
UNIT 16 PLANT AND EQUIPMENT MAINTENANCE

Structure

- 16.1 Introduction
- 16.2 Plant and Equipment in Food Services
 - 16.2.1 Definition
 - 16.2.2 Classification
- 16.3 Types of Plant and Equipment
 - 16.3.1 Plant
 - 16.3.2 Equipment
- 16.4 Maintenance of Plant and Equipment
 - 16.4.1 General Care and Maintenance
 - 16.4.2 Cleaning Systems
 - 16.4.3 Planning for Maintenance
- 16.5 Safety Concerns
 - 16.5.1 Safety Measures in Food Service Operations
- 16.6 Checks and Inspections
 - 16.6.1 Procedures
 - 16.6.2 Schedules
- 16.7 Equipment Suppliers
- 16.8 Let Us Sum Up
- 16.9 Glossary
- 16.10 Answers to Check Your Progress Exercises

16.1 INTRODUCTION

In our previous units, we have learnt about manpower management and the productivity of people working in food services at all levels of the establishment. Productivity in food services depends largely on the skills of people, the equipment available to them and the training they receive in the operation and maintenance of their equipment. This unit deals mainly with the equipment that people use especially at operative levels from where food is actually served to the customer in all types of food services.

The unit introduces some definitions and general classification of different equipments, discusses the types used by various establishments and ways of maintaining them in good working condition. Some design and safety features have also been introduced along with methods of cleaning and developing procedures for maintaining equipment to ensure sanitary practices, as should be observed in their handling, use and storage.

Objectives

After studying this unit, you will be able to:

- define plant and equipment in relation to food operations,
- identify the different types of equipment used in food services and their classification,
- choose the right size and type of equipment for a particular purpose,
- discuss the maintenance of equipments,
- explain the importance of water quality and cleaning agents,

- highlight the importance of personal cleanliness and equipment maintenance,
- describe some safety measures taken in food services, and
- establish procedures for carrying out inspections for ensuring safety of equipment and people.

16.2 PLANT AND EQUIPMENT IN FOOD SERVICES

Any food operation, regardless of its size, needs a plant and an equipment so as to function effectively and smoothly. You might have seen your mother preparing food at home using various equipments. Can you list them down? Well, these could be simple ones such as knife, peeler, grater, toaster, sandwich maker to a little bit complex ones such as blender, juicer-mixer-grinder or food processor, microwave, oven, refrigerator and so on and so forth. The list is endless. Well, before we further move on to this section, let us first understand what do the terms plant and equipment mean. Let us read and find out in the following sub-section.

16.2.1 Definition

With respect to food services, the term *plant* refers to *large pieces of equipment that need to be installed at a particular place in a store, kitchen or service area and used by the staff at that location*. Such equipment is therefore usually immovable and any one who wants to use it has to come to the equipment with the necessary ingredients that need to be processed. In other words, the *equipment is large and heavy enough to be planted or fixed at a chosen site in the establishment*. Some examples of such equipment are peeling machines, fryers, baking ovens, service units such as bain maries and the like. It is important to remember however, that while *all plant are equipment* in the form of large machines, *all equipment are not plant*, as they all cannot be planted or used at one location.

The term *equipment* is used for *all other appliances or tools that are partly or wholly moveable from one area to another for use as required*. These may include anything from a trolley to a ladle or knife that is used in any establishment small or large.

Next, let us get to know how equipment is classified.

16.2.2 Classification

Equipment may be classified in many ways according to *weight or size, the order* in which it is used in the production cycle of a catering establishment, or according to their *mode of operation*. Let us get to know classification based on each of these. We shall begin with weight or size first.

a) *Weight or size*

Equipment is often classified according to the weight of the metal sheet from which they are made, and often referred to as *light, medium* or *heavy-duty* equipment.

Do you know how the word *duty* got linked with equipment in this classification? Simply because, most catering equipment were imported by hotels and other food service establishments either as such or in the form of metal sheets to be used in their manufacture. The heavier sheets were charged a duty by the customs and excise department, which was slightly less for lighter metals. Today, food production equipment is also made in India but the term *duty* continues to be associated with equipment trade, whether it is imported or exported from the country. Let us get to know about these *duty* equipments further.

Heavy duty equipment: Equipment made from heavy metal are generally too heavy to move around easily, and are therefore generally fitted or installed after careful

planning of spaces and equipment use at the desired location. These equipments are therefore either fixed on a permanent platform or may be free standing with a 10 cm clearance from the floor for ease of cleaning. The features of heavy duty equipment are that they:

- perform heavy work,
- can operate for long hours,
- have a longer operational life,
- increase productivity, and
- improve cleaning and maintenance as the manufacturer assists in the servicing of the equipment.

Such equipments however, are *capital intensive* and require heavier initial investment for the buyer. Some examples of such equipment are cooking ranges, ovens, refrigeration equipment; dough-making machines, which are usually ordered through catalogues and specially, manufactured for the buyer and require a lag time before delivery. These equipments can therefore not be delivered immediately.

Medium duty equipment: It refers to those pieces, which with effort can be moved around for rearrangement and occasional cleaning. They may also be so constructed as to get dismantled for ease of cleaning, or fixed on wheels for easy mobility. Some examples are trolleys, food processor, cooking pans, small ovens and so on.

Light duty equipment: Light in weight and convenient in construction, light duty equipment is made from thinner metal or other materials, according to their utility. They can be carried around to any work area or cleaning and washing area. These equipments include most service equipment, cutlery, pans and ladles, knives etc.

The next classification of equipment is based on the *order of use*. Let us review this classification.

b) **Order of Use**

This classification is based on *the order in which equipment is used in the food production and service cycle*. All equipment in food services can therefore be placed into six categories namely, *receiving and storage, food production, service, cleaning, clearing and waste management* equipment. Let us have a brief look at each of these.

Receiving and storage equipment: As the name suggests, this category consists of equipment necessary for receiving food and other materials like linen, disposables, detergents, mops etc. Receiving and storage equipment include items like, weighing equipment for large quantity packs, platforms and other specific furniture and trolleys, storage bins, mobile shelving racks, built in shelving, ventilation and lighting equipment, office and security equipment. Large establishments may need mechanical or motorized lifts and carrying trolleys.

Food production equipment: This includes all appliances necessary for food preparation, cooking, holding and cleaning of utensils, ladles, knives, trolleys, kitchen furniture, crockery, cutlery and glassware. Office furniture for chef, and washing and restroom facilities are also essential for the staff in every food production unit.

Service equipment: Service equipment covers all heating and holding equipment, portioning tools, table dishes and disposables, cutlery crockery, glassware and the like. The type of equipment used is however largely dependent on menu and service style adopted by the establishment.

Cleaning equipment: Washing up or cleaning is usually carried out in one designated part of the kitchen as close to a source of plumbing as possible. The equipment would

involve sink units, sink incinerators, dish washers, glass washing machines and so on, in addition to shelving trolleys for clean utensils, pots and pans, which would involve air drying of the washed equipment. Complete washing up equipments are now available for large kitchens, which provide free flowing water and underground drainage. These are gradually replacing the use of multiple stainless steel sinks connected to water tanks on one end and waste disposal pipe on the other.

