

Witness Statement

Statement of compliance

I understand my duty as an expert witness to the court to provide independent assistance by way of objective unbiased opinion in relation to matters within my expertise. I have complied with that duty and will continue to comply with it. I will inform all parties and where appropriate the court in the event that my opinion changes on any material issues. I further understand that my duty to the court overrides any obligation to the party from whom I received instructions.

Parts 33.2 (1), (2) and (3) and 33.4(j) Criminal Procedure Rules

Declaration of Truth

This statement consisting of...47..... pages, is true to the best of my knowledge and belief and I make it know that, if it is tendered in evidence, I shall be liable to prosecution if I have wilfully stated in it anything which I know to be false or do not believe to be true.

Part 33.4 (k) Criminal Procedure Rules

Statement of conflicts

I confirm that I have no conflict of interest of any kind, other than any which I have already set out in this report. I do not consider that any interest which I have disclosed affects my suitability to give expert evidence on any issue on which I have given evidence and I will advise the party by whom I am instructed if, between the date of this report and the trial, there is any change in circumstances which affects this statement.

Signed: K. Winship.

Date: 31st May 2018

1. My full name is Kevin Samuel Winship and I am currently employed as a Technical Safety Manager for CORGI Technical Services Limited, First Floor 11 Campbell Court, Bramley, Tadley, Hampshire, RG26 5EG
2. 1. **Qualifications and technical knowledge and practical experience of the gas industry.**
3. Qualifications & Training for Kevin Winship;
Technical Safety Manager; CORGI Technical Services Limited;
4. City & Guilds 6043-1 Incident Investigation
EAL 7133 DEI/007 Certificate Electrical Test Procedures
City & Guilds 2381 Level 3 Electrical Requirements
Domestic unvented G3
Non-Domestic Gas Safety Modules of the Accredited Certification Scheme (ACS)
CODNCO1 CORT1 CIGA1 ICPN1 CDGA1 TPCP1A TPCP1 CODC1 COCATA1
Domestic Gas Safety Modules of the Accredited Certification Scheme (ACS)
CKR 1 HTR 1 WAT 1 LAU 1 CEN 1 DAH 1 LEI 1 MET 1 CPA1
City & Guilds 6084 – Part L Appliances / Energy Efficiency
Energy Efficiency Standard Assessment Procedure (SAP) Assessor Qualification

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Institute of Management Executive Diploma in Management Studies
Institute of Management EDMS (NVQ Level 5)
Bond Solon Expert Witness Trained
Institute of Management Certificate in Management Studies
Institute of Management (NVQ Level 4)
Health and Safety in the working environment
Risk Assessment /Risk Management
N.V.Q. Assessor D32 and D33
N.E.B.S.M Certificate of the National Examination Board for Supervisory
Management
D.B.A. Diploma in Business Awareness
British Gas Technicians Examination
B-Tec City & Guilds Gas Utilisation
City and Guilds 662 Gas Service Engineer

5. Having worked within the gas industry for over thirty years I have managed to amass a wealth of technical knowledge, which proves to be a vital attribute when providing assistance to my client base.
6. I have worked for and my roles included the following;
- 1979-91 British Gas – as a domestic and commercial Gas Service Engineer
 - 1991-98 CORGI (the regulatory body) - as a regional inspector, then as a special services inspector responsible for a portfolio of larger businesses.
 - 1998-present CORGI Technical Services – progressed through business from Project Officer to current position of Technical Safety Manager.

The last four positions held within the CORGI Group have seen me successfully move from a regulatory enforcement to providing solutions to a broad range of clients in the gas and gas safety arena.

I am also a trained City and Guilds Carbon Monoxide Incident Investigator. I have undertaken many carbon monoxide incident investigations on behalf of the Health and Safety Executive and other clients. In addition, I have been trained by Bond Solon to be an expert witness.

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7 **2. Background – Reported Evidence**

8 The Metropolitan Police Service (MPS) requested an investigation into the gas installations within Grenfell Tower following a serious fire, the fire took place on the 14th June 2017.

Information provided by MPS

Grenfell Tower is in North Kensington, Inner London. The tower was managed on behalf of Kensington and Chelsea London Borough Council by Kensington and Chelsea Tenant Management Organisation (KCTMO).

The 24-storey tower block was designed in 1967. It was constructed by contractors A E Symes of Leyton and took 2 years to complete (1972-74). The property contained 120 one and two-bedroom flats. The upper 20 of 24 storeys had six dwellings on each floor, comprising of: lounges, kitchens, bathrooms and bedrooms. Originally the lower four storeys were used for non-residential purposes. Later, two of the four lower floors were converted to residential use, bringing the total to 129 apartments, housing up to 600 people.

Grenfell Tower over the years has undergone major renovations, which included the decommissioning of one of the original gas service risers and a new gas service riser being installed in 2017.

At Grenfell Tower, there were 2 gas service riser systems, each supplied by a separate external gas pipe:

1. One service riser system (comprising of initial 4 vertical risers, 2 of which split out to create 6 service risers in total) which was installed during the original construction of the building in 1974.
2. A second service riser system (comprising of one vertical riser) which was installed in 2017, following the isolation of one of the original service risers.

9 **3. Instruction**

10 Having been commissioned by Metropolitan Police Service, our investigation was to answer the following three questions and draw conclusions and offer opinions based on findings, as to;

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- a) whether there is evidence to suggest that Grenfell Tower may have experienced abnormal provision of gas prior to the fire? (see reference section 14)
- b) whether there is evidence to suggest that the design, quality or condition of the gas infrastructure at Grenfell Tower is deficient? (see reference section 15)
- c) whether there was a significant release of gas from any part of the gas supply (excluding destruction of appliances causing gas release at pipe termination)? (see reference section 16)

Pictures to aid the reading of this report have been provided by the Metropolitan Police Service.

11 **4. The CORGI Technical Services Team**

12 The site was inspected during December 2017, January, February, March & May 2018.

The inspections were undertaken by the CORGI Technical Services Team, comprising of;

Mr John Gregory: Technical Services Consultant

Mr Chris Jones: Technical Safety Manager

Mr Kevin Winship: Technical Safety Manager

Mr Trevor Batt: Technical Safety Manager

Mr Mark Duffy: Technical Safety Manager

Curriculum Vita are within Appendix 1. Team CV CORGI Tech - Met Police

13 **5. MPS Team: Direct Interaction**

14 Mr Martin Tucker: Operational Forensic Manager

Mr James McQuen: MPS Investigator

Mr Dan Peters Detective Constable

MPS photographers;

Emma Harrison

Jennifer Clark

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Gbenga Sodeke

Richard Geard

Tarek El-Sirgani

Sarah Hill

Martin Dines

Sam White

E Dempster

LFB (London Fire Brigade)

Peter Miller

BRE; (Building Research Establishment)

Sean Taylor

Kieran Wood

15 **6. Methodology**

16 The inspection of the gas systems within Grenfell Tower was intended to be undertaken on a floor by floor basis. Following our initial 'Risk Assessment' it was agreed in consultation with MPS that CORGI Technical Services would inspect on a riser by riser basis, with the basement being inspected separately.

