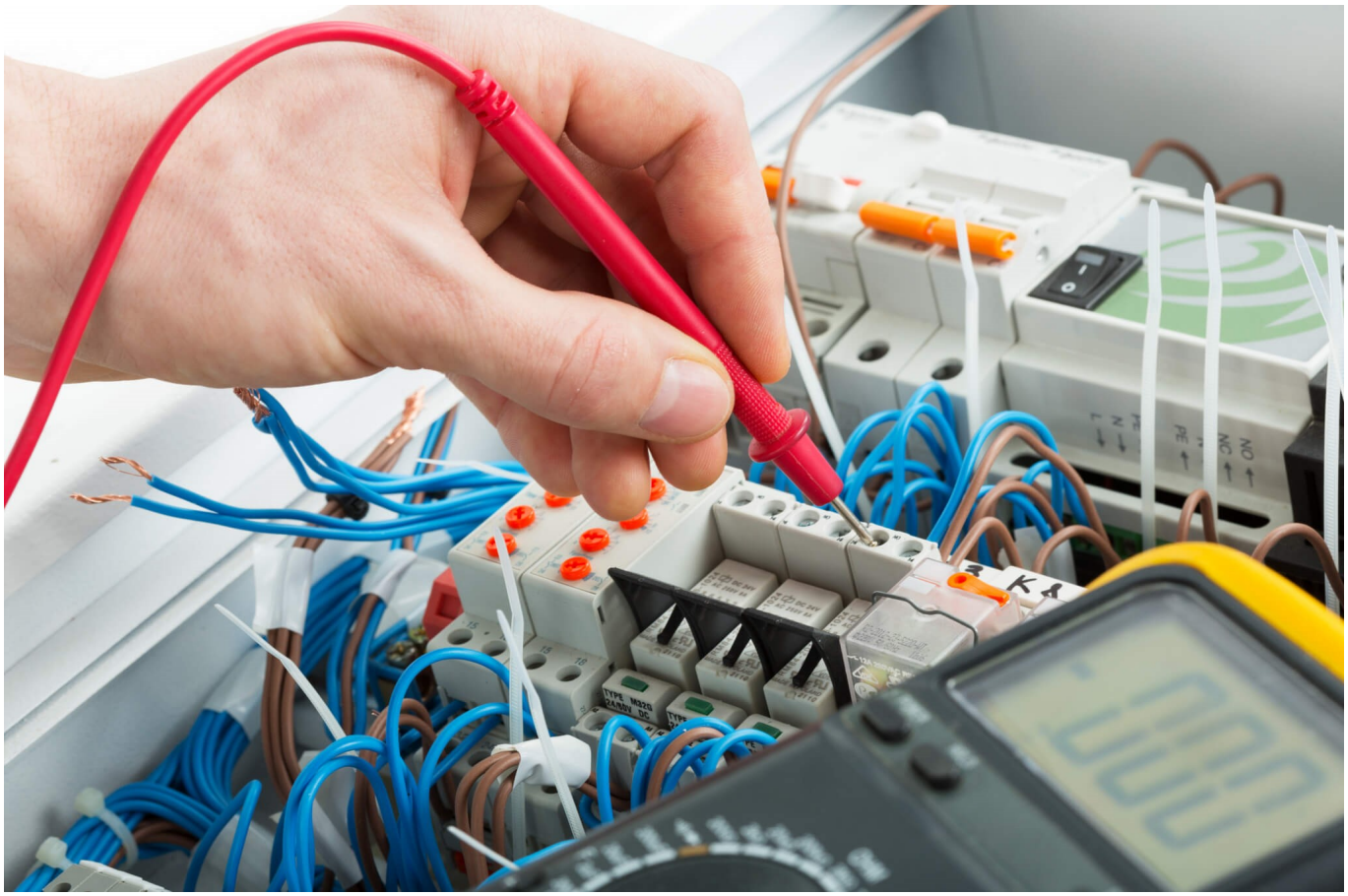
Qualification Pack



Building Management System Service Engineer

QP Code: ELE/Q7104

Version: 1.0

NSQF Level: 5

Electronics Sector Skills Council of India || 155, 2nd Floor, ESC House Okhla Industrial Area-Phase 3
New Delhi- 110020 || email:ceo@essc-india.org

Contents

Qualification Pack

ELE/Q7104: Building Management System Service Engineer

Brief Job Description

A Building Management System (BMS) Service Engineer is responsible for installing the Building Management System (BMS) at the client premises. The person is also responsible for monitoring the BMS for the correct functioning and carrying out its regular repair and maintenance.

Personal Attributes

The individual must have attention to detail along with problem-solving skills. The person must be physically fit to work for long hours with concentration and have the ability to coordinate with others to achieve the work objectives. Good communication skills and strong organisational skills are other important attributes required in this job role.

Applicable National Occupational Standards (NOS)

Compulsory NOS:

1. ELE/N7205: Prepare for installing the BMS
2. ELE/N7206: Carry out the installation of BMS
3. ELE/N7208: Carry out commissioning and testing of BMS
4. ELE/N7207: Carry out repair and maintenance of BMS
5. ELE/N9905: Work effectively at the workplace
6. ELE/N1002: Apply health and safety practices at the workplace

Qualification Pack (QP) Parameters

Sector	Electronics
Sub-Sector	Industrial Automation
Occupation	Engineering-I&A
Country	India
NSQF Level	5
Credits	NA

Qualification Pack

Aligned to NCO/ISCO/ISIC Code	NCO-2015/NA
Minimum Educational Qualification & Experience	Diploma ((after 10th (Electrical or Electronics or Mechanical Engineering) with 3 Years of Relevant experience) OR (Diploma after 12th (Electrical or Electronics or Mechanical Engineering) with 1 Year of Relevant experience) OR B.E./B.Tech (Degree in Electrical or Electronics or Mechanical Engineering) OR Certificate-NSQF (Level-4 in Site Engineer Control Panel) with 2 Years of experience in the relevant field
Minimum Level of Education for Training in School	
Pre-Requisite License or Training	NA
Minimum Job Entry Age	21 Years
Last Reviewed On	24/02/2022
Next Review Date	02/06/2025
Deactivation Date	02/06/2025
NSQC Approval Date	24/02/2022
Version	1.0
Reference code on NQR	2022/EHW/ESSC/05388
NQR Version	1.0

ELE/N7205: Prepare for installing the BMS

Description

This OS unit is about performing various activities before the installation of a Building Management System.

Scope

The scope covers the following :

- Check the availability of required resources
- Check and test the received resources
- Prepare for installing the BMS

Elements and Performance Criteria

Check the availability of required resources

To be competent, the user/individual on the job must be able to:

PC1. co-ordinate with the relevant company personnel/ third-party supplier to ensure timely delivery of all the necessary apparatus for the installation of BMS such as Direct Digital Controller (DDC), sensors, actuators, relevant types of cables, Human Machine Interface (HMI) display, computer, server, etc.

PC2. check that all the components are delivered as per the order

PC3. arrange the necessary tools, equipment, and Personal Protective Equipment (PPE) for the installation

PC4. ensure the availability of trained personnel to assist with the installation process

Check and test the received resources

To be competent, the user/individual on the job must be able to:

PC5. examine the BMS apparatus to ensure they are not physically damaged

PC6. test the BMS apparatus to ensure the correct functioning

PC7. report any issues identified with BMS apparatus promptly to the relevant personnel/ supplier

PC8. co-ordinate with the relevant personnel/ supplier to get a timely replacement of damaged/ faulty components

PC9. maintain the record of receipt/ replacement and testing of the apparatus

Prepare for installing the BMS

To be competent, the user/individual on the job must be able to:

PC10. check that all the civil works are completed in the building and necessary approval/ clearance is obtained before starting the installation process

PC11. prepare the circuit diagram/ shop drawing/ as-built drawings for the installation of BMS in the building

PC12. check that all the outlets related to BMS are accessible and not covered by Mechanical, Electrical and Plumbing (MEP) services

PC13. ensure the work area is ready and safe to start the installation of BMS systems

PC14. plan the installation process to ensure timely completion as per the client requirements

PC15. co-ordinate with the Heating, Ventilation and Air-conditioning (HVAC) installation technician for the installation of HVAC equipment as per the BMS installation plan and client requirements

PC16. identify the locations for the installation of various BMS equipment/ devices such as access control, video surveillance, fire alarms, HVAC control, programmable lighting and electric power management as per the BMS installation plan

PC17. prepare various equipment for installation as per the manufacturer's instructions

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the apparatus required for the installation of BMS such as Direct Digital Controller (DDC), sensors, actuators, relevant types of cables, Human Machine Interface (HMI) display, computer, server, etc.

