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Uninterruptible power supply requirements for closed circuit television security systems

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INTRODUCTION

1. The contents of this Technical Bulletin are advisory only. No work involving expenditure on an MOD account is to be entered into without authority from the Property Manager or the appropriate MOD officer for that location or facility.

2. This Technical Bulletin provides guidelines for the provision of uninterruptible power supplies (UPS) for closed circuit television (CCTV) security systems.

3. This Bulletin is to be distributed to and read by Property Managers, Defence Land Agents, Establishment Works Consultants (EWCs), Works Services Managers (WSMs), Project Sponsors and Project Managers. It is to be read in conjunction with DCI GEN 125/94.

REQUIREMENTS

4. Property Managers and other staff with a responsibility for the provision of television security surveillance should review their systems to ensure that they have adequate backup facilities under mains failure conditions. In this review they shall consult with and seek clarification from Command Security Advisers and, if appropriate, the MOD Technical Authority through the offices of their Defence Works Advisor.

5. Television security systems associated with cameras operating in critical security positions shall have a facility which enables them to continue operating under all mains failure conditions. More detailed information regarding the classification of security positions is included in the "background" section at Annex A.

6. Television cameras in less critical security positions will need to have their power supply requirements assessed on an individual basis. There are no definitive guidelines for this situation. The precise requirements of the security system, as defined by the appropriate Security Authority, will need to be taken into account when evaluating whether or not the expense of a suitable backup system is justified.

7. Television cameras in low security categories may not need to have a backup system for their mains supply. However, there may be other extenuating circumstances which justify a suitable backup system for cameras. Guidance should be sought from the appropriate Security Authority.

8. Where operation under mains failure conditions is essential, it is normally achieved by one of the techniques defined in Annex A.

9. If the cameras use mains locked synchronisation it will be essential to either supply all of the cameras from a single UPS, or synchronise the UPSs (see Annexes A and B).

10. Most UPS systems will not provide a long enough period of supply during mains failure conditions to meet the normal security requirement for 4 hours cover (see Annex A for more
details). In installations which are not backed up by a site standby supply, some form of localised back up supply, such as a standby generator, will be required.

11. In situations where the UPS does not provide a long enough backup, and it is necessary to use a second source of power, the UPS system must be designed to switch automatically to the second source of power after failure of the normal mains supply. This applies to reserve mains supplies as well as standby generators.

12. Wherever a UPS system is used, it must be possible to disconnect each load from all sources of supply, including the UPS, for both safety and maintenance purposes. This is a statutory requirement under Regulation 12 of the Electricity at Work Regulations 1989. It can be achieved either collectively or individually by using approved plug and socket arrangements, suitable isolators or a combination of both. Where isolators are used, they should be located as close to the loads which they isolate as is reasonably practicable. They should also be clearly labelled and preferably have a facility for a padlock to be used so that it can be locked in the isolated (safe) position.

13. If an isolator/plug and socket is remote from the equipment it isolates, then some kind of locking device will be needed to enable the means of isolation to be secured in the “safe” or “off” condition. This is to comply with Regulation 12 (2) of the Electricity at Work Regulations 1989 which requires the provision of adequate means to prevent an isolated circuit being inadvertently energised.

THE LOCATION OF THIS ISOLATION EQUIPMENT MUST BE AGREED WITH THE APPROPRIATE SECURITY BRANCH TO ENSURE THAT ITS LOCATION DOES NOT POSE AN UNACCEPTABLE SECURITY RISK.

Bulletin Authorised By:

P D MEAKIN
Head of Industrial Group
Annex A - Background

SECURITY CATEGORIES

SECURITY CATEGORY REQUIREMENTS

1. The appropriate Security Authority will categorise all security installations according to the needs of each individual locality. The security category is based upon a philosophy of risk management which takes account of:

   - security considerations
   - site conditions (implications of extended failure)
   - maintenance support available locally
   - cost considerations
   - response time of the defensive response force.

2. The precise security requirements fall outside the scope of this Technical Bulletin. However, where appropriate, this information can be sought from the local Security Officer for the site.

TYPICAL BACKUP SYSTEMS

3. Back up systems will need to be designed to accommodate two principle requirements:

   The electronic part of the system will almost certainly require an uninterrupted supply of electricity.

   The power required to provide adequate lighting is almost certainly going to be the largest single electrical load, and therefore, a major factor in determining the cost of the back up system. However, it may be permissible to use a compromise in this area. The backup system may initially provide sufficient power for the cameras to produce acceptable pictures for the short period between mains failure and diesel alternator start up. Once the diesel alternator is up to speed, the remainder of the security lighting can be restored and powered from the diesel maintained supply.

4. The most common uninterrupted back up supply systems use one of the following techniques:

   A battery or batteries to provide an alternative supply direct to the electronic components of the television security system. This usually takes the form of rechargeable battery powered equipment, which is normally supplied via a mains powered battery charger. Under mains failure conditions, the battery continues to
supply the equipment until supply restoration or the battery is totally discharged. (Whilst this system falls outside the scope of this Technical Bulletin, it is worth noting that this requirement applies to all of the television equipment, and not just the camera).

An uninterruptible power supply (UPS) system to power the equipment. UPS systems use a rechargeable battery to supply power during a mains failure. Clearly this battery can only supply energy until it is discharged (flat). The battery’s discharge time determines the maximum length of time that the UPS can supply power under mains failure conditions.

In most installations, the battery is used to provide an interim supply whilst either a switching operation takes place, or a standby generator is started and its supply made available. This arrangement has evolved because typical cost savings in using a smaller battery more than cover the cost of the standby generator. Furthermore, the generator will run for many hours (or days if the fuel supply is available), providing power under prolonged mains failure conditions.

