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GUIDELINES FOR
COPPER GAS PIPING

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GUIDELINES FOR

Copper Gas Piping

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About the book

The objective of the book is to set minimum safety requirements on the use of copper for fuel gas piping systems for gas installers in Malaysia.

These guidelines promote the safe and correct installation of materials for gas piping systems.

Contents

Introduction

These guidelines set out installation procedures and requirements specifically for the use of copper piping systems with natural gas, manufactured gas, liquefied petroleum gas (vapour phase only), or mixtures of these gases.

Where requirements and procedures are common to all piping materials, reference should be made to the Malaysian Standard MS 930 (Code of Practice for the installation of Fuel Gas Piping Systems and Appliances).

These guidelines have been prepared in consultation with the Copper Development Centre South East Asia, one of 31 resource centres worldwide of the International Copper Association (ICA) Ltd.

1. Seamless Copper Pipe And Tube

1.1 Seamless copper pipe and tube shall:

1.1.1 Comply with European Standard EN 1057 (1996) in accordance with dimensions listed in table 1 or equivalent where approved by the Authority.

1.1.2 Be limited for use with vapour phase systems only with an operating pressure not exceeding 140 kPa.

1.1.3 Not be used if the gas contains more than an average of 0.7 mg/100L. of hydrogen sulphide.

1.2 The use of annealed coiled copper pipe shall be limited to pipe systems not exceeding 7 kPa with the exception of flexible copper pigtail connections that shall have a minimum wall thickness of 1.2 mm.

Table 1

Copper Pipe Sizes Conforming To EN1057 (1996) Recommended For Fuel Gas Pipework	
Outside pipe diameter in mm	**Wall thickness in mm**
15	0.7
22	0.9
28	0.9
35	1.2
42	1.2
54	1.2
66.7	1.2
76.1	1.5
108	1.5
133	1.5
159	2.0

2. Copper Fittings And Pipe Joints

2.1 General

2.1.1 Capillary and compression type fittings, threaded nipples, unions and flanges shall conform to European Standard EN 1254 (equivalent to BS 864) or equivalent as approved by the Authority.

2.1.2 Butt welding, threading and soft soldering (melting temperature below 500°C) of copper pipe is not permitted.

2.2 Capillary type fittings and joints

2.2.1 Capillary fitting joints shall be formed using a silver-copper-phosphorus brazing alloy with a recommended silver content of not less than 1.8%

2.2.2 Brazing copper pipe joints shall only be performed by a holder of a valid certificate of qualification who is competent in copper fabrication according to the attached:
Brazing Procedure Specification (Appendix A)
Procedure Qualification Record (Appendix B)

2.2.3 Fitting-less expanded joints (socket and spigot) in straight sections of pipe shall only be formed using expanding tools designed for that purpose. Such joints shall be brazed.

2.3 Compression / thread and flange type joints

2.3.1 Compression / thread and flange type joints shall only be used if capillary type joints are impractical.

2.3.2 Compression type joints and fittings shall have copper alloy compression rings and are only permitted to maximum size of 35 mm in diameter. (Fig. 1)

2.3.3 Mechanical joints larger than 35 mm shall be copper alloy (brasss) threaded union or of flange type only.

2. COPPER FITTINGS AND PIPE JOINTS

2.3.4 Mechanical 45° flare or swage type fittings are permitted where required to conform with connections to gas valves, appliances or termination devices.

2.3.5 Thread sealing tapes or jointing pastes shall not be applied to the copper alloy compression ring, compression nut section of the fitting.

