

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

Chief Examiner's report – December 2020



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Contents

1	Introduction	2
2	Feedback on candidate performance	3
	General feedback	3
	Cable Design Calculations	4
	Knowledge of BS 7671 (Design)	4
	Knowledge of BS 7671 (Selection and Erection)	5
	Verification	5
	Special Locations	5
3	National pass rate	6
	Past examination series	6
	4 Forthcoming Exam Dates are:	6
	5 Note regarding 18 th Edition of IET Wiring Regulations	6

1 Introduction

The purpose of this document is to provide centres with feedback on the performance of candidates in the December 2020 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 2020 question paper was found to be in accordance with the scheme requirements.

The examination entry for this series was approximately 132.

This examination contained no errors and was judged to be of the correct level covering the required parts of the test specification.

Candidates must take care to read a question carefully and follow the verb in the question. Where a question begins with **Explain** or **Describe**, simply quoting text from BS 7671 will not attract marks. Candidates must ensure they interpret the requirements to suit any given **scenario** within the question.

Where questions are seeking **why** particular regulations or measures are required, candidates must take care to explain 'why' as opposed to 'what' the requirements are or 'how/where' they are applied.

Centres should be encouraged to teach candidates the reasons why certain regulations exist, change or are introduced to BS 7671. Understanding why regulations change gives far better insight into why these regulations are essential, and the risks associated. Centres may wish to use resources such as 'Wiring Matters' produced by IET as well as the IET or Safety Electrical First websites where articles and best practice guides can be found giving background to some of the topics which are often raised within this assessment. These include risks such as those associated with PME arrangements, support for wiring systems in order to protect firefighters operating in buildings and structures and situations where some installations require surge protection.

Within this assessment, it was very disappointing that some of the most basic of questions were answered with very basic responses. These include descriptions relating to the installation of luminaires in accordance with Section 422.3 of BS 7671, or the requirements of earthing which were often responded to with descriptions relating to bonding. Even simple questions relating to requirements for trunking housing non-sheathed cables went unanswered by candidates. Very few candidates were unable to list two types of cable connection which is permitted to be inaccessible for inspection and testing. This signals a lack of navigation skills when referencing BS 7671.

Centres should encourage potential candidates to have recently achieved City & Guilds 2382: Requirements for Electrical Installations, before enrolling onto this course or include a similar course of study as an addition to this course.

Cable Design Calculations

Whilst most candidates were able to follow a prescribed design procedure, many were unable to provide an understanding of the requirements for a ring-final circuit and regulation 433.1.204 in BS 7671 where the I_z of a cable must be no less than 20 A. A significant number of candidates halved the design current, ignoring the potential for the ring to imbalance. In addition, many were unable to correctly understand the effects of parallel circuit conductors on voltage drop or R_1+R_2 .

Candidates are still unable to follow question requirements such as determining the **minimum** permissible cpc size and instead select or assume a size. Candidates should be able to use maximum permissible values and work out minimum permissible sizes by eliminating established values. For example, if the external impedance and line conductor impedance is taken away from the maximum permissible impedance, this would leave a cpc impedance to work from and establish a minimum size to suit.

Knowledge of BS 7671 (Design)

Very few candidates were able to reference the fundamental principles relating to thermal effects. Designers should use the Fundamental Principle in BS 7671 as a design checklist for the basis of safe design. Few candidates were able to demonstrate the existence of Chapter 13 despite the clue in the question.

Few candidates were able to provide an explanation of why PME systems have additional earth electrodes with many responses demonstrating very basic understanding of the effects of open circuit PEN conductors. Many responses referred to fault conditions likening them to TT installation electrodes. If persons working in this industry have no understanding of the dangers associated with PME systems, they are potentially at risk even when undertaking what seems a simple task, such as removing a bonding clamp.

Once again, disappointingly few candidates were able to understand the difference between, or purpose of, earthing and bonding. When candidates were required to respond on a question relating to the purpose of earthing, many provided responses relating to bonding. Candidates **must** be able to understand the difference between, and purpose of these protective conductors to effectively design them.

