

**Electrical Control Circuit
G109a
TEST 2A**
Time allowed – 1 hour and 30 minutes
9 Pages in this Question Booklet

Student Feedback/Comments

The results of my performance have been discussed and explained to me.			
Student:		Date:	
If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher.			
Teacher:		Date:	

TOTAL MARKS AVAILABLE

SECTION	Possible Marks	Actual Marks
A	15	
B	40	
C	20	
TOTAL	75	

Instructions to Students:

- All questions are to be answered in the space provided in this Question Booklet.
- Answers to Multi-choice Questions (Section A) are to be recorded on the Answer Sheet attached to this Question Booklet.
- You are not to use any reference book in this examination.
- The whole of this Question Booklet is to be handed to the Supervisor upon completion.

Aids permitted where indicated:

Standard Dictionaries	Bilingual Dictionaries	Technical Dictionaries	Programmable Calculators	Non-programmable Calculators	Mobile Phones	MP3 Players
No	Yes	No	No	Yes	No	No

- **Disallowed electronic devices are to be turned off and removed from your person.**
If you access an electronic device during this examination you will be considered to be cheating. You will receive a Not Yet Competent (NC) result for the unit and disciplinary action will be taken.

Section A – (15 Marks)

Instructions: Select the best answer for the following statements and place the corresponding letter in the answer sheet provided. Each correct answer is worth one mark.

Question 1.

The star and delta contactors in an automatic star-delta starter should be mechanically interlocked to prevent:-

- (A) Over speeding the motor
- (B) Motor starting
- (C) Short circuiting the supply
- (D) Over current

Question 2.

The relationship between the operating time and current of a thermal overload is known as the:-

- (A) time to current ration
- (B) inverse time characteristic
- (C) proportional time characteristic
- (D) trip time characteristic

Question 3.

The starting torque of a three phase induction motor varies:-

- (A) Directly with the applied voltage
- (B) Inversely with the applied voltage
- (C) Inversely with the speed of the motor
- (D) directly with the applied voltage squared

Question 4.

A three phase primary resistance starter connects the resistors:-

- (A) In series with the stator windings
- (B) In parallel with the stator windings
- (C) In series with the rotor
- (D) In parallel with the rotor

Question 5.

Thermistors located within the motor winding as a further protection against overload have a:-

- (A) zero temperature coefficient
- (B) negative temperature coefficient
- (C) positive temperature coefficient
- (D) variable temperature coefficient

Question 6.

During the acceleration of a squirrel cage induction motor the resistance of a primary resistance starter is:-

- (A) Gradually increased
- (B) Gradually decreased
- (C) Left unchanged
- (D) Alternately disconnected and reconnected to the motor

Question 7.

To reverse the direction of rotation of the three phase squirrel cage induction motor you would:-

- (A) Disconnect and reverse the slip ring connections
- (B) Change the delta connected stator to star connected
- (C) Replace the squirrel cage rotor with a slip ring rotor
- (D) Interchange any two of the supply lines

Question 8.

The thermal overload contact in a control circuit is:-

- (A) Normally closed
- (B) Normally open
- (C) Spring loaded normally open
- (D) Spring loaded normally closed

Question 9.

Thermal Overload contacts will trip:-

- (A) When the power circuit draws excessive current
- (B) Inversely proportional to the current and time
- (C) Immediately the control circuit draws excessive current
- (D) After the temperature rise of the motor reaches 95°C

Question 10.

The effect of reducing the applied voltage to a motor will be to:-

- (A) Reduce starting current while increasing starting torque
- (B) Reduce starting current and starting torque
- (C) Increase the starting current while reducing starting torque
- (D) Increase starting current and starting torque

Question 11.

When using a star-delta starter the voltage applied to each phase of a three phase motor during the starting phase will be:-

- (A) 3 times the line voltage
- (B) equal to the line voltage
- (C) 1/3 times the line voltage
- (D) $1/\sqrt{3}$ times the line voltage

Question 12.

A star delta starter is used to start a three phase squirrel cage induction motor, after 10 minutes the motor is running hot and slow, the most likely fault is:-

- (A) Low insulation resistance
- (B) Open circuit coil
- (C) Faulty timer
- (D) Broken earth wire

Question 13.

For star-delta starting the number of terminals required at the induction motor terminal block is:-

- (A) 2
- (B) 3
- (C) 4
- (D) 6

Question 14.

