OPERATIONS

&

INSPECTION MANUAL

FOR

BUILDING COMPONENTS

AND

OTHER STRUCTURES

MILWAUKEE COUNTY DPARTMENT OF TRANSPORTATION & PUBLIC WORKS

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ARCHITECTURAL AND STRUCTURAL CHECKLIST

The visual inspection is usually performed from the ground level; however, binoculars or a ladder may be used to get a close look at certain troubled areas. An awl or other pointed tool may be used if probing is required to determine the solidity. A camera may be utilized to record a visual portrayal of deficiencies. A tape measure is used to estimate areas or quantities of identified work. Levels and plumb bobs are used to evaluate plumbness and movement.

For each deficiency identified during inspection, provide the following information:

A. What action is needed: Repair, replace, paint, clean, etc.

B. Condition: Deteriorated, damaged, leaking, aged, inoperative, etc.

C. What item or items require action: Equipment, material type, surface type, etc.

D. Where: North, east, etc. side of room, building, room number, 1st, 2nd, 3rd floor, etc.

E. Quantity: i.e., linear feet, square feet, square yards, etc.

F. When action should be taken: 0 year, 1 year, 2 years, 3 years, etc.

G. Photograph of condition

Safety: Comply with all current safety precautions during all phases of the inspection.

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INTRODUCTION / USE OF THIS MANUAL

This operations & inspection manual is intended to assist Milwaukee County staff or their designee responsible for operating and maintaining buildings and other structures owned by Milwaukee County. The information provided within this manual should be used to guide the responsible individuals in performing annual and routine maintenance activities and inspections.

Included within this manual are a number of checklists that should be used by the Building Operators when performing these inspections. One document within the manual that Building Operators should become familiar with is the “PROPERTY ASSESSMENT INSPECTION CHECKLIST”.

In January of each year, all Building Operators will be required to submit to the Director of Transportation and Public Works a copy of this checklist completed for each appropriate building and/or structure for which they are responsible. A listing of those buildings will be established with and for each Building Operator.

BUILDINGS' PRIMARY COMPONENTS

1. FOUNDATION SYSTEMS

1.1 FOUNDATION SYSTEMS – Concrete

1. Concrete: spalling, broken areas; cracks; leaks and dampness; exposed reinforcing; out-of-plumb; differential settlement or frost heave indicated by cracks in foundation or walls above, binding of doors and windows, and/or separation of wall or slab from footing or foundation wall.
2. Termites: termite tubes on or penetrating concrete foundation; form boards, scrapwood, or other cellulose material under buildings and/or near foundation, or structural wood.
3. Drainage: Improper surface grading around structure or trash, debris, or other accumulations resulting in water pending or surface runoffs draining back towards building.

1.2 FOUNDATION SYSTEMS - Masonry

1. Masonry: eroded or sandy mortar joints; mortar cracking and pulling away from brick or block; soft brick or spalling brick or block; cracked brick or block units; leaks and dampness; out-of-plumb; differential settlement or frost heave indicated by cracks in foundation or walls above, binding of doors and windows, and/or separation of wall or slab from footing or foundation wall.

1.3 FOUNDATION SYSTEMS - Timber

1. Timber: warping; checking; splitting; bowing; sagging; or broken members; deflection, rotting, fungus growth; evidence of dampness of long duration; damage or possible damage to wooden parts due to closeness (within 8 inches) or direct contact with soil; loose, damaged, corroded, or missing bolts, split rings, other connections.

1.4 FOUNDATION SYSTEMS – Vent Screen

1. Vent Screens: binding, jamming, and poor fit of frames; loose, broken, or missing hardware or connections; metal parts for rust, corrosion, and holes or rotting fabric; wooden parts for rotting and other damage; clogged, blocked, or covered vent openings or inadequacy of ventilated area resulting in under floor condensation.
2. Standard guides for ventilation requirements are as follows:
   a. Buildings of 5,000 sq. ft. area or less: 2 sq. ft. per 100 linear ft. of building perimeter plus 1/3 of 1% of total crawl space ground area
   b. Buildings of more than 5,000 sq. ft. are: 2 sq. ft. per 100 linear ft. of building perimeter plus 1/4 of 1% of total crawl space ground area.
   c. Interior foundation walls: 1 sq. ft. per 25 linear ft. of foundation, with cross ventilation for all spaces.

2. EXTERIOR FAÇADE SYSTEMS

2.1 EXTERIOR FAÇADE SYSTEMS – All Types

1. Inspect all members and areas including general field of wall, joints, flashings, corners, window sills, coping, connections, elevated platforms, miscellaneous appendages and fixtures.
2. Building elements out of plumb, leaning, bulging.

3. Cracks or joints that have moved; other signs of movement.
4. Sealants:
    a. deteriorated, alligatored, damaged, missing, torn, loss of adhesion, signs of movement
    b. at walls, roofs, siding, coping, windows, base of wall, door systems, penetrations
5. Soffits: damaged, missing, loose, deteriorated, vents.
6. Loose elements: trim at windows, flashings, coping, bird strips, lights, fixtures attached to walls, miscellaneous items.
7. Blocked or missing roof drains, gutters, scuppers.
8. Alteration to building: extended door openings, buried elements.
9. Miscellaneous damage: deterioration due to deicing salts, damage due to collision or impact, graffiti.
10. Termite tubes to wood surfaces.

2.2 EXTERIOR FAÇADE SYSTEMS – Concrete and Precast Concrete

1. Concrete surfaces and elements: cracks, spalling, delamination, pop-outs, exposed reinforcing steel, corrosion of reinforcing steel, rust staining.
2. Precast Concrete Connections: deterioration, corrosion, deformation, movement, cracks, spalling.

2.3 EXTERIOR FAÇADE SYSTEMS – Masonry (Brick, Stone, and Concrete Block)

1. Masonry surfaces and elements: cracks, spalling, mortar joint deterioration, exposed reinforcing steel, corrosion of reinforcing steel, rust staining, bulges in plane of wall, separation of wythes, mold.
2. Mortar Joints: deteriorated, worn, eroded, sandy, stained, efflorescence, cracked, open joints, cementitious patches, sealant in mortar joint.
3. Masonry Units: cracked, spalled, chipped, missing, stained, efflorescence, eroded or soft face, shifted unit(s).
4. Control Joints: cracked or spalled units adjacent to joint, sealant condition, missing sealant, bulging sealant.
5. Steel Lintels: corrosion, rust pack, damage to joints above lintel, sagging steel, damaged through-wall flashing.

2.4 EXTERIOR FAÇADE SYSTEMS – Metal

1. Metal Surfaces and Elements: corrosion, loose pieces, scars, dents, puncture, sagging, buckling, failure of base material, breaks in protective coatings.
2. Fasteners: corrosion, loose, missing, replaced with inappropriate fastener.
3. Look for dissimilar metals in contact.

2.5 EXTERIOR FAÇADE SYSTEMS – Wood

1. Wood Surfaces and Elements: Deterioration, rot, warping, swelling, loose pieces, surface cracking, checking, loose or missing knots, fungus, termites, insects, staining, sagging, failure of base material.
2. Fasteners: corrosion, loose, missing, replaced with inappropriate fastener.
3. Look for proximity to soil, holes, water sources and concrete, poor ventilation.
4. Weatherstripping: lack of weathertightness around framed openings, dissimilar surfaces, between joints.

2.6 EXTERIOR FAÇADE SYSTEMS – Stucco

1. Base Material: see appropriate section.

2. Stucco: cracks, rust staining, water staining, disintegration, alligator cracks, bulges, broken areas.
3. Lack of Weathertightness at: windows, door systems, other openings, sills, dissimilar materials, between joints.
4. Paint: alligatoring, blistering, scaling, peeling, wrinkling, fading, chalking, mildew, bleeding, stains, failure of bond.

2.7 EXTERIOR FAÇADE SYSTEMS – Cement-Asbestos

1. Base Material: see appropriate section.
2. Cement-Asbestos: stains, loose fastenings, broken sheets.

2.8 EXTERIOR FAÇADE SYSTEMS – Asbestos Shingles

1. Base Material: see appropriate section.
2. Asbestos Shingles: cracked, missing shingles, deteriorated areas.

2.9 EXTERIOR FAÇADE SYSTEMS – Aluminum or Vinyl Siding

1. Base Material: see appropriate section.
2. Siding: missing or loose pieces or trim, open joints, broken pieces, staining.

3. PAINTED SURFACES - ALL (Interior and Exterior)

3.1 PAINTED SURFACES - ALL (Interior and Exterior)

1. SCOPE: All Painted Surfaces
2. Painting: alligatoring; checking; blistering; crawling; cracking; scaling; peeling; wrinkling; flaking; fading; loss of gloss; excessive chalking; mildew; bleeding; staining caused by insect screens or splashing; discoloration; complete absence of paint. Paint film is less than 3 mils in thickness on metal surfaces. (Note: Painting of concrete is not recommended unless required for sealing.)

4. FLOOR SYSTEMS

4.1 FLOOR SYSTEMS - Wood

1. All Floors-General: inadequacy of floor load postings or lack of conformance by occupant to posted loadings; lack of rigidity of supporting beams or other structural supports and need for immediate correction; loose, splintered, missing, or other damage to supports.
2. Wood: sagging, wear, splintered, loose, warped, scratched, shrinkage cracks, rotted, stains, discolorations, moisture penetration, indentations; absence of protective coatings; evidence of insect infestation in finish and subflooring indicated by presence of sawdust, wood pellets, or small round emergence holes, check damp areas of long duration for infestation and fungus growth.
3. Strip and Plank: sagging, wear, splintered, loose, warped, scratched, shrinkage cracks, rotted, stains, discolorations, moisture penetration, indentations.
4. End-Grain Block: loose, missing, rotted or otherwise damaged individual blocks that form uneven surfaces.
5. All Finished Flooring: overloading; absence of protective coatings, evidence of insect infestation in finish and subflooring indicated by presence of sawdust, wood pellets, or small round emergence holes, check damp areas of long duration for infestation and fungus growth.

4.2 FLOOR SYSTEMS - Concrete

1. Concrete: wear, pitting, roughness discolorations, stains, settlement, spalling, shrinkage cracks, particularly where placed over wood framing; absence of treatment or waxing that would prevent surface dusting; cracked, chipped, or damage caused by settlement.

4.3 FLOOR SYSTEM - Mastic

1. Mastic: wear, depressions indentations, other damage resulting in uneven surfaces; absence of wax protective coatings.

4.4 FLOOR SYSTEM - Terrazzo

1. Terrazzo: wear, pitting, roughness, discolorations, settlement cracks.

4.5 FLOOR SYSTEM - Magnesite

1. Magnesite (magnesium oxychloride): wear, chipping, roughening; delamination; settlement cracks; failure due to inadequate minimum thickness (5/8"); and damage from exposure to moisture.

4.6 FLOOR SYSTEM - Clay and Quarry Tile/Brick

1. Clay and Quarry Tile: brick: sandy, eroded or cracked mortar joints; individually stained, or broken, chipped, or loose, resulting in uneven surfaces.

4.7 FLOOR SYSTEM - Metal

1. Metal: wear, rusted, corroded, loose, bent, or other damage to surfaces and structural supports; broken welds and loose, missing or damaged bolts, nuts, rivets, and screws.

4.8 FLOOR SYSTEM - Conductive

1. Test resistance of conductive floors in hospital operating suites in accordance with Recommended Safe Practice for Hospital Operating Rooms, National Fire Protection Association Bulletin.

5. ROOF SYSTEMS

5.1 ROOF SYSTEMS

1. Safety: Do not walk directly on wood shingles, clay tile, slate, cement-asbestos, asphalt roll, or asphalt shingle roofs. Use ladders or cleated boards to distribute your weight.
2. Where possible, without damaging roof covering, use screwdriver to probe under edge of roof covering at overhang to check for rotted decking or dampness.
3. Wall, Vent, Valley, and Edge Flashings: open joints, loose, proper fastenings, and other damage.

5.2 ROOF SYSTEMS - Wood Shingles

1. Wood Shingles: weathering, warped, broken, loose, split, curling, missing, flashing failures.

5.3 ROOF SYSTEM - Clay Tile

1. Clay Tile: weathering, broken, missing, cracked, loose, flashing failures, deterioration of expansion joint material or tile raising from improper placing or inadequate expansion joints.

5.4 ROOF SYSTEM - Slate

1. Slate: weathering, broken, cracked, loose, missing, flashing failures.

5.5 ROOF SYSTEM - Aluminum/Iron/Steel/Copper

1. Metal: holes, looseness, punctures, broken seams, inadequate side and end laps, joint connections, inadequate expansion joints, rust or corrosion, and damage resulting from contact of dissimilar metals.

5.6 ROOF SYSTEM - Cement-Asbestos

1. Cement-Asbestos: wear from weathering, broken, cracked, loose, missing, insufficient side or end lap.

5.7 ROOF SYSTEM - Asphalt Roll

1. Asphalt Roll: weathering, cracking, alligatoring, buckling, blistering, insufficient or uncemented laps, tearing from nails too close to edge, other damage to coatings, roof debris.

5.8 ROOF SYSTEM - Asphalt Shingles

1. Asphalt Shingle: weathering, lifting, cracking, curling, missing, buckling, blistering, loss of granules, excessive exposure.

5.9 ROOF SYSTEMS - Built-Up

1. Built-Up: cracking, alligatoring, low spots and water ponding; failure or lack of gravel stops; cracks in membrane; exposed bituminous coating; disintegrated, blistered, curled, or buckled felts.
2. Fastenings: improper materials, loose, missing, broken, defective, exposure.
3. Metal Base Flashings: rust, open vertical joints, loose flanges, inadequate or exposed nailing, improper fastening, improper sealing with felt strips, deteriorated or missing cant strip.
4. Other Base Flashings: sagging, deteriorating, separation, adequate coverage or embedment, vertical joints, proper fastening, buckling, cracking, surface coat, cant strip.
5. Metal Cap Flashings: rust, corrosion, open joints, loose, improper fastenings.
6. Pitch Pockets/Pans: replenishment of pitch.
7. Roof Surface and Drains: trash and debris, missing strainer.
8. Other Cap Flashings: open joints, buckling, cracking; surface coat disintegration; improper fastenings.
9. Parapet Walls and Copings: cracks, spalling, defective joints and other damage.
10. Exposed Metal Surfaces: need for rust removal and painting or protective coating.

5.10 ROOF SYSTEM - Asbestos Shingles

1. For wear from: weathering, broken, cracked, loose, missing, sufficient side or end lap.

5.11 ROOF SYSTEM - Single-Ply Membrane (Elastomeric)

1. Membrane Surface: deterioration, cracking, splitting, and cuts.
2. Side and End Lap Seams: separation and failure.
3. Loss or shifting of stone cover on ballasted roof system.
4. Roof Edge Flashing: pulled loose or missing.
5. Adhered Membrane System: separated from fasteners.

5.12 ROOF SYSTEM - Concrete Slabs

1. Concrete Slabs: cracks, spalling, exposed or corroded reinforcing, rust staining, expansion joint deterioration, low spots, improper drainage.

5.13 ROOF SYSTEM - Hatches/Smoke Hatches/Skylights

1. Condition: splitting, cracking, improperly installed, weathertightness, roof pavers.
2. Hardware: rusting and inoperative.

5.14 ROOF SYSTEM - Gutters and Downspouts

1. Gutters and Downspouts: misalignment, rust, corrosion, wrong slope, material accumulations and clogging, breaks, leaks, missing wire guards, loose or missing hangars or other fastenings.
2. Failure to connect downspouts to available storm sewers, or terminate on properly installed splash blocks.

6. OTHER COMPONENTS

6.1 OTHER COMPONENTS - Parapet Walls

1. Parapet Walls: loose coping stones; eroded or sandy mortar joints; expansion cracks; defective cap flashings, out-of-plumb, efflorescence or staining.
2. Weathertightness: lack of weathertightness, where butting dissimilar surfaces, between joints.

6.2 OTHER COMPONENTS - Roof Framing

1. Roof Rafters, Joists, and Sheathing: checks, splits, broken members, open joints, loose boards, sag of members, displacement of joints, insect damage, moisture staining or damage.

6.3 OTHER COMPONENTS - Trusses

1. SCOPE: All types of building trusses that are normally designed for the express purpose of supporting roof loads as well as ceilings where applicable. All lateral and vertical bracing and ties between trusses are included.
2. Truss Sag: Examine trusses for sagging. (Truss Member Identification: Use a sketch of the truss and label the panel points either numerically or alphabetically)

6.3.1 OTHER COMPONENTS - Trusses-Timber

1. Timber
   a. From ground: broken members or connections, cut or removed members, twisted and bowed members; excessive number and size of knots; slope of grain over one inch in ten; checks and splits in ends of web members; separation or slippage at joints; sag; overloading.
   b. From Truss: loose bolts, split rings, shear plates, and fastening devices; checks and splits in bracing, chord members, splice plates (scabs), web members and filler blocks; missing filler blocks; looseness of tie rods.
   c. Steel Splice Plates: rupture, shearing, crushing, rust.
2. Dry Rot, Termites and other Infestation
   a. Wooden Parts: dampness and surface moisture of long duration; termite and other insect, and fungus infestation. Termite and fungus infestations are often detected prior to actual visual damage by probing with a sharp-pointed instrument those areas where prolonged dampness is not directly associated with rainfall or damp climate.

b. Wooden Supports near or at Ground Level: termite tubes or tunnels; dirt piled up to wood level; staining.
c. Painted Surfaces: blistering, checking, cracking, scaling, wrinkling, flaking, mildew, bleeding, rust, corrosion; complete absence of paint, particularly at ends of members; compatibility with primer.

6.3.2 OTHER COMPONENTS - Trusses-Steel

1. SCOPE: All types of building trusses that are normally designed for the express purpose of supporting roof loads as well as ceilings where applicable. All lateral and vertical bracing and ties between trusses are included.
2. From Ground: twisted, bowed, deformed, broken members.
3. From Truss: loose or missing bolts, rivets, defective welds, corrosion of members or connections.
4. From Truss: rupture, shearing, or crushing of steel plates, members, bolts, and rivets.

6.4 OTHER COMPONENTS - Chimneys and Stacks

1. SCOPE: Chimneys and stacks made of brick, reinforced concrete, and steel; foundations for chimneys and accessories.
2. Foundations: settlement; cracks due to heat, shocks, vibrations.
3. Brick and Concrete Walls: weathering; cracking; spalling; eroded or sandy mortar joints; expansion and contraction cracks; damage from gases; out-of-plumb.
4. Caps: weathering; cracking; spalling; loose material.
5. Exposed Metal Surfaces: rust, corrosion, and deteriorated paint; broken, loose or missing, other damage to bolts, rivets, and welds.
6. Linings, Supporting Corbels, and Baffles: cracks, missing, spalling; damage from gases.
7. Guys, Anchorage, and Bands: lack of tautness; rust; corrosion; frayed, broken, loose, missing, mechanically damaged anchorage.
8. Ladders: conforming to OSHA requirements, rust; corrosion, paint scaling; poor anchorage; broken, loose, or missing ladder rungs.
9. Openings for Cleanout Doors, Breechings and Flues: cracking or spalling of the masonry surfaces; metal frames for distortion, rust, corrosion; broken, loose, missing, other damage to bolts, rivets, and welds.
10. Cleanout Doors and Fastenings: distortion; rust; corrosion; wear; broken; cracked; missing parts; other damage.
11. Spark Arrester Screens: clogged with fly ash; rust, tears, and other damage; bolts and screws for rust, corrosion, loose, broken, or missing parts.

6.5 OTHER COMPONENTS - Fire Escapes

1. Treads: wear, splintered, split, cracked, chipped, loose, broken, sagging, rotted, or damaged to supporting structure.
2. Handrailings/Guardrailings and supports: lack of rigidity of supporting members, loose, splintered, missing, or other damage to handrails, and supports, absence of protective coatings. For metal railings, check for rust, loose, bent, or other damage to surfaces and structural supports, broken welds and loose, missing or damaged bolts, nuts, rivets and screws.

6.6 OTHER COMPONENTS - Walkways and Patios

1. Expansion joints: sufficient joint filler, proper bonding of filler, and for foreign material in joints.

2. Rigid pavements: spalling, cracks, depressions, scaling, buckling, and damage.
3. Flexible walkways: raveling, bleeding, depressions, and damage.
4. Brick and stone: depressions, loose or missing parts, and grout or bedding failure.

6.7 OTHER COMPONENTS - Pedestrian Bridges

1. Approach Fill: settlement, particularly at a joint between fill and structure.
2. Fences, Barricades, and Railings at Approaches: inadequacy or structural damage.
3. Concrete Foundations: cracks, scaling, disintegration, exposed reinforcing, wood piling and pads; missing, broken, ineffective bearing, decay, termite and other pest infestation.
4. Wood Flooring: loose, missing, broken, decayed, rotted pieces; protruding nails and other fastenings; checkered wearing plates; loose.
5. Timber Framing: loose, missing, twisted, bowed, warped, split, cracked, checked, unsound members; deteriorated joints; rot, termite and other insect infestation; loose, missing, corroded fasteners.
6. Steel Framing: rust, corrosion, deterioration, missing, bowed, bent, misalignment, broken members; evidence of buckling in web stiffeners; loose, missing, corroded fasteners.
7. Concrete and Masonry Structures: weathering, cracks, spalling, exposed reinforcing; open, eroded, and sandy mortar joints; broken and missing stones; cavities and other deterioration of the stones.
8. Expansion Joints: improper sealing; tearing; loose or missing filler; adequate space for thermal movement; excessive opening of joint; trash or debris in joint, evidence of loose anchorages; cracking or breaking of welds.
9. Handrails/Guardrails: cracking, rust, corrosion, loose, missing, broken, misalignment of metal; decay, rust on bottom side of hollow metal railings.
10. Painted Surfaces: rust, corrosion, cracking, scaling, peeling, wrinkling, alligatoring, chalking, fading, complete loss of paint, compatibility with primer.
11. Sidewalks: cracking, scaling, potholing, spalling or other deterioration of concrete; proper drainage, heaving.

6.8 FURNITURE (Built-In/Anchored in Place)

1. SCOPE: Metal, wood, and upholstered furniture, including bookcases, cabinets, cupboards, desks, dressers, and wardrobes, seating.
2. Finish of Top, Fronts, and Sides: dents, scratches, cuts, gouges, blisters, splits, splintered edges; separation of moldings or veneer at edges; loose fasteners; sharp or rough corners, edges and exposed parts; burns, heat marks, glass rings, warping, stains, absence of finish.
3. Mortise and Tenon Joints: loose screws, dowels, dovetail.
4. Broken Welded Joints: loose or missing screws, nuts, and lock washers.
5. Rails and Frames: rough or splintered edge grain, splitting or checking.
6. Adjustable Seats and Backs: swivel, loose, broken, or other damage to mechanism; badly dented or fractured parts.
7. Seat or Back Springs: sag, broken webbing, torn fabric or finishing cloth; bulges, holes, or tears in raised springs that have broken loose from twine.
8. Coverings: wear; lack of cleanliness; stains, fading, tears; loose face yams; thread breaks at seats; separation of welts from cover; missing finishing tacks; loose finishing gimp.
9. Upholstery: separation of seams, broken fox or roll edging.
10. Arms: threadbare wear or tears, loose gimp tacks, loose upholstered panel on arm front, loose arms.

11. Lacings: broken or frayed.
12. Wood or Upholstered Areas: evidence of insect damage.
13. Doors and Drawers: binding, misalignment of hinges, loose pulls, cracked or chipped glass, missing rubber bumpers. Check door slide operation.
14. Shelves: warping and sagging, split or loose cleats and face moldings.
15. Key Operated Drawers: defective operation of lock and locking devices.
16. Linoleum and Plastic Tops: cuts, gouges, stains, adhesive failure.
17. Wardrobes: loose or missing hooks, bent clothes poles, sprung or warped doors, defective locks, misalignment of hinges, shelves for rough edges, overloading, twisting, support failure.

6.9 OTHER COMPONENTS - Weight Handling Equipment

1. Rails and Supporting Structures: roughness; cracks in head; gaps between joints; damage to joints; corrosion; general deterioration; spalling; bending; weathering.

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BUILDINGS' SECONDARY COMPONENTS

7. CEILING SYSTEMS – Interior

7.1 CEILING SYSTEMS - Interior

1. Wood: checking, cracking; splintered; broken; warping; sagging; support failure; rot termite or other insect, or fungus infestation; abrasion; scuff marks; mechanical damage; personal abuse.
2. Soft fiberboard (acoustical and insulation): open joints; buckling; sagging; support failure; loose; missing; failure of fastenings or adhesive; abrasions; breaks; holes; stains from weather or utility leaks.
3. Wallboard, Plasterboard, Hard Pressed Fiberboard, and Cement-Asbestos Board: open joints; cracking; buckling; sagging; support failure; loose; failure of nailing or adhesive; abrasions; breaks; holes; discoloration from weather or utility leaks.
4. Plaster: cracking, buckling, sagging, support failure; spalling, crumbling, or falling from moisture absorption; efflorescence, peeling, or flaking from moisture or sealer failure; discoloration from weather or utility leaks.
5. Ceramic Tile: chipped, cracked, loose, missing, holes, defective mortar joints; etched, pitted or dull surfaces caused by use of acidulous or abrasive cleaners.
6. Metal: corrosion, rust, abrasions, indentations, punctures, deterioration of protective coating.

8. FLOOR COVERING

8.1 FLOOR COVERING

1. All floor coverings: loose, damaged, or missing bases, binding strips, or thresholds; projecting nails, bolts, or screws; slippery surfaces from oil or water spillage; inadequate exposure of abrasive necessary for nonslip finish surfaces.
2. Carpets and rugs: wear, tear, cuts, raveling, discolorations, fading; binding or anchoring strips for wear, damage, poor anchorage; worn or missing tractive substance on backing of small rugs or carpets where placed over polished floor; beetle or moth damage.
3. Resilient floor coverings (linoleum, vinyl plastic, vinyl asbestos, cork, rubber, and asphalt tiles): wear, cracking, shipping, breaking, scratches, tears, indentations; lack of bonding and unevenness underlayment; evidence of damage resulting from use of solvents or excessive use of water for cleaning; absence of protective wax coatings.

9. WALL AND PARTITION SYSTEM

9.1 WALL AND PARTITION SYSTEM - Interior

1. Wood: checking, cracking; splintered; broken; warping; sagging; support failure; rot; termite or other insect, or fungus infestation; abrasion; scuff marks; mechanical damage; personal abuse.
2. Soft fiberboard (acoustical and insulation): open joints; buckling; sagging; support failure; loose; missing; failure of fastenings or adhesive; abrasions; breaks; holes.
3. Wallboard, Plasterboard, Hard Pressed Fiberboard, and Cement-Asbestos Board: open joints; cracking; buckling; sagging; support failure; loose; failure of nailing or adhesive; abrasions; breaks; holes; discoloration from weather or utility leaks.
4. Plaster: cracking, buckling, sagging, support failure; spalling, crumbling, or falling

from moisture absorption; efflorescence, peeling, or flaking from moisture or sealer failure; discoloration from weather or utility leaks.

5. Ceramic Tile: chipped, cracked, loose, missing, holes, defective mortar joints; etched, pitted or dull surfaces caused by use of acidic or abrasive cleaners.
6. Metal: corrosion, rust abrasions, indentations, punctures, deterioration of protective coating.

9.2 WALL AND PARTITION SYSTEM – Cover (Interior)

1. Resilient Coverings (linoleum, vinyl plastic): curling, loose, adhesive failure, abrasions, indentations, punctures, tears; etched, pitted, or dull surfaces caused by use of acidulous or abrasive cleaner.
2. Canvas and Paper: breaks, wrinkling, fading, adhesive failure.
3. Evidence of mechanical damage or personal abuse.

10. STAIRWAYS (Includes Railings) – Interior and Exterior

10.1 STAIRWAYS (Includes Railings) Interior and Exterior

1. Risers and treads for: wear, splintered, split, cracked, chipped, loose, broken, sagging, rotted, or damaged to supporting structure, or damage caused by settlement.
2. Finished treads: absence of protective coatings, evidence of insect infestation in finish and supporting members, inadequate exposure of abrasive necessary for nonslip finish surfaces; loose, missing, broken, or other damage to abrasive stair nosings or treads, loose, missing, broken, or other damage to abrasive stair nosings or treads, lack of nonslip finish or other types of stair covering.
3. Handrailing and supports for: lack of rigidity of supporting members, loose, splintered, missing, or other damage to handrails, lattices, and supports, absence of protective coatings. For metal railings, check for: rust, loose, bent, or other damage to surfaces and structural supports, broken welds and loose, missing or damaged bolts, nuts, rivets and screws.
4. Steel: wear, rusted, loose, bent, or other damage to surfaces, risers, treads, and structural supports.

11. WINDOW SYSTEMS (Wood and Metal)

11.1 WINDOW SYSTEMS (Wood and Metal) - Exterior

1. Wood sash, frame, casing and trim: splitting, rotting, cracking, loose, poor fit, binding, missing, scratches, indentations, mechanical damage, personal abuse, loose or missing caulking, lack of weathertightness.
2. Metal sash and trim: rust, corrosion, warping, binding, poor fit, nonweathertightness.
3. Screens: loose, broken, or missing hardware; binding, jamming, poor fit of frames; metal parts for rust, corrosion, holes in fabric; wooden parts for rotting, stain, other damage.
4. Shutters: splitting, rotting, cracking, loose, missing, misalignment, and freedom of swing, or little or no free motion as required.
5. Hardware: loose, missing, broken parts; binding, misalignment, improper installation or adjustment, lack of lubrication; corrosion, abrasion, loss of finish coating.
6. Glass: missing or broken panes, disintegration of putty.
7. Storm Sash: binding, jamming, poor fit of frames; metal parts for rust and corrosion; wood parts for rotting and other damage.

11.2 WINDOW SYSTEMS (Wood and Metal) - Interior

1. Wood sash, frame, casing and trim: splitting, rotting, cracking, loose, poor fit, binding, missing, loose or missing caulking, lack of weathertightness.
2. Metal sash and trim or metal storm sash: rust, corrosion, warping, binding, poor fit, nonweathertightness.
3. Hardware: loose, missing, broken parts; binding, misalignment, improper installation or adjustment, lack of lubrication; corrosion, abrasion, loss of finish coating
4. Glass: missing or broken panes, disintegration of putty.
5. Trim: looseness, scratches, indentations mechanical damage, personal abuse.
6. Venetian Blinds, Window Shades: insecure or broken fasteners; poor operation; frayed or broken cords or tapes; broken or damaged slats; worn or torn material.

12. DOOR SYSTEMS (Wood and Metal) – Interior and Exterior

12.1 DOOR SYSTEMS (Wood and Metal) - Interior and Exterior

1. Wood and Trim: splitting, rotting, cracking, loose, poor fit, binding, missing, loose or missing caulking, lack of weathertightness.
2. Metal Doors: rust, corrosion, warping, binding, poor fit, nonweathertightness.
3. Hardware: loose, missing, broken parts; binding, misalignment, improper installation or adjustment, lack of lubrication; corrosion, abrasion, loss of finish coating.
4. Glass: missing or broken panes, disintegration of putty.
5. Trim: looseness, scratches, indentations mechanical damage, personal abuse.

OTHER STRUCTURES

13. SWIMMING POOLS

13.1 SWIMMING POOLS

1. SCOPE: Swimming pools, wading pools, and accessories, such as spring boards or diving towers. Note: Water circulation and purification equipment, shower and bathhouses, enclosing buildings, locker rooms, and flood lights are covered by other Inspection Guides.
2. Concrete: cracks, breaks, spalling; exposed reinforcing; settlement.
3. Tile: chipped, cracked, loose, and missing pieces; mortar joints sandy.
4. Expansion joints: leakage and damage.
5. Wall and floor finishes: roughness and dirty.
6. Depth markers and lane strips: legibility, meet latest code requirements.
7. Springboards: cracks, breaks, splintering and other damage; loose or missing fastenings; absence of non-slip coverings.
8. Ladders: rust or corrosion of metal parts; loose, missing, broken, rot or other damage to wooden parts; alignment of towers.
9. Main Drains: sediment and rust.
10. Gutter Drains: obstructions.
11. Walls: for stains, from corroded fittings.
12. Fences, Barricades, Dividing Walls and Footings: broken, loose, missing, or other damage.
13. Other Metal Accessories: rust, corrosion, broken or missing parts, other damage.
14. Other Wooden Parts: cracks, breaks, splintered, loose joints or fastenings, rot, insect, other damage.
15. Painted Surfaces: blistering, checking, cracking, scaling, wrinkling, flaking, peeling, rust, corrosion, absence of paint.

14. PLAYGROUNDS – Paved and Non-Paved

14.1 PLAYGROUNDS - Paved and Non-Paved

1. Surface area: potholes, uneven areas, bare spots, dead grass, low spots, cracks, spalling, depressions, open expansion joints, frost heaves, drainage.
2. Equipment: broken, bent, loose, missing, rusted parts. Safety hazards, improper installation, and code compliance.
3. Signs: proper installation.
4. Appropriate surfaces for ADA access and fall protection.

15. BASKETBALL AND TENNIS COURTS

15.1 BASKETBALL AND TENNIS COURTS

1. Court surfaces: expansion joint filler, cracks, holes.
2. Lines: legibility.
3. Signs: legibility.
4. Backboard and Nets: holes, rips, tears in nets, damage to surface.
5. Metal Posts: rust, corrosion, loose, bent, broken parts.
6. Wood Parts: rot, loose, broken.
7. Painted Surfaces: rust, corrosion, flaking, scaling, peeling, blistering, or complete absence of paint.
8. Poor drainage.

