Periodic Inspection and Test of Arc Welding Equipment

MCT Unit PROCEEDURE and GUIDE.

This procedure should only be carried out by trained personnel.

IEC 60974-4 explained and a brief description of what we will be doing.

This part of IEC 60974 specifies test procedures for periodic inspection and, after repair, to ensure electrical safety. These test procedures are also applicable for maintenance.

This standard is applicable to power sources for arc welding and allied processes designed in accordance with IEC 60974-1 or IEC 60974-6. Stand-alone ancillary equipment designed in accordance with other parts of IEC 60974 may be tested in accordance with relevant requirements of this part of IEC 60974.
The welding power source can be tested with any ancillary equipment fitted that can affect the test results i.e. water coolers etc.
This standard is not applicable to the testing of new power sources or engine-driven power sources.

The MCT Unit (Machine Compliance Test Unit) when used in conjunction with the documentation software ensures compliance with IEC 60974-4.

The standard has been introduced to ensure the electrical safety of welding equipment, which in turn will protect the machine user or persons tasked with repairing and calibrating the equipment from serious injury or worse.

During the procedure we will carry out a detailed Visual inspection, test the earth circuit of the primary supply to make sure it is present and connected correctly. We will also test (using a generated 500v) for leakage from the Primary supply to earth, the secondary supply to earth and for any leakage between the primary and secondary circuits. When testing a machine after a repair we will carry out a function test to the welder. The owner of the equipment has the responsibility of the safety level and that the inspection has been made in time.

Tests of welding equipment can be hazardous and shall be carried out by a trained and certified expert in the field of electrical test and repair, who is familiar with welding, cutting and allied processes.
Only expert test personnel can open the equipment.

This procedure must be carried out after any repair to a part or replacement of a part that restores a welding of cutting function. For example changing a wheel will not affect a welding or cutting function therefore not restore it, in this case a test is not required. If, for example a PCB is replaced or repaired, a welding socket is replaced or ANY other component affecting welding or cutting, then the test must be carried out.

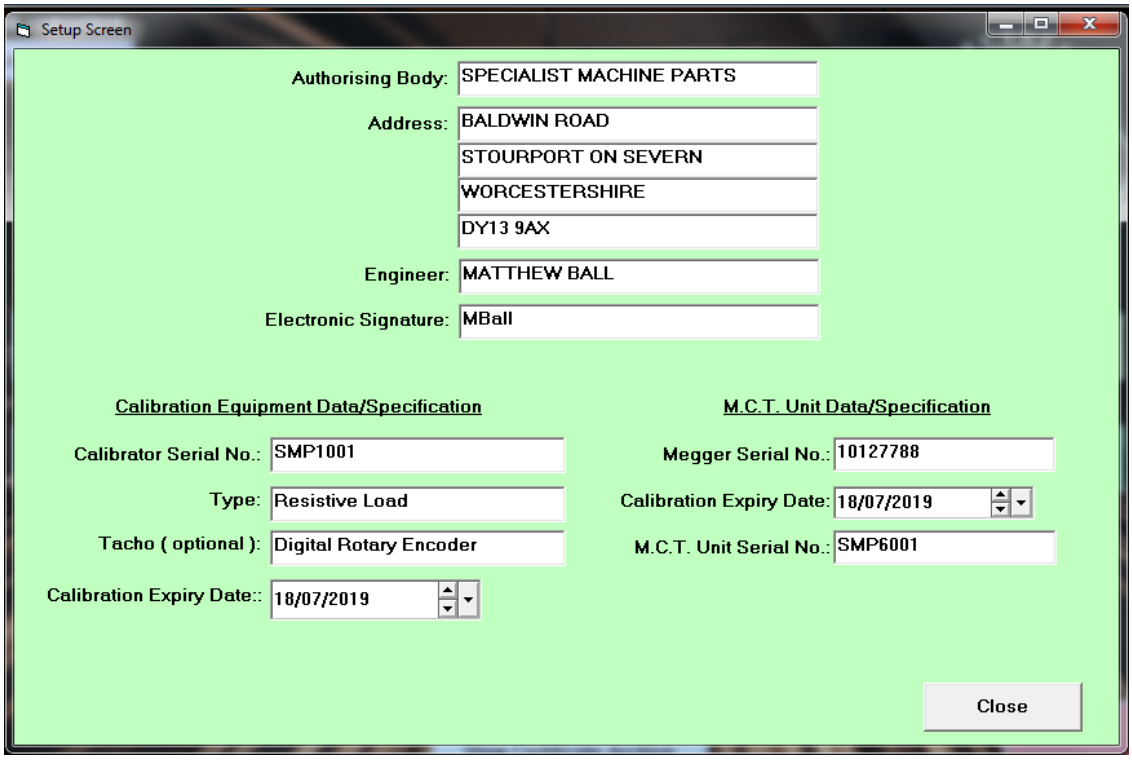
Different manufacturers have different intervals that the test must be carried out. Most are 12 months but a list of manufactures and their recommendations are at the back of this document. If the manufacturer is not list then contact must be made with the manufacturer to determine how often the test must be done. Please note that the conditions in which the machine operates can affect the interval (eg. machines used off shore and in ship yards are typically tested every 6 months)

