ALABAMA STATE PORT AUTHORITY

McDuffie Coal Terminal

Installation and Commissioning Manual

Alabama State Port Authority Contract 246942

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I. PROJECT DESCRIPTION

Alabama State Port Authority (ASPA) is replacing the existing RCD2 Rotary Railcar Dumper and Positioner and TAS2 Take-Away System. Richmond Engineering Works (REW) has been contracted to provide the design and equipment supply for these systems. REW will also provide on-site technical assistance during the installation and commissioning of the equipment.

RCD2 Dumper

The dumper consists of two (2) independent rotary car dumpers installed end to end and operating in tandem. Each dumper will be installed on four (4) equalized trunnions mounted onto two (2) sill beams. Four (4) hydraulic car clamps per dumper will hold the railcar in place while it is rotated. Each end ring will be driven by a rack and pinion drive system.

Positioner

The new positioner will be a rack and pinion design operated by five (5) individual drives engaging a common rack gear mounted along the positioner runway. The positioner arm will be raised and lowered by a mechanical drive to engage the railcar coupling. Power and control connections to the positioner carriage will be supplied by a festoon system.

Three (3) sets of wheel grippers will be embedded in the yard rails to hold the train in position while the dumper is in motion.

Take-Away System

The take-away system is located beneath the dumper and consists of the grizzlies, hoppers, apron feeders and take-away conveyor.

The contractor's scope of work is defined as furnishing all the labor, tools, equipment, field supervision, review of existing procedures and documents and assembly/installation of the Railcar Dumper, Positioner and Take-Away System's mechanical and electrical systems.

This manual describes the technical requirements for the installation of the equipment as well as the commissioning and performance testing.

The contractor shall be required to perform field welding, erection, and paint touch up necessary for final assembly. This includes, but is not limited to:

a. End Ring Splices – full penetration weld including UT testing.
b. Hydraulic piping welded connections.
c. Complete paint touch-up of all connection points, scrapes, scars, welds, bolted connections, bolts etc., on all components of the dumper, whether due to shipping, installation, welding or otherwise.
d. Platen walkways, handrail and deflector plates.
e. Pre-assembly of dumper barrels.

All full penetration welds are to be UT tested to AWS D1.1 Table 6.3 cyclically loaded non tubular construction by a third party. The contractor is responsible for the cost and arrangement of the UT testing.

The contractor is required to review the site conditions and become familiar with the requirements of the project.

II. RECEIVING AND STAGING EQUIPMENT

The mechanical contractor is responsible for unloading supplies and equipment (fabricated steel, parts, and supplies), on site handling and security of supplied equipment and materials on jobsite. This includes, but is not limited to, furnishing tools, material and labor to protect the mechanical and electrical equipment from weather related damage/corrosion, damage that may occur during hoisting and shoring, and securing worksite from normal operation's traffic until the equipment is installed and accepted by the Owner.

The dumper equipment will be shipped to the site via truck. Approximately fifteen (15) trucks will be needed to ship each dumper.

The positioner will take approximately fifteen (15) trucks to ship to the site. This includes the festoon, arm and all three (3) gripper assemblies.

The take-away system will ship via truck and ship.

Equipment will start shipping to the site in mid to late August and continue through September.

The contractor will be responsible for supplying all labor, rigging, lifting equipment, cranes, cribbing, etc., for unloading the trucks. The equipment is to be staged and protected until assembly. The contractor is to provide all dunnage, tarps, temporary shelters or other protection for the equipment.

a. Fabricated steel parts may be stored outside. Contractor is to provide means to avoid or disperse any water collecting on the parts.
b. Electrical components are to be stored in an enclosed space, protected from weather. It is preferred that control enclosures and drive panels be stored in a climate-controlled space.

The contractor shall be responsible for moving all equipment from the laydown or storage areas to the assembly areas and ultimately to the erection area.

III. MECHANICAL INSTALLATION

A. DUMPER ASSEMBLY (PRE-OUTAGE)

1.0 Dumper Barrel Erection

The dumper barrels will need to be erected prior to the outage to keep the outage time for the RCD2 system as short as possible. The contractor is responsible for locating a suitable area for erecting the dumper barrels along with any preparation work to level and stabilize the area (i.e. concrete pad, steel plates, etc.).

Assembly shall be as complete as practical to facilitate setting the dumper in place. The contractor shall specify the extent to which the dumper will be assembled during pre-outage.

Prior to any demo, disassembly or construction work, the contractor is responsible for establishing monuments for the project based on the dumper centerlines. Monuments shall be placed around the perimeter of the dumpers. Locations shall be determined for best reference by contractor and owner. A legend of all monuments shall be documented by the contractor and provided to the owner for future reference. Monuments are to be permanent and will remain for future reference. **ALL** installation work will be based on the dumper centerline monuments.

a. End rings are provided in three (3) sections. Each section is to be laid and supported in the horizontal position. Each section shall be aligned and leveled within 1/8” and joined together at the three (3) splice joints on the web plates with bolted splice plates. (Bolts to be torqued to REW specifications.) Following the field alignment and splice plate connections, a final field survey of the flatness of the assembly must be completed by the contractor and submitted to the owner for approval prior to final welding of the splice joints. NOTE: Be aware of “as shown” and “opp. hand” sections for entry and exit end rings. DO NOT INTER MIX.

b. The three (3) splice joints around the end ring wrapper plate are to be full penetration welds. These welds are to be UT tested to AWS D1.1 Table 6.3 cyclically loaded non-tubular construction. All final U.T. reports are to be submitted to the owner for final review and acceptance.
c. The web splice plates are bolted connections and are expected to require some field reaming as with any bolted structural connection.
d. Assembly of end ring rails and rail clamps will be required following the acceptance of the final splice welds. The rails will need to be surveyed for flatness and adjusted to the drawing required tolerances (+/- 1/8”). The rail bolts will need to be torqued to REW’s bolt torque requirements.
e. Contractor to scribe centerlines, vertical and horizontal, on each end ring for reference during end ring erection. These centerline marks are critical for the end ring setup and assembly with other components bolted to the end rings.
f. When the entry and exit end rings are completely assembled, they are to be stood up to continue the dumper assembly.
g. The entry and exit end rings are to be stood up vertically, plumb and level within 1/16”. The end rings will need to be secured and braced from rolling or tipping over. The use of steel cables, turnbuckles, steel beams and angles can be used as aids. The contractor will need to review their procedure of bracing and securing the end rings with the owner prior to the beginning of construction.

   During the process of standing, securing and bracing the end rings, the entry and exit end rings must be gaged to the correct distance for the platen (within 1/16”) from mounting hole to mounting hole at the platen mounting surface of the end rings. NOTE: The platen mounting surfaces on the end rings must be set level and aligned to each other flat within 1/16” (clocked together). A final review and acceptance of the alignment must be verified by the owner prior to moving forward.
h. Next, the rear lower pipe truss and the spill side lower pipe trusses are to be bolted in place on both end rings. Shim as required and bolts snugged down.
i. Install and bolt the two (2) pipe supports and the clamp access platforms to the lower pipe trusses. Bolts to be snug tight.
j. Install the rear top truss, shim and bolt as required.

k. Install rear pipe truss diagonals and tack weld in place. Final welding of the diagonals and sleeves will be completed once the dumper has been verified to be level and plumb to the drawing required tolerances.

l. Install counterweights and bolt in place. Use REW's torque bolt chart to torque values. Bolts are to be tack welded after torque is completed. Mark bolts after proper torque is achieved. Verify squareness and flatness of the end rings.

m. Install the platen. The platen will need to be shimmed level. Verify flatness along the platen rails, shim as necessary. (Flatness +/- 1/16".) Document and submit the flatness measurements to the owner for review and acceptance. Bolt platen snug tight. Verify squareness and flatness.

n. Install spill girder. Spill girder sets flat onto the end ring shelf. The spill girder will need shimmed out to ensure the dimension 5' 6" +/- 1/8" is maintained to the centerline of rotation. Verify the 5' 6" dimension along the length pf the platen. Install bolts and snug tight all bolts. Verify squareness and flatness.

o. Install platen walkway platforms, handrails and on-board hydraulic mounting bracket. Align and bolt in place; snug tight all bolts. Verify squareness and flatness of the end rings and platen. Verify measurements from the face of the spill wall to the center line of the dumper. Verify elevation of the dumper platen rails to the centerline of rotation.

p. Begin torqueing platen bolts and pipe truss bolts. Use REW's torque bolt chart to torque values. Mark bolts after proper torque is achieved.

q. Begin welding diagonal bracing on rear trusses. All welding to be completed per AWS D1.1 criteria. A visual inspection of the welds is required.

r. Begin bolt torque of the spill wall. Use REW's torque bolt chart to torque values. Mark bolts after proper torque is achieved.

s. Bolt torque is to be verified and accepted by the owner prior to continuing with the assembly.

t. <u>NOTE: During the assembly of the dumper, electrical and hydraulic piping work can be completed simultaneously with the mechanical crew assembling the dumper. All three (3) crews should review work schedules and work together with each other to facilitate time and the assembly of the dumper.</u>

u. Install four (4) clamp assemblies. Two (2) will be shimmed and bolted to the spill wall and two (2) will be shimmed and bolted to the rear truss. Use REW's torque bolt chart to torque values. Mark bolts after proper torque is achieved.
v. Hydraulic piping is to be installed on the dumper barrel from hose loop connection point to the manifolds and the clamp cylinders.

