Notes:

APPENDIX D

ANNUAL MAINTENANCE INSPECTION SPECIFICATION AND RECORD FOR CATEGORY 2 AND 3 CRANES

1. The following are the minimum inspection requirements. Due to the various makes and models of cranes in the Navy inventory with unique or special components, these specifications may require additional instructions. Components need not be disassembled for inspection, except: (a) where noted specifically to disassemble; (b) where activity experience warrants disassembly of specific components; or (c) where problems indicated by these inspections require disassembly for further inspection. Where disassembly and reassembly are required, or for other detailed inspection guidelines, TWDs, SROs, or other work documents shall be utilized (except for inspection covers) to properly document the necessary steps required for disassembly, reassembly, and/or other inspection guidelines. Deleting or reducing the frequency of these inspections requires Navy Crane Center approval (see paragraph 3.6 for deferral of maintenance inspections). Justification shall be provided with the activity's request. Additional or more frequent inspections based upon activity experience or OEM recommendations may be performed at the discretion of the activity. Additional inspection requirements and recommendations for specific OEMs are contained in CSAs and EDMs located on the Navy Crane Center web-site (https:/[/www.navfac](http://www.navfac.navy.mil/ncc)).[navy.mil/ncc).](http://www.navfac.navy.mil/ncc))
2. These specifications include both non-operational and operational inspection criteria. Where necessary to ensure the safety of inspection and maintenance personnel, the crane shall be de-energized in accordance with approved lockout procedures.
3. For inspections that involve fluids (lubricants, coolants, brake fluid, hydraulic fluid, etc.) or grease, inspect the fluid or grease for visual appearance, smell, and feel, and inspect for indications of damaged or malfunctioning components.
4. Where an unsatisfactory condition is found, the item shall be identified on the "Unsatisfactory Items" sheet together with a statement of the condition observed. Corrective action in terms of adjustments, repairs, or replacements of items shall be detailed on a TWD, SRO, or other appropriate document. (See NAVFAC P-300 for a sample SRO.)
5. Brake data measurements shall be recorded on the "Brake Data" sheet. Measurement attributes and criteria shall be based on brake and/or crane OEM and/or activity engineering organization recommendations. In addition to minimum and maximum settings, a preferred setting may be specified where appropriate. Where measurements are inaccessible without disassembly, those measurements need only be taken when the brake is disassembled.
6. Where measurements are specified by the activity engineering organization, those measurements shall be recorded. Wire rope dimensional measurements and chain length measurements shall be recorded.
7. As an alternative to the above dimensional measurements, gages may be used if supplied by the OEM or as approved by the activity engineering organization. If gages are used, the gage part number or drawing number shall be recorded on the MISR.
8. Where an inspection item applies to multiple components (e.g., main hoist, auxiliary hoist), each component shall be identified in the "system inspected" column.
9. These inspection criteria address most of the features and components on typical cranes. If a crane is equipped with features or components not specifically covered by these requirements, those features and components shall be inspected (where inspection is practical, as determined by the activity engineering organization and approved by the certifying official) for proper condition and operation, e.g., emergency dynamic braking, motor overspeed and over temperature sensors, travel and rotate limit switches, and micro drives.
10. Where “NA” is used to note that an inspection criterion does not apply due to a reason other than the component or feature is not on the crane, the reason for the “NA” shall be entered on the “Remarks” sheet. For example, if an “NA” is entered in item 13b, electric magnetic brake system (disc type brakes), due to the crane having a mechanical load brake and this not being the sixth annual inspection, these facts shall be noted on the “Remarks” sheet.
11. Items marked with a lower case sigma (cr) after the item number may be inspected by a mechanic or electrician in lieu of an inspector.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ANNUAL MAINTENANCE INSPECTION SPECIFICATION AND RECORD FOR CATEGORY 2 AND 3 CRANES** SHEET 1\_ OF | | | | | | | | | | |
| Crane | | Type | | OEM | | | Capacity | | | |
| Prior Inspection | | | Current Inspection | | Legend: Check under condition  S = Satisfactory C = Corrected (If deferred, leave  blank and identify on Unsatisfactory Items sheet)  U = Unsatisfactory NA = Not Applicable | | | | | |
| DATE | | | DATE | |
| Item No | Items to be Inspected | | Maintenance Inspection Specification | | | System Inspected | Condition | | | |
| S | U | C | NA |
| 1 | Structure (Bridge Girders, Trolley, Trucks, Equalizer Beams, Gantry, Boom, Jib, Pillar, etc.) | | Inspect structural components for damage, distortion, or deterioration, and for evidence of loose or missing fasteners and cracked welds. Inspect truck equalizer pins for proper lubrication. Ensure there is no interference between crane and building during operation. Ensure drain holes are clear for outdoor cranes. | | |  |  |  |  |  |
| 2 | Rails and Tracks, including top running trolley rail and underhung trolley and runway beams (Not applicable to runway rails for top running bridge cranes and gantry cranes. See NAVFAC Instruction 11230.1.) | | Inspect rails, tracks, splices, switches, hanger rod assemblies, and end stops for damage, deterioration, visible misalignment, and for evidence of loose or missing fasteners and cracked welds. Inspect for abnormal wear or other evidence of bridge or trolley misalignment. For rail systems used by multiple cranes, this rail inspection may be independent of the crane inspection, but shall be performed annually and be current at the time of the cranes' certification. | | |  |  |  |  |  |
