SECTION 11 61 33

STAGE CURTAINS AND RIGGING SYSTEMS

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\*\* NOTE TO SPECIFIER \*\* Wenger Corporation, including all Wenger, J.R. Clancy and GearBoss product brands; Broadcast, theater and stage equipment, sound-control door assemblies, acoustic room components, lockers, storage assemblies, specialty casework, special purpose rooms, integrated lighting, integrated controls and audio video systems.   
This section is based on the products of Wenger Corporation, which is locatedx at:  
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Owatonna, MN 55060  
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[Click Here] for additional information  
Wenger Corporation and J.R. Clancy are Your Performance Partners. In 2011, Wenger and J.R. Clancy brought together almost 200 years of experience to provide complete solutions for Performing Arts Centers and Theatres. We design, manufacture and install leading theatrical equipment worldwide from Complete Rigging Solutions and Controls to Acoustical Shell Enclosures and Orchestra Pit Fillers as well as a full-line of quality furnishings.  
Wenger Corporation provides innovative, high-quality products and solutions for performing arts and music and theatre education. For more than 65 years Wenger has been listening to what our customers need and then designing and manufacturing innovative, durable and functional products to meet those needs.  
Wenger pioneered sound isolation in practice rooms and now offers modular rooms with virtual acoustic technology (VAE) and built-in digital recording/playback. Products for music and theatre spaces include: pre-engineered acoustical doors, sound-isolating music practice rooms, acoustical shells, acoustical wall and ceiling treatment, instrument and equipment storage cabinets, portable audience seating, portable stage platforms and staging systems, music posture and portable audience chairs, orchestra pit fillers, makeup stations, tiered risers and music furniture.  
Since 1885, J.R. Clancy has been a leading designer and supplier of theatrical rigging systems, accessories and services to the theatre and entertainment industries around the world. Our team of experienced mechanical and electrical engineers, project managers, and installers provides expert technical assistance and information to architects, general contractors, theatre consultants, end users, and dealers.  
With a combination of innovative designs, outstanding quality, and a century of experience, J.R. Clancy has become the leading manufacturer of theatrical stage equipment in the United States. We provide everything from the simplest hemp sets and rigging hardware to complete, highly sophisticated motorized rigging systems-for use just about anywhere.

1. GENERAL
   1. SECTION INCLUDES

\*\* NOTE TO SPECIFIER \*\* Delete items below not required for project.

* + 1. Stage Curtains and Rigging Systems:
       1. Fire curtain systems, brail fire curtain.
       2. Fire curtain systems, straight lift curtain, proscenium opening up to 18'T x 34'W.
       3. Fire curtain systems, straight lift curtain, proscenium opening up to 22'T x 42'W.
       4. Fire curtain systems, straight lift curtain, proscenium opening up to 30'T x 50'W.
       5. Fire curtain systems, straight lift curtain, proscenium opening greater than 30'T x 50'W.
       6. Fire curtain systems, curtain accessories.
       7. Counterweight rigging.
       8. Helios hoist.
       9. PowerLift hoist.
       10. PowerLite hoist.
       11. Varion hoist.
       12. Titan hoist.
       13. PowerAssist hoist.
       14. PowerLine hoist.
       15. Self-Climbing hoist.
       16. Performer hoist.
       17. Custom line shaft hoist.
       18. Drum hoist.
       19. Pile-up drum hoist.
       20. Motorized rigging accessories.
       21. Motion control system.
       22. Stage curtains and tracks.
       23. Rope and dead hung rigging.
  1. RELATED SECTIONS
     1. Section 05 12 13 - Architecturally-Exposed Structural Steel Framing.
     2. Division 16 - Electrical for power wiring.
  2. REFERENCES

\*\* NOTE TO SPECIFIER \*\* Delete references from the list below that are not actually required by the text of the edited section.

