GAS VALVE CAPACITY VS. PRESSURE DROP

INTRODUCTION

This paper explains the relationship between the capacity of a gas valve and the pressure drop related to that capacity, and why it is important for you to look at both when choosing a gas valve for a specific application. It also shows you how to determine if a valve has the capacity you need for a specific application.

By understanding the relationship between capacity and pressure drop, you can reduce the inventory you carry, yet guarantee that, in most cases, you will have an appropriate replacement valve available for your service calls.

THE RELATIONSHIP BETWEEN CAPACITY AND PRESSURE DROP

The American Gas Association (AGA) tests valves under specific conditions and then lists the valve's minimum regulated capacity, its maximum regulated capacity, and the valve's capacity at 1 in. w.c. pressure drop. Actually, the valve capacity varies with pressure drop. As pressure drop increases, the capacity of the valve increases. The maximum regulated capacity is the greatest gas flow at which the regulator will maintain the outlet setting. For example, the VR8300 (with 3/4 in. inlet and 3/4 in. outlet) has a maximum regulated capacity of 300 cfh, which means that at the appropriate pressure drop, this valve is suitable for appliances rated up to 300 cfh. Just as capacity increases with increasing pressure drop, as pressure drop decreases, the valve's capacity also decreases. For example, the same VR8300 (with 3/4 in. inlet and 3/4 in. outlet) has a capacity of 200 cfh at a one in. w.c. pressure drop.

True gas valve capacity is fixed at a particular pressure drop, but extends over a range that is a function of the pressure drop through the valve. Depending on the available input pressure, gas valves may be used safely within the entire range of their minimum and maximum AGA regulation ratings. Remember that pressure drop is simply the difference between the pressure supplied to the valve (input) and the pressure available at the outlet of the valve (output), usually 3.5 in. w.c. for natural gas and 10 in. w.c. for LP.

Fig. 1 illustrates the relationship between capacity and pressure drop.

The vertical axis (left side) of the graph indicates the pressure drop across the valve. The horizontal axis (bottom) of the graph indicates capacity. The curve represents the change in the capacity of the gas valve relative to the pressure drop. As available input pressure increases, the capacity of the valve also increases. Because pressure drop is caused by the resistance to gas flow inherent in the valve construction, the relationship between capacity and pressure drop is not a straight line.

THE SOURCE

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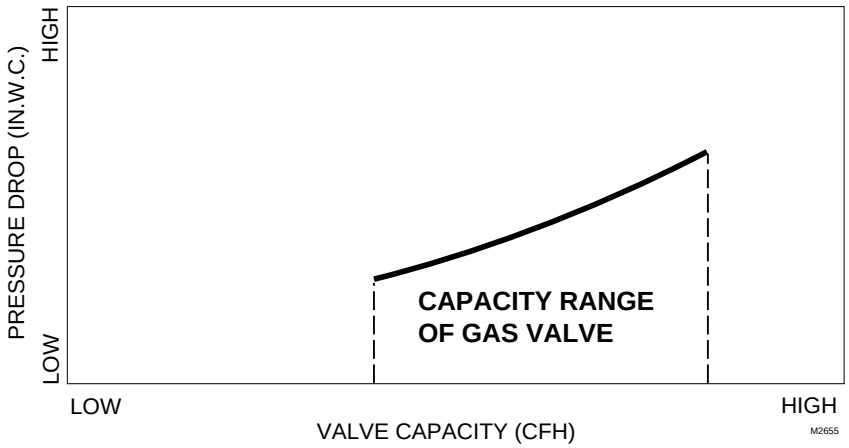

Fig. 1—Typical relationship between gas valve capacity and pressure drop.

CAPACITY VS. PRESSURE DROP FOR THE VR8200 AND VR8300 COMBINATION GAS VALVES

Manufacturers provide capacity/pressure drop information in two ways: through graphs like the one in Fig. 1, or more commonly through specification sheets, where valve capacity is listed at specific pressure drops.

Honeywell VR8200 and VR8300 gas valves are for 24 Vac standing pilot applications, and are designed as universal replacements. Thus they have an extremely wide capacity range in addition to a small size which allows them to fit into newer, smaller footprint high-efficiency appliances.

