PART I GENERAL:

1.01 WORK INCLUDED:

A. This section includes the complete integrated design, fabrication, installation and testing of the door sections of the hangar doors including aperture door panel, unless otherwise specifically stated or indicated in these contract documents. Supplier shall design, build and install a complete aperture door system to meet the specified wind and seismic loads and the anticipated up and down deflection of the building header. There shall be three door sections for each half of the opening; two groups of three door sections for a total of six sections. The center door sections for each half of the opening shall contain an aperture panel and one closure panel. The lead door sections shall meet on the interior most track and seal against one another at the center of the hangar door opening.

B. The following components and assemblies are included in the work of this section:
   1. Steel door sections
   2. Weatherseals
   3. Upper guide rollers
   4. Bottom wheels
   5. Miscellaneous Hardware
   6. Electric power operators
   7. Electric controls
   8. Power supply from each door pocket
   9. Prime paint

1.02 RELATED WORK:

A. Concrete grout around bottom rails
B. Support steel for upper guide tracks
C. Power supply to each door pocket
D. Finish paint
E. Bottom Rails
F. Top Guides

1.03 REFERENCES:

A. Uniform Building Code.
B. American Society for Testing and Materials (ASTM) Publications
A36 - Structural Steel.
A325 - High-Strength Bolts for Structural Steel Joints, Including Suitable nuts and Plain Hardened Washers.
A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
A504 - Wrought Carbon Steel Wheels.
A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process, Lock Forming Quality.
A569 - Steel, Carbon (0.15 Maximum, Percent) Hot-Roller Sheet and Strip, Commercial Quality.
D. American Welding Society (AWS) Publications:
   D 1.1 - Structural Welding Code.
E. American Concrete Institute (ACI) Publications:
   Building Code Requirements for Reinforced Concrete.
F. National Fire Protection Association (NFPA) Publications:
   No. 70 - National Electrical Code.
G. American Iron and Steel Institute (AISI) Publications:
   Specification for the Design of Cold-Formed Steel Structural Members.
H. National Electrical Manufacturers Association (NEMA) Publications:
   ICS - Industrial Controls and Systems.
I. Federal Specifications (Fed. Spec.):
   RR-W-41OC - Wire Rope and Strand.
   Occupational Safety and Health Act (OSHA) Publications.

1.04 SYSTEM DESCRIPTION

A. Design all structural components of doors, guides and rails in accordance with the referenced AISC and ANSI publications. The aperture door system shall be designed for 80 mph wind velocity, exposure C, importance factor 1, in accordance with ANSI A 58.1, and for all relevant dead and live loads, including loads for Seismic Zone 1. The maximum deflection of the horizontal rolling door sections shall not exceed the height of the door divided by 120. The doors shall be designed so they will not flutter more than plus or minus 1/4 inch from the vertical position at the top of the horizontal rolling doors. No member shall be designed to allow a permanent set (yielding).

B. There shall be 6 door sections. . .bi-parting, electrically operated, bottom rolling and top guided from the center line of the door opening. Two groups of three door sections.

C. Each group of door sections in each half of the opening shall roll on a rail embedded in the floor such that the top of the rail is flush with the top of the finished floors. The rail shall transfer the dead load of the door section and half of the wind load on the door section to building floor and footing.
D. Each group of door sections in each half of the opening shall be stabilized by an upper guide track which shall transfer half of the wind load from the door sections to the building support steel. The top track systems shall be integrated with the head weathering to provide a weather tight closure at the top of the doors.

E. Each group of door sections shall be driven by double flanged wheel running on an embedded rail powered by an electric motor drive unit located on the leading edge of the center door sections. The powered door section shall move at a speed of not less than 45 feet per minute nor greater than 60 feet per minute. The door shall operate under winds up to 50 miles per hour. The motor brake system shall be of a magnetic solenoid system operating on the motor shaft. The drive system shall be designed to achieve a friction coefficient between the drive wheel and the rail of .25. The operators shall be designed so that the drive train can be completely disengaged by turning one lever to allow for emergency conversation to manual operation in the event of electrical outage or motor failure. The group of door sections shall slow down to half speed 15’-0” from the hangar door opening centerline to provide a safe operation when closing the door with the aircraft parked in the hangar. This will allow safety when sealing the aperture door to the aircrafts fuselage.

F. All Electrical work shall conform to the requirements of NEMA 4.

G. The doors shall be operated by push button pendant stations located near the leading edge of the powered door section which require constant pressure by the operating personnel who must walk with the door as it moves. When the group of door sections nears the center of the hangar door opening the door sections will slow down to half speed allowing the personnel time to stop and raise or lower the aperture door. This must be done to make the perfect seal around the fuselage by using the up and down aperture pushbutton pendant station to provide the correct alignment and thus continue to close the hangar door sections.

H. Ferrous metal, except for items designed to be continuously coated with lubricants or wear surfaces (such as rails or rollers), shall be prime painted.

I. The aperture panel shall be designed to fit the Boeing 737-800 and one closure door panel mounted on a trolley frame on the leading hangar door section. The aperture panel with the closure door may be lined up with the leading edge of the hangar door section. The aperture panel shall also be adjustable vertically 40” by hydraulic operation with adjustable pressure to prevent fuselage damage.

1.05 QUALITY ASSURANCE:

A. Manufacturer:
Company has been continuously engaged in the design, manufacture and installation of doors of similar size and type for at least 25 years. The door supplier shall have designed, manufactured and installed at least five aperture doors and have an installation that has used this type aperture as built by Door Engineering and Manufacturing, Kasota, MN.

B. Applicator:
Company approved by door supplier.

1.06 REGULATORY REQUIREMENTS:

A. Door Structure conforms to:
   A36 - Structural Steel.
   A325 - High-Strength Bolts for Structural Steel Joints, Including Suitable Nuts and Plain Hardened Washers.
   A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
   A504 - Wrought Carbon Steel Wheels.
   A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality.
   A569 - Steel, Carbon (0.15 Maximum, Percent) Hot-Roller Sheet and Strip, Commercial Quality.
3. American Institute of Steel Construction (AISC) Publications:
4. American Welding Society (AWS) Publications:
   D 1.1 - Structural Welding Code.
5. American Concrete Institute (ACI) Publications:
   Building Code Requirements for Reinforced Concrete.
6. American Iron and Steel Institute (AISI) Publications:
   Specification for the Design of Cold-Formed Steel Structural Members.
7. Federal Specifications (Fed. Spec.):
   RR-W-410C - Wire Rope and Strand.
   Occupational Safety and Health Act (OSHA) Publications.

B. Door Hardware conforms to:
   A36 - Structural Steel.
   A325 - High-Strength Bolts for Structural Steel Joints, Including Suitable Nuts and Plain Hardened Washers.
   A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
   A504 - Wrought Carbon Steel Wheels.
   A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality.
A569 - Steel, Carbon (0.15 Maximum, Percent) Hot-Roller Sheet and Strip, Commercial Quality.

3. American Institute of Steel Construction (AISC) Publications:

4. American Welding Society (AWS) Publications:
   D 1.1 - Structural Welding Code.

5. American Concrete Institute (ACI) Publications:
   Building Code Requirements for Reinforced Concrete.

6. American Iron and Steel Institute (AISI) Publications:
   Specification for the Design of Cold-Formed Steel Structural Members.

7. Federal Specifications (Fed. Spec.):
   RR-W-410C - Wire Rope and Strand.
   Occupational Safety and Health Act (OSHA) Publications.

C. Door Controls conform to:
   1. National Fire Protection Association (NFPA) Publications:
      No. 70 - National Electrical Code.
   2. National Electrical Manufacturers Association (NEMA) Publications:
      ICS - Industrial Controls and Systems.
   3. Occupational Safety and Health Act (OSHA) Publications.

1.09 SUBMITTALS

A. All submittals shall be delivered in accordance with sections [01300] [01340] of this specification.
   1. Shop drawings to completely describe the hangar/aperture door design and interface with building materials, structural connections, fasteners, all collateral work, operating systems, electrical controls, warning and safety devices.
   2. Electrical diagrams and schematics.
   3. Shop painting and finishing specifications.
   4. All calculations concerning this section will be provided by Door manufacturer.

B. The contractor shall provide an integrated design of the entire design of the entire hangar door system in conformance with the requirements as shown on the drawings and as specified herein. The design shall begin at the top of the rough foundation concrete and shall end at the structural framing over the top guides. It shall include rails, rail drainage, rail de-icing if required, soffit closures, jamb weathering, top guides, electrification of the doors, control system and interlocks.

1.10 PROJECT RECORD DOCUMENTS:

All project record documents will be submitted under SECTIONS [01700][01720].
1.11 OPERATION AND MAINTENANCE DATA:

Six complete manuals containing instructions for proper operation and maintenance of the doors shall be furnished to the Owner. They shall contain complete:

1. Operating Instructions.
2. Maintenance Instructions.
3. A chart showing all points to be lubricated, type of lubricant required and frequency of lubrication.
4. A chart giving a checklist of parts to be serviced and adjusted and frequency of servicing and adjustment.
5. A suggested list of spare parts.
6. A manufacturer's catalog for each component used in or on the doors.

1.12 DELIVERY, STORAGE AND HANDLING:

Handle and store all materials and equipment as specified in SECTIONS [01700][01730].

1.15 WARRANTY:

The entire installation, including materials and operation, shall be guaranteed for a period of one year from the date of completion of the work under this contract. During that period any defective equipment shall be replaced at no expense to the Owner, including all labor, material, travel and expenses of personnel brought in, and any other costs associated with the solution and correction of the problem.

PART 2 PRODUCTS

2.02 MATERIALS

A. HANGAR AND APERTURE DOORS:

1. Structural Framing: Framing members shall be true to dimension and square in all directions and shall not be out of line horizontally or vertically more than 1/8 inch in 20 feet. Buckling shall be dealt with in the design process and lateral support provided as regarded. Diagonal bracing shall be provided so that the completed leaf assembly will be adequately braced to withstand shipping, assembly, and operational loads. All joints shall be designed to develop the necessary strength in all places. Top and bottom horizontal full-length splice members shall be provided and field bolted to the sections of each leaf.
   a. Fabrication: Door framework shall be fabricated in specifically designed jigs to prevent bowing, racking or warping during fabrication and to hold the sections to specified tolerances. Exposed welds and welds which interface with the installation of various parts such as corrugated siding (on the hangar door sections) and flat
door covering sheets (aperture and closure doors), shall be ground smooth. Properly sized horizontal and vertical members shall be provided at all necessary intermediate points to limit the unsupported area of flat wall covering sheets to 25 sq. ft. between rows of fasteners. Horizontal members shall be provided to limit the unsupported vertical span of shallow-ribbed metal siding so that the allowable stresses and deflections will not be exceeded.

b. Necessary structural framing and holes shall be provided in the leaves for exit lights, interlock switches, alarm horns and similar items of electrical equipment.

2. Flat Metal Wall Covering-Aperture and Closure Door:
Exterior shall be minimum thickness of 14 gauge. Covering shall be flat, rigid, neat in appearance, free from warps, buckles and other defects, and shall conform to ASTM A366 or A569. Covering shall be fastened and sealed on all edges. Fasten to door leaf framing members with plated steel, hex head, self-tapping screws uniformly spaced at not more than 12 inch centers.

a. Access Panels: Sections of the metal wall covering at motor operators and at each wheel shall be removable for access. Hinged and latched access covers shall be provided in the sheets for ready access to the operators, controls and hardware. Screwed-on access covers shall be provided in the outside sheets for emergency access to the brake or clutch release.

3. Top Rollers:
Each horizontal rolling door leaf shall be provided with a minimum of two "floating" type top roller assemblies. Rollers shall have porous oil impregnated bronze sleeve bearings. Roller assemblies shall be capable of resisting the required wind and operating loading, and shall be designed to permit vertical movement of the structure above, in the amounts shown below. Maximum deflection of the roof structure at the hangar door, under applied loads, has been designed to be limited to the following, measured at the point of maximum deflection.

Liveload deflection: total of five inches
Deadload deflection: total of six inches

4. Bottom Wheels:
Each door leaf shall be provided with a minimum of two bottom wheel assemblies. Wheels shall be made of cast, rolled or forged steel or ductile iron, having a minimum tread diameter designed to adequately carry the load and to permit removal without taking the door leaves from their position on the rails. Center flanged wheels are not acceptable.
a. Treads shall be machined concentric with the axle bores and to fit rails with horizontal clearance between wheel and rail of not more than 5/64 inch at the root of the flange or more than 5/32 inch at the toe of the flange. Wheel tread wearing surfaces shall have hardness of 249 brinnell, minimum.

b. Bearings: Each wheel shall be provided with two tapered roller bearings. Bearing units shall be mounted in the wheel assembly so that both the vertical dead loads and the horizontal windloads can only be transmitted from the leaf to the wheel through the bearings. Bearings shall be provided with seals to retain the grease and prevent the entrance of dirt and shall be equipped with approved type non-leak, high-pressure throat or surface check lubricating fittings. Bearing shall have minimum L 10 life of 3,000 hours with full operating windload and a static rating of at least 120% of calculated dynamic equivalent radial load under full static windload conditions.

5. Supports:
   a. Wheel Carriages: The wheels for each leaf shall be mounted in welded and machined wheel carriages. The finished and fully assembled wheel carriages shall be bolted or welded into the main vertical framing members of the door leaf sections.
   
   b. Motor-Operator Drive Base Supports: Bases shall be supported on rigid structural leaf framing designed to prevent deflection or torsional rotation under the loads imposed during operation of the rolling doors. The supports shall locate the bottom of the operating equipment high enough above the drive wheels so that the wheels can be removed from the leaves. The drive base support framing shall be designed so that the drive base and operating equipment can be easily adjusted with separate pressure and tension members to maintain proper tension in the roller chain drive. Slotted hole adjustments are not acceptable. The operator base shall also be fitted with a disconnect lever that fully disengages the drive train to allow for uninhibited manual operation in the event of an electrical failure.

6. Weathering, Rail Wipers and Toe Guards:
   a. Weatherstripping Material: Material which is adjustable and readily replaceable shall be provided on vertical edges, sills, and heads to afford a substantially weathertight installation.
   
   b. Nonmetallic Weatherstripping Material: Material on vertical edges of doors shall be two rows of EPDM bulb type. Head and sill weathering shall be wipe-type, EPDM. The material shall have a minimum thickness of 1/16 inch and shall be retained continuously with steel
binder bars for its length and secured with 1/4 inch diameter zinc coated fasteners on 9 inch centers.

c. Rail Wipers: Suitable and removable rail wipers shall be provided to clear debris from the railhead and the wheel flange grooves as the leaves are moving. The wipers shall be located at the ends of each leaf.

d. Toe Guards: A full-length flexible toe guard reaching to the floor shall be attached to the interior bottom edge of each leaf.

e. Fuselage profiles shall be weathered using a four inch wide foam rubber insert. The insert shall be totally covered by weather resistant waterproof yellow nylon fabric weighing not less than 18 ounces per square yard.

7. Weathering:
Each door leaf shall be weathertight over the entire surface exposed to the exterior, in all door configurations. Spaces between and all around each door leaf, including spaces adjacent to the fixed opening jambs, heads and floor, shall be tightly closed with flexible material with an average crack opening of not more than 1/16 inch.

8. Aperture and closure door panel:
Mounted on an adjustable trolley frame on the center hangar door section with the proper cut-out frame in this door section to allow the aircraft to park in the hangar bay. The Aperture door fuselage profile panel and closure door shall be incorporated into one with the trolley frame. This aperture/closure panel assembly shall be adjustable vertically by power operation with the closure panel manually operated horizontally to its open position to better accommodate the alignment to the fuselage. When there is no aircraft in the opening, the closure door can be manually closed to make a complete seal with the leading sections of the hangar door to provide a substantial weathertight closure.

9. Each aperture shall be provided with its own set of electrical controls. All controls shall conform to NEMA 4.

10. PAINTING:
A. Primed or Unpainted Items: Except as otherwise provided by this section, prepare and paint all unfinished surfaces.
GENERAL: Do not finish the following items:
Prefinished surfaces
Aluminum, bronze, copper or stainless steel unless otherwise required
Wire ropes or cables and fittings Neoprene weathering and bumpers Chains and sprockets
Bearings
Wheel brake surfaces. . .Bottom Rails
Spring retractors
Actuating bars for limit switches Electrical switches and components

B. Touch-Up: Repair and touch-up all damaged and abraded surfaces, and paint field bolts and welds in accordance with requirements for adjacent surfaces.

PART 3  EXECUTION

3.01 INSPECTION:

Verify
a. Opening and Closing: The hangar doors shall be capable of being fully opened from the closed position by electric power. In addition, the doors shall also be capable of being fully opened from the closed position by manual power and/or other convenient means (such as a diesel or gasoline-powered tractor) in the event of total electric power failure.
b. Weathering forms a substantial seal for complete opening.
c. All ferrous surfaces are prime painted excluding surfaces that are part of a moving system (Rails, Wheel tread, Top rollers, etc.).
d. Door Sections are square and plumb.
e. Wheel treads are set squarely on the rail.

3.02 PREPARATION:

A. Opening must be complete, square and plumb. Jambs must be held to within 1/4" of plumb in all four directions.
B. Concrete floor must be finished including rails.
C. Top Guides must be installed.
D. Electricity must be run to location required for door control panels and limit switches.

3.03 INSTALLATION

A Erect door sections.
B. Install door hardware.
C. Hang control panel and push buttons.
D. Trim and Adjust weathering.
E. Test door – Bottom rolling hangar door and Aperture door.

3.04 FIELD QUALITY CONTROL

Field testing will be performed under provisions of SECTIONS [01400.] [01410.].

3.05 ADJUSTING AND CLEANING

A. Adjust weathering so that it makes complete seal of hangar opening
B. Remove all loose dirt from door panels
C. Paint all exposed steel including all welds made during installation.  
   (Do not paint: operator parts, wheel tread, rails, electrical pmts, top rollers,  
   roller chain, cables or Door Engineering Job Label).
D. Dispose of all packaging according to jobsite policy.

3.06 SYSTEM DEMONSTRATION

A. The complete door system will be demonstrated to either a representative from  
   the general contractor or the owner of the facility.
B. The demonstration will include the working of the door and the maintenance.

3.07 PROTECTION

Protect finished installation under SECTIONS (01500) (01535).