The basement of the Tower was inspected to assess the gas supplies provided. There were 3 gas supplies entering the building, each gas supply entering below ground level, but at high level within the basement, the newest supply (installed 2017) was measured at 4.73m above the basement floor level.

Each riser was inspected individually as far as access allowed, it was also our intention to inspect and assess each flat that the gas risers passed through. This included an assessment of the installation within those flats also.

The risers were visually inspected where access was made possible. There were a number of locations initially, where risers could not be inspected due to access panels or boxing not being removed during the inspection period. On removal of those panels by BRE all risers were subsequently inspected.

It was not possible to fully inspect all installations in all flats due to debris piled over

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gas installations, or gas installations having been removed to permit the provision of building supports.

17 **7. Reference Documents**

18 Legislation/Regulations;

- Gas Safety Regulations (GSR) 1972
- Health and Safety at Work Act (HSWA) 1974
- Gas Safety Management Regulations (GSMR) 1996
- The Pipeline Safety Regulations (PSR) 1996
- Gas Safety (Installation and Use) Regulations (GSIUR) 1998
- The Management of Health & Safety at Work Regulations 1999
- Dangerous Substance and Explosive Atmosphere Regulations (DSEAR) 2002

British Standards and other industry codes of practice;

- TD4 Laying of Steel and Ductile Iron Gas Service Pipes Edition 1 1973
- TD4 Laying of Steel and Ductile Iron Gas Service Pipes Edition 4 2007
- IGEN/G/5 Gas in Multi Occupancy Buildings 2nd Edition 2012
- IGEN/UP/2 Installation pipework on industrial and commercial premises 3rd Edition 2014
- BS6891 Low pressure gas pipework in domestic premises
- BS6172 installation of domestic gas cookers
- BS6400-1 Domestic sized gas meters – low pressure

19 **8. Documents Provided by MPS**

20 MPS provided the following documents;

23/11/17 from Martin Tucker; (further information -Grenfell tower) (e-mail to C Jones)

- Crime Scene manager request (Maps & diagrams of the gas installation in and around Grenfell Tower)
- Figure 3 (tower riser map)

2/2/18 from Martin Tucker; (Operation Northleigh) (e-mail to C Jones)

- Document reference J1656_4QODXG_000 Report Initial Findings 180131 (WSP Engineers report)

8/2/18 from James McQuen; (plan of gas riser) (e-mail K Winship)

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- Figure 3. (note; same as previously supplied by MT)

27/2/18 from James McQuen; (further question -Grenfell tower) (e-mail K Winship)

- Records of gas pressures -Latimer Road Notting Hill

2/3/2018 from James McQuen; Reference CORGI Requested Images (1 Disk)

- Photographs provided of inspection areas by MPS
- Reference: 2575110
- Reference: 2576173
- Reference: 2596498
- Reference: 2596499
- Reference: 2596689
- Reference: 2618842
- Reference: 2623427
- Reference: 2627389
- Reference: 2632559
- Reference: 2633009
- Reference: 2633562

9/5/2018 from James McQuen; Reference 2633009 Valve Sequence (2 disks)

- Additional photographs of inspected areas
- Reference: 2596758
- Reference: 2596772
- Reference: 2596773
- Reference: 2596774
- Reference: 2633009
- Reference: 2596758 pdf
- Reference: 2596772 pdf
- Reference: 2596774 pdf
- Reference: 2633009 pdf

10/5/2018 from James McQuen; (Install Reactive Riser and Services from tRlIO)
(e-mail K Winship)

- z454960_100520183072_001.pdf - Install Reactive Riser and Services -
drawing

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23/5/2018 from James McQuen; (gas supply details from Cadent) (e-mail K Winship)

- CAD00000945 - Grenfell Tower reinst defect (valve)Additional photographs of inspected areas
- CAD00001615 - Photo of reinstatement over new service
- CAD00001616 - Photo of reinstatement
- TRI000001417 - As Laid External Works Drawing

23/5/2018 from James McQuen; (e-mail K Winship)

- Additional photographs of inspected areas
- Reference: 2633537 pdf
- DSC 001 to DSC 0047

21 **9. Incident information**

22 The Metropolitan Police confirmed that at approximately 00:54 hours on the 14th June 2017 the Emergency Services received a report of a fire at Grenfell tower. As a result of their attendance at the scene, the Fire Brigade called National Grid (Cadent) who attended at 03:48 hours on the 14th June 2017.

23 **10. Incident Timeline**

24

Grenfell Incident Timeline (reported by MPS)		
Date	Time (BST)	Event
14/06/2017	00:54	Fire reported to Emergency Services
14/06/2017	03:48	Cadent on site advised to standby by LFB
14/06/2017	07:45	Cadent formally asked to disconnect gas
14/06/2017	11:30	Cadent established excavation sites and LFB gave go ahead to move machines to site. Advised LFB that gas would be disconnected by 19:00 – 20:00
14/06/2017	13:30	Cadent started excavation

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14/06/2017	15:50	Cadent attempt to turn off gas in basement (Manager Jason Allday). Identified as too dangerous after risk assessment due to water level and electricity still live to building so isolation attempt aborted. Unable to isolate gas at SIV's outside building as too close and falling debris
14/06/2017	20:00	Cadent isolated 2 mains supplies. 180mm main turned off at Grenfell Road & 4inch main turned at Testerton Walk
14/06/2017	21:20	Cadent identified 3rd main supply (15inch) at Station Walk
14/06/2017	23:40	Cadent turned off 15inch supply at Station Walk
15/06/2017	03:30	Cadent capped supply Station Walk

25 11. **Equipment Used**

26 The equipment used for this incident include the following;

Hand torches

Vernier calipers

Digital measuring instrument:

Tape measure

Note pads and pens.

PPE – As supplied by MPS

27 12 **Findings**

28 Grenfell Tower gas installation comprises of the following;

Three network supplies enter the basement of the building (two existing and one new, installed during 2017).

The installation in accordance with the standards applicable, should have consisted of;

- External Property Isolation Valve (PIV)
- Installation Isolation Valve (IIV)
- Branch Isolation Valve (BIV)
- Emergency Control Valve (ECV)

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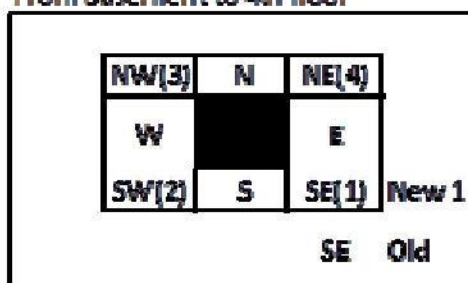
Installation as found;

- One existing 12inch steel (measured after IIV) supply to gas meters in basement to feed Plant Room boilers for heating & hot water
- One existing approx. 6inch steel supply (unable to confirm actual size, reported by MPS to be 4inch steel) to basement splitting at high level into four vertical risers from the basement through the building.
 - 2 x 3inch steel
 - 2 x 2inch steel
- One new (installed 2017) 3inch steel pipe reducing to 2inch steel (from IIV) through basement to replace a decommissioned 2inch steel riser, the decommissioned riser was capped off at ground floor.

