

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.

1.3 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel and familiar with the operations and maintenance of the system, subsystems, and equipment.

1.4 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Prior to the demonstration of equipment, the Contractor shall submit operations and maintenance manuals to the Owner for approval.
- C. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- D. Coordinate content of training modules with content of approved operations and maintenance manuals.

1.5 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes training modules for each system and equipment. Provide instruction manual for operations and maintenance.
 - 1. Training Modules: Develop a learning objective and teaching outline. Include a description of specific skills and knowledge that participant is expected to master, including operations, maintenance, safety procedures, alignments, adjustments, and troubleshooting.

2. Instruction Manual: Assemble educational materials necessary for instruction. Manual shall include:
 - a. Name and contact information of contractor
 - b. Product name, model number, and identifying information.
 - c. Organized descriptions of operations, maintenance, safety procedures, alignments, adjustments, troubleshooting, etc.
 - d. Sequence of operations and diagrams
 - e. Data and tests
- B. Set up instructional equipment at instruction location.

1.6 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate with Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 1. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 1. Schedule training with Owner with at least two weeks' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Cleanup: Collect used and leftover educational materials and remove from Project site unless requested by Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

SECTION 116163 – ORCHESTRA SHELL SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This Section includes all labor, materials, equipment, and services necessary to manufacture, deliver and install an Orchestra Shell System as shown on the drawings and specified herein, including but not limited to the following:
 - 1. Rolling side towers.
 - 2. Overhead ceiling panels.
- B. It shall be the responsibility of the Orchestra Shell Manufacturer to furnish equipment complete in all respects and to provide any additional equipment required to fulfill the intent of these drawings and specifications regardless of whether or not such items are herein specified or indicated.

1.2 GENERAL

- A. Drawings and general provisions of the Contract apply to this Section.
- B. Related Specifications
 - 1. 017900 Demonstration and Training
 - 2. 116123 Stage Rigging Systems
- C. Site Conditions: Contractor shall verify that the job conditions are ready to receive work in this section. Contractor must alert the Owner to any existing conditions that may adversely affect execution of work, so that resolution may be reached before commencement of installation.

1.3 SUBMITTALS

- A. Submittals shall be according to the conditions of the Contract and Specifications.
- B. Orchestra Shell Manufacturer shall prepare and submit complete shop drawings according to the requirements set forth in the Contract Documents.
- C. Shop Drawings shall be submitted and reviewed by the Owner and the Owner's representatives before fabrication can begin.
 - 1. Such review does not relieve the Orchestra Shell Manufacturer of the responsibility of providing equipment in accordance with this Specification.
- D. Shop Drawings shall not be based on reproductions of the provided contract drawings.
- E. Shop Drawings shall include layout, fabrication, and installation drawings showing product components in assembly with adjacent materials and products.

- F. Shop Drawings shall show dimensions, sizes, weights, gauges, thicknesses, finishes, circuiting, joining, attachments, lubrication points, and relationship of work to adjoining construction.
- G. Submittals shall include product data as applicable, including testing by recognized testing agency and compliance with specified standards.
 - 1. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
 - 2. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- H. Deviations and Additional Information: clearly indicate deviations from the Contract Documents, including minor variations and limitations; include relevant additional information and revisions. Indicate by highlighting on submittal or noting on attached separate sheet.
- I. The Orchestra Shell Manufacturer shall furnish satisfactory evidence as to the kind and quality of materials to be furnished by submission of exact samples of equipment to be used in this contract.
 - 1. Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - 2. The samples shall be retained by the Owner until such time that all items contracted for have been installed and accepted.
- J. Upon completion of installation, Orchestra Shell Manufacturer shall submit two copies of an Operation and Maintenance manual which shall include as-built shop drawings, parts lists, operational instruction, maintenance recommendations, etc.
 - 1. One O&M manual shall be a printed hard copy.
 - 2. One O&M manual shall be provided in electronic format on a flash drive.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Delivery and installation of the Orchestra Shell System shall be as required in the Contract Documents.
- B. Factory assemble and finish components prior to delivery.
- C. Deliver all materials to the job site suitably crated, packed and protected, and bearing the manufacturer's identification label and the nomenclature of the product(s) found in the carton.
- D. Orchestra Shell Manufacturer shall confirm delivery dates with the Owner a minimum of 30 days in advance of scheduled delivery.

1.5 WARRANTY

- A. The Orchestra Shell System shall conform to all applicable code requirements and shall be in conformance with industry standards of operations and practice.

