

**Questions:**

- a) What type of starter is required for the following TWO motors: (2 marks)
- (i) The bucket conveyor motor (7.5 kW) and (2 marks)
  - (ii) the grinder drive motor (25 kW) respectively. (2 marks)
  - (iii) Give reasons for the starter's choice made above for each respective motor. (6 marks)
- b) Draw the main power circuit for this application and the respective current ratings according to IET regulations. (12 marks)
- c) Draw the control circuit for this application shown in Figure 1. (18 marks)

**Note:**

The process explained in the above steps 1 to 7 should be followed to answer part (c) above. Candidates are required to include all the necessary control so that the application function properly and safely. This should include the control of the two motors (7.5 kW & 25 kW) and the three sensors (S1, S2 & S3).

**General minimum requirements:**

- i. Start, Stop and emergency buttons
- ii. Green (ON) and Red (OFF) panel lamps.
- iii. Motor control for the two respective motors i.e. the grinder 25 KW and the bucket conveyor 7.5 KW.
- iv. Overload current devices for EACH Motor.
- v. Starters, Contactors and Auxiliary contacts.
- vi. Control transformer 400V / 24V.
- vii. Delay Timer

**Important Note:**

- 1) All diagrams must be neat, clear and fully labelled where necessary.
- 2) The control panel must have the necessary protection devices to protect the motor.
- 3) For safety reason the control circuit is to be supplied from a 400/24 V AC step down transformer.
- 4) Indication lamps are required on the control panel to indicate the power ON or OFF.

**Questions on pages 2, 3 and 4 to be answered on separate paper provided.**

**END OF PAPER**

1. A factory producing a variety of animal feeds has a milling grinder driven by a 25 kW three phase motor. A feed in conveyor tube transfer the grinded pellets to the storage BIN. The conveyor belt (Bucket Elevator) is fitted with a 7.5 kW three phase motor.

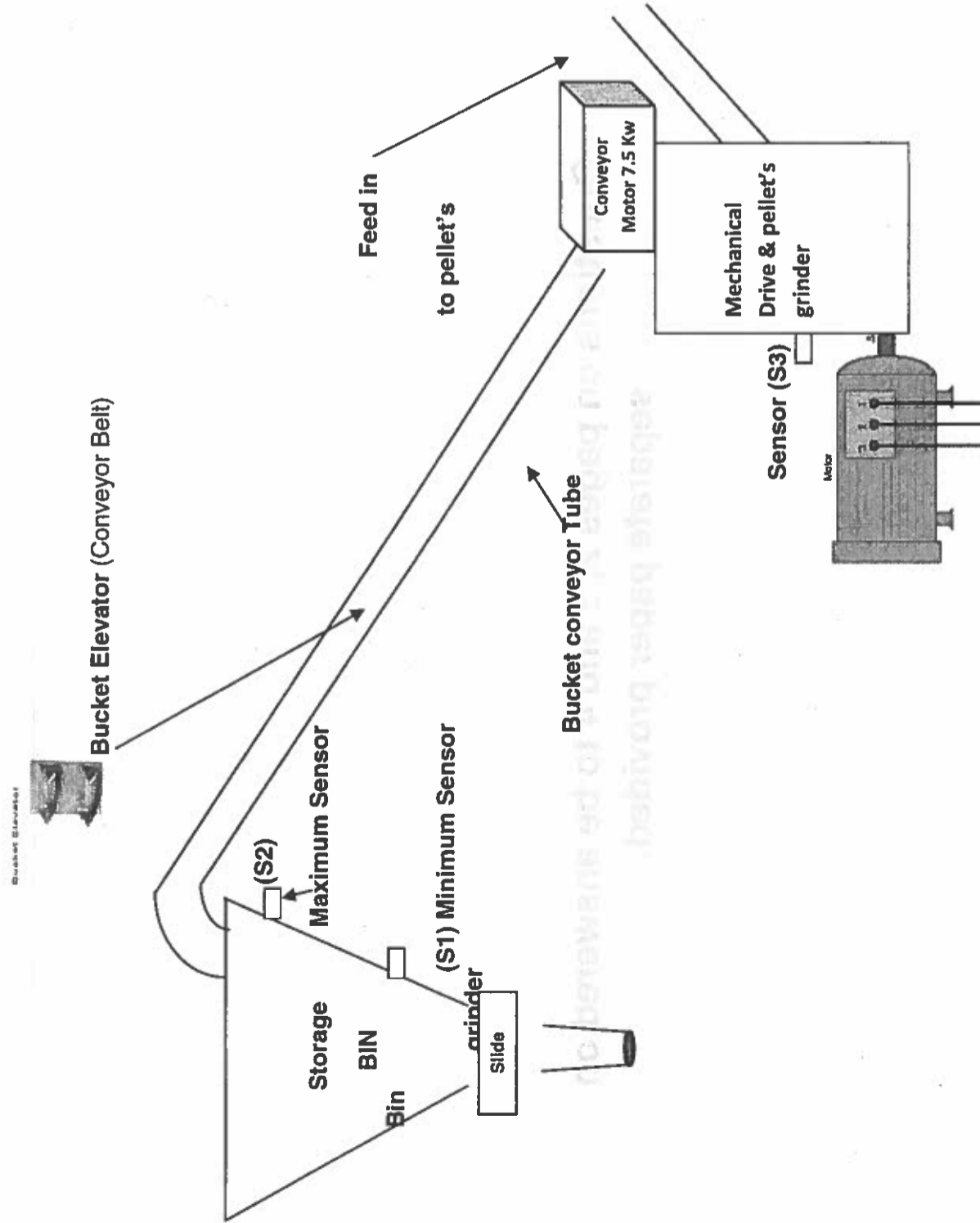


Figure 1 Motor Grinder 25 KW

Refer to Figure 1:

The storage bin is equipped with two sensors (S1- Minimum & S2 - Maximum). The grinded pellets are transferred to the storage bin by a bucket elevator driven by the 7.5 kW motor and the level is controlled by the above mentioned sensors shown in Figure 1.

Assume that the storage Bin is empty. When the system is first switched 'ON' it should follow the following steps on start-up:

1. Examine whether there are pellets to be grinded through sensor (S3).
2. Check safety control chain i.e. emergency stop, motor Over Load, etc.
3. By pressing the START button it energises first the bucket conveyor.
4. After a short delay controlled by a timer-relay the grinder starts automatically considering that start-up conditions are satisfied.
5. Once the grinded pellets reaches the maximum level sensor S2 the grinder is switched 'OFF'. After a short delay the bucket conveyor is turned 'OFF' also so that the bucket conveyor belt is cleaned from the grinded material.
6. The system will ONLY start again when the material is below the minimum sensor S1.
7. The above process is repeated once the material in the Storage Bin is below sensor 1 as stated in point 6.

#### Additional Information

Loading from the Storage Bin to a customer is possible if there is material over the minimum sensor (S1). This is carried out by energising an air piston which opens the slide and is carried out through a pendant control cable by the truck driver. This should NOT be considered when answering the below exam questions.

**AUTHORISATION B - SEPTEMBER 2016**

**Name and Surname** \_\_\_\_\_

**Index No** \_\_\_\_\_

