SPE NEWS LETTER

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RAFALE JETS

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OBITUARY

Er. Rameshchandra N Shah (Retd. SE, GEB), passed away on **31 May 2020**. He was a **Life Member** of SPE (I) Vadodara Chapter. He was also an active member of GEB, Retired Senior Engineer's Forum. He obtained Diploma in Electrical & Mechanical Engineering from MSU-Vadodara. He joined GEB, served in various departments and retired as SE (O&M), Bhuj.

After retirement, he joined TCS and was Consultant to implement e-urja project in DISCOMS of GUVNL. He was very amicable and down to earth individual

In his death, the SPE(I) Vadodara Chapter has lost a well-wisher and an active member.

May God give peace to the departed soul & give strength to his family members to bear the impact.

Er. Natin B Mehta (Retd. EE, GEB), passed away on **16 Jul 2020.** He was a **Life Member** of SPE(I) Vadodara Chapter.

He obtained B. Tech. from Banaras Hindu University Institute of Technology. He joined GEB as JE, served in various departments and retired as EE(Proc.), GSECL. He was very friendly with all the members of SPE(I)

In his death, SPE(I) Vadodara Chapter lost a technically sound, soft spoken, well-wisher and an active member.

May God give peace to the departed soul & give strength to his family members to bear the impact.

Cover page design: Er. Keval Velani, EC Member

From the Chairman's Desk

I am pleased to place this issue of SPE NEWS Letter to the members during the critical time of Covid-19 pandemic. Since the beginning of this year, the world is affected due to outbreak of covid-19 pandemic, which has created unprecedented problems affecting health and overall life of citizens in the world. The pandemic caused lockdown and stoppage of most of the business activities and movement of people, stopping their daily routine and social life as well as causing monetary loss.

In India, it appears that despite initial precautions and subsequent lockdown undertaken by GOI, the spread of corona virous is remarkably high. However, the recovery rate of the affected citizens is exceptionally good, and the death toll is comparatively low, considering dense population areas in the country. This is a silver lining in the cloud.

Thousands of people are confined to their homes, many are working from home through digital media. People need continuous supply of electricity to run their home appliances like TV, Fridges, air conditioners, washing machines, lighting bulbs, entertainment apparatus etc.

The hospitals are running with full speed demanding additional energy for ventilators and other medical equipment and services. Industries have resumed their work in limited way due to various reasons like labor absenteeism, material supply delays, inadequate funds etc.

The exceptional work our power engineers have done during lockdown time and still continuing to do it, made them heroes like other "Corona Warriors" and we are all proud of them that they have provided uninterrupted power to the nation risking their health and safety. **However, this has gone un-noticed in the media.**

The Covid-19 crisis has also given us the opportunity to adopt digital technology much in advance for most of our needs of communication and learning activities in schools and colleges, in associations like IEEMA, ASSOCHAM, IEEE and many others. Last month, IEEMA had organized conference and exhibition of electrical and electronic products for five days, which is an example of how successfully this virtual platform can be used.

SPE(I) has also adopted digital media for their normal activities mainly spreading of knowledge in power sector. We are learning the techniques to use this media and so far, have organized few webinars in association with industries and academy. The technical sub-committee, which is formed specifically to look after this activity, is planning to organize series of webinars on different subjects in coming time. Our EC and AC members are meeting on web more frequently and I am overwhelmed with the eagerness our members are showing in joining these web-meetings and contributing their ideas.

There is an indication that Covid-19 effect will continue to play the turmoil for much longer time than initially envisaged. It is challenging time for all and by observing total discipline we can halt the spread of this deadly pandemic. Please take utmost precautions while you work in your office/factory and at homes. Together we will come out of this crisis.

With warm regards & best wishes.

GV Akre

FROM EDITOR'S DESK

Dear Reader,

In this hour of the unprecedented pandemic COVID-19 crisis, Indian Power Sector demonstrated the load management capability of its national grid on **5th Apr 2020** by managing national load drop of around 32GW within a span of 9 minutes due to switching off of all lightings in the country in response to the Prime Minister's 9 pm: 9 minutes blackout call. The demand went down from **1,17,300 MW** at 20:49 Hrs. to **85,300 MW** till 21:09 Hrs.; *i.e.* a reduction of **32,000MW**. Then it started increasing. Frequency was maintained within a band of **49.70Hz to 50.26Hz**, which means the voltage was kept stable. And above everything else, all of this was very smooth. Our salute to the power warriors of the nation!!

