



Current Waves

ELECTRICAL CONSULTANTS' ASSOCIATION OF INDIA BANGALORE

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EDITOR'S NOTE

One concern that is common and shared by all, all over the world, be it Government, or environment conscious group, such as Greenpeace, for example, or environment conscious individuals, is the global warming, to which electricity generation and utilization can mitigate to a considerable extent. Electricity generation, which now-adays depends mostly on environment polluting (CO₂ and Mercury) fossil fuels such as coal, gas, petroleum etc. can be reduced to some extent by using renewable energy sources like solar, wind (both ground and stream winds), hydro and wave energies. Consumption of electricity and therefore the generation of electricity can be reduced by using energy efficient equipment such as energy efficient motors and transformers and energy efficient devices like compact fluorescent lamps (CFLs), and by discarding energy inefficient devices like incandescent bulbs etc.

The production statistics of CFLs vis-a-vis incandescent bulbs as recent as 2005-06 is not very encouraging. Although there is an increase in the production of CFLs, it is still a paltry 5.0% of the total number of incandescent bulbs.

In India, the Government has no formal plan to phase out or ban the use of incandescent bulbs, although about 18 to 20 % of electricity generated is used for lighting purposes and switching over to CFL would save about 12,000 MW of power generation and lead to reduced CO₂ emission, by 3 to 4 percent.

In the international scene, Venezuela and Cuba were the first countries who took a bold decision in 2005 to phase out the incandescent bulbs and use CFLs. In February 2007, Australia enacted a law to ban the sale of incandescent bulbs by 2010. Similar legislations to phase out incandescent bulbs are under way in Brazil, Canada, New Zealand, Netherlands and some states in the U.S.A.

However, mercury, one of the most toxic elements, is released to the environment during recycling of used CFLs. But it is about 400% less than the amount of mercury released during coal burning to generate the amount of electricity required to use incandescent bulbs for the same amount of light and therefore changing over to CFLs would also reduce the mercury load in the environment.

It seems that all eyes are focusing on the use of CFLs, which are user friendly, with longer life and which consumes only about 20% of electrical energy used by incandescent bulbs to produce the same amount of light. It is time for India to pass legislation in a phased manner, like in other countries to ban the use of incandescent bulbs, and make the use of CFLs in commercial and residential buildings mandatory, of course, with some incentives such as subsidies etc. to start with as the initial cost is high. Government must also stipulate and implement a proper disposal mechanism to prevent the release of mercury to the environment.

Thank you,

Engr. J. D. Krupakar

GOES GLOBAL THIS AUGUST 2007 THROUGH ITS



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LOW VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES

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(Continued from the previous issue, Vol V, Issue-2)

Table 1 Forms of separation as per IEC.

| MAIN CRITERIA | SUB-CRITERIA | FORM | TYPE OF CONSTRUCTION |
|---|--|---------|--|
| No Separation | | Form 1 | |
| Separation of busbars from the functional units | Terminals for external conductors not separated from busbars. | Form 2a | Type1 - Busbar separation is achieved by insulated covering, e.g. sleeving, wrapping or coatings. |
| | Terminals for external conductors separated from busbars. | Form 2b | Type2 - Busbar separation is by metallic or non-metallic rigid barriers or partition |
| Separation of busbars from the functional units and separation of all functional units from one another. Separation of the terminals for external conductors from the functional units, but not from each other. | Terminals for external conductors not separated from busbars. | Form 3a | Type1 - Busbar separation is achieved by insulated covering, e.g. sleeving, wrapping or coatings. |
| | Terminals for external conductors separated from busbars. | Form 3b | Type2 - Busbar separation is by metallic or non-metallic rigid barriers or partition |
| Separation of busbars from the functional units and separation of all functional units from one another, including the terminals for external conductors which are an integral part of the functional unit. | Terminals for external conductors in same compartment as associated functional unit. | Form 4a | Type - 1 Busbar separation is achieved by insulated covering, e.g. sleeving, wrapping or coatings. Cables may be glanded elsewhere. Type - 2 Busbar separation is by metallic or non-metallic rigid barriers or partitions. Cables may be glanded elsewhere. Type - 3 Busbar separation is by metallic or non-metallic rigid barriers or partitions. The termination for each functional unit has its own integral glanding facility. |
| | Terminals for external conductors in same compartment as associated functional unit, but in individual, separate, enclosed protected spaces or compartments. | Form 4b | Type - 4 Busbar separation is achieved by insulated coverings, e.g. sleeving, wrapping or coatings. Cables may be glanded elsewhere. Type - 5 Busbar separation is by metallic or non-metallic rigid barriers or partitions. Terminals may be separated by insulated coverings and glanded in common cabling chamber(s). Type - 6 All separation requirements are metallic or non-metallic rigid barriers or partitions. Cables are glanded in common cabling chamber(s). Type - 7 All separation requirements are by metallic or non-metallic rigid barriers or partitions. The termination for each functional unit has its own integral glanding facility. |

