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NEWSLETTER

EDITOR'S NOTE

Most professionals in engineering consultancy field, be it electrical, mechanical, civil or other engineering disciplines, for a good part of the time are busy with their hectic schedules such as meetings, site visits, outstation travels, reviewing of designs and drawings, estimations, bill certifications, project management etc. apart from the non-engineering activities like administration, personnel management, finance/commercial matters etc. not to forget, the time for family and social obligations. The former group of activities is the result of the demands from the clients and tight project schedules and the latter group of activities is to maintain the stability of the organization and the goodwill from the society.

As a result of the above inevitable situations, the professionals hardly find time for Continuing Professional Development, CPD, which is very essential for honing the professional skills and widening the knowledge, so that the clients are benefited by the best solutions from the consultants.

The Institution of Civil Engineers, London, defines CPD as:

"The systematic maintenance, improvement and broadening of knowledge and skill, and the development of personal qualities necessary for the execution of professional and technical duties throughout your working life".

The above definition will certainly hold good for other disciplines as well.

CPD includes activities like attending seminars, courses, workshops, professional or technical presentations, interaction in product exhibitions, teaching, instructing, presenting papers / lectures / courses, serving on technical panels, reading of technical books, journals, professional magazines and periodicals and product catalogues etc.

Besides, personal qualities like health, personality, integrity, punctuality, discipline, manners and systematism will go a long way for a successful and satisfactory professional life.

In my opinion, with a little bit of skill in time management, for example, cutting down wasteful and non-productive work, and with a judicious division of time spent for the clients and the CPD activities, one can definitely achieve professional development and PQs, which in turn will provide better service to the clients, uphold the dignity of the consultancy profession and fill the consultants with satisfaction.

Thank you.

Engr. J. D. Krupakar

DEFINITION

Professional Practice: It is the regular exercising of special skills derived from proper education, training and experience.

Professional Engineer: One who has acquired considerable knowledge and experience in one's subject of specialization so as to analyze and develop creative and original solutions based on sound scientific principles to problems which cannot be solved by conventional wisdom and respective codes of practice. One should have the necessary statutory accreditation to practice in one's subject of specialization either by law or by recognition. The professional engineers should have the ability to provide leadership in the design and construction process and also have adequate communication skills to impart training, both in the office and in the field.

CAPTIVE GENSETS DON'T NEED CAPACITORS - RIGHT ? WRONG !

By K. SUBRAMANIAN, M. R. SRINIVAS, MUSTAFA WAJID

(Continued from the previous issue)

3.2. Power Losses occuring in the Electrical distribution network:

The total losses occuring in the electrical distribution network, is a function of the current flowing through the network and the resistance offered by the current carrying conductors / switchgear used.

Consequently, reduction of current can be realised by installing RPC systems in the network as close to the load as feasible. This will have the added benefit of reducing losses between the alternator and the point of connection of the RPC systems thereby resulting in further fuel savings.

While the exact savings will be case specific to each network, it will be reasonably accurate to say that savings similar to those mentioned in 3.1 can be achieved by the use of a well engineered scheme.

3.3. Average kW loading pattern on the alternator:

This is the most significant factor in terms of the fuel consumed by a DG set. The graph shown in fig.1 gives a typical curve of kWH / litre yield of DG set versus the percentage loading of the set. It can be seen that most optimum performance is achieved as the loading tends towards 80% of the capability of the machine. Consequently, it should be the endeavour of all the DG set users, particularly those who are using the set as the prime source of power supply, to achieve optimum loading.

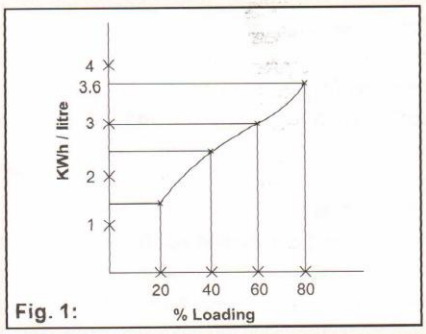


Fig. 1:

In order to understand typical loading pattern of DG sets, it is necessary to go into the process of how a DG set rating is selected. The selection process of a DG set involves the following steps :

STEP 1 : Listing of all loads in terms of their operating kW and PF.

STEP 2 : Aggregate loading based on the step 1 multiplied by a suitable demand factor. (Since all loads may not operate simultaneously).

STEP 3 : Providing additional kW capacity to meet short term peak load requirements which arise due to various load characteristics such as starting of induction motors, operation of traction loads such as lifts, cranes etc., intermittent operation of welding machines etc.

STEP 4 : Providing yet more additional kW capacity in the form of a derating factor, due to the fact that some loads are harmonic generating loads. Typical examples are DC motors, variable speed drives and other devices, which have thyristor based operation.

STEP 5 : Provision of additional kW capacity to meet future needs.

Consequently, the resultant rating of the DG set arrived at by this process is generally higher than needed for regular operation. It is, therefore, quite common to find that most DG sets are loaded only between 40% and 60% of their capacity for a majority of the operating period.

As a result, the practical kWh / litre of HSD achieved is lower than the actual capability of the machine. It is therefore obvious that if the loading can be increased significantly savings in fuel economy can be achieved.

If the total generation = 10,00,000 kWh/year

HSD consumption @ 60% loading (Refer Fig. 1)
= 10,00,000 / 3.0 litres

=3,33,333 litres

HSD consumption @ 80% loading (Refer Fig. 1)
= 10,00,000 / 3.6 litres

= 2,77,778 litres

Annual savings in HSD = 55,555 litres

Annual savings in Rs. = 55,555 X Rs. 25.00 / litre

= Rs. 13,88,875.00

Saving is Rs. 1.39 per unit generated.

RPC systems can enable DG set users to reconfigure their loads / DG sets to achieve better percentage loading on the machines. As a result reduction in cost per kWh can be attained.

4. In order to highlight the practical issues and benefits involved in using RPC systems, typical cases are given below:

4.1 Case 1 :

4.1.1 PROBLEM :

An industry has power supply connection from the Electricity Board and has a captive DG set which is used if there is an interruption in Electricity Board power supply or when incoming power quality is

considered unsuitable. The DG set, therefore, operates for an average of 2000 hrs per year.

This industry has a 250 kVA DG set which is loaded at an average of 120 kW at 0.7 PF. In addition, there are 40 kW of other loads within the same installation which are not loaded on the DG set due to capacity restrictions that arise during occurrence of short term peak loads, such as motor starting and intermittent welding load. Due to this, productivity in the industry is lowered when the DG set is in operation. During the period when Electricity Board supply is available all loads can be operated.

Is it possible to :

Reduce the cost of electricity consumed from the Electricity Board ?

Improve productivity when DG set is in operation ?

Reduce the cost of electricity generated by the DG set ?

4.1.2. SOLUTION :

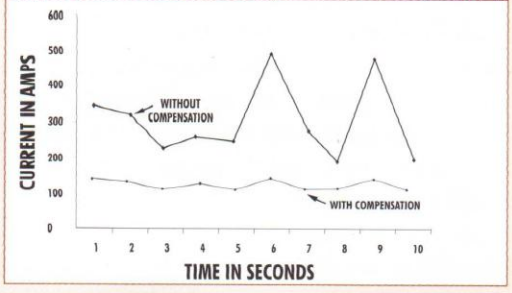
A well-designed RPC scheme can provide the solution as follows:

During the period when the industry is using supply from the Electricity Board the RPC system can ensure consistently high PF, thereby achieving demand savings and reduction in losses and elimination of any PF penalty. Consequently, cost of electricity consumed from the EB will be minimised.

The same RPC system can also be used when the industry is using supply from the DG set.

The fast acting property of the RPC system will reduce the peak load requirements that are to be met from the DG set - (Refer Fig. 2). This is achieved by providing instantaneous compensation from the RPC system during conditions when motors are started and/or welding machines are being operated. This will enable the industry to transfer the 40 kW of additional load on to the DG set and ensure that productivity is improved when the DG set is in operation.

Fig. 2. OUTPUT CURRENT FROM DG WITH/WITHOUT COMPENSATION



Due to better loading, the DG set efficiency will improve in line with the graph shown in fig. 1. Consequently the cost of electricity generated by the DG set will reduce from Rs. 5.30 / kWh to Rs. 4.50 / kWh i.e. a saving of 15% as explained below :

Before the use of RPC system, the loading factor of DG set was 60%, consequently giving an yield of 3 kWh / litre (as per fig. 1). Taking into account Re. 0.30 / unit of electricity generated towards the cost of maintenance and upkeep of DG set, the cost of electricity generated works out to Rs. 5.30 / kWh.

After connecting the RPC system and transferring the additional 40 kW load to DG, the loading factor would improve to 80% and consequently the yield would improve to 3.6 kWh / litre (refer fig. 1). Taking into account the cost of maintenance of DG, the cost of electricity generated works out to Rs. 4.50 / kWh.

Hence, a nett saving of Re. 0.80 / kWh generated i.e. a saving of approximately 15%, is achieved.

4.2. Case 2 :

4.2.1. PROBLEM :

An industry has no power supply connection from the local Electricity Board. It has captive DG sets that are used as the supply source. The DG sets, therefore, operate for an average of 5000 hrs per year.

This industry has 1 x 1000 kVA and 2 x 500 kVA DG sets operating in parallel and loaded at an average of 960 kW at 0.7 PF.

The loading of DG sets is done keeping a provision for short-term peak load requirements that arise due to starting of induction motors and operation of lifting cranes. In addition, extra provision is also made for certain non-linear loads which generate harmonics (thyristor loads, DC motors and UPS systems). The total energy generated per year is 48,00,000 kWh. Total fuel+maintenance costs of the DG sets is Rs. 255 lakhs per year resulting in a cost of Rs. 5.31 per kWh.

Can the cost of electricity generated by the DG sets be reduced ?

4.2.2. SOLUTION :

A well designed RPC and Active Filter System can provide the solution as follows :

The fast acting property of the RPC system will reduce the peak load requirements that are to be met from the DG set (Refer Fig. 2). This is achieved by providing instantaneous compensation from the RPC system during conditions when motor starting / crane operation is taking place.

The harmonics generated by the non-linear loads will be eliminated by the Active Filter System.

Lastly, the current drawn from the DG sets will reduce.

Consequently the same 960 kW load can now be supplied from 1x1000 kVA + 1 x 500 kVA operating in parallel.

One 500 kVA DG set need not be operated.

Due to better loading, the DG set efficiency will improve in line with the graph shown in fig1. Consequently, the cost per unit of electricity generated by the DG set will reduce as shown in the calculation below.

DG sets were initially operating at 60% loading factor. As per figure 1., the DG set yield at 60% loading factor is 3 kWh/litre. The total diesel consumption for 1 no. 1000 kVA and 2 nos 500 kVA DG set is 16,00,000 litres.

When the 960 kW load is transferred to 1 no. 1000 kVA and 1 no. 500 kVA DG sets, the loading factor will improve to 80% and the DG set yield will now be 3.6 kWh / litre (as per fig. 1). The total diesel consumption will now be 13,40,000 litres.

The annual saving in diesel consumption will be 2,60,000 litres, which amounts to approximately Rs. 65 Lakhs per year.

Total savings per year(5000hrs. Operation) = Rs. 65 lakhs.

Taking into account a fixed cost of Re. 0.30 / kWh towards maintenance and upkeep of DG set, the nett savings / kWh of generation of electricity works out to Re. 0.80. This is about 15% saving.

5. Reactive Power Compensation and Active Filter Solutions

RPC systems basically comprise of a microprocessor controller to sense the load PF and/or Reactive Power / current and give commands to connect or disconnect the required kVAR to achieve the desired conditions as programmed in the controller.

The kVAR is provided by suitably sized power capacitors / reactors arranged in appropriate steps. The RPC system hence should have suitable switching devices to connect or disconnect the power capacitors along with protection devices like fuses and relays.

The type of switching and controlling devices used in RPC system depends upon how fast the reactive power is to be introduced into or withdrawn from the electrical system. This, in turn, is dependent upon the type of electrical load to be compensated.

If the response time "tr" of the system is greater than or equal to 5 seconds, contactor switching with suitable discharge devices can be used. However, if "tr" is less than 5 seconds, controlled switching using thyristors is required. If "tr" is less than or equal to 1 second, it is necessary to use a fast acting special purpose controller to operate the whole system.

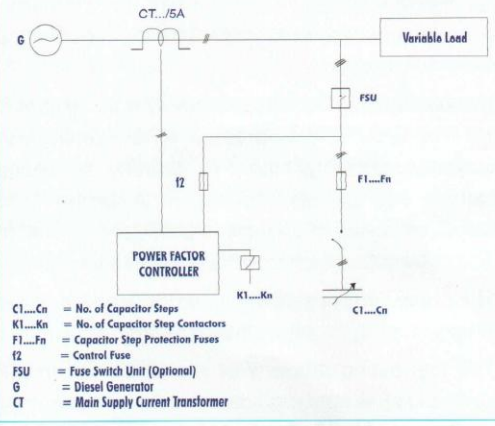
The contactor-switched RPC systems are popularly referred to as Automatic Power Factor Correction (APFC) systems.

The thyristor switched systems are known as Dynamic Compensation Systems (DCS).

5.1. Contactor Switched APFC Systems.

APFC system has a response time, which is quite sufficient for fairly steady and / or slow varying loads. When a contactor switches off a capacitor, a voltage equal to the value of line voltage at the instant of switching off, is retained at the capacitor terminals. Before this capacitor can be reconnected, sufficient time has to be given for the terminal voltage across it to discharge to a safe value, so as to avoid damaging the capacitors. The block diagram of the system is shown in fig. 3.

FIG 3. BLOCK DIAGRAM OF CONTACTOR SWITCHED APFC SYSTEM



5.2. Dynamic Compensation Systems

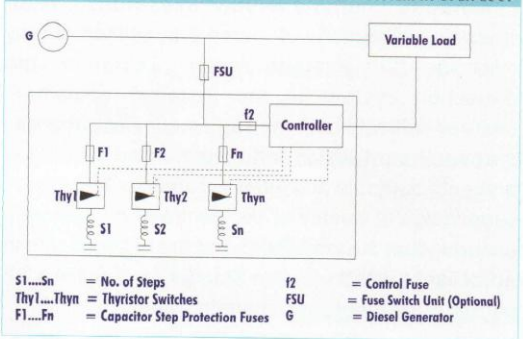
This system features controlled switching of power capacitors using thyristors and associated control / firing circuits for reduced response time. In this system, it is possible to switch in capacitors at the instant when its voltage is equal to that of line voltage, thereby eliminating the need for capacitors to discharge. Based upon the point of sensing, DCS can be classified as Open or Closed loop system.

5.2.1. Open Loop

If the load operation / switching is sensed directly and feedback given to the dynamic compensation system, this is termed as open loop dynamic compensation system. The response time in this arrangement is very short and hence this scheme is usually used for instantaneous compensation. It is also possible to operate this system by an external command, which is given just before the operation of the load. Consequently this system can be operated

in "pre-trigger" mode and therefore has the smallest response time. The block diagram of the system is shown in fig. 4.

FIG 4. BLOCK DIAGRAM OF DYNAMIC COMPENSATION SYSTEM IN OPEN LOOP

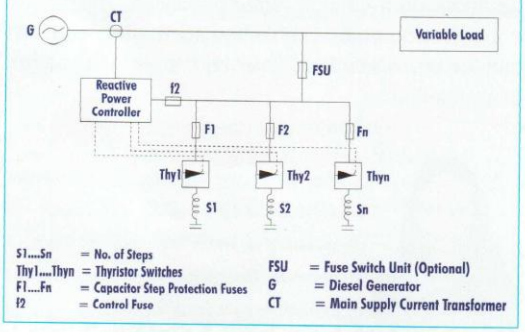


S1....Sn = No. of Steps
Thy1....Thyn = Thyristor Switches
F1....Fn = Capacitor Step Protection Fuses
f2 = Control Fuse
FSU = Fuse Switch Unit (Optional)
G = Diesel Generator

5.2.2. Closed Loop

If the load conditions are sensed as the combination of load and capacitor currents, then this is termed as closed loop dynamic compensation. In this arrangement the DCS works similar to a contactor switched APFC system, but with a much faster response. The block diagram of this system is shown in fig. 5.

FIG 5. BLOCK DIAGRAM OF DYNAMIC COMPENSATION SYSTEM IN CLOSED LOOP



S1....Sn = No. of Steps
Thy1....Thyn = Thyristor Switches
F1....Fn = Capacitor Step Protection Fuses
f2 = Control Fuse
FSU = Fuse Switch Unit (Optional)
G = Diesel Generator
CT = Main Supply Current Transformer

5.3. Active Filter

Active filter is the state of the art technology solution for eliminating harmonics generated from LT non-linear loads, like variable frequency drives, UPS, etc. The active filter works on the principle of generating counter-harmonic currents (i.e. in phase opposition) to that generated by the non- linear load which results in cancellation of all harmonic currents. Thus the non-linear load in combination with active filter presents itself as a harmonic free load to the network. The active filter adopts itself to the requirements of the load on a continuous real time basis. The reader is advised to refer to the companion paper titled "HARMONIC MITIGATION IN LT AC NETWORKS-THE CLEARING MIST" on this subject, published in this seminar for more detailed information on active filters.

6. Conclusion

It is a general practice to oversize the rating of Diesel Generator sets due to various technical and other reasons.

Oversizing results in a lower loading factor on DG sets during their normal operation, leading to increased running cost. Various other issues such as load sharing, escalating fuel cost also have adverse impact in terms of productivity and profitability for the DG set users.

It has been a practice to avoid the use of capacitors in networks that are supplied by DG sets.

The evolution of capacitor application technology as outlined in this paper makes it practical to improve loading factor on DG sets, reduce power losses and finally, lower the cost per kWh generated.

A judicious use of well-engineered capacitor based RPC technologies can therefore result in improved DG set performance, reduced energy cost and better productivity in installations / networks supplied by Diesel Generating sets.

BIO DATA

Mr. K. Subramanian, 50, holds a B.E. Degree in Electronics & Communication Engineering (1975), and a M. Tech. degree in Advanced Electronics (1979). He has a total experience of 29 years. He is currently working on application engineering in reactive power management (RPM), harmonic study and recommendation of harmonic filters. He also conducts seminars on RPM and power quality and conducts special tests on RPM products.

His other interests include travelling to places, computers & cricket.

Mr. Mustafa Wajid, 43, is a B.E. (Electrical) degree holder (1984), with First Class (Distinction) from Sir. M. Visvesvaraya College of Engineering, Bangalore. He was involved in the production of power capacitors since 1977 and he is presently the Executive Director of Meher Capacitors Pvt. Ltd., Bangalore and Chairman of Capacitor & Panel Division of IEEMA. He is also the Vice Chairman of Plastic Capacitors Technology Centre (PCTC) and has presented several technical papers in various seminars. He has conducted several training programmes in the area of Power Quality Management and is a member of BIS Electro Technical Committee on power capacitors.

Oh! Consultants ? !

by

Sheila Narayan, Interior Designer, Bangalore

'Con Sultans', 'Mughals of Manipulation', 'Data Fabricators' - these are some of the epithets people love to ascribe to the practitioners of consultancy. But despite the caricatures portraying them as a tribe preying voraciously on clients' insecurities and using various tactics to create further need for their services, consultants are, on the contrary, exalted for their expertise and problem solving strategies, saving us the misery of expensive goof-ups and much more - good reason why we so willingly submit ourselves to their authority and advice.

Today, consultants, especially of the essential services genre, figure prominently on the check- list of any project management agenda- size or scale notwithstanding. In no other field are advances so hi-tech and rapid as in the world of electronics, where even a daily update is sometimes not fast enough to keep up. Parallelly the power systems that drive them are equally complex and far too sophisticated, to be delegated like before to contractors and the like, with no room for anything even vaguely slap dash.

In the lighting sphere alone, the technology, design and development of commercial lighting has resulted in immense advances and refinements of luminaires. Only a qualified consultant can successfully guide one through the maze of products and their functions, recommending low cost, energy saving systems or providing the correct lumen and lux outputs for a glare and stress free working environment. They enlighten us on right tones and intensities of white light to provide added visual comfort or the correct use of the international colour index that grades lighting to suit various applications. The choices are complicated and bewildering and a very long way from the GLS era. Add to this remote controlled automated building systems, accessed through multi media message services and touch screens- all these just the tip of an iceberg and it is enough to send one scrambling for a consultant to demystify for us the jargons into mortal speak.

Entrusting the working of essential services to a competent consultant is a consolation in itself, eliminating malfunctioning essentials. Their accurate estimations of material quantities greatly minimise the wastage factor. Designing the protection system of the installed equipment ensures safety to both men and machines, whereas the panel board design and accurate load calculation prevents burnouts and other accidents. The overall supervision of quality of the contractors' work and ensuring that the materials used are branded and in accordance with the Indian Standards, result in a job carried out without short changing quality.

In fact, essential services can be correctly designed only by a consultant ensuring uninterrupted and troublefree running, round the clock. Planning ahead for future expansion, without disrupting existing installations is now di rigueur in most commercial and residential projects. Here again methodical planning on the part of the consultant will prove immensely effective in terms of time and money. Meticulously detailed electrical layouts stored in CDs can be referred to at any time when one needs to expand or reconfigure a space, totally eliminating the need to break open walls or dig up floors on a conduit hunting mission - testimony enough to quiet the skirmishes some of us may still indulge in, on whether to be or not to be in the hands of a consultant.

Sheila Narayan is an interior designer and heads Team-2 & Associates, a sister concern of Team-2 Architects, Bangalore. She has 14 years of experience in interior design, having started practice in 1990, handling a variety of projects, commercial and residential, in Bangalore as well as out-of-station.

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ELCA WELCOMES THE NEW MEMBER

Mr. Deepak Ranga Rao Bellare, 58, is a B.E. (Electrical) degree holder (1969) from Karnataka University. He was Scientific Officer/Engineer SC, for R-5 Project at BARC, Trombay, Mumbai (4years), Senior Electrical Engineer/Resident Engineer for International Electric Company at Oman (5years), Assistant General Manager in Power Engineering Corporation at Abu Dhabi, UAE (1 ½ years), Assistant General Manager in Sterling and Wilson Electricals Pvt. Ltd., Mumbai, (5 years). He was a partner in Voltech Electro-Mechanicals, Electrical & Mechanical Consultants, Mumbai (5years). Since 1993 he is on his own as Electrical Consultant. Mr. Bellare is a Member of Institution of Engineers and an Individual member of ELCA.

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Six most important words:
"I admit that I was wrong"
Five most important words:
"You did a great job"
Four most important words:
"What do you think?"
Three most important words:
"Could you please"
Two most important words:
"Thank you"
One most important word:
"We"

POTPOURRI PAGE

Two friends met at a bus stop and struck up a conversation.

One of them kept complaining about his family problems. Finally, the other friend said, " You think you have family problems? Listen to my problems."

A few years ago, I met a widow with a grown up daughter. The widow and I got married and got my self a stepdaughter.

Later my lecherous father married my stepdaughter and that made my stepdaughter, my stepmother and my father became my stepson. Also, my wife became the mother-in-law of her father-in-law. Much later the daughter of my wife, my stepmother, had a son. This boy was my half brother because he was my father's son. But he was also the son of my wife's daughter, which made him my wife's grandson. That made me the grandfather of my half brother.

This was nothing until my wife and I had a son. Now the half sister of my son, my stepmother, is also the grandmother. This makes my father, the brother-in-law of my son whose stepsister is my father's wife. I am my stepmother's brother-in-law, my wife is her own child's aunt, my son is my father's nephew, and I am my own grandfather.

By Joe, you think you have family problems?

Source: PROTEKTA

Q: What do morons do when they have one white sheet and want an extra sheet?

A: They take a photocopy of the white sheet.

Q: Why did 18 morons go to a movie?

A: Because 'below 18' was not allowed.

Q: Why do morons always smile when lightning blazes?

A: They think their pictures are being shot.

Q: Why can't morons dial 911?

A: They can't find 11 on the dial.

Q: What do smart morons and UFOs have in common?

A: You always hear about them, but never get to see them.

A not too bright fresh electrical engineering graduate always failed in the interviews because he could not answer the question "What is copper loss?"

When he told his plight to his friend, his friend said, "Look, whenever they ask 'what is copper loss?', you just say I square R".

" But it is too complicated a term to remember" complained the fresher.

His friend, to help him remember the term said, "You know the nursery rhyme, Twinkle twinkle little star?"

"Yes", replied the fresher.

Then his friend suggested, " Remember like this"

Twinkle twinkle little star
How I wonder what you are
Copper loss is I square R.

In his next interview, after asking all sorts of questions, they finally asked him "what is copper loss?"

The fresher immediately recalled the rhyme but forgot where to start and ended up with

Up above the world so high
Like a diamond in the sky
Copper loss is R square I.

and failed in the interview.

Teacher: Now, children, I want you all to draw a ring.
(Johnny drew a square)
Teacher: Johnny, I told you to draw a ring. You have drawn a square.
Johnny: Mine is a boxing ring.

Teacher: What is the chemical formula for water ?
Johnny: H, I, J, K, L, M, N, O.
Teacher: That is not what I taught.
Johnny: Yeah, you said H to O.

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