In Prime Minister Narendra Modi's Rs. 20 Trillion package, power reforms are the most urgent. On 13th May 2020, the Government of India provided a Rs. 90,000 Crore bailouts to cash starved electricity distribution companies (DISCOMs).

The commercial and industrial sector in India consumes around 52% of electricity, followed by 24% by domestic households and 18% by agriculture sector. The pricing by distribution utilities is set below the actual cost for agricultural sector and domestic households in order to make power affordable for them and the gap is met through a combination of direct subsidy transfers and cross-subsidy from higher tariffs applied to the industrial and commercial sector.

However, the lockdown has impacted the financial health of DISCOMs. India's daily power demand has declined by 25 to 28% since the beginning of the nationwide lockdown, driven primarily by factory and office closures in the commercial and industrial sectors. The price discovered on the exchange platform during the lockdown period has averaged around Rs 2.40 per unit with supply bids at the exchange far outstripping the demand.

It is apprehended that the lockdown will have a significant impact on the DISCOMs' collections and cash-flows due to low demand from industrial consumers; higher-than-expected aggregate technical and commercial (AT&C) losses and higher dependence on direct collections from consumers compared to subsidy.

With load reduction from the industrial consumers, the share of subsidizing consumers has declined while that of the subsidized consumers has increased, thereby impacting collections and the overall tariff design. The inability to increase tariffs immediately could increase the leverage of the DISCOMs given that they would either delay payments to the generating companies (GENCOs) or resort to higher borrowings.

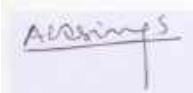
The distribution companies would have to incur higher AT&C losses than the levels specified by the regulators, as the transmission & distribution loss incurred on the low tension (LT) residential consumers is far higher than that incurred on the high tension (HT) industrial and commercial consumers, which could result in under-recovery of cash collection.

The Covid crisis has diverted attention from a major break-through that should have left all of us smiling. The latest auction for 400MW of solar power, including storage, has been won by ReNew Power with a levelized tariff of Rs. 3.52/unit over 15 years. The equivalent thermal power tariff would have been closer to Rs. 4.50/unit. Solar energy has beaten coal-based power hollow and would do so even if taxes and cess on coal were lifted. The bulk of future power generation can be solar without subsidies.

We will be extremely happy to receive your views, opinions and suggestions. Please feel free to reach out to us.

Please take care and stay safe!

Happy Readings!!



(AWADHESH KUMAR SINGH)

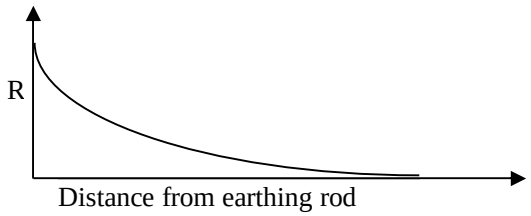
Chapter's Activities

➢ On **02 May 2020**, the **Chapter** organised a **WEBINAR**, jointly with **Babaria Institute of Technology**, Vadodara. **Shri JC Shukla**, CEO & MD, Nahak spoke on the topic of "**BE YOUR OWN BOSS**". The second speaker was **Shri Himanshu Agarwal**, Senior President, Zydex. He spoke on topic of "**Opportunities of GEN-Z in COVID-19 times**". Large number of students & members participated in the event. This was the first of its kind webinar to be organised by SPE (I), Vadodara.

Er. SM Godkhindi, Secretary

STEP VOLTAGE

It is seen that earthing resistance is distributed around the rod as under.

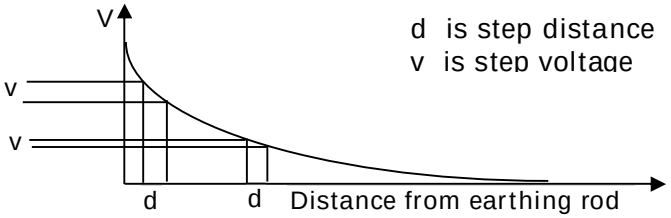


When fault current flows through this resistance, it causes voltage drop across it. Profile of this voltage drop may also be similar. This means potential gradient near grounding is maximum and is decreasing as we move away.

Due to this potential gradient voltage appears between two points in this area. These two points may be two legs of a walking person. Voltage appearing between two legs at step length apart is known as step voltage. Average distance between two legs of walking person may be about half meter. Generally, step voltage is potential different between two points on ground at half meter distance. When potential difference between two legs is high enough, it may lead to electric shock to the person walking on the ground. Therefore, preventive measure is required to avoid accident on this account

Step voltage is higher near the earthing.

Er. ND Makwana
Active LM of SPE(I)
Vadodara



Following diagram indicates voltage profile around the earthing. Various circles indicate equal potential lines.

Various possibilities for person moving in the area.

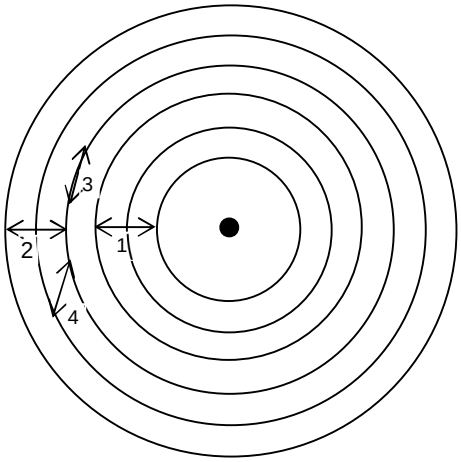
⟷ Indicates step distance.

Case-1: Moving in radial direction near the earthing.
Step Voltage more compared to case 2

Case-2: Moving in redial direction away from earthing.
Step Voltage less compared to case 1

Case-3: Moving in peripheral direction near earthing.
No step voltage being on equal potential line.

Case-4: Moving in direction neither radial nor peripheral
Step voltage less compared to case 2



This phenomenon of step voltage is not occurring in switch yards of sub stations because earthing net (Grid) with multiple earthing is provided throughout the yard making it equal potential area. But step voltage may appear in the field having individual earthing.

Conditions when accident may occur due to step voltage.

1. Moving within effective area of earthing during occurrence of fault.
   Potential gradient is due to flow of ground fault current. But fault is cleared by protective scheme in minimum time. Hence faulty condition persists for very short time only.
2. Earthing may be of high voltage system
   In case of lower voltage, potential gradient
   So, step voltage may not be sufficient to harm.
3. Moving near the earthing.
   Step voltage is highest near the earthing. When person is away from the earthing, the step voltage may be low and that perhaps do not harm. After the safe distance from the earthing there may not be any step voltage. Normal safe distance is 15M, but it depends on soil resistivity.
4. Moving in radial direction from earthing.
   Person may face maximum step voltage at the point. But have no step voltage when moving on peripheral line.
5. Moving in haste with long stride.
   Longer step may experience higher step voltage. Animals may face higher step voltage compared to human.
6. Ground is wet by rain or irrigation of land.
   In hot summer upper strata of ground may be dry and hence poor or non-conducting. Therefore, effect of step voltage is not experienced.
7. Person is bare foot without gum boot or rubber sole footwear.
   Personal insulation system may protect against step voltage.

Mostly above conditions may not exist concurrently. So, probability of shock due to step voltage is very less. But it cannot be ruled out. Farmers are working in the field where EHV line towers exist. The land may be irrigated, and farmer may be bare footed. Flow of fault current due earth fault may lead to accident. To reduce the effect of step potential, stone metal is spread in the switchyard.

But it remains unidentified as electrical accident because concerned person or animal is not in contact with live electric system.

Corona Effect in Electrical System

The word Corona being used is noted first in available history. There are several (about 7-8) meanings in the various fields of life. Out of those 4 meanings are well known in public at present or in near history. They are:

(1) Corona in the sense of a Crown or 'Muguth' which is put on head of Kings and some honorable person
(2) Golden ring seen around sun at time of total solar eclipse.
(3) Electrical effect on surface conducting parts due to high voltage in certain conditions.
(4) Presently worldwide Epidemic Covid19 but known in public as 'Corona' (Disease) due to corona virus.

We will discuss here Electrical effects known as Corona effect or Corona discharge.

The Corona discharge is of concern of Power Engineers in transmission field. It can happen in outdoor equipment too.

It takes place on surface conducting parts or conductors of High voltage lines /equipment in certain conditions and reasons. It occurs in HV more than 345kV but may occur up-to 33kV. It is a glow of bluish colour with hissing sound over the surface of conductors and other open parts called electrodes in atmosphere with smell of Ozone gas.

Some ionization is always present in air due to cosmic rays, ultra-violet radiations & radioactivity in the atmosphere. Therefore, under normal conditions also, conductors contain some ionized particles i.e. free electrons and neutral molecules around them.

When potential difference is created between the conductors, existing free electrons get greater velocities. They collide with neutral atoms and cause another ions & more free electrons. The chain of ionization starts

resulting more ionization and electric discharge up-to Corona discharge but not up-to discharge which can create spark which requires still more P.D.

Therefore, Corona discharge is partial discharge in air due to ionization in surrou-nding air.

Corona discharge is characterized by Violet colour glow, along with hissing noise & smell of Ozone.

The minimum voltage at which Corona occurs is known as critical disruptive voltage. It depends on many factors like radius of conductor, spacing, temperature of surrou-nding, atmospheric pressure, air density etc.

Another value "Visual critical voltage" is also of importance. It is a value of voltage at which Corona glow appears.

These two values are of concern of Design Engineers of Transmission lines/Outdoor Equipment.

It may be noted that corona is of two main types. +ve corona and -ve corona. It is classified so from the source of its occurring. Either it is from +ve electrode or -ve. Also, due to collection of electrons or ions to an electrode causing discharge for corona to occur.

Factors causing Corona:

The main factors causing corona discharge are transmission line voltage, conductors' size, spacing between the conductors, height above sea level, surface condition of conducting parts, no of conductors per phase, local weather condition etc.

As the line voltage increase the potential gradient around conductor will increase. This higher gradient causes more ionization which cause corona discharge.

Greater conductor size has more surface area and hence, lesser electric field gradient, resulting in to less ionization & discharge.

Higher spacing between phases or a phase to ground will have lower gradient and hence less discharge.

The discharge is inversely proportional to the density of Air (or any fluid medium) through which the conductor is passing. Hence, the line passing through hilly area will have more Corona at high altitude locations, as air is thin, so discharge as well as hissing noise will also increase. At every 1,000 ft. height, noise level of hissing sound connected with Corona, will increase by 1db roughly.

Intensity of Corona largely depends on surface condition of conducting parts or conductor. Smoother surface will have lesser Corona. Roughness & such irregularity on surface which causes sharpness on the surface cause more Corona due to increased electric field. The irregularity can be from roughness, scratches, sharp curves, sharp edges of hardware and also due to bad weather which causes on the conductor surface roughness due to dust, water droplets, snow, fog, ice formation, ice crystals etc. Stormy weather also can cause more Corona due to higher counts of ions present in stormy winds.

Lesser size conductors have less surface area and hence high electric charge density. Greater size conductors having more surface area cause less Corona. Use of more than one conductor per phase also reduces corona. Conductor having smooth surface or insulated surface will have less or no Corona.

Effects of Corona:

The Corona causes bluish glow on the conducting part with hissing noise. This causes more transmission loss. And also, interference in communication, navigation and Radio and TV signals, increase audio noise level of surrounding. It may damage polymeric insulators. It produces corrosive/ toxic gases due to ionization of nitrogen in air.

It can also affect to some sensitive electronic devices like synchronous pacemakers and other electronic equipment, computers etc.

There are some good effects of Corona also. It produces Ozone gas in atmosphere. For commercial and industrial purpose, equipment with artificial ionization up to corona formation level, are used.

Reduction of Corona:

1. Good design, keeping minimum voltage stresses, enough spacing between condu-ctors & ground, corona can be reduced /avoided.
2. Use of bundle conductors, smooth condu-ctors, hollow conductors with higher outer diameter, bigger size conductor will reduce corona. Insulated conductor also can avoid corona effect.

3. Treatment on surface of conductor by semiconductor layer, HV putty or corona dope will reduce corona.
4. Good quality homogeneous void free insulators can give good results.
5. Avoiding sharp points, curves, pointed hard wares can be good for avoidance of Corona.
6. Use of new conductor is also a good option.
7. Use of well-designed round shape corona rings will reduce corona.

Disadvantages of Corona

As described in preceding description in details, the following are the disadvantages due to Corona.

1. Transmission lines or equipment are subjected to power loss.
2. Audio noise is produced by corona affected lines.
3. Vibration of conductors of lines.
4. Corona generates ozone gas and subsequently nitrogen oxides and in turn sulfuric acid which badly affect the conductors by corrosive effect.
5. Radio and TV interference as well as communication and navigation interference.
6. Production of NOx and subsequently effluent and toxic gases.
7. Insulation damage of equipment & lines.
8. Possible distress in animals sensitive to UV light which is emitted due to Corona.
9. Progressive damage to insulation of transformers, capacitors, Electric motors and Generators connected to corona effected lines due harmonic currents produced by Corona discharge.
10. Progressive loss of capacitance of Plastic film capacitors due to Harmonic currents.

Advantages:

1. Due to corona around conductors, their virtual diameter (Total of conductor diameter plus width of corona ring) is increased, as Corona ring is also conductive.
2. Reduction of effect of Transients by surge in lines.
3. Production of useful Ozone gas in atmosphere.

An artificial ionization up-to corona discharge level in equipment is used for Industrial and commercial purpose listed below:

1. Removal of electric charge of Airshafts.
2. Manufacture of Ozone gas.
3. Sanitization of pool water.
4. Removal of solid pollutants from waste gas by it passing through ionized Electrostatic precipitators.
5. Removal of scrabbling particles from air in Air conditioning system
6. Photocopying
7. Air ionizers.
8. Production of photons for Kirlian photography to expose photographic film.
9. Nitrogen laser.
10. Ionization of gaseous sample for subsequent analysis in a mass spectrometer or an ion mobility spectrometer.

A table of interesting comparison of corona loss in Electrical Engineering and Medical Science is given below, being circulated at present in social media like WhatsApp for fun:

ELECTRICAL ENGINEERING	**MEDICAL SCIENCE.**
Power loss due to "CORONA"	Life loss due to CORONA
1. When "Conductors" are too close.	1. When HUMANS are too close.
2. When "System Voltage" increased.	2. When Gathering of people increases.
3. It's a complete breakdown of AIR.	3. It's complete breakdown of Economical Growth.
4. It creates ozone around the Conductors.	4. It Recover Ozone holes of Atmosphere.
5. It's more harmful in SOLID conductor.	5. It's more Harmful in Overweight & Elder persons
6. It causes 3rd harmonics.	6. It causes 3rd degree (by police)
7. It produces HISSING/HUMMING Sound.	7. It produces COUGHING/SNEEZING Sound.
8. It increases conductor Temperature.	8. It increased Human Temperature.
9. When Frequency of supply is 0, Corona loss is minimum not 0.	9. When Frequency of going outside is 0, Corona is in controllable not 0.
10. No Specific Device is there to Reduce Corona, but it can be controlled.	10. No specific Vaccines are there to Reduce Corona, but it can be controlled.
11. It Corrodes the CONDUCTOR.	11. It corrodes HUMAN life.

Er. AN Makwana, ECM & active LM of SPE(I), Vadodara

Members in News

Er. BB Mehta, Retd. Chief Engr. (LD), SLDC, GETCO and **Life Member** of Society of Power Engineers(I) Vadodara Chapter has taken over as **Director,** SLDC, Odisha Power Transmission Company Ltd. (OPTCL).

Er. Mehta, a Graduate in Electrical Engineering from BVM, Vallabh Vidyanagar-Anand and Post-Graduate in Computer Science from MSU-Vadodara, joined Gujarat Electricity Board as Trainee Engineer and subsequently elevated to the post of Chief Engineer. During his tenure in GEB and GETCO, he was selected for abroad training to Canada, USA and Australia.

His vast experience in Renewable Energy Forecasting & Scheduling and its Integration with Grid will now be available to SLDC, OPTCL.

Congratulations and best wishes to **Er. Mehta** for his new assignment.

Er. BB Chauhan,

Er. YV Joshi

Er. BB Chauhan, Retd. MD, GETCO and **Er. YV Joshi**, Retd., ACE, GETCO both **Life Members** of SPE(I) Vadodara Chapter have been conferred upon an award of **DISTINGUISHED MEMBER-2020** by **CIGRE**.

This award recognizes the contribution of CIGRE Members to their National Committee whether technical or administrative. Any long-standing individual Member of CIGRE who has contributed significantly to the activities of CIGRE NC and whose active participation and contribution in the technical activities of CIGRE is proved, is eligible for this award. We are proud and privileged to honor them.

Congratulations and best wishes to **Er. Chauhan** and **Er. Joshi**

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