Note : Conductors which are connected to a functional unit but which are external to its compartment or enclosed protected space (e.g. control cables connected to a common marshalling compartment) are not considered to form part of the functional unit.

In Form 4, various options exist as per agreement between user and manufacturer to gland the cable in common cabling chamber, or individual terminal compartment with own integral glanding facility (type 7), or cables terminating at functional unit having own integral glanding facility (type 3).

ARCING FAULTS:

Arcing faults are most frequently short circuit faults in switchboards causing injury to personnel and damage to switchboard. Generally there are three types of arcs:

Type 1 Primary arcs on unprotected busbars or arcs in the primary side of the short-circuit protection of the switchboard

Type 2 Primary arcs on busbars after the short-circuit protection of the switchboard

Type 3 Secondary arcs in outgoing compartments after the short-circuit protection in the compartment

Type 1 arc can cause severe damages and risk of enclosure explosion and personal injury skin burning/getting hit by loose flying objects. Typical arc duration can be 0.15 sec. if H.V. side protection operates to disconnect.

Generally, Air Circuit Breaker on Incoming side of switchboard (between transformer and busbar) is provided with instantaneous short circuit release which reduces the duration of the arc to Type 2 - for approx. 50 m sec. (if ACB does not have time delayed short-circuit release). This reduces the damage, however there will be rise of pressure, hence the lids and covers must be secured safely. Type 3 arcs are the most frequent arcs and release of energy is reduced compared to Type 1 and 2 arcs. However danger exists that a Type 3 arc can re-ignite on primary side of protective equipment and can develop to a Type 2 or Type 1 arc. Form 4 construction of LV switchboard tries to address this issue.

Arc tests - type test - are conducted on switchboards to ensure effects of arcs are contained in limits. Arcs are generated by ionized gases caused by short circuit. Electrical arc can be considered as a conducting gas pile with a temperature in arc core in the range of 10,000 to 20,000 °C. Arc impedance reduces prospective fault current value. Electro-dynamic

forces and the thermal stress forces affect the arc and it will move when conditions permit. The returning voltage together with the heavily ionized arc inside the switchboard can cause re-ignition of arc somewhere else.

Some of the measures to reduce arc damages are:

Current limiting circuit breakers which limit fault current with operation time less than 5 milliseconds.

Non-current limiting circuit breakers with quick acting relay protection.

Use of Arc detection relays. There can be a number of arc detectors suitably located inside the switchboard. The arc detector system detects any large increase in light intensity and sends a signal to arc detection relay to directly trip the incoming circuit breakers and high speed circuit breakers provide the best means to ensure minimum damage and injuries.

The Arc detector system may include:

- Arc monitor with detector - one detector in each cubicle, horizontal & vertical bus bar compartments

- Current sensing unit to work in combination with arc detectors to avoid spurious tripping (e.g. due to sunlight, camera flash, switching arc, etc.)

- Breaker fault unit to provide safeguard against failures in downstream circuit breakers so as to trip the main upstream breaker.

- Use of fibre optic communication in the system to avoid interference from high electromagnetic forces during arc fault.

