Current Waves

ELECTRICAL CONSULTANTS' ASSOCIATION BANGALORE

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NEWSLETTER

EDITOR'S NOTE

One of the main aims of the Electrical Consultants' Association, ELCA, is to promote professional approach to electrical consultancy and highlight the benefits to clients arising from the services of a qualified, experienced and competent consultant.

The above aim is more easily said than achieved. This is because there is a thought in the minds of some of the clients that consultants are unnecessary or expensive or redundant (in case they have their own project team).

ELCA has successfully cracked the above mindset in some of the clients by sheer dedicated professional services rendered by the member consultants to their clients encompassing builders, developers, architects, industrialists etc. It is heartening to note that many clients in Bangalore, having realised the importance of "the ingenious ingredient", insist on having service consultants of caliber on their project teams. I am sure this must be the trend in other places too in India.

If this trend is to continue and improve, it will be worthwhile for all of us to follow the message from the President of the International Federation of Consulting Engineers, FIDIC, Engr. William D. Lewis, which I have reproduced just to refresh the minds of the engineering fraternity about the importance of the engineering consultancy profession.

Thank you,

Engr. J. D. Krupakar

MESSAGE FROM FIDIC

ENGR. WILLIAM D. LEWIS, FIDIC PRESIDENT

THE LARGEST contribution to the quality of life that we enjoy today is made by engineers. Clean, safe water, efficient transportation systems, flood hazard control, waste management, aseismic buildings, electric power generation and distribution schemes and so forth. Most of that, however, has been accomplished in virtual anonymity. We engineers - and only we - are to blame for this state of affairs. We have refused or neglected to take credit for these accomplishments. How do we recover ?

The first step Do good work and then tell the world about it, making our stories exciting. Let the public visualise a world without engineering - "the ingenious ingredient" - so that our achievements are put in the proper perspective. A world without bridges, tall buildings, clean water, electricity, communication, rapid transportation. Then we should all visibly show pride in our profession by putting "Engr." in front of our names like some of our colleagues in Europe and Latin America.

The Second step The compensation for our services has to be valued and performance based, not traded like a commodity. The best trained minds will not choose engineering consultancy if the compensation is not on a par with other learned professions, such as medicine.

Securing the future Let us step out of the shadows of anonymity and exercise leadership in the challenges facing the world in the 21st century. We must become authoritative voices to plead the case for sustainability and prudent resource utilization. Let's quit talking to ourselves and communicate with those who can restore our image. But our voices will not be heard unless we step out of the crowd and up to the podium. Will the invisible profession

please step forward

TRENDS IN TRANSFORMER TECHNOLOGY

Dr. G. V. Rao

Chairman & Managing Director
Rowsons Marketing Pvt. Ltd., Chennai.

(Continued from previous issue)

Cast Resin Transformers :

Cast resin distribution transformers have been in service throughout the world for more than 40 years. Despite their higher cost compared with conventional oil filled types their popularity is increasing.

Cast resin transformers are eminently suitable for tropical climates with high temperatures and high humidity. This is because the castings of both the HV and LV windings are done under full vacuum using moulds. In addition, the HV interconnection piece is also vacuum cast.

The higher tropical temperature is taken into account by designing for lower losses, giving a lower winding temperature rise which results in the same absolute temperature as for moderate climates.

Electrical distribution is economically achieved with an extensive medium voltage (MV) network. This implies that the distribution transformers should be located near the load centres. Distribution networks therefore tend to have a relatively large number of transformers with very limited low voltage (LV) network. The reason behind this is that, for a given power, cable losses are lower at higher voltages. Achieving lower cable losses is especially important when energy cost is high. But other factors also influence the layout. These are associated with the proper functioning of the system under practical circumstances, such as short-circuits and voltage fluctuations with changing loads, or with the availability of space to install transformer substation.

The most economical locations of distribution transformers are near the load centres, which are usually not acceptable with liquid filled types because of the increased fire hazard, even if the flash point of the transformer fluid is higher than 300 Deg C. In such cases, cast resin transformers can be used.

The choice to be made is between a liquid-filled transformer, placed outdoor at some distance from the load centre, and a more expensive cast resin type, placed indoor, close to the load centre and show that electrical distribution with a more expensive cast resin type at the load centre can be economically more attractive than with a conventional type away from the load centre, even at relatively short distance.

Even today, the impregnated dry type transformers are not fully satisfactory, disregarding the fact that it will be damaged due to the effect of over voltage. After a long break in operation any impregnated dry type transformer must not be switched back into the network before firstly being thoroughly dried out. For this reason and to improve the quality of dry insulated transformers, cast resin cry type transformers were introduced.