* + 1. American National Standards Institute (ANSI):
       1. ANSI B17.1 - Keys and Keyseats.
       2. ANSI B106.1M - Design of Transmission Shafting.
       3. ANSI E1.4 - Entertainment Technology - Manual Counterweight Rigging Systems.
       4. ANSI E1.6-1 - Entertainment Technology - Powered Hoist Systems.
       5. ANSI E1.22 - Entertainment Technology - Fire Safety Curtain Systems.
       6. ANSI E1.47 - Entertainment Technology - Recommended Guidelines for Entertainment Rigging System Inspections.
       7. ANSI Z535.4 - Product Safety Signs and Labels.
    2. ASTM International (ASTM):
       1. ASTM A36/A 36M - Standard Specification for Carbon Structural Steel.
       2. ASTM A48 - Standard Specification for Gray Iron Castings.
       3. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
       4. ASTM A536 - Standard Specification for Ductile Iron Castings.
       5. ASTM F1145 - Standard Specification for Turnbuckles, Swaged, Welded, Forged.
    3. International Organization for Standardization (ISO): ISO 9001 Quality management systems - Requirements.
    4. National Fire Protection Association (NFPA):
       1. NFPA 70 - National Electrical Code.
       2. NFPA 79 - Electrical Standards for Industrial Machinery.
    5. Underwriter's Laboratory (UL): UL 508E - IEC Type '2' Coordination Short Circuit Tests of Electromechanical Motor Controllers in Accordance with IEC Publication 947-4-1.
  1. SUBMITTALS
     1. Submit under provisions of Section 01 30 00 - Administrative Requirements.
     2. Product Data: Manufacturer's data sheets on each product to be used, including:
        1. Provide test results by certified independent testing laboratory indicating compliance with performance requirements.
        2. Rated capacities, construction details, material descriptions, dimensions of individual components, profiles, and finishes.
        3. Maintenance instructions and recommendations.
        4. Acoustical testing data demonstrating minimal compliance with required acoustical performance criteria.
        5. Photometric data for light fixtures, if applicable to the product.
     3. Shop Drawings:
        1. 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. Submit for approval before beginning any fabrication, installation, or erection.
        2. Include fabrication and installation details. Distinguish between factory and field work.
        3. Include plans, elevations, sections, attachments and work by other trades.
        4. Include wiring diagrams when applicable.
        5. Indicate seismic bracing and fastening requirements as applicable.
     4. Coordination Drawings: Project-specific Coordination Drawings, indicating the following items drawn and coordinated with each other. Include information required by Installers of each item in order to coordinate the Work. Include the following:
        1. Relationship of items shown on separate Shop Drawings.
        2. Dimensions and required clearances of adjacent or related work.
        3. Order of assembly of separate items.
        4. Information required for interface with other trades and components, including mechanical, electrical, and communication work.
     5. Product Schedule:
        1. Use designations indicated on the Drawings.
        2. Include room locations, dimensions, accessories, finishes, and project specific notes.
     6. Verification Samples:
        1. Exposed Finishes and Finish Materials: Not less than 4 by 4 inches (102 by 102 mm), for each type, color, pattern, surface and material selected.
     7. Closeout Submittals:
        1. Operation and Maintenance Data: For adjusting, repairing and replacing components and accessories.
        2. Warranty: Submit manufacturer's warranty.
        3. As-Built Drawings: For completed work.
     8. Field Quality Control Reports: Documenting inspections and demonstrations of installed products and equipment.
  2. QUALITY ASSURANCE
     1. Source Limitations: Obtain all products from a single manufacturer through one source providing a comprehensive material and installation package:
     2. Manufacturer Qualifications: Minimum 5 years' experience in design and manufacturing of similar products on projects of similar size, scope and complexity, and with the production capacity to meet the construction and installation schedule.
     3. Installer Qualifications: ESTA-certified and experienced in installation of the work of this section and acceptable to the manufacturer and in the regular employ of the manufacturer.
     4. Electrical Components: Listed and labeled per NFPA 70, Article 100 by a testing agency acceptable to Authorities Having Jurisdiction (AHJ).
     5. Curtain and Rigging Systems, Manufacturer Qualifications: Minimum 5 years experience in manufacture of similar products in use in similar environments, including project size, and complexity, and with the production capacity to meet the construction and installation schedule.
        1. 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.
        2. The rigging manufacturer shall have the following programs in place.
           1. The manufacturer shall 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 shall have a quality management system that is registered to the ISO 9001standard.
           3. The manufacturer shall 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.
     6. Rigging Systems, Installer Qualifications: Manufacturer's authorized representative, trained and approved for installation of units required for this Project.
        1. 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 ten installations of this type and scope. The AHJ shall be the final judge of the suitability of experience.
        2. 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.
     7. Rigging Systems, Minimum Standards of Safety, the following factors shall be used:
        1. Cables and 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. Maximum 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 NEMA Service Factor.
        9. Gearboxes: 1.25 Mechanical Strength Service Factor, 1.0 Gearing Service Factor.
  3. DELIVERY, STORAGE, AND HANDLING
     1. Deliver materials in manufacturer's original unopened containers with manufacturer's labels attached. Do not deliver material until spaces to receive them are clean, dry, and ready for their installation. Ship to jobsite only after roughing-in, painting and other finishing work has been completed, installation areas are ready to accept work.
     2. Handle and install materials to avoid damage.
  4. PROJECT CONDITIONS
     1. Environmental Limitations: Do not deliver or install materials until spaces are enclosed and weather tight, wet work in spaces is complete and dry, HVAC system is operating and maintaining ambient temperature at occupancy levels during the remainder of the construction period.
     2. Field Measurements: Verify field measurements as indicated on Shop Drawings. Where measurements are not possible, provide control dimensions and templates.
        1. Coordinate installation and location of blocking and supports as requested.
        2. Verify openings, clearances, storage requirements and other dimensions relevant to the installation and final application.
        3. Where applicable, coordinate locations of electrical junction boxes.
     3. Field Measurements: Verify field measurements as indicated on Shop Drawings. Where measurements are not possible, provide control dimensions and templates.
        1. Coordinate locations of electrical junction boxes.
     4. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.
  5. WARRANTY

