LPCB®

Loss Prevention Standard

LPS 1653: Issue 1.1

Requirements and testing procedures for the LPCB approval and listing of fire detection and fire alarm network systems

bre

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PARTICIPATING ORGANISATIONS

This standard was approved by the BRE Global Governing Body and Expert Group A. The following organisations participated in the preparation of this standard:-

Association of British Insurers
Association of Building Engineers
Association of Chief Police Officers
Association for Specialist Fire Protection
British Automatic Fire Sprinkler Association
British Security Industry Association
BT Redcare
Chief Fire Officers Association
Door & Hardware Federation
Electrical Contractors Association
European Fire Sprinkler Network
Fire Industry Association
Health & Safety Executive
Metronet
Risk Engineering Data Exchange Group
Royal and Sun Alliance
Royal Institution of Chartered Surveyors

REVISION OF LOSS PREVENTION STANDARDS

Loss Prevention Standards will be revised by issue of revised editions or amendments. Details will be posted on our website at www.redbooklive.com

Technical or other changes which affect the requirements for the approval or certification of the product or service will result in a new issue. Minor or administrative changes (e.g. corrections of spelling and typographical errors, changes to address and copyright details, the addition of notes for clarification etc.) may be made as amendments. (See amendments table on page 19)

The issue number will be given in decimal format with the integer part giving the issue number and the fractional part giving the number of amendments (e.g. Issue 3.2 indicates that the document is at Issue 3 with 2 amendments).

USERS OF LOSS PREVENTION STANDARDS SHOULD ENSURE THAT THEY POSSESS THE LATEST ISSUE AND ALL AMENDMENTS.

FOREWORD

This standard identifies the evaluation and/or testing practices undertaken by LPCB for the purposes of approval and listing of products and services. LPCB listing and approval of products and services is based on evidence acceptable to LPCB:-

- that the product or service meets the standard
- that the manufacturer or service provider has staff, processes and systems in place to ensure that the product or service delivered meets the standard

and on:-

- periodic audits of the manufacturer or service provider including testing as appropriate
- compliance with the contract for LPCB listing and approval including agreement to rectify faults as appropriate

NOTES

Compliance with this LPS does not of itself confer immunity from legal obligations. Users of LPSs should ensure that they possess the latest issue and all amendments.

LPCB welcomes comments of a technical or editorial nature and these should be addressed to "the Technical Director" at enquiries@breglobal.co.uk.

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1 SCOPE

This document specifies the requirements for network integrity, methods of test, and performance criteria for a fire detection and fire alarm network system installed in one or more buildings on a single site.

This document does not include overall fire detection and fire alarm system performance since this is covered in other standards e.g. EN 54-2 Fire detection and fire alarm systems – Part 2: Control and Indicating Equipment and EN 54-13 Fire detection and fire alarm systems – Part 13: Compatibility assessment of system components.

Non fire data may be transported by the network.

All components that form part of a fire detection and fire alarm system as defined in EN 54-1 Fire detection and fire alarm systems – Part 1:Introduction are to be assessed to the requirements of this standard.

2 DEFINITIONS

For the purposes of this standard, the definitions given in the EN 54 series of standards apply together with the following:

Distributed Control & Indicating Equipment (CIE)
A collection of separate cabinets that together form the function of B as defined in EN 54-1
Note: a network system may contain more than one distributed CIE (Refer to annex B)

Network
The network transmission paths needed to interconnect the function of 'B' as defined in EN 54-1 where B is not contained in a single cabinet

Network processor
The CPU / processor responsible for data transmission to the network transmission path.

Note: The network program may reside in any processor e.g. main CIE processor.

Network topology
A configuration of the fire system network including both the categories of nodes and interconnections of transmission paths between them

Network transmission path
Connection between the cabinets of a distributed CIE or between CIEs for the transmission of information and/or power

Example: cables, radio links.

Node
A point of access to the network for a part of the CIE

Example: complete CIE, a printer port, or sounder driver, third party or building management system interface

Site
One or more buildings protected by a common fire detection and alarm networked system

3 REQUIREMENTS

3.1 Documentation

The network node shall comply with the CIE documentation requirements specified in EN 54-2 where applicable.

