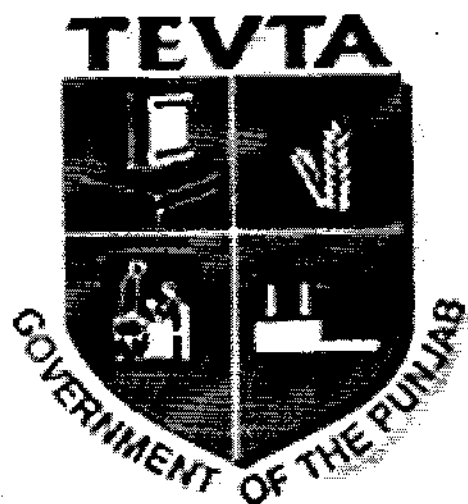


Government of Punjab

**TECHNICAL EDUCATION & VOCATIONAL
TRAINING AUTHORITY**



CURRICULUM FOR

HVACR

(3-Months Course)

CURRICULUM SECTION
ACADEMICS DEPARTMENT

96-H, GULBERG-II, LAHORE

Ph # 042-99263055-9, 99263064

gm.acad@tevta.gop.pk, manager.cur@tevta.gop.pk

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Date: 27-8-2013

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TRAINING OBJECTIVES


The objective of this course is to produce semi-skilled labor through imparting training to fresh entrant's i.e. practical skill and theoretical knowledge about installation, repair and trouble shooting of refrigerator and domestic air-conditioners.

On completion of course the trainee will be able to use common hand tools, measuring instruments, install and dismantle Air Conditioners find faults and rectify the same in AC & refrigerators. He will be conversant with common refrigerants / CFCs understand auto car air conditioning, dismantle and reassemble different types of compressors, understand evaporating, condensing, Expansion, Heating, cooling etc.

After the completion of this course trainee will be able to start a career in industry his own workshop and earn his livelihood by offering his skills.

CURRICULUM SALIENTS

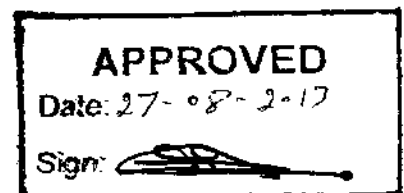
Entry Level:	Middle
Total Duration of Course:	3 Month
Total Training Hours:	300 Hours
	30 Hours in a Week
	05 Hours a Day
Training Methodology:	80 % Practical
	20 % Theory
Medium of Instruction:	Urdu / English

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Skill Competency Detail

After the completion of this course the student will learn the following skills:

1. Selection, use and precautions of tools and measuring instruments for the maintenance of domestic Refrigerator and Air-Conditioner (Window & Split Type).
2. To do the installation of domestic A/C & Refrigerators.
3. Measure, bend, pinch off & cutting of copper tubes.
4. Joining tubing to tubing and tubing to fittings by flaring.
5. Connecting two pieces of soft copper tubing of the same diameter.
6. Making the leak proof connections by brazing or silver soldering.
7. Identification of symbols in electrical circuit of Refrigerator, A/C (Window & split) and deep freezer and checking the circuit.
8. Leak detection in Domestic unit' se.g. A/C, Refrigerator, water cooler, water dispenser etc.
9. Perform the routine maintenance and seasonal servicing of Refrigerator & Air-Conditioner.
10. Check & adjust doors and replaces gas kits on domestic refrigerator & deep freezers.
11. Remove, check, repair, replace or service compressors, condensers & evaporators.
12. Check, clean, remove and replace capillary tubes.
13. Evacuate and charge with refrigerant of domestic units.
14. Observe good house keeping and ethics in carrying out services and customer satisfaction.

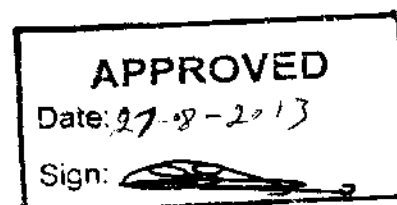


Knowledge Proficiency Detail

After the completion of the course the student will have knowledge of:


1. Selection of proper tools and materials.
2. Handling the Refrigerators/ Air Conditioning Units.
3. To follow the safety precautions of the shop floor.
4. Basic principles of electricity, electric tools, devices and their uses.
5. Selection of proper safety devices in domestic Refrigerators/ Air Conditioning Units.
6. Operation and maintenance of domestic Refrigerators, Deep Freezers, Air Conditioner (Window and split type) and desert cooler.
7. Electrical circuit diagrams of domestic units.
8. Identification of Refrigerators, their properties and precautions/awareness about CFC free products.
9. Installation of window type and split type Air-Conditioners.
10. Fault detection and trouble shooting of domestic units.
11. Gas charging in Refrigeration and Air-Conditioning units.
12. Leak detection in Refrigerator and Air-Conditioner units with deep water, halide torch and electronic leak detector.
13. Dismantle, check and reassemble the domestic refrigeration and air conditioning units.

