GFS

GAS FLEX SYSTEMS

NOVEMBER 2019

Specification for corrugated stainless steel semi-rigid pipe and associated fittings for low-pressure gas pipework of up to DN 50.

bsi.
KM 613886
BS EN 15266
KITEMARK™

DESIGN AND INSTALLATION GUIDE

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1. INTRODUCTION

1.1. SCOPE

British Standards Institution (BSI) has approved under the Kitemark Licence Number KM 613886 to GFS®. This Kitemark can be affixed to all sizes of GFS® CSST Systems which are in conformity BS EN 15266:2007 (Stainless steel pliable corrugated tubing kits in buildings for gas with an operating pressure up to 0,5 bar).

This Installation Guide contains BS 6891 language where appropriate, which is specifies the design, installation, commissioning and maintenance of gas installation pipework carrying 2nd and 3rd family gas of up to 35 mm (R 1¼) on premises, including residential park homes (2nd and 3rd family gas) and caravan holiday homes (2nd family gas). This standard applies to gas installation pipework where the nominal working pressure is 21 mbar.

BS 5482 Part 1 specifies requirements for the installation at permanent dwellings of domestic systems using liquefied petroleum gases (LPG), weather from cylinders of bulk supply at a pressure of 28 mbar for commercial butane and of 37 mbar for commercial propane.

GFS® is Kitemarked to EN 15266 in all sizes from DN15 to DN50. The installation of pipework in sizes above DN50 and for working pressures above 21 mbar falls under the institution of Gas Engineers and Managers Utilization Procedures

IGEM/UP/2 Latest Edition.

Sound engineering principles and practices must be exercised for the proper design of fuel gas piping systems, in addition to compliance with Gas Safety, Building Regulations and with British Standards requirements. The installation guide and procedures contained in this Specification must be strictly followed in order to provide a safe and effective fuel gas piping system or system modification.

This Installation Guide is intended to aid the Gas Safe Registered gas pipe installer in the design, installation and testing of the GFS® semi-rigid piping system.

It is not possible for this specification to anticipate every variation in construction style, building configuration, appliance requirement, or local restriction. This document will not therefore cover every application.

The user should contact us, exercise his/her own judgement on system design and installation, or seek technical input from other qualified sources. Additional information pertaining to gas piping systems is available from IGEM, Gas Safe and your local gas utility.

1.2. SUPPORTING DOCUMENTS

BS EN 15266:2007: Corrugated stainless-steel tubing kits in buildings for gas with an operating pressure up to 0.5 bar.

BS 6891:2015: Installation of low-pressure gas tubing of up to 35 mm (R1 1/4") in domestic premises (2nd family gas).

BS 5482: Code of practice for domestic butane and propane-gas burning installations Part 1: Installations at permanent dwellings, residential park homes and commercial premises, with installation tubing sizes no exceeding DN25 for steel and DN28 for corrugated stainless steel or copper.

BS EN 14800:2007: Corrugated safety metal hose assemblies for the connection domestic appliance using gaseous fuels.

IGEM/UP/1/New Edition 2 2003: Strength testing, tightness testing of industrial and commercial gas installations.

IGEM/UP/1A/New Edition 2 2003: Strength testing, tightness testing and direct purging of small, low pressure industrial and commercial Natural Gas Applications.

IGEM/UP/1B – Edition 2: Tightness testing and purging of domestic sized Natural Gas Installations.

IGEM/UP/2 – Latest Edition: The Institution of Gas Engineers and Managers Communication 1729, Utilization Procedures - Gas Installation Tubing, Boosters and Compressors and installation pipework on industrial and commercial premises.

BS EN 1775:2007: Gas supply. Gas tubing for buildings. Maximum operating pressure less than or equal to 5 bars. Functional recommendations.

BS 476: Fire resistance of building materials / elements.

BS 7671:2008: Requirements for electrical installations. IEE Wiring Regulations. Seventeenth edition BS 7671: Requirements for electrical installations.

BS 6004:2000: Electric cables. PVC insulated, non-armoured cables for voltages up to and including 450/750 V, for electric power, lighting and internal wiring.

BS 6400-2:2006: Specification for installation, exchange, relocation and removal of gas meters with a maximum capacity not exceeding 6 m3/h. Medium pressure (2nd family gases).

BS 6231:2006: Electric cables. Single core PVC insulated flexible cables of rated voltage 600/1000 V for switchgear and control gear wiring.

BS 6007:2006: Electric cables. Single core unsheathed heat resisting cables for voltages up to and including 450/750 V, for internal wiring.

1.3. DEFINATIONS

bend radius:
the radius measured to the axial centreline of the corrugated pipe

coating:
a layer of material bonded to the external surface of the corrugated pipe by the manufacturer and intended to improve the resistance of the pipe to external corrosion and mechanical damage

cover:
a tubular outer sheath applied to the corrugated pipe by the manufacturer and intended to improve the resistance of the pipe to external corrosion and mechanical damage

Fittings:
capillary adaptor:
a fitting with one end intended for connection to corrugated pipe and the other end having a spigot for soldering into a capillary fitting

end-fitting:
a fitting with one end intended for permanent attachment to corrugated pipe, and the other end threaded to BS 21

connector:
a coaxial fitting with both of its ends intended for permanent attachment to corrugated pipe

manifold:
a multiway fitting able to accept one threaded inlet connection and three or more threaded outlets

Connections:
meter union:
a fitting with an outlet intended for permanent attachment to corrugated pipe and an inlet suitable for direct connection to the meter outlet

strapped elbow:
a fitting with one end intended for permanent attachment to corrugated pipe and the other end threaded to BS 21, and including a right-angle bend and lugs for wall mounting

push end-fitting:
end-fitting intended to form a leak tight seal when assembled by the application of a linear force to the fitting

screw end-fitting:
end-fitting intended to form a leak tight seal when assembled by the application of a tightening torque to the fitting

gasway
a duct conveying gas

manufacturer's instructions
instructions issued by the manufacturer for the assembly and installation of the corrugated pipe, fittings and component parts

nominal size (DN):
a numerical designation of size which is common to all components in a piping system other than components designated by outside diameter or by thread size. It is a convenient round number for reference purposes and is only loosely related to manufacturing dimensions

non-chlorinated material:
a synthetic polymer or elastomer with a total chloride content not exceeding 50 ppm

retaining device:
a circlip or other fastener providing a mechanical connection between an end-fitting and a corrugated pipe

semi-rigid
capable of being bent by hand without tools during installation

NOTE The term "bendable" is sometimes used as a synonym for "semi-rigid".

visible
that can be seen when examined in daylight or normal room lighting, by the unaided eye, corrected, if necessary, for abnormal vision

1.4. COMPETENCE AND SYSTEM CONFORMITY

Persons carrying out work that will have an impact on work covered by the scope of this installation guide shall ensure that they have the competence relevant for the task such as not to compromise the requirements/recommendations of this installation guide and in particular the safe installation, commissioning and operation of gas equipment.

Gas installation work should be carried out by a business or self-employed operative who is a member of a class of persons approved by the Health and Safety Executive (HSE). (In Great Britain, it is The Gas Safe Register).

Acceptable certificates of competence are those issued under the: Nationally Accredited Certification Scheme (ACS) for individual gas fitting operatives; or Scottish/National Vocational Qualifications (NVQ) that have been aligned to ACS in matters of gas safety.

All gas appliances and other gas fittings must be installed with due regard to the manufacturer's installation instructions, the Gas Safety (Installation and Use) Regulations 1998 and the relevant requirements of the Building Regulations and British Standards.

2. DESCRIPTION OF GFS® SYSTEM COMPONENTS

2.1. GFS® CORRUGATED STAINLESS-STEEL TUBING (CSST)

GFS® CSST system is manufactured in accordance with BS EN 15266 which are specifies the requirements for material, design, manufacture, testing, marking of stainless steel pliable corrugated gas tubing kits for buildings with a maximum operating pressure less than or equal to 0,5 bars and a nominal size range from DN 10 to DN 50.

· GFS® (CSST) is made from Stainless Metal Hose with a corrugated construction conforming to EN 10380 standard, produced with 316L (1.4404) in accordance with EN 10028-7

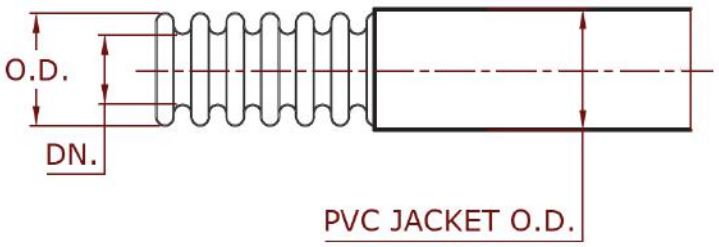
· Available in DN15, DN20, DN25, DN32, DN40, DN50 Nominal Bore Dimensions.

· Based on its material properties, CSST offers a high resistance to corrosion.

· CSST is easy to bend and reduces the number of fittings and materials required with standard rigid pipe installations.

· The corrugated tube is covered with an easy to identify yellow Jacket which is both fire-retardant and resistant to UV (ultra-violets).

· Maximum Operating Pressure (MOP) shall not exceed 0.5 bar as per BS EN15266.



HOSE SIZE (DN)	OUTER DIAMETER (MM)	INTERNAL DIAMETER (MM)	TUBING WALL THICKNESS (MM)	PE JACKET THICKNESS (MM)
DN 15	19,90	16,00	0,20	1,00
DN 20	25,40	20,00	0,25	1,00
DN 25	31,40	25,40	0,25	1,00
DN 32	40,80	33,00	0,30	1,00
DN 40	48,00	40,70	0,30	1,00
DN 50	60,30	50,80	0,30	1,00

Table 1 GFS® Tubing Sizes

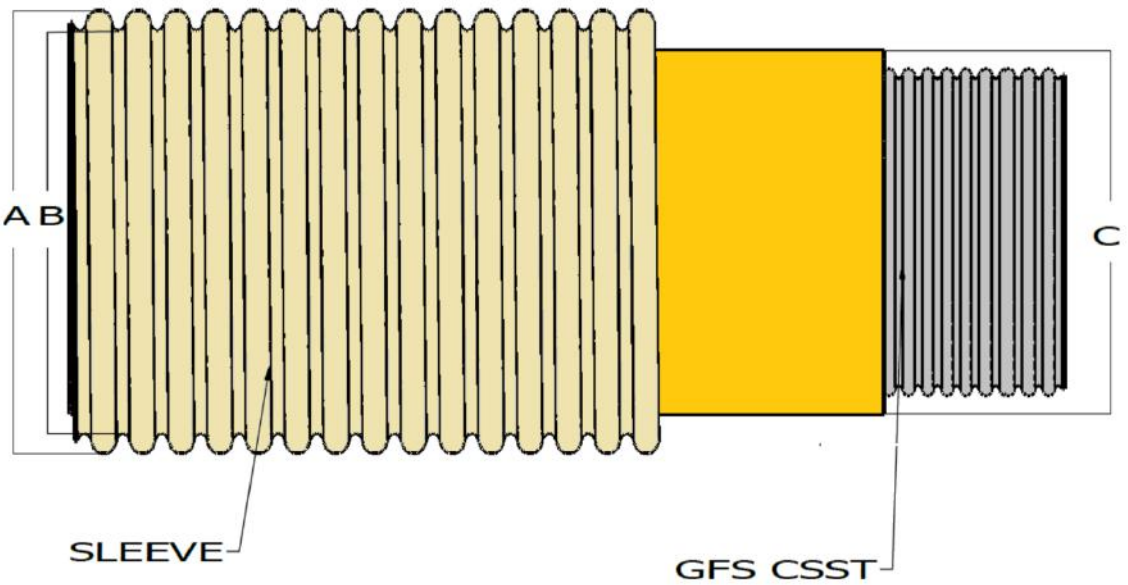
CORRUGATED STAINLESS STEEL PLIABLE TUBING (CSST)

IMAGE	CODE	DIAMETER	LENGTH(M)
	15266-FLX-15-15	DN 15	15
	15266-FLX-15-30	DN 15	30
	15266-FLX-15-60	DN 15	60
	15266-FLX-15-90	DN 15	90
	15266-FLX-20-15	DN 20	15
	15266-FLX-20-30	DN 20	30
	15266-FLX-20-60	DN 20	60
	15266-FLX-20-90	DN 20	90
	15266-FLX-25-15	DN 25	15
	15266-FLX-25-30	DN 25	30
	15266-FLX-25-60	DN 25	60
	15266-FLX-25-90	DN 25	90
	15266-FLX-32-15	DN 32	15
	15266-FLX-32-30	DN 32	30
	15266-FLX-32-60	DN 32	60
	15266-FLX-32-90	DN 32	90
	15266-FLX-40-30	DN 40	30
	15266-FLX-50-30	DN 50	30

CONTRACTOR KITS (CSST / TWO MALE FITTINGS / INSTRUCTION MANUAL)

IMAGE	CODE	GFS® TUBE		GFS® STRAIGHT CONNECTION MALE	
		DIAMETER	LENGTH (M)	DIAMETER	PCS.
	15266-FST-15-05	DN 15	5	DN 15 X 1/2"	2
	15266-FST-15-10	DN15	10	DN 15 X 1/2"	2
	15266-FST-20-05	DN 20	5	DN20 X 3/4"	2
	15266-FST-20-10	DN 20	10	DN20 X 3/4"	2
	15266-FST-25-05	DN 25	5	DN 25 X 1"	2
	15266-FST-25-10	DN 25	10	DN 25 X 1"	2

2.2. GFS PLUS PIPE IN PIPE CSST



DESCRIPTION	A (mm)	B (mm)	C (mm)	CSST MATERIAL	CSST JACKET MATERIAL	SLEEVE MATERIAL
GFS PLUS DN 15	35,0	29,5	21,9	1.4404-316L	PE Compound	PVC Compound
GFS PLUS DN 20	40,0	34,0	27,4	1.4404-316L	PE Compound	PVC Compound
GFS PLUS DN 25	49,0	41,0	33,4	1.4404-316L	PE Compound	PVC Compound
GFS PLUS DN 32	59,0	51,0	42,8	1.4404-316L	PE Compound	PVC Compound
GFS PLUS DN 40	68,0	60,0	50,0	1.4404-316L	PE Compound	PVC Compound
GFS PLUS DN 50	80,0	72,0	62,3	1.4404-316L	PE Compound	PVC Compound

BS6891 (8.7) states:-

-Pipework passing through a wall or a floor, whether or not it contains a cavity, shall pass through a sleeve.

-No sleeve shall have joints along its length.

