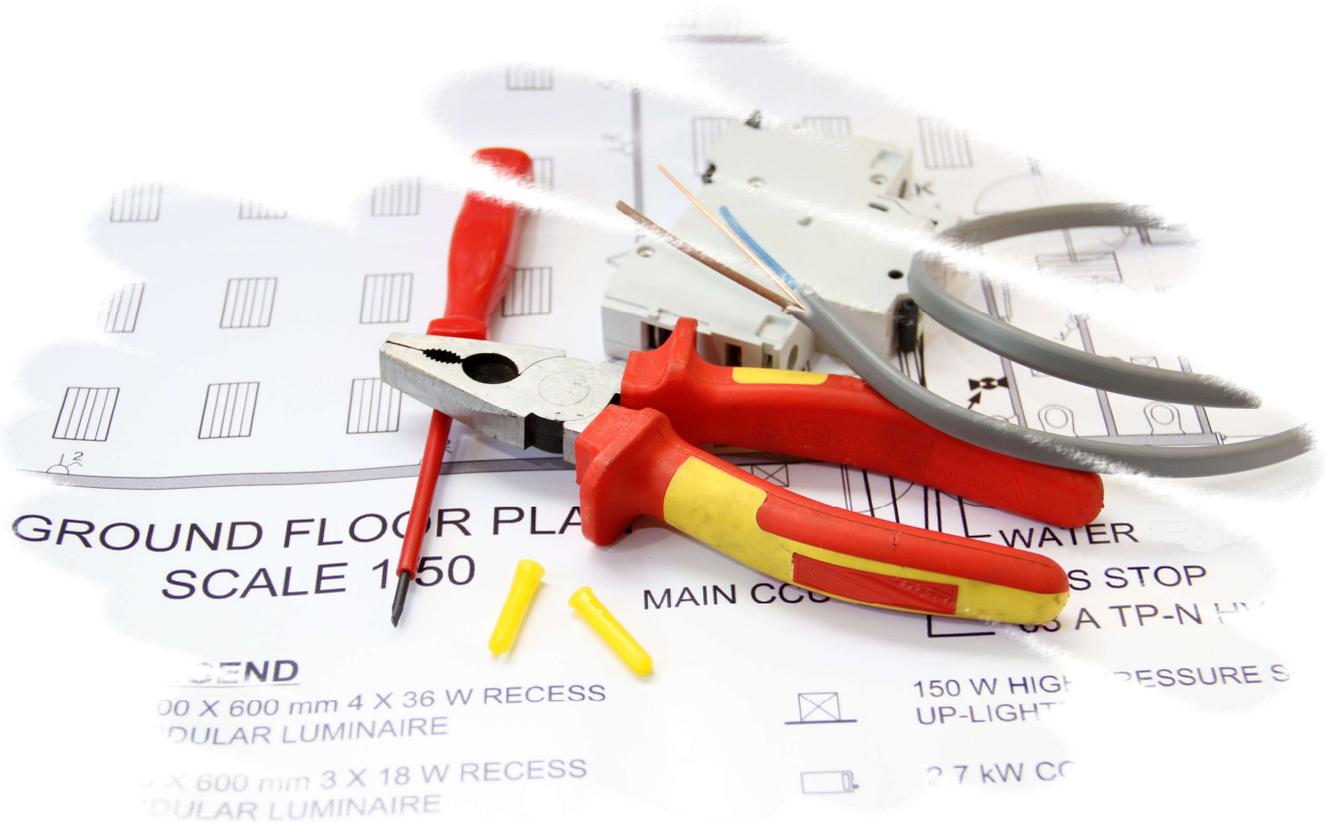


2396-402 Level 4 Principles, Design, Erection and Verification of Electrical Installations.

Chief Examiner's report – **June 2023**



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1 Introduction

The purpose of this document is to provide centres with feedback on the performance of candidates in the **June 2023** examination for 2396-402 Design, Erection and Verification of Electrical Installations.

The Chief Examiners' Report is intended to give centres and candidates guidance in preparing for the written examination.