Brazing, soldering, flaring, swaging oxyacetylene flame.



CURRICULUM DELIVERY STRUCTURE


Area	Curriculum Delivery	Revision	Final Test	Total
W E E K	1 – 10	11	12	12
	10	1	1	12

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SCHEME OF STUDIES

(HVACR Mechanic 3-Months course)

Ser.	Main topics	Theory hrs	Practical hrs	Total hrs
1.	Workshop Practice	9	23	32
2.	Fundamental of Electricity	12	38	50
3.	Servicing	5	26	31
4.	Fundamental of Refrigeration	17	90	107
5.	Gas Charging & Troubleshooting	7	63	70
6.	Work Ethics	10	0	10
	Total	60	240	300

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DETAIL OF COURSE CONTENTS

(HVACR Mechanic)


Sr. No.	Topics	Theory (Hours)	Practical (Hours)
1.	Workshop Practice		
1.1	Workshop safety.	½	-
1.2	First aid for electric shock and simple injury.	½	-
1.3	Use of cutting tools, chisels, Hacksaw, Files, Drills.	1	1
1.4	Use of tube cutters, pipe cutters & wire cutters.	½	1
1.5	Use of swaging tools, Flaring tools & Tube bending tools.	½	4
1.6	Joining of copper tubes of equal & Unequal sizes by silver soldering, brazing with oxyacetylene flame(Gas welding/ Arc Welding)	2	4
1.7	Introduction of brass fitting.	½	1
1.8	Introduction of copper fitting and Copper pipe sizing.	½	1
1.9	Flaring of tube.	½	2
1.10	Swaging of tube.	½	2
1.11	Bending of tube.	½	2
1.12	Cutting of capillary tube & sizing.	½	1
1.13	Welding(Arc, Soldering & Brazing)	1	4

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2. Fundamental of Electricity		1	-
	2.1 Basic Electricity		
	2.2 Ohms law (Resistance, volt & current relation.)	1	2
	2.3 Series circuit.	1/2	2
	2.4 Parallel circuit.	1/2	2
	2.5 Single lamp with one switch.	2	-
	2.6 Series parallel Test Board.	-	1
	2.7 Tube light connection	-	1
	2.8 Use of Volt, Amp and Watt Meter	1	2
	2.9 Use of multi meter(AVO Meter)	1/2	2
	2.10 Use of clamp on meter	1/2	2
	2.11 Electric wiring of direct cool (frost type) Refrigerator.	1	4
	2.12 Electric wiring of Water Cooler.	1/2	4
	2.13 Electric wiring of Deep Freezer.	1/2	4
	2.14 Electric wiring of window AC.	1	4
	2.15 Electric wiring of Split AC.	1	4
2.16 Electric wiring of Non-frost refrigerators.	1	4	
3 Servicing			

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3.1	Overhauling and assembling of all type of domestic compressors.	1	4
3.2	Making of Gas kit(Head & valve plate) of compressors	$\frac{1}{2}$	4
3.3	Air gap adjustment(Rotor& Stator)	$\frac{1}{2}$	4
3.4	Checking of terminal(Compressors & Motors)	$\frac{1}{2}$	4
3.5	Identification of relays and its checking.	$\frac{1}{2}$	2
3.6	Identification of overloads and its checking.	$\frac{1}{2}$	2
3.7	Identification of Thermostat and its checking.	$\frac{1}{2}$	2
3.8	Identification of Capacitors and its checking.	$\frac{1}{2}$	2
3.9	Identification of pressure switches and it's checking.	$\frac{1}{2}$	2
4	Fundamental of Refrigeration		
4.1	Introduction of Automobile Air-Conditioning.	$\frac{1}{2}$	3
4.2	Introduction and use of Refrigerant control (AEV, TEV, HSFV & LSFV, HEV, and EEV).	1	6
4.3	Introduction of electric motor (single phase).	$\frac{1}{2}$	6
✓ 4.4	Calculation of Heat Load.	$\frac{1}{2}$	8
4.5	Pump Down the system.	$\frac{1}{2}$	6
4.6	Compressor Efficiency.	$\frac{1}{2}$	6