When using a secondary resistance starter with a three phase induction motor the starting resistors are:

- (A) connected in series with the stator windings
- (B) connected in parallel with the stator windings
- (C) connected in series with the rotor winding
- (D) connected in parallel with the rotor windings

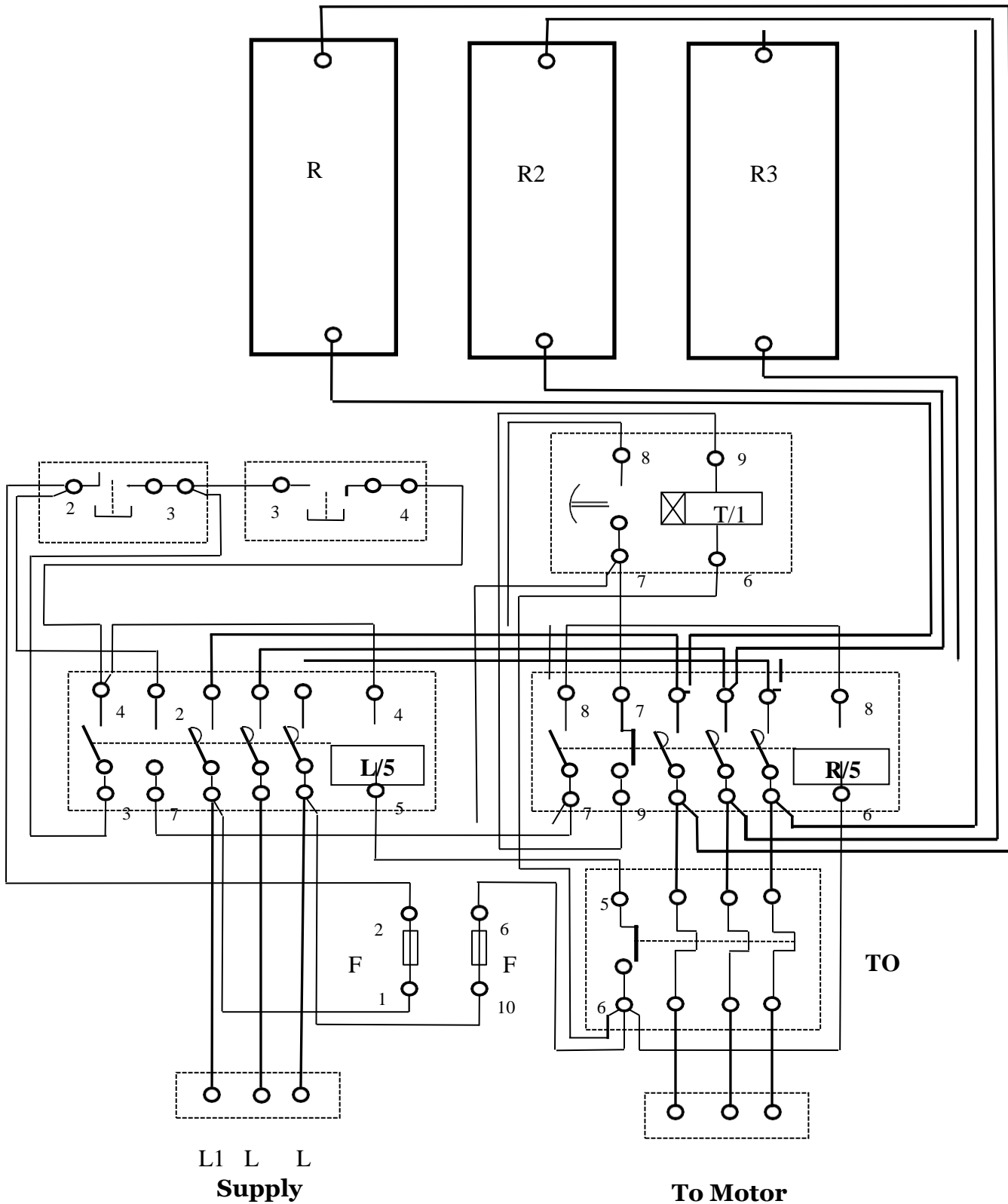
Question 15.

An auto transformer starter is used to start a three phase squirrel cage induction motor. If the torque of the motor when started DOL is 54 Nm the torque of the motor at start when using the 60% tapping of the auto transformer will be:

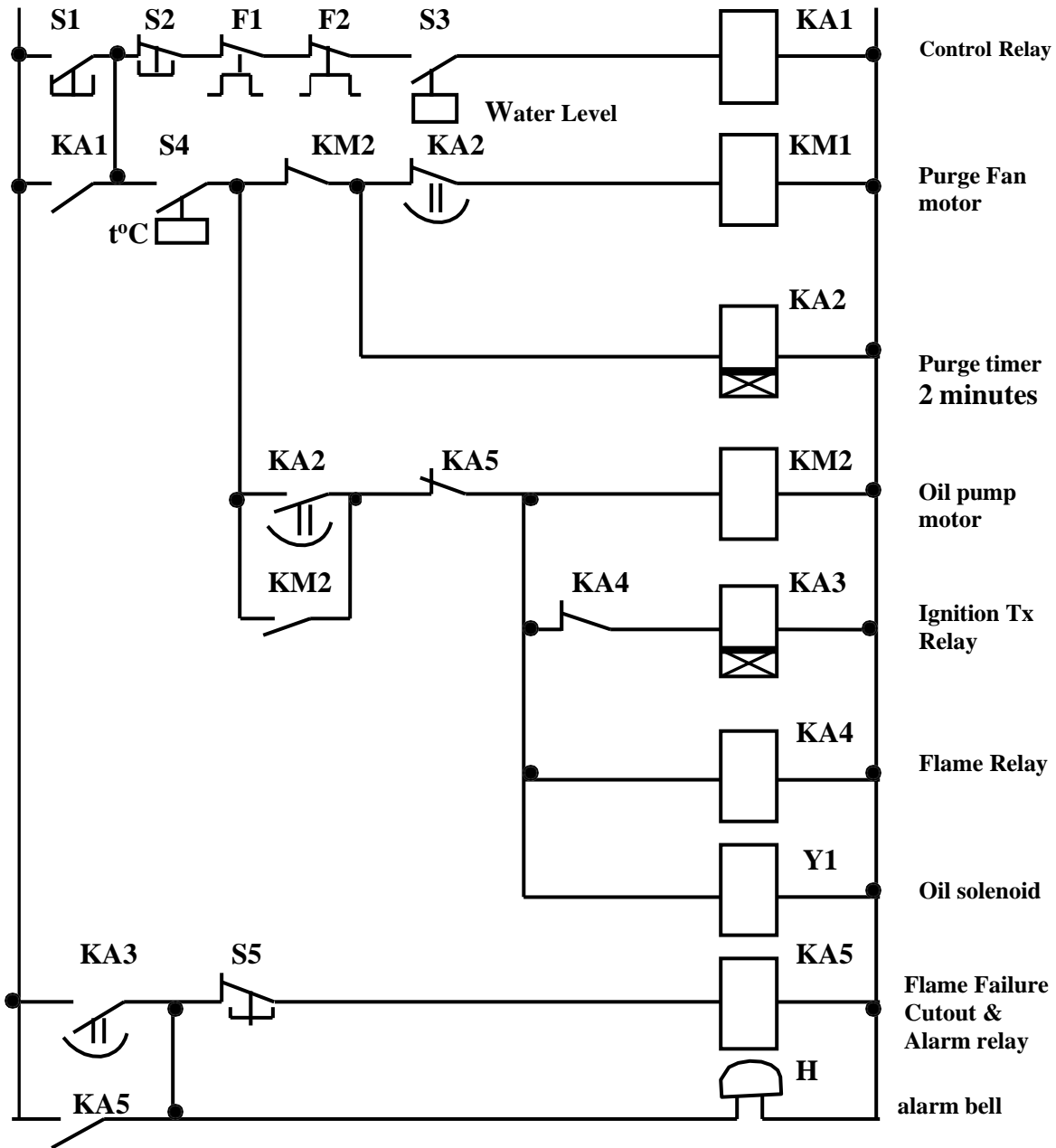
- (A) 60% of the DOL value
- (B) equal to the DOL value
- (C) 36% of the DOL Value
- (D) 57% of the DOL value

Section B – (40 Marks)

Question 1. Convert the Wiring diagram of figure 1 below to a circuit diagram. Include the power and control circuits, line and wire numbering, and all labelling. *(24 Marks)*



Question 3. Answer the following questions in regard to the operation of the control circuit shown in Figure 2 below.



(a) What is the function of the switch marked 'S3'? (3 marks)

(b) If the contacts marked 'KA2' operate what effect will there be on the circuit?

(3 Marks)

(c) Explain the effect of closing contact 'KA3'.

(3 Marks)

(d) Explain the purpose of the N/C contact 'KA4'.

(3 Marks)

(c) The circuit shown in figure 2 involves sequencing. Describe how sequencing is achieved in this circuit.

(4 Marks)

Section C – (20 Marks)

On the grid paper provided, using a neat freehand sketch, draw the power and control circuit to satisfy the following operational criteria.

- A three phase delta connected squirrel cage induction motor is connected to run in forward or reverse direction. Three push buttons are used to provide control for the motor. S1 – forward, S2 – reverse and S3 is the only stop button. The motor is protected by a thermal overload.
- When power is first applied and before any pushbutton is pressed all relays will be de-energised.
- Pressing pushbutton S1 will cause the motor to start and run in the forward direction.
- When the stop button is pressed there must be a 15 second delay before the motor can be restarted in reverse by pressing button S2.
- Number each wire and line in the circuit diagram
- Label all relays, contactors, timers, contacts, and pushbuttons.

