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

Chief Examiner's report – December 2018

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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 2018 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 2018 question paper was found to be in accordance with the scheme requirements.

The examination entry for this series was approximately 140.

This examination contained one typeset error where a protective device given in the Part A scenario was described as a 'Type C circuit breaker to BS EN 60**6**98' instead of a 60**8**98. The vast majority of candidates did not seem to notice the error and of the very small number of candidates who did notice this, they took and used all of the information given in the scenario, which stated exactly what the device was. Less than 1% of candidates who attempted the assessment seemed confused by the error and these were marked according to reasonable assumptions made and potential time issues where candidates may have used time trying to research the BS number. This was also balanced by the facts given in this Level 4 assessment where the device was clearly described including Type.

At the time of this assessment, two version of BS 7671 were current, and marking reflected this. Answers reflecting either version were accepted and marked accordingly.

As BS 7671:2018 will be the only current version from January 2019, future assessments will only permit answers reflecting these requirements until the publication is amended or revised.

Candidates who simply **quote text** from permitted publications, such as BS 7671, will not score well where questions require an explanation or description. Candidates must interpret the requirements to suit any given scenario within the question. Although this issue is commonly highlighted in these reports, this series contained much more citation of BS 7671 as answers, showing that this issue is not improving.

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.

Candidates and centres are also encouraged to understand the risks associated with PME supplies including why these supplies are not permitted in certain circumstances and why installations connected to these systems require more stringent bonding requirements. With more DNOs utilising these types of networks, the risks associated with them becomes more common including changes to requirements for bonding associated with this risk.

Cable Design Calculations

Candidates on the whole show a good ability in the application of circuit design for both live conductors and cpc. A few candidates oversized the conductors as they did not determine the design current correctly. Some marks were still awarded, in this situation, for procedure.

In this question, many candidates failed to take into account voltage drop restrictions due to distribution circuits and as a result, did not verify voltage drop correctly. In addition, few candidates correctly determined precise mV/A/m values.

Candidates generally apply a good understanding of design earth fault loop impedance and the application of the adiabatic equation as Chapter 54 of BS 7671. Many candidates simply chose a cpc size rather than determine the **minimum** permissible size as required by the question.

Conclusions to questions are **as** important as the calculations used to arrive at an answer. A large part of the design process is justification of sizes selected. Candidates are encouraged to conclude their selections by making comparisons to permitted and/or calculated values.

Candidates must be made aware of the two forms of adiabatic equation and where it is suitable to apply each. Incorrect use of the equation requires a candidate to perform more calculations than is required for justification and, if looking at the wrong Chapter in BS 7671, incorrect values of 'k' may be used. Marks will be lost if the wrong data or calculation is utilised especially where a question requires calculations to a specific regulation.

Knowledge of BS 7671 (Design)

A working knowledge of BS 7671 is required by all candidates. Some candidates are able to recite the requirements of BS 7671 but are unable to demonstrate how these requirements are applied by using examples or explanations. Candidates at this level must be able to interpret requirements. Quoting regulation numbers or content only, is not a suitable response unless a question requires a candidate to **state** a requirement.

Most candidates were able to state the requirements from Fundamental Principles or General Characteristics. However, few could identify suitable design considerations when applying diversity.

Many candidates recited the requirements of BS 7671 in relation to protective earthing requirements, but few were able to give full explanations with many straying from the question and describing bonding requirements. Candidates responses must remain focussed on the subject of the question.

For an item which required candidates to determine suitability of short circuit protection for a circuit, it was surprising how many candidates did not fully attempt this question in this series.

Questions relating to the requirements for overvoltage protection and EMI received mixed responses indicating a general weakness in understanding but a strength in recall of these requirements.

Knowledge of BS 7671 (Selection and Erection)

Generally, most candidates demonstrated good levels of understanding and recall in questions associated with selection and erection of electrical equipment.

One question relating to the minimum size of protective bonding conductors seemed to indicate that many candidates did not understand the relationship between the size of Earthing Conductor for an installation and the installations Main Protective Bonding Conductors.

Verification

Many candidates were able to recall the procedures used for testing circuits, but most responses lacked critical detail such as the instrument used and instrument or circuit preparation. Many candidates seemed to ignore references to dimmer switches in the circuit and it was very surprising that some who did note them, thought it suitable to turn them to maximum before testing!

It was surprising to note how many candidates were unable to explain why a cpc must be connected to all earthing during an insulation resistance test.

Special Locations

As well as having an understanding of the requirements of BS 7671 for Special Installations or Locations, candidates at this level need to demonstrate a knowledge of the risks which lead to these further measures. A good understanding of the risks enables designers to select suitable measures including a better understanding of why certain requirements must be met.

Many candidates answered these questions to a reasonably good standard in relation to agricultural locations. Where some candidates starting to identify and describe the risks, their descriptions soon turned into the requirements given in BS 7671 which was not required by the question.

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 2018	**2.9**	**7.9**	**29.5**	**59.7**

Past examination series

Exam series	Distinction (%)	Merit (%)	Pass (%)	Fail rate (%)
December 2017	**6.3**	**23.9**	**29.6**	**40.3**
March 2018	**2.5**	**7.5**	**34.8**	**55.3**
June 2018	**4.8**	**15.7**	**27.2**	**52.3**

4 Forthcoming Exam Dates are:

Thursday 14th March 2019
Thursday 13th June 2019

5 Note regarding 18th Edition of IET Wiring Regulations

Please note that all 2019 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/**

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