16. FENCES AND WALLS

16.1 FENCES - Chain Link

1. SCOPE: Security fences and all other outside partition fences
2. Fences: discontinuity, looseness, vertical and horizontal misalignment, gaps that would permit entry of unauthorized persons or animals.
3. Metal posts: rust, corrosion; loose, bent, leaning, broken, or missing, or mechanically damaged posts, inadequate base support; settlement of concrete foundations.
4. Fabric: looseness, rust, corrosion, broken areas, holes, and loose, missing, broken, or other damage to guard and stretch wires, and fastening wires and clamps, particularly at endposts, comerposts, gateposts, and where attached to structures.
5. Top, Bottom and Metal Mid and Bracing Rails: rust, corrosion, bent, broken, or missing particularly at corners.
6. Metal Gates: misalignment, difficult opening and closing, loose, missing or broken stops, checks, rollers, hinges, latches, and locks.
7. Supplementary Wire Guards and Attachments: rust, corrosion, loose, missing, broken, or other damage.
8. Presence of weeds, trash, or other debris along fence line and growing on fence and damage to metal from burning operations. Trees or shrubs should not be allowed to grow more than 8 inches high along fences. Vines should not be allowed to grow on fences.

16.2 FENCES - Wood

1. Wooden Posts: loose, leaning, splintered, broken, missing, or mechanically damaged posts; rot, termite infestation, improper wood species or failure to receive treatment to resist damage from weather or insects.
2. Wood Pickets or Planks, and Rails: loose, missing, broken, decay, and insect

infestation; failure to provide ground clearance under fence pickets, planks, or bottom rails.

3. Wood Gates: loose, broken, splintered, rotted, or missing parts; misalignment; difficult opening and closing; loose, missing, or broken stops, checks, rollers, hinges, latches, and locks.
4. Supplementary Wire Guards and Attachments: rust, corrosion, loose, missing, broken, or other damage.
5. Presence of weeds, trash, or other debris along fence line and growing on fence and damage to wood parts from burning operations. Trees or shrubs should not be allowed to grow more than 8 inches high along fences and walls. Vines should not be allowed to grow on fences.
6. Wood Walls: broken, rotted, termite or other insect infestation; complete deterioration, out of plumb, discontinuity.

16.3 FENCES - Walls (Masonry)

1. Concrete and Masonry Surfaces: cracks, spalling, broken areas, settlement, eroded and sandy mortar joints.
2. Ponding water and soil erosion at foundations.
3. Loose, missing, or broken capstones.
4. Proper waterproofing and/or slope on capstones for proper drainage.

16.4 FENCES - Safety (Metallic and Wood)

1. SCOPE: Metallic and wooden fences and other permanent barriers surrounding electric power equipment centers and preventing unauthorized personnel from accidentally contacting such equipment. Electrical grounds and grounding systems are covered in other Inspection Guides.
2. Post Foundations/Embedded Pipe Sleeves: Cracked, broken, settling, movement, water ponding at base; severe corrosion or need of re-caulking pipe sleeves.
3. Metal Fence Posts/Gate Posts/Hinges/Fastenings/Rails/Bracings/Component Parts: Rust, corrosion, bent, loose, missing, inadequate, deteriorated paint.
4. Guard Wires/Guard Wire Brackets: Rust, corrosion, bent, broken, loose, missing, sagging, failure to provide three guard wires where accessible to public (regardless of location), deteriorated paint.
5. Wire Fabric: Rust, corrosion, mechanical damage, holes 6 inches or more in diameter.
6. Holding Wires/Clamps/Other Fastenings: Rust, corrosion, loose, missing, broken, other damage.
7. Gates: Rust, corrosion, bent, difficult operation, sagging, inadequate clearances, other damage; loose, missing, or other damage to stops, catches, checks, latches, locks, and other appurtenances.
8. Enclosures/Posts/Rails/Braces/Gates/Other Wooden Parts of Wooden Fences and Wooden Barriers: Rot, insect damage, openings, loose, missing, leaning, broken, lack of rigidity, inadequacy, deteriorated paint.
9. Supplemental Guard Wires: rust, corrosion, sagging, missing parts, broken, inadequate for safety of the public and prevention of entry of unauthorized persons.
10. Adequacy of Security Throughout Entire Perimeter: Construction excavations, washouts, unauthorized changes in ground surface grade both inside and outside fence line; openings, particularly along bottom edge, large enough to permit entry of small children.
11. Lumber, boxes, piles of dirt or other materials within three feet of fence line on either side.

12. Possible installation of new equipment within three feet of fence line that will interfere with safety, maintenance and inspection.
13. Adequacy for Prevention of Damage to Fence or Safety of Personnel: Weeds, trash, or other debris along fence line.
14. Damage to galvanizing or protective coatings from burning operations along fence line.
15. Exposed live electrical parts less than 8 ft from inside of fence or barrier.
16. Warning Signs: Not installed at all gates and other locations on fence, not in sight from each normal approach path, insecurely fastened, illegible.

17. RETAINING WALLS

17.1 RETAINING WALLS

1. SCOPE: Retaining walls of all kinds, including cribbing and sheet piling when used as retaining walls. Waterfront structures are covered by other Inspection Guides.
2. Concrete Foundations: cracked, broken, scoured, spalling, exposed reinforcing; evidence of movement, settlement, and undermining.
3. Concrete or Masonry Walls: cracked, broken, spalling, misplaced sections, general deterioration, exposed reinforcing, eroded and sandy mortar joints, bulging, vertical and horizontal misalignment.
4. Timber Walls and Cribbing: cracked, broken, loose, missing, wearing, undermining, rotting, insect infestation; bulging, or vertical and horizontal misalignment.
5. Sheet Piling and Bulkheads: rust, corrosion, bulging, vertical and horizontal misalignment.
6. Evidence of seepage resulting from obstructions in weepholes or other drainage outlets.
7. Loose or missing premolded expansion joint material allowing washout of backfill.
8. Structural inadequacy and poor physical condition of deadman anchors, other attachments, and fastenings.
9. Embankment Slopes and Areas Behind Walls: erosion, settlement, or slippage resulting from improper drainage, lack of full sod or vegetation cover, damage from burrowing animals, slopes steeper than angle of repose.

18. GROUNDS

18.1 GROUNDS - Grass/Landscape Areas

1. Lawn and Other Turf Areas including Borders: traffic damage; color; density; sparse and bare spots; weeds; undesirable grasses; diseases; insect damage; erosion; silt deposits; excessive height damage caused by burrowing animals; and low spots.
2. Where sections or patches of grass have died: pull up a sample of dead grass and check blades and roots for possible cause(s) of grass dying. Refer to Scott's Grass Manual for possible cause(s) of grass dying if cause cannot be readily determined.
3. Border Strips and Areas Seeded to Rough Grasses for Erosion Control: poisonous or noxious weeds; seedling trees that may hinder future mowing; erosion and siltation; lack of vigor; inadequacy of coverage; evidence of burning.

18.2 GROUNDS – Shrubs/Trees/Plants

1. Trees and Shrubs in Landscaped Areas: lack of vigor, need of trimming, interference with utilities or buildings, injury from mowers, structural weaknesses, and storm, disease, or insect damage.
2. Flower, Plant and Shrub areas: undesirable weeds and grasses; damage caused by

burrowing animals; diseases; insect damage; erosion; dead plants; excessive height; need of trimming and cultivation; need for mulching; need for replacing.

3. Windbreaks of Trees: breakage, lack of vigor, dead or dying trees requiring replacement; disease and insect damage indicated from condition of leaves; branches interfering with utility lines; contour ridges in arid sections inadequate to prevent surface runoff and retain and cause absorption of storm waters around tree.
4. Weed Control: vigor and rapid growths erosion damage where soil sterilants were used; check for emergence of any and all types of vegetation as an index of the efficacy of the remaining soil chemicals and a need for applying additional chemicals to the soil; where selective contact sprays are used, check for percentage of kill and injury to vegetation that is to be preserved; check vegetation on adjoining lands for damage by spray drift.

18.3 GROUNDS – Woodlands/Dams/Channels/Gullies

1. Woodlands: erosion, dead, diseased, or damaged trees; firelanes for being impassable; vegetation growth that may carry ground fires; hollow trees.
2. Earth Dams and Dykes: damage from erosion, burrowing animals; seepage; lack of vegetation density or vigor of growth; drop inlet pipes for stoppage; logs, debris; outlet ends for erosion, seepage, piping damage or failure.
3. Emergency Spillways of Drop inlet Dams: blockage, erosion damage.
4. Permanent Check Dams in Water Course: overflow at notch section, bypassing at ends, erosion on downstream side, damaged and deteriorated walls and apron.
5. Hillside and Terrace Diversion Embankment, Channels, and Culverts: silt, debris, rank vegetation, low and weak sections, overflow, erosion, gullying, burrowing animals.
6. Valley Drainage Channels including Culverts and Lateral Drains and Tile at Entrance Points: overflow, stoppage, silt, debris, rank vegetation, erosion, caving, sloughing, scour.
7. Vegetated Waterways: inadequate vegetation fullness and cover in relation to ground surface area that should be shielded; erosion of waterway and along sides; debris; overflow.
8. Fill Slopes on Barricades, Highways, Railways, Airfield Runways, Igloos, and other Soil- Covered Buildings: erosion, burning, steepness; lack of vigor and insufficient vegetation coverage for protection against beating rain and direct sunshine; inadequate fill depth at top of slope wherever buildings and weather conditions necessitate variations on different slopes; inadequate surface runoff piping; insufficient thickness of inorganic mulch (gravel, slag, etc.)
9. Cut Slopes and Diversion channels: erosion, scour, burning, weaknesses from past or possible overflow, lack of vigor or growth and insufficient vegetation coverage; inadequate surface runoff piping.
10. Gullies including all Surface Water Entrances and Upstream Ends or Head where Mainstream Enters: current rate of erosion; resulting pollution and sedimentation of downstream lakes, channels; damaged lands; impairment of bridges and other structures; need of erosion control.
11. Flood Irrigation systems including Delivery Channels, Gates, Flow-Control and Water Turnout Works, and Border-Dykes: defective operation, erosion, silting, scour, water loss, improper application, failure to supply to all parts of tract.

19. PAVEMENTS

19.1 PAVEMENTS - Curbs/Gutters/Sidewalks/Manholes

1. SCOPE: Streets, walks, parking areas for motor vehicles, and storage areas.
2. Curbs, gutters, manholes: cracks, breaks, misalignment, damaged tops, inadequate expansion joints.
3. Expansion joints in sidewalks: sufficient joint filler, proper bonding of filler, foreign material wedged in joint.
4. Rigid pavement sidewalks: spalling, cracks, depressions, scaling, buckling, and uneven settlement.
5. Flexible pavement sidewalks: raveling, bleeding, depressions, and damage.
6. Brick and Stone Sidewalks: failure of bases, bedding courses, grouting; or loose or missing individual pieces.
7. Drainage: obstructed ditches, improper grading and shoulder protection, low spots, standing water. (See Inspection Guide 18)

19.2 PAVEMENTS - Rigid (Concrete)

1. Concrete Roads
   a. Expansion Joints: not vertical; excessive or insufficient joint filler; filler not bonded to sides of joints; foreign material wedged in joint.
   b. Buckling: caused when the pavement expands beyond joint capacity.
   c. Frost Heave: caused by expansion of a wet subgrade when it freezes.
   d. Depressions: caused by consolidation of soft soil under load. May be evidenced by ponding of water after rains.
   e. Cracks: poor subbase support, overload, improper joint spacing, poor concrete mix, soft or wet subgrade.
   f. Joint Pumping: evidenced by soil particles and water forced upward through joint
   g. Spalling: caused by inadequate expansion joints or freeze/thaw cycles.
   h. Scaling: usually caused by overfinishing which produces concrete with an excess of cement in the pavement surface. Sometimes caused by chemicals used to remove snow and ice.
   i. Abrasion: caused by blading equipment to remove snow and ice or to grade and reshape shoulders.

19.3 PAVEMENTS Flexible (Asphalt)

1. Bleeding: excess bitumen on surface.
2. Potholes: holes in asphalt from water freezing.
3. Raveling: aggregate particles pulled loose from surface by abrasive erosion.
4. Grooving and Shoving: caused by high pressure tires operating on surfacing of inadequate stability.
5. Burned Areas: heat effect from blasts of jet aircraft are cumulative. Surfacings become lifeless and brittle, separated aggregate may be blown about by blast.
6. Softening: caused by spillage of petroleum distillates or jet plane blast.
7. Frost Heave: caused by expansion of a wet subgrade when it freezes.
8. Depressions: caused by consolidation of soft soil under load. May be evidenced by ponding of water after rains.
9. Weathering and Oxidation: asphalt becomes brittle and brown and "dead" in appearance. irregular pattern of fine cracks in areas of little traffic appear in cold weather.

19.4 PAVEMENTS - Brick and Stone

1. High and Low areas: failure of bases, bedding courses, grouting; or loose or missing individual pieces.
2. Differential settlement.

19.5 PAVEMENTS - Gravel/Cinder/Shell/Stabilized Soil

1. High and low areas: bedding courses, breaks, potholes, corrugated, rutting, inadequate crown, general deterioration.

19.6 PAVEMENTS - Parking and Other Paved Areas

1. Asphalt: potholes, cracks, frost heave, bleeding and raveling.
2. Concrete: cracks, spalling, breaks, open expansion joints and buckling.
3. Poor drainage.

19.7 PAVEMENT - Markings/Signs

1. Paint Markings: worn, scaled, shipped, and distorted.
2. Signs: damaged or illegible.

20. STORM DRAINAGE SYSTEMS

20.1 STORM DRAINAGE SYSTEMS

1. SCOPE: Catch-basins, curb inlets, pipelines, headwalls, outfalls and tide gates, drop structures and spillways, manholes, culverts, subsurface drainage, gutters, and ditches. Note: Pumps and pump stations are covered by other Inspection Guides.
2. Valley drainage channels, including culverts and manholes: overflow, stoppage, silt, debris, vegetation, erosion, and caving (includes removing and reinstalling manhole covers).
3. Catch Basins and Curb Inlets: debris, obstructions, and cracked catch basins and broken, or improperly seated grating, settlement.
4. Pipelines: misalignment, settlement, cracked, broken, open joints, sediment, debris, tree roots, erosion in concrete pipes, erosion and corrosion in corrugated metal pipes. (Inspect pipe smaller than 48" diameter by using a light between manholes. Crawl through pipe 48" diameter or larger. Tightness of joints may be checked by blocking off a section between man-holes for 24 hours to determine amount of ground water infiltration; watchman necessary to open line in event of rain.)
5. Headwalls: cracked, broken, spalling, exposed reinforcing, settlement, undermining, improper condition of pipe joint at headwall.
6. Approach Channels: evidence of water channeling under and around pipe or headwall.
7. Outfall and Channel Beyond Headwall: sediment, debris, other obstructions, evidence of erosion of adjoining property.
8. Tide Gates: restricted or tight motion; loose closure; outfall line and bar screens for sediment and obstructions.
9. Drop Structures/Spillways: silt accumulation and erosion.
10. Manhole Frames/Covers: rust, corrosion, poor fit; ladder rungs for rust, corrosion, broken parts, damaged supports.
11. Manhole Walls: cracking, spalling, exposed reinforcing; eroded or sandy mortar joints, loose, broken, or displaced brick.
12. Manhole Bottoms: clogging, restricted flow, silt, sewer pipe fragments (indicating broken pipe), invert elevation of outlet pipe not flush with bottom (if not designed with sump).

13. Culverts: sediment, obstructions at inlets and outlets, ditch bottoms not flush with pipe inverts, and non-compacted or previous soil resulting in channeling. (Cracks in pavement over subsurface drainage and culverts indicate washout of soil from cracked or broken pipe, and obstructions indicated by restricted flow after prolonged rainfall). Damaged or missing sections.
14. Gutters and Ditches: cracked, broken, eroded concrete surfaces, defective expansion joint, misalignment, obstructions, ponding of water, silting or sloughing-off of sides, inadequate side vegetation coverage necessary to prevent erosion.
15. Standing water: would permit mosquito breeding in drainage system.
16. Channel at the outlet end of the culvert: excessive erosion. This can cause a deep gully and weaken the foundation of the structure.
17. Erosion around edges of inlet ground should slope gently downward so that water flows toward the gratings.
18. Rank growing vegetation in vicinity of inlet interference from large roots.

21. WATER SUPPLY SYSTEMS

21.1 WATER STORAGE - Ground/Underground

1. SCOPE: Ground storage reservoirs and tanks in fresh water systems. Included also are the various accessories normally associated with fresh water tanks. Water heating systems are covered by other Inspection Guides. Tank and reservoir roofs are covered by other Inspection Guides. Cathodic protection of tanks is covered by other inspection Guides.
2. Concrete Foundations: settlement, cracks, spalling, exposed reinforcing.
3. Wood Foundations and Pads: checked, split, rot, termite infestation, direct soil contact of untreated wood, termite tubes.
4. Anchor Bolts and Straps: loose, or missing pieces; rust, corrosion.
5. Steel Tanks: rust, corrosion, leakage; damaged protective coatings; bent, bowed, or broken members; loose scale; damaged or deteriorated riveted or welded seams.
6. Concrete Tanks: settlement, cracks, spalling, leakage; defective joint at juncture of floor and walls; exposed reinforcing; damaged protective coatings.
7. Wood Tanks: leakage; cracked, checked, split, warped, or mechanically damaged pieces; rot, termite infestation; wall and base sections for vertical and horizontal misalignment; bands or hoops for rust, corrosion, looseness or missing.
8. Wood and/or Steel Ladders, Walkways, Guardrails Handrails, and Stairways: rust, corrosion, poor anchorage, loose or missing pieces, other damage.
9. Handholes/Manholes/AccessDoors/Hatchways/OtherCovers: loose/missing/broken/rust/corrosion; improper fit; damaged/missing hardware.
10. Concrete Reservoirs: settlement, cracks, spalling, leakage, exposed reinforcing.
11. Expansion Joints: improper sealing; loose or missing filler, failure to allow movement when filled with trash and debris.
12. Earth Embankments: erosion resulting from lack of full sod or vegetation coverage, burrowing animals, improper drainage, ponding water along base, leakage through embankment or along outlet piping.
13. Splices, Bolts, Rivets, Screws and Other Connections: loose missing; broken welds; rust, corrosion; other damage.
14. Accumulations of dirt, trash, debris, foliage.

21.2 WATER STORAGE - Elevated Tanks

1. All covers and seals bolts and screws: check for rust, corrosion, and other deficiencies.

2. Identification and markings: accuracy and legibility.
3. Steel Tower Structure: rust, corrosion; loose, missing, bowed, bent, or broken members; loose sway bracing; misalignment of tower legs, evidence of unstableness.
4. Wood Towers: loose, missing, twisted, bowed, cracked, split pieces, rot, termite infestation; misalignment of tower legs, evidence of unstableness.
5. Tower: rust, corrosion, damage, rot, and insect, infestation as applicable.
6. Wood and/or Steel Ladders, Walkways, Guardrails, Handrails, and Stairways: rust, corrosion, poor anchorage, loose or missing pieces, other damage.

22. FUEL FACILITIES

22.1 FUEL FACILITIES - Distribution (Receiving and Issue)

1. SCOPE: Platforms and islands, small structures, fuel hose, hose connections, and adapters, hose racks and reels, grounding connections, portable ladders and steps, portable gangplanks, signs and markings, general cleanliness, and painting. Pumps, valves, piping, tanks, security fences, derricks, railway trackage, concrete and surfaced roadways, piers and wharves, electric motors and their control equipment, and ground connections for electrical equipment are covered by other Inspection Guides.
2. Signs and markings: accuracy and legibility.
3. Wooden Platforms and Islands: loose, missing, worn, rotted, other damage to individual planks.
4. Wood Framing, Supports, Stairs, and Guardrails: loose, missing, worn, rotted, broken parts.
5. Metal Framing, Supports, Stairs, and Guardrails: rust, corrosion, loose, missing, twisted, bowed, bent, broken parts.
6. Metal Platforms: worn, bent, broken, or otherwise defective gratings and plates.
7. Concrete Islands: cracks, breaks; settlement that may lead to failure of pipe, valves, and related equipment
8. Small Structure Concrete Foundations: cracks, breaks, settlement that may lead to structure failure.
9. Metal areas: rust, corrosion, wear, other damage.
10. Wood framing: wear, rot, insect infestation, other damage.
11. Roofs and/or Walls: leakage, wear, rot, insect infestation, other damage.
12. Doors and Windows: sagging, binding.
13. Hardware: defective hinges, locks, broken glass.
14. Hose Racks and Reels: corrosion of metal; rotting and other damage to wood; mechanical damage or other defects that may result in injury to stored hose.
15. Underground Tunnels: deteriorated protective coatings, rust, corrosion, decay, mechanical damage, defective hinges and locks for access hatches and covers, leakage at roof seams and caulked pipe seams in concrete walls and other locations, settlement, cracked or broken concrete areas.
16. Ladders: rust, corrosion, broken welds, rot, splitting, broken, loose, missing, or damage to individual parts or connections, unsafe, deteriorated paint.

22.2 FUEL FACILITIES - Storage

1. SCOPE: Surface and subsurface tanks, tank enclosures, and tank fittings and appurtenances.
2. Foundations: settling movement, upheaving, inadequate soil coverage.
3. Exterior concrete surfaces: spalling, cracking, exposed reinforcing, leakage.

4. Exterior steel surfaces: rust, corrosion, distortion or other structural failure, leakage, deteriorated paint.
5. Roof surfaces: defects in waterproofing, heat-reflective coating, coverings.
6. Floating and Expansion-Type Roofs, Seals, Supports, and Support Guides: rust, corrosion, improper sealing, deteriorated paint, structural or mechanical damage caused by freezing weather conditions.
7. Structural Supports and Connections: rust, corrosion rot, broken, cracked, distorted, loose, missing, deteriorated paint.
8. Frames and Covers on Manholes and Hatches: rust, corrosion, cracks; breaks, missing/damaged bolts, worn defective hinges and gaskets.
9. Stairs, ladders, platforms, and walkways: rust, corrosion, rot, broken, cracked, loose, missing, members or connections; deteriorated paint.
10. Dikes: cracks, breaks, spalling, rust, corrosion, settlement, heaving, soil erosion, water seepage; inadequate sod cover on outer face, where earth-filled; inadequate treatment of inner face to prevent vegetation growth; access steps for settlement, breaks, other damage.
11. Drainage Ditches, Sumps, and Earth Surfaces between Ditch and Foundation: improper slope to divert surface water away from foundation and berm, trash and debris; erosion.

23. INCINERATORS

23.1 INCINERATORS

1. SCOPE: Incinerators used for refuse and garbage disposal, including special-purpose types. Sanitary and building inspections will be made under other Inspection Guides.
2. Refractory Linings at Throats, Roof Arches, Door Arches and Jambs, Target Wall, Charging Hole Covers, Guillotine Doors, and Combustion Chambers: spalling, loosening, or deterioration of areas or individual units. (Before inspection, operating personnel should thoroughly clean inside of furnace.)
3. Combustion Chambers: deformations, breaks, wear, corrosion, soot deposits, clinkers, ashes, or excessive slag formations indicating excessive lining deterioration or depositing of an excessive amount of noncombustibles.
4. Drying Hearths and Grates: warped sections and burned-out areas.
5. Exterior Settings: settlement, cracks, broken areas, eroded and sandy mortar joints, failure to provide adequate expansion and contraction between furnace setting and building and between flue and chimney.
6. Failure of furnace steel framing supports indicated by damage to arches and roof areas, door casings, and walls.
7. Doors: rust, corrosion, warped, loose fit, damaged or missing parts of latches, and hinges.
8. Tuyere and Tuyere Plates: warped or burned-out areas.
9. Charging Chute Frames and Covers: rust, corrosion, broken, loose, or missing parts.
10. All-Metal Trash Burners and Incinerators: rust, corrosion, burned-through areas, warped and buckled surfaces.

24. REFUSE AND GARBAGE DISPOSAL

24.1 REFUSE AND GARBAGE DISPOSAL (Dump and Landfill)

1. SCOPE: Garbage and refuse disposal by the sanitary fill method.

2. Accessibility of fill area: poor to trucks and equipment required in excavating, filling, backfilling, and compacting.
3. Evidence of drainage polluting surface or subsurface water supplies.
4. Potential washouts resulting from storm water when located in ravines.
5. Maximum depth of fill does not exceed 6 ft. (More than one cell may be used where greater depths are desired.)
6. Minimum covering of clean fill over refuse is not less than 24 inches in completed sections.
7. Evidence of dust resulting from lack of vegetation from completed portions of fill.
8. Evidence of rodents, flies, and/or other pests in area.
9. Cover soil that does not provide effective seal (sandy soil preferred).
10. Locations: less than 750 ft from public highways and human activities.
11. Winds: towards habitation and highways.
12. Soil quality: poor, that prevents ease of excavating and does not provide effective seal. (Sandy soil preferred)

25. ANTENNA - SUPPORTING TOWERS AND MASTS

25.1 ANTENNA - Supporting Towers and Masts

1. SCOPE: Antenna-supporting towers and masts, guyed radiators and guys, antenna-supporting strongbacks, strongback insulation to towers, elevating mechanisms, and obstruction and navigation lighting. This Inspection Guide does not cover the inspection of antenna.
2. Foundations: cracked, broken, or spalled concrete; exposed reinforcing; movement or settlement; heaving from frost action.
3. Anchor Bolts and Straps: rust, corrosion, and loose, missing, or damaged parts.
4. Structural Steel Towers, Ladders, and Safety Cages: rust, corrosion, loose, missing, twisted, bowed, bent, or broken members.
5. Splices, Bolts, and Rivets: rust, corrosion, loose, missing, other damage, broken welds.
6. Timber Towers and Ladders: loose, missing, twisted, bowed, cracked, split, rotted; termite or other insect infestation of wooden members.
7. Guys and Anchorage: cracked, split, rotted; termite or other insect infestation, or looseness of wooden parts; metal parts for rust, corrosion, loose, missing, or other damage; frayed or broken strands and looseness of guys; inadequate deadman anchorage.
8. Deviations from plumbness.

26. AMMUNITION STORAGE - Aboveground

26.1 AMMUNITION STORAGE - Aboveground

1. SCOPE: Ammunition storage facilities that are covered with earth, but aboveground.
2. Foundation, and Retaining Walls: cracks, spalling, broken areas, settlement
3. Metal Surfaces: punctures, breaks, bends, rust, corrosion, mechanical damage.
4. Damaged roof, wall surfaces, or waterproofing: leakage.
5. Leakage at juncture of metal wall with concrete wall.
6. Floor slab grading: improper, resulting in poor floor drainage.
7. Doors: sagging, binding; broken, defective, or inadequate hinges; missing, broken, or other damage to locks and latches.
8. Painted Surfaces: rust, corrosion, cracking, scaling, peeling, wrinkling, alligatoring, chalking, fading, complete loss of paint.

9. Failure to maintain 3 ft. minimum earthfill width at tops of retaining walls and minimum side slope of 1 1/2 to 1 at earth embankments.
10. Sodded areas: poor condition, presence of bare spots; weeds, trash, debris, or other detrimental conditions constituting a fire hazard or tending to promote erosion.
11. Drainage: surface pending, other evidence of subsurface drainage failure.
12. Inorganic Mulch (gravel, slag, etc.): insufficient thickness, vegetation growing through.

27. AMMUNITION STORAGE - Underground

27.1 AMMUNITION STORAGE - Underground

1. See Inspection Guide; Tunnels and Underground Structures.

28. BRIDGES AND TRESTLES

28.1 BRIDGES AND TRESTLES

1. **Note: The Wisconsin Department of Transportation requires that bridges are routinely inspected by certified bridge inspectors every two years. The department has published a comprehensive *Structure Inspection Manual (2003 Edition)* that covers the procedures and requirements for inspection. Specific qualifications and training are mandated to be qualified to inspect bridges.**
2. SCOPE: Highway, Railroad and Pedestrian Bridges and Trestles, including those constructed of steel, timber, masonry, concrete, and composite materials. It does not cover concrete boxes with integral floor, which are classed as culverts regardless of span, and are included under drainage structures.
3. Note: Inspections will not be made with the aid of field glasses.
4. Side Slopes: failure to maintain slopes of 1-1/2 to 1 or more; soil erosion; inadequately protected with vegetation or mulch; concrete overlays (if applicable): cracking, spalling, broken areas, other damage.
5. Bridge and Foundation Protective Structures, such as riprap cribbing, bulkheads, dolphins, piles, or other. Missing, broken, insect and other pest infestation, decay, deterioration, erosion, undermining, scouring, other damage.
6. Drainage Ditches: loose bottom and sides, improper side sloping silting; failure to protect surrounding areas at outfalls from erosion.
7. Roadway of Approaches: cracked, broken, unevenness, settlement, roughness, corrugated and disintegrated concrete or bituminous surfaces; cracked, broken, or other damage to curb and gutter sections.
8. Approach Fill: settlement, particularly at a joint between fill and structure.
9. Fences, Barricades, and Railings at Approaches: inadequacy or structural damage; missing or illegible load and speed limit signs.
10. Drainage Channels: erosion, scouring, accumulations of driftwood and debris above, below, and at structure; evidence of possible course diversion resulting from obstructions, erosion, or other.
11. Concrete Foundations: cracks, scaling, disintegration, exposed reinforcing, wood piling and pads; missing, broken, ineffective bearing, decay.
12. All Foundations: scouring, undermining, settlement.
13. Abutments and Piers: cracks, breaks, scaling, spalling, disintegration, deterioration, open joints, other damage; evidence of damage from impact and vibration; failure of expansion devices; damage from floating debris, ice, and waterborne traffic; significant scour of undercutting of footings.

14. Timber Framing: loose, missing, twisted, bowed, warped, split, cracked, checked, unsound members; deteriorated joints; rot, termite and other insect infestation; excessive deflection under heavy loads.
15. Steel Framing: rust, corrosion, deterioration, missing, bowed, bent, misalignment, broken members; evidence of buckling in web stiffeners.
16. Concrete and Masonry Structures: weathering, cracks, spalling, exposed reinforcing; open, eroded, and sandy mortar joints; broken and missing stones; cavities and other deterioration of the stones.
17. All Superstructures: damage from floating debris, ice, and waterborne traffic; misalignment both horizontal and vertical.
18. Wood Flooring: loose, missing, decayed, rotted pieces; protruding nails and other fastenings; checkered wearing plates; loose.
19. Structure Roadways: cracked, broken, corrugated, disintegrated, leaching, scaling, potholing, spalling, voids or lamination in concrete or bituminous surfaces.
20. Concrete Curbs and Gutters and/or Concrete or Masonry Handrails and Handrail Walls: loose, missing, and broken individual sections; misalignment; sandy and eroded mortar joints; loose or missing capstones; cracks, spalls, and other deterioration of curbs; other damage.
21. Expansion Joints: improper sealing; loose or missing filler; adequate space for thermal movement; excessive opening of joint; trash or debris in joint; evidence of loose anchorages; cracking or breaking of welds.
22. Handrails: cracking, spalling, scaling, or other deterioration of concrete; rust, corrosion, loose, missing, broken, misalignment of metal; decay, secureness of timber, damage from traffic, rust on bottom side of hollow metal railings.
23. Bridge Seats, Bearing and Cover Plates: rust, corrosion, deterioration, tilting, missing, loose, cracks, spalls, other damage.
24. Splices, Bolts, Rivets, Screws and Other Connections: rust, corrosion, loose, missing, broken welds, other damage.
25. Painted Surfaces: rust, corrosion, cracking, sealing, peeling, wrinkling, alligatoring, chalking, fading, complete loss of paint.
26. Sidewalks: cracking, scaling, potholing, spalling or other deterioration of concrete; soundness of timber; corrosion of steel; proper drainage.
27. Suspension Span: condition of protective covering or coating on main suspension cables; corrosion; tight bolts; slippage of bands holding suspenders.
28. Signs: proper place and physical condition of signs showing restricted weight limit, reduced speed limit, or impaired vertical clearance; proper place and physical condition of navigational signs.
29. Underside of Structural Deck: poor or loose concrete, sounding with a steer hammer the areas showing efflorescence or leaking.

29. TUNNELS AND UNDERGROUND STRUCTURES

29.1 TUNNELS AND UNDERGROUND STRUCTURES

1. SCOPE: Tunnels of all kinds, including ammunition storage tunnels; pipeline tunnels, vehicular tunnels, and water tunnels; also, underground structures housing utilities, service installations, and similar equipment or operations. It does not include underground tanks, nor earth-covered ammunition magazines that are wholly or partly aboveground.
2. Portal Structures: drainage defects, cracks, breaks, leaks in face and between face and tunnel lining, eroded slopes or undermining.
3. Wing and Face Walls: inadequate protection to personnel, erosion of slopes, loose

rocks, actual or potential slides, scouring or undermining of walls.

4. Door and Gate Operating and Locking Devices: rust, corrosion, loose, missing, or damaged parts, improper operation.
5. Concrete Floors: cracks, breaks, scaling, other damage surface dusting.
6. Earth and Gravel Floors: improper grading and drainage soft and muddy areas.
7. Vehicular Tunnel Floors: faulting at joints, scaling, abrasion, depressions, buckling.
8. Tracks for misalignment, rails for damage and inadequate or loose connections and supports, and ties for rot or other damage.
9. All linings: leakage, settlement, displacement; concrete; cracks, breaks; metal: looseness, rust, corrosion; timber: cracks, breaks, rot.
10. Unlined Tunnels: spalling, disintegration, loose or fallen rocks.
11. Metal Roofs: rust, corrosion, inadequate supports.

30. AIRCRAFT POWER CHECK FACILITY

30.1 AIRCRAFT POWER CHECK FACILITY

1. SCOPE: Aircraft Power Check Facilities; consisting of aircraft securing fittings and mooring eyes anchored in concrete, tie-down chain assembly with aircraft holdback fitting and blast deflectors.
2. Aircraft Securing Fitting and Mooring Eyes
   a. Cracked, broken or spalled concrete; settlement, movement or heave in vicinity of fittings.
   b. Anchor plates and bolts: rusted, loose bent or broken.
3. Chain
   a. Breakage, rust, corrosion and wear between individual links and between links and fittings.
   b. Chain dimensions: distortion.
4. Aircraft Holdback and Deck Fittings: Rust, corrosion; bent, worn or damaged parts.
5. Blast Deflectors: Rust, corrosion; bent, missing or damaged parts.

31. RAILROAD TRACKAGE

31.1 RAILROAD TRACKAGE

1. SCOPE: Railroad trackage, including running or access tracks, classification yards, sidings, and storage tracks.
2. Tracks
   a. Vertical and horizontal misalignment caused by heaving, sinking, churning, inadequate expansion, particularly during hot weather; examine closely where track passes from earth fill to bridges or trestles. (Standard gage is 4' 8-1/2" which is increased on sharp curves. Maximum gage is 4' 9" on tangents and 4' 9-1/2" on sharp curves.)
   b. Rough spots (Ask train crews).
3. Rails
   a. Breaks, splits; cracks in head, web, or base; damage from flat wheels.
   b. Creeping or shoving, particularly at curves or ends; battering, overflow, chipping.
   c. Joints: loose angle or splice bars, loose and missing bolts, inadequate expansion. Ends of 33 ft. rails should butt at 100 degrees F. At lower temperatures, clearance of 1/32 in. for every 25 degree difference or part thereof.
   d. Loose spikes or failure to provide four per tie; improper tie plate seating (where

used); improper support of rail.
   e. Obstructed flangeways of girder-type rails; obstructed flangeways and tops not flush with pavement or crossing for standard-type rails.
   f. Road Crossings: poor condition, roughness to road traffic, obstructions.
4. Ties: Decay, splitting, general deterioration, rail cutting, insufficient or improper embedment in ballast to prevent movement, inadequate drainage.
5. Ballast: Dirt and mud accumulations, soft or wet spots, grass or weeds, washing away and settlement, inadequate extension beyond ties, slope to grade steeper than 1-1/2 to 1.
6. Drainage: Obstructed drainage ditches and culverts; erosion of side slopes and shoulders; actual or potential slides onto or close to track; washing or erosion at head-walls, inlets, discharge openings.
7. Turnouts: Lack of lubrication, clogged with debris or dirt, inadequately spiked; out-of-gage; improper operating condition of switches, switch latches, targets, and lamps. (Correct throw at switch point is 4-3/4". Gage from point of frog to flange face of guardrail where curvature through turnout is 8 degrees or less, is 4' 6-5/8", and excess of 8 degrees, is 4' 6-3/4". Gage on tangents and curves of 8 degrees or less, is 4' 8-1/2", and for each 2 degrees above 8 degrees on curves, 1/8 in. is added to maximum of 4' 9".
8. Tank Car Unloading Tracks: Bonding Wires Across Rail Joints, Between Rails and Unloading Header Pipelines, and Connections Between Rails and Ground Rods, and Insulated Rail Joints: loose connections, corrosion, frayed or broken strands. (Repair when one strand broken in 7-strand or more than 3 in 19-strand.)
9. Protective Devices
   a. Warning Signs: inadequate, improperly placed, illegible; telltales improperly placed and in poor condition; inadequate and poor structural stability of bumper blocks and cattle guards.
   b. Guard Rails: poor structural condition and improper placing at sharp curves, steep embankments, trestles, bridges or other locations where derailment would be serious.
   c. Retaining Walls: undermining, misalignment, weep-hole obstructions, or other deficiencies that would tend to endanger tracks.
10. Clearances
   a. Clearances at warehouses and structures less than 8' from center line of track from rail to 22' above rail; overhanging shed roof less than 5' 6" from centerline of track from rail to 15' 6" above rail; do not conform to AREA standards and are less than those required by servicing railroad.
   b. Presence of weeds or other obstructions blocking view, creating fire hazard, or reducing clearances.

32. WATERFRONT FACILITIES

32.1 WATERFRONT FACILITIES - Piers/Wharves/Quaywalls/Bulkheads

1. SCOPE: Piers, wharves, quaywalls, and bulkheads constructed of timber, steel, or concrete. Bulkheads constructed of timber, steel, or concrete. Bulkheads constructed of rubble mount (rock) are covered in other Inspection Guides.
2. Horizontal Misalignment outward movement indicated by increase in expansion joint width or cracks in adjacent ground or pavement areas.
3. Vertical Settlement (use surveyor's level).
4. Curbings, Handrails, and Catwalks: loose, missing, broken individual sections; uneven surfaces, obstructions, other hazardous conditions.

5. Bollards, Bits, Cleats, and Capstans: breakage, excessive wear; rough or sharp surfaces and edges detrimental to handling lines; missing, loose, or defective bolts.
6. Deck Drains and Scuppers: loose, missing, or broken screws; water ponding indicating clogged drains or need of deckfill or other repair.
7. Manhole Covers and Gratings: rust, corrosion, mechanical damage, bent or worn hinge points.
8. Asphalt Deck Covering: cracks, weathering, holes, rutting, or porous surfaces.
9. Ladders: rust, corrosion, loose, missing, twisted, bowed, bent, or broken steel members; loose, missing, cracked, split, rotted, or broken wooden members; defective supports and anchorage.
10. Deck Planking: worn, loose, missing, cracked, broken, splintered, deep abrasions, decay; termite and other pest infestation, particularly on underside surfaces.
11. Wood Stringers and Pile Caps: loose, missing, cracked, broken, decay; termite and other pest infestation; crushing of wood fiber, particularly at bearing points; ineffective bearing area not in contact with bearing piles.
12. Wood Bearing Piles: missing, broken, loss of section, porosity of surface; pest infestation, and decay, particularly at top and areas within tide range. (Area subject to teredo attack will require divers' inspection for signs of entry. Pronounced attacks will necessitate removal of several piles for sectionalizing, and extent of damage will constitute a representative sample, and condition of other piles may then be ascertained.)
13. Wood Fender Piles: loose, missing, cracked, broken; excessive wear; mechanical damage; termite and other pest infestation; wrappings for broken, loose, or missing cables and fastenings; loose or missing wedges.
14. Wood Bracings, Wales, and Chocks: loose, missing broken, split, warped, decay, termite and other pest infestation, rotted bolt holes.
15. Individual wooden members: replace when deterioration has reduced cross section area by 30% or more except 50% or more for bracings, wales, and chocks.
16. Fire walls: structural damage, general deterioration, lack of airtightness.
17. Steel Deck Plates, Gratings, and Their Supports: rust, corrosion, loose, missing, broken, bent.
18. Steel Beams/Girders/Piling: rust, corrosion, structural damage, misalignment, defective connections.
19. Steel Tie/Rod Bracings/Long Bolts/Wales: rust, corrosion, broken, bent; loose nuts and anchor plats; lack of tautness; failure or missing wrappings on tie rods; defective connections.
20. Individual steel members: replace or repair when deterioration has reduced flange or web thickness by:
    a. 50% or more for rods and long bolts.
    b. 40% or more for bracings and wales.
    c. 30% or more all other members.
21. Steel: clean and paint where surface area is corroded
    a. 50% or more on deck plates, piles, bracing and wales.
    b. 40% or more on individual beams and girders.
22. Steel beams and girders: clean and paint in those spans where total surface area of beams and girders in one or more adjacent spans are corroded 50% or more.
23. Concrete Slabs: general deterioration, breakage, cracking, spalling, particularly at bottom surfaces; reinforcing steel for exposure, rust, corrosion, expansion joints for loose or missing filler. Report reinforcing for repair when broken or cross section reduced 40% or more.
24. Concrete Beams and Girders: breakage, cracking, spalling, particularly at edges;

reinforcing steel for exposure, rust, corrosion. '

25. Concrete Piles: breakage, cracking, spalling, particularly within areas of tide range; reinforcing steel for exposure, rust, corrosion.
26. Bulkheads: loss of section; excessive weathering; loss or settlement of backfill; erosion of bottom, check depth of water adjacent to bulkhead for comparison with original depth.
27. Bulkhead Tie-Rods: loose or missing connections; corrosion.
28. Protective Coated Areas: rust, corrosion, deteriorated coating, complete loss of coating.
29. Accumulations of combustible materials, debris, or drift materials.

32.2 WATERFRONT FACILITIES - Dolphins

1. SCOPE: Multiple-timber pile dolphins.
2. Piles: missing, loose or broken, splitting, deep abrasions, damage from marine borer activity or decay.
3. Piles: replace when cross section area has deteriorated 30% or more.
4. Dolphin Assembly: vertical misalignment.
5. Cable and Cable Connections: loose, missing, broken, or excessively worn.
6. Wedge Blocks and Wedge Block Holding Bolts: loose, missing, broken or deteriorated, corroded.
7. Chafing Strips and Bands: loose, missing, broken or corroded.
8. Chock Bolt Hangers: loose, missing, broken or corroded.

32.3 WATERFRONT FACILITIES - Camels and Separators

1. SCOPE: Camels and separators constructed of timber and steel.
2. Securing Chains (or lines) Fittings and Hardware: broken, loose, or missing parts; excessive wear, rust, corrosion.
3. Timber
    a. Missing or broken members.
    b. Excessive damage, severe wear, external decay.
    c. Evidence of internal decay, attack by marine borers, deterioration.
    d. Individual Timbers: lack of buoyancy, deterioration in cross section area of 50% or more.
4. Steel Pontoons
    a. Missing units.
    b. Mechanical damage, excessive wear.
    c. Rust, corrosion, lack of paint.
    d. Individual Units: lack of buoyancy, reduction in shell thickness of 40% or more.

32.4 WATERFRONT FACILITIES - Brows and Gangways

1. SCOPE: Brows and gangways constructed of steel, wood, and aluminum.
2. Abnormal deflection or sidesway.
3. Steel and Aluminum Structural Members: mechanical damage, excessive wear, slippery walking surfaces.
4. Handrails (or cables) and Stanchions: damaged or loose members and fittings; wire rope for looseness, frayed or broken strands.
5. Rollers or wheels: hard to move, lack of lubrication.
6. Connections: rust, corrosion, loose, missing, broken, other damage.
7. Wooden Structural Members: loose, missing, twisted, bowed, cracked, split, broken, or rotted members, particularly at joints.
8. Wooden Flooring Members: mechanical damage, excessive wear, slippery walking

surfaces.
9. Loose, missing, or broken wooden handrails.
10. Painted Surfaces: rust, corrosion, cracking, scaling, peeling, wrinkling, alligatoring, chalking, fading, complete loss of paint.

32.5 WATERFRONT FACILITIES – Dredging, Moorings, and Navigation Aids

1. SCOPE: Dredging, moorings, and navigation aids.
2. Dredging: Depth of berthing and navigational areas compared to design depth established for those areas.
3. Moorings
   a. Compare present location with original location. (Use sextant or transit on fixed reference points.)
   b. Buoys, Visible Chains, and Fittings: breakage, rust, corrosion, wear between individual links and links and fittings.
   c. Note: Underwater parts to be inspected by diver.
4. Navigation Aids
   a. Compare present location with original location. (Use sextant or transit on fixed reference points.)
   b. Mechanical Type: ineffective operation.
   c. Tide Gages: illegible, insecure fastenings, deterioration.

32.6 WATERFRONT FACILITIES – Seawalls, Groins, Jetties, and Breakwaters

1. SCOPE: Seawalls, groins, jetties and breakwaters constructed of timber, steel, concrete, and rock-rubble mound.
2. Horizontal Misalignment outward movement indicated by cracks in adjacent ground or pavement areas.
3. Vertical Settlement. (Use surveyor's level)
4. Paved Areas Behind Seawall: eroded; damaged; improper drainage of backfill causing hydrostatic pressure differentials; inadequate.
5. Riprap: loss or lack of, resulting in erosion from wave action of the foreshore and undermining of seawall.
6. Cellular-Type Breakwaters: loss of sand or rockfill.
7. Rubble Mound: loss of section; weathering; sloughing or loss of side slope material; displacement of capstones.
8. Harbor Bottom: bottom erosion or buildup, particularly in berthing areas.
9. Curbing, Handrails, and Catwalks: loose, missing, broken individual sections; uneven surfaces, obstructions, other hazardous conditions.
10. Bollards, Bits, Cleats, and Capstans: breakage, excessive wear, and rough or sharp surfaces and edges detrimental to handling lines; missing, loose, or defective bolts.
11. Timbers: loose, missing, cracked, broken, decay, insect and other pest infestation. (Areas subject to teredo attack will require divers' inspection for signs of entry. Pronounced attacks will necessitate removal of several piles for sectionalizing, and extent of damage will constitute a representative sample, and condition of other piles may then be ascertained.)
12. Concrete: general deterioration, breakage, cracking, spalling, displaced sections; reinforcing steel for exposure, rust, corrosion.
13. Steel Members: rust, corrosion, missing, loose, other structural damage.
14. Connections: rust, corrosion, loose, missing, broken, other damage.
15. Protective Coated Areas: rust, corrosion, deteriorated coating, complete loss of coating.
16. Accumulations of combustible materials, debris or drift materials.

ELECTRICAL CHECKLIST

The inspection is performed by physically moving through the area containing the equipment and checking the condition of each piece of equipment.

For each local interior building system check (smoke detector system, pull-box system, sprinkler alarm, etc.), the Project Manager should be notified of any defect. Comply with all current safety precautions when inspecting fire alarm systems.

Light installations may be visually inspected from the ground; binoculars may be utilized where appropriate.

Because overhead electric distribution systems are energized almost continually, inspection of such components as poles, hardware, and associated accessories should be made from the ground except during those periods when planned outages of the various systems will permit a climbing inspection. Binoculars may be used to inspect overhead equipment where a close observation is desired. Inspection is made by walking the poles and lines as well as using a vehicle when practical.

When inspecting power plants, prior to performing the inspection, contact should be made with the plant operator to determine any operating problems/deficiencies which may exist at time of inspection.

When inspecting components of electrical distribution systems, do not operate any components without prior clearance from responsible operating personnel.

Inspection is made by observation and in some cases, manually operating the component under de-energized conditions, when condition cannot be determined just by visual observation.

Current OSHA safety requirements, and Design Safety Standards for Electrical Systems, should be compiled with when inspecting electrical equipment.

For each repair requirement identified during inspection, provide the following information:

A. What action is needed: Repair, replace, paint, clean, etc.
B. Condition: Damaged, leaking, aged, inoperative, etc.
C. What item or items, system require action
D. Where the problem is located, room number, floor, compass direction
E. Quantity: linear feet, each, square yards, etc.
F. When action should be taken: 0 year, 1st year, 2nd year, etc.

In each case where a deficiency exists, the associated repair requirement should be noted. All checks are made while equipment is operating.

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33. DISTRIBUTION SYSTEMS (Interior) - Cable/Wiring/Conduit

33.1 DISTRIBUTION SYSTEMS (Interior) - Cable/Wiring/Conduit

1. SCOPE: Electrical light and power systems for buildings. 600 volts and below, exclusive of supply and utilization equipment. Building electrical systems extend from the main service switch or breaker to points of connection for lights, motors, or other utilization. It includes wire and cable runs; busways, raceways, and wireways; tubing and conduit; switchboards, panelboards, and cabinets; circuit protective and switching equipment; junction and cutout boxes; insulators, supports, and wiring devices; and other items not associated with supply or utilization equipment, such as metering, motor controls, and starters. It includes fixtures, lamps, switches, outlets, cords, and plugs. 1. Building electrical systems must conform to local ordinances. 2. Ali parts of a grounding system must be continuous and actual connections to earth must be adequate. Technical requirements shall conform to the National Electrical Code.
2. Cable Wiring and Conduit
    a. Dirty, poor ventilation, detrimental ambient conditions, presence of moisture, greases, oil, chemical fumes.
    b. Improper or unauthorized connections and dangerous temporary connections.
    c. Damaged wiring devices, defective insulators, cleats, and cable supports; broken or missing parts or exposed live parts.
    d. Excessive cable sag and vibration, crowded cable spacing, excessive number of conductors in conduit and raceways.
    e. Evidence of overheating, grounds, and short circuits, overheated splices, damaged or defective insulation.
    f. Need for painting of noncurrent-carrying parts subject to corrosion.
    g. Unsafe, unreliable cable and wire to lighting and power panels.
    h. Fuses, switches, and other sources of discontinuity in the neutral wire of grounded AC systems.
    i. Circuits for operation of switches, receptacles, wiring for overloaded circuits and missing cover plates.
3. Cords, Cord Extensions, Portable and Appliance Cords, and Plugs
    a. Inadequate, unsafe, unreliable, incorrect types being used.
    b. Lengths too long, poor insulation, twisted, spliced, exposed to damage underfoot, laying on floor or across heated surfaces or lamps; lamp types used for portable extensions that are subject to moisture, oil, and grease.
    c. Plugs: cracks, breaks, loose connections, wires improperly attached and in danger of pulling away from plug when removing from outlet, missing protective cover on male ends, no grounding terminal or ground wire with clamp. Power Plugs: cable clamps loose or missing.
    d. Improper or unauthorized flexible cords and cable run through holes in walls, ceiling or floor.

33.2 DISTRIBUTION SYSTEMS (Interior) - Service Panels/Panelboards

1. Panelboards
    a. Dirty, corroded, signs of overheating, and need for touch-up painting. Unposted or illegible instructions, identification charts, circuit diagrams, and feeder schedules.
    b. Loose or inadequate connections.
    c. Switches need lubrication, operate improperly; knife switches and fuse clips improperly aligned.

d. Check fuse ratings and ground connections.
e. Removed fuse jumpers and dangerous temporary connections.
f. Uncovered, open breaker spaces in need of protective covers.

33.3 DISTRIBUTION SYSTEM (Interior) - Switchgear

1. SCOPE: Electrical switchgear, associated apparatus, and equipment connected to distribution circuits in buildings, 600 volts and under, and not located in vaults or fire resistant rooms.
2. Housekeeping
   a. Poor appearance, dampness, dirty, inaccessibility or surrounding areas.
   b. Detrimental conditions such as ambient temperatures in excess of 100°, humidity causing sweating of metal enclosures; rodents, insects; stored combustibles; trash, dirt, dust accumulation, poor location, inaccessibility; poor ventilation; gas, steam, or water leakage.
3. Exterior Housings and Enclosure Ground
   a. Rust, corrosion, need for painting, signs of abuse, unauthorized or improper signs, scribbling, calendars, storage of materials or dust accumulations on top of enclosures, missing parts, schedules, or other items.
   b. Poor condition and inadequacy of enclosure ground.
   c. Properly secured.
4. Interior of Compartments, Cubicles, and Drawers: Dirty, condensation, symptoms of overheating, burns from ground and short circuits, defective insulation, defective operation of locks, doors, and drawers.
5. Air and Oil Circuit Breakers, Oil-Less Type Air Blast Breakers (De-Energized) (50 Amperes and Above)
   a. Incorrect wipe of main and arcing contacts on opening and closing.
   b. Overheating, lack of continuity, and looseness of connections on all mechanisms; incorrectly placed pins and cotter pins.
   c. Improper functioning of rods and moving parts and binding occurs when breaker is operated.
   d. No freedom of action in tripping devices and latches; insufficient travel of armature of over- current trip devices to assure release of breaker latch.
   e. Dirty oil in oil-film timers.
   f. Improper functioning and unsatisfactory condition of control switch and closing relay.
   g. Oil Tanks: leaks, cracks, corrosion, defective gaskets, improper oil levels, incorrect gauge indications, oil for presence of dirt, and sludge.
   h. Bushings and Insulators: accumulation of dirt, cracks, chips, lack of rigidity of supports, inadequacy of connections.
   i. Arc Chutes: moisture and other contaminants, arc mufflers for loose scale, runners and springs for wear or other damage.
   j. Inoperative indicating lamps.
6. Pneumatic Systems: Poor general condition and unsatisfactory operation of all components serving breakers including air pressure, valves, pistons, and associated equipment; poor speed of air- pressure recovery, air leaks, moisture and dirt in air lines.
7. Enclosed Switches
   a. Unsatisfactory operation of handle and mechanism; blade latch functions improperly; blades are insecure when closed.
   b. Blade, clips or tongue for lack of cleanliness, signs of oxidation, arcing, overheating, and poor contact.

8. Switchgear Relays: Visible evidence of accumulations of dust and dirt, broken glass, loose or missing nuts, loose mounting, noisy operation, signs of arcs, loose connections.
9. Dry-Type Transformers
    a. Accumulation of dust on core, coils, and leads; evidence of moisture, oil, or other contaminants; evidence of overloads and burned insulation; poor contacts and connections; signs of corrosion; poorly painted surfaces, nameplates, guards and warning signs; inadequate ventilation, detrimental ambient temperatures, and defective ground connections.
    b. Unsatisfactory operation of air-temperature alarms, auxiliary cooling equipment, and tap contacts.
    c. When operating log is kept, check operating temperature loads, and voltage during critical operating periods from log data.
    d. Detrimental ambient conditions, defective lightning protection, moisture, overloads, physical injury or abuse, and short circuits causing insulation deficiencies.
10. Instrument Transformers: Lack of cleanliness, inadequate connections, inadequate insulation, improper ventilation, and unsatisfactory grounding
11. Small Wiring: Physical damage, defective insulation, poorly soldered connections, damage to other connections.
12. Buses and Buswork: Lack of cleanliness, defective insulation, overheating, signs of flashovers.
13. Rheostats/Associated Mechanisms: Inadequate operation, lack of cleanliness, overheating, dirty contacts, overtravel.
14. Mechanical Devices – De-Energized: Unsatisfactory operation and inadequacy of mechanical devices for elevating and lowering or drawing out switchgear; improper operation of interlocks, gang switches, and contact safety shutters.
15. Switchgear Foundations: Settling or movement of floors, pedestals, and other foundations resulting in possible misalignment of operating parts in switchgear.

33.4 DISTRIBUTION SYSTEM (Interior) - Transformers - Energized

1. SCOPE: Energized electric distribution transformers used for voltage reduction.
2. Concrete Foundations and Supporting Pads
    a. Settling and movement, surface cracks exceeding 1/16 inch in width, breaking or crumbling within 2 inches of anchor bolts.
    b. Anchor Bolts: loose or missing parts, corrosion, particularly at points closest to metal base plates and concrete foundation resulting from moisture or foreign matter, and exceeding 1/8 inch in depth.
3. Mounting Platforms, Wooden:
    a. Cracks; breaks, signs of weakening around supporting members; rot, particularly at bolts and other fastening, holes through which bolts pass, wood contacting metal
    b. Burning charring and burning at contact points, indicating grounding deficiency.
    c. Inadequate wood preservation treatment.
4. Mounting Platforms, Metallic: Deep pits from rust, corrosion, other signs of deterioration likely to weaken structure.
5. Hangers/Brackets/Braces/Connect: Rust, corrosion, bent, distorted, loose, missing, broken, split, other damage; burning or charring at wood contact points resulting from grounding deficiency.
6. Enclosures, Cases, and Attached Appurtenances
    a. Collections of dirt or other debris close to enclosure that may interfere with

radiation of heat from transformer or flashover.
   b. Dirt, particularly around insulators, bushings, or cable entrance boxes.
   c. Leaks of liquid-filled transformers.
   d. Deteriorated paint, scaling, rust; corrosion, particularly at all attached appurtenances, such as lifting lugs, bracket connections, and metallic parts in contact with each other.
7. Nameplates and Warning Signs: Dirty, chipped, worn, corroded, Illegible, improperly placed.
8. Grounding: Visual Connections: loose, missing, broken connections; signs of burning or overheating, corrosion, rust, frayed cable strands, more than 1 strand broken in 7 strand cable, more than 3 strands broken in 19 strand cable.
9. Bushings and Insulators: Cracked, chipped, or broken porcelain, indication of carbon deposits, streaks from flashovers, dirt, dust, grease, soot, or other foreign material on porcelain parts, signs of oil or moisture at point of insulator entrance.
10. Grounding and Phase Terminals: Overheating evidenced by excessive discolorations of copper, loose connection bolts, defective cable insulation, no mechanical tension during temperature changes, leads appear improperly trained and create danger of flashovers from unsafe phase-to-phase or phase-to-ground clearances caused by deterioration of leads or expansions during temperature changes.
11. Lightning Arresters: Where attached to or mounted on, refer to Inspection Guide 13.
12. Breathers: Holes plugged with debris, desiccant-type breathers need servicing or replacement.
13. Grills and Louvers for Ventilation of Air-Cooled Transformers: Plugged with debris or foreign matter, interfering with free passage of air. (Openings located near floor or ground line can be inspected with small nonmetallic framed mirror having long insulated handle, used in conjunction with light from hand flashlight having insulated casing. Throw light beam onto mirror and reflect upward into openings.)

33.5 DISTRIBUTION SYSTEMS (Interior) - Transformers - De-energized

1. SCOPE: De-energized electric distribution transformers used for voltage reduction.
2. Safety: Transformer must be de-energized and circuit switches locked out. Use Grounding harnesses on input terminals.
3. Bushings and Insulators
   a. Insulators and Porcelain Parts: indications of cracks, checks, chips breaks; where flashover streaks are visible, reexamine for injury to glaze or for presence of cracks.
   b. Chipped glaze exceeding 1/2 inch in depth or an area exceeding one square inch on any insulator or insulator unit, report for investigation by a qualified electrical engineer.
   c. Severe cracks, chipped cement, or indications of leakage around bases of joints of metal to porcelain parts at terminal and transformer ends.
   d. Terminal Ends: mechanical deficiencies, looseness, corrosion, damage to cable clamps.
   e. Improper oil level in oil-filled bushings.
   f. Heating evidenced by discolorations, and corrosion indicated by blue, green, white, or brown corrosion products on metallic portions of all main and ground terminals, including terminal board and grounding connections inside transformer case.
4. Coils and Cores: When cover is open, examine interior for deficiencies, dirt, sludge. If feasible, probe down sides with glass rod, and if dirt and sludge exceeds

approximately 1/2 inch.

5. Enclosure and Cases: If case is opened for any reason, examine for signs of moisture inside cover, and where present for plugged breathers, inactive desiccant, enclosure leakage, etc.
6. Gauges and Alarms
   a. Liquid Level Gauge and Alarm System: dirty, not legible, improper frequency of calibration.
   b. Test grounding system in accordance inspection Guide No. 12.
7. Additional Inspections: Inspections described in Inspection Guide 1.4.1 Distribution Transformers, Energized, are to be performed as part of this inspection.

34. LIGHTING AND POWER SYSTEMS

34.1 LIGHTING FIXTURES (Interior and Exterior)

1. Lighting Fixtures
   a. Inadequately supported, insecure, and improperly located, evidence of unauthorized removal and relocation.
   b. Incorrect types installed in hazardous locations; change in facility class requires replacement.
   c. Improperly located in clothes closets. (Should be above door or in ceiling and not serviced with cord pendants.)
   d. Cracked or broken luminaries and fixture parts, missing pull cords, metal pull chains not provided with insulating links.
   e. Indications of objects being supported from, hung on, or stored in fixtures.
   f. Evidence of overheating, undersized, or other damage to sockets, exposed or damaged connecting wiring.
2. Lamps
   a. Oversized, blistering, loose base, thermal cracks from contact with fixture, bare lamps in hazardous locations, poor socket lamp connections and proper types for special applications.
   b. Operation of fluorescent fixtures shows poor burning and starting characteristics, and loud humming ballasts.
3. Lighting Voltage
   a. Spot measurement at fixture and lighting outlets indicates measured voltage in excess of 5% of nominal lamp voltages.
   b. Unauthorized connections of hot plates, coffee pots, heating devices and other electrical equipment on lighting circuits.
   c. Interference with branch circuits for power and lighting from motor starting or stopping such as excessive light flicker, or excessive voltage dips causing fluorescent/mercury lamps to drop out.
4. Illumination Levels (Control Inspection Only)
   a. Ambient conditions such as dirty walls and ceilings.
   b. Spot measurement of light levels using accurate foot candle meter indicates depreciation of 20 to 25 percent of level obtainable from clean fixtures and new lamps seasoned for 100 hours.

34.2 LIGHTING AND POWER SYSTEMS - Convenience Outlets

1. Dirty, inadequate, defective contacts, difficult plugging, overheating, evidence of overloading on multiple sockets, servicing lamps or appliances, lack of grounding terminal.
2. Circuit test for correct polarity and ground.

3. Adequate number, proper type, convenient location, loose or damaged plate covers.
4. Receptacles without GFI (Ground Fault Circuit Interrupt) protection in dwelling unit kitchens and bathroom.
5. Outdoor receptacles: not weatherproof.

34.3 LIGHTING AND POWER SYSTEMS - Switches and Breakers

1. Switches and Breakers
   a. Poor condition of contacts, contact misalignment, signs of overheating, signs of oxidation, and inadequate capacity.
   b. Defective operation (try manually and electrically when practicable).
   c. Spot check and report voltage on branch circuits, feeders, and convenience outlets serving motors, heaters, and other utilization equipment.
   d. Group Operated Switches: rust, corrosion, loose brackets.
   e. Contact Blades: rough, pitting from arcing. Misalignment of blades with contacts.
2. Tests (Control inspection only)
   a. Measure ground resistance at various points on metal conduit systems and grounding systems.
   b. Measure insulation resistance in feeders and branch circuits to terminals of utilization equipment between conductors and between each conductor and ground. Keep continuous record of measurements. Insulation resistance should not be less than 300,000 ohms.
3. Switches
   a. Defective operation, broken or missing parts, arcing noises.
   b. Insecure, loose, damaged, missing plate or switch cover.

34.4 LIGHTING AND POWER SYSTEMS - Fuses and Small Circuit Breakers

1. SCOPE: Visual inspection only of fuses and small circuit breakers and their enclosures in electrical circuits operating at 600 volts or below and rated at 30 amperes and below,
2. Safety: Do not contact fuses. Do not remove covers. Do not de-energize.
3. By-passing: Report apparent by-passing of fuses or circuit breakers for further investigation.
4. Housekeeping: dust, dirt, oil, grease, corrosion, foreign matter within enclosure; inadequate identification of circuits.
5. Enclosures: deterioration of enclosures or connecting conduit or cable due to rust or corrosion; loose, corroded, or missing covers.
6. Connections (if visible without removing covers): loose, corroded, inadequate; deteriorated insulation.
7. Capacity: Check size of existing fuses or circuit breakers against system, report oversized fuses and circuit breakers.
8. Fuses: overheating, indicated by discoloration of brass or copper at contact points; distortion, charring, deterioration of fiber cases of cartridge type cases.
9. Circuit Breakers: distortion, charring, deterioration of molded portions of case. B. Grounding: loose corroded connections; deteriorated or abraded insulation; frayed or broken cables.

35. SPECIAL SYSTEMS

35.1 ALARM SYSTEMS - Fire/Theft

1. Wire terminal connections in panel and pull-boxes: tightness or possible corrosion.

2. Pull-boxes and Mechanisms: proper lubrication.
3. Actuate interior heat or smoke detector system by applying heat to a selected heat/smoke detector in the building in order to determine that the local building alarm operates properly and that a proper signal is transmitted over the site's fire alarm system by checking with the Fire Department's operator.
4. Actuate interior heat or smoke detector system by applying heat to a selected heat/smoke detector in the building in order to determine that the local building alarm operates properly and that a proper signal is transmitted over the site's fire alarm system by checking with the Fire Department's operator.
5. In building where individual heat or smoke detectors are installed (not connected to local fire alarm system) actuate detector manually to insure that unit operates properly.
6. Automatic sprinkler system fire department connections are checked as follows:
   a. Alarm lights, alarm bells, fire boxes for trip and zone light operation.
   b. Low air switches for corrosion and moisture.
   c. Actuate trip switch to determine that it operates the local building alarms and that a proper signal is transmitted over the site's fire alarm system by checking with the Fire Department's operator. This test should also be made when dry pipe sprinkler valves are drip tested under wet conditions.
   d. Reset panel, system and alarm boxes upon completion of tests.

35.2 SPECIAL SYSTEMS - Emergency Lighting

1. SCOPE: Interior emergency building lighting, including exit lighting, wall mounted lights and wall hanging battery pack emergency lighting located in auditorium, corridors, lobbies, passageways, stairways, and fire escapes.

35.3 SPECIAL SYSTEMS - Elevators/Platform Lifts/Dumbwaiters/Escalators

1. Inspections shall be performed in accordance with:
   a. American Standard Safety Code for Elevators, Dumbwaiters, Escalators and Moving Walks
   b. American Standard Practice for Inspection of Elevators

35.4 SPECIAL SYSTEMS - Chimneys and Stacks

1. SCOPE: Chimneys and stacks made of brick, reinforced concrete, and steel; and accessories.
2. Lightning Rods, Terminals, Cables, and Ground Connections: corrosion; loose; burned; missing; or other damaged parts and connections. Test for electrical continuity from aerial terminals through ground connections.
3. Lights, Hoods, Reflectors, Shields, and Receptacle Fittings: failure to operate; missing, loose, or damaged parts; moisture; need of re-lamping.
4. Conduit: breaks and other damage.
5. Remove conduit inspection plates and examine internal connections for lack of tightness and inadequacy; relays for defective operation and for loose or weak contact springs; worn or pitted contacts; moisture.

35.5 SPECIAL SYSTEMS - Lightning Protection

1. Rods, Points, Air terminals: bent, damaged, missing.
2. Rod Mounting Bases: improperly anchored to structure, damaged, cable connectors loose or missing.
3. Main Conductor Cable and Downleads: loose, missing, broken, signs of burning, corrosion, frayed cable strands, not anchored to structure.

4. Groundrod: downlead connection loose or damaged, disconnected.

35.6 SPECIAL SYSTEMS - Heat Trace Systems

1. Heating Conductor: overheating, not functioning, exposed, damaged, cracked or splitting insulation.
2. Pipe Attachment: insecure, improperly anchored, damaged.
3. Protective Raceway: damaged, broken, loose attachment.