***The above procedure will be completed for both the entry end exit dumpers during the pre-outage. Dumper barrels should be assembled as complete as they can prior to installation onto the trunnions**.

2.0 Dumper Removal (OUTAGE)

<u>*The contractors, mechanical, electrical and hydraulic are responsible to ensure all employee are safety trained, all LOTO procedures are followed and will need to verify with the owner that all equipment is locked out prior to any work on the dumper or positioner.</u>

The old dumper must be removed before the new dumpers and all other components can be installed. The existing dumper will be the first item removed during the beginning of the outage.

a. *Prior to any demo work, the contractor is to establish and set permanent monuments around the dumper to locate dumper centerlines and mark for dumper elevation. These center marks and elevation marks will aid with the new dumper installation. Consult with owner for locations. A legend of the monuments will need to be generated by the contractor and submitted to the owner for future reference.
b. All fluids from gearboxes, etc., are to be collected by the contractor for off-site disposal. The electrical cable loop will be disconnected by others.
   The dumper can be removed as a single piece or cut and removed in several pieces. The total weight is about 600kip. If cut and removed in pieces, the contractor must secure the dumper from rotating prior to cutting. If the dumper is to be removed in one (1) piece, an acceptable lift plan must be submitted to the owner two (2) weeks prior to the lift for review and acceptance.

The lifting plan shall include crane information as well as details of matting and support necessary for the area and to protect any underground utilities. All matting, supports, crane, operators, etc., shall be provided by the contractor.

c. Remove the existing trunnion equalizer assemblies and sill beams.
d. Remove the existing drive bases and drive components.
e. The dumper shall be disposed of by the contractor.

Removal of additional items after the dumper had been removed.

f. Once the dumper, sill beams and trunnions are removed, the grizzly will need to be removed and disposed of.
g. Remove the existing hoppers, vibrating feeders and transfer belts. All items must be disposed by the contractor.

3.0 Installation of TAS2 Take-Away System and Miscellaneous Items Prior to the Dumper Installation

Reference the TAS2 ICM Manual for Conveyor Installation Standards and Drawings.

a. Conveyor C-16 modifications must be completed.
b. Set and level new take-away conveyor per manufacturer's specifications.
c. Set, level and anchor new apron feeders per manufacturer's specifications.
d. Set and level new hopper. Anchor and secure per Bedeschi America drawings and requirements.
e. Install new grizzlies.
f. Form and pour new sill beam pedestals. Existing concrete to be drilled and rebar and dial rods set in place using epoxy. Set anchor bolts and verify all anchor bolt locations and center distances working from the centerlines of the dumper. Pour the pedestals.
g. Form and pour new concrete piers for drive units. Install new concrete drive piers. Existing concrete to be drilled and tie rods set in place using epoxy. Construct rebar and forms for the concrete piers. Set anchor bolts for the drive bases. Verify all anchor bolt locations and center distances

prior to pouring concrete. Anchor bolt center distances must be worked from the centerlines of the dumper. Pour the concrete piers.

4.0 Dumper Installation

Contractor will be required to work with the electrical contractor and allow time for completion of the conduit and wiring work to the dumper equipment. This includes the cable loop, drive components, dumper barrel instruments and any other control devices.

a. Install new wall wedges. Shim and anchor per REW's drawing requirements. NOTE: The platen wedges will be installed during commissioning.
b. Install new sill beams. The new sill beams shall be leveled and elevation set from the centerline of rotation. Shim as required. Snug down bolts. Verify level and elevation after snugging down bolts. A cross measurement verification of the sill beams is required to ensure squareness and perpendicularity of the sill beams. An owner verification and approval of measurements must be completed prior to torqueing bolts. Bolts are to be torqued to REW's torque specifications.
c. Install new trunnion equalizer assemblies. Trunnion assemblies must be positioned from established dumper centerlines. Trunnion elevations are to be set from the dumper centerline of rotation. Trunnions must be aligned parallel and square to each other from dumper centerline of rotation. A cross measurement verification of all trunnions is required. An owner verification and approval of measurements must be completed prior to torqueing bolts. Bolts are to be torqued to REW's torque specifications. Chock bars are to be set and welded in place after bolts are torqued.
d. Install new dumpers onto the trunnion assemblies. Contractor must develop an acceptable lifting plan for the dumpers and submit it to the owner for review a minimum of two (2) weeks prior to mobilization. (BEFORE THE OUTAGE BEGINS.) The lifting plan shall include crane information as well as details of matting and support necessary for the area and to protect any underground utilities. All matting, supports, crane, operators, etc., shall be provided by the contractor.

e. Once the lift plan is approved for the new dumpers, the dumpers will be lifted and set onto the new trunnions. The dumpers MUST be secured in place to prevent the dumpers from rolling.
f. Once the dumpers are secured, the contractor will then complete assembly of any remaining components on the dumper barrels. This will include, but not limited to, deflector plates, return bumper stops, miscellaneous handrail, platen wedges, bumper stop towers, limit switch brackets, hydraulic loop support structure and hose loop, etc.
g. The contractor will then install four (4) new drive bases on the new and existing concrete piers. The drive bases will need to be shimmed for correct elevation and squared to the dumper centerlines. The elevation is set from the centerline of rotation. Shim as required. Pinion gears shall be aligned such that the teeth are parallel, and have full face contact. Backlash will be set in the seated position at the time of setting the drive bases. Backlash in the seated position will be set at .200". Final backlash setting will be completed during commissioning. Once the drive bases are set, the owner will verify elevation and backlash before final torque of the bolts. NOTE: Shims set under the drive bases must be packed around the anchor bolts for support. Review shim pack placement with the owner. Once the shim packs are set, the bolts snugged down and the measurements have been accepted by the owner, the contractor will set forms for grout around the drive bases.
h. Shop installed lifting point re-enforcement on the end rings to be removed and paint touched up.
i. The new drive components including motor, brake and couplings shall be verified for settings/alignment within manufacturer's recommendations including coupling parallel offset, angular and gap alignment, drive motor brake adjustments and torque and bolt torques.
j. Install grease auto-lubrication piping, fittings, pump, etc., to the new trunnion roller assemblies.
k. Install grease in lubrication lines and purge the lines. (Grease provided by ASPA.)
l. Install open gear lubricant on the dumper gear rack. (Lubricant provided by REW.)
m. Install all machinery guards.

5.0 Car Clamp Hydraulic System

The Car Clamp Hydraulic Power Unit (HPU) will arrive pre-mounted in the Hydraulic Control Building. The control building is to be installed on the existing concrete between the north dumper 2A drive bases. The building shall be levelled, anchored to the concrete and grouted around the perimeter. All hydraulic pipe and fittings will be welded steel and will be supplied by REW. The pipe will be supplied in standard lengths and must be cut to fit by the contractor.

a. The piping will enter the building at the locations marked on the drawings. Access plates on the building and seals are provided by REW.
b. Install the hydraulic piping from the control building to each of the hose loop connection points, including all piping, valves, hoses, supports, etc.
c. Perform pressure and leak test on all piping, new and existing, per hydraulic piping installation specification. Test pressure shall be 1,000 psi. Hydraulic unit and cylinders shall be isolated from test pressure. Contractor to provide all pressure test equipment and temporary connections. Contractor to supply the customer with test reports for review and acceptance.
d. Flush piping, new and existing, per hydraulic piping installation specification. Contractor to provide all flushing oil, flushing equipment and temporary connections.
e. Contractor is to remove all flushing oil and dispose offsite.
f. Remove oil from the HPU reservoir. Open the inspection hatches on the reservoir and wipe the interior and bottom surface clean.
g. Replace inspection hatches, fill reservoir and pump with hydraulic oil. Please note that new hydraulic oil shall be filtered to five (5) micron through a filter cart prior to being installed. Hydraulic oil will be supplied by ASPA.