It is recommended in IEC 60974-14, the standard for Calibration and Validation of Arc Welding Equipment that the procedure is carried out prior to Calibration or Validation.

Program setup

When using the program for the first time you will need to enter all the required details which will be stored and displayed on all Certificates.

On the home page select SETUP SCREEN (top left) and fill in your details, machine data and engineers name and electronic signature. If you would prefer to print and physically sign certificates the leave the signature box blank. We do recommend using the electronic signature so you can run a paperless Testing and Calibration system.

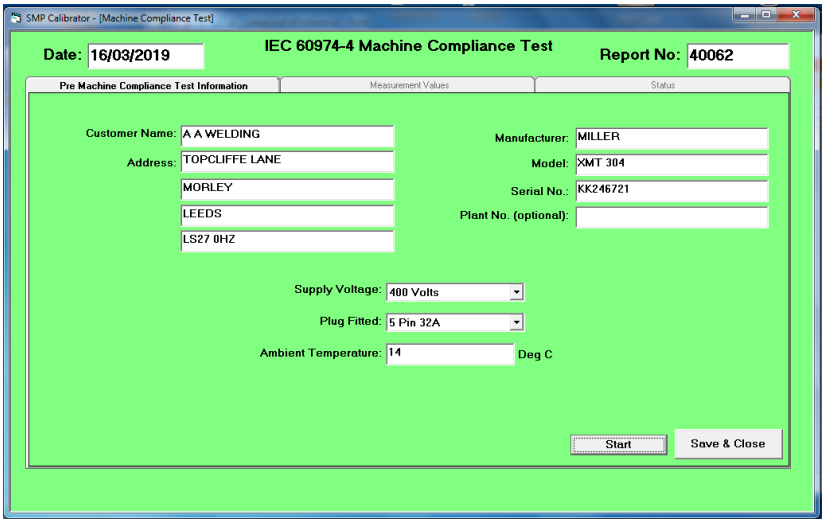


Procedure for Machine Compliance Testing

Firstly disconnect the machine from the mains supply and ensure it has been electrically switched off for at least 2 mins before carrying out any tests.

Open the SMP Elecdoc program and select the Machine Compliance Test form.

Select CREATE NEW REPORT (bottom left)



(Re-testing a machine and duplicating customer info is explained later in the manual.)

The program will step you through the process – fill in the Customer Name box and press enter.

Fill in the address boxes and press enter – NB 2 lines of the address must be filled in to continue.

Fill in the manufacturer and press enter.

Fill in the model and press enter.

Fill in the serial number and press enter

The program will not let you continue without inputting mandatory information.

Plant number is optional – if there isn't one or you have not been instructed to record one just press enter to move to the next step.

Using the up or down arrows on the keyboard select your nominal voltage – usually 400v or 230v in the UK. If you are unsure see the Distribution board the welder is supplied from – the voltage will be displayed on the front. Once you have selected your voltage press enter.

Using the arrows select which plug is fitted – most types are there but if not select OTHER .There is also an option for NONE if a plug is not fitted. If you select OTHER it is good practice to record the type of plug fitted in the additional information box and the end of the test.

Once selected press enter.