Details of all risers and findings can be seen within Appendix 2 & 2a-j.
(3-4-18 Grenfell Tower Daily Log 2017-18).

29

From Basement to 4th floor



There is a total of five risers from the basement that supply the building

- SE - original riser (decommissioned)
- SE (1) - new riser, replaces decommissioned riser
- SE - original riser capped off on the ground floor, SE (1) replaces this supply through building.

Details on services within basement can be seen in Appendix 3. Basement Survey 2017-18.

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30

From 4th Floor to 23rd floor

Flat 5	NW(4)	N	NE(5)	Flat 6
Flat 4	W(3)		E(6)	Flat 1
Flat 3	SW(2)	S	SE(1)	Flat 2

The four risers split into six from fourth (4th) floor;

- SW (2) splits at fourth floor level to become W (3) & SW (2) on higher floors.
- NE (5) splits at fourth floor level to become E (6) & NE (5) on higher floors

Details of all risers and findings can be seen within Appendix 2. All 3-4-18
Grenfell Tower Daily Log 2017-18

31 13 Gas Supplies in Basement

32 Within the basement there are 3 gas supplies, all entering the basement at high level, the newest supply (installed 2017) was measured at 4.73m above the basement floor level. Found not to be readily accessible, due to its location.

Due to site materials such as scaffolding and storage containers, the Property Isolation Valves (PIV) and their positions could not be ascertained externally.

There was no line diagram drawing within the basement to enable understanding of the actual pipework layout within the building. All services entered at high level.

- 1 x 12inch Steel with IIV at low level, combined IIV and Emergency Control Valve (ECV) accessible. Metered supply to communal boiler room. Supplying 3 redundant boilers & 3 new boilers. The supply for the boiler plant was routed through an electric solenoid valve. The activation and control of which is to be determined by others.
- 1 x approx. 6inch Steel supply (no IIV), unable to verify size due inaccessible location. (Previously documented as 4" by MPS) Supply branching with 4 service risers with individual Branch Isolation Valves (BIV) all located at high level. (SE- 4.74m; NE- 4.55m; SW- 4.55m; NW- 4.51m;)
- 1 x 3inch Steel with IIV located at high level, reducing to 2inch downstream of IIV at (4.73m) then rising centrally in building, no fire stops evident at ceiling.

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The 3 gas supplies to the building;

12" supply	Combined IIV and ECV	Accessible
6" supply (approximate size)	No IIV fitted	N/a
3" supply	IIV fitted at high level. 4.73m	Difficult to access, no handle or wheel head attached

Only the gas supply valve to the gas meter and gas heating and hot water boilers was readily accessible to the emergency services.

This supply after the meter was also protected by an emergency solenoid valve. Activated by emergency stop buttons at exit points to basement. Interlock with Building Management System (BMS) could not be confirmed, will require to be confirmed by appropriate competent persons, MPS to confirm.

33 14 **MPS commissioned question:**

(a) Whether there is evidence to suggest that Grenfell Tower may have experienced abnormal provision of gas prior to the fire? (reference section 34)

34 Having analysed the data as provided by Cadent to MPS, a comparison was made of the recorded pressures within the surrounding gas mains in the days and weeks preceding the fire. With a direct comparison of the same times and day, 1 and 2 weeks prior to the fire.

It was concluded, that there were no significant changes in the gas supply pressures in the vicinity of Grenfell Tower before or during the fire. Appendix 4. 4a. & 4b. Cadent Records of gas pressures – Latimer Road Notting Hill.

35 15 **MPS commissioned question:**

(b) Whether there is evidence to suggest that the design, quality or condition of the gas infrastructure at Grenfell Tower is deficient. (reference section 36 to 59)

36 The inspection identified that the existing installations have installation defects not commensurate with the relevant regulations & standards applicable at the time of their installation.

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This is relevant to 2 periods of work undertaken.

1. Original Gas Installation in 1974
2. New Gas Riser Installation completed 2017, due to refurbishment.

37 **15.1 Existing Installation Defects;** (relevant to the original gas installation, circa 1974)

38 The installation in 1974 should have comprised of the following;

- Property Isolation Valves (PIV)
- Installation Isolation Valves (IIV)
- Branch Isolation Valves (BIV)

The PIV and IIV both on supply to building and should be in an accessible location for emergency access and use. BIV's are provided to facilitate sectional isolation.

Line diagrams of pipework layout should also have been provided and displayed at the IIV. (relevant to existing installation).

Reference Pictures as provided by MPS

Possible PIV locations

Reference 2632559 –
0051

To be confirmed by
MPS



Restricted access to
PIV locations.

Reference 2632559 -
0052

To be confirmed by
MPS



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Combined IIV & ECV
Existing Gas
Installation to Meters
supplying the heating
and hot water boilers

No line diagram
displayed at meter
installation

Reference 2633009-
0008



New Service Riser IIV
fitted high in
basement

No wheel head for
operation

No Line diagram of
installation in vicinity
of (IIV)

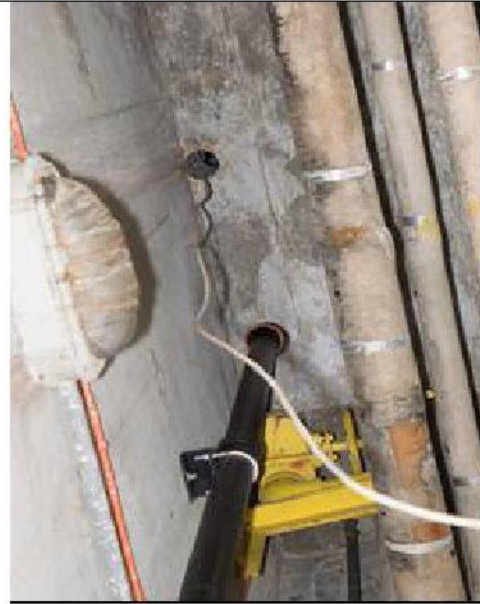
Reference 26330009 –
0019



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Valves to risers in basement – Old decommissioned Riser BIV location (yellow). Adjacent to new Riser.

Reference 2633009 - 0051



Valves to risers in basement – BIV location

Reference: 2633537 - 0014



Valves to risers in basement – BIV location

Reference: 2633537 - 0015



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Valves to risers in
basement – BIV
location

Reference: 2633537 -
0017



39 15.1.1 Gas Safety Regulations 1972: (relevant to when installed)

40 Regulation 5 states where:

- (a) a service pipe is installed of internal diameter of 2 inches or more; or
- (b) a service pipe is installed for the supply of gas to any premises where the nature of the premises or of any activity carried on or to be carried on upon the premises is such that the person who installs the service pipe knows or has reason to suspect that there is a special risk of personal injury, fire, explosion or other dangers arising from the use of gas; or
- (c) a service pipe is installed which supplies more than one primary meter in a building, a service valve shall be fixed in the service pipe in a readily accessible position as near as practicable to the boundary of the premises through or to which the service pipe is laid, and the position of the service valve shall be clearly indicated.

