The Electrical Wires, Cables, Appliances and Protection Devices and Accessories (Quality control) Order 2003.

No person shall by himself or through any person on his behalf manufacture or store for sale, sell or distribute any electrical wires, cables, appliances, protection devices and accessories which do not confirm to the Specified Standards and do not bear Standard Mark of the Bureau on obtaining certification marks Licence:

PRODUCTS

SL NO	ITEM	STANDARD
1.	Safety of Household and similar electrical Appliances-Electrical	
	immersion water Heaters	IS 302 –2- 201 (1992)
2.	Safety of household amd similar electrical Applicances – Electric iron	IS 302 – 2 –3 (1992)
3.	Safety of household amd similar electrical Applicances – Electric stoves	IS 302 –2-202 (1992)
4.	Safety of household amd similar electrical Applicances – Electric raditors	IS – 302-2 – 30 (1992)
5.	Switches for domestic and similar prposes	IS 3854:1988
6.	2 Amp switches for domestic and similar purposes	IS 4949:1968
7.	Tungsten Filament General Services Lamps	IS 418
8.	Electrical Accessories – Circuit Breakers for over current portection for house	
	hold and similar installations	IS 8828
9.	Residual current operated circuti breakers for household and similar uses (pt.1):	
	Circuit breakers without intergral overcurrent Protection (RCCBs)	IS 12640 (pt.1)
10.	Residual current operated circuit breaker for household and similar uses	
	(pt.2): Circuit breakers without Intergral overcurrent Portection (RCVOs)	IS 12640 (pt.2)
	switching elements.	IS 13947 (pt.5)
11.	PVC insulated cables for working voltages upto and including 1100V	IS 694
12.	Elastomer insulated cable (pt.1) for working voltages upto and including 1100 V	IS 9968 (pt.1)
13.	AC Watt-hour meters, class 0.5, 1 & 2 (KWH)	IS 13010
14.	AC static Watt-hour meters, class 0.5, 1 & 2 (KWH)	IS 13779
15	Acstatic transformer operated watt-hour and VAR – hour meters, class 0.2S & 0.5S	IS 14697

IMPLIMENTING AUTHORITY

GOVERNMENT OF KERALA
Power (A) Department
NOTIFICATION

G. O.(Rt.) No. 236/2004/PD Dated: Thiruvanthapuram - 7th June, 2004

S.R.O. No. 606/2004-In exercisf of the powers conferred by sub clause (b) Clause 2 of the electrical wires, Cables, Appliance, an rotection Devices and accessories (Quality contoll) Order, 2003 publiched as notification No. S.O.189(E) in the Gazette of india extraordinary, part II -Section 3, Sub Section (ii) No. 159 dtd. the 17thday of February, 2003, the Geoverment of Kerala Herby appoint the Chief Electrical Inspector, Additional Chief Electrical Inspector, Deputy Chief Electrical Inspector and Eelectrical Inspector as the appropriate authutity to implement the provisions of the said order.

By order of the Governor

Principal Secretary to Government

Definition of Salient Electrical Terms

1. Electricity: Electricity is a form of energy, which is invisible but can be felt by, some of its effects, such as lighting effects, heating effects, magnetic, effects, chemical effects, etc.

2. Votage: It is the electrical pressure which makes the electric current (electrons) to flow in the circuit. The unit by which voltage is measured is called Volt.

In A.C., We have single phase supply 230V and three phase supply 400V. Normally single phase supply is given for lighting loads and three phase supply for power intensified loads.

Low, Medium, High and Extra High Voltage.

Upto 250 Volts, it is called low voltage.

Upto 650 Volts, it is clalled medium voltage

Upto 33,000 Volts, it is called high voltage (HV)

Voltage exceeding 33,000 Volts is called extra high voltage (EHV)

3. Current : Flow of electrons in any conductor is called Current. The Unit by which the current is measured is called Ampere. There are two types of Electric current, viz., Direct and Alternating Current.

Direct Current : It is unidirectional current which changes its mangnitude but not the direction.
Alternating Current : It si the current which changes its mangitude and direction periodically.

4. Resistance: It is the prpperty of a substance which does not allow the electricity to pass through it.
The unit used to masure the resistance is called Ohm.

5. Power Factor : It is the ratio between acutal power and apparent power.

$$\text{Power factor} = \frac{\text{Actural Power}}{\text{Apparent Power}}$$

Normally, the power factor should be maintained above 0.85 (lagging) . The best power factor is 0.98.

6.Watt: It is the unit used for measuring electric power. The product of volt, ampere and the power factor is a watt.

Kilowatt Hour : The unit used to measure electrical energy is called kilowatt hour. This is the product of the electric power used in kilowatts and the No. of hours the power was utilised. The consumption bill sent to L.T consumers is based on kilowatt hour (KW Hr.)

7. Load Factor : It means

$$\frac{\text{Average Demand for the Months in K.Ws.}}{\text{Maximum Demand for the Month in K.Ws}}$$

The average demand for the month means:
Total K.W hours consumed in the month
Total hours in the month

8. Short Circuit: When positive and negative or phase and neutral wires meet each other (bare conductor) without any resistance, then it is called short circuit. High current will flow due to this and cable will be over heated.

Short circuit leading to over heating of cables will result in melting of the cables with fuse blowing out causing strain to the Board equipments.

9. Fuse: Fuse is the weakest point of an electrical circuit that may cut the circuit when an abnormal current flows. It is therefore very essentioal that fulse wire is provided for safety of machines and persons.

Lead or Tinned Copper is uded for fuse wires.

If no fuse is provided in an electrical circuit, in the event of short circuit, high current will flow in the circuit, which will heat the cables and there will be danger of fire.

10. Earth : A solid wire coming from an electrode driven 2.5 to 3 meters deep into the ground is called earth.

Earthing is done to save human life for danger of electric shock and death by blowing the fuse of the apparatus which becomes leaky (faulty).

