



# ELECTRICAL INSTALLATION ENGINEER

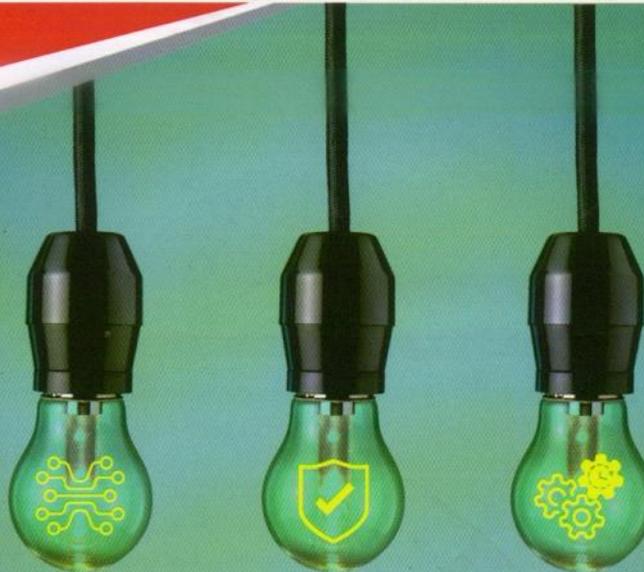
## NEWS LETTER

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## EDITORIAL

Dear Members, Fellow Professionals and Friends,

*Seasons Greetings to All!*

*Prayers for 'Corona' Free Times Soon!*

*Greetings for A Happy Deepavali!*

The month of November immediately brings to our mind our great Pandit Jawaharlal Nehru, whose Birth Anniversary fall on 14<sup>th</sup> of November, celebrated as Children's Day in our country. It also brings to our mind the struggling days since independence and the urgent need for alleviation of poverty and dynamic steps to grow agriculture, industries, economy and steps towards self-reliance in all respects. Pandit Nehru had the vision to focus on irrigation through large dams across the country, soil enrichment through large scale fertilizer plants and industrialization with large scale steel plants, large engineering industries and heavy electrical and power plants across the country. Planning the growth through Five Year Plans could indeed commence the progress of our country in all areas. All these can make us proudly look back the struggling path we have gone through and the overall stability the initiatives provided for us to keep progressing until date be in agriculture, manufacturing or all other areas of modern technologies.

Our neighbouring states celebrate November 1<sup>st</sup> as Rajyothsava Day, as that is the date of birth of linguistic states chiseled out of the them composite Madras State. Even though the economic progress of southern states are much better than many parts of India, it can also be argued that the progress could have been much greater if they would have been together, as many of the inter-state disputes which are resulting in large wastages of time, energy and resources would not have been there.

November also marks the remembrance of "**International Day of preventing the exploitation of the environment in war and armed conflicts**" and "**International Day of Tolerance**". As we all know, our country is driven to focus attention on war preparedness at the borders due to constant threat and terrorism from across the borders from our neighbours. Lack of tolerance result in lot of disturbance, communal and otherwise, within the country forcing us to waste lot of time and resources in establishing peace for the common public. It is time the world and we understand the importance of peace, harmony and tolerance for a happy and prosperous life for all.

The pandemic seems to be slowing down gradually and there are lot of reports about effective vaccines being released during the beginning and middle of 2021. Economy and near normalcy are being addressed in stages which bring back the hopes of better days to follow. It is indeed worth praising ourselves, the community at large and the Governments for all the appropriate and timely actions to go through the challenging times.

***We thank all those members who have helped us by participating in the advertisement appearing for the issue October 2020 – E Power, Mahindra & Mahindra, Mersen, Supreme Power Equipment Pvt. Ltd.***

**Editor**

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## KNOW THY POWER NETWORK - 153

I think that you may be thrilled to learn more about the future Power Grid. Though we may / may not see it in the near future, it always excites us since we move into a new “Dynamic Operating Realm” which was not witnessed nor studied earlier. Let us view its features one by one now.

- (1) Long distance UHV DC transmission lines, which can carry 5 - 8 times more the amount of power that is normally carried by a HV AC transmission circuit of the same rating and right of way, will constitute the main transmission back bone of the grid i.e. High capacity electrical energy transfer will take place with limited number of transmission links.
- (2) As a part of such innovative measures, DC circuits will replace the existing AC circuits in almost all the areas starting from long distance transmission to the local distribution circuits to the centres of Distributed Generations to Microgrids and Energy Storage Systems. Such wide scale application of DC power helps to establish mega size solar farms and wind mills on a wider scale. Off shore wind power generation will also have its share in this scheme of things. Its presence establishes the round the clock availability of “Cheap electric power”. As a consequence, the present higher demand for the polluting coal-based power generation will be brought down to a minimum; so also its carbon foot print in our environment. Hybrid AC / DC micro-grids will also be made available for extending higher benefits of the end consumers.
- (3) Next comes the Dynamic Operation of the grid. The grid will become “More Smarter”; a wide area snap shot of the grid, which reflects the real time behaviour of the network is readily available. Every equipment device in the power station and sub-station will be made “Self-Monitoring” and this ensures its better service/ performance.
- (4) Un-imaginable, very high data will be streamed from the grid; it simply mirrors the condition of the grid, the operating characteristics of its components and the available capacity of the its equipment and devices in real time. This helps us to view the grid in “Real time” and take necessary corrective measures, when ever needed, in time.
- (5) More powerful tools like phasor measurement units will facilitate the viewing of grid instabilities in time i.e. it warns us in the incipient stage itself and helps to ward off “un desirable blackouts”.
- (6) When the grid itself is functioning on a “Smarter mode”, can the components of its line supports like towers and poles and OH conductors / UG cables stay / lag far behind? They will also be made “Smarter” so that they can form part of the smart grid family or smart grid equipment contingent. Dynamic line rating based on real time measurement will be the order of the day. All these will “Morphe” the grid into a Dynamic System with real time management just like the rail networks and computer networks (Internets) in the country. This real time management of the grid aids the system operators to have a dynamic view of the entire grid on their consoles, so that they can operate their facilities closer to their capacity limits and get best out of each asset. Round the clock monitoring of the power flows helps to avert the congestions / jams of power flows. In brief, the diagnostic monitoring and intelligent control of the network are pushed into a “Single tool set” that allows to get most out of the “ageing” and “new” infrastructures as well.

Dynamic Line Rating (DLR) is one more tools added to the arsenal of the grid to know the real conditions of the transmission circuits and furnishes the information how hard they can be pushed to the dynamic operation of the grid. It provides us the ability to witness the events that are going on the entire length of the transmission circuit. Now it is easier to upgrade its loading limits; its mechanical and thermal characteristics will be viewed in real time. This helps to increase its rating by 5-20%. Earlier there were many bottle necks from the transmission constrained grid and the power transfer limits fixed by static rating of the lines. Now all these will become

things of the post. As a whole, the operation efficiency of the grid will be increased with the attendant higher / better utilization of the existing infrastructures.

The smartly controlled grid will become the modern grid of the future. This is achieved with the full support or back up of big data analytics and Internet of things. The presence of smart meters, Smart Monitoring Systems, Sensors and Mobile devices will be seen in every corner of this modern grid. "System sentries", which monitor the transmission circuits in real time, will also be seen at various locations. All these will make the journey across this modern grid will be a memorable one. Now this topic finds its closure.

Kindly stay tuned for the new topic.

*(To be continued)*



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## COVID-19 PREVENTION: 6 IMPORTANT TIPS TO BOOST LUNG IMMUNITY

It is vital to take care of the lungs and make them stronger. Fast&Up Co-Founder Mr Varun Khanna shares a few tips on how to boost lung immunity and keep them healthy:

Covid-19 has put the focus back on health and overall well-being with immunity becoming the buzzword today. As we continue to face challenges imposed by the pandemic and with the rise in air pollution due to an ease in lockdown in most parts of the country, focusing on lung health cannot be emphasised enough. Also Read - Herd Immunity May Come Before Covid Vaccine Goes Off The Shelf: AIIMS Director

It is vital to take care of the lungs and make them stronger. Fast&Up Co-Founder Mr Varun Khanna shares a few tips on how to boost lung immunity and keep them healthy: Also Read - Benefits of Walnuts: How Akhrot Can Help Build Immunity in Winters

**Pranayama** — This yogic technique of breathing is extremely beneficial for the lungs, boosting lung capacity. It is very important for the mind to be calm because when we are stressed or anxious, breathing is affected and the respiratory rate goes up. This puts pressure on the lungs. So pranayama will definitely help in staying relaxed and calm. Also Read - COVID-19 Recovery Schedule: 5 Things to do in a Day to Get Immunity Back

**Avoid Inflammatory Foods**— Ayurveda has its historical roots in ancient India and it lists certain foods to avoid which have a negative prana balance. Foods that increase mucus in the body should be avoided and

foods that help in reducing stress should be consumed more often. India has a variety of natural and abundant antioxidants such as Amla, which will help to keep the lung healthy.

**Take Supplements** — Supplements are an important aspect of our lives today that go hand in hand with a good and well-balanced nutritional diet. Just the way we boost our immunity, it is also important to boost lung immunity with supplements, which have N-Acetyl Cysteine. N-Acetyl Cysteine is recommended for people recovering from Covid-19 to help with lung recovery. At Fast&Up, we recently launched N-Acetyl Cysteine (NAC), which contains a very critical amino acid that aids the breakdown of mucus, which gets accumulated in the lungs.

**Avoid Polluted Places** — As the lockdown is easing, we are seeing a rise in pollution levels across many cities and regions across India. While it is almost impossible to avoid pollution in our country, it is best to cautiously stay away from polluted places and if possible. I firmly believe that do not be an end receiver of pollution and do not be the cause for it as well.

**Wear a Mask at All Times** — This point needs over-emphasis. Wearing a mask is the best way to prevent the virus from entering your respiratory tract.

**Avoid/ Reduce Smoking if Possible** — Covid-19 is known to have an adverse effect on the lungs and the respiratory system, so if you are in the habit of smoking, it is advisable to reduce your intake of cigarettes or have a protein patch on you.

## ENERGY STORAGE EXPECTED TO ALMOST QUADRUPLE BY 2024

According to a new report from Wood Mackenzie, energy storage is expected to develop from approximately 4 gigawatts (GW) of annual deployments in 2019 to more than 15 GW by 2024.



Image Source/ Energy photo created by welcomia/ [www.freepik.com](http://www.freepik.com)

Reasons for this growth include falling costs, direct incentives and clean energy targets are proliferating, and competitive markets and vertically-integrated electricity providers see energy storage's potential.

“In the next decade, the already consolidating web of manufacturers, developers, investors and integrators will compete for their slice of this burgeoning industry, carving out mature supply chains and propelling cost reductions”, the report stated. “As they do, continued policy and regulatory efforts will be key to driving upside in the market”.

According to the report, there are six key themes that will be part of this growth. These are offsetting corporate emissions, promoting economic potential, behind-the-meter (BTM) resiliency, accelerating the energy transition, reshaping the financial world and supply chain constraints.

“The energy storage industry is in the enviable position of juggling growth game changers from multiple directions”, said Daniel Finn-Foley, head of energy storage for Wood Mackenzie. “Plunging costs drove speculation in the first scaled markets, but as price declines enter a steadier rate, further recognition of storage's value—rather than cost—will be the key factor in determining growth”.

Around the world, millions of people are backing this technology, and many believe it has the potential to encourage alternatives to lithium-ion (the current technology standard for large- medium and small-scale energy storage batteries), which could have a lasting impact on the changing market according to the report.

“While solar and wind can displace carbon-emitting forms of energy supply, storing energy will be critical when renewable generation is not prolific”, the report said. “Energy storage can play a role in balancing supply with demand on the electric grid, and opportunities for BTM residential and non-residential energy are growing”, Finn-Foley said.

*Courtesy: William Atkinson*

# 3-PHASE DISTRIBUTION TRANSFORMERS 11KV / 433 KV / 415-240V (OUTDOOR TYPE) - 1

## 1. SCOPE:

- i. This specification covers design, engineering, manufacture, assembly, stage testing, inspection and testing before supply and delivery at site of oil immersed, naturally cooled 3-phase 11 kV/433 - 250V and 33 kV/433-250V distribution transformers for outdoor use.
- ii. The equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation, in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered equipment shall be complete with all components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of bidders supply irrespective of whether those are specifically brought out in this specification and / or the commercial order or not.
- iii. The transformer and accessories shall be designed to facilitate operation, inspection, maintenance and repairs. The design shall incorporate every precaution and provision for the safety of equipment as well as staff engaged in operation and maintenance of equipment.
- iv. All outdoor apparatus, including bushing insulators with their mountings, shall be designed so as to avoid any accumulation of water.

## 2. STANDARD RATINGS:

The standard ratings shall be 16, 25, 63, 100,160, 200, 250, 315, 400, 500, 630, 1000, 1250, 1600, 2000 and 2500 kVA for 11 kV distribution transformers and 100, 160, 200, 315, 400, 500, 630, 1000, 1250, 1600, 2000, 2500 kVA for 33 kV distribution transformers.

