ELECTRICAL INSTALLATION ENGINEER

NEWS LETTER

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EDITORIAL

Dear Members, Fellow Professionals and Friends,

Greetings To All!

Happy Independence Day Greetings!!

August 15th, 2022 is indeed a Day, we can all be proud of as OUR NATION will be completing 75 years of INDEPENDENCE. We are a Large and Successful and Stable Democracy, marching ahead to become a "Super Economic Power" of the World. We are often referred to as a young democracy, but are probably one of the oldest Countries of the World in terms of Civilization, Culture and Traditions. It is History that in Economic Power too, we have been leading the world till about the middle of 18th century.

While celebrating the AMRIT MAHOTSAV of our Independence, we should remember our long struggle for Independence and the sacrifices made by large number of Freedom Fighters and the Movement lead by different leaders at different points of time and finally by Mahatma Gandhi. The final thrust or push or vigor for our Independence, "The Quit India Movement", was actually launched in August 1942 with India getting its Independence in August 1947.

It is worth recalling the extent of poverty and backwardness with which the colonial masters gave us independence after squeezing out everything possible from our country. We were reduced to literally nothing from the state of 'Top Economy of the World' till the mid-18th Century, to a country with not even sufficient food for everyone, let alone any worthwhile industrial activity, as India had already missed the 'Industrial Revolution'. Added to this was the problem of partition of the country with the birth of Pakistan, with continuing problems from them. Chinese aggression in 1962 was another big jolt, which not only resulted in more problems, but also resulted in passing away of our dear Pundit Jawaharlal Nehru, who had groomed friendship with China. As is believed that adversaries can be opportunities too, we made full use of the opportunities with the help of the people power for making the country strong and attain economic growth as well.

We are today an important Nation in the Global fraternity of Nations under the United Nations Organization UNO. Our PM now is one among the top popular and influential leaders of the World. The 75 years period of our country, since Independence, as a proud and stable Democracy, can be split into two periods, one from 1947 to 1990 and the other from 1990 onwards to the present.

In the first phase we achieved establishment of a large industrial base, covering almost the entire spectrum from steel plants to fertilizer plants to heavy engineering to heavy electricals to entire transportation industries for roads, rail and planes to defense industries and covering the entire ranges of medium, small and micro industries of all kinds for all sectors. We had successful "Green" and "White" revolutions in this period which made us a surplus country from the early stages of dependence on imports even for food.

In the second phase from 1990 we switched over to 'Market Economy' accessing the world markets and achieving a leap forward in all technology areas including Communication and IT.

We march forward with the pride of our democracy and capability of our people in all fronts.

We thank all those members who have helped us by participating in the advertisement appearing for the issue June 2022 – 3SI Eco Power LLP, Arrow Marketng, Asias Electricals, E Power Engineering, Galaxy Earthing Electrodes (P) Ltd., Garden Rhapsody, Gravin Earthing & Lightning Protection System (P) Ltd., Pentagon Switchgear Pvt. Ltd., Power Cable Corporation, Sri Bhoomidurga Marketing (P) Ltd., Supreme Power Equipment (P) Ltd., Visewham Electricals.

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REVIEW OF THE FIRE SAFETY OF RESIDENTIAL BUILDINGS IN ACCORDANCE WITH THE NATIONAL BUILDING CODE PART – IV – FIRE AND LIFE SAFETY

Introduction:

There was a time when we were all staying in individual houses where the hazards was very limited. Even today in villages, there are only single houses.

How many of us would have heard of a major fire in our grandmother's house which engulfed the whole building and many residents of the house succumbed to the fire? Not one of us can recollect the same. But now the situation is different.

All over India and in world around whether it is developed or developing country we are hearing of more and more casualities in residential buildings that the situation cannot be ignored at all.

We may all be electrical engineers, electronic engineers, an electrical engineering professor or a manufacturer of electrical products or any professional but by star topology, we all gravitate towards our home, our parents, our families and we all work and live for their welfare. But are we really doing so???

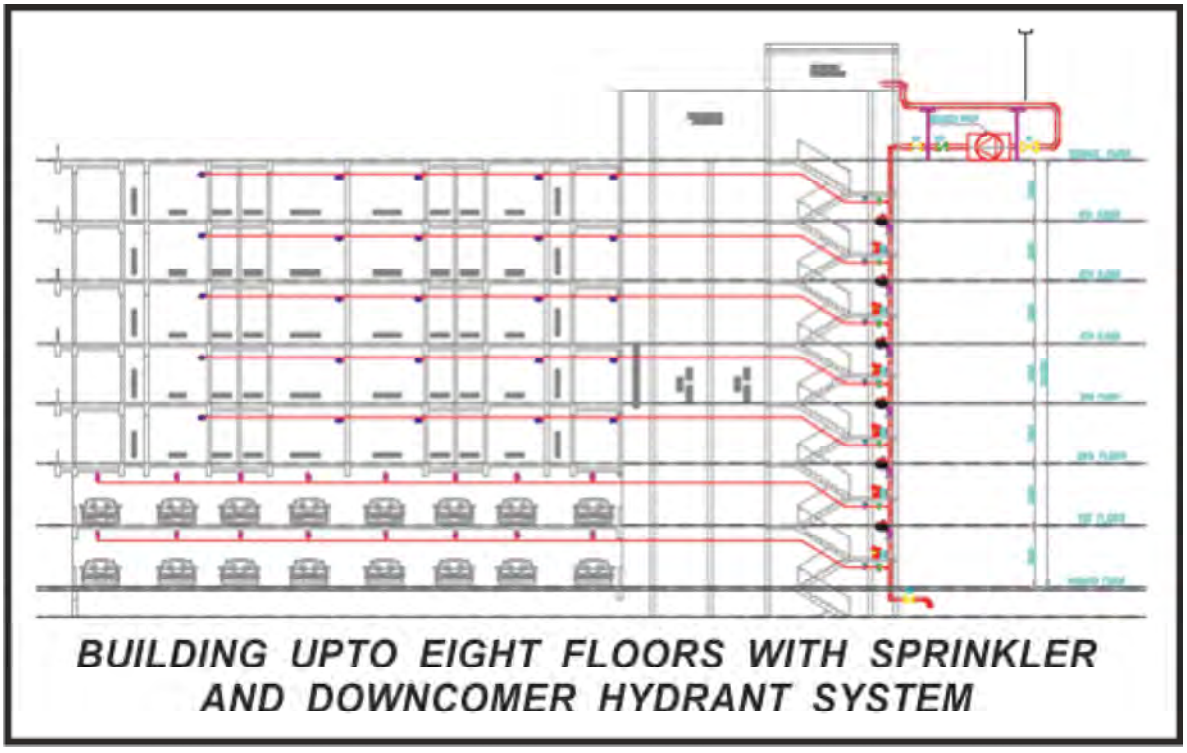
About 20 years back, Industrial Fires and accidents were more in numbers. Luckily Industrial Fire Incidents have not seen a major rise here in India and other parts of the world as well, partly because the industries have matured and also newer hazards are not being introduced much and more educated and trained personnel are available in the Industrial Front.

Further the following benefits are available in Industrial front for better fire safety:

- *Safe Fire Exits and Assembly Points are available for employees to move out thus reducing casualties.*
- *General mechanical and electrical maintenance teams are available who can sort out technical problems at site faster. In residential projects, this facility is not available and further they have to depend on untrained temporary personnel to carry out the rectification jobs.*
- *Work permit systems etc. are better matured in most factories.*
- *As products change, processes change and as processes change, mostly safety systems improve.*
- *Industrial locations have captive fire brigade stations with experienced fire brigade personnel to quickly arrive at the location of fire and take suitable actions. However residential buildings are coming in far-flung areas stretching the existing fire brigade resources badly. Also forest fires affect residential buildings in far-flung areas.*
- *The average age of personnel in factories is around 40 years. Hence personnel have better faculty to rescue themselves and others. In residential complexes, the average age is around 45 years and mixed physical faculty.*
- *Compare this to our residential front wherein:*
- *Once we were staying in individual residences with individual cooking areas, chimneys to dissipate the heat and smoke from the kitchen.*
- *Then we were living in flats upto three floors with no lifts or DG Sets.*

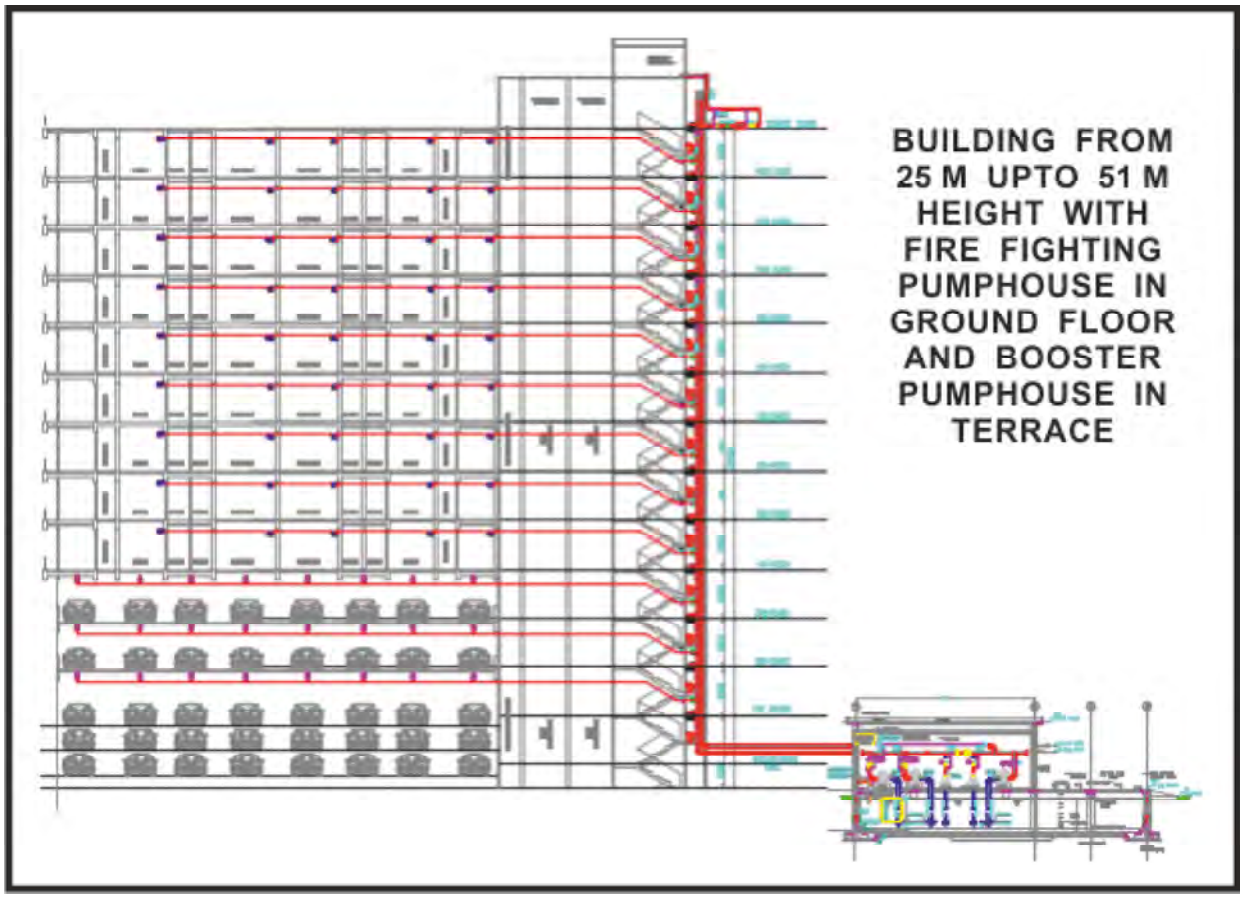
- *Then we started staying in flats upto eight floors with lifts but no DG Sets etc.*
- *Then we started staying in flats upto twenty floors with lifts, DG sets, multilevel car parking etc.*
- *Now many of us are staying in buildings upto 80 floors etc. which are like a city in itself. It is said a city cannot be evacuated in case of fire. These buildings are almost akin to the same.*