KU2. the necessary tools, equipment, and Personal Protective Equipment (PPE) required for BMS installation

KU3. the importance of ensuring that trained personnel assist with the BMS installation process

KU4. the process of examining the BMS apparatus before installation to ensure no physical damage or malfunctions

KU5. applicable documentation requirements

KU6. the importance of ensuring all the civil works are completed in the building and necessary approval/ clearance is obtained before starting the installation process

KU7. how to prepare the circuit diagram/ shop drawing/ as-built drawings for the installation of BMS in the building

KU8. the importance of ensuring all the outlets related to BMS are accessible and not covered by Mechanical, Electrical and Plumbing (MEP) services

KU9. the importance of ensuring the work area is ready and safe to start the installation of BMS systems

KU10. the process of installation of HVAC equipment as per the BMS installation plan

KU11. the process of assembling various BMS equipment such as access control, video surveillance, fire alarms, HVAC control, programmable lighting and electric power management for installation

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. write work-related notes and maintain records

GS2. read the relevant literature to keep abreast with the latest developments in the field of work

GS3. communicate politely and professionally

GS4. listen attentively to understand the information being shared

GS5. plan and schedule tasks to ensure timely completion

GS6. identify possible disruptions to work and take appropriate preventive measures

GS7. take quick decisions to deal with workplaces emergencies/ accidents
GS8. analyse work processes to identify improvements
GS9. coordinate with the co-workers to achieve the work objectives

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Check the availability of required resources	**10**	**12**	**-**	**8**
PC1. co-ordinate with the relevant company personnel/ third-party supplier to ensure timely delivery of all the necessary apparatus for the installation of BMS such as Direct Digital Controller (DDC), sensors, actuators, relevant types of cables, Human Machine Interface (HMI) display, computer, server, etc.	-	-	-	-
PC2. check that all the components are delivered as per the order	-	-	-	-
PC3. arrange the necessary tools, equipment, and Personal Protective Equipment (PPE) for the installation	-	-	-	-
PC4. ensure the availability of trained personnel to assist with the installation process	-	-	-	-
Check and test the received resources	**8**	**12**	**-**	**10**
PC5. examine the BMS apparatus to ensure they are not physically damaged	-	-	-	-
PC6. test the BMS apparatus to ensure the correct functioning	-	-	-	-
PC7. report any issues identified with BMS apparatus promptly to the relevant personnel/ supplier	-	-	-	-
PC8. co-ordinate with the relevant personnel/ supplier to get a timely replacement of damaged/ faulty components	-	-	-	-
PC9. maintain the record of receipt/ replacement and testing of the apparatus	-	-	-	-
Prepare for installing the BMS	**12**	**16**	**-**	**12**
PC10. check that all the civil works are completed in the building and necessary approval/ clearance is obtained before starting the installation process	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. prepare the circuit diagram/ shop drawing/ as-built drawings for the installation of BMS in the building	-	-	-	-
PC12. check that all the outlets related to BMS are accessible and not covered by Mechanical, Electrical and Plumbing (MEP) services	-	-	-	-
PC13. ensure the work area is ready and safe to start the installation of BMS systems	-	-	-	-
PC14. plan the installation process to ensure timely completion as per the client requirements	-	-	-	-
PC15. co-ordinate with the Heating, Ventilation and Air-conditioning (HVAC) installation technician for the installation of HVAC equipment as per the BMS installation plan and client requirements	-	-	-	-
PC16. identify the locations for the installation of various BMS equipment/ devices such as access control, video surveillance, fire alarms, HVAC control, programmable lighting and electric power management as per the BMS installation plan	-	-	-	-
PC17. prepare various equipment for installation as per the manufacturer's instructions	-	-	-	-
NOS Total	**30**	**40**	**-**	**30**

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N7205
NOS Name	Prepare for installing the BMS
Sector	Electronics
Sub-Sector	Industrial Automation
Occupation	After Sales Service-I&A
NSQF Level	5
Credits	TBD
Version	1.0
Last Reviewed Date	24/02/2022
Next Review Date	02/06/2025
NSQC Clearance Date	24/02/2022

ELE/N7206: Carry out the installation of BMS

Description

This OS unit is about carrying out the installation of a building management system as per the plan.

Scope

The scope covers the following :

- Install conduits and carry out wiring
- Install the Direct Digital Controller (DDC) with field devices
- Install the central peripherals
- Install the motion sensors
- Install the duct air temperature sensor and duct temperature/ humidity sensor
- Install the water differential pressure sensor
- Install the air differential pressure sensor
- Install the immersion water temperature sensor
- Install the smoke detectors in AC ducts
- Install the butterfly valves

Elements and Performance Criteria

Install conduits and carry out wiring

To be competent, the user/individual on the job must be able to:

PC1. install Polyvinyl Chloride (PVC)/ Galvanised Iron (GI) conduits between the field devices and the control panel as per the plan

PC2. carry out wiring to connect all the field devices as per the approved BMS point schedule, wiring schedule and schematic diagrams

Install the Direct Digital Controller (DDC) with field devices

To be competent, the user/individual on the job must be able to:

PC3. install the control panel with the required power supply at the selected location as per the approved shop drawings

PC4. install and terminate the temperature sensor, humidity sensor, motorized damper actuators for HVAC equipment as per the manufacturer’s instructions

PC5. install and terminate the CHW temperature sensor, pressure sensor and flow sensors for CHW pipes as per the manufacturer’s instructions

PC6. connect all the field devices as per the approved BMS point schedule, wiring schedule and schematic diagrams

PC7. install and connect the field devices such as outside air humidity sensor, water level sensor, staircase pressurisation sensor as per the approved BMS system

PC8. install the VFD’s inside AHU control panels and make the required cable connections as per the approved schematic diagrams

PC9. install the plumbing system including the water booster pump sets, fire pump sets, water calorifier and pump from the DDC panel, as per the system requirements

PC10. carry out terminations at field ends as per the manufacturer’s recommendations

PC11. carry out control cabling for DDC control panels through GI conduit or GI trunking above the false ceiling as per approved shop drawings, schematic drawings

PC12. label all the control wires with related identifications and connect as per the approved data point schedule

Install the central peripherals

To be competent, the user/individual on the job must be able to:

PC13. carry out bus loop wiring from the Central Controller to all the Variable Air Volume (VAVs) and DDC as per the approved schematic drawings

PC14. install the pre-assembled peripherals with controllers hubs in the BMS control room

PC15. carry out wiring between the central peripherals and the low current systems as per the approved shop drawings

PC16. install the central peripherals such as the computer, printer, monitor as per the approved BMS system and shop drawings

Install the motion sensors

To be competent, the user/individual on the job must be able to:

PC17. identify the locations for installing motion sensors as per the BMS plan

PC18. set up the mounting brackets at the identified locations

PC19. install the motion sensors as per the manufacturer's instructions

PC20. connect the motion sensors for BMS digital control

Install the duct air temperature sensor and duct temperature/ humidity sensor

To be competent, the user/individual on the job must be able to:

PC21. identify the location of the duct air temperature and duct temperature/ humidity sensor as per the approved shop drawings

PC22. drill holes of the recommended diameter using a hole saw cutter and set up the mounting flanges

PC23. insert and install the duct air temperature sensor and duct temperature/ humidity sensor on the mounting flanges

PC24. ensure the duct temperature/ humidity sensor is mounted on the middle of the duct wall and the sensing element is diagonally bent across the cross-section of the duct

PC25. set up the end of the sensing element using the collar provided with the sensor

PC26. ensure that the sensing element does not touch the duct wall

Install the water differential pressure sensor

To be competent, the user/individual on the job must be able to:

PC27. install the water differential pressure sensor below the pressure measuring points using the GI mounting bracket provided with the sensor

PC28. ensure the surface of the installation of the sensor is vibration-free i.e. not on the surface of any equipment with moving parts.

PC29. carry out drilling of holes of the recommended diameter at the bottom of the pipes for pressure tapping

PC30. use the standard fittings supplied with the sensor to make connections

PC31. connect the tapping point to the sensor using the copper capillary tube supplied with the sensor

Install the air differential pressure sensor

To be competent, the user/individual on the job must be able to:

PC32. mount the air differential pressure sensor on the duct wall using fasteners supplied with the sensor

PC33. install the sensors using GI mounting bracket provided with the sensor

PC34. install duct probes in the suction and discharge side of the fans

PC35. connect the probes to the pressure sensor using the plastic tubing provided with the sensor

Install the immersion water temperature sensor

To be competent, the user/individual on the job must be able to:

PC36. install the thermowell in the chilled water pipeline and temperature sensor inside the thermowell

PC37. install the immersion water temperature sensor as per the approved shop drawings and manufacturer's recommendations.

