

Energy conservation in Fluorescent lighting Application Note

The Concept

The performance of Fluorescent lighting is optimum when it supplied with a regulated voltage of 208V. The ratio of power consumption to light output is optimum and Energy saving as high as 25% can be attained. In addition the lamps are protected from the vagaries of the input power supply reducing incidence of choke and lamp failures.

How Fluorescent Lights Work

There are three primary components of a fluorescent lighting system, the **starter**, the **ballast**, and the fluorescent bulb. The fluorescent bulb contains a small amount of gas, such as mercury vapor or argon. The inside of the glass is coated with phosphor. When electricity flows through the gas in the bulb, the gas emits ultraviolet radiation. The phosphor coating the inside of the glass glows when bombarded by the ultraviolet radiation. This is how light is emitted from the tube. However, certain things must happen to start this process, when the light is first turned on. When the bulb is not turned on, the gas vapor in the tube will not conduct electricity. In order for it to conduct electricity, it must be ionized. The gas is ionized by the application of a large electrical charge for a very short time (much less than a second) that heats the electrodes at each end of the bulb, and starts the current flowing through the tube. This process is accomplished by the **starter**. Once the current is flowing, in order to prevent too much current from flowing through the tube, a **ballast** is used, which is essentially a resistor, that limits the flow of electrical current through the tube.

How is energy conserved?

The KRYKARD Energy Conserver is specially made for applications on discharge lighting devices such as Sodium, Mercury and fluorescent lights. The KRYKARD Energy Conserver is designed to supply an optimum voltage across lighting devices, which improves the lighting device efficiency without affecting operations of that area. The KRYKARD Energy Conserver is designed to operate with high efficiency while enabling a savings of the order of 20 to 25 percent of energy.

Sample Study showing power consumption of fluorescent lamps at different voltages

Output Voltage (V)	Current (A)	Power(kW)	% of savings when compared with 230 V
205	3.92	794	15
208	3.98	819	12.5
210	4.06	852	10
220	4.14	898	5
230	4.20	938	0

Features of KRYKARD Energy Conserver:

The KRYKARD Energy Conserver is designed by Alacrity's Product Development team, who have successfully developed patented products such as the Reactance Controlled Voltage Stabiliser (RCS) and Aluminium Foil-wound Transformer (AFT). The reassuring features of the KRYKARD Energy Conserver are:

1. Rugged design proven in over 200,000 Servo Stabilisers supplied operating in varied environment; Digital voltmeter in each phase; One year 'no-questions-asked' warranty & comprehensive all inclusive AMC thereafter - Hassle free operations
2. Individual phase protection for under / over voltage, over load and short circuit
3. By pass switch in each phase for emergency use in the rare event of equipment malfunction.
4. Scope for setting the output voltage to 200V / 220V to suit User preference of increased energy saving / illumination.

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Case Studies of energy saving using the KRYKARD Energy Conserver:

Case Study 1 - The KCP Ltd., Tiruvottiyur, Chennai:

Shed No	Stabiliser Capacity (kVA)	Energy consumption without Stabiliser (kWh)	Energy consumption after installation of Krykard Stabiliser (kWh)	Energy Savings (KWh)	% savings
3 & 4	60	284.18	260.11	24.07	8.5%
5	35	237.93	191.62	46.31	19.5%
6	35	175.51	146.88	28.63	16.3%
2	35	169.82	145.91	23.91	14.1%
1	60	294.16	260.11	34.05	11.6%
	Total	1161.6	1004.63	156.97	13.5%

Case Study 2 - Sree Ananthakumar Mills, Coimbatore:

Time	Without KRYKARD Stabiliser	With KRYKARD Stabiliser
6:00 pm	645196 Units	645361 Units
7:00 pm	645200 Units	645365 Units
8:00 pm	645206 Units	645369 Units
2 Hours	10 Units x MF 4 = 40 Units	8 Units x MF 4 = 32 Units

Savings achieved: $\frac{40-32}{40} \times 100 = 20\%$

Payback calculation:

Units / Hour without Stabiliser	20 Units
Total Units to be spend for 1 Year without Stabiliser	20 x 24 x 365 = 1,75,200 Units
Total Units to be spend for one year with Stabiliser	16 x 24 x 365 = 1,40,120 Units
Difference in Units	175,200 – 140,120 = 35,080 Units
Cost invested against KRYKARD 60 kVA Stabiliser	Rs.105,300. 00
Pay Back Period	$\frac{Rs.105,300}{Rs.157,860} \times 12 \text{ Months} = 8 \text{ Months}$

This above study has been conducted by also measuring the illumination level of lightings and found that the luminance level is within the limits of the industrial lighting standards.

Since the saving of 20% has been achieved at only 50% of the full load, the savings achievable at full load can be expected to be even higher.

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Technical Specifications

Input Voltage Range	Model AL / OL 1080: 310V – 480V Model AL / OL 4080: 340V – 480V Model AL / OL 6060: 360V – 460V
Nominal Output Voltage	208 Volts (360 V Line to Line)
Input Frequency Range	47 - 53 Hz
Type of Cooling	Air Cooled (AL) or Oil Cooled (OL)
Type of Stabiliser	3 Phase 4 wire input with individual phase sensing and correction, suitable for unbalanced loads and input voltage. Stabilisers suitable for indoor application.
Servo Motor Drive	AC Synchronous Stepper Motor
Efficiency	Greater than 97%
Display	Digital Voltmeter with selector switch to read individual phase voltage (R, Y, B)
Resolution and accuracy of Digital Voltmeter	1 V \pm 0.5% or \pm 1 Digit
Output Cut-off	Provided in Individual phases
Output Over / Under Voltage Cut-off	Upper Limit: 240 V \pm 2 V above nominal Lower Limit: 190 V \pm 2 V below nominal
Over Load Cut-off	Above 110% of rated load with graded time delay
Annunciation Panel	LEDs for Input present, Output normal, Input high, Input low, Output high, Output Low, Output Over load
Resetting Mode	Automatic Restart
Service by-pass	Individual Change over switch for each phase up to 50 kVA 3-phase. For higher ratings, provision of Change over switch is Customer's scope. It is preferable to connect three switches, one for each phase.
Input / Output termination	8 way terminal connector for cable terminations and gland plates for fixing cable glands.
Ratings Available	Up to 1000 kVA 3-phase