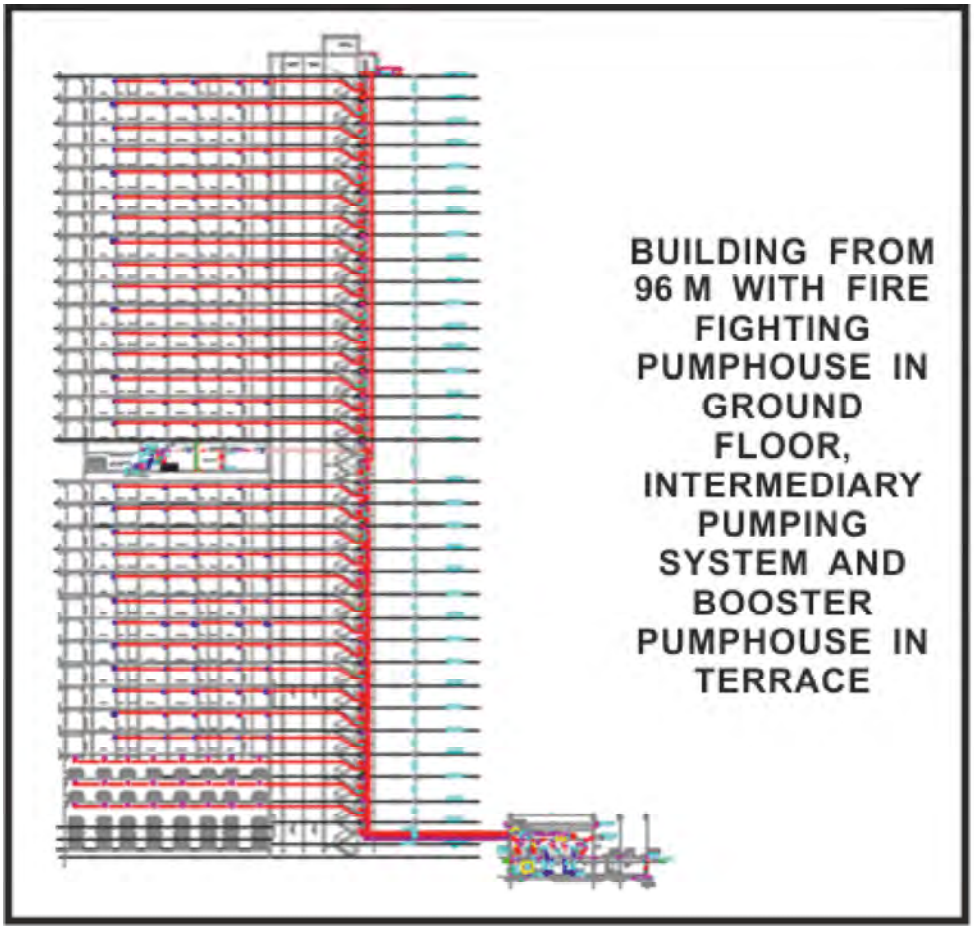
INDIVIDUAL RESIDENTIAL HOUSES



BUILDING UPTO EIGHT FLOORS WITH SPRINKLER AND DOWNCOMER HYDRANT SYSTEM

"India is not, as people keep calling it, an underdeveloped country, but rather, in the context of its history and cultural heritage, a highly developed one in an advanced state of decay." – SHASHI THAROOR


BUILDING FROM 25 M UPTO 51 M HEIGHT WITH FIRE FIGHTING PUMPHOUSE IN GROUND FLOOR AND BOOSTER PUMPHOUSE IN TERRACE


BUILDING FROM 96 M WITH FIRE FIGHTING PUMPHOUSE IN GROUND FLOOR, INTERMEDIARY PUMPING SYSTEM AND BOOSTER PUMPHOUSE IN TERRACE

If we put our finger against each illustration above and ponder for five minutes, we as engineers can easily understand how the fire and other risks have increased.

(It is just the time please that we spend when we view a you-tube video for comparison. So, requesting to spend this valuable time).

Keep marking in the table below what are the safety issues in the buildings above and in next issue.

Type of Building	***Safety Issues***	***Safety advantages / mitigation of risk present***
Individual residential houses		
1.		
2.		
3.		
4.		
Building less than 15 m height		
1.		
2.		
3.		
4.		
Building between 15 m to 25 m height		
1.		
2.		
3.		
4.		
Buildings above 25 m height		
1.		
2.		
3.		
4.		

After that, if one was to buy a house for oneself or for one's sister or be part of development of a new one, then we will be more careful.

We would then want a good guidance and the best and finest information is available in National Building Code 2016 Part - 4.

And we as engineers are best suited to understand and interpret the details enshrined in the National Building Code and take safety forward.

In the next issue of this Journal, we will publish some extracts of NBC – 2016 Part -4.

Until then, keep your "risks and risk mitigation list" ready.

Wishing all to stay safe and be blessed.

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KNOW THY POWER NETWORK - 166

"Connecting with the Life Cycle of an Electrical Equipment – An Structured Approach".

"Building blocks of structured approach".

(1) Objective

(2) Stages / Phases connected with the life cycle of an equipment

(3) Challenges / Threats faced by the equipment – Application of "Nature – Nurture Theory"

(4) Suggested safe guards – A gist

(5) Concluding remarks.

1 Objective

The reconstruction of the life cycle of an Electrical Equipment based on its related phases / stages, challenges / threats faced by it, its operating environment and the severity of the tasks assigned to it, is an interesting but a cumbersome / strenuous task. From the design stage, this journey passes / winds through various phases, barriers for nearly two decades or more and finally reaches its destination / disposal. Multiple challenges, security threats, unpredictable hostile operating environment, and in adequate maintenance and repairs are chiefly faced by the equipment, among other things. In order to get maximum returns on the amount and efforts invested on the equipment, it is imperative to go for this kind of study. This focused study helps to usher an easier, safer, trouble free and happier life for the equipment and the system to which it is connected. This write up outlines and narrates the life history of costly power system equipment.

2 (a) Untold service history of an equipment – stages – In brief

"Equipment service history is nothing but the operational life of an equipment. It brings forth all the events faced by the equipment right from its birth (inception) to its death (final disposal as scrap). In simple terms, all the happenings in its life starting from its "Commissioning to its final discarding / disposal" are etched in it.

Just an Humans his / her assets (electrical equipment), also have a history of its own. It covers all the events that takes place during its service journey. Among other things, it include

- The sufferings, disorders, repairs, adverse impacts on its structure, life-threatening threats and suffocations caused by poor maintenance, hostile operating atmosphere, thermal stresses as a consequence of poor air circulation / cooling and over loading, loss of its worth due to lack of its spares and obsolete conditions faced by it.

(i) Initial or early life period– In this period, its challenges are mainly (Honey Moon period - 0-5 years) due to the teething problems caused as a consequence of poor design, mishandling during transport and erection, improper commissioning tests, failure on the part of the operating personnel to foresee the exact site conditions. Incipient failure, (guarantee / warrantee period failures) or pre mature failure mainly occur during this span.

(ii) Mid Life (5-15 Years) – The normal service period of an equipment. It experiences occasional repairs and similar issues.

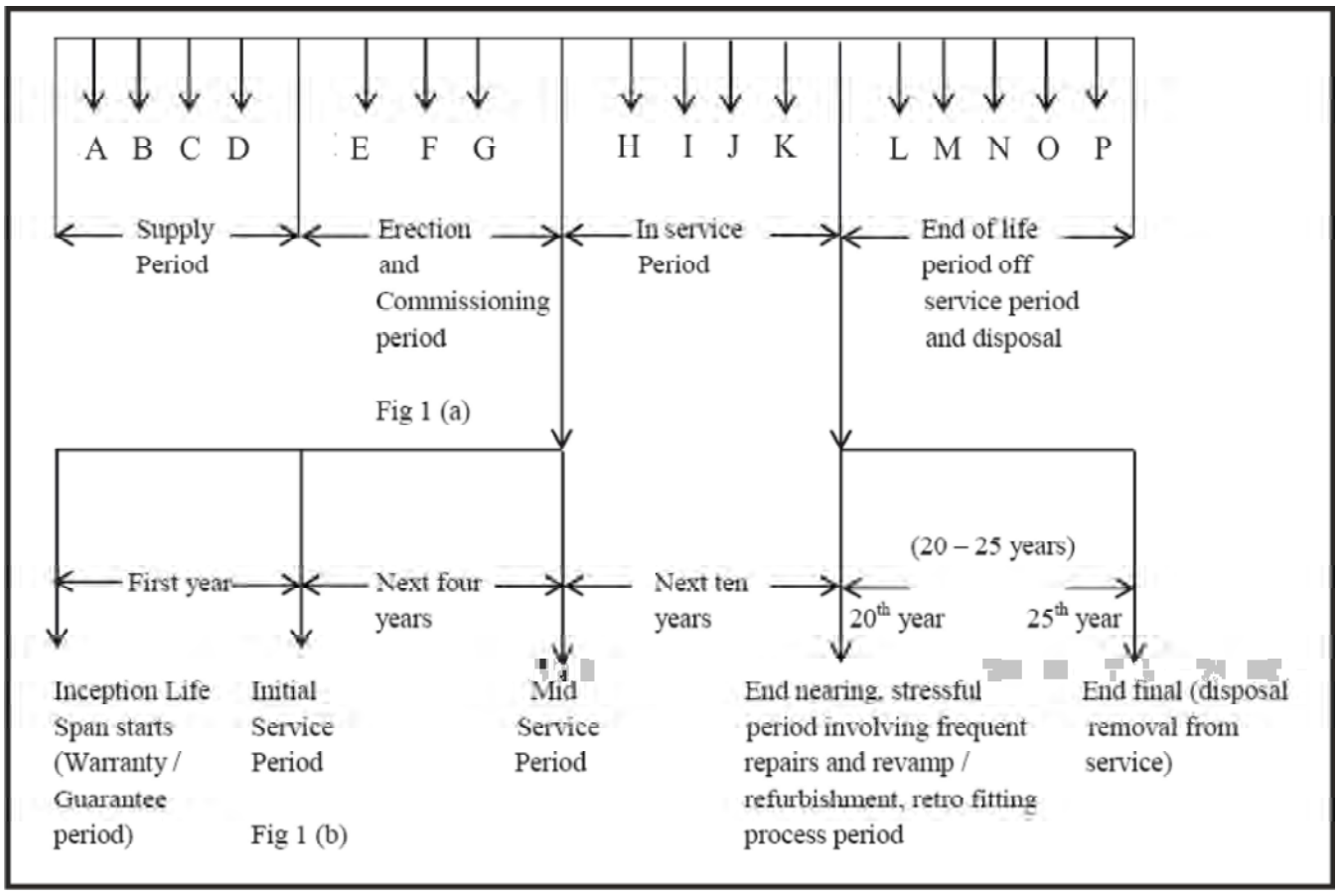
(iii) Final / End Life (After 15 years) – (Special Attention Period) – This period may extend beyond 25 years depending on the site conditions. During this period, the equipment gradually begins its final journey. It is really a stressful period – frequent repairs, sufferings due to lack of spares, obsolete conditions, gradual

reduction / fall of its output, poor treatment because of its reduced net worth, higher losses. All these put barriers in its continued journey and it is "ear marked" for final disposal.

2 (b) Stages / Phases in the life of an Electrical Equipment

Fig 1(a) and 1(b) clearly depict the events indicated in the life cycle of an electrical equipment.

In general, the life span of an electrical equipment lies between "25 – 40" years. It depends chiefly upon the operating environment and the maintenance carried out.



Legend

A – Decision to buy the equipment

B – Tender finalized

C – Order placed

D – Transport of the equipment to the site

E – Erection or Installation

F – Commissioning

G – Take over by the customer

H – Warranty / Guarantee period ends

I – Corrective maintenance (alertness periods)

J – Preventive maintenance (alertness periods)

K – Proactive maintenance (alertness periods)

L – Problem starts requiring repairs, re-modification end of 15th year

M– Repair and Retrofitting

N – Residual life assessment

O – Decommissioning

P – Final disposal as scrap.

In this context, it is not out of place to recall the words of "Shakespeare" who wrote that "The world is a stage and the men and women are merely players in it. They play several roles in their life span. In a similar way the electrical equipment also passes through several phases / stages in its life cycle, meet various challenges, suffer various ailments / health problems and finally meet its death / disposal.

2(c) Application of Nature – Nurture theory to the life cycle of an Electrical Equipment

The classification of **"Nature"**- It connotes the challenges caused by the factors connected with design, selection, placement, protection of the equipment. These are invariably connected with its performance operation and hence its life span. **"Nurture"** relates to the conditions created (man-made conditions / human factors) by the operating and maintenance personnel.

This generally cover the events like failures due to inadequate air circulation causing higher thermal stresses and poor maintenance, improper operation, inadequate protection, failure to conduct pre-operational site activity and operation, mishandling, improper erection, poor quality of input feed / supply, not foreseeing the equipment threats adequately, to quote a few. It normally links all the issues related to human intervention – different from the one related to generic / inherent in the equipment design and manufacture of system itself. (e.g.) A station class 230KV rated gapped arrester designed for class I switching surges (150A, 2000 micro. sec) withstand will not survive long in an operating environment where higher capacity switching surges are expected. In such locations class II / class III silicon carbide arresters are required to be placed (500 Amps / 1000 Amps 2000 micro. Sec withstand) and not the switching surge, class I arresters. In the case in point because of the failure to make right choice (wrong selection) a healthy class I silicon carbide surge arrester was forced to meet pre mature death. This had happened in Tamilnadu grid (Singaperumal koil 230KV SF and Kalpakkam Nuclear Power Station) in the year 1980-85. So this kind of unsafe equipment operating conditions, endangering its life span is brought under the head "Nature". All these can be compared to the recalling the events in one's life journey.

3 (a) Threats faced by the equipment during its life period

(A) External – Lightning (Direct and Indirect strokes), corrosive gases / materials, contaminations like dust, dirt, water ingress, electromagnetic radiations from the sun (sun-storms), floods, heavy rains, mist, ice formation, volcano dusts, vibrations and higher stress from Earthquake, heavy winds, cyclones, flying and falling objects like tress and humidity; atmospheric pollutions like salty winds.

(B) Internal – Switching over voltages, temporary over voltages, harmonics, higher short circuit faults and over loads with the consequential higher temperature and stresses; health risks caused by improper handling during transport and erection.

3 (b) Various stages in equipment life cycle – A synthesis of observed events.

