

CHARGE

June 2016

A Technical News Journal from Deki Electronics Ltd

Editor's Desk

Dear Reader,

More than a third of Deki's capacitor sales are made to the industrial segment which includes energy meters and fan regulators.

Historically, fan regulators relied on variable resistance to vary the fan speed. Though this was a very rugged design it was very inefficient. The regulators were bulky and a lot of energy was wasted as heat.

Today, fan regulators are very sleek and use capacitors to vary the fan speed. While a 4-step regulator uses two capacitors, a 5-step regulator uses three capacitors. Different combinations of capacitance value result in difference in speeds.

In the beginning these regulators too were bulky as the capacitors were large sized and had a high failure rate.

Over the years the regulators have become smaller as capacitors have been miniaturised. In addition, quality has improved tremendously due to technological advances in the metallised film used in the making of the capacitors.

Deki has a large range of Fan Regulator Capacitors starting from the economy design to the high safety design. Deki Fan Regulator Capacitors are available in Metallised Polyester, Metallised Polypropylene and Mixed Dielectric grades.

You will find a lot of information on the Deki range of Fan Regulator capacitors in this issue of Charge.

As always, please keep your valuable comments and suggestions flowing in.

Anil Bali

Deki Achieves a Milestone

Deki achieved Rs 100 crores+ turnover during 2015-16 and to share this good news a Dealer Meet was held at Deki on April 2, 2016.

The meet started with a corporate presentation by Mr RP Pant, AGM-Marketing and Sales. Thereafter, Mr A Bali, Vice President thanked all the dealers for their outstanding contribution and shared the plans for 2016-17. He spoke to them about the Ansoff Matrix which shows how to increase market share by a combination of four factors.

All the dealers present were confident of meeting the target of 30% growth during 2016-17. The entire programme was recorded and a DVD has been sent to all the dealers.



Deki Business Plan Meet

The business plan for 2016-17 was unveiled by the heads of departments to all Deki executives on April 12, 2016. The Single Page Strategy Sheet was presented by Mr Vinod Sharma, Managing Director, Deki Electronics, who reiterated: **Purpose of Deki:** To be a company that makes India proud **Vision:** To be the global benchmark in electronic component manufacturing

Mission: Achieve >50% market share of our existing segment by 2017-18; Increase exports by 20% y-o-y; Achieve new product turnover >25% in 2016-17 and 2017-18; Diversify into two other components and one new product by 2017-18.

Mr A Bali, Vice President, presented the highlights of 2015-16 in which turnover crossed Rs 100 cr, new product turnover was 23.5%, the highest ever CSS score of 84.7% was achieved for the Jul-Dec 2015 period and the inductive line yield was more than 97.3% and the MPET line yield over 98%.

Mr P Sankarraj, VP-Technical, stressed the importance of quality, understanding where Deki capacitors were being used and building quality into the product. This requires close cooperation between Deki and customer R&D departments. In fact, Deki is one of the few companies in the world with a simulator that reproduces operating conditions in a ballast or a CFL or an LED. This simulator helps Deki guarantee the life of the capacitor under actual working conditions.

Subsequently, department heads presented the highlights, lowlights and focus areas for 2016-17 in a one to one meetings with their departments and the senior management team. All executives are clear about their targets and confident of achieving them.



The Deki team at the meeting venue

Deki's R&D is DSIR Approved

Deki is one of the few companies in India whose R&D set up is approved by the Department of Science and Industrial Research, Government of India since 2012. This is based on the R&D infrastructure available. Deki spends nearly 1.6% on R&D every year.

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FAN REGULATOR

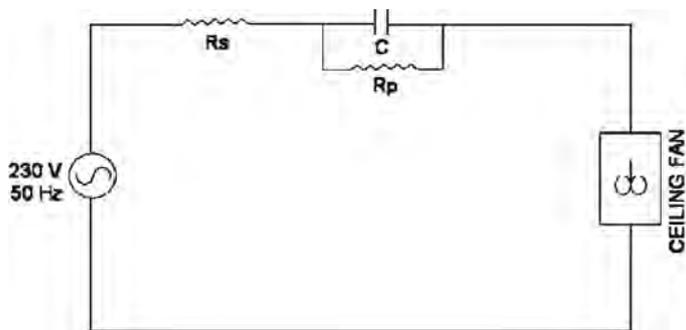
A fan regulator, as the name suggests, regulates or controls the speed of the fan motor. Before dealing with the fan regulator, a brief discussion about the fan motor is necessary. The main purpose of the regulator is to control the speed of the fan motor.