The manufacturer shall supply installation documentation describing compliant network topologies.

The manufacturer shall declare the maximum number of nodes for each network topology.

3.2 Category 'A' Node Requirements

In the event of a single network processor fault, the node shall re-establish communication such that the system complies with all mandatory requirements within 20 seconds of the fault.

In the event of a single network transmission path fault, the node shall establish compliance with all mandatory requirements within 300 seconds of the fault.

Note 1: A network processor fault is regarded as a corruption of the network program or a failure of the processor to execute the network program correctly.

Note 2: The 20s is based on the time that is allowed for the CIE to reset under EN 54-2 clauses 7.6 and 8.7.

Note 3: Mandatory requirements in this context could be met if a node complies with EN54-2 clause 13.7 in the event of a single processor failure.

Note 4: This requirement could be achieved by using a redundant network processor or by any other fallback mechanism that allows the system to comply with EN54-2 clause 13.7.

3.3 Category 'B' Node Requirements

In the event of a single network transmission path fault, the node shall establish compliance with all mandatory requirements within 300 seconds of the fault.

3.4 Category 'C' Node Requirements

Any single fault within a Category C node shall not affect mandatory system functions.

3.5 General requirements

1. The inclusion of non fire functions shall not jeopardise compliance with any requirements of this standard.

2. Network components may be incorporated within the CIE housing or contained within separate housings. In either case, it shall not jeopardise compliance with any requirements of this standard or other EN 54 standards where the network component is housed.

3. Distributed CIEs on the Network shall comply with EN 54-2.

4. Network nodes shall comply with the following:
   a. functionality tests in accordance with the manufacturer's published specification
   b. Electromagnetic compatibility (EMC) in accordance with EN 50130-4
   c. Environmental tests as specified in EN 54 series (depending on the location of the network node)

5. Network systems shall meet the requirements specified in EN 54-13 Clause 4.3.

3.6 Power supply

1. The power for any Category 'A' or 'B' node shall be supplied by a power supply complying with EN 54-4 Fire detection and fire alarm systems-Part 4: Power Supply Equipment.

2. Any single power source failure shall not affect any network transmission path.

Note: A power supply may be common to a CIE and a node.

3.7 General Indications

Each CIE within the network shall have at least one user interface that meets the requirements of EN 54-2 (Clause 12.3.2), additional user interfaces may display limited information provided the information shall not result in contradiction or confusion. For example the additional user interface may display only fire alarms pertinent to a certain part of the building.

All CIEs shall be capable of unambiguously indicating the following functional conditions

- Network fault
- Network node disablement (if provided)

Note: Limited information is intended to allow for site specific requirements

3.8 Network Fault conditions

i. Reception and processing of network fault signals

The CIE shall enter the fault warning condition when signals are received which, after any necessary processing, are interpreted as a network fault.

ii. Indications of Network faults

The following network faults shall be detected:

a) Network loss
b) Loss of a node
c) Invalid data
d) A failure of a network transmission path e.g. open, short, partial circuit , interference on radio link
e) A failure of network processor

The presence of a network fault shall be indicated without prior manual intervention on all CIEs with affected mandatory functions. A network fault shall be indicated on at least one CIE even if it does not affect a mandatory function.

The network fault warning condition is established when the following are present:

1. A visible indication by means of a separate light emitting indicator (the general fault warning indicator).
2. An audible indication, as specified in EN 54-2 clause 8.6.
3. a separate light emitting indicator or alphanumeric display or both

Network fault indications can be suppressed in the fire alarm condition as defined in EN 54-2. Mandatory functions affected by the fault shall be indicated in accordance with EN 54-2 or by a system fault.

iii. Processing of faults

1. CIE that is required to display network fault shall display the appropriate fault messages within 100 seconds of the fault occurring. If the networked system is hierarchical as defined in EN 54-13 then the main CIE shall indicate appropriate fault messages within 120 seconds of the fault occurring.