Clearing and waste disposal equipment: The equipment for cleared and other waste disposal has been transformed from the open dumps to closed bins, sealed bags and incinerators. The latter come as sealed units in models that can be fitted to sinks for crushing peels, bones from meats and any plate waste that is then passed through the incinerator to the general drainage provided. This also helps to reduce the bulk of wastes collected for disposal and keeps the environment of the food service clean. Incinerators are also available as freestanding units for dealing with waste materials collected in covered bins throughout the day. Waste disposal equipment is generally installed at a distance from kitchens, to avoid cross contamination of fresh, raw, as well as, cooked food.

This method of classifying equipment is the most commonly used in food services as it helps to relate equipment with the area in which it is located and used. Next, we move on to the last method of classifying equipments and that is based on mode of operation.

c) *Mode of Operation*

Methods of operating different equipment vary according to their design and functional features. Some are *mechanical*, some *fully hand operated*, others are *semi-automatic* and still others are *fully automatic*. Let us get to know each of these.

Hand operated: These equipments are operated by hand using the mechanical energy and effort of people, as they mix, slice or beat ingredients for food preparation. You must have sliced vegetables or tomatoes for salad using a kitchen knife, or grated ginger and onions for cooking. All these use human energy and we feel tired at the end of such jobs. Imagine what would be the state of people who prepare ingredients day after day by hand, especially in large quantities in food service operations.

Semi-automatic: These make use of electricity to reduce the effort; as such the press of a button operates equipments after connecting to an electrical socket. Some examples are mixers, beaters, toasters, which though functionally electrical, need to be monitored or supervised by people for optimum results.

Automatic: These include models designed with auto controls for temperature and time of use. They are fitted with thermostats and timers that ring an alarm, when the time set for cooking is completed such as bakery ovens, cookers, steamers fryers and so on. Automatic equipments are generally electrical equipment and require less effort to operate, because once the timers are set and the dish placed into the oven to cook, they are started with the press of a button. The productivity also increases as the staff have more time to attend to other work while the cooking is in progress, and monitoring time is saved since the equipment will switch off automatically when the dish is ready.

With this, we finish our understanding of the different types of classifications of large and small equipments and their uses in food operations. Let us further move on to the types of plant and equipment in the next section.

16.3 TYPES OF PLANT AND EQUIPMENT

We have just reviewed both the large and small equipment used in food operations. Let us therefore see how many types of plant and equipment are used by the different kinds of food service establishments such as restaurants, hospitals etc. We start with plant.

16.3.1 Plant

As already defined, plant refers to *all heavy-duty equipment used in any operation*. You may recall reading about *heavy-duty* equipment in this unit earlier. When such equipments are placed in a sequence to perform various functions one after the other as in a factory or base kitchen, the set up is known as a *plant* and is used for very large operations such as in the case of air or railway catering kitchens. These are often called *central kitchens*, the food being produced in large quantities and then distributed to service points. Can you think of any examples? Well, the most common would be the *Nirula's* base kitchen from where the processed food and ingredients are transported in refrigerated vans to their satellite outlets. *Mother Dairy* milk is another example of a factory plant that controls the quality of milk and its products and then transports them in refrigerated vans to the various outlets.

Another type of heavy equipment arrangement is used in *hospital kitchens*, in which selected heavy duty equipment are installed for the performance of those jobs which require a lot of human effort and time and also produces an irregular or variable result. Some examples are *weighing equipment* at receiving points where large quantities of raw foods are delivered, or *peeling machines* usually installed adjacent to sink units, as they require plumbing in addition to electricity supply. Installed equipment not only takes care to provide standard quality of the end product but is quick and requires little human effort to get consistent results. The result is that large quantities can be handled with ease at one time.

Of course, a number of factors are responsible for the right choice of the equipment and its capacity, according to the needs of each food operation such as the menu, design features, ease of operation and cleaning, safety for the operator, cost of installation and the maintenance contract with the supplier.

Next, let us get to know about the equipment.

16.3.2 Equipment

The equipment used in food services is of many types depending on the size and material out of which it is made. Equipment may be small or large and made of metals like copper, aluminium, galvanized steel or iron, chrome, silver, polyethylene, glass, ceramic or even mud pots baked in the sun or glazed in a kiln, or cups and spoons made of leaves, grasses and wood shavings, as was common for traditional disposable equipment. Figure 16.1 shows the shapes and types usually used even today in some food services to give the traditional touch. Other disposable equipment made of plastics, paper, cardboard, aluminium foil and so on, have now largely replaced them in modern versions.



Figure 16.1: Some traditional and modern disposable equipment

Each type of equipment has its own advantages and disadvantages with respect to utility for a particular type of establishment. These are briefly discussed herewith.

- a) *Mobile Equipment*: As the term suggests, such equipment can be moved from one work area to another as is the case with trolleys, sinks, mobile table tops on which food processors may be placed for use to be wheeled to different areas of food production activity. Some equipments are presented in Figure 16.2.

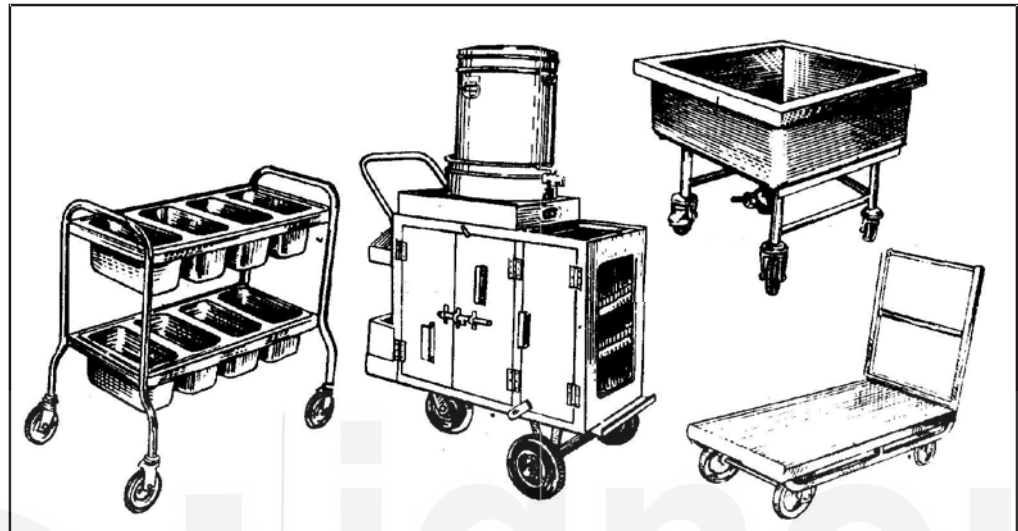


Figure 16.2: Some mobile equipment

Any medium duty equipment can be made mobile for flexibility of use and placement in a food service. This not only saves human energy and time in lifting out equipment and carrying it to wherever it is needed for use, but also enables it to be taken to the sink unit for proper cleaning. The cleaning of spaces under the equipment also becomes easier and more efficient when they are moveable.

- b) *Modular Equipment*: When two or more equipments are put together as a single piece the equipment is called *modular*. For example, a cooking range, which also has an oven and grill built into it along with burners or hot plates on the top for cooking, would be termed *modular*, as it would come as a single module.

This is also sometimes referred to as *multiuse* or *multifunction equipment* because the same piece can be used for performing many different functions in food services. Some equipments are designed in a manner that enables parts of one to be used interchangeably in another equipment. Modular equipment is very useful where size of the establishment is small and number of equipment that can be installed or stored are limited. Some models are indicated in Figure 16.3.