## 3. STANDARDS:

3.1 The major materials used in the transformer shall conform in all respects to the relevant/specified Indian Standards and international Standards with latest amendments thereof as on bid opening date, unless otherwise specified herein. Some of the applicable Indian Standards are listed as hereunder:

3.2

Indian Standards	Title	International Standards
IS -2026	Specification for Power Transformers	IEC 76
IS 1180 (Part-I): 2014	Outdoor Type Oil Immersed Distribution Transformers upto and including 2500kVA, 33kV -Specification	
IS 12444	Specification for Copper wire rod	ASTM B-49
IS - 335	Specification for Transformer / Mineral Oil	IEC Pub 296
IS – 5	Specification for colours for ready mixed paints	
IS - 104	Ready mixed paint, brushing zinc chromate, priming	

IS – 2099	Specification for high voltage porcelain bushing	
IS – 649	Testing for steel sheets and strips and magnetic circuits	
IS – 3024	Cold rolled grain oriented electrical sheets and strips	
IS – 4257	Dimensions for clamping arrangements for bushings	
IS – 7421	Specification for Low Voltage bushings	
IS - 3347	Specification for Outdoor Bushings	DIN 42531 to 33
IS – 5484	Specification for Al Wire rods	ASTM B–233
IS - 9335	Specification for Insulating Kraft Paper	IEC 554
IS - 1576	Specification for Insulating Press Board	IEC 641
IS - 6600	Guide for loading of oil immersed Transformers	IEC 76
IS – 2362	Determination of water content in oil for porcelain bushing of transformer	
IS – 6162	Paper covered Aluminium conductor	
IS – 6160	Rectangular Electrical conductor for electrical machines	
IS – 5561	Electrical power connector	
IS - 6103	Testing of specific resistance of electrical insulating liquids	
IS – 6262	Method of test for power factor and dielectric constant of electrical insulating liquids	
IS – 6792	Determination of electrical strength of insulating oil	
IS - 10028	Installation and maintenance of transformers.	

#### 4. SERVICE CONDITIONS:

4.1 The Distribution Transformers to be supplied against this specification shall be suitable for satisfactory continuous operation under the following climatic as per IS 2026 (Part – 1).

i)	Location	:	At various locations in the country
ii)	Maximum ambient air temperature (°C)	:	50
iii)	Minimum ambient air temperature (°C)	:	-5
iv)	Maximum average daily ambient air temperature (°C)	:	40
v)	Maximum yearly weighted average ambient temperature (°C)	:	32
vi)	Maximum altitude above sea level (Meters)	:	To be specified by the user

#### Note:

1. The climatic conditions specified above are indicative and can be changed by the user as per requirements.

2. The equipment shall generally be for use in moderately hot and humid tropical climate, conducive to rust and fungus growth unless otherwise specified. .

### 5. PRINCIPAL PARAMETERS:

5.1 The transformers shall be suitable for outdoor installation with three phase, 50 Hz, 11 kV or 33 kV system in which the neutral is effectively earthed and they should be suitable for service with fluctuations in supply voltage upto plus 12.5% to minus 12.5%.

(i) The transformers shall conform to the following specific parameters :

Sl. No	Item	11 kV Distribution Transformers	33 kV Distribution
1	System voltage (Max.)	12 kV	36 kV
2	Rated Voltage (HV)	11 kV	33 kV
3	Rated Voltage (LV)	433 – 250 V*	433 – 250 V*
4	Frequency	50 Hz +/- 5%*	50 Hz +/- 5%*
5	No. of Phases	Three	Three
6	Connection HV	Delta	Delta
7	Connection LV	Star (Neutral brought out)	Star (Neutral brought out)
8	Vector group	Dyn-11	Dyn-11
9	Type of cooling	ONAN	ONAN

\*The voltage level can be specified as 433/415-250 volts as per the requirements of the purchaser.

Audible sound levels (decibels) at rated voltage and frequency for liquid immersed distribution transformers shall be as below (NEMA Standards):

kVA rating	Audible sound levels (decibels)
0-50	48
51-100	51
101-300	55
301-500	56
750	57
1000	58
1500	60
2000	61
2500	62

*(To be continued)*

***“Facts are facts and will not disappear on account of your likes.”***

***– JAWAHARLAL NEHRU***

# ABSTRACT OF CPWD INTERNAL ELECTRIFICATION PART-1

## Lighting Circuit

- Per Circuit Not more than 10 Points of Lighting or Total 800Watt which is less

## Power Circuit

- For Residential Per Circuit Less than 2 No of 5A/15A Plug Socket
- For Non Residential Per Circuit Less than 1 No of 5A/15A Plug Socket

## Plug Socket

- In Residential wiring, wiring of Socket outlet shall be done by copper Cable only

## Min Size of Wire

- For Lighting Circuit Smallest size of conductor shall be 1.5 Sq.mm
- For Power Circuit Smallest size of conductor shall be 4 Sq.mm

## Plug Socket

- 5A/6A or 15A/16A Socket shall be installed at following heights:
- For Non Residential building 23cm above Floor,
- For kitchen 23cm above platform,
- For Bathroom not Socket is provided in bathroom MCB/IC will be 2.1 meter from fixed appliance and at least 1 meter away from Shower.

## Operating Rod

- Operating Rod/Handle of Distribution Board at the height of min 2 meter

## D.B Clearance

- Clear Distance in front of Switch Board/D.B shall be min 1 meter.
- If there may be bare connection at back of Switch Board than space behind S/W shall be either less than 20cm or more than 75cm.
- No fuse Body shall be mounted within 2.5 cm edge of D.B or Panel
- Clearance between 2.5 cm is maintained between opposite polarity.

## Switch Box

- Switch Box or Regular Box shall be mounted normally 1.25 meter from floor level.

## Fan Hook

- For Fan Hook in concrete roof 12mm diameter MS Rod in 'U' Shape, horizontally Leg at Top at least 19 cm on either side.
- Connection between adjustment Building (Out House, Garages) (Safety Clearance)
- If the distance with adjustment building is less than 3 meter and there is no any Road interval than GI pipe of suitable size shall be installed. This pipe shall be exposed on wall at height of not less than 2.5 meter.

***“We live in a wonderful world that is full of beauty, charm and adventure. There is no end to the adventures we can have if only we seek them with our eyes open.” – JAWAHARLAL NEHRU***

- If the distance with adjustment building is more than 3 meter and there is any Road interval than GI pipe of suitable size shall be installed. This pipe shall be exposed on wall at height of not less than 4 meter.

### **Metallic Conduit**

- Shall be used for Industrial wiring, Heavy mechanical Stress, shall be ISI marked. The Thickness shall not be less than 1.6mm (16SWG) for conduits up to 32mm Diameter and not less than 2mm (14SWG) for conduit above 32mm Dia.
- No steel conduit less than 20 mm Diameter shall be used.
- For rigid Conduit IS: 2509 /IS: 3419 and For Flexible Conduit IS: 6946.
- All Metallic conduit accessories shall be threaded type (Not pin grip, clamp grip)
- Saddle for surface conduit work on wall shall not less than 0.55mm (24 gauge) for conduit up to 25mm Diameter not less than 0.9mm (20 gauge) for larger Diameter

### **Metallic Outlets**

- Fore Cast Boxes: Wall thickness shall be at least 3mm.
- For Welded mild Steel Box: Wall thickness shall not be less than 1.2mm (18gauge) for Boxes up to size 20cmX30cm. Above this size 1.6mm (16gauge) thick MS Boxes shall be used.
- Clear depth of Out less Box shall not be less than 60mm. This will be increased as per mounting of Fan regulator

### **Bends in Conduits**

- Bending radius not less than 7.5 cm

### **Fixating Conduits on Surface**

- Conduits shall be fixed by saddles not less than 1 meter interval but in case of coupler/Bends in either side of saddles, the saddle shall be fitted 30 cm from fitting.

### **Junction Box**

- Depth of Junction Box shall be min 65mm as per IS: 2667

### **Fish Wire**

- GI fish wire of 1.6mm/1.2mm (16SWG) shall be used

### **Non Metallic Conduit Accessories**

- Normally grip Type.
- PVC Box IS: 5133 (Part II) thickness not less than 2mm, Clear depth of PVC Boxes not less than 60mm.

### **Non Metallic Surface Conduit**

- Conduits shall be fixed by saddles not less than 60cm interval but in case of coupler/Bends in either side of saddles, the saddle shall be fitted 15 cm from fitting.

### **Bus bar**

- Busbar shall be 100A, 200A, 300A, 400A, 500A, 600A, 800A
- The Cross-section area of Bus bar shall be same as Phase Bus bar (Up to 200A) for higher Capacity Neutral Bus bar must be not less than half cross section areas of Phase Bus bar.

***“There is nothing more horrifying than stupidity in action.”***

***– JAWAHARLAL NEHRU***

- Bus bar shall be suitably installed with PVC sleeve/Tap.
- Bus bar Chamber shall be fabricated with MS angle for Frame work and sheet steel of thickness not less than 1.5mm.
- Minimum clearance between phases to earth shall be 26mm and phase to phase shall be 32mm.

### **Bus bar Trucking**

- Bus bar Trucking are generally used for interconnection between T/C over 500KVA/D.G set over 500KVA and their switch Board Panel.
- Bus bar Trucking enclosure sheet steel of min 2mm thickness

### **Earthing**

- Type of earthing are Pipe earthing/Plate earthing/Strip earthing
- Length of Buried strip shall not be less than 15meter.
- Two copper strip, each size 50mm x 5mm shall be provided as each bus bar in 11KV S/S or D.G generally.
- Each strip should be connected separately to earth.
- Two no of Body earthing of T/C, Panel, D.G are connected to earth Bus.
- Neutral Leads of T/C, D.G shall not be connected to earth Bus.
- The minimum Cross-section are of protective conductor (Not contained within cable or wire) 2mm Dia (14SWG) for Copper, 2.5mm Dia (12SWG) for G.I, 2.24mm Dia (13SWG).

### **Earthing Pit shall not be closer than 1.5meter from Building.**

- Top of Pipe earthing electrode shall not be less than 20cm below the ground level.
- Plate electrode shall be buried in ground with face vertical and it's Top not less than 3meter below ground level.
- The strip of earthing electrode shall be buried in trench not less than 0.5m deep.
- If strip electrode cannot be laid in straight length. It may be Zigzag with deviation up to 45 Degree from axis of strip.
- In Plate Earthing Diagram of water pipe shall not be less than 20mm and in Pipe earthing reducer of 40mmX20mm shall be used.
- Earthing Pit Size shall be not less than 30cm x 30cm x 30cm.
- Thickness of MS cover of earthing pit shall be not less than 6mm and having locking arrangements.
- Earthing resistance of each electrode shall be less than 5Ω and for Rocky Soil not less than 8Ω
- Earthing conduit for earthing wire shall be Medium class 15mm Diagram GI pipe and for Earthing Strip shall be medium class 40mm Diagram GI Pipe.

### **Conductor Clearance (min) (Different Voltage)**

- When two conductor of different Voltage are erected on same support min clearance between LV/MV and 11KV shall be min 1meter.

***“Life is like a game of cards. The hand that is dealt  
you is determinism; the way you play it is free will.”***

**– JAWAHARLAL NEHRU**

### **Conductor Clearance (min) (Different Support)**

- A Clearance not less than height of tallest support may be maintained between parallel overhead line on Different support.
- When two overhead line cross each other vertical clearance between LV/MV and 11KV shall not be less than 1.25meter and for LV/MV and 33KV line shall be not less than 2meter.

### **Conductor Clearance (min) (Across Road)**

- Min Conductor Clearance across Road: For LV/MV Line is 5.8 meter and for HV Line 6.1meter

### **Conductor Clearance (min) (Along Road)**

- Min Conductor Clearance along Road: For LV/MV Line is 5.5meter and for HV Line 5.8meter

### **Conductor Clearance (min) (Along/Across)**

- Min Conductor Clearance along/across Road: For LV/MV/HV up to 11KV (Bare Conductor) Line is 4.6meter.
- Min Conductor Clearance along/across Road: For LV/MV/HV up to 11KV (Insulated Conductor) Line is 4.0meter.
- Min Conductor Clearance along/across Road: For HV (11KV to 33KV) Line is 5.2meter.
- Min Conductor Clearance along/across Road: For EHV (above 33KV) is 5.2meter + 0.3 meter for every 33KV (Not less than 6.1).

### **Conductor Clearance (min) (From Building)**

- Min Conductor Vertical Clearance above Building: For LV/MV Line is 2.5meter from highest Point.
- Min Conductor Horizontal Clearance near Building: For LV/MV Line is 1.5meter from nearest Point.
- Min Conductor Vertical Clearance above Building: For MV/EHV (up to 33KV) Line is 3.7meter from highest Point.
- Min Conductor Vertical Clearance above Building: For MV/EHV (above 33KV) Line is 3.7meter + 0.3meter for every 33KV
- Min Conductor Horizontal Clearance above Building: For MV/EHV (Up to 11KV) Line is 1.2meter.
- Min Conductor Horizontal Clearance above Building: For EHV (Up to 33KV) Line is 2 meter
- Min Conductor Horizontal Clearance above Building: For EHV(above 33KV) Line is 2meter + 0.3 meter for every 33KV

*Courtesy: <https://documents.in/document/abstract-of-cpwd-internal-electrification-part.html>*

***“A language is something infinitely greater than grammar and philology. It is the poetic testament of the genius of a race and a culture, and the living embodiment of the thoughts and fancies that have moulded them”***

***– JAWAHARLAL NEHRU, The Discovery of India***

## S 694 / 1554 / 11892 – ABSTRACT OF IS 694

### 1) Cable Sheath (Up to 1.1KV)

- The colour of the sheath shall be black or any other colour as agreed to between the purchaser and the supplier.
- For weatherproof cables, the colour of sheath shall be black only.
- The difference between maximum and minimum measured values of overall diameter of sheathed circular cables shall not exceed 15 percent of the maximum measured value at the same cross-section.

