About the new AM2 and the changes to the old AM2

AM2 or the Achievement Measurement 2 is a practical performance skill test administered by the National Electrotechnical Training (NET).

You must take the AM2 test if you are:

- An Apprentice finishing your JIB Apprentice Training Scheme
- Finishing an Electrical Installation Apprenticeship
- An oversees qualified electrician (from Poland or Hungary for example) who needs approval in order to gain the JIB card as an electrician

Since January 2011 there are some big changes in the AM2 requirements. All candidates must take the exam according to the new program.

The new AM2 exam differs from the old one:

- MIMS (pyro) or Mineral Insulated Metal Sheathed cable use and termination removed
- Installation of steel conduit is now removed**;**
- All the electrical containment is already installed so you only need to do the wiring from one equipment to another;
- All the wiring needs to be installed using the preinstalled cable tray, steel and PVC compartmental trunking and PVC conduit**;**
- In comes the S Plan central heating and hot water system with a solar thermal sustainable energy element**;**
- In comes the requirement to install and test data-cabling systems (Cat5)**;**
- Time for the composite installation has been reduced from 10 hours to 8 h 30 min**.**

Many people say that the new exam is actually less demanding than the old one. This might be true because of the removal of the MIMS cable and the steel conduit installation (these were the hardest parts where candidates used to fail on). However, we must keep in mind that now in the new AM2 exam Inspection and Testing is taken much more seriously, so that candidates must produce a full Electrical Installation Certificate.
What we can certainly agree upon is that the new exam is much more up to date with today's requirements due to addition of data cabling and sustainable energy source utilisation.
The AM2 exam takes three days to complete. In order for the text to be neutral it must be taken in an independent testing facility outside your college or training school. Centres for taking the exam can be found nationwide.

The assessment is split into these sections:

- Section A1 – Risk assessment and safe isolation – Time to complete: 1 hour
- Section A - Composite installation – Time to complete: 8 h 30 min
- Section B – Inspection, Testing and Certification – Time to complete: 3 h 30 min
- Section C – Fault Diagnosis – Time to complete: 2 hours
- Section D – On-line exam – Time to complete: 1 hour

All the sections must be completed within the specified target times and according to the requirements of the current IEE Wiring Regulations (BS7671). You will be required to work on standard AM2 test units using drawings, circuit diagrams and written instructions. You will be permitted to refer to the current edition of the IEE Wiring Regulations, IEE On-Site Guide and to the IEE Guidance Note no.3 Inspection and Testing.

Candidate requirements for the AM2 exam

The AM2 is designed for individuals who wish to work as electricians or as maintenance electricians.

By taking the new AM2 exam you will demonstrate that you have a level of competence expected by the industry in the following key occupational areas:

- The interpretation of specifications, drawings and diagrams,
- Risk assessments and also Health and Safety,
- Safe isolation,
- Planning and preparing to install, terminate and connect identified wiring systems,
- Inspection, testing and certification of electrical installations,
- Fault diagnosis and fault correction,
- The understanding and application of industry recognised procedures, working practices and the requirements of statutory and non-statutory regulations.

You will be required to work on:

- Lighting and power circuits**,**
- A three-phase distribution board and sub-circuit,
- A central heating/sustainable energy system,
- A safety services circuit and device,
- A data cabling system.

Requirements for each AM2 Section in detail

AM2 exam Section A1 – Risk assessment and Safe Isolation

Section A1 consists purely of the completion of a risk assessment form provided by your assessor and by performing safe isolation on the AM2 exam unit which you will be working on.
The target time specified for this section is 1 hour, which should be enough to complete both tasks without the pressure of not having enough time.

You must perform a 100% correct safe isolation process in order to pass this part of the AM2 exam. Practice safe isolation with a friend or colleague until you do every step without thinking about what step to do next.

Don`t forget to place the key in your pocket after you lock the padlock on the isolator! Many people forget that or don't know what to do since the key is not their property. Just keep it in your pocket and return it after the work is done.

