



Current Waves

ELECTRICAL CONSULTANTS' ASSOCIATION OF INDIA BANGALORE

VOLUME VI - ISSUE 1

www.elcaindia.com

OCT - DEC 2007



EDITOR'S NOTE

Importance of conservation of energy is growing day by day. Our country is all set (if not already in place) to release the first Energy Conservation Building Code, ECBC, which follows healthy building practices to conserve energy. ECBC is a product of Bureau of Energy Efficiency, BEE, whose motto is 'Energy is life, Conserve it' and who comes under Ministry of Power, and which was established in 2003 after the constitution of Energy Conservation Act 2001. The intention of the Act is to effect the use energy efficiently and to conserve energy.

The Code is mandatory for commercial or building complexes whose connected load is 500kW or more or whose contract demand is 600kVA or more. The code is mandatory to all buildings with a conditioned floor area of 1000 square metres or more. The code is applicable for existing buildings in a phased manner. Regular energy audits from time to time will be required for buildings with a connected load of more than 500kW.

Although an Act is binding on the citizens, and therefore by virtue of the Energy Conservation Act 2001, BEE has the power to enforce and penalize over the entire range of buildings, industries, appliances and equipment, as a gesture BEE prefers to make it voluntary from the consumers, for a starter. ECBC will aid in controlling the rate of growth of electricity consumption without affecting the productivity. Saving energy alone can help meet the future energy demand and thereby reducing the ever increasing supply-demand gap.

ECBC deals with material of the walls, number of windows, type of glass used, lighting etc. The cost of building adopting ECBC might increase by an average 8.0% and this would be recovered by the energy savings.

Adopting ECBC can lead to about 25 to 40 per cent saving in the electricity bill depending on the annual consumption per square metre of the floor area. Compliance with ECBC and therefore energy saving is beneficial to both the owners and the users by improving the comfort level and productivity. One should know that the saving rate varies with climate zones (There are five climate zones in India) and codes that are best suited for different zones have been designed.

BEE has been supported by International Institute for Energy Conservation, IIEC, as a project team, a committee of experts, and well known organizations, reputed Institutions, Associations, Government departments and Societies. My congratulations to BEE and I am sure this ECBC must be one of the best with respect to Energy Conservation and I am sure the Builders and owners of buildings will surely comply with the norms set by the code, lest they face the penalties from BEE.

Thank you and wish you all a happy and prosperous new year.

Engr. J.D.Krupakar



VACUUM CIRCUIT BREAKERS

by
T.V.RAO, M.Sc., D.I.I.Sc

INTRODUCTION

Switchgear is one of the of the most important equipment in the medium voltage distribution system (3.3kV - 33kV). Reliability of power supply largely depend on the efficiency of the switchgear and its control. Switchgear is like a sentinel guarding the system and therefore it has to be most reliable. Severity of duty can be gauged by the fact that many a times switchgear is not operated for months together, but when a fault occurs efficient switchgear trips immediately. Among all forms of switchgear, the circuit breaker is the most important one. The circuit breaker works as switching device which is capable of breaking even at very heavy current, normally associated with a fault in the system. It can be made to trip automatically in the event of a fault.

HISTORY

In the early part of last century, quantity of power distributed at medium voltage was small and maximum fault currents were very low. The design of the switching device was simple, being essentially an isolating device and the low arc generated while opening operation was quenched by air surrounding the contacts.

As the power distribution network expanded, the current required to break under fault condition became larger and larger. The design of circuit breaker underwent a large change to take care of increased fault currents.

In case of A.C. system, the arc forms an essential part of switching process. The current flows by means of arc when switching device is opened and contacts are separated, till current reaches zero . If the contacts are sufficiently apart at that time, the dielectric media between the contacts will not allow the arc to restart. The use of dielectric media in quenching of the arc became most significant part of the design. The circuit breakers were developed making use of various types of dielectric material. These efforts resulted in development of following types of circuit breakers.