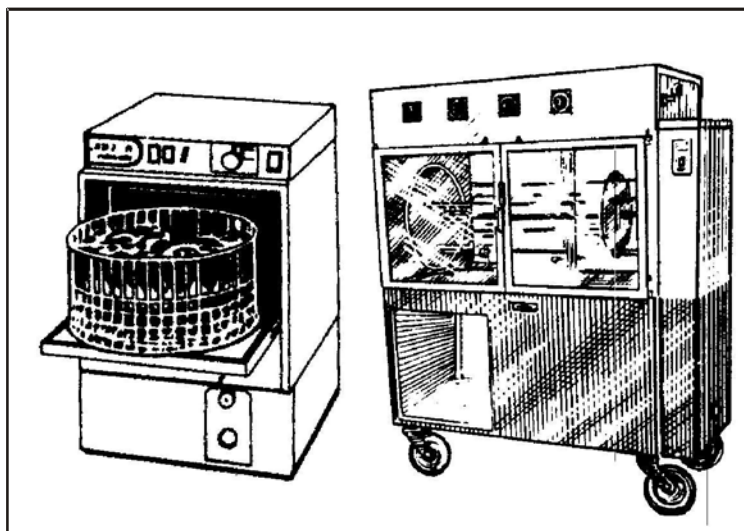


Figure 16.3: Modular equipment

A few of the equipment in this category are briefly described to indicate the different ways in which one piece of equipment can be utilized.

- *Pans and trays*: The pans or trays that fit into a bain marie can be made to dimensions that also fit into the oven for baking, get stored on the refrigerator shelf, fitted into a hot or cold trolley shelf and wheeled in for service as required. Sometimes spaces can be made to size to match the standard sizes of equipment available. For example, a 9" × 12" or 12" × 18" pans to fit into the same sized space. Modular equipment minimizes the handling of food, as well as, washing because food transfer from one pan to another is reduced to a minimum.
- *Food processor*: A food processor comes with multiple attachments and can be used for grating, slicing, chopping, mincing, grinding and even juice extraction. It is however, also a disadvantage to use only one machine all the time because in case it gets spoilt, quality and productivity get hampered. This can however, be overcome by regular maintenance, to extend its life. In addition, replacements too, can be planned in advance as soon as its estimated life is nearing completion.
- *Griddle plate*: A griddle plate is a heavy duty electrically operated equipment and usually comes in square or rectangular shapes. It can be used to cook a variety of dishes such as *chappati*, *dosa*, eggs, pancakes, *papads* and shallow fried products like cutlets, parathas etc.
- *Steamer*: A steamer can also be used for preparation of a large variety of foods such as steamed vegetables, fish, eggs and steamed fermented foods like idli, dhokla, momos and the like.
- *Boiler*: Boilers like steamers are very versatile equipment and can be used for cooking any food in liquid. In food service kitchens they are used for blanching foods, making curries, soups, stews and so on.
- *Kadai or wok*: A *kadai* is a piece of equipment very similar to the Chinese *wok*. It is made of metals like galvanized iron, heavy to medium duty aluminium, iron, steel and today available with non-stick coatings as well in order to make them lighter to handle. For very large quantity cooking, tilting pans are used in hotels to prevent lifting, but the utility is similar to that of a *kadai* especially for stir-frying, mixing, roasting, shallow frying or simmering and poaching foods.

There are a number of equipment available for use of food service operations that are general purpose and multifunction in their potential such as trolleys, trays, bins etc. which can be used in any area of the establishment for carrying goods, crockery, cutlery and so on. Some of these are shown in Figure 16.4.

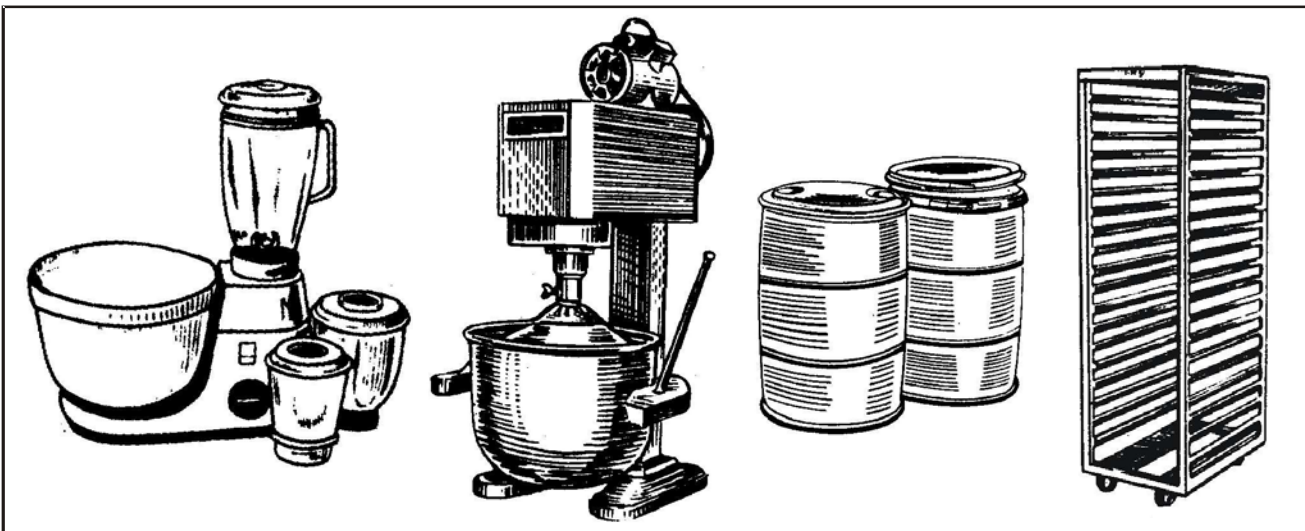


Figure 16.4: Some multifunction equipment

The advantages of such types of equipment are that it:

- occupies less space and therefore can be installed by small to medium sized services,
- flexible in use,
- lowers investment, and
- has a greater utility.

Creative and innovative food production staff can convert equipment designed for a single use into multi function units. An outstanding example of this is the use of the doughnut machine being used for *vada* preparation in the *Nirula's* base kitchen in Delhi. Perhaps other batters of similar consistencies can be used for preparing a greater variety of products with versatility and making the equipment more cost effective.

c) *Labour Saving Devices*: Labour saving devices are equipments which help to reduce energy and time of staff in production and service of food, or in clearing and cleaning of dishes, and in waste management. The special features of such equipment can be summarized as:

- Time and energy saving
- Improve quality of food
- Increase productivity
- Standardize portions
- Decrease food handling
- Ensure food safety

Some examples of labour saving equipment are *peeling machines, dish or glass washing equipment, thermostatically controlled ovens storage equipment, detergent dispensers* and so on.

d) *Custom built Equipment*: As the name suggests, this equipment is usually made according to the specifications and size desired by the buyer. In other words, it is specially designed for the customer's requirements. The equipment may vary from furniture, to a size of container, fridge, blender, peeling machine to just any thing or feature that the buyer might like for his establishment. For instance, equipment can be ordered to fit into a particular space available or made to a size or capacity required.

Since it is specially manufactured for the customer, it is more expensive and spare parts for it would have to be specially designed for it when needed as the standardized mass produced ones would not be appropriate. Manufacturers generally offer the service for manufacturing equipment according to the specific needs of establishments for size, shape, weight and fit.

Before we move on to the care and maintenance of the plant and equipment we just studied, let us take a break here and recapitulate what we have learnt so far.

Check Your Progress Exercise 1

1) What is the difference between plant and equipment?

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- 2) In how many ways can equipment be classified? List the methods giving examples under each.

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- 3) What kind of equipment are the following:

- a) Food processor
- b) Cooking range with oven and grill
- c) Glass or dishwashing machine
- d) Specially designed equipment
- e) Food trolley

16.4 MAINTENANCE OF PLANT AND EQUIPMENT

You must have noticed that it is very essential to keep the equipments clean that we use during food operations. Even at our homes, where the cooking is not done at a massive scale as is in the case of hospitals or restaurants, our mother ensures that all equipments are stored clean and dry. Why it is important to do so? Well, this is to ensure their long use and safety, as well as, the safety of the personnel handling it. All equipment large or small, heavy or light requires careful handling in use, cleaning and storage to maintain it in good, relatively attractive and usable condition. Proper care and maintenance also extends its life by reducing the depreciation or deterioration of efficiency of the equipment. When used improperly or not at all equipment deteriorates in its performance capacity very rapidly. Let us see how we can keep it operating efficiently and maximize the returns on investments made on plant and equipment. General care and maintenance of equipment follows.

16.4.1 General Care and Maintenance

In the case of heavy equipment installed by the manufacturer, general care needs to follow certain simple guidelines such as:

- Keeping equipment clean using methods recommended by the manufacturer.
- Washing all removable parts after use, with suitable detergent and hot water, then air-drying them completely before refitting for next use.
- All small equipment like cutlery, chopping boards, kitchen and service tools should be washed with detergent and rinsed in hot water, air dried, to avoid contamination through excessive handling, and then stored on racks ready for use.
- Close supervision is necessary at work to ensure that correct handling methods are being followed for each type of equipment.
- All electrical inputs to equipment should be checked periodically to ensure that the proper electrical load is available for their efficient operation.
- Insulation, plumbing and other connections need periodic checks to keep them operating at optimum efficiency.
- Simple instructions in a form understood by operators should be pasted above the equipment so that anyone who operates that equipment can refer to the instructions when in doubt, about any sequence in its operation, repositioning washed parts and so on.

- An unusual sound detected while equipment are in use or warning lights found fused, should be attended to immediately. Timely repair will prevent equipment breakdown and long disruptions in production and service.
- A weekly, fortnightly or monthly programme or schedule for oiling or servicing equipment is important to maintain machinery in order.
- Assign the care of each machine to one responsible person.
- Make full use of warranty periods to help train operating staff and supervisors, to learn regular maintenance procedures from the manufacturer's engineers.

The servicing procedure supplied by the manufacturer for each equipment bought, provides a good guide for general care and maintenance of heavy and medium duty equipment. In the case of small or light duty equipment such as cutlery etc. some metals require less specialized care than others. Stainless steel is the most easy-to-care-for metal as it is non-corrosive as compared to silver or other plated materials that get easily scratched and unsightly with use. These therefore need care more frequently in the form of re-plating and polishing.

With kitchen tools like chef's knives, choppers etc. care is limited to preventing the blades from rusting if they are made of iron, and keeping them dry and covered or lightly oiled to prevent oxidation. With whisks and beaters, it is the rotating parts or wiry ends, which need special attention. It is good practice to wash or soak these immediately after use to prevent foods from drying on them and making cleaning difficult.

In small establishments, the care and maintenance functions are usually entrusted to those who operate the equipment, as the types invested on are usually light or medium duty pieces. In larger establishments, heavy-duty equipment predominates, and therefore a maintenance department performs this function for the entire organization.

General cleanliness of equipment in storage and in its operational environment therefore, is the guiding principle in good care and maintenance. Money, time and effort spent on care helps to maintain equipment in continuous working order, while that spent on repair can result in work interruptions causing unnecessary strain on staff, in addition to incurring extra costs.

Let us next have a look at the cleaning schedules. What are these and how these must be administered for better care and maintenance of equipments?

Cleaning Schedules

Before moving on to the cleaning schedules and its understanding, let us understand what do we mean by the term *schedule*. Schedules are *instructions laid down to guide the staff in the cleaning of equipment in their charge*. They should therefore be simple to understand and follow at work.

Cleaning schedules involve routine cleaning of equipment, which is generally the responsibility of the operative staff of an establishment. All staff must understand the proper procedures for cleaning and strictly follow schedules laid down, not only for equipment cleaning but also the areas in and around the organization. Managers in-charge of food operations may make schedules for cleaning on a daily, bi-weekly, weekly or fortnightly basis according to the size of the facility, equipment, its design and frequency of use. The cleaning schedules for some commonly used equipment in small to medium sized establishments are briefly discussed.

- a) *Cooking equipment*: These include, hotplates, gas stoves and cooking ranges. The cleaning schedule for these equipments include:

- Wipe the top daily while still warm using wet cloth or sponge.
 - Any food spilled and burnt during cooking may require the use of mild detergent, or scouring pad.
 - For open burners a weekly boil in warm soapy water will help to remove any food particles that may have caused blockage of pores, leading to inefficient heating.
 - Wipe dry with slightly oiled cloth.
 - Sharp edges should be carefully handled while cleaning.
 - Dry and carefully refit the parts into the machine for use.
 - Small equipment like graters, peelers, knives and other sharp tools should also be cleaned immediately after use so as not to allow food particles to dry on it.
 - Cooking pans need to be soaked in hot water; adhering food removed with a brush, and cleaned using a scouring pad and suitable detergents.
- b) *Ovens*: These may vary in size and type depending on the usage and size of establishment. Cleaning schedule for oven includes:
- Wash and rinse the outer surfaces daily and after every use.
 - Use liquid wax for enamel finished parts.
 - Brush the insides clean to remove any sediment due to food particles charred during cooking, while the oven is switched off but still warm.
 - Any sticky areas may be wiped.
 - Clean all plastic knobs with wet cloth and wipe dry.
- c) *Holding Equipment*: This includes equipment like refrigerators, food warmers, bain maries, each requiring slightly different cleaning routines. The routine include:
- Refrigerators may be cleaned twice a week or weekly depending on the type and amount of foods being stocked.
 - They require to be emptied out, defrosted completely, wiped with a sponge dipped in mild detergent, and then dried with a soft moist cloth dipped in warm water.
 - After cleaning the door should be kept open for air-drying for 15-30 minutes.
 - Close door and switch on the fridge, for half an hour before filling it again.
 - Wipe with a soft cloth wringed in hot water, and let air dry till required for use.
- d) *Preparation Equipment*: All removable parts should be cleaned after every use, with a scouring pad using a light detergent.
- e) *Serving Equipment*: Food warmers need to be cleaned after each use as for ovens. This means at least 2-3 times a day after each mealtime depending on the type of food service operation.

Bain maries require daily cleaning as they are used at mealtimes every day. The routine involved should be:

- Remove the food containers and lids from the equipment and send for pan washing.
- Drain out the hot water used for heating the equipment completely and wipe dry after every use.
- Wipe with sponge containing mild detergent to remove any adhering food that may have spilled during service.

Beverage equipment includes tea and coffee urns, brewing or filtering equipment and vending machines.

- Equipment should be emptied out after each use, the insides cleaned with a hard brush using a solution of sodium bicarbonate.
- Outer surfaces may be cleaned as for any other equipment described.

In general, it is a good policy to follow manufacturer's instructions for care and maintenance of any equipment, small or large.

Now that we have gone through the cleaning schedules that must be followed for different equipment used in the food operations, let us move on to the cleaning systems that are in use in various food service institutions, next.

16.4.2 Cleaning Systems

There are two basic systems followed for cleaning in food service operations, *manual* and *mechanical*. Let us get to know each of these. We shall begin with manual system, first.

- *Manual system:* This system is also known as *hand washing* and is generally followed in small to medium sized establishments. In this, people do the cleaning of pots, pans and other utensils by hand. The system requires a row of sinks from 2-5 depending on space available in the washing area, to enable soaking, washing, rinsing and sanitizing to be done before letting equipment air dry for next use. Manual cleaning is also done for installed or fixed position equipment such as ovens, boilers, griddles and equipment that make use of steam for its operation. Further all removable parts of mixing equipment such as juicers; blenders knives etc. are also cleaned manually.

If hot water is used for sanitizing, the relevant sink compartment should be supplied with enough water that can be maintained at 75-77°C and provided with a basket to allow complete immersion of equipment in it. Figure 16.5 shows the sequence of manual washing operations.

Sanitization can also be done by adding chlorine to water (50 mg per litre at 24°C and immersing the utensil basket in it for one minute. Iodine solution can also be used for the purpose by dissolving 12-13 mg per litre at room temperature and exposing the washed utensils for the same period. The water should however, be changed regularly and temperatures monitored either with a thermometer or a thermostatically fixed device if a heating element is provided in the design of the rinsing sink.

- *Mechanical System:* In this system, dishwashing machines are used for cleaning delicate or expensive equipment such as glassware, crockery and cutlery, which needs to be sanitized for customer use. There are many types and models available according to the needs of each establishment.

Single tank, stationary rack machines wash only one rack at a time, which is loaded manually. These may operate at single or dual temperatures for wash and rinse cycles. Conveyor machines may have one or more tanks which move through the machine automatically. This type of unit is used in very large washing areas connected to base kitchens as in the case of air catering services which are high volume operations.

The basic mechanical washing procedure involves a number of steps that are listed in the user manual provided for each model. These must be strictly followed for proper cleaning and sanitization of equipment. The steps must however be listed clearly in the washing area for the operators to follow, such as:

- Scrape soiled dishes and presoak them.
- Rinse to remove all visible adherents.
- Place in rack so that water will spray evenly on all surfaces.

- Adjust the wash and rinse cycle at 70 - 80°C for 7 seconds or according to instructions in the manual.
- Final rinse at 82°C
- Air dry.
- Stack clean without touching surfaces that come in contact with food.
- Clean the machine according to instructional manual.

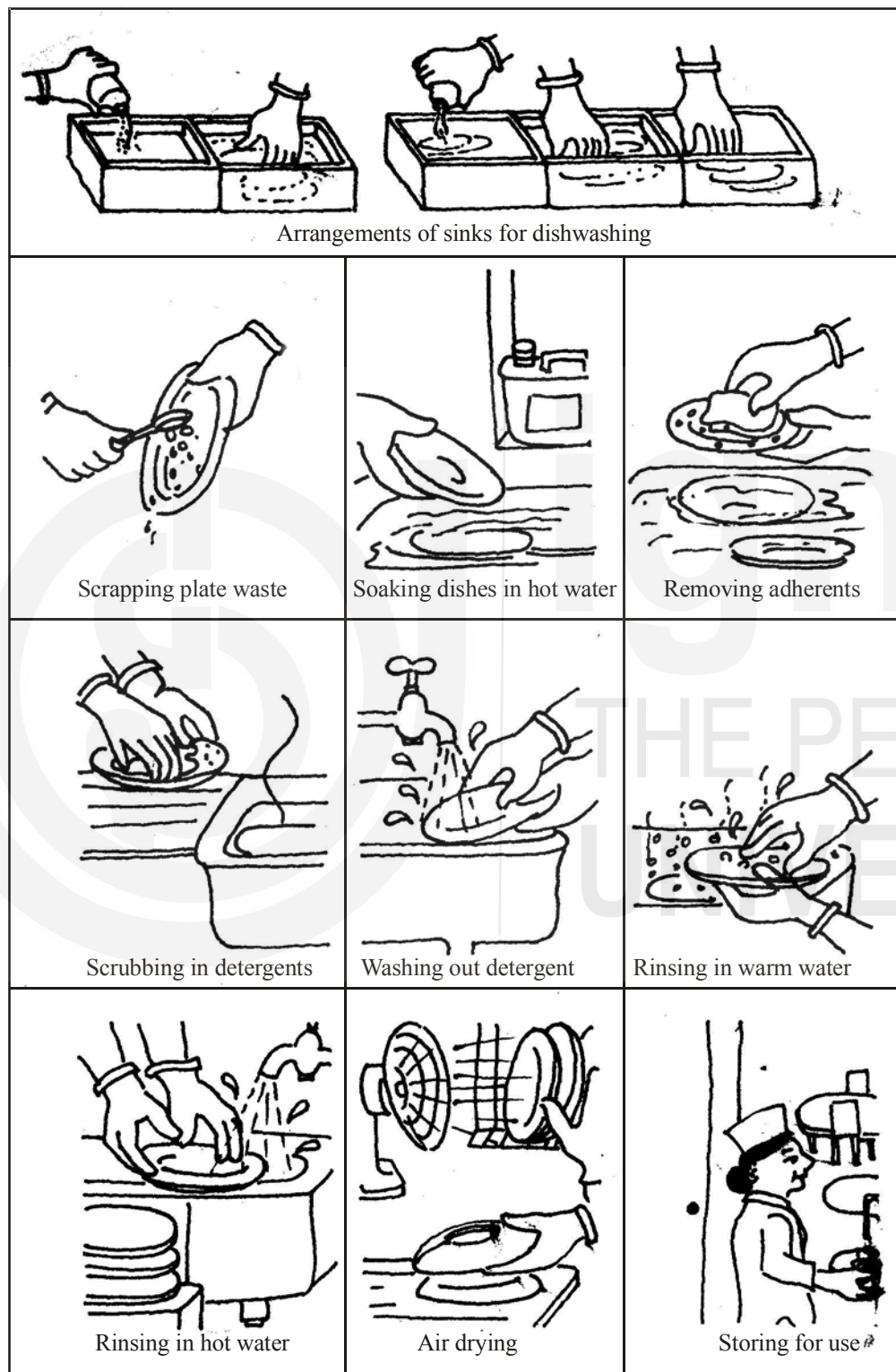


Figure 16.5: Manual dish washing process

To machine wash dishes, it is important to read the instruction manual for each equipment carefully and follow them strictly, to optimize their cleaning and sanitizing ability. As with manual systems, enough counter space must be provided for accumulation of soiled tableware, which must never come in contact with clean equipment at any time.

It is imperative that staff should be well trained in their operation and maintenance to prevent undue risks to themselves, as well as, to the equipment. This would also control the costs of operations in the long term.

Now that we are well versed with the types of cleaning systems, let us study further about the different cleaning materials and cleaning agents that can be used in different food operations.

Cleaning materials

Food operations require a number of cleaning materials according to the surfaces that need to be cleaned. While this requires the most attention, it is observed that cleaning materials are easily wasted especially in large establishments, where attention of supervisors is not focused on this area of activity and usage. While most managers are extremely conscious of the importance of thorough cleaning of utensils used in food preparation and service, even the kitchen staff themselves look upon *dishwashing* as a menial task. This is because cheap unskilled labour is usually employed for cleaning jobs, which therefore become the most unrewarding and the least efficient.

The introduction of dishwashing machines have somewhat upgraded the job, but then staff including supervisors, need to be trained in their use and maintenance. Supervisors usually check for surface cleanliness and pay attention to equipment such as tableware, but not how much cleaning materials like soaps or detergents actually go down the drain. Excess use of cleaners actually damage surfaces, equipment, as well as, the bank balance because cleaning materials are expensive.

Control in this area of work is difficult but essential, and staff needs training in the use of the right cleaning materials and correct measures in terms of cups per sink of water, or tablespoons per wash and so on. This can drastically change the profitability of the establishment. After having understanding of cleaning materials, let us next have a look at the various cleaning agents that are used in food service operations.

Cleaning agents

Cleaning agents are of various types ranging from *water* to *synthetic chemical compounds*, which dissolve or disperse soil, and hold the particles in suspension in the washing water. They are particularly effective in removing fats and oils.

All cleaning involves the use of water, a detergent or scouring powder or abrasive and something to scrub with. The nature of these components, affect the quality of the wash and the degree of cleanliness that can be maintained.

Many formulations are available in the market for cleaning and sanitizing of premises and equipment to make them safe. These act by removing surface dust and soil and destroying microorganisms which if allowed to grow can cause harm to both staff and customers, through the food prepared and served in the establishment. Some cleaning agents used in food operations are discussed below.

- *Water*: The two important aspects to be considered in the water used for dishwashing and cleaning purposes, are its *quality* and *temperature*. The quality refers to its being free from pollutants and soft and therefore requires occasional testing in order to decide what kind of detergents are necessary for a good safe wash. For water to be considered safe, it must contain less than 22 coliform organisms per litre, which though not all pathogenic or disease producing, indicate sewage contamination and requires sterilization before it can be considered fit for use in dishwashing.

The term *pure* or *unpolluted water* is generally used to indicate *the absence of microorganisms*, but it may still contain some dissolved chemicals. When calcium and magnesium salts are present the water is termed as *hard water*. When such water

is repeatedly used for washing dishes or cleaning equipment it leaves a coating that prevents efficient heat transfer. Scaling may also block pipes or leave deposits on which microorganisms can grow making cleaning difficult and affecting food quality. Hard water flowing through boilers therefore reduces their efficiency. The steam from such boilers also becomes alkaline, and starts corroding aluminium and tin lined utensils. If the calcium and magnesium is present as bicarbonates, the hardness can be removed by simple boiling, but as sulphates they make water permanently hard and can be removed only by a process of precipitation.

The use of ammonia softens the water, as well as, emulsifies adhering fat on the dishes being cleaned. Addition of vinegar often helps in cleaning as it neutralizes alkalinity of the water. Washing soda softens water but is injurious to health because it is a strong alkali. It is often used as an ingredient in cheap washing powders but is useful for clearing pipes after the washing is done.

Besides being hard or soft, the *acidity* or *alkalinity* of water varies. Soft water foams better with soaps and brings about better penetration of detergents into materials adhering to dishes resulting in better cleaning. Water at high temperatures destroys microorganisms, besides softening the water. Temperatures best suited for dishwashing are 50°C for the pre-rinse, 60°C for the wash and 80°C for the final rinse. In no case should the temperature be below 60°C for the wash.

- *Detergents*: Chemical compounds or their mixtures used for cleaning purposes are called *detergents* and are relatively unaffected by hard water. They are more alkaline than soaps, which are alkaline salts of organic acids. Soaps are primarily for hand washing because they do not irritate the skin as detergents do. The major disadvantage of using soap is that it produces a scum or residue when combined with hard water. Detergents henceforth are sure better than soaps and water. Then, how do detergents work? Let us see this next.

Action of detergents

Some detergents soften water others exercise a germicidal effect, but they do not replace sanitization which removes harmful bacteria and other microorganisms. There are some factors important to selecting detergents that are:

- Surface to be cleaned,
- Type of soil, and
- Cleaning process.

Dishwashing detergents need to be measured carefully to ensure good results, because using excessive amounts of detergents does not ensure better cleaning and sanitization. Detergents used for manual washing of dishes are usually in liquid form, while those used for dishwashing machines through automatic dispensers are powders. Some highly alkaline detergents may irritate the skin and therefore need to be handled with rubber gloves. Let us review a few of these cleaners.

- i) *Abrasive cleaners*: These are powders used to scour off rust, grease and heavy soil. These contain substances that can permanently scratch stainless steel and porcelain surfaces and therefore should be used with caution.

Contrary to normal belief, staff should be properly trained to use abrasives for proper maintenance of equipment.

- ii) *Acid cleaners*: These vary in their strength according to the amount and degree of cleaning required and the obstinacy of the stains to be removed. Weak citric acid is used for wiping stainless steel, hydrochloric acid (HCl) often called *plumber's acid* is used to remove mineral deposits formed on equipment due to use of hard water. Acid cleaners must be used with care in the correct dilution or strength as they may cause skin irritation and food contamination if the staff are untrained or careless in their use.

- iii) *Degreasers*: These are highly alkaline cleaning agents and also skin irritants, and usually dissolve in solvents like alkali, chlorine and hydrocarbon solvents. Some are water soluble or used as vapours to clean kitchen exhaust ducts. Solvent cleaners are produced from emulsifiers and hydrocarbons used specially for heavy-duty equipment to remove grease from surfaces.
- iv) *Metal cleaners and polishes*: These cleaners are oils or oil emulsions that remove both soil and oxidation from pans and pots. If not rinsed out properly they leave a white film, which contaminates equipment and food.
- v) *Deodorizers*: These are used to remove unpleasant odours, but may leave a residue on surfaces, if not used properly. These should never be used in place of cleaning.
- vi) *Sanitizers*: These are chemical compounds that destroy harmful microorganisms, the details of which you will study in the next unit on sanitation and safety.

By now you must have realized how important these cleaning agents (water, detergents and its types) are and how essential it is to use them effectively and safely. Let us next understand the handling of these in food operation.

Handling cleaners and sanitizers

The cleanliness of any operation, as you would have realized, is largely dependent on the people who handle the products that clean. So while training of staff is vital to impart the methods of using cleaners and sanitizers effectively, some broad guidelines need to be pasted in every area of operation as a constant reminder. These are:

- It is dangerous to mix cleaning formulations with sanitizers.
- Follow manufacturer's instructions before use.
- Clearly label cleaners.
- Store under lock and key.
- Do not store alongside food products.

In some cases, outside agencies are hired for cleaning and maintenance of establishments. They need to be briefed about the dangers of leaving residues from cleaning materials on work surfaces where they could come in contact with food and contaminate it.

You would definitely recall reading about planning as one of the most important steps in the management of any organization. Here, also we do need to plan out equipment and plant maintenance. How can we plan out these effectively for each area of food operation, such as kitchen, service areas, storage etc.? How do we go about it? Let us read and find out in the following sub-section.

16.4.3 Planning for Maintenance

It is useful for every food service operation to keep records of all amounts spent on the care and maintenance of each piece of equipment in every area of operation. The maintenance procedures will vary according to the *size, usage, and simplicity of design and mobility* of each equipment. The larger the size and weight of the machine, the less will be its mobility and more complex its design. All these factors affect the type of maintenance that equipment requires.

Since every type of equipment requires different maintenance treatment, there is a need to plan for it to ensure that equipment do not lie idle due to disuse or misuse at any time when required.

- *Maintenance in kitchens*: The maintenance of equipment in kitchens is extremely important because the maximum number of heavy and medium duty equipment are used in this area of production. For any kitchen therefore, a schedule for

general and specific equipment maintenance is essential, a sample of which is presented in Table 16.1.

Table 16.1: Maintenance schedule for kitchen

Area of Activity	Maintenance Schedule
<i>Drainage</i>	Grease traps properly emptied and cleaned at regular intervals before refitting.
<i>Physical structure</i>	
• Floors	Wash, mop and sanitize daily.
• Walls	Those above sinks and basins wash daily.
• Ceilings	Clean twice a week to prevent cobweb formation, or dust accumulation.
• Work surfaces	Inspect corners or edges for lifting or stripping. Renew as often as necessary.
• Windows/doors	Dust daily and wet clean twice weekly.
• Fittings	Clean weekly.
• Equipment	Light-clean daily; heavy-twice a week following maintenance procedures according to manufacturer's instructions.

Record forms may be kept updated for the maintenance of large and small equipment. A sample of such format is placed in Figure 16.6 and 16.7, respectively.

Appliance or item	Purchased from
Style	Date of purchase
Size	
Quantity purchased	Cost
ReplacedPieces onby	Reason
Balance amount as on	

Figure 16.6: Record form for small equipment

Name of Equipment	Purchased on
Manufacturer	Supplier
Cost	
Estimated life	
Specifications	Motor horsepower
	Wattage/Voltage
Size TypeCapacity	
Estimated rate of depreciation	
Date of repair	
Nature of repair	
Cost of repair	Engineer
Remarks	

Figure 16.7: Record form for large equipment

Next, let us get to know about maintenance in service and storage areas.

- *Maintenance in service areas:* The equipment required to be maintained in service areas differs slightly from that in kitchens being mostly holding equipment for food, cutlery and crockery, glassware, as well as, table appointments such as cruets, candle stands, vases, napkin holders, baskets and table dishes. It will vary with the nature of the establishment, its menu and the style of service followed.

Holding equipment may include bain marie which holds food hot during service and is usually operated by steam. The food warmer, on the other hand, requires direct electric connections. The maintenance of each equipment requires different methods for small, medium or large pieces and therefore separate procedures have to be established for proper maintenance.

- *Maintenance in storages:* Storages usually have a limited number of equipment to maintain such as storage racks, bins, baskets, weighing equipment and trolleys. The schedules for cleaning, on a daily or weekly basis is the norm, or whenever a bin or drum gets emptied of food after issue to user departments.

Other than cleaning and maintenance equipment, tools such as brooms, brushes, mops and buckets are used for cleaning jobs, and need to be stored for easy accessibility. The storage needs to be planned so that they are kept and cleaned away from food handling or production areas to prevent cross contamination of the food, utensils and linen at every stage and area of production and service.

In general, staff is the key to the cleanliness and maintenance of areas using food and cleaning materials, therefore procedures followed by them in all areas of operation are vital. The important message is *clean hands, clean equipment and clean surroundings*, to minimize the possibility of contamination due to microorganisms, insects and rodents. In conditions where staff hygiene is paramount, the agents of contamination and infection cannot thrive, making food operations safe for all – staff, customers and visitors.

When consciousness of the above is high among staff and procedures are systematically carried out, maintenance follows on its own to prolong the life and optimum usage of the appliances, irrespective of their size or nature.

Maintenance, hence, is an ongoing process and needs to be performed according to the schedules prepared for the needs of each operation. All maintenance activities should be recorded in a logbook with details of any special attention needed, along with date and any replacements required. Equipment maintenance should be the responsibility of a single manager, who also deals with engaging outside contract services when required such as fumigation of storages and other areas as required.

Schemes for preventive maintenance need to be planned to reduce both risks and costs. What is the maintenance costs associated with equipment? What factors determine it? Let us read and find out next.

Maintenance Costs

The cost of maintaining any equipment should be determined on the basis of the following factors:

- Cost savings in terms of fuel consumption.
- Cost of servicing and regular cleaning of equipment.
- Rate of depreciation over the expected life of the equipment.
- Better utilization of raw ingredients and prevention of waste after installation.
- Any resultant reduction in staff costs through elimination of daily wagers.

Any equipment that requires less money to buy can prove very expensive in the long run if its maintenance costs are high. It is, therefore, important to weigh investment and maintenance costs carefully before deciding to spend the money on any equipment.

Before we move on to the safety concerns, let us take a break here and recapitulate what we have learnt till now.

Check Your Progress Exercise 2

1) How can the following equipment be maintained?

a) Heavy duty machines

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b) Kitchen tools

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2) Fill in the blanks:

a) All equipment should be washed and with water.

b) inputs should be checked to ensure that proper electrical load is available.

c) operators should be thoroughly before they use any expensive equipment.

3) Briefly discuss the term cleaning systems.

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.....
.....

4) Give the difference between:

i) Detergent and sanitizer

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ii) Abrasives and degreasers

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.....

16.5 SAFETY CONCERNS

When selecting any equipment for a food service its safety features should be the most important criteria. Let us see what these factors or features are. They include all those features that relate to a manager or supervisor's concern for safety of:

- Staff
- Equipment
- Establishment
- Customer

Let us take up each of these next. We shall begin with staff safety first.

- *Staff safety:* Staff needs to feel safe when they operate any equipment, and the confidence will only come if they are instructed and trained properly in its use and maintenance. They also need to understand how the equipment will help them in their jobs to produce the desired quality consistently, and the necessity for its maintenance to reduce their effort and time.

The managers too need to understand the features of the equipment design so that they can judge for themselves the impact it will have on their staff and customers especially in terms of food safety.

- *Equipment safety:* The equipment should be simple in design so that any operator can understand how to use it without much difficulty. Parts, which come in contact with food during operation, should come apart easily for cleaning and sterilization, and then be put back without a problem. It should not have any sharp edges that can cause cuts or bruises every time it is cleaned. Every equipment should be demonstrated in operation prior to sale, so that the expectations of managers and operating staff are satisfied.

It is also important for food services to contract for installation and maintenance, as well as, demonstration and training at the time of purchase. This will enable the organization to avail of expert services for maintenance and advice from the manufacturers during the warranty period.

- *Establishment safety:* Without doubt, every establishment wants to feel safe with respect to the quality of equipment used in it. In electrical devices, features such as insulation, electrical load, quality of wiring all will determine safety from accidents on account of short circuiting caused by the equipment. For pieces operated manually such as toasters, ovens that require handling for placing foods in and out of the equipment, shock proofing needs special attention as staff may use wet hands. Auto timers and alarms are some improvements on equipment in this direction. Equipment in general should not be fragile so that its operation is not affected adversely by breakdowns.
- *Customer safety:* If equipment cannot be cleaned easily, food may remain in crevices not easily visible to the cleaner or reached by ordinarily used cleaning brushes. This can result in food contamination and jeopardize customer safety.

Let us have a look at the safety measures that can be employed in food service operations to ensure cleanliness and hygienic environment.

16.5.1 Safety Measures in Food Service Operations

Simple safety measures can be implemented in food services to eliminate the detrimental effects of microorganisms, insects and rodents. Since people, insects and rodents transfer most of the infections to food, personal hygiene of staff and use of killer traps and equipment should be put in place for the purpose. In areas of heavy infestation, the advice of pest control agencies should be sought, keeping in mind that food and sprays or chemicals are kept wide apart to ensure safety of all who consume the food.