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4.7	Identification and use of Defrosting Timer.	½	6
4.8	Use of Tachometer and Megger meter.	½	6
4.9	Making joints of door gas kit of refrigerators/ deep freezers	½	8
4.10	Preventive maintenance schedule.	½	3
4.11	Introduction & use of insulating material.	½	8
4.12	Introduction and use of heating method.	½	8
4.13	Introductions of valves, solenoid valve, & Service valve.	-	6
4.14	Introduction of Refrigeration Accessories, Muffler, Moisture indicator, Heat Exchanger, Oil Separator, accumulator, Sight Glass, Vibration Absorber, relief valve, Oil pressure control and Liquid receiver.	2	8
4.15	Energy, understanding of pressure works and atmospheric pressure.	1	-
4.16	Understanding of Heat, Sensible Heat, Latent Heat & specific heat	1	-
4.17	Laws of Refrigeration.	½	-
4.18	Refrigeration Cycle.	2	-
4.19	Properties of Refrigerants and Replacement of Refrigerants (R-12, R-22, R-134a, R-404a).	1	-
4.20	Identification and working of Temperature, Pressure and Vacuuming instruments/ devices	1	-
4.21	Charging and Recovery of Refrigerant	½	2

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	C.F.C's	$\frac{1}{2}$	-
	4.22 Eutectics.	$\frac{1}{2}$	-
	4.23 Environment friendly techniques.	$\frac{1}{2}$	-
5	Gas Charging & Troubleshooting		
	5.1 Vacuuming of all type of domestic refrigeration and air-conditioning units.	$\frac{1}{2}$	6
	5.2 Leak testing of all type of domestic refrigeration and air-conditioning units.	$\frac{1}{2}$	4
	5.3 Gas charging of Refrigerators.	$\frac{1}{2}$	5
	5.4 Gas charging of Deep Freezer/ water coolers.	$\frac{1}{2}$	5
	5.5 Gas charging of window AC.	$\frac{1}{2}$	5
	5.6 Gas charging of Split AC.	$\frac{1}{2}$	5
	5.7 Oil charging in compressor.	$\frac{1}{2}$	2
	5.8 Introduction of ducts.	$\frac{1}{2}$	1
	5.9 Introduction of Filters.	$\frac{1}{2}$	2
	5.10 Trouble shooting of Refrigerator.	$\frac{1}{2}$	8
	5.11 Trouble shooting of Window AC.	$\frac{1}{2}$	8
	5.12 Trouble shooting of Split AC.	$\frac{1}{2}$	6
	5.13 Trouble shooting of Deep Freezer/ water cooler.	1	6
6	Work Ethics	10	
Total		60	240

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LIST OF TOOLS & EQUIPMENTS FOR 25 STUDENTS

(For a Class of 25 Students)

Name of trade	HVACR Mechanic
Duration of course	3-Months


Sr. No.	Nomenclature of Equipment / Tools	Quantity
1	Tube Cutter with reamer	10 Nos.
2	Pinch off pliers	05Nos.
3	Hack saw frame	10Nos.
4	Chisels set	02 Nos.
5	Combination Pliers	25Nos.
6	Snipers	05Nos.
7	Venire Calipers	10Nos.
8	Measuring Taps	10Nos.
9	Electric hand drill machines	04Nos.
10	Multimeter (AVO Meter)	10Nos.
11	Absolute Vacuum pump	01No.
12	Wheel Pullers (Pulley Pullers)	02Nos.
13	Taps, dies and reamers	03 sets
14	Tachometer	02 Nos.
15	Clamp on meter	05Nos.
16	Work Tables (4'x6')	13Nos.
17	Flaring tools	05Nos.
18	Tube benders (lever type/ spring type)	05 set each
19	Files sets	25Nos.
20	Punches (Hollow , Centre & Number Punch)	5 set each

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21	Spanners Set (mm & Inch)	5 set each
22	Adjustable screw wrench (8" & 12")	05 each
23	Pair of Scissors	05Nos.
24	Wire Brushes (Metal)	05Nos.
25	Ratchet wrench	05Nos.
26	Gas welding set	01 set
27	Thermometers (digital & Dial type)	05 Each
28	Amp Meters (Digital)	05 Nos.
29	1000 Volt magger Insulators	01 No.
30	Testing & Charging Gauge manifold set	05 set
31	Pipe cutters	10Nos.
32	Electronic Leak Detector	2 Nos.
33	Humidistat digital	01 No.
34	Air-Conditioners (Window type)	02Nos.
35	Air Velocity meter	01 No.
36	Swaging Tools	05 sets
37	Hammer set	02 set
38	Screw drivers set	05 set
39	Socket set (inch & mm)	02 each
40	Allen key set	05Nos.
41	Fin comb set	05 set
42	Arc Welding Equipments	01 sets
43	Spirit Levels (metal)	05Nos.
44	Capacitor Analyzer	02Nos.
45	Refrigerators Direct Cool, Non Frost	3 each
46	A/C Split (1 ton, 1 ½ ton, 2 ton)	01 each