2. If a node is lost, the functions associated with that node can be lost, however all remaining category ‘A’ and ‘B’ nodes shall continue to meet their mandatory requirements in accordance with EN 54-2.
3. Mandatory outputs shall not be falsified for any fault.

4. Power required for the function of the network shall be in accordance with EN 54-4. Faults as specified in EN 54-4 shall be indicated in accordance with EN 54-2 by at least one CIE.

5. Any single earth fault on a network transmission path shall comply with EN 54-2 clause 8.2.4 c) and shall be indicated by at least one CIE.

3.9 Data integrity

i. Invalid data

a) The system shall ensure that errors in received messages are detected.

b) The error rate shall be monitored at the receiving node. The error rate at which an invalid data fault is indicated shall be defined by the manufacturer.

c) An invalid data fault shall be indicated within 100s from exceeding the error rate as specified by the manufacture.

Note: the handling of invalid data faults can be assessed by inspection of the software documentation or through the use of diagnostic tools provided by the manufacturer.

ii. Data loss

The timeframe for retries shall allow the system to operate within the requirements of EN 54-2.

Note: this can be assessed through the use of diagnostic tools provided by the manufacturer.

3.10 Node disablement conditions (option with requirements)

If node disablement is provided then the following shall apply:

- The presence of a network node disablement shall be indicated without prior manual intervention on all CIEs with affected mandatory functions. A network node disablement shall be indicated on at least one CIE even if it does not affect a mandatory function.

The network node disablement condition is established when the following are present:

1. A visible indication by means of a separate light emitting indicator (the general disablement indicator).

2. a separate light emitting indicator or alphanumeric display or both

The disablement shall be indicated in accordance with EN 54-2 clause 9.3 where the disablement can not be completed within 2s, the indication that the disablement process is running shall be given at the point of disablement.

3.11 Loading of network

i. Prioritisation

If the network carries non-fire related data priority shall be given to fire related traffic such that the performance requirements as specified in EN54-2 are met under all traffic conditions.

ii. Fire and Fault traffic loading

1. The network shall be capable of carrying fire related traffic in order to meet the mandatory requirements of EN 54-2 and EN 54-13 on the main CIE in a hierarchical system.

2. The network shall be capable of carrying fault related traffic in order to meet the mandatory requirements of EN 54-2 and EN 54-13 on the main CIE in a hierarchical system.

Note : This can be assessed through the use of diagnostic tools provided by the manufacturer.

3.12 Fire outputs response time (refer to EN54-2 clause 7.7.1)

Unless EN54-2 clause 7.11 (delay) or clause 7.12 type C applies, all mandatory outputs shall be activated within 10 s of the activation of any Manual call point.

Unless EN54-2 clause 7.11 (delay) or clause 7.12 (dependency) applies, the time taken by scanning, interrogation, or other processing of signals from fire detectors, in addition to that required to take the fire alarm decision shall not delay the activation of any mandatory outputs more than 13s.

3.13 Radio link

A network node that utilises radio links shall comply with EN 54-25 and the applicable requirements specified in this standard.

3.14 Software

The network node shall comply with the CIE software requirements specified in EN 54-2 where applicable.

The execution of network program shall be monitored as under EN 54-2 clause 13.4.2 or 13.4.3. If routines associated with network function are no longer executed, either or both of the following shall apply:

a) A system fault as in EN 54-2 clause 8.5 shall be indicated.
b) A network fault shall be indicated.

3.15 Test procedures

3.15.1 Standard atmospheric conditions for testing

Testing shall be carried out after the test specimen has been allowed to stabilize in the standard atmospheric conditions for testing as described in EN 60068-1 as follows:

a) Temperature : 15 ^{o}C - 35 ^{o}C.
b) Relative humidity : 25 % - 75 %.
c) Air pressure : 86 kPa - 106 kPa.

The temperature and humidity shall be substantially constant for each environmental test where the standard atmospheric conditions are applied.

3.15.2 Network configuration

Each network topology shall be configured as per the manufacturers declared worst case(s), e.g. the limitation of the network system, in terms of number of nodes, cabling and architecture etc. The system shall include a mix of physical and simulated nodes in order for it to be representative of a worst case network.