Sl. No.	Description	Events/Challenges faced	Attributable reasons/factors	Classification assigned	Remarks
(I)	(II)	(III)	(IV)	(V)	(VI)
1	Stage I Age – less than one year - Within the first 12 months after commissioning	Equipment in spot light-suffers Starting/teething troubles – sometimes equipment finds it difficult to get aligned with the system to which it is connected and its output may not be in line with the expectations / design	Poor design; poor selection; Poor manufacturing; Inadequate Erection, Mishandling, Errors committed during commissioning process	"Nature" – Since all the issues faced are integral part of the equipment itself.	Occurrence if any failure is treated as "Incipient or Premature failure"

2	Stage – II Age 1 – 5 years	Exciting -Trouble free period – normal functioning start equipment has good chemistry (bond with the system). The issues faced are mainly due to the attribute of "O & M environment", repairs / failures randomly occur. Assigned output is achieved	Occurrence of failure, if any, is assigned to not conducive O & M environment (vibes of a new equipment are observed)	"Nurture"	
3	Stage III Age 5 – 10 years	Gradually enters into its "Stressful life cycle". Repairs / failures curve moves upwards	Aging process is kicks started Operating conditions are severe guidelines of manufacturers may not be fully compliedwith repairs - if any carried out may not be adequate. Maintenance needs a close watch	"Nurture"	
4	Stage IV Age 15 – 20 years	Endures 'Stressful Life Cycle" – Risk factor - is small repairs / failures are frequent; Retro fitting / Refurbishment is arranged whenever needs arise / output gradually falls down, "Burnt Out" conditions invariably occurs enters into its end (final journey / route spares needs are more) – spares needs are more.	Ageing process starts at faster rate - equipment is in a shakened - and stirred condition based on residual life study report, it may be permitted to continue at the work site. Impacts of vibrationary forces are generally noticed	Nurture (Residual life tests are recommended)	
5	Stage V Age 20 -25 years	Risk factor is high. Output is poor. End life starts. Its stands in the queue for final disposal sustainability is difficult. Not advisable to continue its service further since its complete breakdown is imminent and it may occur at any time. Its revival efforts may not be worth / beneficial. Its final disposal process starts.	"End nears" – preparation for its final disposal is required, since it is difficult to arrange keep it in service because difficult to arrange its spares. The equipment model would have become "obsolete" by this period. Hence its revival is well nigh possible.	Nature (End of life conditions) special attention is required along with preparation for final discard	

4**. Equipment life enhancement measures - IN A GIST**

- Maintain a dedicated history card for each equipment
- Make right choice, selection, erection process for the equipment
- Take special attention on the safe guards provided for the equipment. (e,g) Smart Protection, Effective Earthing System, Good Eco System. Concerted measures for stopping the external threats like Lightning, Contamination on their tracks itself. These steps will lead to the presence of "Safe nets" and creation of a "Conducive, Safe Operating Environment" for the equipment in case.
- Make a "360° view" of equipment O&M measures and initiate necessary course connections, whenever needed
- Take care or address in time, all the issues connected with the equipment safety and security – right from its travel from the factory to the work site and bridge all the gaps noticed in it.
- Prepare an "Equipment" watch / surveillance list for all the costly equipment in the plant.
- Take necessary moderating measures to slow down the ageing and wearing process of the equipment or other words,
- Avert the conditions that would accelerate the ageing process of the equipment e.g over loading, higher temperature operation, poor cooling medium.
- Take utmost care of all aged / stressed equipment in the plant. Make a list of it and brought them under special attention category. Under no circumstances their health needs suffer competency i.e they should not be exposed to health risks.
- Adopt / follow a comprehensive maintenance program that would be in line with the guide lines of equipment manufactures.

5. Concluding Remarks

This write-up will help to achieve our aim Viz. a special focus on the Health of Power System Equipment across various age groups. In this context, it is suggested that in a plant, the authorities concerned should make a list of all electrical equipment based on their physical / operational status / age and prioritized them and brought them under equipment care or watch list accordingly. In other words, it is brought under constant surveillance groups. This step helps to conduct the periodical health checks on the equipment in point in occurrence with their health status and needs no dirt, such a slap, if carried out regularly will enhance equipment operational life. There can be no second opinion on providing the aged equipment, a special attention or utmost care.

The health issues related to the equipment like generators, Motors, Transformers, Capacitors and Reactors across different age groups can form the core subject central topic of further studies. These study report on hand can form the base line / foundation of such studies.

To conclude, it is to be stated that the equipment in point may not remember how it entered into your circuit / work site, but it will certainly / definitely remember how it was handled and maintained. This sums up the untold service history of an Electrical Equipment.

With this, I conclude and sign off.

(To be continued)

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PEROVSKITE SOLAR CELLS – THE FUTURE OF SOLAR POWER GENERATION - 1

Presently world consumption of energy is 18.5 TWy / y whereas total solar energy hitting the earth is 23,000 TWy/y based on the assumption that 35% of suns ray gets through the atmosphere and falls on land mass. Solar energy dwarfs every other kind of renewable energy. Solar power is therefore an attractive source of energy as it is readily available and renewable. However, presently about 2% of world energy comes from sun, as solar energy harvesting has been expensive and its efficiency is low. But there is a quantum jump in solar usage over the previous two decades, as the amount of power collected from solar energy worldwide increased over 300 - fold from 2000 to 2019. New technological advances leading to decreasing cost and increasing solar panel efficiency over the last two decades has driven this increased reliance on solar.

French physicist, Alexandre Edmond Becquerel, discovered the photovoltaic effect, the operating principle of solar cell in 1839, that light can be converted into electricity. Back in 1917 Jan Czochralski, a Polish scientist discovered a method for growing single crystals and 104 years later the same method is still used in the manufacture of 90% of semiconductors like silicon, germanium etc. In 1955 Hoffman Electronics introduced photovoltaic products with only a 2% efficiency. In 1985, researchers at University of New South Wales, Australia were able to construct a solar cell that has over 20% efficiency. With the invention of new Techniques and advancement of material science the efficiency of solar cells are increasing (Refer Fig - 1) and cost of solar energy has been decreasing.

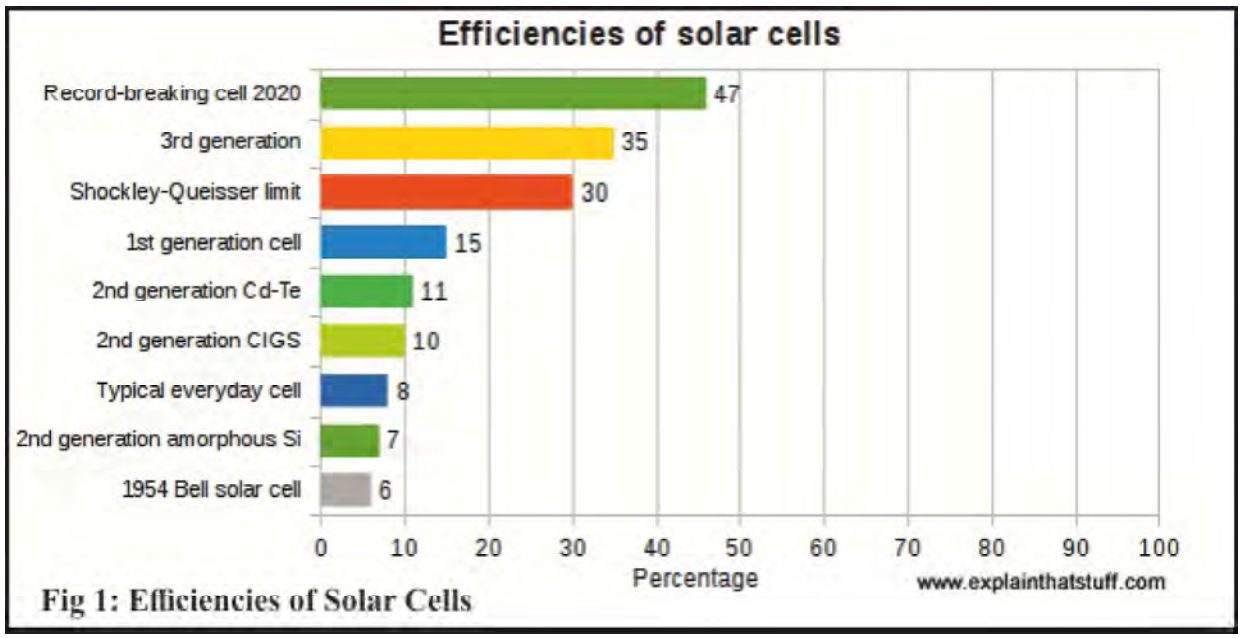


Fig 1: Efficiencies of Solar Cells

Conventional wafer based mono or polycrystalline silicon falls under the first generation category. Second generation solar cells use thin film technology and are significantly more economical than first generation cells. Three common types of second generation cells are amorphous silicon, cadmium telluride and copper indium gallium di - selenide. Common third generation systems include multilayer cells, organic solar cells, quantum dot solar cells. perovskite cells etc. They are potentially able to overcome Shockley - Queisser limit of 31 - 41% power efficiency.

How Solar Cell Work

A simple solar cell is a sandwich of two different layers of semiconductors like silicon that have been doped so that they would let electricity flow through in a particular way. Doping is a process to add impurities in a pure material to make it semiconductor. As shown in Fig - 2, the lower layer is doped with impurities like

indium / gallium, so it has slightly too few electrons. It is called p - type or positive type silicon. The upper layer is doped the opposite way with arsenic / antimony to give it a slightly too many electrons. It is called n - type or negative silicon. When a layer of n - type silicon is placed over a layer of p - type silicon, a barrier is created at the junction of the two materials. No electrons can cross the barrier. But if sunlight falls on the sandwich energetic light particles called "photons " - highlighted in yellow - enter inside the device and they give up their energy to the electrons (green blobs) in the lower p - type layer . The electrons use this energy to jump across the barrier into the upper n - type layer and escape out into the circuit and make the lamp light up.

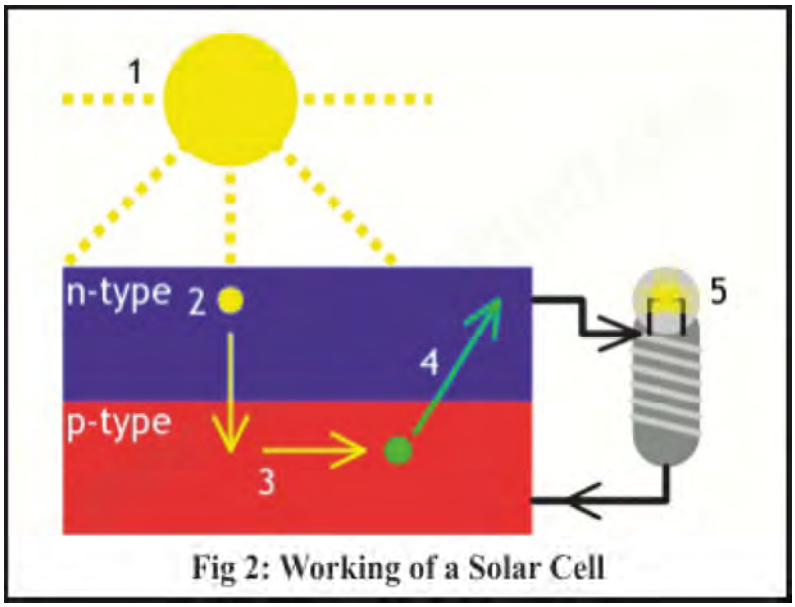


Fig 2: Working of a Solar Cell

Emerging Technologies

While the industry waits for silicon alternatives, solar developers are pursuing other methods of increasing panel efficiency.

One such method is the creation of Multifunction cells. These cells are essentially regular PV panels but with added layers to increase efficiency. Each layer is optimized to a particular wavelength, effectively increasing the efficiency of the panel as high as 47%. However extra materials and special tools and tackles are required to manufacture these devices. Hence these cells are quite costly.

Organic solar cells are a third generation photovoltaic technology using organic materials and are comprising of several layers that are printed on a thin plastic substrate using roll to roll manufacturing like newspaper printing, with thickness in the nanometre scale. They are cheap to produce. They have exhibited about 11% efficiency compared to 22% of silicon solar panels, though some recent laboratory experiments have pushed that number beyond 20%. One of the drawbacks is that exposure to moisture, oxygen and sunlight all have negative effect on these cells. However, a potential solution to these degradation has been surfaced recently, which has envisaged to remove a certain molecule from the topmost layer of organic cell.

Dye sensitized solar cells (DSSC) are third generation thin film solar cells which use photosensitive dye as the photoactive material . The dye catches the photon and uses their energy to excite electrons. Manufacturing of DSSC is simple, mostly low cost and incorporate environmentally friendly materials. They have a good efficiency of about 14% even under low flux of sunlight. However the major drawback is the temperature sensitivity of the liquid electrolyte making the solar cells that is unsuitable at low and high temperature.

Perovskites are among the most promising of the new PV materials. Thin film perovskite cells have reached an impressive efficiency of about 23% after barely a decade of research. The materials are abundant and the solution based manufacturing method makes these cells potentially cheaper than silicon cells.

Perovskite Solar Cells


Fig: 3 Perovskite Mineral

What is Perovskite?

Perovskite is calcium titanium oxide mineral composed of calcium titanate (CaTiO3). Perovskite mineral is shown in Fig - 3. Any other class of compounds which have the same type of crystal structure as CaTiO3 are also called as perovskite. The mineral was discovered by Gustav Rose in 1839 in the Ural Mountains of Russia and he named it Perovskite in honour of Russian mineralogist Lev Perovski. Perovskite is found in Earth's mantle and has been mined in Urals, Arkansas, Sweden, Germany and Switzerland. The mineral has a number of incredible properties. It could hold the keys to boosting internet speeds by 1000 times. It's another characteristic discovered in 2009 is its ability to absorb sunlight and generate electricity. It is also being developed for displays, and as catalyst in catalytic converters.

