

# BRUGG

Pipes

## FLEXWELL® LNG Fueling Station

Project Engineering



**PIONEERS IN  
INFRASTRUCTURE**

## FLEXWELL® LNG All-in-One

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FLEXWELL® LNG All-in-One

## System description

**FLEXWELL® All-in-One is a unique and cost efficient LNG pipe which applies at LNG fuel stations as endless transportation, re-circulation and BOG recovery line: All-in-One!**

**The design of FLEXWELL® LNG All-in-One**

Because of a continuous manufacturing technology of the corrugated pipes, FLEXWELL® LNG All-in-One (AiO) comes in an infinite length, which enables an installation without any need of welded joints.

The multi-layer-construction of the FLEXWELL® LNG All-in-One is able to combine

- LNG flow
  - LNG return
  - BOG return
  - vacuum superinsulation
- in one pipe.

The FLEXWELL® LNG All-in-One is a flexible, multi layer, vacuum-insulated pipe system for the transport of cryogenic liquefied gases.

The pipe consists of three hellically-corrugated stainless steel pipes and cryogenic insulation in between second and third layer. The insulation consists of highly reflective polymer foil and spacers in a vacuum chamber to minimize the total heat inleak into the pipe system. Stainless steel reinforcing armoring is additionally applied to the pipe in order to provide pressure stability of the pipe system and to increase the tensile strength of the pipe for the installation. The final layer is a PE protective coating.

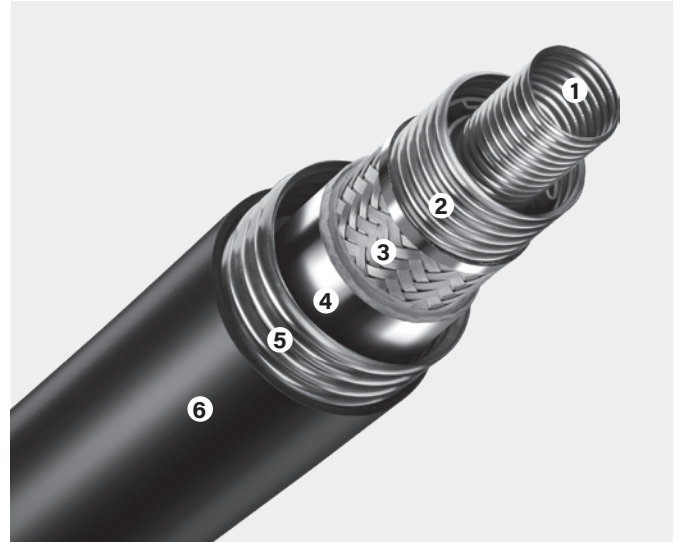
**Areas of application**

Developed as LNG transportation line at LNG fuelling stations, FLEXWELL® LNG All-in-One can be used for the transport of cryogenic liquefiedgases such as

- liquefied natural gas LNG
- liquid nitrogen

**Properties of FLEXWELL® LNG All-in-One**

Material of corrugated pipes	SS 316 L/1.4404
Material of protective jacket	HDPE
Min. working temperature	-200 °C
Max. allowed working pressure	30 bar



- 1 corrugated pipe, stainless steel (Fluid 1)
- 2 corrugated pipe, stainless steel (Fluid 2)
- 3 armoring, stainless steel
- 4 vacuum superinsulation incl. spacer
- 5 corrugated pipe, stainless steel
- 6 protective jacket, PE-LD

**Save costs through a self-compensating and easy to install pipe system**

The corrugated pipe technology enables the FLEXWELL® LNG All-in-One to be endless and flexible. And flexibility leads to self-compensation.

Due to the huge temperature differences, regular rigid pipes need expansion bends (either U or Z shaped) after a certain pipe run. With FLEXWELL® LNG All-in-One no special expansion bends are required with a pipe run which is still straight and continuous.

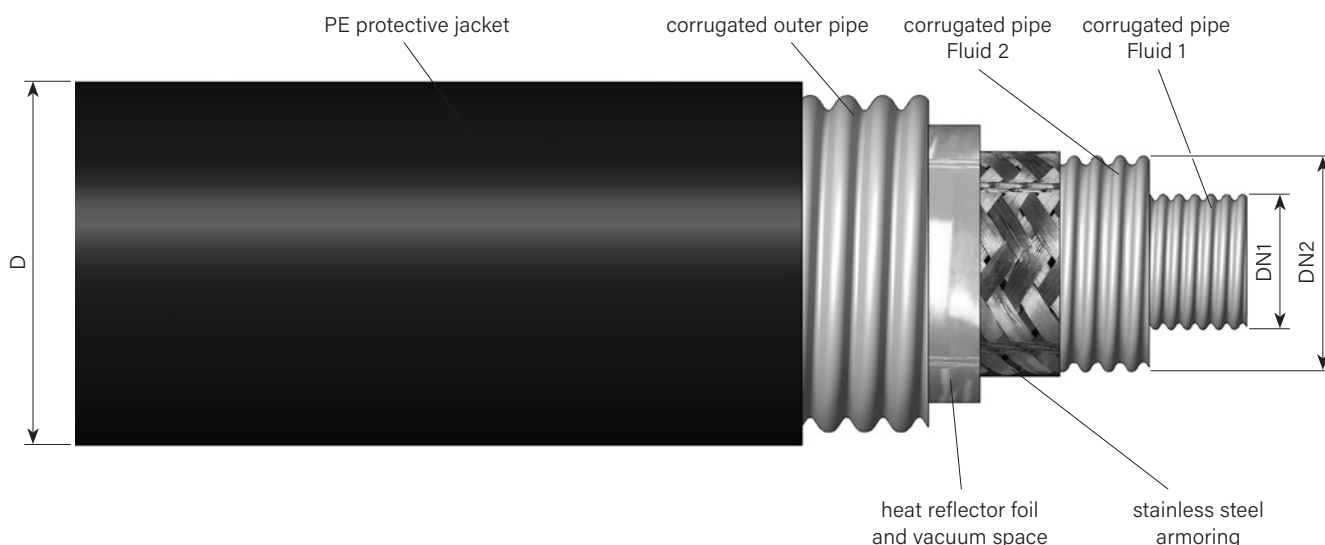
**Safety first!**

With FLEXWELL® LNG All-in-One safety never is a problem! Thanks to its integrated leakage detection system, unlikely leakages will be detected immediately and the whole system can be shut down within seconds.