### 2) Cable Construction (Up to 1.1KV)

- Copper Cable up to  $6\text{mm}^2$  = Solid/Stranded ,
- Copper Cable up to  $10\text{mm}^2$  = Solid/Stranded
- Copper Cable above  $6\text{mm}^2$  = Stranded ,
- Copper Cable above  $10\text{mm}^2$  = Stranded

### 3) Cable-Testing (Up to 1.1KV)

- The core(s) shall be carefully removed from a sample approximately 3 m long from the finished cable. They shall be so immersed in a water-bath at  $60\pm 3^\circ\text{C}$  that their ends protrude at least 200 mm above the water-level. After 24 hours, a voltage of 3 kV (rms) shall be applied between conductors and water. This voltage shall be raised to 6 kV (rms) within 10 seconds and held constant at this value for 5 minutes. If the sample fails in this test, one more sample shall be subjected to this test, which should pass.
- The cores which have passed the preliminary test given in 16.2.1 shall be subsequently tested with a dc voltage of 1.2 kV in the same water-bath at the same temperature. The conductors shall be connected to the negative pole and water to the positive pole of dc supply by means of a copper electrode.
- The core shall withstand this dc voltage test for 240 hours without breakdown.
- The voltage shall be applied continuously, but if there are any unavoidable interruptions during the 4 hours period, that period shall be increased by the time of interruptions. The total of such interruptions shall not exceed 1 hour otherwise the test shall be started again.
- The cables and cords shall withstand without breakdown an ac voltage of 3 kV (rms) or a dc voltage of 7.2 kV applied for a period of 5 min for each test connection
- Single-core cables shall be immersed in water at ambient temperature one hour before the testing and the test voltage shall be applied between conductor and water for the specified period.

### Abstract of IS 1554

#### 1) Insulation Colour (up to 11 KV)

- For reduced neutral conductors, the insulation colour shall be black.

#### 2) Arrangement of Marking (up to 11 KV)

- For cables having more than 5 cores, the core identification may be done by numbers. In that case, the insulation of cores shall be of the same colour and numbered sequentially, starting with number 1 for the inner layer. The numbers shall be printed in Hindu-Arabic numerals on the outer surface of the cores. All the numbers shall be of the same colour which shall contrast with the colour of the insulation. The numerals shall be legible.
- When the number is a single numeral, a dash shall be placed underneath it. If the number consists of two numerals, these shall be disposed one below the other and a dash placed below the lower numeral. The spacing between consecutive numbers shall not exceed 50 mm.

### 3) Type of Armor (up to 11 KV)

- Where the calculated diameter below armoring does not exceed 13 mm, the armor shall consist of galvanized round steel wires. Where the calculated diameter below armoring is greater than 13 mm, the armor shall consist of either galvanized round steel wires or galvanized steel strips.

### 4) Cable Identification/ Marking (up to 11 KV)

- Type of Cable Legend: (i) Improved fire performance or Category C1 FR (Cables in constrained areas, Does not propagate fire even when installed in groups in vertical ducts), (ii) Improved fire performance for Category C2 FR—LSH (Cables in constrained areas with limited human activity and/or presence of sophisticated systems)
- Aluminum conductor = A, PVC insulation = Y, Steel round wire armor = W, Steel strip armor = F, Steel double round wire armor = WW, Steel double strip armor = FF, PVC outer sheath = Y.

### Abstract of IS 11892

#### 1) Max external Diameter of cable

- Maximum external Diameter of Cable is  $(dc) = kc \times d$
- where  $d$  = Nominal dia of conductor standards.  $Kc = 1$  for solid cable. For stranded cable  $kc = 3$  (upto 7 stranded). More than 7 stranded  $kc = 1.16 \times \text{sq.root}(n1)$ ,  $n1$  = Number of stranded

*Courtesy: Jignesh.Parmar*

## HUMOUR – TECHNOLOGY

Did you hear about the monkeys who shared an Amazon account? They were Prime mates.

Q. What is the biggest lie in the entire universe?

A. “I have read and agree to the Terms & Conditions.”

Why are iPhone chargers not called Apple Juice?!

Q. Why did the PowerPoint Presentation cross the road?

A. To get to the other slide.

PATIENT: Doctor, I need your help. I’m addicted to checking my Twitter!

DOCTOR: I’m so sorry, I don’t follow.

I just got fired from my job at the keyboard factory. They told me I wasn’t putting in enough shifts.

Person 1: Do you know how to use Outlook?

Person 2: As a matter of fact, I Excel at it.

Person 1: Was that a Microsoft Office pun?

Person 2: Word.

I tried to say, “I’m a functional adult,” but my phone changed it to “fictional adult,” and I feel like that’s more accurate.

Autocorrect has become my worst enema.

Thanks to autocorrect, 1 in 5 children will be getting a visit from Satan this Christmas.

“I am hungary.” “Maybe you should czech the fridge.” “I’m russian to the kitchen.” “Is there any turkey?”

“We have some, but it’s covered in greece” “ew, there’s norway I’d...”

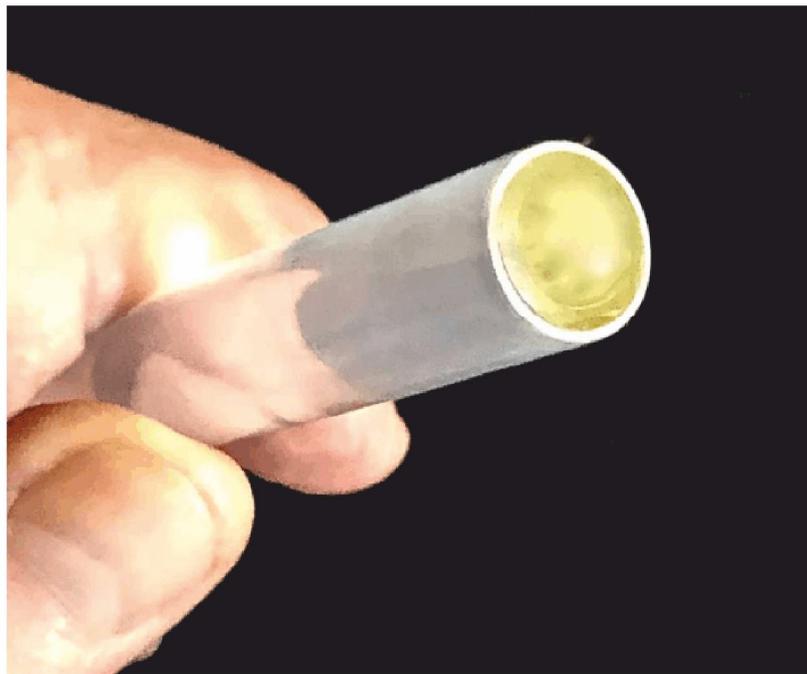
The guy who invented predictive text died last night. His funfair is next monkey.

## FIBER OPTICS IN LIGHTING



**Fig. 1**

One of my recent magazine columns focused on a non-communications use of fiber optics—lighting. In this article, I’ll revisit the topic to flesh out that topic even more, using illustrations to show how fiber optic lighting works and show some examples of the applications.



**Fig 2: Plastic fibers for lighting may be as large as this 12mm example.**

**Fiber optic lighting uses optical fiber as a “light pipe,” transmitting light from a source through the fiber to a remote location.** Some lighting uses large plastic fibers like the one above while others use bundles of glass or plastic fibers to transmit more light. The light may be emitted from the end of the fiber creating a

small spotlight effect (also called “end glow”) or emitted from the outside of the fiber along its length like a neon or fluorescent tube (also called “side glow”).



Fig 3: A plastic optical fiber

The plastic optical fiber above is illuminated by the red laser in a fiber optic visual fault locator, a tool used by almost every fiber optic installer. **It shows how fiber can be used for illumination and design. The light is transmitted through the fiber to produce a red-light source at the end.** The light lost in the fiber is leaking out of the surface of the fiber making it glow like neon tubes.

### Fiber Optic Lighting Components

Optical fibers used for lighting are similar to fibers used in communications, but they are optimized for transmitting light not high-speed signals. The fibers consist of a core that transmits the light and an optical cladding that traps the light in the core of the fiber. Unlike communications fibers that use small cores to maximize bandwidth, lighting fibers use large cores with thin claddings to maximize coupling of the light from the illuminator into the fiber. Side-emitting fibers have a rough interface between the core and the cladding to scatter some of the light out of the core along the length of the fiber to create a consistent lighted look similar to neon light tubes.

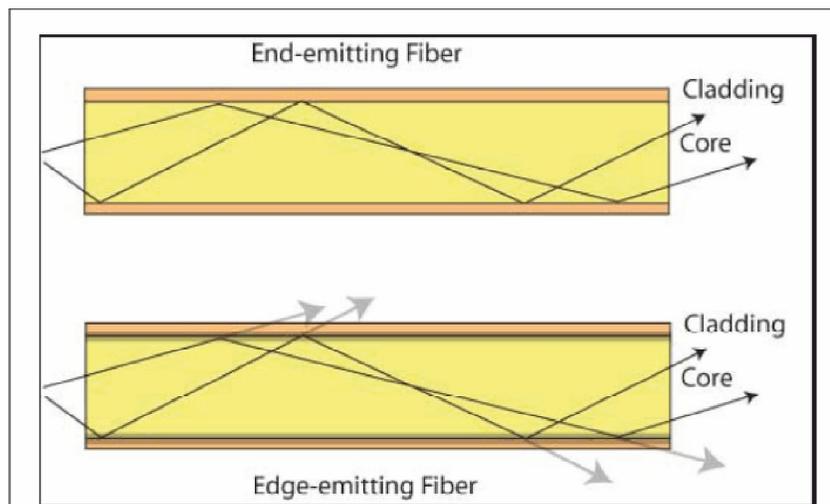


Fig 4: Lighting-fiber types

## End and Edge-Emitting Lighting Fibers

Lighting fibers can be made of glass, just like communications fibers, or plastic. If the fibers are glass, they usually have a very small diameter, and many of the fibers are bundled together in one jacketed cable to provide enough light transmission. Larger diameter plastic fibers are also used, perhaps more commonly, because they are inexpensive and easier to install, but they have higher light loss and cannot withstand heat as well as glass fibers, sometimes limiting the light input from a source.

The light source is usually called a “fiber optic illuminator” and consists of a bright light source and may have some optics to efficiently focus light into the fiber. Sources must be bright, so quartz halogen or xenon metal halide lights are commonly used for larger bundles of fiber. Smaller bundles or individual fibers use LEDs that very efficiently couple light into fibers but do not achieve the light levels of the other lamps used for bundles of fibers.

Here are some examples of fiber optic lighting courtesy of **BL Innovative Lighting** in Vancouver, British Columbia, Canada. These not only show the flexibility of fiber optic lighting but also the possibilities for creative design. Note their other lighting products include some innovative uses of LEDs.

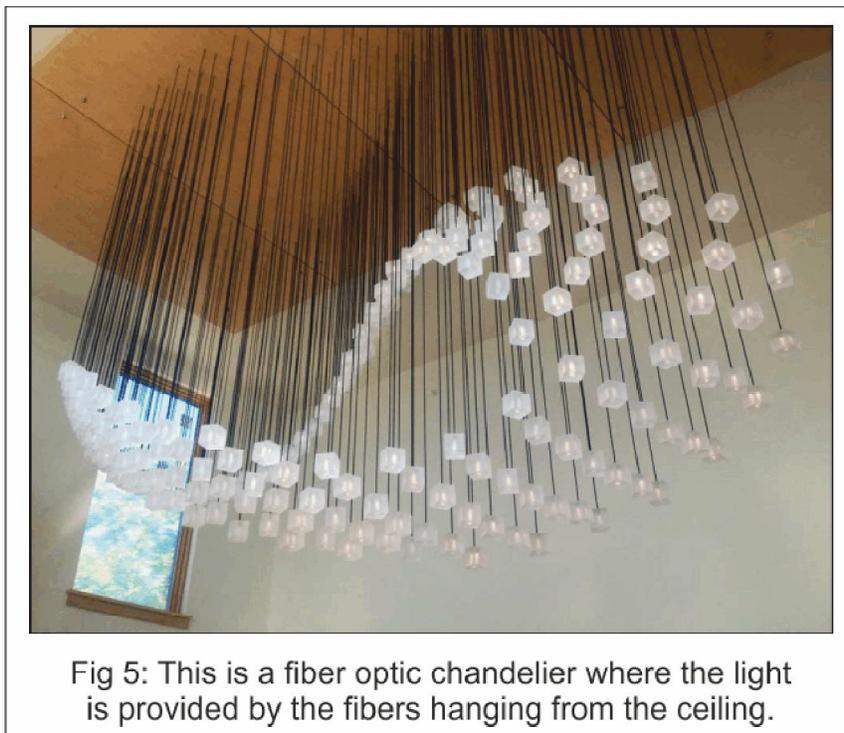


Fig 5: This is a fiber optic chandelier where the light is provided by the fibers hanging from the ceiling.

## Designing Fiber Optic Lighting

Designing fiber optic lighting can be difficult since it seems every product is proprietary, and every application is unique. Plus, unlike communications fiber optics, there are few, if any, industry standards. Since there is so much variety in fiber optic lighting systems, it’s hard to generalize about designing systems. However, every design project will start with some common items: what is being lighted, what kind of light is desired (intensity, illumination pattern, colour, etc.), any unique design features and where the illuminator will be placed.

There are a few design issues unique to lighting. The attenuation of the optical fiber varies with colour, which requires choosing a source colour that will be correct after the chromatic attenuation of the fiber being used is factored in. Heat from lamp illuminators may require ventilation. Edge lit systems may require illumination from both ends to get even lighting along the entire fiber.

If the designer is new to fiber optic lighting, consulting with an experienced designer, contractor or manufacturer is highly recommended. They will be able to recommend designs, fiber optic lighting components and

manufacturers. They should also be able to help design not only the fiber optic lighting system, but also the electrical power and controller for the system.



Fig 6: A fiber optic sculpture in a fountain where the fibers are bigger and stiff, edge-emitting to glow along their length. There is also fiber lighting around the edge of the fountain pool.

The installation of fiber optic lighting systems involves installing cables, illuminators and fixtures. Most of the applications are custom and many will require specialized practices related to the components being used. Working with manufacturers who have not only developed the components but also the installation fixtures and practices is the best way to ensure the installation is properly done. If the application is a new type, experimenting to determine if it will work properly before committing to the actual work may be necessary.



Fig 7: Simulated Mars landscape with starfield sky created by fiber optics

The advice given above about designing fiber optic lighting systems holds here too, as there is no substitute for experience. But any competent electrician able to install lighting should be able to install a fiber optic lighting system, especially since they are experienced in installing cable, light fixtures and electrical power and controllers.

*Courtesy: [www.ecmag.com](http://www.ecmag.com)*

# HYPERDRIVE

## Old Electric Car Batteries May Help Cut Costs of Storing Power



**Fig 1. The Relectrify energy storage system in Melbourne on Jan. 17**

**Photographer: James Bugg /Bloomberg**

As major players jostle for market share in large-scale power storage, **American Electric Power and Nissan Motor Co.** are testing new technology that re-uses old electric vehicle batteries to slash costs.

The pilot study in Ohio will road test technology that could lower system costs by about a half and extend the life of **lithium-ion** batteries by about a third, according to its Australian developer. Costs of energy storage systems are **falling** globally on technology improvements, larger manufacturing volumes, increased competition between suppliers and as the sector adds more expertise, Bloomberg NEF said in an October report. That's driving an expansion in investment in projects to store power, with as much as \$5 billion worth of deals possible this year for systems paired with renewable energy, according to the forecaster.

American Electric's Ohio study is using expired Nissan Leaf car batteries and is intended to test the innovations at scale after laboratory work in Australia and Japan.

Results so far appear promising, Ram Sastry, American Electric's vice president, innovation and technology, said by phone. "It's in a facility that we own, but connected to the real grid." he said.

Read more: [Here's Where 3 Million EV Batteries Will Go When They Retire](#)

The technology is developed by Melbourne-based Relectrify and uses old, or second-life, vehicle batteries and reduces the number of components needed, the company said Friday in a statement. That can reduce costs for key parts of typical industrial or grid storage systems to about \$150 per kilowatt hour, it said.

That compares with a current average price for similar technology using new batteries of \$289 a kilowatt hour, according to the BloombergNEF 2019 Energy Storage System Costs Survey.

Companies like **BMW AG** and **Toyota Motor Corp.** are already putting re-used cells to work in applications including renewable energy storage, electric vehicle charging, and to power street lights and homes. About three-quarters of vehicle batteries are eventually likely to be reused, according to London-based researcher Circular Energy Storage.

## Battery Discount

Utility-scale system prices globally are poised to fall 50% in real terms by 2030

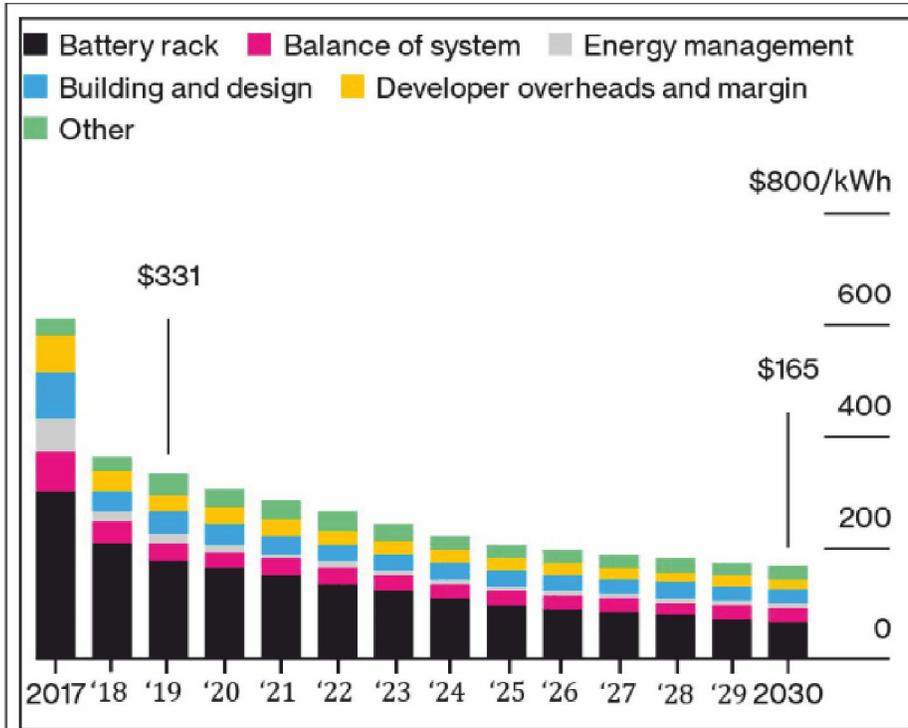


Fig 2.

Source: BloombergNEF

Note: Projected after 2019; all prices in 2019 U.S. dollars

Cheaper energy storage with batteries could provide an alternative to adding more capacity at electricity substations, or building more transformers. It could also be harnessed to provide backup power and bolster reliability for consumers, according to American Electric's Sastry.

"There are many use cases that we have for batteries that are predicated on the cost," he said. "If the battery goes lower in cost, it can compete with the wires."



Fig 3. Relectrify's CTO Daniel Crowley left and CEO Valentin Muenzel.  
Photographer: James Bugg/Bloomberg

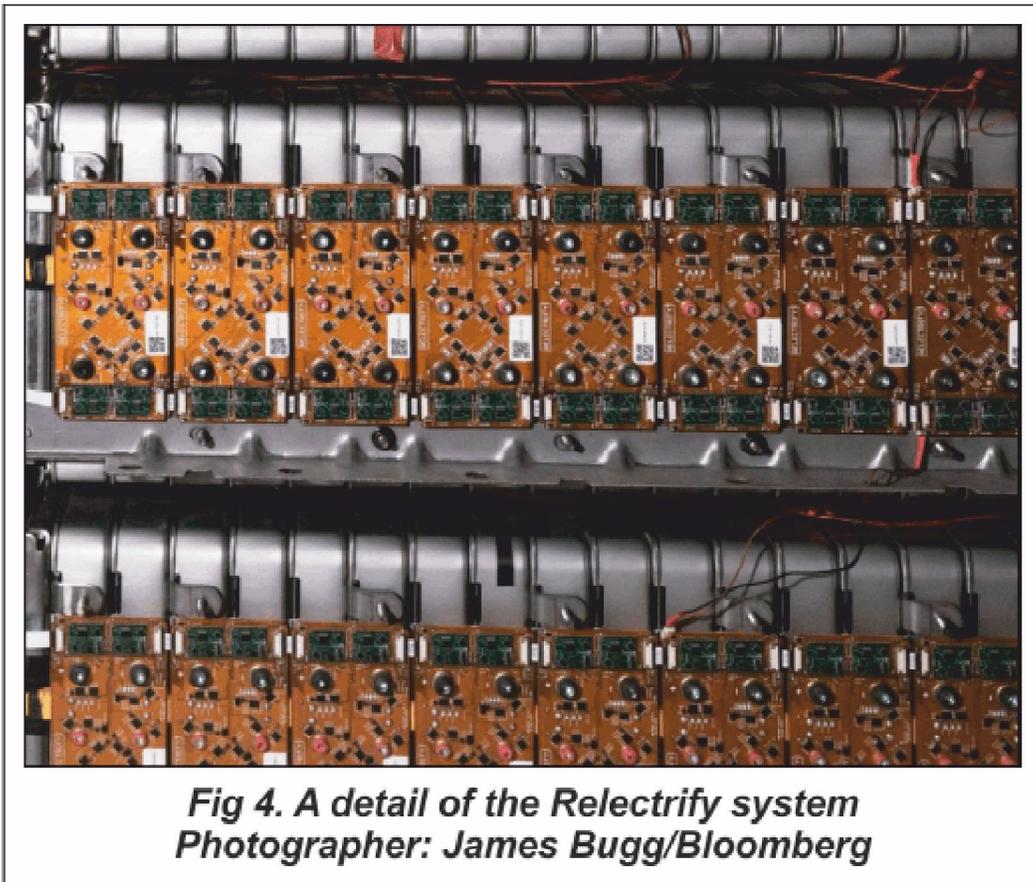
Yet even as the price of lithium-ion battery cells has fallen, it's been difficult to reduce costs of components such as inverters. "The inverter is the Achilles heel of energy storage," said Bradley Smith, president of Covington, Louisiana-based Beauvoir Consulting Services and previously an executive developing second-life battery products at Nissan.

Relectrify's system reduces the need for separate electronics for both the inverter and battery management system, lowering costs, Smith said.

The technology can also extend the lifespan of either reused or new batteries by offering more precise management of individual cells, according to Valentin Muenzel, CEO of Relectrify, a 14-person firm launched in 2015 that's collaborated with companies including Volkswagen AG and International Business Machines Corp.

Some potential end users remain wary of re-using lithium-ion batteries over concerns about their longevity and costs of re-purposing cells, according to BNEF's head of clean power Logan Goldie-Scot.

"Many customers are not yet comfortable with second-life batteries even at a steep discount," he said. **Tesla Inc.** has in the past suggested it will favour recycling spent packs from vehicles to recover raw materials, rather than seek to re-use the cells first.



Relectrify, which is holding talks with battery manufacturers and distributors, sees potential to eventually help improve performance of batteries for the auto sector, in addition to energy storage.

"We see stationary storage as the low hanging fruit," Muenzel said. "We're already getting demand for use in some mobility applications and we expect that is an area that will continue to grow with time."

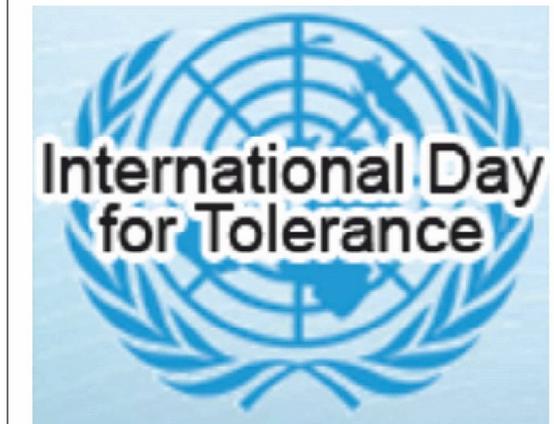
*Courtesy: David Stringer*

**"Culture is the widening of the mind and of the spirit."  
– JAWAHARLAL NEHRU**

# INTERNATIONAL DAY FOR TOLERANCE

16 November

The United Nations is committed to strengthening tolerance by fostering mutual understanding among cultures and peoples. This imperative lies at the core of the United Nations Charter, as well as the Universal Declaration of Human Rights, and is more important than ever in this era of rising and violent extremism and widening conflicts that are characterized by a fundamental disregard for human life.



In 1996, the UN General Assembly (by resolution 51/95) invited UN Member States to observe the International Day for Tolerance on 16 November. This action followed up on the United Nations Year for

Tolerance, 1995, proclaimed by the UN General Assembly in 1993 at the initiative of UNESCO, as outlined in the Declaration of Principles on Tolerance and Follow-up Plan of Action for the Year.

UNESCO-Madanjeet Singh Prize for the Promotion of Tolerance and Non-Violence

In 1995, to mark the United Nations Year for Tolerance and the 125th anniversary of the birth of Mahatma Gandhi, UNESCO created a prize for the promotion of tolerance and non-violence. The UNESCO-Madanjeet Singh Prize for the Promotion of Tolerance and Non-Violence rewards significant activities in the scientific, artistic, cultural or communication fields aimed at the promotion of a spirit of tolerance and non-violence.

The prize is awarded every two years on the International Day for Tolerance, 16 November. The Prize may be awarded to institutions, organizations or persons, who have contributed in a particularly meritorious and effective manner to tolerance and non-violence.

Why do we mark International Days?

International days are occasions to educate the public on issues of concern, to mobilize political will and resources to address global problems, and to celebrate and reinforce achievements of humanity. The existence of international days predates the establishment of the United Nations, but the UN has embraced them as a powerful advocacy tool.

*“At a time when extremism and fanaticism are unleashed too often, at a time when the venom of hatred continues to poison a part of humanity, tolerance has never been more vital a virtue.” —*

**Audrey Azoulay, Director-General of UNESCO on the occasion of the International Day for Tolerance**

*Centre Résolution Conflits* in Democratic Republic of Congo is the laureate of the 2020 Edition

The international Jury of the Prize recommended the CRC in recognition of its work for the defence of human rights, its “tireless [commitment to the] rescue of child soldiers from militia groups, and their rehabilitation and reintegration into their home communities. [CRC] also brings together communities from different tribes to live together in peace by conducting special training for this purpose.”

## **HOW CAN INTOLERANCE BE COUNTERED?**

### **1. Fighting intolerance requires law:**

Each Government is responsible for enforcing human rights laws, for banning and punishing hate crimes and discrimination against minorities, whether these are committed by State officials, private organizations or individuals. The State must also ensure equal access to courts, human rights commissioners or ombudsmen, so that people do not take justice into their own hands and resort to violence to settle their disputes.

### **2. Fighting intolerance requires education:**

Laws are necessary but not sufficient for countering intolerance in individual attitudes. Intolerance is very often rooted in ignorance and fear: fear of the unknown, of the other, other cultures, nations, religions. Intolerance is also closely linked to an exaggerated sense of self-worth and pride, whether personal, national or religious. These notions are taught and learned at an early age. Therefore, greater emphasis needs to be placed on educating more and better. Greater efforts need to be made to teach children about tolerance and human rights, about other ways of life. Children should be encouraged at home and in school to be open-minded and curious.

Education is a life-long experience and does not begin or end in school. Endeavours to build tolerance through education will not succeed unless they reach all age groups, and take place everywhere: at home, in schools, in the workplace, in law-enforcement and legal training, and not least in entertainment and on the information highways.

### **3. Fighting intolerance requires access to information:**

Intolerance is most dangerous when it is exploited to fulfil the political and territorial ambitions of an individual or groups of individuals. Hatemongers often begin by identifying the public's tolerance threshold. They then develop fallacious arguments, lie with statistics and manipulate public opinion with misinformation and prejudice. The most efficient way to limit the influence of hatemongers is to develop policies that generate and promote press freedom and press pluralism, in order to allow the public to differentiate between facts and opinions.

### **4. Fighting intolerance requires individual awareness:**

Intolerance in a society is the sum-total of the intolerance of its individual members. Bigotry, stereotyping, stigmatizing, insults and racial jokes are examples of individual expressions of intolerance to which some people are subjected daily. Intolerance breeds intolerance. It leaves its victims in pursuit of revenge. In order to fight intolerance individuals should become aware of the link between their behavior and the vicious cycle of mistrust and violence in society. Each one of us should begin by asking: am I a tolerant person? Do I stereotype people? Do I reject those who are different from me? Do I blame my problems on 'them'?

### **5. Fighting intolerance requires local solutions:**

Many people know that tomorrow's problems will be increasingly global but few realize that solutions to global problems are mainly local, even individual. When confronted with an escalation of intolerance around us, we must not wait for governments and institutions to act alone. We are all part of the solution. We should not feel powerless for we actually possess an enormous capacity to wield power. Nonviolent action is a way of using that power-the power of people. The tools of nonviolent action-putting a group together to confront a problem, to organize a grassroots network, to demonstrate solidarity with victims of intolerance, to discredit hateful propaganda-are available to all those who want to put an end to intolerance, violence and hatred.

# ENERGY INDEPENDENCE AND ENERGY SELF RELIANCE - 3

## **Sustainable Growth, Sustainable Energy and Renewable Energy**

### **Potentials and the important role of Bio Energy in Energy Self Reliance in India.**

Let us first have a look at the consumption of 'Primary Energy' through different forms and sources for various purposes like Fuel for Power Generation and Fuel for Automobiles and so on.

**The primary energy consumption in India** - is in the calendar year 2018 - Total **809.2 Mtoe** (excluding traditional biomass use), with break up as below:

The total primary energy consumption from-

Coal (452.2 Mtoe; 55.88%) – Mainly for Electricity Generation

Crude oil (239.1 Mtoe; 29.55%) – Mainly for Automobiles and Transportation

Natural gas (49.9 Mtoe; 6.17%) – Partly for Power Generation and mostly for Automobiles

Nuclear energy (8.8 Mtoe; 1.09%) – Power Generation

Hydro electricity (31.6 Mtoe; 3.91%) – Power Generation

Renewable power (27.5 Mtoe; 3.40%) – Mostly Electricity Generation – just commenced for Automobiles use, which is dealt later in this part.

Primary Energy consumption grew by 2.3% in 2019 and is the third biggest after China and USA with 5.8% global share.

In 2018, India's net imports are nearly 205.3 million tons of crude oil and its products, 26.3 Mtoe of LNG and 141.7 Mtoe coal totaling to 373.3 Mtoe of primary energy, which is equal to 46.13% of total primary energy consumption. India is largely dependent on fossil fuel imports to meet its energy demands – by 2030, India's dependence on energy imports is expected to exceed 53% of the country's total energy consumption. About 80% of India's electricity generation is from fossil fuels. India is surplus in electricity generation and also marginal exporter of electricity in 2017. Since the end of calendar year 2015, huge power generation capacity has been idling for want of electricity demand. India ranks second after China in renewables production with 208.7 Mtoe in 2016.

As it is seen from all the earlier presentations, one of the important areas of concern is PETROLEUM CRUDE, as most of it is still imported, compounding the problem of both "Green Fuel" and Economy for our country.

Indian initiatives to address the need for complete replacement of fuel for automobiles to GREEN FUELS or convert them Electrical Vehicles EVs, are already in progress. The initiatives at present and suggested initiatives for the future are listed below:

- a) Compressed Bio Gas known as Bio CNG or CBG, as it is called today, as fuel for automobiles in place of Petrol and Diesel. This initiative is progressing well and some of the latest News items are presented later.
- b) Electrical Vehicles to replace the existing automobiles of all kinds including two wheelers, cars, commercial vehicles and trains. For trains, electrification of various routes and tracks are in progress. Progress is expected with regard to EVs as lot of work is going on about high technology both with regard to batteries and fast charging capabilities etc.
- c) Bio Oil or Bio Crude from biomass can be used either directly or after refining as fuel in automobiles. There is still not any initiative in this regard, but this could be a very high potential area considering the various kinds and quantities of biomass available in our country. One example can be the trashes and

tops of sugar cane – about 50 million tons per annum of trashes and tops from out of about 350 million tons per annum of sugar cane grown in our country.

- d) A combination of GREEN FUEL, either CBG or Bio Oil, and EVs can really be a viable solution. This can ensure CARBON FREE vehicles, long miles of running with adequate storage of GREEN FUEL, and economy of both initial cost of vehicles and running economy. TATAs were working on this technology; calling it as Hybrid EVs, since 2015 and this technology could be useful from small cars to all sizes and capacities of vehicles.

With regard to CBG as GREEN FUEL, let us look at some of the latest news and views.

Is bio-CNG the right green fuel for public transportation?

January 27, 2020



*The transport sector is one of the major contributors to greenhouse gas emissions. As per the UN World Meteorological Organization, global temperatures will rise by 3.5 degrees Celsius in this century if urgent measures are not adopted. Nations have been focusing on exploring renewable energy sources to reduce the transport sector's environmental impact. However, the question that arises is which source is the most effective alternative? Could cow dung or vegetable peels be the answer to this problem?*

A recent study by IFPEN (the French Institute of Petroleum) has revealed that the biogas sector can contribute to decarbonizing transportation. The study collated data about the complete life cycle of compressed natural gas (CNG), bio-methane, gasoline, diesel and electric vehicles, and it concluded that bio-methane is the best option for maintaining air quality. The study recommends using a mix of bio-methane and CNG until 2030 to power vehicles, so that they have a climate impact equivalent to that of an electric car, as a mid-term solution.

Agricultural residues, food waste, organic municipal waste, bio-waste from industries, etc., are the common sources of biomass. Raw biogas (consisting of methane, carbon dioxide and impurities such as hydrogen sulphide and water vapor) is produced from biomass in the absence of oxygen. It can be converted into different automobile fuels like bio-Compressed Natural Gas (bio-CNG) or compressed biogas (CBG), gasoline,

syngas and liquefied biogas. For example, US-based Cornerstone, a Tetra Tech Company, has invented BioCNG, which is a biogas conditioning system to convert methane obtained from the decomposition of organic waste materials into a renewable natural gas (RNG) that can be used as a transportation fuel.

The amount of carbon dioxide produced when bio-CNG is used is equivalent to the amount captured in the formation of biomass, making it carbon neutral. Bio-CNG offers numerous advantages as a renewable vehicle fuel, such as high calorific value and cost savings over conventional fuels. It is similar to natural gas in terms of composition and properties.

Biogas, when purified to get bio-methane by absorbing or scrubbing the contaminants, and pressurized for storage in high-pressure cylinders, is upgraded to bio-CNG. Without proper purification, using biogas can lead to erosion of the metal parts in the vehicles. The purity of bio-CNG reserves in automobiles can be tracked using software and data analysis tools.

In India, there is immense scope for bio-CNG due to the abundance of biomass. Built in 2016, the bio-CNG plant at Mahindra World City, Chennai, converts 100 per cent of the food and kitchen waste generated daily, into raw biogas. The bio-CNG thereby produced is used for cooking purposes, as a fuel for buses and tractors, as well as to power streetlights in the area. In 2017, Tata Motors displayed the nation's first bio-CNG bus at the bio-energy programme 'Urja Utsav'. In the food industry, Amul Dairy has become the first business to start a fully automated bio-CNG generation and bottling plant to generate energy from its plant's waste. Even educational institutions like IIT-Delhi, for instance, are converting biogas to bio-CNG using a water scrubbing technique and supplying this to the CNG refueling stations.

Government policies are further boosting these initiatives of creating wealth from waste and can curb the nation's dependence on imported oil and gas. The National Policy on Bio-fuels, approved by the Union Cabinet in May 2018, targets the blending of 20 per cent of ethanol in petrol and 5 per cent of bio-diesel in diesel by 2030. Bio-CNG, bio-hydrogen, second-generation ethanol, drop-in fuels from municipal solid waste (MSW), bio-methanol, etc., have been included in the list of target bio-fuels for use in the transport and energy sectors. In October 2018, the Sustainable Alternative towards Affordable Transportation (SATAT) scheme was launched by the Ministry of Petroleum and Natural Gas, under which 15 million tons of CBG will be produced from 5,000 plants by 2023. Besides this, the Galvanizing Organic Bio-Agro Resources Dhan (GOBAR-DHAN) scheme, aimed at converting solid waste and cattle dung into compost, fertilizer, biogas and bio-CNG, was announced in the Union Budget 2018-19.

The global adoption of bio-CNG depends on several economic, environmental and technical factors. The capital cost for the installation of bio-CNG plants is high. The sources for feed materials are not consistent and setting up refueling stations is more complex than conventional stations. Due to the low mileage it yields, vehicles may need additional fuel cylinders. There is also a shortage of skilled professionals for the production processes in this field. In addition, there is a lack of proper standards and regulations in many countries when it comes to installation, operation and maintenance of plants.

However, the plethora of advantages will drive the growth of bio-CNG vehicles, primarily trucks and buses, in the future. This will strengthen the role of public transport in both urban and rural India. As per Renewable Watch Research, there are 17 bio-CNG plants in India (as of 2019), with a combined capacity of 46.18 tons per day. Maharashtra and Gujarat are the states with the highest capacity. In Sweden, bio-CNG is already being used on a large scale to run buses. John Lewis, a department store chain in the UK, plans to switch all its heavy delivery trucks to bio-methane-powered versions by 2028.

Petrol as well as diesel vehicles can be powered by bio-CNG through retrofitting. The large-scale generation of bio-CNG can help with the problem of the solid waste that is dumped in landfills as well as the air pollution caused by stubble burning. Simultaneously, it can lead to technological advancements as well as create new employment opportunities. There is a need to create awareness about the benefits of biogas to maximize its use for various purposes, including transportation, in order to achieve sustainable development.

## Centre to include Compressed Bio-Gas under priority sector lending: Minister

*The financial assistance to set up the CBG plants has been extended to 2020-21, Pradhan said while pointing out that the Centre was also exploring global funds for CBG projects*

June 24, 2020, 07:56 IST



Chennai: The Centre is in the process of including compressed biogas (CBG) in the priority sector of lending to ensure ease of financing the setting up of CBG plants in the country, Union Minister Dharmendra Pradhan said on Tuesday.

The Union Minister of Petroleum and Natural Gas, along with Tamil Nadu Chief Minister K Palaniswami and IndianOil Corporation chairman Sanjiv Singh and senior officials, inaugurated a compressed bio-gas plant at Namakkal in the state through video-conference.

IndianOil and Oiltanking GmbH of Germany, through a joint venture, agreed to set up the CBG plant and five CBG retail stations for automobiles in the state. The plant is to be set up under the Centre's sustainable alternative towards affordable transportation (SATAT) scheme and would produce CBG for supply to vehicles in the Salem-Namakkal region besides offering green fuel as an alternative to serve local industries.

The financial assistance to set up the CBG plants has been extended to 2020-21, Pradhan said while pointing out that the Centre was also exploring global funds for CBG projects. IndianOil Corporation and Hindustan Petroleum Corporation Ltd have already been awarded 13 letters of intent in the state for production and supply of 30,000 metric tonnes of CBG per annum, he said. The estimated investments in the plants would be around Rs 450 crore, which was expected to generate direct employment of about 200, he said.

The total CBG potential in Tamil Nadu from the existing bio-mass sources was estimated to be 2.4 metric million tonnes per year. Utilisation of the entire potential would result in setting up of about 600 plants across Tamil Nadu at investments of around Rs 21,000 crore with potential to create 10,000 jobs, he said.

CBG is produced from bio-mass sources like agricultural residue, cattle dung and municipal solid and liquid waste through anaerobic digestion, IndianOil said. The gas can be substituted as a green renewable fuel in the transportation, industrial and commercial sectors. Harnessing the full potential of bio-fuels to generate alternative energy in various forms whether it is CBG, ethanol or bio-diesel would go a long way in achieving Prime Minister Narendra Modi's vision of reducing dependence on crude oil imports while ensuring energy security for the nation, he said.

The oil and gas marketing companies have come up with long-term pricing on CBG and have agreed to execute long-term agreements to procure CBG, he said. He hoped the plant inaugurated on Tuesday would function as a model that can be replicated across the country. Palaniswami, in his address, thanked Pradhan for setting up the first CBG infrastructure and hoped that more such projects would be commissioned in Tamil Nadu.

He said the state leads in the country on production of renewable energy capacity at 15,876 MW. The major sources of renewable energy in the state are hydel energy (2,322 MW), wind energy (8,523 MW), solar energy (4,054 MW), biomass (266 MW) and other forms of such energy (714 MW). Palaniswami said the state government would support any such initiative of the Ministry of Petroleum and Natural gas.

IOCL chairman said CBG has properties similar to CNG and can be used in vehicles that run on CNG fuel without any modifications. It is also suitable for industrial and commercial sectors given the abundance of biomass in the country, he said. According to company officials, the Namakkal plant would process 290 tonne per day of feedstock to produce 15 tonne per day of CBG which shall be sold for use in vehicles from five petrol pumps in Namakkal and Salem besides two industrial units. IndianOil accounts for 309 letter of intents for production and supply of about 0.7 million metric tonne of CBG, they said.



*(To be continued)*

*S. Mahadevan, B.E., F.I.E., M.B.A.,  
Consultant, Energy and Energy Efficiency,  
Mobile: 98401 55209*

## **STAY HEALTHY AND SAFE**

1. The **\*STOMACH\*** is injured when you do not have breakfast in the morning.
2. The **\*KIDNEYS\*** are injured when you do not even drink 10 glasses of water in 24 hours.
3. The **\*GALLBLADDER\*** is injured when you do not even sleep until 11 o'clock and do not wake up to the sunrise.
4. The **\*SMALL INTESTINE\*** is injured when you eat cold and stale food.
5. The **\*LARGE INTESTINES\*** are injured when you eat more fried and spicy food.
6. The **\*LUNGS\*** are injured when you breathe in smoke and stay in polluted environment of cigarettes.
7. The **\*LIVER\*** is injured when you eat heavy fried food, junk, and fast food.
8. The **\*HEART\*** is injured when you eat your meal with more salt and cholesterol.
9. The **\*PANCREAS\*** is injured when you eat sweet things because they are tasty and freely available.
10. The **\*EYES\*** are injured when you work in the light of mobile phone and computer screen in the dark.
11. The **\*BRAIN\*** is injured when you start thinking negative thoughts.
12. The **\*SOUL\*** gets injured when you don't have family and friends to care and share with you in life their love, affection, happiness, sorrow and joy.

