

## **FUNCTIONAL SPECIFICATIONS FOR CONVEYOR BELT LOADER (SKYLOADER)**

### **1 MAIN FUNCTIONS**

- 1.1 The belt conveyor loader (skyloader) is to be used for bulk cargo and baggage loading and unloading operation with a load capacity of not less than 1000kg (2200lbs) and a load density of not less than 980kg/m<sup>2</sup> (220lb/sqft) at a fully extended height.
- 1.2 It must be capable of transferring baggage and bulk cargo into and out of bulk hold of all aircraft types, especially for B787, B747, B777, B767, B757, B737, B727, B707, A350, A340, A310, A320, A380, AB300, DC10, DC9, DC8, L1011, L44, MD11 and MD82 aircraft.

### **2 STATUTORY REQUIREMENTS**

- 2.1 The manufacturer of the unit shall be responsible for:
  - 2.1.2 The design and structural standards of the skyloaders meet or exceed those of IATA, OSHA, SAE, NEA, LTA, MOM and any other applicable standard.
  - 2.1.3 The equipment meets the requirements of the Singapore Vehicle Construction and Use Rules and the requirements for registration with the Singapore Land Transport Authority and the Ministry of Environment.
  - 2.1.4 The engine shall meet with the latest environment requirement for operation in the Changi Airport.
  - 2.1.5 the skyloader must meet the requirements of the Singapore Aerodrome Act and the Vehicle and Equipment Construction and Use Rules.
  - 2.1.6 The skyloader must meet the requirements of the latest AHM 913.

### **3 GENERAL REQUIREMENTS**

- 3.1 Environment:
  - 3.1.1 The skyloader must be designed to function outdoors. Specifically, the nature of operations demands rugged, impact-resistant hardware whose functions and controls must be foolproof and failsafe, consistent with the anticipated level of unskilled labour using the equipment.
  - 3.1.2 "As the airport is located by the sea, stringent rust control measures must be observed in the design of the skyloader. All hydraulic lines shall be of stainless steel and all guides and rails should be of stainless steel. Outdoor conditions are as follows Temperature:

20degrees C to 48degrees C. Relative Humidity: 0% - 100% Exposed to salt water and to heavy tropical rainstorms, moisture and dust. (Tuff Kote Dino on units to be done).”

3.1.3 Supplier must certify that the equipment proposed will operate reliably under the requirements stated above.

3.2 System Safety:

3.2.1 The following are to be observed:

a) All control methods, circuitry, mechanical equipment and operating procedures must be designed to provide maximum safety for operating personnel. Designs must minimize potential damage to equipment or the contents of the cargo handled. Failsafe techniques must be employed to prevent the occurrence of unsafe conditions, which could result from an equipment failure, or improper implementation of operating procedures; a press hold switch or master switch to be installed, this switch must be activated before the boom control switches can be operated. Conveyor boom will not function when gear is selected (To have selector switch for DRIVE and OPERATIONS) or hand brake is released.

b) Service brake must be of the dual system type and able to have smooth braking at slow speed to prevent damage of aircraft structure. Brake system must be in working condition when engine is cut off; and front to be Disc Brakes and rear drum brakes.

c) Two lightweight rubber safety chocks with chain and storage box to be provided for driver’s side front tyre. (Must be proportions to tyre sizes).

3.3 Personnel Safety:

3.3.1 A safety stand/stopper for propping up of conveyor bed in the raised position for maintenance purpose must be attached to the skyloader. (REAR and FRONT Boom).

3.3.2 "The skyloader must be convenient and safe to use and control functions to be performed must be simple to minimize possible errors. Convenient means for emergency system shutdown must be provided at both driver and boom areas (Where ever the control panel is). Mushroom head type switch (Heavy Duty Typed) to be used."

