



## TECHNICAL SPECIFICATION

**SUBJECT** : Bulk Handling Shiploader  
**DOCUMENT NO** : TPT\_TS\_BHSL  
**REV NO.** : 2  
**DATE OF ISSUE** : 27 May 2010

<b>AMENDMENT RECORD</b>		
Rev	Section	Description of Change
2	3.5.4; 12	Added comment: "The dust free chute shall auto retract during the loading operation, depending on the level of product in the hatch"
	3.6.8; 13	Removed comment: "The long and cross travel motions may be hand operated"
	3.8.4; 14	Removed "control trailing cable" – applies to the power cable only
	3.12.3; 17	Weatherproof sockets on sea and land side bogies, not on the machine close to the tripper
	3.18.4; 19	A cross-over / access to the machine from the P-gallery floor level of P01 and P02 shall be provided
	4.2.1; 21	Type of fire suppression system not specified
	4.2.2; 21	Fire extinguishing brackets shall also be supplied

<b>CHANGE MANAGEMENT CONTROL</b>				
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## 1. **Scope**

This specification is for a rail mounted bulk handling shiploader for operation at Berths 703, 704 and 705 at the Dry Bulk Terminal, Richards Bay Port. The shiploader shall be capable of effectively handling all commodities specified in Schedule B.

The bulk handling shiploader shall be complete in all respects, including standard equipment supplied by the manufacturer and shall comply with the South African Occupational Health and Safety Act, Act 85 of 1993 as amended.

## 2. **Operational Requirements**

### 2.1 **Equipment Functionality**

2.1.1 The shiploader shall be capable of loading ships at a design rate of 2,500 tons/hr. continuously, based on a commodity having a bulk density of 1,9 tons/m<sup>3</sup>. The existing gallery feeder belt is 1,350mm in width with a 35deg trough angle and belt speeds of 2m/s (PO1) and 3,3m/s (PO2).

2.1.2 The shiploader shall be designed to serve vessels ranging from 16,000 d.w.t. to 160,000 d.w.t with a water draft not exceeding 17,5 m between high and low spring tides, the range of which is 1,8m.

2.1.3 The following nominal operating speeds for the various motions are desired. Variation of up to 15 % is acceptable:

<b><u>Details of Offer</u></b>	<b><u>Response</u></b>
Long Travel	0 – 25 m/min
Boom extension and retraction	20 m/min
Vertical telescopic travel	12 m/min
Boom luffing from horizontal to maximum	3 min
Boom stowing from horizontal to locking (position using main hoist)	5 min
Boom stowing from horizontal to locking (position using auxiliary hoist)	20 min

2.1.4 The variety of commodities handled present problems of incompatibility and contamination. The design and construction shall lend itself to easy and effective secondary cleaning during operation and thorough primary cleaning between the loadings of two incompatible commodities. This shall be achieved quickly, easily and safely (i.e. without endangering human lives).

2.1.5 A piping network complete with valves for all points where washing is required shall be installed on the machine. A flexible hose connection from the machine to the gallery shall be allowed for. Suitable drainage shall be provided on the ship loader. Details of the sump shall be provided by the Employer.

2.1.6 Provision shall be made for the fast and easy removal of spilled products on the ship loader and the supplier shall provide for this in their design.

## 2.2 Constraints

- 2.2.1 The existing rail infrastructure is of Type A100, Grade 700 with a minimum tensile strength of 690 MPa, in accordance with DIN 536.
- 2.2.2 The location, fixed quay parameters and sizes of ships to be served are indicated on drawing no. HED 1055: Bulk and Export Terminal Ships and Quay Parameters and Clearance Profiles. Boom height, length, luffing and telescopic ranges should be determined accordingly.
- 2.2.3 The wharf surface slope from cope is 1:100.
- 2.2.4 The difference between quayside and landside rail level is 226mm ± 55mm.
- 2.2.5 The shiploader shall be designed to accommodate the following crane rail tolerances (All levels refer to L.W.O.S.T.):
- |                         |   |                                       |
|-------------------------|---|---------------------------------------|
| Rail Gauge              | : | 22,5 m ± 10mm                         |
| Horizontal Offset       | : | 2 m chord:- 3 mm<br>25 m chord:- 6 mm |
| Cross Level             | : | 226 mm ± 55 mm                        |
| (Top of sea side rail)  | : | 5,272 mm + 5 mm – 50 mm               |
| (Top of land side rail) | : | 5,498 mm + 5 mm – 50 mm               |
| Longitudinal level      | : | 2 m length: 3 mm                      |
| Variance                | : | 10 m length: 20 mm                    |
- 2.2.6 The wheel type shall be double flanged with live axle.
- 2.2.7 The maximum wheel loading on the land side rail shall not exceed 34 tons per wheel, with a maximum increase of 25 % allowable for out of service wind conditions only.
- 2.2.8 The maximum loading on sea side rail shall not exceed 22 tons per metre.
- 2.2.9 The maximum permissible horizontal force is 12 tons per wheel.
- 2.2.10 The minimum wheel centres shall be 1,22m.
- 2.2.11 The length over buffers shall not exceed 20,5m.
- 2.2.12 The cable reeling system shall allow for a total long travel distance of 700m with a centrally located feed point.

