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This is the first of a series of articles dedicated to closing the gap in understanding issues and hidden costs in foodservice equipment and design. In addition to gaps in understanding, there are gaps in communication beginning with the construction documents used to build the foodservice space. It may be a receptacle that does not match a plug, or no receptacle where one is required. Floor drains can be misplaced and grease traps forgotten. Ventilation and fire suppression acceptable in one municipality may not be acceptable in another. The total cost of ownership for building or a piece of equipment is greater that the cost of its acquisition. Improperly sized equipment, plumbing lines, ventilation systems, refrigeration, and dry good storage cost operators far more than the first cost of ownership. In this first article we will examine some issues related to natural gas supply services. Future articles will delve into application and use of various pieces of foodservice equipment including steam equipment, mixer kettles, cook/chill and blast chillers. I will also look into commercial kitchen ventilation, fire suppression, plumbing codes, health codes and other codes and standards that impact the foodservice operator.

Setting the stage

Planning and construction of commercial foodservice establishments requires knowledge of the laws and standards that pertain to handling food served to the public. Construction codes, health codes, fire codes and public safety requirements in general have significant impact on operations in the food and food service industry. Many of these laws and standards are specific to foodservice beyond the scope of many architects and engineers core competencies. Architects and/or owners (or their representatives) will often consult a professional (foodservice) facility planner to develop the mechanical and electrical (M&E) specifications and drawings. There are 16 contract divisions in a standard construction document. Division 11400 is food service equipment and includes all of the specialty food service equipment and related systems necessary to meet both legal requirements and the owner’s requirements to have a productive and profitable operation. Division 11400 includes all of those items below the ceiling and above the floor that are related to foodservice. The connection requirements specified in the food service specification must match services being provided by trades (contractors) working in related specification divisions.

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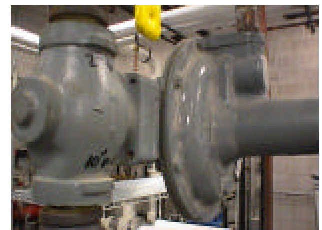
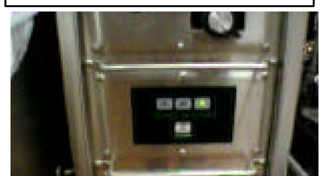
The Natural Gas Gap:

Definitions:

1. W.C.= water column. A unit a measure for low pressure gasses, expressed in terms of inches (") of water column.
2. PSI(a) = pounds per square inch. A unit of measure defining the amount of pressure in a line or vessel relative to (absolute) atmosphere. One (1)PSI is the expressed as "1#", which equals 28"W.C.
3. PRV = Pressure Reducing Valve, designed to reduce pressure of a fluid stream between inlet and outlet.
4. Solenoid valve = Any electrically operated valve that opens or closes upon receiving a signal or loss of power. A normally open (N.O.) valve is open when there is no power across its coil. A normally closed (N.C.) valve is closed when there is no power across its coil.
5. Fire/fuel safety valve and reset station= A code requirement for ALL installations of natural gas fire commercial food service equipment. It is a (N.C.) solenoid valve installed upstream from all cooking equipment that is wired to the fire suppression system so that it will close upon activation, cutting off natural gas flow.



Gas PRV, 2#-10"



Gas reset by Avtec

Fundamentals:

1. Food service equipment manufacturers provide PRV's with their equipment. These PRV's are pre-set by each manufacturer to deliver the exact amount of "operating" gas pressure for optimal performance of their particular piece of equipment. This setting will vary between models and manufacturers.
2. PRV's are often integral to the gas solenoid valve that opens and closes as the thermostat calls for heat. Sometimes PRV's are shipped loose for installation by a Pipefitter (Plumbing Contractor), but usually they are already part of the piece of equipment.
3. PRV's provided by the equipment manufacturers have a maximum tolerance of 14" W.C., even though the pre-set point (operating pressure) may be as low as 4.5"W.C.
4. Gas is often distributed within a building at 2#'s (56"W.C.).
5. Gas must be reduced from 2#'s to something less than 14"W.C., ***BEFORE*** being connected to the gas distribution system in the kitchen.

The gas PRV that comes with each piece of equipment has an inlet high-pressure limit of 14"W.C.. Gas pressure will drop about 1" W.C. between inlet and outlet of a PRV, so 10"W.C. at the inlet leaves 9"W.C. at the outlet. The valve used to reduce from 2#'s to below 14"W.C. needs to be ventilated to atmosphere and cannot be located in a ceiling space used as a return air plenum. Most food service equipment operates at gas pressures below 7" W.C., leaving at least 6-7"W.C. of "headroom capacity". Be sure that your system allows you a bit of "headroom", or you may suffer the consequences.

Symptoms of poor gas distribution:

1. Intermittent pilot outag "WOOOF"
2. Burners come on with a
3. Reduced heat and visible flame height on burners.
4. The unit shuts itself off and won't re-ignite for 20 or more minutes.
5. Uneven cooking (convection and standard ovens).
6. Soggy fries (during peak demand, indicative of poor recovery).