1. All materials, arrangements, and procedures shall comply with applicable OSHA requirements.
- B. The Orchestra Shell Manufacturer shall assure that the shell is properly installed, free of defects in materials and workmanship, and shall provide a warranty on all equipment and workmanship provided under this contract for a minimum two years from the date of the final acceptance by the Owner.
- C. During the warranty period, repair or replacement of defective materials and/or repairs of faulty workmanship shall be provided, at no cost to the Owner, within 10 business days of written notification of defects(s).

PART 2 - PRODUCTS

2.1 GENERAL

- A. The Shell System shall consist of a full stage symphonic enclosure made up of rolling side towers and overhead ceiling panels of sufficient size and density to control and reflect a maximum range of audible frequencies.
- B. The Shell System shall permit adjustment of reflector height and size to accommodate varying performance types and acoustical requirements. Acoustical panels shall be adjusted for angle and position to assure proper blending and projection of sound.
- C. The Shell System towers and panels shall be designed to permit easy storage without dismantling.
- D. Orchestra Shell towers and ceiling panels shall be stressed-skin composite type with a minimum of STC 23 to meet performance requirements.
 1. The core of the towers and ceiling panels shall be 1-1/2" thick honeycomb material that has an open geometric pattern with cell walls vertical to panel skins and defined by alternating straight and sine wave layers.
 - a. Height of sine wave shall be 1/2", wall thickness shall correspond to 60 lb Kraft.
 - b. Bonding of core material to panel faces shall be with permanently cured urethane adhesive. Foam core materials and contact adhesives shall not be permitted.
- E. The face of the panels shall be plastic laminate top surface on 3/16-inch-thick hardboardstressed skin. Plastic laminate shall be in color selected by Owner, with no exposed fasteners.
- F. Back of each panel shall be 3/16" thick hardboard stressed skin, painted black.
- G. Straight panel edges shall be reinforced with extruded aluminum edge frame.

2.2 ROLLING SIDE TOWERS

- A. Side towers shall be self-supporting, sound reflecting structures equipped with leveling, nesting "A-shaped" counterweighted bases and all hardware necessary to safely transport them to and

from storage and lock into place when in "performance" position.

- B. Provide rolling wall towers in sizes in accordance with the drawing. Door to storage room is 12' wide x 22' high, but dimensions shall be field verified by the manufacturer to ensure towers can be transported to and from storage through the door.
- C. The wall tower base shall incorporate a counterweight of required weight to allow the towers to be moved safely about the stage.
- D. Structural frames shall incorporate tower wing hinges.
- E. Each tower shall be movable by provided transporter(s) that lock onto and lift the towers and allows them to move safely about the stage.
 - 1. Transporter shall allow towers to be moved in any direction.
- F. Each tower base shall have multiple, adjustable height levelers to allow for irregularities in the stage floor.
- G. Numbered markers shall be provided on the towers indicating the location of each tower to insure consistent setup.
- H. Towers shall consist of three panels hinged together to obtain tower width as indicated on drawings.
- I. Both downstage-most side wall towers shall be equipped with doors for entering and exiting the performing area. Doorways shall have a minimum of 3'-0" wide open clearance.
 - 1. Doors shall have self-lubricating bearings for quiet operation.
- J. All instructions pertaining to the safe handling and operation of the towers shall be affixed to the tower in plain view.

2.3 OVERHEAD CEILING PANELS

- A. Stage overhead ceiling panels shall be sound reflective and include integral hardware for storage without interference with adjacent stage equipment.
 - 1. Ceiling panel shall be in sizes in accordance with the drawing. Dimensions shall be field verified by the manufacturer.
 - 2. Verify dimensions in shop drawings.
- B. Overhead panels shall be removable and also designed to fold vertically permitting storage on the stage rigging system. The overhead panel design shall allow each panel to be rotated by two people.
- C. When the panels are stored on the rigging batten, the maximum upstage/down stage storage space required shall be 1' 4".
- D. Each overhead panel shall be equipped with necessary hardware to hang from a stage rigging line set 1-1/2" NPS schedule 40 pipe batten.
 - 1. Method of attachment to batten must allow for installation or removal of each overhead

- panel.
 2. Hardware must permit angular adjustment from horizontal plane to 40 degrees.
 3. The hardware must also have the capability of locking the panels in a vertical position so that they may be stored on the batten.
- E. Integral light fixtures shall be incorporated into the acoustical ceiling panels to provide an even, general down light wash of the stage. Shop drawings shall reflect Shell Manufacturer suggested fixture locations.
1. Fixture wiring shall be spliced or two-fer provided so that fixtures can connect to three 20A jumper cables per ceiling panel.
 2. Cables shall connect to the stage left end of the ceiling panel.
 3. Provide 20A jumpers made of black, type "SO" (extra hard usage), three-conductor, #12 cable equipped with 20A theatrical 3-pole stage pin connectors.
 4. Jumper cables shall be sized to reach to the stage left end of each ceiling panel plus an additional 35'-0". Verify cable lengths in shop drawings.
 5. A mechanical tilt switch shall be provided at each light fixture to prevent accidental activation when the ceiling panel is in the vertical, storage position.
- F. Each complete row of ceiling panels shall weigh a maximum of 1800 pounds. Verify weight in shop drawings. If unable to achieve this weight as specified, propose alterations to meet maximum weight.

