



LUSAIL DEVELOPMENT

Gas System Building Internal Gas Piping Design and Installation Guidelines

Document No.: LUS-CPALL-MAQ-SPE-UT-30007

REV. NO	REASON FOR ISSUE	ISSUED DATE	DOCUMENT HISTORY	STATUS	PREPARED BY	CHECKED BY	APPROVED BY
0	IFR	14-April-2013		PFC	Muhamad Kamal Yaacob	Abdullah Abushaikha	D. Reed Phillips
1	IFR	08-September-2014		PFC	Muhamad Kamal Yaacob, Ali Hashim	Vinod K. Kesavannair	D. Reed Phillips
2	IFI	28-April-2015	<i>Note is added: This guideline is subject to change or to be superseded by Civil Defense at any time without notice</i>	PFC	Muhamad Kamal Yaacob	Vinod K. Kesavannair	D. Reed Phillips

REASON FOR ISSUE:

IFR	Issued for Review/Comment(s)
IFI	Issued for Information
IFA	Issued for Approval
IFT	Issued for Tender
IFC	Issued for Construction

STATUS

PFC	Preliminary for Comment
SS	Superseded
A	Approved

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1 INTRODUCTION

The objective of this Building Internal Gas Piping Design and Installation Guidelines is to define and implement a standard and identical design and installation approach for the SNG, NG and LPG Gas System that to be interface between Lusail City Gas Network Distribution System and Gas Utilization Systems (Building Internal Piping). This design and installation guideline is not to be used to override any other international standard in use currently. The purpose of this document is also to provide a clear direction to have safe and prudent gas piping installation.

Note: This guideline is subject to change or to be superseded by Qatar Civil Defense at any time without notice

2 SCOPE

This guideline shall be utilized by Plot Developers for the Gas Utilization System design downstream of the Gas Distribution System.

The work and responsibility of the installation designer and Plot Developers begins at the point of delivery service isolation valve and continues up to and including all installation pipework and gas consuming equipment.

Initially the system will operate using SNG provided via Gas Farm facilities that will blend the LPG with air to produce Synthetic Natural Gas in proportions that match the same Wobbe index of Natural Gas. It is anticipate that at a later stage the SNG fuel supply may be replaced with Natural Gas (NG) supplies as they become available. For this reason the design shall incorporate measures for the use of both LPG and NG downstream of the Gas Farm facilities.

The physical demarcation between the Gas Service Provider and Plot Developers design and build responsibilities are shown in Appendix E and further detailed in these guidelines which consist of Building Internal Gas Piping system.

Others reference for Plot developer shall be as follows:-

- Design Guidelines for Mega-development and Sub-development Gas Distribution System to be referred to LUS-CPALL-MAQ-SPE-UT-0005
- Guidelines for Pressure Reducing Station (Primary Customer Meter) to be referred to LUS-CPALL-MAQ-SPE-UT-0006

3 DEFINITIONS

The document use the terms “should”, “shall” and “must” as follows:

- a) The term “should” identifies a requirement which, it is intended, will be complied with unless, after prior consideration by a competent person, deviation is considered to be acceptable
- b) The term “shall” identifies a requirement which, it is intended, will be complied with in full and without deviation.
- c) The term “must” identifies a requirement by law.

Other definitions applied within this document are provided below:

Consumer - Any person, agency or authority to whom gas is delivered either directly or indirectly.

Consumer (Secondary) Meter Installation - The gas utilization equipment that measures the volume of gas delivered to a consumer.

Customer - a property owner or any person, agency or authority operating under his consent to whom Gas Service Provider sells gas.

Customer (Primary) Meter Installation – Pressure Reducing and Metering Station (PRMS) - A gas utilization facility that measures the volume of gas delivered to a customer. A customer primary meter installation may also filter the gas and/or reduce the pressure of gas to the customer's delivery pressure.

Delivery Pressure - The pressure at which gas is to be delivered to a customer at the inlet to the utilization pipework.

Design Criteria - Design Criteria are established, but usually unquantifiable, inputs that shall be applied in the design process.

Design Parameters - Design Parameters are quantifiable inputs that shall be used in completing a design.

Distribution Main (MOP up to 4 bar) - A gas distribution facility consisting of pipe and other components, used for gas distribution at operating pressures ≤ 4 bar.

Distribution Network - Interconnected group of pipes that are part of the Gas Distribution System.

Distribution Pipeline - (MOP) less than or equal but exceeding 4 bar. A gas distribution facilities consisting of PE and/or steel pipes and other components.

Diversified Load The ratio of the maximum potential demand, typically hourly, to the maximum actual demand.

Dropper Pipework that is part of the Gas Utilization System. The flow of gas through a dropper is vertically downward.

Emergency Control Valve (ECV) A valve that is part of the Gas Distribution System. An ECV is utilized in an emergency to shut off the supply of gas and shall also be deemed to be the customer meter control valve immediately prior to the inlet of the Customer Primary Meter Installation.

Emergency Isolation Valve (EIV) A valve that is part of a Gas Utilization System. An EIV is to be used to isolate a section of pipework such as a lateral or an entire area of a building.

Gas Distribution System A network consisting of pressure regulating stations, distribution pipelines, distribution mains and gas services that distributes gas from the Tank Farm supply system to the Gas Utilization Systems.

Gas Leak Detector gas leak detector is to provide a means for safely detecting any malfunction of a pressurized gas system in order to prevent accumulation of combustible gases so that damage or explosion due to such an accumulation of gases is prevented.

Gas Quality The chemical composition of the gas supplied to the gas distribution system.

Gas Service A gas distribution facility consisting of pipe and other components. A service may be comprised of either steel and/or PE materials. It transports gas between a Distribution Main and a Customer Primary Meter Installation. Gas Services may consist of both below and above ground components.

Gas Service Provider (GSP) the company appointed by LREDC having the authority to supply gas to

customers in Lusail City.

Gas System The combined gas supply system, Gas Farm, Gas Distribution System and Gas Utilization Systems that process, transport, measure, distribute and deliver gas for consumption.

Customer Internal Piping is a Gas Utilization (Building Internal Piping) small network consisting of Customer Primary Meter Installations, installation pipework and utilization equipment that carry gas from the Gas Distribution System to the utilization equipment for consumption.

Maximum Incidental Pressure (MIP) The maximum pressure to which the system may be subjected under abnormal conditions.

Maximum Operating Pressure (MOP) The maximum pressure to which the system may be subjected under normal conditions.

Overpressure Shut Off valve (OPSO) senses the pressure downstream of the regulator but isolates the line pressure of the regulator should the pressure exceed a set value.