## **2.3        Ergonomics**

### **2.3.1        Operator's Cab**

- 2.3.1.1        The operator's cab shall be positioned such that the operator will have full visibility of all operations when seated at the controls. The size of the cab shall be adequate for the operator, assistant operator and the equipment therein and shall allow ample space to permit convenient maintenance.
- 2.3.1.2        The cab shall be manufactured from 316 stainless steel and shall be suitably insulated from the heat of the sun.
- 2.3.1.3        The cabin shall have a double floor (for cabling) with removable hot dip galvanized checkered plates.
- 2.3.1.4        A fully adjustable upholstered seat with armrests shall be provided for the operator and a tip-up seat for an assistant. Easy and safe access to the operator's chair shall be provided for.
- 2.3.1.5        All levers, handles, etc. for controlling the movements of the ship loader shall be arranged in a convenient position so as to enable the operator to manipulate and control all operations, including boom latching, with the minimum effort or strain.
- 2.3.1.6        The major items of equipment are to be so arranged that they can be removed from cab for repair without disturbing the walls, floor and structural frame work.
- 2.3.1.7        A stainless steel door opening onto the exterior access platform shall have handles of robust construction, and shall be arranged for exterior locking.
- 2.3.1.8        The cab shall be glazed to give the operator full visibility and a clear view at all times from the seated position. Structural members shall be arranged to cause the minimum obstruction in the operator's field of vision. All the glazing of the operator's cab shall be of laminated safety glass with a heat reducing film.
- 2.3.1.9        All glass in the vicinity of the floor shall be provided with foot rest protection with minimum obstruction in terms of visibility e.g. horizontal round bar spanning a maximum of 70mm apart.
- 2.3.1.10        Electrically operated self parking windscreen wipers shall be provided for the front windows.
- 2.3.1.11        A walkway with handrails shall be provided to allow for manual cleaning of the windows.
- 2.3.1.12        A suitable marine type certified air-conditioner of the split unit type suitable for operation in a C5 type environment complying with SFS / EN ISO 14713 shall be supplied with due consideration to the high ambient and humidity levels. The condenser of the air-conditioner shall be easily accessible for cleaning.
- 2.3.1.13        A table 800 mm x 400 mm and a suitable locker for operating manuals shall be provided in the operator's cab.
- 2.3.1.14        A notice, stating the starting up and shutting down procedure of the machine mounted in a frame covered with glass, shall be provided in a prominent position in the operator's cab.

## **2.3.2 Operator's Controls**

- 2.3.2.1 Controllers of the universal control lever type with full control on the motions shall be provided. The handles shall move in a horizontal plane and shall have spring return to the "OFF" position.
- 2.3.2.2 The controllers shall electrically be of the stepless type but shall be fitted with artificial mechanical steps and shall be fitted with spring loaded indents which give a light but definite check in each working position. The effort required to operate the controllers shall be such that no discomfort will be suffered by the operator during long spells of duty.
- 2.3.2.3 The main controllers shall be equipped with a dead mans facility causing the ship loader motions to revert to a safe situation when the operator's grip on the controllers is released.
- 2.3.2.4 The grip on controllers shall be of hard wearing synthetic material.
- 2.3.2.5 Each controller shall be fitted with an engraved plate label secured with rivets clearly indicating the motions controlled and the direction of motion corresponding to the lever positions.
- 2.3.2.6 Switch contacts shall be of high quality silver and shall have a wiping action with provision to prevent "tracking" across insulation.
- 2.3.2.7 Indicator lamp colours shall be as varied as possible, and all indicators shall be adequately marked. The use of embossed tape is not permitted.
- 2.3.2.8 A VDU annunciation panel shall be provided in the operators cab to indicate general operating parameters. The parameters to be indicated shall be agreed prior to implementation e.g. boom extension, boom angles, storm pins engaged, etc.
- 2.3.2.9 A foot switch shall be provided to operate an audible alarm.
- 2.3.2.10 The proposed operators cab layout and drivers console layout drawings shall be submitted for approval. This shall be accompanied by detail description of the function of the different controls and the operating philosophy. Approval of the operating philosophy, operators cab layout, control equipment and displays shall be obtained prior to any associated manufacture and/or procurement.

## **2.4 Terminal Specific Requirements**

- 2.4.1 The shiploader shall be able to operate 24 hours a day, 7 days a week in a marine environment subject to the following conditions.

Altitude	:	Sea level
Ambient Temperature	:	5 – 45 deg
Relative humidity	:	Frequently 100%
Air Pollution	:	Heavily saline, corrosive dust laden, industrial fumes, ignitable dusts
- 2.4.2 The equipment offered shall be designed to operate off the available electrical power supply of 11kV, 3 phases, 50Hz AC The voltage may, however, vary within the range of 90% to 110% of the nominal and all equipment installed shall be suitable for continuous operation at any voltage in this range.

- 2.4.3 All electrical equipment shall be suitably treated for use in tropical climate where rapid changes in weather conditions produce severe moisture condensation problems. The equipment shall also be capable of withstanding the highly corrosive effects of moist saline atmosphere which is also contaminated with sulphurous smoke and combustible dust. In addition, all outdoor electrical panels and enclosures and all electrical equipment not inside the electrical room or inside enclosures shall have a minimum degree of protection of IP65. All IP65 electrical equipment shall be issued with IP65 certification.
- 2.4.4 The ship loader shall be capable of handling the rated capacities continuously. It shall be designed and manufactured in accordance with British Standard No 2573, part 1 and 2: "Permissible Stresses in Cranes and Design Rules" and FEM 2: "Rules for the design of mobile equipment for continuous handling of bulk materials", for a Class A8 machine.
- 2.4.5 The ship loader shall be designed to operate effectively and safely in "in-service" winds of up to 80 km/hr in the least favourable direction relative to the machine.
- 2.4.6 The ship loader shall be designed to safely withstand wind pressures under "out of Service" conditions as stipulated below:

<u>Height above wharf level equivalent in metres</u>	<u>'Out of service' design wind pressure in Pa</u>	<u>Approximate wind speeds in m/s</u>
Parts of machine up to 10	1,000	40
Between 10 and 40	1,300	46
Between 40 and 100	1,600	51
Between 100 and 200	1 850	55

- 2.4.7 The ship loader shall be able to travel against a steady uniform wind pressure of 600 Pa and the service brakes shall be able to slow down the machine and bring it to a complete standstill when travelling with a wind of up to 112 km/h.
- 2.4.8 Full protective measures are to be taken to protect the machine and equipment from damage in the event of faults and mal-operation and the equipment shall be designed to fail to safety.

