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# CRANE, RUNWAY AND MONORAIL SYSTEM INSTALLATION

## GENERAL INFORMATION

The following is general information about the installation of a crane and monorail system. It is included in the Operation & Maintenance (O&M) Manual as general information and a reference source, and is to be used in conjunction with the engineering drawings and component information for the equipment on this project. Note that some of the general information may not be applicable.

For specific details of the project equipment, refer to the drawings in the project O&M Manual.

### New Installations

When a new system is installed into a new building or a new addition to an old building, the entire system must be re-inspected after 30 to 60 days. As the building settles, alignment of the monorails may change and may require realignment. All hangers and splice bolts need to be checked for loose or missing bolts and they may need to be re-torqued. Neglecting to do so can result in failure of equipment as well as personal injury. TC/American reserves the right to void all warranty if proper maintenance schedules are not followed.

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## **A. RAIL SUSPENSION SYSTEMS**

1. Be familiar with all hanger types used for suspension – see the O&M manual section titled “Suspension.”
2. Each hanger is designed to handle the listed maximum capacity and is utilized in the system to the designated maximum hanger load.
3. Be certain that each hanger is used at its designated point. Some systems use more than one hanger variety.
4. There are four types of suspension methods: rigid stools, flexible rod, direct bolt, and direct bolt to brackets.
5. High-strength rods are used on all flexible rod suspension systems.
6. Do not, under any circumstances, weld or apply heat to any load carrying rod.
7. All load carrying fasteners are minimum grade 5 or A325 grade. Any fasteners of a lesser grade will change the hanger or clamp capacity.
8. A flat washer must be used if the diameter of the hole is greater than 1/16" above the fastener diameter or has a slotted hole.
9. Each fastener must have a lock washer under its nut.
10. Shimming at hanger points may be necessary to assure that the rail is installed level.
11. After final leveling, at all hanger rod suspension points check that spherical washers are seated properly. Tighten the set screw on each lock nut, then insert the spring pins.
12. Be certain that all hanger rods are plumb.
13. Recheck fasteners to be certain that all are secured and washers are properly placed.

## **B. GENERAL RUNWAY AND MONORAIL INSTALLATION PRACTICE**

1. No holes shall be made in the building structure without permission from the owner.
2. All supporting structures to which the track is suspended shall be installed in accordance with the specifications of the American Institute of Steel Construction, current edition.
3. Where supporting steel or equipment is erected by welding operations, such work shall be installed in accordance with the standards of the American Welding Society, or equivalent technical publication.
4. Rail joints at splices shall be ground smooth and level. The maximum gap between adjacent rail ends shall not exceed 1/16", except at switches or other free ends when 3/16" is permitted.
5. Hanger rods and superstructure rods are special steel and should never be welded or have welding connections applied to them. If any threading is necessary, care must be taken to prevent undercutting or sharp roots of threads.
6. Bracing of track systems, if required, is the responsibility of the installer and is determined largely by field conditions to accomplish the following:
  - a) Monorail tracks must be side braced to prevent excessive swinging, if rod suspended. Normally, this is accomplished at each splice joint.
  - b) Monorail tracks with motor driven carriers must also be end braced to prevent racking from stopping and starting of carriers.
  - c) Crane runway systems normally require one runway to be side braced when runways are hung from rods. Both runways must be end braced.
  - d) Switches should be rigidly connected directly to superstructure.
  - e) When switches are supported by hanger rods, the switches must be rigidly braced.
  - f) Curves must be rigidly braced.
  - g) It is best to brace system after leveling and electrifying. If bracing is done before conductor bar is installed, be sure clearance is maintained 1" from any portion of conductor path.
7. Obtaining the final proper elevation of all tracks is the responsibility of the installer.
  - a) Check all hanger fittings provided with hanger schedule and elevations shown on print (see Crane and Suspension drawings). Be sure these fittings will give the dimensions required for the proper elevation before track is hung.
  - b) Elevation of track tread throughout any system is to be held with 1/8" ±, with elevation readings at each track splice, switch, etc.

## C. SHIELDED ELECTRIFICATION

**! WARNING!** Open the mainline disconnect switch on systems before working on electrical equipment.

Shielded electrification is a highly versatile system of electrification, which when installed according to the following instructions, will give many years of trouble-free operation.

1. **Conductor Bars** - All straight conductor bars are furnished in 5, 10, and 20 foot lengths with PVC cover in place over the bars. Any odd lengths of bars required for the system must be cut to fit at the time of installation. The bar and cover can be cut with a hand hacksaw. All cuts should be square, and the bus bar must be free of burrs, particularly on the inside face of the web of the bus bar channel where the collector shoe rides. The bars must be accurately gaged from the rail tread and accurately aligned with each other horizontally and vertically.
2. **Gauging of Conductor Bars** - In order to assure proper operation of the collectors, the conductor bars must be accurately gaged from the tread of the rail throughout its length, and there should be an absolute minimum of sag or rise between support brackets. The conductor bars are shipped from the factory in a straight condition. With reasonable care, they can be cut and installed with no change in straightness. Any bar that becomes bent or kinked in shipment or handling must be straightened or replaced. All conductor bar systems in the GEM are "side contact" bars, and the mounting holes are pre-punched in the web of the rails, to assure proper gaging.
3. **Support Brackets for 200, 400, 325 and 450 Series Rail** - The shielded support brackets can be mounted while the rail is on the ground or after installation. In either case, they should be loosely assembled so that the conductor bar and cover can be slipped lengthwise into the clips. After the splices have been made, the clips must be securely tightened so that the cover cannot move.
4. **Support Brackets for 2R3-5T Rail** - When mounting the bracket assemblies on 3R3-5T rail, care must be taken to make sure that the lugs on the spacers are set at right angles to the bus bars. This is required to stabilize the bracket assembly and to minimize the possibility of the bus bars being cocked when the bracket is tightened. There must be a support bracket on every hanger on 2R3-5T rail.
5. **End of Runs** - At the extreme ends of a run of electrification, the conductor bar and cover are to be cut off square and flush with one another. To prevent accidental contact at the end, it is necessary to cover the end of each bar with an end cap. This is made of flexible neoprene and can be snapped over the end of the bar with little effort.
6. **Splices** - The ends of each 5, 10, and 20 foot lengths of conductor bar are prepared with holes to accommodate the splice bar. Lengths different from 5, 10, or 20 feet required in a system are cut to length in the field. The holes through the conductor bar must be countersunk for #10-24 x 5/8" flat head screws. To provide a smooth surface

for the collector shoe, ensure that the countersink is deep enough so that the head of the screw is flush or below the face of the conductor bar. Any burrs on the head of the screws, screw slots, or at the joint between the bars must be removed.

7. **Electrical Feed-In** - Electric feed-in can be accomplished anywhere in the system. However, the most convenient is at any splice. This is done by fastening the lug on the feed-in wire under a #10-24 nut. When a feed-in is required at a point that is not spliced, drill a 7/32" diameter hole through the bus bar and countersink for a 10-24 x 5/8" flat head machine screw. The head of the screw must be flush or below the surface of the conductor bar to provide a smooth surface for the collector. Any burrs on the head of the screw or screw slot must be removed. The back of the cover must have a 1/2" diameter hole at this point to allow contact with the conductor bar. A splice cover is used to protect the connection. Any splice cover can be used as a feed-in cover. The only difference between the feed-in and the splice covers is that the feed-in cover is somewhat shorter.
8. **Standard Line Interlocks** - The gaps between bridge rail conductors and spur rail conductors at interlocks must be field fabricated. The bars on the spur must be cut square and flush and positioned 1/4" back from the extreme end of the spur. The conductor bars on the bridge are positioned 1/4" back from the extreme end of the bridge at the factory. The 1/8" gap required between the bridge and spur will leave a 5/8" gap between the conductor bars. This 5/8" gap is minimum and 3/4" is the maximum gap. Guides are provided to be used at ends of conductor bar to facilitate smooth entrance of collector shoes. The bars must be accurately gaged from the rail tread and aligned with the bars on the bridge.
9. **325 and 400 Series Interlocks** – As with standard line interlocks, the gaps between the bridge conductors and spur conductors must be field fabricated. The bars on the spur must be cut square and flush and positioned even with the end of the spur rail. The conductor bars on the bridge are positioned 1/2" back from the extreme end of the bridge at the factory. The 1/8" gap required between the bridge and spur will leave a 5/8" gap between the conductor bars. This 5/8" gap is minimum and 3/4" is the maximum gap. Guides are provided to be used at ends of conductor bar to facilitate smooth entrance of collector shoes. The bars must be accurately gaged from the rail tread and aligned with the bars on the bridge.
10. **Switches** – Conductor bars entering the switches on the straight rail approaches must be cut to fit at the time of installation. The conductor bars entering the switches from the curved rails are cut to fit at the factory. After the switch has been installed, the approach conductor bars and covers should be cut square and flush. A gap of 5/8" minimum and 3/4" maximum must be held between the approach bars and those on the switch. The switches are pre-wired at the factory to provide for electrical continuity throughout the system. The conductor bars on the rail approaching the switch must be prepared for electric power connection. No splice should be made within two feet of a switch. All switches are furnished with four conductor bars mounted on the live section of the switch. The brackets furnished for mounting the approach conductors are also 4-bar brackets. In most instances, only 3 bars are required for the system. It is

necessary, therefore, to convert these brackets to 3-bar brackets. In some instances, it is necessary to convert to 2-bar brackets. Guides are provided to be used at ends of conductor bars to facilitate smooth entrance of collector shoes. The bars must be accurately gaged from the rail tread and aligned with the bars on the bridge.

11. **Curves** – The conductor bars and covers for curves are accurately bent at the factory to match the rail from which they are intended. The ends are cut to either splice into a straight rail or enter a switch as may be required. Covered conductor bars entering a switch must be capped as described under “Switches.” It is important that there is a conductor bar support bracket on every hanger in a 2R3-5T rail curve.
12. **Collectors** - The collector head is mounted to the support bracket by means of a nylon trunion and a coil spring support. The nylon trunion provides the necessary flexibility for the shoe to track well on the conductor bar, and the spring provides support to assist the shoe to ride centered on the conductor bar. It is important that the feed-in wire has an adequate loop to provide flexibility to the collector head. The loop must be trained parallel to the conductor bar to prevent snagging of the wire when the collector has close clearances such as in switches. Remove the rubber grommet from collector stem after collector shoe has been installed in conductor bar.

**NOTE:** In any conductor system with interlock, switch, and other track devices which create gaps in the conductor system, dual collectors are recommended to prevent loss of continuity when the collector crosses the gap.

## **D. 200 SERIES RAIL**

1. Check mark numbers on each track length and curve, identify with location on print.
2. Assemble upper hanger, rod, and track hanger by hand to approximate length required to obtain elevation shown on print. If system is electrified, be sure insulator supports or brackets are in place on rods. It is the responsibility of the mechanical installer to coordinate this work with the electrical contractor. Insulators cannot be installed after track and hangers are installed.
3. Install hanger assemblies in proper location by securing upper fitting.
4. Raise track section in place and secure clamp at track hanger.
5. Install Grade 5 splice bolts and Class 2 nuts (provided with rail) at rail joints.
  - a) Seat splice nuts with air or electric impact wrench.
  - b) If splice bolt is seated by hand, the end of bolts must be center punched to prevent loosening
  - c) A track hanger point must not exceed 1/8 of the span.
6. Adjust each hanger to exact elevation by using a vise grips pliers on the hanger rod and adjust the hanger nuts with an open end wrench.
7. Tighten all nuts on hanger rods.

**NOTE:** Allow enough thread on hanger rod for future leveling.

## **E. 325, 400 and 450 SERIES RAIL**

1. Check mark numbers on each track length (see system layout drawings), identify with location on print.
2. Check all hanger fittings provided with hanger schedule and elevation shown on print. Be sure these fittings will give the dimensions required for the proper elevation before track is hung.
3. Lay out system location from print, establishing each hanger location on supporting steel. This can be done by a chalk layout on floor and plumbing up; a line stretched under steel above; or using a transit marking each location. Be sure layout measurements are from proper building reference.
4. When installing a monorail system, it is recommended to start at a switch and curve located in the system. For a single run of rail, start at one end and work sequentially toward the other end.
5. When installing crane systems, it is recommended to start with the runway that has the electrification, or if a spur track or crossover is incorporated, start at that point. After installing this runway, proceed to align, level and brace. Align the rail both parallel and perpendicular to the web. Always level the rail from the riding tread, never from the top flange. The riding tread elevation should be  $1/8'' \pm$ . Refer to Crane Runway Alignment Tolerances. This rail becomes the benchmark and reference point to install the crane system.
6. For multiple crane runways, the procedure is the same except that all crane runway spans are measured to the first crane runway installed as a benchmark. The span tolerances should not exceed  $1/8'' \pm$ . Refer to Crane Runway Alignment Tolerances.
7. Before track sections are raised into position, electrification, track hangers, etc. should be assembled on track. Bolts should be snug, capable of slight movement for final adjustment.
8. Make splices between rail sections as each track is hung. Splice bolts can be started, but left loose, or make-up bolts can be used. A hanger must be centered over each track splice. If top of rails are not flush at splices when treads are aligned, shims are to be inserted under the low side of lower hanger fittings to bring it up to level.
9. Final adjustments of entire track system:
  - a) Start at most advantageous location and adjust one section to perfect elevation and proper line. Proceed from this section bringing each connecting track in line and to proper elevation.
  - b) Monorail tread alignment at splice points is most important, both horizontally and vertically. Splices will hold this alignment if properly installed. Where track hangers

span the track joint at top flange, it is the responsibility of the installers to place shims under one side of hanger if there is a difference in track girder depths.

- c) After entire system has been leveled, tighten all connection bolts. Make sure each is secured with lock washer and lock nut.
- d) When all hangers are properly installed, the track splices can be tightened for final tread alignment. Use an impact screwdriver to tighten splice bolts. If hand tools must be used, make a special effort in tightening and then center punch around threads to prevent loosening.
- e) *The monorail tread line may require grinding at the splice points, to provide a smooth transition from one piece to another.*

8. Maintenance of track systems:

- a) Every track system must be checked periodically to assure that all installation tolerances are maintained as described in the preceding items.
- b) Each system should be carefully inspected about 30 days after original installation. Vibration may loosen components that could not be secured because of paint, burrs, high spots, etc. All systems should be checked a minimum of once per year for loosening or wear.
- c) TC/American equipment is designed to give maximum service. However, like any other piece of machinery, it must be given regular and careful inspection and maintenance.
- d) The suspension fittings and component parts have been designed to withstand the stress of normal operations. No equipment will last forever. We suggest that you make certain all nuts are kept tight and that hangers are periodically inspected. In the event any of these show wear, nicks or distortion, they should be replaced immediately.
- e) This system has been designed for certain load limits. Operating personnel should be advised that these load limits are not to be exceeded. In the event that any unusual shock is introduced into the system, you should investigate to determine if any damage has been done.
- f) Should your system show excessive rail movement, you may be introducing stresses which have not been anticipated, thus creating a potentially dangerous situation. The system should be examined, and care should be taken to see that this situation is immediately corrected.

## F. SINGLE GIRDER HAND PUSHED CRANES

1. Single girder hand pushed cranes are usually shipped assembled. Bridge electrification is factory mounted.
2. Check drawing for location and mounting of crane and place crane in correct position directly under the runways. Check runway centers with crane span.
3. Remove shipping protection, check trolley tags for register number, and allocate materials to correct area.
  - a) Turn wheels by hand to check for possible damage in shipment. Look for rough bearings, loose bearings and axles.
  - b) Remove trolleys from end trucks and place trolleys on rail in same relative position as crane on floor.

**Four wheel crane trucks** have two wheel trolleys at each end which can be removed from trolley loadbar by removing retainer bolt. Two wheel units can be threaded on rail, loadbar pulled up, and two wheel units reassembled from each end.

**Eight wheel crane trucks** have four wheel trolleys at each end with saddle on top of four wheel trolley loadbar. Remove entire saddle and trolley by removing four bolts in bottom of truck channels. Lift saddle from top of trolley loadbar to check for thrust washer below. Replace saddle and washer and place trolley on rail. Installer must make certain that the thrust washer seats in the trolley yoke. The thrust washer is greased at factory. Be sure this grease is clean. Clean and grease if necessary.

4. If bridge electrification has not been installed at factory, it is recommended that the bridge electrification be installed on the crane bridge while it is on the floor.

## **G. CRANES WITH CENTER MOTOR DRIVE, SINGLE and DOUBLE GIRDER**

(See system crane drawings.)

1. Single girder and double girder motor propelled cranes are assembled and test run at factory, then shipped partially disassembled. Assemble as shown in drawings. This includes bridge electrification.
2. Check drawing for location and mounting of crane and place crane in correct position directly under the runways. Check runway centers with crane span.
3. Remove shipping protection and check trolley tags for register number and allocate materials to correct area.
  - a) Turn wheels by hand to check for possible damage in shipment. Look for rough bearings, loose bearings and axles.
4. Remove trolleys from end trucks and place trolleys on rail in same relative position as crane on floor.

**Four wheel crane trucks** have two wheel trolleys at each end which can be removed from trolley loadbar by removing retaining bolt. Two wheel units can then be threaded on rail; loadbar pulled up and two wheel units reassembled from each end. See that the thrust washer is greased and seated in trolley yoke.

**Eight wheel crane trucks** have four wheel trolleys at each end with a saddle on top of four wheel trolley loadbar. Remove entire saddle and trolley by removing four bolts in bottom of truck channels. Lift saddle from top of trolley loadbar to check for thrust washer below. Replace saddle and washer and place trolley on rail. Installer must make certain that the thrust washer seats in the trolley yoke. This thrust washer is greased at factory. Be sure this grease is clean. Clean and grease if necessary.

5. It is recommended that the bridge electrification be assembled and electrical connections done on the crane while it is on the floor.
6. Make sure crane assembly bolts are in place and tight.
7. Lower drive tires so top surface of tire will be approximately 2" below rail so that the crane can be raised high enough to install the trolleys.
8. Lift entire crane up tight to rail, then move trolleys in under trucks from each end. Secure trolleys in place with previously removed bolts. Double check to see that the thrust washer seats on the trolley yoke. Grease washers.
9. All cranes should be pulled the entire length of the runways to make sure that runways are properly gaged for easy operation.

10. Check rotation of motor before tire is adjusted against rail. Press forward and reverse buttons and interchange wires for phasing at motor terminal box to correct travel direction if necessary.
  - a) Make sure tires at each runway have equal pressure against bottom of rail. (Refer to Drive Tire Adjustment Section.
11. Check to see that drive shaft couplings are tight and keys in place.
12. Check lubrication of motor and gear unit. Refer to instructions with crane drive motor.
  - a) Place vent plug in gear case, in place of the topmost pipe plug.
  - b) Check level plug of oil in gear case and fill to level. Follow manufacturer's - recommendation for type of oil.
13. Parallel helical gear reducer - Before operating drive unit, be sure gear case is filled with oil to proper level indicated. Check gear reducer name plate for proper lubricant or equal, if required.
  - a) After the first 100 hours of operation, the gear case should be drained, magnetic drain plug cleaned, and inspection made for any leakage. Refill the gear case with clean oil to the proper level. Do not overfill, as too much oil causes excess heating and leakage through the oil seals, decreasing the efficiency of the drive unit.
  - b) The oil should be inspected at regular intervals, and should be changed at least twice each year. Check gear reducer name plate for proper lubricant or equal.
  - c) When drive units are exposed to outside weather conditions and are not operated during the winter, the gear case should be completely filled with oil to prevent moisture and rust from forming in the case. Drain oil to proper level before restarting the drive unit.
14. **Drives with brakes** - Observe whether brake is open and not dragging when unit is running. Check stopping action of brake under full load. Refer to instructions on type of brake and adjust as necessary, using manufacturer's instructions.
15. Operate crane entire length of runways, checking clearances and ease of operation.

## H. CRANES WITH MOTORIZED TROLLEY DRIVES: SINGLE & DOUBLE GIRDER

(See system crane drawings.)

1. Single and double girder trolley motor propelled cranes may be shipped partially disassembled. Assemble as shown in drawings. This includes bridge electrification.
2. Check drawing for location and mounting of crane and place crane in correct position directly under the runways. Check runway centers with crane span.
3. Remove shipping protection and check trolley tags for register number and allocate materials to correct area. Turn wheels by hand to check for possible damage in shipment. Look for rough bearings, loose bearings and axles.
4. Remove trolleys and trolley drives from end trucks and place trolleys on rail in same relative position as crane on floor.

**Four wheel crane trucks** have two wheel trolleys at each end which can be removed from trolley loadbar by removing retaining bolt. Two wheel units can then be threaded on rail; loadbar pulled up and two wheel units reassembled from each end. See that the thrust washer is greased and seated in trolley yoke.

**Eight wheel crane trucks** have four wheel trolleys at each end with a saddle on top of four wheel trolley loadbar. Remove entire saddle and trolley by removing four bolts in bottom of truck channels. Lift saddle from top of trolley loadbar to check for thrust washer below. Replace saddle and washer and place trolley on rail.

5. Installer must make certain that the thrust washer seats in the trolley yoke. This thrust washer is greased at factory. Be sure this grease is clean.
6. It is recommended that the bridge electrification be assembled and electrical connections done on the crane while it is on the floor.
7. Make sure crane assembly bolts are in place and tight.
8. Lift entire crane up tight to rail, then move trolleys in under trucks from each end. Secure trolleys in place with previously removed bolts. Double check to see that the thrust washer seats on the trolley yoke. Grease washers.
9. All cranes should be pulled the entire length of the runways to make sure that runways are properly gaged for easy operation.
10. Check rotation of motor. Press forward and reverse buttons and interchange wires for phasing at motor terminal box to correct travel direction if necessary.
11. Check lubrication of the motorized trolley unit. See tags and instructions with motorized trolley drives. Check level plug of oil in gear case and fill to level with a good grade of SAE 90 gear oil.

12. **Trolley drives with brakes** - Observe whether brake is open and not dragging when unit is running. Check stopping action of brake under full load. Refer to instructions on type of brake and adjust as necessary, using manufacturer's instructions.
13. Operate crane entire length of runways checking clearances and ease of operation.

## **I. CROSSOVER SECTIONS**

1. Mark the centerline location on adjacent runways exactly square with each.
2. Raise crossover and set on top of each runway with bolts finger tight.
3. Bring both cranes into place, then adjust crossover at each end by shifting and shimming to align with crane bridges. The mating rail treads shall be level with gap at 1/16" minimum and 3/16" maximum.
4. Crossover track and crane bridges must deflect together as load moves through the interlocks to maintain alignment.

## **J. SPUR TRACK SUPPORTS**

1. While on the floor, bolt spur track support tight to top of spur track section.
2. Raise spur track in place, setting support on top of runway and fastening spur track to runway and to hanger at opposite end.
3. Bring crane into place, then adjust spur track support by shifting and shimming to make proper alignment with crane bridge. The aligning rail treads shall be level and the gap should be adjusted to a tolerance of 1/16" minimum and 3/16" maximum.
4. Spur track and crane bridge must deflect together as load moves through the interlock to maintain alignment.

## **K. GENERAL SWITCH INSTALLATION PRACTICE**

1. Check mark numbers on all switches with catalog description and proper layout location.
2. Each switch is shipped with accessories wired to it. Leave accessories wired to switch until time of installation to prevent loss of parts.
3. Switches should be rigidly connected directly to superstructure after alignment to prevent loosening, binding, or change of position.
4. TC/American standard 200 and 600 Series switches are standard with throw lines, 12' of 5/16" diameter sash cord. 800 and 2000 Series switches are standard with throw lines, 12' of C-4 twist link chain. Unless switches are ordered with special line lengths, material for field revision must be purchased by the customer or the installer.
5. When adjusting length of switch pull cord or chain, mark them for cutting, then throw switch both directions to check length before shortening.

## **L. 200 SERIES TONGUE SWITCHES**

1. These switches are shipped with cross angle for pulls unbolted, rotated, and wired to top of switch. Release and bolt in proper position.
2. Switches should be rigidly connected directly to superstructure. Place switch in position just snug until all tracks are in place. Shift as necessary for optimum clearance. Then level and tighten.
3. Any misalignment of treads can be adjusted by raising or lowering heel pivot pin, or shimming one or both sides at top flange of tongue or incoming tracks.
4. Lubricate latching mechanism and slide surfaces with Mobil water resistant grease or equal all season grease. Relubricate every six months, or more frequently when under heavy usage.

## **M. 200 AND 600 SERIES GLIDE SWITCHES**

1. Switches should be rigidly connected directly to superstructure. Place switch in position just snug until all tracks are in place. Shift as necessary for optimum clearance. Then level and tighten.
2. Shimming for level treads can be made under one or both sides of the rigid hangers supporting the tongue or incoming track.
3. Adjustment of throw can be made by rotating stop lug held by bolt in stationary frame.
4. Lubricate latching mechanism and slide surfaces with Mobil water resistant grease or equal all season grease. Relubricate every six months, or more frequently when under heavy usage.

## **N. 800 AND 2000 SERIES GLIDE SWITCHES**

1. Switches should be rigidly connected directly to superstructure. Place in proper location by dimensions from layout, level to proper elevation, and secure. All tracks are installed from switches and shifted to line up with switches, not vice versa.
2. Shimming for level treads can be made under one or both sides of incoming tracks. If incoming tracks are twisted, they must be bent into correct position.
3. Adjustment of throw for hand switches - bolts and nuts are provided in stationary frame to act as stops for moving carriage. Adjust these to give proper throw and track alignment.
4. After throw adjustment, check to be sure latch moves in place locking carriage in each position. If not, adjust latch cam so it will lock. If switch carriage is hard to move, hold down plate may be too tight.
5. Lubricate latching mechanism and slide surfaces with Mobil water resistant grease or equal all season grease. Relubricate every six months, or more frequently when under heavy usage.

## **O. ELECTRIC ACTUATOR OPERATED GLIDE AND TONGUE SWITCHES**

1. Switches should be rigidly connected directly to superstructure. Place in proper location by dimensions from layout, level to proper elevation, and secure. Radiating tracks are installed from switches and shifted to line up with switches, not vice versa. Switches are numbered for automatic systems with correct control wiring and must be installed in proper location shown on layout.
2. Shimming for level treads can be made under one or both sides of incoming tracks. If incoming tracks are twisted, they must be bent into correct position.
3. Adjustment of switch throw has been preset at factory. The adjustable limit switch on the actuator is adjusted at the factory for maximum travel of the electric actuator to protect the actuator from over-travel. The adjustment of the glide switch travel is done through the use of limit switches mounted on the glide switch frame. All final adjustments for the switch throw should be done by adjustment of these limit switches.
4. Be sure limit switches cut off motor at each end of travel.
5. Align electrical conductor bars as described under electrical section.
6. Lubricate latching mechanism and slide surfaces with Mobil water resistant grease or equal all season grease. Relubricate every six months, or more frequently when under heavy usage.

## **P. AIR OPERATED GLIDE AND TONGUE SWITCHES**

1. Install, shim, and adjust in proper location as described for motor operated switches.
2. Adjusting throw - this adjustment is made by the carriage stop-bolt mounted on the stationary frame of the switch.
3. Air pressure and lubrication - normal air pressure is figured at 80 psi, unless otherwise specified. Lubrication and filter should be located within 10' of the switch being serviced.
4. Solenoid valves are normally furnished for 115 volt, single phase A.C., unless otherwise specified.
5. Lubricate latching mechanism and slide surfaces with Mobil water resistant grease or equal all season grease. Relubricate every six months, or more frequently when under heavy usage.

## **Q. TROLLEYS**

1. Remove shipping protection and check trolley tag for identification number.
2. Turn wheels by hand to check for possible damage in shipment. Look for rough bearings, loose bearings and axles. Some trolleys have guide rollers. These should be checked in same manner.
3. Lubrication
  - a) Trolleys with sealed bearings have no grease fittings and require no lubrication.  
**NOTE:** Normal sealed bearing life is 5000 hours. After 5000 hours bearings should be replaced or re-packed with grease.
  - b) Trolleys with grease fittings in end of axles are packed with grease when assembled. Relubricate after use with Mobil water resistant grease or equal until a light film of grease appears around wheel axle.  
**NOTE:** For abnormal conditions or temperature extremes, consult TC/American factory.
  - c) Guide rollers are furnished in both sealed and shielded types. Lubricate as above for wheels, being careful not to apply excessive pressure on sealed units.
4. Install trolleys on rail. Make certain trolley is assembled in proper relation on the monorail or crane track system, as shown on drawings.

**200 Series and 400 Series trolleys**, thread trolleys on open ends of rails.

**325 Series and 450 Series trolleys** can also be placed on rails by removing the wheel and axle assemblies on one side of the trolley, replace on rail.

5. Check trolleys through system for any interference.

## R. HOISTS and HOIST TROLLEYS

See the Hoist Manuals provided by the hoist supplier. Read and follow all recommendations.

### Hoists

1. Hoists may be shipped direct to job from hoist supplier. This is usual practice for chain hoists and lug mounted electric hoists.
  - a) Installer should check hoist tag for reference to correct customer and TC/American job number.
  - b) Installer must check for any visible shipping damage both before and after uncrating the hoist. Any damage must be reported at once to the agent of the carrier making delivery.
  - c) Installer will uncrate hoist; save any tags, envelopes, or wiring diagrams, record the serial number, and deliver to the customer.
  - d) If hoist is shipped direct, it is the responsibility of the installer to mount, wire current collectors, and make any necessary connections to related equipment. Incidental materials are also his responsibility.
2. Hoists for double girder trolleys are assembled at the TC/American factory and shipped complete with trolley. This is also the case for special hoist carriers, integral motor drive trolleys, and automatic carriers.
  - a) Installer must remove tags, envelopes, or prints from these hoists, record serial numbers, and deliver to customer.

### Hoist Trolleys

1. TC/American drawing must be checked for hoist position with trolley before assembly. Determine correct direction before placing hoist and trolley on rail.
2. Bolt hoist to trolley, seat all bolts and nuts and secure in place with lock washers, lock nuts, or cotter pins.
3. Check and lubricate as necessary trolley wheels, thrust washers, guide rollers, etc.
4. Install hoist and trolley on rail in proper position as shown on TC/American drawings.
5. Electrical power is supplied to hoist by electrification as covered under electrification section.
6. Installer to read instructions and tags furnished by hoist supplier **before** attempting to start hoist.
  - a) Lubricate according to instructions.
  - b) Push **UP** button for an instant.

**WARNING:** Hoist hook traveling in the wrong direction could cause a holding circuit in the electrical system. Have someone standing by the electrical mainline disconnect to turn off electrical power.

- c) If hook *raises*, the hoist is connected correctly.
- d) If hook *lowers*, **do not permit hoist to be used until direction of motor rotation is corrected** as described below:

**Do not** attempt to correct hoist travel direction by changing control wiring either in the pushbutton station or in the control box. Change hoist travel at electrical mainline on the hoist motor only.

**WARNING:** Pull mainline disconnect switch on system before working on electrical equipment.

*Three Phase Motors:* Interchange connections of any two of the three line leads in the motor terminal box.

*Single Phase Motors:* Interchange connection of line terminals T1 with T3 or T2 with T4.

- e) After rotation is found to be correct, check the limit switch by lifting it by hand while the hook is several feet from upper position while hoist is running in up direction.
  - f) **Do not** try to make initial direction test by pushing DOWN button. If the motor rotation is reversed, the hook will raise, but the upper limit switch will not function and cable breakage or other serious damage may result.
  - g) If hoist is equipped with geared type limit switch, set upper geared limit to stop just prior to operation of upper paddle type limit switch. Set lower geared limit for operation height or so that a minimum of two cable wraps remain on drum.
7. Check hoist trolley clearances passing any permanent obstructions.

## S. DRIVETRACTORS

1. Installer to uncrate and check trolley tag for mark number and allocate materials to correct area or areas.
2. Turn wheels by hand to check for possible damage in shipment. Look for rough bearings, loose bearings and axles. Some trolleys have guide rollers. These should be checked in the same manner.
3. Lubrication.
  - a) Trolleys with sealed bearings have no grease fittings and require no lubrication.
  - b) Trolleys with grease fittings in end of axles are packed with grease when assembled. *Relubricate after use* with Mobil water resistant grease or equal until a light film of grease appears around wheel axle.

**NOTE:** For abnormal conditions or temperature extremes, consult TC/American factory.

4. Check assembly of drivetractor with respect to related equipment as shown on drawing. Make sure that drivetractor or hoist is not turned end for end.
5. Install drivetractor on rail.
  - a) Loosen tire adjustment for clearance of rail between wheels and tire.
  - b) **200 Series and 400 Series trolleys**, thread drivetractor on rails of any open end.
  - c) **325 Series and 450 Series drivetractors**, when an open rail end is not convenient, two wheel and axle assemblies can be removed from one side, then drivetractor raised in place. Replace assemblies on rail.
6. Connect drawbar to hoist loadbar or carrier frame. Lock washers or cotter pins must secure pin connections. Lubricate connections for initial start up.
7. Power is supplied to system as covered by electrification section.
8. Check rotation of motor before tire is adjusted against rail. Press forward and reverse buttons and interchange wires for phasing at motor terminal box to correct travel direction if necessary.
9. Adjust tire against bottom of rail, just tight enough so that it will not slip under full load. Tire slippage will accelerate tire wear, but over-tightening places excessive loads on motor, shafts, bearings and wheels. A tire too tight will also prevent proper cornering and will cause excessive kick-up force at switches, lift sections, and scale sections. (Refer to 10. Drive Tire Adjustment Section.)

10. Check lubrication of motor and gear unit. See tags and instructions with drivetractor.

- a) Place vent plug in gear case, in place of the topmost pipe plug.
- b) Check level plug of oil in gear case and fill to level. Follow manufacturer's recommendation on type of oil.
  - 1) **After the first 100 hours of operation**, the gear case should be drained, magnetic drain plug cleaned, and inspection made for any leakage. Refill the gear case with clean oil to the proper level. Do not overfill, as too much oil causes excess heating and leakage through the oil seals, decreasing the efficiency of the drive unit.
  - 2) **The oil should be inspected** at regular intervals, and should be changed at least twice each year.
  - 3) **When drive units are exposed to outside weather conditions** and are not operated during the winter, the gear case should be completely filled with oil to prevent moisture and rust from forming in the case. Drain oil to proper oil level Before restarting the drive unit.
- c) **Drives with brakes** - observe whether brake is open and not dragging when unit is running. Check stopping action of brake under full load. Refer to instructions on type of brake and adjust as necessary using manufacturer's instructions.
- d) Operate unit through entire system.
  - 1) Check clearances of all portions of carrier through curves and switches. See that drivetractor frame, control box, or motor does not contact any portion of carrier on tightest turns both right and left hand.
  - 2) Check that swinging of unit does not increase possibility of interference.
  - 3) Observe that drawbar does not bind either horizontally or vertically at either end under tightest curve conditions.

## T. DOUBLE GIRDER MOTOR PROPELLED HOIST CARRIER

1. Some double girder motor propelled hoist carriers are shipped "knocked down." The drive components and other various subassemblies may be shipped loose, but are match-marked for reassembly. See TC/American match-mark print and reassemble on the job site.
2. Check TC/American drawing for location and mounting of carrier and place carrier in correct position directly under the runways or crane bridges. Check runway centers with the carrier span.
3. Remove shipping protection and check carrier tags for register number. Allocate materials to correct area.
  - a) Turn wheels *by hand* to check for possible damage in shipment. Look for rough bearings, loose bearings and axles.
4. Remove trolleys from end trucks and place trolleys on rail on floor in same relative position as carrier.

**Four-wheel carrier trucks** have two-wheel trolleys at each end that can be removed from trolley loadbar by removing retaining bolt. Two-wheel units can then be threaded on rail.

