137-D.C. Shunt Generator with control panel

(As Per DVET, Maharashtra State SPECIFICATION FOR ELECTRICAL TRAINERS (NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R. – 137 Page No -52**

137.1 BasicIndicativeDiagram

137.2 An integrated workbench consisting of instrument panel and working table should suitable for students to learn and perform various experiments of DC Machines. Measuring Instruments should internally electrically connect and should be fitted in the panel such that only front panel and necessary interfaces are easily accessible to use. Structure of workbench should be made up of min 2.5 mm thick CRC powder coated pipes with top made up of good quality 19 mm thick marine plywood and covered with 1.8 mm off white colour mica. The bench working area should be covered by 2mm thick anti staticmat which help students to controls static discharge as static cause interference or damage to students, equipment and circuitry.

137.3 Thebasicstructureshouldbemadeof38x38x2.5mmCRCpowdercoatedpipesforsturdiness.

137.4 The overall dimensions of Workbench should be not less than W = 1200 mm; D = 770mm; H=1650mm

137.5 MS drawers 03 numbers 415X290X133 mm (HXWX D) and thickness 1.2mm with handle & separate lock one attached. drawer should be provided

137.6 For the panel section, raised back height of 1200mm from floor with matching height support from the side at a depth 500mm for instrument housing with a MS Panel strip below it for housing Electrical Sockets and Switches for external use.

137.7 Two Pole MCB (32A – Havel's / Siemens) to be provided for safety of Workbench

137.8 Workbench should work on Mains Supply-230V AC,50Hz

137.9 Equipped with Measurement Facilities for Experimentation on DCMachines137.10 Rust Free Powder Coating

137.11 StandardBS-10terminals,patch cords for safety purpose

137.12 BS 10 safety terminal sin compliance with IS302-1/IEC60335-1,testedfrom NABL Accredited Lab

137.13 TerminalsshouldbeprovidedtoobtainthreephasefixedaswellasvariableinbuiltDC Supplies with suitable protection

137.14 High Quality Digital Tachometer for RPM Measurement

137.15 Durable good quality spring balance

137.16 Designed considering all safety measures

137.17 Inbuilt 15A,0-220V& 2A,220V DC Regulated Power Supply

137.18 AC Ammeter (4 Nos.)

137.18.1 Type: Digital

137.18.2 Range: 10A

137.19 AC Voltmeter (4 Nos.)

137.19.1 Type: Digital

137.19.2 Range: 450V

137.20 DC Ammeter (4 Nos.)

137.20.1 Type: Digital

137.20.2 Range: 20A

137.21 DC Voltmeter (4 Nos.)

137.21.1 Type: Digital

137.21.2 Range: 300V

137.22 Single Phase Wattmeter (2 Nos.)

137.22.1 Type: Digital

137.22.2 Range: 4kW

137.23 Protective Devices

137.23.1 Three Phase MCB (TPN: 1 Nos.

137.23.2 Single Phase MCB (DP): 1 Nos.

137.23.3 Interconnections: 4mm BS-10

137.24 Safety Terminals Technical Specifications (Set 1):

137.24.1 Both the Machines be flexibly coupled and mounted on a single "C" channel base

137.24.2 Three Phase Squirrel cage Induction Motor (acts as prime mover)

137.24.2.1 Type: Squirrel cage induction Motor

137.24.2.2 Power Rating: 5HP

3.24.2.3 Voltage Rating: 440V ± 10%

137.24.2.4 Rated Speed: 1440 RPM ± 7.5%

137.24.2.5 Insulation: Class 'B'

137.24.3 DC Machine (acts as generator)

137.24.3.1 Type: Shunt

137.24.3.2 Power Rating: 2.5kW

137.24.3.3 Voltage Generated Rating: 220V ± 10%

137.24.3.4 Rated Speed: 1500RPM ± 7.5%

137.24.3.5 Insulation: Class 'B'

137.24.3.6 Loading Arrangement: Electrical

137.24.3.7 Type of Coupling: Flexible "Lovejoy" Coupling

137.24.3.8 Machine Base: "C" Channel

137.24.3.9 Protection: Fuses (mounted at the terminal box of the Machines)

137.25 Technical Specifications (Set 2):

137.25.1 Both the Machines be flexibly coupled and mounted on a 'C' Channel base

137.25.2 Three Phase Squirrel cage Induction Motor (acts as prime mover)

137.25.2.1 Type: Squirrel Cage induction Motor

137.25.2.2 Rating: 5 HP

137.25.2.3 Voltage Rating: 415V AC

137.25.2.4 Speed: 1440 RPM ±5%

137.25.2.5 Insulation: Class 'B'

137.25.3 DC Machine (acts as generator)

137.25.3.1 Type: Compound

137.25.3.2 Rating: 2.5kW

137.25.3.3 Speed: 1500 RPM ±10%

137.25.3.4 Insulation: Class 'B'

137.26 Following accessories should be provided with the training system as the same is required to conduct experiments

137.26.1 Three Phase Variac: 10 A

137.26.2 Rheostat: 220Ohm, 2.8A

137.26.3 Resistive Load: 3.5 kW

137.27 The Workbench should be supplied with online single user Classroom / laboratory teaching, learning and simulation software module with following key features:

137.27.1 The content should designed by using platforms like Visual Basic, Dot Net, Flash etc and should be useful to understand the basic concepts of Electrical Machine Lab. The software should comprise simulations, animations, videos, graphs, charts, along with mandatory rich content and theory to understand fundamental concepts, interactive learning objects, FAQ, MCQ etc following topics:

137.27.2 This module on Electrical should have all the fundamental topics of electrical and electronics and should designed to study the fundamentals and applications of electricity, magnetism, electronics: analog and digital, circuit analysis, network analysis, electromagnetism and electronic instruments, Three

138 Motor-Generator (AC to DC) -

(NSQF -LEVEL-4-Version-2.0)- Revised-2022) - SR.No.138,pg.No.52.

Basic Indicative Diagram

Technical Specification:

138.1 MOTOR:

138.1.1 Squirrel cage Induction motor 7 H.P.415 volts,3 phase 50 Hz 1440 R.P.M. type TEFC cont. rating.

138.1.2 Insulation -class 'F'

138.1.3 frame size 132,Horizontal foot mounted. 6 terminals brought out in the terminal box for connection.

138.2 GENERATOR:-

138.2.1 D.C.shunt generator: 5 K.W. 440 V. S

138.2.2 Self excited : 1440 R.P.M.4 pole with interlope S.P.D.P. type continuous rating

138.3 Insulation class 'F'. Horizontal.

138.3 Control Desk :

- The Control desk consist of an Instrument panel and working area.
- The control desk made of 30mm x 30mm x 1.6mm tubular mild steel and MS sheet of 1 mmthickness, Siemens Grey colour powder coated with wooden top on the working area.
- The overall dimensions W = 900 mm ; D = 625 mm ; H = 1500 mm.
- The Box type Instrument Panel above the working area and of size W = 900 mm ; D = 250 mm ; H = 750 mm & Front side of 6mm thick Bakelite sheet of brown colour and fitted at inside of the tube structure.
- All other sides made of MS sheet, Two sides of the panel are to be perforated for air ventilation.
- Back side in the form of hinged door with suitable locking arrangement.
- The working area top fitted in front of the Instrument Panel at a height of 750 mm from bottom.
- The top of W = 900 mm x D = 375mm and made of 19mm marine plywood fitted with 3 mm Ivory Color edhylam sheet on top.
- The three sides of the working top lipped using 22mm x 6mm teakwood lipping Patti.
- Educational type back elite insulated banana terminals provided for supply and motor generator connection.
- Circuit diagram of panel provided inside the panel.

- All accessories connected with internal wiring ferrules etc.

138.4 The Instrument Panel consist of following accessories :

138.4.1 A.C.SIDE :

- Voltmeter M.I.Type 0-500 volts, 96 x 96 mm Mars Make : 1 no.
- Ammeter M.I.Type 0-15 Amp.96 x 96 mm Mars Make : 1 no.
- Rotory Switch for voltmeter select for OFF/RY/YB/BR 16 Amp.,440 v : 1 no.
    - Automatic STAR / DELTA Starter suitable for above motor Mars Make flush mounted : 1 no.
- Bakelite based HRC fuses of suitable capacity : 3 Nos
- RCCB of Suitable capacity (ISI) marked : 1 no.
- Indicating lamp LED type 12 mm size Red, Yellow, Blue colour : 1 no.each

138.4.2 D.C.SIDE :

- Voltmeter M.C,Type 0-500 volts,96 x 96mm Mars Make : 1 no.
- Ammeter M.C.Type 0-15 Amp.96 x 96 mm Mars Make : 1 no.
- Ammeter M.C.Type 0-1.5 Amp.96 x 96 mm Mars Make : 1 no.
- Field regulator disc type suitable to decrease field current up to min.Amps :1 no.
- D.P.S.T. Knife Switch. 20 Amp. 440 v : 1 no.
- Indicating lamp LED type Red, colour 12mm size : 1 no.

138.4.3 BASE PLATE :

Motor and Generator will be mounted on fabricated base plate of M.S.'C' channel size 75 x 40 x 6 mm thick.

138.4.4 COUPLING :

Motor and Generator are coupled with a flexible coupling & mounted on a common base plate. Coupling guard & anti vibration mounts are also provided.

