Alabama State Port Authority
McDuffie Island Terminal
Mobile, AL

Replacement of
Railcar Dumper #2 System (RCD2)

TECHNICAL SPECIFICATION

Project A218-003

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SI Designations Used in this Specification

All tonnage and tonnage rates are metric using the following SI designations:

Metric Units		Imperial Units	
t	metric tonne	T	short ton
t/h	tonnes per hour	Tph	short tons per hour
t/d	tonnes per day	Tpd	short tons per day
t/a	tonnes per annum	Tpa	short tons per annum

1 Introduction

a. Alabama State Port Authority (ASPA / Owner) is planning to replace and/or modify the existing equipment and components making up the #2 train unloading system (Project), located on McDuffie Island, in Mobile Alabama (Site).

b. Railcars currently deliver unit trains of primarily metallurgical and on occasion thermal coal to the Site to be unloaded and transferred to existing storage yards on existing equipment. The new train unloading system will allow ASPA to unload railcars more reliably and efficiently satisfying immediate needs and future production capacity increases.

c. The Design/Supply Project consists of two distinctive packages:

   i. replacement of the Rotary Railcar Dumper #2, Indexer and Wheel Chock Train Holding System (RCD2), and

   ii. replacement of the receiving hoppers, feeders, collection conveyors, transfer onto the take-away conveyor C-16 and ancillary systems (Take-away System). The Take-away System is a separate package, excluded from this Specification.

d. The new RCD2 System package consists of:

   i. replacement of the existing double rotary railcar dumper with Tandem Single Rotary Dumpers operating within the existing vault;

   ii. replacement of the existing cable drawn railcar Positioner (Indexer) with a rack and pinion driven Positioner, and

   iii. replacement of the Wheel Chock System with a new Wheel Lock System.

e. The RCD Contractor's ("Contractor") Scope of Work ("Work") covered in this Technical Specification is the RCD2 System design, supply and delivery to Site and, technical field services and assistance during construction as explained herein.

f. Drawings and other documents referenced herein and attached hereto form the basis of the RCD2 System conceptual arrangement. The intent of the conceptual arrangement drawings provided in Attachment 1 TUS2 Dwg Package **(Ref. Para. 12)** is to demonstrate the geometric feasibility and functional soundness of the retrofit project, and to identify and define as many scope items as practical that are specific to this type of brownfield project. The conceptual arrangement is not complete. The Contractor shall verify all data and be responsible for final design and performance as outlined in this Specification.

2 Scope of Work

The Contractor shall be responsible for the following:

2.1 Design & supply

a. This Specification and the Attachments hereto: (**Ref: Para. 12**)

b. The Contractor shall be responsible for the Design & Supply portion of the Project that includes, but is not limited to:

   i. Final engineering design and manufacturing of the RCD2 system to include all necessary labor, materials, equipment, controls, manufacturing, component procurement and supply, inspections and final technical documentation,

   ii. delivery to the Site (including all freight, brokerage, duties, and insurance) and,

   iii. field technical services and support during construction, startup, pre-commissioning, commissioning, testing and training.

c. The following Sub-sections provide a high level summary of the items included in the Design & Supply portion of the Work. Section references noted contain specific details.

2.1.1 General (Ref: Para. 5.1)

a. All the items covered by this Specification to be supplied and installed within the RCD2 Scope of Work shall be of the Contractor's standard heavy-duty proven design and construction with consideration given to standardized components and avoidance of custom/special components that cannot be easily acquired from the market place.

b. Contractor shall provide components as described in Attachment 3, Preferred Equipment List, to match equipment on site for commonality of spare parts.

c. The Contractor shall focus on, and make provision for, minimizing the operating and maintenance problems arising from the possible buildup of coal and coal dust.

2.1.2 Rotary Dumper (Ref: Para. 5.2.1)

a. Tandem Single Rotary Dumper assemblies with front and rear girders, blocking and guide plates.

b. Hydraulic railcar clamp system complete with break-away clamp arms

c. Platen assembly, complete with rail track and all rail hardware, centering plates

d. End ring assemblies with replaceable, sectional rails for trunnion wheels

e. Ring gear assembly (segmented, replaceable)

f. Dual wheel trunnion assemblies and support steel to vault concrete

g. Counterweight

h. Rotational drive assemblies complete with motor, gearbox, coupling, pinion, brake and drive base

i. Rotational end of travel stop brackets and buffers

j. Railcar vibration feature to assist emptying railcars containing sticky coal

k. Mechanical lockout stops to arrest any movement of the dumper barrels during maintenance.

l. First fill of lubricants and hydraulic fluids.

2.1.3 Positioner (Indexer) (Ref: Para. 5.2.2)

a. Carriage assembly

b. Arm complete with hydraulic actuator, power unit and all hoses

c. Indexer foundation design, runway, rails and hardware

d. Rack and pinion drive system

e. End stops and buffers

f. First fill of lubricants and hydraulic fluid.

g. Railcar coupling location sensing system

2.1.4 Wheel Lock System (Ref: Para. 5.2.3)

a. Hydraulic Wheel Lock systems located on yard rails at both north (“ingo”) and south (“outgo”) ends including foundation design

b. Wheel location sensors

2.1.5 Hydraulic Systems & Building (Ref: Para. 5.2.4 & 5.2.5)

a. Hydraulic systems (e.g. railcar clamps, wheel locks, positioner arm.) shall include, but not be limited to, all remote hydraulic cylinders, piping, hoses, monitoring and control devices necessary to provide complete operational systems.

b. Hydraulic Building shall be provided as a standalone item complete with: hydraulic power unit(s) servicing all hydraulic driven components.

c. HPUs outside of the hydraulic building shall be in protective enclosures

2.1.6 Automatic Lubrication System (Ref: Para. 5.2.6)

a. Complete dual line, automatic lubrication systems with pump, valves and lubricant reservoir, lubricant distribution manifolds, tubing and hoses.

2.1.7 Manual Lubrication (Ref: Para. 5.2.7)

a. Centralized and accessible manual lubrication systems complete with all hoses, stainless steel lines and manifolds

2.1.8 Fire Detection and Protection Systems (Ref: Para. 5.3)

a. Hydraulic room to be equipped with similar system as that installed by Owner in the existing MCC building (Fire detection with FM-200 waterless suppression system).

b. Hand held extinguishers suitable for type of fire likely to emanate from adjacent sources

2.1.9 Painting & Corrosion Protection (Ref: Para. 5.4)

a. Shop surface preparation and painting systems including all labor, supervision, tools, equipment, cleaning and paint materials and all other materials required to provide an effective protection against corrosion of all supplied equipment as specified herein

b. Protection of all unpainted surfaces for shipping and storage.

2.1.10 Other Requirements (Ref: Para. 5.5)

a. Preparation for shipping and storage of equipment and structures

b. Nameplates for plant and equipment identification and record purposes

2.1.11 Structural Steel (Ref: Para.6)

a. All structural steel following Structural Design Requirements as outlined herein.

2.1.12 Electrical Equipment, Devices and Control System (Ref: Para. 7)

a. Existing electrical building to be reused for Contractor-supplied electrical panels, drives, controls, etc.

b. Fully equipped, prewired operator's cab with support structure and access **(Ref: Para. 7.3.1)**

c. All electrical equipment including motor control centers, motors, variable frequency drives, starters, contactors, devices, transducers and instrumentation etc.

d. PLC, matching HMI hardware, complete set of ABB or Allen Bradley software, functional programming and detail documentation

e. Fiber optic interface hardware for PLC communications

f. All safety and service switches, warning sirens, motion strobe lights and all proximity limit switches complete with activators, flags and supports as required

g. Local control stations for all RCD2 equipment drives for testing and maintenance purposes

h. Flexible cables, cable reels or festoons, cable support system, cable transition between moving elements and stationary termination panel

i. All interconnection wiring inside supplied equipment and to field devices as required

j. All brackets and supports for fixing cable trays, conduit, junction boxes, lighting, pull boxes, switches, etc. either pre-welded to the Rotary Dumper and Positioner structure or supplied loose with predrilled mounting holes on structure

k. Hard-wired interlocks

l. Lighting for all supplied enclosures.

2.1.13 Spare Parts (Ref. Para. 10)

a. Contractor shall identify, supply and deliver critical spare parts for commissioning and for 12 months of operation.

b. Contractor shall provide a separate list of recommended strategic (long term) Spare Parts.

2.1.14 Technical Documentation

a. Contractor to provide the following Technical Documentation:

i. General arrangement and detail drawings, S/M/E arrangement drawings w/ bills of materials, electrical drawings, diagrams, as-built drawings and final alignment drawings.

NOTE: S/M/E arrangement and design drawings shall be submitted to Owner for review and comment at ~30% completion and at completion prior to release for manufacture.

ii. Installation and Commissioning Manual

iii. Operations and Maintenance (O&M) Manual

NOTE: The Operating Philosophy portion of the O&M Manual shall be provided to Owner for review and comment during the design phase of the Work.

iv. Training Manual and Materials

v. Listing and stand-alone pricing of “Special Tools”

vi. Quality Assurance Program

b. Installation and Commissioning Manual shall describe all work associated with receiving, storage on site, field fabrication, field painting and touch-up painting, assembly, S/M/E installation, commissioning and performance testing (no-load, load & performance) of the Contractor supplied equipment and components for the RCD2 System as described in this Technical Specification. The Manual shall provide complete instructions for the installation and commissioning of the RCD2 System. Special focus shall include, but is not necessarily limited to, the following:

NOTE: This Manual shall be a deliverable with the final engineering documents for ASPA to use for inquiry of installation contractor bids.

i. Structural Mechanical Erection Drawings

ii. Electrical drawings and diagrams complete with wiring and interconnection diagrams, wire specifications, cable routing, cable and conduit schedules, device locations and any other information necessary for electrical installation by others.

iii. Add standalone copies of any and all PLC programming and all commissioning drive parameters

iv. Setting, field fitting as required, assembling, aligning and final balancing of all equipment and accessories

v. All grouting and shimming under machinery and structures as required

vi. Installation of first fill of all flushing fluids and lubricants for all lubrication systems drives and bearings including hydraulic fluids

vii. Description of all labor, tools and equipment necessary to support Pre-commissioning, No-Load Tests, Load-Commissioning and Performance Testing

viii. Lubrication, servicing and maintenance records of the RCD2 and maintaining service records of work to be carried out, up to the successful completion of the Performance Test.

ix. Alignment instructions for all critical parts of the Rotary Dumper, e.g. trunnion wheels, drives, end rings, etc.

x. Alignment instructions for the Positioner carriage and rack and pinion drive

xi. Installation and dismantling instructions of temporary structures, supports, cribbing, equipment and services

xii. All required reports, installation and test protocols and schedules.

xiii. The Manual shall be updated to provide a permanent record of: performance and commissioning test data and results, field alignment and surveys and as-built conditions.

c. Operation and Maintenance Manual

i. The Operation and Maintenance (O&M) Manual shall consist of the following Sections: Operation, Safety, General Service Information, Parts Information, Routine Maintenance Schedule, Routine Maintenance Procedures, Troubleshooting Information, Component Service and Replacement and Operating Philosophy.

ii. The O&M Manual shall provide sufficient detail to allow the Owner's personnel to effectively and safely: operate, service, inspect, maintain, adjust, troubleshoot, repair, replace and overhaul all sub-systems and components of the RCD2 System.

iii. Danger, warning and caution, signage shall be posted on the machine and in the MCC building, hydraulic room and operator's cab, and shall also be clearly defined in Safety section of the O&M Manual.

iv. Lockout / tagout procedures, electrical and mechanical, shall be developed in cooperation with ASPA and the results included in the appropriate section(s) of the O&M Manual.

v. Special attention must be given to identification of and methods to control hazardous energy conditions in the O&M Manual.

vi. Contractor shall follow the safety guidelines as outlined by OSHA and ANSI.

vii. Contractor shall comply with ASPA's Access Policy (**Para 4.6**).

d. Training Materials. Contractor to provide all Training Materials used to conduct training sessions consisting of:

i. Electronic presentations and hardcopy handouts

ii. One electronic copy of each training material file in a native software format mutually agreed upon with the Owner and in pdf format

iii. Training materials shall separately address operator and maintainer audiences, and shall provide them with accurate and up-to-date reference material

iv. Training materials shall be separate and distinct from the Operation and Maintenance Manuals

e. Special Tools:

i. Describe all special tools required for major maintenance and repair activity.

ii. Contractor to provide separate pricing in the Proposal for "special tools"

f. Quality Assurance Program

i. Contractor is to describe their Quality Control and Assurance Program in the Proposal (organization & management, documented standards & specifications, shop & field inspections and record keeping, control & prevention of non-conformances, "quality process" during engineering & design, acceptance/rejection of fabrications, etc.)