BULK OIL CIRCUIT BREAKER (BOCB)

MINIMUM OIL CIRCUIT BREAKER (MOCB)

AIR BLAST CIRCUIT BREAKER (ABCB)

Bulk oil circuit breakers first conceived in U.K. uses insulating oil popularly known as Transformer oil. By simplicity in design, low cost and proven design, these were extensively used in our country till 1990s.

European designers reduced the oil content by

having contacts of each pole enclosed in an insulated chamber containing oil and thus emerged Minimum oil circuit breaker. The principal design is same as that of bulk oil circuit breaker. Although the oil content was very much less, these breakers required frequent change of oil as well as chambers (almost every time breaker operates on heavy faults). However these are found more suitable in High Voltage range (33kV-220kV).

Air blast circuit breakers were introduced in order to eliminate the use of oil. The additional requirement of air compressor made it more uneconomical in the Medium voltage range. These types of circuit breakers are however widely used on 132kV/220kV system at large substations.

Earlier attempts to use dielectric other than oil and air dates back 1920s but only in 1950s American company was successful in commercial production of a new generation of circuit breakers - vacuum circuit breakers. At the same time Europe designers tried SF₆ (Sulphur Hexa Floride) gas instead of oil in the circuit breakers. While the design similar to MOCB was successful in case of voltages above 33kV (HV/EHV range), it was not economical in the MV range. The design was modified for MV range by developing rotating arc, puffer type designs with all pole contacts in one gas container to make it commercially viable. However Vacuum circuit breakers became more popular. This article deals with VCB as it generally known.

CURRENT INTERRUPTION IN VACUUM

Vacuum is an extraordinary good dielectric and vacuum pressure above 10-2 torr has a dielectric strength of 40 kV/mm Therefore very small movement of contacts is sufficient to quench the arc.

Here unlike arc in other media gas molecules do not create or carry the current or arc. Vapour arc is formed, during separation of contacts, by evaporation of cathode material.

Initial structure of vacuum arc is conical with its apex at cathode spot, which supplies electrons and positive ions to plasma of the arc. As the current increases the arc splits into two to maintain the current. The two arc columns tend to repel each other. As the current increases the arc mode changes dramatically. The contacts are designed to provide transverse magnetic field resulting the arc to rotate round the toroidal-type contacts. This phenomenon prevents arc from changing to constricted form. The arc continues to form intense tube of plasma, which

cools to normal diffuse arc with many parallel paths as current approaches zero and finally disappears at current zero. The arc does not restrike as contacts are sufficiently apart.

DESIGN AND CONSTRUCTION

The main component of VCB is a VACUUM INTERRUPTER. It consists of high quality ceramic / glass enclosure containing a set of contacts. The vacuum is created inside the enclosure to the desired levels, generally in the order of 10-2 torr or so. The technology is similar to that being adopted in the manufacture of TVs, lamps, and electronic valves and hence there is proven technology available in making vacuum tight envelope.

The second most important component is contact material. The contact material is specially developed Cr Cu alloy. The contacts are toroidal type with slits. Each manufacture has his own designs for increased performance.

Bellows are provided for the movement of contacts. As the travel of the contacts is very small in view of the high dielectric strength in vacuum, the design of bellows is less complicated. In order to keep in line with long life of Vacuum Interrupter, the bellows have to be highly corrosive resistant and hence stainless steel becomes natural choice.

The designers ensure that all the conducting rods inside the interrupter are able to transmit the heat generated in the chamber, since heat cannot be dissipated through convection inside the vacuum.

As for as operating mechanism is concerned, it is simpler than other types of circuit breakers since travel of contacts are small. The operating mechanism are available in various types which includes manual springs, motor operated springs, and solenoid operated devices used in conventional breakers. However the mechanism must be designed to satisfy the switching characteristics of the VCB. Generally opening springs are used to open the interrupters. They should be able to withstand the weight of the interrupters, able to hold open position force, and match the opening characteristics necessary for the interrupters. The wiping springs should be able to put required contact pressure.

The life of the mechanical parts should match with high life of the interrupters.

Vacuum interrupters are taken up for manufacturing units with necessary technology of vacuum sealing while the rest of the unit is made by standard switchgear manufacturer. The modules are made similar to that of L.V. MCCBs, and this enables panel builders to build up tailor made requirement.

Typical details of vacuum interrupter is shown in figure 1 while the figure 2 shows the typical travel of arc.

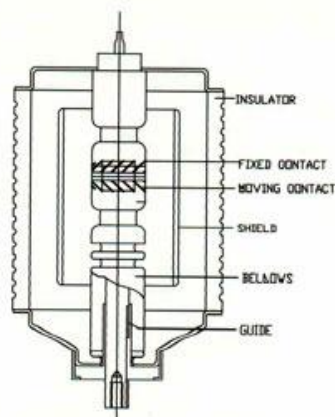


Figure 1

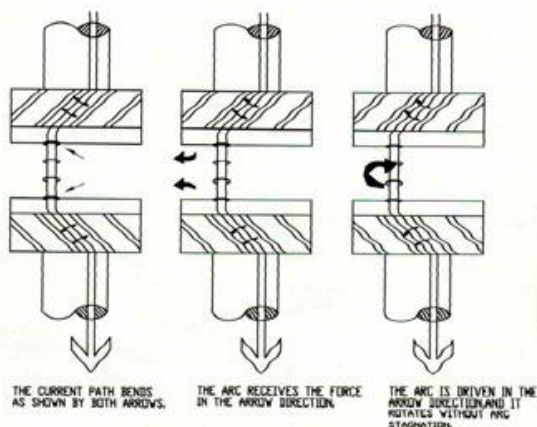


Figure 2

PERFORMANCE OF VCB

Most of the manufacturers of Vacuum Interrupters employ design of extinction of arc by driving the arc around the circular contacts and therefore rating of unit can go as high as 2500A (normal current) and fault current of 40kA. (even 52kA is being attempted). Initially there was an apprehension regarding use of VCBs instead of other types breakers. One of the reasons is possibility of reduction in vacuum pressure when gases produced during interruption. These gases are absorbed by the Getter and there by maintain high degree of vacuum. In the initial designs switching surges generated when interrupting smaller currents used to give rise to undesirable chopping current and thus making VCB unsuitable for many applications. However with better material and alloy combination of contacts, the chopping current is reduced considerably and no surge protection is required for normal applications anymore.

VCB scores over other types of circuit breakers especially in Medium Voltage range, due to the following advantages.

1. No possibility of contamination of dielectric

medium.

2. Low contact wear - Longer life
3. High speed tripping
4. Low operational energy
5. Simple operating mechanism
6. Completely restrike free
7. Totally maintenance free
8. Most compact in size
9. No auxiliary equipment is required

Because of the above advantages VCBs have become universal choice for various applications such as:-

1. Rural Electrification projects
2. Auto reclosing duties
3. Capacitor switching duties
4. Motor control
5. Locomotive traction

On the negative side, there may be a possibility of

leakage of vacuum after a period of time resulting in blowing up of the breaker when operating on fault. This is a very rare possibility, as seen from such large number of Television and Cathode ray tubes which, with similar vacuum pressures, have very long life. However at very important installations, if need be, vacuum pressure can be checked by a gauge periodically. As far as switching surge voltage is concerned, earlier problems were taken care of, by modifying the design of contacts. These are within the limits specified by IEC.

CONCLUSION

With electric power becoming basic need of life, reliability of power supply is most essential. Switchgear is one of the important equipment in the power system in maintaining reliable power supply. They have to be most efficient, and maintenance free to ensure clearance of faults whenever they occur.

It is seen from the above that VCB is most versatile and reliable circuit breaker in MV range. A comparison with other types of circuit breakers is detailed in appendix.