6.0 Operator's Cab

A new operator's cab is provided with the dumper equipment along with a new support platform. The contractor shall install the new support platform on the east side of the dumpers as shown on the drawings. The cab will then be installed onto the platform and secured as shown on REW's drawings.

The existing operator's cab is to be removed from its platform. Grating is to be installed to prevent any open areas or tripping hazards on the platform. The existing operator's cab platform will remain in place to support the existing and new conduit.

7.0 Automatic Grease System

a. The contractor shall install the components of the grease system after all the equipment is set and aligned.
b. Contractor shall disconnect hoses at each point of lubrication and purge air from system, then reconnect.
c. Grease system shall be filled with grease and run to lubricate bearing points to ensure system is working properly.
d. Grease points shall be fully lubed until relief vents show grease. Lubrication points without grease vents, such as pins and bushings, shall be lubricated until grease is visible coming out of the pins and bushing areas.

8.0 Manual Lubrication

a. Furnish grease.
b. Manually lubricate all lubrication points shown on Drawing No. 2806. Points shall be greased until grease is visible coming out of pins and bushing areas.

B. POSITIONER ASSEMBLY

1.0 Positioner Erection

The positioner carriage will need to be erected prior to the outage to keep the outage time for the RCD2 system as short as possible. The contractor is responsible for locating a suitable area for erecting the positioner carriage along with any preparation work to level and stabilize the area. (Pre-outage)

Assembly shall be as complete as practical to facilitate setting the positioner in place. The contractor and owner shall discuss and specify the extent to which the positioner will be assembled during pre-outage.

Before any work is done, the contractor is responsible for establishing monuments for the project based on the dumper centerlines. Monuments are to be permanent and will remain for future reference. **ALL** installation work will be based on the dumper centerline monuments. A legend of the monuments must be generated by the contractor and submitted to the customer for future reference.

2.0 Carriage Assembly

The carriage shall be assembled as much as practical prior to the outage. Certain assembly steps will need to be done after the carriage is placed on the runway.

a. Unloading the carriage from truck. Refer to Drawing No. 3301 for dimensions of carriage.
    i. Carriage to arrive on site via lowboy flatbed. Weight of the unit to be approximately 40,000 lbs. The carriage to be lifted by utilizing the lifting lugs already provided on the carriage.
    ii. The carriage to be set on temporary shoring to level the carriage and allow access for assembly of parts.
    iii. The vertical travel rail closest to the yard rails will be moved 12” to the West toward the yard rail. This modification will need to be completed before installing the completed carriage onto the runway. The East travel rail and both thrust rails on the runway will be modified to extend their lengths for the new arrangement of the carriage guide wheels and travel wheels.
    iv. A survey of the modified rails shall be completed. Rail variance shall be kept to a minimum and shall meet tolerance per the drawings. Special note shall be made where the runway thrust rails have the largest gauge (largest width from rail head to rail head). This location will be important for Step 5.0 below.

b. Install travel wheel equalizer bracket. Refer to Drawing No. 3007 for arrangement.
    i. The equalizer bracket (S1-3304) to be hoisted into position and inserted onto the equalizer pin (P1-3301). The weight of the equalizer bracket is 1,475 lbs. Coat the pin (P1-3301) with grease prior to equalizer install.
    ii. Note that the grease fittings shall be oriented towards the outboard side of the carriage to allow access for greasing.
    iii. Install keeper bars (A3-3304) with bolts (B1-3304). Tighten bolts to the proper torque; see REW's bolt torque requirements.

c. Install travel wheel assemblies.
    a. Wheel assemblies per Drawing No. 3011 to arrive on site with wheel bracket, wheel, bearing, gaskets and pin fully assembled. Four (4) assemblies to be supplied are the same and can be installed in any travel wheel locations.
    b. Install two (2) travel wheel assemblies on the travel wheel equalizer bracket as shown in Drawing No. 3007. Utilize shim packs (C1-3305), eight (8) 3/4" dia. x 2 ¾" long bolts with flat washer and hex nut (FB3-3305-field bolts) on each travel wheel assembly. NOTE: Once carriage is on rails, shims may need adjusted. **Do not torque bolts until the carriage has been leveled!** The grease fitting shall be oriented towards the outboard side of the carriage to allow for piping to the auto-lube system.
    c. Install the remaining two (2) travel wheel assemblies on the positioner carriage as shown in Drawing No. 3005. Utilize shim packs (C1-3305), eight (8) 3/4" dia. x 2 ¾" long bolts with flat washer and hex nut (FB3-3305-field bolts) on each travel wheel assembly. The grease fitting to be oriented towards the outboard side of the carriage to allow for piping to the auto-lube system. Adjust shim pack thicknesses to accommodate design deviations from dimensions due to normal manufacturing tolerances so that the carriage is level when placed on the rail.

d. Install equalized thrust wheel assemblies.
    i. Equalized wheel assemblies to arrive on site with wheel bracket, wheel, bearing, gaskets and pin fully assembled. Refer to Drawing No. 3013 Equalized Thrust Wheel Arrangement. Two (2) complete assemblies to be supplied are the same and can be installed in either location. The location for the assemblies is shown on Drawing No. 3003.
    ii. Remove the pin cap M9-3316 from shaft P2-3316. Clean the exposed portion of shaft and coat with grease prior to installation.
    iii. Insert shaft P2-3316 with trunnion assembly up into bore of carriage (kk-3301).
    iv. Note that the orientation of the grease fitting should face away from the runway to allow easy access to the grease point.
    v. Re-install the cap M9-3316 to the end of the shaft with the 3/4" countersink bolts (FB1-3316). Take note the orientation of the eccentric direction of the shaft. To start, the shaft should be installed in the bore in the "zero" adjustment such that the eccentric is pointed in-line with the length of the carriage providing future adjustment of +/- 1/2". A punch mark exists on the cap and should be pointed in the direction of the eccentric.
    vi. Rotate the cap to align with holes in the carriage and install bolts FB4-3316. Do not torque until after final adjustments are completed.

e. Install inboard thrust wheel assemblies.
    i. The inboard thrust wheel assemblies to arrive on site with shaft mounting bracket, eccentric shaft, wheel, bearing, gaskets and pin fully assembled. Refer to Drawing No. 3012. Two (2) complete assemblies to be supplied are the same and can be installed in either location. The location for the assemblies is shown on Drawing No. 3003.
    ii. Verify the assembly is in the zero (0) position before installation. Install the assembly, shims as required (C1-3313), and ten (10) 1" dia. x 4-1/2" long bolts.

f. Install positioner platform.
    i. Refer to Drawing No. 3006 for assembly of the platform steel.
    ii. C-channels, handrail, ladders, and grating are all supplied loose to the field intended to be stick-built on site. Materials for the platform are supplied per Drawing Nos. 3308, 3309, 3310, 3312 and 3321.
    iii. Once the c-channels are constructed, ensure that the platform structure is square to the main box section of the carriage.
    iv. Diagonal pieces (S1-3321 and S2-3321) bolt in at the end toward the box section. The outboard end shall be field welded to brace the platform and keep it square. A 5/16" fillet all around the angle shall be used.
    v. Install the grating, handrail, and ladders per Drawing No. 3006. Torque all bolts to specification. See REW's bolt torque requirements, and touch-up paint as needed.

g. Install positioner drives.
    i. There are five (5) drives to be installed. Drive components to arrive on site individually and be assembled in the field by the installation contractor. Each drive system consists of a 125HP motor, disc brake with coupling, reducer, coupling and pinion shaft assembly. The pinion shaft assemblies will be complete with bracket, bearings, pinion shaft, pinion gear, shaft coupling, grease seals and retainer plates. All five (5) drives are the same and can be installed in any location.
    ii. The gear racks shall be installed to the runway PRIOR to installing the bearing housings to the carriage. A survey of the installed gear racks shall be completed. Measurements of the location of the thrust rails and pitch line of the gear rack should be documented in reference to the runway centerline.
    iii. As the thrust rollers are able to be adjusted, what is critical at this stage is that each center of drive shaft is located equally from the center of carriage. Center of carriage is defined by the center distance between the inboard and outboard thrust roller shafts. Shims can be used to ensure the drives are equally in line from this center plane. The nominal distance of center of drive shaft to center of carriage is 2'-7 3/8" per Drawing No. 3004.