36. POWER PLANTS

36.1 POWER PLANTS

1. SCOPE: Electrical equipment and apparatus in electric power generating plants.
2. Housekeeping: lack of cleanliness or orderliness.
3. Safety Signs and Posted Instructions: inadequate, illegible, improper location.
4. Operating Log, Plant Log, and Maintenance Records: failure to record pertinent readings and other information necessary to locate and evaluate trouble areas and trends.
5. Evidence of need to follow up deficiencies that may lead to breakdown.
6. Operating Log: review for duration and amount of overload, ambient temperature, temperature rise. Note when rated temperature is approached or exceeded.
7. Generator field, armature windings and cable insulation for visual defects.
8. Adequacy, serviceability and reliability of generator excitation system.
9. Condition of emergency exciters and associated equipment including rheostats, pilot exciters, voltage regulators and drives, if necessary.
10. Ground indicating system in ungrounded exciter circuits.
11. Inspect wiring and electrical controls for loose connections; charred, broken or wet insulation; evidence of short circuiting, proper calibration of controls, and other deficiencies.
12. Instruments for proper calibration, loose electrical connections, broken glass, physical damage, or need of cleaning.
13. Machine operation for noisy, unbalanced, rubbing, excessive vibration, rattling parts.
14. Bearings for proper lubrication (check lubrication schedules), improper oil level in oil gauges, noise, overheated bearing caps or housings.
15. Machine cooling system for leaks, mechanical damage, rust, corrosion, pump vibration, loose or missing hold-down bolts.
16. Check operation log or with plant operator to determine if machine governor is functioning properly.
17. Check circuit breakers and associated protective equipment for proper operation, connections, frayed lines.
18. Plant Battery
    a. Battery Room or Enclosure: lack of cleanliness, unacceptable temperature, inadequate ventilation, unsatisfactory condition of floor, fire hazard from lighting and power fixtures, fittings, and cable.
    b. Operating and Maintenance Records: review for deficiencies in specific gravity levels, cell temperature, makeup water history, equalizing charge practices, sustained overcharges and discharges.
    c. Connections: loose, corroded, dirty, inadequate.
    d. Cells: oversulphated plates, physical erosion, internal shorts, buckled plates, cracked grids, dirty electrolyte, improper electrolyte level, excessive sedimentation.
    e. Chargers and Controls: poor physical condition.

f. Instruments: inaccurate, (check frequency of calibration).

19. Busses: Poor condition, dirty, structural distortion, loose joints and connections, evidence of overheating.
20. Control Switchboards
    a. Poor physical condition, dirty.
    b. Wiring and Connections: lack of neatness, looseness, corrosion.
    c. Fuses in Control Wiring System: improper size.
    d. Indicating Lamps: not operating.
    e. Mimic Buses: illegible, inaccurate.

37. MOTORS AND GENERATORS

37.1 MOTORS AND GENERATORS

1. SCOPE: AC and DC electric motors, generators, exciters, M-G sets, synchronous converters and condensers, other electrical rotating equipment.
2. Log or operator records: evidence of motor or generator overload, induction motor underload, low power factor of load, excessive variations in bearing temperature, operating difficulties.
3. Equipment exposure: accessibility for maintenance of instrumentation; physical or other damage from normal plan functions; inadequate personnel guards or fences; insufficient, missing or illegible safety signs, or operating instructions.
4. Housekeeping procedures: in plant or equipment room.
5. Machine operation: noisy, excessive vibration, rattling, parts unbalanced.
6. Structural supports: cracks, defective vibration pads, shock mounts, loose or corroded bolts and fittings.
7. Machine: adequate ventilation and cleanliness of air slots.
8. Motor and generator leads: damaged insulation, poor taping, moisture, arcs, burns, overheating, inadequate terminal connections.
9. Bearings: proper lubrication improper oil level in oil gauges, noise, overheated bearing caps or housings.
10. Collector Rings, Commutators and Brushes: excessive sparking, surface dirt and grease, excessive brush movement.
11. Starters, Motor Controllers, Rheostats and Associated Switches: damaged or defective insulation, loose lamination, defective heater or resistance elements, worn or arcing contacts.
12. Protective equipment: dirt, signs of arcing, symptoms of faulty operation, burned-out pilot lamps or fuses.
13. Generator fuel tank and system, if applicable: leakage, loose connections, mechanical damage, obstructed vents, loose grounding connections, adequacy of fuel level, strainers/ filters for leaks or obstructions, meters and gauges for leakage or breakage.
14. Motor/generator set grounding system: visual; connections loose, missing, broken. Signs of burning or overheating, corrosion, rust, frayed cable strands.

38. RECTIFIERS

38.1 RECTIFIERS

1. SCOPE: Visual inspection only of metallic and mercury-arc rectifiers. Rectifiers used in cathodic protection systems are covered in Inspection Guide 24.
2. Safety: Rectifier cabinets and enclosures contain energized electrical equipment. Do not tighten wires, make adjustments, or disturb any valve, control, or other

adjustable device.

3. Enclosures
   a. Housekeeping: dust, dirt, trash, debris in general area.
   b. Exterior: mechanical damage, excessive corrosion (more than two rust spots 1/2 inch diameter); corroded, binding, unlubricated hinges and latches.
   c. Interior: rust, corrosion, moisture condensation, indications of excessive heating.
   d. Wiring: broken, damaged, deteriorated, missing insulation or clamps; corroded or mechanically damaged conduit; cracked or broken sleeves on floor or wall brushings.
4. Metallic Rectifiers
   a. Electric Meters: meter readings from all AC and DC ammeter and voltmeters.
   b. Temperature Record readings or water temperature indicators, if provided. On in-door installations record ambient temperature at apparent hottest point five feet from units.
   c. Fans: dirt, excessive vibration, loose hold-down bolts, loose or worn bearings inadequate or improper lubrication.
5. Mercury-Arc Rectifiers
   a. Water Cooling System: leaks, rust, corrosion, mechanical damage, excessive vibration.
   b. Pumps, Fans, and Motors: leaks, excessive vibration, loose or missing hold-down bolts, deteriorated mounting pads or shock pads, inadequate or improper lubrication.
   c. Rectifier grounding system for visual connections - loose, missing, broken, signs of overheating, corrosion, rust, frayed cable strands.
   d. Meters and Gauges: illegible; inadequate lighting; cracked, broken, dirty, badly stained viewport glasses.

39. INSTRUMENTS/METERING

39.1 INSTRUMENTS/METERING

1. SCOPE: Electrical AC and DC indicating, recording, instruments and associated equipment used for measurement of electrical power quantities.
2. Improper shielding, mounting, or enclosures when located near strong magnetic fields, subject to vibrations, extremes in temperature, moisture, metallic and other dust, and acid or corrosive vapors.
3. Not clean, improperly marked and identified, incorrect type and range for application, no manufacturer's instructions for servicing.
4. Loose electrical connections; dirty or corroded contact surfaces; inadequate, poorly arranged, improperly insulated wire, cable and leads.
5. Broken glass, pointer friction, warped or dirty scale, bent pointers, and missing parts.
6. Moving elements not locked when instruments provided with locking devices are not in use.
7. Not serviced, calibrated, or tested at appropriate intervals to accepted standard of accuracy for particular instrument; records of test not available.
8. Outdoor service meters: poor physical condition, loose weather seals, moisture or dirt in enclosure, corrosion, loose connections, missing parts.
9. Instrument Transformers: Poor physical condition, dirty, inadequate connections, visual evidence of overloading or overheating.

40. WOOD POLES AND ACCESSORIES

40.1 WOOD POLES AND ACCESSORIES

1. SCOPE: Wood poles used to support overhead electric distribution systems and/or telephone open wire or aerial cable systems. Included are such accessories and related items as crossarms, insulators, pins, tie-wires, hardware, line wires near the pole, guywires, and groundwires. Inspection of equipment such as transformers, cutouts, lightning arresters, or terminal boxes that are mounted on wood poles is covered in other Inspection Guides.
2. Safety: Because overhead electric distribution systems are energized almost continuously, inspection of such items as poles, hardware, and associated accessories should be made from the ground except during those periods when planned outages of the various systems will permit a climbing inspection. Poles supporting only telephone open wires or telephone aerial cables should not be climbed. Particular attention shall be given to weather conditions, power hazards, traffic warning procedures, and tree and brush cuttings.
3. Ground Area: Water ponding at base, and debris, trash or weeds within 3 ft in any direction.
4. Poles (Visual Inspection, Except as Indicated)
    a. Sound-test with unpainted hammer for hollowness or decay from ground line to the highest point reached from standing position; hollow sections or decay pockets at knotholes or woodpecker holes.
    b. Splits; lightning, bird, insect, vehicle, or other damage.
    c. Make shallow excavation around pole and take increment boring if a faulty condition below ground is suspected.
    d. Ground-line treatment of untreated poles required; failure of originally installed protective treatment of pole.
    e. Poles should not lean except for special reasons. When lean is more than 1 ft at top (to deter-mine whether top of pole is out of alignment, sight the pole from those adjacent to it).
    f. Structural inadequacy or other deficiencies.
5. Crossarms and Buckarms (Field Glasses): Splits, burns, decay, twists, weathering damage, other defects.
6. Insulators and Pins (Field Glasses)
    a. Cracks, breaks, chips, dirty or missing insulators; cracked, broken, missing pins.
    b. Rust, corrosion, or looseness of insulator bolted connections and fastenings to crossarms resulting in strains on lines wires or movement of wires on insulators.
7. Tie-Wires and Line-Wires (Field Glasses): Looseness, chafing, slippage, or other damage within foot or two of insulators and corrosion at points where line wires and tie-wires come together near insulators.
8. Hardware/Pole Steps/Crossarm Braces/Grounding Bonds/Brackets Through Bolts/ or Other (Field Glasses): Signs of fire damage and rot or insect damage around all hardware in contact with pole or crossarms; rust, corrosion, and looseness of all parts.
9. Ground Wires (Field Glasses)
    a. Rust, corrosion, frayed or broken strands, discoloration that may indicate overheating, or complete failure of connections, including connection to ground rod at base of pole. (Do not disconnect or allow contact with body if overhead lines are energized.)

b. Protective moldings: looseness, missing, broken, cracks, decay.

10. Guywires
    a. Loose, missing, or corroded clamps, wires or holding bolts and brackets.
    b. Broken or cracked insulators and complete absence of insulators on circuits over 300 volts.
    c. Excessive tautness or looseness and failure of guys and guy anchors; vehicle damage; inadequacy and non-visibility of shields or protectors; corrosion, fraying, or broken strands.
11. Clearances and Tree Limbs (Field Glasses)
    a. Inadequate separation from limbs, branches, and foliage; dead trees or limbs that may fall on line.
    b. Brush and tree prunings have not been removed.
    c. Inadequacy and poor condition of tree guards and attachments on insulated wire.

41. STEEL POWER POLES AND STRUCTURES

41.1 STEEL POWER POLES AND STRUCTURES

1. SCOPE: Steel power poles and towers, metallic street-lighting standards, A-frames, and all other steel structures used to support electric power lines or equipment, including those used for transmission lines, distribution systems, substations, and switching stations.
2. Safety: Remember these structures are part of an electrical system and may be conducting current. Avoid contact with line poles and structures until they have been grounded and/or de-energized. At least two men shall be assigned to these inspections.
3. Ground Area: Trash, debris, and weeds or brush one foot in height within 3 ft of pole or structure.
4. Concrete Bases/Pads/Anchor Bolts
    a. Cracks, including surface cracks wider than 1/16 inch, breaks, chipped areas deeper than 1/2 inch, settlement, movement, water ponding at base.
    b. Defective paint/galvanizing, visible rust or corrosion to depths exceeding 1/16 inch, loose or missing nuts/bolts, where visible, inspect all metal where it enters concrete.
5. Street Light Standard Handholes and Bell Interiors (Visual Inspection Only, If Energized)
    a. Rust, corrosion, or drops of moisture, indicating poor ventilation.
    b. Installed Transformers: loose wires, excessive discolorations from heating and sparking, signs of insulating compound or other leakage, charred, burned or missing insulation.
6. Poles, Structures, Crossarms, and Beams (Inspection from Ground, Field Glasses)
    a. Defective paint/galvanizing, visible rust or corrosion, especially pitting where visible, inspect all metal in contact with, or entering concrete.
    b. Loose bolts and pins; excessive rust and corrosion between pole and/or structure and braces, equipment supports, insulator pins, guy fastenings, and similar locations.
    c. Checking, chipping, flaking, or scaling of paint on pole and attachments.
    d. Broken or bent structural or accessory members, especially near bolts.
    e. Misalignment. (Top of unguyed pole is out of line more than 1 ft in any direction.)

7. Guys and Anchors
    a. Corroded, cracked or worn hardware at guy take-offs, anchors and insulators; cracked, broken, or dirty insulators; missing insulators.
    b. Defective galvanizing, corrosion, broken strands, battered or corroded buy shields, excessive sag or tautness.
    c. Guy anchor movement.
8. Ground Wire (Visual Inspection Only)
    a. Failure to install at least one wire at every steel pole or structural support, including each steel column in substation or switching station.
    b. Connections: rust, corrosion, looseness, discolorations from overheating, substandard conditions.

42. LINE - INSULATORS/PINS/TIE-WIRES

42.1 LINE - INSULATORS/PINS/TIE-WIRES

1. Cracks, breaks, chips, dirty or missing insulators.
2. Cracked, broken, or missing pins.
3. Rust, corrosion, or looseness of insulator bolted connections and fastenings to crossarms resulting in strains or line wires or movement of wires on insulators.
4. Looseness, chafing, slippage, or other damage within a few feet of insulators and corrosion at points where line wires and tie-wires come together near insulators.

43. POTHEADS

43.1 POTHEADS

1. SCOPE: Electrical potheads used in power distribution systems, including potheads used as terminals of equipment and a part thereof.
2. Porcelain: Cracks, breaks, chips, checking of porcelain glaze. Streaks of carbon deposits indicating flashovers and possible damage. Dirt, dust, grease, other deposits. Cracks, breaks, or deterioration of cement sealing compound, and leakage or signs of moisture.
3. Cable Clamps: Corrosion, loose bolts, solder, ground connection, poor mechanical connections. (Corrosion of lead cables and connections at potheads indicated by presence of a white, brownish, or reddish product.)
4. Terminal Studs and Bolting Pads: Corrosion, loose connections, and poor contacts evidenced by discolorations from heating.
5. Mountings: Corrosion and other weakness.

44. GROUND AND GROUNDING SYSTEMS

44.1 GROUND AND GROUNDING SYSTEMS

1. SCOPE: Electrical grounds and grounding systems for all electrical equipment, apparatus, machinery, metallic conduit, and all accessories that are a part of the outdoor electrical power distribution system. It also includes ground of structural supports, frames, towers, safety fencing, hardware, equipment enclosures, system neutrals, and buried ground cable networks and counterpoises used in sub-station and similar areas. In such places, good engineering practice, and other controlling rules and regulations such as National Electric Code, National Electrical Safety Code, require grounding for operational and personnel safety.
2. Safety: Extreme care must be exercised in inspecting and testing ground and grounding systems to minimize danger of electric shock and possible resulting injury

or death. In general, never open a grounding circuit connection when the equipment it is intended to protect is energized. When equipment is energized do not make inspections at bases of electrical equipment, regardless of circuit voltage.

3. Connections: loose, missing, broken, signs of burning or overheating, corrosion, rust, and frayed cable strands.
4. Underground Connections: unsatisfactory condition or defects, uncovered when 4 or 5 connections are exposed to view by digging.

ELECTRICAL RESISTANCE TESTS (Control Inspectors Only)

	From	**To**	**Allowable Resistance**
5. a.	Point of connection on structure, equipment enclosure, or neutral conductor	Top of Ground	See Table
b.	Ground rod, mat or network	Ground (earth)	See Table
c.	Gates	Gateposts	½ ohm
d.	Operating rods and handles of group-	Supporting structure	½ ohm
e.	Metallic-cable sheathing	Ground rod, cable or metal structure	½ ohm
f.	Equipment served by rigid conduit	Nearest ground-cable attachment on conduit runs of less than 25 ft.	10 ohms

6. When total resistance in check point a or b exceeds allowable, measure resistances of individual portions of the circuits to determine the points of excessive resistance and report.
7. Substandard resistance values resulting from poor contact between metallic portions of grounding system, and earth.
8. Structural steel, piping, or conduit run exceeding 25 ft used as a current-carrying part of grounding circuit for protection of equipment.
9. Absence of ground-cable connections.

TABLE
Maximum permissive resistance for grounds and grounding systems between equipment or structure being grounded and solid ground (earth):

	Maximum Permissive Grounding System Resistances (ohms)
a. For generating stations:	1
b. For main substations, distribution substations and switching stations on primary distribution system:	3
c. For secondary distribution system (neutral) grounding non-current carrying parts of the distribution system itself, and enclosures of electrical equipment not normally within reach of other than authorized and qualified electrical operating and maintenance personnel:	10
d. For individual transformer and lightning-arrester grounds on distribution system:	10

45. LINE - LIGHTNING ARRESTERS

45.1 LINE - Lightning Arresters

1. SCOPE: All types of lightning arresters for protection of electric power distribution lines and equipment. The types include the treated-ceramic-gap type, such as Thyrite or Autovalve, the oxide-film type, the obsolete pellet type used for distribution system and lower voltage transformer protection (up to 34.5kv), the capacitor type used mostly for protection of rotating equipment, and the expulsion-gap type used to reduce outages from flashovers caused by lightning.
2. Safety: Never allow any part of the body to contact any part of an energized lightning arrester or the ground cable connected to it.
3. Foundations and Supports: Signs of weakness, cracked or broken concrete, burns, loose holdown bolts, rust, corrosion, mechanical damage.
4. Grounding Cables for Pole-Mounted Lightning Arresters (where accessible to public): Cracks, breakage, splintering, defective paint, evidence of tampering, other weakness in protective moldings.
5. Treated Ceramic-Gap Type (such as Thyrite and Autovalve)
   a. Porcelain Insulators: signs of flashovers and serious flashover marks; scarring, chipping, or cracking of porcelain; dirt, grease, or other film on porcelain.
   b. Metal bases, Caps, and Intermediate Section Couplings: indications of loose bolts, rust, corrosion, or loose cement.
   c. Connections to Line, Equipment, or Ground Lead: looseness, corrosion, breakage, or misalignment that may put undue mechanical strain on porcelain.
   d. Ground Cable Connection to Ground Mat: loose or corroded connectors where

visible.

6. Oxide-Film Type (Obsolete, not acceptable for replacement)
   a. Accumulation of dirt, particularly on edges of cells, deterioration of paint, rust, corrosion.
   b. Loose connection and mounting bolts, badly corroded connection posts.
7. Pellet-Type (Obsolete, not acceptable for replacement)
   a. Indications of burns and scars on porcelain bodies from flashovers, cracked or broken bodies and caps.
   b. Mounting Clamps: rust, corrosion, loose bolts at arrester and supporting point of bracket.
   c. Poor physical condition of ground cable from arrester to point of connection to ground rod or grounding system, where visible; loose or corroded connectors.
   d. Signs of flashover on porcelain insulators and metal enclosures resulting in cracking, breaking, or burning.
   e. Connection Points: looseness, corrosion, frayed ground cables, evidence of mechanical strain.
   f. Enclosures: excessive rust and corrosion.
   g. Porcelain: dirt accumulations in appreciable amounts.
8. Expulsion-Gap Type
   a. Looseness of mounting, flashovers, damage to tubing, corrosion, loose ground connections, signs of burning and apparent damage from visual check of gap opening between arcing horn and line being protected.
   b. Poor physical condition of ground cable from arrester to point of connection to ground rod or grounding system; loose or corroded connectors.
   c. Signs of burning on external air gaps.
   d. Check opening of air gap; examine tube carefully for damage from flashovers and burnouts; corrosion of metal mounting parts.

46. LINE - TRANSFORMER

46.1 LINE - TRANSFORMER - Energized

1. SCOPE: Energized electric power transformers used for voltage transformation on transmission lines and high voltage distribution systems.
2. Safety: Do not contact any part of the transformer or associated equipment.
3. Concrete Foundations and Supporting Pads
   a. Settling and movement, surface cracks exceeding 1/16 inch in width, breaking or crumbling within 2 inches of anchor bolts.
   b. Anchor Bolts: loose or missing parts, corrosion, particularly at points closest to metal base plates and concrete foundations resulting from moisture or foreign matter, and exceeding 1/8 inch in depth.
4. Mounting Platforms, Wooden
   a. Cracks, breaks, signs of weakening around supporting members; rot, particularly at bolts and other fastenings, holes through which bolts pass, wood contacting metal.
   b. Burning and charring at contact points, indicating grounding deficiency.
   c. Inadequate wood preservation treatment.
5. Mounting Platforms, Metallic: Deep pits from rust, corrosion, other signs of deterioration likely to weaken structure.
6. Hangers, Brackets, Braces, and Connections: Rust, corrosion, bent, distorted, loose, missing, broken, split, other damage; burning or charring at wood contact points caused by grounding deficiency.

7. Enclosures, Cases, and Attached Appurtenances
    a. Collections of dirt or other debris close to enclosure that may interfere with radiation of heat from transformer or flashover.
    b. Dirt, particularly around insulators, bushings, or cable entrance boxes.
    c. Leaks of liquid-filled transformers.
    d. Deteriorated paint, scaling, rust; corrosion, particularly at all attached appurtenances, such as lifting lugs, bracket connections, and metallic parts in contact with each other,
8. Nameplates and Warning Signs: Dirty, chipped, worn, corroded, illegible, improperly placed.
9. Gaskets: Leakage, cracks, breaks, brittleness.
10. Inert Gas Systems
    a. Incorrect pressure in system. (Maximum: 3 to 5 pound, Minimum 1/4 to 1 pound.)
    b. Pipe and Valve Connections: leaking gas (indicated by liquid oozing out of joints)
    c. Loose gas tank fastenings, loose valves.
11. Bushings and Insulators: Cracked/chipped/or broken porcelain, indication of carbon deposits, streaks from flashovers, dirt, dust, grease, soot, or other foreign material on porcelain parts, signs of oil or moisture at point of insulator entrance.
12. Grounding Phase Terminals: Overheating evidenced by excessive discolorations of copper, loose connection bolts, defective cable insulation, no mechanical tension during temperature changes, leads appear improperly trained, and create danger of flash-avers from unsafe phase-to-phase or phase-to-ground clearances caused by deterioration of leads/expansions during temperature changes.
13. Instrument Transformer Junction Boxes and Conduits: Loose or severely corroded components, including secondary lead connections.
14. Breathers: Holes plugged with debris.
15. Temperature Indicating/Alarm Systems, Including Conduit/Fittings: Loose fastenings, rust, severe corrosion, deteriorated paint, other mechanical defects, loose electrical connections.
16. Manual/Automatic Tap Changers: Loose connections, rust, severe corrosion, other mechanical defects, lack of lubrication, signs of burning around conducting and non-conducting parts of terminal boards.
17. Liquid Level Indicators: Rust, corrosion, lack of protective paint, cracked or dirty gauge glasses so that liquid level not discernible, plugged gauge-glass piping, liquid level below permissible level indicated by mark for gaging, signs of leakage around piping, gauge cocks, gauge glasses, or other indicating devices.
18. Fans/Fan Controls for All Air-Cooled Transformers
    a. Lack of rigidity in mounting fastenings.
    b. Motors (external): dirty, moisture, grease, oil, overheating, detrimental ambient conditions.
    c. Apparent deterioration of open wiring and conduit that may cause malfunctioning of either fans or controls.
    d. Improper functioning when manual (not automatic) fan controls operated.
19. Water Cooling Systems
    a. Leaks in piping, fittings, or valve; visible drainage system plugged; open ditches for drainage water fouled with vegetation.
    b. Bearings: evidence of wear, indications of corrosion, external deterioration, leaks.
    c. Incipient deterioration, corrosion, rust, loose fastenings, other mechanical

deficiencies, loose electrical connections for all components of alarm system.
   d. Temperature Devices: signs of deterioration that might cause malfunction or difficulty in taking readings.
   e. When pressure gauge readings on each side of strainer varies more than a pound or two, look for cause, such as plugged strainer.
20. Grounding: Visual Connections: loose, missing, broken connections; signs of burning or overheating, corrosion, rust, frayed cable strands, more than one strand broken in 7 strand cable, more than 3 strands broken in 19-strand cable.
21. Lightning Arresters: Where attached to or mounted on, refer to Inspection Guide 13.
22. Protective Relays: here attached to or mounted on, refer to Inspection Guide 16.

46.2 LINE - TRANSFORMER - De-energized

1. SCOPE: De-energized electric power transformers used for voltage transformation on transmission lines and high voltage distribution systems.
2. Bushings and Insulators
   a. Insulators and Porcelain Parts: indications of cracks, checks, chips, breaks; where flashover streaks are visible, reexamine for injury to glaze or for presence of cracks.
   b. Chipped glazed exceeding 1/2 inch in depth or an area exceeding one square inch on any insulator or insulator unit.
   c. Severe cracks, chipped cement, or indications of leakage around bases of joints of metal to porcelain parts at terminal and transformer ends.
   d. Terminal Ends: mechanical deficiencies, looseness, corrosion, damage to cable clamps.
   e. Improper oil level in oil-filled bushings.
   f. Heating evidenced by discolorations, and corrosion indicated by blue, green, white, or brown corrosion products, on metallic portions of all main and ground terminals, including terminal board and grounding connections inside transformer case.
   g. Pipe, Bar Copper, and Connections: indications of overheating or flashover fusing.
   h. Cable Connections: broken, burned, corroded, missing strands.
3. Enclosure and Cases: If case is opened for any reason, examine immediately for signs of moisture inside cover, and where present, for plugged breathers, inactive desiccant, enclosure leakage.
4. Coil and Cores: If cover is open, examine interior for deficiencies, dirt, sludge.
5. Bushing-Type Instrument Transformers
   a. Indications of deteriorated insulation, overheating evidenced by excessive discoloration of terminals and other visible copper, physical strains indicated by bent or distorted members.
   b. Terminals, including secondaries; corrosion, loose connections.
   c. Secondary Leads: visible broken, cracked, or frayed insulation.
   d. Conduit and Associated Fittings Carrying Secondary Leads: rust, corrosion, other deterioration, loose joints in conduit fittings and around terminal boxes.
6. Automatic Tap-Changers (load ratio control apparatus): Make inspection in accordance with manufacturer's instructions.
7. Forced-Air Fans and Fan Controls
   a. Fans and Motors: defective bearings, inadequate lubrication, presence of dirt, bent or broken fan blades or guards, lack of rigidity of mountings, indications of corrosion or rust.
   b. Starting and Stopping Devices: improper functioning as determined from

operating once or twice.
   c. Fan Speed: not in accordance with nameplate requirements.
8. Water Cooling Systems: Water not being delivered in required quantity.
9. Gauges and Alarms
   a. Liquid Level Gauge and Alarm System: dirty, not readable, improper frequency of calibration.
   b. Pressure Gauges and Valves on Inert Gas Systems: improper frequency of gauge calibration; leaks in piping both before opening and after closing tanks.
   c. Test grounding system in accordance with Inspection Guide 12.
10. Additional Inspections: Inspections described in Inspection Guide 14.1 Line Transformer - Energized, are to be performed as part of this inspection.

47. LINE - SWITCHGEAR/DISCONNECTS

47.1 LINE - Switchgear/Disconnects

1. SCOPE: Manually group-operated and hook-stick-operated disconnecting switches used on transmission lines and distribution system, including grounding switches.
2. Safety: Comply with all current safety precautions. Do not operate until tests show circuit is dead and grounding harnesses have been attached. Do not operate without prior clearance from operating forces. Inspection of pole-mounted switches requires an assistant to operate the switch from the ground.
3. Group-Operated Switches: rust, corrosion, loose brackets and holding bolts, nonrigid bearings and supports.
4. Grounding Cables, Clamps, and Straps: weak supports, broken or frayed portions of conductors, loose connections.
5. Insulating Section of Operating Rod: indications of cracks or signs of flashovers.
6. Movable Connections: inadequate lubrication, rust, corrosion, other conditions resulting in malfunctioning.
7. Switch: stiff gears or proper adjustment. (Operate switch several times to determine. Do not operate without prior clearance).
8. Locking and interlocking Devices and Mechanisms: functional inadequacy to prevent unauthorized operation.
9. Mountings and Bases: rust, corrosion; twisted, bent, or warped; loose or missing ground wire.
10. Insulators:
    a. Cracks, breaks, chips, or checking of porcelain glaze, more than thin or transparent film of dirt, dust, grease, or other deposits on porcelain.
    b. Damage indicated by streaks of carbon deposits from flashovers.
    c. Loose, broken, or deteriorated cement holding insulator to other parts. (Arrange for insulator cleaning during this inspection since it is performed only when line is de-energized.)
11. Blades and Contacts:
    a. Excessive discoloration from overheating; roughness and pitting from arcing.
    b. Misalignment of blades with contacts.
    c. Arcing Horn Contacts: bums, pits, failure to contact each other throughout their length when switch is opened and closed.
    d. Inadequate tension of bolts and springs.
    e. Inadequate blade stop.
    f. Lack of hinge lubrication; insufficient nonoxide grease for blades and contacts.
12. Connections
    a. Cable or Other Electrical Connections: loose bolts, discolorations indicating

excessive heating at connection points.

b. Corrosion, particularly that resulting from atmospheric conditions.
c. Electrical Clearances of Cable or Other Conductor: inadequate to other phases or to ground for applicable circuit voltage. (Switch both open and closed.)
d. Flexible Connections: frayed, broken, or brittle. (Excessive discoloration indicates overheating.)
e. Cable from Grounding Switch to Grounding System: frayed, broken strands, loose connections.

48. RELAYS

48.1 RELAYS

1. SCOPE: Protective relays located in electrical power circuits only. It does not include relays used to protect or control utilization equipment. Relay adjustments, settings, and electrical tests are not covered by this Inspection Guide. Inspection is limited to those aspects that relate to care rather and to the operating characteristics of relays.
2. General: dirty, evidence of moisture, high temperature, and other adverse conditions.
3. Visible corrosion, deterioration, or pitting of contacts, pivots, and coils.
4. Broken or loose parts and connections.
5. Temperature and Pressure Relays
   a. Settings at improper temperature and pressure limits.
   b. Evidence of damaging temperature or pressure conditions.

49. FUSES/CUTOUTS/CIRCUIT BREAKERS

49.1 FUSES/CUTOUTS/CIRCUIT BREAKERS

1. SAFETY: Do not remove covers, contact fuses or de-energize circuits.
2. For by-passing
3. Fuses: overheating, indicated by discoloration of brass or copper at contact points; distortion, charring, deterioration of fiber cases of cartridge type cases, or overheating of enclosure.
4. Circuit Breakers: distortion, charring, deterioration of molded portions of case, or overheating of enclosure.
5. Grounding: loose corroded connections; deteriorated or abraded insulation; frayed or broken cables.

50. CHEMICAL FEED EQUIPMENT - Water Supply

50.1 CHEMICAL FEED EQUIPMENT - Water Supply

1. Motors for overheating and vibration.
2. Wiring and electrical controls for loose connections; charring; broken or wet insulation; evidence of short circuiting and other deficiencies.

51. CHLORINATORS AND HYPOCHLORINATORS - Water Supply

51.1 CHLORINATORS AND HYPOCHLORINATORS - Water Supply

1. Motors: excessive heat or vibration, noisy operation.
2. Wiring, motor controllers and other electrical controls: loose connections; charring; broken or wet insulation, evidence of short circuiting, worn contacts, arcing,

grounds, defective heater or resistance elements, and other deficiencies.
3. Adequacy and operation of ventilation system.

52. AERATION EQUIPMENT – Water

52.1 AERATION EQUIPMENT - Water

1. Motors: operation, noise and excessive heating.
2. Wiring and Electrical Controls: loose connections; charred, broken or wet insulation; evidence of short circuiting and other deficiencies.

53. WATER SUPPLY SYSTEMS

53.1 WATER SUPPLY SYSTEMS - Storage - Ground/Underground

1. Anodic Rods: defects and broken segments, failure to remove anodes where ice forms in freezing weather.
2. Conduit: rust, corrosion, loose, burned, missing, or other damage to parts and connections.
3. Remove conduit inspections plates and examine internal connections: looseness and inadequacy; relays for loose or weak contact springs, worn or pitted contacts, defective operation.

53.2 WATER SUPPLY SYSTEMS - Storage - Elevated Tanks

1. Receptacles, outlets, and conduits: protection against dirt, weather, and entrance of moisture; proper grounding.
2. Wiring and electrical controls; loose connections, charred, broken or wet insulation, evidence of short circuiting and other deficiencies.
3. Obstruction and Navigation Lights: need of relamping, other lights, hoods, shields, receptacle fittings, missing loose, damaged parts, failure to operate.
4. Cathodic Protection System; rust, corrosion, broken or frayed wires, loose connections.
5. Anodic Rods: defects and broken segments, failure to remove anodes where ice forms in freezing weather.
6. Lightning Rods, Terminals, Cables, and Ground Connections: rust, corrosion, loose, burned, missing, or other damage to parts and connections; test for electrical continuity through ground connections.

54. AERATION EQUIPMENT – Sewage

54.1 AERATION EQUIPMENT - Sewage

1. Motors: operation, noise and excessive heating.
2. Wiring and Electrical Controls: loose connections; charred, broken or wet insulation; evidence of short circuiting and other deficiencies.

55. FUEL FACILITIES

55.1 FUEL FACILITIES - Distribution (Receiving and Issue)

1. Permanent Grounding Connections for Steel Structures, Piping and Railway Trackage at Fuel Piers and at Receiving and Issue Stands: mechanical and corrosive damage.
2. Portable Grounding Connections: mechanical and corrosive damage.
3. Test permanent and portable grounding connections with megger or ohmmeter to

assure electrical continuity and zero grounding.

55.2 FUEL FACILITIES - Storage

1. SCOPE: Surface and subsurface tanks, tank enclosures, and tank fittings and appurtenances.
2. Ground Connections: looseness, missing, mechanical damage; corrosion interfering with electrical continuity.

