



บริษัท เอดีดี เฟอร์เนส จำกัด

ADD FURNACE CO.,LTD.

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SIEMENS

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VALVEGYR®

Valve Proving System for automatic Shutoff Valves

LDU11...

The LDU11 ... valve proving system is designed for use with shutoff valves in connection with gas burners and gas appliances. In the event of inadmissible leakage, the system prevents the burner from starting up.

The LDU11... system conforms to the requirements of EN 1643 covering automatic shutoff valves for use with gas burners and gas appliances to EN 161.

The LDU11... and this Data Sheet are intended for use by OEMs which integrate the valve proving system in their products.



Use

The LDU11... is designed for automatic gas valve proving (leakage test) based on the pressure proving principle.

It is for use on gas-fired combustion plant with or without vent pipe to atmosphere.

In the case of plants with no vent pipe where EN standards apply, the notes given in «Connection examples without vent pipe to atmosphere» must be observed.

Used in connection with 1 or 2 commercially available pressure switches, valve proving is automatically initiated with every burner startup, either

- prior to burner startup
- during the prepurge time if it lasts a minimum of 60 seconds
- immediately after controlled shutdown, or
- on completion of the burner control's control sequence, e.g. at the end of the post-purge time

The valve proving test is based on the 2-stage pressure proving principle:

1. First test phase: The valve on the mains side is tested by evacuating the test space and by monitoring the atmospheric pressure in it.
2. Second test phase: The valve on the burner side is checked by pressurizing the test space and by monitoring the gas pressure.

If the pressure increases excessively during the first test phase called «Test1», or decreases excessively during the second test phase called «Test2», the valve proving system will inhibit burner startup and initiate lockout.

In that case, the lockout reset button will light up to indicate the fault. Remote indication of the fault is also possible. A program indicator, which stops whenever a fault occurs, indicates which of the valves is leaking.

The valve proving system can be reset either on the unit itself or via an electric remote reset facility.

Warning notes



To avoid injury to persons, damage to property or the environment, the following warning notes should be observed.

Do not open, interfere with or modify the control unit.

- All activities (mounting, installation and service work, etc.) must be carried out by qualified staff
- Before performing any wiring changes in the connection area of the LDU11..., completely isolate the unit from the mains supply (all-polar disconnection)
- Ensure protection against electric shock hazard by providing adequate protection for the valve proving system's connection terminals
- Ensure that wiring is in an orderly state
- Press the lockout reset button only manually (applying a force of no more than 10 N), without using any tools or pointed objects
- Fall or shock can adversely affect the safety functions. Do not put such units into operation, even if they do not exhibit any damage
- **Do not press the lockout reset button on the unit for more than 10 seconds since longer presses will destroy the lockout relay**

Mounting notes

- Ensure that the relevant national safety regulations are complied with



Installation notes

- Live and neutral conductors may not be interchanged

Commissioning notes

- Prior to commissioning, ensure that wiring is in an orderly state

Norms and certificates



Conformity to EEC directives

- Electromagnetic compatibility EMC (immunity)

89 / 336 EEC

- Directive for gas appliances

90 / 396 EEC



ISO 9001: 2000
Cert. 00739



ISO 14001: 1996
Cert. 38233

Type reference	CE	FM APPROVED	DVGW	SP	PGT	RU
LDU11.323A17	X	---	X	X	---	---
LDU11.323A27	X	---	X	---	---	---
LDU11.523A17	---	X	---	X	X	X
LDU11.523A27	---	X	---	---	X	---

Service notes

- Each time a unit has been replaced, ensure that wiring is in an orderly state

Disposal notes



The unit contains electric and electronic components and may not be disposed of together with household waste.

Local and currently valid legislation must be complied with.

**Mechanical design**

- Valve proving system LDU11...
- Plug-in design
 - Exchangeable unit fuse (including a spare fuse)
- Housing
- Made of impact-proof and heat-resistant black plastic
 - Lockout reset button with viewing window showing:
 - The fault signal lamp
 - The lockout indication
 - Coupled to the program spindle
 - With transparent lockout reset button
 - Easy-to-remember symbols indicate the type of fault and the time lockout occurred
 - Synchronous motor of the sequence switch with geartrain and step action sequence switch
 - Camshaft with 15 nonadjustable cams
 - Program indicator at the head of the camshaft
 - One main and one auxiliary relay
 - Lockout relay can be electrically reset from a remote location and provides the «Lockout» and «Reset» functions
 - Unit fuse and a spare fuse

All electrical components are interconnected via printed circuits.

- Plug-in base
- Plug-in base and connection facility are designed such that only the LDU11... can be plugged in
 - 24 connection terminals
 - 2 auxiliary terminals («31» and «32»)
 - 3 earth terminals joining in a lug for earthing the burner
 - 3 neutral terminals, prewired to terminal 2 (neutral input)
 - 14 knockout holes for cable entry with cable glands, 8 at the side and 6 at the bottom of the base
 - 6 threaded knockout holes at the side for cable entry glands Pg11 or M16

Type summary

Type reference	Mains voltage	t3	t4
LDU11.323A17	AC 100...110 V	2.5 s	2.5 s
LDU11.323A27	AC 220...240 V	2.5 s	2.5 s
LDU11.523A17 ¹⁾	AC 100...110 V	5 s	5 s
LDU11.523A27 ¹⁾	AC 220...240 V	5 s	5 s

- Legend
- t3 Filling the test space
- t4 Evacuating the test space

¹⁾ Valve opening times do not conform to EN 1643

Ordering

When ordering, please give the full type reference (refer to «Type summary»).

Valve proving system LDU11... (without plug-in base) refer to «Type summary»



Accessories

**Plug-in base**

- With Pg11 threads for cable entry glands
- With M16 threads for cable entry glands

AGM11

AGM11.1

**PTC resistor (AC 230 V)**

- For burden on terminal 4

AGK25

Technical data

General unit data LDU11...	Mains voltage	
	- LDU11.323A27	AC 220 V –15 %...AC 240 V +10 %
	- LDU11.323A17	AC 100 V –15 %...AC 110 V +10 %
	- LDU11.523A27 ¹⁾	AC 220 V –15 %...AC 240 V +10 %
	- LDU11.523A17 ¹⁾	AC 100 V –15 %...AC 110 V +10 %
	¹⁾ Valve opening times do not conform to EN 1643	
	Mains frequency	50...60 Hz ±6 %
	Unit fuse (built-in)	T6.3H250V to DIN EN 60 127
	Primary fuse (external)	T10 / 500V
	Weight	
	- LDU11...	approx. 1000 g
	- Plug-in base	approx. 165 g
	Power consumption	
	- During the test	approx. 3.5 VA
- During operation	approx. 2.5 VA	
Mounting position	optional	
Degree of protection	IP 40 (to be ensured through mounting)	
Safety class	I	
Perm. input current at terminal 1	max. 5 A continuously, peak current max. 20 A for 20 ms	
Perm. current rating of control terminals	max. 4 A continuously, peak current max. 20 A for 20 ms	
Required current rating of pressure switch «DW»	min. 1 A, AC 250 V	
Plug-in base AGM...	Degree of protection	IP 00
	Connections (stranded wires require ferrules)	screw terminals for min. 0.5 mm ² and max. 1.5 mm ² cross-sectional area
	Ferrules	suited for appropriate stranded wires
Environmental conditions	Transport	DIN EN 60 721-3-2
	Climatic conditions	class 2K2
	Mechanical conditions	class 2M2
	Temperature range	-50...+60 °C
	Humidity	< 95 % r.h.
	Operation	DIN EN 60 721-3-3
	Climatic conditions	class 3K5
	Mechanical conditions	class 3M2
	Temperature range	-20...+60 °C
	Humidity	< 95 % r.h.

**Condensation, formation of ice and ingress of water are not permitted!**



Function

During the first phase of the valve proving test called «Test1», atmospheric pressure must exist in the length of pipe between the 2 valves to be tested.

In plants with a vent pipe to atmosphere, atmospheric pressure is available if the valve proving test is made prior to or during the prepurge time.

In plants without vent pipe, atmospheric pressure is made available as the valve proving system opens the valve on the burner side during the time «t4».

If the valve proving test is performed after burner operation, the valve on the burner side after the controlled shutdown can be kept open until «t4» has elapsed, thus lowering the pressure in the test space and making certain its gas content is burnt off in the combustion chamber during the postpurge time.

Prerequisite for this procedure is a suitable control program of the burner control as provided by burner controls type LFE..., LFL..., LGK... or LEC...

The test space is closed off after it has been evacuated. During the first test phase «Test1», which then follows, the LDU11... checks with the pressure switch if the atmospheric pressure in the test space is maintained.

If the valve on the mains side is leaking, causing the pressure to rise above the switching point of the pressure switch, the LDU11... will trigger an alarm and initiate lockout. The program indicator then stops to indicate «Test1».

If the pressure does not increase because the valve closes correctly, the LDU11... continues its program with the second test phase «Test2».

For that purpose, the valve on the mains side is opened during «t3» so that the test space is pressurized («filling» the test space).

During the second test phase – if the valve on the burner side is leaking – this pressure may not fall below the switching point of the pressure switch. If it does, the LDU11... will initiate lockout also, thus preventing the burner from starting up.

On successful completion of the second test phase, the LDU11... closes the internal control loop between terminals 3 and 6 (circuit path: terminal 3 – contact «ar2» - terminals 4 and 5 – contact III – terminal 6).

This control loop is normally included in the burner control's start control loop.

After the control loop has been closed, the programming mechanism of the LDU11... returns to its start position to switch itself off.

During these so-called idle steps, the positions of the programming mechanism's control contacts remain unchanged.



Program and lockout indicator

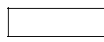
In the event of lockout, the programming mechanism stops and thus the position indicator fitted to the spindle of the mechanism.

The symbol that stops above the reading mark indicates the test phase during which lockout occurred and also gives the number of programming steps completed from the start of this test phase (1 step = 2.5 seconds).

Meaning of the symbols



Start position = operating position



In plants without vent valve:

Evacuation of test space by opening the valve on the burner side

Test1

«Test1» with atmospheric pressure (valve proving test on the mains side)



Filling the test space by opening the valve on the mains side

Test2

«Test2» with gas pressure (valve proving test on the burner side)

III

Idle steps until programming mechanism switches itself off



Operating position = start position for the next valve proving test

In the event of lockout, all terminals receiving voltage from the LDU11... will be deenergized, except terminal 13, which is used for lockout indication.

After a reset, the programming mechanism automatically returns to its start position to immediately program a new valve proving test.

Note

Do not press the reset button for more than 10 seconds.

Control sequence after a power failure

A power failure prior to evacuating the test space does not cause the control sequence to change.

If a power failure occurs after the evacuation, the valve proving test will not be continued when power is restored, but the programming mechanism first returns to its start position and then performs the complete valve proving test.



Calculation of the leakage rate escaping from a length of pipe

$$Q_{\text{Leak}} = \frac{(P_G - P_W) \times V \times 3600}{P_{\text{atm}} \times t_{\text{Test}}}$$

Legend

Q_{leak}	in dm ³ / h	Permissible leakage rate in dm ³ or liters per hour
P_G	in mbar	Overpressure in pipe section between the valves to be tested, at the beginning of the test phase
P_W	in mbar	Overpressure set on pressure switch «DW» (normally set to 50 % of the gas mains pressure)
P_{atm}	in mbar	Absolute pressure (1.013 mbar normal pressure)
V	in dm ³	Volume of test space confined by the valves to be tested, including the space in the valves themselves
T_{test}	in s	Duration of proving time

Example

P_G	= 30 mbar	$Q_{\text{Leak}} = \frac{(30 - 15) \times 10.36 \times 3600}{1013 \times 27.5} = 20 \text{ l/h}$
P_W	= 15 mbar	
P_{atm}	= 1013 mbar	Any valve leakage rate exceeding 20 l/h causes the LDU11..
V	= 10.36 dm ³	. to initiate lockout
t_{Test}	= 27.5 s	

Note

Select volume of pipe section «V» between the gas valves to be checked and over-pressure «P_W» set on pressure switch «DW» such that the maximum permissible gas leakage rate «Q_{Leak}» will not exceed the rate specified in the local regulations.

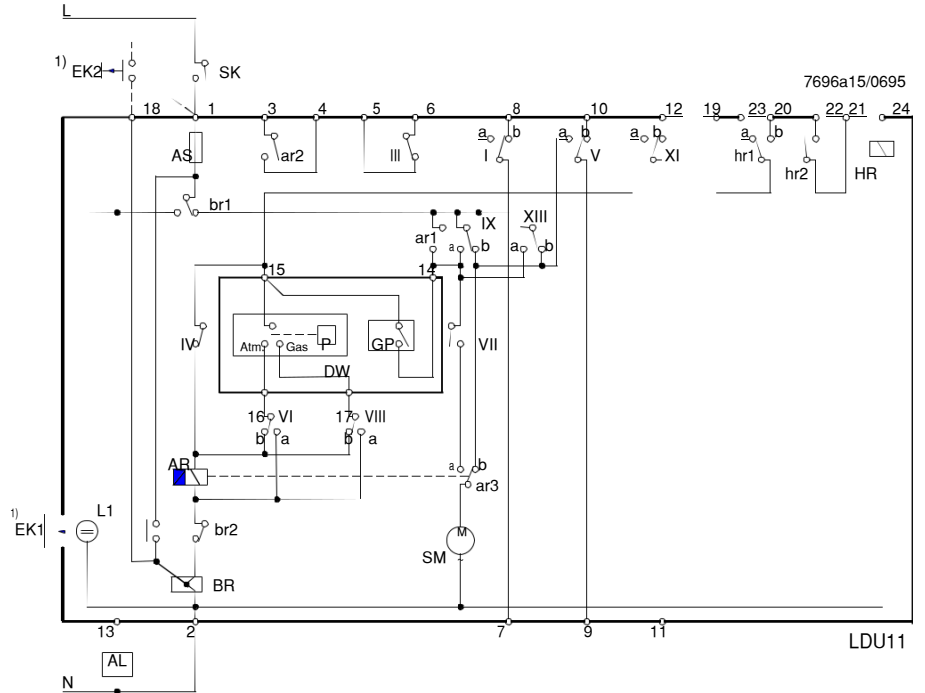


Connection diagram

Legend

- AL Alarm signal for «leaking valve»
- AR Main relay with contacts «ar...»
- AS Unit fuse (built-in)
- BR Lockout relay with contacts «br...»
- DW Pressure switch for valve proving test (does not replace the gas pressure switch used to signal lack of gas)
- EK1 Lockout reset button
- EK2 Remote lockout reset button
- GP Gas pressure switch (for lack of gas)
- HR Auxiliary relay with contacts «hr...»
- L1 Lockout warning lamp (built-in)
- SK Control contact (for initiating the valve proving test)
- SM Synchronous motor of programming mechanism

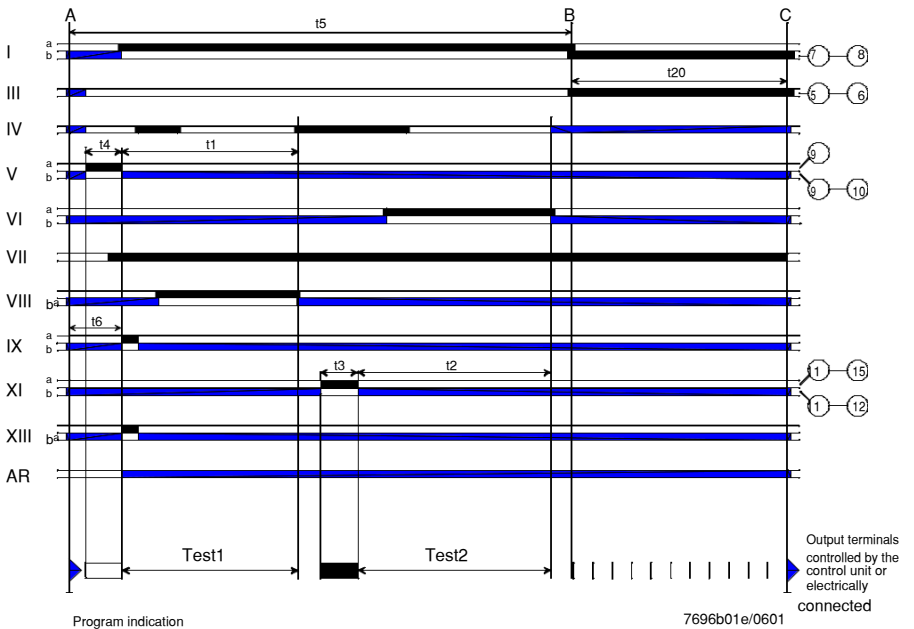
1) Do not press «EK...» for more than 10 seconds



Sequence diagram

Legend

- t1 22.1 s First test phase with atmospheric pressure
- t2 27 s Second test phase with gas pressure
- For LDU11.323...
 - t3 2.5 s Filling the test space
 - t4 2.5 s Evacuating the test space
- For LDU11.523...
 - t3 5 s Filling the test space
 - t4 5 s Evacuating the test space
- t5 66.3 s Total duration of valve proving test until burner is released
- t6 7.4 s Interval from start to energizing main relay «AR»
- t20 22.1 s Running time of programming mechanism until it switches itself off in the operating = start position (idle steps)



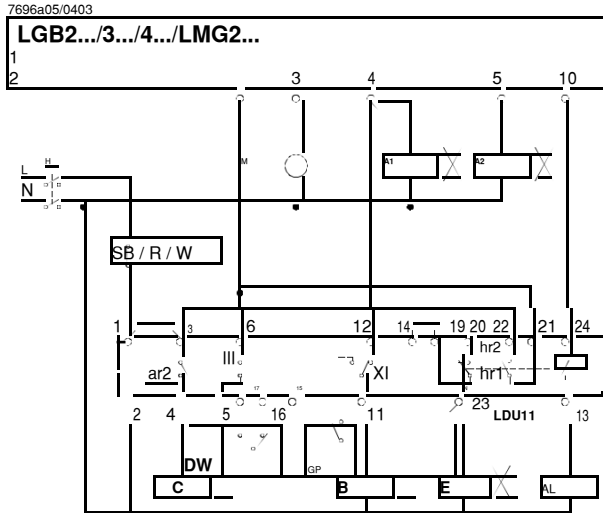
- A Gas valves controlled to evacuate the test space
- B Gas valves controlled to fill the test space
- C Vent valve, normally open; closed during valve proving test from the beginning of «Test1»



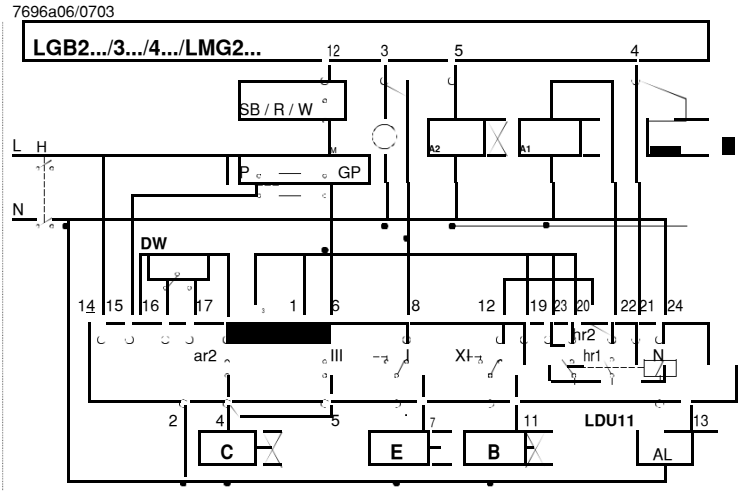
Connection examples with vent pipe to atmosphere using burner controls type LGB2..., LGB3... or LGB4...

For other connections, refer to the connection diagram of the relevant burner control.

Valve proving test prior to burner startup

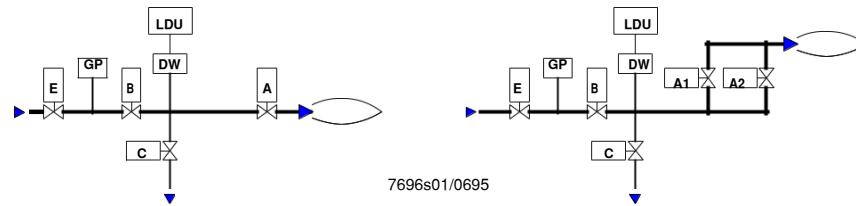


Valve proving test following immediately the controlled shutdown



3) Only in connection with LMG2...

Plants with vent pipe to atmosphere



Connection examples with vent pipe to atmosphere using burner controls type LFE..., LFL... or LGK..., or the control unit LEC...

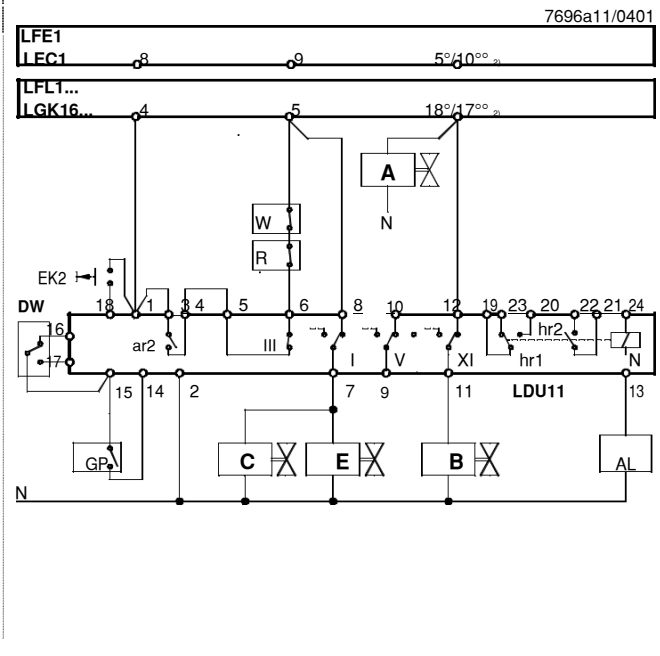
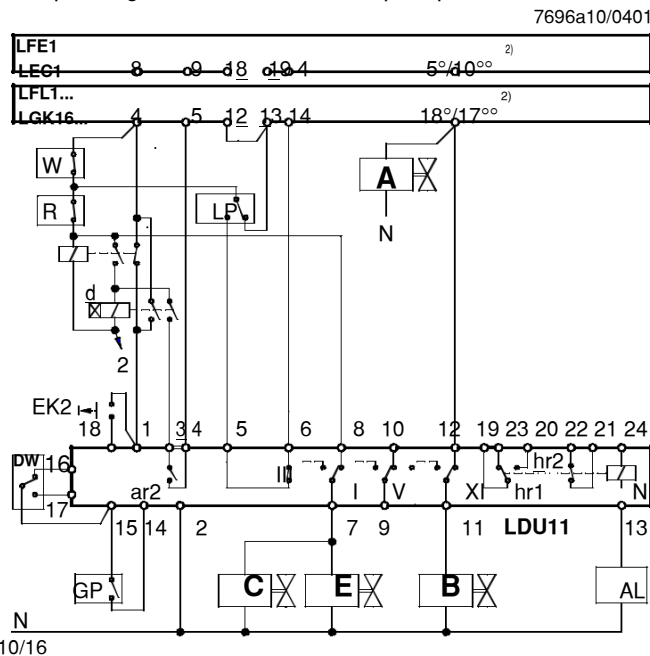
Valve proving test during the prepurge time (min. 60 seconds) and following immediately the controlled shutdown in plants with vent pipe to atmosphere.

Delay on make of relay d > 2 seconds.

2) Expanding flame burner or interrupted pilot burner

Valve proving test following immediately the controlled shutdown

2) Expanding flame burner or interrupted pilot burner

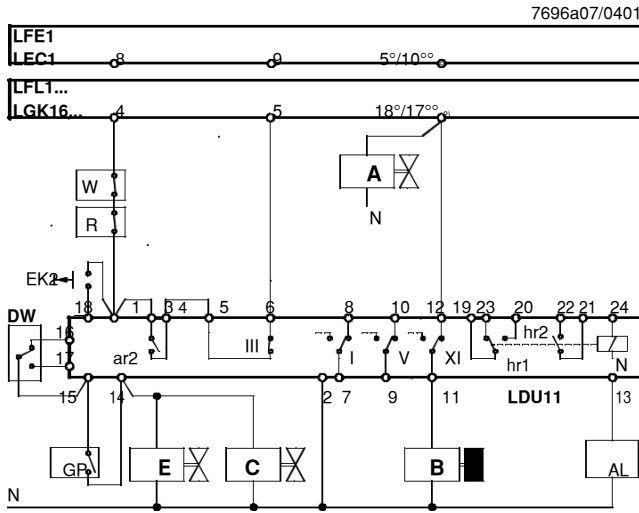




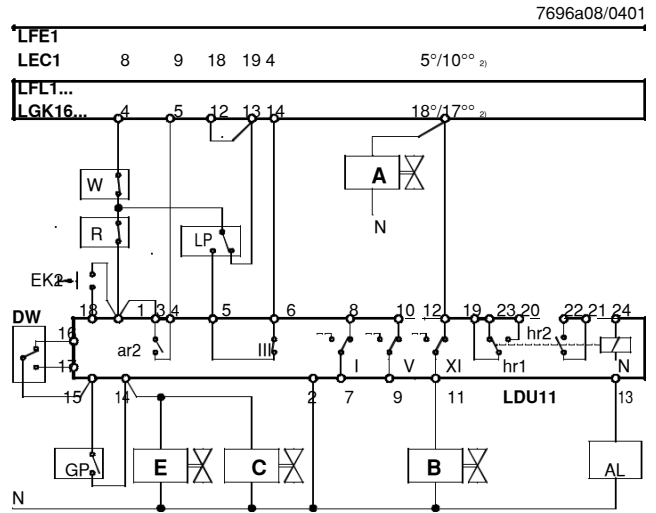
Connection examples with vent pipe to atmosphere using burner controls type LFE..., LFL... or LGK..., or the control unit LEC...

For other connections, refer to the connection diagram of the relevant burner control.

- Valve proving test just prior to burner startup
- 2) Expanding flame burner or interrupted pilot burner



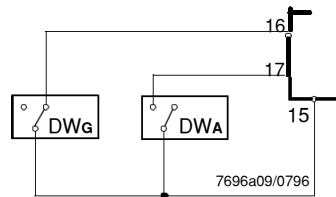
- Valve proving test during the prepurge time (min. 60 s)
- 2) Expanding flame burner or interrupted pilot burner



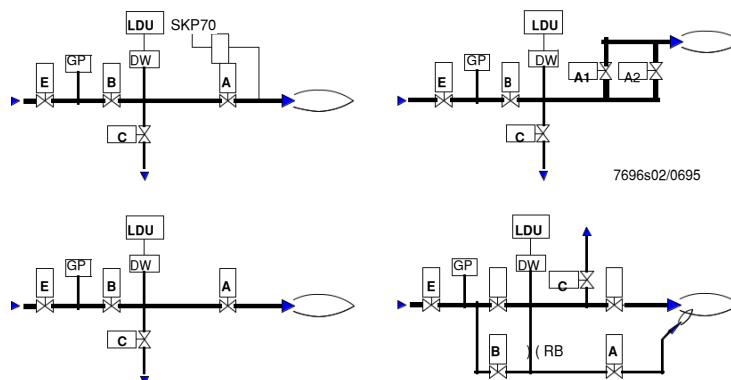
Valve proving test with 2 pressure switches

- DWG** Pressure switch for the valve proving test with gas pressure. This pressure switch must be set to the minimum gas pressure permitted during the proving test. If this pressure is not reached during the test, the LDU11... will initiate lockout.
- DWA** Pressure switch for the gas valve proving test with atmospheric pressure. This pressure switch must be set to the maximum gas pressure permitted during the proving test with atmospheric pressure. If this pressure is exceeded during the test, the LDU11... will initiate lockout.

DWG and DWA must be overload-proof up to the gas pressure level.



Plants with vent pipe to atmosphere



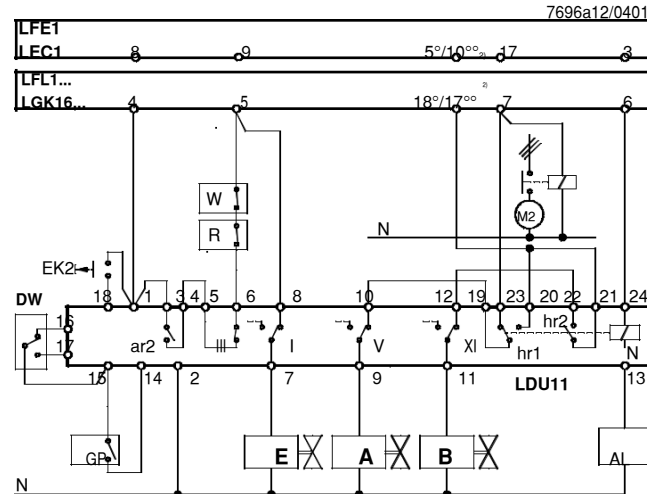


Connection examples without vent pipe to atmosphere (for applications not covered by EN 676) using burner controls type LFE..., LFL... or LGK..., or the control unit LEC...

Valve proving test following immediately the controlled shutdown in plants without vent pipe.

Valve «A» or «A1» remains open after the controlled shutdown until the start of the first test phase is reached in order to evacuate the test space and to burn off the gas in the combustion chamber during the afterburn time.

2) Expanding flame burner or interrupted pilot burner

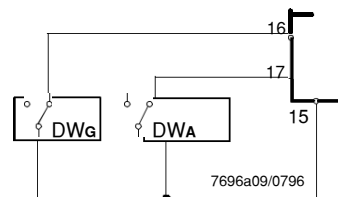


Valve proving test with 2 pressure switches

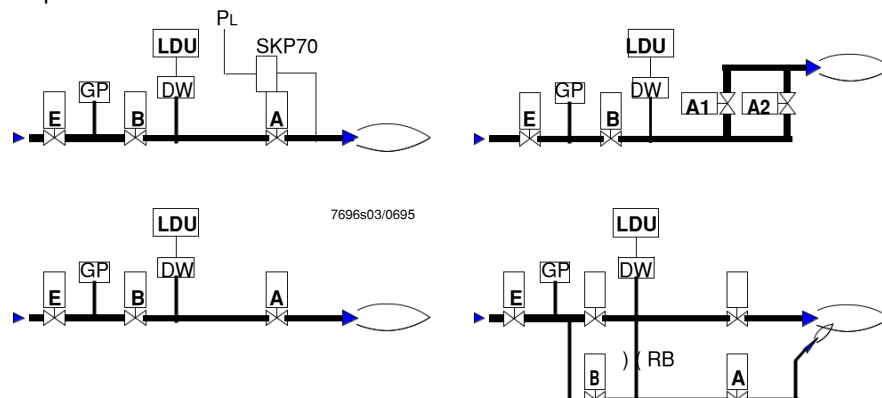
DWG Pressure switch for the valve proving test with gas pressure.
This pressure switch must be set to the minimum gas pressure permitted during the proving test.
If this pressure is not reached during the test, the LDU11... will initiate lockout.

DWA Pressure switch for the gas valve proving test with atmospheric pressure.
This pressure switch must be set to the maximum gas pressure permitted during the proving test with atmospheric pressure.
If this pressure is exceeded during the test, the LDU11... will initiate lockout.

DWG and DWA must be overload-proof up to the gas pressure level.



Plants without vent pipe to atmosphere

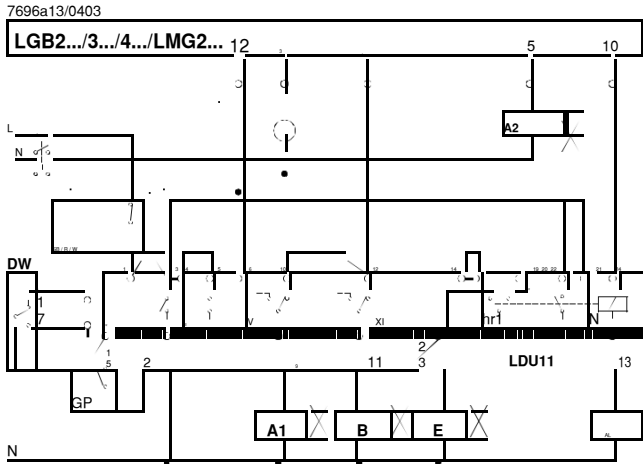




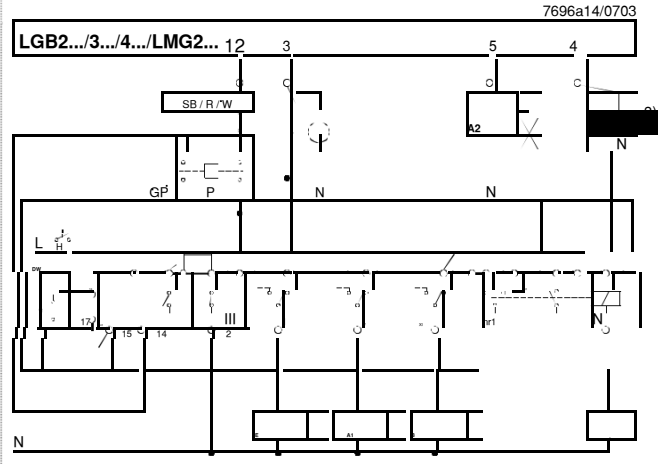
Connection examples without vent pipe to atmosphere using burner controls type LGB2... , LGB3... or LGB4...

For other connections, refer to the connection diagram of the relevant burner control.

Valve proving test prior to burner startup shutdown

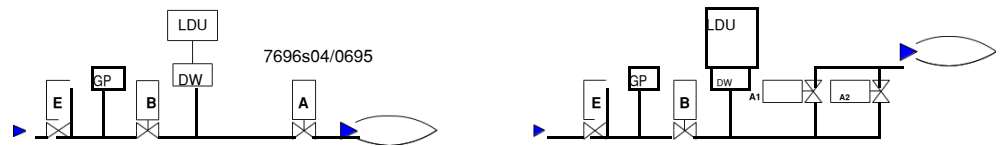


Valve proving test following immediately the controlled



³⁾ Only in connection with LMG2...

Plants without vent pipe to atmosphere



Legend

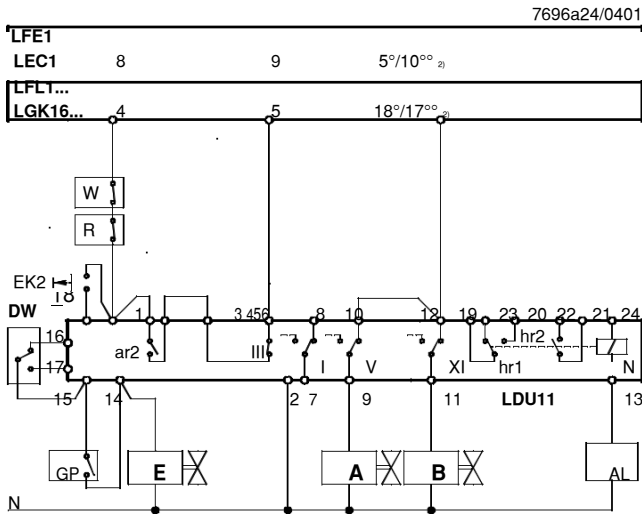
- A, A1, A2** Gas valves controlled to evacuate the test space
- AL** Alarm signal for «Leaking valve»
- B** Gas valve controlled to fill the test space
- C** Vent valve, normally open; closed during valve proving test from the beginning of «Test1»
- DW** Pressure switch for valve proving test (does not replace the gas pressure switch used to signal lack of gas)
- E** Safety shutoff valve, normally closed (optional)
- EK2** Remote lockout reset button
- GP** Gas pressure switch (for lack of gas)
- H** Main switch
- LP** Air pressure switch
- M...** Fan («M2»: pre- and postpurging)
- PL** Reference pressure for SKP70...
- R** Control thermostat or pressurestat (e.g. boiler control thermostat)
- RB** Pipe orifice; its diameter must be determined such that in the event of a leaking pilot gas valve «A», the pilot flame cannot afterburn on completion of the second safety time so that presence of the main flame cannot be simulated
- SB** Safety limit thermostat
- T** Delay off time relay; the time should be set to approx. «t16» (min. «t7»... max. «t10») of the burner control
- W** Limit thermostat or pressure switch or pressure limiter



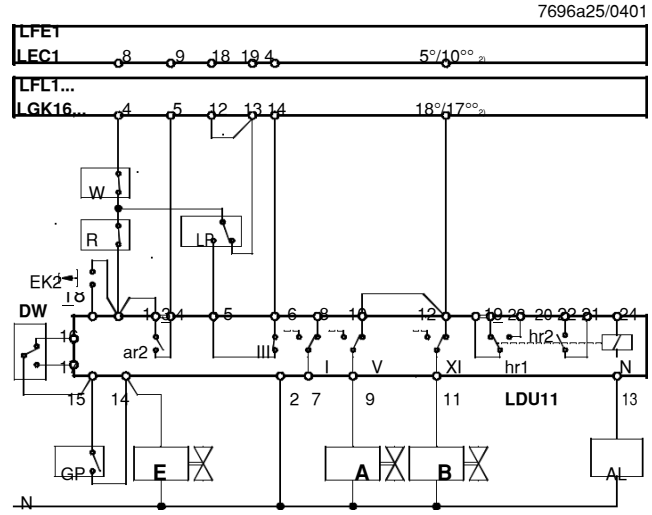
Connection examples without vent pipe to atmosphere using burner controls type LFE..., LFL... or LGK..., or the control unit LEC...

For other connections, refer to the connection diagram of the relevant burner control.

Valve proving test just prior to burner startup
²⁾ Expanding flame burner or interrupted pilot burner



Valve proving test during the prepurge time (min. 60 s)
²⁾ Expanding flame burner or interrupted pilot burner

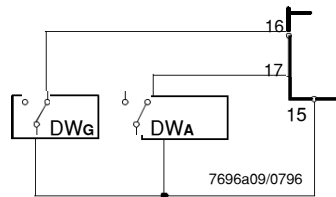


Valve proving test with 2 pressure switches

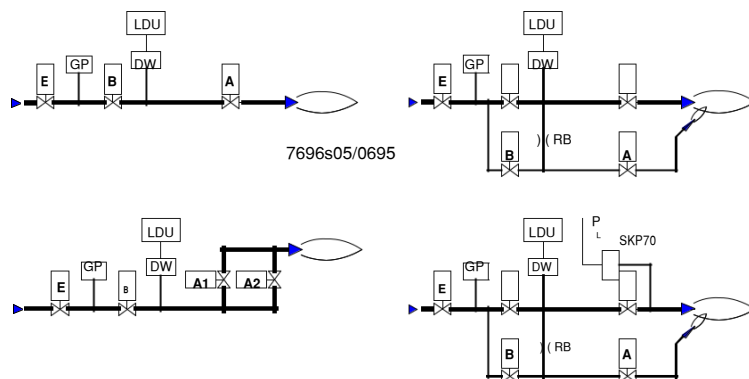
DWG Pressure switch for the valve proving test with gas pressure.
 This pressure switch must be set to the minimum gas pressure permitted during the proving test.
 If this pressure is not reached during the test, the LDU11... will initiate lockout.

DWA Pressure switch for the gas valve proving test with atmospheric pressure.
 This pressure switch must be set to the maximum gas pressure permitted during the proving test with atmospheric pressure.
 If this pressure is exceeded during the test, the LDU11... will initiate lockout.

DWG and DWA must be overload-proof up to the gas pressure level.



Plants without vent pipe to atmosphere



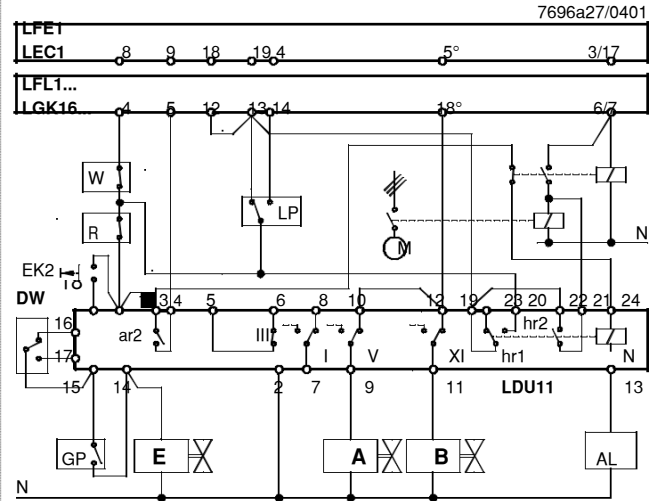
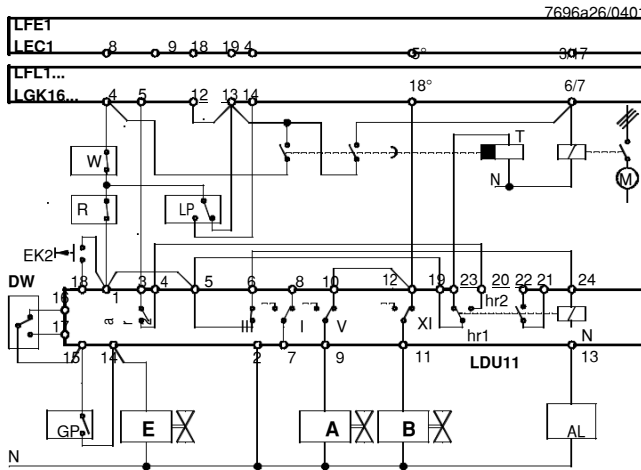


Connection examples without vent pipe to atmosphere using burner controls type LFE..., LFL... or LGK..., or control unit LEC... and the SKP70... with expanding flame burners

For other connections, refer to the connection diagram of the relevant burner control.

Valve proving test just prior to burner startup

Valve proving test during the prepurge time (min. 60 s)

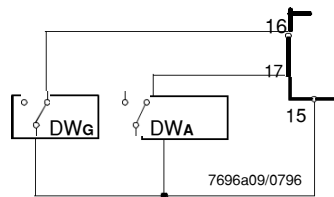


Valve proving test with 2 pressure switches

DWG Pressure switch for the valve proving test with gas pressure.
This pressure switch must be set to the minimum gas pressure permitted during the proving test.
If this pressure is not reached during the test, the LDU11... will initiate lockout.

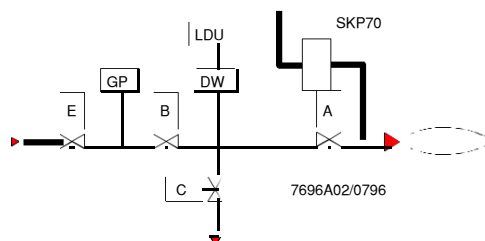
DWA Pressure switch for the gas valve proving test with atmospheric pressure.
This pressure switch must be set to the maximum gas pressure permitted during the proving test with atmospheric pressure.
If this pressure is exceeded during the test, the LDU11... will initiate lockout.

DWG and DWA must be overload-proof up to the gas pressure level.



Air pressure «PL» for the SKP... must be sufficiently high to open the SKP70... although the burner's air damper is closed.
Otherwise, the LDU11... will initiate lockout when performing «Test1».

Plants without vent pipe to atmosphere

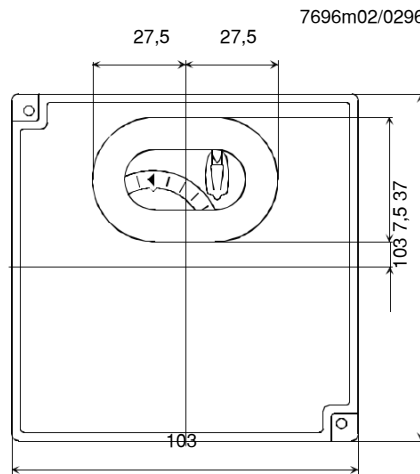
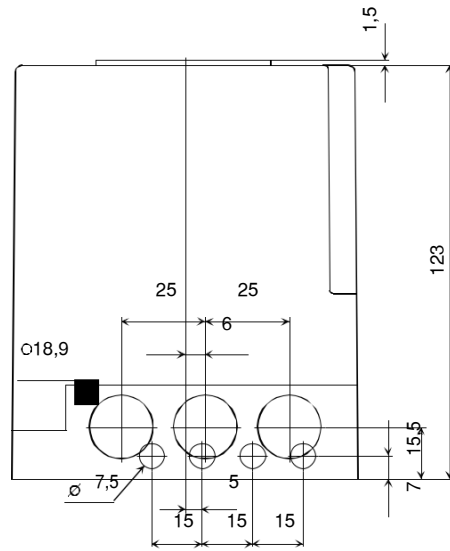




Dimensions

Dimensions in mm

LDU11... with plug-in
base AGM...



Plug-in base AGM... (
Pg11 or M16 thread)