TYPE TESTED ASSEMBLY (TTA) TO IEC 60439-1

To ensure switchboard design will perform effectively, fully 'Type Tested Assembly' shall be used. TTA is a LV Switchgear and Controlgear Assembly conforming to an established type or system without deviations to significantly influence the performance, from the typical assembly verified in accordance with IEC standard. Consultant/user may ensure the switchboard is of the same design as the 'Type Tested' one and it has not been changed sufficiently to alter performance. If fully type tested assembly is not being used, it may be ensured the switchboard is a Partially Type Tested Assembly (PTTA) which may contain both type tested and non-type tested arrangements, provided that the latter arc

TTA is a LV Switchgear and Controlgear Assembly conforming to an established type or system without deviations to significantly influence the performance, from the typical assembly verified in accordance with IEC standard.

| | | |
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derived (e.g. by calculation) from type tested arrangements. Verify this is derived from a design that has been fully type tested at some point and just not a collection of tested compartments. Just because each busbar, fuse or circuit breaker is tested independently does not guarantee that a switchboard design using these components will be safe - hence importance of TTA or PTTA.

Independent type test authorities provide type testing facilities (ASTA, KEMA, CPRI etc.), manufacturer shall provide copy of full type test certificate including all pages for verification by consultant/user.

CONSTRUCTION OF SWITCHGEAR:

In industrial plants, the incoming and outgoing units in a LV switchgear assembly are built as complete functional units. LV switch boards contain all the necessary apparatus, compartments and connections. These are then assembled in modular mechanical units to provide a high degree of protection against unintentional contact with hazardous live parts in adjacent functional units and protection against passage of solid foreign bodies from one unit to another, each functional unit built as a separate, screened compartment with its own door.

The functional units can be designed as

* Fixed parts, where units are connected to vertical busbars by bolts so the units cannot be removed without switching OFF of busbar system.

In 'removable' and 'withdrawable' systems, parts can be safely removed and installed without switching OFF busbars. This allows removal or installation of unit on a LIVE switchgear assembly.

INCOMING AND OUTGOING UNITS:

Incoming unit is generally a circuit breaker cubicle for L.V. substations- withdrawable air circuit breaker provides safety in isolating, as H.V. side of transformer need not be accessed. For Sub main distribution boards and MCCs, incoming units can be ON load or OFF load isolators or MCCB or fuse switch/switch fuse depending on the design. Circuit breakers may be preferable.

Outgoings can be:

- Air circuit breaker or MCCBs as per required rating for distribution

- Fuse switches/switch fuses

- Motor starters of various types like DOL, Star-delta, reversing, dual speed etc. or /and soft starters including associated automatic controllers

- Variable speed drives - AC or DC

- Power factor correction equipment.

Horizontal busbars - generally located at top, it is included in a partitioned compartment.

Vertical busbars - generally located at the rear or side, it distributes current to the different feeders for withdrawable type switchgears. The profiles of the busbars are so as to allow the units to be plugged-in directly. Vertical busbars can be enclosed in a partitioned compartment.

FIXED AND WITHDRAWABLE SYSTEMS:

Fixed Units:

In many applications like buildings and many industrial plants, there may not be any requirement to replace compartments under operating conditions and/or, short standstill times can be tolerated for planned maintenance etc.

Fixed system offers excellent economy, reliability and flexibility in such cases. The functional units can be modular units.

Withdrawable Systems:

Withdrawable units systems offers high availability. Removal and ease of replacement of equipment are done under operating conditions so that switchboard can be adopted to process related modifications, or maintenance purposes without having to be shutdown. Hence, withdrawable L.V. switchboard and M.C.C are in extensive use in power plants, oil/gas/petrochemical plants, metal processing plants and other key industrial plants.

The system has a moving part composed of frame work holding the switchgear and control devices and also a fixed part, holding withdrawal mechanism and the moving part guides. Typically, hand crank is provided to operate withdrawable system. Withdrawable unit has plug-in contacts for both plugging into the vertical busbars and as plug-in

Just because each busbar, fuse or circuit breaker is tested independently does not guarantee that a switchboard design using these components will be safe - hence importance of TTA or PTTA.