2 Feedback on candidate performance

General feedback

The following comments are intended to help students prepare for the examination by having a better understanding of what is expected of them. The feedback within this report would also be valuable to tutors in understanding candidates' difficulties in answering questions and the areas where more guidance is required.

The **June 2023** question paper was found to be in accordance with the scheme requirements.

The examination entry for this series was approximately **172**.

This examination compared as being similar to other, recent series.

Questions in this series covered a wide range of subjects across the assessment criteria of BS 7671. A good knowledge of BS 7671, as well as an understanding of its requirements and **why** the requirements are there would have been an advantage to many candidates.

It was noticeable that some candidates did not demonstrate understanding expected at level 3, let alone level 4 and centres are reminded that this qualification is intended as a progression following an apprenticeship which has been further complemented with recent CPD qualifications such as 2391 and 2382 as well as industry experience. Recommended guided learning hours are based on this progression. For other entries, the course of study should be designed based on the candidate's ability.

This series has been marked to Amendment 2 of BS 7671 (brown cover) only as this is the only version currently compliant. Please see section 5 of this report for the impact of Amendment 2 of BS 7671 and the permitted materials for this exam.

Cable Design Calculations

There seems to be a trend that many candidates simply follow a set procedure when calculating current-carrying capacity and voltage drop and demonstrate little in the way of understanding. Where a question asks for the **minimum** cross-sectional area (csa) of live conductors, this isn't the tabulated (I_t) value from BS 7671, as the minimum must be calculated using the rating factors that apply. Simply choosing a value based on loading is not a suitable method of cable selection, but this seems to be the trend.

It is also important for candidates to be able to understand what limits the current carrying capacity of a circuit, such as temperature, and many candidates were not able to demonstrate an understanding of this, or the factors that impact on it.

The scenario for this section required the calculation of a sub distribution circuit. The candidates were required to determine the **maximum** voltage drop for this circuit, taking into account the voltage drops already calculated for the final circuits being supplied by the distribution circuit. A significant number of candidates were unable to do so or did not take into account that one of the final circuits supplied lighting/luminaires.

Question 2 required candidates to determine the **minimum** cross-sectional area for the distribution circuit cpc to meet Z_s requirements. A significant number of candidates failed to do this either by mathematical error, omission of a calculation, or by attempting to do so with an adiabatic calculation. Candidates need to determine the maximum permitted value of R_2 based on permitted data and select the **minimum** csa of cpc based upon this. Candidates are also reminded that, where a question asks for an answer in relation to a particular regulation and the formula contained in it, no marks will be awarded if the answer uses a different formula. If candidates are in the habit of using the incorrect formula, this also potentially leads to incorrect values of k being applied due to the differences in tables.

Knowledge of BS 7671 (Design)

In general, responses to questions with regards to assessment of characteristics and the nature of demand were well answered. For one question however, which related to the supply voltage to earth for a three-phase four wire supply, it was surprising how many candidates could not answer, particularly in relation to the minimum and maximum voltages permitted. Several candidates also gave the minimum value using the application of c_{min} , rather than the ESQCR value.

A question asking for an explanation relating to the purpose of basic protection generally received very basic responses, many of which were simply quoted from BS 7671. Candidates are reminded that questions asking for an explanation require more than copied or quoted text in order to be awarded significant marks.

Questions relating to the requirements regarding main protective bonding and the risks in relation to diverted neutral current did elicit some good responses from a significant number of candidates. Marks were missed for answers with vague descriptions of the checks to be made in relation to the bonding, rather than a detailed explanation being given.

Some candidates continue to use incorrect formulae in respect of calculations with regard to short circuit thermal constraints. Candidates are reminded that short-circuits are between live conductors and BS 7671 has different requirements in relation to this circumstance, as opposed to those for Earth faults. As mentioned in the section above relating to cable design calculations, use of the incorrect formula and section of BS 7671 leads to incorrect values of k being applied due to incorrect tables being referenced.

