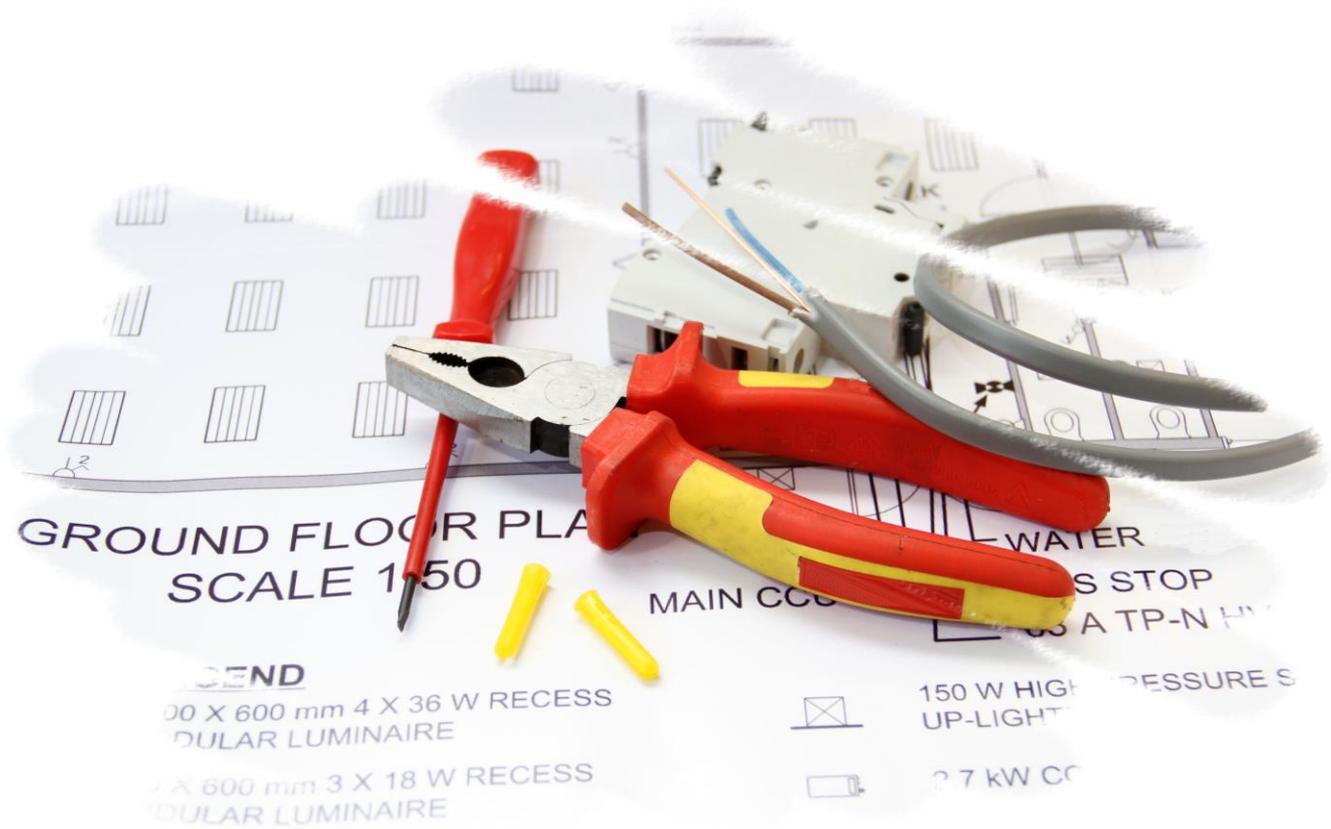


# 2396-402 Level 4 Principles, Design, Erection and Verification of Electrical Installations.

Chief Examiner's report – December 2021



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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 2021 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 2021 question paper was found to be in accordance with the scheme requirements.

The examination entry for this series was 175.

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.

It seems to be a growing trend that candidates can calculate to a set procedure, but if that procedure requires adaption because of the need to use different data, this throws candidates. Candidates should be taught how to use different items of data and how they fit together rather than following one set procedure. For example, where questions seek candidates to calculate the **minimum** permissible csa of cable, data should be manipulated to allow this in a single calculation, rather than by a long process of trial and error or, by simply selecting what the csa should be by chance.

Centres are 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. Publications permitted include BS 7671, IET GN3 and the IET On-site guide.

### Cable Design Calculations

Most candidate were able to deal with most of the calculations and data linked to the sizing of the circuit live conductors. Few however were able to determine the minimum csa of conductor for voltage drop meaning significant marks were lost.

A significant number of candidates did correctly select the reference method, which included thermal insulation, only to then apply the rating factor  $C_i$  additionally. Centres should be making clear that the rating factor  $C_i$  is only to be used where the reference method does not already take account of thermal insulation.

In addition, few candidates seemed to read the question fully as one item required candidates to select, **with reasons**, the type and rating of protective device. Few candidates did this and again lost marks as a result.

Whilst many candidates demonstrated the procedure for calculating circuit earth fault loop impedances, far less could correctly determine the **minimum** cross-sectional area (csa) of protective conductor suitable to provide ADS. Candidates need to be able to demonstrate that they understand the relationship between data and, as a designer, know the minimum suitable csa. They may ultimately select a larger csa for other reasons, but they do so in the knowledge it exceeds the **minimum** permissible. In situations where large csa protective conductors are used, having the capability to determine the minimum permissible csa through

simple calculation has huge economic benefits. Once again, as the instructions in the questions were not fully followed, many candidates lost available marks as a result.

Candidates are encouraged to check which factors must be applied with regard to cable operating temperature and not to apply those which only apply to measured resistance values.

## **Knowledge of BS 7671 (Design)**

In this series, questions in this area were poorly answered with a minority of candidates displaying the required level of understanding. Areas of weakness shown included the following:

- Not demonstrating an understanding of the factors that designers need to assess regarding maintainability with many simply reciting Chapter 34.
- Not understanding the requirements of section 419 of BS 7671 and in particular, how Additional Protection by supplementary equipotential bonding is provided and in what way it provides protection.
- Not understanding what must be satisfied when RCDs are used for fault protection. This is an area of particular concern as the use of RCBOs lead to this becoming more commonplace. Many seem to read the first part of regulation 411.4.204, but few read the second part requiring Chapter 43 compliance, even though this requirement is also repeated in notes below tables such as that below Table 41.5.
- Many candidates, when determining the short-circuit current for a circuit, used the  $Z_e$  value given rather than utilise the  $I_{pf}$  and convert this to ohms. This led to incorrect answers.

Few candidates were able to identify two methods to determining diversity, with many simply stating the Table A2 method from the IET On-site Guide.

Application of diversity is a fundamental skill a designer needs to be capable of applying. Most candidates, when applying diversity to the given scenario, probably over-assessed the demand by a value in the region of 60-80 A.

This was mainly due to over assessing the power consumption needed for the socket-outlet circuits without considering the type of location and use.

Meeting rooms, for example, may have many socket-outlets for convenience but when it comes to consumption, most will be supplying laptop computers or display screen TVs at most. Whilst those who simply followed the IET On-site guide would not have been disadvantaged, the question was seeking innovation in this area that few candidates were able to demonstrate. A significant number of candidates used the protective device rating, rather than calculating the specific load, where given, for the particular circuits.

## **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:

- Lack of understanding or the existence of section 543.7 of BS 7671.
- Lack of understanding of the factors that affect the csa of an earthing conductor. This is highly disappointing as this is seen as a fundamental and basic area of understanding.
- The key difference between an isolator and a switch for mechanical maintenance.

## **Verification**

Most responses to the question relating to information needed for an initial verification and the factors affecting the period to the first periodic inspection were generally answered well.

The question relating to the testing of insulation resistance and separation gave a mixture of responses with many not being able to demonstrate what the requirements for separation are.

## **Special Locations and Appendices**

The question relating to a conductive location with restricted movement attracted mixed responses with high achieving candidates being able to identify the risks. Others however gave brief responses that lacked in key detail or suitable examples.

## National pass rate

The national pass rate for the 2396-402 December 2021 examination is as follows:

Exam series	Distinction (%)	Merit (%)	Pass (%)	Fail rate (%)
December 2021	0.57	5.7	29.7	64

## Past examination series

Exam series	Distinction (%)	Merit (%)	Pass (%)	Fail rate (%)
June 2021	4.7	16.1	30.2	48.9
March 2021	1.6	13.3	41.6	43.3
December 2020	3.0	6.8	17.5	72.5
September 2020	0.0	4.4	37.8	57.8
March 2020	3.4	9.4	17.1	70.1
December 2019	7.6	13.5	28.1	50.8

## 4 Forthcoming Exam Dates are: Thursday 10<sup>th</sup> March 2022

## 5 Note regarding 18<sup>th</sup> Edition of IET Wiring Regulations 2022

Amendment 2 of BS 7671 is expected to be published at the end of March 2022. The March 2022 series will reflect the current edition of BS 7671. The June 2022 series may be sat using either the current version of BS 7671 or amendment 2 and the examination will be marked with both versions in mind. From December 2022 onwards, examinations will only permit BS 7671: 2018 (2022) amendment 2 and will be marked to that version only until the next amendment is published.

Projects may reflect either version of BS 7671 until September 2022 where all project work must reflect changes relating to BS 7671: 2018 (2022).

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