\*\* NOTE TO SPECIFIER \*\* The "special warranty" is a warranty provided by the manufacturer to the building owner. The warranty terms below are available from Wenger Corp. Verify that other manufacturers listed or seeking approval furnish warranty meeting requirements. Durability is a key aspect of Wenger's product value for Owners. The available warranty reflects Wenger's high confidence in the performance of their products. Delete if not required.

* + 1. Special Warranty for Curtain Systems: Provide manufacturer's standard limited 3 year warranty against defects in materials or workmanship from the date of Substantial Completion. The warranty is contingent on inspection of the equipment and training of its use being provided annually by an Entertainment Technician Certification Program (ETCP) Certified Theatre Rigger at the Owner's expense. It is the responsibility of the end user to make arrangements for the annual inspection and training. Failure to obtain the inspection and training annually shall result in a one year warranty. The warranty shall not cover equipment that has become defective due to misuse, abuse, accident, act of God, alteration, vandalism, ordinary wear and tear, improper maintenance, or used not in a manner intended.
    2. Special Warranty for Rigging Systems: Provide manufacturer's standard limited 3 year warranty against defects in materials or workmanship from the date of Substantial Completion. The warranty is contingent on inspection of the equipment and training of its use being provided annually by an Entertainment Technician Certification Program (ETCP) Certified Theatre Rigger at the Owner's expense. It is the responsibility of the end user to make arrangements for the annual inspection and training. Failure to obtain the inspection and training annually shall reduce warranty coverage to one year after substantial completion. The warranty shall not cover equipment that has become defective due to misuse, abuse, accident, act of God, alteration, vandalism, ordinary wear and tear, improper maintenance, or used not in a manner intended.

