnect the motor from the load.
3. Take the motor apart by removing the end plates. As parts are removed from the motor, mark them or observe carefully how they are assembled so you can reassemble them correctly.
4. If a vacuum cleaner with attachments or an air hose is available, suck or blow out as much of the loose dirt of the motor as you can.
5. Clean with dry rags, or a dry paint brush, removing as much of the remaining dirt as you can and then wash the metal parts, except coils, with a non-inflammable cleaning fluid. Be sure that the air passages through the frame of the motor and through the rotor are clear. Do not apply cleaning fluid to the coils of the motor unless it is necessary to remove oily dirt, because such solvents may damage the insulation on the wires. Wipe the motor parts dry with a clean cloth.
6. While the motor is apart, inspect the starting switch, the commutator and the brushes, if any, to see whether they need repair.
7. Repair or replace any worn or damaged parts.
8. Re-assemble the motor, being sure that all parts go back in their correct positions. Tighten the end plate nuts one after another and a little at a time until all are brought down together. Be sure that the end plates fit tightly all the

way around and that the shaft turns freely.

9. Lubricate the bearings of the motor according to instructions.
10. Reconnect the motor to the circuit and note its operation.
11. If it runs normally, reconnect the motor to the load.

#### VENTILATION

Air-cooled motors need to have a good circulation of air around them. They should not be placed in poorly ventilated or overheated enclosures. For example, never place a pump motor in a small, poorly ventilated shelter which is exposed to the hot sun.

#### MOISTURE

Because moisture is a natural enemy of motors, they are best installed in dry rather than damp places. A motor that has been flooded should be thoroughly dried before it is started.

1. KEEP COMMUTATOR AND BRUSHES, IF ANY, IN GOOD CONDITION.

Universal and repulsion-induction motors have on the armature a cylinder or disc of copper bars interspaced with strips of mica. This is called the commutator. Riding on this commutator under spring pressure are two or more carbon brushes. Friction between the commutator and brushes wears the brushes and sometimes cuts a groove in the commutator. With a dirty motor, this wear may be rapid enough to destroy the brushes in a short time. Replace the worn brushes with new ones. Keep brush guides clean and free from gum so the brushes will move freely and be pressed firmly against the commutator by the brush springs.

If the commutator is worn, a condition known as "High Mica" may result; that is, the copper sometimes wears faster than does the mica and leaves the mica projecting above the surface of the copper. These mica ridges prevent the brushes from making good contact with the copper and therefore interfere with the operation of the motor. This is usually accompanied by pronounced arcing at the brushes. When this condition exists, the commutator should be turned down on a lathe and sanded until it is smooth. This is a particular job and should be done by an experienced person.

If the commutator is only dirty, wipe it with a cloth dampened in cleaning fluid. On open-end motors, this can sometimes be done without taking the motor apart. The current must

be turned off during this operation. Never use emery cloth to clean a commutator, as the emery dust may short-circuit the copper bars. Fine sandpaper is safe.

2. BE SURE MOTORS ARE SUPPLIED WITH THE CORRECT VOLTAGE.

A motor connected near the end of a long overloaded circuit may not receive enough voltage to enable it to carry its load. This will cause the motor to slow down or to stop. In either case, unless properly protected by overload protective devices, the motor will quickly burn out. Also, this frequently happens to motors when connected to a long length of small-sized lamp cord. All wiring supplying current to motors should be large enough to carry the necessary current with not more than from 2 to 5 per cent drop in voltage. Wire sizes to use for various horsepower motors and length of circuits are available.

Dual-voltage motors are built to operate on either of two voltages. The standard types used are built for 115 and 230 volts. Be sure that the connections are correctly made for the voltage to which the motor is to be connected.

3. DO NOT OVERLOAD A MOTOR.

A common cause of burned out motors is overloading. A motor overloaded to the point where its speed is noticeably reduced draws an excessive amount of current, which in turn generates excessive heat. The reduced speed of the motor decreases the effectiveness of the cooling fan and the temperature of the motor rises to a point where the insulation burns from the windings. This means rewinding or replacing the motor, either of which is expensive. Always use adequate horsepower for the load involved. Do not expect a small motor to carry a large motor load.

Some types of motors, such as shaded-pole and split-phase used on fans, grinders, and washing machines, have relatively low starting power and should not be called upon to start under a full load. One should start these motors with the lightest possible load and apply the main load only after the motor has come up to speed.

The capacitor and repulsion-induction types of motors are built to start under full load.



4. BE SURE THE MOTOR SHAFT AND LOAD ARE FREE TO TURN BEFORE TRYING TO START A MOTOR THAT HAS NOT BEEN RUN FOR SOME TIME

It occasionally happens, particularly when a motor has not been started in quite a while, that rust, corrosion, dirt, or some foreign object gets into bearings or other moving parts of the machine (driven) so that it does not turn freely. Such a condition may stall the motor and burn it out immediately. For this reason, before starting such a machine, turn it over by hand if possible to make sure that it is free.