At least two CIEs shall be configured in accordance with EN 54-2 clause 15.1.4. “Electrical connection”

Testing as defined by LPCB shall be applied on an agreed configuration and network representation of physical and simulated nodes based on technical discussion between LPCB and the manufacturer.

4 CLASSIFICATION AND DESIGNATION

There are three node categories; ’A’, ‘B’, and ’C’. A network system may consist of any combination of these types of node.

i. Category A Node

A category ‘A’ node provides the top level of reliability for a fire detection and fire alarm system network. To achieve this the fire detection and fire alarm system shall continue to comply with all of the mandatory requirements of EN 54-2 in the event of a single fault either in a network transmission path or a network processor.

ii. Category B Node

A category 'B' node shall continue to comply with all of the mandatory requirements of EN 54-2 in the event of a single network transmission path fault. A fault within a node could mean that communication between the equipment connected to the node and the rest of the network is lost.

iii. Category C Node

A category 'C' node may lose communication with the rest of the system in the event of a single fault on a network transmission path or a single fault within a node.

Note: Category 'C' nodes can not be used for essential components on the fire system but could be used for network printers or non essential repeater CIE.

5 MARKING, LABELLING AND PACKAGING

The manufacturer shall provide appropriate marking, labelling and packaging for the safe transport and subsequent use of the system as well as a clear designation of the manufacturer, their contact address, the system model identification and any other safety requirements.

The requirements for LPCB marking or labelling of a product are described in the accompanying scheme document and in the 'Use of the Mark' publications and not in this standard.

6 PUBLICATIONS REFERRED TO:

1. EN 54-1:2011, Fire detection and fire alarm systems — Part 1: Introduction
2. EN 54-2:1997/A1:2006. Fire detection and fire alarm systems. Part 2 Control and Indicating Equipment.
3. EN 54-3:2001/A1:2002 Fire detection and fire alarm systems — Part 3:Fire alarm devices -Sounders
4. EN54-4:1997/A1:2002/A2:2006 Fire detection and fire alarm systems — Part 4: Power supply equipment
5. EN 54-5:2000/A1:2002, Fire detection and fire alarm systems- Part 5: point heat detectors
6. EN 54-7:2000/A1:2002/A2:2006, Fire detection and fire alarm systems - Part 7: Smoke detectors - Point detectors using scattered light, transmitted light or ionization
7. EN 54-10:2002/A1:2005 Fire detection and fire alarm systems – Part 10:Flame detectors - Point detectors

8. EN 54-11:2001/A1:2006 Fire detection and fire alarm systems - Manual call points
9. EN 54-12:2002 Fire detection and fire alarm systems - Smoke detectors - Line detectors using an optical light beam
10. EN 54-13:2005 Fire detection and fire alarm systems - Compatibility assessment of system components
11. EN 54-16:2008 Fire detection and fire alarm systems - Voice alarm control and indicating equipment
12. EN 54-17:2005 Fire detection and fire alarm systems - Part 17: Short-circuit isolators
13. EN 54-18:2005 Fire detection and fire alarm systems - Part 18: Input/output devices
14. EN 54-20:2006 Fire detection and fire alarm systems - Part 20: Aspirating smoke detectors
15. EN 54-21:2006 Fire detection and fire alarm systems - Part 21: Alarm and fault warning routing equipment
16. EN 54-23:2010 Fire detection and fire alarm systems - Part 23: Fire alarm devices - Visual alarms
17. EN 54-24:2008 Fire detection and fire alarm systems - Part 24: Components of voice alarm systems – Loudspeakers
18. EN 54-25:2008 Fire detection and fire alarm systems - Part 25: Components using radio links and system requirements
19. EN 50130-4:1995, Alarm systems — Part 4: Electromagnetic compatibility — Product family standard: Immunity requirements for components of fire, intruder and social alarm systems
20. EN 50130-4:1995/A1:1998, Alarm systems — Part 4: Electromagnetic compatibility — Product family standard: Immunity requirements for components of fire, intruder and social alarm systems
21. EN 50130-4:1995/A2:2003, Alarm systems — Part 4: Electromagnetic compatibility — Product family standard: Immunity requirements for components of fire, intruder and social alarm systems
22. EN 60068-1:1994, Environmental testing - Part 1: General and guidance (IEC 60068-1:1988 + Corrigendum 1988 + A1:1992)
23. EN 60068-2-1:2007, Environmental testing; part 2: tests; tests A: cold (IEC 60068-2-1:2007)
24. EN 60068-2-6:2008, Environmental testing - Part 2: Tests - Tests Fc: Vibration (sinusoidal) (IEC 60068-2-6:2007)
25. EN 60068-2-47:2005, Environmental testing - Part 2-47: Test Mounting of specimens for vibration, impact and similar dynamic tests (IEC 60068-2-47:2005)