Composition and Crystal Structure

Chemical composition of Perovskite mineral mined from Achmatovsk, Zlatoust district, Ural mountains, Russia are given below :-

Chemical formula - Ca TiO3, Molecular weight - 135.96, Calcium - 29.48%, Titanium - 35.22%, Oxygen - 35.30%.

Generally, perovskite compounds have a generic chemical formula AMX3, where 'A' and 'M' represent cations with different sizes and 'X' is an anion that bonds to both. A large number of different elements can be combined together to form perovskite structure. Using this compositional flexibility scientists can design perovskite crystals to have a wide variety of physical, optical and electrical characteristics. The common representatives of these cations and anions are A = Cs+. CH3NH3+ (MA), CH(NH2)2+ abbreviated as FA, CH3CH2NH3+, M = Pb2+, Sn2+, Cu2+ and X = halogens like Cl. Br and I. Organic - inorganic metal halide perovskite with chemical formula AMX3 (A = CH3NH3, M = Pb or Sn, X = I, Br or Cl) were discovered in 1978 . These compounds change its colour from colourless to orange and to black as anions changes from Cl to Br to 1 respectively, due to decrease in band gap energy. Due to their improved optical and electrical properties, metal halide perovskites, mainly cesium lead halide CsPbX3), methylammonium lead halide (CH3NH3PbX3) and formamidinium I HC (NH2) 2 Pb13 I have received great attention. They have superb photovoltaic performance with power conversion efficiency exceeding 22%. Inorganic CsPbI3 is used to enhance the thermal stability and the conversion efficiency of perovskite solar cell. As lead causes pollution, recent trend is to use tin in place of lead.

Based on the various combinations of A. M and X the perovskite material show unique properties, a tuneable band gap energy ranging from 1.6 eV (FAPbI3) to 3.1 eV (CsPbCI3), long hole-electron diffusion length (>1 micrometre), high charge carrier mobility and low electronic trap states. Thus with such desirable features as light weight, flexible form, low cost and solution based processibility, perovskites based devices are leading in various fields.

(To be Continued)

Courtesy: Ieema Journal, February 2022

"Good health is not something we can buy. However, it can be an extremely valuable savings account." – ANNE WILSON SCHAEF

ELECTRICAL MAINTENANCE UNIT
(QUESTION & ANSWERS) - 13

Insulation classification and testing

1. What is good dielectric break down value for insulating oil?

   60 kV

2. What is the temperature coefficient of insulating materials?

   Insulators are negative temperature coefficient materials.

3. What is the gap between the electrodes in transformer oil testing kit?

   0.1 Inch.

4. What is the life insulation if temperature increased by 10°C?

   The life of the machine insulation decreases by half if the temperature of the insulation increases by 10°C.

5. What is the value of vacuum maintained by vacuum pump in oil filteration machine?

   27 Hg.

6. What is the DC HV test voltage range?

   1.7* 1.5* rated voltage.

7. What do you mean by term insulating resistance? How it is measured?

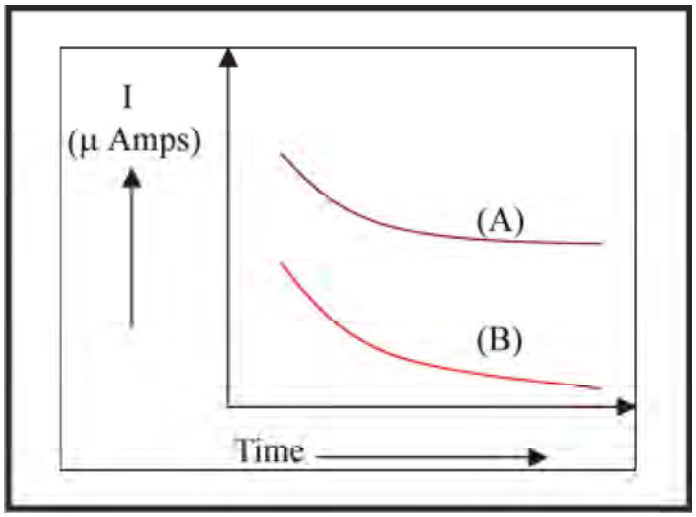
   Insulating resistance: insulating resistance is the opposition offered by an insulating material to the flow of current (electrons) through it when an high potential is applied across it. Insulating resistance are measured by megger.

   First the equipment whose resistance is to be measured is disconnected from supply. If the machine is a large one, there may be accumulated static charge on the machine. So we have to discharge it by connecting a wire between the terminals and ground for 15 minutes. Otherwise megger will give wrong reading.

   After this we should remove the wire and we have to connect megger terminals (live & earth) to the motor terminal and earth. The rating of the megger should be selected properly. Then rotate the megger at rated speed of 160 rpm and take the readings.

8. What you mean by dielectric absorption test?

   Whenever we apply a potential from the megger to test the IR value, initially the needle of the megger will go to low value of the resistance. This is due to the capacitance effect of the insulation material and after some seconds the needle will start moving towards the higher value. Because in the insulating material there is strain on the molecules when the potential is applied. Polarization of the molecules occurs and they form a Di – pole. The negative charges are attracted to positive terminal and positive

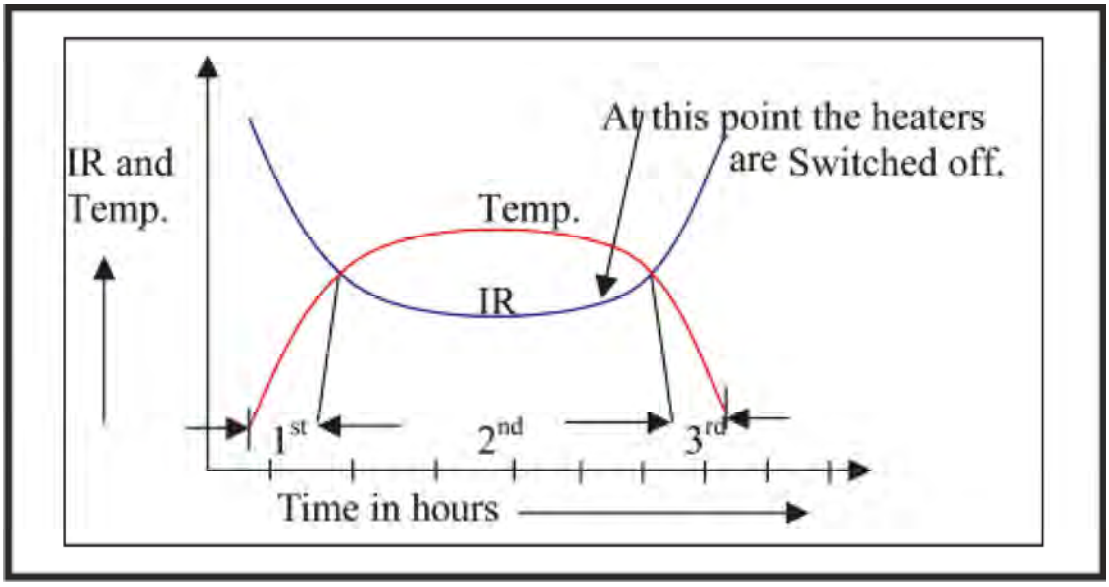


charges are attracted to negative terminal. So there is a strain on the insulation molecules and they align themselves parallel. This aligning may take more time. This test is done to know the condition of insulating material.

If the insulation is good the graph is as shown as B and if there is dirt, moisture the graph will flatten early as shown in A.

After the test terminals to be discharged so that molecules may return to their unstressed state.

9. Draw the transformer drying out curve and explain each stage.



When we start the filtering process initially the temperature will be low, as the insulation value is high. But on temperature increases the IR value starts to decrease because the moisture entrapped in the coils are released due to rise in temperature and this causes the IR value to go down. This is the first stage.

Then comes the point where all the moisture is released and then will be no decrease in IR value or rise in the temperature. This is the second stage.

At this point the heaters are switched off. Now the moisture is removed by the oil filters and the IR value goes up and as the heaters are off the temperature decreases. This is the third stage.

10. The insulation resistance of a DC motor is observed to be 15 MΩ at a temp. of 70°C what is its value corrected to 40°C the correction factor for 70°C is 8.0.

Observed resistance at 70°C – 15 MΩ.

Temperature correction factor – 8.

Rm = kt * Rt kt – correction factor.

Rm = 8 * 15 Rt – resistance measured at +°C.

Rm = 120 MΩ. Rm – corrected value to 40°C

The IR of DC motor corrected to 40°C is 120 MΩ.

11. The armature of a 600 kW, 0.24 k, 1000 rpm DC generator has an indicated IR to ground of 2 MΩ at a temp. of 30°C what is the recommended value of insulation? Is it advisable to put the machine in service? Give reason.

Correction factor for 30°C is 0.5.

Data given are

kV – 0.24

Indicated IR – 2MΩ

Temp. - 30°C

Correction factor – 0.5

Recommended value (Rm) = kV + 1 MΩ

= 0.24 + 1

= 1.24 MΩ

Indicated IR at 30°C = 2MΩ

Correction factor – 0.5

So value corrected to 40°C = Rm = kt * Rt

= 0.5 * 2

= 1MΩ

The generator cannot be put in service because the corrected value is lesser than recommended value. It should be sent for IR re-conditioning.

Motorised valve actuator

1. What are the advantages of motorised valve actuators?

Advantages

a. Can be used to operate in remote areas, high heat areas etc.

b. Suitable logics can be wired up easily.

c. Hammer blow mechanism (which will release valve in stuck open or close). The motor has high torque.

2. What are the four basic parts of any valve actuators?

a. Valve motor.

b. Gear mechanism.

c. Limit switch and torque switch assembly.

d. Terminal box.

3. Explain how the motor motion is transmitted to the valve stem?

The motor shaft is connected to a spar gear. It engages on a worm wheel. The worm wheel has dog teeth. This dog teeth engages or hits the dig teeth on moving or sliding clutch. The sliding clutch has splines and these are on the splines of valve stem. So when the sliding clutch rotates the valve also rotates simultaneously.

4. Do you require separate limit switch for closing and separate limit switch for opening?

YES.

5. What does the limit switch mechanism senses to operate?

   Limit switch mechanism senses whether the open and close travel of the motor has exceeded the limit setting of the motor to operate.

6. What does the torque switch mechanism senses to operate?

   Torque switch senses whether the torque of motor has exceeded the set point irrespective of position of valve.

7. Explain the operational aspects of limit switch and torque switch in rotork valve actuator.
   a. When limit function is selected?
   b. When torque function is selected?

   Limit function – when limit function is selected in rotork valve, the limit switches will operate when the limit set points are reached. Suppose limit switches fails to operate the torque switches will act and cuts off the supply to the motor (both torque switch and limit switches can act when selected to limit function).

   Torque function – when torque function is selected the torque switches will act when set point is reached. The limit switches will not act (only torque switch will act when selected to torque function).

8. Indicate how you will select the limit switch contacts for indication and for cutting the supply to the motor?

   For cutting off the supply to the motor normally closed (NC) contacts of limit switch (LS) should be wired in series with interposing relay coil of respective direction of the valve so that when valve reaches their respective direction contact will open and cut the control supply. For indication normally open contacts (NO) of opposite direction of valve should be used so that when valve fully closes open indication contact should remain NC only and vice-versa.

So for close direction

NC contact of close direction

9. What indication will you get in control room when
   a) valve is open – green
   b) valve is closed – amber
   c) valve is intermediate – both
   d) valve is closing and torque switch operate – both

10. What is the function of hammer blow mechanism?

    Hammer blow mechanism allows motor to rotate freely for ½ or ¼ turn and the dog teeth on worm gear comes against the dog teeth on sliding clutch with a blow. This is use full when valve is stuck in fully open or closed condition.

11. How will you proceed to operate the valve manually after an electrical operation?

    After electrical operation to operate manually we must tilt the lever provided on the actuator to hand (manual) position by which the sliding clutch gets engaged with hand drive.

(To be continued)

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

NUMERICAL ANALYSES OF POWER LOSSES AND TEMPERATURE RISE OF GAS INSULATED SWITCHGEAR (GIS) MODULES - 2

Modeling Details and Technical Parameters

A numerical program has been developed to calculate power losses in GIS. The program considers the exact dimensions of the conductor and grounded enclosure for the estimation of resistance. The variation in resistance is further calculated w.r.t. temperature by considering coefficient of thermal expansion of materials. This variable resistance is used for the estimation of power losses in both conductor and enclosure independently. The properties of materials like resistivity, temperature coefficient, allowable temperature etc., are considered for the accurate estimation of losses. The program has provision to select different types of materials like copper. aluminum alloy, stainless steel for both conductor and enclosure. The return current or enclosure current as fraction of rated current is also considered for simulating the operating conditions.

The MATLAB based numerical program has also a feature of taking heat transfer coefficients at different temperatures as input and obtain a heat transfer coefficient versus temperature curve using polynomial curve fitting techniques. This curve will be useful in estimating the temperatures of conductor and enclosure. Thus the software has the ability to calculate the temperatures based on cooling type (for instance. forced convection or natural convection) through heat transfer coefficient curves. Unlike the estimation of power losses which can be solved algebraically, the temperature estimation of conductor and enclosure needs to be solved using numerical techniques only.

