technical

specification

442 Series FLDU

Advanced Lamp Drive Technology

All Excil 442 variants employ advanced lamp drive technology. The manner in which a fluorescent lamp is struck and operated reflects highly on lamp life. As a result of an extensive research programme, the technology employed enables all single lamp variants to achieve lamp life figures typically in excess of 20,000 hours. This is four to six times longer than our competitors' older technology designs and has been proven by continuous and switched operation tests which are ongoing at Excil.

In addition to achieving extended lamp burning hours, the advanced lamp drive technology greatly increases the number of attainable lamp start-up cycles.

The principle lamp life maximising features are:

True Soft Start System

A closely controlled preheat period of the lamp electrodes ensures a free flow of electrons prior to arc discharge (lamp striking). Preheating to the point of thermionic emission before application of the strike voltage, greatly reduces the amount of electrode emissive material jettisoned onto the lamp's inner glass wall. This prevents lamp end blackening and premature lamp failure.

Low Crest Factor Arc Current Waveform

Once the lamp has struck, the crest factor of the arc current discharge waveform is critical to lamp life. High crest factors result in excessive electrode stress leading to premature lamp failure. Excil's products achieve low crest factors by driving the lamp arc with a near sinewave, achieving a typical crest factor of 1.4.

Fully Symmetrical Arc Waveform

The Excil products present the lamp arc with a symmetrical drive waveform. This ensures equal gas conduction in both directions within the lamp, equal electrode self heating and thus equal electrode wear. This prevents mercury vapour migration within the lamp which is commonly observed as light output from one end of the lamp only.

Near-Sine Arc Current Drive

The lamp is driven with a near-sine high frequency current waveform. The choice of frequency in conjunction with the near-sine waveform ensures freedom from audio frequency noise and minimises RFI radiation from the lamp wiring.

Lamp life is critically dependent upon the correct level of arc discharge current flow, as it is this which generates self heating within the electrodes during lamp operation when the preheating current has been removed or reduced. The self heating process results in a free flow of electrons from the electrode into the lamp gas due to the thermionic emission and reduces electrode erosion. For this reason the FLDU holds lamp arc current constant, irrespective of variations in supply voltage. The arc current is held to +/- 6% of the lamp data sheet specified value, ensuring correct levels of self heating and hence maximum possible lamp life. The arc current will result in an arc voltage and hence arc power within the lamp data sheet limits for high frequency drive.

General Features:

High Operating Efficiency

Dependent upon the variant, operating efficiencies vary between 85 and 93%. In addition to high FLDU efficiency, maximum luminous efficacy (lumens per watt) is attained by high frequency arc drive. At high frequency, about 89% of the arc power is required to achieve the same light output as at 50 Hz. As an example, a 36W 1200mm T8 lamp would be driven with 32 watts of arc power at high frequency.

The ultra high operating efficiency results in low internal component temperature rise which results in low component stresses and therefore high reliability operation.

In the case of DC designs used for emergency lighting, the high operating efficiency enables greater battery-backed emergency lighting periods or battery rating reductions.

Low Lamp Ignition Temperature

The 442 series has the ability to strike the lamps down to -35°C. This performance is achieved over the full operating power supply range of the equipment.

High Reliability Operation

The product is designed for high reliability operation. The calculated MTBF is 131,000 hours at 40°C based on MIL217F parts stress method assuming a ground mobile environment.

Electrical Protection:

The 442 series is protected against

Misconnection of the lamp
DC reverse polarity
Failure of the lamp
Open circuit lamp
Short circuit of the lamp arc or electrodes for an indefinite period
Under Voltage Power Supply

All the above protection features are performed electronically and do not require fuse replacement.

Improved Passenger Environment

The 442 series offers flicker free, first attempt lamp ignition. The generation of a highly stable arc discharge ensures freedom from colour bias and ensures consistent, lamp to lamp illumination and colour.

An intelligent shut-down facility is provided such that in the event of a failed lamp, the FLDU will shut down cleanly. This prevents the annoying attempted re-strike associated with some electronic ballast designs and all conventional electromagnetic systems.

Electronics

The electronics consists of two functional blocks, a boost converter and a lamp drive inverter push-pull stage with resonant L/C output stage.

The boost converter steps up the vehicle supply to a “link” voltage. The link voltage remains constant, irrespective of vehicle supply voltage which means that the boost ratio varies. This is controlled by a closed loop system.

The stable link voltage is used to power the lamp driver stage.

A low voltage cut-out facility is incorporated with 3 volts minimum hysteresis to ensure the inverter cuts out cleanly for a falling supply voltage.

Proven transient suppression circuitry at the power supply input, gains compliance with the surge and transient requirements of EN50155.

A multi layer PCB accommodates the electronics. Surface mount technology has been utilised where possible, conventional technology being limited to power components.

Mechanical and Interface

The PCB is housed in an aluminium extrusion-based enclosure with fixing centres and dimensions compliant with U.I.C.555-1

Electrical interface to the vehicle supply and lamp is via ¼” Faston Blade connectors. An M5 x 10mm stud at the power supply end of the enclosure provides an earth point for connection to the power supply earth.

The enclosure is sealed to IP65 with LSLT silicone gaskets and the complete product is designed to meet the shock and vibration requirements of BRB/LUL/RIA20, and EN50155.

442 Series FLDU Specification Summary

Versions available for lamps including

70 Watt 1800mm T8
58 Watt 1500mm T8
36 Watt 1200mm T8
28 Watt 2D
22 Watt circular
18 Watt 600mm T8
15 Watt 450mm T8
18 Watt PL-L
16 Watt 720mm T8

Dimmable option available. Twin series available.

Other lamp variants available on request.

Supply voltages available

16.8 to 32VDC, 28VDC nominal
32 to 68VDC, 52VDC nominal
50 to 94VDC, 82VDC nominal
67 to 138VDC, 110VDC nominal
160 to 253VAC 50/60Hz, 230VAC nominal

Other AC variants available upon request.

Operating efficiency

Between 85 and 93% dependent upon variant

Operating temperature range

(Over full supply voltage range)
-25°C to + 70°C

Lamp strike temperature range

(Over full supply voltage range)
-35°C to + 55°C

High frequency arc power at 25°C±1°C

* 70W 1800mm T8 = 60 Watt
* 58W 1500mm T8 = 50 Watt
* 36W 1200mm T8 = 32 Watt
  28W 2D = 24.6 Watt
* 18W 600mm T8 = 16 Watt
  18W PL-L = 16 Watt
  16W 720mm T8 = 14 Watt
  15W 450mm T8 = 13.4 Watt

*As specified in BS EN 60081/IEC 81

Arc current waveform

Near sine fully symmetrical
Crest factor <1.7, typically 1.4

Operating Arc Frequency

(Arc discharge conditions)
40 to 50KHz when running

Soft start pre-heat duration

Typically 1 second but varies with lamp style

Unit protected against

DC Reversal (indefinite)
Misconnection of lamp
Failure of lamp
Open circuit output
Short circuit of lamp arc
Short circuit of lamp electrodes
Under voltage power supply

Catastrophic failure protection

PCB non-replaceable T5 style fuse

Lamp strike switch cycles

Minimum >100,000 (defined by UIC555-1)
Typically >1,000,000

Strike scenario

Multi attempt soft start current fed pre-heat with failed or absent lamp shut down.

M T B F

≥ 131,000 hrs (Calculated) based on Parts Stress Analysis to Mil Handbook 217F assuming ground mobile environment at a 40°C surrounding component ambient.

Dielectric isolation

All inputs & outputs to chassis - 1.5kV AC RMS 50Hz for 60 seconds

Dimensions / Weight

To industry U.I.C 555 defined envelope

Supply and lamp connection

¼" Faston Blade push-on connectors
To industry U.I.C 555 Standard

Earth connection

M5 x 10mm stud or ¼" Faston Blade on enclosure end plate at power supply end of inverter

Construction and design

EN 50155 and RIA 13

Surge and transient compliance

EN 50155

Vibration and shock compliance

BRB / LUL / RIA 20 and EN 50155

EMC Compliance

ENV50121 including:
Conducted Emissions
Radiated Electric Field Emissions
Radiated Magnetic Field Emissions
Conducted Susceptibility
Radiated Susceptibility
Transient Burst Susceptibility
Electrostatic Discharge
Surges

Enclosure

BSEN 60529 1992:IP65