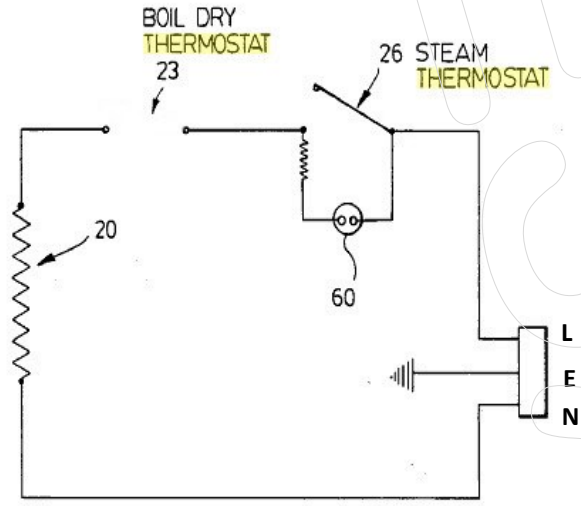
A basic view of PAT testing

Class 1 appliances - Part 1

An EEESafe Technical Team Article



The type of test applied when PAT testing an appliance essentially depends of the electrical classification the appliance falls into. However, it is not always as simple as some believe it to be.

Here we look at two Class 1 products a kettle and a modern electronically controlled washing machine. Kettles have changed little over the years but automatic washing machines along with other major white goods have internally changed quite a lot. Therefore depth of knowledge and practical experience of the product being tested becomes extremely important as this rather simple explanation hopes to illustrate.

The schematic diagram on the left is of the electrical circuit of a standard kettle and it shows the operating circuit the appliance mains lead connects to. The following is only considering the 'Insulation Resistance' test of the PAT test procedure in order to illustrate the need for knowledge and practical experience of product when testing appliances.

When a Class 1 appliance is correctly connected to a PAT tester for the insulation test i.e. plugged into the three pin supply on the PAT test unit and the earth test lead connected to a suitable earth point on the appliance the test can begin (in this instance it would also require enough water added to the kettle to cover the element (as a dry element could give a false reading).

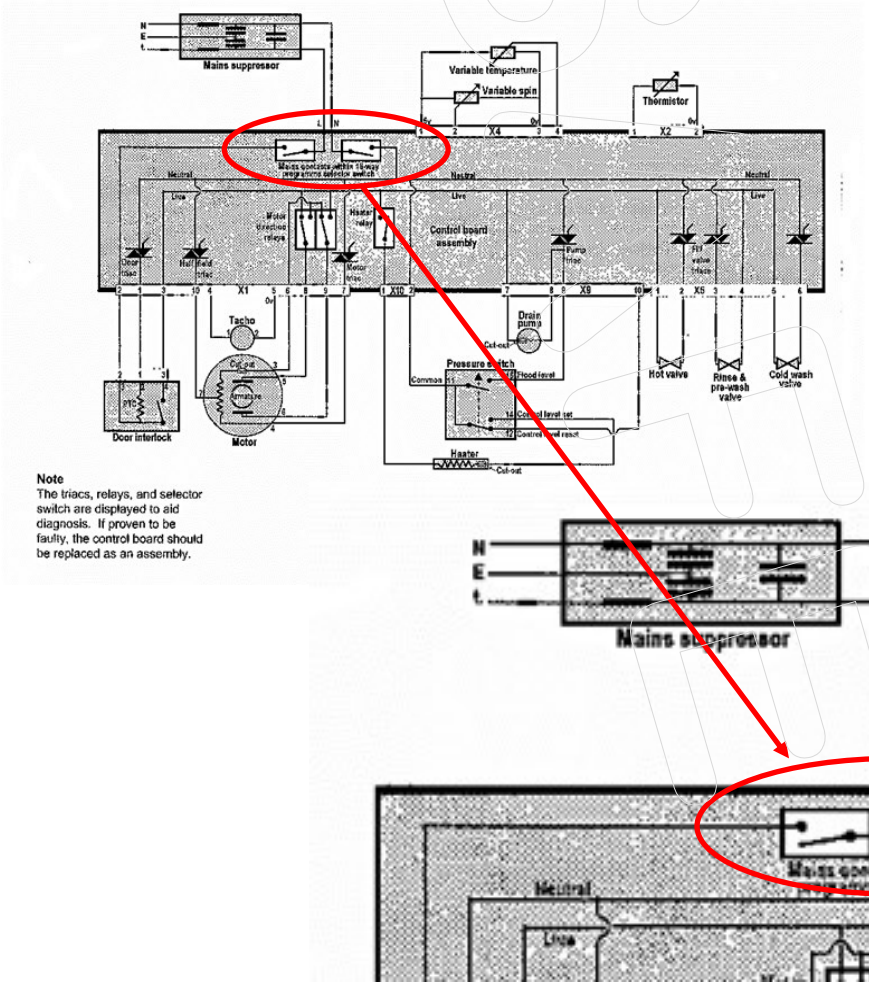
When the PAT tester applies the required insulation DC test voltage (for a 230 AC volt appliance this will be 500 volts DC) they will (should) ensure that the On/Off switch of the appliance is in the On position so as to ensure that the test voltage reaches the internal components that are after the On/Off switch. In this instance the heating element.

