

PART 1 GENERAL

1.01 SCOPE

- A. This specification covers the fabrication, furnishing, delivery, and installation of a performance rigging system. The Rigging Contractor shall provide a complete, fully functional system as described herein.
- B. Included Work:
 - 1. Brail operation fire curtain, hoist and hoist controls
- C. Related Work: Related work which is not included in this section:
 - 1. Structural steel to support the rigging equipment, motors/brackets, total weight of curtain and its fixtures and all other structural steel and miscellaneous metals not specifically called out as part of this section.
 - 2. A maintenance and loading gallery or other access means is required for maintenance and annual inspection of motorized rigging. They are not part of this section.
 - 3. All power and control wire, containment, and terminations are provided by Division 26 and are not a part of this section.

1.02 SUBMISSIONS

- A. Drawings: Submit component and project specific installation drawings, cut sheets, and schedules showing all information necessary to fully explain the design features, appearance, function, fabrication, installation, and use of system components in all phases of operation. They shall be approved by the Departmental Representative and AHJ (Authority Having Jurisdiction) before beginning any fabrication, installation, or erection.
- B. Bill of Material: A copy of the Bill of Material shall be included with the submission for approval.
- C. Drawings submitted: to be sealed for all Building/Seismic/Static/Live/Working loads by a Qualified Structural Engineer registered to practice in British Columbia as required for the proper fastening and operation of the assembly.

1.03 THREE YEAR WARRANTY

- A. The manufacturer of the rigging equipment shall provide a three year warranty against defects in materials or workmanship that goes into effect on the date of substantial completion.

1.04 CONTRACTOR QUALIFICATIONS

- A. Requirements: The Rigging Contractor shall be an approved rigging manufacturer or an authorized representative or dealer of an approved manufacturer. The contractor shall have been installing stage rigging systems for a period of Five years or more, and shall have completed at least 3 installations of this type and scope in Canada.
- B. The Rigging Contractor shall employ an Entertainment Technician Certification Program (ETCP) Certified Theatre Rigger. A Certified Rigger shall be either the project manager or site foreman, and be responsible for the overall project including the layout, inspection, and onsite user training.

- C. Requirements for Approval: Other contractors seeking acceptance must submit the following information at least 10 days prior to the bid opening date. Approval of contractors will be by addenda. Failure to submit any of the required information will automatically disqualify the contractor from consideration of approval.
1. A listing of three equivalent installations including
 - Name, address and telephone number of Owner
 - Name, address and telephone number of Architect
 - Scope of work
 2. A brief written description of the contractor's operation including facilities, financial capabilities, and experience of key personnel.
 3. A statement from a bonding company agreeing to provide the required bonds in the amount required for the project.
 4. A copy of the ETCP Certified Theatre Rigger's certification credentials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Theatrical rigging systems are specialized overhead lifting systems. Due to the highly specialized nature of theatrical rigging equipment, and the safety requirements of the equipment, the rigging products provided for this work shall be the products of a single rigging manufacturer for quality, consistency and ease of integration. Accessory items such as wire rope, fittings, and curtain tracks may be from other specialty manufacturers.
- B. The rigging manufacturer must have the following programs in place. Approval to bid does not release the manufacturer from meeting these requirements:
1. The manufacturer must have a product testing program, including determination of recommended working loads for products based on destructive testing and review by a licensed engineer.
 2. The manufacturer of the performance equipment must have a quality management system that is registered to the ISO 9001:2008 standard.
 3. The manufacturer must carry primary product and general liability insurance of \$2,000,000 each, with excess liability coverage of \$10,000,000 and a Contractors Professional Liability policy with \$2,000,000 coverage.
- C. Requirements for Approval: Other equipment manufacturers seeking approval must submit the following information at least 2 weeks prior to the bid opening date. Approval of manufacturers will be by addenda. Failure to submit any of the required information will automatically disqualify the manufacturers from consideration of approval.
1. Evidence that the manufacturer has been in business for a minimum of ten years manufacturing stage equipment.
 2. A listing of 5 equivalent installations, including:
 - Name, address and telephone number of Owner

Name, address and telephone number of architect

Scope of work

3. A brief written description of the manufacturer's operation including facilities, financial capabilities, and experience of key personnel.
4. Written, third party evidence showing that the manufacturer has the testing, quality management and insurance programs required above in place.