Plot A finite amount of property/land used for commercial or residential purposes. Plots may belong to or be controlled by a specific individual, entity or authority. Plots may be vacant areas but may also be occupied by buildings, facilities or equipment. Buildings are typically located fully within plots but in some circumstances do extend beyond plot boundaries.

Polyethylene (PE) for the purpose of these guidelines means PE100 SDR 11.

Primary Pressure Regulating Station (PPRS) A facility that regulates the pressure of gas received from a Transmission pipeline prior to the gas entering the Gas Distribution System. Depending on the distribution network configuration, a PPRS may be connected to a Distribution Pipeline or Distribution Main.

Gas Riser - Pipework that is part of either a Gas Service or the Gas Utilization System. The flow of gas through a riser is vertically upward.

Secondary Pressure Regulating Station (SPRS) A facility that regulates the pressure of gas received from a Primary Pressure Regulating Station (PPRS) prior to the gas entering a Distribution Main.

Second Stage Regulator is a regulator to be use in the house or apartment after the Customer Primary Meter installation or building Pressure Reducing Metering & Station (PRMS) to reduce the gas pressure from 75mbar or 350 mbar to 21mbar for SNG and NG or 37 mbar for LPG in the house. The second stage regulator must be use incorporated with under pressure shutoff device.

Solenoid valve is an electromechanical device used for controlling gas flow by turning on or off the valve and normally connected to Gas Leak Detector, and Emergency switch. Solenoid valve is considered as part of safety system.

Synthetic Natural Gas (SNG) A blended of LPG and air to produce a fuel gas mixture with Wobbe index similar to those of natural gas.

Under Pressure Shut Off valve (UPSO) shuts off the gas flow should the inlet working pressure be interrupted or a malfunction cause the regulator to fully open (low pressure). The UPSO will also operate if the maximum capacity is exceeded.

4 COMPETENCY LEVEL

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5 DESIGN PRINCIPLES

The key design principles that shall be adhered to are:

- In all matters, the overriding goal designing and installing the utilization network is safety.
- Adoption of the best international practices utilizing appropriate modern technology.
- Ensure that gas piping system installed in Lusail City is identical for ease of operation & maintenance and avoiding any complicated installation.
- Assurance of a safe, reliable, effective, efficient and secure of gas supply system install in all building premises in Lusail City.

6 DESIGN CRITERIA

- Provision shall be made to incorporate means of controlling the gas flow within the building gas piping system including isolation of damaged facilities or components.
- The gas supply source pressure considered in the design shall be determined based on the upstream design conditions.
- System shall be designed to supply a forecast hourly peak demand
- The load that shall be applied during design shall be diversified. Considerations in determining the load diversity shall include the nature of the facility being designed, the type of load and the number of consumers.
- Designs shall minimize the types and size range of materials and use only material items for which approved Material Specifications exist.
- All materials shall be suitable for local climatic conditions.
- All materials, assemblies and installations shall ensure correct functionality and full operability taking into accounts the ambient conditions of the location.
- All piping and fittings as well as other components and accessories shall be suitable for both LPG and NG usage.
- All gas shafts within a building preferred to be dedicated for gas with a minimum size suitable for accessing the shaft for maintenance purposes.
- Gas pipes may run in the same shaft as most other services, including hot and cold water services, electrical conduits, and pipes containing other fuels. However, there are some restrictions when gas pipework is routed in combination with other services, such as services containing oxidizing or corrosive fluids.
- All gas shafts must be open to sky, and have permanent access at each floor of the building.

Due to the possible future conversion from LPG to NG the following parameters shall be considered during the design;

- Designs shall ensure specific considerations are taken to accommodate the significant difference in specific gravity of LPG in SNG and future NG supplies; the value of 0.64 (relative to air) shall be assumed for NG.
- Selection of gas appliances shall be in accordance with BS 3156-11.0.2 and ISO13686:1998 Specification for Family 2 Type Gases and should be fitted with flame failure protection devices.

7 DESIGN PARAMETERS

The following design parameters have been adopted:

7.1 Local Environmental Conditions

Site conditions must be assumed to be as follows:

- Maximum Ambient Temperature; 55°C

- Minimum Ambient Temperature; 1°C
- Design Ambient Temperature; 55°C
- Max. Metal Temperature under Sun; 85°C
- Min Barometric Pressure; 998 Mbar
- Average Barometric Pressure; 1015 Mbar
- Max. Ambient Humidity; 100%
- Min Ambient Humidity; 20%
- Design Ambient Humidity; 100%
- Design Wind Velocity; 160km/Hr
- Yearly Rainfall; 80-150mm
- Seismic Co-Efficient; 0.07g

8 DESIGN STANDARDS AND REGULATIONS

All designs must comply with Qatar laws and regulations in addition to relevant national and international standards relating to design of Gas Utilization Systems, in so far as they apply to the work including;

Relevant International Standards such as;

1. ASME - American Society of Mechanical Engineers.
2. ASTM - American Society for Testing and Materials.
3. Institute of Gas Engineers and Managers (IGEM).
4. National Fire Protection Association (NFPA).
5. American Gas Association (AGA).
6. ANSI - American National Standards Institute.
7. BS - British Standards
8. EN – European Standards.
9. ISO - International Standardization Organization

Main Codes and Standards reference for Gas Piping Design and Installation

8.1 Design Standards

1. IGE/G/5 – Gas in flats and other multi dwelling buildings.
2. IGEM/UP/2 – installation pipework on industrial and commercial premises.
3. IGE/GM/8 Part 1 Meter Installations I & C – Design, MOP ≤ 38 bar.
4. IGE/GM/8 Part 2 Meter Installations I & C – Location and Housing, MOP ≤ 38 bar.

5. IGE/TD/4 – Gas Services.
6. BS EN 6400 –Specification for installation, exchange, relocation and removal of gas meters with a maximum capacity not exceeding 6 m³/h Medium pressure (2nd family gases)
 - Part 1: Low pressure (2nd family gases)
 - Part 2: Medium pressure (2nd family gases)
 - Part 3: Low and medium pressure (3rd family gases).
7. BS 6891 – Specification for installation of low pressure gas pipework of up to 28 mm (R1) in domestic premises (2nd family gas).
8. NFPA 58 - Liquefied Petroleum Gas Code
9. NFPA 54 - National Fuel Gas Code

9 PIPING MATERIAL

Pipe fittings and component shall be designed and installed in accordance with relevant standards.

Material shall have the physical properties suitable to the proposed duty considering all surrounding forces, operating temperature and pressure.

Steel pipe

Carbon steel or wrought iron pipe shall be at least of Schedule 40 Grade B, and shall comply with the following standard.

