Preventive-Maintenance Task List
For Public School Facilities

State of Maryland
Interagency Commission on School Construction

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Record of Changes

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Introduction

The Interagency Commission on School Construction (IAC) provides this Preventive-Maintenance Task List to assist Local Education Agencies (LEAs) with implementing an effective preventive-maintenance (PM) plan.

PM is the planned and regular inspection and servicing of equipment and systems in order to achieve the full expected lifespan and prevent prematurely degraded performance, premature failure, unplanned downtime, and related avoidable costs. In this document, which functions as a searchable PDF file housed on the IAC website, you will find individual information for preventive maintenance of major building systems, including any special instructions, ordered checkpoints, and recommended tools, materials, and equipment for each task. The table of contents, which can be accessed via the link in the footer of each page, as well as bookmarks throughout the PDF file, can be used to guide you through the document.

PM plans play a critical role maintaining and improving learning environments, improving system reliability, and financial stability. LEAs are encouraged to include the information found in this document in their PM plan. This task list is only a small piece of an effective PM plan. A PM plan should:

- include a strategy to identify opportunities and obstacles;
- prioritize and address any outstanding deferred maintenance by level of urgency;
- cover all areas of PM work in detail;
- specify logical and highly descriptive metrics for PM outcomes;
- specify PM program goals and specific targets for each metric;
- explain a logical process and criteria for prioritizing PM work;
- describe the maintenance resources, including staffing, and a thorough deployment strategy with options for adjustability to address changing conditions; and
- link PM activities to relevant capital maintenance plans.

This list may not be inclusive of all types of building systems and equipment found in each LEA. It is up to the LEA to identify the proper PM tasks and frequencies for their equipment so that tasks are not forgotten or overlooked, prioritize PM tasks, and determine whether in-house staff or contracted support staff should or will perform the maintenance. Where a manufacturer's recommendations conflict with information in this document, the manufacturer’s recommendations should control. .

I. Site Exterior

A. Roadways, Parking Lots, & Walkways

1. Roadways and Parking Lots Inspection.

Annual/semiannual

This maintenance task applies to asphalt and concrete roadways or parking lots. This maintenance check should be conducted Annually or Semiannually depending on the age and rate of deterioration of hard surfaces.

- ☐ Inspect and identify areas for cracking and deterioration.
- ☐ Identify and place barriers around areas that could be a tripping or driving hazard.
- ☐ Remove debris that has collected on paved surfaces, around storm drains, and curbing.
- ☐ Use crack filler to seal cracks.
- ☐ Identify areas that appear to have problems with ponding water.
- ☐ Create work orders to resolve issues identified during this preventive-maintenance check.

2. Roadway and Parking Lots Crack Sealing

Bi-Annual/Tri-Annual.

This maintenance task applies to conducting crack sealant of asphalt surfaces to prolong overall life expectancy.

- ☐ On a regular basis crack sealing can prolong the overall useful life of asphalt parking lots and roadways.
- ☐ The below criteria should be considered when determining the periodicity for crack sealant operations.
  - ☐ Existing cracking conditions and causes.
  - ☐ Use of asphalt surfaces.
  - ☐ Location of cracking in asphalt surfaces.

3. Walkways Inspection

Semiannual

This maintenance check should be applied to all walkways throughout the exterior of the facility.

- ☐ Inspect and identify any areas of cracking or settlement that are in the walking path. Generally ½" and above are considered a trip hazard.
- ☐ Inspect expansion joints and sealants. Deterioration of sealants should be identified and sealant replaced.
- ☐ Remove vegetation growth from hard surfaces.
- ☐ Inspect handrails along ramps and stairs to ensure they are sturdy and securely fastened.

- ☐ Inspect non-skid stair treads and ensure that they are in good condition and do not impede foot traffic.
- ☐ Create work orders to resolve issues identified during this preventive-maintenance check.

B. Grounds

1. Fences and Gates, Security/Access

Semiannual

This maintenance task applies to fences and gates found at driveway entrances, walkway entrances, and other areas where pedestrian or vehicular traffic must be controlled. This classification applies only to those fences and gates where a definite need exists for this type of maintenance to be performed.

a. This work should be scheduled at non-peak hours.
b. Notify affected personnel before performing PM (alarmed or security entrances).
c. Post "out of service" signs and/or barricades, as appropriate.

<u>Gates:</u>

- ☐ Inspect all pivot points, hinges, latches, etc. Apply lubricant where needed, wiping off excess.
- ☐ Check all locking devices. Lubricate as required.
- ☐ Inspect center gate support rollers and lubricate as required.
- ☐ Clean roller track of any debris.
- ☐ Check bolts, fasteners, and mounting hardware. Tighten or adjust as necessary.
- ☐ Check for any obstructions that retard full swing or movement of the gate.
- ☐ Check hold open devices for proper operation. Lubricate as required.

<u>Fences:</u>

- ☐ Check posts and corner posts, support guys, and horizontal bars between each support post.
- ☐ Check wire and anchor point; re-stretch and re-anchor if necessary.
- ☐ Inspect fence anchors along the bottom of the fence and at the point where the fence is connected to the post.
- ☐ Treat with galvanized protectant where rust has developed.
- ☐ Apply weed control along the entire base of the fence. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

<u>Recommended Tools, Materials, and Equipment:</u>

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ "Out of Service" signs
- ☐ Cleaning equipment and materials. Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Ladder constructed according to OSHA/ANSI standards. Check ladder for defects. Do not use defective ladders.
- ☐ Lubricants. Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Wire Stretcher
- ☐ Rust Protectant. Consult the MSDS for hazardous ingredients and proper PPE.

2. **Parking Arm Gates**
   Annual

   Checkpoints:
   - ☐ Lubricate mechanism with graphite.
   - ☐ Adjust linkage between motor and arm.
   - ☐ Check and adjust arm pressure.
   - ☐ Check and adjust sensitivity on magnetic coils embedded in asphalt.
   - ☐ Fill cracks in asphalt where coils are embedded.
   - ☐ Clean and adjust electric breakers.

   Recommended Tools, Materials, and Equipment:
   3. Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
   - ☐ Torque wrenches
   - ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
   - ☐ Asphalt filler
   - ☐ Appropriate lubricants. Consult the MSDS for hazardous ingredients and proper PPE.

3. **Manhole: Electrical**
   Annual

   Special Instructions:
   - ☐ Review Procedure for "Confined Space Entry."
   - ☐ Review Procedure for "Selection, Care, and Use of Respiratory Protection."
   - ☐ Wear appropriate protective clothing.

- ☐ No open flames or smoking.
- ☐ Use a barricade around manhole.
- ☐ Provide ventilation within manhole. Ensure that the exhaust from the gas or diesel-powered air compressor or blower is directed well away from the manhole.

Checkpoints:

- ☐ Test for gas.
- ☐ Pump out water.
- ☐ Clean out trash, debris, etc., and dispose of it in a proper container.
- ☐ Inspect cable, racks, splices, etc.
- ☐ Inspect structural features.

Recommended Tools, Materials, and Equipment:

- ☐ Standard tools - basic
- ☐ Respirator
- ☐ Barricade

4. **Manhole: Sewer**
   Quarterly

Special Instructions:

- ☐ Review Procedure for "Confined Space Entry."
- ☐ Review Procedure for "Selection, Care, and Use of Respiratory Protection."
- ☐ Wear suitable protective clothing.
- ☐ No open flames or smoking.
- ☐ Use a barricade around manhole.
- ☐ Provide ventilation within manhole. Ensure that the exhaust from the gas or diesel-powered air compressor or blower is directed well away from the manhole.

Checkpoints:

- ☐ Test for gas.
- ☐ Remove cover.
- ☐ Observe flow.
- ☐ Examine structural features of sewer line, interior of manhole, manhole frame and cover, etc.
- ☐ Clean work area and remove all debris.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Respirator
- ☐ Barricade

5. **Manhole: Water, Steam, and Fuel Oil**
   Semiannual

   This maintenance task applies to hot water, chilled water, condenser water, steam, and fuel oil manholes.

   Special Instructions:

   6. Refer to Standard Procedure for "Confined Space Entry."
   7. Review Procedure for "Selection, Care and Use of Respiratory Protection."
   8. Wear appropriate protective clothing.
   9. No open flames or smoking.
   10. Use a barricade around manhole.
   11. Provide ventilation within manhole. Ensure that the exhaust from the gas or diesel-powered air compressor or blower is directed well away from the manhole.
   12. Maintenance of any equipment located in the manhole will be performed under the appropriate task card in conjunction with this activity.

   Checkpoints:

   - ☐ Test for gas.
   - ☐ Remove cover.
   - ☐ Pump out water.
   - ☐ Clean out trash and debris, and dispose of it properly.
   - ☐ Inspect structural features, interior of manhole, manhole frame and cover for corrosion, deterioration or other defects.

   Recommended Tools, Materials, and Equipment:

   - ☐ Standard Tools – Basic
   - ☐ Cleaning materials and equipment. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
   - ☐ Portable water pump
   - ☐ Gas tester
   - ☐ Barricade
   - ☐ Portable ventilator
   - ☐ Protective clothing

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- ☐ Respirator

6. **Loading Ramp, Adjustable**
   Quarterly

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ Disconnect, lock and tag switch.

Checkpoints:

- ☐ Inspect structural features, framework, support members, anchor bolts, pit, platform, etc. Examine condition of bumper. Does it protect ramp properly?
- ☐ Remove dirt and trash from pit and determine if pit drain is open.
- ☐ Inspect motor, controls, starter, push buttons, solenoids, etc. Clean, adjust and lubricate as necessary. Be sure disconnect switch can be locked.
- ☐ For hydraulic units:
  - ☐ Inspect coupling, pump, control valves, piping, relief valve reservoir, fill pipe, cap, vents, etc. clean, adjust, and lubricate as needed.
  - ☐ Inspect cylinder, ram, packing glands, etc. Add or renew packing as required.
  - ☐ Change oil as required. Review the material data safety sheets (MSDS) for disposal of used oil. If appropriate, recycle oil at an authorized station.
- ☐ For electro-mechanical units:
  - ☐ Clean and inspect coupling, reduction gear, sprockets and chain, gear trains, screw and lever, and/or other mechanical features. Look for misalignment, loose bolts, evidence of binding or wear, excessive clearance, etc., Tighten as necessary.
  - ☐ Examine lubrication devices. Service if required.
  - ☐ Test operation of ramp in all directions using a load if possible. Note if ramp holds and does not creep when load is applied or removed. Adjust if necessary.
  - ☐ Check manual operation, power disengagement, etc.
  - ☐ Lubricate as required.
  - ☐ Clean up work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer’s instruction manual for specialized hand tools, equipment and supplies.
- ☐ Hydraulic fluid

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- ☐ Lubricants. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Cleaning materials. Consult the MSDS for hazardous ingredients and proper PPE.

C. Positive Site Drainage Away from Structure(s)

1. **Drains, Areaway, Driveway, Storm**
   Annual

   Special Instructions:
   - ☐ Perform work in autumn after leaves have fallen.

   Checkpoints:
   - ☐ Remove grate if it exists.
   - ☐ Clean drain and area leading to drain.
   - ☐ Remove debris and trash, and dispose of it properly.
   - ☐ Test drain for free water flow by flushing with hose.
   - ☐ Replace grate if removed in step 1.

   Recommended Tools, Materials, and Equipment:
   - ☐ Standard Tools – Basic
   - ☐ Hose
   - ☐ Work gloves

2. **Below Grade Ventilation Pits, Below Grade Crawl Space Access Pits**
   Annual

   Special Instructions:
   - ☐ Perform work in autumn after leaves have fallen.
   - ☐ This task should be included in a pre weather event checklist.

   Checkpoints:
   - ☐ Remove grate if it exists.
   - ☐ Clean drain and area leading to drain.
   - ☐ Remove debris and trash, and dispose of it properly.
   - ☐ Test drain for free water flow by flushing with hose.
   - ☐ Replace grate if removed in step 1.

D. Playgrounds, Equipment, & Fields

1. **Play Structure, Surfacing, Location and Accessibility, Size, and Placement, and Storage Area, Maintenance Worksheet**
   Monthly

   Special Instructions:

   - ☐ Unsafe conditions found during this maintenance shall be immediately brought to the attention of the school principal and the facility maintenance manager. Secure the equipment or area from further use immediately.
   - ☐ Be particularly alert to potential entrapment hazards in playground equipment.

   Checkpoints:

   - ☐ Surfacing
     - ☐ Check that surfaces underneath play structures where falls are likely to occur are constructed of a resilient (force-absorbing) material. Under-structure surfaces made of concrete, asphalt, or packed dirt should be removed, or covered with resilient material.
     - ☐ Composite loose surfaces shall be at least 6 inches in depth at the shallowest point under equipment of 4 feet or less.
     - ☐ Check to see if composite loose surfaces deeper than 6 inches under structures are higher than 4 feet. The depth should be proportional to the height. Composite loose surfacing shall be replenished on a regular basis as play activity by children necessitates.
     - ☐ Check to see if composite loose surfacing is surrounded by containment barriers.
   - ☐ Containment barriers shall be at least 6 inches higher than the composite loose surfacing.
   - ☐ Containment barriers shall be surrounded by a 5 feet maintenance zone.
   - ☐ The maintenance zone shall contain material to allow settling and clean up of child carried composite loose surfacing.
     - ☐ Containment barriers shall be visible enough to prevent trips.
   - ☐ Locations and Accessibility.
     - ☐ Check the fence surrounding the playground. It should be at least 4 feet in height, and the fence posts must be secured in the ground.
     - ☐ Grease the gate hinges semiannually with non-toxic lubricant.
   - ☐ Size and Placement of Equipment.
     - ☐ Individual pieces of equipment should be at least 10 feet apart.
     - ☐ Any exposed concrete footings should be covered with 6 inches of impact safe covering.

- ☐ Equipment should be placed to avoid crossing traffic patterns which could lead to injury.
- ☐ Equipment for infants or toddlers shall be placed in a separate area.
- ☐ The areas for infants and toddlers shall be separated from the older children by a fence or barrier which effectively prevents crossover.

☐ Ensure that storage areas adjacent to the play areas are locked.

2. **Play Structure, Sliding Equipment**
Quarterly

Special Instructions:

☐ Unsafe conditions found during this maintenance shall be immediately brought to the attention of the school principal and the facility maintenance manager. Secure the equipment or area from further use immediately.

☐ Be particularly alert to potential entrapment hazards in playground equipment.

Checkpoints:

☐ Slides, General

- ☐ Check for missing or broken parts.
- ☐ Check for sharp corners, edges, or projections.
- ☐ Check that all footings are firmly underground.
- ☐ Check that single wide slides are replaced with double wide slides.
- ☐ Check that the slide surface is smooth.
- ☐ Touch up or repaint the slide surface if required, using lead free non-toxic paint.
- ☐ For slides over 4 feet, ensure that the bottom of the slide forms an exit chute which decreases in angle from the rest of the slide surface.
- ☐ The overall height of the slide should not exceed the total of 2.5 times the tallest child in the group.

☐ Hill Slides. The hill slide shall have dirt under and around it so the slide surface is supported and secure.

☐ Spiral and Tunnel Slides. Some part of the child must be visible throughout the descent. Remove slides where children disappear from view during descent.

☐ Tighten all fasteners, nuts, and bolts.

☐ Check that equipment is securely fastened to its foundation, if applicable.

☐ Check that foundation is stable to avoid tipping the structure.

☐ Ensure all surfaces where connections are made are covered to prevent fingers from getting caught or pinched. Examples: Slide to platform and ladder to platform.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

3. **Play Structure, Swing**
   Monthly

Special Instructions:

- ☐ Unsafe conditions found during this maintenance shall be immediately brought to the attention of the school principal and the facility maintenance manager. Secure the equipment or area from further use immediately.
- ☐ Be particularly alert to potential entrapment hazards in playground equipment.

Checkpoints:

- ☐ To and Fro Swings.
  - ☐ Check that seats are of soft material like plastic or rubber. All metal or wooden seats must be replaced.
  - ☐ Check that swings for tots and swings for older children are hung on separate structures.
  - ☐ Check that a barrier should be in front of or behind the action of the swings to prevent running into a moving swing.
  - ☐ Securely fasten all supports in the ground.
  - ☐ Any exposed concrete footings should be covered with 6 inches of sand.
  - ☐ Ensure that rough edges are not exposed to children.
  - ☐ Verify that all metal surfaces are painted with unleaded, non-toxic paint.
  - ☐ Verify that all swing chains are covered to prevent pinches.
  - ☐ Lubricate as necessary, all moving parts of the swing according to manufacturer's specifications.
  - ☐ Tighten all nuts and bolts.
  - ☐ Check that foundation is stable to avoid tipping the structure.
- ☐ Tire Swings.
  - ☐ Ensure that the fulcrum or center point on the swing is in the center of the horizontal beam.
  - ☐ Ensure that the vertical uprights are placed away from the structure at a distance equal to or greater than the radius of the swing arc.
  - ☐ Lubricate as necessary the swivel moving assembly.
  - ☐ If the swivel moving assembly is wearing through its support, correct the deficiency. Ensure assembly is covered so that fingers do not get pinched or caught.

- ☐ Tot Swings.
  - ☐ Ensure that all sides of each tot swing are structurally safe.
  - ☐ Ensure that all hooks which close the seats to the sides are securely latched.
  - ☐ Ensure there are no areas for fingers to get caught or pinched.

4. **Play Structure, Climbing Equipment**
   Monthly

   Special Instructions:
   - ☐ Unsafe conditions found during this maintenance shall be immediately brought to the attention of the school principal and the facility maintenance manager. Secure the equipment or area from further use immediately.
   - ☐ Be particularly alert to potential entrapment hazards in playground equipment.

   Checkpoints:
   - ☐ General Climbing Equipment.
     - ☐ Ensure that all support structures are securely anchored in the ground.
     - ☐ All footings must be covered sufficiently to prevent injury.
     - ☐ Securely fasten all nuts and bolts.
     - ☐ Close all open holes (e.g., at the end of pipes). They should be covered or capped with smooth edges to prevent children from cutting their fingers.
     - ☐ Remove spaces which could entrap hands or fingers.
     - ☐ Ensure that the structure is free of sharp corners, edges, protrusions, splinters, and other defects that could injure a child.
     - ☐ Ensure that all platforms 4 feet or higher are enclosed with guard rails.
     - ☐ If the structure has openings between 4.5 inches and 9 inches, initiate a work order to redesign the parts to be less than 4.5 inches or greater than 9 inches, and remove the equipment from service.
   - ☐ Chain/Rope
     - ☐ Ensure that chains are covered to eliminate pinch points.
     - ☐ Replace chain if links show wear.
     - ☐ Replace all ropes that are frayed or showing wear.
     - ☐ Replace all worn parts which connect rope to the structure, and cover all pinch points.

- [ ] Lubricate the assembly which attaches chain/rope to the structure with a non-toxic lubricant and ensure the area is covered to prevent the hands/fingers of a child from coming into contact with the lubricant.

- [ ] Horizontal Ladders
  - [ ] a. Ensure that all footings cemented under the ground are at least 6 inches.
  - [ ] b. Ensure that there is at least 8 inches of ground cover under the structure to protect against falls.
- [ ] Stairways.
  - [ ] Ensure all stairway bolts must be fastened securely, including those which are used to attach it to the structure.
  - [ ] Ensure all bolts are covered and or were installed in a manner that the children cannot come into contact with them.
- [ ] Geodesic Domes.
  - [ ] Fasten all stairway bolts securely.
  - [ ] Fastened all nuts and bolts securely.
  - [ ] Ensure that there is at least 8 inches of suitable ground cover, such as sand, under the structure to protect against falls.
- [ ] Climbing Poles.
  - [ ] Ensure that all pole footings are cemented under the ground at least 6 inches. Initiate a work order if necessary to correct.
  - [ ] Fasten all connections at the top of the pole securely and cover any areas that could be pinch points.
  - [ ] Ensure that there is at least 8 inches of suitable ground cover, such as sand, under the structure to protect against falls.
- [ ] Balance Beams.
  - [ ] Ensure that all balance beam footings are cemented under the ground at least 6 inches.
  - [ ] Remove all protrusions found at the connecting points.
  - [ ] Sand all rough edges smooth.
  - [ ] Ensure that there is at least 8 inches of suitable ground cover, such as sand, under the structure to protect against falls.
- [ ] Chinning Bars.
  - [ ] Ensure that all chinning bar footings are cemented under the ground at least 6 inches.
  - [ ] Fasten all nuts and bolts securely.
  - [ ] Ensure that all nuts and bolts are properly installed and covered to prevent a child from coming in contact with them. Cover as needed to accomplish satisfactory protection.

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- ☐ Ensure that all horizontal bars are perpendicular to the uprights.
- ☐ Ensure that there is at least 8 inches of suitable ground cover, such as sand, under the structure to protect against falls.

☐ Parallel Bars.

- ☐ a. Ensure that all parallel bar footings are cemented under the ground at least 6 inches.
- ☐ Ensure that all nuts and bolts are properly installed and covered to prevent a child from coming in contact with them. Cover as needed to accomplish satisfactory protection.
- ☐ Fastened all nuts and bolts securely.
- ☐ Ensure that there is at least 8 inches of suitable ground cover, such as sand, under the structure to protect against falls.

☐ Bridges

- ☐ Ensure that all bridge footings are cemented under the ground at least 6 inches.
- ☐ Fastened all nuts and bolts securely.
- ☐ Ensure that all nuts and bolts are properly installed and covered to prevent a child from coming in contact with them. Cover as needed to accomplish satisfactory protection.
- ☐ Ensure that all bridge pinch points are covered.
- ☐ Ensure that there is at least 8 inches of suitable ground cover, such as sand, under the structure to protect against falls.

Recommended Tools, Materials, and Equipment:

☐ Standard Tools – Basic

5. **Play Structure, Rotating, Spring Rocking, and Seesaws**
Monthly

Special Instructions:

- ☐ Unsafe conditions found during this maintenance shall be immediately brought to the attention of the school principal and the facility maintenance manager. Secure the equipment or area from further use immediately.
- ☐ Be particularly alert to potential entrapment hazards in playground equipment.

Checkpoints:

☐ Merry-go-round, Swinging Gates.

- ☐ Level and firmly secure the support structure in the ground as needed.
- ☐ Ensure that all joints and fasteners are secure and covered to prevent a child from coming into contact with them.

- ☐ Ensure that the structure is free from all sharp corners and edges.
- ☐ All open spaces in the center of the structure between the center post and the outer perimeter must be covered.
- ☐ Lubricate all moving parts with a non-toxic lubricate.
- ☐ The structure may not have moving parts which create a shearing action that could sever or crush body parts (if installed, they are usually underneath). All structures that have a shearing action shall be removed.
- ☐ Ensure that the gear box is covered.
- ☐ There must be a minimum of 20 feet of cleared running space surrounding the structure to be used for getting off.

☐ Spring Rocking Equipment.

- ☐ Ensure that the support structure is firmly secured in the ground.
- ☐ Ensure all joints and fasteners are secured and covered to prevent a child from coming into contact with them.
- ☐ Remove any sharp corners, edges, or projections.

☐ Seesaw Equipment.

- ☐ Ensure that the support structure is firmly secured in the ground.
- ☐ Ensure all joints and fasteners are secured and covered to prevent a child from coming into contact with them.
- ☐ Remove any sharp corners, edges, or projections.
- ☐ All nuts and bolts must be countersunk.
- ☐ Lubricate all moving parts with a non-toxic lubricant.
- ☐ All moving parts must be covered to eliminate pinch points for fingers, hands, feet.
- ☐ Ensure that there is a cushioning surface (e.g., tire) under each end of the seesaw where it would normally come in contact with the ground.
- ☐ Ensure that the overall height of the seesaw at the top of the arc is less than 4 feet.
- ☐ Ensure all handholds are 3 inches in length.

Recommended Tools, Materials, and Equipment:

☐ Standard Tools – Basic

6. **Play Structure, Sand and Water Play Equipment**
   Monthly

   Special Instructions:

   ☐ Unsafe conditions found during this maintenance shall be immediately brought to the attention of the school principal and the facility maintenance manager. Secure the equipment or area from further use immediately.

- ☐ Be particularly alert to potential entrapment hazards in playground equipment.

Checkpoints:

- ☐ Designated Sand Play Area.
  - ☐ Ensure that there is adequate drainage provided to prevent collection of water.
  - ☐ Ensure all sand play area boundary joints and fasteners are secured.
  - ☐ Remove all sharp corners and edges from the sand play area structure.
  - ☐ Replenish the sand as needed.
  - ☐ Note whether there is an elevated sand play area for wheelchair access (e.g., sand table).
  - ☐ The sand play area must be covered when not in use to prevent access to animals. Note whether there is a serviceable cover available.
  - ☐ Note whether adult seating is being provided near the sand play area.
- ☐ Designated Water Play Area.
  - ☐ Remove all lime or water mineral build-ups on the spray heads.
  - ☐ Lubricate movable parts for water clues or water wheels, using a safe, non-toxic lubricant.
  - ☐ Repair as needed all standing water areas fences and gates to ensure the area is secured when inadequately supervised.
  - ☐ Free the water play area structure from all sharp corners and edges.
  - ☐ Note whether there is an elevated water play area for wheelchair access (e.g., water table).
  - ☐ Ensure that there is adequate drainage provided to prevent unwanted collection of water.
  - ☐ Note whether adult seating is to be provided near the water play area.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

7. **Play Structure, Signs, Trees, and Pathways**
   Semiannual

Special Instructions:

- ☐ Unsafe conditions found during this maintenance shall be immediately brought to the attention of the school principal and the facility maintenance manager. Secure the equipment or area from further use immediately.
- ☐ Be particularly alert to potential entrapment hazards in playground equipment.

Checkpoints:

- ☐ Signs. Check all signs and ensure that they are properly mounted, in good repair, and legible. Repair or replace as needed.
- ☐ Trees and Shade Structures.
  - ☐ Note whether the trees block the prevailing, provide proper shade within the limits of the play structure borders, and shade structures such as slide surfaces and sand areas.
  - ☐ Rake and remove leaves from the site.
  - ☐ Trim and maintain trees.
  - ☐ Ensure that all tree houses are securely fastened.
  - ☐ Note whether adult seating is provided near the play areas.
  - ☐ Check and clean the fountainhead and base. Remove all sharp corners, edges, or projections.
- ☐ Verify that the drinking fountains are cleaned in accordance with the building plan (should be daily).
- ☐ Pathways.
  - ☐ Free pathways from weeds and other growth.
  - ☐ Note whether pathways are wide enough for the widest wheel toy.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Anti-entrapment kit

8. **Play Structure, Playhouse, Garden, and Manipulatives**
   Annual

Special Instructions:

- ☐ Unsafe conditions found during this maintenance shall be immediately brought to the attention of the school principal and the facility maintenance manager. Secure the equipment or area from further use immediately.
- ☐ Be particularly alert to potential entrapment hazards in playground equipment.

Checkpoints:

- ☐ Playhouse.
  - ☐ Securely fasten all joints.
  - ☐ Remove sharp corners, edges, or projections from all surfaces. Ensure that surfaces are non abrasive.
  - ☐ All surfaces that are painted or treated must use non-leaded, non-harmful materials.

- ☐ Note whether playhouses are open enough to allow easy visual and quick access by an adult play leader.
- ☐ Playhouses in trees (tree houses) must be securely fastened on major large branches.

☐ 2. Wheel/Riding Toys.

- ☐ Tightened all nuts and bolts on wheel toys.
- ☐ Lubricate all moving parts on wheel toys.
- ☐ Follow other additional manufacturer instructions for maintenance, if provided.
- ☐ Remove sharp corners, edges, or projections from all surfaces. Ensure that surfaces are non abrasive.
- ☐ All surfaces that are painted or treated must use non leaded, non harmful materials.

☐ Gardens. Weed and mulch the gardens as needed.

☐ Manipulatives.

- ☐ Remove all sharp corners, edges, or projections from wooden blocks and other manipulatives.
- ☐ Lubricate all moving parts on smaller wheel toys.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Anti-entrapment kit

9. **Play Structure, Carriages and Buggies**
Annual

Special Instructions:

- ☐ Unsafe conditions found during this maintenance shall be immediately brought to the attention of the school principal and the facility maintenance manager. Secure the equipment or area from further use immediately.
- ☐ Be particularly alert to potential entrapment hazards in playground equipment.

Checkpoints:

- ☐ Check handles and toddler restraint straps. Make certain they are in good condition and securely fastened to the buggy.
- ☐ Check hand/foot brakes for proper operation and braking effectiveness.
- ☐ Ensure that all nuts and bolts are properly tightened.
- ☐ Lubricate moving parts as appropriate.
- ☐ Check the frame for structural deformities, and especially sharp corners/edges.

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- ☐ Check for cracks around the weight bearing sections and around structure near bolt holes/rivets.
- ☐ Check the wheels and axles. Ensure the wheels are in good condition and properly attached to the axle, and axle properly attached to the buggy.
- ☐ All surfaces that are painted or treated must use non-leaded, non harmful materials.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Anti-entrapment kit

10. **Bleachers Inspection, Folding and Telescopic**
Annual

- ☐ Annual inspections of folding and telescopic bleachers should be conducted on an annual basis to ensure safe conditions.
- ☐ OEM recommended inspection procedures should be followed and carried out by a qualified inspector.

11. **Outdoor Grandstands**
Annual

- ☐ Annual inspections of outdoor grandstands should be conducted on an annual basis to ensure safe conditions.
- ☐ OEM recommended inspection procedures should be followed and carried out by a qualified inspector.

E. Relocatables & Additional Structures

1. Relocatable and additional structures should be included in the applicable building preventive-maintenance program.

II. Building Exterior

A. Exterior Structural & Finishes

1. Brick or block, Concrete Facade, Painted Facade

Annual

Special Instructions:

- ☐ Use care when working on high places.
- ☐ Use a safety line with belt if necessary.

Checkpoints:

- ☐ Perform visual inspection of all exterior surfaces to identity:
  - ☐ Cracking
  - ☐ Deterioration
  - ☐ Vegetation growth on exterior structures
  - ☐ Expansion joint condition
- ☐ Perform visual inspection of painted facade to identify deterioration of painted surfaces.
- ☐ Create work orders to resolve issues identified during this preventive-maintenance check.

B. Roof Drains, Gutters, & Downspouts

1. **Roof Drains, Downspout, and Gutter Inspection**

Annual

Special Instructions:

- ☐ Use care when working on high places.
- ☐ Use a safety line with belt if necessary.

Checkpoints:

- ☐ Check gutters, drains, and downspouts to ensure that they are properly attached to the building, connections sealed, and free of debris.
- ☐ Check drain strainers/screens for condition and proper installation.
- ☐ If downspouts have heaters, test, operate and correct deficiencies.
- ☐ Remove all trash, debris or unsecured material from the roof area.
- ☐ Where downspout discharges onto lower roofs, check if there has been any scouring of the surfacing.
- ☐ Check for missing or damaged splash blocks.

Recommended Tools, Materials, and Equipment:

- ☐ Standard tools - basic
- ☐ Ladders constructed according to OSHA/ANSI standards or scaffolding. Check ladder for defects. Do not use defective ladders.

C. Windows, Caulking, & Skylights

Annual, Bi annual

Special Instructions:

- ☐ Review manufacturer's instructions.

Checkpoints:

- ☐ Inspect window sealants for deterioration
- ☐ Inspect window panes for condensation, discoloration, or opaque appearance
- ☐ Inspect windows for broken or cracked window panes
- ☐ Inspect weather sealants around operable windows for completeness
- ☐ Operate windows and locks to ensure proper operation
- ☐ Insect the condition of window frames and structures
- ☐ Enter corrective maintenance work orders for repairs of issues identified during inspections.

D. Entryways & Exterior Doors

1. **Door, Power Operated**
   Semiannual

Special Instructions:

- ☐ Review manufacturer's instructions.

Checkpoints:

- ☐ Inspect general arrangement of door and mechanism, mountings, tasks, wind locks, anchor bolts, counterbalances, weather stripping, etc. Clean, tighten, and adjust as required.
- ☐ Operate with power from stop to stop and at intermediate positions. Observe performance of various components, such as brake, limit switches, motor, gear box, etc. Clean and adjust as needed.
- ☐ Check operation of electric eye, treadle, or other operating devices. Clean and make required adjustments.
- ☐ Check manual operation. Note brake release, motor disengagement, functioning or hand pulls, chains sprockets, clutch, etc.
- ☐ Examine motor, starter, push button, etc., blow out or vacuum if needed.
- ☐ Inspect gearbox, change or add oil as required.
- ☐ Perform required lubrication. Remove old or excess lubricant.
- ☐ Clean unit and mechanism thoroughly. Touch up paint where required.
- ☐ Clean up and remove all debris.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer’s instruction manual for specialized hand tools, equipment and supplies.

- ☐ Lubricants. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Cleaning Materials. Consult the MSDS for hazardous ingredients and proper PPE.

2. **Key Card System**
   Quarterly

   Special Instructions:
   - ☐ Review manufacturer's instructions.

   Checkpoints:
   - ☐ Disassemble card reader head and vacuum.
   - ☐ Check card printer unit and vacuum.
   - ☐ Check wiring for loose connections, discoloration, etc.
   - ☐ Change filter – (A).
   - ☐ Change batteries – (A).
   - ☐ Check cards to see if codes are in operation.
   - ☐ Reassemble unit.
   - ☐ Clean exterior and surrounding area of unit.

   Recommended Tools, Materials, and Equipment:
   - ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
   - ☐ Spare filter and batteries
   - ☐ Cleaning equipment and material. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
   - ☐ Vacuum cleaner

3. **Door, Automatic Hydraulic Electric or Pneumatic Operated Main Entrance**
   Quarterly

   Checkpoints:
   - ☐ Check alignment of door and mechanism. Inspect mountings, hinges, mats, and trim, weather stripping, etc. Replace, tighten, and adjust as required.
   - ☐ Operate with power, observing operation of actuating and safety mats, door speed, and checking functions.
   - ☐ Check manual operation.
   - ☐ Inspect power unit, lubricate and tighten lines as required.

- ☐ Check operation of control board relays; clean, replace or adjust contacts as required.
- ☐ Inspect door operating unit, tighten lines, and adjust as required.
- ☐ Clean and lubricate door pivot points.
- ☐ On pneumatic or hydraulically operated door operators, check for correct operating pressures per manufacturer's instructions.
- ☐ Clean up and remove all debris from the work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Lubricants. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

4. **Doors, Main Entrance**
   Semiannual
   This maintenance task applies to entrance doors used in main entries to buildings where a poorly operating door may be dangerous and cause congestion.

   Special Instructions:

   - ☐ Set suitable barriers at the entrance and exit of the door. Prevent obstructions from impeding pedestrian traffic around the work area.

   Checkpoints:

   - ☐ Hinged Doors
     - ☐ Inspect the frame and supporting structures.
     - ☐ Inspect hardware; hinges, latch keeper, lock. etc. Apply graphite where needed, wipe off excess.
     - ☐ Inspect glass, putty, or retaining pieces. Correct any deficiencies.
     - ☐ Operate door to observe functioning. Adjust and service as needed.
     - ☐ Touch up paint as needed.
     - ☐ Clean up and remove all debris from the work area.
   - ☐ Revolving Doors
     - ☐ Remove obstructions and clean out track.
     - ☐ Fold door. Note action and freedom of motion.
     - ☐ Inspect locking device, adjust as needed.
     - ☐ Clean pivot points and apply graphite.
     - ☐ Inspect felt or rubber seals.

- ☐ Set the emergency fold pressure on the door to the manufacturer's specifications. Check automatic speed control, which should limit the speed of the door to 12 RPM.
- ☐ Touch up paint as required.
- ☐ Clean up all debris from the work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Graphite. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Clean wiping cloths
- ☐ Suitable barriers

5. **Door, Manual Overhead**

Annual

This maintenance task applies to manually-operated overhead doors. These doors normally range in size from to 24 feet wide by 7 to 20 feet in height. Power operated overhead doors will be serviced using standard task D-1.

Special Instructions:

- ☐ If the door is equipped with intrusion alarms, notify the appropriate person before operating.
- ☐ Schedule maintenance on these doors so that it does not interfere with loading dock operations.

Checkpoints:

- ☐ Inspect general arrangement of door and mechanism, mountings, tasks, wind locks, anchor bolts, counterbalance, weather-stripping, etc. Clean, tighten, and adjust as required. Make minor repairs as needed.
- ☐ Inspect cables for frayed or broken strands or excessive rusting.
- ☐ Inspect winding drum for tightness and proper tracking of cables.
- ☐ Manually raise and lower door, noting that door tracks evenly and action of brake release, functioning of hand pulls, chains, sprockets, clutch, etc.
- ☐ If equipped, inspect gearbox; change or add oil as needed.
- ☐ Perform required lubrication. Remove old or excess lubricant.
- ☐ Clean unit and mechanism thoroughly. Touch up paint where needed.

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Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Rust inhibitor and paint. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Grease gun, oil, and grease
- ☐ Ladder constructed according to OSHA/ANSI standards. Check ladder for defects. Do not use defective ladders.

E. Roofs, Flashing, & Gravel Stops

1. **Roof Inspection & Checklists, Various Types**
   Semiannual

Special Instructions:

- ☐ Review manufacturer's or installer's instructions.
- ☐ Before performing any physical maintenance inspection, explore the roof's history.
- ☐ Perform Inspections in the Spring and Fall when the roof is driest and most accessible.
- ☐ Additional inspections should be performed after any severe winds or storms and after leaves have fallen if the roof is low.
- ☐ A maintenance check list and copy of the roof plan should be used at time of inspection; areas of concern should be clearly marked so they can be easily located by repair crews.
- ☐ It is vitally important to identify and repair the cause of any problem to prevent further damage to the roofing system.
- ☐ Use care when working in high places, use safety belts if necessary.

Checkpoints:

- ☐ Check ceilings and the underside of roofs and decks for signs of water entry; i.e. such as stained ceiling tiles, dry rot in a wooden deck, or rust in a steel deck. Note all deteriorated areas on your roof and deck plan for comparison later on the roof.
- ☐ Walk around the perimeter of the building. Check for cracks and signs of water entry into the walls, examine exterior drainage accessories such as downspout, scupper heads and gutters for signs of leakage. Mark the deficiencies on the roof plan and proceed to the roof.
- ☐ Check roofs and decks for ponding and plant growth (roof should drain within 48 hours of a rainfall). Any accumulation of water (ponding) should be noted on the roof plan. Pay particular attention to areas near building air intakes. Remove all trash, debris, or unsecured material from the roof and dispose of it properly.

- ☐ Check for physical damage such as punctures, exposed nails, note location of patches, repairs and accumulation of debris especially near drains.
- ☐ Check for cracking, loss of coating, brittleness, curling wrinkles, buckles, bubbles and sponginess. Note exposure of bituminous coating due to loose or missing gravel.
- ☐ Check all flashing for wind damage caulking and curling, and exposed edges. Check flashing fasteners for looseness and deterioration. Check any fibrous material that might be asbestos for deterioration.
- ☐ Check the condition of any joints, roof to wall joints in particular. Check the termination of roofing expansion joints at parapet walls. Be sure that water drains off the top of the coping and that it is well attached.
- ☐ Check whether walkways are in logical locations and in good condition with no blistering below them.
- ☐ Check that any installed equipment such as antennas, HVAC equipment and flagpoles are properly installed according to building codes, including necessary I-beam supports for heavy A/C equipment, and are flashed and secured to the building.
- ☐ Refill pitch pockets.
- ☐ Check ballast (rock) for even spread; remove any with very sharp edges.
- ☐ Remove all trash, debris or unsecured material from the roof and dispose of it properly.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Ladder constructed in accordance with OSHA/ANSI STANDARDS. Check ladder for defects. Do not use defective ladders.
- ☐ Safety line (if necessary).

Roof Inspection Checklists:

Building:	
Location:	
Maintenance Inspector's Name:	
Date:	

General Appearance	Good	Fair	Poor
Water Tightness	No Leaks	Leaks with Long Rain	Leaks with Every Rain
Ballast (as applicable)		Even spread without sharp edges.	

BUILT-UP ROOF

Reported Cause of Leaks

Weathering Material	
Hail Damage	
Low Spots	
Faulty Material	
Faulty Construction	
Gravel Stop Failure	
Faulty Design	
Roof Traffic	
Wind Damage	
Flashing Failure	
Other	

Adhesion of Mineral Surfacing to Bitumen

Good	
Fair	
Poor	

ASPHALT SHINGLE ROOF

Reported Cause of Leaks

Wind	
Faulty Application	
Weathering of Shingles	
Faulty Design	
Faulty Material	

Other Problems

Hail Damage	
Traffic on Roof	
Other Mechanical Damage	
Failure of Flashings	
Other	

Condition of Shingles

Unchanged	
Blistered	
Tabs Missing	
Buckled	
Curled	
Other	

Loss of Granules

Slight	
Medium	
Severe	

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Other Problems

Asphalt Coating Damaged	
Coating Alligatored or Cracked	
Other	

WOOD SHINGLE ROOF

Reported Cause of Leaks

Weathering	
Failure of Nails	
Cracked Shingles	
Flashing Failure	
Curled Shingles	
Other	

Condition of Shingles

Unchanged	
Cracked %	
Curled %	
Loose	

TILE ROOF

Reported Cause of Leaks

Weathering	
Faulty Construction	
Flashings	

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Faulty Design	
Faulty Material	
Under-layer	
Wind	
Hail	
Other	

Condition of Tile

Unchanged	
Broken Tiles %	

Cause of Breakage

Nailed too Tight	
Other	

Failure of Fasteners

No	
Yes %	

Other Failures

Describe	

ASPHALT ROLL ROOFING ROOF

Reported Cause of Leaks

Weathering	

Faulty Material	
Wind	
Traffic	
Faulty Application	
Hail Damage	
Other	

Condition of Roofing

Unchanged	
Buckled	
Blistered	

Loss of Granules

Slight	
Medium	
Severe	

Other Problems

Asphalt Coating Damage	
Coating Alligatored or Cracked	
Other	

SLATE ROOF

Reported Cause of Leaks

Weathering	
Faulty Material	

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Wind	
Traffic	
Faulty Application	
Hail Damage	
Other	

Condition of Slate

Unchanged	
Disintegrated	

Amount of Disintegration

Slight	
Severe	
Broken	
Other	

Failure of Fasteners

No	
Yes %	

METAL ROOF

Reported Cause of Leaks

Corrosion	
Faulty Design	
Broken Seams	
Faulty Construction	

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Faulty Seams	
Insufficient Lap	
Defective Fasteners	
Flashings	
Other	

General Condition

Rust or Corrosion	None	Slight	Severe

Condition of Protective Coating

Good	
Fair	
Poor	

Seams Broken

Yes	
No	
Location	

CEMENT COMPOSITION ROOF

Reported Cause of Leaks

Weathering	
Faulty Construction	
Wind	

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Faulty Design	
Faulty Material	
Hail	
Flashings	
Underlayment	
Other	

Condition of Roofing

Unchanged	
Loose Shingles	
Broken Shingles %	
Broken Corrugated Sheets %	

Failure of Fasteners

No	
Yes %	

Flashings

Chimney Flashings	Satisfactory	Defective
Wall Flashings	Satisfactory	Defective
Ridge Flashings	Satisfactory	Defective
Vent Flashings	Satisfactory	Defective
Valley Flashings	Satisfactory	Defective
Edge Flashings	Satisfactory	Defective

Drainage

Gutters	Satisfactory	Defective
Downspouts	Satisfactory	Defective

General Remarks

Comments

Roof Detail Grid

Use to indicate location of problem areas

Roof Inspection Worksheet - Comments

Instructions: This worksheet may be used to supplement other worksheets or as an alternative to other worksheets provided with the task lists. Check the response. i.e., Yes, No or Unknown or not observed. If Y (yes), circle the type of problem.

A. Evaluation of Interior Conditions

1. Does the roof leak?

Yes	No	Unknown
Describe:		

2. Are there water stains on:

Walls	Deck	Structural Elements	Ceilings	Floor	Other:
Describe:					

3. Do structural elements show any of the following?

Cracks	Alteration	Physical Damage	Splits	Rotting	Insect Damage	Spalling	Settlement	Other
Describe:								

4. Does the underside of the deck show any of the following?

Rusting	Spalling	Sagging	Rotting	Cracks	Other
Describe:					

B. Evaluation of Exterior Conditions

1. Do the exterior walls show any of the following?

Cracks	Spalling	Water Stains	Rusting	Peeling	Other
Describe:					

2. Does the fascia or soffit show any of the following?

Cracks	Spalling	Water Stains	Rusting	Movement	Other
Describe:					

3. Do the gutters or downspouts show any of the following?

Loose	Missing	Clogged	Damaged	Disconnect	Other
Describe:					

C. Evaluation of Rooftop Conditions

1. Is there any unauthorized, unnecessary, or improperly installed equipment on the roof?

Yes		No		Unknown	
Equipment	Antennas	Cables	Signs	Platforms	Other
Describe:					

2. Do adjacent parapet walls show any of the following?

Cracks	Cap Cracked	Sealant	Spalling	Cap Missing	Other
Describe:					

D. Remarks:

2. **Roof Inspection, Maintenance & Repair**
Semiannual
All roofs require periodic inspection and maintenance in order to perform as designed and to provide a long and effective service life. Periodic inspection and maintenance is also typically required by roofing system manufacturers to keep roofing warranties in full force and effect. Although all building owners should establish a periodic roof inspection program, inspection and maintenance of any roof should be undertaken only by qualified persons who are familiar with safe roofing practices, including all applicable occupational, health and safety regulations relating to the roofing and construction industries.
Because modern roofing systems contain a wide variety of components and installation techniques, all roof inspections should be conducted by a licensed roofing contractor or similar roofing professional. Typically two inspections should be conducted each year, one in the spring and one in the late fall. If the roof is warranted, at least one roof inspection each year should be conducted by the licensed contractor who originally installed the roof.

Inspection and Maintenance Guidelines:

Section	Subject
A	Roof Traffic
B	Contaminants
C	Drainage
D	Wind Storm Damage
E	Moisture Infiltration
F	Roof Membrane Seams
G	Base Attachments
H	Roof Inspection Checklist

A. Roof Traffic
Introduction:
Almost all roofing systems are subjected to some amount of foot traffic. Typically, roof traffic is necessary to service roof-top equipment. Occasionally, roofs may also be subjected to unauthorized foot traffic. Because roof traffic can damage the roofing system, periodic inspection is very important to assure that any damage is identified and addressed quickly.
Where to Look:

1. Roof Access Points: The roof surface area immediately adjacent to a point of access, such as a ladder, hatch or door typically receives more foot traffic than any other area of the roof.
2. Walkways and "Natural" Pathways: Even if a walkway system is provided, always look for the "natural" pathway, or the most direct route between access points and areas of frequent maintenance. If roof walkways are installed in a square or right angle configuration, look for diagonal "short cuts" between adjoining walkways.
3. Rooftop Mechanical Equipment: Look around any equipment that requires periodic service.
4. Litter: The presence of bottles, cans or other litter is usually an indication of roof traffic and use.

What to Look For:

1. Cuts & Punctures: Small cuts in a roofing membrane are difficult to detect if the membrane is covered with a layer of dust or dirt. If cuts and punctures are suspected, the membrane should be cleaned with water and inspected. Most cuts and punctures will produce small bubbles in a film of water applied to the surface of the membrane.
2. Compressed or Crushed Roof Insulation: Most roof insulations have relatively low compressive strengths and can easily be compressed or crushed if traffic loads exceed the strength of the insulation. Crushed insulation can be indicated by the presence of ponding water and "tented" insulation fasteners which did not compress along with the insulation.

Remedial Actions:

1. Emergency Repair of Small Cuts & Punctures: Most single-ply cuts and punctures can be repaired temporarily by covering the cut or puncture with duct tape. Clean the membrane around the cut with a non-abrasive cleaner and apply a piece of duct tape extending beyond the cut or puncture at least one inch in all directions. Most cuts and punctures in asphalt membranes can be repaired temporarily by applying plastic roof cement to the affected area. Make arrangements for a permanent repair as soon as possible.
2. Permanent Repair of Cuts & Punctures: Permanent repair of cuts and punctures should be performed by a licensed roofing contractor.
3. Compressed or Crushed Roof Insulation: Insulation which has been crushed should be replaced with new insulation. Because this procedure will also require extensive repairs to the roofing membrane, this work should be performed by a licensed roofing contractor.

Preventive Actions:

1. Roof Walkways: If roof traffic is extensive, the installation of a new or an enhanced roof walkway system should be considered. See Section II for roof walkway specifications and guidelines.
2. Roof Access Log: In order to control and monitor roof access, procedures should be established to record the personnel, purpose, time and duration of all rooftop visits.

B. Contaminants

Introduction: Although most roof membranes provide outstanding resistance to natural weathering, their durability can be adversely affected by contact with many organic substances, including oils, fats, and organic solvents. Because exposure to these types of contaminants will cause many roofing membranes to lose strength and resiliency, periodic inspection is very important to assure that any damage is identified and addressed quickly.

Where to Look:

1. Air Conditioner Compressors: Frequently, air conditioning units will leak oil, or oil may be spilled during periodic maintenance.
2. Kitchen Exhaust Fans: Grease from cooking exhausts can accumulate, especially if filters are not cleaned frequently.

What to Look For:

1. Membrane Swelling: Some single-ply membranes, such as EPDM, will exhibit swelling or buckling of the membrane. This is an indication that the membrane has absorbed the contaminant and that fundamental physical properties of the membrane have been compromised.
2. Membrane Splitting & Cracking: Contact with oils or organic solvents can embrittle asphalt roofs and some single-ply membranes by accelerating the loss of lighter weight components.

Remedial Actions:

1. Membrane Swelling, Splitting or Cracking: Membrane which has swelled or cracked should be replaced by a licensed contractor.

Preventive Actions:

1. Redundant Membrane Layer: If contamination, especially from cooking exhausts, is considered to be chronic, a redundant layer of roofing membrane should be applied around the exhaust vent and the roof surface area typically affected by grease deposits. This additional layer should be installed by a licensed roofing contractor.
2. Grease Traps: A number of proprietary grease traps are available which can be placed around exhaust units to absorb fats and grease. Typically, these units will require periodic maintenance to function properly. These units can be installed by any contractor competent in sheet metal work, but the installation should be coordinated with a licensed roofing contractor.

C. Drainage

Introduction: Ponding or standing water can cause problems for both asphalt and single-ply roofing systems. Because asphalt compounds are not inherently resistant to the sun's rays, most modified bitumen and built-up roofing membranes use either a layer of factory-applied granules, a field-applied liquid coating or a layer of roofing gravel to protect the membrane from ultraviolet degradation. Under constant exposure to standing water, however, granule and gravel coatings will tend to wash off and liquid coatings may blister and peel. Once this

important coating is removed, the underlying asphalt membrane will begin to degrade due to direct exposure to sunlight. Although single-ply roof membranes provide excellent resistance to water and sunlight, the potential for damage to the roof is also significant when water is allowed to stand on a roof. A small cut or puncture in the roof membrane may cause little damage on a well-drained roof surface, but the same puncture located in an impacted drainage area can produce extensive damage to the roof insulation, roof deck and building contents. Although effective roof drainage can be achieved through a variety of methods, all roofs should be designed and maintained to provide a consistent and effective path for water to completely drain off and away from the roof surface within 24 to 48 hours of a rain storm. Effective drainage must also accommodate build-ups of snow and ice that may typically occur during winter months.

Where to Look:

1. Mid-Span Of Roof Beams And Joists: Because most horizontal structural members deflect in the center of the span, ponded areas are located frequently along the mid-span of these framing members.
2. Large Rooftop Units. Heavy rooftop units can frequently cause deck deflection and create a ponding area around the unit.
3. Roof Drainage Components. Typical roof drainage components include:
    a. Roof drains
    b. Wall scuppers
    c. Gutters & downspouts.

What to Look For: Although improper roof drainage can best be observed immediately after a rainstorm, most impacted drainage conditions will leave "tell-tale" indications even after standing water has evaporated:

1. Accumulated Debris. Debris frequently accumulates in ponding areas. Because water eventually evaporates from impacted areas, a concentric pattern of debris or dirt is a good indication of a ponding condition.
2. Visible Sagging or Deflection.
3. Discoloration of Curbs and Walls. The discoloration may be due to a build-up of snow or ice, or it may be an indication that water may "back up" during very severe rain storms.
4. Damage to Drainage Components. Please refer to Item E - "Inspecting for Moisture Infiltration"

Remedial Actions:

1. Remove Debris: Bag and remove from the roof.
2. Repair Drainage Components. Please refer to "Inspecting Roof Sealants and Sheet Metal."

Preventive Actions:

1. Roof drains can be added to remove water from impacted areas.
2. Add Taper Systems. Water in impacted areas can be diverted by adding tapered "saddles" and "crickets."

3. Redundant Membrane Layer. If it is not economically possible to rework an impacted drainage area, the potential for damage can be reduced by the application of redundant layers of membrane and flashing, in order to reduce the possibility of cutting or puncture.

D. Wind Storm Damage

Introduction: Wind storms can damage roofing systems in several different ways. The effect of the wind itself can exert a force on important roof system attachments that prevent the roof system from separating from the roof deck and building. Wind forces can also damage exposed sheet metal items, such as gutters and downspouts. In addition, the force of the wind-borne debris may cause puncture or cutting of the roof membrane. In fact, severe wind storms can even dislodge rooftop units and cause the units to blow across the roof, causing extensive roof membrane damage.

When to Look: As soon as possible after any significant wind storm.

Where to Look:

1. Roof Membrane Surface
2. Rooftop Units
3. Roof Edge Metal, Gutters, & Downspouts

What to Look For:

1. Ballasted Roofing Systems
    a. Look for missing or displaced roof ballast.
    b. Look for shuffled or displaced insulation boards beneath the roof membrane.
2. Adhered Roofing Systems
    a. Look for loose or disbonded areas of roof membrane.
    b. Look for deflection or distortion of the insulation boards beneath the roof membrane.
    c. Look for "tented" insulation fasteners and plates.
3. Mechanically Attached Roofing Systems
    a. Look for large cuts or slices in the roof membrane.
    b. Look for deflection or distortion of the insulation boards beneath the roof membrane.
    c. Look for "tented" or loose roofing fasteners and plates.
4. Displaced or Damaged Rooftop Units or Damaged or Missing Sheet Metal Components
5. Membrane Cuts and Punctures

Remedial Actions:

1. Remove Debris
2. Replace or Re-Disperse Roofing Ballast. This must be done carefully in order to avoid puncturing the membrane.
3. Repair Damaged Roof Membrane & Components. Permanent repairs should always be performed by a licensed roofing contractor. In order to respond to emergency situations, the following actions can be taken by the building maintenance staff:

a. Small cuts and punctures can be sealed temporarily.
b. If large areas of membrane have become detached and are actively billowing, it is very important to cut the membrane to reduce the internal pressure build-up. Even though this procedure may cause some water to enter the roof system, it may prevent additional detachment of the membrane and the potential for a roof "blow-off."
c. Roof membrane which has detached at the perimeter anchorages should be re-secured by weighting the membrane with sand bags or by securing with a wood batten or nailer.

Preventive Actions:

1. Add Roof Ballast. If some areas of ballast stone are frequently displaced by winds, consider adding a larger size of ballast stone or replacing ballast stone with concrete pavers. Note: Ballast should not be added to a roof without a review of the roof load capacity by a structural engineer.
2. Review Roof System Design. If damage consistently occurs in certain areas of the roof, the roof system design should be reviewed by an engineer or roof consultant.

E. Moisture Infiltration

Introduction: Moisture can enter into a roofing system many different ways. In addition to water entry due to roof membrane leaks, moisture can enter a roofing system due to condensation from internal humidity, infiltration through building walls, water entry through equipment housings and latent moisture trapped beneath the roof system.

Where to Look:

1. Building Walls & Parapets. Many types of wall construction, especially masonry and stucco, can allow moisture infiltration due to porosity and cracking. Particular attention should be paid to metal flashings associated with walls, including wall copings, reglets, counter-flashings, and termination bars.
2. Large Rooftop Units. Frequently the metal housings around these units may allow water entry.
3. Skylights. Skylight glazing beads and metal trim flashings typically require periodic maintenance.

What to Look For: Although improper roof drainage can best be observed immediately after a rainstorm, most impacted drainage conditions will leave "tell-tale" indications even after standing water has evaporated:

1. "Soft" Roof Insulation. If the roof insulation appears to be "soft" under foot, it may have absorbed excessive moisture.
2. Cracking, Spalling or Discoloration Of Walls. The deterioration may be an indication of moisture entry.
3. Loose Metal Wall Flashings. Look for any discontinuities in the firm, uniform compression between metal flashings and the wall surface.

4. Covered "Weep Holes." Look for masonry weep holes that have become clogged or were accidentally covered over by the roof flashings.
5. Missing Or Broken Weather Seals On Equipment Housings. Frequent maintenance of rooftop equipment may allow weather seals and sheet metal joints to lose water-tightness.
6. Cracked or Sunken Caulking. Almost all joints in metal flashings are sealed with an application of sealant or caulking. Any cracking or other discontinuity is a potential source of water entry.

Remedial Actions:

1. Replace Wet Roof Insulation. A licensed roofing contractor should perform this work.
2. Re-Attach and Re-Caulk Metal Components. Maintenance of metal flashings and caulking joints typically can be performed either by a roofing contractor or trained maintenance personnel.
3. Repair Deteriorated Walls. Repair of walls can be performed by a variety of trades. Be sure to select a recognized professional.

Preventive Actions:

1. Roof Moisture Survey. If a new roof will be installed over an existing roof, or whenever moisture is suspected to be entrapped within a roof deck, a roof moisture survey should be conducted by a recognized professional, and the findings of the survey should be used by the roof designer to select the most appropriate roofing system.
2. Rooftop Equipment Maintenance Standards: A roof access log should be maintained in order to review and monitor the maintenance of rooftop equipment.

F. Roof Membrane Seams

Introduction: Modern roof seams are designed to provide many years of water-tight performance, but these seams are subjected to stresses which over time may produce water entry, especially at intersections and angle changes. Typically, field seams do not need to be inspected during the normal ten to fifteen warranty period unless observations of possible leakage have been observed. After the normal warranty period, it is advisable to completely renovate the field seams by re-covering with a new layer of seaming material.

Where to Look:

1. "T"-Joints. "T" joints occur where two sheets of roofing membrane intersect. Because of the extra thickness of membrane at these locations, these joints may over time begin to open up due to the "memory" of the membrane.
2. Angle Changes. Roof seams which travel through an angle change, such as a deck-to-wall joint, are subject to the same long-term stresses as "T" joints, and may begin to open up over time.

What to Look For:

1. Edge Cavitations. The leading edge of the seam may be starting to open up, allowing dirt to accumulate in a cavity at the seam edge.

2. Entrapped Moisture. Seams which are taking on moisture will typically exhibit "bubbling" along the seam edge when foot pressure is applied to the seam.

Remedial Procedures:

1. Emergency Repair of Field Seams. Most single-ply field seams can be repaired temporarily by covering the seam edge with duct tape. Clean the membrane around the edge with a non-abrasive cleaner and apply a piece of duct tape extending beyond the affected area at least one inch in all directions. Most seams in modified bitumen membranes can be repaired temporarily by applying plastic roof cement to the seam edge. Make arrangements for a permanent repair as soon as possible.
2. Permanent Restoration of Roof Seams. Restoration of aged roofing seams should be performed by a licensed roofing contractor.
    a. Single-Ply Seams. EPDM seams typically can be restored by "stripping in" the seam with a new covering of membrane material. See Section II for specific repair procedures.
    b. Modified Bitumen Seams. Minor repairs to modified bitumen seams can be performed by pulling open the affected seam area and re-sealing the seam using a roofing torch. When seam deficiencies are widespread, the only effective long-term repair is the installation of a new layer of modified bitumen membrane over the affected roof surface area.

G. Base Attachments

Introduction: Modern perimeter attachments are designed to provide many years of secure performance, but these attachments are subjected to stresses which over time may produce distortion of the base attachments. Typically, base attachments do not need to be inspected during the normal ten to fifteen warranty period unless observations of distortion have been observed. After the normal warranty period, it may be advisable to completely renovate the base attachments by installing new base attachments.

Where to Look:

1. Parapet Walls and Equipment Curbs
2. Sheet Metal Roof Edges

What to Look For:

1. "Bridging": "Bridging" refers to the tendency for roofing membranes to pull away from any angled intersection due to the inherent "memory" of the manufactured roofing sheet. Minor bridging, extending beyond the angle change less than one inch, can typically be expected from any roofing membrane after a reasonable period of service. Bridging greater than one inch may indicate that the base attachment itself is beginning to experience stress, and this stress may lead to water entry through roof seams which run through the angle change of the base attachment.

2. Loose Fasteners. The observation of loose or "tented" fasteners beneath the membrane at the base attachment may indicate that the original installation of the fastener was inadequate to accommodate long-term stress on the base attachment.

Remedial Procedures:

1. Emergency Repair. If bridging or distortion at a base attachment is causing active leakage, try to seal the leak with a construction-grade butyl caulking.
2. Permanent Restoration of Roof Seams. Restoration of aged base attachments should be performed by a licensed roofing contractor.

H. Roof Inspection Checklist

Roof Identification:	*Building Address:*
Date Roof Installed:	*Original Contractor:*
Manufacturer's Warranty No.:	*Date of Warranty Expiration:*
Date of Roof Inspection:	*Inspected by:*

Item:	Where to Look:	What to Look For:
Roof Traffic	Roof Access Points	Membrane Cuts & Punctures
	Walkways	Crushed Roof Insulation
	Mechanical Units	Trash & Sharp Objects
Contaminants:	Mechanical Units	Oil Spills
	Kitchen Exhausts	Cooking Fats & Grease
Drainage:	Mid-Span of Beams & Joints	Accumulated Debris
	Large Rooftop Units	Visible Deflection
	Roof Drains	Discoloration of Curbs & Walls
	Wall Scuppers	Loose Sheet Metal

	Gutters & Downspouts	Cracked Caulking
Wind Storm Damage:	Roof Perimeter	Loose Perimeter Sheet Metal
	Roof Membrane Surface	• Loose Areas of Roof Membrane • Buckled Insulation • Displaced Roof Ballast
Moisture Infiltration	Adjoining Walls & Parapets	"Soft" Roof Insulation
	Large Rooftop Units	Discoloration of Walls
	Skylights	• Loose Sheet Metal Flashings • Missing Weather Seals • Cracked or Sunken Caulking
Roof Membrane Seams	T-Joints	Edge Cavitations or Curling
	Angle Changes	Entrapped Moisture
Base Attachments	Parapet Walls & Curbs	Membrane "Bridging"
	Roof Edge	Loose Fasteners

Conditions Observed:
Actions Recommended:

- *Attach Roof Sketch*
- *Use Additional pages as necessary*

Index to Roof Repair & Renovation Procedures:

Section	Subject
A	Cuts and Punctures
B	EPDM Field Seams
C	Modified Bitumen Field Seams
D	EPDM Base Tie-Ins

Return to Table of Contents

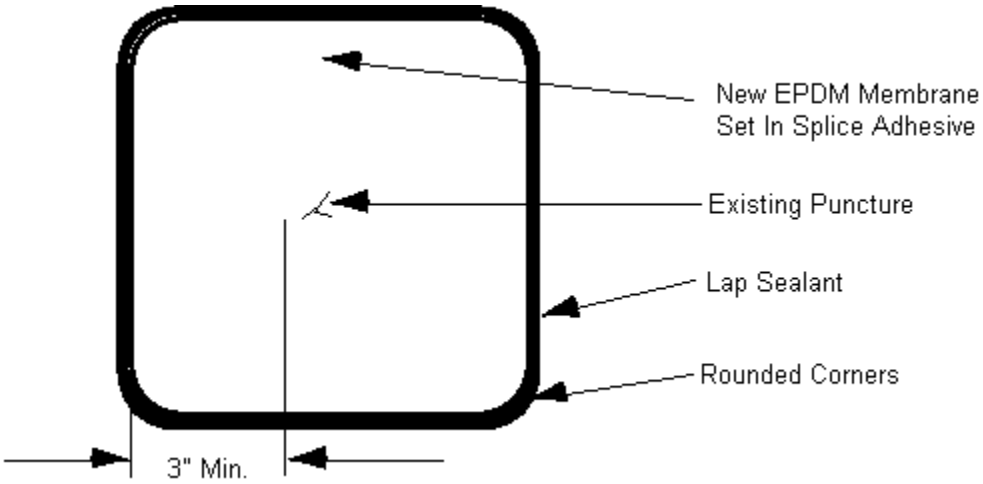
E	Modified Bitumen Base Flashings
F	Cleaning & Priming of In-Service EPDM Membrane
G	Walkway Systems

Roof Repair & Renovation: Even with periodic inspection and maintenance, roofing systems will require repair from time to time. Although roof repair is typically conducted as a response to some type of damage to the roof, a ***proactive*** approach to roof repair and renovation can improve the performance and extend the service life of most modern roofing systems. The procedures and specifications contained in this section provide valuable general information about the efficient and effective repair of different roofing systems, including EPDM and modified bitumen roofs.

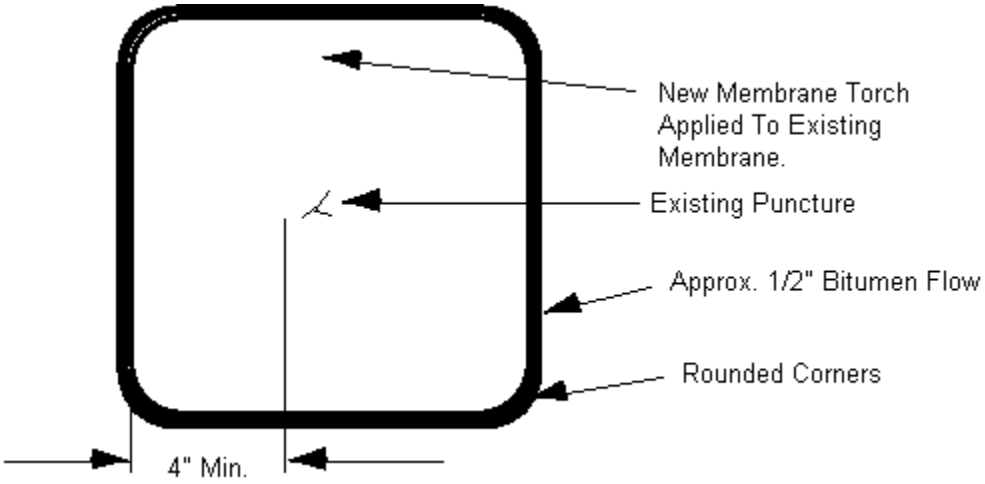
A. Repair of Cuts and Punctures

NOTE: These drawings show general procedures for typical roof system repair and renovation. Please refer to firestone technical specification manuals for additional information. Roof repairs and renovations should be performed only by a professional roofing contractor who is licensed and trained by the roof system manufacturer.

1. Typical Repair of EPDM Membrane:
   Note: The application of new EPDM membrane to existing in-service EPDM membrane requires special cleaning and priming procedures. Refer to Section F - "Cleaning and Priming of In-Service EPDM Membrane."



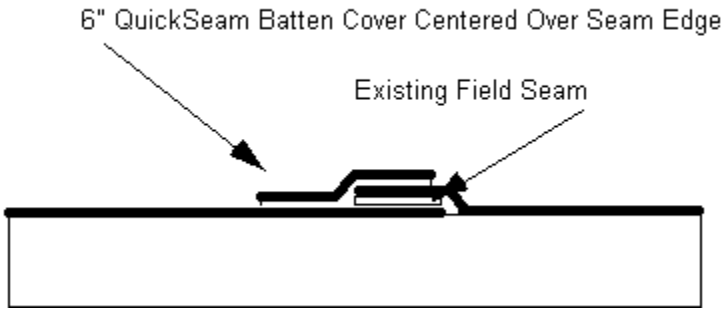
2. Typical Repair of Modified Bitumen Membrane
   Note: Preparing existing surface by heating with a roofing torch and embedding any exposed roofing granules with a heated trowel.



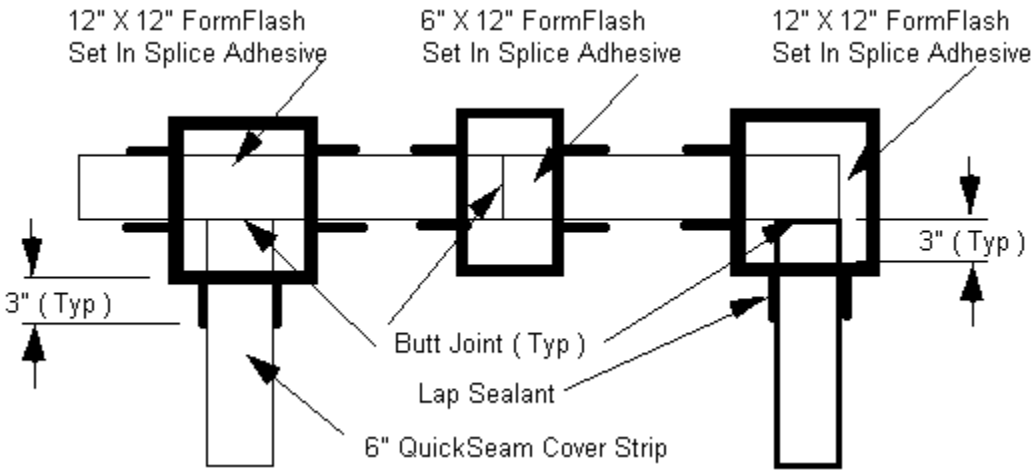
B. EPDM Field Seams

Note: These drawings show general procedures for typical roof system repair and renovation. Please refer to firestone technical specification manuals for additional information. Roof repairs and renovations should be performed only by a professional roofing contractor who is licensed and trained by the roof system manufacturer.

1. Typical Seam Cross-Section



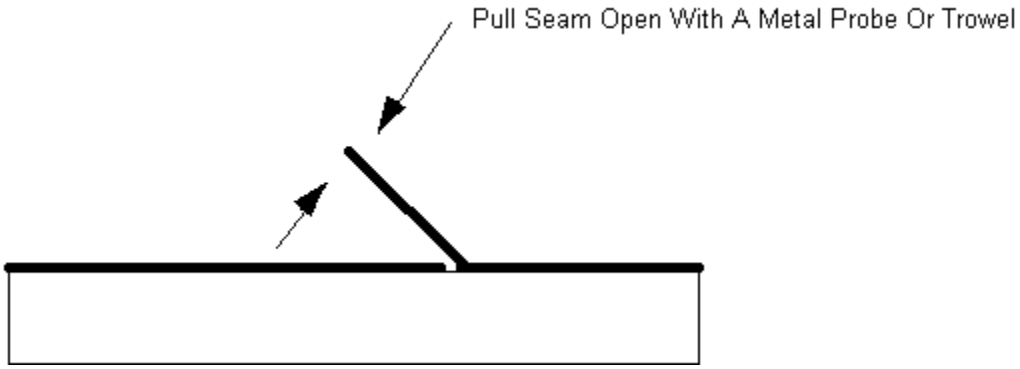
2. Typical Joint Details:
   Note: The application of QuickSeam Tape and FormFlash to existing in-service EPDM membranes requires special cleaning and priming procedures. Refer to Section F - “Cleaning and Priming of In-Service EPDM Membrane.



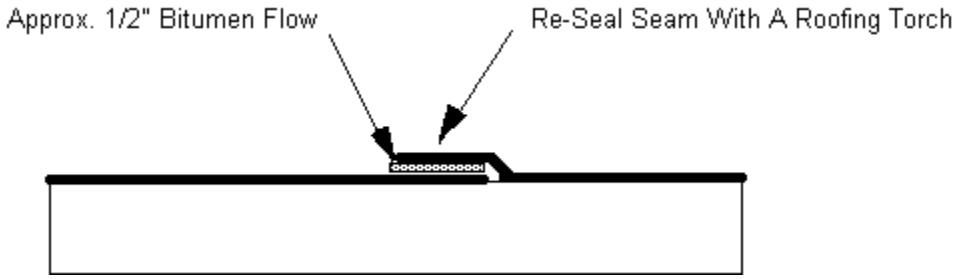
C. Modified Bitumen Field Seams

Note: These drawings show general procedures for typical roof system repair and renovation. Please refer to firestone technical specification manuals for additional information. Roof repairs and renovations should be performed only by a professional roofing contractor who is licensed and trained by the roof system manufacturer.

Step 1:



Step 2:

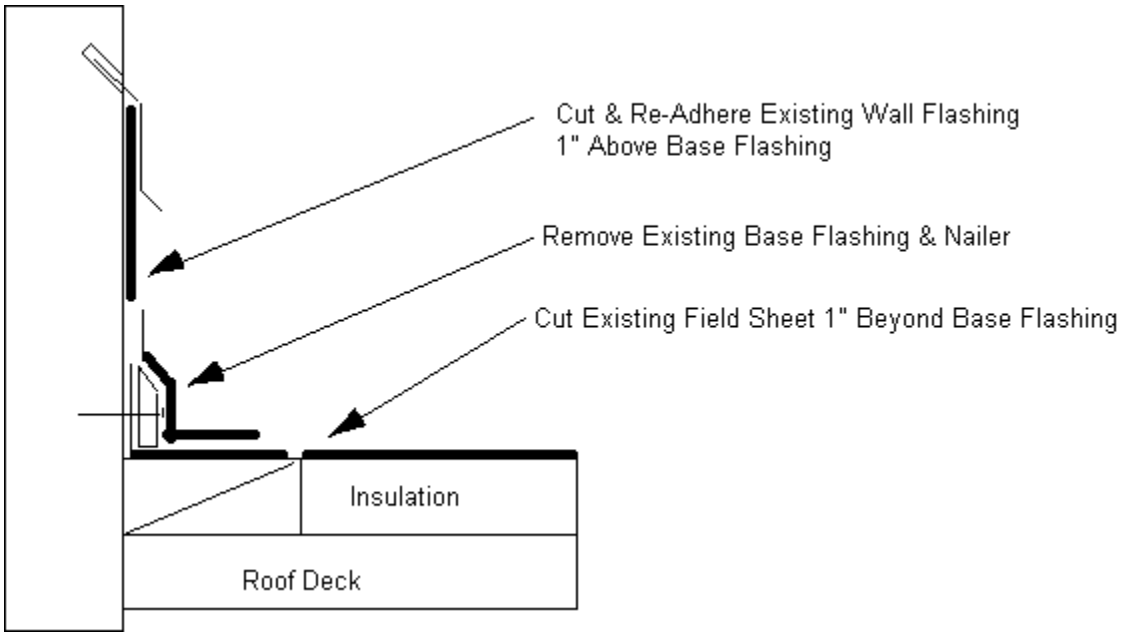


D. EPDM Base Tie-Ins

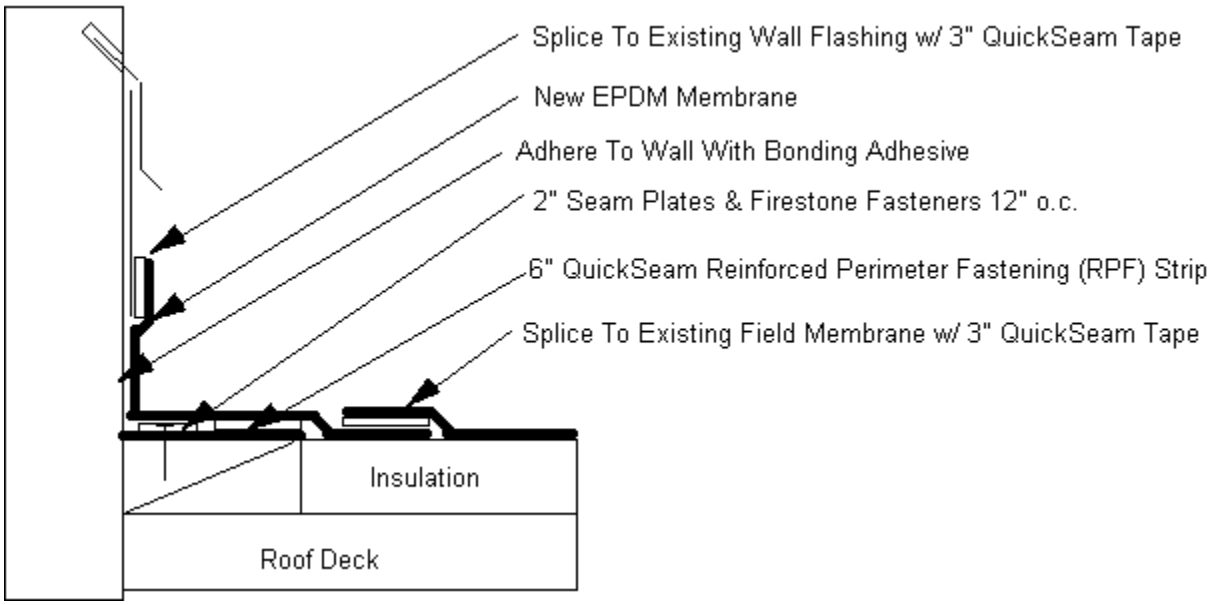
Note: These drawings show general procedures for typical roof system repair and renovation. Please refer to firestone technical specification manuals for additional information. Roof repairs

and renovations should be performed only by a professional roofing contractor who is licensed and trained by the roof system manufacturer.

Step 1:



Step 2:

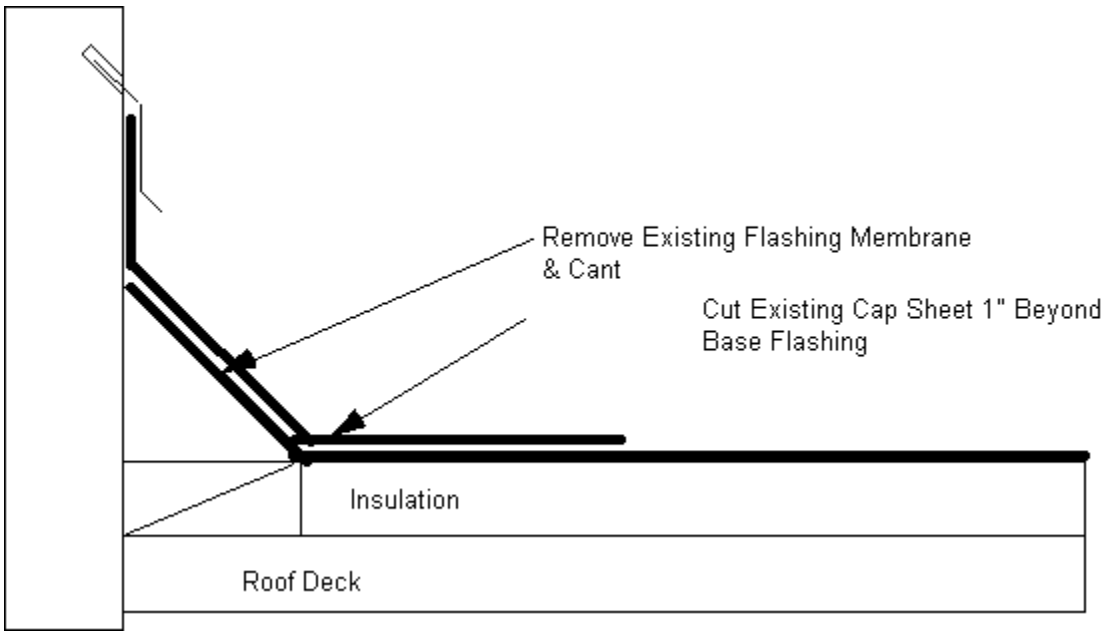


Note: The application of QuickSeam Tape to existing in-service EPDM membrane requires special cleaning and priming procedures. Refer to Section F - “Cleaning and Priming of In-Service EPDM Membrane.

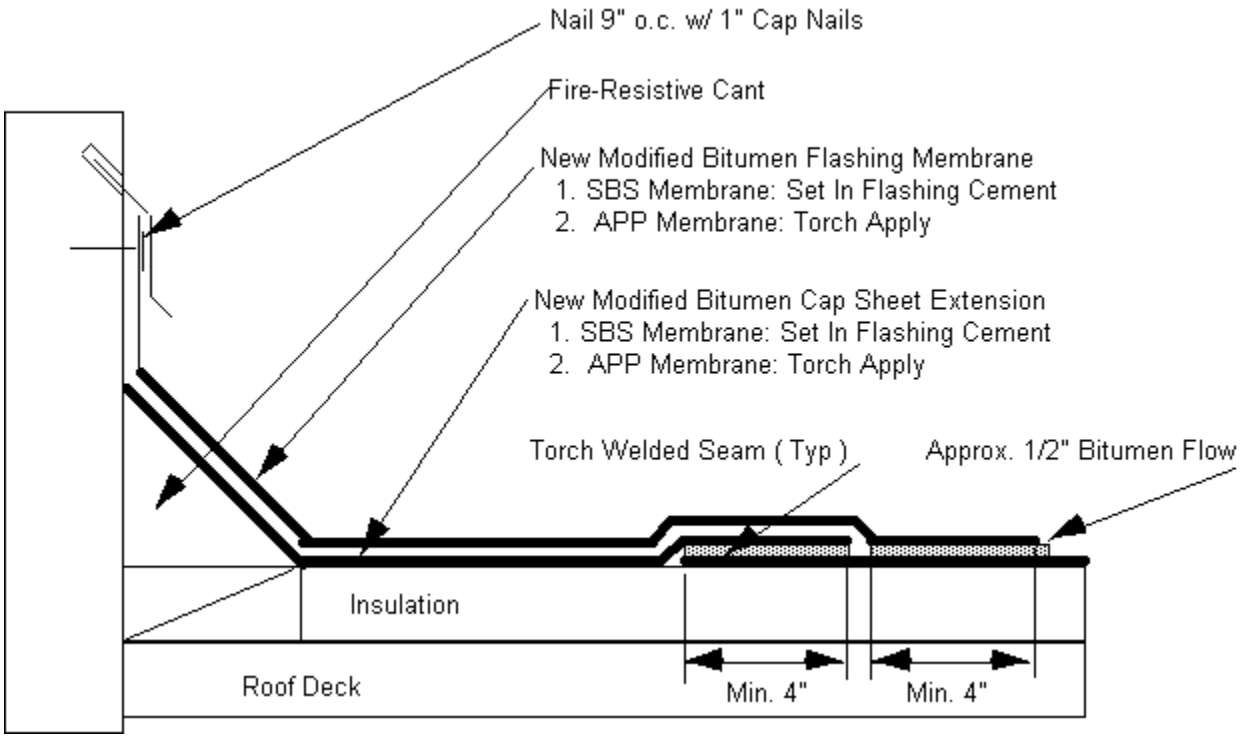
E. Modified Bitumen Base Flashings

Note: These drawings show general procedures for typical roof system repair and renovation. Please refer to firestone technical specification manuals for additional information. Roof repairs and renovations should be performed only by a professional roofing contractor who is licensed and trained by the roof system manufacturer.

Step 1:



Step 2:



F. Cleaning & Priming Of In-Service EPDM Membrane

Note: These drawings show general procedures for typical roof system repair and renovation. Please refer to firestone technical specification manuals for additional information. Roof repairs and renovations should be performed only by a professional roofing contractor who is licensed and trained by the roof system manufacturer.

Step 1: Cleaning

a. Performance Standards
   i. Properly cleaned EPDM membrane shall be dark gray in color without visible streaks.
   ii. The cleaned area shall extend at least 3" beyond the repair area.
   iii. The membrane shall be cleaned in a two-phase process:
      1. Cleaning and scrubbing as required with detergent and water.
      2. Cleaning and scrubbing ***at least twice*** with Splice Wash.

b. Detergent & Water Cleaning: Cleaning may be achieved by one of the following methods:
   i. Brush-wash by hand with a solution of mild dish soap and water and a stiff bristle brush.
   ii. Scrub with an electric floor scrubber and a wet vacuum.
   iii. Power wash with a power water washer and a wet vacuum.

Rinse the receiving surface until clean. Be careful not to flood the roof surface and cause leakage into the roof. Allow the receiving surface to dry thoroughly, using clean towels or rags. Make sure that no moisture is trapped.

c. Splice Wash Cleaning: Wash the existing membrane ***twice*** with Splice Wash and clean cotton rags, allowing the surface to dry completely between washings. Change cleaning rags frequently.
d. Cleaning of New Membrane Patching Material: New EPDM membrane shall be cleaned using Clear Splice Wash in accordance with current specifications for new installations. NOTE: FormFlash membrane and QuickPrime Tape products ***do not*** require cleaning.

Step 2: Priming

a. Performance Standards: In-service membrane must be primed with a brush application of Splice Adhesive (note: QuickPrime application with QuickScrubber pads ***is not*** acceptable for use with in-service membrane).
b. Apply Splice Adhesive to the previously cleaned membrane using a solvent resistant paint brush, minimum 3" wide. Adhesive shall be applied at a rate of 150 to 175 lineal feet per gallon for a 3" splice (approximately 40 square feet per gallon).
c. At the same time Splice Adhesive is applied to the existing surface, also apply an equal coverage of Splice Adhesive to the EPDM or FormFlash membrane patch (Note: the exposed surface of QuickSeam Tape products ***does not*** require priming).
d. Allow the adhesive to set up on each surface until the surface of the adhesive does not stick or string to a clean, dry finger.

Note: After cleaning and priming the in-service membrane, proceed with the application of the new EPDM membrane, FormFlash, Lap Sealant and QuickSeam Tape in accordance with current application specifications for new construction.

G. Walkway Systems

Effective roof walkway systems must be designed to accommodate two different forces:

1. Puncture forces, which can cut the roofing membrane. Puncture forces can be exerted on the roof membrane by dropped tools, broken glass, nails, metal scraps, etc., especially when such sharp objects are stepped on by foot traffic.
2. Compressive forces, which can crush the underlying roof insulation. Although little formal research has been conducted regarding the forces exerted by foot traffic on the roof, it is generally acknowledged that an individual will exert a foot force anywhere from 10 PSI to 30 PSI depending on body mass, shoe profile and momentum. This wide range of variability is very important since many common types of roof insulation, such as expanded polystyrene and polyisocyanurate foam, have relatively low compressive strengths. While rubber walkway pads will provide effective protection against cutting and puncture, these pads are relatively thin and they cannot distribute large compressive

forces. If frequent or heavy roof traffic loads are anticipated over a roof system which uses low compressive strength insulation, one or more of the following products should be considered:

a. Smooth Concrete Pavers. Concrete pavers have very high compressive strengths and can significantly distribute the force of foot traffic. Because the edges of the pavers can be sharp, and because concrete over time may crack or spall, it is advisable to install a protective fabric mat or a redundant layer of roofing membrane beneath concrete pavers. Before an extensive concrete paver walkway is installed, the live load capacity of the roof deck and building structure should be evaluated to verify that the structure can accommodate the added weight of the pavers.

b. High-Density Roof Boards. Compressive forces can also be distributed by installing a high-density roofing board directly over the roof insulation prior to installing the roofing membrane. Examples of common roofing boards are:

   i. Class E Wood Fiber. (Federal Specification LLL-I-535B). This product is similar in compressive strength to conventional wood fiber wall sheathing. Typical thicknesses are 1/2" and 1".

   ii. "Dens-Deck" Roof Board. This product is a moisture-resistant gypsum sheathing product with fiberglass facers. Typical thicknesses are 1/4" and 1/2". If a high-density roof board is selected, it will still be necessary to install rubber walkway pads over the membrane to protect against cutting and puncture.

c. Protected Membrane Systems. Protected membrane systems utilize a layer of high density extruded polystyrene board loosely laid directly above the roofing membrane and covered with a fabric mat and concrete pavers. As with any concrete paver system, the load capacity of the roof should be evaluated before installing this type of system. Although this type of system can provide very excellent protection against both crushing and puncture, it is very difficult to service if a leak does occur. Because of this, the roofing warranty coverage available for protected membrane systems may be less than the warranty coverage available with other roofing systems.

III. Building Interior

A. Interior, Doors, Walls, Partitions, & Finishes

1. Fire Doors – Stairwells and Exit Ways, Swinging

Quarterly

This maintenance task applies to all swinging fire doors located in stairwells and exit ways.

Special Instructions:

- ☐ Review manufacturer's operation, maintenance manual and safety instructions.
- ☐ The work required by this task may cause the activation of an alarm and/or supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.

Checkpoints:

- ☐ With the exception of electromagnetic hold-open devices, remove all hold-open devices such as fusible links.
- ☐ Inspect the door for damage.
- ☐ Check the hang and swing of the door for close fit. Doors must latch on a normal closing cycle and have a neat fit.
- ☐ Remove any obstructions that retard full swing or movement of the door.
- ☐ Test the operation of the panic hardware.
- ☐ Inspect door coordinates on double doors. Make sure the coordinates on double doors are securely attached and adjusted properly to allow the first leaf (inactive leaf) to close before the second leaf (active leaf). Check this by completely opening both doors and simultaneously releasing them.
- ☐ Check the operation of any special devices such as smoke detectors or electromagnetic door releases.
- ☐ Check for breaks in the face covering of the door.
- ☐ Examine tin-clad and kalamein doors for dry rot.
- ☐ Inspect all other hardware for damage or wear.
- ☐ Lubricate the hinges of the door.
- ☐ Clean up and remove all debris from the work area.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Lubricants. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

2. **Fire Doors – Sliding and Vertical Rolling**
   Quarterly
   This maintenance task applies to all sliding and vertical rolling doors located in fire walls.

   Special Instructions:
   - ☐ Review manufacturer's operation, maintenance manual and safety instructions.
   - ☐ The work required by this task may cause the activation of an alarm and/or supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.

   Checkpoints:
   - ☐ Clean the track.
   - ☐ Lubricate all pulleys, task lists, and bearings.
   - ☐ Inspect the cable or chain for proper threading through the pulley.
   - ☐ Inspect the cable or chain for damage or wear. Replace damaged or stretched cables or chains and adjust them to the proper length.
   - ☐ Replace fusible links and other heat actuated devices that have been painted. Check the operation of heat actuated devices other than fusible links.
   - ☐ Check the counterweight for proper suspension.
   - ☐ Operate the door by disconnecting or lifting the counter-weight, or other appropriate means.
   - ☐ Check for proper fit in the binders and a tight fit of the wedge against the stay roll.
   - ☐ Check for breaks in the face covering of the door.
   - ☐ Examine tin-clad and kalamein doors for dry rot.
   - ☐ For vertical rolling-type doors:
     - ☐ Check the vertical task lists for dents, damage, and obstructions.
     - ☐ Check for paint or other deposits in the space between the slats.
   - ☐ Inspect all other hardware for damage or wear.
   - ☐ Clean up and remove all debris from the work area.

   Recommended Tools, Materials, and Equipment:
   - ☐ Standard Tools – Basic
   - ☐ Lubricants. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

B. Floors

1. **Hard Surface Floors; VCT, Terrazzo, Polished Concrete, Sheet Rubber.**
   Semi-annual, annual
   This maintenance task applies to all hard surfaces in stairs and stairwells, classrooms, and hallways.

   Special instructions

   - ☐ Consult the side asbestos management plan to identify if flooring materials have the potential to contain asbestos. Follow asbestos procedures if needed.

   Checkpoints

   - ☐ Inspect flooring areas for damage or deterioration
   - ☐ Inspect stair treads and stairwells for loose or missing treads, bullnoses, or non-slip coating
   - ☐ Inspect doorways and transition strips for loose material
   - ☐ Inspect flooring protective finish (if used)

2. **Carpets Flooring**
   Quarterly, Semi-annual

   Checkpoints

   - ☐ Inspect carpeted areas for rips, tears, ripples, or runs that could be a potential trip hazard Create work orders for areas requiring repairs
   - ☐ Inspect carpeted areas for stains and address as required

C. Interior Cleanliness & Appearance (including of Equipment Rooms)

1. **Storage Closets**
   Semi annual
   Storage spaces should be inspected on a regular basis for organization, cleanliness, identification and remediation of hazards.

   Checkpoints:

   - ☐ Ensure flammable materials are properly stored following manufacturers and SDS recommendations.
   - ☐ Storage should be organized in such a way that access is provided to the entire storage area.

- ☐ Inspect storage areas for indications of rodents and report as needed to the pest management coordinator.
- ☐ Storage directly under sprinkler head locations should have a minimal clearance of 18 inches.
- ☐ Inspect area for general cleanliness and clean as required.

2. Classrooms / Hallways / Common Areas / Bathrooms

Daily

- ☐ Clean and disinfect high touch surfaces including but not limited to:
  - ☐ Door handles
  - ☐ Sinks
  - ☐ Desks
  - ☐ Light switches
  - ☐ Plumbing fixtures
- ☐ Empty trash receptacles
- ☐ Sweep floors
- ☐ Spot mop flooring as needed
- ☐ Inspect area for any damaged equipment or safety concerns
- ☐ Mop and disinfect bathroom floors

Weekly

- ☐ Wipe down and thoroughly clean all high touch surfaces including but not limited to:
  - ☐ Doors handles, frames, and vertical surfaces
  - ☐ Sinks, counter tops, and cabinets
  - ☐ Desks and chairs
  - ☐ Common classroom equipment
- ☐ Sweep and mop floors
- ☐ High dust and low dust horizontal and vertical surfaces

3. Mechanical rooms

Weekly / Monthly

- ☐ Inspect mechanical room areas for proper storage.
- ☐ Remove any improperly stored equipment or material.
- ☐ Clean any water or debris on floors.
- ☐ Inspect ceilings and lighting.

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- ☐ Inspect equipment for leaks or signs of deterioration.

D. Ceilings

Weekly / Monthly

- ☐ Inspect ceilings for indications of deterioration.
- ☐ Document signs of deterioration by creating a work order for replacement.
- ☐ Investigate root cause of any staining of ceiling tiles.
- ☐ Create a work order for correction of root causes of stained ceiling tiles.

E. Interior Lighting

Weekly

- ☐ Inspect lightning systems for lights that are not functioning properly.
- ☐ Investigate causes of lighting systems not working properly.
- ☐ Create a work order for lighting that is not working properly. Include in the work order:
  - ☐ Steps taken to troubleshoot the light
  - ☐ Location
- ☐ Properly dispose of used light tubes.

IV. Building Equipment and Systems

A. HVAC: Forced-air Heating, Ventilation, & Air Conditioning (including Filters)

I. Air Conditioning/Heating Units

1. **Air Conditioning Unit, Ceiling/Wall Mounted**

   Annual

   This maintenance task applies to ceiling or wall mounted air conditioning units, i.e., mini-mates. The unit may be for comfort or special purpose cooling and can be either air cooled or water cooled. Humidifiers will be operated on those units serving computer space and will be inventoried and serviced under This maintenance task list.

   Special Instructions:

   - ☐ Schedule this maintenance task list with operating personnel.
   - ☐ Schedule preventive maintenance on associated equipment in conjunction with This maintenance task, i.e., air cooled condensers, glycol dry coolers, cooling tower, etc.
   - ☐ Review manufacturer's instructions and Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock-out, and tag electric circuits.

- [ ] Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.
- [ ] No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
- [ ] Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
- [ ] Recover, recycle, or reclaim the refrigerant as appropriate.
- [ ] If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal of the equipment.
- [ ] If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- [ ] Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.
- [ ] Closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.

Checkpoints:

- [ ] Thoroughly inspect and clean the interior and exterior of the machine with vacuum (remove panels).
- [ ] Clean drain pan and note excessive corrosion. Correct as necessary.
- [ ] Check for refrigerant leaks using a halogen leak detector, soap bubbles, or similar testing. Consult the Material Safety Data Sheets (MSDS) for disposal requirements.
- [ ] Check refrigerant levels and recharge if necessary.
- [ ] Check the condition of cooling and reheat coils. Use fin comb as needed.
- [ ] Clean coils using detergent solution and warm water if the coil is heavily soiled.
- [ ] Drain and clean humidifier pan or pad, whichever applies. Replace pad if required. Remove corrosion, prime, and paint as needed.
- [ ] Lubricate motor and fan bearings, if not sealed. Check alignment of motor and fan. Clean all fans or blowers.
- [ ] Check belt tension and condition. Adjust or replace as required if belt driven.
- [ ] On direct drive units, check set screws on the fan shaft to make sure they are tight.
- [ ] Replace filters as needed.
- [ ] Check compressor oil level (not on hermetically sealed units) if the compressor is equipped with a sight glass.
- [ ] Run machine. Check action of controls, relays, switches, including fused disconnect type, etc., to see that:
    - [ ] Compressor(s) run at proper setting.
    - [ ] Reheat coils activate properly (if applicable).

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- ☐ Humidistat activates humidifiers (if applicable).
- ☐ Suction and discharge pressures are proper.
- ☐ Discharge temperature is set properly.

☐ Clean up work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning tools and materials
- ☐ Vacuum
- ☐ Fin comb
- ☐ Grease gun and oiler
- ☐ Ladder constructed according to OSHA/ANSI standards – ceiling mounted units. Check ladder for defects. Do not use defective ladders.
- ☐ Self sealing quick disconnect refrigerant hose fittings
  Refrigerant recovery/recycle unit
- ☐ EPA/DOT approved refrigerant storage tanks
- ☐ Safety goggles
- ☐ Gloves
- ☐ Approved refrigerant
- ☐ Electronic leak detector

2. **Air Conditioning Unit, Ceiling/Wall Mounted**
   Monthly - Special Use
   This maintenance task applies to ceiling or wall mounted air conditioning units, i.e., mini-mates. The unit may be for comfort or special purpose cooling and can be either air cooled or water cooled. Humidifiers will be operated on those units serving computer space and will be inventoried and serviced under This maintenance task card.

   Special Instructions:

   - ☐ Schedule outage with operating personnel.
   - ☐ Schedule preventive maintenance on associated equipment in conjunction with This maintenance task, i.e., air cooled condensers, glycol dry coolers, cooling tower, etc.
   - ☐ Review manufacturer's instructions and Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock-out, and tag electric circuits.
   - ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.

- [ ] No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
- [ ] Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
- [ ] Recover, recycle, or reclaim the refrigerant as appropriate.
- [ ] If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal of the equipment.
- [ ] If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- [ ] Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.
- [ ] Closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.

Checkpoints:

- [ ] Thoroughly inspect and clean the interior and exterior of the machine with vacuum (remove panels).
- [ ] Clean drain pan and note excessive corrosion. Correct as necessary.
- [ ] Check for refrigerant leaks using a halogen leak detector, soap bubbles, or similar testing. Consult the Material Safety Data Sheets (MSDS) for disposal requirements.
- [ ] Check refrigerant levels and recharge if necessary.
- [ ] Check condition of cooling and reheat coils. Use fin comb as needed.
- [ ] Clean coils using detergent solution and warm water if the coil is heavily soiled.
- [ ] Drain and clean humidifier pan or pad; as applicable. Replace pad if required. Remove corrosion, prime, and paint as needed.
- [ ] Lubricate motor and fan bearings, if not sealed. Check alignment of motor and fan. Clean all fans or blowers.
- [ ] Check belt tension and condition. Adjust or replace as required if belt driven.
- [ ] On direct drive units, check set screws on fan shaft to make sure they are tight.
- [ ] Replace filters as needed.
- [ ] Check compressor oil level (not on hermetically sealed units) if compressor is equipped with a sight glass.
- [ ] Run machine. Check action of controls, relays, switches, including fused disconnect type, etc., to see that:
    - [ ] Compressor(s) run at proper setting.
    - [ ] Reheat coils activate properly (if applicable).
    - [ ] Humidistat activates humidifiers (if applicable).
    - [ ] Suction and discharge pressures are proper.

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- ☐ Discharge temperature is set properly.
- ☐ Clean up work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning tools and materials
- ☐ Vacuum
- ☐ Fin comb
- ☐ Grease gun and oiler
- ☐ Ladder constructed according to OSHA/ANSI standards – ceiling mounted units. Check ladder for defects. Do not use defective ladders.
- ☐ Self sealing quick disconnect refrigerant hose fittings
- ☐ Refrigerant recovery/recycle unit
- ☐ EPA/DOT approved refrigerant storage tanks
- ☐ Safety goggles
- ☐ Gloves
- ☐ Approved refrigerant
- ☐ Electronic leak detector

3. **Air Conditioning Unit; Split System**
   Annual
   This maintenance task applies to those packaged type air conditioning machines that are equipped with chilled water coils or direct expansion coils on split systems.

4. Special Instructions:
   - ☐ Review manufacturer's instructions.
   - ☐ A/C machine maintenance should be scheduled to coincide with condensing unit or package chiller maintenance as noted above.
   - ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.
   - ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
   - ☐ Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
   - ☐ Recover, recycle, or reclaim the refrigerant as appropriate.
   - ☐ If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal.

- [ ] If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- [ ] Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.
- [ ] Closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.

Checkpoints:

- [ ] Thoroughly inspect and clean the interior and exterior of the machine with vacuum (remove panels).
- [ ] Clean drain pan and note excessive corrosion. Treat rusted areas with rust inhibitor. Ensure that the rust inhibitor chemical does not add volatile organic compounds or contaminants to the drain pan. If possible, rinse well after application or choose a less hazardous material. Consult the chemicals Material Safety Data Sheets for this information.
- [ ] Perform checks according to the type of unit.
    - [ ] Chilled water units:
        - [ ] Check for chilled water leaks on all lines, valves, strainers, coils, etc.
        - [ ] Clean strainer on chilled water unit.
    - [ ] Direct expansion units: Check for refrigeration leaks on all lines, valves, fittings, coils, etc., using a halogen leak detector or similar testing device.
- [ ] Check the condition of cooling and reheat coils. Use fin comb if needed to straighten fins.
- [ ] Clean coils. Use detergent solution and warm water if coil is heavily soiled.
- [ ] Drain and clean humidifier pan or pad; as applicable. Replace pad if required. Remove corrosion as needed.
- [ ] Clean and lubricate motor and squirrel cage fan(s). Check alignment of motor and fan. Check bearings for excessive wear.
- [ ] Check belt tension and condition. Adjust or replace as required.
- [ ] Replace pre-filters if needed.
- [ ] Replace final filter if needed.
- [ ] Run machine, check action of controls, relays, switches, etc., to see that:
    - [ ] Chilled water units:
        - [ ] Chilled water valve(s) are operating properly.
        - [ ] Reheat coils activate properly.
- [ ] Humidistat activates humidifiers.
- [ ] Valves regulating water pressure are proper for cooling.
- [ ] Discharge air temperature is set properly.
- [ ] Check and record chilled water inlet and outlet temperatures.

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- ☐ Direct expansion units:
  - ☐ Humidistat activates humidifiers.
  - ☐ Reheat coils activate properly.
  - ☐ Discharge air temperature is set properly.
- ☐ Check and adjust vibration eliminator mountings if equipped. Repair or replace if required.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning tools, grease gun, oil and materials. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Vacuum
- ☐ Fin comb
- ☐ Filters
- ☐ Spare V-belts
- ☐ Self-sealing quick disconnect refrigerant hose fittings, if applicable.
- ☐ Refrigerant recovery/recycling unit, if applicable.
- ☐ EPA/DOT approved refrigerant storage tanks
- ☐ Safety goggles
- ☐ Gloves
- ☐ Approved refrigerant
- ☐ Electronic leak detector

5. **Air Conditioning Unit; Split System**
   Monthly - Special Use
   This maintenance task applies to those packaged type air conditioning machines that are equipped with chilled water coils or direct expansion coils on split systems.

   Special Instructions:

   - ☐ Review manufacturer's instructions.
   - ☐ A/C machine maintenance should be scheduled to coincide with condensing unit or package chiller maintenance as noted above.
   - ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.
   - ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
   - ☐ Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.

- ☐ Recover, recycle, or reclaim the refrigerant as appropriate.
- ☐ If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal.
- ☐ If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- ☐ Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.
- ☐ Closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.

Checkpoints:

- ☐ Thoroughly inspect and clean the interior and exterior of the machine with vacuum (remove panels).
- ☐ Clean drain pan and note excessive corrosion. Treat rusted areas with rust inhibitor. Ensure that the rust inhibitor chemical does not add volatile organic compounds or contaminants to the drain pan. If possible, rinse well after application or choose a less hazardous material. Consult the chemicals Material Safety Data Sheet (MSDS) for this information.
- ☐ Perform checks according to the type of unit.
    - ☐ Chilled water units:
        - ☐ Check for chilled water leaks on all lines, valves, strainers, coils, etc.
        - ☐ Clean strainer on chilled water unit.
    - ☐ Direct expansion units: Check for refrigeration leaks on all lines, valves, fittings, coils, etc., using a halogen leak detector or similar testing device.
- ☐ Check condition of cooling and reheat coils. Use fin comb if needed to straighten fins.
- ☐ Clean coils. Use detergent solution and warm water if coil is heavily soiled.
- ☐ Drain and clean humidifier pan or pad, whichever applies. Replace pad if required. Remove corrosion as needed.
- ☐ Clean and lubricate motor and squirrel cage fan(s). Check alignment of motor and fan. Check bearings for excessive wear.
- ☐ Check belt tension and condition. Adjust or replace as required.
- ☐ Replace pre-filters if needed.
- ☐ Replace final filter if needed.
- ☐ Run machine, check action of controls, relays, switches, etc., to see that:
    - ☐ Chilled water units:
        - ☐ Chilled water valve(s) are operating properly.
        - ☐ Reheat coils activate properly.
        - ☐ Humidistat activates humidifiers.

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- ☐ Valves regulating water pressure are proper on cooling.
- ☐ Discharge air temperature is set properly.
- ☐ Check and record chilled water inlet and outlet temperatures.

☐ Direct expansion units:

- ☐ Humidistat activates humidifiers.
- ☐ Reheat coils activate properly.
- ☐ Discharge air temperature is set properly.

☐ Check and adjust vibration eliminator mountings if equipped. Repair or replace if required.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning tools, grease gun, oil and materials. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Vacuum
- ☐ Fin comb
- ☐ Filters
- ☐ Spare V-belts
- ☐ Self-sealing quick disconnect refrigerant hose fittings, if applicable.
- ☐ Refrigerant recovery/recycling unit, if applicable.
- ☐ EPA/DOT approved refrigerant storage tanks
  Safety goggles
- ☐ Gloves
- ☐ Approved refrigerant
- ☐ Electronic leak detector

6. **Air Handler Unit**
   Annual

Special Instructions:

- ☐ Schedule maintenance with operating personnel, as needed.
- ☐ Review manufacturer's instructions.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, lock out and tag electrical circuit(s).
- ☐ Schedule PM on motor in conjunction with this task.

Additional Special Instructions: Include the following additional special instructions in cases where the air handler is equipped with a direct expansion cooling coil:

- [ ] Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency regulations as they apply to protection of stratospheric ozone.
- [ ] No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
- [ ] Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
- [ ] Recover, recycle, or reclaim the refrigerant as appropriate.
- [ ] If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal of the equipment.
- [ ] If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- [ ] Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.
- [ ] Closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.

Checkpoints:

- [ ] Check fan blades for dust buildup and clean if necessary.
- [ ] Check fan blades and moving parts for cracks and excessive wear.
- [ ] Check fan RPM against design specifications.
- [ ] Check bearing collar set screws on fan shaft to make sure they are tight.
- [ ] Check dampers for dirt accumulations, clean as necessary. Check felt, repair or replace as necessary.
- [ ] Check damper actuators and linkage for proper operation. Adjust linkage on dampers if out of alignment.
- [ ] Lubricate mechanical connections of dampers sparingly.
- [ ] Clean coils by brushing, blowing, vacuuming, or pressure washing.
- [ ] Check coils for leaking, tightness of fittings. On direct expansion units, check for refrigerant leaks on all lines, valves, fittings, coils, etc., using a halogen leak detector or similar testing device.
- [ ] Use fin comb to straighten coil fins.
- [ ] Flush and clean condensate pans and drains, remove all rust, prepare metal, and paint. Consult the Material Safety Data Sheets to ensure that the paint lead level is 0.06% or less. Hose down coils and drain pans and wash with an appropriate EPA approved solution. Treat condensate pans with an EPA approved biocide.
- [ ] Check belts for wear and cracks, adjust tension or alignment, and replace belts when necessary. Multi-belt drives shall only be replaced with matched sets.

- ☐ Check rigid couplings for alignment on direct drives, and for tightness of assembly. Check flexible couplings for alignment and wear.
- ☐ Before heating season (chilled water coils only): Drain cooling coils; blow down to remove moisture; refill with antifreeze and water solution; drain.
- ☐ Check freezestat for proper temperature setting and operation.
- ☐ Vacuum interior of unit.
- ☐ Lubricate fan shaft bearings while the unit is running. Add grease slowly until slight bleeding is noted from the seals. Do not over lubricate. Remove old or excess lubricant.
- ☐ Clean up work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Tachometer
- ☐ Grease gun and oiler
- ☐ Pressure washer
- ☐ Vacuum
- ☐ Fin comb
- ☐ Cleaning tools and materials. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Safety goggles
- ☐ Gloves

7. **Air-Conditioning Unit Package Unit (Comfort Cooling)**
   Annual
   This maintenance task applies to units that may have the evaporator, compressor, fan unit components, and condenser within a single housing or may have the condenser separate from the housing.
   Special Instructions:
   - ☐ Review manufacturer's instructions.
   - ☐ De-energize, lockout, and tag the electrical circuits.
   - ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.
   - ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
   - ☐ Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
   - ☐ Recover, recycle, or reclaim the refrigerant as appropriate.

- [ ] If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal of the appliance.
- [ ] If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- [ ] Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.
- [ ] Closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.

Checkpoints:

- [ ] Thoroughly inspect and clean interior and exterior of machine with vacuum cleaner, (remove panels).
- [ ] Clean drain pan and note excessive corrosion, prepare metal and paint as necessary. Consult the Material Safety Data Sheet (MSDS) to ensure that the paint lead level is 0.06% or less.
- [ ] Check for refrigerant leaks using a halogen detector or similar testing device. Repair all leaks before recharging unit.
- [ ] Check refrigerant levels for proper charge and recharge as needed.
- [ ] Check condition of cooling and reheat coils. Use fin comb if needed to straighten fins.
- [ ] Clean coils, use coil cleaner detergent solution and high pressure water.
- [ ] Check belts for wear, adjust tension or alignment, and replace when necessary.
- [ ] Drain and clean humidifier drip pan, if applicable. Remove corrosion; prime, and paint as needed.
- [ ] Lubricate motor and fan bearings, if not sealed. Check alignment of motor and fan.
- [ ] Replace prefilters if needed.
- [ ] Replace final filters if needed.
- [ ] Check compressor oil level, if compressor has an oil sight glass.
- [ ] Run machine, check action of controls, relays, switches, etc., to see that:
    - [ ] Compressor(s) run at proper settings.
    - [ ] Reheat coils activate properly.
    - [ ] Humidistat activates humidifiers.
    - [ ] Suction and discharge pressures are proper.
    - [ ] Discharge air pressure is set properly.
- [ ] Check and tighten any loose unit electrical terminals, disconnect switches, or connectors.
- [ ] Check and adjust vibration eliminators. Replace if required.
- [ ] Remove all trash or debris from work area. Consult the MSDS for proper personal protective equipment (PPE).

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning tools and materials, vacuum wet/dry, fin comb, grease gun and oil, filters and pre filters, spare belts.
- ☐ Approved refrigerant
  Paint and brushes as required. Consult the MSDS to ensure that the paint lead level is 0.06% or less.
- ☐ Self sealing quick disconnect refrigerant hose fittings
- ☐ Refrigerant recovery/recycle unit
- ☐ EPA/DOT approved refrigerant storage tanks
- ☐ Safety goggles
- ☐ Gloves
- ☐ Electronic leak detector

8. **Air-Conditioning Unit, Package Unit (Special Purpose)**
   Monthly
   This equipment is typically found in computer rooms, CAD rooms, laboratories, etc. It is identical in design and configuration to the A-6 unit for comfort cooling. One difference is that it may use a glycol dry cooler during favorable outside air conditions.

   Special Instructions:

   - ☐ Review manufacturer's instructions and Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock out, and tag electrical circuits.
   - ☐ Perform any required drycooler or air cooled condenser maintenance simultaneously with this PM.
   - ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.
   - ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
   - ☐ Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
   - ☐ Recover, recycle, or reclaim the refrigerant as appropriate.
   - ☐ If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal of the equipment.
   - ☐ If materials containing refrigerants are discarded, comply with EPA regulations as applicable.

- ☐ Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.
- ☐ Closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.

Checkpoints:

- ☐ Thoroughly inspect and clean the interior and exterior of the machine with wet/ dry vacuum, (remove panels).
- ☐ Clean drain pan and note excessive corrosion, prepare and paint necessary. Consult the Material Safety Data Sheet (MSDS) to ensure that the paint lead level is 0.06% or less.
- ☐ Check for refrigerant leaks using a halogen detector or similar testing device.
- ☐ Check refrigerant levels and recharge if needed. Consult the MSDS for disposal requirements.
- ☐ Check condition of cooling and reheat coils. Use fin comb if needed to straighten fins.
- ☐ A dirty coil surface can be cleaned using a coil cleaner solution and warm water.
- ☐ Drain and clean humidifier drip pan, replace pan if applicable. Remove scale and paint if necessary.
- ☐ Lubricate motor and fan bearings, if not sealed. Check alignment of motor and fan. Clean fan or blower.
- ☐ Check belt tension and condition. Adjust or replace as required.
- ☐ Replace prefilters if needed.
- ☐ Replace final filters if needed.
- ☐ Check compressor oil level if compressor has a sight glass.
- ☐ Run machine, check action of controls, relays, switches, etc. to see that:
    - ☐ Compressor(s) run at proper settings.
    - ☐ Reheat coils activate properly.
    - ☐ Humidistat activates humidifiers.
    - ☐ Suction and discharge pressures are proper.
    - ☐ Discharge air temperature is set properly.
- ☐ Check and adjust vibration eliminators. Replace if required.
- ☐ Check and tighten all electrical terminals, connections, and disconnect switches.
- ☐ Remove all trash or debris from work area. Consult the MSDS for proper personal protective equipment (PPE).

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.

- ☐ Cleaning tools and materials, vacuum, fin comb, grease gun and oil, filters and pre filters, spare belts.
- ☐ Clamp meter (volt-ohm-amp meter)
- ☐ Paint and brushes as required. Consult the MSDS to ensure that the paint lead level is 0.06% or less.
- ☐ Self sealing quick disconnect refrigerant hose fittings
- ☐ Refrigerant recovery/recycle unit
- ☐ EPA/DOT approved refrigerant storage tanks
- ☐ Safety goggles
- ☐ Gloves
- ☐ Electronic leak detector

9. **Air-Conditioning, Window Unit**
   Annual

   Special Instructions:

   - ☐ Disconnect electric cord to unit.
   - ☐ Review manufacturer's instructions.
   - ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.
   - ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
   - ☐ Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
   - ☐ Recover, recycle, or reclaim the refrigerant as appropriate.
   - ☐ If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal of the equipment.
   - ☐ If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
   - ☐ Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.
   - ☐ Closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.

   Checkpoints:

- ☐ Clean condenser, cooling coil fins, drain pan, and fans. Slime or mold found on the cooling coil or drain pan should be cleaned with an appropriate EPA approved solution. Place an EPA approved biocide tablet in the drain pan.
- ☐ Inspect fins. Straight with a fin comb as required.
- ☐ Remove dirt, or rust from all interior parts, repaint as necessary.
- ☐ Replace or clean filter.
- ☐ Inspect and adjust fresh air damper.
- ☐ Lubricate motor and fan bearings.
- ☐ Inspect gaskets. Look for leaks between unit and window, caulk as necessary.
- ☐ Check for refrigerant leaks with halogen leak detector and soap bubbles. Consult the Material Safety Data Sheets (MSDS) for disposal requirements.
- ☐ Start unit and observe operation.
- ☐ Check the temperature differential between air entering evaporator and leaving the evaporator.
- ☐ Check frame of unit with ohmmeter for proper electric ground.
- ☐ Replace covers, clean filter and front filter grill.
- ☐ Clean up the work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning tools and materials. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Lubricants. Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Vacuum cleaner wet/dry type
- ☐ Fin comb
- ☐ Filters
- ☐ Self sealing quick disconnect refrigerant hose fittings
- ☐ Refrigerant recovery/recycle unit
- ☐ EPA/DOT approved refrigerant storage tanks
- ☐ Safety goggles
- ☐ Gloves
- ☐ Approved refrigerant
- ☐ Electronic leak detector

10. **Automatic Mixing Box Pneumatic or Electric**
Annual

Special Instructions:

- ☐ Review manufacturer's specifications.

Checkpoints:

- ☐ Check to see that the operating control thermostat activates the damper per design specifications. If not, recalibrate. Replace if it is defective with the same type action (direct or reverse action) and temperature range.
- ☐ Check damper linkage for tightness or damage. Lightly oil all moving parts.
- ☐ Inspect dampers for free movement in mixing box. Replace felt or other type seals as required.
- ☐ Inspect mixing box and hot and cold connecting ducts for air leaks. Correct leaks with duct tape or tighten connections, as required.
- ☐ Inspect damper actuators for tightness to mounting brackets.
- ☐ Tighten electrical connections to servo-motors, and test if applicable.
- ☐ If pneumatic actuator does not stroke properly, correct sticking valve stem or binding linkage. Replace diaphragm or actuator if necessary.
- ☐ Inspect for air leaks around actuator and in air line between controller and actuator.
- ☐ Inspect thermostat for proper location and check main and branch air lines at thermostat for crimps, breaks, etc. Repair if needed.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Control drawings
- ☐ Calibration tools
- ☐ Lubricants. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Duct tape
- ☐ Cleaning materials and equipment. Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Safety goggles

11. **Central Mini-Computer, HVAC Systems**
Quarterly

Special Instructions:

- ☐ Schedule maintenance with operating personnel.
- ☐ Obtain and review manufacturer's information for servicing, testing and operating.

- [ ] Obtain "AS BUILT" diagrams of installation.

Checkpoints:

- [ ] Clean, calibrate and adjust all central (main-frame), remote (peripheral) and interface systems.
- [ ] Test and analyze results for systems operational integrity.
- [ ] Test all power supplies and battery charging networks.
- [ ] Test all software and firmware programs for applied results.
- [ ] Prepare a written service report as to test results and service performed and file with the facility maintenance manager.

Recommended Tools, Materials, and Equipment:

- [ ] Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- [ ] Manufacturer's testing instruments
- [ ] Cleaning tools and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- [ ] Lubricants. Consult the MSDS for hazardous ingredients and proper PPE.

12. **Controls, Central System HVAC**
Annual

Special Instructions:

- [ ] Read and understand manufacturer's instructions before making adjustments or calibration.
- [ ] Obtain control system diagrams.
- [ ] Before calibrating or adjusting pneumatic controls, adjust the pressure of the main control air supplying pneumatic sensors, thermostats, and controllers to manufacturer's specifications.
- [ ] Servicing of pneumatic air compressors and control air reducing stations shall be performed at the same time to prevent duplication of some service checkpoints.

Checkpoints:

- [ ] Check set point of controls (temperature, humidity, or pressure).
- [ ] Compare control points with an external measuring device, note deviations, and adjust.
- [ ] Check the unit over its range of control. If possible, impose simulated conditions to activate controls and check operation.
- [ ] Check for control point cycling.

- ☐ Check for correct pressure differential on all two position controllers (on-off-open-closed).
- ☐ Check condition and action of primary elements in the controllers (bi-metallic strips, and or sealed bellows with capillary tubing for remote sensing.
- ☐ Note the action of the controlling device (thermostats, humidistats, and pressurestats) which changes the action of the controlled device (motors, valves, dampers, etc).
- ☐ On electronic controls check the source of the signal and its amplification.
- ☐ Check air systems for leaks, check for correct main control air pressure to control devices. Check units for proper closing and loose connections.
- ☐ Check the condition and the ability of humidity sensing control elements (hair, wood, leather, or similar substances) to read the moisture changes and their action on the control mechanism.
- ☐ Check resulting action of the pressure sensing primary control elements such as diaphragms, bellows, inverted bells, and similar devices when activated by air, water, or similar pressure. Check operation of all relays, pilot valves, and pressure regulators.
- ☐ Replace air filters in sensors, controllers, and thermostats as required.
- ☐ Use test kits and manufacturer's instructions whenever possible. Replace rather than rebuild a control installed in the system. Take control to shop for repair.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Pressure gauge, psychrometer
- ☐ Volt Ohm Meter
- ☐ Air filter replacements
- ☐ Control spares as needed

13. **Fan Coil Unit, Ceiling Hung**

Annual

This maintenance task applies to those ceiling hung units that provide heating and/or cooling and have functions similar to the I-2 fan coil units. They may be equipped with either a hot and/or cold water coil or a direct expansion (refrigerant) coil. Those ceiling hung fan coil units with direct expansion coils will have a refrigeration condensing unit (C-24) associated with them and maintenance on this equipment should be accomplished in conjunction with this activity. Ladders, scaffolds, and/or lifts may be required to service this type unit.

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ Review Procedure for use of respiratory protection.

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- [ ] Task Frequency shutdown with operating personnel.
- [ ] Open, lock, and tag electrical circuits.
- [ ] If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.

Checkpoints:

- [ ] Check unit for noise and vibration.
- [ ] Check V-belt condition and tension. Adjust or replace as necessary.
- [ ] Clean and wash permanent filters. Recharge wire mesh filters with oil. Replace disposable filters.
- [ ] Drain and clean condensate pan.
- [ ] Lubricate fan shaft bearings (if not sealed).
- [ ] Lubricate motor bearings sparingly, using SAE 10W motor oil (if not sealed).
- [ ] Clean coils by vacuuming or brushing.
- [ ] Use fin comb to straighten coil fins.
- [ ] Check for leaks on all lines, valves, strainers, coils, etc. Report leaks to supervisor.
- [ ] Clean strainers for accumulations of dirt.
- [ ] Check controls, trap, freezestat, and control-stat for proper operation.
- [ ] Clean fan blades and interior surfaces of unit to remove soil.
- [ ] Damp-wipe exterior surfaces.
- [ ] Clean up work area.

Recommended Tools, Materials, and Equipment:

- [ ] Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- [ ] Cleaning materials and equipment. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- [ ] Fin comb
- [ ] Oilers
- [ ] Filters
- [ ] Belts
- [ ] Vacuum
- [ ] Respirator
- [ ] Goggles

- [ ] Ladder constructed according to OSHA/ANSI standards, scaffold, or lift (as required). Check ladder for defects. Do not use defective ladders.

14. **Fan Coil Unit, Ceiling Hung, VAV Box with Electric Reheat**
Annual
This maintenance task applies to those ceiling hung units that provide heating and/or cooling.

Special Instructions:

- [ ] Review manufacturer's instructions.
- [ ] Review Procedure for "Controlling Hazardous Energy Sources."
- [ ] Review Procedure for respiratory protection.
- [ ] Schedule Frequency shutdowns with operating personnel.
- [ ] De-energize, lock, and tag circuits.

Checkpoints:

- [ ] Check to see that operating control stat activates damper per design specifications. Replace if malfunctioning.
- [ ] Check damper linkage for tightness or damage. Lightly oil all moving parts.
- [ ] Inspect dampers for free movement in duct or mixing box. Replace felt or other type seals as required.
- [ ] Inspect mixing box and connecting ducts for air leaks. Correct leaks with duct tape or tighten connections as required.
- [ ] Inspect damper activators for tightness to mounting brackets.
- [ ] Tighten electrical connections to servo motors. Clean vent ports.
- [ ] If pneumatic actuator does not stroke properly, correct sticking valve stem or binding linkage. Replace diaphragm if necessary.
- [ ] Inspect for air leaks around actuator and in air line between controller and actuator.
- [ ] Check unit for noise and vibration.
- [ ] Check V-belt condition and tension. Adjust or replace as necessary.
- [ ] Clean and wash permanent filters. Recharge wire mesh filters with oil.
- [ ] Replace disposable filters.
- [ ] Lubricate fan shaft bearings if not sealed.
- [ ] Lubricate motor bearings sparingly, using SAE 10w motor oil if not sealed.
- [ ] Clean coils by vacuuming or brushing.
- [ ] Clean fan blades and interior surfaces of unit to remove soil.
- [ ] Damp-wipe exterior surfaces.
- [ ] Clean up work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning materials and equipment. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Fin comb
- ☐ Oilers
- ☐ Filters
- ☐ Belts
- ☐ Vacuum
- ☐ Respirator and goggles
- ☐ Ladder constructed according to OSHA/ANSI standards, scaffold, or lift as required. Check ladder for defects. Do not use defective ladders.

15. **Fan Coil Units, Under Window Type**
Quarterly

Special Instructions:

- ☐ Review Procedure for respiratory protection.
- ☐ If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.

Checkpoints:

- ☐ Check unit for noise and vibration.
- ☐ Check V-belt condition and tension. Adjust if needed, or replace.
- ☐ Clean and wash permanent filters. Recharge wire mesh filters with oil.
- ☐ Replace disposal filters.
- ☐ Drain and clean condensate pan.
- ☐ Lubricate fan shaft bearings (if not sealed).
- ☐ Lubricate motor bearings sparingly using SAE 10W motor oil (if not sealed).
- ☐ Clean coils by vacuuming or brushing.
- ☐ Use fin comb to straighten coil fins.
- ☐ Clean strainers for accumulation of dirt.
- ☐ Check controls, trap, freeze-stat, and control-stat for proper operation.
- ☐ Clean fan blades and interior unit surfaces to remove soil.
- ☐ Damp wipe exterior surfaces.

- [ ] Clean surrounding floor area, and remove any dirt and debris from work area.

Recommended Tools, Materials, and Equipment:

- [ ] Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- [ ] Cleaning materials and equipment. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- [ ] Fin comb
- [ ] Oiler
- [ ] Filters
- [ ] Belts
- [ ] Vacuum
- [ ] Respirator
- [ ] Goggles

16. **Heat Pumps**
Annual

Special Instructions:

- [ ] Review manufacturer's instructions and Procedure for "Controlling Hazardous Energy Sources."
- [ ] De-energize, lockout, and tag electrical circuits.
- [ ] Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.
- [ ] No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
- [ ] Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
- [ ] Recover, recycle, or reclaim the refrigerant as appropriate.
- [ ] If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal of the equipment.
- [ ] If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- [ ] Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.
- [ ] Closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.

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Checkpoints:

- [ ] Inspect piping for evidence of leaks and vibration.
- [ ] Inspect all wiring for deterioration, and tighten electrical contacts. Check for corrosion, clean, prime, and paint as necessary.
- [ ] Check mounting bolts and tighten if needed.
- [ ] Check crankcase heater.
- [ ] Check fan for vibration or excessive noise. Lubricate fan and motor if required.
- [ ] Check refrigerant levels, recharge if necessary. Check for leaks if loss of refrigerant is detected, using halide leak detector and soap bubbles. Consult the Material Safety Data Sheets (MSDS) for disposal requirements.
- [ ] Check temperature drop across condensing coil.
- [ ] Clean air intake and screens; change filters as necessary.
- [ ] Brush or pressure wash coil surfaces. Straighten fins with fin comb.
- [ ] Check that the reversing valve is energized in the "heat" mode and de-energized in the "cool" mode.Replace defective valves.
- [ ] Check all electrical connections and fused disconnect switches.
- [ ] Check all controls, indoor and outdoor thermostats, timers, and control delays, especially for units with electric supplemental heaters. Repair or replace as necessary.
- [ ] Check oil if compressor is equipped with a sight glass.
- [ ] Clean up work area.

Recommended Tools, Materials, and Equipment:

- [ ] Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- [ ] Lubricants. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).
- [ ] Cleaning materials. Consult the MSDS for hazardous ingredients and proper PPE.
- [ ] Fin comb
- [ ] Vacuum or pressure washer.
- [ ] Self sealing quick disconnect refrigerant hose fittings
- [ ] Refrigerant recovery/recycle unit
- [ ] EPA/DOT approved refrigerant storage tanks.
- [ ] Safety goggles.
- [ ] Gloves.
- [ ] Approved refrigerant.
- [ ] Electronic leak detector.

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17. **High Efficiency Purge Units**
Annual

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, lock out, and tag electrical circuits.
- ☐ The replacement filter-drier cores absorb water vapor from ambient air, so they are shipped in sealed containers. Do not open them until the cores can be installed and sealed in the purge tank.
- ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.
- ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
- ☐ Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
- ☐ Recover, recycle, or reclaim the refrigerant as appropriate.
- ☐ If an appliance is disposed of, follow regulations concerning removal of refrigerants and disposal of the appliance.
- ☐ If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- ☐ Refrigerant oils removed for disposal must be analyzed for hazardous waste and handled accordingly.
- ☐ Closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and to all labels on refrigerant containers.

Checkpoints:

- ☐ Check out and Water Removal
  - ☐ Perform the purge system control check as described in the controls section of the manufacturer's instructions.
  - ☐ Purge tank service.
- ☐ Isolate the purge tank by closing the valves on the purge tank inlet and liquid return lines.
- ☐ With the purge condensing unit turned off, pressurize the purge tank through the purge tank drain valve to manufacturer's specifications and test the solenoid valves to ensure they seal properly.
- ☐ Check the purge tank sight glass to determine if there is water in the purge tank. If the refrigerant level is visible in the sight glass but there is no water in the tank, then perform the following:

- [ ] Connect a refrigerant hose from the purge tank Schrader valve to an access valve on the evaporator.
- [ ] Open the vapor line and disconnect the refrigerant hose.
- [ ] Proceed with the service procedure.
- [ ] If, on the other hand, there is a layer of water on the refrigerant in the purge tank sight glass, then perform the following.
    - [ ] Connect a refrigerant hose from the purge tank Schrader valve to an approved containment vessel.
    - [ ] Disconnect the line at the pump-out compressor.
    - [ ] Hold the service switch in the ON position. This will energize the solenoids and allow the purge tank to fill with air. The liquid refrigerant will drain into the container.
    - [ ] Pour or siphon the water from the top of the refrigerant in the container. Seal the refrigerant in the container for later use or other disposition.

- [ ] Filter-drier service.
    - [ ] Empty the purge tank and relieve the test pressure. Lift the purge tank body from the base plate by removing the mounting bolts that secure it.
    - [ ] Remove the cap from the top of the upper filter-drier core. Then remove the two filter-drier cores from inside the purge tank.
    - [ ] Visually inspect the core and all internal parts. Clean where necessary.
    - [ ] Inspect the tank drain valve and line to ensure it is free of any debris.
    - [ ] Replace the tank gasket.
    - [ ] Install new filter-drier cores and gaskets as necessary.
    - [ ] Put the tank back in place using a new gasket and replace the mounting bolts that secure it to the base plate. Torque the bolts manufacturer's specifications.
    - [ ] Reconnect the pump-out line and solenoid valve.
    - [ ] Pressurize the purge tank to manufacturer's specifications through the isolation solenoids, with the solenoids energized. Check for leaks. Release the pressure.
    - [ ] Switch the purge system to the manual ON position and wait for the pump-out compressor to start.
    - [ ] If refrigerant needs to be returned to the system, remove the cap from the purge tank drain valve and connect a hose from the drain valve to the container. As the pump-out compressor operates, a vacuum is created in the purge tank, drawing the liquid refrigerant from the container into the purge tank. Disconnect the hose when completed and replace the valve cap.
    - [ ] Open the valves on the purge tank inlet and liquid return lines.

- ☐ Purge pump-out and fault check. This procedure tests the ability of the purge to remove non-condensable elements from the unit. This is done by isolating the purge, adding air to the purge tank, and then using the purge compressor to remove the air again.
  - ☐ Note the timer setting and reset to for the time recommended by the manufacturer.
  - ☐ Set purge control switch on purge control panel to OFF and then to MANUAL ON or depress the RESET switch for a minimum of 1/2 second. This will reset the fault timer and turn on the purge condensing unit.
  - ☐ Close the shutoff valves on the purge tank inlet and liquid return lines to isolate the purge tank.
  - ☐ Disconnect the inch line from the inlet of the pump-out compressor.
  - ☐ Press and hold service switch in the MOMENTARY ON position for approximately five seconds, energizing the pump-out solenoids and pump-out compressor. The purge will draw air into the purge tank back through the isolation solenoid valves. **Note**: Repeat this procedure until sufficient air is drawn into the purge tank to initiate a pump-out sequence. Within approximately five minutes the pump-out compressor should start and run until the fault timer setting is exceeded. The pump-out compressor then shuts down.
  - ☐ De-energize the purge by turning the purge control switch to OFF. **Note**: On retrofit (field-installed) purges, this will reset the fault circuit. On factory-mounted purges, however, press the reset switch to reset the fault circuit.
  - ☐ Reconnect the line at the inlet of the pump-out compressor.
  - ☐ Restore original fault timer setting.
  - ☐ Restart the purge by turning the purge control switch to AUTO.
  - ☐ Open the shutoff valves on the purge tank inlet and liquid return lines.

18. **Hot Air Furnace**

Annual

Hot air furnaces are used primarily to heat, but can be used with refrigerant coils to cool or as a backup for heat pump applications using multi-speed fan motors.

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ Review Procedure for respiratory Protection.
- ☐ Schedule shutdown with operating personnel.
- ☐ Coordinate other related preventive-maintenance items.
- ☐ Shut off fuel and power; tag and lock out all circuits.

Checkpoints:

- ☐ Remove furnace ends and access panels if applicable.
- ☐ Check the fire box liner or refractory for cracks and leaks.
- ☐ Check smoke stack for obstructions, leaks, etc.
- ☐ Clean bottom of smoke stack (breaching).
- ☐ Clean all fans and motors.
- ☐ Check operation of controls and safeties.
- ☐ Lubricate as required.
- ☐ Check and clean plenum (clean cooling coils and check for leaks, if equipped).
- ☐ Replace furnace and access panels ends if removed.
- ☐ Check all motors, belts, pulleys, shafts, etc. for alignment.
- ☐ Treat all rusted areas with rust inhibitor and touch up paint.
- ☐ Remove lock outs and tags. Restore fuel and power supply.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Vacuum cleaner and attachments
- ☐ Rust inhibitor, paint, brushes. Consult the Material Safety Data Sheet (MSDS) for hazardous ingredients and proper personal protective equipment (PPE). Consult the MSDS to ensure that the paint lead level is 0.06% or less.
- ☐ Cleaning and patching materials. Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Respirator, goggles and gloves
- ☐ Flue and stack cleaning brushes

19. **Humidification Systems**
Semiannual

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ Review Procedure for respiratory protection.
- ☐ Turn off water supply.
- ☐ Secure electrical service before servicing humidification system, if applicable.
- ☐ Use of work gloves may be necessary due to caustic residual mineral deposits.

Checkpoints:

- ☐ Operate humidistat through its throttling range to verify activation, or deactivation of humidifier.
- ☐ Clean and flush condensate pans, drains, water pans, etc. Remove corrosion, and repaint as needed. If a corrosion preventive chemical is used, ensure that it does not become a part of the indoor air by creating large amounts of volatile organic compounds or irritants. Check the Material Safety Data Sheet (MSDS) to see what hazardous products are present. If hazardous products are present, rinse very well before the system is returned to use. Ensure that the paint lead level is 0.06% or less.
- ☐ Check condition of heating element. Clean steam coils.
- ☐ Clean steam/water spray nozzles. Adjust/replace as needed.
- ☐ Chemically clean exterior of coil to remove scale and encrustations.
- ☐ Inspect steam trap for proper operation.
- ☐ Inspect pneumatic controller for air leaks.
- ☐ Inspect water lines for leaks and corrosion. Tighten all connections and repair leaks.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Psychrometer
- ☐ Coil cleaning chemical. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Work gloves
- ☐ Safety goggles
- ☐ Respirator

20. **Induction Units, Under Window Type**
Annual

Special Instructions:

- ☐ If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.

Checkpoints:

- ☐ Clean and wash permanent filters. Recharge wire mesh filters with oil.
- ☐ Replace disposable filters.
- ☐ Drain and clean condensate pan.

- ☐ Clean coils by vacuuming or brushing.
- ☐ Use fin comb to straighten coil fins.
- ☐ Clean strainers for accumulation of dirt.
- ☐ Check controls, trap, freeze-stat, and control stat for proper operation.
- ☐ Check induction nozzles. Clean if required.
- ☐ Clean interior unit surfaces to remove soil.
- ☐ Damp-wipe exterior surfaces.
- ☐ Clean surrounding floor area, and dispose of dirt and debris properly.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Filters, if disposable
- ☐ Cleaning materials and equipment. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Vacuum
- ☐ Fin comb

21. **Unit Heater (Gas and Oil Fired)**
Annual

Special Instructions:

- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ Open and tag electric circuit.
- ☐ Review manufacturer's instructions.
- ☐ If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.

Checkpoints:

- ☐ Clean and adjust heater deflector fins and element.
- ☐ Clean fan and lubricate motor.
- ☐ Clean burner, chamber, thermocouple and control. (Use a high suction vacuum and/or brush).
- ☐ Adjust pilot or electric ignition device.
- ☐ Inspect vent and damper operation.
- ☐ Operate unit and adjust burner.

- ☐ Check operation of safety pilot, gas shut-off valve, and other burner safety devices.
- ☐ Clean up work site.
- ☐ Test the room air around the unit for carbon monoxide emission. Ensure that carbon monoxide level averages less than 9ppm/day (parts per million/day). If the level of carbon monoxide in the room exceeds 9ppm, turn the unit off and repair. Retest the unit before it is placed back into service.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Fin comb
- ☐ Vacuum
- ☐ C02 analyzer
- ☐ C0 analyzer
- ☐ Lubricants. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

22. **Unit Heater, Electric**
Semiannual

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ Disconnect, tag, and lock out electrical circuit.

Checkpoints:

- ☐ Clean coils and other components with vacuum.
- ☐ Change filter, if necessary.
- ☐ Check for loose electrical connections in unit and tighten as necessary.
- ☐ Clean and wipe any excess dust or dirt and oil as required.
- ☐ Oil motor bearings as necessary.
- ☐ Check operation of fan motor for excessive bearing wear.
- ☐ Check operation of all controls, such as PE switches, dampers, damper operators, and thermostats.

Recommended Tools, Materials, and Equipment:

- ☐ Standard tools – basic
- ☐ Vacuum

- [ ] Lubricants. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

23. **Unit Heaters (Steam and Hot Water)**
Annual

Special Instructions:

- [ ] If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.

Checkpoints:

- [ ] Clean strainer ahead of valve. Check valve head and seats for wear and cutting.
- [ ] Replace valve if seats need regrinding. Send old valve to manufacturer for overhaul.
- [ ] Steam quality should be examined for foreign matter if valves are being damaged.
- [ ] Check steam gauges.
- [ ] Check pop safety or pressure relief valve for relieving and seating.
- [ ] Check diaphragms for failure.
- [ ] Check binding of valve stem.
- [ ] Clean and adjust heater deflector fins and element.
- [ ] Clean fan and lubricate motor.
- [ ] Adjust weighted lever or spring control tension.
- [ ] Clean up work site.

Recommended Tools, Materials, and Equipment:

- [ ] Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- [ ] Fin comb
- [ ] Vacuum
- [ ] Lubricants. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

24. **Unitary, Heating and Cooling Unit Application**
Annual
This maintenance task applies to self-contained heating and cooling units containing a complete cooling system and heating unit (gas or oil burner). These are normally installed on rooftops, but can be in other locations. They are also referred to as climate changers, roof packs, etc.

Special Instructions:

- [ ] Schedule maintenance with operating personnel, as needed.
- [ ] Review manufacturer's instructions.
- [ ] Review Procedure for "Controlling Hazardous Energy Sources."
- [ ] De-energize, lock and tag electrical circuits.
- [ ] Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.
- [ ] No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
- [ ] Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
- [ ] Recover, recycle, or reclaim the refrigerant as appropriate.
- [ ] If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal.
- [ ] If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- [ ] Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.
- [ ] Closely follow all safety procedures described in the
- [ ] Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.

Checkpoints:

- [ ] Remove debris from air screen and clean underneath unit.
- [ ] Inspect gaskets. Look for leaks between unit and structure, caulk as necessary.
- [ ] Clean condenser, cooling coil fins, and fans.
- [ ] Remove dirt or dust from all interior parts.
- [ ] Replace filter.
- [ ] Inspect and adjust damper.
- [ ] Lubricate motor and fan bearings.
- [ ] Check fan RPM to design specifications.
- [ ] Check bearing collar set screws on fan shaft to make sure they are tight.
- [ ] Check dampers for dirt accumulations. Check felt. Repair or replace as necessary.
- [ ] Check damper motors and linkage for proper operation.
- [ ] Lubricate mechanical connections of dampers sparingly.
- [ ] Clean coils by brushing, blowing, vacuuming or pressure washing.
- [ ] Check coils for leaking, tightness of fittings:

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- [ ] Check for refrigerant leaks using a halogen detector or similar testing device. Consult the Material Safety Data Sheets (MSDS) for disposal requirements.
- [ ] Check refrigerant levels and recharge if needed.

- [ ] Use fin comb to straighten coil fins.
- [ ] Flush and clean condensate pans and drains.
- [ ] Check belts for wear, adjust tension or alignment and replace belts when necessary. Multi-belt drives should be replaced with matched sets.
- [ ] Check rigid couplings for alignment on direct drives and for tightness of assembly. Check flexible couplings for alignment and wear.
- [ ] Check electrical connections for tightness.
- [ ] Check mounting for tightness.
- [ ] Check for corrosion.
- [ ] Check mounting bolts and tighten if needed.
- [ ] Check and adjust, or replace if necessary, vibration eliminators.
- [ ] Compressor.
    - [ ] Check compressor oil level.
    - [ ] Run machine, check action of controls, relays, switches, etc., to see that:
        - [ ] Compressor(s) run at proper settings.
        - [ ] Reheat coils activate properly.
        - [ ] Crankcase heater is operating properly.
        - [ ] Suction and discharge pressures are proper.
        - [ ] Discharge air temperature is set properly.
- [ ] Heating Unit.
    - [ ] Gas and/or oil fired (if equipped).
        - [ ] Check burner for flashback and tight shutoff of fuel.
        - [ ] Check operation of controls. Clean and adjust if necessary.
        - [ ] Clean burner, chamber, thermocouple and control (use a high suction vacuum and/or brush). Check combustion chamber for cracks, holes, or other defects.
        - [ ] Adjust pilot or electric ignition device.
        - [ ] Inspect vent and damper operation.
        - [ ] Operate unit and adjust burner.
        - [ ] Check operation of safety pilot, gas shutoff valve, and other burner safety devices.
        - [ ] Check temperature differential and controls.
        - [ ] Check frame of unit with ohmmeter for proper electric ground.
        - [ ] Replace covers (if any) and clean area.

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- ☐ Electrical (if equipped).
  - ☐ Visually inspect for broken parts, contact arcing or any evidence of overheating. Inspect all wiring for deterioration.
  - ☐ Check nameplate for current rating and controller manufacturer's recommended heater size (heater size shall not be changed without an engineer's approval).
  - ☐ Check line and load connections and heater mounting screws for tightness.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer instruction manual for specialized hand tools, equipment and supplies.
- ☐ Tachometer
- ☐ Grease gun and oiler
- ☐ Pressure washer
- ☐ Vacuum
- ☐ Fin comb
- ☐ Cleaning tools, approved refrigerant, and materials. Consult the MSDS for hazardous ingredients and proper personal protective equipment.
- ☐ Safety goggles and gloves
- ☐ CO2 analyzer
- ☐ Self sealing quick disconnect refrigerant hose fittings
- ☐ Refrigerant recovery/recycle unit
- ☐ EPA/DOT approved refrigerant storage tanks

II. Compressed Air

1. **Air Compressor**
   Semiannual

Special Instructions:

- ☐ Review manufacturer's instructions and equipment history record.
- ☐ Coordinate motor PM on an annual basis.
- ☐ Compressor should be inspected and tested by a qualified inspector.
- ☐ De-energize, tag, and lock out circuits.
- ☐ Review the Procedure on "Controlling Hazardous Energy Sources."

Checkpoints:

- [ ] Perform normal tour checks and operations. Perform a visual inspection of the air system, noting any obvious leaks or portions of the air distribution network that may be subject to physical damage.
- [ ] Change compressor crankcase oil.
- [ ] Clean or replace air intake filter.
- [ ] Check air dryer, automatic condensate drains, and air tank for proper operation. Clean condenser coils and cover grills.
- [ ] Inspect belt alignment and condition. Adjust or replace belts as required.
- [ ] Check for corrosion and scale on water cooled units.
- [ ] Clean heat exchange surfaces.
- [ ] Check accuracy of gauges with calibrated test gauge.
- [ ] On a two stage compressor, check intermediate pressure.
- [ ] Test relief valves, replace if leaking or the relief range is incorrect. Do not readjust safety relief valves in the field.
- [ ] Check operation of compressor unloaders, repair or replace if not loading and unloading properly.
- [ ] Check compressor suction and discharge valves for proper operation. Replace leaking valves.
- [ ] Check cut in and cut out of compressor pressure controller, readjust if necessary for proper air pressure requirements. Do not exceed ASME maximum tank pressure.
- [ ] Check to make sure belt guard is installed prior to putting air compressor back in service.
- [ ] No pressure vessel is to have its hand hole or manhole covers removed unless the vessel is at atmospheric pressure.
- [ ] Check if air compressor is running excessively or frequently cycling on and off (possible leaks). Log meter hour readings.
- [ ] Perform an air leak check of the compressor and air distribution network in the equipment room, using an appropriate ultrasonic scanning device. Check hoses, hose connections, hose fittings, quick couplers, filters, regulators and lubricators. Correct or schedule repair as a work item. Tag location and date of leaks.

Recommended Tools, Materials, and Equipment:

- [ ] Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- [ ] Belts
- [ ] Lubricants. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- [ ] Fin comb
- [ ] Vacuum cleaner commercial type

- ☐ Test gauge
- ☐ Ultrasonic scanner with trisonic and contact scanning modes.

2. **Air Dryer, Refrigerated or Regenerative Desiccant Type**
   Semiannual
   This maintenance task applies to refrigerated or regenerative desiccant type air dryers with a capacity of 10 SCFM or greater. Those units with a capacity of less than 10 SCFM will be maintained in conjunction with the air compressor that they are associated with.

   Special Instructions:
   - ☐ Schedule this maintenance in conjunction with the maintenance on the associated air compressor.
   - ☐ Review manufacturer's instructions.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock and tag electrical circuits.
   - ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.
   - ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
   - ☐ Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
   - ☐ Recover, recycle, or reclaim the refrigerant as appropriate.
   - ☐ If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal of the item.
   - ☐ If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
   - ☐ Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.
   - ☐ For refrigerant type units, closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.

   Checkpoints:
   - ☐ Lubricate valves and replace packing, if necessary.
   - ☐ Check dryer operating cycle.
   - ☐ Inspect and clean heat exchanger.
   - ☐ Check outlet dew point.
   - ☐ Clean and lubricate blower.
   - ☐ Check automatic blowdown devices.

- ☐ Inspect and replace or reinstall inlet filters.
- ☐ Refrigerated Type:
  - ☐ Check traps.
  - ☐ Check refrigerant level and moisture content. If low level or moisture is indicated, check for refrigerant leaks using a halogen leak detector or similar device.
  - ☐ Clean and lubricate condenser fan motor.
- ☐ Desiccant Type:
  - ☐ Replace filter cartridges, both pre-filter and after-filter.
  - ☐ Check the inlet flow pressure, temperature and purge rate.
  - ☐ Check the desiccant and replace if necessary.
  - ☐ Inspect and clean solenoids, purge valves, and strainers.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning equipment, lubricants, approved refrigerants if applicable, and materials. Consult the Material Safety Data Sheets and container labels for hazardous ingredients and proper personal protective equipment.
- ☐ Filter cartridges (for desiccant type dryer)
- ☐ Gasket and packing material
- ☐ Fin comb
- ☐ Self sealing quick disconnect refrigerant hose fittings
- ☐ Refrigerant recovery/recycle unit
- ☐ EPA/DOT approved refrigerant storage tank

III. Condenser/Heat Exchangers/Glycol/Chillers

1. **After-Cooler/Separator**
   Semiannual
   This maintenance task applies to the after-cooler/separator utilizing chilled water to condense moisture from large compressed air systems. These differ from mechanical/chemical type air dryers.

Special Instructions:

- ☐ Review manufacturer's instructions and Procedure for "Controlling Hazardous Energy Sources."
- ☐ Schedule maintenance outage with operating personnel.
- ☐ Provide an alternate source of air, if necessary.
- ☐ Schedule Preventive Maintenance (PM) on associated equipment if possible.

- ☐ Secure air and chilled water valves and tag them.
- ☐ Secure, lockout and tag electrical supply to compressor.
- ☐ Wear appropriate protective equipment.
- ☐ Use caution when disassembling. Check for and relieve pressure where found.

Checkpoints:

- ☐ Unbolt and remove supply and discharge water lines.
- ☐ Unbolt supply and discharge air flanges and lower assembly.
- ☐ Remove tube bundle assembly.
- ☐ Check tube bundle for deterioration or ruptured tubes.
- ☐ Clean exterior of the tube of all scale buildup.
- ☐ Flush out the tube bundle shell.
- ☐ Visually inspect the shell, flanges, piping, etc. for deterioration, cracks, etc.
- ☐ Clean the trap orifice of all carbon and heavy grease buildup.
- ☐ Reassemble the tube bundle in the shell using new gaskets and seals.
- ☐ Replace assembly and separator in pipe line, using new gaskets.
- ☐ Reconnect the supply and discharge water lines.
- ☐ Remove tags, open air and water valves, restore power, and start air compressor.
- ☐ Check operation of unit. Check the air and water inlet and outlet temperatures.
- ☐ Check all connections for leaks.
- ☐ Wire brush; treat with rusticide and primer rusted areas. Consult the Material Safety Data Sheet (MSDS) for hazardous ingredients and proper personal protective equipment (PPE). Consult the Material Safety Data Sheet to ensure that the paint lead level is 0.06% or less.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Ladder constructed according to OSHA/ANSI standards. Check ladder for defects. Do not use defective ladders.
- ☐ Vacuum and Tube Cleaning Equipment
- ☐ Gasket material and Seals
- ☐ Lifting device (hoist, come-a-long, hydraulic lift etc).
- ☐ Length of garden hose
- ☐ Rusticide, primer and paint supplies. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).

2. **Air-Cooled Condenser**
   Annual

This maintenance task applies to equipment which has the condenser, fan(s), and fan motor(s) enclosed within the same housing. The compressor and other components are at a separate location. PM of these other devices should be scheduled simultaneously with the units serviced by the condenser. If the condenser motor(s) is/are rated at 1 HP or higher, Schedule PM of motor(s) with this PM.

Special Instructions:

- [ ] Review manufacturer's instructions.
- [ ] Review Procedure for "Controlling Hazardous Energy Sources."
- [ ] Review Procedure for respiratory Protection.
- [ ] De-energize, lock out, and tag electrical circuit breakers.
- [ ] Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.
- [ ] No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
- [ ] Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
- [ ] Recover, recycle, or reclaim the refrigerant as appropriate.
- [ ] If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal of the equipment.
- [ ] If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- [ ] Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.
- [ ] Closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.

Checkpoints:

- [ ] Remove debris from air screen and clean underneath unit.
- [ ] Pressure wash coil with coil cleaning solution.
- [ ] Straighten fin tubes with fin comb.
- [ ] Check electrical connections for tightness.
- [ ] Check mounting for tightness.
- [ ] Check for and remove all corrosion or rust from unit and supporting steel, prime and paint as necessary. Consult the Material Safety Data Sheets to ensure that the paint lead level is 0.06% or less. Consult the MSDS for proper personal protective equipment.
- [ ] Check fan blades and belts. Clean fan blades as necessary.

- ☐ Check wires at condenser electrical fused safety switches for tightness and burned insulation. Repair as necessary.
- ☐ Clean up work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ High pressure washer
- ☐ Fin comb
- ☐ Paint brushes
- ☐ Cleaning materials. Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Respirator
- ☐ Safety goggles
- ☐ Gloves
- ☐ Self sealing quick disconnect refrigerant hose fittings
- ☐ Refrigerant recovery/recycle unit
- ☐ EPA/DOT approved refrigerant storage tanks.

3. **Central Chilled Water Package Unit: Comfort Cooling or Drinking Water**
   Annual
   This maintenance task applies to chilled water producing units that are self-contained, consisting of refrigeration compressors, air cooled condenser, chilled water coils, refrigerant receivers, fan and motor, etc., contained in a common housing or assembly. These units are normally installed where:

   - Several packaged air conditioning units are required for seasonal service. One central chilled water packaged unit will serve several packaged air conditioning units.
   - Drinking water is cooled at a central location and circulated to remote fountains.

   Special Instructions:

   - ☐ If necessary, schedule a shutdown with operating personnel.
   - ☐ Review manufacturer's instructions.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock out, and tag electrical circuits serving motors when applicable.
   - ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.
   - ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.

- [ ] Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
- [ ] Recover, recycle, or reclaim the refrigerant as appropriate.
- [ ] If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal of the item.
- [ ] If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- [ ] Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.
- [ ] Closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.
- [ ] Remove access covers prior to accomplishing check points.

Checkpoints:

- [ ] Condenser
    - [ ] Remove debris from air screen and clean underneath unit.
    - [ ] Pressure wash coil with proper cleaning solution.
    - [ ] Straighten fin tubes with fin comb.
    - [ ] Check electrical connections for tightness. Check fused disconnect switches for condition and operation.
    - [ ] Check mounting for tightness.
    - [ ] Check for corrosion. Clean and treat with inhibitor as needed.
    - [ ] Clean fan blades.
    - [ ] Inspect pulleys, belts, couplings, etc.; adjust tension and tighten mountings as necessary. Change badly worn belts. Multi-belt drives should be replaced with matched sets.
    - [ ] Perform required lubrication and remove old or excess lubricant.
    - [ ] Inspect water-cooled tubes for corrosion and scale. Clean if required.
- [ ] Compressor(s)
    - [ ] Lubricate drive coupling.
    - [ ] Lubricate motor bearings (non-hermetic).
    - [ ] Check and correct alignment of drive couplings.
    - [ ] Inspect evaporator tubes for scale. Clean if required. Leak test tubes using a halogen leak detector or suitable substitute.
    - [ ] Add refrigerant per manufacturer's instructions if needed.
    - [ ] Check compressor oil level.
    - [ ] Run machine; check action of controls, relays, switches, etc. to see that:
        - [ ] Compressor(s) run at proper settings.

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- [ ] Suction and discharge pressures are proper.
- [ ] Outlet water temperature is set properly.
- [ ] Check and adjust vibration eliminators. Replace as necessary.
- [ ] Sample test the refrigerant and oil to verify compliance with the Air Conditioning and Refrigeration Institute standards. Based on the results, refrigerant may need to be replaced or recycled, and oil replaced.
- [ ] Check and calibrate safety controls.

- [ ] Controls
  - [ ] Check operation of all relays, pilot valves, and pressure regulators.
  - [ ] Check resulting action of pressure sensing primary control elements such as diaphragms, bellows, inverted bells, and similar devices when activated by air, water, or similar pressure.
- [ ] Motors
  - [ ] Check ventilation ports for soil accumulations; clean if necessary.
  - [ ] Clean exterior of motor surfaces of soil accumulation.
  - [ ] Lubricate bearings according to manufacturer's recommendations.
    - [ ] Remove filler and drain plugs (use zerk fittings if installed).
    - [ ] Free drain hole of any hard grease (use piece of wire if necessary).
    - [ ] Add grease. Use good grade lithium base grease unless otherwise specified.
  - [ ] Check motor windings for accumulation of soil. Blow out with low pressure air or vacuum as needed.
  - [ ] Check hold-down bolts and grounding straps for tightness.
  - [ ] Remove tags, start unit, and check for vibration or noise.

<u>Recommended Tools, Materials, and Equipment:</u>

- [ ] Review manufacturer’s instruction manual for specialized hand tools, equipment and supplies.
- [ ] Pressure washer
- [ ] Fin comb
- [ ] Paint brushes
- [ ] Cleaning materials and equipment. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- [ ] Respirator
- [ ] Safety goggles
- [ ] Gloves
- [ ] Self sealing quick disconnect refrigerant hose fittings
- [ ] Refrigerant recovery/recycle unit

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- ☐ EPA/DOT approved refrigerant storage tanks
- ☐ Approved refrigerant
- ☐ Electronic leak detector

4. **Central Chilled Water Package Unit: Special Purpose or Computer Cooling**
   Quarterly
   This maintenance task applies to chilled water producing units that are self-contained, consisting of refrigeration compressors, air cooled condenser, chilled water coils, refrigerant receivers, fan and motor, etc., contained in a common housing or assembly. These units are normally installed where:
   - Several packaged air conditioning units are required for seasonal service. One central chilled water packaged unit will serve several packaged air conditioning units.
   - Drinking water is cooled at a central location and circulated to remote fountains.

   Special Instructions:
   - ☐ If necessary, schedule a shutdown with operating personnel.
   - ☐ Review manufacturer's instructions.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources".
   - ☐ De-energize, lock out, and tag electrical circuits serving motors when applicable.
   - ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.
   - ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
   - ☐ Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
   - ☐ Recover, recycle, or reclaim the refrigerant as appropriate.
   - ☐ If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal of the item.
   - ☐ If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
   - ☐ Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.
   - ☐ Closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.
   - ☐ Remove access covers prior to accomplishing check points

   Checkpoints:
   - ☐ Condenser

- [ ] Remove debris from air screen and clean underneath unit.
- [ ] Pressure wash coil with proper cleaning solution.
- [ ] Straighten fin tubes with fin comb.
- [ ] Check electrical connections for tightness. Check fused disconnect switches for condition and operation.
- [ ] Check mounting for tightness.
- [ ] Check for corrosion. Clean and treat with inhibitor as needed.
- [ ] Clean fan blades.
- [ ] Inspect pulleys, belts, couplings, etc.; adjust tension and tighten mountings as necessary. Change badly worn belts. Multi-belt drives should be replaced with matched sets.
- [ ] Perform required lubrication and remove old or excess lubricant.
- [ ] Inspect water-cooled tubes for corrosion and scale. Clean if required.

- [ ] 2. Compressor(s)
  - [ ] Lubricate drive coupling.
  - [ ] Lubricate motor bearings (non-hermetic).
  - [ ] Check and correct alignment of drive couplings.
  - [ ] Inspect evaporator tubes for scale. Clean if required. Leak test tubes using a halogen leak detector or suitable substitute.
  - [ ] Add refrigerant per manufacturer's instructions if needed.
  - [ ] Check compressor oil level.
  - [ ] Run machine; check action of controls, relays, switches, etc. to see that:
    - [ ] Compressor(s) run at proper settings.
    - [ ] Suction and discharge pressures are proper.
    - [ ] Outlet water temperature is set properly.
  - [ ] Check and adjust vibration eliminators. Replace as necessary.
  - [ ] Sample test the refrigerant and oil to verify compliance with the Air Conditioning and Refrigeration Institute standards. Based on the results, refrigerant may need to be replaced or recycled, and oil replaced.
  - [ ] Check and calibrate safety controls.
- [ ] Controls
  - [ ] Check operation of all relays, pilot valves, and pressure regulators.
  - [ ] Check resulting action of pressure sensing primary control elements such as diaphragms, bellows, inverted bells, and similar devices when activated by air, water, or similar pressure.
- [ ] Motors
  - [ ] Check ventilation ports for soil accumulations; clean if necessary.

- ☐ Clean exterior of motor surfaces of soil accumulation.
- ☐ Lubricate bearings according to manufacturer's recommendations.
  - ☐ Remove filler and drain plugs (use zerk fittings if installed).
  - ☐ Free drain hole of any hard grease (use piece of wire if necessary).
  - ☐ Add grease. Use good grade lithium base grease unless otherwise specified.
- ☐ Check motor windings for accumulation of soil. Blow out with low pressure air or vacuum as needed.
- ☐ Check hold-down bolts and grounding straps for tightness.
- ☐ Remove tags, start unit, and check for vibration or noise.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Pressure washer
- ☐ Fin comb
- ☐ Paint brushes
- ☐ Cleaning materials and equipment. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Respirator
- ☐ Safety goggles
- ☐ Gloves
- ☐ Self sealing quick disconnect refrigerant hose fittings.
- ☐ Refrigerant recovery/recycle unit.
- ☐ EPA/DOT approved refrigerant storage tanks.
- ☐ Approved refrigerant
- ☐ Electronic leak detector

5. **Coils Preheat, Reheat, Etc. (Remote Locations)**
   Annual
   This maintenance task applies to coils that are not part of an air washer or air handling unit.

   Special Instructions:

   - ☐ Review Procedure for "Selection, Care, and Use of Respiratory Protection."

   Checkpoints:

   - ☐ Vacuum or blow out the fins, coils, etc.
   - ☐ Remove obstructions to air flow.

- ☐ Check coils. Correct or report any leaks.
- ☐ Test and inspect controls that protect coils against freezing.
- ☐ Check for rust or corrosion around coil frame and coil mounting bracket. Clean, prepare for painting and coat with proper type paint as necessary.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Vacuum Cleaner wet/dry
- ☐ Radiator brush
- ☐ Coil cleaner. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Respirator
- ☐ Safety goggles
- ☐ Materials to properly prepare and paint metal. Consult the MSDS to ensure that the paint lead level is 0.06% or less.