| 3 | Handrails, Walkways, Ladders, and Personnel Safety Guards | | Inspect for damage or deterioration, and for evidence of loose or missing fasteners and cracked welds. | | |  |  |  |  |  |
| 4 | Bumpers | | Inspect for damage or deterioration, and for evidence of loose or missing fasteners. | | |  |  |  |  |  |
| 5 | Jib Boom Bearings | | Inspect rotate bearings for proper lubrication. Rotate boom and inspect for evidence of bearing damage, overheating, and abnormal wear. | | |  |  |  |  |  |
| 6 | Wheels and Axles | | Inspect wheels for uneven wear, flat spots, chips, flange wear, or cracks, for evidence of loose or missing fasteners and bearing caps, and for proper lubrication. During operation, inspect for excessive movement between components, improper tracking, overheating, and other evidence of component wear or bearing damage. Listen for abnormal noise. | | |  |  |  |  |  |
| 7 | Shafts and Couplings, including couplings integral to motor/speed reducer assemblies | | Inspect for evidence of damage, misalignment, leaking seals, and loose keys, coupling bolts, and covers. During operation, inspect for vibration, overheating, and other evidence of misaligned, worn, or damaged components or bearings.  Listen for abnormal noise. Inspect pillow blocks for damage, paying special attention to possible cracks in cast iron pillow blocks loaded in shear and tension, loose or missing fasteners, and cracks caused by over-tensioned fasteners. | | |  |  |  |  |  |
|  | Shafts and Couplings (Hoist Drives) | | Verify coupling alignments are within OEM tolerances at every eighth annual inspection (not applicable to NEMA c, d, and p- face motors, or similar configurations). Coupling alignment verification data shall be included in the crane’s history file. | | |  |  |  |  |  |
| 8a | Gearing (Hoist, Rotate, Travel) External Gears | | Inspect for damaged or worn gears, for evidence of misalignment or loose keys, and for proper lubrication. During operation, listen for abnormal noise, and inspect for other evidence of possible damage. Inspect for evidence of bearing damage, overheating, and abnormal wear. Inspect pillow blocks for damage, paying special attention to possible cracks in cast iron pillow blocks loaded in shear and tension, loose or missing fasteners, and cracks caused by overtensioned fasteners. | | |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ANNUAL MAINTENANCE INSPECTION SPECIFICATION AND RECORD FOR CATEGORY 2 AND 3 CRANES** SHEET 2\_ OF | | | | | | | | | | |
| Crane | | Type | | OEM | | Capacity | | | | |
| Item No | Items to be Inspected | | Maintenance Inspection Specification | | System Inspected | | Condition | | | |
| S | U | C | NA |
| 8b | Gearing (Hoist, Rotate, Travel) Internal Gears, including clutches. (Not applicable to manual chain hoists). | | Inspect gear case for proper lubricant level. Inspect for leaks and for evidence of loose or missing fasteners. Inspect breathers for restrictions. During operation, inspect for vibration, overheating, and other evidence of misaligned, worn, or damaged internal components or bearings. Listen for abnormal noise. | |  | |  |  |  |  |
|  | Hoist Gears (Not applicable to category 2 and 3 package hoist assemblies or manual chain hoists.) | | Additionally, internal gearing for hoists shall be monitored by an oil or vibration analysis program. The oil or vibration analysis shall be performed at least once each certification period with results analyzed by a qualified source and documented and retained in the equipment history file for the life of the component. | |  | |  |  |  |  |
|  |  | | As an alternative to oil or vibration analysis, internal gears shall be visually inspected for wear or damage and for evidence of misalignment. If all gears cannot be visually inspected through inspection ports or by video probe or similar inspection devices, gear cases shall be disassembled for visual inspection. If this alternative is selected, perform no later than every 12th annual inspection**.** | |  | |  |  |  |  |
| 8c | Gearing, Manual Chain Hoists | | Inspect for evidence of worn, corroded, cracked, or distorted parts such as shafts, gears, bearings, pins, rollers, load sprockets, idler sprockets, or hand chain wheels.  Manual chain hoists shall be disassembled at every sixth annual inspection for detailed inspection of above noted items. For cranes in the quadrennial load test program, this disassembly may be performed at every eighth annual inspection. | |  | |  |  |  |  |
| 9a | Mechanical Load Brakes  - Powered Hoists | | Inspect for proper lubricant level and for leaks. During operation, inspect for chattering, vibration, overheating, or other evidence of misaligned, worn, or damaged internal components. Listen for abnormal noise. For mechanical load brakes that cannot be tested independently (see appendix E), disassemble no later than every 12th annual inspection and inspect for damage and deterioration. | |  | |  |  |  |  |
| 9b | Mechanical Load Brakes  – Manual Hoists | | Inspect for evidence of worn, glazed, or oil contaminated friction discs; worn pawls, cams or ratchet; corroded, stretched, or broken pawl springs in brake mechanism.  Manual hoist load brakes shall be disassembled at every sixth annual inspection for detailed inspection of above noted items. For cranes in the quadrennial load test program, this disassembly may be performed at every eighth annual inspection. | |  | |  |  |  |  |