2.02 GENERAL

A. Standards:

1. Materials shall conform to the following ASTM and ANSI standard specifications:
 - .1) ANSI B17.1M - Keys and key seats
 - .2) ANSI B18.2.1&2 - Specification for square and hex bolts and nuts
 - .3) ANSI B106.1M - Design of Transmission Shafting
 - .4) ANSI E1.4 - Entertainment Technology – Manual Counterweight Rigging
 - .5) ANSI E1.6-1 - Entertainment Technology – Powered Hoist Systems
 - .6) ANSI E1-22 - Entertainment Technology – Fire Safety Curtain System
 - .7) ASTM-36 - Specification for structural steel
 - .8) ASTM-48 - Specification for gray iron casting
 - .9) ASTM-120 - Specification for black and hot-dipped zinc-coated, (galvanized) steel pipe for ordinary use
2. In order to establish minimum standards of safety, the following factors shall be used:
 - .1) Cables & fittings - 8:1 Safety Factor
 - .2) Cable D/d ratio - Sheave tread diameter is the minimum D/d ratio per the "Wire Rope User Manual" or recommended by the wire rope manufacturer
 - .3) Tread Pressures - 500 lbs. for cast iron, 900 lbs. for Nylatron, 1000 lbs. for steel
 - .4) Max. fleet angle - 1-1/2 degrees
 - .5) Steel - 1/5 of yield strength or per AISC Specification
 - .6) Bearings Two times required load at full speed for 2000 hours
 - .7) Bolts - Minimum SAE J429 Grade 5 (ISO R898 Class 8.8), zinc plated
 - .8) Motors - 1.0 AGMA Service Factor
 - .9) Gearboxes - 1.25 Mechanical Strength Service Factor

.10) Gearboxes - 1.0 Gearing Service Factor

- B. Materials: All materials used in this project shall be new, unused and of the latest design. Re-furbished and obsolete materials are not permitted.
- C. Head blocks: Recommended working load of head blocks shall exceed the overall load imparted on the head block.
- D. Sheaves
 - 1. Sheaves shall be of the following materials, as specified:
 - .1) ASTM A-48 Class 30 grey iron castings
 - .2) Molybdenum disulphide filled or polyamide Nylon
 - 2. Groove depths shall be sufficient to fully encompass the cables and ropes. Grooves shall have sloped sides (8 degree minimum) and conform to rope and cable manufacturers' standards for groove shape and tolerance.
 - 3. All rope and cable grooves in a sheave shall have equal pitch diameters.
- E. Bearings
 - 1. Bearings shall be manufactured per AFBMA/ANSI standards
 - 2. Ball bearings shall be sealed precision with double seals
 - 3. Pillow block bearings must be loaded into their base.
- F. Block Shafts
 - 1. Shafts shall be machined steel, have fine screw threads, and be keyed to one side plate to prevent rotation.
 - 2. Shaft lengths shall be set so that the shaft bears on a side plate for full strength, not on threads.
 - 3. Proper adjustment of the sheave and bearings shall be accomplished by means of a fine thread, self-locking nut on the opposite end of the shaft. Each sheave shall run plumb and true without rubbing its side plates when rotated.
- G. Block Side Plates
 - 1. Hot rolled steel.
 - 2. Spacers shall be used to stiffen the side plates and to prevent cables from escaping from the sheave grooves.
- H. Fabrication
 - 1. The mechanical fabrication and workmanship shall incorporate best practices for good fit and finish. There shall be no burrs or sharp edges to cause a hazard to personnel.
 - 2. All moving parts shall meet specified tolerances.
 - 3. All equipment shall be built and installed to facilitate future maintenance and replacement.
- I. Finishes
 - 1. Paint shall be the manufacturer's standard black finish except as noted.

2. All turnbuckles, clips, tracks, chains and other items of incidental hardware shall be furnished plated or painted.
- J. Recommended Working Load: This specification calls for minimum recommended working loads for many hardware items. This is the maximum load which the manufacturer recommends be applied to properly installed, maintained, and operated for new equipment. Manufacturer's recommended working loads shall be confirmed and sealed by a Licensed Professional Engineer.

2.03 FIRE CURTAIN SYSTEM

A. Fire Curtain Hoist

1. General Description:

- .1) Furnish and install a motorized brail lift, automatically closing fire safety curtain as indicated on the drawings. The curtain shall fold up above the proscenium arch, and shall lap the side walls not less than 18" at each side of the proscenium opening and 24" at the top of the proscenium opening.
- .2) The curtain shall be arranged to comply with applicable codes and, in general, intercept fire and smoke and prevent glow from severe fire on the stage from showing on the auditorium side for at least thirty (30) minutes in order to permit safe egress of all people from the auditorium.
- .3) The curtain shall close :
 - i) By gravity due to over-balance of the curtain as specified below. Emergency closing must occur in less than thirty seconds when the fire line is released or fusible links separate.
 - ii) Automatically upon sprinkler activation,
 - iii) Automatically upon fire alarm system activation,
 - iv) Manually by remote control device located at the curtain control panel and at each side of the stage.
2. Hoist shall consist of a cable drum, coupled to an electric gear motor. Hoist shall have a 1,100lb lifting capacity at a minimum rate of 25 feet per minute. (the entire opening upon activation by i),ii),iv) above to be in its closed position in no more than 80 seconds The hoist shall be fully enclosed and supplied with a engineered metal stand or wall brackets.
3. The cable drum shall be of welded steel construction and carry 75'-0" of 5/16" diameter 7x19 galvanized utility cable. Twin guards shall keep the cable in the drum groove.
4. The hoist (and curtain) shall be locked in position by the motor brake located within the enclosure. Releasing the fire line shall disengage the motor brake, permitting the cable drum to rotate, lowering the curtain. The brake handle shall extend through the top of the case, for easy attachment to the end of the fire line. No more than 35 lbs. of tension in the fire line shall be required to hold the full load capacity of the winch.

5. The unit shall be equipped with an adjustable hydraulic speed governor to provide maximum control and safety in the closing of the fire curtain and to establish the travel time.
6. Gear motor
 - .1) The motor and helical/bevel gearbox shall be an integrated unit, with the first stage pinion mounted directly on the motor's armature shaft.
 - .2) Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum AGMA service factor of 1.0 for constant operation, motor shall be minimum 2 HP/3Phase.
 - .3) The gear case shall be cast iron for protection against shock damage. The output shaft shall have double lip oil seals to prevent leaks. The gearing service factor shall be a minimum of 1.0 with a mechanical strength service factor of 1.25.
7. Rotary Limit Switch
 - .1) Rotary limit switch assembly shall have four independently adjustable switch/cam sets. Cams shall be driven by a geared assembly.
 - .2) Switches shall have snap acting contacts.
 - .3) Switches shall be mounted within the winch base as to allow for easy adjustment of the switch settings.
8. All components in the hoist shall be fully enclosed. Access panels for adjustment and maintenance shall be removable without removing the hoist from service.
9. Fixed Speed Starter
 - .1) The hoist shall be controlled by a UL 580E listed, full voltage, self-protected, reversing starter. Enclosure shall be NEMA 12 with hinged, latching cover. The interior of the starter cabinet shall be "touch safe" per IEC 204-1 "Protection against direct contact" rules.
 - .2) The NEMA/IEC magnetically operated, mechanically and electrically interlocked, reversing starter shall be sized to match the hoist motor horsepower and shall be rated for plugging and jogging. Units shall incorporate UL580E Type 2, non-welding, positive break contactors.
 - .3) Overcurrent protection shall be provided by an IEC Class 10 overload. Short circuit protection shall be provided by a circuit breaker.
 - .4) Starters shall be wired so that operation of the normal end of travel limit switches shall only allow movement away from the limit switch. Operation of an over travel limit switch shall open the line contactor, and will not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the over travel limits for resetting purposes.

10. Control Station: Controls, consisting of up and down pushbuttons and an emergency stop switch, are mounted on the motor starter.
 11. Any equipment that does not meet or exceed this section shall not be allowed
- B. Sides of curtain shall have bronze guides every 18", securely fastened to a 6" hem with at least three bolts or rivets, or as required by the governing code.
- C. Smoke Pockets
1. Smoke Pockets: Furnish and install one pair of smoke pockets to extend from the stage floor to a point 8'-0" above the top of the raised curtain. Pockets shall consist of a 8" deep "Z" channel formed from 1/4" steel plate and a 1/4" x 18" steel plate which shall be bolted to the channels on 2'-0" centers. Channels shall be anchored to the walls on 4'-0" centers.
 2. Guide Cables: Provide wire rope guide cables at each side of the curtain. Cables shall be sized for a minimum 2 pound per square foot horizontal pressure differential, attached at the stage floor level and extending to the roof steel or gridiron where they shall be attached with turnbuckles, thimbles, cable clips and other fittings as required.
 3. Any equipment that does not meet or exceed this section shall not be allowed
- D. Fire Line Release
1. The fire line release engages a ring that is attached to the fire line. The ring is held within a tube by a pin with an over-center design lever. The device is steel and is finished in red for easy identification. The design ensures that the lever positively releases the ring to allow curtain closure regardless of the tension in the fire line.
 2. Fire Line Release Enclosure: The enclosure consists of a metal case with a clear acrylic window to accommodate the Fire Line Release. The door is easy opening but protects the device against accidental release. The window and high contrast lettering on the cover provide easy identification.
 3. Any equipment that does not meet or exceed this section shall not be allowed
- E. Round Weight Arbor and Guard
1. A round weight arbor shall consist of a 3/4" diameter by 18" long hot rolled bar with double nuts and a forged eye nut at the top.
 2. 5 pounds of cast iron or steel round weights are supplied on the arbor and are held by the bottom double nuts.
 3. The round weight arbor guard consists of a 4 foot tall sheet steel cylinder to guide the arbor and keep it from being blocked in its travel.
- F. Electrical Fire Line Release:
1. The fire curtain shall be equipped with an electro-mechanical fire line release mechanism, activated by normally open or normally closed devices including rate of rise heat detectors, smoke detectors, emergency switches, etc. (furnished and installed by others) or by release of tension in the fire line. A switch shall be mounted in the release mechanism enclosure for testing system operation. Activation of the mechanism shall

release tension in the fire line which, in turn, allows the fire curtain arbor to rise and the fire curtain to close in the normal manner. The release unit shall incorporate three pulleys permitting its attachment to the fire line at any point and to help prevent accidental release.

2. The release shall contain an integral sealed, rechargeable "Gel Pac" battery and charger to provide emergency power during power interruptions. A charged battery shall keep the curtain raised for a half hour minimum without building power. The release shall operate from a 120 VAC power source provided by others.
3. The electrical fire line release shall be UL Listed.
4. Any equipment that does not meet or exceed this section shall not be allowed

G. Rate of Rise Heat Detector:

1. A heat detector that closes a normally open electrical contact at a fixed temperature or at a temperature rise of 15°F in one minute.
2. Rating: 3.0A at 6 to 125 VAC, 1.0 A at 6 to 24VAC, 0.3 A 125 VDC, and 0.1 A VDC
3. UL/ULC rating temperature - 135°F
4. UL/ULC maximum temperature at ceiling - 100°F
5. Any equipment that does not meet or exceed this section shall not be allowed.