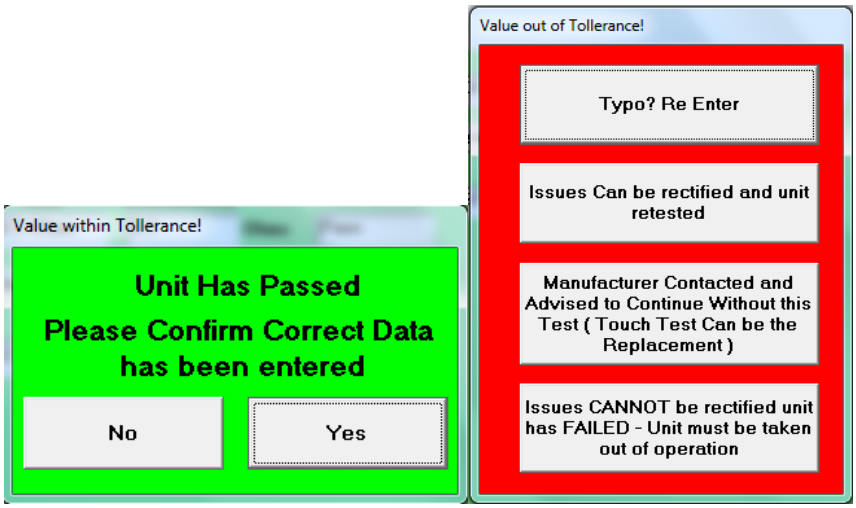
Fill in the ambient temperature, tests must be carried out between 10 and 40 Deg C, a popup box will be displayed if you are outside these parameters.

Once the temperature is filled in press enter.

The start button is now highlighted, press enter if you are ready to start the procedure.

You are now taken to the MEASUREMENT VALUES section.

After every test result is entered you will either see the ‘confirmation popup’ or ‘value out of tolerance’ popup. We ask you to confirm the information you have entered is correct to ensure 100% compliance and avoid any mistakes.



If at any time a parameter is entered which is out of tolerance (fail situation) the program will ask if you have mistakenly entered the wrong details (Typo), if the problem can be resolved and the machine re tested, does the manufacturer have special requirements for a specific test or in the worst case scenario it cannot be resolved. If the last option is selected you will then be sent straight to the fail section where the reason for failure is entered and the machine is taken out of operation. The user MUST be notified that the machine cannot be used until the faults are rectified and the machine passes a re-test

Visual Inspection

Before connecting the MCT Unit a visual inspection is carried out. You can use the VIEW PROTOCOL box on the program to ensure all required items are checked – for reference the check list is –

a) Torch/electrode holder, welding clamp
- missing or defective insulation
- defective connections
- defective, damaged switches
- other damage

b) Mains supply
- defective, damaged cable
- deformed, faulty plug
- broken or thermally damaged plug pins
- ineffective cable anchorage
- cables and plugs unsuitable for the intended use and performance

c) Welding circuit
- defective, damaged cable
- deformed, faulty or thermally damaged coupler/sockets
- ineffective cable anchorage
- cables and couplers unsuitable for the intended use and performance

d) Enclosure

- missing or damaged parts
- unauthorized modifications
- cooling openings blocked or missing air filters
- signs of overload and improper use
- missing or defective protective devices, for example, gas cylinder holder
- missing or defective wheels, lifting means, holder, etc.
- defective wire reel mounting means
- conductive objects placed in the enclosure

e) Controls and indicators

- defective switches, meters and lamps
- defective pressure regulator or flowmeter
- incorrect fuses accessible from outside the enclosure