| 10 | Mechanical Brakes | | Inspect system for damage, for evidence of binding, loose, and worn components, and for proper lubrication. Disassemble as required to inspect brake linings for wear, de-bonding, and glazing, and drums for smoothness and for evidence of overheating. Inspect brakes for proper settings and for alignment of brake shoes. During operation, verify proper release, engagement, and stopping action in both directions  of motion. Inspect for evidence of overheating.  Note: For hoists without mechanical load brakes or self- locking worm gears, and where the brake stops the movement of the load, disassembly shall be done annually (quadrennially for cranes in the quadrennial program). For hoists with mechanical load brakes or self-locking worm gears, and for holding brakes and travel and rotate brakes, disassemble at every eighth annual inspection. | |  | |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ANNUAL MAINTENANCE INSPECTION SPECIFICATION AND RECORD FOR CATEGORY 2 AND 3 CRANES** SHEET 3\_\_ OF | | | | | | | | | | |
| Crane | | Type | | OEM | | Capacity | | | | |
| Item No | Items to be Inspected | | Maintenance Inspection Specification | | System Inspected | | Condition | | | |
| S | U | C | NA |
| 11 | Hydraulic Brake System | | Inspect system for damage, for evidence of binding, loose, and worn components, and for proper lubrication. Disassemble as required to inspect brake linings for wear, de-bonding, and glazing, and drums for smoothness and for evidence of overheating. Inspect brakes for proper settings and for alignment of brake shoes. Inspect master cylinders for proper hydraulic brake fluid level. Inspect lines for damage, leakage, and evidence of loose connections. During operation, verify proper release, engagement, and stopping action in both directions of motion. Inspect for evidence of overheating.  Note: For hoists without mechanical load brakes or self- locking worm gears, and where the brake stops the movement of the load, disassembly shall be done annually (quadrennially for cranes in the quadrennial program). For hoists with mechanical load brakes or self-locking worm gears, and for holding brakes and travel and rotate brakes, disassemble at every eighth annual inspection. | |  | |  |  |  |  |
| 12 | Air Brake System | | Inspect system for damage, for evidence of binding, loose, and worn components, and for proper lubrication. Disassemble as required to inspect brake linings and discs for wear, de- bonding, and glazing, and drums or rotors for smoothness and for evidence of overheating. Inspect brakes for proper settings and for alignment of shoes and calipers. Inspect air lines for damage and evidence of loose connections. During operation, verify proper release and engagement, and stopping action in both directions of motion. Inspect air lines and air application valves for proper operation and air leaks.  Note: For hoists without mechanical load brakes or self- locking worm gears, and where the brake stops the movement of the load, disassembly shall be done annually (quadrennially for cranes in the quadrennial program). For hoists with mechanical load brakes or self-locking worm gears, and for holding brakes and travel and rotate brakes, disassemble at every eighth annual inspection. | |  | |  |  |  |  |
| 13a | Electric Magnetic Brake System (Shoe and Band Type Brakes including Thruster Brakes) | | Inspect system for damage, for evidence of binding, loose, and worn components, and for proper lubrication.  Disassemble as required to inspect linings for wear, de- bonding, and glazing, and brake drums for smoothness and for evidence of overheating. Inspect brakes for proper settings and alignment of brake shoes. Inspect wiring for damage or deterioration, and for evidence of loose connections. During operation, verify proper release, engagement, and stopping action in both directions of motion and timing of release and engagement. Inspect for evidence of overheating or other evidence of incomplete brake release. For thruster brakes, check hydraulic thruster actuator reservoir for fluid level and leakage.  Note: For hoists without mechanical load brakes or self- locking worm gears, and where the brake stops the movement of the load, disassembly shall be done annually (quadrennially for cranes in the quadrennial program). For hoists with mechanical load brakes or self-locking worm gears, and for holding brakes and travel and rotate brakes, disassemble at every eighth annual inspection. | |  | |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ANNUAL MAINTENANCE INSPECTION SPECIFICATION AND RECORD FOR CATEGORY 2 AND 3 CRANES** SHEET 4\_\_ OF | | | | | | | | | | |
| Crane | | Type | | OEM | | Capacity | | | | |
| Item No | Items to be Inspected | | Maintenance Inspection Specification | | System Inspected | | Condition | | | |
| S | U | C | NA |
| 13b | Electric Magnetic Brake System (Disc Type Brakes) | | Inspect brake housings for damage or evidence of loose hardware. Inspect brakes for proper settings. Inspect wiring for damage or deterioration, and for evidence of loose connections. Disassemble, as required, to inspect for damaged brake discs, splines, or other components, for glazing, de-bonding, alignment of components, and for proper brake lining thickness. During operation, verify proper release, engagement, alignment of components, and stopping action in both directions of motion and timing of release and engagement. Listen for abnormal noise, and inspect for vibration and overheating.  Note: For hoists without mechanical load brakes or self- locking worm gears and where the brake stops the movement of the load, disassembly shall be done annually (quadrennially for cranes in the quadrennial program). For hoists with mechanical load brakes or self-locking worm gears, and for holding brakes and travel and rotate brakes, disassemble at every eighth annual inspection. | |  | |  |  |  |  |