2.2 Technical Services - Design & Supply

a. Contractor to provide the following Technical Services during Design & Supply portion of the Work:

i. Services of Contractor and Contractor's sub-contractors' personnel for technical consultation during detailed design, design reviews by the Owner, shop fabrication and delivery.

ii. In shop inspection and testing services, including load testing of dumper and positioner drives (motors, speed reducers, electrical controls, PLC, programming, etc.)

2.3 Technical Field Services & Support

a. The Contractor shall provide the following Technical Field Services and Support:

i. Field supervision and support consisting of: S/M/E construction / installation, startup, pre-commissioning, commissioning, and testing (no-load, load & performance) in accordance with the detailed Installation and Commissioning Manual.

b. The Contractor shall provide On-Site Training to include.

i. Sufficient information, training materials, and experienced trainers to successfully instruct Owner's operators and maintenance personnel how to safely operate, service and maintain the RCD2 System equipment under all conditions. **(Ref: Para. 2.1.14**)

ii. Contractor shall provide the services of equipment suppliers' personnel where applicable

c. On-call Staffing: Contractor shall provide 24 hour on call staffing for the first 30 days of operation following successful performance testing.

2.4 Work EXCLUDED

a. Demolition and disposal of existing Tandem Rotary Railcar Dumper, Positioner System, Wheel Chock System and Take-away System.

b. Installation and field assembly of the RCD2 System.

c. Removal of existing electrical panels inside the MCC building, hardware and wiring on the existing RCD2 System (including inside the MCC building) not applicable to the new RCD2 System electrical. To be coordinated between Contractor and Owner.

d. Foundation construction, modifications and/or replacement, including all anchor bolt supply, (as required) to dumper vault concrete, railcar Positioner and Wheel Chock System to suit Contractor's foundation designs

e. Modifications to or reconditioning of the "ingo" and "outgo" yard rail to the TUS

f. Civil work, site preparation and access (if applicable)

g. TUS area lighting

h. Sump pumps, agitators and water injection supply and install

i. Work associated with the Take-away System, e.g. hoppers, feeders, conveyor, transfers ventilation fans, service hoists etc.

j. Electrical substation and 4160V and/or 480V power supply feeder cables switchgear, circuit breakers, electrical hardware, cabling etc. terminated inside and /or located inside the existing MCC building

k. Fiber optic Ethernet cable from the Owner's PLC to Contractor's RCD2 PLC

l. Supply of lubricants after Performance Testing

m. Dust suppression system and water supply

n. Field painting and touch-up.

2.5 Boundary Limits

The boundary limits of the Work will be as follows:

a. The top of concrete with anchor bolts, by others, for the barrel trunnion support sill beams, dumper barrel drives, wheel lock equipment, hydraulic building, rotation buffer stops and positioner equipment including rack, track, festoon, end-stops, clamps, arms, etc.

b. Interface of the RCD2 based PLC communication equipment and programming with Plant system within the MCC building.

c. 4.16kV switchgear incoming terminals.

d. 4.16kV and/or 480V MCC main switch incoming terminals. Contractor to coordinate with TAS Contractor as to the adequacy of the existing 480V switch capacity for the new RCD2 and TAS2 system equipment.

e. The yard rail up to the entry and exit from the dumper barrels.

3 Design Criteria

3.1 General

a. The RCD2 System consists of Tandem Single Rotary Dumpers, Positioner, Wheel Lock Systems, complete with electrical and hydraulic systems to form a fully functional facility designed in accordance with the latest technology and standards and to perform to the requirements specified in these documents.

b. RCD2 System will be operated in a corrosive and dusty environment located in an area of high humidity and saltwater mist.

c. Gondola type railcars will enter the RCD2 System from the north, discharged in a counter-clockwise barrel rotation and advance clockwise around the existing train loop.

d. The Tandem Single Rotary Dumpers shall be designed to dump two railcars simultaneously, or each dumper can dump independently of the other.

e. The highest practicable standards of safety shall be adopted and implemented at the design stage. A formal safety review shall identify and eliminate potential risks at the outset of the Project.

f. Safe access shall be provided for the purpose of routine maintenance, operation and/or replacement of major equipment and components.

g. Industry standard and good engineering practice shall be used in the design to maximize ease of service and maintenance, access to equipment, ergonomics, ready change-out, light weight covers, easy clean-up and wash-down.

h. All major components shall be accessible by cranes. Where components are not accessible by crane, suitably sized monorails or jacking equipment shall be provided.

i. The design shall be driven by installation and removal procedures for components, providing the safest and quickest replacement when required. This includes modularity for components subject to wear, minimal adjustment and alignment requirements for components and maintainability with regard to manageable size of components. Lifting lugs shall be provided on all components.

3.2 Performance Requirements & Guarantee

3.2.1 Working Duty and Economic Life

a. The RCD2 System shall be designed for heavy-duty service based on the following criteria:

i.	Throughput (Future projection)	12 – 14 Million Tpa
ii.	Working shifts per day	3
iii.	Working hours per day	24
iv.	Working days per year (One planned maintenance outage day per month)	353

3.2.2 Design Life

a. The RCD2 System components and structures shall be designed, treated and painted to attain a 30-year Design Life (2 million cycles) based on Design Life to failure minus two standard deviations. The Contractor shall define the operating and maintenance conditions required to achieve this Design Life in an economical fashion.

3.2.3 Dumper Availability

a. The RCD2 System design shall achieve a minimum availability of 97%, as defined below:

   i. RCD2 System availability shall be calculated as the total calendar hours in a year, less the total scheduled downtime hours in a year, divided by the total calendar hours in a year. Scheduled downtime shall include Planned Maintenance plus any planned downtime outside of scheduled maintenance.

   ii. Planned Maintenance shall take no more than ~265 h/y (~3% of 8,760 h/y), in accordance with the Planned Maintenance requirements outlined by the Contractor in the O&M manual.

   iii. The Planned Maintenance program shall not consider any opportunistic time for planned maintenance during non-operating periods

   iv. The RCD2 System availability shall be calculated on a yearly basis. The dumper availability shall be warranted only for the duration of the "defects liability" period which is the same as the Warranty Period.

b. The Contractor shall provide guidelines and procedures to assist the Owner in achieving these objectives.

3.2.4 Dumper Reliability

a. The RCD2 System design shall achieve a minimum reliability of 98% according to the following:

   i. RCD2 System reliability shall be achieved over any 12-month period within the RCD2 System's specified design life.

   ii. The RCD2 System reliability shall be calculated as the time the System is being utilized, less the repair time, divided by the time the System is being utilized. Utilized time shall be defined as the time during which the System is working at full and/or reduced rates.

3.3 Unloading Rates

a. The Unloading Performance Rate is an hourly rate, at which the RCD2 is able to unload and handle one complete unit train including the time to position and dump the first cars and position the last railcars. Any breakdown or external delays caused by the railway and/or Take-away System shall be excluded. The following are the required design rates:

3.3.1 General

a. Annual Unloading Rate ~60,000 cycles/yr

   (Projected 14 Million Tpa / 236 T/cycle Tandem Dump)

b. RCD2 Unloading Capacity (Peak Design Rate - Future) 6,000 Tph

c. Nominal rates as described below for each coal product, based on present-day downstream equipment capabilities.

3.3.2 Metallurgical Coal (Primary Product Governing Design)

a. Cycle Tonnage (Tandem Dump – Met coal) ~236 T/cycle

   (Aluminum Railcars - Density @ 67 pcf)

b. Downstream Conveyors (Peak Rate – Met coal) ~4,800 Tph

(Conveyor C16 - 72" belt, 650 fpm, 35° trough, 25^0 surcharge angle, 60 pcf volumetric, 90% CEMA fill)

3.3.3 Thermal Coal (Occasional Product System Programmed to Adjust Accordingly)

a. Cycle Tonnage (Tandem Dump – Steam coal) 200 T/cycle

(Aluminum Railcars - Density @ 50 pcf)

b. Downstream Conveyors (Peak Rate – Thermal coal) ~3,700Tph

(Conveyor C16 - 72" belt, 650 fpm, 35° trough, 20^0 surcharge angle, 45 pcf coal volumetric, 90% CEMA fill)

3.3.4 Performance Rate

a. Design Performance Rate 25 tandem-car cycles per hour

(6,000 Tph / 236 T/cycle met coal)

b. Minimum Performance Rate 110 cars / Not to Exceed 4 hours

(110 cars / ~25 cars/cycle)

c. The Contractor shall submit the necessary drawings and calculations to demonstrate to the satisfaction of Owner the ability of the RCD2 System to achieve the specified Future Peak Design Rate.

3.3.5 Dump Cycles

Dump cycles shall be adjustable, varying with product characteristics and downstream conveying rate constraints. The PLC program shall allow for variability in indexing speed and dump rotation speed to account for the various modes of operation, product variables and considering the future design rate. Dump cycle conditions include the following Contractor to advise Owner the cycle time for each condition to achieve current and future unloading rates.

a. Tandem Dump w/ Metallurgical Coal

b. Tandem Dump w/ Thermal Coal

c. Single Dump (North or south Dumper) Metallurgical Coal

d. Single Dump (North or south Dumper) Thermal Coal

e. Sticky Coal Requiring Railcar Vibration and 180^0 Rotation

3.4 Coal Properties & Characteristics

3.4.1 Metallurgical Coal

a. Metallurgical coal shall be the primary product handled through the TUS System being the basis of the RCD2 System design. The characteristics of the metallurgical coal are as follows:

Table 3-1 – Metallurgical Coal Characteristics

No.	Characteristics	Metallurgical Coal
	Bulk Density (power calculations)	67 PCF
	Bulk Density (volumetric calculations)	60 PCF
	Stacking Angle of Repose	35 Deg

	Surcharge Angle on Moving Conveyor	25 Deg
	Particle/Lump Size	100% < ¾" w/ ~93 -97% <1/4"
	Moisture Content	9% - 11% as high as 13%
	Flow Characteristics	Poor
	Product Abrasiveness	Moderate

3.4.2 Thermal Coal

a. Thermal coal will be handled by the RCD2 System. The typical characteristics of the thermal coal are as follows:

Table 3-2 – Thermal Coal Characteristics

No.	Characteristics	Thermal Coal
	Bulk Density (power calculations)	50 PCF
	Bulk Density (volumetric calculations)	45 PCF
	Stacking Angle of Repose	35 Deg
	Surcharge Angle on Moving Conveyor	25 Deg
	Particle/Lump Size	Granular. 100% < ~2"
	Moisture Content	8% - 10%
	Flow Characteristics	Average to Free flowing
	Product Abrasiveness	Moderate

3.5 Railway Data

3.5.1 Unit Train

a. Unit Train 110 railcars pulled by 2 locomotives

b. Railcars shall be equipped with a rotating coupling at leading end and the locomotives with fixed (non-rotating) couplings. Maximum coupling slack action shall be assumed to be approx. 1" per coupling pair.