Types of Fan Regulators

Currently Fan Regulators are of these four types:

- Resistive regulator
- Phase angle controlled regulator
- Inductive regulator
- Capacitive regulator (latest)

Capacitive Type Fan Regulator



A fan regulator, as the name suggests, regulates or controls the speed of the fan motor. Before dealing with the fan regulator, a brief discussion about the fan motor is necessary. The main purpose of the regulator is to control the speed of the fan motor.

Basic Principle

The main purpose here is to control the voltage across the fan. The voltage across the capacitor (V_c) is given by the formula $V_c = Q/C$ where Q is the charge across the capacitor and C is the capacitance value. The voltage across the fan is denoted by V_f . According to above formula we have, $V_c = 1/C$.

As C increases, the voltage V_c decreases which in-turn causes the voltage across the fan to increase. This causes the speed to increase. So, by increasing the value of capacitor, the speed of the fan can be increased. Thus, by employing suitable combinations of capacitors a fan's speed can be regulated.

Purpose of R_s and R_p

R_s is a resistance which is used in series with the capacitor to limit the current flowing to the capacitor up to a safe limit.

R_p is a resistance used in parallel with the capacitor which serves as a discharging path for the capacitor.

Let us examine the IS standards for fan regulators as per **IS: 374-1979**:

Regulators including electronic type of speed regulators shall be capable of reducing the speed of the fan at least 50% of the full speed at the test voltage.

- Fans shall be capable of running on all the running positions of the regulator at the rated voltage or within the whole rated voltage range.
- Shall have an 'OFF' position preferably next to the lowest speed contact.
- Shall be provided with not less than five running positions except in case of continuously variable speed regulators.
- The speed difference at any running position shall not deviate by more than $\pm 50\%$ from the ideal speed difference

- calculated on the basis of maximum and minimum speeds divided by the number of steps.

For example:

- Max speed of the fan: 320 rpm
- Min speed of the fan: 160 rpm
- Regulator steps: 5
- Ideal speed difference = $160/4 = 40$ rpm

Speed difference between two consecutive running positions should be between 40 ± 20 rpm.

- Electronic type regulators shall be provided with radio and television interference suppressing devices.
- The voltage drop across the electronic type regulators at the maximum speed position shall not exceed 2% of the rated voltage of the fan.

Experimental Study

Fans from different manufacturers were tested on a standard regulator with combinations of 2.2, 1.0 and 3.1 μF .

To understand the operation refer to the circuit diagram as shown. The equivalent capacitance at different running speeds will be:

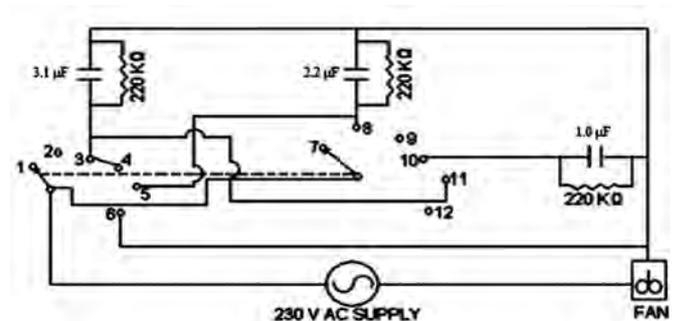
At speed 1 = 2.2 μF

At speed 2 = 3.1 μF

At speed 3 = 4.1 μF

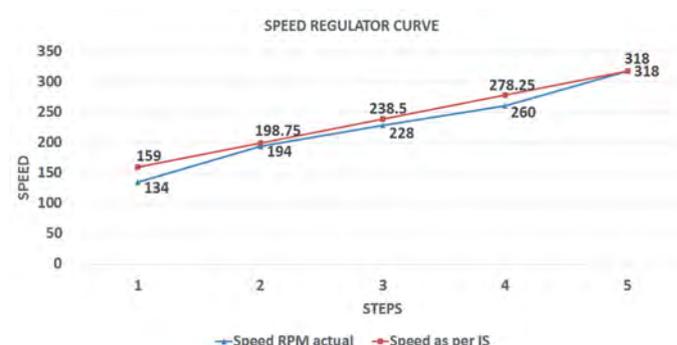
At speed 4 = 5.3 μF

At speed 5 = no capacitor hence maximum speed



Same fan was tested on a standard regulator at 230V. The following observations were noted:

Running Speed	Voltage V_f Volts	Current Amps	Power Watts	Voltage V_c Volts	Speed RPM	Acc. IS
1	83	0.110	9.13	208.000	134	159.00
2	116	0.160	18.56	190.200	194	198.75
3	137	0.190	26.03	171.200	228	238.50
4	155	0.220	34.10	150.000	260	278.25
5	230	0.260	59.80	0.222	318	318.00



FAN REGULATOR

Analysis and Conclusion

So, can a common or general fan regulator be designed?

To address this we tested different types of fans using a general regulator. From the data we observed that with one standard fan regulator we can achieve speed regulation approximating a linearity pattern but cannot satisfy the IS standards for different fans.

Full rated RPMs of different fans vary due to different electrical designs which differ by manufacturer. Therefore, a common, general fan regulator is unable to regulate the speed within the IS standards.

It is evident that these capacitors are used in AC applications where the self-heating of capacitor is higher which can lead to capacitor failure in short circuit mode implying higher chances of the capacitor catching fire. This can be overcome by using metallised film to benefit from its self healing property. As shown in the diagram, the self-healing or "clearing" removes a fault or short circuit in the dielectric film by vapourising the metallisation near the defect as shown in *fig. 1*.

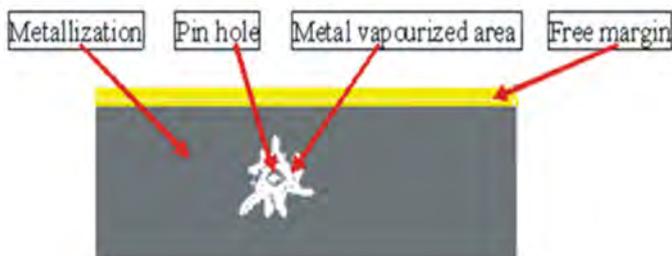


fig 1

The vapourised metal oxidizes over time, aiding the isolation of a fault area. However excessive self healing can also lead to failure of the capacitor in short circuit mode.

To further reduce and/or eliminate the chances of failure of capacitor in short circuit mode, Deki has designed safety type capacitors using fuse type metallised film as shown in *fig. 2*.



fig. 2

In this film the affected segment will be isolated due to the provision of fuse when excessive self healing takes place.

Deki Capacitor Range for Fan Regulators

1. MPET SW- Metallised Polyester film capacitors.
2. MPET EC- Metallised Polyester film capacitors.
3. MPP SW - Metallised Polypropylene film capacitors.
4. MPET ULTIMA-Metallised Polyester segmented film capacitors.
5. MPET EC ULTIMA-Metallised Polyester segmented film.
6. MPP ULTIMA-Metallised Polypropylene segmented film.
7. OPTIMA-Mix Metallised segmented film.

Let us understand how can we select a suitable capacitor from the Deki capacitor range mentioned above:

1. For high safety and performance Deki recommends MPP series offering high dielectric strength, low dissipation factor, high insulation resistance and better self healing properties resulting in good performance over a long period of time. However to obtain same value of capacitor in MPP series, the amount of film used will be more as the dielectric constant of PP is less and, hence the size of the capacitor will be more.

2. For size constraint Deki recommends the MPET series as it offers the same value with smaller size. The performance of this series, though good, is not as high as the MPP series.

To provide our customers with some features of both series like reduced size, comparatively better safety and dissipation factor, Deki's R&D team developed the Optima series.

Comparison between Deki safety capacitor

Dielectric	Polyester	Polyester	Mix	Polypropylene
I.R.	At 100 VDC for 1 min	Time constant $T=C_r \times R_s$ >2500s	Time constant $T=C_r \times R_s$ >7500s	Time constant $T=C_r \times R_s$ >7500s
Charge Discharge	Charge to test 550 voltage and discharge thru 2.2 Ω resistance	600	650	650
Life Test (Endurance) 500 hours	at 85°C for 250 VAC	275 VAC	275 VAC	275 VAC

Customer Review

Based on extensive market reviews received by our team the following points were noted:

- Drop in Speed
- Burning of capacitor
- Humming/vibration
- Reduced life of regulator

To address these concerns, we conducted trials for our fan regulator series. From the data obtained we concluded: if the primary design need is high safety and high performance then the design can incorporate these properties up to a certain extent but under no conditions will these be taken to the highest level in a single capacitor design.

Humming or Vibration: Humming is directly proportional to pressing, the process of removing air gaps in capacitors. Lower pressing can result in the corona effect that generates noise.

However high pressing can be more dangerous because:

1. It can damage the dielectric.
 2. Voltage breakdown will decrease.
 3. It can decrease Insulation Resistance of the capacitor.
- Hence optimum pressing is required.

It is worth mentioning that humming neither affects the life of capacitor nor any electrical parameter. To prove this we went through articles regarding humming. Here is an excerpt from an article published by a renowned electronics manufacturer:

"Hum produced by capacitor due mechanical vibration of the film is caused by the coulomb force which exists between electrodes of opposite polarity. A louder hum is produced when applied voltage waveform has distorted and/or higher frequency components, etc. Although hum does not spoil characteristics of capacitors."

Deki has ensured optimum pressing standards in its production line leading to minimum humming in its Ultima range of Safety capacitors.

External Customer Satisfaction Survey

Deki conducts an external customer satisfaction survey every six months. The results of the last survey for the period July-Dec 2015 indicate another term of a consistently improving trend. We have been carrying out this survey for over 11 years and customers have acknowledged the improvements made by Deki based on their suggestions. This is borne out by the improving trend in our score from 75% in July-Dec 2004 to 84.72% in the most recent survey. In fact this is the highest ever score and motivates us to further improve our performance.



Employee Motivation Survey

Deki conducts an employee satisfaction survey every six months in which employees are asked a set of fifteen questions pertaining to their work environment, salary, satisfaction level, growth opportunity, knowledge of targets, standard specifications, operating procedures, etc. The marks they give to each of the questions are consolidated and compared with the results of the most recent survey. The consolidated report along with the action points for improvement are discussed with all the employees in an "Open House" by our MD, Mr Vinod Sharma. The February 2016 survey showed an improvement from 85% to 88% with all areas doing well. Major improvements were in facilities like water, canteen, working environment, wages, cooperation of section incharge, and grievance handling.

Training in Deki

Of utmost importance at Deki, training is an integral part of continual skill enhancement and has been growing consistently. Detailed stage wise training is conducted in which knowledge of the process and the machines is imparted. This is followed by a written test. An employee has to score a minimum of 80% at critical stages to qualify to run the machine. Deki's spends close to 3% of working time on training and our training modules are well recognised, serving as a benchmark for component manufacturers.



Mr Vinod Sharma with Mr Markus Maas, Ms Priya Pershad and Ms Piene Claessen

Deki hosts interns from Holland

Recently Deki played host to three student interns from Holland who spent four months understanding the business environment in India. Here is what they had to say about their Indian experience and stay at Deki Electronics.

My name is Markus Maas and I am a Dutch bachelor student from the Fontys University. I wanted to do my internship abroad since it gives a lot of extra learning experiences (new culture, new business culture, etc.). Once I came into contact with Deki Electronics, I wanted to do my internship there. I chose for this company in India although the fact that I never thought of myself doing an internship in India. My first experiences in India were all new and exciting since The Netherlands and India are two completely different worlds. My first expression in the company was that it is much more professional and well structured as I expected to be on my arrival. After four months doing my internship here at Deki Electronics, I can say that I do not regret my decision to come here and that I learned a lot regarding my university requirements but most of all of from the many extra learning experiences.

Best regards,

Markus Maas

Internship in India sounds like an adventure and it surely was! A big chaotic city, a combination of anti-social and polite civilians but they are very good in making you feel comfortable. During my four month stay here I never felt unsafe. India is on the other side of the world, but it still felt as home.

Deki Electronics Ltd., from the security guards to the department heads, each and every person tried to make us feel comfortable and welcome. As a company, Deki Electronics has all things in good order. It is nice to work in a place where everything is managed in a good way, which I hadn't expected before coming here.

The typical Indian image that everyone has, which I also had of India has changed drastically in these four months. If I get a chance to do this again, I will do that without any doubts.

With kind regards,

Priya Pershad

My name is Piene Claessen and I am a student from Holland. For my study Business Management I did my graduate internship at Deki Electronics. During my internship here I learned a lot of professional skills, but also a lot about India and the culture.

In the beginning I had some doubts about going to India, but fortunately this was not needed at all. The company was very helpful and gave us also tips about where to go in India. The people were very open minded and friendly.

The image I had from India is partially confirmed. It is true that there are cows everywhere and that it can be a mess sometimes. But this internship here gave me also another look inside this country: it has a beautiful culture and the companies are very professional. After my 4 month stay here, I can say that this internship will be a good start up for my professional carrier.

Greetings,

Piene