### **3. Technical / Technology Requirements**

#### **3.1 Long Travel Structure**

- 3.1.1 The ship loader shall be supported at each corner by a system of equalised bogies designed to ensure an equal distribution of the load over all wheels.
- 3.1.2 Bogie assemblies shall be fully compensating and pin connected to the leg. Wheel centres within the same assembly shall be not less than 1,220mm.
- 3.1.3 An anti-crabbing device shall be provided if anti-crabbing cannot be achieved with long travel speed control.
- 3.1.4 Without the use of anchoring devices, the ship loader shall comply with the following stability requirements:-

- 3.1.4.1 With telescopic boom and chute at maximum outreach and blocked plus an "In service" wind pressure of 500 Pa from the least favourable direction, the stability factor shall be not less than 1, 2.
- 3.1.4.2 In "out of service" conditions with a wind pressure stipulated in Clause 2.4.6 from the least favourable direction and with the boom in the stowed position or with the boom removed, the stability factor shall be not less than 1, 4.
- 3.1.5 A sufficient number of wheels, but in any case not less than 50 %, shall be individually driven and braked to meet the operating and performance requirements. The long travel drives shall be capable of moving the machine and one tripper against a wind pressure of 600 Pa.
- 3.1.6 The driving units shall be enclosed in weatherproof housings which shall offer easy access for maintenance and servicing purposes.
- 3.1.7 Long travel drives are to be mounted such that they do not stand proud of the bogies in a position that can cause a collision hazard for passing traffic. Suitable protection shall be installed for the long travel drives.
- 3.1.8 Where gearboxes are fitted with pumps, sight glasses shall be provided. Silica gel breathers shall be installed on all gearboxes.
- 3.1.9 The wheels shall be of rolled steel or cast steel to BS EN 10293, Grade A3, double flanged, with a maximum flange depth of 25 mm to suit the specified rail, and shall be carried on live axles in anti-friction bearings. The minimum diameter of the wheels shall be 610 min. The roller bearing shall be of adequate load bearing capacity mounted in split type housings for easy removal.
- 3.1.10 The wheel, axle and bearing assembly shall be so designed that removal for maintenance, inspection or replacement can be achieved with the minimum of delay. Substantial jacking points shall be provided.
- 3.1.11 Hardwood rail sweeps shall be provided on the leading bogies.
- 3.1.12 Hydraulic type impact absorbing buffers rated to absorb the kinetic energy of the fully laden machine travelling at full speed with service wind pressure shall be provided on the leading bogies. The buffers shall have suitable boots over the rams. The centre line of the buffers shall be 600 mm vertically above the rail.
- The machine structure shall suffer no noticeable damage in case of it colliding with the end stops of the long travel at maximum travelling speed, with rated load and at "in service" wind conditions.
- 3.1.13 In addition to the service brakes, automatically released, stamp down type storm brakes or similar are to be provided on both sides of the machine. These brakes are to engage automatically when the machine is powered down or in the event of a power failure.
- 3.1.14 Anti-collision devices shall be provided to slow down and stop the loader at the extremes of travel and at a safe distance, minimum one metre, from the next machine or obstacle on the rail. Anti-collision devices shall operate independently from the terminal management and monitoring system and shall be provided to operate at both travel ends of the loader. A spring loaded key switch override shall be provided on the leading bogies.

- 3.1.15 Storm pins not more than 100 mm diameters and suitable for manual connection to the existing sockets located directly opposite each other on the sea-side of the crane rails shall be provided. When parked, pins shall project 75 mm below rail level.
- 3.1.15.1 The storm pins shall be electrically interlocked with the travelling motion so that they must be disengaged before the motion can be operated. An indication of storm pin engagement is to be provided in the operator's cabin.
- 3.1.15.2 A ground control station, next to the access stairs on the sea-side of the land-side leg, to give adequate view of stowage operation, shall be provided. (Position to be indicated on General Arrangement drawing).
- 3.1.15.3 Controls in the ground control station shall allow for inching of the long travel motion while the stowage pins are engaged in order to facilitate release of the stowage pin.
- 3.1.16 Two weatherproof klaxons of approved design shall be provided on the machine, mounted on the legs, one on each side. The klaxons are to sound automatically and continuously whenever the long travel motion is selected. A push button or foot switch shall also be provided for the operator to sound the alarms as a warning.
- 3.1.17 Four orange coloured flashing beacons mounted on the machine legs, one on each corner and at one metre above quay level, to operate automatically whenever the long travel motors are energised, shall be provided.
- 3.1.18 A presettable time delay between selection of long travel motion and the actual energising of the motors shall be provided for.
- 3.1.19 Interlocking shall be provided such that when the operator is in control of the machine, the long travel from the ground control station is inoperative. It shall, however, still be possible to operate the emergency brakes from this position.
- 3.1.20 The machine will be required to open the louvres in front of the P-gallery and a suitable louvre comb shall be provided. The design of the comb shall be such that no damage to the louvre and hinge arrangement will occur during operation.

## **3.2 Boom and Boom Operation**

- 3.2.1 The boom shall be of the telescopic type and Suppliers are to offer the type of design which will best suit the reach required to load the various sizes of ships specified.
- 3.2.2 The main boom and the telescopic boom shall be fully clad with all walkways and equipment enclosed.
- 3.2.3 The specified loading rates shall be sustained at the maximum working angle of 15° at which the boom is required to operate.
- 3.2.4 The boom shall be of rigid welded construction, hinged at the inshore end and supported in the horizontal position by ropes between the outer ends and the head of the main frame and by support pads at the hinged joints. Provision shall be made for the easy removal and replacement of ropes. A

pad shall be supplied to support the boom in a lowered position for changing of steel wire ropes.

- 3.2.5 A winch shall be provided on the retractable portion of the boom which will be used for exchanging and maintenance of the loading chute. The hoisting and lowering range of the winch shall be such that the hook will reach the wharf surface when the boom is in a position where the chute is above the wharf side.
- 3.2.6 The access platform for the changing of the chutes shall be fastened to the boom of the loader and not attached to the chute.
- 3.2.5 The cantilevered boom complete with loading chute and distribution spout shall be capable of being raised to clear the ship clearance profile and lowered so that the underside of the boom structure clears the wharf side clearance profile by means of a boom hoist drive with two independent ropes, each capable of supporting the boom and relevant equipment.
- 3.2.6 An auxiliary hoist drive operating from a separate electric shore supply shall be provided for raising and lowering the boom under emergency conditions such as power blackouts or the failure of the boom hoist motor. The time to undertake this operation shall not exceed 20 minutes.  
  