PART 3 - EXECUTION

3.1 GENERAL

- A. Examine all conditions under which all Orchestra Shell items shall be installed and notify the Owner in writing of any condition detrimental to the proper and timely completion of the work.
- B. Responsibility for the manufacture and installation of the Orchestra Shell shall rest solely and exclusively with the Orchestra Shell Manufacturer.
- C. The Orchestra Shell System Manufacturer shall be responsible for storage of all equipment and tools during the period of installation.
- D. The Orchestra Shell Manufacturer shall be responsible for collecting and removing all packing materials, trash, scrap materials, etc. from the job site.
- E. The Orchestra Shell Manufacturer shall be responsible for the protection of equipment and/or finished materials provided by other Contractors.
- F. Prior to the completion of the installation, the Orchestra Shell Manufacturer shall notify the Owner to arrange a date for observation of the system.
 1. At the time of the observation, the Orchestra Shell Manufacturer shall furnish sufficient personnel to operate all equipment and to perform adjustments as required by the Owner's representatives.

3.2 INSTALLATION

- A. Installation of the Shell System shall be supervised by the Orchestra Shell Manufacturer's own experienced superintendent having extensive experience in installing work of this kind.
- B. Orchestra Shell overhead ceiling panels shall be installed on motorized line sets provided by the Rigging Manufacturer/Installer in locations shown on the drawings.
- C. Verify setting of units in performance and storage positions.
- D. Verify adjustability of units.
- E. Verify transport of towers to and from storage and performance locations.
- F. Install and test integral lighting.
- G. Orchestra Shell Manufacturer's representative shall provide minimum four hours of instruction to Owner's designated representatives in the safe, efficient operation of the Orchestra Shell System.

3.3 FIELD QUALITY CONTROL

- A. All equipment shall be installed in locations shown on Construction Drawings and shall be installed plumb, straight and true, and function as designed, safely and quietly, in accordance with manufacturer's recommendations and approved submittals.
- B. All lighting fixtures shall be focused by the Orchestra Shell Manufacturer to provide an even, general down light wash of the stage.
- C. Clean exposed surfaces of acoustical shells. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- D. Repair or replace defective work as directed by Owner or Owner's Representative upon inspection.

END OF SECTION 116163

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SECTION 116123 – THEATRICAL RIGGING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 WORK OF THIS SECTION

- A. This Section includes all labor, materials, equipment, and services necessary to furnish and install the Stage Rigging System as shown on the drawings and/or specified herein, including but not limited to the following:
 - 1. Rigging of stage lighting system multicables.
 - 2. Seven variable speed motorized package hoists.
 - 3. Emergency stops.
 - 4. One automated rigging controller with remote.
 - 5. One push-button rigging controller.
 - 6. 16 dead-hung pipe battens.
 - 7. Fixed lighting pipes.
 - 8. Pin rails.
 - 9. Miscellaneous equipment listed herein and on schedules, for installation by others.
 - 10. Mule blocks, idler sheaves, cable rollers or guides as required assuring proper alignment and operation of the rigging system.
- B. It shall be the responsibility of the Stage Rigging Contractor to furnish equipment complete in all respects and to provide any additional equipment required to fulfill the intent of these drawings and specifications whether or not such items are herein specified or indicated.

1.3 PROJECT CONDITIONS

- A. All dimensions shall be verified in the field prior to fabrication by the Stage Rigging Contractor, who shall make at least one visit to the job site prior to preparation of shop drawings.
- B. No extras will be allowed due to the Stage Rigging Contractor's misunderstanding of the work involved or its lack of knowledge of any field conditions due to failure to make accurate field measurements or a thorough investigation of the job site.

1.4 SUBMITTALS

- A. Stage Rigging Contractor shall prepare and submit complete shop drawings according to the requirements set forth in the Contract Documents.

