SECTION 116100 - THEATER AND STAGE EQUIPMENT

PART 1 – GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. The General Conditions, Supplementary Conditions, and Division 01 – General Requirements apply.

1.2 SECTION INCLUDES

A. Demolition of Existing Rigging Systems
B. Replacement of Fire curtain Release System.
C. Repair and Maintenance of Fire Curtain Rigging System
D. Supply & Installation of Fire Vent Closure System
E. Supply and Installations of Counterweight Rigging System.
F. Supply and Installation of Stage Drapery
G. Supply and Installation of Stage Drapery Tracks.

1.3 RELATED SECTIONS

A. Division 26 - Electrical: Electrical systems and components.

1.4 REFERENCES

A. American National Standards Institute (ANSI):

1. Individuals, organizations and companies involved in the design and construction of manually powered counterweight rigging systems shall comply with the rules and recommendations of the following standard ANSI E1.4 - 2014, Entertainment Technology - Manual Counterweight Rigging Systems.

2. Individuals, organizations and companies involved in the design, manufacture and/or installation of boom and base assemblies, simple ground-support devices for lighting equipment and accessories shall comply with the rules and regulations of the following standard. ANSI E1.15 - 2006, Entertainment Technology-- Recommended Practices and Guidelines for the Assembly and Use of Theatrical Boom & Base Assemblies.

3. Individuals, organizations and companies involved in design, fabrication, installation, operation, testing, and maintenance of fire safety curtains and fire safety curtain systems used for theatre proscenium opening protection shall comply with the rules and regulations as described in the following standard. ANSI E1.22 – 2009, Entertainment Technology - Fire Safety Curtain Systems.

4. Individuals, organizations and companies involved in the design and construction of

powered hoist systems shall comply with the rules and recommendations of the following standards ANSI E1.6-1 - 2012, Entertainment Technology – Powered Hoist Systems.

E. National Fire Protection Association (NFPA):

1. NFPA 70, National Electrical Code.
2. NFPA 80, Standard for Fire Doors and Other Opening Protectives.
3. NFPA 701, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

I. Wire Rope Technical Board (WRTB):

1. Wire Rope Users Manual, Fourth Edition, December 2005.

1.5 PERFORMANCE REQUIREMENTS

A. Comply with the following:
1. Tension Load Path Components and Systems: Design factor of eight (8).
2. Cable Bending Ratio: Minimum of 30 times the rope diameter.
3. Steel: 1/5 of stress yield.
4. Maximum Fleet Angle: 1.5 degrees
5. Fabrics: Class “A” IFR synthetic

1.6 SUBMITTALS

A. Prepare submittals under the supervision of an ETCP Certified Rigger.

1. Shop drawings shall be signed and sealed by ETCP Certified Rigger.
2. Responsibility shall include all elements related to overhead lifting, support of elements provided by the stage rigging contractor, and all overhead suspended elements.

B. Product Data: For each product specified, provide details, dimensions, anchoring and mounting requirements, material and finish descriptions, electrical requirements, and manufacturer's warranty.

C. Shop Drawings: Indicate plans, elevations, and detailed sections of typical stage equipment systems and elements, electrical riser diagrams, schematics, loads and panel details, estimated building loads imposed by furnished equipment, anchor and fastening details, drapery and lineset schedules, miscellaneous equipment details and any additional information required to evaluate the completeness and correctness of the rigging systems.

D. Deviations: Highlight any and all deviations from specified equipment in Shop Drawings and cut sheets with the word “Deviation” in bold font, no smaller than the largest font used on the sheet for other notes and labels. Immediately adjacent to the word “Deviation” will be an explanation of the deviation or a note describing where details of the deviation are explained.

E. Samples: For each type of curtain specified, include color charts illustrating the manufacturer’s full range of colors, textures, and patterns. Provide a 12-inch square sample of each type of fabric in any color.