56. CATHODIC PROTECTION SYSTEMS

56.1 CATHODIC PROTECTION SYSTEMS

1. SCOPE: Cathodic protection systems, including galvanic or sacrificial anode types and rectifier types installed for prevention and mitigation of corrosion of steel structures buried in the ground or in contact with water or other corrosive liquids. It does not cover electrical operation tests.
2. Safety: Do not bridge insulated couplings. Do not make or break electrical connections.
3. Galvanic or Sacrificial anode Systems
   a. Terminals and Jumpers of Test Leads (permanently installed and accessible on underground systems): rust, corrosion, broken or frayed wires, loose connections, similar deficiencies.
   b. Anode Suspensions (elevated water tanks and systems for waterfront structures): rust, corrosion, bent or broken suspension members or braces, frayed or broken suspension lines or cables, loose bolts, loose cable connections, frayed or broken suspension lines or cables, loose bolts, loose cable connections, frayed or broken wiring.
   c. Anodes (waterfront structures, where visible): when more than 3/4 spent, report apparent average diameter remaining.
   d. Bushing (supporting anode): severe rust and corrosion; where resistors including variable types are installed in circuit, examine units for corrosion, broken/frayed wires, loose connections.
   e. Electric wiring (hot water tanks): poor insulation, loose connections.
4. Rectifier-Powered Systems
   a. Exterior of enclosure: rust, corrosion, mechanical damage.
   b. Cover Hinges and Locks: inadequate lubrication, rust, other deficiencies.
   c. Wiring and Fastenings near Rectifier: broken or damaged insulation; rust, corrosion on conduit.
   d. Interior of Enclosure: rust, drops of moisture, loose wiring, signs of excessive heating. (Do not put hand or tools inside enclosure.)
   e. Perform anode inspection in accordance with Check Points 2 and 3.
   f. Exposed Wires and Cables: insecure fastenings, frayed or broken insulation.
   g. Electrical Connections (wires and cables connected, except rectifier Enclosures): poor condition, loose connections other deficiencies.

57. STREET AND OTHER EXTERIOR LIGHTING

57.1 STREET AND OTHER EXTERIOR LIGHTING

1. Lighting fixture: proper support and location.
2. Luminaries and fixtures: cracked or broken, missing parts; evidence of overheating or other damage.
3. Wiring and electrical controls/switches: loose connections; charred or broken

insulation; evidence of short circuiting and other deficiencies.
4. Reflectors and diffusers: cleanliness.
5. Light: operates as designed.

58. VAULTS AND MANHOLES

58.1 VAULTS AND MANHOLES

1. SCOPE: Vaults and manholes used in electrical power distribution system. Vaults include any space or structure used to house electrical distribution equipment. Manholes include in-ground structures used to provide junctions for cable runs, for pulling in cable, to allow space for expansion and contraction of cable, to provide ventilation, to drain underground conduit runs, or to house electrical equipment. Transformers and switchgear are covered by other Inspection Guides.
2. Safety: An assistant should always be available to render assistance or first aid. Underground vaults and manholes should be entered only after allowing sufficient time for natural ventilation. An approved tube-type power blower should be used for ventilating such areas when the presence of dangerous, noxious, or inflammable gases is detected or suspected. Sources of such gases or highly explosive mixtures should be reported for immediate correction, particularly when the cable is heavily loaded, when the source is near electric welding work, or when other possible sources of ignition are present. Before entering vaults or manholes, observe the following precautions. Do not carry lighted tobacco, open flames, or extension lamps near, or into, vaults and manholes. Do not lower electric fans for the purpose of ventilation. Do not wear hobnailed shoes. Request that a test be made with the approved United States Bureau of Mines gas-detecting equipment for the type and concentration of gases.
3. Dangerous, noxious, or flammable gases detected or suspected.
4. Manhole Covers and Gratings: Plugged vents, defective gaskets, cracks, rust, corrosion, particularly on underside, poor fit, structural inadequacy.
5. Ladders and Steps: Rust, corrosion, loose anchorage, other defects.
6. Roofs, Walls, and Floors: Dirty, evidence of burning, cracks, leakage, flooding, structural inadequacy, other defects.
7. Vault Doors: Unlocked, binding, difficult operation, does not swing clear and free; defective hinges, latches, locks, and other similar devices; rust, corrosion, abrasions or other defects.
8. Ventilating Systems, Ducts, Blowers, and Automatic Controls: Dirty, rust, corrosion, excessive noise and vibration, dirty air filters, defective operation.
9. Lights and Switches: Broken or missing globes and protectors; types not in accordance with safety regulations, if required; defective operation; rust and corrosion from excessive moisture.
10. Firefighting Equipment: Inadequate and apparent unsatisfactory operating condition. (Determine from fire inspector's tags.)
11. Signs, Instructions, and Identification Tags: Dirty, illegible, and improperly located.
12. Sewer and Sump: Trash, other obstructions, clogged drains causing ponding or flooding, faulty operation of pump.
13. Grounding Wire or Cable, and Ground Rods Where Visible
    a. Lack of continuity, loose connections, signs of corrosion.
    b. Measure ground-resistance values; report those in excess of 3 ohms.
14. Bonding Sheaths
    a. Bonding wire or cable touching cable sheath at other than point of connection.
    b. Lack of continuity; corrosion, loose connections.

15. Cables
    a. Excessive strain on sheath, poor arrangement, crowding, inadequate maintenance; splices for overheating, leaks, bulges.
    b. Cracks, punctures, deep scratches in cable sheath.
16. Ducts: Cable damage from abrasion, cable not free to expand and contract, inadequate cable training, defective or rusted cable shields.
17. Fireproofing Cable (2200 volts or more) (Visual Inspection): Wrapping not in place, loose, insecure.
18. Potheads: Rust, corrosion, corrosion, cracked or broken porcelain, leakage of joint compound.
19. Subway Junction Boxes
    a. Rust, corrosion, loose, missing, or defective cover bolts.
    b. Breaks, aging, or leaking gaskets, particularly in pressurized boxes. Where leakage is suspected remove cover, if box is opened, check physical condition of sectionalizing fuses and copper links.

59. TUNNELS AND UNDERGROUND STRUCTURES

59.1 TUNNELS AND UNDERGROUND STRUCTURES

1. SCOPE: Tunnels of all kinds, including ammunition storage tunnels; pipeline tunnels, vehicular tunnels, and water tunnels; also, underground structures housing utilities, service installations, and similar equipment or operations. It does not include underground tanks, nor earth-covered ammunition magazines that are wholly or partly aboveground.
2. Lighting Systems and Fixtures: poor operating condition, inadequate, improper types.
3. Grounding Connections: electrical discontinuity, loose, missing, corrosion, or other damage to the connections. (Grounding of metal parts is required in ammunition tunnels.)

60. INCINERATORS

60.1 INCINERATORS

1. Wiring and Controls: loose connections, damaged insulation; evidence of short circuits; loose or weak contact springs; worn or pitted contacts.
2. Examine Motor windings and brush rigging.

61. ANTENNA - SUPPORTING TOWERS AND MASTS

61.1 ANTENNA - Supporting Towers and Masts

1. SCOPE: Antenna-supporting towers and masts, strongback insulation to towers, obstruction and navigation lighting. This Inspection Guide does not cover the inspection of antenna.
2. Obstruction and Navigation Lights: relamping.
3. Improper operation and lack of cleanliness of fights, shields, hoods, and receptacle fittings.
4. Sticking, binding, arcing, or burning of relay contacts; loose connections, missing parts of relays.
5. Lightning Rods and Aerial Terminals: damage from burning.
6. Conduits, Terminals, and Downleading Cables: corrosion, loose or missing attachments to structures, other damage.

7. Poor or unsatisfactory mechanical bonding of joints of aerial terminals, downleading cables, and ground connections.
8. Lack of electrical continuity from aerial terminals through ground connections.
9. Dirt, dust, grease, or other deposits on insulators, or cracks, breaks, chips, or checking of the porcelain glaze.

62. WATERFRONT FACILITIES

62.1 WATERFRONT FACILITIES

1. SCOPE: This Inspection Guide covers electrical circuits for light and power on piers. It includes the cable and wire circuits from the distribution center or substation to the pier service outlets. Utilization equipment and portable cable are not covered. Vaults and manholes are covered by Inspection Guide.
2. Conductor Enclosures and Supports
    a. Corrosion of or damage to, conduits and ducts: missing or unsecured covers and fittings; improper internal drainage, plugged drain openings; missing fasteners; accumulations of dirt and debris in ducts and wireways.
    b. Undersized conduit, ducts, wireways and racks.
    c. Overcrowding of conductors in conduits, ducts, wireways and racks.
    d. Disorderly arrangement of conductors within enclosures, unidentified/unused conductors, conductors not enclosed and/or inadequately supported for long runs.
    e. Inadequately supported conductors at terminals, insufficient slack at terminals and at sharp bends.
3. Insulation
    a. Abraded (worn) conductor insulation at points of support, at sharp bends and at points of entry into panel boxes, switchgear and other enclosures and where exposed.
    b. Frayed/broken insulation, defective insulation at splices, inadequate or loose tape; check insulation of all temporary service conductors exposed to pedestrian or vehicular traffic.
    c. Overheated or burned insulation, rodent or insect damaged insulation.
    d. Exposure to water, grease and oil.
    e. Check all insulation within panel boxes, switchgear, hooded service enclosures, service outlets, ship-to-shore outlets; check for hot spots, burns and arcing.
4. Receptacle Outlets and Miscellaneous Fittings
    a. Protection against foul weather and entrance of dirt and moisture; dirty or corroded contacts; check for hot spots, burning and arcing; loose fittings, illegible/inadequate identification; missing/loose covers; corrosion of exposed metal surfaces.
    b. Cross-threaded caps, broken chains, loose connections, defective swing-type caps; check open type fittings with rubber flaps for poor closures and sealing.
    c. Adequate number, proper types, and convenient locations of service and ship-to-shore outlets. Long runs of temporary circuits to users indicate inadequate number or location.
    d. Adequate number of circuits, proper size conductors; check for overloaded circuits.
5. Panels
    a. Missing, illegible, incorrect and inadequate indexing, instructions and phase and polarity markings.
    b. Defective or inadequate grounding; lack of continuity.

c. Serviceability; dirty, rusted, loose, or broken connections, unprotected countersunk bolts.

6. Breakers and Outlets
   a. Malfunctioning, dirty/corroded and misaligned contacts; broken or loose connections; defective or missing cover/hood gaskets.
   b. Indicating lamps malfunctioning, heaters inadequate for preventing condensation.
7. Pier Lighting Luminaries, Flood Lights including Standards and Switches
   a. Dirt, rust, corrosion, internal condensation, inadequate ventilation.
   b. Loose connection, charred insulation, arcing.
8. Tests
   a. Measure insulation resistance between cable conductors and ground in pier circuit feeders; keep running record of insulation resistance measurements, noting test points, instrument used, and dates of test; report evaluations of such measurements; insulation resistance measurements should exceed 300,000 ohms for safe operation.
   b. Spot-check illumination levels, light output depreciation of 20 to 25 percent below level obtainable from clean fixtures and new lamps will require lamp replacements.
9. Grounding
   a. Grounding Connections: loose, missing, rust, corrosion, mechanical damage, electric discontinuity.
   b. Connections: rust, corrosion, loose, missing, broken, other damage.

63. TELEPHONE

63.1 TELEPHONE - Substations

1. SCOPE: Telephone substations, their wiring and associated equipment.
2. Terminal: Defective face plate, broken lugs, dirt; connections for crosses and shorts; drop wire attachments and connections for looseness.
3. Drop or Block Wire from Terminal (Visual from Ground): Deteriorated, damaged, improperly placed, inadequately supported, insufficient clearances from trees and utilities, damaged insulation, missing or damaged guards.
4. Protector
   a. Improperly located with respect to liability to damage from moisture or mechanical injury.
   b. Loose and inside wire connections.
   c. Test ground connection for ground at protector.
5. Inside Wire (Where Accessible)
   a. Improperly or not securely fastened, damaged or defective insulation, inadequate clearance or insulation from electric wires, water pipes, etc.
   b. Existing location subjects wire to liability of damage from moisture, mechanical injury, or other cause.
   c. Connection Block, if used: improper mounting, loose connections, bent cover in contact with terminals.
   d. Ground Connection: defective, improperly made, subject to mechanical injury, insufficient separation from light or power wires is evident.
6. Transmitter Mouthpiece: cracks, breaks.
7. Receiver
   a. Shell: cracks, breaks.
   b. Diaphragm: dents, rust, etc.

8. Case: Dirty, cracked, broken, rubber or felt pads missing on desk sets.
9. Dial: Insecurely mounted, bent wheel or finger stop. Test speed and functioning of dial.
10. Cords: Frayed or worn; secure loose stay cords and hooks; straighten twisted cords.
11. Capacitors: Leads improperly soldered, terminals loose.
12. Ringer: Improperly adjusted; insecurely mounted; loose gongs; nicks, dents, or improper connections in coils.
13. Induction Coil: Insecurely mounted; nicks, dents, or breaks in windings.
14. Hookswitch: Tight lever action; bends, rust, pitting, in springs; contacts make and break improperly.
15. Wire Forms: Incorrect color code and connections, broken or frayed wires, poor soldered connections, defective lacings, inadequate wire lengths.
16. Screws and Nuts: Missing, stripped, or worn screws and nuts.

63.2 TELEPHONE - Aerial Cable

1. SCOPE: Aerial cable portion of outside telephone plant.
2. Safety: Before riding messenger wire, test it for holding at least double the weight of the man who is to ride it. Throw a 1/2 inch manila rope over the strand at the center of the span so that the thrown end falls to the ground. Two men should than grasp both strands of the rope and allow their full weight to hang from the rope.
3. Suspension Strand (Messenger Wire)
    a. Sag and clearance does not conform to standard construction requirements, particularly at road crossings in connection with reclassification, regrading, or rerouting of roads in vicinity of cable pole line.
    b. Loose through-bolts, drivescrews, reinforcing straps, and links; bonding ribbon not intact, insecurely fastened.
    c. Corrosion, particularly in hot and humid climates, or where enclosed in tree guards, or in vicinity of railroads, industrial or chemical plants, and other locations where severe corrosion conditions exist (Minor corrosion, but one broken wire at single cross section, requires reinforcing.)(Two or more broken wires at single cross section, but general condition of strand is such that it is to be continued in service, will require removal of broken section and cutting in new piece of strand, using strand connectors.) (Considerable corrosion will require measuring to determine remaining strength. Follow procedure in check points 4 and 5).
    d. Measure the diameter of the suspension strand accurately with a micrometer as follows:
        (1) Clean the outside wires of the corroded strand with emery cloth or a fine flat file. The surfaces of the strand wires on which the contact edges of the micrometer will rest should be substantially clean bright steel but rust between adjacent wires of the strand need not be removed. Corrosion extending over a considerable area should be removed. The wire should not be filed sufficiently to remove small distributed pits where the pits are so small that their cross-section areas may be disregarded. To do so would tend to reduce the cross-section area of the wire below the real area, thereby affecting the strength of the strand.
        (2) Place the contact edges of the micrometer on diametrically opposite wires of the strand. Turn the micrometer around the strand to determine the minimum reading, with the micrometer edges resting on diametrically opposite wires. In all cases the strand should be rated on the smallest diameter measured at the test location.

(3) Measure the strand tension by means of a strand dynamometer.

e. If the minimum strand diameter is equal to, or less than, the values in standard tables for the tension corresponding to the measured strand tension, the strand should be reported as requiring immediate replacement.

4. Aerial Cable
   a. Missing or improper suspension ring spacing, loose or improper size grade clamps, creeping cable, loose or misplaced cable guards, bowing cable, nonstandard construction.
   b. Cable Sheath: cracks, ring cutting, damage under grade claps, evidence of corrosion and crystallization.
   c. Cuts in cable supported on 10M and 16M strand deeper than 1/3 thickness of sheath or when supported on 6M strand deeper than 1/2 thickness of sheath.
   d. Extensive replacement or re-spacing of rings appears necessary.
   e. Lashing wire improperly terminated, cable not supported at poles with cable supports.

63.3 TELEPHONE - Open Wire Lines

1. SCOPE: Open wire portion of outside telephone plant.
2. Safety: When it is necessary to climb poles that are not definitely known to be strong enough to withstand additional loads, a temporary support should be provided. Prior to climbing, particular attention should be given to weather conditions, power hazards, traffic warning procedures, and tree brush cuttings.
3. Hazards created by deviation from standard practices, by use of old standards of construction, or by use of obsolete materials.
4. Unauthorized attachments on poles.
5. Clearances
   a. Nonconformance to local regulations where over private and public property, waterways, streets, driveways, alleys, sidewalks, and other.
   b. Nonconformance to accepted standards where over or under railways and railroads.
   c. Inadequate clearance from electric light and power wires, trolley feeders, contact wires, or transformers, including supporting structures for plant of this nature, creating potential hazard to personnel from direct crosses, or *power arc follow-up".
6. Sag
   a. Non-uniform, inadequate, abnormal in some degree as to constitute a hazard or cause service interference.
   b. Non-uniform, obviously excessive, or insufficient sag caused by inadequate or defective guys, including crossarm guys, and anchors.
7. Scrap or Debris: Pieces of scrap wire, metallic material, or other debris hanging on wires.
8. Tree Interference
   a. Inadequate separation through trees, hedges, etc.; contact with limbs, branches, or foliage is to be expected during sleet, now, rain, and wind storms; growth resulting in inadequate separation will occur prior to next inspection.
   b. Dead limbs or trees in danger of falling onto line; brush and young tree growth under lines may cause future interference.
   c. Improper disposal of branches and brush where pruning or cutting has been done.
9. Wire
   a. Badly rusted, corroded, kinks, cuts, nicks, tie bums. (In sections where

condition of wire cannot be otherwise determined, climb a number of poles at selected locations to determine if deterioration exists; where badly deteriorated wire is found, make further climbing inspections; note extent of damage and amount of replacement required.)

b. Defective insulation, faulty ties and attachments, and loose connections on twisted pair, parallel or other insulated wire in long spans, ring runs, and through trees, including temporary twisted pair and emergency cable.
c. Open Wire Dead Ends: improperly made, insecure.
d. Wire Jumpers: not installed where required.
e. Bridle Cables and Wires: improperly placed, improperly terminated, loose connections, abraded insulation, kinks, loose or uninsulated splices.
f. Bridle Rings: not installed where required.
g. Poor connections, line wire joints, improper wire size in spans crossing over railroads and in adjacent spans.
h. Report locations where placing of exchange cable or cable terminals will eliminate excessive wire; report locations where it appears economical to replace defective drop wire in line spans with cable, or with crossarms and bare wire.
i. Dead wire in hazardous condition.
j. Excessive strain on attachments, wires, and ties caused by severe grade changes; wire on wrong side of insulators with respect to pull on corner poles.

10. Connections
    a. Handmade and other unauthorized or obsolete types of splices, joints, or connections in fine wire and between line and bridle wires.
    b. Loose and poor condition at cable terminals, binding posts, bridging, and test connectors.
    c. Ties: missing, broken, loose; incorrect placement, size, or type; unsatisfactory condition.
    d. Improper makeup, excessive corrosion, inadequate, loose, other defects.
11. Insulators
    a. Missing, broken, floating, obviously loose, incorrect types in lines.
    b. Bridle Wire Insulators: missing where required, poor condition, improperly installed.
12. Protective Equipment
    a. Mountings: improperly and insecurely attached to pole, broken cover, hinge-type cover closes improperly, broken ground wires.
    b. Defective or corroded springs, missing or defective blocks, moisture or dirt inside mounting.
    c. Ground and Bridle Wires: improperly installed, connection and protector blocks in poor condition.
    d. Protector blocks improperly placed on open wires entering cables. (Check local instructions with respect to areas where protector blocks should be provided on exchange open wires less than one-half mile in length.)
    e. If open wires and drops entering particular terminal are equipped with protector blocks note whether all open wires or drops entering terminal are so equipped.
    f. Ground plate of protector mounting improperly connected to suspension strand or sheath of underground or buried cable.
13. Loading Coils
    a. Cases and supports used with open wire loading in poor condition and insecurely attached.
    b. Exposed wires: improper placing, loose connections, defective insulation.

14. Long Span Construction
    a. Insecure attachment of steel crossarms and angle iron braces at dead end and suspension strand fixtures.
    b. Arms and Braces: warping, buckling, other defects likely to weaken structure.
    c. Crossarms or Suspension Strand Hangars: bad alignment, loose hangar clamps, non-uniform sag in suspension strand.
    d. Clamps for head guys and riding and suspension strand at dead ends in poor condition and insecurely attached.
    e. Loose wire dead ending clamps, wire loop and splice in poor condition.
    f. Suspension Insulator Eye-Bolt: poor condition, end of bolt not upset to prevent it working loose.
    g. Suspension insulator broken, wire hangar and wood block in poor condition, span wire insecurely held.
    h. All Steel Surfaces: rust, corrosion, damage to galvanizing or protective paint.

63.4 TELEPHONE - Buried and Underground Cable

1. SCOPE: Buried and underground lead-covered telephone cables, including cable trench and trench markers.
2. Safety: Comply with all current safety precautions. An assistant should always be available to render assistance or first aid. Underground vaults and manholes containing telephone cables should be entered only after allowing sufficient time for natural ventilation. An approved tube-type power blower should be used for ventilating such areas when the presence of dangerous, noxious, or flammable gases are detected or suspected. Sources of such gases or highly explosive mixtures should be reported for immediate correction, particularly where heavily loaded power cables occupy the same ducts and manholes. Before entering vaults or manholes, observe the following precautions. Do not carry lighted tobacco, open flames, or extension lamps near, or into, vaults and manholes. Do not lower electric fans for the purpose of ventilation. Do not wear hobnailed shoes. Request that a test be made with approved United States Bureau of Mines gas-detecting equipment for the type and concentration of gases.
3. Buried Cable (Walk over all areas where buried cable is known to exist.)
    a. Evidence of construction work threatening interference of damage.
    b. Sunken trench indicates depressions so pronounced that a drop in trench base is evident. (Have test excavation made to disclose deficiencies).
    c. Trench markers displaced, missing, or damaged.
    d. Men at work instructed not to damage cable and their supervisor instructed to station a person to see that warning is carried out.
4. Underground Cable
    a. Manholes: loose, poor fit, or missing covers; flooding, excessive moisture, seepage of water through walls or floor and around duct entrances.
    b. Loose duct plugs allowing water or gas seepage.
    c. Cable Racks and Ties: looseness, corrosion.
    d. Cables: evidence of corrosion; area of fine cracks granular appearance on sheath metal indicating crystallization, particularly near point where cable leaves duct and at sharp bends.
    e. Electrolytic action on cable sheath, sleeves, and wiped joints.
    f. Drainage wires: defective fuses; poor connection to cable and bus bar or racks.
    g. Test for maximum and minimum values of current flowing in drainage wire and note appreciate differences in amounts measured and that measured on previous tests.

64. AMMUNITION STORAGE - Aboveground

64.1 AMMUNITION STORAGE - Aboveground

1. SCOPE: Ammunition storage facilities that are covered with earth, but aboveground.
2. Grounding Connections: corrosion, mechanical damage. Test with megger or ohmmeter to assure electrical continuity and zero grounding.

65. FENCES – Safety

65.1 FENCES - Safety

1. SCOPE: Metallic fences and other permanent barriers surrounding electric power equipment centers and preventing unauthorized personnel from accidentally contacting such equipment.
2. Electrical Grounding
   a. Cables not attached to posts and fabric of fence; missing flexible connections at all gates.
   b. Rust, corrosion, frayed or broken, missing connectors, broken strands.
   c. Loose, missing, or other damage to visible connections at top of ground rods. (Do not disconnect ground connections or open any connections between ground cables and ground rods.)
   d. Failure to connect or provide, or damage to ground wires attached to supplementary guard wires on wooden structures.

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HVAC and PLUMBING CHECKLIST

Perform the inspection by checking the operation and examining the condition of each piece of equipment or component.

Comply with all current safety precautions when conducting the inspection.

Perform the inspection by walking through the site checking the operation of each piece of equipment and examining the condition of each component.

If a ladder is required to gain access to inspect large tanks or other overhead places, transport to site.

When it is necessary to test all alarm systems associated with a fire sprinkler system, all building occupants and the fire department should be notified that the system's alarms will be tested.

For each repair requirement identified during inspection, provide the following information:

A. Method of repair: Replace, clean, calibrate, etc.
B. Current condition: Damaged, leaking, inoperative, etc.
C. What component or item requires repair
D. Location: Room number, building number, etc.
E. Quantity: Each, linear feet, etc.
F. When action should be taken: 0 year, 1 year, 2 years, 3 years

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66. AIR CONDITIONING (Buildings)

66.1 AIR CONDITIONING (Buildings) - Systems

1. SCOPE: Air-conditioning equipment
2. Lubrication: inadequate lubricating, excessive bearing temperature; inadequate lubrication of bearings and moving parts; low oil level, poor oil condition.
3. Rust and Corrosion: damage from rust and corrosion.
4. Motors, Drive Assemblies, and Fans: dust, dirt, grease, accumulations; worn, loose, missing, or damaged connections and connectors; bent blades; worn or loose belts; unbalance, misalignment, excessive noise and vibration, end play of shafts, ineffective sound isolators, poor condition of motor windings and brushes.
5. Wiring and Electrical Controls: loose connections, charred, broken or wet insulation, short circuits, loose or weak contact springs, worn or pitted contacts, defective operation, wrong fuses, other deficiencies.
6. Temperature and Humidity Controls: improper setting, loose connections, worn, dirty, pitted or misalignment of contacts, defective operation noted in observing operation through complete cycle, inaccuracy of thermostats, humidistats.
7. Thermal Insulation and Vapor Barriers: wet, damaged, or missing, broken tie wires, loose bands, torn canvas jackets.
8. Air Filters: dust, grease, other deposits, missing, improper fit.
9. Guards, Casings, Hangers, Supports, Platforms, and Mounting Bolts: loose, broken, or missing parts and connections, deformations, improper level, ineffective sound isolators.
10. Pump Units: dust, dirt, other deposits, leaks, noise, vibration, loose or missing connections or parts, defective operations.
11. Piping: leaks, corrosion, deformations, material defects of fittings, copper tubing, steel piping.
12. Water Sprays, Weirs, and Similar Devices: external scale, leakage, defective valves including float valve in sump, clogged nozzles or pipes; improper positioning of spray drift, to compensate for prevailing winds, or to provide cooling for entire coil; material defects.
13. Compressors: dirt, dust; leakage of oil, water or refrigerants; loose connections, loose or worn belts or parts, misalignment, excessive noise and vibration, incorrect suction and discharge pressure.
14. Shell-and-Tube Type Condensers: dust accumulations, leaks including connection to cooling tower.
15. Self-Contained Evaporative Condensers: leaks at pump or in piping, improper setting of float control device, improper overflow of solids contained in water, insufficient outdoor air flow, clogged nozzles, inadequate spread of water.
16. Air-Cooled Condensers: dust accumulations, leaks, excessive noise and vibration, loose, missing, or damaged parts.
17. Liquid Receivers: leaks, clogging, cracked gauge glasses, damaged parts.
18. Refrigerant Driers, Strainers, Valves, Oil Traps, and Accessories: inadequate operation.
19. Cooling Coils: dust, leaks not located and marked or tagged, bent fins, out of level and liquid flow not toward outlet of coil, obstructions to air flow, excessive frosting, and automatic temperature controls.
20. Contamination: connection of potable water to sewer system; absence of air gap between potable water and waste pipe.

66.2 AIR CONDITIONING (Buildings) – Ducts, Dampers, Registers, Grills, Louvers

1. SCOPE: Air ducts and accessories.
2. Air Ducts, Dampers, Registers, Grills, Louvers, and Bird and Insect Screens: soot, dirt, dust, and other deposits, leaks, broken, loose, or missing connections and parts, excessive vibration, material defects, defective operation of movable parts, hinge-parts failure, improper seasonal or operating settings of dampers, inadequate air distribution in branch circuits.

67. HEATING (Buildings)

67.1 HEATING (Buildings) - Equipment

1. SCOPE: Components of building heating systems of the low-pressure steam, hot water, and warm air type; also electric space heaters and direct-fired coal, gas, and oil space heaters. Steam boilers and hot water boilers for such systems are not included in this Guide. The steam heating system components include steam coils, radiators, convectors, unit heaters, and exposed radiant heating panels. The warm air heating system components include registers, return air grilles, air ducts, and furnaces. Space heaters include fixed heaters equipped with electrical heating elements, coal-fired heaters, and direct-fired gas and oil heaters.
2. Users Comment: ask occupants of building or system operator for comments on performance of heating system before starting inspection.
3. Lubrication: excessive bearing temperatures, inadequate lubrication of bearings and moving parts.
4. Rust and Corrosion: damage from rust and corrosion.
5. Motors, Fans, Drive Assemblies and Pumps: dust, dirt, other accumulations; leakage, wear, defective operation indicated from observation, loose, missing, or damaged connections and connectors; bent blades; worn or loose belts; unbalance; misalignment; of motor windings and brush rigging.
6. Wiring and Electrical Controls: loose connections; charred, frayed, broken, or wet insulation; short circuits; loose or weak contact springs; worn or pitted contacts; low voltage; defective operation; wrong fuses; other deficiencies.
7. Thermostats and Automatic Temperature Controls: improper operation; improper "on" and "off" operation.
8. Thermal insulation and Protective Coverings: open seams, breaks, missing sections, missing or loose fastenings.
9. Piping System Identification: illegible, incorrect, improper, missing.
10. Burner Assemblies: loose, damaged or missing connections and parts; leakage; clogged jets, orifices, valves, and fuel supply lines; dirty wicks, oil rings, oil pots, oil filters, and heat- transfer surfaces; low quality fuel, insufficient oil or gas pressures, low voltage, incorrect damper or thermostat settings, misalignment non-uniform flame or heat spread, defects in multiple-step heating device.
11. Combustion Chambers and Smokepipes: soot, dirt, coal deposits, other accumulations, abrasions, wear, deformations, misalignment; broken, loose, or missing parts of stokers, ash-pits, grates, hinges, doors; lack of weathertightness of seams and joints, breaks in thermal insulation casings.
12. Registers, Grills, Dampers, Draft Diverters, Plenum Chambers, Supply and Return Ducts: soot, dust, and other deposits; clogging, deformations, broken, loose, or missing parts, loose seams and joints, breaks in vapor barriers, hinge parts failure, improper air distribution at branch ducts, improper seasonal damper or register settings.

13. Electrical Heating Units: burned, pitted, or dirty electrical contacts, short-circuited sections of elements, dirty reflective heat-transfer surfaces.
14. Guards, Casings, Hangers, Supports, Platforms, and Mounting Bolts: loose, broken, or missing parts and connections, deformations, improper level, ineffective sound isolators.
15. Steam and Hot Water Heating Equipment: dust, scale, corrosion, other deposits, clogging, leaks, air-binding or water hammer, misalignment and improper slope of unit resulting in inadequate drainage and heating efficiency.
16. Accessible Steam, Water, and Fuel Oil Piping and Valves (steam and condensate return, hot water heating, humidifier water supply, fuel oil systems): defective operation, leaks, clogging, casting blowholes, material defects, moisture, vibration, other faults that interfere with proper operation.
17. Traps: leakage, defective operation.
18. Humidifier Assemblies: dust, leaking pans, solids in water, clogged piping, inoperative valves, danger of water over-flow.
19. Air Filters: dust, grease, other deposits; missing, improper fit.
20. Contamination: connection of potable water to sewer system; absence of air gap between potable water and waste pipe.