***\*All these parts are NOT available in the market\*.  
So take good care and keep your body parts healthy.***

***Stay Healthy and Safe.***

***It is HEALTH that is real WEALTH and not pieces of Gold and Silver.***

***– MAHATMA GANDHI***

## **ABSTRACT OF IS 1255 (INSTALLATION & MAINTENANCE OF CABLE) - 3**

### **25) Cable Pulling (Up to 33KV)**

- For Cables Pulled by Pulling Eye — If the cables are pulled by gripping the conductor directly with pulling eye, the maximum permissible tensile stress depends on the material of the conductor and on their cross-section as given below: For aluminum conductors 30 N/mm<sup>2</sup> and For copper conductors 50 N/mm<sup>2</sup>
- Expected Pulling Force When Pulling Cables by Winch — The following values of pulling force are expected:
  - P = (approximately percentage of cable weight): In trenches without large bends 15-20 %
  - In trenches with 1 or 2 bends of 90° each 20-40 %
  - In trenches with 3 bends of 90° each (assuming the use of easy-running support and corner rollers) 50-60 %
  - In ducts with bends totaling 360° Up to 100 %

### **26) Cable Laying Direct in Ground (Up to 33KV)**

- This method involves digging a trench in the ground and laying cable(s) on a bedding of minimum 75 mm riddled soil or sand at the bottom of the trench, and covering it with additional riddled soil or sand of minimum 75 mm and protecting it by means of tiles, bricks
- Depth — The desired minimum depth of laying from ground surface to the top of cable is as follows:
  - High voltage cables, 3.3 kV to 11 kV rating = 0.9 m
  - High voltage cables, 22 kV, 33 kV rating = 1.05 m
  - Low voltage and control cables = 0.75 m
  - Cables at road crossings = 1.00 m
  - Cables at railway level crossings (measured from bottom of sleepers to the top of pipe) = 1.00m

### **27) Cable Clearance (Up to 33KV)**

- Clearances: The desired minimum clearances are as follow:
  - Power cable to power cable = Clearance not necessary; however, larger the clearance, better would be current carrying capacity
  - Power cable to control cables = 0.2 m
  - Power cable to communication cable = 0.3 m
  - Power cable to gas/water main = 0.3m
  - Inductive influence on sensitive control cable on account of nearby power cables should be checked
  - The power cable should not be laid above the telecommunication cable, to avoid danger to life of the person, digging to attend to the fault in the Telecommunication cable.

### **28) Crossing (Up to 33KV)**

- Cables Laid Across Roads, Railway Tracks and Water Pipe Lines: Steel, cast iron, plastics, cement or earthenware ducts, or cable ducting blocks should be used where cables cross roads and railway tracks. Spare ducts for future extensions should be provided. Spare duct runs should be sealed off. Buried ducts or ducting blocks should project into footpath or up to the edge of road, where there is no footpath, to permit smooth entry of cable without undue bending

### **29) Diameter of Pipe (Up to 33KV)**

- The diameter of the cable conduit or pipe or duct should be at least 1.5 times the outer diameter of cable. The ducts/pipes should be mechanically strong to withstand forces due to heavy traffic when they are laid across road/railway tracks.

### 30) Bending Radius (Up to 33KV)

- The bending radius of steel or plastics ducts should not be less than 1.5 m.

### 31) Cable on Over Bridge (Up to 33KV)

- Cable Over Bridges — On bridges, the cables are generally supported on steel cable hooks or clamped on steel supports at regular intervals. While designing a cable layout on a bridge; expansion of bridge due to changes in atmospheric temperature should be taken into account. On most of the rail-cum-road bridges, the cables are subjected to vibrations. For such conditions, round wire armored and lead alloy 'B' sheathed cables are preferred. Cables can be laid on bridges duly suspended from catenary wire at regular intervals

### 32) Cable on Railway Crossing (Up to 33KV)

- Cables Below Railway Crossing — When the cables are laid under railway tracks the cables should be laid in reinforced spun concrete or cast iron or steel pipes at such depths as may be specified by the railway authorities but not less than 1 m measured from the bottom of sleepers to the top of the pipe

### 33) Cable on Duct (Up to 33KV)

- On long run ducts, it is desirable to apply lubrication to the lead or serving/outer sheath as it enters the duct. Petroleum jelly or graphite powder or a combination of both is effective for this purpose and through lubrication will reduce the pulling tension by about 40 percent.

### 34) Laying on Racks in Air (Up to 33KV)

- Lying on Racks in Air-The vertical distance between the two racks should be minimum 0.3 m and the clearance between the first cable and the wall (if racks are mounted on wall) should be 25 mm. The width of the rack should not exceed 0.75 m in order to facilitate installation of cables.
- Un galvanized steel work of cable racking/trays should be painted with a coat of primer and thereafter finished with suitable anti-corrosive paint.
- Only single-core cables laid on horizontal racks need be clamped at suitable intervals. Multi-core cables need not be clamped. The distance between the vertical clamps should not be more than 2 m

### 35) Laying Cables on Racks Inside a Tunnel (Up to 33KV)

- Laying Cables on Racks Inside a Tunnel: Horizontal distance between Two cable is min Diameter of Cable and vertical distance between two cable row is 30cm. In cable tunnel, the head room should not be less than 2 m and width sufficient to leave a free passage of at least 600 to 800 mm either from one side or in the middle.
- With temperatures below 3°C, the cables should be warmed before the laying out, since otherwise the bending would damage the insulation and protective coverings of cables. The cable laying must be carried out swiftly, so that the cable does not cool down too much
- Identification strips/tags of metal or plastics should be attached to the cables, particularly if several are laid in parallel, 8 to 10 m apart. Identification tags should also be attached at every entry point into the buildings and at the cable end termination
- The spacing between three cables laid in one plane should be not less than the cable diameter.
- When the cable run is several kilometers long, the cables should be transposed at one-third and at two-thirds of the total lengths.

### 36) Trefoil arrangement in ducts (Up to 33KV)

- If several single-core cables are laid per phase, these should be arranged as follows to ensure balanced current distribution in Horizontal direction: R-Y-B-Distance-B-Y-R, (Distance = 2 x Diameter of Cable), vertical distance shall be 6 x Diameter of Cable.

*Courtesy: Jignesh.Parmar*

# ELECTRICAL THUMB RULES VENTILATION & CEILING FAN - 3

## Fan Blade Pitch Angle and No of Blade

Fan Blade pitch	It is the angle of fan's blades (measured in degrees) and it is in conjunction with the fan motor.
	It is show how well fan is able to circulate air.
	Higher blade pitches typically move more air in cubic feet per minute, or CFM.
	The optimal blade pitch for a ceiling fan is between 12 and 15 degrees.
Blade number	It can contribute to the amount of air movement as well.
	The typical ceiling fan comes standard with 4 or 5 blades.
	Fans with more blades are usually quieter but also move less air.

## Ceiling Fan Size Guide

Room Size	Room Type	Blade Span	CFM Rating
Up to 100 Sq. Ft	Bathroom, Breakfast Nooks, Utility Rooms, Small Bedrooms, Porches	29" To 36" (700 to 900mm)	
100 To 144 Sq. Ft	Bathroom, Breakfast Nooks, Utility Rooms, Small Bedrooms, Porches	36" To 42" (700 to 1000mm)	1,000 To 3,000
100 To 225 Sq. Ft	Medium Bedrooms, Kitchens, Dining Rooms, Dens, Patios	44" To 50" (1200 to 1270mm)	1,600 To 4,500
225 To 400 Sq. Ft	Master Bedrooms, Family Rooms, TV Rooms, Small Garages, Gazebos	Over 50" (1270mm)	2,300 To 6,500
Over 400 Sq. Ft	Great Rooms, Large Garages, Basements, and Open Floor Plans	Over 62" (1600mm)	5,500 To 13,500

## Ceiling Fan Size

Room Size	Fan Blade Sweep
< 90 Sq.Foot	15" to 42" (400 to 1000mm)
90 to 100 Sq.Foot	44" to 46" (1000 to 1200mm)
100 to 150 Sq.Foot	52" to 54" (1300 to 1400mm)
> 150 Sq.Foot	56" to 70" (1400 to 1800mm)

## Ceiling Fan Speed and RPM

Speed	Watt	RPM	Air Flow (M3/Hr)	Efficiency (M3/Hr/Watt)
Low	62.3	171	8736	140
Medium	34.9	130	6774	197
High	15.2	86	4066	267

## Various distance of Ceiling Fan in Room

Ceiling Fan Blades and Floor	7 ft
Ceiling Fan Blades and Ceiling	8 to 10 inches
Ceiling Fan Blades and Light fixtures	39 inches
Ceiling Fan Blades and Wall	18 inches

**Minimum Efficacy Levels of Ceiling Fans (ENERGY STAR)**

Speed	Air Flow	Efficiency (CFM/Watt)
At low speed	1250 CFM	155 cfm/W
At medium speed	3000 CFM	100 cfm/W
At high speed	5000 CFM	75 cfm/W

**Size of Rod / Cord for Hanging Light (As per NBC)**

Nominal Cross-Sectional Area of Twin Cord mm for Hanging Light	Maximum Permissible Weight mm <sup>2</sup> kg
0.5	2
0.75	3
1	5
1.5	5.3
2.5	8.8
4	14

**Standard Exhaust Fan Size**

Fan DIA (MM / inches)	Speed (RPM)	Input Power	Phase	Current (A)	M <sup>3</sup> /HR (CFH)	M <sup>3</sup> /MI (CFM)	Sound level dB
150/6"	1200	24	Single	0.1	270	5	44 To 50
200/8"	1350	28	Single	0.12	500	8	44 To 50
250/10"	1350	36	Single	0.15	800	13	44 To 50
305/12"	1400	50	Single	0.4	1710	29	50 To 55
305/12"	900	50	Single	0.21	1145	19	35 To 40
380/15"	1400	160	Single	0.75	3250	54	60 To 65
380/15"	1400	150	Three	0.45	3250	54	60 To 65
380/15"	900	90	Single	0.4	2000	33	50 To 55
380/15"	900	100	Three	0.29	2000	33	50 To 55
457/18"	1400	410	Single	1.7	6120	102	65 To 70
457/18"	1400	410	Three	0.65	6120	102	65 To 70
457/18"	900	150	Single	0.65	3900	65	55 To 60
457/18"	900	150	Three	0.3	3900	65	55 To 60
610/24"	700	240	Single	0.4	7100	118	55 To 60
610/24"	900	500	Three	0.5	7100	118	55 To 60
610/24"	900	500	Single	2.6	9400	157	60 To 65
610/24"	900	500	Three	0.85	9400	157	60 To 65
750/30"	900	870	Single	3.8	12000	200	70 To 75
750/30"	900	910	Three	1.8	12000	200	70 To 75
900/36"	700	1200	Three	2.4	28100	468	75 To 80

*Courtesy: Jignesh.Parmar*

# ELECTRICAL MAINTENANCE UNIT

## (QUESTION & ANSWERS) - 3

31. What is electrode?

A conducting element used for converging (centering) current to and from a medium is called electrode. There are two types of electrode. A positive and other is negative.

32. What is force?

Force is that which change or tends to change a body state of rest or uniform motion through a straight line. The unit of force is Newton.

33. What is Newton?

One Newton is that amount of force which acting on one-kilogram mass for one second gives an acceleration 1 meter/sec/sec.

34. What is weight?

Weight is the gravitation force by which a body attracted to the earth. Gravitational unit of force in M.K.S system is kilogram weight or 9.81 Newton.

Weight is the force with which 1-kilogram mass is attracted by the earth towards its center.

35. What is bayer?

Bayer is the C.G.S unit of pressure and is equal to 1-dyne/cm<sup>2</sup>.

36. What is conductor?

Substances such as metals, which have large number of free electrons are said to offer a low resistance to the flow of electrons under the influence of emf and hence are called conductors.

Conductors are used to conduct electricity from one place to another place due to its major property conductance. Conductors are classified into three main groups.

- a. Good conductors.
- b. Semi conductors.
- c. Fair conductors.

37. What are the properties of good conductor?

### **Properties of good conductor**

- a. It posses very low resistance or specific resistance.
- b. It posses more conductance and there by conducts electricity readily through it.
- c. It is a good conductor of heat.
- d. It is highly resistance to corrosion by liquid.
- e. It must be malleable and ductile.
- f. It must be flexible.
- g. It posses better tensile strength.
- h. It should not react with climatic conditions.

- i. It can be drawn in very fine wires.
- j. It must be readily joinable.
- k. It must be very low in cost.
- l. It must available in plenty.

37. What are the common conductors in sequence with high conductivity?

- a. Silver
- b. Silver copper alloy
- c. Copper (Hard drawn and Annealed)
- d. Gold
- e. Zinc
- f. Platinum
- g. Tin
- h. Aluminum
- i. Iron
- j. Brass
- k. Phosphorous bronze
- l. Nickel
- m. Lead
- n. Germanium silver
- o. Antimony
- p. Platinoid
- q. Mercury
- r. Bismuth
- s. Platinum iridium

38. What is semiconductor?

Semiconductors possess less conductivity (conductance) than good conductors. That is semiconductors give opposition (resistance) to the flow of free electrons than that of good conductor.