DURATION OF SECURITY COVER

5. The requirement for 4 hours security cover is based upon current practice. However, the duration of the cover must be chosen to provide adequate time for alternative security arrangements to be provided. This will normally be the time it will take to provide adequate manpower to secure the site. Clearly, for some installations, this will be possible in less than 4 hours and may be as short as 30 minutes. In such cases, the Security Authority for that site may reduce the period of cover accordingly.

TELEVISION EQUIPMENT AND UPS SYSTEMS

6. Television security systems may comprise part or all of the following:

   television cameras

   associated lighting equipment

   transmission equipment (including slow scan transmission equipment)

   distribution equipment - cables, fibre optics etc.

   video recorders

   monitors (usually in the control room).

7. Most closed circuit television (CCTV) systems, and their associated lighting systems (where fitted), are mains powered, and will consequently stop functioning during a mains failure. Since the loss of mains supplies may be as a direct result of terrorist activity, the total loss of the CCTV part of a security system will almost certainly be unacceptable. If a UPS system is used to overcome this problem, it must ensure that the CCTV system, its associated equipment and lighting continue to function normally for an adequate period. It will normally involve using one of the two following arrangements:

   A single UPS system supplies the entire CCTV system.

This has the advantage that all of the lighting and video equipment is powered from one source, and may be the only suitable method for some types of video system, such as those which use mains locked synchronisation. (There is no need for the lighting to be synchronised).
However, additional maintained mains power distribution circuits may be needed for this system, and on large sites, it may prove more economical to use the method given below.

The use of a number of local UPS systems to supply groups or single items of equipment.

This arrangement is suited to large sites, where single UPS systems would lead to high distribution costs, and areas where the possibility of an explosion near the central UPS poses an unacceptable security risk.

(Note: if mains locked synchronisation is used, it will be essential to either supply all of the cameras from a single UPS, or synchronise the UPSs).

8. If either of the above methods are used with microprocessor controlled equipment, the equipment incorporating the microprocessor(s) must be supplied from an "on line" UPS system. (See Annex B for definition of "on line" and "off line" UPS systems).

9. Lighting requirements for CCTV security systems vary enormously from infra-red headlights fitted to the camera to general floodlights and security fence lighting. As a general guide, the larger the area covered by the camera, the more lighting is required, and the more difficult it is to provide continuous lighting during mains failure conditions. Guidance should be sought from the appropriate Security Officer regarding the lighting requirements for large area coverage. In some highly sensitive areas, even the loss of lighting whilst a diesel generator starts will be unacceptable. However, the costs of UPS systems for lighting can be prohibitively high, and such a system should only be provided where the Security Authority deems it essential.
Annex B - Definitions

DEFINITIONS

"ON LINE" AND "OFF LINE" UPS SYSTEMS

1. There are two basic types of uninterruptible power supply (UPS) systems:

   The "off line" system is configured so that the load is connected directly to the mains under normal conditions. When the mains supply fails, a high speed switch connects the load to a battery driven inverter which then supplies the load. Once the mains supply is restored, the load is rapidly switched back to the mains. These systems usually use electronic switches and inverters. Whilst the switching operation is very fast, loss of data can still occur, which is unacceptable for microprocessor based security systems. Another serious disadvantage of this system is that inverter or switch failure may only become apparent during a mains failure.

   The "on line" system consists of a mains powered battery charger, battery and inverter (electronic or rotary). The load is permanently connected to the inverter. Under normal supply conditions, the battery charger supplies the inverter and keeps the battery fully charged. When the mains fails, the battery takes over from the battery charger and supplies the inverter. Consequently, the inverter, and hence the load, receives a genuinely uninterrupted supply.

   There are a number of other rotary UPS systems which rely on mechanical energy storage systems, such as a flywheel, to provide an electricity supply between mains failure and diesel alternator supplies becoming available. These are seen by the load as electrically identical to the "on line" system defined above.

INVERTER

2. An inverter is either a rotary (motor generator) or electronic device which converts direct current (usually from a battery) into alternating current (similar to the mains supply).

MAINS SYNCHRONISED

3. Whilst this system was dropped for public service broadcasting with the end of the 405 line TV system, it is still used for some security cameras. When more than one camera is in use, and mixed or multiplexed with other cameras, it is essential that each camera starts the same line at the same time. In other words, they have to be synchronised. This can involve running an extra cable to carry synchronising pulses to each camera. Alternatively, the camera can be designed so that it synchronises itself to the 50 Hz mains, thereby saving the costs of the additional cable. Under normal mains supply conditions, this is very straightforward, since all the supplies are synchronised by the generating authority, and the electronics in the camera can easily accommodate the timings of three phase supplies. However, if independent UPS systems are used, there is no guarantee that they will produce exactly 50 Hz or be synchronised. Consequently, cameras on different UPS systems will lose synchronism,
leading to frame rolls and other undesirable defects on the displayed picture. This would render monitors with split screen displays, which show two or more security camera outputs simultaneously, completely unintelligible.

**BIBLIOGRAPHY**

Electricity at Work Regulations 1989.


Property Services Agency Mechanical and Electrical Standard Specification No 108 Uninterruptible Power Supply Equipment, which includes references to:

VDE 0875 - Regulation for Radio Interference Suppression of Electrical Appliances and Systems.

IEC 146-4 - Semiconductor Converters - Method of Specifying the Performance and Test Requirements of Uninterruptible Power Systems.

Electricity Council's Engineering Recommendation G5/3 - Limits for Harmonics in the United Kingdom Electricity Supply System.