PC38. ensure the stem length is completely immersed in chilled water and the cable entry to the sensor is not from the top of the sensor

PC39. apply seal on the socket and sensor threads using Teflon tape

Install the smoke detectors in AC ducts

To be competent, the user/individual on the job must be able to:

PC40. drill mounting holes as per the manufacturer's recommendations for duct housing and to insert air sampling and exhaust tubes

PC41. carry out the wiring for detector connection as per the approved shop drawings

PC42. install the smoke detector with the base unit inside the smoke chamber using the adopter plates

Install the butterfly valves

To be competent, the user/individual on the job must be able to:

PC43. install the butterfly valves in a sandwiched position using appropriate flanges

PC44. install actuators after installing and insulating the valves

PC45. ensure the valve actuators are not installed upside down

PC46. maintain the other actuators in the position recommended by the manufacturer

PC47. connect the two-port valves to the piping using threaded fittings or flanges depending upon the pipe diameter

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the process of installing (PVC)/ (GI) conduits and carry out cabling to connect all the BMS equipment/ devices

KU2. how to install and terminate the temperature sensor, humidity sensor, motorized damper actuators for HVAC equipment

KU3. how to install and terminate the CHW temperature sensor, pressure sensor and flow sensors for CHW pipes

KU4. the process of connecting all the field devices as per the approved BMS point schedule, wiring schedule and schematic diagrams

KU5. how to install the field devices such as outside air humidity sensor, water level sensor, staircase pressurisation sensor as per the approved BMS system

KU6. the process of installing the VFDs inside AHU control panels as per the approved schematic diagrams

KU7. the process of installing conduits and carrying out the wiring for plumbing systems such as water booster pump sets, fire pump sets, water calorifier and pump from the DDC panel as per the system requirements

KU8. the process of carrying out terminations at field ends and control cabling for DDC control panels as per approved shop drawings, schematic drawings

KU9. the process of installing the central peripherals such as the computer, printer, monitor as per the approved BMS system and shop drawings

KU10. the process of installing the motion sensors and connecting them for BMS digital control

KU11. how to install the duct air temperature sensor and duct temperature/ humidity sensor

KU12. how to install the water differential pressure sensor

KU13. the process of installing an air differential pressure sensor

KU14. the process of installing an immersion water temperature sensor

KU15. how to install smoke detectors in AC ducts

KU16. the process of installing butterfly and two-port valves

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. maintain work-related records

GS2. read the relevant literature to get the latest updates about the field of work

GS3. communicate politely and professionally

GS4. listen attentively to understand the information being shared

GS5. plan and schedule tasks for efficient time management

GS6. take quick decisions to deal with workplace emergencies/ accident

GS7. evaluate all possible solutions to a problem to select the best one

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Install conduits and carry out wiring	**4**	**4**	**-**	**4**
PC1. install Polyvinyl Chloride (PVC)/ Galvanised Iron (GI) conduits between the field devices and the control panel as per the plan	-	-	-	-
PC2. carry out wiring to connect all the field devices as per the approved BMS point schedule, wiring schedule and schematic diagrams	-	-	-	-
Install the Direct Digital Controller (DDC) with field devices	**4**	**6**	**-**	**4**
PC3. install the control panel with the required power supply at the selected location as per the approved shop drawings	-	-	-	-
PC4. install and terminate the temperature sensor, humidity sensor, motorized damper actuators for HVAC equipment as per the manufacturer's instructions	-	-	-	-
PC5. install and terminate the CHW temperature sensor, pressure sensor and flow sensors for CHW pipes as per the manufacturer's instructions	-	-	-	-
PC6. connect all the field devices as per the approved BMS point schedule, wiring schedule and schematic diagrams	-	-	-	-
PC7. install and connect the field devices such as outside air humidity sensor, water level sensor, staircase pressurisation sensor as per the approved BMS system	-	-	-	-
PC8. install the VFD's inside AHU control panels and make the required cable connections as per the approved schematic diagrams	-	-	-	-
PC9. install the plumbing system including the water booster pump sets, fire pump sets, water calorifier and pump from the DDC panel, as per the system requirements	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC10. carry out terminations at field ends as per the manufacturer's recommendations	-	-	-	-
PC11. carry out control cabling for DDC control panels through GI conduit or GI trunking above the false ceiling as per approved shop drawings, schematic drawings	-	-	-	-
PC12. label all the control wires with related identifications and connect as per the approved data point schedule	-	-	-	-
Install the central peripherals	**4**	**4**	**-**	**4**
PC13. carry out bus loop wiring from the Central Controller to all the Variable Air Volume (VAVs) and DDC as per the approved schematic drawings	-	-	-	-
PC14. install the pre-assembled peripherals with controllers hubs in the BMS control room	-	-	-	-
PC15. carry out wiring between the central peripherals and the low current systems as per the approved shop drawings	-	-	-	-
PC16. install the central peripherals such as the computer, printer, monitor as per the approved BMS system and shop drawings	-	-	-	-
Install the motion sensors	**2**	**2**	**-**	**4**
PC17. identify the locations for installing motion sensors as per the BMS plan	-	-	-	-
PC18. set up the mounting brackets at the identified locations	-	-	-	-
PC19. install the motion sensors as per the manufacturer's instructions	-	-	-	-
PC20. connect the motion sensors for BMS digital control	-	-	-	-
Install the duct air temperature sensor and duct temperature/ humidity sensor	**4**	**6**	**-**	**4**

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC21. identify the location of the duct air temperature and duct temperature/ humidity sensor as per the approved shop drawings	-	-	-	-
PC22. drill holes of the recommended diameter using a hole saw cutter and set up the mounting flanges	-	-	-	-
PC23. insert and install the duct air temperature sensor and duct temperature/ humidity sensor on the mounting flanges	-	-	-	-
PC24. ensure the duct temperature/ humidity sensor is mounted on the middle of the duct wall and the sensing element is diagonally bent across the cross-section of the duct	-	-	-	-
PC25. set up the end of the sensing element using the collar provided with the sensor	-	-	-	-
PC26. ensure that the sensing element does not touch the duct wall	-	-	-	-
Install the water differential pressure sensor	**2**	**4**	**-**	**4**
PC27. install the water differential pressure sensor below the pressure measuring points using the GI mounting bracket provided with the sensor	-	-	-	-
PC28. ensure the surface of the installation of the sensor is vibration-free i.e. not on the surface of any equipment with moving parts.	-	-	-	-
PC29. carry out drilling of holes of the recommended diameter at the bottom of the pipes for pressure tapping	-	-	-	-
PC30. use the standard fittings supplied with the sensor to make connections	-	-	-	-
PC31. connect the tapping point to the sensor using the copper capillary tube supplied with the sensor	-	-	-	-
Install the air differential pressure sensor	**2**	**2**	**-**	**1**
PC32. mount the air differential pressure sensor on the duct wall using fasteners supplied with the sensor	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC33. install the sensors using GI mounting bracket provided with the sensor	-	-	-	-
PC34. install duct probes in the suction and discharge side of the fans	-	-	-	-
PC35. connect the probes to the pressure sensor using the plastic tubing provided with the sensor	-	-	-	-
Install the immersion water temperature sensor	**4**	**4**	**-**	**2**
PC36. install the thermowell in the chilled water pipeline and temperature sensor inside the thermowell	-	-	-	-
PC37. install the immersion water temperature sensor as per the approved shop drawings and manufacturer's recommendations.	-	-	-	-
PC38. ensure the stem length is completely immersed in chilled water and the cable entry to the sensor is not from the top of the sensor	-	-	-	-
PC39. apply seal on the socket and sensor threads using Teflon tape	-	-	-	-
Install the smoke detectors in AC ducts	**2**	**4**	**-**	**1**
PC40. drill mounting holes as per the manufacturer's recommendations for duct housing and to insert air sampling and exhaust tubes	-	-	-	-
PC41. carry out the wiring for detector connection as per the approved shop drawings	-	-	-	-
PC42. install the smoke detector with the base unit inside the smoke chamber using the adopter plates	-	-	-	-
Install the butterfly valves	**2**	**4**	**-**	**2**
PC43. install the butterfly valves in a sandwiched position using appropriate flanges	-	-	-	-
PC44. install actuators after installing and insulating the valves	-	-	-	-
PC45. ensure the valve actuators are not installed upside down	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC46. maintain the other actuators in the position recommended by the manufacturer	-	-	-	-
PC47. connect the two-port valves to the piping using threaded fittings or flanges depending upon the pipe diameter	-	-	-	-
NOS Total	**30**	**40**	**-**	**30**

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N7206
NOS Name	Carry out the installation of BMS
Sector	Electronics
Sub-Sector	Industrial Automation
Occupation	After Sales Service-I&A
NSQF Level	5
Credits	TBD
Version	1.0
Last Reviewed Date	24/02/2022
Next Review Date	02/06/2025
NSQC Clearance Date	24/02/2022

ELE/N7208: Carry out commissioning and testing of BMS

Description

This OS unit is about carrying out commissioning and testing of a BMS to ensure it works as expected without any issues.