3.3.3 The skyloader must provide adequate means for ensuring the safety of maintenance personnel. Devices such as disconnect switches, circuit breakers, overload control relays and INTERLOCK system, both electrical and mechanical, must be provided to prevent the accidental activation of those positions of the system under operation maintenance. These devices must be located in areas where access is restricted to maintenance

personnel. A press hold (ENABLE) switch or master switch to be installed; this switch must be activated before BOTH (Rear & Front) boom control switches can be operated. Conveyor boom will not function when gear is selected.

## **4 CHARACTERISTICS**

### **4.1 General:**

4.1.1 The skyloader must be designed with power steering for easy maneuvering and to allow transfer of loads to be effected as follows

a) At the front at a lowest height measured from the ground level of not more than 762mm (30") and the minimum raised height of not less than 3910mm (154").

b) At the rear at a lowest height measured from the ground of not more than 508mm (20") and at a raised height of not less than 1219mm (48").

c) Tubeless Pneumatic tires used with tubeless type rims.

d) Rear protections guards to be install not more than 600mm above the ground and paint with anti-slip material to prevent slip. The protections guard should be mounted to the rear chassis with bolt and nuts for easy repairs and removal.

4.1.2 The skyloader must be able to traverse at a cruising speed of 30kmph (18.8mph) and climb a gradient of 1:15 with motion even after coming to a halt at the gradient. Speed of skyloaders to be set at 30 kmh.

4.1.3 In case of breakdown, there must be facilities for towing by a vehicle with a draw bar pull of 500kg (1100lbs). Recessed towing eyes are to be provided at the front and rear.

### **4.2 The Skyloader Conveyor:**

4.2.1 The conveyor must have an effective length of not less than 7.44m (290").

4.2.2 The belt must have a width of at least 610mm (24").

4.2.3 The belt must be made of strong fabric with steel reinforced heavy-duty material selected for high abrasion and weather resistance while providing good traction for transfer of cargo and baggage.

4.2.4 The conveyor belt should have an operating speed as follows:

a) a high speed for expeditious transfer of light load. With adjustable control valve.

b) a low speed high torque operation for transfer of heavy or high-density load.

- c) high demand throttles to be located at rear near belting control switch.
- 4.2.5 The conveyor shall be able to transfer a high-density load of 200kg (440lbs) over 1ft run of the belt to an elevated height of 4064mm (160") from a height of 610mm (24"). Gap between belting and front bumper bracket should be 0.5cm.
- 4.2.6 The skyloader when loading from 610mm (24") to 4060mm (160") shall have an overall load capacity of 1000kg (2200lbs).
- 4.2.7 Personnel walkway and safety railings on both sides provided. Tenderer to submit detailed design. Safety railing when fully extended shall have an opening of 20" from railing to front bumper (With auto lock (spring loaded) functions upon impact should retract inwards) Both railings Front Bumpers to be RED & Black colour rubber type.
- 4.2.8 The conveyor shall be able to maintain its raised position even after engine is switched off. (Check valve installed for both Front & Rear Boom Lift Cylinders).
- 4.2.9 The conveyor boom shall be fitted with full length rubber bumper at the front and rear. With a bumper sensor and buzzer to cut off the engine of the skyloader upon contacted.
- 4.2.10 The conveyor boom should be installed with two pieces of rectangular poly-carbon transparent canopy with opaque roof. One sliding and the other lockable. The interior canopy must be flat and no protrusions of bolts and nuts to prevent Head injury to staff.
- 4.2.11 The conveyor boom structure must be strong and rugged to withstand operation to push some cargo load. When in drive mode, boom function must be disabled.
- 4.3 Stability:
- 4.3.1 The skyloader must be structurally designed to operate efficiently with no noticeable vibration bouncing and noise under uneven load with the boom in various angles.
- 4.3.2 Brakes to be provided on the 4 wheels and parking brake at the rear.
- 4.4 Operating Systems
- 4.4.1 The skyloader is to be powered by diesel engine of reputable make and model that have good after sales service in Singapore. Preference will be given to Modular Power Pack for quick change. Able to start within 5 seconds will be an added advantage.
- 4.4.2 The engine has also to be equipped with a high demand throttle during belt operation for efficiency and fuel economy (Should be the Turning Knob Type). Low oil pressure shutoff device, low radiator coolant shutdown device, low fuel indicator with buzzer, cold starting device if any and other features to be given by the manufacturer.

- 4.4.3 The engine shut down device shall be one that is inbuilt into the fuel injection pump through a fuel cut-off fuel solenoid valve (which is replaceable). External linkages for engine shut down are not recommended.
- 4.4.4 The cooling system for the transmission if any must be separated from the cooling system of the engine.
- 4.4.5 The cooling system shall incorporate an expansion tank (Sub Tank) for the recycling of radiator coolant.
- 4.4.6 The hydraulic pump shall be direct driven by engine (with a coupler design to absorb shock).
  
- 4.5 Control System:
  - 4.5.1 Consoles;
    - a) All controls shall be grouped in consoles to minimize operating points throughout the system. Grouping shall generally be in accordance with the group, subgroup and component.
    - b) Consoles functions shall be identified in English using elementary concise terms and supplemented by graphic symbols. (Engraved Wordings).
    - c) Consoles shall be designed in accordance with sound human engineering principles
    - d) Consoles shall conform to the environmental requirements specified in para 3.1 and shall employ weather tight boxes, switches, joysticks and lights.
    - e) All identification plates and emergency procedure plates shall be mechanically affixed to the console panel, preferred aluminum plates with engraved wordings.
    - f) Controls shall be arranged to logically reflect the equipment movements required.
    - g) All electrical controls levers and joysticks shall avoid the use of internal mechanical linkage to transmit control action.
    - h) Mushroom head emergency stop push buttons (Heavy Duty Type) to disrupt electrical power shall be employed where an emergency may require immediate shut down. Drawings indicating locations of such buttons shall be submitted to SAS for approval
    - i) Control elements such as switches, pushbuttons, handles, etc, shall be selected for ease of operations in the specified environment (weather proof or IP67 or higher ratings).

j) Control elements such as switches, pushbuttons, indicator lights, bulbs, etc, shall be easily replaceable. (weather proof or IP67 or higher ratings).

#### 4.6 Hydraulic System:

##### 4.6.1 The hydraulic system;

a) must not exceed 2000 psi in operating pressure; and

b) its components such as pump, motor, cylinder and valve banks must be of reputable make and have sales and service representatives in Singapore. Information on these must be submitted together with other tender submissions.

c) Repair kits (seals) must be available for all hydraulic components and part numbers of the manufacturer provided.

d) Preferences for hydraulic steel pipes, wherever possible (reduced numbers of hydraulic hoses where ever possible).

#### 4.7 Interlocks and Limits:

4.7.1 Failsafe interlocks and limits such as check valves shall be provided in the system to ensure safe operations as specified in the groups, subgroups, and components specifications. However, the supplier shall be responsible for the integration of all additional interlocks and limits that may be necessitated by the characteristics of the elements selected for combination into a total system. Interlocks and limits shall be included for the protection of personnel, equipment and cargo in the performance of the operational functions specified for the subgroups and elements comprising the group. A low skill level of operator competence and intelligence, and conditions of personnel in attention shall be assumed in the design of such interlocks and limits.

#### 4.8 Electrical System:

4.8.1 It is to be of 12 volts system with heavy-duty battery of not less than 100AH. The charging system shall be designed for high charging at low engine speed at a rated capacity of no less than 85AH.

4.8.2 A master switch for the electrical system installed. (Heavy Duty typed IP67 rated or higher).

4.8.3 The batteries shall be easily accessible for routine inspection and maintenance purposes with latch system or swing out and have double lock on the doors.

- 4.8.4 Starter Motor - Double Cranking Relay to be install to prevent over cranking or overheat of starting system.
- 4.8.5 Wiring should be insulated with fire proof insulator
- 4.8.6 Weather proof CCTV Camera should be installed on the side railing facing the front bumper.
- 4.8.7 Lightings:
  - a) Lighting system should be ON only after engine is started.
  - b) a flashing LED AMBER BEACON (B16-11131-03) H80MM (AIRPORT USE) beacon light, mounted on top of the canopy (SAS approval before installation).
  - c) Headlights (LED IP67 rated), Sidelights (front and rear) (LED IP67 rated) and Tail lights (LED IP67 rated).
  - d) Signal light (amber) (LED IP67 rated).
  - e) Rear reflectors.
  - f) Reversing light (LED IP67 rated) with horn.
  - g) Rear brake lights (LED IP67 rated).
  - h) Brake light indicator on control panel (LED IP67 rated).
  - i) Both front and rear lights to be protected with thick metal guard.
  - j) All pilot lights must be (LED IP67 rated).
- 4.9 Canopy:
  - 4.9.1 The canopy shall be designed to function and withstand rugged and harsh outdoor operating conditions. The canopy is to be a two part sliding type. The front portion of the canopy shall be able to slide forward and backward Both Front and Rear canopy end to have Rubber Bumper installs).
  - 4.9.2 The canopy shall be welded onto square/round channels, which are welded to the sides of the boom.
  - 4.9.3 The canopy shall be so designed that it will not cause obstruction to movements/visibility for the operator at the driver's seat.
  - 4.9.4 The canopy shall be covered with clear two piece rectangular poly-carbon transparent canopy with opaque roof which shall have the following properties:

- 4.9.5 Impact -resistant PERSPEX.
- 4.9.6 Light- weight.
- 4.9.7 UV- resistant.
- 4.9.8 ALL bolts and nuts must not be protruding to prevent Head injuries (Round Type bolt and Nuts).
- 4.9.9 Canopy shall have bumper at front and rear and no protruding of bolts and nuts (Round Type).
- 4.9.10 Handle (Stainless Steel Type) to be installed on both rear canopy frame for climbing up the conveyor belt.
- 4.9.11 The canopy shall consist of simple and easy to operate locking mechanism with an interval of 6 inches apart in its forward direction.
- 4.9.12 The minimum effective width of canopy shall be 900 mm.
- 4.9.13 The effective height of canopy shall be 1205 mm.
- 4.9.14 The frame from aft to belt conveyor shall be 660 mm.
- 4.9.15 Rust proofing measures shall be applied to prevent corrosion
- 4.9.16 The maximum weight of canopy and structure should not exceed 100kg or even lighter
- 4.10 Additional Features
  - 4.10a Auxiliary hand pump for raising and lowering of boom provided.
  - 4.10b Seat ergonomically (Cushion Type) to absorb shocks designed and adjustable and suitable for all weather use.
  - 4.10c Fuel tank cap should be big enough so that when Top Up Diesel there will be no back flow (Screw type or lockable without key type). Cover is to be provided if expose to water and rain.
  - 4.10d Ignition switch keyless type controlled.
  - 4.10e Hour-meter (DIGITAL TYPE), fuel gauge with Low Warning indicator LED IP67 and buzzer rated set at 1/4 of total Diesel Tank Capacity, oil pressure gauge, speedometer and other applicable instruments shall be fitted at front panel.
  - 4.10f Bodywork and undercarriage shall be effectively preserved against corrosion with well-known anti corrosion agent e.g. Tuff Kote Dino.
  - 4.10g Sliding typed metal engine cover must be provided with lock pin insertion type.



- 4.10h One passenger seat to be installed behind driver. The seat should face forward and a handrail at the front of the passenger and seat belt is to be provided. All handrails to install Rubber Protections Guard.
- 4.10i A forward/reverse safety interlock is to be provided (Interlock Gear Lever System with the need to pull up before engaging Forward & Reverse). This means the engine would be killed off when the operator attempts to shift from forward to reverse (and vice-versa) without coming to a complete stop.
- 4.10j The exhaust pipe shall be directed to the front right side of the equipment away from the driver's operator console.
- 4.10k Rear view mirror on RIGHT sides of body which is visible from the drivers point.
- 4.10l The adjustment of the slack in the chain (if any) at the front roller should be done via an idler sprocket with easy access for Maintenance to adjust.
- 4.10m A conveyor bed canopy, with fixed lower portion and sliding upper portion.
- 4.10n Warning Lights for High Demand Activations to be install at the Drivers Panel or Console.
- 4.10p Stainless steel chain must be installed to restrict/prevent the over extension of side railings.
- 4.10q Side railing sensors must be installed to disable all frontal and lifting movement when side railings are not retracted back to home position.

## **5 OTHERS**

### **5.1 Paint Work, Logo and Decals:**

- 5.1a Two under coats of primer with marine coating agent and finishing coat according to SATS Corporate Identity; details of which will be given upon award.
- 5.1b All working member surfaces i.e. rollers (Heavy Duty Type), belting, and caster (lift and drive chains excepted) must be of non-corrosive material or hot-dipped galvanized to prevent rust and corrosion.
- 5.1c All Hydraulic, Diesel Tank must imprint capacity in Liters. All Safety Decals to be weather proof & Vinyl type eg: WARNING SIGNS FOR RETRACTABLE EXTENSIONS RAILINGS, Sliding Railings Canopy Locks & ETC.

### **5.2 After Sales Responsibility**

5.2.1 The supplier must provide his factory engineer to commission the equipment on delivery. The engineer is required to provide practical training to SAS's staff for 2 weeks on the following:

5.2.1a Operations;

5.2.1b Preventive maintenance; and

5.2.1c Repair/Overhaul of components.

5.3 The Supplier is required to furnish the following manuals:

5.3.1a 24 sets of operator's handbooks;

5.3.1b 8 sets of operating manual;

5.3.1c 4 sets of workshop repair manual;

5.3.1d 4 sets of parts manual;

5.3.1e 1 set of audio-visual training material (to be specified at time of tender) for operation and maintenance of the equipment.

5.3.1f 3 sets of accurate "as built" drawings; and electric schematic; and

5.3.1g 3 sets of detailed components manual comprising of engine, main pump, hydraulic cylinder & motor, starter motor, alternator etc.

5.3.1h Recommended spare stocking list.

5.3.1i Two sets of the above manuals and drawing in CD ROM.

5.3.1j Two sets of training manual in CD ROM.

5.4 Additional Items to be supplied:

5.4.1 1 2.0 kg CO2 fire extinguisher per unit;

5.4.2 (KEYLESS TYPE) spare of Two Sets.

5.4.3 1 set of spare tyres (Tubeless Type) and Tubeless rims per unit.

5.4.4 1 pocket/compartments to be installed for flight document fitted behind the driver seats.

5.4.5 Recommended list of spares for 4 years maintenance with price to be held for the said period.

## **6 ACCEPTANCE TESTS**

### **6.1 General:**

- 6.1.1 The supplier must perform all necessary inspections and tests to demonstrate that the skyloader meets all requirements of this specification. Supplier's records of inspections and tests must be kept complete and available to SAS at all times. Records or reports of inspections and tests must be signed and approved by the supplier. SAS reserves the right to witness any test to determine if the skyloader meets all specified requirements. An acceptance test shall be conducted in accordance with a test plan and procedure provided by the supplier and approved by SAS. The supplier must provide adequate personnel to assist SAS in inspecting and testing the skyloader in Singapore.
- 6.1.2 Reasonable notice must be given to SAS prior to the performance of final acceptance test. SAS or its appointed representatives will witness all acceptance tests and indicate acceptance by signing and dating the test data sheet. To comply before shipment to SAS.
- 6.1.3 The tests and inspections identified in this Specification represent the minimum requirement for skyloader acceptance and do not necessarily represent the complete final test requirements as variations in equipment types and designs, which will evolve under a competitive bid, may require additional specific tests. The supplier must develop a test plan and procedure that will insure performance of the specified tests as well as the additional tests, which may become necessary.
- 6.1.4 Each system and its elements will be tested with load devices of various sizes loaded to their maximum capacities. Specifically, the skyloader will be tested to 1.5 times the designed load. On site testing, a pressure water hose of 80 psi will be used to simulate raining condition.
- 6.1.5 The test program must verify system compliance with the requirements specified herein. In general, load capabilities, speed, stop and guide function, sensors, controls, ruggedness, deflection, smoothness of acceleration and deceleration, noise, continuous cycling, unitised load flow and safety features will be verified.
- 6.1.6 During the performance of the specified tests there must be no damage to the baggage cartoon or equipment. All mechanisms and stops must operate as described. None of the components must overheat and shut down due to overload, malfunction or misapplication.

### **6.2 Test Reports**

- 6.2.1 Fifteen days after completion of the tests, the contractor must submit a report summarizing the detailed results of the test. The contractor must make available to SAS, upon request, the results of all tests conducted.
  
- 6.3 Final Acceptance:
  - 6.3.1 Final acceptance of the skyloader will be made only after all the following conditions have been fulfilled:
    - 6.3.1a The skyloader has been successfully tested as specified;
    - 6.3.1b The skyloader is found to comply with all specifications;
    - 6.3.1c There has been no experience of any failure; irregular operation abnormal wear after the equipment has been operated by SAS a month;
    - 6.3.1d After fulfilment of requirements stated in Clause 5.2.
    - 6.3.1e After delivery of spare parts, as approved by SAS; and approval to the relevant Singapore Authorities (NEA, LTA, MOM and Others).
    - 6.3.1f After the supplier has provided the names, addresses, and 24-hour phone numbers of at least 2 staff of the local representative (approved by SAS) of the supplier with authority and experience to make replacements and repairs immediately for the full life of all warranties. As stated in the WARRANTY Clause 7.1.
  
- 6.4 Conditional Acceptance:
  - 6.4.1 If the skyloader is found to be unacceptable at the time of final inspection, SAS will inform the supplier of the particular defects that must be remedied before final acceptance will be made. At this time, SAS may at its sole discretion elect to advise the supplier in writing that a conditional acceptance has been made. The conditional acceptance will to the extent set forth herein, relieve the supplier of responsibility for the security and insurance on the skyloader and will also be used to initiate the time of warranty of the skyloader. In no case, however, will a conditional acceptance relieve the supplier of the responsibility for performing all the work set forth in the contract documents, including the correction of deficiencies noted at the time that the conditional acceptance is made; and SAS will be entitled to retain from the supplier's payments an amount commensurate with the work remaining to be accomplished. Further, SAS may elect to put the skyloader into operation subsequent to the issuance of a conditional acceptance in which case the supplier must perform all works.

6.5 Parts Availability:

- 6.5.1 The supplier must guarantee the availability of all spares and replacement parts and sub-assemblies required by any equipment items supplied for a minimum fifteen-year operational period. Such parts must be either available from component manufacturers when an unmodified commercial component is required or from sub-contractors when "special" components are required.
- 6.5.2 Should the supplier, sub-contractor, or such suppliers as the supplier may specify, fail to make such parts available during the fifteen-year operation period, or should the supplier's pricing become unreasonably high on a competitive basis, SAS has the right to use the supplier's drawings, at its sole discretion, for fabricating such parts, or having such parts fabricated.
- 6.5.3 The supplier must provide a recommended spare parts list and must hold stock of value no less than 10% of the contract value (items and numbers as approved by SAS) in Singapore for the duration of the warranty period.

**7 WARRANTY**

- 7.1 A warranty period of not less than 24 months, not inclusive of hour meter reading. Warranty of all units must be done within 3 working days from the received of warranty Notice Claim form SATS. At Any time that the Warranty is not completed within the 3 days period they will be extensions of the Warranty Period base on the days of the equipment unserviceable.