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47	Deep Freezers	01No.
48	Nitrogen cylinder set	01 set
49	Capillary tube cutter	05Nos.
50	Grip Pliers	05Nos.
51	Thimble fixing pliers	05Nos.
52	Soldering Iron 75 w	05Nos.
53	Hand Electric Blower	01 No.
54	Frillier gauge set	01No.
55	Door gas kit heater set	01 No.
56	Long nose pliers	05Nos.
57	Lock Pliers set	01 set
58	Consume able Items	As required

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Sl.No	List of Labs/workshops
1.	Basic lab/work shop
2.	Electric lab/work shop
3.	HVACR lab/work shop

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List of Consumable Items

S.No	Name of item	For 1 trainee	For 25 trainees
1.	MS flate 1/4 inch	4 inch	8.33 ft
2.	Soft copper tube 1/4 inch	8 inch	16.66 ft
3.	Soft copper tube 3/8 inch	6 inch	12.5 ft
4.	Capillary tube 0.036 inch	4 inch	8.33 ft
5.	Oxygen gas		2 cylinder refill
6.	Accitleen gas		1 cylinder refill
7.	Nitrogen gas		1cylinder refill
8.	Soldering rod		250 gram
9.	Brazing rod		250 gram
10.	Welding flux		250 gram
11.	PVC wire 3/29		1 coil
12.	PVC tap		6 no
13.	Fuse 6 Amp		12 no
14.	Single pole switch		12 no
15.	Two pin socket		12 no
16.	Lamp Holder		12 no
17.	Electric board 8x6		12 no
18.	Tube Rod 40 w		5
19.	Choke 40w		5
20.	Starter		5
21.	Connector		10
22.	Voltmeter		5
23.	Ampmeter		5
24.	Watt meter		5
25.	Flexible wire 40/76		1 coil
26.	Bulb 60 w		12
27.	Bulb refrigerator		12
28.	Bulb deep freezer		12
29.	Indication light (red,green)		12
30.	Refrigerator bulb holder		5
31.	Deep freezer bulb holder		5
32.	Door switch		5
33.	Double door switch		5
34.	Female thembols		12 dozen
35.	Current relay(non capacitor)		5
36.	Current relay(capacitor type)		5
37.	Potential relay		5
38.	PTC relay(electronics)		5

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39.	Overload		5
40.	Thermostat (refrigerator)		5
41.	Thermostat(AC)		5
42.	Selector switch(AC)		2
43.	Defrost timer		5
44.	Defrost heater		2
45.	Defrost termination switch + fuse		2
46.	Defrost fan motor		1
47.	Fan capacitor 5 micro farad		2
48.	Running capacitor 50 micro farad		5
49.	Starting capacitor 80-110 micro farad		54 liter
50.	Compressor oil		18.75 kg
51.	Refrigerator R 134 A	750 gram	75 kg
52.	Refrigerator R 22 A	3 kg	100 no
53.	Filter drier	4	1
54.	Drill bit set		5
55.	PCB kit remote type (split AC)		5
56.	Gas kit sheet	6 inch	12.5 foot
57.	Door gas kit refrigerator type	6 inch	12.5 foot
58.	Deep freezer motor type		5


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Minimum Qualification of Teacher / Instructor

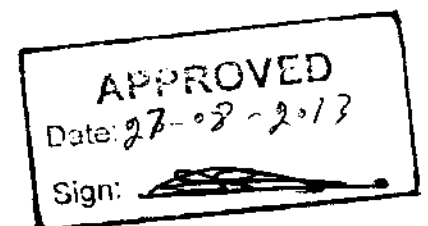
- 1. DAE (HVACR) with minimum 2-years' experience in relevant field.
OR
- 2. Two years trade proficiency certificate in (HVACR) with five-year teaching experience.

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EMPLOYABILITY OF PASS-OUT

The pass-out of this course will be able to work in the following areas / positions:

1. Maintenance mechanic in offices, hospitals etc.
2. Mechanic in Refrigerator and Air Conditioner manufacturing industry.
3. Salesman at dealers/spare parts seller shop



REFERENCE BOOKS

- 1 Modern Refrigeration and Air-Conditioning by Athous Tranquest And Good Heart.
- 2 Principal of Refrigeration by Roy J. Dossat.
- 3 Refrigeration & Air Conditioning Practice By Billy C. Langelly
- 4 Refrigeration, Air-Conditioning and Cold Storage by Raymond C. Gunther.