iv. Install the pinion shaft assemblies utilizing shim packs C3-3302 and FB4-3302 bolts. The pinion shafts shall also be checked to be plumb with the rack gear teeth.

v. Contractor to supply and pump grease into the grease fitting located at the top bearing of the pinion shaft assembly until grease is observed coming out of the seals at the top and bottom of the bearing housing assembly. Replace the grease fitting with plumbing for the automatic lubrication system, or re-install the temporary plug.

h. Install gear reducer units.

i. There are five (5) gear reducers to install. All reducers are similar and either can go to any location. The low speed coupling half will need to be installed on the reducer output shaft. The input shaft shall receive the brake disc half of the torque limiting coupling. Coupling halves to be installed per Drawing No. 3004.

ii. Hoist each reducer to the location and orientation per Drawing Nos. 3003 and 3004. The reducer will sit directly down to the carriage surface with no shims. Ensure the 1/8" gap between output shaft and bearing shaft.

iii. Align the coupling at this time and connect the coupling covers per Rexnord installation guide. Position the reducer square to the pinion drive shaft (level) and in line with the theoretical center line of the drive.

iv. Install four (4) mounting bolts FB1-3104 for each gearbox. Torque bolts to specification; see REW's bolt torque requirements.

v. Contractor to fill gear boxes with oil to the proper level. Reference lubrication chart and SEW operation manual.

i. Install electric drive motors.

i. There are five (5) 125hp motors to be installed to the carriage frame. The motor is coupled to the reducer with the detent coupling which includes a brake disc.

ii. Install high speed detent coupling (Brunel) onto the end of the motor shaft. The motor receives the detent half of the coupling assembly.

iii. Motors are to be set in place utilizing shim pack C2-3104 and bolts FB2-3104. Align the coupling halves by adjusting the position of the motor. Reference Brunel installation guide for alignment and tightening of the coupling halves.

iv. Torque the motor mounting bolts to specification. See REW's bolt torque requirements.

j. Install disc brakes.

i. There are five (5) disc brakes to be installed. The brakes are to be located at the brake disc coupling between the motor and reducer.

ii. Locate the brake onto the carriage using shims C3-3104 and bolts FB3-3104.

iii. Align the brake caliper to the disc per Pintsch Bubenzer installation guide. Set the caliper stroke (air gap) at the thruster. Adjust shims as necessary, and torque the foot mount bolts to specification. See REW's bolt torque requirements.

3.0 Runway Gear Rack Installation (Outage)

The gear racks are to be installed onto the supplied sub plate embedded into the runway concrete by epoxy grout. Only once the embedded plate is set to the runway, shall the gear racks be installed.

NOTE: A void of gear racks will be required for the installation of the carriage to the runway. Once the location of the widest thrust rail distance is determined, a section of racks shall be left uninstalled adjacent to this location. This is to allow for best clearance when lowering the carriage over the rails.

a. Gear rack segments are to be installed by locating and mounting the first rack at the south end and consecutively installing each rack directly adjacent to the last previously installed rack. The racks should **NOT** be installed by starting at both ends of the runway and setting the last rack between two (2) previously installed racks. Each gear rack installed must be aligned, shimmed and fastened complete before the start of installation of another rack. A gear rack template (S1-3106) will be supplied to set the gear rack pitch between the adjacent rack segments.

b. For the consideration of lowering the carriage to the runway, rack segments shall all be installed, then a section of racks removed at the area where the carriage will be lowered onto the runway. Only the minimum number of racks should be removed as necessary to provide clearance for the pinion gears when lowering.
c. Location of crane(s) should also be considered for determining where the carriage can best and safely be lowered onto the runway.
d. The embedded plate must be clean of debris, mill scale and burrs to assure that any welding processes are not jeopardized and to insure a flat clean surface for the gear rack to bear onto.
e. Six (6), 1" diameter x 3 ½" long bolts will be installed through the holes of the cast rack segments into the tapped base plate. Shims (C1-3102) shall be used to keep the pitch line of all rack segments in alignment with respect to the thrust rails.
f. Each gear rack segment shall be set utilizing a lifting device (i.e. nylon sling) that will not damage the rack.
g. Once all racks are located per the drawings, the chock bars (M1-3102) shall be welded to the middle ears of the installed rack segments.
h. The above procedure shall be repeated for the remaining rack segments once the carriage is installed to the runway and pushed clear of the void.

4.0 Hoisting the Carriage onto Runway

a. Lifting lugs are provided on the top surface of the carriage box section. There are three (3) lugs, 8"x 8", 2 1/2" thick with 2 3/16" holes designed for 25ton shackles. Rigging is designed to be minimum of 60deg from horizontal from the single lift point. Reference lifting plan drawing for rigging details and COG location.
b. Ensure that all mechanical equipment is secured with bolts or temporary tie-downs such that the load does not shift during lifting.
c. The carriage assembly (without arm and arm drive) estimated weight is 126,500 lbs.
d. Lower the carriage to the dedicated location on the runway. As the carriage is lowered, ensure that the trust wheels clear the horizontal runway rails.

e. Once the carriage is on the rails, manually push/pull the carriage up and down the entire length of runway to ensure that there is no interference or binding of thrust wheels or gears.
f. Slide the carriage inward toward the yard rails until the outboard equalized thrust wheels are in contact with the thrust rail.
g. Install wooded wedges at base of travel rollers or alternately tie down positioner carriage. The positioner is now secured for alignment of the drives.
h. Adjust the outboard equalized thrust wheels such that a backlash of .088" to .122" is achieved on all drive pinions. If necessary, changes to the shims for the pinion bearing housings may need made (this is not anticipated, and should only be done if there is not enough adjustment in the equalized thrust wheels). Once achieved, the equalized thrust wheels are adjusted and all pinion shafts are aligned. Ensure all pinion housing bolts are torqued, and the equalized thrust wheel caps are tightened to lock in the adjustment.
i. Adjust the inboard single thrust wheels by rotating the shafts until a gap of 1/8" is achieved. Tighten the bolts B3-3314 to lock in the adjustment. The single thrust wheels are now set.
j. Install hold down brackets.
    i. There are four (4) hold down brackets to be attached to the sides of the carriage. Refer to Drawing No. 3003 for location.
    ii. Install hold down brackets (S1-3307) and fasten with four (4) 1 ¼" x 5 1/2" long bolts FB1-3307 each. Adjust shims such that there is a 1/2" gap between the head of the rail and inside of the hold down bracket. Vertically position the brackets such that there is 1/4" to 3/8" of gap between the bottom of the thrust rail and the top of the hold down bracket.
    iii. Torque bolts to specification. See REW's bolt torque requirements.

5.0 Install Positioner Arm (Refer to Drawing No. 3005)

a. Positioner arm will need cribbing to hold in place during installation. Contractor to supply and install cribbing as required.

b. Positioner arm shall be lifted from truck and set on cribbing next to the positioner adjacent to its mounting location in a level manner.
c. The pivot blocks for the arms will be supplied with the bushing, key and retainer ring already assembled. Slide the pivot block assembly (S1-3203) onto the arm pins with the grooved retaining ring facing the arm.
d. Install the centering guide S1-3206 onto the carriage box section per Drawing No. 3005. Leave bolts snug in case shims need to be adjusted later.
e. Slide the arm into the carriage frame through the slots in the side mounting plates 3301-"ss" and 3301-"st". Install the 1 ¼" dia x 10" bolts FB2-3203 through the bearing block and attach to the carriage. Before torqueing the bolts, ensure the center distance and arm alignment per dimensions on Drawing No. 3005. Note that the bolts on the carriage are oversized to allow for some adjustment. Tighten all bolts to the proper torque; see REW's bolt torque requirements. Ensure smooth rotation of the arm by lifting the arm up to the 90deg position and back down. Loosen bolts and adjust if necessary.
f. Push the arm either forward or backward to make room in one (1) of the boxes for the draft gear M7-3208 to install (reference Drawing No. 3005). Install draft gear into carriage frame. The draft gear is designed to sit loosely in the box. Slide the arm against the installed draft gear and install the second.
g. Install the draft gear cover plates 2A-3301 and fasteners. NOTE: Once the first index is completed, the draft gears will "unload" and tighten inside the box. This should be verified later by removing the covers and inspecting that there is no gap between the arm shaft and draft gear head.
h. Install bearing block chock bars as shown in Drawing No. 3005.
i. Install four (4) limit switch targets (M2-3209) onto positioner arm. Refer to Drawing No. 3005 for location and installation specifications.
j. Install limit switch sensor support bracket (S1-3209) onto carriage. Refer to Drawing No. 3005 for location and installation specifications.