FLEXWELL® LNG All-in-One

## FLEXWELL® LNG All-in-One VIP

Vacuum insulated pipe with stainless steel inner pipe, medium pipe and outer pipe



**Version:**

All-in-One vacuum insulation

**Material:**

Corrugated pipes 1.4404/316 L  
 Armouring 1.4404/316 L  
 Heat inleak approx. 2.5 W/m

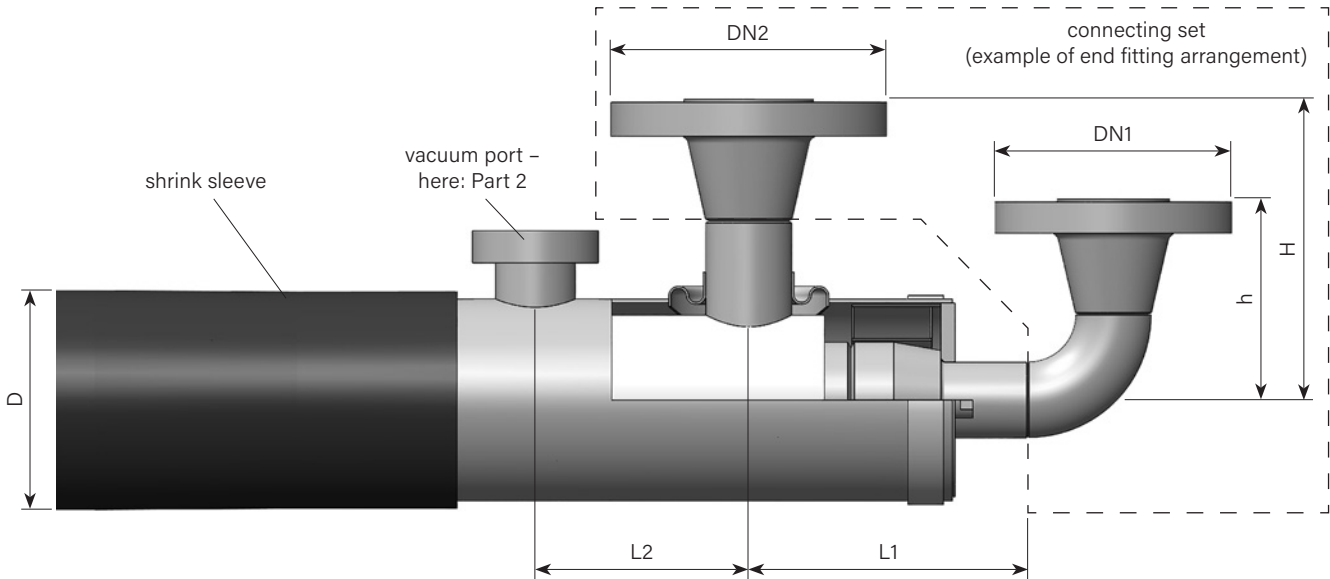


Typ	DN1	DN2	PN	D	Volume	Volume	Weight	Bending	Article No.
				inch/mm	DN1	DN2		radius	
					l/m	l/m	kg/m	inch/mm	
AiO VIP 39-64/115	1 ¼" DN 32	1 ¼" DN 32	30	4.6/117	1.35	2.13	7.5	39/1000	1081178
AiO VIP 48-83/152	1 ½" DN 40	2" DN 50	30	6.0/152	2.00	4.00	11.0	47/1200	1081414

FLEXWELL® LNG All-in-One

# FLEXWELL® LNG All-in-One VIP

Endfitting – TIG welding – vacuum insulated



**Version:**

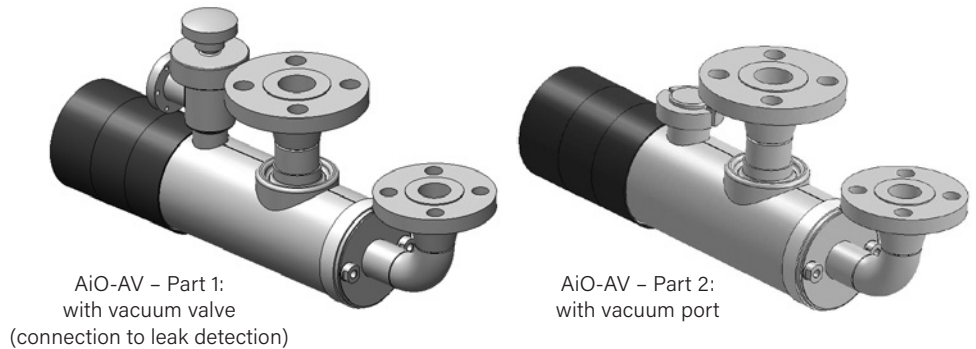
Butt weld ends  
Connecting set optional

**Material:**

Stainless steel 1.4404/316 L

**Insulation:**

Vacuum Super Insulation



Type	DN1	DN2	D	L1	L2	Article No
<b>Part 1 vacuum valve</b>						
AiO-AV VIP 39-64/115 – P1	1 ¼" DN 32	1 ½" DN 40	4.6/117	6.2/158	5.1/130	1070440
AiO-AV VIP 48-83/152 – P1	1 ½" DN 40	2" DN 50	6.0/152	8.8/224	5.1/130	on request

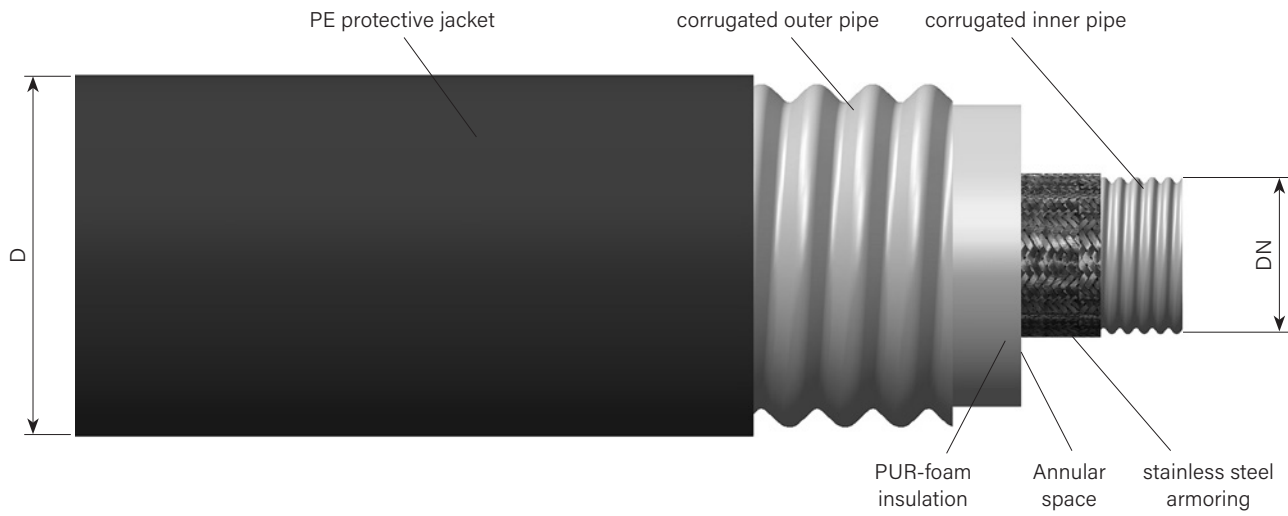
Type	DN1	DN2	D	L1	L2	Article No.
<b>Part 2 vacuum port</b>						
AiO-AV VIP 39-64/115 – P2	1 ¼" DN 32	1 ½" DN 40	4.6/117	6.2/158	4.7/120	1070441
AiO-AV VIP 48-83/152 – P2	1 ½" DN 40	2" DN 50	6.0/152	8.8/224	5.1/130	on request

Connecting set	Remarks	H (e.g.)	h (e.g.)	Article No.
AiO-AV CS	specific for each project	inch/mm 6.7/169	inch/mm 4.5/113	1070442

FLEXWELL® LNG All-in-One

## FLEXWELL® LNG SL PUR

PUR-foam insulated pipe with stainless steel inner pipe and outer pipe

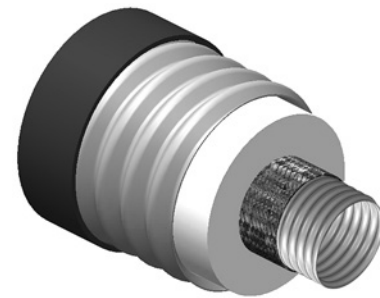


**Version:**

LNG SL PUR-foam insulation

**Material:**

Corrugated pipes 1.4404/316 L  
 Armoring 1.4301/304  
 Insulation Polyurethane  
 Heat inleak approx. 25 W/m



**Application:**

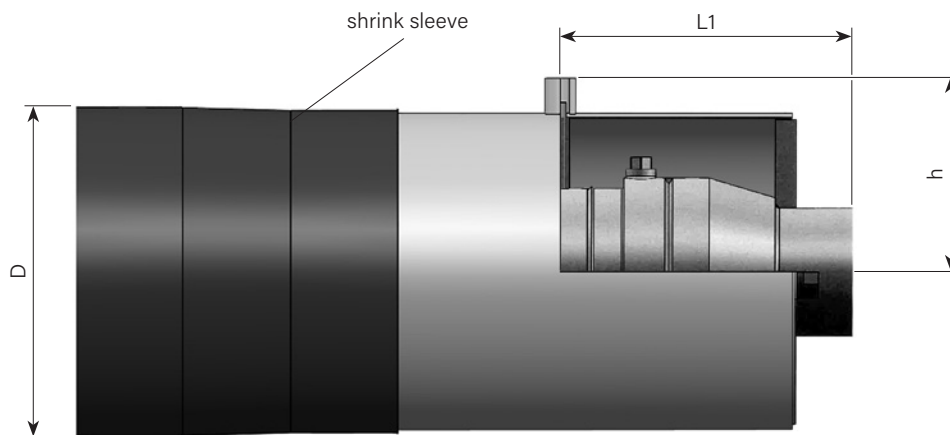
Filling line

Type	DN	PN	D	Volume	Weight	Bending	Article No.
			inch/mm	l/m	kg/m	radius	
						inch/mm	
SL PUR 60/148	2 ½" DN 50	25	6.1/155	3	8.1	47/1200	1061107

FLEXWELL® LNG All-in-One

**FLEXWELL® LNG SL PUR**

Endfitting – TIG welding – PUR-foam insulated

**Version:**

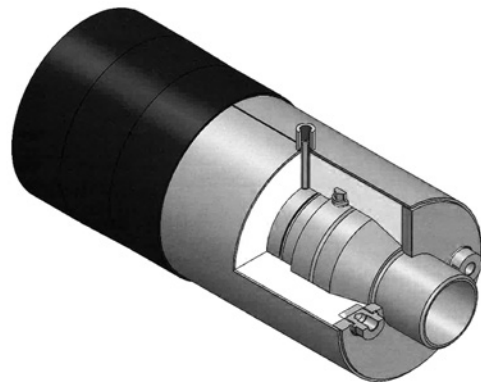
Butt weld end

**Material:**

Stainless steel 1.4404/316 L

**Insulation:**

Polyurethane PUR-foam

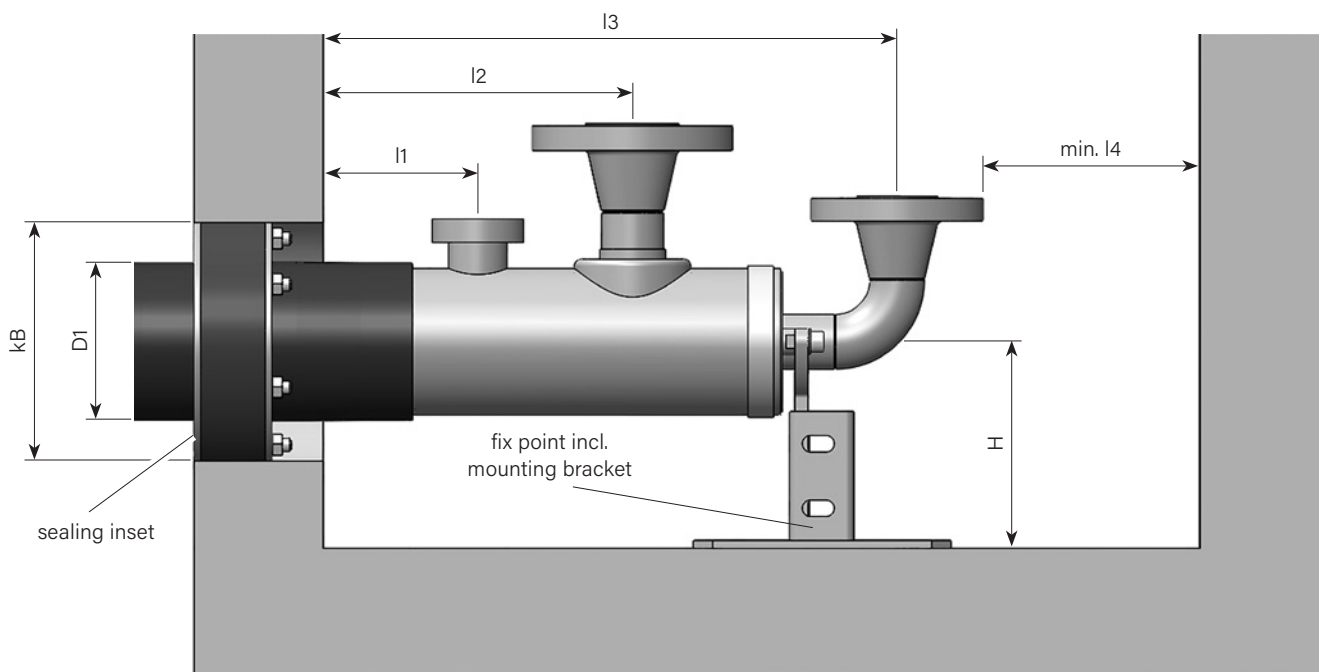


Type	DN	D inch/mm	L1 inch/mm	h inch/mm	Article No.
SL-AV PUR 60/148	2 ½" DN 50	6.1/155	5.9/150	3.6/92	1061110

FLEXWELL® LNG All-in-One

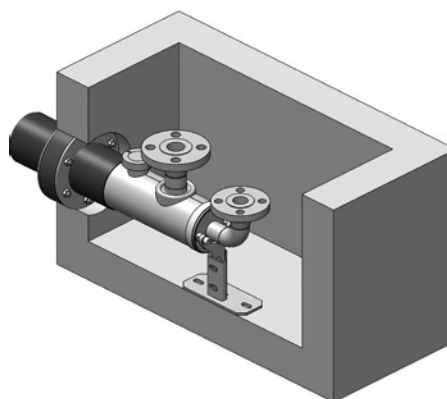
# FLEXWELL® LNG All-in-One

Accessories



**Version:**

Installation in concrete sump with sealing inset and fix point incl. mounting bracket



Type	l1	l2	l3	l4	D1	kB	H	Article No. fix point	Article No. sealing insert
	min.	min.	min.	min.					
	inch/mm	inch/mm	inch/mm	inch/mm	inch/mm	inch/mm	inch/mm		
AiO VIP 39-64/115 – Part 1	10.2/260	15.7/400	23.2/590	5.5/140	4.6/117	11.8/300	6.3/160	1070443	1081776
AiO VIP 39-64/115 – Part 2	4.7/120	9.4/240	17.3/440	5.5/140	4.6/117	11.8/300	6.3/160	1070443	on request
AiO VIP 48-83/152 – Part 1	10.2/260	15.7/400	24.6/625	5.5/140	6.0/152	15.8/400	7.0/180		1081776
AiO VIP 48-83/152 – Part 2	4.7/120	9.8/250	18.6/473	5.5/140	6.0/152	15.8/400	7.0/180		on request



FLEXWELL® LNG All-in-One

# Lecküberwachung LD-VIP

FLEXWELL® LNG All-in-One can be monitored permanently with the leak detector LD-VIP. The LD-VIP monitors the vacuum of the superinsulation. If there is a unlikely but significant increase of the pressure it will immediately give an acoustic and optical signal.

The vacuum space between casing and middle pipe prevents the uncontrolled escape of the LNG into the environment in the event of a leakage.

### Advantages of the system

The use of FLEXWELL® LNG All-in-One with leak monitoring has, besides offering excellent operational safety, significant economic advantages:

- the entire system can be simply checked at any time without any downtime in operations
- requirements such as e.g. pressure or volume measurements, pressure tests or inspection of the route can be eliminated
- maintenance interval for reevacuating the insulation space is displayed by the "soft alarm"

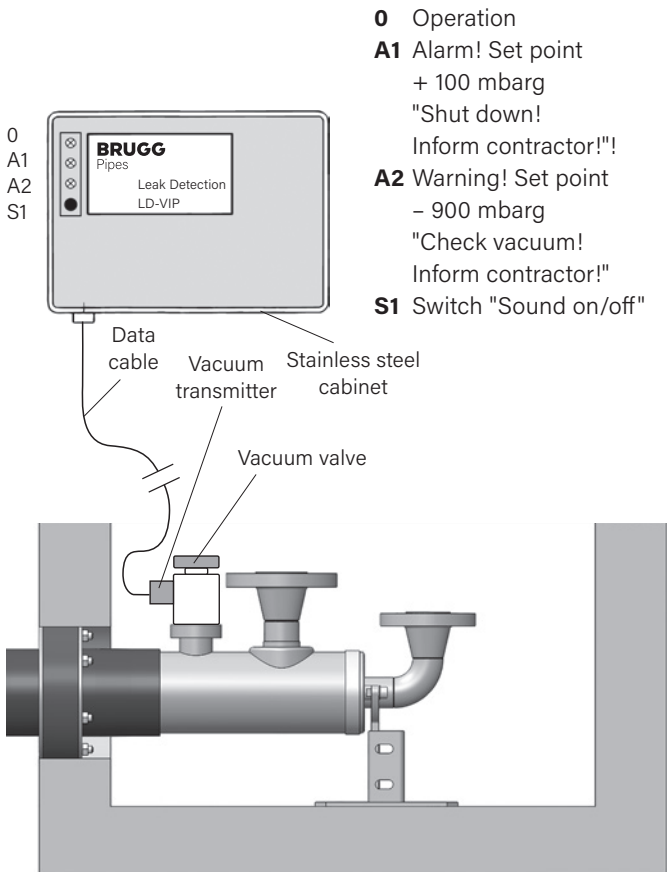
### System components

LD-VIP type leak detectors consist of a leak indicator as well as an vacuum transmitter, which is to be flanged on pipe side.

There are two versions of the leak indicator, to be able to monitor one or two pipes. If two lines are to be monitored simultaneously, two vacuum transmitters sets are also connected to the leak indicator.

A display and control setup for a pipe consists of an acknowledgement button for the acoustic alarm, a green operating light, a red alarm light and a yellow warning light as well as a yellow LED for the service interval.

The assembly set consists of a safety pipe against mechanical damage and a flange with an explosion-proof pressure sensor, for connection to the surveillance space.



Leak detection LD-VIP Alarm unit



Leak detection LD-VIP Vacuum transmitter

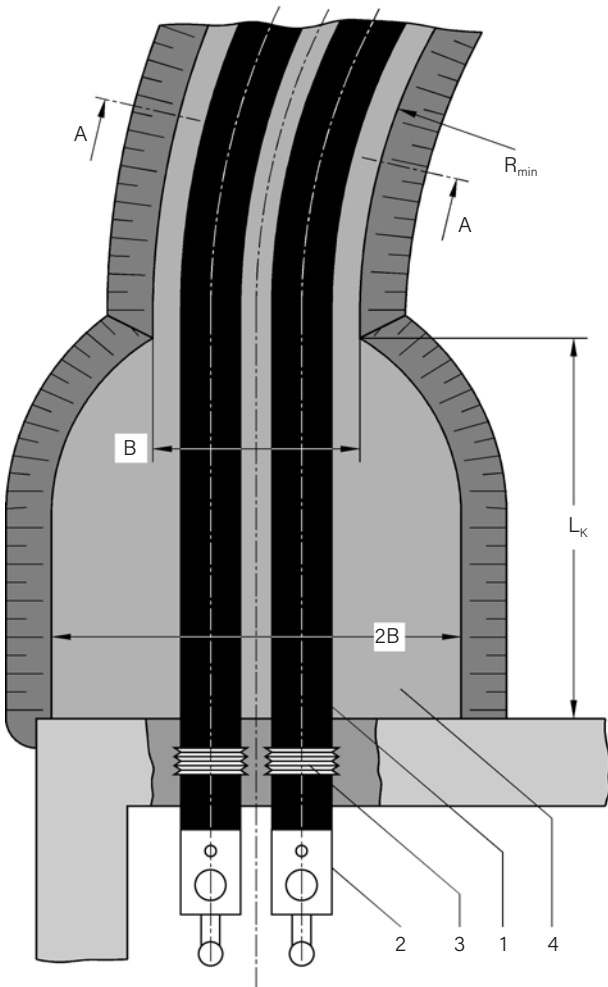
Artikel	Artikel-Nr.
LD-VIP UNO System - 1 line	1083146
LD-VIP DUO System - 2 lines	1083147
LD-VIP Leak detection UNO	1070437
LD-VIP Alarm unit DUO	1070439
LD-VIP Vacuum transmitter	1070439

FLEXWELL® LNG All-in-One

# Basic planning parameters

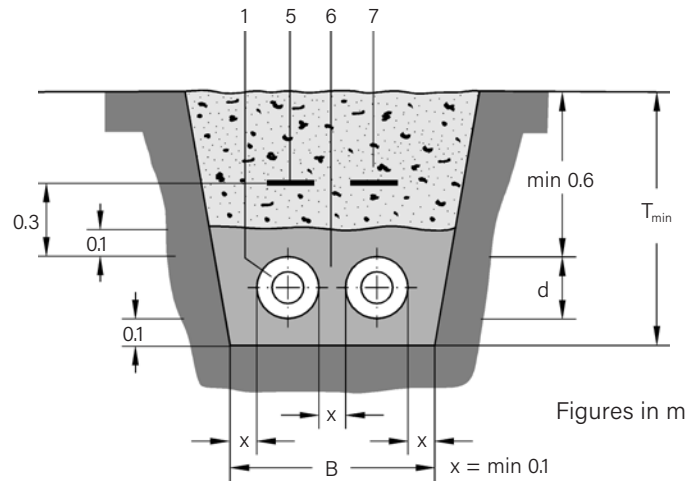
Details for underground work

**Figure 1: Layout plan of trench**



**Figure 2: Cross-section of trench**

Section A – A



Figures in m

- 1 FLEXWELL® LNG All-in-One
- 2 End fitting
- 3 Sealing inset
- 4 Working space in front of buildings and sumps
- 5 Pipe warning tape (optional)
- 6 Sand filling (0 – 4 mm round particles)
- 7 Filling material (reusable excavated material)

**Trench and working space dimensions, quantities of excavated material and sand filling**

FLEXWELL® LNG AiO			39-64/115	60/148	48-83/152
			VIP	SL PUR	VIP
Outer diameter of pipe	d	mm	115	152	152
Trench depth	T <sub>min</sub>	for SLW 60 <sup>1)</sup> m	0.85	0.85	0.85
Minimum coverage height		for SLW 60 m	0.60	0.60	0.60
Trench width	B	m	0.55	0.60	0.60
Working space width	2B	m	1.10	1.20	1.20
Working space length	L <sub>k</sub>	m	0.50	1.00	1.00
Minimum trench radius <sup>2)</sup>	R <sub>min.</sub>	m	1.20	1.50	1.50
Material excavated from trench <sup>3)</sup>		for SLW 60 m <sup>3</sup> /m	0.47	0.51	0.51
Sand filling		m <sup>3</sup> /m	0.16	0.18	0.18

Trench widths "B" are recommended values. Please follow generally valid technical rules, guidelines and accident prevention regulations.

- 1) SLW 60 = 100 kN wheel load to DIN 1072
- 2) Smaller radii only after consulting BRUGG Pipe Systems
- 3) Excavation quantities ignoring gradient of embankment

FLEXWELL® LNG All-in-One

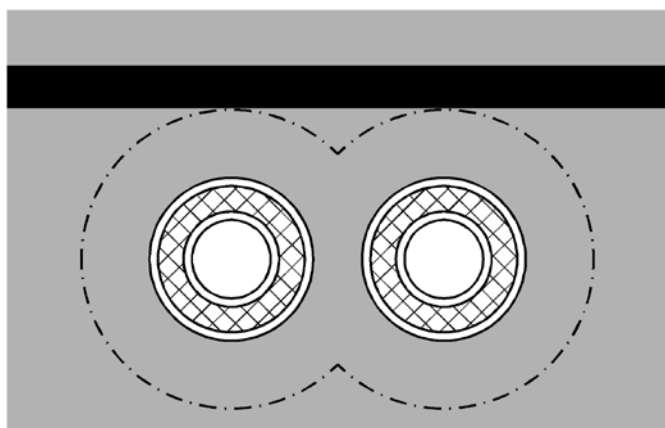
## Details for underground work

### Distance from other supply lines

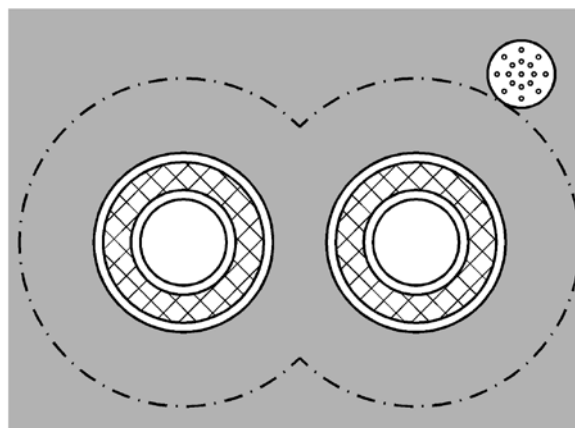
The ground temperature in the immediate vicinity of FLEXWELL® LNG AiO piping laid in the ground can be less than normal.

This can influence the transmission performance of electrical lines laid underground. Appropriate minimum distances are therefore required between the supply lines and the LNG pipes (also see VDE 0100 and VDE 0101).

**Figure 1: Crossing lines/pipes**



**Figure 2: Parallel lines/pipes**



**Table 1:  
Minimum distance from crossing pipes/lines**

Type of supply line	Minimum distance m
1 kV, signal/measuring cable	0.3
10 kV or on 30 kV cable	0.6
Several 30 kV cables or cables above 60 kV	1.0
Gas and water pipes	0.2

**Table 2:  
Minimum distance from parallel pipes/lines**

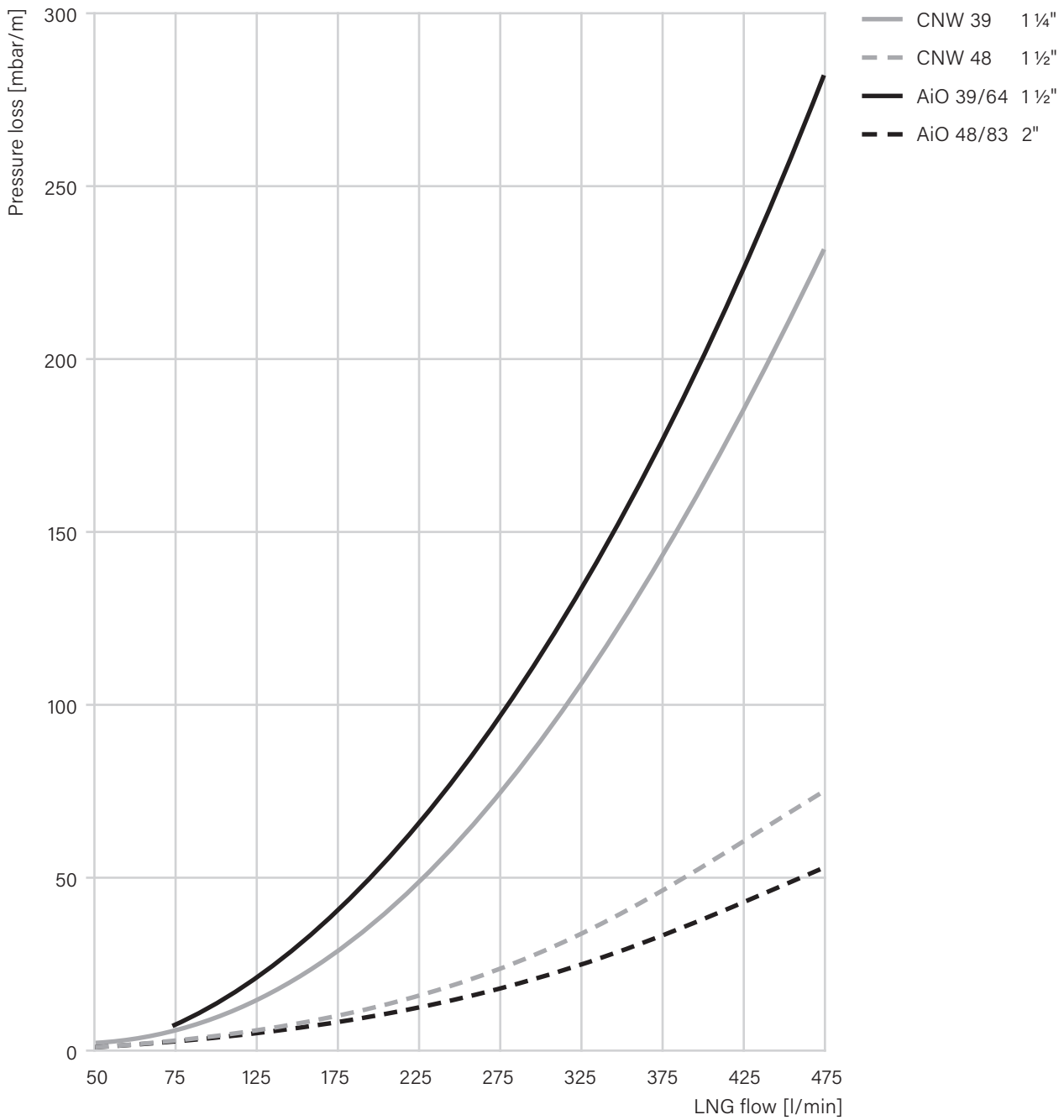
Type of supply line Parallel routing Length	Minimum distance	
	5 m m	> 5 m m
1 kV, signal/measuring cable	0.3	0.3
10 kV or on 30 kV cable	0.6	0.7
Several 30 kV cables or cables above 60 kV	1.0	1.5
Gas and water pipes	0.4	0.4

FLEXWELL® LNG All-in-One

**Fluid engineering**

LNG Pressure loss diagramm

Temperature: -163 °C  
 Specific weight: 450 kg/m<sup>3</sup>  
 Kinematic viscosity: 134 · 10<sup>-6</sup> kg/(m·s)



FLEXWELL® LNG All-in-One

# Processing enquiries

FLEXWELL® LNG All-in-One

### Customer/Contractual partner

Company: \_\_\_\_\_

Country: \_\_\_\_\_

Contact person \_\_\_\_\_

E-Mail: \_\_\_\_\_

### Project details

Project name: \_\_\_\_\_

ZIP / City: \_\_\_\_\_

Final customer: \_\_\_\_\_

### Project data

Number of dispensers: \_\_\_\_\_ Date of installation: \_\_\_\_\_

### Distance [m]

	LNG tank	Dispenser 1	Dispenser 2	Dispenser 3
LNG tank	_____	_____	_____	_____
Dispenser 1	_____	_____	_____	_____
Dispenser 2	_____	_____	_____	_____
Dispenser 3	_____	_____	_____	_____

### Flow rate [kg/m]

	Flow	Return		LNG	Return
Flow to dispenser 1	_____	_____	Density [kg/m³]	_____	_____
Flow to dispenser 2	_____	_____	Temperature [°C]	_____	_____
Flow to dispenser 3	_____	_____	Pressure [bar]	_____	_____

### Quotation for

- FLEXWELL® LNG All-in-One VIP – dispenser line, vacuum insulation, flow and return "all in one"
- FLEXWELL® LNG SL PUR – fill line, PUR-foam insulation, single line

### Notes

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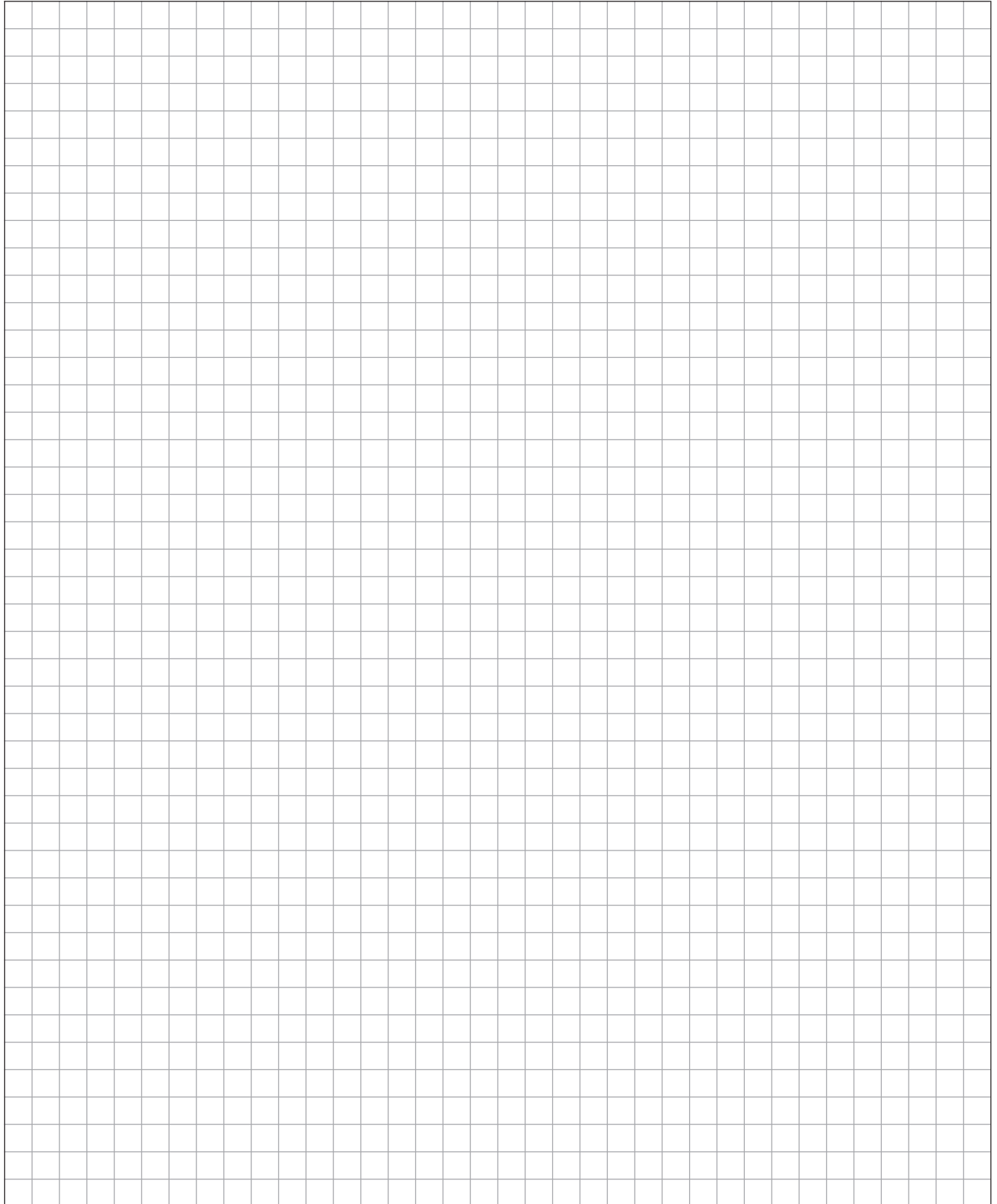
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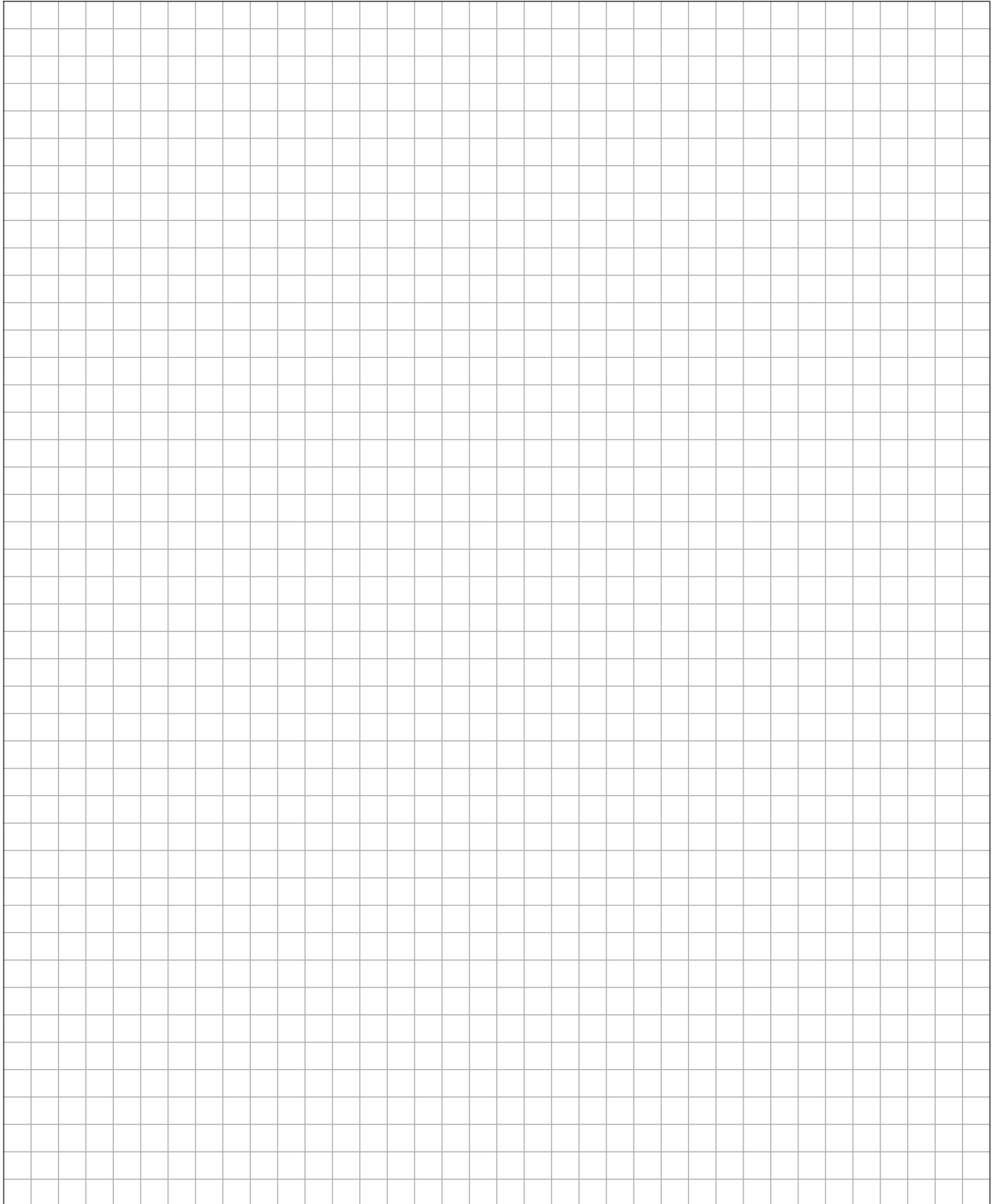
FLEXWELL® LNG All-in-One

## Notes



FLEXWELL® LNG All-in-One

## Notes



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