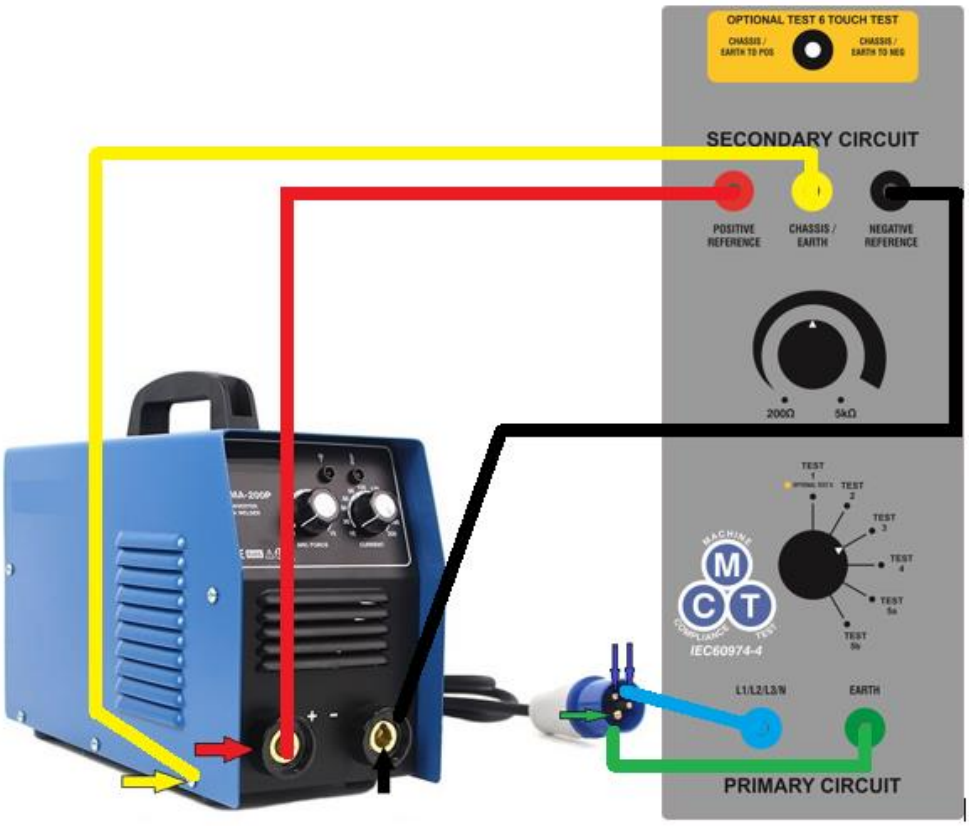
f) General condition

- excessive dust or pollution
- cooling liquid circuit leaking or incorrect cooling liquid level
- defective gas hoses and connections
- poor legibility of markings and labelling
- other damage or signs of improper use

Use the arrows to select PASS or FAIL and press enter , if any additional work is carried out i.e. the earth clamp is damaged and changed, you can record this in the additional information box at the end of the test. If there are issues which pass the test but you would recommend the customer monitors or rectifies, record them in the Engineers Recommendations. For example you may have a steel braided (SY) mains lead which has nicks in the outer sheathing but the steel braid is intact, this will not fail the test but it is good practice to recommend minor issues like this are rectified in the not too distant future.

When the visual inspection is complete and documented connect the MCT Unit to the equipment under test as shown below. Take particular care to get all connections correct, you will not damage the MCT Unit or the welder but incorrect connection will affect results.

MCT Unit set up



All cables, adaptors and connectors are supplied.

Connect all cables to the colour corresponding socket on the MCT Unit.

Secondary connections. RED – YELLOW – BLACK.

Using the croc clip or Dinze adaptor connect the red cable to the Positive (+) welding socket or stud.

Using the croc clip or Dinze adaptor connect the black lead to the negative (-) welding socket or stud.

If it is not possible for safety or control reasons to connect directly to the sockets / studs you can connect the red cable to the Mig torch tip (positive) and the black cable to the work return lead or clamp (negative).

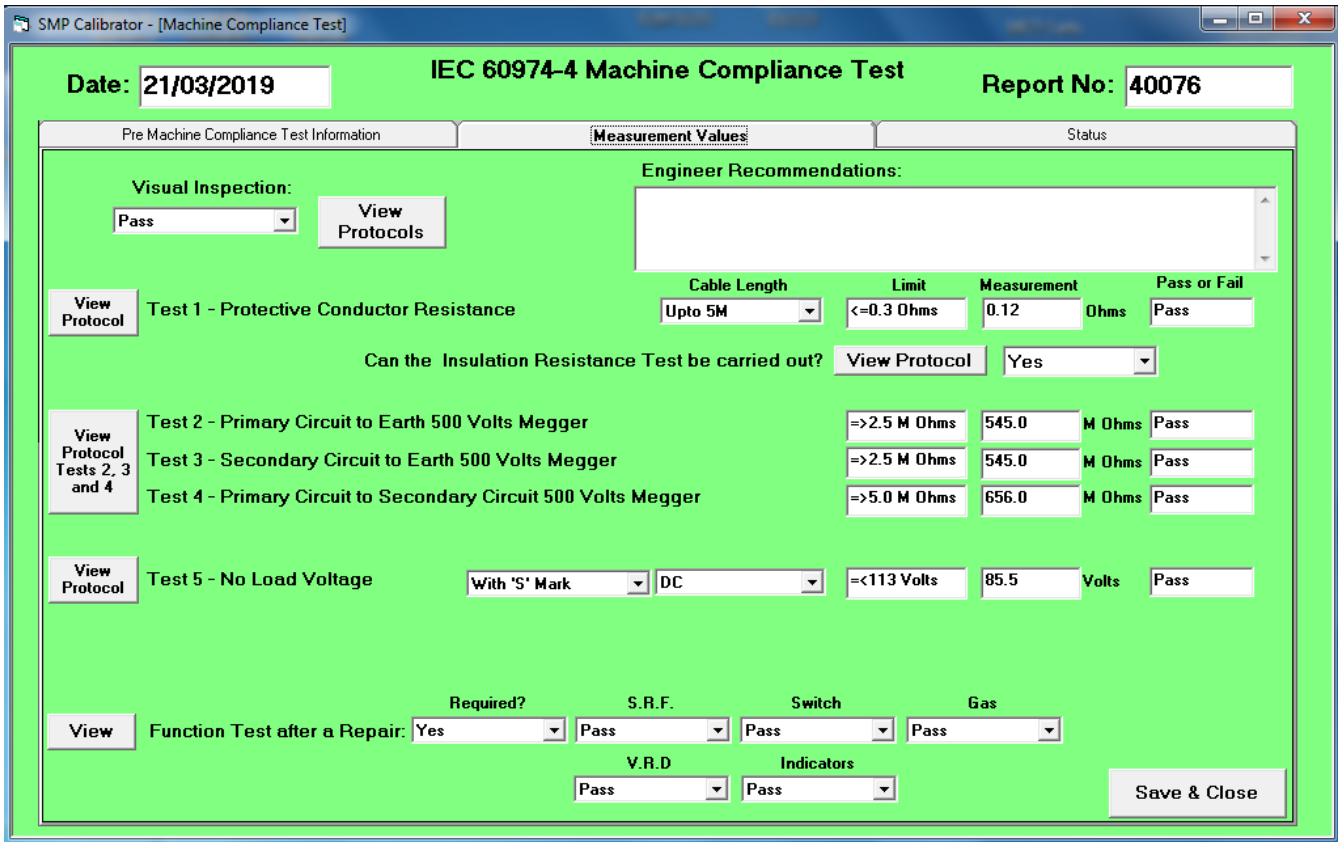
Connect the yellow lead to the welder chassis (exposed conductive part) using the croc clip. If this is not possible you may need to loosen 1 cabinet screw, attach the chassis clamp provided and tighten for a good connection.

Primary connections. BLUE – GREEN.

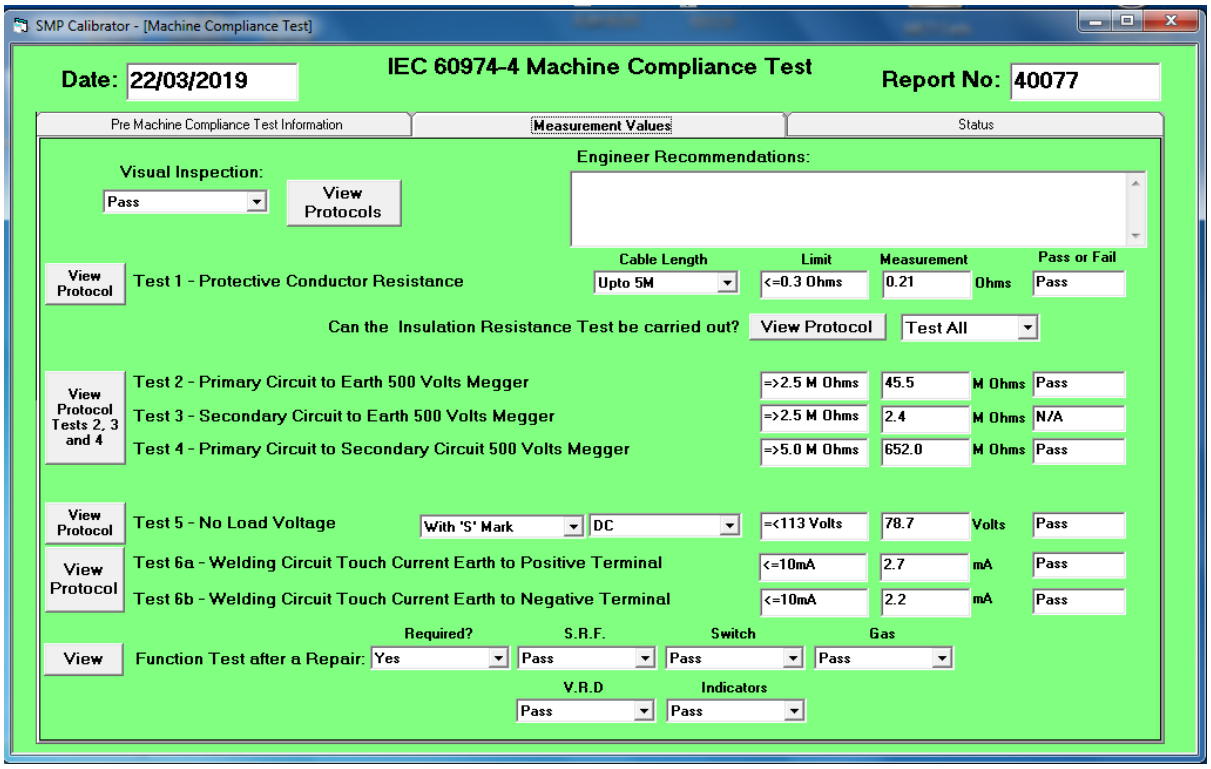
Connect the green lead to the primary earth pin on the plug using the croc clip or an adaptor socket.

Connect the blue lead to all supply circuits – in the case of a single phase welder that means live and neutral. In the case of a three phase welder that means L1, L2 and L3. NB It is advisable on a three phase 5 pin plug to also connect the blue cable to the neutral line too, neutral may not be used but there could be defects in the plug itself. To connect to the supply circuit use the blue multi-croc clip set up or an adaptor. Once everything is connected correctly we can start the measurement tests.

Measurement Value Page completed without the optional test 6



Measurement Value Page completed without the optional test 6



Test 1 - **Continuity of the protective circuit (earth)**

Select switch position Test 1 on the MCT Unit. Using the arrows select the cable length on the program (this will calculate the permissible tolerance) and press enter. Set the Megger to the **Ω** position as shown below.

During the measurement, the cables shall be bent, flexed or twisted along the whole length, Especially in the vicinity of cable entries into the enclosure, in order to detect interruptions in the protective conductor. This will highlight any breaks / defects.

Fill in the Ohms value shown on the Megger in the result box of the program and press enter, if the machine passes the test you will be asked to confirm the reading you have entered is correct, this is to ensure 100% that correct data is entered.

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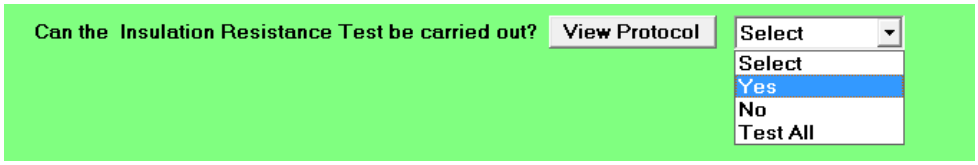
You will then be asked if the Insulation Resistance test can be carried out, if testing a machine for the first time select YES and press enter. Only select NO for machines that are known to fail the test due to suppression assemblies which cannot be disconnect or removed for the test. If you select no you will carry out the optional Touch Current test. There is an option to TEST ALL (insulation resistance and touch current test) which is not mandatory but you may wish to do.



When you have selected your option and pressed enter you will be reminded to ensure the primary power switch is in the ON position and if a unit has a contactor to depress it manually.

If you are testing a welder with a primary contactor you will have to open the unit to manually depress the contactor during the test.

Please note that only expert test personnel can open welding equipment. Hazardous voltages and currents are present which can cause shock, burn or death
(this is a statement from IEC 60974-4)

Once that is done press enter and you will be taken to the Test 2 box for recording M Ohms.

Test 2 – Insulation test, Primary to Earth.

Select switch position 2 on the MCT Unit. Turn the Megger to the 500v position. Press and hold the test button and record the result in the box and press enter.

TAKE CARE TO READ THE METER CAREFULLY, IF THE INSULATION IS VERY GOOD YOU MAY READ GIGA OHM – 1 GIGA OHM = 1000 MEGA OHM.

As long as the result in within tolerance you will be moved to the next step after confirming the reading is correct, press enter to confirm.

Test 3 – Insulation test, Secondary to Earth

Select switch position 3 on the MCT Unit. Ensure the Megger is still in the 500v position. Press and hold the test button and record the result in the next box and press enter. As long as the result in within tolerance you will be moved to the next step automatically after confirming the reading is correct, press enter to confirm.

Test 4 – Insulation test, Primary to Secondary.

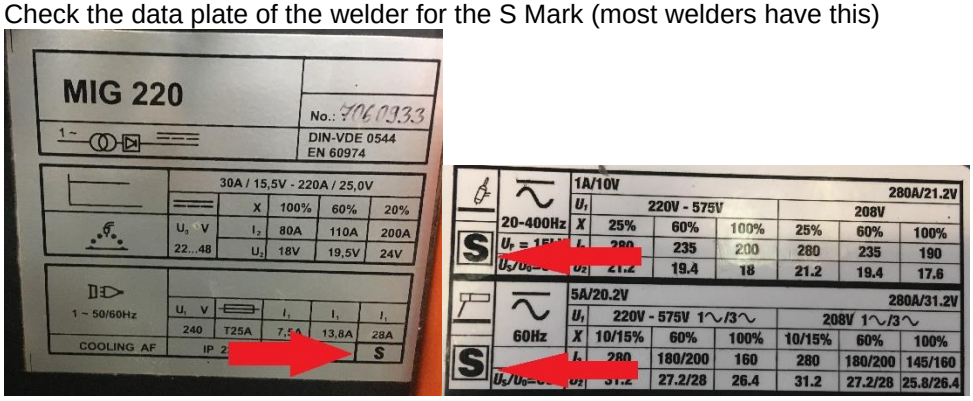
Select switch position 4 on the MCT Unit. Ensure the Megger is still in the 500v position. Press and hold the test button and record the result in the next box and press enter. As long as the result in within tolerance you will be moved to the next step automatically after confirming the reading is correct, press enter to confirm.

Test 5a OR 5b – No Load Voltage test.

Test only on 5a when there is an available DC open circuit voltage.
Ensure polarity is correct as you will not get a reading if they are the wrong way round.

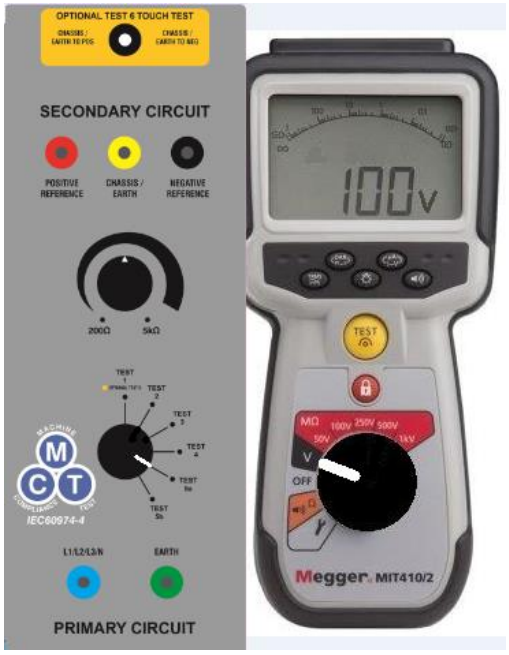
If you have an AC/DC welder test only in DC as is the case with Calibration.

Check the data plate of the welder for the S Mark (most welders have this)



On the MCT form use the drop down bar to select With ‘S’ Mark or Without ‘S’ Mark and press enter. Then select DC or AC from the next drop down bar and press enter. You will now be in the Volts box ready to take your reading.

Select test 5a on the MCT unit (or 5b if an AC voltage is being read) and select Volts on the Megger.



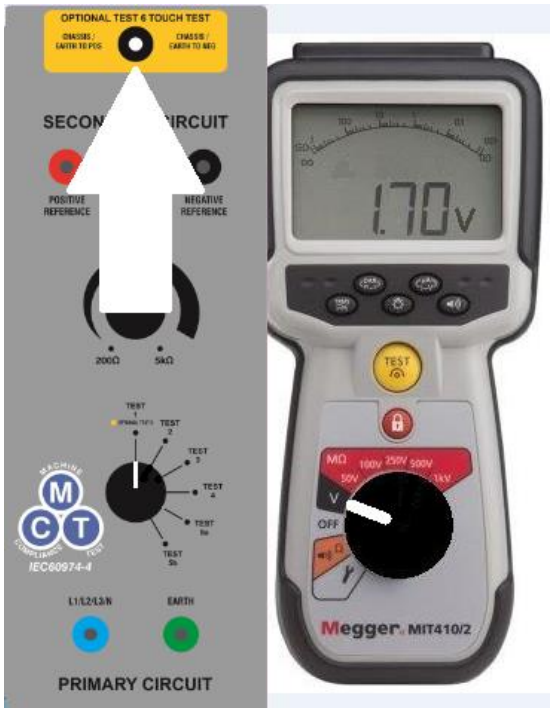
Turn the output of the welder on taking care to disable or disconnect HF which could damage the Megger and ensure any Voltage Reduction Device (VRD) is turned off. If it is impossible to turn off the VRD then record the low voltage and during the function test ensure the VRD is operating correctly.
NB – if you do not see a voltage reading double check you have the polarities the correct way around.

Rotate the 200 – 5K ohm rheostat from min to max and record the highest voltage reading you see. This is in most circumstances at the max position of the rheostat.
Once the reading is taken press enter, confirm your reading is correct and you will move on to the final part of the procedure – Function Test.

Test 5b will be carried out INSTEAD of 5a in the rare circumstance that there is no available DC voltage i.e. AC only welders.
Select the voltage mode on the Megger and press the TRMS button for AC voltage. Turn on the output of the welder, again taking care regarding HF and VRDs, rotate the rheostat and record the highest voltage reading as instructed for 5a.

OPTIONAL TEST 6.
This test only needs to be carried out when an insulation resistance test is not possible due to fixed suppression devices which cannot be removed or bypassed for the test. Please contact us for a list of known machines with manufacturer recommendations to carry out the test, alternatively consult the manufacturer in relation to the test.
During the test we will measure in the volts mode using a known value resistor and Ohms Law to calculate mA from a voltage reading.
This test will determine how many mA are present between earth / chassis and the welders output sockets. There is a maximum allowance of 10mA

To carry out the test select Test 1 / optional Test 6 and select Volts on the Megger.



Turn the output on with the Positive, Negative and Chassis leads connected. Push the touch test switch to the Positive – earth position. Take the voltage reading from the Megger and insert into test box 6a. For example – as above enter 1.70, this equates to 1.70mA when Ohms law is applied. If the reading was 22.4 volts we would enter 22.4 in the box. That would equate to 22.4mA and a fail situation.
Repeat the test in the Negative – earth position and record the result.
Once complete move on to the final test.

Function Test.

The function test is only required after a repair in which a welding function has been restored, if you are testing a unit in use (for example prior to Calibration or as part of a maintenance / service schedule) this test is not required. Use the arrows to select NOT REQUIRED if this is the case.

If the function test IS required complete the check list (you can use the VIEW PROTOCOL button to see what needs to be tested) If a function is not available select N/A in the drop down box i.e. on a sick only machine there is no gas valve so the gas test will be N/A.

S.R.F- safety-related function judged as relevant by the test personnel shall be checked for correct operation.

SWITCH - The supply switch shall be checked for correct operation.

VRD - if applicable the voltage reduction device shall be checked.

GAS- Gas valve and gas leakage checked, a simple drop test will be carried out.

INDICATORS - all signal and control lamps / indicators shall be checked for correct operation.
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When the final test is complete you will then be taken to the STATUS screen.

The date will be highlighted and the standard 1 year retest date is filled in. If you need to change the retest date because of working conditions (i.e. equipment working in a moist environment require testing every 6 months) use the drop down bar to select a new retest date.

If required enter any additional information or any reasons for failure in the appropriate box.

You then have the option to save and close if carrying out the Safety test only or you can select Calibrate /validate this machine. This will open a Calibration / Validation form with all the customer and machine info already entered, saving a huge amount of time. Please see the Calibrator Manual if using this option.

Once you have saved and closed the report you will be taken back to the Machine Compliance Test Search and Report screen.

To print or to email the report double click in the SELECT column so that select is shown. You can select as many as you wish to print or email.
Press PRINT CERTIFICATE (bottom left) and the press GENERATE EXCEL REPORT.
Once that is done an Excel certificate available to print or email.
The certificate is the stored in a folder specific to that customer which is easily accessible from the VIEW CERTIFICATE ARCHIVE button on the home screen.

Re Test and Duplicate Customer info.

These functions can save up to 60% of test time.

To duplicate the customer info only highlight a report with the required customers details and press the DUPLICATE CUSTOMER INFO button, all info is filled in and you will start at the manufacturer box on the program.

To Re-test and machine find an old report using the search boxes (you can search by serial number, customer name, date or old report number).

Once the welder is found hit the Re-Test button and you will start at the Plug drop down box NB the plug may have changed since the last test. Then continue to test as before.

Warranty
The M.C.T. comes with a 2-year parts and labour warranty.
If a Megger device is supplied it comes with a standard 1 year warranty from Megger which is extended to 3 years when *you* register the device with Megger themselves shortly after purchase.