6.0 Install Positioner Arm Drive

a. Install the arm drive reducer M1-3208 onto the positioner carriage. Position per dimensions specified on Drawing No. 3005. Ensure that the reducer is shot in parallel to the arm pivot axis and that the center of output shaft is aligned with the positioner arm pin ears. There are no shims required between the reducer foot and carriage frame. Tighten mounting bolts to specification.
b. Install the drive link (S2-3202) on the reducer output shaft. Remove the outboard plate “bd” from the drive link and set aside for re-installation later.
c. Install the coupling half to the input shaft of the reducer.
d. The positioner arm linkage will be provided to site per Drawing No. 3009. It will have all components banded or boxed together.
e. Install the trunnion block M4-3204 with bushing M3-3204 into the drive link and re-install the end plate “bd”.
f. Install the opposite end of the arm rod S1-3204 to the positioner arm S1-3201 with the supplied pin P1-3204 and spacers M2-3204 as shown in Section F-F on Drawing No. 3005. The arm or reducer output may need rotated to allow the pin to install through the rod eye. Install the keeper bar C1-3202 and bolts FB3-3202.
g. Install the torque limit coupling M6-3208 to the arm motor E1-3208. Reference Rexnord installation guide for proper installation and alignment.
h. Perform the “burn in” procedure for the slip coupling. Follow procedure recommended per Rexnord installation guide. Secure the arm and anchor down to cribbing and ground as necessary to resist motion of the output shaft.
i. Once burn in is complete, set the torque limit coupling to 113ft*lbs (1,355in*lbs).
j. Hoist the motor to the carriage. Install using shims C2-3208 and bolts FB2-3208. Align the motor to the reducer and tighten the motor bolts to specification. Tighten the torque coupling cover bolts.

k. Install the 8” brake wheel M4-3208 onto the motor shaft and install the shoe brake M2-3208 using shims C1-3208 and bolts FB1-3208. Reference Pintsch Bubenzer installation guide for alignment to the brake drum and setting of the thruster.
l. Un-couple the torque coupling and perform burn in procedure to bed the brake pads to the drum. Ensure at least 60% drum to pad contact; adjust the brake as needed. Re-couple the torque coupling.
m. Install the encoder on the end of the motor shaft.
n. Install the brake cover.

7.0 Install Encoder Gear Assembly

a. Install bracket S1-3317, shims C1-3317 and corresponding fasteners.
b. Assemble encoder shaft P1-3317, bearings M2-3317, encoder gear P1, P2-3102 and shaft end plate 2A-3317. Refer to Drawing No. 3317 for assembly general arrangement.
c. Install assembly utilizing shims C1-3317 to obtain a backlash of .100 inches.
d. Install encoder enclosure and coupling.
e. Manually grease bearings.

8.0 Automatic Grease System

a. The contractor shall install the components of the grease system after all the equipment is set and aligned. Refer to Drawing Nos. 3801 thru 3807.
b. Contractor shall disconnect hoses at each point of lubrication and purge air from system; then reconnect.
c. Grease system shall be filled with grease and run to lubricate bearing points to ensure system is working properly.
d. Grease points shall be fully lubed until relief vents show grease. Lubrication points without grease vents, such as pins and bushings, shall be lubricated until grease is visible coming out of the pins and bushing areas.

9.0 Manual Lubrication

a. Manually lubricate all lubrication points shown on Drawing Nos. 3806, 3809, and 3810. Points shall be greased until grease is visible coming out of pins and bushing areas.
b. Install gear rack lubrication on racks.

10.0 Festoon Installation

The festoon system consists of setting pre-fabricated posts onto pre-installed concrete foundations and assembly of monorail beam, cross bracing and monorail carriage.

a. Festoon posts to be set onto four (4), 1" diameter anchor bolts as shown in drawings. Posts to be set plumb and inline.
b. Festoon beams to be mounted to festoon posts according to arrangement.
c. Install cross bracing supports.
d. Install festoon pick-up post (S1-3604) to carriage as shown in GA Drawing No. 3003.
e. Install festoon carriage. Care and precautions must be taken to not damage electrical cables. The festoon system is shipped completely assembled and the main shipping beam is to be installed as the first monorail beam of the final assembly. The entire festoon, including the main beam, is to be lifted into place as a unit and attached to the festoon posts.
f. Once the festoon system is installed, the tow trolley must be connected to the festoon pick-up post on the positioner carriage.
g. The electrical contractor will be responsible for connecting the cables on both ends of the festoon.

11.0 Wheel Grippers Installation

There is one (1) set of wheel grippers to be installed at the exit end of the dumper and two (2) sets of grippers on the entry end. The grippers will arrive on site fully assembled. New foundations are required for each of the wheel grippers and will be installed by others.

The installation procedure will be the same for each of the wheel gripper assemblies.

a. Existing rail to be cut at both ends to allow the installation of the wheel gripper assembly. Each gripper assembly will have rail installed. The existing rail to be cut to obtain a 1/2” gap between the existing yard rail and new installed wheel gripper. The yard rail must be anchored in this area so as to prevent the yard rail creeping and lock rail to maintain 1/2” gap. Gap tolerance to be +/- 1/16”.
b. The concrete foundation slab shall be clean of all grout, oil and loose debris.
c. Install the new wheel grippers into the pit and match the anchor bolts to the hole pattern in frame. The grippers shall be set level and shall match top of yard rail to the top of grippers’ rail elevation.
d. Install grout beneath all frame components upon completion of alignment and level set. A gap is to be left in the grout under the steel for drainage.
e. Install piping and supports from grippers to existing air supply. Installation shall include a solenoid control panel with pressure switch for each wheel gripper assembly.
f. Perform pressure and leak test on all piping. Test pressure shall be 200 psi. Cylinders shall be isolated from test pressure.
g. Material and equipment supplied by contractor.
    i. Piping supports.
    ii. High strength epoxy grout.
    iii. Grease.
h. Installation requirements.
    i. Piping shall be installed and conform to ASME B31.1, Process Piping.
    ii. Pipe to be routed by the erector to avoid obstacles, simplify supports required and make for a neat and orderly installation.
    iii. Piping runs shall be installed using maximum length pipe sections to minimize joints. Unions shall not be used to splice pipe connections.
    iv. All equipment shall be installed per manufacturer’s recommendations.

v. All hose shall be installed insuring that the proper bend radius is maintained. Contractor shall install hoses without kinks and twists.

vi. Pipe, fittings, hose, tubing and any other components comprising the piping system shall be absolutely clean, free of scale and any other kind of foreign matter.

vii. The inside edges of tubing and pipes shall be reamed after cutting to remove burrs. Also, remove burrs from outside edge.

viii. All openings into the piping system shall be kept covered to keep out dirt and metal debris when work such as drilling, tapping, cutting, brazing or welding is being done near the opening.

ix. Exposed portions of cylinder rods shall be suitably protected during installation activities.

x. Threaded fittings shall be inspected so that no metal slivers get into the system. Teflon tape shall not be used to seal pipe threads.

i. Pressure testing requirements.

i. Contractor shall pressure test the field installed piping systems. Equipment and hoses shall be isolated and not included in the pressure test. All air pipe runs shall be pressure tested to 200 psi and held for 30 minutes. Contractor shall inspect for leaks.

ii. Any leaks found shall be repaired and the system retested until there are no leaks.

iii. Pressure testing shall be witnessed by the Owner or Owner's representative.

IV. ELECTRICAL INSTALLATION

Electrical wiring and materials shall conform to the latest edition of the IEC, National Electric Code (NEC) and to the applicable ANSI, IEEE and NEMA standards. All wires shall be tagged at each end and color coded for permanent identification. Minimum size of power conductor shall be #12 AWG copper. Insulation shall be moisture and oil resistant flame retarding covering, in accordance with IPCEA (Insulated Power Cable Engineers Association) specifications.

MV cables for fixed installation shall have copper conductors with XLPE insulation and screens rated for the prospective ground fault current of the respective system. Three (3) core MV cables shall be single wire armored with an overall PVC sheath.

480V power cables shall have stranded copper conductors, 0.6/1kV 90° XLPE insulation with an overall PVC sheath. For high current application, single core XLPE insulated cables may be used. For cables subject to “flexible” applications, EPR/CSP rubber type cabling shall be used.

All VFD power cabling shall be special VFD duty shielded cable.

120V multi-core control cables shall have #14 AWG stranded copper conductors 0.6/1kV 90° insulation with a ground conductor as standard.

24VDC control and instrument cables shall have a twisted pair format with overall or individual screened pairs as required for signal conditions. The cables shall be rated 300VDC.

Fiber optic cables shall have loose tube construction.

A. DUMPER ASSEMBLY

1.0 Dumper Barrel

The dumper barrels will be erected by the mechanical contractor prior to the outage to keep the outage time for the RCD2 system as short as possible.

The electrical contractor will provide and install all conduit and cable onboard the new dumper barrel. Connections to the field devices shall be made using CGB’s or suitable sealed fittings and cable in free air to allow for adjustment of the devices. No flexible conduit is to be used on the dumper barrel.

The conduit on board the dumper barrel shall follow the same routing as the hydraulic piping. The hydraulic piping is to be installed first and the conduit will then be installed so as not to interfere with the piping.

Both dumper barrels are to be completely wired prior to installation into the dumper pit.

a. Install junction box JB-DB on the on-board mounting bracket.

b. Install conduit from junction box JB-DB to junction boxes JB-ESOL and JB-XSOL and the dumper barrel instruments.
c. Pull and terminate cables to the devices on the dumper barrel.

2.0 Dumper Removal

Several items that are part of the existing control system will be removed for the new dumper control. All conduit to be removed must be properly sealed for future use at an approved location or completely removed.

a. The dumper drives are to be disconnected so they can be removed (by others) for installation of the new dumper. The conduit and cable to the existing dumper drives must be removed. Some of the embedded conduit in the dumper drives area will be re-used.
b. The three (3) dumper rotation limit switches are to be removed. The cable and conduit are to be removed.
c. The entry and exit end photo-eyes are to be removed. The mounting brackets and conduit are to be retained for the new photo-eyes.
d. The dumper local jog push button stations are to be removed with their cable and conduit.
e. The existing operator's cab will be removed from service. The electrical contractor shall disconnect all wiring from the existing cab and remove the wiring back to the control panels.

3.0 Dumper Installation

The contractor shall install new conduit and cable to the new dumper drive equipment. Each dumper drive will include a new motor, brake and motor feedback encoder. The exit end drive will also include a dumper position encoder. The dumper drive motors will require VFD cable that must be run in separate conduits. Minimum bend radius requirements of the VFD cable necessitates the need to use sweep 90° bends as opposed to tight radius or Lbs. Pull boxes can be used to maintain the minimum bend radius.

A new stationary cable loop junction box JB-DL will be installed for each dumper and new wiring and conduit will connect the box to the dumper control panel. The new junction box is to be mounted on the new cable loop support stand. The cable loop to the dumper will also be new and installed by the contractor.

The contractor will install the new off-board dumper devices including limit switches, photo-eyes and local push button stations. New conduit and cable to these devices are provided and installed by the contractor.

4.0 Car Clamp Hydraulic System

The Car Clamp Hydraulic Power Unit (HPU) will arrive pre-mounted in the Hydraulic Control Building. The control building will be installed by others on the existing concrete between the north dumper 2A drive bases.

Conduit will enter the building at the locations marked on the drawings. Access plates on the building and seals are provided by REW.

The conduit and cable will be routed around the interior of the control room as shown on the drawings to connect the HPU junction box and motors as well as the control room distribution panels.

The heat exchanger for the HPU will be mounted external to the control room. The contractor will provide and install conduit and wiring to the heat exchanger.

5.0 Operator's Cab

The new operator's cab will be mounted, by others, on the new support platform.

The contractor will provide and install new conduit and wiring from the electric building to the new operator's cab.

6.0 Trunnions Auto-Lube

The new auto-lube panel for the dumper trunnions will be located near the operator's cab platform. The contractor will provide and install new conduit and wiring between the auto-lube panel and the electric building.

There are two (2) pressure switches mounted at the dumper trunnions. The contractor shall provide and install conduit and wiring between the pressure switches and the auto-lube panel.

B. ELECTRICAL BUILDING

1.0 Equipment Removal

The existing control panels for the RCD2 and TAS2 systems are to be removed from the electric building to make room for the new control panels. This work must all be done during the outage period.

a. The existing dumper and positioner drive panels along the North wall of the building are to be removed. All field cables connected to these panels are to be removed in their entirety. The embedded conduit under these panels will be abandoned.
b. The slide gate control panel on the North wall is to be removed along with all field cables.
c. The add on vibrators control panel on the West wall is to be removed along with the adjacent tilt switch controllers and field cables.
d. The dumper MCC and PLC control panels along the West wall are to be removed along with the field cables. There is embedded conduit under these panels that will be partially re-used.
e. The vibrator drive panel located in the middle of the room is to be removed along with the field cables.

2.0 Equipment Installation

The new control panels are to be installed into the electric building as shown on Drawing No. SO3497-200.

C. POSITIONER ASSEMBLY

1.0 Positioner Removal

During the outage period of the work, the positioner carriage will be removed by the mechanical contractor and the runway modifications will be installed. The electrical contractor will disconnect all cable from the carriage, positioner drive, rope take-up and truck locks as well as any field instruments for the existing positioner.

2.0 Positioner Carriage

The positioner carriage will be assembled by the mechanical contractor. The electrical contractor will provide and install all cable tray, conduit, wiring and terminations on the positioner carriage.

a. Install cable tray below the carriage platform to route the festoon cables to the various motors, junction box and devices on the carriage. The positioner arm and drive motor cables are VFD cables. Minimum bend radius requirements of the VFD cable necessitates the need to use sweep 90° bends as opposed to tight radius or Lbs. Pull boxes can be used to maintain the minimum bend radius.
b. Install the positioner junction box.
c. Install the control instruments, E-stop stations, limit switches, etc.
d. Install conduit and wiring between the junction box, cable tray and devices.

3.0 POSITIONER FESTOON

The positioner festoon will be installed by the mechanical contractor. The electrical contractor will route the festoon cables to the positioner carriage junction box and make all terminations including the fiber optic cable terminations.

Install the stationary festoon junction box and route the festoon cable into the junction box and terminate.

Provide and install cable tray from the festoon to the electric building. Route the festoon cables to the control panels in the electric building and terminate. The positioner arm and drive motor cables are VFD cables. Minimum bend radius requirements of the VFD cable necessitates the need to use sweep 90° bends as opposed to tight radius or Lbs. Pull boxes can be used to maintain the minimum bend radius.

4.0 Wheel Grippers

There are three (3) wheel grippers for the RCD2 system, one (1) at the exit end of the dumper and two (2) at the entry end.

Each wheel gripper assembly will include four (4) released limit switches, one pressure switch and two (2) solenoids. The contractor will provide conduit and wiring to connect these devices to the control panel in the electric building.

At the entry south wheel gripper, there will be two (2) photo-eyes and a wheel sensor for spotting the train. The contractor will provide conduit and wiring to connect these devices to the control panel in the electric building.

D. TAKE-AWAY SYSTEM ASSEMBLY

The take-away system is controlled by the PLC in the electric building. The motors and controls are to be wired back to the electric building using a combination of existing embedded conduit and contractor supplied new conduit and cable.

1.0 Conveyor C-16 Modifications

A new speed switch is to be installed on the tail end of the C-16 conveyor. The contractor will provide conduit and wiring to connect these devices to the control panel in the electric building.

2.0 Take-Away Conveyor Installation

The take-away conveyor motor is to be wired back to the VFD panel in the electric building. The drive motor will require VFD cable that must be run in separate conduit. Minimum bend radius requirements of the VFD cable necessitates the need to use sweep 90° bends as opposed to tight radius or Lbs. Pull boxes can be used to maintain the minimum bend radius.

A junction box is provided for the take-away conveyor. The contractor is to mount the junction box and provide conduit and wiring from the electric building to the junction box as well as from the junction box to the conveyor devices. The conveyor devices include: one (1) speed switch, two (2) plugged chute switches, four (4) alignment switches, four (4) pull cord switches, two (2) warning horns, two (2) warning lights and one (1) local control station.