Auxiliary drives shall also be supplied for the retraction of the dust free chute and telescopic boom under emergency conditions.
- 3.2.7 The boom shall be provided with a spring applied electrically released service brake. An additional emergency brake shall be provided to operate directly onto the rope drum. The emergency brake shall be of the spring applied thruster released type and shall be capable of stopping and holding the boom if the emergency stop circuit is energised, or if the lowering speed exceeds 115% of the rated speed.
- 3.2.8 Thruster operated latches shall be provided to lock the boom in its stowed position so that the load on the hoist rope can be released. The mechanism shall be positive, automatic and "fail safe". Provision shall be made so that the latch cannot be operated while the boom is resting on it. The boom latching operation shall be able to be safely performed and monitored from the operator's cabin.
- 3.2.9 Impact absorbing buffer stops shall be provided at the extreme ends of travel of the boom.
- 3.2.10. Limit switches / proximity switches shall be provided to prevent over-hoisting and overpowering.
- 3.2.11. Interlocks shall be provided to ensure that the cross-feed belt conveyor and distribution spout equipment are inoperative during boom raising and lowering motions - between the boom stowed position and the maximum operating angle of 15 degrees.
- 3.2.12. Facilities shall be provided to protect the cross-feed conveyor belt from damage during boom hoist and to ensure that the conveyor belt reverts to the correct position, without any possibility of damage to the belt, after lowering of the boom.

### **3.3 Belt Conveyors and Associated Equipment**

- 3.3.1 A continuous cross-feed belt conveyor system, receiving product from either of the existing two gallery conveyors and which can retract and extend with the telescopic boom, is required.
- 3.3.2 A standard (with a minimum width of 1,350mm) belt with heavy duty idlers of the three roller staggered design and 35° toughing angle is preferred.
- 3.3.3 The belt speed shall be infinitely variable from 2 m/s to 4 m/s. However all structural strength and power calculations shall be based on the requirement that the ship loader shall be able to meet specified performance rates at a belt speed of 2 m/s.
- 3.3.4 The design of the belt conveyor, drive, take-up and structures shall accommodate the total luffing and horizontal telescopic range.
- 3.3.5 The cross-feed belt conveyor shall be able to be fed from either the P01 or P02 tripper and the design of the structure shall be such that it can push or tow the tripper to the required position and shall also be retractable to a third position in order to clear both tripper structures.
- 3.3.6 Suitable protection such as OLEO type buffers or similar shall be provided to prevent the tripper from damaging the rear end of the shuttle belt.
- 3.3.7 Alignment of the conveyor belt shall be such that optimal alignment is ensured under all conditions, irrespective of the amount of extension of the telescoping boom.
- 3.3.8 A transfer chute shall be supplied with the belt conveyor to ensure effective transfer of product from the belt to the inlet of the flexible coupling feeding the ship loading chute.
- 3.3.9 The transfer chute shall be equipped with the necessary blocked chute detector.
- 3.3.10 The flexible coupling shall be integral to the telescopic boom and shall be suitable for the full luffing range of the boom.
- 3.3.11 A quick attachment arrangement shall be provided for the attachment of various loading chutes, with a facility to provide a gathering capacity of 100mm to aid positioning of the loading chute.
- 3.3.12 In addition, flexibility in the coupling shall allow for movement of the chute up to 10 degrees from vertical in any direction.
- 3.3.13 The belt conveyor and its associated equipment shall be capable of accommodating the maximum handling rate and shall be in full compliance with Specification EEAM-Q-001.
- 3.3.14 The preferred belt cleaning device is the 2 x secondary Scorpio scrapers between Head and Snub pulley.
- 3.3.15 The belt conveyor shall be fitted with an electrical, single-idler belt weighing scale with indication of momentary rate and resetable cumulative tonnage displayed in the operator's cabin. The accuracy shall be at least 3 % over the full range

### **3.4 Loading Chute and Distribution Spout**

- 3.4.1 A fixed length loading chute of 9 metres is required for the effective loading of the various sizes of ships.
- 3.4.2 A fail-safe, simple but effective quick exchange mechanism shall be provided to release and attach the loading chute. Facilities shall be provided for the loading chute to be lowered to the quay without the use of separate cranes.
- 3.4.3 The hoist drums shall be grooved and sufficiently wide to accommodate in one layer the length of rope required for the specified lift including three (3) dead turns.
- 3.4.4 The loading chute shall be designed such as to minimise dust generation during loading operation.
- 3.4.5 The chute shall be so designed so that the product to be handled will not build up in the chute and cause an obstruction to material flow.
- 3.4.6 A bifurcated distribution spout capable of slewing through 360 degrees shall be provided at the bottom end of the chute.
- 3.4.7 A radio controlled actuator shall be fitted to enable flow of the product stream from a fully vertical position to 45 degrees from the horizontal. The spout shall be lined with high abrasion resistant and impact resistant material.
- 3.4.8 The slewing mechanism of the distribution spout shall be located in a position to keep it clear of the commodity loaded into the ship. The sides of the spout shall be so designed the material will not build up in the spout and cause obstruction to material flow. In addition all corners shall be rounded with a minimum radius of 100 mm.
- 3.4.9 Easily removable wear plates of a material compatible with the variety of commodities to be handled and of suitable thickness shall be fitted to the inside of the spout.
- 3.4.10 The loading chute and distribution spout shall be designed to ensure quick and easy cleaning by washing.