This was not the case at Grenfell Tower;

If valves were fitted, they were not clearly marked or readily accessible.

MPS to identify with Cadent the actual valve locations.

Reference 37, 38: (15.1) Existing Installation Defects

41 Regulation 7 states:

- (1) No service pipe shall be installed in a cavity wall nor so as to pass through a cavity wall otherwise than by the shortest practicable route.

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(2) Where a service pipe is installed so as to pass through any wall or is installed so as to pass through any floor of solid construction-

(a) the service pipe shall be enclosed in a sleeve; and

(b) the service pipe and sleeve shall be so constructed and installed as to prevent gas passing along the spaces between the pipe and the sleeve and between the sleeve and the wall or floor and so as to allow normal movement of the pipe.

(3) No service pipe shall be installed in an unventilated void space.

This was not the case at Grenfell Tower;

Pipework was not installed to the regulations and standards applicable.

Pipework not sleeved or sealed throughout the property, in addition, pipework was routed within unventilated voids.

Reference Pictures as provided by MPS

No pipe
sleeves

Reference:
2633009 - 0004



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No pipe
sleeves

Reference:
2633009 - 0038



No pipe
sleeves

Pipework
installed within
a non-
ventilated void
/duct

Pipework with
signs of
corrosion.

Reference:
2575110 - 0003



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No pipe
sleeves

Pipework
installed within
a non-
ventilated void
/duct

Reference:
2596758 - 0098



Throughout the building there are further examples of the above.

42

Regulation 8 states:

All service pipes installed shall be constructed of material which is inherently resistant to corrosion or shall be protected against corrosion externally and, unless there is no risk of internal corrosion, internally.

This was not the case at Grenfell Tower;

The pipework was found to be suffered from surface corrosion on all original existing gas service risers through the property.

Reference Pictures as provided by MPS

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No pipe
sleeves

Pipework
installed within
a non-
ventilated void
/duct

Pipework with
signs of
corrosion

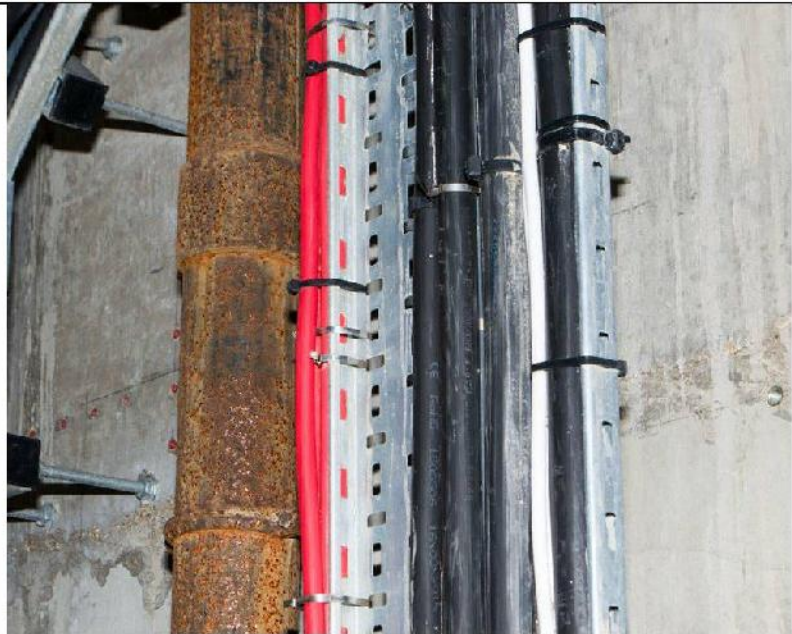
Reference:
2575110 - 0024



Pipework
installed within
a non-
ventilated void
/duct

Pipework with
signs of
corrosion

Reference:
2575110 - 0017



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Service
pipework with
signs of
corrosion

Reference:
2575110 - 0041



Throughout the building there are further examples of the above.

43

Regulation 11 States:

All service pipes installed above ground shall be properly supported and so placed or protected as to ensure that there is no undue risk of accidental damage to the pipes.

This was not the case at Grenfell Tower;


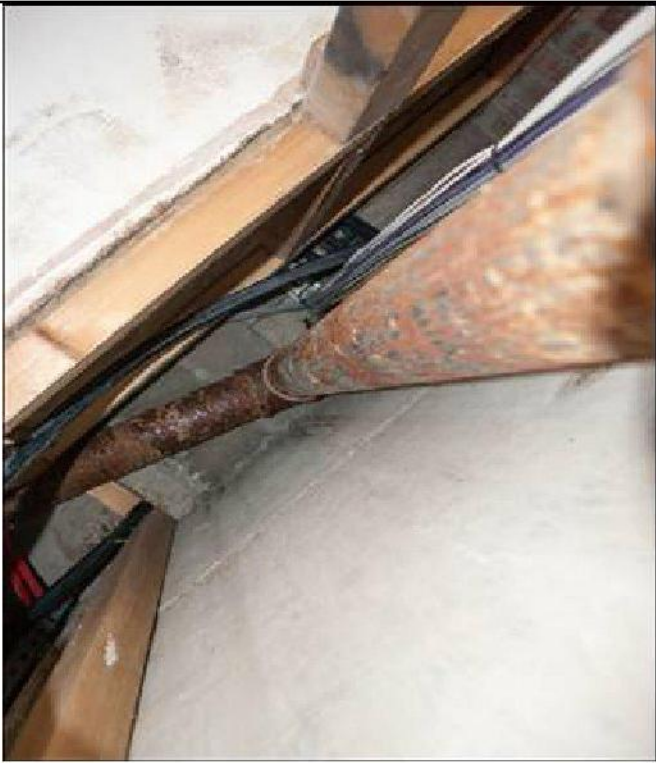
This is relevant to the existing gas service risers from the basement of the Tower, lack of sleeving, supports and protection.

Reference Pictures as provided by MPS

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<p>No visible sleeves</p> <p>Pipework installed within a non-ventilated void /duct</p> <p>Pipework with signs of corrosion</p> <p>No support other than cemented in top & bottom</p> <p><i>Reference: 2596758 - 0153</i></p>	
<p>Pipework installed within a non-ventilated void /duct</p> <p>Pipework with signs of corrosion</p> <p>No support and change in direction</p> <p><i>Reference: 2596758 - 0070</i></p>	

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No visible sleeves

Pipework installed within
a non-ventilated void
/duct

Pipework with signs of
corrosion

Incomplete support and
change in direction

**Reference: 2596758 -
0111**



Throughout the building there are further examples of the above.

44

Regulation 12 states:

No service pipe shall be installed in such a way as to impair the structure of any building nor so as to impair the fire resistance of any part of its structure.