As per IS 1534 - 1988
Certified by : CPRI
Approved by : KPWD

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contacts on the cable connection side. Automatic shutters are provided covering the live side power bushing after the withdrawal of the moving part to prevent any accidental contact. An End stop is provided limiting the moving part travel on withdrawal. Withdrawable units can be either MCCBs or various combinations of starter units as the case may be, trucks may be used for Air Circuit Breaker units which are heavier. The line side bushings may have special clamps for plugging into the vertical busbars and plugs and sockets arrangement for auxiliary circuits.

Outgoing side for these systems will have three positions for the units - connected when in operation, withdrawable 'Test' position and 'Disconnected' position. In 'test' position (air circuit breaker, starter circuit etc.) the main power circuit is disconnected, while the auxiliary circuit is live, so that the ON/OFF control functions can be tested without 'main contacts' being live on no-load. In 'disconnected' position, both main and auxiliary circuits are disconnected. In all 3 positions, the doors are closed and withdrawable unit mechanically connected to switchboard. This provides safety to the personnel and degree of protection is upheld. Movement from the 'connected' into 'Test' position and vice versa passes through the disconnected positions. Also when circuit breaker is closed (ON) moving of 'withdrawable' unit is not possible i.e. Hand crank cannot be attached, so as to prevent any mal operation. The position of a withdrawable unit can be clearly indicated by use of auxiliary isolating contacts and limit switches for positions.

In withdrawable functional units, all equipment and movable parts are with the units and therefore protected from changes. ON/OFF push buttons, selector switches, indication lamps, meters etc., are located on a hinged panel so that settings can be done during the operation. Modules are exactly similar as per breaker ratings in the case of feeders or as per starter in case of MCCs, so that spare modules can replace any unit at anytime almost instantaneously after withdrawal of a unit-so maintenance on the unit can be done later after withdrawal of unit.

These arrangements may differ among various manufacturers.

(To be continued in the next issue, Vol V, Issue-4)

MOVING?

IN CASE YOU ARE PLANNING TO MOVE PLEASE SEND US YOUR NEW ADDRESS AS SOON AS YOU MOVE TO THE NEW LOCATION, SO THAT OUR 'CURRENT WAVES' FOLLOWS YOU.

PLEASE INTIMATE THE EDITOR
THANK YOU!

LIFE

Once A professor began his class by holding up a glass with some water in it. He held it up for all to see; asked the students, "How much do you think this glass weighs?"

50gms! '...' 100gms! '...' 125gms! '...' The students answered.

"I really don't know unless I weigh it", said the professor, "but my question is": What would happen if I held it up like this for a few minutes?

"Nothing" the students said.

"OK!! What would happen if I held it up like this for an hour?" Professor asked.

"Your arm would begin to ache" said one of the students.

"You're right, now what would happen if I held it for a day?"

"Your arm could go numb; you might have severe muscle stress paralysis; have to go to hospital for sure!" ventured another student; all the students laughed.

"Very good. But during all this, did the weight of the glass change?" asked the professor.

"No" replied the students.

"Then what caused the arm ache; the muscle stress?"

"Instead what should I do?". The students were puzzled.

"Put the glass down!" said one of the students.

"Exactly!" said the professor.

"Life's problems are something like this. Hold it for a few minutes in your head, they seem OK. Think of them for a long time, they begin to ache. Hold it even longer, they begin to paralyze you. You will not be able to do anything. It's important to think of the challenges (problems) in your life, but EVEN MORE IMPORTANT to 'put them down' at the end of every day before you go to sleep. That way, you are not stressed, you wake up every day fresh, strong and can handle any issue, any challenge that comes your way!

Remember to PUT THE GLASS DOWN TODAY!
That's life.

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POTPOURRI PAGE

Impossible English...

Non-English speaking countries sometimes go out of their way to communicate with their English-speaking tourists:

Cocktail Lounge, **Norway**:

LADIES ARE REQUESTED
NOT TO HAVE CHILDREN IN THE BAR.

