

CHAPTER 15

MAINTENANCE

15-1. GENERAL.

Because pool equipment and its related piping and instrumentation vary from one pool facility to another, the operating, maintenance, and servicing, instructions provided in equipment manufacturer's literature will be used to augment the instructions provided herein. The different types of equipment and conditions under which they operate make proper lubrication extremely important. Improper lubrication (overlubrication as well as underlubrication) causes damage to wearing surfaces, increases maintenance costs, increases power consumption, and increases power outages. The use of cleaning solvents (types, hazards, and safe storage) in swimming pool water filtration plants, along with the use of mercury in manometers and other instrumentation is covered in the TM 5-660 series.

15-2. PREVENTIVE MAINTENANCE.

A preventive maintenance program, effectively implemented, will improve equipment operating performance and extend equipment life. In addition, preventive maintenance program records can be used as an inventory planning tool and as a manpower scheduling tool.

15-3. ESTABLISHING A PREVENTIVE MAINTENANCE PROGRAM.

Establishing a preventive maintenance program requires a record of past operating experience and the equipment manufacturer's recommendations in order to develop individual equipment maintenance and scheduling requirements. The actual process used to develop such a program is outlined in TM 5-652 (Steam/Hot Water Distribution Systems).

15-4. DAILY OPERATION PROCEDURE.

A swimming pool operating log, DA Form 3164-R must be maintained by pool operating personnel. All entries are to be made as soon as readings are taken. The accuracy of this form is important; do not enter readings as they should be, but as they are. DA Form 3164R will be reproduced locally on 11 inch by 8-1/2 inch paper. Copy for reproduction purposes is located at the back of the manual.

15-5. SEASONAL CARE.

Pools that are closed during winter should be inspected

once a month during the off-season. Particular attention should be given to any moisture forming in the filter room or chemical storage area. If excess moisture is prevalent, diatomaceous earth filter elements should be removed and stored in a dry place to avoid corrosion. Chemicals stored during the off-season should be kept dry to prevent caking or corrosion. The off-season is considered a good time to paint interiors and to repair deck furniture, bathhouse facilities, and electrical fixtures and wiring.

15-6. POOL OPENING.

Before a pool is opened in the late spring or early summer, certain operation and maintenance routines must be followed. Several months prior to opening, a thorough inspection should be made of all equipment and supplies, including pool shell, deck area, pool inlets and outlets, control valves, drains, heaters, filters, pumps, chemical feed equipment, and electrical systems. Cracking or spalling concrete should be patched with special hydraulic cement or other approved compounds. If necessary, surfaces should be repainted using procedures recommended by the paint manufacturer. The amount and condition of filter media should be checked and replaced as necessary. Adequate chemical supplies should be ordered.

15-7. POOL STARTUP.

Pool startup includes the following procedures:

- a. Chlorinator. The chlorinator should be checked in accordance with the manufacturer's recommendations. If chlorine bottles have been left connected since the last swimming season, they should be disconnected carefully by someone wearing an air pack or chlorine mask.

CAUTION

Where the chlorine bottles have been left connected to the chlorinator and the valve left on, a second person should be present (for safety) when the valve is closed. Valves often corrode under these circumstances and cannot be completely turned off. When this condition is found, the fitting should be cracked slightly and the presence of chlorine tested by holding an opened bottom of household ammonia close to the fittings; if chlorine is present a white cloud of ammonium chloride will be produced. If the valve cannot be completely

closed, contact your supplier.

b. Soda Ash Feeder. This should be checked to see that it is working properly and that no dried soda ash is remaining inside.

c. Piping and Pumps. Check for proper pump operation and any deteriorated pipe. Where steel pipe has corroded, recommend replacement with PVC pipe.

d. Filters. Where diatomaceous earth filters are used the filter should be disassembled and its elements checked for leaks annually. If socks are used over the filter elements, they should be examined and replaced if holes or worn places are found. If the filter needs extensive repairs, it should be replaced with a high rate sand filter.

e. Sand Filters. Sand filters seldom need maintenance other than backwashing. Check to see that the pressure drop across the filter is not above the manufacturer's recommendation.

f. Paint. Where the walls of the pool require painting, use chlorinated rubber base paint. Do not use epoxy since it tends to chalk when exposed to sunlight (even under water) and tends to give the water a milky appearance.

g. Recirculating Lines. When recirculating lines have to be replaced use polyvinyl chloride (PVC) piping. It is not necessary to tear up the deck since the replacement pipe can be grouted into the right angle spaces between the pool sides and the bottom.

h. Chlorine and pH Test Kit. A copy of TB MED 575 dated Jun 82 should be obtained and used as a guide for swimming pool operations. A good chlorine/pH kit should be obtained and these parameters maintained in accordance with limits shown in Para 3-23d(2) of the TB MED. It is not necessary to obtain the LaMotte - Palin DPD Chlorine-pH test set described in appendix C of TB MED 575; it now costs \$92.80. DBD Chlorine-pH test sets are available from other companies at lower cost. (Example: The DPD Chlorine-pH test set from the Hach Company costs \$67.00).

i. Remove Floating Debris. Remove leaves and other floating debris from pool surfaces with a leaf skimmer.

j. Add water. If water is added to the makeup tank, the pump is started and the filters are placed in operation when the makeup tank is nearly filled. If water is added directly to the pool, allow the pool to fill approximately one-third full and then turn on the pump and filters. If the only return to the filters is from overflow of the pool, the pool must be filled and overflowed before water is available to the pump and filters, which should then be started. When sand and anthracite filters are first started, add floe and waste the filter effluent for a few minutes until effluent is clear.

k. Chemical Feed. Start chlorination as soon as filtration begins. Start pH control as soon as pH tests of the water indicate need. Take frequent pH and residual

chlorine readings.

l. Reduce Water Supply. When the pool is filled, reduce the amount of makeup water from the water supply to the amount that will produce a constant overflow about 1/8 inch deep all around pool overflow troughs or deck level.

m. Final Check. When pool is ready for use, check turbidity, pH, temperature, alkalinity, and chlorine residual. Do not open pool until all readings are satisfactory.

15-8. POOL CLOSING.

The following procedures should be followed when closing outdoor pools at the end of the season.

a. Wash filters (backwash) several times thoroughly, perform any necessary filter cleaning with appropriate chemicals, and rinse with freshwater. Pump freshwater through all chemical feedlines and equipment. Carefully check operation of all equipment, including pump and motor.

b. Open main pool, filter, and other drains to dewater pool and equipment. Make sure there is a valve at the lowest point in piping system so that all water can be drained. Leave this valve and pool drain valves open to allow rain and snowmelt to runoff. In pools where it is necessary to maintain water to prevent the pool shell from cracking or floating out of the ground, close the main pool drains to maintain desired water level in pool. Drain the filters and all the piping system. Check the main drain valves to be sure there is no leakage.

c. Inspection. Make complete inspection of all equipment and supplies.

d. In order to prevent deterioration of equipment during storage, take the following steps:

(1) Open diatomaceous earth filters and check filter elements for cleanliness. If any dirt or grease remains on the elements, use a cleaner recommended by the filter manufacturer or higher technical authority. Handle elements carefully to prevent damage. After cleaning, reassemble and wash the filter several times.

(2) Drain all pipelines, pump cases, and the hair catcher. Clean the hair catcher buckets and store them in a dry place.

(3) Clean and recondition all check valves, sump pumps, sight glasses, gages, and meters.

(4) Thoroughly wash all pump bearings and pump motors with an approved solvent such as kerosene or other armed services approved solvents. Immediately fill bearings with an approved rust-preventive compound.

(5) Clean all oxidation from exposed copper surfaces on transfer switches, safety switches, pump starters, and other electrical equipment by burnishing the copper with a burnishing tool.

(6) In cold climates, remove and empty all traps in lavatories in the bathhouse.

(7) If the pool is to be left full of water, logs or other materials approved by higher technical authority should be floated to prevent ice damage. Material should be fastened to maintain spacing and prevent bunching. Plastic covers should be securely fastened to prevent algae growth and keep out debris.

(8) Remove ladders and clean them with a chrome cleaner or polish. Put one ladder back in place in the pool; store the remaining ladders in a safe place.

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15-9. PREPARING UNPAINTED SURFACES FOR PAINTING.

Prior to painting, the unpainted concrete or tile surfaces must be cleaned of all dirt, oil, grease, or residual chemicals. Concrete surfaces may be cleaned with an 8:1 solution of muriatic acid (8 parts water to 1 part acid, by volume) and tile surfaces with 12:1 solution of muriatic acid (12 parts water to 1 part acid, by volume). The acid solutions should be applied with straw brooms, or plastic or fiber brushes. The acid solution should be left on the surfaces for 6 to 15 minutes before removal by flushing with clean water. All cleaned surfaces should be flushed with clean water under pressure at least four times in an 8 hour period. After the last flushing, random spot checks should be made with blue litmus paper to assure complete removal of the acid. The pH of the cleaned surface should be not less than 6.5. Surface cracks must be cleaned and filled with a suitable filler prior to painting.

15-10. SANDBLASTING.

Sandblasting should be utilized to remove grease, oil, and old paint. Iron or brass slag may be used as the sandblast media. Sandblasted areas must then be cleaned with acid (see paragraph 15.9) to etch the surfaces, and thereby improve the bond for new paint.

15-11. CLEANING STEEL SURFACES.

Exposed steel components of the swimming pool must be sandblasted and wiped clean of dirt and dust before painting.

15-12. PAINTING CONCRETE SURFACES.

After the pool surfaces have been thoroughly cleaned, patched, and dried (allowing at least 16 hours drying time), paint the surfaces with material conforming to Federal Specification TT-P-95, Paint, Rubber-Base (for swimming pools). The first coat will be thinned, using 1 gallon of paint to 1 quart of xylol, and used as a primer sealer coat. After drying for 16 hours, brush on one or two coats of the paint. Thinning is permissible for spray application. A drying time of 16 hours is required between coats, and at least 5 days after the fi-

nal coat before filling the pool with water. For further information, reference Army TM-5-618, Paints and Protective Coatings.

15-13. PAINTING STEEL SURFACES.

Exposed steel surfaces will be prime coated immediately after cleaning to prevent rusting. The primer used will conform to Military Specification MIL-P-12472, Primer coating, Phenolic, Water Immersible. Pool ladders will be given one finish coat of aluminum paint consisting of aluminum paste conforming to Federal Specification TT-P-320, type II, class B thinner compatible with varnish and varnish conforming to Federal Specification TT-V-119, mixed in the proportion of 2 pounds of paste to not more than 1 pint of thinner to 1 gallon of varnish. The paste, thinner, and varnish will be mixed on the job.

15-14. PAINTING PIPING.

The piping system should be marked for easy identification of lines. This can be accomplished by painting colored bands and placing markers on pipes with arrows to indicate direction of flow. The following color code is suggested:

- a. Pool supply line—bright blue.
- b. Filtered water return line—bright green.
- c. Pool water return line—brown.
- d. Chlorine line—bright yellow.
- e. Backwash and sewer lines—bright red.

15-15. CHEMICAL CLEANING (DIATOMITE FILTERS).

a. Each filter manufacturer has developed cleaning methods which are considered best for their particular filter. These cleaning instructions are included in the manufacturer's operation manual provided with each filter installation; the manual should be followed carefully when the filter is cleaned. (A manual should be available at the Directorate of Engineering and Housing's office for reference.)

b. The following cleaning methods have been found successful. Filter elements in swimming pool filters can be cleaned either by removing and cleaning by hand, or by removing and soaking with a suitable chemical solution to loosen the plugging materials. Cleaning is then followed by a thorough rinsing in place. Iron oxide (rust) is best removed by inhibited hydrochloride (muriatic) acid. For elements covered by metallic cloth and those covered with most synthetic fiber filter cloths, the acid concentration should never be more than two percent. For aluminum oxide or stone elements, the concentration can be as high as five percent. If other metallic oxides (particularly manganese) or a filter aid is the main contaminant, use about one pound of anhydrous sodium bisulfite to ev-

ery 50 gallons of two percent to five percent acid used. Where dirt or organic matter is the primary plugging material, use a two percent solution of inhibited sulphuric acid, or an eight percent solution of anhydrous sodium acid sulfate in water instead of the hydrochloric acid.

NOTE

Do not use acid on nylon filter cloth.

c. The solution should be mixed and pumped into the filter. While the soaking of the metallic elements should not exceed one half hour (unless the filter manufacturer's instructions indicate longer soaking is satisfactory), stone elements may be soaked up to 3 hours. Where possible, mild agitation during the soaking period will aid cleaning. After cleaning, the filter should be drained and flushed with water. If acid has been used, rinse the filter with water followed by a solution of 0.1 pound per gallon of soda ash to neutralize any remaining acid, and follow with a final water rinse.

15-16. BACKWASHING.

Backwashing a pressure filter at too high a rate, or operating it beyond a 5-pound loss of head results in an upset or broken gravel bed. Inspecting the gravel bed of a pressure filter is difficult because sand must first be removed from the gravel. Therefore, the condition of the gravel bed usually is observed by noting whether the condition of the sand bed or anthracite coal indicates a uniform distribution of wash water. The condition can also be determined by noting whether the effluent contains sand or fine gravel. When the condition of the sand bed shows that the wash water distribution is not uniform or when sand is found in the filter effluent, complete removal and replacement of the filtering medium usually are advisable.

15-17. FILTER REPAIRS.

Damaged filter element sleeves (cloths) are easily replaced. It is advisable to have at least two replacement sleeves on hand. In the event that no replacement is available, the filter element with the damaged sleeve should be removed from the tank, the exposed manifold outlet plugged, and the filter unit returned to operation. The removed filter element will shorten the filter cleaning cycle, but operation can be maintained until a replacement sleeve becomes available.

15-18. OPERATING AND REPAIR PROCEDURE FOR CHLORINE EQUIPMENT.

Many chlorine equipment failures and chlorine leaks can be attributed to improper procedures in operation and handling of chlorine valves. This item should receive first attention in the training of pool operators who are to operate gas chlorinators. Chlorine cylinder valves are specially designed and contain a fusible met-

al plug. This plug is a safety device which softens and melts at temperatures of 1580 F to 1650 F. The valve should never be operated with other than the special wrench provided. A light bump on the wrench with the hand may be necessary to crack the valve open. Always refer to manufacturer's instructions when adjusting or otherwise maintaining chlorinators. In case of major difficulty, request that a manufacturer's representative investigate the problem.

15-19. PREVENTIVE MAINTENANCE.

Preventive maintenance services covering volumetric dry feeders, gravimetric belt-type dry feeders, loss-in-weight-type gravimetric feeders, continuous lime slakers, and other auxiliary equipment are covered in TM 5-661.

15-20. CORROSION CONTROL.

Generally, there are two types of corrosion:

- a. That which acts externally on pipes buried in the soil.
- b. That which, through certain liquids conveyed, acts internally on the piping. Although the damaging results are similar in both types, the methods of prevention or control differ.

15-21. CORROSION PREVENTION.

a. While it normally is possible to chemically treat fluids flowing inside pipes to minimize internal corrosion, the prevention of external pipe corrosion, resulting from certain surrounding soils, requires special consideration. Where corrosive ground conditions are known to exist, a protective coating for buried pipe or piping made of noncorrosive materials should be used.

b. Where internal corrosion of a piping system is of such nature as to require corrective action, competent advice should be obtained through qualified Facilities Engineer personnel. Likewise, similar advice should be obtained when algae and slime persist in the system. Only chemicals approved for use in potable water treatment processes are permissible and at prescribed dosages.

15-22. UNDERWATER LIGHTING.

The underwater pool lighting system will be inspected as often as required to insure safe and proper operation. Every 6 months the lighting system, including equipment grounding, will be tested with proper instruments to insure compliance with Article 680, National Electrical Code. For pools which are closed seasonally, one of the semiannual tests will be made prior to reopening of the pool. Deficiencies found will be corrected immediately.

15-23. OTHER ELECTRICAL FACILITIES.

Other electrical facilities for the pool, bathhouse, and

equipment will be inspected in accordance with TM 5-681. For pools which are closed seasonally a complete

inspection will be made prior to reopening of the pools. Deficiencies found will be corrected immediately.