When an operator encounters one of the above symptoms, they will usually call the manufacturers local warranty servicer. The service agent will check the suspect unit and the quick disconnect gas hose. Gas hoses must match the requirements of the unit they are attached too. If the unit calls for a larger volume of

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gas than the hose can accommodate the unit will not perform properly. Gas starvation is often experienced when the kitchen is busy. Since the kitchen is busy, the service agent is told to arrive when things quiet down a bit, so that he is not in the way of the chef(s), cooks and other staff. By the time the servicer gets his readings, the rush is over and gas pressure readings have recovered. The owner is billed for the service call, as the problem is not a defect in materials or workmanship with the piece of equipment. Unfortunately, the servicer for a piece of food service equipment is not generally able (or enabled) to repair a problem encountered with the gas supply system. If a problem with gas supply is found, they will notify the owner (or owner rep) by noting on their invoice that the problem is related to gas pressure. The 1997 ASHRAE Fundamentals Handbook states the issue succinctly.

Piping for gas appliances should be of adequate size and installed so that it provides a supply of gas sufficient to meet the maximum demand without undue loss of pressure between the point of supply (the meter) and the appliance. The size of the gas pipe required depends on (1) maximum gas consumption to be provided, (2) length of pipe and number of fittings, (3) allowable pressure loss from the outlet of the meter to the appliance, and (4) specific gravity of the gas.

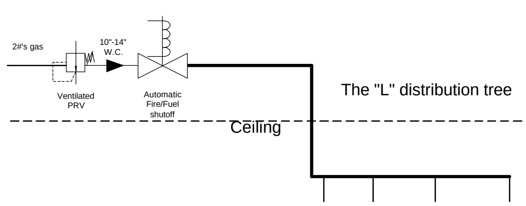
Gas line size and gas pressure determines the total volume of gas that can flow in a given line. Gas flowing through a line encounters resistance (static) each time it changes direction or hits a restriction or obstacle. The size of your gas line and type of distribution "tree" installed in the wall behind your cooking equipment determines the total capacity of your cook line. The different design approaches have different cost structures, both first and future cost.

Gas Distribution "trees".

Gas distribution manifolds, or "trees" have some things in common. For example, NFPA (National Fire Protection Association) requirements call for a "fire/fuel" shutoff valve before connection to a piece of commercial food service equipment beneath a type I canopy (NFPA 96) with surface fire suppression. The fire/fuel shut-off solenoid valve is a normally closed (N.C.) valve. It automatically slams shut upon activation of the fire suppression system, or loss of electrical power cutting off the fuel to the fire. The fire/fuel shutoff valve is downstream from the PRV that reduces from 2#'s to <14"W.C., but upstream from connection to your distribution "tree". Each of these trees is formed from black iron (schedule 80) pipe with a diameters ranging from 1" to 2"dia. or other listed products) The most common distribution manifolds can be categorized symbolically.

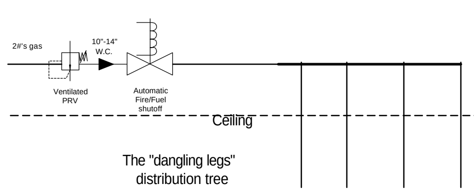
The "L"

Many Food Service cooking batteries are designed as "L" systems. They have a single gas piping leg running down (or up) the inside of the wall then behind the equipment (horizontally) the entire length of the cooking "battery". They have individual "stubs" or outlets branching off to connect to individual pieces of commercial food service equipment. In the hierarchy of preferred distribution "tree's, the "L" tree is least desirable from a functional standpoint, though it is the least expensive first cost. The piece of equipment at the (dead) end of the L is at the most hydraulically remote point of the tree.



"Dangling legs"

Another common approach to distributing gas service, the dangling leg approach is similar to the "L" in that a single connection ends up being the most hydraulically remote point. As gas consumption approaches system capacity, the last piece in the line gets cut short by those pieces upstream.



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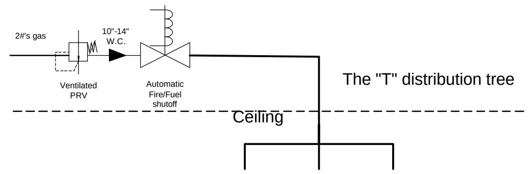
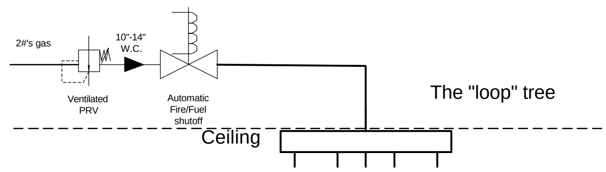
The “T”

Next in line is the “T” tree. Primary gas service enters the horizontal run at its average “load center”. This may cost a bit more then the “L” tree, as you may have to run your supply piping a few more feet to hit your desired average load center. The two pieces of equipment on either end share the burden of being at the most hydraulically remote points.



Looped gas service

The gas “loop” is the best, scaleable alternative. It is also the most expensive first cost. With this system, a “T” is installed after the fire/fuel shut-off valve. One leg of the T goes down the wall near to the first piece of equipment on the left. The other leg goes down the wall near to the first piece of equipment on the right, with a horizontal run in between with stubs for each piece of equipment. The amount of gas pressure to any piece is averaged, as the piping loop acts to equalize pressure throughout the line. All of the connection points share an averaged amount of gas…no one or two pieces are more hydraulically remote than any other.



In summary, your gas distribution system should be designed to accommodate simultaneous peak flow conditions, with a bit of “headroom” in reserve. Don’t be too quick to blame equipment for problems in operation, especially if the problem is intermittent. Challenge the design professionals engineering your space to provide systems that are scaleable and sensible given your immediate and future energy needs.

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