AM2 exam Section A – Composite installation

This is the longest section in the new AM2 exam. You will have 8 h 30 min to finish all the tasks at hand. You will be expected to install the following:

- Protective devices in a TP&N distribution board
- A two-way and intermediate lighting circuit in a PVC/PVC multi-core cable
- A BS 1363 13A socket outlet ring circuit in **a** PVC single core cables
- A carbon monoxide detector safety service circuit in **a** FP200 type cable
- Data outlets circuit in **a** Cat 5 cable
- A BS EN 60309 16A socket outlet in **a** XLPE SWA cable
- Protective equipotential bonding to gas and water services
- A 3-phase direct on line motor/starter circuit in **a** SY cable
- An S Plan central heating and hot water system with a solar thermal sustainable energy element utilising heat resistant flexible cable and PVC single core cables

Protective devices in a TP&N distribution board

During the new AM2 exam, as a part of the composite installation you will be required to determine and select the appropriate protective device for every circuit.
You will be provided with a selection of protective devices but among the right ones there will also be some which are not suitable for the given circuit. You will be expected to know which ones to avoid for a given type of circuit.

At the end of this text you will find the correct selection of protective devices for every circuit in the AM2 composite installation exam. It is vital for you to know how to choose the right protective device for a certain circuit in order to be competent for electrical installation work. We have prepared a short guide just for this.

Determining the protective device characteristics for circuits in the AM2 exam

Electrical installation design can be a long process. However, in the AM2 exam there are given details for every circuit, which makes the design much easier and faster. All you need to know is to use the given details to select the appropriate protective device for a given circuit.

The main formula we can start with:
Iz >= In >= Ib
Ib – design current of circuit (A) (the load to be connected to the circuit)
In – nominal current of protective device (A)
Iz – effective current carrying capacity (A)

This means that in every circuit at all times the current carrying capacity of the cables must be higher than the highest possible load current. Also the protective device rating must be higher than the load current but lower than the maximum current carrying capacity of the cable installed.

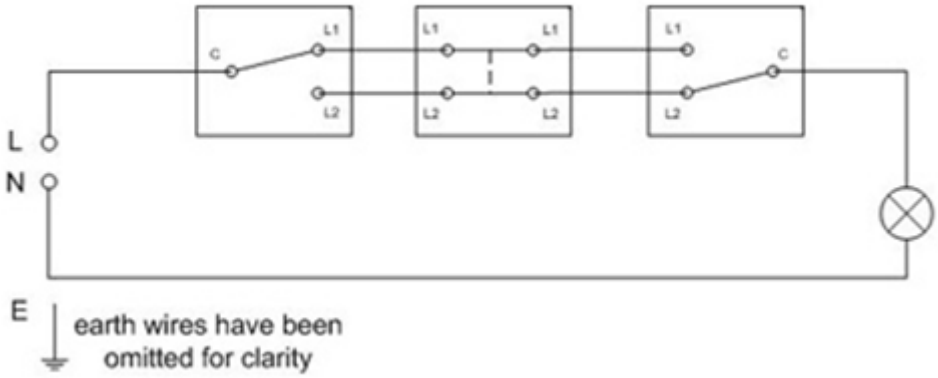
Two-way and intermediate lighting circuit (AM2 Exam)

As a part of the **new AM2 exam** *you will have to wire up a 2 way and intermediate lighting circuit with one light. To do this you must memorise the wiring diagram from below and follow it on the day of the exam.*

You will use 1.5 mm2 twin and earth cable and “push in” terminals to connect the wires together where needed.

Your first cable will go from the CU to the nearest switch where you will connect the brown (L) to the common (C) terminal. Your next length of cable will run from here to the last switch with the brown wire not in use and the blue (N) and green-yellow (E) connected together with the first lengths blue (N) and green-yellow (E) inside the first switch using the “push in” connectors. Next is a length of cable from the first to the intermediate switch connecting together the L1 of the first switch with the L1 of the intermediate switch and the same for the L2 terminals. You will use the brown wire for the L1 to L1 connection and the blue wire to the L2 to L2 connection. Very important is to mark the blue wire with brown slewing because it will be a Line conductor! Repeat this step from the intermediate switch to the last switch.
For the last part you will need a length of cable from the last switch to the light. On one end the brown wire (L) will go to the common (C) terminal while the blue (N) and green-yellow (E) needs to be connected with the other cables blue (N) and green-yellow (E) using “push in“ connectors. The other end of the last cable connects to the appropriate connectors in the light.

Since the whole installation is located in front of you it will be very easy to work with the short lengths of cables.



The protective device for this circuit is a 6A Type B MCB.

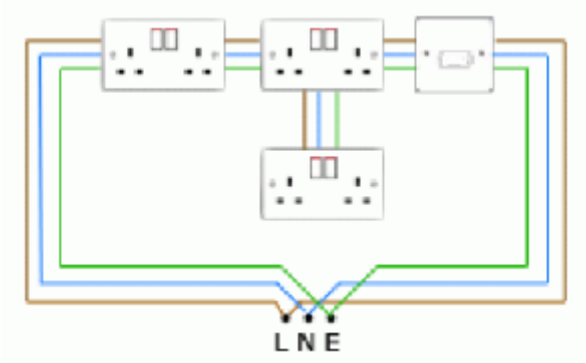
BS 1363 13A socket outlet ring circuit (AM2 Exam)

During the AM2 exam you will be presented with 3 already mounted sockets and a fused connection unit which will have to be wired in a ring circuit with the exemption of one of the sockets which will have to be wired as an un-fused spur from one of the other sockets.

To do this simply follow the diagram below.

You will be required to use 2.5mm2 single core cables which must be placed in to the middle part of the compartmental trunking.
The wiring is really simple. You will start in the CU with 3 lengths of single core cables (brown, blue, yellow-green) from the protection device to the nearest socket. From here you will continue to the next unit which is the fused connection unit. From here to the last socket and from there back to the protection device in the CU. After this you will have to connect another length of 3 single core cables from one of the sockets to the IP rated socket which will be your spurred socket.

The correct protection device for this circuit is a 32A Type B MCB



Carbon monoxide detector circuit (AM2 Exam)

Installing a carbon monoxide detector is part of the AM2 exam. This is one of the simplest tasks in the AM2 exam since all you have to do is to choose the correct cable and protective device and connect the preinstalled detector to the CU.

You will be using 1.5mm2 FB200 cable for this task. The fireproof FB200 cable will need to be secured on the preinstalled cable tray using fireproof ties with fireproof glands at the fused connection unit.

You will start by connecting the fused connection unit to the protective device in the CU and follow by connecting the load side of the fused connection unit to the detector itself.

The correct protective device for this circuit is a 6A Type B MCB.

Data outlets circuit (AM2 Exam)

A new addition to the AM2 exam is the data circuit with the use of Cat5 cable. In modern times electricians are required to deliver not only the electrical containment but the IT infrastructure of the building as well. This usually involves the installation of LAN networks which use Cat5 cable and data outlets.

For this task you will need a special tool – a “PunchDown” tool which will be provided by the examination centre.

All you need to do is to connect the two data outlets together with Cat5 cable.
To do this you will need to follow the colour codes on the data outlets and make sure that every wire goes to the same coloured terminal on both data outlets.

It is very important that the Cat5 cable must be placed in to the top or bottom section of the compartmental trunking and where it is necessary to cross the middle section a bridging part must be inserted in to the middle section of the trunking.

BS EN 60309 16A socket outlet (AM2 Exam)

This part of the AM2 composite installation exam is one of the most difficult one**s**.

You will be required to terminate SWA cable from the CU to the nearby IP rated isolator. It is required that the cable is exactly the right length so that it will be placed on the preinstalled cable tray with a 90° bend. From the isolator you will be required to use 2.5mm2 singles cable to the 16A socket outlet.

Terminating SWA cable takes a lot of practice to master. The best way to learn is to get a short length from somewhere and practice with a SWA gland until you do it fast and precisely every time.

Do not be confused if you will be presented with a four core SWA cable. This simply means that you will have to use the outer metallic sheeting of the cable as Earth. In the case that you are presented with a five core SWA cable you will still need to earth bond the outer metallic sheeting of the cable.

This circuit is ideally protected by a 20 A Type C MCB.

Protective equipotential bonding to gas and water services

Bonding is designed to limit the voltage level of any accessible electrically conductive parts in order to reduce the risk of electrical shock.

Main bonding is the electrical interconnection between the main earthing terminal and the incoming metallic services (water, gas or oil pipes) plus any other extraneous conductive parts of a building or an installation.

On the AM2 exam you will be presented with TN-C-S earthing arrangements.
According to regulation 544.1.1 and Table 54.8 of the IEE Wiring Regulations (BS7671 17th edition) the required size of the main bonding conductor is 10mm2 for supplies with a Neutral conductor of 35mm2 or less.

Because of this you will be required to use 10mm2 single core earth cable to connect both the incoming water pipe and the incoming gas pipe to the main earthing terminal inside the CU.

3-phase direct on line motor/starter circuit (AM2 exam)

This part of the **AM2 exam** requires you to wire up a 3 phase DOL motor starter to a simulated 1 KW motor.
Although this might sound as a difficult task it is not. The DOL starter itself is already prewired for you. All you need to do is to connect a 3 phase supply to the starter itself and connect the cable supply from the starter to the motor.

To start you would use 1.5mm singles cable from the 3 phase protection device in the CU to the DOL starter. Singles cable is acceptable for this task since it will be located in steel trunking. As always on the new AM2 exam – you don`t need to worry about the trunking itself because it is already preinstalled for you.
From the DOL starter you will be using SY cable to supply the simulated motor. You will need to terminate the SY cable with the appropriate SY cable glands. We recommend that you practice this before the exam so that it won't take too much time. Don`t forget to secure the SY cable to the preinstalled cable tray with cable ties.

The required protection device for this circuit is a 10A Type C MCB.

S Plan central heating and hot water system with solar

As part of the new AM2 exam you will be required to fully wire up an S plan central heating and hot water system with a solar thermal element.

This part of the new AM2 is the most time consuming one so our advice is to leave it to the end so that you can spend all you remaining time on it if needed.

The easy part of this task is to supply the system from the CU via a Fused Connection Unit.
To do this you will need to use 2.5mm2 singles cable run in the metallic trunking to the FCU from the protection device inside the CU. From the FCU you will continue with 2.5mm2 singles cable to the appropriate connectors in the wiring centre box.

At this stage you will need to follow the provided wiring diagram to wire up the whole system. Being able to followwiring diagrams is essential to finish this part of the AM2 exam.

The recommended protection device for this circuit is a 16A Type B MCB.

Safe Isolation for Dead Working

All LV installations must be isolated and proven dead before work can commence, except in case when dead working is unreasonable. Don`t forget that electricity kills, so it is vital that everyone in the electrical industry adopts safe working practices.

Safe isolation sequence:

- Seek permission from a relevant responsible person to isolate supply.
- Select the correct and mains approved test equipment **a**nd ensure it works correctly by testing on the proving unit.
- Identify the point of isolation for the system or circuit. Lock off, place warning label and keep the key to the lock with yourself.
- Test circuit to make sure it is dead.
- Re-test the test equipment on the proving unit.
- Begin work

Testing Single Phase Installation:

Test for voltage between the following:

- Phase and Neutral
- Phase and Earth
- Neutral and Earth

Testing 3 Phase four wire systems:

Test for voltage between the following:

- L1 and L2
- L1 and L3
- L1 and Neutral
- L1 and Earth
- L2 and L3
- L2 and Neutral
- L2 and Earth
- L3 and Neutral
- L3 and Earth
- Neutral and Earth

Remember:
When isolating the main source of energy it is also essential to isolate any secondary sources such as standby generators, uninterruptible power supplies (UPS) and microgenerators.

Guidance to the Electricians Risk Assessment Form

Risk assessment is an important step in protecting yourself, your business and others, as well as complying with the law. It helps to focus on the risks that might cause real harm.
The law does not expect you to eliminate all risks, but you are required to protect people as far as reasonably practicable.

A General Risk Assessment Form is in accordance with the Health and Safety guidelines
The risk assessment form comes with a general layout and with detailed guidance on completing each section of the form.

Date: (1)	Assessed by: (2)	Checked / Validated* by: (3)	Location: (4)	Assessment ref no (5)	Review date: (6)
Task / premises: (7)					

Activity (8)	Hazard (9)	Who might be harmed and how (10)	Existing measures to control risk (11)	Risk rating (12)	Result (13)

Result: T = trivial, A = adequately controlled, N = not adequately controlled, action required, U = unknown risk

Notes to accompany General Risk Assessment Form

This form is the one recommended by Health & Safety Services.

(1) Date : Insert date that assessment form is completed. The assessment must be valid on that day, and subsequent days, unless circumstances change and amendments are necessary.

(2) Assessed by : Insert the name and signature of the assessor.