3.0 Apron Feeder Installation

The four (4) apron feeder motors are to be wired back to the VFD panel in the electric building. The drive motors will require VFD cable that must be run in separate conduits. Minimum bend radius requirements of the VFD cable necessitates the need to use sweep 90° bends as opposed to tight radius or Lbs. Pull boxes can be used to maintain the minimum bend radius.

Each of the apron feeders includes a dribble conveyor mounted beneath the feeder. The dribble conveyor motors are to be wired back to the MCC in the electric building.

A junction box is provided for each of the four (4) apron feeders. The contractor is to mount the junction box and provide conduit and wiring from the electric building to the junction box as well as from the junction box to the apron feeder devices. The feeder devices include: two (2) speed switches, one (1) plugged chute switch, and two (2) local control station.

A slide gate is included in the hopper above each apron feeder. The slide gate will include two (2) limit switches and one (1) local station that will be wired to the respective feeder junction box. Additionally, an analog gate position signal will need to be wired by the contractor to the PLC panel in the electric building.

V. COMMISSIONING

The installation contractor shall not proceed with any commissioning prior to the Owner's acceptance of the installation and the entire commissioning team is on site.

Commissioning shall involve the owner, RCD/TAS contractor and its sub-contractors (as required) and the installation contractor. These personnel will be referred to as the commissioning team.

A. I/O CHECKOUT

The Electrical Contractor is responsible for verifying the integrity of the electrical system. Tests are required to be performed at various stages of erection. By performing tests at the appropriate times, erection can be carried out more efficiently and overall erection time can be minimized. In addition, faulty components can be identified early and corrective action can be taken to avoid schedule delays.

1. The contractor shall ring out all wires to ensure that they are correct and terminated per the design drawings.
2. Once the system is installed and all wires are terminated, the power to the system can be energized. Use caution and follow all plant LOTO procedures and energize only one (1) circuit at a time.
3. Energize the PLC panel and HMI. Verify the communication.
4. Verify the operation of each system input. Some of the inputs may require equipment motion and can be verified at the appropriate stage of commissioning.
5. PLC outputs can be forced from the PLC program to verify the operation of each system output. Caution must be used as some of the outputs may cause equipment motion and can be verified at the appropriate stage of commissioning.

B. MOTOR/DRIVE VERIFICATION

Each motor and drive shall be individually checked.

1. All motor and power cables are to be meagered and recorded. ***Cables must be disconnected from any electronics or VFD prior to megger checks.***
2. Motors should be uncoupled until proper rotation is verified. Once the megger tests are complete and acceptable, the motor starter or VFD can be energized to bump the motor for rotation. ***Be sure to follow all plant LOTO and safety procedures for energizing equipment.***
3. With the motor uncoupled, energize the brake and verify settings per the manufacturer manual. Verify the brake released limit switch operation and adjust as needed. Seat the brake shoes/pads with the drum/disc per manufacturer instructions.
4. Once the motor rotation is confirmed, the starter or VFD can be de-energized and the motor coupled for operation.

C. DUMPER OPERATION

Once the I/O and motor rotation is verified and the motors coupled, the dumper operation can be verified. The steps will be the same for each of the two (2) dumpers. The HMI should be used for operation.

1.0 Car Clamps

a. Confirm operation of the HPU filter loop pump.
b. Energize clamps HPU Pump #1. Verify the hydraulic system pressure is set at 700psi.
c. Manually change the tank level signal and confirm that the pump stops and HMI alarm is displayed.
d. Start HPU Pump #2 and verify system pressure.
e. Start HPU Pump #3 and verify system pressure.
f. Start Pump #1 and operate the clamps on the dumper. Run one (1) clamp at a time and verify full stroke of the cylinder.
g. With the clamp up, adjust the counterbalance valve as needed to prevent the clamp from drifting down.

h. Run the clamp all the way down, then raise it until the normal up limit is tripped; verify the correct height.
i. Run the clamp all the way up and verify the max up limit is set correctly.
j. Run all four (4) clamps together and verify that they are running at the same speed. Confirm the speed is correct per the drawings.

2.0 Dumper Rotation

a. Notify all personnel that dumper rotation will be starting. Rope off the platen on both ends so that no personnel cross onto the platen.
b. Set the dumper seated limit switch and encoder to stop the dumper prior to the seated position.
c. Set the dumper rotation speed to approximately 10%. Station personnel at each drive and ready to push the E-stop buttons. Position additional personnel around the dumper to monitor potential interference areas as the dumper rotates.
d. Using the jog station at the entry drive, start rotating the dumper at the slow speed watching for any interference and making sure that the rack and pinion gears remain properly engaged throughout the rotation. Any major gear engagement issues or interference requires stopping the dumper immediately and making corrections.
e. Once the dumper has rotated through a complete dump and return without interference, it needs to be rotated in steps to measure the backlash at each gear rack. The backlash readings are to be recorded and submitted to the REW engineer for determination of adjustments to the drive base and rack gear shims.
f. Adjust the backlash as directed by the REW engineer.
g. Set the dumper speed to the return slow speed level and adjust the seated limit switch so the yard rails align with the platen rails when the dumper stops. Set the encoder seated limit at the same point.
h. Rotate the dumper to the full 180° rotation and adjust the max dump limit switch to stop the dumper at this position. Set the encoder max dump limit to the same position.
i. Return the dumper to seated and adjust the slow down limit switch to approximately 15°. Set the encoder slow down limit switch to the same position.

j. With all of the limits set, rotate the dumper through a full dump cycle at slow speed using the dump button in the operator's cab. Verify the car clamps operation lowering on the dump cycle and raising on the return to seated.
k. Increase the speed by 10% and rotate the dumper through another full cycle. Continue raising the speed in increments until the dumper rotates through full cycle at 100% speed. Verify the clamps operation on each cycle.
l. Place an empty rail car on the dumper and verify the position of the photo-eyes and the platen wheel sensor; adjust as needed for car spotting.
m. Rotate the empty car through a full dump cycle. Verify the clamp pressures holding the empty car.

D. POSITIONER OPERATION

Once the I/O and motor rotation is verified and the motors coupled, the positioner operation can be verified. The HMI should be used for operation.

1.0 Positioner Arm

a. With the arm still cribbed in the lowered position, confirm the connecting link is installed and properly torqued; see REW's bolt torque requirements.
b. Energize the VFD and raise the arm so it is just clear of the cribbing. The brake should hold the arm in this position.
c. Set the lower limit switch at this point. Set the lower slowdown limit switch well above the lower limit.
d. Raise the arm at slow speed to 90°. Set the raised limit switch at this point and verify the encoder followed the angle correctly.
e. Lower the arm at slow speed and verify when the decel limit activates. Continue to lower the arm to the lower limit.
f. The arm can now be raised and lowered at slow speed to set the limit switches and encoder settings.
g. Continue to raise and lower the arm, increasing the speed and confirming that the limits, encoder and drive are operating correctly. Park the arm in the raised position to move on to the carriage testing.

2.0 Wheel Grippers

Perform the following checks for each of the three (3) wheel grippers.

a. Energize the air supply to the wheel grippers.
b. Verify the air pressure at the grippers.
c. Energize the set solenoid and observe the operation of the grippers. Confirm that all four (4) limit switches indicate the grippers are not released.
d. De-energize the set solenoid, energize the release solenoid and observe the gripper operation. Confirm that the grippers are released and that all four (4) limit switches indicate the same.
e. Cycle the grippers several times to confirm operation.

3.0 Positioner Carriage

a. Notify all personnel that the positioner carriage will be moving. Rope off the entire positioner area, including the tracks so that no personnel cross into the travel area.
b. Set the carriage speed to approximately 10%. Station personnel around the positioner to monitor potential interference areas as the carriage moves. DO NOT position anyone in front of the carriage arm and DO NOT ride on the carriage.
c. Using the radio control, start moving the positioner at the slow speed toward the center of the runway watching for any interference and making sure that the rack and pinion gears remain properly engaged throughout the rotation. Any major gear engagement issues or interference requires stopping the positioner immediately and making corrections.
d. Once the positioner has moved through a complete forward and reverse cycle without interference, it can be run end to end of the runway to assure the backlash of the pinion/gear rack is maintained to a minimum of .088”, the encoder gear/gear rack maintain backlash a minimum backlash of .100” and the thrust wheels maintain a clearance of less than 1/8” but not binding. Any adjustments to the pinion shafts must be done to all the pinions shafts. Any adjustments to the inboard thrust wheels to be the same adjustment to both inboard thrust wheels. Any adjustments to the

equalized wheel assemblies to be the same to both equalized thrust wheel assemblies.

e. Install pinion shaft chock bars after all adjustments are complete. Refer to Drawing No. 3005 for installation specifications.
f. Set the positioner speed to the slow speed level and adjust the forward and reverse limit switches so the positioner arm is at the correct positions for engagement with the train. Set the encoder limits at the same point.
g. Adjust the forward decel limit switch according to the drawing setpoint. Set the encoder decel limit to the same position.
h. With all of the limits set, move the carriage through a forward and reverse cycle at slow speed using the buttons in the operator's cab.
i. Increase the speed by 10% and move the carriage through another full cycle. Continue raising the speed in increments until the carriage travels through full cycle at 100% speed. Verify the decel operation on each cycle.
j. Place a string of empty railcars in front of the positioner and verify the position of the photo-eyes and the entry gripper wheel sensor; adjust as needed for car spotting.
k. Manually run the positioner and verify all settings for automatic operation.
l. Set the positioner controls into automatic and start the auto cycle. Verify that the train is spotted in the correct position and the positioner is spotting correctly to lower the arm.

E. TAKE-AWAY SYSTEM START-UP PROCEDURES

1.0 Inspect Tail End

a. Remove tail pulley guard.
b. Inspect tail pulley assembly. Note: Concentricity and alignment of tail pulley should have been checked prior to belt installation.
    i. Hub screws and set screws pulled up tight.
    ii. Bearing bolts tight to support.
    iii. Bearing block screws against bearing housing and locked.
    iv. Bearings lubricated with proper lubricant.

c. Inspect zero (0) speed switches.
    i. Read nameplate and drawing; be sure it is the proper switch.
    ii. Remove coupling guard.
    iii. Check alignment and mounting bolts.
d. Replace and secure tail pulley guard.
e. Check V-plow alignment and safety cables on return run of belt.

2.0 Inspect Loading Area

a. Visually inspect skirt adjustment. It should fit lightly on the belt.
b. Inspect loading chute and skirtboard. Remove all debris (especially welding rod).
c. Look for and remove debris on, under and alongside of conveyor.

3.0 Inspect Conveyor Run

a. Remove conveyor cover at intervals. Look for and remove debris.
b. Inspect cover for belt clearances and loose bolts.
c. Inspect idlers.
d. Move all carrying idlers forward in their mounting brackets.
e. Move all return idlers toward the tail in their mounting brackets. (This will aid belt training as the idlers should be square.)
f. Bolted connections tight.
g. Belt alignment switches in operating position.
h. Pull cord switches in operating position.

4.0 Inspect Screw Take-Up

5.0 Inspect Head End

a. Inspect drive pulley assembly (same as tail pulley, Section 1.B).
b. Inspect belt scrapers.
    i. Check scraper tension for both primary and secondary cleaners.
    ii. Check physical stops that prevent scraper from tearing the belt.
c. Inspect shaft seals. Seals fitted properly and trimmed as required.

6.0 Inspect Drive Components

a. Check nameplate on reducer with design drawing. Check size, type, horsepower, and ratio, input RPM, and output RPM.
b. Reducer torque arm bolted to frame.
c. Inspect lubrication level. If required, add per manufacturer's recommendation or specifications.
d. Confirm reducer rotation.
e. Confirm motor rotation.
    i. Should rotate in same direction as marked on reducer housing, or
    ii. If rotation is incorrect, reverse electrical leads. If rotation is now correct, proceed to Step "f".
f. Check motor lubrication. Grease per manufacturer's specifications.

7.0 Conveyor Start-Up

a. Shorter belts can usually be trained with one (1) or two (2) men.
b. When the belt is first started, it should be jogged for passage. This initial movement will provide indication of where corrections are to be made.
c. If corrections are needed, they should be made as listed below and then the same procedure repeated until the belt is running in the center of the idlers and pulleys.

8.0 Training of Belt

a. If properly erected and if the correct installation procedures have been followed, conveyor belts will usually run true with little additional alignment work.
b. If the belt is loaded on one (1) side or if the splice is not square, the belt cannot be made to run straight during both the loaded and unloaded conditions.
c. When the tail pulley has been correctly installed and the take-ups set in their proper position before the belt has been spliced, the take-up or bearings should need no further adjustment.

i. If the belt tends to run off at the loading point, it may be necessary to adjust the take-up or bearings. However, before this is done, the return idlers should be adjusted to lead the belt onto the tail pulleys in the central position. This may correct the run out of the belt coming off the tail pulley and under the loading skirts.

ii. If the belt continues to run off at the tail pulley, the take-up should be adjusted or tightened on the side to which the belt travels.

d. If the pulleys are not level, the belt will run to the lower side and the pulleys must be leveled before any other adjustments are made.

i. After the head or drive pulley has been aligned properly with the drive, it should not be moved as a training means for the belt.

e. If the belt runs off at the same location on the belt run, then the frame work is not level or the idlers are not perpendicular to the centerline of the conveyor.

i. First, check the conveyor frame and level up, if necessary.

ii. If the belt continues to run off after the frame is level, the idlers should be adjusted to guide the belt toward the center. At a point approximately 10'-0 back from where the belt starts to run off and on the side that the run out is occurring, two (2) or three (3) idlers should be moved forward. Do not move any one (1) idler more than 1/4" at a time.

9.0 Running with Load

a. After the belt has been trained empty, a light load should be applied and the loading point of each conveyor checked. The alignment of the belt should be checked on both the top and return runs for the full length of the conveyor.

b. If the belt tends to run off the idlers, the following checks should be made:

i. Check the loading chute to see that material is being loaded in the center of the belt. It may be necessary to adjust or add a baffle in the chute to accomplish this.

ii. Make sure the load is leaving the loading chute properly and not spreading too much.

iii. Check the tail pulley or idlers as covered above.

F. PERFORMANCE TEST

The performance testing is to verify the operation of the entire system working together. The HMI should be used for operation.

The system will be operated with material. The first train will be used to test the operation and make adjustments to the system under load. The system should be operated in automatic mode and stopped as needed to make adjustments.

The performance tests will be carried out according to Section 9 of the Technical Specification to demonstrate the full operation and capacity of the system.

VI. FORMS AND SUBMITTALS CHECKLIST

A. MANUFACTURER FORMS

- ☐ End Ring Flatness Survey
- ☐ End Rings Rail Survey
- ☐ Platen Flatness Report
- ☐ Sill Beam & Trunnion Survey

TAKE-AWAY SYSTEM FORMS (forms are located in Section 1.8 of the TAS2 ICM Manual)

- ☐ Mechanical: Conv BMWC Belt Conv Inspection Checklist
- ☐ Mechanical: Conv BMWC Visual Standard Belt Conveyor Inspection Report
- ☐ Structural: Struct BMWC Structural Steel Erection Record
- ☐ Structural: Weld BMWC Visual Weld Report
- ☐ Electrical: Elec BMWC Electric Motor Installation Checklist
- ☐ Electrical: Elec BMWC Electric Motor Temperature Checklist
- ☐ Electrical: Elec BMWC Vibration Analysis
- ☐ Start-Up (Commissioning): Conv BMWC Startup Procedure Belt Conveyor
- ☐ Start-Up (Commissioning): Conv BMWC Conveyor Run Time Log

B. CONTRACTOR REPORTS

- ☐ Monuments Legend
- ☐ End Ring Weld Reports
- ☐ End Ring Bracing & Securing Plan
- ☐ Dumper Lift Plan

C. ELECTRICAL (Contractor Reports)

- ☐ Termination Verification
- ☐ Communication Verification
- ☐ PLC Input Verification
- ☐ PLC Output Verification
- ☐ Power Cables Megger Reports

VII. ATTACHMENTS

- **Dumper General Arrangement Drawings**
- **Positioner General Arrangement Drawings**
- **Take-Away System General Arrangement Drawings**
- **Take-Away System Erection Drawings**
- **Piping Drawings**
- **Foundation Drawings**
- **Electrical Installation Drawings**
- **Electrical Conduit Drawings**
- **Dumper/Positioner Equipment Manual**
- **Estimated Dumper Weights**
- **Estimated Positioner Weights**
- **Dumper Field Bolt Lists**
- **Positioner Field Bolt Lists**
- **Cable Schedule**
- **TAS2 ICM Manual**
- **Estimated TAS2 Erection Weights**
- **Hydraulic Piping Installation Specification**
- **Bolt Torque Table**
- **Standard Paint Specification PS-3497**
- **Equipment Storage Procedure**