Kitchen Equipment Engineering

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Kitchen equipment engineering is the title of this paper to be presented within an allotted time of twenty-five minutes. The field for discussion is so vast that proper coverage would be incomplete in a volume of three to four hundred pages.

In our industry Kitchen Equipment is commonly referred to as Food Service Equipment and concerns itself primarily with commercial and institutional installations and not with domestic or home set-ups.

Kitchen Equipment Engineering covers not only the preparation of specifications and construction details involved in the fabrication and selection of equipment, but involves primarily the planning and relationship of the space areas required for the type and number of persons to be fed and the necessary space requirements for service, food preparation, cooking, storage, refrigeration, employee facilities, etc.

Where the construction is new, the kitchen equipment engineer, working in close cooperation with the architect, and whenever possible with the owner or management, advises on the space allocation, its relative location and works out a harmonious and efficient relationship between all departments of the feeding establishment.

After the proper space allocation has been determined, the kitchen equipment is then planned. The floor plan showing the actual layout of equipment is prepared.

At this stage the most careful study is made affecting the operation of the complete storage, food preparation, and food service installation. The trained kitchen equipment designer assumes the roll of an industrial engineer, since on large installations vast quantities of bulk foods must be efficiently handled into the storage areas, from there into the preparation areas, into the cooking areas, thence to food service, and on to consumption. Here the problem does not end, as dishes and waste materials must be efficiently and effectively handled, properly stored or disposed of, with a minimum of traffic lines, and a minimum of traffic congestion.

After the layout of equipment has been completed, the necessary provision is made for the roughing in of the necessary plumbing, heating, electrical, and ventilation requirements.

Following the preparation of roughing in drawings, detailed specifications for equipment involving storage, preparation, and cooking are prepared. These specifications must be thoroughly descriptive, must specify materials to be used, and general construction detail. The type of specification and construction will vary greatly with the type of feeding establishment and must fall within budgetary requirements.

The problem of planning, is, of course, simplified where new construction is involved. More often, however, installations are made in existing buildings or altering or additions to existing installations. In these situations, the kitchen equipment engineer is often sorely taxed to work out an efficient and effective layout. Exist-
ing space conditions must be carefully studied and consideration given to existing plumbing, heating, and electrical lines, as well as other services. Problems involved in such installations are so varied as to beggar description. Alternate layouts must be studied and consideration given to every possible factor to produce a satisfactory and acceptable layout. The overall space allocation must be carefully studied, existing partition walls used wherever possible. The final decision must be the best decision and the one most nearly correct to produce an effective installation. The final layout of the kitchen equipment itself is so closely tied in with the construction that it is most costly to make changes after installation. For example, a counter improperly placed or improperly planned means an expensive alteration and more often than not a complete replacement. The greatest possible ingenuity is involved in perfect planning, so that the final result will leave no regrets on the part of the operator, the architect, and the equipment engineer.

It is important to understand the fundamental nature of kitchen equipment. The equipment engineer recognizes two forms of kitchen equipment:

(1) Fixed Equipment, such as is commonly purchased by the manufacturer of kitchen equipment and involving such items as dishwashers, ranges, ovens, broilers, stock kettles, steamers, mixers, peelers, etc. It is the responsibility of the kitchen equipment engineer to select such items of standard equipment as fit the requirements and budget for a given installation. For example, ranges and dishwashers respectively have their given capacities and output and it is the responsibility of the kitchen equipment engineer neither to over-equip nor under-equip for a given requirement.

(2) Fabricated Equipment, such as is normally produced in the manufacturing plants of the kitchen equipment manufacturer, involving counters, back bars, cook tables, soiled and clean dish tables, plate warmers, steam tables, etc.

The kitchen equipment engineer is invariably connected with a fabricator or distributor of food service equipment, and since fabricated equipment generally forms, by far, the major proportion of an installation, I shall without burdening you with too much detail, give you a few fundamental thoughts on this subject. I shall briefly discuss the following, as they affect and are affected by food service equipment:

I. Factors affecting cost of equipment.
II. Operation and maintenance of equipment.
III. Sanitation.
IV. Fundamental principles of construction involved in good fabricated food service equipment.