5. USE OVERLOAD PROTECTION.

Under the best of operating conditions there is always the possibility of unintentional or accidental overloads being placed on a motor. Also, low voltage conditions sometimes unavoidably occur. For these reasons, motors should be protected with overload and low-voltage protective devices. This applies particularly to motors on automatic machines, such as milk coolers and water pumps, and to motors on non-automatic machines that are operated without an attendant present. The following types of overload protective devices are in common use:

TIME DELAY FUSES PROTECT AGAINST OVERLOAD AND LOW VOLTAGE.

THERMAL OVERLOAD ELEMENTS IN MOTOR SWITCH PROTECT AGAINST OVERLOAD AND LOW-VOLTAGE.

THERMAL OVERLOAD ELEMENTS BUILT INTO MOTOR FRAME PROTECT AGAINST OVERLOAD, LOW VOLTAGE, AND OVERHEATING OF THE MOTOR FROM ANY CAUSE.

An overload protective device which is responsive to current only should be rated or set at not more than 125 per cent of full-load current rating for motors marked for a temperature rise of not more than 40 degrees C, and at not more than 115 percent for all other types of motors. The sizes of time-delay fuses to use for common horsepower sizes of motors are available.

6. REPLACE WORN BUSHINGS AND BEARINGS.

If the bushings or bearings on a motor become badly worn, the rotor may be pulled out of line by the belt until it drags on the stationary fieldpole pieces. This produces an overload condition, stalls the motor, and causes it to burn out. Motors, particularly those with sleeve bearings, which have been in service for some time or which have been run without adequate

lubrication should be inspected for this wear.

A quick inspection can be made by removing the belt and pulley from the motor and then pushing back and forth on the motor shaft in line with the pull of the belt. If there is a noticeable "chuck" in the bearings, it is time to replace the bushing; or if it is a ball-bearing motor, a new bearing may be needed. When making this test do not confuse sidewise chuck of the shaft with endplay chuck. Most motors are designed with a small amount of endplay on the rotor. This is a normal condition.

The renewal of bushings may require the use of a press to force out the old and press in the new bushings. Also, the new bushings may need to be reamed a little to obtain an exact fit on the shaft. If a press and a reamer are not available at your work site, take the motor to a repair shop for this job.

Reference #1 (National Custodian - March - April - 1969)

#### CARE AND MAINTENANCE OF FLOOR MACHINES AND VACUUM CLEANERS

This is another area that covers a wide variety of our equipment.

Most single disc floor machines are vacuum cleaners built today are designed to give years of service with very little attention being required on the part of the user. Perhaps the manufacturers have succeeded too well since experience shows that machines suffer more from abuse than use.

Both single disc machines and vacuum cleaners require a minimum of mechanical adjustments and no lubrication, at least during the original warranty period. Warranty periods usually range from one to three years, and in some cases, five years. For specific details, consult the warranty card and instruction sheet provided by the manufacturer with each machine.

For simplicity, let us look at single disc and vacuum machines separately. A single disc machine consists of a handle; electrical wires, switches and components; an electric motor; a gear reduction unit; a brush shroud; and a brush. The simpler components, such as electrical plugs, are usually the ones that require attention.

Basically, motors are either of the brush or the brushless type with the latter being the most popular today. When plugged into the proper current, there are no adjustments or any periodic maintenance



required, with the possible exception of blowing out the dust and lint collected in or near the ventilation louvers of the motor. Normally, gear units are factory lubricated and properly protected by seals and gaskets for the life of the gears themselves, and unless warranty work should be required, (in which case the proper type and quantity of grease would be supplied) no additional lubricant need be added by the user. Some machines, when brand new, will release a small quantity of grease through an expansion hole provided in the gear case. This should be wiped off, but under no circumstances should an additional amount be added to the gear case by the user.

In most cases, the only adjustments or service (other than electrical) required for the handle, brush shroud or wheels would be the tightening of nuts and screws that might become loosened through continued use of the equipment. Many manufacturers have even eliminated this problem by the use of self locking and/or elastic stop nuts.

Most of the remaining items connected with single disc machines fall under the general heading of accessories. These include brushes, solution tanks, power spray units, rubber pad drivers, steel wool drivers and nylon pads. Used in connection with most floor dressings available today, nylon pads may be washed, dried and re-used until worn out. Steel wood drivers last indefinitely as long as drive plate adaptors are not damaged and the wood backing is not deteriorated by extended soakings in cleaning solutions. Rubber pad drivers perform and deteriorate in the same manner, except that, additionally, the rubber pad should be cleaned if it becomes apparent that the type of cleaning solution being used causes a "build-up" or slippery condition on the driving surface itself.

Power spray unit containers should be washed and the system flushed periodically. Care should be taken that dirt and contamination does not occur in the container, hose or nozzle, as it will certainly cause clogging or be transferred to the floor. Spray heads should be cleaned after usage to prevent clogging by dried cleaning material since the efficiency and usefulness of these spray heads depends upon their emitting a fine mist rather than droplets. Solution tank screens should be checked and cleaned periodically - more often if powder cleaners are used, less often with detergents and in between when soaps are involved. The tank could not be harmed by the process and

than one which is too small.

Vacuum cleaners, too, need little attention mechanically. The only lubrication normally required would be for the caster bearings or dolly wheels - both of which should be free swiveling or free rolling. Motor units, both ventilated and by-pass, are subject to motor brush wear and thus require eventual replacement. This period may vary from 250 to 1500 hours and such information can best be supplied by the manufacturer from whom the machine was obtained. As a result of use, dust and lint will collect in both types of motors so their covers should be removed for cleaning every 90 days. At this time, motor brushes can be checked and replaced if worn to the critical mark indicated on the carbon brush. Removal of dust and lint is more critical in ventilated motors since they are cooled by air which (having already passed through the inside of the tank, through the filter, and up into and around the motor field) is usually higher in temperature than the motor cooling air on a by-pass motor which comes directly from the atmosphere outside of the motor, passes around the motor field and is then exhausted. Clogged filters can also restrict the flow of motor cooling air in ventilated motor types.

Moisture introduced into the turbine, or into the turbine and motor itself, on a ventilated motor type, can not only reduce operational efficiency but, in the cases of the latter, slow down or even stop its further operation. While water shut-off mechanisms are provided either with the machine, or with an optional wet pick-up kit, the additional use of a synthetic deep filter is also recommended when excessive suds exist, or when carpet shampooing operations are being performed. For large quantity water pickup, the shut off mechanism will function satisfactorily providing the float operates freely and the closure point is fitted with a gasket that effectively stops water transfer to the turbine area.

Turbines, too, can be reduced in efficiency by the accumulation of dust and damp lint. Since most turbines are removable from the machine when the motor is off, turbine intake and outlet ports can be checked and cleaned at the same time the motor brushes are checked.

The filter is probably the most important part of any vacuum cleaning operation. Since all machines operate on an "air exchange" principle (i.e. air and dirt come in, air goes out, dirt stays) rather than vacuum as the name implies, it is of primary importance

that the filter which is responsible for this action be in proper condition in order to be effective. Dry filters should be shaken or brushed out each time the dirt tank is emptied and, if still clogged, replaced with a clean one, and the soiled one washed. Besides having a slight self-cleaning action when in use, synthetic cloth filters will last longer when subjected to repeated washings. Germicidal filters fall into a special category and, to be effective, the manufacturer's use instructions must be followed implicitly. Some require liquid germicide re-activation every so many hours and may or may not include disposable bag tank liners. Others include auto-claving among their requirements. Normally, stainless steel tanks need protecting only against severe blows. Regular steel tanks should always be rinsed and dried after use, if possible, particularly when they have been utilized for wet cleaning purposes.

Check wands, hoses and floor tools for clogging each time they are used. Again, such clogging not only reduces cleaning efficiency, but reduces the normal life of the unit by placing an extra load on the motor.

Electrical plugs, connections, trailing wires etc., covered under single disc machines apply equally well to vacuums and should be checked regularly.

By observing the above suggestions, you should obtain long and profitable usage from your single disc and vacuum machines. Wiping off both types of equipment after use is always recommended. Clean and new appearing equipment always receives better attention from cleaning personnel than old or beat-up looking machines.

If warranty work is needed, always contact the manufacturer of your machine, one of their local branches, or the distributor from whom you purchased the machine. Remember, they are in the business and want the equipment you are using to perform as it should. All they require is that you provide them with the model and serial number, date of purchase and that the machine be placed in their hands freight prepaid. Of course, this will be done only after you have made certain that the non-operation of the machine is not due to a plug being pulled loose from a wall socket, or a clogged vacuum hose.

Remember, floor machines and vacuum cleaners are worthless unless they are kept running!

Reference #2 (National Custodian - March - April 1966)

### GASOLINE ENGINES

Gasoline engine maintenance has by now been pretty well standardized, and most engine manufacturers include an engine maintenance book with each piece of equipment. Daily checks should include the dipstick for proper oil level in crankcase, condition of starting battery and connections, tightness of spark plug wires, and condition of air cleaner. Replacement recommendations for crankcase oil, air filter, and spark plugs vary among different manufacturers so their recommendations should be followed as to proper time intervals. When dealing with Propane units, in addition to the above, two additional precautions must be taken. Be sure the fuel used matches the type of system you have, i.e. a vapor withdrawal type will ice up in operation if a liquid tank is accidentally used. And two, when the propane engine is shut off at the end of usage, do not permit gas to remain in regulator or lines. Close off cylinder valve and allow engine to run until it stops - then turn off the ignition switch.