A cast resin transformer consists of three following main parts :

- 3 HV Coils
- 3 LV Coils
- Magnetic Circuit, the Core

Windings/Moulds:

The HV Coil is made from enameled copper wire, wound on a mandrel. After winding, the former is removed and the coil is put into a casting mould, in such a way that the die floats and there are no contacts between the die and the inner side of the windings.

It is possible to make many variations in the dimensions of the moulds. However, because of standardization the number of mould sizes are limited.

Casting Process:

The casting process for the coil is the most critical phase during manufacture. The coil and the casting mass (resin) should be de-gassed and be free of moisture. Also the temperature curve during the gelatin process is of utmost importance.

The windings will be surrounded completely by resin during the vacuum-casting process and with the cast-resin they form a solid structure in accordance with the DYNAGRID principle.

The resin system does not need any flexibilisers and another advantage of this system is that during sudden current surges, heat is dissipated from the copper conductor very easily to the resin, which again lowers the mechanical forces.

Conclusion :

Transformers have a significant impact on the losses of a utility's transmission and distribution system. Using currently available transformer technologies these energy losses can be cost effectively reduced by 10 - 40 %. High efficiency transformers reduce operating costs, improve the quality and reliability of customer service and improve environmental performance.

BIO DATA

Dr. G. V. Rao, Ph.D, is a Senior Member of IEEE-PES and has held responsible positions in G. E. C. of India Ltd., before starting his own business in 1983, and at present he is the Chairman and Managing Director of Rowsons Marketing Pvt. Ltd., Chennai, marketing transformers, stabilizers, unitised sub-stations etc. He has published a manual on transformers in the form of Question and Answer and booklets on capacitors, resin cast transformers, voltage regulators. He has conducted technical seminars on power and distribution transformers, industrial servo voltage stabilizers, mobile sub-stations, fire prevention system for transformers, unitised package sub-stations, ventilation systems etc. He was awarded Doctor of Philosophy in Marketing Management from the Inter American University of Humanistic Studies, Florida, USA.

FIRE DUE TO ELECTRICITY

by

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1.0 1ntroduction

Sometimes the cause of a fire, due to electricity is wrongly ascribed. The explanations given by many are misleading and wrong. Workers' indiscipline, heavy rains, thunder storms and short circuit are some of the reasons put forward.

After the occurrence of a fire or electrical failure the emphasis is on rescue, fire fighting, repairs and the earliest possible restoration of services. If any formal enquires are ordered every one goes on the defensive and the findings of the enquiry committee has no real effect. Similar incidents continue to take place.

No one seems to have either the time or the inclination to undertake in depth investigation of the root cause of such incidents and there is no sustained drive to prevent their recurrence. There seems to be an acceptance of the notion that electrical failures and fires are bound to occur. Many seem to believe that sooner or later materials will fail and men will make mistakes. Material failure or human failure are two last words after occurrence of electrical failures or fires.

Our educational curricula, either for the engineering course or for the industrial technician courses, do not give satisfactory coverage of the issues involved in the problem.

An electrical installation of today consists of components and materials which have been manufactured, processed and installed by a large number of organisations located several hundreds of kilometres from each other. The defect which is responsible for the fire may have been introduced in any of these widely dispersed centres but the ultimate responsibility rests always with the last unit in the chain, i.e., the user industry. In any case it is the user who has to suffer the consequences of fire and failures.

Special care has to be taken by the user in drafting of specifications, selection of suppliers, inspection of materials and training of men. Manufacturers of electrical equipment should aim at supplying items which do not fail and they should stop looking at supply of spares as profit centres.

Electrical fires are rare, but if and when they do occur, the consequence can be so serious that even the insurance can only partially cover the total losses.

When a fire occurs, the reason given is short circuit. A short circuit is an effect and not a cause. It is only a stage in the process which starts with an insulation failure and ends in a fire.

Failure and fire in an electrical equipment create problems for the owners by way of losses in production or revenue, and

the general public suffers because of interruptions or delays in essential services like electricity, water supply etc. When this happens, the supervisors and the engineers in charge of maintenance come under pressure from all quarters to restore the services as early as possible. Therefore, emphasis will only be on repairs and restoration. Those in charge of maintenance often work round the clock under difficult conditions to carry out repairs and to restore the service. Generally there is no sustained effort thereafter to determine the root cause of the failure and to implement effective measures to prevent recurrence. There are several reasons for this apparent lack of interest. A few examples are given below.