3.5.2 Railcars

a. Technical data of the railcars summarized below; refer to Attachment 4 Railcar Data Sheets.

i.	Construction	Aluminum
ii.	Max Gross Weight	286,000 lbs
iii.	Railcar Payload (Rated Capacity – Aluminum Cars)	~ 118 T
iv.	Volumetric Capacity	4,200 cu. ft.
v.	(Volumetric Capacity w/ 10" avg. heap)	4,598 cu. ft.
vi.	Extreme Width (Strict compliance w/ Plate C width)	10'-8"

vii.	Plate Designation	Strict Compliance Plate C width
viii.	Max / Min Height (Above Top of Rails)	14’-0” / 11’–0”
ix.	Length Over Coupler Pulling Face	53’-1”
x.	Truck Centers	40’-6”
xi.	CL Coupling height (Above Top of Rails)	34 + 0.5”
xii.	Length of box	47’-3”

xiii. Railcars assumed to be symmetrical about the centerline of the rail track. Damaged railcars, worn springs or uneven loading could result in up to 6 inches offset on either side at the top of the car.

3.5.3 Locomotives:

a. Technical data of the locomotives summarized below (Refer to Attachment 5 Locomotive Data Sheet)

i.	Locomotive Manufacturer, Model & Load Rating	GE AC4400 CW
ii.	Locomotive Plate Designations	Plate L
iii.	Gross Weight	420,000 lbs
iv.	Number of Axles	6
v.	Max Plate L Clearance Height Above rails	16’-3”
vi.	Max Plate L Width	10’-8”

3.5.4 Loop Track

a. The layout of the existing loop track and the survey of the approach and outgoing track plan and elevations are shown in Attachment 6 Train Loop Survey

b. Existing Yard Rail (Dumper platen rail to match) AREA 136 lb/yd

3.6 Operating Wind Speed

The following is the RCD2 System operating wind speed requirements

a.	Warning Wind Speed (no shut down, monitor wind closely)	20 mph
b.	Shut Down Wind speed	35 mph

3.7 Climatic and Service Conditions

a. Location Mobile, Alabama

b. Temperatures:

i.	Average Maximum (5/19 thru 9/27)	84° F (29^0 C)
ii.	Maximum Dry Bulb	104° F (40^0 C)
iii.	Average Minimum (12/1 thru 2/27	66° F (19^0 C)
iv.	Minimum Dry Bulb	14° F (-10^0C)

c. Precipitation

i.	Rainfall (Annual average)	66.29”
ii.	Extreme Daily Rainfall	7.25”

d. Humidity

i.	Relative humidity	up to 100%

e. Winds:

i.	Average speed (Jan thru Apr) (Other months lower)	~10.2 mph
ii.	Most Frequent Directions	North (Feb thru July), East (Aug thru Oct)
iii.	Maximum Hourly Speed	TBD
iv.	Maximum Gust Speed	TBD
v.	Days with Winds >35 mph (shutdown speed)	TBD
vi.	Storm wind	130 mph

f. Additional Comments

i. RCD2 System design shall be appropriate for the ambient conditions, which include marine atmosphere with fine coal dust.

ii. The RCD2 System equipment shall be suitably designed to withstand washdown sprays at 150 PSI.

iii. For the design of bearings and gearboxes, the maximum ambient shade dry bulb temperature shall be taken as 122°F and a minimum temperature of 14°F.

iv. For structural design, a minimum temperature range of 120°F, from minimum to the maximum air temperature shall be adopted.

v. Train Unloading Station will be open to the elements, i.e. not enclosed.

4 CODES AND STANDARDS

4.1 General

a. The RCD2 System shall be designed to internationally accepted standards approved by the Owner.

b. The Contractor shall state in its Proposal the standards to be applied. If the Contractor prefers to work to standards other than those specified in these Technical Specifications, Contractor shall submit with the Proposal, sufficient data, in English, to permit the Owner to judge the suitability thereof.

c. In case of conflict between standards and this Specification, the most stringent requirements shall apply unless otherwise approved by the Owner.

d. All references to codes, standards and/or material specifications shall be to the latest revision, including all effective supplements or addenda thereto, as of the date of the invitation to submit Proposals.

4.2 Mechanical Standards

a. Unless specifically noted otherwise, all mechanical components, equipment and materials to be supplied under the "Scope of Work" shall meet or exceed the requirements of all applicable codes and standards as referenced in the text and listed below:

Table 4-1. Mechanical Standards	
BS 2573 Part 2	Rules for Design of Cranes: Specification for classification, stress calculations and design of mechanisms
AGMA	American Gear Manufacturer's Association
AFBMA	Antifriction Bearing Manufacturers Association
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
FM	Factory Mutual
ISO	International Standards Organization
NFPA	National Fluid Power Association
JIC	Joint Industry Conference
SAE	Society of Automotive Engineers
UL	Underwriters Laboratories

4.3 Structural Standards

a. Unless specifically noted otherwise, all structural components, equipment and structural materials to be supplied under the "Scope of Work" shall meet or exceed the requirements of all applicable codes and standards as referenced in the text and listed below:

Table 4-2. Structural Standards	
BS 2573 Part 1	Rules for the Design of Cranes: Specification for classification, stress calculations and design criteria for structures

AISC	American Institute of Steel Construction
AWS	American Welding Society
AREMA	American Railway Engineering Maintenance-of-Way Association
ASTM	American Society for Testing and Materials
ASTM A325M/A325	High-Strength Bolts for Structural Steel Joints Including Suitable Nuts and Plain Hardened Washers
ASTM A370	American Society for Testing and Materials
IBC	International Building Code
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
SSPC	Society for Protective Coatings

4.4 Electrical Standards

a. Unless specifically noted otherwise, all electrical components, equipment and electrical materials to be supplied under the "Scope of Work" shall meet or exceed the requirements of all applicable codes and standards as referenced in the text and listed below:

Table 4-3. Electrical Standards	
ANSI	American National Standards Institute
IEEE	Institute of Electrical and Electronic Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
UL	Underwriter’s Laboratory
FM	Factory Mutual

4.5 Corrosion Protection Standards

a. The following corrosion protection standards generally apply and form part of this Specification:

Table 4-4. Corrosion Protection Standards	
SSPC	Steel Structures Painting Council, all applicable standards

4.6 Safety Standards & Procedures

a. The following safety standards generally apply and form part of this Specification:

Table 4-5. Safety Standards	
OSHA	Occupational Safety and Health Administration
ANSI	American National Standards Institute
Alabama State Port Authority Access Policy: http://www.asdd.com/portaccess.html	

5 Design Requirements

5.1 General

The Contractor shall:

a. provide all the items covered by this Specification and to be installed within the RCD2 Scope of Work and shall be of the Contractor's standard heavy-duty proven design and construction. Contractor shall notify Owner of any departure from its available and proven design and specifications unless otherwise required to suit the operation and duty specified herein

b. provide, where possible, standardized electric motors, gear reducers, shafts, bearings and all other components requiring periodic maintenance to minimize spare parts and components inventory,

c. avoid the use of custom / special components that cannot be easily acquired from the market place,

d. identify any custom / specialized parts or components in the Proposal, should they be required,

e. focus on, and make provision for, minimizing the operating and maintenance problems arising from the possible buildup of coal and coal dust,

f. furnish the necessary equipment drawings, design loads and calculations in accordance with the project schedule to enable the Owner's installation contractor to design, construct and/or modify the concrete vault, Positioner foundations, Wheel Lock pits and other foundations, where applicable to accommodate the new RCD2 equipment.

g. include time and resources to confirm the final installation foundation drawings (provided by Others) for general fit-up and compliance with Contractor's design,

h. identify for the Owner the maximum electrical power requirement for all supplied equipment,

i. provide all access platforms / walkways mounted to the rotary dumper necessary for routine inspection, maintenance and service. E.g. along platen on both sides of the rails, along the northern and southern most trunnion support beams, and to any other equipment. Access shall not compromise material flow or risk coal buildup

j. provide foundation designs for the positioner and wheel lock systems, loads, anchor bolt sizes, bolt patterns, shear pockets, etc. necessary for installation contractor to construct the foundations,

k. provide drawings showing the dimensional clearances required to avoid interferences between the dumper, vault and foundation concrete. Cutouts shall be performed by the installation contractor; example, end rings with vault walls,

l. provide all field bolts, fasteners, shims, gaskets, brackets, etc

5.2 RCD2 System Description

a. As RCD2 System consists of two (2) single dumpers in tandem, all comments herein apply to each unit.

5.2.1 Rotary Dumper

a. Dumper Barrel Rotation: The Tandem Single Railcar Dumpers shall unload all cars in a fully automatic mode. Under normal operating conditions each dumper will rotate approximately 160° and be capable of rotating 180° to allow discharge of sticky coal and to facilitate maintenance functions.

b. Lead-In Deflectors: Car lead-ins (deflector plates) shall be mounted on both ends of each dumper end rings to guide cars centrally onto the dumpers. The lead-ins shall protect the dumper, car clamp mechanisms and all other equipment, that may be damaged due to cars that are either not centrally located on the rail tracks or are leaning in either direction up to 6” due to an uneven load in the car.

c. Support Girders: The sides of each car shall be adequately and uniformly supported, during dumping, to prevent damage to the car. The dump side of each railcar shall be supported by a front (spill) girder and two car clamps. The non-dump side shall be supported by two car clamps supported by the rear girder. The dumper design shall take into consideration the loads from cars shifting laterally to rest on the blocking. Side travel movement of a centrally positioned railcar body shall be limited to a maximum of 2”.

d. Safeguards

   i. The dumper structure shall include inherent safeguards against unforeseen failure of either major individual structural and mechanical components or operating conditions that could cause loss of the machine’s overall structural integrity or its availability. These shall include, but not be limited to the following:

      - One rail car clamp not engaging
      - Failure of the hydraulic power unit motor/pump rendering railcar clamps and wheel locks inoperable

   ii. The motions of the lead and trailing couplings of a car as it is rotated in the dumper shall not cause the slope and relative positions of the lead and trailing coupling pairs to exceed the tolerance specified by the railcar manufacturer. Wheel wear and spring set shall be taken into account.

   iii. A modification allowance equivalent to ten percent (10%) of the mass of total counterweight, acting at the radius of the total counterweight center of gravity, shall be considered in the design of the dumper. The modification allowance is intended to accommodate the addition of mass to the dumper barrel as a result of modification or repair of the barrel in the future. The mass and the resulting imbalance of the barrel shall be taken into account in the design of the dumper structure, including the trunnion beams, and the mechanical components, including the dumper drives and the trunnion wheels.

e. Dumper Platen

   i. The dumper platen shall incorporate wheel guide plates to prevent derailment of the cars as they move onto and off the dumper and as the dumper returns to the seated position at the end of the dumping cycle.

   ii. Platen rails shall be installed with short independent lengths at each end to facilitate easy replacement of these rails when the ends become worn.