Most candidates provided suitable responses to questions where items from BS 7671 needed recalling or listing such as where overload protection could be omitted for safety reasons.

One question related to types of monitoring device. A significant number of candidates included one or more protective devices when answering this question. Candidates must read questions carefully and only include answers which relate to the specific question.

Few candidates were able to understand the concept of IT systems. Whilst questions relating to these systems do not require technical design responses, candidates are expected to understand the basic concept of how protection is provided and where they may be implemented.

Like most series before this one, a large number of candidates who, when asked to determine **short-circuit** current protection, determined **earth fault loop impedance** values and centres need to pay particular attention to this during delivery. A short circuit is between live conductors and an earth fault is between Line and Earth. Using an earth loop impedance value to determine short circuit will not attract marks. In addition, the correct adiabatic equation used for short circuit protection is contained in Chapter 43 and should not be confused with the one in Chapter 54 and its values of k .

It was very surprising how few candidates were able to apply simple ohms law to determine a short circuit impedance based on recorded prospective short circuit current.

Knowledge of BS 7671 (Selection and Erection)

Very few candidates were able to reference section 526 of BS 7671 which required a very simple list of types of cable connections which are permitted to be inaccessible. Many responses were actually giving examples of practices that should be accessible such as joints using screwed connections under floors.

A question relating to high integrity protective conductors attracted very mixed responses with very few able to explain why they are required where a protective conductor current exists. Many of those who gave responses to the question were basic with random requirements stated such as minimum conductor csa.

Very few candidates were able to select a suitably sized main protective bonding conductor in relation to the earthing conductor of an installation. It was also very surprising that very few candidates were able to cite the maximum voltage for a ceiling rose as given in BS 7671.

Verification

Responses to a question relating to the need for all cpc's to be connected during an insulation resistance were at best very basic. Few candidates demonstrated any understanding of the potential for faults to go undetected if cpc's were not connected.

One question asked about the process of obtaining an external earth fault loop impedance for a TT installation. A significant number of candidates described the process for a ground resistance test, which would not give the required value of impedance.

Few candidates were able to demonstrate any understanding of the different methods used to verify an earth electrode's connection to earth forming part of a TT system and how one method provides a loop path reading where the other provides the resistance of the soil around the electrode.

Special Locations

Normally questions relating to special locations attract good responses. Bathrooms are probably the most common of special locations within BS 7671 and yet the responses to the risks associated with bathrooms were very poor. Few responses were able to demonstrate an understanding of body resistance effected by humidity, water or lack of clothing and footwear. Even fewer response acknowledged the risk to equipment by water splashes and jets.

One question related to the use of low voltage equipment within Zone 1 of a bathroom. A significant proportion of responses related to SELV equipment and showed the candidate had not read and understood the question properly. Correct interpretation of terminology is key to the correct application of BS 7671.

3 National pass rate

The national pass rate for the 2396-402 December 2020 examination is as follows:

Exam series	Distinction (%)	Merit (%)	Pass (%)	Fail rate (%)
December 2020	3.0	6.8	17.5	72.5

Past examination series

Exam series	Distinction (%)	Merit (%)	Pass (%)	Fail rate (%)
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
June 2019	0.0	4.6	30.3	65.2

4 Forthcoming Exam Dates are: Thursday 11th March 2021

5 Note regarding 18th Edition of IET Wiring Regulations

Please note that all 2020 series will only accept answers versioned to the 18th Edition of the IET Wiring Regulations (BS 7671:2018). Candidates are encouraged to ensure they have received a copy of the corrigendum to BS 7671:2018 published by IET and available at <https://electrical.theiet.org/bs-7671/updates/> Future assessments may require candidates to have amendment 1 of BS 7671 (2020) which can also be downloaded from the IET website above, including its corrigendum. Should any question come under the scope of amendment 1, it will be marked to amendment one and its corrigendum only.

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