Reference #3 (National Custodian - May - June 1966)

### HOT WATER EXTRACTION EQUIPMENT

Our findings are that 85% of all down time is a direct result of poor maintenance habits. If maintenance is a difficult function to schedule into your busy operation, here is one important parallel that may influence your thinking toward maintenance procedure:

Each hour of machine operation is equal to 75 miles of driving.

A 5½ hour average day equals 310 miles.

An average 5 day week or 27½ hours + 2062.5 miles.

Each month an average of 8660 miles is put on the machine

One year of average machine operation is equal to 103,920 miles.

Compare this to your car and the maintenance you would give it for this many miles of trouble-free driving!

Reference #4 (Hydra-Master Maintenance Manual)

The following is a typical Maintenance Check Log for hot water extraction equipment with gas engine propulsion.

8 HOUR CHECK OR DAILY					
ENGINE OIL					
PUMP OIL					
COAT BLOWER LOBES W/LPS #3					
INSPECT GENERAL MACHINE					
50 HOUR CHECK	Date Hr.	Date Hr.	Date Hr.	Date Hr.	Date Hr.
CHANGE ENGINE OIL (3' qts.)					
CHANGE ENGINE FILTER (½ qt.)					
100 HOUR CHECK					
REMOVE MACHINE FROM VAN AND INSPECT THE FOLLOWING					
Battery & Electrolyte					
Belts & Pulley					
Fuel Line for Chaffing					
Nuts & Bolts					
Heater Core & Burner					
Engine Air Clean					
Clean Vacuum Tank					
Lube Hose Quick Connects					
Spray By Pass W.LPS #3					
Replace Spark Plugs					
Torque Dodge Couplers					
Bolts (10) to 20 ft. lbs. ea.					
Lovejoy Couplers - check for security					
200 HOUR SERVICE					
INSPECT POINTS & CONDENSER GAP .020					
500 HOUR SERVICE					
CHANGE CAT PUMP OIL					
CHECK ENG. VALVE CLEARANCE					
GREASE BLOWER FRONT BEARINGS					
1000 HOUR SERVICE					
CHANGE VACUUM BLOWER OIL					
CHECK PUMP SEALS & CUPS					
OIL FILTER	P.E.R. 64 - PUROLATER				
ENGINE OIL	SAE 30 DET.				
PUMP	SPECIAL CAT OIL				
BLOWER	SAE 40 NON-DET.				

This check list will vary but the point to remember is to use the suppliers suggested maintenance procedures.



The list of equipment and technical data can go on and on but at this point I'm sure you have gotten many basic principals you can use on a variety of equipment.

#### TYPES OF EQUIPMENT

Today with our modern designs and technical advancements together with experience in cleaning a wide variety of items and components have been shaken down to produce compact, smooth operating long lasting machines that require only similar care and attention, normally given the family automobile, with the same reliability of results.

One who experiences otherwise, must fall into one of two categories: either the wrong machine is being used for the application required, or there is misuse and abuse of the unit by the operator. The first can hardly be corrected by anything that might be printed here, but proper attention to the suggestions and procedures outlined could substantially reduce, if not eliminate entirely, problems caused by the second.

Among the machines available from manufacturers today are found all kinds, combinations, and types. However, regardless of this fact, type of power; solution tanks, etc. and distribution systems; propulsion systems; scrubbing or brush drive systems; and, vacuum pick-up systems. Once the power source has been determined and the proper care provided, the maintenance for the remaining components is virtually the same for all machines.

The main thing to remember here is to match equipment to the job. Secondly we should know our supplier and rely on his good judgement as to our requirements. If you have a good supplier he will carry a good line of equipment and trust him for professional advice. Use name brands and remember that you get what you pay for.

#### CONCLUSION

A machine or piece of equipment should be treated with respect and placed as high on our importance list as any of our supervisors, office help, etc. Look on our tools of the trade in a different light. Even at best we as humans break down on occasions and so will equipment, but never have to say to your-self - If only I had done this or that it wouldn't have happened. Give it your best shot.



Time is money and equipment saves us time. Don't forget PREVENTIVE MAINTENANCE - Keep it clean, lubricated, and maintained according to specs and you will be surprised. If you take care of it, it will take care of you. We feel that if you will be honest with yourself, at least 75% of maintenance problems are caused by improper care. Don't blame the equipment - blame neglect.

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