Scope

The scope covers the following :

- Carry out pre-commissioning of BMS
- Carry out commissioning of DDC panels
- Carry out commissioning of the Fan Coil Unit (FCU)
- Test the digital and analogue inputs and outputs
- Test the communication link, printer and alarms
- Test the third-party system interface connectivity

Elements and Performance Criteria

Carry out pre-commissioning of BMS

To be competent, the user/individual on the job must be able to:

PC1. ensure that the installation of all BMS components is complete, as per with the approved shop drawings and manufacturer's recommendations

PC2. check that mechanical and electrical installation inspection recommendations are incorporated, ensuring no damage during mechanical completion and pre-commissioning

PC3. replace any damaged components as per the SOP

PC4. ensure all the relevant systems are pre-commissioned and commissioned as standalone systems

PC5. check all peripheral devices are mounted and connected

PC6. check all mechanical installations for the correct location and application

PC7. check all the cables are connected correctly inside the control panels/ DDC controllers and to the peripheral devices

PC8. check the control panel input terminals for interference voltages using an AC range voltmeter

PC9. ensure all Fan Coil Unit (FCU) controllers are installed and connected via communication bus

PC10. ensure the installation of all the sensors, DP switches, valves is completed both mechanically and electrically

PC11. test all control cables point to point using a multimeter

Carry out commissioning of DDC panels

To be competent, the user/individual on the job must be able to:

PC12. check the DDC panels have the correct power supply, ensuring personal safety

PC13. install the DDC controller software for correct automation of DDC, as per the instructions included with the licensed software

PC14. set the controller address, date and time and check for any system alarms

PC15. connect the field wiring at DDC controller

Carry out commissioning of the Fan Coil Unit (FCU)

To be competent, the user/individual on the job must be able to:

PC16. check for 240Vac at Miniature Circuit Breaker (MCB) or spur socket as applicable

PC17. check the status of the LEDs for communications after switching on the power supply module and check for any alarm

PC18. check that the network communication link is up between the BMS servers, workstations, DDC Panels, LON to IP converters (LIP) and Building Automation and Control Network (BACnet) controllers

PC19. check the values displayed on the graphics screen and confirm that they are linked to the points of concerned plant as per the DDC I/O testing and commissioning check list

PC20. test that changes occur in field as per the sequence of operation and the changes are displayed correctly on the graphics screen

Test the digital and analogue inputs and outputs

To be competent, the user/individual on the job must be able to:

PC21. check all the Digital Inputs (DI) and Digital Outputs (DO) cables coming from field are volt free

PC22. connect each pair of field instrument cable at the appropriate terminals as per the panel wiring termination drawing

PC23. shorten and disconnect the wires at the field end and check for appropriate LED status at the DI module

PC24. change the Hand-Off-Auto selector switches for all the equipment to auto position

PC25. connect all cables of field instruments for analogue inputs/ outputs at the appropriate terminals as per the panel wiring termination drawing

PC26. check for availability of 24Vac at each valve motor and field instrument

PC27. connect all cables of field instruments for analogue inputs/ outputs at the appropriate terminals as per the panel wiring termination drawing

Test the communication link, printer and alarms

To be competent, the user/individual on the job must be able to:

PC28. check that the communication link is up between the servers/ workstations and printers

PC29. check the drivers are correctly installed as per the manufacturer's instructions

PC30. test each alarm in the system and validate that the system generates the appropriate alarm message, the message appears at workstations and printers, and any other related actions occur as defined

Test the third-party system interface connectivity

To be competent, the user/individual on the job must be able to:

PC31. match the values on the BMS graphics and on the third party system display for different parameters in real time after the third party systems are configured

PC32. check and verify the sequence of operations according to the Sequence of Operation Manual after all field cables are verified and checked

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the process of pre-commissioning a BMS

KU2. the importance of ensuring that all peripheral devices are mounted and connected

KU3. the importance of checking the mechanical installations for the correct location and application

KU4. how to check if all the cables are connected correctly inside the control panels/ DDC controllers and to the peripheral devices

KU5. the process of checking the control panel input terminals for interference voltages with the use of an AC range voltmeter

KU6. how to check if the Fan Coil Unit (FCU) controllers are installed and connected via communication bus

KU7. the importance of ensuring the installation of all the sensors, DP switches, valves is completed both mechanically and electrically

KU8. use of a multimeter to test all control cables

KU9. the process of commissioning DDC panels including the installation of relevant DDC controller application software

KU10. the process of testing the digital input/ output and analogue input/ output

KU11. the process of commissioning the Fan Coil Unit (FCU)

KU12. the importance of checking the network communication between the BMS servers, workstations, DDC Panels, LON to IP converters (LIP) and Building Automation and Control Network (BACnet) controllers

KU13. the process of testing the sequence of operation according to changes in the field devices

KU14. the process of checking the printer and alarms for correct functioning

KU15. how to check that the communication link is up between the servers/ workstations and printers

KU16. how to check the third-party system interface connectivity

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. maintain work-related records

GS2. read the relevant literature to get the latest updates about the field of work

GS3. communicate politely and professionally

GS4. listen attentively to understand the information being shared

GS5. plan and schedule tasks for efficient time management

GS6. take quick decisions to deal with workplace emergencies/ accident

GS7. evaluate all possible solutions to a problem to select the best one

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Carry out pre-commissioning of BMS	**5**	**10**	**-**	**5**
PC1. ensure that the installation of all BMS components is complete, as per with the approved shop drawings and manufacturer's recommendations	-	-	-	-
PC2. check that mechanical and electrical installation inspection recommendations are incorporated, ensuring no damage during mechanical completion and pre-commissioning	-	-	-	-
PC3. replace any damaged components as per the SOP	-	-	-	-
PC4. ensure all the relevant systems are pre-commissioned and commissioned as standalone systems	-	-	-	-
PC5. check all peripheral devices are mounted and connected	-	-	-	-
PC6. check all mechanical installations for the correct location and application	-	-	-	-
PC7. check all the cables are connected correctly inside the control panels/ DDC controllers and to the peripheral devices	-	-	-	-
PC8. check the control panel input terminals for interference voltages using an AC range voltmeter	-	-	-	-
PC9. ensure all Fan Coil Unit (FCU) controllers are installed and connected via communication bus	-	-	-	-
PC10. ensure the installation of all the sensors, DP switches, valves is completed both mechanically and electrically	-	-	-	-
PC11. test all control cables point to point using a multimeter	-	-	-	-
Carry out commissioning of DDC panels	**5**	**5**	**-**	**5**