The program takes the parameters like enclosure and conductor materials, heat transfer coefficients at different temperatures, conductor / enclosure dimensions, emissivity and current flowing through the conductor / enclosure as input parameters. Table 1 shows the input parameters and the range of values considered for the study. The program calculates the parameters like conductor losses, enclosure losses, conductor temperature and enclosure temperature as output parameters. Different materials are considered for the study and their characteristics are listed in Table 2. Different configurations that are considered in the study are listed in Table 3. The configurations are designed by considering different type of materials for conductor and enclosure of GIS module.

Table 1: Input parameters considered for study

Enclosure material	Aluminum Alloy or Stainless Steel (SS)
Conductor material	Copper or Al. alloy
Conductor emissivity	0.9
Enclosure emissivity	0.9
Conductor current	1000-5000 A
Enclosure current	30% to 95% of conductor current
Conductor heat transfer coefficients at different temperatures	2-10 W/m2-K
Enclosure heat transfer coefficients at different temperatures	1-5 W/m2-K
Conductor outer diameter	125 mm
Conductor inner diameter	90 - 100 mm
Enclosure outer diameter	544 mm
Enclosure Inner diameter	504 - 526 mm
Conductor length, mm	1000

Enclosure length, mm	1000
Ambient temperature	25°C - 40°C

Table 2: Material properties considered for Study

Property Material	Resistivity at 20°C, ohm-m	Thermal coefficient of expansion, K^{-1}
Aluminum alloy	12.65×10^{-8}	0.004
Stainless steel	6.9×10^{-7}	0.001
Copper	1.68×10^{-8}	0.004

Table 3: Different Configurations of the Study

Type Configuration	Conductor	Enclosure
1	Aluminum alloy	Stainless steel
2	Copper	Stainless steel
3	Copper	Aluminum alloy
4	Aluminum alloy	Aluminum alloy

Results and Discussions

The analyses have been carried out for determining power losses and temperature of enclosure and conductor by considering different types of materials for enclosure and conductor of GIS. The analysis has been carried out by varying conductor current, enclosure current, ambient temperature and voltage class of GIS.

In first configuration, an aluminium alloy conductor of outer diameter of 125 mm. inner diameter of 90 mm and length 1 meter has been considered. A stainless steel enclosure of outer diameter 544 mm. inner diameter 526 mm and length 1 meter has been considered for the analysis. 70% of main conductor current is assumed as enclosure current for the analysis. Ambient temperature is assumed to be 25°C. The losses of conductor and enclosure for various conductor currents are plotted and shown in Fig. 1. The variation of temperature of conductor and enclosure with respect to conductor current are plotted as shown in Fig. 2. From the analysis, it is understood that the dimensions of Aluminium conductor are not sufficient enough to withstand normal current rating beyond 4000 A with SS enclosure. Further, the SS enclosure may not be good enough to use for current rating beyond 3150 A as the enclosure temperature reaches beyond 50°C which is not acceptable as enclosure cannot be accessible to operating personal. It is also evident from the results that even area of cross section of enclosure is much higher than area of cross section of conductor. the enclosure losses are six times more than enclosure losses.

In second configuration, a copper conductor of outer diameter of 125 mm, inner diameter of 100 mm and length 1 meter has been considered. A stainless steel enclosure of outer diameter 544 mm. inner diameter 526 mm and length 1 meter has been considered for the analysis. 70% of main conductor current is assumed as enclosure current for the analysis. Ambient temperature is assumed to be 25°C. The losses of conductor and enclosure for various conductor currents are plotted and shown in Fig. 3. The variation of temperature of conductor and enclosure for various conductor currents are plotted and shown in Fig. 4. From the analysis, it is understood that the dimensions of copper conductor are sufficient enough to withstand normal current rating of 5000 A with SS enclosure. However, the SS enclosure may not be good enough to use for current rating of 4000 A as the enclosure temperature reaches beyond 50°C which is not acceptable as enclosure cannot be accessible to operating personal. It is also evident from the results that even area of cross section of enclosure is much higher than area of cross section of conductor; the enclosure losses are seven times more than enclosure losses.

The enclosure material in both the models i.e., configuration-1 and configuration-2 is stainless steel only but the conductor material in configuration-1 is Aluminium alloy and in configuration-2, it is high conductivity copper. From the results, it is evident that the Copper conductor losses are less compared to those of Aluminium alloy conductor losses and consequently temperatures of Copper conductor are less compared to those of Aluminium alloy conductor while the enclosure losses and temperatures are almost same for both the configurations.

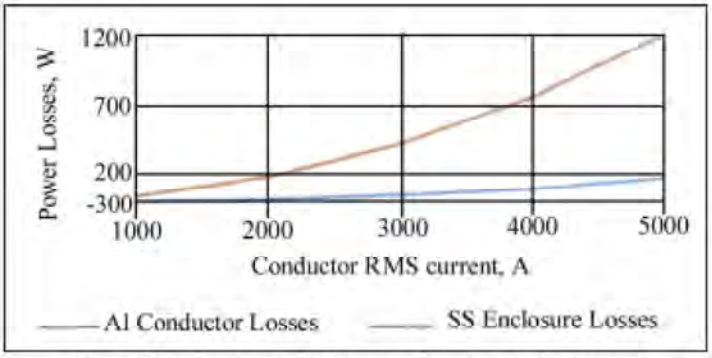


Fig. 1 Variation of Power losses at different Conductor currents of first configuration

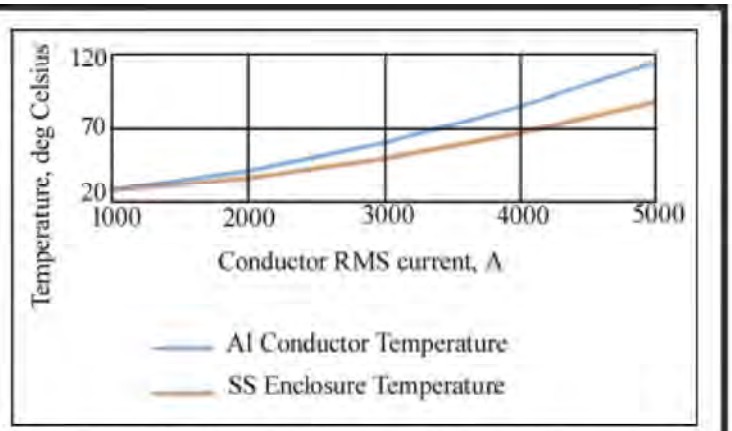


Fig. 2 Variation of Temperature at different Conductor currents of first configuration

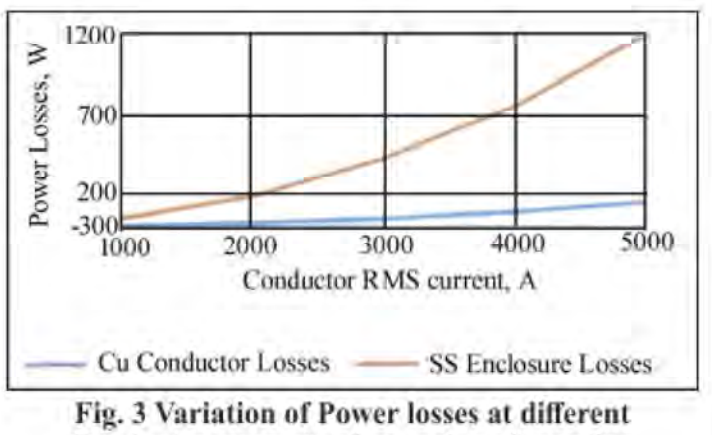


Fig. 3 Variation of Power losses at different Conductor currents of second configuration

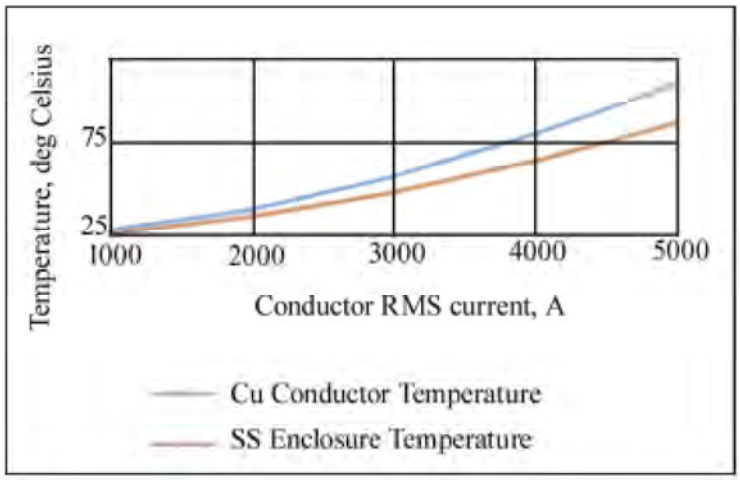


Fig. 4 Variation of Temperature at different conductor currents of second configuration

In third configuration, copper conductor of outer diameter of 125 mm, inner diameter of 100 mm and length 1 meter has been considered. An Aluminium alloy enclosure of outer diameter 544 mm, inner diameter 504 mm and length 1 meter has been considered for the analysis. 70% of main conductor current is assumed as enclosure current for the analysis. Ambient temperature is assumed to be 25°C. The losses of conductor and enclosure for various conductor currents are plotted and shown in Fig. 5. The variation of temperature of conductor and enclosure for various conductor currents are plotted and shown in Fig. 6. From the analysis, it is understood that the dimensions of copper conductor are sufficient enough to withstand normal current rating beyond 5000 A with aluminium all enclosure. Further, the aluminium enclosure is good enough to use for current rating beyond 5000 A as the enclosure temperature reaches hardly 32°C even at 5000 A. It is also evident from the results that conductor losses are five times more than enclosure losses unlike first two configurations.

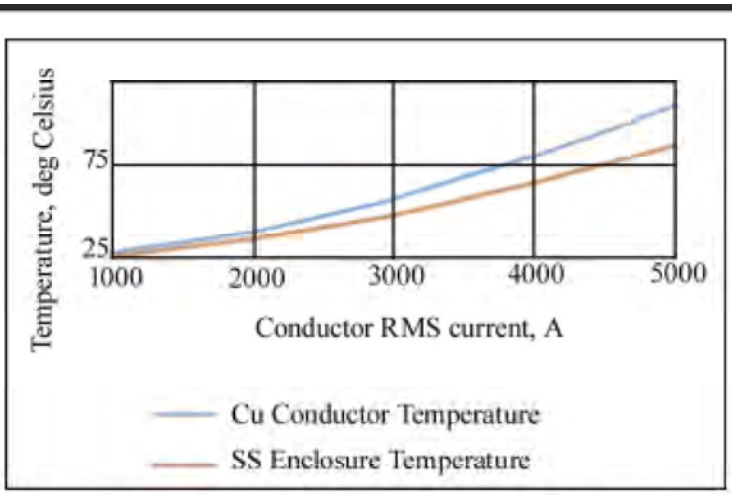


Fig. 5 Variation of Power losses at different Conductor currents of third configuration

"India has two million gods, and worships them all. In religion all other countries are paupers; India is the only millionaire." – MARK TWAIN

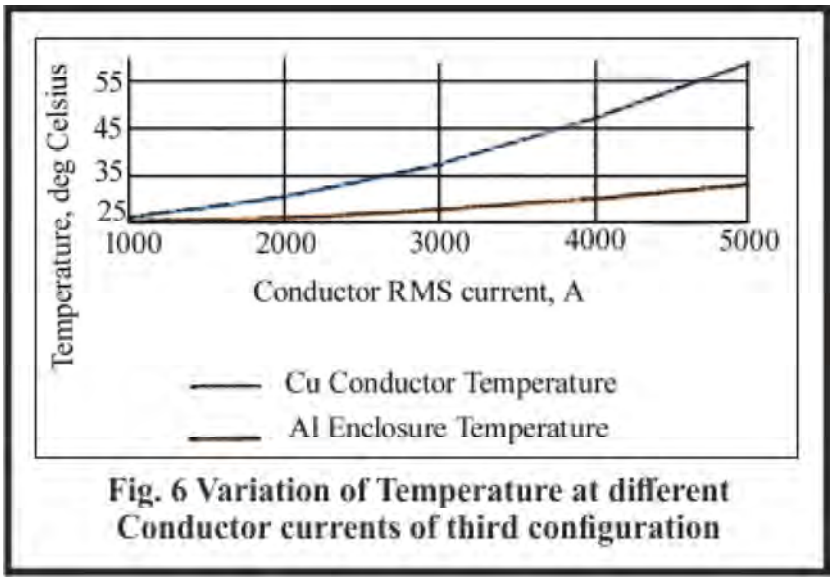


Fig. 6 Variation of Temperature at different Conductor currents of third configuration

(To be Continued)

Courtesy: Ieema Journal, February 2022

HOW TO HANDLE DOMESTIC ELECTRICAL APPLIANCES & GADGETS SAFELY

House wiring, electrical fault attending and repairing work should be handled or attended only by the Electrical Licensed people issued by Electrical Licensing Board of Tamil Nadu.

Use only the I.S.I labeled appliances and gadgets. ELCB (Earth Leakage Circuit Breaker) to be fitted in the service mains of the new flats and buildings to avoid electrical leakage.

Don't use damaged or faulty switches, plugs and appliances and gadgets.

Please ensure effective earthing system in your houses and industrial establishments.

Please ensure switches and plugs are fixed at the safe height from the floor, so that kids or children couldn't reach them. Also plugs corm should be provided for safety.

Once in 5/6 years the wiring strength to the insulation resistance (I.R) of your house wiring to be checked and replaced.

In bathrooms and in other damped places switches shouldn't be fixed.

Don't operate the switches and electrical gadget in wet hands.

Please ensure that you are always using I.S.I labeled and above 3 star rated electrical appliances.

S. Srinivasan
Consultant

"Indians are the Italians of Asia and vice versa. Every man in both countries is a singer when he is happy, and every woman is a dancer when she walks to the shop at the corner. For them, food is the music inside the body and music is the food inside the heart. 'Amore' or 'Pyar' makes every man a poet, a princess of peasant girl if only for second eyes of man and woman meets." – GREGORY DAVID ROBERTS

SUBSTATION DESIGN APPLICATION GUIDE – 6

3.5 Earthing Switches and Portable Earths

Earthing switches which may be integral with isolators or separately mounted, and portable earths are necessary to ensure compliance with Safety Rules, the British safety rules requiring that an earth be applied between a possible point of supply and where a man may work.

To reduce the cost, portable earths are used instead of earthing switches wherever possible. However, the following limitations are important:

a) They should not be used where there is a risk of the equipment being alive or becoming alive whilst the earth is being applied.

b) Unless there is already an earth between the point of supply and the point of application, portable earths should be applied using an insulated pole.

It should be noted that earthing switches may or may not have a rated making current. Portable earths have no rated making current.

It follows therefore that earth switches are required to discharge overhead lines and cables, both of which may also have voltages induced in them by the proximity of parallel circuits, and also to provide a discharge path for any lightning strikes. They are also required on transformer circuits where it is impossible to ensure (by locking or interlocking if necessary) that the transformer cannot be energised, and on generator circuits where voltages can be produced by residual magnetism in the excitation circuit. Earth switches may also be used where it is inconvenient to apply portable earths using an insulated pole either because of access or height of the conductor. (At the higher voltages e.g. 400kV earth switches are more extensively used for this reason).

To achieve lower cost earth switches are wherever possible fitted to isolators rather than be separately mounted. They are thus fitted to the line isolators leaving any voltage transformers line traps etc. on the line side of the earthing switch.

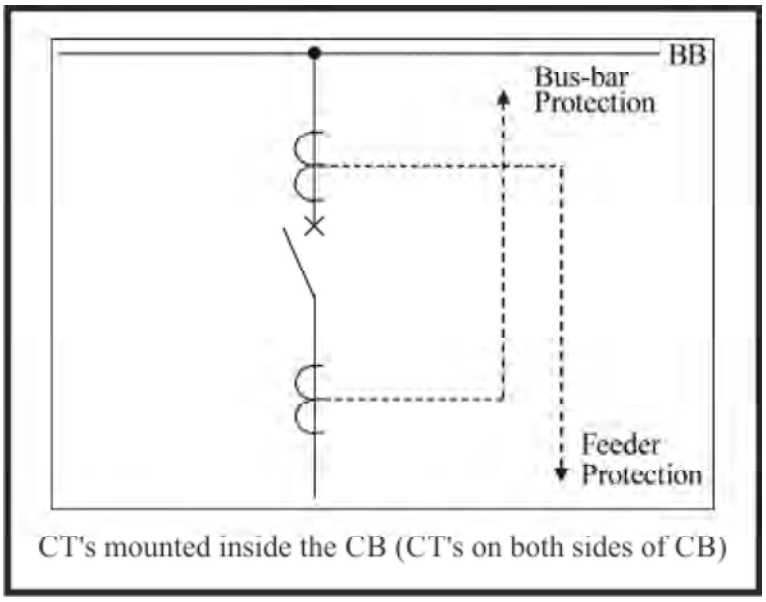
3.6 Location of Current Transformers

Current transformers are used for protection, instrumentation, metering and control. It is only the first function that has any bearing on the location of the current transformer.

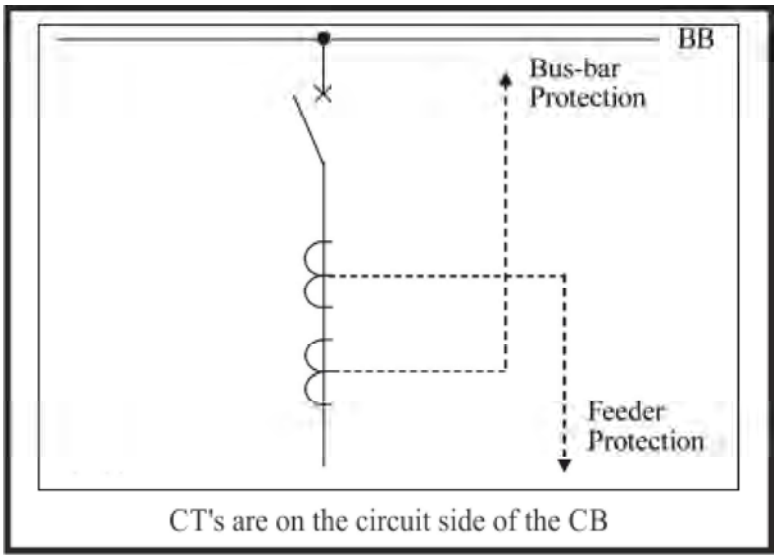
Ideally the current transformers should be on the power source side of the circuit breaker that is tripped by the protection so that the circuit breaker is included in the protective zone. In many circuits the power flow can be in either direction and it then becomes necessary to decide which location of fault is most important or likely and to locate the current transformers on the side of the circuit breaker remote from those faults. In the case of generator (and some transformer) circuits it is necessary to decide whether the protection is to protect against for faults in the generator or to protect the generator against system faults. Current transformers can often be located in the generator phase connections at the neutral end and will then protect the generator from the system faults and to a large degree give protection for faults in the generator.

When current transformers can be accommodated within the circuit breaker, they can in most cases be accommodated on both sides of the circuit breaker and the allocation of the current transformers should give the desired overlapping of protective zones. With some designs of circuit breaker the current transformer accommodation may be on one side only and it may be necessary to consider the implications of the circuit breaker position in the substation before deciding on the electrical location of the current transformers.

However the risk of a fault between the current transformers and the circuit breaker and within the circuit breaker itself is very small and so the economics of accommodating the current transformers may have an important influence on their location.



CT's mounted inside the CB (CT's on both sides of CB)



CT's are on the circuit side of the CB

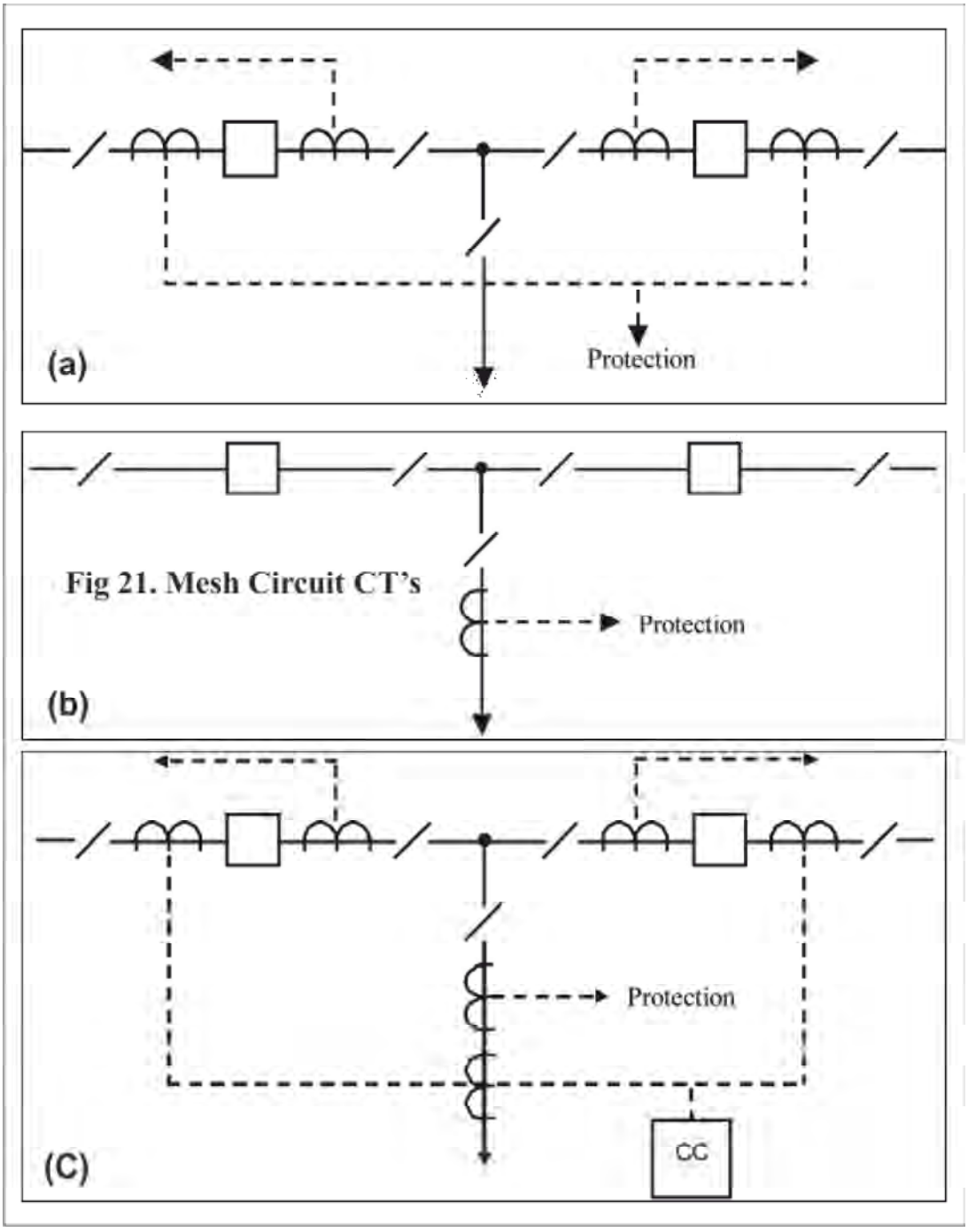
Where separate current transformer accommodation has to be provided, the cost of separately mounted current transformers and also the extra substation space required almost always results in them being located only on one side of the circuit breaker. In practice this is generally on the circuit side of the circuit breaker. This follows metalclad switchgear practice where this is the easiest place to find accommodation, and is also the optimum position when bus zone protection is required.

Often it may be possible to accommodate current transformers on the power transformer bushings or on through wall bushings. When this is done it is usually for economic reasons to save the cost of and space for separately mounted current transformers. Transformer mounted current transformers have minor disadvantages in that a longer length of conductor and, more especially, the bushing is outside the protected zone, and in the event of the transformer being removed then disconnections have to be made to the protective circuits.

Note that the arrangement of the individual current transformers within a unit should preferably be arranged that any protective zones overlap and that current transformers for other functions are included within the protected zone.

Under by-pass conditions (where this is provided) the circuit is switched by the bus coupler circuit breaker. The location of the current transformers is determined by whether the protective relaying and current transformers

are provided by the bus coupler circuit, or whether the protective relaying and current transformers of the circuit are used with the tripping signal being routed to the bus coupler circuit breaker during by-pass. If the latter method is used then the current transformers must be separately mounted on the line side of the by-pass isolator. The advantage of this method is that the circuit protection is unchanged to the possibly inferior protection of the bus coupler circuit. On the other hand the circuit would have to be taken out of service to work on the current transformers. The need for continued metering of the by-passed circuit needs also to be considered.



Figures 21 (a), (b) and (c) show possible locations of current transformers in a portion of mesh substation.

In arrangement *(a)* the current transformers are summed to equate to the feeder current and to operate the circuit protection. The protection also covers a portion of the mesh and, with overlapping current transformers as shown, the whole mesh is included in discriminative protective zones. Because the feeder current may be

significantly smaller than the possible mesh current, the ratio of the mesh current transformers may be too high to give the best feeder protection .

In arrangement *(b)* the current transformers are in the feeder circuit and so their ratio can be chosen to give the best protection. However there is now no discriminative protection for the mesh. Note that the current transformers can be located either inboard or outboard of the feeder isolator, the choice being dependent on the ease of shutting down the feeder circuit and the undesirability of opening the mesh if maintenance of the current transformer were required.

The arrangement shown in *(c)* is a combination of *(a)* and *(b)* with, if necessary, different ratio current transformers in the feeder circuit. This arrangement however requires three sets of current transformers as opposed to two and one in arrangements *(a)* and *(b*).

Similar arrangements are possible with breaker-and-a-half substations with the slight difference that at the end of the diameter the protection becomes protection for the bus-bar instead of a feeder. All the diameter currents are summed for the bus zone protection.

3.7 Location of Voltage Transformers

Voltage transformers are required to provide an appropriate voltage for protection, instrumentation, metering, synchronising and voltage control. They may be single-phase connected line-to-earth or line-to-line, or three phase. At voltages of 72kV and above they are usually single-phase units connected line-to-earth. Voltage transformers may be required on circuits and bus-bars.

The need for three-phase voltages will depend upon the requirements of the protection, the instrumentation and the metering. Synchronising and voltage control normally only require a single-phase voltage but with generator control, a three-phase voltage is usually required.

Voltage transformers may be electromagnetic or capacitive, the latter being the lower cost at voltages 72kV and above. Capacitor voltage transformers also have the advantage that they can be used for line coupling with power line carrier signalling. However they do not usually have the very high accuracy required for some special metering functions.

Circuit voltage transformers are usually directly connected on the circuit side of the circuit isolators so that they can indicate whether or not circuit is alive when the isolator is open. They are also required to be in this position if they are the capacitive type and are required for PLC coupling. (If the voltage transformers are electromagnetic, then a separate line coupling capacitor is required for PLC.)

Bus-bar voltage transformers are often connected to the bus-bars through isolators and can present problems with the physical design of the substation especially when they have isolators.

It is debatable whether the present reliable designs of voltage transformers significantly increase the risk of bus-bar faults. The need for isolators is also debatable since the maintenance requirement of voltage transformers is minimal and the desirability of operating a bus-bar without its voltage transformer should be considered. Where bus-bar voltage transformers are not used, the circuit voltage transformers can be used to give a representation of the bus-bar voltage by routing the secondary voltage through isolator and circuit breaker auxiliary switches and a voltage selection relay.

Voltage transformers are frequently omitted on outgoing circuits (such as transformers) where there is no need for a synchronising voltage. However, if the protection of the circuit requires a voltage, then voltage transformers are usually fitted rather than have the protection dependent upon auxiliary switches and voltage selection relays.

(To be Continued)

Courtesy: V Ayadurai Bsc, C.Eng, FIEE
Engineering Expert

ENERGY – GLOBAL MISSION AND INITIATIVES INDIA'S COMMITMENTS AND STRATEGIES - 6

Sustainable Growth, Sustainable Energy, Emission reduction and Renewable Energy.

EV Electrical Vehicles form an important part of the Indian strategy for reducing emission and pollution and marching towards 'Net 0'.

Overview on India's 2030 Vision on Electric Vehicle (5 years ago)

- By the year 2030, the NDA Government wants India to be 100%, electric vehicle nation.
- India spent Rs 4.7 Lakh Crores in 2016-17 in importing crude oil. Electric Vehicles will help lower the bill.
- Every car sold in India from 2030 will be electric, under new government plans.
- India aims to become a 100% electric vehicle nation by 2030. The National Electric Mobility Mission Plan (NEMMP) targets seven million electric and hybrid vehicles by 2020* (Plans in 2018).

Though there are delays, there are lot of activities with regard to technologies of batteries, charging, vehicles, hybrid technology and so on. The news item below is also an important dimension indicating what could be relevant to our country.

Do Hybrid Cars Make More Sense Than EVs In India?

Several companies, including Maruti Suzuki India and Toyota have often argued that hybrid cars make more sense in markets where infrastructure is not ready for electric vehicles and that it needs to offer a variety of choices

Outlook Business Team

28 JUN 2022

Maruti Suzuki India (MSI) seems to be losing its grip in the country's car market as Tata Motors, Hyundai, and others have come up with modern SUVs and Electric Vehicles (EVs) that have captured the attention of Indian people. However, India's largest carmaker is now betting big on hybrid cars to give stiff competition to rivals.

The company has now revealed that instead of EVs, it plans to invest in hybrid cars as what it believes is the future of mobility in a country like India.

Vehicles powered by hybrid technology, natural gas, and biofuels present a better path toward a cleaner future than electric cars considering the nation generates about 75 per cent of its electricity from dirty coal, MSI chairman RC Bhargava said in an interview recently.

While there is a lot of buzz around EVs these days and a lot of carmakers are aggressively launching new cars in the market, MSI has so far maintained its distance from the EV bandwagon. The company believes EVs are not going to be a large part of car sales, irrespective of what other manufacturers are saying or planning.

"The ability to get green transportation is going to take time in India because of the nature of our electricity generation. Talking about electric cars without looking at the greenness of the electricity generated in the country is an inadequate approach to this problem," Bloomberg quoted Bhargava as saying.

"Until the time we have a cleaner grid power, it's necessary to use all the available technologies like CNG - compressed natural gas* (CBG – Compressed Bio Gas is the renewable alternative), ethanol, hybrid and biogas, which will help reduce the carbon footprint and not push any one technology."

Is Maruti Suzuki saying no to EVs?

Recently, Maruti Suzuki and Toyota Kirloskar Motor confirmed plans of jointly working on an SUV model that would be manufactured at the Toyota Kirloskar Motor's facility in Bengaluru.

Besides hybrid cars, the company wants to stick to CNG cars so it doesn't look like the company is in any hurry to jump into the EV market.

Hybrid cars are also a better alternative than EVs given India lacks adequate charging infrastructure, Bhargava recently said. He added that the company will additionally move "aggressively" into cars that run on CNG because they're cleaner than petrol or diesel models and cheaper than EVs, making them a viable option for those who want to upgrade from a two-wheeler.

Maruti, whose share in the non-SUV segment stands at 67 per cent, has seen sales declining in the last few months. However, the sales are picking pace as the data for the month of May showed signs of recovery.

That said, the company has stayed away from EVs just as rivals such as Tata Motors, MG Motors, and others rush to capture the market. According to reports, Suzuki Motor, the Japanese counterpart, will launch its first compact electric vehicle by 2025 to accelerate the adoption of EVs.

Do Hybrid Cars Make More Sense In India?

Several companies, including Maruti Suzuki India and Toyota have often argued that hybrids make more sense in markets where infrastructure is not ready for electric vehicles (EVs) and that it needs to offer a variety of choices.

Companies often claim that much of the electricity in India and other developing countries is generated by burning coal or other fossil fuel, hence, EVs are more polluting in those markets than hybrids.

Even Honda, which recently launched its hybrid car e:HEV in India, believes hybrid cars make more sense in India and stressed that lowering taxes on hybrid vehicles can lead to faster adoption of EVs in the country.

The total tax incidence on hybrid vehicles in the country is 43 per cent, which is inclusive of GST, while battery electric vehicles attract a tax of about 5 per cent.

This takes the cost of hybrid cars up and makes EVs way cheaper in a price-sensitive market in India. From that standpoint, EVs are a better option but then Hybrid cars are more practical for Indian roads, considering limited support for full-fledged EVs.

Besides, the EV fire incidents were initially limited to e-scooters but recently, a Tata Nexon EV caught fire in Mumbai which may dent the sentiments of prospective buyers towards EVs.

Thus, hybrid vehicles could bridge the trust deficit for those who are still not ready for a pure EV in the country.

Even Honda Cars India's Vice-President (Marketing and Sales) Kunal Behl recently said hybrid vehicles could help in the transition to fully electric vehicles while at the same time helping in cutting down vehicular emissions and fossil fuel consumption.

India wants carmakers to build more electric models but the uptake for such vehicles so far has been slow, and only Tata Motors builds them locally.

Suzuki committed in March to investing $1.4 billion in the country to produce BEVs and batteries, but its local unit, Maruti Suzuki, has said it will not launch a fully electric vehicle before 2025.

Meanwhile, Italian luxury sportscar maker Ferrari recently outlined an electrification strategy that calls for 40 per cent full-electric vehicles and 40 per cent hybrid models by 2030.

Are EVs Cheaper Than Hybrid Cars?

While EVs are currently expensive for mainstream buyers in India, so are hybrids such as Honda e:HEV and Toyota Camry hybrid which costs around Rs 41 lakh.

The challenge faced by the hybrid vehicle market is the high cost as compared to diesel- and petrol-powered vehicles. The price difference is due to parts such as battery and regenerative brake prices. However, there has been a significant decrease in the cost of batteries in the past few years.

By partnering with Suzuki, Toyota may look to bring a low-cost hybrid car in India that may take on pure EVs.

The demand for the hybrid vehicle market is rising due to stringent emission regulation standards and the growing demand for low or zero-emission vehicles.

The overall hybrid vehicle market, by volume, is estimated to be 4,169 thousand units in 2018 and is projected to grow at a CAGR of 8.94 per cent from 2018 to 2025, to reach 7,593 thousand units by 2025.

Though India is the fifth-largest automotive market globally, EV sales in the country are pretty slow despite subsidies and push by the government.

The adoption of EVs saw a steep rise in the last two years, with EV sales rising 155 per cent year-on-year to 4,29,217 units in FY22, as per the Federation of Automobile Dealers Associations' (FADA). The number of hybrid vehicles sold in FY21 was just 564.

Will Indians find it easy to shift to hybrid or electric cars from conventional petrol, diesel cars?

Honda earlier noted that hybrid technology is currently best suited for Indian conditions as it is not dependent on external charging infrastructure.

High import duties and lack of subsidies have made it tough for the demand of hybrid cars in the country. Hybrid vehicles attract 43 per cent tax which is inclusive of GST, while battery electric vehicles attract a tax of about 5 per cent.

In a price-sensitive market such as India, it gets tough for carmakers to sell these vehicles.

MG Hector and Honda's City eHEV are a few of the hybrid cars in the country starting under Rs 20 lakh. On the other hand, pure EVs in India starts from Rs 12 lakh and there are several options people get to pick from.

Interestingly, according to a global survey conducted by Deloitte, 68 per cent of Indians prefer internal combustion engine-powered vehicles as their next purchase. 24 per cent prefer a hybrid as their next vehicle while only 4 per cent prefer a pure EV.

In December last year, a parliamentary panel recommended treating HEVs at par with EVs for tax incentives in order to achieve India's targets of carbon emission cuts but nothing much has been done so far.

However, the charging infrastructure for EVs is at a nascent stage and that becomes a deal breaker for many in the country. This is where hybrid cars come into the picture but not every common man can purchase a hybrid car due to its cost. This leaves many with the conventional petrol and diesel cars that fit in their budget and have been a reliable option.

TATA Car – Hybrid EV or REEV (Range Extended Electrical Vehicle) Car

Tatas have been working on an alternative Hybrid concept for over a decade now, focusing on the concerns of reliability and affordability. They were also addressing environment concerns, energy efficiency and fuel economy. They actually announced '100 Kms/ Litre of Petrol car' and they developed "Megapixel' and displayed it in International shows. As understood from conceptual details available about the car, the petrol engine runs at a single speed and produces electricity through generator, which charges a set of batteries. The power from the batteries is used to run the car and provide power for all the other accessories of the car. As Electricity

generation to batteries to running the car is continuous, long distances can be covered by the car like normal petrol cars. Kms per litre increases mainly because of elimination of gear box.

- Tata Motors - Tata Megapixel is a new four-seater city-smart global range extended electric vehicle (REEV) concept for the performance-seeking and environment-conscious motorist anywhere in the world.
- Combining a lithium ion phosphate battery and an on-board petrol (can easily be made 'Green' by replacing petrol with CBG) engine generator for recharging on the move, the Tata Megapixel offers a range of up to 900 km (with a single tank of fuel), path-breaking CO2 emission of just 22 gm / km and fuel economy of 100 km / litre (under battery only power).

Tatas mention that the 'Megapixel' can also run as an EV Car with external charging of batteries, which can run only around 70 kms per charge. 'Megapixel' has not been launched commercially in India.

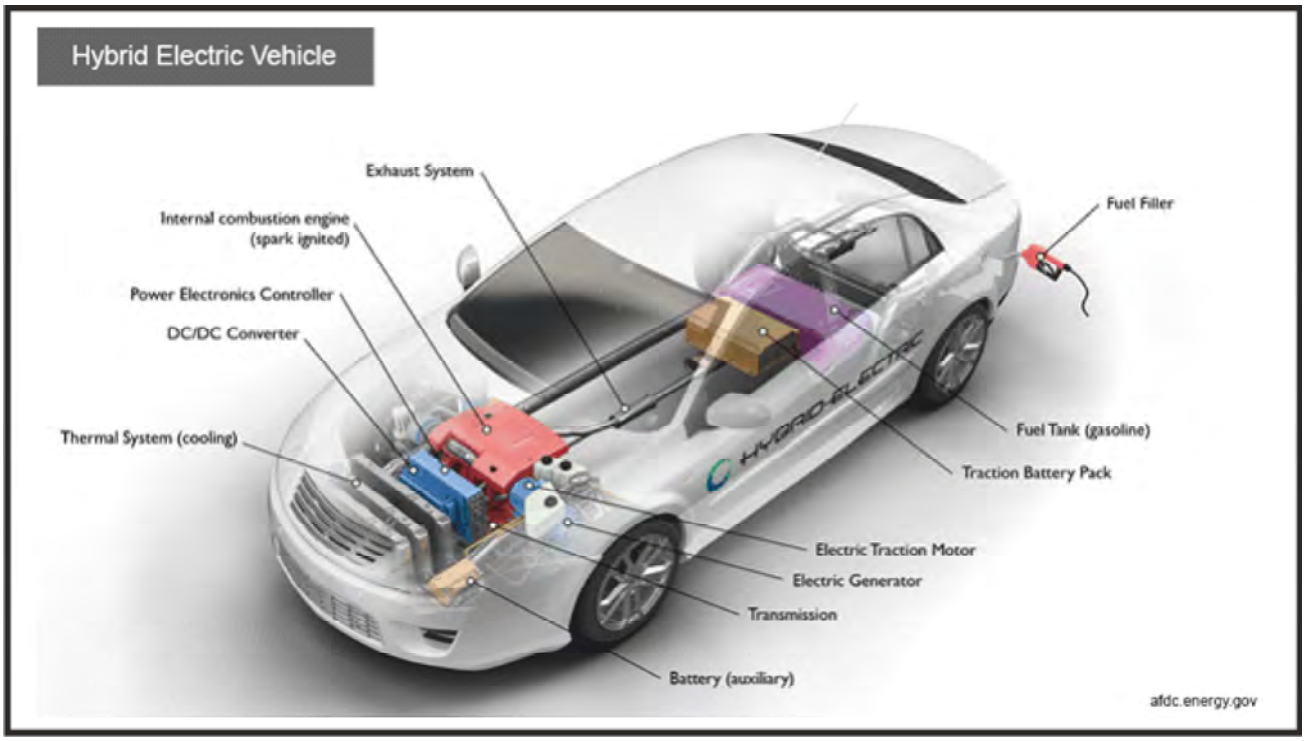
Given below are the details gathered about the latest Hybrid Cars.

How Do Hybrid Electric Cars Work?

Hybrid electric vehicles are powered by an internal combustion engine and one or more electric motors, which uses energy stored in batteries. A hybrid electric vehicle cannot be plugged in to charge the battery. Instead, the battery is charged through regenerative braking and by the internal combustion engine. The extra power provided by the electric motor can potentially allow for a smaller engine. The battery can also power auxiliary loads and reduce engine idling when stopped. Together, these features result in better fuel economy without sacrificing performance.

Key Components of a Hybrid Electric Car

Battery (auxiliary): In an electric drive vehicle, the low-voltage auxiliary battery provides electricity to start the car before the traction battery is engaged; it also powers vehicle accessories.



DC/DC converter: This device converts higher-voltage DC power from the traction battery pack to the lower-voltage DC power needed to run vehicle accessories and recharge the auxiliary battery.

Electric generator: Generates electricity from the rotating wheels while braking, transferring that energy back to the traction battery pack. Some vehicles use motor generators that perform both the drive and regeneration functions.

Electric traction motor: Using power from the traction battery pack, this motor drives the vehicle's wheels. Some vehicles use motor generators that perform both the drive and regeneration functions.

Exhaust system: The exhaust system channels the exhaust gases from the engine out through the tailpipe. A three-way catalyst is designed to reduce engine-out emissions within the exhaust system.

Fuel filler: A nozzle from a fuel dispenser attaches to the receptacle on the vehicle to fill the tank.

Fuel tank (gasoline): This tank stores gasoline on board the vehicle until it's needed by the engine.

Internal combustion engine (spark-ignited): In this configuration, fuel is injected into either the intake manifold or the combustion chamber, where it is combined with air, and the air/fuel mixture is ignited by the spark from a spark plug.

Power electronics controller: This unit manages the flow of electrical energy delivered by the traction battery, controlling the speed of the electric traction motor and the torque it produces.

Thermal system (cooling): This system maintains a proper operating temperature range of the engine, electric motor, power electronics, and other components.

Traction battery pack: Stores electricity for use by the electric traction motor.

Transmission: The transmission transfers mechanical power from the engine and/or electric traction motor to drive the wheels.

(To be continued)

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‘HAR GHAR TIRANGA’ DRIVE
CENTRE ASKS FIRMS TO ARRANGE TRICOLOUR

Government to start ‘Har Ghar Tiranga’ drive

The Centre is set to launch a large-scale campaign to encourage Indians to fly the national flag at their homes to mark the 75th Independence Day and has reached out to manufacturers and e-commerce sites to boost the availability of the Tricolour, according to officials aware of the programme.

In order to facilitate the Har Ghar Tiranga campaign, the Union Home Ministry had last year amended the Flag Code, which earlier only allowed hand-woven or hand-spun flags to be made, to allow flags to be polyester and machine-made. File | Photo Credit: M. Periasamy

As a part of Azadi ka Amrit Mahotsav, the Culture Ministry is planning on celebrating August 11 to August 17 as “Independence Week” across the country, Culture Secretary Govind Mohan said. During the week, the 26 crore households in the country would be encouraged to hoist the Tricolour as a part of the ‘Har Ghar Tiranga’ programme. Mr. Mohan said the Ministry had been in touch with textile manufacturers to make sure the production of the national flag was adequate. He added that meetings with e-tailers like Amazon and Flipkart were being held, to make sure these sites would be a platform to buy flags.

“India – a land where the last thing one needs to bother with is looking good. In India – at least in the circles I moved in – it’s natural to look beautiful by the smile in your heart and the way you move through the world.” – ERIN REESE

The Ministry was in talks with States and Union Territories to coordinate the programme as well, with some States like Maharashtra already coming out with their plans, he said. The Government-e-Marketplace (GeM) portal, through which Government Departments and Ministries procure products, had also written to Ministries that they could place orders for flags for their offices through the portal.

On the demand side of the plan, Mr. Mohan said an awareness campaign to inspire individuals to hoist the national flag would be launched in July. The campaign would be rolled out in mid-July in railway stations, airports and Metro stations as well as at the panchayat-level in rural areas. A song by renowned musicians had also been commissioned.

In order to facilitate the Har Ghar Tiranga campaign, the Union Home Ministry had last year amended the Flag Code, which earlier only allowed hand-woven or hand-spun flags to be made, to allow flags to be polyester and machine-made. According to two sources, the aim of the Har Ghar Tiranga campaign was to inspire people, rather than carry out a distribution drive.

Apart from encouraging households, the campaign would cover government offices, civil society groups and the corporate sector. In a letter to Ministries, the Culture Ministry had on May 20 said "the idea behind this initiative is to invoke the feeling patriotism in the hearts of citizens and promote awareness about our national flag".

On May 13, the Cabinet Secretary chaired a meeting of a Committee of Secretaries where it was decided that employees of Ministries, Public Sector Undertakings, self-help groups and civil society organisations and their families would have "active participation" in Har Ghar Tiranga. The May 20 letter had said that corporate and private organisations "may also be encouraged, wherever possible, to participate and contribute including CSR [corporate social responsibility] resources".

Damini Nath

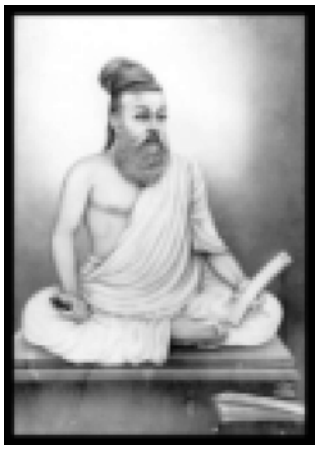
NEW DELHI JUNE 26, 2022 18:07 IST

KNOW ACTUAL FULL FORM OF SOME WORDS

PEN	–	***Power Enriched in Nib***
CHESS	–	***Chariot, Horse, Elephant, Soldiers.***
COLD	–	***Chronic Obstructive Lung Disease.***
JOKE	–	***Joy Of Kids Entertainment.***
AIM	–	***Ambition In Mind.***
DATE	–	***Day And Time Evolution.***
EAT	–	***Energy And Taste.***
TEA	–	***Taste and Energy Admitted.***
SMILE	–	***Sweet Memories In Lips Expression.***
BYE	–	***Be with You Everytime.***
NEWS PAPER	–	***North East West South Past And Present Events Report.***

"India is, the cradle of the human race, the birthplace of human speech, the mother of history, the grandmother of legend, and the great grandmother of tradition. our most valuable and most instructive materials in the history of man are treasured up in India only." – MARK TWAIN

TIRUKKURAL ON DEFENSE OF A COUNTRY



This August marks the completion of 75 years, Amrit Mahotsav, of our Independence. Defense of our borders has been a challenge since the time of our independence, starting with problems from Pakistan and then with the Chinese aggression in 1962. Since then we have indeed stepped up our defense preparedness with 'men and materials' and are able to fight our ways through. Tirukkural deals with many aspects of defense and 2 Kurals are chosen which portray our dimensions and committed forces.

Manineerum Mannum Malaiyum Aninizhar
Kaadum Udaiya Tharan ***Kural 742***

மணிநீரும் மண்ணும் மலையும் அணிநிழற்
காடும் உடைய தரண். குறள் *742*

"Water courses, deserts, mountains (and snow too) and thick jungles; all these constitute various kinds of defense barriers"

Enaimaatchith Thaakiyak Kannum Vinaimatchi
Illarkan Illadhu Aran ***Kural 750***

எனைமாட்சித் தாகியக் கண்ணும் வினைமாட்சி
இல்லார்கண் இல்லது அரண். குறள் *750*

"However strong the fortress or barriers of defense may be, it will avail nothing if the defenders show not vigour in action"

தண்ணீர்! தண்ணீர்!

நீரின் றமையா துலகெனின் யார்யார்க்கும்
வானின் றமையா தொழுக்கு. (குறள் 20, அதிகாரம் 2 – வான்சிறப்பு)

More than 70% of earth's surface is covered with water. You can find water in various forms such as oceans, seas, rivers, lakes, streams, water vapours, glaciers rain and snow. It also present in the food you prepare and eat and drink. Water also present in our body and in almost all living things.

Benefits of water to the human body:

- Benefits your physical performance
- Accelerate human body and its metabolism
- Flushes out toxins from the body through sweat and urine
- Keeps body's smooth and moisturising
- A hydrated body houses an alert mind.
- Essential in the process of detoxifying the body
- Helps the kidneys to regulate fluid in the body.

Conservation of Water:

- Taps should be closed immediately after their use.
- All the leaking taps should be immediately attended to arrest the leakage.
- Ensure taps are closed while you're brushing.
- Use minimum water for bathing.
- Water the plants less frequently.
- Match the water in laundry as per loading.
- You can reuse the water, for gardening or other purpose.

S. Srinivasan
Consultant

"[India is] the One land that all men desire to see, and having seen once, by even a glimpse, would not give that glimpse for all the shows of all the rest of the globe combined." – MARK TWAIN

HOME FESTIVALS - 8

ஆவணி - AVANI (August/September)

This is a busy month, with two major festivals celebrated both at home and at the temple. Krishna Jayanthi, the birth of Lord Krishna, comes first. In the painting at right is the rescue of the baby Krishna, who was born in a prison. His father carries him across a swollen stream while the seven-headed serpent, AdiSeshan, protects the incarnation of Lord Vishnu from the storm. In the Home, offerings of butter and yoghurt are made to Krishna's image, and footprints made with red powder reveal his path from the home's front door to the shrine room, suggesting that Krishna has come to participate. Ganesha Chathurthi is a mammoth festival across all of India, ten days in celebration of His manifestation. Shown in the centre of the painting is a statue of Lord Ganesha and a devotee offering obeisance by pulling his ears and bobbing up and down, a practice called *thopukarnam* in Tamil, done only for Ganesha – one explanation being that it is to make the Baby Ganesha laugh. The icon of Ganesha is made by the devotees from river clay and painted and decorated. At festival's end is the Visarjana or departure, when the clay icon is placed into the river the Deity is bid farewell. In North India Visarjana is celebrated by millions of people. At far right in the art is depicted the story of Ganesha consuming so many sweet offerings that He had to tie a snake around his belly to keep it from bursting. Ganesha chastised the Moon for laughing at His predicament, and as penance the Moon has ever since waxed and waned through the month instead of remaining constantly bright.

HOME FESTIVALS - 9

புரட்டாசி - Purattasi (September/October)

Navaratri ("nine nights") is the principal festival this month. The Goddess is worshipped in Her many forms, and on the ninth day, Sarasvati (centre of the painting) is invoked to bless musical instruments, account books, agricultural instruments and home tools(upper left). On Vijaya Dasami, the day following Navaratri, Goddess Durga is invoked as children are given their first instruction, worship their school books and honour their teacher. A decorated display of dolls is displayed through the nine days, then dismantled and stored on the tenth day. **Vijaya Dasami is also the birthday of Lord Venkateshwara**, presiding Deity of Tirupati temple in Andhra Pradesh, India's wealthiest temple.

(To be continued)

SMART FLOWER

Smartflower was founded in Austria, a country steeped in a heritage of design, innovation, and manufacturing excellence. Energy Management Inc. (EMI), a Boston, MA corporation with over 43 years of experience developing large energy projects, acquired Smartflower in 2018.

The SmartFlower has 12 photovoltaic petals, each one a combination of 40 monocrystalline photovoltaic cells. At its **peak power** of 2.50 kW, it will be able to produce between 3,800 kWh and 6,200 kWh per year (depending on the region and sun exposure).

- It follows the sun's trajectory: just like a sunflower, the SmartFlower rotates automatically throughout the day, which means it enjoys maximal sun exposure from dusk till dawn. This is done thanks to "smart tracking" (solar trackers and a double horizontal and vertical rotating axis).
- Its panels clean themselves automatically thanks to a "smart cleaning" system, which makes the photovoltaic panels more efficient and also means the product requires only minimal maintenance.
- Its photovoltaic panels cool down automatically: heat reduces the efficiency of the photovoltaic cells by 5% every 10 degrees, but thanks to a "smart cooling" ventilation system, a SmartFlower's panels are not affected by this, which allows for an extra 5 to 10% in production.
- Its panels remain protected in case of strong wind: thanks to the SmartFlower's "smart safety" system, if the wind ever reaches 47 km/h, its petals will fold back into a horizontal position, and fold up completely past 63 km/h. No need to worry about the panels getting damaged during violent gusts of wind.
- Its electricity production and consumption can be supervised thanks to the dedicated SmartFlower mobile App.
- It comes with a unique "Plug Play" technology: once installed, the SmartFlower will be operational within an hour, and can be set up on any type of surface thanks to its four screws planted into the ground. It can be dismantled, contrary to roof systems, and can be taken along in case of a house move. All this makes it flexible, quick and easy to use.

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