This was not the case at Grenfell Tower;

This is relevant to the existing service risers from the basement of the Tower, lack of supports and protection, pipework not sleeved through each floor and in direct contact with concrete.

Joints / flanges not assembled completely, not all retaining bolts installed.

In addition, provisions were not made for vertical and lateral expansion of the pipework.

Reference Pictures as provided by MPS

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Service pipework
installed within
basement

Fittings incomplete not
all flange retention bolts
installed.

*Reference: 2633009 –
0017 & 0017a*



Pipework installed
passing through floor
not sleeved, no
provision for expansion.

Pipework with signs of
corrosion and distorted.

Incomplete support and
change in direction

*Reference: 2633562 -
0058*



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Pipework installed in floor with no signs of protection from corrosion.

Reference: 2618842 - 0046



Pipework installed in floor with no signs of protection from corrosion.

Pipework rising and changing direction

Reference: 2575110 - 0029



Pipework installed in floor with no sleeve no signs of protection from corrosion.

Pipework separated at steel threaded joint, ruptured, no provision for expansion

Reference: 2618842 - 0057

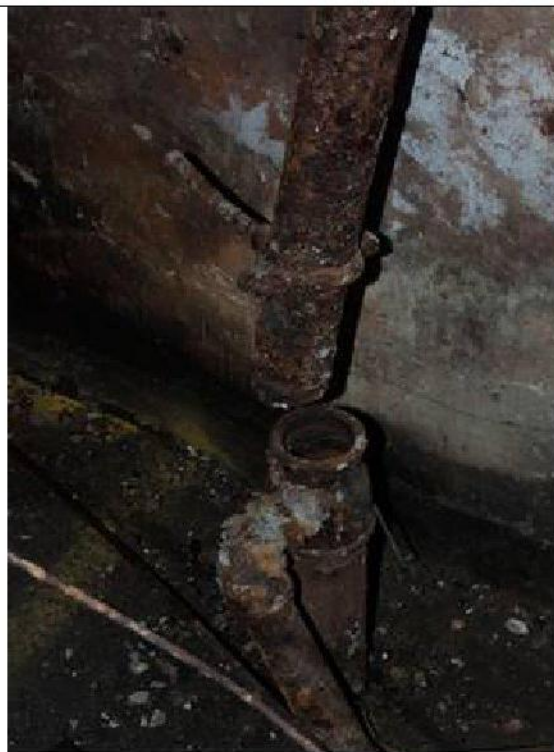


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Pipework installed in floor with no sleeve no signs of protection from corrosion.

Pipework separated at steel threaded joint, ruptured, no provision for expansion

Reference: 2618842 - 0058



Throughout the building there are further examples of the above.

45

Regulation 42 states:

Where installation pipes supplied from primary meters are installed in a building for the supply of gas to which a service pipe of internal diameter of more than 2 inches is installed and the supply of gas is required for purposes other than domestic use-

(a) a valve or cock shall be properly fixed in a conspicuous and readily accessible position in the following cases: -

(i) in the case of a building having two or more floors to which gas is supplied, in the incoming installation pipe to each such floor; and

(ii) in the case of a floor of a building having self-contained areas to which gas is supplied (whether or not the building has more than one floor), in the incoming installation pipe to each such self-contained area;

(b) a line diagram shall be attached to the building in a readily accessible position as near as practicable to the primary meter indicating the position of all installation pipes, meters, meter controls, valves or cocks, pressure test points, condensate receivers and electrical bonding

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This was not the case at Grenfell Tower;

This is relevant to the boilers and pipework within the basement for the Tower's heating and hot-water provision. An Emergency Control Valve is fitted and accessible, however, a line diagram of all pipework and valves was not provided or in a readily accessible location.

Reference 37, 38: (15.1) Existing Installation Defects

46 15.1.2 TD4 Laying of Steel and Ductile Iron Gas Service Pipes 1973 (relevant to
when original services installed)

47 6.2 Steel Services states:

6.2.7 Where the service enters a building through a solid floor or a load-bearing or cavity wall, a sleeve of non-corrodible material should be built into the wall, the internal diameter of the sleeve being at least 25 mm (1 in) greater than the external diameter of the service pipe. When underground, the ends of the sleeve should project not less than 25 mm (1 in) beyond the finished wall surfaces.

6.2.8 A similar sleeve, though not necessarily projecting beyond the finished surface, may be provided when a service pipe or riser passes through any partition wall or floor.

6.5 Service Valves states:

6.5.1 Every service pipe should terminate at the meter with a meter control of the standard type normally used by the gas undertaking.

6.5.2 In addition, a service cock or valve should be fitted if any of the following conditions apply:

- (a) The service pipe has a nominal size of 54 mm or 2 inches or more.
- (b) A hazardous trade is carried on in the building or the area in which it is situated.
- (c) The building or the form of construction of the service pipe form a special risk.
- (d) The service pipe is a common service supplying two or more primary meters.

The service cock or valve should be of a type approved by the gas undertaking and fixed in a position outside but as near as practicable to the property boundary and should be fitted with a surface box and cover.

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Witness Statement

When, by reason of special circumstances (e.g. in blocks of flats or buildings with large forecourts), a service cock or valve is fixed within the property boundary, it should be placed outside the building in a readily accessible position.

7.1 Risers states:

7.1.3.3 The riser should rise in a vertical line from its point of support to its highest point without any changes in direction. The riser should be secured clear of the duct wall with suitable pipe clips to prevent lateral movement. These should permit thermal movement and on no account should the riser be clamped at these supports. Where the riser passes through each floor, a sleeve should be provided. No joint should be sited within the sleeve. The sleeve should be suitably plugged to produce a 'fire stop' in accordance with building regulations.

7.1.3.1 Every riser should be supported at its base by a duck foot or similar flanged device, capable of supporting the total weight of the riser. (See Figure 19.) This should preferably be sited on the building foundation or on a properly constructed raft or pillar. Where this is not practicable the support should be located no higher than the level of the first floor of the building.

7.1.3.3 The riser should rise in a vertical line from its point of support to its highest point without any changes in direction. The riser should be secured clear of the duct wall with suitable pipe clips to prevent lateral movement. These should permit thermal movement and on no account should the riser be clamped at these supports. Where the riser passes through each floor, a sleeve should be provided. No joint should be sited within the sleeve. The sleeve should be suitably plugged to produce a 'fire stop' in accordance with building regulations.

7.1.3.4 Wherever possible, the use of a ventilated duct to accommodate the riser is recommended. (See the British Standard Code of Practice CP 413 'Design and construction of ducts for services'.) Ducts should be so sited that pipework may be inspected, and any work carried out with a minimum of inconvenience to the consumer.

7.1.3.5 A service valve should be fitted in the service pipe supplying every riser in an accessible position outside the building.

Witness Statement

This was not the case at Grenfell Tower;

If property isolation valves were fitted, they were not clearly marked or readily accessible. (Their location and accessibility are to be confirmed by MPS)

2 of the original 4 service risers, split into two additional risers from the 4th floor. Therefore, they do not rise without deviation to the highest point.