**Eight-wheel carrier trucks** have four-wheel trolleys at each end with a saddle on top of the four-wheel trolley loadbar. Remove entire saddle and four-wheel trolley by removing four bolts in bottom of truck channels. Lift saddle from top of trolley loadbar to check for thrust washer between saddle and loadbar. Replace saddle and install trolley and saddle assembly on rail.
5. Make sure carrier assembly bolts are in place and tight.
6. Lower drive tires so top surface of tire will be approximately 2" below rail so that the carrier can be raised high enough to install the trolleys on the end trucks.
7. Where motorized trolley drives are used, disconnect electrical (mark wiring) and install with trolleys.
8. Lift entire carrier up tight to rail. Move trolleys in under trucks from both ends. Secure trolleys in place with previously removed bolts. Double check to see that the thrust washer seats on the trolley yoke. Grease thrust washer.
9. All carriers should be pulled the entire length of the runway or crane bridges to check for easy operation and obstructions.
10. Check rotation of drive motor before tire is adjusted against the rail. Press the forward and reverse buttons and interchange wires for phasing at motor terminal box to correct travel direction if necessary.
  - a) Make sure tires at each rail have equal pressure against rail. (Refer to Drive Tire Adjustment Section.)
  - b) Check to see that drive shaft couplings are tight and that keys are in place.
11. Install vent plugs & lubricate drive units and hoist according to manufacturer's instructions.

## U. DRIVE TIRE ADJUSTMENT

**Caution:** Correct tire pressure is of the utmost importance because: (1) excessive tire pressure by over-tightening *will cause premature tire failure* and put undue stress on the other components (2) inadequate tire pressure will cause the drive wheel to slip, making *starts and stops impossible to control*. We do not recommend “short cuts” in the tire pressure adjustments.

To achieve optimum tire life, we recommend the following tire adjustment when the unit is fully loaded.

### **Drivetractors:**

Adjustments are accomplished by both the forward and aft trolleys being tightened simultaneously. Keep in mind that the frame of the drivetractor must be level in relationship to the runway rail. What is to be achieved is minimal slip. To obtain this, several repeated adjustments are in order. Start with the drive wheel just touching the rail and turn the pressure nuts one full turn. Start and stop the drivetractor. If the tire slips in either motion, adjust both pressure nuts **one half** turn again; start and stop the drivetractor. If the tire slips in either motion again, adjust both pressure nuts **one half** turn. Continue until the tire does not slip at initial start or stop. When this is achieved, tighten the pressure nuts one more **half** turn and tighten all remaining hardware. Adjustments are now complete.

### **Cranes:**

Adjustments are accomplished by both the inboard and outboard adjustments on both end trucks. Keep in mind that the tires are to be vertical in relationship to the runway rail tread. What is to be achieved is minimal slip. To obtain this, several repeated adjustments are in order.

- a) Start with the drive wheel just touching the rail and turn the four pressure nuts (on each drive wheel) one full turn.
- b) **Note: All drive wheels must be adjusted at the same time.**
- c) Start and stop the crane. If the tires slip in either motion, adjust the four pressure nuts **one half** turn.
- d) Continue until the tire does not slip at initial start or stop.
- e) When this is achieved, tighten the pressure nuts **one half** turn and tighten all remaining hardware.

Adjustments are now complete.

## **V. FINAL CHECK OF SYSTEM**

1. Check the runway to ensure that all suspension and splice plate points are connected and securely bolted.
2. Make sure that all suspension points are equally loaded with the dead weight of the crane and runway.
3. Check that all end stops are in place and securely bolted. There must be one at each end of the runway and on each end of the bridge rails.
4. Check the end truck and/or trolley wheel engagement. All wheels must rest squarely, equally and firmly on the rail tread surface. All wheels must be properly spaced to manufacturer's specifications. Check for adequate clearance between the wheels and the splice plates. Check to make sure that no interference occurs with the electrical conductor bars.
5. Check all gear cases for lubrication. If required, fill to manufacturer's specifications and install vent plugs.
6. Inspect the hoist per the manufacturer's instruction manual.
7. Check all safety stops and limit switches for proper operation.
8. Inspect wire ropes and sheaves or chain per data supplied in the hoist manufacturer's instruction manual.

## **W. STACKER TYPE EQUIPMENT**

1. On work platforms and stacker cranes, check the rotation bearing and clutch to ensure free and clear rotation.
2. On work platforms and stacker cranes, check all mast rollers to ensure that they are all lubricated and turn free.

## **X. TEST OPERATION**

**CAUTION:** A person should be stationed at the main electrical disconnect to shut off power in case of any malfunction.

1. Slowly drive the bridge the full length of the runway to check for possible interferences and to confirm adequate crane operation.
2. Check electrical conductors and collectors or powertrack for adjustment and proper tracking.
3. Soft start drives - for startup, set the time adjustment at the maximum point and the initial torque adjustment at the minimum point. (This setting provides the softest start, but the initial torque might be too small to start the motor for the first few cycles.) Usually, 1/4 to 1/2 turn from the minimum torque setting is adequate. Decrease the time adjustment if the starting is too soft under a half load condition.

**NOTE:** For two-speed control, refer to manual for settings.

4. Variable frequency drives - check each speed step by pressing button progressively. Speed steps are preset at factory. Refer to variable frequency manual for instructions to change speeds if required.
5. Slowly drive the trolley or carrier the full length of travel to check for possible interferences and to confirm adequate operation.
6. Test operate the hoist per manufacturer's specifications.
7. If equipped, test operate all interlocks and switches for proper operation.
8. Conduct load test as required.

## Crane Runway Alignment Tolerances

