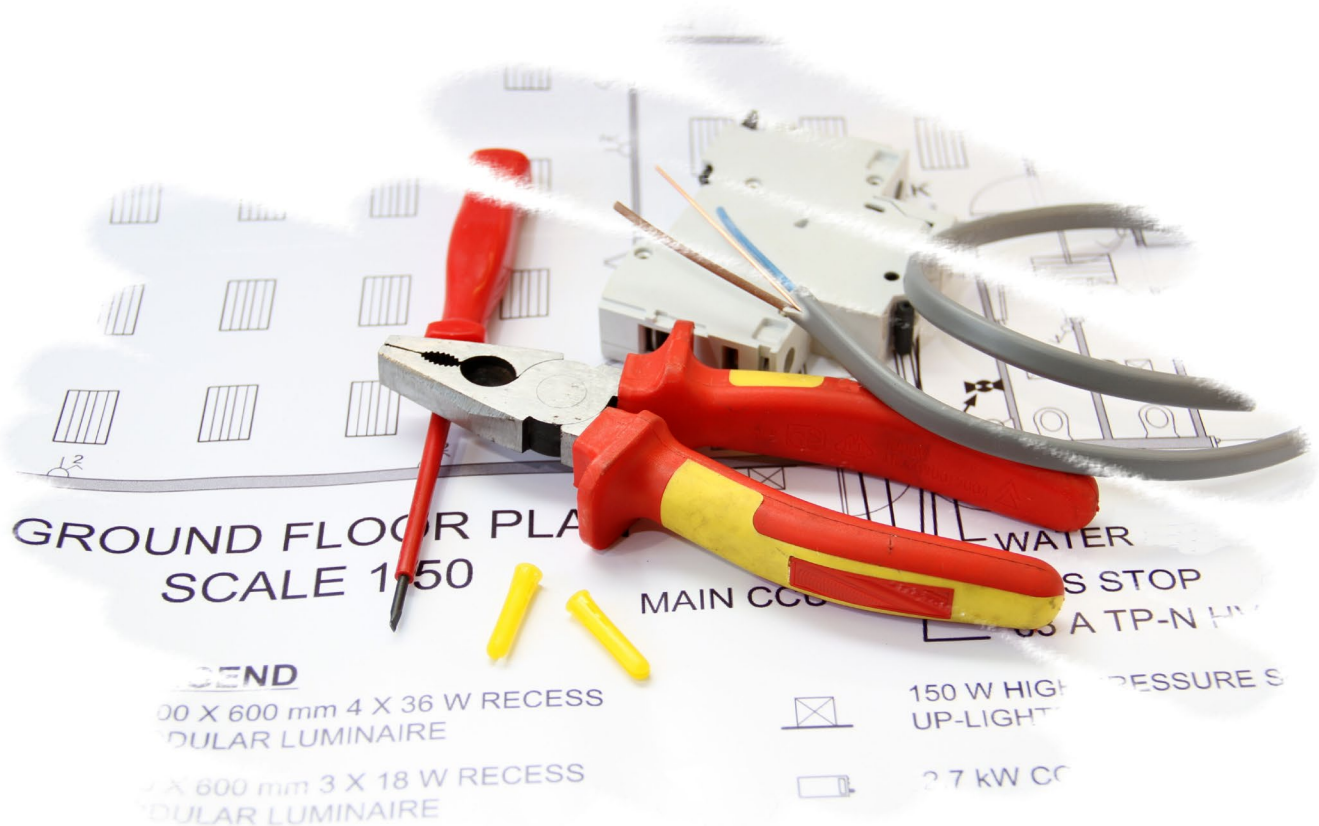


2396-402 Level 4 Principles, Design, Erection and Verification of Electrical Installations.

Chief Examiner's report – **December 2022**



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1 Introduction

The purpose of this document is to provide centres with feedback on the performance of candidates in the **December 2022** examination for 2396-402 Design, Erection and Verification of Electrical Installations.

The Chief Examiners' Report has been reintroduced as a result of feedback from centres, to give them guidance in preparing candidates 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 **December 2022** question paper was found to be in accordance with the scheme requirements.

The examination entry for this series was approximately **222**.

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 where they are applicable, would have been an advantage to many candidates.

Once again, it seems that many candidates simply follow a set procedure when calculating current-carrying capacity and voltage drop. Candidates at this level need to be able to understand what each step represents and to be able to adjust procedures to suit changing requirements. This can only be achieved if candidates understand the relationship between each stage of the design process and how to adapt these figures or processes to find specific values.

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**.

This series has been marked against amendment 2 of BS 7671 (brown cover).

Cable Design Calculations

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?

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.

It is also important for candidates to be able to understand what limits the current carrying capacity of a circuit and some candidates were not able to understand this, or the factors that impact on it. This series included a circuit design where the cable was under thermal insulation. Candidates are reminded that rating factors for thermal insulation should only be applied where the reference method does not already take this into account.

The majority of candidates suitably demonstrated the procedure for calculating circuit earth fault loop impedances, as well as the thermal constraints. Some candidates, however, are applying factors which are only applicable to measured resistances. Candidates are reminded to read any associated notes that are given relating to tables in reference materials.

This series had a question requiring the calculation of the minimum cross-sectional area of cpc to comply with maximum earth fault impedance limit. A significant number of candidates either didn't attempt to calculate this or attempted a thermal constraint calculation in lieu.

Knowledge of BS 7671 (Design)

Few candidates were able to explain the factors that need to be assessed with regard to maintainability including how this should be undertaken. The majority of candidates copied or paraphrased Regulation 341.1. Candidates at this level must show understanding of the topic to gain maximum marks.

One question asked about a circumstance where maximum disconnection times could not be met due to a high Z_e value. When asked to describe how protection against electric shock could be provided, many candidates again copied or paraphrased BS 7671 or simply listed a whole range of protective measures, virtually all not applicable to the circumstance. Candidates must pay attention to any scenario element of the questions and answer with specific reference to this.

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.

When asked to confirm compliance with Regulation 434.5.2, many candidates were awarded good marks. It was apparent from some scripts, however, that some candidates do not understand what the resultant value relates to and thus worked out the right value but gave the wrong conclusion. Some candidates still confuse short circuits and ADS disconnection times. Learners must be able to understand and correctly conclude calculations.

Where a follow-on question asked candidates to confirm if the circuit met the requirements for automatic disconnect under earth fault conditions, some candidates correctly undertook the calculation but then went through a complicated process in conclusion, rather than comparing against tabulated values. This wasn't penalised but did waste the candidates' exam time.

A question relating to a piece of equipment with a 15 mA protective conductor current was particularly poorly answered. Many candidates did not associate the 15 mA with the requirements where high protective conductor currents are present, and thus just gave general requirements in answers, rather than those from 543.7 of BS 7671. Many of those that did determine the right section of BS 7671 then just copied the requirements, again without applying these specifically to the scenario in the question.

Some questions in this series asked the purpose of particular devices, but also asked for examples of each device. A significant number of candidates gave the purpose but not an example, or vice versa. Candidates are reminded to read the full question and answer all parts to gain maximum marks.

One question asked the purpose of firefighter's switching. Marks were generally awarded for the responses to this, but many candidates did stray onto the requirements, such as the mounting height, rather than the purpose. This additional information does not warrant additional marks and thus, again uses the candidate time for no gain.

Where a follow-on question asked about the purpose of undervoltage protection, a significant number of candidates did not show a full knowledge of this topic and, in particular, the risk associated with equipment re-energising without human interaction. This is an important topic for designers to understand and apply appropriate protection in their designs.

Verification

Questions with regard to information to be provided by the designer and factors that would influence the period to the first periodic inspection were generally well answered.

When asked to describe how to test for separation and insulation resistance of a SELV lighting system, some candidates gave good responses but there were a number of candidates simply quoting from Guidance Note 3 and not showing their own understanding.

Special Locations and Appendices

There were two questions relating to conducting locations with restricted movement. The first asked the risks involved, and the second to list examples. A number of candidates listed protective measures to be employed, not the risks, and thus at best wasted exam time. Most candidates got marks on these questions but it is clear that some candidates do not understand the full range of additional risks or type of location that falls under the scope of this special location.

In general, questions within this exam that require a list can be quoted from the relevant part of BS 7671 or other permitted guidance. The exception to this is where a question asks to list examples. A question on this series related to examples of mobile and transportable units. A significant number of candidates quoted the overall scope of Section 717 and not giving examples of each. Another error on this question was citing leisure vehicles, which are not part of the scope of this section. Learners must learn to recognise which installations fall under the additional requirements of Part 7 and which specific Section or Sections relate.

3 National pass rate

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

| Exam series | Distinction (%) | Merit (%) | Pass (%) | Fail rate (%) |
|----------------------|------------------------|------------------|-----------------|----------------------|
| December 2022 | 2.81% | 10.11% | 19.10% | 67.98% |

Past examination series

| Exam series | Distinction (%) | Merit (%) | Pass (%) | Fail rate (%) |
|----------------------|------------------------|------------------|-----------------|----------------------|
| December 2021 | 0.57% | 5.71% | 29.71% | 64.00% |
| December 2020 | 3.03% | 6.82% | 17.42% | 72.73% |

4 Forthcoming Exam Dates

9th March 2023

8th June 2023

7th December 2023

5 Note regarding 18th Edition of IET Wiring Regulations 2022

Amendment 2 of BS 7671 was published at the end of March 2022. Examinations will only permit BS 7671 (2018) 2022 amendment 2 (brown) and will be marked to that version only until the next amendment is published.

All project work must reflect changes relating to BS 7671:2018(2022) until a further amendment is published.

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