

Norstrom Proflush Dynamic Powerflushing Techniques.

The purpose of this training module is to give a thorough understanding of Dynamic Powerflushing Techniques and we will be covering the methods used to Powerflush a sealed Combi system and a vented system.

Some people have asked why it is now necessary for systems to be Powerflushed when they have managed to clean systems without this requirement in the past.

The reasons are simple. In the past it has proved impossible for systems to be fully cleaned, even by using a hose, but it is only when circulating pumps fail or when new boilers or radiators have to be fitted that it is realised that previous methods have not achieved the results that have been expected.

Manufacturers', in the past, have had to accept numerous warranty claims of which 80-85% have not been their fault. There are several reasons for these failures but incorrect or incomplete flushing procedures have played a great part in those failures.

It is not, generally, realised that flushing a system just with plain water will only remove 10% of the debris. As soon as you introduce a Powerflush to a system that figure rises to around 30% but when you also use a chemical aid this figure increases substantially to 95%.

Powerflushing is therefore the only effective way you can clear a system of the debris that may have been accumulating for years.

The Industry has realised that effective cleansing procedure need to be introduced and, therefore, system cleaning must now comply with initiatives such as *Benchmark*, otherwise Manufacturers' warranties could be invalidated.

The first thing that has to be ascertained is the state of corrosion within the system and its cause. This can be done with a field analysis test kit, which will give in-depth information on the type of corrosion within the system.

The next thing to think about is what you want to achieve with the particular system you are going to work on.

You should be looking at the following:

What is the overall condition of the system?

How many years has it been operating?

What does the system look like, visually?

Do the radiators show signs of corrosion damage externally?

Are there any cold spots on the radiators? If the answer is Yes, then are these areas at the top of the radiators (indicating aeration within the system – see note 1 below) or are the cold spots in the middle or bottom of the radiators (indicating corrosion debris blockage)?

Is the boiler noisy?

Has the circulating pump failed or is it noisy also?

Are there any aeration noises from within the system?

Are there any visible signs of leaks or telltale stains on the pipework or around connections?

The answers to these questions will determine how you go about cleaning the system because it may be that some remedial work may have to be done before you even consider Powerflushing it.

(Note 1 Aeration can be caused by various problems. In an open-vented system this can be as a result of 'pumping over'. Other causes can be micro leaks on the suction side of the pump, leaky valves or connectors or small water leaks where water comes out at the same time as air enters the system. Where aeration is a fault then the sludge build up within the system will be red or reddish brown instead of black. In all cases where this fault is found the problem must be dealt with first before any cleaning of the system is carried out as the situation will only get worse)

1. As a rule of thumb it is best to treat any system over 10 years old with a neutral cleaning fluid, not an acid based Descaler. On a vast number of situations the Sludge Remover will shift most Magnetite and light Lime scale problems. If kettling is still evident on the boiler, then the heat exchanger can be treated on its own with a Descaler. This will need to be neutralised before it is sent to the foul drain. (See the section on Using Acid Cleaners on Page 5)

Powerflushing of a vented system is carried out as follows:

Put a water proof sheet on the floor before you commence the job.

2. If the circulating pump is accessible, then isolate the power supply and close any mechanical isolation valves to it. Remove the pump and put it to one side. If there is a build up of corrosion in the impellor chamber you can lay the chamber in a shallow bowl with the appropriate cleaning solution in it to soak whilst the Powerflushing operation is carried out.

Connect the two 1 ½" BSP pump adaptors to the remaining female connectors. Do not forget the sealing washers. Then connect the flow and return hoses supplied with the machine to the two adaptors. Connect the other ends to the powerflushing machine connections marked flow and return. If it is not possible to get at the pump you can connect to the system via the two valves left after removing a radiator. If connecting in this manner be sure to isolate the electrical supply to the pump.

Make sure all valves on the machine are closed at this stage. Connect a suitable hose from a cold water mains supply and connect to the fill line on the machine. Connect a suitable hose to the dump line and run to a foul drain NOT surface water drain. If the machine has an overflow, connect a suitable hose and run to foul drain. If a secondary containment tank is available, then stand the powerflushing machine in the tank to safeguard against accidental spillage and the overflow will not then need a hose fitting to it.

3. Make sure all Valves and TRV's on the system are fully open. Any zone valves or motorised valves should be opened. If this is not possible they will have to be bridged. You now need to deal with the Feed and Expansion tank in the loft. Ideally you will temporarily join together the 15mm feed pipe to the 22mm expansion pipe. This can be achieved with something like John Guest Speedfit and should have a drain tap in it to bleed off any air. To enable this, tie up the ball valve or isolate the water supply to the expansion tank.
4. Open the flow and return valves on the powerflushing machine and allow the contents of the tank to flow into the powerflush machine reservoir. This will usually hold up to 40 Litres thus leaving the expansion tank empty. The tank can be removed and cleaned ready for re instatement at the end of the flush. By doing this we create a sealed system and the feed and expansion pipes will be cleaned during the flushing process. If you find any bio-fouling such as a jelly in the expansion tank UNDER NO CIRCUMSTANCES allow that contamination to enter the system. The Tank will need to be cleaned out thoroughly with proprietary bleach or disinfectant within a safe environment, and for this purpose you should always wear a mask and goggles.

5. We now have a system and machine full of system water. It is advised that the system is now purged, thus extinguishing all loose debris and any chemicals in the system and replacing with clean water from the mains as you go. Start the powerflush machine and get circulation going by opening the flow and return valves. If the machine has a direction of flow diverter valve fitted, change the direction of flow frequently over the next 10 minutes, this will bring all loose debris into suspension ready to dump.
6. In order to purge the entire system you now close the return valve on the machine and open the dump valve. This will allow all dirty water to go out to drain. By opening the cold water fill line you will be replacing the water in the system as you go. Do not let the level of water in the machine drop or air will enter. When the water running to drain is clear or has a TDS (Total Dissolved Solids) reading within 20% of the mains water being fed into the machine, you can then stop dumping and reinstate the flow.
7. At this point you can introduce the cleaning fluid, with an appropriate dosage as recommended by the manufacturer, into the reservoir of the machine. If you are working on a single pipe or micro bore system it is advised to either dose the system several days before or double the dose on the day. Allow this to circulate around the system and if the machine is capable of handling the temperature, (Normal operating temperature of a system is usually around 82°) you can fire up the boiler and run at normal system temperature. This will allow the chemicals to work quicker and more efficiently than if doing it cold. **Always check to see what the maximum temperature of the powerflushing machine is before starting the flush.** This part of the process may run on an average 10 radiator system for around 3 hours. This process cannot be rushed.
8. When all radiators appear hot and all cold spots have been eliminated you can assume that the cleaning operation is complete and can then commence with the dumping out process. You now close all radiator valves on both sides of every radiator except the one nearest to where the machine is located. You are now flowing liquid around that one radiator, pipe work and the boiler only. Utilise the diverter valve as often as you feel necessary over a 5 minute period then repeat the dump procedure: i.e. close the return valve on the machine and open the appropriate dump valve. Open the cold water supply to the machine to compensate for the black water going to drain. This time, when the contents going to drain have a TDS figure within 10% of the mains water, it can be taken that the radiator is clean. Reinststate the flow etc. and turn both valves off to the radiator that you have just flushed so that you keep it isolated from the rest of the system as it now has clean water in it.
9. Go to the next radiator in the series. Open the valves and repeat the process. When all radiators have been flushed and you have flushed the very last radiator, open all radiator valves again for full circulation. At this time a sample of system water should be taken from an active leg of the system and the TDS reading compared to the mains water. If it is still within 10% of the mains water the system is deemed clean. If not, continue to run fresh water through the system purging to drain until a satisfactory reading is established.
10. Isolate the Powerflushing machine from the system. Stop the machine and remove from the system. Replace the system circulating pump if clean. If not, clean the impeller chamber etc. before refitting.
11. Reconnect the feed and expansion pipe to the Feed and Expansion tank and before dropping the ball valve put the correct dosage of corrosion inhibitor in the F & E tank. Drop the ball valve and refill. Start the boiler and check for air and leaks and if all ok balance the system.
12. If you are unsure of inhibitor dosage, check within 2 hours the strength of inhibitor in the system using the appropriate inhibitor test kit. It is better to overdose than under dose.