139 D.C. Compound Generator with control panel

(As Per DVET, Maharashtra State SPECIFICATION FOR ELECTRICAL TRAINERS (NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.139,pg.no.52.**

Basic Indicative Diagram

139.1 An integrated workbench consisting of instrument panel and working tableshould-suitable for students to learn and perform various experiments of DCMachines.Measuring Instruments should internally electrically connect and should befitted inthe panel such that only front panel and necessary interfaces are easily accessibletouse. Structure of workbench should be made up of min 2.5 mm thick CRCpowdercoated pipes with top made up of good quality 19 mm thick marine plywoodandcovered with 1.8 mm off white colour mica. The bench working area shouldbecovereredby2mmthickantistaticmatwhichhelpstudentstocontrolsstaticdischargeas static causeinterferenceordamagetostudents,equipment andcircuitry.

139.2 Thebasicstructureshouldbemadeof38x38x2.5mmCRCpowdercoatedpipesforsturdiness.

139.3 The overall dimensions of Workbench should be not less than W = 1200 mm; D = 770mm; H=1650mm

139.4 MS drawers 03 numbers 415X290X133 mm (HXWX D) and thickness 1.2mmwithhandle&separate lockoneachdrawer shouldbe provided

139.5 Forthepanel section,raisedbackheightof1200mmfromfloorwithmatchingheightsupportfromthesideatadepth500mmforinstrumenthousingwithaMSPanelstripbelowitfor housingElectricalSocketsandSwitches for externaluse.

139.6 Two Pole MCB (32A – Havells / Siemens) to be provided for safety of Workbench

139.7 Workbenchshouldwork onMains Supply-230V AC,50Hz

139.8 Equipped with Measurement Facilities for Experimentation on DCMachines139.10 RustFreePowder Coating

139.11 StandardBS-10terminals,patch cordsforsafetypurpose

139.12 BS10safetyterminalsincompliancewithIS302-1/IEC60335-1,testedfromNABL accreditedLab

139.13 TerminalsshouldbeprovidedtoobtainthreephasefixedaswellasvariableinbuiltDC Supplieswithsuitableprotection

139.14 High Quality Digital Tachometer for RPM Measurement

139.15 Durablegoodqualityspring balance

139.16 Designedconsideringallsafetymeasures

139.17 Inbuilt 15A,0-220V& 2A,220V DCRegulatedPowerSupply

139.18 AC Ammeter (4 Nos.) 139.18.1 Type: Digital 139.18.2 Range: 10A

139.19 AC Voltmeter (4 Nos.)

139.19.1 Type: Digital

139.19.2 Range: 450V

139.20 DC Ammeter (4 Nos.)

139.20.1 Type: Digital

139.20.2 Range: 20A

139.21 DC Voltmeter (4 Nos.)

139.21.1 Type: Digital

139.21.2 Range: 300V

139.22 Single Phase Wattmeter (2 Nos.)
- 139.22.1 Type: Digital
- 139.22.2 Range: 4kW

139.23 Protective Devices
- 139.23.1 Three Phase MCB (TPN: 1 Nos.
- 139.23.2 Single Phase MCB (DP): 1 Nos.
- 139.23.3 Interconnections: 4mm BS-10

139.24 Safety Terminals Technical Specifications (Set 1):
- 139.24.1 Both the Machines be flexibly coupled and mounted on a single “C” channel base
- 139.24.2 Three Phase Squirrel cage Induction Motor (acts as prime mover)
- 139.24.2.1 Type: Squirrel cage induction Motor
- 139.24.2.2 Power Rating: 5HP
- 139.24.2.3 Voltage Rating: 440V ± 10%
- 139.24.2.4 Rated Speed: 1440 RPM ± 7.5%
- 139.24.2.5 Insulation: Class 'B’
- 139.24.3 DC Machine (acts as generator)
- 139.24.3.1 Type: Shunt
- 139.24.3.2 Power Rating: 2.5kW
- 139.24.3.3 Voltage Generated Rating: 220V ± 10%
- 139.24.3.4 Rated Speed: 1500RPM ± 7.5%
- 139.24.3.5 Insulation: Class 'B’
- 139.24.3.6 Loading Arrangement: Electrical
- 139.24.3.7 Type of Coupling: Flexible “Lovejoy” Coupling
- 139.24.3.8 Machine Base: “C” Channel
- 139.24.3.9 Protection: Fuses (mounted at the terminal box of the Machines)

139.25 Technical Specifications (Set 2):
- 139.25.1 Both the Machines be flexibly coupled and mounted on a ‘C’ Channel base
- 139.25.2 Three Phase Squirrel cage Induction Motor (acts as prime mover)
- 139.25.2.1 Type: Squirrel Cage induction Motor
- 139.25.2.2 Rating: 5 HP
- 139.25.2.3 Voltage Rating: 415V AC
- 139.25.2.4 Speed: 1440 RPM ±5%
- 139.25.2.5 Insulation: Class ‘B’
- 139.25.3 DC Machine (acts as generator)
- 139.25.3.1 Type: Compound
- 139.25.3.2 Rating: 2.5kW
- 139.25.3.3 Speed: 1500 RPM ±10%
- 139.25.3.4 Insulation: Class ‘B’

139.26 Following accessories should be provided with the training system as the same is required to conduct experiments
- 139.26.1 Three Phase Variac: 10 A
- 139.26.2 Rheostat: 220Ohm, 2.8A
- 139.26.3 Resistive Load: 3.5 kW

139.27 The Workbench should be supplied with online single user Classroom / laboratory teaching, learning and simulation software module with following key features:

139.27.1 The content should designed by using platforms like Visual Basic, Dot Net, Flash etc and should be useful to understand the basic concepts of Electrical Machine Lab. The software should comprise simulations, animations, videos, graphs, charts, along with mandatory rich content and theory to understand fundamental concepts, interactive learning objects, FAQ, MCQ etc following topics:

139.27.2 This module on Electrical should have all the fundamental topics of electrical and electronics and should designed to study the fundamentals and applications of electricity, magnetism, electronics: analog and digital, circuit analysis, network analysis, electromagnetism and electronic instruments, Three Phase Circuits, Transformers, AC and DC Machines, Power electronics Semiconductor

devices.

140 DC Series Motor coupled with spring balance load- 2.5 KW, 220 Volts

(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.140,pg.no.53.**

140.1 Basic Indicative Diagram

140.2 Basic Item Specification An integrated panel workbench consisting of instrument panel and working table should suitable for students to learn and perform various experiments of electrical related subjects. Instruments should internally electrically connected and should be fitted in the panel such that only front panel and necessary interfaces are easily accessible to use. Structure of workbench should be made up

of 1.5 mm thick CRC powder coated pipes with top made up of good quality 19 mm thick plywood and covered with 1.8 mm off white colour mica. The bench working area should be covered by 2 mm thick antistatic mat which help students to controls static discharge as static cause interference or damage to students, equipment and circuitry. There should be demonstration / training at consignee end on how to use Workbench and utilization of this bench for various applications.

140.3 Structure and design of panel should follow the below specifications:

140.3.1 The basic structure should be made of 38 X 38 X 1.5 mm CRC powder coated pipes for sturdiness.

140.3.2 The overall dimensions of Workbench should be not less than Width = 900mm; Depth = 750 mm; Height = 1650 mm

140.3.3 MS drawers 02 numbers: Width = 275 mm; Depth = 375 mm; Height = 100 mm and Thickness = 1.2mmwith handle & separate lock on each drawer should be provided

140.3.4 For the panel section, raised back height of 1200mm from floor with matching height support from the side at a depth 500mm for instrument housing with a MS Panel strip below it for housing Electrical Sockets and Switches for external use.

140.3.5 Two Pole MCB (32A – Havells / Siemens) to be provided for safety of Workbench

140.3.6 There should be provision to mount main / mother training and development platform on front panel along with the instruments for easy performing the experiments which should provide visibility for the students working in a group.

140.3.7 The training setup be supplied with BS10 safety terminals in compliance with IS302-1/IEC60335-1, tested from NABL accredited Lab

140.4 **Control Board**:

140.4.1 Rust free power coated Control board which prevent from any abnormal electrical hazards. 98.4.2 The Control panel should be provided to fit the instruments mentioned below

140.4.3 Micro-controller based digital meters of size 72mm x 72mm

140.4.3.1 DC Voltmeter 300 Volt, DC - 1No.

140.4.3.2 DC Ammeter 20 Amp DC - 2No. (1 for measure Field Current)

140.4.4 Screen printed diagrammatic connections

140.4.5 Patch cords of different sizes and color for easy and safe connections

140.4.6 Separate single phase socket for auxiliary supply 140.4.7In-
built 25A, 0 - 250VDC & 2A, 220V DC Regulated Power Supply

140.4.8 Speed Regulator Rheostat : Suitable for regulating speed of motor, circular with knob & Sticker of %

140.4.9 Suitable Two Point Starter for DC Motor

140.4.10.Panel Workbench should work on Mains Supply - 240 V AC, 50 Hz Equipped with

Measurement

140.4.11 Terminals should be provided to obtain fixed as well as variable inbuilt DC Supplies with

suitable protection Designed considering all safety measures

140.5 Technical Specifications of DC Machine (Motor)

140.5.1 Type: Series
140.5.2 Power Rating: 3 H.P.
140.5.3 Voltage Rating: 220V ± 10%
140.5.4 Rated Speed: 1500RPM ± 7.5%
140.5.5 Insulation: Class 'B'
140.5.6 Confirming To I.S.: 4722-1992
140.5.7 S.P.D.P. Type,Horizontal Foot Mounted
140.5.8 Loading Arrangement: Mechanical, fitted on machine base "C" channel,Durable good quality Spring Balance: 2 Nos. (Tubular Type) with Belt,Brake Drum/Pulley: Aluminum cast with heat suppression Facility
140.5.9 Machine Base: Fabricated MS "C" Channel (75 x 40 x 6 mm.4.11 Terminals should be provided to obtain fixed as well as variable inbuiltDC Supplies with suitable protectionDesigned considering all safety measures