67.2 HEATING (Buildings) - Boilers

1. SCOPE: Boilers, expansion drums on high temperature water installations, boiler auxiliaries, and controls. (Inspection shall be performed in accordance with National Board Inspection Code)
2. Safety: Before entering the shell or drums of the boiler make sure that they have been properly ventilated; that there is no inflammable gas present; that the blow-off and surface blow-off valve, the main and auxiliary steam valves, feed-water valves, and all other valves on connecting pipes are closed; and that a reliable method is used to safeguard these valves while anyone is inside the boiler. When electric cords are used inside a boiler they should be in good condition, well insulated, designed to withstand mechanical injury and provided with a suitable guard. Naked lights are prohibited.
3. Exterior (*Authorized Inspector Only)
    a. Safety and Relief Valves: accumulated rust, scale or other debris; obstructed drain; hazardous conditions created by discharge; try lever not free;* gags removed; stems not bent.
    b. Automatic Low-Water (Level or Flow) Fuel Cut-Off and/or Water Feeding Device: rust, corrosion, deteriorated or defective parts, improper function.*
    c. Gauges: cracked, broken, missing or dirty glass; illegible markings; bent pointer; leaking connections; improper function of cock between gauge and boiler.*
    d. Water Columns and Gauge Glasses: excessive corrosion, cracked or dirty glasses, leakage, improper drainage, leaking isolation valves.*
    e. Material storage: lumber or other material stacked against boiler.
    f. Lagging: loose or missing material, cracks, open seams, evidence of vapor or water leaks.
    g. Casing: distortion, slippage of bricks, open seams, cracks, looseness, sheared bolts.
    h. Shell: corrosion; cracks; leaking roofs, valves, pipes; rust streaks on covering.
    i. Boiler Doors: sagging, warping, cracking, chipped or broken edges, worn hinges, defective locks or latches; improper operation; deteriorated or damaged blast deflectors; condition of gasket.

j. Breechings: excessive corrosion, cracked welds, loose or broken connections, separated sections, barometric damper.
k. Overhead Machinery: loose parts or material that may drop on or strike boiler.
l. Foundation: settlement, improper level, cracks.
m. Piping: leakage, strain or torsion, excessive corrosion, improper drainage, misalignment, lack of support, inadequate provision for expansion or contraction, excessive vibration; water pockets at valves and connections; loose, deteriorated, strained, inadequate connections; settlement, improper tension and alignment in supports.
n. Stop and Check Valves: loose, missing, broken parts; excessive wear or corrosion; leakage; obstructed drain openings, stem packing.
o. Pressure Reducing Valves: loose, missing, broken parts; rust, scale, other substance preventing proper operation, tubing, gauges.
p. Blow-Off Tanks: excessive corrosion, cracks, distortion, other weakness; leaks, water pockets; improperly placed valves, venting.
q. Ladders and Runways: broken, cracked, split, badly worn members; excessive corrosion; loose or missing bolts or other connections; broken welds; abnormal deflection; loose or warped sections; slippery surfaces; inadequate anchorage.
r. Electric Steam Generators: loose connections, burnt, corroded, frayed, or broken strands in grounding cable; loose connections, broken, or deteriorated screens or guards; missing, illegible, or improperly posted warning signs.
s. Contamination: connection of potable water to sewer system; absence of air gap between potable water and waste pipe.
t. Steam gauge: improperly calibrated, gauge valves leaking.
u. Boilers Secured or Stored: Wet layup: incompletely filled; Dry layup: not completely dry; inadequate supply of desiccant; improper or inadequate placement of desiccant.
v. Waterside Metal Surfaces; evidence of oil; indications of scale.
w. Plates: cracks, defective joints, distortion, erosion, excessive corrosion; grooving; lap seam cracks; cracked or severely corroded rivets; cracked welds.
x. Stays and Braces: cracks, bends, looseness, uneven tension, excessive corrosion or erosion; loose, cracked, broken connections.
y. Reinforcing Plates: excessive corrosion, worn, cracked, deformed, insecurely fastened, openings obstructed.
z. Openings and Connections for Piping and External Attachments: obstructed; inadequate; excessive corrosion.
aa. Internal Piping and Fittings: loose connections, breaks, cracks, excessive corrosion, clogging.
bb. Protection for Blow-Off Connection: spalling, cracking, looseness; missing or worn parts.
cc. Manholes and Handholes: corrosion, leakage; distorted, elongated, excessively corroded holding clamps.
dd. Tubes: deterioration, excessive reduction in thickness, bulges, cracks, defective welds, erosion, corrosion, waste pockets, scale, distortion.
ee. Ligaments: broken, cracked, leaks.
ff. Drumheads: cracks, deformation, excessive corrosion, gaskets.
gg. Flanging: grooving.
hh. Soot Blowers: worn, loose, or inadequate bearings and parts; incorrect alignment of nozzles; excessive scouring of refractory baffles, incorrect blowing ranges; inadequate traps; condition of packing; signs of direct impingement of steam on tubes.

ii. Fireside or Gas-side Metal Surfaces: steam pockets, corrosion, bulging, blistering, distortion, deformation, excessive burning action, fly ash deposits, flame leakage, localization of heat, deteriorated or loose tie rods and buck stays.
jj. Fusible Plugs: poor condition; unsound metal; exposed to steam temperature in excess of 425°F.
kk. Setting: improper level, tendency to settlement; inadequate provision for expansion and contraction; excessive corrosion; holes; cracks; slippage; distortion; binding; loose bricks; improper air space, poor insulation of steel supporting members; excessive vibration.
ll. Furnaces and Baffles: spalling, cracking, settlement, distortion, abnormal cracks and seams, excessive burning and corrosion, fly ash deposits, inadequate expansion joints, improper protection of mud drums; loose, missing, deteriorated, improperly placed baffling.
mm. Firing Equipment and Dampers: Burners; loose, broken, or missing parts; excessive wear or corrosion. Grates, Stokers and Feeders: loose, broken or missing parts; excessive wear or corrosion. Dampers: loose, broken, missing, bent, warped, or binding parts; excessive wear or corrosion; improper operating condition.
nn. Low-Water Fuel Cut-Off and/or Water Feeding Device: scale or dirt deposits; restricted moving parts; excessive wear; loose, broken, or missing parts; improper function.

4. Inspection of Operation (Authorized Inspector Only)
   a. Firing Equipment: improper or inefficient operation.
   b. Controls: inability to maintain proper steam pressure or water temperature and air-fuel ratio throughout capacity range of boiler with load swings of the rapidity encountered in operation; improper programming sequence and timing; improper cutoff of fuel supply; inability to maintain proper water level or to operate cutoff devices.
   c. Steam and Water Piping: leakage, excessive vibration, water-hammer, tendency to crystallize.
   d. Water Columns and Gauge Glasses: restricted connections.
   e. Steam Gauges: stuck pointer; restricted movement of pointer; obstructed connections, gauge glass.
   f. Temperature Indicating Devices: excessive temperatures indicated, particularly during and immediately after high load demands.
   g. Blow-Off Valves: restricted openings; excessively worn or otherwise defective.
   h. Stop and Check Valves: excessive vibration, ineffective of defective operation.
   i. Pressure Reducing Valves: defective, inadequate, improper operation.
   j. Metering and Recording Devices: improper operation.
   k. Boiler Auxiliaries: steam leakage, wastage to atmosphere, unnecessary use, inadequate or improper functioning.
   l. Boiler Safety and Water-Pressure Relief Valves: improper operation, obstructed discharge, does not release at required pressure.
   m. Feedwater Treatment: Equipment; ineffective, inadequate, improper operation. Materials: incorrect, insufficient.
   n. Fuel Handling Practices: multiple handling, use of duplex equipment for small loads, unnecessary heating, improperly maintained equipment, inefficient operation.
   o. Partial Loading: unnecessary use of similar equipment at part load when one unit could carry load.

67.3 HEATING (Buildings) - Steam Traps

1. SCOPE: Steam Traps.
2. Note: Control Inspection only except for item 6 and visible leakage.
3. Hand or Glove Test
   a. Proper Operation: higher temperature in inlet line than in discharge line.
   b. Defective Operation: cool inlet indicates obstructed flow from trap that is stuck when closed or when obstruction is trapped in system; hot outlet indicates steam blowing through trap from stuck or leaking valve mechanisms; on bucket traps, steam leakage may be from loss of prime.
4. Aural Test (Listen to operative mechanism through a rod or stethoscope)
   a. Proper Operation: opening for condensate audible, closing against steam flow audible.
   b. Defective Operation: inability to hear operation may indicate trap stuck close, stuck open, or leaking; may indicate undersized trap continuously passing condensate.
5. Bypass Valve Assembly: Defective Operation: leakage or partially open.
6. Associated Equipment: Defective Operation: improper heating usually indicates a closed trap that is not properly passing the condensate and/or entrained air. Effects such as a drop of pressure in the heat exchanger, some loss of efficiency, excessive flashing of the condensate return water, or steaming of the condensate return tank usually indicate that the trap (or bypass where installed) is passing steam.
7. General
   a. All Traps and Strainers, Inlet, Discharge and Bypass Valves: leakage, defective operation, deterioration.
   b. Float Traps: leakage, defective operation, deterioration.
   c. Thermostatic Traps (bellows-type): leakage, cracks misalignment, defective operation, deterioration.
   d. Thermostatic Traps (bellows-type with valve disks and seats): leakage, defective operation, deterioration.
   e. Thermostatic Traps (Valve stems - bimetallic strip type): leakage, defective operation, deterioration.
   f. Inverted Bucket Traps: leakage, defective operation, deterioration.
   g. Integral Check Valves: leakage, defective operation, deterioration.
   h. Impulse Traps: leakage, defective operation, deterioration.
   i. Orifice Traps: leakage, defective operation, deterioration.

68. VENTILATING AND EXHAUST AIR SYSTEMS (Buildings)

68.1 VENTILATING AND EXHAUST AIR SYSTEMS (Buildings)

1. SCOPE: Ventilating system and industrial exhaust air and dust collecting systems in active service. Ventilating equipment used in exhausting odors and smoke in cooking areas, providing air movement to prevent moisture accumulation supplying tempered and filtered outdoor air, and furnishing a limited amount of cooling for personnel comfort. Equipment in out-of-service status requires no inspection when proper preservation methods are followed, utilities are disconnected, and dry storage is provided. See other Inspection Guides for power plant forced draft or induced-draft fans at boilers, ventilating fans of drydocks or floating structures, fans for desert-type evaporative air-cooling systems, blowers for warm air heating systems.
2. Fire Hazards: dust, dirt, soot, drippings, and grease deposits on hoods, filters, and

in systems; flammable materials on fans, guards, dusts, dampers, and discharge louvers.

3. Lubrication: excessive bearing temperatures, inadequate lubrication of bearings and moving parts.
4. Rust and Corrosion: damage from acid, chemical fumes, rust.
5. Motors, Drive Assemblies, and Fans: dust, dirt, other accumulations; worn, loose, missing, or damaged connections and connectors; bent blades, worn or loose belts; unbalance; misalignment; excessive noise and vibration; end play of shaft, ineffective sound isolators; poor condition of motor windings and brush rigging.
6. Wiring and Electrical Controls: loose connections, charred, frayed, broken, or wet insulation, short circuits, loose or weak contact springs, worn or pitted contacts, defective operation, wrong fuses, other deficiencies.
7. Fire Protective Devices: incorrect temperature fusible links, improper setting of thermal unit of releasing device, excessive high-temperature setting of fan-stop device.
8. Steam and Hot Water Coils: clogging, rust, corrosion, scale, leaking, loose connections and parts, bent fins, misalignment, water hammer, air-binding, nonuniform heat spread, open bypass valves, below normal temperature readings, defective valves, traps, and strainers.
9. Electrical Heating Units: pitted, burned, or dirty electrical contacts, short-circuited sections of elements, low voltage in electrical circuits, dirty reflective heat-transfer surfaces.
10. Ducts, Collectors, Smokepipes, and Hoods: clogging, soot, dirt, grease, other deposits; loose connections and parts, abrasions, wear deformations; lack of weathertightness of seams and joints.
11. Ducts in Heads and Showers: leaking, broken, or poorly soldered seams and joints.
12. Thermal Insulation and Protective Coverings: open seams, breaks, missing sections, missing or loose fastenings, moisture.
13. Baffles, Dampers, Vanes, Access Doors, Registers, Louvers, Bird and Insect Screens: soot, dirt, dust, grease, other deposits; broken, loose, or missing connections and parts; material defects defective operation of movable parts, loose or poor fit of flashings in surrounding wall surfaces, hinge parts failure, improper seasonal or operating settings of dampers, inadequate air distribution at branch ducts.
14. Air Filters: dust, grease, other deposits; missing, improper fit.
15. Exhaust Air Systems: lack of air and weathertightness; inadequate separation of solids from air stream; incorrect suction at intakes; defective operation of blast and interlocking gates, motor-driven dampers, solenoids, and like parts; vegetation destruction, air pollution, or fire hazard of exhaust air dispensing; inadequacy of protective guards or warning signs.
16. Guards, Casings, Hangers, Supports, Platforms, and Mounting Bolts: loose, broken, or missing parts and connections, deformations, improper level, ineffective sound isolators.
17. Bag Collectors: tears, leakage, need of cleaning.
18. Wet Collectors: plugged spray nozzles or drain pipes, sludge accumulations, improper feedwater levels.

69. PLUMBING (Buildings)

69.1 PLUMBING (Buildings) - Fixtures/Grease Traps/Piping/Vents/Plumbing Accessories/Pipe Supports

1. SCOPE: Plumbing fixtures, grease traps, piping, vents, plumbing accessories, and pipe supports used for domestic hot water potable water, distilled water, chilled drinking water, salt water for flushing, sanitary sewage, drain, acid waste, rainwater, and gas systems. Gas systems include systems for natural gas, manufactured gas and bottled gas. Inspection limits include piping and accessories within the building from the service entrance or meter in the building.
2. Contamination: connection of potable water to sewer systems; absence of air gap between potable water unit or faucet and waste pipe or rim of sink, hospital sterilizer or sprinkler test pipe and drain, or similar installations; evidence of backflow in water tanks and flush valves, fixtures installed but not used.
3. Water Temperature: ineffective heating elements, incorrect thermostat setting. (Minimum allowable water temperatures: 120EF for domestic hot water, 140EF for kitchens, laundry, and hospital hot water, 180EF for sterilizing hot water systems for kitchens.)
4. Water Piping: external rust, leakage, loose connections, internal scale and corrosion, clogging, insufficient water flow, water hammer, material defects.
5. Faucets, Hose-Bibbs, Gate Valves, Flush Valves, and Flush Boxes: leakage, water drip, faulty or noisy operation.
6. Shower Heads, Water Sprays, and Mixing Valves: clogging, improper water temperatures and water spread, inoperative mixing valves, defective materials.
7. Thermal and Ice water No-drip insulation: open seams, breaks, missing sections, missing or loose fastenings that might cause heat loss or condensation.
8. Platforms, Pedestals, and Supports: corrosion, missing or loose connections, deformed or unsafe parts, misalignment, unsuitable for service, material defects.
9. Sanitary/Drain Piping: solid accumulations in strainers, slow drainage, closed openings in vents, odors and sewer gas from loss of water seal in traps, grease, chemical wastes, back pressure caused by clogging, ground water through leaky joint/broken pipe, trap siphonage.
10. Floor Drains: clogging, corrosion, leaking pipe connections, presence of sewer gas and odors.
11. Backwater Valve in Floor Drain: defective float and valve seat.
12. P-traps and Trap Standards: clogging, corrosion, grease, leaks.
13. Grease and Lint Traps: check for missing baffles traps, clogging, broken seals.
14. Pressure-Reducing and Relief Valves and Vent Line Installations: improper pressure settings; unsafe or defective operation; inaccuracy; rust, corrosion, loose connections.
15. Plumbing Fixtures: leaks, improper trapping, misalignment, evidence of water contamination, material defects, damage including chips in porcelain or concrete, cracks in china, corrosion of metal parts, deterioration of sink stoppers, similar defects.
16. Process Sinks: improper trapping, presence of odors, other hazards.
17. Piping Identification: illegible, incorrect, improper, missing.
18. Low-Pressure Gas Piping: leaks, loose or broken connections, defective gas cocks, material defects. Leaks can be found by using soapsuds supplied with brush to joints and other connections. Gas bubbles will indicate leaks.

69.2 VALVES - (All Types)

1. Piping: leakage, strain or torsion, excessive corrosion, improper drainage, misalignment, lack of support, inadequate provision for expansion or contraction, excessive vibration; water pockets at valves and connections; loose, deteriorated, strained, inadequate connections; settlement, improper tension and alignment in

supports.

2. Stop and Check Valves: loose, missing, broken parts; excessive wear or corrosion; leakage; obstructed drain openings.
3. Pressure Reducing Valves: loose, missing, broken parts; rust, scale, other substance preventing proper operation.
4. Blow-Off Tanks: excessive corrosion, cracks, distortion, other weakness; leaks, water pockets; improperly placed valves.
5. Blow-Off Valves: restricted openings; excessively worn or otherwise defective.
6. Stop and Check Valves: excessive vibration, ineffective of defective operation.
7. Pressure Reducing Valves: defective, inadequate, improper operation.
8. Auxiliaries: steam leakage, wastage to atmosphere, unnecessary use, inadequate or improper functioning.
9. Safety and Water-Pressure Relief Valves: improper operation, obstructed discharge, does not release at required pressure.

69.3 PLUMBING (Buildings) - Water Heaters

1. SCOPE: Water heaters for domestic hot water service and for so-called commercial hot water service. The equipment included is of the integral heater and storage tank. The separate heater and storage tank, or the instantaneous steam water heater type. The heating facilities covered include gas burners, electrical heating elements, steam coils, and oil burners.
2. Users' Comment: ask operator or supervisor for comment on equipment performance before starting inspection.
3. Lubrication: motor of oil burner and moving parts of mechanical devices.
4. Rust and Corrosion: damage from rust or corrosion.
5. Automatic Control: improper operation through complete cycle; improper "on" and "off" operation.
6. Safety and Flame Failure Devices: unsatisfactory as disclosed when tested through complete "on" and "off" cycle of operation.
7. Thermal Insulation and Protective Coverings: open seams, breaks, missing sections, missing or loose fastenings.
8. Burner Assemblies: loose, damaged, or missing connections and parts, leakage, incorrect height and position of pilot light, improper baffle adjustment causing impingement, dirty heat-transfer surfaces, non-uniform flame spread, misalignment, clogged jets, orifices, and valves, dirty oil filters, defective oil wicks, oil rings, and pots.
9. Combustion Chambers: deformations, breaks, cracks, wear, water and flue gas leakage, burnt-out grates, defective coal feed mechanisms, broken latches and hinges, door misalignment and poor fit, soot deposits, clinkers, ashes.
10. Electrical Heating Elements and Controls: loose connections, charred, frayed or broken insulation, short circuits, loose or weak contact springs, worn or pitted contacts, defective operation, wrong fuses, other deficiencies.
11. Gauges: inoperative gauges, instruments, and protective devices.
12. Water Compartments and Tanks: leaks, loose connections, chipped enamel finish, cracked cement linings, defective manhole gaskets, dripping, corrosion, damage from freezing, defective operation of drain valves; deteriorated anodic rods or other devices provided for limiting corrosion.
13. Water Relief and Steam Safety Valves: rust, corrosion, scale, mechanical defects, defective operation. {Code violations: a. hazardous conditions created by discharge; b. improper size vent pipe; c. improper vent material {not harddrawn copper.))
14. Supports: unstable, material defects, loose, missing, or broken parts.

15. Steam Coils and Instantaneous Water Heaters: improper steam pressure and water temperature, steam trap blowing, mechanical defects, clogged strainers, scaled heat- transfer surfaces, open bypass valves, leaking pipe connections.

69.4 PLUMBING (Buildings) - Pumps (Sump and Bilge)

1. SCOPE: Commercial-type sump and bilge pumps used to deliver drainage from low elevations into the sewage systems. These pumps may be located at points other than at pumping stations.
2. Safety: The generation of explosive and toxic gases in sewers and in closed spaces in sewer systems is a common occurrence. Do not allow open flames in the vicinity. Be sure that tank vents are not clogged.
3. Alternate Operation: is not being performed. (Where two or more pumps of same size are installed they should be operated alternately to equalize wear.)
4. Sumps: floating objects, accumulated deposits in sump bottom.
5. Wiring and Controls: loose connections, breaks and other damage to wiring and insulation, short circuits, loose or weak contact springs, worn or pitted contacts, defective float switch.
6. Floats: bent rod, binding, other damage; check operation of alarm system.
7. Pump Operation: failure to start when switch makes contact; rough operation; fails to empty basin at normal rate; inadequate suction, discharge, and shutoff heads against normal operating standards.
8. Packing Glands: evidence of leakage.
9. Bearings: inadequate lubrication, non-availability of lubricating instructions.
10. Motor: unusual noises, vibration, end play of shaft, overheated bearings, lubrication leaks, improper lubrication practices, presence of dirt, moisture, other accumulations.
11. Supports: unsound, ineffective, misalignment of shafting indicated.
12. Piping System: evidence of strain on pump casing.

70. FIRE EXTINGUISHING (Buildings) Sprinkler

70.1 FIRE EXTINGUISHING (Buildings) Sprinkler - Wet/Dry Pipe Systems

1. Dry Pipe System
   a. Check pressure gauge on air side of system to ensure that air pressure of 50 to 60 PSI is being maintained on the system by air compressor.
   b. Open alarm test valve to ensure that outside water motor alarm will operate and that alarm has been transmitted over fire alarm system to the fire department. Reset alarm box.
2. Wet Pipe System
   a. During flow tests, ensure that outside water motor alarm operates and that alarm has been transmitted over fire alarm system to the fire department. Reset alarm box.
   b. If system is equipped with retard chamber or excess pressure pump, test in accordance with manufacturer's instructions, as appropriate.
3. Both Wet and Dry Pipe Systems: Check general condition of piping, valves, hangers and sprinkler heads to ensure that heads are free of excessive dirt and paint.

70.2 FIRE EXTINGUISHING (Buildings) - Dry Chemical System

1. Inspect nozzles, heads and fusible links to ensure that they are free of dirt, grease and paint, and have not been damaged.
2. Observe gas pressure on system to ensure that proper pressure is being maintained

in accordance with manufacturer's specifications.
3. Adequate clearance of heads, nozzles and fusible links from obstructions.

71. PLATFORM LIFTS, DUMBWAITERS, ESCALATORS AND ELEVATORS (Buildings)

71.1 PLATFORM LIFTS. DUMBWAITERS, ESCALATORS AND ELEVATORS (Buildings)

1. Inspections shall be performed in accordance with:
   a. American Standard Safety Code for Elevators, Dumbwaiters, Escalators and Moving Walks,
   b. American Standard Practice for Inspection of Elevators, Inspector's Manual

72. OTHER SERVICE SYSTEMS (Buildings) - Gas

72.1 OTHER SERVICE SYSTEMS (Buildings) - Gas Distribution

1. SCOPE: Gas distribution systems for both natural gas and artificial gas.
2. Exposed Piping: leakage, loose connections, rust, corrosion, other damage.
3. Underground Piping: signs of leakage such as brown grass strips across lawns, dead trees and shrubs when other plants are green in areas of buried piping. Determine condition when buried piping and valves are exposed for alteration and repair.
4. Pressure-Regulating and Reducing Valves: leakage, loose connections, rust, corrosion, defective operation; possible damage from freezing resulting from water infiltration into valve pits; clogged vent to outside of building, defective screen, pipe alignment.
5. Gas Cutoff Valve on Face of Building: improper operation, difficult access, not clearly visible.
6. Meters: loose connections, leakage, corrosion, rust broken glasses, moisture behind glasses, defective gaskets, dirty or difficult to read, settlement.
7. Pits: debris, water, cracks and leakage, rust and corrosion. Clean debris and water from pit; caulk all cracks; clean and paint all exposed parts, except moving parts.
8. Earthquake Valves and Pits
   a. Do not tap on jar valve and keep all wrenches and metal objects from making contact with valve.
   b. Pit: (Sweep cover and surrounding area clean before removing cover.) debris, water, cracks, leakage, rust, corrosion.
   c. Valve: not absolutely level, leakage around all joints, gaskets, and cap plug on top.
   d. Prior to operational check and tripping of valve, examine appliances having pilot lights and record their location; open all windows in rooms where these appliances are located.
   e. Close remote shutoff valve if so equipped or tap lightly by hand only (never with metal object) until, by listening close to valve, the sound indicates that valve pendulum has dropped and is now in closed position.
   f. Light gas burner at fixture nearest valve and test for leakage through valve. (If flame dies out after a few minutes, the valve is tight).
   g. Remove cap plug at top of valve, and reset valve by lifting up on exposed valve stem.
   h. Replace plug, tighten, and test for leakage around plug.
   i. Make sure that all pilot lights are relit.

72.2 OTHER SERVICE SYSTEMS (Buildings) - Piping for Gas Systems

1. SCOPE: Piping, vents, piping supports, piping fixtures and accessories for gas systems including acetylene, methyl acetylene propadiene (MAPP), oxygen, natural gas, manufactured gas, and bottled gas. Inspection limits include piping and accessories within the building from the service entrance or meter in the building.
2. Safety: Wear goggles or a face shield under any condition that might cause damage to eyes. Where there is a risk of asphyxiation, wear gas masks with oxygen supply which are approved fresh air masks, or self-contained air breathing equipment. Do not use a flame near a leak.
3. Valves: leakage, loose connections, corrosion, alignment.
4. Pressure-Reducing and Relief Valves, Pressure Gauges: improper pressure settings, unsafe or defective operation, inaccuracy, rust, corrosion, loose connections.
5. Valve Boxes: Cleanness, operable access door.
6. Water Seals, Drip Pan: deterioration, damaged paint, proper paint color.
7. Piping, Fittings: leaks, loose connections, defective gas cocks, deterioration, alignment, material defects. Damaged paint, proper paint color.
8. Vent Line: Vent to outside of building and discharge to a safe location, damaged or plugged pipe.
9. Valve Pits: check sump pumps and pump lines; deterioration, cracks, standing water.
10. Pipe Hangers: deterioration.

72.3 OTHER SERVICE SYSTEMS (Buildings) - Unfired Pressure Vessels

1. Note: Inspection shall be performed in accordance with National Board Inspection Code.
2. SCOPE: Unfired pressure vessels except (a) cylinders for shipment of compressed or liquefied gasses; (b) air tanks for brakes on vehicles. SAFETY: Before entering an unfired pressure vessel make sure (Inspection shall be performed in accordance with National Board Inspection Code) that it has been properly ventilated, that there is no inflammable gas or toxic material present, that all valves on connecting pipes are closed, and that a reliable method is used to safeguard these valves while anyone is inside the vessel. When electric cords are used inside an unfired pressure vessel they should be in good condition, well insulated, designed to withstand mechanical injury, and provided with a suitable guard. Naked lights are prohibited.
3. External Inspection
    a. Safety and relief valves: accumulated rust, scale, or other debris; obstructed drain; hazardous conditions created by discharge; (try lever not free); (Authorized Inspector Only) sterns bent.
    b. Rupture Disks: burst, leaking, deteriorated; plugged vent.
    c. Pressure indicating gauges: broken, missing, or dirty glass; illegible markings; bent pointer; leaking connections; inoperative.
    d. Lagging: loose or missing material; cracks, open seams, evidence of vapor or water leaks.
    e. Shell: corrosion, leakage, cracks, distortion; loose or cracked rivets.
    f. Supports: settlement, deterioration, lack of rigidity; cracks, loose or dislodged material; excessive corrosion, cracked or broken welds, loose or missing bolts or rivets, warped or bent structural members.
    g. Piping: leakage, strain or torsion, excessive corrosion, improper drainage, misalignment, lack of support, inadequate provision for expansion or contraction, excess vibration.
    h. Stop and check valves: loose, missing, broken parts; excessive wear or

corrosion; leakage; obstructed drain openings.

i. Pressure reducing valves: loose, missing, broken parts; rust, scale, or other substance preventing proper operation.
j. Pressure control switch: loose, missing, broken parts or connections; corrosion, rust or other substance preventing proper operation.

4. Internal Inspection (Authorized Inspector Only)
   a. Corrosion resistant lining: cracks, corrosion behind lining, corrosion behind deposits on lining.
   b. Shell plates and reinforcing plates: cracks, defective joints, distortion, erosion corrosion, grooving, lap seam cracks; cracked or severely
   c. Heads: cracks, deformation, excessive corrosion, loose, cracked, broken connections.
   d. Stays and braces: cracks, bends, looseness, excessive tension, excessive corrosion or erosion; loose cracked, broken connections.
   e. Nozzles: distortion, excessive corrosion; cracked welds; loose, cracked, or severely corroded rivets or bolts; poor or ineffective threaded conditions.
   f. Openings and connections for piping and external attachments: obstructed; inadequate; excessive corrosion.
5. Inspection of Operation (Authorized Inspector Only)
   a. Apply hydrostatic or pneumatic test to vessel and observe drop in pressure for 15 minutes. An excessive drop in pressure indicates leakage which must be corrected.
   b. Controls: inability to maintain proper pressures; improper adjustment for cut-out and cut-in devices.
   c. Pressure indicating gages: stuck pointer; restricted movement of pointer, obstructed connections.
   d. Temperature indicating devices: excessive temperatures indicated, particularly during and immediately after high load demands.
   e. Piping stop and check valves: excessive vibration, ineffective or defective operation, leakage.
   f. Pressure reducing valves: defective, inadequate, improper operation.
   g. Metering and recording devices: improper operation.
   h. Safety and relief valves: improper operation, obstructed discharge, does not release at required pressure.

72.4 OTHER SERVICE SYSTEMS (Buildings) - Refrigerators and Freezers (Domestic)

1. SCOPE: Mechanical-type domestic refrigerators and freezers.
2. Safety: Wear goggles to protect eyes. Never breathe fumes of refrigerants, toxic or nontoxic. Avoid contact with refrigerants; on exposure, rinse with water immediately to minimize burns. Do not apply heat to refrigerant systems, and use a Halide torch carefully. Do not disconnect refrigerant piping.
3. User's Comment: Ask user for comment on equipment performance before starting inspection. Also determine whether the user is familiar with the correct periods and best methods for manual defrosting, proper temperature regulation, and sanitary dusting of exteriors and cleaning of interior surfaces; if not, the user should be given brief instructions.
4. Sanitation: unsanitary conditions, or dust, dirt, and other accumulations on housings, fans, fan motors, heat transfer and air-cooled heat exchange surfaces, burners, pilot light, flues, dampers, draft diverters, safety devices, cabinets and openings in cabinets for air circulation.
5. Lubrication: inadequate lubricating instructions, excessive bearing temperatures,

inadequate lubrication of bearings and moving parts, low oil level, poor oil condition. Lubricate as required; add lubricant if grease dispenser or oil cup is less than half full; add oil to crankcase of refrigerant compressor if below correct level and change if dirty, using symbol 2075 oil or correct type of refrigerant lubricants; clean clogged oil lines.

6. Rust and Corrosion: damage from rust and corrosion. Remove rust, paint bare spots and corroded areas, where applicable.
7. Supply of Refrigerant: insufficient, hissing sounds at the expansion valve during operation, low reading on the discharge pressure gauge, worn coil and suction pipe, or bubbles in receiver sight glass.
8. Controls and Wiring: worn or pitted contacts of magnetic unloaders at compressor, off-on and defrost switch, and switches for heating devices; defective operation of switches when operated manually, inaccuracy of response to thermostat settings, compartment temperature deficiencies evidenced when taken with mercury thermometer, loose connections, frayed or broken wire, damaged insulation, short circuits. Clean contacts; adjust settings to restore proper operation; tighten connections; make other minor repairs.
9. Fans: difficult hand rotation, obstructions, loose fit, deformations, misalignment, unbalance, excessive noise, loose or worn belts. Make minor repairs; tight belts or replace those worn.
10. Motors: defective operation. Replace worn brushes or entire motor assemblies.
11. Air Filters: dust, grease, other deposits; missing, improper fit. Replace dirty throwaway types and those missing or improper fit; wash permanent types, restore viscous coatings in accordance with manufacturer's instructions.
12. Guards, Casings, Hangers, Supports, Platforms, and Mounting Bolts: loose, missing, damaged or broken parts and connections, improper level, ineffective sound isolators, lack of rigidity, unsafe. Tighten, repair or replace loose, missing or damaged parts; adjust level; replace defective sound isolators; make other minor repairs.
13. Cabinets: stains, defects, cuts, scratches, corrosion of exterior surfaces, misalignment of doors, worn or deteriorated gaskets and rubber seals, damaged hinges and latches, damaged or missing drawers, covers, shelves, and shelf supports, chipped or cracked trays, obnoxious odors, defective light and door switches, burnt-out lamps. Replace defective switches and burnt-out lamps; make minor repairs.
14. Hermetic Units: housing leaks, evidence of overheating since housing surface temperature exceeds 130°F, excessive noise and vibration from wear and loose parts, defective operation indicated by continued operation for extra long periods and preset temperatures are not being maintained, electrical service disconnected. (Hermetic units are those in which the compressor, motor, lubricants, and coolants are sealed in a common housing at the factor. On semi-hermetic units, the compressor and motor are in separate housings. Internal inspection of sealed units is not permitted.)
15. Refrigerant Compressors (open-unit type): leaks of refrigerant and oil, particularly around shaft seals, magnetic unloaders, valves, pipe connections; knocks or excessive noises; inadequate compression of refrigerants indicated by feeling surface temperatures of suction gas and discharge high-pressure liquid lines. (Usually in F-12 systems, temperature should be about 50°F for suction gas and 105°F for liquid; if compression is poor, temperature difference will be slight, much less than 50°F). Clean off dust with brush; use Halide torch to check F-12 refrigerant leaks and watch for flame color change indicating leak.

16. Condenser Assemblies: refrigerant leaks in condenser and pipe connections, incorrect air flow resulting from improper position of baffles. Adjust baffles and tighten baffle screws.
17. Liquid Receivers or Combined Receiver and Highside Float Valve Devices: refrigerant leaks in receivers, pipe connections, refrigerant charging valve; misalignment of combined receiver and float valve devices causing erosion in needle valve and seat from entrance of vapor. (A well-frosted evaporator indicates defective needle valve or leaky seat. Complete defrost indicates sticking or leaking float.)
18. Automatic Thermostatic Expansion Valve Assembly: improper contact of bulb with suction gas pipe, liquid leaks, tubing deformations and defective parts of remote bulb, capillary tubing of thermostatic expansion valve assemblies and all pressure-operated or other types of temperature-operated automatic expansion valves; poor contact of equalizer line. (No noticeable temperature difference between liquid inlet and evaporator indicates clogged strainer or that other valve is defective or needs adjustment. Hissing expansion valve indicates insufficient supply of refrigerant in system.) Restore good bulb contact by removing loosely connected bulb, cleaning and scraping metallic surfaces, and resoldering or clamping bulb to suction gas line.
19. Capillary Tube or Orifice-Type Expansion Devices: dirty heat-exchange surfaces of tube on expansion devices and inadequate air circulation around it; leaks, deformations, and temperature differential of capillary tubes, orifices, or other flow restriction devices.
20. Accessories: defective filter-dryer cartridges, dirty strainers or oil traps, other deficiencies. Replace cartridges; clean accessible baskets; make other repairs.
21. Evaporators and Refrigerated Shelves: leaks, improper cooling output, heavy frost on coils resulting in nonstop operation or overloading of compressor, inadequate air circulation between food and walls of shelves caused by food being packed too close to cooling surface. Defrost.
22. Valves and Piping: leaks at pipe connections between equipment and valves; breaks, loose connections, deformations, and clogging of refrigerant piping; defective operation of refrigerant charging, suction, discharge shutoff, solenoid valves and all other valves of electrically energized mechanical refrigeration system.
23. Ammonia System Components: leakage of refrigerant, water, gas, oil, water jackets, valves, and piping; low gas pressure, defective gas filters and gas regulators, flame impingement and missing baffles of kerosene burners, defective electric heating elements, obstructions prevent ease of movement, full opening, or tight closure of solenoid valves, improper operation of safety devices. Tighten joints; clean water-strainer and oil-strainer baskets; adjust water flow as required; replace defective gas filters and gas regulators; adjust fuel-air mixture to produce blue flame at burners; adjust fuel flow and pilot as required; make required adjustments on damper settings; make minor repairs or replace defective heating elements; replace defective gas filters and regulators; make other minor repairs.
24. Compression Test for Refrigerant Compressors (Open unit type): Stop unit and install pressure gauge on discharge shutoff valve and a compound gauge on suction shutoff valve. Close suction valve. Watch compound gauge and when 25 inches of vacuum or more is indicated, stop compressor and note gauge readings. If vacuum reading remains constant and discharge-pressure reading falls, leaks are probably external and on high- pressure side. If vacuum reading is unstable, the trouble may be worn compressor rings, defective suction valve, or faulty discharge valve.
25. Refrigerants: Refrigerants do not wear out and do not need to be changed periodically unless moisture, oil, or other contamination makes the refrigerant

unsuitable for further use. Different types of refrigerants are used in different systems, and one type cannot be substituted for another, nor will unlike refrigerants mix. Even Type F-12 and Type F-22 have unlike characteristics; therefore, they cannot be mixed.