- *Staff Cleanliness:* Personal grooming of staff is extremely important in the food service environment. Ideally, staff should be provided with clean overall and caps every day for work in food production and service areas. If working footwear is also provided, the contamination through dust and dirt from street shoes can be controlled.

Most important simple instructions like *Wash your hands* should be pasted at the entrance to kitchens and other entrance points where food is to be handled. This would act as a reminder before they enter for work. Some handy hand washing tips are highlighted herewith.

Some hand washing Tips

- Wash hands before touching food, and after touching any thing else.
- Use antibacterial soap and wash for at least 30 seconds.
- Wash nails with brush each time, washing between fingers too.
- Dry thoroughly.

Rules should be made and adhered to strictly or else punishable in some way. Managers should keep abreast with newer developments in technologies for cleanliness maintenance and organize sessions to educate staff, making them aware of the relationship of personal hygiene and food safety.

According to a survey reported in the Clean and Hygiene Review (vol.2 no.6. Nov.-Dec. 2002), 60% of food service personnel do not wash their hands after using toilets, and only 28.6% who handle food in hospitals wash their hands between handling cooked and uncooked food. You can imagine how many would be scratching their heads, or other body parts while cooking, or sneezing, yawning or coughing over the food, all of which are sources of contamination and hazardous for the customer.

Thus, you would appreciate that it is the staff alone, which can reduce the risks of food poisoning outbreaks in food services. Maintenance of clean equipment and premises, as well as, personal cleanliness is the key to the success of any operation.

Let us next review about checks and inspections, which form a very essential part of any food service operation.

16.6 CHECKS AND INSPECTIONS

Regular checks and inspections are necessary in every area of activity to detect and control any possible causes of contamination whether it is food handling practices, hygiene and cleanliness of staff, particularly those who rejoin duty after sick leave, equipment cleaning and drying methods, waste disposal methods, service techniques and so on. Equipment in service areas requires to be fitted with sneeze guards to prevent the possibility of infection from customers particularly in self-service operations. So let us move further and find out what these procedures and schedules are all about in the following sub-sections.

16.6.1 Procedures

Procedures should be set up in every food service establishment for the routine checking of all equipment irrespective of their size and frequency of use. Some examples of scheduling for cleaning and maintenance have already been discussed under section 16.4 of this unit. However, it is important to construct a timetable for routine checkups to ensure against breakdowns and maximize utility of the equipment.

A sample procedure format is presented in Table 16.2, which will provide a guideline for establishing and implementing checks on the functioning of equipment and the skill development of the operators in each area of activity.

Table 16.2: Format for checking equipment

Equipment	Procedure	When	Checked by	Remarks
Kitchen tools	Random check of washing and storing quality	Daily	Head chef	
Small Equipment	Check	After use	-do-	
Large	Cleanliness/readiness	After use	Supervisor	
All Equipment	General	On round	Manager	

When such a format comes with the remarks of staff who have checked the equipment, the manager takes notice of discrepancies, establishes controls for defects, need for expert maintenance, cleaning procedure changes, staff training or direction and so on.

16.6.2 Schedules

A number of schedules can be worked out and set by every manager for each area of activity as presented in Table 16.2, according the type and number of equipment used. In fact, the authorized person for implementation may prepare detailed schedules for each operator. Daily checks for implementation can then be put in place to ensure concurrence with the schedules. A weekly inspection report may be submitted to the catering manager for information and necessary action taken where required.

Lastly, let us move on to the various suppliers, which can supply equipment to the food service institutions.

16.7 EQUIPMENT SUPPLIERS

A number of equipment suppliers for food services are listed in the *Yellow Pages* directory in India. Another source is to make enquiries from other food services using certain *models* to ascertain which ones are cost effective and efficient in terms of utility, as well as, maintenance. *Trade journals* are another source of information and the addresses can be used to call for catalogues and study the features of the equipment models available.

With this, we end our study on plant and equipment. Before we move on to the next unit on sanitation and safety, let us review what we have learnt till now by answering the questions in check your progress exercise 3.

Check Your Progress Exercise 3

- 1) What safety concerns need to be kept in mind before purchasing equipment?

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- 2) What is personal cleanliness and how can it be implemented in a food service operation.

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- 3) What sources of information can be used to select equipment for a food service?

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16.8 LET US SUM UP

In this unit, we learnt about plant and equipment. While plant refers to large machines, installed at a particular place for use by operative staff. Those pieces that can be moved to different areas for use are called equipment or appliances.

Then we moved on to the classification of equipment based on weight or size, order of use or mode of operation. Then, we learnt that every type of equipment requires careful handling in use, cleaning and maintenance in order to maximize its utility and extend its life.

Next, the unit focused on to the cleaning materials that are and should be used in food operations. Here we also got to know that parts with which food comes in contact need to be removable as they require proper sterilization, followed by air drying before refitting for use. Knowledge of cleaning agents like soaps and detergents was then given.

Next, we got to learn that supervision and monitoring the implementation of cleaning and maintenance schedules is of paramount importance in view of concerns regarding safety of the establishment, equipment, staff and customers. Also, training and retraining of staff are important features of cleaning and maintenance of equipment and premises.

16.9 GLOSSARY

Baine marie : is a device used in industry, chemical laboratories, and in cooking to heat materials gradually to a fixed temperature.

16.10 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

- 1) There are many differences between plant and equipment. These are:
 - a) All tools or machines used for food production and service are called equipment, while only heavy machines fixed at one place are referred to as plant.
 - b) Equipment is small and large, plant is only large.
 - c) Equipment is moveable while plant is fixed at one location.
 - d) Equipment is cheaper than plant.
- 2) Equipment can be classified in three ways.
 - i) by weight or size ii) by order of use iii) by mode of operation.List the examples for each of the three category on your own.
- 3)
 - a) multifunction
 - b) modular
 - c) labour saving
 - d) custom built
 - e) mobile

Check Your Progress Exercise 2

- 1)
 - a) Heavy duty machines should be wiped clean with a wet cloth after each use. Parts that come in contact with food need to be dismantled and thoroughly cleaned after use in hot water at 75-77°C. If parts cannot be separated, thorough cleaning using special cleaners as directed by manufacturers should be employed.
 - b) Kitchen tools can be maintained by daily washing using suitable detergent and rinsing in hot water followed by air-drying for next use.
- 2)
 - a) rinsed, hot.
 - b) Electrical, periodically.
 - c) Equipment, trained.
- 3) Cleaning systems mean methods used for cleaning, such as manual and mechanical. Refer to sub-section 16.4.2 and present a detail discussion on cleaning system in your own words.
- 4)
 - i) Detergents are chemical compounds or their mixtures used for cleaning purposes. Sanitizers, on the other hand, are chemical compounds that destroy harmful microorganisms.
 - ii) Abrasive cleaners are powders used to scour off rust, grease and heavy soil. Degreasers are highly alkaline cleaning agents and also skin irritants, and usually dissolve in solvents like alkali, chlorine and hydrocarbon solvents. Some are water soluble or used as vapours to clean kitchen exhaust ducts. They are used specially for heavy-duty equipment to remove grease from surfaces.

Check Your Progress Exercise 3

- 1) Safety concerns to be kept in mind before purchasing equipment are staff, equipment, establishment and customer safety.
- 2) Personal cleanliness refers to the cleanliness of staff working in a food service establishment. It means clean hands and nails, clean clothes, shoes and above all, clean work habits such as the avoidance of hair touching, nose picking, coughing or sneezing while handling food.
- 3) Sources of equipment information are catalogues, trade journals, directories and other food service establishments.