f. End Rings

   i. The outer flange of each end ring shall consist of a rolled structural T-section formed to the required radius.

ii. The number of flange splices shall be minimized and shall be located away from locations of greatest loading during dumper operation.

iii. Stiffeners attached to the end ring web, which bear upon the inner surface of the outer flange shall either be fitted to bear fully against the outer flange and be connected to the flange by fillet welds on both sides of the stiffener, or connected to the flange by full penetration groove welds.

iv. While making the stiffener to flange weld connections, the Contractor shall take adequate precautions to ensure minimum distortion of the flange.

v. The curved rails which contact the trunnion wheels shall be connected to the outer flanges of the end rings by bolts or bolted clips such that replacement of the rails during the service lifetime of the dumper may be performed without undue difficulty.

vi. The Contractor shall submit to the Owner for review the size, type and grade of bolts, nuts, washers, and other fasteners to be used for making the rail to flange connection; bolt tightening pattern; and means to be employed during bolting to control bolt tension.

vii. The mating surfaces of the rail and outer flange shall have the same radius of curvature about the center point of the end ring; both surfaces shall be parallel and without curvature in cross section; both surfaces shall be perpendicular to the plane of the end ring web; and the rail centerline shall correspond to the centerline of the end ring web; all within the Contractor's specified tolerances. The Contractor shall submit to the Owner, for review and approval, the permissible deviation tolerances for each of the foregoing parameters, the means to be used during manufacture to maintain the dimensional parameters within the stated tolerances, and the quality control procedures to be employed to verify that actual deviations remain within permitted tolerances.

viii. It is expected that the number of rail segments forming the rail on each end ring will be kept to the minimum consistent with the requirement to enable rail replacement during the dumper service lifetime, thus also minimizing the number of joints between rail segments (rail joints).

ix. Rail joints shall preferably be located away from locations on the end rings experiencing the largest reaction loads from the trunnion wheels.

x. The Contractor shall submit to the Owner for review, details of the method and tolerances for making rail joints.

xi. Except when welded rail joints are employed, fitted splice bars shall be employed at rail joints.

g. Railcar Clamps

i. Car clamps shall be of sufficient strength to hold fully loaded cars in a fully rotated position and shall not obstruct the fall of material during dumping.

ii. Hydraulic car clamp systems shall be designed such that if one of the clamp systems fails during the dump, the other car clamps would be capable of holding a partially loaded car at any angle of dumper rotation and arranged to complete the cycle and shut down.

iii. An alarm system shall signal, in the Operator's cab, any failure of a car clamp hydraulic system. The alarm system shall be interlocked with the train unloading control system. In the event that one or more of the car clamps fail to signal the

required engagement of the railcar at the onset of the dump, the dump shall be aborted and returned to the seated position and shut down

iv. The design of the car clamp mechanism shall provide for the possibility that during the movement of a car through the dumper, a car clamp may catch on the top of the car. To minimize the potential for damage to the dumper structure, car clamps and associated components, the car clamp arrangement will incorporate a shear-type break-away system.

v. Railcar clamp design shall provide easy access to the hydraulic cylinders for maintained and replaced.

h. Dumper Drive System

i. The drive for rotating the dumper shall be a ring gear and pinion system.

ii. All dumper drive components shall be mounted on a rigid drive base for installation by others.

iii. The drive shall be designed to withstand the peak design load inclusive of a minimum service factor of 2.0.

iv. The meshing of the ring gear and pinion rotating drive gears shall comply with the Contractor's requirements. The load classification of these gears shall comply with AGMA requirements.

v. The dumper drives shall be located at ground level for easy access and maintenance. Dumper drives shall be fitted with a failsafe system to prevent runaway in the event of a drive, brake, or power failure during the dumper operation. It shall be possible under manual control to rotate a loaded railcar the full 180 degrees and to stop the dumper rotation partway through its dumping cycle and to return the dumper to the seated position from any angle of rotation between 0 and 180 degrees with or without a car in the dumper.

vi. Buffers shall be provided to safely decelerate the dumper in an overtravel condition when returning to its seated position. The buffers and buffer supports shall be anchored to the vault foundation. In the event of an end of travel limit switch or encoder failure, the buffer design shall be capable of the dumper being driven into the buffer at full speed and with full drive torque. The buffer units shall be of the automatic resetting, reusable type. Contractor shall provide the necessary calculations to validate the design of the buffers under this extreme condition.

vii. Mechanical lock out stops, consisting of a short gear segment shall be permanently mounted for easy engagement of the ring gear to lock out the dumper barrel rotation, preventing unplanned rotation of the barrels during maintenance of the rotation drives or other parts of the dumper.

viii. Design of each of the dumper drive support platforms and/or foundations as required to be installed by others.

i. Trunnion Assemblies

i. The end ring trunnions shall be located in accessible chambers outside of the receiving hopper. Each ring shall be supported by two trunnions of two wheels each.

ii. Each trunnion assembly shall be fitted with adjusting screw arrangement to allow for horizontal adjustment of ~1-3/4".

iii. The trunnion assemblies shall be mounted on shims to allow for vertical adjustment.

iv. Jacking pads shall be provided to allow the dumper cage to be elevated and facilitate removal of the trunnion wheels.

j. Railcar Vibrator

The metallurgical coal has a high percentage of fines and moisture content causing coal to be retained in the railcars after a dump. This condition results in the need for the railcars to be vibrated during the dump. Recognizing there are several ways to accomplish this action, Owner is requesting Contractor to explain the railcar vibrator system they are offering. The following conditions should be considered:

i. Variable speed railcar vibrators

ii. Provide an excitation frequency for up to 10 secs to shake loose material remaining in the railcar

iii. Be able to pause at critical frequencies for up to 2 s each.

iv. Consider the impact of the railcar vibrator on the design of the dumper barrel and support elements for fatigue design as well as the railcar clamp system.

5.2.2 Positioner (Indexer) System

a. The Positioner shall be of a well proven design to move and position a fully loaded unit train of 110 railcars plus two locomotives and be capable of accurately locating the car couplings prior to commencement of the positioning stroke and, accurately positioning cars in the dumper(s) at the end of the positioning stroke.

b. The positioner shall be located at the ”ingo”, north end, of the dumpers, utilizing as much of the existing positioner foundation as practical. Existing foundation drawings are provided for reference in Attachment 2 Existing Vault & Indexer Foundations. The Contractor shall:

i. evaluate the existing foundation design and geometry and provide a design for a replacement positioner that minimizes demolition and rework of existing foundations to the maximum extent practical,

ii. provide drawings of the new foundation design, showing the scope of foundation rework and/or replacement required to accommodate the proposed positioner design

iii. consider the extent of foundation rework for selection of the positioner system

c. Once the first two cars are positioned in the dumper by the locomotives, the positioner shall be capable of indexing, without assistance from the locomotive, all cars up to and excluding the last railcar into the dumper. The last car will be positioned on the dumper(s) by the locomotives.

d. Positioner shall be capable of auto indexing two cars at a time or one car at a time to either dumper. (**Refer to Para 7.4** Modes of Operation)

e. Carriage

i. The positioner carriage shall travel on a runway rail track.

ii. Access shall be provided on the carriage to safely inspect equipment inaccessible from grade and to access a control station / platform as described in Para 7.4.5.

f. Drive

i. Drives shall be of rack and pinion type, electo-mechanically powered and VFD controlled.

g. Positioner Arm

   i. The Positioner arm design shall allow for both the variation of the railcar coupling centerline height due to wheel wear and spring set, and for a 2" relative settlement of the mainline track and the positioner runway.

h. Runway Track and Buffers

   i. The positioner runway track will be installed on a concrete beam foundation, designed by the Contractor and installed by others. The bases of the runway and mechanisms shall be designed with provisions to take-up settlement to a maximum of 4" from the design elevation. The positioner system shall be able to operate with a settlement, either local or uniform of 2" in the concrete foundations without the need to adjust the shims and grouting. The settlement tolerance specified shall be considered in addition to permissible coupling height variations.

   ii. Buffers and buffer support brackets shall be provided at either end of the runway. The buffers shall be capable of bringing the carriage to a controlled stop in the event that it is driven into the buffer at full speed and with full torque acting after failure of the end limit switches when the positioner arm is connected to a train. The buffer units shall be of the automatic resetting, reusable type. Contractor shall provide the necessary calculations to validate the design of the buffers under this extreme condition.

5.2.3 Wheel Locks

a. The train is secured against movement during the discharge of railcars by the wheel locks installed on the yard rails at both north ("ingo") and south ("outgo") ends. The Contractor shall:

   i. utilize as much of the existing wheel chock foundations as practical for the new system. Existing foundation drawings are provided for reference in Attachment 2,

   ii. evaluate the existing foundation designs and geometries and provide a design for a replacement wheel lock system that minimizes demolition and rework of existing foundations to the maximum extent practical,

   iii. provide drawings of the new foundation designs, showing the scope of foundation rework and/or replacement required to accommodate the proposed wheel lock design,

   iv. consider the extent of foundation rework for selection of the wheel lock system,

b. The wheel locking system shall be able to hold the impulse force from the train from the time that the locks are engaged as soon as the section of the train at the dumper stops.

c. The wheel locks shall keep the train stationary during the unloading cycle when the positioner arm is disengaged from the railcar coupling.

d. The system shall be fail-safe and, in the event of a power interruption or other failure Manual reset of the system shall be required to resume normal operation of the wheel locks.

5.2.4 Hydraulic Systems

The following requirements apply to the railcar clamp, wheel locks and positioner arm hydraulic systems, where applicable.

a. The hydraulic system's operating pressure shall not exceed 2,000 psi. All the components used for the system shall be rated for continuous operation at 3,000 psi;

b. Each hydraulic power unit shall be complete with fluid reservoir with adequately sized dry cartridge breathers, suction strainers, filters, pumps, valves, automatic controls, pipes, fittings and hoses

c. Replacement components and parts shall be available from dealer stock located in Alabama.

d. Oil reservoirs shall be protected from the effects of moisture condensation within the tanks, and shall be outfitted with water drains and heaters

e. Reservoirs with large oil volume changes during operation shall be fitted with closed-circuit air bag breathing systems

f. All pipes entering a reservoir below normal oil level shall be fitted with shut-off valves, lockable in both the open and closed positions

g. Hydraulic pipe sizes shall be selected so that the maximum oil speeds under normal operating conditions shall not exceed the values shown below

Table 5-1. Maximum Oil Speed

Application	Maximum Oil Speed
Suction lines	5 ft/sec
Pressure lines	15 ft/sec
Return lines	10 ft/sec

h. Pipes shall have welded joints where possible

i. Pipes on major hydraulic systems shall be color-coded

j. Hoses shall be kept to a minimum, and where used, shall be specified as extra heavy-duty (5,000 psi rating) and no-skive

k. Adequate lighting shall be provided around the hydraulic unit(s) to facilitate maintenance;

l. Hydraulic units shall be adequately protected and mounted to prevent damage from vibration and shock

m. Hydraulic oil shall be filtered to the strictest requirements of all component manufacturers' specifications. Oil filters shall be accessible, shall include replaceable elements, and shall be equipped with condition indicators

n. The maximum allowable oil temperature measured at the hottest areas in the oil reservoirs shall not exceed 140 °F during conditions of maximum ambient temperature. Oil coolers of sufficient size shall be provided to dissipate excess heat

o. Hydraulic oil shall be premium, anti-wear type, compatible with all components in the system, recommended by the equipment manufacturer, suitable for year-round operation, environmentally friendly and readily available in Alabama

p. Hydraulic pumps shall be direct-drive with flexible couplings. If hydraulic motors are subject to side loading, the Contractor shall supply the Owner with the motor manufacturer's ratings to prove that actual overhung loads are within the published rating for the circuit pressures used

q. Air bleed points shall be located at the top of all loops in the hydraulic system, and shall be readily accessible. The bleeding sequence shall be defined in the start-up instructions.

r. Hydraulic power unit shall be provided with a secondary motor/pump pre-piped and wired for immediate change over should the primary motor/pump fail. Design shall enable the failed component, motor or pump, to be isolated, electrically and hydraulically, from the system to enable maintenance or replacement while the system continues to operate.

5.2.5 Hydraulic Building

a. Hydraulic building, housing the railcar clamp HPU, will be located on the west side of the dumpers (non-dump side) centered on the dumper where the old hydraulic drive used to be. Foundation footprint is approx. 10'x 20' (Contractor to confirm before final design).

b. The hydraulic building will be of steel construction, fully insulated, and provided fully assembled with all hydraulic power units, controls, lighting, fire detection / protection, HVAC and necessary maintenance monorails and hoists etc. ready for installation on a foundation by others. Equipment not easily accessible from the front or sides shall be accessed from removable panels.

c. Building shall have double doors suitable to remove the largest component.

d. Contractor shall consider powering the Wheel Lock System from a common power unit located in the Hydraulic Building. This is contingent upon ensuring performance, maintainability and that the HPU location is within a practical distance of the wheel locks,

   Alternatively, if not practical to locate wheel lock HPU in the building, individual HPUs shall be located closer to each wheel lock and shall be equipped with a protective enclosure with removable panels for easy maintenance access.

   NOTE: The same type of enclosure shall be provided for the positioner arm HPU.

5.2.6 Automatic Lubrication System

The lubrication system shall meet the following requirements

a. The design of each system shall consist of a dual-line, automatic lubrication system

b. The electrical controls and wiring shall be routed to the closest junction box

c. Each automatic lubrication system shall include a high-pressure/low-pressure alarm to indicate conditions such as plugged lines, broken lines, etc. These alarms shall be tied to the condition monitoring system. The system shall also have an indicator, preferably mechanical, signifying the problem line

d. Flow rates to individual lubrication points shall be manually adjusted at the distribution metering blocks. Lubrication cycle time shall be adjusted at the pump, which will vary the frequency of lubrication to all points connected to that particular system. Individual grease quantities at each point shall be set up during commissioning

e. Distribution lines shall be made of stainless steel

f. All metering blocks shall be mounted in stainless steel cabinets

g. Tanks shall be sized to minimize refilling frequency, and each tank shall have a level indicator

h. Lubrication pipes shall be located and/or protected against falling material, and shall allow servicing and dismantling of adjacent components without pipe removal

i. Flexible lines, where required, shall be wire-braid, grease-resistant, rubber-covered non-skive hose

5.2.7 Manual Lubrication

Manual lubrication systems shall meet the following requirements:

a. Manual lubrication shall be applied to grease points requiring lubrication no more frequently than every six months.

b. All grease lines shall be grouped together to central distribution blocks that are accessible from walkways, platforms or floors.

c. Grease nipples shall be provided for bearings where appropriate.

d. All grease nipples shall be standard Alemite #A1184 button-head grease fittings.

5.3 Fire detection and Protection

5.3.1 Hydraulic Building

The following is a description of the existing system currently being installed, by Owner, in the existing MCC building and shall be applicable to the hydraulic building.

a. System shall have fire detection suitably placed to quickly detect a fire condition. The fire suppression system shall be an FM-200 waterless suppression system.

5.3.2 Fire Extinguishers

a. Additional to the automatic fire suppression system, hand-held extinguishers, complete with hangers, shall be provided and located inside and outside the MCC building, control room and hydraulic room. Hand held extinguishers shall also be located at the Positioner and the Dumper drives.

b. The extinguishers at each location shall be appropriate for fighting the type of fire likely to emanate from the adjacent sources.

5.4 Surface Preparation and Painting Design Criteria

This following paint system is for structural steel in a corrosive environment

a. General

   i. Remove all weld splatter, and grind rough welds to a smooth surface.

   ii. Remove sharp edges and corners by grinding or machining to a minimum of 1/32 inch plus radius, unless otherwise noted. Edges of bolt holes shall be deburred, but need not be rounded.

   iii. Prime, intermediate and finish painting of the internal and external surfaces of all fabricated structures, chutes, hydraulic enclosures etc

   iv. All paint shall be of the same manufacturer and applied in strict accordance with manufacturer's instructions.

b. Abrasive Blast Cleaning:

   i. Fresh water wash to remove all dirt and contamination.

   ii. Remove all oil, grease and similar materials by solvent cleaning according to SSPC-SP1, prior to blast cleaning.

   iii. Near white blast to Sa 2½ (ISO 8501-1:1988) or SSPC-SP10. Ensure that an anchor profile of 40 - 60 microns (1.5 to 2.5 mils) is achieved.

   iv. Ensure that chloride and sulphate levels on the blasted surfaces are less than 10-20 mg / cm2.

v. If oxidation has occurred between blasting and application, the surface will be re-blasted to the specified standard.

vi. Weld, grind, and re-blast any surface defects revealed by the blast cleaning process.

vii. All plates used to fabricate box / enclosed sections shall be blasted to an SSPC-SP6 prior to welding. Box / enclosed sections, unable to be painted with a minimum zinc rich primer and top coat, shall be sealed in accordance with Para 6.3.

c. Paint System:

Contractor shall propose a paint system that is equal to or better than the system requested below, suitable for structural steel in a corrosive environment.

Table 5-2 Paint System		
Surface Preparation:	SSPC-SP10	
Paint System:	**DFT (mil)**	
Primer	2-3	Organic Zinc Rich Epoxy
Intermediate coat	5-6	High build epoxy polyamide
Top coat	5-6	High build epoxy polyamide Color to be advised by the Owner
Minimum Total DFT 3 coats	12	(9 mil with alternate top coat)

d. Equipment

i. Components such as electrical motors etc. will be packaged for ocean shipment to prevent ingress of salt water and salt fog.

ii. Motors and manufactured machinery components furnished to the Contractor by others shall have original manufacture's coating suitable for use in a corrosive operating environment.

iii. Bare mechanical surfaces will be coated with a temporary rust preventative, Rus-Ban 373, 375 or equal.

iv. Galvanic corrosion will be prevented by electrically insulating dissimilar metals.

v. Care will be exercised in the selection and installation of electrical fixtures, conduits, and cable trays.

vi. Aluminum and copper alloys will be avoided.

e. Color Code

The color of the primer will contrast with the surface being painted, and the color of each subsequent coat will contrast with the previous coat and be approved by the Owner.

Safety colors in accordance with the standard MSHA will be as follows:

i. Safety Yellow will be used for designating caution, to mark stumbling, falling or tripping hazards such as protruding parts, curbing, dead ends, handrails, and kickplates, ladders, cages and equipment safety guards.

ii. Safety Red will be used to mark instruments used for combating fire, such as fire extinguishers, fire hydrants, fire stations, fire water pipes (exposed) etc.

iii. Safety Green will be used to mark first aid equipment, such as dispensaries, medicine, cabinets, gas mask containers, respirator containers, safety showers, stretchers, etc.

iv. Safety Orange will be used to promote safety and exposed unguarded hazards such as on machines or equipment that might cut, crush, electrocute or otherwise injure workers. Surfaces of machinery guards, exposed parts such as pulleys, gears or cutting devices. Electric and crane pendant switches.

f. Contractor to define in the Proposal where, if any, galvanizing of components or structures is being considered.

5.5 Other Requirements

a. Preparation for Shipping and Storage

i. All mechanical equipment shall be cleaned of dirt, grease, mill scale and other foreign matter with all finished surfaces coated with a protective material that will prevent rust formation or damage during shipment and job storage, but which can be readily removed when equipment is installed.

ii. Contractor shall prepare equipment for shipment to protect it from damage during shipment and subsequent 3-month storage.

iii. Equipment shall be completely drained of all water and thoroughly dry prior to shipment. When such draining requires removal of plugs, drain valves, etc., Vendor shall make sure that these parts are reinserted or reassembled prior to shipment.

iv. All openings and machined surfaces shall be provided with protection to prevent damage, corrosion and entrance of foreign matter during shipment and storage.

v. Threaded or socket weld connections shall be protected with screwed or snap-in (snap-on) type, securely held, plastic protectors. Cast-iron plugs are not acceptable for protection unless part of the permanent assembly.

vi. Prepared weld connections shall be protected by wooden disks that cover the entire weld end area, and are secured by metal straps and fasteners.

vii. Covers, straps or fasteners shall not be welded to equipment.

viii. Equipment shall be adequately supported for shipment. All loose parts shall be crated or boxed for shipment and appropriately identified. Where shipment is braced internally, it shall be marked conspicuously, "Remove internal braces before testing and operating."

ix. All large and heavy shipping units shall have suitable skids for moving. Crating shall also be adequate for lifting with slings. If location of slings is critical, these locations shall be marked accordingly.

x. Vendor to identify storage requirements for up to 3 months.

b. Nameplates

i. Nameplates for plant and equipment identification and record purposes shall be manufactured from stainless steel with a matte or satin finish, and engraved with black lettering of a size which is legible from a working position. The nameplate shall note the purchaser’s equipment number, the item designation, and important technical data.

6 Structural Design Requirements

6.1 General

a. The Rotary Dumper barrels and platen structures shall be of heavy duty construction and of adequate strength, stiffness and durability to withstand all loads and conditions to which it will be subjected, without excessive vibration and deflection.

b. Designs shall ensure critical components have a design safety margin appropriate for the perceived risk, maximize safety and use proven methods and materials.

c. Unless specifically stated otherwise, the design and construction shall be based on the applicable sections and latest revisions of the applicable codes.

6.2 Design Loads

a. The Contractor shall assume full responsibility for calculating all design loads including dead loads, live loads and all dynamic loads.

6.2.1 Live & Dynamic Loads

a. Live loads shall consider all loads resulting from the intended use and operation of the RCD2 equipment including the effects of:

i. Locomotive weight and dynamics

ii. Loaded, unloaded and plugged cars

iii. Traction forces (longitudinal forces transferred to the rail platen by locomotives and/or cars during train acceleration or deceleration). Contractor shall advise Owner what friction factor they use for calculation of traction forces.

iv. ASPA policy is to prohibit locomotives stopping on the dumper and restarting when pulling a string of loaded railcars. However, Contractor shall recognize the risk of such an event, outside of Owner's control, could arise.

v. Impact forces

vi. Clamping forces

vii. Normal unbalanced drive torques

viii. Loads to stairs, platforms and walkways. (Minimum 100 psf)

ix. Incrustation

x. Spillage

xi. Test loads (if in excess of normal operating loads).