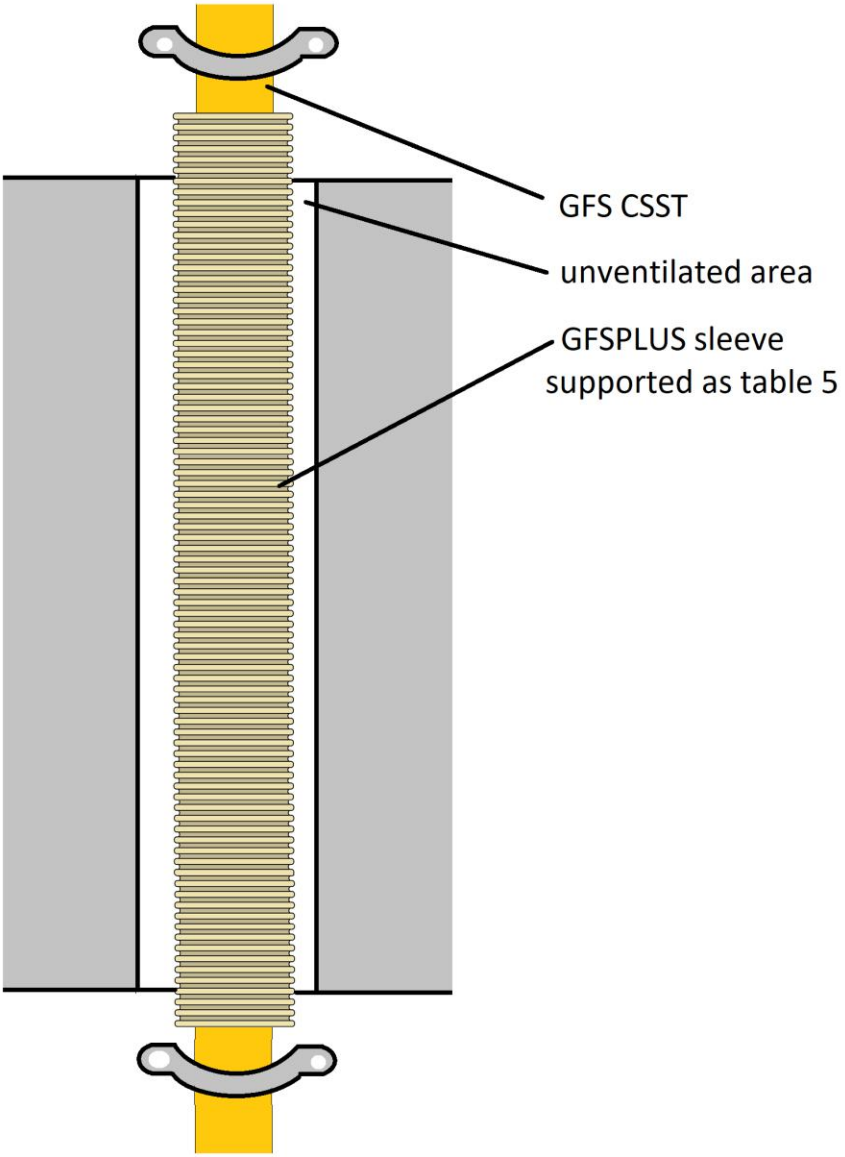
-Any sleeve shall pass through the full width of the wall or the full thickness of the floor. The outside of the sleeve shall be secured and sealed at each end to the structure of the building with a suitable building material, e.g. cement mortar or flexible sealant.

NOTE: The internal diameter of any sleeve should allow for an annular space around the pipework to enable satisfactory insertion and withdrawal of the pipework and allow adequate sealing between the pipework and the sleeve.

Support of GFS PLUS

When you install GFS PLUS vertically in unventilated areas you should support GFS CSST (not from the sleeve) but before and after the unventilated area on the CSST pipe.

In the unventilated area you should clip GFSPLUS from the sleeve. (Please see “Table 5 - vertical run column” for intervals)



2.3. GFS® MECHANICAL CONNECTIONS

It is advised that all installations are correctly supported and clipped.

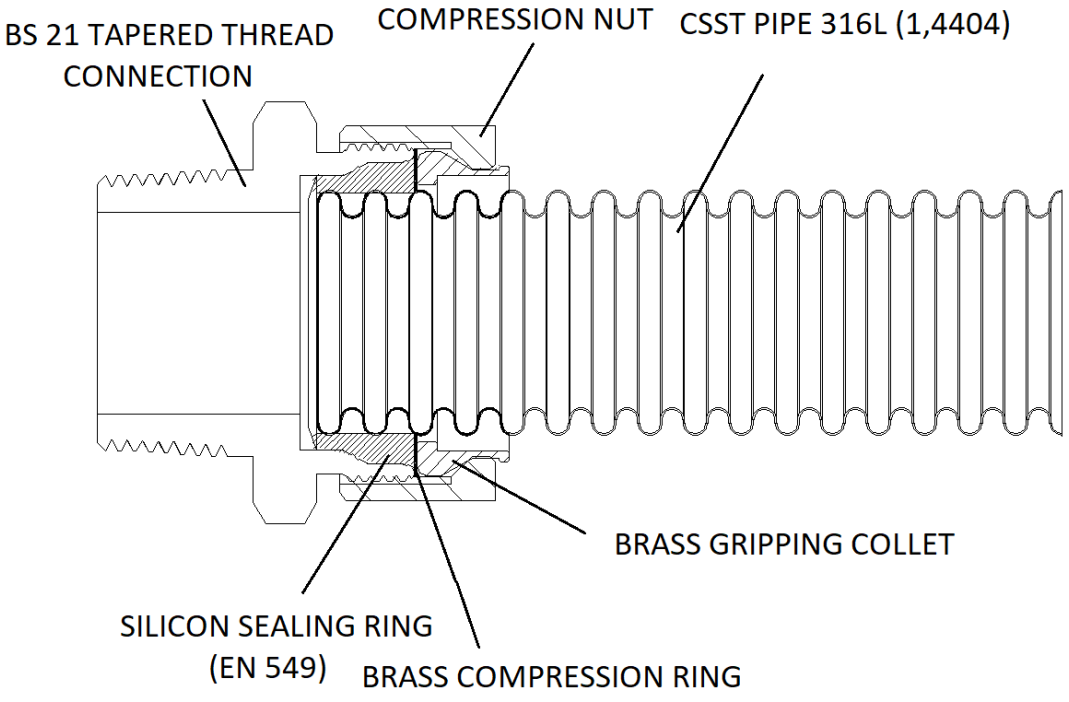
· Fittings are made from De-Zincification Resistant Brass (DZR) to EN12164. They are Nickel coated for added material protection and corrosion resistance.

· All fittings include a heat resistant Silicon Rubber, Olive and a Brass Compression Washer.

· The flame-retardant Silicone Rubber Sealing Ring, enables the fitting to pass the high temperature test A of BS EN 1775.

· Multiple Connecting Fittings Available.

· Each Fitting has a yellow plastic clip to prevent compression turns before inserting the CSST, this needs to be removed before installation.



2.3.1. GFS® TEE CONNECTIONS

GFS® REDUCING AND EQUAL TEE CONNECTIONS

IMAGE	CODE	DIAMETER (DN)
	15266-RTE-01	20X15X15
	15266-RTE-02	20X20X15
	15266-RTE-03	25X20X15
	15266-RTE-04	20X20X25
	15266-RTE-05	25X20X25
	15266-RTE-06	25X20X20
	15266-RTE-07	25X25X15
	15266-RTE-08	25X25X20
	15266-RTE-09	25X25X32
	15266-RTE-10	32X25X25
	15266-RTE-11	32X25X32
	15266-RTE-12	32X32X25
	15266-ETE-01	15X15X15
	15266-ETE-02	20X20X20
	15266-ETE-03	25X25X25

2.3.2 GFS® STRAIGHT MALE CONNECTIONS

GFS® STRAIGHT MALE CONNECTIONS

IMAGE	CODE	DIAMETER (DN)
	15266-SCM-01	DN15 X 1/2"
	15266-SCM-02	DN15 X 3/4"
	15266-SCM-03	DN20 X 1/2"
	15266-SCM-04	DN20 X 3/4"
	15266-SCM-05	DN20 X 1"
	15266-SCM-06	DN25 X 1/2"
	15266-SCM-07	DN25 X 3/4"
	15266-SCM-08	DN25 X 1"
	15266-SCM-09	DN25 X 1-1/4"
	15266-SCM-10	DN32 X 1/2"
	15266-SCM-11	DN32 X 3/4"
	15266-SCM-12	DN32 X 1"
	15266-SCM-13	DN32 X 1" 1/4
	15266-SCM-14	DN40 X 11/2"
	15266-SCM-15	DN50 X 1-1/4"
	15266-SCM-16	DN50 X 2"

2.3.3. GFS® STRAIGHT FEMALE CONNECTIONS

GFS® STRAIGHT FEMALE CONNECTIONS

IMAGE	CODE	DIAMETER (DN)
	15266-FRD-01	DN15 X 1/2"
	15266-FRD-02	DN15 X 3/4"
	15266-FRD-03	DN20 X 1/2"
	15266-FRD-04	DN20 X 3/4"
	15266-FRD-05	DN25 X 1/2"
	15266-FRD-06	DN25 X 3/4"
	15266-FRD-07	DN25 X 1"
	15266-FRD-08	DN32 X 1 1/4 "

2.3.4. GFS® COUPLINGS

GFS® COUPLINGS AND REDUCING COUPLINGS

IMAGE	CODE	DIAMETER (DN)
	15266-DRC-01	DN20 X DN15
	15266-DRC-02	DN25 X DN20
	15266-DRC-03	DN32 X DN25
	15266-NRC-01	DN15 X DN15
	15266-NRC-02	DN20 X DN20
	15266-NRC-03	DN25 X DN25
	15266-NRC-04	DN32 X DN32
	15266-NRC-05	DN40 X DN40
	15266-NRC-06	DN50 X DN50

2.3.5. GFS® COMPRESS COUPLINGS

GFS® COMPRESS COUPLINGS

IMAGE	CODE	DIAMETER (DN)
	15266-CAD-01	DN15 X 15MM
	15266-CAD-02	DN20 X 15MM
	15266-CAD-03	DN20 X 22MM
	15266-CAD-04	DN25 X 22MM
	15266-CAD-05	DN25 X 28MM
	15266-CAD-08	DN32 X 22MM
	15266-CAD-06	DN32 X 28MM
	15266-CAD-07	DN32 X 35MM

2.3.6. GFS® GAS METER CONNECTIONS

GFS® GAS METER CONNECTIONS

IMAGE	CODE	DIAMETER (DN)
	15266-STR-01	DN20 X 1-1/4"
	15266-STR-02	DN25 X 1-1/4"
	15266-STR-03	DN32 X 1-1/4"
	15266-STR-19	DN20 X 1"
	15266-STR-20	DN25 X 1"
	15266-STR-21	DN32 X 1"

2.3.7. GFS® STRAIGHT CONNECTION MALE WITH TEST NIPPLE

GFS® STRAIGHT CONNECTION MALE WITH TEST NIPPLE

IMAGE	CODE	DIAMETER (DN)
	15266-STN-01	DN20 X 3/4"
	15266-STN-02	DN25 X 1"
	15266-STN-03	DN32 X 1-1/4"

2.4. GFS® SLEEVE

IMAGE	CODE	DIAMETER
	15266-SLV-01	DN 15 - DN 20 - DN 25
	15266-SLV-02	DN 32 - DN 40 - DN 50

2.5. GFS® ACCESSORIES

IMAGES	CODE	DESCRIPTION	DIAMETER / SIZE
	15266-BKM-01	GFS® HOSE CUTTER	DN15 - DN25
	15266-BKM-02	GFS® HOSE PEELER	DN15 - DN25
	15266-IDC-15	GFS® SILICON GASKET	DN15
	15266-IDC-20	GFS® SILICON GASKET	DN20
	15266-IDC-25	GFS® SILICON GASKET	DN25
	15266-IDC-32	GFS® SILICON GASKET	DN32
	15266-IDC-40	GFS® SILICON GASKET	DN40
	15266-IDC-50	GFS® SILICON GASKET	DN50
	15266-SCO-01	GFS® WASHER BRASS	DN15
	15266-SCO-02	GFS® WASHER BRASS	DN20
	15266-SCO-03	GFS® WASHER BRASS	DN25
	15266-SCO-04	GFS® WASHER BRASS	DN32
	15266-SCO-05	GFS® WASHER BRASS	DN40
	15266-SCO-06	GFS® WASHER BRASS	DN50
	15266-SAT-25	GFS® SELF-AMALGAMATING TAPE	25 MM
	15266-SAT-50	GFS® SELF-AMALGAMATING TAPE	50 MM

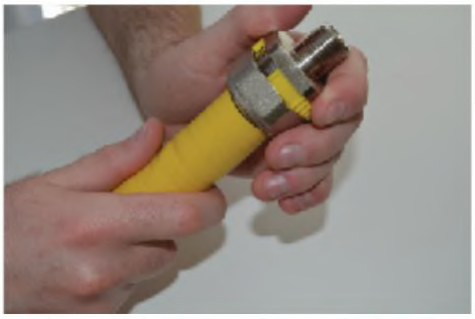
3.0 GFS® FITTING ASSEMBLY

Using a Pipe-Cutting Tool, make the required cut in the valley of two corrugations to the GFS® CSST, ensuring full circular rotations are made in the same direction.

Using a Stripper/Safety Knife, cut the yellow sleeve approximately 30 mm from tubing end. The cut should be made in the valley of two corrugations, taking care and ensuring the minimum amount of material is removed.

Also, care should be taken when rotating the knife ensuring the cut is only deep enough to remove the yellow sleeve.

Apply Slight pressure to the cutting tool between rotations to ensure that the tube is free from sharp edges, burrs and that a clean cut is achieved.



Push the GFS® CSST firmly into the GFS® Fitting ensuring the tube is fully inserted, and has bottomed-out against the stop of the fitting body.

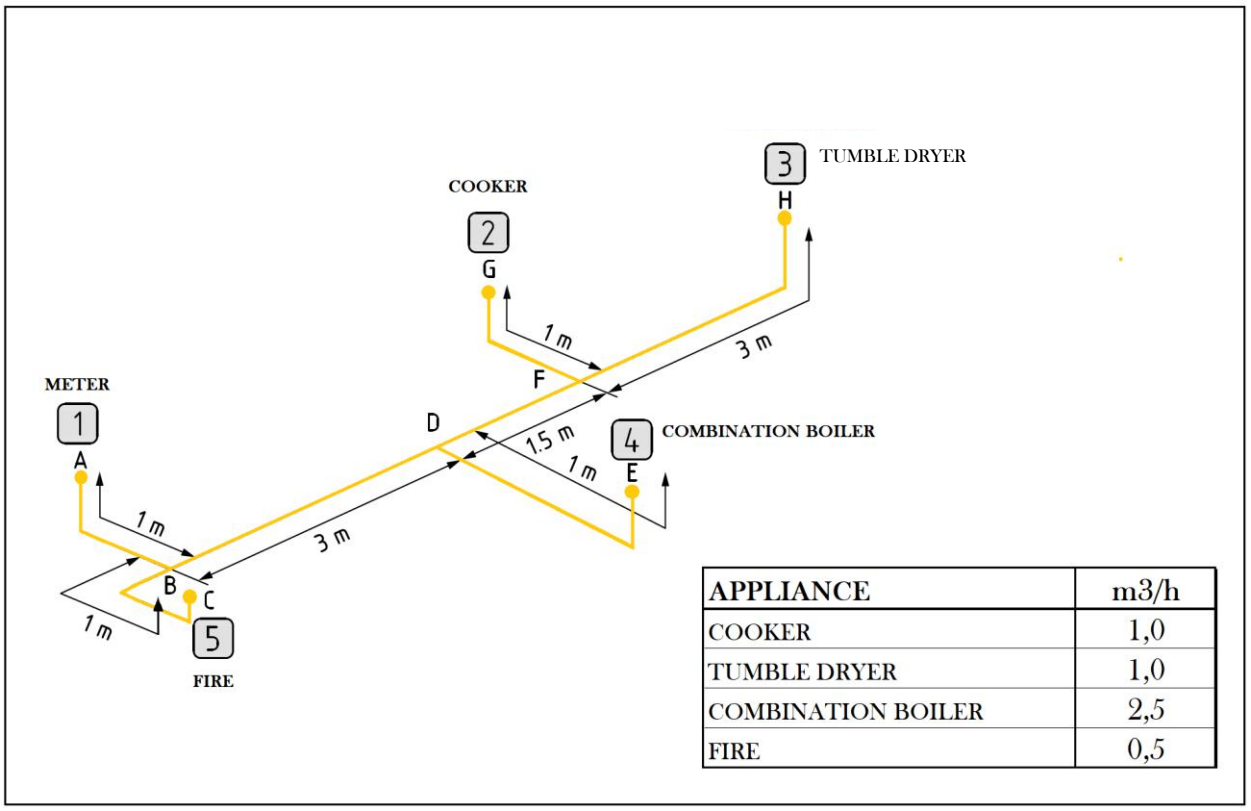
Once the GFS® tube is fully inserted into the GFS® Fitting, remove the yellow plastic transportation ring situated between the GFS® Hex and Compression Nut.

Tighten the assembled joint by hand, then using two spanners (one to hold the hex on the fitting, the other to tighten the nut) tighten to achieve a mechanically secure gas tight seal.

Ensure all joints are mechanically sound before conducting a pressure drop gas tighten test. Once satisfied the installation is gas tight, wrap any exposed CSST and nut with self-amalgamating tape. This is to prevent corrosion threat that may occur from the ingression of corrosive debris or cleaning products.

Important: The tape should run onto the back nut, leaving sufficient space to apply an earthing connection to the back nut or fitting body.

4. SIZING AND CONFIGURATIONS



APPLIANCE	m3/h
COOKER	1,0
TUMBLE DRYER	1,0
COMBINATION BOILER	2,5
FIRE	0,5

Pipe Section	m3/h	Pipe Length	Equivalent Length of Fitting From Table 11		Total Length	Pipe Diameter
			Type and Number	Equivalent Length		
A-B	5	1	One Elbow	0,4+0,4= 0,8	1,8	DN 20
B-C	0,5	1	One Tee - Two Elbows	0,4+0,8= 1,2	2,2	DN 15
B-D	4,5	3	None	0	3	DN 20
D-E	2,5	1	One Tee - One Elbow	0,4+0,4= 0,8	1,8	DN 15
D-F	2	1,5	None	0	1,5	DN 15
F-G	1	1	One Tee - One Elbow	0,4+0,4= 0,8	1,8	DN 15
F-H	1	3	One Elbow	0,4	1,4	DN 15

Table 2 Sizing Results

5. GFS® INSTALLATION PRACTICES

5.1. PRECAUTIONS

-Prior to any work being undertaken on the pipework a risk assessment shall be carried out. This shall include:

a) Risks involved in working on installations that contain fuel gas; and

b) Stray electrical currents.

-Suitable precautions shall be taken to determine the possibility of stray electrical voltages being present.

-Where an installation is temporarily isolated to allow work to be undertaken on it, the risks involved in working on an installation that contains fuel gas shall be assessed.

-During any work that necessitates removal of a meter, breaking into the gas supply, or connection or disconnection of any metal pipework, a temporary continuity bond shall be fixed securely to the pipework either side of any intended connection or disconnection point or between the pipework and any fitting to be installed or removed. Such a temporary continuity bond shall always be used irrespective of any permanent protective bonding that is installed.

-All open ends of the pipework shall be sealed with an appropriate fitting before any work is left unattended.

-Where work is in progress on the pipework that exposes the gas ways, for example open ends on the pipework, sources of ignition shall be kept away from the exposed gas ways.

-When work has been completed, the open ends of pipework shall be sealed with an appropriate fitting that will facilitate purging the installation, for example suitably plugged or capped.

-When any installation is to be decommissioned (for example, prior to the installation removal or property demolition), a risk assessment shall be carried out to

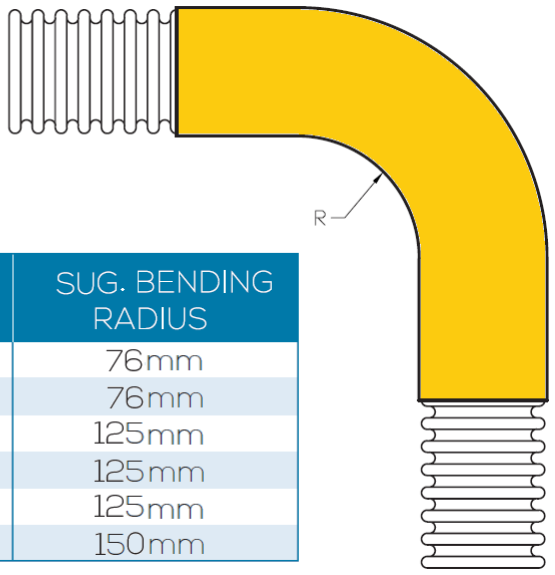
determine whether there is a requirement to purge any fuel gas from the installation (see IGEM/UP/1 [21], IGEM/UP/1A [22] and IGEM/UP/1B [23]).

-Where any pipework is no longer required, the pipework shall be disconnected as close to the point of connection to the live gas supply as practicable. In all circumstances, any exposed gas ways shall be sealed with an appropriate fitting and any part of the installation that might contain gas shall be labelled as such.

-Precautions shall be taken to avoid damage to any electrical conductor when installing pipework.

5.2. BENDING RADIUS

GFS® CSST is a flexible piping system and can be bent during installation around obstructions. Avoid stressing the tubing with tight bends and repeated bending. Refer to Table 3 for recommended bend radius for GFS® CSST.



TUBE DIAMETER DN	MIN. BENDING RADIUS	SUG. BENDING RADIUS
15	20mm	76mm
20	25mm	76mm
25	76mm	125mm
32	76mm	125mm
40	76mm	125mm
50	102mm	150mm

Table 3 Bending Radius

5.3. TORQUE VALUES

Use two spanners (one to hold the hex on the fitting, the other to tighten the nut) tighten to achieve a mechanically secure gas tight seal.

TUBING DIAMETER DN	MAXIMUM TIGHTENING TORQUE (NM)
15	55
20	60
25	85
32	180 - 240
40	240 - 300
50	300 - 370

Note: Torque vulues supplied for reference only.

Table 4 Torque Values

5.4. PRESSURE TEST POINTS

A pressure test point shall be fitted for the purpose of gas tightness testing. Where there is no meter installed that includes a test point, a test point shall be fitted not more than 300 mm downstream of the ECV or any AECV.

NOTE: *Careful consideration should be given to the positioning of the test point to allow for ease of tightness testing.*

Where a suitable test point is not provided with the appliance, a test point shall be fitted at the point to be connected on any fixed appliance inlet.

NOTE: *This test point can be incorporated into the appliance isolation valve.*

5.5. SLEEVES

-Pipework passing through a wall or a floor, whether or not it contains a cavity, shall pass through a sleeve.
All sleeves shall be of a material:
a) resistant to corrosion;
b) impermeable to gas, e.g. copper, steel, PE or polyvinyl chloride (PVC); and
c) capable of protecting the pipework against failure caused by movement of the structure.

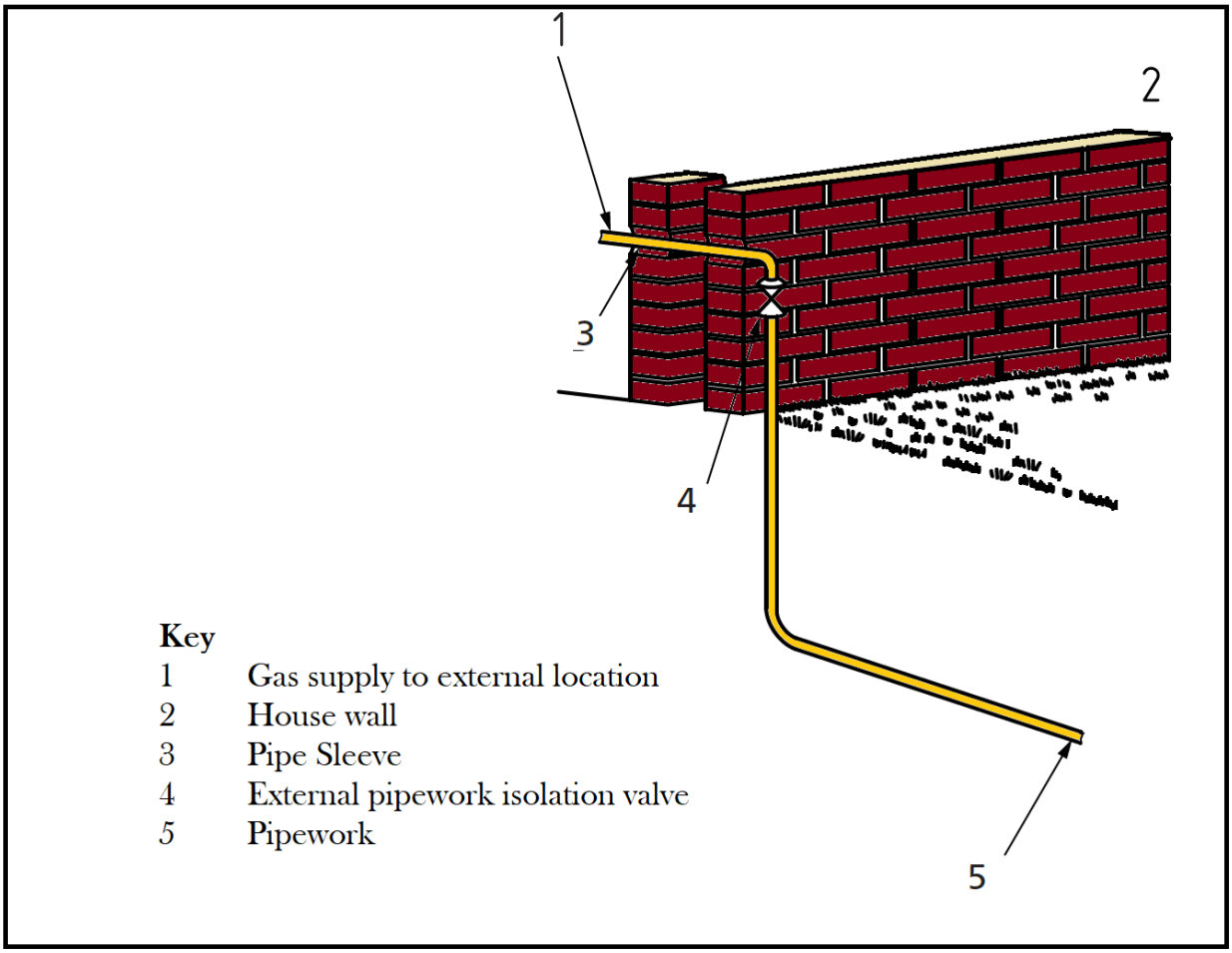


Figure 1 Typical exterior pipework

-No sleeve shall have joints along its length.

<u>Factory-applied coatings or covers on pipe do not fulfil the purpose of a sleeve</u>.

Consideration should be given to the selection of the material for a sleeve to ensure that it has no detrimental effect on the pipework installation, such as electrolytic corrosion caused by dissimilar metals.

-Any sleeve shall pass through the full width of the wall or the full thickness of the floor. The outside of the sleeve shall be secured and sealed at each end to the structure of the building with a suitable building material, e.g. cement mortar or flexible sealant.

-Any sleeve shall not impair the structural stability, fire resistance, or thermal and sound insulation of a building. The annular space between the pipework and the sleeve shall be sealed at one end to the pipework with a flexible fire-resistant compound. Where a sleeve passes through an exterior wall, the sealing of the annular space between the pipework and the sleeve shall be on the inside of the wall. However, for a sleeve that forms part of a low-pressure fed meter installation sited in a meter housing, the seal shall be inside the housing.
NOTE: *The internal diameter of any sleeve should allow for an annular space around the pipework to enable satisfactory insertion and withdrawal of the pipework and allow adequate sealing between the pipework and the sleeve.*
-Screwed, quick-release and mechanical joints and press end connections shall not be located on the pipework within a sleeve.

5.6. SUPPORTS AND SUPPORT SPACING

-GFS® CSST shall be adequately supported in accordance with Table 5

-All pipework supports shall be suitable for the environment in which they are installed and shall be designed to remain stable for the lifetime of the installation, e.g. for external use corrosion resistant or UV-stabilized plastic.

-Where GFS® CSST is installed in protected areas, all supports shall be fire-resistant, e.g. of metallic construction.

-The supports used shall be designed to prevent the pipework coming into contact with surfaces of the structure which are likely to cause corrosion.

NOTE: *Timber is a notable example of a material with which contact is unlikely to cause corrosion. Other acceptable types of support include those made from metal (see BS 1494-1) and plastic materials.*

TUBE DIAMETER DN	INTERVAL FOR VER. RUN	INTERVAL FOR HOR. RUN
15	1.2m	1.2m
20	1.8m	1.8m
25	1.8m	1.8m
32	2.5m	2.5m
40	2.5m	2.5m
50	2.5m	2.5m

Table 5 Support Lengths

5.7. INTERRELATION WITH OTHER SERVICES

5.7.1. SEPARATION OF PIPEWORK FROM ELECTRICAL SERVICES

-Where GFS® is not separated from electrical equipment or cables by an insulating enclosure, dividing barrier, trunking or conduit, it shall be spaced as follows:

a) at least 150 mm away from electricity supply equipment, such as metering equipment, main service cut-outs or supplier (main) isolation switches, and distribution boards or consumer units; or

b) at least 25 mm away from electrical switches, sockets and electricity supply and distribution cables.

-The installation pipework shall not be positioned in a manner that prevents the operation of any electrical accessory, i.e. a switch or socket outlet.

5.7.2. MAIN PROTECTIVE BONDING CONDUCTOR

A gas installation within a property with an electrical supply shall have a main protective bonding conductor connecting the pipework to the electrical installation's main earth terminal, as specified in BS 7671.

It is possible for stray currents to be transmitted through the gas pipework. Therefore, to avoid electric shock or a spark which could ignite the gas, it is important to maintain electrical continuity in the pipework at all times.

The main protective bonding conductor (main equipotential bonding connection) shall be connected to the gas consumer's fixed rigid pipework on the outlet of any primary meter installation, if fitted:
a) as near as is practicable to the point of entry into the premises;
b) before any branch in the pipework;
c) in a position where it is accessible and can be visually inspected and fitted with a warning label stating "Safety electrical connection. Do not remove."; and
d) by a mechanically and electrically sound connection which is not subject to corrosion.
The main protective bonding conductor (main equipotential bonding connection) shall not be directly connected to any pliable corrugated (stainless-steel) tube or pliable connectors from the outlet of the primary meter installation.

For internal meters, for verification purposes the bonding connection should be within 600 mm of the meter outlet union.

For meters in outside meter boxes/compartments, the bonding connection should preferably be inside the premises and within 600 mm of the point of entry of the pipework into the premises.

Alternatively, the connection can be made within the box/compartment, but it is essential that the bonding cable does not interfere with the integrity of the box/compartment and the sealing of any sleeve (see Figure 2).
For guidance on equipotential bonding in multi-dwelling buildings see
IGEM/GM/5 [26].

When relocating a meter, an existing main protective bond conductor might be satisfactory as found, or it might need to be altered. Where the bonding conductor

requires altering, any alterations should be carried out by an electrically competent person, and inspected and tested in accordance with BS 7671.

Further guidance on the connection to installations containing pliable corrugated (stainless-steel) tube can be obtained from the product manufacturer.

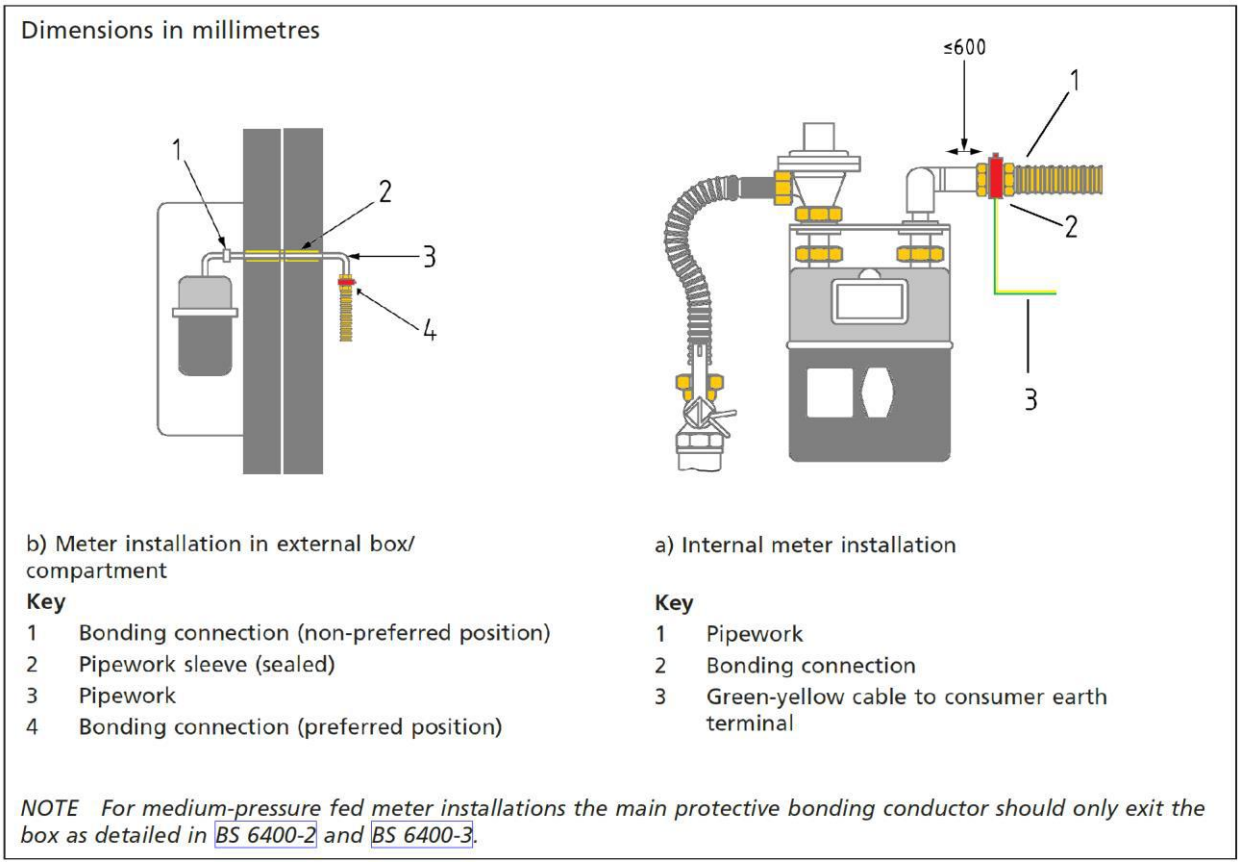


Figure 2 Main equipotential bonding

5.7.3. ELECTRO-OSMOTIC DAMP-PROOFING

Where electro-osmotic damp-proofing has been installed in a property, all metallic as pipework shall be located above ground floor level.

5.8. INSTALLATION IN DUCTS

5.8.1. VENTILATION

-Vertical and horizontal ducts containing pipework shall be ventilated to ensure that minor gas leakage does not cause the atmosphere within the duct to become unsafe.

- Any ventilation opening shall be located such that air movement can occur within the duct and hall lead to a safe place, preferably to outside air.

- Ducts shall be sealed from any cavity, wall or floor void through which they pass.

The duct can run freely through a number of storeys or take the form of an enclosure at each storey level. Where ducts are continuous, ventilation can normally be achieved by the provision of openings sized in accordance with Table 6 [see Figure 3)].

A duct, or an isolated section of duct contained solely within a room or space, can be ventilated within that room or space, provided the room or space is ventilated to normal occupational standards.

CROSS-SECTIONAL AREA (m^2)	MINIMUM FREE OF OPENING (m^2)
Not exceeding 0.01	0
0.01 and not exceeding 0.05	Cross-section area
0.05 and not exceeding 7.5	0.05
Exceeding 7.5	1/150 of the cross-section area

Table 6 Free Area of Ventilation Openings

5.8.2. FIRE RESISTANCE

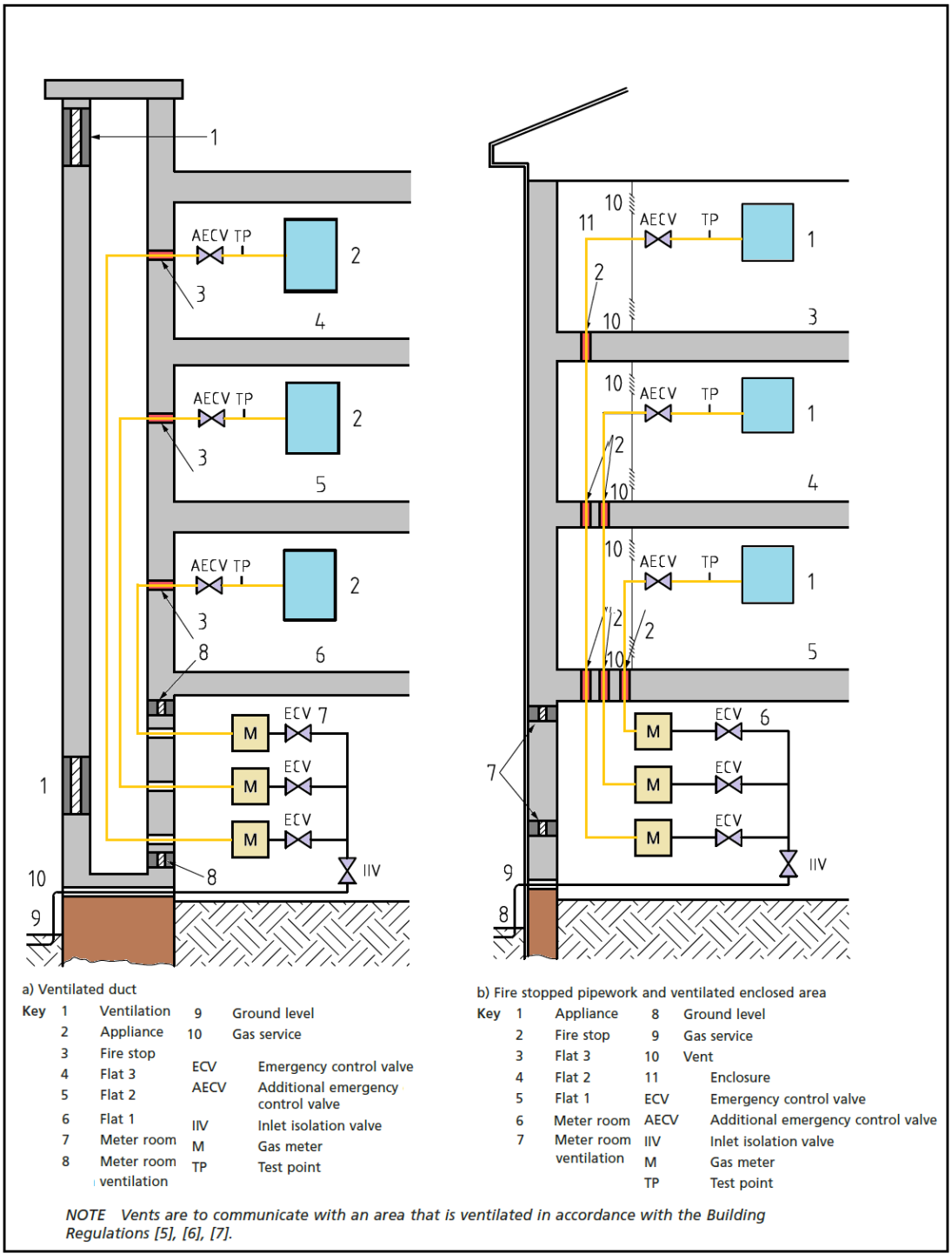
The fire resistance of any duct containing pipework shall have a fire rating equal to or greater than any void through which it passes.

The requirements for fire resistance and fire stopping CSST carrying gas installed in, or passing through, a protected area shall be manufactured to withstand fire test A of BS EN 1775:2007, Annex A.

5.9. FIRE STOPPING

For buildings containing flats and/or maisonettes, pipework shall be fire-stopped as it passes from one floor to another, unless it is installed in its own protected shaft that is ventilated top and bottom to outside air. When pipework from a protected shaft enters a flat or maisonette, it shall be fire-stopped at the point of entry [see *Figure 3)*].

When pipework passes through the protecting structure (i.e. compartment walls or floors) all openings should be kept as small, and as few in number, as practicable, and should be suitably fire-stopped in such a manner as to allow thermal movement of the pipework and ensure the fire resistance is not impaired. To prevent displacement, materials used for fire stopping should be supported by, or reinforced with, materials of limited combustibility. Any proprietary fire stopping should, when tested in accordance with the applicable part of BS 476, achieve the relevant periods of fire resistance for the structure in respect of load bearing capacity, integrity and insulation.



a) Ventilated duct

Key					
	1	Ventilation	9	Ground level	
	2	Appliance	10	Gas service	
	3	Fire stop	ECV	Emergency control valve	
	4	Flat 3	AECV	Additional emergency control valve	
	5	Flat 2	IIV	Inlet isolation valve	
	6	Flat 1	M	Gas meter	
	7	Meter room	TP	Test point	
	8	Meter room ventilation			

b) Fire stopped pipework and ventilated enclosed area

Key					
	1	Appliance	8	Ground level	
	2	Fire stop	9	Gas service	
	3	Flat 3	10	Vent	
	4	Flat 2	11	Enclosure	
	5	Flat 1	ECV	Emergency control valve	
	6	Meter room	AECV	Additional emergency control valve	
	7	Meter room ventilation	IIV	Inlet isolation valve	
			M	Gas meter	
			TP	Test point	

NOTE Vents are to communicate with an area that is ventilated in accordance with the Building Regulations [5], [6], [7].

Figure 3 Typical pipework in multi-storey buildings containing flats or maisonettes

5.10. GFS® CSST IN WOODEN JOISTED FLOORS

-Where pipework is to be installed in joisted floors and roof spaces it shall run either in the direction of the joists or at 90° to the joist direction. Diagonal runs of pipework shall not be installed.

-Where pipework is installed parallel to or at 90° to joists in floors, intermediate floors or roof spaces, it shall be supported in accordance with Table 4.

- The flanges of timber-engineered joists and metal web joists shall not be notched, drilled, altered or damaged.

-Where pipework is laid across solid timber joists fitted with flooring, the pipework shall be located in purpose-made notches or circular holes. Notches and holes shall conform to Figure 4.

-Solid timber joists with a depth less than 100 mm or greater than 250 mm shall not be notched, unless this has been confirmed as acceptable by a structural engineer.

-Where pipework is installed within roof spaces, roof rafters, purlins, trussed rafters, bracing, etc., shall only be notched, drilled or cut away with the approval of a structural engineer.

-Where pipework is installed in a void under a floor, unless there is sufficient adventitious ventilation available, ventilation shall be provided in accordance with 5.8.1, Table 6. For LPG and LPG/air mixtures this ventilation shall be at the lowest point. Alternatively, the gas pipework shall be contained within a vented duct where it passes through the void.

-Where pipework is installed within intermediate joisted floors, unless there is sufficient adventitious ventilation available, ventilation shall be provided in accordance with 5.8.1, Table 6. For LPG and LPG/air mixtures this ventilation shall be at the lowest point.

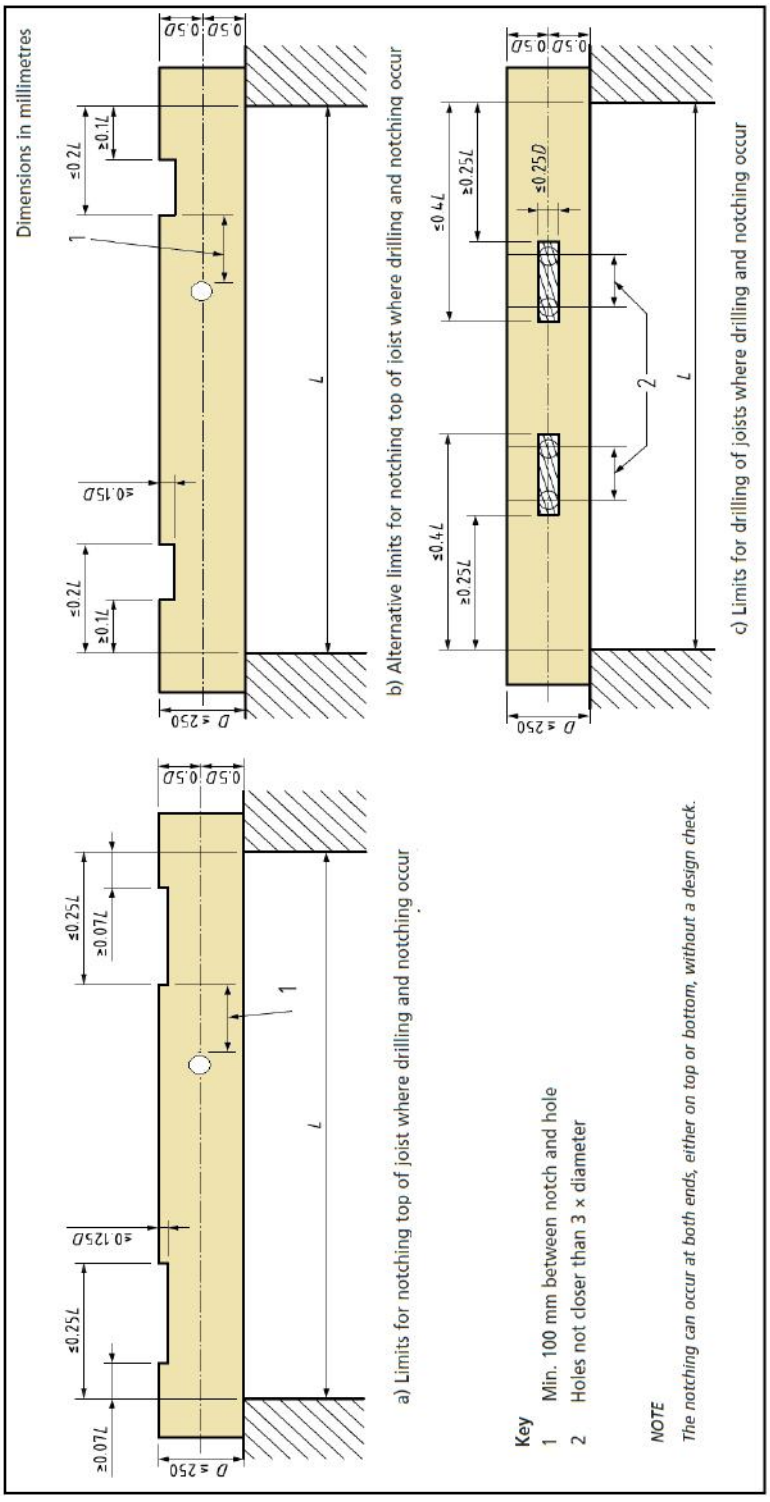


Figure 4 Limits for notches and drilling of solid timber floors

5.11. GFS® IN SOLID FLOORS

GFS® CSST may be directly buried in concrete floors.