H. Fire Safety Curtain

1. The curtain shall be fabricated from tightly woven, non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070" thickness weighing at least 40 ounces per square yard. All strips of fabric shall be in continuous lengths running the full height of the curtain. There shall be no horizontal seams. Each seam shall be sewn with two lines of stitching using fiberglass thread. Top and bottom pockets shall be 6". The bottom pocket shall be equipped with a 3" yield pad filled with tightly woven fabric as described above.
2. The curtain/assembly to be tested by UL and to meet or exceed the requirements of testing standard "UL 10D –Standard for Fire Tests of Fire Curtain Assemblies". The assembly to carry an attached UL label.
3. Any equipment that does not meet or exceed this section shall not be allowed.

I. Guided Clew: Cable clew shall be cut from 5/16" minimum steel, with the proper number of holes for proper attachment of turnbuckles for multiple cables. One larger hole for the drive cable shall be so located as to prevent the clew from jamming on its guide cables. Provide two parallel guide cables between the head block and the brail hoist to guide the clew.

J. Safety Chains: Supply one more safety chain than the number of lift cables. The 1/4" proof coil chains shall be located between lift cables except at the ends where chains shall be 12" or less from the end of the batten. Chains shall be attached to the top of the curtain with pipe clamps around the top of the batten

and chain shackles. The other end shall be appropriately attached to the building structure.

K. Single Line Loft Block:

1. The sheave shall have an 8-1/2" outside diameter, and shall be an iron casting, with a machined groove. The sheave shall be equipped with a 17 mm diameter shaft and two sealed, precision ball bearings.
2. Base angles shall be a minimum 1-1/2" x 1-1/2" x 3/16" angle punched with a universal hole pattern for easy installation.
3. Side plates shall be a minimum of 12-gauge steel, and shall fully enclose the sheave. Side plates shall be bolted to the base angles.
4. The block and associated mounting hardware shall have a recommended working load of at least 500 lbs. and shall be designed for use in either upright or underhung usage.
5. Loft blocks shall be grooved for one 1/4" lift line.

L. Multi Line Loft Block

1. The sheave shall have an 8-1/2" outside diameter, and shall be an iron casting, with machined grooves. The sheave shall be equipped with a 1" diameter shaft and two tapered roller bearings.
2. Base angles shall be a minimum 1-1/2" x 1-1/2" x 3/16" angle.
3. Side plates shall be a minimum of 10-gauge steel, and shall fully enclose the sheave. Side plates shall be bolted to the base angles.
4. The block and associated mounting hardware shall have a recommended working load of at least 500 lbs. per line and 1,300 lbs. total, and shall be designed for use in either upright or underhung usage.
5. Loft blocks shall be grooved for 8 – 1/4" lift lines.

M. Half Pipe Clamps:

1. Pipe clamps shall be made of two strips of 1/8" by 2" hot rolled steel formed to almost encompass and clamp the pipe batten leaving the bottom open. Corners shall be rounded.
2. There shall be a 3/8" x 1" hex bolt with lock nut above the batten. A 5/8" hole in the top of each clamp half allows the attachment of cable, chain, or other fittings.
3. Half pipe clamps shall have a manufacturer's recommended load rating of at least 200 lbs.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Equipment shall be installed by fully trained superintendents and workmen. The Rigging Contractor shall employ Entertainment Technician Certification Program (ETCP) Certified theatre Riggers. Certified Riggers shall, at a minimum, be used as the project manager and site foreman and be responsible for the overall project including the layout, inspection, and onsite user training.

