CHAPTER 7

OPERATION AND MAINTENANCE

7-1. General. Good operation and maintenance manuals (O&M) are important because most arctic and subarctic sites may be isolated by weather conditions for 2 to 3 weeks at a time. During these periods, the survival of personnel at remote sites depends upon self-sufficient operation. Personnel rotation increases training and maintenance problems; some incoming personnel may be inexperienced. Repair parts may be scarce. Operation and maintenance manuals should cover the system components and should be explicit. O&M manuals, such as the sample manual shown in appendix B, should be developed to supplement shop drawings and equipment manuals prepared by the construction contractor. Additional manuals described herein should be prepared by the designers to cover complete operation of the various systems. A manual should describe how and why the system functions and what will happen if it is not operated as intended. Operation and maintenance requirements vary among architectural, structural, mechanical, and electrical systems. Specific aspects of each of these four systems are discussed in separate paragraphs below.

7-2. Architectural.

a. Exits. All exterior and exit doors should be kept in operable condition at all times. Snow and ice should be cleared from stoops, steps, and walks leading to entrances. Door sills should be kept ice free, and exterior doors, when not in use, should be completely closed to prevent drifting snow from entering vestibules. Snow drifts covering first floor windows should be removed so potential exit routes are not blocked in case of fire. High condensation on the surfaces and perimeters of exterior doors, especially emergency exit doors that may not have frequent use, can freeze them shut. Therefore, infrequently opened doors should be checked periodically for such icing.

b. Roof penetrations. Designers try to limit penetrations; therefore, no new roof penetrations should be made for any reason until the proposed installation has been reviewed and approved by competent personnel. Failure to conform to this direction can result in leakage within the building.

c. Roofs and roof drains. Roofs and roof drains should be kept clean and clear of debris at all times to prevent water ponding of the roof. All debris (such as the cans, lumber, bottles, cardboard boxes, paper, rope, broken glass, etc., which have been found on many roofs) should be removed and periodic examinations should be performed. Nonessential foot traffic should be prohibited.

d. Removal of ice dams at eaves. Ice dams at the eaves should not be removed unless a problem exists from ponded water or hazardous overhang. Hot water or steam may be used to melt channels to drain the water behind the ice. Extreme care should be exercised when removing ice dams to avoid puncturing or damaging the roof membrane or flashing.

e. Bird screens. Bird screens at intake and exhaust hood openings should be removed periodically for cleaning and repair work. The screens should be kept free from frost buildup which reduces the hood capacity and restricts system operation.

f. Ridge and eave vents. Normally, ridge and eave vents on buildings having cold attic spaces experience little or no stoppage from snow or ice buildup; however, these vents should be regularly checked and physical blockage should be eliminated. If these vents are closed or plugged up, personnel in charge of the facility should be consulted to decide the method to be used to clear them, and maintenance should be performed as soon as possible. A delay in clearing vents may result in water leakage from the attic or roof.

7-3. Structural.

a. Building design loadings. The design loadings for the building (wind, snow, seismic, floor loadings, etc.) should be stated in the facility Operations and Maintenance Manual. If personnel from the using agency do not know the design capacities, they sometimes become alarmed when the structure is subjected to a heavier than normal loading. Heavy snow should not be removed unless it is clearly detrimental (overloading the roof or endangering personnel or equipment). A roof designed for a load of 30 psf can safely support an ice load approximately 8 inches thick over its entire surface. If it becomes necessary to remove snow from the roof, leave the lower six inches of snow in place to avoid damaging the membrane. Also leave snow in place around penetrations to protect the flashings. Personnel involved in snow removal shall not be placed at risk. If loads in excess of design loadings are realized or contemplated, refer the problem to a structural engineer for professional recommendations.

b. Foundation. The integrity of the building foundation must be preserved. If the structure is on piling, which requires a frozen foundation be preserved, no action should be taken which will tend to thaw this foundation. Open spaces under some structures have been skirted to maintain warm floors inside the building. This action has thawed the permafrost and caused foundation settlement and heaving. Sometimes structures have been skirted for the summer months when outside temperatures exceed the building temperatures. In this case, skirting should be removed when the exterior temperatures drop. If the foundation subgrade is a free draining material, unrestricted drainage must be maintained.

c. Paint and protective coatings. Protective coatings such as paints and rust inhibitors should be maintained to prevent structural deterioration or other adverse effects.

d. Condition of structural wood. In the dry arctic winter conditions, timbers tend to dry out, shrink, and crack. If checking cracks run diagonally across a member, they can destroy its strength. Shrinkage can loosen bolts and timber connectors. Methods of combating these conditions are: using clamps to force cracks shut and prevent their extension; drilling holes at ends of cracks to intercept them; adding moisture to the atmosphere; and reinforcing members by adding steel, plywood plates, or additional members. Bolted timber construction should be periodically inspected, and bolted connections tightened or shimmed to maintain joint tightness. This process reduces the possibilities of connectors becoming ineffective or members twisting. Proper maintenance and renewal of paint systems and seal coats will reduce the timber drying hazard.

e. Protecting the floors where tracked vehicles are housed. Frequently, arctic buildings that house tracked vehicles have certain floor areas reinforced with steel rails or plates to prevent floor damage from the steel cleats. Vehicles with chains or metal lugs should not be operated on unarmored floor areas. If such vehicles must be operated on unprotected floors, the floors should be planked, covered with metal plates, or protected by some other armoring means to prevent chipping or gouging.

f. Expansion and contraction joints. Expansion and contraction joints should be periodically inspected to ensure they are free of ice or other foreign materials which would restrict expansion and cause unanticipated stresses.

g. Inspection for ice jacking of slabs and foundations. Periodic inspections should be made of slabs on grade and foundations to detect jacking because of ice or settlement of foundation materials. Foundations, walls, columns, and connections should be inspected after seismic disturbances or flooding to detect any changed conditions. If there is any indication of damage to the structural integrity of the building, a structural engineer should be consulted.

7-4. Mechanical. The building contractor normally furnishes equipment manuals containing descriptive literature, parts lists, and installation, maintenance, and lubrication instructions. The following additional information on mechanical features is needed for proper operation and maintenance:

a. Heating and ventilating. A description of the operation of heating and ventilation, air conditioning, exhaust, and waste systems is needed. The control system or sequence should be explained, and the importance of maintaining the system design should be stressed.

b. Operating requirements. The design criteria needed for proper system operation should be stated. For example, how many vehicles, and of what type, is the exhaust system designed to handle? Users should be cautioned not to warm up vehicles in areas that were not designed for that purpose.

c. Anticipating trouble from incorrect operation. An explanation of what can happen if the system is not operated as designed should be included. For example, if the humidity is set too high, condensation will occur and the structure will deteriorate more rapidly than if humidity is regulated correctly.

d. Flow diagrams. Flow diagrams are required to simplify explanations of the system.

e. Maintenance instructions. Additional maintenance instructions beyond those recommended by the equipment manufacturer should be included, if required.

7-5. Electrical. Generally, electrical controls are an integral part of systems such as heating and ventilating systems, and they should be covered in the instructions for each particular system. Equipment manuals should be examined for accuracy and adequacy. If the manuals are not adequate to fully cover the electrical systems, additional material should be obtained. Instructions for specific items should refer to the material in the equipment manuals. Schematics and wiring diagrams are generally shown on the contract drawings and should be referred to in the operating instructions. If sufficient schematics and wiring diagrams are not shown, they should be added to the operating instructions. The system operation description should refer to schematic control diagrams and cover each diagram in detail, describing how and why the system functions. The instructions should explain exactly what will happen if the system is operated incorrectly. Special design

limitations should also be noted. Where chemical soil treatment is necessary to obtain an acceptable ground, a yearly check should be made to see if a good ground is being maintained.

7-6. Sample operation and maintenance manual. Appendix B is a sample Operation and Maintenance Manual typical of those described in this chapter.