1. Factors Affecting Cost of Equipment

The basic cost of materials entering into fabricated food service equipment—stainless steel, light structural sections, galvanized iron—has increased but nominally during the past ten years, stainless steel in particular having suffered but a negligible increase in price. True, other materials entering into the production of fabricated food service equipment have increased in price considerably, particularly such items as castings, forgings, and stampings, but these form relatively minor components. It is reasonable to state, therefore, that the major item of material, stainless steel alone more than any other product, affects the cost of fabricated equipment. We shall see how this factor is to be considered in the proper design of fabricated equipment.

Labor Cost, on the other hand, particularly the skilled labor required to build equipment, has, during the past
ten years, increased more than 100 per cent.

It should be understood, therefore, that in any consideration of a properly drawn specification, the factors involving the relatively small increase in the cost of material and the high increase in the cost of labor must be carefully and seriously considered. How do these factors affect a given set of specifications? It is obvious that complicated, unnecessary construction should be avoided and, wherever possible, gadgets and unnecessary details should be eliminated. The progressive manufacturer of fabricated equipment has made every effort possible to counter-balance his greatly increased labor costs through improved manufacturing methods. Hand operated machines have been replaced by heavy power driven machinery, on which the heaviest gauges of material can be efficiently and economically handled. Construction methods had to be modified, dies, tools and welding fixtures designed and installed to produce fabricated equipment more rapidly. Improved shearing, forming, and welding techniques were developed in an effort to counter-balance the abnormally high labor rates affecting our industry.

The prime factor now is not emphasis on material, but emphasis on construction detail and all factors which eliminate high labor costs. It is obvious, therefore, that working in light gauge stainless steel to effect a saving in cost of material is not always economical, since working in light materials involves backing up light stainless steel with heavier steel sections, additional framing, additional welding, and obviously higher labor costs, altogether out of proportion to what has been saved in the material. If a question should arise as to whether a top of a wide unit, involving a large span, should be made of #16 gauge, #14 or #12 gauge, the decision should not rest with the saving in cost between the lighter and heavier material, but what will be the extra cost in labor to produce the lighter top? How much additional reinforcing will be required? To what extent will the lighter top require closer spacing of bracing and therefore more bracing? What will be the effect on the cost of welding? How much more buckling will occur through use of the lighter sections, and how much additional labor will be required to remove this buckling and warpage? These are the factors which the well trained kitchen equipment engineer knows how to handle.

2. Operation and Maintenance of Equipment

Paralleling the high labor costs of the highly skilled factory labor required to build equipment is the very high cost of the operating and maintenance help used in and about a food service equipment installation. It is important, therefore, that the kitchen equipment engineer design all fabricated equipment to afford a minimum cost of operating that equipment. This, of course, involves proper construction detail, but likewise emphasizes the proper planning and layout of equipment. It is easy to understand how important it is, within a given piece of fabricated equipment having an abnormally long length, that it be so designed as to afford a minimum of travel between sections of that given piece of equipment. Consider also the confusion that may arise on the other side, say of a large serving counter, because service sections have not been placed in proper sequence, or the confusion and chaos that can result in the area between an improperly planned large serving counter and a back bar installation. Now more than ever must the kitchen equipment engineer pay close attention to the elimination of unnecessary personnel in the preparation and serving areas, and unless equipment is properly planned and designed, the cost of operation can run to abnormally high figures. It is important, too, that
the equipment be specified, designed, and built to withstand normal and rough usage about a kitchen. Not always is the highest type of kitchen help obtainable. Equipment which cannot stand up results in inconveniences, as well as in costly repairs. Where the overall equipment is light and flimsy, or where metal of sufficient thickness has been used but has been poorly put together the cost of maintenance can reach staggering proportions. It is important, therefore, that the kitchen equipment engineer, from the very beginning, plan the equipment layout to reduce operating costs within the preparation and service areas, as well as to reduce maintenance costs through proper selection of materials, proper design, and proper craftsmanship.

