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

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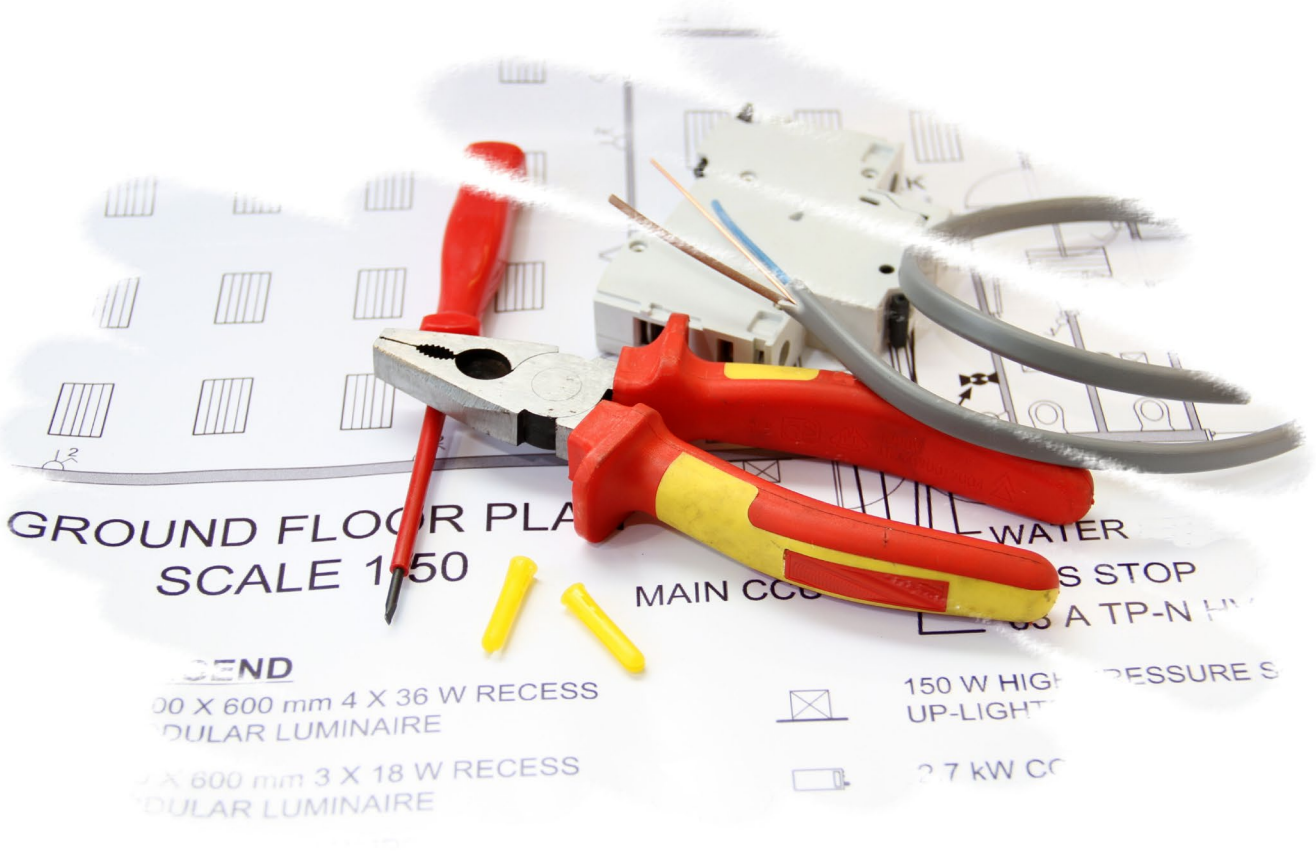
Chief Examiner's report – March 2023



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1 Introduction

The purpose of this document is to provide centres with feedback on the performance of candidates in the March 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 March 2023 question paper was found to be in accordance with the scheme requirements.

The examination entry for this series was approximately 115.

This examination contained no errors and was considered to be correctly levelled and 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 quite 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 and 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.

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.

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

It was also very surprising that candidates at this level consider the C, for a Type C circuit breaker to stand for commercial. Others who selected a Type C device justified their choice incorrectly by considering a heating element as having inrush current. A significant number of candidates also stated the choice of a Type C to handle high fault currents, which is not a specific characterisation between circuit breaker Types nor required in this particular scenario.

Candidates are reminded that in circumstances where overload protection is omitted, or where it is provided remote from the origin of a circuit, short circuit thermal constraints must also be confirmed.