6. **Cooling Tower, Cleaning**
   Quarterly
   This maintenance task applies to all cooling towers and evaporative condensers. Those located on the mezzanine or lower levels and near fresh air intakes are particularly important.

   Special Instructions:

   - ☐ Perform work before seasonal start-up (unless system has remained clean and free of biodeposits), before seasonal shutdown, and quarterly during the cooling season.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ Review manufacturer's instructions.
   - ☐ De-energize, tag, and lock electrical circuits.
   - ☐ Review Procedure for use of respiratory protection.
   - ☐ Ensure that there are safe and sturdy ladders and platforms to perform the lifting and cleaning required.
   - ☐ If biological growth is excessive, have a qualified water treatment specialist review your treatment program.
   - ☐ Refer to Table A for information on chlorine use.
   - ☐ If materials to be worked on, such as the wet deck panels, are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.

Checkpoints:

- ☐ Close building air intake vents within the vicinity of the cooling tower until the cleaning procedure is complete.
- ☐ Shut down, drain, and flush the cooling tower with water (check with state to determine if there are any restrictions on discharging the water). Isolate the cooling tower from the rest of the condenser water system where applicable.
- ☐ Clean the wet deck, remove all debris, and dispose of it properly. If the wet deck panels contain asbestos, follow the asbestos management plan for isolation, notification, work practice, and waste disposal.
- ☐ Inspect the tower, the tower basin and holding tank for sediment and sludge, and any biological growth.
- ☐ Using low pressure water hose or brushes, clean the tower, floor, sump, fill, spray pans and nozzles and removable components such as access hatches, ball float, and other fittings until all surfaces are clean and free of loose material. Porous surfaces such as wooden and ceramic tile towers will require additional cleaning and brushing. Clean cracks and crevices where buildup is not reached by water treatment.
- ☐ Clean all system strainers and strainer housings.
- ☐ Remove drift eliminators and clean thoroughly using a hose, steam, or chemical cleanser.
- ☐ Check fan and air inlet screens and remove any dirt or debris.
- ☐ Reassemble components, and fill tower and cooling system with water.
- ☐ Monitor the water pH and maintain pH within a range of 7.5 to 8.0. The pH can be monitored with litmus paper or a pH meter. Perform the following if a more thorough disinfectant cleaning is needed.
    - ☐ Add a silicate-based low or non-foaming detergent as a dispersant at a dosage of 10-25 pounds per thousand gallons of water in the system.
        - ☐ Use a silicate-based low or non-foaming detergent such as Cascade®, Calgonite®, or equivalent product.
        - ☐ If the total volume of water in the system is not known, it can be estimated to be ten (10) times the recirculating rate (gallons per minute) or 30 gallons per ton of refrigeration capacity.
        - ☐ The dispersant is best added by first dissolving it in water and adding the solution to a turbulent zone in the water system, such as the cooling tower basin near the pump suction.
        - ☐ Contact a professional water treatment specialist for a dispersant which may be safely used without interfering with the operation of the system.
    - ☐ Add chlorine disinfectant to achieve 25 parts per million (ppm) of free residual chlorine.

- ☐ Maintain 10 ppm of free residual chlorine in water returning to the cooling tower for 24 hours.
- ☐ A swimming pool test kit may be used to monitor the chlorine. Follow the manufacturer's instructions. Test papers such as those used to monitor restaurant sanitizing tanks may also be used.
- ☐ Monitor every 15 minutes for two hours to maintain the 10 ppm level. Add chlorine as needed to maintain this level.
- ☐ Two hours after the slug dose or after three measurements are stable at 10 ppm of free residual chlorine, monitor at two-hour intervals to maintain the 10-ppm of free residual chlorine.
- ☐ Some kits cannot measure 10 ppm. In this case dilute the test sample with distilled water to bring it within the test set range.

- ☐ After 24 hours, drain the system (check with the state to determine if there are any restrictions on discharging the water).
- ☐ Adjust bleed, float, and central valve for desired water level.
- ☐ Open any building air vents that were closed prior to the cleaning of the cooling tower.
- ☐ Implement an effective routine treatment program for microbial control.
- ☐ Document all maintenance and cleaning procedures by date and time. Record the brand name and the volume or weight of chemicals used.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Pressure washer with hose and nozzle
- ☐ Cleaning tools and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Appropriate chemicals and detergents (see task list for details). Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Respirator with acid/gas/mist/HEPA filters. For other chemicals, refer to the Material Safety Data Sheet (MSDS) for recommended respirator).
- ☐ Safety goggles
- ☐ Waterproof clothing (while working inside a wet tower).
- ☐ Gloves (refer to MSDS on chemicals used for the type of gloves required).
- ☐ Rubber boots if wet.
- ☐ Litmus paper or pH meter
- ☐ Swimming pool test kit

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TABLE OF VALUES

Chlorine Compounds Percent Available Weight per

Chlorine 1000 gallons

Hypochlorites

Calcium, Ca(OCl)2 (HTH) 70 0.3 lb.

Sodium, NaOCl

Industrial grade 12-15 1.5 lb.

Domestic grade (bleach) 3-5 5.25 lb.

Potassium or sodium

chlorinated isocyanurates 55-65 0.4 – 0.33 lb.

66-90 0.33 – 0.25 lb.

*Only those compounds commonly available in most communities are listed. Other appropriate compounds may be suggested by a water treatment specialist.

**These weights are approximate and are calculated to attain a free chlorine level of 25 ppm in a theoretical cooling tower system with no biodeposits. If biodeposits are present, additional chlorine will be required. Calculate the volume of the entire cooling tower system, including the cooling tower water and the recirculating water; it should be several times more than the holding capacity of the tower.

***Select only fast-release compounds, which are available in pellets, granular or extra granular forms in the 55-65% available chlorine category. Compounds with higher percentages of available chlorines (66- 90%) release more slowly; use only the granular or extra granular forms.

7. **Cooling Tower, Maintenance**
   Annual

   Special Instructions:

- [ ] Schedule performance of this PM activity prior to seasonal start-up. Consider the time needed to affect any required repairs.
- [ ] Review Procedure for "Controlling Hazardous Energy Sources."
- [ ] Schedule cleaning of the cooling tower with this PM activity.
- [ ] Review manufacturer's instructions.
- [ ] De-energize, lock out, and tag electrical circuits.
- [ ] Review Procedure for use of respiratory protection.
- [ ] Properly dispose of any debris, excess oil, and grease.
- [ ] If materials to be worked on, such as the wet deck panels, are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.

Checkpoints:

- [ ] Exterior Structural:
  - [ ] Inspect louvers for correct position and alignment, missing or defective items, and supports.
  - [ ] Inspect casings and attached hardware for leaks or defects. Check the integrity and secure attachment of the corner rolls.
  - [ ] Inspect for loose or rotten boards on wood casings. Examine from the interior. Extensive damage may require replacement with fiberglass sheathing.
  - [ ] Inspect condition of access doors and hinges. Repair as necessary.
  - [ ] Inspect the distribution system including flange connectors and gaskets, caulking of headers on counterflow towers, deterioration in distribution basins, splash guards, and associated piping on crossflow towers. If configured with water troughs check boards for warpage, splitting, and gaps.
  - [ ] Examine the drain boards for damage and proper drainage. Check the fasteners also.
  - [ ] Inspect stairways including handrails, knee rails, stringers, structure and fasteners for rot, corrosion, security and acid attack.
  - [ ] Shake ladders to verify security, and check all rungs.
  - [ ] Check the security, rot, and corrosion on walkway treads. Check treads, walkways, and platforms for loose, broken, or missing parts. Tighten or replace as necessary.
  - [ ] Ladders must be checked for corrosion, rot, etc. Verify compliance with Occupational Safety and Health regulations regarding height requirements. Check ladder security.
  - [ ] Check fan decks and supports for decay, missing and broken parts, and gaps. Check the security.

- [ ] Fan cylinders must be securely anchored. Check fastening devices. Note any damaged, missing, or corroded items. Watch for wood rot and corrosion of steel. Verify proper tip clearance between the fan blade and interior of cylinder. Verify compliance with OSHA requirements regarding height. Check its condition.
- [ ] Apply protective coatings as needed on exterior surfaces. Be sure rust and dirt have been removed first.

- [ ] Interior Structural:
  - [ ] Inspect the distribution system piping for decay, rust, or acid attack. Check the condition and tightness of connections and branch arms. Observe spray pattern of nozzles if possible and note missing and defective nozzles. Note condition of the redistribution system under the hot water system.
  - [ ] Inspect mechanical equipment supports and fasteners for corrosion. Wood structural members in contact with steel should be checked for evidence of weakness. Check condition of springs or rubber vibration absorption pads, including adjusting bolts, ferrous members, and rubber pads.
  - [ ] Check valves and operating condition of fire detection system. Check for corrosion of pipes and connectors. Check wiring of any thermocouple installed.
  - [ ] Check drift eliminators and supports. Remove any clogging debris. Replace missing blades.
  - [ ] Inspect tower fill for damage, ice breakage, deterioration, and misplaced, missing, or defective splash bars.
  - [ ] Examine interior structural supports. Test columns, girts, and diagonal wood members for soundness by striking with a hammer. A high pitched, sharp sound indicates good wood, whereas a dull sound indicates soft wood. Probe rotted areas with a screwdriver to determine extent of rot. Look for iron rot of metal fasteners in contact with wood. Check condition of steel internals. Check condition and tightness of bolts.
  - [ ] Inspect the nuts and bolts in partitions for tightness and corrosion. Look for loose or deteriorated partition boards. Note if partitions are installed so as to prevent wind milling of idle fans. Make sure wind walls parallel to intake louvers are in position. Boards or transite members should be securely fastened. Check condition of wood or steel supports for rot and corrosion.
  - [ ] Check wooden cold water basins for deterioration, warps, splits, open joints, and sound of wood.
  - [ ] Inspect steel basins for corrosion and general condition. Inspect concrete basins for cracks, breaking joints, and acid attack.
  - [ ] Check all sumps for debris, condition of screens, antiturbular plates, and freely operating drain valves.
- [ ] Mechanical:

- ☐ Check alignment of gear, motor, and fan.
- ☐ Inspect fans and air inlet screens and remove any dirt or debris.
    - ☐ Check hubs and hub covers for corrosion, and condition of attaching hardware.
    - ☐ Inspect blade clamping arrangement for tightness and corrosion.
- ☐ Gear box
    - ☐ Clean out any sludge.
    - ☐ Change oil. Be sure gear box is full to avoid condensation.
    - ☐ Rotate input shaft manually back and forth to check for backlash.
    - ☐ Attempt to move the shaft racially to check for wear on the input pinion shaft bearing.
    - ☐ Look for excessive play of the fan shaft bearings by applying a force up and down on the tip of a fan blade. Note: Some output shafts have a running clearance built into them.
- ☐ Power transmission.
    - ☐ Check that the drive shaft and coupling guards are installed and that there are no signs of rubbing. Inspect the keys and set screws on the drive shaft, and check the connecting hardware for tightness. Tighten or install as required.
    - ☐ Look for corrosion, wear, or missing elements on the drive shaft couplings.
    - ☐ Examine the exterior of the drive shaft for corrosion, and check the interior by tapping and listening for dead spots.
    - ☐ Observe flexible connectors of both ends of the shaft.
    - ☐ Inspect bearings, belts, and pulleys for excessive noise, wear or cracking, alignment, vibration, looseness, surface glazing, tension. Replace or repair as required.
- ☐ Check water distribution. Adjust water level and flush out troughs if necessary. Check all piping, connections, and brackets for looseness. Tighten loose connections and mounting brackets.Replace bolts and braces as required.
- ☐ Check nozzles for clogging and proper distribution.
- ☐ Inspect keys and keyways in motor and drive shaft.

- ☐ Electrical:
    - ☐ Check electric motor for excessive heat and vibration. Lubricate all motor bearings as applicable. Remove excess lubricant.
    - ☐ Inspect fused disconnect switches, wiring, conduit, and electrical controls for loose connections, charred or broken insulation, or other defects. Tighten, repair, or replace as required.

- ☐ Remove dust from air intakes, and check for corrosion. Check TEFC motors for conditions of air passages and fans.
- ☐ If there is a drain moisture plug installed, see if it is operational.
- ☐ Check amps and volts at operating loads, recommend pitching of fan blades to compensate.
- ☐ Look for corrosion and security of mounting bolts and attachments.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Protective coating, brushes, solvent, etc. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Manufacturer approved lubricants. Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Cleaning tools and materials. Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Respirator
- ☐ Safety goggles
- ☐ Work gloves
- ☐ Ladders of appropriate size constructed according to OSHA/ANSI standards or scaffolding. Check ladder for defects. Do not use defective ladders.
- ☐ Amp probe and voltmeter
- ☐ High pressure washer

8. **Evaporative Condenser**
   Annual
   This maintenance task applies to all cooling towers and evaporative condensers. Those located on the mezzanine or lower levels and near fresh air intakes are particularly important.

   Special Instructions:

   - ☐ Perform work before seasonal start-up (unless system has remained clean and free of biodeposits), before seasonal shutdown, and quarterly during the cooling season.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ Review manufacturer's instructions.
   - ☐ De-energize, tag, and lock electrical circuits.
   - ☐ Review Procedure for "Selection, Care, and Use of Respiratory Protection."
   - ☐ Ensure that there are safe and sturdy ladders and platforms to perform the lifting and cleaning required.

- [ ] If biological growth is excessive, have a qualified water treatment specialist review your treatment program.
- [ ] Refer to Table A for information on chlorine use.
- [ ] If materials to be worked on, such as the wet deck panels, are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.

Checkpoints:

- [ ] Close building air intake vents within the vicinity of the cooling tower until the cleaning procedure is complete.
- [ ] Shut down, drain, and flush the cooling tower with water (check with state to determine if there are any restrictions on discharging the water). Isolate the cooling tower from the rest of the condenser water system where applicable.
- [ ] Clean the wet deck, remove all debris, and dispose of it properly. If the wet deck panels contain asbestos, follow the asbestos management plan for isolation, notification, work practice, and waste disposal.
- [ ] Inspect the tower, the tower basin and holding tank for sediment and sludge, and any biological growth.
- [ ] Using low pressure water hose or brushes, clean the tower, floor, sump, fill, spray pans and nozzles and removable components such as access hatches, ball float, and other fittings until all surfaces are clean and free of loose material. Porous surfaces such as wooden and ceramic tile towers will require additional cleaning and brushing. Clean cracks and crevices where buildup is not reached by water treatment.
- [ ] Clean all system strainers and strainer housings.
- [ ] Remove drift eliminators and clean thoroughly using a hose, steam, or chemical cleanser.
- [ ] Check fan and air inlet screens and remove any dirt or debris.
- [ ] Reassemble components, and fill tower and cooling system with water.
- [ ] Monitor the water pH and maintain pH within a range of 7.5 to 8.0. The pH can be monitored with litmus paper or a pH meter.
- [ ] Perform the following if a more thorough disinfectant cleaning is needed.
    - [ ] Add a silicate-based low or non-foaming detergent as a dispersant at a dosage of 10-25 pounds per thousand gallons of water in the system.
        - [ ] Use a silicate-based low or non-foaming detergent such as Cascade®, Calgonite®, or equivalent product. (Trade names mentioned do not imply endorsement by the government).

- ☐ If the total volume of water in the system is not known, it can be estimated to be ten (10) times the recirculating rate (gallons per minute) or 30 gallons per ton of refrigeration capacity.
- ☐ The dispersant is best added by first dissolving it in water and adding the solution to a turbulent zone in the water system, such as the cooling tower basin near the pump suction.
- ☐ Contact a professional water treatment specialist for a dispersant which may be safely used without interfering with the operation of the system.

☐ Add chlorine disinfectant to achieve 25 parts per million (ppm) of free residual chlorine.

- ☐ Maintain 10 ppm of free residual chlorine in water returning to the cooling tower for 24 hours.
- ☐ A swimming pool test kit may be used to monitor the chlorine. Follow the manufacturer's instructions. Test papers such as those used to monitor restaurant sanitizing tanks may also be used.
- ☐ Monitor every 15 minutes for two hours to maintain the 10 ppm level. Add chlorine as needed to maintain this level.
- ☐ Two hours after the slug dose or after three measurements are stable at 10 ppm of free residual chlorine, monitor at two-hour intervals to maintain the 10-ppm of free residual chlorine.
- ☐ Some kits cannot measure 10 ppm. In this case dilute the test sample with distilled water to bring it within the test set range.

☐ After 24 hours, drain the system (check with the State to determine if there are any restrictions on discharging the water).

☐ Adjust bleed, float, central valve for desired water level.

☐ Open any building air vents that were closed prior to the cleaning of the cooling tower.

☐ Implement an effective routine treatment program for microbial control.

☐ Document all maintenance and cleaning procedures by date and time. Record the brand name and the volume or weight of chemicals used.

<u>Recommended Tools, Materials, and Equipment:</u>

- ☐ Review manufacturer’s instruction manual for specialized hand tools, equipment and supplies.
- ☐ Pressure washer with hose and nozzle.
- ☐ Cleaning tools and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

- ☐ Appropriate chemicals and detergents (see task list for details). Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Respirator with acid/gas/mist/HEPA filters. For other chemicals, refer to the Material Safety Data Sheet (MSDS) for recommended respirator).
- ☐ Safety goggles
- ☐ Waterproof clothing (while working inside a wet tower).
- ☐ Gloves (refer to MSDS on chemicals used for the type of gloves required).
- ☐ Rubber boots if wet.
- ☐ Litmus paper or pH meter
- ☐ Swimming pool test kit

TABLE OF VALUES

Chlorine Compounds Percent Available Weight per

Chlorine 1000 gallons

Hypochlorites

Calcium, Ca(OCl)2 (HTH) 70 0.3 lb.

Sodium, NaOCl

Industrial grade 12-15 1.5 lb.

Domestic grade (bleach) 3-5 5.25 lb.

Potassium or sodium

chlorinated isocyanurates 55-65 0.4 – 0.33 lb.

66-90 0.33 – 0.25 lb.

*Only those compounds commonly available in most communities are listed. Other appropriate compounds may be suggested by a water treatment specialist.

**These weights are approximate and are calculated to attain a free chlorine level of 25 ppm in a theoretical cooling tower system with no biodeposits. If biodeposits are present, additional chlorine will be required. Calculate the volume of the entire cooling tower system, including the

cooling tower water and the recirculating water; it should be several times more than the holding capacity of the tower.

Select only fast-release compounds, which are available in pellets, granular or extra granular forms in the 55-65% available chlorine category. Compounds with higher percentages of available chlorines (66 -90%) release more slowly; use only the granular or extra granular forms.

9. **Glycol Dry Cooler**
Annual
These units will be associated with packaged air conditioning units and refrigeration units, or would stand alone when utilized in free cooling.

Special Instructions:

- ☐ Schedule maintenance with operating personnel.
- ☐ Obtain and review manufacturer's instructions for starter to be tested (including the time current characteristic curve).
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ Review Procedure for "Selection, Care, and Use of Respiratory Protection."
- ☐ De-energize, tag, and lock out circuit.

Checkpoints:

- ☐ Dry Cooler Checkpoints:
  - ☐ Remove debris from air screen and clean underneath unit.
  - ☐ Pressure wash coil with coil cleaning solution. Check the Material Safety Data Sheets (MSDS) to ensure that the coil cleaner does not contain hydrofluoric acid or another irritating or hazardous compound.
  - ☐ Straighten fin tubes with fin comb.
  - ☐ Check electrical connections for tightness.
  - ☐ Check mounting for tightness.
  - ☐ Check for corrosion. Clean and treat with rust inhibitor and touch up paint as needed. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Motors and Fans Checkpoints:
  - ☐ Inspect pulleys, belts, couplings, etc.; adjust tension and tighten mountings as required. Change badly worn belts. Multi-belt drives should be replaced with matched sets.
  - ☐ Perform required lubrication and remove old or excess lubricant.

- ☐ Clean motor with vacuum or low pressure air (less than 40 psi). Check for obstructions in motor cooling and air flow.
- ☐ Expansion Tank Checkpoints:
  - ☐ Examine exterior of tank, including fittings, manholes, and handholes for leaks, signs of corrosion. Repair/paint as necessary.
  - ☐ Inspect structural supports and repair or replace damaged insulation or covering.
  - ☐ Clean, test, and inspect sight glasses, valves, fittings, drains, and controls.
  - ☐ Perform hydrostatic tests if required.
  - ☐ Check antifreeze level with hydrometer and add glycol based antifreeze as required for protection to minus 40 degrees Fahrenheit.
- ☐ Electrical Controls Checkpoints:
  - ☐ Visually inspect for broken parts, contact arcing, or any evidence of overheating.
  - ☐ Check motor name plate for current rating and controller manufacturer's recommended heater size. (Heater size shall not be changed without an Engineer's approval.)
  - ☐ Check line and load connections and heater mounting screws for tightness.

<u>Recommended Tools, Materials, and Equipment:</u>

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Pressure washer
- ☐ Fin comb
- ☐ Paint brush
- ☐ Cleaning materials. Consult the Material Safety Data Sheets for hazardous ingredients and proper personal protective equipment.
- ☐ Respirator
- ☐ Safety goggles
- ☐ Antifreeze – glycol base
- ☐ Rust inhibitor. Consult the Material Safety Data Sheets for hazardous ingredients and proper personal protective equipment.
- ☐ Vacuum cleaner
- ☐ Hydrometer (to check antifreeze level)

10. **Glycol Dry Cooler**
    Semiannual -Special Use
    These units will be associated with packaged air conditioning units and refrigeration units, or would stand alone when utilized in free cooling.

Special Instructions:

- [ ] Schedule maintenance with operating personnel.
- [ ] Obtain and review manufacturer's instructions for starter to be tested (including the time current characteristic curve).
- [ ] Review Procedure for "Controlling Hazardous Energy Sources."
- [ ] Review Procedure for "Selection, Care, and Use of Respiratory Protection."
- [ ] De-energize, tag, and lock out circuit.

Checkpoints:

- [ ] Dry Cooler Checkpoints:
  - [ ] Remove debris from air screen and clean underneath unit.
  - [ ] Pressure wash coil with coil cleaning solution. Check the Material Safety Data Sheets to ensure that the coil cleaner does not contain hydrofluoric acid or another irritating or hazardous compound.
  - [ ] Straighten fin tubes with fin comb.
  - [ ] Check electrical connections for tightness.
  - [ ] Check mounting for tightness.
  - [ ] Check for corrosion. Clean and treat with rust inhibitor and touch up paint as needed. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).
- [ ] Motors and Fans Checkpoints:
  - [ ] Inspect pulleys, belts, couplings, etc.; adjust tension and tighten mountings as required. Change badly worn belts. Multi-belt drives should be replaced with matched sets.
  - [ ] Perform required lubrication and remove old or excess lubricant.
  - [ ] Clean motor with vacuum or low pressure air (less than 40 psi). Check for obstructions in motor cooling and air flow.
- [ ] Expansion Tank Checkpoints:
  - [ ] Examine exterior of tank, including fittings, manholes, and handholes for leaks, signs of corrosion. Repair/paint as necessary.
  - [ ] Inspect structural supports and repair or replace damaged insulation or covering.
  - [ ] Clean, test, and inspect sight glasses, valves, fittings, drains, and controls.
  - [ ] Perform hydrostatic test if required.
  - [ ] Check antifreeze level with hydrometer and add glycol based antifreeze as required for protection to minus 40 degrees Fahrenheit.
- [ ] Electrical Controls Checkpoints:
  - [ ] Visually inspect for broken parts, contact arcing, or any evidence of overheating.

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- ☐ Check motor name plate for current rating and controller manufacturer's recommended heater size (heater size shall not be changed without an Engineer's approval).
- ☐ Check line and load connections and heater mounting screws for tightness.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Pressure washer
- ☐ Fin comb
- ☐ Paint brush
- ☐ Cleaning materials. Consult the Material Safety Data Sheets for hazardous ingredients and proper personal protective equipment.
- ☐ Respirator
- ☐ Safety goggles
- ☐ Antifreeze – glycol base
- ☐ Rust inhibitor. Consult the Material Safety Data Sheets for hazardous ingredients and proper personal protective equipment.
- ☐ Vacuum cleaner
- ☐ Hydrometer (to check antifreeze level)

11. **Non-Destructive Chiller Tube Analysis**

Three Years

This maintenance task applies to all centrifugal and absorption type chillers.

Special Instructions:

- ☐ Coordinate performance of this PM activity with performance of annual PM on the central or packaged chilled water units.
- ☐ Complete an eddy current test of all heat exchanger tubes, both evaporator and condenser (plus concentrator and absorber in absorption units).
- ☐ The test shall be performed in accordance with current requirements and procedures of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section V Nondestructive Examination, Article 8, Eddy Current Examination of Tubular Products and applicable recommended practice standards of the American Society for Testing and Materials for Eddy Current Testing.
- ☐ A Certified Level II or higher technician or equivalent shall be used for this analysis in accordance with the American Society of Non-destructive Testing Recommended Practices, SNT-TC-1A, or current version.

- [ ] The test is to be witnessed by the Facility Maintenance manager or designated inspector.

Procedure:

- [ ] Prepare equipment for non-destructive testing (NDT). Remove heat exchanger heads, piping, clean tubes, and erect scaffolding as necessary.
- [ ] Tests shall be recorded as required by the ASME code Section V (Article 8 – Appendix I, Article I-20).
- [ ] System calibration shall be confirmed hourly.
- [ ] The written procedure in paragraph I-23, Article 8 – Appendix I in the ASME code is required to be followed.
- [ ] Strip chart recordings shall be provided for:
    - [ ] Each calibration standard and artificial discontinuity comparator used. Annotate to identify each defect machined in the standard and calibration of each division on the chart.
    - [ ] Typical good tube in each bundle.
    - [ ] For each defective tube, annotate to identify tube. Indicate nature and extent of defect.
- [ ] Test each tube to detect, as a minimum, leaks, saddle damage, pitting, interior erosion/corrosion, gasket condition, presence of "tramp" metal, presence of tube bulges, tube seem condition; visual inspection, if possible, of scale build-up, and tube sheet condition.
- [ ] Correct deficiencies as directed.
- [ ] Restore equipment to service.

Reports and Records:

- [ ] A copy of the magnetic tape record shall be maintained by the NDT contractor and furnished if requested by the State Government.
- [ ] A preliminary job site report shall be provided as soon as the test is completed.
- [ ] Within ten (10) working days following completion of the test, the NDT contractor shall provide two complete test reports. Include the following:
    - [ ] Written test procedure
    - [ ] Recommendations – List all tubes recommended for replacement or isolation.
    - [ ] Make complete description of defects (location, depth, inside or outside surface).
    - [ ] Map location – Show tube row, number, and support for each tube bundle.
    - [ ] Name of technician performing tests and evaluating data.
    - [ ] Contractor's certification of technician qualifications.

12. **Water Treatment for Cooling Systems**

Monthly

This maintenance task is applicable to both condenser water and chilled water systems. Included are open recirculating systems, closed systems, air washers, and sprayed coil unit and evaporative condensers; once through systems are not applicable. Note: This maintenance task does not eliminate daily testing where it is an established policy.

Special Instructions:

- ☐ Chemicals must comply with the Environmental Protection Agency (EPA) regulations and be handled in accordance with occupational safety requirements. Employ personal protection against corrosive or hazardous treatment chemicals as appropriate.
- ☐ Be familiar with the Material Safety Data Sheets of any chemicals used in the water treatment program.
- ☐ Water treatment specialists must be properly trained.
- ☐ Water treatment must be based on proven standard engineering practices. Treatment methods that claim mysterious magnetic or catalytic forces shall not be used.
- ☐ Follow treatment as directed by manufacturer or water Treatment Company.
- ☐ Maintenance includes chemicals, chemical feeding, maintaining proper water conditions, controlling bleed off, protecting idle equipment, and recordkeeping.
- ☐ Select water treatment methods which protect the life of equipment, maximize heat transfer, and minimize scale, corrosion, solid matter buildup, algae, fungi, biological growth, and water usage. Alternate biocides. Changes to higher dosage levels may be required to control growth.
- ☐ Ensure chemicals are properly stored, test equipment clean, and that chemicals have not passed expiration date.
- ☐ Special attention must be paid to wooden towers and solar heating systems which can be more difficult to properly maintain.
- ☐ Physical inspections of towers and piping systems are to be made to determine water treatment effectiveness.
- ☐ Maintain records and test results.

Checkpoints:

- ☐ Inspect cooling tower and piping system to determine effectiveness of water treatment.
- ☐ Test each system for proper pH, total dissolved solids, conductivity, biological dosage level, scale and corrosion inhibitors; test supply water for base conditions.
- ☐ Test for biological growth using either on-site or laboratory. Include iron-related bacteria, sulfate reducing bacteria, slime forming bacteria, fluorescing pseudomonas, and blue-green algae.

- ☐ Add or adjust chemical and biological treatment dosage and water bleed off rate as appropriate.
  - ☐ Follow treatment as directed by manufacturer or water Treatment Company.
- ☐ If makeup is excessive, determine source of leak and correct.
- ☐ Monitor and test corrosion coupons as applicable.
- ☐ Record test results, action taken, type of chemicals, and treatment quantities used.
- ☐ If treatment is not effective, it may require a change in the treatment used or cleaning and preservation of the cooling tower and piping system.

Supplemental Information

- ☐ Make-up Water:
  - ☐ It is advisable to frequently test the quality of make-up water used. Have the water tested and a report performed to show the results. The following is an example of such a report.
    DATE: _____
    SOURCE: _____
    DATE ANALYZED: _____
    TOTAL DISSOLVED SOLIDS _____ppm
    CALCIUM _____ppm
    ORGANIC MATTER _____ppm
    MAGNESIUM _____ppm
    SUSPENDED MATTER _____ppm
    SODIUM &
    CHLOROFORM (Oil, etc.) _____ppm
    POTASSIUM _____ppm pH _____
    BICARBONATE _____ppm
    PHENOLPHTHALEIN ALK. _____ppm
    CARBONATE ppm
    METHYL ORANGE ALK. _____ppm
    HYDROXIDE
    HYDROXIDE ALK. _____ppm (as OH) _____ppm
    HARDNESS _____ppm
    SULFATE _____ppm
    SPECIFIC CONDUCTANCE _____ppm
    NITRATE _____ppm
    SILICA _____ppm
    CARBON DIOXIDE _____ppm
    IRON _____ppm

TURBIDITY _____ppm
OTHER _____ _____ppm

- ☐ Adjust the application of chemicals as determined by the water analysis.

IV. Fans/Dampers

1. **Cafeteria Exhaust Hood, Duct System**
   Semiannual
   This maintenance task applies to duct systems attached to exhaust hoods and fans for food service and vending facilities in buildings under the jurisdiction of public school or leased by public school.

   Special Instructions:

   - ☐ Have the systems serviced only by properly trained personnel or a qualified contractor.
   - ☐ The work required may set off an alarm or a supervisory signal. The facility maintenance manager and/or fire department that will receive the alarm and/or signal must be notified prior to start of work and at completion of work.
   - ☐ Schedule maintenance work on exhaust ducts with food service operators to minimize disruption of food service.
   - ☐ Review manufacturer's instructions.
   - ☐ The preventive maintenance on the hood and duct system may affect the functioning of related fire extinguishing and alarm systems.
   - ☐ This work applies to the first three floors of vertical duct above the cafeteria and at the fan on the roof.

   Checkpoints:

   - ☐ Check and clean grease off of duct interiors at connections to the hood.
   - ☐ Check and clean grease from duct interiors at access panels.
   - ☐ Check access panels for tight seals to prevent air leaks and for grease leaks. Clean, repair, and tighten seals as required.
   - ☐ Check and clean grease from all visible and accessible duct seams or joints.
   - ☐ Check hood exhaust fans for grease including exterior surfaces, fan housing, blades and protective grills or screens. Clean as required.
   - ☐ Check and clean building surfaces at the discharge end of the exhaust duct or exhaust fan housing.
   - ☐ Remove grease from interior surfaces of exhaust system ducts, including but not limited to horizontal and vertical shafts, fan and fan housing, and fan motor exterior (fan motor interior excluded).

- ☐ Check operation of exhaust blower on roof; lubricate bearings; adjust tension of fan belts and clean fan blades as required.
- ☐ Check with the operator to ascertain whether the ventilation rate of the hood is being maintained at the design flow rate. A work order may need to be initiated to have this checked and adjusted if there is improper flow.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning materials – Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

2. **Exhaust Fans, Roof Top**
   Semiannual
   This maintenance task applies to roof top facility exhaust fans that are both belt driven and direct drive units. Equipment will need to be identified that is controlled by a building management system, thermostat, or switch to allow for operation during this check

   Special instructions

   - ☐ Ensure energy isolation procedures are followed during this preventive-maintenance check.

   Checkpoints

   - ☐ Open and clean fan interiors.
   - ☐ Inspect electrical wiring and connections for loose connections or deterioration.
   - ☐ Inspect bearings and shaft for wear or abnormal conditions.
   - ☐ Check drive belt if applicable for wear, deterioration, and proper tension.
   - ☐ Grease bearings with recommended grease.
   - ☐ Operate fan and observe running conditions for proper operation.

3. **Fan, Centrifugal**
   Annual

   Special Instructions:

   - ☐ Review manufacturer's instructions.
   - ☐ Schedule shut-downs with operating personnel, as needed.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ Review Procedure for "Selection, Care and Use of Respiratory Equipment."
   - ☐ De-energize, lock out and tag fan motor electrical circuitry

- ☐ Refer to appropriate task lists and manufacturer's instructions for motor maintenance.

Checkpoints:

- ☐ Check fan blades for dust buildup and clean if necessary.
- ☐ Check fan blades and moving parts for excessive wear. Clean as needed.
- ☐ Check fan RPM to design specifications.
- ☐ Check bearing collar set screws on fan shaft to make sure they are tight.
- ☐ Vacuum interior of unit if accessible. Clean exterior.
- ☐ Lubricate fan shaft bearings while unit is running. Add grease slowly until slight bleeding is noted from the seals. Do not over lubricate. Remove old or excess lubricant.
- ☐ Check belts for wear, adjust tension or alignment, and replace belts when necessary. Multiple belts should be replaced with matched sets.
- ☐ Check structural members, vibration eliminators, and flexible connections.
- ☐ Remove all trash and clean area around fan and fan room.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Tachometer
- ☐ Cleaning equipment and materials – Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Vacuum
- ☐ Grease guns, lubricants – Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Respirator

4. **Fans, Propeller, 24" Diameter or Larger**
Annual

Special Instructions:

- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, tag and lock out fan motor disconnect.
- ☐ Read manufacturer's instructions.

Checkpoints:

- ☐ Clean unit, especially fan blades.
- ☐ Inspect pulleys, belts, couplings, etc.; adjust tension and tighten mountings as necessary. Change badly worn belts. Multiple belts should be replaced with matched sets.
- ☐ Perform required lubrication and remove old or excess lubricant.

- ☐ Clean motor with vacuum or low pressure dry air (less than 40 psig). Check for obstructions in motor cooling and air flow.
- ☐ Remove tags, start unit and check for vibration and noise.
- ☐ Remove all trash and debris.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Vacuum
- ☐ Cleaning materials – Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Lubricants – Consult the MSDS for hazardous ingredients and proper PPE.

5. **Remote Air Intake Dampers**
   Semiannual

Checkpoints:

- ☐ Check damper for freedom of movement and proper operation.
- ☐ Observe damper operation through full operating range, by activating controller. Adjust linkage on vanes if out of alignment.
- ☐ Check damper surfaces for wear and clean vanes.
- ☐ Check actuator/damper linkage for proper operation. Adjust if needed. Tighten operator arm set screws.
- ☐ Lubricate mechanical connections sparingly. Wipe off excess.
- ☐ Check actuator for proper operation. If it does not stroke properly, check for binding drive stem. If actuator still does not operate properly, replace the diaphragm (pneumatic actuators).
- ☐ Check for air leaks around actuator and in the air line between controller and actuator.
- ☐ Lubricate actuator linkage sparingly. Wipe off excess lubricant. DO NOT LUBRICATE actuator/drive stem.
- ☐ Clean off any corrosion or rust on damper frame and or damper blades, coat with proper type and color paint.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Lubricants

V. Filters

1. **Filter, Control Air**
   Quarterly
   This maintenance task applies to all control air filters installed in control air systems that are not part of the basic air compressor or air drier configurations.

   Checkpoints:
   - ☐ Valve filter out of service.
   - ☐ Remove and discard old cartridges.
   - ☐ Clean inside of housing.
   - ☐ Install new cartridge.
   - ☐ Open inlet valve and check for leaks.
   - ☐ Open outlet valve.

   Recommended Tools, Materials, and Equipment:
   - ☐ Standard tools – basic
   - ☐ Cartridge

2. **Filter, Movable Curtain, Oil Coated**
   Quarterly

   Special Instructions:
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ The efficiency of all filters used in public school controlled space will conform to the requirements of ASHRAE test method 52.1-92.
   - ☐ Review manufacturer's instructions and become familiar with manufacturer's recommended operating velocity. This information will assist in selecting proper filter efficiencies.
   - ☐ De-energize fans and filter motor, lock out and tag circuits.

   Checkpoints:
   - ☐ Inspect framework, and structure. Replace filters if the frame is bent or warped, or if the filter medium is punctured. Look for loose and missing bolts, air leaks, condition of flashing or caulking, etc.
   - ☐ Examine all moving parts for proper alignment, freedom of motion, excessive clearance or play, etc.
   - ☐ Inspect and adjust motor and drive unit, gear reducer, sprockets, drive chains, belts, etc. Perform required lubrication.

- ☐ Inspect pressure sensing device, pressure switches (if automatic), selector(s), starters, electric controls, warning and indicator lights, etc. Clean and adjust as necessary.
- ☐ Remove sludge from pit, change or replenish oil.
- ☐ Remove tags, restore to service and check operations.
- ☐ Remove all trash from work area, and clean up oil spills.

Recommended Tools, Materials, and Equipment:

- ☐ Standard tools - basic
- ☐ Lubricants – Consult the MSDS for hazardous ingredients and proper personal protective equipment.

3. **Filter, Roll Type Disposable Media, Manual or Motor Driven**
   Annual

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ Review Procedure for "Selection, Care and Use of Respiratory Equipment."
- ☐ De-energize power to fan motor and media motor drive, tag and lock out circuits.
- ☐ Review manufacturer's instructions and become familiar with manufacturer recommended operating velocity. This information will assist in selecting proper filter efficiencies.
- ☐ The efficiency of all filters used in public school controlled space will conform to the requirements of ASHRAE test method 52.1-92.

Checkpoints:

- ☐ Remove old filter media roll, vacuum heavy dust and remove debris.
- ☐ Inspect framework and structure. Look for loose or missing bolts, air leaks, and condition of flashing or caulking.
- ☐ Inspect all moving parts for proper alignment, freedom of motion, excessive clearance or play, clean, adjust or tighten as necessary.
- ☐ Install new media roll, inspect powered roll, and take-up roll for correct tracking of media. On manual operation, check wheel or hand crank.
- ☐ On motor drives, check pressure sensing device(s) and pressure switches. Test settings for starting and stopping motor.
- ☐ Inspect motor, starter, controls, selector switch for auto warning or indicator lights.
- ☐ Check oil in gear case. Change or replenish as required. Perform required lubrication using graphite where it is suitable. Remove old or excess lubricant.
- ☐ Remove all trash and debris to proper disposal area.

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Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Respirator
- ☐ Goggles
- ☐ Appropriate lubricants – Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

4. **Filter, Roll Type; Disposable**
   Quarterly
   This maintenance task applies to changing dirty roll filter media.

   Special Instructions:

   - ☐ Review manufacturer's instructions.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ Review Procedure for "Selection, Care and Use of Respiratory Equipment."
   - ☐ De-energize fan, media motor; tag and lock out circuit.

   Checkpoints:

   - ☐ Remove old filter media as required and install new roll.
   - ☐ Vacuum heavy accumulation of dust and remove debris.
   - ☐ Inspect for proper alignment and operation of automatic controls, adjust as necessary.
   - ☐ Remove all trash from area and room, put equipment back in operation.

   Recommended Tools, Materials, and Equipment:

   - ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
   - ☐ Respirator
   - ☐ Goggles

5. **Filter, Throw Away**
   Quarterly

   Special Instructions:

   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ Review Procedure for "Selection, Care and Use of Respiratory Equipment."
   - ☐ De-energize tag and lock out fan motor circuit.
   - ☐ The efficiency of all filters used in IRS controlled space will conform to the requirements of ASHRAE test method 52.1-92.

- [ ] Review manufacturer's instructions and become familiar with manufacturer recommended operating velocity. This information will assist in selecting proper filter efficiencies.
- [ ] De-energize tag and lock out fan motor circuit.

Checkpoints:

- [ ] Replace filters when they lose their efficiency or when they are so clogged that they produce too much pressure drop across the filter.
- [ ] Replace filters if the frame is bent or warped, or if the filtering medium is punctured.
- [ ] Replace filters with the arrows on the frame pointing in the direction of airflow.
- [ ] Check filter size and ensure filters are installed to prevent leakage between the filter bed and its supporting frame.
- [ ] Remove tags, restore to service, and check for proper operation.
- [ ] Clean up work area and remove trash.

Recommended Tools, Materials, and Equipment:

- [ ] Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- [ ] Filter replacement
- [ ] Vacuum
- [ ] Respirator

6. **Filter, Throw Away**
   Monthly

Special Instructions:

- [ ] Review Procedure for "Controlling Hazardous Energy Sources."
- [ ] Review Procedure for "Selection, Care and Use of Respiratory Equipment."
- [ ] De-energize tag and lock out fan motor circuit.
- [ ] The efficiency of all filters used in IRS controlled space will conform to the requirements of ASHRAE test method 52.1-92.
- [ ] Review manufacturer's instructions and become familiar with manufacturer recommended operating velocity. This information will assist in selecting proper filter efficiencies.
- [ ] De-energize tag and lock out fan motor circuit.

Checkpoints:

- [ ] Replace filters when they lose their efficiency or when they are so clogged that they produce too much pressure drop across the filter.
- [ ] Replace filters if the frame is bent or warped, or if the filtering medium is punctured.

- ☐ Replace filters with the arrows on the frame pointing in the direction of airflow.
- ☐ Check filter size and ensure filters are installed to prevent leakage between the filter bed and its supporting frame.
- ☐ Remove tags, restore to service, and check for proper operation.
- ☐ Clean up work area and remove trash.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Filter replacement
- ☐ Vacuum
- ☐ Respirator

7. **Filter, Throw Away, Bag Type**
Semiannual
This maintenance task applies to bag type, throw away filters. These bag type filters come in various sizes, as do all filters and in depths from four inches to four feet. Some are simple inserts while others are required to be fitted over a wire frame or clipped to hanger bars.

Special Instructions:

- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ Review Procedure for "Selection, Care and Use of Respiratory Equipment."
- ☐ Open and tag switches controlling the air handler.
- ☐ Filters should be changed when static pressure reading indicates.
- ☐ Special handling precautions shall be taken when changing filters for shooting or target ranges.
- ☐ NIOSH/MSHA approved respirator, disposable clothing, and other protection from exposure as needed will be used.
- ☐ Special disposal precautions should be taken to place filters into plastic bags with a minimum of handling. Vacuum bags used to clean filter housings will be disposed of as soon as work on the range filters is completed.
- ☐ Dispose of filters contaminated with lead according to Federal and state regulations.

Checkpoints:

- ☐ Remove old filters.
- ☐ Vacuum filter section of air handler.
- ☐ Inspect frame, clamps, etc.
- ☐ Install new filters. Make sure direction of air flow corresponds to the airflow shown on the filters and that filters are properly sized to cover the opening.

- ☐ Remove tags and restore to service.
- ☐ Properly dispose of filters and disposable clothing. Consult the Material Safety Data Sheets (MSDS) for proper disposal.
- ☐ Ensure firing ranges are tested annually for lead levels. The lead level must be less than 50 micrograms per cubic meter (50µg/m3).

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Filter replacements
- ☐ Vacuum
- ☐ Respirator (NIOSH/MSHA approved); high efficiency particulate air filter (HEPA) for firing ranges.
- ☐ Protective disposable clothing
- ☐ Plastic trash bags and wire ties, if required

8. **Filters, Electrostatic**
Quarterly

Special Instructions:

- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ Review Procedure for "Selection, Care and Use of Respiratory Equipment."
- ☐ De-energize power supply, tag and lock out disconnect switch.
- ☐ Ground bus trips, top to bottom.
- ☐ Review manufacturer's instructions.

Checkpoints:

- ☐ Before securing unit, check indicators for defective tubes or broken ionizing wires.
- ☐ Secure filter unit and air handler.
- ☐ Wash each manifold until totally clean. Units with water wash spray require approximately four (4) minutes with warm water or seven (7) minutes with cold water.
- ☐ If dry filters are dirty, remove and clean or replace filter.
- ☐ While cells are drying, look for defects, particularly broken wires or hum suppressor. Wipe insulators with soft dry cloth.
- ☐ If unit requires disassembly, check it thoroughly, clean, and adjust as required.
- ☐ Restore to service and check for evidence of shorts.
- ☐ Clean work area and remove trash to the proper disposal area.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Respirator
- ☐ Cleaning equipment and materials – Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

9. **Filters, Viscous Type (Wire Mesh)**
Quarterly
This maintenance task is for reusable filters and includes time for removing, cleaning, and replacing the filters. The throw-away filters are usually more economical than the viscous type. Therefore, this filter shall only be used where economically justified.

Special Instructions:

- ☐ Review Procedure for "Selection, Care and Use of Respiratory Equipment."
- ☐ The efficiency of all filters used in public school controlled space will conform to the requirements of ASHRAE test method 52.1-92.
- ☐ Filter efficiencies will be selected in accordance with the operating velocity recommended by the manufacturer.
- ☐ Liquid adhesive coatings used on air filters shall have a flash point no lower than 325°F (163°C) as determined by ASTM D93 and the filter will meet all NFPA and UL standards.
- ☐ De-energize tag and lock out fan motor circuit.

Checkpoints:

- ☐ Remove filters and replace with filters that have been cleaned and recoated. Examine frame and clean it with a high suction vacuum.
- ☐ Move dirty filters to cleaning station.
- ☐ Clean, recoat, and store filters removed until next task scheduled change.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Respirator
- ☐ Goggles
- ☐ Vacuum
- ☐ Filter replacement
- ☐ Extra set of wire mesh filters

VI. Refrigeration

1. **Condensing Unit, Refrigeration**
Annual

This maintenance task applies to those units that have the compressors located inside the air cooled condenser housing. These units are considered one-half of a split system. Normally installed where compressor noise and/or vibration is undesirable and normally associated with air handlers, air conditioning machines, and modular A/C units, ceiling/wall mounted, split system. The unit may stand alone and be associated with walk-in freezers and refrigerators.

Special Instructions:

- ☐ The Schedule of maintenance for these units will be the same schedule as is established for the air handler or packaged A/C unit it services.
- ☐ Comfort cooling units should be serviced just prior to the cooling season.
- ☐ Schedule outage with operating personnel.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ Obtain and review manufacturer's instructions.
- ☐ Review Procedure for "Selection, Care, and Use of Respiratory Protection."
- ☐ De-energize, tag, and lock out electrical circuits.
- ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.
- ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
- ☐ Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
- ☐ Recover, recycle, or reclaim the refrigerant as appropriate.
- ☐ If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal of the item.
- ☐ If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- ☐ Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.
- ☐ Closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.

Checkpoints:

- ☐ Remove debris from air screen and clean underneath unit.
- ☐ Pressure wash coil with coil cleaning solution. Rinse and neutralize (cleaning solution) in accordance with manufacturer's recommendations.
- ☐ Straighten fin tubes with fin comb.
- ☐ Check electrical connections for tightness.
- ☐ Check mounting for tightness.

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- [ ] Check all refrigeration lines for support and signs of wear.
- [ ] Thoroughly inspect and clean interior and exterior of machine.
- [ ] Clean and treat all rusted areas. Touch up prime and paint as needed.
- [ ] Check for refrigerant leaks using a halogen leak detector, soap bubbles, or similar testing device.
- [ ] Check refrigerant levels and recharge if needed.
- [ ] Perform required lubrication and remove old or excess lubricant.
- [ ] Clean motor with vacuum or low pressure air (less than 40 psi). Check for obstructions in motor cooling and air flow.
- [ ] Visually inspect fused disconnect switches and contactors for condition, proper operation, arcing or any evidence of overheating.
- [ ] Check motor name plate for current rating and controller manufacturer's recommended heater size (heater size shall not be changed without an Engineer's approval).
- [ ] Check line and load connections and heater mounting screws for tightness.
- [ ] Check fan blades for dust buildup and clean if necessary.
- [ ] Check fan blades and moving parts for excessive wear.
- [ ] Check fan RPM to design specifications.
- [ ] Check bearing collar set screws on fan shaft to make sure they are tight, if applicable.
- [ ] Check dampers for dirt accumulation. Check felt; repair or replace as required.
- [ ] Check damper motors and linkage for proper operation. Adjust linkage on vanes if out of alignment, if equipped.
- [ ] Lubricate mechanical connections of dampers sparingly, if equipped.
- [ ] Check compressor oil level (non-hermetically sealed units only) if compressor is equipped with a sight glass.
- [ ] Run machine with service gauge manifold attached, checking action of controls, relays, switches, etc. to see that:
    - [ ] compressor(s) run at proper settings.
    - [ ] controls activate properly.
    - [ ] controls activate unit.
    - [ ] suction and discharge pressures are proper.
- [ ] Check setting on controls and return to normal operation.
- [ ] Clean up the work area and properly dispose of debris and waste.
- [ ] Note: Seal off all service ports with flare caps. Report any missing caps or dust covers.

Recommended Tools, Materials, and Equipment:

- [ ] Review manufacturer’s instruction manual for specialized hand tools, equipment and supplies.
- [ ] Refrigeration manifold

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- ☐ Pressure washer
- ☐ in comb
- ☐ Paint brush
- ☐ Cleaning materials and tools, vacuum, grease gun, and oil. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Respirator
- ☐ Safety goggles
- ☐ Gloves
- ☐ Rust inhibitor and protective coatings. Consult the MSDS for hazardous ingredients and proper PPE. Consult the MSDS to ensure that the paint lead level is 0.06% or less.
- ☐ Self sealing quick disconnect refrigerant hose fittings.
- ☐ Refrigerant recovery/recycle unit
- ☐ EPA/DOT approved refrigerant storage tanks
- ☐ Approved refrigerant
- ☐ Electronic leak detector

2. **Condensing Unit, Refrigeration**
   Monthly - Special Use
   This maintenance task applies to those units that have the compressors located inside the air cooled condenser housing. These units are considered one-half of a split system. Normally installed where compressor noise and/or vibration is undesirable and normally associated with air handlers, air conditioning machines, and modular A/C units, ceiling/wall mounted, split system. The unit may stand alone and be associated with walk-in freezers and refrigerators.

   Special Instructions:
   - ☐ The Schedule of maintenance for these units will be the same schedule as is established for the air handler or packaged A/C unit it services.
   - ☐ Schedule outage with operating personnel.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ Obtain and review manufacturer's instructions.
   - ☐ Review Procedure for "Selection, Care, and Use of Respiratory Protection."
   - ☐ De-energize, tag, and lock out electrical circuits.
   - ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.
   - ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.

- [ ] Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
- [ ] Recover, recycle, or reclaim the refrigerant as appropriate.
- [ ] If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal of the item.
- [ ] If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- [ ] Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.
- [ ] Closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.

Checkpoints:

- [ ] Remove debris from air screen and clean underneath unit.
- [ ] Pressure wash coil with coil cleaning solution. Rinse and neutralize (cleaning solution) in accordance with manufacturer's recommendations.
- [ ] Straighten fin tubes with fin comb.
- [ ] Check electrical connections for tightness.
- [ ] Check mounting for tightness.
- [ ] Check all refrigeration lines for support and signs of wear.
- [ ] Thoroughly inspect and clean interior and exterior of machine.
- [ ] Clean and treat all rusted areas. Touch up prime and paint as needed.
- [ ] Check for refrigerant leaks using a halogen leak detector, soap bubbles, or similar testing device.
- [ ] Check refrigerant levels and recharge if needed.
- [ ] Perform required lubrication and remove old or excess lubricant.
- [ ] Clean motor with vacuum or low pressure air (less than 40 psi). Check for obstructions in motor cooling and air flow.
- [ ] Visually inspect fused disconnect switches and contactors for condition, proper operation, arcing or any evidence of overheating.
- [ ] Check motor name plate for current rating and controller manufacturer's recommended heater size (heater size shall not be changed without an Engineer's approval).
- [ ] Check line and load connections and heater mounting screws for tightness.
- [ ] Check fan blades for dust buildup and clean if necessary.
- [ ] Check fan blades and moving parts for excessive wear.
- [ ] Check fan RPM to design specifications.
- [ ] Check bearing collar set screws on fan shaft to make sure they are tight, if applicable.
- [ ] Check dampers for dirt accumulation. Check felt; repair or replace as required.

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- ☐ Check damper motors and linkage for proper operation. Adjust linkage on vanes if out of alignment, if equipped.
- ☐ Lubricate mechanical connections of dampers sparingly, if equipped.
- ☐ Check compressor oil level (non-hermetically sealed units only) if compressor is equipped with a sight glass.
- ☐ Run machine with service gauge manifold attached, checking action of controls, relays, switches, etc. to see that:
  - ☐ compressor(s) run at proper settings.
  - ☐ controls activate properly.
  - ☐ controls activate unit.
  - ☐ suction and discharge pressures are proper.
- ☐ Check setting on controls and return to normal operation.
- ☐ Clean up the work area and properly dispose of debris and waste.
- ☐ Note: Seal off all service ports with flare caps. Report any missing caps or dust covers.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Refrigeration manifold
- ☐ Pressure washer
- ☐ Fin comb
- ☐ Paint brush
- ☐ Cleaning materials and tools, vacuum, grease gun, and oil. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Respirator
- ☐ Safety goggles
- ☐ Gloves
- ☐ Rust inhibitor and protective coatings. Consult the MSDS for hazardous ingredients and proper PPE. Consult the MSDS to ensure that the paint lead level is 0.06% or less.
- ☐ Self sealing quick disconnect refrigerant hose fittings.
- ☐ Refrigerant recovery/recycle unit
- ☐ EPA/DOT approved refrigerant storage tanks
- ☐ Approved refrigerant
- ☐ Electronic leak detector

3. **Refrigerant Monitor**
   Monthly

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ Review calibration procedures.

Checkpoints:

- ☐ Check flow loss; check filter light; change filter as required. Note: Particle filter must be used; avoid getting it wet.
- ☐ Use carbon organic filter to zero unit. Check filter every two months under normal conditions and average humidity.
- ☐ Store unused cartridges in sealed container.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Filters, as required

4. **Refrigeration Controls, Central System**

Annual

This maintenance task applies to those controls used to protect and control the operation of central refrigeration units. Included are electric, electronic, pneumatic or a combination of several or all of them. Including, but not limited to capacity controllers, demand controllers, and temperatures as well as pressure controls and safeties.

Special Instructions:

- ☐ Read and understand the manufacturer's instructions.
- ☐ Obtain "As Built" diagrams of the control and safety systems.
- ☐ Replace defective control safeties found while performing preventive maintenance.

Checkpoints:

- ☐ Check flow or pressure differential switches for proper operation. Calibrate or replace as necessary.
- ☐ Check oil temperature control and safety for proper operation. Calibrate or replace as necessary.
- ☐ Check set point of low temperature control and safety for proper operation. Calibrate or replace if necessary
- ☐ Check capacity controller or demand limiter for proper operation. Calibrate or replace if necessary.
- ☐ Check oil pressure control and safety for proper operation. Replace if necessary.

- ☐ Check high pressure cutout for proper setting and operation. Adjust or replace if necessary.
- ☐ Check and clean all electrical contacts and pneumatic orifices.
- ☐ Check pneumatic tubing for leaks or damage. Repair or replace as required.
- ☐ Check electrical wiring insulation and connections. Tighten or replace if necessary.
- ☐ Check damper or un-loader controller for proper operation. Check position of damper for proper operation. Calibrate or replace if necessary.
- ☐ Check all settings and set points with manufacturer's instructions.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Pneumatic Control Gauge
- ☐ Volt Ohm Meter
- ☐ Manufacturer's Control Kit

5. **Refrigeration Machine, Absorption Unit**
   Annual

Special Instructions:

- ☐ Review manufacturer's instructions.

Checkpoints:

- ☐ Clean unit strainer. Clean unit pump motor cooling circuit in accordance with manufacturer's instructions.
- ☐ Check and clean all strainers and traps in steam or hot water supply, condensate return, and condensing water circuit.
- ☐ Use oil-dry nitrogen under positive pressure to check for air leaks around valves, gaskets, seals, etc.
- ☐ Units with external purge pump system:
  - ☐ Check pulley alignment and V-belt extension.
  - ☐ Clean purge drive belts with safety solvent.
  - ☐ Change purge pump vacuum oil in accordance with manufacturer's instructions.
  - ☐ Note: Review the Material Safety Data Sheets (MSDS) for proper disposal of used oil. If appropriate, recycle oil at an authorized station.
- ☐ Lubricate purge pump motor with machine oil.
- ☐ Check and service system controls in accordance with manufacturer's instructions.
- ☐ Add octyl alcohol to working fluids per manufacturer's charts and procedures.

- ☐ Inspect and clean cooling water circuit.
- ☐ Inspect system water circuit. Check log sheets for indications of increased temperature trends.
  - ☐ If cleaning is required, use chemical flushing methods.
  - ☐ If chemical flushing is not effective, brush or punch tube bundles until scale is removed.
- ☐ Check pumps, motors, controls, and lubricate as required (evaporator pumps, solution pump).

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Gloves
- ☐ Goggles
- ☐ Lubricants. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Cleaning materials. Consult the MSDS for hazardous ingredients and proper PPE.

6. **Refrigeration Unit, Centrifugal**
   Annual

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ Coordinate PM of refrigeration machine control panel and refrigeration machine controls in conjunction with this PM activity.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, lock out, and tag electrical circuits.
- ☐ The replacement filter-drier cores for the high efficiency purge unit absorb water vapor from the ambient air. They are shipped in sealed containers and are not to be opened until they can be installed and sealed in the purge tank.
- ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.
- ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
- ☐ Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
- ☐ Recover, recycle, or reclaim the refrigerant as appropriate.

- [ ] If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal of the item.
- [ ] If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- [ ] Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.
- [ ] Closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.
- [ ] Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications,” as applicable.

Checkpoints:

- [ ] Lubricate drive couplings.
- [ ] Lubricate motor bearings (non-hermetic)
- [ ] Lightly lubricate vane control linkage bearings, ball joints and pivot points. DO NOT LUBRICATE the shaft of the vane operator.
- [ ] Remove refrigerant in accordance with manufacturer's instructions. Sample test the refrigerant and oil to verify compliance with the Air Conditioning and Refrigeration Institute standards.
- [ ] Drain and replace oil in compressor oil reservoir including filters, strainers and traps. Have oil analyzed to determine bearing conditions. Review the Material Data Safety Sheets (MSDS) for proper disposal of used oil. If appropriate, recycle oil at an authorized station.
- [ ] Drain and replace oil in purge compressor.
- [ ] Drain and replace oil in purge gearbox. Check and clean oil strainer.
- [ ] Check and correct alignment of drive couplings.
- [ ] Inspect cooler and condenser tubes for scale. Clean if required.
- [ ] Clean all water strainers in the system.
- [ ] Use oil-dry nitrogen to test for leaks per manufacturer's instructions.
- [ ] Pull vacuum on refrigeration machine in accordance with manufacturer's instructions. Add refrigerant as required per specifications.
- [ ] Megger compressor and oil pump motors and record readings.
- [ ] Check dash pot oil in main starter.
- [ ] Tighten all starter, control panel, motor terminals, overloads, and oil heater leads, etc.
- [ ] Check all contacts for wear, pitting, etc.
- [ ] Check and calibrate overloads, record trip amps and trip times.
- [ ] Check and calibrate safety controls.

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- ☐ Clean up the work area. Properly recycle or dispose of materials in accordance with environmental regulations.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Gloves
- ☐ Safety goggles
- ☐ Lubricants and gear box oil. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Cleaning materials. Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Self sealing quick disconnect refrigerant hose fittings
- ☐ Refrigerant recovery/recycle unit
- ☐ EPA/DOT approved refrigerant storage tanks
- ☐ Tube cleaning pressure washer
- ☐ Paint and brushes as required
- ☐ Dry nitrogen gas, cylinder, and regulator
- ☐ Approved refrigerant
- ☐ Electronic leak detector
- ☐ Megger
- ☐ Variac

7. **Refrigeration Unit, Reciprocating and Scroll**
   Annual

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, lock out, and tag electrical circuits.
- ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.
- ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
- ☐ Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
- ☐ Recover, recycle, or reclaim the refrigerant as appropriate.
- ☐ If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal of the item.

- [ ] If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- [ ] Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.
- [ ] Closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.
- [ ] Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

Checkpoints:

- [ ] Service drive coupling and check alignment.
- [ ] Lubricate motor bearings (non-hermetic).
- [ ] Check sequence if multiple stages.
- [ ] Pump down system. Remove refrigerant in accordance with manufacturer's instructions. Use appropriate refrigerant recovery/recycling equipment. Sample test the refrigerant and oil to verify compliance with the Air Conditioning and Refrigeration Institute standards.
- [ ] Drain and replace oil in compressor oil reservoir, including filters, strainers and traps. Review the Material Data Safety Sheets (MSDS) for proper disposal of used oil. If appropriate, recycle oil at an authorized station.
- [ ] Check crankcase heater if applicable.
- [ ] Check and correct alignment of drive couplings.
- [ ] Inspect cooler and condenser tubes for scale. Clean if required. Leak test the tubes using a halogen leak detector.
- [ ] Clean all water strainers in the system.
- [ ] Use oil-dry nitrogen to test compressor/system for leaks per manufacturer's instructions.
- [ ] Pull vacuum on refrigeration machine in accordance with manufacturer's instructions.
- [ ] Check external interlocks, flow switch, fans, and pumps. Calibrate operating and safety controls.
- [ ] Check and tighten all electrical, control panel, and motor terminals. Check contacts for wear.
- [ ] Megger compressor motor and record readings.
- [ ] Check appropriate temperatures and pressures (some are combined for multi-staged scroll systems.
- [ ] Clean up the work area. Recycle or dispose of materials in accordance with environmental regulations.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Gloves
- ☐ Safety goggles
- ☐ Lubricants. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Cleaning materials. Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Self sealing quick disconnect refrigerant hose fittings
- ☐ Refrigerant recovery/recycle unit
- ☐ EPA/DOT approved refrigerant storage tanks
- ☐ Tube cleaning pressure washer
- ☐ Paint and brushes (as required)
- ☐ Dry nitrogen as, cylinder, and regulator
- ☐ Approved refrigerant
- ☐ Megger
- ☐ Electronic leak detector

8. **Refrigeration Unit, Rotary Screw**
   Semiannual

   Special Instructions:
   - ☐ Review manufacturer's instructions.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock out, and tag electrical circuits.
   - ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency (EPA) regulations as they apply to protection of stratospheric ozone.
   - ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
   - ☐ Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
   - ☐ Recover, recycle, or reclaim the refrigerant as appropriate.
   - ☐ If disposal of the equipment item is required, follow regulations concerning removal of refrigerants and disposal of the item.
   - ☐ If materials containing refrigerants are discarded, follow regulations concerning hazardous waste where applicable.
   - ☐ Refrigerant oils to be removed for disposal must be analyzed for hazardous waste and handled accordingly.

- [ ] Closely follow all safety procedures described in the Material Safety Data Sheet (MSDS) for the refrigerant and all labels on refrigerant containers.
- [ ] Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

Checkpoints:

- [ ] Perform chemical oil analysis, change oil if required.
- [ ] Change compressor oil filter element; clean housing.
- [ ] Inspect filter for metal particles which could indicate bearing wear. Inform supervisor if any are found.
- [ ] Oil return system.
    - [ ] Clean Strainer.
    - [ ] Check nozzle of educator for foreign particles.
- [ ] Electrical controls and safety cutouts.
    - [ ] Check for loose or burnt connections.
    - [ ] Check oil heating circuit.
    - [ ] Check for proper factory settings on safety shutdown controls.
- [ ] Check tightness of motor mounting screws.
- [ ] Check for refrigerant leaks at each joint and weld. Tighten flare nuts or flange bolts as required.
- [ ] Repair weld leaks using certified recovery and recycling equipment to conserve refrigerant. Upon completion of any repairs, unit should be pressure and vacuum tested in accordance with the manufacturer's literature.
- [ ] Sample test the refrigerant and oil to verify compliance with the Air Conditioning and Refrigeration Institute standards.
- [ ] Megger motor and record results.
- [ ] Check dash-pot oil in main starter.
- [ ] Tighten all starter, control panel, and motor terminals, oil heater leads, and overloads, etc.
- [ ] Check all contacts for wear, pitting, etc.
- [ ] Check and calibrate overloads and record trip amps and trip times.
- [ ] Clean up the work area. Properly recycle or dispose of materials in accordance with environmental regulations.

Recommended Tools, Materials, and Equipment:

- [ ] Review manufacturer’s instruction manual for specialized hand tools, equipment and supplies.

- ☐ Gloves
- ☐ Safety goggles
- ☐ Lubricants. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Cleaning materials. Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Self sealing quick disconnect refrigerant hose fittings
- ☐ Refrigerant recovery/recycle unit
- ☐ EPA/DOT approved refrigerant storage tanks
- ☐ Tube cleaning pressure washer
- ☐ Paint and brushes (as required)
- ☐ Dry nitrogen as, cylinder, and regulator
- ☐ Approved refrigerant
- ☐ Megger
- ☐ Variac

9. **Control Panel, Central Refrigeration Unit**
   Annual
   This maintenance task applies to central control panels that are installed to regulate and control large capacity central refrigeration machines. It includes service to controls, controllers, transmitters, sensors, relays, etc., associated with the central control panel.

   Special Instructions:
   - ☐ Schedule this maintenance shutdown with operating personnel.
   - ☐ Obtain and review manufacturer's information for servicing, testing, and operating.
   - ☐ Obtain "As Built" diagrams of installation.

   Checkpoints:
   - ☐ Clean and calibrate all controlling instruments.
   - ☐ Clean or replace orifices and/or contacts.
   - ☐ Check for pneumatic leaks and/or loose wiring and repair.
   - ☐ Replace charts, add ink, and check calibration of flow meter, temperature recorders, and kilowatt charts.
   - ☐ Check for bad indicator lights and gauges and replace as necessary.
   - ☐ Test all controllers and set at proper set points.
   - ☐ Check operating data and analyze for proper operation.

   Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning materials and equipment. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Pressure gauge
- ☐ Temperature analyzer
- ☐ Multi-meter

B. Electrical Distribution & Service Equipment

I. Battery

1. **Battery Charger**
   Quarterly
   This maintenance task is for chargers used for battery powered custodial equipment and items related to PBS functions.

   Special Instructions:
   - ☐ Use no open flames, cigarettes, etc., in battery charging room or area.
   - ☐ Review manufacturer's instructions.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock out, and tag electric circuits.

   Checkpoints:
   - ☐ Check room ventilation, and be sure charger is not exposed to moisture or water.
   - ☐ Clean accessible interior and exterior parts, including electrical connections.
   - ☐ Check tightness of electrical connections including alligator clips.
   - ☐ Inspect wiring and connections in charging circuit.
   - ☐ Record charger output voltage.
   - ☐ Clean and paint as necessary all equipment used for battery trays and charging equipment. Use acid resistant paint only.
   - ☐ Check, clean all battery terminals and connections, then add a light film of NO-OX-ID or pure Vaseline to terminals and connectors.
   - ☐ Check all cells to determine if any are defective.
   - ☐ Check electrolyte strength of all cells with an hydrometer, make corrections as necessary.
   - ☐ Clean vent plugs.
   - ☐ Dispose of used or defective batteries properly.

   Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Goggles and rubber apron
- ☐ Acid resistant paint and brushes
- ☐ Hydrometer
- ☐ No-oxide-Id grease or pure Vaseline
- ☐ Baking soda
- ☐ Clean wiping cloths
- ☐ Battery terminal and connector cleaner
- ☐ Emergency eyewash that provides at least 0.4 gallons/min for at least 15 minutes.

2. **Battery, Uninterruptible Power System**
   Monthly
   This maintenance task applies to batteries that support uninterruptible power systems (UPS). UPS are designed to support a computer through utility power fluctuations (sags and surges) and short duration discharges.

   Special Instructions:
   - ☐ Review manufacturer's instructions. Battery systems under active warranty shall be maintained in full compliance with the manufacturer's specifications.
   - ☐ Never smoke or carry an open flame in or near the battery room or area.
   - ☐ Use caution in handling the electrolyte, it is harmful to the skin and clothing.
   - ☐ Never remove any connecting cables or straps while charger is on or there is a possibility of a load being on the batteries, (this can cause a spark that may ignite ever present hydrogen gas).
   - ☐ Wear acid resistant apron, gloves, and plastic face shield when handling electrolytes.
   - ☐ Note the location of emergency eyewash and/or shower equipment.
   - ☐ Tables of lead-acid battery characteristics and minimum hours of equalization charge are included for convenience.
   - ☐ Dispose of old batteries in accordance with all applicable Federal, state, and local regulations.
   - ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance" and the InterNational Electrical Testing Association publication, "Maintenance Testing Specifications", as applicable.

Checkpoints:

- ☐ Check battery rack for any structural bending or loose fasteners.
- ☐ Check grounding straps, if applicable, for loose connections.
- ☐ Check the appearance of the battery and its cleanliness. Clean as necessary.
- ☐ Measure and record the total battery float voltage and charge current.
- ☐ Check and adjust as necessary the electrolyte levels.
- ☐ Check the jars and covers for cracks and leakage. Clean and repair or replace battery cells as necessary.
- ☐ Check visually for evidence of any corrosion and clean, if necessary.
- ☐ Measure and record the ambient temperature and adjust to manufacturer's recommendations if necessary (adjust to 77°F in the absence of specific instructions. This is the temperature that will most likely allow the battery to perform to 100% of its rated service life).
- ☐ Check that the ventilation equipment is operating properly.
- ☐ Measure and record the pilot cell voltage. The pilot cell can be any representative cell used repeatedly as a benchmark. (The weakest cell is recommended as the pilot cell).
- ☐ Measure and record the specific gravity of the pilot cell. (Annotate which cell of which battery is the pilot cell.)
- ☐ Record the details of all findings on a maintenance history record.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Hydrometer
- ☐ Distilled water
- ☐ Soft cleaning cloths
- ☐ Thermometer
- ☐ Acid resistant apron, gloves, and plastic face shield.
- ☐ Emergency eye wash that provides at least 0.4 gallons/minute for at least 15 minutes.
- ☐ Digital micro-ohmmeter

Note: The battery gasses much more than normal when equalizing. Take the following precautions when equalizing:

1. Proper ventilation must be employed to remove excessive explosive gasses.

2. As the battery gasses, it displaces electrolyte and levels increase. If levels increase substantially, electrolyte must be removed (save to replace later) to prevent the cells from overflowing. The electrolyte should be replaced after the levels recede.

3. Due to the extreme gassing, it may be necessary to add water to the cells after the equalizing and after any electrolyte has been replaced.

4. Temperature is also a major factor. The cell temperature should be kept as close to normal as possible and under no condition should the temperature be allowed to exceed 110°F.

3. **Battery, Uninterruptible Power System**

Quarterly

This maintenance task applies to batteries that support uninterruptible power systems (UPS). UPS are designed to support a computer through utility power fluctuations (sags and surges) and short duration discharges.

Special Instructions:

- ☐ Review manufacturer's instructions. Battery systems under active warranty shall be maintained in full compliance with the manufacturer's specifications.
- ☐ Never smoke or carry an open flame in or near the battery room or area.
- ☐ Use caution in handling the electrolyte, it is harmful to the skin and clothing.
- ☐ Never remove any connecting cables or straps while charger is on or there is a possibility of a load being on the batteries, (this can cause a spark that may ignite ever present hydrogen gas).
- ☐ Wear acid resistant apron, gloves, and plastic face shield when handling electrolytes.
- ☐ Review Procedure for "Emergency Eyewash and Shower Equipment."
- ☐ Note the location of emergency eyewash and/or shower equipment.
- ☐ Tables of lead-acid battery characteristics and minimum hours of equalization charge are included for convenience.
- ☐ Perform the monthly maintenance simultaneously with this quarterly maintenance.
- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance" and the InterNational Electrical Testing Association publication, "Maintenance Testing Specifications", as applicable.

Checkpoints:

- ☐ Verify the integrity of the battery rack.
- ☐ Measure and record the specific gravity of each cell.
- ☐ Measure and record representative cell temperatures randomly (a minimum of 10% of the system).
- ☐ Use thermographic instrument for sealed battery.
- ☐ Measure and record the float voltage of all cells.

- ☐ Randomly measure and record the torque on 10% of the inter-unit connectors. Adjust improperly torqued connections as necessary.
- ☐ Measure and record a random sampling of 10% of the battery connections resistances, using a calibrated digital micro-ohmmeter.
- ☐ Measure and record battery connection resistance of 10% randomly selected intercell connections.
- ☐ Use a digital micrometer. Clean and remake high resistance connections as necessary.
- ☐ Measure and record the internal impedance of the Valve Regulated Lead Acid (VRLA) battery (AKA sealed or maintenance free battery).

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Hydrometer
- ☐ Distilled water
- ☐ Soft cleaning cloths
- ☐ Thermometer
- ☐ Acid resistant apron, gloves, and plastic face shield.
- ☐ Emergency eyewash that provides at least 0.4 gallons/minute for at least 15 minutes.
- ☐ Digital micro-ohmmeter
- ☐ Torque wrench
- ☐ Thermographic instrument if sealed batteries

4. **Battery, Uninterruptible Power System**
   Annual
   This maintenance task applies to batteries that support uninterruptible power systems (UPS). UPS are designed to support a computer while undergoing utility power fluctuations (sags and surges) and short duration discharges.

   Special Instructions:

   - ☐ Review manufacturer's instructions. Battery systems under active warranty shall be maintained in full compliance with the manufacturer's specifications.
   - ☐ Never smoke or carry an open flame in or near the battery room or area.
   - ☐ Use caution in handling the electrolyte, it is harmful to the skin and clothing.
   - ☐ Never remove any connecting cables or straps while charger is on or there is a possibility of a load being on the batteries, (this can cause a spark that may ignite ever present hydrogen gas).
   - ☐ Wear acid resistant apron, gloves, and plastic face shield when handling electrolytes.
   - ☐ Review Procedure for "Emergency Eyewash and Shower Equipment."

- ☐ Note the location of emergency eyewash and/or shower equipment.
- ☐ Tables of lead-acid battery characteristics and minimum hours of equalization charge are included for convenience.
- ☐ Perform the monthly and quarterly maintenance simultaneously with this annual maintenance.
- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

Checkpoints:

- ☐ Re torque all bolted connections to the battery manufacturer's recommendations.
- ☐ Measure and record all bolted battery connections resistances in micro-ohms.
- ☐ Conduct a performance test to determine the ability of the battery system to perform under load.
- ☐ Notify appropriate personnel. Do this not more than once per year as excessive loading may shorten battery life. Interrupt the power supplied to the UPS to initiate a battery run. Measure and record the discharge time and ensure that it meets the design specification. Monitor the battery jar interconnections with a thermographic device for signs of heat and poor connections. Correct any deficiencies found.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer’s instruction manual for specialized tools, equipment and supplies.
- ☐ Hydrometer
- ☐ Distilled water
- ☐ Soft cleaning cloths
- ☐ Thermometer
- ☐ Acid resistant apron, gloves, and plastic face shield.
- ☐ Emergency eye wash that provides at least 0.4 gallons/minute for at least 15 minutes.
- ☐ Digital micro-ohmmeter
- ☐ Torque wrench
- ☐ Thermographic instrument

5. **Lead Acid Battery**
   Quarterly
   This maintenance task is for regular lead acid type batteries used for switch gear, control circuits, fire alarm systems, sprinkler supervisory systems and transformer supervisory systems where the source of DC power must be reliable.

Special Instructions:

- [ ] Review manufacturer's instructions.
- [ ] Never smoke or carry an open flame in or near the battery room or area.
- [ ] Use caution in handling the electrolyte, it is harmful to the skin and clothing.
- [ ] Never remove any connecting cables or straps while charger is on or there is a possibility of a load being on the batteries, (this can cause a spark that may ignite ever present hydrogen gas).
- [ ] Wear acid resistant apron, gloves, and plastic face shield when handling electrolytes.
- [ ] Review Procedure for "Emergency Eyewash and Shower Equipment." Note the location of emergency eyewash and/or shower equipment.
- [ ] Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance" and the InterNational Electrical Testing Association publication, "Maintenance Testing Specifications", as applicable.

Checkpoints:

- [ ] With the battery charger disconnected, measure voltage and specific gravity for each cell and record results. Check and record the temperature of two cells in each row. The specific gravity shall be within the range specified by the manufacturer. (Typically ranging from 1.205 – 1.220 for regular batteries and from 1.240 – 1.260 for high performance batteries).
- [ ] With the battery charger disconnected, conduct a load voltage test by measuring and recording the voltage of each cell with the battery carrying the full connected load. An artificial load equal to the full load connected to the battery may be used for this test. The battery voltage shall not fall below 2.05 volts per cell while under load.
- [ ] With the battery disconnected, conduct a discharge test by following the manufacturer's instructions and measuring and recording the voltage of each cell after load testing the batteries for a minimum of 30 minutes. An artificial load equal to the full load connected to the battery may be used for this test.
- [ ] The voltage shall not fall below the levels specified.
- [ ] When the electrolyte is at the lowest mark, add distilled water to bring it to the proper level. Record amount of water used. Abnormal use of water indicates overcharging.
- [ ] If a wide variance was found between cell voltages, raise voltage from charger for 8 to 24 hours to give the batteries an equalizing charge. Then, return to floating rate.
- [ ] Check voltage and specific gravity for each cell and record results. Compare readings with manufacturer's recommendations.

- ☐ With the battery charger connected and the batteries fully charged, conduct a charger test by measuring and recording the voltage across the batteries. The voltage shall be 2.30 volts per cell ±0.02 volts (at 25°C or 77°F) or as specified by the manufacturer.
- ☐ Wipe salt and dirt accumulation from batteries with disposable cloth taking care not to drop foreign matter into batteries.
- ☐ Clean terminals and tighten connections and check condition of wiring.
- ☐ Check battery cable and battery supports for deterioration, paying special attention to wooden members.
- ☐ Replace battery when it no longer carries the proper charge. Old batteries will be disposed in accordance with all applicable Federal, state, and local regulations.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Hydrometer
- ☐ Distilled water
- ☐ Soft cleaning cloths
- ☐ Thermometer
- ☐ Acid resistant apron, gloves, and plastic face shield.
- ☐ Emergency eyewash that provides at least 0.4 gallons/minute for at least 15 minutes.

6. **Lead Acid Battery – Sealed Type (Gel Cell)**
   Quarterly
   This maintenance task is for sealed lead acid type batteries used for switchgear, control circuits, fire alarm systems, sprinkler supervisory systems and transformer supervisory systems where the source of DC power must be reliable.

   Special Instructions:

   - ☐ Review manufacturer's instructions.
   - ☐ Never smoke or carry an open flame in or near the battery room or area.
   - ☐ Use caution in handling the electrolyte, it is harmful to the skin and clothing.
   - ☐ Never remove any connecting cables or straps while charger is on or there is a possibility of a load being on the batteries.
   - ☐ Wear acid resistant apron, gloves, and plastic face shield when handling electrolytes.
   - ☐ Review Procedure for "Emergency Eyewash and Shower Equipment." Note the location of emergency eyewash and/or shower equipment.
   - ☐ 8. Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance"

and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

Checkpoints:

- ☐ With the battery charger disconnected, measure voltage for each cell and record results.
- ☐ With the battery charger disconnected, conduct a load voltage test by measuring and recording the voltage of each cell with the battery carrying the full connected load. An artificial load equal to the full load connected to the battery may be used for this test. The battery voltage shall not fall below 2.05 volts per cell under load.
- ☐ With the battery disconnected, conduct a discharge test by following the manufacturer's instructions and measuring and recording the voltage of each cell while load testing the batteries for a minimum of 30 minutes. An artificial load equal to the full load connected to the battery may be used for this test. The voltage shall not fall below the levels specified.
- ☐ If a wide variance was found between cell voltages, raise voltage from charger for 8 to 24 hours to give the batteries an equalizing charge. Then, return to floating rate.
- ☐ Check voltage for each cell and record results. Compare readings with manufacturer's recommendations.
- ☐ With the battery charger connected and the batteries fully charged, conduct a charger test by measuring and recording the voltage across the batteries. The voltage shall be 2.30 volts per cell ±0.02 volts (at 25°C or 77°F) or as specified by the manufacturer.
- ☐ Wipe salt and dirt accumulation from batteries with disposable cloth taking care not to drop foreign matter into batteries.
- ☐ Clean terminals and tighten connections and check condition of wiring.
- ☐ Check battery cable and battery supports for deterioration, paying special attention to wooden members.
- ☐ Replace battery every four years. Disposal of old batteries will be in accordance with all applicable Federal, state, and local regulations.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer’s instruction manual for specialized tools, equipment and supplies.
- ☐ Soft cleaning cloths
- ☐ Acid resistant apron, gloves, and plastic face shield.
- ☐ Emergency eyewash that provides at least 0.4 gallons/minute for at least 15 minutes.

7. **Nickel Cadmium Battery**
   Quarterly
   This maintenance task applies to nickel cadmium type batteries that are used for switchgear, control circuits, fire alarm systems, sprinkler supervisory systems and transformer supervisory systems that require a reliable source of DC power.

Special Instructions:

- [ ] Review manufacturer's instructions.
- [ ] Never smoke or carry an open flame in or near the battery room or area.
- [ ] Use caution in handling the electrolyte, it is harmful to the skin and clothing.
- [ ] Never remove any connecting cables or straps while charger is on or there is a possibility of a load being on the batteries.
- [ ] Wear acid resistant apron, gloves and plastic face shield when handling electrolytes.
- [ ] Review Procedure for "Emergency Eyewash and Shower Equipment." Note the location of emergency eyewash and/or shower equipment.

Checkpoints:

- [ ] With the battery charger disconnected, measure voltage for entire battery and record results.
- [ ] With the battery charger disconnected, conduct a load voltage test by measuring and recording the voltage of the entire battery with the battery carrying the full connected load. An artificial load equal to the full load connected to the battery may be used for this test. Under load, the battery voltage shall not fall below 1.42 volts per cell nominal. Measure cells individually if possible.
- [ ] With the battery disconnected, conduct a discharge test by following the manufacturer's instructions and measuring and recording the voltage of each cell while load testing the batteries for a minimum of 30 minutes. An artificial load equal to the full load connected to the battery may be used for this test. The voltage shall not fall below the levels specified.
- [ ] With the battery charger connected and the batteries fully charged, conduct a charger test by placing an amp meter in series with the battery under charge. The charging current shall be the manufacturer's recommendation for the type of battery used.
- [ ] Add distilled water to bring the electrolyte up to the proper level, and record the amount used.
- [ ] Abnormal use of water indicates overcharging. Allow room for liquid expansion.
- [ ] Wipe salt and dirt accumulation from batteries with disposable cloth taking care not to drop foreign matter into batteries.
- [ ] Clean terminals and tighten connections and check condition of wiring.
- [ ] Check battery cable and battery supports for deterioration, paying special attention to wooden members.
- [ ] Replace battery every three years. Disposal of old batteries will be in accordance with all applicable Federal, state, and local regulations.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Electrolyte
- ☐ Soft cleaning cloths
- ☐ Acid resistant apron, gloves, and plastic face shield.
- ☐ Emergency eye wash that provides at least 0.4 gallons/minute for at least 15 minutes.

8. **Primary Battery (Dry Cell)**
   Monthly
   This maintenance task is for primary type (1.5 volt dry cell) batteries used for switchgear, control circuits, fire alarm systems, sprinkler supervisory systems and transformer supervisory systems where the source of DC power must be reliable.

   Special Instructions:
   - ☐ Review manufacturer's instructions.
   - ☐ The maximum load for a No. 6 primary battery shall not be more than two amperes per cell.

   Checkpoints:
   - ☐ Conduct a load voltage test by measuring and recording the voltage when applying a one test ohm load on an individual (1.5 volt) cell.
   - ☐ Replace the battery when the voltage is reduced below one volt.
   - ☐ Replace a 6-volt battery assembly when a test load of four ohms reduces the voltage below four volts.
   - ☐ Clean terminals and tighten connections and check condition of wiring.

   Recommended Tools, Materials, and Equipment:
   - ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
   - ☐ One ohm test load
   - ☐ Soft cleaning cloths
   - ☐ Replacement batteries

II. Bus Duct

1. **Bus Duct, Low Voltage, and Connectors (Aluminum)**
   Annual
   This maintenance task applies to grounded metal enclosures rated not higher than 600 volts and containing conductors that are either bare or insulated and normally constructed of copper or aluminum bars, rods, or tubes.

Special Instructions:

- [ ] Schedule this maintenance outage with operating personnel. Adjust the scheduling of the checkpoints below to minimize disturbances to the students. Electrical tests should be performed during maximum building loads. Other PM and repair work may be done at other than normal working hours.
- [ ] Review the one line diagram.
- [ ] Review "as-built" electric drawings for location of connections.
- [ ] Review manufacturer's specifications and test standards.
- [ ] Review Procedure for "Controlling Hazardous Energy Sources."
- [ ] De-energize, lock, and tag circuit.
- [ ] Aluminum wiring, bus duct and connectors require special care. Follow manufacturer's recommendations when assembling and torturing aluminum connections.
- [ ] All tests shall conform to the appropriate ASTM test procedure and infrared field procedures; the values used as standards shall conform to the manufacturer's and ANSI Standards specifications.
- [ ] Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

Checkpoints:

- [ ] Remove all covers, insulators, etc., in accordance with manufacturer's specifications and test standards.
- [ ] Inspect for physical damage and mechanical conditions, including all connections where bus is joined, at turns, and at feeder connections. Verify that ventilation openings are unobstructed. Visually inspect for bus alignment according to electrical drawings.
- [ ] Inspect for proper bracing, suspension alignment, and enclosure ground.
- [ ] Remove any corrosion and all trash, debris, and combustible material found in the bus duct.
- [ ] Check indoor bus ducts for signs of exposure to liquids and take steps to remove them or protect the bus duct from sources of these liquids.
- [ ] Check outdoor bus ducts and verify that all weephole screws have been removed in accordance with the manufacturer's instructions, if applicable, and that the joint shield has been properly installed. Ensure that weep holes are on the bottom covers only.
- [ ] Plugs:
    - [ ] Check for the proper operation of the circuit breaker and fusible plugs.
    - [ ] Check plug hangars for tightness to ensure a suitable ground.

- [ ] If hook sticks are required for plug installation, check their availability.
- [ ] Visually check cable and raceways for proper bonding to fittings (plugs, tap boxes).
- [ ] Check tightness of bolted connections with a calibrated torque-wrench in accordance with manufacturer's specifications. If instructions are unavailable use tables included in this task. If Belleville type spring washers were installed and are visible; check them for flatness as a way to indicate tightening to the proper torque. CAUTION: Do not over torque.
- [ ] Energize the system. Thermo graphically scan bus duct, bus duct connections, bus duct switches, and bus duct switchgear in their entirety with a thermographic (infrared) scanner. Perform this survey while the system is under maximum possible load, but not less than ten percent (10%) of the rated load of the electrical equipment being inspected, to detect hot spots.
- [ ] Check neutral conductors with an ammeter if harmonic (nonlinear) loads are present or suspected (i.e., computers, variable speed drives and UPS systems). Report any abnormal currents.
- [ ] De-energize the system. Correct the cause of all hot spots, heat rises, phase imbalances, and any other problem that the test reveals. All such corrected deficiencies shall be retested to ensure proper performance levels.
- [ ] Replace all covers as applicable.
- [ ] Perform an insulation resistance test of each bus run phase to phase and phase to ground. If the results of this test create uncertainty about the adequacy of the insulation, a high potential test according to the manufacturer's recommendations is recommended. Note: Frequent high potential testing is undesirable.
- [ ] Verify heater operation.
- [ ] Correct deficiencies according to the manufacturer's instructions. Remove tags and locks; Megger circuit to expose any short circuits prior to returning unit to service.
- [ ] Thermo graphically scan bus along entire length while under load.
- [ ] Provide thermographic test results on all initially tested areas and thermographic imaging pictures of "hot spots" to the buildings manager.
- [ ] Provide thermographic test results and thermographic imaging pictures of all repaired areas as marked in the field to the buildings manager.
- [ ] Clean work area.

Recommended Tools, Materials, and Equipment:

- [ ] Standard Tools – Basic.
- [ ] Calibrated torque-wrenches.
- [ ] Infrared thermographic scanner that can detect a one degree Centigrade rise in temperature between subject area reference at 30 degrees Centigrade.

- ☐ Appropriate Megger (megohmmeter) and ammeter test equipment in accordance with industry standards.
- ☐ A.C. or D.C. high potential test equipment, as directed.
- ☐ Materials required for repairs, such as bus conductor, cable, bolts, nuts, and equipment in accordance with industry standards.
- ☐ Ladder. Check ladder for defects. Do not use defective ladders.

2. **Bus Duct, Low Voltage, and Connectors (Copper)**
   Three Years
   This maintenance task applies to grounded metal enclosures rated not higher than 600 volts and containing conductors that are either bare or insulated and normally constructed of copper or aluminum bars, rods, or tubes.

   Special Instructions:
   - ☐ Schedule this maintenance outage with operating personnel. Adjust the scheduling of the checkpoints below to minimize disturbances to the students. Electrical tests should be performed during maximum building loads. Other PM and repair work may be done at other than normal working hours.
   - ☐ Review the one line diagram.
   - ☐ Review "as-built" electric drawings for location of connections.
   - ☐ Review manufacturer's specifications and test standards.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock, and tag circuit.
   - ☐ Aluminum wiring, bus duct and connectors require special care. Follow manufacturer's recommendations when assembling and torturing aluminum connections.
   - ☐ All tests shall conform to the appropriate ASTM test procedure and infrared field procedures; the values used as standards shall conform to the manufacturer's and ANSI Standards specifications.
   - ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

   Checkpoints:
   - ☐ Remove all covers, insulators, etc., in accordance with manufacturer's specifications and test standards.
   - ☐ Inspect for physical damage and mechanical conditions, including all connections where bus is joined, at turns, and at feeder connects. Verify that ventilation openings are unobstructed. Visually inspect for bus alignment according to electrical drawings.

- [ ] Inspect for proper bracing, suspension alignment, and enclosure ground.
- [ ] Remove any corrosion and all trash, debris, and combustible material found in the bus duct.
- [ ] Check indoor bus ducts for signs of exposure to liquids and take steps to remove them or protect the bus duct from sources of these liquids.
- [ ] Check outdoor bus ducts and verify that all weephole screws have been removed in accordance with the manufacturer's instructions, if applicable, and that the joint shield has been properly installed.
- [ ] Ensure that weep holes are on the bottom covers only.
- [ ] Plugs:
    - [ ] Check for the proper operation of the circuit breaker and fusible plugs.
    - [ ] Check plug hangars for tightness to ensure a suitable ground.
    - [ ] If hook sticks are required for plug installation, check their availability.
- [ ] Visually check cable and raceways for proper bonding to fittings (plugs, tap boxes).
- [ ] Check tightness of bolted connections with a calibrated torque-wrench in accordance with manufacturer's specifications. If instructions are unavailable use tables included in this task. If Belleville type spring washers were installed and are visible; check them for flatness as a way to indicate tightening to the proper torque. CAUTION: Do not over torque.
- [ ] Energize the system. Thermo graphically scan bus duct, bus duct connections, bus duct switches, and bus duct switchgear in their entirety with a thermographic (infrared) scanner. Perform this survey while the system is under maximum possible load, but not less than ten percent (10%) of the rated load of the electrical equipment being inspected, to detect hot spots.
- [ ] Check neutral conductors with an ammeter if harmonic (nonlinear) loads are present or suspected (i.e., computers, variable speed drives and UPS systems). Report any abnormal currents.
- [ ] De-energize the system. Correct the cause of all hot spots, heat rises, phase imbalances, and any other problem that the test reveals. All such corrected deficiencies shall be retested to ensure proper performance levels.
- [ ] Replace all covers as applicable.
- [ ] Perform an insulation resistance test of each bus run phase to phase and phase to ground. If the results of this test create uncertainty about the adequacy of the insulation, a high potential test according to the manufacturer's recommendations is recommended. Note: Frequent high potential testing is undesirable.
- [ ] Verify heater operation.
- [ ] Correct deficiencies according to the manufacturer's instructions. Remove tags and locks; Megger circuit to expose any short circuits prior to returning unit to service.
- [ ] Thermo graphically scan bus along entire length while under load.

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- ☐ Provide thermographic test results on all initially tested areas and thermographic imaging pictures of "hot spots" to the facility maintenance manager.
- ☐ Provide thermographic test results and thermographic imaging pictures of all repaired areas as marked in the field to the facility maintenance manager.
- ☐ Clean work area.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Calibrated torque-wrenches
- ☐ Infrared thermographic scanner that can detect a one degree Centigrade rise in temperature between subject area reference at 30 degrees Centigrade.
- ☐ Appropriate Megger (megohmmeter) and ammeter test equipment in accordance with industry standards.
- ☐ A.C. or D.C. high potential test equipment, as directed.
- ☐ Materials required for repairs, such as bus conductor, cable, bolts, nuts, and equipment in accordance with industry standards.
- ☐ Ladder. Check ladder for defects. Do not use defective ladders.

3. **Bus Duct, Low Voltage, and Connectors (Outdoors)**
   Annual
   This maintenance task applies to grounded metal enclosures rated not higher than 600 volts and containing conductors that are either bare or insulated and normally constructed of copper or aluminum bars, rods, or tubes.

   Special Instructions:

   - ☐ Schedule this maintenance outage with operating personnel. Adjust the scheduling of the checkpoints below to minimize disturbances to the students. Electrical tests should be performed during maximum building loads. Other PM and repair work may be done at other than normal working hours.
   - ☐ Review the one line diagram.
   - ☐ Review "as-built" electric drawings for location of connections.
   - ☐ Review manufacturer's specifications and test standards.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock, and tag circuit.
   - ☐ Aluminum wiring, bus duct and connectors require special care. Follow manufacturer's recommendations when assembling and torturing aluminum connections.

- ☐ All tests shall conform to the appropriate ASTM test procedure and infrared field procedures; the values used as standards shall conform to the manufacturer's and ANSI Standards specifications.
- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

Checkpoints:

- ☐ Remove all covers, insulators, etc., in accordance with manufacturer's specifications and test standards.
- ☐ Inspect for physical damage and mechanical conditions, including all connections where bus is joined, at turns, and at feeder connects. Verify that ventilation openings are unobstructed. Visually inspect for bus alignment according to electrical drawings.
- ☐ Inspect for proper bracing, suspension alignment, and enclosure ground.
- ☐ Remove any corrosion and all trash, debris, and combustible material found in the bus duct.
- ☐ Check indoor bus ducts for signs of exposure to liquids and take steps to remove them or protect the bus duct from sources of these liquids.
- ☐ Check outdoor bus ducts and verify that all weephole screws have been removed in accordance with the manufacturer's instructions, if applicable, and that the joint shield has been properly installed.
- ☐ Ensure that weep holes are on the bottom covers only.
- ☐ Plugs:
    - ☐ Check for the proper operation of the circuit breaker and fusible plugs.
    - ☐ Check plug hangars for tightness to ensure a suitable ground.
    - ☐ If hook sticks are required for plug installation, check their availability.
- ☐ Visually check cable and raceways for proper bonding to fittings (plugs, tap boxes).
- ☐ Check tightness of bolted connections with a calibrated torque-wrench in accordance with manufacturer's specifications. If instructions are unavailable use tables included in this task. If Belleville type spring washers were installed and are visible; check them for flatness as a way to indicate tightening to the proper torque. CAUTION: Do not over torque.
- ☐ Energize the system. Thermo graphically scan bus duct, bus duct connections, bus duct switches, and bus duct switchgear in their entirety with a thermographic (infrared) scanner. Perform this survey while the system is under maximum possible load, but not less than ten percent (10%) of the rated load of the electrical equipment being inspected, to detect hot spots.

- ☐ Check neutral conductors with an ammeter if harmonic (nonlinear) loads are present or suspected (i.e., computers, variable speed drives and UPS systems). Report any abnormal currents.
- ☐ De-energize the system. Correct the cause of all hot spots, heat rises, phase imbalances, and any other problem that the test reveals. All such corrected deficiencies shall be retested to ensure proper performance levels.
- ☐ Replace all covers as applicable.
- ☐ Perform an insulation resistance test of each bus run phase to phase and phase to ground. If the results of this test create uncertainty about the adequacy of the insulation, a high potential test according to the manufacturer's recommendations is recommended. Note: Frequent high potential testing is undesirable.
- ☐ Verify heater operation.
- ☐ Correct deficiencies according to the manufacturer's instructions. Remove tags and locks; Megger circuit to expose any short circuits prior to returning unit to service.
- ☐ Thermo graphically scan bus along entire length while under load.
- ☐ Provide thermographic test results on all initially tested areas and thermographic imaging pictures of "hot spots" to the facility maintenance manager.
- ☐ Provide thermographic test results and thermographic imaging pictures of all repaired areas as marked in the field to the facility maintenance manager.
- ☐ Clean work area.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Calibrated torque-wrenches
- ☐ Infrared thermographic scanner that can detect a one degree Centigrade rise in temperature between subject area reference at 30 degrees Centigrade.
- ☐ Appropriate Megger (megohmmeter) and ammeter test equipment in accordance with industry standards.
- ☐ A.C. or D.C. high potential test equipment, as directed.
- ☐ Materials required for repairs, such as bus conductor, cable, bolts, nuts, and equipment in accordance with industry standards.
- ☐ Ladder. Check ladder for defects. Do not use defective ladders.

4. **Bus Duct, Metal Enclosed and Connectors (Aluminum)**
   Annual
   This maintenance task applies to medium voltage (600 v. to 15 KV.) grounded metal enclosures containing conductors that are either bare or insulated and normally constructed of copper or

aluminum bars, rods, or tubes. This is the non segregated type of bus duct used for the connection of transformers and switchgear and interconnection of switchgear lineups.

Special Instructions:

- [ ] Schedule this maintenance outage with operating personnel. Adjust the scheduling of the checkpoints below to minimize disturbances to the tenants. Electrical tests should be performed during maximum building loads. Other PM and repair work may be done at other than normal working hours.
- [ ] Review the one line diagram.
- [ ] Review "as-built" electrical drawings for location of connections.
- [ ] Review manufacturer's specifications and test standards.
- [ ] Review Procedure for "Controlling Hazardous Energy Sources."
- [ ] De-energize, lock, and tag circuit.
- [ ] Aluminum wiring, bus duct and connectors require special care. Follow manufacturer’s recommendations when assembling and torquing aluminum connections.
- [ ] All tests shall conform to the appropriate ASTM test procedure and infrared field procedures; the values used as standards shall conform to the manufacturer's and ANSI Standards specifications.
- [ ] Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.
- [ ] Use ladders constructed according to OSHA/ANSI standards. Check ladder for defects. Do not use defective ladders.

Checkpoints:

- [ ] Remove all covers, insulators, etc., in accordance with manufacturer's specifications and test standards.
- [ ] Inspect for physical damage and mechanical conditions, including all connections where bus is joined, at turns, and at feeder connects. Verify that ventilation openings are unobstructed. Visually inspect for bus alignment according to electrical drawings.
- [ ] Inspect for proper bracing, suspension alignment, and enclosure ground.
- [ ] Remove any corrosion and all trash, debris, and combustible material found in the bus duct.
- [ ] Check indoor bus ducts for signs of exposure to liquids and take steps to remove them or protect the bus duct from sources of these liquids.
- [ ] Check outdoor bus ducts and verify that all weephole screws have been removed in accordance with the manufacturer's instructions, if applicable, and that the joint shield has been properly installed.

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- [ ] Ensure that weep holes are on the bottom covers only.
- [ ] Visually inspect bus supports for dirt or tracking. Clean dirty insulators; replace insulators that are cracked or show evidence of tracking.
- [ ] Check tightness of bolted connections with a calibrated torque-wrench in accordance with manufacturer's specifications. If Belleville type spring washers were installed and are visible, check them for flatness as a way to indicate tightening to the proper torque. CAUTION: Do not over torque.
- [ ] Check for proper operation of space heaters. Ammeters in heater supply circuits allow observation of heater loads to determine if one or more heater units are defective.
- [ ] Energize the system. Thermo graphically scan bus duct, bus duct connections, bus duct switches, and bus duct switchgear in their entirety with a thermographic scanner. Perform this survey while system is under maximum possible load, but not less than ten percent (10%) of the rated load of the electrical system being inspected, to detect hot spots.
- [ ] Check neutral conductors with an ammeter if harmonic (nonlinear) loads are present or suspected (i.e., computers, variable speed drives and UPS systems). Report any abnormal currents.
- [ ] De-energize the system. Correct the cause of all hot spots, heat rises, phase imbalances, and any other problem that the test reveals. All such corrected deficiencies shall be retested to ensure proper performance levels.
- [ ] Replace all covers as applicable.
- [ ] Perform an insulation resistance test of each bus run phase to phase and phase to ground. If the results of this test create uncertainty about the adequacy of the insulation, a high potential test according to the manufacturer's recommendations is recommended. Note: Frequent high potential testing is undesirable.
- [ ] Unless otherwise directed, perform a high potential test in accordance with IEEE 27. Conduct this test at 75% of the rated insulation withstand levels that follow:
- [ ] Correct deficiencies according to the manufacturer's instructions. Remove tags and locks. Megger circuits to expose any short circuits prior to returning unit to service.
- [ ] Thermo graphically scan bus along entire length while under load.
- [ ] Provide thermographic test results on all initially tested areas and thermographic imaging pictures of "hot spots" to the facility maintenance manager.
- [ ] Provide thermographic test results and thermographic imaging pictures of all repaired areas as marked in the field to the facility maintenance manager.
- [ ] Clean work area.

Recommended Tools, Materials, and Equipment:

- [ ] Standard Tools – Basic
- [ ] Calibrated torque-wrenches

- ☐ Infrared thermographic scanner that can detect a one degree Centigrade rise in temperature between subject area references at 30 degrees Centigrade.
- ☐ Appropriate Megger (megohmmeter) and ammeter test equipment in accordance with industry standards.
- ☐ A.C. or D.C. high-potential test equipment, as directed.
- ☐ Materials required for repairs, such as bus conductor, cable, bolts, nuts, and equipment in accordance with industry standards.
- ☐ Ladder. Check ladder for defects. Do not use defective ladders.

5. **Bus Duct, Metal Enclosed and Connectors (Copper)**
   Three Years
   This maintenance task applies to medium voltage (600 v. to 15 KV.) grounded metal enclosures containing conductors that are either bare or insulated and normally constructed of copper or aluminum bars, rods, or tubes. This is the non segregated type of bus duct used for the connection of transformers and switchgear and interconnection of switchgear lineups.

   Special Instructions:
   - ☐ Schedule this maintenance outage with operating personnel. Adjust the scheduling of the checkpoints below to minimize disturbances to the tenants. Electrical tests should be performed during maximum building loads. Other PM and repair work may be done at other than normal working hours.
   - ☐ Review the one line diagram.
   - ☐ Review "as-built" electrical drawings for location of connections.
   - ☐ Review manufacturer's specifications and test standards.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock, and tag circuit.
   - ☐ Aluminum wiring, bus duct and connectors require special care. Follow manufacturer’s recommendations when assembling and torquing aluminum connections.
   - ☐ All tests shall conform to the appropriate ASTM test procedure and infrared field procedures; the values used as standards shall conform to the manufacturer's and ANSI Standards specifications.
   - ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.
   - ☐ Use ladders constructed according to OSHA/ANSI standards. Check ladder for defects. Do not use defective ladders.

   Checkpoints:

- [ ] Remove all covers, insulators, etc., in accordance with manufacturer's specifications and test standards.
- [ ] Inspect for physical damage and mechanical conditions, including all connections where bus is joined, at turns, and at feeder connects. Verify that ventilation openings are unobstructed. Visually inspect for bus alignment according to electrical drawings.
- [ ] Inspect for proper bracing, suspension alignment, and enclosure ground.
- [ ] Remove any corrosion and all trash, debris, and combustible material found in the bus duct.
- [ ] Check indoor bus ducts for signs of exposure to liquids and take steps to remove them or protect the bus duct from sources of these liquids.
- [ ] Check outdoor bus ducts and verify that all weephole screws have been removed in accordance with the manufacturer's instructions, if applicable, and that the joint shield has been properly installed.
- [ ] Ensure that weep holes are on the bottom covers only.
- [ ] Visually inspect bus supports for dirt or tracking. Clean dirty insulators; replace insulators that are cracked or show evidence of tracking.
- [ ] Check tightness of bolted connections with a calibrated torque-wrench in accordance with manufacturer's specifications. If Belleville type spring washers were installed and are visible, check them for flatness as a way to indicate tightening to the proper torque. CAUTION: Do not over torque.
- [ ] Check for proper operation of space heaters. Ammeters in heater supply circuits allow observation of heater loads to determine if one or more heater units are defective.
- [ ] Energize the system. Thermo graphically scan bus duct, bus duct connections, bus duct switches, and bus duct switchgear in their entirety with a thermographic scanner. Perform this survey while system is under maximum possible load, but not less than ten percent (10%) of the rated load of the electrical system being inspected, to detect hot spots.
- [ ] Check neutral conductors with an ammeter if harmonic (nonlinear) loads are present or suspected (i.e., computers, variable speed drives, and UPS systems). Report any abnormal currents.
- [ ] De-energize the system. Correct the cause of all hot spots, heat rises, phase imbalances, and any other problem that the test reveals. All such corrected deficiencies shall be retested to ensure proper performance levels.
- [ ] Replace all covers as applicable.
- [ ] Perform an insulation resistance test of each bus run phase to phase and phase to ground. If the results of this test create uncertainty about the adequacy of the insulation, a high potential test according to the manufacturer's recommendations is recommended. Note: Frequent high potential testing is undesirable.

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- ☐ Unless otherwise directed, perform a high potential test in accordance with IEEE 27. Conduct this test at 75% of the rated insulation withstand levels that follow:
- ☐ Correct deficiencies according to the manufacturer's instructions. Remove tags and locks. Megger circuits to expose any short circuits prior to returning unit to service.
- ☐ Thermo graphically scan bus along entire length while under load.
- ☐ Provide thermographic test results on all initially tested areas and thermographic imaging pictures of "hot spots" to the facility maintenance manager.
- ☐ Provide thermographic test results and thermographic imaging pictures of all repaired areas as marked in the field to the facility maintenance manager.
- ☐ Clean work area.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Calibrated torque-wrenches
- ☐ Infrared thermographic scanner that can detect a one degree Centigrade rise in temperature between subject area references at 30 degrees Centigrade.
- ☐ Appropriate Megger (megohmmeter) and ammeter test equipment in accordance with industry standards.
- ☐ A.C. or D.C. high-potential test equipment, as directed.
- ☐ Materials required for repairs, such as bus conductor, cable, bolts, nuts, and equipment in accordance with industry standards.
- ☐ Ladder. Check ladder for defects. Do not use defective ladders.

6. **Bus Duct, Metal Enclosed and Connectors (Outdoors)**
Annual
This maintenance task applies to medium voltage (600 v. to 15 KV.) grounded metal enclosures containing conductors that are either bare or insulated and normally constructed of copper or aluminum bars, rods, or tubes. This is the non segregated type of bus duct used for the connection of transformers and switchgear and interconnection of switchgear lineups.

Special Instructions:

- ☐ Schedule this maintenance outage with operating personnel. Adjust the scheduling of the checkpoints below to minimize disturbances to the tenants. Electrical tests should be performed during maximum building loads. Other PM and repair work may be done at other than normal working hours.
- ☐ Review the one line diagram.
- ☐ Review "as-built" electrical drawings for location of connections.
- ☐ Review manufacturer's specifications and test standards.

- [ ] Review Procedure for "Controlling Hazardous Energy Sources."
- [ ] De-energize, lock, and tag circuit.
- [ ] Aluminum wiring, bus duct and connectors require special care. Follow manufacturer's recommendations when assembling and torquing aluminum connections.
- [ ] All tests shall conform to the appropriate ASTM test procedure and infrared field procedures; the values used as standards shall conform to the manufacturer's and ANSI Standards specifications.
- [ ] Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance" and the InterNational Electrical Testing Association publication, "Maintenance Testing Specifications", as applicable.
- [ ] Use ladders constructed according to OSHA/ANSI standards. Check ladder for defects. Do not use defective ladders.

Checkpoints:

- [ ] Remove all covers, insulators, etc., in accordance with manufacturer's specifications and test standards.
- [ ] Inspect for physical damage and mechanical conditions, including all connections where bus is joined, at turns, and at feeder connects. Verify that ventilation openings are unobstructed. Visually inspect for bus alignment according to electrical drawings.
- [ ] Inspect for proper bracing, suspension alignment, and enclosure ground.
- [ ] Remove any corrosion and all trash, debris, and combustible material found in the bus duct.
- [ ] Check indoor bus ducts for signs of exposure to liquids and take steps to remove them or protect the bus duct from sources of these liquids.
- [ ] Check outdoor bus ducts and verify that all weephole screws have been removed in accordance with the manufacturer's instructions, if applicable, and that the joint shield has been properly installed. Ensure that weep holes are on the bottom covers only.
- [ ] Visually inspect bus supports for dirt or tracking. Clean dirty insulators; replace insulators that are cracked or show evidence of tracking.
- [ ] Check tightness of bolted connections with a calibrated torque-wrench in accordance with manufacturer's specifications. If Belleville type spring washers were installed and are visible, check them for flatness as a way to indicate tightening to the proper torque. CAUTION: Do not over torque.
- [ ] Check for proper operation of space heaters. Ammeters in heater supply circuits allow observation of heater loads to determine if one or more heater units are defective.
- [ ] Energize the system. Thermo graphically scan bus duct, bus duct connections, bus duct switches, and bus duct switchgear in their entirety with a thermographic scanner. Perform

this survey while system is under maximum possible load, but not less than ten percent (10%) of the rated load of the electrical system being inspected, to detect hot spots.

- ☐ Check neutral conductors with an ammeter if harmonic (nonlinear) loads are present or suspected (i.e., computers, variable speed drives, and UPS systems). Report any abnormal currents.
- ☐ De-energize the system. Correct the cause of all hot spots, heat rises, phase imbalances, and any other problem that the test reveals. All such corrected deficiencies shall be retested to ensure proper performance levels.
- ☐ Replace all covers as applicable.
- ☐ Perform an insulation resistance test of each bus run phase to phase and phase to ground. If the results of this test create uncertainty about the adequacy of the insulation, a high potential test according to the manufacturer's recommendations is recommended. Note: Frequent high potential testing is undesirable.
- ☐ Unless otherwise directed, perform a high potential test in accordance with IEEE 27. Conduct this test at 75% of the rated insulation withstand levels that follow:
- ☐ Correct deficiencies according to the manufacturer's instructions. Remove tags and locks. Megger circuits to expose any short circuits prior to returning unit to service.
- ☐ Thermo graphically scan bus along entire length while under load.
- ☐ Provide thermographic test results on all initially tested areas and thermographic imaging pictures of "hot spots" to the facility maintenance manager.
- ☐ Provide thermographic test results and thermographic imaging pictures of all repaired areas as marked in the field to the facility maintenance manager.
- ☐ Clean work area.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Calibrated torque-wrenches
- ☐ Infrared thermographic scanner that can detect a one degree Centigrade rise in temperature between subject area references at 30 degrees Centigrade.
- ☐ Appropriate Megger (megohmmeter) and ammeter test equipment in accordance with industry standards.
- ☐ A.C. or D.C. high-potential test equipment, as directed.
- ☐ Materials required for repairs, such as bus conductor, cable, bolts, nuts, and equipment in accordance with industry standards.
- ☐ Ladder. Check ladder for defects. Do not use defective ladders.

7. **Clocks, Central System**
   Semiannual

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ This maintenance task should be done in spring and fall when time is changed from standard to daylight and back.

Checkpoints:

- ☐ Clean dirt and dust from interior and exterior of cabinet.
- ☐ Adjust relays, check transmission of signal.
- ☐ Tighten contacts and terminal screws.
- ☐ Burnish contacts if necessary.
- ☐ Perform work suggested by manufacturer's instruction book.

8. **Dimmer and Control, Stage and General Lighting**
Quarterly
This maintenance task applies to dimmers and control panels, both at unit and remotely located, used to control light levels of general and special lights in auditoriums, large conference rooms, etc.

Special Instructions:

- ☐ Obtain and review manufacturer's instructions and precautions.
- ☐ Schedule maintenance with usage of facility to prevent disruption.

Checkpoints:

- ☐ Dimmer Unit:
  - ☐ Remove necessary access covers and panels.
  - ☐ Check supply voltage.
  - ☐ Tighten all connections to main breaker, sub breakers, contactors, etc.
  - ☐ Check operation of contactors, clean and adjust as necessary.
  - ☐ Check operation of drive motor and drive mechanism. Lubricate as necessary.
  - ☐ Check for discoloration and overheating on rheostat and printed circuit board.
  - ☐ Check all wiring, including control wiring for deterioration, overheating, etc.
  - ☐ Clean interior of housing.
  - ☐ Clean rheostat contact surface.
  - ☐ Check dimmer rating against actual load.
- ☐ Control Unit (Local and Remote):
  - ☐ Remove, disassemble and clean slide bars.
  - ☐ Check indicator lamps, replace as necessary.

- ☐ Clean interior of unit.
- ☐ Check all connections to slide bars, terminal strip switches, etc.
- ☐ Check calibration of voltage meters.
- ☐ Lubricate control buttons, slide bars and switches.
- ☐ Reassemble unit.
- ☐ Test operation of dimmer throughout full range noting light fluttering or level difference (required for each control unit).
- ☐ Replace covers on dimmer unit after making any adjustments.
- ☐ Clean exterior of units.

Recommended Tools, Materials, and Equipment:

- ☐ Standard tools
- ☐ Cleaning supplies and materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment (PPE).
- ☐ Multimeter
- ☐ Amp-meter
- ☐ Lubricants. Consult the MSDS for hazardous ingredients and proper PPE.

III. Generator

1. **Automatic Transfer Switch**

Three Years

This maintenance task applies to those devices utilized to automatically switch an electrical power supply from its normal source to an alternate or emergency source of supply. These devices are normally associated with emergency power generators, but they can also be used to transfer from one commercial source to another. Multiple devices may be used where Uninterruptible Power Supply (UPS) systems are installed.

Special Instructions:

- ☐ Review manufacturer's instructions on operation and maintenance.
- ☐ Review the switching diagram and the affected electrical systems diagrams.
- ☐ Verify location of generator, transfer switches, critical load and affected operations.
- ☐ Schedule maintenance outage with operating personnel.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ All tests shall conform to the appropriate ASTM test procedure and the values used as standards shall conform to the manufacturer's and ANSI standards specifications.
- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance”

and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

Checkpoints:

- ☐ Check with affected occupant agencies and request that agency determine what equipment will be de-energized.
- ☐ Turn automatic transfer switch and generator automatic controls off. Tag control switches.
- ☐ Open and tag supply breaker.
- ☐ Open doors on automatic transfer switch and check phase-to-phase and phase-to-ground for presence of voltage.
- ☐ Clean inside of switch cubicle.
- ☐ Tighten all connections, checking for signs of overheating wires.
- ☐ Disconnect wires attached to each phase of the normal supply that supplies power to the under voltage relays. Test the under voltage relays. After testing relays, reconnect wires.
- ☐ Lubricate mechanism bearings, if required.
- ☐ Locate and disconnect operating mechanism control wires and, using a remote source of voltage, operate the mechanism.
- ☐ With the mechanism electrically held, use a micro-ohmmeter to check the contact resistance. Make sure the micro-ohmmeter is connected from the normal supply cable connection to the critical load cable connection. Perform the same test on the emergency source.
- ☐ Reconnect the operating mechanism control wires.
- ☐ Clean indicating lenses and change lamps as needed.
- ☐ Restore the transfer switch to normal position.
- ☐ Check with affected occupant agencies for generator operations.
- ☐ Remove tags and energize normal supply breaker, picking up the critical load.
- ☐ Remove tags and place generator controls in the automatic position.
- ☐ Open normal power breaker; the generator should start and the transfer switch should transfer the critical load.
- ☐ Close the normal power breaker; the transfer switch should transfer the load and the generator should shut down after a cool down period.
- ☐ Check with the affected occupant agencies to see that normal services have been restored to all areas.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer’s instruction manual for specialized tools, equipment and supplies.
- ☐ Micro-ohmmeter

- ☐ Variable AC voltage source (test cable)
- ☐ AC and DC voltmeter
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment (PPE).

2. **Emergency Generators, Electric**
   Weekly
   This maintenance task applies to all permanently installed electric generators used for providing emergency electrical power.

   Special Instructions:
   - ☐ Review manufacturer's instructions. One copy of the instruction manual(s) shall be kept in a secure, convenient location near the equipment and another kept in a different source location.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ A written record of all inspections, service, tests, exercising, operation, and repairs to the emergency generator shall be maintained in an equipment log book and kept on the premises. This record shall include the date of maintenance, identification of service personnel, and notation of any unsatisfactory condition and the corrective action taken, including parts replaced.
   - ☐ Have a properly serviced fire extinguisher in proper working order on hand.
   - ☐ Allow no open flames or smoking in the area.
   - ☐ If the unit has a self-contained fuel tank, use only Underwriters Laboratories listed safety cans for fuel transfer.
   - ☐ Hearing protection is required whenever the engine is running.
   - ☐ If the unit has a self-contained fuel tank, use only Underwriters Laboratories listed safety cans for fuel transfer.

   Checkpoints:
   - ☐ Check generator room conditions:
     - ☐ Adequate temperature, not less than 70°F. (40°F. for generator rooms with engine heater).
     - ☐ Ventilating louvers free to operate.
     - ☐ Clean with no miscellaneous storage.
   - ☐ Check that fuel tanks (main and day) are full (fill if less than ¾ full).
   - ☐ Verify that day tank float switch is operational.
   - ☐ Verify that fuel solenoid valve is operational.

- ☐ Drain condensate from fuel filters (if applicable), bottom of day tank, bottom of main fuel tank, and check fuel for water contamination.
- ☐ Verify that supply or transfer fuel pump is operational.
- ☐ Check fuel line flexible hoses and connectors for damage or leaks.
- ☐ Check engine oil level and appearance (add as required).
- ☐ Verify that lube oil heater is operational (if applicable).
- ☐ Check coolant level and squeeze hoses and inspect hoses and connections for leaks.
- ☐ Check engine water pump(s) for leaks and noise.
- ☐ Verify that water-jacket heater is operational (if applicable).
- ☐ Verify that adequate water is available to the heat exchanger (if applicable).
- ☐ Verify that radiator has adequate fresh air.
- ☐ Drain exhaust system condensate trap.
- ☐ Batteries (2): Verify that voltage and charging current readings are normal, pilot lights are on or battery failure (2) pilot lights off, electrolyte level normal, are dry, and terminals are clean, tight, and free from corrosion.
- ☐ Inspect electrical system, engine, and generator.
- ☐ Verify that system is set for automatic start and transfer.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Spare air cleaner
- ☐ Battery tester
- ☐ Engine oil
- ☐ Cleaning equipment and materials

3. **Emergency Generators, Electric**
   Monthly
   This maintenance task applies to all permanently installed electric generators used for providing emergency electrical power.

   Special Instructions:

   - ☐ Review manufacturer's instructions. One copy of the instruction manual(s) shall be kept in a secure, convenient location near the equipment and another kept in a different source location.
   - ☐ The work required by this procedure may cause the activation of an alarm and/or a supervisory signal. The school maintenance manager and/or fire department that will

receive the alarm and/or signal must be notified prior to start and at the completion of work.

- ☐ Qualified operating personnel shall be in attendance during the monthly generator operation.
- ☐ Hearing protection is required whenever the engine is running.
- ☐ Records of changes to the emergency electrical system should be maintained so that the demand likely to be produced by the connected load will be within the available capacity.
- ☐ Review Procedure for "Emergency Eyewash and Shower Equipment." Note the location of emergency eyewash and/or shower equipment.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ A written record of all inspections, service, tests, exercising, operation, and repairs to the emergency generator shall be maintained in an equipment log book and kept on the premises. This record shall include the date of maintenance, identification of service personnel, and notation of any unsatisfactory condition and the corrective action taken, including parts replaced.
- ☐ Have a properly serviced fire extinguisher in proper working order on hand.
- ☐ Allow no open flames or smoking in the area.
- ☐ If the unit has a self-contained fuel tank, use only Underwriters Laboratories listed safety cans for fuel transfer.

Checkpoints:

- ☐ Examine generator for moisture and dirt. Clean as required.
- ☐ Check and record battery system specific gravity and voltage of the pilot cell of each battery.
- ☐ Check level of electrolyte. Refill to proper level. Record amount of water used. Abnormal use of water indicates overcharging.
- ☐ Equalize charge, if required.
- ☐ Check governor oil level (add as required) and linkages and ball joints. Check for unusual oil leakage.
- ☐ Check fan and alternator belts for condition and proper tension.
- ☐ Record engine running time meter reading at start and end of test.
- ☐ Simulate normal power failure from a "cold start" by use of the test switch in the automatic transfer switch or by opening normal power supply to the emergency power supply system (EPSS). Observe and record time delay on start.
- ☐ Record cranking time (terminates when engine starts).
- ☐ Transfer the load to the EPSS and operate the unit under full load for a minimum of 30 minutes. It is important that the unit be operated under load. If a portion of the building load cannot be connected, a resistance load should be used. The electrical load shall be

not less than fifty percent of the total connected EPSS load (not less than thirty percent of the EPS nameplate rating and preferably at least fifty percent of the EPS nameplate rating). NOTE: If the generator set is used for standby power or for peak load shaving, these uses shall be recorded and may be substituted for task scheduled operations and testing of the generator set if the appropriate data is also recorded.

- ☐ Equivalent loads used for testing shall be automatically replaced with the emergency loads in case of failure of the primary source.
- ☐ Record AC voltage, schedule, and amperage.
- ☐ Record oil pressure, battery-charging rate, and water or air temperature after 15 minutes running time.
- ☐ Verify that battery charger is operating properly.
- ☐ While unit is operating, thoroughly observe operation for any indication of defects or possible malfunctions.
- ☐ Check exhaust system and muffler for leaks.
- ☐ Check for proper supervisory signals. When applicable, supervised temperature and oil pressure circuits should be mechanically closed and checked for proper signals.
- ☐ After unit has operated for 25 minutes, log the operation to show at least the following information: engine and generator speed in R.P.M., operating voltage, schedule, operating amperage, engine temperatures, engine oil pressure, hour meter readings.
- ☐ Return test switch to normal or reestablish normal power supply at such time as will cause a minimum running time under load.
- ☐ Record time delay on retransfer.
- ☐ Record time delay on shutdown on units so equipped.
- ☐ Verify that transfer switch normal position pilot light is illuminated and isolating switch is closed – standby (emergency) and system is set for automatic start and transfer.
- ☐ Verify that all alarm pilot lights off.
- ☐ After unit has been operated, check lubricant and coolant according to manufacturer's instructions.
- ☐ Maintain engine log in Generator Room.
- ☐ Clean generator room and remove all debris.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer’s instruction manual for specialized hand tools, equipment and supplies.
- ☐ Engine oil
- ☐ Hydrometer
- ☐ Distilled water

- ☐ Tachometer
- ☐ Acid resistant apron, gloves, and plastic face shield
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.
- ☐ Emergency eyewash that provides at least 0.4 gallons/minute for at least 15 minutes.
- ☐ Hearing protection

4. **Emergency Generators, Electric**
Quarterly
This maintenance task applies to all permanently installed electric generators used for providing emergency electrical power.

Special Instructions:

- ☐ Review manufacturer's instructions. One copy of the instruction manual(s) shall be kept in a secure, convenient location near the equipment and another kept in a different source location.
- ☐ The work required by this procedure may cause the activation of an alarm and/or a supervisory signal. The school maintenance manager and/or fire department that will receive the alarm and/or signal must be notified prior to start and at the completion of work.
- ☐ Qualified operating personnel shall be in attendance during the monthly generator operation.
- ☐ Hearing protection is required whenever the engine is running.
- ☐ Records of changes to the emergency electrical system should be maintained so that the demand likely to be produced by the connected load will be within the available capacity.
- ☐ Review Procedure for "Emergency Eyewash and Shower Equipment." Note the location of emergency eyewash and/or shower equipment.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ A written record of all inspections, service, tests, exercising, operation, and repairs to the emergency generator shall be maintained in an equipment logbook and kept on the premises. This record shall include the date of maintenance, identification of service personnel, and notation of any unsatisfactory condition and the corrective action taken, including parts replaced.
- ☐ Have a properly serviced fire extinguisher in proper working order on hand.
- ☐ Allow no open flames or smoking in the area.
- ☐ If the unit has a self-contained fuel tank, use only Underwriters Laboratories listed safety cans for fuel transfer.

Checkpoints:

- ☐ Clean the fuel strainer, filter, and dirt leg.
- ☐ Clean the crankcase breather, replace in accordance with manufacturer's instructions.
- ☐ Check the exhaust system for proper clearance and that insulation is complete.
- ☐ Check that battery terminals are clean and cable connections are tight.
- ☐ Check that where wires are subject to movement that chafing has not occurred.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Spare crankcase breather
- ☐ Cleaning equipment and materials. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).

5. **Emergency Generators, Electric**
   Semiannual
   This maintenance task applies to all permanently installed electric generators used for providing emergency electrical power.

   Special Instructions:

   - ☐ Review manufacturer's instructions. One copy of the instruction manual(s) shall be kept in a secure, convenient location near the equipment and another kept in a different source location.
   - ☐ The work required by this procedure may cause the activation of an alarm and/or a supervisory signal. The school maintenance manager and/or fire department that will receive the alarm and/or signal must be notified prior to start and at the completion of work.
   - ☐ Qualified operating personnel shall be in attendance during the monthly generator operation.
   - ☐ Hearing protection is required whenever the engine is running.
   - ☐ Records of changes to the emergency electrical system should be maintained so that the demand likely to be produced by the connected load will be within the available capacity.
   - ☐ Review Procedure for "Emergency Eyewash and Shower Equipment." Note the location of emergency eyewash and/or shower equipment.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ A written record of all inspections, service, tests, exercising, operation, and repairs to the emergency generator shall be maintained in an equipment log book and kept on the premises. This record shall include the date of maintenance, identification of service

personnel, and notation of any unsatisfactory condition and the corrective action taken, including parts replaced.
- ☐ Have a properly serviced fire extinguisher in proper working order on hand.
- ☐ Allow no open flames or smoking in the area.
- ☐ If the unit has a self-contained fuel tank, use only Underwriters Laboratories listed safety cans for fuel transfer.

Checkpoints:
- ☐ Test and record the coolant freeze protection and level. Add coolant as required for proper freeze protection.
- ☐ Check the flexible exhaust section for leaks.
- ☐ Verify that all engine-operating alarms and safety shutdown devices function properly. (Generator not under load during this check)
- ☐ Check that electrical boxes, panels, and cabinets are properly enclosed and not damaged.
- ☐ Service the air cleaner. Replace as required.
- ☐ Check the choke setting and carburetor adjustment on gasoline engines.
- ☐ Check generator brush appearance and length; verify that brushes are free to move in their holders; check brush spring tension or contact pressure, should approximate 2½ psi.
- ☐ Check and record specific gravity and voltage of each individual cell. Uneven cell specific gravities and voltages indicate trouble or approaching failure. If trouble is due to undercharging, an equalizing charge will restore all cells to normal.
- ☐ Verify that battery cap vents are open.
- ☐ With the battery charger disconnected, conduct a voltage test by measuring and recording the voltage of the battery during the generator starting cycle. An artificial load equal to the full load of the starter to the battery may be used for this test. The battery voltage shall not fall below 2.05 volts per cell while under load.
- ☐ Replace the battery when it no longer carries the proper charge and load capacity.

Recommended Tools, Materials, and Equipment:
- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Coolant tester
- ☐ Coolant. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients.
- ☐ Spare air cleaner
- ☐ Cleaning equipment and materials. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).

6. **Emergency Generators, Electric, Diesel Engines**
   Quarterly

This maintenance task applies to all permanently installed electric generators used for providing emergency electrical power whose prime movers are diesel engines.

Special Instructions:

- [ ] Review manufacturer's instructions. One copy of the instruction manual(s) shall be kept in a secure, convenient location near the equipment and another kept in a different source location.
- [ ] Review Procedure for "Controlling Hazardous Energy Sources."
- [ ] A written record of all inspections, service, tests, exercising, operation, and repairs to the emergency generator shall be maintained in an equipment log book and kept on the premises. This record shall include the date of maintenance, identification of service personnel, and notation of any unsatisfactory condition and the corrective action taken, including parts replaced.
- [ ] Have a properly serviced fire extinguisher in proper working order on hand.
- [ ] Allow no open flames or smoking in the area.
- [ ] If the unit has a self-contained fuel tank, use only Underwriters Laboratories listed safety cans for fuel transfer.

Checkpoints:

- [ ] Check fuel supply. Prior arrangements should be made for local procurement of fuel in emergencies.
- [ ] Check fuel piping for damage or leaks.
- [ ] Verify that fuel tank vents and overflow piping are unobstructed.
- [ ] Check engine oil (add as required) and filter(s) (change as required) and perform other lubrication on engine and generator. Review the Material Safety Data Sheet (MSDS) for proper disposal of used oil. If appropriate, recycle oil at an authorized station.
- [ ] Clean exterior of radiator.
- [ ] Inspect ductwork to radiator, if applicable, and clean louvers.
- [ ] Check and lubricate louver motors and controls. Verify that louvers operate properly.
- [ ] Clean generator room and remove all debris.

Recommended Tools, Materials, and Equipment:

- [ ] Review manufacturer’s instruction manual for specialized hand tools, equipment and supplies.
- [ ] Hearing protection
- [ ] Engine oil. Consult the Material Safety Data Sheet (MSDS) for hazardous ingredients. Unused engine oil is not hazardous.
- [ ] Oil filters

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- [ ] Cleaning materials. Consult the MSDS for hazardous ingredients and proper Personal Protective Equipment.

7. **Emergency Generators, Electric, Diesel Engines**
   Annual
   This maintenance task applies to all permanently installed electric generators used for providing emergency electrical power whose prime movers are diesel engines.

   Special Instructions:
   - [ ] Review manufacturer's instructions. One copy of the instruction manual(s) shall be kept in a secure, convenient location near the equipment and another kept in a different source location.
   - [ ] Review Procedure for "Controlling Hazardous Energy Sources."
   - [ ] A written record of all inspections, service, tests, exercising, operation, and repairs to the emergency generator shall be maintained in an equipment log book and kept on the premises. This record shall include the date of maintenance, identification of service personnel, and notation of any unsatisfactory condition and the corrective action taken, including parts replaced.
   - [ ] Have a properly serviced fire extinguisher in proper working order on hand.
   - [ ] Allow no open flames or smoking in the area.
   - [ ] If the unit has a self-contained fuel tank, use only Underwriters Laboratories listed safety cans for fuel transfer.
   - [ ] Test medium and high voltage circuit breakers in accordance with circuit breaker maintenance tasks.

   Checkpoints:
   - [ ] Change fuel filters.
   - [ ] Inspect and adjust rack on unit injector or fuel distributor pump according to manufacturer's instructions. Check injector pump and injectors and verify flow rate, pressure and spray pattern.
   - [ ] Adjust governor for proper operating speed.
   - [ ] Flush cooling system and check hoses. Replace hoses every five years minimum. Replace coolant. Review the Material Safety Data Sheet (MSDS) and dispose of the coolant at an authorized recovery facility.
   - [ ] Rod out heat exchanger.
   - [ ] Tighten control and power wiring connections.
   - [ ] Check the calibration of voltage-sensing relays/devices.
   - [ ] Change governor oil. Review the Material Safety Data Sheet (MSDS) for proper disposal of used oil. If appropriate, recycle oil at an authorized station.

- ☐ Inspect and clean generator rotor, stator, and exciter.
- ☐ Clean commutator and collector rings. Check brush wear and tension, in accordance with manufacturer's instructions.
- ☐ Clean voltage regulator.
- ☐ Measure and record resistance reading of generator windings with insulation tester (Megger). Note: First separate brushes from commutator to avoid damage to control circuits.
- ☐ Check generator bearings and bearing grease. Lubricate in accordance with manufacturer's instructions.
- ☐ Exercise the Emergency Power Supply System (EPSS) circuit breakers, including main and feed breakers between the Emergency Power Supply (EPS) and the transfer switch load terminals.
- ☐ Visually check bus bars, bracing, and feeder connections for cleanliness and signs of overheating.
- ☐ Perform other work prescribed by the manufacturer.
- ☐ Every 3 years or 500 operating hours:
  - ☐ Check and adjust valve clearance.
  - ☐ Torque bolts.
- ☐ Clean generator room and remove all debris.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Belts (fan, water pump, alternator)
- ☐ Fuel filters
- ☐ Governor oil. Consult the MSDS for hazardous ingredients.
- ☐ Coolant. Consult the MSDS for hazardous ingredients.
- ☐ Hoses
- ☐ Generator bearing grease. Consult the MSDS for hazardous ingredients.
- ☐ Megger
- ☐ Hearing protection
- ☐ Cleaning materials. Consult the MSDS for hazardous ingredients and proper Personal Protective Equipment.

8. **Emergency Generators, Electric, Gasoline, or Natural Gas Engines**
   Annual
   This maintenance task applies to all permanently installed electric generators used for providing emergency electrical power whose engines are powered by gasoline or natural gas.

Special Instructions:

- [ ] Review manufacturer's instructions. One copy of the instruction manual(s) shall be kept in a secure, convenient location near the equipment and another kept in a different source location.
- [ ] Review Procedure for "Controlling Hazardous Energy Sources."
- [ ] A written record of all inspections, service, tests, exercising, operation, and repairs to the emergency generator shall be maintained in an equipment log book and kept on the premises. This record shall include the date of maintenance, identification of service personnel, and notation of any unsatisfactory condition and the corrective action taken, including parts replaced.
- [ ] Have a properly serviced fire extinguisher in proper working order on hand.
- [ ] Allow no open flames or smoking in the area.
- [ ] If the unit has a self-contained fuel tank, use only Underwriters Laboratories listed safety cans for fuel transfer.
- [ ] Test medium and high voltage circuit breakers in accordance with circuit breaker maintenance tasks.

Checkpoints:

- [ ] Set distributor point dwell. Replace points, capacitor, rotor, cap, and spark plugs or after 100 operating hours. Check secondary wire insulation for wear.
- [ ] Set timing and distributor advance. Timing should be set at both idle and operating speed of generator.
- [ ] Adjust carburetor and governor for proper operating speed.
- [ ] Check fuel supply. If fuel is over 9 months old, discard and replace with fresh fuel. Gasoline deteriorates with age, so a large supply of fuel should not be maintained. Prior arrangements should be made to purchase fuel locally for emergencies.
- [ ] Check fuel piping for damage or leaks.
- [ ] Verify that fuel tank vents and overflow piping are unobstructed.
- [ ] Change engine oil and filter(s) and perform other lubrication of engine and generator. Review the Material Safety Data Sheet (MSDS) for proper disposal of used oil. If appropriate, recycle oil at an authorized station. Contact Regional S&EM office if you have any questions.
- [ ] Flush cooling system and check hoses. Replace hoses every five years minimum. Replace coolant. Review the Material Safety Data Sheet (MSDS) and dispose of the coolant at an authorized recovery facility.
- [ ] Clean exterior of radiator.
- [ ] Inspect ductwork to radiator, if applicable, and clean louvers.

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- [ ] Check and lubricate louver motors and controls. Verify that louvers operate properly.
- [ ] Rod out heat exchanger.
- [ ] Tighten control and power wiring connections.
- [ ] Check the calibration of voltage-sensing relays/devices.
- [ ] Change governor oil.
- [ ] Inspect and clean generator rotor, stator, and exciter.
- [ ] Clean commutator and collector rings. Check brush wear and tension, in accordance with manufacturer's instructions.
- [ ] Clean voltage regulator.
- [ ] Measure and record resistance reading of generator windings with insulation tester (Megger). Note: First separate brushes from commutator to avoid damage to control circuits.
- [ ] Check generator bearings and bearing grease. Lubricate in accordance with manufacturer's instructions.
- [ ] Exercise the Emergency Power Supply System (EPSS) circuit breakers, including main and feed breakers between the Emergency Power Supply (EPS) and the transfer switch load terminals.
- [ ] Visually check bus bars, bracing, and feeder connections for cleanliness and signs of overheating.
- [ ] Perform other work prescribed by the manufacturer.
- [ ] Every three years or 500 operating hours:
    - [ ] Check and adjust valve clearance.
    - [ ] Torque bolts.
- [ ] Clean generator room and remove all debris.

Recommended Tools, Materials, and Equipment:

- [ ] Review manufacturer’s instruction manual for specialized hand tools, equipment and supplies.
- [ ] Engine Tune-up Kit
- [ ] Belts (fan, water pump, alternator)
- [ ] Engine oil. Consult the Material Safety Data Sheet (MSDS) for hazardous ingredients.
- [ ] Oil filters
- [ ] Governor oil. Consult the MSDS for hazardous ingredients.
- [ ] Coolant. Consult the MSDS for hazardous ingredients.
- [ ] Generator bearing grease. Consult the MSDS for hazardous ingredients.
- [ ] Megger
- [ ] Cleaning materials. Consult the MSDS for hazardous ingredients and proper Personal Protective Equipment.

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IV. Lighting

1. **Lighting, Outside; Incandescent**
   Semiannual
   This maintenance task applies to parking lot, street, loading dock, and perimeter lighting, and provides for group re-lamping and maintenance of such fixtures outside the building.

   Special Instructions:
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."

   Checkpoints:
   - ☐ Open and tag switch.
   - ☐ Remove old lamp and clean fixtures including reflector, refractor, and globes.
   - ☐ Inspect condition of wiring, contacts, terminals, and sockets. Look for evidence of overheating.
   - ☐ Install new lamp and assemble checking gaskets for proper seat.
   - ☐ Test operation of automatic switches.
   - ☐ Inspect lamp standards and mounting devices.
   - ☐ Clean up work area and remove all trash.

   Recommended Tools, Materials, and Equipment:
   - ☐ Standard tools – Basic
   - ☐ Cleaning materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper Personal Protective Equipment (PPE).

2. **Lighting, Special Fixture**
   Annual
   This maintenance task applies to special lighting fixtures such as those found in lobbies, porticos, court rooms, and auditoriums, and for fixtures above 12 feet.

   Checkpoints:
   - ☐ Clean fixture thoroughly.
   - ☐ Check all sockets, replace as needed.
   - ☐ Inspect anchors or anchoring devices, tighten as needed.
   - ☐ Examine fixture glass, side panels, diffusers, etc., for cracks, breaks, etc. Replace as necessary.
   - ☐ If group re-lamping is due, change all lamps; otherwise, replace only those that are burned out.
   - ☐ Check operation.

- ☐ Clean up work area and remove all debris.

Recommended Tools, Materials, and Equipment:

- ☐ Standard tools – Basic
- ☐ Ladder constructed according to OSHA/ANSI standards. Check ladder for defects. Do not use defective ladders.

3. **Lightning Protection (Per Down Conductor)**
   Annual

   Special Instructions:

   - ☐ On first inspection, check that:
     - ☐ All air terminals (lightning rods) are interconnected, and;
     - ☐ At least two down conductors are installed with their own ground connection.

   Checkpoints:

   - ☐ Inspect air terminals for corrosion and rigid attachment to structure.
   - ☐ Examine conductors for corrosion, strong mechanical joints which provide good electrical conductivity, and loose or broken fasteners.
   - ☐ Check for loops, sharp bends (less than 8" radius) and frayed horizontal and vertical conductors.
   - ☐ Check for damaged guards and down conductors.
   - ☐ Inspect grounding attachment for permanency and corrosion (if practical).
   - ☐ Test resistance to ground for each down conductor.
   - ☐ Clean up work area and remove debris.

   Recommended Tools, Materials, and Equipment:

   - ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.

4. **Spotlights, Fixed and Portable**
   Monthly
   This maintenance task applies to both fixed and portable spotlights used in the lighting and highlighting of performers and stage areas in auditoriums and large conference rooms.

   Special Instructions:

   - ☐ Keep record of hour usage of spotlight bulb, noting its estimated life and date of installation.
   - ☐ Obtain and review manufacturer's instructions and precautions.

Checkpoints:

- ☐ Check power supply cord and connections to plug.
- ☐ Remove necessary access panels.
- ☐ Check connection at, and operation of switch. Lubricate as needed.
- ☐ Clean lens and reflector.
- ☐ Lubricate and check operation of all slide rods, adjust rods and linkage.
- ☐ Check bulb and socket, clean or change as required.
- ☐ Clean housing interior.
- ☐ Clean and check operation of color slides.
- ☐ Replace removed access panels.
- ☐ Lubricate wheels and pivot points as required.
- ☐ Check mounting supports.
- ☐ Clean exterior of unit.
- ☐ Test.
- ☐ Clean up work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Lubricants. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper Personal Protective Equipment (PPE).
- ☐ Cleaning tools and materials. Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ New bulb

V. Motor

1. **Motor Control Center (MCC)**
   Semiannual
   This maintenance task applies to MCC's and includes motor starters under 100 hp.

   Special Instructions:

   - ☐ Schedule this maintenance outage with operating personnel.
   - ☐ Review manufacturer's instructions.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, tag and lockout circuit.
   - ☐ All tests shall conform to the appropriate ASTM test procedure and the values used as standards shall conform to the manufacturer's and ANSI Standards specifications.

- [ ] Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

Checkpoints:

- [ ] Tighten all connections to main bus.
- [ ] Inspect breakers and fuses connected to the main bus and secondary transformers for correct ratings and tightness.
- [ ] Inspect starter coils. Clean contacts, replace as required.
- [ ] Use vacuum or dry compressed air to remove dust or other material which may cause shorts or arcing, or interfere with heat dissipation.
- [ ] Inspect all interlocks and controls. Clean and lightly lubricate friction points. Remove excess lubricant (refer to manufacturer's instructions).
- [ ] If applicable, inspect contactor/switch arc chutes for cracks or pitting. Repair and clean as needed.
- [ ] Test starter heaters for correct design amperage and size.
- [ ] Test main breaker or fuses to MCC for correct voltage drop at rated amperage.
- [ ] Operate breakers to ensure proper making.
- [ ] Open the starter cover and place the starter in the "test" or "safe" position. Energize the starter.
- [ ] Look for arcing or improper contacting.
- [ ] Visually check coils and contacts. Clean the contacts if needed.
- [ ] Clean the starter interior with dry compressed air.
- [ ] Tighten all connections. Make sure all electrical connections and contacts are properly made between the control apparatus and the motor.
- [ ] Carefully lubricate the friction points on the moving parts of the starter and wipe off excess lubricant.
- [ ] Lubricate the blower-motor of the adjustable speed drive with 10 to 20 drops of SAE 10W or 20W non detergent oil (ML type) or with electric motor oil.
- [ ] Touch up paint as required to restore the finish.
- [ ] Remove tags and lock; return circuit to service.
- [ ] Clean work area.

Recommended Tools, Materials, and Equipment:

- [ ] Review manufacturer’s instruction manual for specialized tools, equipment and supplies.
- [ ] Cleaning supplies and materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment (PPE).

- ☐ Lubricants. Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Vacuum cleaner
- ☐ Contact burnishing tool

2. **Motor Controller Unit, 600 Volts or 200 Hp and Above**
   Annual
   This maintenance task applies to those motor controller units designed for starting and controlling 3 phase, 60 cycle, AC motors, rated at 600 volts and above. These units may be found on larger refrigeration or heating equipment.

   Special Instructions:
   - ☐ Task Frequency outage with operating personnel.
   - ☐ Obtain and review manufacturer's instructions, including time current characteristic curve.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, tag, and lockout the circuit.
   - ☐ Make certain that the contactor and its operating mechanism are disconnected from all power sources before attempting to work on the unit.
   - ☐ All tests shall conform to the appropriate manufacturer's test specifications and standards.

   Checkpoints:
   - ☐ Visually inspect for broken parts, contact arcing or evidence of overheating, looking for discoloration of any copper, current carrying parts. Look for signs of corona.
   - ☐ Check motor nameplate for current rating and contactor or controller manufacturers recommended current overload settings.
   - ☐ Perform time current characteristics test according to system requirements, settings and manufacturer's instructions.
   - ☐ Record test results and findings; record as found and as left value.
   - ☐ Clean contactor, looking for signs of rust. Touch-up paint minor spots and report if excessive.
   - ☐ Tighten all electrical connections and check flexible links for frayed or broken strands.
   - ☐ Check fuse clip spring pressure. Polish fuse ferrules if copper. Check for loose fuse ferrules or arc horns and for proper fuse size.
   - ☐ Check both main and arcing contacts, looking for copper oxide scale and dress only if necessary. Check roll and wipe contacts.
   - ☐ Check bearings for freedom of motion (do not oil).
   - ☐ Check (blow out) magnets and clean faces. Check shading coil for misalignment, mechanical binding, striking of coil, etc.

- ☐ Check arc shields for breaks and burning (look for corona).
- ☐ Clean remote push buttons and check contacts.
- ☐ Check resistors and reactors for signs of overheating. Tighten all connections.
- ☐ Check contacts resistance in micro-ohms and the dielectric strength in megohms. Record results on contactor test sheet.
- ☐ Check starter connection by applying a thin film of black contact grease to the line and load stabs, then rack the contactor in and out of the cubicle and measure the wipe marks on the stabs. Clean off contacts.
- ☐ With contactor in test position, apply control power only and electrically close. Using emergency trip buttons and motor/current overload relays, trip electrically.
- ☐ Remove tags and lock, return circuit to service.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Test set (time/current characteristics)
- ☐ Micro-ohmmeter
- ☐ Megger
- ☐ Cleaning equipment
- ☐ Vacuum

3. **Motor Starters, 100 Hp and Greater**
   Three Years
   This maintenance task applies to individually enclosed and electrically supplied motor starters rated less than 600 volts and greater than 100 horsepower.

   Special Instructions:

   - ☐ Schedule this maintenance outage with operating personnel.
   - ☐ Obtain and review manufacturer's instructions, including the time current characteristic curve.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, tag and lockout circuit.
   - ☐ All tests shall conform to the appropriate ASTM test procedure and the values used shall conform to the manufacturer's and ANSI Standards specifications.
   - ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance" and the InterNational Electrical Testing Association publication, "Maintenance Testing Specifications", as applicable.

Checkpoints:

- ☐ Visually inspect for broken parts, contact arcing or any evidence of overheating.
- ☐ Check motor name plate for current rating and controller manufacturer's recommended heater size.
- ☐ Check line and load connections and heater mounting screws for tightness.
- ☐ Perform time/current characteristics test at the appropriate multiple of heater rating.
- ☐ Record test results on Low Voltage Circuit Breaker Test Record. Show both as found and as left.
- ☐ Check contact resistance in micro-ohms and dielectric strength in megohms.
- ☐ Check starter connection by applying a thin film of contact grease to the line and load stabs, then rack the breaker in and out of the cubicle and measure the wipe marks on the stab. Clean contacts.
- ☐ Document findings and repairs in an appropriate format. Clearly indicate the location and type of deficiency, and the corrective action taken.
- ☐ Remove tags and lock; return circuit to service.
- ☐ Clean work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ High Current Test set (time/current characteristics)
- ☐ Micro-Ohmmeter
- ☐ Megger
- ☐ Cleaning equipment. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.
- ☐ Vacuum

4. **Motors, 3-Ph, 600 Volts or 200 Hp and Above**
   Annual
   This maintenance task applies to three-phase induction, synchronous, and wound rotor motors rated at 600 volts and above or 200 horsepower and above. Motor disassembly is not required.

   Special Instructions:

   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ Schedule maintenance shutdown with operating personnel as necessary.
   - ☐ Coordinate this maintenance with the motor controller and the driven equipment.
   - ☐ Some units require removal of access screens or plates.
   - ☐ Review manufacturer's instructions.
   - ☐ De-energize, tag, and lock out power circuits.

- [ ] Ground electrical circuits in the unit prior to cleaning or servicing to discharge any capacitors.
- [ ] Record and report deficiencies.
- [ ] Cleaning: Without disturbing adjacent areas or redistributing dirt, dust, and contaminants; use a small vacuum cleaner to enter into narrow openings, such as end bells, ventilation ports, etc.
- [ ] Do not spray liquid solvents onto motor windings. If solvents must be used, only those approved for electric motor cleaning should be used. Wipe with damp but not wet rags. Several wipings may be required for heavily soiled areas.
- [ ] Lubrication: Use lubricants specified by the manufacturer only, or get approval from the regional office for substitutes.

Checkpoints:

- [ ] All Motors:
  - [ ] Clean ventilation ports of accumulations of dirt, dust, and other foreign material with vacuum cleaner (see special instruction no. 8).
  - [ ] Closely examine condition of all motor covers, screens, protective shields, inspection plates, and motor lead connection compartments.
  - [ ] Inspect for proper anchoring coupling, mounting, grounding, and ground connection. Look for signs of loose or broken bolts, motor housing cracks, broken motor support brackets, and any evidence of abnormal rust or chemical action on mechanical and electrical parts.
  - [ ] Inspect bearings for signs or wear and deterioration. Where journal bearings are used evaluate bearing condition and clearance.
  - [ ] The lubrication system of all bearings should be inspected for satisfactory and normal operation. Change oil and grease. Do not over lubricate.
  - [ ] Ground motor windings according to manufacturer's instructions or 30 minutes prior to performing electrical testing, and 30 minutes after completion of the test.
  - [ ] All protective devices should be tested in accordance with all applicable procedures.
- [ ] Synchronous and wound rotor motors:
  - [ ] Clean and check condition of slip rings and indicators.
  - [ ] Check condition of all brushes. Look for chipped, cracked, broken, or otherwise defective brushes. Inspect brush pigtails for damage resulting from wear and environmental effects.
  - [ ] Inspect all brushes for satisfactory operation and correct length.
  - [ ] Check brush box, look for signs of brushes binding due to carbon dust.

- [ ] Measure the brush contact pressure of all brushes. Using manufacturer's instructions, verify the amount of brush pressure to be applied per square inch.
- [ ] Clean and visually inspect resistor bank associated with motor.

- [ ] Shaft Driven Exciters:
  - [ ] Measure distance from brush box to commutator on all brush boxes. Refer to manufacturer's specifications for the correct clearance.
  - [ ] Check spacing between each brush box for equal spacing around commutator.
  - [ ] Inspect commutator surface for indication of sparking, threading, drag grooving, feathering, etc.
  - [ ] Inspect commutator for chips from broken brushes which may get stuck between commutator segments.
  - [ ] Check mida insulation between segments.
  - [ ] Resurface commutator if necessary, by hand stoning, sandpapering, etc.
  - [ ] Check the run-out of the commutator at several points to verify the accuracy of the commutator surface. Look for high bars and out of round conditions.
- [ ] Non Shaft Driven Exciters:
  - [ ] Remove access covers and vacuum the unit.
  - [ ] Tighten all connections and look for signs of overheating.
- [ ] Electrical Tests (All Motors):
  - [ ] Perform dielectric absorption or polarization test on all windings including exciter windings.
  - [ ] Conduct dielectric absorption test for a ten minute duration. Sixty/thirty ration test shall be for a one minute duration. Polarization test shall be for a ten minute duration. Record test results.
  - [ ] Evaluate test results on motor condition. NOTE: On synchronous motor with solid state excitation, disconnect exciter circuits for motor before performing tests.

<u>Recommended Tools, Materials, and Equipment:</u>

- [ ] Review manufacturer’s instruction manual for specialized hand tools, equipment and supplies.
- [ ] Megger
- [ ] Vacuum cleaner with attachments
- [ ] Grease gun and fittings
- [ ] Oil can and funnel
- [ ] Cleaning material, rags, sandpiper, small brush, etc. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

5. **Motors, Preventive Maintenance**

Annual

This maintenance task is for induction, wound-rotor and synchronous motors in excess of 1 horsepower. The maintenance specified by this task is not intended to require disassembly of the motor. This task does not normally apply to motors rated less than 1 horsepower, for which maintenance is normally limited to cleaning and lubrication, and is done with the maintenance of the driven machine.

Special Instructions:

- ☐ Notify and this maintenance task shut-down with operating personnel.
- ☐ Review manufacturer's instructions.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, tag, and lock circuit serving motor, when applicable.
- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance" and the InterNational Electrical Testing Association publication, "Maintenance Testing Specifications", as applicable.

Checkpoints:

- ☐ Check ventilation ports for soil accumulation, clean if necessary.
- ☐ Clean exterior of motor surfaces of soil accumulation.
- ☐ Lubricate bearings according to horsepower ratings:
  - ☐ Remove filler and drain plugs (use zerk fittings in place of filler plug if not installed).
  - ☐ Free drain hole of any hard grease (use piece of wire if necessary).
  - ☐ Add grease – use good grade lithium base grease unless otherwise noted.
  - ☐ Run motor at operating temperature for 15 minutes, wipe off excess grease at drain hole and reinstall drain plug.
- ☐ Check motor windings for accumulation of soil. Vacuum with long bottle type brush then blow out with dry air if required, air pressure must not exceed 30 psig.
- ☐ Check hold down bolts and grounding straps for tightness.
- ☐ Replace worn or broken ground straps.
- ☐ Check slip with tachometer.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Tachometer
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

- ☐ Lubricants. Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Vacuum with long bottle type brush attachment

6. **Motors, Predictive Maintenance**
   Annual
   This maintenance task is for predictive maintenance testing of squirrel-cage, wound-rotor and synchronous motors rated 10 horsepower and greater. These tests are intended to reveal deficiencies that shorten motor life, waste energy, and reduce performance. They can also help predict the remaining life of the machine. The maintenance testing specified by this task is not intended to require disassembly of the motor. This task does not normally apply to motors rated less than 10 horsepower. Testing for these motors is accomplished at the motor control panel and is non-destructive in nature.

   Special Instructions:
   - ☐ Schedule maintenance shut-down with operating personnel.
   - ☐ Review manufacturer's instructions.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, tag, and lock circuit serving motor, when applicable.
   - ☐ Keep comprehensive, accurate records of these tests to assist in trending motor parameters during its life cycle.
   - ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance" and the InterNational Electrical Testing Association publication, "Maintenance Testing Specifications", as applicable.

   Checkpoints:
   - ☐ The electrical circuits and the motors shall be non-destructively tested from the load side of either 1) the fused side of the disconnect or 2) the secondary side of the breaker. Testing shall be done to establish the present operating parameters of the wiring and the motors for the following aspects:
     - ☐ Resistance imbalance (hot spots) with results expected to be less than 0.05 ohms in each phase; per NEMA MGI – 14.35. Note: A Wheatstone bridge tester will give these results.
     - ☐ Total inductance imbalance (hot spots) with results expected to be less than 35% from a phase to phase analysis on the system. Note: A low voltage surge tester will give these results.
     - ☐ Leaks to ground with results expected to be greater than 5 megohms in each phase; per IEEE 43-1974, pg. 93. Note: A Megger may be used to give this result.

- ☐ Report on any visual findings of significance or conditions found from testing that need further investigating.
- ☐ Three phase dynamic testing of AC motors in operation will be done on all systems operating at 600 volts or less. Record each phase voltage balance with results expected to be less than 1% imbalance; per EASA Task Book, pg. 18. Note: Volt meters will give these results.
- ☐ Capacitance imbalance when capacitors are part of the installation with results expected to be less than 10% imbalance. Note: "Capacitance Measurement Bridge" will give these results.
- ☐ Record amps at full load or at maximum design load to be on system with results expected to be less than nameplate full load amps. Note: An ammeter will give this result. Do not exceed nameplate ratings.
- ☐ Record the power factor of the system under load, using a power factor meter.

- ☐ Compare the results of each test performed in step #1 with the previous year's results and consider how serious the combination of problems are, and what priority they have for repair or correction.
- ☐ Restore all equipment as it was when this work was started. Remove tags and return to service.
- ☐ Clean up work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Wheatstone bridge
- ☐ Surge tester
- ☐ Megger
- ☐ Volt meter
- ☐ Capacitance Measurement Bridge
- ☐ Amp meter
- ☐ Power factor meter

7. **Motor Starter, Less than 100 Hp**
   Annual
   This maintenance task applies to individually enclosed and electrically supplied motor starters rated less than 600 volts and less than 100 horsepower.

   Special Instructions:

   - ☐ Schedule this maintenance outage with operating personnel.

- [ ] Obtain and review manufacturer's operation and maintenance instructions.
- [ ] Review Procedure for "Controlling Hazardous Energy Sources."
- [ ] De-energize, lock, and tag circuit, as applicable. Caution: Some starters are designed to be supplied from more than one power source (for supply or control). Check all circuits for voltage.
- [ ] Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

Checkpoints:

- [ ] Visually inspect for broken parts, contact arcing or any evidence of overheating.
- [ ] Check motor name plate for current rating and controller manufacturer's recommended heater size (report discrepancy to supervisor).
- [ ] Check line and load connections for tightness (check manufacturer's instructions for torque specifications.
- [ ] Check heater mounting screws for tightness.
- [ ] Check all control wiring connections for tightness.
- [ ] On units equipped with motor reversing capacity, check mechanical interlock.
- [ ] On units equipped with two stage starting, check dash pots and timing controls for proper operation. Adjust as required.
- [ ] On units equipped with variable speed starters:
    - [ ] Check tightness of connections to resistor bank.
    - [ ] Check resistor coils and plates for cracking, broken wires, mounting and signs of overheating. Clean as required.
    - [ ] Check tightness of connections to drum controller.
    - [ ] Check contacts of drum controller for arcing and overheating. Apply a thin film of lubricant to drum controller contacts and to rotating surfaces.
- [ ] Check starter primary contact connections by applying a thin film of contact grease to line and load stabs; operate contacts and check surface contact; remove grease.
- [ ] Lubricate all moving parts with proper lubricant.
- [ ] Clean interior of cabinet.
- [ ] Clean exterior of cabinet.
- [ ] Energize circuit and check operation of starter and any pilot lights. Replace as required.

Recommended Tools, Materials, and Equipment:

- [ ] Review manufacturer’s instruction manual for specialized tools, equipment and supplies.

- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.
- ☐ Vacuum cleaner
- ☐ Electrical contact lubricant
- ☐ Ladder constructed in accordance with OSHA/ANSI standards. Check ladders for defects. Do not use defective ladders
- ☐ Megger
- ☐ Torque wrench

VI. Relay/Protection/Switching

1. **Auxiliary Protective Relays**
   Annual
   This maintenance task applies to those auxiliary relays used on large motors, generators, network protectors and high/low voltage switchgear.

   Special Instructions:
   - ☐ Schedule this maintenance outage with operating personnel.
   - ☐ Obtain and review manufacturer's instructions and circuit diagrams for relays and test sets.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock out and tag the circuit.
   - ☐ Remove control fuses (125 volt AC/DC).
   - ☐ All tests shall conform to the appropriate ASTM test procedures and the values used as standards shall conform to the manufacturer's and ANSI standard specification.
   - ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

   Checkpoints:
   - ☐ Visual and mechanical inspection.
     - ☐ Mechanically and visually inspect panel and wiring.
     - ☐ Clean relay cover and remove for visual inspection of contacts and coil.
     - ☐ Mechanically check all connections for tightness.
     - ☐ Inspect and burnish all normally closed contacts.
     - ☐ Operate relay mechanically – inspect and burnish all normally open contacts.
   - ☐ Electrical test.

- ☐ With the circuit breaker in the test or de-energized position, install the control fuses and mechanically operate the protective relay that will electrically operate the auxiliary relay, tripping the circuit breaker.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Relay test set
- ☐ Cleaning materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.
- ☐ Rubber gloves

2. **Bolted Pressure Contact Switch (low voltage) Ground Fault Operated**
   Annual
   This maintenance task applies to low voltage switches that are usually fused and usually the first line of protection at the service entrance. They may be either manually operated, motor operated or ground fault relay operated.

   Special Instructions:

   - ☐ Schedule maintenance outage with operations personnel.
   - ☐ Review manufacturer's instructions.
   - ☐ Schedule PM at same time as PM of Ground Fault Relay.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock-out and tag circuit.
   - ☐ All tests shall conform to the appropriate ASTM test procedure and the values used shall conform to the manufacturers and ANSI Standard Specifications.
   - ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance" and the InterNational Electrical Testing Association publication, "Maintenance Testing Specifications", as applicable.

   Checkpoints:

   - ☐ Inspect for physical damage, proper insulation, anchoring and grounding.
   - ☐ Vacuum and clean interior of unit.
   - ☐ Clean insulation, arc chutes and inter-phase barriers.
   - ☐ Check fuse linkage and element for proper holder and current rating. Record fuse data.
   - ☐ Check contact alignment, wipe and pressure; clean and lubricate contact surfaces as necessary. Make necessary adjustments.
   - ☐ Perform contact resistance test across each switch blade and fuse link.
   - ☐ Perform insulation resistance test phase to phase and each phase to ground.

- ☐ Record all test and inspection results.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Relay test set
- ☐ Test blocks and jumpers
- ☐ Cleaning materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.
- ☐ Electrical safety group II 5000 volt rubber gloves

3. **Bolted Pressure Contact Switch (low voltage) Stand Alone**
   Three Years
   This maintenance task applies to low voltage switches that are usually fused and usually the first line of protection at the service entrance. They may be either manually operated, motor operated or ground fault relay operated.

Special Instructions:

- ☐ Schedule maintenance outage with operations personnel.
- ☐ Review manufacturer's instructions.
- ☐ Schedule PM at same time as PM of Ground Fault Relay.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, lock-out and tag circuit.
- ☐ All tests shall conform to the appropriate ASTM test procedure and the values used shall conform to the manufacturers and ANSI Standard Specifications.
- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance" and the InterNational Electrical Testing Association publication, "Maintenance Testing Specifications", as applicable.

Checkpoints:

- ☐ Inspect for physical damage, proper insulation, anchoring and grounding.
- ☐ Vacuum and clean interior of unit.
- ☐ Clean insulation, arc chutes and inter-phase barriers.
- ☐ Check fuse linkage and element for proper holder and current rating. Record fuse data.
- ☐ Check contact alignment, wipe and pressure; clean and lubricate contact surfaces as necessary. Make necessary adjustments.
- ☐ Perform contact resistance test across each switch blade and fuse link.
- ☐ Perform insulation resistance test phase to phase and each phase to ground.

- ☐ Record all test and inspection results.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Relay test set
- ☐ Test blocks and jumpers
- ☐ Cleaning materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.
- ☐ Electrical safety group II 5000 volt rubber gloves.

4. **Disconnects (Isolating Switch; Per Switch)**

Annual

This maintenance task applies to disconnect or isolating and quick make, break (QMB) fusible switches that are rated at 600 volts or less and 200 amps or more.

Special Instructions:

- ☐ Schedule this maintenance outage with operating personnel.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize and tag circuit. Note: These switches do not have an interrupting rating and can only be operated after the circuit has been opened by some other means. They should never be operated under load.
- ☐ Obtain and review manufacturer's literature on the equipment.
- ☐ All tests shall conform to the appropriate ASTM test procedure and the values used as standards shall conform to the manufacturer's and ANSI Standards specifications.
- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance" and the InterNational Electrical Testing Association publication, "Maintenance Testing Specifications", as applicable.

Checkpoints:

- ☐ Inspect for signs of overheating and loose or broken hardware.
- ☐ Inspect torque connections to bus and cables.
- ☐ Clean main contacts, adjust and put a thin film of conductive lubricant on them if recommended by manufacturer.
- ☐ Perform a contact resistance test; adjust the contacts with the highest readings to correspond with the lowest reading contact. A maximum value can be obtained from the manufacturer's instructions.
- ☐ Check the fuse tubes and renewable elements for corrosion, dirt and tracking. Clean or replace as required.

- ☐ Clean entire cubicle with vacuum.
- ☐ Remove tags and return circuit to service.
- ☐ Clean work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Torque wrench
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment (PPE).
- ☐ Vacuum
- ☐ Micro-ohmmeter
- ☐ Appropriate lubricants. Consult the MSDS for hazardous ingredients and proper PPE.

5. **Ground Fault Type Transformer or Differential Relay**
   Annual

Special Instructions:

- ☐ Schedule this maintenance outage with operating personnel.
- ☐ Obtain and review manufacturer's instructions and circuit diagrams for relays and test sets.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, tag and lockout circuits.
- ☐ All tests shall conform to the appropriate ASTM test procedure and the values used shall conform to the manufacturer's and ANSI Standards specifications.
- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance" and the InterNational Electrical Testing Association publication, "Maintenance Testing Specifications", as applicable.

Checkpoints:

- ☐ Visual and mechanical inspection:
  - ☐ Mechanically and visually inspect panel and wiring.
  - ☐ Remove cover from relay case. Inspect the cover gasket; and replace if necessary. Check glass for cracks, tightness in frame, etc.; clean both sides of glass.
  - ☐ Remove relay from case and visually inspect both. Remove dust by blowing or preferably sucking air using a small insulated vacuum cleaner. Rust or metal particles should be removed from the disc with a magnet cleaner or brush. The presence of moisture may indicate an incorrect application or lack of air tight seal.

- ☐ Hold relay up to the light and ensure that the disc does not rub and has sufficient clearance between the magnet poles.
- ☐ Except for pivotal joints, tighten all screws, nuts, and bolts, especially the taps.
- ☐ Examine condition and appearance of bearings. Rotate the disc manually to close the contacts and check for smooth operation. Allow the disc restraint spring to return the disc to its normally de-energized position. Inspect disc restraint spring for proper tension and possible damage. Replace bearings if defective.
- ☐ Check operation of target by manually lifting the armature and observing appearance of target.
- ☐ Check relay coils for damage from excessive current.
- ☐ Inspect contacts and backstops as required. Burnish contacts as required.

☐ Electrical test:

- ☐ Test the relay and record the existing settings. Compare results with coordination study and previous test results, or relay setting and manufacturer's instructions.
- ☐ Perform zero check if relay has a time dial.
- ☐ Perform test as required by particular settings and system requirements conforming to manufacturer's instructions for the particular relay. Check the minimum pickup values using operating and differential currents, the slope (differential characteristic), and harmonic restraint.
- ☐ Check continuity of circuit from relay to the current transformer.
- ☐ Calibrate panel ammeter within 3 percent of test meter reading.
- ☐ Mechanically operate relay to ascertain that it will electrically operate the breaker or device.
- ☐ Record results of test and inspection and report deficiencies. Update prints. Return relay to service, replacing cover and removing test leads and jumpers.
- ☐ Remove tags and lock; return circuit to service.

<u>Recommended Tools, Materials, and Equipment:</u>

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Relay test set
- ☐ Test blocks and jumpers
- ☐ Cleaning materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.
- ☐ Electrical safety group II 5000 volt rubber gloves.

6. **High Voltage Air Circuit Breaker**
   Annual

Special Instructions:

- ☐ Schedule this maintenance outage with operating personnel.
- ☐ Obtain and review manufacturer's instructions.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, lockout and tag circuit.
- ☐ All tests shall conform to the appropriate ASTM test procedure and the values used as standards shall conform to the manufacturer's and ANSI Standards specifications.
- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

Checkpoints:

- ☐ Test circuit to be sure it is not energized.
- ☐ Check and adjust interlocks.
- ☐ Clean breaker and cubicle.
- ☐ Perform any and all mechanical adjustments and inspections as indicated by the proper manufacturer's instructions, i.e., contact condition.
- ☐ Reassemble and measure contact resistance (micro-ohms).
- ☐ Perform 2,500 volt Megger test; breaker fully open and fully closed.
- ☐ Perform Hypotential test (optional).
- ☐ Operate breaker in test position of cell when available.
- ☐ Operate breaker open and closed by all means.
- ☐ Record results separately for each breaker.
- ☐ Remove tags and lock, return circuit to service.
- ☐ Clean work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer’s instruction manual for specialized tools, equipment and supplies.
- ☐ Micro-Ohmmeter
- ☐ Megger
- ☐ Hypot tester
- ☐ Cleaning materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.

7. **High Voltage Oil Circuit Breaker**
   Annual

Special Instructions:

- [ ] Schedule this maintenance outage with operating personnel.
- [ ] Obtain and review manufacturer's instructions.
- [ ] Review Procedure for "Controlling Hazardous Energy Sources."
- [ ] De-energize, tag and lockout circuit.
- [ ] All tests shall conform to the appropriate ASTM test procedure and the values used shall conform to the manufacturer's and ANSI Standards specifications.
- [ ] Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

Checkpoints:

- [ ] Test circuit to be sure that it is not energized.
- [ ] Take oil samples from bottom and top if available. Test dielectric strength, neutralization number, interfacial tension and color as per appropriate ASTM specifications. Record results of these tests.
- [ ] Inspect for leaks.
- [ ] Inspect and adjust interlocks.
- [ ] Perform any and all mechanical adjustments, as indicated by the proper manufacturer's instructions, i.e., contact condition, over-travel, rebound, alignment, wipe, including dropping the tank.
- [ ] Oil should be filtered or replaced as the tests indicate.
- [ ] Measure contact resistance (micro-ohms) after assembly.
- [ ] Perform 2,500 volt dielectric tests; breaker open, each pole ground to a frame and breaker closed each phase to grounded and adjacent phases.
- [ ] This type breaker is normally relay operated. Maintenance of the relay is performed under another task list. The close and trip circuit should be checked by local and remote control switches.
- [ ] Minimum acceptable test specifications:
- [ ] Clean work area.
- [ ] Document findings and repairs in an appropriate format. Clearly indicate the location and type of deficiency, and the corrective action taken.
- [ ] Remove tags and lock; return circuit to service.
- [ ] Place an appropriate identification sticker on each breaker cover. I.D. sticker shall show the name of the testing firm or agency, date of test and initials of tester.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Oil test kit (field testing or lab)
- ☐ Micro-Ohmmeter
- ☐ Megger
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.

8. **Induction Disc – Directional Over Current Relay**
Annual
Special Instructions:
   - ☐ Schedule this maintenance outage with operating personnel.
   - ☐ Obtain and review manufacturer's instructions and circuit diagrams for relays and test sets.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, tag and lockout circuit.
   - ☐ All tests shall conform to the appropriate ASTM test procedure and the values used shall conform to the manufacturer's and ANSI standards specifications.
   - ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance" and the InterNational Electrical Testing Association publication, "Maintenance Testing Specifications", as applicable.

   Checkpoints:
   - ☐ Visual and mechanical inspection:
     - ☐ Mechanically and visually inspect panel writing.
     - ☐ Remove cover from relay case. Inspect the cover gasket; and replace if necessary. Check glass for cracks, tightness in frame, etc.; clean both sides of glass.
     - ☐ Remove relay from case and visually inspect both. Remove dust by blowing or preferably sucking air using a small insulated vacuum cleaner. Rust or metal particles should be removed from the disc with a magnet cleaner or brush. The presence of moisture may indicate an incorrect application or lack of air tight seal.
     - ☐ Hold relay up to the light and ensure that the disc does not rub and has sufficient clearance between the magnet poles.
     - ☐ Except for pivotal joints, tighten all screws, nuts, and bolts, especially the taps.
     - ☐ Examine condition and appearance of bearings. Rotate the disc manually to close the contacts and check for smooth operation. Allow the disc restraint spring to return the disc to its normally de-energized position. Inspect disc restraint spring for proper tension and possible damage. Replace bearings if defective.

- ☐ Check operation of target by manually lifting the armature and observing appearance of target.
- ☐ Check relay coils for damage from excessive current.
- ☐ Check case connections, particularly shorting links.

☐ Electrical test:

- ☐ Test the relay directional unit and record the existing settings. Compare results with coordination study and previous test results, or relay setting and manufacturer's instructions.
- ☐ Perform zero check if relay has a time dial.
- ☐ With the directional unit blocked closed, test the unit for minimum pickup, maximum torque angle, contact gap, and clutch pressure.
- ☐ Perform time and current characteristic tests according to system requirements and settings on at least three points on the time/current curves. Adjust if required.
- ☐ Check target and seal in operation.
- ☐ Perform instantaneous element pickup test and adjust as required.
- ☐ Completely check the continuity of current circuit from relay to current transformer.
- ☐ Test ammeter transfer switch for "non-interruption" of current circuit.
- ☐ Calibrate panel ammeter within 3 percent of test meter reading.
- ☐ Mechanically operate relay to ascertain that it will electrically operate the breaker or device as per original design intention.
- ☐ Record results of test and inspection and report deficiencies. Update prints. Return relay to service, replacing cover and removing test leads and jumpers.
- ☐ Remove tags and lock; return circuit to service.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Relay test set
- ☐ Test blocks and jumpers
- ☐ Cleaning materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.
- ☐ Electrical safety group II 5000 volt rubber gloves

9. **Induction Disc Over Current Relay**
Annual

Special Instructions:

- ☐ Schedule this maintenance outage with operating personnel.
- ☐ Obtain and review manufacturer's instructions, circuit diagrams for relay and test set.

- [ ] Review Procedure for "Controlling Hazardous Energy Sources."
- [ ] De-energize, lock-out and tag the circuit.
- [ ] All tests shall conform to the appropriate ASTM test procedure and the values used shall conform to the manufacturer's and ANSI Standards specifications.
- [ ] Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

Checkpoints:

- [ ] Visual and mechanical inspection.
    - [ ] Mechanically and visually inspect panel wiring.
    - [ ] Remove cover from relay case. Inspect the cover gasket; replace if necessary. Check glass for cracks, tightness in frame, etc.; clean both sides of glass.
    - [ ] Remove relay from case and visually inspect both. Remove dust by blowing or preferably sucking air using a small vacuum cleaner. Rust or metal particles should be removed from the disc with a magnet cleaner or insulated type brush. The presence of moisture may indicate an incorrect application or lack of air tight seal.
    - [ ] Hold relay up to the light and ensure that the disc does not rub and has sufficient clearance between the magnet poles.
    - [ ] Except for pivotal joints, tighten all screws, nuts, and bolts, especially the taps.
    - [ ] Examine condition and appearance of bearings. Rotate the disc manually to close the contacts and check for smooth operation. Allow the disc restraint spring to return the disc to its normally de-energized position. Inspect disc restraint spring for proper tension, alignment, and possible damage. Replace bearings if defective.
    - [ ] Check operation of target by manually lifting the armature and observing appearance of target.
    - [ ] Check relay coils for damage from excessive current.
    - [ ] Inspect contacts and contact backstops for pitting or burning. Burnish contacts in direction of contact motion, if necessary.
    - [ ] Examine case connections, particularly current shorting links.
- [ ] Electrical test.
    - [ ] Test the relay and record the existing settings. Compare results with coordination study and previous test results, or relay setting and manufacturer's instructions.
    - [ ] Perform zero check if relay has a time dial.
    - [ ] Perform a minimum pickup test to determine the minimum operating current. Adjust by moving control spring/plate.

- ☐ Perform time and current characteristics tests according to system requirements and settings on at least three points on the time/current curves. Adjust by moving restraint magnet.
- ☐ Examine target and seal-in operation.
- ☐ Perform instantaneous element pickup test, and adjust as required.
- ☐ Check continuity of current circuit from relay to current transformer.
- ☐ Test ammeter transfer switch for "non-interruption" on current circuit.
- ☐ Calibrate panel ammeter within 3 percent of test meter reading.
- ☐ Mechanically operate the relay to ascertain that it will electrically trip the breaker.
- ☐ Record results of test and inspection and report deficiencies. Update prints. Return relay to service, replacing cover and removing test leads and jumpers.
- ☐ Remove tags and lock, return the circuit to service.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Relay test set
- ☐ Cleaning Materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.
- ☐ Test blocks and jumpers
- ☐ Electrical safety group II 5000 volt rubber gloves

10. **Low Voltage Molded Case Circuit Breaker**

Three Years

This maintenance task applies to low voltage molded case circuit breakers and main incoming breakers that are less than 600 volts. A main breaker is one that is located on the incoming feeder that serves all or a major portion of the building and acts as the first line of protection between the building and the service entrance.

Special Instructions:

- ☐ Schedule this maintenance outage with operating personnel.
- ☐ Obtain and review manufacturer's instructions (including time current characteristic curve).
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, tag and lock out the circuit.
- ☐ All inspections and tests shall conform to the appropriate ASTM test procedure and the values used shall conform to the manufacturer's and ANSI Standards specifications.

- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable

Checkpoints:

- ☐ Visually inspect breaker for cracks in the case and signs of overheating. Tighten loose connections using manufacturer's recommended torque values. Remove contaminants. Manually operate the breaker several times.
- ☐ Perform a time current characteristic test on the time delay element at three times the rated current. Compare results with those specified by the manufacturer and record.
- ☐ Check contact resistance in milli-volts at rated current and the dielectric strength in megohms.
- ☐ If the breaker has an instantaneous element, check the trip setting and test accordingly. Record the results.
- ☐ If the breaker does not perform within the prescribed limits, it should be replaced.
- ☐ Place an appropriate identification sticker on each breaker cover. I.D. sticker shall show the name of the testing firm or agency, date of test and initials of tester.
- ☐ Remove tags and lock; return circuit to service.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer’s instruction manual for specialized tools, equipment and supplies.
- ☐ Micro-Ohmmeter
- ☐ Megger
- ☐ Hi-pot test equipment
- ☐ Cleaning materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.

11. **Low Voltage Power Air Circuit Breakers (Over 100 Amps)**
Three Years

Special Instructions:

- ☐ Schedule this maintenance outage with operating personnel.
- ☐ Obtain and review manufacturer's instructions.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, tag and lock out the circuit.
- ☐ All inspections and tests shall conform to the appropriate ASTM test procedure and the values used shall conform to the manufacturer's and ANSI Standards specifications.

- [ ] Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

Checkpoints:

- [ ] Open breaker, rack it out and remove from cubicle. Breaker should be handled with some type of lifting device.
- [ ] Inspect primary fingers on back of the breaker for missing or broken springs, finger wear and dirt.
- [ ] Remove arc chutes and inspect for cracks, broken or burned parts.
- [ ] Inspect and clean main and arcing contact.
- [ ] With the arc chutes removed, close the breakers mechanically to check contact action and alignment. CAUTION: Keep all parts of the body in the clear. The contacts are spring operated and could cause serious injury.
- [ ] Operate breaker several times, check for smooth operation.
- [ ] Lubricate the racking-in mechanism in accordance with manufacturer's instructions. Take care not to use excess lubricant.
- [ ] Tighten all bolts and screws.
- [ ] Remove dust and dirt from breaker, cubicle and arc chutes with high suction industrial insulated vacuum cleaner.
- [ ] Check trip bar movement to operate breaker.
- [ ] Check the trip arm on each trip device for proper contact with trip bar.
- [ ] Measure contact resistance in milli-volts at rated current from the breaker primary fingers.
- [ ] Determine the applicable curve and the proper setting for the breaker. The proper setting can usually be determined from the nameplate data and "as found indicator" on the breaker. If the system characteristic curves originally prepared for the project short circuit study are available, they shall be used. Bring any deviation or questionable setting to the attention of regional office for electrical engineering design approval.
- [ ] Check the breaker alignment in the cubicle by applying a thin film of black contact grease to the line and load stabs, then rack the breaker in and out of the cubicle and measure the primary finger wipe marks off the stab.
- [ ] Determine that instantaneous device will operate at its rate or setting value.
- [ ] Perform a dielectric strength test between each phase (ACB closed) and each pole to grounded case (ACB open).
- [ ] Needed repair or replacement should be reported.
- [ ] Record results of test and inspection and report deficiencies on GSA Form 2543, Low Voltage Circuit Breaker Test Record, or appropriate form substitute.

- ☐ Remove tags and lock, return circuit to service.
- ☐ Place an appropriate identification sticker on each breaker cover. I.D. sticker shall show the name of the testing firm or agency, date of test and initials of tester.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Lubricants. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment (PPE).
- ☐ Cleaning supplies and materials. Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Vacuum cleaner
- ☐ Micro-Ohmmeter
- ☐ "Multi-Amp" test equipment

12. **Network Protectors 600V Class**

Annual

A network protector is an air circuit breaker equipped with specialized relays that sense network circuit conditions and command the circuit breaker to either open or close. All control power is taken from the system and not separately provided for. They are used where a large amount of power is distributed to high load density areas.

Special Instructions:

- ☐ Schedule this maintenance outage with operating personnel.
- ☐ Obtain and review manufacturer's instructions. Refer to these for a description of the operation, adjustment, replacement of any part that looks suspicious.
- ☐ De-energize, lockout and tag circuit.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources." Large fault currents will result from a short circuit on any point in the system on an energized unit. Do not remove any barriers from enclosure; replace defective ones.
- ☐ Use insulated safety gloves and tools.
- ☐ All tests shall conform to the appropriate ASTM test procedure and the values used shall conform to the manufacturer's and ANSI Standards specifications.
- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance" and the InterNational Electrical Testing Association publication, "Maintenance Testing Specifications", as applicable.

Checkpoints:

- [ ] Trip the protector to the open position. Remove fuses at the top and disconnecting links or bolt actuated disconnecting fingers at the bottom.
- [ ] Withdraw unit from housing.
- [ ] Clean complete unit of dust accumulations with a vacuum cleaner. Use clean cloth rags on clinging dirt. Visually inspect mechanisms such as motor, over-travel contact action and alignment, arc chutes, mechanical operation of relays, and loose or missing parts.
- [ ] Remove arc chutes; replace broken splitter plates.
- [ ] Inspect main contacts; smooth any heavily frosted area with a fine file or suitable abrasive material that doesn't shed particles. Protect hinge joint from falling particles during dressing.
- [ ] File smooth exceptionally high projections of metal found on arcing contacts.
- [ ] Ensure that all electrical connections are tight.
- [ ] Check wire insulation for abrasion.
- [ ] Check for overheating of control wire and current carrying parts.
- [ ] Ensure all springs are in place and not broken.
- [ ] Ensure all nuts, pins, snap rings, and screws are in place and tight.
- [ ] Replace any broken barriers.
- [ ] Perform these on enclosure:
    - [ ] Look for any loose hardware on the floor or under the frame. Trace any found to the source.
    - [ ] Clean stand-off bus insulators.
    - [ ] Remove any oxide film from terminal contacts if necessary.
- [ ] Manually close protector in accordance with manufacturer's instructions. It should close with a definite snap action. Friction causes sluggish action. Move trip lever to "tripped" position. Breaker should snap open.
- [ ] Perform an operational test using a network protector test kit.
- [ ] Perform an insulation resistance test, dielectric test, and electrical operating tests in strict accordance with the manufacturer's recommendations. Calibrate relays as necessary to required values, in accordance with manufacturer's instructions.
- [ ] Record test results on Network Protector Test Record, or other appropriate form.
- [ ] Reinstall unit, transformer secondary connections and fuses.
- [ ] Remove tags and restore to service.

Recommended Tools, Materials, and Equipment:

- [ ] Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- [ ] Insulated safety gloves
- [ ] Test table
- [ ] Network protector test kit

- ☐ Appropriate abrasive materials
- ☐ Cleaning materials and equipment. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.

13. **Over and/or Under Voltage Relay**
Annual

Special Instructions:

- ☐ Schedule this maintenance outage with operating personnel.
- ☐ Obtain and review manufacturer's instructions and circuit diagrams for relays and test set.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, tag and lock out circuit.
- ☐ All tests shall conform to the appropriate ASTM test procedures and the values used shall conform to the manufacturer's and ANSI Standards specifications.
- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

Checkpoints:

- ☐ Visual and mechanical inspection.
  - ☐ Disconnect any potential transformers (by low voltage links, etc) to prevent dangerous high voltage feedback.
  - ☐ Mechanically and visually inspect the panel wiring.
  - ☐ Remove cover from relay case. Inspect the cover gasket; and replace if necessary. Check glass for cracks, tightness in frame, etc.; clean both sides of glass with lens paper.
  - ☐ Remove relay from case and visually inspect both. Remove dust by blowing or preferably sucking air using a small vacuum cleaner or insulated brush. The presence of moisture may indicate an incorrect application or lack of air tight seal.
  - ☐ Hold relay up to the light and ensure that the disc does not rub and has sufficient clearance between the magnet poles.
  - ☐ Except for pivotal joints, tighten all screws, nuts, and bolts, especially the taps.
  - ☐ Examine condition and appearance of bearings. Rotate the disc manually to close the contacts and check for smooth operation. Allow the disc restraint spring to return the disc to its normally de-energized position. Inspect disc restraint spring for proper tension, alignment, and possible damage. Replace bearings if defective.
  - ☐ Check operation of target by manually lifting the armature and observing appearance of target.

- ☐ Check relay coils for damage from excessive current.
- ☐ Inspect contacts and contact backstops for pitting or burning. Burnish contacts in direction of contact motion, if necessary.
- ☐ Examine case connections, particularly current shorting links.

☐ Electrical test:

- ☐ Test the relay and record the existing settings. Compare results with coordination study and previous test results, or relay setting and manufacturer's instructions.
- ☐ Perform zero check if relay has a time dial.
- ☐ Perform pickup test to determine the minimum/maximum voltage required to operate the trip circuit. Adjust per manufacturer's recommendations.
- ☐ Perform time current or voltage characteristic test on at least three points on the time/current curves according to system requirements, settings and manufacturer's instructions.
- ☐ Test target and/or seal-in operation.
- ☐ Calibrate panel volt master within 3 percent of test meter reading.
- ☐ Test associated wiring as required, avoiding any unintentional transformer high voltage back feed.
- ☐ Mechanically operate the relay to ascertain that the relay will electrically operate the associated devices as designed.
- ☐ Record results of test and inspection and report deficiencies. Update prints. Return relay to service, replacing cover and removing test leads and jumpers.
- ☐ Remove tags and lock; return the circuit to service.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Relay test set
- ☐ Cleaning materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.
- ☐ Test blocks and jumpers
- ☐ Electrical safety group II 5000 volt rubber gloves

14. **Power Factor Reverse Current or Watt Type Relay**
Annual

Special Instructions:

- ☐ Schedule this maintenance outage with operating personnel.
- ☐ Obtain and review manufacturer's instructions and circuit diagrams for relays and test sets.

- [ ] Review Procedure for "Controlling Hazardous Energy Sources."
- [ ] De-energize, tag and lockout circuit.
- [ ] All tests shall conform to the appropriate ASTM test procedure and the values used shall conform to the manufacturer's and ANSI Standards specifications.
- [ ] Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

Checkpoints:

- [ ] Text Visual and mechanical inspection:
    - [ ] Mechanically and visually inspect panel and wiring.
    - [ ] Remove cover from relay case. Inspect the cover gasket; and replace if necessary. Check glass for cracks, tightness in frame, etc.; clean both sides of glass.
    - [ ] Remove relay from case and visually inspect both. Remove dust by blowing or preferably sucking air using a small insulated vacuum cleaner. Rust or metal particles should be removed from the disc with a magnet cleaner or brush. The presence of moisture may indicate an incorrect application or lack of air tight seal.
    - [ ] Hold relay up to the light and ensure that the disc does not rub and has sufficient clearance between the magnet poles.
    - [ ] Except for pivotal joints, tighten all screws, nuts, and bolts, especially the taps.
    - [ ] Examine condition and appearance of bearings. Rotate the disc manually to close the contacts and check for smooth operation. Allow the disc restraint spring to return the disc to its normally de-energized position. Inspect disc restraint spring for proper tension and possible damage.
    - [ ] Replace bearings if defective.
    - [ ] Check operation of target by manually lifting the armature and observing appearance of target.
    - [ ] Check relay coils for damage from excessive current.
    - [ ] Inspect contacts and backstops as required. Burnish contacts.
- [ ] Electrical test:
    - [ ] Test the relay and record the existing settings. Compare results with coordination study and previous test results, or relay setting and manufacturer's instructions.
    - [ ] Perform zero check if relay has a time dial.
    - [ ] Perform test as required by particular settings and system requirements conforming to manufacturer's instructions for that particular relay.
    - [ ] Check continuity of circuit from relay to the current transformer.
    - [ ] Test ammeter transfer switch for "non-interruption" of circuit.

- ☐ Calibrate panel ammeter within 3 percent of test meter reading.
- ☐ Mechanically operate relay to ascertain that it will electrically operate the breaker or device.
- ☐ Record results of test and inspection and report deficiencies. Update prints. Return relay to service, replacing cover and removing test leads and jumpers.
- ☐ Remove tags and lock; return circuit to service.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Relay test set
- ☐ Test blocks and jumpers
- ☐ Cleaning materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.
- ☐ Electrical safety group II 5000 volt rubber gloves

15. **Supervision Set**
Annual

Special Instructions:

- ☐ Care shall be taken while performing maintenance. Operations of the tripping relays in a Supervisory Set will disconnect all electricity into the building.
- ☐ Study the manufacturer's instructions and the building one line diagram.
- ☐ Schedule this maintenance outage with the operating personnel.

Checkpoints:

- ☐ Clean the exterior and interior, all contact points, etc.
- ☐ Check all connections for tightness.
- ☐ Check all wiring for signs of deterioration.
- ☐ Mechanically operate each relay, verify its functions.
- ☐ Check each alarm bell and light.
- ☐ Upon completion of all work, tour each electrical vault and verify that the Supervisory Set is indicating the correct position of all electrical devices.
- ☐ Record results of all tests on appropriate equipment history form; report deficiencies for repair action.
- ☐ Clean work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Supply of lights, lenses.

- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.
- ☐ Vacuum

16. **Switchboard, Low Voltage (Per Cubicle)**

Three Years

This maintenance task applies to low voltage (up to 600 volts) free standing switchboards that can be opened from the rear for preventive maintenance. It does not apply to wall mounted breaker panels.

Special Instructions:

- ☐ Schedule work and notify all operating personnel. The initial maintenance of new equipment should be six months after installation, or later if permitted under the manufacturer's warranty.
- ☐ Review manufacturer's instructions.
- ☐ Caution: This work requires a total board outage and safe removal of all possible sources of electricity. Review Procedure on "Controlling Hazardous Energy Sources." Review one-line diagrams to be sure that all circuits have been located. Identify the breakers necessary to remove all voltage sources including feedback. All incoming and outgoing circuits from this bus must be safely cleared, including any voltage transformers. Upon completion of checkpoints
- ☐ #1 and #2 below de-energize and lock-out the switchboard bus.
- ☐ All protective devices mounted in the switchboard should be tested at this time, using appropriate PM task lists.
- ☐ These tests shall conform to the appropriate ASTM test procedures and the values used as standards shall conform to the manufacturers and ANSI Standards Specifications.
- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

Checkpoints:

- ☐ Perform a complete visual inspection. Check for:
  - ☐ Proper alignment, anchorage and equipment grounding.
  - ☐ Grounds or shorts.
  - ☐ Evidence of overheating or arcing.
  - ☐ Cable arrangements and supports, cracked or damaged insulators.
- ☐ Perform a thermographic scan of the complete switchboard and all protective devices while it is energized.

- ☐ Remove cover plates (do not scan through glass).
- ☐ Scan at times of heaviest loading for optimum results, but not less than 20% of full load.
- ☐ Record locations of hot spots, and the temperature rise. NOTE: Any connection with a temperature rise above 20°C should be corrected immediately.

- ☐ Upon accomplishing special instruction #2 above, thoroughly vacuum all dust and dirt. Wipe clean the interior of the switchboard, including buses, insulators, and cables.
- ☐ Inspect fuse clips for tightness and alignment.
- ☐ Torque cable and bus connections to factory specifications, paying special attention to hot spots shown on the thermographic scan. Hot circuits could be an indication of overloaded circuits, improper connections, or unbalanced loads.
- ☐ Perform an insulation resistance test from phase to phase and phase to ground on each bus. Compare the results with previous tests to detect any weakening trend.
- ☐ Perform a second thermographic scan upon completion of repair work. Repeat these steps until device(s) perform satisfactorily.
- ☐ Refinish any damaged paint surfaces found.
- ☐ After re-torque and repairs, perform another thermographic scan to ensure that all of the hot spots were eliminated.
- ☐ Document findings and repairs in an appropriate format. Clearly indicate the location and type of deficiency, and the corrective action taken.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Cleaning supplies and materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.
- ☐ Vacuum
- ☐ Calibrated torque wrench
- ☐ Insulation resistance test set

17. **Switchboards, Medium Voltage**

Three Years

This maintenance task applies to medium voltage (600 – 15 KV) free standing switchboards that can be opened from the rear for preventive maintenance.

Special Instructions:

- ☐ Schedule work and notify all operating personnel. The initial maintenance of new equipment should be six months after installation, or later if permitted under the manufacturer's warranty.

- [ ] Caution: This work requires a total board outage and safe removal of all possible sources of electricity. Review Procedure on "Controlling Hazardous Energy Sources." Review one-line diagrams to be sure that all circuits have been located. Identify the breakers necessary to remove all voltage sources including feedback. All incoming and outgoing circuits from this bus must be safely cleared, including any voltage transformers. Upon completion of checkpoints
- [ ] #1 and #2 below de-energize and lock-out the switchboard bus.
- [ ] All protective devices mounted in the switchboard should be tested at this time, using appropriate PM task lists.
- [ ] These tests shall conform to the appropriate ASTM test procedures and the values used as standards shall conform to the manufacturers and ANSI Standards Specifications.
- [ ] Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

Checkpoints:

- [ ] Enter board from rear and perform complete inspection. Check for:
  - [ ] Proper anchoring, and equipment grounding.
  - [ ] Grounds or shorts.
  - [ ] Evidence of overheating or arcing.
  - [ ] Cable arrangements and supports, cracked or damaged insulators.
- [ ] Perform an infrared scan of the complete switchboard and all protective devices while it is energized.
  - [ ] Remove cover plates (do not inspect through glass).
  - [ ] Scan at times of heaviest loading for optimum results, but not less than 20% of full load.
  - [ ] Record locations of hot spots and the temperature rise. NOTE: Any connection with a temperature rise above 20°C should be corrected immediately.
- [ ] De-energize and lock out the switchboard. Torque cable and bus connections to factory specifications, paying special attention to hot spots shown on the infrared scan. Hot circuits could be an indication of overloaded circuits or unbalanced loads.
- [ ] Inspect fuse clips for tightness and alignment.
- [ ] Thoroughly vacuum and clean inside board.
- [ ] Inspect for correct identification labels or plates.
- [ ] Inspect operation of shutters.
- [ ] Inspect all internal heaters, etc.
- [ ] Mechanically and visually inspect all current and potential transformers.

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- ☐ Inspect and align high voltage disconnects. NOTE: High voltage breakers while removed at this time should be 2500 volt Megger tested and hi-potted with appropriate AC RMS or DC voltage as per factory recommendations and ASA standards. Test voltage should not exceed 65% of AIEE factory test level. Schedule maintenance per appropriate PM task.
- ☐ When all work is complete and personnel are clear of the bus and all pot transformers removed or disconnected, the high voltage bus should be 2500 volt Megger tested and high-potential tested at appropriate AC RMS as voltage as in "NOTE" above.
- ☐ Document findings and repairs in an appropriate format. Clearly indicate the location and type of deficiency, and the corrective action taken.
- ☐ Place an appropriate identification sticker on each breaker cover. I.D. sticker shall show the name of the testing firm or agency, date of test and initials of tester.
- ☐ Reinstall all breakers before removing tags, return to service, and clean work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ High-pot
- ☐ Megger
- ☐ Cleaning supplies and materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.
- ☐ Vacuum
- ☐ Calibrated Torque wrench

18. **Thermal Over Current Relay**
Annual

Special Instructions:

- ☐ Schedule this maintenance outage with operating personnel.
- ☐ Obtain and review manufacturer's instructions and circuit diagrams for relays and test sets.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize and tag and lockout circuit.
- ☐ All tests shall conform to the appropriate ASTM test procedure and the values used shall conform to the manufacturer's and ANSI Standards specifications.
- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance" and the InterNational Electrical Testing Association publication, "Maintenance Testing Specifications", as applicable.

Checkpoints:

- [ ] Visual and mechanical inspection:
  - [ ] Mechanically and visually inspect panel and wiring.
  - [ ] Remove cover from relay case. Inspect the cover gasket; and replace if necessary. Check glass for cracks, tightness in frame, etc.; clean both sides of glass.
  - [ ] Remove relay from case and visually inspect both. Remove dust by blowing or preferably sucking air using a small vacuum cleaner. Rust or metal particles should be removed from the disc with a magnet cleaner or brush. The presence of moisture may indicate an incorrect application or lack of air tight seal.
  - [ ] Hold relay up to the light and ensure that the disc does not rub and has sufficient clearance between the magnet poles.
  - [ ] Except for pivotal joints, tighten all screws, nuts, and bolts, especially the taps.
  - [ ] Examine condition and appearance of bearings. Rotate the disc manually to close the contacts and check for smooth operation. Allow the disc restraint spring to return the disc to its normally de-energized position. Inspect disc restraint spring for proper tension and possible damage. Replace bearings if defective.
  - [ ] Check operation of target by manually lifting the armature and observing appearance of target.
  - [ ] Check relay coils for damage from excessive current.
  - [ ] Inspect contacts and backstops. Burnish contacts in the direction of contact motion, if necessary.
  - [ ] Examine case connections.
- [ ] Electrical test:
  - [ ] Test the relay and record the existing settings. Compare results with coordination study and previous test results, or relay setting and manufacturer's instructions.
  - [ ] Perform zero check if relay has a time dial.
  - [ ] Perform minimum pickup test to determine the minimum operating current.
  - [ ] Perform time and current characteristic tests according to system requirements and settings on at least three points on the time/current curves. Adjust as required by moving restraint magnet.
  - [ ] Examine target and seal-in operation.
  - [ ] Perform instantaneous element pickup test, and adjust as required.
  - [ ] Check continuity of circuit from relay to the current transformers.
  - [ ] Test ammeter transfer switch for "non-interruption" of current circuit.
  - [ ] Calibrate panel ammeter within 3 percent of test meter reading.
  - [ ] Mechanically operate relay to ascertain that it will electrically operate the breaker device.
  - [ ] Record results of test and inspection and report deficiencies. Update prints. Return relay to service, replacing cover and removing test leads and jumpers.

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- [ ] Remove tags and lock; return circuit to service.

Recommended Tools, Materials, and Equipment:

- [ ] Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- [ ] Relay test set
- [ ] Test blocks and jumpers
- [ ] Cleaning materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.
- [ ] Electrical safety group II 5000 volt rubber gloves

VII. Transformer

1. **High Voltage Network and Power Dry Type Transformers**
   Annual

Special Instructions:

- [ ] Schedule this maintenance task with operating personnel.
- [ ] Obtain and review manufacturer's instructions.
- [ ] Review Procedure for "Controlling Hazardous Energy Sources."
- [ ] De-energize, lockout and tag circuit, circuit usually must be cleared on primary beyond any primary disconnect switch.
- [ ] All tests shall conform to the appropriate ASTM test procedure and the values used as standards shall conform to the manufacturer's and ANSI Standards specifications.
- [ ] Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance" and the InterNational Electrical Testing Association publication, "Maintenance Testing Specifications", as applicable.

Checkpoints:

- [ ] Thoroughly clean unit inside and out with vacuum cleaner. Dust may be blown from hard to reach areas with low pressure dry air.
- [ ] Tighten connections with torque wrench.
- [ ] Inspect for signs of overheating or other defects.
- [ ] Inspect spacing and rigidity of conductors.
- [ ] Clean and inspect bushings.
- [ ] Inspect operation of any fans or cooling apparatus.
- [ ] Test operation of any temperature alarms or trips.
- [ ] On power type transformers only: perform appropriate Megger or insulation resistance tests with primaries shorted and the secondaries shorted.

- ☐ On power type transformers only: with primaries and secondaries shorted, perform AC RMS high potential tests at no more than 65% of factory test voltages (ANSI C57.1290), test primary to secondary and ground and also secondary to primary and ground.
- ☐ Record test results.
- ☐ Remove tags and lock; return circuit to service.
- ☐ Clean work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Vacuum or low pressure blower
- ☐ Torque wrenches
- ☐ Megger
- ☐ Hi-pot

2. **High Voltage Network and Power Type Transformer (Oil Filled)**
Annual

Special Instructions:

- ☐ Schedule this maintenance task with operating personnel.
- ☐ Obtain and review manufacturer's instructions.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, tag and lockout circuit, test circuit before beginning work.
- ☐ All tests shall conform to the appropriate ASTM test procedure and the values used as standards shall conform to the manufacturer's and ANSI Standards specifications.
- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance" and the InterNational Electrical Testing Association publication, "Maintenance Testing Specifications", as applicable.

Checkpoints:

- ☐ Examine condition of mounting and support members.
- ☐ Examine grounding wire.
- ☐ Inspect accessible insulators for chips, cracks or fractures.
- ☐ Clean accessible insulators according to manufacturer's instructions. This is usually accomplished with a soft cloth dipped in a silicone type compound and polish (never use water, caustic solutions or abrasives such as steel wool or a wire brush). When cleaned, polish with a soft cloth or lamb's wool.
- ☐ Take oil sample. Mineral samples from bottom; askarel and pyronals samples should be removed from the top. Test for:

- [ ] Color number.
- [ ] Neutralization number.
- [ ] Dielectric strength.
- [ ] Interfacial tension.

- [ ] Inspect for leaks and check oil level and oil reservoir. Sealed oil filled transformers with internal open space should be purged and left with an inert gas (nitrogen ultra high purity) pressure of about 1 psig at 30oC. Perform positive pressure tests on outside transformers.
- [ ] Tighten all connections.
- [ ] Remove rust spots from body, caps and flanges by sanding. Prime bare metal with rust inhibitor primer and paint (never use aluminum or copper base paints or primers).
- [ ] Inspect disconnects for structure and condition of contact surfaces.
- [ ] Check operation of all cooling apparatus such as fans or pumps, etc.
- [ ] Check operation of any temperature or sudden pressure alarms or trips and electrical interlocks.
- [ ] On power type transformers only, perform appropriate dielectric or Megger tests with primary terminals shorted, secondary terminals shorted, measure primary to secondary and ground, primary to secondary, secondary to primary and ground.
- [ ] On power type transformers only with primaries shorted and secondaries shorted, perform AC RMS high-potential tests at (ANSI C57.1290) no more than 60 percent of test voltage for a new transformer. Test primary to secondary and ground and secondary to primary and ground.
- [ ] Record results of test and inspection separately for each transformer.
- [ ] Remove tags and lock, return circuit to service.
- [ ] Clean work area.

Recommended Tools, Materials, and Equipment:

- [ ] Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- [ ] Oil test kit – sample bottle (field test or lab).
- [ ] Cleaning materials and equipment, soft cloth or lamb's wool. Consult the Material Safety Data Sheet (MSDS) for hazardous ingredients and proper Personal Protective Equipment (PPE).
- [ ] Megger (power type transformer)
- [ ] Hi-pot test equipment
- [ ] Sandpaper
- [ ] Primer paint. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- [ ] Equipment for purging with nitrogen (if required)

- ☐ Rubber gloves

3. **Low Voltage Dry Type Transformer (30 KVA or More, 600 Volts or Less)**
   Three Years
   This maintenance task applies to low voltage (primary voltage of 600 volts or less) dry type transformers with a rated capacity of 30 KVA or more. Transformers of this size and type normally function to provide low voltage power for lighting, general purpose outlets, data processing equipment, etc.

   Special Instructions:
   - ☐ Schedule this outage with operating personnel.
   - ☐ Obtain and review manufacturer's instructions.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock out and tag the circuit. The circuit is usually cleared by a disconnect switch on primary side. If a network system is used, disconnect the secondary side also.
   - ☐ All tests shall conform to the appropriate ASTM test procedures and the values used as standards shall conform to the manufacturer's and ANSI Standard specification.
   - ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

   Checkpoints:
   - ☐ Thoroughly clean unit inside and out with vacuum cleaner. Dust may be blown from hard to reach areas with low pressure dry air.
   - ☐ Tighten connections with torque wrench to manufacturer's specifications.
   - ☐ Visually inspect for signs of overheating.
   - ☐ If unit is equipped with forced fan cooling, check fan and controls for proper operation. Lubricate as required.
   - ☐ Perform a dielectric absorption test, which shall be winding to winding, for 10 minutes and from winding to ground for 10 minutes. Record test results.
   - ☐ Reenergize transformer and, with a calibrated voltmeter, check the secondary output voltage from phase to phase and from phase to ground.
   - ☐ Measure and record the electrical load.
   - ☐ Check surrounding area for proper ventilation.

   Recommended Tools, Materials, and Equipment:
   - ☐ Review manufacturer’s instruction manual for specialized tools, equipment and supplies.
   - ☐ Vacuum or low pressure blower

- ☐ Torque wrenches
- ☐ Megger and Volt Meter

4. **Power Distribution Units (PDU)**
   Semiannual

   Special Instructions:
   - ☐ Obtain and review manufacturer's operation and maintenance instructions.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ Schedule maintenance outage with operating personnel.
   - ☐ Keep accurate records for future trouble-shooting.
   - ☐ Keep unit clean and free of dust and moisture.
   - ☐ All tests shall conform to the appropriate manufacturer's test procedures and the values used as standards shall conform to ANSI specifications.
   - ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

   Checkpoints:
   - ☐ Measure the following using high precision digital multimeter and ammeter.
     - ☐ System rectifier input voltage and current.
     - ☐ System bypass input voltage and current.
     - ☐ Rectifier output voltage.
     - ☐ Inverter output voltage and current.
     - ☐ Static switch output voltage and current.
     - ☐ Bypass input frequency.
     - ☐ Inverter frequency.
   - ☐ Check front panel meters for accuracy.
   - ☐ Check front panel alarm lamps/indicators and replace if defective.
   - ☐ Check all cooling fans for proper operation.
   - ☐ Vacuum interior and exterior with a nonmetallic nozzle and brush.
   - ☐ Check all electrical terminations for tightness.
     - ☐ Breakers.
     - ☐ Contactors.
     - ☐ Rectifiers.
     - ☐ Relays.
     - ☐ Inverters.

- ☐ Terminal blocks.
- ☐ Check logic voltage supply.
- ☐ Place rectifier under manual control and check the following:
  - ☐ DC over voltage alarm.
  - ☐ Low battery alarm.
  - ☐ DC under voltage alarm.
  - ☐ Phase rotation Detector.
- ☐ Using an oscilloscope, check static switch transfer forward and reverse.
- ☐ Test and adjust the following:
  - ☐ Inverter and nominal output voltage.
  - ☐ Inverter phase lock.
- ☐ Check and adjust rectifier bridge balance.
- ☐ Manually check static switch to ensure proper operation under load

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ High precision digital meter for amperage and voltage measurements.
- ☐ Oscilloscope
- ☐ Vacuum cleaner
- ☐ Cleaning materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment (PPE).

VIII. Uninterruptible Power Systems (UPS)

1. **Lighting, Outside; Fluorescent, Mercury Vapor or High Pressure Sodium**

Five Years

This maintenance task applies to parking lot, street, loading dock, and perimeter lighting, and provides for group re-lamping and maintenance of such fixtures outside the building.

Special Instructions:

- ☐ Review Procedure for "Controlling Hazardous Energy Sources."

Checkpoints:

- ☐ Open and tag switch.
- ☐ Remove old lamps and clean fixture including reflector, refractor, and globes.
- ☐ Inspect condition of wiring, contacts, terminals, and sockets. Look for evidence of overheating.
- ☐ Install new lamp and assemble checking gaskets for proper seat.
- ☐ Test operation of automatic switches.

- ☐ Inspect lamp standards and mounting devices.
- ☐ Clean up work area and remove all trash.

Recommended Tools, Materials, and Equipment:

- ☐ Standard tools – Basic
- ☐ Cleaning materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper Personal Protective Equipment (PPE).

2. **Uninterruptible Power Systems (UPS)**
Quarterly
This maintenance task applies to a standard Series 600 UPS module.

Special Instructions:

- ☐ Obtain and review manufacturer's operation and maintenance instructions.
- ☐ Review Procedure for Controlling Hazardous Energy Sources.
- ☐ Schedule maintenance outage with operating personnel.
- ☐ Keep accurate records for future trouble-shooting. Record data on a permanent maintenance log.
- ☐ Keep unit clean and free of dust and moisture.
- ☐ Keep the unit cool at approximately 25°C (77°F).
- ☐ Keep connections tight.
- ☐ All tests shall conform to the appropriate manufacturer's test procedures and the values used as standards shall conform to GSA and ANSI specifications.
- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.
- ☐ Note: Air filters shall be checked bimonthly and replaced if dirty.

Checkpoints:

- ☐ Vacuum the UPS to remove dust.
- ☐ Check for and remove moisture.
- ☐ Tighten connections.
- ☐ Check the battery and terminal voltages, specific gravity, and connection resistance in accordance with the battery manufacturer's instructions.
- ☐ Verify that the output voltage is within 26 of the normal voltage.
- ☐ Verify that the battery mimic indicates normal DC voltage with the battery charge current not exceeding 31 amperes.

- ☐ Verify that the input current on each phase is within 10* of the average input current.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Vacuum cleaner
- ☐ Cleaning materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment (PPE).

3. **Uninterruptible Power Systems (UPS)**
   Annual
   This maintenance task applies to a rotary UPS module made by Power Systems

Special Instructions:

- ☐ Obtain and review manufacturer's operation and maintenance instructions.
- ☐ Review Procedure for Controlling Hazardous Energy Sources."
- ☐ Schedule maintenance outage with operating personnel.
- ☐ Keep accurate records for future trouble-shooting. Record data on a permanent maintenance log.
- ☐ Keep unit clean and free of dust and moisture.
- ☐ Keep the unit cool at approximately 25°C (77°F).
- ☐ Keep connections tight.
- ☐ All tests shall conform to the appropriate manufacturer's test procedures and the values used as standards shall conform to ANSI specifications.
- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance" and the InterNational Electrical Testing Association publication, "Maintenance Testing Specifications", as applicable.
- ☐ This inspection requires the load to be operated on bypass for six (6) hours and complete power down for two (2) hours. Coordinate date for inspection with operating personnel.
- ☐ This inspection should be performed in the month of November, and should be performed on the weekend, nights, or holiday.

Checkpoints:

- ☐ Repeat quarterly maintenance and add following additional services.
- ☐ Inspect and clean all open contacts, knife-edges, etc.
- ☐ Remove and re-install all plug-in components. Clean current carrying points-of-contact.
- ☐ Check M/G set alignment with dial indicator.
- ☐ Inspect and tighten all major cable connections including circuit breakers.

- ☐ Cycle system and discharge battery if possible. Recharge and observe charging rate and battery condition.
- ☐ Check calibration of meters where possible.
- ☐ Inspect condition of flexible coupling.
- ☐ Inspect M/G set bearings and seals for excessive heat, noise or loss of lubricant.
- ☐ Check each battery cell for proper voltage and specific gravity.
- ☐ Supply user with written report of service and recommendations if any.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Vacuum cleaner.
- ☐ Cleaning materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment (PPE).

4. **Uninterruptible Power Systems (UPS)**
   Annual, Semi-Annual
   This maintenance task applies to a PILAR Uniblock II Rotary UPS.

Special Instructions:

- ☐ Obtain and review manufacturer's operation and maintenance instructions.
- ☐ Review the "Procedure for Controlling Hazardous Energy Sources."
- ☐ Schedule maintenance outage with operating personnel.
- ☐ Keep accurate records for future trouble-shooting. Record data on a permanent maintenance log.
- ☐ Keep unit clean and free of dust and moisture.
- ☐ Keep the unit cool at approximately 25°C (77°F).
- ☐ Keep connections tight.
- ☐ All tests shall conform to the appropriate manufacturer's test procedures and the values used as standards shall conform to ANSI specifications.
- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, "Electrical Equipment Maintenance" and the InterNational Electrical Testing Association publication, "Maintenance Testing Specifications", as applicable

Standard Preventive-Maintenance Tasks:

- ☐ **Performance Requirements**
  - ☐ The on-line requirements are to be performed on a semi-annual basis. The annual requirements are to be performed once a year in conjunction with the on-line requirements.

- [ ] The on-line requirements should be completed in approximately one hour (per unit). The annual requirements should be completed in approximately four hours (per unit).

- [ ] **On-line Requirements (Semi-Annual)**
  - [ ] Refer to Uniblock II Start & Calibration Procedure or Programming Procedure as required. In order to facilitate the timely implementation of required remedial actions, all previous recorded data should be reviewed to detect negative trends.
  - [ ] Conduct a visual inspection of each Uniblock II.
  - [ ] Check all intakes and exhaust grills for obstructions (dust, dirt, paper, etc) to airflow. Remove obstructions (either by hand or with a vacuum cleaner) as required.
  - [ ] Inspect the control cabinet for accumulations of dust or debris. Clean as required. Compressed air shall not be used for this purpose.
  - [ ] Inspect the general condition of the input and output connections. In particular, visually inspect for signs of overheating.
  - [ ] Inspect all cable harnesses with the control cabinet for signs of insulation breakdown.
  - [ ] Grease both the upper and lower bearings. Refer to manufacturer's manual for the factory specified quantity of grease.
    - [ ] On early machines, the grease fitting is located on the left post of the Main control cabinet.
    - [ ] On newer machines, the grease fitting is located behind the access door located in the rotary cabinet.
    - [ ] Caution must be taken checking on-line symptoms. Safely remove dust from the equipment by using a vacuum cleaner with nonconductive attachments. In some cases where poor housekeeping or other unusual circumstances are encountered, make a recommendation to the facility maintenance manager that access to the KW equipment is to be provided to you while you are there, or during the next visit to thoroughly clean the equipment.
    - [ ] It is extremely important that only Cyprina grease is used and only in the quantities listed. Use of too much grease will result in over pressure of the bearing.
  - [ ] Inspect the bearings. Listen for abnormal noises and visually inspect for signs of overheating.
  - [ ] Verify that all GSK/CP LEDs are operating.

- [ ] Capture the GSK/CP event memory and status screen. Perform on-site review for the purpose of implementing the appropriate corrective actions due to abnormal conditions as necessary.
- [ ] With reference to the UBII Programming Procedure, reset the event memory.
- [ ] Verify that the GSK/CP date and time is correct. Correct if necessary.
- [ ] Verify that the rectifier is at the correct flat voltage setting for the battery system.
- [ ] Record all pertinent information on the technical report form.
- [ ] Record all pertinent information on the Uniblock II PM Revision Level Checklist.

- [ ] **Annual Requirements**
  - [ ] With the facility maintenance manager's permission, shutdown Uniblock II. The facility maintenance manager shall isolate all power to the unit.
  - [ ] Perform all "on-line" requirements.
  - [ ] Check and clean the top grease tray.
  - [ ] With reference to the Manufacturer's Torque Specifications check all power connections and ensure that they are tight. All input, output, AC/DC buswork, choke, and transformer connections shall be checked in the same manner.
  - [ ] Remove the front doors of the rotary cabinet and inspect the general condition of the input, output and DC choke connections. In particular, visually inspect for signs of overheating, insulation breakdown and that cables are isolated from metal with insulating material. With reference to the Manufacturer's Torque Specifications check all power connections and ensure that they are tight.
  - [ ] With reference to the Manufacturer's Torque Specifications check the input/output connections in the MOTS (if applicable) and ensure they are tight.
  - [ ] With reference to the Manufacturer's Torque Specifications check the input/output connections in the DCDS and ensure they are tight.
  - [ ] With reference to the Manufacturer's Torque Specifications, randomly check all internal connections (i.e., breaker control wiring, multiple conductor plugs, voltage/current transformers, etc) and ensure they are tight.
  - [ ] With reference to the Piller Uniblock II Operating Manual, remove the old grease from the top bearing housing after every tenth greasing.
  - [ ] With reference to the UBII Start-Up Procedure verify the operation of the EPO Pushbuttton3.
  - [ ] With reference to the UBII Start-Up Procedure perform a functional test of each Uniblock II.
  - [ ] Verify that all GSK/CP calibrations are correct. With reference to the UBII Programming
  - [ ] Procedure calibrate as required using an appropriately programmed computer.

- ☐ With reference to the UBII Programming Procedure save all set-ups and generate an LST while the computer is connected to the GSK/CP.
- ☐ With reference to the UBII Start-Up Procedure start-up the Uniblock II and restore power to the critical load.

☐ **Uniblock II Battery Maintenance Tasks**

- ☐ Exercise caution when performing maintenance on the battery string(s) connected to the Uniblock II. The rectifier can cause a DC ground fault.
- ☐ When cleaning the batteries, the Q211 Mains control voltage can be turned off to isolate the Uniblock II rectifier. Discuss this with the facility maintenance manager prior to opening the breaker. The Uniblock II will still be capable of transferring to battery if required.
- ☐ If performing annual battery maintenance which requires the DCDS to be open, advise the facility maintenance manager that it is recommended that the Uniblock II operate on Mains or the rectifier/inverter path. This allows the UPS to operate with a wider input voltage range. If the facility maintenance manager agrees, proceed as follows:
  - ☐ Open the Q212 Mains control voltage breaker and then open the DCDS. **DO NOT OPEN** the DCDS prior to opening the Q212 Mains control breaker.
  - ☐ Upon completion of battery maintenance, close the DCDS and the Q212 Mains control voltage breaker.

Preventive-Maintenance Checklist:

☐ **General Information**

- ☐ Sites:
- ☐ Address:
- ☐ Serial #: Site #:
- ☐ Rated kVA: Op. Hours:
- ☐ Insp. Date: Technician:

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized tools, equipment and supplies.
- ☐ Vacuum cleaner
- ☐ Cleaning materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment (PPE).

Ogden Being Worked: The following diagnostic checks on the UPS shall be performed:

☐ **SEMI-ANNUAL**

- ☐ Verify all protection settings for equipment operation.
- ☐ Check cooling fans for proper operation. (If applicable)

- [ ] Ensure that all ventilation openings are clean.
- [ ] Inspect all connections and re-torque if necessary.
- [ ] Inspect all operating mechanisms for proper operation. This includes mechanical/electrical operation of breakers and loose or missing parts.
- [ ] Verify all protection settings for equipment operation (i.e., over-voltage, under-voltage, over-frequency, under-frequency, etc).
- [ ] Inspect and recalibrate status panel instruments, meters, alarms, etc., and repair or replace all non functioning devices.
- [ ] Check the UPS backup wet cell batteries and provide a written report on the status and condition of each cell's specific gravity, voltage, temperature, and recommendations that would enhance/prolong battery life and performance.
- [ ] Change all defective panel indicator lights and replace with new lamps (e.g., monitors, switchgear, etc).
- [ ] The Contractor shall provide the facility maintenance manager with a hard copy and software copy of all programs being used on these systems. **First copies should be provided at the beginning of the contract period and every six months thereafter.**

- [ ] **Annually**
  - [ ] Perform time current characteristics test of the main UPS circuit breakers. If a breaker has instantaneous elements, check the trip setting and test accordingly. If a breaker does not perform within the prescribed limits, it shall be replaced.
  - [ ] Perform infrared scan on all electrical parts and supply the facility maintenance manager with three (3) copies of the report.
- [ ] **Manufacturer's Recommendations**
  - [ ] All maintenance and repairs shall be in accordance with the UPS equipment manufacturer's recommendations. This shall be in addition to the diagnostics previously listed in this section.
  - [ ] The Contractor shall make no modifications to the systems that would degrade or void the manufacturer's warranty.
- [ ] **Logging/Reporting Requirements**
  - [ ] The Contractor shall maintain a log of all pertinent data gathered during PM or RM inspections. The Contractor shall keep a chronological log of all problems encountered and remedial actions taken.
  - [ ] The Contractor shall submit a copy of these logs to the facility maintenance manager after each service.
  - [ ] The Contractor shall submit a written report, together with infrared and actual photographs, within fourteen calendar days after completion of each preventive-maintenance or remedial-maintenance activity. The report shall identify

the problems encountered, the tests performed and the action taken to remedy the problem.

- ☐ The report shall also include the following information:
- ☐ Name and location of each item of equipment or device.
- ☐ The results of each inspection, any maintenance performed or any part replaced, including specifications and nomenclature.
- ☐ List all actual measurements taken and certify whether or not the readings taken are within the range of the manufacturer's recommendations and/or industry standards.
- ☐ Certification by the contractor that all tests have been performed as described in this specification and that each unit is operating satisfactorily.
- ☐ The time the contractor arrived at the site and his departure time for each PM and RM activity.
- ☐ The Contractor shall prepare a checklist with the name and location of all devices and shall use it as a part of the reporting procedures. A copy of each report shall be provided to the facility maintenance manager at the site.

5. **Uninterruptible Power Systems (UPS) Static**
   Annual

   Special Instructions:

   - ☐ Obtain and review manufacturer's operation and maintenance instructions.
   - ☐ Review Procedure for Controlling Hazardous Energy Sources."
   - ☐ Schedule maintenance outage with operating personnel.
   - ☐ Keep accurate records for future trouble-shooting. Record data on a permanent maintenance log.
   - ☐ Keep unit clean and free of dust and moisture.
   - ☐ Keep the unit cool at approximately 25°C (77°F).
   - ☐ Keep connections tight.
   - ☐ All tests shall conform to the appropriate manufacturer's test procedures and the values used as standards shall conform to ANSI specifications.
   - ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

   Checkpoints - Annual Period (solid state/static):

- ☐ Perform time current characteristics test of the delay elements of the battery circuit breakers. If a breaker has instantaneous elements, check the trip setting and test accordingly. If a breaker does not perform within prescribed limits, it shall be replaced. Note: There are commercially available D.C. circuit breaker test sets that will provide the facilities for these tests without the removal of the breaker and the expensive test banks. A manual test is not acceptable.
- ☐ Check capacitors for leakage.
- ☐ Check magnetics for signs of overheating.
- ☐ Check power connectors for tightness.
- ☐ Check alarm circuits by depressing alarm test push.
- ☐ Check operations for all switches, indicators, and meters.
- ☐ Verify all protection settings for equipment operation and automatic transfers including over-voltage, under-voltage, bypass transfer limits, over-frequency, and under-frequency.
- ☐ Remove and inspect static subassemblies.
- ☐ Perform thermographic infra-red survey of all power components, including CB's heat sinks, capacitors, chokes, transformers, cabling, and bus connectors. Hand-held digital infra-red meters for detecting hot spots will be acceptable.
- ☐ Check and record thresholds.
- ☐ Perform operational tests

C. Boilers, Water Heaters, Steam, & Hot-water Distribution

I. Boiler

1. **Boiler, Internal Inspection and Hydrostatic Test**
   Annual
   This maintenance task applies to both heating boilers and power boilers. The task list will identify which information applies to only one of these two boilers.

   Special Instructions:
   - ☐ Perform boiler internal inspection with external inspection and annual preventive maintenance.
   - ☐ Perform internal boiler inspection in accordance with requirements of American Society of Mechanical Engineers (ASME), Section VI, Recommended Rules for Care and Operation of Heating Boilers, and Section VII, Recommended Rules for Care of Power Boilers; and National Board Inspection Code ANSI/NB-23, A Manual for Boiler and Pressure Vessel Inspectors.
   - ☐ Inspection shall be performed by inspectors certified by the National Board of Boiler Pressure Vessel Inspectors.

- [ ] Prepare boiler for internal inspection in the following manner:
    - [ ] Fuel supply and ignition system shall be locked out.
    - [ ] Water shall be drawn off and water side thoroughly washed out.
    - [ ] Manhole and handhole plates, washout plugs, inspection plugs in water column connections shall be removed.
    - [ ] The boiler shall be cooled and thoroughly cleaned.
    - [ ] All grates of internally fired boilers shall be removed.
    - [ ] Insulation and brickwork shall be removed as required to determine condition of boiler, headers, furnace, supports or other parts.
    - [ ] Pressure gage(s shall be removed and tested.
    - [ ] Any leakage of steam or hot water into the boiler shall be prevented by disconnecting the pipe or valve at the most convenient point.
    - [ ] Before opening the manhole and entering any part of the boiler, the required steam or water system stop valves must be closed, tagged, and padlocked. All drain valves or cocks located between the two valves shall be opened.
- [ ] Inspector will not enter the boiler until satisfied that necessary safety precautions and pre inspection preparations have been made.
- [ ] If a boiler has not been properly prepared for an internal inspection, the inspector should decline to make the inspection.
- [ ] If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.
- [ ] Account for all tools, materials, and equipment before closing boiler.

<u>Procedure:</u>

- [ ] Insulation and Brickwork: Check for defects and deterioration commonly found in the particular type of boiler being inspected.
- [ ] Lighting: Flashlight should be used in preference to an extension light. When a portable extension light is used in a confined space, it shall not be operated at more than 12 volts.
- [ ] Scale, oil, etc.:
    - [ ] Examine all surfaces of exposed metal on waterside of boiler for deposits caused by water treatment, scale, oil, or other substances.
    - [ ] The smallest amount of oil is dangerous and immediate steps should be taken to clean affected surfaces and prevent further contamination, excess scale or other deposits should be removed by appropriate chemical or mechanical means.
- [ ] Stays and stay bolts:

- ☐ Examine stays to determine whether or not they are in even tension. All fastened ends should be examined to determine whether cracks exist where stays are punched or drilled for rivets or bolts.
- ☐ Test firebox stay bolts by tapping one end of each bolt with a hammer and, where practical, a hammer or other heavy tool should be held on the opposite end to make the test more effective. An unbroken bolt should give a ringing sound while a broken bolt will give a hollow sound. Replace broken stay bolts.

☐ Examine manholes, reinforcing plates and nozzles or other connections flanged or screwed into the boiler for evidence of defects both internally and externally. If possible, observation should be made from the inside of the boiler as to whether connections are properly made to the boiler. Examine all openings leading to external attachments, such as water column connections, low water fuel cutoff devices, openings in dry pipes and openings to safety valves to ensure they are free from obstruction.

☐ Fire Surfaces:

- ☐ Examine for bulging and blistering:
- ☐ Inspect all plate or tube surfaces exposed to the fire also check whether any part of the boiler has become deformed by bulging and blistering.

☐ Cracks:

- ☐ Examine vulnerable areas such as ligaments between the holes on watertube boiler drums, between tube holes on tube sheets of firetube boilers, at any flange where repeated flexing of the plate occurs during operation and around welded pipe and tube connections.
- ☐ Lap joint boilers are subject to cracking where plates lap in the longitudinal seam. If there is any evidence of leakage or other distress at this point, the inspector should thoroughly examine the area to determine whether cracks exist in seams. REPAIR OF LAP JOINT CRACKS ON LONGITUDINAL SEAMS IS PROHIBITED.

☐ Corrosion:

- ☐ Inspect for corrosion.
- ☐ When active corrosion is found, provide advice to correct as necessary.

☐ Grooving:

- ☐ Inspect for grooving. Examine as construction permits all flange surfaces, particularly the flanges of unstayed heads.
- ☐ Provide corrective advice for any defects found.

☐ Firetubes: Examine closely for reduction in thickness near or at tube ends.

☐ Watertubes:

- ☐ Inspect for corrosion, erosion, bulges, cracks, or any evidence of defective welds.

- ☐ Examine short tubes and nipples used to join drums and headers, there is a tendency for fuel and ash to lodge in these areas and corrosion is likely in the presence of moisture.

- ☐ Blowoff Piping:
  - ☐ Inspect blowoff piping connections and fittings.
  - ☐ Determine that blowout piping is properly secured and discharges at a safe point.
- ☐ Automatic Low Water Fuel Cutoff and Water Feeding Devices: Ensure automatic low water fuel cut off and water feeding devices are properly installed. The float linkage and connections should be examined for wear and the float chamber should be free of sludge or other accumulation.
- ☐ Safety and Safety Relief Valves:
  - ☐ Check valves for correct pressure setting and adequate discharge pipe supports.
  - ☐ The safety or safety relief valve on a steam or hot water heating boiler should be tested manually once each month and pressure tested once each year.
- ☐ Pressure Gages:
  - ☐ When required, pressure gauges shall be tested and calibrated.
  - ☐ Location of steam pressure gauge(s) should be noted to determine whether it is exposed to high temperature from an external source or to internal heat due to lack of protection by a proper siphon or trap.
- ☐ Hydrostatic Test:
  - ☐ The test pressure should not exceed 1½ times the maximum allowable working pressure.
  - ☐ The safety valve or valves should be removed or each disk shall be held down by means of a testing clamp.
- ☐ Record Review: Review boiler log, records of maintenance and feed water treatment to determine what regular tests have been made on boiler and controls.
- ☐ Conclusions: Any defects or deficiencies in condition, operating and maintenance practices of the boiler and auxiliary equipment should be discussed by the inspector with the owner or user at this time.

<u>Reports and Records:</u>

- ☐ An Inspection Report of Boiler shall be prepared for each boiler when it is inspected.
- ☐ A Certification of Inspection shall be issued when the boiler has been approved for operation. The original and one copy are required. The original is posted on or near the equipment and the copy is forwarded to the facility maintenance manager's regional office.

2. **Boiler (Coal, Oil, and Gas)**
Annual

Special Instructions:

- ☐ Review manufacturer's instructions and ASME Boiler and Pressure Vessel Codes for boilers.
- ☐ Review Procedure for respiratory protection.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, tag, and lock out circuits.
- ☐ Close and tag all hand or motorized valves required to isolate the boiler. Chain and lock all valves that are closed for safety. These valves shall not be unlocked and reopened unless authorized by the originator of the work authorization. Enter this information in the boiler log and sign.
- ☐ Wear appropriate respirator, goggles, and gloves while in contact with hazardous materials.
- ☐ If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.
- ☐ Account for all tools, materials, and equipment before closing boiler.

Checkpoints:

- ☐ Apply hydrostatic test of waterside pressure vessel (1½ times operating pressure, safety valve gagged or clamped shut).
- ☐ Drain boiler, tag valves and controls. NEVER attempt to remove a manhole or handhole cover without first properly venting the water or steam side of a boiler to the atmosphere. Prior to opening or entering a boiler it must be at atmospheric pressure. To protect the boiler from unnecessary stresses the boiler water temperature should be allowed to reach the boiler room temperature before draining the boiler.
- ☐ Brush all tubes clean of scale.
- ☐ Brush plate surfaces clean, use vacuum cleaner.
- ☐ Clean breaching, ducts, fireboxes, or main fire tube, and flue passages.
- ☐ Check and replace worn or damaged insulation. Repair the damage and remove the debris. If the insulation contains asbestos, follow the asbestos management plan for isolation, notification, work practice, and waste disposal.
- ☐ Check refractory and brick work; if damaged, notify facility maintenance manager and enter this data in boiler log.
- ☐ When the boiler has cooled to the ambient boiler room temperature, wash out mud legs, and flush boiler.

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- ☐ Refill boiler with water and chemicals if boiler is to be put back in service or if wet-lay-ups are to be employed.
- ☐ Determine if there is ample provision for expansion between the sections.
- ☐ Check for excessive rust build-up between sections (cast iron type).
- ☐ Examine all steam and water lines to controls to determine that they are clear of scale and arranged to ensure proper control operations.
- ☐ Clean stems and shafts, and tighten packing nuts on valves and pumps.
- ☐ Flush fuel oil strainer baskets and oil solenoid valve seats.
- ☐ Dismantle low water fuel cut offs and water feeders to ensure freedom from obstructions and proper functioning of the working parts. Always replace old gaskets before reassembling.
- ☐ Inspect connecting lines to boiler for accumulations of mud, scale, etc., and clean as needed.
- ☐ Examine all visible wiring for brittle or worn insulation, and make sure electrical contacts are clean, adequately tightened, and functioning properly.
- ☐ On electrical type detection devices, replace vacuum tubes annually, and replace defective solid state devices.
- ☐ Replace fusible plugs, if applicable.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Scrapers, wire brush, cleaning materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Combustion testing equipment
- ☐ Hydrostatic pump and safety valve gag
- ☐ Respirator
- ☐ Safety goggles
- ☐ Safety signs
- ☐ Suitable chain and locks for securing isolation valves.
- ☐ Boiler chemicals as directed by a competent water treatment company. Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Vacuum cleaner wet/dry type

3. **Burner, Gas**
   Annual

Special Instructions:

- [ ] Review manufacturer's instructions.

Checkpoints:

- [ ] Check boiler room for ventilation in accordance with the American Gas Association (AGA) burner requirements.
- [ ] Check operation of all gas controls and valves including: manual gas shutoff; petal gas regulator; safety shutoff valve (solenoid); automatic gas valve; petal solenoid valve; butterfly gas valve, motor, and linkage to air louver; safety petal solenoid (if used).
- [ ] Check flue connections for tight joints and minimum resistance to air flow. (Combustion chamber, flues, breaching, and chimney are clear before firing).
- [ ] Draft regulators require slightly negative pressure in the combustion chamber at maximum input.
- [ ] On forced draft burners, gas manifold pressure requirements should correspond to modulating (butterfly) valves in full open position and stable at all other firing rates.
- [ ] Take and record and record flue gas readings to determine boiler efficiency. Use manufacturer's instructions if available. If not, use attached table as a task for performance criteria. If efficiency is low; check baffling and passes for short-circuiting, and boiler for air infiltration. Adjust dampers and controls to optimize efficiency. Run test at following load points.
    - [ ] 100%, 70%, and 40% of rated full load for boilers having metering controls or modulation capacity at these load points.
    - [ ] At high and low fire rates on boilers equipped with OFF/LOW FIRE/HIGH FIRE control.
    - [ ] At single firing load point on boilers equipped with OFF/ON controls only.
- [ ] Check burner for flashback and tight shutoff of fuel.
- [ ] Check operation of automatic controls and combustion flame safeguards. Clean and adjust, if necessary.
- [ ] Operation and adjustments should conform to manufacturer's instructions.

Performance Criteria for Gas Burners
Natural Gas (1,000 BTU/SCF)

Percent Load	40.0%	70.0%	100.0%
Carbon Dioxide (CO2)	8.5%	9.0%	10.0%
Oxygen (O2)	6.0%	5.0%	4.0%
Excess Air (XA)	40.0%	25.0%	20.0%

Smoke Scale No.	0	0	0

- ☐ Combustibles should be zero or negligible percent in the flue gas.
- ☐ Output (steam or water flow) where meters are available should correspond to combustion level not less than 100% of rated capacity at rated load.
- ☐ Boiler section outlet flue gas temperature is not more than 30°F (17°C) higher than rated. When expected gas temperature is not known, the manufacturer should be contacted for typical conditions for the type of boiler being tested.
- ☐ Boiler section outlet flue gas temperature should not be more than 150°F to 180°F (84°C to 100°C) higher than the corresponding saturated steam temperature for water tube boilers and 100°F to 125°F (56°C to 70°C) for fire tube boilers.
- ☐ Excess air within 5 percent of manufacturer's performance level.
- ☐ Feedwater temperature, burner atomizing pressure, draft loss, and combustion appearance in accordance with manufacturer's data or be close to industry standards.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer’s instruction manual for specialized hand tools, equipment and supplies.
- ☐ Flue gas analyzer
- ☐ Clean wiping cloths

4. **Burner, Oil**
   Annual

Special Instructions:

- ☐ Review manufacturer’s Instructions.

Checkpoints:

- ☐ Test and inspect burner (with or without firing) at rated pressure for leaks.
- ☐ Timed trial for ignition on pilots and burners in accordance with instructions in the programmer timer.
- ☐ Check automatic controls and combustion flame safeguards for normal operation. There should be no presence of oil discharge, ignition or flame.
- ☐ Check pre-ignition purging capability of burner, combustion chamber, boiler passes, and breaching. Stack dampers should be fully open during purge and light off period.

- ☐ Check delivery of fuel in relation to its response to the ignition system. Examine electrodes for carbon buildup, discoloration, distortion, and burning of parts, clean and adjust as necessary.
- ☐ Check ignition transformer to supply dependable arc, adjust and regulate as required for clearance and air gap.
- ☐ Clean and adjust draft regulator and air shutter on a natural draft burner to ensure excess air quantities are minimum for complete combustion. Test with flue gas analyzer.
- ☐ On mechanical draft burners clean and check power driven fan blowers.
- ☐ Check out forced draft fan, clean fan and fan housing, check bearings, pulleys and or couplings and adjust belt tension if required, replace worn belts and lubricate pivot points on linkages as necessary.
- ☐ Check and replace filters. Check and clean water separators, primary and secondary filters.
- ☐ Clean, check operation, and adjust controls and safeties.
- ☐ Burners designed to change firing rates automatically should be checked for adequate proportioning changes in fuel and air rates.
- ☐ Check oil level sight glass to see that burner maintains proper oil level (within 1/3") at rated output.
- ☐ Check to ensure that power cannot feed back and energize ignition devices or feed valves after a control shuts off burner.
- ☐ Clean or replace nozzles or cups, and check for tight shutoff of fuel.
- ☐ Check stacks for smoke or haze and adjust burner accordingly.
- ☐ Take and record flue gas readings to determine boiler efficiency. Use manufacturer's instructions if available. If not, use attached table as a task for performance criteria. If efficiency is low, check baffling and passes for short circuiting, and boiler for air infiltration. Adjust dampers and controls to optimize efficiency. Tests should be run at the following load points:
  - ☐ 100%, 70%, and 40% of rated full load for boilers having metering controls or modulation capacity at these load points.
  - ☐ At the high and low fire rates on boilers equipped with OFF/LOW FIRE/HIGH FIRE control.
  - ☐ At the single firing load point on boilers equipped with OFF/ON controls only.

Performance Criteria for Oil Burners

LIGHT OILS, Grade 2, Diesel Fuel, JP5, Navy Distillate			
Percent Load	40.0%	70.0%	100.0%
Carbon Dioxide (CO2)	10.5%	11.0%	12.5%

Carbon Monoxide (CO)	0	0	0
Oxygen (O2)	6.0%	5.0%	4.0%
Excess Air (XA)	40.0%	30.0%	20.0%
Smoke Scale No.	2	2	2
MEDIUM OILS, Grade 4, NFSO			
Percent Load	40.0%	70.0%	100.0%
Carbon Dioxide (CO2)	11.0%	12.0%	13.0%
Carbon Monoxide (CO)	0	0	0
Oxygen (O2)	6.0%	5.0%	4.0%
Excess Air (XA)	40.0%	30.0%	20.0%
Smoke Scale No.	3	3	3
HEAVY OIL, Grades 5&6			
Percent Load	40.0%	70.0%	100.0%
Carbon Dioxide (CO2)	12.0%	12.6%	13.6%
Carbon Monoxide (CO)	0	0	0
Oxygen (O2)	6.0%	5.0%	4.0%
Excess Air (XA)	40.0%	30.0%	20.0%
Smoke Scale No.	0	0	0

- ☐ Combustibles zero or negligible percent in flue gas.
- ☐ Output (steam flow or water flow) where meters are available to correspond with combustion level not less than 100% of rated capacity at rated load.
- ☐ Boiler section outlet flue gas temperature is not more than 30°F (17°C) higher than rated.
- ☐ When expected gas temperature is not known, manufacturer should be contacted for typical conditions for the type boiler being tested.
- ☐ Boiler section outlet flue gas temperature should not be more than 150°F to 180°F (84°C to 100°C) higher than corresponding saturated steam temperature for water tube boilers and 100°F to 125°F (56°C to 70°C) for firetube boilers.
- ☐ Excess air within 5 percent of manufacturer's expected performance level.

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- ☐ Feedwater temperature, burner atomizing pressure, fuel oil viscosity at the burner, draft loss and combustion appearance in accordance with manufacturer's data or be close to industry standards.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Flue gas analyzer
- ☐ Varsol and rags. Use varsol in well ventilated area. Dispose of as hazardous waste.
- ☐ Lubricants. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Clean wiping cloths

5. **Boiler, Electric**
   Annual

Special Instructions:

- ☐ Review manufacturer's instructions and ASME Code for boilers.
- ☐ Review boiler wiring diagram.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, lock out, and tag electrical circuits.

Checkpoints:

- ☐ Clean boiler by:
  - ☐ Placing boiler cleaning compound through appropriate opening in top of boiler (compound must not react against copper elements).
  - ☐ Operate boiler according to instructions.
  - ☐ Shut-off power by turning off pilot switch.
  - ☐ Open bottom blow-down valve to fully open to let sludge and scale blow out of boiler.
  - ☐ Refill with water and close pilot switch.
- ☐ Check nameplate for KW rating, voltage and amperage. Check electrical supply voltage to verify it conforms to boiler requirements.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning compounds. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

- [ ] Clean wiping cloths

6. **Boiler Instruments/Controls**
   Annual
   This maintenance task applies to large boiler room operations where the boiler task lists do not sufficiently cover the maintenance required for the boiler room controls. These boiler controls include such items as boiler masters, draft and oil controllers, levelometers, flow transmitters and recorders, ratio transmitters and totalizers, recorders and indicators, etc.

   Special Instructions:
   - [ ] Read and understand manufacturer's instructions before making any adjustments or calibrations.
   - [ ] Schedule maintenance with operating personnel, as needed.
   - [ ] Review control wiring and piping diagrams.
   - [ ] Review and understand sequence of operation.