The VR8200 (Fig. 2) is AGA listed at a 1 in. w.c. pressure drop capacity of 130 cubic feet per hour (cfh) and the VR8300 (Fig. 3) is listed at about 200 cfh, depending on inlet and outlet sizes. (References to capacity are in cubic feet per hour. To convert to Btu/h for natural gas, assume a heat content of 1000 Btu/ft^3, and multiply the values given by 1000. To convert to Btu/h for LP, assume a heat content of 1620 Btu/ft^3 and multiply the values given by 1620.)

As the graphs show, these capacities are at a one inch w.c pressure drop. Yet as the maximum regulation capacity curves indicate, the VR8200 can accommodate systems that require valves with capacities from 20 to 200 cfh and the VR8300 can

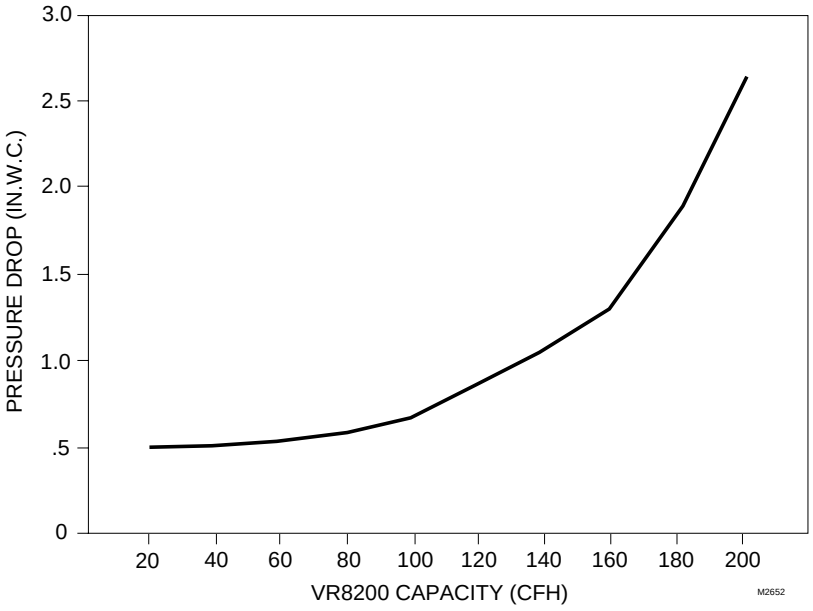

Fig. 2—Regulation capacity of the VR8200 relative to pressure drop.

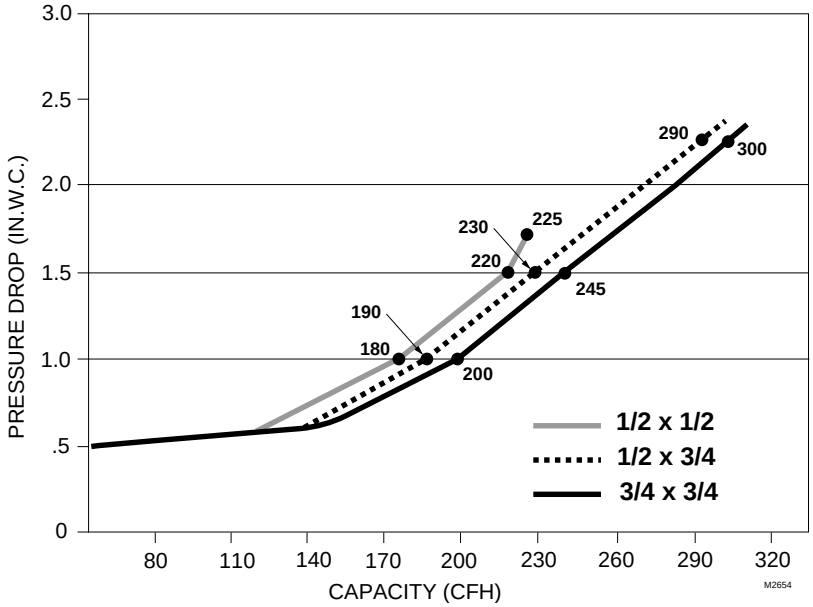

Fig. 3—Regulation capacity of the VR8300 relative to pressure drop.

accommodate systems requiring valves with capacities from 30 to 300 cfh if there is adequate input pressure. And indeed, both valves meet ANSI standards for safe operation within those ranges.

The broad capacity range of these two valves means that they can be used in about 95 percent of all systems in existence today. When you stock such valves you can minimize your inventory investment and be assured of having an appropriate replacement valve for most service calls.