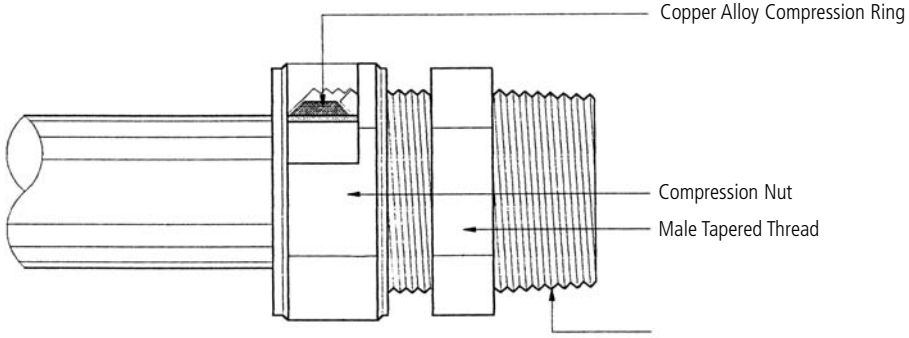

FIG.1 COMPRESSION FITTING

3. Bends In Copper Pipework

3.1 Bends in the pipe shall only be formed using bending tools equipment and procedures intended for that purpose.

3.2 Bends shall be free from buckling, cracks and other evidence of mechanical damage.

3.3 The centre line radius shall not be less than 3.5 times the diameter of the pipe being bent.

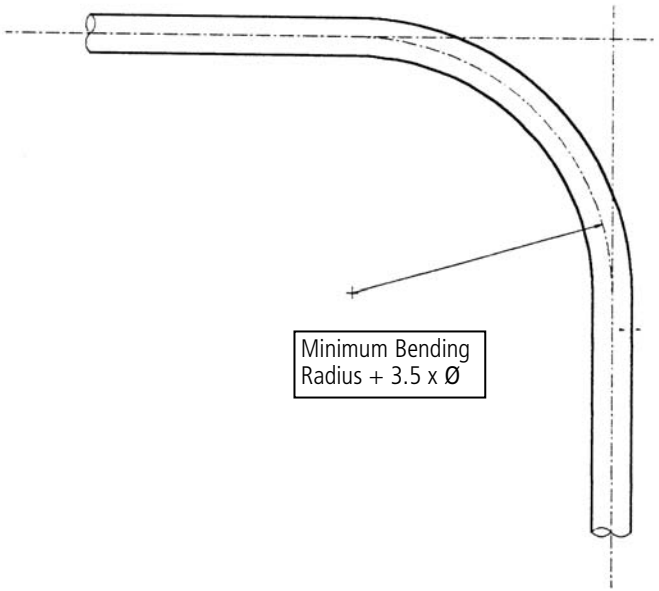

FIG. 2 MINIMUM RADIUS FOR BENDS IN COPPER PIPEWORK

4. Concealment Of Copper Gas Pipes (Inaccessible)

4.1 General

4.1.1 Only capillary brazed joints are permitted and shall be pressure tested prior to concealment.

4.1.2 Where embedded pipes are exposed to excessive moisture or corrosive substances, the piping shall be adequately protected by sheating in a water tight coating using factory applied polyethylene coated pipe and/or the use of petrolatum impregnated protective tapes. (Fig. 3)

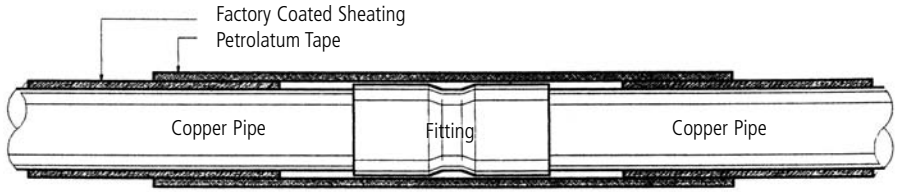

FIG. 3 PROTECTION FOR PIPES AND JOINTS

4.2 Piping in non-fire rated hollow walls

4.2.1 A galvanised sheet steel "striker" plate of no thinner than 1.2mm shall be fixed on both sides of the wall frame extending a minimum of 50mm beyond the location where the pipe passes through vertical or horizontal structural members. (Fig. 4)