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC12. check the DDC panels have the correct power supply, ensuring personal safety	-	-	-	-
PC13. install the DDC controller software for correct automation of DDC, as per the instructions included with the licensed software	-	-	-	-
PC14. set the controller address, date and time and check for any system alarms	-	-	-	-
PC15. connect the field wiring at DDC controller	-	-	-	-
Carry out commissioning of the Fan Coil Unit (FCU)	**5**	**5**	**-**	**5**
PC16. check for 240Vac at Miniature Circuit Breaker (MCB) or spur socket as applicable	-	-	-	-
PC17. check the status of the LEDs for communications after switching on the power supply module and check for any alarm	-	-	-	-
PC18. check that the network communication link is up between the BMS servers, workstations, DDC Panels, LON to IP converters (LIP) and Building Automation and Control Network (BACnet) controllers	-	-	-	-
PC19. check the values displayed on the graphics screen and confirm that they are linked to the points of concerned plant as per the DDC I/O testing and commissioning check list	-	-	-	-
PC20. test that changes occur in field as per the sequence of operation and the changes are displayed correctly on the graphics screen	-	-	-	-
Test the digital and analogue inputs and outputs	**5**	**10**	**-**	**5**
PC21. check all the Digital Inputs (DI) and Digital Outputs (DO) cables coming from field are volt free	-	-	-	-
PC22. connect each pair of field instrument cable at the appropriate terminals as per the panel wiring termination drawing	-	-	-	-
PC23. shorten and disconnect the wires at the field end and check for appropriate LED status at the DI module	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC24. change the Hand-Off-Auto selector switches for all the equipment to auto position	-	-	-	-
PC25. connect all cables of field instruments for analogue inputs/ outputs at the appropriate terminals as per the panel wiring termination drawing	-	-	-	-
PC26. check for availability of 24Vac at each valve motor and field instrument	-	-	-	-
PC27. connect all cables of field instruments for analogue inputs/ outputs at the appropriate terminals as per the panel wiring termination drawing	-	-	-	-
Test the communication link, printer and alarms	**5**	**5**	**-**	**5**
PC28. check that the communication link is up between the servers/ workstations and printers	-	-	-	-
PC29. check the drivers are correctly installed as per the manufacturer's instructions	-	-	-	-
PC30. test each alarm in the system and validate that the system generates the appropriate alarm message, the message appears at workstations and printers, and any other related actions occur as defined	-	-	-	-
Test the third-party system interface connectivity	**5**	**5**	**-**	**5**
PC31. match the values on the BMS graphics and on the third party system display for different parameters in real time after the third party systems are configured	-	-	-	-
PC32. check and verify the sequence of operations according to the Sequence of Operation Manual after all field cables are verified and checked	-	-	-	-
NOS Total	**30**	**40**	**-**	**30**

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N7208
NOS Name	Carry out commissioning and testing of BMS
Sector	Electronics
Sub-Sector	Industrial Automation
Occupation	After Sales Service-I&A
NSQF Level	5
Credits	TBD
Version	1.0
Last Reviewed Date	24/02/2022
Next Review Date	02/06/2025
NSQC Clearance Date	24/02/2022

ELE/N7207: Carry out repair and maintenance of BMS

Description

This OS unit is about carrying out the repair and maintenance of the building management system.

Scope

The scope covers the following :

- Carry out repair and maintenance of BMS field devices
- Carry out repair and maintenance of electrical panels
- Manage the BMS helpdesk, complaints and requests
- Maintain the records

Elements and Performance Criteria

Carry out repair and maintenance of BMS field devices

To be competent, the user/individual on the job must be able to:

PC1. test the valve actuators, damper actuator, sensors, transducers, high-low limit thermostats, frost thermostats, pressure switches, control valve, relays, emergency stop button and fire/ smoke shut-down, the shut-off operation of spring return actuators and Digital Input and Output (I/O) for the correct functioning

PC2. check the field devices for wear and tear or damage

PC3. check the BMS is connected with the control system and is online

PC4. check repair and maintenance needs of the BMS control system

PC5. check the motion sensors are working as expected

PC6. clean the valve actuators, damper actuators and sensors

PC7. re-calibrate all sensors, transducers, valve start points and actuator travel times as per the requirement

PC8. replace the worn out or damaged field devices as per the Standard Operating Procedure

PC9. carry out maintenance of the motion sensors or replace them as required

PC10. carry out control panel modifications, up-gradation and installations as required

Carry out repair and maintenance of electrical panels

To be competent, the user/individual on the job must be able to:

PC11. examine the panel exterior for signs of damage

PC12. check the tightness of all the electrical terminations

PC13. check the integrity of power cabling insulation

PC14. check settings, ratings and operation of protective devices such as overloads, residual current devices, circuit breakers and fuses

PC15. check for signs of overheating of components such as contactors, cables, connectors, as well as the internal temperature within the panel

PC16. check and re-torque the busbar nuts and bolts

PC17. inspect the transformers and power supplies for wear and tear or damage

PC18. check the panel is correctly earth-bonded

PC19. ensure main door electrical isolator is engaged and operational

PC20. ensure ventilation fans and grilles are functional and clean

PC21. ensure the isolators, relays, contactors and starters are functioning correctly and free from pitting

PC22. ensure the incoming power supply voltages are within the prescribed limits

PC23. ensure the cleanliness of panel and components and risk of ingress of dirt or moisture is minimised

PC24. ensure status indicators on all panels are functional

Manage the BMS helpdesk, complaints and requests

To be competent, the user/individual on the job must be able to:

PC25. manage the BMS help desk, providing a central point for all the BMS-related requests/ complaints

PC26. ensure closure of BMS-related requests/ complaints with timely resolution

PC27. direct the BMS complaints requiring vendor attention to the concerned vendor promptly

PC28. escalate the unresolved complaints to the relevant authority as per the escalation matrix

Maintain the records

To be competent, the user/individual on the job must be able to:

PC29. maintain the logs of calls reporting any issues with the BMS

PC30. maintain and update documents related to BMS room, device hosting and its maintenance

PC31. maintain records and logs regarding the building temperatures, energy consumption, control panel readings, issues encountered and the steps taken to correct the problem, etc.

PC32. prepare the daily/ weekly/ monthly Management Information Systems (MIS) report regarding the requests/ complaints received and share with the relevant authority

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the process of testing the valve actuators, damper actuator, sensors, transducers, high-low limit thermostats, frost thermostats, pressure switches, control valve, relays, emergency stop button and fire/ smoke shut-down, the shut-off operation of spring return actuators and Digital Input and Output (I/O) for the correct functioning

KU2. the importance of ensuring the field devices are not worn-out or damaged

KU3. how to check the BMS is connected with the control system and is online

KU4. how to identify the repair and maintenance needs of the BMS control system

KU5. how to check if the motion sensors are working as expected and replacing them if required

KU6. the process of cleaning the valve actuators, damper actuators and sensors

KU7. the process of re-calibrating all sensors, transducers, valve start points and actuator travel times

KU8. the process of replacing the worn out or damaged field devices

KU9. how to check settings, ratings and operation of protective devices such as overloads, residual current devices, circuit breakers and fuses

KU10. signs of overheating of components such as contactors, cables, connectors and internal temperature within the electrical panels

KU11. the process of re-torqueing the busbar nuts and bolts

KU12. how to check if the electrical panel is earth-bonded correctly

KU13. how to check if the main door electrical isolator is engaged and operational

KU14. the importance of ensuring ventilation fans and grilles are functional and clean

KU15. the importance of ensuring isolators, relays, contactors and starters are functioning correctly and free from pitting

KU16. the importance of ensuring incoming power supply voltages are within the prescribed limits

KU17. the importance of ensuring status indicators on all panels are functional

KU18. the importance of ensuring the closure of BMS-related requests/ complaints with timely resolution

KU19. the importance of directing the BMS complaints requiring vendor attention to the concerned vendor promptly and escalating the unresolved complaints to the relevant authority as per the escalation matrix

KU20. various records to be maintained regarding the BMS operations

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. make work-related records

GS2. read the relevant literature to get the latest updates about the field of work

GS3. communicate politely and professionally

GS4. listen attentively to comprehend the information being shared

GS5. take quick decisions to resolve work-related issues to minimise the impact on productivity

GS6. plan and prioritise tasks to ensure timely completion

GS7. identify possible disruptions to work and take appropriate preventive measures