   Checkpoints:
   - [ ] Visually check equipment sensing lines, operating valves, and internal assembly for leaks.
   - [ ] Perform friction test.
   - [ ] Zero meter to scale, check pen(s) for zero indication, make necessary adjustments.
   - [ ] Simulate flow by use of check weights, provided water column, or other appropriate external simulation devices.
   - [ ] Check pen or indicator for proper chart or scale percentage at recommended checkpoints; (or discretionary checkpoints, if none are recommended) record actual indication; make minor adjustments as necessary.
   - [ ] Check control over full range. Set zero and full range stops as necessary.
   - [ ] Mark integrator or counter checks by simulating flow (usually 50% of full scale) and check number of counts over a specific time period (minimum period of 30 minutes is recommended). Calculate correct number of counts for the time period used and make necessary minor adjustments. Re-check after any adjustments; ascertain that the integrator or counter does not count at zero.
   - [ ] Repeat step #6.
   - [ ] Open meter supply line to check for plugging. Put meter back in service.
   - [ ] Check electronic stations for proper electrical connections and pneumatic stations for any leaks by using a leak detector (soap solution).
   - [ ] Check operation of station panel switch and manual control for excessive friction and looseness of control knobs.
   - [ ] Check for correct supply pressure or voltage to the station.

- ☐ Compare sender over its range of control with an accurate external measuring device such as a Utube, pneumatic calibrator, or electronic calibrator (all other measurements in the control loop should be made with the same device).
- ☐ Check all indicators by simulating pneumatic or electronic signals to the appropriate port of terminal for proper indication to the related gauge or indicator (in most cases, mathematical calculations will be necessary to determine the proper indication at each test point).
- ☐ Ascertain that the automatic signal is not restricted when the station is activated.
- ☐ Record and report all deficiencies.
- ☐ Notify facility maintenance manager that services are complete.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Calibration device for meter being checked
- ☐ Differential flow meter and indicator
- ☐ Soap solution for air leak test, accurate test gauges (check before use).

7. **Boiler, External Inspection**
   Annual
   This maintenance task applies to both heating boilers and power boilers. The maintenance task lists will identify which information applies to only one of these two boilers.

   Special Instructions:

   - ☐ Perform boiler external inspection with internal inspection and annual preventive maintenance.
   - ☐ Perform internal boiler inspection in accordance with requirements of American Society of Mechanical Engineers (ASME), Section VI, Recommended Rules for Care and Operation of Heating Boilers, and Section VII, Recommended Rules for Care of Power Boilers; and National Board Inspection Code ANSI/NB-23, A Manual for Boiler and Pressure Vessel Inspectors.
   - ☐ Following internal inspection and as part of external inspection boiler shall be brought up to operating pressure and temperature.
   - ☐ Inspection shall be performed by inspectors certified by the National Board of Boiler Pressure Vessel Inspectors.
   - ☐ All automatically and manually operated control devices provided for controlling operation and safety of the vessel, steam or water pressure, hot water temperature, combustion, and boiler water level shall be inspected under operating conditions.

- ☐ All associated valves and piping, pressure and temperature indicating devices, metering and recording devices, and all boiler auxiliaries shall be inspected under operating conditions.
- ☐ All combustion controls attached to the boiler regardless of the fuel being fired must be in good working order or the inspection certificate shall be withheld.
- ☐ If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.

Procedure:

- ☐ Inspect overall cleanliness and accessibility of boiler and auxiliary equipment. Boiler fittings, valves and piping should be checked for compliance with ASME code and jurisdictional requirements.
- ☐ Pressure Gages: Note the pressure reading indicated on pressure gauge and compare it with another gauge on the same system or with a standard test gauge.
- ☐ Water Level Gage Steam Boilers:
  - ☐ Observe the blowdown of the water gauge in its normal manner and the promptness of the return of water in the gauge should be noted.
  - ☐ During the test of the water level gauge, water and steam connections should be blown separately to ensure both are clear.
- ☐ Safety and Safety Relief Valves:
  - ☐ Safety valves should be tested by allowing the pressure in the boiler to rise to the popping pressure, and subsequent fall, to check the actual popping pressure and blowdown. If this is not practical, the valve should be tested by the boiler operator for free operation by use of the lifting lever, provided the boiler pressure is 75% or more of the set pressure.
  - ☐ Inspect valve discharge pipe to determine if discharge pipe is free and in accordance with ASME Code requirements:
  - ☐ When inspections reveal that a safety valve is not operating properly, the boiler shall be taken out of service and the valve shall be replaced or repaired.
- ☐ Low Water Fuel Cutoff or Feed Controls: Observe the test of these controls after the drain has been opened. Close the drain and observe the promptness of the return to normal such as the silencing of an alarm or stopping of a feed pump should be noted.
- ☐ Blowoff Piping Power Boilers: Observe blowdown of the boiler in normal manner, check for freedom of piping to expand and contract and ensure there is no excessive vibration.
- ☐ Piping, Connections and Fittings:
  - ☐ Inspect piping to ensure there is provision for expansion and adequate support.

- ☐ Piping and fittings should be examined for evidence of leakage and excessive vibration. Also closely examined to determine that they are properly rated for the service conditions to which they are subjected.
- ☐ Pressure controls (heating steam boilers): Verify that each automatically fired steam boiler is protected from over pressure by not less than two pressure operated controls one of which may be an operating control.
- ☐ Record Review: Review the boiler log and records of maintenance and feed water treatment to ensure that regular and adequate tests have been made on the boiler and controls.
- ☐ Reports and Records:
  - ☐ An Inspection Report of Boiler shall be prepared for each boiler when it is inspected.
  - ☐ A Certification of Inspection shall be issued when the boiler has been approved for operation. The original and one copy are required. The original is posted on or near the equipment and the copy is forwarded to the facility maintenance manager's regional office.
- ☐ Conclusions: During all tests the actual operating and maintenance practices should be noted by the Inspector and a determination made as to their acceptability.

II. Fuel/Filters/Water Quality

1. **Fuel Oil Filter/Strainer**

   Semiannual

   This maintenance task applies to inline cartridge filters used on light fuel oils No. 1, 2, or 4, as well as the larger basket type used on heavier oils (#5 or #6).

   Special Instructions:

   - ☐ Flammable liquids are being handled. Use all applicable safety precautions.
   - ☐ Check with operating personnel before starting work.
   - ☐ Secure and tag pumps, burners, and other necessary equipment.
   - ☐ Shut off and tag inlet and outlet valves.
   - ☐ Wear gloves while cleaning strainer. Consult the Material Safety Data Sheets (MSDS) for proper personal protective equipment (PPE).

   Checkpoints:

   - ☐ Drain housing, bowl, etc.
   - ☐ Remove covers, bowls, housing, etc. to filter/strainer.
   - ☐ Remove filter/strainer. Check gasket and replace if required.
   - ☐ Clean bowl, housing, etc. with approved solvent.
   - ☐ Clean strainer with approved solvent.

- ☐ Replace filter. Reinstall strainer.
- ☐ Replace cover bowl and clean any spillage from the outside.
- ☐ Open inlet valve and vent air.
- ☐ Check for leaks.
- ☐ Open outlet valve, remove tags from valves, pumps, burners, or other equipment.
- ☐ Operate equipment and re-check filter.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Gaskets and filters
- ☐ Solvents approved for use with fuel oils. Consult the MSDS for hazardous ingredients and proper PPE.

2. **Tank, Air/Refrigerant/LP Gas**

Annual

This maintenance task applies to three types of fixed storage tanks; air, refrigerant, and LP gas. These are large permanently mounted supply or supply or reserve tanks. Not included are main supply tanks serviced by the supplier, or small returnable tanks used on mobile equipment or for maintenance.

Special Instructions:

- ☐ Maintenance shall be coordinated with required inspections.
- ☐ Review Procedure for "Confined Space Entry." if required.
- ☐ Review Procedure for "Selection, Care and Use of Respiratory Protection."
- ☐ When personnel are required to enter tanks, test for oxygen deficiency and supply each with proper respirator and ventilating equipment.
- ☐ Secure and tag supply valves.
- ☐ No smoking or open flames permitted.
- ☐ If asbestos containing materials are present, check the building's asbestos management plan as described in the Environmental Management portion of the Safety and Environmental Management Program. Manage asbestos in accordance with the asbestos management plan.

Checkpoints:

- ☐ Examine exterior of tank, including fittings, gauges, manholes, and handholes for leaks, rust, and corrosion. Wire brush and touch up paint.
- ☐ Open tank and remove rust, scale and sludge by scraping, wire brushing, or shot cleaning.

- ☐ Inspect interior of tank carefully, recording the size and depth of pits, presence of cracks and condition of openings, fittings, weld, rivets and joints.
- ☐ Touch up interior coat with an approved protective coating.
- ☐ Inspect structural supports and condition of insulation, if any. If insulation contains asbestos and is damaged or eroded, remove all debris while keeping debris wet; dispose of this material as asbestos containing waste.
- ☐ Perform hydrostatic test, if required. Note: Hydrostatic test of unfired pressure vessels is required of any vessel that has a capacity of greater than 30 gallons and operates at a pressure in excess of 60 psig.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Paint. Consult the Material Safety Data Sheet (MSDS) to ensure that the paint lead level is 0.06% or less.
- ☐ Protective coating material. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Expansion meter or gas meter
- ☐ Approved fire extinguisher. Ensure that the fire extinguisher is properly serviced and that it is in proper working condition.
- ☐ Respirator

3. **Tanks, Fuel Oil Storage**
   Four Years

Special Instructions:

- ☐ If a person must enter tank, test for oxygen deficiency, and supply proper respirator as needed.
- ☐ Safety harness must be worn.
- ☐ Review manufacturer's instructions.
- ☐ Review Procedure for Confined Space Entry.
- ☐ Review Procedure for "Selection, Care, and Use of Respiratory Protection."

Checkpoints:

- ☐ Prior to end of heating season, adjust oil deliveries so oil will be nearly consumed.
- ☐ Remove manhole.
- ☐ Pump oil tank down to within 6" of bottom of tank.
- ☐ Pump sludge from bottom of tank and flush. Dispose of appropriately.
- ☐ Disconnect heating coil, remove from tank and clean.

- ☐ Examine tank for leaks, condition of piping connections.
- ☐ Clean and adjust oil transfer pumps (oil or steam driven).
- ☐ Examine, clean, and adjust operation of strainers, traps, control valves, oil flow meter, oil temperature and pressure gauges.
- ☐ Check floats and leveling devices in tank. Check float adjustment with depth level indicators.
- ☐ Clean breather vents, conservation vents, and flame arrestors where appropriate.
- ☐ Clean up work area, and remove all debris.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Goggles
- ☐ Respirator
- ☐ Safety harness

4. **Underground Storage Tank (UST)**
   Monthly
   This maintenance task applies to UST systems used to store regulated substances (i.e., petroleum products and hazardous substances) defined under the Resource Conservation and Recovery Act (RCRA) codified in 40 CFR 280.

   Special Instructions:

   - ☐ UST systems storing regulated substances must prevent releases due to corrosion or structural failure for the operational life of the system. Must be cathodically protected against corrosion or constructed and lined with a material that is compatible with the stored substance.
   - ☐ UST systems using cathodic protection must be inspected for proper operation by a qualified cathodic protection tester.
   - ☐ Inspection criteria used to determine adequate cathodic protection must be in accordance with a code of practice developed by a nationally recognized association, such as the National Association of Corrosion Engineers Standard RP-02-85
   - ☐ All cathodic protection systems must be tested within 6 months of installation or after completion of repairs and at least every 3 years thereafter. Also, UST systems with impressed current cathodic protection systems shall be inspected every 60 days to ensure equipment is operating properly.
   - ☐ UST system owners and operators are required to maintain operational records which include but are not limited to the results of the last two inspections performed by a qualified cathodic protection tester, and documentation of all UST repairs.

- ☐ Release detection must be provided for UST systems which will detect a release from any portion of the tank and underground piping that routinely contains product. Owners and operators of new and existing UST systems must provide a method or combination of methods of release detection that can detect a release from any portion of the tank and connected underground piping that routinely contains product. Also, owners and operators must provide spill and overfill prevention equipment.
- ☐ Monitoring requirements: Tanks installed after December 22, 1988, must meet all EPA requirements. Note: Tanks installed prior to this date should have been tested by December 22, 1993. Some states regulate non EPA requirements. Comply with all such regulations.
- ☐ EPA requires existing tanks to have corrosion protection and spill/overfill devices by December, 1998. However, some states require tanks to be upgraded (i.e., have corrosion protection and spill/overfill devices) by December 1994. Information can be found in 40 CFR 280.30 and 31.

Checkpoints:

- ☐ Tanks must be monitored for releases at least every 30 days, or administered monthly inventory testing, or provided annual tank tightness testing.
- ☐ Pressurized underground piping must be monitored for releases at least every 30 days, or provided with annual line tightness testing.
- ☐ Repaired tanks and piping shall be tightness tested within 30 days following completion of repair.

5. **Tank, Chemical**
   Annual
   This maintenance task applies to chemical tanks other than water softener tanks or plastic expendable vats or tanks.

   Special Instructions:

   - ☐ Maintenance shall be coordinated with required inspections.
   - ☐ Review Procedures for Confined Space Entry.
   - ☐ Review Procedure for "Selection, Care, and Use of Respiratory Protection."
   - ☐ If a person must enter tanks, test for oxygen deficiency and supply each with proper respirator and ventilating equipment.
   - ☐ No smoking or open flames permitted.

   Checkpoints:

   - ☐ Examine exterior of tank, including fittings, gauges, structural supports, manholes, and handholes for leaks, signs of corrosion, or other defects. Correct as indicated.

- ☐ Drain and flush the tank.
- ☐ Open tank and remove rust or chemical deposits from interior surfaces.
- ☐ Inspect thoroughly the interior of the tank; record the size and depth of pits, presence of cracks, and the condition of openings, fittings, welds, rivets, and joints.
- ☐ Check condition of agitators and/or float assemblies.
- ☐ Clean strainer(s).
- ☐ Touch up cost with approved protective coating.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Paint. Consult the Material Safety Data Sheet (MSDS) to ensure that the paint lead level is 0.06% or less.
- ☐ Protective coating material. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Respirator and ventilation equipment
- ☐ Face shield and rubber apron

6. **Water Treatment for Heating Systems**
Monthly
This maintenance task is applicable to boilers and both steam and hot water distribution and return systems. Note: This maintenance task does not eliminate daily testing where it is an established policy.

Special Instructions:

- ☐ Chemicals must comply with the Environmental Protection Agency (EPA) regulations and be handled in accordance with occupational safety requirements. Employ personal protection against corrosive or hazardous treatment chemicals as appropriate.
- ☐ Be familiar with the Material Safety Data Sheets of any chemicals used in the water treatment program.
- ☐ Water treatment specialists must be properly trained.
- ☐ Water treatment must be based on proven standard engineering practices. Treatment methods that claim mysterious magnetic or catalytic forces shall not be used. Follow treatment methods as directed by the manufacturer or water Treatment Company.
- ☐ Maintenance includes chemicals, chemical feeding, maintaining proper water conditions, controlling blow down, protecting idle equipment, and records.
- ☐ Select water treatment methods which protect the life of equipment, maximize heat transfer, and minimize scale, corrosion, solid matter buildup, biological growth, and water usage.

- ☐ Ensure chemicals are properly stored, test equipment clean, and that chemicals have not passed expiration date.
- ☐ Special attention must be paid to infrequently used boilers, or boilers subjected to long periods of idleness.
- ☐ Physical inspections of boilers and supply and return piping systems are to be made to determine water treatment effectiveness.
- ☐ Maintain records and test results.
- ☐ Follow the Recommended Rules for Care and Operation of Heating (or Power) Boilers as contained in the American Society of Mechanical Engineers.
- ☐ When boilers are out of service, they must be protected from corrosion either by draining the boiler and keeping surfaces thoroughly dry or by completely filling the boiler with water.

Checkpoints:

- ☐ Inspect boiler and piping system to determine effectiveness of water treatment.
- ☐ Circulate heating water using heating water pumps and boiler for 10 minutes.
- ☐ Test each system for proper pH, alkalinity, total dissolved, hardness, conductivity, scale and corrosion inhibitors, and sludge conditioners. Test supply water for base conditions.
- ☐ Add or adjust chemical and biological treatment dosages and water blow down as appropriate.
- ☐ If make up is excessive, determine source of leaks and correct.
- ☐ Record test results, action taken, type of chemicals, and treatment quantities used.
- ☐ If treatment is not effective, it may require change in current methods and procedures.

III. Hot Water

1. **Hot Water Converters (Steam)**

Annual

This maintenance task does not apply to boilers or hot water heaters.

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ Obtain operating logs.
- ☐ Review operating logs to check loss of efficiency of heat exchange surfaces, indicating scale and/or corrosion build-up.
- ☐ If the insulation is known or suspected to contain asbestos, check the building's asbestos management plan to see it has been tested for asbestos. If it is suspect but has not been tested, have it tested. Manage asbestos in accordance with the plan.

Checkpoints:

- ☐ tInspect element header for signs of leaking or corrosion. Remove corrosion and encrustations.
- ☐ Remove heat exchanger element and clean only if a loss of efficiency is indicated, or signs of leaking around header are evident.
- ☐ Tighten all bolts around header.
- ☐ Renew paint/protective coating/insulation as required.
- ☐ Drain storage and expansion tanks, and flush to remove sediment, scale, etc.
- ☐ Clean sight glasses on tanks.
- ☐ Clean strainer, check condition of traps. Report leaks.
- ☐ Clean pump, controls, switches, and starters. Check condition of pump seal or packing, and replace as required.
- ☐ Clean up work area and remove trash.
- ☐ If the insulation contains asbestos, follow the asbestos management plan for isolation, notification, work practice and waste disposal.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Wrenches from stock for large bolts
- ☐ Paint/brushes. Consult the Material Safety Data Sheet to ensure that the paint lead level is 0.06% or less.
- ☐ Cleaning materials. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Hose
- ☐ Goggles

2. **Hot Water Heater – Gas**
   Annual

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ If the insulation is known or suspected to contain asbestos, check the building's asbestos management plan to see it has been tested for asbestos. If it is suspect but has not been tested, have it tested. Manage asbestos in accordance with the plan.

Checkpoints:

- ☐ Drain several gallons from tank to remove sediment.
- ☐ Manually check operation of safety valve. Check for corrosion.

- ☐ Check all connections – electric, gas and water. Tighten as necessary.
- ☐ Check operation and setting of aquastat. Check hot water temperature with dial thermometer, and set aquastat at minimum value.
- ☐ Check pilot and burner assembly. Clean and adjust nozzles for proper flame distribution and quality.
- ☐ Check operation of electric ignition device, if applicable. Check spark gap and adjust if needed.
- ☐ Check flue for proper draft, leaks, and corrosion. Check thermocouple for corrosion or soot. Clean if required.
- ☐ Clean up work area and remove all debris.
- ☐ If the insulation contains asbestos, follow the asbestos management plan for isolation, notification, work practice and waste disposal.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools - Basic
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Thermometer
- ☐ Clamp-on ammeter
- ☐ Gap gauge (auto ignition)

3. **Hot Water Heater – Electric**
   Annual

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ If the insulation is known or suspected to contain asbestos, check the building's asbestos management plan to see it has been tested for asbestos. If it is suspect but has not been tested, have it tested. Manage asbestos in accordance with the plan.

Checkpoints:

- ☐ Drain several gallons from tank to remove sediment.
- ☐ Manually check operation of safety valve. Check for corrosion.
- ☐ Check all connections – electric and water. Tighten as necessary. (Make sure power is disconnected to electric heaters).
- ☐ Check operation and setting of aquastat. Check hot water temperature with dial thermometer, and set aquastat at minimum value.
- ☐ Check amperage draw of upper and lower elements and compare to nameplate data.
- ☐ Clean element contacts, and check for proper closing under load.

- ☐ Clean up work area and remove all debris.
- ☐ If the insulation contains asbestos, follow the asbestos management plan for isolation, notification, work practice and waste disposal.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools - Basic
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Thermometer
- ☐ Clamp-on ammeter

4. **Plate Heat Exchanger**
   Annual

Special Instructions:

- ☐ Review manufacturer's instructions and drawings.
- ☐ Open unit only when defective plates are suspected or leaks occur that cannot not be stopped by tightening.
- ☐ If unit is opened, follow manufacturer's instructions concerning disassembly, internal cleaning and reassembly.
- ☐ Never open the unit when hot.
- ☐ The pressure of both liquids should be simultaneously decreased gradually when shutting down a unit.
- ☐ If leaks occur tighten to average dimension as shown on assembly drawing or unit data plate, follow manufacturer's suggested tightening sequence.
- ☐ Back flush the unit when fibers or large particulate are present this can be accomplished by flushing the unit with clean water in reverse flow at 1 to 1½ times product flow or by arranging piping and valves so the unit may be operated in reverse flow mode on the product side for certain periods of time.
- ☐ Clean in Place (CIP) when backflushing does not provide desired results, The unit must be flushed clear to obtain a thorough cleaning and it is necessary to flow CIP solution bottom to top to ensure wetting of all surfaces the rate of flow should be greater than normal product flow rate.
- ☐ Strainers should be installed in supply lines ahead of the exchanger when the streams contain significant solids or fibers.

Checkpoints:

- ☐ Check exposed bolt threads, upper task bars, rollers in the moveable end frame and connecting frame. Clean and coat with a light grease.

- ☐ Check unpainted carbon steel surfaces, clean and coat with light grease, SAE-30 oil or other rust inhibiting product.
- ☐ Check pressure and temperature gauges, back flush unit and clean in place annually or any time pressure/temperature profile exceeds set limits.
- ☐ Check unit for leaks, follow manufacturer's troubleshooting task to locate defective plates.
- ☐ Check overall external appearance and condition of unit.

5. **Solar Heating System**
   Semiannual

   Special Instructions:
   - ☐ Review manufacturer's instructions.
   - ☐ Review operating logs to check loss of efficiency of heat exchanger surfaces, indicating scale and/or corrosion buildup.
   - ☐ Schedule storage tank maintenance and coordinate with required inspections.

   Checkpoints:
   - ☐ Check system pressure on closed loop for loss of fluid; pressure should be 40 psig.
   - ☐ Check glycol strength. Run pH test on glycol-water solution. If required, drain entire solution and replace with a 50-50 mixture of glycol and water.
   - ☐ Check for leaks and condition of insulation on lines.
   - ☐ Remove heat exchanger element and clean only if a loss of efficiency is indicated or signs of leaking are evident around header.
   - ☐ Inspect element header for signs of leaking or corrosion. Remove corrosion and encrustations.
   - ☐ Tighten all bolts around header.
   - ☐ Clean strainer and check condition of traps. Report leaks.
   - ☐ Check and secure all pipe hangers, expansion joints, and associated items.
   - ☐ Drain storage and expansion tanks; flush to remove sediment, scale, etc.
   - ☐ Clean sight glasses and flow indicators on tanks.
   - ☐ Check valves for proper positioning.
   - ☐ Clean pump, controls, switches, and starters. Check condition of pump seal or packing and replace as required. Lubricate motor if required.

   Recommended Tools, Materials, and Equipment:
   - ☐ Standard tools – basic
   - ☐ Antifreeze tester

- ☐ Cleaning materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Lubricants. Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Hose
- ☐ Goggles

6. **Solar Heating System (Solar Collectors)**
   Annual

   Special Instructions:
   - ☐ Review manufacturer's instructions.

   Checkpoints:
   - ☐ Check collector glazing for cracks or deterioration. Clean as required.
   - ☐ Check collector for damage and report same to facility maintenance manager.
   - ☐ If conditions warrant, clean collector glass with warm water or, if badly soiled, with a mild detergent and water. Never use a chemical glass cleaner, abrasives, steel wool, or any substance that could scratch the surface. Cold water should never be sprayed on hot collector surfaces.
   - ☐ Renew paint and/or protective coating.
   - ☐ Check collector framework and lines; ensure that unit is firmly bolted and anchored.

   Recommended Tools, Materials, and Equipment:
   - ☐ Standard tools – basic
   - ☐ Wrenches for large bolts
   - ☐ Paint/brushes. Consult the Material Safety Data Sheet to ensure that the paint lead level is 0.06% or less.
   - ☐ Cleaning materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

7. **Radiator, Heating**
   Five Years

   Special Instructions:
   - ☐ Perform preventive maintenance prior to heating season.
   - ☐ If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.

Checkpoints:

- ☐ Remove and inspect seat of trap. Clean out trap.
- ☐ Replace thermo-element with new or tested unit. NOTE: Replace defective seats in traps fitted with removable type.
- ☐ Check radiator valve for free turning and seating at same time. Check packing.
- ☐ If radiator has automatic temperature regulating valve, remove valve cover and remove dirt by vacuuming.
- ☐ For hot water radiators, check bleed valve.
- ☐ Clean work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Radiator brush
- ☐ Vacuum

8. **Radiation – Baseboards/Convectors**

Two Years

This maintenance task applies to baseboard radiator and convector heating units using hot water, steam, or electricity as the heating medium. These units will be found in offices, entrance lobbies, vestibules, etc. They vary from simple finned tube baseboard units with no controls to zoned or individually controlled units.

Special Instructions:

- ☐ Review building plans for special instructions where removal of wall panels is necessary.
- ☐ Review Procedure for respiratory Protection.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ Secure, lock out, and tag circulating pumps, steam valves, and electric circuits supplying the units to be serviced.
- ☐ Coordinate PM of associated equipment.
- ☐ Rope off or post signs at vestibules or entrances where work involves these areas.

Checkpoints:

- ☐ Remove covers or wall panels. Note: Extreme care must be taken when removing marble or granite wall panels. These panels are extremely heavy and very fragile.
- ☐ Check housing, braces, supports, hangers, and hardware for signs of deterioration or damage.
- ☐ Wire brush and treat with rust inhibitor all rusted areas.

- ☐ Check coils, piping, and fin material for damage, leaks or looseness. Straighten finned material as necessary.
- ☐ Check temperature or flow controls, shutoff valves, vents and traps for proper operation.
- ☐ Vacuum or blow out finned tube area and interior housing.
- ☐ Touch up paint as required.
- ☐ Clean and replace covers or wall panels and caulk wall panels as required.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Vacuum and/or portable air tank
- ☐ Goggles, respiratory protection, and gloves
- ☐ Rope and/or out of service signs
- ☐ Rust inhibitor and appropriate paints. Consult the Material Safety Data Sheet (MSDS) to ensure that the paint lead level is 0.06% or less and for the proper personal protective equipment (PPE).

9. **Hot Water Heater – Steam Coil**

Annual

This maintenance task applies to independent domestic hot water heaters, which consists of a hot water storage tank with coils for hot water or steam submerged into the water to be heated. The storage capacity is from 100 to 1000 gallons, with a temperature rise from 90ºF to 140ºF. The tank will require manholes or hand hole inspection plates.

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ Obtain operating logs.
- ☐ Review operating logs to check loss of efficiency of heat exchange surfaces, indicating scale and corrosion buildup.
- ☐ Check inspection certificate.
- ☐ If the insulation is known or suspected to contain asbestos, check the building's asbestos management plan to see it has been tested for asbestos. If it is suspect but has not been tested, have it tested. Manage asbestos in accordance with the plan.

Checkpoints:

- ☐ Inspect element header and exterior of tank including fittings, manholes, and hand holes for leaks and signs of corrosion.
- ☐ Hand-operate and test pressure relief valve.
- ☐ Drain and flush tank.

- ☐ Remove tank inspection plate and inspect tank interior. Record the size and depth of pits, presence of cracks, and condition of openings, fittings, welds, rivets, and joints.
- ☐ Check condition of heat exchanger element. Remove and clean as necessary.
- ☐ Inspect condition of epoxy tank lining.
- ☐ Replace all gaskets and manhole inspection plates, and tighten all bolts as required.
- ☐ Fill tank and check for leaks.
- ☐ Clean strainer; check condition of traps. Report leaks.
- ☐ Clean pump, controls, switches, and starters. Check condition of pump seal or packing, replace as required.
- ☐ Clean, test, and inspect sight glasses, valves, fittings, drains.
- ☐ Inspect structural supports, and repair or replace damaged insulation or covering.
- ☐ Schedule hydrostatic testing according to established procedures.
- ☐ Return tank to service and observe temperature control operation. Adjust as required.
- ☐ If the insulation contains asbestos, follow the asbestos management plan for isolation, notification, work practice and waste disposal.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools - Basic
- ☐ Wrenches from stock for large bolts
- ☐ Paint and brushes. Consult the Material Safety Data Sheet (MSDS) to ensure that the paint lead level is 0.06% or less.
- ☐ Cleaning and patching materials. Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Hoses
- ☐ Goggles

IV. Pump/Piping

1. **Condensate or Vacuum Pump**
   Annual

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ This maintenance should only be performed when it will not prevent operation of the steam boiler.

Checkpoints:

- ☐ Operate unit to check for steam binding.

- ☐ Check condensate temperature. It should be approximately 30°F (17°C) below steam temperature if traps are not leaking.
- ☐ Examine flanges for steam leaks; replace gaskets as necessary.
- ☐ Pump receiver down.
- ☐ Turn condensate to sewer.
- ☐ Shut down unit.
- ☐ Clean and examine receiver, vent pipe, inlet and discharge openings for corrosion; remove all external corrosion, and paint with appropriate type paint.
- ☐ Clean and adjust motor float switch and float operation on high low water level. Inspect float rods and pressure switches.
- ☐ Make any adjustments as necessary.
- ☐ Check alignment of motor and pump coupling with straight edge. Align if necessary.
- ☐ Lubricate pump and motor.
- ☐ Adjust packing glands and change packing when necessary.
- ☐ Examine vacuum breaker operation.
- ☐ Inspect ball floats, rods, and other linkage, adjust as necessary.
- ☐ Properly dispose of all debris.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Lubricants. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Clean wiping cloths
- ☐ Gasket materials as required
- ☐ Metal cleaning materials and appropriate paint as necessary. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Six inch level and straight edge

2. **Expansion Joints In Piping**
   Annual
   This maintenance task applies to slip type joints only (Bellows type joints to be replaced when a leak occurs).

   Checkpoints:

   - ☐ Slip-type Joint with packing-gland.

- ☐ Examine joint closely, look for evidence of displacement, loose or defective anchors or bolts, alignment of joint with piping, task rods, etc. Correct what can be done with pressure on.
- ☐ Observe packing gland, adjust to stop weeping or leaks.
- ☐ Renew packing completely when system is down for other reasons such as repair, overhaul or maintenance of other components.

☐ Gun-packed type.

- ☐ Perform work prescribed above for slip-type joint with gland.
- ☐ Add packing if needed.

☐ Clean up work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Lubricants. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.
- ☐ Cleaning supplies and materials. Consult the Material Safety Data Sheet for hazardous ingredients and proper Personal Protective Equipment.

3. **Traps, All Types, Low Pressure**
   Five Years

Special Instructions:

- ☐ Check trap operation under steam pressure.
- ☐ Remove and replace faulty traps or trap elements.

Checkpoints:

☐ Thermostatic traps. (Bellows or diaphragm type)

- ☐ Remove cap or bonnet.
- ☐ Clean interior of trap, valve, and seat.
- ☐ Inspect bellows and diaphragm and note by sound whether it contains liquid charge.
- ☐ Replace bellows or diaphragm as necessary.
- ☐ If valve seat is cut, replace seat.

☐ Float and/or thermostatic traps.

- ☐ Remove bonnet.
- ☐ Inspect linkage and float operation for leakage, defective operation or deterioration.
- ☐ Examine, clean, and check operation of bellows as above.

- ☐ Inverted bucket trap.
  - ☐ Remove bonnet
  - ☐ Clean interior or trap.
  - ☐ Inspect valve linkage mechanism and seating of valve.
  - ☐ Examine condition of bucket.
  - ☐ Examine vent or face, inlet and outlet for evidence of corrosion.
- ☐ Impulse trap.
  - ☐ Remove bonnet
  - ☐ Inspect valve disc, inlet valve, outlet outface.
  - ☐ See that fulcrum point is free of dirt.
  - ☐ Clean body of trap.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.

4. **Traps, All Types, High Pressure**
   Annual

Special Instructions:

- ☐ Check trap operation under steam pressure.
- ☐ Remove and replace faulty traps or trap elements.

Checkpoints:

- ☐ Thermostatic traps. (Bellows or diaphragm type)
  - ☐ Remove cap or bonnet.
  - ☐ Clean interior of trap, valve, and seat.
  - ☐ Inspect bellows and diaphragm and note by sound whether it contains liquid charge.
  - ☐ Replace bellows or diaphragm as necessary.
  - ☐ If valve seat is cut, replace seat.
- ☐ Float and/or thermostatic traps.
  - ☐ Remove bonnet.
  - ☐ Inspect linkage and float operation for leakage, defective operation or deterioration.
  - ☐ Examine, clean, and check operation of bellows as above.
- ☐ Inverted bucket trap.
  - ☐ Remove bonnet
  - ☐ Clean interior or trap.

- ☐ Inspect valve linkage mechanism and seating of valve.
- ☐ Examine condition of bucket.
- ☐ Examine vent or face, inlet and outlet for evidence of corrosion.

☐ Impulse trap.

- ☐ Remove bonnet
- ☐ Inspect valve disc, inlet valve, outlet outface.
- ☐ See that fulcrum point is free of dirt.
- ☐ Clean body of trap.

Recommended Tools, Materials, and Equipment:

☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.

5. **Valve, Safety Relief**

Monthly

This maintenance task applies to safety relief valves installed on boilers, steam lines, and other equipment. The safety valves are designed to safely relieve excessive pressure, thus preventing rupture or explosion of the pressure parts. Safety valves differ from relief valves in that the safety relief valve opens fully when the applied pressure exceeds its lifting set-point and remains open until the applied pressure drops below its reset point. Relief valve starts to open when pressure overcomes the spring pressure and remains open to the degree that the applied pressure pushes it open. When pressure drops, the spring closes the valve.

Special Instructions:

- ☐ The safety relief valves are designed to be operated by steam and should only be tested when sufficient pressure exists to clear the seating area of any debris.
- ☐ Check with operating personnel before performing this test.
- ☐ If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.

Checkpoints:

- ☐ Inspect condition of spring, flanges, and threaded connections.
- ☐ Inspect and hand lift the manual lifting lever, checking for binding of the stem or seat. Note that valve returns to proper position when the lever is released.
- ☐ Inspect support brackets and tighten as required.
- ☐ Check that the discharge piping support is tight and not causing stress on the valve.
- ☐ Clean the valve body.

- ☐ Lubricate the stem and lever pivot.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

6. **Valves, Regulating**
   Monthly
   This maintenance task applies to single or double seated, diaphragm or spring loaded pilot operated valves.

   Checkpoints:

   - ☐ Inspect for dirt collected at bleed port and restriction elbow. Clean if necessary.
   - ☐ Inspect joints for leakage. Tighten all bolts
   - ☐ Check for dust or other material on the upper face of the pilot pressure plate. Clean if needed.
   - ☐ Remove and clean line strainer (back-flush where possible).
   - ☐ Inspect valve head and seats for nicks or abrasions.
   - ☐ Inspect pressure reading against set point.
   - ☐ Check for free operation of valve stem.
   - ☐ Inspect condition of diaphragm.
   - ☐ Inspect pilot line for leaks.
   - ☐ Clean up work area and remove all debris.

   Recommended Tools, Materials, and Equipment:

   - ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
   - ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

7. **Check Valve, Critical**
   Annual
   This maintenance task applies to check valves in primary fluid systems that improve operating efficiency or prevent damage to system components. It applies only to check valves not serviced in conjunction with their associated equipment.

8. Special Instructions:
   - ☐ Schedule maintenance with operating personnel.
   - ☐ Isolate check valve, secure and tag the valves.
   - ☐ Post out of service signs on the appropriate equipment.

- ☐ Review manufacturer's instructions.
- ☐ If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.

Checkpoints:

- ☐ Remove the cover and clean the valve seat and disc.
- ☐ Examine the hanger, disc, and seat for cracks or wear.
- ☐ Check seals, packing, and gaskets for deterioration; replace if necessary.
- ☐ Reassemble valve using a new cover gasket or seal.
- ☐ Remove tags and test for leaks. Test under operating conditions if possible.
- ☐ Remove out of service signs.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Packing, seals, and gaskets
- ☐ Lapping compound and lapping block

9. **Pump, Centrifugal**
   Annual

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ Pump maintenance should be scheduled to coincide with drive motor maintenance, and fire pump maintenance where applicable.
- ☐ De-energize, lock out and tag circuit, except where noted.
- ☐ For replacement of mechanical seals, see the addendum at the end of this guide. It is generally not a good idea to tamper with pumps using mechanical seals if they are otherwise performing properly.
- ☐ Since mechanical seals can cost as much as the pump, it is usually not cost effective to risk damaging the seal by performing an annual internal inspection of the pump.

Checkpoints:

- ☐ Mechanical Seals:

- [ ] Refer to manufacturer's instructions. Generally, the only maintenance required would be lubrication of the seal faces with oil or grease. The type of lubricant used depends upon the pump service. Many applications require no lubrication other than from the liquid being pumped.
- [ ] Visually inspect the energized pump and motor.
    - [ ] Look for fluid leaks originating from the area of the mechanical seal. Replace seal even if leaking only slightly.
    - [ ] Look for fluid leaks from other areas of the pump, flanges and gaskets, pressure gauges and fittings, bypass tubes or piping, and air release valves.
    - [ ] Look for bearing oil or grease leaks.
    - [ ] Observe coupling for excessive noise or obvious misalignment.
    - [ ] Observe fluid temperatures, pressures, and bearing temperatures if thermometers and pressure gauges are available.
- [ ] De-energize pump and motor.
- [ ] Observe pump and motor during shutdown. Oftentimes, vibration and bearing problems become more noticeable during a coasting slowdown of the pump and motor.
- [ ] Close suction and any bypass valves. Bleed off pressure but do not drain pump. Observe pressure gauges for signs that the discharge check valve is not closing tightly.
- [ ] Close discharge valve. Bleed off pressure but do not drain pump. Observe pressure gauges for signs that the discharge and suction valves are not closing tightly.
- [ ] Lubricate pump and motor bearings. DO NOT OVER LUBRICATE.
- [ ] Use a torque wrench to check the tightness of all bolts, especially the bolts of cast iron pumps.
- [ ] Closely inspect the pump-motor coupling.
- [ ] Check motor and pump alignment.
- [ ] Inspect and clean suction strainers and blowdown valves.
- [ ] Clean pump and casing surfaces.

- [ ] Other pumps:
    - [ ] Check that base bolts are securely fastened.
    - [ ] After shut-down, drain pump housing, check suction, discharge and check valve for holding.
    - [ ] Remove cover gland and packing.
    - [ ] Remove corrosion from impeller shaft and housing cover.
    - [ ] On pumps with oil ring lubricated bearings, drain oil, flush, and fill to proper oil level with new approved type oil.
    - [ ] Inspect water rings, seals, and impellers.

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- ☐ Clean pump suction strainers, and pump packing water seal filter/strainer.
- ☐ Replace packing, and reassemble.
- ☐ Start and stop pump, noting vibration, pressure, and action of check valve.
- ☐ Adjust packing.
- ☐ Lubricate impeller shaft bearings. Do not over lubricate.
- ☐ Check motor and pump alignment.
- ☐ Check drive shaft coupling.

☐ Clean up work area and remove all debris.

- ☐ **COUPLING SIZE ALLOWABLE ALIGNMENT**
- ☐ 1"-2" 0.101 Total ind. reading
- ☐ Over 2"-4" 0.015 Total ind. reading
- ☐ Over 4"-7" 0.020 Total ind. reading

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Alignment indicator
- ☐ Grease gun
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Hoist assembly for large pumps

Addendum: Centrifugal Pump Mechanical Packing

Special Instructions:

- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ When replacing a mechanical seal on a pump, it is important that the seal is designed for the type and temperature of the liquid to be pumped.
- ☐ De-energize, lock out and tag circuit. Close off pump suction and discharge valves. Drain pump housing.
- ☐ A balanced mechanical seal can fail suddenly on start-up. Stand in a safe location out of range of the potential gland spray area when starting the pump.
- ☐ When installing mechanical seals that utilize gland bolts as seal retainers, be very careful to level the gland bolts, centering the bolts horizontally on the split of a split case pump.

Procedure:

- ☐ Disconnect and remove pump/motor coupling from pump shaft.

- ☐ Clean external pump housing and shaft, remove flange on pump housing to remove pump mechanical seal assembly while noting how the seal is assembled on the shaft and in the pump housing.
- ☐ After old seal has been removed, clean surfaces of shaft sleeve. If this sleeve is galled or damaged, a new seal will not hold for long. It is best to replace the shaft sleeve at this time. If the shaft sleeve is not damaged, follow seal manufacturer's instructions and install new mechanical seal. Install new pump housing "O" ring or gasket, reinstall pump housing. Slowly open discharge and suction valve, then rotate pump shaft to assist in setting mechanical seal. Check alignment of pump and motor couplings. The use of shims may be necessary under the motor or pump to align the pump coupling with the motor coupling.
- ☐ Examine both suction and discharge pressure gauges if they are not registering 0 psig. Replace one or both gauges if defective. Open pump suction and discharge valves, vent air out of pump housing.
- ☐ Log static pressure, if any, from pump suction gauge. Start pump motor, record pump operating suction and discharge pressures. Any unusual noises should be investigated and corrected before allowing pump to be put back in service. Record pump motor voltage and operating amps. Restore pump to service, remove tag.
- ☐ Clean up work area.

10. **Pump, Vacuum**
    Semiannual
    This maintenance task applies to vacuum pumps used in printing plants, photographic plants, and other operation that requires a vacuum to operate. These units vary in size and appearance. They may resemble a small tankless air compressor or a larger tank mounted and belt driven air compressor.

11. Special Instructions:
    - ☐ Schedule shutdown with operating personnel.
    - ☐ Secure and tag electrical power and valves to vacuum lines.
    - ☐ Use protective equipment.

    Checkpoints:
    - ☐ Drain oil separator and change oil with specified type.
    - ☐ Change crankcase oil if applicable.
    - ☐ Change air filter if applicable.
    - ☐ Check air dryer.
    - ☐ Check belt condition and alignment. Adjust or replace if required.
    - ☐ Check for corrosion on water cooled units.

- ☐ Lubricate as recommended by manufacturer.
- ☐ Vacuum or blow out motor air passages on hermetic, direct drive, or fractional horse motors.
- ☐ Inspect tank and piping for deterioration, cracks, leaks, etc.
- ☐ Clean exterior of unit with vacuum.
- ☐ Check gauge accuracy with calibrated test gauge.
- ☐ Remove tags, open valves, and restore power.
- ☐ Test the operation by observing at least one complete cycle.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Lubricants and oil
- ☐ Fin and comb
- ☐ Vacuum cleaner
- ☐ Calibrated test gauge
- ☐ Appropriate safety equipment

V. Plumbing

1. **Valve, Manually Operated**

   Annual

   This maintenance task applies to valves other than those used on Fire Protection systems. Maintenance for valves used on fire protection systems are described under the appropriate task for the specific item of fire protection equipment.

   Special Instructions:

   - ☐ If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.

   Checkpoints:

   - ☐ Operate valve in full open/closed position. Loss of ability to close tightly will require inspection of valve seals and discs for wear and contaminant build-ups.
   - ☐ Check for sticking valve stems and lubricate stems and fittings sparingly.
   - ☐ Replace packing; dress, re-bush, or replace packing gland assembly, if required.
   - ☐ Check for freedom of motion on valves equipped with wheel and chain for remote operation.
   - ☐ Clean up work site.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Lubricants. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

2. **Valve, Manually Operated**
   Five Years, Over 2 inch
   This maintenance task applies to valves other than those used on Fire Protection systems. Maintenance for valves used on fire protection systems are described under the appropriate task for the specific item of fire protection equipment.

   Special Instructions:

   - ☐ If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.

   Checkpoints:

   - ☐ Operate valve in full open/closed position. Loss of ability to close tightly will require inspection of valve seals and discs for wear and contaminant build-ups.
   - ☐ Check for sticking valve stems and lubricate stems and fittings sparingly.
   - ☐ Replace packing; dress, re-bush, or replace packing gland assembly, if required.
   - ☐ Check for freedom of motion on valves equipped with wheel and chain for remote operation.
   - ☐ Clean up work site.

   Recommended Tools, Materials, and Equipment:

   - ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
   - ☐ Lubricants. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

3. **Valve, Motor Operated**
   Annual

   Special Instructions:

   - ☐ If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they

are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.

Checkpoints:

- ☐ Clean unit and make visual examination of all parts.
- ☐ Operate from limit to limit. Observe operation, look for binding, sluggishness, action of limits, etc.
- ☐ Determine if valve seats and holds properly.
- ☐ Check condition of packing.
- ☐ Check condition of dials and positioners.
- ☐ Apply graphite to moving parts of valve.
- ☐ Lubricate motor and gear box as necessary.
- ☐ Inspect contacts, brushes, motor, controls, switches, etc. Clean and adjust as necessary.
- ☐ Clean up work site.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Lubricants. Consult the MSDS for hazardous ingredients and proper PPE.

4. **Valve, Hydraulic/Pneumatic/Electric**

Annual

This maintenance task applies to those valves that are equipped with electric or pneumatic motors or hydraulic drivers. The primary difference between these and other valves is the use of motors to drive them open or closed. They are applied wherever automatic or remote operation is essential. V-6 valves use diaphragms, bellows, or small electric modulating motors to operate the valve, whereas the V-7 valves use electric motors and gear box, air turbines, or hydraulic pistons.

Special Instructions:

- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ Schedule an outage with operating personnel if required.
- ☐ Secure, tag, and lock out associated electric circuits, pneumatic or hydraulic lines before servicing motor, gear box, or piston.
- ☐ If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they

are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.

Checkpoints:

- ☐ Clean unit and visually examine all parts.
- ☐ Operate from limit to limit and observe. Look for binding, sluggishness, action of limits, etc.
- ☐ Determine if valve seats and holds properly.
- ☐ Apply graphite to moving parts of valve.
- ☐ Clean solenoids.
- ☐ Inspect cylinder, piston, washers or "O" rings, controls, and switches.
- ☐ Clean and adjust as necessary.
- ☐ Clean up work site.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Lubricants. Consult the MSDS for hazardous ingredients and proper PPE.

5. **Chemical Feeder**

Semiannual

This maintenance task applies to tank type water chemical feeders with pumps and agitators.

Special Instructions:

- ☐ Review the Procedure for respiratory protection.

Checkpoints:

- ☐ Drain chemicals from feeder into storage containers.
- ☐ Flush and clean feeder tank.
- ☐ Flush piping with water.
- ☐ Remove agitator and clean shaft and propeller; lubricate as required.
- ☐ Check oil in pump reservoir.
- ☐ Lubricate pump pistons.
- ☐ Check operation of pressure relief valve.
- ☐ Lubricate motors.

- [ ] Replace chemicals into feeder storage tank.

Recommended Tools, Materials, and Equipment:

- [ ] Standard tools – basic
- [ ] Rubber gloves and apron
- [ ] Filter air mask
- [ ] Goggles
- [ ] Grease gun and oiler
- [ ] Cleaning materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

D. Plumbing Fixtures & Equipment

1. **Filter, Charcoal**

Quarterly

This maintenance task applies to charcoal filters used in air distribution systems to clean air of undesirable or hazardous materials. These filters may be cleaned by group forces or require shipping to manufacturer for recycling.

Special Instructions:

- [ ] Review Procedure for "Controlling Hazardous Energy Sources."
- [ ] Notify operating personnel before shut down.
- [ ] Secure fan and tag switch.
- [ ] Maintenance personnel must wear NIOSH/MSHA respirators and appropriate protective clothing and equipment when servicing filters involving hazardous materials, i.e., shooting ranges, research laboratories, chemical laboratories, photographic development labs, etc.
- [ ] Follow manufacturer's recommendations for handling, transporting, cleaning and shipping filters.

Checkpoints:

- [ ] Remove old filters and place in plastic bags.
- [ ] Clean filter holder, rack and surrounding area.
- [ ] Install new filter.
- [ ] Place cleaning materials in plastic bags for disposal if work involves hazardous materials. Consult the Material Safety Data Sheets (MSDS) for proper disposal.
- [ ] Remove tags, restore power and check for proper operation.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Protective clothing and plastic bags
- ☐ Cleaning materials – Consult the MSDS for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Filters

2. **Fountain, Memorial or Decorative**
   Semiannual
   The work required by this maintenance task applies to memorial fountains. These fountains normally operate during the summer season. They are usually drained and secured in the fall and are reactivated again in the spring.

   Special Instructions:
   - ☐ Secure and tag pumps and valves in the fall.
   - ☐ Be alert to any structural damage to the fountain.

   Checkpoints:
   - ☐ **Fall**
     - ☐ Drain fountain
     - ☐ Remove fountain head(s)
     - ☐ Clean scale from head(s) after removing and install cover plate.
     - ☐ Clean bolts and spacers. Replace defective bolts as needed.
     - ☐ Check and clean fill tube; remove spacer pipe and cap fill tube.
     - ☐ Clean overflows and strainers.
   - ☐ **Spring**
     - ☐ Remove fill tube cap, install spacer pipe and install fill tube.
     - ☐ Remove fountainhead cover(s) (if applicable) and install fountain head.
     - ☐ Clean basins
     - ☐ Remove tags from valves and fill fountain
     - ☐ Remove tags from pump and put into service.
     - ☐ Add an appropriate biocide.

   Recommended Tools, Materials, and Equipment:
   - ☐ Standard tools – Basic
   - ☐ Hip boots
   - ☐ Cleaning equipment and materials – Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

- ☐ Biocide.

3. **Grease Traps**
   Monthly

   Special Instructions:
   - ☐ Use appropriate protective clothing, especially safety glasses.

   Checkpoints:
   - ☐ Clean out trap and sterilize.
   - ☐ Inspect for clogging, scale, and improper positioned or missing baffles.
   - ☐ Tighten loose parts as necessary.
   - ☐ Clean up work area and remove all trash.

   Recommended Tools, Materials, and Equipment:
   - ☐ Standard Tools – Basic
   - ☐ Gloves
   - ☐ Goggles

4. **Sewage Ejector (Pneumatic Tank Type Ejectors)**
   Annual
   This maintenance task applies to sump type sewage ejectors that operate by means of an electric motor and pump.

   Special Instructions:
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ Review Procedure for respiratory protection.
   - ☐ Schedule outage with operating personnel.
   - ☐ De-energize, lock out, and tag all electrical circuits.
   - ☐ Wear rubber apron, gloves, boots, full face shield, and respirator when performing this work.
   - ☐ If a person must enter the pit, test for oxygen deficiency and supply proper ventilating equipment as needed.
   - ☐ No open flames or smoking.
   - ☐ Strainer and check valve cleaning requires removal of pump unit and should be handled as a repair.

   Checkpoints:

- ☐ Remove cover plates, flush pit, and pump out.
- ☐ Check bail, floats, rods, and switches. Make sure float operates as designed.
- ☐ Clean pump and lubricate as required.
- ☐ Inspect check valve.
- ☐ Inspect interior of pit for cracks.
- ☐ Clean motor with vacuum or low pressure air (less than 40 psi). Check for obstructions in motor cooling and air flow.
- ☐ Check for corrosion. Clean and treat with rust inhibitor as needed.
- ☐ Inspect cover plate gaskets and replace if necessary.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning equipment and materials.
- ☐ Lubricant (per manufacturer's instructions).
- ☐ Rubber apron, gloves, and boots
- ☐ Full face shield
- ☐ Respirator
- ☐ Ventilating equipment
- ☐ Toxic gas test meter
- ☐ Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

5. **Sewage Ejector, Sump Type**
   Annual
   This maintenance task applies to sump type sewage ejectors that operate by means of an electric motor and pump.

   Special Instructions:

   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ Review Procedure for respiratory protection.
   - ☐ Task Frequency outage with operating personnel.
   - ☐ De-energize, lock out, and tag all electrical circuits.
   - ☐ Wear rubber apron, gloves, boots, full face shield, and respirator when performing this work.
   - ☐ If a person must enter the pit, test for oxygen deficiency and supply proper ventilating equipment as needed.

- ☐ No open flames or smoking.
- ☐ Strainer and check valve cleaning requires removal of pump unit and should be handled as a repair.

Checkpoints:

- ☐ Remove cover plates, flush pit, and pump out.
- ☐ Check bail, floats, rods, and switches. Make sure float operates as designed.
- ☐ Clean pump and lubricate as required.
- ☐ Inspect check valve.
- ☐ Inspect interior of pit for cracks.
- ☐ Clean motor with vacuum or low pressure air (less than 40 psi). Check for obstructions in motor cooling and air flow.
- ☐ Check for corrosion. Clean and treat with rust inhibitor as needed.
- ☐ Inspect cover plate gaskets and replace if necessary.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Lubricant (per manufacturer's instructions). Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Rubber apron, gloves, and boots
- ☐ Full face shield
- ☐ Respirator
- ☐ Ventilating equipment
- ☐ Toxic gas test meter

6. **Sump Pump**
   Annual

Special Instructions:

- ☐ Strainer cleaning requires removal of pump unit and should be handled as a repair.
- ☐ Excessive sediment and debris, not removed by flushing the pit should be handled on a project basis, and not considered under this guide.
- ☐ Review manufacturer's instructions.
- ☐ If the material removed from the pump is hazardous, review disposal instructions.

Checkpoints:

- ☐ Flush pit and pump out.
- ☐ Check bail, floats, rods, and switches (make sure float operates as designed).
- ☐ Inspect and lubricate motor, and pump (repack if needed).
- ☐ Inspect check valves.
- ☐ Clean up work area, and remove all debris.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Lubricants. Consult the MSDS for hazardous ingredients and proper PPE.

7. **Strainer, Y-Type**
   Annual

Special Instructions:

- ☐ The maintenance of Y-type strainers, as outlined by this guide card, should be scheduled to coincide with the maintenance of the equipment that they are associated with.

Checkpoints:

- ☐ Secure strainer isolation valves.
- ☐ Drain strainer housing.
- ☐ Back flush if possible or remove and clean strainer cage, if applicable.
- ☐ Replace cartridge type and clean out strainer housing, if applicable.
- ☐ Reassemble unit or replace drain plug and open isolation valve.
- ☐ Check unit for leaks.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – basic
- ☐ Hose and bucket
- ☐ Gaskets or gasket material
- ☐ Cartridge filter replacement

8. **Strainer, Bolted Flange Type (Water and Steam)**
   Annual

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ Secure and tag inlet and outlet valves.

Checkpoints:

- ☐ Remove flange cover bolts.
- ☐ If required, use a hoist or crane to remove cover plate.
- ☐ Remove device or devices; clean and inspect for damage.
- ☐ Clean strainer housing cover plate and any interior apparatus. Check for cracks and deterioration.
- ☐ Install new cover gasket and reassemble.
- ☐ Remove tags and open valves; check for leaks.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – basic
- ☐ Hose and bucket
- ☐ Gaskets or gasket material
- ☐ Crane or hoist

9. **Dual Strainer**
   Annual
   This maintenance task applies to those strainers used to remove the larger particles of debris in water that may be drawn from rivers, reflecting pools, etc.

Special Instructions:

- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, tag, and lock out electrical circuit.
- ☐ Review manufacturer's instructions.
- ☐ This task normally requires two employees.

Checkpoints:

- ☐ Close off main water inlet.
- ☐ Close off condenser valves.
- ☐ Open all drains and start drain pump if necessary.
- ☐ Clean both strainer lid covers and remove baskets.

- [ ] Clean inner housing, baskets, and screens.
- [ ] Replace lid hatch seals.
- [ ] Check sliding door seals and replace if necessary.
- [ ] Check for pitting and corrosion and paint with rust inhibitor wherever necessary.
- [ ] Check strainer baskets; repair or replace as necessary.
- [ ] Remove and replace gland packing.
- [ ] Remove and replace lubricant in gearbox with manufacturer's recommended type.
- [ ] Lubricate motor.
- [ ] Check starter, relays, contactor, points, and wire connections.
- [ ] Run drive mechanism and check for proper operation.
- [ ] Install baskets, close lids, open valves, and check for leaks.
- [ ] Replace hoist ropes if necessary and inspect pulleys.
- [ ] Clean outside casing and touch up pitted or corroded areas with rust inhibitor.
- [ ] Clean up work site.

Recommended Tools, Materials, and Equipment:

- [ ] Standard Tools – Basic
- [ ] Lubricants. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- [ ] Cleaning equipment and material. Consult the MSDS for hazardous ingredients and proper PPE.
- [ ] Multimeter
- [ ] Rust inhibitor. Consult the MSDS for hazardous ingredients and proper PPE.

10. **Backwash Strainer**

Annual

This maintenance task applies to those strainers used to remove the small solids found in water drawn from rivers, reflecting pools, etc.

Special Instructions:

- [ ] Review manufacturer's instructions.
- [ ] Review Procedure for "Controlling Hazardous Energy Sources."
- [ ] De-energize, tag, and lock out electrical circuit.

Checkpoints:

- [ ] Close inlet and outlet valves.
- [ ] Drain backwash.
- [ ] Install hoist and remove lid bolts.

- [ ] Remove wiring harness and shaft hex nuts.
- [ ] Lift cover flange.
- [ ] Remove tube support rod nuts and tie bar.
- [ ] Individually remove tubes and acid/detergent clean each tube.
- [ ] Clean inner casing and tube sheet. Inspect for pits and cracks.
- [ ] Remove side inspection plate and clean bottom sump.
- [ ] Inspect arm assembly and bolt flange.
- [ ] Inspect cutless bearing, bearing housing, set screw, shaft coupler bolt and nut, shaft, and distributor barrel seat.
- [ ] Install tubes, rod nuts, and tie bars.
- [ ] Replace shaft gasket.
- [ ] Inspect main shaft, bearing housing, set screw, cutless bearing, drive shaft bearing, and the stud and nut (upper unit).
- [ ] Replace gasket for main cover.
- [ ] Install cover lid and bolts.
- [ ] Replace packing and inspect gland bolt.
- [ ] Replace two "O" rings on upper shaft.
- [ ] Inspect thrust bearings and replace if necessary.
- [ ] Replace shear key and install hex nuts.
- [ ] Drain oil from gear case and replace.
- [ ] Install wiring harness and lubricate motor if necessary.
- [ ] Check all starting relay contacts and wire connections.
- [ ] Start backwash; observe rotation and arm movement through inspection plate.
- [ ] Clean half inch tubing and flange for pressure gauge.
- [ ] Secure unit and install inspection plate.
- [ ] Close drain valve and open inlet and outlet valves.
- [ ] Start backwash and adjust packing.
- [ ] Inspect unit for leaks.
- [ ] Touch up rusted and corroded areas with rust inhibitor and paint.
- [ ] Clean up work site.

Recommended Tools, Materials, and Equipment:

- [ ] Standard Tools – Basic
- [ ] Lubricants. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- [ ] Cleaning equipment and materials. Consult the MSDS for hazardous ingredients and proper PPE.

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- ☐ Multimeter
- ☐ 8 foot ladder constructed according to OSHA/ANSI standards. Check ladder for defects. Do not use defective ladders.
- ☐ Chain or cable hoist
- ☐ Rust inhibitor and paint. Consult the MSDS to ensure that the paint lead level is 0.06% or less and proper PPE.

11. **Tanks, Water, (All Types)**
Three Years

Special Instructions:

- ☐ Maintenance shall be coordinated with required inspections. This maintenance task applies to hot water, cold water, expansion tanks, etc., but not to hot water converter (steam) tanks.
- ☐ Review Procedure for Confined Space Entry.
- ☐ Review Procedure for respiratory protection.
- ☐ If asbestos containing materials are present, check the building's asbestos management plan as described in the Environmental Management portion of the Safety and Environmental Management Program. Manage asbestos in accordance with the asbestos management plan.

Checkpoints:

- ☐ Examine exterior of tank including fittings, manholes, and handholes for leaks, signs of corrosion, and correct as indicated.
- ☐ Drain and flush tank.
- ☐ Open tank and remove rust, scale and buildup by scraping, wire brushing or shot cleaning.
- ☐ Inspect thoroughly the interior of tank; record the size and depth of pits, presence of cracks and condition of openings, fittings, welds, rivets, and joints.
- ☐ Coat with epoxy or other approved protective coatings.
- ☐ Inspect structural supports and repair or replace damaged insulation or covering. If insulation contains asbestos and is damaged or eroded, remove all debris while keeping debris wet; dispose of this material as asbestos-containing waste.
- ☐ Clean, test and inspect sight glasses, valves, fittings, drains, and controls.
- ☐ Perform hydrostatic test if required.
- ☐ Fill and return to service.
- ☐ Add an EPA approved biocide.
- ☐ Clean up work site.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Safety signs
- ☐ Respirator
- ☐ Goggles
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ EPA approved biocide. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

12. **Septic Tank**
Annual

Special Instructions:

- ☐ Wear suitable protective clothing.
- ☐ No open flames or smoking.
- ☐ Use barricades around tank opening.

Checkpoints:

- ☐ Remove cover.
- ☐ Agitate contents of septic tank to mix sludge with liquid.
- ☐ Pump out contents of tank into container truck that meets State health requirements.
- ☐ After contacts are removed, inspect to make sure that baffle plates are in place and tank is in good condition.
- ☐ Run water from inside of building to ensure that there are no blockages in the waste pipe from the building to the septic tank.
- ☐ Install cover.
- ☐ Contents of tank should be disposed of in accordance with State health requirements.

Recommended Tools, Materials, and Equipment:

- ☐ Standard tools – basic.
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Long handled scraper
- ☐ Barricade

13. **Backflow Preventer**

Annual

This maintenance task applies to backflow prevention devices installed in water lines to prevent the backflow of contaminated water into the potable water system. Standard check valves or double check valves are not approved backflow preventers and are not included for servicing under this task.

Approved backflow preventers are installed in main supply lines and water lines that supply boilers, central chilled water units, cooling towers, deep sinks used for cleaning, lawn sprinklers, lavatories, kitchen equipment, fire sprinkler systems, hose bibbs, laboratories, or wherever contaminated water could backflow into the potable water system.

Special Instructions:

- ☐ Schedule this maintenance outage of equipment with operating personnel. For cafeteria kitchens, coordinate the maintenance activity with the cafeteria operator.
- ☐ Typically, backflow prevention devices **MUST** be tested by a licensed journeyman tradesperson certified by the authority having jurisdiction. Comply with this authority as required.
- ☐ Review manufacturer's instructions for maintenance and testing procedures and required equipment. These procedures may vary depending on the model and size of the backflow preventer.
- ☐ Study the test procedures to be used.

Checkpoints:

- ☐ Secure the incoming potable water line(s).
- ☐ On reduced pressure zone backflow preventers, perform the following tests in accordance with the manufacturer's specifications, using the appropriate test kit:
  - ☐ Test check valve number 2 for tightness against reverse flow.
  - ☐ Test gate valve number 2 for tightness.
  - ☐ Test check valve number 1 for tightness.
  - ☐ Test operation of pressure differential relief valve.
- ☐ Service the first and second checks. **CAUTION:** If the check valve is spring loaded, **do not remove** the spring retainers. Consult the manufacturer's instructions for proper servicing.
  - ☐ Carefully remove screws, cover, and check.
  - ☐ Disengage the disc and spring assembly into individual components in accordance with manufacturer's instructions. Remove any embedded foreign objects, and inspect for corrosion, worn seals, etc. Clean or replace the assembly as required.
  - ☐ Clean or replace seals as necessary. Apply a light coating of manufacturer's specified and FDA approved lubrication prior to installation of seals.

- ☐ Reassemble the check valve module in reverse order.
- ☐ Repeat for second check.

☐ Service the relief valve. CAUTION: Springs may be loaded. Strictly comply with manufacturer's instructions.

- ☐ Remove bolts, cover, diaphragm, and relief valve piston assembly per manufacturer's instructions.
- ☐ Clean or replace wiper seal, piston "O" ring, and relief valve disc as required. Apply appropriate lubricant to "O" ring per manufacturer's specifications prior to reinstallation.
- ☐ Inspect bottom spring assembly. If defective, replace entire unit. **Do not attempt to remove the spring.**

☐ Following the manufacturer's procedures, vent both chambers and return the system to normal operation. Verify that there is no dripping or periodic spitting, and that the water flows properly and pressure drop is normal.

☐ For cafeterias and kitchens only, inspect food cookers, post-mix carbonated beverage machines, dishwashers, hose bibs, and service sinks and determine whether a backflow preventer is installed. If missing, ensure a preventer isn't located upstream, then initiate a work order to install one if required.

Recommended Tools, Materials, and Equipment:

☐ Review manufacturer’s instruction manual for specialized hand tools, equipment and supplies.

☐ Cleaning equipment and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

☐ Manufacturer's specified lubricant. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

☐ Manufacturer's testing, service, and calibration kits.

14. **Drinking Water Filter Systems**
Quarterly

Special Instructions:

☐ Review Procedure on respiratory protection

Checkpoints:

☐ Drain, clean, and flush drinking water system.

☐ Disassemble filters, flush and drain.

☐ Install new gravel, sand, and charcoal.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools - Basic
- ☐ Respirator.
- ☐ Gravel, sand, and charcoal.

15. **Water Softener**

Semiannual

This maintenance task applies to the three most common types of serviceable water softeners: lime, zeolite, and anthracite. They are normally found in large boiler plant operations, but may also be used elsewhere. Some applications may use all three types in series to achieve the required results.

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ Schedule this maintenance task with operating personnel.
- ☐ Secure and tag associated steam and water valves.
- ☐ Allow the tank to cool before starting work.

Checkpoints:

- ☐ All Tanks, where applicable:
  - ☐ Drain the tank.
  - ☐ Examine exterior of tank, including fittings, gauges, manholes, and handholes for signs of leaks or corrosion; correct as needed.
  - ☐ Inspect structural supports and insulation or coverings for defects or deterioration.
  - ☐ Open tank and remove rust or chemical deposits from interior tank surfaces.
  - ☐ Remove and clean all spray nozzles.
  - ☐ Thoroughly inspect interior of tank for pitting, cracking, and other defects.
- ☐ Lime Water Softener.
  - ☐ Dismantle vacuum breakers. Inspect stem, valve seat, and spring. Lap seat if required, and reassemble.
  - ☐ Inspect, clean, and flush nozzle ring.
  - ☐ Remove vent condenser heads and clean tubes.
  - ☐ Inspect and clean sight glass, level indicators, and level controllers.
- ☐ Zeolite Water Softener.
  - ☐ Check filter bed for proper level.
  - ☐ Take sample of zeolite resin according to manufacturer's instructions, and send to a lab for analysis.
  - ☐ Check the operation of the multiport valve.

- ☐ Anthracite Water Softener. Check the filter bed for proper level.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's manual for tool list.
- ☐ Grinding compound and lapping block.
- ☐ 12 volt drop light.

16. **Filter, Water**

Semiannual

This maintenance task applies to water filters installed in secondary water systems for heating and cooling systems. These filters may be either a disposable cartridge type filter or a washable and reusable filter media.

Special Instructions:

- ☐ Notify affected personnel of outage.
- ☐ Secure and tag filter inlet and outlet valves.

Checkpoints:

- ☐ Drain water from filter housing.
- ☐ Remove cover from filter housing.
- ☐ Remove spring, "O" rings, etc., and old filter.
- ☐ Clean and flush filter housing.
- ☐ Clean filter media, if applicable.
- ☐ Install filter media or cartridge.
- ☐ Replace springs and "O" rings.
- ☐ Replace housing cover.
- ☐ Open inlet and outlet valves.
- ☐ Check housing cover for leaks.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Filter cartridge or media, if applicable.
- ☐ Gaskets or "O" rings, as applicable.

E. Fire and Safety Systems & Utility Controls

I. Emergency Lights

1. **Emergency Lights, Closed Systems**
   Quarterly

   Special Instructions:

   - ☐ Use acid-resistant gloves, apron and plastic face shield.
   - ☐ Do not spark battery terminals or smoke while performing maintenance.
   - ☐ Review manufacturer's instructions.

   Checkpoints:

   - ☐ Inspect for structural defects and deposits.
   - ☐ Clean off corrosion deposits and apply silicone grease to terminals.
   - ☐ Push test button and observe light operation (see manufacturer's instructions).
   - ☐ Check vent holes.
   - ☐ Clean exterior with dry cloth.
   - ☐ Disconnect power to check operation. The battery should maintain the light output for 1.5 hours.
   - ☐ Record battery cell voltage. Replace cells below manufacturer's recommended low level.
   - ☐ If unit has to be discarded, review the Material Safety Data Sheet (MSDS) for proper disposal of battery and electrolyte
   - ☐ Clean up work area.

   Recommended Tools, Materials, and Equipment:

   - ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
   - ☐ Cleaning equipment and materials. Consult the MSDS for hazardous ingredients and proper Personal Protective Equipment.
   - ☐ Direct Current Voltmeter.
   - ☐ Hydrometer.
   - ☐ Silicone grease.
   - ☐ Acid resistant apron, gloves and face shield.

2. **Emergency Lights, Wet Cell**
   Quarterly

   Special Instructions:

- ☐ Do not spark battery terminals or smoke while performing maintenance.
- ☐ Review manufacturer's instructions.
- ☐ Use acid-resistant gloves, apron and plastic face shield.
- ☐ Consult the Material Safety Data Sheet (MSDS) for the electrolyte and proper personal protective equipment (PPE).
- ☐ Note the location of emergency eyewash and/or shower equipment.
- ☐ When practicable, remove light units to shop area for inspection and maintenance.
- ☐ Refer to the latest editions of the American National Standards Institute/National Fire Protection Association (ANSI/NFPA) publication 70B, “Electrical Equipment Maintenance” and the InterNational Electrical Testing Association publication, “Maintenance Testing Specifications”, as applicable.

Checkpoints:

- ☐ Inspect for structural defects and deposits.
- ☐ Clean off corrosion deposits and apply silicone grease to terminals.
- ☐ Inspect water level and take specific gravity readings. If reading is less than specified by battery manufacturer, the battery should be replaced with a freshly charged one. The old battery should be charged and tested before discarding. Review the MSDS for proper disposal of battery and electrolyte.
- ☐ Add distilled water to raise electrolyte to proper level.
- ☐ Push test buttons and observe light operation (see manufacturer's instructions).
- ☐ Check vent holes.
- ☐ Clean exterior with dry cloth, Paint if necessary with an appropriate type and color paint. **CAUTION:** Do not paint over any indicator lights.
- ☐ Unplug unit to check operation. The battery should maintain the light output for 1.5 hours.
- ☐ Clean up work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer’s instruction manual for specialized hand tools, equipment and supplies.
- ☐ Distilled water.
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheet MSDS for hazardous ingredients and proper Personal Protective Equipment PPE.
- ☐ Hydrometer.
- ☐ Silicone grease.
- ☐ Acid resistant apron, gloves, and plastic face shield.
- ☐ Emergency eyewash that provides at least 0.4 gallons/minute for at least 15 minutes.

- ☐ If unit has to be discarded, review the (MSDS) for proper disposal of battery and electrolyte.

II. Emergency Showers/Eyewash

1. **Emergency Shower**
   Annual

   Special Instructions:
   - ☐ Review manufacturer's instructions.

   Checkpoints:
   - ☐ Check operation of self-closing valve.
   - ☐ Check fittings.
   - ☐ Check pull lever for proper function.
   - ☐ Check showerhead for signs of corrosion, encrustation, or foreign particles. Clean as necessary.

   Recommended Tools, Materials, and Equipment:
   - ☐ Standard tools – basic
   - ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

2. **Wash, Emergency**
   Weekly
   This maintenance task includes emergency showers, eye-wash equipment, eye/face wash equipment, hand held drench hoses, and combination shower and eye-wash equipment, installed for the emergency treatment of the eyes and body of a person who has been exposed to injurious material. This includes water treatment chemicals, battery acid, cleaning solvents and compounds, etc.

   Special Instructions:
   - ☐ Review manufacturer's instructions.
   - ☐ On non-plumbed units (units containing their own water supply), use manufacturer's instruction to perform maintenance.
   - ☐ Where units have been sealed, be certain seals are available to re-seal the unit after PM is accomplished.
   - ☐ Where flow alarms have been installed, check with responding unit before activating the unit.

Checkpoints:

- ☐ Activate the unit to flush the line and verify proper operation.
- ☐ Assure that area is free of obstructions, that activation mechanisms are accessible to personnel in a distressed condition.
- ☐ Operate valve in full open and close position. Loss of ability to close tightly will require inspection of valve seals and discs for wear and contaminate build-up.
- ☐ Check systems for cleanliness and clean if necessary.

Recommended Tools, Materials, and Equipment:

- ☐ Standard tools – basic
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

3. **Water Spray Extinguishing Systems**
   Monthly
   This maintenance task applies to water spray extinguishing systems. These systems are similar to automatic sprinkler systems except that they use open heads that are specifically designed to project a particular water pattern to a precisely defined area and are used to provide protection to special hazards such as cooling towers, electrical transformers, and cable trays.

   Special Instructions:

   - ☐ Review manufacturer's instructions.

   Checkpoints:

   - ☐ Inspect system piping and fittings for the following:
     - ☐ Mechanical damage (broken piping, cracked fittings).
     - ☐ External conditions (damaged paint, rust, corrosion).
     - ☐ Misalignment or trapped sections.
     - ☐ Low point drain operation (automatic or manual).
     - ☐ Not subject to external loads.
     - ☐ Not leaking.
     - ☐ Rubber gasket fittings damaged or having missing gaskets.
   - ☐ Inspect pipe hangers and supports shall be inspected for the following:
     - ☐ External conditions (damaged paint, rust, corrosion).
     - ☐ Secure attachment to structural support and piping.
     - ☐ Damaged or missing hangers.
   - ☐ Inspect water spray nozzles to verify the following:
     - ☐ All nozzles are in place.

- ☐ That equipment has not been changed that would block nozzle discharge.
- ☐ That additional equipment has not been added and lacks proper protection.
- ☐ Are free from corrosion, foreign materials, or physical damage.
- ☐ Aimed in the direction of design.
- ☐ Where dust caps or blow-off plugs are required, verify they are in place and free to operate as intended.

- ☐ Visually align nozzles out of aim into the design direction.
- ☐ Verify control valves are open and pressure gauges show proper pressures.
- ☐ Inspect that spot heat detectors and line heat detectors are not damaged and are in service.
- ☐ Verify drainage facilities, such as trap sumps and drainage trenches, to ensure that they are not blocked.
- ☐ Verify that retention embankments and dikes are in good repair.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

4. **Water Spray Extinguishing Systems**

Annual

This maintenance task applies to water spray extinguishing systems. These systems are similar to automatic sprinkler systems except that they use open heads that are specifically designed to project a particular water pattern to a precisely defined area and are used to provide protection to special hazards such as cooling towers, electrical transformers, and cable trays.

Special Instructions:

- ☐ Due to the special requirements for maintaining this type of extinguishing system, it is recommended that the servicing of the system be provided by a fire equipment company experienced in water spray extinguishing system service.
- ☐ Review manufacturer's instructions.
- ☐ The work required by this task may cause the activation of an alarm and/or a supervisory signal. The facility maintenance manager and/or fire department that will receive the alarm and/or signal must be notified prior to start as well as at the completion of work.
- ☐ Annual preventive maintenance should be scheduled for the deluge valve, the detection system, the control panel, and the item being protected at this time.
- ☐ Take necessary steps to prevent water damage during full flow drain test.
- ☐ Prior to water flow test, install a pressure gauge at the hydraulically most remote spray nozzle. This can be done by removing the most remote nozzle, installing a tee with a pressure gauge attached and replacing the spray nozzle.

- [ ] Perform these procedures in the spring after there is no danger of freezing.
- [ ] Open and close all control valves slowly.

Checkpoints:

- [ ] Record static pressure (the pressure on supply side gauge).
- [ ] Open 2-inch drain and check for proper water flow. If water flow is weak, (considerable drop in water pressure when 2-inch is wide open), supply valves may not be fully open or there may be other piping obstructions. Continue water flow until it runs clear.
- [ ] Record the flow full drain residual pressure (lowest pressure on supply side gauge).
- [ ] Close 2-inch drain.
- [ ] Close main supply valve for the sprinkler system, then open two-inch drain valve.
- [ ] Immediately close drain valve when water pressure on incoming side of alarm check valve has dropped to 10 to 20 psi. If pressure rises within one minute, main supply valve is not seated properly. In such case, open drain valve and alternately open and close supply valve several times in an attempt to flush the valve seat. If not successful, supply valve needs to be repaired.
- [ ] Test the heat detectors in accordance with manufacturer recommendations.
- [ ] Trip deluge valve with water supply valve fully open in accordance with manufacturer's instructions.
    - [ ] Record the response time for the detector to actuate the special water control valve.
    - [ ] Detector shall respond within 40 seconds.
    - [ ] Repair or replace as necessary.
- [ ] Record the time lapse between the detector operation and the water delivery.
- [ ] Where water spray systems cannot be discharged due to the material being protected, the test should be conducted in a manner that does not discharge water in the protected area.
- [ ] Where water spray systems cannot be shut down (e.g. energized electrical equipment), a full flow system test shall be conducted at the next scheduled shutdown. In all cases, the test frequency shall not exceed three years.
- [ ] Record pressure at hydraulically most remote nozzle to ensure that there are not any impediments to water flow.
- [ ] Record pressure at deluge valve to ensure adequate water supply.
- [ ] Compare pressure gauge readings with original design pressures and the last test to determine if there has been any deterioration of the water supply.
- [ ] Observe nozzle discharge patterns to ensure adequate pattern and coverage. Adjust nozzles as necessary.
- [ ] Clean obstructions as necessary. If obstructions occur, retest system after cleaning.
- [ ] Flush mainline strainer until clear.

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- ☐ Remove, inspect and clean nozzle strainers.
- ☐ If more than one system is designed to activate at the same time, the maximum number of systems expected to operate shall be tested simultaneously to ensure water supply adequacy.
- ☐ Any manual actuation devices shall be operated.
- ☐ Verify that alarm, trouble, supervision, and annunciation signals function properly.
- ☐ After trip test, completely drain the system. Internally clean deluge valve and reset in a normal manner with special attention to renewal of rubber parts or adjustment or adjustment of gauges or alarm devices.
- ☐ Return system to service in accordance with manufacturer's instructions.
- ☐ At the conclusion of the test, the valve shall be tagged with the latest trip test date and the name and organization of the person performing the test.
- ☐ Every five years the interior of strainers, filters, and restricting orifices shall be inspected and cleaned.
- ☐ Drain all piping at low point drains or weep holes to prevent freezing and corrosion.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

III. Fire Alarm/Detection

1. **Automatic Fire Detection – Heat Detectors**

   Annual

   This maintenance task applies to all heat detectors, including:

   - Spot-type – Sensitive element is confined to a small area.
   - Fixed-temperature (non-restorable).
   - Rate-of-rise (restorable).
   - Combination fixed-temperature and rate-of-rise (has both non-restorable and restorable elements)
   - Line-type – Sensitive element is in a continuous line.
   - Cable type – fixed-temperature (non-restorable).
   - Cable type – rate-of-rise (restorable).
   - Sealed Pneumatic type – rate-of-rise (restorable).

   Special Instructions:

   - ☐ Review Manufacturer's instructions for each applicable type of detector.
   - ☐ The work required by this task may cause the activation of an alarm and/or a supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.

- [ ] Check detectors for physical damage, obstruction, corrosion, or painting. Painting slows or inhibits detector response to a fire. Replace damaged or painted detectors and cables.
- [ ] Check for any changes in partitions or floor plans since detector installation may need to be rearranged.
- [ ] When it is both feasible and safe, the environmental conditions being monitored should be altered to actuate the device.

Checkpoints:

- [ ] Text Inspect conduit for loose hangers or clamps.
- [ ] Fixed-temperature spot detectors (non-restorable).
    - [ ] Do not heat test as heat will damage the detectors and they will have to be replaced.
    - [ ] Test mechanically and electrically for function.
    - [ ] After fifteen years in service, replace all devices or laboratory test two detectors for each one hundred detectors installed. Replace the two detectors. If a failure occurs on any of the detectors removed, additional detectors shall be removed and tested to determine if either a general problem involving faulty detectors is present or if it is a localized problem involving one or two defective detectors. If one of the two detectors fails, either test additional detectors or replace all existing detectors. Repeat this same test every five years thereafter.
- [ ] Rate-of-rise spot detectors (restorable).
    - [ ] Test by exposing the detector to a heat source (such as a hairdryer or a shielded dryer) per manufacturer's instructions for response within one minute.
    - [ ] Test ten percent of detectors semiannually in order that all detectors have been tested within five years.
- [ ] Combination fixed-temperature and rate-of-rise spot detectors (has both non-restorable and restorable elements).
    - [ ] Test the same as rate-of-rise spot detectors.
    - [ ] Caution must be taken to avoid damage to the non restorable fixed temperature element in the detector.
    - [ ] This detector can also be tested by cooling the detector and then causing it to rise in temperature. This will generally activate the rate-of-rise element without the risk of damage to the non-restorable fixed-temperature element.
- [ ] Test rate compensation spot detectors (restorable) the same as rate-of-rise spot detectors.
- [ ] Cable fixed temperature line detector (non-restorable).
    - [ ] Do not heat test as heat will damage the cable and it will have to be replaced.
    - [ ] Test mechanically and electrically for function.

- ☐ Measure loop resistance to determine if it is within acceptable limits for the equipment used. Record loop resistance. Investigate changes from acceptance test and previous tests.
- ☐ Test cable rate-of-rise line detector (restorable) by exposing the detector to a heat source (such as a hairdryer or a shielded dryer) per manufacturer's instructions for response within one minute.
- ☐ Pneumatic tube rate-of-rise line detector (restorable).
  - ☐ In locations susceptible to damage, check tubing for crimps, damage or leaks.
  - ☐ Test by exposing the test chamber to a heat source such as a hairdryer or a shielded dryer (if a test chamber is in the circuit) or tested pneumatically with a pressure pump per manufacturer's instructions.
  - ☐ Adjust release device and replace diaphragm if necessary.
- ☐ General – Check other features for activation by the devices through the fire alarm control panel. These features include alarm bells, elevator capture, releasing of fire doors held open, notification of fire department, smoke control, etc.
- ☐ Clean up and remove debris from work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Voltmeter
- ☐ Cleaning Materials – Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

2. **Automatic Fire Detection – Smoke Detectors**

Annual

This maintenance task applies to all smoke detectors, including ionization, photoelectric, combination ionization/photoelectric, photoelectric projected beam, and air sampling. These detectors may provide open area protection or HVAC duct protection.

Special Instructions:

- ☐ Review Manufacturer's instructions.
- ☐ The work required by this procedure may cause the activation of an alarm and/or a supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.
- ☐ Check detectors for physical damage, obstruction, or corrosion. Replace damaged detectors.
- ☐ Check for any changes in partitions or floor plan since detector installation may need to be rearranged.

- [ ] Functional tests are to be made in place to assure smoke entry. Test duct detectors to assure that the device will sample the air stream.
- [ ] When it is both feasible and safe, the environmental conditions being monitored should be altered to actuate the device.
- [ ] Before each test, clean the detectors according to the manufacturer's instructions. In addition, the frequency of cleaning and tests must be based on results of regular tests and local conditions.

Checkpoints:

- [ ] Inspect conduit for loose hangers or clamps.
- [ ] Ionization detectors (including duct type) – Functionally test by activating alarm with aerosol spray or by blowing smoke near detector. Test for proper signals. Check and test at air sampling tubes for duct type.
- [ ] Photoelectric detectors (including duct type) – Inspect for proper alignment. Functionally test by activating alarm with aerosol spray or by blowing smoke near detector. Test for proper signals. Check and test at air sampling tubes for duct type.
- [ ] Photoelectric projected beam detectors – Functionally test by introducing smoke, other aerosol, or an optical filter into the beam path. Test for proper signals.
- [ ] Aerosols – It is specifically prohibited to use aerosol sprays which contain chlorofluorocarbons or halogens. Aerosol sprays with zero ozone depletion potential are available on the open market.
- [ ] General – Check other features for activation by the devices through the fire alarm control panel. These features include alarm bells, elevator capture, releasing of fire and smoke doors held open, notification of fire department, smoke control, etc.
- [ ] Detector sensitivity shall be tested one year after installation and every alternate year thereafter. To assure that each smoke detector is within its listed and marked sensitivity range, it shall be tested using either:
    - [ ] A calibrated test method, or
    - [ ] The manufacturer's calibrated sensitivity test instrument, or
    - [ ] Listed control equipment arranged for the purpose, or
    - [ ] A smoke detector/control unit arrangement whereby the detector causes a signal at the control unit when its sensitivity is outside its acceptable sensitivity range. Detectors found to have a sensitivity 0.25 percent/foot obscuration or more outside the listed and marked sensitivity range shall be cleaned and re-calibrated or replaced. Detectors listed as field adjustable, may be either adjusted within the listed and marked sensitivity range, cleaned, and re calibrated or replaced. The detector sensitivity shall not be tested or measured using any device that administers an unmeasured concentration of smoke or other aerosol into the detector.

- ☐ Air sampling detectors – Test per manufacturers recommended test methods including verification of sampling from each opening.
- ☐ Keep records of results of all sensitivity tests and re calibrations.
- ☐ Clean up work area and remove debris.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning Materials – Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

3. **Fire Alarm Control Panel – Special Systems**
   Annual
   This maintenance task applies to control panels for specialized fire suppression systems such as Halon 1301, carbon dioxide, pre-action, deluge, water spray systems, and other systems with special shutdown features.

Special Instructions:

- ☐ Review manufacturer's instructions for all system components.
- ☐ The work required by this procedure may cause the activation of the building fire alarm system and/or supervisory signals. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.
- ☐ When work requires the actuation of building evacuation systems, the work must be performed after hours and must be coordinated through the facility maintenance manager to prevent the unnecessary evacuation of building occupants.
- ☐ If a test that includes actual discharge of the system is desired, special precautions must be taken with the using agency to prevent shutdown and discharge during routine work performance causing subsequent equipment or software damage. If an actual discharge test is not desired, be sure to prevent gas discharge, ventilation system, and computer system or other equipment shutdown.

Checkpoints:

- ☐ Inspect the cabinet for damage (exterior and interior) including locks, door hinges, and plastic covers.
- ☐ Check all lamps/LED's (including remote annunciators).
- ☐ Check all fuses.
- ☐ Check power supply output voltage in normal and under load conditions.
- ☐ Check standby battery voltage under load for a minimum of 5 minutes (if applicable).

- [ ] Check battery charge current (be sure it is within manufacturer's limits).
- [ ] Verify trouble signals by opening all supervised circuits one at a time (Class A circuits open two return wires; Class B circuits open end of the line device).
- [ ] Verify ring back feature for systems using a trouble-silencing switch which requires resetting.
- [ ] When panel has been disconnected and switches isolated, verify that each switch performs its intended function and a trouble signal is received when a supervised function is disconnected.
- [ ] Check for proper alarm on all input circuits.
- [ ] Verify return to normal operation after each alarm circuit input.
- [ ] Verify for proper reset (either automatic or manual) of the trouble signal when the circuits are closed.
- [ ] Verify for proper contact closure and signal transmission for all panel modes of operation (trouble, alarm, ground, etc).
- [ ] When system has ground detection feature, verify that a ground fault indication is given whenever any installation conductor is grounded.
- [ ] Verify transmission of signals to main fire alarm control panel:
    - [ ] Actuate an appropriate initiating device and verify that alarm signal is received at the main fire alarm control panel.
    - [ ] Create a trouble condition and verify that a trouble signal is received at the main fire alarm control panel.
    - [ ] Actuate a supervisory device and verify that a supervisory signal is received at the main fire alarm control panel. If transmission carrier is capable of operation under a single or multiple fault condition, activate an initiating device during such fault condition and verify that a trouble signal is received at the main fire alarm control panel in addition to the alarm signal.
- [ ] Verify for proper operation and confirm proper identification for all remote annunciators. When provided, verify proper operation under a fault condition.
- [ ] Test electrically operated release devices (control heads). Note: Combine release test with detector test.
- [ ] Test manual overrides electrically to cause direct actuation of release devices.
- [ ] Test cross-zoned systems by operating one sensor or detector on each zone. Verify that correct sequence of alarms, release devices, and auxiliary functions occurs with operation of first zone and then with operation of second zone.
- [ ] Test abort feature by operating the abort approximately in the middle of the time interval. Verify correct sequence and operation. At the end of the time interval, confirm that the aborted functions did not occur.
- [ ] Test the manual override device over the abort feature.

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- ☐ Test matrix type circuit by operating all sensors in system. Verify correct matrix develops with each sensor operated.
- ☐ Test verified, sequential, or counting zone type circuits by operating required sensors at a minimum of four locations in circuit. Verify correct sequence with both the first and second detector in alarm.
- ☐ Verify operation of solenoid release circuits.
- ☐ Test squib release circuits by using AGI flashbulb or other test light acceptable to the manufacturer. Verify operation of flashbulb or light.
- ☐ Check all meters in panel for proper operation and deflection.
- ☐ Check modules in panel for signs of heat or deterioration.
- ☐ Check standby batteries (if located in the panel) for signs of overcharging, heat, and leakage.
- ☐ Clean interior of panel.
- ☐ Return all circuits and subsystems to normal. Leave panel in normal operating condition with door locked.
- ☐ Inform involved personnel that testing is complete.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Cleaning materials – Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

4. **Fire Alarm Control Panel and Remote Annunciators**

Annual

This maintenance task applies to all fire alarm panels and remote annunciators in both interior and exterior locations.

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ The work required by this task will cause the activation of the building fire alarm system and/or supervisory signals. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.
- ☐ When work requires the actuation of building evacuation systems, the work must be performed after hours and must be coordinated through the facility maintenance manager to prevent the unnecessary evacuation of building occupants.
- ☐ Dispose of old batteries in accordance with all applicable Federal, state, and local regulations.

Checkpoints:

- [ ] Inspect the cabinet for damage (exterior and interior) including locks, door hinges, and plastic covers.
- [ ] Check all lamps/LED's (including remote annunciators).
- [ ] Check all fuses, verify proper rating.
- [ ] Check power supply output voltage in normal and under load conditions for at least 5 minutes.
- [ ] Check standby battery voltage under load for a minimum of five minutes (if applicable).
- [ ] Check battery charge current (be sure it is within manufacturer's limits).
- [ ] Verify trouble signals by opening all alarm and supervision circuits one at a time (Class A circuits open two return wires; Class B circuits open end of the line device).
- [ ] Verify ring back feature for systems using a trouble silencing switch which requires resetting.
- [ ] When panel has disconnect and isolating switches, verify that each switch performs its intended function and a trouble signal is received when a supervised function is disconnected.
- [ ] Verify for proper alarm on all input circuits.
- [ ] Verify return to normal operation after each alarm circuit input.
- [ ] Verify for proper reset (either automatic or manual) of the trouble signal when the circuits are closed.
- [ ] Verify for proper contact closure and signal transmission for all panel modes of operation (trouble, alarm, ground, etc).
- [ ] When system has ground detection feature, verify that a ground fault indication is given whenever any installation conductor is grounded.
- [ ] Verify transmission of signals to a 24 hour manned control station or central station:
    - [ ] Actuate an appropriate initiating device and verify that alarm signal is received at the off-premises location.
    - [ ] Create a trouble condition and verify that a trouble signal is received at the off-premises location.
    - [ ] Actuate a supervisory device and verify that a supervisory signal is received at the off-premises location. If transmission carrier is capable of operation under a single or multiple fault condition, activate an initiating device during such fault condition and verify that a trouble signal is received at the off-premises location in addition to the alarm signal.
- [ ] Verify for proper operation and confirm proper identification for all remote annunciators. When provided, verify proper operation under a fault condition.
- [ ] Test electrically operated release devices (control heads). Note: Combine release test with detector and water flow tests.
- [ ] Check all meters in panel for proper operation and deflection.

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- ☐ Check modules in panel for signs of heat (discoloration) or deterioration.
- ☐ Check standby batteries (if located in the panel) for signs of overcharging, heat, and leakage.
- ☐ Clean interior of panel.
- ☐ Return all circuits and subsystems to normal. Leave panel in normal operating condition with door locked.
- ☐ Inform involved personnel that testing is complete.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Cleaning materials – Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

5. **Fire Alarm System – Audio Control Panel**
   Annual
   This maintenance task applies to fire alarm system audio control panels in state owned buildings.

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ The work required by this task may cause activation of an alarm or a supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.

Checkpoints:

- ☐ Clean exterior surfaces with a damp soft cloth and wipe dry.
- ☐ Perform an operational test of the tape player, and check voice for clarity.
- ☐ Perform a lamp and LED circuit test.
- ☐ Operate the individual speaker and phone circuit switches.
- ☐ Operate the function switches for Phone Page, Microphone Page, Tone, Tape and Silence, and verify that the proper indicator light has activated.
- ☐ Check system status and command switch status. Indicator lights are typically provided for normal, CPU failure, generator failure, fire alarm, waterflow alarm, security alarm, trouble, tamper, power/charger trouble, tape trouble, amp trouble, and city fire trouble.

Recommended Tools, Materials, and Equipment:

- ☐ Standard tools - basic
- ☐ Soft cleaning cloths
- ☐ Spark indicator light bulb or LED

6. **Fire Alarm System – Event Printer**
   Quarterly
   This maintenance task applies to fire alarm system event printers in state owned buildings.

   Special Instructions:
   - ☐ Review manufacturer's instructions.

   Checkpoints:
   - ☐ Visually check machine for:
     - ☐ Frayed cables. Replace as required.
     - ☐ Loose connections. Tighten as required.
     - ☐ Burned-out components. Replace as required.
   - ☐ Clean exterior surfaces with a damp soft cloth and wipe dry.
   - ☐ Clean face of print drum.
     - ☐ Use a small stiff brush.
     - ☐ Use only alcohol or low hazard cleaner recommended by manufacturer.
   - ☐ Clean out print mechanism with a vacuum or small brush.
   - ☐ Lubricate print mechanism.
   - ☐ Replace inked ribbon.
   - ☐ Check log and alarm printing functions.

   Recommended Tools, Materials, and Equipment:
   - ☐ Standard tools - basic
   - ☐ Soft cleaning cloths
   - ☐ Alcohol or recommended cleaner. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
   - ☐ Small stiff brush
   - ☐ Small vacuum cleaner or cleaning brush
   - ☐ Print mechanism lubricant. Consult the MSDS for hazardous ingredients.
   - ☐ Spare inked ribbon

7. **Fire Alarm System – Recorder**
   Weekly
   This maintenance task applies to recorders in state owned buildings.

   Special Instructions:
   - ☐ Review manufacturer's instructions.

Checkpoints:

- ☐ Clean recording devices.
- ☐ Check pre-wound mechanisms. Rewind if necessary.
- ☐ Examine alignment and tension of paper tape and supply of tape on reels. Install new tape when needed.
- ☐ Manually move ribbon to prevent ink from drying. (Paper-marking type).
- ☐ Inspect for legibility, that it is properly coded, and for punctures or markings on tape.
- ☐ Check for correct time on time stamp. Reset if necessary.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Ink

8. **Fire Alarm System – Remote Amplifier**
   Annual
   This maintenance task applies to fire alarm remote amplifiers in state owned buildings.

   Special Instructions:

   - ☐ Review manufacturer's instructions.

   Checkpoints:

   - ☐ Check for proper input voltage – 3 volts RMS at 1 KHz tone.
   - ☐ Check output voltage – 70 volts RMS at 1 KHz tone.
   - ☐ Blow out interior with either compressed air or the exhaust outlet of a vacuum cleaner.
   - ☐ Check standby battery voltage under load for a minimum of 5 minutes.
   - ☐ Check battery charge current (be sure it is within manufacturer's limits).

   Recommended Tools, Materials, and Equipment:

   - ☐ Standard tools - basic
   - ☐ Compressed air or a vacuum cleaner

9. **Fire Alarm System – Remote Controller**
   Annual
   This maintenance task applies to fire alarm system remote controllers in state owned buildings.

   Special Instructions:

   - ☐ Review manufacturer's instructions.

- ☐ The work required by this procedure may cause activation of an alarm and/or a supervisory signal.
- ☐ The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.

Checkpoints:

- ☐ Visually check machine for:
  - ☐ Frayed cables. Replace as required.
  - ☐ Loose connections. Tighten as required.
  - ☐ Burned-out components. Replace as required.
- ☐ Clean exterior surfaces with a damp soft cloth and wipe dry.
- ☐ Blow out interior with either compressed air or the exhaust outlet of a vacuum cleaner.
- ☐ Check standby battery voltage under load for a minimum of 5 minutes.
- ☐ Check battery charge current (be sure it is within manufacturer's limits).
- ☐ Perform remote controller annunciation test.
  - ☐ Make spot check of a few initiating devices and output commands.
  - ☐ Verify that alarms are annunciated at the console during the access period.
- ☐ Lubricate print mechanism.
- ☐ Replace inked ribbon.
- ☐ Check log and alarm printing functions.

Recommended Tools, Materials, and Equipment:

- ☐ Standard tools - basic
- ☐ Soft cleaning cloths
- ☐ Compressed air or a vacuum cleaner
- ☐ Print mechanism lubricant. Consult the MSDS for hazardous ingredients.
- ☐ Spare inked ribbon

10. **Fire Supervisory Signals – Testing**
Quarterly
This maintenance task applies to all supervisory signals of fire protection equipment and systems.

Special Instructions:

- ☐ Review manufacturer's operation, maintenance manual and safety instructions. The work required by this task may cause the activation of an alarm and/or a supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.

- ☐ When feasible the position of valves, air pressure, temperature, or water level being monitored should be altered to actuate the signals.
- ☐ Check all supervisory devices for damage, corrosion, and pitted electrical contacts.
- ☐ Inspect conduit for loose joints, hangers, and clamps.

Checkpoints:

- ☐ Valve supervision – turn valve stem about three (3) revolutions and check for signal. Adjust tamper device if necessary.
- ☐ Air pressure supervision.
  - ☐ Inspect pressure gauges for any damage.
  - ☐ Tap gauge to see if needle is jammed or immovable.
  - ☐ Check for proper air pressure.
  - ☐ Gradually release air pressure and note pressure at which pressure switch activates signal. When necessary, adjust pressure switch. Re-pressurize system.
- ☐ Temperature supervision – Mechanically activate temperature switches and check for signal. Adjust if necessary
- ☐ Water level supervision – Check float mechanism for corrosion and freedom of movement. Move float until signal is received. Adjust if necessary.
- ☐ Reset all devices to normal positions.
- ☐ Clean up and remove all debris from work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.

11. **Manual Fire Alarm Stations – Coded and Uncoded**

Annual

This maintenance task applies to all manual fire alarm stations in both interior and exterior locations.

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ The work required by this procedure may cause activation of an alarm and/or a supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.
- ☐ When alarm systems are connected to municipal systems, test signals to be transmitted to them will be limited to those acceptable to that authority.
- ☐ Record all test results.

Checkpoints:

- ☐ Examine box for damage and legible box number.
- ☐ Check external tamper devices.
- ☐ When practical, remove "Break Glass" or glass rods and follow instructions for actuating alarm.
- ☐ Verify that proper signal (coded or uncoded) is transmitted to fire alarm control panel and to receiving station (facility manager, fire department, police department, etc).
- ☐ Verify that audible alarms or signals, both local and general that are actuated by the fire alarm station are operating.
- ☐ General – Check all other features for activation by stations through the fire alarm control panel. These features include elevator capture, releasing of fire doors held open, notification of fire department, smoke control, etc.
- ☐ Inspect recording register (if applicable) for legibility, time, code number, and number of rounds.
- ☐ On systems with shunt non-interfering or positive non-interfering circuits, operate one box and then operate another box on each box loop prior to the completion of the first cycle. Check for interference at receiving station or recording register.
- ☐ Restore fire alarm station and accessories to normal position promptly after each test. This may include rewinding, resetting, replacement of tamper devices, etc.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Cleaning materials – Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

12. **Smoke Control Systems – Operational Testing**
Semiannual
This maintenance task applies to all building smoke control systems.

Special Instructions:

- ☐ Review manufacturer's instructions for all system components.
- ☐ The work required by this procedure will cause activation of an alarm and/or supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.
- ☐ Initiation of the smoke control system for each smoke control zone shall be accomplished by activation of a fire detection device that is programmed to initiate automatic smoke control within that smoke control zone.
- ☐ Determine and list all programmed actions which should automatically occur upon activation of smoke control system for each smoke control zone (programmed actions are

not standardized for the operation of air handling systems due to the various HVAC system design).

- ☐ The scheduling of the smoke control testing of the various smoke control zones should be evenly distributed during those months when outside temperatures are above freezing.

Checkpoints:

- ☐ Initiate the smoke control mode for one smoke control zone.
- ☐ Physically check to see that all programmed actions occur in the proper manner.
- ☐ Reset system to normal operation.
- ☐ Repeat the above procedure for all other smoke control zones.

Special Conditions

- ☐ When both of the following conditions exist, testing of the smoke control systems shall be semiannual.
  - ☐ Building is not required to have a smoke control system (less than 12 floors above grade).
  - ☐ There are 3 or more smoke control zones with repetition of the same programmed actions; such as, pressurized zones, elevator recall, closing corridor smoke doors, etc., in other than the smoke control zone.
- ☐ When the items above apply and both automatic multiplex and manual activation are installed, operational testing of each smoke control zone shall be performed annually in both the automatic and manual modes.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

IV. Fire Extinguishers

1. **Fire Department Pumper Connections – Standpipe or Sprinkler**
   Monthly
   This maintenance task applies to all fire department pumper connections to the building standpipe and sprinkler systems.

   Special Instructions:

   - ☐ Never stand directly in front of connection when removing cap.

   Checkpoints:

   - ☐ Remove any obstructions which hinder accessibility and visibility.
   - ☐ Verify that each pumper connection is identified with a sign.

- ☐ Inspect for external collision damage. Protective posts may be needed to protect the connection from vehicle damage.
- ☐ Verify that all hose connections have caps in place
- ☐ Remove caps and check for damaged threads and verify that the gasket is in place.
- ☐ Inspect for internal obstruction or debris and signs of a leaking check valve.
- ☐ Inspect the swing check valves for free movement (Siamese type).
- ☐ Inspect the interior check valve for corrosion and leakage at the joints.
- ☐ Check for couplings not swiveling properly. Lubricate with soapy water if required.
- ☐ Screw the caps on hand-tight. When applicable, install new frangible caps.
- ☐ Inspect the check valve on the building interior for corrosion and leakage at the joints.
- ☐ Check the ball drip for free movement.
- ☐ Inspect the drain for corrosion, blockage, and cross connection.
- ☐ Clean up and remove all debris from the work area.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

2. **Fire Extinguishers – Inspection**
   Monthly
   This maintenance task is for a monthly visual inspection of all fire extinguishers.
   Special Instructions:
   - ☐ Follow manufacturer's instructions.
   - ☐ Remove from service and discard all inverting-type fire extinguishers, including soda-acid, chemical foam, water cartridge-operated and loaded stream cartridge-operated extinguishers.
   - ☐ Whenever an extinguisher is removed from service, immediately replace it with an extinguisher of a size and extinguishing agent appropriate for the hazard protected.
   - ☐ Each extinguisher shall have an inspection tag securely attached that indicates the month and year the inspection was performed and the initials of the person performing the inspection shall be recorded.
   - ☐ Records are to be kept of those extinguishers that were found to require correction, with a notation of when and how the corrections were made.
   - ☐ The requirement for an inspection tag and the recording of the inspector's initials does not preclude the use of electronic record keeping utilizing bar codes or some other method of insuring that the extinguishers were actually inspected.
   - ☐ In addition to the required tags and/or labels, a permanent file record is to be kept for each extinguisher. This file record should include the following information as applicable:
     - ☐ The date when each extinguisher was purchased and installed.

- ☐ The maintenance date and the name of the person or agency performing the maintenance.
- ☐ The date when last recharged and the name of the person or agency performing the maintenance.
- ☐ The hydrostatic retest date and the name of the person or agency performing the maintenance.
- ☐ Description of dents remaining after passing a hydrostatic test.
- ☐ The date of the six-year maintenance for stored pressure dry chemical and Halon extinguishers.
- ☐ The date when non rechargeable extinguishers are to be removed from service and discarded.

Checkpoints:

- ☐ A visual inspection is a quick check to see that the fire extinguisher is in its proper location, that it is not blocked, is fully charged, and that it appears to be in good working order. This inspection generally consists of walking to the extinguisher and doing the following:
  - ☐ Confirm that the extinguisher is in its designated place.
  - ☐ Verify that the extinguisher is appropriate for the hazard protected (Class A, B, C, or D).
  - ☐ Ensure that the extinguisher is accessible and visible.
  - ☐ Confirm that the operating instructions face outward and are visible.
  - ☐ Check that the seals or tamper indicators are intact. If they are not intact, examine further for evidence of use or tampering. Recharge if required.
  - ☐ Examine for obvious physical damage, corrosion, leakage, or clogged nozzle. Recharge or replace as required.
  - ☐ Verify that the pressure gauge is in the normal range. If not, recharge the extinguisher.
  - ☐ Initial and date inspection tag.

Recommended Tools, Materials, and Equipment:

- ☐ Seals or tamper indicators
- ☐ Inspection tags

3. **Fire Extinguishers – Non rechargeable**
   Annual
   This maintenance task applies to dry chemical and Halon extinguishers that cannot be recharged and are intended to be disposed of after use.

Special Instructions:

- ☐ Review manufacturer's instructions, if available.
- ☐ Non rechargeable extinguishers shall be removed from service and disposed of at a maximum interval of 12 years from the date of manufacture.
- ☐ When a non rechargeable dry chemical extinguisher is to be disposed of, it is to be discharged before discarding.
- ☐ When a non rechargeable Halon extinguisher is to be disposed of, it is to be returned to the manufacturer, fire equipment dealer, or fire equipment distributor without being discharged so that the Halon can be recovered.

Checkpoints:

- ☐ If nameplate is missing or illegible, discard extinguisher.
- ☐ Weigh extinguisher. If weight is less than the required weight on the extinguisher nameplate, discard extinguisher.
- ☐ Check seals and tamper indicators. If broken or missing, dispose of the extinguisher.
- ☐ Examine for obvious physical damage, corrosion, leakage, or clogged nozzle. If any such condition is found, dispose of the extinguisher.
- ☐ Verify if pressure gauge reading or indicator is in the operable range or position. If not, dispose of the extinguisher.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

4. **Fire Extinguishers, Gas Cartridge or Cylinder (No Gauge)**

Annual

This maintenance task applies to fire extinguishers that use a nitrogen cartridge to expel the extinguishing agent or the agent is self-expelled due to the agent being a compressed gas. This includes dry chemical, dry powder, Halon 1301, and carbon dioxide extinguishers.

Special Instructions:

- ☐ Review manufacturer's instructions, if available.
- ☐ Whenever an extinguisher is removed for servicing, a replacement extinguisher is to be provided of the same type and at least equal rating.
- ☐ Each extinguisher shall have a tab or label securely attached that indicates the month and year the inspections, maintenance, and recharging were performed and shall identify the person and firm performing the service.

- ☐ Always recharge an extinguisher with the same type of extinguishing agent as specified on the nameplate.
- ☐ No extinguisher shall be converted from one type to another nor be converted to use a different type of extinguishing agent.
- ☐ Never mix multipurpose dry chemical agents with any other dry chemical agents.

Checkpoints:

- ☐ Check the extinguisher for the date of the last hydrostatic test. Perform hydrostatic tests on extinguishers where applicable.
- ☐ Verify that the appropriate extinguisher is provided for the hazard protected (Class A, B, C, or D).
- ☐ Remove any obstructions to extinguisher visibility and easy accessibility.
- ☐ Inspect shell for mechanical damage, broken hanger attachments or hangers, corrosion at seams, damaged and illegible operating instructions. Correct broken or damaged parts and discard extinguishers with damaged shells.
- ☐ Inspect valves and carrying handles for corroded or damaged handles, springs, stems, fasteners, joints, threads, and jammed levers.
- ☐ Check for broken seals, bent, damaged, or missing pins, or any other signs that extinguisher has been used or tampered with.
- ☐ Weigh carbon dioxide and Halon 1301 extinguishers and compare to stamped gross or full weight (usually shown on valve body). Recharge as required.
- ☐ Cartridge operated dry chemical or dry powder extinguishers:
  - ☐ Inspect for damaged, jammed, bent or corroded puncture lever, pin, and fastener on puncture mechanism for gas cartridges.
  - ☐ Check cartridge for signs of damage or tampering. Weigh cartridge to verify that gas has not been lost. Correct cartridge weight is on the cartridge. Replace cartridge if less than correct weight. Weigh replacement cartridge to verify that it is correct.
  - ☐ Verify that shell is filled with extinguishing agent to the proper level. Fill as required.
  - ☐ Inspect for corroded, cracked, or blocked siphon tube; damaged, cut, or brittle "O" rings and seals. Replace parts as required. Properly lubricate all "O" rings.
  - ☐ Verify that siphon tube and pickup tube, are clear and free of any obstruction.
- ☐ Carbon Dioxide extinguishers: Test hose assembly for conductivity. Replace non conductive hose assemblies.
  - ☐ Carbon dioxide hose assemblies have a continuous metal braid that connects to both couplings to minimize the static shock hazard.
  - ☐ The purpose of the conductivity test is to determine that the hose is conductive from the inlet coupling to the outlet orifice.

- ☐ To conduct the test, use a flashlight having an open circuit and a set of two wires with a conductor (clamps or probe) at each end.
- ☐ Replace cracked, cut, or brittle hose, and nozzle or horn, and damaged couplings. Remove any obstructions in nozzle, horns, or hose.
- ☐ Check for leaks.
- ☐ Replace seal or tamper indicator.
- ☐ Attach the inspection tag and replace on designated hanger.
- ☐ Clean up and remove all debris from work area.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Spare hoses, couplings, nozzles and horns
- ☐ Seals or tamper indicators
- ☐ "O" rings and lubricant
- ☐ Scales for gas cartridge and extinguishers
- ☐ Inspection tags
- ☐ Pull pins
- ☐ Cleaning materials – Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

5. **Fire Extinguishers, Hydrostatic Testing of Carbon Dioxide, Stored Pressure and Cartridge Type**
Five Years
This maintenance task applies to all fire extinguishers in service except for the non chargeable type.

Special Instructions:

- ☐ Hydrostatic testing of extinguishers requires experienced personnel and suitable testing equipment. It is recommended that this service be performed by a fire equipment company specializing in this type of service.
- ☐ If the hydrostatic testing is to be accomplished on the premises, it should be limited only to non compressed gas type extinguishers (water base, dry-chemical, and dry-powder). Compressed gas extinguishers (Halon 1211 and 1301 and carbon dioxide) require special internal inspections and high test pressures.
- ☐ Wheeled extinguisher testing is beyond the scope of this maintenance task. Utilize a fire equipment company if wheeled extinguishers are on the premises.
- ☐ Discharge and discard extinguishers when the cost of new extinguishers is cheaper than the cost of extinguishing agent and a hydrostatic test.

- ☐ Refer to National Fire Protection Association Standard No. 10, "Portable Fire Extinguishers" for additional detailed information about hydrostatically testing extinguishers.
- ☐ Fire extinguishers are to be hydrostatically tested in accordance with the following test interval (years):
    - Stored Pressure Water, Loaded Stream, or Antifreeze 5 Years
    - AFFF (Aqueous Film Forming Foam) 5 Years
    - FFFP (Film Forming Fluoroprotein Foam) 5 Years
    - Dry Chemical with stainless steel shells 5 Years
    - Carbon Dioxide 5 Years
    - Dry Chemical, Stored Pressure with mild steel shells, brazed brass shells, or aluminum shells 12 Years
    - Halon 1211 and 1301 12 Years
    - Dry Powder, Stored Pressure, Cartridge-or Cylinder-Operated, with mild steel shells 12 Years
- ☐ In addition, anytime an extinguisher shows evidence of physical injury or corrosion, and extinguishers with aluminum cylinders or shells are suspected of being exposed to temperatures in excess of 350°F., they are to be immediately discharged and hydrostatically tested.
- ☐ Halon extinguishers requiring hydrostatic testing are to be returned to a fire equipment company so that the agent can be recovered.
- ☐ Extinguishers that are required to be returned to the manufacturer for recharging, are to be hydrostatically tested by the manufacturer.

Checkpoints:

- ☐ Destroy any cylinders or shells when: they have been repaired by soldering, welding, or brazing; the cylinder or shell threads are damaged; corrosion exists that has caused pitting; when burned in a fire; or a calcium chloride type of extinguishing agent was used in a stainless steel extinguisher.
- ☐ Operate stored pressure and cartridge type extinguishers and check performance.
- ☐ For dry chemical and dry powder extinguishers, dismantle and remove all traces of extinguishing agent from inside of shell and hose assembly.
- ☐ For cartridge operated extinguishers, remove the cartridge and insert a suitable plug into shell opening.
- ☐ Fill with water and connect to the test pump.
- ☐ Secure shell in protective cage and apply proper test pressure. Pressure to be applied at a rate so that test pressure is reached within 30 seconds. Required test pressures are:
    - ☐ Type of Extinguisher Hydrostatic Test Pressure
    - ☐ Carbon dioxide 5/3 the service pressure

- ☐ Stored pressure type Original factory test pressure, not to exceed three times the operating pressure
- ☐ Cartridge operated type Original factory test pressure

☐ Maintain test pressure for at least 30 seconds.
☐ Observe shell and gauge for any distortion, leakage, or if the test pressure has dropped. Destroy shells that fail the test.
☐ All dry chemical and dry powder extinguishers must have all traces of water removed from the shell. A heated air stream is recommended with its temperature not exceeding 150º F.
☐ For cartridge operated extinguishers, weigh the replacement cartridge to ensure that it is the correct weight. Replace if less than correct weight.
☐ Hose assemblies for non compressed gas type extinguishers are to be hydrostatically tested as follows:

- ☐ Remove discharge nozzle from the hose assembly without removal of any hose couplings.
- ☐ For dry chemical and dry powder types, remove all traces of extinguishing agent.
- ☐ Fill with water and connect to the test pump.
- ☐ Secure hose assembly in protective cage and apply proper test pressure of 300 psi or at service pressure whichever is higher. Pressure to be applied at a rate so that test pressure is reached within one minute.
- ☐ Maintain test pressure for at least one full minute.
- ☐ Observe hose for distortion or leakage, or if the test pressure has dropped, or if the couplings have moved. Destroy hose assemblies that fail the test.
- ☐ All dry chemical and dry powder extinguisher hose assemblies must have all traces of water removed from the hose.

☐ Recharge extinguisher according to manufacturer's instructions.
☐ Affix a label to the extinguisher shell by means of a heatless process that is self-destructive when removal is attempted. The label shall include the following information:

- ☐ Month and year the test performed, indicated by a perforation, such as by a hand punch.
- ☐ Name or initials of person performing the test, or name of agency performing the test.

☐ Clean up and remove all debris from work area.

Recommended Tools, Materials, and Equipment:

☐ Standard Tools – Basic
☐ Seals or tamper indicators
☐ Hydrostatic test labels

- ☐ Scale for gas cartridges
- ☐ Appropriate testing equipment

6. **Fire Extinguishers, Stored Pressure with Gauge**
Annual
This maintenance task applies to fire extinguishers that use stored air or nitrogen pressure to expel the extinguishing agent. This includes extinguishers containing water, foam, dry chemical, dry powder, and Halon 1211. This maintenance task does not apply to carbon dioxide extinguishers.

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ Do not pressurize any extinguisher that shows signs of mechanical damage, corrosion, or burned in a fire. Relieve the pressure as indicated below and destroy the extinguisher.
- ☐ Whenever an extinguisher is removed for servicing, a replacement extinguisher is to be provided of the same type and at least equal rating.
- ☐ Each extinguisher shall have a tag or label securely attached that indicates the month and year the inspections, maintenance, and recharging were performed and shall identify the person and firm performing the service.
- ☐ Always recharge an extinguisher with the same type of extinguishing agent as specified on the nameplate.
- ☐ No extinguisher shall be converted from one type to another nor be converted to use a different type of extinguishing agent.
- ☐ Never mix multipurpose dry chemical agents with any other dry chemical agents.
- ☐ Compressed air is satisfactory to pressurize water type extinguishers. Use standard industrial-grade nitrogen for pressurizing all other extinguishers.
- ☐ When the discharging and recharging of Halon 1211 extinguishers is necessary as part of the required maintenance, an experienced fire equipment firm should perform the maintenance so that the Halon can be captured with a closed recovery system. Discharge Halon in accordance with Clean Air Act regulations.

Checkpoints:

- ☐ Check the extinguisher for the date of the last hydrostatic test. Perform hydrostatic tests on extinguishers where applicable.
- ☐ Verify that the appropriate extinguisher is provided for the hazard protected (Class A, B, C, or D).
- ☐ Remove any obstructions to extinguisher visibility and easy accessibility.

- ☐ Inspect shell for mechanical damage, broken hanger attachments or hangers, corrosion at seams, damaged and illegible operating instructions. Correct broken or damaged parts and discard extinguishers with damaged shells.
- ☐ Inspect valves and carrying handles for corroded or damaged handles, springs, stem, fasteners, joints, threads, and jammed levers.
- ☐ Check for broken seals, bent, damaged, or missing pins, or any other signs that extinguisher has been used or tampered with.
- ☐ Regardless of gauge readings, if seal or tamper device is broken, release pressure (without discharging extinguishing agent) and check for proper level of extinguishing agent. Re-pressurize extinguisher and check for leaks.
- ☐ Tap gauge to see if it is jammed or immovable. Read gauge. If not in operating range, check for leaks and re-pressurize. Inspect gauge casing and crystal for damage.
- ☐ Verify that nozzle and hose are clear and free of obstructions.
- ☐ Replace cracked, cut, or brittle hose, and damaged couplings.
- ☐ The premixed agent in liquid charge type AFFF (aqueous film forming foam) and FFFP (film forming fluoroprotein foam) shall be replaced at least every three years. The agent in solid charge type AFFF extinguisher shall be replaced once every five years.
- ☐ Check for leaks.
- ☐ Replace seal or tamper indicator, tag extinguisher and replace on hanger with the operating instructions facing outward.
- ☐ Clean up and remove all debris from work area.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Spare hoses and couplings
- ☐ Seals or tamper indicators
- ☐ Inspection Tags
- ☐ Cleaning materials – Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

7. **Fire Extinguishing Systems, Carbon Dioxide (High Pressure) Halon, Dry Chemical**
   Semiannual
   This maintenance task applies to all fixed fire extinguishing systems utilizing carbon dioxide, Halon 1211 or 1301, or dry chemical and includes both total flooding and local application types.

   Special Instructions:

   - ☐ Due to the special requirements for maintaining these extinguishing systems, it is recommended that the servicing of the systems be provided by a fire equipment company experienced in fire extinguishing system service.

- ☐ Follow manufacturer's instructions.
- ☐ The work required by this procedure may cause the activation of an alarm and/or a supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.
- ☐ When replacement cylinders are received from supplier, check that hydrostatic test date is current.
- ☐ In addition to the required tags and/or labels, a permanent file record is to be kept for each extinguishing system. This file record should include the following information as applicable:
    - ☐ The date when each extinguishing system was purchased and installed.
    - ☐ The dates when maintenance was done and the name of the person or agency performing the maintenance.
    - ☐ The date when cylinders were last recharged and the name of the person or agency performing the maintenance.
    - ☐ The hydrostatic test date and the name of the person or agency performing the maintenance.

Checkpoints - General:

- ☐ Check each cylinder for the date of the last hydrostatic test (all dates are stamped on cylinder).
- ☐ Replace those cylinders for which the elapsed time exceeds:
    - ☐ Carbon dioxide – 12 years
    - ☐ Halon – 20 years
    - ☐ Dry Chemical – 12 years
    - ☐ **Note**: Halon and carbon dioxide cylinders shall not be recharged without a hydrostatic test if more than five years have elapsed since the date of the last test and inspection.
- ☐ Weigh or check pressure on remaining cylinders. Replace if:
    - ☐ Carbon dioxide – weight loss is 10% or greater.
    - ☐ Halon – weight loss is 5% or greater or if pressure loss (adjusted for temperature) is 10% or greater.
    - ☐ Dry Chemical – weight loss in gas expellant cylinder exceeds acceptable limit on system (or the cylinder) or if pressure gauge indicates "inoperable" range.
    - ☐ Verify that cylinder pressure and weight are on tag attached to cylinder.
- ☐ Check system hoses for damage. Replace or hydrostatically test defective hoses.
- ☐ Operate control heads by removing from cylinders and actuate a detector or manual release. Control head plungers should be fully extended.
- ☐ Verify that the alarm, trouble, supervision, and annunciation signals function properly.

- ☐ Annually -
  - ☐ Conduct an operating test by removing the control heads from the cylinders prior to test so that no agent is discharged. Actuate the system with a detector or manual release and confirm all functions of the system such as system control panel, power supply, emergency power, detectors, supervisory signals, time delay device alarm devices, selector valves, release devices for doors and dampers, equipment shutdown, and manual releases.
  - ☐ Two detectors on separate zones may have to be operated if the detection system is arranged with cross-zoned circuits such as with total flooding systems.
- ☐ Annually: Replace all fusible alloy type temperature elements (fusible links). Replace links with new links of the same temperature rating.
- ☐ When all maintenance procedures are completed, restore system to "ready" status and record data on system tag.
- ☐ Clean up and remove all debris from work area.

Checkpoints - Carbon Dioxide Systems:

- ☐ Every five years – Test system hoses, including those used as flexible couplings, at 2,500 psi.

Checkpoints - Halon Systems - Every Five Years:

- ☐ Halon 1211 Systems – Test system hoses, including those used as flexible couplings, at 2½ times the container pressure at 70°F.
- ☐ Halon 1301 Systems – Test system hoses, including those used as flexible couplings, at 1,500 psi for 600 psi charging pressure systems and at 900 psi for 360 psi charging systems.
- ☐ Cylinders continuously in service without discharging shall be given a complete external and internal visual inspection every five years, in accordance with Compressed Gas Association pamphlet C-6, Section 3, except that the cylinders need not be emptied and stamped while under pressure.

Checkpoints - Dry Chemical Systems:

- ☐ If the system has an external expellant gas cartridge, check the pressure of nitrogen cartridges and the weight of carbon dioxide cartridges.
- ☐ In systems with expellant cartridges, examine dry chemical in cylinders to determine that it is free flowing and without caking. If caking is found, discard and replace the dry chemical.
- ☐ Every six years: In stored pressure systems, release pressure and examine cylinders internally and examine dry chemical to determine that it is free flowing and without caking. If caking is found, discard and replace the dry chemical and recharge the system.

- ☐ Every twelve years: During a six year internal examination, hydrostatically test cylinders and hose assemblies with a pressure equal to the marked factory test pressure or the test pressure specified by the manufacturer.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Seals or tamper indicators
- ☐ Inspection Tags
- ☐ Scale for gas cartridge or cylinders

8. **Fire Extinguishing Systems, Carbon Dioxide (High Pressure) Halon, Dry Chemical – Inspection**
Monthly
This maintenance task applies to all fixed fire extinguishing systems utilizing carbon dioxide, Halon 1211 or 1301, or dry chemical and includes both total flooding and local application types.

Special Instructions:

- ☐ When extinguishing system service is required, use a fire equipment company experienced in fire extinguishing system service.

Checkpoints:

- ☐ Check nozzles for damage that nozzle caps (if installed) are in place that nozzles are properly aligned for the hazard being protected.
- ☐ Check for signs of physical damage to all system components. Have damaged components checked and replaced or repaired accordingly.
- ☐ Check entire piping systems and cylinders for signs of leakage and adequate support.
- ☐ Check cylinder pressures, if provided, for proper pressure. Service system if pressures are outside of operable range.
- ☐ Check for grease accumulation on the fusible links and nozzles on systems protecting cooking equipment.
- ☐ Check that manual system actuators are not obstructed.
- ☐ Check that seals or tamper indicators are intact.
- ☐ Verify that any detection system(s) used to activate the extinguishing system is operational.
- ☐ Verify that there are no changes in the size or type of hazard being protected and that no alterations have been made to the equipment or room being protected.
- ☐ Where total flooding extinguishing systems protect space, verify that all doors are not blocked and will be free to close with system activation.
- ☐ Initial and date inspection tag.

Recommended Tools, Materials, and Equipment:

- ☐ Seals or tamper indicators
- ☐ Inspection tags

V. Fire Protection

1. **Alarm Check Valves and Accessories**
   Monthly
   This maintenance task applies to all wet pipe sprinkler alarm check valves.

   Special Instructions:

   - ☐ Review manufacturer's instructions.

   Checkpoints:

   - ☐ Verify that the gauges are in good condition and indicate that normal water supply pressure is being maintained.
   - ☐ Verify that the valve is free from physical damage.
   - ☐ Verify that all valves are in their appropriate open or closed position.
   - ☐ Verify the valve is labeled so as to indicate the system served and the proper operating position.
   - ☐ Verify that there is no leakage from the retarding chamber or alarm drains.
   - ☐ If provided, verify that the hydraulic nameplate is securely attached to the sprinkler riser and is legible.
   - ☐ Verify that the required number and type of spare sprinkler heads, as well as the proper sprinkler wrench(es) are located in an accessible cabinet.

   Recommended Tools, Materials, and Equipment:

   - ☐ Standard tools - basic
   - ☐ Review manufacturer’s instruction manual for specialized hand tools, equipment and supplies.

2. **Alarm Check Valves and Accessories**
   Quarterly
   This maintenance task applies to all wet pipe sprinkler alarm check valves.

   Special Instructions:

   - ☐ Review manufacturer's instructions.
   - ☐ The work required may cause the activation of an alarm and/or a supervisory signal. The school maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.

- [ ] Take precautions to prevent water damage during full flow drain test if the drains are not piped to the outside of the building. Rate of discharge from 2-inch drain may exceed capacity of floor drain.
- [ ] Annual preventive maintenance for all control valves (main supply) and post indicator valve of the automatic sprinkler system should be task scheduled during one of these quarterly procedures since its functional purpose can be tested (stop water flow).
- [ ] Open and close all control valves slowly.

Checkpoints:

- [ ] Record static pressure (pressure on supply side gauge).
- [ ] Open 2-inch drain and check for proper water flow. If water flow is weak, (considerable drop in water pressure when 2-inch is wide open), supply valves may not be fully open or there may be other piping obstructions. Continue water flow until it runs clear.
- [ ] Record the flow full drain residual pressure (lowest pressure on supply side gauge).
- [ ] Close 2-inch drain.
- [ ] Close main supply valve for the sprinkler system, then open the 2-inch drain valve.
- [ ] Immediately close drain valve when water pressure on incoming side of alarm check valve has dropped to 10 to 20 psi. If pressure rises within one minute, main supply valve is not seated properly. In such case, open drain valve and alternately open and close supply valve several times in an attempt to flush the valve seat. If not successful, supply valve needs to be repaired.
- [ ] Check that water flow through water motor gong is stopped to ensure that clapper of alarm check valve is properly seated.
- [ ] Record static pressure (pressure on supply side gauge).
- [ ] With supply valve open, check operation of alarm check valve, water motor gong and its drain, and all other alarm or supervisory signals, such as water flow paddle alarms, pressure switches, etc., by flowing water through inspector's test both at valve and at remote connection.
- [ ] Flow shall be timed so that from the start of flow to annunciation does not exceed 60 seconds.
- [ ] When applicable, check that excess pressure, booster, jockey, and fire pumps equipped with automatic start are operating.
- [ ] Perform any other steps required in manufacturer's instructions.
- [ ] Perform internal inspections of alarm valves, and their associated strainers filters and restriction orifices, when normal testing procedures indicate the need or every five years. Examine valve body for tuberculation and check freedom of clapper operation. Replace clapper facings or resurface seat rings, if necessary.

- ☐ All gauges must be tested and calibrated every five years. If gauge is not accurate within 3 percent, it shall be re-calibrated or replaced.
- ☐ Clean up and remove all debris from work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.

3. **Antifreeze Solution in Sprinkler Systems**
   Annual
   This maintenance task applies to those small portions of wet pipe sprinkler systems that are in unheated areas and are subject to freezing that use an antifreeze solution to protect the system from freezing.

   Special Instructions:

   - ☐ Review manufacturer's instructions.
   - ☐ The work required by this task may cause the activation of an alarm and/or a supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.
   - ☐ Whenever the valve is closed, a clearly visible impairment tag is to be installed on the valve and the fire department connection. A typical impairment tag is illustrated in the National Fire Protection Association Standard 25, "Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems."
   - ☐ The use of antifreeze solutions in sprinkler systems is only intended for limited portions of wet pipe systems typically containing less than forty gallons of water in small unheated areas such as loading docks. Dry pipe sprinkler systems are to be installed to protect larger areas.
   - ☐ Prepare the antifreeze solution with a freezing point below the expected minimum temperature for the locality.
   - ☐ Sprinklers with antifreeze solution must be located below the interface between the water and antifreeze solutions so that the heavier antifreeze solution will prevent the lighter water from migrating into the unheated area.
   - ☐ Beyond certain limits, increasing the proportion of antifreeze does not lower the freezing point of the solution.
   - ☐ Always mix glycerin, diethylene glycol, ethylene glycol, and propylene glycol with water in the proper proportions before putting the solution into the piping because these materials tend to thicken near 32F.
   - ☐ Protect chlorinated polyvinyl chloride (CPVC) pipe from freezing only with glycerin.

- ☐ A potable water system is one that is suitable for drinking.

Checkpoints:

- ☐ Remove any obstructions to valve accessibility.
- ☐ Check all valves and piping connections for leaks.
- ☐ Determine the freezing point of the solution by measuring the specific gravity using a hydrometer or refractometer.
- ☐ Adjust solution as necessary in accordance with the tables listed below by draining and refilling the system with new solution as required.
- ☐ If solution specific gravity tests are satisfactory ensure that the sprinkler system is full.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Hydrometer or refractometer

4. **Dry Pipe, Deluge and Preaction Valves**
   Weekly
   This maintenance task applies to all dry pipe, deluge, and pre-action sprinkler valves.

Special Instructions:

- ☐ Due to the special requirements for maintaining these types of valves, it is recommended that the servicing of these valves be provided by a fire equipment company experienced in this type of service.
- ☐ Review manufacturer's instructions.
- ☐ The work required by this task may cause activation of an alarm and/or a supervisory signal. The facility maintenance manager and/or fire department that will receive the alarm and/or signal must be notified prior to start of work and at the completion of work.
- ☐ If drains are not piped to the outside of the building, take necessary steps to prevent water damage during water flow alarm test. Rate of discharge may exceed capacity of floor drain.

Checkpoints:

- ☐ Determine that legible manufacturer's maintenance instructions are posted in a convenient location near valve.
- ☐ Verify that the valve is free from physical damage.
- ☐ During periods of freezing weather, the valve heating equipment (if applicable) shall be inspected **DAILY** to ensure its ability to maintain a minimum temperature of 40°F.

- [ ] Readings shall be taken on both the supply and system pressure gauges to ensure adequate water supply and proper ratio of air or nitrogen to water.
- [ ] The gauge on the quick opening device shall indicate the same pressure as the system gauge.
- [ ] The valve and accessories shall be visually inspected to ascertain if they are free from physical damage, all trim valves are in their appropriate open or closed positions, and that there is no leakage from the intermediate chamber.
- [ ] Check priming water level, latching arrangements, automatic drip connections and general condition of valve room.
- [ ] All low point drains should be drained and kept free of water.
- [ ] Leaks resulting in pressure losses greater than 10 psi per week shall be located and repaired.
- [ ] Record static pressure (pressure on supply side gauge).
- [ ] Open the 2-inch drain and check for proper water flow. If water flow is weak, (considerable drop in water pressure when the 2-inch drain is wide open), supply valves may not be fully open or there may be other piping obstructions. Continue water flow until it runs clear.
- [ ] Record the flow full drain residual pressure (lowest pressure on supply side gauge).
- [ ] Close 2-inch drain.
- [ ] Close main supply valve for the sprinkler system, then open the 2-inch drain valve.
- [ ] Immediately close the drain valve when water pressure on incoming side of alarm check valve has dropped to 10 to 20 psi. If pressure rises within one minute, main supply valve is not seating properly. In such case, open drain valve and alternately open and close supply valve several times in an attempt to flush the valve seat. If not successful, supply valve needs to be repaired.
- [ ] Record static pressure (which is the pressure on supply side gauge).
- [ ] Test priming water level and low air pressure alarms in accordance with manufacturer's instructions.
- [ ] The supervisory low air pressure switch and the alarm pressure switch should be inspected to indicate that normal pressure is being maintained.
- [ ] Test the water flow alarm by opening alarm by-pass valve. Do not use the inspector's test connection as it will cause the dry pipe valve to trip.
- [ ] Verify that water flow alarm, trouble, supervision, and annunciation signals function properly.
- [ ] If provided, verify that the hydraulic nameplate is securely attached to the sprinkler riser and is legible.
- [ ] Quick opening devices shall be tested in accordance with manufacturer's instructions.
- [ ] Clean up and remove all debris from work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.

5. **Dry Pipe, Deluge, and Preaction Valves**
   Annual
   This maintenance task applies to all dry pipe, deluge, and preaction sprinkler valves.

Special Instructions:

- ☐ Due to the special requirements for maintaining these types of valves, it is recommended that the servicing of these valves be provided by a fire equipment company experienced in this service.
- ☐ Review manufacturer's instructions.
- ☐ The work required by this task may cause activation of an alarm and/or a supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start of work and at the completion of work. If drains are not piped to the outside of the building, take necessary steps to prevent water damage during full flow drain test. Rate of discharge may exceed capacity of floor drain.
- ☐ On preaction and deluge valves, the associated fire detection system must also be serviced. Whenever possible, the operation of the preaction or deluge valves should be tested by the initiation of the fire detection system using the appropriate simulated fire condition, i.e., heat or smoke.
- ☐ Annual preventive maintenance should be task scheduled during one quarterly procedure for all control valves (main supply) and post indicator valve of the automatic sprinkler system since its functional purpose can be tested (stop water flow).
- ☐ Prior to water flow test on deluge systems, install a pressure gauge at the hydraulically remote sprinkler head. This can be done by removing the most remote head, installing a tee with a pressure gauge attached and replacing the head.
- ☐ Perform these procedures in the spring after there is no danger of freezing.
- ☐ Open and close valves slowly.

Checkpoints - Dry Pipe Valve:

- ☐ Trip valve with control valve partially open. Perform all steps in accordance with the manufacturer's instructions, including a full flow drain test.
- ☐ Observe operation of any quick opening devices while making trip tests. The manufacturer's instructions for testing and resetting the quick opening device should be carefully followed.
- ☐ Verify that water flow alarm, trouble, supervision, and annunciation signals function properly.

- [ ] After annual trip test, completely drain system. Dry-pipe valve should be internally cleaned and reset in a normal manner with special attention to renewal of rubber parts or adjustment of gauges or alarm devices.
- [ ] At the conclusion of the test, the valve shall be tagged with the latest trip test date and the name and organization of the person performing the test.
- [ ] Every three years, and whenever the system is altered, dry-pipe valves shall be trip tested with the control valve wide open by opening the inspector's test valve. Any quick opening devices, if installed, are to be in service. Flow shall be timed so that the time from opening the inspector's test valve until water flow through the valve does not exceed 60 seconds. Record the elapsed time.
- [ ] Every five years the interior of strainers, filters and restricting orifices shall be inspected and cleaned.
- [ ] Low points shall be drained before the onset of freezing temperatures.
- [ ] Clean up and remove all debris from work area.

Checkpoints - Preaction and Deluge Valves:

- [ ] Test the heat detectors in accordance with manufacturer recommendations. .
    - [ ] Trip valve with water supply fully open in accordance with manufacturer's instructions.
    - [ ] Record the response time for the detector to actuate the special water control valve.
    - [ ] Detector shall respond within 40 seconds.
    - [ ] Repair or replace as necessary
- [ ] Record the time lapse between the detector operation and the water delivery.
- [ ] Where deluge systems cannot be discharged due to the material being protected, the test must be conducted in a manner that does not discharge water in the protected area.
- [ ] Where deluge systems cannot be discharged unless protected equipment is shut down (e.g., energized electrical equipment), a full flow system test shall be conducted at the next task scheduled shutdown. In all cases, the test schedule shall not exceed three years.
- [ ] For deluge systems, record pressure at the hydraulically most remote head to ensure that there are not any impediments to water flow.
    - [ ] Record pressure at deluge valve to ensure an adequate supply.
    - [ ] Compare pressure gauge reading with original design pressures and the last test to determine if there has been any deterioration of the water supply.
- [ ] Flush mainline strainer until clear.
- [ ] Manual actuation devices shall be operated.
- [ ] Preaction automatic air pressure maintenance devices shall be tested in accordance with manufacturer's instructions.

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- ☐ Verify that alarm, trouble, supervision, and annunciation signals function properly.
- ☐ After annual trip test, completely drain the system. Internally clean deluge valve and reset in a normal manner with special attention to renewal of rubber parts or adjustment of gauges or alarm devices.
- ☐ Return to service in accordance with manufacturer's instructions.
- ☐ At the conclusion of the test, the valve shall be tagged with the latest trip test date and the name and organization of the person performing the test.
- ☐ Every five years the interior of strainers, filters and restricting orifices shall be inspected and cleaned.
- ☐ Clean up and remove all debris from work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.

6. **Fire and Smoke Dampers**
   Two Years
   This maintenance task applies to all fire and smoke dampers in HVAC systems.

   Special Instructions:

   - ☐ Verify that dampers are not installed backwards. Air movement should always tend to close the damper.
   - ☐ Verify that dampers are not held open by the air stream.
   - ☐ NEVER replace the fusible link with a piece of wire.

   Checkpoints:

   - ☐ Make sure the access door is reasonably air tight and latches properly.
   - ☐ If the damper is closed, check for a ruptured fusible link, broken attachment or hinges, corrosion, or damage.
   - ☐ Remove the fusible link and operate the damper to verify that it is self-closing and fully closes and latches. Operate damper with normal system airflow to assure that they are not held open by the air stream.
   - ☐ Verify that the damper is not rusted or blocked. Check hinges and other moving parts. Lubricate moving parts. Adjust the damper as required.
   - ☐ Check the temperature rating of the fusible link. The fusible links shall have a temperature rating approximately 50°F above the maximum temperature that normally is encountered when the system is in operation or shut down, but not less than 160°F. Where fire dampers are within air ducts which are part of an engineered smoke control system, fusible links

shall have a temperature rating approximately 50°F above the operating temperature for which the smoke control system is designed, but not to exceed 286°F.

- ☐ Check operation of the motorized damper control. Lubricate friction points and exercise the damper to ensure complete freedom of movement. Remove old or excess lubricant.
- ☐ Install new fusible link of proper rating and tensile strength in areas of vibration.
- ☐ Reinstall fusible link where vibration is not a problem.
- ☐ Close the access door and check for air noise or leakage.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Lubricants – Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

7. **Fire Control Valves**
   Monthly
   This maintenance task applies to all valves controlling water-based fire protection systems, including outside control valves and post indicating valves.

   Checkpoints:

   - ☐ Where applicable, remove debris and water from valve pit.
   - ☐ Remove any obstructions to valve accessibility.
   - ☐ Determine that safe ladders or access ways are in place where needed.
   - ☐ Inspect for damage to valve or accessories, including tampering devices.
   - ☐ Determine that the valve is in the proper operating position.
   - ☐ If a valve is found closed at the time of the inspection, confirmation must be obtained through the building manager's office on the proper normal valve position.
   - ☐ Determine that valve is properly identified as to system that it serves and proper open or closed position.
   - ☐ Check that non-rising stem and underground valves are marked with direction in which to open. If not, permanently mark valve with proper direction to open.
   - ☐ Inspect for leaks.
   - ☐ Clean up and remove all debris from work area.

   Recommended Tools, Materials, and Equipment:

   - ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.

8. **Fire Control Valves**
   Quarterly

This maintenance task applies to all valves controlling water-based fire protection systems, including outside control valves and post indicating valves.

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ The work required by this task may cause the activation of an alarm and/or a supervisory signal. Tamper switches may be provided. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.
- ☐ This work should be done when other quarterly Task list Scheduled maintenance is being performed on sprinkler alarm check valves, dry pipe, preaction, or deluge valves.

Checkpoints:

- ☐ Partially close the valve (2-3 turns) then open until spring or tension is felt in the rod, indicating that the rod has not become detached from the valve. Valves shall be backed one-quarter turn from the wide open position to prevent jamming.
- ☐ Verify that a trouble signal was received from the tamper switch at the fire alarm panel indicating that the valve was being closed.
- ☐ Clean up and remove all debris from work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.

9. **Fire Control Valves**

Annual

This maintenance task applies to all valves controlling water-based fire protection systems, including outside control valves and post indicating valves.

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ The work required by this procedure may cause the activation of an alarm and/or a supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.
- ☐ Whenever the valve is closed, a clearly visible impairment tag is to be installed on the valve and the fire department connection. A typical impairment tag is illustrated in the National Fire Protection Association Standard 25, "Inspection, Testing, and Maintenance of

Water-Based Fire Protection Systems." Most fire system control valves are normally in the open position.

- ☐ This work should be done when other annually Task list Scheduled maintenance is being performed that involves water flowing through valve(s).

Checkpoints:

- ☐ Lubricate outside stems and other friction points used for operating valves.
- ☐ Remove any tamper locking devices and completely close (or open) valves. Check that water flow has ceased when valve is closed.
- ☐ Verify that a trouble signal from the tamper switch was received at the fire alarm panel indicating that the valve was closed.
- ☐ Inspect for leaks.
- ☐ Reopen (or close) valve and check for leaks at stem and joints.
- ☐ Ensure valve is electronically supervised or locked.
- ☐ Clean up and remove all debris from work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.

10. **Fire Department Hose Connections – Standpipe Outlets**
Monthly
This maintenance task applies to the standpipe system and hose connections in the building for use by the fire department.

Special Instructions:

- ☐ The work required by this procedure may cause the activation of an alarm and/or supervisory signal. The facility maintenance manager, or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.
- ☐ When cracking the valve, do not stand directly in front of the opening.

Checkpoints:

- ☐ Remove obstructions that hinder accessibility and visibility of hose connection.
- ☐ Verify that each standpipe connection is identified with a sign.
- ☐ Inspect control valve and check valve (usually located at the base of the standpipe riser) for corrosion or leakage. Cut off valve and repack if necessary.
- ☐ Remove the cap from the hose connection and check for damaged threads and verify that the gasket is in place.
- ☐ Crack the valve until water weeps through. Then close the valve and check for leaks.

- ☐ Screw the cap onto the valve until it is hand-tight.
- ☐ Inspect the piping for damage or missing supports.
- ☐ Clean up and remove all debris from the work area.

Recommended Tools, Materials, and Equipment:

- ☐ Standard tools - basic

11. **Fire Department Hose Connections – Standpipe Outlets**
Five Years
This maintenance task applies to the standpipe system and hose connections in the building for use by the fire department.

Special Instructions:

- ☐ The work required by this task may cause the activation of an alarm and/or supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.
- ☐ When opening the valve, do not stand directly in front of the opening.
- ☐ Hydrostatic testing requires experienced personnel and proper water flow testing equipment.
- ☐ Record the results of these checks in an appropriate format.

Checkpoints:

- ☐ Conduct a flow test by flowing the required volume of water at the design pressures to the hydraulically most remote, highest, or dead-end hose connection of each zone of the standpipe system.
- ☐ For dry pipe standpipes, conduct hydrostatic tests at not less than 200 psi pressure for two hours, or at 50 psi in excess of the maximum pressure, when the maximum pressure is in excess of 150 psi.
- ☐ Clean up and remove all debris from the work area.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Water flow testing equipment

12. **Fire Hose – 1.5 in., Racked in Buildings**
Monthly
This maintenance task applies to all 1½ in. fire hose in hose cabinets or racks used for interior fire fighting.

Checkpoints:

- ☐ tRemove any obstructions which hinder accessibility and visibility of the cabinet.
- ☐ Verify that the hose cabinet has a conspicuous sign.
- ☐ Verify that the hose cabinet or door glazing is not damaged and opens easily.
- ☐ If the cabinet is the break-glass type, be sure the lock is functioning properly and the glass break device is attached.
- ☐ Verify the valve handle is in place and valve is not leaking.
- ☐ Verify that the nozzle is attached to hose and operates freely.
- ☐ Check for damaged or mildewed hose.
- ☐ Verify hose is properly racked.
- ☐ Swing out hose rack. Verify that it will swing out 90 degrees.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

13. **Fire Hose – 1.5 in., Racked in Buildings**

Annual

This maintenance task applies to all 1½ in. fire hose in hose cabinets or racks used for interior fire fighting.

Special Instructions:

- ☐ When replacement is made, the new hose shall be of woven synthetic fiber, single jacketed, with lining, equipped with a plastic combination straight stream-fog nozzle with shutoff.
- ☐ A flow test is to be conducted every five years by flowing the required volume of water at the design pressures to the hydraulically most remote, highest, or dead-end hose connection of each zone of the standpipe system.

Checkpoints:

- ☐ Un-rack and uncouple the hose and examine for mildew, wetness, abrasions, or deterioration.
- ☐ Remove and discard deteriorated hose (justification is required to replace this hose).
- ☐ Remove the nozzle and check for gasket in place, smooth operation, and any obstruction.
- ☐ Inspect all couplings for gaskets. Check all gaskets for deterioration and replace as required.
- ☐ Inspect all couplings for damaged threads, corrosion, slip on the hose, out-of-round, missing lugs, and swivel not rotating properly. Repair or replace all defective couplings. Lubricate couplings that do not rotate properly with a lubricant specified by the hose manufacturer. Soapy water may be used if the manufacturer is not known.

- ☐ Service test the hose pressure in accordance with NFPA 1962 "Care, Use, and Service Testing of Fire Hose Including Couplings and Nozzles" provides detailed information on fire hose testing.
- ☐ Record all hose test results with regular hose records. NFPA 1962 provides information on proper hose records.
- ☐ Re-rack hose so that the transverse folds in the hose do not occur in the same place.
- ☐ Clean up and remove all debris from the work area.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Hose testing equipment
- ☐ Water flow testing equipment

14. **Fire Hydrant Flow Test- Dry Barrel and Wet Barrel**

Five Years

This maintenance task applies to all fire hydrants, including wall and flush hydrants, in both interior and exterior locations.

Special Instructions:

- ☐ Flow test dry barrel (frost proof) hydrants in the fall before the first frost.
- ☐ When flow testing hydrants in interior locations, use fire hose to direct the flow of water outside of the building.
- ☐ Hydrant flow testing requires the use of at least two hydrants:
  - ☐ Pressure hydrant – The hydrant closest to the building.
  - ☐ Flow hydrant – The next closest hydrant from the pressure hydrant on the downstream side of the water supply.
- ☐ Although hydrant flow testing is fairly simple and straightforward, guidance and assistance can be obtained from your city Fire Chief if needed.

Checkpoints:

- ☐ Remove a cap from the pressure hydrant and tighten the other caps. Open the hydrant fully to flush away any sediment.
- ☐ Close the hydrant and place the hydrant cap/gauge device on the hydrant outlet. Open the air bleeder petcock.
- ☐ Open the hydrant fully. When a steady stream of water flows from the air bleeder petcock, all of the air will be out of the hydrant. Close the petcock and record the pressure indicated on the gauge. This is the static pressure.
- ☐ Remove a hydrant cap from the flow hydrant.

- ☐ Measure the inside diameter of the flow hydrant outlet to within 1/16th of an inch.
- ☐ Determine and record the hydrant coefficient by feeling the inner edge of the hydrant outlet where the outlet connects to the hydrant barrel. If the joint is rounded, the coefficient is 0.9; if the joint is square, the coefficient is 0.8; and if the joint is square and extends into the hydrant barrel, the coefficient is 0.7.
- ☐ Open the hydrant fully.
- ☐ After the water flow has stabilized and the water is clear and discharging in a solid stream, insert the pitot tube into the center of the stream. Hold the pitot tube a distance from the hydrant opening equal to one half the diameter of the hydrant outlet. If the water is not discharging in a solid stream, close the hydrant and attach a smaller diameter nozzle to the hydrant outlet. The coefficient of a short smooth bore nozzle is 0.96; the coefficient for a short nozzle with a shut-off is 0.9.
- ☐ Record the pitot tube pressure gauge reading for the flow hydrant.
- ☐ Return to the pressure hydrant (or have someone observing the pressure hydrant) and record the pressure indicated on the cap gauge while the flow hydrant is still fully flowing. This is the residual pressure and will be less than the static pressure.
- ☐ For good test results the residual pressure should have dropped to at least ¾ to ½ the value of the static pressure. E.g., with a static pressure of 80 psi, the residual pressure should be between 60 and 40 psi. If the pressure drop is less than ¾ of the static pressure, open the second hydrant outlet and record the second residual pressure. The total flow will be the sum of the flows from the two hydrant outlets. Two flow hydrants can also be used if an additional pressure drop is needed. Best test results are obtained from pitot residual pressure readings between 10 and 30 psi.
- ☐ Close each hydrant slowly. Verify that the water has drained out of dry barrel hydrants.
- ☐ Ensure that the outlet caps are screwed on hand-tight.
- ☐ Determine the water flow from the hydrant from the Gallons per Minute Water Flow Tables. The water flow from the flow tables is the theoretical flow from the listed orifices. This theoretical flow must be multiplied by the applicable hydrant or nozzle coefficient to determine the actual flow.
- ☐ Compare the results of the waterflow test with previous tests to determine if there has been any deterioration in the water supply. A large drop in the water supply could be caused by a closed or partially closed valve or other obstruction in the main. Check all water supply valves that could affect the hydrant flow to ensure that they are completely open.
- ☐ If the water flow has dropped substantially since the last test and all supply valves are open, contact your city Fire Chief for assistance in evaluating and correcting the problem.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

- ☐ Pitot tube with pressure gauge
- ☐ Hydrant cap with gauge and bleeder petcock
- ☐ Tape marked in 16ths of an inch
- ☐ Hydrant wrench

15. **Fire Hydrants – Dry Barrel and Wet Barrel**
Semiannual
This maintenance task applies to all fire hydrants, including wall and flush hydrants, in both interior and exterior locations.

Special Instructions:

- ☐ All hydrants are to be inspected after each operation.
- ☐ Dry barrel (frost proof) hydrants are always to be checked in the fall before the first frost.
- ☐ Wet barrel hydrants only have to be inspected annually.

Checkpoints:

- ☐ Remove any obstructions which hinder hydrant visibility and accessibility.
- ☐ Ensure that hydrant outlets are at least 18 inches above the ground or floor and the hydrant is in a plumb position.
- ☐ Ensure that only dry barrel type hydrants are used in unheated areas (indoor or outdoor) where freezing conditions may be encountered.
- ☐ Check for leakage at the hose outlets and at the top of the hydrant. Repair or replace the gaskets or packing if required.
- ☐ Examine the barrel for cracks. Replace any cracked barrels.
- ☐ Examine operating nut. Replace nut if it is worn or has rounded corners.
- ☐ Remove the outlet caps and check for ease of removal. Examine outlet threads. Replace worn or damaged threads.
- ☐ Replace all but one 2½ inch outlet. Flush the hydrant until the water is clear but for not less than one minute. Shut the hydrant.
- ☐ Replace the hydrant cap then open the hydrant two turns. Check for leaks. Shut the hydrant.
- ☐ Whenever shutting the hydrant, always back off the valve ½ turn.
- ☐ For dry barrel hydrants:
    - ☐ Remove one cap immediately after shutting hydrant. Check the barrel for drainage by:
        - ☐ Placing the palm of your hand over the outlet opening. If a decent amount of suction is created, the hydrant is draining properly; or
        - ☐ Dropping a weight on a string into the barrel to determine the water level.

- ☐ If water remains in the barrel:
  - ☐ Unplug the drain hole at the bottom of the barrel (when the water table is lower than the drain hole) or
  - ☐ Plug the drain hole and pump out the water in the barrel (when the water table is higher than the drain hole).
- ☐ If water still remains in the barrel, replace the main hydrant valve.

☐ Lubricate:

- ☐ The screw in the top of the operating nut.
- ☐ The packing and thrust collar by oiling the joint between the nut and collar.
- ☐ The threads.

☐ Verify that all outlet caps are screwed on hand-tight.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Hydrant wrench
- ☐ Lubricants – Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

16. **Post Indicator Valves**

Annual

This maintenance task applies to all valves controlling water based fire protection systems that have an indicating post that tells whether the valve is open or shut.

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ The work required by this task may cause the activation of an alarm and/or a supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.
- ☐ This work should be done when other task scheduled maintenance is being performed that involves other water flow control valves.
- ☐ Whenever the valve is closed, a clearly visible impairment tag is to be installed on the valve and the fire department connection. A typical impairment tag is illustrated in the National Fire Protection Association Standard 25, "Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems."

Checkpoints:

- ☐ Remove any obstructions to easy accessibility.
- ☐ Inspect valve for being set plumb, so that post indicator is vertical.

- ☐ Replace damaged or missing cap, window glass, target plate, operating wrench, post, bonnet, and valve tamper switch.
- ☐ Remove cap, check for corrosion or damage to extension rod, coupling, threads, and signs of leaking valve.
- ☐ Lubricate threads.
- ☐ Remove and clean window glass.
- ☐ Clean both target plates. Illegible target plates should be replaced or painted.
- ☐ Completely close valve and check for easy operation and leaks from stuffing box.
- ☐ Verify that a trouble signal was received from the tamper switch at the fire alarm panel indicating that the valve was closed.
- ☐ Adjust target plate (shut) so it is centered in window frame.
- ☐ Open valve until torque of rod is noticed (tendency for wrench to spring back) then back off valve about ¼ turn.
- ☐ Check position of target (open). Adjust if necessary.
- ☐ Replace cap, tamper seal, and wrench.
- ☐ Ensure valve is electronically supervised or locked.
- ☐ Clean up and remove all debris from work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Lubricants. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Cleaning materials. Consult the MSDS for hazardous ingredients and proper PPE.

17. **Sprinkler Heads – Sprinklered Areas**

Annual

This maintenance task applies to all of the various types of sprinkler heads installed in state owned buildings.

Special Instructions:

- ☐ Replace any damaged sprinkler heads prior to performing maintenance on dry pipe, deluge, or alarm check valves.

Checkpoints:

- ☐ Visually inspect from floor level the sprinkler piping and heads to verify that they are in good condition and free from mechanical damage, leakage, corrosion, and alignment.
- ☐ Identify and replace damaged, bent, corroded, weeping, or painted sprinkler heads. Repair any observed sprinkler piping problems.

- ☐ Replacement sprinkler heads must be of the same type and temperature rating as the heads being replaced.
- ☐ Remove any insect nests attached to sprinkler heads.
- ☐ Ensure that sprinkler heads protecting spray coating areas are protected against overspray residue.This can be achieved by using plastic bags having a thickness of 0.003 inches or less or with small paper bags. Replace bags when deposits or residue accumulate.
- ☐ Verify that sprinkler heads which are subject to above normal temperatures (adjacent to steam pipes, furnaces, ovens, unit heaters, HVAC outlets, exhaust outlets, sky lights, etc). are the proper color code indicating that they are for that temperature range. Identify and replace any heads with improper temperature ranges.
- ☐ Remove any ladders, stock, or material which is being supported by the sprinkler system.
- ☐ Replace broken pipe hangers and refasten any hangers that have become loose.
- ☐ Verify that a minimum distance of 18 inches is maintained between the sprinkler head deflector and the top of all storage, equipment, etc.
- ☐ Verify that ducts, tables, equipment, etc. over four feet wide have sprinkler heads installed under them.
- ☐ Verify that the required number and type of spare sprinkler heads, as well as the proper sprinkler wrench(es) are located in an accessible cabinet. The stock of spare sprinklers shall be proportionally representative of the types and temperature ratings of the system sprinklers. Provide a minimum of two sprinklers of each type and temperature rating installed. Provide a stock of spare sprinklers as follows:
  - ☐ Six heads for buildings having not over 300 sprinklers.
  - ☐ Twelve heads for buildings having 300 to 1,000 heads.
  - ☐ Twenty four heads for buildings having over 1,000 heads.
- ☐ Replace annually all sprinklers and automatic spray nozzles used for protecting commercial-type cooking equipment and ventilating systems. Where bulb-type sprinkler heads or spray nozzles are used and the inspection shows no buildup of grease or other material on the sprinklers or spray nozzles, they do not have to be replaced.
- ☐ Verify that all water is drained from low points in dry piping systems.
- ☐ Replace sprinkler heads that have been in service for fifty years. The date of manufacture is stamped on the sprinkler head deflector.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Spare sprinkler heads of proper temperature ratings
- ☐ Ladder – Check ladder for defects. Do not use defective ladders.

18. **Valves, Fire System – Pressure Regulating Type**

Monthly

This maintenance task applies to all pressure regulating type valves located in automatic sprinkler systems, and in the sprinkler portion of combined automatic sprinkler and standpipe systems. Refer to an appropriate diagram of a typical system as necessary.

Special Instructions:

- ☐ This flow test is to be conducted in strict accordance with the manufacturer's instructions.
- ☐ The purpose of this flow test is to determine if the system design water flow can be met with the current valve pressure settings.
- ☐ The work required by this procedure may cause the activation of an alarm and/or supervisory signal. Tamper switches may be provided. The school maintenance manager, or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.
- ☐ This work should be done when other annually Task Frequency maintenance is being performed involving water flowing through valve(s).
- ☐ Check what the design pressure downstream from the pressure regulating valve is from the automatic sprinkler system design documents so that the pressure can be verified during the flow test.
- ☐ A pressure gauge is required on both the upstream and downstream sides of the pressure reducing valve in order to accomplish this flow test.
- ☐ Some valves can be adjusted in the field while others are preset and must be returned to the factory for adjustment. To establish the pressure setting, the following three variables must be known:
  - ☐ Valve inlet pressure
  - ☐ Required outlet design pressure, and
  - ☐ Required flow.
- ☐ When valves are returned to the factory for testing or adjustment, care must be taken to reinstall them on the same floor from which they were removed. This is to ensure that valves with the proper pressure settings are reinstalled according to the system design. Design pressure settings will vary from floor to floor.
- ☐ Waterflow testing requires experienced personnel and proper water flow testing equipment.

Checkpoints:

- ☐ Fully open the sprinkler system drain valve and compare the pressure readings with the design pressure, original installation or acceptance test pressure readings.

- ☐ Adjust pressure setting if design pressure is not being maintained and the valve can be field adjusted.
- ☐ Determine the water flow rate (gallons per minute) with the valve fully open by either a flowmeter on the drain line or attach a fire hose to the drain line tee with 2½ inch swivel fitting (swivel fitting and plug are required on at least every other floor) and measure the water flow with a pitot tube while discharging the water outdoors from the system drain valve. Let the water run long enough to allow the pressure to stabilize to the valve setting.
- ☐ Document the following values:
  - ☐ Inlet pressure – static
  - ☐ Outlet pressure – static
  - ☐ Inlet pressure – residual (flowing)
  - ☐ Outlet pressure – residual (flowing)
  - ☐ Water flow rate – gallons per minute
  - ☐ **Note**: If flow tests have been conducted previously, compare those test results with the current ones to determine if any changes have occurred. Record the results of these tests in an appropriate form.
- ☐ Verify that the water flow rate meets the design criteria for the pressure readings involved.
- ☐ Partially close the valve incrementally and repeat the flow test at least three times to determine that the pressure regulator will control the pressure at different flow rates. This also exercises the valve mechanism.
- ☐ After the flow test, slowly close the sectional drain valve and restore the system back to service.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Water flow testing equipment

19. **Valves, Fire System – Pressure Regulating Type**

Annual

This maintenance task applies to all pressure regulating type valves located in automatic sprinkler systems, fire department standpipe hose connections, and standpipe connections with 1.5 in. racked fire hose. These valves are found in combined automatic sprinkler and standpipe systems as well as in standpipe systems. Refer to an appropriate diagram of a typical system as necessary.

Special Instructions:

- ☐ This inspection is to be performed in strict accordance with the manufacturer's instructions.

- ☐ For combined automatic sprinkler and standpipe systems, determine what the design pressure downstream from the pressure regulating valve is from the automatic sprinkler system design documents so that it can be checked during the inspection.
- ☐ This work should be done when other task frequency maintenance is being performed that involves water flow control valves and standpipe connections.
- ☐ A pressure gauge is required on both the upstream and downstream sides of the pressure reducing valve in order to accomplish this flow test. If gages have not been installed, install them so that the monthly inspections can be facilitated.
- ☐ Some valves can be adjusted in the field while others are preset and must be returned to the factory for adjustment. To establish the pressure setting, the following three variables must be known:
  - ☐ Valve inlet pressure
  - ☐ Required outlet design pressure, and
  - ☐ Required flow.
- ☐ When valves are returned to the factory for testing or adjustment, care must be taken to reinstall them on the same floor from which they were removed. This is to ensure that valves with the proper pressure settings are reinstalled according to the system design. Design pressure settings will vary from floor to floor.

Checkpoints:

- ☐ Verify that the valve is in the open position, is in good condition, with the hand wheel
- ☐ Check for leaks. Repair any leaks.
- ☐ Verify that downstream pressures are being maintained per design criteria. Adjust pressure setting if design pressure is not being maintained and the valve can be field adjusted.
- ☐ Verify that the hose threads are not damaged.
- ☐ Verify that the reducer (if supplied) and cap are in place.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.

20. **Valves, Fire System – Pressure Regulating Type**
    Five Years
    This maintenance task applies to all pressure regulating type valves located in fire department standpipe hose connections and connections with 1.5 inch racked fire hose.

    Special Instructions:

- ☐ This flow test is to be conducted in strict accordance with the manufacturer's instructions.
- ☐ The purpose of this flow test is to determine if the system design water flow can be met with the current valve pressure settings.
- ☐ The work required by this procedure may cause the activation of an alarm and/or supervisory signal. Tamper switches may be provided. The facility maintenance manager, or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.
- ☐ This work should be done when the standpipe systems are flow tested.
- ☐ Check what the design pressure downstream from the pressure regulating valve is from the standpipe system design documents so that the pressure can be verified during the flow test.
- ☐ A pressure gauge is required on both the upstream and downstream sides of the pressure reducing valve in order to accomplish this flow test.
- ☐ Some valves can be adjusted in the field while others are preset and must be returned to the factory for adjustment. To establish the pressure setting, the following three variables must be known: (1) valve inlet pressure, (2) required outlet design pressure, and (3) required flow.
- ☐ When valves are returned to the factory for testing or adjustment, care must be taken to reinstall them on the same floor from which they were removed. This is to ensure that valves with the proper pressure settings are reinstalled according to the system design. Design pressure settings will vary from floor to floor.
- ☐ Waterflow testing requires experienced personnel and proper water flow testing equipment.

Checkpoints:

- ☐ Fully open the sprinkler sectional drain valve and compare the pressure readings with the design pressure, original installation or acceptance test pressure readings.
- ☐ Adjust pressure setting if design pressure is not being maintained and the valve can be field adjusted. If design pressure is not known, contact manufacturer's office for assistance in determining the pressure to be maintained or the test procedure.
- ☐ Determine the water flow with the valve fully open by either a flow meter on the drain line or attach a fire hose to the drain line tee with 2½ inch swivel fitting (swivel fitting and plug are required on at least every other floor) and measure the water flow with a pitot tube while discharging the water outdoors from the system drain valve. Let the water run long enough to allow the pressure to stabilize to the valve setting.
- ☐ Document the following values:
  - ☐ Inlet pressure – static
  - ☐ Outlet pressure – static

- ☐ Inlet pressure – residual (flowing)
- ☐ Outlet pressure – residual (flowing)
- ☐ Water flow rate – gallons per minute
- ☐ **Note**: If flow tests have been conducted previously, compare those test results with the current ones to determine if any changes have occurred. Record the results of these tests in an appropriate form.

☐ Verify that the water flow rate meets the design criteria for the pressure readings involved.
☐ Partially close the valve incrementally and repeat the flow test at least three times to determine that the pressure regulator will control the pressure at different flow rates. This also exercises the valve mechanism.
☐ After the flow test, slowly close the sectional drain valve and restore the system back to service.

Recommended Tools, Materials, and Equipment:

☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
☐ Water flow testing equipment

VI. Fire Pump

1. **Fire Pump – Diesel Engine Driven**
   Weekly
   This maintenance task applies to all fire pumps powered by a diesel engine.

   Special Instructions:

   ☐ Review manufacturer's instructions.
   ☐ The work required by This maintenance task may cause the activation of an alarm and/or a supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at the completion of work.
   ☐ Qualified operating personnel shall be in attendance during the weekly pump operation.
   ☐ Hearing protection is required whenever the diesel engine is running.
   ☐ Tests of diesel engine driven pumps shall be conducted without flowing water.
   ☐ First Test – On systems that do not have a manual start button, close starting circuit mechanically. Run long enough to ensure engine is running properly.
   ☐ Second Test – Test shall be conducted by allowing automatic starting of the pump to occur. The diesel pump shall run a minimum of 30 minutes.
   ☐ The following items shall be checked and tested in order to ensure that the pump assembly is in operating condition and is free from physical damage.

Checkpoints:

- ☐ Check pump room or house conditions:
  - ☐ Adequate temperature, not less than 70°F (40°F for pump rooms with engine heater).
  - ☐ Ventilating louvers free to operate.
  - ☐ Clean with no miscellaneous storage.
- ☐ Inspect water piping for leaks.
- ☐ Verify that suction reservoir is full (if applicable).
- ☐ Verify that pump suction, discharge and bypass valves are fully open.
- ☐ Verify that day tank float switch is operational.
- ☐ Verify that fuel solenoid valve is operational.
- ☐ Drain condensate from fuel filters (if applicable), bottom of day tank, bottom of main fuel tank, and check fuel for water contamination.
- ☐ Verify that supply or transfer fuel pump is operational.
- ☐ Check fuel line flexible hoses and connectors for damage or leaks.
- ☐ Check engine oil level and appearance.
- ☐ Check oil level and appearance in right angle gear drive.
- ☐ Verify that lube oil heater is operational (if applicable).
- ☐ Check coolant level and squeeze hoses and inspect hoses and connections for leaks.
- ☐ Check engine water pump(s) for leaks or noise.
- ☐ Verify that water-jacket heater is operational (if applicable)
- ☐ Verify that adequate water is available to heat exchanger (if applicable).
- ☐ Verify that radiator has adequate fresh air.
- ☐ Start engine.
- ☐ Record system suction and discharge pressure gauge readings.
- ☐ Check pump packing glands for slight discharge and adjust gland nuts if necessary to attain slight discharge.
- ☐ Check packing boxes, bearings, and pump casing for overheating.
- ☐ Check for unusual noise or vibration.
- ☐ Record pump starting pressure, time for engine to crank, time for engine to reach running speed, and time pump runs after starting (for automatic stop controllers).
- ☐ Record engine running time meter at start and end of test.
- ☐ Check engine oil pressure, speed indicator, water and oil level, and temperature indicators while engine is running.
- ☐ Check exhaust system for leakage.
- ☐ Verify that controller pilot light (power on) illuminated and selector switch in Auto position.

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- ☐ Verify that transfer switch normal pilot light illuminated, and isolating switch closed – standby (emergency) source.
- ☐ Verify that all alarm pilot lights off.
- ☐ Drain exhaust system condensate trap.
- ☐ Check that fuel tank is full (fill if less than ¾ full).
- ☐ Batteries (2): Verify that voltage and charging current readings are normal, pilot lights are on or battery failure (2) pilots lights off, electrolyte level normal, terminals free from corrosion, and test for full charge.
- ☐ Check for proper supervisory signals. When applicable, supervised temperature and oil pressure circuits should be mechanically closed and checked for proper signals.
- ☐ The circulation pressure relief valve shall be inspected to ensure that sufficient water flows through the valve when the fire pump is at churn so as to prevent overheating.
- ☐ The pressure relief valve shall be inspected so as to ensure that the pressure downstream of the relief valve fittings in the fire pump does not exceed the pressure for which the system components are rated.
- ☐ Clean up and remove all debris from work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Battery tester
- ☐ Hearing protection

2. **Fire Pump – Diesel Engine Driven**
   Monthly
   This maintenance task applies to all fire pumps powered by a diesel engine.

   Special Instructions:

   - ☐ Review manufacturer's instructions.
   - ☐ The work required by this procedure may cause the activation of an alarm and/or a supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at the completion of work.
   - ☐ This maintenance task establishes three extra checkpoints: to be performed once each month on all fire pumps that are equipped with automatic starting features.
   - ☐ Hearing protection is required whenever the diesel engine is running.

   Checkpoints:

- ☐ Alter condition programmed to start fire pump, such as reducing water pressure or causing water flow by opening bypass or drain valves, etc. This method will prove automatic starting of fire pump on drop in water pressure.
- ☐ Check battery system specific gravity or state of charge, charging rate, and the charger itself.
- ☐ Equalize charge.
- ☐ Clean up and remove all debris from work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Battery tester
- ☐ Hearing protection

3. **Fire Pump – Diesel Engine Driven**
   Quarterly
   This maintenance task applies to all fire pumps powered by a diesel engine.

Special Instructions:

- ☐ Review manufacturer's instructions.
- ☐ This maintenance task establishes six extra Checkpoints: to be performed once each quarter on all fire pumps that are powered by diesel engines.

Checkpoints:

- ☐ Engine:
  - ☐ Clean fuel system strainer, filter and dirt leg.
  - ☐ Clean crankcase breather. Replace in accordance with manufacturer's instructions.
  - ☐ Clean cooling water strainer.
  - ☐ Check exhaust system for proper clearance and that the insulation is complete.
- ☐ Electrical system:
  - ☐ Check that where wires are subject to movement that chafing has not occurred.
  - ☐ Clean electrical boxes, panels and cabinets.
- ☐ Clean up and remove all debris from work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Battery tester

4. **Fire Pump – Diesel Engine Driven**
   Annual
   This maintenance task applies to all fire pumps powered by a diesel engine.

   Special Instructions:
   - ☐ Review manufacturer's instructions.
   - ☐ The work required by this task may cause the activation of an alarm and/or a supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.
   - ☐ A yearly test shall be made at full pump capacity and over to make sure that neither pump nor suction pipe is obstructed.
   - ☐ Hearing protection is required whenever the diesel engine is running.

   Checkpoints:
   - ☐ Engine.
     - ☐ Change engine oil and filter(s) and perform other lubrication of engine. Review the Material Safety Data Sheets (MSDS) for proper disposal of used oil.
     - ☐ Flush cooling system and check hoses, replace coolant.
     - ☐ Clean air and fuel filters, replace when needed.
     - ☐ Tune engine.
     - ☐ Increase RPM until overspeed or governor operates. Adjust if necessary.
     - ☐ Check for proper operation of speed controller.
     - ☐ Check for alignment and vibration.
     - ☐ Adjust clutch.
     - ☐ Check for water or foreign material in tank.
     - ☐ Remove obstructions found at tank vents and overflow piping.
     - ☐ Check all piping.
     - ☐ Check lubrication oil heater.
     - ☐ Rod out heat exchanger.
     - ☐ Test for excessive back pressure.
     - ☐ Check exhaust system hangers and supports.
     - ☐ Perform other work prescribed by manufacturer.
   - ☐ Mechanical Transmission
     - ☐ Lubricate coupling.
     - ☐ Change right angle gear drive oil.
   - ☐ Electrical system
     - ☐ Inspect and operate emergency manual starting means (without power).

- ☐ Trip Circuit breaker (if mechanism is provided).
- ☐ Tighten electrical connections as necessary.
- ☐ Lubricate mechanical moving parts (excluding starters and relays).
- ☐ Calibrate pressure switch settings.

☐ Pump Test – An annual test of any pump assembly shall be conducted with power output adjusted to "no load", "rated load", and "peak load."

- ☐ The test shall be conducted in one of the following ways:
  - ☐ Option 1 – Using pump discharge via hose streams, the pump suction and discharge pressures as well as flow measurements of each hose streams shall determine the total pump output. Hose lines shall have a flow approximately equal for each line.
  - ☐ Option 2 – Using pump discharge via by-pass flow meter to drain or to suction reservoir, pump suction and discharge pressures as well as flow meter measurements shall determine the total pump output.
  - ☐ Option 3 – Using pump discharge via by-pass flow meter to pump suction (closed loop metering), pump suction and discharge pressures as well as flow meter measurements shall determine the total pump output.
  - ☐ NOTE: When the annual test is periodically conducted in accordance with option 3, a test shall be conducted every three years in accordance with options 1 or 2 in lieu of option 3.
- ☐ The following observations, measurements and adjustments shall be conducted while the pump is running and flowing water under the specified output condition:
  - ☐ At No Flow Condition. (Churn) Conduct this test first.
    - ☐ Check circulation relief valve for operation to discharge water.
    - ☐ Check pressure relief valve for proper operation.
    - ☐ Continue test for 30 minutes.
  - ☐ At each Flow Condition:
    - ☐ Record pump speed in rpm.
    - ☐ Record simultaneous (approximately) readings of pump suction and discharge pressures, and pump discharge flow.
    - ☐ Observe operation of any alarm indicators for any visible abnormalities.

☐ Clean up and remove all debris from work area.

<u>Recommended Tools, Materials, and Equipment:</u>

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Coolant. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients.

- ☐ Engine oil. Consult the MSDS for hazardous ingredients.
- ☐ Oil, air, fuel filters
- ☐ Cleaning equipment and materials. Consult the MSDS for hazardous ingredients and proper PPE.
- ☐ Tune-up kit
- ☐ Hearing protection

5. **Fire Pump – Electric Motor Driven**
   Weekly
   This maintenance task applies to all fire pumps powered by an electric motor.

   Special Instructions:
   - ☐ Review manufacturer's instructions.
   - ☐ The work required by this task may cause the activation of an alarm and/or a supervisory signal. The facility maintenance manager, or fire department that will receive the alarm and/or signal must be notified prior to start and at the completion of work.
   - ☐ Qualified operating personnel shall be in attendance during the weekly pump operation.
   - ☐ Tests of electric motor driven pumps shall be conducted without flowing water.
   - ☐ First Test – On systems which do not have a manual start button, close starting circuit mechanically. Run long enough to ensure motor is running smoothly.
   - ☐ Second Test – Test shall be conducted by allowing automatic starting of the pump to occur. The electric pump shall run a minimum of 10 minutes.
   - ☐ The following items shall be checked and tested in order to ensure that the pump assembly is in operating condition and is free from physical damage.

   Checkpoints:
   - ☐ Pump room or house conditions:
     - ☐ Heat not less than 40°F.
     - ☐ Clean with no miscellaneous storage.
   - ☐ Ventilating louvers free to operate.
   - ☐ Inspect piping for leaks.
   - ☐ Suction reservoir full (if applicable).
   - ☐ Pump suction, discharge and bypass valves fully open.
   - ☐ Start motor.
   - ☐ Check pump packing glands for slight discharge and adjust gland nuts if necessary to attain slight discharge.
   - ☐ Check packing boxes, bearings, and pump casing for overheating
   - ☐ Check for unusual noise or vibration.

- ☐ Record pump starting pressure and time pump runs after starting (for automatic stop controllers).
- ☐ Motor running time meter reading.
- ☐ Controller pilot light (power on) illuminated and selector switch in Auto position.
- ☐ Transfer switch normal pilot light illuminated, and isolating switch closed – standby (emergency) source.
- ☐ Reverse phase alarm pilot light off, or normal phase rotation pilot light on.
- ☐ Record time controller is on first step (for reduced voltage or reduced current starting).
- ☐ All alarm pilot lights off.
- ☐ Check for proper supervisory signals.
- ☐ The circulation pressure relief valve shall be inspected to ensure that sufficient water flows through the valve when the fire pump is at churn so as to prevent overheating.
- ☐ The pressure relief valve shall be inspected so as to ensure that the pressure downstream of the relief valve fittings in the fire pump does not exceed the pressure for which the system components are rated.
- ☐ Check oil level in vertical motor sight glass (bearings).
- ☐ Clean up and remove all debris from work area.

Recommended Tools, Materials, and Equipment:

- ☐ Standard tools - basic
- ☐ Battery tester

6. **Fire Pump – Electric Motor Driven**
   Monthly
   This maintenance task applies to all fire pumps powered by an electric motor.

   Special Instructions:

   - ☐ Review manufacturer's instructions.
   - ☐ The work required by this procedure may cause the activation of an alarm and/or a supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.
   - ☐ This maintenance task establishes two extra checkpoints to be performed once each month on all fire pumps that are equipped with automatic starting features.

     Checkpoints:

   - ☐ Alter condition programmed to start fire pump, such as reducing water pressure or causing water flow by opening bypass or drain valves, etc. This method will prove automatic starting of fire pump on drop in water pressure.

- ☐ Exercise electrical system isolating switch and circuit breaker.
- ☐ Clean up and remove all debris from work area.

Recommended Tools, Materials, and Equipment:

- ☐ Standard tools - basic

7. **Fire Pump – Electric Motor Driven**
   Annual
   This maintenance task applies to all fire pumps powered by an electric motor.

   Special Instructions:

   - ☐ Review manufacturer's instructions.
   - ☐ The work required by this procedure may cause the activation of an alarm and/or a supervisory signal. The facility maintenance manager or fire department that will receive the alarm and/or signal must be notified prior to start and at completion of work.
   - ☐ A yearly test shall be made at full pump capacity and over to make sure that neither pump nor suction pipe is obstructed.

   Checkpoints:

   - ☐ Pump Test
     - ☐ Annual test of any pump assembly shall be conducted with power output adjusted to "no load", "rated load", and "peak load." The test shall be conducted in one of the following ways:
       - ☐ Option 1 – Using pump discharge via hose streams, pump suction and discharge pressures as well as flow measurements of each hose stream shall determine the total pump output. Hose lines shall have a flow approximately equal for each line.
       - ☐ Option 2 – Using pump discharge via by-pass flow meter to drain or to suction reservoir, pump suction and discharge pressures as well as flow meter measurements shall determine the total pump output. Option 3 – Using pump discharge via by-pass flow meter to pump suction (closed loop metering), pump suction and discharge pressures as well as flow meter measurements shall determine the total pump output.
       - ☐ NOTE: When the annual test is periodically conducted in accordance with option 3, a test shall be conducted every three years in accordance with option 1 or 2 in lieu of option 3.
     - ☐ The following observations, measurements and adjustments shall be conducted while the pump is running and flowing water under the specified output condition:

- ☐ At No Flow Condition (Churn) (Conduct this test first)
  - ☐ Check circulation relief valve for operation to discharge water.
  - ☐ Check pressure relief valve for proper operation.
  - ☐ Continue test for 30 minutes.
- ☐ At each Flow Condition:
  - ☐ Record electric motor voltage and current (all lines).
  - ☐ Record pump speed in rpm.
  - ☐ Record simultaneous (approximately) readings of pump suction and discharge pressures, and pump discharge flow.
  - ☐ Observe operation of any alarm indicators for any visible abnormalities.
- ☐ The following procedure shall be followed for systems having an automatic transfer switch:
  - ☐ Simulate normal power failure while pump is delivering peak power output to cause connection of the pump motor to alternate power source.
  - ☐ Restore peak power output, then remove simulated normal power failure condition, which shall after a time delay, cause the reconnection of the pump motor to the normal power source.
  - ☐ Ensure that the over-current protection devices do not open.
- ☐ Clean up and remove all debris from work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.

F. Conveyances

1. **Elevators, Electric or Hydraulic**
   Monthly

   Special Instructions:

   - ☐ Check manufacturer's instructions; those that have more stringent tasks for preventive maintenance shall be followed. The frequencies shown here are minimum requirements and are in addition to the regular PBS inspection tour. Items regularly inspected on a weekly basis include the motor-generator unit, hoist machine, controls and governor. Doors, hangers, closers, interlocks and door operators should be checked frequently for proper operation by PBS elevator mechanics or contract inspectors as they ride the

elevators. Items requiring attention should be reported to the facility maintenance manager or elevator contractor.

- ☐ Review Procedure on "Controlling Hazardous Energy Sources."
- ☐ Use energy efficient lighting to the fullest practical extent.
- ☐ If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.
- ☐ Comply with state and local codes as applicable.

Checkpoints:

- ☐ Machine Room: Dust drive machines, motor generator sets, and control cabinets. Sweep floor, relamp inoperative machine room lights and remove trash. Inspect controllers, signal, scheduling and dispatch panels, selectors and selector tapes. Make maintenance adjustments necessary for proper operation.
- ☐ Pits: Dust ironwork, sweep floor, empty drip pans, relamp inoperative lights, remove trash and check for leaks. Check runby, buffer switch, compensating switch and emergency stop switch. Make maintenance adjustments necessary for proper operation.
- ☐ Motors; hoist motor, motor generator and regulators: Inspect oil level, oil pick up and belts. Make maintenance adjustments necessary for proper operation. Check for excessive heat, noise and leaks. Lubricate in accordance with manufacturer's specification. Renew brushes as necessary for proper operation. Keep end bells, commutators and brush riggings clean.
- ☐ Geared Machines: Inspect worm and gear for bottoming and backlash, thrust end play, bearing wear, oil pick up, oil level and packing. Check for leaks and empty drip pan. Renew brushes as necessary. Keep end bells, commutators and brush riggings clean.
- ☐ Brakes: Observe operation of brakes. Inspect drum and shoe clearance and adjust as necessary for proper operation. Clean and lubricate pivot points. Where brake shoes are asbestos-containing, check for dust, and practice appropriate cleanup and maintenance precautions.
- ☐ Car Gate: Clean, lubricate and inspect hangers and all related gate operating mechanisms. Check rollers, upthrust, interlock, gear box, motor brushes, door control box, cables, safety edge, light rays, gibs, sills, proper operating speed and force close speed. Make maintenance adjustments necessary for proper operation.
- ☐ Speed Governor: Observe operation, including tension sheave. Check electrical switches for proper operation; check that inspection seals are in place and not broken. Clean and lubricate pivot points.

- ☐ Lighting: Relamp all inoperative lamps located in lamp hatchway, hall landings, position indicators, car stations, dome, and wherever else required. Clean light diffusers and car stations.
- ☐ Hydraulic Machines: Observe operation of motor and pump, oil lines, tank, controls, plunger and packing. Adjust as necessary for proper operation. Correct excessive creeping. Test manual and emergency control. Clean and lubricate as necessary. Check for and repair leaks on oil lines, tank, and packing. Test manual and emergency control. Clean and lubricate all equipment as necessary for proper operation.
- ☐ Emergency Items: Check that emergency procedure sign is in place and inspection certificate is current and visible (or filed in facility maintenance manager's office). Check top and side exits and related switches for proper operation. Test alarm bell, emergency stop switch, communications system, fire recall service (key capture, minimum one floor run on Phase II), and any other emergency recall features. Repair, replace, and adjust parts and equipment as necessary to ensure operation in accordance with the manufacturer's specifications. Document each test performed, including the date and results of each test.
- ☐ Clean up and remove all debris from work areas.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning supplies and materials. Consult the Material Safety Data Sheet (MSDS) for hazardous ingredients and proper Personal Protective Equipment (PPE).
- ☐ Out of service signs.
- ☐ Barricades
- ☐ Lubricants. Consult the MSDS for hazardous ingredients and proper PPE.

2. **Elevators, Electric or Hydraulic**
   Quarterly

Special Instructions:

- ☐ Check manufacturer's instructions; those that have more stringent task lines for preventive maintenance shall be followed. The frequencies shown here are minimum requirements and are in addition to the regular PBS inspection tour. Items regularly inspected on a weekly basis include the motor-generator unit, hoist machine, controls and governor. Doors, hangers, closers, interlocks and door operators should be checked frequently for proper operation by PBS elevator mechanics or contract inspectors as they ride the elevators. Items requiring attention should be reported to the facility maintenance manager or elevator contractor.
- ☐ Review Procedure on "Controlling Hazardous Energy Sources."

- ☐ Use energy efficient lighting to the fullest practical extent.
- ☐ If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.
- ☐ Comply with state and local codes as applicable.

Checkpoints:

- ☐ Tasks: Inspect, clean, lubricate, and properly adjust all roller tasks, task shoes, and rail oilers.
- ☐ Car Tops: Remove all dirt, dust, and oil. Clean and lubricate fans.
- ☐ Emergency Lighting: Check the operation of the emergency lights; replace as necessary.
- ☐ Solid State Components and Circuit Boards: Inspect printed circuit board and other solid state devices for cleanliness, condensation spots, evidence of heating and deterioration. Check and replace defective solid state devices.
- ☐ Leveling: Inspect leveling operation. Clean and lubricate switches, vanes, and all other related parts. Adjust to obtain the proper leveling at all landings in both the UP and DOWN directions within ¼ inch above or below the landing sill.
- ☐ Clean up and remove all debris from work area.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning supplies and materials. Consult the Material Safety Data Sheet (MSDS) for hazardous ingredients and proper Personal Protective Equipment (PPE).
- ☐ Out of service signs
- ☐ Barricades
- ☐ Lubricants. Consult the MSDS for hazardous ingredients and proper PPE.

3. **Elevators, Electric or Hydraulic**
   Semiannual

Special Instructions:

- ☐ Check manufacturer's instructions; those that have more stringent task lines for preventive maintenance shall be followed. The frequencies shown here are minimum requirements and are in addition to the regular PBS inspection tour. Items regularly inspected on a weekly basis include the motor-generator unit, hoist machine, controls and governor. Doors, hangers, closers, interlocks and door operators should be checked frequently for proper operation by PBS elevator mechanics or contract inspectors as they ride the

elevators. Items requiring attention should be reported to the elevator shop supervisor or elevator contractor.

- ☐ Review Procedure on "Controlling Hazardous Energy Sources."
- ☐ Use energy efficient lighting to the fullest practical extent.
- ☐ If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.
- ☐ Comply with state and local codes as applicable.

Checkpoints:

- ☐ Motors: Inspect connections, armature and rotor clearances of the hoist motor and motor generator set: Clean and adjust as necessary to obtain proper operation.
- ☐ Cables: Inspect, lubricate and properly adjust hoist cables, compensating cables, governor cables, and traveling cables to their manufacturer's specifications. Check all cable fastenings. Inspect task rails and counter weights. Check and adjust the slow down and limit switches. Adjust all other items as necessary to obtain proper operation
- ☐ Sheaves: Inspect, clean, and lubricate in accordance with manufacturer's specifications all deflector, compensating, and top of car sheaves.
- ☐ Clean up and remove all debris from work areas.

Recommended Tools, Materials, and Equipment:

- ☐ Review manufacturer’s instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning supplies and materials. Consult the Material Safety Data Sheet (MSDS) for hazardous ingredients and proper Personal Protective Equipment (PPE).
- ☐ Out of service signs
- ☐ Barricades
- ☐ Lubricants. Consult the MSDS for hazardous ingredients and proper PPE.

4. **Elevators, Electric or Hydraulic**
   Annual

Special Instructions:

- ☐ Check manufacturer's instructions; those that have more stringent task lines for preventive maintenance shall be followed. The frequencies shown here are minimum requirements and are in addition to the regular PBS inspection tour. Items regularly inspected on a weekly basis include the motor-generator unit, hoist machine, controls and governor. Doors, hangers, closers, interlocks and door operators should be checked frequently for

proper operation by PBS elevator mechanics or contract inspectors as they ride the elevators. Items requiring attention should be reported to the elevator shop supervisor or elevator contractor.

- ☐ Review Procedure on "Controlling Hazardous Energy Sources."
- ☐ Use energy efficient lighting to the fullest practical extent.
- ☐ If materials to be worked on are known or suspected to contain asbestos, check the building's asbestos management plan to see if they have been tested for asbestos. If they are suspect but have not been tested, have them tested. Manage asbestos in accordance with the plan.
- ☐ Comply with state and local codes as applicable.

Checkpoints:

- ☐ Brakes: Completely dismantle brake assembly, clean, and inspect for wear. Replace defective parts required for proper operation. Where brake shoes are asbestos-containing, check for dust, and practice appropriate cleanup and maintenance precautions. Lubricate bearing, pins, and pivot points.
- ☐ Selector: Inspect, clean, lubricate, replace parts, and make repairs or adjustments required for proper operation of selector unit components, including cables, chains, clutches, cams gears, fuses, motor brushes, wiring, connections, contacts, relays, tape, tape tension sheave, broken tape switch and tape wipers.
- ☐ Controller: Thoroughly clean controller with blower or vacuum. Inspect and check the operation of switches, relays, timers, capacitors, resistors, contacts, overloads, wiring, connections, fuses, oil level of overloads and overload settings. Check for MG shutdown, high call reversal, zone control, and load by-pass door failure time. Check programming up peak, down peak, off peak, off hours. Replace worn or defective parts and adjust controller for proper operation.
- ☐ Hoistway Doors: Clean, inspect, and lubricate all door operating mechanisms; including but not limited to rollers, upthrusts, interlocks, clutches, self closing, gibs and sills. Replace worn or defective parts, repair and adjust door mechanisms as required for proper operation.
- ☐ Hoistways: Clean rails, beams, and all related iron work in hoistway. Dust hoistway walls. Clean top, bottom, and sides of car. Clean counterweight and pit area.
- ☐ Hoist Machine and Motor-Generator: Clean with blower or vacuum. Clean end bells, and brush riggings and commutator. Inspect connections, armature and rotor clearances.
- ☐ Buffers: Check oil level and operation of switches. Add oil or adjust switches as necessary for proper operation. Manually compress buffer; test the proper return in accordance with ASME/ANSI A17.1 Safety Code for Elevators and Escalators, Rule 201.4e(1).
- ☐ Scheduling, Dispatch, and Signal Boards: Clean with blower or vacuum. Inspect and check the operation of all switches, relays, timers, fuses, capacitors, resistors, contacts,

overloads, wiring and connections. Replace worn or defective parts and adjust for proper operation.
- ☐ Motors: Change oil in hoist motor, motor generator set, geared machines, and gear boxes with lubricants as specified by the equipment manufacturer(s).
- ☐ Safeties: Inspect, clean, lubricate and manually operate safety mechanisms. Replace parts or adjust as necessary.
- ☐ Clean up and remove all debris from work area.

Recommended Tools, Materials, and Equipment:
- ☐ Review manufacturer's instruction manual for specialized hand tools, equipment and supplies.
- ☐ Cleaning supplies and materials. Consult the Material Safety Data Sheet (MSDS) for hazardous ingredients and proper Personal Protective Equipment (PPE).
- ☐ Out of service signs
- ☐ Barricades
- ☐ Lubricants. Consult the MSDS for hazardous ingredients and proper.

5. **Elevator, Electric, Inspection**
Semiannual
This maintenance task applies to electrically operated passenger and freight elevators.

Special Instructions:
- ☐ Adhere to local codes when applicable.
- ☐ Avoid the wearing of loose clothing and neckties during the performance of this inspection.
- ☐ Be at all times vigilant of the location and movement of cars, counterweights, projections, rotating machinery, etc. Note the clearance available when working on top of the car or in the pit. Do not enter any pit containing standing water.
- ☐ Be sure that safety devices are operational before performing any inspection work.
- ☐ A copy of the ANSI/ASME Checklist for Electric Elevators is included for convenience.
- ☐ The semiannual inspection of electric elevators includes those designated as routine in the code.
- ☐ Comply with state and local codes as applicable.
- ☐ Review Procedure on "Controlling Hazardous Energy Sources."

Checkpoints:
- ☐ Inside of Car: Door reopening device; stop switches; operating control devices; car floor and landing sill; car lighting; car emergency signal; car door or gate; door closing force;

power closing of doors or gates; power opening of doors or gates; car vision panels and glass car doors; car enclosure; emergency exit; ventilation; signs and operating device symbols; rated load, platform area, and data plate; standby power operation; restricted opening of car or hoistway doors; and car ride.

- ☐ Machine Room: Lighting and receptacles; housekeeping; ventilation; fire extinguisher; pipes, wiring, and ducts; guarding of exposed auxiliary equipment; numbering of machines and disconnect switches; disconnecting means and control; controller wiring, fuses, grounding, etc.; static control; drive machine brake; traction drive machines; gears and bearings; winding drum machine; belt- or chain-drive machine; motor generator; absorption of regenerated power; AC drives from a DC source; traction sheaves; secondary and deflector sheaves; rope fastenings; terminal stopping devices; slack rope devices; governor, overspeed switch, and seal; and car and counterweight safeties.
- ☐ Top of Car: Top-of-car stop switch; car top light and outlet; top-of-car operating device and working platforms; top-of-car clearance and refuge space; top counterweight clearance; car, overhead, and deflector sheaves; normal terminal stopping devices; final terminal stopping devices; broken rope, chain, or tape switch; car leveling devices; top emergency exit; counterweight and counterweight buffer; counterweight safeties; hoistway smoke control; pipes, wiring, and ducts; hoistway clearances; multiple hoistways; traveling cables and junction boxes; door and gate equipment; car frame and stiles; task rails fastening and equipment; governor rope; governor releasing carrier; wire rope fastening and hitch plate; suspension rope; and compensating ropes and chains.
- ☐ Outside Hoistway: Car platform guard; hoistway doors; vision panels; hoistway door locking devices; access to hoistway; power closing of hoistway doors; sequence operations; elevator parking devices; emergency doors blind hoistways; and standby power selection switch.
- ☐ Inspections Made in the Pit: Pit access, lighting, and stop switch, and condition; car and counterweight buffer; final terminal stopping devices; normal terminal stopping devices; traveling cables; governor-rope tension devices; compensating chains, ropes, and sheaves; car frame and platform; and car safeties and guiding members.

<u>Recommended Tools, Materials, and Equipment:</u>

- ☐ Flashlight with a non-conductive case for inspecting wire ropes or other equipment where there is insufficient light.
- ☐ 6 ft (2 m) rule of non-conductive material
- ☐ Set of thickness gages
- ☐ Small hammer, preferably a ½ lb. (0.2 kg) ball peen
- ☐ Chalk or crayon
- ☐ Small metal mirror for examining wire ropes or other items normally inaccessible.
- ☐ Non-conductive safety hat

- ☐ Rope caliper
- ☐ Sheave groove gage
- ☐ Copy of the latest edition of the ANSI/ASME A17.1 Safety Code for Elevators and Escalators
- ☐ Copy of the latest edition of the ANSI/ASME A17.2 Inspector's Manual for Elevators and Escalators
- ☐ Copy of the latest edition of the Elevator Industry Field Employees' Safety Handbook
- ☐ Stop watch
- ☐ 50 ft (15 m) non-conductive tape
- ☐ Tachometer, preferably one provided with a 1 ft (305 mm) circumference wheel for measuring speeds, or one that reads directly in feet per minute (meters per second)
- ☐ Meter, to check grounding continuity, phasing, and voltages
- ☐ Spirit level
- ☐ Door test scale (gage) to check closing door force
- ☐ Suitable test weights
- ☐ Suitable light meter for measuring light intensity
- ☐ Pressure gage, preferably one with a maximum scale of twice the working pressure to be tested
- ☐ Latest edition of ASME A17.4, Evacuation of Passengers from Stalled Elevators

6. **Elevator, Electric, Inspection**
   Annual
   This maintenance task applies to electrically operated passenger and freight elevators.

   Special Instructions:

   - ☐ This elevator inspection task is adapted from the ANSI/ASME Codes A17.1, Safety Code for Elevators and Escalators, and A17.2, Inspectors' Manual for Electric Elevators, hereinafter referred to as the "code." Refer to these documents for comprehensive instructions on elevator inspections.
   - ☐ Adhere to local codes when applicable.
   - ☐ Inspectors shall meet the requirements of the ANSI/ASME QEI-1 Standard for the Qualifications ofElevator Inspectors and shall be recognized by the State of Maryland. Inspectors and inspection supervisors shall be certified by an ASME accredited organization in accordance with the requirements of ASME QEI-1. Inspections and tests shall be performed by an inspector employed by the State of Maryland Public School system or by an outside contractor/inspector authorized by the State of Maryland. Immediately following these inspections and tests, the inspector shall submit to the State

of Maryland Public School regional director or superintendent a statement certifying that the inspections and tests have been performed and a report on the results thereof.

- ☐ Avoid the wearing of loose clothing and neckties during the performance of this inspection.
- ☐ Be at all times vigilant of the location and movement of cars, counterweights, projections, rotating machinery, etc. Note the clearance available when working on top of the car or in the pit. Do not enter any pit containing standing water.
- ☐ Be sure that safety devices are operational before performing any inspection work.
- ☐ A copy of the ANSI/ASME Checklist for Electric Elevators is included for convenience.
- ☐ The annual inspection of electric elevators are described in the periodic section of the code.
- ☐ Perform the semiannual inspection simultaneously.
- ☐ Comply with state and local codes as applicable.
- ☐ Review Procedure on "Controlling Hazardous Energy Sources."

Checkpoints:

- ☐ Inside of Car: Car lighting; standby power operation.
- ☐ Machine Room: Static control (checks and torque all connections to correct specifications, and check and lubricate cooling fan); check primary and secondary voltages phase to phase and phase to ground; winding drum machine; AC drives from a DC source; traction sheaves; terminal stopping devices; slack rope devices; governor, overspeed switch, and seal; and car and counterweight safeties.
- ☐ Top of Car: Final terminal stopping devices; and counterweight safeties.
- ☐ Outside Hoistway: Standby power selection switch.
- ☐ Inspections Made in the Pit: Car and counterweight buffer; final terminal stopping devices; normal terminal stopping devices; and car safeties and guiding members.
- ☐ Firefighter's Service: Operation of elevators under fire and other emergency conditions, A17.1b-1973 through A17.1b-1980; operation of elevators under fire and other emergency conditions, A17.1-1981 through A17.1b-1983; firefighter's service A17.1-1984 through A17.1a-1988 and A17.3; firefighter's service A17.1b-1989 and later editions.

Recommended Tools, Materials, and Equipment:

- ☐ Flashlight with a non-conductive case for inspecting wire ropes or other equipment where there is insufficient light.
- ☐ 6 ft (2 m) rule of non-conductive material
- ☐ Set of thickness gages
- ☐ Small hammer, preferably a ½ lb. (0.2 kg) ball peen
- ☐ Chalk or crayon

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- ☐ Small metal mirror for examining wire ropes or other items normally inaccessible
- ☐ Non conductive safety hat
- ☐ Rope caliper
- ☐ Sheave groove gage
- ☐ Copy of the latest edition of the ANSI/ASME A17.1 Safety Code for Elevators and Escalators
- ☐ Copy of the latest edition of the ANSI/ASME A17.2 Inspector's Manual for Elevators and Escalators
- ☐ Copy of the latest edition of the Elevator Industry Field Employees' Safety Handbook
- ☐ Stop watch
- ☐ 50 ft (15 m) non conductive tape
- ☐ Tachometer, preferably one provided with a 1 ft (305 mm) circumference wheel for measuring speeds, or one that reads directly in feet per minute (meters per second).
- ☐ Meter, to check grounding continuity, correct phasing, and verification of voltages.
- ☐ Spirit level
- ☐ Door test scale (gage) to check closing door force.
- ☐ Suitable test weights
- ☐ Suitable light meter for measuring light level in foot-candles (lux)

7. **Elevator, Electric, Inspection**
   Five years
   This maintenance task applies to electrically operated passenger and freight elevators.

   Special Instructions:
   - ☐ This elevator inspection task is adapted from the ANSI/ASME Codes A17.1, Safety Code for Elevators and Escalators, and A17.2, Inspectors' Manual for Electric Elevators, hereinafter referred to as the "code." Refer to these documents for comprehensive instructions on elevator inspections. Adhere to local codes when applicable.
   - ☐ Inspectors shall meet the requirements of the ANSI/ASME QEI-1 Standard for the Qualifications of Elevator Inspectors and shall be recognized by the State of Maryland. Inspectors and inspection supervisors shall be certified by an ASME accredited organization in accordance with the requirements of ASME QEI-1. Inspections and tests shall be performed by an inspector employed by the State of Maryland Public School system or by an outside contractor/inspector authorized by the State of Maryland. Immediately following these inspections and tests, the inspector shall submit to the State of Maryland Public School regional director or superintendent a statement certifying that the inspections and tests have been performed and a report on the results thereof.

- [ ] Avoid the wearing of loose clothing and neckties during the performance of this inspection.
- [ ] Be at all times vigilant of the location and movement of cars, counterweights, projections, rotating machinery, etc. Note the clearance available when working on top of the car or in the pit. Do not enter any pit containing standing water.
- [ ] Be sure that safety devices are operational before performing any inspection work.
- [ ] A copy of the ANSI/ASME Checklist for Electric Elevators is included for convenience.
- [ ] The 5 year inspection of electric elevators are described in the periodic section of the code.
- [ ] Perform the semiannual inspection simultaneously.
- [ ] Comply with state and local codes as applicable.
- [ ] Review Procedure on "Controlling Hazardous Energy Sources."

Checkpoints:

- [ ] Inside of Car: Power opening of doors or gates; standby power operation.
- [ ] Machine Room: Traction sheaves; terminal stopping devices;
- [ ] Top of Car: Counterweight safeties.
- [ ] Outside Hoistway: None
- [ ] Inspections Made in the Pit: Car and counterweight buffer.
- [ ] Firefighter's Service: None.

Recommended Tools, Materials, and Equipment:

- [ ] Flashlight with a non-conductive case for inspecting wire ropes or other equipment where there is insufficient light.
- [ ] 6 ft (2 m) rule of non-conductive material
- [ ] Set of thickness gages
- [ ] Small hammer, preferably a ½ lb. (0.2 kg) ball peen
- [ ] Chalk or crayon
- [ ] Small metal mirror for examining wire ropes or other items normally inaccessible
- [ ] Non-conductive safety hat
- [ ] Rope caliper
- [ ] Sheave groove gage
- [ ] Copy of the latest edition of the ANSI/ASME A17.1 Safety Code for Elevators and Escalators
- [ ] Copy of the latest edition of the ANSI/ASME A17.2 Inspector's Manual for Elevators and Escalators
- [ ] Copy of the latest edition of the Elevator Industry Field Employees' Safety Handbook

- ☐ Stop watch
- ☐ 50 ft (15 m) non conductive tape
- ☐ Tachometer, preferably one provided with a 1 ft (305 mm) circumference wheel for measuring speeds, or one that reads directly in feet per minute (meters per second).
- ☐ Meter, to check grounding continuity, correct phasing, and verification of voltages.
- ☐ Spirit level
- ☐ Door test scale (gage) to check closing door force
- ☐ Suitable test weights
- ☐ Suitable light meter for measuring light level in foot-candles (lux)

8. **Elevator, Hydraulic, Inspection**
   Semiannual
   This maintenance task applies to hydraulically operated passenger and freight elevators.

   Special Instructions:
   - ☐ This elevator inspection task is adapted from the ANSI/ASME Codes A17.1 and A17.2, hereinafter referred to as the "code." Refer to these documents for comprehensive instructions on elevator inspections. Adhere to local codes when applicable.
   - ☐ Inspectors shall meet the requirements of the ANSI/ASME QEI-1 Standard for the Qualifications of Elevator Inspectors and shall be recognized by the State of Maryland. Inspectors and inspection supervisors shall be certified by an ASME accredited organization in accordance with the requirements of ASME QEI-1. Inspections and tests shall be performed by an inspector employed by the State of Maryland Public School system or by an outside contractor/inspector authorized by the State of Maryland. Immediately following these inspections and tests, the inspector shall submit to the State of Maryland Public School regional director or superintendent a statement certifying that the inspections and tests have been performed and a report on the results thereof.
   - ☐ Avoid the wearing of loose clothing and neckties during the performance of this inspection.
   - ☐ Be at all times vigilant of the location and movement of cars, counterweights, projections, rotating machinery, etc. Note the clearance available when working on top of the car or in the pit. Do not enter any pit containing standing water.
   - ☐ Be sure that safety devices are operational before performing any inspection work.
   - ☐ Inspection checklists adapted from the code are included for convenience.
   - ☐ The semiannual inspection of hydraulic elevators includes those designated as **routine** in the code.
   - ☐ Comply with state and local codes as applicable.
   - ☐ Review Procedure on "Controlling Hazardous Energy Sources."

Checkpoints:

- ☐ Inside of Car: Emergency stop switch; car emergency signal; rated load, platform area capacity and data plate; signs in freight elevator; car enclosure; ventilation of passenger elevators; side emergency exits; car door or gate; car door or gate electric contacts; closed position of car door or gate; power opening of doors or gates; power closing of doors or gates; door reopening device; car floor and landing sill; operating control device; emergency signal device; and car lighting (including emergency).
- ☐ Outside Hoistway: Car platform guard; power closing of hoistway doors; sequence operation; hoistway enclosure; hoistway doors; vision panels; hoistway door locking device; elevator parking device; access to hoistway; and emergency doors.
- ☐ Top of Car: Top car clearance and refuge space; stop switch top of car; top car operating device; top car light and outlet; traveling cables and junction; door gate contacts, cams, etc., hangars and connections; hoistway clearances; normal terminal stopping device; top emergency exit; crosshead data plate; construction of hoistway; floor over hoistway; hoistway smoke control; task rails, fastenings, and alignment; pipe, wiring, and ducts; floor numbers; landing sill guards, projections, and recesses; car frame and stiles; and anti creep leveling device.
- ☐ Machine Room and Machinery Space: Access to machine space; pressure tanks; lighting machine space; ventilation of machine and control space; guards for exposed equipment; control valve; terminal stopping device; pumps; relief and check valve; drives; flexible hose and fittings; tank and oil level; controller wiring fuses, etc.; piping supply line and shutoff.
- ☐ Pit: Pit light and stop switch; pit access; car clearance and runby; construction of oil buffer; oil buffer oil level gage; oil buffer data plate; spring buffer and data plate; solid bumper; cylinder oil collection; pipes, valves, fittings, and supports; plunger; plunger connection to car; normal stopping device; guard between pits; pit access; illumination; traveling; car frame and platform; and pit construction.
- ☐ Test: Oil buffer; terminal stopping devices; and emergency power operation.

Recommended Tools, Materials, and Equipment:

- ☐ Flashlight with a non-conductive case for inspecting wire ropes or other equipment where there is insufficient light.
- ☐ 6 ft (2 m) rule of non-conductive material
- ☐ Set of thickness gages
- ☐ Small hammer, preferably a ½ lb. (0.2 kg) ball peen
- ☐ Chalk or crayon
- ☐ Small metal mirror for examining wire ropes or other items normally inaccessible.
- ☐ Non-conductive safety hat
- ☐ Rope caliper
- ☐ Sheave groove gage

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- ☐ Copy of the latest edition of the ANSI/ASME A17.1 Safety Code for Elevators and Escalators.
- ☐ Copy of the latest edition of the ANSI/ASME A17.2 Inspector's Manual for Elevators and Escalators.
- ☐ Copy of the latest edition of the Elevator Industry Field Employees' Safety Handbook.
- ☐ Stop watch
- ☐ 50 ft (15 m) non conductive tape
- ☐ Tachometer, preferably one provided with a 1 ft (305 mm) circumference wheel for measuring speeds, or one that reads directly in feet per minute (meters per second).
- ☐ Meter, to check grounding continuity, correct phasing, and verification of voltages.
- ☐ Spirit level
- ☐ Door test scale (gage) to check closing door force
- ☐ Suitable test weights
- ☐ Suitable light meter for measuring light level in foot-candles (lux)
- ☐ Pressure gauge, preferably one with a maximum scale of twice the working pressure to be tested.

9. **Elevator, Hydraulic, Inspection**
   Annual
   This maintenance task applies to hydraulically operated passenger and freight elevators.

   Special Instructions:
   - ☐ This elevator inspection task is adapted from the ANSI/ASME Codes A17.1 and A17.2, hereinafter referred to as the "code." Refer to these documents for comprehensive instructions on elevator inspections. Adhere to local codes when applicable.
   - ☐ Inspectors shall meet the requirements of the ANSI/ASME QEI-1 Standard for the Qualifications of Elevator Inspectors and shall be recognized by the State of Maryland. Inspectors and inspection supervisors shall be certified by an ASME accredited organization in accordance with the requirements of ASME QEI-1. Inspections and tests shall be performed by an inspector employed by the State of Maryland Public School system or by an outside contractor/inspector authorized by the State of Maryland. Immediately following these inspections and tests, the inspector shall submit to the State of Maryland Public School regional director or superintendent a statement certifying that the inspections and tests have been performed and a report on the results thereof.
   - ☐ Avoid the wearing of loose clothing and neckties during the performance of this inspection.

- ☐ Be at all times vigilant of the location and movement of cars, counterweights, projections, rotating machinery, etc. Note the clearance available when working on top of the car or in the pit. Do not enter any pit containing standing water.
- ☐ Be sure that safety devices are operational before performing any inspection work.
- ☐ Inspection checklists adapted from the code are included for convenience.
- ☐ The annual inspection of hydraulic elevators includes those designated as periodic in the code.
- ☐ Review Procedure on "Controlling Hazardous Energy Sources."

Checkpoints:

- ☐ Inside of Car: Emergency stop switch; car emergency signal; rated load, platform area capacity and data plate; signs in freight elevator; car enclosure; ventilation of passenger elevators; side emergency exits; car door or gate; car door or gate electric contacts; closed position of car door or gate; power opening of doors or gates; power closing of doors or gates; door reopening device; car floor and landing sill; operating control device; emergency signal device; and car lighting (including emergency).
- ☐ Outside Hoistway: Car platform guard; power closing of hoistway doors; door closing force; sequence operation; hoistway enclosure; hoistway doors; vision panels; hoistway door locking device; elevator parking device; access to hoistway; and emergency doors.
- ☐ Top of Car: Top car clearance and refuge space; stop switch top of car; top car operating device; top car light and outlet; traveling cables and junction; door gate contacts, cams, etc., hangars and connections; hoistway clearances; normal terminal stopping device; top emergency exit; crosshead data plate; construction of hoistway; floor over hoistway; hoistway smoke control; task rails, fastenings, and alignment; pipe, wiring, and ducts; floor numbers; landing sill guards, projections, and recesses; car frame and stiles; and anti creep leveling device.
- ☐ Machine Room and Machinery Space: Access to machine space; pressure tanks; lighting machine space; ventilation of machine and control space; guards for exposed equipment; control valve; terminal stopping device; pumps; relief and check valve; drives; flexible hose and fittings; tank and oil level; controller wiring fuses, etc.; piping supply line and shutoff.
- ☐ Pit: Pit light and stop switch; pit access; car clearance and runby; construction of oil buffer; oil buffer plunger return; oil buffer oil level gage; oil buffer data plate; spring buffer and data plate; solid bumper; cylinder oil collection; pipes, valves, fittings, and supports; plunger; plunger connection to car; normal stopping device; guard between pits; pit access; illumination; traveling; car frame and platform; and pit construction.
- ☐ Test: Flexible hose and fittings; oil buffer (perform the five year test as necessary); terminal stopping devices; firefighters service; emergency power operation; power door closing force; pressure tank (three year); pressure switch; relief valve setting; static load test; emergency terminal speed limiting device.

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Recommended Tools, Materials, and Equipment:

- ☐ Flashlight with a non-conductive case for inspecting wire ropes or other equipment where there is insufficient light.
- ☐ 6 ft (2 m) rule of non-conductive material
- ☐ Set of thickness gages
- ☐ Small hammer, preferably a ½ lb. (0.2 kg) ball peen
- ☐ Chalk or crayon
- ☐ Small metal mirror for examining wire ropes or other items normally inaccessible.
- ☐ Non-conductive safety hat
- ☐ Rope caliper
- ☐ Sheave groove gage
- ☐ Copy of the latest edition of the ANSI/ASME A17.1 Safety Code for Elevators and Escalators.
- ☐ Copy of the latest edition of the ANSI/ASME A17.2 Inspector's Manual for Elevators and Escalators.
- ☐ Copy of the latest edition of the Elevator Industry Field Employees' Safety Handbook.
- ☐ Stop watch
- ☐ 50 ft (15 m) non conductive tape.
- ☐ Tachometer, preferably one provided with a 1 ft (305 mm) circumference wheel for measuring speeds, or one that reads directly in feet per minute (meters per second).
- ☐ Meter, to check grounding continuity, correct phasing, and verification of voltages.
- ☐ Spirit level
- ☐ Door test scale (gage) to check closing door force
- ☐ Suitable test weights
- ☐ Suitable light meter for measuring light level in foot-candles (lux).
- ☐ Pressure gauge, preferably one with a maximum scale of twice the working pressure to be tested.

10. **Escalators and Moving Walks, Inspection**

Annual

This maintenance task applies to escalators and moving walks.

Special Instructions:

- ☐ This escalator and moving walk inspection task is adapted from the ANSI/ASME Codes A17.1 and A17.2, hereinafter referred to as the "code." Refer to these documents for comprehensive instructions on elevator inspections. Comply also with all state, county, city, and town codes.

- [ ] Inspectors shall meet the requirements of the ANSI/ASME QEI-1 Standard for the Qualifications of Elevator Inspectors and shall be recognized by the State of Maryland. Inspectors and inspection supervisors shall be certified by an ASME accredited organization in accordance with the requirements of ASME QEI-1. Inspections and tests shall be performed by an inspector employed by the State of Maryland Public School system or by an outside contractor/inspector authorized by the State of Maryland. Immediately following these inspections and tests, the inspector shall submit to the State of Maryland Public School regional director or superintendent a statement certifying that the inspections and tests have been performed and a report on the results thereof.
- [ ] Avoid the wearing of loose clothing and neckties during the performance of this inspection.
- [ ] Be at all times vigilant of the location and movement of cars, counterweights, projections, rotating machinery, etc. Note the clearance available when working on/around this equipment.
- [ ] Be sure that safety devices are operational before performing any inspection work.
- [ ] Set up a barricade at the escalator entry point. Use signs to direct passengers to stairs. Once escalator is vacant, set up another barricade at the exit point, and stop the escalator.
- [ ] Review Procedure on "Controlling Hazardous Energy Sources."
- [ ] Comply with state and local codes as applicable.

Checkpoints:

- [ ] Speed Governors. Where a speed governor is required, test by manually operating the trip mechanism.
- [ ] Escalator Broken Step-Chain Device. Test the broken step-chain device by operating it manually.
- [ ] Broken Drive-Chain Devices. Test the broken drive-chain device by operating the actuating mechanism manually.
- [ ] Moving Walk Broken Treadway Devices. Test by manually operating the actuating device.
- [ ] Stop Switches. Test all stop switches, including those located in machine spaces, and all mainline disconnect switches for proper operation.
- [ ] Fire Shutters. Test the fire shutters to verify that their operation will stop the escalator or moving walk. If power operated. The force and reversing requirements must be met.
- [ ] Escalator Skirt-Obstruction Devices. These devices are to be manually operated by simulating an actual obstruction.
- [ ] Brakes. Test the operation of the electrically released brake by manually operating the other safety devices and observing.
- [ ] Starting Switches. Test for proper operation and type.
- [ ] Escalator Reversal Stop Devices. Inspect and test operation.

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- [ ] Escalator Step Upthrust Devices. Test by manually displacing the step, which should cause the device to operate.
- [ ] Remove barricades and place escalator back into service.

Recommended Tools, Materials, and Equipment:

- [ ] Flashlight with a non-conductive case for inspecting wire ropes or other equipment where there is insufficient light.
- [ ] 6 ft (2 m) rule of non-conductive material
- [ ] Set of thickness gages
- [ ] Small hammer, preferably a ½ lb. (0.2 kg) ball peen
- [ ] Chalk or crayon
- [ ] Small metal mirror for examining wire ropes or other items normally inaccessible.
- [ ] Non-conductive safety hat
- [ ] Rope caliper
- [ ] Sheave groove gage
- [ ] Copy of the latest edition of the ANSI/ASME A17.1 Safety Code for Elevators and Escalators.
- [ ] Copy of the latest edition of the ANSI/ASME A17.2 Inspector's Manual for Elevators and Escalators.
- [ ] Copy of the latest edition of the Elevator Industry Field Employees' Safety Handbook.
- [ ] Stop watch
- [ ] 50 ft (15 m) non conductive tape
- [ ] Tachometer, preferably one provided with a 1 ft (305 mm) circumference wheel for measuring speeds, or one that reads directly in feet per minute (meters per second).
- [ ] Meter, to check grounding continuity, correct phasing, and verification of voltages.
- [ ] Spirit level
- [ ] Door test scale (gage) to check closing door force.
- [ ] Suitable test weights
- [ ] Suitable light meter for measuring light level in foot-candles (lux).
- [ ] Pressure gauge, preferably one with a maximum scale of twice the working pressure to be tested.
- [ ] Barricades, ropes

11. **Wheelchair Lift**
    Monthly
    This maintenance task applies to wheelchair lifts, normally found at entrances and in entrance lobbies of various public buildings.

Special Instructions:

- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ Disconnect, tag, and lock out electric circuits serving the unit.
- ☐ Review manufacturer's instructions.

Checkpoints:

- ☐ Thoroughly clean the drive assemblies lift platform, travel area, etc. Remove trash and debris.
- ☐ Inspect structural features, framework, support members, anchor bolts, lift platform, etc., for condition and structural integrity. Tighten any loose bolts or screws.
- ☐ Lubricate screw mechanisms, gears, sprockets and chains, pillow blocks, bearings, etc., as required.
- ☐ Check condition of drive chains or belts and adjust or replace as required.
- ☐ Operate lift through its full range of travel, in both directions, using a load if possible. Note operation of controls, safety devices, leveling, and other devices or features.

Recommended Tools, Materials, and Equipment:

- ☐ Standard tools – Basic
- ☐ Cleaning equipment and materials. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).
- ☐ Lubricants. Consult the MSDS for hazardous ingredients and proper PPE.

G. Kitchen Equipment

1. **Kitchen Equipment, Dish/Tray, and Busing Conveyor**
   Quarterly
   This maintenance task applies to cafeteria kitchen conveyor equipment.

   Special Instructions:

   - ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
   - ☐ If any safety deficiencies are found which could cause injury or damage, notify the cafeteria operator immediately and secure the equipment from further operations.
   - ☐ Review manufacturer's instructions.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock out, and tag electrical circuits.

   Checkpoints:

   - ☐ Operate conveyor and observe movement. Adjust chain if necessary.

- ☐ Lubricate conveyor drive bushings , chain drive, and gear head assembly.
- ☐ Check conveyor belt condition and tension; adjust if necessary.
- ☐ Check operation of safety stop and clutch on conveyor belt motor; adjust cut-off switch mechanism as required.
- ☐ Check with operator, verify cleaning program.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

2. **Kitchen Equipment, Dish/Tray, and Busing Conveyor**
   Semiannual
   This maintenance task applies to cafeteria kitchen conveyor equipment.

   Special Instructions:

   - ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
   - ☐ If any safety deficiencies are found which could cause injury or damage, notify the cafeteria operator immediately and secure the equipment from further operations.
   - ☐ Review manufacturer's instructions.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock out, and tag electrical circuits.

   Checkpoints:

   - ☐ Examine belt rollers, sprockets, slats, tasks, idlers, and limit switch.
   - ☐ Check and clean drain under conveyor and test wash apparatus.
   - ☐ Inspect control panel and all wiring connections.
   - ☐ If variable speed, check for proper feet per minutes (fpm) travel.

   Recommended Tools, Materials, and Equipment:

   - ☐ Standard Tools – Basic

3. **Kitchen Equipment, Dishwashing Machine**
   Quarterly
   This maintenance task applies to electrically and steam operated cafeteria kitchen dishwashing equipment.

   Special Instructions:

   - ☐ Preventive-maintenance services should be performed by a qualified manufacturer's service representative.

- ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
- ☐ If any safety deficiencies are found which could cause injury or damage, notify the cafeteria operator immediately and secure the equipment from further operations.
- ☐ Review manufacturer's instructions.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, lock out, and tag electrical circuits.
- ☐ Follow all instructions of Material Safety Data Sheets for lubricants.

Checkpoints:

- ☐ Check with operator or manager for any deficiencies, verify cleaning program.
- ☐ Check motor and bearings for excessive noise, vibration, and overheating. Clean motor ventilator openings
- ☐ Check operation of wash and rinse spray mechanism for spray coverage and drainage.
- ☐ Inspect soap and spray solution feeder lines; clean as necessary.
- ☐ Inspect water/steam lines and fittings for leaks; tighten fittings as necessary.
- ☐ Check packing glands on wash, rinse, and drain valves; add or replace packing as required. Tighten nuts, bolts, and screws.
- ☐ Check lubricant in gear case; add manufacturer’s recommended oil if required.
- ☐ Inspect splash curtain for tears, clearance, and water tightness; adjust if required.
- ☐ Check proper operation of solenoid valve and float in fill tank; adjust as required. Check and repair insulation as needed.
- ☐ Check proper operation of micro-switch.
- ☐ Clean lime off thermostatic probe and heating elements. Drain booster heater to remove scale from the bottom.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic
- ☐ Manufacturer’s recommended lubricants. Consult the Material Safety Data Sheets (MSDS) for hazardous ingredients and proper personal protective equipment (PPE).

4. **Kitchen Equipment, Dishwashing Machine; Electric**
   Semiannual
   This maintenance task applies to electrically operated cafeteria kitchen dishwashing equipment.

   Special Instructions:

   - ☐ Preventive-maintenance services should be performed by a qualified manufacturer's service representative.
   - ☐ Notify cafeteria operator and get permission prior to performing all maintenance.

- ☐ If any safety deficiencies are found which could cause injury or damage, including proper temperature or chemical requirements, notify the cafeteria operator immediately and secure the equipment from further operations.
- ☐ Review manufacturer's instructions.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, lock out, and tag electrical circuits.

Checkpoints:

- ☐ Check electric insulators, connections. and wiring, including inside access panels and junction boxes, and final connections. Tighten loose connections.
- ☐ Test electrical controls, signal lights, timer, and OFF/ON switches. Test timer and switches
- ☐ Examine all pump suction and discharge connections for leakage, adjust packing nuts as required.
- ☐ Check temperature regulator and adjust or calibrate as required.
- ☐ Check thermostatic control solenoid valve for a minimum of 100° pre-wash, 140° for wash, and 140° or 180°F for final rinse. (Low temperature machines at 140°F).
- ☐ Check doors for operations of chains and counterweights, warping, alignment and water tightness.
- ☐ Replace door gaskets if needed.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

5. **Kitchen Equipment, Fryer**
   Quarterly
   This maintenance task applies to electrically operated or gas fired cafeteria kitchen fryer equipment, including deep fat, counter-top, drop-in, and free standing varieties.

   Special Instructions:

   - ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
   - ☐ If any safety deficiencies are found which could cause injury or damage, including tank leaks, notify the cafeteria operator immediately and secure the equipment from further operations.
   - ☐ Review manufacturer's instructions.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock out, and tag electrical circuits.

   Checkpoints:

- ☐ Check with operating or area personnel for any deficiencies.
- ☐ Examine utility supply line, valve packing, specialties and insulation. Tighten fittings as required.
- ☐ Examine elements, switches, controls, indicating lights, safety switch.
- ☐ Check with operator to verify cleaning program.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

6. **Kitchen Equipment, Fryer**
   Semiannual
   This maintenance task applies to electrically operated or gas fired cafeteria kitchen fryer equipment (including deep fat, counter-top, drop-in, and free standing), and both pressurized broaster and automatic conveyor belt types.

   Special Instructions:

   - ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
   - ☐ If any safety deficiencies are found which could cause injury or damage, including tank leaks, notify the cafeteria operator immediately and secure the equipment from further operations.
   - ☐ Review manufacturer's instructions.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock out, and tag electrical circuits.

   Checkpoints:

   - ☐ Check pilot and flame on gas operated unit; adjust as necessary.
   - ☐ Check thermostat; calibrate if necessary.
   - ☐ Check basket raising mechanism.
   - ☐ Check basket/rack for bends, breaks, or defects; straighten bends or repair as necessary.
   - ☐ Check operation of unit.
   - ☐ Check flue for proper draft or obstructions.
   - ☐ Check nuts, bolts, and screws for tightness; tighten or replace as necessary.
   - ☐ Verify that drop-in units must have flange to counter seal.
   - ☐ Clean interior walls and elements to obtain maximum heat transfer.
   - ☐ Inspect grease compartment.
   - ☐ Lubricate gas valves.

   Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

7. **Kitchen Equipment, Grill**
   Quarterly
   This maintenance task applies to electrically operated or gas fired cafeteria kitchen grill equipment, including counter-top, drop-in, or freestanding varieties.

   Special Instructions:
   - ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
   - ☐ If any safety deficiencies are found which could cause injury or damage, notify the cafeteria operator immediately and secure the equipment from further operations.
   - ☐ Review manufacturer's instructions.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock out, and tag electrical circuits.

   Checkpoints:
   - ☐ Check with operating or area personnel for any deficiencies.
   - ☐ Examine utility supply line, valve packing, specialties and insulation. Tighten fittings as required.
   - ☐ Examine elements, switches, controls, indicating lights, safety switch.
   - ☐ Check with operator to verify cleaning program.

   Recommended Tools, Materials, and Equipment:
   - ☐ Standard Tools – Basic

8. **Kitchen Equipment, Grill**
   Semiannual
   This maintenance task applies to electrically operated or gas fired cafeteria kitchen grill equipment, including counter-top, drop-in, or free standing varieties.

   Special Instructions:
   - ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
   - ☐ If any safety deficiencies are found which could cause injury or damage, notify the cafeteria operator immediately and secure the equipment from further operations.
   - ☐ Review manufacturer's instructions.
   - ☐ Review Procedure for "Controlling Hazardous Energy Sources."
   - ☐ De-energize, lock out, and tag electrical circuits.

Checkpoints:

- ☐ Check nuts, bolts, and screws for tightness; tighten or replace as required.
- ☐ Inspect grease trough, drip tray, splash guard, and surface condition.
- ☐ On gas operated units, check pilot and gas burners for uniform flame; adjust as required.
- ☐ On electrically operated units, check switches, connections, and wiring for proper operation.
- ☐ Check calibration of thermostats; calibrate if required
- ☐ Check flue for proper draft or obstructions.
- ☐ Lubricate gas valves.
- ☐ Check elements to obtain maximum heat transfer.
- ☐ Examine control knobs and indicating lights; adjust/replace as required.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

9. **Kitchen Equipment, Ice Cream and Shake Maker**
Quarterly
This maintenance task applies to cafeteria kitchen ice cream and shake maker equipment.

Special Instructions:

- ☐ Preventive-maintenance services should be performed by a qualified manufacturer's service representative.
- ☐ Review manufacturer's instructions.
- ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
- ☐ If any safety deficiencies are found which could cause injury or damage, notify the cafeteria operator immediately and secure the equipment from further operations.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, lock out, and tag electrical circuits.
- ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency regulations as they apply to protection of stratospheric ozone.
- ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
- ☐ Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
- ☐ Recover, recycle, or reclaim the refrigerant as appropriate.
- ☐ If appliance is disposed of, follow regulations concerning removal of refrigerants and disposal of the appliance.

- ☐ If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- ☐ Refrigerant oils removed for disposal must be analyzed for hazardous waste and handled accordingly.
- ☐ Closely follow all safety procedures described in the Material Safety Data Sheet for the refrigerant and to all labels on refrigerant containers.

Checkpoints:

- ☐ Check with operating or area personnel for any deficiencies; verify cleaning program
- ☐ Verify daily lubrication of bearings beater shaft, drive shaft, and required rings.
- ☐ Check electrical cord, receptacle, inlet plug, ground and off/on switch.
- ☐ Inspect and lubricate casters.
- ☐ Examine noise and vibration.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

10. **Kitchen Equipment, Ice Cream and Shake Maker**
Semiannual
This maintenance task applies to cafeteria kitchen ice cream and shake maker equipment.

Special Instructions:

- ☐ Preventive-maintenance services should be performed by a qualified manufacturer's service representative.
- ☐ Review manufacturer's instructions.
- ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
- ☐ If any safety deficiencies are found which could cause injury or damage, notify the cafeteria operator immediately and secure the equipment from further operations.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, lock out, and tag electrical circuits.
- ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency regulations as they apply to protection of stratospheric ozone.
- ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
- ☐ Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
- ☐ Recover, recycle, or reclaim the refrigerant as appropriate.

- ☐ If appliance is disposed of, follow regulations concerning removal of refrigerants and disposal of the appliance.
- ☐ If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- ☐ Refrigerant oils removed for disposal must be analyzed for hazardous waste and handled accordingly.
- ☐ Closely follow all safety procedures described in the Material Safety Data Sheet for the refrigerant and to all labels on refrigerant containers. Cafeteria operator immediately and secure the equipment from further operations.

Checkpoints:

- ☐ Examine the differential pressure pump. Check the "O" ring seal and replace if defective.
- ☐ Test for proper soft serve ice cream texture.
- ☐ Inspect wash kit faucet (single lever swing spout).
- ☐ Check beater motor, clean and grease assembly.
- ☐ Inspect gear reduce oil level and lubricate fan motor.
- ☐ Examine pulley alignment, belt condition, and belt tension.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

11. **Kitchen Equipment, Ice Maker**
Quarterly
This maintenance task applies to cafeteria kitchen ice makers, including storage and dispenser types.

Special Instructions:

- ☐ Preventive-maintenance services should be performed by a qualified manufacturer's service representative.
- ☐ Review manufacturer's instructions.
- ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
- ☐ If any safety deficiencies are found which could cause injury or damage, notify the cafeteria operator immediately and secure the equipment from further operations.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, lock out, and tag electrical circuits.
- ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency regulations as they apply to protection of stratospheric ozone.

- ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
- ☐ Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
- ☐ Recover, recycle, or reclaim the refrigerant as appropriate.
- ☐ If appliance is disposed of, follow regulations concerning removal of refrigerants and disposal of the appliance.
- ☐ If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- ☐ Refrigerant oils removed for disposal must be analyzed for hazardous waste and handled accordingly.
- ☐ Closely follow all safety procedures described in the Material Safety Data Sheet for the refrigerant and to all labels on refrigerant containers.

Checkpoints:

- ☐ Check with operating or area personnel for any deficiencies; verify cleaning program.
- ☐ Visually check for refrigerant, oil or water leaks. Inspect ice condition.
- ☐ Check and tighten any loose screw-type electrical connections.
- ☐ Check all controls; adjust if necessary.
- ☐ Examine water connection; open and close water valve; test ice dispensing valve and (door) metering adjustment.
- ☐ Check and clear ice machine draining system (drain vent, strainer and trap).
- ☐ Examine condition of bin doors-closure, hinges, gaskets, handles and ease of slide; lubricate as required. Check storage bin condition.
- ☐ Clean motor, compressor, and condenser coil.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

12. **Kitchen Equipment, Ice Maker**
Semiannual
This maintenance task applies to cafeteria kitchen ice makers, including storage and dispenser types.

Special Instructions:

- ☐ These preventive-maintenance services should be performed by a qualified manufacturer's service representative.
- ☐ Review manufacturer's instructions.

- ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
- ☐ If any safety deficiencies are found which could cause injury or damage, notify the cafeteria operator immediately and secure the equipment from further operations.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, lock out, and tag electrical circuits.
- ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency regulations as they apply to protection of stratospheric ozone.
- ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
- ☐ Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
- ☐ Recover, recycle, or reclaim the refrigerant as appropriate.
- ☐ If appliance is disposed of, follow regulations concerning removal of refrigerants and disposal of the appliance.
- ☐ If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- ☐ Refrigerant oils removed for disposal must be analyzed for hazardous waste and handled accordingly.
- ☐ Closely follow all safety procedures described in the Material Safety Data Sheet for the refrigerant and to all labels on refrigerant containers.

Checkpoints:

- ☐ Replace in-line water filter.
- ☐ Lubricate all moving parts, pivot points, and fan motor.
- ☐ Check lubrication of evaporator thrust bearings and chain drive.
- ☐ Disassemble drum assembly, clean and/or replace seals, or examine gear motor auger section, dispenser drive assembly.
- ☐ Replace gear box lubricant with proper oil.
- ☐ Remove supply water screen from strainer and clean.
- ☐ Lubricate water pump and components.
- ☐ Check float valve in makeup tank.
- ☐ Inspect water distribution holes in header.
- ☐ Drain, flush, and clean water contact surfaces of the ice machine.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic.

13. **Kitchen Equipment, Kettle**
Quarterly
This maintenance task applies to cafeteria kitchen kettles, including steam, electric, gas, and tilting (braising pan).

Special Instructions:

- ☐ This preventive-maintenance service should be performed by a qualified manufacturer's service representative.
- ☐ Review manufacturer's instructions.
- ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
- ☐ If any safety deficiencies are found which could cause injury or damage, notify the cafeteria operator immediately and secure the equipment from further operations.

Checkpoints:

- ☐ Check with operating or area personnel for any deficiencies; verify the cleaning program.
- ☐ Examine utility supply line, valve packing, specialties, and insulation.
- ☐ Inspect safety pressure valve.
- ☐ Lubricate tilting gear mechanism and trunnion bearings, if applicable.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

14. **Kitchen Equipment, Kettle**
Semiannual
This maintenance task applies to cafeteria kitchen kettles, including steam, electric, gas, and tilting, (braising pan).

Special Instructions:

- ☐ This preventive maintenance task should be performed by a qualified manufacturer's service representative.
- ☐ Review manufacturer's instructions.
- ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
- ☐ If any safety deficiencies are found which could cause injury or damage, notify the cafeteria operator immediately and secure the equipment from further operations.

Checkpoints:

- ☐ Calibrate thermostats as required.
- ☐ Check and replace leaking packing washers.
- ☐ Examine water supply control and fill valve.

- ☐ Inspect temperature gauge, lid hinge and condition. Lubricate hinge.
- ☐ Test timer, switches, pilot light.
- ☐ Check for adequate steam pressure to unit.
- ☐ Examine condensate trap, thermostatic trap, and regulator.
- ☐ Lubricate valves
- ☐ Tighten all screws in electrical wiring connections, i.e., panels, junction boxes, final connections, etc.
- ☐ Check elements to obtain maximum heat transfer.
- ☐ NOTE: Remaining checks pertain to gas units.
- ☐ Check and clean burner orifices.
- ☐ Clean and adjust pilot lights.
- ☐ Check air shutters to make sure air/gas mixture is correct.
- ☐ Check flue for obstructions and proper draft.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

15. **Kitchen Equipment, Oven**

Quarterly

This maintenance task applies to cafeteria kitchen ovens, including wet/dry steam, charbroiler, convection or baking.

Special Instructions:

- ☐ This preventive-maintenance task should be performed by a qualified manufacturer's service representative.
- ☐ Review manufacturer's instructions.
- ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
- ☐ If any safety deficiencies are found which could cause injury or damage, notify the cafeteria operator immediately and secure the equipment from further operations.

Checkpoints:

- ☐ Check with operating or area personnel for any deficiencies; verify cleaning program.
- ☐ Check all controls, mechanisms for proper operation; adjust as required.
- ☐ Examine utility supply line, piping, valve packing, specialties, and insulation; look for leaks.
- ☐ Check gaskets and seals; check doors for tightness and warping; lubricate hinges and repair as necessary.
- ☐ Check handle, knobs, pilot, and signal.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

16. **Kitchen Equipment, Oven**
Semiannual
This maintenance task applies to cafeteria kitchen ovens, including wet/dry steam, charbroiler, convection or baking.

Special Instructions:

- ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
- ☐ If any safety deficiencies are found which could cause injury or damage, notify the cafeteria operator immediately and secure the equipment from further operations.

Checkpoints:

- ☐ Check and clean fan blades for convection ovens.
- ☐ Check to ensure ovens and oven racks are level.
- ☐ Check the operation of thermostats; calibrate if required
- ☐ Check gas/air mixture on gas
- ☐ Clean and adjust gas burners.
- ☐ Check safety pilot and solenoid.
- ☐ Clean and adjust pilot light.
- ☐ Check flue for proper draft or obstructions.
- ☐ Lubricate gas valves.
- ☐ Tighten all electrical connections in panels, junction boxes, final connections, etc.
- ☐ Clean interior walls and elements to obtain maximum heat transfer.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

17. **Kitchen Equipment, Range**
Quarterly
This maintenance task applies to cafeteria kitchen ranges, including electric, or gas; open burner, hot plate, and griddle top. For oven base, see oven task.

Special Instructions:

- ☐ This preventive-maintenance task should be performed by a qualified manufacturer's service representative.
- ☐ Review manufacturer's instructions.

- ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
- ☐ If any safety deficiencies are found which could cause injury or damage, notify the cafeteria operator immediately and secure the equipment from further operations.

Checkpoints:

- ☐ Check with operating or area personnel for any deficiencies; verify cleaning program.
- ☐ Check electric power line condition, switch, disconnect, etc.; or check condition of gas supply, valves, regulators, and inspect pilot.
- ☐ Examine handles, knobs and controls for tightness and safe condition.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

18. **Kitchen Equipment, Range**

Semiannual

This maintenance task applies to cafeteria kitchen ranges, including electric, or gas; open burner, hot plate, and griddle top. For oven base, see oven task.

Special Instructions:

- ☐ This preventive-maintenance task should be performed by a qualified manufacturer's service representative.
- ☐ Review manufacturer's instructions.
- ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
- ☐ If any safety deficiencies are found which could cause injury or damage, notify the cafeteria operator immediately and secure the equipment from further operations.

Checkpoints:

- ☐ Check operation of thermostats, calibrate as required.
- ☐ Check gas/air mixture.
- ☐ Tighten all screws in electrical wiring connections on panels, junction boxes, final connections, etc.
- ☐ Clean and adjust gas burners.
- ☐ Clean and adjust pilot lights.
- ☐ Check automatic burner lighters and safety controls.
- ☐ Lubricate gas valves.
- ☐ Check for tight fit of oven doors; adjust door hinges, gasket and molding.
- ☐ Check gas pressure regularly to ensure proper combustion.
- ☐ Check flue for proper draft or obstructions.

- ☐ Clean interior walls and elements to obtain maximum heat transfer.
- ☐ Check and clean fan blades for convection ovens.
- ☐ Check electric power line condition (switch, disconnect, etc) or check condition of gas supply, valves, regulators, and inspect pilot adjustment.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

19. **Kitchen Equipment, Refrigerators/Freezers (Walk-In Units)**
Quarterly
This maintenance task applies to cafeteria kitchen refrigerators/freezers (walk-in units).

Special Instructions:

- ☐ This preventive-maintenance task should be performed by a qualified manufacturer's service representative.
- ☐ Review manufacturer's instructions.
- ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
- ☐ If any safety deficiencies are found which could cause injury or damage, notify the cafeteria operator immediately and secure the equipment from further operations.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, lock out, and tag electrical circuits.
- ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency regulations as they apply to protection of stratospheric ozone.
- ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
- ☐ Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
- ☐ Recover, recycle, or reclaim the refrigerant as appropriate.
- ☐ If appliance is disposed of, follow regulations concerning removal of refrigerants and disposal of the appliance.
- ☐ If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- ☐ Refrigerant oils removed for disposal must be analyzed for hazardous waste and handled accordingly.
- ☐ Closely follow all safety procedures described in the Material Safety Data Sheet for the refrigerant and to all labels on refrigerant containers.

Checkpoints:

- ☐ Check with operating or area personnel for any deficiencies; verify cleaning program.
- ☐ Verify indicator light on; check compartment temperature.
- ☐ Examine handles, hinges and tightness of door closure.
- ☐ Inspect door gaskets for damage and proper fit; adjust gaskets as required and lubricate hinges with food grade oil.
- ☐ Verify defrost cycle and timer operation.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic

20. **Kitchen Equipment, Refrigerators/Freezers (Walk-In Units)**
Semiannual
This maintenance task applies to cafeteria kitchen refrigerators/freezers (walk-in units).

Special Instructions:

- ☐ This preventive-maintenance task should be performed by a qualified manufacturer's service representative.
- ☐ Review manufacturer's instructions.
- ☐ Notify cafeteria operator and get permission prior to performing all maintenance.
- ☐ If any safety deficiencies are found which could cause injury or damage, notify the cafeteria operator immediately and secure the equipment from further operations.
- ☐ Review Procedure for "Controlling Hazardous Energy Sources."
- ☐ De-energize, lock out, and tag electrical circuits.
- ☐ Comply with the latest provisions of the Clean Air Act and Environmental Protection Agency regulations as they apply to protection of stratospheric ozone.
- ☐ No intentional venting of refrigerants is permitted. During the servicing, maintenance, and repair of refrigeration equipment, the refrigerant must be recovered.
- ☐ Whenever refrigerant is added or removed from equipment, record the quantities on the appropriate forms.
- ☐ Recover, recycle, or reclaim the refrigerant as appropriate.
- ☐ If appliance is disposed of, follow regulations concerning removal of refrigerants and disposal of the appliance.
- ☐ If materials containing refrigerants are discarded, comply with EPA regulations as applicable.
- ☐ Refrigerant oils removed for disposal must be analyzed for hazardous waste and handled accordingly.

- ☐ Closely follow all safety procedures described in the Material Safety Data Sheet for the refrigerant and to all labels on refrigerant containers.

Checkpoints:

- ☐ Clean fan, condenser fins/plates/blower coils, and intake screens; lubricate motor.
- ☐ Check starter panels and controls for proper operation, burned or loose contacts, and loose connections.
- ☐ Clean coils, evaporator drain pan, blowers, fans, motors, and drain piping as required; lubricate motor(s).
- ☐ During operation of unit, check refrigerant pressures and compressor oil level, add refrigerant and oil as required.
- ☐ Inspect defrost systems for proper operation, including timer; adjust as required. Have automatic defrosters adjusted as required so freezer will defrost during "Off Peak" hours
- ☐ Check operation of thermostats; calibrated as required.
- ☐ Inspect and service all electric motors.

Recommended Tools, Materials, and Equipment:

- ☐ Standard Tools – Basic