4.2.2 Gas pipework shall not be installed in fire rated partition walls.

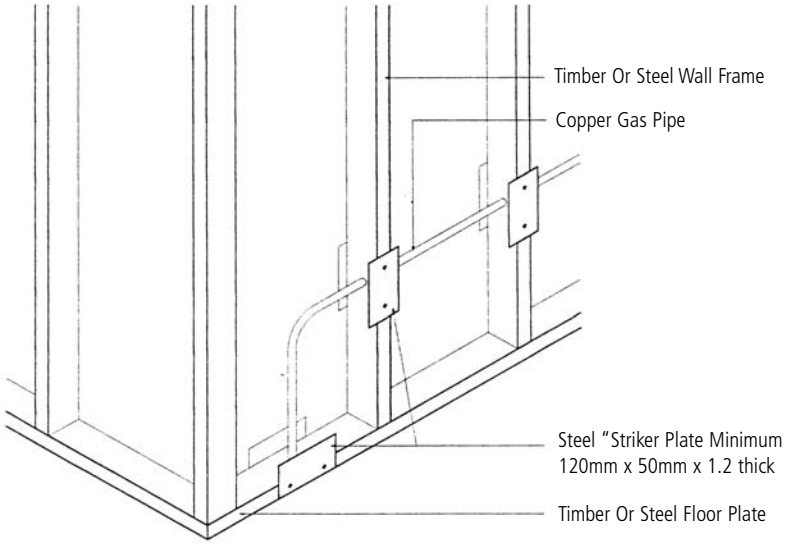

FIG. 4 PIPING IN NON-FIRE RATED HOLLOW WALLS

4. CONCEALMENT OF COPPER GAS PIPES (INACCESSIBLE)

4.3 Piping penetrating through solid walls or floors

4.3.1 Shall be protected by non-metallic sleeve or sheathed with a plastic material. Sleeve and penetration shall be sealed with an approved fire barrier / fire stop material. (Fig. 5)

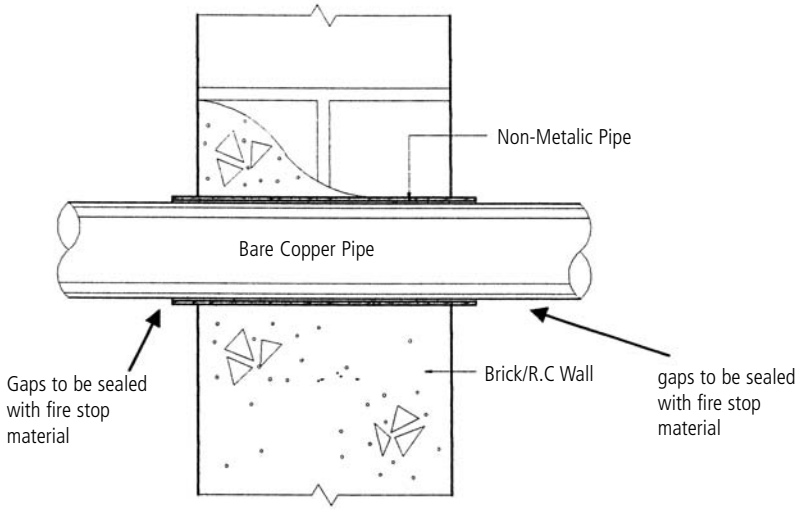

FIG. 5 PIPE PENETRATING THROUGH SOLID WALL OR FLOOR

4.4 Piping embedded in solid walls

4.4.1 Joints to be kept to a minimum.

4.4.2 Operating pressure shall not exceed 7 kPa.

4.4.3 Piping embedded in solid walls is only recommended when other means of routing are impractical.

4.4.4 Entire pipework section shall be adequately protected from corrosion by sheathing in a water tight coating using factory applied polyethylene coated pipe and/or the use of petrolatum impregnated protective tapes.(Fig. 6)

4.4.5 A protective steel angle/plate no thinner than 1.2 mm shall be fitted along that entire length of the concealed pipe as per Fig. 6. A sizing table and detailed cross sectional elevation are shown in Appendix C.