The maintenance supervisors and engineers are too busy with repair works to be able to make special effort which is necessary for investigating failures and fires. By the time repairs are completed in one place, another type of failure in another place might call for urgent attention. The maintenance staff thus move around from one failure site to another.

Everyone has got so used to the idea of electrical fires and failures occurring from time to time that there is an acceptance of periodical fires and failures of electrical equipment and is considered as normal way of modern life. Even the top managements are generally not prepared to approve the deployment of adequate resources to investigate and prevent electrical failures and fires. They are satisfied as long as repairs are carried out quickly, and if, occasionally, they feel that something should be done to prevent such costly failures and fires, the only action taken is to advise the maintenance engineers to ensure correct and timely maintenance. Actually less than 15.0 % of the failures of electrical equipment can be ascribed to deficiencies in maintenance.

The majority of electrical failures are because of the defects or deficiencies in design or manufacture. The responsibility for design usually rests with manufacturers. If the maintenance engineers complain about the failures to the manufacturers, their complaints are generally returned with suggestions of poor maintenance or mal-operation. Often the maintenance engineers stop making complaints and manage as best as they can in the circumstances. The net result is that failures due to design defects continue to take place.

Failure investigations always involve design considerations. Maintenance engineers are generally not trained to examine design aspects. As a result they tend to shy away from any effort in that direction.

Equipment failures are far more expensive than the mere cost of the repairs.

Root causes for electrical fire are electrical failures. Design defects and maintenance defects lead to electrical failures. If the protective system is defective or non existent, any electrical failure is almost certain to develop into a fire. If the failure is not detected quickly by a suitable protective system and power supply to the affected part is not disconnected at once, there is a fire.

Failures which result into fires are caused by defects. They may be in the form of a visible or measurable physical conditions. The defect may be detected during normal maintenance before it develops into failure. Some common examples of defects are given below :-

- Damaged insulation of the wires because of abrasion or moisture.
- Wire insulation which has cracked or deteriorated because of ageing.
- A vibrating conductor which has developed hair line cracks because of metal fatigue.

Most technicians and engineers recognise a defect which could lead to a failure, either immediately or within a short time. For instance, if a cable with a visible damaged insulation is allowed to remain in the service, it could lead to a short circuit and perhaps a fire. Gross defects of this type do occur from time to time, but failures because of them are rare as the maintenance staff usually recognise and eliminate them quickly.

2.0 Seed defects :

The majority of failures and fires which occur in practice are those caused by defects of different kind, which we will call seed defects, that is, defects that develop slowly or lie dormant harmlessly for years without causing any problems. If, for instance the cable insulation is bearing hard on a structural member it may be neglected. This is an example of a seed defect which may or may not develop into a defect and later into a failure or fire.

Seed defects may not look like defects, or they may even be invisible. They generally lie dormant for months or even years. Some of them may, when the conditions are favourable germinate and develop into defects and then into failures or perhaps further into fires. Seed defects grow insidiously and silently and then strike suddenly when least expected.

Defects in protective devices should also be considered as seed defects in the system. Protective devices operate only when there is a fault. If a defect in a protective device remains undetected, there would be no problem and operations will continue normally as long as there is no fault in the system. But if and when a fault does occur, a fire and perhaps a disaster may follow.

Every defect, sooner or later will develop into a failure or fire, but only a few seed defects will only do so. Most of the seed defects will remain harmless during the life time of the equipment. Since it is not possible to predict which seed defect will create problem and which will remain harmless it is necessary to identify and remove all of them. Fires which originate from defects in electrical equipment are called

electrical fires. The effect of electrical fires vary in magnitude from minor burning of an insulating board or insulated cable to a major disaster involving several hundred injuries and fatalities, among the public, apart from property loses worth crores of rupees. The severity of the effect depends on local conditions such as breeze, inflammability of surrounding materials, availability and effectiveness of fire detection and fire fighting system and the surrounding behaviour under crisis conditions. All these are, for all practical purposes, beyond the control of electrical engineers.

The best possible course of action to minimise loses is to attack the problem at its root i.e, to prevent the fire from starting. It is possible to prevent electrical fires and failures. The lacuna is only with regard to training of the electrical artisans.

3.0 Electrical fire :-

The following are the causes of electrical fire :

- Overloading
- Insulation failures
- Pressure contact failures
- Conductor fractures

Whereas insulation failures and overloading are more frequent than pressure contact failures and conductor fractures, fires are more likely because of the former two causes. The apparent paradox is explained by the fact that all electrical installations are provided with automatic protective devices which are capable of preventing fires when the fault is either overload or an insulation failure. Unfortunately, there is no such device available for general use to guard against pressure contact failure or conductor fractures.

The prevention of electrical fires require two folded action :

- Protection system must be designed, manufactured, installed and maintained correctly.
- Great care must be exercised in designing manufacturing and installing all components involving pressure contacts and conductors.

3.1 Overloading :

Overloading of an electrical equipment results in excessive current. As the heat developed in the cables is proportional to the square of the current, they get overheated. The insulation on cables is generally made of materials which are damaged easily

NEW MEMBERS

Mr. S. Kumar, 47, is a graduate in Electrical Engineering and has worked as Design Assistant in KLK Industrial Lines, Chennai from 1977 to 1979 and as Deputy Manager Marketing - Marine, in GE Power Controls from 1979 to 1999. Since 1999, he is working as a Senior Engineer - Electrical, in M/s. Semac Private Limited, Bangalore, and is incharge and responsible for all the projects handled by Electrical Department.

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Mr. J. L .Shaw Sumanam, 49, holds a degree in Electrical Engineering (1978) from College of Engineering, Trivandrum, Kerala University. He was a consultant with M/s. Iyer & Mahesh Architects from 1982-98 looking after the design of all electrical systems and other engineering services. Since 1998, he is having his own consulting firm, under the name 'Sumanam Engineering Services Consultant' in Trivandrum, Kerala. His specialisation is lighting design. He is a member of IEEE, IEE, IALD and is a life member of ELCA.

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Mr. Bijo K. John, 36, holds a B.E. degree in Electrical Engineering from STJIT, Ranebennur, Karnataka University. He has worked as an Engineer in various organisations and later in the year 1995, established his own consultancy firm under the style 'Tri Tech Corporation' at Edapally, Cochin, Kerala. His specialisation is CAD software. He is an individual member of ELCA.

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ELCA WELCOMES THE NEW MEMBERS

by excessive temperature. They may therefore lose their insulation properties and lead to short circuits. Overloading of electrical equipment is usually the result of defective system design or unplanned or unauthorised additions to installations. The remedy is obvious. Sometimes, overloading of electrical machines may occur because of defects in the driven machinery such as pumps and other machines. The remedy in such cases is to provide adequate protective systems.

3.2 Insulation failures :

Insulation failures are generally because of the degradation of the insulation either as a result of normal ageing or as a result of some defect in design, manufacture or maintenance. It is possible to minimise insulation failures resulting from normal ageing by timely preventive replacement of cables. But the cables do not age at every location at the same rate and some failures may occur before the scheduled replacement is accomplished. Very few insulating materials are immune to such degradation and there is no totally dependable, practical method available to monitor the condition of the insulation continuously. Insulation failures can be minimised but not totally eliminated. Prevention of electrical fires depend therefore on protective systems which can detect insulation failures and automatically and instantaneously switch off the power supply to the defective zone, thereby preventing the ignition of insulating materials. Metals can retain their mechanical properties almost indefinitely. There are a very few insulating materials which retain their insulating properties for ever. Unfortunately , these few insulating materials are brittle, rigid and hence unsuitable for cable insulation. Further, insulating materials are easily damaged due to abrasion, environmental effects, mechanical damage, overheating and rodent attack . Insulation failure and short circuits occur quite frequently and regularly in any large installation.

3.2.1 Types of Insulation failures :

There are three main types of insulation failures :-

- Insulation failures due to initial defect .
- Insulation failures due to normal ageing
- Insulation failure due to external damage

Insulation failures due to initial defects or deficiency in the strength of the insulation may be caused by an error in either the design, manufacture or the installation of the equipment. This type of defect can be prevented by ensuring the following measures.

- using materials with B.I.S. certification and manufactured by reputed manufacturers.
- Getting the installation designed by professionals and installed by licenced electrical contractors.
- Carrying out High Voltage (H.V.) tests on the installation before energising it.

All the three measures mentioned above are mandatory according to the Indian Electricity Act and Rules.

The reasons for carrying out H.V. test may be clarified here. Despite using materials which comply with the Indian Standards and despite getting the work done by licensed or qualified contractors, there is still a small probability of some defects

remaining in the installation. To guard against even this small chance, it is mandatory requirement that the installation be subjected to a high voltage test before energising. In this test, a high voltage which is two or three times the normal operating voltage is applied for one minute between the main lines and also between the main lines connected together and the earth. The exact value of the test voltage for any equipment is furnished in the relevant Indian Standards.

If there is any defect or weakness in the insulation, a fault will be indicated by the testing equipment. The fault will then have to be located, repaired and then tested. If the precaution mentioned above is taken, the possibility of an insulation failure occurring in service will practically be nil and hence there will be no fires on new installations.

3.2.2 Insulation failures due to normal ageing or external damage :-

If certain precautions are taken ,there is no possibility of any insulation failure or fire in a new installation. However, we have to guard against the effect of time and usage. Firstly, all insulating materials deteriorate in their insulating properties with passage of time. The rate of deterioration depends on many factors which are beyond measurement or control. Some of these factors are electrical loading on the wires, the ambient temperature, the layout and surroundings of the wires, presence of foreign materials, the original quality of the design and the materials.

Therefore, despite the original installation being in the best possible standard, we must be prepared for insulation failures occurring in service after installations have been in use for sometime. This is ensured by providing what are known as protective systems.

3.3 Fire due to failures of pressure contacts and fractures

These two types of defects are discussed together because they have common features.

There are no protective systems available which can automatically and immediately disconnect the power supply when failure of pressure contacts or fractures of conductors occur in service.

In other words there is no second line of defence against fire arising out of such defects. The protective systems which are usually provided are only capable of detecting short circuits or earth faults caused by the insulation failures. There are no protective systems available for detecting failures of pressure contacts or fracture conductors. When such defects occur, over heating and arcing will take place and continue to grow until a fire is started. It is therefore of utmost importance to ensure during design, manufacture, installation and maintenance, that neither defects nor seed defects could develop to such failures of pressure contacts or fractures of conductors are introduced at any stage.

(to be continued in the next issue)

DOs

- ⇨ Always buy / use electrical appliances / equipment with ISI mark and strictly follow the instruction manual.
- ⇨ Seek advice from an electrical consultant for safe design and location of electrical equipment.
- ⇨ Get the electrical work done only by a Govt. Licenced electrical contractor. Insist on production of the licence of the contractor.
- ⇨ Use fully insulated tools while handling electric wires and equipment.
- ⇨ Always ensure that a matching plug and socket is used to avoid loose contact and consequent heating and melting.

ANALYSIS OF ELECTRICAL ACCIDENTS OCCURED IN THE STATE OF KARNATAKA

Sl. No.	Reasons	2001 - 2002		
		Fatal to Human	Non Fatal to Human	Fatal to Animals
1.	Snapping of conductor	55	46	196
2.	Accidental contact with live electric wire / equipment	95	102	15
3.	Violation / neglect of safety measure / lack of supervision	14	09	15
4.	Defective appliance / tools /apparatus	04	-	04
5.	Inadequate / lack of maintenance	08	05	46
6.	Unauthorised work	15	09	82
7.	Any other reasons	121	78	40
	TOTAL	312	249	392

POTPOURRI PAGE

An angry person is seldom reasonable,
reasonable person is seldom angry.

Anger opens the mouth and shuts the mind.

An optimist laughs to forget, a pessimist forgets to laugh.

An archaeologist is the best husband any woman can have.
The older she gets, the more interested he is in her.

Antiques are things one generation buys,
the next generation gets rid off, the following
generation buys at auction at amazing prices.

A few of the answers from a medical entrance test :

Tablet	- a small table
Ultrasound	- radical noise
Urine	- opposite of you are out
Rupture	- ecstasy
Pace maker	- winner of Nobel peace prize
Dilate	- the late British Princess Diana
Cyst	- short form of Sister
Labour pain	- hurt at work
Lactose	- people without feet
Lymph	- walk unsteadily
Obesity	- city of obe
Antibody	- against everyone
Artery	- the study of fine paintings
Bacteria	- back door to a cafeteria
Protein	- in favour of teens

An accountant is having a hard time sleeping and goes to see his doctor.
"Doctor, I just can't get to sleep at night".
"Have you tried counting sheeps".
"That is the problem. I make a mistake and then spend three hours trying to find it".

An elderly woman died last month and having never married, she requested no male pallbearers. In her handwritten instruction for her memorial service, she wrote: "They wouldn't take me out while I was alive. I don't want them to take me out when I am dead".

A new minister was talking to the oldest member of his congregations. "I am 90 years old, Sir, and I haven't an enemy in the world", said the aged one. "That is a beautiful thought", said the clergyman approvingly. "Yes, Sir," was the answer, "I am thankful to say that I have outlived them all".

A newsboy was standing at the corner with a stack of papers, yelling "Read all about it. Fifty people swindled ! Fifty people swindled". Curious, a man walked over, bought a paper and checked the front page. Finding nothing, the man said, "There is nothing in here about fifty people being swindled". The newsboy ignored him and went on yelling "Read all about it. Fifty one people swindled".

- from web

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