

## Combustion

# DIFFERENTIAL PRESSURE RATIO REGULATOR

## FLOW BALANCE AIR/GAS RATIO CONTROL

### TYPICAL APPLICATIONS:

- RATIO CONTROL ON COLD AIR SIDE OF RECUPERATOR SYSTEMS.\*

7288 Regulators are used as flow balancing air/gas ratio control devices in air primary systems. The 7288 matches pressure drop across an orifice in the gas line to the drop across an orifice in the combustion air line, thereby matching gas and air flows from high fire to low.

Standard arrangement uses an 1807-type limiting orifice valve as the gas orifice, adjusting it for desired air/gas ratio.

Differential pressure ratio regulators represent the least expensive method of ratio control on applications where resistance and/or back-pressure varies in the air and gas lines downstream of the orifices.

### WHY FLOW BALANCE

Many heat recovery installations require flow balance ratio control because resistance in the air line increases as recuperator or reclaimer temperature rises.

The 7288 system works on the principle that matched differential pressures mean matched flows (assuming air and gas temperatures are maintained at each orifice).

For example, as a recuperator's temperature goes up and air flow through it is restricted, pressure drop across the orifice plate in the cold air line decreases. The 7288 senses this and reduces pressure drop across its orifice (usually a limiting orifice valve), thus decreasing gas flow in the same proportion as the air flow reduction. Preset air/fuel ratio is maintained.

Accurate turndowns of 7:1 or more can be realized if pressure drop is appropriate across the air orifice at high fire.

### MULTIPLE BURNERS

More than one burner can be fed by a single 7288 Regulator as long as individual burner adjustments, once set, are not altered or do not change inadvertently due to burner air or gas orifices plugging or individual downstream resistance changing from other causes. (The 7288 will maintain ratio if both gas and air are shut off on individual burners.)

In multiple burner set-ups, the main benefits of the 7288 control can be realized on some installations by venting the downstream gas connection. The Regulator then maintains an outlet static pressure in proportion to the differential pressure across the air orifice. Consult Fives re the practicality of this arrangement for a potential application.

\*Assuming there is no hot air bleed in the recuperator system.

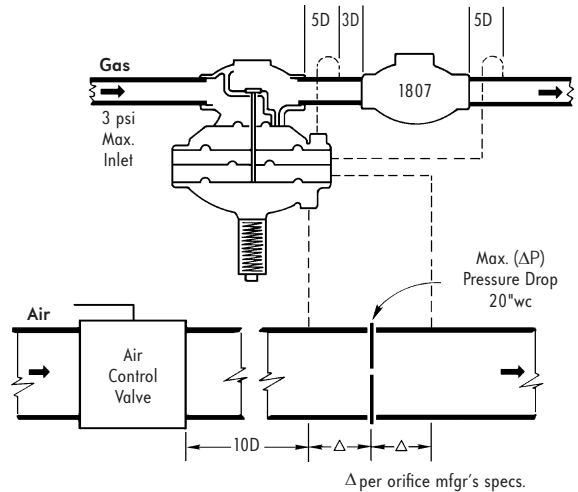


Table 1. CAPACITIES  
cfh  
with 2 osi drop through regulator

Regulator designation	Gas gravity		
	0.4	0.6	1.5
7288-0	300	250	150
7288-1	500	400	250
7288-2	1000	800	500
7288-3	1500	1200	775
7288-4	3000	2400	1500
7288-5	5000	4000	2500
7288-6	7350	6000	3800
7288-7	13400	11000	7000

(for capacities at other pressure drops, use square root law or Table 2 on back of this sheet)

**Table 2.** Capacity correction factors for various pressure drops across 7288 Regulators (see Table 1).

Pressure drop, psi	Factor	Pressure drop, psi	Factor
1	0.707	8	2.00
2	1.00	10	2.24
3	1.22	12	2.45
4	1.41	14	2.65
6	1.73	16	2.83

(16 psi is maximum recommended drop)

There are three basic methods of air/fuel ratio control:

- 1. Area Control**--normally done with linked valves in air and gas lines, maintaining constant upstream pressures. The valve combination is opened or closed to accomplish flow changes. With fixed port valves, desired ratio usually can be realized at only two points. Adjustable port valves enable closer matching of flow characteristics. But Area Control is crude, not considered satisfactory for the great majority of industrial combustion installations.
- 2. Pressure Balance**--a cross-connected regulator matches its outlet gas pressure to air pressure. Thus, as an air control valve modulates (in an air primary system), gas pressure to the burner follows air pressure. Pressure Balance ratio control is used on most industrial furnaces, kilns, and ovens. It overcomes the need to match valve areas and flow characteristics, and it compensates for reasonable variations in upstream pressures. However, it aggravates ratio variations caused by increased resistance in the downstream air line.
- 3. Flow Balance**--described herein for the 7288 Regulator.

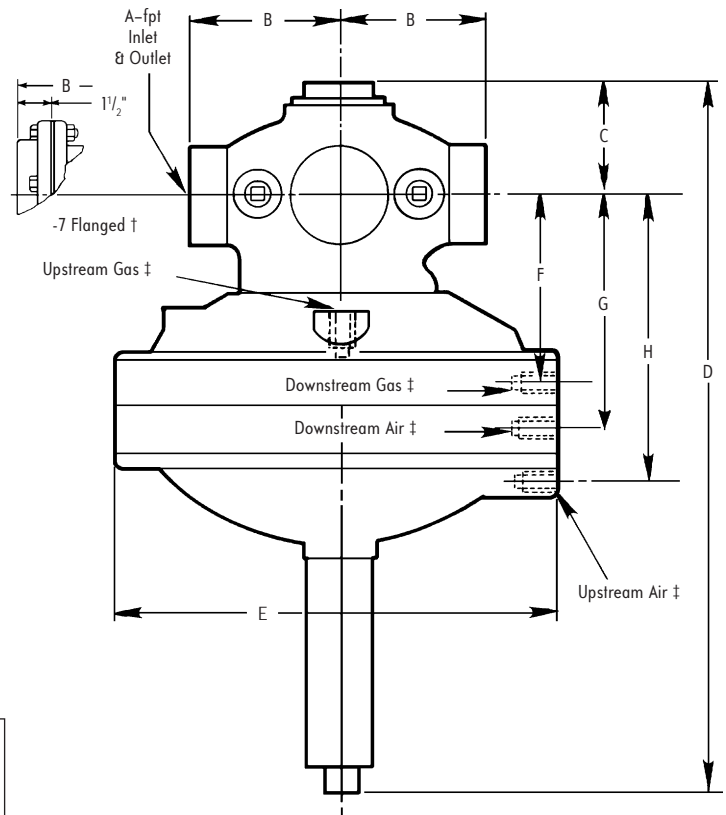
Note: Flue gas analysis is rarely used as the primary method of ratio control. Some sophisticated installations use flue gas oxygen readings to "trim" a Pressure Balance or Flow Balance system.

**WARNING:** Situations dangerous to personnel and property may exist with the operation and maintenance of any combustion equipment. The presence of fuels, oxidants, hot and cold combustion products, hot surfaces, electrical power in control and ignition circuits, etc., are inherent with any combustion application. Parts of this product may exceed 160F in operation and present a contact hazard. Fives North American Combustion, Inc. urges compliance with National Safety Standards and insurance Underwriters recommendations, and care in operation.

**CONSTRUCTION**

Body: cast iron  
Diaphragm cases: cast aluminum  
Internals: brass, steel, stainless steel, aluminum (for gases corrosive to brass, consult Fives)  
Diaphragms: silicone rubber  
Maximum pressure: 3 psi (shock loads to 4 psi)  
Maximum temperature: 180 F ambient  
Available spring bias: +0.7"wc to -0.7"wc

**NOTE:** 7288 Regulators should be installed horizontally with spring on bottom.



‡ All pressure connections are 1/4" fpt.

Regulator designation	dimensions in inches								Approx. weight, lb
	A	B	C	D	E	F	G	H	
7288-0	3/4	2 1/2	1 7/8	9 3/8	10 1/2	3 5/8	4 3/8	5 5/16	26
7288-1	1	2 3/4	2 1/16	9 3/8	10 1/2	3 5/8	4 3/8	5 5/16	26
7288-2	1 1/4	2 3/4	2 1/2	14 3/8	10 1/2	3 5/8	4 3/8	5 5/16	28
7288-3	1 1/2	3 1/16	2 5/8	14 3/8	10 1/2	3 5/8	4 3/8	5 5/16	28
7288-4	2	3 5/16	3 1/4	18	13 1/2	4 3/8	4 7/8	5 15/16	30
7288-5	2 1/2	4 1/2	4 3/8	22 1/2	18 1/2	5 3/8	6 15/16	8	50
7288-6	3	4 13/16	4 7/8	22 1/2	18 1/2	5 3/8	6 5/16	8	50
7288-7†	4	8 21/32	5 3/4	24	18 1/2	5 15/16	7 1/2	8 9/16	90

† Threaded companion flanges included.

DIMENSIONS SHOWN ARE SUBJECT TO CHANGE. PLEASE OBTAIN CERTIFIED PRINTS FROM FIVES NORTH AMERICAN COMBUSTION, INC. IF SPACE LIMITATIONS OR OTHER CONSIDERATIONS MAKE EXACT DIMENSION(S) CRITICAL.



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