| 13c | Electric Magnetic Brake System (Caliper Brakes on Wire Rope Drums) | | Inspect system for damage, for evidence of binding, loose and worn components, and for proper lubrication. Disassemble as required to inspect brake linings for wear, glazing, and de- bonding. Inspect brake surfaces on drums for smoothness and for evidence of overheating. Inspect brakes for proper settings and alignment of calipers. Inspect wiring for damage or deterioration, and for evidence of loose connections. During operation, inspect for proper release and engagement and stopping action in both directions of motion and timing of release and engagement. For brakes with Belleville torque springs, record the number of cycles as shown on the brake cycle counter. Compare the total number of cycles applied to each brake actuator's Belleville springs to the allowable maximum number of cycles specified for that actuator and ensure that none of the springs have exceeded the maximum value. Record Belleville spring cycle limit and number of cycles in the equipment history file. (For brakes without cycle counters, the activity shall conservatively estimate the brake usage and ensure that the springs are replaced before their fatigue life is reached.)  Note: For hoists without mechanical load brakes or self- locking worm gears and where the brake stops the movement of the load, disassembly shall be done annually (quadrennially for cranes in the quadrennial program). For hoists with mechanical load brakes or self-locking worm gears, and for holding brakes and travel and rotate brakes, disassemble at every eighth annual inspection. | |  | |  |  |  |  |
| 14 | Sheaves, Equalizer Bar | | Inspect for abnormally worn or corrugated grooves, flat spots, abnormal play, and broken or cracked flanges. Inspect for evidence of loose or missing fasteners, keepers, and lubrication fittings. Gage the wire rope grooves of all sheaves. Expose and examine sections of equalizer sheaves and saddles in contact with wire rope and where corrosion may develop because of poor drainage. During operation, verify free movement of all sheaves, and inspect for abnormal play, overheating, and other evidence of bearing or component wear or damage. Inspect equalizer bar for damage or deteriorated components. Ensure free movement and that bar does not bottom out over range of hoist operation. | |  | |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ANNUAL MAINTENANCE INSPECTION SPECIFICATION AND RECORD FOR CATEGORY 2 AND 3 CRANES** SHEET 5\_\_ OF | | | | | | | | | | |
| Crane | | Type | | OEM | | Capacity | | | | |
| Item No | Items to be Inspected | | Maintenance Inspection Specification | | System Inspected | | Condition | | | |
| S | U | C | NA |
| 15 | Wire Rope Drum, Followers, and Machinery Foundations | | Inspect drums for distortion, cracks, worn grooves, and for evidence of cracked welds and loose or missing fasteners. Inspect wire rope followers for proper adjustment and alignment. Inspect bearings for evidence of damage, overheating, or abnormal wear. Inspect machinery foundations for damage or deterioration, and for evidence of loose or missing fasteners and cracked welds. During operation, verify that at least two complete wraps of wire rope remain on grooved drums (at least three complete wraps on ungrooved drums) in all operating conditions. Listen for abnormal noise. Inspect for vibration, overheating, and other evidence of misaligned, worn or damaged components or bearings. Inspect pillow blocks for damage, paying special attention to possible cracks in cast iron pillow blocks loaded in shear and tension, loose or missing fasteners, and cracks caused by over-tensioned fasteners. | |  | |  |  |  |  |
| 16 | Wire Rope, Fastenings, and Terminal Hardware. See next page for wire rope rejection criteria | | Thoroughly inspect entire length of wire rope. The depth and detail of the inspection shall be that necessary to ensure that the entire rope is acceptable with special attention paid to areas of expected wear or damage, areas not normally visible to the operator during operation or pre-use check, and to rotation-resistant rope. During the inspection, pay the wire rope out as far as possible. For sections that cannot be spooled off the drum, visual inspection of the wire rope on the drum is sufficient. Remove wire rope dressing from selected areas subjected to significant wear, exposure, and abuse.  Diameter measurements shall be performed at several places over the length of the rope. Record minimum dimension measured in the “Remarks” block. Expose and examine sections in contact with equalizer sheaves and saddles or where corrosion may develop because of poor drainage.  Lubricate areas after inspection. Inspect sockets, swivels, trunnions, and connections for undue looseness, wear, cracks, corrosion, or other damage, a special area to inspect is the base (lug or bail) to shank transition area for swaged sockets. Undue looseness in poured sockets is defined as looseness or evidence of slippage of wires in the securing material, evidence of deterioration of the securing material, looseness of wire rope strands or wires adjacent to the socket or any looseness resulting from cracks or other defects in the basket. Evidence of looseness between the securing material and the basket resulting solely from seating of the material in basket is acceptable. Drum end fittings need only be disconnected or disassembled when experience or visible indications deem it necessary. | |  | |  |  |  |  |
| 17 | Load Chains, Chain Guides, and Sprockets | | Inspect for damage or deterioration, and for evidence of loose or missing fasteners and cracked welds. Measure for increase in chain length. Record measurements or gage part/drawing number in the “Remarks” block. Ensure chain is not twisted and is properly oriented with link welds facing away from load sprockets unless otherwise specified by the OEM. During operation, listen for abnormal noise. Inspect for overheating and other evidence of worn or damaged components and bearings. Inspect chain guides, guide rollers, and side plates for evidence of damage. Verify that chain bag or container is not overfilled with excess load chain, that chain correctly enters and exits container, and that container is in the correct location. | |  | |  |  |  |  |

Wire Rope Rejection Criteria. Remove damaged portions (or replace entire length, if necessary) if any of the following are found:

1. Kinked, Birdcaged, Doglegged, or Crushed Sections. Kinked, birdcaged, doglegged, or crushed rope in straight runs where the core is missing or protrudes through or between strands, or where the rope does not fit properly in sheave or drum grooves. (This does not apply to runs around eyes, thimbles, shackles).