F. Samples: For any equipment or component when requested by the Architect/Owner.

G. Warranty: Provide sample of manufacturer's standard warranty for materials and parts.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Provide three (3) sets of data including parts list for fire curtains, rigging and each piece of equipment provided or installed to include in the operation and maintenance manuals.
B. Record Drawings: Provide three (3) sets of "as-built" shop drawings.
C. Test Certificates: Provide flame retardant certificates for each fabric utilized.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A company with a minimum five (5) years experience installing similar projects.
B. Components in each of the following major systems shall be by a single manufacturer:
   1. Counterweight rigging system
   2. Fire Vent closure system
   3. Fire Curtain release system
   4. Curtain system
   5. Curtain Track system

C. Fire-Test-Response Characteristics: Provide curtains with flame-resistance ratings that pass NFPA 701.
D. Installation shall be performed by a Theatrical Contractor with experience installing 10 or more systems of similar size & scope.
E. The Installation Supervisor must be ETCP certified in Theatrical Rigging. The Installation Supervisor must be present and actively engaged in operations at all times work is being performed.
F. The Installation Crew is to be under the direct supervision of the Installation Supervisor and experienced in installation of similar rigging systems. For purposes of this requirement "experienced" shall mean no more than 1 in 4 members of the Installation Crew shall have less than 160 documented hours experience installing similar rigging equipment in an entertainment environment.
G. The Theatrical Contractor shall be responsible for conducting an analysis of the jobsite and identifying potential hazards. They shall formulate a Safety Plan and conduct jobsite meetings as required to ensure all employees are aware of, and follow, the Safety Plan. Use of fall arrest equipment and hard hats must be included in the Safety Plan.
H. Under no circumstances shall any product be installed in a manor inconsistent with the manufacturer's design intent.

1.9 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings and construction contiguous with theater and stage equipment by field measurements before fabrication begins. Indicate measurements on shop drawings.

1.10 DELIVERY, STORAGE AND HANDLING

A. Package and ship in accordance to manufacturer's recommendations and in a manor that prevents damage prior to installation.

B. Store in compliance to manufacturer's instructions and in a manor that prevents damage prior to installation. Onsite storage prior to designated dates of installation shall not be permitted.
C. The Theatrical Contractor shall be responsible for having personnel available to accept delivery of all equipment and for providing the necessary labor, fork lifts, cranes, derricks, dollies, ramps, and tools to unload & place the equipment.

1.11 COORDINATION

A. Coordinate locations of theater and stage equipment with other work to prevent interference with clearances required for access, and for proper installation, adjustment, operation, cleaning, and servicing.

1.12 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective theater and stage equipment components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three (3) years from date of Substantial Completion.
2. Warranty may be contingent upon annual inspections by a qualified representative.
3. Cost for (3) annual inspections during the warranty period shall be included bid.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Products:
   a. Counterweight rigging system: BellaTEX, Inc.
   b. Fire Vent closure system: Thern Stage Equipment
   c. Fire Curtain release system: H&H Specialties
   d. Stage Curtain system: BellaTEX, Inc.
   e. Curtain Track system: H&H Specialties

B. Subject to compliance with specifications, the following manufacturers are preapproved:

a. Counterweight rigging system:

BellaTEX, Inc.
124 Conalco Dr.
Jackson, Tennessee USA
Phone: (800) 372-3373

Blackwell Rigging
10179 Broadsward Drive
Bristow, VA USA 20136
Phone: (804) 767-8730

J.R. Clancy
7041 Interstate Island Road
Syracuse, NY USA 13209-9713
Phone: 315-451-3440

Peter Albrecht Company
6250 Industrial Ct.
Greendale, WI USA 53129
Phone: 414-421-6630

Thern Stage Equipment
5912 Industrial Park Drive
Winona, MN USA 55987
Phone: 800-553-2204

b. Fire Vent closure system:

Thern Stage Equipment
5912 Industrial Park Drive
Winona, MN USA 55987
Phone: 800-553-2204

Peter Albrecht Company
6250 Industrial Ct.
Greendale, WI USA 53129
Phone: 414-421-6630

BellaTEX, Inc.
124 Conalco Dr.
Jackson, Tennessee USA
Phone: (800) 372-3373

J.R. Clancy
7041 Interstate Island Road
Syracuse, NY USA 13209-9713
Phone: 315-451-3440

c. Fire Curtain release system:

H&H Specialties
14850 Don Julian Rd
City of Industry, CA 91746
Phone: (626) 575-0776

J.R. Clancy
7041 Interstate Island Road
Syracuse, NY USA 13209-9713
Phone: 315-451-3440

d. Curtain system:

BellaTEX, Inc.

124 Conalco Dr.
Jackson, Tennessee USA
Phone: (800) 372-3373

Rosebrand
4 Emerson Lane
Secaucus, NJ 07094
Phone: 201-809-1730

e. Curtain Track system

H&H Specialties
14850 Don Julian Rd
City of Industry, CA 91746
Phone: (626) 575-0776

BellaTEX, Inc.
124 Conalco Dr.
Jackson, Tennessee USA
Phone: (800) 372-3373

Automatic Devices Company
2121 South 12th Street
Allentown, PA 18103
Phone: 610-797-6000

C. Additional manufacturers will be considered, subject to compliance with requirements of this specification
   a. Approval will be by addenda.
   b. Submit request for approval 3 weeks prior to bid. Include:
      i. Company profile
      ii. Representative list of projects with contact references
      iii. Project Name, City, and State of all similar projects complete in past 3 years.
      iv. Any required deviations from specifications
      v. Brief description why approval will be beneficial to owner.
      vi. Please indicate if samples of major components can be provided before bid date, if requested.

2.2 FINISHES

A. Shop Primer: Manufacturer's standard primer.
B. Finish Paint:
   1. Metal Components: Matte black textured powder coat.
   2. Special Finishes: As specified.

C. Miscellaneous Hardware, Cable Fittings, Clips and Chain, and Hardware: Painted, galvanized or cadmium plated as required.

2.3 FIRE SAFETY CURTAINS

A. Operation:

1. Meet or exceed the requirements set forth in the Building Code
2. Raising and lowering of the fire safety curtain is normally operated using a hand winch. In an emergency, a release system will cause the curtain to lower by gravity. An emergency release will close the curtain with an closing speeds to meet ANSI E1.22.
3. The rigging equipment supplied for the fire safety curtain shall in all respects meet the quality standards established for the theater and stage equipment specified

B. Emergency Release:

1. Emergency release system must effectively lower curtain in event of fire with or without human intervention.
2. Incorporate an emergency release line constructed from 1/8-inch small diameter specialty cord impregnated with dry lubricant, fitted with not less than six (6) 165 degree Fahrenheit fusible links. Install one (1) fusible link for every 15 lineal feet of emergency release line and one (1) fusible link no more than 7'-6" from the vertical rise of the release line. When a link separates or the manual pull pin is removed from the manual release station the fire curtain will lower automatically.
3. Manual emergency deployment of the fire curtain shall be accomplished by the activation of one (1) of two (2) quick-release assemblies, one (1) located at each side of the proscenium. Activate either assembly by lifting a lever to release the 1-1/2-inch diameter red ring attached to the emergency release line.
4. Normal operation of the fire curtain shall not disable the emergency operation of the fire curtain system.

D. Scope:

1. Replace the release system in it's entirety, except the electro-mechanical release device currently in the system. Reinstall the JRC Model: SureGuard electro-mechanical release.
2. Replace all cable clip wire terminations on ¼" lift lines and 3/8" drive line with NiCo compression sleeves.
3. Replace mounting Unistrut for loft blocks with P5501 strut and appropriate fittings.
4. Adjust all blocks to minimize wire rope contact with loft wells. Replace worn and damaged cables.
5. Service winch
6. Make adjustments as necessary for Fire Curtain system to comply with ANSI E1.22-2009

2.4 COUNTERWEIGHT RIGGING

A. Lineset Components:

1. 12" diameter head block
2. Eight (8) inch diameter Nylatron GSM turned loft blocks with incremental grooves.
3. T-Bar Frontloading Counterweight Arbor with BAT
4. 10" diameter tension block
5. Rope Lock, non-pinching type
6. Batten clamp & turnbuckle
7. 1/4-inch Nicopress® oval sleeve.
8. 1/4-inch Heavy Duty Cable Thimble
9. 3/4-inch 3-braid twist Handline. Multi-Line II or equivalent.
10. 1-1/2-inch I.D. Schedule 40 Steel Pipe Batten
11. Counterweight Bricks

12. ¼” 7x19 IRWC wire rope impregnated with dry lubricant

B. 12" Head Block:

1. Construction
   a. Block assemblies shall consist of a housing that encompasses one or more sheaves with ball or tapered roller bearings, and one or more shafts. Lines shall be prevented from unintentionally leaving the grooves. Provisions shall be made for accurately mounting the block assembly to the structural framing in a secure and safe manner.
   b. Shafts shall be fabricated from cold finished steel with a minimum Yield Strength of 310,230 KPa (45,000 psi). Shafts shall be installed so that no thread contacts the bearing or sheave housing. Unless specifically designed to rotate, shafts shall be locked against rotation within the block housing. Shaft nuts shall have a minimum rating of SAE J429 Grade 2. Shafts shall not move axially.
   c. All grooves on a sheave shall have equal pitch diameters.
   d. The sheaves shall be of nylon construction and shall have grooves for the purchase line and the required number of loft lines.
   e. See Section labeling and Marking for labeling requirements.
   f. Sheaves, bearings, materials, and mountings shall meet ANSI E1.4-2014

2. Mounting
   a. Provisions shall be made for accurately mounting the block assembly to the supporting structure in a secure and safe manner. The mounting shall be designed to prevent block movement and prohibit loosening of block or mounting hardware over time by either load or vibration.
   b. When attaching blocks, the anchors shall be selected and installed according to both the manufacturer's recommendations and local code requirements, for the loads and the materials into which they are inserted.
   c. Mounting clips shall be constructed and sized for the block load and mounting condition. They shall be installed so that the block cannot shift on the support structure. When clips are used to grip a beam flange, the clip shall deflect not more than 3mm (7/64 inch) when fully clamped at the block manufacturer’s recommended torque values.

C. Eight (8) Inch Loft Block:

1. Construction
   a. Loft blocks shall meet the requirements of Section Head Blocks.
   b. All sheaves shall have the required number of grooves to support the loft line descending from it and to support all loft lines passing over the sheave and on to the other loft blocks in the block set. Pitch diameter of all grooves shall be equal.
2. Upright
   a. Upright blocks shall mount to the top side of the structural framing with the lift line passing over the sheave above the mounting base. The block shall be designed to facilitate the passage of lift line wire ropes between the load and the head block.
3. Mounting

a. Mounting shall be done in accordance with Section Head Blocks: Mounting.

D. Mule blocks

Construction

1. Mule blocks shall meet the requirements of Section Head Blocks. If field conditions require, the assembly shall be adjustable to maintain proper fleet angle alignment of the lift lines. The block shall lock in position after final adjustment, so it is not supported by wire rope tension.

2. Mountings shall meet the requirements of Section Mounting.

E. Tension Block:

1. Construction
   a) Tension blocks shall meet the requirements of Section Head Blocks.
2. Mounting
   a) Tension blocks shall be mounted in a manner that prevents interference between the purchase line and any other system or structural element.
   b) Tension block mountings shall meet the requirements of Section 2.01 Head Blocks Item C Mounting, or shall use guide shoes when mounting to guide rails. If guide shoes are used, they shall be fabricated to permit block travel along the guide mechanism without the use of tools. Lubrication shall not be required for either the guide shoes or the guide mechanism. The guide shoes shall prevent the tension block from releasing when the counterweight set is operated, but shall also allow readjustment of tension when so intended.

F. Counterweight Arbor (Single Purchase):

1. Counterweight arbor shall be a Front Loading Arbor and manufactured under appropriate licensing.
2. Side loading rod arbors shall not be deemed equal.
3. Arbor must enclose the counterweight bricks on three sides.
4. The arbor shall have a vertical gate at the front of the arbor to prevent bricks from sliding out the front of the arbor. The gate shall engage and lock in the slot or indentation at the front of the counterweight bricks in the event the bricks slide forward in the arbor and shall engage the shelf of the arbor in a locked position.
5. The arbor shall have shelves no more than 24 inches apart and shall not require loading in any particular order.
6. Arbors shall not requiring spreader plates .
7. The arbor shelves shall impose an angle on the counterweight bricks causing them to be slanted toward the back of the arbor.
8. The arbor shall be single purchase and shall have tie off points for up to 10 loft lines and for one ¾ inch purchase line.

9. The arbor shall be delivered at pipe weight. Pipe weight may be achieved by the delivering an arbor that is pipe weight and/or by the addition of counterweights.
10. The arbor shall be sized to accommodate counterweights as indicated in drawings and schedules.
11. The arbor shall be designed in such a way that up to three arbors can be bolted together side by side and operated as a single arbor, with each arbor carrying full compartments of counterweight bricks.
12. Counterweight arbors shall be designed to hold weights for balancing loads in a manner that permits safe handling and easy access while retaining the counterweights within the arbor, even in the case of unexpected impact. Arbor frames and fittings shall be of materials having ductile properties that deform plastically without fracturing.
13. All counterweight arbor tops shall be equipped with attachment points for the lift lines and purchase lines, and the attachment points shall be sized so that terminations do not rest on, pinch, or otherwise bind adjacent terminations.
14. Counterweight arbors shall be designed to hold counterweights as described in Section Counterweights, and shall be designed to hold such counterweights without dislodging in the event of unexpected impact loads.
15. The inside of the counterweight arbor bottom frame shall be configured so that the counterweights rest without rocking. Counterweights shall not be permitted to rest on any bolt, nut, fastener, or other mounting hardware.
16. The arbor frame shall contain guide assemblies for engaging guide rail systems. Guide assemblies shall run freely, and engage the rail assembly in a manner that prevents arbors from disengaging under normal usage. The guide assemblies shall be designed to minimize noise and friction.
17. See Section labeling and Marking for labeling requirements.

G. BAT

1. The BAT (BellaTEX Arbor Trap) shall be manufactured under appropriate licensing.
2. The BAT shall be an out-of-balance safety device that prevents arbor movement when the batten is loaded/unloaded at the full “in” (loading) position.
3. The BAT shall mechanically trap the arbor. Engagement shall be passive, taking place automatically when the batten reaches it’s full “in” (loading) position.
4. The BAT shall be fixed to the head steel of the building by means of pre-engineered channel and fittings dselected and installed to meet or exceed the arbor’s capacity.
5. The BAT shall be located above the arbor’s travel in a manner so the arbor blades properly engage it.
6. The BAT must prevent arbor movement unless the lineset is reasonably balanced allowing the operator to remove any load from the BAT
7. The release device must be incapable of intentional or unintentional disengagement while the BAT is under load.

H. Counterweights

1. Counterweights shall be made of steel or other materials having ductile properties that will deform plastically without fracturing.
2. The weights shall be CNC cut with plasma, laser, or waterjet. Edges shall be smoothed and free from sharp edges.

3. The counterweights shall have an oblong shaped hole to be used as a handle cut toward one end. The same end shall have a notch to accommodate the locking gate.
4. Counterweights shall be of dimensions and shapes that can be safely handled by an average worker, and shall vary in size by no more than 3 mm (1/8 inch).
5. Individual counterweights shall not weigh more than 13.6Kg (30 lbs).
6. There shall be 50% capacity counterweights supplied for each arbor. This amount will be in addition to the counterweights required to achieve pipe weight balance.
7. The counterweights shall be 90 per cent 1 inch thick and 10 per cent 0.5 inch thick.

I. Rope Locks:

1. Once the rope lock handle is placed in the locked position the rope locks shall remain locked until released.
2. Each rope lock shall be adjustable to sustain an out of balance condition of exactly 22.6 Kg (50 pounds).
3. Rope locks shall have an integral mechanism designed to prevent accidental release. Loose locking rings that can vibrate and create noise are not acceptable.
4. Housings shall be made of a material having ductile properties that will deform plastically without fracturing.
5. An adjustment mechanism on the rope lock shall permit adjustment of the clamping members for worn ropes or ropes of differing diameters.
6. Attachment of the lock to the rail shall be such that loads imposed on the lock are safely transferred to the rail structure.
7. Rope locks shall be positioned to impose minimal wear on the operating line as it passes through the system.
8. Rope locks shall apply a braking force to the rope by means of bending the rope. Devices that squeeze or pinch the rope to hold it in place shall not be allowed.
9. Rope locks shall not be welded to the locking rail.
10. See Section labeling and Marking for labeling requirements.

J. Locking rails

1. The locking rail shall be constructed from structural steel shapes and shall consist of a top railing and its supports.
2. The rail top shall be drilled to receive the rope locks on the required centers.
3. The rail shall be designed to accept either the anticipated loads imposed by the counterweight sets, or 34 Kg (75 pounds) per rope lock or concentrated loads of 227 Kg (500 pounds) at the midpoint between each locking rail upright, whichever is greater.
4. It shall also be designed to absorb a horizontal load as dictated by system design and applicable codes.
5. If not on the rope locks, the locking rails shall have an individual, permanent number or name displayed at each rope lock. Provisions shall be made for the temporary display of secondary descriptions.
6. The rail shall be attached to the building structure using bolts or anchors specifically sized and designed for the loads, mounting surfaces, and conditions, or shall be welded.

7. All anchorages and weldments shall fully resist anticipated loads, without loosening.
8. See Section labeling and Marking for labeling requirements.

K. Tee-Bar Guide System:

1. The minimum spacing between the guide rails shall be such that adjacent counterweights or obstructions cannot come into contact with each other under normal operating conditions.
2. Guide rail systems shall consist of minimum 38 mm x 38 mm x 4.7 mm (1-1/2 inch x 1-1/2 inch x 3/16 inch) aluminum T-bar, rigidly fastened to a horizontal supporting structure at not more than five-foot intervals. Other sizes, profiles and metals shall be permitted for guide systems as long as they meet the operational criteria of this standard.
3. Guide rails shall be attached to steel support members located perpendicular to the guide rails.
4. All splices shall be finished in a manner that provides smooth transition between the abutted edges, without offset, warping or twisting of the rails.
5. Guide rail horizontals shall be rigidly attached to the building structure so that the guide rails cannot move in any direction.
6. Guide rail horizontals shall also be equipped with bracing where required to maintain rigidity of the guide system. The bottom support shall be bolted or anchored to the floor using anchorages specifically designed for the loads, mounting surface and conditions.
7. Stop battens or bars shall be attached where they will provide a secure stop for the arbors at their designated upper and lower limits of travel, and shall be structurally attached in locations that prevent interference by the arbor or stop, with any other component of the system. The bottom stop shall be located above the level of the tension blocks and shall be capable of supporting the weight of a fully loaded arbor, plus an additional 22.6 Kg (50 lbs) of allowable load imbalance. The top stop shall be capable of supporting the weight of a batten when loaded to the capacity of its arbor, plus an additional 22.6 Kg (50 lbs) of allowable load imbalance. Hardwood bumpers shall be bolted to the impact face of both stop assemblies, or shall be permitted to attach to the top and bottom of the arbor assembly.
8. Head blocks shall be positioned over the guide rails so that the support lines are plumb and the counterweight arbor does not impose a horizontal force on the guide system.
9. Guide system shall have no visible signs of deflection or movement during arbor operation.

L. Pipe Battens:

1. Pipe Battens shall be constructed from 1.5" id schedule 40 steel pipe. Lengths greater than 20' shall be formed by means of an internal sleeve not less than 2' long with a ¼" or greater wall thickness and no more than 1/16" play. Internal sleeve will be fixed in place by means of (4) 3/8" G5 bolts and nylock nuts.

2. Batten for weight pipes shall be ¾" id schedule 40 steel pipe. Lengths shall be 10'. Splices shall be formed by threaded conduit coupling with smooth exterior.

3. All burrs and sharp edges are to be removed.

4. For each 1.5" batten supply model #680 batten clamps with a 1400 lbs WLL. Supply not less than (1) clamp for every 10' of batten length, or portion there of, plus (1) clamp.

5. Battens shall have a textured matte black powder coat finish.
6. A minimum of 100 mm (4 inches) at each end of the batten shall be marked with an approved OSHA color, except in architecturally sensitive areas.
7. The batten shall be capable of supporting at minimum 45 Kg/m (30 lbs/ft) of uniformly distributed load. Battens shall be capable of sustaining a point load of 45 Kg (100 pounds) at mid-span between any two lift lines with a maximum span deflection of 1/180 of the span.

M. Hardware

1. With regard to load bearing components, except for wire rope all products shall be manufactured and distributed by entities within the United States. Components shall be load rated and documentation of such shall be freely and publicly available from the manufacturer. Each component must bear a durable manufacturer's mark and must be clearly identifiable by make and model without ambiguity.

   a. Shackles:
      1. Shackles shall be domestically produced, load rated, screw pin anchor shackles, drop forged and galvanized.
      2. After final adjustment, mouse shackles to prevent loosening.

   b. Turnbuckles:
      1. Fabricate from forged and galvanized steel conforming to ASTM F1145, Type 1, Grade 1.
      2. After final adjustment, mouse turnbuckles with wire to prevent loosening.

   c. Pipe Clamps:

      1. Two-piece construction fabricated from two (2) strips of 7-gage by 2-inch hot rolled steel formed to encompass and clamp pipe batten to prevent rotation. Round corners to prevent snapping on adjacent curtains.
      2. Provide a 3/8-inch Grade 5 hex bolt, lock washer, and hex nut above and below batten.
      3. A 17/32-inch hole at top of clamp shall allow for attachment of rigging hardware.

4. Each pipe clamp shall have a recommended working load of 650 lbs.

N. Wire Rope Lifting Lines:

1. Lift Line: 1/4-inch 7x19 IRWC impregnated with dry lubricant
2. Only US or Korean produced wire rope with Lot Testing Certificates shall be utilized.
3. Damaged or deformed cables shall be discarded.
4. All wire rope rigging shall be installed so as to prevent abrasion of wire rope against any part of building, structure, mechanical systems, or any other surface not specifically designed for the contact.
5. Finish cable termination points with HD galvanized cable thimbles and one (1) Nicopress® oval sleeve installed per manufacturer's written instructions.
6. A measurable amount of cable shall extend past the top of the sleeve, but not more than 1 cable diameter. The cut cable end shall be covered with epoxy to prevent injury.

O. Hand Line:

1. 3/4-inch 3-braid twist. Multi-Line II as manufactured by New England Ropes or equivalent.
2. Whip ends with 6" of heat shrink.
3. Terminate hand line to arbor per arbor manufacturer instructions.
4. If manufacturer does not specify terminate of hand lines use two (3) half hitches and two (2) nylon zip ties to attach rope end to standing part of the rope.
5. Make all rope terminations match visually.

P. Outrigger Pipe for Index Strip Light:

1. 1-1/2-inch Schedule 40 outrigger pipe to run full length of locking rail.
2. Outrigger pipe shall have same construction as pipe battens.
3. Support outrigger pipe from tee bar battery at 10' O.C. maximum spacing by 3/16-inch by 4-inch flat steel brackets and appropriately sized U-bolts with lock washers and nuts.
4. Alternate: Support outrigger pipe from two (2) wall battens at 10 feet O.C. maximum spacing by 2-inch by 3/16-inch steel angle brackets bolted to two (2) wall battens with 5/16-inch Grade 5 bolts, lock washers and nuts. Support pipe by appropriately sized 3/8-inch U-bolts with lock washers and nuts.

Q. Index Strip Light:

1. Furnish and install an index light strip for full length of locking rail and support from the outrigger pipe. Construct housing to adequately light the locking rail without spilling onto the stage.
2. Light strip shall have two (2) dimmable lighting circuits. One circuit shall have white 40 watt lamps or equivalent LED and one circuit shall have blue 40 watt lamps or equivalent LED's
3. Rigging contractor shall provide dimmer or dimmer controller. Electrical connections shall be by division 26 contractor.