### **3.5 Dust free chute**

- 3.5.1 Three (3) dust free loading chutes of the cascade type shall be supplied with specific requirements to handle Andalusite, Chloride and Rock Phosphate.
- 3.5.2 Attachment to the flexible coupling and chute shall be by means of the same facilities as for the loading chute.
- 3.5.3 The chute sections shall be retracted and extended on two wire ropes, running on suitable sheaves and drums. Each rope shall be capable of holding the full load.
- 3.5.4 The dust free chute shall auto retract during the loading operation, depending on the level of product in the hatch.
- 3.5.5 The extension and retraction of the chute shall be by rope drums driven through a reduction geared motor. Rope drums to be supplied complete with brakes, limit switches, overload and slack rope switches.

### **3.6 Machinery and Electrical House**

- 3.6.1 The ship loader shall be provided with separate self contained fully weatherproof steel framed and metal clad machinery and electrical houses and shall allow ample space and strength for all the machinery, electrical equipment and control panels housed therein. The houses shall be of sufficient size to permit unrestricted access to all equipment for routine service and maintenance and the headroom shall not be less than 2,13m. A minimum of 700 mm working space shall be provided around all machinery and electrical panels.
- 3.6.2 The major items of machinery and electrical equipment shall be so arranged that they can be removed for repairs or replacement without disturbing the walls, roof, floor or structural framework, and furthermore, shall be so arranged that full access to all holding down bolts is provided from the inside of the house.
- 3.6.3 Roof and side cladding, and accessories, shall be 316 stainless steel.
- 3.6.4 Side cladding plates are to be joined with butting joints with butt cover straps where required (no lap joints), and the plates are to be in large sizes as practicable to reduce the number of vertical joints, and to eliminate horizontal joints. The whole of the framing shall be well stayed and fixed on the platform.
- 3.6.5 It shall be ensured that joints in cladding are effectively sealed so as to meet pressurisation and/or air conditioning requirements.
- 3.6.6 All door frames shall be 316 stainless steel and suitably insulated. Weatherproofing pieces are to be provided above doors. Particular care shall be taken in the roof construction to exclude the weather.
- 3.6.7 Access hatches shall be provided, protected with toe boards and removable hand railing, to allow removal of the largest single item of equipment.
- 3.6.8 A suitable rated gantry crane with an electrically operated hoist, capable of lowering or raising the heaviest piece of equipment to and from the quay level, shall be provided. It must be possible to remove and replace the heaviest assembly without the use of a mobile crane. Sufficient headroom for rigging purposes shall be available. The hoist brake shall be capable of controlling the lowering of the test load.
- 3.6.9 Two access doors to suit pressurisation and/or air conditioning, one on each side of each house, arranged for exterior locking, are to be provided.
- 3.6.10 The machinery house shall be insulated on the inside with acoustically absorbing material to absorb machinery noise. The noise level shall be less than 85 dB (A) one metre around the machinery house.
- 3.6.11 For machinery houses, adequate pressurisation with filtered air shall be provided with due consideration to the high ambient temperatures and humidity levels. Dust emanating from the commodities being handled shall be filtered out to suit the hazardous conditions and suppliers are to guarantee this aspect.
- 3.6.12 A work bench, vice and storage lockers shall be provided in the machinery house.
- 3.6.13 The electrical house shall be air conditioned, with a suitable marine type certified air-conditioner of the split unit type suitable for operation in a C5 type environment complying with SFS / EN ISO 14713, with due consideration to the high ambient and humidity levels. The condenser of the air-conditioner shall be easily accessible for cleaning. The temperature in the electrical house shall be within the working range of the switchgear (min temperature to prevent the formation of condensate).

### **3.7 Electrical Drives**

- 3.7.1 The boom luffing, boom telescoping, and long travel motions shall be individually driven, preferably by squirrel cage AC motors, suitable for the operating conditions referred to.
- 3.7.2 All drives shall be able to operate simultaneously.
- 3.7.3 The long travel motion, boom telescoping and luffing motions shall preferably be thyristor controlled arranged in a closed loop feedback system providing electrical braking to less than 10 % of the motion speed, after which mechanical brake will apply.
- 3.7.4 Input voltage to the motors shall be controlled using reversing thyristor regulators to provide stepless control of the motion throughout the entire speed range.
- 3.7.5 The control systems shall provide smooth acceleration and deceleration over their entire speed range.
- 3.7.6 Conventional (non-electronic) counter-torque and single quadrant lowering speed control systems are not acceptable.
- 3.7.7 To prevent overload in the event of excessively rapid controller movement, acceleration and deceleration shall be limited to predetermined values. All solid state electronic control equipment shall be protected against over voltage, over current and over temperature.

### **3.8 Cable Reels and Festoon Systems**

- 3.8.1 The power supply to the ship loader shall be via trailing cable and stainless steel reeling drum system to be located on the landside of the travelling bridge structure.
- 3.8.2 The reeling drums systems shall be of the mono-spiral type in full compliance with Specification EEAM-Q-019 and designed to hold lengths of cable sufficient for the ship loader to travel the full distance.
- 3.8.3 The power cable reeling drum system shall be complete with all cables, sleeves, rollers, guides and cable mid-point change-over equipment. In addition, centre feed guides, rollers and change-over equipment shall be supplied and installed in an existing aperture at the centre feed point.
- 3.8.4 The cable tray to receive the power cable is elevated at 15,5m.
- 3.8.5 The power trailing cable shall be capable of withstanding a breaking capacity of 350 MVA for time duration of 0, 25 seconds.
- 3.8.6 Festoon cable systems shall be of the diamond track of similar type.
- 3.8.7 Festoon cable systems shall employ heavy duty cable carriers and shall be designed to minimize lateral movement of the cable loops during the traversing motion by means of at least two lateral cable clamps per loop. The movement of the carriers shall be controlled by tension wires. Tension wires shall be one off for each cable loop and terminated at each cable carrier by means of swivel shackles. Approved junction boxes and cable glands shall be provided at the cable terminations.
- 3.8.8 The festoon cable shall be highly flexible and suitable for festoon application, resistant to oils and chemicals with UV-stable outer sheathing and of adequate cross-section to avoid overheating in service.
- 3.8.9 The festoon cable carrier channel shall extend the full operational range of each system. The first carrier at the trolley shall be mechanically attached

thereto and the last carrier at the connection box end shall be attached to the channel.

- 3.8.10 The festoon cables and carriers shall be accessible from a platform or access way to facilitate maintenance and repairs to the system.

### **3.9 Control, Monitoring and Interlocking**

- 3.9.1 Control, monitoring and interlocking on the machine shall be carried out by means of a Siemens Simatic S7 Programmable Logic Controller. All ultimate limits and emergency stops shall be hard wired.
- 3.9.2 A SCADA system shall be provided.
- 3.9.3 Communication between the ship loader and the Central Control Room shall be via radio link control.
- 3.9.4 A maintenance computer system for real time data, fault indication, storage, printing and fault finding shall be provided in the electrical house for use by maintenance personnel. The system shall allow for detailed fault annunciation with a minimum 5 day memory.
- 3.9.5 A digital type message display unit shall be provided in the operator's cabin for messages to the operator.
- 3.9.6 The main PLC and maintenance computer shall have self diagnostic facilities for fault finding.
- 3.9.7 The shiploader shall normally be operated in a manual mode, controlled by the operator from the operator's cabin. However, a maintenance mode shall be provided to allow for all interlocks to be released and drives to be able to be started from local control stations.
- 3.9.8 The conveyor drive shall be interlocked with the boom to prevent the conveyor being operated when the boom angle is in excess of the maximum conveyor operating angle (15°).
- 3.9.9 An indicator indicating the operating angle shall be provided in the operator's cab.
- 3.9.10 The control circuitry shall be interlocked to prohibit the receiving of material if the crossfeed conveyor is stationary.
- 3.9.11 The loading chute and dust free chutes shall be provided with suitable high level switches to stop the flow of material in the event of blockage.
- 3.9.12 An accurate anemometer indicating the wind speed in km/h and a manometer for the dust extraction unit shall be provided and the indicator shall be fitted in the operator's cab.
- 3.9.13 A boom outreach indicator shall be provided in the operator's cab and shall be calibrated at intervals of 50mm.
- 3.9.14 An audible siren is to be provided and is to be operative when the conveyor is started. The siren shall sound for 40 seconds prior to the start up of the conveyor.
- 3.9.15 The various sirens on the ship loader shall differ in sound and pitch to facilitate ease of identification.
- 3.9.16 Latching of the boom shall only be possible with the boom fully retracted.
- 3.9.17 The control circuit shall be so interlocked as to ensure that the correct flow sequence of the commodity is maintained
- 3.9.18 The operator shall have control over all motions (properly sequenced and interlocked) on the machine.

- 3.9.19 Emergency stop buttons of the red mushroom head, stay-in type shall be provided as below to obtain complete isolation of the electrical supply.
- One fitted in the operator's cab
  - One fitted in each machinery house/s and electrical house/s
  - One fitted on the machine in close proximity to the tripper
  - One fitted at ground level on at each corner of the machine
- 3.9.20 An hour meter recording system shall be supplied.
- 3.9.21 Pull wire trip switch facilities shall be provided on both sides of all conveyors.
- 3.9.22 Encoders shall be provided to continuously monitor the boom angle and provide indication to the operator.

### **3.10 Electrical Equipment Mounting Panels**

- 3.10.1 The electrical, electronic control and protection equipment provided in the electrical house and operator's cabin shall be housed in NEMA Type 2 or BS 587 Type 2 metal cubicles, with lock-up hinged doors or lockable lift-off covers, floor mounted in a suitable position so as to provide sufficient space for maintenance purposes. These panels shall have a minimum degree of protection of IP44.
- 3.10.2 The electrical, electronic control and protection equipment not located in the electrical house or operator's cabin shall be housed in totally enclosed NEMA Type 2 or BS 587 Type 3 metal cubicles with lock-up hinged doors mounted in a convenient position. All doors shall be gasket and the complete enclosure shall be dust tight, weatherproof cubicles complete with air filters if required. These enclosures shall have a minimum degree of protection of IP 65 and shall be provided with anti-condensation heaters.
- 3.10.3 All externally mounted enclosures shall be manufactured from 316 stainless steel and shall be painted in accordance with Specification EEAM-Q-008 and come with IP 65 certificate.
- 3.10.4 The enclosures shall be designed to provide free and easy access to all equipment for maintenance and calibration purposes and adequate space for internal wiring.
- 3.10.5 All equipment in cubicles shall be front mounted, front assembled and front wired in suitable trunking. Cubicles shall be fitted with an internal light and a 15A, 230V, single phase, 3 pin switched socket outlet.
- 3.10.6 Where applicable, enclosures shall be provided with louvres and/or ventilation fans for the dissipation of heat that may build up in the panels

### **3.11 Limit Switches**

- 3.11.1 All "slow down", "end" and "ultimate" limit switches (e.g. end of travel position, maximum travel position, etc.) shall be of the rotary cam operated type housed in an extremely rigid cast iron enclosure with large roller layer of the spring return-to-neutral action: It is stressed that the entire limit switch shall be of an extremely robust construction,
- 3.11.2 All other limit switches shall be of the proximity type and shall have a minimum enclosure protection of IP65.
- 3.11.3 All limit switches shall be mounted in easily accessible positions to facilitate adjustment, maintenance and replacement.

### **3.12**      **Power Points**

- 3.12.1      In addition to the 15A, 230V, single phase, 3 pin switched socket outlets fitted inside the main electrical panels, socket outlets shall also be provided in the following positions:
- One in the operator's cab
  - Two in the electrical house
  - Two in the machinery house
- 3.12.1.1      Sockets to be supplied from the 400/230V lighting transformer.
- 3.12.1.2      Automatic earth leakage protection complying with SANS 767 shall be provided on all 230V sockets outlets.
- 3.12.2      Approved, IP 65 enclosed, 5A, 2 pin, 24V socket outlets for portable lead lights complete with screw-up type covers and matching male plug (preferably of the Nippon type) shall be provided.
- 3.12.2.1      The socket outlets shall be supplied from a 400/24V transformer, and shall conform to BS4343.
- 3.12.3      Weatherproof sockets (65A) for welders shall be provided at the following positions:
- on sea side and land side bogies
  - in close proximity to the conveyor drive
- 3.12.4      The following external 15 amp, 230V, single phase, 3 pin waterproof sockets (IP65) shall be supplied:
- one on each bogie
  - one at the E-house
  - one at the boom conveyor level
  - one at the machine house
  - one in the vicinity of the boom latches

### **3.13**      **Lighting**

- 3.13.1      Lighting shall be provided according to Specification EEAM-Q-012 but shall be to the following minimum requirements:
- Four travelling lights, one on each corner of the gantry
  - Sufficient flood lights underneath the gantry
  - Two floodlights underneath the cab to illuminate the working area
  - Walkways, platforms and staircases shall be supplied with bulkhead lights switchable from the ground and operator's cab. Every fourth light fitting shall be equipped with a battery back up power supply and will be automatically activated in the case of a loss of power
  - Machinery house, electrical house and operator's cab shall be fitted with fluorescent type fittings with emergency facilities
  - Aircraft warning light to be installed on the highest point of the machine with a 6 hour battery backup
- 3.13.2      Adequate luminaires shall be provided at transfer points, chutes, dust control equipment, walkways, platforms, machinery house and operator's cab.
- 3.13.3      All fixed lighting shall be supplied from a 400/230V double wound air cooled transformer connected to the incoming supply side of the main isolator to

two phases. The centre point of the secondary 230V winding shall be solidly earthed to the structure.

- 3.13.4 The lighting circuits shall be supplied through moulded case circuit breakers.
- 3.13.5 High pressure sodium vapour type floodlights shall be mounted on the shiploader boom to illuminate the ship's hold while unloading at night. Floodlights mounted on the shiploader shall illuminate the wharf area. Lighting shall be minimum 100 Lux.

### **3.14 Cabling on Structure**

- 3.14.1 All electrical cables shall be mounted on wire mesh type stainless steel cable trays, installed vertically.
- 3.14.2 Where physical damage of cables is possible, cables shall be of the steel wire armour type, or shall be protected by mechanical means.

### **3.15 Brakes**

- 3.15.1 An efficient and ample braking system in for all motions, including storm brakes, consistent with the requirements of maximum safety shall be provided.
- 3.15.2 Brakes shall be constructed of non corrosive material suitable for a marine type environment and shall be of the fail safe, spring applied, electrically or electromagnetically released type with provision for manual release in case of power failure.
- 3.15.3 Suppliers are to note that all braking systems are to be designed such that brakes may be readily inspected, adjusted and/or removed for overhaul without resorting to stripping of major components such as motors, etc.
- 3.15.4 All brakes shall preferably be fitted with automatic brake lining wear adjustment of which full details are to be submitted at time of tendering.
- 3.15.5 All brakes shall be operated from a separate brake relay and shall not rely solely on the energising and de-energising of the respective motors for operation.

### **3.16 Dust Control System**

- 3.16.1 An efficient multi stage self contained dust extraction and collection system shall be provided.
- 3.16.2 The type of unit envisaged for the first stage of filtration would be a centrifugal dust separation system, which shall return the product captured to the conveying system. The system shall also be designed in a manner to enable easy cleaning and inspection.
- 3.16.3 The second stage of filtration will be a bag type filter with reverse type pulsing that enables the efficient and easy disposal of product collected.
- 3.16.4 The complete filtration system shall be capable of achieving emission levels of less than 75mg/m<sup>3</sup>.
- 3.16.5 The efficiency of the unit shall be such as to ensure satisfactory working conditions at all transfer points.
- 3.16.6 Dust hoods and ducts shall be of adequate design incorporating hinged air tight inspection flaps.

- 3.16.7 Any dust enclosures or ducting shall be so designed to allow an unobstructed passage of dust laden air. The inside shall be free of protrusions where dust can lodge. This is of particular importance due to the corrosive nature of certain of the commodities as well as for the prevention of contamination.
- 3.16.8 The material used in the construction of the dust hoods, ducting, etc. shall be protected against corrosion internally and externally.
- 3.16.9 Explosion relief doors are to be provided in the enclosures, the ducting and dust collection unit.
- 3.16.10 Ducting shall be adequately secured to fixtures and be positioned clear of drives, especially where maintenance work will be undertaken on other equipment.
- 3.16.11 The dust control systems shall be electrically interlocked to prevent the contamination of product.
- 3.16.12 Care should be exercised when selecting filter cloth as certain cloth materials are subject to clogging when exposed to hot and wet atmospheres.

### **3.17 Air Compressor**

- 3.17.1 An electric motor driven stationery air-compressor complete with the necessary pipe reticulation and tap-off points is required for filter cleaning and for maintenance purposes.
- 3.17.2 The compressor shall be supplied complete in all respects with electric motor, air receiver, air filter and intake muffler, unloading and regulating devices for guarding against excessive delivery temperature; compressor oil temperature gauge, pressure gauge; tachometer and the usual standard equipment supplied and shall be in full compliance with specification EEAM-Q-007.
- 3.17.3 An ATLAS COPCO air compressor is preferred.

### **3.18 Stairs, Walkways, Platforms and Ladders**

- 3.18.1 Stairs, walkways and platforms shall be provided to give easy access to the operator's cab, machinery house, latches, anemometer, and all sections of the boom for inspection, maintenance and lubrication, and shall be in full compliance with specification EEAM-Q-006.
- 3.18.2 Access to the first walkway shall be possible from land and water-side.
- 3.18.3 A cross-over on the P02-tripper shall be provided. This is required when the machine is receiving product from the P02-conveyor.
- 3.18.4 A cross-over / access to the machine from the P-gallery floor level of P01 and P02 shall be provided.
- 3.18.5 Notwithstanding the requirements of specification EEAM-Q-006, all handrails and stanchions shall be prefabricated units manufactured from stainless steel tubing or solid round bar.