Interestingly it can be seen in this instance that the appliance only has a single switch on the 'live' supply to the circuit the therefore a test reading could still be obtained even if the On/Off switch was not closed . Although this would not constitute a professional approach to testing such products.

A basic view of PAT testing Class 1 appliances - Part 2

The schematic diagram below is another Class 1 appliance in this instance a modern 'computer controlled' washing machine. Unlike the kettle this appliance has far more internal components and more importantly has a more complex wiring system. As before the three core mains lead connects to the appliance and in this instance passes through a suppression unit before continuing on to the main control circuitry (PCB). If you look closely as the top of the board the L & N terminals connect to two 'Normally Open' relay switches i.e. they do not 'latch' mechanically as with simple push On and push again for Off type mains switches. These PCB mounted 'relay switches' can only close when instructed to do so i.e. when a programme has been selected and the 'start' 'short stoke' low voltage selection button is pressed. NOTE: This action 'Cannot' be carried out when using the PAT tester for insulation testing. Therefore an insulation test on this type of circuitry is unable to go beyond the two 'Normally Open' relay switches which means that critical components such as the heating element, wash motor etc. are not tested. In such cases the applied test essentially only tests the plug, the mains lead, the suppression unit and the two wire up to the main control board. Although there are methods of compensating for this type of situation it takes knowledge of the product and additional equipment as a PAT test unit is unsuitable for the additional testing required.

- **A point to note is that there are many other appliances that utilise 'double pole' switching.**
- **Are you or your supplier of product aware of these features?**
- **More importantly is the person charged with PAT testing the appliances?**



Normally 'Open' relay switches are found on many products - washing machines, washer dryers, dishwashers , microwave ovens etc. in-depth appliance technical and practical knowledge is therefore required when testing such products.

A basic view of PAT testing Class 1 appliances - Part 3

Why are there concerns with using a PAT test to verify that reconditioned/refurbished major appliance and what are they?

- Firstly PAT testing procedures were not primarily designed for the specific purpose of verifying electrical safety of reconditioned/refurbished appliances. The PAT testing procedures, guidance and resulting 'none mandatory' 'qualification' target was for electrical appliances used in the work place.
- Instead of developing a testing procedure specifically for the reconditioned/refurbished sector it was deemed by the powers that be that the PAT test procedure should implemented so as to indicate a reconditioned/ refurbished appliance was electrically fit for resale.
- PAT testing requires an operative only to be 'competent' in the PAT testing procedures. This can be self taught by studying the IET guidance procedures or attending a training seminar where upon a 'recognised' certificate of qualification (2377) is issued. Unfortunately such courses are often of one days duration regardless of any pre-existing knowledge or not and an open book written assessment is often carried out to verify ability. This is an area of concern in itself as the simple ability to follow guidance procedures is not a demonstration of the individuals depth of technical knowledge and practical understanding of the various types of equipment needed to safely and effectively carry out such testing and just as importantly know when testing should not be carried out.
- Many in the Recycling sector choose to employ/use 'qualified electricians' that have gained the above certification/qualification. However, although electricians will have had to demonstrate extensive technical knowledge, understanding and practical experience of electrical installations such knowledge rarely if ever covers the internal workings of electrical appliances themselves. As can be seen from the two simple scenario's on pages 1 & 2 appliance construction and function are a key factor in ensuring that safety testing is not just skin deep.