2. Flattened Sections. Flattened sections where the diameter across the flat is less than 5/6 of nominal diameter. (This does not apply to runs around eyes, thimbles, and shackles.)
3. Broken Wires. Six randomly distributed broken wires in one lay or three broken wires in one strand in one lay. For rotation-resistant wire rope, two in a length equal to six times the rope diameter or four in a length equal to 30 times the rope diameter. One outer wire broken at the point of contact with the core of the rope that has worked its way out of the rope structure and protrudes or loops out from the rope structure ("valley break"). For end connections, two broken wires within one lay length of the end connection.
4. Loss in Diameter. Reduction from nominal diameter of more than five percent.
5. High or Low Strand. High or low strand where the height or depth exceeds one-half the strand diameter.
6. Corrosion. Corrosion such that significant pitting occurs on the surfaces of outside wires and obvious signs of internal corrosion such as magnetic debris coming from the valleys. Minor surface roughness on outside wires is acceptable provided no significant pitting occurs and the rope is not corroded internally. Significant pitting is defined as pitting that cannot be removed by abrasive removal of less than 1/3 of the original diameter of individual outside wires.
7. Heat Damage. Evidence of heat damage from any cause.
8. Wavy Rope. Wavy rope (where the longitudinal axis of the wire rope takes the shape of a helix instead of a line) when the diameter of the envelope of the wave is greater than 110 percent of the diameter of the nominal diameter of the wire rope (133 percent in straight runs where the rope does not pass over sheaves or the drum). Use ISO 4309 as a guide.
9. Accumulation of Defects. An accumulation of defects that in the judgment of the inspector creates an unsafe condition.
10. Splices. Wire rope shall not contain splices.

NOTE: For those sections of wire rope with high strands, wavy or flattened rope, consideration should be given to increasing the inspection periodicity due to the possibility of increased wear and reeving/spooling issues.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ANNUAL MAINTENANCE INSPECTION SPECIFICATION AND RECORD FOR CATEGORY 2 AND 3 CRANES** SHEET 6\_\_ OF | | | | | | | | | | |
| Crane | | Type | | OEM | | Capacity | | | | |
| Item No | Items to be Inspected | | Maintenance Inspection Specification | | System Inspected | | Condition | | | |
| S | U | C | NA |
| 18 | Hoist Blocks and Hooks (Including Hoist Mounting Hooks) | | Inspect hoist blocks, cheek plates, swivels, trunnions, and lubrication fittings for damage or deterioration, cleanliness, freedom of movement, and for evidence of loose or missing fasteners. Inspect for loose, damaged, missing, or improperly sized retaining rings. Inspect hooks and mousing devices for damage. Inspect drip pans and gaskets for damage, proper clearance, and for evidence of loose or missing fasteners.  Inspect for evidence of bearing damage, overheating, and abnormal wear. See appendix E for further inspection and test of hooks. | |  | |  |  |  |  |
| 19 | Insulated Link | | Inspect link surface for conductive contaminants such as graphite, grease, metallic particles, or rust streaks. Inspect for damage. See appendix E for further inspection and test of insulated links. | |  | |  |  |  |  |
| 20 | Air Operating System | | Inspect motors, valves, filters, water separators, cylinders, lines, regulators, and gauges for missing parts, damage, and evidence of loose or missing fasteners. Inspect for proper lubrication. Verify proper operation and inspect system for leaks. If no filters, lubricators, or water separators are installed, request engineering evaluation of system. | |  | |  |  |  |  |
| 21 | Runway and Trolley Electrification (Collector Bar, Festoon, and Cable Track Systems) | | Inspect system and associated wiring for damage or deterioration, and for evidence of loose fasteners or connections (e.g., track joint assemblies, track hanger clamps, end clamps/stops, saddle assemblies, cable connectors, tow trolley). Inspect collector shoes, springs, and conductor bar surfaces for evidence of excessive wear and/or misalignment. Verify proper operation and that all moving parts operate freely without binding. | |  | |  |  |  |  |
| 21a | Crane Grounding | | At eighth annual inspection, for all cranes where the bridge or trolley frames are grounded through the bridge and trolley wheels and their respective rails, perform a resistance check to determine the reliability of the crane’s ground in at least four areas of the trolley and/or runway. Resistances greater than five ohms require corrective action and/or activity engineering evaluation. Wheels and/or rails may require cleaning to reduce the resistance to less than five ohms. The resistance check shall be performed both between the load block and ground and between the pendant and ground. If there is no metallic pendant, but an external metallic strain relief cable, the check shall be between the strain relief cable and ground. If there is no metallic pendant or external strain relief cable, or no metallic pendant and the strain relief cable is non-conductive, the pendant to ground check may be omitted. | |  | |  |  |  |  |