140.6 Technical Specifications of DC Machine (Motor)

140.6.1 Type: Series
140.6.2 Power Rating: 3 H.P.
140.6.3 Voltage Rating: 220V ± 10%
140.6.4 Rated Speed: 1500RPM ± 7.5%
140.6.5 Insulation: Class 'B'
140.6.6 Confirming To I.S.: 4722-1992
140.6.7 S.P.D.P. Type,Horizontal Foot Mounted
140.6.8 Loading Arrangement: Mechanical, fitted on machine base "C" channel,Durable good quality Spring Balance: 2 Nos. (Tubular Type) with Belt,Brake Drum/Pulley: Aluminum cast with heat suppression Facility
140.6.9 Machine Base: Fabricated MS "C" Channel (75 x 40 x 6 mm

141 DC Shunt Motor 2.5 KW, 220 V.

(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.141,pg.no.53.**

141.1 Basic Indicative Diagram

141.2 Basic Item Specification An integrated panel workbench consisting of instrument panel and working table should suitable for students to learn and perform various experiments of electrical related subjects. Instruments should internally electrically connected and should be fitted in the panel such that only front panel and necessary interfaces are easily accessible to use. Structure of workbench should be made up of 1.5 mm thick CRC powder coated pipes with top made up of good quality 19 mm thick plywood and covered with 1.8 mm off white colour mica. The bench working area should be covered by 2 mm thick antistatic mat which help students to controls static discharge as static cause interference or damage to students, equipment and circuitry. There should be demonstration / training at consignee end on how to use Workbench and utilization of this bench for various applications.

141.3 Structure and design of panel should follow the below specifications:

141.3.1 The basic structure should be made of 38 X 38 X 1.5 mm CRC powder coated pipes for sturdiness.

141.3.2 The overall dimensions of Workbench should be not less than Width = 900mm; Depth = 750 mm; Height = 1650 mm

141.3.3 MS drawers 02 numbers: Width = 275 mm; Depth = 375 mm; Height = 100 mm and Thickness =1.2mmwith handle & separate lock on each drawer should be provided

141.3.4 For the panel section, raised back height of 1200mm from floor with matching height support fromthe side at a depth 500mm for instrument housing witha MS Panel strip below it for housing Electrical Sockets and Switches for external use.

141.3.5 Two Pole MCB (32A – Havells / Siemens) to be provided for safety of Workbench

141.3.6 There should be provision to mount main / mother training and development platform on front panel along with the instruments for easy performing the experiments which should provide visibility forthe students working in a group.

141.3.7 The training setup be supplied with BS10 safety terminals in compliance with IS302-1/IEC60335-1,tested from NABL accredited Lab

141.4 Control Board:

141.4.1 Rust free power coated Control board which prevent from any abnormal electrical hazards. 98.4.2 The Control panel should be provided to fit the instruments mentioned below

141.4.3 Micro-controller based digital meters of size 72mm x 72mm

141.4.3.1 DC Voltmeter 300 Volt, DC - 1No.

141.4.3.2 DC Ammeter 20 Amp DC - 2No. (1 for measure Field Current)

141.4.4 Screen printed diagrammatic connections

141.4.5 Patch cords of different sizes and color for easy and safe connections

141.4.6 Separate single phase socket for auxiliary supply

141.4.7 Inbuilt 25A, 0 - 250VDC & 2A, 220V DC Regulated Power Supply

141.4.8 Speed Regulator Rheostat : Suitable for regulating speed of motor,circular with knob & Sticker of %

141.4.9 Suitable Two Point Starter for DC Motor

141.4.10.Panel Workbench should work on Mains Supply - 240 V AC, 50 HzEquipped withMeas-urement

140.4.11 Terminals should be provided to obtain fixed as well as variable inbuiltDC Supplies with suitable protection Designed considering all safety measures

141.5 Technical Specifications of DC Machine (Motor)

141.5.1 Type: Shunt

141.5.2 Power Rating: 3 H.P.

141.5.3 Voltage Rating: 220V ± 10%

141.5.4 Rated Speed: 1500RPM ± 7.5%

141.5.5 Insulation: Class 'B'

141.5.6 Confirming To I.S.: 4722-1992

141.5.7 S.P.D.P. Type, Horizontal Foot Mounted

141.5.8 Loading Arrangement: Mechanical, fitted on machine base "C" channel, Durable good quality Spring Balance: 2 Nos. (Tubular Type) with Belt, Brake Drum/Pulley: Aluminum cast withheat suppression Facility

141.5.9 Machine Base: Fabricated MS "C" Channel (75 x 40 x 6 mm.4.11 Terminals should be provided to obtain fixed as well as variable inbuilt DC Supplies with suitable protection Designedconsidering all safety measures

141.6 Technical Specifications of DC Machine (Motor)

141.6.1 Type: Shunt

141.6.2 Power Rating: 3 H.P.

141.6.3 Voltage Rating: 220V ± 10%

141.6.4 Rated Speed: 1500RPM ± 7.5%

141.6.5 Insulation: Class 'B'

141.6.6 Confirming To I.S.: 4722-1992

141.6.7 S.P.D.P. Type, Horizontal Foot Mounted

141.6.8 Loading Arrangement: Mechanical, fitted on machine base "C" channel, Durable good quality Spring Balance: 2 Nos. (Tubular Type) with Belt, Brake Drum/Pulley: Aluminum cast withheat suppression Facility

141.6.9 Machine Base: Fabricated MS "C" Channel (75 x 40 x 6 mm

142 DC compound Motor with starter and switch- 2.5 KW ,220 volts

(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.142,pg.no.53.**

142.1 Basic Indicative Diagram

142.2 Basic Item Specification An integrated panel workbench consisting of instrument panel and working table should suitable for students to learn and perform various experiments of electrical related subjects. Instruments should internally electrically connected and should be fitted in the panel such that only front panel and necessary interfaces are easily accessible to use. Structure of workbench should be made up of 1.5 mm thick CRC powder coated pipes with top made up of good quality 19 mm thick ply- wood and covered with 1.8 mm off white colour mica. The bench working area should be covered by 2 mm thick antistatic mat which help students to controls static discharge as static cause interference or damageto students, equipment and circuitry. There should be demonstration / training at consignee end on how to use Workbench and utilization of this bench for various applications.

142.3 Structure and design of panel should follow the below specifications:

142.3.1 The basic structure should be made of 38 X 38 X 1.5 mm CRC powder coated pipes forsturdiness.

142.3.2 The overall dimensions of Workbench should be not less than Width = 900mm; Depth = 750 mm; Height = 1650 mm

142.3.3 MS drawers 02 numbers: Width = 275 mm; Depth = 375 mm; Height = 100 mm andThickness = 1.2mmwith handle & separate lock on each drawer should be provided

142.3.4 For the panel section, raised back height of 1200mm from floor with matching height support from the side at a depth 500mm for instrument housing with a MS Panel strip below it forhousing Electrical Sockets and Switches for external use.

142.3.5 Two Pole MCB (32A – Havells / Siemens) to be provided for safety of Workbench

142.3.6 There should be provision to mount main / mother training and development platform onfront panel along with the instruments for easy performing the experiments which should providevisibility for the students working in a group. 96.3.7 The training setup be supplied with BS10 safety terminals in compliance with IS302-1/IEC60335-1, tested from NABL accredited Lab

142.4 Control Board:

142.4.1 Rust free power coated Control board which prevent from any abnormal electrical hazards.

142.4.2 The Control panel should be provided to fit the instruments mentioned below

142.4.3 Micro-controller based digital meters of size 72mm x 72mm 96.4.3.1 DC Voltmeter 300 Volt, DC - 1No.

142.4.3.2 DC Ammeter 20 Amp DC - 2No. (1 for measure Field Current)

142.4.4 Screen printed diagrammatic connections

142.4.5 Patch cords of different sizes and color for easy and safe connections

142.4.6 Separate single phase socket for auxiliary supply 96.4.7Inbuilt 25A, 0 - 250VDC & 2A, 220V DC Regulated Power Supply

142.4.8 Field Regulator: 220Ohm, 2.8A for regulating speed of motor,circular with knob & Sticker of %

142.4.9 Suitable Four Point Starter for DC Motor

142.4.10.Panel Workbench should work on Mains Supply - 240 V AC, 50 HzEquipped withMeasurement Facilities for Experimentation on DC Machines

142.4.11 Terminals should be provided to obtain fixed as well as variable inbuiltDC Supplies with

suitable protection Designed considering all safety measures

142.5 Technical Specifications of DC Machine (Motor)

142.5.1 Type: Compound

142.5.2 Power Rating: 3 H.P.

142.5.3 Voltage Rating: 220V ± 10% 96.5.4 Rated Speed: 1500RPM ± 7.5%

142.5.5 Insulation: Class 'B'

142.5.6 Confirming To I.S.: 4722-1992

142.5.7 S.P.D.P. Type,Horizontal Foot Mounted

142.5.8 Loading Arrangement: Mechanical, fitted on machine base "C" channel,Durable good quality Spring Balance: 2 Nos. (Tubular Type) with Belt,Brake Drum/Pulley: Aluminum cast with heat suppression Facility

142.5.9 Machine Base: Fabricated MS "C" Channel (75 x 40 x 6 mm)

143 Motor Generator(DC to AC) set

(As Per DVET, Maharashtra State SPECIFICATION FOR ELECTRICAL TRAINERS (NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.143,pg.no.53.**

Basic Indicative Diagram

143.1 The training system should have motor & generator on a common rail & should be directly coupled with flexible coupling. The trainer should be provided with controlpanelandmeasurementunit.Thetrainingsetupbesuppliedwith BS10safety terminals in compliance with IS302-1/IEC60335-1, tested from NABL accredited Lab and-ControlPanelconsistofhighgradeFRPmaterialforbettersafetyandincompliance withIS302-1/IEC60335-1,tested from NABL accredited Lab.

143.2 Motor:

143.2.1 Type: DC Shunt
143.2.2 Capacity: 5 HP
143.2.3 Arm Voltage: 220VDC
143.2.4 Field Voltage: 220VDC

143.3 Generator:

143.3.1 Type: Synchronous Type
143.3.2 Capacity: 3.5KVA,3ø
143.3.3 OutputVoltage:400V AC (line to line),3Phase,4 wiresystem50 Hz

143.4 **ControlBoard:** Rust free power coated Control board made up of high grade- Fibre moulded body (FRP)which prevent from any abnormal electrical hazards.

143.4.1 TheControlpanelshouldbeprovidedtofittheinstrumentsmentionedbelow

143.4.2 Micro-controller based digital meters of size 72mm x 72mm (1 No.300VDCVoltmeter,2No.20ADCAmmeter.,1No.450VACVoltmeter,1No.10AACAmmeter,1No

143.4.2.1 Shock proof banana jack terminal (BS-10)
143.4.2.2 Provided with digital tachometer
143.4.2.3 Screen printed diagram matic connections
143.4.2.4 Patch cords of different sizes and color for easy and safe connections
143.4.2.5 Separate single phase socket for auxiliary supply
143.4.2.6 Mandatory Items(connected externally)required to conduct experiment
143.4.2.7 25A,0-220V&2A, 220VDC RegulatedPower Supply
143.4.2.8 DC Excitation Unit,2A,300V – 1 No.

143.5 The training setup should include online single user Classroom / laboratoryteach- ing,learningandsimulationsoftwaremodulewithfollowingkeyfeatures:

143.5.1 The content should designed by using platforms like Visual Basic, DotNet,Flash etc and should be useful to understand the basic concepts of varioustechnologiesinelectronicsincludingadvancetechnologies. The- softwareshouldcompriseofsimulations,animations,videos,graphs,c harts,alongwithmandatory rich content and theory to understand fundamental concepts,interactivelearningobjects,FAQ,MCQetcfol- lowing topics:

143.5.2 Basic Electrical and Electronics should have all the fundamental topics ofelectrical and electronics and should be designed to study the fun- damentals and applications of electricity, magnetism, electronics: ana-log and digital,circuitanalysis,networkanalysis, electromag- netismandelectronicinstruments,ThreePhaseCircuits,Trans for- mers,ACandDCMachines,PowerelectronicsSemiconductorDevices.

144 AC Squirrel Cage Motor with star delta starter and triple pole iron clad switch fuse with Mechanical Load.- 5 HP, 3-Phase, 415 V,50 Hz

(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.144,pg.no.53.**

144 1 Basic Indicative Diagram

144.2 TECHNICAL SPECIFICATION :

144.2.1 Motor A.C. 3 Phase 3 HP 415 volts, 50 Hz, Squirrel cage Induction Motor 1440 RPM, TEFC, class 'F'insulation, frame 100, horizontal foot mounted. Six terminals brought out on terminal box.

144.2.2Control Desk : The Control desk consist of an Instrument panel and working area. The control desk made of 30mm x 30mm x 1.6mm tubular mild steel and MS sheet of 1 mm thickness, Siemens Grey colour powder coated with wooden top on the working area. The overall dimensions W = 900 mm ; D = 625 mm ; H = 1500 mm. The Box type Instrument Panel above the working area and of size W = 900 mm ; D = 250 mm ; H = 750 mm& Front side of 6mm thick Bakelite sheet of brown colour and fitted at inside of the tube structure.

All other sides made of MS sheet, Two sides of the panel are to be perforated for air ventilation.

Back side in the form of hinged door with suitable locking arrangement. The working area top fitted in front of the Instrument Panel at a height 1 No. of 750 mm from bottom. The top of W = 900 mm x D = 375mm and made of 19mm marine plywood fitted with 3 mm Ivory colour sheet on top. The three sides of the working top lipped using 22mm x 6mm teakwood lipping patti.

. Educational type backelite insulated banana terminals provided for supply and motor connection.

. Circuit diagram of panel provided inside the panel

. All accessories connected with internal wiring ferrules etc.

144.2.3 The Instrument Panel consist of following accessories :

144.2.3.1 Voltmeter M.I. Type 96 mm x 96 mm Sq. 0-500V with selector switch Off/RY/YB/BR : 1 No.

144.2.3.2 Ammeter M.I. type 96 mm x 96 mm Sq. 0-10A : 1 No.

144.2.3.3 Suitable star delta. Starter : 1 No.

144.2.3.4 TP MCB 16 Amp 415 V. ISI Marked mounted on panel board. : 1 No.

144.2.3.5 Indicating lamp LED type 12 mm size for incoming & outgoing in colour code : 6 Nos.

144.2.3.6 HRC fuses Bakelite type base with top 16 Amp 440 V : 3 Nos.

144.2.3.7 withload Educational type Suitable friction brake Dynamometer set having 2 Nos.

144.2.3.8 dial type spring balances & belt provided with fixed with motor base plate

144.3 PAINT : Motor will be painted with two coats of smoke gray oil paint and panel board will be powder coated.

144.4 BASE PLATE : Motor mounted on fabricated base plate of M.S.'C' channel size 75 x 40 x 6mm thick .

145 **AC phase-wound slip ring Motor** with starter switch5 HP, 440 V3 Phase, 50 Hz

(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.145,pg.no.53.**

Basic Indicative Diagram

145.2 Technical Specification:

145.2.1 Motor : A.C. 3 Phase 5 HP 415 volts, 50 Hz, slip ring Induction Motor 1440 RPM, TEFC, class 'B' insulation,frame 100, horizontal foot mounted.

Educational type Bakelite banana type terminals 30 Amps is provided on terminal box.

Six terminals are brought out on terminal box. Rugged construction.

145.2.2 Control Desk : The Control desk consist of an Instrument panel and working area.

The control desk made of 30mm x 30mm x 1.6mm tubular mild steel and MS sheet of 1 mm thickness, Siemens Grey colour powder coated with wooden top on the working area. The overall dimensions W = 900 mm ; D = 625 mm ; H = 1500 mm. The Box type Instrument Panel above the working area and of size W = 900 mm ; D = 250 mm ; H = 750 mm & Front side of 6mm thick bakelite sheet of brown colour and fitted at inside of the tube structure. All other sides made of MS sheet, Two sides of the panel is perforated for air ventilation. Back side in the form of hinged door with suitable locking arrangement. The working area top fitted in front of the Instrument Panel at a height of 750 mm from bottom. The top of W = 900 mm x D = 375mm and made of 19mm marine plywood fitted with 3 mm Ivory coloured sheet on top. The three sides of the working top lipped using 22mm x 6mm teakwood lipping patti. Educational type backelite insulated banana terminals provided for supply and motor connection.Circuit diagram of panel provided inside the panel. All accessories connected with internal wiring ferrules etc.

145.2.3 The Instrument Panel consist of following **accessories** :

145.2.3.1 (1)Voltmeter M.I. Type 96 mm x 96 mm Sq. 0-500V with: 1No.selector switch Off/RY/YB/BR

145.2.3.2 (2) Ammeter M.I. type 96 mm x 96 mm Sq. 0-20A: 1 No.

145.2.3.3 (3) Suitable Rotor Resistance starter : 1 No.

145.2.3.4 (4) TP MCB 16 Amp 415 V. ISI Marked is mounted on panel board -1No.

145.2.3.5 (5) Indicating lamp LED type 12 mm size for incoming & outgoing in colour code- 6Nos.

145.2.3.6 (6) HRC fuses Backelite type base with top 16 Amp 440 V -3Nos

145.3 PAINT : Motor is painted with two coats of smoke gray oil paint and panel board is powder coated.

145.4 BASE PLATE : Motor mounted on fabricated base plate of M.S.'C' channel size 75 x 40 x 6mm thick

146 **Universal Motor** with starter/switch- 240 V, 50 Hz, 1 HP

(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.146,pg.no.53.**

146.1 Basic Indicative Diagram

146.2 Specification

146.2.1	Type	Universal
146.2.3	Input Voltage	250 V AC /DC
146.2.4	Speed	10000-15000 Rpm
146.2.5	Power	**1 HP**
146.2.6	Protection	IP 65
146.2.7	Confirming	IS : 325
146.2.8	Enclose	SPDP
146.2.9	Mounting	Horizontal Foot Mounting

147 Synchronous motor with accessories like starter, excitation arrangements. 3 Phase, 3 HP, 440V,50Hz, 4 Pole

(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.147,pg.no.53.**

147.1 Basic Indicative Diagram

147.2 **MOTOR**: Synchronous motor 3 Phase, 3 HP, 415V, 50Hz, 4 Pole,

147.3 **Control Desk** : The Control desk consist of an Instrument panel and working area.

147.3.1 The control desk made of 30mm x 30mm x 1.6mm tubular mild steel and MS sheet of 1 mm thickness, Siemens Grey colour powder coated with wooden top on the working area.

147.3.2 The overall dimensions W = 900 mm ; D = 625 mm ; H = 1500 mm. The Box type Instrument Panel above the working area and of size W = 900 mm ; D = 250 mm ; H = 750 mm & Front side of 6mm thick bakelite sheet of brown colour and fitted at inside of the tube structure. All other sides made of MS sheet, Two sides of the panel are to be perforated for air ventilation. Back side in the form of hinged door with suitable locking arrangement. The working area top fitted in front of the Instrument Panel at a height of 750 mm from bottom. The top of W = 900 mm x D = 375mm and made of 19mm marine plywood fitted with 3 mm Ivory colour sheet on top. The three sides of the working top lipped using 22mm x 6mm teakwood lipping patti. Educational type backelite insulated banana terminals provided for supply and motor connection Circuit diagram of panel provided inside the panel. All accessories connected with internal wiring ferrules etc.

147.4.3 The Instrument Panel consist of following **accessories**

147.4.31. Three Nos. of Moving Coil Ammeter of Range 10A AC of size 96*96mm provided on the Panel.

147.4.32. Three Nos. of Moving Coil Ammeter of Range 3A AC of size 96*96mm provided on the Panel.

147.4.33. One No. of Moving Coil Ammeter of Range 3A DC of size 96*96mm provided on the Panel.

147.4.34. Two Nos. of Moving Coil Voltmeter of Range 500V AC of size 96*96mm provided on the Panel.

147.4.35. One No. of Frequency Meter of Range 50/55Hz of size 96*96mm provided on the Panel.

147.4.3 6. Two Nos. of Miniature Circuit Breaker of Range 16Amps (MCB/ TPN) Provided on the Input Side & Output Side.

147.4.37. One No. of Variable Rheostat of Range 250 Ohms/ 200 Watts Provided behind the Front Panelwith SPST Switch.

147.4.38. One No. of Direct On Line Starter of Range 7HP/ 10Amps Provided on the Front Panel.

147.4.39. One No. of Starter Switch of Range 9 - 14Amps. Provided On the Front Panel.

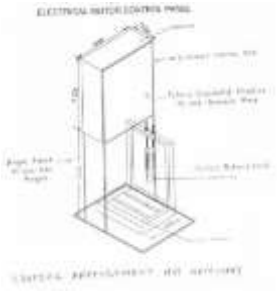
147.4.310. Six Nos. of Indicators provided on the Input & Output side.

147.4.311. Dimensions : 775 x 360 x 560 mm (L x B x H).

147.4.312. Power Requirement : Three Phase 415V AC

148 **Thyristor /IGBT controlled D.C. motor drive** with tacho-generator feedback arrangement 1 HP
(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.148,pg.no.53.**

148.1 Basic Indicative Diagram



148.2 The Control desk consist of an Instrument panel and working area.

148.2.1 The control desk made of 30mm x 30mm x 1.6mm tubular mild steel and MS sheet of 1 mm thickness, Siemens Grey colour powder coated with wooden top on the working area.

148.2.2 The overall dimensions W = 900 mm ; D = 625 mm ; H = 1500 mm.

148.2.3 The Box type Instrument Panel above the working area and of size W = 900 mm ; D = 250 mm ; H = 750 mm & Front side of 6mm thick bakelite sheet of brown colour and fitted at inside of the tube structure.

148.2.4 All other sides made of MS sheet, Two sides of the panel are to be perforated for air ventilation. 148.

148.2.5 Back side in the form of hinged door with suitable locking arrangement.

148.2.6 The working area top fitted in front of the Instrument Panel at a height of 750 mm from bottom.

148.2.7 The top of W = 900 mm x D = 375mm and made of 19mm marine plywood fitted with 3 mm Ivorycolour sheet on top.

148.2.8 The three sides of the working top lipped using 22mm x 6mm teakwood lipping patti. 30 A. Educational type Bakelite insulated banana terminals provided for supply and motor connection.

148.2.9 Circuit diagram of panel provided inside the panel.

148.2.10 All accessories connected with internal wiring ferrules etc. Digital RPM meter suitable for operation up to 3000 RPM Other Accessories ON / OFF

Rotary Switch, '16 Amp, 250 V , Digital Ammeter, Digital Voltmeter, Pot, switches, Indication for

148.3. Digital input Motor : DC Motor rating 1 HP, 220 V. 4 Amp, 2 Pole

148.3.1 Suitable Frame size

148.3.2 Operations Required – Auto start, Switch/Skip Frequency

148.3.3 Forward & Reverse directions, Speed control Torque control

148.3.4 Protections Required – Over load trip, over voltage trip, under voltage trip, Earth fault, Short circuit, Locked motor protection,

148.3.5 Operating Temp. – Ambient. Relative Humidity – 95% (without condensation)

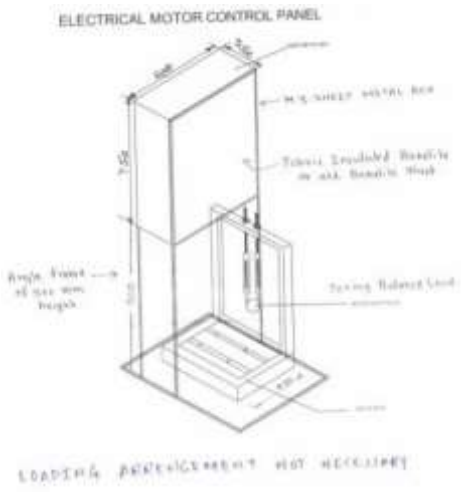
148.3.6 Degree of Protection – IP 20 or IP 21

148.3.7 Serial Interface – RC 485

149 Thyristor/IGBT controlled A.C. motor drive with VVVF control 3Phase, 2 HP

(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.149,pg.no.53.**

149.1 Basic Indicative Diagram



149.2 Technical Specifications: -

149.2.1 Voltage (Input) – 230 Volt, 1 Phase (+/- 10%)

149.2.2 Frequency (Input) – 48 to 63 Hertz.

149.2.3 Voltage (Output) – 220 Volt, 3 Phase A.C (+/- 10%)

149.2.4 Capacity (Output) – 2.0 HP / 1.5kw

149.2.5 Frequency (Output) – 0 to 1500 Hertz

149.2.6 Type of Control – I. G. B. T. based VVVF Control

149.3 Digital Input – Isolated Switchable. Relay Output –

149.3.1)Max. Switching V = 250 V AC/30 V DC

149.3.2)Max. Switching I = 6Amp

149.3.3) Max. Continuous I =2 Amp. Analog Input –

149.3.3.1) Voltage Signal 0 to10 Volt

149.3.3.2) Current Signal 0 to 20 milliamp Analog Output – 0 milliamp to 20 milliamp

149.3.3.3)Auxiliary Voltage – 24 Volt (+/- 10%)

149.4 Motor of Drive – A. C. Squirrel Cage Induction Motor 2 HP , 220 Volt, 1440 Rpm, 3Phase,

149.4.1 Suitable Frame size

149.4.2 Operations Required – Auto start, Switch/Skip Frequency

149.4.3 Forward & Reverse directions, Speed control Torque control

149.4.4 Protections Required – Over load trip, over voltage trip, under voltage trip, Earth fault, Short circuit, Locked motor protection,

149.4.5 Operating Temp. – Ambient. Relative Humidity – 95% (without condensation)

149.4.6 Degree of Protection – IP 20 or IP 21

149.4.7 Serial Interface – RC 485

149.5 MOUNTING PROVISION : CONTROL BOARD (As follows)

149.5.1) THIS CONTROL BOARD SHOULD AS SHOWN AS A EXAMPLE ON WHICH ALL THE INSTRU-

MENTS WILL BE FIXED. & IT SHOULD CONSIST OF 10 mm FABRIC INSULATED BACKLITE / STANDERD BA-KELITE SHEETAS FRONT FACIA WITH PANNEL . THE M.S. BOX SIZE SHOULD BE W=600MM H= 750MM

D=250MMFABRICATED IN 16 SWG M.S SHEET WITH DOOR AND LOCKING ARRENGEMENT AT BACK SIDE.

FABRICATED BOX SHOULD BE POWDER COATED. THE BOX SHOULD HAVE AIR VENTILATION WITH WIRE MESH PROTECTION FROM WORMS AND INSECT.

149.5.2) CONTROL BOARD MOUNTED ON AN 35X5MM SIZE M.S. ANGLE FRAME

149.5.3) MOTOR SHOULD BE MOUNTED ON SEPRATE BASE PLATE OF M.S.'C' CHANNEL SIZE 70X40X5MMTHICK APART FROM CONTROL BOARD

149.5.4) MOTOR TERMINALS & DRIVE TERMINALS SHOULD BE BROUGHT OUT SEPRATELY ONCONTROL BOARD TO PERFORM VARIOUS PRACTICALS.

149.5.5) CONTROL/ POWER CABLES SHOULD BE USED OF POLYCAB/FINOLEX /HAVELLS MAKE.

149.5.6) MOTOR PROVIDED MUST PROOVE THE FOLLOWING TESTS SATISFACTORILY…

* INSULATION RESISTANCE MEASUREMENT ,

HIGH VOLTAGE, NO LOAD,*LOCKED ROTOR * OVERLOAD

* OR TESTING CERTIFICATE FROM ORIGNAL EQUIPMENTS MANUFACURERSS

149.5.7) MOTOR & DRIVE PROVIDED SHOULD CONFIRM THE I .E. STANDARDS.

149.5.8) CONTROL BOARD FRAME SHOULD BE PAINTED WITH POWDER COATING

149.5.9) CONTROL BOARD ACCESSORIES :

149.5.9.1) DIGITAL VOLTMETER 3½ Digit Red LED,14.2 mm height, Display dimension should be W48XL 96XD88 mm, terminal connections thermoplastic, Input Volt 230 V AC , Range 0-750V A.C(ME/MECO/RISHABH/OR EQUIVALENT

149.5.9.2) DIGITAL AMMETER, 3½ Digit Red LED,14.2 mm height
Display, dimension should be W48XL 96XD88 mm, terminal connections – thermoplastic,
Input Volt 230 V AC Range 0-20 AMP A.C (ME/ MECO / RISHABH /OR EQUIVALENT)

149.5.9.3) SUITABLE RATED 2 POLE MCB SHOULD BE PROVIDED TO PROTECT CONTROL BOARD FROM ELECTRIC FAULTS . (SPRECHUER SCHUE/ SIEMENS/TELEMECHANIQUE/ L&T /OR EQUIVALENT MAKE)

149.5.9.4) Φ 25 MM LED TYPE INDICATING LAMPS FOR INCOMING AND OUTGOING SUPPLY

149.5.9.5) ALL OTHER REQUIRED ACCESSORIES SHOULD BE ISI MAKE

149.6 INSTRUCTIONS :

149.6.1) OPERATING MANUAL WITH CIRCUIT DIAGRAM MUST BE PROVIDED.

149.6.2) PRACTICALS LIST TO BE PERFORMED SHOULD BE PROVIDED.

150 Single phase Transformer, core type, air cooled 1 KVA , 240/415 V,50 Hz

(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.150,pg.no.53.**

Basic Indicative Diagram
150.1

150.2 Phase	Single Phase
150.3 Input Voltage	250 Volts AC
150.4 Output Voltage	100 Volts AC
150.5 Power	1 KVA
150.6 Winding	Copper
150.7 Cooling	Natural air cooled
150.8 Encloser	Ventilated Sheet steel enclose with 10 mm Bakelite sheet provided on top
150.9 Terminals	Educational type Banana terminals of suitable capacity for Primary & Secondary provided on Top

151 Three phase transformer, shell type oil cooled with Delta/ Star 3 KVA , 415/240 V, 50 Hz

(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.151,pg.no.53.**

151. 1 Basic Indicative Diagram

151.2 Cooling &Type	Oil Cooled, Shell type
151.3 Input Primary Voltage	440 V Delta Connected
151.4 Output Secondary Voltage	220 V Star Connected
151.5 Phase	Three Phase, 50 Hz
151.6 Rating	3 KVA Delta/Star
151.7 Encloser	Fabricated leak proof MS Tank with Oil level Indicator & Drain plug, 10 mm Bakelite sheet provided on top
151.8 Terminals	Educational type Banana terminals of suitable capacity for Primary & Secondary provided on Top
151.9 Winding	Copper
151.10 Oil	Transformer Insulating Oil should be provided with transformer

151.11 Shell type Totally enclosed, maximum ambient temp 45° C

151.12 Insulation Class 'B'

151.13 Educational type Bakelite insulated banana terminals . With colour code provided on the top of the transformer and on 6mm backelite sheet

151.14 The tank will be provided oil filling Hole with cap, oil level indicator, drain plug and earthling terminal

151.15 Plain unidirectional Roller will be fitted to the tank for movement

152 **Electrical Machine Trainer** – Different Type of D.C.& A.C.M/C'S

152. **1-**BasicIndicativeDiagram

152.2 Suitable for demonstrating the construction and functioning of different type of D.C.machines and A.C. machines (1 phase and 3 phase) consisting of following machines and panels.

152.2.1 The trainer should be made of well machined M.S.12 mm thick base plate. The plateshould be fitted on M.S C channel of 70X40X6mm.

152.2.2 The bearing housing should be spilt type and prepared from aluminum casting.

152.2.3 Trainer should include Following 6 Machines & Control Panel

152.3.1) MACHINE NO.1 *D.C.MACHINE – Consisting of shunt ,series and inter pole for two poles.Series field and Interpole winding should be interconnected. All connections of field winding and armatureshould brought on terminal plate by banana terminals. Working voltage- 110V DC, 300 Watt

152.3.2) MACHINE NO.2 * 3 PHASE SQUIRREL CAGE INDUCTION MOTOR – Working voltage 110V 3phase,300 watt, 1440R.P.M.,50HZ .six terminals should be provided on terminal plate by banana terminals.

152.3.3) MACHINE NO.3 * A.C. SINGLE PHASE CAPACITOR START MOTOR -with centrifugal switcharrangement working voltage 110V,300watt ,1440 R.P.M.50 HZ, 2 terminals of starting winding ,2 terminals of centrifugal switch and 2 terminals of capacitor ,two terminals of main winding ,total 8 terminals should brought on terminal plate with banana terminals.

152.3.4) 3 PHASE SLIPRING INDUCTION MOTOR Working voltage 110v, 300watt,1440 rpm ,50HZprovided with suitable rotor resistance starter. Terminals should brought on terminal plate by banana terminal.

152.3.5) 3 PHASE ALTERNATOR Salient pole type rotor provided with field coils used for rotating type alternator 110v,300watt, 50 HZ, 1500 rpm also consist of change over switch for synchronous motorexperiment.

152.3.6) 3 PHASE ROTARY CONVERTOR AND INVERTOR – Consisting of field pole and field windingworking voltage 110v ,300watt,AC/DC Suitable terminals should brought on terminals plate with proper banana terminals

152.3.7)POWER SUPPLY PANEL BOARD 3 PHASE 415x110v –

* Panel should be made of steel cabinet and painted with gray colour oil paint minimum size 600x600 x300mm

* Front panel should be of fabric insulated backlite / standerd bakelite / of 10 mm thick mounted with following accessories *Back side of panel board should be provided with door & locking arrangement for it

* Digital voltmeter 0-500v A.C. (48x96mm) for input (ME/MECO/RISHABH/OR EQUIVALENT)
*Digital voltmeter 0-150v A.C.(48x96mm) for output (ME/MECO/RISHABH/OR EQUIVALENT)

*Digital ammeter 0-5AMP A.C. (48x96mm) for input (ME/MECO/RISHABH/OR EQUIVALENT)
*Digital ammeter 0-5AMP A.C (48x96mm) for output (ME/MECO/RISHABH/OR EQUIVALENT)
* Incoming mains three phase 415v ,50HZ ,A.C.
* Outgoing three phase 0-110v 50HZ A.C. regulated by 3 phase 5A autotransformer
*Incoming 4 pole M.C.B. 10A 415V
*Outgoing 4 pole M.C.B. 10A 415V
*25mm led indicating lamp for incoming & outgoing R,Y,B, supply
*30A banana terminals for incoming 3 phase 4 wire & for outgoing 3 phase 4 wire with colour code
*All accessories should be connected internally by proper gauge & ISI multistranded wire with propertermination of lugs
* Voltage selector switch for incoming & separate for outgoing for checking phase to phase voltage

152.3.8) POWER SUPPLY PANEL BOARD SINGLE PHASE & D.C.230AC x 110v AC/DC –

* Panel should be made of steel cabinet and painted with gray colour oil paint & minimum size600x600x300 mm
* Front panel should be of backlite of 10mm thick mounted with following accessories
* Back side of the panel board should be provided with door & locking arrangement
* Digital voltmeter A.C. 0-300v (48x96mm) for incoming supply (ME/MECO/RISHABH/OR EQUIVALENT)
*Digital ammeter A.C. 0-5A (48x96mm) for incoming supply (ME/MECO/RISHABH/OR EQUIVALENT)
*Digital voltmeter A.C.0-150v (48x96mm) for outgoing (ME/MECO/RISHABH/OR EQUIVALENT)
*Digital ammeter A.C.0-5A (48x96mm) for outgoing (ME/MECO/RISHABH/OR EQUIVALENT)
*Digital Voltmeter D.C. 0-150v (48x96mm) for outgoing (ME/MECO/RISHABH/OR EQUIVALENT)
*Digital ammeter D.C.0-5A (48x96mm) for outgoing
*Incoming A.C. 230v ,50HZ
*Outgoing A.C. 0-110v A.C. 50HZ regulated by autotransformer 5A capacity
*Outgoing D.C. 0-110v with suitable 5 A capacity rectifier with AC/DC selector switch
*2 pole 10A M.C.B. for incoming
*6A two H.R.C. fuse for outgoing of autotransformer
*30 A colour code banana terminals for incoming AC & outgoing DC
*All accessories should be connected internally by proper gauge ISI multistanderd wires with propertermination of lugs
*25 mm led indicating lamp for incoming & outgoing supply 9)ATTACHMENT
* Variable resistive load for alternator & DC generator loading *Change over switch for synchronous motorexperiment should be provided with separate box 10)NOTES-I
*The rotor attachments of AC&DC machine should be replace the center position in minimum time
*Brush rocker arrangement of repulsion motor should be movable in running condition
*The motor kit should be covered by transparent acrylic sheet box frame for each machine (6 NOS)
*Aluminum bearing housing should be red coloured with powder coating
*All terminals should be educational type and 30A capacity with proper colour coding
*All machines should be able to coupled with flexible coupling to each other with vibration free rotation
*Earthing terminal should be provided each machine stator & panel board
*Circuit diagram of detail instructional manual of all experiment should be provided with 2 numbers of booklet 11) NOTES-II
* Should provided machine manual book with circuit diagram detail of power circuit control troubleshooting and fault remedies with two copies
*List of spare parts (bearing number, brush size, material ,coupling
*List of local service center their phone and contact number should be provided THE ELECTRIC MACHINE

152.4TRAINER SHOULD HAVE THE FACILITIES TO PERFORM THE FOLLOWING TYPE OF AC,DC MOTOR , DCGENERATOR AND ALTERNATOR

152.4 .1 D.C. series motor
152.4 .2 D.C. shunt motor
152.4 .3 D.C. compound motor
152.4 .4 D.C. series generator
152.4 .5 D.C. shunt generator
152.4 .6 D. C. compound generator
152.4 .7 Separately excited DC generator

152.4 .8 AC series motor
152.4 .9 Single phase AC repulsion motor
152.4 .10 Rotary convertor
152.4 .11 Rotary inverter
152.4 .12 3 phase squirrel cage induction motor
152.4 .13 3 phase slip ring induction motor
152.4 .14 3 phase synchronous motor
152.4 .15 3 phase alternator rotating field type
152.4 .16 3 phase alternator rotating armature type
152.4 .17 Single phase alternator rotating field type
152.4 .18 Single phase capacitor start induction motor

153 **Diesel Generator Set** with changeover switch, over current breaker and water/ air-cooled with armature, star-delta connections AC 3 phase7.5 KVA, 415 volt or higher rating (NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.153,pg.no.54.**

153. 1 Basic Indicative Diagram

153.2	Genset Rating	kVA	7.5
153.3	Duty	Prime / Standby	Prime
153.4	Number of cylinders	nos.	1
153.5	Aspiration	-	Naturally Aspirated
153.6	Engine power (gross)	BHP	11.5
153.7	Engine power (net)	BHP	11.5
153.8	Rated speed & frequency	RPM /Hz	1500/ 50 Hz
153.9	Stroke	mm	125
153.10	Bore	mm	100
153.11	Displacement	cc	981
153.12	Compression ratio	-	17.5:1
153.13	Reference standard	-	BS: 5514, ISO: 3046, IS: 10000, ISO: 8528
153.14	Type of governor	-	Mechanical
153.15	Fuel injection System / FIP	Type	- Block Type PF1AV
153.16	Class of Governing	-	A1
153.17	Air cleaner	-	Dry
153.18	Type of cooling	-	Air Cooled
153.19	Fuel Tank Capacity	L	50
153.20	Fuel Consumption at 100% load*		L/h 2.08
153.21	Fuel Consumption at 75% load*		L/h 1.64
153.22	Fuel Consumption at 50% load*		L/h 1.22
153.23	Lube oil Sump capacity (with filters)		L 5.0
153.24	Lube Oil Consumption	%ge of FC	< 0.15% of FC
153.25	Coolant Capacity - TOTAL	L	Not Applicable
153.26	Coolant Capacity - Radiator	L	Not Applicable
153.27	Phase	-	3Phase-4 wire
153.28	Voltage	VAC	230/ 240, 415
153.29	Voltage Regulation	%ge of Rated voltage	+/- 1%
153.30	Power Factor	Lag	0.8
153.31	Power Alternator Type	-	Single Bearing, Brushless
153.32	Insulation	-	Class-H
153.33	Starting System	-	Electric
153.34	Battery	Volts, Ah	12 Volts, 60 / 65 Ah
153.35	Battery Make	-	Exide / AMCO / Amaron
153.36	Silencer Location & Type		Internal / Residential
153.37	Acoustic Insulation Type	-	PU FR- Acoustic Foam
153.38	Acoustic Insulation Thickness		mm 40
153.39	DG Set Dimensions (L X B X H)		mm 1500 X850 X 1225
153.40	Wet Weight (Engine) (Approx)+		kg 260

153.41	Weight of DG Set (Approx)+kg	700

154 Used DC Generators- series, shunt and compound

(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.154,pg.no.54.**

154.1 Basic Indicative Diagram

Specification

154.2 Series Generator

Technical Specifications of DC Machine (USED Generator)

154.1.1 Type: Series
154.1.2 Power Rating: 3 H.P.
154.1.3 Voltage Rating: 220V ± 10%
154.1.4 Rated Speed: 1500RPM ± 7.5%
154.1.5 Insulation: Class 'B'
154.1.6 Confirming To I.S.: 4722-1992
154.1.7 S.P.D.P. Type, Horizontal Foot Mounted
154.1.8 Loading Arrangement: Mechanical, fitted on machine base "C" channel, Durable good quality Spring Balance: 2 Nos. (Tubular Type) with Belt, Brake Drum/Pulley: Aluminum cast with heat suppression Facility
154.1.9 Machine Base: Fabricated MS "C" Channel (75 x 40 x 6 m

154.3 Shunt Generator

Technical Specifications of DC Machine (USED Generator)

154.2.1 Type: Shunt
154.2.2 Power Rating: 3 H.P.
154.2.3 Voltage Rating: 220V ± 10%
154.2.4 Rated Speed: 1500RPM ± 7.5%
154.2.5 Insulation: Class 'B'
154.2.6 Confirming To I.S.: 4722-1992
154.2.7 S.P.D.P. Type, Horizontal Foot Mounted
154.2.8 Loading Arrangement: Mechanical, fitted on machine base "C" channel, Durable good quality Spring Balance: 2 Nos. (Tubular Type) with Belt, Brake Drum/Pulley: Aluminum cast with heat suppression Facility
154.2.9 Machine Base: Fabricated MS "C" Channel (75 x 40 x 6 m

154.4 Compound Generator

Technical Specifications of DC Machine (USED Generator)

154.3.1 Type: Compound
154.3.2 Power Rating: 3 H.P.
154.3.3 Voltage Rating: 220V ± 10%
154.3.4 Rated Speed: 1500RPM ± 7.5%
154.3.5 Insulation: Class 'B'
154.3.6 Confirming To I.S.: 4722-1992
154.3.7 S.P.D.P. Type, Horizontal Foot Mounted
154.3.8 Loading Arrangement: Mechanical, fitted on machine base "C" channel, Durable good quality Spring Balance: 2 Nos. (Tubular Type) with Belt, Brake Drum/Pulley: Aluminum cast with heat suppression Facility
154.3.9 Machine Base: Fabricated MS "C" Channel (75 x 40 x 6 m

155 **Pillar Electric Drill Machine** Motorized12-20 mm Capacity, 1HP, 440V, 3 phase, Induction Motor with DOL starter,
(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.155,pg.no.54.**

155. 1 Basic Indicative Diagram

155.2 Specification

155.2.1	PARAMETERS	REQD .AS PER 'PER "I.E APEC
155.2.2	DRIILL CAPACITY IN M.S	20 MM
155.2.3	DRILL CAPACITY IN C.I	22MM
155.2.4	TAPER IN SPINDLE	MT-2
155.2.5	SPINDLE TRAVEL	MIN.100MM
155.2.6	NO.OF SPINDALE SPEEDS	5-10NOTS
155.2.7	RANGE OF SPEEDS	50-150TO 1200-2500PRM
155.2.8	PILLAR DIAMETA	MIN.90MM
155.2.9	PIIIAR LENGHTH	MIN.1100MM
155.2.10	DISTANCE BERWEEN CENTRE OF SPINDLE &PILLAT FRONT	250 TO 300MM
155.2.11	MAX DISTANCE BETWEEN SPINDLE &BASE	1000 TO1100MM
155.2.12	MAX DISTTAACE BETWEEN SPINDLE AND BASE `	1000TO 1100MM
155.2.13	TABLE WORKING SURFACE SQUARE OR ROUND	SQUARE 370-300-X370-400 OR ROUND MIN DIA 300MM
155.2.14	BASE WORKING SURFACE	275-300 TO 350-400MM
155.2.15	OVERALL SIZE OF BASE	370-400*550-600MM
155.2.15	MOTOR INPUT	1 HP 440 V (CONFIRMING TO ISI SPCEFICATIONS)
155.2.16	COOLANT PUMP	0.1KV

155.3 STANDARD ACCESSORIES

155.3.1 DRILL CHUK - 16MM WITH ARBOR AND KEY 1 NO
155.3.2 MACHINE VICE SWIVEL TYPE 100MM - 1 NO
155.3.3 COOLANT SYSTEMS SUITABLE FOR MACHINE
155.3.4 CO ORDINATE TABLE OPTIONAL
155.3.5 REVERSING SWITCH EQUIPMENT OPTIONAL
155.3.6 BORING HEAD OPTIONAL
155.3.7 TOOL TRAY OPTIONAL
155.3.8 DRILL REDUCTION SLEEVES OPTIONAL
155.3.9 QUICK POSITIONING SLEEVES OPTIONAL
155.3.10 DRILL COLLECT FOR QUICK CHANGE CHUCK
155.3.11 QUICK CHANGE CHUCK
155.3.12 OTHER STANDARD ACCESSORIES

A) AC SINGLE PHASE ELECTRIC MOTOR OF 1 HP ISI BRAND FITTED WITH THE MACHINE
B) SWITCHING EQUIPMENT FOR THE ABOVE MOTOR FITTED WITH MACHINE
C) TRIPLE POLE INTERLOCKED ISOLATOR
D) COOLANT PUMP UNIT WITH COMPLETE FITTINGS FITTED WITH MACHINE
E) MACHINE LIGHT WITHOUT LAMP
F) SUITABLE LUBRICATION SYSTEM FOR MANUALLY THROUGH OIL CAN
G) V BELTS (2 PES) AND PULLEY
H) DRILL DRIFT
T) TAPPING ATTACHMENT
J) OIL CAN
K) SET OF ALLAN KEYS AND SPANNER SET(2 PES IN EACH SET
L) OPERATING MANUAL

156 **Motorized Bench Grinder1 HP**. -3 phase, 440V with DOL starter, Double side with smoothand rough wheel with Tool Base
(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.156,pg.no.54.**

156. 1 Basic Indicative Diagram

156. 2 Grinder Motor 1HP 1440RPM

156 .3 Wheel Size 250 x 25 x 25.4 mm

156 .4 Spindle RPM 1440 RPM

156 .5 Motorized With Double side with smooth and rough wheel with Tool Base

156.6 Bench Grinders complete with inbuilt drive suitable for
Operation on AC 415 Volts 3 Phase, 50 Cycles Supply.

156.7 Grinder should be complete with two grinding wheels.

156.7.1 One fine & one coarse wheel

156.7.2 Two wheel Guards with exhaust outlets,

156.7.3 Two adjustable tools rests

156.8 Rotary switch in the base and connecting cable or terminal block

156.9 Low Noise : below allowable noise level

156.10 High Filtering efficiency even for the finest dust

157 **A.C. Series type Motor1 HP**, 240 V, 50 Hz
(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.157,pg.no.54.**

157.1 Basic Indicative Diagram

157.2 Specification	Type	A.C.Seriess
157.2.1		
157.2.3	Input Voltage	250 V AC
157.2.4	Speed	10000-15000 Rpm
157.2.5	Power	**1 HP**
157.2.6	Protection	IP 65
157.2.7	Confirming	IS : 325
157.2.8	Encloser	SPDP
157.2.9	Mounting	Horizontal Foot Mounting

158 **Single Phase Capacitor Motor** with starter switch1 HP, 240 V, 50 Hz (NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.158,pg.no.54.**

158.1 Basic Indicative Diagram

158.2 Specifications:

158.2.1 158.2.2	Type	Split Phase With C.F switch
158.2.1	Frequency	50 Hz
158.2.3	Voltage	230-250 V
158.2.4	Number of poles	4
158.2.5	Degree of Protection	IP65
158.2.6	Synchronous speed	1500 rpm
158.2.7	Output rating	0.5 HP
158.2.8	Mounting	Horizontal Foot-mounted
158.2.9	Terminal box[1]	With Terminal Box
158.2.10	Confirming	IS : 325
158.2.11	Enclosure	IC410 - SPDP

159 **Manual Motor coil Winding Machine** With step arbor
(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.159,pg.no.54.**

159. 1 Basic Indicative Diagram

159.2 With straight and step coil arbors

159.3 Should wind both single and three phase motor coils. .

159.4 for winding motors from 1/2 hp to 40 hp.

159.5 No of arbors - five Step arbors-01 No straight arbors-01 No

159.5.1 Material of arbors Aluminum

159.6 with Manual counter

159.6.1 Count Range: 0-9999 rings

159.7 Size & Material

159.7.1 Size - Base 13" x 15" Package Dimensions: 13 " x 8" x 10"

159.7.2 Material - Mild Steel

159.8 Features:

159.8.1 Easy operations

159.8.2 Easy functioning

159.8.3 Superior performance

160 **Ceiling fan coil Winding Machine-**250V, 50 Hz, 1-Φ,with speed control (NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.160,pg.no.54.**

160. 1 Basic Indicative Diagram

160.2 Capacity 35 to 40 Stator Per Day
160.3 Counter Type 3 Digit FRD
160.4 Stator Diameter 105mm to 165mm
160.5 Frequency 50 Hz
160.6 Wire Gage 30 to 40
160.7 Winding Direction Clockwise
160.8 Phase Single with speed control
160.9 Motor 1/4 H.P. Single Phase 220v.AC
160.10 Power Supply 220v.AC
160.11 Machine Type Automatic
160.12 Dimensions 810mm x 280mm x 1500mm
160.13 Standard accessories
160.13.1 • all Standard Dies and stand
160.13.2 • Wire guides
160.13.3 • Wire cut sensor
160.13.4 • Spool container with tensioner mounting stand
160.14. INSTRUCTIONS :
160.14.1) OPERATING MANUAL WITH CIRCUIT DIAGRAM MUST BE PROVIDED.
160.14.2) PRACTICALS LIST TO BE PERFORMED SHOULE BE PROVIDED.WITH CIRCUIT DIAGRAM
160.14.3) CONTROL BOARD SHOULD BE FITTED WITH NUT & BOLT PROPERLY AT THE INSTITUTE TO PERFORM PRACTICALS ATMAN-HEIGHT LEVEL FOR TRAINEE'S SAFTY

161 **Primary current injection set-**220V, 50 Hz, 1-Φ,output current - 200 A (min) with timer

161. 1 Basic Indicative Diagram

(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.161,pg.no.54.**

161.2 Specification

Display Type	Digital
Accuracy (%)	Grater than 1.0Percent (F. S).
Supply	AC
Control	With the help of Manual Auto Transformer (according to customer demand)
Current Source	10 to 200 Amp (according to customer demand).
Condition	New
Measuring	Isolated CT for current output, digital Voltmeter for voltage output
Output Power	6.0V (according to customer demand). Up to 15kva
Protection	a) Overload b) Open circuit c) Over temp.
Timer Control Circuit Modes	0.001 to 99999ms, Accuracy 0.1 Percent of reading Plus minus1ms
Warranty	1 Year against manufacturing defects & Extended optional.
Input voltage	Single phase 230V AC, 50Hz Protected with MCB & HRC fuse , or as per customer demand
Operation time	1min ON, 5mins OFF.
External Current Meter range	100A to 200 A, Accuracy 1 Percent of reading, Plus minus 20 mA
Timer Stop Input	Voltage input (24 to 300 V, DC or peak AC), dry contact input, orre-moval of primary current

162 Stepper Motor with Digital Controller

As Per DVET, Maharashtra State SPECIFICATION FOR ELECTRICAL TRAINERS (NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.162,pg.no.54.**

162.12 Basic Indicative Diagram

162.13 Different modes of operation
162.14Half and Full step angle
162.15 Visual indication of the coil excitation
162.16 External connector for programming with different controllers
162.17Separate unit for Motor in a see through cabinet.
162.18 Motor Type: Unipolar
162.19Torque: 6 Kg-cm
162.20Phase Current: 0.8 Amp.
162.21Stepping Angle: 1.8° /0.9°
162.22Operating Voltage: 12 V DC
162.23Input Pulse: 5V TTL Compatible
162.24Test Points: 20
162.25 Cabinet for Motor
162.26 Power Supply: 110 / 230V, 50Hz
162.27Operating Conditions: 0-40° C, 80% RH
162.28 Learning Material: Online learning material including Theory,procedure, reference results, etc.)
162.29 The trainer should support to perform the following experiments:

162.18.1 Study and use of Stepper Motor in Wobble Mode
162.18.2 Study of Stepper Motor in Full Step, Single Phase, Free Running Mode
162.18.3 Study of Stepper Motor in Full Step, Single Phase, Step Running Mode
162.18.4 Study of Stepper Motor in Full Step, Two Phase, Free Running Mode
162.18.5 Study of Stepper Motor in Full Step, Two Phase, Step Running Mode
162.18.6 Study of Stepper Motor in Half Step, Free Running Mode
162.18.7 Study of Stepper Motor in Half Step, Step Running Mode

163 **Shaded Pole Motor-** Fractional H.P., 240 V, 50 Hz

(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.163,pg.no.54.**

163.1 Basic Indicative Diagram

163.2 Specifications:

163.2.1	Type	**Shaded Pole Motor** Fractional H.P
163.2.2	Frequency	50 Hz
163.2.3	Voltage	230-250 V
163.2.4	Number of poles	4
163.2.5	Degree of Protection	IP65
163.2.6	Synchronous speed	1500 rpm
163.2.7	Output rating	Fractional HP
163.2.8	Mounting	Horizontal Foot-mounted
163.2.9	Terminal box[1]	With Terminal Box
163.2.10	Confirming	IS : 325
163.2.11	Enclosure	IC410 - SPDP

164.Smart Meter -(1 Phase - Smart Energy Meter/3 Phase - Smart /EnergyMeter)

(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **) - S.R.164,pg.no.54.**

Specifications:

- ISI Certified, 1 Phase, 5-30A, 2 Wire (Copper), 240V, 50Hz, 3200imp/kWh. Class 1.0 High Accuracy (IS 13779-1999, CBIP Report-88 &IEC Standards).
- 6-Digit Bright Back-lit Display Counter Records Most Accurate Error Free Forward Energy Recording Irrespective of Current Direction.
  Multifunctional, Defect-Free, High Surge Resistant, Hackproof, Low Power Consumption, High Insulation Resistance (> 5 M Ohms) & Dielectric Strength (2KV RMS for 1 Min.), Anti-Tamper Features (Phase-Neutral or Main & Load Wire Interchanged, Neutral Missing, DC Immunity, Abnormal Voltage, Earth Load Tamper Indication etc).
- Light Weight, Dust Proof Body, Elegant Poly-Carbonate Casing & Rugged Construction provides High Resistance to UV.

165. EV Charger (3 phase input)

(NSQF -LEVEL-4-Version-2.0)- Revised-2022) - **S.R.165,pg.no.54.**

Specifications:

- Overload protection
- Over-temperature shutdown with auto-recovery
- Reverse polarity protection
- Suport 2 & 3 Wheeler

166. EV Charger - (1 Phase input)

(NSQF -LEVEL-4-Version-2.0)- Revised-2022 **)** - **S.R.166,pg.no.54.**

Specifications:

- Extremely safe for the EV: With CE certification and IP67 control box; the EV charger offers protection against over current, over voltage, over temperature, earth leakage, lightening etc prioritizing both your car and EV charger's safety.
- 1.6 inch bright LCD Screen: Monitor your electricity consumption, voltage and other parameters easily using this Portable EV Charger
- Ease of use: Plug into 32A Industrial mains socket, Adjust current through button (10A to 32A), Insert gun into EV and charging starts. After full charge, the EV Charger stops charging automatically
- Fast Charging Capability: Employs advanced 32A rapid charging technology, ensuring quick power-ups for your electric car.
- Durable Build: This EV Portable Charger has been built with best materials for long-lasting performance.
- Waterproof Design: IP67 Certified. With robust waterproofing, this EV charger is reliable and safe even in adverse weather conditions.
- Universal Compatibility: Compatible with all electric cars. Tata Nexon EV, Tiago EV, Tigor EV, Punch EV, Volvo XC40, BYD Atto 3, BYD E6, MG ZS EV, Mahindra XUV400, Hyundai Kona EV, Hyundai ioniq EV, Kia EV6, Citroen and many more
- Compact Portability: Designed for easy transport, enabling charging flexibility at home, work, or during travel.