26. EN 60068-2-75:1997, Environmental testing - Part 2: Tests - Test Eh: Hammer tests (IEC 60068-2-75:1997)

27. EN 60068-2-78:2001, Environmental testing — Part 2-78: Tests, Test Cab: Damp heat, steady state (IEC 60068-2-78:2001)

28. EN 60529:1991, Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)

29. EN 60721-3-3:1995, Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 3: Stationary use at weather protected locations (IEC 60721-3-3:1994

ANNEX A (Informative)
CIE Function Sharing in Networked Systems

It is accepted that it is often detrimental to display all information everywhere on a network, and that only one output need be provided for a function rather than one for every CIE.

As such some network equipment may be designed to respond to events, and other equipment may not, dependant on site layout and use.

For example one CIE may use the routing output of another networked CIE to call the fire brigade.
This output is used by both CIE. This is illustrated below:

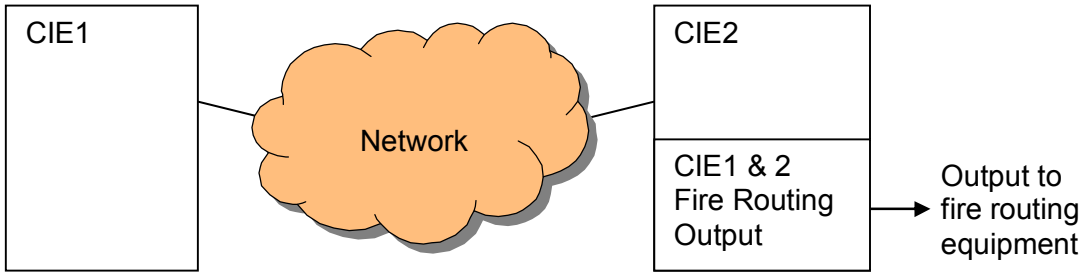

Figure A1: Illustrated example of distributed CIE

The Fire routing output equipment of CIE2 has also been programmed for use by CIE1. The signal from the CIE is considered to occur at the terminals of CIE2, not on entry to the network from CIE1. CIE1 is by definition a distributed CIE and the Fire Routing output equipment is logically a part of CIE1, as well as a part of CIE2. The following should apply:

- As CIE1 is dependant on CIE2 for its mandatory routing function, the network nodes may not be category C.

- If CIE1 has more than 512 detectors and/or manual call points then CIE1 and CIE2 must both have category A network nodes and ensure the mandatory output is not affected by a single CPU failure in either CIE or the network nodes.

- If CIE2 uses a CPU to control the mandatory output then this CPU will be subject to the system fault requirements of EN 54-2 and will be responsible for this output for both CIEs. This effectively sets a limit of 512 detectors and/or call points for both CIE1 and CIE2 combined, unless redundant processors or transmission paths are provided.

ANNEX B (Informative)
Fire System Network in relation to Control and Indicating Equipment

In relation to Control and Indicating Equipment (CIE) as defined in EN 54: Part 1 the Fire System Network interconnects between CIE and distributed CIE elements.