1. PRODUCTS
   1. MANUFACTURERS
      1. Acceptable Manufacturer: Wenger Corporation, JR Clancy and GearBoss, which is located at:555 Park Dr.Owatonna, MN 55060Toll Free Tel: 800-4WENGER (493-6437)Tel: 507-455-4100Fax: 507-455-4258Email: [request info (info@wengercorp.com)](https://arcat.com/rfi?action=email&company=Wenger%252BCorporation%252C%252BJR%252BClancy%252Band%252BGearBoss&message=RE%253A%2520Spec%2520Question%2520(11064wen)%253A%2520&coid=36487&spec=11064wen&rep=&fax=507-455-4258);Web: <https://www.wengercorp.com> | <https://www.jrclancy.com>

\*\* NOTE TO SPECIFIER \*\* Delete one of the following two paragraphs; coordinate with requirements of Division 1 section on product options and substitutions.

* + 1. Substitutions: Not permitted.
    2. Requests for substitutions shall be considered in accordance with provisions of Section 01 60 00 - Product Requirements.
       1. Manufacturers seeking approval shall submit the following:
          1. Product data, including third-party certified acoustical data and proposed graphic/drawing layout for this project.
          2. Project references: Minimum of 5 installations not less than 3 years old, of comparable size, scope and complexity of this project, complete with owner contact information.
          3. Sample warranty.
       2. Submit substitution request not less than required days prior to bid date.
       3. Approval shall be indicated by issuance of written Addendum.
       4. Approved manufacturers shall meet separate requirements of Submittals Article.
       5. Manufacturers' products that are either listed as pre-approved in these Specifications or who have been granted approval as an alternate must still demonstrate all of the material performance and operational characteristics required by this Section.
    3. Rigging Systems, Requirements for Approval: Other equipment manufacturers seeking approval shall submit the following information at least 2 weeks prior to the bid opening date. Approval of manufacturers shall be by addenda. Failure to submit any of the required information shall 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 10 equivalent installations, including:
          1. Name, address and telephone number of owner.
          2. Name, address and telephone number of architect.
          3. 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.

\*\* NOTE TO SPECIFIER \*\* Delete if not required.

* 1. FIRE CURTAIN SYSTEMS, BRAIL FIRE CURTAIN

\*\* NOTE TO SPECIFIER \*\* Delete operation not required for project.