APPENDIX
DESIGN PARAMETERS AND THEIR EFFECTS ON VARIOUS KINDS OF CIRCUIT BREAKERS

SL.No.	DESIGN PARAMETER	TYPE OF CIRCUIT BREAKER			
		OIL CIRCUIT	MINIMUM OIL CB	SF6 CIRCUIT BREAKER	VACUUM CIRCUIT BREAKER
1	Operating mechanism	Bulky, with heavy wear & tear due to large contact stroke	Medium weight and medium contact stroke	Average wear & tear due to lower stroke	Compact & very light due to minimal stroke
2	Contact stroke	Large contact stroke (150mm)	Average contact stroke	Average contact stroke	Minimal contact stroke (12mm) (Approx.)
3	Dielectric medium used	Oil = 10 kV /mm	Oil = 10 kV /mm	SF6 Gas 40 kV/mm to 100 kV/mm, depends on gas pressure	VACUUM 40 kV /mm to 100 kV/mm, depends on vacuum level)
4	Construction & Housing	Bulky but rugged	Average sized	Average sized	Compact
5	Arc duration	High = 10 ms (Approx.)	High = 10 ms (Approx.)	Medium = 8 ms (Approx.)	Low = 7 to 10 ms (Approx.)
6	Mechanical reaction & Noise	Average (but dependant on fault current magnitude)	-	Low (but dependant on fault current magnitude)	Low (independant of fault current magnitude)
7	Flammability	Prone to fire and explosion hazard which is inevitable due to the use of oil as dielectric medium which is flammable	Due to low oil content fire and explosion hazard is less	Fire & explosion hazard limited to SF6 container alone	Fire and, explosion proof due to construct and lack of dielectric medium
8	Maintenance aspects	Frequent maintenance required oil to be changed after 6-10 fault interruptions wear is very high in such operating mechanism	Very frequent maintenance required oil to be changed after every fault interruption	Negligible maintenance leading to long life and high reliability with practically no maintenance costs	Negligible maintenance leading to long life and high reliability and maximum saving in maintenance costs
9	Mechanical & Electrical Life	Low upto 2000 operations	Low upto 4000 operations	Very high 1000 to 20000 operations on 100% rated fault current	Very high 20000 to 30000 operations 100 to 150 on rated 100 to 150% current



MPCAB[®]
CABLES & WIRES

Bangalore Office:
Cell : 09341336194, E-mail : bangaloreoffice@krishnacables.com
Chennai Office :
Cell : 09444093985, E-mail : chennai@krishnacables.com
HEAD OFFICE :
sales@krishnacables.com
Website : www.krishnacables.com

KRISHNA ELECTRICAL INDUSTRIES LIMITED
(AN ISO 9001 : 2000 COMPANY)

HT & LT PRODUCT RANGE

- XLPE & PVC POWER CABLES UPTO 33 KV (UE)
- XLPE & PVC CONTROL CABLES
- HEAT RESISTANT/LAME RETARDANT LOW SMOKE/FRFR CABLES
- AERIAL BUNCHED CABLES (ABC) UPTO 33 KV
- AAAC, ACSR & AAC CONDUCTORS UPTO 91 STRANDS
- INSULATED AAAC & ACSR CONDUCTORS
- SIGNALING & INSTRUMENTATION CABLES
- DWA PVC MINING CABLES UPTO 11 KV
- AIRPORT LIGHTING CABLES
- DRY/JELLY FILLED & OILAD TELECOM CABLES
- SPECIAL CABLES AS PER BIS / BSS / IEC / NEMA / VDE / ASTM STANDARDS

OUR CUSTOMERS INCLUDE :

NTPC, PGCIL, BHEL, RELIANCE, NDPL,
ABB, ALSTOM, CROMPTON, L&T,
BESCOM, KPTEL, MECON &
ALL STATE ELECTRICITY BOARDS ETC.