Examples for semiconductor are

- a. Dilute acid
- b. Metallic ores
- c. Sea water
- d. Moist earth
- e. Silicone
- f. Germanium

39. What is fair conductor?

Fair conductors are the materials, which have less conductivity than that of semiconductor. Fair conductor gives more opposition to the flow of free electrons than that of semiconductors.

Examples for fair conductors are

- a. Charcoal
- b. Coke
- c. Carbon
- d. Plumbago

40. What is resistor?

Resistors possess high resistance, but less conductance. This property is well utilized to convert electrical energy into heat energy. Common applications of resistors are production of heaters. Examples are eureka, carbon, nichrome, tungsten, manganin, germanium, and tantalum. In case of heaters, electrical iron and soldering iron etc the heating element are made of nichrome, but in lamps filament is made of tungsten.

41. What is the difference between resistor, rheostat and potential divider?

Resistor: a fixed resistance connected permanently in the circuit for limiting the current to definite value is called the resistor.

Rheostat: a variable resistance by sliding contacts on it the current can be varied is called rheostat.

Potential divider: when a resistance is used to develop a voltage drop it is called a potential divider.

42. What is solder?

Solder is an alloy of lead and tin mixed in different proportions as per the work to be done. In some cases certain % of bismuth and cadmium is also added to decrease the melting point of the solder. Antimony increases the melting point of the solder.

Bismuth has a special quality in comparison to most of other metals. That is it expands when it cools. This property helps to shrink the solder and thereby it allows the joint become firm.

The quality of the solder depends on the % of tin in the solder. To get stronger joint add more tin in the solder.

For electrical work fine solder of 1½ part tin and 1 part lead is used and for sheet metal works soft solder of 1 part tin and 1 part lead is used.

43. What is flux?

Flux is a cleanser and is used to remove and prevent oxidation of the metals, allowing the solder to flow from and to, to unite the solder more firmly with the surface to be joined.

44. What is skin effect?

Electricity has affinity (fondness) to pass through peripheral surface of the conductor. This effect of electricity flowing through the peripheral surface of the conductor is known as skin effect.

45. What are the advantages of stranded cables?

- a. It gives flexibility.
- b. It prevents skin effect.
- c. Increases current carrying capacity.
- d. It provides easy in soldering joint.
- e. If one strand breaks the other will carry the load current.

46. State the Ohm's law.

In a closed electrical circuit, at a constant temperature, the ratio between the resulting unvarying current or direct current and applied voltage is a constant. That constant is known as resistance.

OR

In simple manner Ohm's law says that, in a closed electrical circuit the current is directly proportional to the voltage and inversely proportional to the resistance of the circuit.

$$I = V/R \text{ or}$$

$$R = V/I \text{ or}$$

$$E = IR.$$

47. What is series circuit? What are the characteristics of series circuit?

It is that circuit where two or more electrical consuming devices are connected so as to provide only one path to the flow of current.

#### **Characteristics of series circuit**

- a. It has only one path for the flow of current.
- b. If any breakage happens the whole system will be out of that circuit.
- c. It is very difficult to find the fault.
- d. Individual voltage drop depends on individual resistance ( $V = I r_n$ ).
- e. The total resistance of a series circuit is the sum of the individual resistance.
- f. Addition of the resistance increases total resistance and decreases the current.
- g. Individual device will not get its full efficiency.

48. What is parallel circuit? What are the characteristics of parallel circuit?

It is that circuit where two or more electrical consuming devices are connected so as to provide as many parallel paths to the flow of current.

#### **Characteristics of parallel circuit**

- a. As many parallel paths as there are devices.
- b. Individual devices will get its full efficiency.
- c. Breakage in one circuit will not affect the other circuit.
- d. Current in each device is different according to the resistance of the device.
- e. If the individual resistance increases the total resistance will decrease  
( $1/R = 1/r_1 + 1/r_2 + 1/r_n$ )
- f. The reciprocal of total resistance is equal to the sum of the reciprocal of individual parallel resistances  
( $1/R = 1/r_1 + 1/r_2 + 1/r_n$ ).
- g. Individual conductance is inversely proportional to the individual resistance.
- h. If two same value resistors are connected in parallel circuit the total resistance is the resistance of one resistor. And the total of parallel circuit resistance will be less than the least resistance in that circuit.

(To be continued)

Courtesy: <https://www.scribd.com/document/244623258/Question-and-Answers-Electrical-Maintenance-Unit>

## ELECTRICAL Q & A PART – 3 (4)

### 31) Conductor corona is caused by?

- Corona on a conductor can be due to conductor configuration (design) such as diameter too small for the applied voltage will have corona year-around and extreme losses during wet weather, the opposite occurs during dry weather as the corona produces nitric acid which accumulates and destroys the steel reinforcing cable (ACSR) resulting in the line dropping. Road salts and contaminants can also contribute to starting this deterioration.

### 32) What is flash-over and arcing?

- Flash-over is an instantaneous event where the voltage exceeds the breakdown potential of the air but does not have the current available to sustain an arc, an arc can have the grid fault current behind it and sustain until the voltage decreases below 50% or until a protective device opens.
- Flash-over can also occur due to induced voltages in unbounded (loose bolts, washers, etc) power pole or substation hardware, this can create RFI/TVI or radio/TV interference. Arcing can begin at 5 volts on a printed circuit board or as the insulation increases it may require 80kVAC to create flash-over on a good cap and pin insulator.

### 33) How to Minimizing Corona Effects

- Installing corona rings at the end of transmission lines.
- A corona ring, also called anti-corona ring, is a toroid of (typically) conductive material located in the vicinity of a terminal of a high voltage device. It is electrically insulated.
- Stacks of more spaced rings are often used. The role of the corona ring is to distribute the electric field gradient and lower its maximum values below the corona threshold, preventing the corona discharge.

### 34) What is BIL and how does it apply to transformers?

- BIL is an abbreviation for Basic Impulse Level. Impulse tests are dielectric tests that consist of the application of a high frequency steep wave front voltage between windings, and between windings and ground. The Basic Impulse Level of a transformer is a method of expressing the voltage surge (lightning, switching surges, etc.) that a transformer will tolerate without breakdown.
- All transformers manufactured in this catalog, 600 volts and below, will withstand the NEMA standard BIL rating, which is 10 KV.
- This assures the user that he will not experience breakdowns when his system is properly protected with lightning arrestors or similar surge protection devices.

### 35) The difference between Ground and Neutral?

- NEUTRAL is the origin of all current flow. In a poly-phase system, as its phase relationship with all the three phases is the same, (i.e.) as it is not biased towards any one phase, thus remaining neutral, that's why it is called neutral.
- Whereas, GROUND is the EARTH on which we stand. It was perceived to utilize this vast, omnipresent conductor of electricity, in case of fault, so that the fault current returns to the source neutral through this conductor given by nature which is available free of cost. If earth is not used for this purpose, then one has to lay a long metallic conductor for the purpose, thus increasing the cost.
- Ground should **never** be used as neutral. The protection devices (eg. ELCB, RCD etc) work basically on principle that the phase currents are balanced with neutral current. In case you use ground wire as the neutral, these are bound to trip if they are there – and they must be there. at least at substations. And these are kept very sensitive i.e. even minute currents are supposed to trip these.

- One aspect is safety – when someone touches a neutral, you don't want him to be electrocuted – do you? Usually if you see the switches at home are on the phase and not neutral (except at the MCB stage). Any one assumes the once the switch is off, it is safe (the safety is taken care of in 3 wire system, but again most of the fixtures are on 2 wire) – he will be *shocked* at the accidental touching of wire in case the floating neutral is floating too much.

### 36) What is impedance of a transformer?

- If you mean the percentage impedance of the transformer it means the ratio of the voltage (that if you applied it to one side of the transformer while the other side of the transformer is short circuit, a full load current shall flow in the short circuit side), to the full load current.
- More the %Z of transformer, more Copper used for winding, increasing cost of the unit. But short circuit levels will reduce, mechanical damages to windings during short circuit shall also reduce. However, cost increases significantly with increase in %Z.
- Lower %Z means economical designs. But short circuit fault levels shall increase tremendously, damaging the winding & core.
- The high value of %Z helps to reduce short circuit current but it causes more voltage dip for motor starting and more voltage regulation (% change of voltage variation) from no load to full load.

### 37) How are transformers sized to operate Three Phase induction type squirrel cage motors?

- The minimum transformer KVA rating required to operate a motor is calculated as follows:
- Minimum Transformer KVA = Running Load Amperes x 1.73 x Motor Operating Voltage / 1000
- **NOTE:** If motor is to be started more than once per hour add 20% additional KVA. Care should be exercised in sizing a transformer for an induction type squirrel cage motor as when it is started, the lock rotor amperage is approximately 5 to 7 times the running load amperage. This severe starting overload will result in a drop of the transformer output voltage.
- When the voltage is low the torque and the horsepower of the motor will drop proportionately to the square of the voltage.
- For example: If the voltage were to drop to 70% of nominal, then motor horsepower and torque would drop to 70% squared or 49% of the motor nameplate rating.
- If the motor is used for starting a high torque load, the motor may stay at approximately 50% of normal running speed, the underlying problem is low voltage at the motor terminals. If the ampere rating of the motor and transformer over current device falls within the motor's 50% RPM draw requirements, a problem is likely to develop. The over current device may not open under intermediate motor ampere loading conditions.
- Overheating of the motor and/or transformer would occur, possibly causing failure of either component.
- This condition is more pronounced when one transformer is used to power one motor and the running amperes of the motor is in the vicinity of the full load ampere rating of the transformer. The following precautions should be followed:
  - **(1)** When one transformer is used to operate one motor, the running amperes of the motor should not exceed 65% of the transformer's full load ampere rating.
  - **(2)** If several motors are being operated from one transformer, avoid having all motors start at the same time. If this is impractical, then size the transformer so that the total running current does not exceed 65% of the transformer's full load ampere rating.

**38) Which Point need to be consider while Neutral Earthing of Transformer?**

- The following points need to check before going for Neutral Grounding Resistance.
- Fault current passing through ground, step and touch potential.
- Capacity of transformer to sustain ground fault current, w.r.t winding, core burning.
- Relay co-ordination and fault clearing time.
- Standard practice of limiting earth fault current. In case no data or calculation is possible, go for limiting E/F current to 300A or 500A, depending on sensitivity of relay.

**39) Why a neutral grounding contactor is needed in diesel generator?**

- There would not be any current flow in neutral if DG is loaded equally in 3 phases, if there any fault (earth fault or over load) in any one of the phase ,then there will be un balanced load in DG. At that time heavy current flow through the neutral, it is sensed by CT and trips the DG. So neutral in grounded to give low resistance path to fault current.
- An electrical system consisting of more than two low voltage Diesel Generator sets intended for parallel operation shall meet the following conditions:
  - (i) Neutral of only one generator needs to be earthed to avoid the flow of zero sequence current.
  - (ii) During independent operation, neutrals of both generators are required in low voltage switchboard to obtain three phases, 4 wire system including phase to neutral voltage.
  - (iii) required to achieve restricted earth fault protection (REF) for both the generators whilst in operation.
- Solution:
- Considering the requirement of earthing neutral of only one generator, a contactor of suitable rating shall be provided in neutral to earth circuit of each generator. This contactor can be termed as “neutral contactor”.
- Neutral contactors shall be interlocked in such a way that only one contactor shall remain closed during parallel operation of generators. During independent operation of any generator its neutral contactor shall be closed.
- Operation of neutral contactors shall be preferably made automatic using breaker auxiliary contacts.

**40) Neutral grounded system vs solidly grounded system**

- In India, at low voltage level (433V) we **MUST** do only Solid Earthing of the system neutral.
- This is by IE Rules 1956, Rule No. 61 (1) (a). Because, if we option for impedance earthing, during an earth fault, there will be appreciable voltage present between the faulted body & the neutral, the magnitude of this voltage being determined by the fault current magnitude and the impedance value.
- This voltage might circulate enough current in a person accidentally coming in contact with the faulted equipment, as to harm his even causing death. Note that, LV systems can be handled by non-technical persons too. In solid earthing, you do not have this problem, as at the instant of an earth fault, the faulted phase goes to neutral potential and the high fault current would invariably cause the Over current or short circuit protection device to operate in sufficiently quick time before any harm could be done.

*Courtesy: Jignesh.Parmar*

***“The policy of being too cautious is the greatest risk of all.”***

**– JAWAHARLAL NEHRU**

# LABORATORIES FOR THE 21<sup>ST</sup> CENTURY: BEST PRACTICE GUIDE EFFICIENT ELECTRIC LIGHTING IN LABORATORIES - 3

## Controls

### **Strategy #6: Use daylight controls for ambient lighting in perimeter zones.**

One of the major benefits of day lighting is the ability to save energy by reducing the use of electrical lighting by dimming or switching. The cost-effectiveness of daylight-based dimming is a function of electricity prices and the cost of dimming systems. One way to improve cost-effectiveness is to right-size the HVAC system by accounting for the reductions in cooling load that result from lower internal heat gains achieved by reducing electrical lighting loads. Another way to improve cost-effectiveness is to use dimming technology further into the occupied space rather than at the perimeter. The rationale for this is that a well-day lit space provides enough daylight at the perimeter so that perimeter luminaires can be switched rather than dimmed. It is more economical to limit use of daylight-harvesting dimming ballasts to luminaires further away from the fenestration, where they will be most effective. A caveat to this approach is that it assumes users at the perimeter will turn off the lights when there is adequate daylight. Consider the use of physical models or computation daylight simulation software such as RADIANCE to optimize integrated daylight designs and establish life cycle costs.

### **Strategy #7: Ensure that lighting zones are small enough to provide local control.**

Occupants generally prefer manual control of their environments over automatic control. Something as simple as an override to a larger low-voltage switching/ dimming system satisfies this desire for direct local control. To limit lighting in unoccupied areas in periods of low occupancy, use smaller lighting zones of about 800 to 1000 sf. Note that task lighting effectively provides local control.

