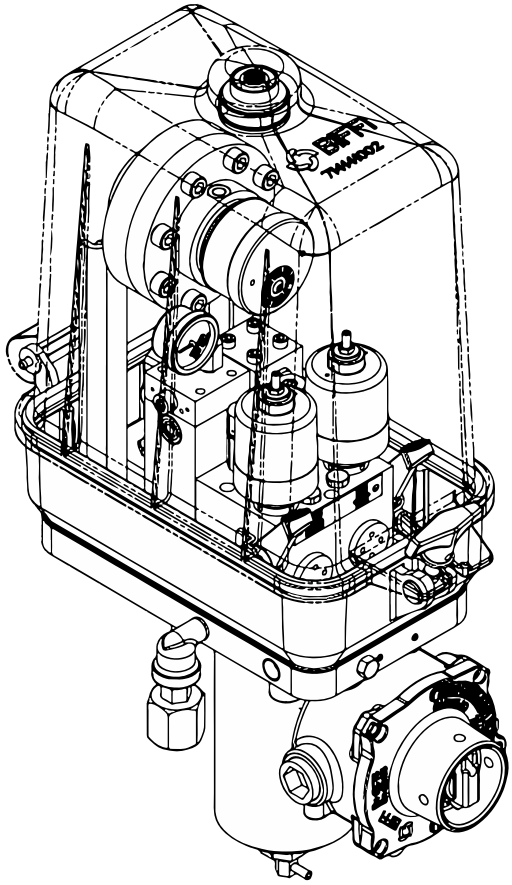
Installation, Operation and Maintenance Manual
MAN 615 Rev. 0
January 2023

Biffi Line Break Automatic Closing Control Unit

Device Setting



Biffi Italia s.r.l. - Strada Biffi 165, 29017 Fiorenzuola d'Arda (PC) – **Italy PH**: +39 0523 944 411 – biffi_italia@biffi.it

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NOTICE

Before carrying out any operation with the automatic closing device or any maintenance intervention, all the instructions, procedures, and warnings described in this Installation, Operation and Maintenance Manual must be read and understood.

Furthermore, please refer to the acknowledgement documentation for further information about the configuration of the automatic closing control unit.

To be kept for future reference.

NOTICE

Biffi Italia s.r.l. has taken every care in collecting and verifying the documentation used in drafting the present instruction manual. Nevertheless, Biffi Italia s.r.l. does not provide any guarantees with regard to this Installation, Operation and Maintenance Manual. Biffi Italia s.r.l. shall not be held responsible for any mistake or inaccuracy contained herein, or for any damage whether accidental or arising from the use of this manual.

Biffi Italia s.r.l. is the owner of intellectual property rights with regard to the content hereof, which can be subject to subsequent modifications without prior notice.

The information contained in this IOM refers only to the automatic closing control unit and not to any of the accessories which reference must be made to the relevant documentation.

Section 1: Introduction

1.1 Purpose of This Manual

The purpose of this manual is to specify the expected use of the automatic closing control unit as intended in the design and to provide the necessary instructions about adjustment and use, staff training, accident prevention, maintenance, and spare parts ordering. A description of the main technical features of the automatic closing control unit is also included.

However, in terms of conditions of use, risk assessment and accident prevention the content of the manual cannot be a substitute for the user's experience.

1.2 Who Should Use This Manual

- Safety Supervisor of the plant where the automatic closing control unit is being used.
- Personnel in charge of lifting and transport.
- Personnel in charge of assembly, use and adjustment.
- Personnel in charge of maintenance and disposal.

1.3 Safe Keeping of This Manual

For a proper safe keeping, please keep the manual in a protected and dry place, sheltered from dust and sunbeams. A copy of the manual must always be available to hand for both operator and maintenance technician.

Do not remove, add or modify any part of the manual: only the Manufacturer of the automatic closing control unit is entitled to make any changes.

NOTICE

This manual must be kept at the automatic closing control unit location at all times and for the entire life cycle, even in case of conveyance or sale to third parties.

1.4 Supplements and Revisions

This manual reflects the state-of-the-art technology existing when the machine was marketed and cannot be considered as inadequate due to subsequent revisions made on the basis of new knowledge.

The Manufacturer reserves the right to make changes to the production and relevant documentation, without being bound to make changes to the previous production and documentation, except in those cases where the health and safety of persons and property is concerned.

1.5 Reading Through This Manual

This instruction manual consists of sections, each relating to a specific topic. The paragraphs are numbered according to sections.

Warnings and pieces of information have each been inserted within the most appropriate section and are not repeated elsewhere. For this reason, the manual must be read first entirely and in sequence, from beginning to end, and all such information must be understood and kept in mind. Afterwards, only the required paragraphs can be referred to.

1.6 Symbols Used in the Text

The graphical symbols used in this manual to point out precautions or warnings that must be observed, are listed below:

OBLIGATION Sign
It is absolutely MANDATORY to carry out the actions indicated by this sign.

PROHIBITION Sign
It is absolutely PROHIBITED to carry out the actions indicated by this sign.

DANGER Sign
It indicates an action or behavior likely to cause damage to property or persons.

Below are list of the graphic symbols used in this manual in order to make the reading easier and understanding of certain significant parts of the text faster. Each symbol (ISO 7000) is identified by its related image, code number and meaning.

0421 EXAMINE – CHECK

0717 CALL FOR MAINTENANCE

0981 DATA CARRIER

Section 2: General Information

NOTICE

The manual is an integral part of the machine. It should be carefully read before carrying out any operation and it should be kept for future references.

2.1 Identification Data of the Manufacturer

Biffi Italia s.r.l.

Phone: +39 0523 94.44.11

Fax: +39 0523 94.18.85

biffi_italia@biffi.it

www.biffi.it

Strada Biffi n. 165

29017 Fiorenzuola d'Arda (PC)

ITALY

Member Company under the management and coordination of Emerson Electric Co. (USA)
Cap. Soc. € 1.820.000 i. v. - Registro Imprese di Piacenza/Cod. Fisc./P. IVA n. 01018580330
R.E.A. di Piacenza n. 121628 - Meccanografico PC 00279 - Authorized Economic Operator
IT AEOF 11 0383

2.2 Instruction Manual Identification Data

The identification code, the revision number and the edition of this manual are featured on the footer of each page: these data must be specified when purchasing additional copies of the manual.

2.3 Requesting Technical Assistance

For any information regarding:

- use
- maintenance
- calibration

You can contact Biffi Italia s.r.l. After Sales Service:

Strada Biffi 165 - 29017 Fiorenzuola d'Arda (PC), Italia

Phone: +39 0523 94 45 23

Fax: +39 0523 94 18 85

e-mail: service@biffi.it

NOTICE

Any inquiry or request for assistance submitted to the After Sales Service must indicate the data featured on the rating plate of the machine.

2.4 Spare Parts Ordering

The parts subject to normal wear and tear require periodic replacement. Whenever ordering spare parts, make sure they can be clearly identified by submitting the relevant info, such as: code number featured in the diagrams, ID data featured on the physical label, any reference code mentioned in this IOM, etc.).

The request must be addressed to:

Biffi Italia s.r.l. - Spare parts service

Strada Biffi 165 - 29017 Fiorenzuola d'Arda (PC), Italia

Phone: +39 0523 94 45 23

Fax: +39 0523 94 18 85

e-mail: service@biffi.it

NOTICE

Always use genuine spare parts to preserve the safety conditions provided by the Manufacturer.

2.5 Intended Use

The automatic closing device is designed to be used by adequately instructed and trained technical personnel for PROFESSIONAL applications only.

The machine must only be used as intended by the Manufacturer.

In particular:

- the automatic closing device must be installed properly;
- the characteristics regarding the electrical power supply, pneumatic supply, hydraulic supply, etc.;
  - must correspond to the values indicated on the actuator rating plate; and
  - must have a variability that does not exceed the contractual limit values or those indicated on the actuator rating plate.
- the environmental operating conditions must always be observed;
- the specified performance values must always be observed, namely: pressure, temperature, load conditions, etc.;
- the procedures described in this manual as regards use and maintenance must always be observed; and
- all the provisions concerning the safety of the people and property must be strictly observed.

Any exception to what so far stated must be decided upon during the contractual stage. Should that not be the case, the Purchaser shall be charged with both civil and criminal liability in relation to any improper use whatsoever of the actuator.

Any other use not specifically indicated must be considered IMPROPER.

2.6 Misuses

Any use of the actuator not described in this manual must be regarded as “not intended” by the Manufacturer.

2.7 Limitation of Liability

Biffi Italia s.r.l. declines all liability arising from the misuse or not reasonably foreseeable use of the actuator, use of non-genuine spare parts and from any modification or tampering whatsoever.

The Safety supervisor is responsible for the thorough and scrupulous enforcement of the safety provisions. The Safety supervisor must also ascertain that the personnel entrusted with the use of the machine hold the qualifications to carry out the required task and knowledgeable about the instructions described in this manual and about the general safety provisions applicable to the actuator.

2.8 Warranty

Biffi Italia s.r.l. guarantees that all the items produced are free of defects in workmanship and manufacturing materials and meet relevant current specifications, provided they are installed, used and serviced according to the instructions contained in the present manual. The warranty can last either one year from the date of installation by the initial user of the product, or eighteen months from the date of shipment to the initial user, depending on which event occurs first. All detailed warranty conditions are specified in the documentation forwarded together with the product.

The warranty does not cover special products or components not covered by warranty in their turn by subcontractors, or materials that were used or installed inappropriately, which were modified or repaired by unauthorized staff.

In the event that a fault condition is caused by improper installation, maintenance or use or by irregular working conditions the repairs will be charged according to applicable fees.

The warranty and Biffi Italia s.r.l. liability shall lapse in the event that any modification or tampering whatsoever be performed on the actuator.

2.9 Demolition and Disposal

At the end of its lifespan, the automatic closing control unit must be dismantled, and the various parts and components must be disposed of accordingly.

During this stage, strictly comply with all the relative regulations in force in the country where the actuator was in use.

Section 3: Description

On the gaslines, it is necessary to provide automatic safety devices to close the valves in case of breaking of the pipeline to stop the gas losses which could create damages for the people, things, and economic damages.

The breaking of the pipeline causes a rate of pressure drop this depending on various factors, mainly as follows:

- diameter and length of the pipeline
- dimension of the break
- temperature and pressure of the gas
- flow rate
- distance from the breaking point to the valve on which the actuator, is equipped with “LINE BREAK” control unit. The longer the distance is the less is the pressure drop rate acting on the “LINE BREAK” control unit.

Also, during the normal operation of the gasline there are pressure drop rates caused by changes in the compression stations operation or by increased gas quantities, required by branches and users.

A very reliable way to identify the breaking of the pipeline is to detect the “abnormal” value of the rate of pressure drop (DP/DT) exceeding the normal values verified during the normal operation of the pipeline.

The Biffi “LINE BREAK” control unit, for the automatic valve closing in case of gasline breaking is based on the principle to detect the pressure drop rate (DP/DT) by measuring the pressure difference between the reference tank and the pipeline, being the reference tank connected to the line through a calibrated orifice.

The device can be easily set to meet the dimensional and operating features of gasline. The system does not need any external power source and uses only the gas of the pipeline.

For the setting of the device, we must consider the minimum rate of pressure drop caused by the breaking of the line (which must assure the operation of the “LINE BREAK” control unit) and the maximum rate of pressure drop originated during the normal operation (which has not to cause the “LINE BREAK” control unit operation).

Section 4: Working Principle

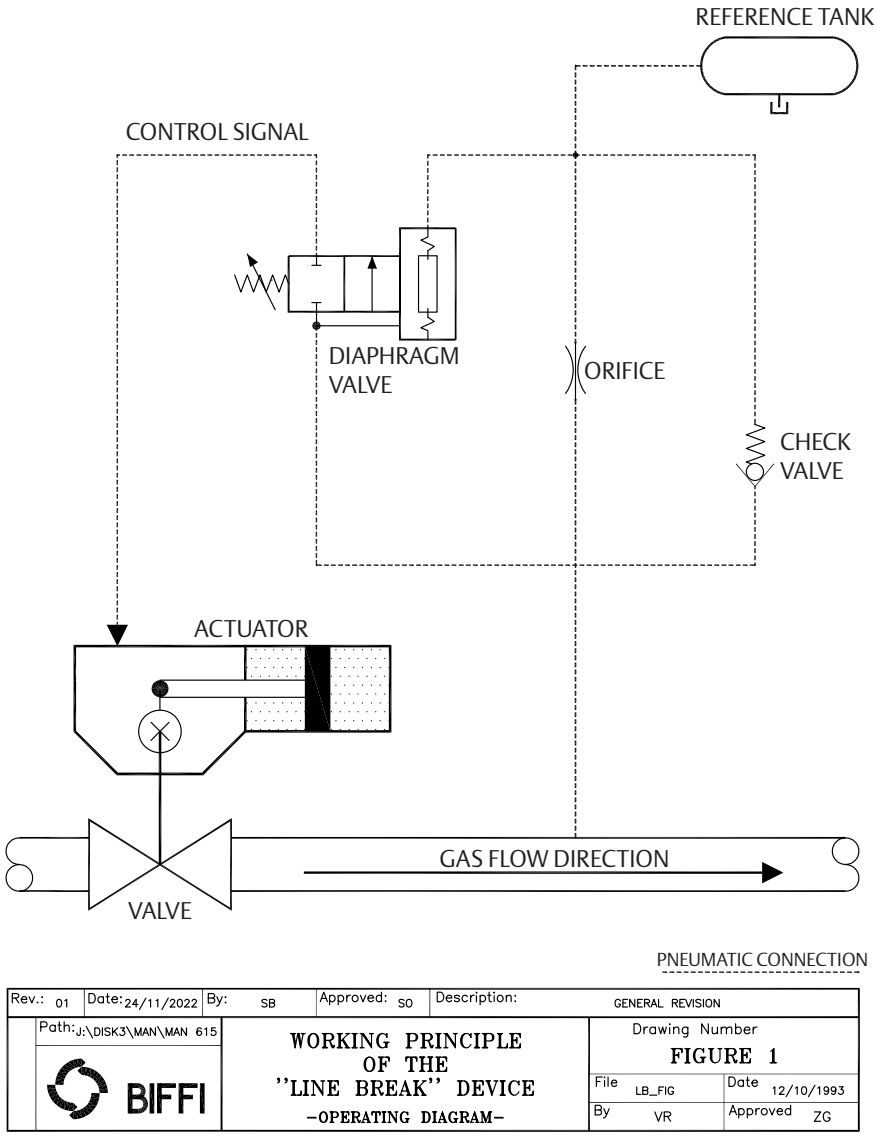
A break in the gasline causes an increase of the gas speed and consequently an increase of the pressure drop rate across the valve, but this cannot be used as a signal for the central device operation because being the valve fully open the pressure drop is very low.

If a reference tank is connected to the gasline through a calibrated orifice with check valve when the pressure in the gasline increases the pressure into the tank equalizes quickly whit the line pressure. On the contrary, when the line pressure decreases, the pressure in the reference tank remains higher than the pressure into the gasline.

The higher is the pressure drop rate in the pipeline the smaller has to be the diameter of the orifice the larger has to be the volume of the reference tank, and the higher is the pressure difference between the reference tank and the pipeline.

This differential pressure is measured by a diaphragm device which, when the differential pressure exceeds the set point, controls the valve closing operation and prevents the valve operation in opening.

Figure 1 Working Principle of the "Line Break" Device



Section 5: Description of the Operation

5.1 Description of the Operation of the "Line Break" Control Unit

Refer to Figure 2 on the next page.

The "LINE BREAK" control unit is connected to the gasline downstream to the valve referring to the gas flow direction, in order to avoid the undesired valve closing when the valve is actuated in opening under differential pressure (we assume in fact that the upstream pressure is always higher or equal to the downstream pressure).

The connection to the gasline can be isolated by the stop valve (601). The gas used for the device is filtered in the filter (610). The gasline is connected to the reference tank (31) through the check valve with orifice (625).

When the gasline pressure raises the check valve opens and the reference tank pressure equalizes immediately whit the gasline pressure.

On the contrary, when the gasline pressure drops the check valve remains closed and the connection between the gasline and the reference tank is made through the orifice only in this way the pressure in the reference tank remains higher than the pressure in the gasline.

The gasline and the reference tank are connected to the two chambers of the diaphragm valve (645) and the differential pressure acts on its diaphragm.

The higher is the pressure drop rate, the higher is the differential pressure.

When the differential pressure exceeds the set value of the valve (645) this trips and a pressure signal comes out. The differential pressure value of valve (645) set point is adjustable by the setting of its return spring.

The pneumatic signal coming from the diaphragm valve (645) controls the actuator operation to close and prevents the open operation.

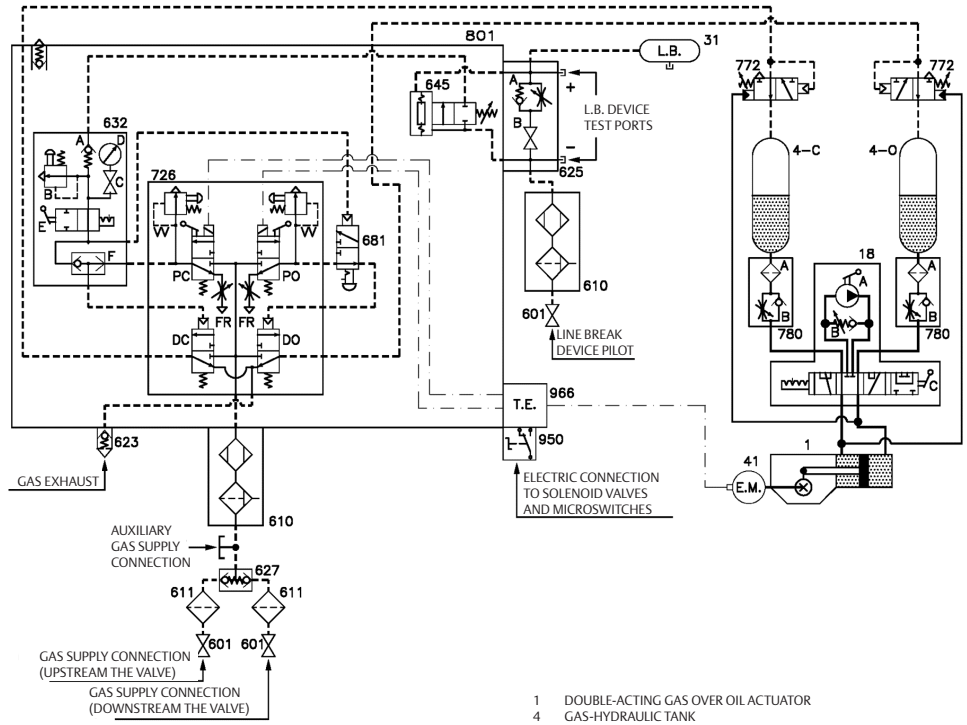
The pneumatic signal coming from the diaphragm valve (645) through the valve (632) pressurizes the pilot of the "to close" valve (726 DC).

The pneumatic signal coming from the diaphragm valve (645) pilots also the valve (681) which stops the pneumatic signal coming from the valve (726 PO) and connects to the atmosphere the pilot of the "to open" valve (726 DO).

The vent valve (632 B) allows to exhaust the pneumatic signal from the pilot of the "to close" valve (726 DC) so as to stroke the valve back in open position this after the reset of the valve (681) as well.

The stop valve (632 E) allows to prevent the close operation by the "Line break control unit" when the setting or the working test of the unit are performed during the normal operation of the gasline and closure of the valve is not permitted.

Figure 2 GPO Gas Hydraulic Actuator Local and Remote Control "Line Break" Device



ELECTRIC REMOTE CONTROL
ENERGIZE, BY A PULSE SIGNAL, THE SOLENOID VALVE 726PC TO CLOSE OR 726PO TO OPEN THE ACTUATOR.

LOCAL CONTROL
PRESS, BY PULSE CONTROL, THE LEVER OF VALVES 726PO TO OPEN OR 726PC TO CLOSE WITH POWER SUPPLY.

LINE BREAK OPERATION
A RATE OF PRESSURE DROP IN THE GAS PIPELINE CAUSES A DIFFERENTIAL PRESSURE ACROSS THE DIAPHRAGM OF VALVE 645. WHEN THE DIFFERENTIAL PRESSURE IS HIGHER THAN THE PRESET VALUE, THE DIAPHRAGM VALVE 465 TRIPS AND PILOTS THE VALVE 681 TO INHIBIT OPEN OPERATION AND THE POWER VALVE 726DC CAUSES THE ACTUATOR TO CLOSE.
AFTER THE LINE BREAK INTERVENTION, THE INHIBITION VALVE 681 MUST BE MANUALLY RESET BEFORE THE ACTUATOR CAN BE REOPENED.
THE LINE BRAK PILOT HAS TO BE CONNECTED TO THE PIPELINE (DOWNSTREAM THE VALVE) AND THE PRESSURE INTAKE HAS TO BE SEPARATED FROM THE GAS SUPPLY PRESSURE INTAKE.

TORQUE LIMITING DEVICE
WHEN THE ACTUATOR OUTPUT TORQUE EXCEEDS THE SET VALUE, THE TORQUE LIMITING SWITCH 772 STOPS THE GAS FLOW TO THE RELEVANT GAS-HYDRAULIC TANK 4 AND THE ENCLOSED GAS IS EXHAUSTED.

MANUAL OPERATION
SELECT BY THE VALVE 18-C THE OPENING OR CLOSING OPERATION AND ACTUATE THE HANDPUMP 18-A.
NOTE: THE DIRECTIONAL CONTROL VALVE 18-C MUST BE IN "AUTOMATIC" POSITION TO ALLOW THE OPERATION WITH GAS SUPPLY.

NOTE:
THE DIAGRAM IS DRAWN WITH CONTROL VALVES NOT ACTUATED

1 DOUBLE-ACTING GAS OVER OIL ACTUATOR
4 GAS-HYDRAULIC TANK
18 HYDRAULIC MANUAL OVERRIDE
A - HANDPUMP
B - ADJUSTABLE RELIEF VALVE
C - HAND OPERATED DIRECTIONAL CONTROL VALVE
31 REFERENCE TANK FOR LINE BREAK DEVICE
41 ELECTRIC MICROSWITCHES
601 STOP VALVE
610 GAS DEHYDRATING FILTER/CONDENSATE SEPARATOR
611 MECHANICAL FILTER
623 DUST EXCLUDER WITH CHECK VALVE
625 CHECK THE VALVE WITH ORIFICE FOR LINE BREAK DEVICE
A - CHECK VALVE WITH ORIFICE
B - STOP VALVE
627 HIGHER PRESSURE SHUTTLE VALVE (DOUBLE CHECK VALVE)
632 SHUTTLE VALVE DEVICE
A - CHECK VALVE
B - LOW PRESSURE VENT VALVE
C - STOP VALVE FOR PRESSURE GAUGE
D - PRESSURE GAUGE
E - 2/2 HAND OPERATED VALVE
F - HIGHER PRESSURE SHUTTLE VALVE
645 2/2 N.C. DIAPHRAGM PILOT VALVE (ADJUSTABLE)
681 3/2 N.O. PNEUMATIC PILOT/HAND RETURN VALVE
726 DOUBLE 3/2 N.C. SOLENOID VALVE WITH MAN. OVERR. AND PULSE CONTROL
PC - 3/2 N.C. PIL. SOLENOID VALVE, MAN. OVERR. (TO CLOSE)
PO - 3/2 N.C. PIL. SOLENOID VALVE, MAN. OVERR. (TO OPEN)
DC -3/2 N.C. PNEUM. PILOT/SPRING RET. VALVE (TO CLOSE)
DO -3/2 N.C. PNEUM. PILOT/SPRING RET. VALVE (TO OPEN)
FR - FLOW REGULATOR
772 TORQUE LIMITING SWITCH
780 HYDRAULIC FLOW CONTROL VALVE WITH FILTER
A - FILTER
B - ADJUSTABLE HYDRAULIC FLOW CONTROL VALVE
801 CONTROL VALVES ENCLOSURE WITH VENT VALVE
950 HAND OPERATED ELECTRIC SWITCH
966 TERMINALS ENCLOSURE

PNEUMATIC CONNECTION HYDRAULIC CONNECTION ELECTRIC CONNECTION

Rev.	Date	By	Approved	Description

Path BIFFI	GPO GASHYDRAULIC ACTUATOR LOCAL AND REMOTE CONTROL ''LINE BREAK'' DEVICE –OPERATING DIAGRAM– L–R–LB	Drawing Number FIGURE 0 File SGZJG003 Date 14/10/22 By Approved

Section 6: Curves to be Considered for the "Line Break" Device Operation

When the pressure into the gasline drops, also the pressure into the reference tank decreases but with a certain delay as the connection is made through the calibrated orifice.

The difference between the two pressures increases with the time until it reaches a maximum value (dP MAX) and then slightly decreases.

The value of the differential pressure is in function of the gasline pressure drop rate, the orifice diameter and the gasline pressure value.

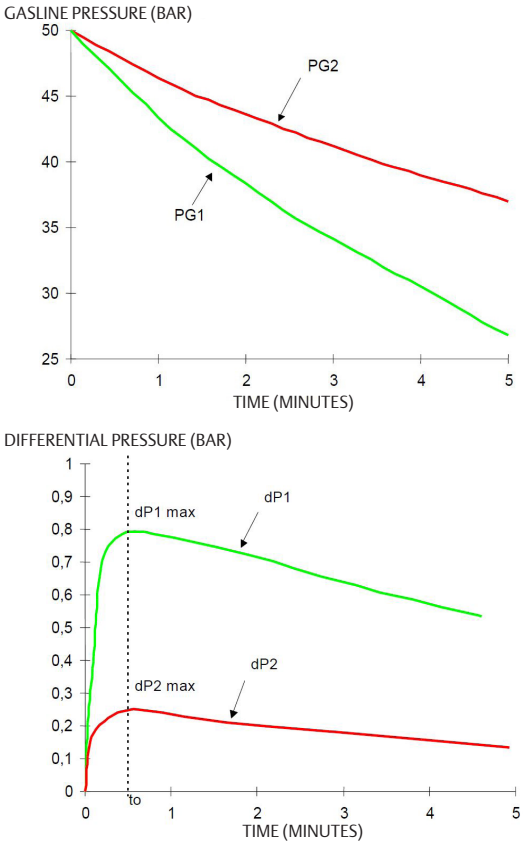
6.1 Change of Differential Pressure with Time (Case A)

Change of differential pressure with time for two different pipeline pressure drop rates, by same orifice diameter and same pipeline initial pressure (see Figure 3).

The curves of Figure 3 show that the differential pressure between the reference tank and the gasline is higher if the pressure drop rate is higher.

The curves show also that, by same orifice diameter, the time "t0" required to reach the dP max value is the same for all the pressure drop rates and it is depending only on the orifice diameter.

Figure 3



CURVES OF PRESSURE DROPS AND OF DIFFERENTIAL PRESSURES
WITH DIFFERENT PRESSURE DROP RATES BY SAME ORIFICE DIAMETER
AND SAME INITIAL GASLINE PRESSURE

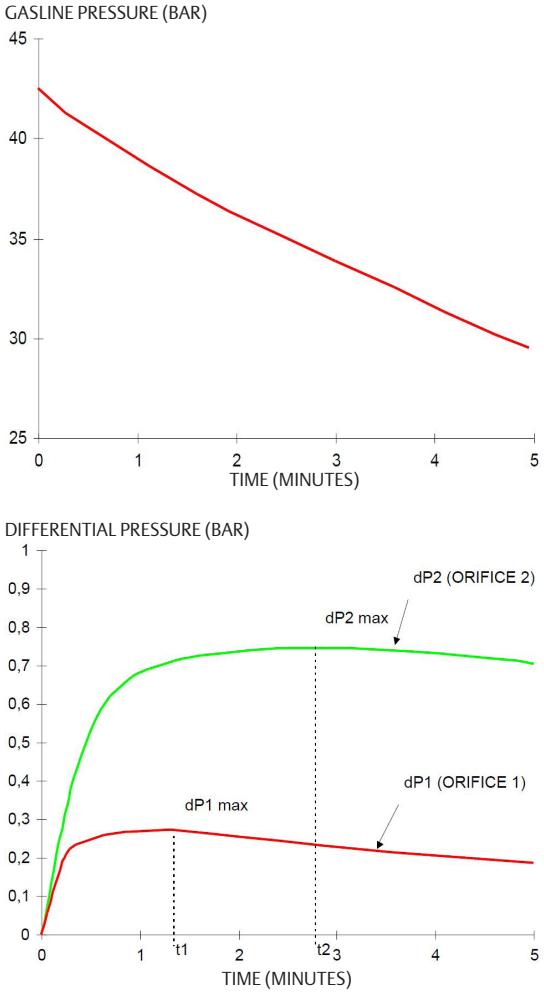
6.2 Change of Differential Pressure with Time (Case B)

Change of differential pressure with time for two different orifice diameters, by same gasline pressure drop rate and same initial pressure (see Figure 4).

The curves of Figure 4 show that by same pressure drop rate the pressure difference between the reference tank and the gasline is higher if the orifice diameter is smaller: the values of differential pressures dP2 are higher than dP1, being the diameter of orifice 2 smaller than the diameter of orifice 1.

The curves show also that the time required to reach the value dPmax of the differential pressure is longer if the orifice diameter is smaller.

Figure 4



The orifice diameter 2 is smaller than the orifice diameter 1

CURVES OF PRESSURE DROP AND OF DIFFERENTIAL PRESSURES FOR DIFFERENT ORIFICE DIAMETERS BY SAME PRESSURE DROP RATE AND SAME INITIAL GASLINE PRESSURE

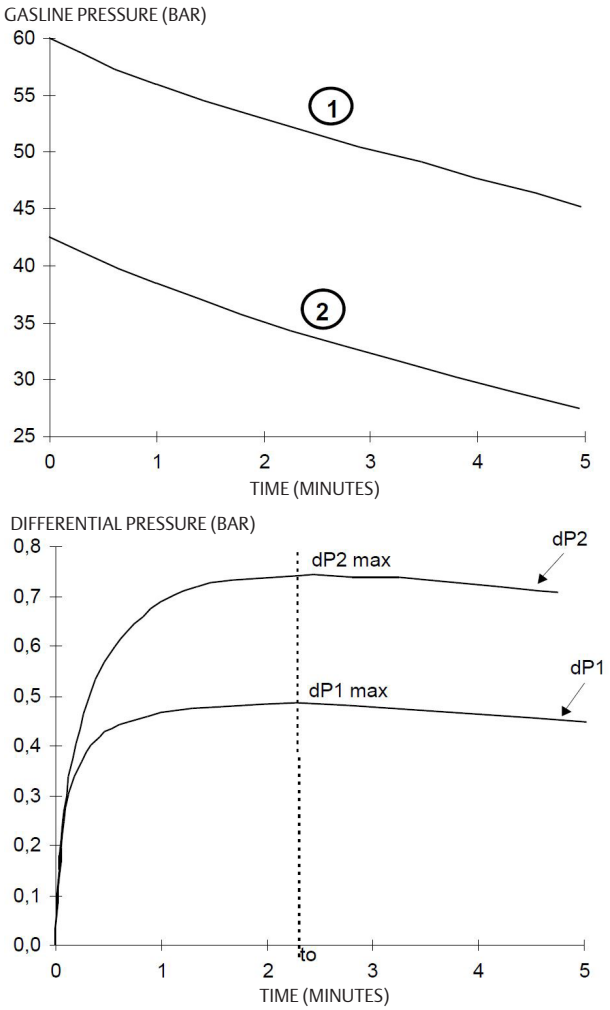
6.3 Change of Differential Pressure with Time (Case C)

Change of differential pressure with time, for two different initial gasline pressures, by same pressure drop rate and same orifice diameter (see Figure 5).

The curves of Figure 5 show that by same pressure drop rate, the pressure difference between the reference tank and the gasline is higher if the initial pressure is lower: the values of the pressure difference dP2 are higher than dP1, being the initial pressure of the curve 1 higher than the initial pressure of the curve 2.

The curves show also that the time required reaching the maximum values “dP1 max” and “dP2 max” of the differential pressures are the same and are depending only on the orifice diameter.

Figure 5



CURVES OF PRESSURE DROPS BY SAME PRESSURE DROP RATE
BUT WITH DIFFERENT GASLINE INITIALPRESSURES AND OF DIFFERENTIAL
PRESSURES BY SAME ORIFICE DIAMETER

6.4 Maximum Differential Pressure Values Generated by Different Pressure Drop Rates, by Different Gasline Initial Pressures and Different Orifice Diameters (Case D)

The curves in Figures 6, 7, and 8 provide the values of the maximum differential pressure between the reference tank and the gas line in function of the rate of pressure drop with three different initial gas line pressure values (35, 55, 75 bar) which are in the range of the normal operating pressure of gas lines.

The curves are plotted for five different orifice diameters: 0.33 mm as shown in Figure 6; 0.5, 0.7 mm as shown in Figure 7 and 0.9, 1.25 mm as shown in Figure 8.

Pressure drops are calculated as an average value during one minute.

The curves make it possible to identify the orifice diameter that must be used to ensure the setting of the “LINE BREAK” control unit under the actual working conditions of the gas line (pressure, rate of pressure drop in case of line breakage).

Figure 6

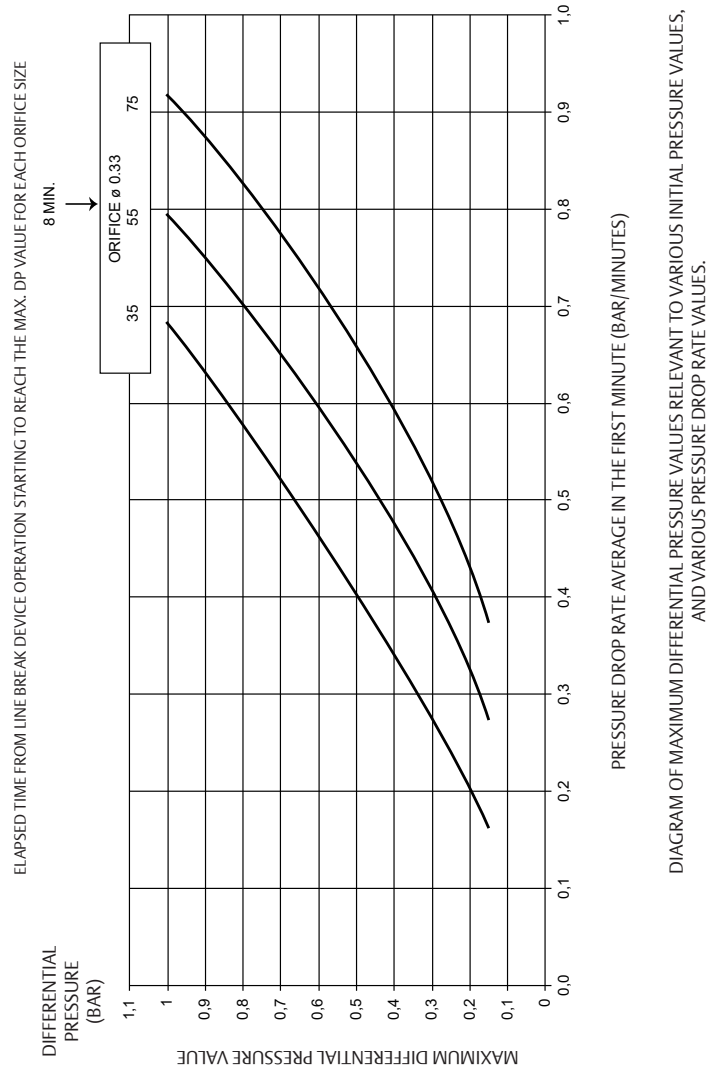


Figure 7

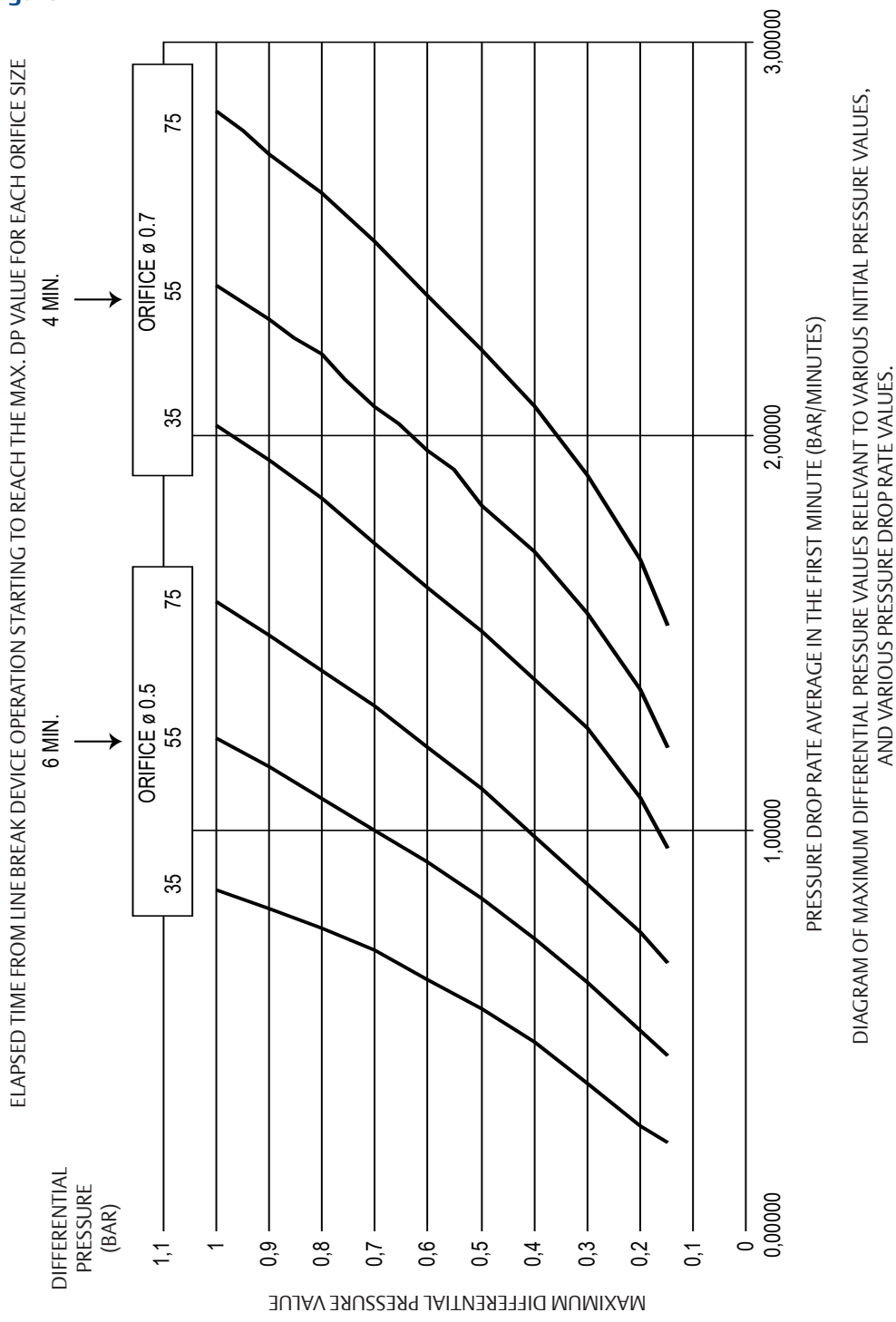
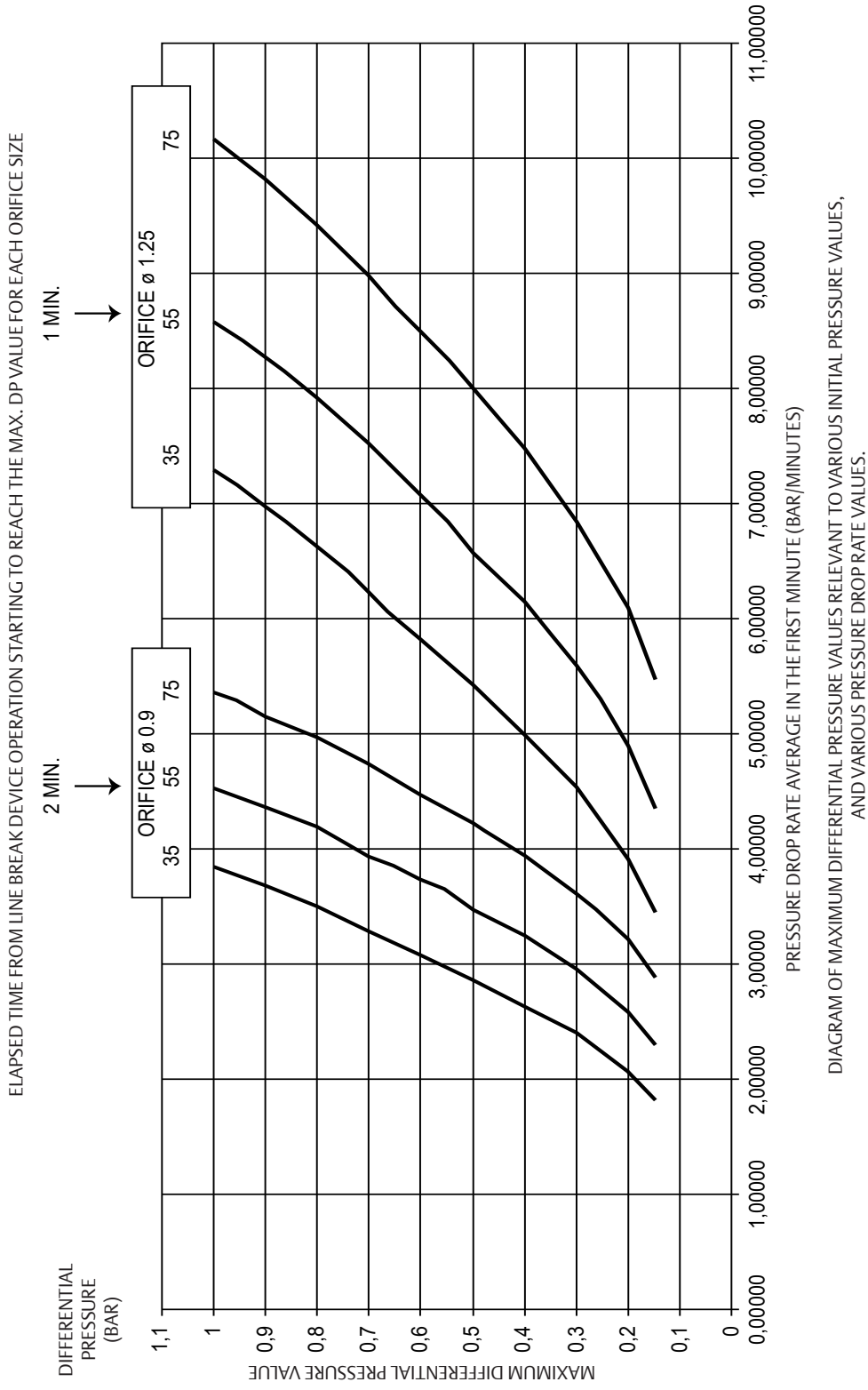

ELAPSED TIME FROM LINE BREAK DEVICE OPERATION STARTING TO REACH THE MAX. DP VALUE FOR EACH ORIFICE SIZE
4 MIN.
6 MIN.
ORIFICE ø 0.5
ORIFICE ø 0.7
35
55
75
DIFFERENTIAL PRESSURE (BAR)
1,1
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
MAXIMUM DIFFERENTIAL PRESSURE VALUE
0,00000
1,00000
2,00000
3,00000
PRESSURE DROP RATE AVERAGE IN THE FIRST MINUTE (BAR/MINUTES)
DIAGRAM OF MAXIMUM DIFFERENTIAL PRESSURE VALUES RELEVANT TO VARIOUS INITIAL PRESSURE VALUES, AND VARIOUS PRESSURE DROP RATE VALUES.

Figure 8


ELAPSED TIME FROM LINE BREAK DEVICE OPERATION STARTING TO REACH THE MAX. DP VALUE FOR EACH ORIFICE SIZE
2 MIN.
1 MIN.
ORIFICE ø 0.9
35
55
75
ORIFICE ø 1.25
35
55
75
DIFFERENTIAL PRESSURE (BAR)
1,1
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
MAXIMUM DIFFERENTIAL PRESSURE VALUE
0,00000
1,00000
2,00000
3,00000
4,00000
5,00000
6,00000
7,00000
8,00000
9,00000
10,00000
11,00000
PRESSURE DROP RATE AVERAGE IN THE FIRST MINUTE (BAR/MINUTES)
DIAGRAM OF MAXIMUM DIFFERENTIAL PRESSURE VALUES RELEVANT TO VARIOUS INITIAL PRESSURE VALUES,
AND VARIOUS PRESSURE DROP RATE VALUES.

Section 7: Setting

7.1 Setting of the “LINE BREAK” Control Unit

Refer to Figures 9, 10, and 11.

To set the “LINE BREAK” control unit it is necessary to know the working conditions of the gasline:

- range of the gas pressure;
- value of the minimum pressure drop rate, measured in the portion of gasline where the valve is installed, in case of gasline breaking for minimum, normal and maximum working pressures of the pipeline; and
- value of the maximum pressure drop rate, measured in the portion of gasline where the valve is installed, during the normal operation, for minimum, normal and maximum working pressures of the pipeline.

The device setting must be carried out, to assure its intervention for all the pressure drop rates caused by the gasline breaking but to avoid the intervention of the “LINE BREAK” control unit for all the pressure drop rates which can occur during the normal pipeline operation.

It is necessary that the pressure drop rate in the normal working conditions is always lower than the pressure drop rate caused by the line breaking, at the same working pressure.

For the device setting we must identify a value of pressure drop rate which must cause the device intervention: such value must be higher than all the pressure drop rates which may occur during the normal working conditions but lower than all the pressure drop rates caused by the line breaking. When the pressure drop rate and the corresponding working pressure have been defined we can identify the orifice diameter. See Figure 9, Figure 10, or Figure 11 (according to the selected orifice) and Figure 12: on the abscissas axis (BAR/MIN) we fix the point corresponding to the value of the pressure drop rate selected for the setting, we draw a vertical line up to the intersection with the curve of the maximum differential pressure values related to the selected working pressure, from the intersection point we draw a horizontal line which crosses the ordinate axis in the point of the maximum differential pressure value which can be used for the setting of the diaphragm valve. The value of the differential pressure must be in the range from 0.2 to 1 bar.

For the diaphragm valve setting it is recommended to select a differential pressure value not higher than 90% of the value defined by the above-described procedure, to be sure of the device intervention.

The time required for the device intervention is depending on the diameter of the used orifice.

For the device setting, we must install the orifice with the determined hole diameter, and we must adjust the diaphragm valve to the selected differential pressure.

For the adjustment of the diaphragm valve (see Figure 11) we must unloose the locking screw “A”, which prevents the rotation of the setting ring nut.

Turn the ring nut “B” until his edge reaches the position corresponding to the selected differential pressure value shown by the scale of the nameplate “C”.

Figure 9

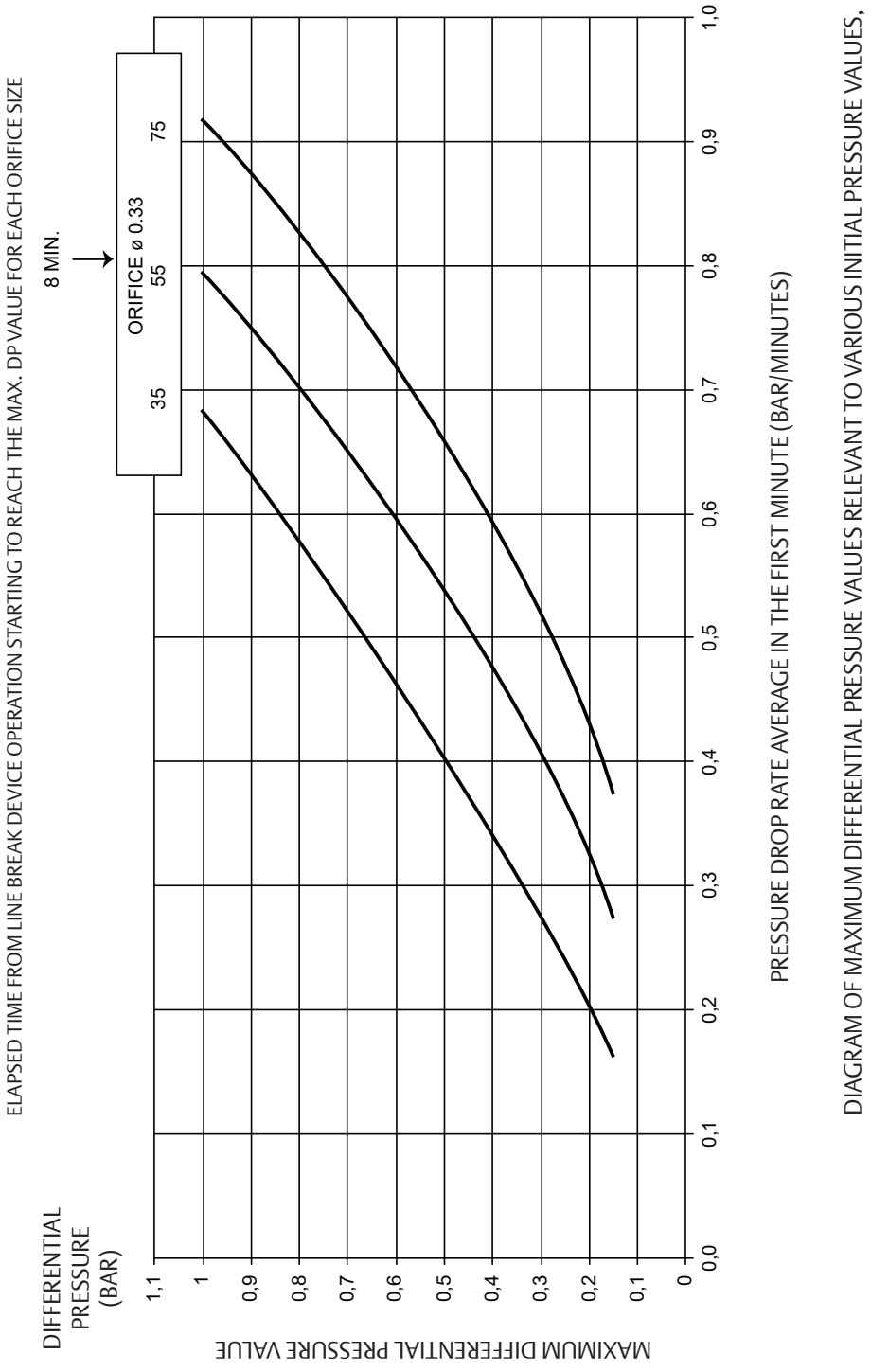


DIAGRAM OF MAXIMUM DIFFERENTIAL PRESSURE VALUES RELEVANT TO VARIOUS INITIAL PRESSURE VALUES, AND VARIOUS PRESSURE DROP RATE VALUES.

Figure 10

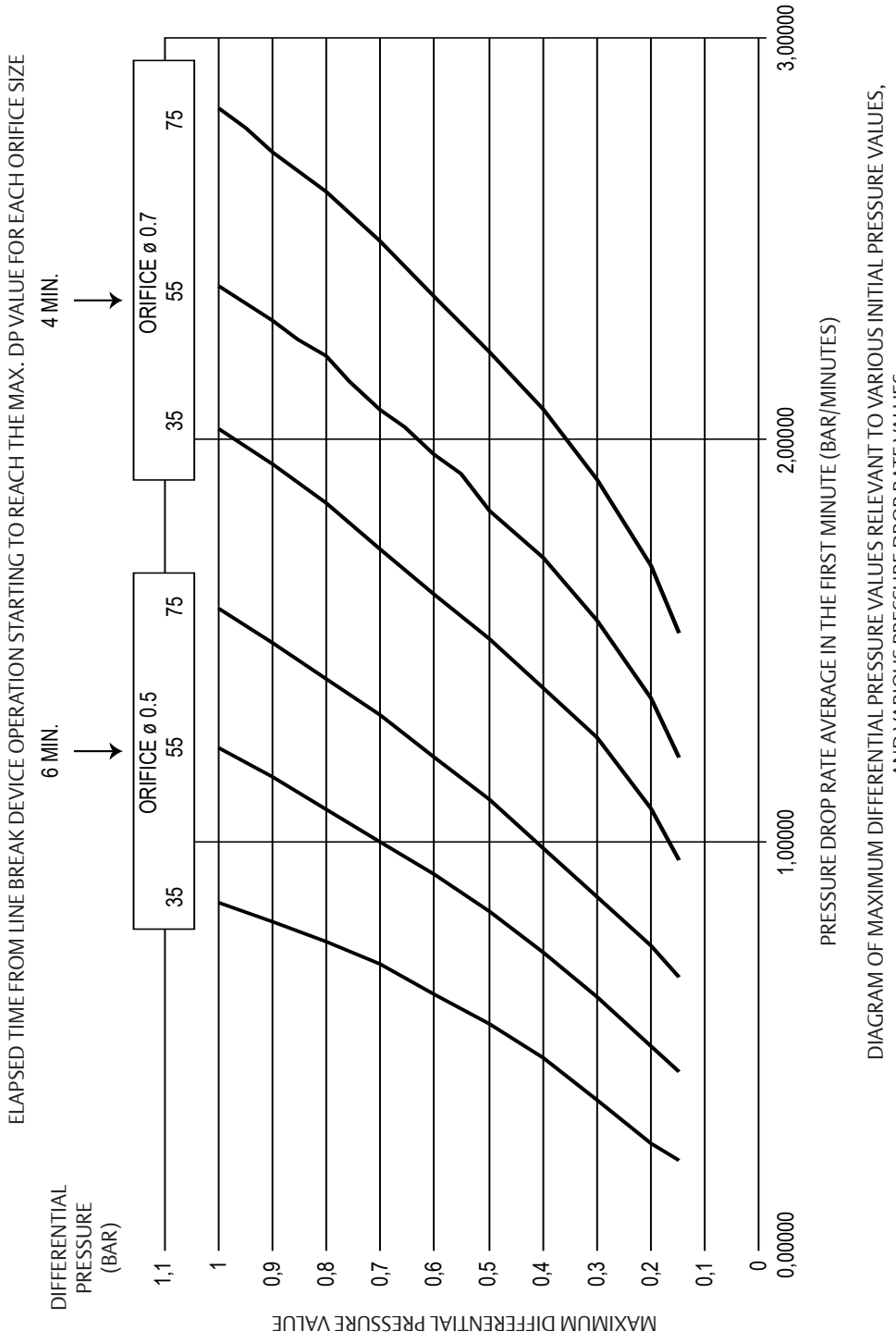

ELAPSED TIME FROM LINE BREAK DEVICE OPERATION STARTING TO REACH THE MAX. DP VALUE FOR EACH ORIFICE SIZE
4 MIN.
6 MIN.
ORIFICE ø 0.5
ORIFICE ø 0.7
35
55
75
DIFFERENTIAL PRESSURE (BAR)
1,1
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
MAXIMUM DIFFERENTIAL PRESSURE VALUE
0,00000
1,00000
2,00000
3,00000
PRESSURE DROP RATE AVERAGE IN THE FIRST MINUTE (BAR/MINUTES)
DIAGRAM OF MAXIMUM DIFFERENTIAL PRESSURE VALUES RELEVANT TO VARIOUS INITIAL PRESSURE VALUES,
AND VARIOUS PRESSURE DROP RATE VALUES.

Figure 11

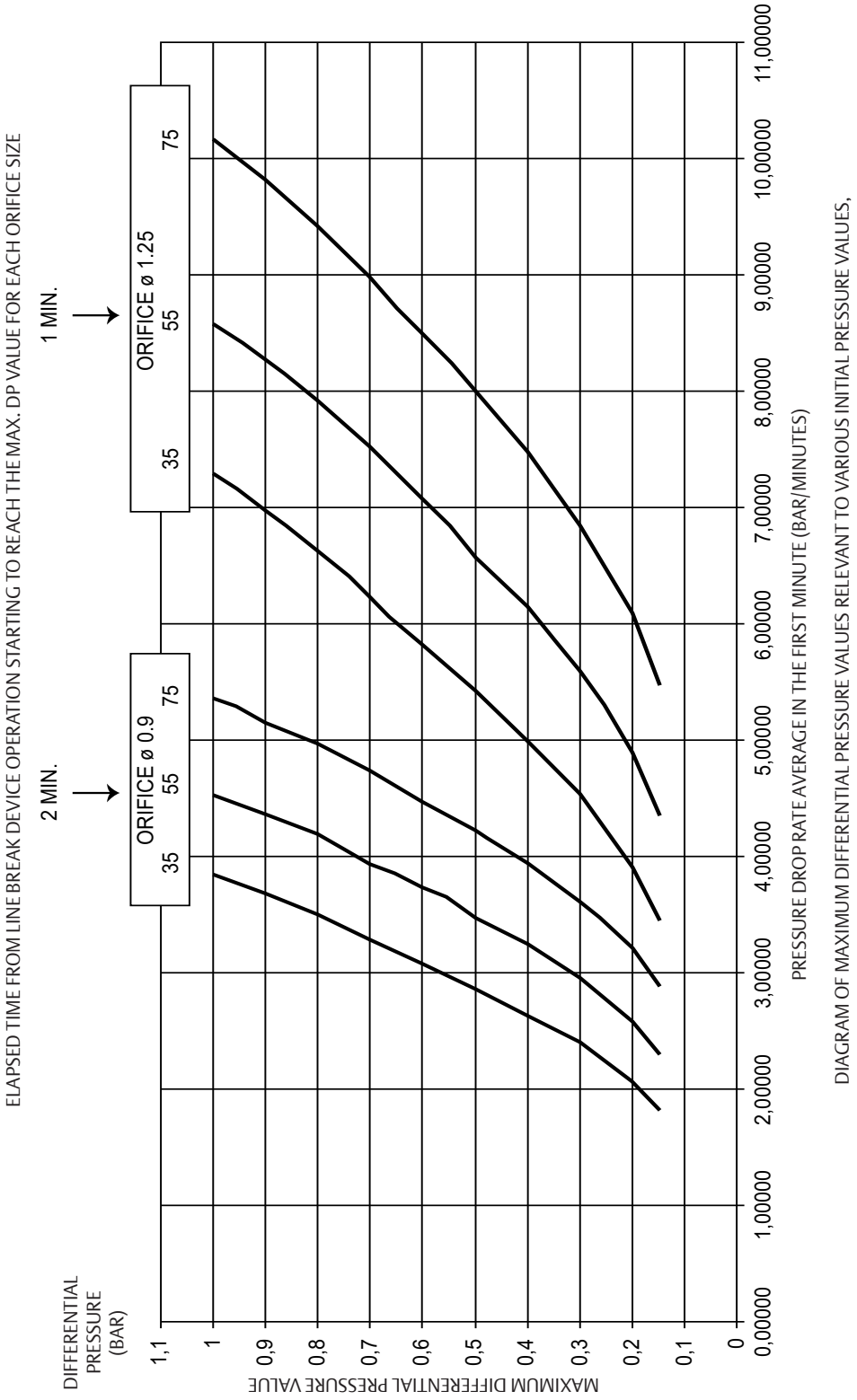
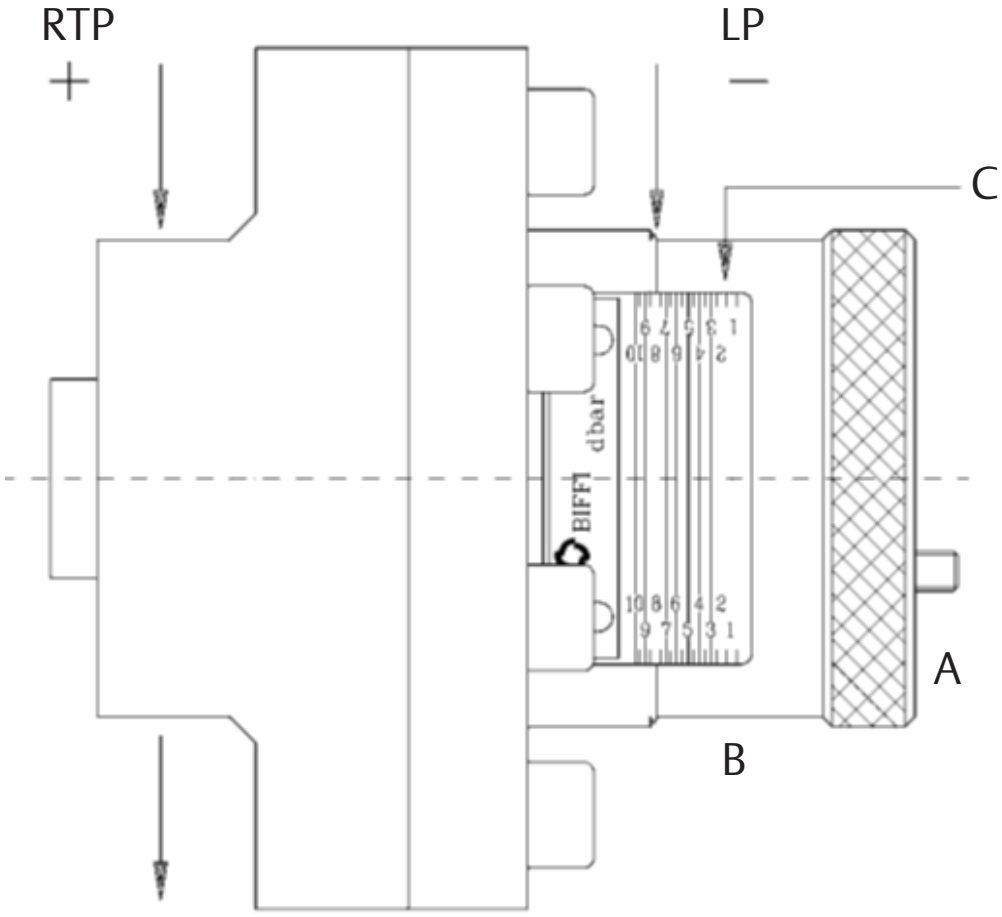


DIAGRAM OF MAXIMUM DIFFERENTIAL PRESSURE VALUES RELEVANT TO VARIOUS INITIAL PRESSURE VALUES, AND VARIOUS PRESSURE DROP RATE VALUES.

Figure 12 Pneumatic Control Signal



Setting of the Diaphragm Valve
(RTP = Reference Tank Pressure; LP = Line Pressure)

Section 8: Example of the Device Setting

Refer to Figure 13.

Let's suppose that the gas pressure into the pipeline is 55 bar, that the maximum pressure drop rate during the normal operation is 0.5 bar/min and that the minimum pressure drop rate caused by a line breaking is 1.5 bar/min.

We select to set the device so to cause its operation in case of a pressure drop rate of 1 bar/min.

By using the curves of Figure 9, Figure 10, or Figure 11 (according to the selected orifice) and Figure 12 which are also plotted in Figure 13, we can check that the orifice to be used is the 0.5 mm. curve one, in order to obtain a differential pressure in the range between 0.2 and 1 bar.

On the abscissas axis (BAR/MIN), we fix the point corresponding the pressure drop rate value = 1 bar/min.

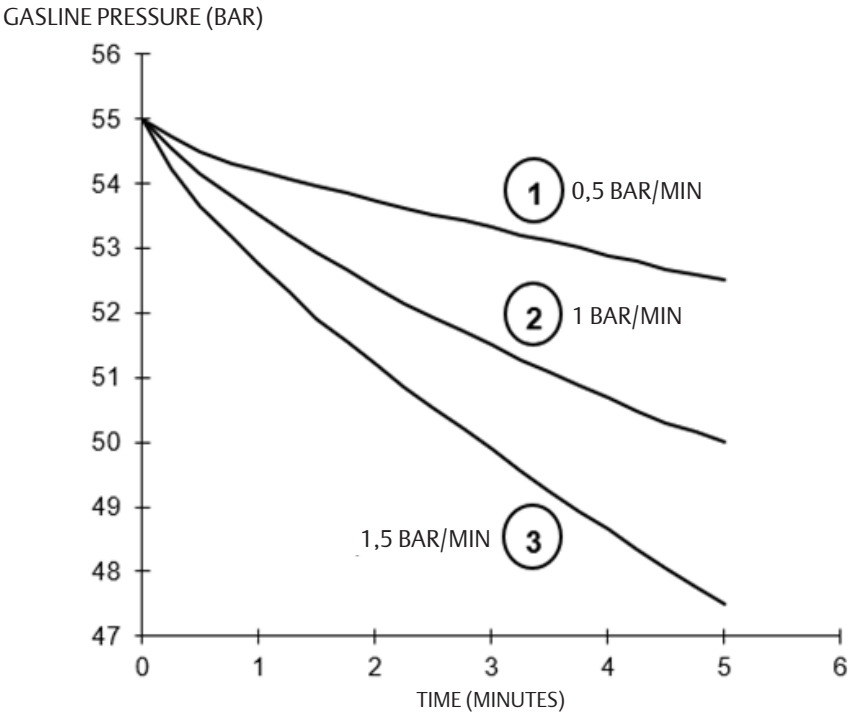
We draw a vertical line up to the intersection with the curve of the maximum differential pressure values related to the working pressure 55 bar.

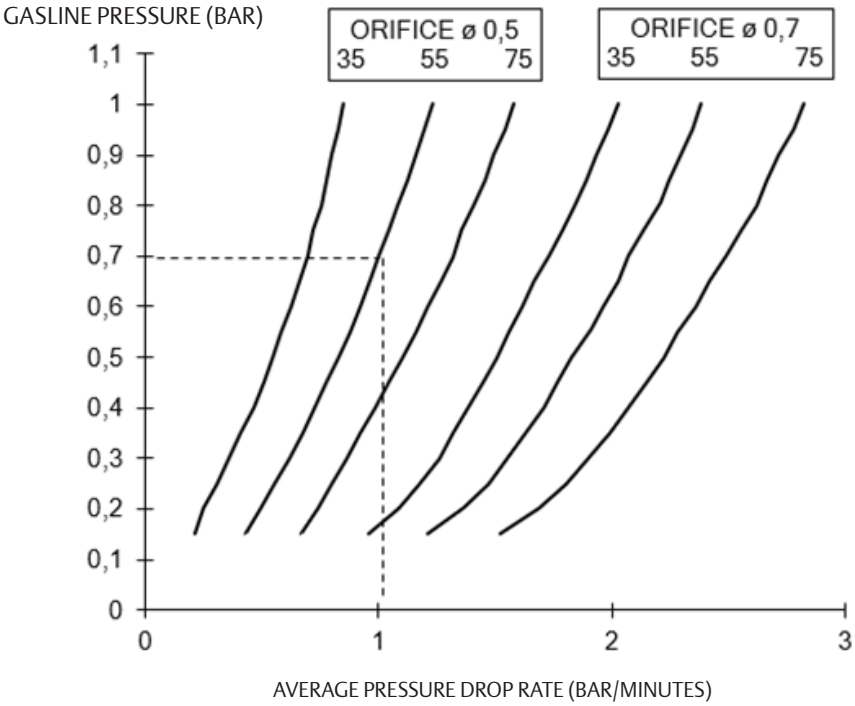
From the intersection point, we draw a horizontal line that crosses the ordinate axis at the point of differential pressure 0.7 bar.

For safety reasons, we suggest to set the diaphragm valve at the differential pressure of 0.65 bar.

For the device setting, it is necessary to install the orifice with a hole diameter of 0.5 mm and adjust the diaphragm valve at a differential pressure value of 0.65 bar.

Figure 13


GASLINE PRESSURE (BAR)
56
55
54
53
52
51
50
49
48
47
0
1
2
3
4
5
6
1
0,5 BAR/MIN
2
1 BAR/MIN
1,5 BAR/MIN
3
TIME (MINUTES)


GASLINE PRESSURE (BAR)
ORIFICE ø 0,5
35 55 75
ORIFICE ø 0,7
35 55 75
1,1
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
0
1
2
3
AVERAGE PRESSURE DROP RATE (BAR/MINUTES)

Section 9: Check of the Device

9.1 Check the Setting and Working of “LINE BREAK” Control Unit by Portable Control Unit

The checks of device working and setting (if the customer specifies the working conditions) are carried out at the Biffi test department and the test certificate is supplied with the “LINE BREAK” control unit.

A portable control unit (supplied by Biffi) can be used to check on site the proper setting of the “LINE BREAK” this means to verified that the device controls the valve closing operation and inhibits the valve opening when the gas pressure drops with a rate higher than the setting value of the control unit.

The above-mentioned control unit can also be used to check the value of the differential pressure set on the diaphragm valve of the “LINE BREAK” device.
The procedures for the above-mentioned checks are described in the documentation “DT 5009. Biffi Electronic Portable Unit - Pneumatic Line Break Setting and Test Device” service manual availabe at the Biffi website.

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