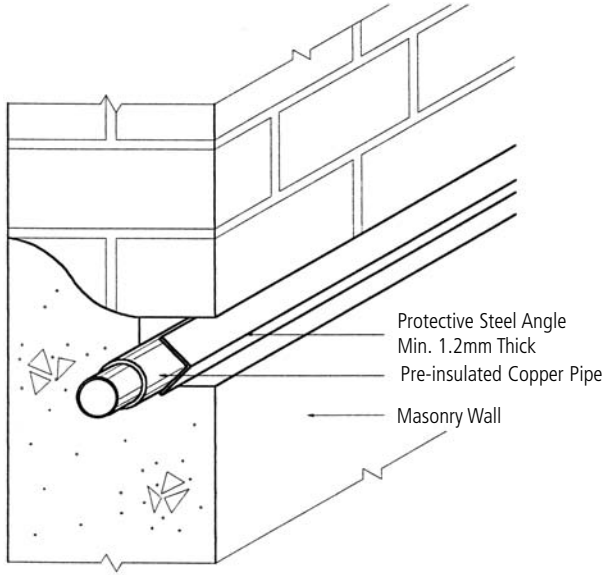

FIG. 6 PIPE EMBEDDED IN SOLID WALL

4. CONCEALMENT OF COPPER GAS PIPES (INACCESSIBLE)

4.5 Piping embedded in concrete floors

4.5.1 Piping embedded in concrete floors is permitted subject to the requirements of sub-clauses 4.4.1 - 4.4.4 (piping embedded in solid walls) and to the following:

4.5.2 Pipe shall be surrounded with a minimum of 40 mm of concrete. (Fig. 7)

4.5.3 Pipes shall not traverse concrete expansion or construction joints.

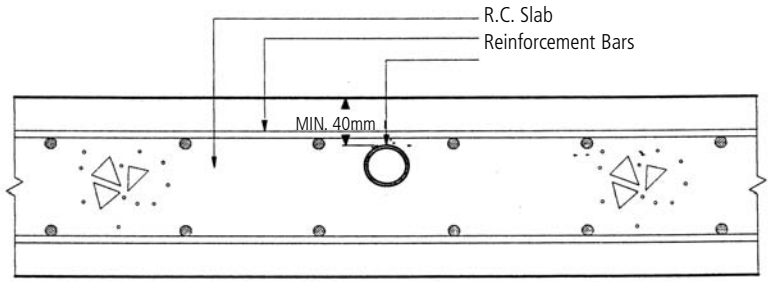

FIG. 7 PIPING EMBEDDED IN CONCRETE FLOOR

4.6 Piping buried in the ground or under concrete external of the building (non-vehicular traffic areas)

4.6.1 Joints to be kept to a minimum.

4.6.2 Warning or marking tape shall be located 150 mm above the pipe. (Fig. 8).

4.6.3 UPVC slab markers located 150 mm above the pipe shall be used to provide additional protection where a pipe passes through gardens, shrub beds or such cultivated areas where damage is reasonably expected.

4.6.4 Entire pipework section shall be sheathed in a water tight coating using the factory applied polyethylene pipe and/or the use of petrolatum impregnated protective tapes.