2.5 STAGE CURTAINS

Tracks & Battens

A. Tracks

1. Small curtains weighting no more than 3 pounds per linier foot and no more than 8’ H shall be equipped with T40 track, H&H model 100 series, or other approved equal.

2. Midsized Curtains weighing no more than 9 pounds per linier foot and no more than 14’ H shall be equipped with T60 track, H&H model 200 series, or other approved equal.

3. Heavy Curtains weighing no more than 15.5 pounds per linier foot and more than 20’H shall be equipped with T70 track or H&H model 400 series or other approved equal.

4. Lightweight curved tracks shall be as specified above when possible or H&H 300 series with a matching curved 1.5” diameter steel pipe batten backbone.

5. Midsize and Heavy weight curved tracks shall be as specified above when possible or H&H 500 series.

B. Carrier & Pulley Sizes

1. Curtains weighing less than 50% of the maximum specified weight above may utilize standard carriers and smaller pulley options. All others shall utilize ball-bearing carriers and large pulley options.

2. All Grand Drape tracks and any rope operated track greater than 32’ overall width shall be supplied with back-pack guides even if not part of the standard model package.

3. All Grand Drape tracks shall utilize a minimum of 3/8” diameter rope.

4. Tracks models specifically called out in schedule shall supersede section A above.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for supporting members, blocking, installation tolerances, clearances, and other conditions affecting performance of theater and stage equipment.
B. Notify of Architect of any conditions, measurements, quantities, or other data, required for proper execution, fit and completion of the Work, and for safe and proper operating clearances.
C. Do not begin installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stage rigging contractor is responsible for becoming familiar with and verifying pertinent dimensions and conditions, both on Drawings and in the field, before proceeding with the Work.

3.3 INSTALLATION

A. Install equipment in accordance with the manufacturer's printed instructions and shop drawings, as indicated.
B. Install equipment square, plumb and true to adjacent work.
C. Position equipment accurately as indicated on Drawings. Note any deviations required to adjust for field conditions. Incorporate deviations on as-built drawings.
D. Coordinate Work with trades performing adjoining work.
E. Use only qualified riggers for installation, trim and adjustment.
F. Protect stage flooring, regardless of whether flooring has been stained or sealed. Protect flooring from both structural damage and cosmetic damage.
G. Clean and touch up field welds and abraded paint work with matching finishes.
H. Mouse turnbuckles and screw pin shackles shut after adjustment.
I. Fabricate and install operating equipment to minimize operating noise levels for live performances.
J. Hang and trim curtains only after construction is completed and final building cleaning has been accomplished.
M. Remove all construction rubbish and spare materials at project completion and as needed to maintain a clean and safe working environment.

3.4 FIELD QUALITY CONTROL

A. During installation of equipment arrange for access to equipment by Architect.
B. After completion of installation, notify Architect that equipment is ready for review.
C. Provide necessary personnel required to operate equipment and assist Architect with review process.
D. Repair or replace any equipment that does not meet requirements of Drawings or specifications with suitable equipment.
E. Final acceptance of equipment will be withheld until all equipment has been reviewed, tested, and found to be in conformance with Drawings and specifications.

3.5 DEMONSTRATION

A. Furnish a rigging operation and safety class to Owner's representatives. Make class of sufficient length to cover all work of this section.
B. Train Owner's maintenance personnel to adjust, operate, inspect, and maintain theater and stage equipment.

3.6 ADJUSTING

A. Prior to expiration of warranty arrange performance of the following services at the Owner's convenience:

1. Complete inspection of rigging system
2. Adjustment of equipment as required.
3. Correction of defective work covered by warranty.
4. Provide written recommendations for required repairs or changes that are not covered under the warranty.
5. One (1) hour rigging operation and safety class. Provide a written proposal for next year's inspection and maintenance visit.

END OF SECTION 116100