1. ASME B36.10 M
2. ASTM A106
3. API 5 L
4. ASTM A53 M, black steel
5. BS EN 10208, BS EN 10216, BS EN 10217 – 1, BS EN 10255

Copper

Copper tube install in the building (inside kitchen only) shall be rigid type.

Annealed-Temper or Drawn-Temper Copper Tube shall comply with ASTM B 88, Type K (ASTM B 88M, Type A) / ASTM B 88, Type L (ASTM B 88M, Type B) /ASTM B 837, Type G.

Copper Fittings shall be to ASME B16.22, wrought copper and streamlined pattern.

Copper Pipe to BS EN 1057 shall be also be used and the maximum diameter shall be limited to 108 mm.

Fittings shall be in compliance to:

- BS 2051-1
- BS EN1254

Fittings shall be protected from mechanical damage

Polyethylene

Pipe shall be to BS EN 1555-1 and -2

PE pipe shall be for buried used only.

PE pipe must not be used within building, for entry or exit it shall be sleeved with special requirement.

Gas hose

Gas hose connection to the kitchen Equipment shall comply with BS 3212 or BS EN 1762 or equivalent.

Gas hose connection to kitchen equipment and excess flow valve must use female or male NPT threaded coupler.

The hose mechanical coupler shall be of factory manufactured fitting.

Hose shall have marking and steel braided is preferable.

Second stage regulator

It must reduce the pressure to 21mbar for SNG or NG and 37mbar for LPG

It must be incorporated with under pressure shutoff device (UPSO).

Regulator vent shall be piped to outdoor atmosphere.

Solenoid valve

Solenoid valve must be explosion proof type and suitable to be used for fuel gas.

Gas leak detector

The primary objective of the gas leak detector is to provide a means for safely detecting any malfunction of a pressurized gas system in order to prevent accumulation of combustible gases so that damage or explosion due to such an accumulation of gases is prevented.

The gas leak detector must be calibrated to the type of gas to be detected.

Installation shall be as per manufacturer recommendation.

The kitchen domestic gas detector shutoff switch shall be located outside the kitchen area (near to kitchen entry).

The pipe in pipe, PRMS, Gas shafts gas detector must be explosion proof type.

10 PIPE SIZING

Pipework should be sized so that the pressure at the appliance input is safe and compatible with optimum operation as per the manufacturer's instructions.

11 CUSTOMER PRIMARY METER

Customer meter design and installation shall be referred to LUS-CPALL-MAQ-SPE-UT-0006.

12 JOINTING

All joint shall be as per codes, standard and manufacturer requirements and recommendation.

Ream ends of pipes and tubes and remove burrs.

Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

Threaded Joints:

- Thread pipe with tapered pipe threads complying with ASME B1.20.1.
- Cut threads full and clean using sharp dies.
- Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
- Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
- Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

Welded Joints:

All welding of metallic piping shall be in accordance with ASME Boiler and Pressure Vessel Code, Section IX or API1104, using qualified processes and welding operators.

All welding end preparation shall be in accordance with ANSI B16.25

All joints to be welded unless otherwise required example the connection to threaded valves or pressure gauge.

Steel pipe fitting shall be in accordance to ANSI ASME B16.9

Welded pipe joint shall be tested with Non Destructive Test, X –ray, Dye Penetration Test, Magnetic particle Test or Ultra Sound Test. See Section 18.

Brazed Joints:

Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube".

Brazing Filler Metals: Alloy with melting point greater than 540 Degree Celsius complying with AWS A5.8/A5.8M.

Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

Flanged Joints:

Flanged joint shall be to ASME B16.5

Install gasket material, size, type, and thickness appropriate for natural- gas service. Install gasket concentrically positioned.

Flared Joints:

Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not over-tighten.

PE Piping Heat-Fusion Joints:

Pipe fittings shall be clean and dry joining surfaces by wiping with clean cloth or paper towels. Join shall be according to ASTM D 2657.

Plain-End Pipe and Fittings: Use butt fusion.

Plain-End Pipe and Socket Fittings: Use socket fusion.

13 BUILDING INSTALLATION PIPEWORK

13.1 General

Designer shall ensure the gas pipes service to the plot is accurate.

Customer Installation Pipework extends from the outlet valve of the Pressure Reducing & Metering Station (Customer Primary Meter) to the consumer appliances.

At the initial stages of building design and planning the Designer/Installer needs to ensure that the Customer Internal Piping connected to the meter outlet valve are adequately designed in order to provide a safe supply of gas to the point of use.

Residential and unit apartment pipe work in the kitchen shall be installed with shutoff valve, solenoid valve, low pressure regulator with under pressure shut off (UPSO), auto-shutoff valve, gas meter, Emergency switch, and domestic gas leak detection system as minimum.

Gas regulator in the building shall be able to be operated with 75mbar incoming pressure from the main Pressure Reducing and Metering Station.

13.2 Residential - Villas

Where the customer meter installation is located at the boundary wall downstream piping should be extended to the villa below ground using PE pipe (with GRP sleeve) or above ground using Steel, PEX (with GRP sleeve). The belowground pipe work shall not run in villa or conceal in cement. Below ground pipework shall be in accordance with IGE/TD/4 – Gas Services.

- Pipework operating pressure shall depend on load and distance between Customer Primary Meter Installation and point of entry to a building but shall not exceed 75 mbar.
- Maximum pipework operating pressure within the building should be 21mbar.
- Where the external installation pipework operates in excess of 21 mbar, secondary pressure regulation should be installed prior to or immediately after pipework entry into a building. Secondary pressure regulator installations shall incorporate UPSO and OPSO capabilities. Gas regulator shall be vented to outdoor air.
- An OPSO device installed inside a building which is fitted with relief mechanisms shall ensure that the gas is vented directly to the outside atmosphere.
- Pressure loss calculations and friction factor shall be in accordance with the relevant standard. Equivalent lengths of valves and fittings shall be added to the pipe length.
- An isolation valve shall be installed and should be inside the building as close as practicable and within 2m of the point of entry of the pipework into the building.
- The Building Internal Piping shall be designed to deliver at least the minimum operating pressure of all connected appliances.
- LPG related safety equipment (i.e. solenoid valve, combustible gas detector, and separate low pressure shut off) shall be installed to monitor leakage and isolate the gas supply.
- Natural Gas provisions shall be considered during design stage.

13.3 Residential And Residential/Commercial Multi-Story Buildings

- Pressure from the Gas Distribution System at the outlet of the Pressure Reducing & Metering Station should not exceed 75 mbar.
- Pressures from the Gas Distribution System at the outlet valve of the Pressure Reducing & Metering Station in excess of 75 mbar shall be in consultation on an individual basis with the Gas Service Provider and only in cases where;
 - Riser pipework is external to the building and secondary pressure regulation is deployed to ensure pressures within the building do not exceeding 75 mbar.
 - Commercial supplies require pressures in excess of 75 mbar.
- Diversity should be taken into account when determining pipe sizes.
- Pressure loss calculations and friction factor shall be in accordance with the above relevant standard. Equivalent lengths of valves and fittings shall be added to the pipe length.