Pipe laid in concrete shall be installed in accordance with (*Figure 5*). After the piping is laid and prior to pouring screed the entire run of GFS® CSST that is to be buried must be examined visually and manually. The installer must closely inspect the jacket over the entire length to check for any damage or voids which could affect corrosion resistance. Repair any damage by wrapping with tape. Tape wrapping must be done using GFS® CSST self-bonding silicone tape.

-Where pipework is to be installed in solid floors it shall run parallel or at 90° to the walls.

-Pipework shall not be buried in structural elements of the floor, such as concrete slabs or structural toppings. Pipework shall not be buried in power-floated floors that form part of the structure.

-Pipework in acoustic floors shall only be installed with the agreement of the building designer.

-Pipework that is to be buried in a solid floor shall be suitably protected against corrosion and degradation.

-Pipework installed in solid floors shall be protected against failure caused by movement.

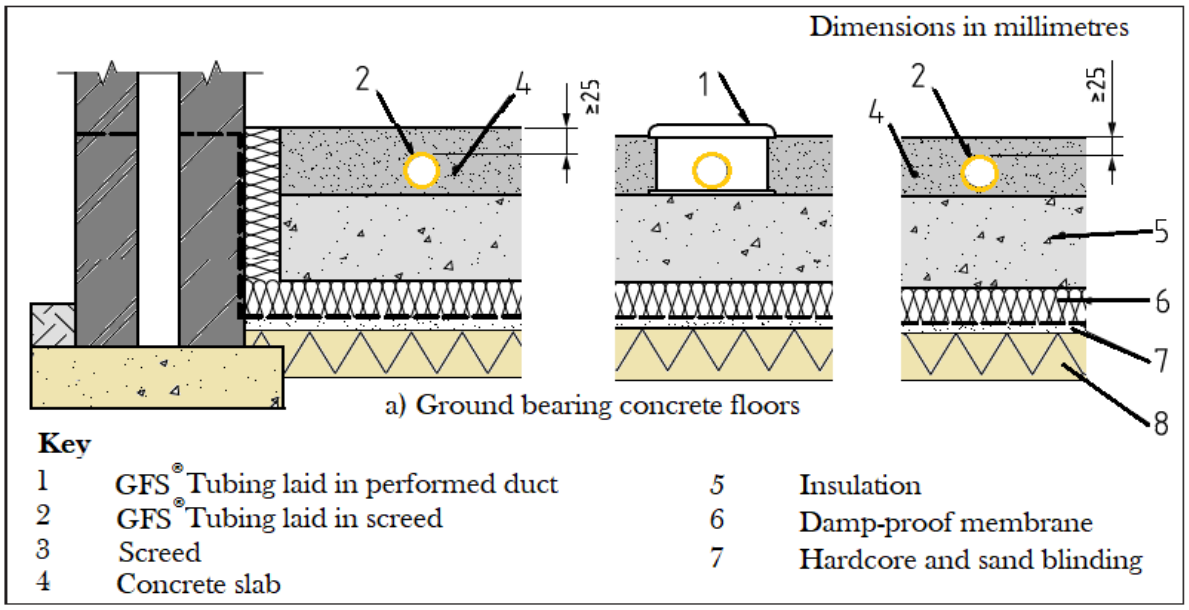


Figure 5 *Typical examples of pipework installed in solid floors (a)*

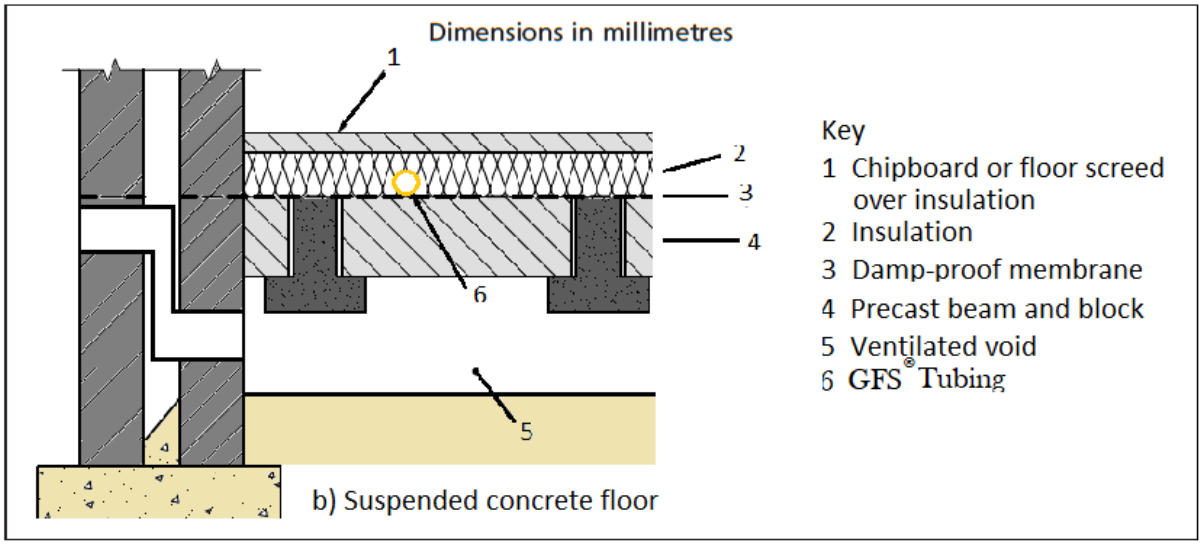


Figure 5 Typical examples of pipework installed in solid floors (b)

Figure 5 Typical examples of pipework installed in solid floors

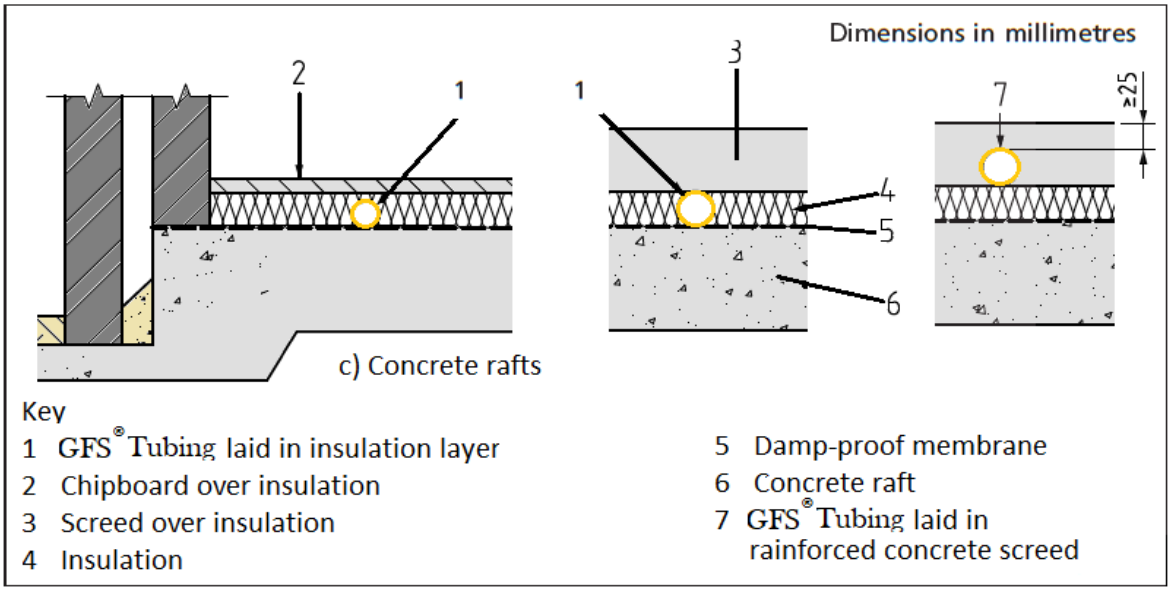


Figure 5 Typical examples of pipework installed in solid floors (c)

5.12 GFS® IN WALLS

Examples of GFS® tubing in masonry and timber frame walls are presented in *Figures 6-7-8.*

GFS® CSST runs shall, where possible, be vertical and shall be placed in ducts with convenient access points or placed in pipe chases.

5.12.1 CAVITY WALLS

GFS® CSST shall not be placed within the cavities of cavity walls. Pipework passing through a cavity wall shall take the shortest practicable route from one side to the other and shall be sleeved *(see 5.5).*

5.12.2 DRY LINED SOLID CONSTRUCTION WALLS

When installing GFS® CSST behind dry lining, tubing shall be encased by building material.

5.12.3 TIMBER-FRAME AND LIGHT STEEL-FRAMED WALLS

For GFS® CSST installed within timber construction walls shall either:

a) Run within channels or ducts that are purpose-designed

b) Be free to move away from potential puncture threats behind the plasterboard; have no fittings behind the wallboard; and be protected where appropriate from mechanical damage.

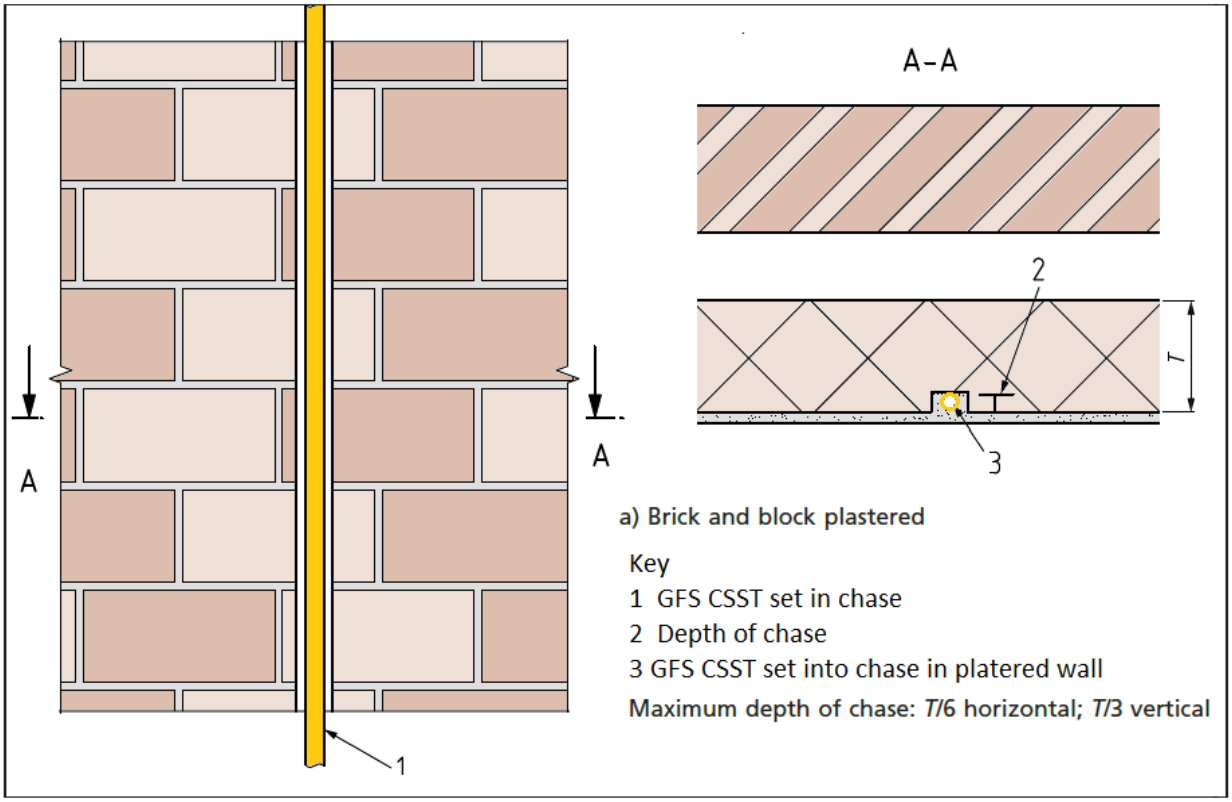
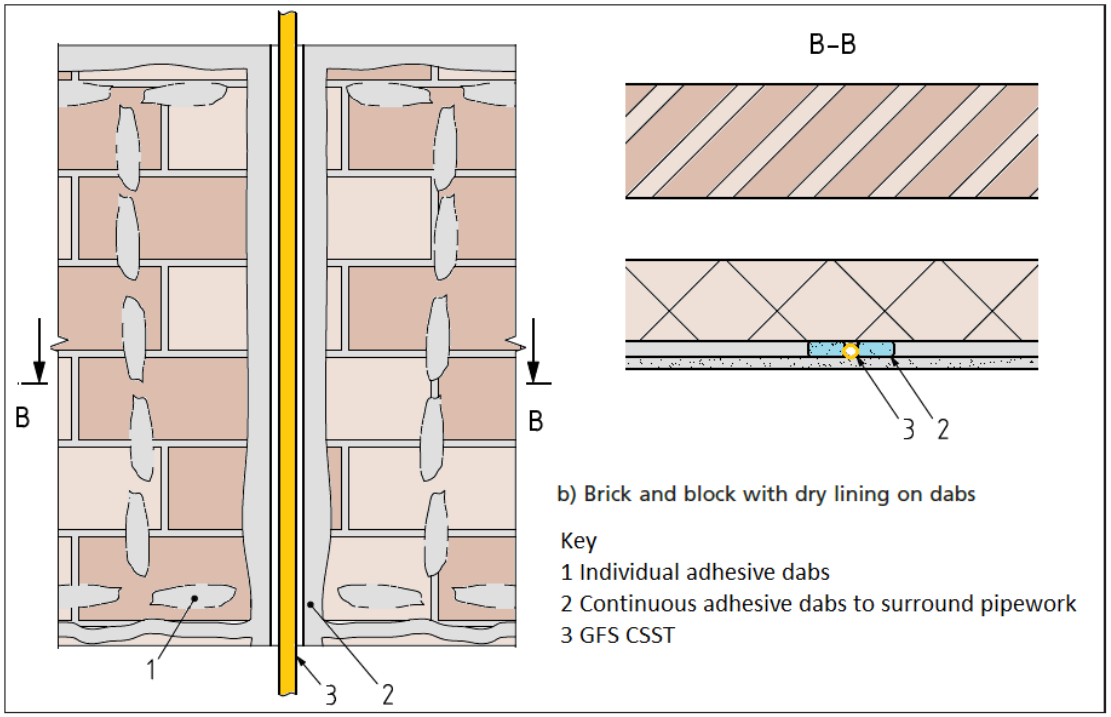


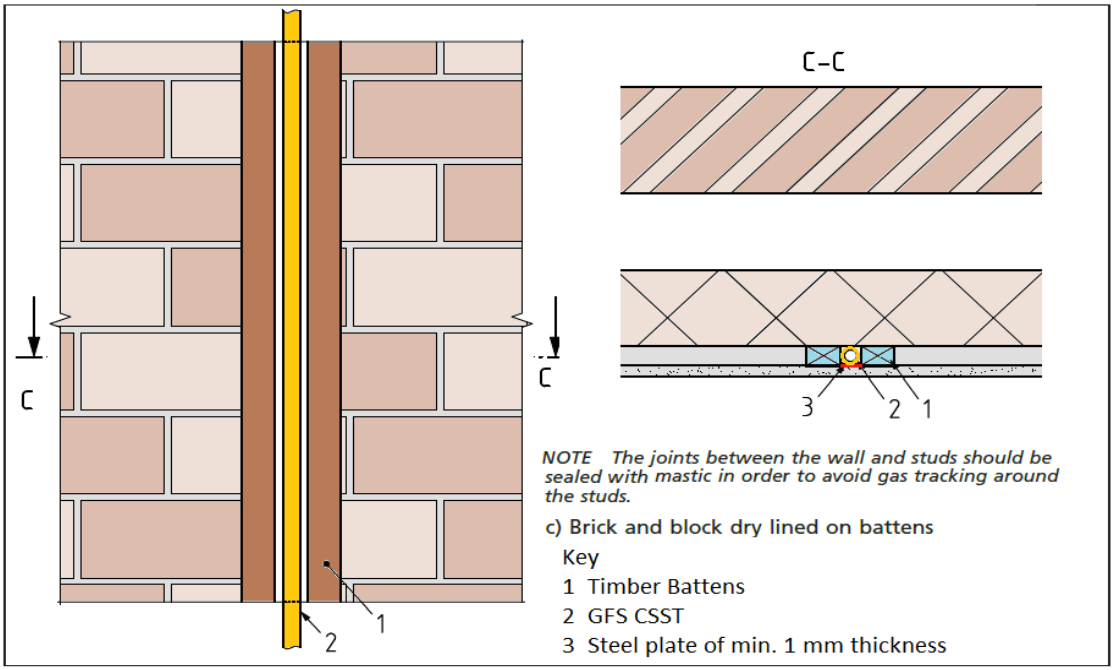
Figure 6 Typical Example of Pipework installed brick and block plastered wall



b) Brick and block with dry lining on dabs

Key
1 Individual adhesive dabs
2 Continuous adhesive dabs to surround pipework
3 GFS CSST

Figure 7 Typical example of pipework installed in brick and block with dry lining dabs



NOTE The joints between the wall and studs should be sealed with mastic in order to avoid gas tracking around the studs.

c) Brick and block dry lined on battens

Key
1 Timber Battens
2 GFS CSST
3 Steel plate of min. 1 mm thickness

Figure 8 Typical example of pipework installed in brick and block dry lined on battens

5.13 EXTERIOR PIPEWORK

GFS® is suitable for exterior, exposed use. GFS® CSST covered with the yellow polyethylene jacket which has been tested for ultraviolet attack. Any exposed stainless steel should be covered with self-amalgamating tape.

External pipework shall be protected against the risk of mechanical damage.

Buried external pipework shall be inherently resistant to, or otherwise adequately protected against, corrosion and degradation.

Pipework shall have a minimum depth of cover as given in *Table 7*.

	MINIMUM DEPTH OF COVER FOR NATURAL GAS PIPEWORK		MINIMUM DEPTH OF COVER FOR LPG PIPEWORK	
LOCATION OF PIPE UNDER	MOP ≤ 75 mbar and Ø ≤ 63 mm	MOP > 75 mbar or Ø > 63 mm	Gas and Liquid Pipework	Service Pipework
Carriageways	0,45	0,75	0,75	0,6
Path footways	0,6	0,6	0,75	0,6
Verges	0,6	0,75	0,75	0,6
Other fields and agricultural land	1,1	1,1	0,75	0,6
Other private ground	0,6	0,6	0,6	0,375

Table 7 Minimum depths of cover

Buried metallic pipework (other than proprietary systems intended for underground use) shall only be installed when appropriate and where:

- a risk assessment has been carried out; and

- an inspection strategy has been developed and provided to the gas consumer.

In all cases, GFS® fittings shall not be buried below ground.

6. DAMAGE AND REPAIR

Fittings:

Leaking fittings should be repaired in accordance with this installation guide. In some cases, the entire fitting or parts of the fitting must be replaced totally.

CSST Tubing:

If the tubing is damaged, the severity of damage and if necessary, the method of repair shall be determined as follows:

-Tubing shall be repaired if damaged due to a puncture of any kind from nails, screws or drill bits. *(See (A) in Figure 9)*

- Tubing shall be repaired if bent beyond its minimum bend radius and there is a crease or kink in the tubing. *(See (C) in Figure 9)*

-No repairs or replacements of tubing is necessary if the tubing is only slightly dented due to minor impact or crushing. *(See (B) in Figure 9)*

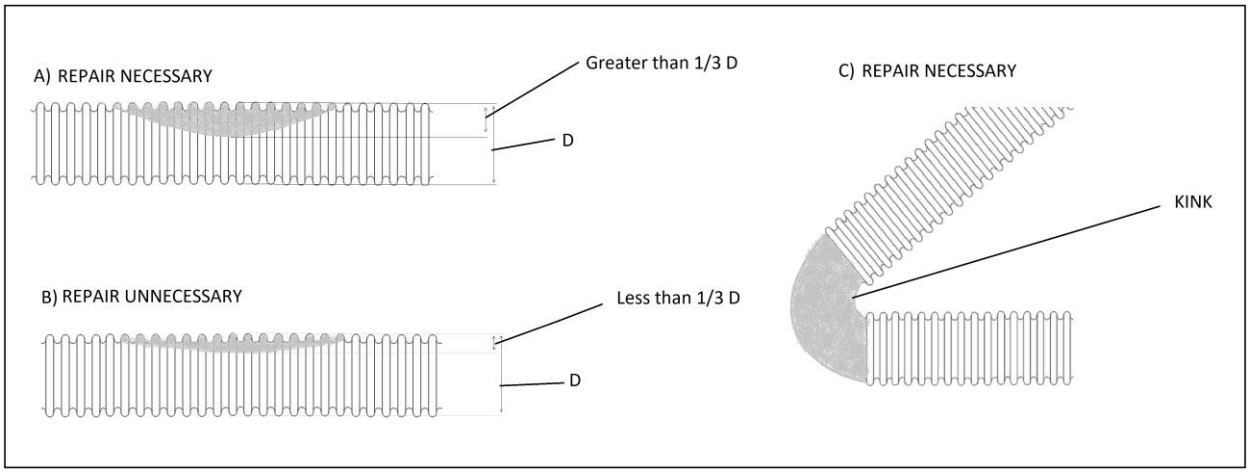


Figure 9 CSST Damages

Repair the damaged section according to the *Figure 10*.

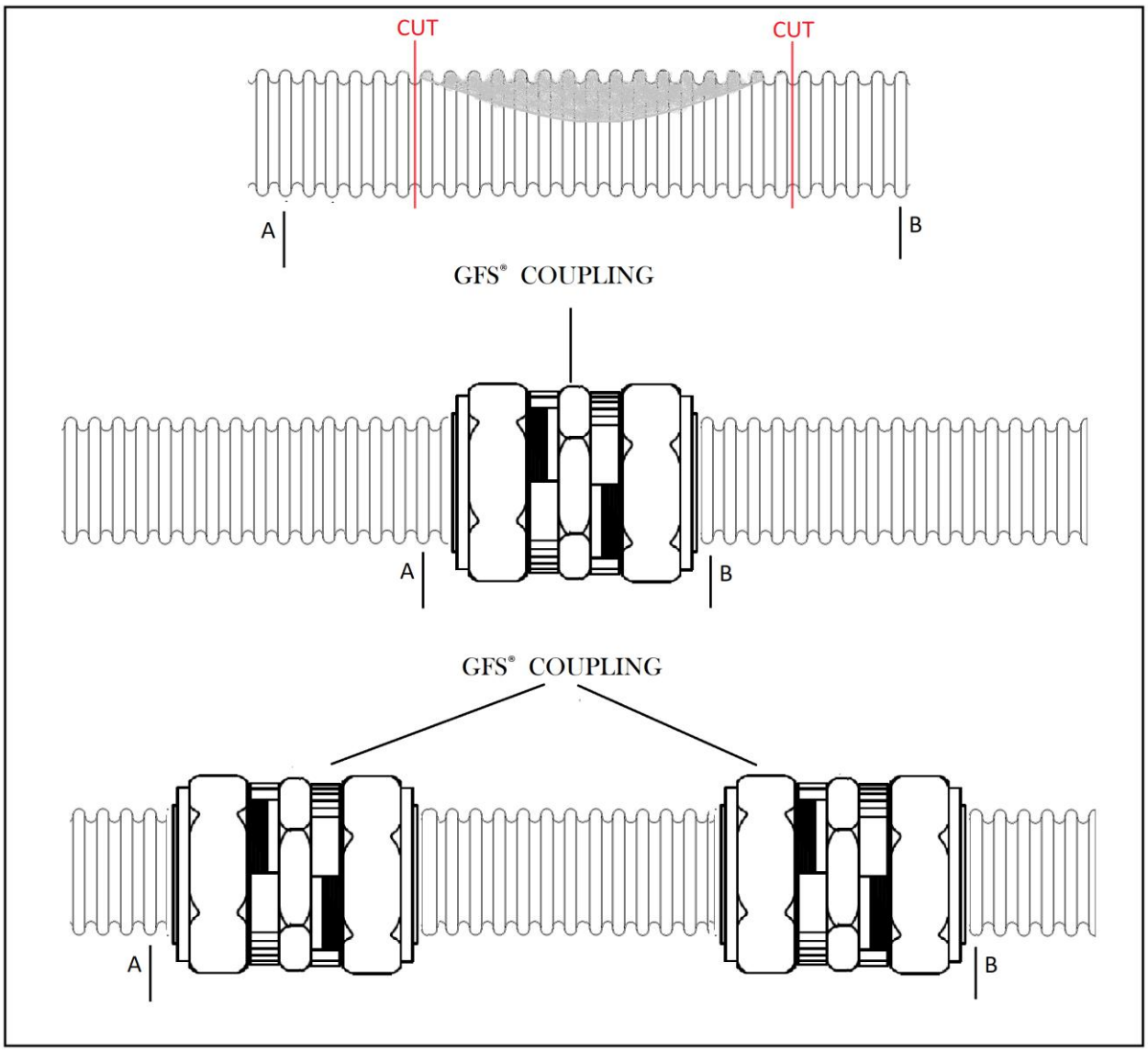


Figure 10 Repairing of Damaged CSST

Cover:

Damage to the cover can lead to corrosion the GFS® Tubing. Repair any damage of the cover by the GFS® self-amalgamating tape.

7. GAS TIGHTNESS AND PURGING

Domestic installations, apart from those below, should be tested and purged in accordance with IGE/UP/1B – Tightness testing and direct purging of small Liquefied Petroleum Gas/Air, Natural Gas and Liquefied Petroleum Gas installations.

A visual inspection of joints should be made to ensure they have been correctly made and a check should then be made to confirm there are no open ends on the tubing system.

It is important to note that some leak detection fluids (LDF) contain compounds that can be corrosive, either to stainless steel or to brass. Should the use of LDF's be necessary the operator must ensure that all traces are removed by washing with clean water. Household or 'washing up' liquid should NOT be used as leak detection fluid, as the high chloride content is corrosive to metals.

GFS® self-amalgamating silicon tape should be used to cover exposed stainless steel; it is essential that this is not applied until the pipework has been tested and deemed to be gas tight, (and any traces of LDF, if used, washed away and the pipe and fitting dried).

The tape should run onto the back nut, leaving sufficient space to apply an earthing connection to the back nut or fitting body.

8. SIZING TABLES

Table 8 Approximate discharge through GFS® CSST in cubic metres per hour for Natural Gas (relative density 0.60)

(1/3)

Inlet Pressure: 21 mbar *Pressure Drop: 1mbar*	Tubing Size					
Tubing Length (m)	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50
1	4,39	10,91	18,74	35,30	57,10	131,96
2	3,14	7,78	13,34	25,11	40,23	93,49
3	2,58	6,39	10,94	20,58	32,78	76,42
4	2,25	5,55	9,50	17,87	28,34	66,23
5	2,02	4,98	8,51	16,01	25,32	59,27
6	1,85	4,56	7,79	14,64	23,09	54,13
7	1,72	4,23	7,22	13,57	21,36	50,14
8	1,61	3,96	6,76	12,71	19,97	46,92
9	1,52	3,74	6,38	12,00	18,82	44,25
10	1,44	3,56	6,06	11,39	17,84	41,99
11	1,38	3,39	5,78	10,87	17,00	40,05
12	1,32	3,25	5,54	10,42	16,27	38,35
13	1,27	3,13	5,33	10,02	15,63	36,85
14	1,23	3,02	5,14	9,66	15,05	35,52
15	1,19	2,92	4,97	9,34	14,54	34,32
16	1,15	2,83	4,81	9,05	14,07	33,24
17	1,12	2,75	4,67	8,78	13,65	32,25
18	1,09	2,67	4,54	8,54	13,26	31,35
19	1,06	2,60	4,42	8,31	12,90	30,52
20	1,03	2,54	4,31	8,11	12,57	29,75
21	1,01	2,48	4,21	7,91	12,26	29,03
22	0,99	2,42	4,12	7,74	11,98	28,37
23	0,97	2,37	4,03	7,57	11,71	27,75
24	0,95	2,32	3,95	7,41	11,46	27,17
25	0,93	2,28	3,87	7,27	11,23	26,62
26	0,91	2,23	3,79	7,13	11,01	26,11
27	0,89	2,19	3,72	7,00	10,80	25,62
28	0,88	2,15	3,66	6,87	10,60	25,16
29	0,86	2,12	3,60	6,75	10,42	24,73
30	0,85	2,08	3,54	6,64	10,24	24,31
31	0,84	2,05	3,48	6,54	10,07	23,92
32	0,82	2,02	3,43	6,44	9,91	23,55
33	0,81	1,99	3,38	6,34	9,76	23,19
34	0,80	1,96	3,33	6,25	9,61	22,85
35	0,79	1,93	3,28	6,16	9,47	22,52
36	0,78	1,91	3,23	6,07	9,34	22,21
37	0,77	1,88	3,19	5,99	9,21	21,91
38	0,76	1,86	3,15	5,91	9,09	21,62
39	0,75	1,83	3,11	5,84	8,97	21,34
40	0,74	1,81	3,07	5,77	8,86	21,07
41	0,73	1,79	3,03	5,70	8,75	20,82
42	0,72	1,77	3,00	5,63	8,64	20,57
43	0,71	1,75	2,96	5,57	8,54	20,33
44	0,71	1,73	2,93	5,50	8,44	20,10
45	0,70	1,71	2,90	5,44	8,34	19,87
46	0,69	1,69	2,87	5,39	8,25	19,66
47	0,68	1,67	2,84	5,33	8,16	19,45
48	0,68	1,66	2,81	5,27	8,08	19,25
49	0,67	1,64	2,78	5,22	7,99	19,05
50	0,66	1,62	2,75	5,17	7,91	18,86

Flow rates based on Standard Conditions of 21 C and 1 bar.

Flow rates above include losses for four 90-degree bends and two end fittings. For tubing runs with additional bends or fittings, increase pipe length by the values given in Table 10.

Table 8 Approximate discharge through GFS® CSST in cubic metres per hour for Natural Gas (relative density 0.60)

(2/3)

Inlet Pressure: 21 mbar *Pressure Drop: 1mbar*	Tubing Size					
Tubing Length (m)	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50
51	0,66	1,61	2,73	5,12	7,83	18,67
52	0,65	1,59	2,70	5,07	7,76	18,50
53	0,64	1,58	2,68	5,02	7,68	18,32
54	0,64	1,56	2,65	4,98	7,61	18,15
55	0,63	1,55	2,63	4,93	7,54	17,99
56	0,63	1,54	2,60	4,89	7,47	17,83
57	0,62	1,52	2,58	4,85	7,41	17,67
58	0,62	1,51	2,56	4,81	7,34	17,52
59	0,61	1,50	2,54	4,77	7,28	17,37
60	0,61	1,49	2,52	4,73	7,22	17,23
61	0,60	1,47	2,50	4,69	7,16	17,08
62	0,60	1,46	2,48	4,65	7,10	16,95
63	0,59	1,45	2,46	4,61	7,04	16,81
64	0,59	1,44	2,44	4,58	6,98	16,68
65	0,58	1,43	2,42	4,54	6,93	16,55
66	0,58	1,42	2,40	4,51	6,88	16,43
67	0,58	1,41	2,39	4,48	6,82	16,31
68	0,57	1,40	2,37	4,44	6,77	16,19
69	0,57	1,39	2,35	4,41	6,72	16,07
70	0,56	1,38	2,33	4,38	6,68	15,95
71	0,56	1,37	2,32	4,35	6,63	15,84
72	0,56	1,36	2,30	4,32	6,58	15,73
73	0,55	1,35	2,29	4,29	6,54	15,62
74	0,55	1,34	2,27	4,26	6,49	15,52
75	0,55	1,33	2,26	4,24	6,45	15,42
76	0,54	1,32	2,24	4,21	6,40	15,31
77	0,54	1,32	2,23	4,18	6,36	15,22
78	0,53	1,31	2,21	4,16	6,32	15,12
79	0,53	1,30	2,20	4,13	6,28	15,02
80	0,53	1,29	2,19	4,10	6,24	14,93
81	0,53	1,28	2,17	4,08	6,20	14,84
82	0,52	1,28	2,16	4,05	6,16	14,75
83	0,52	1,27	2,15	4,03	6,12	14,66
84	0,52	1,26	2,14	4,01	6,09	14,57
85	0,51	1,25	2,12	3,98	6,05	14,49
86	0,51	1,25	2,11	3,96	6,02	14,40
87	0,51	1,24	2,10	3,94	5,98	14,32
88	0,50	1,23	2,09	3,92	5,95	14,24
89	0,50	1,23	2,08	3,89	5,91	14,16
90	0,50	1,22	2,06	3,87	5,88	14,08
91	0,50	1,21	2,05	3,85	5,85	14,00
92	0,49	1,21	2,04	3,83	5,81	13,93
93	0,49	1,20	2,03	3,81	5,78	13,85
94	0,49	1,19	2,02	3,79	5,75	13,78
95	0,49	1,19	2,01	3,77	5,72	13,71
96	0,48	1,18	2,00	3,75	5,69	13,63
97	0,48	1,18	1,99	3,73	5,66	13,56
98	0,48	1,17	1,98	3,71	5,63	13,50
99	0,48	1,17	1,97	3,70	5,60	13,43
100	0,47	1,16	1,96	3,68	5,57	13,36

Flow rates based on Standard Conditions of 21 C and 1 bar.

Flow rates above include losses for four 90-degree bends and two end fittings. For tubing runs with additional bends or fittings, increase pipe length by the values given in Table 10.

Table 8 Approximate discharge through GFS® CSST in cubic metres per hour for Natural Gas (relative density 0.60)

(3/3)

Inlet Pressure: 21 mbar *Pressure Drop: 1mbar*	Tubing Size					
Tubing Length (m)	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50
101	0,47	1,15	1,95	3,66	5,55	13,29
102	0,47	1,15	1,94	3,64	5,52	13,23
103	0,47	1,14	1,93	3,62	5,49	13,17
104	0,47	1,14	1,92	3,61	5,47	13,10
105	0,46	1,13	1,91	3,59	5,44	13,04
106	0,46	1,13	1,90	3,57	5,41	12,98
107	0,46	1,12	1,90	3,56	5,39	12,92
108	0,46	1,12	1,89	3,54	5,36	12,86
109	0,45	1,11	1,88	3,53	5,34	12,80
110	0,45	1,11	1,87	3,51	5,31	12,74
111	0,45	1,10	1,86	3,49	5,29	12,69
112	0,45	1,10	1,85	3,48	5,26	12,63
113	0,45	1,09	1,85	3,46	5,24	12,57
114	0,45	1,09	1,84	3,45	5,22	12,52
115	0,44	1,08	1,83	3,43	5,19	12,46
116	0,44	1,08	1,82	3,42	5,17	12,41
117	0,44	1,07	1,81	3,40	5,15	12,36
118	0,44	1,07	1,81	3,39	5,13	12,31
119	0,44	1,07	1,80	3,38	5,11	12,25
120	0,43	1,06	1,79	3,36	5,08	12,20
121	0,43	1,06	1,79	3,35	5,06	12,15
122	0,43	1,05	1,78	3,34	5,04	12,10
123	0,43	1,05	1,77	3,32	5,02	12,05
124	0,43	1,04	1,76	3,31	5,00	12,01
125	0,43	1,04	1,76	3,30	4,98	11,96
126	0,42	1,04	1,75	3,28	4,96	11,91
127	0,42	1,03	1,74	3,27	4,94	11,86
128	0,42	1,03	1,74	3,26	4,92	11,82
129	0,42	1,02	1,73	3,25	4,90	11,77
130	0,42	1,02	1,72	3,23	4,88	11,73
131	0,42	1,02	1,72	3,22	4,86	11,68
132	0,41	1,01	1,71	3,21	4,84	11,64
133	0,41	1,01	1,70	3,20	4,83	11,59
134	0,41	1,01	1,70	3,19	4,81	11,55
135	0,41	1,00	1,69	3,17	4,79	11,51
136	0,41	1,00	1,69	3,16	4,77	11,47
137	0,41	0,99	1,68	3,15	4,75	11,42
138	0,41	0,99	1,67	3,14	4,74	11,38
139	0,40	0,99	1,67	3,13	4,72	11,34
140	0,40	0,98	1,66	3,12	4,70	11,30
141	0,40	0,98	1,66	3,11	4,69	11,26
142	0,40	0,98	1,65	3,10	4,67	11,22
143	0,40	0,97	1,64	3,09	4,65	11,18
144	0,40	0,97	1,64	3,07	4,64	11,14
145	0,40	0,97	1,63	3,06	4,62	11,11
146	0,40	0,96	1,63	3,05	4,60	11,07
147	0,39	0,96	1,62	3,04	4,59	11,03
148	0,39	0,96	1,62	3,03	4,57	10,99
149	0,39	0,95	1,61	3,02	4,56	10,96
150	0,39	0,95	1,61	3,01	4,54	10,92

Flow rates based on Standard Conditions of 21 C and 1 bar.
Flow rates above include losses for four 90-degree bends and two end fittings. For tubing runs with additional bends or fittings, increase pipe length by the values given in Table 10.

Table 9 Approximate discharge through GFS® CSST in cubic metres per hour for PROPANE (relative density 1.52)

(1/3)

Inlet Pressure: 37 mbar *Pressure Drop: 2 mbar*	Tubing Size					
Tubing Length (m)	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50
1	3,86	9,60	16,54	31,17	50,92	117,04
2	2,76	6,85	11,77	22,18	35,87	82,91
3	2,27	5,62	9,65	18,17	29,23	67,77
4	1,97	4,89	8,38	15,78	25,28	58,74
5	1,77	4,39	7,51	14,14	22,58	52,57
6	1,62	4,01	6,87	12,93	20,59	48,01
7	1,51	3,72	6,37	11,99	19,05	44,47
8	1,41	3,49	5,97	11,23	17,81	41,61
9	1,33	3,29	5,63	10,60	16,78	39,24
10	1,27	3,13	5,35	10,06	15,91	37,24
11	1,21	2,99	5,10	9,60	15,16	35,52
12	1,16	2,86	4,89	9,20	14,51	34,01
13	1,12	2,75	4,70	8,85	13,93	32,69
14	1,08	2,66	4,54	8,53	13,42	31,50
15	1,04	2,57	4,38	8,24	12,96	30,44
16	1,01	2,49	4,25	7,99	12,55	29,48
17	0,98	2,42	4,12	7,75	12,17	28,60
18	0,95	2,35	4,01	7,54	11,82	27,80
19	0,93	2,29	3,91	7,34	11,50	27,06
20	0,91	2,23	3,81	7,16	11,21	26,38
21	0,89	2,18	3,72	6,99	10,94	25,75
22	0,87	2,13	3,63	6,83	10,68	25,16
23	0,85	2,09	3,56	6,68	10,45	24,61
24	0,83	2,04	3,48	6,55	10,22	24,10
25	0,81	2,00	3,41	6,42	10,01	23,61
26	0,80	1,97	3,35	6,29	9,82	23,16
27	0,78	1,93	3,29	6,18	9,63	22,72
28	0,77	1,90	3,23	6,07	9,46	22,32
29	0,76	1,86	3,17	5,96	9,29	21,93
30	0,75	1,83	3,12	5,87	9,13	21,56
31	0,73	1,80	3,07	5,77	8,98	21,22
32	0,72	1,78	3,02	5,68	8,84	20,88
33	0,71	1,75	2,98	5,60	8,70	20,57
34	0,70	1,73	2,94	5,52	8,57	20,26
35	0,69	1,70	2,89	5,44	8,45	19,97
36	0,68	1,68	2,85	5,36	8,33	19,70
37	0,67	1,66	2,82	5,29	8,21	19,43
38	0,67	1,63	2,78	5,22	8,10	19,17
39	0,66	1,61	2,74	5,16	8,00	18,93
40	0,65	1,59	2,71	5,09	7,90	18,69
41	0,64	1,57	2,68	5,03	7,80	18,46
42	0,63	1,56	2,65	4,97	7,71	18,24
43	0,63	1,54	2,62	4,92	7,61	18,03
44	0,62	1,52	2,59	4,86	7,53	17,82
45	0,61	1,51	2,56	4,81	7,44	17,63
46	0,61	1,49	2,53	4,76	7,36	17,43
47	0,60	1,47	2,50	4,71	7,28	17,25
48	0,59	1,46	2,48	4,66	7,20	17,07
49	0,59	1,44	2,45	4,61	7,13	16,90
50	0,58	1,43	2,43	4,56	7,06	16,73

Flow rates based on Standard Conditions of 21 C and 1 bar.

Flow rates above include losses for four 90-degree bends and two end fittings. For tubing runs with additional bends or fittings, increase pipe length by the values given in Table 10.

Table 9 Approximate discharge through GFS® CSST in cubic metres per hour for PROPANE (relative density 1.52)

(2/3)

Inlet Pressure: 37 mbar *Pressure Drop: 2 mbar*	Tubing Size					
Tubing Length (m)	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50
51	0,58	1,42	2,41	4,52	6,99	16,56
52	0,57	1,40	2,38	4,48	6,92	16,40
53	0,57	1,39	2,36	4,44	6,85	16,25
54	0,56	1,38	2,34	4,40	6,79	16,10
55	0,56	1,36	2,32	4,36	6,72	15,95
56	0,55	1,35	2,30	4,32	6,66	15,81
57	0,55	1,34	2,28	4,28	6,60	15,67
58	0,54	1,33	2,26	4,24	6,55	15,54
59	0,54	1,32	2,24	4,21	6,49	15,41
60	0,53	1,31	2,22	4,17	6,43	15,28
61	0,53	1,30	2,20	4,14	6,38	15,15
62	0,52	1,29	2,19	4,11	6,33	15,03
63	0,52	1,28	2,17	4,08	6,28	14,91
64	0,52	1,27	2,15	4,04	6,23	14,79
65	0,51	1,26	2,14	4,01	6,18	14,68
66	0,51	1,25	2,12	3,98	6,13	14,57
67	0,51	1,24	2,11	3,95	6,09	14,46
68	0,50	1,23	2,09	3,93	6,04	14,35
69	0,50	1,22	2,08	3,90	6,00	14,25
70	0,50	1,21	2,06	3,87	5,95	14,15
71	0,49	1,21	2,05	3,84	5,91	14,05
72	0,49	1,20	2,03	3,82	5,87	13,95
73	0,49	1,19	2,02	3,79	5,83	13,86
74	0,48	1,18	2,01	3,77	5,79	13,76
75	0,48	1,17	1,99	3,74	5,75	13,67
76	0,48	1,17	1,98	3,72	5,71	13,58
77	0,47	1,16	1,97	3,69	5,67	13,49
78	0,47	1,15	1,95	3,67	5,64	13,41
79	0,47	1,14	1,94	3,65	5,60	13,32
80	0,46	1,14	1,93	3,62	5,56	13,24
81	0,46	1,13	1,92	3,60	5,53	13,16
82	0,46	1,12	1,91	3,58	5,50	13,08
83	0,46	1,12	1,90	3,56	5,46	13,00
84	0,45	1,11	1,88	3,54	5,43	12,92
85	0,45	1,10	1,87	3,52	5,40	12,85
86	0,45	1,10	1,86	3,50	5,36	12,77
87	0,45	1,09	1,85	3,48	5,33	12,70
88	0,44	1,09	1,84	3,46	5,30	12,63
89	0,44	1,08	1,83	3,44	5,27	12,56
90	0,44	1,07	1,82	3,42	5,24	12,49
91	0,44	1,07	1,81	3,40	5,21	12,42
92	0,43	1,06	1,80	3,38	5,18	12,35
93	0,43	1,06	1,79	3,37	5,16	12,29
94	0,43	1,05	1,78	3,35	5,13	12,22
95	0,43	1,05	1,77	3,33	5,10	12,16
96	0,42	1,04	1,76	3,31	5,07	12,09
97	0,42	1,04	1,76	3,30	5,05	12,03
98	0,42	1,03	1,75	3,28	5,02	11,97
99	0,42	1,03	1,74	3,26	5,00	11,91
100	0,42	1,02	1,73	3,25	4,97	11,85

Flow rates based on Standard Conditions of 21 C and 1 bar.

Flow rates above include losses for four 90-degree bends and two end fittings. For tubing runs with additional bends or fittings, increase pipe length by the values given in Table 10.

Table 9 Approximate discharge through GFS® CSST in cubic metres per hour for PROPANE (relative density 1.52)

(3/3)

Inlet Pressure: 37 mbar *Pressure Drop: 2 mbar*	Tubing Size					
Tubing Length (m)	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50
101	0,41	1,02	1,72	3,23	4,95	11,79
102	0,41	1,01	1,71	3,22	4,92	11,73
103	0,41	1,01	1,71	3,20	4,90	11,68
104	0,41	1,00	1,70	3,19	4,87	11,62
105	0,41	1,00	1,69	3,17	4,85	11,57
106	0,41	0,99	1,68	3,16	4,83	11,51
107	0,40	0,99	1,67	3,14	4,80	11,46
108	0,40	0,98	1,67	3,13	4,78	11,40
109	0,40	0,98	1,66	3,11	4,76	11,35
110	0,40	0,97	1,65	3,10	4,74	11,30
111	0,40	0,97	1,64	3,09	4,72	11,25
112	0,39	0,97	1,64	3,07	4,69	11,20
113	0,39	0,96	1,63	3,06	4,67	11,15
114	0,39	0,96	1,62	3,05	4,65	11,10
115	0,39	0,95	1,62	3,03	4,63	11,05
116	0,39	0,95	1,61	3,02	4,61	11,01
117	0,39	0,95	1,60	3,01	4,59	10,96
118	0,38	0,94	1,60	2,99	4,57	10,91
119	0,38	0,94	1,59	2,98	4,55	10,87
120	0,38	0,93	1,58	2,97	4,53	10,82
121	0,38	0,93	1,58	2,96	4,51	10,78
122	0,38	0,93	1,57	2,95	4,50	10,73
123	0,38	0,92	1,56	2,93	4,48	10,69
124	0,38	0,92	1,56	2,92	4,46	10,65
125	0,37	0,92	1,55	2,91	4,44	10,60
126	0,37	0,91	1,54	2,90	4,42	10,56
127	0,37	0,91	1,54	2,89	4,41	10,52
128	0,37	0,90	1,53	2,88	4,39	10,48
129	0,37	0,90	1,53	2,87	4,37	10,44
130	0,37	0,90	1,52	2,86	4,35	10,40
131	0,37	0,89	1,52	2,84	4,34	10,36
132	0,36	0,89	1,51	2,83	4,32	10,32
133	0,36	0,89	1,50	2,82	4,30	10,28
134	0,36	0,88	1,50	2,81	4,29	10,24
135	0,36	0,88	1,49	2,80	4,27	10,21
136	0,36	0,88	1,49	2,79	4,26	10,17
137	0,36	0,88	1,48	2,78	4,24	10,13
138	0,36	0,87	1,48	2,77	4,22	10,10
139	0,36	0,87	1,47	2,76	4,21	10,06
140	0,35	0,87	1,47	2,75	4,19	10,02
141	0,35	0,86	1,46	2,74	4,18	9,99
142	0,35	0,86	1,46	2,73	4,16	9,95
143	0,35	0,86	1,45	2,72	4,15	9,92
144	0,35	0,85	1,45	2,72	4,13	9,88
145	0,35	0,85	1,44	2,71	4,12	9,85
146	0,35	0,85	1,44	2,70	4,11	9,82
147	0,35	0,85	1,43	2,69	4,09	9,78
148	0,34	0,84	1,43	2,68	4,08	9,75
149	0,34	0,84	1,42	2,67	4,06	9,72
150	0,34	0,84	1,42	2,66	4,05	9,69

Flow rates based on Standard Conditions of 21 C and 1 bar.
Flow rates above include losses for four 90-degree bends and two end fittings. For tubing runs with additional bends or fittings, increase pipe length by the values given in Table 10.

Table 10 Approximate discharge through GFS® CSST in cubic metres per hour for BUTANE (relative density 2,07)

(1/3)

Inlet Pressure: 28 mbar *Pressure Drop: 2 mbar*	Tubing Size					
Tubing Length (m)	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50
1	3,31	8,23	14,17	26,71	43,63	100,29
2	2,37	5,87	10,09	19,00	30,74	71,05
3	1,94	4,82	8,27	15,57	25,05	58,07
4	1,69	4,19	7,18	13,52	21,66	50,33
5	1,52	3,76	6,44	12,12	19,35	45,05
6	1,39	3,44	5,89	11,08	17,65	41,14
7	1,29	3,19	5,46	10,27	16,32	38,10
8	1,21	2,99	5,11	9,62	15,26	35,66
9	1,14	2,82	4,83	9,08	14,38	33,63
10	1,09	2,68	4,58	8,62	13,63	31,91
11	1,04	2,56	4,37	8,23	12,99	30,43
12	1,00	2,45	4,19	7,88	12,43	29,15
13	0,96	2,36	4,03	7,58	11,94	28,01
14	0,92	2,28	3,89	7,31	11,50	26,99
15	0,89	2,20	3,76	7,07	11,11	26,08
16	0,87	2,13	3,64	6,84	10,75	25,26
17	0,84	2,07	3,53	6,64	10,43	24,51
18	0,82	2,01	3,44	6,46	10,13	23,82
19	0,80	1,96	3,35	6,29	9,86	23,19
20	0,78	1,91	3,26	6,13	9,61	22,61
21	0,76	1,87	3,19	5,99	9,37	22,06
22	0,74	1,83	3,11	5,85	9,15	21,56
23	0,73	1,79	3,05	5,73	8,95	21,09
24	0,71	1,75	2,98	5,61	8,76	20,65
25	0,70	1,72	2,92	5,50	8,58	20,23
26	0,68	1,68	2,87	5,39	8,41	19,84
27	0,67	1,65	2,82	5,29	8,25	19,47
28	0,66	1,62	2,77	5,20	8,10	19,12
29	0,65	1,60	2,72	5,11	7,96	18,79
30	0,64	1,57	2,67	5,03	7,83	18,48
31	0,63	1,55	2,63	4,95	7,70	18,18
32	0,62	1,52	2,59	4,87	7,58	17,89
33	0,61	1,50	2,55	4,80	7,46	17,62
34	0,60	1,48	2,52	4,73	7,35	17,36
35	0,59	1,46	2,48	4,66	7,24	17,11
36	0,59	1,44	2,45	4,60	7,14	16,88
37	0,58	1,42	2,41	4,53	7,04	16,65
38	0,57	1,40	2,38	4,48	6,95	16,43
39	0,56	1,38	2,35	4,42	6,85	16,22
40	0,56	1,37	2,32	4,36	6,77	16,02
41	0,55	1,35	2,30	4,31	6,68	15,82
42	0,54	1,33	2,27	4,26	6,60	15,63
43	0,54	1,32	2,24	4,21	6,52	15,45
44	0,53	1,30	2,22	4,16	6,45	15,27
45	0,53	1,29	2,19	4,12	6,38	15,10
46	0,52	1,28	2,17	4,08	6,31	14,94
47	0,51	1,26	2,15	4,03	6,24	14,78
48	0,51	1,25	2,12	3,99	6,17	14,63
49	0,50	1,24	2,10	3,95	6,11	14,48
50	0,50	1,23	2,08	3,91	6,05	14,33

Flow rates based on Standard Conditions of 21 C and 1 bar.

Flow rates above include losses for four 90-degree bends and two end fittings. For tubing runs with additional bends or fittings, increase pipe length by the values given in Table 10.

Table 10 Approximate discharge through GFS® CSST in cubic metres per hour for BUTANE (relative density 2,07)

(2/3)

Inlet Pressure: 28 mbar *Pressure Drop: 2 mbar*	Tubing Size					
Tubing Length (m)	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50
51	0,49	1,21	2,06	3,87	5,99	14,19
52	0,49	1,20	2,04	3,84	5,93	14,06
53	0,49	1,19	2,02	3,80	5,87	13,92
54	0,48	1,18	2,01	3,77	5,82	13,79
55	0,48	1,17	1,99	3,73	5,76	13,67
56	0,47	1,16	1,97	3,70	5,71	13,55
57	0,47	1,15	1,95	3,67	5,66	13,43
58	0,46	1,14	1,94	3,64	5,61	13,31
59	0,46	1,13	1,92	3,61	5,56	13,20
60	0,46	1,12	1,90	3,58	5,51	13,09
61	0,45	1,11	1,89	3,55	5,47	12,98
62	0,45	1,10	1,87	3,52	5,42	12,88
63	0,45	1,09	1,86	3,49	5,38	12,78
64	0,44	1,09	1,84	3,46	5,34	12,68
65	0,44	1,08	1,83	3,44	5,30	12,58
66	0,44	1,07	1,82	3,41	5,25	12,48
67	0,43	1,06	1,80	3,39	5,21	12,39
68	0,43	1,05	1,79	3,36	5,18	12,30
69	0,43	1,05	1,78	3,34	5,14	12,21
70	0,42	1,04	1,77	3,32	5,10	12,12
71	0,42	1,03	1,75	3,29	5,06	12,04
72	0,42	1,03	1,74	3,27	5,03	11,96
73	0,42	1,02	1,73	3,25	4,99	11,87
74	0,41	1,01	1,72	3,23	4,96	11,79
75	0,41	1,01	1,71	3,21	4,93	11,72
76	0,41	1,00	1,70	3,18	4,89	11,64
77	0,41	0,99	1,69	3,16	4,86	11,56
78	0,40	0,99	1,67	3,14	4,83	11,49
79	0,40	0,98	1,66	3,12	4,80	11,42
80	0,40	0,97	1,65	3,11	4,77	11,35
81	0,40	0,97	1,64	3,09	4,74	11,28
82	0,39	0,96	1,63	3,07	4,71	11,21
83	0,39	0,96	1,62	3,05	4,68	11,14
84	0,39	0,95	1,61	3,03	4,65	11,07
85	0,39	0,95	1,61	3,01	4,62	11,01
86	0,38	0,94	1,60	3,00	4,60	10,94
87	0,38	0,94	1,59	2,98	4,57	10,88
88	0,38	0,93	1,58	2,96	4,54	10,82
89	0,38	0,93	1,57	2,95	4,52	10,76
90	0,38	0,92	1,56	2,93	4,49	10,70
91	0,37	0,92	1,55	2,91	4,47	10,64
92	0,37	0,91	1,54	2,90	4,44	10,58
93	0,37	0,91	1,54	2,88	4,42	10,53
94	0,37	0,90	1,53	2,87	4,39	10,47
95	0,37	0,90	1,52	2,85	4,37	10,42
96	0,36	0,89	1,51	2,84	4,35	10,36
97	0,36	0,89	1,50	2,82	4,33	10,31
98	0,36	0,88	1,50	2,81	4,30	10,26
99	0,36	0,88	1,49	2,80	4,28	10,20
100	0,36	0,87	1,48	2,78	4,26	10,15

Flow rates based on Standard Conditions of 21 C and 1 bar.

Flow rates above include losses for four 90-degree bends and two end fittings. For tubing runs with additional bends or fittings, increase pipe length by the values given in Table 10.

Table 10 Approximate discharge through GFS® CSST in cubic metres per hour for BUTANE (relative density 2,07)

(3/3)

Inlet Pressure: 28 mbar *Pressure Drop: 2 mbar*	Tubing Size					
Tubing Length (m)	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50
101	0,36	0,87	1,48	2,77	4,24	10,10
102	0,35	0,87	1,47	2,76	4,22	10,05
103	0,35	0,86	1,46	2,74	4,20	10,01
104	0,35	0,86	1,45	2,73	4,18	9,96
105	0,35	0,85	1,45	2,72	4,16	9,91
106	0,35	0,85	1,44	2,70	4,14	9,86
107	0,35	0,85	1,43	2,69	4,12	9,82
108	0,34	0,84	1,43	2,68	4,10	9,77
109	0,34	0,84	1,42	2,67	4,08	9,73
110	0,34	0,83	1,41	2,66	4,06	9,68
111	0,34	0,83	1,41	2,64	4,04	9,64
112	0,34	0,83	1,40	2,63	4,02	9,60
113	0,34	0,82	1,40	2,62	4,00	9,56
114	0,34	0,82	1,39	2,61	3,99	9,51
115	0,33	0,82	1,38	2,60	3,97	9,47
116	0,33	0,81	1,38	2,59	3,95	9,43
117	0,33	0,81	1,37	2,58	3,93	9,39
118	0,33	0,81	1,37	2,57	3,92	9,35
119	0,33	0,80	1,36	2,56	3,90	9,31
120	0,33	0,80	1,36	2,54	3,88	9,27
121	0,33	0,80	1,35	2,53	3,87	9,24
122	0,32	0,79	1,34	2,52	3,85	9,20
123	0,32	0,79	1,34	2,51	3,84	9,16
124	0,32	0,79	1,33	2,50	3,82	9,12
125	0,32	0,78	1,33	2,49	3,81	9,09
126	0,32	0,78	1,32	2,48	3,79	9,05
127	0,32	0,78	1,32	2,47	3,78	9,02
128	0,32	0,78	1,31	2,47	3,76	8,98
129	0,32	0,77	1,31	2,46	3,75	8,95
130	0,31	0,77	1,30	2,45	3,73	8,91
131	0,31	0,77	1,30	2,44	3,72	8,88
132	0,31	0,76	1,29	2,43	3,70	8,84
133	0,31	0,76	1,29	2,42	3,69	8,81
134	0,31	0,76	1,28	2,41	3,67	8,78
135	0,31	0,76	1,28	2,40	3,66	8,75
136	0,31	0,75	1,27	2,39	3,65	8,71
137	0,31	0,75	1,27	2,38	3,63	8,68
138	0,31	0,75	1,27	2,38	3,62	8,65
139	0,30	0,74	1,26	2,37	3,61	8,62
140	0,30	0,74	1,26	2,36	3,59	8,59
141	0,30	0,74	1,25	2,35	3,58	8,56
142	0,30	0,74	1,25	2,34	3,57	8,53
143	0,30	0,73	1,24	2,33	3,56	8,50
144	0,30	0,73	1,24	2,33	3,54	8,47
145	0,30	0,73	1,24	2,32	3,53	8,44
146	0,30	0,73	1,23	2,31	3,52	8,41
147	0,30	0,72	1,23	2,30	3,51	8,38
148	0,30	0,72	1,22	2,30	3,49	8,36
149	0,29	0,72	1,22	2,29	3,48	8,33
150	0,29	0,72	1,22	2,28	3,47	8,30

Flow rates based on Standard Conditions of 21 C and 1 bar.
Flow rates above include losses for four 90-degree bends and two end fittings. For tubing runs with additional bends or fittings, increase pipe length by the values given in Table 10.

GFS CSST SIZE (DN)	90 DEGREE BEND (M)	TEE (M)
15	0,4	0,4
20	0,4	0,4
25	0,4	0,4
32	0,6	0,7
40	0,6	0,7
50	0,7	1

Table 11 Equivalent tubing lengths (m) for fittings and bends for 1 mbar differential pressure.

9. WARRANTY

Gas Flex Systems ("GFS®") hereby provides a limited warranty that its GFS® Products will be free from any defect of workmanship and material for a period of two years from the date of proof of purchase. If any of the GFS® Products are determined to be defective, the measure of the damage is the price of the defective goods only. No charge for labour or expense required to repair defective goods, or occasioned by them, will be allowed. GFS® shall have no liability whatsoever for any amount in excess of the price paid for the product.

Should any defect of the GFS® Product be claimed, the proposed defective product must be returned to GFS® within the limited warranty period of two years from the date of purchase. The obligation of GFS® under this limited warranty is, at its discretion, may replace the defective product, repair the defective product or refund the purchase price paid for the product following proof of purchase of its product.

This limited warranty shall not apply to any part or parts of the GFS® Products if it has been installed, altered, repaired or misused, through negligence or otherwise, in a way that in the opinion of GFS® affects the reliability of, or detracts from, the performance of the product. Nor does not this limited warranty cover replacements or repairs necessitated by loss or damage resulting from any cause beyond the control of GFS®, including but not limited to acts of God, acts of government, floods or fires.

In order for the GFS® limited warrant to apply; its installation must have been performed strictly in accordance with local plumbing and/or building regulations, and in accordance with the GFS® Installation Guide. The GFS® limited warranty will only apply if the GFS® product was installed by a Qualified Installer.

The foregoing is in lieu of any other warranties expressed, implied or statutory, including, without limitation, the implied warranty of merchantability, and GFS® neither assumes nor authorizes any person to assume for GFS® any other obligation or liability in connection with the sale of its products.

GAS FLEX SYSTEMS

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