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- B. Shop Drawings shall be submitted for review by the Architect before fabrication can begin. Such review does not relieve the Stage Rigging Contractor of the responsibility of providing equipment in accordance with this Specification.
- C. Shop Drawings:
1. Shop Drawings shall show dimensions, sizes, gauges, thicknesses, finishes, joining, attachments and relationship of work to adjoining construction.
 2. Shop drawings shall clearly show power, wire, and conduit requirements for all work to be provided by the Stage Rigging Contractor.
 3. Where items must fit and coordinate with finished surfaces and/or constructed spaces, take measurements at site and not from drawings.
 4. Where other materials must be set to exact locations to receive rigging, furnish assistance and directions necessary to permit other trades to locate their work.
 5. Where welded connections, concrete or masonry inserts are required to receive work, shop drawings shall show exact locations required and all such drawings shall be furnished to the trades responsible for installing the connectors or inserts.
 6. Show locations of all lubrication points.
 7. Shop drawings for motorized equipment shall include engineering and load calculations as well as stamp and seal of a registered professional engineer.
 8. Catalog work sheets showing illustrated cuts of items may be submitted for standard manufactured items.
 9. Shop drawings shall include a copy of the installation superintendent's ETCP Certified Rigger - Theatre certification. A copy of the installation superintendent's ETCP certification shall be available on the job site for the length of the installation.
- D. Any deviation from this Specification shall be "starred" and noted in letters a minimum 1/4" high.
1. For a deviation to be considered, it must upgrade the quality of the equipment or respond to a field condition.
- E. The Stage Rigging Contractor shall, if requested by the Owner or Architect, furnish satisfactory evidence as to the kind and quality of materials he proposes to furnish by submission of exact samples of hardware to be used in this contract.
1. The samples shall be retained by the Owner until such time that this contract has been completed and accepted.
- F. Upon completion of installation, Stage Rigging Contractor shall provide Operation and Maintenance manuals that shall include record shop drawings, parts lists, operational instruction, service/maintenance recommendations, component working load limits, etc.
1. One O&M manual shall be a printed hard copy.
 2. O&M manual shall also be provided in electronic format on two flash drives.
- G. Rigging System Log Book:
1. At Owner training, furnish a system log book, configured to permit Owner tracking of inspections, system issues and maintenance history. Provide overview of observations and actions that should be documented for appropriate record keeping and compliance with industry standards for safety. Log book shall include:
 - a. Schedule and ID of all installed rigging sets (manual and motorized).

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- b. Identification of design parameters for each set, including high and low trim limits, set live loading capacity, hoist configuration settings, etc.
- c. Log sheet for periodic system-wide inspections, including commissioning date of system as first entry.
- d. Journal fields for each set to document date, status, observations, actions taken, and resolution.

1.5 WARRANTY

- A. The Stage Rigging Contractor shall assure that the rigging is properly installed, free of defects in materials and workmanship and shall provide a warranty on all equipment and workmanship provided under this contract for a period of two years from the date of the final acceptance.
- B. During the warranty period, repair or replacement of defective materials and faulty workmanship shall be provided, at no cost to the Owner, within 10 days of written notification of defects(s).
- C. Post Installation Safety Inspection:
 - 1. One year after the date of final acceptance by the Owner, the Stage Rigging Contractor Supervisor shall return to the job site to conduct a thorough inspection of the rigging installation.
 - a. All bolts shall be checked and tightened as required, cables and all cable connections inspected, and all items given a thorough safety inspection in compliance with ANSI E1.47, Entertainment Technology – Recommended Guidelines for Entertainment Rigging System Inspections.
 - b. All damage not caused by negligence on the part of the Owner shall be repaired and/or damaged components replaced.
 - c. If the original supervisor is unavailable either because the supervisor no longer works for the contractor or due to issues fully beyond the control of the contractor, then an alternate rigger superintendent shall perform the inspection, under the following conditions:
 - 1) The alternate superintendent shall be ETCP-RT certified.
 - 2) The alternate superintendent shall have experience supervising installation on projects of similar scope and scale.
 - 2. All materials, superintendent labor, transportation and living expenses for this work shall be furnished by the Stage Rigging Contractor at no additional cost to the Owner.
 - a. The inspection and repair work shall be conducted during normal working hours at a time mutually agreed upon by the Owner and the Stage Rigging Contractor.
 - 3. Within two weeks of the completion of the inspection, the Stage Rigging Contractor shall provide the Owner and Architect with a written report stating the findings of the inspection.

1.6 STAGE RIGGING MANUFACTURERS / STAGE RIGGING CONTRACTORS

- A. The Stage Rigging Contractor shall have been continuously engaged in the production of theatrical stage rigging equipment for at least 15 years.

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- B. The Stage Rigging Contractor shall have installed a total of not less than five installations of equal or greater scope to system specified herein, which have been in service for a minimum of one year and a maximum of 10 years.
1. Each of the listed stage rigging installations shall be in service in fully professional commercial theatres being operated by professional technicians.
- C. Stage Rigging Manufacturers for work of this section shall include:
1. Electronic Theatre Controls (ETC)
3031 Pleasant View Rd.
Middleton, WI 53562
Contact: Gary Henley gary.henley@etconnect.com
800-688-4116
 2. J.R. Clancy, Inc.
7041 Interstate Island Rd.
Syracuse, NY 13209
Contact: Mike Murphy mikemurphy@jrclancy.com
800-836-1885
- D. Stage Rigging Contractors for work of this section shall include:
1. Integrated Theater Systems
117 Roup Avenue
Pittsburgh, PA 15206
(412) 441 8000
 2. Vincent Lighting
920 Vista Park Dr.
Pittsburgh, PA 15205
(412) 788-5250
 3. Chicago Flyhouse
2925 W. Carroll Ave.
Chicago, IL 60612
773-533-1590
 4. J.R. Clancy, Inc.
7041 Interstate Island Rd.
Syracuse, NY 13209
800-836-1885
 5. Stage Rigging Services (SRS)
831 Winston Street
Greensboro, NC 27405
336-370-1900

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6. Texas Scenic
611 Lofstrand Ln #A
Rockville, MD 20850
(301) 874-1747
7. 4Wall Entertainment
9525 Berger Rd,
Columbia, MD 21046
(410) 242-3322
8. Barbizon Lighting
6437 General Green Way #2413
Alexandria, VA 22312
(703) 750-3900

- E. The Contractor for this section shall be the same Contractor that furnishes and installs the following related Division 11 theatrical systems specified on this project:
- ~~1. 11 61 13 Theatrical Drapery and Track (ADDENDUM 01)~~
 1. 11 61 29 – Pipe Grids and Fixed Lighting Pipes

PART 2 PRODUCTS

2.1 MATERIALS

- A. Ferrous materials and accessories shall conform to the following ASTM and ANSI standard specifications:
1. Standard structural steel shapes and plates: ASTM A-36.
 2. Miscellaneous steel items: ASTM A-283, grade optional.
 3. Steel pipe: ASTM A-120
 4. Gray iron castings: ASTM A-48, Class 30 unless otherwise specified.
 5. Malleable iron castings: ASTM A-47
 6. Bolts and nuts: B18.2.1&2
 7. Welding electrodes shall be as permitted by AWS Code D1.0.
- B. Wire Rope and Fittings
1. Wire rope shall be 7x19 construction, utility cable, sized as required, that meets Federal Specification RR-W-410E.
 - a. Damaged or deformed cables shall not be used.
 2. Cable fittings shall be Nicopress copper sleeves or forged steel clips and conform to wire rope manufacturer's recommendations as to size, number and method of installation.
- C. Aluminum Materials and Accessories
1. Thicknesses, gauges and tempers of aluminum products shall be as required for proper forming operations and to meet structural standards.
 2. Aluminum Castings: 214 or 356 alloy as per strength requirements.

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3. Fasteners: Include bolts, nuts, washers, screws, nails, rivets and other fastenings necessary for proper erection and/or assembly of aluminum work.
4. Fabrication shall be by AWS certified welders.

D. Finishes for Items Without Factory Finish

1. Welds, burrs, and rough surfaces on all interior ferrous metals shall be ground smooth and the completed assembly cleaned, and all metal surfaces shall be given a minimum one coat of finish paint.
2. No painted finish is required on aluminum finishes.
3. All exposed fastenings shall match color and finish of adjacent material.

2.2 SAFETY STANDARDS

A. To establish minimum standards of safety, the following factors shall be used:

1. Cables and fittings: 8:1 Safety Factor
2. Terminating hardware: 5:1, or not exceeding WLL, whichever is more restrictive.
3. Trim chain assembly: 5:1, or not exceeding WLL, whichever is more restrictive.
4. Batten clamps: 5:1, or not exceeding WLL, whichever is more restrictive.
5. Motors: 1.0 Service factor
6. Gearboxes: 1.25 Mechanical Strength Service Factor
7. Cable bending ratio: Sheave diameter is 30 times diameter of cable
8. Tread pressures: 500# for cast iron, 900# for Nylatron, 1000# for steel
9. Maximum fleet angle: 1-1/2 degrees
10. Steel: 1/5 of yield
11. Bearings: L10 life of 2000 hours at two times required load at full speed
12. Bolts: Grade 5 or better, plated

2.3 SIGNAGE

- A. Provide and install signs with white background and 3/8" high red letters to be mounted on the wall on the stage level, fly gallery level, and loading bridge level at a position that is conspicuous to workers performing rigging work.
1. The signs shall read as shown on the drawings.
 2. "Date of Last Inspection" and "Date of Next Required Inspection" information shall be in erasable marker.

2.4 VARIABLE SPEED MOTORIZED LINESETS

- A. Provide four motorized, 1,200# capacity linesets, each with variable speed motorized winch, head blocks, loft blocks, 7x19 pickup cables, and pipe batten as shown on the drawings.
1. Manufacturer shall be responsible for steel, hardware, etc. required to provide means of attachment of the motorized linesets to building structure.
- B. Provide three motorized, 1,800# capacity linesets, each with fixed speed motorized winch, head blocks, loft blocks, 7x19 pickup cables, and pipe batten as shown on the drawings.
1. Manufacturer shall be responsible for steel, hardware, etc. required to provide means of attachment of the motorized linesets to building structure.

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- C. Each motorized set shall be U.L. approved and include the following:
1. Electric motor with gearbox, starter and brake-motor.
 - a. The motor shall be 480-volt type and have a minimum AGMA service factor for 1.0 for continuous operation and the gearing service factor shall be a minimum of 1.0 with a mechanical strength factor of 1.3.
 - b. Motor shall have ramp up/down providing "soft start" and "soft stop" capability to lessen impact load when motor starts and stops
 2. The variable hoist lifting speed shall be variable from 0' to 120' per minute.
 3. Provide minimum 5 mechanical limit switches including over travel high, high, low and over travel low.
 4. Linesets shall have overload sensors on each lift cable.
 5. Linesets shall have slack line detection sensors on each lift cable.
- D. Head blocks:
1. Each head block shall be underhung, multi-sheave type and have at least six pipe spacers, through bolted to the side plates, to prevent cables escaping from the sheave grooves.
 2. The 12" diameter cast or nylon sheaves shall be machined, faced, lathe turned and grooved for the lifeline cable.
 - a. Grooves shall conform to cable manufacturer's recommendations.
 3. The sheaves shall operate on a 1" diameter steel shaft mounted in tapered roller bearings with felt seals press fitted in the head block bore.
 - a. The head block shaft shall be keyed to one side plate or otherwise restrained to prevent rotation.
 - b. Proper adjustment of the bearings to be accomplished by "Flexloc" self-locking nut on the opposite side of the shaft.
 4. Side plates shall be fabricated of not less than 10-gauge steel and each side plate shall be welded to the base angle.
 5. Each head block shall be furnished with support angle irons, sized to support the specified loads.
 - a. Provide a minimum of two bolts per base angle, sized for the specific load, or mounting clips of sufficient size.
 6. When completely installed, each head block shall be aligned so that each sheave, its center and sides, remain in the same vertical axis when the sheave is rotated.
- E. Loft blocks:
1. Loft blocks shall be underhung and shall have an 8" diameter nylon sheave with a hub of at least 2" in diameter.
 2. Sheaves shall have a lathe turned cable groove of required size plus 1/64" clearance.
 - a. The sheaves shall be machined, faced and bored for shaft and bearings.
 3. Each loft block sheave shall contain two tapered roller bearing assemblies operating on a 1/2" diameter steel shaft or sealed precision ball bearings on a 5/8" diameter steel shaft.
 - a. The head of the shaft to be keyed to one side plate and the opposite end of the shaft shall be threaded and equipped with "Flexloc" self-locking nut to prevent shaft from rotating.
 - b. Side plates shall be a minimum of 11-gauge steel.
- F. Mule blocks:

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1. The component parts of all mule blocks shall meet the same specifications as the head blocks, except that sheave shall be 10" in diameter, provided with suitable universal joint swivel bases and mounting stands or bracket to meet the job conditions.
- G. Idler blocks:
1. Idler blocks shall consist of one or more sheaves contained within an assembly to provide only vertical support of the lift lines.
 2. Idler blocks shall be mounted to loft blocks or from building structure.
- H. Pipe Battens:
1. Single pipe battens shall be constructed of 1-1/2" NPS, schedule 40 steel pipe.
 2. All joints shall be sleeve spliced with 18" long sleeves, 9" extending into each pipe. The pipe sections of each set shall be bolted through the sleeve with two 3/8" x 1" hex head, grade 5 bolts. Holes shall be drilled in pipes and sleeves so that all pipe sections are interchangeable.
 3. Battens shall be painted black. The last 12" at each end of the truss and pipe batten shall be painted white or shall have yellow plastic end caps.
 4. Each batten shall have its centerline marked with a 1/2" painted yellow line around the circumference of the bottom pipe.
 5. Each batten shall have 1' increments marked around the circumference of the batten, starting at center and working out to the ends, with 1/2" wide, white painted lines.
 6. At each liftline point, provide a red tape mark on each side of the trim chain for the full circumference of the top pipe.
 7. Each batten shall have its line set number in 1" high white numerals on the top and bottom of each batten 18" from each end, and 12" stage left of the centerline mark.
 8. Liftline batten connections shall be trim chains.
- I. Liftline Cables:
1. All liftline cables shall be 7 x 19 utility cable and shall be free of oil. Certification will be required.
- J. Trim Chains:
1. Trim chain shall be either J.R. Clancy Grade 63 *AlphaChain* or SECOA *STC* chain, with 3,250# working load and meeting OSHA 1910.184(e)(5) – Sling use, 36" long, and used at the batten end of the pickup cables.
 2. One end of the trim chain shall connect to liftline with thimbles and Nicopress sleeves.
 3. The other end of the trim chain shall be fitted with a 1/4" screw-pin shackle.
- 2.5 VARIABLE-SPEED AND FIXED-SPEED STAGE RIGGING CONTROL PANEL:
- A. General:
1. The controller shall be wall mounted at a height to provide ADA mandated accessibility.
 2. Controller shall have remote control pendant with 30'-0" cable and plug in locations at stage left and stage right.
- B. Control Interface:
1. An operator control panel shall be provided that features "Go Up", "Go Down", and "Go Target" pushbuttons and a Joystick for dynamic override of pre-programmed speeds.
 2. Dual Playback Controls

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- a. Two separate GO buttons and a joystick. Any system that does not allow dynamic change of recorded hoist speed is not acceptable.
3. Show data shall be backed up automatically at regular intervals, and by user command to a solid-state flash drive system.
4. Five modes of operation shall be supported:
 - a. Direct Operation - One or more sets can be selected and operated manually
 - b. Single Target - One or more sets may be selected and sent to a common target height
 - c. Multiple Targets – Multiple sets may be selected and sent to differing target heights
 - d. Relative Target - One or more sets can be selected and sent to specific distances from their present positions.
 - e. Current Position as Target – One or more sets may be moved, then returned to their starting positions. For example, a stage electric might be lowered to change gels, then accurately returned to its previous position.
- C. Recorded Cues and Presets:
 1. An operator recording cues and presets may specify:
 - a. Target position – a specific target position, a relative move (e.g. go out 10'), or a match to a present or previous position.
 - b. Acceleration – a set specific rate or a default value
 - c. Speed - a velocity, a percentage of full speed, or a travel time. Default values also supported.
 - d. Deceleration - A set specific rate or a default value
 - e. Number of hoists controlled – each with its own speed and target
 - f. Synchronized Groups
 - g. Cue and preset names and labeling
- D. Safety Requirements:
 1. For safety, movement may be initiated only by hold to run (dead man) hardware pushbuttons or joysticks.
 2. A console-controlled limit function shall allow the operator to set “soft” upper, lower and preset limits for each encoder-equipped hoist.
 3. Where the load monitoring option is specified, the control system shall be capable of “learning” the load characteristics and monitoring load changes. The load monitoring system shall accommodate change to the suspended weight of electric cables and other predictable variables, without false tripping.
 4. The system shall include password-protected for “Access”, “Edit” and “System” levels of operation at a minimum. Additional user levels shall be password-protected and created as directed by Owner.
 5. Height and distance data may be entered as feet and inches, decimal feet, or metric units as directed by the Owner.
 6. A mushroom head "EMERGENCY STOP" button wired to a failsafe circuit that conforms to NPFA 79 requirements shall be provided.
 7. An "ON/OFF" key operated switch shall be provided that removes power to the console, motor starters and drives. Any control system that requires motors and drives energized while the system is not in use is not acceptable.
- E. Remote Hand-Held Pendant Controller w/ E-Stop:

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1. Provide one remote motorized winch line set controller that allows separate control of the line sets and contains the same programming modules as the Main Controller.
2. Pendant shall have an E-stop that meets the requirements above.
3. Provide Pendant Controller with 30'-0" of control cable.
4. Pendant controller shall connect into the main controller and remote-control receptacles.

2.6 FIXED, DEAD-HUNG, PIPE BATTENS

- A. Provide 16 fixed, dead-hung pipe battens and 7x19 pickup cables as shown on the drawings.
- B. Manufacturer shall be responsible for steel, hardware, etc. required to provide means of attachment of the fixed battens to building structure.

2.7 FIXED LIGHTING PIPES

- A. Provide fixed lighting pipes in the proscenium theater as shown on the drawings at the following locations:
 1. House left near and far box booms
 2. House right near and far box booms
 3. Front wall of control room
- B. Manufacturer shall be responsible for steel, hardware, etc. required to provide means of attachment of the fixed lighting pipes to building structure.
- C. Coordinate with structural and architectural finishes.

PART 3 - EXECUTION

3.1 GENERAL

- A. Examine all conditions under which all theatrical rigging items shall be installed and notify the Construction Manager in writing of any condition detrimental to the proper and timely completion of the work.
- B. Responsibility for the satisfactory completion of this rigging system shall rest solely and exclusively with the Stage Rigging Contractor.
- C. The Stage Rigging Contractor shall supply all tools required for the successful installation of the equipment herein.
- D. The Stage Rigging Contractor shall be responsible for storage of all equipment and tools during the period of installation and shall be responsible for collecting and removing from the job site all packing materials, trash, scrap materials, etc.
- E. The Stage Rigging Contractor shall be responsible for the protection of equipment and/or finished materials provided by other Contractors.

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- F. Prior to the completion of the installation, the Stage Rigging Contractor shall notify the Construction Manager and Architect to schedule an inspection of the system.
1. At the time of the inspection, the Stage Rigging Contractor shall furnish sufficient personnel to operate all equipment and to perform adjustments and tests as may be required by the Architect and/or the Owner's representatives.
 2. Any equipment that fails to meet with the Specifications shall be repaired or replaced with new equipment, and the inspection shall be re-scheduled under the same conditions listed previously.
 3. All temporary equipment shall be removed to permit full operation and access to all equipment.
 4. Final acceptance will be withheld until all systems have been thoroughly tested and found to be in first class operating condition in every circumstance.
- G. The Stage Rigging Contractor's installation Supervisor shall provide up to 12 hours of instruction. Up to eight hours of instruction shall cover the safe and proper operation of the equipment, including limit switch placement and adjustment, use of the control panel, etc., to the Owner's designated representative. An additional four hours of training for up to six users shall be dedicated to demonstrating an ANSI inspection of one lineset of each type. ANSI inspection training shall cover what to look and listen for, how to identify common problems in each rigging system, and when a problem needs to be addressed immediately by a professional rigger.
1. Stage Rigging Contractor shall schedule instruction with the Owner's designated representatives.
 2. Instruction shall not necessarily follow immediately after the system check-out and activation.
 3. Instruction shall be independent of the system check-out and activation. Length of engineering check-out and activation shall not affect the length of instruction time.
 4. Instruction, at Owner's discretion, may occur in multiple time blocks.
 5. Written documentation of Owner training shall be provided to the Owner upon completion.
 - a. Form to include:
 - 1) The date, time, and location of training.
 - 2) Name, title, company and signature of trainer.
 - 3) Name, title, and signature of all participants.
 - 4) Topics covered at training.
 - b. If training is non-continuous, provide one form for each training segment.
 6. Training may be video and audio recorded by the owner at the owner's expense.

3.2 INSTALLATION SUPERVISION

- A. Installation of the rigging systems shall be supervised by the Rigging System Contractor's own experienced superintendent having extensive experience in installing work of this kind.
1. Superintendent shall be an Entertainment Technician Certification Program (ETCP) Certified Rigger - Theatre.
 - a. Rigging System Contractor shall provide the Architect with a copy of the superintendent's ETCP certification and shall make a copy of this certification available on the job site for the length of the installation.

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2. An ETCP Certified Rigger - Theatre shall be present at all times during the rigging system installation.
 - B. The same individual shall remain in charge of the work throughout the installation of the rigging system until work is completed excepting only the intervention of circumstances completely beyond the control of the Stage Rigging Contractor.
 - C. The superintendent shall represent the Rigging System Contractor and all directions given to him shall be binding as if given to the Rigging System Contractor.
 1. The Rigging System Contractor may require the Owner to confirm such directions in writing.
- 3.3 FIELD QUALITY CONTROL
- A. Rigging System shall be installed in accordance with OSHA Safety and Health Standards and all local codes. All welding shall be in full compliance with the most recent edition of the Structural Welding Code (ANSI / AWS D1.1).
 - B. All equipment shall be installed in locations shown on Construction Drawings and shall be installed plumb, straight and true, and shall function as designed.
 - C. All components shall be installed to prevent abrasion of moving items against any part of the building structure or other equipment.
 1. Sheaves shall be so aligned as to provide fleet angles of the cables not exceeding two degrees.
 2. Provide mule blocks, cable rollers, and guides as required to provide proper alignment and movement around obstructions.
 - D. Eyes at cable terminations shall be formed over thimbles of correct size.
 - E. The Stage Rigging Contractor shall perform all drilling and fitting required in the setting of materials and all cutting and fitting required in the fitting of materials to the adjoining work of other Contractors.

END OF SECTION 116123