- Expansion joints and flexible connections shall be considered to avoid unacceptable stresses being inflicted on any steel riser, dropper or lateral pipework.
- Riser, dropper and lateral pipework should be a minimum of 400mm away from any electrical line and a minimum 150mm away from any electrical instrument
- Pipework shall be supported adequately along its entire length
- Threaded steel pipework $\leq 2"$ shall be of schedule 80 and $> 2"$ schedule 40
- Provision of gas sensors in all confined space where the gas pipe is passing through, for example in areas within false ceiling of the kitchen and corridor etc. as well as void spaces which are confined or any pipe in pipe systems.
- Pipework above ceilings or in voids shall have pipe in pipe arrangements and gas detection equipment linked to a safety shut off devices capable of monitoring and shutting off the pipework supplying that area.

13.4 Risers

- Risers should be installed external to the building or in a duct or shaft designed in accordance with IGEM/G/5 and the additional requirements for LPG pipework in ducts/shafts. Refer to Appendix A to F.
- External risers may be operated at a higher pressure (e.g. 350mbar) than droppers, secondary regulators shall be required to provide a lower pressure to droppers i.e. 75mbar. Gas regulator shall be vented to outdoor air.
- Risers may be extended to form a rooftop distribution manifold fitted with isolation valve at the top of each dropper. All riser and dropper shall be provided with $\frac{1}{4}"$ valve with plug for ease of purging and commissioning the pipeline.

13.5 Ducts and Shafts

Ducts or shafts used to convey gas pipework in buildings shall be dedicated for gas, and incorporating the following requirements into the design;

- Ventilated by means of both an open to sky and base level opening that will direct any leakage to outside the building.
- Sealed from the building such that gas leakage into any duct shall not be able to enter any part of the building other than the duct/shaft.
- Fitted with sealable access panels to enable operation and maintenance activities to be undertaken.
- Fitted with a gas detection system at suitable locations.
- Provision must be made for safe and adequate access for inspection of any riser, valve, lateral, meter and other gas equipment.

13.6 Pipe in Pipe Systems

- Pipe in pipe systems shall be used to prevent gas leakage entering a building in the exceptional cases where it is necessary for the gas pipe to run above false ceiling inside kitchens.
- The system can be connected to the duct /shaft system described above to provide the ventilation requirements to outside but shall be adequately sealed to ensure any gas leakage shall not enter the kitchen.
- Pipe sleeve material shall be of similar type of the annular/carrier pipe with proper spacing between the annular and sleeve pipes.
- Pipe sleeve shall be vented to outdoor atmosphere air.

13.7 Gas detection and safety shut off Equipment

- Gas detection equipment shall be installed in pipe in pipe systems, PRMS, gas shafts, kitchens, and any other areas where there is a potential for gas release inside the building.
- The gas detectors should be installed at regular intervals and connected to safety shut off devices that are strategically placed to isolate the section of pipework that the gas detector is monitoring.
- To avoid isolating areas not affected by fault conditions, consideration should be applied to zoning gas detection and safety shut off systems.
- Combustible gas detector linked to a solenoid valve and separate low pressure shut off shall be installed in areas where appliances are connected to monitor leakage and isolate the gas supply to that particular area.
- Location of gas detector for LPG/SNG should be at low level 300mm from floor level
- Location of gas detector for NG should be at high level 150mm from false ceiling level, provision for the same should be incorporated into the design.
- PRMS, shaft and gas detector must be explosion proof type.
- Gas detection equipment should be positioned per manufacturers' instructions.

13.8 Installation Pipework

- Installation pipework in buildings, downstream of any regulator operating at a maximum of 21 mbar could be carbon steel or copper. Maximum allowable copper length is only 2 meter.
- Maximum pipework operating pressure within individual residential units is 21 mbar.

13.9 Secondary Pressure Regulation and Isolation Valve

- Where the external installation pipework operates in excess of 21 mbar, secondary pressure regulation should be installed prior to or immediately after pipework entry into a building. Where a secondary regulator is installed inside a building, it shall be installed within 2m of the entry point. Secondary pressure regulator installations shall incorporate UPSO and OPSO capabilities.
- An isolation valve is required for each consumer unit. The isolation valve shall be installed inside the building as close as practicable and within 2m of the point of entry of the pipework into the building.
- Where a secondary pressure regulator is installed for the consumer unit the isolation valve shall be upstream of the regulator.

13.10 Gas meter in high rise building

- A meter installation shall be located in a cupboard or compartment, designed for the purpose and ventilated to outdoor atmosphere.
- All meters should be located in well-ventilated areas and be easily accessible to allow them to be read, maintained and isolated when necessary.
- Meters must not be exposed to extreme temperatures, excessive humidity, vibration, corrosive substances, accidental damage, or ignition sources.
- Gas meter installed in individual apartment shall be located in individual compartment designed for the purpose.
- Gas meter installed in high rise building (multi dwelling building) shall have smart metering capability that should include for billing, monitoring and controlling. Gas smart meter reading facilities shall be able to be connected using TCP/IP communication protocol to Lusail City main control center.
- Gas meter shall be installed at minimum 3 meter away from any building opening and source of ignition, and not installed above basement.

13.11 Pipe support and hangers

Pipework can be subject to movement from thermal expansion, thermal contraction, structural movement of the building, vibration and rotation or torsion.

- Pipework support should allow for pipe movement without damage being caused to corrosion protection or pipework installation.
- When supporting pipework on a horizontal or near horizontal surface, the support brackets should ensure that the pipework remains clear of the surface.
- The support brackets and screws should be of corrosion resistant materials.
- Ferrous materials e.g. screws and support brackets should not be in contact with copper piping.

14 SMALL COMMERCIAL INSTALLATIONS

- Meter installation should connect into the Customer Internal Pipework as close as possible to the entry point to the building.
- Isolation valves are required immediately downstream of the point of entry into any building.
- An isolation valve shall be installed in the pipework immediately after passing through interior partition walls and shall be clearly tagged as such.
- Secondary pressure regulator installations installed within Customer Installation
- Pipework shall incorporate UPSO and OPSO capabilities.
- Pipework should be Carbon Steel Schedule 40 Grade B.
- The maximum allowable pressure drop is 10% of the delivery pressure.
- Diversity should not apply to the design of commercial piping systems
- Pressure loss calculations and friction factors shall be in accordance with IGE/UP/2.
- Equivalent lengths of valves and fittings will be added to the pipe length.
- LPG related safety equipment (i.e. solenoid valve, combustible gas detector, and separate low pressure shut off) shall be installed to monitor leakage and isolate the gas supply.