When undertaking calculations for current carrying capacity and voltage drop, it is very important for candidates to validate and justify each stage. If a capacity or value is determined, what makes it the correct or suitable value? What does the value measure against?

When it came to selecting a cross-sectional area of circuit protective conductor for the circuit wired in single-core conductors, no restrictions, such as minimum, were imposed in the question and this free reign to select and justify a csa seemed to upset some candidates who rely on prescribed procedures. It is important to reiterate that understanding circuits, circuit principles and effects of factors and methods is important, not simply following a procedure. Having the understanding means the procedure becomes natural and adaptable when situations change.

Some candidates used a temperature derating factor, when calculating R_1+R_2, for cables that were not bunched. Candidates are reminded that cables in trunking, unless specifically held apart, are likely to bunch themselves due to gravity.

Knowledge of BS 7671 (Design)

Even though the calculation of maximum demand is a relatively simple process, few could explain the main considerations in any detail based on regulation 123.3 of BS 7671.

The question relating to reasons for additional protection attracted very basic responses and did not, again, demonstrate the level of understanding required. Learners at this level need to understand the risks involved, not just that a requirement is there, or repeat what the requirement states. Many answers either linked to disconnection times or hinted at very basic understanding of external influences but gave very little detail relating to the environment or user amongst other factors that lead to the need for additional protection.

Even though Automatic Disconnection of Supply (ADS) is the most commonly used method of fault protection used in the UK, it seems that many still do not understand much of the basic requirements for it, and how it works with other forms of protection for safety within Part 4 of BS 7671.

For example, if an RCD’s residual current setting is relied upon to fulfil the requirements for disconnection times under earth faults, how are the requirements for short circuit protection confirmed? If a circuit breaker or the circuit breaker components of an RCBO are confirmed as giving earth fault protection by disconnecting in the required time, it can reasonably be assumed that this device will also fulfil the function of disconnecting under short circuits? Can this be assumed when an RCD is relied upon for disconnection?

A proportion of candidates did not seem to understand why certain Type AC RCDs should, or should not, be used on some circuits. It was clear from candidate responses that there is lack of understanding as to what the term 'DC components' relates to. A significant number referred to DC equipment being supplied and not DC harmonic currents affecting the operation of the RCD.

Despite the links not being made between the reliance on RCDs for earth fault protection and the need to prove short circuit protection, a proportion of candidates were able to suitably prove the given scenario for short circuit protection in the following question. Some mistakes were made where attention to detail should have been better such as providing units of measurements to calculated values. Some candidates quoted maximum Z_s values for comparison in the question. Candidates are reminded that Z_s values do not apply to short circuit conditions and compliance with regard to disconnection relates solely to the thermal constraints of the cable. It was surprising however, that a larger proportion than normal did not attempt this item.

Very few candidates were able to demonstrate a full understanding of reduced-low-voltage systems and how they are arranged. Many considered the secondary side to have a neutral and many were unable to demonstrate understanding of how protective devices are arranged in these systems.

Few candidates were unable to identify and use the formula on Table 41.8 (also on Table 41.3) of BS 7671 which is applied to nominal ratings, not listed in the table, in order to determine maximum Z_s values.

Knowledge of BS 7671 (Selection and Erection)

Like 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.

Questions relating to arc fault detection devices (AFDDs) were generally well researched and answered as were items relating to surge protection devices and their locations.

Verification

Most candidates were able to provide a reasonable description of the procedure for testing ring-final circuit continuity, but there was quite a mixture of responses making use of the allocated diagram section. Many did not achieve some of the marks on offer as descriptions tended to be brief and lacked key areas of understanding such as anticipated values.

There was quite a wide range of responses relating to the understanding of earth fault loop impedance test results on a ring final circuit which, again, seems to demonstrate a learning of procedure but not understanding.

Special Locations and Appendices

Many candidates were able to list additional risks associated with swimming pool locations, but few actually described them. The same is true for the follow-on question asking for details relating to the requirements to mitigate specific risks.

3 National pass rate

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

Exam series	Distinction (%)	Merit (%)	Pass (%)	Fail rate (%)
March 2023	**0.88%**	**11.50%**	**30.09%**	**57.52%**

Past examination series

Exam series	Distinction (%)	Merit (%)	Pass (%)	Fail rate (%)
March 2022	**6.96%**	**16.52%**	**33.91%**	**42.61%**
March 2021	**1.67%**	**13.33%**	**41.67%**	**43.33%**

4 Forthcoming Exam Dates

- 8th June 2023
- 7th December 2023
- 14th March 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 GN3 and the IET On-site Guide **only.**

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.

From September 2022 all project work must reflect changes relating to BS 7671:2018(2022).

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