72.5 OTHER SERVICE SYSTEMS (Buildings) – Chimneys and Stacks

1. SCOPE: Chimneys and stacks made of brick, reinforced concrete, and steel; and accessories.
2. Painters Trolley: wear, corrosion, other damage to tiller ropes, pulleys, and pulley supports; poor pulley support anchorage.

73. SEWAGE SYSTEMS

73.1 SEWAGE SYSTEMS - Collection and Disposal

1. SCOPE: Underground and exposed sewer piping, manholes, inverted siphons or depressed sewers, treatment facilities that operate automatically or do not require operators in constant attendance, and outfall piping and appurtenances. Septic tank systems are covered by Inspection Guide M-8.2.
2. Safety: Comply with all current safety precautions. Before entering manholes or closed spaces, test for toxic or explosive gases and oxygen deficiencies.
3. Grease Traps, Oil Interceptors, and Similar Equipment: accumulations of scum and grit, defective operation.
4. Manholes
   a. Frame, Cover, and Ladder Rungs: rust, corrosion, broken, missing, poor fit of covers, physical damage.
   b. Concrete and Masonry: cracks, breaks, concrete rings, spalling, deteriorated mortar joints.
   c. Cleanliness, submerged invert, sand, mud, grit, broken sewer pipe fragments, debris, grease or oil scum from other causes than defective operation of grease traps and oil interceptors.
5. Underground Piping
   a. Piping: corrosive or erosive attack on invert section at first manhole from building, open joints, cracked or crushed section at first manhole from building, open joints, cracked or crushed sections, obstructions. Rate of flow is less than 3 feet per second.
   b. Inverted Siphons and Depressed Sewers: clogging, sluggish flow, accumulations of grit and debris.
6. Aboveground Piping
   a. Condition: leakage, rust, corrosion, deteriorated coatings. Remove rust, spot paint.
   b. Supports and Anchors: loose, missing, broken, settlement, other damage.
7. Comminutor
   a. Bar Screen and Raker: corrosion, other damage.
   b. Cutters: missing, dull, other damage.
   c. Lubrication: inadequate for bearings and moving parts.
   d. Channel: debris, rubbish.
8. Chlorinator
   a. Housing: inadequate ventilation especially as outlets near floor.
   b. Assembly: rust, corrosion, leaks. Remove rust or corrosion and spot paint.
   c. Surge Tank: proper operations, conditions, and leaks.
   d. Comminutor: operation, unusual noise, quality of cutting and leaks.

e. Raw Sewage Tank: condition and leaks.
f. Treatment Plant: operation, condition and leaks.
g. Magnetic flow meter: operation and ink supply.
h. Final holding tank: operation, condition and leaks.
i. Valves: operation and leaks.
j. Operation of mechanical linkage systems: loose, worn, broken parts and proper adjustment.
k. Electrical system: loose, broken, frayed, corroded connections.
l. Pumps: operation and leakage.
m. Electric motors: noise, heating, vibration and proper operating high and low cut in and off switches.

73.2 SEWAGE SYSTEMS - Septic Tanks

1. SCOPE: Septic tank systems including the septic tank structure, dosing tanks, distribution boxes, and tile disposal fields.
2. Safety: The generation of explosive and toxic gases in sewers and closed spaces in sewer systems is a common occurrence. Do not allow open flames in the vicinity. Be sure that tank vents are not clogged.
3. Manhole Frames and Covers: rust, corrosion, poor fit, missing, physical damage.
4. Concrete and masonry Surfaces: cracks, breaks, spalling, deteriorated mortar joints.
5. Inlet and Outlets: clogging, high concentration of suspended solids, which may clog subsurface disposal field.
6. Flooding: wall surfaces above normal liquid levels show signs of frequent or occasional flooding. Determine source of infiltration on influent side.
7. Septic Tanks: Sediment: check depth. When sediment is two feet or less from effluent invert, deposits of grease or oil scum indicate improper operation of interceptors.
8. Dosing Tanks
   a. Tank: if liquid level is less than 3 inches below level of liquid in septic tank. Defective operation of siphon or clogged drainage field is indicated.
   b. Siphon: overflow clogged or blocked, unsatisfactory operation.
9. Distribution Boxes
   a. Stopboards and Gates: improper functioning, undue leakage.
   b. Water Levels: water level above invert of outlet or slow drainage indicates poor functioning of drain fields.
10. Tile Disposal Fields: Ground Surface: ponding; indications of heavy trucking loads or other traffic, which may break drains or force them out of alignment.

73.3 SEWAGE SYSTEMS - Pumps

1. SCOPE: Sewage pumps of the horizontal and vertical type. More specific instructions for special equipment should be added to this guide. Sludge pumps are covered by inspection Guide M-8.4.
2. Safety: Before entering manholes or closed spaces, test for toxic or explosive gases and oxygen deficiencies.
3. Alternate Operation: is not being performed. (Where two or more pumps of same size are installed they should be operated alternately to equalize wear, keep motor windings dry, and keep lubricant distributed in bearings.)
4. Wiring and Controls: loose connections, breaks and other damage to wiring and insulation, short circuits, loose or weak contact springs, worn or pitted contacts, defective float switch.

5. Motor: unusual noises, vibration, end play of shaft, overheated bearings, lubrication leaks, improper lubrication practices, presence of dirt, moisture, other accumulations.
6. Pump and Motor Alignment: misalignment, unsound or ineffective piping supports.
7. Floats: bent rod, binding, other damage. Straighten bent rod, relieve binding, apply light oil to moving parts, check operation of alarm system.
8. Pump Operation: failure to start when switch makes contact; rough operation; fails to empty basin at normal rate; inadequate suction, discharge, and shutoff heads against normal operating standards.
9. Packing-Gland Assembly: excessive leakage.
10. Packing-Gland Seal (Water-Seal Type): excessive leakage, not protected with clear water supply, cross-connections in line, water pressure at water-seal-valve entrance point is less than pressure at pump shutoff head. (Slight seal leakage necessary to keep packing cool and in good condition is permissible during pump operation, amount depending on type of equipment and operating condition.)
11. Packing Gland-Seal (Grease-Seal Type): constant grease pressure not being maintained at all times during operation, and incompletely loaded grease cup for spring-loaded types. (About one once of grease per day should be forced through the packing).
12. Sleeve Bearings: oil ring does not turn freely with shaft; inadequate lubrication. If bearing runs too hot (check temperature with thermometer) check alignment of motor and/or disassemble and inspect bearing.
13. Antifriction Bearings: improper lubrication. Hot bearing may indicate overlubrication.
14. Cleanup: clean pump by closing all valves, draining pump, removing hand hold cover, and removing all solids.
15. Servicing: signs of wear of rotating element, defective operation of foot and check valves causing water hammer when pump stops.

73.4 SEWAGE SYSTEMS - Sludge Pumps (Reciprocating)

1. SCOPE: Reciprocating sludge pumps. Drives and control mechanisms are covered by other Inspection Guides.
2. Safety: Before entering closed spaces, test for toxic or explosive gases and oxygen deficiencies.
3. Lubrication: inadequate or improper lubricating practices.
4. Shear Pins: deformation, wear, improper material and size as specified by manufacturer of pump, necked-down portion of necked pins improperly positioned with respect to shearing surfaces, spares not stocked and not readily available.
5. Packing: leakage, no more takeup on packing-gland nuts.
6. Ball Valves: badly worn.
7. Valve Chamber Gaskets: blown out, deteriorated, inadequate supply of replacements.
8. Unusual Noises: noticeable water hammer.
9. Eccentric: binding, operates too freely, undue heating, or too loosely adjusted bearings.

73.5 SEWAGE SYSTEMS - Screening. Grinding, and Grit Removal Equipment

1. SCOPE: Equipment for screening and grinding sewage and removing grit there from prior to treatment or discharge into receiving waters.
2. Safety: Before entering manholes or closed spaces, test for toxic or explosive gases and oxygen deficiencies.

3. Motor Drives: unusual noises, hot bearings, excessive end-play of shaft, vibration, dirt, moisture, lubrication leaks, improper lubrication.
4. Motor Controls: loose connections, dirt, moisture, insect habitations, burnt-out indicator lamps.
5. Gear Reducers: overheating, water condensation in oil, improper oil level.
6. Bearings: wear.
7. Chains: wear, excessive looseness or sag, improper or insufficient lubrication.
8. Sprockets: wear, misalignment.
9. Shear Pins: looseness, wear, incorrect size or material.
10. Rollers: wear, binding, misalignment, unusual noises, inadequate lubrication.
11. Gears: wear, mechanical defects, improper clearances.
12. Housings and Chambers: accumulation of grit, corrosion, cracks, spalling, exposed reinforcing steel, loose bolts, deteriorated paint. Flush and remove grit, stones, bottle caps, etc., tighten bolts; remove rust spots and spot paint.
13. Base Seals: wear, damage, objects wedged between water-base seal and drum.
14. Cutting Blades: worn, dull, damaged. Clean blades, replace or sharpen if dull.
15. Screens: worn, broken, clogged, inefficient.
16. Potable Water Lines: report all connections to potable water system used for lubricating bearings or flushing down equipment.
17. Abnormal Flow: sewage rises above top bearing housing of comminutors.

73.6 SEWAGE SYSTEMS - Aeration Equipment

1. SCOPE: Equipment utilized in the activated-sludge process or other process involving the principle of aeration. Systems utilizing mechanical aerators and those that employ blowers with diffusers of the swing or fixed type, and compressed air, are included.
2. Blowers: operation, noise and output.
3. Air lines and diffusers: operation, clogging, bent or corroded.
4. Airlifts: operation and leaking.
5. Gate valves: operation and leaking.
6. Check valves: operation and sealing.
7. Compressor: unusual noises, excessive vibration, leakage, overheated bearings, dirty air filter, defective pressure relief valve.

74. WATER SUPPLY SYSTEMS

74.1 WATER SUPPLY SYSTEMS - Supply and Distribution

1. SCOPE: Underground and surface water supplies, intakes, piping valves, valve pits roadway boxes and manholes, and meters. Pumps are covered by other Inspection Guides.
2. Safety: No fire hydrant or valve in distribution system shall be operated unless a representative of Fire Department is present.
3. Exposed Piping: leakage, corrosion, loose connections, defective caulked joints on bell and spigot pipe, loose bolts on flanged pipe and clamp type connections, damaged or missing hangers and supports, mechanical damage, damage to protective coating.
4. Underground Piping: evidence of leakage, pending, erosion, or settlement of areas adjacent to piping; excessive supply pressure, water hammer or vibratory noises in line.
5. Buried Gate Valves: damaged operating nuts, bent stem, opens clockwise, difficult to operate when partially closed and then opened wide, location tie-in in error.

6. Unburied Gate Valves: leaks, corrosion, visible defects in stem, operating handwheel, lever, body, packing gland, flanges, and gaskets, damage to protective coatings, difficult to operate when partially closed and then opened wide, location tie-in in error.
7. Check Valves: leakage, rust and corrosion, other damage.
8. Vacuum Air Relief Valves or Bypass Valves: leakage, corrosion, defective operation, unauthorized or doubtful cross connections in bypass valves.
9. Blowoff Valves: leakage, corrosion, defective operation, plugged drain.
10. Double-Check Valves: corrosion, leakage, tightness, failure to prevent backflow.
11. Reduced Pressure Valve: rust, corrosion, loose connections, water draining continuously from relief valve opening, clogged drain.
12. Test Reduced-Pressure Valve: pressure in zone between check valves should be at least 2 psi less than supply pressure. Check valves must be tight against reverse flow under all pressure differentials.
13. Meters: leaks, corrosion, broken glasses, moisture behind glasses, settlement, evidence of faulty operation, records indicate periodic test not performed.
14. Hydrants and Hydrant Shutoff Valves(SOV): missing caps, missing or broken chains, damaged or worn nozzle threads and operating nuts, missing protective guards or identification markings, corrosion, deteriorated paint, evidence of improper wrenches being used on operating nuts.
15. Test Hydrants and Shutoff Valves:
    a. Do not flush in cold weather; starting with hydrant nearest source, slowly open hydrant to wide open position and let flow until reasonably clear, then shut tight.
    b. Close hydrant and shutoff valve; water spillage from nozzle indicates hydrant valve and seat or SOV leakage; noisy valve indicates leakage; quite valve and stable water level indicates drain-valve stoppage.
    c. Where ground-water table is above hydrant drain, plug drain and pump out barrel; lower small weight on string for evidence of ice in barrel.
16. Valve and Meter Pit Manholes, and Roadway Boxes: buried, protruding, cover too close to stem, poor fit, or missing covers, clogged vent holes, rust, corrosion, rot, cracked, split, and structural damage to individual members, improper grading of adjacent surrounding areas resulting in diversion of surface water into enclosures, debris or other accumulations, errors in location tie-ins.
17. Manhole Frames, Covers and Ladder Rungs: rust, corrosion, loose, broken, missing, rot, splintered, other damage to individual parts.
18. Manholes: cracked, broken, spalling, deteriorated mortar joints, other damage, improper grading of adjacent surrounding areas resulting in diversion of surface water into manholes.
19. Reduction in Water Yield in Wells, Infiltration Galleried, and All Storage, Treatment, and Collection Basins: openings in casings, imperviousness of soils and porous linings, leakage, clogged intake screens, continued dry spells, defective well pump operation.
20. Overflow Pipes: installed below-surface water entrance, rust, damage to screens.

74.2 WATER SUPPLY SYSTEMS - Chemical Feed Equipment

1. SCOPE: Chemical feed equipment, solution tanks, and accessories for water supply systems.
2. Equipment: for leakage, rust, corrosion, loose bolts and damage.
3. Piping: encrustation, potable water lines below rim of tank, air gap to prevent siphonage.
4. Strainers: clogged, or partially obstructed.

5. Valves: proper operation.
6. Sight glasses and rate-of-flow indicators: dirty glass and proper operation.
7. Water meters: proper operation.
8. Feed control units: proper operation.
9. Pumps: vibration and adequate belt tension and safety guards.

74.3 WATER SUPPLY SYSTEMS - Chlorinators and Hvpochlorinators

1. Gas mask and ammonia-water bottle in place. Check gas mask cartridge expiration and date and seal.
2. Leakage or corrosion on cylinders, piping valves and connections.
3. Bottle assembly: proper operation accurate scales, cylinder pressure gauge, or flowmeter.
4. Water supply system: leakage, corrosion, proper water levels, water splash, dirty or clogged strainers, backflow preventers.
5. Valves: proper operation, leakage, evidence of sticking.
6. Vacuum relief: proper operation, plugging.
7. Metering devices: proper operation.
8. Ventilation: proper operation and adequacy.

74.4 WATER SUPPLY SYSTEMS - Aeration Equipment

1. SCOPE: Spray, tray, cascade, and diffusion types of aeration equipment in fresh water systems.
2. Operation of Air Diffuser: proper operation; joints for leaks, diffusers for breakage, piping for rust and corrosion.
3. Compressor: unusual noises, excessive vibration, leakage, overheated bearings, dirty air filter, defective pressure relief valve.
4. Drive Unit: proper operation.
5. Packing glands: leakage.
6. Valves: proper operation, leakage, damage.
7. Piping for corrosion: leakage, or defective joints.
8. Structure: damage or deterioration.

74.5 WATER SUPPLY SYSTEMS - Storage (Ground/Underground)

1. SCOPE: Ground storage reservoirs and tanks in fresh water systems. Included also are the various accessories normally associated with fresh water tanks. Water heating systems are covered by other Inspection Guide. Tank and reservoir roofs are covered by other Inspection Guides. Cathodic protection of tanks is covered by other Inspection Guides.
2. Improper Operation of Valve Control: illegible and improper operating condition of water level indicator.
3. Valves, Piping, Fittings, Sleeves, and Other Accessories: broken, loose, missing; rust, corrosion, leakage; other damage.
4. Nonintegrity of riser frost casings or insulating materials.
5. Water Level Indicator: proper operation.

74.6 WATER SUPPLY SYSTEMS - Storage (Elevated Tanks)

1. All threaded caps: security
2. Recirculating pump:
3. Valves, Piping, Fittings, and Sleeves: Rust, corrosion, leakage, and damage.
4. Water Level Indicator: proper operation.

75. TURBINE SYSTEMS

75.1 TURBINE SYSTEMS - Large

1. SCOPE: Large Turbines. (Controlled Inspection by Authorized Inspector.)
2. Running Inspection
   a. Vibration: excessive.
   b. Lubrication: dirt babbitt or other metal indicated in lube oil strainer or emulsified oil, improper level in sump, excessive temperature at bearing inlet and outlet, inadequate operation of emergency oil pump, inadequate operation of governor, throttle trip valve, and bleeder non-return tripping mechanism when lube oil pressure is low.
   c. Steam Leakage: excessive steam leakage through carbon rings or labyrinth seals.
   d. Pressure: improper stage pressures, improper gland seal pressure under varying loads.
   e. Rankine (non-bleeding) Steam Rate: check at rated load and half load, compare with manufacturer's standards.
   f. Exhaust Casing Relief Valve: inadequate operation.
   g. Varying Loads and Extraction Demands: inadequate operation of governor.
   h. Reduced Load: inadequate operation of bleeder non-return valves,
   i. No Load: inadequate operation of governor and trip valve when speed is raised to rpm of overspeed tripping mechanism. (Usually 10% above rated speed.)

75.2 TURBINE SYSTEMS - Small

1. SCOPE: Small mechanical-drive turbines. (Controlled Inspection by Authorized Inspector.)
2. Running Inspection
   a. Vibration: excessive
   b. Bearings: excessive temperature
   c. Lubrication: dirty strainer, dirty or emulsified oil, improper level of oil or grease.
   d. Oil Rings: improper operation.
   e. Carbon Ring Seals: excessive steam leakage.
   f. Constant Speed Machines: improper speed (check with tachometer).
   g. Excess Pressure Governed Turbines: improper pump discharge pressure.
   h. Trip Valve: improper operation (overspeed unit and check speed with tachometer).

75.3 TURBINE SYSTEMS - Surface Condensers

1. SCOPE: Large condensers used for exhausting steam from turbines.
2. External
   a. Bonding and Cathodic Protection Equipment: rust, corrosion, loose bolts, loose cable connections frayed or broken wiring and insulation. Condition of pressure gauges, relief valves thermometers and installed controls.
   b. Casing expansion joint corrosion.

76. FUEL FACILITIES

76.1 FUEL FACILITIES - Distribution (Issue and Receiving)

1. SCOPE: Fuel distribution facilities including piping, valves, accessories, signs and markings, ground connections, pits, tunnels, and ladders. Pumps are covered by

another Inspection Guide.

2. Above-Ground Piping: leakage, loose connections, damaged or missing hangers and supports, misalignment causing undue stresses at pipe joints or failure to allow freedom of movement at expansion joints, defective gland nuts and bolts at expansion joints and clamp-type couplings, deteriorated or damaged paint or protective coverings.
3. Underground Piping: leakage indicated by earth discoloration, dead vegetation, presence of odors or review of periodic oil sampling records shows entrainment records shows a loss of fuel. (Of underground leaks may be determined by sectionalizing the pipelines and applying hydrostatic tests)
4. Valves: leaks, corrosion; visible defects in stem, operating handwheel or lever, body, packing gland, flanges, and gaskets; inadequate lubrication, wear, mechanical damage; damage to protective coatings; difficult operation. Inspect plug valves for incorrect adjustment. Remove inspection covers of check valves and inspect such parts as valve seats, gates, and hinges, for wear and damage. Lift pressure vacuum relief valves by hand to assure against sticking.
5. Meters and Pressure Gauges: leakage, cracked dial cover glasses, defective gaskets, moisture behind glasses, mechanical damage or inaccuracy of indicating and recording mechanisms.
6. Thermometers: inaccuracy, mechanical damage, loss of indicating fluid.
7. Strainers: leaks, defective operation.
8. Shock Arresters: leaks and mechanical damage; liquid in U-bend of liquid-cushion type not a proper level; tube pressure at which pneumatic-tube type operates is below normal pressure plus the amount specified by manufacturer; hammering sound in pipelines of bellows-type, liquid in air-chamber type.
9. Vents: damage screens, dirt or other obstructions blocking discharge to atmosphere.
10. Grounding Connections: loose, missing, mechanical or corrosive damage, failure to maintain electrical continuity.
11. Pits for Valves, Meters, and Pumps: defective cover gaskets, hinges, locks; dry hinges; trash and debris; cracked, spalled, or broken concrete areas; rotted, splintered, broken, and other damage to wooden parts; rust, corrosion, and cracks in metal covers and frames.
12. Debris and Spillage: that may cause safety or fire hazard.

76.2 FUEL FACILITIES - Storage

1. SCOPE: Surface and subsurface tanks, tank enclosures and tank fittings and appurtenances.
2. Vents: rust, corrosion, dirty screens.
3. Pressure and Vacuum Relief Valves: defective operation, leakage, improper adjustment.
4. Manometers and thermometers: inaccuracy, mechanical damage, loss of fluid.
5. Float Gauges: wear, binding, apparent inaccuracy.
6. Cables, Sheaves, and Winch of Swing Lines: wear; mechanical damage; stuffing boxes and liquid seals; deterioration; improper operation.
7. Interior Heating, Inlet and Outlet Pipes, Nozzles, Supports, Sumps, and Sump Drains: rust, corrosion, wear, loose or missing parts, obstructions, other defects.
8. Roof Drains and Screens: missing, rust, clogging.
9. Leakage: review of records indicates fuel losses; water in oil samples.

77. GROUNDS

77.1 GROUNDS - Sprinkler System

1. Sprinkler System Nozzles, Sprays, Hose, Pipe, and Valves: rust, corrosion, clogging, inadequate width or pressure, leakage, defective operation; evidence of water usage waste.

78. INCINERATORS

78.1 INCINERATORS

1. SCOPE: Incinerators used for refuse and garbage disposal, including special-purpose types. Sanitary and building inspections will be made under other Inspection Guides.
2. Cables and Rigging of Adjustable Dampers and Counter-weighted Doors: rust; corrosion, inadequate lubrication, damaged or frayed strands, improper operation, through defective pulleys, wheels, or other parts.
3. Combustion Chamber Draft Gauge: improper operating condition, inaccuracy.
4. Need of supplementary full.
5. Burner Assemblies: improper full-air mixtures; leakage; clogged jets, orifices, pet cocks, valves; improper positioning of pilot lights; nonuniform flame spread; dirty filters.
6. Pulleys; Winches, Cables, Ropes, or Other Elevating Mechanisms and Gears: inadequacy or improper operating conditions.
7. Inadequate ash-handling and ash-removal facilities.
8. Portable-Type Pyrometers and Recording or Indicating Types fitted with High and Low Temperature Warning Lights: inadequate, inaccurate.
9. Ali-Metal Trash Burners and Incinerators: rust, corrosion, burned-through areas, warped and buckled surfaces.
10. Can-Wash Equipment: vacuum breakers not installed in water lines, improper operating conditions; improper drainage for cleaning areas.

79. WEIGHT HANDLING EQUIPMENT

79.1 WEIGHT HANDLING EQUIPMENT (Control Inspection by Authorized Inspector)

1. SCOPE: Cranes and hoists, including overhead traveling, wall, gantry, jib, pillar and pillar jib cranes, monorail hoists, and simple electric hoists. On special equipment, manufacturer's instructions should be used. For electric motors, see Inspection Guide E-5. For cab heaters and air conditioners use Inspection Guides M-2.1 and M-1.1.
2. Safety: Cranes with regularly assigned operators shall not be inspected without the operator in complete charge of the controls. The crane, trolley, or hoist shall not be in motion unless required for continued operations. When possible, all power shall be cut off, preferably at the runway conductor feed; in the absence of a regularly assigned operator, the switch shall be locked open. To inspect any part of the crane or hoist that requires electric power, the power shall be isolated to the particular requirement by opening all unnecessary isolating switches, when such switches are provided. The current shall be turned on or off only by the regularly assigned operator; if no operator is regularly assigned, one designated member of the inspection crew shall control the current. Secure lifelines, chairs, or scaffolding shall be used where inspection cannot be made from a deck, platform, ladder, or stair.
3. Housekeeping: oil and grease spillage, accumulated drippings, litter, trash, loose

boxes, pails, illegible, or missing signs, labels, instructions, or nameplates.

4. Lubrication: overflow of oil or grease from antifriction bearings of over 800 rpm; plugged or frozen grease fittings, ineffective pressure relief fittings; oil leaks, foaming, improper oil level in bearing boxes or gear casings; worn or damaged gaskets or seals; other than thin film on grease-lubricated open gearing.
5. Structural Framing: bends, dents, cuts, rope-rubbing points, corrosion, loose rivets and bolts evidenced from observation or by hitting lightly with hammer; cracks, particularly around rivet and bolt holes, at sharp reentrant angles, through throat of welds and along edge, particularly at ends of girders, trucks, and near loaded sections; overstrain detected by flaking of paint along lines at 45 degree angle to axis of member or in broad bands across one side of member, (likely to occur at reentrant angle cutouts and loaded ends of stiffeners).
6. Bridge End and Gantry Trucks: nonintegrity of diaphragms and diaphragm connections, wear of rocker pinholes, insecure rocker pins, loose wheel-bearing boxes, loose bolts in aligning gussets, corrosion.
7. Cabs: dirty, broken, or loose windowpanes; warped or misfitting window sash, doors, and gates; broken or damaged hardware; insecure equipment; unsafe electrical exposure; inaccessibility to personnel.
8. Platforms, Ladders, and Stairs: loose and rotted planking and platform edge openings, open and inoperative trapdoors, bent handrails, loose or bent ladder rungs and rails, smooth worn spots on platforms and stairs, defects and improper operation of gate hardware and springs, corrosion.
9. Trolley Rails: roughness, peeling, rolling over of the heads, cracks in heads, gaps between joints, loose bolts or clips, longitudinal slippage of running and bearing surfaces, corrosion.
10. Combination Bridge and Track Members: rough, peened, rolled and cracked track flanges; wavy and uneven wheelbearing surfaces; worn wheel-guide surfaces; damage to joints, corrosion.
11. Conductor supports: loose, displaced, or improperly adjusted, resulting in possible improper tracking of collectors.
12. Monorail Switches: excessive width of gaps, out-of-level, misalignment of joints; frayed or worn pull ropes or chains, damaged or rough operating handles; worn pivots and sliding surfaces, evidence of pounding; ineffectiveness and deterioration of baffles, locks, guides, and interlocks; wear of springs and attachments, corrosion.
13. Bumpers and End Stops: loose bolts or rivets, cracks, cracked welds, out-of-line contact, evidence of longitudinal slipping, split wooden contact blocks, general deterioration from excessive pounding.
14. Rail Wipers and Brushes: wear on sides of wiper extending over sides of railhead indicates misalignment of crane, also evidenced by wear of wheel flanges; wiper out of place and bristles of brushes; difficulty in adaptation of pressure to rails.
15. Guards: looseness, misplacement, ineffectiveness, damaged or worn hardware, defective gaskets. Close and secure gear guard openings; replace defective gaskets.
16. Cabinets: corrosion, particularly in bottoms and corners of interiors; clogged vents; poor fit of doors; damage to hardware. Clear vents.
17. Gears: looseness of shaft; teeth are dull, rough, chipped, broken, cracked. (For data on forms of surface deterioration, failure, and causes see American Gear Manufactures Association Standards.)
18. Shafts: bends, flutter in action, cuts and nicks, loose or worn keyways, misalignment, corrosion.
19. Bearings: looseness, chatter, excessive heat of sleeve bearings; worn shields,

noise, heating of antifriction bearings, visible discolorations indicate overheating from overloading, misalignment, or improper lubrication practices; uneven loading on bearing, wear of pins, pinholes, untrue vertical placement that may cause jib to drift laterally for pintle bearings of jib, pillar, and pillar jib cranes.

20. Brakes (General): excessive wear in linkages, pins, cams; weakness of springs; wear and general deterioration of linings; roughness of drum; clearance between drum or disks not in accordance with manufacturer's instructions; toggle points approaching dead center too closely and no allowance for lining wear when brake is applied. Adjust brake if pedal travel is approaching its ultimate under full pedal pressure.
21. Hydraulic Brakes and Hydraulic-Electric Brakes With Hydraulic-Locking Mechanism or solenoids: leakage indicated in lines to wheel rod to master cylinder if pedal gradually moves with constant foot pressure; overtravel of wheel cylinder indicates improper lining and drum clearances; softness felt in pedal action indicates air in system; malfunctioning of control unit, push buttons, and signal lights of locking mechanism; improper solenoid air gap; evidence of overheating; damaged brass air gap material and loose core lamination, particularly on AC brakes; delay or restriction in opening of brakes; adjusted length of holding spring not in accordance with manufacturer's set length. Adjust to proper lining and drum clearances; fill reservoir when necessary; bleed air from system where soft pedal action and refill reservoir; correct maladjustment of holding spring.
22. Electric Solenoid Brakes: improper solenoid air gap; evidence of overheating; damaged brass air gap material and loose core lamination, particularly on AC brakes; delay or restriction in opening of brake; adjusted length of holding spring not in accordance with manufacturer's set length. Correct maladjustment of holding spring.
23. Thrustor Brakes: low level and improper consistency of hydraulic fluid, dirt, looseness of orifice settings, looseness of setting of holding spring; deterioration of motor; worn brushes, burned or high commutators of DC motors; loose bearings, misfitting brushes; rough or dull slip rings on AC motors.
24. Eddy Current Brakes: loose bearings, signs of dragging armature, looseness of anchor bolts.
25. Automatic Mechanical Load-Lowering Brakes: rough unpolished screw threads, cams, and friction plates; worn or damaged friction linings; obstructed oil passages in linings; worn, peened, or chipped ratchets and pawls; excessive clearance between friction plates, between ratchets and pawls, and between restraining bands and band drums; oil in oil- immersed brakes for excessive sediment, gumminess, too heavy viscosity and loss of lubricating properties. (Defective operation noted when lowering loads, such as irregular speeds, jerky lowering, and jerky starting from rest, indicate defects resulting from one or more of the above conditions.)
26. Rope Drums and Sheaves: cracks, particularly around hubs; chips, wire corrugations, or other forms of roughness on rope grooves and flanges.
27. Hooks: rough or sharp surfaces for rope slings, cracks or deformations from true shape, interference to smooth and easy swiveling.
28. Wire Ropes: slippage, loose nuts, bolts, wedges, improperly placed clips for all connections; broken wires, internal corrosion, kinks, high strands, excessive wear (when one-third of cross sectional area of outer wires is worn away), note causes of crushed wires, popped cores, and birdcages; internal corrosion within and between strands of standing parts and portions adjacent to sockets for broken wires; lack of thick, clinging, preservation lubricant or internal and external strands. (Use extreme caution in separating wires, to prevent damage.)