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Carry out repair and maintenance of BMS field devices	**8**	**12**	**-**	**8**
PC1. test the valve actuators, damper actuator, sensors, transducers, high-low limit thermostats, frost thermostats, pressure switches, control valve, relays, emergency stop button and fire/ smoke shut-down, the shut-off operation of spring return actuators and Digital Input and Output (I/O) for the correct functioning	-	-	-	-
PC2. check the field devices for wear and tear or damage	-	-	-	-
PC3. check the BMS is connected with the control system and is online	-	-	-	-
PC4. check repair and maintenance needs of the BMS control system	-	-	-	-
PC5. check the motion sensors are working as expected	-	-	-	-
PC6. clean the valve actuators, damper actuators and sensors	-	-	-	-
PC7. re-calibrate all sensors, transducers, valve start points and actuator travel times as per the requirement	-	-	-	-
PC8. replace the worn out or damaged field devices as per the Standard Operating Procedure	-	-	-	-
PC9. carry out maintenance of the motion sensors or replace them as required	-	-	-	-
PC10. carry out control panel modifications, up-gradation and installations as required	-	-	-	-
Carry out repair and maintenance of electrical panels	**10**	**10**	**-**	**10**
PC11. examine the panel exterior for signs of damage	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC12. check the tightness of all the electrical terminations	-	-	-	-
PC13. check the integrity of power cabling insulation	-	-	-	-
PC14. check settings, ratings and operation of protective devices such as overloads, residual current devices, circuit breakers and fuses	-	-	-	-
PC15. check for signs of overheating of components such as contactors, cables, connectors, as well as the internal temperature within the panel	-	-	-	-
PC16. check and re-torque the busbar nuts and bolts	-	-	-	-
PC17. inspect the transformers and power supplies for wear and tear or damage	-	-	-	-
PC18. check the panel is correctly earth-bonded	-	-	-	-
PC19. ensure main door electrical isolator is engaged and operational	-	-	-	-
PC20. ensure ventilation fans and grilles are functional and clean	-	-	-	-
PC21. ensure the isolators, relays, contactors and starters are functioning correctly and free from pitting	-	-	-	-
PC22. ensure the incoming power supply voltages are within the prescribed limits	-	-	-	-
PC23. ensure the cleanliness of panel and components and risk of ingress of dirt or moisture is minimised	-	-	-	-
PC24. ensure status indicators on all panels are functional	-	-	-	-
Manage the BMS helpdesk, complaints and requests	**8**	**12**	**-**	**8**
PC25. manage the BMS help desk, providing a central point for all the BMS-related requests/ complaints	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC26. ensure closure of BMS-related requests/ complaints with timely resolution	-	-	-	-
PC27. direct the BMS complaints requiring vendor attention to the concerned vendor promptly	-	-	-	-
PC28. escalate the unresolved complaints to the relevant authority as per the escalation matrix	-	-	-	-
Maintain the records	**4**	**6**	**-**	**4**
PC29. maintain the logs of calls reporting any issues with the BMS	-	-	-	-
PC30. maintain and update documents related to BMS room, device hosting and its maintenance	-	-	-	-
PC31. maintain records and logs regarding the building temperatures, energy consumption, control panel readings, issues encountered and the steps taken to correct the problem, etc.	-	-	-	-
PC32. prepare the daily/ weekly/ monthly Management Information Systems (MIS) report regarding the requests/ complaints received and share with the relevant authority	-	-	-	-
NOS Total	**30**	**40**	**-**	**30**

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N7207
NOS Name	Carry out repair and maintenance of BMS
Sector	Electronics
Sub-Sector	Industrial Automation
Occupation	After Sales Service-I&A
NSQF Level	5
Credits	TBD
Version	1.0
Last Reviewed Date	24/02/2022
Next Review Date	02/06/2025
NSQC Clearance Date	24/02/2022

ELE/N9905: Work effectively at the workplace

Description

This unit is about the communicating and managing work effectively at the workplace as well as taking measures to enhance own competence and working in a disciplined and ethical manner.

Scope

The scope covers the following :

- Communicate effectively at the workplace
- Work effectively
- Maintain and enhance professional competence
- Work in a disciplined and ethical manner
- Uphold social diversity at the workplace

Elements and Performance Criteria

Communicate effectively at the workplace

To be competent, the user/individual on the job must be able to:

PC1. exchange information and instruction with colleagues, and seek clarifications and feedback as necessary

PC2. assist colleagues where required

PC3. follow business communication etiquette in all interactions and communicative formats (online, digital, and in-person)

PC4. document and share all relevant information with stakeholders in agreed formats and as per agreed timelines

Work effectively

To be competent, the user/individual on the job must be able to:

PC5. identify and obtain clarity regarding organisational, team and own goals and targets

PC6. prioritise and plan work in order to achieve goals and targets

PC7. monitor own and team performance as per agreed plan

PC8. complete duties accurately, systematically and within required timeframes

PC9. express emotions appropriately at the workplace and manage own response to heightened emotions

PC10. maintain orderliness and cleanliness in the work area

Maintain and enhance professional competence

To be competent, the user/individual on the job must be able to:

PC11. identify own strengths and weaknesses in relation to goals and targets

PC12. adapt self, service, or product to meet success criteria

PC13. seek and select opportunities for continuous professional development

PC14. formulate a professional development plan to enhance capabilities

PC15. build or contribute to the organizational knowledge base of cases, clients, issues, solutions, and innovations

PC16. examine developments and trends in field of work and their potential impact on work

PC17. take feedback from peers, supervisors and clients to improve own performance and practices

Work in a disciplined and ethical manner

To be competent, the user/individual on the job must be able to:

PC18. perform tasks as per workplace standards, organisational policies and legislative requirements

PC19. display appropriate professional appearance at the workplace and adhere to the organisational dress code

PC20. demonstrate responsible and disciplined behaviour at the workplace such as punctuality; completing tasks as per given time and standards; demonstrating professional behaviour at all times, adopting environment- friendly practices, etc.

PC21. identify the cause of conflict and options for resolution with peers or escalate grievances and problems to appropriate authority as per procedure for conflict resolution

PC22. protect the rights of the client and organisation when delivering services

PC23. ensure services are delivered equally to all clients regardless of personal and cultural beliefs

PC24. operate within an agreed ethical code of practice and report unethical conduct to the appropriate authorities

PC25. follow organisational guidelines and legal requirements on disclosure and confidentiality

Uphold social diversity at the workplace

To be competent, the user/individual on the job must be able to:

PC26. recognize and evaluate biased practices against underrepresented groups like women and persons with disabilities, in workplace systems and processes

PC27. identify and report discrimination and harassment based on gender, disability, or cultural difference at the workplace

PC28. use inclusive or neutral language and gestures in all interactions

PC29. respect the personal and professional space of others

PC30. access grievance redressal mechanisms as per legislations

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. organisation's policies on dress code, workplace timings, workplace behaviour, performance management, incentives, delivery standards, information security, etc.

KU2. organizational hierarchy and escalation matrix

KU3. importance of the individual's role in the workflow

KU4. organisational norms on health, safety and sustainability

KU5. work area inspection procedures and practices

KU6. professional etiquette and grooming

KU7. communication etiquette across communicative mediums (online, digital, and in-person) including strategies/methods for sharing information, documentation, and providing and receiving feedback

KU8. importance of self-evaluations and developing a continuous learning and professional development plan

KU9. developments and trends impacting professional practice

KU10. importance of taking and using feedback from colleagues and clients to identify and introduce improvements in work performance

KU11. professional ethics and workplace norms on reporting and/or penalizing unethical behaviour and practices.

KU12. guidelines and legal requirements on disclosure, confidentiality, and conflicts of interest

KU13. strategies for collaboration with colleagues and clients.

KU14. professional responses and strategies against inappropriate language or behaviour toward self and others

KU15. Implicit bias (based on gender, disability, class, caste, colour, race, culture, religion, etc.) and its consequences in the workplace

KU16. organizational guidelines, prevalent legislations and accessibility norms and processes to support PwDs at the workplace

KU17. strategies for time, effort and resource allocation towards the goals.

KU18. basic concepts of work productivity including waste reduction, efficient material usage and optimization of time

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. complete documentation and forms such as work orders, invoices maintenance records activity logs, attendance sheets as per organizational format in English and/or local language

GS2. write basic accident or incident report accurately in an appropriate format

GS3. read warnings, instructions and other text material on product labels, components, etc. and relevant signages, warnings, labels or descriptions on equipment, etc. while carrying out work activities

GS4. convey and share technical information clearly using appropriate language

GS5. clarify task-related information

GS6. liaise with authorities and supervisors as per organizational protocol

GS7. listen, speak, and write in an inclusive, respectful manner in line with organizational protocol

GS8. seek clarification from immediate supervisor or responsible authority or exercise most appropriate solutions to safety breaches at work

GS9. report to the supervisor and when to deal with a colleague depending on the type of concern

GS10. deliver product to next work process on time

GS11. improve work process and report potential areas of delays and disruptions

GS12. communicate problems appropriately to others

GS13. identify symptoms of the fault to the cause of the problem and resolve, otherwise seek assistance and support from other sources to solve the problem

GS14. anticipate and avoid hazards that may occur during repairs because of tools, materials used or repair processes

GS15. complete tasks efficiently and accurately within stipulated time

GS16. appreciate and respect social diversity in all professional settings

GS17. develop awareness and accountability for perspectives on gender, disabilities, and socio-cultural issues leading to discrimination, bias, or harassment at the workplace

GS18. maintain positive and effective relationships with colleagues and customers