But before you use a valve in an appliance that requires a capacity greater than the 1 in. w.c. pressure drop capacity AGA rating of that valve, you must satisfy yourself that the valve is appropriate for the appliance. To do that, you must know whether you have enough input pressure to accommodate the pressure drop required for the capacity you need.

HOW TO CALCULATE THE CONTROL CAPACITY OF A GAS VALVE AT A SPECIFIC PRESSURE DROP

Assume that you need to replace the gas control in an appliance that requires 230 cfh. Referring to 1 in. w.c. pressure drop AGA ratings, you might assume that you need a valve with a higher capacity than the VR8300, since its rating (depending on inlet and outlet size) at 1 in. w.c. pressure is 180 to 200 cfh. The fact is, the VR8300 has the capacity you need, if the available input pressure is sufficient.

Here is how to determine if the VR8300 can do the job.

Step 1

Check the appliance manufacturer's specification. Determine what the regulated outlet pressure of the gas valve to the burner manifold must be. In most systems, this is 3.5 in. w.c. for natural gas, 10 in. w.c. for LP.

Step 2

Determine the pressure drop across the gas control at the capacity you need. Use the capacity/pressure drop graph for the gas control and proceed as follows; see Fig. 4 for this example:

a. Find the capacity you need on the graph's horizontal line. (For example, 230 cfh.)
b. Project a vertical line from that point to where it intersects the valve's curve (Line A).
c. At this point, extend a horizontal line to the left until it intersects the graph's vertical axis, which shows pressure drop, (Line B).
d. Read the pressure drop of the gas valve at that capacity (1.4 in. w.c pressure drop).

Step 3

Add the pressure drop required for the valve, and the input pressure required for the burner. Assuming natural gas in our example, this would be 1.4 in. w.c. for the valve and 3.5 in. w.c. for the burner. The total available supplied gas pressure to the gas control must be 4.9 in. w.c. or greater for the valve to deliver 230 cfh to the appliance.

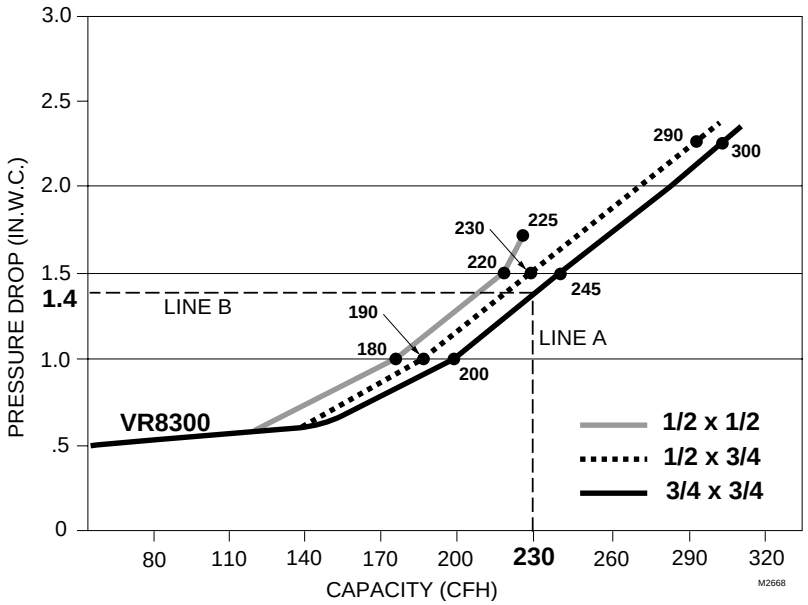

Fig. 4—Determining Gas Valve Capacity.

Step 4

Check the gas pressure supplied to the gas valve. There are two ways to determine this. One way is to call the local gas supplier and ask what the supplied pressure is in your area. The second, more reliable way, is to use a manometer to check the inlet pressure to the inlet of the gas valve. In most areas of the country, supplied natural gas pressure is from 6 to 7 in. w.c. and LP pressure is 14 in. w.c., more than enough pressure to install the VR8300 as a replacement valve in an appliance that requires 230 cfh.

SUMMARY

When you think about the capacity of a gas valve, train yourself to think in terms of the valve's usable range. Practice using the capacity/pressure drop information provided by the manufacturer so that you can satisfy yourself that the valve will handle the intended application. You will find that the number of valves you have to stock, inventory, and carry to service calls can be greatly reduced.

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