What would be the result of simply applying the PAT routine to the scenario on page 2 i.e. an appliance with double pole latching relays?

As stated the applied PAT 'insulation' test would essentially only test wiring and components up to the two 'open circuit' relays and if there were no problems up to that point then the appliance would be labelled 'Passed'. However, as can be seen the items beyond the two latching relays would not have been subjected to the 'insulation' test which an EEESafe DAT or DAR is required to undertake.

What could result if the above occurred?

Firstly lets assume that the components beyond the latching relays were unknowingly OK i.e. above the required minimum insulation level then essentially there would be no problem with labelling the item as passing the applied safety test. However, this scenario is reliant on luck and not fact. In reality there are many reasons that wiring and/or component within appliances may have degradation (a breaking down) of their insulation. In relation to the washing machine scenario on **page 2** the two most likely items for lower than acceptable insulation are the heating element and main motor and these are also common items across a range of such major appliances.

What could be the result of having low insulation of items not tested?

Like all accidents and incidents things are rarely all that simple and the result if any bad or good are more often than not dependant on a series of apparent diverse factors coming together. In this scenario if the appliance was passed as 'Safe' and was correctly installed into a premises which had the correct electrical supply criteria depending on the severity of the insulation breakdown the appliance may work for sometime before failing by blowing a fuse or tripping and RCD (Residual Current Device) or similar protective device. Annoying for the customers and not instilling confidence in the suppliers of the supplied product either.

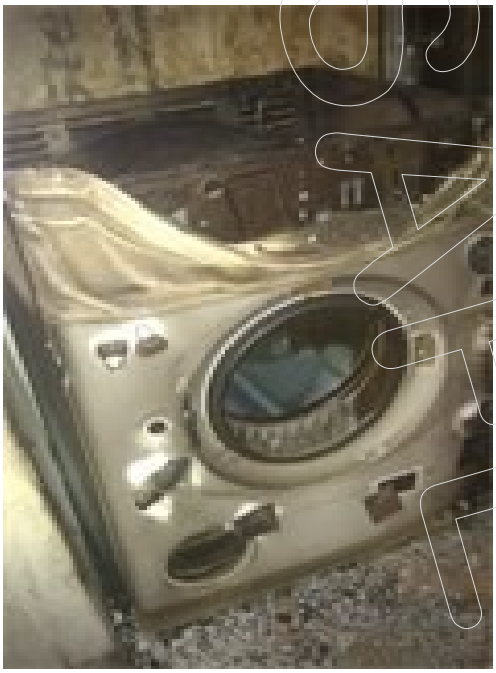
However, the installation of appliances is in itself often not carried out to a suitable standard (as essentially none exists). In the case of washing machines (and similar appliances) it is often a case of - connect fill and drain hoses - plug it in - fill and empty the appliance and leave. In many instance it does not even go that far. All Qualifed EEESafe DARq's who undertake delivery, will be required to record the required safety readings.

What's the problem with that it works doesn't it?

The problem is that just because something works it does not mean it is doing so correctly or more importantly 'Safely'. For instance if the installation of the premises had a poor or none existent earth in the electrical supply then components with 'low insulation' could essentially make the external metal shell of the appliance 'live' to the touch exposing those in the vicinity to electric shock hazard or worse electrocution. However, there is another potentially fatal event of greater magnitude that could occur in such instances and that is fire.

If an installation has a poor or none existent earth in the supply the appliance would be unable to rupture (blow) its protective fuse which could result in a faulty component over heating and in a worse case scenario setting fire to the appliance and its surroundings.

*There are numerous variables that can adversely or otherwise affect the outcome of the safety issues raised which have not been included in an attempt to keep the article understandable by those not so technically knowledgeable.

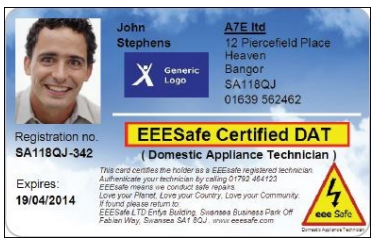


For Appliances Repaired by EEESafe "Registered Competent Persons"

Look for an EEESafe DAT or DAR.

For Approved Refurbished Appliances look for the Label below on your purchase.

Only EEESafe Centres & DATs can issue "Approved Refurbished Appliances".



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