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Keeping the lights on

***Jim Wallace* reports on the use of specialist equipment for the vital service and maintenance of airfield ground lighting systems.**

Airfield Ground Lighting (AGL) systems fulfil the critical role of ensuring that airports remain operational at all times – including at night and during adverse weather conditions.

AGL systems are the networks of lights and circuits that help to guide aircraft in take-off, landing and taxiing around the airfield. It follows that AGL installations need to perform at optimum levels to ensure that aircraft can constantly use approach, runway and apron areas at all times – and the responsibility for this invariably rests with the airport electrical maintenance, engineering or electrical lighting teams.

Given the growth in air travel, maintenance teams often face constraints imposed by reduced time to access airside installations to carry out their duties.

At the same time, various regulatory compliance and performance standards for AGL systems are laid down that must be met and proven on an ongoing basis. For example, occupational standards and recommended safety guidelines for airfield service work are stipulated by organisations such as the Civil Aviation Authority and US Federal Aviation Authority.

As a result, in carrying out AGL inspection, testing and service work – as is the case with all electrical maintenance activities – the requirement is that all operations are carried out safely and efficiently.

AGL systems

AGL systems have developed considerably in recent years with the addition of computer controlled systems managed by air traffic controllers using touch screen panels, and, in low traffic airports, by pilot-controlled systems.

Although the basic lighting system is always the same, with a dedicated power distribution and monitoring system, each individual arrangement is bespoke to a specific airfield to meet different runway layouts and air traffic volumes.

In general terms, runway edge lighting and approach lighting circuits are interleaved with every other lamp connected to the same circuit, so if one circuit fails or there is a cable fault, a pattern of lights will always remain around the runway.

The circuits around the airfield operate like a ring main system. Each lamp has a transformer attached to it and a constant current ensures that at the same airfield the lamps are at the same brilliance.

In the UK, AGL systems utilise an output voltage of 2kV and in the USA the systems are based on 4kV. Other countries generally use systems based on one or other of these voltages.

Safe working

For electrical maintenance personnel working on such systems, safe working practice requires that the power is isolated before work commences – including for such tasks as removing an airfield lighting unit to replace a bulb, for example. This is known as proving dead and is standard practice.

Airfield lighting systems pose a particularly danger to those working on them. AGL systems operate from constant current regulators (CCR) which are designed to maintain a constant output, typically around 6A, to ensure constant lamp brightness. This is primarily because the cables are buried underground and often have poor insulation resistance due to poor joints or other insulation damage. The CCR automatically compensates for any earth leakage. For example, if current leaks through the insulation to ground, the CCR will increase the output voltage to compensate for the loss.

As AGL systems are designed to maintain constant lamp brightness under all conditions, they are not equipped with any RCD or other trip mechanism as this could result in a loss of power which would extinguish all lamps on that particular circuit; clearly not a good idea if an aircraft is coming in to land in darkness.

The net result of having a CCR with no trip mechanism is that if a person comes into contact with live parts, the system will increase the output to compensate for the current lost through this additional load. This is likely to be fatal for the operator in contact with a 2kV – or even higher – electrical system which is trying to drive a large current through the service engineer's body.

Testing for voltage

Historically, there have been two main types of voltage detector available. At one end of the scale there are the low voltage type testers used by electricians to identify the presence of circuit voltages up to around 700V.

At the other end of the scale there are high voltage detectors used mainly in the power generation and distribution sector which are suitable for the indication of voltages between 6kV and 33kV.

In the absence of a suitable voltage detector for AGL circuits, the common practice has been to use a current measuring device, typically a current clamp, to measure the output current of the CCR and assume that the power is isolated if there is no current flow. However, because it is still possible for voltage to be present even when no current is detected, this method does not prove the system is isolated. The only 'failsafe' method to prove the absence of voltage, i.e. to prove dead, is to measure voltage.

Two pole voltage detection

To remedy this situation a new type of voltage indicator has been developed to ensure safe working on AGL systems.

The new Seaward AGL-5 two pole voltage detector provides a fast and convenient means for airfield service engineers, maintenance personnel and technical staff to verify that runway and airfield lighting circuits have been isolated from the power supply before maintenance or inspection work commences.

The two pole voltage detection system has been designed specifically for ground lighting systems and can be used to detect the presence of voltages from 50V up to 5KV.

For ease of connection to AGL lighting electrical circuit terminals, the AGL-5 test rods are equipped with tapered contact points and the presence of voltage is indicated by the illumination of high intensity red LEDs. A polarising filter makes the voltage indication clearly visible in all working environments and conditions.

Designed and manufactured in compliance with international safety standards, the unit is totally encapsulated in a shock resistant high impact rugged enclosure and is IP64 rated.

The new two pole AGL-5 is supplied with a proving unit for self-test proof of performance before and after use.

Jersey Airport

This innovative test instrumentation is now successfully helping a busy airport to ensure that important electrical maintenance work can be carried out safely and efficiently in compliance with aviation industry regulations.

The engineering team at Jersey Airport in the Channel Islands is using specialist Seaward AGL- 5 voltage indicator equipment to ensure that airfield ground lighting circuits have been isolated from the power supply before essential maintenance and inspection work is carried out.

Thousands of metres of cabling provide the power to Jersey Airport’s runway, taxiway and apron lighting systems that guide aircraft during take-off and landing operations.

To maintain effective operating conditions the engineering maintenance team at Jersey Airport constantly monitor the field lighting circuits to check for any deterioration in cable insulation and lighting performance; for example, damage to the underground cables from indigenous wildlife can sometimes cause problems.

The team uses any trends highlighted during the monitoring to identify trigger points requiring formal maintenance work and this requires a powering down of system so that any repairs or remedial measures can be carried out safely.

In compliance with the Civil Aviation Authority's CAP 168 regulations, Jersey Airport's engineering services team follows formal in-house safety rules and working procedures to ensure that all runway and airfield lighting circuits are isolated from the power supply before any maintenance or inspection work commences.

The Seaward AGL-5 voltage indicator system has been specifically designed to meet this 'proving dead' requirement.

Operation and control of the ground lighting systems at Jersey Airport is maintained by three on-site substations. Ahead of all electrical work, after switching off and locking out the CCR units, the AGL-5 is used to make contact with the cable termination points of the field circuits to verify safe working conditions.

Jersey Airport saw a 3% increase in passenger numbers during 2014 taking the total to nearly 1.5 million people. With growing visitor numbers, a team of seven airfield electrical technicians monitor and maintain the airfield's ground lighting systems to ensure the continued and ongoing operation of the runways and associated areas.

Peter Page, Engineering Services Manager at Jersey Airport, said: "Ground lighting systems have to perform at optimum levels to ensure that aircraft can use the approach, runway and apron areas at all times – and responsibility for this critical need rests with the airport electrical maintenance, service and lighting teams.

"Working with what can be potentially dangerous high voltage electrical circuits means that proving dead is essential to ensure safe working conditions and failsafe maintenance practices.

"The Seaward AGL-5 allows us to meet this requirement safely, efficiently and effectively – enabling important airfield work to be undertaken without delay and disruption to important airport schedules."