3. Sanitation

More and more will we be confronted by ordinances and codes regulating eating establishments. While such ordinances and codes are of general application, in time to come they will be specifically applied to food service equipment. From now on, the kitchen equipment engineer must place great emphasis on his thinking to achieve satisfactory results in this most important direction. One need only read the literature of The National Sanitation Foundation, insofar as it affects our industry and with specific reference to dishwashing equipment, to realize the importance of sanitation— not only in the dishwashing machine, but in all of the fabricated food service equipment which concerns our industry. The problem of maintaining equipment in a clean and sanitary condition is the instant problem of the kitchen equipment engineer. Unless equipment is designed and specified to afford simplicity in cleaning and maintenance of sanitary conditions, it can never be expected that such equipment will be so maintained despite any codes or regulations that may be imposed upon feeding establishments. Briefly, it is not the code alone, but the simplicity in the design of equipment to meet code requirements that will produce the desired result. I regret to state that there is virtual disregard today for the building of equipment so designed and constructed to afford ready accessibility for cleaning. Cabinets and enclosures are often so poorly designed as to make it utterly impossible to reach interiors. Shelves are rigidly fixed, doors are not removable, understructures are built with excessive light structural framing affording inaccessible crevices, nooks, and corners to harbor dirt, filth, and vermin, so that in an establishment of medium size, on the food service equipment alone, thousands of inaccessible corners and crevices are prevalent. With the high cost of labor and the scarcity of skilled kitchen help, equipment is not cleaned as often as it should be for the reason that the equipment itself presents obstacles against ease in cleaning. Often, no thought whatever is given to the design of a given piece of equipment from the standpoint of what happens to it after it leaves the fabricator's plant. How will the equipment be cleaned? What accessibility is there to all parts of it? I refer now to the most simple elementary forms of construction wherein it is possible to design equipment so that ready access is available to every inside and outside corner. I repeat again that it is of the utmost importance that the kitchen equipment engineer, who is responsible for the design and fabrication of kitchen equipment from now on be more fully concerned with such phases of design and construction that will afford sanitary maintenance of equipment at the lowest possible cost and with the least amount of back-breaking effort. The problem is simple, feasible, and attainable, but the will to accomplish it must be strengthened and emphasized. The cost of redesign and retooling will be high, but the progressive kitchen equip-
ment fabricator must face the problem sooner or later. Why not start right now?

In the past, but little attention has been given to the problem of sanitation at the site of the installation of food service equipment. Pieces of equipment are made in short sections with inaccessible spaces between them. Equipment is butted against walls with no possibility of cleaning in the rear of equipment. In other words, a myriad of inaccessible areas remain to collect, harbor, and retain dirt, filth, and vermin. It is possible to so design equipment as to keep such inaccessible spaces down to a minimum, or to reduce them entirely, and from now on this sadly neglected condition will have to be studied and remedied, properly planned for, and the plans scrupulously carried out.

4. FUNDAMENTAL PRINCIPLES OF CONSTRUCTION INVOLVED IN GOOD FABRICATED FOOD SERVICE EQUIPMENT

The fundamental principles of good fabricated equipment obviously involve considerations of first cost, operation and maintenance, and sanitation. I could not possibly attempt to cover such design and construction factors in this paper, but presentation of a few of the highlights will doubtless start constructive thinking along proper channels to achieve the desired result. I shall outline just a few elementary fundamental principles in construction detail:

(a) Consider any type of enclosed cabinet, whether heated or unheated. Just what would you look for? The cabinet should, by all means, be self-supporting, without the need of internal bracing by means of angles and channels, and, of course, should be made of a substantial gauge of stainless steel. The back and ends and part of the front should be formed of one piece wherever possible, with corners not too sharply broken. Sliding doors should be of overhead roller bearing type, readily and instantly removable, so that the entire interior of the cabinet may be exposed to view. The doors should preferably be of double wall box construction, thereby eliminating inaccessible recesses. Closed channels at the bottom should be avoided to prevent the accumulation of dirt and filth. The door itself should run free of the bottom and top guides, and not rub nor scrape nor grate against the retaining sections. The door should be guided top and bottom by means of independent clips on the uppermost of which are mounted the roller bearings. Handles should be of flush type and self-locking. With the doors readily removable, the intermediate shelf or shelving and bottom of the cabinet are immediately and fully exposed to view. The intermediate shelf or shelves should likewise be readily removable, and the bottom shelf, if over steam coils, should also be removable. We now have a cabinet readily accessible for rapid cleaning, simple and easy operation, and maintenance. Wherever possible and the budget permits, the cabinet and doors should be insulated and the rolling doors sound deadened to avoid radiation of heat and unnecessary clatter and noise. The external faces of the cabinet should be free of trim, thus avoiding a myriad of dirt catching crevices, making it so much simpler to wipe the exterior of the cabinet clean.

(b) I wish to emphasize the importance of rounded corner construction. It should be so obvious that a piece of equipment built with fully rounded corners is simple to clean, and since it is simple to clean, the equipment will be kept clean. The first cost is negligible when compared with the daily repeated high cost of cleaning square cornered equipment. It is the equipment itself, through improper design, which offers resistance to cleanliness and sanitation. Sinks, drainboards, soiled and clean dish tables, upturned flashings and splashbacks etc., should,
in all cases, have either fully rounded or slightly rounded corners, and all intersections at corners be fully coved. Not only will this afford greater ease in cleaning and maintenance of equipment, but it is important to emphasize that sharp corners accumulate dirt. Dirt invites corrosion, particularly on stainless steel, and corrosion is often apt to be progressive. In time, the corrosion could go right through a corner. True, round corner and coved construction is costlier in the beginning, but it soon pays for itself in savings of operations and maintenance, let alone the feeling of pride which we all have in clean food preparation and serving areas.

(c) Great strides have been made in the welding, grinding, and finishing of pipe and tubular understructures for tables, soiled and clean dish tables, and other equipment. Angle construction should be avoided and likewise pipe and rail fitting construction are undesirable. It is now possible to build understructures of pipe legs with longitudinal tubular cross bracing and pipe runners of all-welded design. Care should be exercised that the excess weld metal be ground smooth and polished, and the entire structure, where of stainless steel, polished to a high lustre. It is possible to accomplish this with modern techniques of assembly, welding and grinding. Such substitutes as tack welding in spots only and not finishing the welds, leaving crevices at joints, should be considered as unacceptable. Each crevice left with improper welding and finishing invites the accumulation of dust and filth. Wiping cloths catch in these crevices, making cleaning difficult. Improperly finished welding, in addition to forming dirt catching pockets, is often the cause of lacerated fingers and hands.

Consider, for a moment, how simple it is to take a cloth and instantly wipe clean the tubular understructure of a table, or of a soiled and clean dish table. The work requires minutes to do, instead of hours against what would be required on improperly built equipment.

Good sanitary construction not only invites cleaning because it is simple to do, but creates a sense of pride in keeping equipment as it was when installed. If the above elements are considered and incorporated in the design, specifications and building of a given piece of equipment, the important factors outlined in this paper will have been achieved, namely reasonably low first cost, ease and low cost of operation and maintenance, and good sanitation.

In conclusion, I realize that I was not expected to cover the entire field of kitchen equipment engineering. I have touched upon a few high spots. I know that this group does not have to be impressed with the importance of proper sanitation. That is your concern and your profession. If I have pointed out weaknesses in our industry, it is not because I am critical. If I have thrown light on a hitherto neglected phase of the food service equipment industry, I know that some good will result from my effort. That is one of the reasons why I accepted the invitation to address you. Insofar as the writer personally is concerned with respect to these engineering aspects, it is the chief concern of his company to build equipment that will meet the highest possible standards with particular respect to sanitation. Our investment in retooling is enormous and I hope that the results will be commensurate with the effort and cost.