| 22 | Cable Reels | | Inspect reel assembly and associated wiring for damage or deterioration, and for evidence of loose fasteners or connections. Inspect slip rings for damage, deterioration, indications of excessive wear, streaking or arcing/overheating, and proper contact. Verify proper operation. | |  | |  |  |  |  |
| 23cr | Electrical Hardware and General Lighting | | Inspect conduits, raceways, junction boxes, light fixtures, and associated wiring for damage or deterioration, and for evidence of loose connections. Verify operation of lights.  The activity engineering organization may reduce the frequency of opening enclosures based on their exposure to weather and past findings. The reduced frequency shall be no less frequent than every eighth annual inspection. | |  | |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ANNUAL MAINTENANCE INSPECTION SPECIFICATION AND RECORD FOR CATEGORY 2 AND 3 CRANES** SHEET 7\_\_ OF | | | | | | | | | | |
| Crane | | Type | | OEM | | Capacity | | | | |
| Item No | Items to be Inspected | | Maintenance Inspection Specification | | System Inspected | | Condition | | | |
| S | U | C | NA |
| 24 | Control Panels, Relays, Coils, Transfer and Disconnect Switches (including main disconnect switch), Conductors and Electronic (Solid State) Drive Control Systems | | Inspect (without removing) contacts for proper alignment, pitting, and evidence of excess heating and arcing. Inspect transfer and disconnect switches, conductors, coils and contact leads, and shunts for insulation breakdown, missing hardware, and evidence of overheating. Inspect wiring for damage, deterioration, and evidence of loose connections. Inspect fuses for proper ratings and type (see note 1 regarding disassembly), and for evidence of loose connections and overheating. Inspect overload devices for evidence of loose connections and overheating. Inspect circuit breakers and switches for cleanliness, loose broken worn or missing parts, and proper operation. Inspect panel boards and arc shields for cracks, evidence of loose or missing fasteners, cleanliness, and moisture. Manually operate relays, switches, contactors, and interlocks and verify that all moving parts operate freely without binding or excessive play. Inspect enclosures for cleanliness or damage, and for evidence of loose or missing fasteners, support components, and gaskets. During operation, verify proper operation of panel indicating lights and contactor sequence. Verify proper operation of environmental controls (e.g., strip heaters, cooling fans).  Inspect the electronic (solid state) drive control systems wiring for damage or deterioration, and for evidence of loose connections. Visually inspect (without removing) components for evidence of damage or overheating. Verify that the drive is dry and free of dust, dirt, and debris. If applicable/possible, inspect condition of or replace drive backup batteries. Ensure disconnect switches are not blocked and are accessible to personnel in accordance with National Electric Code NFPA 70. | |  | |  |  |  |  |
|  |  | | At every eighth annual inspection, verify that the switch  mechanism and/or handle on disconnects and safety switches cannot be moved to the energized or on position when locked in the de-energized or off position and that the handle properly indicates whether the switch is energized or de-energized. | |  | |  |  |  |  |
| 25 | Controllers | | Inspect cab and floor operated controllers for broken or loose springs, cracked or loose operating levers or push buttons, and pitted or burned contact points and segments. Inspect for broken segment dividers and insulators, proper contact pressure, excessive arcing, and worn or loose cams, pins, rollers, or chains, and for evidence of loose or missing fasteners. Inspect wiring, seals, boots, and guards for damage or deterioration, and for evidence of loose connections.  Inspect pendant cable for proper securing hardware. Inspect for identifying label plates and direction indicators, and that crane and controller horizontal direction indicators match.  Crane directional indicators may be located on the facility in lieu of the crane as long as the markings are visible to the operator from all operating locations. Inspect such parts as bearings, star wheels, and pawls for proper lubrication. During operation, verify proper sequencing of speed points and operation of indicating lights, and deadman switches. Verify proper spring return and neutral latching.  For cranes that utilize secondary or backup controllers, all controllers shall be operationally tested during either this inspection or the CCIR/test. If performed at the CCIR/test, note this in Remarks. | |  | |  |  |  |  |
| 26 | Resistors | | Inspect resistors, insulators, and brackets for damage, distortion, or deterioration, and for evidence of loose or missing fasteners. Inspect wiring for damage or deterioration, and for evidence of loose connections. Inspect for evidence of overheating. | |  | |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ANNUAL MAINTENANCE INSPECTION SPECIFICATION AND RECORD FOR CATEGORY 2 AND 3 CRANES** SHEET\_\_8\_\_ OF | | | | | | | | | | |
| Crane | | Type | | OEM | | Capacity | | | | |