6.3 Design Basis

a. All structural components shall be designed using the appropriate load factors. Deflections shall be checked using un-factored loads.

b. A corrosion or wear allowance shall be included in the design where applicable.

c. Components shall be designed to accommodate the loads and effects produced by thermal expansion and contraction.

d. Consideration shall be given to the installation and replacement of heavy items.

e. Where practical, the member and connection details shall be designed to avoid accumulation and retention of coal and coal dust or water during normal operation or wash down. Remaining areas, which would otherwise be subject to accumulation of coal fines, shall be provided with shedding plates so arranged as to not impede access to the structure or equipment for inspection or maintenance. Where pockets or depressions cannot be avoided, ample drain holes of minimum 1 inch diameter (or equivalent area for non-circular holes) shall be provided at low points in each pocket or depression.

f. Closed metal sections shall be used where possible to assist in preventing build up. Closed sections shall be sealed to prevent ingress of moisture. End cover plates of minimum ¼ inch thickness shall be installed by welding all-around on all open ends of all hollow structural sections and structural pipe members, including handrails.

g. Box structures and hollow sections shall be provided with access holes and inspection ports closed by bolted cover plates (minimum 3/8 inch thickness), lifting lugs and handles. Each cover plate shall be provided with a weather-resistant and oil resistant elastomeric seal and re-useable sealing washers under the heads of all cover plate bolts, to ensure that moisture cannot enter the hollow section. In addition, tapped drain holes shall be provided at the low points as noted below for inspection.

h. Seal welds shall not be used on faying surfaces of bolted connections and where continuous seal welding would contravene the requirements of the AWS code. In this case, the un-welded corners of the lap joint shall be sealed using a suitable sealant or caulking material prior to application of topcoat paint.

i. At all low points in all box structures and all hollow sections whose greatest cross-sectional dimensions exceed 4 inches, the Contractor shall provide tapped drain holes closed by threaded plugs to permit periodic inspection for dryness. Tapered pipe thread of minimum nominal diameter of ½ inch shall be used for drain holes and plugs. Plugs shall be stainless steel and provided with hexagonal head or square head to permit removal.

j. For all box structures which contain internal baffles, diaphragms or stiffeners, the Contractor shall provide drainage, by means of drain holes of minimum ½ inch diameter and/or corner copes in internal structural elements to ensure that any moisture, which enters any portion of the box structure, will drain to low points equipped with drain holes and plugs. Stress concentrations arising from the use of internal baffles and diaphragms shall be considered in the design.

k. Arrangements and details, which create closed areas, e.g. areas difficult to reach for welding and painting, such as back-to-back angles, shall not be used.

6.4 Fatigue Design

a. All structural details in regions of fluctuating stress shall be designed to avoid stress concentrations likely to result in excessive reduction of the fatigue strength of members and connections. Any exceptions shall be submitted to the Owner for review. Care shall be taken to avoid sudden changes of shape of a member or thickness of material and sharp re-entrant corners, especially in regions of tensile stress or local secondary bending.

b. All structural details in regions of fluctuating stress shall be designed in accordance with the provisions of AISC Load and Resistance Factor Design Specification for Structural Steel Buildings, or other standard acceptable to the Owner's Engineer. The number of cycles used in fatigue design shall be determined from the location of the component under consideration, and the design life and coal tonnages specified elsewhere in these Technical Specifications. ISO 5049/1, AWS D1.1 and other authoritative documents may be used for guidance in determining the appropriate number of fatigue cycles to be used in

design of components for which fatigue cycles cannot be directly calculated. Where the proposed fatigue design cycles cannot be directly calculated, the proposed fatigue design cycles for such components shall be referred to the Owner for review prior to commencement of final design.

6.5 Materials

a. All material used in construction shall be new and free from defects.

b. The materials selected shall be stated in the proposal documents, noting their qualifications under ASTM or other acceptable standards and their impact test properties as established by Charpy V-notch impact testing.

c. All structural steel and miscellaneous steel shall be ASTM A36 or better. Additionally, all structural steel plate 2 inch or greater in thickness shall be produced using fine-grain practice and each heat of such plate shall be subject to Charpy V-notch impact testing at 70°F to provide minimum acceptable absorbed impact energy of 27J. Mill certificates or material test reports providing chemical composition and physical properties shall be obtained by the Contractor for all structural steel. Copies of mill certificates or test reports shall be furnished to the Owner upon request.

d. Unless otherwise agreed in writing by the Owner, minimum steel thicknesses for plates and rolled sections shall be:

i.	Flanges and stiffeners	3/8 inch
ii.	Webs of rolled sections	3/16 inch
iii.	Angles and stems of Tees	¼ inch

e. Walkway and platform grating shall be anti-skid, heavy duty, hot dipped galvanized and free draining.

6.6 Connections

a. Wherever practical, connections shall be located away from highly stressed areas.

b. Work points at the intersection of connecting members shall be located to minimize eccentricities.

c. Beam connections combined with bracing connections or subject to lateral or longitudinal loads from columns, shall be designed for the combined effect of the bracing forces plus the beam reaction plus the axial force transmitted through the connection.

d. Cross bracing shall be connected at intersection points.

6.7 Bolting

a. Bolted connections shall use high strength bolts, installed fully tensioned.

b. Exclude threads from shear planes where possible.

c. Design connections where slippage cannot be tolerated (including connections subject to fatigue or frequent load reversal) as slip critical connections.

d. All structural steel bolts shall be galvanized.

e. All high strength bolts shall be supplied with raised distinguishing marks.

f. Faying surfaces of slip-critical bolted connections shall be coated with inorganic zinc rich primer or other surface coating certified to satisfy the applicable requirements. Such surfaces shall not be painted or contaminated in any other way.

g. All bolted structural connections shall have at least two bolts.

h. Minimum size for high strength bolts shall be 3/4 inch.

6.8 Liners

a. Wear plates shall be AR400 BHN and shall be placed wherever coal can come in contact with the structure. The liner thickness shall be 1/2" for impact and sliding areas.

6.8.1 Welding Processes

a. Welding methods other than electric arc welding will not be accepted.

b. All welding shall be carried out in strict accordance with the requirements of AWS D1.1.

6.8.2 Additional Welding Requirements

a. All welds shall be continuous for the full length of the joint, unless accepted otherwise by the Owner. Intermittent fillet welds shall not be used.

b. No welded joint shall be located in the highest stressed area of any structural member.

c. Field welded splices in members will not be permitted unless reviewed and approved by Owner.

d. Access holes ("mouse-holes") may be employed as required to facilitate sound groove welds. These access holes shall be no larger than necessary for access, free from sharp or re-entrant corners, and finished to be free from notches, nicks, gouges, slag and welding spatter. These access holes need not be filled with weld metal or cover plated. Access holes shall in any case not be made in highly stressed members.

e. Critical welds shall be identified in the quality control plan.

f. The Contractor shall submit the manufacturer's Test Certificates of mechanical properties and chemical analysis, for all structural steel used.

g. Contractor shall clearly identify on the drawings all critical weld areas and arrange for the appropriate non-destructive testing method of these welds, e.g. end rings, by a testing laboratory registered by the ASTM, or other approved authority. Testing procedures include, where applicable

   i. Radiographic testing

   ii. Ultrasonic testing

   iii. Magnetic particle testing

   iv. Both ultrasonic and magnetic particle testing.

   v. Dye penetration testing

6.9 Trial Assembly

a. All structural components shall be trial-assembled and match marked and/or doweled during fabrication to ensure correct fit during filed erection. The RCD2 components shall be designed to be shipped in the fewest pieces possible to minimize the number of field connections.

7 Electrical Design Requirements

7.1 General

a. MCC building: The existing MCC building will be re-used to house all Contractor supplied electrical equipment. The only electrical equipment to remain in the building will be the 4160V and 480V switchgear, a small PLC cabinet and lighting panel.

b. This section provides the electrical power and control system requirements for normal control and emergency operation of the RCD2 System. The electrical system, comprising power, control, lighting, and all associated RCD2 System electrical equipment and wiring shall be designed and supplied; pre-assembled and tested wherever possible, prior to shipment to the Site.

c. Programming, testing and commissioning of the entire electrical system shall be the responsibility of the Contractor.

d. The electrical system shall include, but is not limited to:

   i. VFDs, switchgear and MCCs

   ii. Supply of festoon cable system to feed electrical power and control signals to the Positioner and a loop system for the rotating barrel, complete with a fixed junction box, monorail system and supports, and trolleys with cable saddles

   iii. Motors and motor control equipment

   iv. Miscellaneous transducers and control devices

   v. Control power transformers and panel boards

   vi. Lighting fixtures in hydraulic building, fittings, transformers and distribution panels

   vii. Operator's and auxiliary control consoles, including all required operating and control pushbuttons, switches, indicators and instrumentation

   viii. Programmable Logic Controller (PLC) including PLC programming and documentation

   ix. Operator's cab Human Machine Interface (HMI) panel and HMI programming

   x. Fiber optic Ethernet

e. The electrical system shall incorporate only new equipment. Workmanship shall be of the highest quality. The shop installation and assembly shall be neat in appearance and in compliance with all required local, national and international codes, standards and practices.

f. All equipment and material supplied shall conform to project standards unless otherwise approved by the Owner. Refer to Attachment 3 – Preferred Equipment List for acceptable manufacturers.

7.1.1 Design References

a. All design work and content of the Installation Manuals shall comply with all rules and regulations of statutory authorities having jurisdiction over the facility in Alabama.

7.1.2 Area Classification

a. Equipment locations to be NEC Class II Division 1 Group F (combustible or conductive dust, present during normal operation for coal dust)

b. Motors shall be NEMA TEFC

c. Field panels, instruments, pushbuttons, switches, etc., shall be NEMA 4X stainless steel.

d. MCC building switchgear, MCCs, and panels shall be rated minimum NEMA 12.

7.2 Power Distribution - Standard Voltages

Table 7-1. Standard Voltages

Description	Voltage	Phase	Wire	Frequency
Medium Voltage	4160V	3	3	60 Hz
Low Voltage	480V/120V	3	4	60 Hz
Motors above 150 hp	4160V	3	3	60 Hz
Motors 1 hp to 150 hp	480V	3	3	60 Hz
Motors smaller than 1 hp	240V	1	2	60 Hz
Control Power	24VDC 120 VAC	1 1	2 2	 60 Hz
Lighting	120V	1	2	60 Hz
VFD Variable Frequency Drives input voltage can be as high as 4160V for large KW motor				

7.2.1 Process Control Equipment

a. 4-20mA DC field signals for analog measurement and control.

7.3 Equipment

7.3.1 Operator's Cab

Contractor shall provide a complete operator's cab as described below. The Owner shall approve the operator's cab layout and construction.

a. A structural platform with access stairs and external walkway to elevate the room approximately 10' from grade. Height of the cab to accommodate line of vision layout.

b. Position to be laid out to demonstrate operators have clear and reasonable lines of sight to the Positioner, railcar clamps, dumper barrels and hoppers. A line of sight dwg shall be prepared to demonstrate compliance with this requirement. Contractor to ensure operator's line of sight of dumper hoppers is not obstructed by control panel directly in front of seat. A clear inclined floor panel may be required in the front of the cab to enable operator to see into the hoppers. Operator controls shall be located in the side panels and monitoring screens located in overhead consoles are preferred.

c. Reference shelf suitable for a small microwave, eyewash station and chair. Chair shall be of heavy-duty construction and covering with swivel, height adjustment and rolling features;

d. 120 VAC duplex outlets, dimmable lights, hand held fire extinguishers, computer/operator interface station.

e. Heated, air conditioned, pressurized, and ventilated with filtered, outside air. The unit shall be sized and temperature thermostatically controlled to maintain between 60^0 F and 75 °F regardless of season;

f. All connections shall be wired to electrical terminals and shall be clearly and permanently labelled;

g. 360 deg access around cab to enable windows to be maintained

h. Fire-proof and weather-proof, safety glass windows;

i. Air-tight door with suitable locks and heavy industrial-duty door handles;

j. Designed so that internal operating noise levels do not exceed 50 dBA;

k. Space for a future CCTV monitor and system. Use of an overhead console for monitoring devices to be considered in the cab layout

l. Provision shall be made in the operator's control panel for the hardware to control the four feeders and in the PLC to operate according to product being handled. This will have to be coordinated with the Take-away contractor's design.

m. Completely assembled and wired, and fully shop-tested prior to shipment. The Owner and inspection authority having jurisdiction shall be given two weeks' notice prior to testing and,

7.3.2 MV Switchgear Assemblies

a. 4160V switchgear is currently located in the existing MCC building.

   i. Contractor shall inspect the current 4160 V switchgear and coordinate with the TAS Contractor to determine its suitability and capacity to support both the TAS and RCD2 systems.

7.3.3 480V Motor Control Centers

a. Motor Control Centers (MCCs) shall be located in the existing MCC building. MCCs shall be suitable for the voltage and NEMA 12 rating. The unit shall be a free standing structure and suitable for installation against the wall. All the electrical components shall be accessible from the front and sides. MCC building requires cable entries at top of the unit. Internal separation of the assemblies shall be conformed to IEC Form 4a.

b. 480V MCCs shall comply with the following:

   i. Motor starter unit shall be a combination of circuit breaker, contactor, overload protection unit, control transformer, wire terminals, manual reset and pilot lights outside each door. Each unit shall be fully wired and connected to the various motor drive and control systems. Contactors shall be magnetically operated and powered from 120V, single phase control supplies derived from within the starter unit. The minimum size starter shall be NEMA Size 1.

   ii. Thermal overloads shall be reset from the front of the starter door.

   iii. Each starter or disconnect switch shall be equipped with an external handle in front of the door. On each door handle there shall be provision for minimum of three padlocks to lock the unit in "ON" or "OFF" position.

7.3.4 Variable Frequency Drives (VFDs)

a. Modular type VFDs using Pulse Width Modulated technology shall be supplied as required for the TUS.

b. In general each motor requiring a VFD shall be fed from its own standalone VFD. An exception to this would be a mechanical device requiring 2 or more motors on the same device. In this case one standalone VFD would be allowed to drive all the motors on that device.

c. General Description and Construction of VFDs

i. The VFDs shall be mounted in dust tight enclosures, rated NEMA 12, with external mounted safety disconnect devices. VFDs shall be installed in stand-alone cabinets suitable for wall or floor mounting in the existing MCC building with manufacturer recommended space around for cooling.

ii. VFD cabinet internal components shall be constructed of a modular nature such that drive maintenance and replacement of parts can be done in the field with front access only and without any required removal or rear access to the main cabinets.

iii. A mechanical interlock shall prevent an operator from opening any VFD door when the safety disconnect is in the ON position. Another mechanical interlock shall prevent an operator from placing the safety disconnect switch in the ON position while a VFD door is open. It shall be possible for authorized personnel to mechanically defeat these interlocks.

iv. Provisions shall be made for locking all VFD disconnects in the OFF position with up to three padlocks. Provisions shall also be made for accepting a padlock to lock the VFD enclosure doors.

v. Current limiting fuses shall be installed and wired to the VFDs inputs.

vi. The drives shall be able to slow down a motor operating in reverse and start the same motor in correct rotation.

vii. Over current capacity shall be 150% for 1 minute.

viii. Operating carrier frequency shall be maximum 10 kHz.

ix. VFDs shall be able to develop no less than 200% of rated motor torque at .5 Hz (60 Hz base) in a Sensorless Flux Vector mode using a standard squirrel cage induction motor without an encoder feedback signal.

7.3.5 Motors

a. General

i. All electrically driven equipment shall be supplied complete with drive motor.

ii. All motors shall be horizontally mounted. If required, vertically mounted motors shall be provided with an adequately sized peaked cover to prevent dust and material from collecting on and in the fan.

iii. All motors shall be high efficiency, AC squirrel cage, induction type motors of NEMA B, design and suitable for operation from 60 Hz power.

iv. Motors shall have Class F insulation and be rated with a Class B temperature rise at full load current.

v. Motors shall have a 1.15 service factor, copper rotor and windings, and shall be rated for extra severe duty.

vi. If variable frequency drives are used, the motors shall be specifically inverter duty rated for this service.

b. Standard Voltage Ratings (Refer Para. 7.2)

7.3.6 Cables and Wiring

Contractor shall consider the following when preparing the electrical portion of the Installation & Commissioning Manual.

a. Electrical wiring and materials shall conform to the latest edition of the IEC, National Electrical 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 #12AWG copper. Insulation shall be moisture, ozone and heat resistant with moisture and oil resistant flame retarding covering, in accordance with IPCEA (Insulated Power Cable Engineers Association) specifications:

b. 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 core MV cables shall be single wire armored with an overall PVC sheath.

c. 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.

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

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

f. 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.

g. Fiber optic cables shall have loose tube construction.

h. The train Positioner shall be pre-wired by the Contractor in the shop with all electrical devices connected to terminal strips in a junction box or boxes mounted on a stationary portion of the equipment. All loose parts and cables shall be identified and supplied by the Contractor with field installation by Others.

i. The rotary dumper shall be pre-wired by the Contractor in the shop with all electrical devices connected to terminal strips in a junction box or boxes mounted on a stationary portion of the equipment. All loose parts and cables shall be identified and supplied by the Contractor with field installation by Others.

7.3.7 PLC Equipment

a. General

   i. All inputs/outputs required for the PLC from field mounted control and monitoring devices shall be wired directly to the PLC via area marshalling panels. (i.e. parallel or series connections in the field will not be permitted).

   ii. The PLC shall be sized to monitor and control all train unloading station equipment and all ancillary equipment with at least 50% spare memory capacity. It shall have at least 20% spare inputs/outputs installed. Extra space shall be provided for an additional 25% of inputs/outputs.

   iii. The PLC shall be provided with Ethernet communications protocol to allow it to connect to the Owner’s PLC system.

b. PLC & Marshalling Cubicle

   i. PLC equipment shall be mounted in separate cubicles of similar construction to the MCC. The PLC cubicle shall also contain marshalling terminals for the interconnection of field and other cabling to the PLC inputs and outputs.

ii. PLC software shall be included with the PLC and programmed by the Contractor for full operation of the TUS. Refer to Attachment 3 for preferred manufacturer and software.

7.3.8 Instruments, Relays, Control Devices, etc.

a. Instruments and meters shall be provided to adequately indicate the functioning of the equipment.

b. Ammeters shall be furnished on all 4160V starter panels, on VFDs, and on 480V starters for motors larger than 100 hp.

c. Voltmeters, with three phase voltmeter switches, shall be furnished to indicate primary and secondary voltage. Where the above is available from the electronic motor protection units, separate meters are not required.

d. Current transformers shall have sufficient thermal and mechanical ratings to withstand currents equal to the maximum interrupting and momentary current ratings of the protective equipment.

e. Instruments, panel-mounted relays and meters shall be semi-flush. All instruments, gauges, charts, etc., shall have units in the metric system of measurement.

f. In general, all panel-mounted relays shall be of the switchboard draw out type, with built-in testing facilities, and shall be fitted with targets as required to indicate operation.

g. Field mounted instruments requiring routine inspection or calibration shall be provided with rain/sun shields. Field instruments shall be sealed to IP65 minimum.

h. Field instruments shall have standard 4-20 mA output signals, isolated where possible.

7.3.9 Lighting

a. A complete lighting system shall be provided where stated in this Specification, i.e. enclosed rooms. These areas shall be fully illuminated in accordance with required regulatory standards. All lighting shall be LED type.

b. As a guide, the following minimum illumination levels shall be required:

i.	Platforms, passageways, stairways & ladders	100 lux (10 footcandle)
ii.	Operator's Cab	1000 lux (90 footcandle)
iii.	MCC building	500 lux (46 footcandle)

c. Lighting in the Operator's control cab shall be separately switched and provided with means of dimming.

7.3.10 Hopper Level Sensing System

a. A scanning system shall be provided to determine the level of product in each hopper. If the level in any one hopper is not below a predetermined level the dump operation will stop. Purpose of this system is to detect product hanging up the hopper while the downstream feeder and conveying syste continues to run. Failure of any of the downstream equipment will be interlocked with the dump operation and shut down the dump operation as is typical.

7.4 Modes of Operation

7.4.1 Summary

RCD2 unloading operation shall be PLC controlled from the Operator's cab as follows:

a. Product Selection Normal Operation – Operator to select the coal to be unloaded, i.e. Thermal or Metallurgical, for each of the Automatic Modes below.

b. Sticky Metallurgical Coal Operation: when a train arrives and the operator determines the coal in the cars is not fully emptying, operator can select the vibratory 180^0 rotation feature for each of the Automatic Modes below.

c. Automatic – Normal Tandem Dump Operation

d. Automatic – North Dumper Operation / south dumper out of service

e. Automatic – South Dumper Operation / north dumper out of service

f. Manual – Allows Operator manual control of all the functions from the Operator's cab if necessary. Operator shall have the option to perform a double dump operation should coal remain in the railcar after a dump.

g. Local – For testing and maintenance purposes there shall be local control stations to operate individual equipment.

h. Take-away System Interface: Operator must be given the ability to select the dump cycle based on the type of coal to be unloaded, (i.e. metallurgical or thermal coal) and to adjust hopper feeder speeds and/or shear gate opening with the product mode selection and the ability to individually adjust the feeder operation to ensure uniform drawdown of product in the hoppers. This product mode of operation is necessary to prevent overloading of the downstream conveyors because of the difference in the product densities and the current rate constraints of the downstream conveying system.

7.4.2 Automatic Normal Tandem Dump Operation

a. RCD Operator selects Tandem Dump and the coal and/or coal condition to be unloaded. Other preset adjustments may be required and will be determined through consultation with the Owner.

b. The TAS apron feeders speeds will be automatically adjusted to pre-determined settings (determined through testing) appropriate for the cargo handled and tandem dump operation.

c. Positioner and Wheel Locks – The locomotives pass through the dumpers and position the first two rail cars in the dumper for the initial dump. An automatic detection system shall be capable of spotting the railcar wheels and activate the wheel locks. The "Outgo" wheel locks shall not engage until the next two cars are indexed wherein the locomotives are clear of these wheel locks.

d. RCD2 Operator initiates dump sequence with momentary CYCLE START push button signal from the Operator's cab. The tandem dumpers automatically rotate to dump and return to the seated position.

e. The positioner will have engaged and locked onto the coupling of the next two upstream cars.

f. Once the dumper has completed its cycle, the train positioner automatically advances the next two railcars, both north and south wheel locks are set and the positioner returns to its starting position (two railcars) and engages with the next coupling during the dump operation. The locks remain engaged until the dump is complete and the positioner is ready to index again. Sequence is repeated until the last railcar

g. The locomotives index the last railcar(s) into the dumper with the "outgo" wheel locks holding the empty railcars.

h. The TUS operator may also index the railcars into the dumper under manual control.