At a **Budapest** Zoo:

PLEASE DO NOT FEED THE ANIMALS.
IF YOU HAVE ANY SUITABLE FOOD,
GIVE IT TO THE GUARD ON DUTY.

Doctor's Office, **Rome**:

SPECIALIST IN WOMEN AND OTHER DISEASES.

Information booklet about using a hotel air conditioner,

Japan:-

COOLES AND HEATES: IF YOU WANT CONDITION OF
WARM AIR IN YOUR ROOM, PLEASE CONTROL
YOURSELF.

In a **Nairobi** restaurant:

CUSTOMERS WHO FIND OUR WAITRESSES RUDE
OUGHT TO SEE THE MANAGER.

On the grounds of a **Nairobi** private school:

NO TRESPASSING WITHOUT PERMISSION.

In a **Tokyo** bar:

SPECIAL COCKTAILS FOR THE LADIES WITH NUTS.

Hotel, **Japan**:

YOU ARE INVITED TO TAKE ADVANTAGE OF THE
CHAMBERMAID.

In the lobby of a **Moscow** hotel across from a Russian
Orthodox monastery:

YOU ARE WELCOME TO VISIT THE CEMETERY WHERE
FAMOUS RUSSIAN AND SOVIET COMPOSERS,
ARTISTS, AND WRITERS ARE BURIED DAILY EXCEPT
THURSDAY.

Advertisement by a **Hong Kong** dentist:

TEETH EXTRACTED BY THE LATEST METHODISTS.

Tourist agency, **Czechoslovakia**:

TAKE ONE OF OUR HORSE - DRIVEN CITY
TOURS - WE GUARANTEE NO MISS CARRIAGES.

The box of a clockwork toy made in **Hong Kong**:

GUARANTEED TO WORK THROUGHOUT ITS USEFUL
LIFE.

Airline ticket office, **Copenhagen**:

WE TAKE YOUR BAGS AND SEND THEM IN ALL
DIRECTIONS.

In a **Japanese** cemetery:

PERSONS ARE PROHIBITED FROM PICKING
FLOWERS FROM ANY BUT THEIR OWN GRAVES.

*

Some reasons to be grateful if you grew up speaking English:

7

The bandage was wound around the wound.

The farm was used to produce produce.

The dump was so full that it had to refuse more refuse.

We must polish the Polish furniture.

He could lead if he would get the lead out.

The soldier decided to desert his dessert in the desert.

There is no time like the present, he said it was time to present the present.

At the Army base, a bass was painted on the head of a bass drum.

When shot at, the dove dove into the bushes.

I did not object to the object.

The insurance was invalid for the invalid.

There was a row among the oarsmen about how to row.

They were too close to the door to close it.

The buck does funny things when the does are present.

A seamstress and a sewer fell down into a sewer line.

To help with planting, the farmer taught his son to sow.

The wind was too strong to wind the sail.

After a number of Novocain injections, my jaw got number.

Upon seeing the tear in the painting I shed a tear.

I had to subject the subject to a series of tests.

How can I intimate this to my most intimate friend?

I spent last evening evening out a pile of dirt

*

An airplane was flying from Los Angeles to New York. About an hour into the flight, the pilot announced, "We have lost an engine, but don't worry, there are three left. However, instead of 5 hours it will take 7 hours to New York".

A little later, the pilot announced, "A second engine failed, but we still have two left. However, it will take 10 hours to get to New York"

Somewhat later, the pilot again came on the intercom and announced, "A third engine had died. Never fear, because the plane can fly on a single engine. However, it will now take 18 hours to get to New York."

At this point, one passenger said, "My God, I hope we don't lose that last engine, or we will be up for forever"

*

Say them fast!

Peter Piper picked a peck of pickled peppers.

A peck of pickled peppers Peter Piper picked.

If Peter Piper picked a peck of pickled peppers,

Where is the peck of pickled peppers Peter Piper picked?

*

Current Waves

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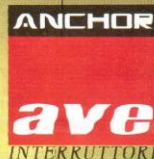


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