| Item No | Items to be Inspected | | Maintenance Inspection Specification | | System Inspected | | Condition | | | |
| S | U | C | NA |
| 27 | Electric Motors (Hoist, Rotate, Travel) | | Inspect motors (including accessible internal areas such as commutators and brushes) and associated wiring for cleanliness, damage, or deterioration, and for evidence of loose connections. Inspect for proper lubrication. Inspect slip rings for damage and proper contact and commutators for evidence of destructive commutation. Inspect brushes for proper brush tension and length. Inspect insulation for deterioration and evidence of overheating. During operation, inspect for any abnormal vibration, overheating, or other evidence of misaligned, worn, or damaged internal components or bearings. Verify proper operation of environmental controls (e.g., strip heaters, cooling fans). | |  | |  |  |  |  |
| 28 | Eddy Current Brakes | | Inspect for cleanliness, damage, or deterioration, and for evidence of loose connections. Inspect for proper lubrication. Inspect wiring for damage or deterioration, and for evidence of loose connections. During operation, listen for any abnormal noise. Inspect for vibration, overheating, or other evidence of misaligned, worn, or damaged internal components or bearings. | |  | |  |  |  |  |
| 29 | Limit and Bypass Switches | | Remove covers and inspect electrical and mechanical components for damage or deterioration, and for evidence of loose connections. Inspect enclosures for evidence of moisture and arcing. Inspect wiring for damage or deterioration, and for evidence of loose connections. Inspect drive and actuating components for damage, deterioration, and proper lubrication, and for evidence of loose connections.  During operation, verify proper functioning of primary and secondary limit switches, indicator lights, settings, and bypass switches. Ensure proper functioning and setting of secondary hoist limit switches by using block to engage limit switch and ensure block does not two-block. This shall be performed and documented at least once during the life of the crane (or limit switch) and re-performed if the setting is affected or changed. Before performing, ensure switch is functioning properly electrically and station watch-stander to prevent damage.  Check electrical function annually at this inspection, CCIR, or appendix E no-load test by using hand or other means to activate the switch. If proper operation of secondary upper limit switch and/or lower limit switch is performed at the CCIR or appendix E no-load test, note this in Remarks. | |  | |  |  |  |  |
| 30 cr | Operator’s Cab | | Inspect for leaks, broken glass, deterioration, and cleanliness. Inspect louvers, doors, windows, windshield wipers, heaters, air conditioners, operator's chair, and communication equipment for proper operation. | |  | |  |  |  |  |
| 31 | Warning Devices, Operational Aids, General Safety Devices (Horns, Bells, Lights, etc.), Wind speed Indicator. | | Inspect components and associated wiring for damage or deterioration, and for evidence of loose connections. The activity engineering organization may reduce the frequency of opening enclosures based on their exposure to weather and past findings. The reduced frequency shall be no less frequent than every eighth annual inspection. During operation, verify proper functioning of devices. Verify proper functioning of wind speed indicator. | |  | |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ANNUAL MAINTENANCE INSPECTION SPECIFICATION AND RECORD FOR CATEGORY 2 AND 3 CRANES** SHEET\_\_9\_\_ OF | | | | | | | | | | |
| Crane | | Type | | OEM | | Capacity | | | | |
| Item No | Items to be Inspected | | Maintenance Inspection Specification | | System Inspected | | Condition | | | |
| S | U | C | NA |
| 32 | Load Warning Devices, Load Shutdown Devices | | Inspect wiring for damage or deterioration, and for evidence of loose connections. During a load test year only, these devices shall be tested for proper operation at this inspection or the CCIR/load test (mark N/A and note this in Remarks if performed at the CCIR/load test). If not specified by the device OEM, the preferred accuracy requirement for all devices is to warn or shutdown at the set weight minus 10 percent of the actual weight at the set point. If preferred accuracy requirement cannot be met, the minimum accuracy requirement is to warn or shutdown at the set point plus 5 percent minus 10 percent of the actual weight at the set point. Do not test beyond 125 percent of rated capacity. This inspection item does not apply to overload clutches; for overload clutches, see item 36. Testing shall ensure the overload warning or shutdown works properly to warn or prevent an overload and does not engage at a nuisance low level. Testing values will depend on test weight availability and is not required to prove exact tolerances specified above. | |  | |  |  |  |  |
| 32a | Load Indicators | | Inspect wiring for damage or deterioration, and for evidence of loose connections. During a load test year only, these devices shall be tested for proper operation at this inspection or the CCIR/load test (mark N/A and note this Remarks if performed at the CCIR/load test). If not specified by the device OEM, the preferred accuracy requirement for all devices is plus 10 percent minus 0 percent of actual weight. If preferred accuracy requirement cannot be met, the minimum accuracy requirement is plus 10 percent minus 5 percent of the actual weight. Do not test beyond 125 percent of rated capacity. | |  | |  |  |  |  |