Key to Figure 1
B Control and Indicating Equipment
B^1 Distributed Control and Indicating Equipment
N^A Category A Network System Node
N^B Category B Network System Node
N^C Category C Network System Node

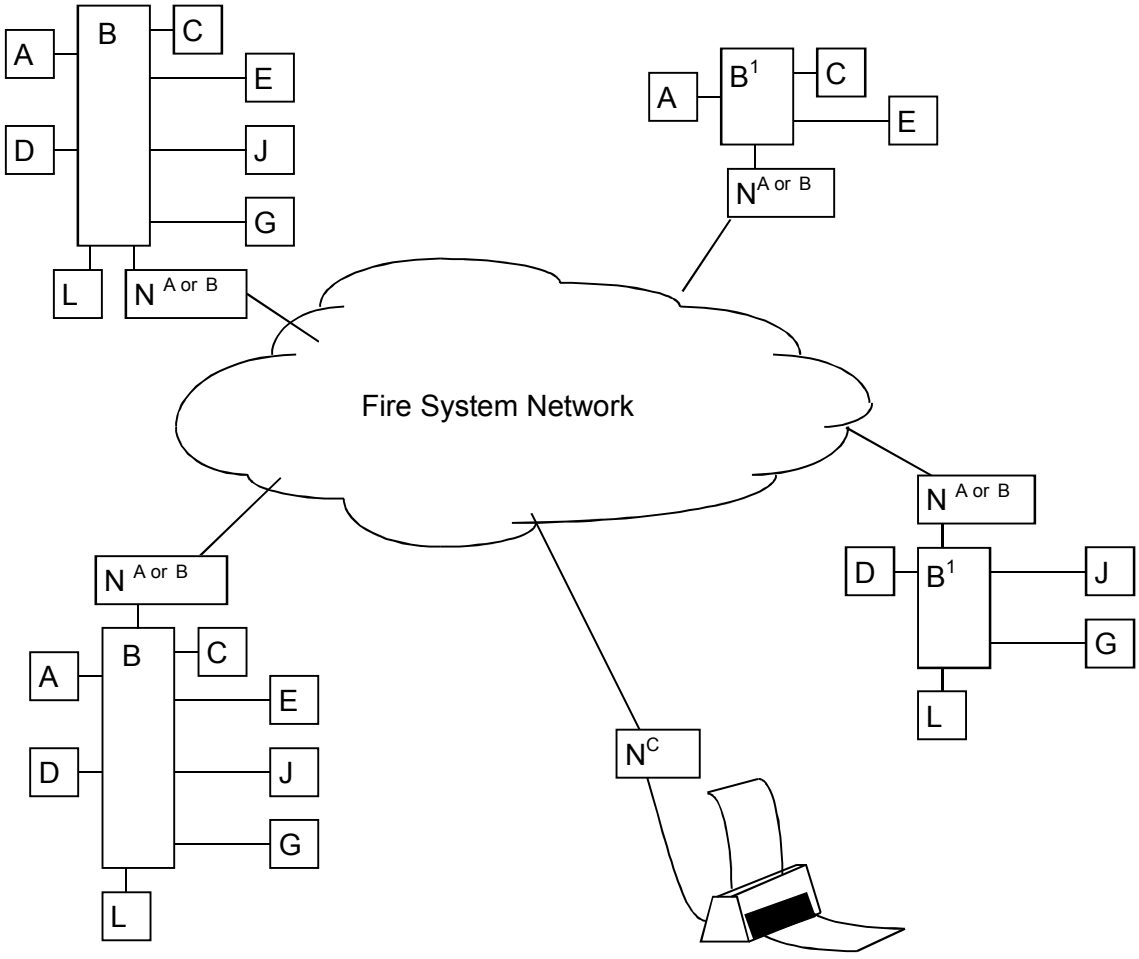

Figure B1: Example of a Fire System Network in relation to Control and Indicating Equipment

ANNEX C (Informative)
Overview of Network Topologies

This standard defines different node categories necessary to achieve adequate system reliability. The nodes however need to be applied in a manner that meets the requirements of EN54-2 and EN54-13.

This annex describes the different topologies and how they relate to the terms defined in the EN54 standards.

The network itself may be implemented in many ways. The manufacturer must provide sufficient documentation to the test agency to explain how the network must be implemented to ensure it is at a minimum single fault tolerant. The manufacturer must also supply sufficient information to the system designer to ensure they can implement it in a compliant fashion.

C.1 Hierarchical Network System

A hierarchical system is one in which complete CIEs are connected to a main CIE via a network that is able to display the status and control the other CIEs. The hierarchy is a representation of the system and does not necessarily represent the physical implementation directly.

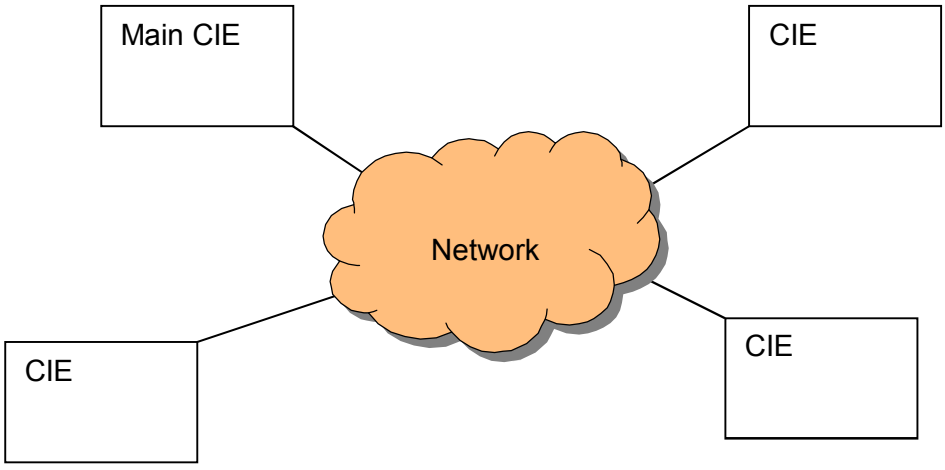

Figure C1: Example of Hierarchical Network System

The aim of a hierarchical system is to allow multiple CIEs to be monitored from a single point. The Main CIE must be capable of unambiguously indicating the source of any events – e.g. the CIE of origin and the zone. Each CIE within a hierarchical system may be distributed.

C.2 Distributed CIE

A distributed CIE is one in which multiple cabinets are used to house a complete CIE. This may be as a result of the distribution of the components of the CIE into separate cabinets or may be because part of a specific CIE is being used by more than one CIE e.g. a fire routing output.

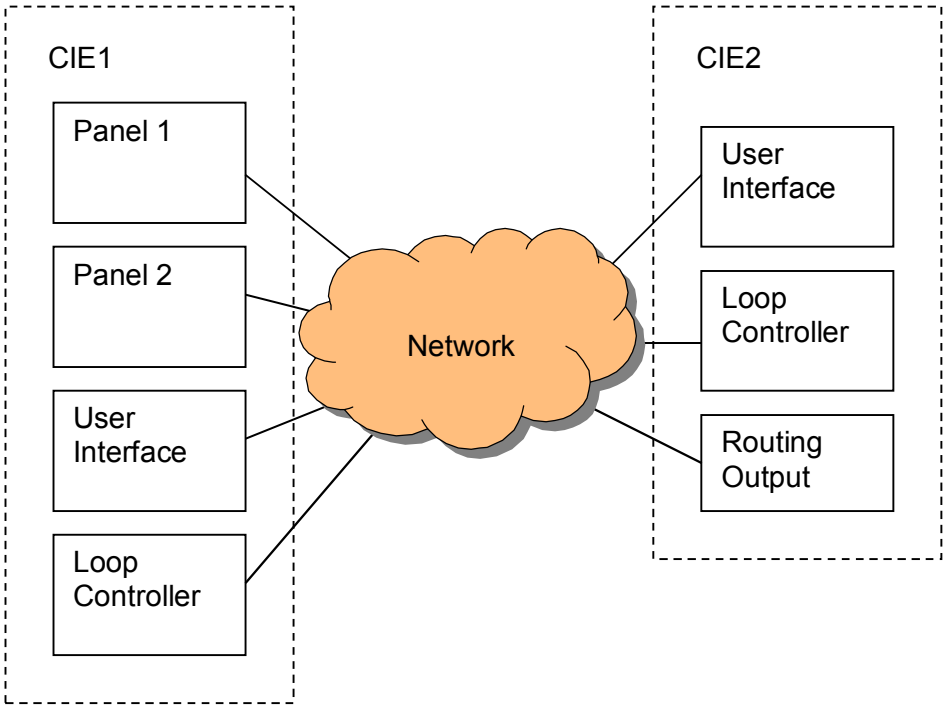

Figure C2: Example of Distributed CIEs

In Figure C2 CIE1 is composed of 4 separate cabinets. Two complete Panels plus a User Interface cabinet and a Loop Controller cabinet. The Panels may be capable of being complete CIEs in their own right, however the implementation in this example chooses to make them both part of a single CIE. This is appropriate where all these cabinets are contained within a single building which needs to have unified detection, control and indications. It is acceptable for a CIE to have multiple user interfaces provided that there is no conflict or ambiguity of display. E.g both panels in CIE1 and the User Interface could show identical information. Alternatively the User Interface could be the CIE's access and indication point while the panels only show a limited subset of information, and may have limited control capability.

C.3 Complex Systems

A system may be a hierarchy of distributed CIE which make use of parts of other CIE. i.e. all the above mentioned topographies may be used together.

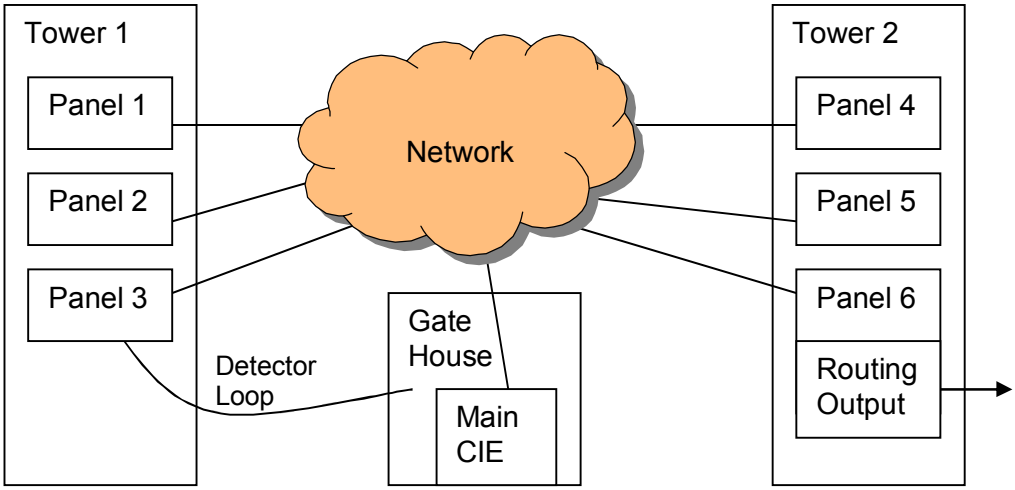

Figure C3: Example of Complex Installation

In Figure C3 a site with 3 buildings is shown. The two towers are implemented as distributed CIEs. The three buildings are joined as a hierarchical system with the main CIE in the Gate House giving an overview indication of all three CIE's.

The Tower 1 CIE is using the Tower 2 CIE to provide its routing output (via panel 6).
The Gate House CIE is using the Tower 1 CIE to provide its fire detection (via Panel 3 detector loop).

The indication of faults must be given careful consideration. An open circuit fault in the detector loop of Panel 3 would be shown as a fault on the Tower 1 CIE and the Gate House CIE (as well as the Main CIE indication). However if a detector in the gatehouse was removed without affecting the integrity of the loop wiring, then it would be acceptable to only indicate the fault on the gate house CIE even though the device is physically attached to the Tower 1 CIE.

Indications must be given on all CIEs that could be affected by a fault, test, disablement or fire. (a detector could be an input to more than one CIE).

Amendments Issued Since Publication

DOCUMENT NO.	AMENDMENT DETAILS	SIGNATURE	DATE
LPS 1653-1.1	1. New front cover 2. Title added to header 3. Notes amended on Page 3 4. Repagination 5. Update to copyright information	DC	Jan. 2014