29. Wheels: uneven wear, flat spots, spawls, chips, (particularly on wheels with tapered treads); pattern of wear on flanges for possible misalignment of crane or loss of reversal on treads; cracks, especially in flanges of cast-iron wheels; looseness of axle-pins or securing devices, misplacement of pins.
30. Couplings: looseness of compression-type; wear of grids, teeth, and lugs of grid or internal types; lack of lubricant, worn or disintegrated seals; rotational looseness or lash, and decomposition of material of couplings with rubber, plastic, or composition parts.
31. Mechanical Locks and Interlocks: irregularities of action, worn or out-of-shape latch sockets, bent shear bars, tendencies to release under load, insecure setting and misalignment.
32. Electrical Service
    a. Electric Circuits: corroded, loose, nonwatertight conduit and fittings; breaks or openings in armored cable; broken, cracked, or otherwise damaged insulation; loose or insecure wiring connections; signs of burns or flashovers; incomplete or inadequate grounds; accidental or inadvertent grounds. Tighten loose wiring connections; remove accidental or inadvertent grounds.
    b. Bridge and Runway Conductors.
        1) Insulators: conductive dust, arc tracks, other evidence of arcing or leaking, breaks, chips, loss of glaze, loose or bent supports.
        2) Rigid and Enclosed Type: oxidation sufficient to cause high resistance or sparking; burns, pits, bends, twists, loose or rough joints, insecure joint bonds, evidence of nonuniform bearing of collectors or undesirable rubbing or scraping of collectors on enclosures; disintegrated or misaligned enclosures.
        3) Tension Wire-Type: excessive sag or low tension between supports, loose locking nuts or tension devices; burns, pits, excessive wear.
    c. Current Collectors.
        1) Insulators: conductive dust, arc tracks, other evidence of arcing or leaking, breaks, chips, loss of glaze, loose or bent supports, broken wires or loose connections in shunts or pigtails.
        2) Collectors: irregular and nonuniform bearing and wear, untrue riding on conductors, loss of graphite or other lubricant; unit bearing pressure too light or too heavy; loose support connections, loose or worn pins, worn pinholes, tight or obstructed movement of supporting arms; improper location of pickup-type shoes to deposit wires near center of spool indicators after passage of shoes; burned or pitted wheels; worn tread, flanges, wheel bores or pins; rough guide track for wheel-type.
    d. Cable Reels: bent or dented drums, tight or loose bearings, inoperable overrunning clutches, insecure cable connections or supports, caked dirt or foreign matter in mechanism housings; loss of seal in watertight or dust tight enclosures; loose covers and loss of grounding in explosion-proof reels; inadequate spring tension or improper motor conditions, excessive wear on rings and brushes, signs of sparking, grooving, or scoring, weak spring pressure.
    e. Lighting System: ineffective circuit breakers, loose or burned out fuses, sluggish switches, burnt-out receptacles, broken, dirty, fogged reflectors, burnt-out bulbs. Replace burnt-out fuses and bulbs.
33. Operating Controls
    a. Manual Switches: loose hinges, low tension in spring contacts, broken, cracked, or loose handles of knife switches; low and rough contact segment division,

inadequate contact shoe pressure of faceplate switches; slowness and uncertainty of snap, excessive arcing improper action of arcing shields or suppressors of snap-action switches; wear of cams, looseness of cams or retaining means, wear of cam rollers and pins, uneven or insecure feel of star wheels, inadequate contact spring tension, evidence of moisture within enclosing boxes of cam-type master and drum-type switches; worn or frayed rope, insecure connections of rope and handles, broken handles, weak return springs of pendant-rope operated switches; burns, welds, pits, corrosion, misfit, uneven contact surfaces. Refinish contact points and surfaces when damage is not severe; replace contact points when damage is severe.

b. Pendant Pushbutton Stations: defective insulation on electrical cable, particularly at junctions to pendant box and control enclosure; looseness of weight-carrying and grounding cable, failure to support weight of station, insecure grounding connections top or bottom; material not flexible, stranded, continuous wire rope; breaks or bends in suspended case, insecure gaskets and seals where watertight or explosion-proof pendant boxes are used; variable and light feel of speed notches of pushbuttons, burned or worn contacts, damaged or faded colors, especially stop button, illegible markings; dead pilot lights.
c. Contractors, Relays, and Electrical Protective Devices: sticking solenoid armatures, broken or insecure arcing shields, weak pressure-holding or closing springs of contractors, relays, and electrical protective devices, excessive hum and chattering of AC contractors; non-uniformity of timing, insecurity of air-gap shims or washers, poor consistency of oil in oil- type dashpots, dirt in air-type dashpots, obstructions in orifices, looseness of contacts in adjustable-type resistors and capacitors for relays and electrical protective devices; mechanically delayed tripping, non-resetting, and weak springs of electrical protective devices.
d. Transformers, Reactors, and Magnetic Amplifiers: excessive hum, indicating loose laminations.
e. Rectifiers: loss of full voltage when malfunctioning of rectifier-operated or rectifier- controlled apparatus occurs.
f. Motor Control Panels.
    1) Panelboards: cracks, arc tracks, missing or loose bolts, insecure mounting.
    2) Power Off: improper sequence and timing of all accessible components for hoisting, lowering, forward and reverse. (Proper sequence and timing obtained from wiring diagrams posted on crane.)
    3) Power On: improper sequence, lack of smoothness (improper timing), improper adjustment of power resistors, inherent characteristics of controls causing rough operation.
    4) Adjustment: note correctable deficiencies of speed, torque, regulation, and acceleration peaks from load-speed curves of hoists, speed-time curves of trolley, and rotating and traveling motions for each point of control.
g. Power Resistors: loss of section from pits, corrosion, burns; loose clamping rods and pars; broken or shipped insulators; loose taps and connections; warped and short-circuited elements; charred or broken insulation; hot spots or visible red heat indicating too small current capacity.
h. Limit Switches: (Must be maintained in excellent condition) unsatisfactory operation without load, excessive drift; non-dust tight housings for interior use;

non-watertight housings for exterior use; worn, cracked or rough cams, dogs, rollers, roller pins; loose cams or other setting or operating devices; signs of dragging of any part, tight bearings, sluggish snap action, insecure fastenings; broken wires in shunts or pigtails; burned or pitted contacts, improper fit of welded contacts; poor contact spring tension; too short, bent, battered, misaligned, or displaced paddles or arms; wear, insecure guides and rope connections, inoperative rope sheaves, loose counterweights on rope-guided tripping devices; block does not stop drifting before plugging device operates, and maloperation of plugging device when limit switch fails on semi-mass-produced packaged hoists with pilot on control circuit limit switches.

i. Signal Equipment: improper functioning of bells, horns, signal lights.

80. TUNNELS AND UNDERGROUND STRUCTURES

80.1 TUNNELS AND UNDERGROUND STRUCTURES

1. SCOPE: Tunnels of all kinds, including ammunition storage tunnels; pipeline tunnels, vehicular tunnels, and water tunnels; also, underground structures housing utilities, service installations, and similar equipment or operations. It does not include underground tanks, nor earth-covered ammunition magazines that are wholly or partly aboveground.
2. Pipeline Tunnels: rust, corrosion, misalignment, broken, leakage.
3. Pipeline Supports and Anchors: rust, corrosion, loose, missing, or broken parts.
4. Defective drainage systems or facilities, particularly in ammunition tunnels, indicated by dampness, flooding, or ponding.
5. General Condition of Ventilation Equipment: apparent defects in operation, rust, corrosion, loose, missing, or other damage to related parts.

81. BRIDGES AND TRESTLES

81.1 BRIDGES AND TRESTLES

1. SCOPE: Highway, Railroad and Pedestrian Bridges and Trestles, including those constructed of steel, timber, masonry, concrete, and composite materials. It does not cover concrete boxes with integral floor, which are classed as culverts regardless of span, and are included under drainage structures.
2. Note: Inspections will not be made with the aid of field glasses.
3. Utility Supports: rust, corrosion, loose, missing, or broken parts.
4. Utility Lines: corrosion, leaks, sagging, insulation and waterproofing defects, mechanical damage.
5. Rollers and Other Similar Devices: rust, corrosion, inadequate lubrication, failure to allow movement.
6. Cables: frayed, raveled, or broken strands, inadequate lubrication; defective anchorage; interference from overhanging objects.
7. Movable Bridges: rust, corrosion, wear, inadequate lubrication.

82. ANTENNA-SUPPORTING TOWERS AND MASTS

82.1 ANTENNA-SUPPORTING TOWERS AND MASTS

1. SCOPE: Antenna-supporting towers and masts, guyed radiators and guys, elevating mechanisms. This Inspection Guide does not cover the inspection of antenna.
2. Pulleys, Winches, Cables, Ropes, or Other Elevating Mechanisms and Gear: inadequacy or improper operating condition.

83. WATERFRONT FACILITIES - Piers/Wharves/Quaywalls/Bulkheads

83.1 WATERFRONT FACILITIES - Piers/Wharves/Quaywalls/Bulkheads

1. SCOPE: Piers, wharves, quaywalls, and bulkheads constructed of timber, steel or concrete.
2. Rails and Supporting Structures for Weight Handling Equipment: roughness; cracks in head; gaps between joints; damage to joints; corrosion; general deterioration; spalling; bending; weathering.

84. AMMUNITION STORAGE (ABOVEGROUND)

84.1 AMMUNITION STORAGE (ABOVEGROUND)

1. SCOPE: Ammunition storage facilities that are covered with earth, but aboveground. Ammunition storage not covered with earth, and storage that is underground, is covered by other Inspection Guides.
2. Ventilators: rust, corrosion, torn or missing insect screens.

LIFE CYCLES

SYSTEMS	MATERIAL/TYPE	AVERAGE USEFUL LIFE
01 Foundation	Concrete	100
02 Exterior Walls	Masonry	100
	Concrete	100
	Stucco	40
	Metal	30
	Wood	40
	Vinyl	30
03 Floor Structure	Concrete	100
	Wood	100
04 Roof Covering	Built-Up	25
	Single-Ply	20
	Metal	30
	Asphalt Shingle	20
	Wood Tile	30
	Slate	50
	Concrete Tile	50
	Clay Tile	40
	Rolled Asphalt	15
05 Other Primary Structures	Concrete Site Work	25
	Asphalt	15
	Brick/Concrete Pavers	25
06 Ceiling	Plaster	40
	Drywall	25
	Acoustical Tile	20
07 Floor Covering	Carpet	10
	Vinyl	30
	Wood	40
	Masonry	100
	Ceramic	40
	Marble	100
08 Interior Walls	Plaster	40
	Drywall	25
	Ceramic	40
	Wood Paneling	20
	Vinyl	10
	Marble	100
09 Stairways	Wood	50
	Metal	75
	Concrete	100
10 Windows	Metal	40
	Wood	40
11 Doors	Metal	30
	Wood	30
12 Cooling	Central including ducts and piping	20
	Window Units	10
	Cooling Towers	20
13 Heating	Furnaces and Boilers	20
	Radiators, Convectors and Piping	25
	Unit Heaters – Gas/Steam	20
	Unit Heaters - Electric	20
14 Ventilation	Fans and Exhausts	20
	Duct Work	20

LIFE CYCLES (continued)

SYSTEMS	MATERIAL/TYPE	AVERAGE USEFUL LIFE
15 Electric Service	Bus Duct	30
	Capacitor	20
	Service Entrance and Sub-Feeders	30
	Switchboards	30
	Switch Units	30
	Transformers, Oil	30
	Transformers, Dry	30
16 Lighting and Distribution	Conduit and Wire	30
	Fixtures	15
17 Electrical, Special Systems	Fire Alarm	20
	Intercom	20
	Telephone	20
18 Plumbing	Fixtures	20
	Piping – Cast Iron Waste	35
	Concrete	30
	Copper	30
	Plastic	20
	Steel	20
	Vitrified Tile	30
	Sump Pumps	15
	Water Heaters	10
19 Extinguishing	Wet/Dry Systems	30
	Fire Pumps	20
20 Conveying	Elevators	30
	Escalators	40

PROPERTY ASSESSMENT INSPECTION CHECKLIST

Building _____

Inspector _____

- SITE WORK
- Roads, Walks, and Parking Lots
  - Surface Conditions
  - Subsurface Conditions
  - Cracks, Holes
  - Drainage and Slope
  - Curbing
- Turf
  - Health and Coverage
  - Water Supply
- Playgrounds
  - Surfacing
  - Equipment Adequacy
  - Equipment Condition
  - Maintainability
- BUILDING EXTERIOR
- Foundations
  - Settlement, Alignment Changes or Cracks
  - Moisture Penetration
  - Surface Material Deterioration
- Structure
  - Deflection, Settlement, Cracks
  - Surface Deterioration
  - Corrosion, Rot
- Exterior Walls
  - Material Integrity
  - Paint Conditions
  - Caulking
  - Cracks
  - Evidence of Moisture
  - Flashing Condition
  - Insulation
- Windows and Doors
  - Frame Fitting
  - Paint or Surface Finish
  - Operations
  - Rot or Corrosion
  - Insulated Glazing
- Roofing
  - Age
  - Water Tightness
  - Flashing
  - Drainage
  - Material Degradation
  - Insulation
- BUILDING INTERIOR
- Walls
  - Evidence of Moisture
  - Cracks
  - Cleanliness
  - Surface Condition
  - Stains
  - Maintainability
- Floors
  - Age
  - Evidence of Moisture
  - Tripping Hazards
  - Excessive Wear
  - Stains
  - Discoloration
  - Cracks
- Ceilings
  - Age
  - Settlement or Sagging
  - Evidence of Moisture
  - Stains, Discoloration
  - Acoustical Quality
  - Surface Condition
- Elevators/Lifts
  - Maintenance History Available
  - Certification
  - Operations
  - Handicapped Access
- Stairs and Ramps
  - Exits Marked
  - Tripping Hazards
  - Lighting Adequate
  - Handrails
- MECHANICAL SYSTEMS
- Plumbing
  - Leaks, Dripping, Running Faucets and Valves
  - Supply Adequacy
  - Sanitization Hazards
  - Backflow Protection
  - Fixture Quantity
  - Fixture Types and Conditions
  - Handicapped Access
  - Metal Pipe Fittings Corrosion
  - Pipe Joints and Sealing
  - Pipe Insulation
  - Sanitization Hazards
  - Water Pressure Adequate
  - Odors, Tastes
  - Water Heating Temperature Setting
  - Chemical Resistance
- Fire Suppression
  - Regular Inspections
  - Code Compliance
  - Coverage
  - Water Pressure
- HVAC
- In Mechanical Equipment Rooms
  - General
    - Age
    - Rust and Corrosion
    - Air Quality
    - Equipment Condition
    - Lubrication Bearings and Moving Parts
    - Leaks
    - Proper Guards
    - Cleanliness
  - Heating and Cooling
    - Capacity
    - Energy Consumption
    - Noise Level
    - Air Circulation and Ventilation
    - Humidity Control
    - Temperature Control
    - Reliability
  - Ventilation System
    - Air Velocity
    - Filtration
    - Fire Hazards
- In Building Spaces
  - Temperature Control Adequacy
  - Rust and Corrosion

PROPERTY ASSESSMENT
INSPECTION CHECKLIST (CONTINUED)

_____ **ELECTRICAL**
_____ **General**
_____ **Safety Conditions**
_____ **Service Capacity, % Used and Age**
_____ **Switchgear Capacity, % Used and Age**
_____ **Panel Capacity**
_____ **Clearances for Equipment**
_____ **Transformer**
_____ **Transformer Tested**
_____ **Transformer Arcing or Burning**
_____ **Ownership (Facility or Utility)**
_____ **Interior Distribution System**
_____ **Main Circuit Breaker Marked**
_____ **Panels Marked**
_____ **All Wiring in Conduit**
_____ **Missing Breakers**
_____ **Panel Boards, Junction Boxes Covered**
_____ **Conduit Properly Secured**
_____ **Proper Number of Outlets**
_____ **Grounding**
_____ **Emergency Circuits**
_____ **Emergency Generator(s)**
_____ **Condition and Age**
_____ **Testing Schedule**
_____ **Circuits Appropriate**
_____ **Fuel Storage (Capacity)**
_____ **Emergency Lighting**
_____ **Coverage**
_____ **Battery Operation**
_____ **Exit Signs**
_____ **Separate Power Feed**
_____ **SAFETY STANDARDS**
_____ **General**
_____ **Means of Egress**
_____ **Fire Ratings**
_____ **Extinguishing Systems**
(see also *Fire Suppression*)
_____ **Fire Alarms (see *Electrical*)**
_____ **Lighting System (see *Electrical*)**
_____ **Handicapped Accessibility**
_____ **Entry Access**
_____ **Vertical Access (see also *Elevators*)**
_____ **Bathroom Access (see also *Plumbing*)**
_____ **Doors and Hardware**
_____ **Fire Alarm Systems**
_____ **Panel Visible**
_____ **Audio-Visual Alarms**
_____ **Pull Station Condition**
_____ **Detector Conditions**
_____ **Hazardous Materials**
_____ **Asbestos**
_____ **PCB**
_____ **Chemical Storage**

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01 FOUNDATIONS INSPECTION CHECKLIST

	Deficiencies		Causes
_____	Settlement, alignment changes or cracks	_____	Soils – changes in load bearing capacity due to shrinkage, erosion, or compaction. Adjacent construction undermining foundations. Reduced soil cover resulting in frost exposure.
		_____	Design loads – building equipment loads exceeding design loads. Vibration from heavy equipment requiring isolated foundations.
		_____	Structural or occupancy changes – inadequate bearing capacities. Foundation settling.
		_____	Earthquake resistance non-functioning.
_____	Moisture penetration	_____	Water table changes – inadequate drainage.
		_____	Ineffective drains or sump pump/sump pits.
		_____	Roof drainage – storm sewer connections inadequate or defective. Installation of roof drain restrictors, gutters, and downspouts where required.
		_____	Surface drainage – exterior grades should slope away from building and structures.
		_____	Utilities – broken or improperly functioning utility service lines or drains.
		_____	Leakage – wall cracks, opening of construction joints, inadequate or defective waterproofing.
		_____	Condensation – inadequate ventilation, vapor barrier, and/or dehumidification.
_____	Temperature changes	_____	Insulation – improperly selected for insulating value, fire ratings, and vermin resistance.
_____	Surface material deterioration	_____	Concrete, masonry, or stucco – spalling, corrosion of reinforcing, moisture penetration, or chemical reaction between cement and soil.
		_____	Steel or other ferrous metals – corrosion due to moisture or contact with acid-bearing soils.
		_____	Wood – decay due to moisture or insect infestation.
_____	Openings deterioration	_____	Non-functioning of doors, windows, hatchways, and stairways.
		_____	Utilities penetration due to damage, weather, wear, or other cause.

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02 SUBSTRUCTURES INSPECTION CHECKLIST

	Deficiencies		Causes
_____	Floors, concrete – cracking or arching	_____	Shrinkage or settlement of subsoil
		_____	Inadequate drainage
		_____	Movement in exterior walls or frost heave
		_____	Improper compaction of base. Erosion of base.
		_____	Heaving from hydraulic pressure
_____	Floors, wood – rotting or arching	_____	Excessive dampness or insect infestation
		_____	Leak in building exterior
		_____	Lack of ventilation
_____	Wall deterioration	_____	Concrete or masonry (see *01 Foundations*)
_____	Crawl space ventilation and maintenance	_____	Inadequate air circulation due to blockage of openings in foundation walls
		_____	Moisture barrier ineffective
		_____	Pest control, housekeeping, and proper drainage

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03 SUPERSTRUCTURES INSPECTION CHECKLIST

The primary materials encountered in the superstructure inspection are concrete, steel, and wood. Typical observations of deficiencies will be observed by: Failures in the exterior closure systems of exterior walls, openings and roofs; cracks; movement of materials; moisture penetration; and discoloration. The exterior visual survey will detect failures of surface materials or at openings that will require further inspection to determine whether the cause was the superstructure system.

	Deficiencies		**Causes**
Concrete (columns, walls, and floor and roof slabs)			
_____	Overall alignment	_____	Settlement due to design and construction techniques
		_____	Under designed for loading conditions (see *01 Foundations*)
_____	Deflection	_____	Expansion and/or contraction due to changes in design loads
		_____	Original design deficient
		_____	Original materials deficient
_____	Surface Conditions		
	_____ Cracks	_____	Inadequate design and/or construction due to changes in design loads
		_____	Stress concentration
		_____	Extreme temperature changes; secondary effects of freeze-thaw
	_____ Scaling, spalls, and pop-outs	_____	Extreme temperature changes
		_____	Reinforcement corrosion
		_____	Environmental conditions
		_____	Mechanical damage
		_____	Poor materials
	_____ Stains	_____	Chemical reaction of reinforcing
		_____	Reaction of materials in concrete mixture
		_____	Environmental conditions
	_____ Exposed reinforcing	_____	Corrosion of steel
		_____	Insufficient cover
		_____	Mechanical damage

03 SUPERSTRUCTURES INSPECTION CHECKLIST (continued)

Deficiencies	Causes
Steel (structural members, stairs, and connections)	
_____ Overall alignment	_____ Settlement due to design and construction techniques; improper fabrication.
_____ Deflection or cracking	_____ Expansion and/or contraction _____ Changes in design loads _____ Fatigue due to vibration or impact
_____ Corrosion	_____ Electrochemical reaction _____ Failure of protective coating _____ Excessive moisture exposure
_____ Surface deterioration	_____ Excessive wear
Wood (structural members and connections)	
_____ Overall alignment	_____ Settlement; design and construction techniques.
_____ Deflection or cracking	_____ Expand and/or contraction _____ Changes in design loads _____ Fatigue due to vibration or impact _____ Failure of compression members _____ Poor construction techniques _____ General material failure
_____ Rot (decay)	_____ Direct contact with moisture _____ Condensation _____ Omission or deterioration of vapor barrier _____ Poor construction techniques _____ Damage from rodents or insects

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04 EXTERIOR CLOSURE INSPECTION CHECKLIST

General Inspection

- Overall appearance
- Displacement
- Paint conditions
- Caulking
- Window and door fit
- Flashing condition
- Material integrity
- Cracks
- Evidence of moisture
- Construction joints
- Hardware condition

Exterior Walls

_____ Wood (Shingles, weatherboard siding, plywood)

_____ Paint or surface treatment condition
_____ Rot or decay
_____ Moisture penetration
_____ Loose, cracked, warped, or broken boards and shingles

_____ Concrete, Masonry, and Tile (Concrete, brick, concrete masonry units, structural tile, glazed tile, stucco, stone)

_____ Settlement
_____ Construction and expansion joints
_____ Surface deterioration
_____ Parapet movement
_____ Structural frame movement causing cracks
_____ Condition of caulking and mortar
_____ Efflorescence and staining
_____ Tightness of fasteners

_____ Metal (Corrugated iron or steel, aluminum, enamel coated steel, protected metals)

_____ Settlement
_____ Condition of bracing
_____ Tightness of fasteners
_____ Flashings
_____ Structural frame movement
_____ Surface damage due to impact
_____ Caulking
_____ Corrosion

_____ Finishes (Mineral products, fiberglass, polyester resins, and plastics)

_____ Settlement
_____ Surface damage due to impact
_____ Stains
_____ Adhesion to substrate
_____ Flashings
_____ Asbestos products
_____ Structural frame movement
_____ Cracks
_____ Fasteners
_____ Caulking
_____ Lead paint

_____ Insulation

_____ Insulation present
_____ Satisfactory condition

Windows and Doors

_____ Frame fitting
_____ Paint or surface finish
_____ Hardware and operating parts
_____ Cleanliness
_____ Rot or corrosion
_____ Frame and molding condition
_____ Putty and weatherstripping
_____ Security
_____ Material condition (glass, wood, and metal panels)
_____ Screens and storm windows

Shading Devices

_____ Material conditions
_____ Cleanliness
_____ Operations

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05 ROOFING INSPECTION CHECKLIST

General Appearance

Good _____ Fair _____ Poor _____

_____ Water Tightness

- _____ Evidence of leaks on undersurface
- _____ Faulty material
- _____ Faulty application
- _____ Weather damage
- _____ Fastening failure
- _____ Surface weathering
- _____ Faulty design
- _____ Standing water
- _____ Mechanical damage
- _____ Flashing failure

_____ Roofing Surface

_____ Built Up (Felt or bitumen surfacing)

- _____ Adhesion
- _____ Bare areas
- _____ Cracks, holes, tears
- _____ Alligatoring
- _____ Moisture meter readings
- _____ Blisters, wrinkles
- _____ Fish mouths
- _____ Ballast

_____ Single Ply (Thermosetting, thermoplastic, composites)

- _____ Adhesion
- _____ Bare areas
- _____ Cracks
- _____ Seam conditions
- _____ Ballast
- _____ Moisture meter readings
- _____ Blisters, wrinkles
- _____ Holes, tears
- _____ Protective coating

_____ Metal Roofing (Preformed, formed)

- _____ Corrosion (%)
- _____ Seams
- _____ Holes
- _____ Protective coating
- _____ Cracks or breaks
- _____ Expansion joints

_____ Shingles and Tiles (Metal, clay, mission, concrete, or others)

- _____ Disintegration
- _____ Missing (%)
- _____ Underlayment
- _____ Broken or cracked (%)
- _____ Fasteners

_____ Wood Shingles

- _____ Cracked
- _____ Missing (%)
- _____ Curled

05 ROOFING INSPECTION CHECKLIST (continued)

_____ Insulation
- _____ Full coverage (%)
- _____ Satisfactory condition
- _____ Full thickness (%)

_____ Roof Penetrations
- _____ Weather tightness
- _____ Operable

_____ Flashing
- _____ Deterioration
- _____ Holes or damage
- _____ Protective coating
- _____ Open joints
- _____ Anchoring

_____ Drainage
- _____ Alignment
- _____ Clamping rings secure
- _____ Corrosion
- _____ Free flowing
- _____ Screens

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06 PARTITIONS AND DOORS INSPECTION CHECKLIST

General Inspection

- Strength and stability
- Acoustical quality
- Maintainability
- Physical condition
- Adaptability
- Code compliance – Fire Wall

Deficiencies	Causes
Wall Material	
_____ Cracks	_____ Settlement
_____ Holes	_____ Defective material
_____ Looseness	_____ Operational abuse or vibrations
_____ Missing segments	_____ Environmental attack
_____ Water stains	_____ Moisture
_____ Joints	_____ Structural expansion or contraction
_____ Surface appearance	_____ Wind pressure
Hardware	
_____ Overall condition	_____ Appearance
_____ Keying system	_____ Operations
_____ Fit	_____ Locksets
_____ Cylinders	_____ Panic devices
_____ Maintainability	_____ Security operations

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06 WALLS AND FINISHES INSPECTION CHECKLIST

General Inspection

Overall Appearance

Good _____ Fair _____ Poor _____

_____ Evidence of moisture
_____ Cracks
_____ Cleanliness
_____ Discoloration
_____ Settlement
_____ Surface condition
_____ Stains

_____ Paint
_____ Re-painting necessary
_____ Reflectivity
_____ Lead paint
_____ Peeling, cracking, flaking
_____ Maintainability

_____ Coverings and Coatings
_____ Replacement necessary
_____ Rips, tears
_____ Adhesion
_____ Peeling
_____ Holes
_____ Seams

_____ Interior Glazing
_____ Cracks
_____ Frame condition
_____ Shading devices
_____ Seals
_____ Missing panes

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06 CEILINGS AND FINISHES INSPECTION CHECKLIST

General Inspection

Overall Appearance

Good _____ Fair _____ Poor _____

- Settlement or sagging
- Attachment
- Stains, discoloration
- Suitability
- Code compliance
- Alignment
- Evidence of moisture
- Missing units
- Acoustic quality

Exposed Systems (Unpainted, painted, spray-on, decorative)

_____ Cracks
_____ Surface deterioration
_____ Missing elements
_____ Adhesion

Applied to Structure and Suspended

General Condition:

Good _____ Fair _____ Poor _____

_____ Fasteners
_____ Trim condition

Openings:

_____ Panels
_____ Lighting fixtures
_____ Fire protection
_____ Inserts
_____ Air distribution
_____ Other

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06 FLOORS AND FINISHES INSPECTION CHECKLIST

General Inspection

Overall Appearance

Good _____ Fair _____ Poor _____

- Evidence of moisture
- Irregular surface
- Handicapped hazards
- Visible settlement
- Tripping hazards
- Replacement necessary

Carpet (Tufted, tile)

_____ Age
_____ Stains
_____ Holes, tears
_____ Excessive wear
_____ Discoloration
_____ Seam conditions

Resilient (Asphalt tile, cork tile, linoleum, rub, vinyl)

_____ Broken tiles
_____ Shrinkage
_____ Fading
_____ Porosity
_____ Loose tiles
_____ Lifting, cupping
_____ Cuts, holes
_____ Asbestos present

Masonry (Stone, brick)

_____ Cracks
_____ Joints
_____ Porosity
_____ Deterioration
_____ Stains
_____ Sealing

Monolithic Topping (Concrete, granolithic, terrazzo, magnesite)

_____ Cracks
_____ Joints
_____ Porosity
_____ Sealing

Wood (Plank, strips, block, parquet)

_____ Shrinkage
_____ Excessive wear
_____ Decay
_____ Cupping, warpage
_____ Unevenness
_____ Sealing

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07 CONVEYING INSPECTION CHECKLIST

General Inspection (Passenger Conveying)

Overall Appearance (interior)

Good _____ Fair _____ Poor _____

Overall Appearance (exterior)

Good _____ Fair _____ Poor _____

_____ Maintenance history available

_____ Regular inspection frequency

_____ Door operations

_____ Control systems

_____ Noise

_____ Code compliance

_____ Handicapped access

_____ Major repairs necessary

_____ Replacement necessary

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08 MECHANICAL/PLUMBING INSPECTION CHECKLIST

General Inspection

General Appearance
Good _____ Fair _____ Poor _____

Leaks, dripping, running faucets and valves _____

Maintenance history _____

Supply adequacy _____

Sanitation hazards _____

Drain and waste connection _____

Backflow protection _____

Cross connections _____

Fixture quantity _____

Fixture types and conditions _____

Handicapped fixtures _____

Female facilities _____

Metal pipe and fittings corrosion _____

Pipe joints and sealing _____

Pipe insulation _____

Hanger supports and clamps _____

Filters _____

Building user comments _____

_____ Water System
- _____ Water pressure adequate
- _____ Main cutoff operable
- _____ Pump condition
- _____ Odors, tastes
- _____ Water heating temperature setting
- _____ Insulation condition

_____ Sanitary and Storm System
- _____ Flow adequate
- _____ Floor drains
- _____ Gradient
- _____ Cleanouts access
- _____ Chemical resistance
- _____ On-site disposal system

_____ Code Requirements
- _____ EPA/local permits
- _____ Other

_____ Fire Protection System
- _____ Regular inspections
- _____ Complies with code
- _____ Hose cabinets functional
- _____ Sprinkler heads operable
- _____ Controls operable
- _____ Water pressure sufficient

08 MECHANICAL/HVAC INSPECTION CHECKLIST

General Inspection

General Appearance
Good _____ Fair _____ Poor _____

Lubrication: bearings and moving parts _____

Rust and corrosion _____

Motors, fans, drive assemblies, and pumps _____

Wiring and electrical controls _____

Thermostats and automatic temperature controls _____

Thermal insulation and protective coatings _____

Guards, casings, hangers, supports, platforms, and mounting bolts _____

Piping system identification _____

Solenoid valves _____

Burner assemblies _____

Combustion chambers, smokepipes, and breeching _____

Electrical heating units _____

Steam and hot water heating equipment _____

Accessible steam, water, and fuel piping _____

Traps _____

Humidifier assemblies and controls _____

Strainers _____

Water sprays, weirs, and similar devices _____

Shell- and tube-type condensers _____

Self-contained evaporative condensers _____

Air cooled condensers _____

Compressors _____

Liquid receivers _____

Refrigerant driers, strainers, valves, oil traps, and accessories _____

Building user comments _____

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08 MECHANICAL/HVAC INSPECTION CHECKLIST

Cleaning, Maintenance, Repair, and Replacement

_____ Registers
_____ Dampers
_____ Plenum chambers
_____ Louvers
_____ Grills
_____ Draft diverters
_____ Supply and return ducts
_____ Fire dampers

Air Filters

_____ Correct type
_____ Replacement schedule

Heating System Evaluation

_____ Heating capacity
_____ Heating
  _____ Seasonal
_____ Temperature control
_____ All year

_____ Noise level
_____ Air circulation and ventilation
_____ Humidity control
_____ Energy consumption
_____ Filtration

Cooling System Evaluation

_____ Cooling capacity
_____ Cooling all season
_____ Energy consumption
_____ Filtration
_____ Temperature and humidity control
_____ Noise level
_____ Air circulation and ventilation
_____ Reliability

Ventilation System Evaluation

_____ Air velocity
_____ Bag collection
_____ Steam and hot water coils
_____ Fire hazards
_____ Exhaust air systems
_____ Wet collectors
_____ Electrical heating units
_____ Fire protective devices

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09 ELECTRICAL/SERVICE AND DISTRIBUTION INSPECTION CHECKLIST

General Inspection

Safety conditions _____

Service capacity, % used, and age _____

Switchgear capacity, % used, and age _____

Feeder capacity, % used, and age _____

Panel capacity _____

Thermo-scanning _____

Maintenance records available _____

Convenience outlets _____

Builder user comments _____

Exterior Service

_____ Line drawing
_____ Feed source:
  _____ Utility/owned
  _____ Above/below ground

_____ Transformer:
  _____ Transformer tested
  _____ Transformer PCB's
  _____ Transformer arcing or burning
  _____ Ownership (facility or utility)

Interior Distribution System

_____ Line drawing
_____ Main circuit breaker marked
_____ All wiring in conduit
_____ Panels marked
_____ Missing breakers
_____ Incoming conduit marked
_____ Panel boards, junction boxes covered
_____ Conduit properly secured
_____ Panel schedules

Emergency Circuits

Emergency generator(s)
_____ Condition and age
_____ Testing schedule
_____ Service schedule
_____ Circuits appropriate
_____ Fuel storage (capacity)
_____ Auto start and switchover
_____ Test records available
_____ Service schedule records available
_____ Cooling and exhaust

Emergency Lighting/Power Systems

_____ Battery operation
_____ Exit signs
_____ Elevators
_____ HVAC
_____ Separate power feed
_____ Stairways/corridors
_____ Interior areas
_____ Exterior

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10 SAFETY STANDARDS INSPECTION CHECKLIST

General Inspection

Code compliance _____

Maintainability _____

Means of egress _____

Fire ratings _____

Audible and visual device condition _____

Extinguishing systems (see also *08 Mechanical/Plumbing)* _____

Type _____

Lighting system (see also *09 Electrical Lighting/Power)* _____

Type _____

Handicapped accessibility _____

Building user comments _____

_____

Exterior Lighting

Adequacy
Good _____ Fair _____ Poor _____

Condition _____

Controls (type and location) _____

Fire Alarm Systems

_____ Panel visible
_____ Pull station condition
_____ Operational
_____ Detector conditions

Stairs and Ramps

_____ Exits marked
_____ Tripping hazards
_____ Lighting adequate
_____ Hardware operational
_____ Surface conditions
_____ Handrails

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12 SITE WORK INSPECTION CHECKLIST

General Inspection

Overall Appearance
Good _____ Fair _____ Poor _____

Maintainability _____

Repairs/replacements _____

Code compliance _____

Roads, Walks, and Parking Lots

Surface conditions _____

Subsurface conditions _____

Settling and uplift _____

Cracks, holes _____

Drainage and slope _____

Curbing

Alignment _____

Erosion _____

Repairs/replacements _____

Drainage and Erosion Controls

Surface drainage _____

Manholes, catch basins _____

Vegetation _____

Channels, dikes _____

Retention, detention _____

Drains _____

Parking Lot Controls

Location _____

Operation _____

Repairs/replacements _____

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