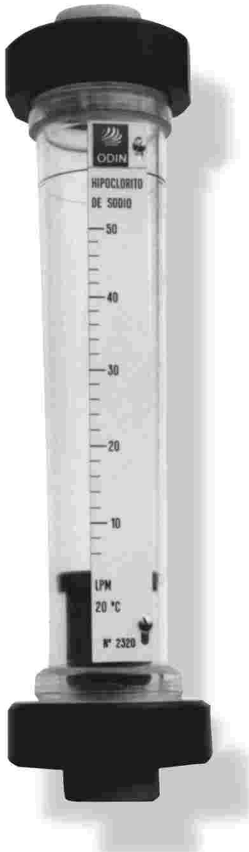
Rotameters

Area Variable Flowmeters



ODIN is a leading manufacturer of flowmeters and fittings in Argentina
It has a wide experience in the chemical, food and oil markets
It designs, manufactures and controls all fittings under strict procedures
It calibrates every meter individually and has its error curve delivered
It keeps a continuous inventory and stock of parts
It provides free pre and post sale services and guarantees its entire line of products
Made in Argentina

Made in Argentina

Description

Rotameters are simple, economic and reliable flowmeters. They are made up of three basic elements as shown in the drawing.

It is powered by the fluid itself (liquid, gas or vapor), which pushes the float upwards until the annular area (where a ring lies between the float and the tube) becomes wide/large enough to allow the passage of instantaneous flow. The float goes up as flow increases and it goes down as flow decreases. The various conic shapes available cover a range of 1:10 between the minimum and maximum flow.

Floats

Various designs are used to obtain the desired gage and minimize their alignment. Some typical profiles are shown below.

For gases — **Non viscous liquids** — **Viscous liquids**

Conic Tubes

They are the most critical components of the equipment because measurement accuracy depends on high quality manufacturing procedures.

ODIN uses three types of conic tubes:

- Acrylic Plastic: CP, CM, CME, CGL Models.
- Boron Silicate Glass: IQM, IQP, GGL Models.
- Stainless Steel: TM Model.

The first two models are used with transparent fluids while metal ones are suitable for opaque fluids in which the float is magnetically attached to an indicator where the metering pin turns around a circular gage.

Gages

En el mercado argentino, se utilizan de forma excluyente, escalas de lectura directa y en unidades volumétricas, con la excepción del vapor de agua para el que se utilizan gravimétricas.

ODIN gages contain the following data:

- Fluid (name and code)
- G: Specific Gravity
- μ: Viscosity (for liquids)
- Pf: Operating Pressure
- Tf: Operating Temperature
- Flow unit: $\frac{\text{Volume}}{\text{Time}}$

Typical units are:

$CCM = \frac{cm^3}{min}$ $MCM = \frac{m^3}{min}$

$LPM = \frac{dm^3}{min}$ $MCH =: \frac{m^3}{hour}$

Volume Standarization

The ISO 5024 standard series has set the conditions to standardize the volume of fluids and hence the flow.

The cubic meter for liquids is the full volume at 15ºC.

There is more diversity for gases:

- SM3: (Standard) Volume measured at 15º C o 288.15 ºK and 1 At.A or 101.3 KPa
- NM3: (Normal) Volume measured at 0º C o 273.15 ºC and 1 At.A or 101.3 Kpa
- AM3: (Regular) Volume measured at regular temperature and operation pressure.

MODEL		CP		CPL
FLUID		LiQUIDS AND GASES		LIQUIDS
OPERATING CONDITIONS	Bar (A)	8 BAR	4 BAR	20 BAR
	ºC	20º C	60º C	20 ºC
MAXIMUM ERRORS WITHIN THE RANGE		PRECISION: ± 2 % of the reading value ACCURACY: ± 5 % FE		PRECISION: ± 2 % of the reading value ACCURACY: ± 5 % FE
MATERIALS IN CONTACT WITH THE FLUID		TUBE ACRÍLIC FLOAT SS 304 O'RING BUNA N		TUBE ACRÍLIC FLOAT SS 304 O'RING BUNA N
FLOW TABLE		(see CP flow table below)		(see CPL flow table below)
TECHNICAL SPECIFICATIONS		For more information, please refer to technical sheets EPT 01-01-01		For more information, please refer to technical sheets EPT 01-09-01
OPTIONS AND COUPLING DIAMETERS		FLOW CONTROL VALVE CONECTORS COUPLING: 3/8" BSP H REAR. PR.DIF.REG.		FLOW CONTROL VALVE CONECTORS COUPLING: ½" o ¾" BSP REAR - ALARMS
MAIN APPLICATION		SMALL COLD LIQUID & GAS FLOWS		WATER FLOWS IN DRAINING PROCESSES

FLOW TABLE – CP

Mod.	liquids	Gases
1	1.5 – 15 CCM	
2	2.5 – 25 CCM	
3	5 – 50 CCM	0.1 – 1 SLPM
4	10 – 100 CCM	0.2 – 2 SLPM
5	20 – 200 CCM	0.5 – 5 SLPM
6	50 – 500 CCM	1 – 10 SLPM
7	0.1 – 1 LPM	2 – 20 SLPM
8	0.2 – 2 LPM	5 – 50 SLPM
9	0.3 – 3 LPM	7 – 70 SLPM
10	0.5 – 5 LPM	10 – 100 SLPM

FLOW TABLE – CPL

Model	Range
1	1 – 10 LPM
2	2 – 20 LPM
3	3 – 30 LPM
4	4 – 40 LPM
5	5 – 50 LPM

CM	CME-L	CME-C
		
LIQUIDS AND GASES	LIQUIDS AND GASES	LIQUIDS AND GASES
8 BAR / 20º C; 4 BAR / 60º C	7 BAR / 20º C; 3 BAR / 40º C	7 BAR / 20º C; 3 BAR / 40º C
PRECISION: ± 0.5 % of the reading value ACCURACY: ±1% FE	PRECISION: ± 1 % of the reading value ACCURACY: ±2% FE	PRECISION: ± 1.5 % of the reading value ACCURACY: ±3% FE
TUBE: ACRILIC FLOAT: SS 316 HEAD CAPS: SS 316 O'RING: BUNA N	TUBE: ACRILIC FLOAT: SS 316 HEAD CAPS: POLIPROPILENE O'RING: BUNA N	TUBE: ACRILIC FLOAT: SS 316 HEAD CAPS: POLIPROPILENE O'RING: BUNA N
For more information, see technical sheet EPT 01-02-01	For more information, see technical sheet EPT 01-03-01	For more information, see technical sheet EPT 01-14-01
BSP INTERNAL THREADED COUPLING OPTIONAL FLANGED ALARMS	BSP INTERNAL THREAD	BSP INTERNAL THREAD
MEDIUM FLOWS OF COLD LIQUIDS AND GASES	ORDINARY FLOWS OF COLD LIQUIDS AND GASES	MEDIUM FLOWS OF COLD LIQUIDS AND GASES

CM

Mod	ND"	liquids	Gases
1	½	0.5 – 5 LPM	10 – 100 SLPM
2	½	1 – 10 LPM	20 – 200 SLPM
3	¾	2 – 20 LPM	50 – 500 SLPM
4	¾	3 – 30 LPM	70 – 700 SLPM
5	1	5 – 50 LPM	0.1 – 1 SMCM
6	1	10 – 100 LPM	0.2 – 2 SMCM
7	1½	10 – 100 LPM	0.2 – 2 SMCM
8	1½	20 – 200 LPM	0.5 – 5 SMCM
9	2	30 – 300LPM	0.7 – 7 SMCM
10	2	50 – 500 LPM	1 – 10 SMCM
11	3	75 – 750 LPM	3 – 15 SMCM
12	4	0.1 – 1 MCM	4 – 20 SMCM

CME-L

Mod	ND"	liquids	Gases
1	½	0.5 – 5 LPM	10 – 100 SLPM
2	½	1 – 10 LPM	20 – 200 SLPM
3	¾	2 – 20 LPM	50 – 500 SLPM
4	¾	3 – 30 LPM	70 – 700 SLPM
5	1	5 – 50 LPM	100 – 1000 SLPM
6	1	10 – 100 LPM	200 – 2000 SLPM

CME-C

Mod	ND"	liquids	Gases
1	½	0.5 – 5 LPM	10 – 100 SLPM
2	½	1 – 10 LPM	20 – 200 SLPM
3	¾	2 – 20 LPM	50 – 500 SLPM
4	¾	3 – 30 LPM	70 – 700 SLPM
5	1	5 – 50 LPM	0.1 – 1 SMCM
6	1	10 – 100 LPM	0.2 – 2 SMCM

CG

LIQUIDS

	ACRILIC		GLASS
15 BAR	5 BAR	15BAR	10BAR
20º C	50º C	20ºC	90º C

PRECISION: ± 1 % of the read value
ACCURACY: ±2% FE

TUBE	ACRILIC-GLASS
FLOAT	SS 316
HEAD CAPS	SS 316
O'RING	BUNA N/VITON

Mod	ND"	RANGE
1	1½	2 - 10/3 – 15 MCH
2	2	4 - 20/10 – 50 MCH
3	3	10 - 50/15 – 75 MCH
4	4	15 - 70/20 – 100 MCH
5	6	20 - 100/50 – 250 MCH
6	8	64 – 320/80 – 400 MCH
7	10	80–400/150–600 MCH

For more information, see techical sheet EPT 01-04-02

ACRYLIC-GLASS TUBE
MAX & MIN ALARMS

LARGE FLOWS OF HOT LIQUIDS AND GASES

TM-C

LIQUIDS

100 BAR

180º C

PRECISION: ± 1% of the read value
ACCURACY: ±2% FE

TUBE	SS 316/304/MONEL
FLOAT	SS 316/304/MONEL
OTHER	SS 316

Mod.	COUPLING		WATER (1CsT)
	FLANGE	INTERNAL THREAD	RANGE
1	½" a 1"	¾" NPT/BSP	0.4 – 2 LPM
2	½" a 1"	¾" NPT/BSP	0.6 – 3 LPM
3	½" a 1"	¾" NPT/BSP	0.8 – 4 LPM
4	½" a 1"	¾" NPT/BSP	1 – 5 LPM
5	½" a 1"	¾" NPT/BSP	2 – 10 LPM

For more information, see techical sheet EPT 01-15-01

THREADED COUPLING
OPTIONAL FLANGED COUPLING
4-20 mA TRANSMITTER
MAX & MIN ALARMS

VISCOUS LIQUIDS AND GASES UNDER EXTREME CONDITIONS

TM

LIQUIDS AND GASES

100 BAR

180º C

PRECISION: ± 1% of the read value
ACCURACY: ±2% FE

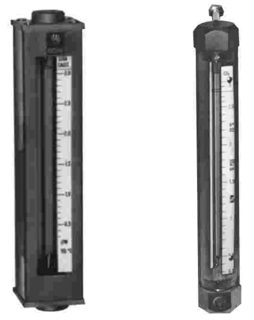
TUBE	SS 316/MONEL
FLOAT	SS 316/MONEL
OTHER	SS 316

		TML	TMG
MOD	ND"	llquids	Gases
1	½ a ¾	1 – 10 LPM	60 – 300 SLPM
2	¾ a 1	3 – 30 LPM	100 – 500 SLPM
3	1	5 – 50 LPM	0.2 – 1 SMCM
4		10 – 100 LPM	0.6 – 3 SMCM
5	1 ½	10 – 100 LPM	0.6 – 3 SMCM
6	2	30 – 300 LPM	1 – 5 SMCM
7	2 ½	50 – 500 LPM	2 – 10 SMCM
8		75 – 750 LPM	3 – 15 SMCM
9	3	0.1 – 1 MCH	4 – 20 SMCM

For more information, see techical sheet EPT 01-07-01 and EPT 01-10-02 (Transmiter)

FLANGED COUPLING
OPTIONAL THREADED COUPLING
4-20 mA TRANSMITTER
MAX & MIN ALARMS

VISCOUS LIQUIDS AND GASES UNDER EXTREME CONDITIONS

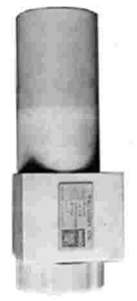
		
IQP	IQM	MODEL
LIQUIDS AND GASES	LIQUIDS AND GASES	FLUID
10 BAR / 5 BAR	10 BAR / 8 BAR	BAR (A) — OPERATING CONDITIONS
20° C / 150° C	20° C / 150° C	°C — OPERATING CONDITIONS
PRECISION: ± 0.5% of the read value ACCURACY: ±1% FE	PRECISION: ± 0.5% of the read value ACCURACY: ±1% FE	MAXIMUM ERRORS WITHIN RANGE
TUBE: GLASS BORUM SILICATE FLOAT: SS 316 HEAD CAPS: SS 316 O'RING: BUNA/VITON	TUBE: GLASS BORUM SILICATE FLOAT: SS 316 HEAD CAPS: SS 316 O'RING: BUNA/VITON	MATERIALS IN CONTACT WITH THE FLUID
See IQP flow table below	See IQM flow table below	FLOW TABLES
For more information, see technical sheet EPT 01-05-01	For more information, see technical sheet EPT 01-06-01	TECHNICAL SPECIFICATIONS
AXIAL COUPLING ¼ , 3/8 , ½” REAR COUPLING 3/8” DIFERENCIAL PRES. REG. MAX & MIN ALARMS	½”, ¾”, 1” INTERNAL BSP COUP. OPTIONAL FLANGED PIN VALVE OR DIAPHRAGM MAX & MIN ALARMS	OPTIONALS AND COUPLING DIAMETERS
SMALL FLOWS OF THE CHEMICAL INDUSTRY	MEDIUM FLOWS OF THE CHEMICAL INDUSTRY	MAIN APPLICATION

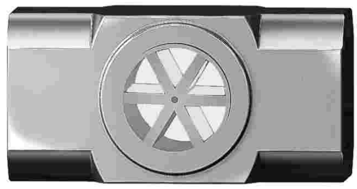
FLOW TABLES — IQP

Ta	liquids	Gases
1	0.5 – 5 CCM	10 – 100 SCCM
2	1 – 10 CCM	20 – 200 SCCM
3	2 – 20 CCM	50 – 500 SCCM
4	5 – 50 CCM	0.1 – 1 SLPM
5	10 – 100 CCM	0.2 – 2 SLPM
6	20 – 200 CCM	0.5 – 5 SLPM
7	50 – 500 CCM	1 – 10 SLPM
8	0.1 – 1 LPM	2 – 20 SLPM
9	0.2 – 2 LPM	5 – 50 SLPM
10	---------	10 – 100 SLPM

FLOW TABLES — IQM

Ta	DN”	liquids	Gases
1	½	0.5 – 5 LPM	10 – 100 SLPM
2	½	1 – 10 LPM	20 – 200 SLPM
3	¾	2 – 20 LPM	50 – 500 SLPM
4	¾	3 – 30 LPM	70 – 700 SLPM
5	1	5 – 50 LPM	0.1 – 1 SMCM
6	1	10 – 100 LPM	0.2 – 2 SMCM





LIQUID-LIQUID EJECTOR	FRP FLOW REGULATOR	FLOW DISPLAY
LIQUID	LIQUIDS AND GASES	LIQUIDS AND GASES
2 BAR (MIN. F/OPERAT.)	7 BAR	30 BAR
A/MANUFAC. MATERIAL	50º C	150º C
NON APPLICABLE	NON APPLICABLE	NON APPLICABLE
ACRYLIC POLYPROPYLENE OR OTHERS UNDER REQUEST	DIAPHRAGM PTFE/BUNA OTHER SS 316	BODY BRASS DISPLAY GLASS BASKET SS 316 MOVING P. PLASTIC/GLASS

MOTIVE FLOWS QM IN MCH FOR PM BETWEEN 2 Y 5 Kg/cm³

Pm	Ejector Size				
	E1	E2	E3	E4	E5
2	0.84	1.96	2.8	4.2	7
3	1.02	2.36	3.4	5.1	8.5
4	1.4	2.66	3.8	5.7	9.5
5	1.26	2.94	4.2	6.3	10.5

COUPLING

	E1	E2	E3	E4	E5
MOT	½”	¾”	1”	1”	1” ½”
VAC	¾”	1”	1” ½”	1” ½”	2”
DIS	¾”	1”	1” ½”	1” ½”	2”

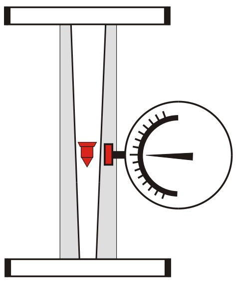
FLOW RANGES

S	FLUID	MAXIMUN	MINIMUN
1	AIR	60 SLPM	0.5 SLPM
	WATER	3 LPM	0.025 LPM
2	AIR	200 SLPM	2 SLPM
	WATER	10 LPM	0.1 LPM

APPLICATION TABLE ACCORDING TO MODEL

COUPLING	MODEL	MODEL
½”	V - 401	VR - 401
¾”	V - 402	VR - 402
1”	V - 403	VR - 403
1½”	V - 404	VR - 404
2”	V - 405	VR - 405

LIQUID-LIQUID EJECTOR	FRP FLOW REGULATOR	FLOW DISPLAY
For more information,see technical sheet EPT 05-05-02	For more information, see technical sheet EPT 01-08-01	Technical sheet in preparation
½”, ¾”, 1”, 1 ½”, 2” BSP INTERNAL THREAD	¼” AND ½” BSP OR NPT INTERNAL THREAD	PLASTIC OR GLASS SPHERE, OR PLASTIC ROTOR
PUMPING OF LIQUIDS THAT MUST BE MIXED AT A SPECIFIC PROPORTION	KEEP FLOW CONSTANT WHEN SYSTEM COUNTER PRESSURE VARIES	WATCHING WHETHER THERE IS OR NOT AN EFFECTIVE PASSAGE OF FLOW



INDUCTIVE ALARM SYSTEM FOR TM

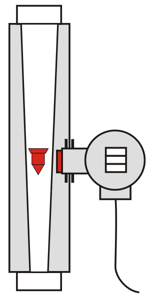
DESIGN CHARACTERISTICS

It is an inductive-type alarm system which detects the position of the pointer on the gage spot where you want to obtain an alarm signal which becomes normal when the pointer stops facing the sensor. If the signal is to be kept, locking must be made by relay and an external reset push button must be provided. The system allows operation all along the rotameter gage and either a PNP or NA output may be obtained (NPN- and NC-types are optional).
A second sensor may be added to obtain a maximum and minimum flow alarm.

CONNECTION

The sensor works on three wires: +Vcc; Output and GND. The alarm system is connected by wiring the charge/load between GND and the OUTPUT taking into account that current must not exceed 200 mA. The voltage may vary from 10 to 30 Vcc.
The equipment carries a 1.8 m long cable to be connected at the output of the rotameter indicator box with a cable clamp.
For applications with two sensors (maximum and minimum), two 1.8 m laying lengths are provided for connection at the output of the rotameter indicator box by means of a cable clamp.

For more information, see technical sheet EPT 01-12-01



INDUCTIVE ALARM SYSTEM FOR CM E IQM

DESIGN CHARACTERISTICS

It is an inductive-type alarm system which detects the position of the pointer on the gage spot where you want to obtain an alarm signal which becomes normal when the pointer stops facing the sensor. If the signal is to be kept, locking must be made by relay and an external reset push button must be provided. The system allows operation all along the rotameter gage and either a PNP or NA output may be obtained (NPN- and NC-types are optional).
A second sensor may be added to obtain a maximum and minimum flow alarm.

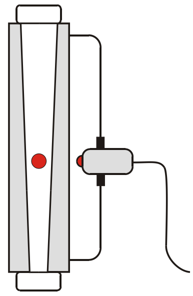
CONNECTION

To mount the alarm system, the charge/load must be connected between the GND (blue) and the OUTPUT (black), taking into account that current must not exceed 200 mA. NOTE: The standard supply is NA.

OPTIONALS

The alarm system may be provided in an antiexplosion case.

For more information, see technical sheet EPT 01-11-00



OPTICAL ALARM SYSTEM FOR CP ROTAMETERS

DESIGN CHARACTERISTICS

It is an optical-type emitter-receiver alarm system which detects the position of the float on the gage spot where you want to obtain an alarm signal which becomes normal when the float stops facing the sensor.
If the signal is to be kept, locking must be made by relay and an external reset push button must be provided. The system allows operation all along the rotameter gage providing an NPN-type output.
A second sensor may be added to obtain a maximum and minimum flow alarm.

CONNECTION

The sensor works on three wires: +Vcc; Output and GND. The alarm system is connected by wiring the charge/load between +Vcc and the OUTPUT taking into account that current must not exceed 100 mA. The input voltage may vary between 5 and 24 Vcc. The equipment is supplied with a 1 m long cable for connection.

For more information, see technical sheet EPT 01-13-01

A. CHANGE IN OPERATING CONDITIONS

The rotameter gage is usually converted into another as a result of some change in the fluid parameters that defined the original design.

$$Qv = Fva\,(Qv)\ design$$

Fva (the conversion factor) is the ratio of original and new densities.

1.- LIQUIDS

$$Fva = \sqrt{\left(\frac{\rho f}{\rho fl - \rho f}\right)_{design} \cdot \left(\frac{\rho fl - \rho f}{\rho f}\right)_{new}}$$

Where: ρf : Fluid density.
ρfl : Float density.

This ratio, however, is more practical if specific gravity rather than density is used, and as by definition:

$$Gb = \frac{\rho b}{\rho\ water} \quad 15°C\ and\ 101.325KPa$$

And replacing the water density, on base conditions:

$$Gb = \frac{\rho b}{999.0121} \quad or \quad Gf = \frac{\rho f}{999.0121}$$

And substituting in the Fva equation, you can obtain:

$$Fva = \sqrt{\left(\frac{Gf}{Gfl - Gf}\right)_{design} \cdot \left(\frac{Gfl - Gf}{Gf}\right)_{new}}$$

Example: A rotameter calibrated for the measurement of water at 20°C will be finally used to measure gasoline at 38°C. ¿Which will the gasoline flow be when the instrument displays a 10 Lpm reading?

(Gf) design = 1 (water at 20°C)
(Gf) new = 0.725 (gasoline at 38°C)
(Gfl) float SS 316 = 8.02

$$Fva = \sqrt{\left(\frac{1}{8.02 - 1}\right) \cdot \left(\frac{8.02 - 0.725}{0.725}\right)} = 1.195$$

Then:
Qv gasoline = 1.195 . 10 LPM = 11.95 LPM

2.- GASES

Here, the float density ρfl. is so large if compared to that one of gas that can be eliminated: $\rho fl - \rho f$

$$Fva = \sqrt{\frac{\rho f\ (design)}{\rho f\ \ (new)}}$$

In gases, the relationship between density and gravity is:

$$\rho f = 3.483 \cdot \frac{G_F \cdot P\,f}{Zf \cdot Tk}$$

Where: Pf = Fluid pressure (absolute)
Tk = Fluid temperature (in°K)
Zf = Compressibility Factor (negligible)

$$Fva = \sqrt{\left(\frac{G \cdot Pf}{Tk}\right)_{design} \cdot \left(\frac{Tk}{G \cdot Pf}\right)_{new}}$$

In practice, the three parameters can be taken up separately:

$$Fva = Fp \cdot Ft \cdot F_G$$

$$Fp = \sqrt{\frac{(Pf)d}{(Pf)\ new}} = \sqrt{\frac{(1.033 + P\ design)\ Kg/cm^2}{(1.033 + P\ new)\ Kg/cm^2}}$$

$$FT = \sqrt{\frac{(Tk)new}{(Tk)\ d}} = \sqrt{\frac{273.15 + T_n\ °C}{273.15 + T_d\ °C}}$$

$$F_G = \sqrt{\frac{(G_F)\ d}{(G_F)\ new}}$$

Example: A rotameter calibrated in ALPM of air at 20°C and 0.5 Kg/cm2 will be used with oxygen at 15°C and 1 Kg/cm2, ¿which will be the oxygen flow be when the rotameter indicates 10 ALPM?

G_F air = 1 G_F oxig. = 1.105 Tk air = 293.15
Tk = 288.15 Pf air = 1.533 Pf oxigen. = 2.033

$$Fp = \sqrt{\frac{1.533}{2.033}} = 0.868 \quad F_T = \sqrt{\frac{288.15}{293.15}} = 0.98$$

$$F_G = \sqrt{\frac{1}{1.105}} = 0.95$$

Then: Fva = 0.868 x 0.98 x 0.95 = 0.808
And then:Qv (oxigen) = 0.808 . 10 ALPM = 8.84 ALPM

B. CHANGE IN THE VOLUMETRIC STANDARD

If the design gage is made in a standard: S, A or N, and it is to be changed to another standard, the equation should be the following:

$$Fva = \left(\frac{G \cdot Pb}{Tkb}\right)_{design} \cdot \left(\frac{Tkb}{G \cdot Pb}\right)_{new}$$

Example 1: Calculate the ALPM gage of the example above in SLPM:

$G_D = G_N = 1.105$ $Pb_D = 2.033$ $Tk_D = 288.15$
$Pb_N = 1.033$ $Tk_N = 288.15$

$$Fva = \left(\frac{2.033 \cdot 1.105}{288.15}\right)_{design} \cdot \left(\frac{288.15}{1.105 \cdot 1.033}\right)_{new} = 1.96$$

Qv_{SLPM} = 1.96 x 8.08 = 15.9 SLPM

Example 2: Calculate the previous value in NLPM

$Tk_N = 273.15$

$$Fva = \left(\frac{1.105 \cdot 1.033}{288.15}\right)_{design} \cdot \left(\frac{273.15}{1.105 \cdot 1.033}\right)_{new} = 0.948$$

Qv_{NLPM} = 0.948 x 15.9 = 15.07 NLPM

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