(3) Checked / Validated* by :

Checked by : Insert the name and signature of someone in a position to check that the assessment has been carried out by a competent person who can identify hazards and assess risk, and that the control measures are reasonable and in place. The checker will normally be a line manager, supervisor, principal investigator, etc. Checking will be appropriate for most risk assessments.

Validated by : Use this for higher risk scenarios, eg where complex calculations have to be validated by another “independent” person who is competent to do so, or where the control measure is a strict permit-to-work procedure requiring thorough preparation of a workplace. The validator will probably be a chartered engineer or professional with expertise in the task being considered. Examples of where validation is required include designs for pressure vessels, load-bearing equipment, lifting equipment carrying personnel or items over populated areas, and similar situations.

(4) Location : insert details of the exact location, ie building, floor, room or laboratory etc

(5) Assessment ref no : use this to insert any local tracking references

(6) Review date : insert details of when the assessment will be reviewed as a matter of routine. This might be in 1 year's time, at the end of a short programme of work, or longer period if risks are known to be stable. Note that any assessment must be reviewed if there are any significant changes – to the work activity, the vicinity, the people exposed to the risk, etc

(7) Task / premises : insert a brief summary of the task, eg typical office activities such as filing, DSE work, lifting and moving small objects, use of misc electrical equipment. Or, research project [title] involving the use of typical laboratory hardware, including fume cupboards, hot plates, ovens, analysis equipment, flammable solvents, etc.

(8) Activity : use the column to describe each separate activity covered by the assessment. The number of rows is unlimited, although how many are used for one assessment will depend on how the task / premises is sub-divided.

(9) Hazard : for each activity, list the hazards. Remember to look at hazards that are not immediately obvious. For example, use of a lathe will require identification of the machine hazards, but also identification of hazards associated with the use of cutting oils (dermatitis), poor lighting, slipping on oil leaks, etc. The same activity might well have several hazards associated with it. Assessment of simple chemical risks (eg use of cleaning chemicals in accordance with the instructions on the bottle) may be recorded here. More complex COSHH assessments eg for laboratory processes, should be recorded on the specific COSHH forms (link).

(10) Who might be harmed and how : insert everyone who might be affected by the activity and specify groups particularly at risk. Remember those who are not immediately involved in the work, including cleaners, young persons on work experience, maintenance contractors, Estates personnel carrying out routine maintenance and other work.

(11) Existing measures to control the risk : list all measures that already mitigate the risk. Many of these will have been implemented for other reasons, but should nevertheless be recognised as means of controlling risk. Controls might also include use of qualified and/or experienced staff who are competent to carry out certain tasks; an action plan might include training requirements for other people who will be carrying out those tasks.

(12) Risk Rating : the simplest form of risk assessment is to rate the remaining risk as high, medium or low, depending on how likely the activity is to cause harm and how serious that harm might be.

The risk is LOW - if it is most unlikely that harm would arise under the controlled conditions listed, and even if exposure occurred, the injury would be relatively slight.

The risk is MEDIUM - if it is more likely that harm might actually occur and the outcome could be more serious (eg some time off work, or a minor physical injury.

The risk is HIGH - if injury is likely to arise (eg there have been previous incidents, the

situation looks like an accident waiting to happen) and that injury might be serious (broken bones, trip to the hospital, loss of consciousness), or even a fatality.

(13) Result : this stage of assessment is often overlooked, but is probably the most important. Assigning a number or rating to a risk does not mean that the risk is necessarily adequately controlled. The options for this column are:

T = trivial risk. Use for very low risk activities to show that you have correctly identified a hazard, but that in the particular circumstances, the risk is insignificant.

A = adequately controlled, no further action necessary. If your control measures lead you to conclude that the risk is low, and that all legislative requirements have been met, then insert A in this column.

N = not adequately controlled, actions required. Sometimes, particularly when setting up new procedures or adapting existing processes, the risk assessment might identify that the risk is high or medium when it is capable of being reduced by methods that are reasonably practicable. In these cases, an action plan is required. The plan should list the actions necessary, who they are to be carried out by, a date for completing the actions, and a signature box for the assessor to sign off that the action(s) has been satisfactorily completed. Some action plans will be complex documents; others may be one or two actions that can be completed with a short timescale.

U = unable to decide. Further information required. Use this designation if the assessor is unable to complete any of the boxes, for any reason.

For T and A results, the assessment is complete.

For N or U results, more work is required before the assessment can be signed off.