15 MEDIUM/LARGE COMMERCIAL

- Medium and large commercial premises shall be treated on an individual basis.
- Meter installation should be located at or near the property boundary and any downstream piping shall be extended below ground in PE and/or steel pipe to the point(s) of entry into building.
- All above ground Customer Internal Piping should be welded steel.
- Delivery pressures shall depend on the requirements of the equipment.
- Delivery pressures in excess of 75mbar should be considered on an individual basis.

Regulator installations within installation pipework shall incorporate UPSO and OPSO capabilities.

- Pressure loss calculations and friction factors shall be in accordance with IGE/UP/2.
- Equivalent lengths of valves and fittings shall be added to the pipe length.
- Suitable isolation valves shall be installed in appropriate locations in the pipework downstream of the Customer (Primary) Meter Installation and shall be clearly tagged as such.
- Where the gas installation has multiple branches an isolation valve shall be installed on each branch.

16 PAINTING AND COLOR CODES

16.1 General

The steel piping shall be protected from corrosion and to be provided with piping color for ease of identification of the pipelines and their content. Pipeline color coding shall follow to

international acceptable standard.

Copper piping shall be marked with yellow color band around the pipes internal every 2 meter.

16.2 Technical Details

- The material surface to be painted shall be cleaned from any welding slag, dust, grease or debris.
- Various methods of surface preparation can be adopted e.g. degreasing, high pressure fresh water hosing, hand tool cleaning, power tool cleaning, blast cleaning etc.
- Paint shall be in 3 layer coating system as given below:-
 - Primer coating shall be 85% metallic zinc by weight, grey colour, matte finish
 - Intermediate coating shall be Polyamide Epoxy, matte finish
 - Finish coating shall be polyurethane, golden yellow, high gloss finish.
- Procedure for painting shall be submitted to Marafeq for approval.
- Color coding for SNG, LPG and NG steel piping shall be Golden Yellow color RAL 1007
- Material surface to be painted shall be dry
- Paint shall be fully cured before another layer to be applied.
- Paint application shall follow manufacturer specification or procedure.

16.3 Pipe Marking

- Pipe shall be provided with arrow marking direction of the gas.
- Arrow marking shall be black with word "GAS".
- Copper piping can be marked with yellow color band around the pipes internal every 2 meter.
- All supply pipework in a multiple meter installation should be clearly marked to indicate the premise number, floor number and/or section of building being supplied.
- The marking of pipework is essential for correct meter recording, safe operation, maintenance and accurate billing of gas consumed.

17 RISK ASSESSMENT

The requirements of Risk Assessment are based on reducing risks "As Low as Reasonably Practicable. Where there are established or standards design, this requirement can be met by the application of standards and best practice. Where there are not, as with all multi-occupancy

buildings, a risk assessment approach is required in addition to demonstrate the necessary risk reduction.

A generic consideration of the hazards and risks from different supply options leads to a number of general principles:

- Gas supplies should be as far as possible sited out of doors.
- Gas supplies should be sited in well-ventilated area
- Gas supplies should be excluded from poorly ventilated or strongly confined spaces such as basements and cellars.
- Apparatus should be sited to avoid accidental damage or interference with the supply wherever possible.
- Consideration shall be given to the location of the supply with respect to the ability of the structure to withstand the consequence of an ignition in the event of a gas escape.

18 TESTING

- Any installation shall be subject to pneumatic strength test and tightness tests. Testing shall be carried out prior to application of paint or other protective coatings and before the installation is put into service.
- The Contractor shall submit the Testing & Commissioning procedures and shall be approved by Marafeq. The submission shall be made at least one month before the commencement of Testing & Commissioning.
- Before carrying out any test, the Contractor shall ensure that the installation fully complies with the relevant statutory obligations and regulations.
- Upon completion of such Testing, the Contractor shall complete and sign a testing certificate to the effect that agreed Testing procedures have been duly carried out.
- The installation shall generally comply with the requirements of the Local Authority requirement and codes of practices.
- Meters, regulators and associate equipment shall not be subjected to on site pneumatic or test. It shall be tested by manufacturer in factory.
- Minimum 10% (or as per authority requirement) x-ray to be applied to building steel pipe installation to ensure the welding quality is met according to welding procedure. The installation shall use API 1104 or ASME IX as welding standard and guidelines.
- Items to be buried underground shall be inspected and tested before protective finishing is applied and the finished work is buried. The Contractor shall arrange Gas Authority to inspect and witness the tests including pressure test and "Holiday test" for the underground pipeline prior to cover up/back-filling.

18.1 Pressure and Leak Test

- After the completion of internal gas piping installation, it shall be subjected to pneumatic pressure test.
- The Pressure Test shall be witnessed by Local Authority, or Marafiq Qatar together with customer. The Contractor is required to liaise with Local Authority on the arrangement and should advise Marafiq Qatar the parties involve accordingly.
- In accordance with the standard requirement, installer /contractor is requested to conduct pressure test the piping installation not less than 1.5 times maximum operating pressure for not less than one hour depending on the volume of gas pipe to be tested.
- Marafiq will reserve the right not to connect / gasify the building internal piping if the testing result is not satisfactory.
- Marafiq will commission the gas facilities with LPG, Synthetic Natural Gas or Natural Gas only after customer/contractor obtaining No Objection Certificate (NOC) from Authority on the internal piping installation.

18.2 Safety

The test procedure should not jeopardize the safety of persons or property. All testing operations should comply with the following:

- i) The task should be performed by competent persons;
- ii) The person responsible for the test should ascertain the extent of the pipework to be tested;
- iii) The person responsible for the test should be present during pressurising and depressurising the pipework;
- iv) The test should be carried out in site and where possible all joints should be easily accessible and free from covering; Open ends of pipework and valve outlets should be sealed with an appropriate fitting.
- v) Any appliances or other components considered not capable of withstanding the test pressure should be disconnected or isolated. E.g. regulators, meters, safety devices, etc.
- vi) Only work related to the test is carried out on the pipework while the test is in progress;
- vii) If the test is deemed to be potentially dangerous when the test is in progress, persons not under the supervision of the person responsible for the test should be prohibited from the area and warning signs should be displayed;
- viii) During the test any pressure increase should be gradual;
- ix) If the test is not immediately followed by commissioning, the pressure in the pipework tested should be reduced to working pressure and the pipework sealed.