7.4.3 Single Dump Operation (North or South Dumper)

a. The single car dump operation is much the same process as the Normal Tandem Dump. The operator selects the Active Dumper for the unloading process. The type coal (metallurgical or Steam) and, if metallurgical, its condition (normal or sticky). The Positioner will be pre-programmed to automatically adjust for single car indexing.

b. Dump South Operation: RCD Operator selects South Dump and the coal and/or coal condition to be unloaded. Other preset adjustments may be required and will be determined through consultation with the Owner.

   i. Locomotives position the first railcar on the south dumper

   ii. The apron feeder speeds will be automatically adjusted to the pre-determine settings appropriate for the coal being handled.

c. North Dump Operation: RCD Operator selects North Dump, type of coal and condition similarly to South Dump.

   i. Locomotive positions the first railcar at the face of the north dumper, north wheel locks set, loco is uncoupled from the train and moves clear of the south dumper. during north dumper rotation. For safety reasons this would be concern. Locos should be clear of the dumper regardless of which dumper is operating.

   ii. First railcar is manually indexed onto the north dumper, north wheel locks set, railcar dumped, positioner indexes second car, north wheel lock sets, dumps and third railcar is indexed, both north and south wheel locks set and locos recoupled to the train. Normal single car automatic dumping operation is initiated. Compressed air is available should the railcar brakes begin to set when loco is disconnected. Or an accepted procedure to minimize loco operation on barrels

7.4.4 Manual Mode

a. In the manual mode, the train positioner, wheel locks and car clamps shall be individually controllable from the HMI on the operator's panel located in the RCD2 operator's cab. All safety interlocks shall be active, railcars accurately positioned, wheel locks set before dump and railcar clamps automatically activate with dump signal, etc.

7.4.5 Local Mode - Maintenance

a. In the local mode, the train positioner, wheel locks and the dumpers shall be fully controllable from individual local control stations located at grade elevation.

b. The local operator's station for the train positioner shall be mounted on the train positioner, with a secured platform, such that a clear view of the arms is possible at all times.

c. A local JOG-STOP control station shall be provided for each dumper drive and the positioner drive for maintenance purposes and shall be located adjacent to each drive.

d. The local control station can only be activated when the RCD operator selects Jog on the Auto-Off-Jog selector switch inside the cab.

7.5 Safety Interlocks

The safety interlocks shall include but not be limited to the following:

7.5.1 Control System

a. The control system shall automatically verify, for rotation to continue, that the wheel locks are set, that the car is properly located in the dumper and the railcar clamps are set before the dumper reaches a given rotational angle that ensures the railcar is resting on the blocking panels. When these conditions are satisfied a READY TO DUMP light shall appear on the central operator's panel.

b. The control system shall also verify that the dumper cycle is complete and the dumper fully seated and the railcar clamps and wheel locks are released before the positioner may advance.

c. The operator's panel shall provide control in automatic, manual, or local mode and shall include the AUTOMATIC-MANUAL-JOG selector switch.

d. Local operator's stations for both positioner and dumpers shall only be active when JOG mode is selected on the operator's control panel. All local motion controls shall be spring-return-to-off stopping equipment motion when switch is released.

e. Control circuits shall be energized at 24 VDC from sources within the dumper system.

f. Locomotive detection shall be provided and interlocked with the dumper to sense presence of locomotive in dumper barrel and prevent rotation.

7.5.2 Position Encoders and Sensing Systems

a. The train positioner shall be provided with an absolute position encoder and a railcar coupling location sensing system directly linked to the PLC for all normal position limits.

b. One discrete proximity type limit switch shall be provided for each encoder and positioned such that the switch is operated once during each normal motion of the positioner. This limit shall be used by the PLC to check and correct the calibration of the encoder and alarm if the error exceeds a pre-set alarm limit. If the error exceeds a second, higher set-point, the machine shall shut down.

7.5.3 Overtravel Limits

a. Each motion shall be equipped with discrete over-travel limit switches, which shall stop all motions when actuated. Over-travel limits shall be hard wired to stop their respective motion.

7.5.4 Emergency Pull Cord

a. Across each free end of the dumper there shall be an emergency pull cord system. Each pull cord shall extend from approximately the circumference of the end ring in towards the center of rotation to a point just outboard of the clearance envelope. The pull cord shall be located at a height of 3 feet above grade.

7.5.5 Programmable Logic Controller (PLC)

a. A PLC shall be implemented for all internal dumper and positioner control logic which does not involve human safety.

b. Safety controls including emergency stops, all personnel safety devices and equipment overtravel devices shall be hard wired to the associated starter in MCCs and/or VFDs with indication to the PLC.

c. The data handling capability of the PLC shall be used to transmit and receive status, permission and trouble signals over a fiber optic data highway to the PLC or PC in the designated substation at the Site.

d. The PLC shall be packaged in a suitably rated enclosure with doors equipped with gaskets, and shall be located in the MCC building.

e. Remote I/O, supplied by the Contractor, shall be located in the control cab for all cab control functions. An HMI panel, supplied and programmed by the Contractor shall be located in the operator's cab.

f. An adequately rated (minimum for 30 minutes full operation after normal power failure) UPS shall be provided for the PLC.

7.5.6 Local Operator's Stations

a. Local operator's stations shall be approved for the location in which they are installed. The minimum stainless steel enclosure classification shall be NEMA 4X.

b. Local operator's stations shall be waterproof.

8 Commissioning

a. The installation contractor shall not proceed with any Commissioning of any RCD2 equipment prior to the Owner's acceptance of the RCD Contractor's Installation & Commissioning Manual as described in Section 2.1.14 and the Contractor's technical commissioning personnel are on Site.

b. Commissioning shall involve the Owner, the RCD Contractor and its subcontractors (as required), the TAS Contractor and its subcontractors (as required) and the installation contractor. Herein after referred to as the Commissioning Team. Commissioning shall include, but not be limited to:

   i. Pre-commissioning tests including lubrication, drive rotation, control sequence, input/output, grounding and continuity tests;

   ii. Cold Commissioning tests to check the operation of the RCD2 System in isolation from the Take-away System;

   iii. Full-load Commissioning tests in conjunction with the Take-away System equipment;

   iv. Compilation of punch-list of items required to complete construction and prompt resolution thereof; and,

   v. Inclusion of all final testing and commissioning data into the final Installation & Commissioning Manual.

c. The RCD Contractor shall be responsible for supervising and supporting all stages of Commissioning associated with its Work, and shall recognize that a significant time interval may transpire between the Cold Commissioning and Full-load Commissioning. Specialists and necessary tools shall be provided by the RCD Contractor to assist with start-up and calibration of the equipment to ensure performance.

d. RCD Contractor's field personnel shall be capable, qualified and able to perform the duties required to the satisfaction of the Owner and shall be vested with authority to make decisions binding on the RCD Contractor.

e. Prior to Commissioning, the RCD Contractor shall conduct safety walk-throughs with the Owner's staff. These walk-throughs will review the safety provisions of the Work and may trigger remedial actions that must be completed before Commissioning may start.

f. Also prior to Commissioning, the RCD Contractor shall review the lockout procedures outlined in the Safety section of the O&M manuals for any new, replacement or modified equipment in consultation with the Owner.

g. During Commissioning, the RCD Contractor shall furnish necessary technical services as required to resolve preliminary operating problems as they develop. Commissioning shall not be complete until satisfactory operation is achieved.

9 Performance Test

a. The RCD2 System Performance Tests shall involve the Owner, the RCD Contractor and its subcontractors (as required), the TAS Contractor and its subcontractors (as required), and the installation contractor Herein after referred to as the Commissioning Team. The Performance Test shall be based on the following:

   i. RCD2 and TAS Systems shall be operated in the Normal Tandem Dump, North Dumper Operation and South Dumper Operation Modes with various coal conditions as described in Section 7.4 and herein.

   ii. Be executed following successful completion of Full-load Commissioning;

   iii. Verify dumper motor currents operate within the motor and VFD ratings;

   iv. Show proof of locomotives passing through the dumper with designed clearances;

   v. Demonstrate the RCD2 System's ability to achieve the desired Performance Rate as specified in Para. 3.3.4.

   vi. Demonstrate the RCD2 System's ability to unload railcars according to the operational performance conditions presented in Section 3.2.

   vii. The unloading tests shall demonstrate the RCD2 System's Normal capacity and Ideal capacity as noted below:

b. Normal Cycle

   The Normal Cycle Time test shall demonstrate the RCD2 System's ability to unload under simulated sticky coal conditions assuming the following parameters:

   i. One 110-railcar train with 2 locomotives.

   ii. 180° rotation for each railcar with a 10 second pause in the 180 degree position for vibration. Only ten of the railcars will be vibrated if sticky coal does not exist to prove the vibratory system.

c. Ideal Cycle

   The Ideal Cycle Time test shall demonstrate the RCD2 System's ability to unload railcars under the typical conditions handling metallurgical coal with no pauses:

   i. One 110-railcar trains with 2 locomotives.

   ii. 160° rotation for each railcar with no pauses and no vibration.

   iii. The railcar cycle time shall be determined by the RCD Contractor such that is satisfies the Performance Rates outlined in Para. 3.3.4, excluding the first two railcars that are manually positioned.

d. In support of the Performance Tests, the Owner will ensure that adequate train(s) are available for unloading, the remainder of the downstream system is operational and performing at the required desired rate, and the appropriate storage yard capacity is available. If any down-stream delays occur, the system will be paused immediately before a dump cycle, and the pause time will not be included in the cycle time.

e. No delays shall be attributable to the RCD2 System during the Performance Tests. Any cause for interruption attributed to the RCD Contractor shall be resolved to the satisfaction of the Owner and the test repeated.

f. If the Guaranteed Performance data is attained during the Performance Tests, the RCD Contractor shall prepare an acceptance report, which shall be immediately signed by the RCD Contractor and the Owner. This report shall be considered a correct and complete record of the Performance Test. If the Guaranteed Performance data is not attained, the Contractor shall repair the deficiencies and repeat the Performance Test.

10 Spare Parts

a. Contractor shall prepare a detailed list and breakout cost in the Proposal pricing for all critical short term recommended spare parts necessary for:

   i. Commissioning and start-up

   ii. Twelve (12) months of operation

b. Contractor to prepare a similar list and cost breakdown for recommended strategic (long term) spares for ASPA's future consideration. .

11 Contractor's Proposal

The Contractor's proposal shall include the following as identified in this Technical Specification

11.1 Acknowledgement of Technical Specification

a. Contractor shall acknowledge their Proposal is in compliance with this RCD2 Technical Specification and if not, clearly identify all deviations, exceptions and exclusions to the requirements outlined herein.

b. The Contractor shall advise the Owner of any recommendations that could improve safety, efficiency, availability, reliability, throughput or functionality, or that may have a significant impact on the cost or operation of the Dumper.

   Such recommendations shall be priced as options to the base Proposal.

11.2 Proposal Pricing

Contractor shall breakout the following pricing and information as requested and referenced by paragraph herein;

a. Special Tools (**Ref: Para. 2.1.13.a.vi**)

b. Technical Field Services & Support (**Ref: Para. 2.2**)

   Contractor to provide estimated number of hours, duration, rates and expenses, for the following Technical Field Services & Support defined herein

   i. Field supervision and support beginning with installation thru performance testing.

   ii. On Site training

   iii. On-call Staffing

11.3 Additional Information

Contractor shall provide the following additional information in their Proposal as requested and referenced by paragraph herein;

a. Identify all proprietary, custom and/or special parts and/or components not easily available in the market place. **(Ref: Para. 5.1.c)**

b. Railcar vibration: explanation of the type of railcar vibrator system being offered. **(Ref: Para. 5.2.1.j)**

c. Submit Contractor's Quality Assurance Program

12 Attachments

a. Attachment 1 – TUS2 Drawing Package

b. Attachment 2 – Existing Vault and Indexer Foundation Drawings

c. Attachment 3 – Preferred Equipment List

d. Attachment 4 – Railcar Data

e. Attachment 5 – Locomotive Data

f. Attachment 6 – ASPA Rail Loop Plan and Profile Drawing

END OF SPECIFICATION