"MPI" House, Gola Ka Mandir, Airport Road, Gwalior - 474 005, (M.P.) INDIA Tel: 91-751-2663397, 3290388, 4049163, Fax: 91-751-4048008

DESIGN PARAMETERS AND THEIR EFFECTS ON VARIOUS KINDS OF CIRCUIT BREAKERS					
SL.No.	DESIGN PARAMETER	TYPE OF CIRCUIT BREAKER			
10	Gas exhaust	Necessary, due to vaporised oil after interruption, which has to be released through gas vents	Necessary to release vaporised oil after interruption	Necessary to release fluorine gas exhaust after interruption	Not necessary as there is no emission of any sort
11	Internal pressure development	Due to heavy pressure development due to vaporised oil during interruption, the oil tank is subject to high stresses	Heavy pressure is developed subjecting the circuit breaker to some stresses	Average pressure is developed during interruption	No internal pressure is developed due to interruption in vacuum
12	Power loss in the circuit (contact resistance of main contacts)	High value = 200 MICRO OHMS	High value = 200 MICRO OHMS	low value = 50 MICRO OHMS	Low value = 20 to 50 MICRO OHMS
13	Operating speeds	Average due to high contacts stroke and heavy moving contacts depends upon fault current	Average due to heavy moving contact depends upon fault current	Fast due to lower stroke but depends on fault current	Fast due to low stroke & totally independent of fault current
14	Temperature rise	Average well within limits usually due to the presence of large amount of oil	Average to high depending on individual design & volume of action	Average due to the fast action	Average to high, due to the lack of dielectric medium, heat flows to terminal ends, hence care to be taken in spite of fast operation and low arc time
15	Transient Recovery Voltage & Surge Voltage	Due to slower operating speeds the changes of TRV or Surge Voltage being high are remote.	TRV and Surge Voltage may occasionally occur depending on connected circuit	TRV & Surge voltage are usually well within the limits specified by the standards. Mainly due to the electro negative properties of SF gas	TRV & Surge Voltages may appear due to fast & very efficient ARC extinction & high dielectric charges, of vacuum special care should be taken in some applications
16	Type of interruption device used & size	Arc control pot in oil tank (common) (big)	Arc interruption in individual oil containers (average)	SF6 gas in a container	Vacuum bottles (compact)
17	Environmental aspects	Unsuitable for hazardous areas, mines etc., Fire hazards exists	Better suitable than ocb's but still not preferred due to fire hazard	Environmental free	Totally environment proof, no effect on performance of tube due to Altitude, Ambient Temp. & Saline Atmosphere. Universally suitable, in nuclear areas ships or earthquake prone areas
18	Alignment of common shaft for 3 phase operation	Not so critical due to a large contact stroke	Not so critical due to a large contact stroke	Critical, so as to not affect the simultaneous 3 phase operation with a minimal phase to clear factor	Very critical due to low contact stroke of 12mm, hence, operating mechanism to be very precisely assembled & tested
19	Type of main contact coupling (butt or wipe)	Wipe type	Wipe type	Wipe type	Butt type
20	Contact wear	Severe during fault interruptions, due to wiping contacts and heavy operating mechanism	Moderate due to wiping contact, during fault interruptions	Moderate during fault operations	Low, due to low stroke & butt contacts with special contact material
21	Complexity of operating mechanism	High number of parts involved hence complex	High number of parts involved hence complex	Less complex with less number of parts	Very simple mechanism due to low stroke & minimum parts
22	Current sensitive or voltage sensitive	Voltage sensitive	Voltage sensitive		Current sensitive
23	Overall reliability	Moderate	Good	Excellent	Excellent
24	Arc quenching efficiency	Based on low ionic mobility	Based on low ionic mobility	Based on low ionic mobility	Based on absence of dielectric breakdown
25	High frequency current interrupting (small current) without current zero	Not possible	Not possible	Not possible	Possible due to high dielectric strength of vacuum & speed of operation

Note: The Article on Low Voltage Switchgear and Controlgear Assemblies, by Mr. C. S. Nambisan will be conclude in the next issue (Vol. VI, Issue-2))



PASOLITE
Lighting

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



7, 14th Cross, Kilari Road, Bangalore- 560 053. Ph : 080-22870185, 22871845, Fax : 080- 22255526, E-mail: pasolite@gmail.com, Website : www.pasolite.net

BIO DATA

Name : T. V. Rao

Date of Birth : 28.03.1935

Qualifications :

M.Sc (Physics), D.I.I.Sc in Electrical Technology, Indian Institute of Science, Bangalore.

Work Experience :

The General Electric Co. of India (for over 19 years)

Gangappa Cables Ltd. (for 5 years)

Southern Switchgears Ltd. (Former BSES Gp.) (for 8 years)

Easun Switchgears Ltd., (EASUN Gp.) (for 3 years)

Areas of Experience:

Designing of Electrical Installations including large substations, factories, hospital, hotels etc.

Execution of large electrical installations.

Application engineering, Developing market for new products.

Upgrading of 11kV Switchgear, Retrofits etc.

Developing 11kV Vacuum Circuit Breakers, Package substations.

Type Testing of switch gear.

Others:

Presented papers in number of All India Seminars including IEEMA. Was member of committee of Bureau of Indian Standards for drafting standards of HRC fuses. Participated in meetings for review of Indian Electricity Rules and Act. Was member of Institute of Engineers (India) and member of Rotary Club.

After Retirement:

Worked as ADB approved consultant for Ennor Port project.

Did number of ENERGY AUDITS, was Adviser for Maritech Ltd., for their Aqua Culture projects and Adviser for Sanelac Consultant.

*

Life's Little Instruction Book.....

Have a firm handshake.

Look people in the eye.

Keep secrets.

Never give up on anybody. Miracles happen everyday.

Always accept an outstretched hand.

Be brave. Even if you're not, pretend to be. No one can tell the difference.

Avoid sarcastic remarks.

Choose your life's mate carefully. From this one decision will come 90 per cent of all your happiness or misery.

Make it a habit to do nice things for people who will never find out.

Never deprive someone of hope; it might be all that they have.

When playing games with children, let them win.

Don't allow the phone to interrupt important moments. It's there for your convenience, not the caller's.

Be a good loser/Winner.

Be modest. A lot was accomplished before you were born.

Keep it simple.

Beware of the person who has nothing to lose.

Don't burn bridges. You'll be surprised how many times you have to cross the same river.

Live your life so that your epitaph could read, 'No Regrets'.

Be bold and courageous. When you look back on life, you'll regret the things you didn't do more than the ones you did.

Remember no one makes it alone. Have a grateful heart and be quick to acknowledge those who helped you.

Take charge of your attitude. Don't let someone else choose it for you.

Visit friends and relatives when they are in hospital; you need only stay a few minutes.

Once in a while, take the scenic route.

Answer the phone with enthusiasm and energy in your voice.

Keep a note pad and pencil on your bed-side table. Million-dollar ideas sometimes strike at 3 a.m.

Show respect for everyone who works for a living, regardless of how trivial their job.

Compliment the meal when you're a guest in someone's home.

Remember that 80 per cent of the success in any job is based on your ability to deal with people.

Don't expect life to be fair.

*

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!

Published by Electrical Consultants' Association of India, Bangalore □ For Private Circulation only □ Not for sale □ Editor : Mr. J. D. Krupakar, Flat No. F107, Temple Trees, 29/2, Kanakapura Road, Jaraganahalli, J.P.Nagar, 6th Phase, Bangalore - 560 078. Tel/Fax: 080 2666 2387, Tel:080 2666 2459, Mobile: 99454 36521, e-mail: kdonkar@rediffmail.com □ Associate Editors: Mr. B.R.V. Murthy, 080 2649 3122, Mr. S.R. Rao, 080 2336 9642, Ms. A.L. Nirmala, 080 4120 9183 □ Printed at: G.R. Designs, No. 2, 12th Cross, Cubbonpet, Bangalore, 560 002. Tel: 080-2212 9011, 41464424 □ Copies printed 4000 Nos. □ No part of this newsletter shall be reproduced without the written permission of the Editor. □ The publisher has made every effort to ensure that the contents of this newsletter are correct. However, we accept no responsibility for any errors and for any loss or damages caused by this reason. □ Statements and opinions presented by the authors in this newsletter do not necessarily be those of ELCA of India □ E & O. E

POTPOURRI PAGE

Several men are in the locker room of a golf club.

A cell phone on a bench rings and a man engages the hands free speaker-function and begins to talk. Everyone else in the room start listening him.

MAN: "Hello."

WOMAN: "Honey, it's me. Are you at the club?"

MAN: "Yes."

WOMAN: "I am at the mall now and found this beautiful leather coat. It's only \$1,000. Is it OK if I buy it?"

MAN: "Sure, go ahead if you like it that much."

WOMAN: "I also stopped by the Mercedes dealership and saw the new 2006 models. I saw one I really liked."

MAN: "How much?"

WOMAN: "\$90,000."

MAN: "OK, but for that price, I want it with all the options."

WOMAN: "Great! Oh, and one more thingthe house I wanted last year is back on the market. They're asking \$950,000."

MAN: "Well, then go ahead and give them an offer of \$900,000. They will probably take it. If not, we can go the extra 50 thousand. It is really a pretty good price."

WOMAN: "OK. I'll see you later! I love you so much!!"

MAN: "Bye! I love you, too."

The man hangs up. The other men in the locker room are staring at him in astonishment, mouths agape.....

Then he smiles and asks: "Anyone know who this phone belongs to?"

★

**Someone out there either has too much spare time
or
is deadly at Scrabble.**

DORMITORY:

When you rearrange the letters:
DIRTY ROOM

PRESBYTERIAN:

When you rearrange the letters:
BEST IN PRAYER

ASTRONOMER:

When you rearrange the letters:
MOON STARER

THE EYES:

When you rearrange the letters:
THEY SEE

GEORGE BUSH:

When you rearrange the letters:
HE BUGS GORE

THE MORSE CODE:

When you rearrange the letters:
HERE COME DOTS

SLOT MACHINES:

When you rearrange the letters:
CASH LOST IN ME

ANIMOSITY:

When you rearrange the letters:
IS NO AMITY

ELECTION RESULTS:

When you rearrange the letters:
LIES - LET'S RECOUNT

SNOOZE ALARMS:

When you rearrange the letters:
ALAS! NO MORE Z'S

A DECIMAL POINT:

When you rearrange the letters:
IM A DOT IN PLACE

THE EARTHQUAKES:

When you rearrange the letters:
THAT QUEER SHAKE

ELEVEN PLUS TWO:

When you rearrange the letters:
TWELVE PLUS ONE

MOTHER-IN-LAW:

When you rearrange the letters:
WOMAN HITLER

★

A pretty nurse broke her engagement to a doctor. The ditched medico asked her to return the engagement ring and other presents he had given. "Do you mean to say", exclaimed another nurse "he actually asked you to give back all his presents".

"Not only that", replied the young nurse, "he sent me a bill for 36 visits".

★

Current Waves

SPONSORED BY



Hairline Blue



Hairline Silver



Hairline Green



Hairline Brown

The new symbol of style...is metallic

Introducing the suave 'Hairline series', finished with an exquisite metallic sheen and remarkable texture. So good, you'll love to have them around.



WOODS

Great Switches from Great Britain

Website: www.anchor-world.com

Anchor Electricals Pvt. Ltd. is a member of Panasonic group. **Panasonic**