19 COMMISSIONING

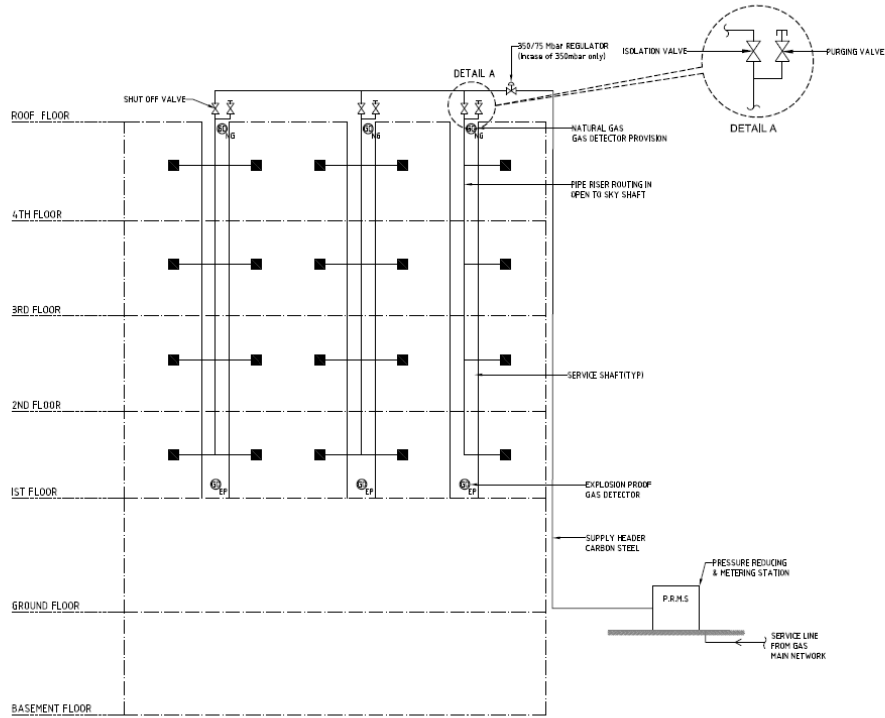
Prior to commissioning of the building internal gas piping, the building Owner or Consultant or Gas Contractor is required to provide Test Certification, Pre-commissioning, and


commissioning procedure, Local Authority approval and other details deem required for commissioning.

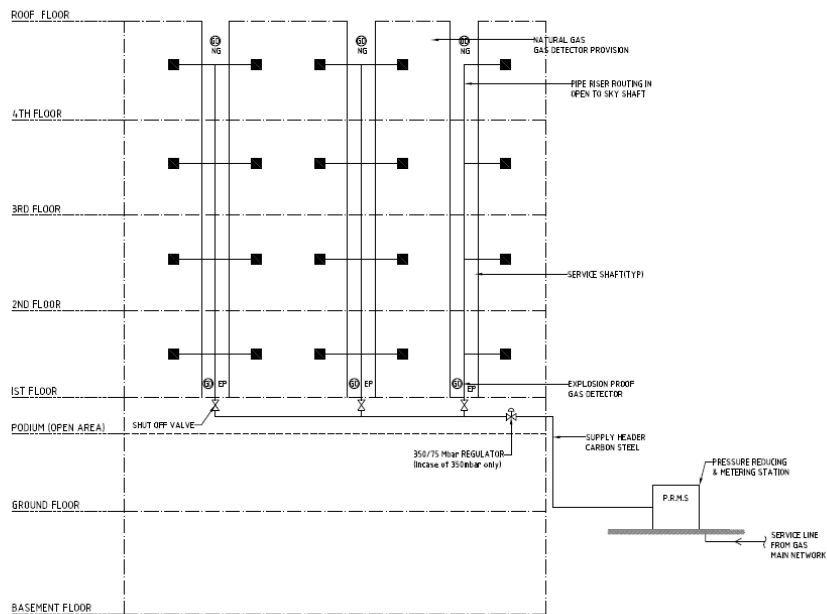
20 APPENDICES

1. Appendix A – Single Riser Multiple Dropper & Multiple riser
2. Appendix B – Pipe Riser (Ventilated Shaft) Detail
3. Appendix C – Fire Stop Detail
4. Appendix D – Typical Branch and Kitchen Gas Pipes Routing
5. Appendix E – Demarcation Point
6. Appendix F - Design Checklist

APPENDIX A

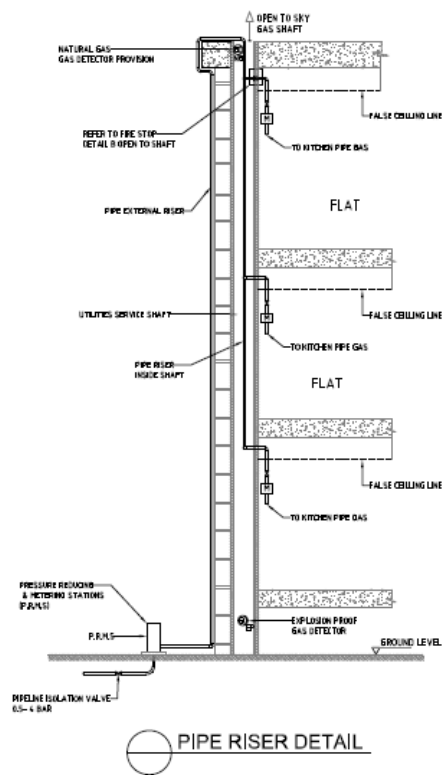



 SINGLE RISER MULTIPLE DROPPER



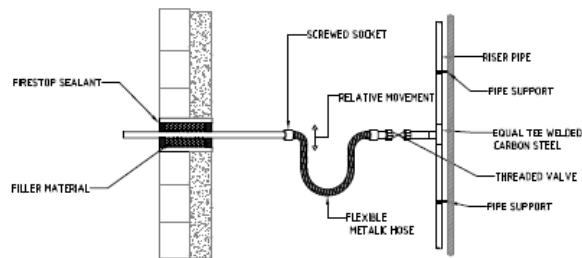

 MULTIPLE RISER

APPENDIX B

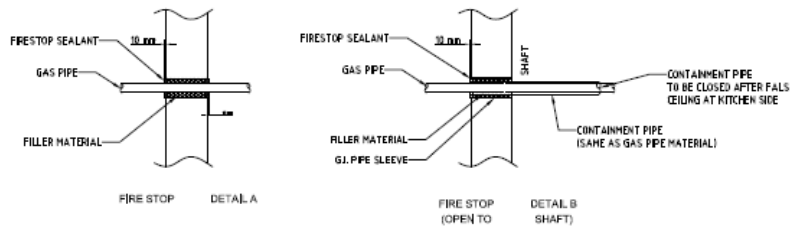


NOTE:
 ALL GAS SHAFT SHALL BE PROVIDED WITH ADEQUATE SIZE FOR MAINTENANCE ACCESS

APPENDIX C

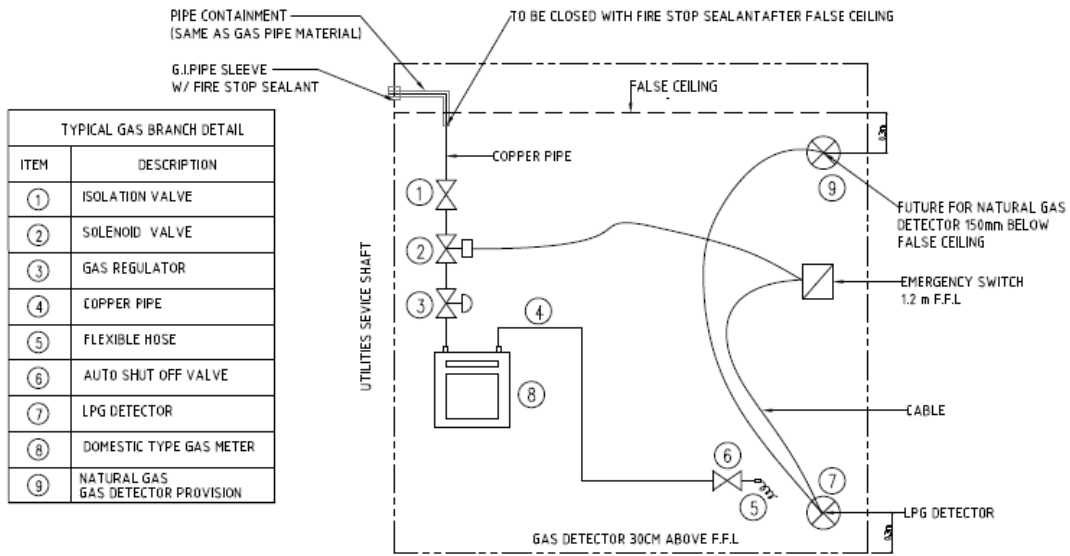


PIPE ASSEMBLY

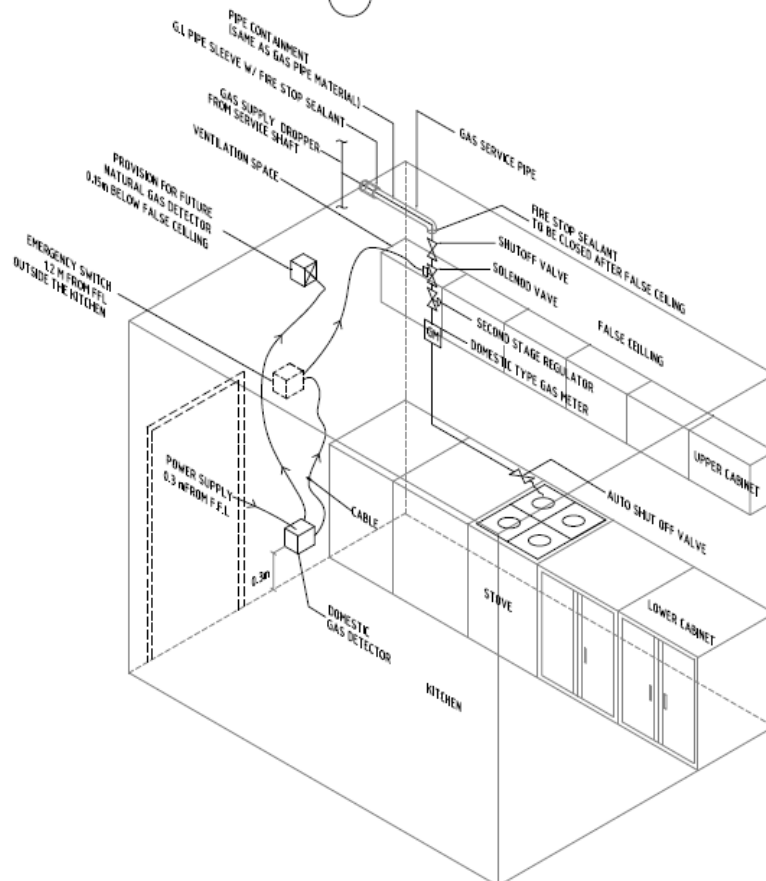


FIRE STOP DETAILS

APPENDIX D

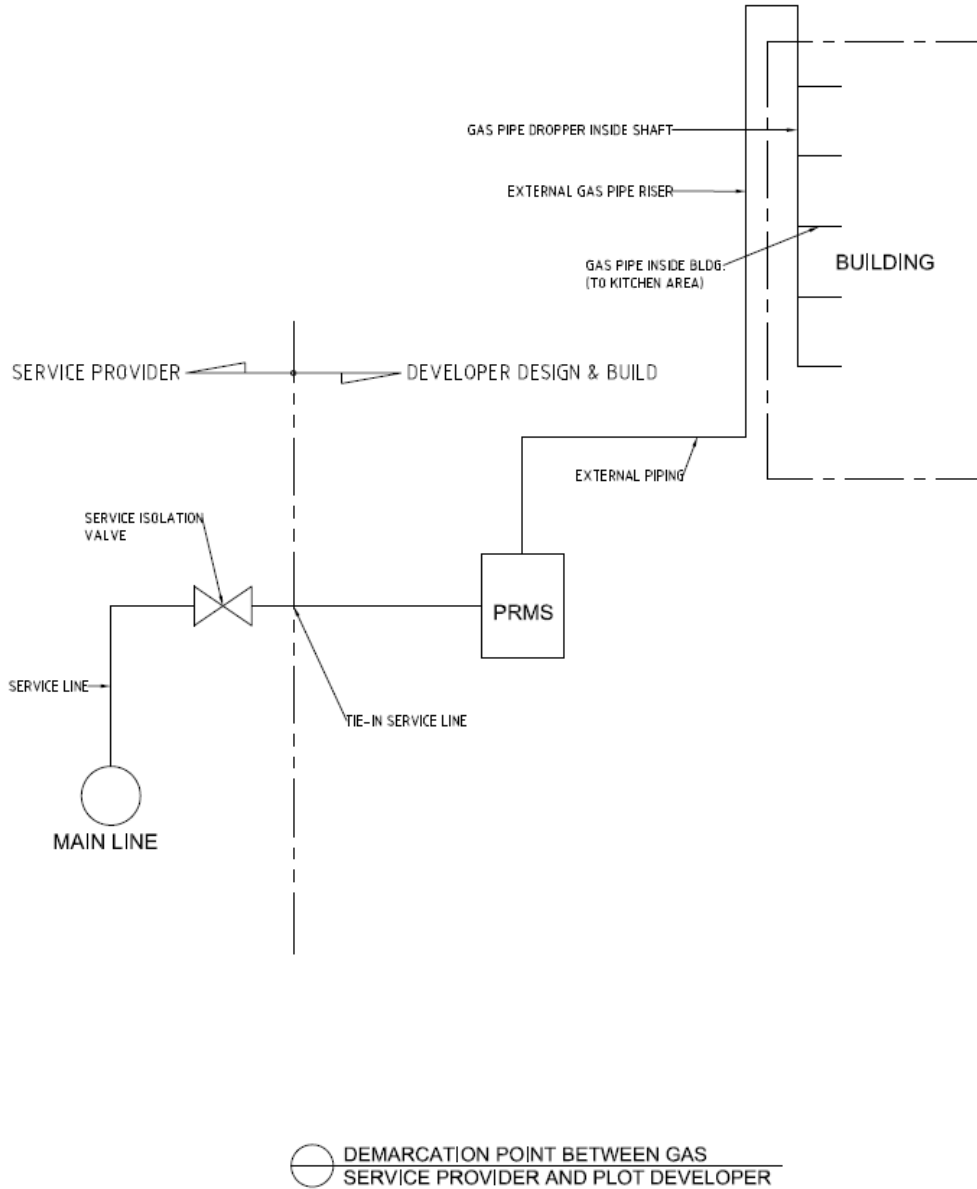


TYPICAL GAS BRANCH



KITCHEN GAS PIPES ROUTING

APPENDIX E



APPENDIX F

DESIGN CHECKLIST

Section	Check Item	Compliance	Notes
A	Specific Guidelines, Safety & Integrity General Requirements		
1	Gas pipe shall be designed at 75mbar pressure.		
2	The maximum allowable Gas Pressure within the Building is 75 mbar. In case more-than 75mbar is required (eg 350 mbar) the pipe riser shall be installed outside the building.		
3	The design of the Gas System within the Building shall include the Calculation, Pressures Drop, Piping Location, Routing, Piping Construction, Gas Leak Detection System, Piping Ventilations and Materials to be used are in compliance with IGE/UP/2 & IGE/G/5 latest Edition and the Latest Marafeq Qatar Gas Internal Piping Guidelines.		
4	All kitchens and boilers rooms shall be properly and safely ventilated to outdoor atmosphere.		
5	All gas firing appliances in the apartment or house shall be equipped with Safety Systems.		
6	All Building Shafts, Ducts and Access Panels dedicated for the Gas Riser and Droppers shall be Fire Rated and comply with the Structural Requirements of Building Regulation. Locations & Routings shall comply with Local Authorities' Requirements.		
7	All Building Shafts, Ducts and Access Panels shall provide ease of access for Maintenance and Inspection of the Gas Piping. The door shall be tight proof type.		
8	Piping design shall consider Building Shrinkage & Movements and to be provided with necessary expansion joints for the expansion and contraction of the Pipe Work. Connections of the Laterals to the Riser and/or Droppers should be with flexible joint.		
A	Specific Guidelines, Safety & Integrity General Requirements		
9	All Riser & Droppers shall be Steel Pipe and NDT tested. (Minimum 10% X-ray and DPT)		
10	All the Piping in confined space (e.g. above false ceiling) shall be NDT (steel pipe) tested and inside an adequate containment pipe (steel pipe) and ventilated to a safe open air. Copper pipe shall be pneumatically tested.		
11	Necessary safe ventilations for all the Installations Pipe Work within the Customer's Premises.		
12	All Materials, Pipes, Valves and Fittings shall comply with codes and standard requirement and the		

Section	Check Item	Compliance	Notes
	Specifications shall be approved prior to installation.		
13	The Construction, Testing & Commissioning of the Gas Installations Pipe Work shall comply with the latest version of these guidelines.		
14	The Main Gas Leak Detection / Control Panel System shall be interlinked with the Fire Alarm and BMS System of the Buildings. Main Gas solenoid valve shall be installed with manual emergency button. Gas detector must be explosion proof type.		
15	The Supervision, Inspection and Testing of the Gas Installation Pipe Work shall be carried out by a specialized contractor and third party inspector		
16	Intentionally left blank		
17	Gas piping in the kitchen shall be installed with manual shutoff valve, solenoid valve, auto shut-off valve, gas meter, FNPT-NPT hose connector to the appliances.		
18	Domestic type gas leak detector installed in the kitchen area must be connected to solenoid valve. The emergency switch shall be located outside the kitchen area.		
B	Prohibited Location for Gas Installation Pipe Work as per Requirements		
	Gas Installation Pipe Work in the following areas and under the following circumstances shall not be installed:		
1	Gas pipe installed in basement shall be avoided.		
2	No gas pipes installed under concrete flooring within the Building.		
3	No gas pipes installed under Building Foundation		
4	No gas pipes installed in a Fire Isolated Stairway, Passage way or Ramp.		
5	No gas pipes shall be installed in a clothes or rubbish chute.		
6	No gas pipes installed in a Fire Hydrant or Reel Cupboard.		
7	No gas pipes installed in a Ventilation Duct and Vacuum Pipes that operate at Sub-Atmospheric Pressure and that are not Welded or Brazed Construction.		
8	No gas pipes installed in a Fire Control Room Fire Fighting Lobbies and Rescue Command Centers, Smoke Stop Lobbies, Fire Pump Room, Fire Fighting Water Tank Rooms, Sprinkler Control Rooms, Fire Fighting Riser Ducts, Areas of Refuge, protected corridors.		
9	No gas pipe to be installed in bedrooms, or chased in common partition walls with Bedrooms. Where the		

Section	Check Item	Compliance	Notes
	Bedroom and Kitchen are located in a common area such as Studio Apartments, Gas Installation Pipe Work and Gas Appliances shall be separated by a full height wall from the sleeping area.		
10	No gas pipe to be installed attached to a fence.		
11	No gas pipe to be installed any location defined as "required exits."		
B	Prohibited Location for Gas Installation Pipe Work as per Requirements		
12	No gas pipe to be installed any voids within a cavity in a partition wall unless specifically designed and purpose built as ventilated ducts.		
13	No gas pipe to be installed in a Building Shaft/Duct that does not comply within the Structural Requirements of local Building Regulation.		
14	No gas pipe to be installed in the same Building Shaft/Duct with services containing Oxidizing or Corrosive Fluids.		
15	In a Ductwork that is used to distribute Air around the Buildings.		

Remarks:

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Inspected by:

Reviewed by:

Date:

Date: