

FLEXWELL®-LPG

Pipe Systems for Petrol Stations
Technical Details



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System description

General description

FLEXWELL®-LPG is a single walled flexible pipe system suitable for automotive LPG (Autogas) installations of service stations in both vapour and liquid phase.

LPG's main constituents are Propane (C₃H₈) and Butane (C₄H₁₀) which have different boiling points : -42 °C for propane and -1 °C for butane. The actual mixture of propane and butane of any automotive LPG marketed varies considerably from one country to another, depending on their sources of LPG.

The mix of propane and butane has a profound impact on design requirements of LPG fuelling components; the one for a propane only mix being the most stringent. The selection of the material depends on the minimum temperatures, which can occur during failure of the equipment, and has been carried out in accordance with the european Pressure Equipment Directive PED 97/23/EG.

FLEXWELL®-LPG Piping is designed for operating temperatures from -50 °C up to +60 °C and operating pressures of PN 25 (360 PSI).

System advantages

- fast and simple to install without welding and x-raying of welds on site
- no downtime and only minimal interruptions to petrol sales on retrofits
- the most cost effective pipe system

Application

Typically FLEXWELL®-LPG Piping is used as an underground or above ground liquid feedline and vapour return between the LPG storage tanks and the liquid gas dispenser in fuelling stations.

Construction

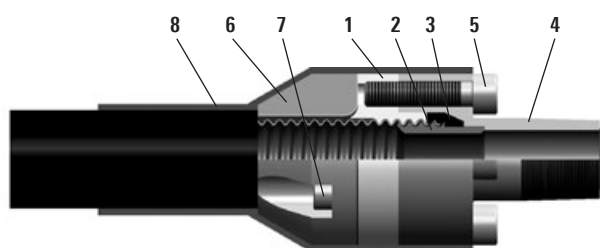
The flexible composite pipe has a helically corrugated primary pipe. This is manufactured of EN 1.4404 stainless steel (US equivalent: AISI TP 316 L) and has excellent corrosion resistance characteristics as a result. Around this carrier pipe, high-strength reinforcing bands are fitted, which effectively limit longitudinal expansion even at high operating pressures. Corrosion protection for buried installation in the ground is afforded by an external PE-LD jacket.

Installation

FLEXWELL®-LPG Piping is manufactured in standard factory lengths up to 700 m. The pipework is supplied on a cable reel or coil allowing it to be run directly off the reel or coil into position in the pipe trench. The corrugated primary pipe and the helically fitted reinforcing bands give this piping system remarkably good flexibility and ease of laying. FLEXWELL®-LPG pipework can be cut to the required length on site and, as necessary, bent through very tight angles to run around, under or over existing services.

Type testing, approvals




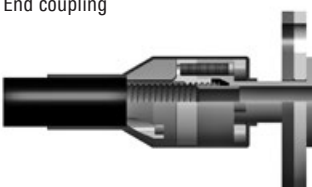
Certificate for pressure equipment acc. to directive PED 97/23/EG Module A1, CE 0620, KIWA declaration of conformity TÜV-Nord, Germany, report to burst pressure testing of FLEXWELL® end couplings with graphite sealing


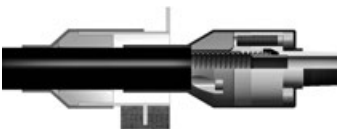


- 1 pressure ring
- 2 core piece
- 3 graphite sealing
- 4 connecting piece with thread
- 5 cylindrical screw
- 6 clamping ring
- 7 cylindrical screw
- 8 heat shrink tube