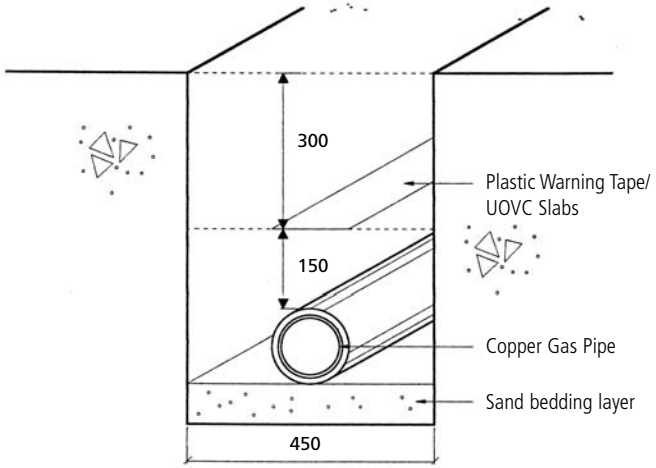

FIG. 8 PIPING BURIED IN GROUND OR UNDER CONCRETE EXTERNAL OF BULDING IN NON-TRAFFIC AREA

4.7 Protection against galvanic corrosion

4.7.1 Provision shall be made to prevent harmful galvanic action where copper is connected underground to steel.

5. Design And Fixing Brackets

5.1 Pipework located in areas vulnerable to physical damage shall be provided with adequate protection.

5.2 The pipe system shall be designed to have sufficient flexibility to prevent thermal expansion or contraction from causing excessive stresses in the pipe or loads at joints.

5.3 Fixings shall be of non-ferrous metal or alternatively, galvanised steel with a non-conductive insulation material fitted between the pipe and bracket.

5.4 Pipework shall not be used as a support or anchor for gas appliances or connecting equipment.

6. Testing And Marking

6.1 Non-destructive testing of brazed copper joints is not required.

6.2 Pressure and leak testing, purging, painting and marking shall be performed in accordance with procedures as prescribed by the Authority.

APPENDIX A

BRAZING PROCEDURE SPECIFICATION (BPS) - (Copper Alloy)

BPS No | Date | B PQR No

Company

Brazing Process : Manual hand held torch brazing

Brazing equipment: Oxygen / acetylene heating torch
(acetylene and LPG / air mixture heating torches are also suitable)

BRAZING CONDITIONS

BASE METAL

Identification : Brass and bronze alloys conforming to EN 1254 | BM No.: 300

Thickness: As per EN 1254 | Preparation: Slight abrasive cleaning to remove dirt / grease or heavy oxidization

FILLER METAL

FM No.: 150 | AWS Classification: BcuP-6

Form: Rod / Stick | Method of Application : Hand application

FLUX: AWS Type: 3A comprising - Boric acid, Borates, Fluorides and Fluoborates

ATMOSPHERE: AWS Type: 1 & 2 combusted fuel gas / air

TEMPERATURE: 1300 - 1500°F | TEST POSITION: 6G

FUEL GAS: Oxygen / acetylene mixture (acetylene and LPG / air mixture are also suitable) | TIP SIZE: Ranging from 8 to 25

POSTBRAZE CLEANING: Wipe with wet cloth to remove residual solidified flux

POSTBRAZE HEAT TREATMENT: Not required

JOINT

Type: Capillary socket and spigot as per EN 1254

Clearance: As defined in fitting standard EN1254 ranging 0.02 to 0.13mm

BRAZING PROCEDURE SPECIFICATION (BPS) - (Copper to Copper)

BPS No. | Date: | B PQR No.:

Company:

Brazing Process: Manual hand held torch brazing

Brazing equipment: Oxygen / acetylene heating torch
(acetylene and LPG / air mixture heating torches are also suitable)

BRAZING CONDITIONS

BASE METAL

Identification: Deoxidised copper C12200 as per EN 1057 / EN 1254 | BM No.: 300

Thickness: Various as per EN 1057 tube specification table | Preparation: Slight abrasive cleaning to remove dirt / grease or heavy oxidization

FILLER METAL

FM No.: 150 | AWS Classification: BcuP-6

Form: Rod / Stick | Method of Application: Hand application

FLUX: AWS Type: Flux not required for copper to copper joints

ATMOSPHERE: AWS Type 1 & 2 combusted fuel gas / air

TEMPERATURE: 1300 - 1500°F | TEST POSITION: 6G

FUEL GAS: Oxygen / acetylene mixture acetylene and LPG / air mixture are also suitable) | TIP SIZE: Ranging from 8 to 25

POSTBRAZE CLEANING: Not required

POSTBRAZE HEAT TREATMENT: Not required

JOINT

Type: Capillary socket and spigot as per EN 1254

Clearance: As defined in fitting standard EN1254 ranging 0.02 to 0.13mm

APPENDIX B

BRAZING PERFORMANCE QUALIFICATION RECORD (copper and copper alloy)

Name: Id:

Date: BPS No.:

Brazing Process: Manual hand held torch brazing

TEST BRAZEMENT

Base Metal ID: Deoxidised copper C12200 As per EN 1254/EN 1057 BM No.: 300 BM T: As per pipe and fitting standard EN 1057 & EN 1254

Filler Metal ID: BcuP-6 FM No.: 150 FM Feed: By hand

Text Position: 6G Joint Type: Capillary socket and spigot

TEST RESULTS

VISUAL	PASS	FAIL
Filler metal shall be present on full circumference	Pass	
No unfused filler metal present	Pass	
No evidence of base metal melting	Pass	
No cracks to be visible in the joint perimeter	Pass	
Undercutting shall have a maximum depth of five percent of the base metal thickness, or 0.25mm whichever is lesser	Pass	

MACROETCH OR PEEL

SPECIMEN NO.	REMARKS	PASS	FAIL
To be marked	(MACROETCH) No individual cross section shall have a total length of discontinuities, such as pores, voids, unbrazed areas or inclusions greater than 20% of any single joint length.	Pass	
To be marked	(PEEL) No individual exposed surface shall have a total area of discontinuities, such as pores, voids, unbrazed areas or inclusions greater than 30% of the faying surface.	Pass	
To be marked	(PEEL) No discontinuity dimensions or combination of discontinuity dimention shall extend more than 25% along any line that would provide a leak path from one plate or pipe surface to the opposing	Pass	

QUALIFIED FOR

Brazing Process: Manual hand held torch brazing Positions: 6G

BM No.: 300 BM T: As per pipe and fitting standard

FM No.: 150 FM Feed : Hand feed

Joint Type: Capillary socket and spigot

The above named individual is qualified in accordance with the American Welding Society Standard for Brazing Procedure and Performance Qualification, ANSI/AWS B2.2-91.

Date: Signed:

Qualifier

Protective Steel Angle Sizing Guide

COPPER PIPE SIZE (MM)	ANGLE (MM) (THICKNESS MIN. 1.2MM)
15	20 x 20
22	20 x 20
28	25 x 25
35	30 x 30

Detail of cross sectional elevation of protective steel angle

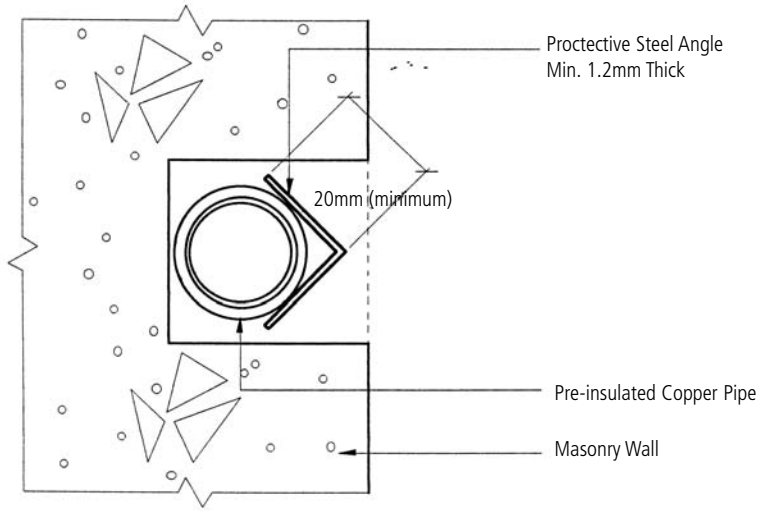

FIG. 6 PIPE EMBEDDED IN SOLID WALL

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