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GENERATOR MECHANIC



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CBT Curriculum

National Vocational Certificate Level 4

Version 1 - November, 2019



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Introduction

Generators are machines that transform mechanical energy into electrical energy; they can be used to run a variety of electrical appliances for home or commercial use. There are numerous types of generators; some rely on natural gas, diesel or petrol as energy sources. This generator mechanic course is provided to train the unskilled trainees to service/repair/install engines and generators for home or industrial use. This course is aimed at introducing and developing the basic skills with an understanding of different energy sources, power quality and its influences on standby generator sets, different loads, startup and running of a standby generator. Set, size and select the most appropriated standby generator set of the application and provide the trainees with electrical and electronic principles to enable effective fault finding of the standby generators and associated systems alongside the installation of different types of generators. The trainees are encouraged to experiment with a focus on acquiring a wide range of new skills. They are also exposed to the commercial market and taught how to deal with clients and their demands.

In order to improve the quality of training and to ensure relevance, National Vocational & Technical Training Commission (NAVTTTC) through Qualification Development Committee (QDC) developed National Competency Standards for generator mechanic. The learning outcomes provided in this curriculum form the basis of this instruction, which are in accordance with the approved National Competency Standards for generator mechanic. The curriculum can be implemented in a variety of pathways and provides flexible learning opportunities.

Purpose of the Training Programme

In this training program trainee will learn and acquire specialized knowledge and particle skills required to function as a generator mechanic both at public and private levels. The specific objectives of developing these qualifications are as under:

- Improve the overall quality of training delivery and setting national benchmarks for training of generator mechanic in the country
- Provide flexible pathways and progressions to learners enabling them to receive relevant, up-to-date and current skills

- Provide basis for competency-based assessment which is recognized and accepted by employers
- Establish a standardized and sustainable system of training for generator mechanic in the country.

Overall objectives of the course

The prime objective of this one-year certificate in Generator mechanic is to provide the trainee with a comprehensive introduction and skill oriented practical work of generator at workplace. It develops trainee's abilities, interests and offers an outstanding opportunity for an intense engagement with various stages of installation, overhauling, maintenance work of generator. It encourages individual creativity while giving a solid ground in terms of identification of faults, maintenance of faulty parts, overhauling, earthing and installation alongside the skill to perform winding, work plan, documentation and develop professionalism by using appropriate technology. Part of the task is to help the trainees realize their commercial viability as an independent generator mechanic or an employee in a commercial setup. They are also made aware of the ever changing and evolving demands and challenges of market trends. This course is open to students of all levels and experiences under following main objectives.

Competencies to be gained after completion of course

The detail of the competency standards included in this qualification are given below:

National Vocational Certificate level 4, in "Generator Mechanic"

1. Contribute to Work Related Health and Safety (WHS) Initiatives
2. Analyze Workplace Policy and Procedures
3. Perform Advanced Communication
4. Develop Advance Computer Application Skills
5. Manage Human Resource Services
6. Develop Entrepreneurial Skills
7. Perform Winding
8. Perform tests as per specification
9. Plan Work

Job opportunities available immediately and in the future

The Pass outs of this course may find job / employment opportunities in the following areas:

- Work as Generator Mechanic Supervisor (Level 4)

Trainee Entry Level:

The entry for National Vocational Certificate level 4, Generator Mechanic is given below:

Title	Entry requirements
National Vocational Certificate level 4, in Generator Mechanic	Entry for assessment for this qualification is open. However, entry into formal training institute for this qualification is person holding National Vocational Certificate level 3, "Generator Mechanic" in (Mechanical Sector)

Minimum Qualification of Trainer

- 2 years of teaching/ professional relevant experience after Diploma
- 1 year of teaching/ professional experience after B-Tech/ BSc Engineering

Recommended Trainer: Trainee ratio

The recommended trainer and trainee ratio are 1:24 per class

Medium of Instruction:

Urdu, English or Local Language

Duration of course (total time, Theory & Practical)

The proposed curriculum is composed of **09** modules that will be covered in **490** hrs. It is proposed that the course may be delivered in a **Six months** period. The distribution of contact hours is given below:

- **Theory:** (20.41%) **Practical** (79.59%)
- **Theory: 100 hours**
- **Practical: 390 hours**
- **Total: 490**

11. Sequence of the modules

Following is the structure of the course:

NVQF Level	Module #	Title	Category	Theory (hours)	Practical (hours)	Total (hour)	Credits hours	Total Credit Hours
4	1	Contribute to Work Related Health and Safety (WHS) Initiatives	Generic	06	24	30	03	49
	2	Analyze Workplace Policy and Procedures	Generic	06	24	30	03	
	3	Perform Advanced Communication	Generic	06	24	30	03	
	4	Develop Advance Computer Application Skills	Generic	08	32	40	04	
	5	Manage Human Resource Services	Generic	04	16	20	02	
	6	Develop Entrepreneurial Skills	Generic	06	24	30	03	
	7	Perform Winding	Technical	38	152	190	19	
	8	Perform tests as per specification	Technical	10	40	50	05	
	9	Plan Work	Technical	16	54	70	07	
TOTAL				100	390	490	49	
Percentage.				20.41%	79.59%			

Overview of the Curriculum for Mobile Phone Technician (Level 4)

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of Modules
<p>Module 1: Contribute to Work Related Health and Safety (WHS) Initiatives</p> <p>Aim: This unit describes the skills and knowledge required to manage the identification, review, development, implementation and evaluation of effective participation and consultation processes as an integral part of managing work health and safety (WHS).</p>	<p>LU1. Contribute to initiate work-related health and safety measures</p> <p>LU2. Contribute to establish work-related health and safety measures</p> <p>LU3. Contribute to ensure legal requirements of WHS measures</p> <p>LU4. Contribute to review WHS measures</p> <p>LU5. Evaluate the organization's WHS system</p>	06	24	30
<p>Module 2: Analyze with Workplace Policy and Procedures</p> <p>Aim: This unit describes the skills and knowledge required to implement a workplace policy & procedures and to modify the policy to suit changed circumstances. It applies to individuals with managerial responsibilities who undertake work developing approaches to create, monitor and improve strategies and policies within workplaces and engage with a range of relevant stakeholders and specialists.</p>	<p>LU1. Manage work timeframes</p> <p>LU2. Manage to convene meeting</p> <p>LU3. Decision making at workplace</p> <p>LU4. Set and meet own work priorities at instant</p> <p>LU5. Develop and maintain professional competence</p> <p>LU6. Follow and implement work safety requirements</p>	06	24	30
<p>Module 3: Perform Advanced Communication</p> <p>Aim: This unit describes the performance outcomes, skills and knowledge required to develop communication skills used professionally. It covers plan and organize work and conduct trainings at workplace, along with demonstrating</p>	<p>LU1. Demonstrate professional skills</p> <p>LU2. Plan and Organize work</p> <p>LU3. Provide trainings at workplace</p>	06	24	30

professional skills independently				
<p>Module 4: Develop Advance Computer Application Skills</p> <p>Aim: This unit provides an overview of Microsoft Office programs to create personal, academic and business documents following current professional and/or industry standards, i.e. Data Entry, Power Point Presentation and managing data base and graphics for Design. It applies to individuals employed in a range of work environments who need to be able to present a set range of data in a simple and direct forms</p>	<p>LU1. Manage Information System to complete a task LU2. Prepare Presentation using computers LU3. Use Microsoft Access to manage database LU4. Develop graphics for Design</p>	08	32	40
<p>Module 5: Manage Human Resource Services</p> <p>Aim: This unit describes the skills and knowledge required to plan, manage and evaluate delivery of human resource services, integrating business ethics. It applies to individuals with responsibility for coordinating a range of human resource services across an organization. They may have staff reporting to them.</p>	<p>LU1. Determine strategies for delivery of human resource services LU2. Manage the delivery of human resource services LU3. Evaluate human resource service delivery LU4. Manage integration of business ethics in human resource practices</p>	04	16	20
<p>Module 6: Develop Entrepreneurial Skills</p> <p>Aim: This Competency Standard identifies the competencies required to develop entrepreneurial skills, in accordance with the organization's approved guidelines and procedures. You will be expected to develop a business plan, collect information regarding funding sources, develop a</p>	<p>LU1. Develop a business plan LU2. Collect information regarding funding sources LU3. Develop a marketing plan LU4. Develop basic business communication skills</p>	06	24	30

marketing plan and develop basic business communication skills. Your underpinning knowledge regarding entrepreneurial skills will be sufficient to provide you the basis for your work.				
<p>Module 7: Perform Winding Aim: After completing this learning module, the learner will be able to make winding, perform paper insulation, insert coils relevant slots, connect coils, perform varnishing as per standard and perform winding continuity Test.</p>	<p>LU1. Make winding Coils LU2. Perform paper insulation LU3. Insert coils in relevant slots LU4. Connect coils LU5. Perform varnishing as per standard LU6. Perform winding continuity Test</p>	38	152	190
<p>Module 8: Perform tests as per specification Aim: After completing this learning module, the learner will be able to perform voltage testing, perform frequency testing procedure, test heat testing procedure, observe speed testing procedure and write test load report for record.</p>	<p>LU1. Perform test on full load LU2. Record Voltage LU3. Record Ampere LU4. Record frequency LU5. Record Temperature LU6. Record Engine Speed LU7. Compile all the Test result</p>	10	40	50
<p>Module 9: Plan Work Aim: After completing this learning module, the learner will be able to ensure all paperwork is filled out in a clear, legible and accurate format, and completed with required information. Also ensure all required information is documented in accordance with SOP's.</p>	<p>LU1. Assess site hazards LU2. Ensure work procedures LU3. Follow symbols LU4. Ensure drawing parameters LU5. Ensure environmental concerns</p>	16	54	70

National Vocational Qualifications Level 4 in Generator Mechanic

		TOTAL	180	390	490

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Module-7

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Module 7: Perform Winding

Objectives: After completing this learning module, the learner will be able to make winding, perform paper insulation, insert coils relevant slots, connect coils, perform varnishing as per standard and perform winding continuity Test.

Duration:	Total hours	190	Theory	38	Practical	152
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Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials (Tools & Equipment) Required	Learning Place
LU1. Make winding coils	<ul style="list-style-type: none"> • Select wire as per required gauge • Make coils as per specifications 	<ul style="list-style-type: none"> • Describe winding types including short pitched, full pitched, single layer and double layer winding • Describe types of winding wires • Describe standard wire gauge (SWG) • Describe coil making techniques including number of turns, number of coils and coil pitch 	8 hours Theory 32 hours Practical	<ul style="list-style-type: none"> • Laminated core • Enameled copper wire of different SWG • Wire gauge • Winding coil firms • Tool kit 	Class Room and workplace
LU2. Perform paper insulation	<ul style="list-style-type: none"> • Select insulation paper • Cut insulation paper as per slot size • Insert insulation paper in stator /rotor slots 	<ul style="list-style-type: none"> • Describe types of insulation paper • Describe techniques for insertion insulation paper 	6 hours Theory 24 hours Practical	<ul style="list-style-type: none"> • Laminated core • Insulated paper of different SWG • Steel foot rule • Scissor 	Class Room and workplace

<p>LU3. Insert coils in relevant slots</p>	<ul style="list-style-type: none"> • Insert coil in internal slot as per pitch • Insert coil in external slot as per pitch • Insert wedge/insulation paper 	<ul style="list-style-type: none"> • Describe the insertion procedure of coils in proper slots 	<p>6 hours Theory</p> <p>24 hours Practical</p>	<ul style="list-style-type: none"> • Laminated core • Winding coils • Insulating paper • Rawhide mallet • Fibre stick 	<p>Class Room and workplace</p>
<p>LU4. Connect coils</p>	<ul style="list-style-type: none"> • Inter connect coil as per circuit diagram • Perform lacing of coils 	<ul style="list-style-type: none"> • Describe coil connections procedure • Describe lacing procedure of winding 	<p>6 hours Theory</p> <p>24 hours Practical</p>	<ul style="list-style-type: none"> • Winded laminated core • Sleeves of different sizes • Cotton tap • Tool kit. 	<p>Class Room and workplace</p>
<p>LU5. Perform varnishing as per standard</p>	<ul style="list-style-type: none"> • Select varnish grade as per standard • Apply varnish to coil • Dry varnish 	<ul style="list-style-type: none"> • Describe varnishing procedure 	<p>6 hours Theory</p> <p>24 hours Practical</p>	<ul style="list-style-type: none"> • Winded laminated core • Varnish • Heat gun • Steel tray 	<p>Class Room and workplace</p>
<p>LU6. Perform winding continuity Test</p>	<ul style="list-style-type: none"> • Adjust test parameters of test bench as per requirement • Perform continuity, high voltage, and power input tests • Record warning indication and follow as per SOPs 	<ul style="list-style-type: none"> • Describe different winding testing procedure and techniques 	<p>6 hours Theory</p> <p>24 hours Practical</p>	<ul style="list-style-type: none"> • Winded laminated core. • Clamp on mater • Multi meter 	<p>Class Room and workplace</p>

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				<ul style="list-style-type: none">• Series test lamp• Electrical tool kit	
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Module-8

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Module 8: Perform tests as per specification

Objectives: After completing this learning module, the learner will be able to perform voltage testing, perform frequency testing procedure, test heat testing procedure, observe speed testing procedure and write test load report for record.

Duration:	Total hours	70	Theory	16	Practical	54
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Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials (Tools & Equipment) Required	Learning Place
LU1. Perform test on full load	<ul style="list-style-type: none"> Identify full load as per manufacturer Connect load bank with generator Select full load of load bank 	<ul style="list-style-type: none"> Knowledge about the generator capacity and load bank 	4 hours Theory 8 hours Practical	<ul style="list-style-type: none"> Clamp on mater Load bank Electrical toolkit 	Class Room and workplace
LU2. Record Voltage	<ul style="list-style-type: none"> Record start time Record fluctuation in voltage Repeat the process up to 3-time intervals Document the average Voltage 	<ul style="list-style-type: none"> Describe voltage testing procedure 	2 hours Theory 8 hours Practical	<ul style="list-style-type: none"> Multi meter 	Class Room and workplace
LU3. Record Ampere	<ul style="list-style-type: none"> Record start time Record fluctuation in Current Repeat the process up to 3-time intervals 	<ul style="list-style-type: none"> Describe current testing procedure 	2 hours Theory 8 hours Practical	<ul style="list-style-type: none"> Clamp on meter 	Class Room and workplace

	<ul style="list-style-type: none"> • Document the average Ampere 				
LU4. Record frequency	<ul style="list-style-type: none"> • Record start time • Record fluctuation in Frequency • Repeat the process up to 3-time intervals • Document the average Frequency 	<ul style="list-style-type: none"> • Describe frequency testing procedure 	<p>2 hours Theory</p> <p>8 hours Practical</p>	<ul style="list-style-type: none"> • Hertz meter • Connecting wires 	Class Room and workplace
LU5. Record Temperature	<ul style="list-style-type: none"> • Record start time • Record fluctuation in Temperature • Repeat the process up to 3-time intervals • Document the average Temperature 	<ul style="list-style-type: none"> • Describe heat testing procedure 	<p>2 hours Theory</p> <p>8 hours Practical</p>	<ul style="list-style-type: none"> • Temperature gauge 	Class Room and workplace
LU6. Record Engine Speed	<ul style="list-style-type: none"> • Record start time • Record fluctuation in record per minute (RPM) • Repeat the process up to 3-time intervals • Document the average Speed 	<ul style="list-style-type: none"> • Describe speed testing procedure 	<p>2 hours Theory</p> <p>7 hours Practical</p>	<ul style="list-style-type: none"> • Technometer 	Class Room and workplace

<p>LU7. Compile all the Test result</p>	<ul style="list-style-type: none"> • Prepare table • Enter all the average data in the table • Take signatures on the document from the customer and expert 	<ul style="list-style-type: none"> • Knowledge about the test report writing 	<p>2 hours Theory</p> <p>7 hours Practical</p>	<ul style="list-style-type: none"> • Log book 	<p>Class Room and workplace</p>
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Module-9

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Module 9: Plan Work

Objectives: After completing this learning module, the learner will be able to ensure all paperwork is filled out in a clear, legible and accurate format, and completed with required information. Also ensure all required information is documented in accordance with SOP's.

Duration:	Total hours	80	Theory	10	Practical	70
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Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials (Tools & Equipment) Required	Learning Place
LU1. Assess site hazards	<ul style="list-style-type: none"> Inspect site visually Identify actual and potential hazards Communicate with site supervisor/customer/supplier 	<ul style="list-style-type: none"> Define hazards Describe types of hazards e. g flood water, electrical poles, noise, fire etc. 	2 hours Theory 14 hours Practical	<ul style="list-style-type: none"> safety Instructions chart 	Class Room and workplace
LU2. Ensure work procedures	<ul style="list-style-type: none"> Identify Tools & equipment Prepare job sheet /job card/work order Follow job sequence Demonstrate/co-ordinate activities with others 	<ul style="list-style-type: none"> Describe job sheet/ job card/work order 	2 hours Theory 14 hours Practical	<ul style="list-style-type: none"> Job card/Job sheet/work order 	Class Room and workplace
LU3. Follow symbols	<ul style="list-style-type: none"> Follow warning symbols Follow electrical symbols Follow mechanical symbols 	<ul style="list-style-type: none"> Describe various types of warning symbols and marks 	2 hours Theory 14 hours Practical	<ul style="list-style-type: none"> Warning symbols chart 	Class Room and workplace

<p>LU4. Ensure parameters drawing</p>	<ul style="list-style-type: none"> • Follow metric and imperial measurements • Adopt inter-conversion of metric and imperial measurement • Distinguish between plan, side view and section 	<ul style="list-style-type: none"> • Describe metric and imperial measurement system • knowledge about inter conversion of units 	<p>2 hours Theory 14 hours Practical</p>	<ul style="list-style-type: none"> • Ruler set • measurement set • Sufficient Paper • Drawing material • cutting set 	<p>Class Room and workplace</p>
<p>LU5. Ensure environmental concerns</p>	<ul style="list-style-type: none"> • Identify actual and potential environmental concerns (proximity to water courses, noise levels, fuel leaks and hazardous materials) • Review environment concerns • Review work plan as per standard • Communicate report to site supervisor 	<ul style="list-style-type: none"> • Knowledge and understanding of environmental concerns (proximity to water courses, noise levels, fuel leaks and hazardous materials) 	<p>2 hours Theory 14 hours Practical</p>	<ul style="list-style-type: none"> • Writing materials on environment concerns (proximity to water courses, noise levels, fuel leaks and hazardous materials) 	<p>Class Room and workplace</p>

List of Tools and Equipment

Sr. No	A. Testing instruments	Quantity,24-25 students
1.	Volt meter	10
2.	Clamp on mater	10
3.	Phase sequence meter	10
4.	Pressure gauge (oil)	10
5.	vacuum gauge	10
6.	PH meter	10
7.	Growler	10
8.	Bench power supply (variable DC)	5
9.	Megger/insulation tester,	10
10.	Frequency meter	10
11.	Temperature mater	10
12.	Tachometer	10
13.	Watt meter	10
14.	Multimètre	10
15.	Power factor meter	10
Tools and Equipment		
1.	Timing light	5
2.	Engine analyzer	5 set
3.	Electronic Fuel Injection (EFI) engine diagnostic scanner	2
4.	Compression gauge	10
5.	Cylinder leakage tester	10
6.	Fuel injection test device	5
7.	Fuel injector pressure tester	5
8.	Glow plug analyzer	10
9.	Smoke diagnostic tool kit	10
10.	Heat gun	10
11.	Torque wrench	15
12.	Open end spanner set	15
13.	Combination spanner set	15

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14.	Ring spanner set	15
15.	Socket box	15
16.	Adjustable screw wrench set	15
17.	Vice grip pliers	15
18.	Universal pliers	15
19.	Nose pliers	15
20.	Combination pliers	15
21.	Inside circlip pliers	15
22.	Outside circlip pliers	15
23.	Bearing puller inside	15
24.	Bearing puller outside	15
25.	Ring installer	15
26.	Ring remover	15
27.	Ridge remover	15
28.	C clamp	15
29.	Ring compressor	15
30.	Hammer set(steel)	15
31.	Hammer set (plastic/rubber)	15
32.	Allen key set	15
33.	Screw driver set (star, flat)	15
34.	Feeler gauge	15
35.	Micrometer	15
36.	Vernier caliper	15
37.	Winding machine	10
38.	Hydrometer	15
39.	Bench vise	10
40.	Hand hacksaw frame	25
41.	Scriber	25
42.	Scraper (triangular & flat)	25 set
43.	Surface gauge	10
44.	Surface plate	10
45.	Air blower	10
46.	Hand drill machine	10
47.	Oil cane	15
48.	valve re-facer machine	2

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49	Filter chain	25
50.	Oil drain plug spanner	25
51.	Spark plug spanner	25
52.	Hand grinder machine	5
53.	Tap and die set (inch & millimeter)	25 set
54.	Nipple forming set	25
55.	Tri square	25
56.	Hand file set	25
57.	Needle file set	25
58.	Cross cut chisel	25
59	Flat chisel	25
60.	Round chisel	25
61.	Centre punch	25
62.	Pin punch set	25
63.	Insulation remover	25
64.	Thimble press	25
65.	Funnel	25
66.	Pipe wrench set	10
67.	Portable petrol and diesel generator	5
68.	Label maker (wire, tape, plastic)	10 Dozen
69.	Soldering iron (25W & 100 W)	15
70.	Lifts (scissor, Paper cutter)	25
71.	Air compressor with full accessoires	2
72.	Personale Protective Equipment	25
73.	High voltage gloves, (rubber and leather)	25
74.	Materials safety Data Sheets (MSDS)	25
75.	Temperature sensor	25
76.	Tool box (23 pieces)	25
77.	Tool belt (13 pieces)	25
78.	Silicone gun	25
79.	Heat sensor	25
80.	Oil pressure sensor	25
81.	RPM sensor/magnetic pickup	25
82.	Mallet	25
	Rawhide mallet	25

83.	Battery (200 Ah) and battery charger	2 each
84.	Hydraulic jack (portable, 200kg)	5
85.	AVR	10
86.	Fuel solenoid switch	10
87.	Tool trolley	5
LIST OF CONSUMABLE SUPPLIES		
1.	Spark plug	10 Dozen
2.	Atomizer nozzle	24
3.	Filter (air, oil, fuel, water)	10
4.	Lubricants	5 *4
5.	Overhauling kit	5
6.	Belts different sizes	50
7.	Bearings different sizes	50
8.	Radiator hose pipes	15
9.	Engine alternator foundation	15
10.	Bridge set/diode plates	25
11.	Enamel copper wire different SWG	5 KG each
12.	Insulation paper with different SWG	10 KG each
13.	Varnish	10 liters
14.	Wire sleeves different sizes	100 No. each
15.	Valve lapping stick	25
16.	Emery pastes	10 tin
17.	Emery paper different sizes	25 No. each
18.	Slip rings	10
19.	Carbon brushes different sizes	15 set each
20.	Insulation taps	200.No
21.	Cables (3/29, 7/29,7/36, 4)	300 meter each
22.	Cables (7/44, 7/52,7/64) etc.	300 meter each
23.	Flexible cable different sizes	200 meter each
24.	Multi core cables different sizes	100meter each
25.	Cotton tap	100 No.

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26.	Flexible pipes	10
27.	Circuit breaker different rating	50
28.	Relays	25
29.	Selector switch	25
30.	Bulbs	50
31.	Fuses different rating	50 No. each
32.	Magnetic contactor different rating	5 No. each
33.	Penal box	5
34.	High tension lead	15 set
35.	High tension tap	15 set
36.	Soap	25 No
37.	Detergent etc.	25 No
38.	Cotton waste	10 Dozen