| 33 | Capacity Signs and Load Ratings | | Inspect capacity signs and brackets for damage or deterioration, and for evidence of loose or missing fasteners. Verify that load ratings are correct, are noted in pounds, and are posted in view of operator and riggers. In those instances where two or more hoists may be arranged on a single beam, such as an interlocking monorail system, verify that the capacity of the supporting beam is clearly marked to preclude an overload condition. | |  | |  |  |  |  |
| 34 cr | Fire Extinguishers | | Ensure inspection is current. | |  | |  |  |  |  |
| 35 | Crane Davits | | Inspect davit structure for proper operation and any signs of damage. Check davit rope for cuts, abnormal wear, heat damage, or discoloration. Check tackle for free movement and operation. Check hook and tackle attachments for signs of damage and corrosion. | |  | |  |  |  |  |
| 36 | Overload Clutches/Load Limiting Clutches for Air Hoists. | | For air hoists that are not equipped with limit switches, follow OEM procedure if available; however, do not follow if OEM procedure requires overloading more than 125 percent of capacity. If no OEM procedure is available, operationally inspect overload clutch by running the stop or block into the upper hoist frame at slowest possible speed. While continuing to hoist, listen for a clutching noise. If no clutching noise is heard, contact the hoist OEM for further evaluation. If a test weight is used, do not test beyond 125 percent of rated capacity. Note that padding or dunnage may need to be temporarily installed between the top of the block and upper hoist frame to prevent minor damage.  This item is for air hoists only (not manual or electric hoists). Due to the wide variation in overload clutch settings for various models and vintages of electric hoists, and the large amount of torque that can be produced by a motor in a locked rotor condition, testing of overload clutches for electric hoists shall not be performed. | |  | |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ANNUAL MAINTENANCE INSPECTION SPECIFICATION AND RECORD FOR CATEGORY 2 AND 3 CRANES** SHEET \_ OF | | | | | | | | | | |
| Crane | | Type | | OEM | | Capacity | | | | |
| Item No | Items to be Inspected | | Maintenance Inspection Specification | | System Inspected | | Condition | | | |
| S | U | C | NA |
| 37 | Lubrication and Servicing Records | | Perform a review of lubrication and servicing records since the last annual maintenance inspection to ensure the lubrication and servicing were performed as specified. | |  | |  |  |  |  |
|  |  | |  | |  | |  |  |  |  |
|  |  | |  | |  | |  |  |  |  |
|  |  | |  | |  | |  |  |  |  |
|  |  | |  | |  | |  |  |  |  |
|  |  | |  | |  | |  |  |  |  |
|  |  | |  | |  | |  |  |  |  |
| **REMARKS:** | | | | | | | | | | |
|  | | | | | | | | | | |
|  | | | | | | | | | | |
|  | | | | | | | | | | |
|  | | | | | | | | | | |
|  | | | | | | | | | | |
|  | | | | | | | | | | |
|  | | | | | | | | | | |
|  | | | | | | | | | | |
|  | | | | | | | | | | |
|  | | | | | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ANNUAL MAINTENANCE INSPECTION SPECIFICATION AND RECORD FOR CATEGORY 2 AND 3 CRANES**  **UNSATISFACTORY ITEMS** SHEET \_\_ OF | | | | | | |
| Crane | | | | | | |
| NOTE: DESCRIBE ITEMS FOUND UNSATISFACTORY AND LIST SRO NUMBER ISSUED FOR CORRECTIVE ACTION. SIGN AND DATE TO VERIFY THAT THE DEFICIENCY HAS BEEN CORRECTED OR ACCEPTED AS IS. IDENTIFY DEFERRED ITEMS BY ANNOTATING A “D” IN THE SRO BLOCK. (SEE SECTION 3 FOR REQUIREMENTS FOR DEFERRAL OF WORK.) | | | | | | |
| Item No. | Deficiency | | | SRO No. | Verification of Correction (Signature and Date) | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
|  |  | | |  |  | |
| Mechanical Inspector (Signature): | | Date: | Electrical Inspector (Signature): | | | Date: |
| Mechanical Inspector (Signature): | | Date: | Electrical Inspector (Signature): | | | Date: |
| Mechanic (Signature): | | Date: | Electrician (Signature): | | | Date: |

D-15

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MAINTENANCE INSPECTION SPECIFICATION AND RECORD FOR CATEGORY 2 AND 3 CRANES  BRAKE DATA SHEET OF | | | | | | | | | | | |
| CRANE: | | | | | | | | | | | |
| NOTE TO INSPECTOR: Fill in applicable data as recommended by the brake and/or crane OEM. Record actual measurement inspected in ”INSP” block. If adjustments are made, record adjusted setting in “ADJ” block. Otherwise indicate “NA”. List repair document number and corrective action required under Remarks. | | | | | | | | | | | |
| BRAKE | TYPE | SPRING LENGTH/ TORQUE SETTING | | | | AIR GAP/ PLUNGER STROKE | | | | LINING THICKNESS | |
|  | | MIN | MAX | ACTUAL | | MIN | MAX | ACTUAL | | MIN | ACT |
| INSP | ADJ | INSP | ADJ |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |

D-16

|  |
| --- |
| MAINTENANCE INSPECTION SPECIFICATION AND RECORD FOR CATEGORY 2 AND 3 CRANES  BRAKE DATA SHEET OF |
| REMARKS: |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |