

SPECIFICATIONS
FOR
ONE (1) SHIP LOADER

AT

MCDUFFIE COAL TERMINAL
DOCK NO. 1
MOBILE, ALABAMA

FOR

ALABAMA STATE PORT AUTHORITY



REVISION: 0



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SECTION 1 - SHIP LOADER CHARACTERISTICS (MINIMUM REQUIREMENTS)

1.1 GENERAL DESCRIPTION AND PERFORMANCE

The scope of these Specifications shall include, but not necessarily be limited to, the design, supply, delivery, transportation, erection and testing of a traveling, rail-mounted ship loader, trailer and collapsible type tripper, complete with all other items contained in these Specifications, ready for service at the McDuffie Coal Terminal, Dock No. 1, Mobile, Alabama for the Alabama State Port Authority. The Loader shall comprise a rail mounted, electrically powered, traveling tower, gantry type structure capable of loading coal at a minimum discharge rate of 4500 metric tons per hour (defined at the rate at which coal can be transferred from a dock conveyor to vessel sizes ranging from 35,000 DWT, to Panamax 75,000 DWT, to Cape 150,000 DWT).

The loader shall be capable of a minimum outreach of 40 ft. (12.19m) to maximum outreach of 100 ft. (30.48m) from the centerline of waterside rail to centerline of telescoping spout. It is required that the sizing, motion and conveyor speeds, and capacity be based on the following:

- Material
 - Material description – Metallurgical Coal
 - Max. Lump size – 2” x 2”
 - Material density – 50 lbs/ft³ [801 kg/m³]
60 lbs/ft³ - [961 kg/m³]
 - Moisture content – 5 ~ 15%
 - Angle of Repose - 35 ~ 40° – 37.5° for design

The Loader shall be equipped with luffing and telescoping type boom or shuttle type boom, capable of being moved to clear the design vessels’ structures. For luffing type, safety hatches shall be provided to secure the boom in its raised position, suitably interlocked with operating motion.

The Loader shall be completely equipped in all respects with electric motors, motor controls, boom luffing and telescoping machinery, shuttling machinery (if used), traveling machinery, telescoping spout and rotating spoon, conveyor systems with chutes and hopper, trailer and collapsible type tripper, compatible with the existing dock conveyor, electrical protective devices, emergency and operating brakes, operator’s cab, machinery enclosures, all other essential items required to provide a complete, efficient and “trouble free” operating installation.

The Loader shall be equipped to operate manually from operator’s cab or remotely with wireless controls, to maximize the efficiency of loading. Simultaneous conveying with any one of the other Loader motions (luffing, telescoping boom, shuttling boom (if used), gantry and telescoping spout/spoon). Remote control of individual operations, for maintenance purposes, will also be included.

The boom telescoping shuttle movement shall be capable of extending the boom conveyor to any position from its fully retracted to fully extended limits and must be able to accomplish this movement if the boom is inclined up to 40 degrees above horizontal, in order to lift the loading spout over the hatch coaming of larger vessels. The operating incline (luffing) of the boom conveyor can vary from 8 degrees below horizontal to 12 degrees above the horizontal. The boom luffing can be raised from its lowest horizontal position to a fully raised position to clear the fender line. If shuttle type boom is used, the boom conveyor and telescoping spout will be capable of any position from maximum outreach of 100 ft. to minimum near waterside leg.

The boom hoist or shuttle drive(s) and all electrical equipment shall be mounted upon the Loader structure with a properly accommodated protective enclosure. The electrical control equipment to be housed in a separate air-conditioned enclosure. The gantry drive system shall utilize totally enclosed reducers, without any open gearing. Structural, mechanical and electrical design, the loading condition, stability and duty cycles shall be as defined in the Specification and shall comply with the statutory requirements for safety, etc., as defined in Section 2.6.

The structural fatigue life, mechanical durability and electrical thermal sizing requirements shall be based on the design rated loading capacity. The Loader shall be capable of continuous duty cycle operations at speeds up to full speed with the weight of material and shall comply with the requirements of the F.E.M. standards, Section II, "Rules for the Design of Mobile Equipment for Continuous Handling of Bulk Materials". The duty cycle requirements and FEM classification are provided in later sections of these Specifications.

The Loader shall be easily maintained and suitable for operation in the atmosphere conditions described in Section 1.6.

These Specifications contain many references to "equal to" or "ASPA approved equal." It will be ASPA's right and discretion to approve or disapprove a Contractor's alternative proposed supplier.

1.2 CAPACITY

Rated Design 4500 MT(metric tons)/hour

(Based on the coal delivered by a dock conveyor, with 72" belt width at a speed of 720 ft./min. The belt is located 33.0 ft. (10.06m) above the waterside rail.)

1.3 PRINCIPAL DIMENSIONS AND MINIMUM OPERATING SPEEDS

The speeds and dimensions below are noted as minimum only. The Loader's design must be based on achieving the capacity ratings noted above. Speeds and/or dimensions must be increased as necessary to achieve the ratings.

Maximum Outreach from waterside rail (centerline rail to centerline maximum spout location)	30.48m (100 ft.)
Minimum Outreach from waterside rail (centerline rail to centerline minimum spout location)	18.29m (40.0 ft.)
Gage (Distance Between Rail Centers)	18.29m (60.0 ft.)
Rail	135 lb/yd (75mm width)
Belt	72" width
Boom conveyor	72" width
Trailing conveyor	72" width
Minimum Telescoping Spout Distance	15.2M 50ft.
Boom conveyor	720 fpm
Trailer conveyor	720 fpm
Clearance of Boom Structure Above Rail (Under Operating Conditions) (at 12 degrees for luffing type)	22.8m (75.0 ft.)
Clearance Under Portal	12.19M 40 ft.
Boom hoist time (from level to stowed position)	6 minutes
Boom Telescoping	15 m/min (50 ft/min)
Boom Shuttle (if used)	15m/min (50 ft/min)
Gantry travel	30.5 m/min (100 ft/min)
Minimum Number of Wheels Per Corner	4

1.4 PERFORMANCE AND DUTY CYCLE

The Loader shall be capable of simultaneous loading and any other one motion (luffing, telescoping, shuttle (if used), telescoping spout/spoon, and gantry), along with all the necessary conveying components. All components and equipment shall be designed or selected to meet the most rugged, uninterrupted, bulk handling applications in extreme climatic and atmospheric conditions. Mechanical and electrical equipment shall be selected for the critical cycle involved, plus torque ratings and thermal heating capacity.

The Contractor shall submit a theoretical duty cycle analysis for each drive prepared by the electrical control system supplier which verifies the adequacy of the selected equipment for the specified cycle. Each submittal shall include, but not be limited to, calculations and catalog information which substantiates the equipment design. (See Section 3.6)

1.5 MINIMUM DESIGN CRITERIA

The Loader will comply, unless noted otherwise, in all respects with the current legislation and relevant regulation of the F.E.M. Section II, document FEM 2 131/ 2 132 "Rules for the Design of Mobile Equipment for Continuous Handling of Bulk Materials", and relevant other design standards noted in these Specifications. The Loader shall be designed for continuous duty rating with service life greater than twenty-five (25) years and for continuous twenty-four (24) hours operation per day. The Loader shall be designed according to the following classification:

Complete Machine:	A8
Structural Components:	E8

The drive mechanisms shall be designed according to the following classifications:

MECHANISM	CLASS OF UTILIZATION	SPECTRUM CLASS	GROUP
Boom and Trailer Conveyor	T9	L4	M8
Boom Shuttling (if used)	T5	L4	M7
Boom Luffing	T5	L4	M7
Boom Telescoping	T5	L4	M7
Gantry Traveling	T5	L4	M7

Classifications of individual structural and mechanical components shall be consistent with classification of the structure or mechanism containing the component.

1.6 GENERAL OPERATING ENVIRONMENT AND CONDITION

The Contractor shall study the onerous climatic conditions which exist, as failure to do so may result in the production of a Loader and equipment unsuitable for the required application. The site of the works in Mobile, Alabama is in an area of high and low temperature and high humidity, which in conjunction with a salty, coal dust-laden marine environment produces very severe corrosive conditions. The design features, all material and equipment supplied and the protective treatment of steelwork must be designed for the following conditions:

<u>Item</u>	<u>Low</u>	<u>High</u>
Electrical	-10°C	40°C
Mechanical	-10°C	40°C
Structural	-10°C	40°C
(Plus allowance for solar radiation that may increase surface temperature to 50°C)		
Relative humidity	Up to 100%	

The Loader and equipment will be designed to operate with minimum maintenance in the defined conditions, and care must be taken to ensure against overheating of the electrical and mechanical equipment, especially where exposed to direct sunlight.

The Loader and its components shall be designed for wind loads as specified by local codes, but no less than those specified in Section 3.3, Loader Design Loads.

The Loader and its components shall be provided with appropriate lightning protection.

1.7 TELESCOPING SPOUT AND ROTATING SPOON

The telescoping spout and rotating spoon is to be suspended from the discharge end of the conveyor with a hinged device which shall allow the spout to be tilted by hydraulic mechanism for loading.

The telescoping spout shall be provided with a telescoping stroke of 50 ft. (15.24m). A height indicator shall be provided in the cab to indicate relative height of the spout. Telescoping shall be activated by an electrical winch. At the end of spout, it shall be equipped with a rotating spoon which shall be designed to be removable by quick disconnect clamps. The operator shall have complete control of the spoon from operator's cab and via wireless remote station. The control of spoon shall be variable and shall allow operator to position the spoon in and out of the flow of material, elevate and rotate to allow maximum "throw" of material, for distance and direction. The spoon shall be oversized as required so that there is no loss of material capacity. In order to service spoon, or stow, in the case of luffing boom, the boom shall be fully raised, shuttle retracted and spoon assembly lowered to a platform attached to A-Frame. If shuttle boom type crane, the spout shall be retracted to a location over dock and platforms be provided, as necessary, for maintenance. Spout shall have a hydraulic mechanism to tilt spout up to 25° for loading.

1.8 COLLAPSIBLE TRIPPER AND TRAILING CONVEYOR MECHANISM

The collapsible tripper, which is to interface with the existing dock conveyor, and the trailing conveyor shall be provided as an integral part of the Loader. The tripper shall be capable of being raised or lowered depending on the mode of operation. It is preferable that the hoisting system (raising/lowering) shall be by means other than hydraulic, unless specifically approved otherwise by ASPA. The design of mechanical and electrical systems for trailing conveyor shall be identical to that required for boom conveyor and other pertinent sections of the Specifications.

1.9 LUBRICATION

Speed reducers, enclosed gears, and gear type couplings shall be oil lubricated. High-pressure button type grease lubricating fittings shall be provided for all sheave bearings, shaft anti-friction bearings, sleeve bearings, pins and surfaces in sliding contact, and equalizer pins.

Pins shall be drilled and grooved annularly at the midpoint of each bearing member. Each bearing member shall have separate lubrication passage and fitting. Motors shall be lubricated at the manufacturer's plant and utilize a different type grease fitting. Wire ropes shall be internally and externally lubricated by the manufacturer with the manufacturer's recommended lubricant.

The Contractor shall submit a schedule indicating their complete lubrication plan, technical specification, and recommended maintenance procedure. (See Section 5.11).

1.10 CONTROL SYSTEM

An ASPA-approved electrical Loader control system shall be provided. Unless otherwise approved, the control systems for the boom hoist, telescoping boom, boom shuttle (if used), gantry, telescoping spout and conveyor drives shall be, AC adjustable voltage/frequency, stepless, regulated, and reversing over the entire range of speeds.

A uniform electrical control system be provided by a single manufacturer of electrical control equipment. The systems shall include power conversion units, required transformers, switch gear, filters (if required), power-factor correction (if required), circuit breakers, motors, fully digital speed regulated drives, programmable controllers, I/O devices, maintenance and diagnostic devices, and all other equipment necessary for safe and efficient Loader operation. Enhanced on-board electronic fault diagnostic and Loader management systems shall be provided as an integral part of the Loader drive controls and the controls shall include semi-automatic stacking and reclaiming.

For the transformer and the high voltage switchgear, with application approval from the electrical control system supplier (including full compliance with all relevant codes and regulations, NEC, UL, etc. for an installation in the USA, ASPA will consider a Contractor's direct supply. Final decision on scope of supply will be at ASPA's discretion, after discussions with Contractor and electrical control system supplier during design review.

Contractor shall provide state-of-the-art AC control systems for the Loader, as furnished by ABB, TM-GE or Owner Approved Equal.

1.11 REMOTE AND LOCAL CONTROL STATIONS

A Wireless Remote Control system shall be furnished, to provide control for boom luffing, boom telescoping, boom shuttle (if used), telescoping spout and spoon, conveyors, tripper and gantry motions. (All motions required for normal loading operations.) In addition, remote stations for maintenance purposes, shall be provided for control of each individual motion, including tripper. (See Section 7.3) Actual location shall be approved by ASPA.

1.12 POWER SUPPLY

Planned electrical power supply to the Loader is 4,160 volts, 3 Phase, 60 Hz through Contractor supplied cable and cable reel. (See Section 6.2) Power factor and harmonic filtering equipment shall be provided, if required, to achieve the system performance specified. Contractor shall verify specifications, power supply, power factor correction and harmonic filtering requirements with site acceptance.

Loader electric power supply will be taken from local cable termination box(es). The Contractor is responsible to install and terminate the trailing power cable and fiber optic cores. Termination shall be performed as required by local codes.

1.13 SITE ACCEPTANCE

The Contractor shall ascertain, by visiting and inspecting, that all conditions at the Erection Site have been considered in the design of the Loader, including the severe climatic and atmospheric conditions, gantry runway interface conditions, dock conveyor and tripper/trailer runway conditions, and that the Loader(s) can operate effectively without any restrictions due to conditions at the Erection Site. The Contractor shall submit this in writing to ASPA prior to delivery of the Loader to the Erection Site.

The maximum rail loads are as follows:

The gantry arrangement shall be based on wheels spaced, as required to meet allowable rail loads and maximum overall Loader width.

Operation Condition (Landside and Waterside)

Vertical – 40.2 t/m

Transverse – 0.75 t/m

Stowed Condition

Vertical – 53.5 t/m

Transverse – 4.0 t/m

The maximum stowage pin loads per rail are as follows:

Waterside – 95 tonnes
Landside – 115 tonnes

The maximum tie down loads per corner are as follows:

Waterside – 75 tonnes
Landside – 75 tonnes

All loads above stated in metric tons.

Rails are 135 lb/yd. type with 75mm width, and installed to the following tolerances:

Rail Centers - $\pm 1/4$ inch
Maximum out of level, one corner of Loader leg to other three ± 1 inch
Top of landside rail is 75mm lower than top of waterside rail

Site acceptance shall include resolution of runway interface conditions including Loader rail size, relative elevations, tie downs, stowage pin sockets, rail bumpers, dock conveyor and tripper/trailer runway, cable trough, power supply, any obstructions (light poles), erection loads, existing conveyor details two existing conveyors and structures (to be removed for roll-off) and shipping clearances.

1.14 DRAWING INDEX

The drawings included with these specifications are as follows:

1-1: Dock #1 – Project Site Location

G-1: Luffing Type Crane

G-2: Shuttle Type Crane

SECTION 2 TECHNICAL REQUIREMENTS

2.1 STANDARD SPECIFICATIONS

Reference to Standards or any other Mandatory Documents in this Specification relates to their latest issue current at the time of placing the order.

The Specification is written on the basis of F.E.M. Section II, document FEM 2 131/2 132 “Rules for the Design of Mobile Equipment for Continuous Handling of Bulk Materials”. Other applicable equivalent Specifications will be considered.

Electrical work and equipment shall conform to the latest editions of NEMA, IEEE, NEC, UL and other applicable local codes, agencies or bodies having jurisdiction at the Erection Site.

The Loader shall comply with applicable portions of the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA).

2.2 WORKMANSHIP

All work shall be done in a thorough workmanlike manner and shall follow the best modern practice in the manufacture of high-grade machinery. All work shall be performed by workmen in their particular trades.

All welders, welding operators and tackers shall have been certified as qualified for the materials, processes and type of weld being performed, by an independent testing laboratory within six (6) months prior to performing any work. The qualifying standard shall be A.W.S. The certifying laboratory shall be approved by ASPA.

Certification of the qualifications of each individual welder, tacker and welding operator, and each procedure shall be furnished to ASPA’s Engineer. Welds installed using unqualified procedures or welding performed by non-certified welders shall be subject, at the discretion of ASPA’s Engineer, to removal by and at the Contractor’s expense. Welders shall have qualifications displayed on their person for easy identification.

All electrical wiring works shall be undertaken by qualified electricians for the type of installation work being performed.

2.3 MATERIALS

All materials shall be new and unused and shall ensure reliability and durability under the operating and environmental conditions. Materials shall be suitable for exposure to the environmental conditions or shall be effectively protected from them. Should the local codes or the environmental conditions at the Erection Site be more restrictive than herein specified, the materials shall meet the more restrictive requirements. See Section 1.6 for general operating environment and conditions.

All materials or combination of materials shall be selected for maximum corrosion resistance.

Aluminum or aluminum alloys shall not be used for housings, fans, blowers, motors, motor brakes or other weather exposed parts and components unless otherwise indicated in these specifications or approved by ASPA. Aluminum alloys may be used for window frames.

Ferrous components, not contained in weatherproof enclosures, shall be either: (a) hot dipped galvanized after fabrication, (not less than two (2) ounces per square foot), and before painting, if painting is required over the galvanized parts, or (b) treated with special method according to Sweden industry standard or SSPC-SP10 and painted immediately. Painting shall be as specified in SECTION 8 "Cleaning and Coating". Cadmium plating is not acceptable.

All screws, bolts, nuts, washers, pins, studs, springs, small wire ropes and other miscellaneous fastenings and fittings shall be of corrosion resistant materials such as monel or stainless steel, unless otherwise specified or approved by APSA on a case by case basis.

Material for stainless steel enclosures shall be a minimum thickness of 2.0 mm, 316 stainless steel.

Sheet material used for enclosures (non stainless steel, where allowed) shall be a minimum thickness of 3.0mm.

Materials shall be designated on the Contractor's Drawings. Designation may be explicit or may be by reference to generally accepted standards, whose requirements establish the suitability of the material for the intended use in the design. Plates and pipes to be formed shall have the rolling direction indicated on the shop drawings.

Where possible, plates shall not be subjected to through plate tension, and, where unavoidable, they shall be inspected by UT methods to detect lamination. If lamination is found, it will be reported to ASPA's Engineer and the plate shall be rejected or the Contractor shall submit a repair scheme which shall be accepted or rejected by ASPA's Engineer.

Forging or casting drawings shall be prepared by the forging or casting source showing the elongations for test specimens and the orientation of the specimens. The drawings shall be approved by the Contractor's Engineer verifying that the test specimens will be truly representative of the critical sections of his design. The verified drawings shall be furnished to ASPA's Engineer.

The critical end properties of parts required to be heat treated by other than the prime mill source, and the method and basis for acceptance or rejection of parts requiring nondestructive testing shall be shown on the Contractor's Drawings.

The Contractor shall maintain material traceability for all structural members from the prime mill source through all manufacturing processes to and including each finished part. Original mill test reports, showing conformance to all specified requirements, shall be furnished for all material. Random samples for destructive batch tests shall be required to verify the mill test reports. Certification papers shall be required from all sources who determine chemistry, cleanliness, mechanical properties and notch toughness properties. The Contractor shall provide all items in connection with these requirements at no additional cost to ASPA.

Where possible, material for the main structural members shall be domestic to the country where the Loader is manufactured. The intent of this requirement is to maintain the relationship between the Contractor and his supplier. The Contractor shall be responsible for the procurement, installation and testing of all materials and parts of the Loader to insure that he turns over to ASPA an operable Loader capable of unloading coal from vessels on a repetitive basis with only routine maintenance required.

Material specifications for load bearing parts shall specify minimum chemical, physical and mechanical properties including both toughness and steel cleanliness, and shall require verification tests and certified test reports. The method(s) and temperature of testing, sampling procedure and criteria for acceptance or rejection shall be as herein specified.

Material used for structural stiffeners shall be the same material as the plate to which it is attached.

Where material does not conform to a relevant current ASTM Specifications, sufficient information shall be provided for ASPA's Engineer to identify the mechanical, electrical and chemical suitability of the material.

All primary structural members will have a notch ductility of the 3.5 kpm/cm² class measured in accordance with ISO sharp notch test ISO R 148. Test temperature shall be as required by FEM for the minimum Loader ambient temperature specified in Section 1.6. Steel plate toughness verification testing requirements shall be as per ASTM A709 as appropriate for fracture critical and non-fracture critical members.

The minimum thickness for load carrying structural plates and rolled sections shall be 8mm.

Keys shall be accurately fitted in an approved manner and shall have stops to prevent slackening or accidental disengagement except where the position of a key makes the fitting of a stop unnecessary. Couplings shall be keyed to their respective shafts and the two halves of the couplings shall be connected together by turned and fitted bolts. Motor couplings shall be of the flexible type.

Welding shall be carried out in accordance with the requirements of AWS D1.1 and other relevant A.W.S. Standards including those for dynamically loaded structures. The Contractor shall comply with ASPA's Engineer's requirements to establish that he can make satisfactory welds with the type of electrodes and welding procedure he will use in the Loader

Loader manufacture. The suitability of electrodes, welding procedures and operators shall be determined by satisfactory completion of the tests described in A.W.S. as applicable.

The Contractor shall take all necessary measures to prevent distortion of the steelwork during, or as a result of, welding.

If ASPA's Engineer so requires, the Contractor shall furnish ASPA's Engineer or the ASPA's Representative with one (1) copy of all purchase orders written in the English language to vendors for material procurement or manufacture. These will be furnished on the same date as issued to the vendor or for manufacture.

Should any question arise on the part of ASPA as to the quality or identity of any materials or equipment incorporated into the Loader, or as to the quality of any work performed thereon or in respect thereof, the Contractor shall bear the reasonable cost of furnishing evidence that the quality of such materials, equipment, or workmanship complies with the requirements of this Contract, or if such materials, equipment, or workmanship are not specifically covered by this Contract, that the same are of the intended quality.

2.4 ENCLOSURES

Weatherproof or watertight enclosures of the hood latch type shall be used in all locations permanently exposed to the weather. Weatherproof enclosures shall as a minimum comply with NEMA 4X and be of stainless steel construction. Outdoor enclosures which may be exposed to streaming water shall as a minimum comply with NEMA 4X and be of stainless steel construction and vertically mounted.

Junction boxes, terminal boxes, outlet boxes, and similar fittings in locations exposed to weather shall be made of stainless steel or other approved corrosion resistant material. Cover screws shall not extend into boxes or any other weathertight enclosures.

Supports and structures shall be designed and braced to withstand the vibration encountered in the Loader.

Panels shall be accessible and removable from the front. Adequate access for service and maintenance shall be provided in front of all panels.

All covers of machinery and panel enclosures shall be hinged and shall be capable of being opened to fully expose and allow removal of panels and/or other equipment mounted inside. Latches shall be provided to secure all covers when opened for servicing; such latches shall be adequate to secure covers in high winds.

2.5 GLOSSARY OF TERMS

Bearing - The compressive load on an interface.

Brinell	-	A hardness test to determine resistance to penetration and is occasionally employed to obtain a quick approximation of tensile strength.
Brinell Hardness Number	-	A number related to the applied load and to the surface area of the permanent impression made by a ball indenture (symbol HB).
Buffer Effects	-	The resulting loads on the structure in terms of the deceleration imported to the equipment by the buffer in use.
Conveyor Loads	-	Refer to Section 3.3 for definition.
Dead Load	-	Refer to Section 3.3 for definition.
Ductility	-	The ability of a material to deform plastically before fracturing.
Duty Cycle	-	The theoretical cycle of operation as defined in Section 3.6, which shall be the basis for establishing minimum equipment ratings of mechanical and electrical parts.
Duty Cycle Load	-	Refer to Section 3.6 for the definition.
Earthquake Load	-	Refer to Section 3.3 for definition.
Emergency Stopping of the Telescoping Chute	-	The chute shall have level limit switch such that when chute is blocked, the switch shall issue “Emergency Stop” signal stopping the boom trailer and dock conveyors.
Incrustation	-	The material accumulation on the equipment from spillage, etc.
K/H	-	The symbol for kilometers per hour.
Lateral Load	-	Refer to Section 3.3 for definition.
Material Load	-	The material loads carried on conveyors.
Mechanical or		

Physical Properties	-	The properties of a material that are associated with elastic and inelastic reaction when force is applied, or that involve the relationship between stress and strain.
Metric Ton	-	A metric ton is 1000 kilograms (symbol MT).
N/M ²	-	The symbol for newtons per square meter.
N/mm ²	-	The symbol for newtons per square millimeter.
Non-destructive	-	Includes all test methods that do not impair the serviceability of the material, part, or assembly under test.
Notch Ductility Test	-	A dynamic test in which a selected specimen, machined or surface ground and notched, is struck and broken by a single blow in a specifically designed testing machine and the energy absorbed in breaking the specimen is measured.
Operating Wind Load	-	Refer to Section 3.3 for definition.
Set	-	The strain remaining after the complete release of the load producing the deformation.
Stowed Wind Load	-	Refer to Section 3.3 for definition.

2.6 SAFETY

As a minimum, all equipment must be designed and furnished to the standards required by statutory requirements, the requirements of the U.S. Department of Labor, Occupation Safety and Health Administration, the requirements of FEM 1.001 and generally to the reasonable satisfaction of ASPA's Engineer.

SECTION 3 DESIGN CONDITIONS

3.1 OPERATION FUNCTIONS AND MODES

The primary operational function of the Loader shall be to load coal to vessels up to 150,000 DWT, within all ranges of tide and draft such that there is no interference between vessel and Loader during normal operation. Receiving coal from an existing dock conveyor shall be through the use of a collapsible tripper and trailing conveyor integral with the Loader, positioned on the dock conveyor structure. Loading positions of telescoping spout shall be changed by the boom hoist, luffing and/or telescoping, shuttle boom (if used), telescoping spout and spoon, and travel motions of the machine.

3.2 STOWED MODE

When not in operation, the Loader shall be stowed with the boom secured, gantry secured, and all securing and stowage devices in place. Storm wind tie-downs shall be applied. Equipment heaters shall be automatically energized.

For maintenance and/or positioning purposes, with the securing devices released, reduced speed gantry, boom luffing/telescoping, boom shuttling (if used) and telescoping spout, motions shall be operable from the local remote control station(s).

3.3 LOADER DESIGN LOADS

The Contractor shall design the Loader for all possible loads and load combinations. As a minimum, the following loads, in the combinations as set forth in the F.E.M. Standards for “The Design of Mobile Equipment for Continuous Handling of Bulk Materials”, shall be considered:

CONV	Conveyor Load	Belt tensions, chain tensions which have effects on the structure.
DYN	Permanent Dynamic Effects	The dynamic effect of the falling masses at transfer points, the rotating parts of machinery, the vibratory factors, as acting locally.
DL	Dead Load	The weight of the structure, including chutes and all machinery and equipment permanently attached, which present a constant magnitude and position on the machine.

EQ	Earthquake Load	Earthquake loads shall be as per local codes for leg lift/stability calculations. For structural design, 0.2 (DL + ML + IL) acting in any horizontal direction.
IL	Incrustation Load	The material accumulation on device based on the specific density.
ML	Material Load	The material loads carried on conveyors, transfer chute and a fully “plugged” telescoping spout, based on the bulk density specified.
WLO	Operating Wind Load	The load due to an operating wind pressure of 10 psf (which includes drag and gust factors) assumed uniform over the full height of the Loader applied in the least favorable direction, including diagonal wind.
NRL	Nominal or Design Rated Load	The throughput received or delivered by the machine under normal working conditions.
SKW	Skew Load	The reactions resulting from the traveling movement of the unit under a skewing angle.
PIL	Peak Instantaneous Rate	The maximum practical throughput used for sizing equipment where flow surges are expected. It is the maximum rate that the machine will move in operation.
MRL	Maximum Average Rate	The maximum operational throughput for short term, uninterrupted operation.
EQS	Stowed Earthquake Load	A minimum load of 0.2 (DL + IL) but no less than local code requirements.
WLS	Stowed Wind Load	The load due to a stowed base wind speed of 130 mph. The wind force shall be considered to be acting in the least favorable direction, including diagonal wind and the basic pressure to be acting in accordance with F.E.M. 1.001. Stowed wind load shall use the specified wind

specified wind at the base of the Loader and prorate increased pressure at corresponding heights as per FEM.

The Loader's design shall include consideration of the torsional forces and movement which are developed due to the activation of motors and drive systems, the eccentric application of horizontal and vertical forces to structural girders and components, and the effect of unequal elevations of rails.

3.4 LOAD COMBINATION

The loads described above shall be combined in all possible combinations with simultaneous operations occurring in the most severe directions. The combinations shall be as stipulated in F.E.M. Section II, Document 2 131/2 132", Rules for the Design of Mobile Continuous Handling of Bulk Materials".

3.5 SPEEDS

The minimum speeds of the boom luffing and telescoping, boom shuttle (if used) and gantry shall be as listed in Section 1.3. The speeds must be increased as necessary to achieve the nominal (design) rated and maximum rated Capacities.

3.6 DUTY CYCLE

The theoretical duty cycle for use in calculating times and equipment ratings of the boom luffing and telescoping, boom shuttle (if used), conveyors, telescoping spout and gantry drive systems shall consist of the cycle requirements in the loading of a typical Cape size vessel, as noted below.

For a general loading procedure:

- a) The conveyors will start up in the following sequence – boom conveyor, trailing conveyor, and dock conveyor.
- b) With the conveyor sequence in operation, the boom is suitably positioned by luffing/telescoping or shuttling. The vertical height of telescoping chute and location of spoon is adjusted by operator based on a height indicator in the operator's cab.
- c) The machine is operated with maximum capacity. The boom position and height are adjusted. The telescoping chute and spoon are adjusted. The machine is traveled. This procedure is continued until vessel hold is at capacity.
- d) Each motion accelerates travels and decelerates at the maximum rating in which the equipment is designed. One motion with conveyors are simultaneous, as per required design, and conveyors are operating continuously.

- e) The above cycle is repeated indefinitely.
- f) The wind load is 50% of the WLO.

The Contractor can submit an alternative duty cycle for review by ASPA, if it meets or exceeds the above or Industry Standards for this type equipment.

SECTION 4 STRUCTURAL SPECIFICATIONS

4.1 GENERAL

The Contractor shall have the structural analysis of the Loader performed and or carefully and thoroughly reviewed by a qualified professional structural engineer, registered to practice structural engineering in his state of residence or country of residence. He shall be experienced in design of Loader structures and shall sign each calculation sheet and structural drawing, certifying that he is responsible for the adequacy of the structural design. He shall visually inspect the completed structure and satisfy himself that the classification of members, joints, and other details required for the fatigue stress analysis is appropriate and that no attachments or fixtures of any kind other than those designed on the drawing have been attached to the structure. The responsible structural engineer shall certify in writing that he has reviewed the completed structure and that it is constructed in accordance with his design assumptions.

The criteria specified herein represents minimum acceptable standards. If, in the Contractor's opinion, any of the standards specified are inadequate or insufficient for the use intended, it shall be the Contractor's responsibility to use more stringent criteria.

All structural calculations including structure finite element analysis shall be submitted for ASPA's Engineer's review.

Structural design shall be based strictly on FEM (for shape factors, etc), and only the stability calculations, wheel loads, tie downs loads and stowage pin loads shall be based on the results of the wind tunnel tests.

4.2 LOADER STRUCTURE

The structure shall consist of Trapezoidal Box-type construction for the main and upper A-Frame with four (4) legs. The boom shall be a truss type design (plate girder design shall be considered by ASPA), with sufficient fatigue resistance and torsional stiffness. The gantry frame shall be connected to the gantry trucks through equalizer beams and the upper frame shall be connected to the gantry frame by welding, resulting in a complete structural unit.

The trailer conveyor structure shall be a fixed single type, and of I-beam construction. Horizontal structural members shall be provided on the trailer frame for support of the cable reel, mechanical and electrical house, if arrangement requires, transformers and other miscellaneous equipment. The trailer is supported at its four (4) corners by idler trucks (non-driven) supported on the existing dock conveyor rail system. The components of the trailer trucks and the gantry trucks shall be identical.

A collapsible tripper shall be provided as described in Section 1.8.

A wire rope boom hoisting system is preferred and would be connected to the waterside end, for raising and lowering the boom structure (for shuttling, if that type system is used), to appropriate working locations (Alternatives will be considered by ASPA). A counterweight system (if necessary) shall be supplied complete with all necessary components, with design load stamped in the counterweight, in an easily visible size, indicating the total weight of the counterweight and the ballast.

The boom hinge pins (if luffing/telescoping type boom used) shall be mounted in self-aligning bushings or bushing type bearings and be readily replaceable. Access shall be provided to allow the boom hinges to be easily accessible for maintenance and lubrication, and to allow for replacement of the boom hinge pin bushings or bearings.

The boom telescoping mechanism shall be a gear and pinion system. The fixed boom section shall be provided with a "stroke" limit switch to restrict the maximum and minimum extension distance of the shuttle boom.

If shuttle boom type used the shuttle shall be accomplished by a wire rope haulage system, meeting all the applicable requirements noted for boom hoist (luffing) system.

All members shall be amply proportioned to provide a rigid structure. Maximum deflections for operating conditions shall be included in the calculations submitted to ASPA's Engineer for review. In addition, deflections of members shall be limited to such that operations are not impaired and the Loader operational requirements are not affected. The Contractor shall submit calculations and supporting documentation which proves that the proposed deflections meet this criteria. The calculated vertical deflection shall be submitted for review by ASPA's Engineer.

Excessive vibrations of the Loader or vibrations harmful to the Loader shall be avoided.

All members, except where not practical and approved by ASPA, shall be made airtight by seal welding. Sealed members shall be pressure tested to 1.5psig using soap film to demonstrate air tightness. All airtight structures shall be designed for air test loads and calculations submitted for review by ASPA's Engineer.

All interior surfaces of non-airtight structures shall be primed, coated with an intermediate coat of paint, and provided with drains.

Pockets, where water or dirt may collect, shall be avoided. Where unavoidable pockets are formed, drains shall be provided so that water can drain regardless of the position of the boom.

Box members, in which access is required, and main member field joints that are not permanently sealed, shall have access manholes for inspection. Edges of openings shall be raised such as would result with doublers. Bolted covers with neoprene rubber gaskets, or ASPA approved equal, shall be used to cover the opening.

Steel plate diaphragms shall be provided inside box-type members to back-up all concentrated loads and connections.

Shop and field erection lugs that will not interfere with the operation of the Loader or personnel and are not detrimental to the Loader's appearance shall be left on the Loader for potential hangers of painting scaffolds. The structure shall have sufficient lugs for painting and maintenance purposes. All welding, including that required to install platforms, ladders, electrical wiring, terminal boxes, limit switches, etc. shall be completed prior to painting.

The design shall carefully consider fatigue and shall provide transition elements (corner gussets, sloped thickness changes, etc.) to minimize affect of stress concentrations.

The design shall avoid as much as possible welding in areas where high stresses and/or considerable fatigue stresses might occur. Intermittent welding shall not be permitted in areas exposed to the atmosphere (See SECTION 8 for description of "areas exposed to the atmosphere.").

4.3 CONNECTIONS

All connections shall be detailed so as to provide for a ductile frame structure capable of withstanding yielding without brittle failure. ASPA's Engineer may require redesign of connections that, in his opinion, cause unnecessarily high stress concentrations and/or restraint.

Bolted splices of box members shall not be used unless necessary and approved by ASPA's Engineer. All splices shall be designed to preclude entrance of water between plates by means other than caulking. Splices details are subject to review by ASPA's Engineer.

Connections shall be designed for member loads based on the average of the allowable and the calculated stress, but they shall be designed for not less than 75% of the allowable strength of the member. Notice that whenever calculated stresses are less than 0.5 times allowable stress, the 75% requirement applies.

Stress at weld throats shall be calculated as the vector sum of individual stresses applied to the weld throat. For fatigue design when calculating stress range, the vector difference of the greatest and least vector sum stress may be used instead of the algebraic difference.

Welded joint design shall conform to applicable provisions of AISC and AWS requirements for dynamically loaded structures.

"Wrap around welds" (fillet welds on opposite sides of a common plane of contact between two parts) shall be interrupted at a corner common to both welds. Connections shall be detailed such that "wrap around welds" do not occur.

Intermittent welding shall not be permitted in areas exposed to the atmosphere, (including interiors of non-airtight structures and the interior of the Electrical House).

Bolted joints shall be provided in accordance with the “Specification for Structural Joints using ASTM A325 or A490 Bolts” or other ASPA approved recognized international standard. A490 bolts shall be used only with approval of ASPA. The surface of all plates or members intended to be joined together shall be in contact over the whole area, and where stiffeners are necessary, they shall bear tightly both at the top and at the bottom. Prying action and bolt fluctuating stress shall be considered. The faying surfaces of all main structural friction-type bolted connections shall be machined.

All bolts 12mm or less shall be stainless steel. High strength bolts shall not be galvanized. All bolts shall have a maximum of 2 to 3 threads remaining after tightening.

Pins shall not be used for connections subject to reversal of loads in the operating condition.

Eyebars shall be designed in accordance with AISC Specification using 0.9 times AISC allowable values, and shall be checked for fatigue using the allowable net section stress range for Class F details. If the net section is governed by fatigue, then all other proportions shall be increased on a basis consistent with the AISC requirements.

4.4 MINIMUM LOADS

The loads to be taken into account shall include, but are not limited to, all loads listed in Section 3.3 and as noted in F.E.M. Section II, Document 2 131/2 132.. Loads due to temperature effects, erection stresses, and other special loads based on the Contractor’s experience shall be included in the analysis if they cause significant stresses. If rational analysis indicates loads larger than specified, the larger loads shall be used.

The structure shall be designed to withstand the load combinations listed under the above noted F.E.M.

The supporting structures of gantry bumpers shall be designed for the calculated load in bumper direction and an additional load perpendicular to the bumper direction of a magnitude of 10% of the calculated bumper load.

The Loader shall be capable of traveling over occasional portions of gantry rail where tolerances of rail centers are 100% in excess of those specified without buckling or yielding of any structural member.

4.5 MINIMUM LOADER STABILITY

Under operating and stowed conditions, the Loader(s) shall have a stability factor (ratio of stabilizing moments to overturning moments) not less than that noted in F.E.M., including the conditions created by “plugged” telescoping spout. Worst case angled wind effects shall be

be included.

Uplift forces in tie downs resulting from horizontal loads on stowage pins shall be considered. Unless otherwise approved, appropriate tie downs shall be installed at corners of the Loader.

Stability and wheel load calculations shall be submitted to ASPA's Engineer for review.

4.6 ALLOWABLE STRESSES

The allowable stresses for operating conditions, overload conditions, stowed conditions and fatigue shall be as specified.

Flat and curved plates subject to buckling and crippling shall be analyzed using BS 5400, Part 3, or other ASPA approved recognized classical buckling theory. As a minimum, coefficients against buckling and crippling established in the B.S. Specification shall be used.

The basic allowable bearing stress for pins shall be as follows:

Rotating Pins:	0.4 F_y (F_y = Elastic Limit)
Non-Rotating Pins:	0.8 F_y
Equalizer Pin:	0.25 F_y (Operating Combinations)
	0.4 F_y (All other combinations)

4.7 STRUCTURAL MAINTENANCE PROGRAM

The Contractor shall provide recommendations for a Structural Maintenance Program for the Loader and hoists (if provided). This program shall include inspection intervals, locations, and procedures, reporting procedures, repair procedures, and a detailed description of the methods used to determine inspection intervals.

The program shall have a rational basis utilizing fracture mechanics principles.

The Contractor's Structural Engineer shall review the program and he shall certify in writing that he has reviewed the program and is satisfied with it. The program shall be included in the Maintenance and Inspection Manual (see SECTION 13).

The Contractor shall provide either portable or permanent access ladders and platforms at all inspection locations described in the Contractor's Structural Maintenance Program. Access for inspection shall be provided to all critical areas of the structure and must meet applicable safety laws and regulations and be submitted to ASPA for review.

4.8 AS-BUILT WHEEL LOAD TEST / VERIFICATION

The Contractor shall confirm that the Loader as-built wheel loads comply with the specified maximum rail loads prior to shipment of the Loader from the Fabrication Site by weighing of the component assemblies. After erection of the Loader the weight shall be verified again prior to final load certification at the Erection Site. Verification shall be accomplished by jacking all wheels (together) on the corners until they are clear of the rails and determining the wheel loads by means of a calibrated load cell or hydraulic jacking system. The weight measurements shall be repeated a minimum of three (3) times. The Contractor shall submit a written test procedure for ASPA's Engineer's review at least six weeks prior to testing and a written report of the results. It is recommended that the as-built wheel loads are verified prior to operating the Loader.

If the results of this testing reveal that the as-built condition of the Loader does not comply with the specified structural, mechanical or electrical standards as set forth by these Specifications, or if the maximum rail loadings are exceeded, it shall be the responsibility of the Contractor to make any necessary changes to the Loader to bring it back into compliance. Any proposed corrective action must be provided in writing to ASPA's Engineer for review prior to implementation.

SECTION 5 MECHANICAL SPECIFICATIONS

5.1 GENERAL

The mechanical analysis of Loader components shall be performed or thoroughly reviewed by a qualified Mechanical Engineer. He shall be completely experienced in design of Loader components and shall sign each calculation sheet and mechanical drawing, certifying that he is responsible for the adequacy of the mechanical design. All mechanical calculations shall be submitted to ASPA's Engineer for review.

The mechanical parts shall be designed to withstand all possible combinations of loadings with appropriate durability and safety factors. The design classifications and allowable stresses of the mechanical components will be in accordance with F.E.M. Section II, document FEM 2 131/2 132, "Rules for the Design of Mobile Equipment for Continuous Handling of Bulk Materials".

Mechanical parts shall have thermal and mechanical ratings as required by the loads and the theoretical duty cycles defined in Section 3.6.

Mechanical calculations shall be submitted to show compliance of mechanical parts with requirements of this Specification and shall include, but not be limited to, the following:

- * Stress and durability calculations of all load-bearing parts not having published catalog ratings.
- * Calculations verifying the rating adequacy of standard catalogued items.
- * Calculations verifying that the required speeds, accelerations and decelerations will be attained.
- * Calculations verifying the traction requirements of gantry drive (braking and gantrying in high wind).

Published catalog data shall define the rating criteria of the component and the safety or service factors applied.

All welding and stress relieving of machinery parts shall be in accordance with AWS D1.1, latest revision and other applicable AWS standards. Welding in highly stressed areas shall be avoided as much as possible. If welding is required in these areas, attention shall be paid to proper welding procedures, weld preparation and smooth machining of welds to improve the fatigue resistance.

Stress concentration factors used in the calculations for fatigue considerations shall be as determined by tolerances and class of finishes on the shop drawings.

Parts shall be constructed so they are readily accessible for easy repair, maintenance, and inspection. Openings around wire rope drums shall not exceed 150 mm clear and shall have toe plates in accordance with applicable safety regulations.

A minimum maintenance clearance of 450mm shall be provided around all machinery.

Groups of equipment shall be mounted on rigid base frames with machined support pads, at least 12 mm wider than equipment at all sides, and pads supporting electric motors for main drives shall allow the motors to be pushed backwards to release them from couplings. An adjustment filling of approximately 3 mm shall be applied under electric motors in order to absorb shaft height differences from spare motors. Tapered Dowel pins or welded shear blocks shall be used for initial alignment (minimum requirement). Other methods of alignment will be considered provided they are presented prior to the execution of the Contract.

The fleet angles of wire ropes shall not exceed the following:

To drums, the angle to the axis of the drum grooving at the point of tangency 2 ½ Degrees

To sheaves with fleet angle or where the varying angle does not pass through zero degrees near the midpoint of travel..... 2 ½ Degrees

To sheaves with fleet angle varying approximately equally either side of zero degrees during normal travel..... 3 Degrees

Fleeting sheaves shall not be used.

When the sheave axles are not mounted in a horizontal plane, running wire rope shall be supported by auxiliary sheaves of appropriate size to prevent the wire rope from jumping off the main sheaves and drums.

For luffing/telescoping boom type, the two independent ropes for the boom hoist shall lead from the drum to the gantry frame top, then to a multi-part reeve-up between the boom and the gantry frame top. The dead ends of the reeve-up shall be independent but equalized.

Fastenings shall be secured with locking devices. Critical areas, such as fastenings for any rotating equipment, shall have fastener groups wired together. Locknuts, lockwashers and snap rings are not acceptable on rotating equipment. Loctite shall not be applied to any fastening, unless approved in writing by ASPA's Engineer.

The Contractor shall provide for the safety of personnel by providing ample open space and/or safety devices around rotating equipment. The drive layouts and space around all equipment shall be adequate to safely and conveniently perform all routine maintenance and

troubleshooting. Particular care shall be taken to assure ample space around motors for maintenance.

Wherever possible, designs and layout of equipment shall allow performance of routine maintenance procedures by one man. The Loader shall conform to applicable safety regulations noted in Section 2.6.

A transparent and removable grease shield shall be provided between the boom hoist wire rope drum (or boom shuttle drum) and nearby equipment (motors, brakes, etc.).

Pockets where water and dust can collect shall be avoided. If unavoidable, pockets shall be outfitted with drain provision to prevent standing water and its potential hazards.

All major machinery and electrical components shall be furnished with lifting lugs for ease of attaching hoists gear when components are changed with maintenance lifts. The proposals shall include a description of the method to be used to service machinery house, electrical equipment and sheaves at all locations.

Bolts shall be properly torqued and shall not be subjected to fluctuation stresses. Pins shall not be used to resist reversing forces.

All major machinery and electrical components shall be furnished with identification tags complete with all parameters, serial number, year of manufacture, and contract information.

5.2 GANTRY DRIVE

A gantry truck assembly designed to distribute the point load of gantry frame equally to all wheels shall support each corner load equalizer of the Loader gantry frame. In addition, a gantry truck assembly shall also be designed for the Loader Trailer. The details shall be identical to the gantry frame trucks, but will be idler type only (non-driven). The number of wheels and spacing shall be determined by the Contractor, based on the allowable wheel loads. The number of driven wheels per equalizer shall be a minimum of 50% of the total number of wheels per corner.

Each drive shall consist of, (other alternatives will be considered), an AC electric motor with an approved electric spring set caliper disk brake, or ASPA approved equal, with protective removable cover, driving a totally enclosed reducer directly driving an individual gantry wheel. The trucks and drive machinery shall accomplish interchangeability of all gantry drive components. The gantry wheels shall be sized as required.

Wheels shall be mounted in equalizer trucks with equalizer beams to insure that the gantry loading is equally distributed to all wheels.

All gearing shall be oil bath lubricated in enclosed oil tight cases. Open, grease lubricated gearing shall not be used, unless specifically ASPA-approved.

Wheels shall be double-flanged rolled steel rim toughened with straight treads. Wheel treads shall be turned to a true surface and shall be of uniform diameter. Axles shall be finish machined all over, and pressed or shrunk into wheels and drive gears with a heavy press fit. Driving wheels shall be without keys. Equalizer pins shall be annealed steel, lubricated at all bearing surfaces and shall be 185 HB minimum hardness. All equalizer pins shall be designed to be removable during the life of the Loader. The pin shall be 50 HB harder than the base material.

All drive trucks shall be identical in design. Trucks of a type shall be interchangeable mechanically and structurally. Each truck shall be provided with drop blocks, which shall limit the drop to 25 mm if an axle breaks. Trucks and drop blocks shall be designed to withstand the impact of the truck dropping without sustaining damage. Suitable rail sweeps shall be provided at both ends of each two-wheel truck. Jacking pads shall be provided on equalizing assemblies for the removal of wheel trucks for repair. Except for drop blocks, there shall be a minimum of 50 mm clear between any truck component and the top of rail or dock surface.

Travel warning gongs shall be provided of sufficient size and decibel rating to be heard at any position within the Loader envelope and distance of 15 m along the rail against a 17m/sec wind. The gongs shall be automatically energized when gantry travel controls are actuated.

Means shall be provided for enabling the drives to allow gantry motion with a gantry motor out of service.

In addition to other requirements, gantry motors must be sized to achieve rated gantry speed and acceleration, for a minimum of 60 minutes continuous duty, with 50% WLO blowing in the most adverse direction.

In addition to normal operational requirements specified elsewhere, to allow travel of the Loader to a tie down position during high wind, gantry motors and brakes shall provide capability for gantry travel with 32m/s wind (into and with) in the least favorable direction, including angled wind. Motors shall have thermal capability to travel into the worst direction wind for minimum of 200m without over heating. Motor brakes shall hold against 32m/s wind from the worst direction without use of wheel brakes or other securing devices. Calculations demonstrating this capability shall be submitted to ASPA's Engineer for review.

5.3 BOOM HOIST/SHUTTLE (IF USED)

For luffing type boom, the inboard end shall be supported by the gantry structure at the hinge point and the outboard end shall be supported by a wire rope reeving system to the top of the gantry frame. The boom structure shall comply with SECTION 4. All pin joints shall be pressure grease lubricated. Provision shall be made for access to the pins for lubrication and inspection.

The boom shall be raised and lowered by the boom hoist, through two independent redundant sets of wire rope reeving, either one of which shall be adequate to safely stop and support the boom. The ropes for the boom hoist shall lead from the drum to the gantry frame top, then to a multi-part reeve-up between the boom and the gantry frame top. The dead ends of the reeve-up shall be independent but equalized and shall be safely accessible for inspection. All parts of the reeving system shall be designed to withstand motor stall and maximum brake torque without exceeding 75% of the yield of the material used. (An alternative hoisting system will be considered; however, the rope reeving hoist/support system is the preferred system.

Provision shall be made to prevent rope being payed off the boom hoist drum without proportionate lowering of the boom. (Slack rope protection), for luffing type system.

A boom latching system shall be provided for securing the boom in the elevated or stowed position. For luffing type system, a minimum of two latches, secured at the top of the gantry frame, shall automatically engage and shall be released by push button operations. The latching system shall unload the boom hoist ropes. Bumpers shall be provided to cushion entry of the boom into the latches and shall prohibit unlatching the boom unless it is suspended by the boom hoist ropes. An electric or electro-hydraulic thruster unit(s) shall be provided on the gantry structure for operating the latch release mechanisms. An alternate method for control of the boom latching system may be submitted to ASPA for review. If necessary to completely secure the boom from movement during design stowed wind conditions, an auxiliary securing system shall be provided which will allow easy installation and removal by maintenance personnel. A system for securing boom (if shuttle boom system is used) shall be provided and shall be approved by ASPA.

For shuttle type boom, a wire rope “haulage” type system shall be used. A wire rope system complete with drum, reducer, motor, brake, couplings, bearings, sheaves, wire rope, fittings, rope tensioning, etc. shall be provided. All components shall meet the requirements noted later in these Specifications. The motors shall be rated for continuous repeated start/stop operations and drive shall be design for frequent incremental traverse during hatch loading.

For shuttle type boom, the boom shall be supported at all four (4) corners with a shuttle wheel assembly, complete with double flange steel wheels, solid steel shafts and heavy duty self aligning roller pillow blocks (the system shall be as approved by ASPA). Horizontal guide rollers shall also be provided. The bearings shall be designed for radial and axial loadings to accommodate such loadings until contact is made with the horizontal guide rollers. Jacking points shall be provided in the shuttle truck assemblies to permit replacement of the wheels or bearings, as necessary. The limit shuttle boom will be provided with switches and hard stop devices to prevent boom extension past its limits of outreach and in back reach. The ends shall also be provided with buffers to absorb impact energy.

Controls for the boom hoist (or boom shuttle) shall be located in the Operator's Cab, individual remote station for maintenance, and control station. The location of the cab and individual remote control location shall be where the Operator may operate and fully observe the boom hoisting and lowering or shuttling.

The boom hoist/or shuttle drive shall consist of an AC electric motor driving a single layer grooved drum(s) through an enclosed helical gear reduction unit. The drive end of the drum(s) shall be directly connected to the low speed shaft(s) of the reduction unit by a drum coupling(s), specifically designed and rated for combined shear and torsional loads as evidenced by published data and ratings. The idler end of the drum(s) shall be supported by self-aligning anti-friction bearing(s). A spring set thruster released disk brake, shall be provided. The brake disk hub shall be pressed and keyed directly to one end of the reduction unit high-speed shaft extension. If the brake is mounted between the motor and the reduction unit, a double internal gear type coupling shall be used and the coupling shall allow removal of the brake disk without moving the motor backward.

For luffing type system, an ASPA-approved redundant boom hoist drum mounted spring set electric hydraulically released caliper type disk brake(s) shall be provided to stop the descent of the boom at any point in its travel from over speed without any assistance from the motor brake. Devices shall be provided to maintain a clean (rust-free) disk surface. Alternative boom hoist designs shall be considered by ASPA.

Boom hoist or shuttle drums shall be cylindrical. Conical drums shall not be used. Drums shall be driven directly by the gear reduction unit. Open gears shall not be used.

5.4 BOOM TELESCOPING MECHANISM

The telescoping boom movement shall be accomplished with a positive drive system. Friction type will not be accepted.

The drive shall be capable of operating the telescoping boom under all operating conditions up to an incline of 12° above the horizontal and capable of retracting the telescopic boom in non-operating conditions up to 40° above the horizontal. It shall be capable of providing

sufficient force to overcome the wheel friction and any external forces due to belt tensions and wind. The brake assembly shall be suitable for holding any external loads put on the traverse system due to belt tensions and wins.

A rack and pinion drive shall be used. The pinion drive shall be two (2) complete opposed drives consisting of reducer, output shaft and pinion motor, hydraulic thruster operated brake, couplings, and bearings mounted on a common base. The rack shall be securely mounted on the boom. The rack shall either be a cut tooth assembly or a link and pin arrangement. If more than one rack or multiple drive is necessary to transmit the driving force, the arrangement must be designed to provide for proper load sharing. The rack shall be located so as to avoid build-up of spilled material. The engagement of the pinion and rack shall be arranged to accommodate minor misalignment and/or deflections of the bridge.

The motors shall be rated for continuous repeated start/stop operations. The drive shall be designed for frequent incremental traverse during hatch loading and a maximum speed of 50 fpm (15.2 m/min).

The shuttle wheel assemblies shall be complete with double flange steel wheels, solid steel shafts and heavy duty self-aligning roller pillow blocks.

Horizontal guide rollers shall be provided.

The bearings shall be designed for radial and axial loadings to accommodate such loadings until contact is made with the horizontal guide rollers.

Jacking points shall be provided in the telescoping truck assemblies to permit replacement of the wheels or bearings as is necessary.

The fixed boom shall be provided with “stroke” limit switch to restrict the maximum and minimum extension, distance of the telescoping boom. The two (2) ends of fixed boom shall be provided with hard stop devices to prevent boom extension past limits. The minimum ultimate position shall be provided with a buffer to absorb impact energy.

5.5 GEARING

All gearing shall be hobbled helical with an overlap ratio not less than 1.5 and shall be contained in heavy rigid, totally enclosed oil-bath gear reducer cases. Unless otherwise approved by ASPA, the cases shall be flanged and horizontally split on the common shaft centerlines and shall be horizontally mounted. Lifting lugs shall be provided on upper and lower sections. Open gearing shall not be used unless approved by ASPA.

All gear cases shall be fabricated or cast steel, (or ductile iron for gantry gear cases only). Gear cases shall be equipped with dryer type vents, weatherproof vent caps, inspection

covers, oil level sight gauges, oil thermometers, and drains with cock and valves. All reducer drains shall be lockable type. Millimeter sized bearings only shall be used.

Gearing shall be suitably hardened for the intended service with suitable gear tooth protuberance when case hardened and ground gearing is used. Fillet roofs of ground gears shall not be ground.

Boom hoist, boom telescoping, boom shuttle (if used), telescoping spout and gantry gearing, including gear strength and stress, shall be designed and rated in accordance with the latest applicable standards issued by ISO 6336 (SFS 4790) and AGMA and design loads as per F.E.M. Gearing for conveyor drives shall be sized using an AGMA service factor for 24-hour service and capable of carrying instantaneous loads of 200% of the connected motor rating.

Factors contained in the F.E.M. standards shall be conservatively selected according to the prevailing conditions in Loader operations.

The required strength rating of all gearing shall be a minimum of 1.5 times the required durability rating.

For gearing design the combined operating condition shall include inefficiency, 50%WLO, and specified speeds and acceleration/deceleration rates.

Conveyor gearing shall have a durability service factor of not less than 1.5 based on transmitted motor torques required for combined operating condition in F.E.M. at rated speed and a service factor of not less than 1.0 based on the stall torque completed using the rated speed of motor.

Gantry, boom shuttle (if used), boom hoist, boom telescoping and telescoping spout gearing shall have a durability service factor of 1.0 based on the maximum transmitted motor horsepower for combined operating condition in F.E.M. at rated speed.

Reducer bearings shall be provided with positive means of lubrication. Oil troughs, which direct splashed oil into the bearings, are acceptable. Bearing housings shall retain sufficient oil such that the lower rolling elements of the bearing are maintained immersed in oil after extended idle periods. Reducers exposed to the weather shall be equipped with grease purged double shaft seals. Provisions shall be made to prevent grease from contaminating the gear case oil.

Gear reducers for all the above noted main motions shall be manufactured by the same company. See SECTION 12 for Required Suppliers.

5.6 COUPLINGS

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Couplings shall be flanged forged steel with exposed bolts and, except for drum couplings and motor brake couplings as previously specified, couplings shall be flexible gear type and shall transmit only torque.

Gantry couplings shall have a durability service factor of 2.0 based on the transmitted load for combined operating condition in F.E.M. Boom hoist and telescoping, boom shuttle (if used) and telescoping spout couplings shall have a durability service factor of 2.0 for the maximum transmitted load during the boom raise or lower cycle or shuttle cycle, as applicable. Conveyor couplings shall also have a durability service factor of 2.0 based on the maximum (peak) rated loads. All couplings shall have a safety factor of 5 or greater based on the manufacturer's published breaking strength for the above conditions.

Drum couplings, which transmit combined shear and torque loads, shall have service factors as above. The rating and required service factor for the combined loading shall be verified by published catalog data.

Couplings shall be fitted with fill and drain plugs for relubrication.

Couplings in areas of normal personnel access shall be covered with suitable removable cover guards with hinged openings for lubrication and inspection. Removable guards shall not be bolted, but shall be of the hood latch type.

5.7 BEARINGS AND SEALS

Bearings shall be anti-friction type in millimeter sizes. Seals shall be in millimeter sizes. Only bearings and seals manufactured as part of regularly scheduled production runs by internationally known manufacturers and easily obtainable from commercial distributors doing business in the vicinity of Mobile shall be used. Bearings shall be as supplied by SKF, NTN, FAG or NSK.

The selection and design calculations of bearings shall conform to FEM. Service life of bearings for the boom hoist and telescoping and shuttle (if used) reducers, telescoping spout reducer and pillow block bearings for conveyors shall not be less than 50,000 hours B10. Service life of bearings for gantry reducer shall not be less than 6,300 hours B10. Maximum bearing loads under any condition shall not exceed the basic static capacity of the bearing.

Cast iron pillow blocks or bearing cartridges shall not be used.

Split bearing housings shall be doweled on the split line to eliminate shear loads on the outer races (rings) of the bearings.

Pillow block bolts shall not be subjected to external tension, e.g. tensile forces, other than due to tightening the bolts.

Bearings and housings shall be sealed by caps or spring loaded lip-garter type seals, and except for reducer bearings, provided with pressure grease lubrication. Bearing seals shall be readily available from a local supplier's stock and be commonly used millimeter sizes.

Bearing housings shall have removable caps to facilitate periodic inspection of the shafts by non-destructive methods. Closed end cartridges shall not be used.

The base of each bearing pedestal shall be machined and shall bear against a machined surface. Where shafts or axles are fixed, bushing material in the rotating member shall be submitted to ASPA for review. They shall be pressed in, suitably secured and the ends of the bushing inset 1 mm within the face or faces of the revolving member.

5.8 SHEAVES, ROLLERS, AND DRUMS FOR WIRE ROPE

Wire rope sheaves shall be machined from rolled or forged steel or rolled steel welded construction with die forged rim per AISE No. 6. Rope grooves shall be surface hardened or hard faced to HB 321 minimum.

Tolerances shall be indicated and gauges shall be provided to indicate worn out sheaves. In addition, the Contractor shall recommend repair/replacement methods and periods to insure safe operation.

Running sheaves shall have a minimum pitch diameter of 24 rope diameters for the boom drive.

Sheaves shall have substantial close-fitting continuous peripheral plate guards around the rope contact area which prevent the rope from coming out of the sheave groove under any condition of slack or bouncing rope. Guards shall be at least 12 mm thick steel plate.

Sheaves and sheave bearings within a system shall be interchangeable, whether stationary, idler, or part of a block. Sheaves shall be equipped with anti-friction bearings in accordance with Section 5.7.

Sheave arrangements requiring reverse bends of rope shall not be used.

Drum and sheave design shall accommodate both metric and equivalent US sized wire rope.

Drums shall be of fabricated or centrifugally cast steel with stub shafts with double end diaphragms. Rope flanges of adequate thickness shall be provided at the ends of the drums. The flanges shall protrude radially not less than two wire rope diameters above the top of the

wire rope. Drums shall have a pitch diameter not less than 24 rope diameters for the boom hoist. Rope grooves shall be machined and surface hardened to HB321 minimum. Groove depth shall be a minimum of 38% of rope diameter, with a slight radius on groove edges. Rope shall be spooled in one layer, with three unclamped full wraps remaining in the grooves when the rope for normal operation and overtravel lift or travel is payed out. Drum shell thickness beneath the grooves shall be at least as thick as the wire rope diameter and checked for strength. In addition, a minimum of one (1) full wrap shall be provided to accommodate rope stretch.

Drums are to be stress relieved before machining and shall be statically balanced with rope clamps in place after machining by adding bolted on weights.

5.9 WIRE ROPE

Wire rope shall be extra-improved plow steel with independent wire rope core supplied prelubricated, internally and externally by an ASPA-approved wire rope manufacturer. Wire rope shall be inspected and tested by an independent testing laboratory. Boom hoist or boom shuttle wire ropes shall be 6 x 37 construction. Wire ropes shall have the following safety factors considering reeving efficiency and based on the rope manufacturer's catalogued breaking strength for extra-improved plow steel grade rope:

Boom Hoist Ropes	6.0
Boom Shuttle Hoist Ropes (if used)	6.0

Each rope is to be supplied with full test certification.

The Contractor shall use methods that minimize reverse bending and the development of kinks, and the need to replace (change) the wire rope. In the Operating Instructions, Maintenance and Inspection Manuals, he will describe methods to make required re-reeving easier. The Boom hoist or boom shuttle (if used) re-reeving system shall be submitted to ASPA for review and the re-reeving system shall be described in detail in the proposal.

Dead end wire rope terminations shall be by means of thimbles with wire rope clips or open wedge sockets with wire rope clips. The method of dead end rope terminators must be reviewed by ASPA. Zinc wire rope sockets shall not be used. The Contractor shall recommend the method and timing of periodic inspections and the repair methods for the wire rope connections he uses. The Contractor's selection and recommendation shall consider the potential for galvanic action and/or corrosion.

Hardwood or synthetic buffers shall be provided for protection of wire rope at all points where contact with Loader structure could occur.

5.10 CONVEYOR EQUIPMENT

5.10.1. Boom Belt Conveyor

The boom conveyor drive shall be fully redundant and shall consist of AC squirrel-cage motors, suitable fluid type couplings, spiral bevel gear planetary reducers, double shoe brakes, and couplings, etc. and shall be mounted on a base which is fitted with a torque arm. In normal operations both drives will operate and in case of a failure, the remaining drive shall permit full load/full speed operation until the failure is resolved.

Starting, braking and running shall be smooth and reliable.

The coupling shall be able to ensure that the motor can be started with no load and smoothly started under rated current with impact and overload protection.

The boom belt conveyor shall be designed as a linear type with adequate conveying capacity under various loading conditions, including designed inclined position of the conveyor. The take-up of the boom belt conveyor shall be by gravity, or if approved by ASPA, by double acting hydraulic jack type with mechanical locking. The hydraulic and locking device shall be anti-corrosive and be suitably arranged for maintenance.

Safety protection and detection devices shall be provided for the boom belt conveyor. These include detector switch for belt running off center, speed detection device, detection device for blockage in the trailer discharge chute, telescoping spout, emergency stop cord switch, brake status detector, temperature detection for the fluid coupling, (if used) detector switch for the flap position, limit switches (including those for brakes and take-up). See SECTION 12 for Preferred Suppliers List.

An electronic two-idler belt scale shall be provided on the boom conveyor. The scale shall have angle compensation to accommodate variation of the boom angle. Accuracy of the scale shall not be worse than $\pm 2\%$. The scale shall have functions to display transient flow and accumulative amount and to give flow output (signal).

Walkways of 800mm width and guard boards against wind made of checkered steel plate shall be installed at both sides of the boom conveyor. An overhead bridge shall be provided over the conveyor. Service platforms shall be provided at all maintenance locations for the boom.

Components of the conveyor shall be selected to match the conveyor and as noted in these specifications.

The boom conveyor shall be designed to receive material at design capacity and carry the material to the discharge point without spillage anywhere along the conveyor, including the condition when the tripper on the dock conveyor is traversing backwards against the dock conveyor belt travel.

All components for the conveyor shall be as approved by ASPA and be commercially available in the local Mobile market.

5.10.2. Trailer Belt Conveyor

The trailer belt conveyor and structure shall be an integral part of the Loader. Design of the trailer belt conveyor shall be identical to the boom conveyor, including the fully redundant drives. The adjustable multi-blade type alloy made cleaner shall be installed at the discharge pulley of the trailer conveyor.

5.10.3. Tripper

The tripper provided to interface between the existing dock conveyor and the trailing conveyor shall be provided as an integral part of the Loader and shall be complete with idlers, pulley assemblies, discharge chute, structural frame, etc. The tripper shall be capable of being raised or lowered depending on the mode of operation. It is preferred that the hoisting system (raising/lowering) shall be by means other than hydraulic, unless specifically approved otherwise by ASPA.

5.10.4. Shafting

All shafting, unless otherwise noted, shall be carbon steel, AISI 1045 for non-driven shafts and AISI 4140 for conveyor head shafts.

All shafting shall have a maximum shaft deflection of .0015 radians at the end disk and a maximum bending stress of 8,000 psi.

The lengths shall be adjusted to suit the specific bearings and couplings supplied by the Contractor.

5.10.5. Pulleys

All pulleys shall be welded steel pulleys to meet or exceed ANSI/CEMA B105.1-1992 Standards. Pulleys are to be designed per appropriate belt tensions.

All pulley rims shall be machined flat faced within 0.030" T.I.R of hub centerline. Rim surface shall be 250-500 RMS prior to lagging.

All pulleys shall be statically balanced.

All pulleys shall have a diameter tolerance of $\pm 1/4\%$.

The total eccentricity of all pulleys shall not exceed manufacturer's standard.

All pulleys shall have two continuously welded end disks that shall be designed for optimum stress distribution throughout end disk (profile or "engineered" type) with a maximum stress of 8,000 psi.

The rims of all pulleys shall be designed for a maximum stress of 3,000 psi, but in no case, shall the shells have a thickness less than the following:

- a. Pulleys 24" diameter 1/2" thick
- b. Pulleys 30" diameter 5/8" thick
- c. Pulleys 36" diameter 3/4" thick
- d. Pulleys 42" diameter 7/8" thick

Hubs shall be Bikon/DoBikon keyless friction type locking device with no weld to the end disks or Engineer-approved equal.

All drive pulleys for conveyors shall be spiral bevel wing type (rubber lagging is not acceptable). Design shall be as approved by ASPA. All non-drive pulleys for conveyors shall be lagged with 1/2" baked on lagging with crowned smooth surfaces, 60 +/- 5 Durometer Shore A, SBR rubber. Lagging shall be attached to pulley in strict accordance with manufacturer's recommendation.

The take-up of conveyors shall be accomplished by gravity, or if approved by ASPA, by double acting hydraulic jacks, with mechanical locking. The hydraulic and locking device shall be anti-corrosive and be suitably arranged for ease of maintenance.

5.10.6. Blade Belt Cleaners

All conveyor head pulleys shall be equipped with a Gordon, Martin or FLEXCO primary belt cleaner, mounted to the underside of head pulley on centerline, as per manufacturer's specification or equal.

Hoods and hoppers shall be made to receive cleaner so removal of either unit will not be hindered.

Shafting shall be Sch. 160 pipe sized as shown on manufacturer's drawing. Blade belt unit shall be mounted to provide best cleaning possible for belt. Unit shall include adjustable system as per manufacturer's specification to vary contact of blade on belt.

Contractor shall provide one blade for spare for each conveyor.

5.10.7. Idlers

Idlers shall be CEMA E SDX-Plus Series as manufactured by Continental Conveyor or Engineer-approved equal and shall conform to CEMA Standards for Class E idlers. Some acceptable alternate manufacturers are Hewitt Robins and FMC Linkbelt. . ASPA will endeavor to assist in the procurement of these idlers and the idlers may be shipped directly to ASPA.

Idlers shall be self-lubricated.

Troughing idlers shall be 35°, 6" diameter equal length rolls mounted on 1¾" diameter end pointed shaft with tapered roller bearings. Idlers shall be installed as shown on drawings with head and tail sections being transitioned down with adjustable transition idlers where practical.

Self-aligning troughing idlers shall be installed at maximum of 100 ft. centers with self-aligning troughing idler approximately 30 ft. from head or tail terminals.

Return idlers shall be 6" diameter mounted on 1¾" diameter end pointed shaft with 1¼" tapered roller bearings. .

Self-aligning return idlers shall be installed at maximum of 100 ft. centers and no closer than 30 ft. head and tail terminals.

Hydraulic self-aligning return idler unit shall be as manufactured by Hewitt-Robins Company or equal. Unit to have actuator hanger bracket modified in field to accommodate low clearance.

5.10.8. Belting

Belting shall be 72" wide, 4-ply Goodyear, Pylon Plus 800, Style "Guardian", 3/16" top and 1/8" bottom covers, 800 PIW or Engineer-approved equal. ASPA will endeavor to assist in the procurement of these belts and the belts may be shipped directly to ASPA.

Belt splices shall be field vulcanized in accordance with industry standards by an experienced contractor. Contractor shall purchase adequate belting to accommodate field vulcanized splices.

5.10.9. Emergency Shutdown

Emergency pull cords shall be installed on each conveyor accessible from walkway area. The units shall be as manufactured by Material Control, Inc. and will be provided at maximum spacing of 100'-0". Unit to be furnished with one SPDT switches and cast iron housing.

Zero speed control belt conveyors to be as manufactured by Telemecanique, Model VSA-V1151034330-120V. Unit to be mounted at take-up bend pulley on the tail pulley side of the take-up pulley of belt conveyors.

Plug chute/spout tilt switches shall be Ramsey Model 20-38 with 20-39 heavy duty probe or equal.

Belt alignment switches shall be Ramsey, Model ROS2D-3-NP or equal. Two (2) switches shall be located 75' from each end of the conveyor.

5.10.10. Material Chute (Trailer Conveyor to Boom Conveyor)

The material shall be manufactured of steel plate welded construction. The lower part with rubber strip is connected with flap by clips and bolts. A moving tripper board shall be provided, to prevent blockage at a location where material flow could be blocked in the chute.

The chute shall be designed to accommodate for the different boom angles of luffing type boom system. The chute shall be provided with adjustable receiving flap and snub board to adjust material flowing direction. An observation window shall be provided on the hopper to allow the inspection personnel to access the chute. The chute shall be provided with a blockage protection device. Snub device shall be hung below the gantry.

The design of mechanical and electrical systems shall be identical to that required for boom conveyor and other pertinent sections of the Specifications.

5.10.11. Magnet Separator

Magnet Separator(s) shall be installed at appropriate conveyor locations. Separators shall be as manufactured by Walker, Erizes or ASPA approved equal.

5.11 LUBRICATION

Oil lubrication shall be provided for speed reducers (See Section 5.5.). A lockable valve with sufficient access for a bucket or drain pan shall be provided at all drain locations.

Lubrication for other mechanical operating parts shall be by high-pressure grease gun. Industrial buttonhead type grease fittings made of brass, monel or stainless steel, shall be used throughout. Only one type of fitting shall be used except that fittings used for motor bearings shall be different than other fittings. The lubricating fittings shall be readily accessible or shall be remotely piped to convenient locations. Each remote greasing point must be clearly labeled with a stainless steel or plastic label to indicate which mechanism it serves.

All pins shall be lubricated.

Removable drip pans shall be installed on the flooring under the boom hoist wire rope drums to contain the excess wire rope lubricant. The drip pans shall be removable and fabricated in sections with lifting lugs to facilitate easy handling.

An embossed lubrication chart showing all lubrication requirements shall be provided in the machinery house.

The Contractor shall furnish lubricants in accordance with the original manufacturer's recommendations in sufficient quantities for initial lubrication of the Loader. The Contractor shall furnish a list of oil and grease lubricants needed for each reducer, coupling and all other lubricated equipment, prior to the start of Field Erection.

5.12 HYDRAULIC SYSTEM

Hydraulic systems shall conform to the applicable requirements of JIC Hydraulic and Electrical Standards for Industrial Equipment with emphasis on safety, uninterrupted service, long life of equipment, minimum maintenance, and rated for two and one half (2 ½) times the system operating pressure with no component used in excess of the original manufacturer's regular catalog rating; however, system pressure shall not exceed 140 bar in actual operation. The entire system shall be suitable for the environmental conditions at the site. Pumping and control units shall be furnished by Rexroth, Vickers or an ASPA-approved supplier who has been regularly engaged in manufacturing similar units.

Selection of equipment and connections shall pay particular attention to preventing leakage. Wherever possible, hydraulic units shall not be located on the luffing boom. Accumulators shall be used only where approved by ASPA's Engineer. All accumulators shall have an isolation valve which can be locked.

All components shall have over-pressure protection, designed to relieve at least 110% of the hydraulic pump's maximum flow capacity.

Piping shall not be used to support valves or equipment. Suitable supports shall be provided to attenuate induced or sympathetic detrimental vibrations or movements of pipe and equipment.

Plastic hose shall not be used. Tapered pipe thread connections shall not be used for pressure lines. Hydraulic high pressure hose and tube fittings shall be flanged O-ring boss or flared JIC type.

Systems shall have adequate filtration to remove particles 10 micron or greater in size. Filter elements shall be spin-on, readily accessible during system operation and located in readily accessible areas. Filters employing earth or clay are not acceptable.

Filters shall be sized for the maximum flow encountered in operating conditions at the highest viscosity and the lowest temperature. Indicators shall be provided on filters to indicate when the filter needs changing.

Reservoirs shall be made of 316 stainless steel, and shall be of sufficient capacity to allow for small losses of hydraulic fluid and for the differential capacity of the operating cylinders. They shall be provided with a suitable filler/air breather incorporating a filter, a magnetic drain plug, an oil level site glass, a temperature indicating device, a low level alarm (fed to the Loader control PLC), and a removable cover, giving full access to any parts inside the tank. Hydraulics pumps and filters shall not be located inside reservoirs.

The equipment and components shall be "through-bolt" and shock mounted with corrosion resistant fasteners. Blind tapped bolt holes shall be avoided.

Exposed hydraulic equipment shall be suitable for the environmental conditions. Fasteners for access covers shall be stainless steel. Hose fittings, tube fittings and hydraulic plumbing lines shall be 316 stainless steel. Where movement is required, flexible hoses with swivel fitting terminations shall be used. The number of different sizes and variations of fittings shall be kept to a minimum. Burst pressure shall be at least 690 bar. Hose shall be proof tested at 345 bar. Flexible hoses shall be of Wire Braid Reinforced Rubber Hose Type 2 as manufactured by Aeroquip, Parker or ASPA-approved equal and shall be of the preferred nominal sizes unless otherwise approved by ASPA's Engineer. When in position, the radii of flexible hoses shall not be less than the design bend radii given in JIC Standards.

Cylinder rods shall be retracted as much as possible when the system is not in use, and shall be stainless steel with nickel chromium plating and rod wiper seals. Boots shall not be used. Additional protection shall be provided for exposed cylinder rods where applicable.

Hydraulic fluids suitable for use with all hydraulic systems shall be provided. The fluid type shall be approved by the original manufacturer of the components and be for use under all environmental conditions specified without negatively affecting the normal life expectancy of any components. Hydraulic fluid shall be fire resistant.

To minimize components, all hydraulic pumps shall be identical regardless of function or location, and shall be horizontal mounted, piston type, pressure compensated, and have variable displacement.

All components shall be of standard manufacture.

Valves shall be subplate mounted with a “O” ring seal on the subplate. Valves shall have the following stamped on the main body of valve.

Manufacturer’s Name
Serial Number
Function Identified

Alternatively, this information may be etched or engraved on an additional nameplate that is affixed to the valve.

Solenoid operated valves shall have the following features included:

A neon light or LED to indicate functioning of the solenoid.
Operable by external mechanical means (pencil, screwdriver, etc.) in order to free sticky valve.
Closed Center Spring Centered.
Plug-in Coils.

As applicable for safety, hydraulic circuitry shall have load check valves to prevent inadvertent movement should a hydraulic hose fail.

A schematic of each hydraulic system shall be permanently installed in the vicinity of its control unit. All components in the schematic shall be labeled with a permanently installed label adjacent to the component using the identical nomenclature in the schematic. All schematics and labels shall be made of etched or engraved stainless steel.

As appropriate for maintenance purposes or temporary operations, hydraulic systems shall be provided with a hand pump for use in the event of the main pump fails.

All hydraulic systems shall have a manual dump valve. This valve, when opened, shall depressurize the entire system. To prevent inadvertent operation, the valve's operator shall be removed and stored adjacent to the valve.

All hydraulic systems and components shall be provided with adequate access systems to facilitate maintenance activities, in accordance with the requirements of this Specification.

5.13 COLLISION PREVENTION AND BUMPERS

Gantry trucks, at the corners of the Loader shall be provided, with pneumatic hydraulic buffers supplied by OLEO or ASPA approved equal of sufficient energy absorbing capacity to prevent damage when Loader meets the end of rail bumper or existing ASPA bucket unloader, traveling at full speed. Resulting loads shall be provided by the Contractor to ASPA's Engineer within 60 days of Notice to Proceed. The bumper location shall facilitate interface with existing dock bumper/stop and bucket unloader bumper location.

Gantry bumpers shall be designed to ensure maximum deceleration rate in the operator's cab is less than 5 m/s^2 , in accordance with FEM.

The Loader shall be provided with means to prevent the collision of Loader and existing bucket unloader on same rails. Collision prevention between may be by means of light, laser or other devices (no striker types) which shall be effective under all conditions of ambient lighting and local environmental conditions, including direct sunlight and extreme coal dust, and provided to ASPA for review. The system shall be provided with a pushbutton in the operator's cab allowing operator by-pass.

5.14 GANTRY SECURING DEVICES

Other than the gantry drive brakes, which secure the Loader against movement during normal operation, the Loader shall be equipped with the following securing devices:

Stowage Pins
Wheel Friction Brakes
Boom Securing Support Frame

The stowage pins are to be engaged when the Loader is stowed. The pins, located on the center line of the Loader, shall engage by gravity into sockets in the rail beams and shall be designed for ease of manual operation by one workman and not requiring more than 25 kg force. Locking devices shall be provided to secure the pin in both the raised (disengaged) position and the lowered (engaged) position.

Automatic caliper type side wheel loaded friction brakes shall be installed. They shall be capable of holding the Loader on wet rails at any location on the wharf, against a 40 m/s wind load in the most adverse direction in conjunction with the holding power of 80% of the gantry motor brakes. The brakes shall be adjustable and fitted with renewable shoes that bear on the side of the gantry wheels.

The wheel brakes shall be capable of application with the Loader in motion without inducing severe dynamic braking loads in the Loader and their dynamic braking torque shall be no less than the required static braking torque.

The control for the wheel brakes shall be connected to the Loader control system to automatically set and release in conjunction with the motor brakes on the Loader gantry drive. The wheel brakes shall release completely and permit gantry motion within two (2) seconds after release motion of the gantry drive motor brakes is initiated. An adjustable hydraulic time delay shall delay full setting of the wheel brakes between 0 to 15 seconds after de-energization of the gantry motor brakes (including E-stop and loss of power). In addition, an adjustable electronic time delay shall be provided to delay the start of the hydraulic delay until 0 to 120 seconds after de-energization of the gantry motor brakes. This electronic delay allows fine positioning of the Loader without waiting for the wheel brakes to set and release. This electronic delay shall be bypassed in E-stop or loss of power conditions. Electrical interlocks shall be provided to prevent gantry motion unless all wheel brakes are fully released.

Upon loss of power, the wheel brakes shall be automatically applied. The rate of application shall be maximum but shall not subject the Loader, traveling at rated speed, to excessive inertia forces.

Provisions shall be made to manually or manually hydraulically release the brakes in case of a malfunction. The means of release shall be tamper-proof so it can only be accomplished by authorized personnel.

The wheel brakes, their power units and other associated equipment shall provide long life in heavy duty Loader operation. They shall be suitable for cyclic operation that occurs with gantry drive operation and shall not over heat or experience rapid wear.

The complete wheel brake system shall require minimum maintenance and shall be easily maintained and serviced by Loader maintenance personnel. Friction materials shall be asbestos free, readily available and easily replaced. Adjustment features shall be provided to compensate for wear of the friction materials.

Wheel brake system to meet requirements of Section 5.12 for the hydraulic system and components, Section 2 and Section 8 for enclosures and electrical systems and components.

A boom securing frame shall be provided (by others) to secure the boom during stowed wind conditions. The Contractor shall provide brackets on the boom to facilitate such and provide interface details for design and installation of frame.

Calculations indicating force vectors and drawings for securing devices shall be submitted within 60 days after notice to proceed.

5.15 LOADER ALIGNMENT

The Loader alignment shall meet the requirements of F.E.M.

5.16 EQUALIZER PINS

Steel to steel equalizer pin bearings in trucks and equalizer beams, for gantry and boom, shall have 50 points HB difference between pins and housings with the pin being harder.

Equalizer pins shall be designed to be removable during the life of the Loader. Pin diameters shall be reduced in internal non-bearing areas to facilitate removal.

Pins shall be drilled for grease lubrication with annular grooves at the midpoint of each bearing member.

SECTION 6 ELECTRICAL SPECIFICATIONS

6.1 GENERAL

The work covered by this section consists of furnishing all labor, material and equipment to design, manufacture, ship and install all required equipment and appurtenances, to shop test as far as practical and to field test the Loader's entire electrical equipment. Responsibility for the reliable operation of the equipment in accordance with the requirements of this Specification shall be borne entirely by the Contractor. However, the selected control system supplier shall have the entire electrical installation (system) within their scope of supply and integration. The Contractor shall demonstrate with his drawings and specifications, and with the required tests, that the equipment is capable of performing all of the required functions with a minimum of down time. A complete listing and description of all electrical systems and components shall be included in the manuals required in these specifications.

The electrical system shall provide reliable power for safe, rapid and precise handling of Loader in continuous loading operations.

The control system for the boom hoist and telescoping, boom shuttle (if used), telescoping spout and gantry drives shall be AC variable frequency/voltage, stepless, regulated, reversing and regenerative over the entire range of speeds. The drive systems for the conveyors shall be fully redundant and shall consist of standard start/stop control(s) utilizing fluid type coupling(s).

The electrical installation shall include the necessary power units and appropriate distribution and control systems as well as all necessary motors, brakes, controls, signals, indicators, instruments, alarms, protective devices, wiring, software and all other features necessary for a safe, reliable and highly efficient Loader control system.

The control system shall incorporate an IGBT "front end" for the Loader.

Power factor correction equipment and harmonic filtering equipment (for current/voltage distortion, etc.) shall be provided on the Loader as required to achieve/maintain specified limits. (If the Loader system achieves/maintains the specified limits without dedicated equipment, then dedicated power factor and harmonic filtering equipment is not required.)

All material shall be new and of the highest grade of quality and designed to at least conform to the latest applicable IEEE Standards. All wiring shall conform to the latest revisions of IEEE, NEC and any other applicable local codes, standards, and regulatory requirements. As a minimum unless otherwise specified, all electrical equipment, material, workmanship, and tests shall also conform to the applicable current standard rules,

regulations, and specifications of IEEE, NEMA, NBFU, NEC, UL and ANSI. The control system shall as a minimum conform to the rules, regulations, specifications and standards of NEMA, IEC and NEC and shall be NRTL certified for use in North America.

All equipment shall be of the type normally furnished for heavy duty Loader applications, shall be designed for satisfactory operation under conditions of heavy exposure to sand, dust and salt laden moisture, and shall be adequately treated or protected against corrosion, moisture, salt, mold, dust, sand, and other destructive elements to which it may be exposed during operation in the climates described in Section 1.6.

All sensitive electronic devices (drives) shall be installed in an enclosed Electrical Control Room, including all inverter-type drives (including gantry cable reel as applicable). Systems must be properly wired, shielded and filtered with all communication via fiber optics.

Maximum allowable temperature rise on equipment and wiring shall be predicted on an ambient temperature as per Section 1.6. Space heaters shall be sized to protect the equipment when stowed and under operating conditions as noted in Section 1.6. Adequate consideration shall be given to temperatures within enclosures and to ventilation during operation.

All work shall be performed in a neat and workmanship manner and in accordance with applicable statutory safety regulations and safety rules.

All electrical equipment (components, sub-assemblies, etc.) shall be thoroughly tested to demonstrate compliance with design requirements.

All electrical equipment and systems shall be adequately protected against radio frequency interference.

All equipment shall be designed and located for ready accessibility for repair, maintenance, and/or removal. In order to facilitate routine repairs or adjustments, ladders, walkways, or access platforms fitted with handrails and toe plates as appropriate for the location shall be provided as required for convenient access.

Contractor shall provide ASPA-approved high-voltage safety interlock system (such as Kirk-Key Interlocks) to interface with the facility substation/switchgear.

Equipment and materials for the same, similar or allied service shall be of the same manufacturer and when of the same rating, be interchangeable to facilitate maintenance and minimize spare part requirements. The nominal supply voltage of all electrical appliances shall be common to the local market. 60Hz 3 phase, 480V 60Hz 3 phase, 120V 60Hz 1 phase, etc.). Major electrical equipment shall also be selected to maximize commonality of spares and equipment and shall be suitable for tropical environments.

Unless otherwise approved by ASPA, as proper set up and adjustment of the control system is essential to achievement of full Loader performance and efficiency, at least one field engineer from the control system supplier shall be on site, at no additional cost to ASPA, during start-up and testing and during acceptance testing, final commissioning, Substantial Completion and Punchlist completion of the Loader at the Erection Site. In addition, the manufacturer's field engineer shall remain at the Erection Site after Substantial Completion until commercial service has reasonably proven the capability of the control system to perform properly and efficiently.

6.2 MAIN POWER CABLE AND CABLE REEL

The power supply voltage is 4.16 kV, 3 phase, 60 HZ, and shall be supplied to the Loader through an ASPA-approved cable reel manufactured by Specimas (Cavotec), Stemmann, Wampfler or ASPA-approved equal. Trailing cable shall be as manufactured by Prysmian, or ASPA-approved equal. The cable reel shall be mounted on the trailer of the Loader parallel to the Loader runway. Fairlead sheaves shall be provided to lead the cable from the reel to a conveyor trough (furnished by others) located on the dock conveyor structure. Tandem fairlead sheaves shall be provided at the trough level so that the cable can be retrieved.

The diameter of the fairlead sheaves shall be as recommended by the cable manufacturer.

Particular attention shall be given to the elimination of the possibility of the cable becoming snagged in the system or crushed by the moving Loader.

The reel shall wrap the cable in a single spiral coil (monospiral type), and shall have a capacity to spool the length of cable required. The reel shall be suitable for high voltage service and shall be equipped with a redundant slip ring with brush(es), brush holder(s), etc. such that the Loader may continue operation with failure of one slip ring or brush. All parts shall be weatherproof and shall be provided with corrosion prevention (see Sections 2.4 and 6.2). The slipring shall have transparent inspection plates. A minimum of two (2) dead wraps of cable shall be provided.

The cable retrieval drive shall be powered. The cable reel drive type shall be ASPA-approved and shall be of heavy-duty durable type capable of reliable service with minimum maintenance. The drive shall provide adequate torque and speed to lift the cable from the rail level and prevent slack under any operating condition. A spring set brake or similar device, shall be provided to prevent cable from spooling off the reel when the drive is de-energized. The drive shall be capable of being continuously stalled without overheating. Devices for manual control of the reel shall be provided, the proposed location to be submitted to ASPA for review.

The cable reel drive shall be interlocked with the gantry drive equipment as follows:

The cable reel drive shall be energized and de-energized simultaneously with the gantry brakes.

The gantry drive shall be de-energized whenever the reel drive is de-energized.

The reel shall be supplied with sufficient cable to provide for 250 meters (to be verified at site acceptance) of gantry travel in either direction. The cable shall be rated by the cable manufacturer for reeling service at the voltage and peak current required for operation of the Loader. The voltage rating of the cable shall not be less than the nominated supply voltage. Due consideration shall be given in selecting the cable rating to allowable voltage drop, to the thermal effects of coiling on the reel, and to cable trough conditions.

The cable and cable reel shall include provisions for grounding as required by local conditions or codes.

The cable reel and cable shall be provided with fiber-optic assembly to facilitate remote communications with a minimum of 200% spare cores.

The high voltage cable and fiber-optic junction box and control box shall be furnished by others. Termination of power cable and fiberoptic cable shall be the responsibility of the Loader Contractor and all termination shall conform to all local codes and requirements.

6.3 MAIN POWER DISTRIBUTION SYSTEM

The Loader shall be supplied with one or more medium voltage drive isolation and auxiliary power transformers supplied by the control system supplier. The transformers shall be convection cooled dry type and designed for operation at rated KVA as defined in accordance with IEC 726 or applicable previously noted standards. Transformers shall be 4.16 KV primary, with approved secondary voltages, 3-phase, 60 Hz. A minimum of two 2½ % full capacity taps above nominal voltage and two 2½ % full capacity taps below nominal voltage shall be provided at the tap board. Insulation shall be selected for long life under specified operating ambient temperature conditions. Core-coil assembly shall be mechanically braced to withstand short circuit tests and verified by testing. Coil construction and bracing shall be designed for Loader duty and shall prevent mechanical breakdown of insulation during short circuit.

Each drive isolation and auxiliary power transformer primary shall be protected against overcurrents and overloads utilizing overcurrent relays in conjunction with SF6 circuit breakers of adequate voltage rating and interrupting rating suitable for the maximum voltage and short circuit capacity of the terminal utility system. The system must be properly coordinated with the utility feeder protection switchgear overcurrent relays. The medium voltage switchgear on board the Loader shall also include detection and protection against undervoltage, overvoltage, ground fault, and phase loss. The SF6 circuit breakers shall be equipped with low bottle gas pressure detection, alarm, and lockout. The lockout feature shall prevent reclosure of the breaker if low gas conditions exist. Each vacuum

contactor/disconnect and SF6 circuit breaker shall be provided with visual indication that the device is closed, open, or tripped. If stored energy spring operators are employed, there shall be a visual indication that the spring is fully charged. A G.E. or equivalent PQM (Power Quality Meter) and transducer unit shall be provided which allows continuous, real time monitoring of:

- Line to line Voltages (A-B, B-C, C-A)
- Line Currents (A, B, C)
- Line Frequency
- Kilowatts
- Kilovars
- KVA
- Kilowatt-Hrs.
- Kilovar-Hrs.
- Kilowatt Demand
- Kilovar Demand
- KVA Demand
- Harmonic Distortion
- RS485 Communication Port for Loader management system

Drive isolation transformers and auxiliary power transformers shall be supplied with grounded electrostatic shields, and primary lightning arresters (TM-GETranquell ZEP MOV type or equal). Each transformer secondary shall be provided with molded case circuit breaker secondary protection and appropriate ground fault equipment. Drive isolation transformer secondary neutrals shall be high resistance grounded with ground fault detection and protection. Auxiliary power transformer secondary neutrals shall be solidly grounded with differential current ground fault detection and protection.

Power factor correction shall be provided (if required) on the Loader to meet the following requirements unless local power utility and/or relevant code requirements are more stringent. The power factor shall not be less than 0.90 lagging average over a fifteen (15) minute demand period at the point of common coupling. The power factor of the electric load at the main supply shall at no time be permitted to fall below 0.85 lagging.

Harmonic filtering shall be provided (if required) on the Loader to meet the following requirements unless local power utility and/or relevant code requirements are more stringent. Harmonic filtering shall meet the requirements of IEEE Std. 519-1992, Table 11.1 and Table 10.3 at the point of common coupling for the predominant 5th and 7th order harmonics.

6.4 AUXILIARY POWER TRANSFORMERS

The Loader shall be supplied with auxiliary power transformers. The transformers shall be convection cooled dry type and designed for operation at rated KVA as defined in accordance with IEC726 and applicable previously noted standards. Transformers have

approved secondary voltages, 3-phase, 60 Hz. Transformer casing and enclosures shall be corrosion resistant and insulation shall be selected for long life under specified operating ambient temperature conditions.

Transformers shall be supplied with grounded electrostatic shields and primary lightning arresters. Each transformer secondary shall be provided with molded case or air circuit breaker secondary protection and appropriate ground fault equipment. Auxiliary power transformer secondary neutrals shall be solidly grounded with differential current ground fault detection and over temperature protection.

6.5 GROUND FAULT PROTECTION

All power systems derived on board the Loader shall be provided with ground fault detection and protection.

In addition to the primary system ground fault protection schemes, individual branch circuit ground fault protection shall be provided for the following auxiliary loads. The system level ground fault trip levels must be appropriately coordinated with the individual branch circuit ground fault protection levels to insure that selective tripping will occur such that individual, non-critical ground faults will not interrupt Loader operation as well as to facilitate trouble shooting by inherent identification of the ground fault location.

- Each individual floodlight branch circuit, 30 mA sensitivity.
- Each space heater branch circuit, 30 mA sensitivity.
- Welding machine power receptacles, 30 mA sensitivity.
- Walkway lighting branch circuits, 15 mA sensitivity.

All 120 VAC utility outlets used on board the Loader, except those supplied in control panels for instrumentation, shall be GFCI type receptacles with 5 mA sensitivity. Receptacles operated at 220, 230 or 240 VAC shall be protected by ground fault sensors located near the receptacle.

All ground fault protection and circuit interrupting equipment supplied must be certified for the specified duty as required by the regulatory bodies and guidelines applicable at the Erection Site.

6.6 WIRING AND CONDUIT

All wiring shall be stranded copper with flame retardant, heat resistant, oil and moisture resistant, thermoplastic with nylon jacket and shall be sized in accordance with applicable Regulations and Codes of Practice, suitably derated to suit ambient temperatures. Cables and insulation shall be selected for resistance to insect and vermin attack.

All wiring shall run in suitable rigid heavy wall galvanized seamless conduit, galvanized not less than two (2) ounces per square foot, amply dimensioned for the size and number of

conductors to be accommodated. Pipe shall not be used for conduit. The conduit system shall be neatly arranged on the exterior of the Loader. All conduit installation shall meet NEC requirements. Conduit shall be located so as to prevent any possible damage. Where conduits enter or leave the structure, doubler plates shall be used and rigid couplings shall be welded at these locations. Draw-in-type conduit systems must be used and wiring must be easily removed and replaced. Alternately, with ASPA approval, wiring may be run in external cable trays or raceways. The cable trays, if approved for use, shall be either integral to the structure of the Loader or shall be stainless steel, grade 316, suitable for installation in a marine environment and shall have a minimum wall thickness of 2.0mm. They shall be installed parallel to walkways, stairs, and ladders to be readily accessible for maintenance at any part of the run. For this alternative, wiring conductors shall be polyvinyl chloride (PVC) jacketed cables.

Automatic moisture drain valves are to be provided as appropriate for all vertical conduit and for junction boxes.

All single conductor power and control wiring external to control panels shall not be less than 2.5mm² other than digital communication and control circuits, local area network cables, and other circuits that operate at low DC voltage levels and require special cables. If multiple conductor power and control cables are used external to control panels, they shall not be less than 1.5mm². Exceptions will be considered by ASPA on a case by case basis.

All high voltage wiring is provided using shielded type high voltage wire or cable with outer semi-conductor tape wrap that is properly terminated using approved high voltage termination kits to prevent deterioration due to electric and magnetic field stresses. All voltage cables and terminations shall be high-pot tested at final assembly.

Cable entrance to panel boards, junction boxes, and/or other enclosures exposed to the weather shall be from below. Side entrance may be provided only where entry from below is impractical and ASPA approval must be obtained in each specific case.

Any cable not running in conduit shall be protected from direct sunlight by appropriate means.

All flexible conduit used shall be UL approved, liquid tight flexible metallic conduits, terminated in approved end fitting from the same manufacturer and installed as per NEC requirements. Imprinted UL approved markings are to be clearly visible at intervals on the external jacket, the flexible conduit and on the end fittings. The use of flexible conduit shall be minimized and occur only where required to accommodate relative motion, etc. All flexible conduit locations shall be submitted to ASPA's Engineer for review.

Flexible, multi-conductor power and control cables shall be used to make connections between the boom structure and waterside support beams. These cables shall be designed for low temperature cable reel type service.

Other than at points of penetration through the structure, welding shall not be used to support conduits. Points of penetration shall be shown on the shop drawings and approved by the Contractor's Structural Engineer. All nuts on embedded conduit straps shall, after installation, be tack welded.

Wires shall be properly identified on both ends with wire numbers that are coordinated with the schematic documentation using a self-laminating, moisture, heat and oil resistant type label. All wire labels shall be computer generated and printed on a letter quality printer; after the wire label is installed, both the wire label and terminal sleeve shall be further protected with a clear shrink tube. The proposed wire label shall be provided to ASPA's Engineer for review.

All AC power and control, DC power, and Low Level digital communication circuits shall be segregated to avoid the inducement of noise due to electro-magnetic induction and/or capacitive coupling. Segregation shall be accomplished by installing wire and cable of different voltage levels in separate conduits or segregated wireways. Separate junction boxes shall be supplied for AC and DC power to maintain segregation and provide optimum safety. High voltage (greater than 500 VAC) wire and cable shall be in completely segregated conduit systems including junction boxes, pull boxes and conduit systems. To maximum extent possible, all high voltage wire and cable pulls will be continuous without intermediate junction points or terminations.

All control system communication (outside of the drive panels) shall be via fiber optic.

The entire electrical installation, and cable specifications where appropriate, shall meet the requirements of the Control System Supplier.

Two (2) spare shielded twisted pairs shall be run from:

- (a) the end of the boom to the Electrical Control Room.
- (b) the operator's cab to the Electrical Control Room and
- (c) the ground remote station to the Electrical Control Room.

Twelve (12) spare control wires shall be installed between the electrical control room to the gantry level junction boxes (Total of 24 wires). The location for terminating the spare wires shall be submitted to ASPA's Engineer for review.

6.7 SPACE HEATERS

Space heaters shall be provided for control panels, all motors greater than 15kW, brake enclosures, and switch enclosures. A red warning plate shall be provided at each heater location, warning of the separate power source. Heaters in motors and brakes shall be automatically cut off during Loader operation. A monitoring system to indicate power to

the space heater bus when the Loader is stowed shall be provided. LED and CMS indication of current flow in the main function motor space heater circuits shall be provided.

6.8 MOTORS AND BRAKES

All motors, including main function motors, shall be totally enclosed and waterproof, (IP55 rating) with appropriate cooling provisions. All electric motor brakes shall be totally enclosed and waterproof (IP55). Aluminum or aluminum alloys shall not be used for enclosures or windings.

As much as practical, all motors shall be of the same manufacturer, type and rating in order to facilitate maintenance and minimize spare parts requirements. In any case, they shall be made by a manufacturer with an excellent service record and a worldwide service organization with service available in close proximity to Mobile. Main function motors shall be supplied by the Control System Supplier or an ASPA-approved equal. Type F insulation shall be used as a minimum. Where multiple motors are used for a system, all motors shall be identical.

All motors and brakes shall be sized for torque ratings and thermal loadings of design requirements specified elsewhere, including the duty cycles of Section 5.6, and shall meet requirements of applicable codes and regulations. All motor specification requirements for thermal capacity and acceleration/deceleration rates apply with 50% operating wind from the worst direction.

Boom hoist and telescoping motors shall be waterproof totally enclosed with continuous duty rating. Boom shuttle (if used) and telescoping spout motors shall be waterproof, totally enclosed with continuous duty rating. Boom and trailer conveyor motors shall be waterproof, totally enclosed with continuous duty rating. Gantry motors, shall be waterproof, totally enclosed, with minimum of 60 minute duty rating. Other arrangements may be used if approved by ASPA.

Motor brakes and redundant drum brakes (boom hoist) shall be sized in accordance with applied loads, duty cycles and applicable codes to provide maximum safety and efficiency. There shall be at least one boom hoist and telescoping motor (holding) brake with torque rating no less than (160%) of the maximum torque required to raise the boom and at least one boom hoist drum (redundant) disk brake with torque rating no less than 175% of maximum boom hoist torque required to raise the boom. There shall be at least one boom shuttle (if used) motor (holding) brake for each motor with torque rating equivalent to 200% of rated motor torque. The shuttle brake(s) shall be adequate to hold the shuttle boom with stowed wind load from the least favorable direction. Each gantry motor shall have a motor (holding) brake with torque rating no less than 250% of rated motor torque. Telescoping spout and conveyor brake(s) shall be sized according to F.E.M.

All brakes shall have adequate thermal capacity for two successive emergency stops under worst case operating condition with WLO from the most severe direction.

Waterproof motors shall be provided with suitable drain plugs and breathers as recommended by the manufacturer.

Where feasible, sealed bearings, adequate for the life of the motor, are preferred. Otherwise, motors shall be equipped with regreaseable anti-friction bearings designed to handle required thrust and radial loads and to provide a 50,000-hour minimum life expectancy. Fan motors shall have a 100,000-hour minimum life expectancy. Grease fittings for motor bearings shall be of a different configuration than the other grease fittings used on the Loader(s). Motors shall be completely greased prior to shipment from their place of manufacture. Thrust bearings shall be provided as required and shaft end play shall be limited to bearing clearances. Motor bearings shall include resistance to damage due to induced currents in bearings.

All motors equipped with anti-friction bearings using pressure grease fittings shall have relief plugs so designed that grease cannot be forced into the motor windings.

Where motors are fitted with brakes or gears, if the design precludes the use of conventional wheel pullers, tapped holes or other means shall be provided for removal of the brake or gear. All motor connection box covers shall have at least four bolts. Electrical motor brakes shall be of sufficient capacity to decelerate design loads from full speed, independent of any regenerative braking, and shall meet the requirements of the applicable design, test and acceptance procedures. All brakes shall have provisions for manual release.

Electric spring set thruster released caliper disk brakes shall be adjustable and furnished with autowear compensator with self centering feature to equalize pad to disk air gaps, a hand release mechanism, and brake release limit switch.

Brakes shall be fitted with incombustible linings not adversely affected by moisture and where applicable, with waterproof coils. Waterproof brakes shall be equipped with external hand release.

Electric brakes for motors exposed to the weather shall be fully enclosed in water resistant housings with access covers easily removable for adjustment and repair, and furnished with external hand releases.

All pins in brakes shall be of high strength bronze or stainless steel. Adequate clearance shall be provided around brakes for maintenance and disassembly. Watertight enclosures shall be provided with drain check valves.

6.9 CONTROL EQUIPMENT

Master switches, controllers, circuit breakers, limit switches, and similar gear shall be within the scope of the Control System Supplier and as much as practical be of the same manufacturer, type and rating to facilitate maintenance and to minimize spare parts. This may be accomplished by using oversized relays and conductors for the lowest rated demand.

All automatic controls including limit switches and interlocks shall have provisions for manual override. Circuit breakers shall be capable of opening circuits when carrying the maximum fault currents obtainable at their point of application. The protective features and interrupting ratings of all circuit breakers shall be coordinated to provide protection for the entire electric installation without exposing any equipment to excessive thermal or mechanical stress.

Circuit breakers shall be equipped with thermal magnetic overload trips that are ambient compensated.

Drive control panels shall be installed in the electrical control room in NEMA 12 gasketed enclosures with wiring having both ends of each conductor labeled with permanent wire numbers. Each section shall have hinged front doors, front access only, open bottoms and space heaters.

All control panels shall be interlocked electrically and mechanically and be provided with maintenance lockouts. For testing and check out, it shall be possible to by-pass the interlocks.

A desk and storage cabinet shall be provided for the programmable controller in the electrical control room. The desk shall be so located to provide unobstructed view of all controls in the control room and machinery in the machinery house.

6.10 CONTROL SYSTEM

A uniform electrical control system manufactured by an ASPA-approved manufacturer of electrical Loader controls shall be provided. The system shall be the latest state-of-the-art digital AC adjustable voltage/frequency control system as manufactured by ABB Industrial Systems.

In general the control system shall include the following equipment:

Digital direct power conversion units for variable speed control of Loader functions.

Programmable master controllers with user-friendly ladder diagram programming for drive coordination and sequencing.

Network for remote input/output data collection and communication bus link to master controllers.

User-friendly diagnostic system.

For each Loader, one set of all instruments, test devices, monitors, computers, and other devices required for control system diagnostics, troubleshooting, or maintenance shall be provided. This quantity shall include all devices necessary to upload, download, or change software. One laptop computer, with all necessary hardware and software, shall be provided with each Loader. Laptop and CMS computers shall be provided with read/writeable CD drives.

Any other devices required for reliable, safe, and efficient control of a Loader meeting the intent of these specifications.

The control system supplier shall have responsibility to review the design and installation of the entire Loader's electrical system and certify to ASPA that the design and installation are in conformance to the drive requirements, and shall have within their scope all parts, components and systems that affect performance of the drive system, and shall be required to perform and provide electrical design details/calculations including duty cycle calculations and power system study (including coordination study). The control system supplier shall be required to attend at least the first two (2) design review meetings.

The electrical drive system for boom hoist and telescoping, boom shuttle (if used), telescoping spout, gantry motions, and conveyors shall provide reliable power for rapid, smooth, and precise handling through the use of AC variable voltage/frequency power conversion units controlling AC induction motors. The system shall be designed for maximum simplicity and maintainability. (This is to be demonstrated during the submittal and review process).

Protection against loss of motor regenerative capability shall be provided in all hoists control systems. The circuit shall sense any difference between reference speed and actual speed and in such a case initiate a controlled shutdown of the drive. The torque-proving circuit shall be provided to prevent release of the motor brakes unless the motors are developing torque to control the load based on current and voltage feedback.

All main function motors shall be provided with tachometer feedback (speed feedback). Gantry system shall have one encoder per rail.

Control of boom hoist and telescoping, boom shuttle (if used), telescoping spout, gantry, and conveyor motors shall be stepless, digitally regulated, and regenerative over the entire operating range of the equipment.

Master switches shall be either inductive or digital without sliding contacts. The operator shall be able to increase or decrease the speed of the boom hoist, telescoping, shuttle (if

used) and gantry drives and alter their direction by moving the master switches in the appropriate manner. In addition, the operator will have the ability to fix the speeds at any intermediate point between zero and full speed.

The acceleration and deceleration of the drives shall be under the control of the operator, except that if the operator moves the master switches rapidly, acceleration and deceleration shall be limited, automatically, to predetermined adjustable values. The linear time ramps for the boom hoists, shuttle and gantry motions shall be asymmetrical for acceleration and deceleration times. The deceleration time shall be less than the specified acceleration time and shall be based on the motor/drive system's capabilities. All ramps shall have capability for adjustable rate of change of both acceleration and deceleration. When the operator moves the master switch toward the "off" position, the load shall be slowed electrically. The speed of all motions shall be infinitely variable from full speed through zero to full speed in the opposite direction with no dead band.

The controls shall electrically stop all drives on motor torque before setting brakes. Normal handling brakes for the boom hoists, slewing and gantry shall set after independently adjustable time delays (0-30 seconds), when the master switches are returned to the off position. The control circuits shall be so designed that all brakes are delayed in setting during normal operation until the associated motor has stopped (zero speed) by means of regenerative braking, at which time the adjustable delay shall begin. Motor torque shall be maintained until the brakes have set. If the control power has been removed for any reason, all brakes shall set immediately.

Brake control relays shall be adequate to extinguish the arc upon opening under all operation conditions.

All Loader motion initiated by master switches shall have an independent backup circuit which monitors motion of the master switch and the corresponding Loader movement - sometimes referred to as a "tach loss" circuit.

The time between the initial movement of any master switch and the start of rotation of the corresponding machinery shall not exceed seven tenths of a second. This timing shall be demonstrated with chart recordings from other currently operating drives (chart speed shall not be less than 5 mm/sec.), as well as during the test procedure for the Loader.

Each power conversion unit assembly shall be selected using the following criteria, as a minimum:

The nominal current rating of the assembly shall exceed the RMS current of the motor as determined by the theoretical duty cycle.

The continuous current rating of the assembly shall exceed the motor current required to move load.

The 60-second current rating of the assembly shall be 150% of the required RMS current as determined by the theoretical duty cycle.

The 10-second current rating of the assembly shall exceed the current limit setting established to meet the acceleration and deceleration rates required by these specifications.

All the above ratings shall be based on the maximum specification design ambient temperature.

All power wiring termination shall be brought to terminal studs or bus bar flags mounted at the bottom of the control panel. In no case shall external power or control connections be made directly to drive control units.

All terminal blocks, wires, conduit space shall have 10% spares provided, with a minimum of one (1). Power cable for gantry motor shall have one spare (minimum) provided in each leg, to be reviewed to a mutually agreeable solution in the design review phase. The requirement for conductors and conduit fill will be reviewed on a case by case basis and applies to all runs outside the Electrical House.

Convenient means shall be provided to electrically isolate all motor circuits from regulator and converter circuits for maintenance and troubleshooting.

Gantry motors shall be arranged with each drive controlling half of the motors on each rail (east and west). Conveyor motions and at least one other motion must be capable of operating simultaneously at full performance .

The drives must be organized such that problems can be resolved by replacement of drive modules (boards) which are interchangeable between all motions on the Loader.

The control system shall incorporate a state-of-the-art programmable logic controller using ladder logic for general Loader control, interlocking, and sequencing except for emergency stops and end of travel circuits. Emergency stops and emergency end of travel stops for all motions in all directions shall be hard wired external to the controller.

Where applicable, remote I/O blocks shall be installed to reduce electrical components and wiring. Any instruments or equipment required to test or configure I/O blocks shall be provided; one complete set of required equipment shall be provided for each Loader.

Industrial rack-mounted computer(s) with the required software installed for programming and troubleshooting shall be provided with each Loader control system. An appropriate color printer, storage case (if removable), program disks, instruction manuals, etc. shall be included.

The electrical control system shall have an integral diagnostic system which will provide integral monitoring, and diagnostics. All diagnostic messages and status data shall be user-friendly and programmable.

6.11 ENHANCED DIAGNOSTIC MANAGEMENT SYSTEM

An enhanced control system diagnostic, monitoring and management system, (hereafter called CMS), shall be provided. In addition to advanced control system faults and diagnostics, the system shall provide Loader drive and production monitoring, including belt weights, material flow and accumulative throughput fault and event logging, preventative maintenance date logging, alarms and information to aid in determining causes of faults. The system shall use graphical displays as feasible. The system shall include the capability to program drive parameters using the CMS. The system shall also monitor auxiliary drive parameters and performance such as the main power cable reel drive.

The supply and wiring of fiber optic cables between conveyance system and termination box are not supply scope of the Contractor.

6.12 MOTOR CONTROL CENTER

The AC motor control shall be in an NEMA 12 gasketed enclosure with wiring with both ends of conductors labeled with permanent wire markers. Each panel shall have hinged front doors, removable bottom cable entry plates, front access only, and space heaters. Feeder breakers shall be thermal-magnetic type circuit breakers. Integral motor starters shall be provided that include disconnect means, over-current protection, and over load protection in a single device.

Each starter shall have mechanical indication and a normally open auxiliary interlock wired to the terminal board. Lamacoid nameplates shall be provided for each module.

The motor control center shall be installed in the electrical control equipment room and shall include, but not necessarily be limited to, the following:

- a) A 3-phase main line circuit breaker, branch circuit breakers including those for the maintenance hoists feeders, welding outlets, control panel feeders, and cab feeders.
- b) Lighting circuit breaker and 3 phase lighting contactor.
- c) Combination full voltage non-reversing units for machinery house fan, motor blower motors (if used), and wheel brakes.
- d) Three spare sets of overload relays and one spare starter.

6.13 CONTROLS

The operation can be by wireless remote, manual control of simultaneous operations or local control of individual operation. The manual control of simultaneous operations shall be from operator's cab and by wireless remote, and the local control of individual operations from the near vicinity of mechanisms.

All necessary controls, indicators and equipment for emergency action shall be conveniently located in the cab for ease of operation by the operator when he is seated in the fully adjustable chair provided for his use. All controls shall be clearly marked to indicate operation and direction of motion; markings shall be in English. Arrangement of controls shall be similar to the existing Loaders and submitted to ASPA for review.

The operator's console shall contain all control mechanisms and indicating lights necessary for stacking and reclaiming operation. "Set-up" type of controls and indicating lights such as control power on, hydraulic pump controls, and heater controls may be placed elsewhere, but shall be within easy reach of the operator.

The console shall contain at least the following:

Pushbuttons for the following:

- (a) Emergency stop
- (b) Control re-set
- (c) On-board trailer conveyor
- (d) On-board boom conveyor
- (e) Cab Window Washers/Wipers
- (f) Floodlights
- (g) Tripper

Master Switches for the following:

- (a) Shuttle (if used)
- (b) Luffing
- (c) Telescoping
- (d) Telescoping Spout and Spoon
- (e) Gantry Travel

In addition, a rheostat to dim cab overhead lights and an ashtray secured against sliding shall be provided.

A visual display is to be positioned above and in front of the operator so as not to obstruct the view.

Flood lights and access lights shall be turned on and off at the gantry level, from the electrical control equipment room, and from the cab. All lighting control shall be hard wired.

Transfer switches shall not be used to transfer control between cab, and vicinity remote control stations. Beginning with control power off, resetting control power at any station shall transfer control to that station.

6.14 SWITCHES AND RECEPTACLES

Pushbutton stations and selector switches shall be provided in the locations, types, and for the purposes as described elsewhere in these specifications. Pushbuttons and selector switches shall be of heavy-duty oil-tight construction and shall be NEMA 4X in all locations.

Switches, convenience outlets and cord connectors shall be industrial heavy duty corrosion resistant with adequate rating. Switches and outlets in exposed locations shall be in IP54 enclosures, with switches having external operators and outlets having screw caps and gaskets.

Not less than twenty (20), 20A 120V single phase, duplex convenience outlets shall be provided, in accordance with local codes and requirements, as follows:

- One in the Operator's Cab.
- Two on the boom (one at each end).
- One on the peak of the gantry frame.
- Four (4) in the Machinery House.
- Two at gantry level (one adjacent to each rail).
- Two in Electrical Control Room.

All outlets shall be grounded type, suitable for operation of conventional hand power tools, and if directly exposed to the weather, shall be weathertight. Wiring shall be 600-volt insulation.

Six (6) AC welding outlets shall be provided, one in the Machinery House, one at the gantry peak, one at the boom tip, one at boom hinge area (or waterside support if shuttle type provided), one on the waterside leg near the rail level, and one on the landside leg near the rail level. The voltage and receptacles are as required by local codes and requirements.

6.15 PANELBOARDS AND TERMINALS

Terminal boards, strips, blocks, etc. shall be of self-extinguishing phenolic or similar nonhygroscopic insulation material and shall be equipped with barriers between terminals. Twelve (12) to eighteen (18) spaces on each terminal board, strip, and block shall be provided as spares.

Solderless screw type terminal lugs shall be provided for all connections. "Twist-on" type wire nuts shall not be provided in any location on the Loader. For connection/termination of prewired components, ring terminal lugs with stainless steel bolts or ASPA approved compression type joints shall be provided. Terminal lugs shall be solderless clamp or compression ring type, except that 1.5mm² or smaller wiring may be fitted with crimp type terminals, or equal. The conductivity of the connected cable shall not decrease due to the conductivity of connections. Cable supports shall be provided where necessary to avoid undue stress on devices or terminals. Softeners shall be provided where necessary to prevent chafing of insulation.

All bolts, studs, nuts, screws, and washers shall be stainless steel or another approved corrosion resistant material and of adequate size. Lock washers or other vibration resistant means to prevent loosening and rotation shall be used on all connections. Aluminum terminals or connections shall not be used.

All control panels shall be constructed so all contents may be readily and quickly serviced, repaired, or removed.

Panelboards shall be dead front, circuit breaker type, to applicable Standards.

Switching units, which are identified by directory cards, shall be numbered serially.

All bus bars shall be made of hard drawn pure commercial copper and all bus bar joints and contact areas shall be finely finished and silver surfaced throughout. Silver for contact areas and studs shall be practically pure, not coin silver, and the dipping and brushing method of electroplating shall not be used.

Bolts, nuts, and washers used to maintain contact on bus and connection bars shall be of stainless steel.

All bus and connection bars shall be adequately supported to prevent vibration and to withstand short circuit stresses.

Gauges shall be provided as follows at an ASPA approved location within the electrical control room:

- (1) Voltmeters for all AC main function motor stators.
- (2) Ammeters for all AC main function motor stators.
- (3) Frequency meters for all AC main function motors.
- (4) Voltmeter, ammeter, and frequency meters for main AC supply.
- (5) Tachometers for all motors with tachometer feedback.

For the gantry motors, two sets of gauges shall be provided – one set per drive.

In addition, elapsed time indicators reading in hours and tenths of hours to a maximum of 99,999.9 hours, non-resettable, shall be installed in the main control panel for the boom hoist function, slewing function, conveyors, bucket wheel and gantry function to record running time when the equipment is energized.

6.16 LIGHTING SYSTEM

In order to safely and efficiently perform stacking/reclaiming functions and to facilitate necessary maintenance of the Loader, the Contractor shall furnish and install an adequate, centrally located lighting system. Light level measurements shall be provided as follows:

Head of Boom (on boom) - 100 lux at ground level (designed for fog conditions)
Drive/Conveyor Drives/Telescoping Drive - 100 Lux at Access Level
Operator's Cab - 150 Lux (Anti-glare type)
Control Panels - 50 Lux
Walkways, Platforms, Stairways, ladders - 50 Lux
Gantry Travel - 50 Lux (outer side of gantry)
Machinery House/Electrical House – 300 Lux

Provision shall be made to adjust the angle of mounting, and for permanent, suitable access for maintenance and relamping. All floodlights shall be provided with external safety chains connecting the lamp fixture to the mounting foundation.

All operating lights shall be mounted so that movement of the Loader, any part thereof, or the load shall not cast shadows on the work area below, or on any access passage.

Controls for operating floodlights shall be located in the electrical control equipment room, at ground level and in the cab. All lighting control shall be hard wired.

The Machinery House and electrical control room shall be equipped with self-contained, battery operated emergency lighting units. This system shall have a 3-hour duration in case of main or auxiliary power supply failure, and shall provide sufficient illumination for safe transit through the areas.

The lighting system shall be supplied from the Loader power system through a 3-pole circuit breaker, a suitable size, 3-phase, dry-type transformer, and a suitable lighting panel which shall be installed in the electrical control room. Auto transformers are not acceptable. The transformer shall have a minimum of fifteen (15) KW unused capacity. The Contractor shall submit total calculated load for review.

Aircraft and navigational obstruction warning lights, marking and control (if required) shall be provided in accordance with applicable requirements. These lights shall be automatically controlled. Spare lamps equal to two complete system replacements shall be furnished.

6.17 LIMIT SWITCHES & INTERLOCKING

The Loader shall have all necessary protection and interlock functions to provide a safe and efficient operation, limiting and interlocking functions may be achieved through an appropriate programmable logic control (PLC) unit, with the exception of those functions to be operated with complete mechanical switch gear as required by safety, applicable codes, certifying bodies, or otherwise noted in the Specifications.

Rotary Limit Switches shall be such that if one of the contacts in the unit is operated while traveling in a given direction, it will remain in that direction and will reset only when rotated in the opposite direction. Each switch shall be easily adjustable to operate at any point within the entire range of travel.

All switches shall be heavy duty, dustproof, watertight and suitable for marine use. Lever operated limit switches shall be rated for the speed of the tripping cam and, shall be heavy duty type. Fork lever switches shall not be used.

All limit switches shall be mounted in easily accessible positions to facilitate adjustments, maintenance, and replacement. Limit switches shall not be mounted in access systems where they are subject to damage or will present a tripping hazard.

Hardwired over-travel limit switches shall be provided for all motions in all directions, including, boom up/down, telescoping in/out, shuttle forward/backward (if used), telescoping spout upper/lower and gantry left/right.

In addition to the functions specified or identified elsewhere in these specifications, the Contractor shall furnish switches for any additional functions that, due to peculiarities of the design, as required for safe and efficient operation.

If interlock conditions are not met, when the Loader is to be operated, the system will automatically display the reason. If the Loader is being operated and a fault occurs and operation is stopped, the system will automatically indicate the cause.

When the operation is stopped due to activation of any protection or interlock, the system will have a “smart” function, and the mechanism on which that fault occurred can be re-started only after the fault has been eliminated and the “fault reset/confirm” button in the cab has been pressed.

When any end emergency limit is activated the reverse travel at low speed is possible only after “Reverse by-pass” button is pressed.

All electrical equipment shall be provided with proper protective devices and alarms, as well as clear fault displays. This includes the protection against short-circuit, overcurrent, overvoltage, grounding, overloading, over-temperature, break down, undervoltage (voltage loss), grounding leakage, phase loss, instantaneous overload protection including

appropriate lightning protection. All protective devices must be submitted to ASPA's Engineer for review.

At a minimum, the main electrical equipment shall be provided with the following protections:

1	High-tension switchboard and transformer	1. Short circuit 3. Voltage loss (undervoltage) 5. Zero sequence protection	2. Overcurrent 4. Overvoltage 6. Over temperature (transformer)
2	Low-voltage power distribution cubicle	1. Short circuit 3. Phase sequence 5. Overvoltage	2. Overcurrent 4. Voltage loss (undervoltage) 6. Grounding (leakage)
3	Motors	1. Overload 3. Short-circuit 5. Grounding (leakage)	2. Phase loss 4. Overtemperature
4	Lighting circuit	1. Short-circuit	2. Grounding (leakage)
5	PLC and speed regulation unit	1. System Protection 3. Unit self-protection	2. Motor protection
6	Power Source	1. Voltage loss (under voltage) 3. Short-circuit 5. Grounding (leakage)	2. Overvoltage 4. Overcurrent
7	Cable reeling unit	1. Cable slackened 3. Three wraps of cable left when fully paid out	2. Cable over-tensioning

In addition to protection functions mentioned above, each mechanism of the Loader shall also be provided at least with the following interlocks:

- (1) Zero position interlock of the master controllers.
- (2) Fault interlocks of PLC, inverter and protection devices.
- (3) Interlocks and response of operation in sequence of the trailing conveyor, boom conveyor, hopper, tripper board etc. under operation condition. In addition, interlock of these mechanisms with the ground belt conveyor.
- (4) Interlock of the brake status.
- (5) Traveling:
 - a. Gantry rail clamps, stowage pins, anti-collision device, cable reeling unit and anti-tear device of ground belt shall be interlocked with gantry traveling;
 - b. Wheel brakes shall be applied automatically when wind speed exceeds 20m/s;
 - c. Correction of position of gantry traveling;
 - d. Other necessary interlocks.
- (6) Boom Luffing
 - a. Interlock of upper end limit and extreme emergency stop limit;
 - b. Interlock of lower end limit and extreme emergency stop limit;
 - c. Permit of boom height (or angle) detection;
 - d. Other necessary interlocks.

- (7) Boom Telescoping:
 - a. Interlock of telescoping shuttling with boom height (angle)
 - b. Detection of breakdown stall and protection interlock;
 - c. Telescoping end limit and emergency limit interlock;
 - d. Limit interlock of boom stowage position;
 - e. Interlock of boom anti-collision (pull cord switches are to be used, one of each left and right side of boom);
 - f. Other interlocks as necessary.
- (8) Shuttle Mechanism (if used)
 - a. Emergency limit and protection means at boom stowage location;
 - b. Normal limit and protection means at boom stowage location;
 - c. Shuttle minimum and maximum emergency limits;
 - d. Shuttle minimum and maximum normal limits;
 - e. Other interlocks as necessary
- (9) Belt Conveyor Mechanism:
 - a. Speed detection interlock;
 - b. Switch of belt running off center, cord switch interlock;
 - c. Pushbutton for by-pass of belt running off center;
 - d. Protection against blockage in the hopper and telescoping spout;
 - e. Interlock of dock belt on the tripper running off center;
 - f. Other necessary interlocks.

The electric main switch on the Loader shall incorporate means of protection against earth leakage. The means of protection shall be by earth equipotential bonding and automatic disconnection supply.

On all master switches, it shall be necessary to return the handle to the “OFF” position in order to reset control power.

All motors shall be equipped with a thermal overload switch and motors over 15kW shall be equipped with “motor over-temperature lights” located in the main control panel. All thermal overload indicator circuits shall be connected to a pair of audible warning devices located at dock level.

Circuit breakers used in panelboards shall be of the commercial marine molded case type, quick-break, with inverse time tripping characteristics on overloads and an instantaneous trip device for short circuits. Welding outlet circuit breakers shall be interlocked with the drive breakers. Main function circuit breakers shall be provided with a contact for input to the CMS.

Fuses are not desirable, but if used, shall be of the nonrenewable standard cartridge type and size except for special applications such as current limiting fuses.

- (10) Alarm System

An acoustic and visual alarm system shall be provided for the gantry traveling system. There will be four (4) sets in total at both ends of traveling trucks. When traveling is in operation, acoustic and visual alarms will be automatically activated.

The boom shall be provided with acoustic alarm for starting of telescoping or shuttle (if used) and boom conveyor. The trailer shall be provided with acoustic alarm for starting of trailer conveyor. When a command signal of the conveyor starting is given, the alarm shall be activated giving alarm signal, and then the conveyor starts running after several seconds.

An acoustic alarm shall be fitted in the operator's cab and the operator may give alarm to personnel concerned if he thinks necessary.

(11) Wind Alarm:

An anemometer shall be mounted on the highest point of the Loader. The operators cab shall be provided with acoustic and visual alarms of the set wind speed. The operator's cab and electrical house shall be provided with wind speed display. Transient wind speed and mean wind speed for 2 minutes shall be displayed in the driver's cab. Alarm signal is given when wind speed reaches 17 m/s.

(12) Emergency Stop

Emergency stop pushbuttons shall be installed at the following locations, as a minimum:

- a. One in the operators cab;
- b. One in the electrical house;
- c. One in the machinery house;
- d. One at each side of the boom head (two in total);
- e. One at each side of the boom rear part;
- f. One at each side (waterside and landside) near access stairs;
- g. One at each side of the trailer (two in total).
- h. One at wireless control device

The emergency Stop buttons shall be the large "mushroom" head type and shall trip control power. The buttons shall be located at a height for convenient operation by a man standing (except in the Operator's cab). The buttons shall be plainly marked "Emergency Stop", in English.

(13) Electronic Scale on Boom Conveyor

The boom belt conveyor shall be provided with an electronic belt scale with angle compensation, dynamic accumulative error $< \pm 0.5\%$. This electronic scale shall have at least the following functions:

- a. Display of transient material flow and accumulative amount through the belt;
- b. Communication with PLC on the machine.

- (14) Interlock between controls on machine and on ground.
- (15) Detection Devices: detection accuracy and final selection shall be decided by ASPA during preliminary design review.
 - a. Detection and correction device for gantry traveling position;
 - b. Detection of boom luffing position;
 - c. Detection of boom telescoping position
 - d. Detection of boom shuttle position (if used);
 - e. Detection of height of telescoping spout.

6.18 COMMUNICATION SYSTEM

A low voltage telephone system shall be furnished by Gaitronics or Control and installed between the Operator's Cab, the Machinery House, the electrical equipment control room, the A-frame, the boom tip, and the remote control panels near each function (additional locations may or may not be needed, depending on location of other systems). Loudspeakers shall be connected to the system to permit a user at any station to address persons in the Machinery House, electrical equipment control room, operator's cab, and on the ground. All stations shall have call buttons, "Press to Talk" buttons and volume controls. Units exposed to weather shall be housed in weatherproof enclosures.

Telephone "hands-free" headsets with flexible coiled cords, shall be installed in the Machinery House and in the electrical equipment control room inside labeled watertight enclosures. The extended lengths of the cords shall allow use of the headsets anywhere in the machinery house or electrical control room.

In addition, provisions shall be included in Operator's Cab for ASPA supplied radio communication equipment. This will include a mounting platform, power supply, antenna, etc.

6.19 GROUNDING

All electrical apparatus and motors shall be effectively grounded by means of appropriate size copper conductors brought to a common point, which shall be grounded in accordance with local requirements. The minimum cross-sectional area of earthing conductors shall be 70 square millimeters for copper (or ASPA-approved equivalent for other material). Series connections are not permissible. The Loader structure shall also be grounded. Grounding conductors shall not be run or be fixed on any access path, floor, passage or walkway.

All ground cables shall be terminated in mechanical lugs, which in turn shall be rigidly bolted to the ground terminals of the equipment. The ground connections shall be made on to rigid conduits by means of heavy-duty type copper clamps.

Flexible metallic conduit should not be used as a protective conductor. Ground continuity shall be provided by separate ground conductor connecting the rigid conduit and the ground terminal of the equipment. To ensure that effective grounding continuity is maintained, the

maintained, the ground conductor shall be installed with corrosion resistant stainless steel or brass mounting hardware on to the end fittings.

The whole installation is to be carried out in a neat and workmanlike manner to comply with appropriate regulations, including local ordinances, and to the satisfaction of ASPA's Engineer.

Unless otherwise approved by ASPA's Engineer, only UL listed/approved flexible conduit and end fittings shall be used.

6.20 MACHINERY HOUSE VENTILATION

Power and control shall be installed for Machinery House fans. Control shall consist of a manual-off-automatic switch, an adjustable thermostat, circuit breaker, and starter. The thermostat shall control in the automatic mode. The automatic mode shall interlock with Control Power "ON".

6.21 NAMEPLATE, WARNING PLATES & CIRCUIT IDENTIFICATION

All electrical equipment, the function and application of which is not immediately self-evident as judged by appearance, location, or other indications, or the service relationship of which to other equipment is not readily apparent, shall be supplied with a nameplate immediately adjacent and symmetrical to the equipment. The nameplates shall carry appropriate inscriptions, or identification markings, which will enable the operator and service men to form a quick and accurate appraisal of the overall relationship and relative functions of the components. All nameplates shall be in English and the native language.

Nameplates shall be provided for all devices on switchboards to identify function, indication, circuit, or purpose. Nameplates for voltage coils for shunt, undervoltage, or reverse current shall show voltage rating and value of external resistance used. Any special precaution, maintenance, or operating instructions shall be included on the nameplates or on a separate plate attached to the equipment.

In addition to the nameplates provided by the manufacturer of individual components, each major item of electrical equipment shall be provided with a nameplate designating its function and service.

Nameplates shall be engraved brass if exposed to the weather and may be engraved phenolic if located in the Operator's Cab or inside watertight/weatherproof enclosures.

Standard nameplates for motors and brakes must be legible and may be engraved or stamped.

All nameplates shall be attached with stainless steel screws.

Painting over nameplates will be cause for rejection.

All conductors shall be identified with wire numbers and prefix at each terminal to which they are connected, in accordance with the wiring diagram.

Positive and negative polarities of direct current buses and supply terminals shall be indicated by plus and minus signs, respectively, and shall be color-coded.

Phase identification of alternating current buses and supply terminals shall be indicated by the capital letters A, B, or C, respectively, as applicable. The letters, in that order, shall indicate the phase sequence.

Color-coding of power supply conductors shall be consistent. Where insulation colors are not compatible, colored synthetic tubing or sleeves shall be used at conductor ends and identified with circuit letter and number.

Cables shall be tagged at the main control center and junction boxes. Each conductor shall be identified at each end to agree with the circuit diagram.

Designation on markers and nameplates shall agree with designation on plans. Detail nameplate requirements and method of marking conductors shall be submitted to ASPA's Engineer for review.

6.22 BEARING BYPASS PROTECTION AND LIGHTNING PROTECTION

A minimum of one heavy-duty rail type collector shoe will be furnished at each rail for grounding the Loader. Provide a bolted wire mesh connection across each structure joint and bearing. A bolted on flexible cable shall bypass the boom hinge.

A lightning protection system is to be provided by the Contractor in accordance with BS 6651:1999. At a minimum, this system shall incorporate the following:

- a) Air terminals on the top of the tower and on the boom tip.
- b) Down conductors from the terminals which shall be isolated from the main structure, to conduct the lightning strike to the ground without flash-over to the main structure. The down conductor shall be the ERICORE conductor by Erico of Solo, Ohio, or ASPA-approved equal and shall be supported by insulated supports (insulators) at a minimum standoff distance of 6" (150mm) from the main supporting structure.
- c) Appropriate surge suppression protection to protect the Loader drive and other electrical equipment from surges on incoming power lines caused by lightning strikes in the vicinity.

It should be noted that the Mobile, Alabama vicinity has one of the largest number of lightning strikes of any vicinity in the United States. Extreme care shall be taken in the design of this system.

Final design of the lightning protection system shall be submitted to ASPA's Engineer for review.

SECTION 7 MISCELLANEOUS EQUIPMENT

7.1 MACHINERY HOUSE

A weathertight Machinery House, aesthetically appealing, constructed of steel plate and structural shapes, shall be provided on the Loader to enclose all boom hoist; boom shuttle (if used) electrical drives, switchgear and related equipment. The platform shall be sufficiently stiff to prevent deflection due to dead load, live load, wind and other forces.

All exterior welds shall be continuous. Bolted section joints shall be seal welded in assembly. The minimum wall thickness for all equipment enclosures is 2.5mm.

A roll-out access hatch shall be provided in the Machinery House deck sized to permit removal of the largest piece of equipment by means of a manual JIB or monorail type maintenance hoist described later in these Specifications. Smaller hatches shall be provided for handling small equipment and tools.

Platforms shall be provided around all sides of the Machinery House. Waterproof metal doors with locks keyed alike and with safety glass windows in the upper panel shall be provided in two walls of the Machinery House. Door hardware shall be brass or stainless steel. Drip shields shall be provided over doors. An automatic closer and a latching device to hold doors open shall be provided. All doors shall be steel, 36 inches wide and hinged with safety glass in the upper panel.

The Machinery House will be pressurized with filtered air by a suitable blower arranged to prevent the entry of rain water, snow and water vapor. The blower size selected shall be of sufficient capacity to change the air in one (1) minute. The Machinery House shall be adequately ventilated to maintain a maximum temperature rise in the Machinery House of five degrees above the ambient under working conditions.

A sign shall be posted indicating: "KEEP DOOR CLOSED WHEN MACHINERY IS IN OPERATION", written in English.

A separate air-conditioned enclosure shall be provided inside the Machinery House for the electrical control equipment. This enclosure shall incorporate double paned glass windows so as to provide visibility between areas and also visibility to the outside operating areas. A door shall be provided in this wall to allow access between areas. A fully partitioned section of the electrical enclosure shall be provided to house the CMS system and related equipment, as approved by ASPA. The enclosure shall meet the same requirements as the full electrical enclosure. The walls of this enclosure shall be double wall construction with sound and thermal insulation between the double layers. An exterior door shall also be provided and shall be as specified above. A continuous rubber carpet, free of all metallic items, minimum of 12mm thick shall be provided. A desk, chair, and storage cabinet shall be provided in the electrical enclosure. The electrical equipment room shall be equipped with a thermostatically controlled, heater/air conditioner system which will maintain

conditions of 20-25°C and 50% relative humidity under all outside weather conditions. This system must incorporate a minimum of two (2) units sized such that specification requirements are met with both units operating but with one unit not operating the remaining unit will maintain a temperature lower than 35°C and within the parameters required by the drive system design.

The layout of electrical equipment shall provide adequate space and access for all required equipment.

No heat-producing elements, such as large resistor assemblies, shall be located in the electrical control room.

ASPA desires that one (1) key fit all door locks on the Loader, but will accept one (1) master key that can be used by the maintenance personnel in lieu of one (1) key fitting all the locks.

7.2 OPERATOR'S CAB

The prime consideration in the design of the cab and the operator's console will be the operator's safety, comfort, and efficiency. The cab, control console, control devices, and their locations will be submitted to ASPA's for review. The cab shall be located on the upper portal structure of the luffing type Loader or boom of the shuttle type loader, with a clear view of all motions and operations, and submitted to ASPA for review.

The location and elevation shall be selected for optimum operator visibility and comfort. The cab shall be of double walled steel construction designed to be fire resistant and weather proof under all weather conditions. All cab exterior welds shall be continuous. The space between the double floor plates shall be used for electrical wiring. The upper floor plate shall be vinyl covered and bolted to provide access to the electrical wiring. Sound and thermal insulation shall be provided between the double layers of the walls and ceiling. Cab framing shall be securely fastened to the trolley by means of high strength structural fasteners. Final size and layout of operator's cab shall be submitted to ASPA for review.

The cab shall be equipped with a thermostatically controlled heater/air conditioner system which will maintain conditions of 24°C and 50% relative humidity under required specification ambient conditions.

Access to the operator's cab shall be by means of a platform and access door at the side or rear of the cab. The access door shall be identical in construction and keying to the Machinery House doors. Access shall be such that a disabled operator can be removed by stretcher without special rigging.

Cab design shall provide the operator full visibility of all boom, telescoping spout and conveyor operations and adequate window area. Glazing shall be from inside the cab.

External access to all glass shall be provided for cleaning purposes. Chair/console mounted electrical defoggers shall be installed as necessary to afford the operator unimpaired vision.

A large sun shade/drip rail shall be provided over the main front and side windows. Drip rails shall be provided over other windows and doors. All glass shall be safety glass. The top half of the front and two side windows shall have a heavy tint to reduce sun glare, but not so heavy a tint as to reduce operator visibility. Windows on the front and sides of the cab shall slide open for ventilation. A sufficient number of electric windshield wipers shall be provided that will allow operator complete visibility even in a wind driven rainstorm.

In order to provide comfort to the operator and to avoid fatigue, the operator's console shall be integral with a leather, upholstered, adjustable (three directions) chair. This high quality chair and console shall revolve together through 270 degrees. Both the console and chair shall be submitted to ASPA for review, and shall be supplied by the Control System Supplier.

Controls necessary for safety, communication, and operations shall be located on the console at the operator's fingertips when he is seated in a relaxed position with his arms on the arm rests. These shall include boom hoist, boom telescoping, boom shuttle (if used), telescoping spout, spoon, conveyors, and gantry master switches, and emergency stop push buttons. Indicator lights, which monitor the status of cyclic or safety functions shall be located within the peripheral vision of the operator when he is viewing the area. Non-cyclic operational controls shall be mounted on the console, but shall not be within "fingertip" reach of the operator. It is preferred that start-up controls and indicating lights, not essential to cyclic operation or safety be located on a separate control panel located on the cab wall rather than on the console. Space shall be provided on the console for the future addition of controls and indicating lights necessary for the operation of added future equipment.

Control devices shall be selected and located so a competent operator can quickly learn to safely perform cyclic operations by "touch" rather than "vision". The force required for spring return devices shall be minimum, commensurate with safety. The handle throw of master switches shall be minimum, commensurate with fine control.

An appropriate AC/DC power service shall be installed in the operator's cab for ASPA installed radio equipment.

7.3 REMOTE CONTROL STATION AT THE MECHANISMS FOR MAINTENANCE

A key switch activated, remote control station for the boom hoist, boom telescoping, boom shuttle (if used) conveyors, telescoping spout/spoon, tripper and gantry shall be provided and located adjacent to each mechanism. All motions shall be at 10% speed. The panel for gantry travel shall include a computer port (CMS port) for access to all maintenance and trouble-shooting activities, via a laptop plug-in. A control pendant for gantry travel control shall be provided. In addition, anemometer and weight indicating display shall be provided.

provided. Station shall be weatherproof or fully weather protected. Locations for all other remote stations shall be approved by ASPA. (See also Section 6.18). Momentary contact switches shall be used for boom hoist, boom telescoping, boom shuttle (if used) and gantry control in accordance with normal safety requirements.

7.4 WIRELESS REMOTE CONTROL

A key-activated, wireless remote control shall be provided for “stevedoring” purposes, and shall include all necessary loading operations and motions as well as safety. System and all details shall be as approved by ASPA.

7.5 VENTILATION

Machinery house enclosure(s) shall be adequately ventilated by fans to match the climatic conditions defined under Section 1.6. Fans shall be connected such that in the event of failure of one unit, the others will continue to work. All fans shall be thermostatically controlled (except motor blowers) and shall automatically switch on when the power to machinery is on.

7.6 STAIRS, LADDERS, PLATFORMS AND WALKWAYS

The platform arrangement shall be submitted to ASPA for review.

Stairs, ladders, platforms, and walkways shall be provided on the Loader to make readily accessible all parts and areas to which access is required for the Loader’s operation, lubrication, service, maintenance or inspection, including structural inspections. Details and locations shall be submitted to ASPA for approval and shall, in all respects, meet US OSHA, FEM and all local codes.

Walks, platforms, and stair treads shall be covered with bar grating or ASPA approved equal.

All handrails, ladders, cages, steel grating and stair treads shall be hot-dipped galvanized (not less than two (2) ounces per square foot) of a robust construction with high corrosion allowance. The handrails, ladders and cages shall also be painted. All platforms and stairway stringers shall be painted. Tread noses on stairs shall be of a standard round nose anti-slip type. All grating and stair treads shall be connected to the frames by hot dip galvanized saddle clips and/or bolts.

Walks, platforms, and stairs shall comply with SECTION 4 and shall be designed to sustain a distributed load of at least 2.5 kpa and a concentrated load of at least 150 kg. The concentrated load can move to any location on the platform and shall be placed in locations where it will cause the greatest stress. Handrails shall be designed for at least 30kg/m applied at the top rail run. Handrails shall be of solid construction or with ASPA’s approval sealed 4mm thick heavy wall type steel tubing. Stanchions shall be of solid steel plate, bar

plate, bar or shape construction. The top handrail shall be not less than 1.05m above the platform level. Openings in handrails shall be equipped with hinged gate arranged to automatically close safely. Walks and platforms shall have a toe plate with a minimum height of 100mm. Connections to the structure shall be approved by the Contractor's Structural Engineer.

Vertical ladders shall be avoided if possible, but may be used if necessary and approved by ASPA. Ladders shall be equipped with safety cages as required by the applicable codes. Platforms shall be furnished to limit the straight vertical run of a ladder or stair to 6.1m. Rungs shall be spaced at minimum of 300mm with a minimum of 180mm toe clearance to the nearest obstruction. All stairways and platforms shall be adequately braced to prevent sway and excessive vibration.

All horizontal girders that have a removable access hatch shall be equipped with handrails on both sides. Walking surfaces of horizontal girders shall be covered with a non-slip compound after final painting.

Stairs, ladders, walkways and platforms shall be provided as required to access the cable reel system at the gantry level in case of total loss of power to the Loader.

7.7 FIRE SAFETY

Two (2) CO₂ fire extinguishers (5 kg) shall be provided and installed in the Machinery House (one in the machinery room and one in the electrical equipment room). Each shall be located immediately inside the entrance doors. One (1) CO₂ fire extinguishers (5 kg) shall be provided and installed at the cable reel platform. In addition, three (3) CO₂ fire extinguishers (2.5 kg) shall be provided as follows: One (1) shall be installed in the Operator's Cab, one (1) shall be installed at dock level on each side of gantry. All extinguishers shall be of suitable type for the likely type of fire with consideration given to prevention of damage due to the extinguishers.

Temperature sensing fire detectors, gas automatic fire extinguishing device and alarms etc. shall be provided in the electric control room. The temperature sensing fire detector and automatic fire extinguishing system shall be interlocked with electrical system and shall give alarm to the operator's cab and ground central control room. The fire-fighting products shall have sizes and quantities conforming to national applicable standard.

7.8 WORKBENCH

A 1m x 1.5m metal frame, wood-topped workbench, of a standard manufacturer, complete with a 100mm jaw bench vise, shall be furnished and installed in the Machinery House to provide for service and maintenance operations. The bench shall be complete with sliding storage drawer and lock.

7.9 TOOL AND EQUIPMENT LOCKERS

Two (2) standard industrial type metal lockers shall be furnished and permanently installed in the Machinery House. One shall have standard shelving and the other shall have parts storage bins of various sizes. Each locker shall be approximately 1200mm wide by 1800mm high by 400mm deep and be lockable.

7.10 SPECIAL TOOLS

The Contractor shall furnish a set of all special tools required for the Loader operation, maintenance, repair and inspection. The Manufacturer shall provide a list during the design stages.

All software, programming tools and devices necessary to maintain and troubleshoot all components and equipment on the Loader (drives, encoders, etc.) shall be provided.

7.11 WIND ALARM AND ANEMOMETER

An ASPA approved anemometer wind alarm with service and support in the vicinity of Mobile and extensive industrial application experience shall be provided to indicate abnormal wind velocities. The alarm signal shall, by means of audible bell or horn mounted adjacent to the boom hoist local station, warn the operator that winds in excess of the operating criteria are prevalent and the Loader(s) should be shut down and stowed. Additionally, an audible bell or horn shall be mounted in the operator's cab. An audible bell or horn and a visual flashing light shall be provided adjacent to the gantry remote control station at the rail level. An anemometer wind speed display panel shall be mounted in the operator's cab and adjacent to the remote control station at the rail level. The design shall consider the following:

- (a) Adjustable for wind range.
- (b) The signal can be set for any speed between 15 m/sec and 30 m/sec.
- (c) The signal shall have at least two (2) set points for any wind speed between 15 m/sec. and 30 m/sec. The first set point shall be interlocked with all audible and visual alarms. The second set point shall be interlocked with the audible and visual alarms and set all gantry wheel and motor brakes.
- (d) The periodic maintenance is not more frequent than once per year.
- (e) Not sensitive to wind gusts of short duration.
- (f) Is not sensitive to a dusty, salty environment.
- (g) Is not sensitive to vibration of the Loader.
- (h) A bypass button shall be provided on the operator's console to allow the operator to override the high wind shutdown, reset control power, and gantry the Loader to the stowage position.

The anemometer system and its location shall be submitted to ASPA for review.

7.12 NAMEPLATES

A nameplate showing Contractor's name, address, Loader main specifications, serial number and Contractor's trademark shall be attached to the Loader. The lettering on the plates shall be readily legible. ASPA's logo and Loader number shall be placed on each side of the Loader in colors and layout as directed by ASPA.

All controls and drives used for normal operation or safety shall be clearly marked with labels in English.

7.13 WIRE ROPE RE-REEVING WINCH

A self-contained motor driven wire rope re-reeving device shall be provided in the Machinery House and shall be arranged to allow convenient re-reeving of the boom hoist or boom shuttle (if used) ropes during routine rope replacement. Access systems shall be provided to assure safe and convenient access of the re-reeving winch. The winch shall accommodate regular commercial cable reels and shall be equipped with a steel reel of a capacity adequate for the size and lengths of the ropes used in the system. A compressed air controlled variable torque disk brake, or other type as approved by ASPA, shall be supplied to control the payout of the replacement rope during re-reeving operations. Hand-applied brakes are not permitted. The re-reeving device shall be located so that the cable spools can be easily handled and installed by the Machinery House service Loader. The drive arrangement shall give adequate attention to safety and the drive motor shall include integral disk brake.

7.14 BOOM CONVEYOR ELECTRONIC SCALE

The boom belt conveyor shall be provided with an electronic belt scale with angle compensation, and dynamic accumulative error < 2%. The scale shall be two-idler system supplied by Ramsey or ASPA approved equal and contain at least the following functions:

*Display of transient material flow and accumulative amount through the belt.

*Communication with PLC.

7.15 MANUAL MAINTENANCE HOISTS

A minimum of three (3) manual 500 lbs. minimum working capacity jib or monorail type maintenance hoists shall be installed, one at the apex of the gantry frame, one above the outer boom platform and one above the tripper collapsible mechanisms position. A detachable manual block and chain fall shall be provided at each location. The apex hoist shall be designed to enable lifting components from the ground to the apex access surface. Maintenance hoist shall be designed to enable lifting components to and from the ground. The tripper hoist shall be designed to service and maintain the tripper collapsible system components. The location and design of the hoists shall be submitted for review.

A manual jib or monorail type maintenance hoist shall be provided at the machinery house frame area for boom hoist, boom shuttle (if used), machinery and electrical house equipment. The hoist(s) location and configuration shall be designed to enable lifting any of the drive components and lowering to ground. Capacity, type and location shall be approved by ASPA.

Manual jibs shall be provided at other locations as appropriate for servicing of heavy components (sheaves, wheels, etc.).

7.16 NOISE LEVELS

Noise levels shall meet the requirements of OSHA, but shall not be greater than 75db(A) in the cab and electrical house and not greater than 85 db(A) at exterior operation locations.

SECTION 8 CLEANING AND COATING

8.1 GENERAL

All metallic surfaces of the Loader shall be painted except nameplates, marine corrosion-resistant stainless steel, nickel and wearing or internal surfaces of mechanical parts. As used herein, "exposed surfaces," means surfaces exposed to the atmosphere; and "sealed surfaces," means interior surfaces of members sealed by welding and pressure tested.

The paint system shall be by Carboline, IP or ASPA approved equal and submitted to ASPA for review.

8.2 SURFACE PREPARATION

Any dirt, oil, grease or chemical contamination shall be removed by solvent washing or other suitable means before the start of shotblasting.

All surfaces to be painted shall be cleaned by shotblasting or centrifugal blasting unless otherwise specified or directed by ASPA's Engineer. The cleaning method to be used shall be stated on the shop drawings. The steel surfaces shall be cleaned per SSPC to Grade SP6 Blast Cleaning. This method of preparing the metal surface shall remove all mill scale, rust, rust scale, paint or foreign matter by use of abrasives propelled through nozzles.

The resulting surface shall have a uniform mottled gray appearance and shall have a surface anchor pattern of at least forty (40) microns and not over seventy-five (75) microns.

Prior to shotblasting all welds shall be given special attention for removal of welding flux in crevices. Welding spatter, slivers, laminations and underlying mil scale not removed during fabrication and exposed before and during the blast cleaning operation shall be removed by the best mechanical means. All exposed edges of steel shall be rounded to assure proper adhesion and build-up of coatings.

The compressed air supply used for shotblasting shall be free of detrimental amounts of water and oil. Separators and traps of a size and type recommended by the compressor manufacturer shall be provided and these shall be emptied prior to passing water and/or oil into the air stream.

Only bone dry shotblasting grit or mineral shot procedures will be allowed. Blasting grit shall be Graded Flint, Crystal Silica, Green Diamond or a synthetic media equal to the preceding.

The shotblasted surface shall be rendered dust free prior to the application of any prime coat.

No acid washes or other cleaning solutions or solvents shall be used on metal surfaces after being shotblasted. This includes any inhibitive washes intended to prevent rusting.

Shotblasting and painting operations shall be scheduled so that they will not be in progress at the same time, or so that blasting is not in progress while there is wet paint within the range of shotblasting contamination. The shotblasted surface shall be coated with one coat of primer, as specified, within four (4) hours of blasting and prior to sunset of that day, and also before any visible rusting occurs. Shotblasted steel wet by rain or moisture prior to priming shall be reblasted.

Outdoor shotblasting will be permitted only during daylight hours and on surfaces that are not wet after blasting or before painting.

Shotblasting will not be permitted when surfaces are less than 3°C above dew point or the relative humidity is greater than eighty percent (80%). The only exception to this will be for rough initial shotblasting which will be allowed during the night, provided the surfaces are cleaned and brightened the next morning with fresh light shotblasting to provide a “commercial” blasted metal surface.

8.3 COATING APPLICATION

All coating materials shall be furnished in unopened, clearly identifiable containers. No mixing of different coatings shall be done without the express permission of the ASPA’s Representative.

All coats shall be applied in accordance with the paint manufacturer’s recommendations.

Coatings shall be thinned only as recommended by the paint manufacturer.

The surfaces shall be clean, free from dust, and shall be dry before and during applications of any coating.

No coating shall be applied if the relative humidity is greater than eighty percent (80%) unless the paint manufacturer allows application at levels up to eight-five percent (85%), if the temperature is below 5°C, or in conditions outside the paint manufacturer's recommendations.

All coatings shall be allowed to dry thoroughly and/or allowed to dry the minimum time specified by the paint manufacturer, prior to application of a succeeding coat.

Coatings shall not be applied within 150mm of unblasted areas.

Coating film thickness limits shall be strictly adhered to. The film thickness shall be checked with a micro test or other approved calibrated film thickness gauges. Prior to application of any coat of material, all damage to previous coats shall be thoroughly cleaned

cleaned and touched up with corresponding specified coating. Damage to finish coatings shall be reprimed by the Contractor.

ASPA may make destructive tests of coatings on reasonably small areas to insure adherence of the coating. Cost of the repair of such areas shall be borne by the Contractor.

The sequence to be followed in painting shall be such that a minimum of damage to finished coating will result.

Each coat is to be applied uniformly and completely over the entire surface. Skims, skips, sags and drips will not be acceptable.

The Contractor shall provide step by step procedures for all cleaning and coating conditions to all painters and quality control personnel.

8.4 SPRAY APPLICATION

All paint shall be spray applied, except where inaccessible to spray and permission has been granted to use brush application. Airless application is acceptable. Coating materials, colors and minimum dry film thickness shall be in accordance with the Coating System described in this section.

All coating equipment shall be in good working order and will be inspected by the ASPA's Representative. Lines and pots must be cleaned before starting new applications.

A moisture trap of a type and size recommended by the paint equipment manufacturer shall be placed between the air supply and the pressure pot and the pressure feed to gun. The trap shall continuously bleed off any water or oil from the air supply.

Suitable regulators and gauges shall be provided for both the air supply to the pressure pot and the air supply to the pressure gun.

The spray gun shall be held no closer than 150mm nor more than 300mm from the surface to be coated and shall always be held at right angles to the surface. Even parallel passes shall be made with the spray gun. Arching of the spray gun will not be tolerated. Fluid pressure shall be maintained and regulated to deliver not more than 680g per minute of material from the spray gun.

Atomizing air shall be regulated to the minimum amount required to properly atomize the material. Spray width adjustment on the gun shall be made and readjustment of atomizing pressure at the regulators shall be made until the proper spray pattern is found. In the application of the coatings, each spray pass shall overlap the previous spray by fifty percent (50%).

8.5 BRUSH APPLICATION

Brush application is permitted on sealed surfaces. On surface areas where permission is granted for brush application, care shall be taken that each coat application does not exceed the manufacturer’s recommendation for maximum dry film thickness to avoid “mud cracking”.

Brushes shall be of a style and quality that will enable the proper application of materials. Brush width shall be no greater than 125mm.

Paint shall be worked into all crevices and corners, and all runs or sags shall be brushed out in order to assure no air pockets, solvent bubbles, “mud cracks”, or voids.

8.6 COATING SYSTEM “A”

The coating system used shall be provided with a full five (5) year warranty by the Contractor with responsibility as defined below. The coating system shall be generally as follows, but the Contractor shall provide an application approval from the paint supplier and assure the planned coating system meets the paint supplier's requirements to be warranted for the full five years.

Interior Sealed (Air-tight) Surfaces

	<u>Type Coating</u>	<u>Minimum Dry Film Thickness (Microns)</u>
First Coat	Pre-Construction Primer	25-30

Surfaces damaged by welding, both interior and exterior surfaces, may NOT be primed prior to airtight testing.

Upon completion of the airtight testing the exterior surfaces shall be properly prepared and coated and the interior surfaces shall remain uncoated.

Interior Non-sealed Surfaces

	<u>Type Coating</u>	<u>Minimum Dry Film Thickness (Microns)</u>
Shop Primer	Pre-Construction Primer	25 - 30

Prior to painting, the surfaces shall be blasted to grade SP6 finish.

First Coat	Epoxy Zinc Primer	65
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Second Coat	Epoxy Polyimide	125
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Exterior Surfaces

	<u>Type Coating</u>	<u>Minimum Dry Film Thickness (Microns)</u>
Shop Primer	Pre-Construction Primer	25 - 30
First Coat	Epoxy Zinc Primer	65
Second Coat	Epoxy Polyimide	125
Third Coat	Aliphatic Acrylic Polyurethane	50-75

Prior to painting, the surfaces shall be blasted to grade SP6 finish.

*Each coat shall be of a contrasting color. Finish coat colors shall be as specified by ASPA and in compliance with applicable codes and regulations at the Erection Site. Upper portions of the Loader frame, boom and supporting structures shall be painted with air craft warning striping meeting FAA regulations.

The second and third coats shall be applied after all shop welding has been completed.

Not more than seventy-two (72) hours prior to the application of the second and third coats, all surfaces shall be cleaned to remove all the surface contaminants. Coating abrasion from construction and welding shall be repaired as per original coating specifications before the second coat is applied.

Galvanized parts shall be degreased, washed, primed with a Wash Primer of 20 microns maximum thickness, and top coated with 50 microns of Aliphatic Acrylic Polyurethane.

The Contractor shall paint ASPA’s logos at locations on the Loader as directed by ASPA. Aviation striping shall be painted if required by local codes.

Representatives of the paint supplier shall be on site to qualify the Contractor’s initial application of the paint system. The paint supplier’s representative shall continue to monitor application of the coating system as required to assure a high quality durable coating system is provided.

After construction at the Erection Site, shipping transportation and erection damaged areas shall be cleaned by power tools to the Grade of St3, primed with 125 microns of coating with excellent adhesion characteristics to rusted steel and aged paints, and finish painted with 50 microns of Aliphatic Acrylic Polyurethane.

The conditions of coating system warranty are as follows:

The warranty covers the main structure, including walkways, handrails, stairs, etc. The purchased parts and accessories shall maintain the warranty provided by the supplier.

Failure is defined as corrosion of substrata in excess of ASTM-D610/SSPC-Vis2 Grade 5 on 1% of the total area or 3% of an area of 10 sq. meters.

Corrosion caused by physical and mechanical abuse or damage shall be excluded from warranty.

Deterioration caused by fire, explosion, welding or other related acts shall be excluded.

ASPA shall notify the Contractor, in writing, giving details of the nature of claim immediately and Contractor will give prompt attention. Repairs falling within the warranty shall be made only after the consultation of the Contractor.

8.7 COATING SYSTEM "B"

Faying surfaces, except those of slip critical connections, shall receive the first coat of the coating described under Coating System "A". Coatings shall be used on faying surfaces of slip critical connections only if they have been qualified to provide the slip coefficient required by the connection design. The Contractor shall provide supporting documentation if faying surfaces of slip critical connections are coated.

SECTION 9 SHIPPING AND ERECTION

9.1 GENERAL

The Loader shall be fully assembled, and tested as much as possible at the Fabrication Site or at another site selected by the Contractor.

After arrival of the component assemblies on the vessel at ASPA, the erection and transportation work shall be performed by an ASPA approved subcontractor. There are two (2) existing conveyor structures on the dock which must be removed for roll-off. This work will be scheduled and accomplished by ASPA, but must be fully coordinated via details and scheduled with this Contractor to limit shut-down of the conveyors and diminish delays for roll-off.

After erection is completed, the following shall be accomplished. Touch up painting as described in Section 8, field testing and certification as described in Section 10, clean up of the Erection Site and delivery of the Loader to ASPA. Adequate area will be provided at the Erection Site to allow erection of the Loader. Contractor shall be required to coordinate on-site activities with the conveyor removal contractor to allow re-erection of the conveyor system, after roll-off is completed.

Except for repair of damaged items such as platforms, walkways, stairs and ladders, field welding will not be allowed. Prior to repair of damage to any structural members, the Contractor shall submit his methods of repair for review by ASPA's Engineer.

The Contractor shall obtain all necessary permits required to install and test the Loader. Unless otherwise agreed to by ASPA, he shall also obtain all guard services, fire watches, telephone, utilities, and all supplies needed for the erection, testing, and delivery.

The Contractor shall provide, full time, a qualified Erection Engineer who shall insure that the Loader is off loaded, erected and tested in accordance with Contractor's recommendations and the requirements of this specification.

A qualified start-up engineer from the control system manufacturer shall be provided at the Erection Site during delivery, acceptance testing and initial Loader service to assure the control system is set up and adjusted in accordance with the manufacturer's requirements for optimum performance.

Plans for commissioning and overall detailed Erection Site schedule must be submitted with the Bid.

9.2 PACKING AND SHIPPING

The Contractor shall load out the Loader parts at his site, stow on the vessel, and transport to the Erection Site. All parts are to be packed in a manner that they arrive on site in good

condition with no deterioration in transit. The Loader shall be secured on the vessel to prevent any undue stresses that would affect the expected life of the Loader.

All mechanical and electrical equipment shall be properly covered and secured to prevent damage from movement, moisture, etc.

9.3 PRE-SHIPMENT CERTIFICATE

The Loader shall not be transported from the Fabrication Site until the Contractor has completed sufficient commissioning work and functional/acceptance testing such that in ASPA's opinion, subsequent to inspection of the Loader, it is reasonable that all remaining commissioning work and functional/acceptance testing can be successfully completed within an agreed upon period, after arrival of the Loader at the Erection Site. ASPA shall issue a Pre-Shipment Certificate once the existing status of the Loader and schedule of remaining work justify such an evaluation.

9.4 DELIVERY

The Contractor shall place the Loader on the rails at a location designated by ASPA, at the Erection Site, by approved methods.

All sea bracing/fastening, lifting padeyes, etc. shall be removed to parent metal and the welded areas repaired and ground smooth to the pre-welded state, cleaned, NDT inspected as required, and painted in accordance with Section 10. All work shall be in accordance requirements of AWS.

After arrival at the Delivery Site, the Loader shall be thoroughly washed down with fresh water until the sea salt residue has been fully removed.

Prior to start up for testing, the Loader shall be lubricated in accordance with the lubrication charts as described in Section 7.11. The Erection Engineer shall inspect and certify that all areas, including motors, are properly lubricated and that the Loader is ready for start up and testing.

9.5 CONTRACTOR SUBMITTALS

Ninety (90) days prior to shipment, the Contractor will submit for review his preliminary plans for loading and securing the Loader on the vessel and the preliminary plans and calculations for off loading and transporting the Loader at the Erection Site and completing all necessary Erection Site erection and commissioning work. The Contractor's Structural Engineer shall prepare, or review, and sign all calculations for shipping and erection.

9.6 CLEAN UP AND FINAL ACCEPTANCE

The Contractor shall repair any damage occurring as a result of his activities. This includes damage to fender systems, curbs, dock surface, pavement, and utilities. All debris resulting from his activities shall be removed and disposed of off-site. A final inspection by the ASPA's Engineer and the Erection Engineer shall include the clean up of the Erection Site. Prior to Final Acceptance, all "punch-list" items for the Loader and the Erection Site shall be satisfactorily completed.

SECTION 10 QUALITY ASSURANCE

10.1 SCOPE

It shall be the responsibility of the Contractor to establish a Quality Assurance Program. This program shall follow the guidelines established hereinafter. The Quality Assurance Program is to include, but is not limited to providing, a qualified supervisor, qualified inspectors, required inspections, and records. This program shall assure ASPA that all materials and/or work are supplied and/or conducted in accordance with the applicable codes, reviewed shop drawings, this Specification, and proper work practices for the various trades.

At least one of the Contractor's quality control employees shall be assigned full time to each location where components are fabricated. Components such as electrical motors and gear reducers should be tested and accepted by the Contractor at the manufacturer's plant.

All quality assurance shall be conducted at the Contractor's expense.

10.2 GENERAL

Upon the award of this Contract, the Contractor shall submit a detailed program proposal. This proposal shall include approach, schedule, and personnel resumes. Resumes are to include name, title, specialty, and experience. Acceptance of quality assurance inspectors will be pending the review of resumes. Inspection of multiple trades will be allowed only if these qualifications are reflected in the resume.

All non-destructive testing, materials testing, and bolt torque testing shall be conducted by an independent testing firm (Subcontractor), acceptable to ASPA. The Contractor shall also be allowed the option of utilizing a Subcontractor for the entire Quality Assurance Program. Acceptance of Subcontractors will be subject to the same criteria stated above.

ASPA reserves the right to retain independent inspection laboratories and/or engineers to insure strict compliance with the terms of the Contract Documents as well as local regulations required by Governmental laws. The Contractor shall keep ASPA and ASPA's Engineer fully informed as to the general progress of the work and shall notify ASPA and ASPA's Engineer, well in advance, when any item of equipment, component, or subassembly is ready for testing. If any subassembly should be assembled by the Contractor without such notification, or without allowing ASPA or ASPA's Engineer reasonable opportunity to inspect all of its components, ASPA will have the right to require the Contractor to remove or disassemble the assembly in whole or in part, so that proper inspection of its components can be made. The Contractor shall bear the cost of such removal or disassembly and no extension of time to the Contract completion date for this work will be allowed.

ASPA's inspectors shall have free access to the mills or shops of the Contractor and his subcontractors or vendors, and shall be supplied with all drawings and specifications

required to carry out the inspection. This independent inspection does not relieve the Contractor of his responsibility to carry out his own quality control.

Any work, materials, or equipment not conforming to these specifications will be considered defective, whether in place or not, and will be rejected by the ASPA's Representative. Work performed from drawings or revisions thereto which have not been signed or initialed by the Contractor's responsible Engineer will not be inspected and will be considered rejected. Refusal of ASPA to exercise such authority shall not impose any responsibility on him, and the Contractor shall remain fully responsible for the completion of his work as specified. Defective work shall be repaired using recognized and established procedures.

No inspector is authorized to change any provision of the Specification without written authorization of ASPA or ASPA's Engineer, nor shall the inspection and review by the ASPA's Representative, or lack of inspection and review, relieve the Contractor from any requirements of the Contract. Inspection by the ASPA's Representative will be performed in such a manner as not to unnecessarily delay the work.

10.3 RECORD KEEPING

Written record of inspections shall be submitted to ASPA's Engineer as required by this Section. Typewritten copies of each required inspection record or report shall be submitted to ASPA's Engineer bi-weekly. All inspection forms and reports shall identify job title, contract number, Loader number, type of test or inspection, location, comments, date of inspection, and the inspector's signature. Subcontractor's standardized forms will be accepted, if the above stated information is included on them.

The Contractor shall be required to submit all manufacturer's certificates and welder certificates in accordance with the General Provisions of this Specification.

All radiographic film shall be submitted to ASPA's Engineer for review.

Digital progress photographs shall be taken and submitted to ASPA's Engineer each week for the duration of the project. The photographs shall reflect the work being conducted in that particular week. All photographs shall be dated and labeled and forwarded via e-mail to ASPA's Engineer at least bi-weekly. Two (2) bound copies and 2 CDs of each submittal shall be required by ASPA's Engineer.

10.4 INSPECTION METHODS

Acceptable inspection methods for this project are as follows:

10.4.1. Visual Inspection

This type of inspection shall be conducted with the human eye and measuring devices. Verification of proper dimensions, ratings, working space, access, labeling, sizes, and work practices shall be accomplished by this type of inspection.

10.4.2. Non-Destructive Testing

This type of testing will be used to test welds and material for defects. Acceptable methods of non-destructive testing are as follows:

1. M.T. - Magnetic Particle Testing
2. Dye Penetrant Testing
3. U.T. - Ultrasonic Testing
4. Radiographic Testing (x-ray)

10.4.3. Electrical Testing

The acceptable instruments for testing electrical installations are as follows:

1. Calibrated Voltmeter
2. "Ground Resistance" Test Meter
3. Light Meter calibrated in footcandles or lux.
4. Ammeter
5. Oscilloscope
6. Control Diagnostic Instrument with Print Out
7. Megger
8. High Pot Tester
9. Sound Pressure Meter (decibels)

The scope of tests shall include:

- a. Continuity of Protective Conductors
- b. Insulation resistance
- c. Polarity
- d. Functional check of all protection devices

10.4.4. Air Test

This test is a pressure test to determine the air and/or watertight integrity of a specified structural member or tank. This test is accomplished by filling a member or tank with air to a pressure of 1.5 psi. Upon pressurization, a soap solution is applied to all welded joints, fittings and bolted covers. These joints shall then be visually inspected for evidence of leakage, (soap bubbles). If leaks are discovered in screwed or bolted joints, leakage shall be corrected by tightening until all evidence of soap bubbles disappears. If leaks are discovered

in welded joints, the pressure shall be released before repair is initiated. Leaking welds shall be corrected by removing the defective portion of the weld by air arc gouging and rewelding. Peening shall not be accepted as a means to correct leakage in welded joints. After the weld has been repaired, the member or tank shall again be pressurized and testing shall be repeated.

The testing rig shall include a calibrated pressure gauge, a positive closing valve to shut off the air supply, and a relief valve set at a pressure not to exceed the specified test pressure (1.5 psi). A calculated head of water to maintain the test pressure is recommended in lieu of a mechanical relief valve.

10.4.5. Water Hose Test

This test is used to determine the air and/or watertight integrity of welded joints and fittings in structures that cannot be air tested.

This test is accomplished by subjecting the test areas to a spray of water from a 38mm diameter hose at a pressure of 50 psi. The nozzle of this hose is to be held a maximum of 3m from the test area.

While the test areas are being subjected to the spray of water, the inspector shall visually inspect the opposite side for evidence of leakage. If leakage is discovered, these shall be corrected by the methods specified under "Air Test" and the test repeated.

10.4.6. Air Hose Test

This test is to serve as an alternative to the "Water Hose Test". Test areas are to be subjected to an airflow from a 10mm nozzle at 90 psi. The nozzle is to be held as close as possible to the test area.

A soap solution is to be supplied to the test areas opposite the areas subject to the airflow. The inspector shall then inspect for evidence of leakage, (air bubbles). If leakage is discovered, these shall be corrected by the methods specified under "Air Test" and the test repeated.

10.4.7. Chalk Test

This test is to serve as an alternative for testing manhole covers for watertight integrity. This test is to be used on manhole covers where only the covers are required to be tested.

Chalk is applied to the entire sealing flange edge opposite the gasket. The manhole cover will then be closed and then opened. Upon opening, the inspector shall visually inspect the gasket for a continuous chalk mark. A break

in the chalk mark indicates an improper seal. This defect is to be corrected by adjustment.

10.4.8. Hydrostatic Test (Piping)

This test is to determine the tightness of piping systems. The piping shall be pressurized with water to one hundred-fifty percent (150%) of the working pressure. Pumps and miscellaneous equipment in the system, which are unable to withstand the test pressure, are to be isolated using blanks.

Upon attaining the specified test pressure, all joints in the system are to be visually inspected for evidence of leakage. If leakage is discovered, pressure shall be released from the system, and leakage shall be corrected by the methods specified under "Air Test" and the test repeated.

10.4.9. Bolt Torque Test

The Contractor is to utilize the services of an independent testing firm acceptable to ASPA to perform this test. This test is to assure the proper torques of structural and mechanical fasteners.

Ten percent (10%) of all critical structural and equipment mounting fasteners, but not less than two (2) fasteners per critical connection, are to be randomly checked for proper torque values. This test must be conducted using a calibrated torque wrench. ASPA's Engineer will require submittal of the torque records upon completion of the test for review.

10.4.10. Blueing of Mounting Surfaces

This test is to verify that adjoining mounting surfaces are in proper contact.

The test shall be conducted by applying a thin film of blue machinist's dye to one (1) of the adjoining surfaces. The two (2) surfaces shall be joined and separated. The surface that was not coated with dye shall be visually inspected. If this surface is not fully coated, there is improper contact. This defect shall be corrected by approved remachining or shimming.

10.4.11. Mechanical Property Testing of Critical Structural and Mechanical Fasteners

The Contractor is to submit all manufacturers' fastener certificates to ASPA's Engineer. As a double check, the Contractor shall be required to randomly test the fastener system to verify mechanical properties. This testing shall be performed by an independent testing firm, acceptable to ASPA, commissioned by the Contractor. The sample fastener system shall be tested for proof load, tensile strength (wedge test), and hardness. Samples are to be selected at random from each shipping lot. These samples shall include the entire fastener

system. Included in the system are the bolt, nut, and washer. The quantities of samples to be tested per shipping lot are to be determined as follows:

<u>Number of Pieces In Shipping Lot</u>	<u>Number of Specimens</u>
150 or less	1
151 to 280	2
281 to 500	3
501 to 1,200	5
1,201 to 3,200	8
3,201 to 10,000	13
10,001 or more	20

If any fastener in a shipping lot is found to be defective, the entire lot is to be rejected. Records of these tests shall be required by ASPA's Engineer for review.

10.4.12. Supplemental Hardness Testing of Critical Structural and Mechanical Fastener Systems

In addition to the test specified above, the hardness of one random fastener per connection shall be checked. If the hardness is below tolerance for size and grade, hardness tests on the other fastener systems in the connection shall be checked. If others are found to be below tolerance, proof-loading tests shall be conducted on the "suspect" fastener systems. If any fails the proof loading, the connection fasteners shall be considered rejected.

10.4.13. Hydrostatic Testing (Tank)

This test is to determine the watertight or oil tight integrity of a tank.

The tank shall be filled with clean, fresh water until it overflows thru the overflow pipe. This will simulate a full tank. The inspector shall inspect all welded joints of the tank for evidence of leakage. If leaks are discovered, these shall be corrected by the methods specified under "Air Test" and the test repeated. Prior to correcting any welded joint, the tank shall be completely drained of all water.

10.5 FABRICATION INSPECTIONS AND TESTS

10.5.1. Structural Materials

All structural materials are to be visually inspected for any apparent defects. Size of materials is to be inspected as required.

All critical structural fasteners are to be visually inspected upon receipt. In addition to visual inspection, the Contractor shall be required to test fastener systems to verify their mechanical properties as specified under “Inspection Methods”.

All welding electrode and flux container labels are to be inspected to verify compliance with the Specifications.

10.5.2. Structural Fabrication

Structural members are to be periodically visually inspected throughout fabrication. Dimensional verification of all structural components for compliance with the design drawings and specifications shall be made by the Contractor throughout the fabrication and erection process. All structural components shall be fitted together at ground pre-assembly prior to erection stages to insure proper fit-up of bolted connections, welded joints and pin connections. As the fabrication of individual members and ground pre-assembly is completed, the Contractor shall conduct a final inspection, before releasing that member to be painted. This inspection shall include visual inspection, dimensional and nondestructive testing (NDT).

All weld inspection shall be in accordance with AWS requirements for dynamically loaded structures

All full penetration groove welds used in tension members and members subject to reverse loadings, including flanges of members in bending, shall be inspected by both radiographic and ultrasonic testing. Unless otherwise instructed, these welds shall be radiographed for 20% of its length and the remaining 100% ultrasonically tested. In the event welding defects are discovered, the amount of radiographic examination may be increased at ASPA’s Engineer’s direction to 100% of the length of the welds. Testing shall be done by or under the direct supervision of properly qualified personnel. All fillet welds in members subjected to a fatigue stress range exceeding 70% of the allowable stress range shall be inspected by magnetic particle testing. In areas that cannot be reached properly with magnetic particle testing equipment, ultrasonic testing shall be used.

If a structural member is to be hermetically sealed, it shall first be air tested in accordance with the "Air Test" requirements prior to applying any coating to the exterior of this structure or the interior welds unless approved by ASPA's Engineer. Records of air tests are required by ASPA's Engineer for review. These sections shall be retested after the covers are installed and painted, and Contractor shall seal weld around the plug when the air test is complete.

All primary structural members which are not hermetically sealed and tested by the "Air Test" method are to be either "Water Hose" or "Air Hose" tested prior to applying any coating to the interior or exterior of the structure. This testing shall be conducted as specified under "Inspection Methods." Records of this testing are required by ASPA's Engineer for review.

If any critical structural fastener systems are permanently installed during fabrication, torque values shall be checked in accordance with "Torque Test" requirements. Records of this testing shall be required by ASPA's Engineer for review.

10.5.3. Mechanical Materials

Certificates for mechanical stock and wire rope proof loads shall be submitted to ASPA's Engineer for review.

Purchased machinery is to be visually inspected for apparent defects or damage upon receipt.

All castings, forgings, pins, and axles shall be non-destructively tested (NDT) by an independent testing firm. Acceptable test methods are "Ultrasonic Testing" (U.T.) and "Radiographic Testing" (x-ray). Records of these tests shall be required by ASPA's Engineer for review.

Mechanical property testing shall be conducted on all critical mechanical fastener systems. These tests shall be conducted in accordance with the mechanical property test requirements. ASPA's Engineer shall require records of this testing for review.

10.5.4. Mechanical Fabrication

All fabricated machinery parts shall be inspected for compliance with the reviewed shop drawings, applicable codes, and proper machinist practices.

Measurements of critical machined surfaces shall be required to verify compliance with the reviewed shop drawings. Records of these measurement inspections shall be submitted to ASPA's Engineer for review.

10.5.5. Painting Materials

The Contractor's Inspector shall verify that all paint complies with the Specifications upon receipt from the manufacturer.

10.5.6. Paint Application

All blasted surfaces are to be visually inspected prior to coating applications.

Each coat of a paint system shall be visually inspected to verify application in accordance with the Cleaning and Coating Section.

Dry film thickness readings shall be taken for each coat of a paint system. These readings shall be taken every two square meters. Ten percent (10%) of all readings shall be taken on surfaces not easily accessible, such as inside stiffener angles. Records of these readings shall be required by ASPA's Engineer. These records shall indicate the Loader number, member, type of paint, and color. Adhesion tests shall be taken as appropriate and as directed by ASPA's Engineer.

10.5.7. Electrical Materials

Electrical components, such as wiring, conduit, motors, transformers, and generators, shall be inspected for damage and defects upon receipt from the manufacturer.

10.5.8. Electrical Wiring

Shop wiring shall be visually inspected for compliance with the electrical specifications, reviewed wiring diagrams, applicable codes, and proper wiring practices.

10.6 SHOP ERECTION INSPECTION AND SHOP TESTS

10.6.1. Structural

Supplemental hardness testing of critical structural connection fastener systems permanently installed in the shop shall be tested in accordance with "Supplemental Hardness Testing of Critical Structural and Mechanical Fastener Systems". Records of this testing are to be submitted to ASPA's Engineer for review.

10.6.2. Mechanical

Installation of all major machinery shall be inspected to verify proper mounting and alignment. Record of machinery installation inspections shall be required by ASPA's Engineer for review.

Critical mechanical fasteners shall be torque tested in accordance with "Torque Testing" requirements, after machinery installation. Records of the Torque Testing shall be required by ASPA's Engineer.

Supplemental hardness testing of critical mechanical connection fastener systems permanently installed in the shop shall be tested in accordance with "Supplemental Hardness Testing of Critical Structural and Mechanical Fastener Systems". Records of this testing are to be submitted to ASPA's Engineer.

Prior to shipping, all major mechanical components and machinery shall be shop tested to demonstrate proper working order. Shop testing is to include, but is not limited, to all travel assemblies and all hoists drives. Equipment will be allowed to be tested without the full reeving of drums and sheaves. All sheaves are to be moved by hand to determine proper free-movement. Rope clearances shall be inspected in the shop. Records of all shop testing shall be required by ASPA's Engineer.

10.6.3. Electrical

All motors are to be checked for proper rotation and wiring prior to shop testing.

During commissioning and final acceptance testing, motor vibrations shall be verified for all 3 major axis with the acceptable vibration limits based on the motor manufacturer's acceptance criteria. Equipment shall be subjected to applicable vibration tests and records shall be submitted to ASPA's Engineer for review.

Lighting shall be shop tested prior to shipping for verification of proper working order.

During final acceptance testing, slewing, boom hoist and gantry brakes shall be verified to meet the Contractor's specified brake capacities. The method and procedure for performing the testing shall be submitted to ASPA's Engineer for review. Testing shall be done after installation of the equipment on the Loader.

10.6.4. Painting

All painted surfaces are to be inspected prior to shipping. If any damaged coatings are found, they shall be repaired prior to shipping.

10.7 DELIVERY INSPECTIONS

10.7.1. Structural

Upon delivery of the Loader to the Erection Site, structure and machinery shall be inspected for any damage incurred during shipping. These inspections shall be conducted in the presence of ASPA's Engineer. Reports of these inspections are to be submitted to ASPA's Engineer and appropriate parties for review.

Bolt torque tests on structural joints, as described in Section 10.4.9, shall be performed at the delivery site after shipment. ASPA's Engineer shall require records of the Torque Testing.

10.7.2. Electrical

All electrical equipment and wiring is to be inspected prior to the start of the operational tests.

10.7.3. Painting

After the application of the touch-up coat, an inspection of this coating shall be conducted. Total dry film thickness shall be taken and recorded as specified in this Section. Thickness shall comply with those specified in the coating Section of this Specification. Records of the readings shall be submitted to ASPA's Engineer for review.

10.8 ACCEPTANCE/PERFORMANCE TESTS

Prior to the Erection Site testing, all systems must be complete and functional. All significant component/systems shall be commissioned at the Erection Site by the applicable component manufacturer's representative (including the brakes, cable reels, etc.) The Contractor shall prepare formal test procedures for all required tests and submit them to ASPA's Engineer for review, ninety (90) days prior to scheduled tests. These test procedures will prove the compliance of this Loader to the Specifications. The Contractor shall successfully complete performance tests and provide the test reports to ASPA's Engineer for review prior to shipment of the Loader.

10.8.1. Safety Test

The Contractor shall operate the Loader without load in each mode at full rated speeds to establish integrity of all limit switches, including over travel switches, back up limit switches, interlocks lights, and controls to the satisfaction of ASPA's Engineer.

These tests shall be completed as part of the Acceptance/Performance Tests.

10.8.2. Speed and Power Test

The Contractor shall complete the following operations and record the measurements of voltage, amperage of the drive motors, and the operational speeds of the functions during these operations.

1. Run all motions at full speeds to the limits of their travel. Slowdown and end limit switches are to be checked by running each motion at full speed into its extremes of travel, depending solely on the limit switches to slow and stop that particular motion. Operation of over travel switches shall be verified at full speed.
2. Perform any tests as required by applicable local codes and regulations for rated capacity.

10.8.3. Endurance Test

The Loader shall be operated through a cyclic operation, which simulates an actual operation. ASPA will provide material; however, Contractor shall be responsible for all other incidentals and the carrying out of test. The Loader shall be demonstrated to be able to raise/lower and telescope boom, shuttle (if used), telescopic spout, rotate spoon and gantry (one at a time) while loading test material at maximum and rated capacity. With test material, run through a normal operation. This cycle is to be repeated continuously for twenty (20) hours. The last eight (8) hours are to be trouble free. The Contractor shall correct all malfunctions that develop and these corrections shall be made to the satisfaction of ASPA and without affecting the guarantee.

The testing and adjustments specified shall be made by and at the expense of the Contractor.

During the testing measurements are to be taken of speed, voltage and amperage at the drive motors as follows: (A report of these readings shall be furnished to ASPA's Engineer.)

a. Boom Hoist Motor

1. Raise boom without material
2. Lower boom without material
3. Raise with load material
4. Lower with load material

b. Telescope

1. Telescope "out" boom without material
2. Telescope "in" boom without material

3. Telescope “out” boom with material
 4. Telescope “in” boom with material
- c. Shuttle Motor(s) (if used)
1. Shuttle boom without material
 2. Shuttle boom with material
- d. Gantry Motors
1. Travel right without material.
 2. Travel left without material.
 3. Travel right with material.
 4. Travel left with material.
- e. Conveyors (Boom & Trailer)
1. Run without material
 2. Run with material
- f. Telescopic Spout
1. Lower spout full length
 2. Raise spout full length
- g. Spoon
1. Rotate clockwise
 2. Rotate counter clockwise
- h. Wind velocity and direction of the wind, as well as the mean temperature, shall be taken and recorded at the time of test.
- i. In addition, strip charts of master switch reference, motor speed (if equipped with tachometer), current, voltage, and frequency shall be made with a chart recorder supplied by the Contractor. The readings and chart recordings shall be submitted to ASPA’s Engineer in a clear and easy to comprehend format prior to acceptance of the Loader.
- j. During the endurance tests, a chart recording of motor current, voltage, frequency and speed at a chart speed of 5mm/second for one complete cycle shall be made for the boom hoist and another for the shuttle motor. The portion of the cycle shall be logged on the chart recording.

5. Electrical Systems Operational Test

Prior to the Acceptance/Performance Test, the following systems or equipment shall be tested and reported as herein specified.

1. Verify that the taps on all transformers are set to deliver voltage indicated in the Contract Documents with the system in full operation. This test shall be conducted with a calibrated voltmeter.
2. Each grounding point shall be tested after all connection to ground points are made but before grounding conductor connection is made to the frame. Ground point installations shall be tested by “fall of potential” measuring method using ground resistance test meter.
3. All electrical systems shall be tested for compliance with the Specifications. The Contractor shall provide personnel and equipment required to assist the ASPA’s Representative in conducting the tests.
4. Equipment covers such as panelboards, trims, motor control covers, device plates and junction box covers shall be removed for inspection of internal wiring. All circuits throughout the project shall be energized and tested for operation and equipment connections tested for in compliance with Contract Documents.

6. Additional Acceptance Tests

1. Illumination Tests

Illumination readings shall be taken and recorded on the access systems and in the work areas specified in the Lighting Section. These readings shall be taken with all machinery in operation and during the nighttime hours with all facility lighting off. Access lights shall be measured with main floodlights off.

2. Climate Control Tests

All climate controls shall be demonstrated to verify proper operation. Temperature in climatically controlled spaces shall be measured and recorded.

3. Functional Tests

The following equipment shall be tested to demonstrate proper operation.

- a. Maintenance Lockouts
- b. Communication Equipment
- c. Signals, alarms, and by-passes
- d. Gantry Stowage Pins, Tie Downs and other Stowing Devices
- e. Boom Securing System
- f. Interface of Gantry Bumpers with Bucket Unloader and Dock Bumper

- g. Safety systems (anti-collision, overload, anemometer, belt weight system, over travel switches, etc.) and bypasses
- h. Power factor correction/harmonic filtering equipment
- i. Motor vibration tests

5. Gantry Gage Measurements

- a. Gantry wheel gage (of trucks) shall be verified prior to acceptance.

10.9 CERTIFICATION

The Contractor shall perform all actions necessary to obtain certification required by the Regulatory Bodies in order to place the Loader in service.

The Loader shall be certified in accordance with regulations of the local governing agency. It shall be the responsibility of the Contractor to have this certification made by an accredited individual or organization. The tests and inspection made by the accredited individual or organization shall be combined with the above acceptance tests and it shall be the responsibility of the Contractor to furnish to the accredited individual or organization a copy of the test procedure at least two (2) weeks prior to the tests.

The Contractor shall furnish ASPA's Engineer with a copy of the certificate on the wire rope and on the air tank or air compressor.

10.10 FINAL INSPECTION AND PUNCH LIST

Upon successful completion of the operational tests, an inspection shall be conducted by ASPA's Engineer. This inspection shall identify remaining work, missing parts and defects. The Contractor's Inspector is to accompany ASPA's Engineer during this inspection.

A punch list will be compiled by ASPA's Engineer indicating items found during the inspection. This list will be distributed to both ASPA and the Contractor. Final Acceptance will not be considered until all items noted in the punch list have been supplied or corrected to ASPA's satisfaction. The Contractor's Inspector shall verify correction of all punch list items before requesting ASPA's Engineer for a subsequent inspection.

SECTION 11 ADDITIONAL EQUIPMENT

11.1 GENERAL

The Contractor shall provide all labor, materials, equipment, and service necessary to design, construct, deliver, erect, test, and place in service a Loader complete, operational, and certified as described in these Specifications. In addition, the additional equipment as hereinafter described shall be provided.

Additionally, ASPA seeks maximum Loader performance, productivity and ease of maintenance and will entertain other options that may result in enhancements in these areas. Contractor may provide information including prices and descriptions for any additional options they feel beneficial.

11.2 SPARE PARTS

The Contractor shall provide an itemized list of recommended spare parts for the Loader along with prices as the design of the Ship Loader progresses. ASPA shall select the spare parts to be provided from these lists.

SECTION 12 MAJOR COMPONENT SUPPLIERS

COMPONENT	REQUIRED SUPPLIER(S)
Shuttle Drum Coupling (if used)	Malmedie
Shuttle Motor Brake (if used)	Bubenzler-Bremsen
Shuttle Gear Coupling (if used)	Bubenzler-Bremsen
Conveyor Belt	Goodyear
Conveyor Belt Cleaner	Martin, Flexco, Gordon
Idlers	Continental, Hewitt-Robins, FMC-Linkbelt,
Gantry Motor Brakes	Bubenzler-Bremsen
Boom Hoist Drum Coupling	Malmedie
Boom Hoist Drum Brake	Bubenzler-Bremsen
Boom Hoist Motor Brake	Bubenzler-Bremsen
Boom Hoist Gear Coupling	Bubenzler-Bremsen
Boom Telescoping Motor Brake	Bubenzler-Bremsen
Boom Telescoping Gear Coupling	Bubenzler-Bremsen
Gear Reducers	Flender, SEW, Sumitomo, Falk or ASPA approved
Bearings	see breakdown in Section 5.7 for suppliers
Couplings	Flender, Sumitomo, Falk, Brooks-Hansen
Wire Rope	Bethlehem, MacWhyte, Bridon
Hydraulic Fittings	Parker
Hydraulic Hose	Aeroquip, Parker
Hydraulic System Components	Rexroth, Vickers
Hydraulic Bumpers	Oleo
Gantry Wheel Brakes	Hillmar
Gantry Cable Reel	Specimas, Stemmann, Wampfler
Trailing Power Cable	Prysmian

COMPONENT	REQUIRED SUPPLIER(S)
Control System	ABB, TM-GEor ASPA approved
Transformer, Switch Gear	ABB, TM-GEor ASPA approved
Main Function AC Motors	ABB, GE
Floodlights	GE, ASPA approved
Communication System	Gaitronics, Control
Lightning Protection	Erico
Paint	Carboline, IP
Weight Belt System	Ramsey
Belt Slip Detector	Telemecanique
Belt "Snaking" Detector	ASPA approved
Magnet Separator	Walker, Erizes
Erection and Transportation Sub-Contractor at ASPA	ASPA approved
Conveyor fluid coupling	Voith/Transfluid
Telescoping Spout and Rotating Spoon	DCL or ASPA approved

SECTION 13 DRAWING AND TECHNICAL DATA, SUBMITTAL LIST, MINIMUM REQUIREMENTS & SCHEDULED SUBMITTAL DATES

The Contractor shall submit “ALL” design drawings, calculations, technical data, purchased component information, shop drawings, etc. pertaining to the Loader for review.

The following list of drawings and technical data establishes the “minimum” requirements for submittal of information to allow ASPA’s Engineer to perform a thorough technical review of the Loaders which will be supplied to ASPA:

1. <u>Calculations</u>	<u>Submittal Date</u>
1. <i>Stability Analysis</i>	
1. Factor of safety criteria	
2. All component dead weight calculations	
3. Wind loading calculations (wind pressure, surface area, drag coefficients, etc...)	
4. Gantry corner and wheel loads	
5. Operating stability condition calculations	
6. Stowed stability condition calculations	
7. Gantry tie down and stowage pin calculations	
8. As-Built dead load calculations	
9. As-Built operating and stowed stability calculations	
2. <i>Fatigue Calculations</i>	
1. Duty cycle calculations	
2. Description of design and design code criteria	
3. Stress calculations of all members, connections etc.	
3. <i>Design Criteria</i>	
1. Structural	
2. Mechanical / Electrical	
3. Electrical	
4. Design Code(s)	
4. <i>Structural Calculations</i>	
1. Gantry Components	
2. Frame	
3. Trailer/Tripper	
4. Boom	
5. Machinery House/Support Structure	
6. Electrical Room/Support Structure	
7. Walks, Platforms, support, etc.	
8. Conveyor Components	
9. Tie downs/Stowage pins	
10. Natural Frequency	

	11. Hopper/Chutes	
	12. Counterweight Support	
5.	<i>Mechanical Calculations</i>	
	1. Gantry Drive (Wheels, axles, bearings, couplings, reducers, brakes, wheel brakes, etc.)	
	2. Telescoping Boom or Shuttle Drive Components (Gear box, brakes, couplings, Ring Bearings, shafts, wheels, axles, brakes, etc.)	
	3. Cab Travel Components	
	4. Boom Hoist Components	
	5. Hopper/Chute	
	6. Collapsible Tripper Components	
	7. All hydraulic systems and schematics	
	8. Telescopic Spout and Rotating Spoon	
	9. Wire Rope(s)	
	10. Boom Hoists Wire Rope Equalizer Assembly	
6.	<i>Electrical Calculations</i>	
	1. Cable Reel/Slip Ring	
	2. Electrical Control System Description/Component Details	
	3. All electrical schematics and wiring diagrams	
	4. Wiring/Conduit Sizing	
	5. Gantry, Boom Telescoping, Shuttle Conveyors, Telescopic Spout, Tripper Boom Motors (if used)/Controls	
	6. Motor/Drive Duty Cycle/Sizing Calculations	
	7. Power Consumption Calculations	
	8. Safety devices and limit switch(s), proximity(s), etc. operational and interlock description	
	9. Operator's Console Control/Interface description	
	10. Belt Weight Indicating System	
	11. Floodlights/Access Lighting	
	12. Switchgear, Transformer, etc..	
	13. Heating and Air Conditioning	
	14. Belt Anti-Tear Device	
2.	<u>General Arrangement Drawings</u>	
	1. Complete Loader and Rail Interface	
	2. Operator's Cab/Console	
	3. Telescoping Boom or Shuttle Arrangement	
	4. Boom Hoist Arrangement	
	5. Conveyor Drive Arrangement	

6.	Gantry Drive/Arrangement	
7.	Collapsible Tripper Arrangement	
8.	Telescoping Spout and Rotating Spoon	
9.	Electrical Control Room	
10.	Machinery House	
11.	Hopper/Chute	
12.	Walks, Ladders, Platforms, Elevator	
13.	Boom control booth	
14.	Flood and access lighting	
15.	Painting Drawing	
3. <u>Detailed Structural Drawings</u>		
1.	Gantry trucks Equalizer Beams	
2.	Complete Frame and Boom	
3.	Counterweight Arm/Support	
4.	Machinery House and Support Structure	
5.	Electrical Room Enclosure/Support Structure	
6.	Telescoping Spout Support	
7.	Boom Support System	
8.	Hopper	
9.	Collapsible Tripper	
10.	Conveyor Support	
11.	Cable Reel Access/Support	
12.	Walks, Platforms, etc..	
4. <u>Detailed Mechanical Drawings</u>		
1.	Gantry Drive/Wheel Assembly	
2.	Gantry Pins	
3.	Boom Hoist Drive Components	
4.	Telescoping Boom or Shuttle Drive Components	
5.	Shuttle Wheels/Axles/Bearings	
6.	Conveyor Drive Components	
7.	Telescoping Spout Drive Components	
8.	Collapsible Tripper Drive Components	
9.	Boom Hinge Assembly	
10.	Wire Rope Reeving	
11.	Maintenance Hoist/500# hoists	
12.	Gantry Wheel Brakes	
13.	Tie-down/Stowage Pins	
14.	Cable Reel Assembly	
15.	All Travel Sheaves/Bearings	
16.	Hopper Components	
5. <u>Detailed Electrical Drawings</u>		

1.	Electrical Room Layout/Equipment
2.	Electrical Schematic/Interlocks
3.	Operators Console Arrangement/Details
4.	Telescoping Boom or Shuttle Drive Components
5.	Gantry/Drive Components
6.	Conveyor Drive Components
7.	Boom Hoist Components
8.	Telescopic Spout Drive Components
9.	Hopper Components
10.	Electrical Control System
11.	Machinery House Equipment
12.	Cable Reel Assembly
13.	Wiring/Conduit
14.	Limit Switch Arrangement(s)
15.	Wind Anemometer System
16.	Walkway/Flood Lighting System
17.	Belt Weighting system
18.	Lightning Protection System
19.	Communication System
20.	Belt Anti-Tear Device System
6.	<u>Erection/Testing/Shipping Drawings & Information</u>
1.	Erection Procedures and Drawings
2.	Performance Testing Procedures
3.	Commissioning Testing Procedures
4.	Shipping Procedures and Drawings
5.	Sea fastening calculations
6.	Off-Loading Procedures, Calculations and Drawings
7.	<u>Operation and Maintenance Manuals</u>
1.	Operation Instructions
2.	Recommended Spare Parts List
3.	Maintenance Manual
4.	On-Site Training Procedure/Class Outline (Contractor and Control System Supplier)
8.	<u>As-Built(s)</u>
1.	All component weights, dimensions, materials, etc..
2.	All As-built drawings and calculations of items submitted in the design review.

All information submitted for review, (including drawings and other submittals via email), shall have a cover letter listing all items submitted for review including drawing number & revision. The drawings shall be in the English language and include a description and notation of items revised from revision to revision. Drawings and calculations shall be submitted in a logical order and grouped by assemblies so that the review process can be expedited and all submittal data checked against previous information submitted.

DRAWINGS



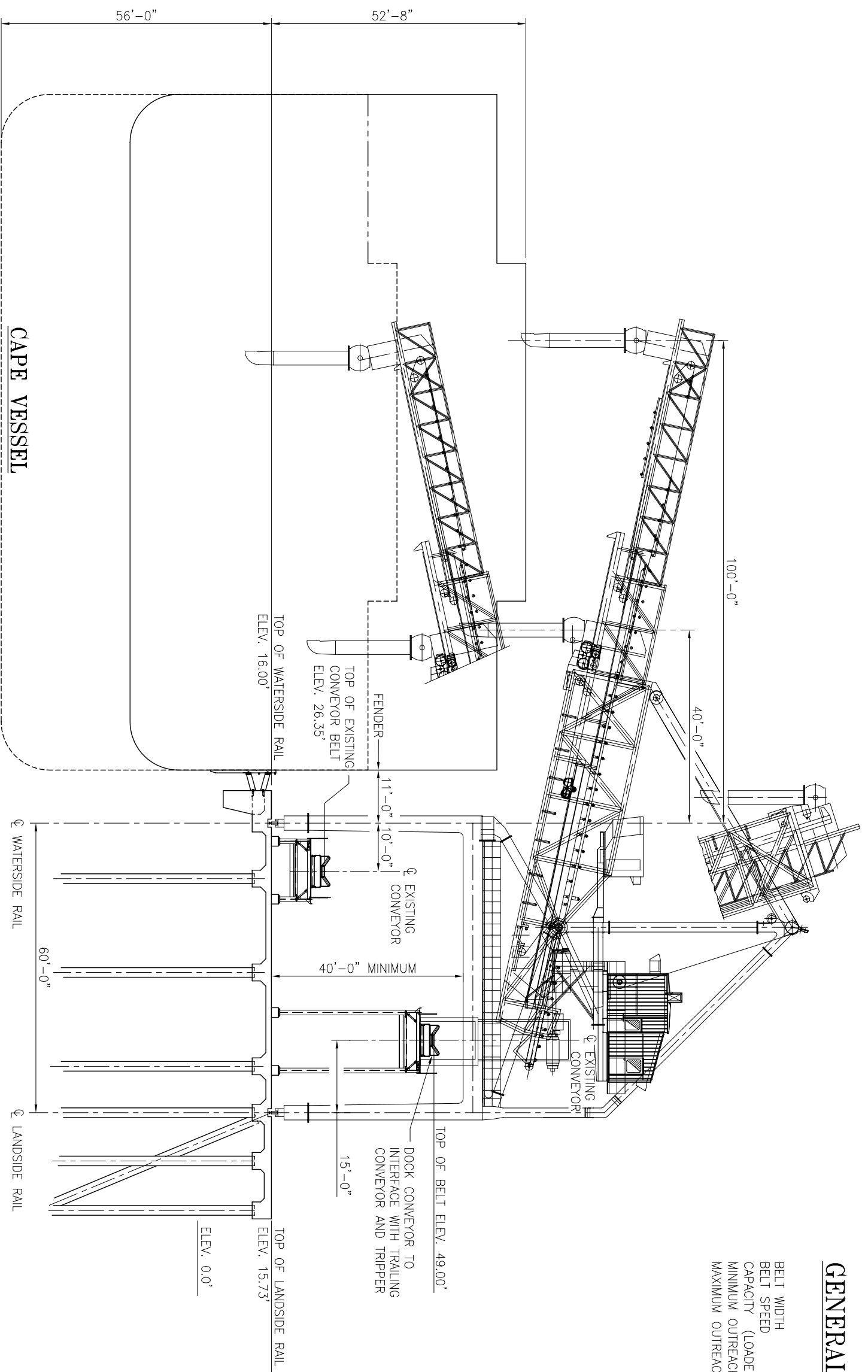
PROJECT SITE
 McDUFFIE COAL TERMINAL
 DOCK #1

Mobile Bay

REV	DATE	DESCRIPTION	BY
0	04/09/09	ISSUE FOR BID	JLL

<p>ALABAMA STATE PORT AUTHORITY ALABAMA</p>	<p>Shaw GBB, LLC</p>
<p>PROPOSED NEW LOADER DOCK #1</p>	<p>Alabama State Authority</p>

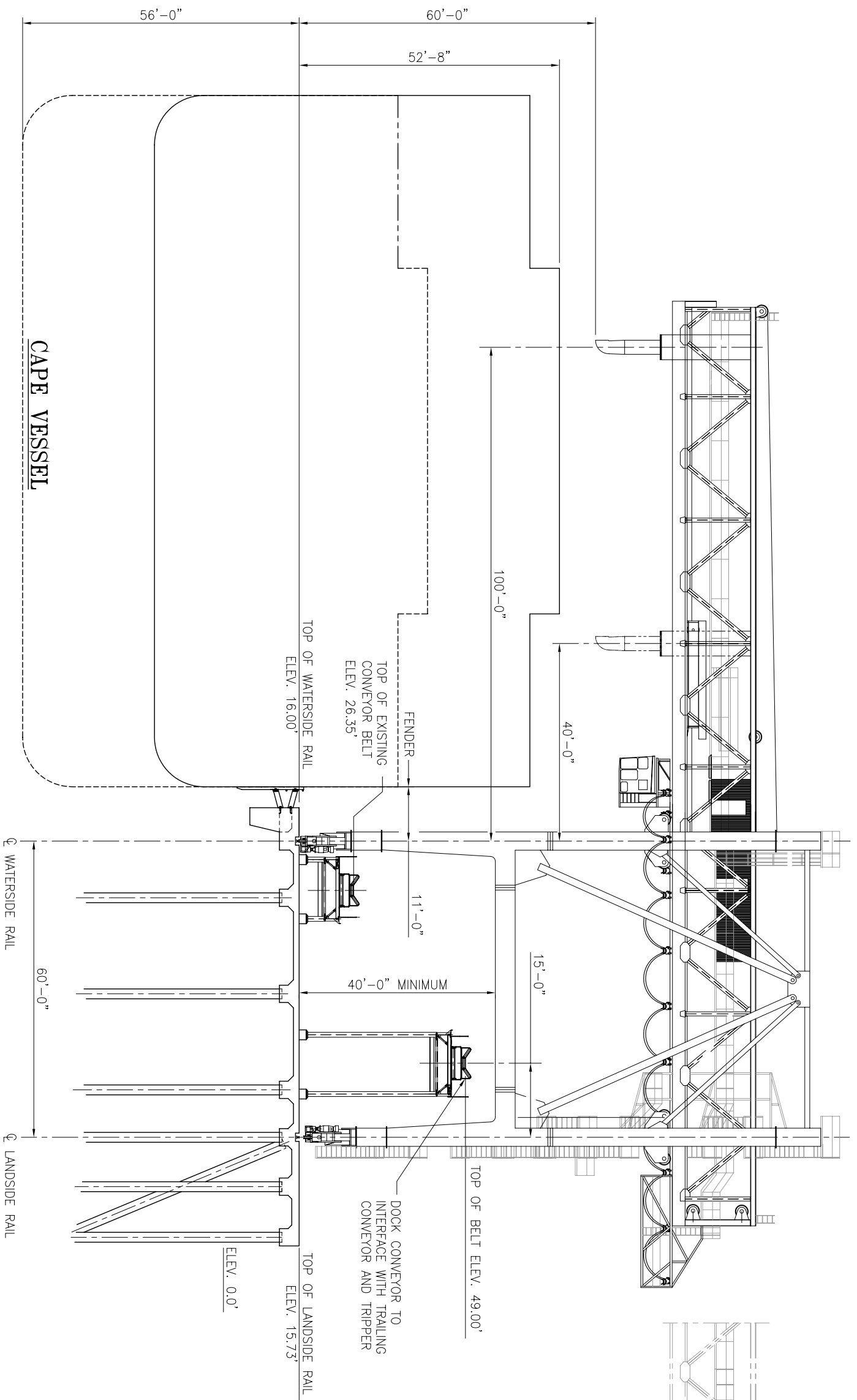
<p>Drawn By: JLL Date: 04/09/09</p> <p>Checked By: JLL Date: 04/09/09</p> <p>Scale: AS NOTED</p>	<p>Project No.</p> <p>Drawing No. L-1</p> <p>REV. 0</p>
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GENERAL INFORMATION

BELT WIDTH 72 IN.
 BELT SPEED 720FPM
 CAPACITY (LOADER) 4500 MT/H
 MINIMUM OUTREACH 40'-0"
 MAXIMUM OUTREACH = 100'-0"

<p>ALABAMA STATE PORT AUTHORITY ALABAMA</p>		<p>PROPOSED NEW LOADER DOCK #1</p>	
<p>Drawn By: DEE Date: 04/09/09 Checked By: J.L.L. Date: 04/09/09 Project: AS NOTED</p>	<p>NOBILIS</p>	<p>ISSUE FOR BID</p>	<p>DATE</p>
<p>0</p>	<p>04/09/09</p>	<p>ISSUE FOR BID</p>	<p>JUL</p>
<p>RR#</p>	<p>DATE</p>	<p>DESCRIPTION</p>	<p>BY</p>
<p>0</p>	<p>04/09/09</p>	<p>ISSUE FOR BID</p>	<p>JUL</p>
<p>RR#</p>	<p>DATE</p>	<p>DESCRIPTION</p>	<p>BY</p>
<p>0</p>	<p>04/09/09</p>	<p>ISSUE FOR BID</p>	<p>JUL</p>



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REV	DATE	DESCRIPTION	BY
0	04/09/09	ISSUE FOR BID	JLL

 ALABAMA STATE AUTHORITY ALABAMA	PROPOSED NEW LOADER DOCK #1

SHAW GBB, LLC Shaw GBB, LLC Drawn By: D.E.F. Date: 04/09/09 Checked By: J.L.L. Date: 04/09/09 Scale: AS NOTED	NOBILIS DRAWING NO. G2-SHUTTLE
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