NAVAL SHIPS' TECHNICAL MANUAL

CHAPTER 651

COMMISSARY EQUIPMENT

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NOTE

THIS CHAPTER HAS BEEN REFORMATTED FROM DOUBLE COLUMN TO SINGLE COLUMN TO SUPPORT THE NSTM DATABASE. THE CONTENT OF THIS CHAPTER HAS NOT BEEN CHANGED.

CHAPTER 651

COMMISSARY EQUIPMENT

SECTION 1.
APPLIANCES

651-1.1 PURPOSE OF CHAPTER

651-1.1.1 This chapter contains instructions pertaining to commissary equipment used in ships of the United States Navy. Operating personnel should also make use of manufacturers' technical manuals for this equipment, which are furnished to all Navy ships.

651-1.2 VEGETABLE PEELERS

651-1.2.1 Vegetable peelers are furnished with capacities of 10-15, 30, and 50 pounds, and have a cylindrical hopper with abrasive covered wall and an abrasive covered rotating disk in the bottom. The disk has a wavy surface to agitate the vegetables in a manner that will continually present new surfaces for action by the abrasive material. In general, the abrasive material used is carborundum, imbedded in the cast iron cylinder and disk while the cast iron is in a molten state.

651-1.2.2 The machine should be started and the water turned into it before any vegetables are added. The quantity of vegetables dumped into the machine should not exceed approximately 66 percent of the total hopper capacity. If a larger quantity is added, the vegetables will not be thoroughly agitated.

a. If the abrasive surfaces of the machine are kept reasonably clean, a charge of potatoes will be satisfactorily peeled in approximately 1 minute. Other vegetables take different times. It is wasteful to allow vegetables to remain in the machine longer than necessary.

b. Before discharging the vegetables from the machine, place a suitable container under the door at the side of the cylinder. When the door is opened while the machine is in operation, the vegetables will be discharged rapidly.

c. The drain from the machine must be of adequate cross section and sufficiently unobstructed to permit fine particles of peelings to be rapidly washed away.

d. The direction of rotation of the disk should occasionally be reversed in order to prolong the life of the abrasive surface. It is important that the disk revolve at its designed constant speed.

e. Bearings and gears should be thoroughly lubricated.

651-1.3 FOOD-MIXING MACHINES

651-1.3.1 Food-mixing machines are furnished in 12-, 20-, 60-, and 80-quart sizes with the necessary accessories to permit the mashing of potatoes, mixing of soup, mixing of powdered milk, whipping of mayonnaise, mixing of cake dough, and bread dough. Slicing, grinding, and shredding attachments are also available. The 20-quart

size machines are provided with both 12- and 20-quart bowls. The 60-quart size machines are provided with both 30- and 60-quart bowls. The 80-quart size machines are provided with both 30- and 80-quart bowls. Proper speeds are attained by means of a gear shift.

651-1.3.2 Before changing gears, it is necessary to stop the motor, or if a clutch is furnished, place the clutch in neutral. Lock both sides of the bowl in place and securely insert beater before starting machine. Start the motor with no load in clutch type machine.

651-1.4 MEAT CHOPPERS

651-1.4.1 Meat choppers consist of a hopper and a worm which feeds and forces the food through a perforated plate, against which rotates a disk-type knife that chops the meat.

651-1.4.2 Meat choppers are furnished in various sizes according to the ship's complement, and in both hand and motor-operated types.

651-1.4.3 Motor-driven meat choppers are usually equipped with a replaceable drive collar or pin which breaks or shears if a bone or other hard object gets into the machine.

651-1.4.4 Plates, knives, chopper head, and pan should be cleaned after use at the end of each day.

651-1.4.5 Do not tighten end ring too tightly as this will cause rapid wear on knives and plates and create heat. Do not run chopper when meat bowl is empty.

651-1.4.6 Always use stomper when feeding meat into grinder.

651-1.5 MEAT, BONE, AND FISH CUTTERS

651-1.5.1 Meat, bone, and fish cutters comprise an iron or steel frame arranged to support a table, band saw, motor, and controller. The machines are designed for cutting steaks, chops, bones, and fish.

651-1.5.2 Clean the machine daily, including emptying and cleaning of scrap pan. Do not use water on main bearings. Use whisk broom and dampened hot cloth. Keep all wheel and saw cleaners in good condition. Be sure guide bearings turn freely.

651-1.5.3 Do not twist cutting blade while operating. Do not leave machine running when not in use.

651-1.6 MEAT SLICERS

651-1.6.1 Meat slicers consist of a rotating slicing knife and a meat carriage arranged to move the meat reciprocally in relation to the knife. The machines are suitable for slicing boneless hot or cold meats, cheese, bread, fruits, vegetables, and other sliceable food products.

651-1.6.2 The machine should be cleaned daily. The exterior surfaces of the machine are easily wiped clean with a damp cloth. The various parts of the machine, such as knife, knife guard, and knife plate should be cleaned in accordance with the manufacturer's instructions.

651-1.6.3 The knife should be sharpened lightly every few days. Thorough cleaning of the knife before sharpening will help prevent the sharpening stones from getting greasy.

651-1.6.4 Do not operate machine without knife guard in place. Do not use hands to press down food.

651-1.7 VEGETABLE PREPARATION MACHINES

651-1.7.1 MEAT AND VEGETABLE CUTTERS.

a. Meat and vegetable cutters are electrically operated machines with a set of curved knives revolving at high speed close to a slowly revolving bowl on one end and with vegetable and meat-grinding attachments on the other end. They are designed for cutting and mixing vegetables, meats, and fruits; for grinding meat; for slicing and shredding potatoes, celery, cucumbers, carrots, beets, nuts, fruits; and for grating cheese and coconut.
   1. Size A. Five pounds of raw beef per charge.
   2. Size B. Ten pounds of raw beef per charge.
   3. Size C. Fifteen pounds of raw beef per charge.
   4. Size D. Twenty pounds of raw beef per charge.

b. Sizes A and B machines are equipped with 9-inch vegetable slicing attachments and are capable of slicing 400 pounds of potatoes in 1/8-inch slices in one hour, or 175 pounds of coleslaw per hour.

c. Sizes C and D machines are equipped with 12-inch vegetable slicing attachments and are capable of slicing 700 pounds of potatoes in 1/8-inch slices in one hour, or 300 pounds of coleslaw per hour.

d. The cutting knives are protected by a knife guard connected to a safety interlock which prevents operation of the machine when the guard is not locked in the guard position.

651-1.7.2 VEGETABLE CUTTERS AND SLICERS.

a. Vegetable cutters and slicers, which replace meat and vegetable cutters, are electrically operated machines which, without the use of attachments or removable parts, make three classes of cuts, any one or all three of which may be made at one time with a separate discharge opening for each class of cut.

b. The machines are designed for cutting, slicing, and dicing potatoes, carrots, beets, radishes, onions, cucumbers, apples, pears, and pineapples, and for chopping cabbage, lettuce, and onions.

c. The machine is capable of turning out approximately 600 pounds per hour of various cuts of potatoes, carrots, and other types of vegetables.

d. The machine is equipped with a safety switch which prevents the operation of the machine when the cover is raised.

651-1.7.3 VEGETABLE CUBERS AND SLICERS.

a. Vegetable cubers and slicers are hand-operated and are suitable for cutting, cubing, or slicing potatoes, carrots, turnips, onions, and beets.

b. When set to cut 1/2-inch cubes, the machine has the capacity of approximately 480 pounds per hour.

651-1.8 REFRIGERATORS (SELF-CONTAINED)

651-1.8.1 Refrigerators for use in storing foodstuffs and medical supplies at a temperature of approximately 40°F for operation in pantries, sick bays, and bacteriological laboratories.

651-1.8.2 Refrigerators are provided for operation on 110-volt ac, 60-cycle, or 115-volt dc circuits, as specified, and may be operated from lighting power circuits.

651-1.8.3 The equipment should be located as far as possible from any source of artificial heat in a clean, dry, and well-ventilated space. The unit must be installed level with the back of the refrigerator at least 4 inches from any bulkhead or obstruction which may tend to reduce the air flow required for the air-cooled condenser.

651-1.8.4 The refrigeration operating parts should be maintained and serviced in accordance with chapter 9590.

651-1.9 DOUGH MIXERS

651-1.9.1 Dough mixing machines are slow speed type and are supplied in two sizes, namely:

a. Size B, capacity of tank is 2 barrels of flour plus other ingredients, size of motor 3 hp.

b. Size C, capacity of tank is 1/2 barrel of flour plus other ingredients, size of motor 1 hp. Dough mixers are gear-driven by an enclosed motor. A handwheel is provided for tilting the tank in order to facilitate unloading of dough into a trough or truck tubs. On recent machines a safety switch is installed whereby the agitator device is made inoperative when the tank is tilted about six inches or more.

651-1.9.2 The practice of cutting the dough while the agitator is revolving has led to many casualties. Therefore, dough shall not be cut while the agitator is revolving.

651-1.10 MEAT BLOCKS

651-1.10.1 Meat blocks located in the galley on vessels not having butcher shops are 30 by 30 by 16 inches on vessels of 2,000 tons or more displacement and 24 by 24 by 16 inches on destroyers and vessels under 2,000 tons displacement. Meat blocks in butcher shops are 35 by 50 by 16 inches deep. They are made of hard maple, and are carried in stock at naval supply depots.

651-1.11 ELECTRICAL SAFETY PRECAUTIONS

651-1.11.1 Numerous items of commissary equipment are either driven by electric motors (vegetable peelers, meat choppers, dough mixers, refrigerators, oil burners, etc.), or are heated electrically (ranges, broilers, griddles, fry kettles, etc.). Safety precautions must be observed around all electrical equipment to avoid injury from shock.

One of the most important of these safety precautions is grounding the frame and exposed metal parts of electrically operated equipment. (See **NSTM Chapter 300, Electric Plant - General** for instructions on grounding and other electrical safety precautions.)

SECTION 2.

BAKING, COOKING, ROASTING EQUIPMENT

651-2.1 RANGES, ELECTRIC

651-2.1.1 Electric ranges are provided in the following types:

a. Type A. Three surface units and one oven.

b. Type B. One surface unit and one oven.

c. Type C. Two surface units and one oven.

651-2.2 TYPE A RANGES

651-2.2.1 DESCRIPTION. The type A range has three surface cooking units and an oven.

651-2.2.2 SURFACE UNITS. Older models of type A ranges have either one of the following arrangements:

a. Three hotplates, each controlled by one three-heat switch or two single-heat switches.

b. Three griddles, each controlled by a three-heat switch and a thermostat.

c. Combinations of hotplates and griddles. The newer models of type A ranges are equipped with three combination griddle-hotplates, each controlled by one thermostatic switch having a temperature range from 250°F to 850°°F.

Cooking may be done directly on those hotplates and griddles which have grease drains.

651-2.2.3 OVEN. Two heating elements are provided in the oven-one located near the top of the oven and one located near the bottom of the oven. Each of these heating elements is controlled by a three-heat switch. The average temperature in the oven is regulated by an adjustable thermostat and the three-heat switches are used to regulate the relative temperatures at the top and bottom of the oven.

651-2.3 TYPE B RANGES

651-2.3.1 DESCRIPTION. The type B range consists of a surface unit and an oven.

651-2.3.2 SURFACE UNIT. Older models of type B ranges have a combination griddle-hotplate which is controlled either by one three-heat switch or by two single-heat switches. The newer models of type B ranges are equipped with one thermostatic switch having a temperature range from 250°F to 850°F. Cooking may be done directly on the griddle hotplates.

651-2.3.3 OVEN. Two heating elements are provided in each oven-one located near the top of the oven and one located near the bottom of the oven. Each of these heating elements is controlled by a three-heat switch. The average temperature in the oven is regulated by an adjustable thermostat and the three-heat switches are used to regulate the relative temperatures at the top and bottom of the oven.

651-2.4 TYPE C RANGES

651-2.4.1 DESCRIPTION. The type C range has two surface units and an oven.

651-2.4.2 SURFACE UNITS. The type C range has two combination griddle-hotplates. On the older models the surface units are controlled by either one or two three-heat switches. On the newer models the surface units are controlled by one thermostatic switch having a temperature range from 250°F to 850°F. Cooking may be done directly on the combination griddle-hotplate.

651-2.4.3 OVEN. Two heating elements are provided in each oven-one located near the top of the oven and one located near the bottom of the oven. Each of these heating elements is controlled by a three-heat switch. The average temperature in the oven is regulated by a thermostat and the three-heat switches are used to regulate the relative temperatures at the top and bottom of the oven.

651-2.5 OPERATING, CARE, AND MAINTENANCE INSTRUCTIONS FOR RANGES

651-2.5.1 OPERATION OF SURFACE UNITS.

a. Use the switch or thermostat setting at maximum heat only to heat food to cooking temperature or to bring water to boil, then reduce the switch or thermostat setting to the heat required by the food being cooked. Using more heat than necessary is not only a waste of power but produces inferior food.
b. Do not leave the surface units turned on when not in use.
c. Use a small amount of water for cooking vegetables. Using more water wastes power and soaks vitamins from the food.
d. When steaming, keep utensils covered. Food will stick and burn if cover is left off and power will be wasted.

651-2.5.2 OPERATION OF OVEN. Turn oven on for preheating before use. To preheat, both upper and lower units of the oven should be turned to ″high″ until the desired temperature is reached. When oven reaches this temperature, thermostat control will automatically cut off the current and will supply only enough energy to keep the temperature constant.

651-2.5.3 CARE AND MAINTENANCE INSTRUCTIONS.

a. Care and Cleaning. Keep surface units clean and avoid spilling grease under edges of hotplates. Keep spaces around the surface units scraped clean. Remove and clean drip pans daily. Keep oven door opening free of all carbonized material so that the door will close tightly. Brush crumbs from oven occasionally. The range should be thoroughly cleaned once a week. The griddle-hotplate type surface units can be satisfactorily cleaned using pumice stone blocks, General Stores Supply Office Stock Number GM-7930-291-1237. Use only soap and water on enameled surfaces. Although soap and water is preferable, powdered cleansers may be used on polished steel areas.

b. Maintenance and Servicing. Before starting any service work on the range, be sure that it is entirely disconnected from the circuit. When removing any electrical parts, particularly thermostat sensing elements, observe closely the arrangement of parts and tag leads to facilitate replacement. Refer to the technical manual, furnished with the range for exact procedures to be used in disassembly, replacement of parts, or calibration of thermostats.

651-2.6 ELECTRIC ROASTING OVENS

651-2.6.1 Electric ovens for naval use are provided in four sizes as listed in Table 651-2-1.

Table 651-2-1 NAVY ELECTRIC OVENS

Oven Type	No. of Compartments	Capacity (Lbs. of Meat)
60	2	120
60	3	180
125	2	250
125	3	375

651-2.6.2 Each oven section is provided with two heating units, one located at the top of the compartment and the other located underneath the deck. Each heating unit is controlled by a separate three-deck switch, and the temperature of each section is regulated by a thermostat. Heating units of the type 60 ovens are approximately 3 kilowatts each or a total of 6 kilowatts per oven section. The electrical load of the type 125 ovens is approximately 5 kilowatts per section.

651-2.7 OPERATING, CARE, AND MAINTENANCE INSTRUCTIONS FOR ROASTING OVENS

651-2.7.1 OPERATING INSTRUCTIONS. Ovens should be turned on for preheating before use. To preheat, both upper and lower units of the compartment should be turned to ″high″ until the desired temperature is reached. When ovens reach this temperature, the thermostat control will automatically cut off the current and will supply only enough energy to keep the temperature constant. After preheating, set the two 3-heat oven switches for the proper ″top″ and ″bottom″ heat to suit the product to be baked. In roasting meat, avoid spilling grease on heating elements or thermostats as damage to this equipment may result.

651-2.7.2 CARE. Clean oven thoroughly at least once a week in addition to the normal daily cleaning to prevent the accumulation of foreign material. Keep door edges clean. Crusty deposits prevent proper closing of doors, causing loss of heat and corrosion due to escape of steam and fumes. Do not throw water in the oven to cool the decks or to wash them. When using a wet rag to swab or clean the decks, it should be thoroughly wrung out before using.

651-2.7.3 MAINTENANCE AND SERVICING. Before starting to service the oven, be sure that it is entirely disconnected from the circuit. When removing any electrical parts, particularly thermostat sensing elements, observe closely the arrangement of parts and tag leads to facilitate replacement. Refer to the technical manual, furnished with the oven, for exact procedures to be used in disassembly, replacement of parts, or calibration of thermostats.

651-2.8 ELECTRIC COOKING TOPS

651-2.8.1 Cooking tops similar to type A ranges equipped with three hotplates, but having an open storage space below in lieu of the oven, were used in cases where additional cooking surface was required and separate roasting ovens provided. Dimensions and electrical characteristics are similar to type A ranges. Cooking tops are no longer furnished.

651-2.9 GRIDDLES

651-2.9.1 Electric griddles are specified in one size only. The griddle consists of a cooking surface approximately 34″ by 18″ surrounded by a grease receptacle, all suitably supported on an enclosing body which is mounted on four legs or angle iron construction. A griddle guard, consisting of a rectangular bottomless frame and cover, is furnished for certain types of frying such as the preparation of home-fried potatoes.

651-2.9.2 The heating element is divided into two sections-on the older models of the griddle by a three-heat switch, and on the newer model, each heating element section is controlled by a thermostatic switch.

651-2.10 OPERATING, CARE, AND MAINTENANCE INSTRUCTIONS FOR GRIDDLES

651-2.10.1 OPERATION.

a. Use high heat only for preheating and continuous heavy frying. Use low heat for idle periods and for light intermittent use.

b. Use the griddle guard when necessary to keep food from sliding off the cooking surface.

c. For satisfactory operation of the griddles, it is important that no frozen meat or fish be placed on the cooking surface.

651-2.10.2 CARE AND MAINTENANCE.

a. Carbonized grease on the grids hinders transfer of heat from grids to food, resulting in spotty frying and loss of efficiency. This carbon on the grids has a tendency to flake off and cause black spots on the fried products. Grease, if allowed to accumulate within or on the outside of griddles, will ruin the finish, clog and corrode switches, and cause breakdowns and failures. In addition, the breakdown of grease under heat imparts an acrid, musty flavor to food.

b. Keep the cooking surface scraped and wiped clean at all times. The grease gutters should be kept clean at all times to facilitate draining off excess grease and reduce smoke. The grease receptacle should be emptied frequently.

c. The cooking surface can be satisfactorily cleaned by use of pumice stone block, General Stores Supply Office catalog number GM7930-291-1237.

d. Griddles may be cleaned periodically by placing a cloth dampened with ordinary household ammonia on the surface when the plate is cold, and allowing it to remain from 4 to 5 hours. The ammonia will soften the carbon so that it is easily removed with a cloth. Care must be observed in this operation that the ammonia is not

allowed to enter sections containing electric wiring or other electric parts, as it will destroy insulating materials. All traces of ammonia will disappear as the grids are heated. This cleaning should not be required if pumice stone blocks are used.

e. Refer to the technical manual furnished with the griddle for exact procedures to be used in disassembly, replacement or servicing of parts, or calibration of thermostats.

651-2.11 FRY KETTLES

651-2.11.1 Four sizes of deep fat fryers are now furnished. They are the types 23, 35, 51, and 90. The Type 35 is obsolete and will be discontinued when stocks are depleted. The type numbers represent the approximate number of pounds of french fried potatoes which may be prepared per hour. The deep fat fryer consists of a rectangular fat container substantially constructed of heavy reinforced sheet metal.

651-2.11.2 Fry kettles are heated by immersion electric heaters located at such a level that the portion of the fat below heater remains comparatively cool in order to allow the sediment from the frying food to settle to the bottom of the fat container without being burned. Heating elements are controlled by a magnetic conductor and a thermostat to maintain the fat at the desired temperature.

651-2.12 OPERATING INSTRUCTIONS FOR FRYERS

651-2.12.1 Before using a deep fat fryer, make sure that the drain valve is closed tightly.

651-2.12.2 Fill the fryer with fat, using the proper amount as stated in the technical manual furnished with the fryer. If possible, the fat should be heated and melted before placing it in the fry kettle. Cold solid fat may have moisture pockets which will explode, casting hot melted fat over a wide area. Also, if the cold fat is not uniformly distributed around the heating elements, the bare portions of the heating element may heat up to a point where a sudden splash of fat on the overheated element would cause the fat to burn.

651-2.12.3 After the fat is added, set the thermostat at the desired cooking temperature and no higher. Each product has an ideal frying temperature at which best results will be obtained. These temperatures may be found in the Navy Recipe Service.

651-2.12.4 Check the temperature of the fat with the dial or hand thermometer at least once a day. The temperature should never, under any circumstances, go above 400°F.

651-2.12.5 The foods to be fried should be as free from moisture as possible. Excess moisture causes the fat to foam, sputter, and boil over. It also causes some fats to break down and shorten its useful life.

651-2.12.6 It is bad practice to fry bacon in the deep fat fryer as the fat from the bacon causes the fat level to rise above that which is safe.

651-2.12.7 Each product has a definite energy requirement for frying and it is important that batches do not exceed the capacity of the deep fat fryer. Proper loads for various deep fat fryers are given in the technical manual furnished with the fryer and on the instruction plate on the fryer.

651-2.12.8 Keep all unguarded electrical sockets, sparks, or flames away from the deep fat fryers when they are operating. If the fryer is used next to a range, griddle, toaster, or electric coffee maker, erect a splash guard to prevent any fat from migrating from the fryer to a hot surface which may cause a fire.

651-2.12.9 In the event a fire should occur in the deep fat fryer, the damage control officer should be notified immediately. **Under no circumstances should water be thrown on a fat fire.** The fire should be smothered with foam and the deep fat fryer covered with a metal cover as soon as possible. Keep the cover on the fryer until the fat has cooled below the ignition temperature.

CAUTION

Always turn the line switch to ″OFF″ when the deep fat fryer is not in use.

651-2.13 CLEANING OF FRYERS

651-2.13.1 It is important to keep the deep fat fryer clean. Each fryer should be cleaned every day. Before cleaning, turn off the heating element and allow the fat to cool about 150°F. Place a container under the drain spout, open the drain valve, and allow the fat to drain out. Remove the basket support screen, scrape off oxidized fat from the sides of the kettle with a knife, and flush down the sediment with a dipper of fat. Remove the sediment container and clean off the sediment. After each cleaning, the container should be placed in back of the fry kettle. If kettle has become very dirty, fill to fat level with hot water containing dish-washing machine detergent or vinegar. Energize the heating element and allow to come to a boil. Boil from 5 to 10 minutes, turn off the heating element, drain, rinse thoroughly, and dry the fry well before filling with fat. The outside of the fry kettle should be cleaned with a grease solvent.

CAUTION

Never leave heating elements turned on when the deep fat fryer is empty. This may burn out heating elements.

651-2.14 RE-USE OF FAT

651-2.14.1 The fat in the deep fat fryer may be strained and re-used. To re-use the fat, place the strainer bag inside the fryer with the ring resting on top and put the fat back into the fryer through the strainer bag. Add new fat to bring the level up to normal. For proper care of frying fat, see the instructions in the Navy Recipe Service.

651-2.15 ELECTRIC WARMING OVEN

651-2.15.1 Electric warming ovens are used to hold foods at a desirable temperature after food has been prepared. Warming ovens are provided for pantries on some larger ships. The oven is heated by a single heating element located in the lower part of the warning compartment, controlled by a three heat switch.

651-2.15.2 Warming ovens should be preheated for at least 40 minutes before inserting food which is already at or above the temperature desired to maintain. Preheat with the control switch at ″high″ and turn to ″low″ or ″medium″ for maintaining the desired temperature.

651-2.16 MAINTENANCE AND CARE OF WARMING OVENS

651-2.16.1 Electric warming ovens require very little care except for cleaning. Keep the warming compartment and the outside of the oven clean. The door opening and door edges should be kept clean to permit the door to close tightly.

651-2.16.2 Refer to the technical manual, furnished with the oven, for exact procedure to be used in replacing heating elements, switches, or other parts.

651-2.17 BAKE OVENS

651-2.17.1 Bake ovens are furnished in four types: Types 4, 6, 12, and 18.

651-2.17.1.1 The types 4 and 6 are the older type ovens having four and six compartments, respectively. In those ovens, the heating elements are located at the bottom of each compartment and at the top of the upper compartment. The compartments are not insulated so the bottom heating element of one compartment serves as the upper heating element of the compartment immediately below. Each heating element is controlled by three-heat switches. Each baking compartment is equipped with a temperature indicator. The bake oven is also provided with means to prevent overheating by limiting the maximum temperature attainable in any compartment to 500°F or 550°F under any operating or idle condition.

651-2.17.1.2 The type 12 (2 compartments) and type 18 (3 compartments) are the newer design of bake ovens. These ovens have the same available oven space as the type 4 and type 6 bake ovens, respectively. Each oven compartment of the newer ovens is heat insulated from the others and is controlled separately by an adjustable thermostatic switch. These are top and bottom heating elements in each section, controlled separately by three-heat switches.

651-2.18 OPERATION, CARE AND MAINTENANCE OF BAKE OVENS

651-2.18.1 Preheat oven to desired temperature with all switches on ″high″ position, then turn to ″low″ or ″medium″ as desired. Avoid excessive opening of doors; steam should not escape around doors. Avoid direct air currents on ovens. Keep dampers as nearly closed as possible.

651-2.18.2 Load the decks evenly, distributing products uniformly over the deck area not closer than 3 inches to the door. Load pans in row from rear to front of oven along right wall. Next row, etc., until oven is full. Start unloading with first row on right. This procedure gives even baking for each pan.

651-2.18.3 Keep inside of oven and decks scraped clean to avoid spotty heating, particularly around doors and edges. If dirt accumulates so doors cannot close tightly, poor baking will result.

651-2.18.4 Cool compartments by opening vents using control rod at front of oven. Do not throw water in oven to cool the oven decks or to wash them. When using a wet rag to swab or clean the decks, it should be thoroughly wrung out before using.

651-2.18.5 On Type 12 and 18 bake oven, check the oven temperature by thermometer periodically and adjust thermostat, if necessary.

651-2.18.6 Instructions of thermostat calibration, replacement of other servicing of the oven are contained in the technical manual, furnished with a particular oven.

651-2.19 COFFEE URNS, ELECTRICALLY HEATED

651-2.19.1 DESCRIPTION. In general, electric coffee urns used aboard Naval ships are of the combination type consisting of an inner compartment or tank for coffee and on outer pressure tight tank for water. The two tanks are separated by an air space to avoid rapid temperature changes of coffee when cold water is added to the water tank. A siphon pipe between the water and the spray head in the urn cover, or lid, permits spraying the hot water over the ground coffee in the leacher in lieu of pouring the hot water over the ground coffee by hand. An agitating valve is provided for thoroughly mixing the liquid coffee in the coffee tank in lieu of drawing off coffee and pouring over by hand to mix. Urns are furnished in sizes for making coffee in one-gallon (nonautomatic urn, requires hand pouring), two-gallon, and four-gallon batches. Electric immersion heaters are installed for heating the urns and pressure type controls are provided for automatic temperature control.

651-2.19.2 OPERATING INSTRUCTIONS.

1. Open the cold water filling valve and fill the urn with water to the full mark indication on the water gage.
2. Turn the electric power switch to the ″ON″ position.
3. When the indicator on the pressure gage reaches 2-1/2 pounds pressure (or premarked operating position), the urn is ready for making coffee.
4. Clamp the leacher cloth firmly on the leacher, spread ground coffee uniformly inside the leacher in quantity required by the Navy Recipe Service for gallons of coffee to be made (quantity of ground coffee may be varied to suit taste), and place the leacher in the top of the urn.
5. Close the urn cover or lid.
6. Open the siphon valve and allow required volume of water to siphon over the ground coffee in the leacher. If full batch of coffee is being made, the water will cease to siphon when the correct volume of water has been sprayed over the coffee grounds and heavy steam will show around the urn cover.
7. Close siphon valve.
8. Slowly open agitating valve to end of stern and, without pausing, slowly close agitating valve.
9. Open the cold water filling valve and again fill the water tank.
10. Remove leacher, remove used coffee grounds, rinse leacher and leacher cloth in clean cold water, and store in clean cold water until required for use again. Replace leacher cloth once a week. Discoloration of the cloth does not affect its utility provided it has been properly cared for.
11. Draw coffee as required.
12. Time the preparation of coffee so that it does not stand longer than 30 minutes before serving.

651-2.19.3 CLEANING INSTRUCTIONS.

1. Heat water in urn water tank, by turning electric power switch on, until pressure gage indicates 2 1/2 pounds, or operating pressure.
2. With urn cover closed, open the siphon valve and siphon sufficient hot water to half fill the coffee tank.
3. Wash the inside of the coffee tank, top rim and cover, using a clean cloth. Do not use a brush or mop for washing urns having a glass lined coffee tank. Clean the faucet, gage glass, and draw-off pipe after each use with wet brush GSSO stock number GA7920-24-6359 and with de-staining compound GA7930-282-5066.
4. Drain water off by opening coffee faucet.
5. With urn cover closed, open the siphon valve and siphon approximately one gallon of hot water into the coffee tank. Open coffee faucet and then open the agitating valve for about one minute to sterilize the dispensing route and coffee faucet.
6. Close the coffee faucet.
7. Siphon coffee tank half full of hot water. This water should remain in urn when urn is shut down for night and drained prior to making coffee in the morning.
8. Clean the urn in accordance with the above, at the end of each day.
9. Twice weekly, sweeten the urn by using a solution of one cup of baking soda to one gallon of hot water. The baking soda solution should remain in the urn approximately 15 minutes, then agitate by opening agitating valve for one minute, drain, and flush thoroughly with hot water. Never use cold water on glass lined urns; always use hot water by operating the siphon valve.
10. Cool the urn when polishing exterior. Use a metal polish or nonabrasive paste.

651-2.19.4 MAINTENANCE.

1. Periodically lubricate hinge bearing (in hinge, holding cover to body of urn) with any good ball-bearing lubricant.
2. Flush the water tank periodically by removing the drain cap and opening the cold water filling the valve.
3. Consult the applicable technical manual for the urn in question for maintaining and repairing agitating valve, faucets, water fill valve, safety valve, pressure control unit, etc.
4. Check vent holes in upper gage glass fittings in coffee urns. Vents must be kept open to get correct readings.

651-2.20 HORIZONTAL ROTARY OIL BURNERS

651-2.20.1 DESCRIPTION.

a. This type of burner consists essentially of a centrifugal fan and atomizing cup connected to an electric motor, either directly or by a V-belt. The above essentials are installed within a housing and provided with the necessary valves, switches, and controls for adjustment and operation.

b. The Ray type DG-21, size 0000; type BG-23, size 000; type BP-13, size 000; preferred model DOTR-1; and model DOTR-1S oil burners are of the horizontal-rotary design.

c. The Ray type BP-13, size 000 oil burner has a built-in pump for handling Bunker C fuel oil, when the fuel

oil is preheated to a temperature of 150°F, and will handle diesel oil without preheating. The Ray type BG-23, size 000 oil burner will handle diesel oil or, when a fuel oil pump is installed in the oil line, it will handle preheated Bunker C fuel oil. The Ray type DG-21, size 0000 and preferred model oil burners will not handle oil heavier than diesel oil.

d. The horizontal-rotary oil burner is the most efficient type of manually controlled oil burner for use with galley ranges and bake ovens due to its ability to operate over a wide range (1/2 to 2 1/2 gallons per hour) with efficient atomization of oil on low consumption when properly adjusted and operated.

651-2.20.2 PRINCIPLES OF ATOMIZATION.

a. Atomization is accomplished by the open-cup method, that is, oil entering the inside of a conical cup and being atomized by a combination of air and centrifugal force which sprays oil in minute particles from the rim of the revolving atomizing cup surrounded by air discharged at low pressure, in a direction parallel to or in a helix with axis common to the axis of rotation, which carries the atomized oil as a vapor into the firebox. The volume of primary air necessary for atomization is supplied by the fan and regulated by a butterfly or slide valve. (See technical manual furnished with burner for correct adjustment of this valve since its proper adjustment is essential to efficient operation.)

651-2.20.3 OIL PRESSURE AT BURNER.

a. Horizontal-rotary burners having built-in oil pumps, such as the Ray type BP-13, size 000, or having oil supplied by duplicate pump sets, such as the Ray type BG-23, size 000, where Bunker C fuel oil is the grade of oil used, should have an oil pressure at the burner of between 5 and 8 psi. The pressure should never exceed 8 psi.

b. Horizontal-rotary burners fed by gravity, such as the Ray type DG-21, size 0000, or the preferred model DOTR-1, where diesel oil is the fuel used, should have an oil head of from 3 to 4 feet. The burner will not feed properly on less than a 3-foot head and will throw sparks when the head of oil is more than 4 feet due to excessive pressure. A constant level float valve should be installed in the oil line between the day tank and the burner to provide the correct head of oil. The constant-level valve should be installed not less than 3 feet nor more than 4 feet above the center of the burner. Where the top of the oil day tank is more than 14 feet above the center of the burner, a special constant-level float valve for high-head system will be required.

651-2.20.4 FIREBOX DRAFT. Horizontal-rotary burners must have a firebox draft of 0.03 to 0.05 inch. A draft of less than 0.03 inch will cause the fire to hang in the vicinity of the firebox in lieu of circulating through the flues to provide an even distribution of heat in the range or bake oven. This hanging of fire, due to insufficient draft, causes hot spots in the vicinity of the firebox while areas remote from the firebox remain cool. Puffing of the burner indicates lack of uniform draft. A draft of more than 0.05 inch will cause the hot gases to circulate through the range or bake oven flues too fast for the heat to be extracted from them thus cooling the equipment and causing high stack temperatures.

651-2.20.5 ADJUSTMENT.

a. The information given herein is general for the adjustment of all horizontal-rotary burners. For detailed instructions as to the location of adjusting screws, valves, etc., the technical manual which is furnished with the oil burner should be used.

b. The oil burner should be adjusted for the range through which it will normally operate; that is, it should have

the proper minimum and maximum settings for the equipment which it will fire and the air-oil ratio adjusted to give the most efficient performance throughout this operating range. If the range or oven normally requires a minimum oil consumption of 1/2 gallon per hour and a maximum oil consumption of 1 1/2 gallons per hour, then the air-oil ratio should be adjusted to give the most efficient performance between 1/2 and 1 1/2 gallons per hour, not between some other setting, such as 1/2 to 2 gallons per hour because the adjustment cannot be made so fine and, therefore, results in less efficient performance.

c. These adjustments cannot be made at the factory since they are influenced by the size of firebox, height and shape of smoke pipe, and the adjustment of the secondary-air slides or ports on the range or bake oven. Different sizes of equipment require different minimum and maximum air-oil ratio settings on the oil burners. A large piece of equipment, such as a three-oven range, will require higher minimum and maximum settings than a two-oven range because it will have more surface and space to heat.

d. The operating range should first be obtained by operating the burner and the minimum and maximum settings made. The air-oil ratio should then be adjusted (see technical manual furnished with burner for location of adjusting screws) to give the most efficient performance between the minimum and maximum settings. If this air-oil ratio adjustment is not properly made, the fire will smoke at some settings of the throttle and will have too much air at other settings. The air-oil ratio should be adjusted to provide just enough primary-air to prevent smoking over the entire range of operation, but not enough to cool the equipment, since too much air passing through the burner will tend to cool the equipment and cause the splash tile at the back of the firebox to disintegrate. The secondary-air slides on the range or bake oven should also be adjusted to provide a firebox draft of 0.03 to 0.05 inch. Too great a volume of secondary air (draft) passing through the firebox will likewise cool the equipment. Too little secondary air (draft) for the amount of oil supplied will cause smoke and soot, and the formation of carbon in the firebox.

651-2.20.6 OPERATION.

a. To start Bunker C oil burners, such as the Ray type BP-13 size 000 or the Ray type BG-23 size 000, when Bunker C oil is used, turn the fuel-oil heater on, swing the burner into firing position and fasten with latch. Check to make sure that valve controlling flow of oil to burner atomizing cup is closed. Open the shut-off valve to pump on Ray type BP-13 size 000 oil burner. Start the pump and burner motor by closing the starting switch or switches. Allow the pump to circulate the fuel oil until return pipe at top of burner hinge pin feels hot (an oil temperature of 140°- 150°F is necessary for good combustion and start-up conditions). The pressure on the burner oil gage should register between 5 and 8 psi (no higher than 8 psi). Light a large piece of paper or oiled rag and place in center of firebox directly beneath the burner nozzle. Open air-oil control lever (throttle) at side of burner to half-way position. Open shut-off and metering valve (this valve permits oil to flow to atomizing cup) slowly. Allow fire to burn freely until a steady and clear orange flame is obtained, and then adjust the fire to the required size by operating the control lever, at which time no smoke should be present. The shutoff and metering valve should not be used for adjusting the size of the fire unless a hand throttle or control lever is not provided. On new installations refractory and stack should be allowed to come up to temperature before adjusting the fire. Starting and regulating of the fire should be done with the small cover plate over the combustion chamber removed from the top of the range for observing conditions. An observation port is provided in the front of bake oven fireboxes for this purpose.

b. To stop Bunker C oil burners, such as the Ray type BP-13 size 000 or the Ray type BG-23 size 000, when Bunker C oil is used, close the valve (shut-off and metering valve) that controls the flow of oil to the atomizing cup. Allow burner to run a full minute after fire has gone out. Unlatch burner and swing out of firebox. With burner still running, clean excess oil out of the atomizing cup by placing a small rag on index finger and inserting into the rotating cup. Clean the nozzle off with a rag. Stop burner and pump by opening the starting switch or switches. Turn the fuel oil heater off. Check fuel oil tank to see that sufficient fuel is available for

next period of operation. Leave burner swung out of firing position until firebox has cooled to prevent refracted firebox heat from damaging the burner nozzle and atomizing cup. **The above must be done every time the burner is shut down.**

c. To start diesel oil burners, such as the Ray type DG-21 size 0000 or the Ray type BG-23 size 000, swing the burner into firing position and fasten with latch. Check to make sure that the shut-off and metering valve which controls the flow of oil to the atomizing cup is closed. Start the burner by closing starting switch. Light a large piece of paper or oiled rag and place in center of firebox directly beneath the burner nozzle. Open air-oil control lever (throttle) at side of burner to halfway position. Open shut-off and metering valve slowly (this valve permits oil to flow to atomizing cup). Allow fire to burn freely until a steady and clear orange flame is obtained, and then adjust the fire to the required size by operating the control lever, at which time no smoke should be present. The shut-off and metering valve should not be used for adjusting the size of the fire unless a hand throttle or control lever is not provided. On new installations refractory and stack should be allowed to come up to temperature before adjusting fire. Starting and regulating of the fire should be done with the small cover plate over the combustion chamber removed from the top of the range for observing conditions. An observation port is provided in the front of bake oven fire boxes for this purpose.

d. To stop diesel oil burners, such as the Ray type DG-21 size 0000 or Ray type BG-23 size 000, close the shut-off and metering valve which controls the flow of oil to the atomizing cup. Allow burner to run a full minute after fire has gone out. Unlatch burner and swing out of firebox. With burner still running clean excess oil out of the atomizing cup by placing a small rag on index finger and inserting into the rotating cup. Clean the nozzle off with a rag. Stop burner by opening starting switch. Check oil tank to see that sufficient oil is available for next period of operation. Leave burner swung out of firing position until firebox has cooled to prevent refracted firebox heat from damaging the burner nozzle and atomizing cup. **The above must be done every time the burner is shut down.**

e. To start preferred model diesel oil burners, swing the burner into firing position and latch. Start burner by closing switch which is on back of burner housing. Light a large piece of paper or oiled rag and place in center of firebox directly beneath burner nozzle. Open globe valve in oil line. Push oil valve reset switch button which is on side of burner. Open metering valve which is on top of burner to half-way mark. Allow fire to burn freely until a steady and clear orange flame is obtained, and then adjust fire to required size by operating the metering valve on the top of the burner, at which time no smoke should be present. The size of the fire is regulated by the metering valve since this burner is not equipped with a control lever or throttle. On new installations refractory and stack should be allowed to come up to temperature before adjusting fire. Starting and regulating of the fire should be done with the small cover plate over the combustion chamber removed from the top of the range for observing conditions. An observation port is provided in the front of the bake oven fireboxes for this purpose.

f. To stop preferred model diesel oil burners, close the globe valve in the oil line tight. Allow burner to operate a full minute after fire has gone out. Unlatch burner and swing out of firebox. With burner still running, clean excess oil out of the atomizing cup by placing a small rag on index finger and inserting into the rotating cup. Clean the nozzle off with a rag. Stop the burner by opening the starting switch. Check oil tank to see that sufficient oil is available for next period of operation. Leave burner swung out of firing position until firebox has cooled to prevent refracted firebox heat from damaging the burner nozzle and atomizing cup. **The above must be done every time the burner is shut down.**

651-2.20.7 RESTARTING BURNER AFTER POWER FAILURE OR OVERLOAD.

a. To restart Ray burners if motor stops because of power failure, close the shut-off and metering valve. Restart by pressing starting button when each motor is provided with a magnetic starting switch. If only one magnetic switch is used in the line with a mechanical switch for each motor, place each mechanical switch in the ″OFF″

position. Close the magnetic switch by pressing the starting button, then close the mechanical switch on each motor to be run. Make sure that no unburned oil is in the firebox. Light a large piece of paper or oiled rag and place in the firebox directly beneath the burner nozzle or burners that have been restarted. Set air-oil control lever at side of burner to halfway position. Open shut-off and metering valve slowly. Allow fire to burn freely until a steady and clear orange flame is obtained. Adjust the fire to required size by operating the air-oil control lever. If motor stops because of overload (overload is evident if magnetic switch repeatedly opens or fails to stay in closed position when starting button is operated), close the shut-off and metering valve and call an electrician. Installations having a magnetic switch for each motor will be indicated by the individual magnetic switch opening and stopping the burner it controls while the other burners in the line continue to run. Installations having a mechanical switch for each burner motor will be indicated by the magnetic switch automatically opening the circuit and stopping all burner motors, said magnetic switch refusing to remain closed until the cause of the overload is corrected.

b. To restart Preferred model burners if motor stops because of power failure, open the starting switch. Close the metering valve or throttle which is on top of the burner housing. Close the starting switch. Light a large piece of paper or oiled rag and place in firebox directly beneath burner nozzle. Press the oil valve reset switch button which is on side of burner housing. Open the metering valve halfway. Allow the fire to burn freely until a steady and clear orange flame is obtained. Adjust the fire to required size by operating the metering valve. If motor stops because of overload, open the starting switch, close the metering valve, and call an electrician to check the cause for overload.

651-2.20.8 CARE AND MAINTENANCE.

a. Ray types BP-13 and BG-23 size 000 oil burners: The main burner ball bearings are lubricated from the oil reservoir located at the bottom of the burner. This reservoir should be kept full of oil at all times. The filling oil cup is located on the side of the burner housing and should indicate that the reservoir is full when the burner is shut down. Use a good grade of SAE No. 30 engine oil as often as necessary to keep proper level. Care should be taken not to over-lubricate the burner motor. Only two or three drops of oil should be supplied to each of the motor bearings once a month. The oil strainer, which should be installed in the oil line and as close to the burner inlet as possible, should be cleaned as often as necessary depending on the amount of dirt in the oil being used. Failure to clean the strainer will slow or stop the flow of oil to the burner. Before cleaning the strainer, stop the burner and close the globe valve which is installed in the oil line on the oil tank side of the strainer. Remove the cap of the strainer. Lift out the basket and wash it in kerosene. In replacing the strainer cap be sure it is seated properly and that the gasket is in good order. Keep the atomizing cup and nozzle clean and free of carbon at all times.

b. Under no circumstances should carbon be permitted to build up on the inside of the atomizing cup or in the vanes of the air nozzle. This condition is usually caused by failing to clean the atomizing cup and nozzle each time the burner is shut down. The atomizing cup and air nozzle should be inspected periodically by the engineer to ensure cleanliness. A secondary-air opening is always provided in the bottom of the combustion chamber of ranges and bake ovens when horizontal-rotary burners are employed. If this opening is not provided, the burner will not operate and either a yard should make repairs or NAVSHIPS be notified immediately, giving name and type of range or bake oven. Keep this secondary-air opening free of carbon and open at all times. Never allow carbon to form on walls of combustion chamber or around the burner nozzle. If carbon does form, the burner should be adjusted to provide more primary air and the draft should be checked to see that it is between 0.03 and 0.05 inch, since lack of oxygen causes carbon and soot.

c. The primary air inlet to the burner fan is located at the bottom of the burner housing. A butterfly valve controls the primary air through the air-oil control lever. Clean this air inlet periodically of all grease and dust accumulations. The oil is fed to the atomizing cup by means of a stationary fuel tube running through the hollow main burner shaft. This fuel tube is supported at the tailpiece end only; and if not properly centered, it

will rattle and vibrate with a loud noise by rubbing against the fast rotating burner shaft. When this occurs, shut the burner down immediately and adjust by means of the centering screws on the burner tailpiece. Inspect the brushes and clean the commutator on direct current motors after each 1,000 hours of operation.

d. Ray types AG-21 and DG-21 size 0000 oil burners: Keep the oil cups on the burner filled at all times with a good grade of SAE No. 30 engine oil taking care not to overflow the cups. Keep the burner clean on the outside. The oil strainers, which should be installed in the oil line as close to the burner inlet as possible, should be cleaned as often as necessary, depending on the amount of dirt in the oil being used. Failure to clean the strainer will slow or stop the flow of oil to the burner. Before cleaning the strainer, stop the burner and close the globe valve which is installed in the oil line on the oil tank side of the strainer. Remove the cap of the strainer. Lift out the basket and wash it in kerosene. In replacing the strainer cap be sure it is seated properly and that the gasket is in good order.

e. Keep the atomizing cup and air nozzle clean and free of carbon at all times. Under no circumstances should carbon be permitted to build up on the inside of the atomizing cup or in the vanes of the air nozzle. This condition is usually caused by failing to clean the atomizing cup and nozzle each time the burner is shut down. The atomizing cup and nozzle should be inspected periodically by the engineer to ensure cleanliness. A secondary-air opening is always provided in the bottom of the combustion chamber of ranges and bake ovens when horizontal-rotary burners are employed. If this opening is not provided, the burner will not operate and either a yard should make repairs or NAVSHIPS be notified immediately, giving name and type of range or bake oven. Keep this secondary-air opening free of carbon and open at all times. Never allow carbon to form on walls of combustion chamber or around the burner nozzle. If carbon does form, the burner should be adjusted to provide more primary air and the draft should be checked to see that it is between 0.03 and 0.05 inch since lack of oxygen causes carbon and soot.

f. The primary air inlet to the burner fan is located at the bottom of the burner housing. A butterfly valve controls the primary air through the air-oil control lever. Clean this air inlet periodically of all grease and dust accumulations. The oil is fed to the atomizing cup by means of a stationary fuel tube running through the hollow main burner shaft. This fuel tube is supported at the tailpiece end only; and if not properly centered, it will rattle and vibrate with a loud noise by rubbing against the fast rotating burner shaft. When this occurs, shut the burner down immediately and adjust by means of the centering screws on the burner tailpiece. Inspect the brushes and clean the commutator on direct current motors after each 1,000 hours of operation.

g. Preferred model oil burners: Keep the oil cups on the burner filled at all times with a good grade of SAE No. 30 engine oil taking care not to overflow the cups. Keep the burner clean on the outside. The oil strainer, which should be installed in the oil line as close to the burner inlet as possible, should be cleaned as often as necessary depending on the amount of dirt in the oil being used. Failure to clean the strainer will slow or stop the flow of oil to the burner. Before cleaning the strainer, stop the burner and close the globe valve which is installed in the oil line on the tank side of the strainer. Remove the cap of the strainer. Lift out the basket and wash it in kerosene. In replacing the strainer cap be sure it is seated properly and that the gasket is in good order.

h. Keep the atomizing cup, nozzle, and rifled bushing clean and free of carbon at all times. Under no circumstances should carbon be permitted to build up on the inside of the atomizing cup, nozzle, and rifled bushing. Carbon formation on these parts is usually caused by failing to clean the parts each time the burner is shut down. These parts should be inspected periodically by the engineer to ensure cleanliness. A secondary-air opening is always provided in the bottom of the combustion chamber of ranges and bake ovens when horizontal-rotary burners are employed. If this opening is not provided, the burner will not operate and either a yard should make repairs or NAVSHIPS be notified immediately giving the name and type of range or bake oven. Keep this secondary-air opening free of carbon and open at all times. Never allow carbon to form on walls of combustion chamber or around the burner nozzle; if carbon does form, the burner should be adjusted to provide more primary air and the draft should be checked to see that it is between 0.03 to 0.05 inch since lack of oxygen causes carbon and soot.

i. The primary air for the burner is pulled through a filter at the bottom of the burner. This filter should be kept clean by removing the air filter pad from basket and rinsing it in kerosene until clean. After cleaning, replace the filter pad in the basket and install the basket on the burner. The oil is fed to the atomizing cup by means of a stationary fuel tube running through the hollow burner shaft. If the fuel tube becomes noisy, the burner should be shut down immediately and the tube centered in the burner shaft by adjusting the screws at the back end of the fuel tube. Inspect the brushes and clean the commutator on ac motors after each 1,000 hours of operation.

651-2.20.9 PRECAUTIONS FOR ALL HORIZONTAL-ROTARY BURNERS.

a. Never light burner when using heavy (Bunker C) fuel without first circulating hot oil (140°- 150°F) freely through the system.

b. Never shut burner down without cleaning the atomizing cup and nozzle.

c. Never keep burner in firing position when burner is shut down if the firebox is hot.

d. Never stand with head in front of combustion chamber opening when starting or adjusting burner.

e. Never fill oil-storage tank when burner is operating.

f. Never allow oil in storage tank to fall to a low level. Air pockets may form in the oil line and cause the fire to go out.

g. Never burn rubbish in the firebox or pile it near the burner.

h. Never poke walls of firebox with shovel or poker to clean. A lean fire, that is little oil and much air, will consume the carbon on firebox walls.

i. Never relight burner if oil has accumulated in the firebox.

j. Never relight burner from hot bricks of combustion chamber.

k. Never run Ray BP-13 and BG-23 size 000 oil burners without oil in housing.

l. Never permit unauthorized or unqualified personnel to tamper with the burner adjustments.

651-2.20.10 SAFETY DEVICES.

a. Starting equipment consists of either a magnetic across-the-line starter for each burner motor or a magnetic switch for use in the main line to all motors with a mechanical switch for each motor. Where the burner is so designed that the control equipment is incorporated in or on the burner, as is the case with Preferred burners, it is necessary that a drip-proof remote-control switch be installed in the main line to burner or burners, said switch being mounted on a bulkhead, clear of burners, and being normally closed. This remote-control switch is for the purpose of stopping burners in event they catch fire.

b. No-voltage protection is provided in the form of a magnetic switch with reset type starting button for controlling the motor and oil valve, or the oil valve is equipped with a reset type coil and switch to prevent the flow of oil to the burner in event of a current failure. When the magnetic switch has opened, in the case of a reset type starting button being used, either because of low voltage or overload, it will not re-close on resumption of electric service or resetting of overload until the starting button is again operated; likewise, when the switch has opened, in the case of a reset type coil and switch for oil shut-off, either because of low voltage or overload, it will not re-close on resumption of electric service or resetting of the overload, thus allowing flow of oil to the burner, until reset switch is closed manually. All overload devices are of the thermal type.

651-2.21 BLOWER TYPE POT BURNERS

651-2.21.1 DESCRIPTION.

a. This burner is rectangular in shape and consists of an oil pot, air box, centrifugal fan, electric motor, and the necessary controls. The air box and the oil or fire pot fit in the firebox of the range while the blower unit, electric motor, and controls are fastened to the outer end of the air box and protrude from the front of the range.

b. A slide damper is attached to the side of the blower unit for regulating the volume of air for efficient combustion and a metering valve is attached to the front of the burner for regulating the flow of oil to the oil or fire pot.

c. Although these burners are manufactured under various trade names, they are essentially the same in principles of operation and maintenance. The trade names of this type of burner that are generally used aboard ship are the Therm Type 0, Therm Type 10, Therm Type C, Brown LCI Seacook, Deluxe No. 2, Kresky No. 1-KR, and Kresky No. 2R.

651-2.21.2 VAPORIZATION. This type of burner prepares oil for combustion by vaporizing it. Oil entering the hot fire pot vaporizes much the same as water in a kettle will form a vapor or steam when heated. As the oil vapor rises from the bottom of the fire pot and is mixed with the air from the blower fan, it ignites or burns.

651-2.21.3 OIL PRESSURE AT BURNER.

a. There are two methods for controlling the oil pressure on blower type pot burners. The first method of control is by utilizing a constant level metering float valve, such as the Detroit CRC-505, which is attached to the front of the burner. The second method of control is by employing a needle or metering valve in the oil line, said metering valve being installed as near the burner as possible, and a constant level valve in the oil line as near as possible in the axis of the burner and high enough so the percentage of change in relative position of the constant level valve and burner is reduced to a minimum when the vessel pitches or rolls.

b. The constant level metering float valve is similar in appearance to a carburetor on an automobile and essentially consists of two parts within one housing. One of these parts is the float which controls the flow of oil from the day tank and the other part is a metering valve for controlling the flow of oil to the burner. The knob on the top of the metering float valve operates the metering valve, and when turned on, it permits oil to flow to the burner in the desired quantity. The metal float has a pivoted lever arm with a needle valve at the back end which stops the flow of oil from the day tank when the float has been raised to maximum height by the level of oil in the bowl.

c. In the second method of control, the constant level valve controls the oil pressure and the needle or metering valve controls the flow of oil to the burner.

651-2.21.4 FIREBOX DRAFT. The blower type pot burner is not so sensitive to draft as the horizontal-rotary burner because the blower type pot burner has only one means of air supply whereas the horizontal-rotary burner has a primary air supply which is supplied by the burner fan and a secondary air supply which is created by natural draft. The fan in the blower type pot burner supplies all the necessary air to the burner pot for combustion, draft only being necessary in sufficient quantity to carry the heated gases through the flues and up the smoke pipe, provided the atmospheric pressure within the galley does not drop too low for the burner fan to resist the back-draft caused by the low galley pressure. Low pressure in the galley is generally caused by unbalanced ventilation, mechanical exhaust ventilation being in excess of supply ventilation.

651-2.21.5 ADJUSTMENT. There is no permanent adjustment on the blower type pot burner for controlling the air-oil mixture such as there is on the horizontal-rotary burner. This burner must be adjusted or regulated each time the size of the fire is changed by opening or closing the air damper on the blower. As the quantity of oil flowing to the burner is increased for a larger fire by opening the metering valve, the air damper on the side of the blower housing should be opened correspondingly until a good clear fire is obtained. Each different setting on the metering valve requires a different setting of the air damper if a clear fire is to be expected. An increase in oil requires an increase in air. Likewise a decrease in oil requires a decrease in air. Too little air for the quantity of oil admitted to the pot will cause a smoky fire and too much air for the quantity of oil admitted will tend to cool the range or blow the fire out.

651-2.21.6 OPERATION. Open the globe valve (a globe valve and an oil strainer should be installed in the oil line between the day tank and metering valve) in the oil line. Open the damper in range (if any) so that the gases will pass directly into the smoke pipe in lieu of traveling around the oven thus making it easier to start the fire. There should be no damper in the smoke pipe, but if there is one, be sure it is open and at the first opportunity have it removed. Open the metering valve and allow a small amount of oil to flow into the burner pot about enough to cover the bottom of the burner pot to a depth of 1/8 inch. Close the metering valve, throw a small piece of waste into the burner pot and light. When the oil in the burner pot is about consumed, start the blower but keep the air damper on the side of the burner closed. Open the air damper slightly to test flame. If the flame clears up and appears to strengthen, the burner is hot enough to operate; if the flame tends to flow out, allow more time for preheating. When the flame appears strong enough to operate, adjust oil and air so that flame is desired size and is clear and strong without giving off any soot or smoke. Adjust oil and air at the same time and remember that more oil requires more air. Close the range damper (if any) so that the hot gases will pass around the oven and heat it. When shutting burner down, the globe or stem valve in the oil line should be closed and the burner permitted to burn until it goes out. Close the metering valve and open the switch on the blower motor.

651-2.21.7 CARE AND MAINTENANCE.

a. **Care of burner.** The electric motor should be kept free of grease and dirt and should be oiled after each 300 hours of operation. The needle valve in constant-level metering float valves, such as the Detroit CRC-505, has a tendency to become gummy with use, thus prohibiting the needle from seating properly and permitting oil to seep through. When seepage or leakage occurs, the needle should be removed and cleaned or honed so that it will seat tightly.

b. Carbon, soot, and sparks: Many complaints are received on the blower type pot burner filling up with carbon, causing soot to form in the flues, and sparks to issue forth from the top of the smoke pipe. Carbon and soot in the burner, firebox, and flues are caused by particles of oil failing to ignite due to the lack of air (oxygen). Some of this carbon (unburned particles of oil) accumulates in the firebox forming a hard crust which clogs the burner air inlets (especially the air inlets in the Kresky type burner because they are so small), thus decreasing the air supply and increasing the carbon formation to such a degree, if not cleaned out, that the burner will cease to function. With insufficient air (oxygen) small particles of unburned oil will travel through the flues and up the stack, either lodging in the flues or the stack in the form of soot or passing out of the top of the stack where, due to the oxygen present and the heated condition of the oil particles, these oil particles will ignite and cause sparks.

c. To remove hard carbon from the burner pot without removing the burner from the range, turn off the oil and as soon as the flame is out, scrape the burner pot with any tool that will fit. When the carbon has been loosened, remove as much as possible of the loose particles with a damp cloth. Start the fire again, keep the fire very lean, which means little oil-much air. This will result in the remainder of the loosened carbon either being burned up or blown away. Repeat as necessary.

651-2.21.8 PRECAUTIONS.

a. Never leave burner unattended while it is operating. Many fires have started while burners have been operating unattended.

b. Never secure the galley without making sure the globe valve in the oil line is closed tight.

c. Never fill oil storage tank when burner is operating.

d. Never allow oil in storage tank to fall to a low level.

e. Never burn rubbish in the firebox or pile it near the burner.

f. Never let carbon accumulate in the burner pot.

651-2.21.9 SAFETY DEVICES.

a. Constant level metering float valve: This type of valve, when in proper working order, prevents the burner from being flooded with oil in event the fire goes out. When the fire goes out, the bowl of the valve will fill up which in turn causes the metal float to rise to its maximum level and close the needle valve. A globe valve is installed in the oil line and should be closed when the burner is not operating because constant level metering float valves have failed on occasions and flooded the deck with oil, in a few instances causing fires. Three types of failure are possible with constant level metering float valves; a pin hole in the metal float will cause it to fill with oil and sink in lieu of floating; the metal float becomes detached from the lever arm which operates the needle valve thus allowing oil to flow directly through the valve because no pressure is applied on the needle; and the needle sticking or failing to seat which permits a steady leakage of oil.

b. Bucket and safety trip valve: On burners equipped with a constant level valve and a metering valve in lieu of a constant level metering float valve, an overflow bucket and trip valve are provided. This overflow bucket and trip valve will generally be found on Therm burners, most of the other types being equipped with a constant level metering float valve. If the fire goes out while the metering valve is open, the oil will flow into the burner pot until the level of oil reaches the height of the overflow port. The oil then flows through the overflow pipe and into the bucket. The bucket is attached to the trip valve and the weight of the overflowing oil in the bucket causes the trip valve to close and stop the flow of oil. A globe valve is installed in the oil line and should be closed when the burner is not operating in event the metering valve leaks and the trip valve fails to close. The trip valve will fail to work if the tension on it is greater than the weight of the bucket full of oil or if the bucket guide becomes filled with dirt and grease and prohibits the bucket from dropping.

651-2.22 PRESSURE ATOMIZING BURNERS

651-2.22.1 DESCRIPTION.

a. This type of burner is an integral unit consisting of electric motor, dual-stage oil pump, fan fuel tube and nozzle, high-tension ignition transformer, ignition electrodes and the necessary controls. The fuel nozzle and electrodes fit inside the fire box of the range while the motor, pump, fan, transformer, etc., are contained in a housing which is bolted to the range front. These burners are for use with the Navy Standard two-oven automatic oil-fired range which is equipped with an oven thermostat for controlling the ″ON-OFF″ cycle of the burner.

b. Air for combustion is drawn through an air inlet housing (6 3/8 X 3 5/8 inches, outside dimensions) at the bottom of the burner housing. The combustion air is controlled by means of an adjustable butterfly valve

damper in the air inlet housing. A duct can be attached to the air inlet housing to provide an independent air supply to the burner in event the pressure in the galley is below atmosphere.

c. Diesel oil is supplied to the atomizing nozzle, via the fuel tube, by a dual-stage oil pump. The oil is delivered to the nozzle at a minimum pressure of 100 psi.

d. Ignition is accomplished by means of an electric spark caused by high-tension voltage passing between adjacent electrodes within the fire box of the range.

e. An oven thermostat (supplied with and mounted on the range) controls the ″ON-OFF″ cycle of the burner to maintain temperatures as determined by the thermostat setting. A stack switch (mounted on range with helix located in fire-box refractory) is utilized in the control circuit to lock the burner out in event the fuel fails to ignite.

651-2.22.2 PREPARATION OF FUEL. The diesel oil is atomized by forcing the oil through the nozzle at a pressure of at least 100 psi, and is then mixed with combustion air that is forced through the blower tube and over the air diffuser vanes to obtain maximum turbulation. The atomized oil when mixed with the turbulated air forms a combustible mixer.

651-2.22.3 FIREBOX DRAFT. An over-the-fire reading of 0.04-inch water column is required for proper combustion.

651-2.22.4 OPERATION. The burner is started by turning the oven thermostat (mounted on the range front) to the desired temperature. Closing down is accomplished by turning the oven thermostat to the ″OFF″ position.

651-2.22.5 MAINTENANCE AND ADJUSTMENT.

a. On new installations, there are apt to be metal chips from the pipe threads or pipe sealing compound in the oil line which can clog the burner nozzle if the following procedure is not followed at initial starting:
   1. Remove the blower case cover assembly.
   2. Remove the nozzle tip and strainer assembly and then re-connect the fuel tube assembly to the fuel pipe so it will discharge fuel outside of the firebox.
   3. Disconnect the ignition transformer from the line terminals.
   4. Place a receptacle (3 or 4 gallon capacity) under the discharge end of the fuel tube.
   5. Start the burner and allow the pump to flush 1 or 2 gallons of oil through the system. (To prevent the stack switch from shutting the burner off during this flushing period, it will be necessary to turn the helix spring clutch of the stack switch counterclockwise and then releasing the clutch after burner has started. It will be necessary to reset the stack switch, after flushing, by turning the helix spring clutch clockwise and releasing the clutch after firing.)
   6. After flushing, replace the nozzle tip and strainer and reassemble the fuel tube in the burner, making sure that the ignition transformer is connected to the line terminals.
   7. Check ignition electrodes to see that they are between 1/8 to 3/l6-inch apart.
   8. Set air inlet damper (butterfly valve) approximately one-half open when using a 1.65 gallon per hour nozzle (correct size nozzle for the Navy Standard two oven automatic range).
   9. Start the burner by setting the oven thermostat to the desired temperature.
   10. Adjust the oil pressure so that the gage registers between 100 and 125 psi.
   11. Adjust the air inlet damper so that there is no trace of smoke (less than 3 on the Shell-Bacharach Scale)

or even a haze when restarting burner or under running conditions. Smoke or haze will eventually cause the range passages to fill with soot. The flame should have a smooth, steady sound, without pulsations or rumblings, and should be light orange to clear in color. A red flame indicates insufficient air.

12. Check burner frequently during the first week of operation to determine that the nozzle is free from dirt. A dirty nozzle will cause the burner to smoke.

b. The following should be accomplished as indicated:

1. Clean galley range flues at least once each 6 months.
2. Remove burner motor and fan (fan is fastened to motor shaft) approximately every 6 months. Rinse fan in a cleaning solution or solvent to remove grime and dirt. Inspect fan for any damage that may cause it to be out of balance.
3. Remove, inspect, and clean the fuel unit every month.
4. Inspect, clean, and adjust the ignition electrodes at least once each 3 months. Check for cracked insulators and replace if necessary.
5. Inspect and clean the oil filter cartridge in the suction line at least once each month. Replace the cartridge at least once each year. The vacuum gage on the fuel unit will indicate when the fuel unit strainer or the line filter is clogged up. An increase of approximately 5 inches in vacuum indicates that they need cleaning.
6. Clean nozzle every 3 months or more often if burner smokes.
7. The helix on the stack switch should be inspected and cleaned once every 6 months. If helix is distorted, it should be replaced. Do not attempt to file or dress the stack switch contacts.
8. The burner motor has ball bearings of the double-sealed, pre-lubricated type with sufficient grease to last the life of the bearings. The ball bearing housings in the motor are also packed with grease approximately one-third full. Whenever the oil burner motor is overhauled, these housings should be flushed clean with kerosene and repacked with ball bearing grease conforming to Navy Specification 14-L-3.
9. On dc motors the commutator and slip-ring brushes are designed to give a service life of between 8 and 10 thousand operating hours. It is important that the brushes in the dc motor-inverter be replaced with the correct type indicated in the technical manual.
10. Be sure to reconnect the radio interference noise reduction filters, installed in the junction box on the dc motor-inverter, after any inspection or maintenance operation that requires removal of the filters.

651-2.23 COMBUSTION AND ITS REQUIREMENTS

651-2.23.1 ESSENTIALS OF COMBUSTION. (For principles of atomization see **NSTM Chapter 541, Ship Fuel and Fuel Systems**).

a. Air and oil mixture: Tests have indicated that complete combustion will require approximately 1,900 cubic feet of air for each gallon of oil burned. This figure should be used when determining the volume of air required for an induced draft system. Sufficient air is being supplied to the burner when the fire burns clear, that is, without smoke.

b. The smoke pipe: The primary purpose of the smoke pipe is to supply air (oxygen) to the fuel within the firebox, since the fuel, whether it be wood, coal or oil, will not burn unless mixed with the correct amount of oxygen. When oxygen and fuel are mixed in the correct proportion, there should be no smoke to be carried away by the smoke pipe. Smoke is an indication of insufficient air (oxygen). The secondary purpose of the smoke pipe is to carry smoke, of which there should be none if the air and oil are mixed in correct proportion, from the range to the weather.

c. Size of smoke pipe: The breeching, if any, and the smoke pipe should have an area at least equal to 1.25 times the areas of all range and bake oven smoke pipes leading into it. As an example, three ranges, each having an 8-inch diameter (50.27 square inches) smoke-pipe outlet, will require a main smoke pipe having an area of 1.25 (3 x 50.27) or 188.51 square inches. A main smoke pipe having an inside diameter of 15 1/2 inches (188.69 square inches) will be required to provide sufficient draft for these three ranges. In the case of one range with an 8-inch diameter outlet, a main smoke pipe having an inside area of 1.25 x 50.27 or 62.84 square inches will be necessary. A main smoke pipe having an inside diameter of 9 inches (63.62 square inches) will be required.

d. Draft: Draft is a natural means of supplying air (oxygen) to the firebox of a range or bake oven for burning the fuel therein. Since hot or warm air is lighter in weight than cold air, it has a natural tendency to rise or be displaced by cold air. In the case of a range or bake oven, the air in the firebox becomes hot as the fuel burns and rises up through the flues and smoke pipe to the weather where it is carried away by the prevailing wind or motion of the ship. As the heated air rises out of the firebox, it is replaced with cooler air from the galley which not only heats and rises but supplies the necessary oxygen for combustion. This action is continuous and creates what is commonly known as draft. The amount of draft available depends on the height of smoke pipe above the range or oven, the number of turns in the smoke pipe, the cross-sectional area of the smoke pipe, the length of the horizontal run of the smoke pipe, the type of smoke pipe cap, and whether the smoke pipe and flues are clean or dirty. Any obstruction in the smoke pipe or flues caused by poor design or dirt and soot due to lack of cleaning will retard or stop the heated air from rising. Consequently the heated air cannot be displaced with cold air and draft and combustion will cease.

651-2.23.2 DRAFT TROUBLES AND THEIR CORRECTION.

a. Elimination of excess draft: Stove pipe or stack dampers should never be installed except where Valjean carburetor burners are employed for controlling excess draft in oil-burning galley or bakery equipment. If installed they should be removed or kept in an open position at all times. All oil-burning bake ovens and ranges of good design are equipped with adjustable secondary-air ports or slides. On most commercial designs, these secondary-air ports or slides are located on the front of the range or bake oven below the burner. On the Navy Standard 65-R-3 oil-burning range, the secondary-air ports are located on the end of the range at the firebox end, are circular in shape, and are slotted. Where excess draft prevails, these secondary-air ports should be adjusted by closing them until the correct amount of firebox draft is obtained. Generally horizontal-rotary burners of the size used on galley ranges and bake ovens require a fire-box draft of from 0.03 to 0.05 inch. When the correct firebox draft is obtained, the secondary-air ports should be locked in position by the studs provided.

b. Insufficient draft - Causes and remedies: Insufficient draft is caused by one or more of the following conditions which must be corrected as indicated to obtain efficient operation of the equipment:

   1. Secondary-air ports or slides closed: These ports or slides are located in the range casing under the firebox. Open these slides or ports until sufficient draft is obtained, generally 0.03 to 0.05 inch in the firebox. If insufficient draft prevails when the slides are at their maximum opening, look elsewhere for the trouble.

   2. Dirty flues or smoke pipe: All ranges have a flue clean-out opening under each oven for cleaning the soot from the bottom horizontal flue. The top plates can be removed for cleaning the top horizontal flue over the ovens. Soot in the down flue at the end of the range can be pushed into the bottom horizontal flue when the top plates are off and removed via the flue clean-outs under the ovens. The Navy Standard 65-O-3 oil-burning bake oven has a large plug in the front of the oven between the bottom oven door and the top of the burner apron. This plug should be removed at regular intervals and the radiator flues, which are behind this plug, cleaned out with the tool provided for this purpose. The smoke pipe can be cleaned by removing the clean-out plugs and using a suitable tool to scrape the soot out. Where clean-out plugs are not provided in the smoke pipe, it will be necessary to blow the smoke pipe out, at an opportune time,

with air or steam. Clean-out plugs should be installed in smoke pipes not equipped with same. Little or no soot will form if burners are in adjustment and sufficient draft is available.

3. Smoke pipe, breeching, or smoke pouch leaking air: inspect the smoke pipe, breeching, and smoke pouch to see that all joints are tight and that there are no holes. Also see that there are no gaps in range top plates.
4. Smoke pipe of insufficient area: Check range or bake oven flue outlets and size of main smoke pipe to see that they meet the requirements of paragraph 651-2.22.1c.
5. Horizontal lead sloping down: The horizontal run of smoke pipe from ranges or bake ovens to main vertical smoke pipe should slope up from the ranges or bake ovens to the main vertical smoke pipe. The greater the slope, the better the draft. Heated air rises and when the horizontal run of smoke pipe slopes down instead of up, it retards the flow of hot gases to the weather and reduces draft.
6. Excessive bends or turns in the smoke pipe: There smoke pipe. The fewer the bends, the better the draft. Each bend retards the flow of hot gases to the weather and fewer bends of smaller degree will tend to improve draft.
7. Long horizontal run: The horizontal run of smoke pipe between ranges or bake ovens and main vertical smoke pipe should never exceed 20 feet. The shorter the horizontal lead, the stronger the draft will be. The most ideal condition is to run the smoke pipe straight up to the weather from the ranges or bake ovens but this arrangement is seldom if ever possible due to interferences aboard the vessel.
8. Top of smoke pipe adjacent to ship's structure: The top of the smoke pipe should extend at least 3 feet above any adjacent structure. Installation of the top of the smoke pipe on a level with, or below, the top of the uptake causes downdraft, resulting in flare backs in the galley or bakery.
9. Faulty smoke pipe cap: A downdraft-diverting smoke pipe cap should be used. The Briedert-air-exhauster smoke pipe cap has in many instances proved unsatisfactory and its use in new or replacement installations is not recommended. Replacement smoke pipe caps should be constricted in accordance with NAVSHIPS plan S3402-939999.
10. Flareback: Flareback, which is flame shooting back into the galley or bakery from range or bake oven fireboxes, in lieu of traveling through the flues, is the result of negative draft (downdraft) which is caused by the top of the smoke pipe being in a pressure area (not high enough above ship's adjacent structure), top of smoke pipe not being fitted with a suitable downdraft-diverting cap or excessive mechanical exhaust ventilation in the galley or bakery. When the galley or bakery oil burners are operating, the supply ventilation to the galley or bakery should never be shut off or reduced. The mechanical exhaust should never be more than three 90° bends in the entire ventilation should be turned on after the supply ventilation and turned off before the supply ventilation unless the burners are secured. All supply ventilation intakes should be kept clean and clear of obstructions at all times so that the volume of air supplied will not be reduced below design calculations. See current ventilation instructions for correct operation of ventilation equipment.
11. Mechanical draft inducers: Where it is not possible to rearrange the smoke pipe to improve poor draft conditions due to structural interferences, it will be necessary to install a mechanical draft inducer in the smoke pipe. A venturi (aspirating) type of inducer is recommended. It should be designed and installed to permit continued operation of the oil-burning equipment even in the event that the draft inducer fan must be secured for any reason. The primary (forced) air supply for the inducer should be supplied by a separate Navy standard axial flow fan (that is, the air from an existing ventilation system fan should not be utilized for this purpose). A centrifugal fan may be used if necessary in lieu of an axial flow fan. The system shall be so installed that the hot gases do not come in contact with the fan and fan motor.
12. When a mechanical draft inducer is installed, it will be necessary to install an adjustable damper in the fan discharge duct to adjust the volume of induced air being supplied to the smoke pipe. An automatic marine type draft adjuster should also be installed at the end of the smoke pipe or breeching in the galley and/or bakery to provide an even or balanced draft under all conditions. The automatic marine type

draft adjuster should be adjusted to trip when the maximum draft for the burners it serves is exceeded. If the draft adjuster serves five burners and each burner requires a maximum draft of 0.05 inch, the draft adjuster should be regulated to trip when a draft of 0.25 inch is exceeded. Since there may be a tendency due to the breeching or smoke pipe layout for one burner to draw 0.07-inch draft and another burner to draw 0.03-inch draft, adjustment should be made by regulating the secondary-air ports of the ranges or bake ovens to ensure that each burner receives 0.05 inch of draft. The induced draft fan should be started before the burners and not shut down until the burners are secured. This method of improving draft should only be resorted to when no other means of improving draft is possible.

651-2.24 NAVY STANDARD 65-R-3 OIL-BURNING RANGES

651-2.24.1 DESCRIPTION.

a. Size of ranges. Navy Standard 65-R-3 ranges are made in three sizes, as listed in Table 651-2-2.

b. Size of ovens. All ovens in Navy Standard 65-R-3 ranges are 18 inches wide by 24 inches deep by 15 inches high.

c. General Arrangement. Class A, right-hand ranges have the firebox to the right, and the ovens to the left, observer facing the front of the range. Class B, left-hand ranges have the firebox to the left and the ovens to the right, observer facing the front of range.

d. Burner mounting. Navy Standard 65-R-3 oil-burning ranges are designed to operate with horizontal-rotary burners and will use diesel oil or Navy fuel oil depending on the type of burner supplied with the range.

e. Dampers. Navy Standard 65-R-3 ranges are not equipped with oven dampers as is the case with some commercial type ranges. The hot gases must travel around the ovens in lieu of bypassing up the smoke pipe.

Table 651-2-2 NAVY OIL BURNING RANGES

Type	Number of Ovens	Width	Size in Inches Depth	Height
A	1	49	42	36
B	2	70	42	36
C	3	91	42	36

651-2.24.2 BURNERS. For operation, maintenance, and repair of burners for Navy Standard 65-R-3 oil-burning ranges, see paragraph 651-2.20, Horizontal-Rotary Burners.

651-2.24.3 HEAT CONTROL OF OVENS. If oven temperatures suitable for roasting and baking cannot be maintained without the top plates developing hot spots, check all flues and firebox to make sure they are clear of soot and carbon. Clean burner nozzle, atomizing cup, fan and air jacket around burner. Determine whether burner atomizing cup is of proper angular size. Atomizing cup that operates most efficiently in these ranges has an angle of 60° between the vertical and the outer edge of the cone, or an internal angle of 60 degrees. Check speed of atomizing cup to see that it is not less than 3,450 rpm; that oil pressure at burner, when pumps are used, is not less than 5 psi or more than 8 psi; that oil head on gravity feed (diesel oil) burners is not less than 3 feet nor more than 4 feet; that the smoke pipe leading from range to the weather has no holes or broken joints and that it is clear of soot. It is to be noted that insufficient draft will cause the fire to hang in the vicinity of the firebox in lieu of passing around the ovens thus causing hot spots in the range top plates and cool ovens. Excess draft will cause the hot burner gases to pass around the ovens too fast for the heat to be extracted from them thus cooling the ovens and causing high stack temperatures. Should ranges continue to have cool ovens and over-

heated tops, after investigation in accordance with the above has been made, notify the home shipyard or the Naval Ship Systems Command stating in detail the facts regarding each range or burner. When reporting trouble, give all pertinent information such as manufacturer's name, size of equipment, contract number, etc.

651-2.24.4 REPAIR AND CONSTRUCTION OF NAVY STANDARD 65-R-3 RANGES.

a. Removal of grease. Burned grease will accumulate on the edges of the top plates and should be removed at frequent intervals. Expansion joints, provided between the extension plates and range top, allow for normal expansion due to heat provided the edges of the top plates are kept free from burned grease, the accumulation of which makes the range top longer. Further, this accumulated grease contaminates food and presents a fire hazard. Keep the range free of grease. Top plates and range body should not be cleaned with lye and water. Grease should be removed from the range body with kerosene or other non-corrosive grease solvent and from the top plates by wiping off with a cloth and using steel wool for polishing when necessary.

b. Removal of unburned oil from firebox. A drip pan is provided under the firebox so that unburned oil inadvertently admitted to the firebox will drain to the front of the range. This drip pan, which is removable, should be kept clean to avoid the possibility of fire.

c. Removal of carbon from firebox. Carbon deposits should be brushed out of the firebox to ensure efficient combustion. Fireboxes are constructed to definite dimensions to provide the correct volume of air for efficient combustion but this purpose is defeated if large deposits of carbon are permitted to form in the firebox and reduce the volume of same.

d. Removal of inner casing and insulation. The inner casing of the range body and insulation is made up in sections, as shown on NAVSHIPS plans S3402-860311 and S3402-860312 so that any part of the inner casing and asbestos insulation may be removed without disturbing the adjacent casing when renewal is required.

e. Firebox linings. These linings or tiles are of long-life, silicon-carbide, refractory tile, capable of withstanding a temperature of approximately 3,000°F. After a few hours use, the tile presents a dark color and possesses a peculiar quality of re-radiating heat into the firebox. Under ordinary circumstances and proper treatment, these linings will give not less than 3 years of satisfactory service before replacement should become necessary. Replacements should not be attempted by ship's force if avoidable, and if attempted, the exact original size of the firebox should be adhered to. Do not fire with oil immediately after relining. Fire with wood for at least 5 hours after relining the range. A complete set of spare firebox tiles, as follows, is furnished with each range:

   1 refractory hearth tile, part No. 55.
   1 refractory head tile, part No. 56.
   1 refractory head tile, part No. 56A.
   1 refractory splash tile, part No. 57.
   1 refractory splash tile, part No. 57A.
   1 refractory right-side tile, part No. 58.
   1 refractory right-side tile, part No. 58A.
   1 refractory left-side tile, part No. 59.
   2 refractory throat tile, part No. 60.
   10 pounds of silica cement for joining tile.

f. Firebox insulation construction. The firebox tile is insulated from all metal parts of the range by a wall of diatomaceous earth or calcined grog which permits the firebox to expand and contract without excessive strain. The casing of the firebox is composed of an inner casing of sheet steel 0.0781 inch thick, a center lining of one-fourth-inch thick millboard asbestos, and an outer casing of sheet steel 0.0781 inch thick. Spare firebox insulation, as follows, is furnished with each range:

7 pieces of block calcined granular grog or diatomaceous earth 2 by 6 by 36 inches. 50 pounds of calcined granular grog or diatomaceous earth.

g. Top flue lining over ovens. Split firebricks are used over the ovens. Those bricks should be laid up with a minimum amount of fire clay. When replacing brick or tile, care should be exercised to cover exposed surfaces of angles and casing with plastic firebrick to eliminate deterioration of the metal parts. Do not fire with oil immediately after rebricking. Fire with wood for at least 5 hours.

h. Range top plates. The range top plates are made of special high-grade castings containing a certain percentage of chromium and nickel to lend tensile strength at the high temperatures to which they are subjected. Tests of ranges conducted at a naval shipyard indicate that top plate temperatures need not exceed 750°F when a baking temperature of 500°F is maintained in the ovens. In this connection it is advised that baking and roasting temperatures in excess of 400°F are seldom, if ever, necessary. Sagged plates may be straightened by heating to the same temperature that caused them to sag and pressing them back into shape. Care should be exercised to prevent cracking when pressure is applied to straighten the plates. This work should preferably be done at a shipyard. Spare top plates, as follows, are furnished with each range:

1 top plate for over firebox, part No. 51.

1 top plate for over firebox, part No. 52.

i. Drain holes. Drain holes will be found on the outboard side of range foundations, at top of deck covering, which will allow water that may accumulate under range to drain off. The holes also permit directing a stream of steam or hot water under the range occasionally to maintain sanitary conditions.

651-2.25 NAVY STANDARD AUTOMATIC OIL-BURNING RANGE

651-2.25.1 DESCRIPTION.

a. The Navy Standard automatic oil-burning range is currently stocked in one size (6 feet - 2 inches long by 3 feet - 2 inches deep by 2 feet - 9 inches high), is of double-wall insulated construction, is right-hand fired, has two ovens (each 19 inches wide by 30 inches deep by 14 inches high), and is fired by a pressure atomizing burner. (See paragraph 651-2.22.) This range conforms to the requirements of NAVSHIPS drawing numbers S3402-1419231, S3402-1419232, S3402-1419233, S3402-1419234, S3402-1419235, and S3402-1419236.

b. Range top plates are heavy duty castings which have been ground smooth so that frying and grilling can be done directly on top of the range in addition to cooking in conventional pots and pans. The castings over the firebox are special heat resisting, nickel alloy castings, known commercially as ″NI-RESIST.″ Top panel castings above the ovens are fine grain, gray cast iron. All other fittings on the range, such as sea-rail stanchions, oven hinges, brackets, etc., are malleable iron.

c. A grease trough is provided along the front of the range which drains into a removable grease drawer at the left end of the range.

d. An opening is provided in the right front of the range for mounting of the pressure atomizing burner. A second hole is provided in the range front to the right and above the burner opening for installing the stack switch which is furnished with the burner. The oven thermostat is mounted on the range front above and to the left of the burner opening.

e. The oven thermostat installed on the range will operate on either ac or dc. However, the pressure atomizing burner must be ordered to operate on the available current, the correct stack switch is packed with each burner.

651-2.25.2 HEAT CONTROL.

a. The burner is started and required temperatures are maintained by setting the oven thermostat to the desired temperature.

b. In order to maintain uniform temperatures throughout the ovens (to prevent hotspots), each oven door has four ventilating slots or openings (two at the top and two at the bottom of each door). There are also two additional oven ventilating slots at the back of each oven near the bottom and an exhaust vent at the top center of each oven which is connected by a duct to the vent outlet hood on the top back of the range. By means of these vent openings and exhaust ducts there is created within each oven a movement of air through the ovens to equalize the temperatures for uniform baking and roasting. These vents should not be closed or plugged up.

651-2.25.3 INSTALLATION INSTRUCTIONS.

a. Uncrating. Use care in removing the crate so as not to damage the range and component parts, in particular the oven thermostat. Spare refractory is packed in the ovens and spare top plates are packed on top of the range. Remove top and side crating leaving bottom crating in place until range is about to be landed on its foundation. Removal of repair parts and top plates will reduce weight and facilitate moving range into place.

b. Setting the range. When the range is in the vicinity of its installation position, the base of the crate should be removed, care being taken that the weight of the range is equally distributed on the deck. Provide a level foundation for the range which is capable of substantially supporting the range weight of approximately 2000 pounds.

c. Stack connection. The range is furnished with a 30-inch long transition pipe section which converts from the oval range outlet to a 10-inch diameter smoke pipe. The stack should be run full size (10-inch diameter) pitching up from the transition section. Horizontal runs should be avoided wherever possible or sloped up at least 30 degrees. The stack should extend at least 15 feet above the top of the range. The stack should provide a firebox draft of 0.04-inch water column. When more than one range is installed, the smoke pipe should be constructed in accordance with paragraph 651-2.23.1c.

d. Mounting the oil burner. Tapped holes are provided in the range front for attaching the pressure atomizing burner to the range. The burner mounting plate is equipped with an asbestos rope gasket fitted between the mounting flange and the blower tube of the burner. See that the gasket is in place and then bolt the burner to the range. Follow instructions in the oil burner technical manual for installing the stack switch and the electrical and plumbing connections on the burner. When mounting the burner and stack switch, the top plates over the firebox should be removed and the refractory inspected for damage. It is particularly important that the helix of the stack switch not be in contact with the refractory.

651-2.25.4 INITIAL FIRING OF RANGES. After the burner is properly installed, the range should be fired gradually in accordance with the following procedures:

a. Range top plates are covered with a wax preparation to protect them from corrosion during storage. Remove this wax preservative from the top plates.

b. Set the oven thermostat to 150°F at which setting the burner should start. Allow burner to operate until it shuts off (approximately 10 minutes).

c. When the burner comes on automatically again, set the thermostat to 200°F. (Do not reset the thermostat until the burner has come on at the 150°F setting). If top plates are to be prepared for direct frying and grilling, let the burner cycle ″ON″ and ″OFF″ at 200°F while the top plates are treated as described under ″Preparation of Range Top Plates.″

d. Again allow the burner to operate until it shuts off at the 200°F setting and, after the burner comes on again, reset the thermostat to 250°F.

e. Continue as above, resetting the thermostat 50°F higher after each automatic ″ON″ operation.

f. At 350°F allow the burner to cycle ″ON″ and ″OFF″ two or three times. Continue resetting the thermostat 50°F higher after each automatic ″ON″ operation.

g. Continue above until maximum setting of 550°F is reached, which should take about 2 hours from the initial start.

h. To keep top plates in the best possible condition, the dressing operation should be repeated every time the range is cleaned but not less than once each week.

651-2.25.5 GENERAL CARE. The Navy Standard automatic oil burning range has been designed and built to withstand severe usage; however, this does not imply abuse. The oil burner to be used has been particularly designed and selected for this range and is furnished with a 1.65-GPH, 60° nozzle, which under no circumstances should be replaced with a larger nozzle. This capacity nozzle will allow for normal heating of the range. The range is not to be brought up to maximum temperatures in less than one hour. Preferably, when starting a cold range, the oven thermostat should be set no higher than 300°F and, after the burner has cycled on and off a few times at this temperature, then set the thermostat for whatever higher temperature is desired.

651-2.25.6 CARE OF COMBUSTION CHAMBER AND REFRACTORY. The combustion chamber in this range has been lined with the best, super duty, light-weight refractory fire brick available and will last indefinitely with proper care.

a. The main cause of trouble is the formation of carbon on the refractory as the result of improper burner adjustment or a clogged burner nozzle. Avoid carbon deposits by keeping the burner in adjustment.

b. Carbon should be removed by carefully chipping it from the refractory. Remove large pieces of carbon from the firebox, the smaller particles will be consumed by the fire.

c. The fire brick may become loose as a result of severe vibration or shock and repeated operation of the range. However, loose bricks can be reset since it is generally not possible to burn out this type of refractory.

d. A spare set of refractory is furnished with each range in event replacement should become necessary. If and when refractory is replaced, the firebox insulation (behind refractory) should also be renewed.

651-2.25.7 OVEN TOP AND RANGE LINING. Oven tops are protected with a tapering thickness of light-weight, insulating, castable refractory; the range body above the ovens is protected with the same material; and the down flue at the end of the second oven is protected with a high temperature insulating millboard (asbestos). These parts should be inspected periodically at least every 6 months to determine whether they have been damaged by over-heating or improper firing of the burner and repaired or replaced as necessary.

651-2.25.8 CLEANING THE RANGE. Apart from the regular cleaning of the outside surfaces of the range and the inside surfaces of the ovens, the flue passages within the range must be cleaned.

a. Beneath each oven is a flue clean-out door to facilitate the removal of soot and inspection of bottom flue baffles; oven bottom plates are also removable to aid cleaning of the bottom flue. All of the flues should be cleaned of soot every six months, the necessity for more frequent cleaning is an indication that the burner is not properly adjusted.

b. Once a year the flue adapter should be removed and the smoke box behind the combustion chamber cleaned of soot.

651-2.26 COMMERCIAL OIL-BURNING RANGES

651-2.26.1 The instructions applicable to Navy Standard 65-R-3 oil-burning ranges apply in general to all commercial type oil-burning ranges with the following exceptions:

a. Oven dampers. Many commercial type ranges are equipped with oven dampers which are capable of diverting the flue gases directly up the smoke pipe in lieu of around the ovens. These dampers, when open, facilitate starting the fire because the draft can draw straight from the firebox instead of going around the ovens. The handles controlling the oven dampers are generally located below the top plates along the front of the range. When the fire has been started and is burning efficiently, make sure these oven dampers are closed. Otherwise the ovens and the top plates most remote from the firebox will not heat.

b. Firebrick. The special type of refractory (silicon-carbide) used in the Navy Standard 65-R-3 range will not be found in commercial ranges. The fireboxes of commercial ranges are generally lined with clay firebricks or shapes.

c. Burner mounting. Most of the single oven and some of the two oven commercial type oil-burning ranges aboard ship are equipped with blower type pot burners. For operating blower type pot burners, see paragraph 651-2.22; for horizontal-rotary burners, see paragraph 651-2.20.

651-2.27 NAVY STANDARD 65-O-3 OIL-BURNING BAKE OVENS

651-2.27.1 DESCRIPTION. This bake oven is manufactured in one size only being 54 5/8-inches wide by 42 3/16 inches deep by 73 3/16 inches high. There are four baking compartments in the upper part each being 42 inches wide by 32 inches deep by 7 inches high and in the lower portion are the heating unit or stove and radiator assembly to which the oil burner is attached. This oven is the most efficient oil-burning bake oven that has been designed and constructed to date and when operated in accordance with instructions it will produce good bakery products. This oven complete comes packed in six containers, marked as follows:

a. Front section, oven body, marked ″A.″

b. Back section, oven body, marked ″B.″

c. Stove assembly lined with firebrick, marked ″C.″

d. Oil burner and accessories, marked ″D.″

e. Spare set of firebrick and cement, marked ″E.″

f. Spare parts (electrical and mechanical) and technical manuals, marked ″F.″

651-2.27.2 DESIGN. The Navy Standard 65-O-3 oil-burning bake oven is designed so that the hot gases must travel from the firebox to the back end of the stove dome, thence up to the radiator and forward through the five center flues of the radiator, and then back through the outside flues of the radiator to the back flue. This scheme was devised for the purpose of extracting the heat from the hot gases before they reach the back burner flue.

651-2.27.3 BURNER. This oven is equipped with a horizontal-rotary diesel oil burner, features of which are covered in paragraph 651-2.20.

651-2.27.4 FIRING THE OVEN. To start fire swing the burner into firing position and latch to furnace plate. Be sure that the oil shut-off valve (globe valve) in the oil line ahead of strainer is closed tight. Start the motor by closing the starting switch. Place lighted torch (a piece of oiled waste or a piece of paper) in firebox in front of nozzle via lighting port assembly, item 49, piece 1788-1. Open oil shut-off valve (globe valve) in oil line ahead of strainer. Push oil valve reset switch (on side of burner housing). Open metering valve (on top of burner near back) gradually until oil ignites in firebox, then continue opening metering valve until a maximum consumption of 1 1/4 to 1 1/2 gallons per hour is obtained. Should the burner start to puff as the metering valve is being opened, the metering valve should be turned back until puffing stops. After a few minutes advance metering valve slowly until a rate of 1 1/4 to 1 1/2 gallons per hour is obtained or burner starts to puff again. Puffing of the burner indicates a lack of draft. This might be caused by a cold stack which will warm up on low fire in a few minutes. If the burner persists in puffing and smoking, follow instructions in paragraph 651-2.23. The metering valve should be kept on high fire (1 1/4 to 1 1/2 gallons per hour) until the correct baking temperature is obtained. Cut back to a consumption which will maintain the desired temperature until ready to load the oven. Just prior to loading the oven, the metering valve should be set on high fire (1 1/4 to 1 1/2 gallons per hour) since opening the oven doors and the wet dough will cause a temperature drop. The oven should not be fired at a greater rate than will obtain a temperature of 450°F in 75 minutes from a cold start. Too many bakers force the oven and cause damage by trying to obtain high temperatures in too limited a time. After the oven is loaded, the metering valve should be adjusted in accordance with temperature requirements.

651-2.27.5 CONTROLLING HEAT DISTRIBUTION WITHIN OVEN. The vent damper (item 15, piece No. 3627) on the top of the oven should be adjusted to vent the oven properly. In most cases the vent should be wide open. This damper is important because it controls the flow of heated air through the baking compartments of the oven and is necessarily adjustable because it will be affected to some extent by the exhaust ventilation in the bakery. Opening the vent damper causes air to flow through the baking compartments and closing the vent damper slows or stops the flow of air through the baking compartments. There are a series of round holes in a line around the burner apron for the purpose of admitting air to the heating compartment. Air entering the heating compartment through these holes is heated and rises upward through the oven. The rate of rise depends on the vent damper opening. The air passes over and around the stove dome and radiator thus extracting the radiated heat from same and transferring it to the baking compartments via the heating flues around the baking chamber. The heated air, which has cooled to some extent because it has transmitted much of its heat to the bakery products within the oven, then passes out of the oven via the vent at the top. When the vent damper on the top of the oven is closed, there is no continuous flow of air through the oven and uneven temperatures and hot spots will result.

651-2.27.6 VENT DAMPERS. Overheated bottom baking compartments with cool upper baking compartments are an indication that the vent damper is not open far enough to permit the proper flow of air through the baking compartments for efficient distribution of heat. The above condition is brought about by the cool air which is in the oven when the burner is first started and the air which is cooled when the wet dough absorbs the heat from it being forced toward the top of the oven by the hot air from the heating compartment and the cool air not being able to escape from the top of the oven because the vent damper is closed. Although this cool air at the top of the oven will eventually reach a temperature suitable for baking under continuous heavy firing, the temperature of the bottom baking compartments will rise so high that the products therein will burn. Furthermore the intense bottom heat will damage the equipment. When in doubt about how wide to open the vent damper, the best course is to keep it wide open.

651-2.27.7 EFFECT OF DRAFT AND OVERFIRING. Overfiring the ovens only tends to burn them out and causes localized hot spots with uneven temperatures. The draft for the burners on these ovens should be regulated by means of the secondary-air slides (item 51, piece No. 2262) on the front of the stove under the burner and not by installing dampers in the smoke pipe. When these secondary-air slides are correctly adjusted to meet

draft conditions peculiar to the vessel involved, it should not be necessary to move or adjust them constantly unless the draft has a high rate of change. Should a high draft change prevail NAVSHIPS should be notified so a study can be made to correct the condition. The Preferred Model DOTR-1 diesel oil burner, which is furnished with this oven, is designed to operate on a firebox draft of 0.03 to 0.05 inch. By closing the secondary-air slides as necessary when excess draft is prevalent, an orderly and even flow of the hot burner gases passes through the radiator so the heat transmitted by the hot gases through the medium of the radiator can be absorbed by the tempering air admitted through the holes in the burner apron and pass up through the baking compartments. Excess unregulated draft has a tendency to pull the hot gases through the radiator too fast for the heat to be extracted from them. Due to the cooling effect of excess unregulated draft, the bakers have a natural tendency to overfire in an attempt to heat the oven which results in high stack temperatures, hot spots in the back of the oven, and the burning out of the equipment.

651-2.27.8 SMOKE PIPE DAMPERS. Dampers in the smoke pipe to regulate excess draft are not desirable because they trap the hot gases in the burner back flue at the back of the oven thus causing the back of the bakery compartments to have temperatures relatively higher than the front of the baking compartments. In view of the above, the secondary-air slides are to be used for regulating draft in lieu of installing dampers in the smoke pipe. Insufficient draft will also cause hot spots, uneven temperatures, and the burning out of the equipment. A lack of draft causes incomplete combustion which results in carbon deposits, smoke, and the hanging of fire in the stove dome and in some of the radiator flues. The hot gases lag or hang in the stove and radiator flues because the draft is too weak to pull the gases to the stack and is not capable of supplying enough air for complete combustion. The retarded passage of heated gases causes hot spots in the stove dome and radiator which in turn cause uneven heat distribution in the baking compartments. In an effort to heat the oven evenly, the baker overfires and damages the equipment. The large plug (item 18, piece No. 3620) between the bottom oven door and the top of the burner apron should be removed at regular intervals and the radiator flues, which are behind this plug, cleaned out with the tool (item 11, piece No. 3578) provided for this purpose. For correction of draft troubles, see paragraph 651-2.23.

651-2.28 OLD TYPE NAVY STANDARD OIL-BURNING BAKE OVEN

651-2.28.1 DESCRIPTION. This type of oven has a baking compartment in its upper portion and a heating unit or firebox in its lower portion. This oven is a redesigned coal-burning oven and is little better in heat distribution than a commercial type oven. This type of oven has been furnished in two sizes as listed in **Table** 651-2-3.

Table 651-2-3 NAVY OIL BURNING OVENS

Over-all Dimensions (Inches)				Baking Chamber (Inches)		
Size	**Width**	**Depth**	**Height**	**Width**	**Depth**	**Height**
No. 1	57	30	70	45	29	32
No. 2	43	30	70	31	29	32

651-2.28.2 DESIGN. The old type Navy Standard oil-burning bake oven is designed so that the hot gases travel up both sides of the oven to the smoke pipe. Such a design causes the sides of the baking chamber to become much hotter than the center of the baking chamber with resulting burning of products if pans are not shifted regularly.

651-2.28.3 BURNER. This type of oven is equipped with a horizontal-rotary oil burner, features of which are covered in paragraph 651-2.20.

651-2.29 COMMERCIAL TYPE OIL-BURNING BAKE OVENS

651-2.29.1 DESCRIPTION. There are a number of different makes and models of commercial oil-burning bake ovens installed aboard ship, many of which are inefficient due to poor heat distribution. Some of the ovens are similar in design to the old type Navy Standard oven, while others have a heating flue at the back of the oven only which causes products at the back of the oven to burn unless pans are constantly shifted.

651-2.29.2 BURNER. Commercial type oil-burning bake ovens are equipped either with horizontal-rotary burners described in paragraph 651-2.20, or with blower-type pot burners described in paragraph 651-2.21.

651-2.29.3 VENT DAMPERS. Some commercial-type ovens have a vent damper in the top which manufacturers illustrate being connected to the smoke pipe with small diameter stove pipe. Do not make the connection because it has no value and reduces or stops draft to the burner. Always keep any such vent damper wide open at all times as it will aid in distributing heat within the oven.

651-2.30 STEAM BAKERY PROOFERS

651-2.30.1 DESCRIPTION. Steam proofers are provided to facilitate the raising of bread dough prior to baking and are generally furnished in two sizes for shipboard use. The number and sizes of proofers furnished depend on the capacity of the bake ovens installed. Each shelf within the proofers (illustrated on NAVSHIPS plans 133573 and 133574) will accommodate 3 Navy Standard bread pans 11 1/2 by 28 inches. The No. 1 proofer has 6 shelves and a capacity of 12 pans. Proofers are mounted on bases 10 3/4 inches high and have dimensions listed in **Table** 651-2-4.

Table 651-2-4 NAVY STEAM BAKERY PROOFERS

	Height		Width		Depth	
Size	**Feet**	**Inches**	**Feet**	**Inches**	**Feet**	**Inches**
No. 1	4	3-1/16	3	4-1/8	2	8-11/16
No. 2	3	9/16	3	4-1/8	2	8-11/16

651-2.30.2 OPERATION. For proofing Navy bread dough, the temperature in the proofer should be kept between 95° and 98°F with a relative humidity of 80 to 85 percent. Turn the steam valve on full and crack open the pet cock (piece No. 31, which is in the steam coil in the right front corner at the bottom of the proofer) to provide the necessary amount of steam for humidity. Place the pans of dough on the shelves within the proofer and close the doors. Adjust the steam inlet valve to obtain the desired temperature. Allow the dough to proof from 30 to 60 minutes or until the loaves have doubled in size. At no time should there be more than 35 pounds of steam pressure allowed to pass through the steam coils of the proofer. Condensation should be drained from the drip pan at regular intervals by opening the pet cock (piece No. 32) which is on the outside of the proofer at the lower front right-hand corner.

651-2.30.3 PROPORTION OF PROOFERS TO OVENS. Proofer capacity should be equivalent to oven capacity, i.e., one size No. 2 proofer for each type 4 or type 12 bake oven and one size No. 1 proofer for each type 6 or type 18 bake oven. The Navy Standard 65-O-3 oil burning bake oven has the same capacity as the type 4 electric bake oven.

651-2.31 STEAM-JACKETED KETTLES

651-2.31.1 DESCRIPTION. Steam-jacketed kettles are provided in 20-, 30-, 40-, 60-, and 80-gallon sizes (10-gallon sizes are provided under special conditions but are not stocked) for cooking vegetables, boiling liquids, and making coffee. The lower two-thirds (approximate) of the kettles are surrounded by a jacket which is offset from the main kettle body to provide space for steam to circulate and heat the contents of the kettle. The kettles are stationary, mounted on three legs, have a hinged lid or cover, a tube at the bottom of the hemispherical body of the kettle with a faucet at the outer end for drawing liquids in lieu of dipping them out, a vapor exhaust stack connected to an exhaust pipe for carrying the vapor to the weather (not considered necessary), a steam inlet connection, a steam outlet connection, and a safety valve. Kettles now in use are of three types of materials, corrosion-resisting steel, aluminum, and single clad corrosion-resisting steel. The corrosion-resisting steel kettles are the most serviceable and the easiest to clean.

651-2.31.2 OPERATION. When heating a cold kettle, the steam should be turned on gradually, thus allowing the shells to become thoroughly warm before full pressure is applied. After the shells have become warm, but before applying full pressure, open the safety valve by pulling the lever. Opening of the safety valve, while the shells are under pressure, will remove air from within the jacket and prevent the jacket from becoming air-bound. Air presents the steam from coming in contact with the inner shell, thus causing the kettle to heat slowly. Do not tamper with the safety valve or tie it closed; it is there to prevent the kettle from exploding.

a. Safety valves

1. Aluminum and single-clad corrosion-resisting steel kettles. - These kettles are constructed to operate on a maximum steam pressure of 45 psig. If steam lines to the galley carry a pressure that causes the safety valves on these kettles to continually open and release steam to the atmosphere, a steam pressure reducing valve should be installed in the steam line leading to the kettles to reduce the pressure sufficiently to prevent continual opening of the safety valves. In no instance should the relief setting of the safety valves on these kettles be raised above the 45 psig setting.
2. Corrosion-resisting steel kettles. - The safety valves on these kettles are, in general, set to release at a pressure of 45 psig. In event the pressure in the steam lines to these kettles causes the valves to continually open and release steam to the atmosphere, it will be satisfactory to readjust the safety valves to a 55 psig setting to prevent continual opening of the valve. Corrosion-resisting steel kettles will operate safely on the higher relief setting.

651-2.31.3 STEAM-JACKETED KETTLES SIZES. Steam-jacketed kettles are available in various sizes and dimensions as listed in **Table** 651-2-5.

Table 651-2-5 STEAM-JACKETED KETTLE SIZES

Size	**Inside Diameter**	**Height from Deck**	**Weight**
Gallon	**Inches**	**Inches**	**Pounds**
10	16	31	50
20	21	33	70
30	23	36	80
40	25	38	90
60	29	41	125
80	32	45	155

651-2.31.4 CLEANING. The kettles should be cleaned thoroughly after being used, and prior to being used they should be given a rinse with hot water. The draw-off tube and fittings should be cleaned with a round brush having a flexible wire handle, and hot water. When cleaning the draw-off tube, remove the plug from the faucet (Caution: Do not change plugs from one kettle to another. Each plug is machined to match the faucet it comes with, and if plugs are interchanged, it is possible they will leak) and run the cleaning brush back and forth through the tube while a small stream of hot water is running through the tube. Caustic cleansers should not be used in cleaning the kettles. The paint on the outside of clad steel kettles will chip and wear off in use. The outside of these kettles should be painted as necessary with a heat-resisting paint to keep them in good condition. On the older kettles the draw-off is made up of several pieces which are threaded for screwing together. All of these older type draw-offs have a threaded plug or cap at the back end which should be removed each time after the kettle is used so that the cleaning brush can be run back and forth through the tube. All of these old type draw-off fittings should be removed and thoroughly cleaned at least once a week.

651-2.31.5 VAPOR EXHAUST PIPING. The exhaust ventilation canopy installed above steam-jacketed kettles is adequate for carrying away food vapors emitting from the kettles. Accordingly, the exhaust piping and stack should be removed from each kettle, and the stack hole in each kettle blanked off. Pipes or structure, located between the kettles and the exhaust canopy, that will cause the vapor to condense and drip into the kettles, should be covered or isolated with removable corrosion-resisting steel sheets arranged to prevent the condensate from dripping into the kettles. Preferably, interfering pipes or structure should be rerouted, if practical, so that they are not in way of kettles and ventilation canopy.

651-2.31.6 TESTING. During each ship's regularly scheduled overhaul, to avoid casualties from sudden failures under operating conditions, test single-clad, corrosion-resisting steel, steam-jacketed kettles (kettles having a stainless finish on the inside and painted on the outside) as follows:

a. Subject each such kettle to a cold-water pressure test of 90 psi for not less than 30 minutes.

b. Check safety valves on each such kettle to determine that they are in proper working condition and will release at a working pressure of 45 psi.

c. Kettles that have a badly pitted (rust spots) inside surface or that crack or bulge under the pressure test should be replaced. Likewise, malfunctioning safety valves should be replaced.

651-2.31.7 LATCH, STRAINER SECURING. A device (FSN H7310-390-1759) is available in stock at SPCC, Mechanicsburg, to secure the strainer in the bottom of corrosion-resisting steel steam-jacketed kettles for those CRES kettles not so fitted. (The device is not to be used on aluminum and single clad corrosion-resisting steel kettles.) The device consists of a special pin that is welded to the kettle bottom in the vicinity of the draw-off opening, a new strainer, and a latch that engages with the special pin to hold the strainer securely in place over the draw-off opening. The latch is demountable for cleaning.

651-2.32 CONTAINERS, FOOD, COOKING AND STOWAGE

651-2.32.1 DESCRIPTION. Containers referred to herein are those used for steam cookers, steam tables, bread and pie stowage, but do not include pots and pans.

651-2.32.2 UNSATISFACTORY MATERIAL. Zinc salts are harmful when taken internally, and porcelain-enameled containers are liable to chip and to rust in chipped areas; they present the danger that porcelain-enameled chips may get into the food. Accordingly, containers having the interior surface zinc-coated or porcelain-enameled are not to be used.

651-2.32.3 ACCEPTABLE MATERIALS. The above described containers should be made of class FS-304 (A.I.S.I. No. 304), finish 4, corrosion-resisting steel conforming to specification QQ-S-766. Existing containers made of class FS-430 (A.I.S.I. No. 430) corrosion-resisting steel should be retained in service until beyond economical repair.

651-2.33 COFFEE URNS, STEAM HEATED

651-2.33.1 DESCRIPTION. Steam-heated coffee urns used aboard Naval Ships are of the combination type, consisting of an inner compartment or tank for coffee and an outer pressure tight tank for water. The two tanks are separated by an air space to avoid rapid temperature changes of coffee when cold water is added to the water tank. A siphon pipe between the water tank and the spray head in the urn cover, or lid, permits spraying the hot water over the ground coffee in the leacher in lieu of pouring the hot water over the ground coffee by hand. An agitating valve is provided for thoroughly mixing the liquid coffee in the coffee tank in lieu of drawing-off coffee and pouring over by hand to mix. Steam heated urns are furnished in sizes for making coffee in one gallon (nonautomatic urn or requires hand pouring), two-gallon, four-gallon, and eight-gallon batches. A steam coil, installed in the bottom of the water tank, provides the heating means for these urns. Electricity is required to operate the pressure type controls used in all but the one gallon urn to maintain required temperatures.

651-2.33.2 OPERATING INSTRUCTIONS. Same as electrically heated urns. (See paragraph 651-2.19.)

651-2.33.3 CLEANING INSTRUCTIONS. Same as electrically heated urns. (See paragraph 651-2.19.)

651-2.33.4 MAINTENANCE. Same as electrically heated urns. (See paragraph 651-2.19.)

651-2.34 URNS, COFFEE, MASS PRODUCTION TYPE

651-2.34.1 DESCRIPTION. Mass production coffee urns are of the two following types:

a. The two-unit type consisting of a water boiling tank and one side urn for coffee.

b. The three-unit type consisting of a water boiling tank and two side urns for coffee (one urn on each side of the water tank).

c. The units are either mounted on legs or on a dresser so that the bottom of the coffee draw-off faucets are approximately 30 inches above the deck. A steam coil is used for heating the water in the boiling tank and the side urns have steam jackets for keeping the coffee hot. Electrically operated pressure and temperature controls are provided for maintaining proper temperatures. Units are of the pressure-siphoning type for automatic leaching of coffee. Two-unit type mass production urns are of the following sizes: 20-35, 30-50, and 50-75. The first figure represents urn coffee capacity in gallons and the second figure the water tank capacity in gallons. Three-unit type mass production urns are of the following sizes: 20-50-20, 30-75-30, and 50-125-50. The first and third figures represent coffee urn capacities and the second, or middle figure the water tank capacity

in gallons. Water tank and shells of side urns are made of corrosion-resisting steel. Inside liner of side urns is either made of corrosion-resisting steel or porcelain enameled steel (porcelain enameled steel has the appearance of blue colored glass).

651-2.34.2 COFFEE URN OPERATING INSTRUCTIONS

1. Open the cold water filling valve and fill the water tank. (Watch water level gage to determine when tank is full.) Close cold water filling valve.
2. Turn the electric switch for water tank to the ″ON″ position.
3. When the indicator on the water tank pressure gage reaches 3-1/2 pounds pressure (or premarked operating position), the unit is ready for making coffee.
4. Place wet leacher bag (soak new bags in clean cold water before using) in side urn leacher basket or baskets.
5. Spread ground coffee uniformly over the bottom of each leacher bag. These units should make good quality coffee by using 4-1/2 ounces to 5 ounces of ground coffee for each gallon of water. It is important that coffee be weighed accurately. Close each side urn cover or lid.
6. Open siphon valve or valves. On the two-unit type, only the correct volume of water can be siphoned for a full urn of coffee. However, on the three-unit type, it is necessary to open the siphon valves simultaneously so that each side urn receives the same volume of hot water. One method of ensuring the correct volume of water for each of the two side urns is to open one siphon valve until the water gage on the water tank indicates that the correct volume for one urn has been siphoned; then close the siphon valve and open the siphon valve for the second side urn. In either case close the siphon valve or valves when the correct volume of water has been siphoned into the urn or urns.
7. Close pet cock at the bottom of the coffee gage glass on each side urn and open the agitating valve for each side urn for two or three minutes.
8. Close the agitating valves and open the pet cocks at the bottom of side urn coffee gage glasses.
9. Open cold water filling valve and fill the water tank. Close cold water filling valve.
10. Remove leacher bag, rinse, and store in clean cold water. Coffee is now ready to draw.
11. Replace leacher bags about once a week. Discoloration of the cloth does not affect the bag’s utility provided it has been properly cared for.
12. Time the preparation of coffee so that it does not stand longer than 30 minutes before serving.

651-2.34.3 COFFEE URN CLEANING INSTRUCTIONS

1. Heat water in water boiling tank, close side urn covers, and open siphon valves to side urns to flush the urns out.
2. After flushing, wipe the inside of side urns with a clean soft cloth.
3. Close side urn covers and sterilize side urns by opening water and steam sterilizing valves (these valves are near top of urns and connect to the two tubes just above the leacher shelf on the inside of the urns) for about 4 minutes. Coffee draw-off faucets should be open during this operation.
4. Close water valve at top of side urns first, then close steam valve.
5. Accomplish the above daily, in general, when the units are shut down for the day.

6. At least once each week accomplish the following:
   a. Open water valve at top of each side urn and fill each side urn full of water. Close water valve on each urn and close the cover on each urn.
   b. Open the steam sterilizing valve at the top of each side urn and heat the water in each side urn to approximately the boiling point.
   c. Close steam sterilizing valves and add three cups of baking soda to the water in each urn. Close urn covers and open steam sterilizing valves.
   d. Allow steam sterilizing valve to remain open sufficiently to keep water agitating for 30 minutes.
   e. Drain the side urns, then flush and sterilize in accordance with daily cleaning instructions.
   f. Flush water boiling tank by opening drain valve near bottom of tank, open fresh water filling valve and allow water to run through tank.

651-2.34.4 MAINTENANCE. Accomplish the following periodically:

1. Lubricate hinge bearings (in hinge, holding cover to body of urn) with a good ball-bearing lubricant.
2. Check all valves and fittings for leakage.
3. Check vent holes in upper gage fittings of side urns. Vents must be kept open to get correct coffee level readings.
4. Remove and clean filter screens from steam strainers.
5. Periodically remove the handhole covers from the water boiling tank and clean out lime deposits.

651-2.34.5 REPAIRS. Consult applicable technical manual for mass production coffee urn in question.

SECTION 3.

MECHANICAL DISHWASHING

651-3.1 IMPORTANCE

651-3.1.1 As a result of extensive bacteriological tests, it has been established that many communicable diseases are transmitted by improperly washed and unsanitary dishes, glasses, and utensils. Such unsanitary mess gear is generally coated with a sticky hard-water film which, in addition to presenting an unsightly appearance, is also a good environment for bacterial growth. Therefore, the importance of proper washing of mess gear, not only from an aesthetic, but especially from a sanitary standpoint, cannot be over emphasized.

651-3.1.2 Dishwashing machines, when properly used with a suitable compound, will remove food residues without deposition of hard-water film and will leave mess gear physically clean and relatively free of bacteria. A suitable dishwashing compound has been developed for naval use which will clean dishes effectively and prevent the formation of films on dishes and on the interior of machines.

651-3.1.3 The following directions for the use of dishwashing machines and Navy dishwashing compound, if followed, will result in clean and sanitary mess gear. Unsatisfactory results are almost always caused by failure of personnel to use machines and compound properly.

651-3.2 EQUIPMENT AND SUPPLIES

651-3.2.1 DISHWASHING MACHINES. Machines provided for naval use are of two general types, single or double tank models either manually or automatically operated.

a. Single-tank model. Single-tank machines should only be used when, because of space and weight considerations, it is not practicable to use the small sized double-tank machines. It is not possible to operate a single-tank dishwashing machine under ideal conditions as outlined below for double-tank machines. Certain sacrifices in design of the single-tank machine are made to conserve space and weight since they are usually used when a small number of persons, up to 150, are to be served during any one meal. The machine contains one tank for warm wash water which is pumped and sprayed upon the dishes from above and below.
   1. Rinsing is accomplished by means of hot water which is sprayed upon the dishes from an outside source, and is controlled by an adjustable automatic steam-mixing valve which maintains the temperature of the rinse water between 180° and 210°F.
   2. In order to conserve fresh water which must come from the ship's hot-water system, the rinse time interval is limited to 10 seconds.
   3. Wash and rinse sprays are separately controlled by automatic, self-opening and closing valves in the automatic machine, or by handles in the manually operated machine. The automatic machine provides for 40 seconds' wash and 10 seconds' rinse; for manually operated machines wash and rinse intervals are controlled by the operator who should allow this same time for washing and rinsing.

b. Double-tank model. Double-tank machines are available with several different capacities and are used when more than 150 persons are to be served. These machines are provided with separate wash and rinse tanks and also have a final rinse of hot water sprayed on the dishes from an outside source. The final rinse is fitted with an adjustable automatic steam-mixing valve which maintains the temperature between 180° and 210°F. Double-tank machines are also equipped with a thermostatically operated switch in the rinse tank which prevents operation of the machine if the temperature of the rinse water falls below 180°F. Dishbaskets pass through the machine automatically by means of conveyor chains.

651-3.2.2 DISHWASHING COMPOUND. Navy dishwashing compound consists of a uniform, free-flowing mixture of alkaline salts, and is highly effective both in soft and hard water for cleaning dishes when used properly in machines. It prevents the formation of hard-water film on dishes and on the interior of the machine, and is noncorrosive to aluminum. Its solutions are necessarily highly alkaline in order to saponify and emulsify greasy food residues. For this reason solutions should not be allowed to come in contact with the skin for long periods of time. Trisodium phosphate should not be used as a dishwashing compound since it is corrosive to aluminum, coats dishes and machines with hard-water film, and is far inferior in performance to the Navy dishwashing compound. Soap should never be used in dishwashing machines because the pump and spray jets will not operate when the machine is filled with suds. In hard water, soap also forms an insoluble residue which will coat the machine and dishes.

651-3.2.3 Select detergents from the following:

Type I for hard water:

GF7930-267-4930 - 2 lb. carton

GF7930-267-4931 - 50 lb. drum

Type II for soft water:

GF7930-267-4932 - 2 lb. carton

GF7930-267-4933 - 50 lb. drum

651-3.2.4 Dishwashing baskets are available from naval supply depots under the following stock numbers:

Stock No.	Type
GF7320-369-5105	Bowl
GF7320-369-5104	Compartment tray
GF7320-369-5103	Cup
GF7320-369-5102	Cutlery
GF7320-369-5101	Mixed dish
GF7320-369-5100	Plate

651-3.3 OPERATING INSTRUCTIONS

651-3.3.1 INTRODUCTION. Inspection of dishwashing machinery both in naval vessels and at shore stations indicates that the equipment is not being properly operated nor adequately maintained to ensure satisfactory cleaning and sanitization of eating utensils.

651-3.3.2 Negligence in carrying out routine operating instructions and preventive maintenance introduces an undue health hazard among the people served. It is, therefore, of vital importance that correct operating procedure be followed, that a cleaning schedule be carefully adhered to, and that the machines be given adequate preventive maintenance.

651-3.3.3 In general, in accordance with Navy regulations, the operation of the dishwashing facilities in naval vessels is the responsibility of the supply officer, the maintenance of the equipment is the responsibility of the engineering officer, while sanitary standards are the responsibility of the medical officer.

651-3.3.4 A sufficient number of copies of these operating and maintenance instructions (NAVSHIPS 250-522) will be made available for distribution to the operating and maintenance personnel, and also for adequate ″in service″ training of all personnel concerned.

651-3.3.5 Dishwashing machines of several sizes are installed in naval vessels. They can, however, be divided into two general classes, namely, single tank dishwashing machines for small messes, and double tank dishwashing machines for larger messes. The operating instructions will be given separately herein for the two types of machines. Maintenance instructions are combined for both types of machines.

651-3.4 OPERATING INSTRUCTIONS FOR DOUBLE TANK DISHWASHING MACHINES

651-3.4.1 GENERAL. The machine operator should read and become familiar with the operating instructions included on the instruction plate which is mounted on the hood of each machine.

651-3.4.2 Double tank dishwashing machines shall be operated, cleaned, and inspected in accordance with the following schedule:

a. Each meal.

1. Inspect the machine to see that the wash tank is clean and all spray openings are free from food particles, strings, etc.
2. Close drain valves in both wash tank and rinse tank.
3. Open hot water fill valve for both wash tank and rinse tank. If the tanks are equipped with water level indicators and they are functioning properly, fill to the indicator level. If tanks are not fitted with water level indicators, remove a section of the scrap trays in each tank so that the overflow pipe can be observed and fill to the approximate level of the overflow pipe. Do not fill tanks with cold water.
4. Inspect to see that all scrap trays are clean and in place, that all spray arms are assembled and adjusted so that all spray nozzles or slots are located so that the jets will be sprayed properly on the eating utensils. Also see that no caps are missing from the wash or rinse spray tubes.
5. See that splash curtains are in place at each end of the machine. These splash curtains should not hang closer than five inches to the conveyor.
6. Open the steam valve to the rinse tank and observe that the temperature as indicated on the rinse tank thermometer increases gradually. When it indicates 180°F, the machine can be started up.
7. Open the steam and hot water valves to the final rinse and adjust the mixing valve to the ″hot″ position.
8. If all dockside or shore base water is used, its hardness should be determined and the proper detergent used.
9. Add the proper amount of dishwashing machine compound (detergent) to the wash tank of the machine. The proper amount will depend upon the capacity of the wash tank and the hardness of water. The machine operator should be instructed by his supervisor in regard to the amount of compound to be added to the machine in question. The amount should be determined from **Table** 651-3-1.
10. In general, the water used on shipboard may be considered as ″soft.″ The above is the initial charge. It is necessary to add one-fourth of the above amount every ten minutes to compensate for dilution and the increasing food particle load in the wash water.
11. For a list of the General Stores stock numbers of the dishwashing machine detergents which should be used, see paragraph 651-3.2.3.
12. Push the start button to start up the pumps and conveyor. The rinse tank is fitted with a thermostat which, if properly set, will prevent the motor from starting until the temperature in the rinse tank has reached 180°F or higher. If the motors and pumps do not start when the start button is pushed, it may be due to the temperature in the rinse tank being too low. If the machine fails to start when the temperature is above 180°F, the electrician should be called to ascertain the cause for failure to operate, and appropriate repairs should be made.
13. The machine should be operated for one or two minutes during which time the heat from the rinse spray should cause the temperature in the wash tank to increase gradually to approximately 140°F.
14 Check the force of the recirculating wash spray by holding a tray inside the ends of the machine so as to deflect the spray from the upper spray assembly further into the machine, and observe that the lower spray, when not meeting the upper spray, will rise to approximately the top of the machine. If this is not occurring, there is insufficient spray velocity to produce satisfactory results. The cause should be determined and corrected. It may be due to any of the following causes:
    (a.) Blocked pump suction line.
    (b.) Missing cap on spray tube.
    (c.) Missing spray tube. Make any necessary corrections or call the maintenance man.
15. You are now ready to wash dishes.
16. During the entire operating period, the final rinse valve should be adjusted so that the final rinse water temperature is between 180°and 195°F. The steam valve for heating the rinse water temperature should be adjusted so that the temperature of the recirculating rinse water will be between 180° and 195°F. The

temperature of the recirculating wash water should be kept between 140° and 160°F. If it has a tendency to rise above 160°F, open the fill valve enough to admit only a small amount of additional water. When washing eating utensils soiled with egg, wash water temperature should be kept on the low side of the temperature range (140°F).

17. Surplus food scraps should have been effectively removed from the eating utensils before they were stacked in the dishwashing machine racks.
18. Prior to inserting each rack into the dishwashing machine, see that the eating utensils are properly racked; that dishes, bowls, cups and glasses are upside-down so as not to trap water; that dishes, trays, plates, and saucers are adequately separated so that the spray can reach all parts; that cutlery is properly distributed in the basket so that it is not more than one or two pieces deep. Presoaking of cutlery is advisable where practical.
19. Push the rack into the machine on the conveyor until it comes up against the conveyor lug. In no case shall the rack be pushed beyond the wash spray.
20. The maximum conveyor speed is set so as to ensure that the eating utensils are under the wash spray for 20 seconds, and under the rinse spray for 20 seconds. Do not push racks through the sprays faster than the conveyor is traveling.
21. Allow the conveyor to push the rack at least halfway out of the end of the machine before it is removed by the operator.
22. Observe that as the first rack is discharged from the machine, the thermometer on the final rinse shows a temperature between 180° and 195°F.
23. Eating utensils should remain in the racks for approximately one minute for drying.
24. When cutlery racks are discharged from the machine, as they are removed, they should be shaken slightly to get rid of entrapped water in the bowls of spoons and from the surface of other cutlery.
25. The wash tank should be drained and the scrap trays removed and cleaned periodically in accordance with **Table** 651-3-2. After the wash tank has been drained, the drain valve should be closed and the wash tank refilled as described in paragraph 651-3.4.2.a.3

b. After each meal.

1. Close the hot water and steam valve on the final rinse.
2. Add from 3/4 to 1 1/2 cups of detergent (depending upon the size of the machine) to the rinse water tank.
3. Allow the machine to operate approximately five minutes.
4. Close steam valve to rinse tank.
5. Push stop button to stop motors and conveyors.
6. Open drain valves to both wash and rinse tanks.
7. Open side doors.
8. Remove and clean scrap trays from both wash and rinse tanks.
9. Clean pump intake strainer.
10. Inspect and clean, if necessary, all wash spray openings.
11. Remove any foreign particles that may be present from the bottom of the wash tank and spray tank.
12. Close the drain valve on both the wash and rinse tanks.
13. Fill both tanks approximately one-half full of water.
14. Replace scrap trays, all spray manifolds and side doors.
15. Open steam valve to rinse tank and when the temperature in the rinse tank reaches 180°F or higher, push the start button and operate the machine for approximately five minutes.
16. Stop the machine.

17. Open all drains.
18. After the machine has completely drained, close the drain valves.
19. Remove and scrub splash curtains. Hang in sunshine to dry if practical. An extra set of splash curtains should be available and used alternately.
20. The machine should now be ready for the next meal.

c. After each noonday meal.

1. Remove and clean with a brush all wash spray tubes or nozzles, both the upper and lower set.
2. Replace all spray assemblies.

Table 651-3-1 DISHWASHER DETERGET QUANITIES (DOUBLE TANK)

Water Hardness	**Water in Wash Tank**	**Type of Compound**	**Amount Ounces Cups**
(Grains)	(Gallons)	Soft	
0 to 7	10	II	3-1/2 or 1/2
0 to 7	15	II	5-1/2 or 2/3
0 to 7	20	II	7 or 1
0 to 7	25	II	9 or 1-1/4
		Medium Hard	
7 to 14	10	I	5 or 2/3
7 to 14	15	I	7-1/2 or 1
7 to 14	20	I	10 or 1-1/3
7 to 14	25	I	12 or 1-1/2
		Hard	
14 to 20	10	I	7 or 1
14 to 20	15	I	10 or 1-1/3
14 to 20	20	I	14 or 1-3/4
14 to 20	25	I	16-1/2 or 2-1/4

Table 651-3-2 DISHWASHER CLEANING REQUIREMENTS DURING OPERATION

Machine Model	**Time of Operation**
60DA	every 45 minutes
85DA	every 40 minutes
135DA	every 35 minutes
185DA	every 30 minutes
250DA	every 30 minutes

651-3.5 OPERATING INSTRUCTIONS FOR SINGLE TANK DOOR TYPE DISHWASHING MACHINES

651-3.5.1 GENERAL. The machine operator should read and become familiar with the operating instructions included on the instruction plate which is mounted on the hood of each machine.

651-3.5.2 Single tank dishwashing machines shall be operated, cleaned, and inspected in accordance with the following schedule:

a. Each meal.

1. Inspect the machine to see that the wash tank is clean and all spray openings are free from food particles, strings, etc.
2. Close drain valve in wash tank.
3. Open the hot water valve to the rinse water mixing valve or the rinse water booster, whichever is fitted.
4. Open the steam valve to the mixing valve or the booster. Adjust the mixing valve to the ″hot″ position.
5. Open the hot water valve and partly fill the tank with water at approximately 140°F. Finish filling the tank with 180°F, water through the rinse water booster system so as to get a mixture at about 160°F. If the machine is manually timed, it is only necessary to hold the control lever to the ″rinse″ position until tank is full. If the machine is automatically timed, the rinse line should be fitted with a spring-closed valve bypassing the rinse valve for filling the tank with 180°F water. If the tank is fitted with a water level indicator and it is functioning properly, fill to the indicated level. If it is not fitted with a water level indicator, remove a section of the scrap trays so that the overflow pipe can be observed and fill to the approximate level of the overflow pipe. Do not fill tank with cold water.
6. Inspect to see that all scrap trays are clean and in place, that all spray arms are assembled and adjusted so that all spray nozzles or slots are located so that the jets will be sprayed properly on the eating utensils. Also, see that no caps are missing from the wash and rinse spray tubes.
7. Observe that the temperature as indicated on the wash tank thermometer is between 140° and 160°F.
8. Observe that when the rinse valve or bypass valve around the rinse valve is open, the temperature in the rinse water booster is indicated between 180° and 195°F.
9. Add the proper amount of dishwashing machine compound (detergent) to the wash tank of the machine. The proper amount will depend upon the capacity of the wash tank and the hardness of the water. The machine operator should be instructed by his supervisor in regard to the amount of compound to be added to the machine in question. The amount should be determined from **Table** 651-3-3. In general, the water used on shipboard may be considered as ″soft.″ The above is the initial charge. It is necessary to add one-half of above amount after each six racks to compensate for dilution.
10. For a list of the General Stores stock numbers of the dishwashing machine detergents which should be used, see paragraph 651-3.2.3.
11. Push the start button to start up the pump and the timing mechanism. On new machines a small tank in the rinse circuit is fitted with a thermostat. This thermostat, when properly set, prevents the motor from starting until the temperature of the rinse water has reached 180°F or higher. If the motor or pump does not start when the start button is pushed, it may be due to the temperature in the rinse being too low. If the machine fails to start and the temperature is above 180°F, the electrician should be called to ascertain the cause for failure to operate, and appropriate repairs should be made.
12. You are now ready to wash dishes.
13. During the entire operating period the rinse valve or booster should be adjusted so that the rinse water temperature is between 180° and 195°F.
14. Surplus food scraps should have been effectively removed from the eating utensils before they were stacked in the dishwashing machine racks.
15. Prior to inserting the rack into the dishwashing machine, see that the eating utensils are properly racked; that dishes, bowls, cups, and glasses are upside down so as not to trap water; that the spray can reach all parts; that cutlery is properly distributed in the basket so that it is not more than one or two pieces deep.
16. Open the door and push the rack into the machine. Close the door and move the control handle to the wash position; or, if it is an automatic machine, operate the control handle or the foot pedal to start the operating cycle.

17. After about 40 seconds on manually timed machines, move the control handle to the rinse position and hold it in the position until you have slowly counted twenty (10 seconds). Then release the handle which should return to the closed position.
18. If the machine is automatically timed, all sprays will shut off after the wash and rinse cycles are complete.
19. When the wash and rinse cycle is complete, open the door and remove the rack.
20. Eating utensils should remain in the racks for approximately one minute for drying.
21. When cutlery racks are removed from the machine, they should be shaken slightly to get rid of entrapped water in the bowls of spoons and from the surface of other cutlery.

b. After each meal.

1. Close steam valve to the rinse water circuit.
2. Close hot water valve to the rinse water circuit.
3. Open drain valve on the wash tank.
4. Open doors, remove and clean scrap trays.
5. Clean pump intake strainer.
6. Inspect and clean, if necessary, all wash spray openings.
7. Remove any foreign particles that may be present from the bottom of the wash tank.
8. Close the drain valve.
9. Fill the tank approximately one-half full of water.
10. Replace scrap trays and all spray manifolds.
11. Open both hot water and steam valve to the rinse line mixing valve or booster and see that the temperature reaches 180°F. See paragraphs 651-3.5.2.a.4 to 651-3.5.2.a.5.
12. Add one-half cup of detergent.
13. Push the start button and operate the machine through five complete operating cycles without any racks in the machine.
14. Stop the machine.
15. Open the drain.
16. After the machine has completely drained, close the drain valves.
17. The machine should now be ready for the next meal.

c. After each noonday meal.

1. Remove and clean with a brush all wash spray tubes or nozzles, both the upper and lower set.
2. Replace all spray assemblies.

Table 651-3-3 DISHWASHING DETERGENT QUANTITIES (SINGLE TANK)

Hardness	Wash Tank	Compound	Amount Ounces Cups
(Grains)	(Gallons)	Soft	
0 to 7	10	II	3-1/2 or 1/2
0 to 7	15	II	5-1/2 or 2/3
0 to 7	20	II	7 or 1
		Medium Hard	
7 to 14	10	I	5 or 2/3

Table 651-3-3 DISHWASHING DETERGENT QUANTITIES (SINGLE TANK) - Continued

Hardness	Wash Tank	Compound	Amount Ounces Cups
7 to 14	15	I	7-1/2 or 1
7 to 14	20	I	10-1/2 or 1-1/3
		Hard	
14 to 20	10	I	7 or 1
14 to 20	15	I	10 or 1-1/3
14 to 20	20	I	14 or 1-3/4

651-3.6 MAINTENANCE INSTRUCTIONS FOR DISHWASHING MACHINES

651-3.6.1 GENERAL. The maintenance personnel should read the manufacturer's instruction book for the machines and become familiar with all its operating characteristics and its basic design. Dishwashing machines shall be inspected by the maintenance personnel in accordance with the following schedule. Any necessary repairs and replacements shall be made and reported on Naval Ship Systems Command Material Analysis Data Report, Form NAVSHIPS 3621.

651-3.6.2 WEEKLY.

a. Check adjustment of tension on the conveyor chains of machines equipped with conveyors. If both chains are equipped with lugs, see that the lugs on both chains are directly opposite each other.

b. See that guide sprockets are properly located on their shaft so that the conveyor chain rides properly on the track assembly.

c. On single tank machines, inspect the operation of the doors and see that all counterweights are properly attached and the doors are held in the open position when raised.

d. After the machine has been placed in operation in accordance with the foregoing operating instructions, check operation of thermometers, pressure gages, thermostats, and automatic mixing valve or booster.

e. The thermostat on the rinse tank of double tank machines should be adjusted so that the machine cannot be started up unless the temperature in the rinse tank is 180°F or higher.

f. The automatic mixing valve, when the rinse valves are open, should be adjusted to maintain the temperature of the water between 180° and 195°F.

g. Inspect pump packing and adjust as necessary to stop leakage around the pump shaft.

h. Check the force of the recirculating wash spray by holding a tray inside the ends of the machine so as to deflect the spray from the upper spray assembly further into the machine and observe that the lower spray when not meeting the upper spray will rise to approximately the top of the machine. If this is not occurring, there is insufficient spray velocity to produce satisfactory results. The cause should be determined and corrected. It may be due to any of the following causes:

   1. Blocked pump suction line.
   2. Missing cap on spray tube.
   3. Missing spray tube.
   4. Jet orifices worn so as to be too large.

5. Pump running backwards.
6. Pump impeller eroded.
7. Check to determine that conveyor on conveyor type machine is functioning in a proper manner.

i. Check to determine that the final rinse valve on double tank machines is functioning in a satisfactory manner and that when the valve is opened, a uniform spray is coming from each of the orifices.

j. Clean orifices if necessary.

k. Lubricate motor and pump bearings.

l. Check and lubricate, as necessary, the gear reducer unit.

m. Lubricate the conveyor shaft bearings and drive mechanism, sprocket chains, etc.

n. Replace any missing lubrication fittings.

o. Inspect all steam and water valves.

p. Adjust gland nuts as necessary to prevent leakage.

q. Fill tanks to normal operating level but do not open any steam valve and observe that for a period of five minutes there is no appreciable reduction or rise in water level due to faulty fill or drain valves.

r. Fill tanks to the overflow opening and determine that the overflow drain is functioning in a manner to prevent the water level from rising any higher in the machine and does not flow into the adjacent tank on double tank machines.

s. Clean drains and overflow if necessary.

651-3.6.3 ANNUALLY. Disassemble pumps and inspect rotors to see that there has been no undue erosion or corrosion.

APPENDIX A.

INDEX TO COMMISSARY EQUIPMENT

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REAR SECTION

NOTE

TECHNICAL MANUAL DEFICIENCY/EVALUATION EVALUATION REPORT (TMDER) Forms can be found at the bottom of the CD list of books. Click on the TMDER form to display the form.