A good earthing gives very low resistance to the flow of whole current of a circuit.
Double earth is necessary for all three phase machine for the following reasons:

(a) To give low resistance.
(b) If one earth is out of order, the second will do the work.

11. Capacitor : IT is a static device consisting of two metallic plates insulated by a dielectric medium. This dielectric medium can be air, paper or polyproplene.

The capacity of a capacitor is expressed in terms of KVAR.

12. Generator : This is an appliance which converts mechanical energy into electrical energy. The mechanical energy is produced by a prime mover, like diesel engine, steam turbine, etc.

13. Transformer : This is a static machine which converts high voltage into low voltage and vice versa, without change in supply frequency.

14. Frequency : The rate at which the no. of cycles are performed in one second is termed as frequency. The standard frequecny for AC supply in India is 50 cycles/sec.

15. Insulation Resistance : Insulation reisistance denotes the strength of the insulation of any electrical appliance. This is measured in “Meg ohms”. The instrument used for measuring the insulation resistance is called “Megger”.

CABLE SIZE SUGGESTED FOR ESTIMATED FULL LOAD OF MOTOR

HP	KW	Single Phase Amps	3 Phase Amps	Cable size in Sq.mm. Copper	Alum
0.5	0.37	3.7	1.0	1.5	-
1.0	0.75	6.5	1.9	1.5	-
1.5	1.10	11.5	2.6	1.5	-
2.0	1.50	-	3.7	1.5	-
3.0	2.20	-	4.8	1.5	-
5.0	3.7	-	7.8	1.5	-
7.5	5.5	-	11.2	1.5	-
10.0	7.5	-	15.5	1.5	-
12.5	9.3	-	19.0	2.5	-
15.0	11.0	-	22.0	2.5	6.0
20.0	15.0	-	29.0	6.0	10.0
25.0	18.5	-	35.0	10.0	16.0
30.0	22.0	-	40.0	10.0	16.0
35.0	26.0	-	47.0	16.0	25.0
40.0	30.0	-	53.0	16.0	25.0
50.0	37.0	-	65.0	25.0	35.0
60.0	45.0	-	80.0	35.0	50.0
75.0	55.0	-	94.0	50.0	70.0
100.0	75.0	-	127.0	70.0	95.0
125.0	90.0	-	152.0	95.0	150.0

A GENERAL IDEA ABOUT THE POWER CONSUMTION OF HO

TableFan	-	40W
Ceiling Fan	-	60W
Electric Iron	-	400W to 750W
Imersion Heater	-	250W to 1000W
Coil Stove	-	1250 W to 2000W
Refrigerator	-	90W (165 Ltr. Fridge consume 1 unit per day average)
500VA Stabilizer for Refrigerator	-	4 to 6 W.
Washing Machnine (without heater)	-	200 W to 350 W.
Washing Machine (With heater)	-	1500 W to 2000W.
Grinder /Mixie	-	350 to 500 W.
Window Type A/c	-	1500 to 3000 W.
Stabilizer for Air Conditioner	-	20 to 40 W
Water heater	-	1500 to 2000 W.
Television sets	-	60 to 90 W.
Video Cassette Recorder	-	70 to 120 W

Out of above items like auto electric Iron, auto Coil stove, Water heater, Refrigerator, Air Conditiners having thermostat controls consumption is only according to its usage.

UNITS OF ELECTRICAL ENERGY CONSUMED BY COMMON DOMESTIC APPLIANCES/ EQUPMENTS

Electrical Appliance	Wattage Rating	Time for 1 unit of Consumption
Incandescent Bulb	25W	40 hrs
Incandescent Bulb	60 W	25 hrs
Incandescent Bulb	100 W	10 hrs
Flourescent Tube light 2 ft.	20 W	20 hrs
Flourescent Tubelight 4 ft.	40W	25 hrs
Night Lamp	15 W	66 hrs 40 mins
Mosquito Repellent	5 W	200 hrs
Fan	60 W	16 hrs 40 mins
Air Cooler	170 W	5 hrs 50 mins
Air Conditioner (1-1.5 Ton)	1500 –2500 W	40 to 30 mins
Refrigerator (165 liters)	100 W	10 hrs
Mixer/ Blender/Juicer	450 W	2 hrs 15 mins
Toaster	800 W	1 hr 15 mins
Hot Plate	1000 –1500 W	1 hr 40 mins
Oven	1000 W	1 hr

CFL lamp replaces the GLS lamp in brightness as follows:

CFL Watt	5	7	9	10	11	13	15	16	20	25	26
GLS Watt	25	40	50	60	60	70	75	80	100	130	130

Note: Wattage ratings given above are only indicative

Please avoid using heavy domestic appliances between 6 and 9 both in the morning and evening. These are Peak Hours when power consumption should be minimised.

SAVE POWER IN THE INTEREST OF THE NATION

How to Calculate Electric Power Consumption:

1000W burned for 1 hour = 1 unit of electricity consumed = 1 klowatt Hour (kwh). Thus the rule is to multiply rating by the number of hours used and divide by 1000 to get Kilowatt Hours (1 kwh = 1 unit of Electricity)

UNITS OF ELECTRICAL ENERGY CONSUMED BY COMMON DOMESTIC APPLIANCE /EQUIPEMNTS

Electrical Appliance	Wattage Rating	Time for 1 unit of Consumption
Electric Kettle	1000-2000W	1 hr to 30 mins
Iron	450-700 W	2 hrs 15 mins to 1 hr 25 mins
Water Heater 1 ½ - 2 litre capacity (Instant Geyser)	3000 W	20 mins
10-20 litre (storage type)	2000W	30 mins
Immersion Heater	1000 W	1 hr.
Vaccum Cleaner	700 –750 W	1 hr. 20 mins
Washing Machine	325 W	3 hr
Water pump	750 W	1 hr 20 mins
Television	60-120 W	16 to 8 hrs
Radio	15 W	66 hrs 40 mins
Video	40 W	25 hrs
Tape Recorder	20 W	50 hrs
Stereo Systyem	50 W	20 hrs

COMBINATION OF LUMENS REQUIRED FOR ROOMS

The lamp lumens required to light a room are conputed from the following formulae:

Lamp lumens required = $\frac{\text{lux x Area of Room (sq.m)}}{\text{Utilization factor x Maintenance factor}}$

Lamp lumens per liminaire = $\frac{\text{Total limes required}}{\text{Numer of luminaires to be installed}}$

Or conversely, Lux = $\frac{\text{Total lamp lumes x utilization factor x Maintenance factor}}{\text{Total are in square metre}}$

READY RECKONER FOR DOL STARTING MORTORS 415 V : 3 PHASE 50 HZ

Motor Rating Current in		Full Load Range	OverLoad Back up HRC Fuse			Recommended Switchgear Rating	Recommended in size sq. mm.		Cable
HP	KW	Amps				Amps	Amps	Al.	Cu
0.5	0.37	1	7.72	-	1.14	4	16	1.5	1.5
0.75	0.55	1.4	1	-	2	6	16	1.5	1.5
1	0.75	2	1.5	-	2.5	6	16	1.5	1.5
1.5	1.1	2.6	2.5	-	4	10	16	1.5	1.5
2	1.5	3.5	2.5	-	4	16	16	1.5	1.5
3	2.2	4.8	4	-	6	16	16	1.5	1.5
5	3.7	7.5	6	-	10	25	32	2.5	1.5
7.5	5.5	11	9	-	14	25	32	1.5	1.5
10	7.5	14	10	-	16	35	63	2.5	2.5
12.5	9.3	18	13	-	21	35	63	4	2.5
15	11	22	18	-	24	50	63	6	4
20	15	28	20	-	32	63	63	10	6
25	18.5	35	28	-	42	80	100	16	10
30	22	40	28	-	42	100	100	16	16

READY RECKONER FOR STAR DELTA STARTING MORTORS 415 V : 3 PHASE 50 HZ

Motor Out put	Full Load Current		OverLoad	Recommended Back up HRC Fuse			Recommended Switchgear	Recommended Cablex	
HP	KW	Line	Phase	Relay range in Amps			in Amps	in Amps	in Sipply side	Sq.mm Motor Side
3	2.2	5	2.8	2.5	-	4	16	16	1.5	1.5
5	3.7	7.5	4.3	3	-	6	16	16	1.5	1.5
7.5	5.5	11	6.5	6	-	10	25	32	2.5	1.5
10	7.5	15	9	6	-	10	25	32	2.5	1.5
12.5	9.3	18	11	9	-	14	35	63	4	2.5
15	11	22	12.7	10	-	16	35	63	6	2.5
20	15	29	16.8	13	-	21	50	63	10	4
25	18.5	35	20.2	18	-	24	50	63	16	6
30	22	40	23	20	-	32	63	100	16	6
35	26	47	27	20	-	32	63	100	25	10
40	30	53	30.6	20	-	32	63	100	25	10
45	33.5	60	35	28	-	42	100	200	35	16
50	37	66	38	28	-	42	100	200	35	16
60	45	80	46	45	-	70	120	200	50	25
75	55	100	57	45	-	70	160	200	70	35
90	67.5	120	69	60	-	100	200	250	95	50
100	75	135	78	60	-	100	200	250	95	50
125	90	165	95	90	-	150	250	300	150	70
150	110	200	115	90	-	150	250	400	185	95
175	130	230	133	120	-	200	320	400	240	120
200	150	275	159	120	-	200	350	400	240	120

FIRST AID IN CASE OF ELECTRIC SHOCK HOLGER NIELSEN METHOD OF ARTIFICIAL RESUSCITATION

1. Protect yourself with dry insulating material.

2. Break the circuit by opeing the power switch and release the victim.

3. Don't touch the victim with your bare hands until the circuit is broken.

4. Lay the patient, face downwards with forehead resting on the hands, placed one above the other.

5. Remove false teeth, tobacco or gum form the patient's mouth:make sure the tongue is free by firm blows between the shoulders with the fist of the hand.

6. Kneel, on one knee at the patient's head,one foot by the patient's elbow.

7. Place palms of your hands on patient's shoulder blades.

8. Rock forward until arms are vertical;the pressure should be light and without force (22.30 lbs. Is sufficient):this should take 20 seconds.

9. Release the pressure by allowing the hands to slide down the arms to the patient's elbows(approx. 1 second)then rise the patient's arm and shoulders slightly pulling, at the same time by swinging backwards (approx. 2-1/2 second). Lower the patient's arn and return your hand to the patient's shoulder blades.

10. Repeat the movements taking 7 seconds for each complete respiration.

11. While artificial respiration is continued, have someone else,

a. Loosen Patient's clothing.
b. Send for the doctor
c. Keep patient warm

12. If the patient stops breething,continue artificial respiration. Four hours or more may be required.

13. Do not give liquids until patient is conscious.

TREATEMENT FOR ELECTRIC BURNS

If as a result of electric shock the patient is suffering from burns, the following treatement should be given without hindrance to artificail resuscitation.

a. Remove clothing locally to enable the burn to be treated but do not break blisters.

b. Saturate burns with warm solution of one dessert spoonful of bicarbonate of soda to a pint of warm water, or a tea-spoonful of salt to a pint of warm water.

c. Cover with lint soaked ina similar solution and bandage (lightly if blisters have formed).

d. If the above solutions are not available, cover with sterile dressing

e. Warm, weak, sweet tea may be given when the patient is able to swallow.

DIRECT ARTIFICAIL RESUSCITATION (Mouth to Mouth method)

1. Place the victim on back immediately.

2. Clear throat of water, mucus, toys, coins or food.

3. Tilt head back as far as possible.

4. Lift jaw up to keep tongue out of air passage.

5. Pinch nostrils to prevent air leakage when you blow.

6. Blow until you see the chest rise.

7. Listen for snoring and gurgling signs of throat obstruction.

8. Repeat blowing 10-20 times a minute.

In the case of infants and small children tilt the head fully back, surround the moth and nose completely with your mouth. Blow with only enough force to produce a visible rise in the victim's chest and no more. Repeat every 2 seconds.

Continue direct artificial resuscitation until victim breathes for himself, or unitl expert help is obtained.

SCHAFER'S METHOD OF ARTIFICIAL RESUSCITATION.

1. Protect yourself with dry insulating material.

2. Break the circuit by opeing the power switch and release the victim.

3. Don't touch the victim with your bare hands until the ciruit is broken.

4. Lay patient on stomach-one arm extended, the other bent at elbow. Turn face outward resting on foream.

5. Remove false teeth, tobacco or gum from patient's mouth.

6. kneel on one side of patient's thigh facing his head, with knees and hips bent.

7. Place palms of your hands on patient's back with little fingers just touching the lowest ribs.

8. With arms straight, swing forward gradually brining the weight of your body to bear upon the patient (approx. 2 seconds.)

9. Swing backward slowly to relieve the pressure (approx. 3 seconds).

10. Repeat twelve times per minute taking 5 seconds for every complete double movement.

11. While artificial resuscitation is continued, have someone else;

a. Loosen patient's clothing.

b. Send for doctor.

c. Keep patient warm.

12. If patient stops breathing, continue artificial resuscitation. Four hours or more may be required.

13. Don't give liquids until patinet is conscious.

GUIDELINES FOR CONSERVATION OF ELECTRICAL ENERGY

Conservation of electrical energy has become the challenge of today. Reduction in demand through efficient utilisation of energy and wast reduction may be deemed as "energy conservation".

The easiest and quickest method is by way of adopting simple measures immediately by all sectors of power consumers without involvement of cost.

IMMEDIATE MEASURES:

The easiest and quickest method is by waw of adopting simple measures immediately by all sector of power consumers without involvement of cost.

A. DOMESTIC SECTOR

1. Swich off lights, fan coolers, air conditioners and heaters,when not required.

2. Make greater us of day light for illumination and abvoid use of electrical light during day time.

3. Accumulation of dust and soot reduces the useful light output. Keep lamps and fixtures free form dust and soot.

4. Avoid us of energy for decorative lighting. Switch off all the lights other than those needed for security, when building is unoccupied.

5. Repair leaks and insulate the pipes of hot water supply.

6. Minimise opeing of fridge doors to the extent possible

B.COMMERICLA ESTABLISHMENT:

1. Switch off water coolers at the end of normal business hours.

2. Reduce the number of lifts in service during hours, when most occupants are not leaving or entering builing. Switch off the electrical mechanism for the lifts not in use.

3. Encourage persons walk up and down one flight of stairs rather than use the lift.

C. INDUSTRIAL SECTOR:

1. Tighten the belt and pulley at required intervals to reduce losses due to slip.

2. Lubricate motors and drives regularly to reduce friction.

3. The motors should be cleaned to facilitate proper cooling.

4. Heat losses in furnace can be reduced by minimising opening of doors.

Note : Measures given at 'A' are also applicable to B &C category of consumers.

SHORT TERM MEASURES :

In addition to the above, there are certain short tem measures which will involve very little cost, resulting

in appreciable saving in electricity. These measures are mentioned for adoption by the respective category of power consumers.

A. DOMESTIC AND COMMERCIAL SECTOR :

1. Use high efficiecy lamps giving more light for each watt or energy consumed. For proper selection of lamps and tubes, the luminous efficiency (lumens per watt) of various light sources are given below :

Incandescent	17.32	lumens per watt
Mercury Vapour	58.66	- do-
Fluorescent	67.91	- do-
High pressure Sodium vapour	90-110	- do-
Low pressure Sodium vapour	183	- do-

2. Use high quality switches to ensure minimum loss

3. Dark surfaces generally absorb light and more energy will be consumed to provide acceptable light level. Use light colours for walls and ceiling.

4 Always use good and standard quality of electrically operated equipment and appliances

5. Improve lighting system efficiency by adopting more frequent fixture maintenance.

6. Reduce the level of illumination at selected work which will not affect work performance and safety levels.

7. Modify existing lighting fixtures and their location in the room to provide a greater amount and better quality of lighting.

B. COMMERCIAL ESTABLISHMENTS :

1. Mark all ganged switches with identification of light contrl and instruct occupants and maintenance personnel to switch off all lights which are not required even for a portion of the day.

2. Decrease the partition heights where possible.

3. Provide time switches for areas that are commpnly used for short periods.

C. INDUSTRIAL SECTORS :

1. Motor should be placed as close to load as possible.

2. Group driving should be replaced with individual driving as far as possible and feasible.

3. The alignment betwwn the motor and the drive equipment should be checked periodically to reduce the excessive troques on bearings.

4. Replace wornout bearings immediately.

5. Suitable interlocks should be provided to avoid idle running of motors.

6. An improvement in mechanical efficiency of the drive to which loads have been connected is necessary for reducing losses.

D. IRRIGATION SECTOR :

Most of the pumpsets that are being used at present are very inefficient with the result that they consime large quantum of electricity. There is scope for saving about 25% of the total energy consumed by the pumpsets without affecting their output. Some of the short term measures which can be adopted with a small capital inverstment are :

1. Proper alignment of pump and motor shaft :

The pump and motor shafts should be in proper alignment. If shafts meet at an angle of their centres are not in line, it causes damage to impeller and couplings and also results in heating of bearings. This alignment should be checked regularly with the help of the spirit level.

2. Use of low resistance foot valve can reduce electrical energy consumption by about 100%

3. Use of PVC pipes instead of G.I pipes and reducing the number of bends insuction and delivery protions will reduce friction and theryby resulting in appreciable saving in electricity.

E. STREET LIGHTING :

Reduce the consumption of street light by providing lamps of high efficiency, viz., Sodium Vaporu lamps.

LONG TERM MEASURES :

There are certain long term measures which will involve capital investment so as to achineve considerable saving in electricity:

DOMESTIC & COMMERCIAL

1. Use of standard quality and correct size of cable.

2. Using lamps with built in reflectors which would enable the use of lower wattange bulbs and to have lesser light points to achieve the needed illumination.

3. When designing new high schemes, the cost of operations and power consimption should be considered and not merely the initial cost of the installation.

INDUSTRIES :

1. The factory premises shall be do designed as to avoid use of electric lights during day time and fans during summer. Substantial energy can be saved.

2. Illumiation system should be properly designed so that minimum recommended lumens are made avilabel through improved type of electrical fittings. Use of vapourlamps instead of incandescent lamp for illuminating large areas will not only improve the illuminations by alsoreduce electricity consumption.

3. Bulk of power consumption in industries is accounted for by the motor drives. It is therfore essential that motors insttalled are effiecient (consuming less power) and conform to ISI Standards. It is also essential that proper size motors are installed after examining the nature of load it has to drive.

4. Where variable speed motors are requred, it is desirable to use D.C motors with Thyristor control instead of slipring induction motors.

5. Power Factor, Power Factor plant operation and energy conservation go hand in hand.

A good factor means less load on the feeder, better plant voltage and a good size reduction in monthly consumption bill.

WHAT IS POWER FACTOR?

The electric system carrries two types of power, viz useful; power (KW) that goes to pull load and reactive power (KVAR) which generates magnetism in induction motors.

Power Factor is the ratio between actual powe and apparent power, i.e KW/KVA. This should not be less 0.85. The best power factor is 0.98.

POWER FACTOR IMPROVEMENT :

Improvement in power factor can be achieved by employing shunt capacitor across motor terminals or by using thyristor contrl shunt capacitors for heavy loads, like are furnace for steel melting. This avoids fulctuations in supply net-work due to rapid changes in reactive power. In other cases also, though there may not be direct benefit but improvemtn in power factor means a stable voltage which avoids damages to the equipments. It is in the interest of the consimers to maintain power factor within prescribed limits. Shunt capacitors certified by ISI should be used. Polyproplene capacitors should invariably be used instead of paper capacitors. The polyproplene capacitos have substantially lower losses and are lighter as compared to paper capacitors.

Recommeded values of static capacitive reactance in KVAR for power factor improvements

A. INDUCTION MOTORS (L.T)

Sl. No.	Total Motor Rating	Insisted H.P			KVAR rating Of Capacitors
1.	Upto	3			1
2.	Above	3	Upto	5	2
3.	“	5	“	705	3
4.	“	7.5	“	10	4
5.	“	10	“	15	5
6.	“	15	“	20	6
7.	“	20	“	25	7.5
8.	“	25	“	30	10
9.	“	30	“	40	12
10.	“	40	“	50	14
11.	“	50	“	60	18
12.	“	60	“	80	22
13.	“	80	“	100	25
14.	“	100	“	130	35

OBSERVANCE OF PERIODICAL MAINTENANCE SCHEDULE OF MACHINES/ EQUIPMENTS :

Observance of proper maintenance schedule on daily/monthly/quarterly and yearly bais will help in efficient operation of the equpment of the plant and saving in energy. This will thus avoid overloading/ damage to the motors:

ENERGY AUDIT :

Energy audit is a systematic and scientific approach for energy conservation.

What is meant by Energy/Audit?

It is detailed study made in three stages, viz.

1. How much quantity of energy is consumed every month?

2. The areas where energy is consumed, and

3. How is the energy actually utilised and the extent of possible reduction?

The above study will enable any industry to reduce its monthly consumption to samll percentage intially and result in sizable saving ultimately.

A Committee comprising of Production Manager, Electrical Engineer or Supervisor and Workers representative (among those working) will have to be formed by every industry to undertake the above study.

The following are some guidelines for taking up Energy Audit:

i. Identify specific areas of electricity consumption viz., Offices, Factory premises, Processing Section etc. Use monthly figures of consimption and production for comparative study.

ii. Examine the areas of high electricity consumption and possibility for substantial saving.

iii. Find out the possibel course of action and choose the best and after examining the finaicial implications.

iv. Check whether any modification to the existing arrangement of the plant will have unforeseen benefits or adverse effects.

v. Examine whether the opeating instructions have to be updated and frequency of maintenace increased for power intensive plant equipments.

vi. Examine whether the existing porcess of manufacture will have to be replaced by a new method.

STREET LIGHTS:

i. During off peak night hours (i.e after 10 P.M) alternate street light can be switched off.

ii. Photo sensitive time switches can be used to control the switching off street lights.

iii. Use of low pressure sodium vapour lamps at important junction in replacement of Flourescent tubes could be though inspite of high cost, which would give more light spread over greater area with less power consumption.

AGRICULTURAL PUMPSETS :

1. The agricultural consumers should be advised to instal shunt capacitors of adequate capacity with referece to H.P of their pumpsets. This will not only improve the looses but would facilitate to maintain the voltage and thereby avoid damage to the motor.

2. Practical studies conducted in rural areas have revealed that the use of low resistance mylon foot valve saves 10% of the energy consumed by a pumpset.

3. Use of rigid PVC pipes on the suction side can save another 10%. PVC rigid pipes can also be used on the delivery side. It has been noticed that there will a over all saving of 25% energy consumption by using PVC pipes and lowresistance footvalve.

STANDARD SIZE OF CABLES AND EARTHING CONDUCTORS FOR MOTORS.

Rating of Motors (HP)	Cable Sizes PVC APVAC	Backup fuse DOL. Starting	Backup fuse Assisted Starting	Earthing conductors CU.	Earthing conductors Al.
Upto 5	4	25	25	10	25
6 to 10	6	35	25	10	25
11 to 175	10	50	35	10	25
18 to 20	16	63	63	10	25
21 to 25	25	80	63	10	25
26 to 30	25	100	63	6	35
31 to 40	35	120	100	6	35
41 to 50	50	160	100	6	35
51 to 60	70	200	120	4	50
61 to 75	65	200	120	40	50
76 to 100	185	250	200	2	70
101 to 125	240	320	250	2	95
126 to 150	400	350	320	1/0	120
151 to 175	2x150	400	320	1/0	120
176 to 200	2x185	500	350	1/0	120
201 to 225	2x240	500	350	25x3	185
226 to 250	2x240	600	500	25x3	185

APPROXIMATE WEIGHT OF COPPER STRIPS ELECTROLYTIC GRADE

WT IN KGS/MTRS

Width	1/16" 1.6mm	1/8" 3.2mm	3/16" 4.67mm	¼" 6.4mm	3/8" 9.53mm	½" 12.7mm
½" or 12.70 mm	.184	.367	.574	.746	1.089	1.434
5/8" or 15.88 mm	.230	.456	.717	.932	1.363	1.793
¾" or 19.05 mm	.275	.550	.860	1.119	1.635	2.151
1" or 25.40 mm	.362	.734	1.417	1.491	2.180	2.868
1 ¼" or 3.75 mm	.459	.918	1.434	1.864	2.725	3.585
1 1 /2" or 38.10 mm	..	1.104	1.720	2.237	3.720	4.302
2" or 50.80 mm	..	1.470	2.294	2.982	4.359	5.736
2 ½" or 57.15 mm	..	..	2.582	3.356	4.905	6.453
2 ½" or 63.50 mm	..	..	2.868	3.729	5.449	7.170
3" or 76.20 mm	..	..	3.442	4.475	6.539	8.604
4" or 101.60 mm	..	..	4.588	5.965	8.719	11.472
5" or 127.00 mm	..	..	5.736	7.457	10.898	14.340
6" or 152.40 mm	..	..	6.883	8.948	13.078	17.208

ALUMINIUM STRIPS WEIGHT (Appx.) IN K.G PER 12 RFT (3.656 MTS)

Width	1/8" or 3.2mm	3/16" or 4.76mm	1/4" or 6.4mm	3/8" or 9.53mm	½" or 12.7mm
1 ¼" or 31.8 mm	1.000	1.600	2.000	3.200	4.000
1 ½" or 38.1 mm	1.300	..	2.400	3.600	4.800
1 ¾" or 44.5 mm	1.400	..	2.800	..	..
2" or 50.8 mm	..	..	3.200	4.800	6.400
2 ½" or 63.5 mm	..	..	4.000	6.000	8.000
3" or 76.2 mm	..	..	4.800	6.000	9.000
4" or 101.6 mm	..	..	6.500	..	13.600
5" or 127.0 mm	..	..	..	..	16.600
6" or 203 mm	..	..	9.900	..	19.800
8" or 203.2 mm	..	..	..	19.00	..

CURRENT RATING FOR COPPER & ALUMINIUM CONDUCTORS VULCANISED RUBBER, PVC OR POLYTHENE INSULATED CABLES (SINGLE, TWIN, THREE & FOUR CORE)

Item	Standard Copper Conductor		Continuous Current Rating (Subject to Voltage Drop)(Amps)					Standard Aluminium Conductor	
	Area	Strand	In conduit Trouging or casing (2 single Core Cables)	Bunche in free Air or Open Trench		One Twin Core DC or AC	One 3 or 4 Core Cable Balanced 3phase	Area	Strand
	(Sq.in)	(Inch)		2 Single Core Cables	3or4 Core Cables			(Sq. mm)	(mm)
1	0.0015	1/004	5	5	5	5	5	-	-
2	0.002	3/.029	10	10	10/9	10	8/7	1.5	1/1.40
3	0.003	3/.036	15	15	13/12	15	10/11	2.5	1/1.80
4	.0045	7/029	20	20	15	20	15	-	-
5	-	-	20	20	17	20	14	4	1/2.80
6	-	-	27	27	24	27	19	6	1/2.80
7	0.007	7/.052	28	28	25	28	20	-	-
8	-	-	34	34	31	34	24	10	1/3.55
9	0.01	7.044	36	36	31	34	24	10	1/3.55
10	0.0145	7/052	43	43	39/38	43	30	16	4/1.70
11	0.225	7/.64	53	53	48	53	37	-	-
12	-	-	59	59	54	59	42	25	7/2.24
13	0.03	19/044	62	62	56	62	43	-	-
14	-	-	69	69	62	69	48	35	7/2.50
15	0.04	19/052	74	74	67	74	52	-	-
16	-	-	-	91	82	91	62	50	7/3.00
17	0.06	19/064	-	97	88	97	68	-	-
18	0.075	190.072	-	123	107	115	78	-	-
19	-	-	-	134	118	118	82	70	19/2.24
20	-	-	-	153	138	135	94	95	9/2.50
21	0.1	19/083	-	160	140	140	98	-	-
22	0.12	37/064	-	177	158	158	109	-	-
23	-	-	-	184	170	162	114	120	37/2.24
24	0.15	37/083	-	205	185	180	126	-	-
25	-	-	-	210	185	181	157	150	37/2.24
26	-	-	-	246	216	209	146	185	37/2.4
27	0.2	37/083	-	250	220	218	153	-	-
28	-	-	-	290	248	240	169	225	37/2.80
29	25	37/093	-	293	260	252	178	-	-
30	0.3	37/093	-	335	295	284	199	-	-
31	-	-	-	354	302	389	202	300	61/2.50
32	-	-	-	425	360	342	240	-	-
33	-	-	-	453	372	-	-	400	31/3.00
34	5	61/0.93	-	480	410	-	-	-	-
35	-	-	-	480	411	-	-	500	91/2.65
36	-	-	-	565	484	-	-	625	91/2.65
37	75	91/103	-	610	520	-	-	-	-
38	1.0	127/103	-	740	630	-	-	-	-

"Rating Ambient Temprature 30^0 C"

For Ambient Temprature other than 30^0 C

Rating should be multiplied by the following Rating factors 25^0 C 35^0 C 40^0 C 45^0 C
Rating factor1.13 96 69 47

In the above table current rating (subject to voltage drop) have been given for Copper conductor cables(in conventional British Standard sizes)and also for the cables with Aluminium conductors(in the new metric sizes as per I.S 1753-1961)from this chart, the requires size of Aluminium conductor can be established if either the Current Rating or the size of the Copper conductor is known.

STANDARD SIZE OF CABLES AND EARTHIG CONDUCTORS FOR GENERATORS

Generator Capacity In KVA	Cable Size PVC/APVC	Earthing Conductor
15	10	10
63	50	4
100	95	2/25 x3
160	185	25 x 3
200	2 x 120	25 x 3
250	2 x 185	25 x 3
400	2 x 400/ 3x 300	25 x 3
500	3 x 400/ 4x 240	25 x 3

PROTECTION FOR GENERATORS

Upto 15 KVA	-	MCB
15 TO LESS THAN 63 kva	-	MCB
63 "100 KVA.	-	MCCB or Contractor adequately backed up by HRC fuse
100 "200 KVA	-	MCCB/OCB/ACB with thermal O/L backed up by HRC fuse.
200 "250 KVA	-	OCB/ACB with thermal O/L backed up by HRC fuse
250 "500 KVA	-	OCB/ACB with thermal O/ L,O/C, E/F,REF/differential protection and fuel shut off.
500 "1 MVA	-	OCB/ACB with thermal O/ L,E/Fdifferential voltage controlled O/C relay, and fuel shut off.
1MVA and above	-	Thermal O/L, differntial, Voltage controlled O/C relay O/V, U/V over speed, Roter E/F negative sequence relay

COPPER PLATE	COPPER TUBE
1.2' X 2' X 1/8" siz	1.34" x 5.8" 1/8"
-11kg per plate	-0.25kg per teet
2.2' x 2' x 1.4" size	2.58" x ½" 18" t
-22 Kg per plate	-0.22 Kg per tee
3.1' x 1' x 1/8" size - 2.80 Kg per plate	

Rubber Mat.

(1) 6' x 3' x 1" thick siz

-6 Kg Sq.tt

(2) 6' x3' x 1.4" thick
Size – 27 Kg per sheet

GALVANISED EARTHING DETAILS

G.I Cond Size	Area MM2 Kg/M	Nominal Dia MM Ohm/M	Approx Weight	Approx Resistance
14 S.W.G	3.24	2.03	0.020	.0.433
12 S.W.G	5.48	2.64	0.044	0.02565
10 S.W.G	8.35	3.26	0.067	0.0162
8 S.W.G	12.97	4.06	0.104	0.01063
4 S.W.G	27.27	5.89	0.218	0.00505
25 X 3MM	75.00	-	0.600	0.0017
32 X 6 MM	192.00	-	1.536	0.0007
50 X 6 MM	300.00	-	2.400	0.00033

WEIGHT OF G.I FLAT / WIRE

	Size	Weight	Per
G.I FLAT	1" X 1/8" or 25 x 3 mm	656 Kgs	Metere
	1 ¼" or 25 x 6 mm	1,300 Kgs	"
	1 ¼" x ¼" or 31 x 6mm	1,600 Kgs	"
	1 1 /2" x ¼" or 38 x 6 mm	1,900 Kgs	"
	2" x ¼" or 50 x 6mm	2,500 Kgs	"
G.I Wires	16 SWG	0.021 Kgs	"
	14 SWG	0.030 Kgs	"
	12 SWG	0.054 Kgs	"
	10 SWG	0.082 Kgs	"
	8 SWG	0.131 Kgs	"
	6 SWG	0.192 Kgs	"
STRANDED	7/20 SWG	0.041 Kgs	"
G.I WIRE	7/11 SWG	0.430 Kgs	"

WELDING TRNASFORMERS

KVA rating Transformer	Required Capacitor rating In KVAR	KVA rating of Transformer	Required Capacitor rating In KVAR
9	4	36	18
12	6	57	25
18	8	95	45
24	12	128	50
30	15	160	75

WEIGHT OF BRASS FLATS IN KILOGRAMS PER METRE

Thickness In inches	Dimensions of Width in inches								
	½"	¾"	1"	1 ¼"	1 ½"	1 ¾"	2"	2 ¼"	2 ½"
1/8"	0.340	0.510	0.680	0.850	1.020	1.190	1.360	1.530	1.71
3/16'	0.512	0.768	1.024	1.280	1.536	1.792	2.048	2.304	2.50
¼"	0.684	1.026	1.369	1.710	2.052	2.394	2.736	3.078	3.41
5/16'	0.858	1.280	1.715	2.144	2.573	3.002	3.430	3.859	4.21
3/8"	1.029	1.544	2.059	2.573	3.088	3.603	4.007	4.632	5.11
7/16'	1.199	1.798	2.398	2.997	3.597	4.196	4.796	5.325	5.91
½"	-	2.057	2.742	3.428	4.114	4.799	5.485	6.171	6.81
5/8"	-	2.570	3.427	4.284	5.141	5.998	6.854	7.711	8.51
¾"	-	-	4.1113	5.142	6.170	7.198	8.227	9.255	10.2

WEIGHT OF COPPER FLATS IN KILOGRAMS PER METRE

Thickness In inches	Dimensions of Width in inches								
	½"	¾"	1"	1 ¼"	1 ½"	1 ¾"	2"	2 ¼"	2 ½"
1/8"	0.359	0.538	0.718	0.897	1.077	1.256	1.435	1.615	1.76
3/16"	0.536	0.804	1.072	1.340	1.608	1.876	2.144	2.412	2.68
¼"	0.718	1.077	1.436	1.795	2.154	2.513	2.872	3.231	3.56
5/16"	0.896	1.344	1.792	2.240	2.688	3.136	3.584	4.032	4.46
3/8"	1.076	1.614	2.152	2.690	3.228	3.766	4.304	4.842	5.38
7/16"	1.256	1.884	2.512	3.140	3.768	4.396	5.024	5.652	6.26
½"	-	2.153	2.870	3.588	4.305	5.023	5.740	6.459	7.17
5/8"	-	2.692	3.589	4.486	5.383	6.280	7.178	8.075	8.91
¾"	-	-	4.307	5.383	6.460	7.537	8.613	9.690	10.70

SELECTION CHART FOR MCB s HOUSEHOLD APPLIANCES

Appliance	Capacity/Approx. Wattage at 230 Volts A.C. Single Phase	Current Rating of MCB	Type of MCB
Air Conditioner	1 Tonne Capacity	10 amps.	'G' Series
	1.5 Tonne Capacity	16 amps.	"
	2 Tonne Capacity	20 amps	"
Refrigerator	165 liters	1.5 amps	'G' Series
	285 liters	2 amps	"
Cooking Range with Oven cum Griller	4500 watts	25 amps	'L' Series
Oven cum Griller	1750 watts	10 amps	"
Oven Only	750 watts	6 amps	"
Hot Plate only	2000 watts	10 amps	"
Room Heater	1000 watts	6 amps	'L' Series
	2000 watts	10 amps	"
Washing Machine	300 watts	2 amps	'G' Series
-Do- (With Heaters)	1300 watts	7.5 amps	"
Water Heater (Storage or Instantaneous)	1 KW	6 amps	'L' Series
	2 KW	10 amps	"
	3 KW	16 amps	"
	6 KW	30 amps	"
Electric Iron	750 watts	6 amps	'L' Series
	1250 watts	7.5 amps	"
Electric Kettle	1500 watts	10 amps	'L' Series
Auto Toaster (2 slices)	1200 watts	6 amps	'L' Series

ADVERTISER'S INDEX

Sl.No.	Name of Firm	Item	Page No.
1	Ajanta Electricals, Mumbai	Full page	53
2	Akash Electricals, Delhi	Full page	37
3	Almonard Ltd, Ernakulam	Full page	68
4	Atual Industries, Mumbai	Full page	48
5	Central Marketing Syndicate, Ernakulam	Full page	1
6	Chaarms Electricals & Electronics, Mumbai	Full page	60
7	Coastal Agencies, Ernakulam	Full page	28,29,30,31
8	Coastal Enterprises, Ernakulam	Full page	6,7,8,9,10,11
9	Dalal Electricals, Aligarh	Full page	62
10	Elle Electricals Pvt. Ltd, Ernakulam	Back Inside page	77
11	Electromag India (P) Ltd, Ernakulam	Half page	66
12	Everest Agencies, Ernakulam	Full page	4, 27, 51,
13	Finolex Cables Ltd, Ernakulam	Full page	47
14	Gem Agencies (Kerala), Ernakulam	Full pages	18,19,20,21,22,23,24,25,26,
15	Guru Agencies, Ernakulam	Full page	35
16	Guru Instruments & Spares, Ernakulam	Full page	41
17	Hari Om Trades, Ernakulam	Full page	32.33
18	Havell's India Ltd, Ernakulam	Full page	40,46,52
19	Henley Cable Corporation (India), Delhi	Half page	14
20	Hi- Power Electricals, Delhi	Full page	70,
21	HPL India Ltd, Ernakulam	Full page	16,17
22	Jalaram's, Ernakulam	Full page	39
23	Josalin Electrical Industries, Madurai	Full page	58
24	Kalki Industries, Mumbai	Full page	71
25	Kalki Switchgear (P) Ltd, Mumbai	Full page	5
26	Katson Traders, Ernakulam	Full page	3
27	Legrand India (P) LTD, Ernakulam	Full page	45
28	Manmal Electricals, Coimbatore	Full page	55
29	Mepro Electricals, Aligharh	Full page	50
30	Orient Fans, Ernakulam	Half page	66
31	Rank Iluminators, Aligarh	Full page	72
32	R.C.Electricals, Kannur	Half page	36
33	Real Electricals Pvt. Ltd, Ernakulam	Full page	61
34	Rolex Electro Products Pvt. Ltd. Cochin 33	Home Page	
35	Shree Ganesh Electricals, Mumbai	Full page	38,54,57
36	Shri.Somnath Electricals, Mumbai	Full page	12
37	Shuli Trade Links, Thalassery	Full page	42,43
38	Shyam Industries, Ernakulam	Full page	69
39	Sooraj Electricals, Thiruvananthapuram	Full page	44,49
40	Super Tech Power Control Pvt. Ltd, Jalandhar	Half page	36
41	Techno Meters & Electronics, Ernakulam	Full page	34
42	Techno Plastics (India) Pvt. Ltd, Mumbai	Full page	15
43	The Standard Agencies, Ernakulam	Back Inner(facing page)	73,74,75,76
44	Thejus Enterprises, Ernakulam	Full page	13
45	Tony Enterprises, Ernakulam	Full page	64
46	Trans Electrics, Ernakulam	Full page	56,59,63,65,67
47	U.K.Agencies & Electricals, Tvm.	Full page	2
48	Veena Electric Industries, Mumbai	Half page	14