**3.19**      **Signage, Marking and Colour Scheme**

- 3.19.1      All necessary warning notices, i.e. emergency exits, no entry, warning signs, no unauthorized persons signs, etc. shall be provided where necessary.
- 3.19.2      A notice, stating the starting up and shutting down procedure of the loader, mounted in a frame covered with glass, shall be provided in a prominent position in the operator's cabin
- 3.19.3      The loader shall be prominently and permanently marked with a metal nameplate bearing the following information:
- Employer's name and loader number.
  - Manufacturer's name and serial number
  - The year of manufacture
  - Rated capacity
  - Machine classification with state of loading and class of utilization
  - Classification of each mechanism with state of loading and class of utilization

**3.20**      **Corrosion Protection**

- 3.20.1      The machine shall be painted in full compliance with the Employer specification EEAM-Q-008.
- 3.20.2      All hydraulic fittings shall be Denso wrapped.
- 3.20.3      Dissimilar materials shall be adequately insulated to prevent galvanic corrosion.

## **4            Safety and Environment**

### **4.1            Safety Requirements**

- 4.1.1            The equipment in general and the intended operation of the equipment to be supplied, shall be in full compliance with the South African Occupational Health and Safety Act, Act 85 of 1993, as amended and its regulations.
- 4.1.2            The shiploader shall be designed and built to ensure maximum reasonable safety and comfort of the operator, maintenance personnel and people in the area of the loader.
- 4.1.3            Full protective measures are to be taken to protect personnel and the shiploader equipment from harm and damage in the event of faults and mal-operation and the loader shall be designed to fail to safety.
- 4.1.4            Sudden electrical power losses will not have any adverse effect on the equipment and shall not unduly delay return to operation after power is restored.
- 4.1.5            Operational interlocks shall in general lead to controlled stops and not emergency stops.
- 4.1.6            All field instruments, limit switches etc. shall be individually wired to the PLC marshalling rack.
- 4.1.7            Emergency stop buttons shall be of the red mushroom head, stay-in type shall be provided as specified to obtain complete isolation of the electrical supply.
- 4.1.8            Lockable emergency stops shall be fitted with individual lockout calipers, where possible. Key switches shall also be included. Alternatively the shiploader shall be locked out in the machine house without isolating the auxiliary supply.
- 4.1.9            Separate emergency drives arranged and wired to be powered from an external 380V power supply are required for the following functions:
- chute retraction
  - boom retraction
  - boom hoist

### **4.2            Fire Protection**

- 4.2.1            A suitable and complete, locally supplied fire suppression system shall be provided inside major electrical and hydraulic panels. It shall have automatic selective activation. The design of the system in all areas shall be suitable for the type of fire that can be expected.
- 4.2.2            4,5 kg Fire extinguishers and mounting brackets shall be provided by the Supplier and accompanied by a valid South African certificate, in the following positions:
- At the foot of the stairs leading to the superstructure
  - In the operator's cab just inside the door
  - Outside the doors of the machinery house and electrical house (with weather protection)

- In the machinery and electrical houses and electrical enclosures if applicable

4.2.3 Suppliers shall confirm that these positions are adequate, or alternatively to indicate additional positions.

#### **4.3 Environmental Requirements**

4.3.1 Special attention shall be given to the control of dust which shall satisfy the requirements of the South African Atmospheric Pollution Prevention Act 1965 (Act 45 of 1965) as amended by the South African Atmospheric Pollution Prevention Amendment Act 1973 (Act 17 of 1973) as well as any requirements imposed by the local South African authority for adjoining municipal areas.

### **5 Maintenance Requirements**

#### **5.1 Lubrication**

5.1.1 All bearings on shafts, axles, etc., and other bearings wherever practicable on the machine, shall be arranged for lubrication by a positive grease lubrication system using an efficient button type nipple which will allow the grease gun being attached by the operator to the nipple and left hanging on the nipple, so that if necessary he can use both hands in shifting his position to get better command when screwing down the grease gun in difficult positions.

Parts difficult to access should be provided with spring feed lubricators of approved type.

5.1.2 Particular attention should be given to provide straight or angle nipples, as the case may be, making it as easy and safe as possible for the operator to grease the bearings efficiently.

5.1.3 All lubricating nipples shall be of the hexagon type in accordance with either types Nos. 11A or HE under Table I of B.S. No. 1486 Part 1/Latest Edition, and shall be spaced for the "hook-on" type of lubricating connector as reflected under Table 10 of the abovementioned specification.

5.1.4 The arrangement of the lubrication system shall be such that all greasing points are brought out to common batteries which are easily accessible. Where ground lubrication is used the diameter of the mild steel piping used shall be ample and in no case shall they be less than 6 mm outside diameter.

#### **5.2 Accessibility**

5.2.1 All replaceable items including (but not limited to) critical components shall be designed for easy access, removal and replacement.

## **6        General**

- 6.1        The shiploader shall be designed to allow for a high degree of Interchangeability of drives, motors, gearboxes, etc.
- 6.2        All steel wire ropes shall be in compliance with specification EEAM-Q-003, of the very best quality, ungalvanised, and supplied by an approved manufacturer. The factor of safety for service conditions in respect of all wire ropes shall not be less than 6.
- 6.3        The mechanical details of the equipment shall conform to the specification and the factor of safety for all mechanical portions, unless otherwise stated, shall not be less than 6 based on the minimum breaking strength of the material.
- 6.4        Safety guards and devices shall be incorporated on the equipment to protect the operator and maintenance staff. All safety guards shall be designed and fitted to be easily removable and replaceable. The safety guards shall be removable and replaceable by a single person.
- 6.5        Continuous on line measurement of effective unloading rate (in ton/hr) shall be provided with suitable numeric display thereof in the operator's cabin. The measurement shall both instantaneous and cumulative (over a 24 hour period).
- 6.6        All equipment fitted to the shiploader shall be capable of being operated at full capacity on a continuous basis except where otherwise specified. All additional parts shall be designed so that they may be easily assembled, adjusted, removed for replacement and be accessible for inspection and maintenance. All moving parts to be suitably protected.

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