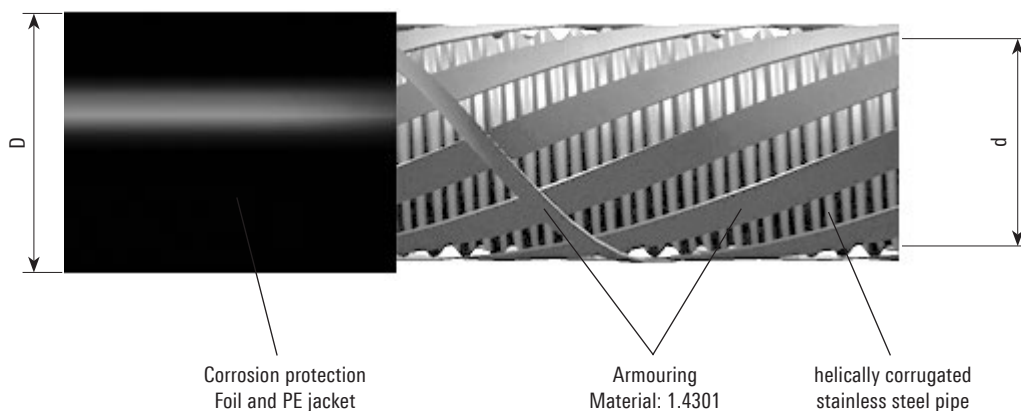
Product scheme

Pipelines, end couplings, straight couplings, steel ducts

Execution	Type LPG	Nominal diameter	Pressure PN	Connection connection method	Material No.	Work- sheet		
Pipeline 	22/33	20	25	helically corrugated primary pipe armouring	1.4404/1.4571	LPG 5.120		
	30/40	25			1.4301			
	39/50	32						
	48/61	40						
	60/74	50						
End coupling 	22/33	¾"	25	with welding end up to -20 °C	25CrMo4	LPG 5.201		
	30/40	1"			ST 52.3			
	39/50	1 ¼"			(1.0570)			
	48/61	1 ½"			CrNi			
	60/74	2"			1.4404			
End coupling 	22/33	¾"	25	with NPT thread up to -50 °C	25CrMo4	LPG 5.211		
	30/40	1"						
	39/50	1 ¼"						
	48/61	1 ½"						
	60/74	2"						
End coupling 	30/40	¾"	25	with NPT thread reduced	25CrMo4	LPG 5.221		
	39/50	¾"						
	22/33	20			with collar and split flange acc. to DIN EN 1092-1, PN 40 up to -50 °C		25CrMo4	LPG 5.221
	30/40	25					P355NL	
	39/50	32						
	48/61	40						
	60/74	50						
	22/33	20			with collar and split flange acc. to ANSI (300lb/B16.5)		25CrMo4	LPG 5.221
	30/40	25					P355NL	
	39/50	32						

Execution	Type LPG	Nominal diameter	Pressure PN	Connection connection method	Pipe sleeve on site	Material No.	Work- sheet
Straight coupling 	22/33	20	25	up to -50 °C		25CrMo4	LPG 5.401
	30/40	25			1.4571		
	39/50	32					
	48/61	40					
	60/74	50					
Steel duct 	22/33	20			76.1 x 2.9	split plastic	LPG 5.515
	30/40	25			88.9 x 3.2	spacer and	
	39/50	32			114.3 x 3.6	heat shrink	
	48/61	40			114.3 x 3.6	tube	
	60/74	50			139.7 x 4.0		

Petrol Station Pipeline



Material

Primary pipe: Material No. 14404/1.4571

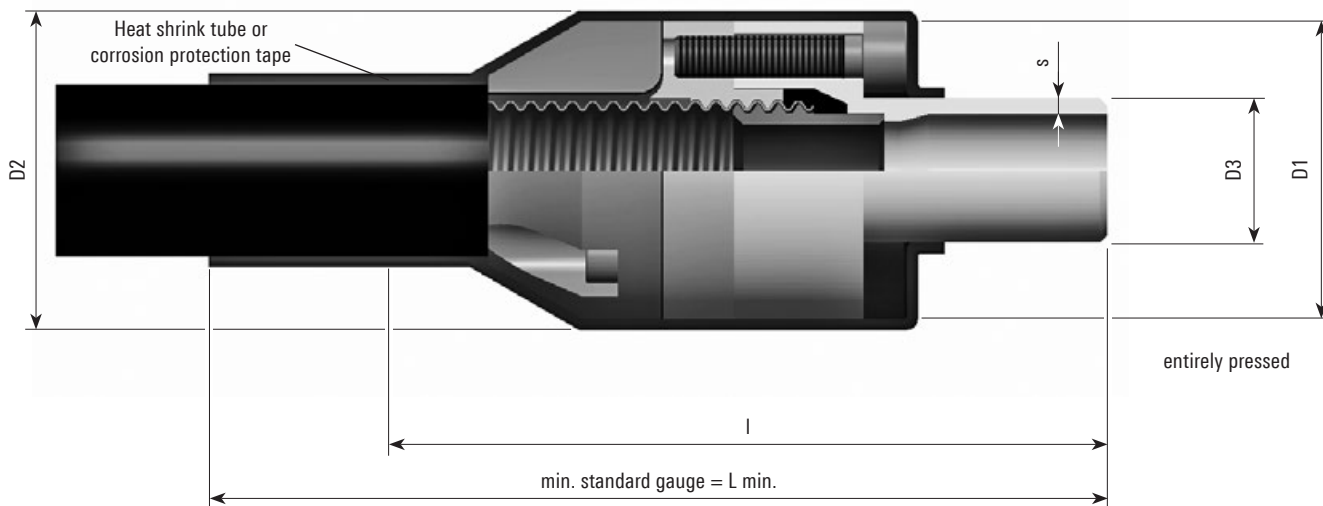
Type	DN	Dimensions		Bending radius*	Weight	Volume	Article No.
		d	D				
		mm	mm	m	kg/m	dm ³ /m	
LPG 22/33	20	22.0	33	0.2	0.74	0.37	1014379
LPG 30/40	25	30.0	40	0.2	0.94	0.80	1014380
LPG 39/50	32	38.9	50	0.3	1.52	1.30	1014382
LPG 48/61	40	48.5	61	0.4	1.94	2.00	1014384
LPG 60/74	50	60.0	74	0.6	2.72	3.00	1014385

* Bending of the pipe by means of a bending template.

End coupling

screwed with graphite sealing, connection with welding end

Heat resistant up to -50 °C, nominal pressure 25 bar



Material composition:

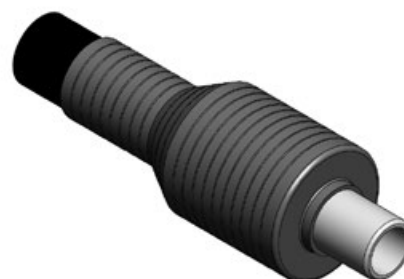
Connecting piece with welding end Material No. 1.0570 (St 52-3) -20 °C
Material No. 1.4404 -50 °C

Pressure ring cryogenic steel 25CrMo4 (No. 1.7218)

Sealing ring graphite (SIGRAFLEX F...Z)

Core piece stainless steel (No. 1.4571)

Clamping ring cryogenic steel 25CrMo4 (No. 1.7218)



End coupling GRAPA with welding end

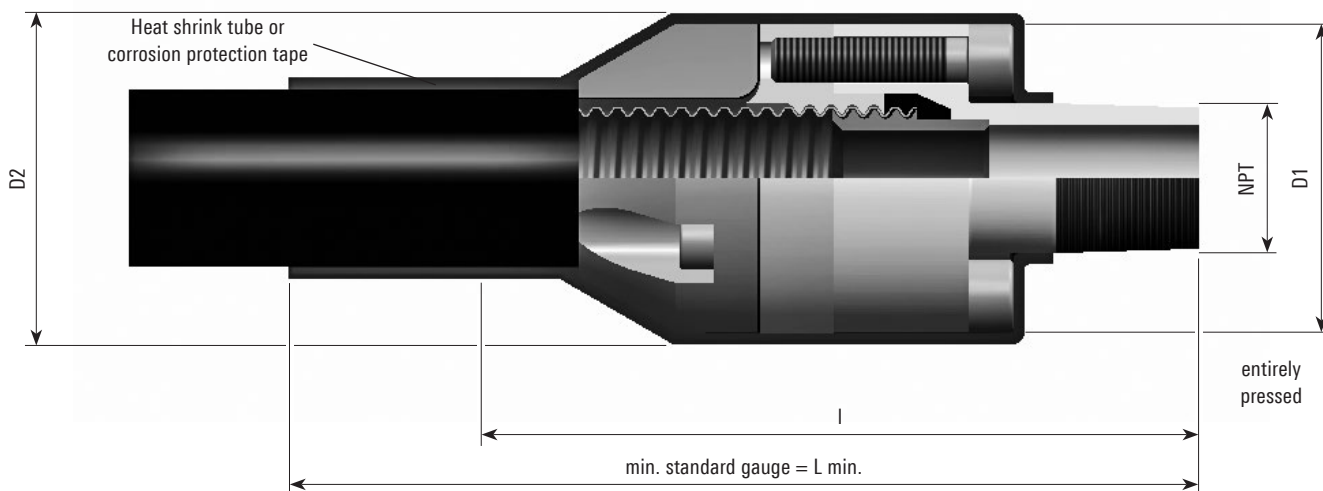
Type	DN	l	L min.	s	D1	D2	D3	Article No.	Article No.
								Connection -20 °C	Connection -50 °C
								Material 1.0570	Material 1.4404
LPG 22/33	20	125	210	2.95	55	61	26.7	1014392	1014393
LPG 30/40	25	129	210	3.40	65	71	33.4	1014399	1014400
LPG 39/50	32	140	220	3.55	81	87	42.2	1014407	1014408
LPG 48/61	40	154	230	3.70	93	99	48.3	1014415	1014416
LPG 60/74	50	158	240	3.90	109	115	60.3	1014421	1014422

Testing of quality, treatment, pressure and material in line with the system approval by external inspection authorities and the internal quality management.

End coupling

screwed with graphite sealing, connection with NPT male thread

Heat resistant up to -50 °C, nominal pressure 25 bar



Material composition:

- Connecting piece with NPT male thread cryogenic steel 25CrMo4 (No. 1.7218)
- Pressure ring cryogenic steel 25CrMo4 (No. 1.7218)
- Sealing ring graphite (SIGRAFLEX F...Z)
- Core piece stainless steel (No. 1.4571)
- Clamping ring cryogenic steel 25CrMo4 (No. 1.7218)



End coupling GRAPA with NPT male thread

Type	DN	I	L min.	NPT thread	D1	D2	Article No.
		mm	mm	inch	mm	mm	
LPG 22/33	20	121	210	3/4"	55	61	1014394
LPG 30/40	25	129	210	1"	65	71	1014401
LPG 39/50	32	140	220	1 1/4"	81	87	1014409
LPG 48/61	40	154	230	1 1/2"	93	99	1014417
LPG 60/74	50	158	240	2"	109	115	1014423

End coupling GRAPA with NPT male thread, reduced

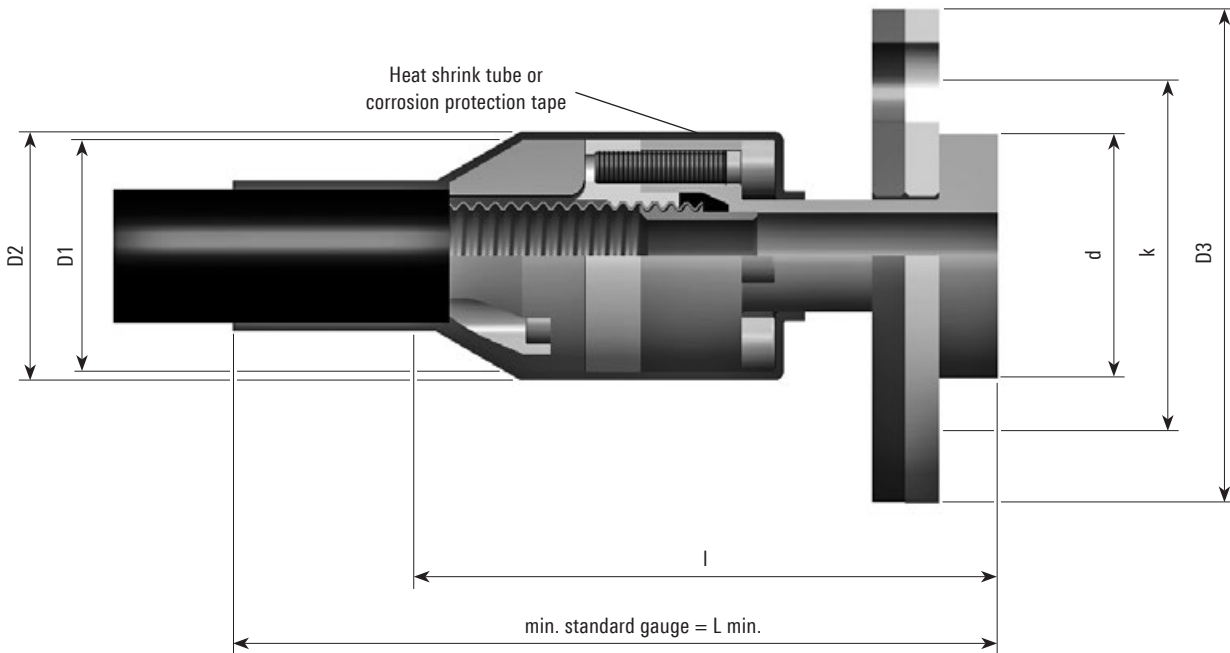
Type	DN	I	L min.	NPT thread	D1	D2	Article No.
		mm	mm	inch	mm	mm	
LPG 30/40	25	129	210	3/4"	65	71	1014402
LPG 39/50	32	140	220	3/4"	81	87	1014410

Testing of quality, treatment, pressure and material in line with the system approval by external inspection authorities and the internal quality management.

End coupling

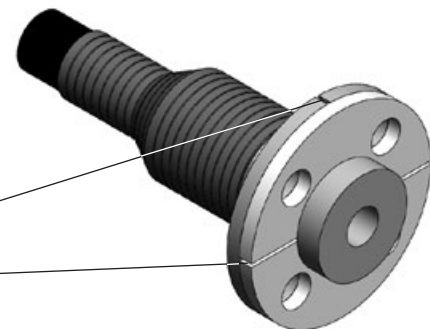
screwed, with graphite sealing, connection: collar and split flange

Heat resistant up to -50 °C, nominal pressure 25 bar



Material composition:

- Connecting piece with collar cryogenic steel 25CrMo4 (No. 1.7218) nickel-plated
- Pressure ring cryogenic steel 25CrMo4 (No. 1.7218) nickel-plated
- Sealing ring graphite (SIGRAFLEX F...Z)
- Core piece stainless steel (No. 1.4571)
- Clamping ring cryogenic steel 25CrMo4 (No. 1.7218) nickel-plated
- split flange fine grained steel P355NL2 (No. 1.1106) nickel-plated



Installation advice split flange:

The split flanges have to be installed in a 90° offset pattern

End coupling GRAPA with split flange acc. to EN 1092-1

Type	Pipeline DN	l mm	L min. mm	Flange DN	Screws	d mm	D1 mm	D2 mm	D3 mm	k mm	Article No.
LPG 22/33	20	140	220	20	4 x M12 x 65	58.0	55	61	105	75	1014391
LPG 30/40	25	144	230	25	4 x M12 x 70	68.0	65	71	115	85	1014398
LPG 39/50	32	155	240	32	4 x M16 x 75	73.1	81	87	140	100	1014406
LPG 48/61	40	176	260	40	4 x M16 x 75	88.0	93	99	150	110	1014414
LPG 60/74	50	181	260	50	4 x M16 x 80	102.0	109	115	165	125	1014420

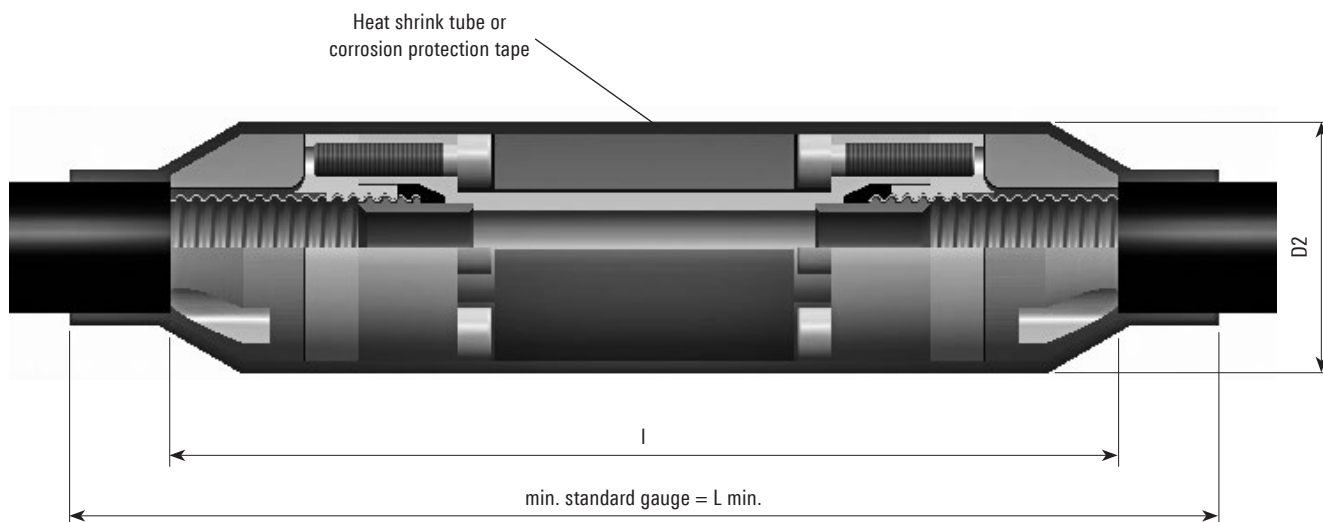
End coupling GRAPA with split flange acc. to ANSI B16.5 - 300 lb

Type	Pipeline DN	l mm	L min. mm	Flange DN	Screws	d mm	D1 mm	D2 mm	D3 mm	k mm	Article No.
LPG 22/33	20	140	220	20	4 x M16 x 70	42.9	55	61	117.3	82.5	1014390
LPG 30/40	25	144	230	25	4 x M16 x 75	50.8	65	71	123.9	88.9	1014397
LPG 39/50	32	155	240	40	4 x M20 x 80	73.1	81	87	155.4	114.3	1014405

Straight coupling

screwed, with graphite sealing

Heat resistant up to -50 °C, nominal pressure 25 bar



Material composition:

- Both-sided connection piece stainless steel (No. 1.4571)
- Pressure ring cryogenic steel 25CrMo4 (No. 1.7218) nickel-plated
- Sealing ring graphit (SIGRAFLEX F..Z)
- Core piece stainless steel (No. 1.4571)
- Clamping ring cryogenic steel 25CrMo4 (No. 1.7218) nickel-plated
- Cylindrical fill body plastic PE-HD

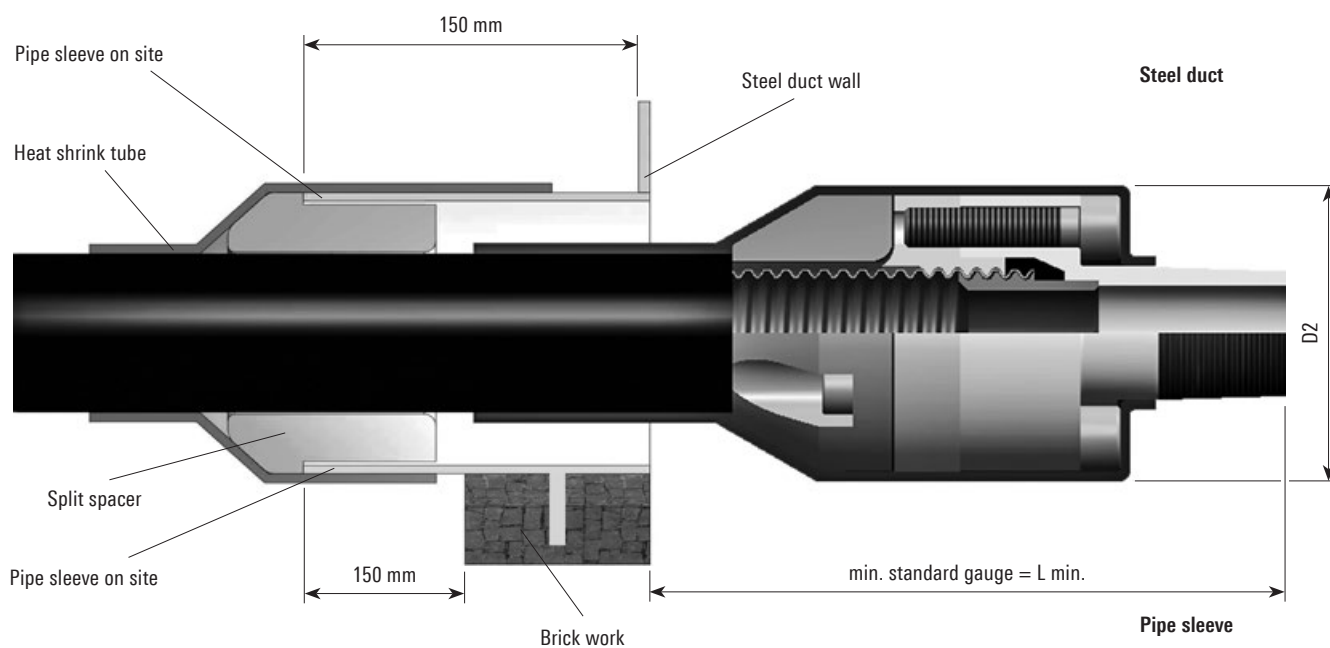


Type	Nominal diameter DN	L min. mm	l mm	D2 mm	Article No.
LPG 22/33	20	410	250	61	1014395
LPG 30/40	25	420	260	71	1014403
LPG 39/50	32	440	280	87	1014411
LPG 48/61	40	470	310	99	1014418
LPG 60/74	50	480	320	115	1014424

Steel duct and pipe sleeve

General

The FLEXWELL®-LPG steel duct type SSE is constructed for fixed dimensioned pipe sleeves.
The pipe sleeves have to be provided on site.



Type SSE	Pipe sleeve on site mm	D2 mm	L min. mm	Article No.
LPG 22/33	76.1 x 2.9	61	150	1014389
LPG 30/40	88.9 x 3.2	71	150	1014396
LPG 39/50	114.3 x 3.6	87	200	1014404
LPG 48/61	114.3 x 3.6	99	200	1014412
LPG 60/74	139.7 x 4.0	115	200	1014419

BRUGG delivery scope: split spacer and heat shrink tube

Installation guide

Safety Requirements

This Installation Guide should be read in full prior to system specification and installation. Installations should only be carried out in accordance with the statutory requirements and LPG codes of practice of the country of installation and all Health and Safety guidelines must be followed.

FLEXWELL®-LPG is suitable for LPG (Autogas) buried installations on Propane and Butane in both vapour and liquid phase.

Requirements for the installer

The installer

- is qualified for installation and testing of LPG and liquid fuel equipment
- follows Codes of Practice for the country in question
- has completed installation training by BRUGG or its Authorised Partner
- carries out the installation as per current BRUGG Installation Instructions

Pipe trench

FLEXWELL®-LPG Piping needs a top covering of at least 60 cm above the pipe crown when laid into trenches not subject to traffic loading. Under traffic loading, cover of at least 75 cm is necessary. Allow a minimum of 10 cm trench depth on top of this for the sand bedding under the pipe. When digging the trench, carefully remove all sharp-edged stones or fragments of masonry, piping etc.

The floor of the trench must then be tamped flat and level. Cover this flat surface with a layer of at least 10 cm of closely packed sand. This should have a grain size of < 2 mm and be free of sharp-edged foreign objects. The sand bedding must be in place before the pipe is drawn in. If several parallel pipes are being laid, calculate at least 10 cm lateral distance between pipes and trench wall. FLEXWELL®-LPG Piping must be covered by a layer of sand at least 10 cm thick above the pipe crown when filling in the trench. The top filling can then be added. A yellow plastic indicator tape, or equivalent should be laid between 200 mm and 300 mm above the pipe.

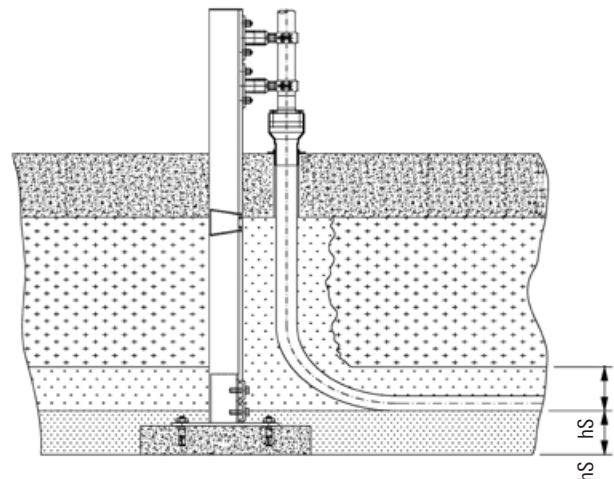
Fixed anchor points

Stresses occur during operation and during pressure testing of FLEXWELL®-LPG Piping due to linear expansion at the connections. Additional stress is placed on the connection joint by earth-compacting work and the weight of heavy components of the assembly added later (flanges, valves etc.). These stress forces must be compensated by a simple fixed point anchor. The fixed point is installed for this purpose before the piping is laid.

Take care that the anchor is of sufficient dimensions and is firmly secured in place.

After laying the piping, the FLEXWELL®-LPG connections are securely fixed in place in the mountings of the anchor point by means of stable pipe clamps (see figure).

If it is not possible to attach the piping to an anchor point at the time of laying the FLEXWELL®-LPG Piping then care must be taken that excessive loading is not applied to the pipe ends i.e. pressure testing above 6 bar gauge must not be carried out and valves / fittings must not be affixed to the pipework. When carrying out the first pressure test, please observe clause **Pressure Testing**.



Thickness of the sand bedding $h_S = 10 - 15$ cm, grain size < 2 mm

Installation guide

Safety measures

Take care to ensure adequate protection from mechanical damage to the piping during laying and subsequent construction work. In particular, ensure that no mechanical damage can occur to above-ground FLEXWELL®-LPG connection joints, e.g. by providing protection against vehicles driving against them.

FLEXWELL®-LPG Piping must be fitted with a system to prevent the permissible working pressure being exceeded during operation. Please take this into account when planning the installation of safety equipment.

Free pipe ends must be sealed to prevent any liquid escaping.

Prior to Laying Pipework

Prior to laying the FLEXWELL®-LPG Piping, a visual test must be carried out to see if the piping has been damaged during transit in any way. Slight scratches in the plastic outer casing are not a problem. Deeper scratches in the outer plastic casing or extensive abrasion of the plastic surface can be easily repaired where necessary using a heat shrink tube.

If there are deeper cracks in the outer plastic casing which make it seem likely that there is damage to the reinforcing bands, or if the pipe surface is dented, please only continue work on the pipe after consultation with BRUGG.

Laying into the trench

The trench must be dug according to the instructions of clause **Pipe trench**.

FLEXWELL®-LPG Piping is laid direct off the reel or from the ring into the trench and the appropriate length cut off as required. Due to its extreme flexibility you can lay great lengths of piping in one piece. Use the bending jig supplied by BRUGG for bending the pipe through very tight bending radii.

Fix the pipe ends to the pipe supports as per clause **Pipe trench**. Apply abrasion resistant cloth where the pipework passes through backfill and concrete layers as per clause **Pipe trench**.

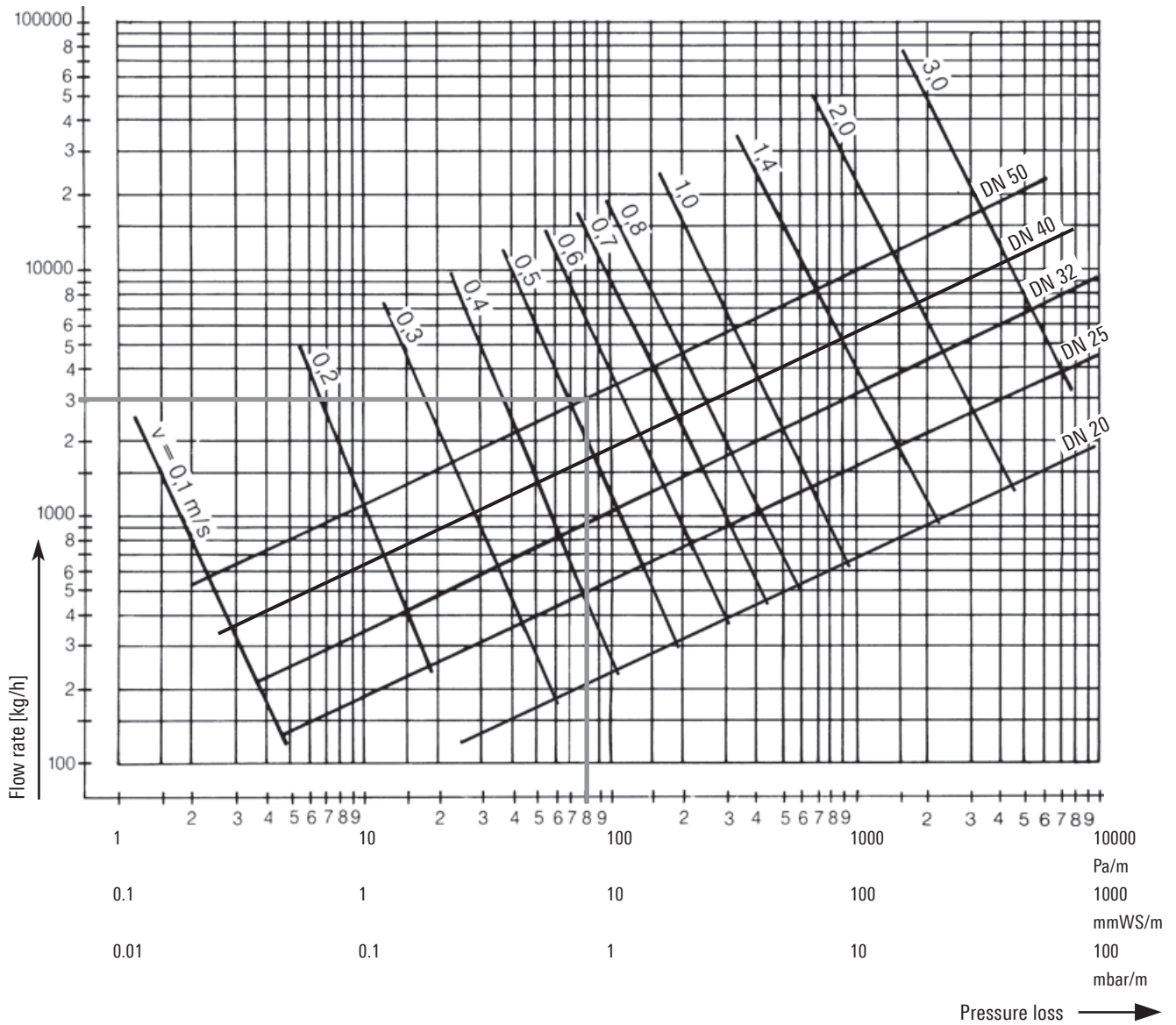
Pressure Testing

Pressure testing must be carried out in accordance with Codes of Practice for the country of installation. A maximum pressure of 1.43 times the operating pressure must not be exceeded. A pressure gauge of suitable accuracy to meet local Codes of Practice is to be used for this. If analog gauges are used, the scale diameter should be at least 100 mm. The pressure gauges must be calibrated once a year to a suitable standard and the calibration data recorded.

Fluidics

Pressure loss diagram for fluid propane

Temperature: 15 °C
 Specific weight: 508 kg/m³
 Kinematic viscosity: 2.1 · 10⁻⁷ m²/s



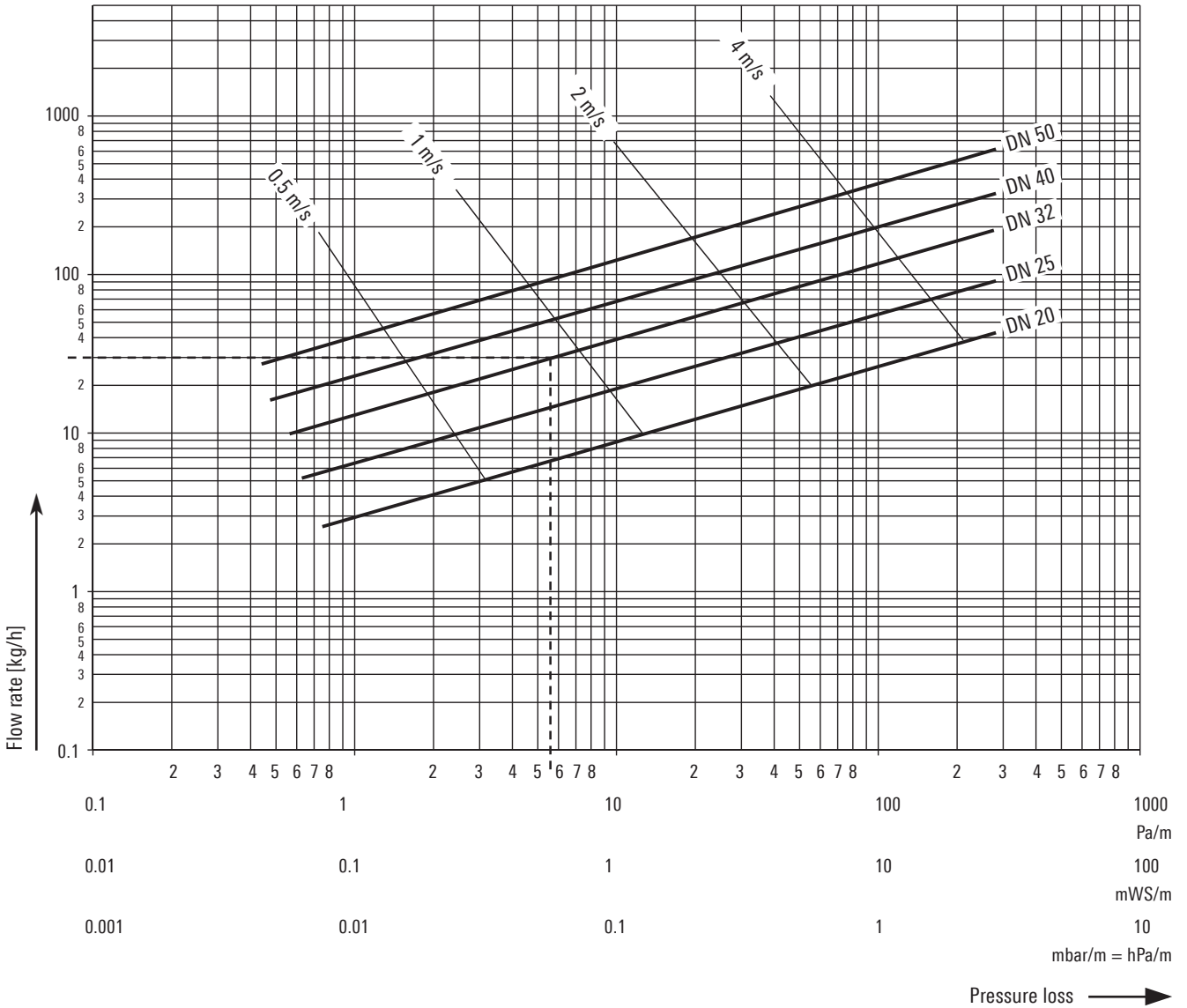
Example:

Pipe DN 50
 Mass flow rate 3000 kg/h:
 at a velocity of approx. 0.5 m/s the
 pressure loss is 0.8 mbar/m

Fluidics

Pressure loss diagram for vaporized propane

Temperature: 15 °C
 Specific weight: 8 kg/m³ (3 bar)
 Dynamic viscosity: 7.9 · 10⁻⁶ Ns/m² = kg/ms



Example:

Pipe DN 32
 Mass flow rate 30 kg/h:
 at a velocity of approx. 0.9 m/s the
 pressure loss is 5.6 · 10⁻² mbar/m = hPa/m

Notes

A large grid area for taking notes, consisting of a 30x30 grid of small squares. The grid is empty and occupies the central portion of the page.

Pipe systems for the future

District heating – Industry – Petrol stations – System packages



Your partner for pipe systems

We are the people you should talk to when you need to find efficient solutions for transporting liquid materials. With our project engineers, development department, in-house production unit, and our professional team of fitters, we have the know-how and the resources to look after your projects competently and reliably in the sectors of heating systems, petrol station construction, industrial plant construction, and system packages.

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Our global partnership network can be reached on site at any time. More than 34 partners in 20 different countries will look after you wherever you are.

Customer-specific solutions

Brugg is the full service provider in the field of single-wall, double-wall and insulated pipe systems. This know-how allows us to manufacture project-specific customised items.

Give us a call!

Our engineers would be pleased to advise you and find a made-to-measure solution.

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