### **Strategy #8: Use bi-level switching.**

Light levels are often greater than required, but occupants do not have the choice to reduce them. Bi-level controls are a low-cost or no-cost add-on (if done at construction) and allow two or three levels. In a typical installation, one switch controls 1/3 of the lamps in a space while the other controls 2/3 of the lamps. This allows for four light levels: off, 1/3, 2/3, and full. Bi-level switching is now required by code in some locations, and may be very appropriate for laboratory spaces, because they are designed to high light levels that many tasks may not even require.

### **Strategy #9: Use occupancy sensors for ambient and task lighting.**

Lighting in general and task lights in particular tend to be left on by users. They become part of the visual "landscape," and users are not consciously aware that they should be turned off when not required. Occupancy sensors are an effective way to reduce energy waste for both ambient and task lighting in laboratories. Dual sensors, composed of both passive infrared and ultrasonic technologies, require the absence of both heat and motion to shut off, minimizing false-triggering problems. To maximize savings, lighting should be controlled separately for each bay. The cost-effectiveness of occupancy controls can be improved if they are also used for laboratory HVAC system control. As in other building types, occupancy sensors are also effective in conference rooms, rest rooms, and other intermittently used rooms.

### **Strategy #10: Use sweep-off lighting schedule with manual overrides.**

This is appropriate for labs that tend to be occupied on a predictable schedule, and are not occupied around the clock. Lights are turned off according to preset schedules, based on occupancy patterns. Safety concerns should be carefully evaluated when considering such a system. In Washington State, code requires that lighting for areas larger than 5000 sf must have automatic controls to turn off lights at night.

### **Strategy #11: Commission lighting controls.**

Commissioning and calibration of lighting controls are essential if energy savings are to be achieved and maintained. For example, occupancy sensors with sensitivity set too high can fail to save energy, but occupancy sensors with too low a sensitivity or too short a delay time can be annoying or even potentially hazardous to

occupants. Similarly, improperly adjusted daylighting controls or improperly located photo sensors can dim the lights too low, causing occupants to override them (e.g., by taping over the sensor), or can fail to dim the lights at all.

**Performance Parameters**

**Required Illumination Levels**

The goal of good lighting design is to provide the quantity and quality of light needed for the task. Lighting designed for laboratories has many things in common with lighting designed for offices or other places where mixed visual tasks are performed. One significant difference is that the work surfaces in labs are typically at various heights, hence most tasks are of a three-dimensional nature, involving multiple horizontal and vertical work surfaces. Lighting for good visual acuity necessarily includes a balance between horizontal work surface illumination and the brightness of other surfaces near and distant in the field of view. Minimizing dramatic contrast in the entire field of view will help to reduce eyestrain and visual fatigue, although some contrast is essential to prevent visual dullness, which can also cause fatigue.

**Strategy #12: Don't overdesign. Carefully assess required illuminance levels in conjunction with other performance parameters.**

While designers have traditionally focused on the required illumination levels for a space, there are several other aspects of lighting design that significantly affect visual performance and the overall visual perception of the space, as will be discussed later. Therefore, it is important to recognize at the outset that illuminance requirements must always be considered in conjunction with other visual performance parameters. For example, the “see-ability” of 50 to 70 foot-candles (fc) of indirect lighting is comparable to 100 to 130 fc of direct lighting, due to the elimination of glare with indirect sources (Doberdruk 1999). Thus, “qualitative” factors directly affect lighting energy use.

The 9<sup>th</sup> edition of the IESNA Handbook has revised its illuminance recommendations for laboratories downward from the previous edition, as indicated in Figure 9. Many owners of laboratory facilities are questioning traditionally conservative engineering practices, which frequently led to significant over-sizing of basic building services, costing owners more money for both construction and ongoing operation.

There are no universally applicable standards for illuminance in laboratory spaces. While there may be a need to light a specific task to between 80 and 100 fc, it is rarely necessary to light the whole laboratory to that level. In fact, high illuminance levels may *reduce* visual acuity for tasks that require reading monitors and other electronic displays. Therefore, the lighting designer should carefully assess illumination needs based on the task. If flexibility is required, then incorporate appropriate strategies to vary the light levels. For example, a design guideline developed for a University of California laboratory advocated a flexible configuration which had 30 to 50 fc of ambient lighting, with additional illuminance provided by under-cabinet task lighting, and a re-locatable articulated arm task light in a few locations for high-illuminance tasks.

**Brightness, Uniformity and Other Qualitative Factors**

As noted earlier, visual acuity is a function of several factors beyond illuminance levels. The 9<sup>th</sup> edition of the IESNA handbook lists 23 criteria, including colour appearance, direct glare, and surface light distribution. The resources at the end of this guide provide more information on these factors. Some important considerations for laboratory spaces are discussed below.

*(To be continued)*

*Courtesy: Lawrence Berkeley National Laboratory*

IESNA Lighting Handbook- 9th Edition 2000 Illuminance Maintained (fc)	IESNA Lighting Handbook- 8th Edition 1993 Illuminance Maintained (fc) (horizontal)
<b>Specimen collecting</b> horizontal 50 vertical 10	<b>Specimen collecting</b> 50 - 75 - 100
<b>Science laboratory</b> horizontal 50 vertical 30	<b>Laboratories</b> Tissue laboratories 100 - 150 - 200 Microscopic reading room 20 - 30 - 50 Gross specimen review 100 - 150 - 200
	<b>Chemistry room</b> 50 - 70 - 100
	<b>Bacteriology rooms</b> General 50 - 75 - 100 Reading culture plates 100 - 150 - 200
	<b>Hematology</b> 50 - 75 - 100 (pg. 461, 462)
Design Guide Section (Interior pg. 4, 6, 7)	

Figure 9. A comparison between the IESNA laboratory illuminance recommendations in the current (9th) edition and the previous (8th) edition. Data source: IESNA.



தமிழ்நாடு அரசு

மக்கள் நல்வாழ்வு மற்றும் குடும்பநலத்துறை

இந்திய மருத்துவம் மற்றும் ஹோமியோபதி ஆணையரகம்

# நிலவேம்பு குடிநீர்

இவற்றில் சேரும் மருந்துகள்



நிலவேம்பு



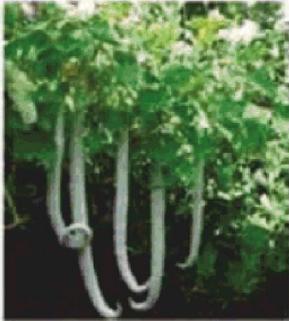
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விலாமிச்சம்வேர்



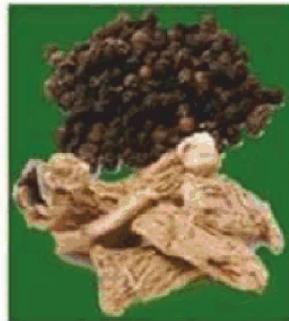
சந்தனம்



பேய்ப்புடல்



கோரைக்கிழங்கு



சுக்கு, யிளகு



பற்பாடகம்

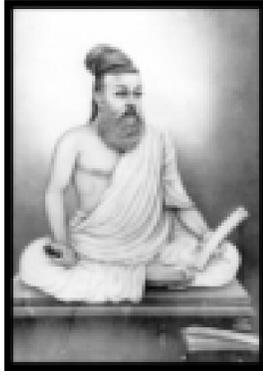
## குடிநீர் அளவு

5 வயது முதல் 12 வயது வரை உள்ள குழந்தைகளுக்கு 10 மி.லி. தினமும் 2 வேளை அருந்தவும்.  
பெரியவர்களுக்கு 50மி.லி. தினமும் 2 வேளை அருந்தவும்.

எல்லா வகை காய்ச்சலும் குணமாகும்

## TENETS FROM TIRUKKURAL FOR EDUCATION

Education is very important for every one and Tiruvalluvar has conveyed a lot about education and the educated as well as the ills of the neglect of education. Evolution of human civilization in various parts of the country and all over the world has given birth to a large number of languages, each one with its own beauty and depth, and knowledge of a number of languages can make you comfortable where ever one goes. There is one's own language, the mother tongue, languages within the country and international languages in the context of present times. While dealing with education, Tiruvalluvar dwells on one's happiness and spreading happiness and one's going places and feeling comfortable and acceptable in those places. Happiness should be possible with education through mother tongue and pursuing subjects of one's interest and passion. Going places and feeling comfortable and



regarded should be possible with knowledge of a number of languages, in the context of present times. The Education Bill, which is being debated, addresses both happiness dimensions and the number of languages dimensions in the education to be imparted from very young age.

*Uvappath Thalaikkoodi Ullap Piridal  
Anaitthe Pulavar Thozhil Kural 394*

உவப்பத் தலைக்கூடி உள்ளப் பிரிதல்  
அனைத்தே புலவர் தொழில். குறள் 394

“It is the festival of joy when learned men come together; but wistful grow their hearts when the time of their parting arriveth.”

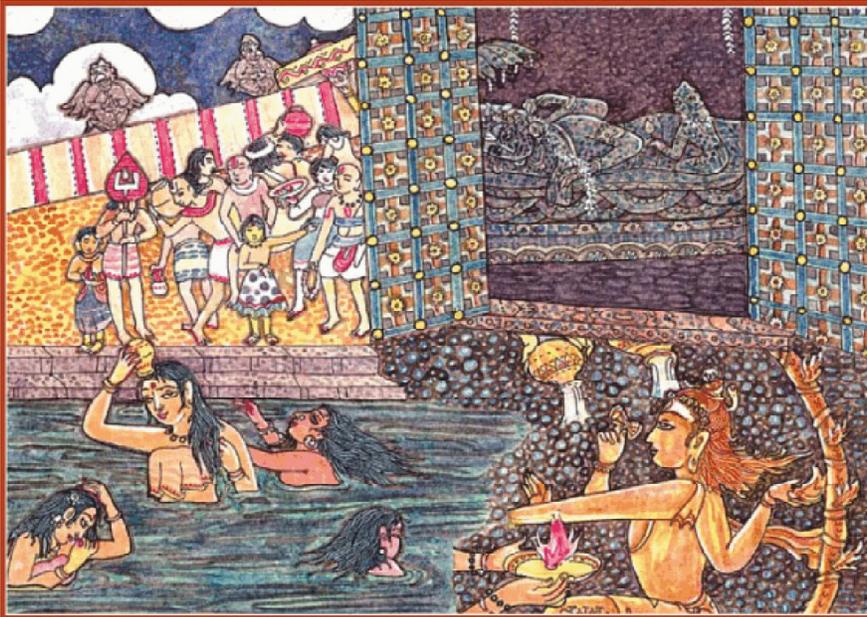
*Yaadhaanum Naadamaal Ooraamaal Ennoruvan  
Saandhunaiyung Kallaadha vaaru? Kural 397*

யாதானும் நாடாமால் ஊராமால் என்னொருவன்  
சாந்துணையுங் கல்லாத வாறு. குறள் 397

“Everywhere is his home to the learned man and everywhere his native land; why then doth a man neglect instructions upto his dying day?”

## HOME FESTIVALS - 12

மார்கழி - Markali (December/January)



During Tirupaval (below, in upper left of painting), people bathe (lower left) and gather in the early morning to go on procession singing devotional Vaishnava songs (upper left). Especially popular are those of the 9<sup>th</sup> century lady saint Andal, venerated as one of South India's greatest devotional poets. On **Vaikunth Ekadasi**, the 11<sup>th</sup> day of the lunar month, the doors of the huge temple of Srirangam

are opened to devotees from morning to night for darshan of Rangan, an aspect of Lord Vishnu, sleeping on Adishani, the serpent king (upper right). Another famed festival is **Ardra Darshana**, when Siva Nataraja is decorated and taken from the temple in procession throughout the community (lower right). Especially the ill and those of old age seek to have a glimpse of Nataraj. A renowned sweet, **aurudra kalli**, is made with vegetables on this day.

“All of these festivals are earnestly conducted. People wait for the day with their mind on God. The purpose is to gather in the home and worship for the prosperity of the family and of all mankind.”



# SUPREME POWER EQUIPMENT PRIVATE LIMITED

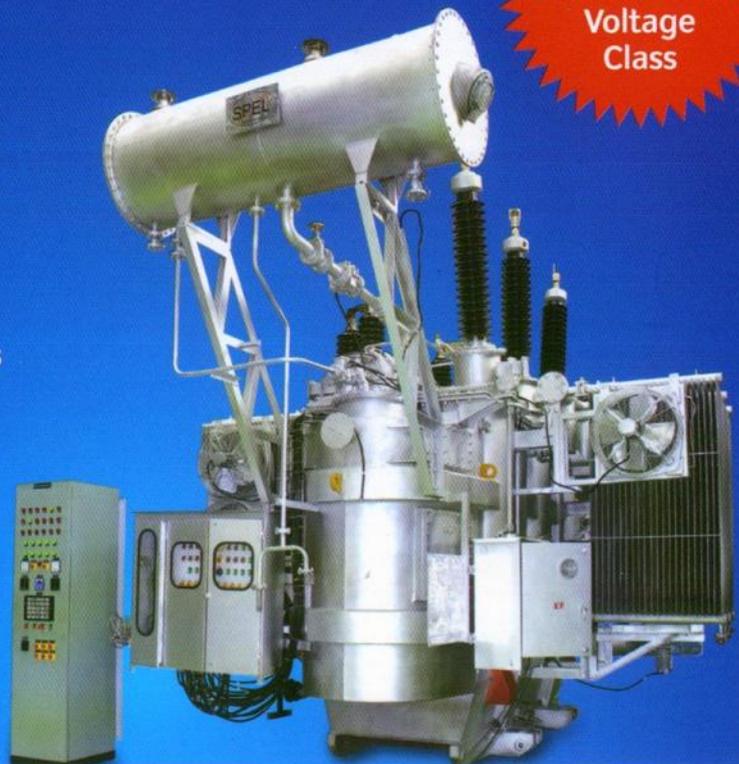
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