*Service risers change direction and are not supported effectively.
Service risers are not sleeved as they pass through floor structures and are in contact with corrosive material.*

No provision has been made for lateral and vertical expansion, as they are fixed at entry and exit points through the concrete floors.

Sleeves and supports have not been installed in accordance with the regulations or the applicable standards.

*Service risers do not have isolation valves fitted external to the building.
They have Branch Isolation Valves fitted at high level within the basement of the building. These are not readily accessible in the event of an emergency.*

Reference 37, 38, 39, 40, 41, 42, 43, 44, 45: (15.1) Existing Installation Defects

48 15.2 **New Installation Defects;** (relevant to refurbished gas service riser, work undertaken on pipework during 2017)

49 The installation in 2017 should have comprised of the following;

- Property Isolation Valves (PIV)
- Installation Isolation Valves (IIV)
- Branch Isolation Valves (BIV)

The PIV and IIV both on supply to building and should be in an accessible location for emergency access and use. BIV's are provided to facilitate sectional isolation. Line diagrams of pipework layout should also have been provided and displayed at the IIV. (relevant to new installation).

This was not the case at Grenfell Tower;

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Witness Statement

We were unable to locate Property Isolation Valve (PIV) external to the building. (There location and accessibility are to be confirmed by MPS)

Installation Isolation Valve (IIV) is fitted at high level in basement, not readily accessible in the event of an emergency.

Reference 37, 38: (15.1) Existing Installation Defects

50 **Gas Safety (Installation and Use) Regulations (GSIUR) 1998** (relevant to when
installed)

51 **Regulation 9 states:**

(1) No person shall for the first time enable gas to be supplied for use in any premises unless there is provided an appropriately sited emergency control to which there is adequate access.

(2) Any person installing an emergency control shall ensure that -

(a) any key, lever or hand-wheel of the control is securely attached to the operating spindle of the control;

(b) any such key or lever is attached so that -

(i) the key or lever is parallel to the axis of the pipe in which the control is installed when the control is in the open position; and

(ii) where the key or lever is not attached so as to move only horizontally, gas cannot pass beyond the control when the key or lever has been moved as far as possible downwards;

(c) either the means of operating the key or lever is clearly and permanently marked or a notice in permanent form is prominently displayed near such means so as to indicate when the control is open and when the control is shut; and

(d) any hand-wheel indicates the direction of opening or closing of the control. (3)

(3) Where a person installs an emergency control which is not adjacent to a primary meter, he shall immediately thereafter prominently display on or near the means of operating the control a suitably worded notice in permanent form indicating the procedure to be followed in the event of an escape of gas.

This was not the case at Grenfell Tower;

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Witness Statement

The Installation Isolation Valve (IIV) was fitted at high level within the basement and therefore not readily accessible.

There is no handle or wheel head attached for operating.

There is no line diagram displayed within the proximity of the valve.

Reference Pictures as provided by MPS

<p>New Service Riser IIV fitted high in basement</p> <p>No wheel head for operation</p> <p>No Line diagram of installation in vicinity of (IIV)</p> <p>Reference 26330009 – 0019</p>	
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Examples: Reference 37, 38: (15.1) Existing Installation Defects

52

Regulation 19 states:

(1) No person shall install any part of any installation pipework in a wall or a floor or standing of solid construction unless it is so constructed and installed as to be protected against failure caused by the movement of the wall, the floor or the standing as the case may be.

(2) No person shall install any installation pipework so as to pass through a wall or a floor or standing of solid construction (whether it contains any cavity) from one side to the other unless -

(a) any part of the pipe within such wall, floor or standing as the case may be takes the shortest practicable route; and

(b) adequate means are provided to prevent, so far as is reasonably practicable, any escape of gas from the pipework passing through the wall, floor or standing

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from entering any cavity in the wall, floor or standing.

(6) Where any installation pipework is not itself contained in a ventilated duct, no person shall install any installation pipework in any shaft, duct or void which is not adequately ventilated.

This was not the case at Grenfell Tower;

The new gas service riser pipework comprised of a 2" vertical riser with 1" and ¾" laterals malleable steel pipe, with screwed Branch Isolation Valves (BIV) either fitted to supply for a flat or plugged off. Not all flats had a gas supply connected, provision was however made for future connection. For those flats that did have a supply a mechanical joint was installed after the BIV, this being a welded flanged joint with fibre gasket.

With the exception of BIV's and flanged gasket joint all the joints were welded.

The new gas service riser pipework was not correctly sleeved or sealed throughout the property, sleeves not made good to the fabric of the building and the space between pipe and sleeve not sealed with a heat resistant mastic. This is not an issue with pipework in the same zone, however this was passing between zones, stairwell and the lift lobby areas, therefore, zones breached and fire and smoke protection impaired.

In addition, pipework was then boxed in on the stairwell with no purpose provided ventilation direct to outside air. Therefore, this became gas pipework in an unventilated void.

Reference Pictures as provided by MPS

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Witness Statement

New service riser in basement, sleeving incorrectly installed

Reference: 2633009 - 0050



New service riser in stairwell, sleeving incorrectly installed

Reference: 2627389 C1 - 0056



New service riser in stairwell, sleeving incorrectly installed

BIV's and mechanical flanged joint with fibre gasket

Reference: 2627389 C2 - 0020



Witness Statement

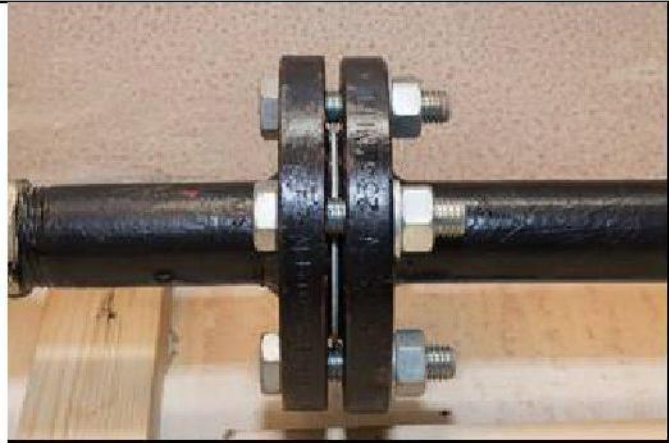
New service riser in stairwell, sleeving incorrectly installed

Reference: 2627389
C2 - 0025



New service riser in stairwell, mechanical flanged joint with fibre gasket

Reference: 2627389
C1 - 0053



New service riser in stairwell, sleeving incorrectly installed

Reference: 2627389 –
C1 - 0077



Witness Statement

New service riser in stairwell, sleeving incorrectly installed

Reference: 2627389
C2 - 0046



New service riser in stairwell, sleeving incorrectly installed

Reference: 2627389
C1 - 0076

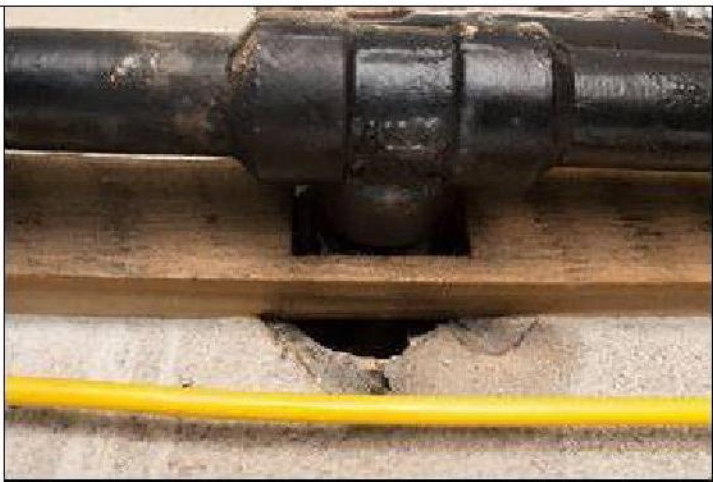


New service riser in stairwell to lift lobby, sleeving incorrectly installed

Reference: 2627389
C1 - 0070



Witness Statement

<p>New service riser in lift lobby to stairwell, sleeving incorrectly installed</p> <p>Reference: 2627389 C2 - 0053</p>	

53

Regulation 20 states:

No person shall install any installation pipework in a way which would impair the structure of a building or impair the fire resistance of any part of its structure

This was not the case at Grenfell Tower;




The new gas service riser pipework was not correctly sleeved or sealed throughout the property, sleeves were not made good to the fabric of the building and the space between pipe and sleeve not sealed with a heat resistant mastic. This is not an issue with pipework in the same zone, however this was passing between zones, stairwell and the lift lobby areas, therefore, zones breached and fire and smoke protection impaired.

Reference Pictures as provided by MPS

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<p>New service riser in stairwell to lift lobby, sleeving incorrectly installed.</p> <p>Shows route of smoke</p> <p>Reference: 2632559 - 0014</p>	
<p>New service riser in lift lobby from stairwell, sleeving incorrectly installed</p> <p>Reference: 2576173 - 0003</p>	
<p>New service riser boxing showing signs inside of scorching and smoke damage.</p> <p>Reference: 2576173 - 0057</p>	

54

Regulation 24 states:

(1) Where the service pipe to any building having two or more floors to which gas is supplied or (whether or not it has more than one floor) a floor having areas with a separate supply of gas has an internal diameter of 50 mm or more, no person shall install any incoming installation pipework supplying gas to any of those floors or areas, as the case may be,

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MET00016757_0037

Witness Statement

unless –

(a) a valve is installed in the pipe in a conspicuous and readily accessible position;
and

(b) a line diagram in permanent form is attached to the building in a readily accessible position as near as practicable to –

(i) the primary meter or where there is no primary meter, the emergency control, or
(ii) the gas storage vessel,

indicating the position of all installation pipework of internal diameter of 25 mm or more, meters, emergency controls, valves and pressure test points of the gas supply systems in the building.

This was not the case at Grenfell Tower;

A valve was not correctly located, it was not in a conspicuous and readily accessible position, with a line diagram showing the pipework layout.

Reference Pictures as provided by MPS

New Service Riser IIV
fitted high in
basement

No wheel head for
operation

No Line diagram of
installation in vicinity
of (IIV)

Reference 26330009 –
0019



55 15.2.1 TD4 Laying of Steel and Ductile Iron Gas Service Pipes Edition 4 2007
(relevant to when installed)

56 P1.5.13 Inlet Isolation Valve (IIV)

P1.5.13.1 where required by IGE/G/5, an IIV shall be located near to the point of

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entry of a service to enable that part of the building complex being fed by the service to be isolated for maintenance or safety reasons.

57 **15.2.2 IGE/G/5 Gas in Multi Occupancy Buildings 2nd Edition 2012** (relevant to when
new service and riser installed)

58 **6. Network Pipelines**

6.1.3 Any network pipeline shall be installed so as not to impair the structure or fire resistance of any part of the structure of the building, for example compartment walls, methane barriers or damp-proof course (DPC).

6.1.11 Where network pipelines are installed such that it passes through a cavity wall, solid wall or solid floor

- It shall be the shortest practicable route
- It shall be enclosed in a sleeve and not contain mechanical joints
- The annulus between pipe and sleeve shall be sealed with fire resistant, flexible material, so as to prevent passage of gas
- The annulus between sleeve and wall, and or sleeve and floor, shall be sealed so as to prevent the passage of gas, with fire resistant material.
- Allowance shall be made for normal movement of the pipe and the building

6.1.12 Network pipelines shall not be installed in an unvented void space, unless continuously contained in a gas tight metallic sleeve through the void.

6.1.15 Any network pipeline shall be installed in a position so as to allow adequate access for installation, inspection, maintenance and repair. Wherever possible, working in a confined space shall be avoided.

6.1.16 Where there is more than one network pipeline entering a common area of a building a warning notice shall be placed at each entry stating that further network pipelines into the building exist.

6.1.17 Consideration shall be given to the provision of a line diagram at each building entry / IIV, depicting the dwellings served by that particular network pipeline.

6.1.18 Consideration shall be given to labelling above ground network pipelines.

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6.3 Below-Ground Entry

6.3.1.1 Where multiple entries are unavoidable, consideration shall be given to mitigating the risks of such installations.

Note: This may include the use of positive labelling so that in the event of an emergency, all the appropriate valves are turned off.

6.4.3.3 Any common stairwell, or other protected shaft, containing a network pipeline that is itself not contained in a sealed duct ventilated directly to outside, shall be ventilated directly to outside air.

6.4.3.4 Any network pipeline incorporating a screwed or other joint capable of developing a leak (excluding a screwed joint on the inlet of an ECV that is located within an individual dwelling) shall be ventilated directly to outside air.

7.3 Pipeline Isolation Valves (PIV)

7.3.1 Where a network pipeline supplies a multi-occupancy building, a Property isolation valve (PIV) shall be installed outside the building to enable isolation of the building complex.

7.3.3 A PIV shall be protected with a valve cover and shall be permanently identified

7.3.4 The location of PIV shall permit access to it in normal circumstances.

In selecting the location of the PIV:

- It shall be sited as near as is practicable to the boundary of the property
- The effect of a building fire on its operability shall be considered
- It shall not be positioned where vehicles are likely to stop or park

7.4 Inlet Isolation Valve (IIV)

Inlet Isolation Valve (IIV) enables that part of the building complex being fed by an internal pipeline to be isolated for maintenance or safety reasons.

7.4.1 An IIV shall be located near to point of entry of a network pipeline into a multi-occupancy building.

7.4.2 Any IIV shall:

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- be clearly identified as a gas valve
- resist the efforts of any person not competent to restore gas supplies from re-opening a closed IIV
- be accessible for maintenance purposes
- not be accessible to members of the public
- normally, be located inside the building.
- Where there is low risk of vandalism or misuse, give consideration for enclosing the IIV in a gas meter box or equivalent structure.
- Where vandalism or misuse is considered a possibility, have access restricted by means of locked door or an equivalent device.
- Have permanent identification and gas escape action notices posted on or near the IIV.

7.4.3 Any IIV shall be one of the following:

- An integral valve of a building b(house) entry tee, operable only by a special key, or
- When a 90° lever action ball valve is used, it locks shut when operated, or
- Requires a security key to close and re-open, or
- When a wheel valve used, it is locked in the open position or it has the handle removed and secured away from the valve spindle.

8.3.3 An isolation valve shall be installed as close to point of entry as practicable, and in any case within 2m of the entry point

This was not the case at Grenfell Tower;

Unable to locate Property Isolation Valve (PIV) external to the building. (Its location and accessibility are to be confirmed by MPS)

Installation Isolation Valve (IIV) is fitted at high level in basement, not readily accessible in the event of an emergency, no handle or wheel head available to isolate in the event of safety issues.

There were no notices indicating that there is more than one service to the building, in addition there were no line diagrams to show the pipework layout within the building.

The new gas service riser pipework was not correctly sleeved or sealed

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throughout the property, sleeves not made good to the fabric of the building and the space between pipe and sleeve not sealed with a heat resistant mastic. This is not an issue with pipework in the same zone, however this was passing between zones, stairwell and the lift lobby areas, therefore, zones breached.

Gas service pipework and risers were contained within unventilated voids / ducts, these also incorporated mechanical joints, flanges with fibre gaskets.

59 16 MPS commissioned question:

(c) Whether there was a significant release of gas from any part of the gas supply (excluding destruction of appliances causing gas release at pipe termination)? (reference section 60)

60 As a result of the fire there could have been a significant release of gas into the building. This would have been attributable to not being able to isolate the gas supplies to the building.

If gas fittings, pipework and regulators had been subjected to flames and heat, then this could have caused a significant release of gas.

- The fire and heat caused the steel gas riser pipework to rupture in Flat 5, floor 14, if gas supply was still live to the building when this occurred then there would have been a significant release of gas.
- 18 flats were found to have regulators that had melted due to fire and heat, if the gas supply was still live to the building when this occurred then there would have been a significant release of gas.

It is not possible to state at exactly what time the regulators melted or the pipework ruptured but what can be stated is that live gas would have been escaping from these breaches of pipework integrity until the gas supplies to Grenfell Tower were isolated.

It was verbally reported by MPS that "flames went down after the gas was isolated" which shows that natural gas was escaping from the pipework breaches and that this gas had been ignited by the fire, thus providing an ongoing source of combustion fuel.

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Witness Statement

Based on the following:

- (a) an average supply pressure of 24 mbar, - taken from the average pressure over the 24 hours before the fire. (Appendix 4. 2-3-18 Cadent Records of gas pressures - Latimer Road Notting Hill Day Prev).
- (b) gas escaping through eighteen 1inch breaches in the case of the melted regulators.
- (c) gas escaping through a 1 ¼inch breach in the case of the ruptured pipe.

It is estimated that the release of gas from the pipework and regulators could have been as much as 223m³/h of gas.

This would equate, based on a consumption rate of 2.5m³/h for an average domestic boiler, to the volume of gas to simultaneously run 89(no) domestic gas boilers being released into the Tower until the supplies were isolated.

61 17 Discussion

62 During my investigation, Officers of the Metropolitan Police verbally confirmed events that had occurred during this incident.

They reported that National Grid (Cadent) had attempted to turn off the gas to the Tower, but, were prevented from turning the Property Isolation Valves (PIV's) by falling debris, due to their proximity to the building.

A request was made by the Metropolitan Police to Cadent to identify where these valves are located, at the time of producing this report that information has not been received.

It was also reported that National Grid (Cadent) had attempted to turn off installation Isolation Valves (IIV's) located in the basement of the Tower. This was not possible due to water levels and live electrical supplies within the basement. All but one of the IIV's were located at high level and would have required ladders or scaffolding to access. The only accessible valve was that for the heating and hot water boilers within the basement.

It was verbally reported by MPS, that the flames within the Tower visibly reduced when the gas mains at Station Walk were confirmed as having been turned off, at

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23:40hrs on the 14/6/2018.


From statistical analysis of the defects and faults as found during the inspection of Grenfell Tower, the following situations if effective before gas was shut off, would have resulted in gas escaping and fuelled the fire.

Gas Service Risers and Flats;

- (a) 1 installation was identified as having a ruptured gas riser.
- (b) 26 installations were found with emergency control valve (ECV) in the ON or partially ON position with an open pipe end.
- (c) 18 of above installations in (b) identified with melted or holed regulators
- (d) 8 others found with ECV, meter or regulator removed

See Appendix 5. 2-3-18 General Gas Safety Defects Data

Reference Pictures as provided by MPS

<p>(a) Gas Service Riser ruptured at joint</p> <p>Reference 2633537 – 0047</p>	
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Witness Statement

(b) Emergency control valve (ECV) in the ON or partially ON position with an open end

Reference: 2633562 – 0017



(c) Installation with melted Regulator, melted on meter

Reference: 2633562 – 0072



(d) ECV with open end

Reference: 2633562 – 0074



Throughout the building there are further examples of the above.

A request was made by to the Metropolitan Police to provide any 'Risk

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Assessments' undertaken by Cadent or the property owners that may have been undertaken to demonstrate having assessed any risks and the controls need to manage those risks.

This is a requirement of Dangerous Substance and Explosive Atmosphere Regulations (DSEAR) 2002. This requires the completion of a risk assessment, under Regulation 5 of DSEAR to carry out a risk assessment lies with the employer, that is the undertaking that owns the Building.

Or in the case of networks to buildings, up to the outlet of the Emergency Control Valve, this is the responsibility of the gas transporter e.g. Cadent, Southern Gas Networks etc. This part of the gas installation is covered by The Pipeline Safety Regulations 1996 which is the primary legislation and The Gas Safety (Management) Regulations 1996.

At the time of producing this report evidence was not provided of any suitable and sufficient Risk Assessments undertaken on the gas supplies to Grenfell Tower, or the gas services within the property. Therefore, we are unable to comment on their accuracy and suitability.

63 18 Conclusion

In the opinion of the author of this report, the cause of the fire was not Gas. However, due to the inability to isolate the gas supplies it exacerbated the fires' duration.

The lack of information and the location of Property and Installation Isolation Valves (PIV & IIV) prevented the quick and safe isolation of the gas supplies to Grenfell Tower.

Evidence was not provided of any suitable and sufficient Risk Assessments undertaken on the gas supplies to the Tower, or the gas services within the property. Therefore, we are unable to comment on their accuracy and suitability. If these risk assessments had been completed, then the defects highlighted within this report could have been identified and rectified.

It is my opinion that if the original and newer gas installations had adhered to the

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regulations and standards relevant to the time of installation, this would have lessened the impact and duration of the fire.

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