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Communicate effectively at the workplace	**5**	**13**	**-**	**-**
PC1. exchange information and instruction with colleagues, and seek clarifications and feedback as necessary	1	3	-	-
PC2. assist colleagues where required	1	3	-	-
PC3. follow business communication etiquette in all interactions and communicative formats (online, digital, and in-person)	1	4	-	-
PC4. document and share all relevant information with stakeholders in agreed formats and as per agreed timelines	2	3	-	-
Work effectively	**6**	**13**	**-**	**-**
PC5. identify and obtain clarity regarding organisational, team and own goals and targets	1	2	-	-
PC6. prioritise and plan work in order to achieve goals and targets	1	2	-	-
PC7. monitor own and team performance as per agreed plan	1	2	-	-
PC8. complete duties accurately, systematically and within required timeframes	1	2	-	-
PC9. express emotions appropriately at the workplace and manage own response to heightened emotions	1	2	-	-
PC10. maintain orderliness and cleanliness in the work area	1	3	-	-
Maintain and enhance professional competence	**8**	**7**	**-**	**-**
PC11. identify own strengths and weaknesses in relation to goals and targets	1	1	-	-
PC12. adapt self, service, or product to meet success criteria	1	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC13. seek and select opportunities for continuous professional development	1	1	-	-
PC14. formulate a professional development plan to enhance capabilities	2	1	-	-
PC15. build or contribute to the organizational knowledge base of cases, clients, issues, solutions, and innovations	1	1	-	-
PC16. examine developments and trends in field of work and their potential impact on work	1	1	-	-
PC17. take feedback from peers, supervisors and clients to improve own performance and practices	1	1	-	-
Work in a disciplined and ethical manner	**11**	**16**	**-**	**-**
PC18. perform tasks as per workplace standards, organisational policies and legislative requirements	2	2	-	-
PC19. display appropriate professional appearance at the workplace and adhere to the organisational dress code	1	2	-	-
PC20. demonstrate responsible and disciplined behaviour at the workplace such as punctuality; completing tasks as per given time and standards; demonstrating professional behaviour at all times, adopting environment- friendly practices, etc.	1	2	-	-
PC21. identify the cause of conflict and options for resolution with peers or escalate grievances and problems to appropriate authority as per procedure for conflict resolution	2	2	-	-
PC22. protect the rights of the client and organisation when delivering services	1	2	-	-
PC23. ensure services are delivered equally to all clients regardless of personal and cultural beliefs	1	2	-	-
PC24. operate within an agreed ethical code of practice and report unethical conduct to the appropriate authorities	2	2	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC25. follow organisational guidelines and legal requirements on disclosure and confidentiality	1	2	-	-
Uphold social diversity at the workplace	**10**	**11**	**-**	**-**
PC26. recognize and evaluate biased practices against underrepresented groups like women and persons with disabilities, in workplace systems and processes	2	2	-	-
PC27. identify and report discrimination and harassment based on gender, disability, or cultural difference at the workplace	2	2	-	-
PC28. use inclusive or neutral language and gestures in all interactions	2	2	-	-
PC29. respect the personal and professional space of others	2	2	-	-
PC30. access grievance redressal mechanisms as per legislations	2	3	-	-
NOS Total	**40**	**60**	**-**	**-**

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N9905
NOS Name	Work effectively at the workplace
Sector	Electronics
Sub-Sector	Generic
Occupation	Generic - Organizational Behaviour
NSQF Level	4
Credits	TBD
Version	2.0
Last Reviewed Date	24/02/2022
Next Review Date	30/12/2026
NSQC Clearance Date	30/12/2021

ELE/N1002: Apply health and safety practices at the workplace

Description

This OS unit is about knowledge and practices relating to health, safety and security that candidates need to use in the workplace.

Scope

The scope covers the following :

- Deal with workplace hazards
- Apply fire safety practices
- Follow emergencies, rescue and first-aid procedures
- Effective waste management/recycling practices

Elements and Performance Criteria

Deal with workplace hazards

To be competent, the user/individual on the job must be able to:

PC1. identify job-site hazards and possible causes of accident in the workplace

PC2. perform work complying to organizational safe working practices and observing hazard signs displayed on containers, equipment and in various work areas such as inside buildings, in open areas and public spaces, etc.

PC3. use appropriate personal protective equipment (PPE) for specific tasks and work conditions, contaminant (concentration w.r.t air) requirements and severity of hazard while conforming to the Indian/International standards

PC4. follow standard safety procedures while handling tool/ ,equipment, hazardous substances and while working in hazardous environments

PC5. dispose electronic waste (such as toxins; metals such as lead, cadmium, barium; flame retardant plastics, welding slag etc.) as per industry approved techniques

PC6. avoid damage of components due to negligence in electrostatic discharge (ESD) procedures

PC7. locate general health and safety equipment in the workplace such as fire extinguishers; first aid equipment; safety instruments, clothing and installations (fire exits, exhaust fans)

PC8. maintain appropriate posture while handling heavy objects

PC9. apply good housekeeping practices at all times

Apply fire safety practices

To be competent, the user/individual on the job must be able to:

PC10. take preventive measures to prevent fire hazards

PC11. • use appropriate fire extinguishers for different types of fires
• Types of fires: Class A: e.g. ordinary solid combustibles, such as wood, paper, cloth, plastic, charcoal, etc.; Class B: flammable liquids and gases, such as gasoline, propane, diesel fuel, tar, cooking oil, and similar substances; Class C: e.g. electrical equipment such as appliances, wiring, breaker panels, etc. (These categories of fires become Class A, B, and D fires when the electrical equipment that initiated the fire is no l

PC12. exhibit rescue and first-aid techniques in case of fire or electrocution

Follow emergencies, rescue and first-aid procedures

To be competent, the user/individual on the job must be able to:

PC13. administer appropriate first aid to victims in case of bleeding, burns, choking, electric shock, poisoning etc.

PC14. administer first aid to victims in case of a heart attack or cardiac arrest due to electric shock,

PC15. participate regularly in emergency procedures such as raising alarm, safe/efficient, evacuation, correct means of taking shelter and escaping, correct assembly point, roll call, correct return to work

PC16. use correct method to move injured people and others during an emergency

Effective waste management/recycling practices

To be competent, the user/individual on the job must be able to:

PC17. identify recyclable and non-recyclable, and hazardous waste generated

PC18. segregate waste into different categories

PC19. ensure disposal of non-recyclable waste appropriately

PC20. deposit non-recyclable and reusable material at identified location

PC21. follow processes specified for disposal of hazardous waste

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. importance of working in clean and safe work environment following safety practices and procedures

KU2. health and safety roles and responsibilities of relevant personnel within and outside the organisation

KU3. key internal and external sources of health and safety information

KU4. basic knowledge of electronic devices and related health risks

KU5. meaning of hazards and risks

KU6. various types of health and safety hazards commonly present in the work environment such as physical hazards, electrical hazards, chemical hazards, fire hazards, equipment related hazards, health hazards, etc.

KU7. methods of accident prevention

KU8. importance of using protective clothing/equipment while working

KU9. general principles for identifying and controlling health and safety risks

KU10. main hazards and preventive as well as control measures while working with different types of equipment

KU11. importance of carrying out electrical and non-electrical isolation to prevent hazards from loss of machine/system/process control

KU12. main hazards and preventive as well as control measures when working with electrical systems or using electrical equipment

KU13. forms and classifications of hazardous substances

KU14. safe working practices while working at various hazardous sites

KU15. prevention and control measures to reduce risks from exposure to hazardous substances

KU16. health effects associated with exposure to noise and vibration and the appropriate control measures

KU17. precautionary activities to prevent the fire accident

KU18. various causes of fire such as heating of metal, spontaneous ignition, sparking, electrical eating, loose fires (smoking, welding, etc.) chemical fires etc.