Powerflushing of Sealed or Combi Systems.

1. Turn off both valves on the radiator nearest the boiler or the one that is the most convenient to get to. Drain this radiator into a suitable receptacle and remove from the system.
2. Make up two connectors utilising a pair of old radiator tails. These will be connected to the two radiator valves, and the flow and return hoses from the Powerflushing machine will be connected to these.
3. Make all other connections to the machine. Open all radiator valves and TRV's. Start the machine and open the flow and return ball valves. Circulate around the system for around 10 to 15 minutes using the direction change valve regularly, then put the machine into dump mode, refilling with fresh water from the mains. When the water running to drain is clear or has a TDS reading within 20% of the mains, stop dumping and reinstate the flow.
4. Put the correct dosage of system cleanser into the Powerflushing machine and circulate for around 10 minutes. Turn off the flow and return ball valves on the machine and stop the machine. Isolate from the system by turning off the two radiator valves where it is connected to the system.
5. Open the filling loop on the boiler and bring up to normal system pressure i.e. 1 to 1 ½ bar. Fire up the boiler and let it run for the required time to eliminate all cold spots etc. Again this cannot be rushed. It will take as long as is required dependant on the state of corrosion within the system. When you are satisfied that the chemicals have completed the cleaning part of the cycle you can stop the boiler. Go back to the Powerflushing machine and start up. Then open the flow and return and radiator isolating valves. You can now use the diverter valve on the machine to change the direction of flow thus picking up all loose debris into suspension ready for dumping out.
6. Proceed to dump using the same method as on a vented system. When all radiators have been flushed out and the TDS reading is within 10% of mains water you can put the required amount of Corrosion Inhibitor in the Powerflush machine and circulate for 10 minutes. Turn off flow and return ball valves on the Powerflush unit and isolate from the system. Remove the flow and return hoses and if you have not already flushed out the radiator that you took off the system, do so now before refitting.
7. When the system is back to normal, open the bleed valve on this radiator and open the filling loop to bring the system back to normal working pressure. Fire up the boiler and check for leaks and air. Check inhibitor strength if required within 2 hours.
8. The importance of making sure the system is clean cannot be stressed enough. The only true way of doing this is with a Total Dissolved Solids (TDS) meter. Checking samples with eyesight is not good enough. If the system is not clean and a fault occurs within the warranty period, the boiler manufacturer will throw out the claim and it will be up to the installer to rectify the problem. With more and more condensing boilers entering the market some with aluminium heat exchangers, and also the increasing use of aluminium radiators, it is also important to make sure that the **pH value is within that specified by the boiler manufacturer** to avoid corrosion of the heat exchanger.
9. Finally, always make sure that the Corrosion Inhibitor is at the right strength. An under dosed system is useless and is worse than having no inhibitor at all. The strength of an Inhibitor should be checked on a regular basis, ideally annually. Although most inhibitors have a life of approx 4 years, one can never be sure that the system has not had to be drained and refilled at any time by another heating engineer who has neglected to include corrosion inhibitor.

Using Acid Cleaners

1. Acid Cleaners should always be used with caution and must be used in accordance with the manufacturers instructions.
2. An acid cleaner will dissolve all debris within the system and will, therefore, go right back to the bare metal. It is, therefore, likely that the use of such a chemical will expose previously formed pinholes that may have been held together with scale, and radiators and valves showing visible signs of corrosion should not be subjected to acid cleaning.
3. Should you decide that an acid clean is necessary then the same procedures for cleaning should be followed but the length of time the acid is in the system must be reduced in accordance with the manufacturers' recommendations.
4. Care should always be taken if there is Aluminium within the system and if in any doubt always refer individual queries and problems to the chemical manufacturer for advice before proceeding.
5. When flushing to drain following an acid clean you must always ensure the acid has been neutralised before dumping to drain.
6. Please note that Water Authorities require a pH discharge of between 6.5 and 8.5. No system water should be drained unless it is within these parameters.