- B. Equipment shall be installed per plans and specifications. Equipment shall be aligned, adjusted, and trimmed for the most efficient operation, the greatest safety and for the best visual appearance.
- C. Standards: Installation practices shall be in accordance with OSHA Safety and Health Standards and all local codes. All welding must be performed in full compliance with the latest edition of the Structural Welding Code (ANSI/AWS D1.1).
- D. Alignment: Mule blocks, cable rollers and guides shall be installed, as required, to provide proper alignment, to maintain specified fleet angles, and to prevent contact with other surfaces.
- E. Attachments: All equipment shall be securely attached to the building structure.

3.02 INSPECTION AND TESTING

- A. Inspection: During the installation of equipment the Rigging Contractor shall arrange for access as necessary for inspection of equipment by the Departmental Representative.
- B. System Pre-Testing By Rigging Contractor: On completion of installation the Rigging Contractor shall conduct a complete test of the system to ensure it is working properly and in conformance with this specification.
- C. Completion Testing: Upon completing the installation, the Rigging Contractor shall notify the Departmental Representative, who will schedule inspection and testing of the full rigging system. At the time of testing, the Rigging Contractor shall furnish sufficient workers to operate all equipment and to perform such adjustments and tests as may be required by the Departmental representative. All testing equipment and personnel shall be at the Rigging Contractor's expense. Any equipment, which fails to meet with approval, shall be repaired or replaced with suitable equipment and the inspection shall be re-scheduled under the same conditions as previously specified. At the time of these inspections, no other work shall be performed in the auditorium and stage areas. All temporary bracing, scaffolding, etc. shall be removed to permit full operation of, and access to, all equipment. Final approval will be withheld until all systems have been thoroughly tested and found to be in full working order and meets requirements herein.
 - 1. Manual counterweight rigging shall be tested in accordance with ANSI E1.4 "Entertainment Technology Manual Counterweight Rigging Systems."
 - 2. Powered rigging shall be tested. Each hoist shall be operated over five full continuous cycles at 1.25 times its full working load at full speed and travel distance. The emergency stop function shall be tested at 100% WLL in both the ascending and descending directions.
 - 3. Demonstrate that all over travel limit switches have been correctly set for the actual field conditions of the specific project.
 - 4. If it applies to the project, demonstrate that all position encoders have been correctly set for the actual field conditions of the specific project.
 - 5. Provide written recommendations to the Departmental Representative for necessary repairs or changes not included in the warranty. Provide a copy to the rigging equipment Manufacturer and in the Operations Manual.

- D. The Departmental Representative shall witness and sign off on the inspection. A copy of the certificate shall be included in the permanent log turned over to the owner.
- 3.03 INSTRUCTION
- A. Upon completion of the work, the Rigging Contractor shall submit 3 copies of a comprehensive Operating and Maintenance Manual including as-built shop drawings, equipment descriptions, and parts lists. The Rigging Contractor shall provide a safety and instruction class with personnel designated by the Departmental Representative to demonstrate and explain the operation and maintenance of the systems.
 - B. Signage with basic operating instructions and warnings shall be posted in the area where the equipment will be operated. Signage shall be in conformance with ANSI-Z535.
- 3.04 FOLLOW-UP INSPECTION
- A. One year after the completion of installation the Rigging Contractor shall return to the site, and provide the following services at the Rigging Contractors expense:
 - B. Perform a complete inspection of the rigging system in accordance with OSHA 29 CFR 1926.550 Cranes and Derricks, 1926.550(a)(6)
 - C. Make all required adjustments.
- 3.05 Correct all warranty items and provide a written report to the Owner and Manufacturer.
- A. Provide written recommendations to the Departmental Representative for necessary repairs or changes not included in the warranty. Provide a copy to the rigging equipment Manufacturer.
 - B. Conduct a 1 hour rigging operation and safety class.
 - C. Provide a written proposal for the next year's maintenance visit.

END OF SECTION