KU19. techniques of using the different fire extinguishers

KU20. different methods and material to extinguish fires

KU21. different materials used for extinguishing fire such as sand, water, foam, CO2, dry powder

KU22. rescue techniques used during a fire hazard

KU23. various types of safety signs and their meaning

KU24. basic first aid treatment relevant to the common work place injuries e.g. shock, electrical shock, bleeding, breaks to bones, minor burns, resuscitation, poisoning, eye injuries

KU25. contents of written accident report

KU26. potential injuries and ill health associated with incorrect handing of tools and equipment

KU27. safe lifting and carrying practices

KU28. potential impact to a person who is moved incorrectly

KU29. personal safety, health and dignity issues relating to the movement of a person by others

KU30. ESD measures and 5S

KU31. efficient utilization and management of material and water

KU32. ways to recognize common electrical problems and practices of conserving electricity

KU33. usage of different colours of dustbins, categorization of waste into dry, wet, recyclable, nonrecyclable and items of single-use plastics

KU34. organization's procedure for minimizing waste

KU35. waste management and methods of waste disposal

KU36. common sources of pollution and ways to minimize it

KU37. names, contact information and location of people responsible for health and safety in the workplace

KU38. location of documents and equipment for health and safety compliance/practices in the workplace

KU39. safety notices, signs and instructions at workplace

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. interpret general health and safety guidelines labels, charts, signages

GS2. read operation manuals

GS3. write health and safety compliance report

GS4. write an accident/incident report in local language or English

GS5. provide an emergency or safety incident brief to seniors or relevant authorities in a calm, clear and to-the-point manner

GS6. communicate general health and safety guidelines to colleagues/co-workers

GS7. communicate appropriately with co-workers in order to clarify instructions and other issues

GS8. act in case of any potential hazards observed in the work place

GS9. plan and organize their own work schedule, work area, tools, equipment in compliance with organizational policies for health, safety and security

GS10. take adequate measures to ensure the safety of clients and visitors at the workplace

GS11. identify immediate or temporary solutions to resolve delays

GS12. evaluate the work area for health and safety risks or hazards

GS13. use cause and effect relations to anticipate potential issues, problems and their solution in the work area related to safety

GS14. recognise emergency and potential emergency situations

GS15. protect self and others from a health and safety risk or hazard

GS16. communicate and collaborate to incorporate sustainable practices (greening) in workplace processes

GS17. record data on waste disposal at workplace

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Deal with workplace hazards	**20**	**31**	**-**	**-**
PC1. identify job-site hazards and possible causes of accident in the workplace	2	3	-	-
PC2. perform work complying to organizational safe working practices and observing hazard signs displayed on containers, equipment and in various work areas such as inside buildings, in open areas and public spaces, etc.	3	4	-	-
PC3. use appropriate personal protective equipment (PPE) for specific tasks and work conditions, contaminant (concentration w.r.t air) requirements and severity of hazard while conforming to the Indian/International standards	3	4	-	-
PC4. follow standard safety procedures while handling tool/ ,equipment, hazardous substances and while working in hazardous environments	3	4	-	-
PC5. dispose electronic waste (such as toxins; metals such as lead, cadmium, barium; flame retardant plastics, welding slag etc.) as per industry approved techniques	2	4	-	-
PC6. avoid damage of components due to negligence in electrostatic discharge (ESD) procedures	2	3	-	-
PC7. locate general health and safety equipment in the workplace such as fire extinguishers; first aid equipment; safety instruments, clothing and installations (fire exits, exhaust fans)	2	3	-	-
PC8. maintain appropriate posture while handling heavy objects	1	3	-	-
PC9. apply good housekeeping practices at all times	2	3	-	-
Apply fire safety practices	**4**	**9**	**-**	**-**
PC10. take preventive measures to prevent fire hazards	2	3	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. • use appropriate fire extinguishers for different types of fires • Types of fires: Class A: e.g. ordinary solid combustibles, such as wood, paper, cloth, plastic, charcoal, etc.; Class B: flammable liquids and gases, such as gasoline, propane, diesel fuel, tar, cooking oil, and similar substances; Class C: e.g. electrical equipment such as appliances, wiring, breaker panels, etc. (These categories of fires become Class A, B, and D fires when the electrical equipment that initiated the fire is no l	1	3	-	-
PC12. exhibit rescue and first-aid techniques in case of fire or electrocution	1	3	-	-
Follow emergencies, rescue and first-aid procedures	**6**	**13**	**-**	**-**
PC13. administer appropriate first aid to victims in case of bleeding, burns, choking, electric shock, poisoning etc.	1	3	-	-
PC14. administer first aid to victims in case of a heart attack or cardiac arrest due to electric shock,	1	2	-	-
PC15. participate regularly in emergency procedures such as raising alarm, safe/efficient, evacuation, correct means of taking shelter and escaping, correct assembly point, roll call, correct return to work	2	4	-	-
PC16. use correct method to move injured people and others during an emergency	2	4	-	-
Effective waste management/recycling practices	**5**	**12**	**-**	**-**
PC17. identify recyclable and non-recyclable, and hazardous waste generated	1	3	-	-
PC18. segregate waste into different categories	1	2	-	-
PC19. ensure disposal of non-recyclable waste appropriately	1	2	-	-
PC20. deposit non-recyclable and reusable material at identified location	1	3	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC21. follow processes specified for disposal of hazardous waste	1	2	-	-
NOS Total	**35**	**65**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N1002
NOS Name	Apply health and safety practices at the workplace
Sector	Electronics
Sub-Sector	Generic
Occupation	Generic - Health Safety
NSQF Level	4
Credits	TBD
Version	3.0
Last Reviewed Date	24/02/2022
Next Review Date	03/05/2026
NSQC Clearance Date	03/05/2023

Assessment Guidelines and Assessment Weightage

Assessment Guidelines

1. Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down the proportion of marks for Theory and Skills Practical for each PC.

2. The assessment for the theory part will be based on the knowledge bank of questions created by the SSC.

3. Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/option NOS/set of NOS.

4. Individual assessment agencies will create unique question papers for the theory part for each candidate at each examination/training center (as per assessment criteria below).

5. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/ training center based on these criteria.

6. To pass the Qualification Pack assessment, every trainee should score a minimum of 70% of % aggregate marks to successfully clear the assessment.

7. In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack.

Minimum Aggregate Passing % at QP Level : 70

(**Please note**: Every Trainee should score a minimum aggregate passing percentage as specified above, to successfully clear the Qualification Pack assessment.)

Assessment Weightage

Compulsory NOS

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
ELE/N7205.Prepare for installing the BMS	30	40	-	30	100	20
ELE/N7206.Carry out the installation of BMS	30	40	-	30	100	20
ELE/N7208.Carry out commissioning and testing of BMS	30	40	-	30	100	20
ELE/N7207.Carry out repair and maintenance of BMS	30	40	-	30	100	20
ELE/N9905.Work effectively at the workplace	40	60	-	-	100	10
ELE/N1002.Apply health and safety practices at the workplace	35	65	-	-	100	10
Total	**195**	**285**	**-**	**120**	**600**	**100**

Acronyms

NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training

Glossary

Sector	Sector is a conglomeration of different business operations having similar business and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests.
Sub-sector	Sub-sector is derived from a further breakdown based on the characteristics and interests of its components.
Occupation	Occupation is a set of job roles, which perform similar/ related set of functions in an industry.
Job role	Job role defines a unique set of functions that together form a unique employment opportunity in an organisation.
Occupational Standards (OS)	OS specify the standards of performance an individual must achieve when carrying out a function in the workplace, together with the Knowledge and Understanding (KU) they need to meet that standard consistently. Occupational Standards are applicable both in the Indian and global contexts.
Performance Criteria (PC)	Performance Criteria (PC) are statements that together specify the standard of performance required when carrying out a task.
National Occupational Standards (NOS)	NOS are occupational standards which apply uniquely in the Indian context.
Qualifications Pack (QP)	QP comprises the set of OS, together with the educational, training and other criteria required to perform a job role. A QP is assigned a unique qualifications pack code.
Unit Code	Unit code is a unique identifier for an Occupational Standard, which is denoted by an 'N'
Unit Title	Unit title gives a clear overall statement about what the incumbent should be able to do.
Description	Description gives a short summary of the unit content. This would be helpful to anyone searching on a database to verify that this is the appropriate OS they are looking for.
Scope	Scope is a set of statements specifying the range of variables that an individual may have to deal with in carrying out the function which have a critical impact on quality of performance required.

Knowledge and Understanding (KU)	Knowledge and Understanding (KU) are statements which together specify the technical, generic, professional and organisational specific knowledge that an individual needs in order to perform to the required standard.
Organisational Context	Organisational context includes the way the organisation is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility.
Technical Knowledge	Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
Core Skills/ Generic Skills (GS)	Core skills or Generic Skills (GS) are a group of skills that are the key to learning and working in today's world. These skills are typically needed in any work environment in today's world. These skills are typically needed in any work environment. In the context of the OS, these include communication related skills that are applicable to most job roles.
Electives	Electives are NOS/set of NOS that are identified by the sector as contributive to specialization in a job role. There may be multiple electives within a QP for each specialized job role. Trainees must select at least one elective for the successful completion of a QP with Electives.
Options	Options are NOS/set of NOS that are identified by the sector as additional skills. There may be multiple options within a QP. It is not mandatory to select any of the options to complete a QP with Options.