Knowledge of BS 7671 (Selection and Erection)

Similarly, to the knowledge of design above, this series again had many candidates who were unable to demonstrate a sufficient understanding of selection and erection. Areas of weakness shown included the following:

- Devices for switching for mechanical maintenance.
- Devices for undervoltage protection.

It was apparent in this section that a significant number of candidates were not fully reading the question scenarios and applying these to the answers they were giving. One common

example was a question relating to a fire-fighter's switch. Many candidates gave the example of a petrol station, even though the scenario was within a factory. Candidates are reminded that they will not be awarded full marks where generic answers are given that are contrary to any given scenario.

One question asked why high integrity protective conductors were required for the given scenario. Some responses showed a good level of understanding with regard to this topic, but there were a significant number of candidates giving answers relating to having to carry large currents and/or reducing the circuit Z_s , neither of which are the reason these are prescribed. There were also a significant number of candidates who answered with the ways to provide a high integrity protective conductor, which was not the question asked and thus received no marks.

A question asking how an RCBO could provide additional protection was generally poorly answered. Some candidates gained marks for operational currents and tripping time, but then failed to explain how an RCBO operates to provide this type of protection. A significant number of candidates gave answers in relation to fault protection, as opposed to additional protection.

A question about the types of earth electrode which may be used was correctly answered by most candidates.

Verification

Most candidates were able to list checks which must be carried out in respect of a low resistance ohmmeter and most candidates were also able to correctly answer with regard to the requirement to null the lead resistance or to take the value away from readings.

There was a clear dividing line between candidates which had referred to Guidance Note 3, and those that had not, in regard to a question relating to the pattern of test results for a ring final circuit test. Candidates are reminded that the guidance on this was changed with the publication of the ninth edition of Guidance Note 3 in 2022. This now better reflects the reality of readings expected where live and protective conductors are a different cross-sectional area to each other. It was also apparent that some candidates were quoting from the guidance, without paying particular attention to the scenario and hence using phrases like 'if the conductors' rather than giving a specific answer in line with the circumstance given.

Functional Requirements, Special Locations and Appendices

Many candidates were able to give basic answers in regard to the use of prosumer's installations. Many mentioned battery storage and solar panels, but few candidates gained full marks for showing a sufficient level of understanding of this how this emerging technology can be used to full effect.

Many candidates were able to list additional risks associated with bath and shower locations. What was apparent is that a significant number of candidates gave answers relating to the additional safety requirements, rather than the risks which necessitate these. Candidates must answer the question asked if they are to receive marks. Giving related information, which does not answer the question, only takes exam time without benefit to the candidate.

3 National pass rate

The national pass rate for the 2396-402 **June** examination is as follows:

Exam series	Distinction (%)	Merit (%)	Pass (%)	Fail rate (%)
June 2023	3.88%	10.08%	31.01%	55.04%

Past examination series

Exam series	Distinction (%)	Merit (%)	Pass (%)	Fail rate (%)
June 2022	2.27%	6.06%	25.76%	65.91%
June 2021	4.58%	15.69%	30.07%	49.67%

The grade boundaries for this paper are as follows:

Distinction	150 marks
Merit	125 marks
Pass	100 marks

4 Forthcoming Exam Dates

- 7th December 2023
- 14th March 2024
- 13th June 2024

5 Note regarding 18th Edition of IET Wiring Regulations 2022

Centres must be reminded that permitted materials for this examination must comply with the requirements within the permitted materials document on the qualification webpage. This means that notes or sheets giving design calculation procedures should not be allowed. The permitted publications for this exam are BS 7671, IET Guidance Note 3 and the IET On-site Guide **only**. The **2023** Corrigendum to BS 7671 is also currently permitted although the purpose of this is for candidates to update their version of BS 7671, using the corrigendum, negating the need to take this into the examination.

Amendment 2 of BS 7671 was published at the end of March 2022.

All exam series in 2023 will be set and marked to BS 7671:2018(2022) Amendment 2.

Projects undertaken and marked in 2023 and onwards must also reflect BS 7671:2018(2022) Amendment 2.

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