* + 1. 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 wall not less than 18 inch (457 mm) at each side of the proscenium opening and 24 inch (610 mm) 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 by gravity due to over-balance of the curtain as specified below. Emergency closing shall occur as specified in NFPA 80 or as required by local codes when the fire line is released or fusible links separate.
       2. Special Conditions: It is the intention of this specification to provide a fully functioning fire safety curtain system. Actual equipment and components shall reflect building conditions and approved construction drawings. All dimensions shall be field verified by the Rigging Contractor.
       3. ZetexPlus Fire Safety Curtain: The curtain shall be fabricated from tightly woven J.R. Clancy ZetexPlus 1210-ZP non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070 inch (1.8 mm) thickness weighing at least 40 ounces per square yard (1.35 KG/sq m). The curtain shall be listed and approved by the State of California Fire Marshall the NYC Material and Equipment Acceptance Division, and shall bear a certification label from a nationally recognized listing agency. 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 inch (152.4 mm). The bottom pocket shall be equipped with a 3 inch (76.2 mm) yield pad filled with Zetex. D-rings shall be sewn 18 inch (457.2 mm) apart in vertical rows at each lift line location.
       4. Sides of curtain shall have bronze guides every 18 inch (457.2 mm), securely fastened to a 6 inch (152.4 mm) hem with at least three bolts or rivets, or as required by the governing code.
       5. Guides: Provide 1/4 inch (6.4 mm) wire rope guide at each side of the curtain. These cables shall be attached to a ring at the stage floor level and extend to the roof steel or gridiron where they shall be attached with 3/8 inch x 6 inch (9.525 mm x 152.4 mm) turnbuckles, thimbles, swage sleeves and other fittings as required.
       6. Smoke Pockets: Furnish and install one pair of smoke pockets to extend from the stage floor to a point above the top of the raised curtain or to the height specified in the drawings. Pockets shall consist of an 8 inch (203.2 mm) deep "Z" channel formed from 1/4 inch (6.4 mm) steel plate and a 1/4 inch x 18 inch (6.4 mm x 457.2 mm) steel plate which shall be bolted to the channels on 2 feet-0 inch (609.6 mm) centers. Welded construction shall not be accepted. Channels shall be anchored to the walls on 4 feet-0 inch (1,219 mm) centers.
       7. Smoke Seal: Provide a smoke seal consisting of a triple layer of folded fabric fastened above the proscenium with a mounting clamp so it rubs the curtain and seals the top of the opening. The fabric shall be Zetex 800 cloth with a minimum weight of 27 ounces per square yard (0.9 KG/sq m).
       8. Fire Curtain Hoist:
          1. Hoist shall consist of a cable drum, coupled to an electric gear motor. Hoist shall have a 1,100lb (500 KG) lifting capacity at a rate of 25 feet/min (0.13 m/s). The hoist shall be fully enclosed and supplied with a sturdy metal stand or wall brackets.
          2. The cable drum shall be of welded steel construction and carry 75 feet (22.86 m) of 5/16 inch (7.9 mm) diameter 7x19 galvanized utility cable. Twin guards shall keep the cable in the drum groove.
          3. 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 20lbs (9 KG) of tension in the fire line shall be required to hold the full load capacity of the winch.
          4. 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.
          5. Gearmotor:

The motor and helical/bevel gearbox shall be an integrated unit, with the first stage pinion mounted directly on the motor's armature shaft.

Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.

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.

* + - * 1. Rotary Limit Switch:

Rotary limit switch assembly shall have four independently adjustable switch/cam sets. Cams shall be driven by a geared assembly.

Switches shall have snap acting contacts.

Switches shall be mounted within the winch base as to allow for easy adjustment of the switch settings.

Rotary limit switches shall be Ravasi.

* + - * 1. All components in the hoist shall be fully enclosed. Access panels for adjustment and maintenance shall be removable without removing the hoist from service.
        2. Fixed Speed Starter:

The hoist shall be controlled by a UL 508E 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.

The NEMA/IEC, magnetically operated, mechanically and electrically interlocked and reversing starter shall be sized to match the hoist motor horsepower and shall be rated for plugging and jogging. Units shall incorporate UL 508E Type 2, non-welding, positive break contactors.

Overcurrent protection shall be provided by an IEC Class 10 overload. Short circuit protection shall be provided by a circuit breaker.

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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

* + - 1. Control Station: Controls, consisting of up and down pushbuttons and an emergency stop switch, are mounted on the motor starter.
      2. Guided Clew: Cable clew shall be cut from 5/16 inch (7.94 mm) 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.
      3. Head Block:
         1. The sheave shall have a 12 inch (304.8 mm) pitch diameter, and shall be an iron casting, with a machined groove. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
         2. Base angles shall be a minimum 2 inch x 1-1/2 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle.
         3. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, and shall fully enclose the sheave.
         4. The block and associated mounting hardware shall have a recommended working load of at least 2,500lb (1.1 KG), and shall be designed for use in either upright or underhung usage.
         5. Block shall be grooved for (8) 1/4 inch (6.4 mm) lift lines.
      4. Loft Block:
         1. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter, and shall be 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 inch x 1-1/2 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle.
         3. Side plates shall be a minimum of 12-gauge (2.78 mm) steel, and shall fully enclose the sheave.
         4. The block and associated mounting hardware shall have a recommended working load of at least 500lb (317 KG), and shall be designed for use in either upright or underhung usage.
         5. Loft blocks shall be grooved for one 1/4 inch (6.4 mm) lift line.
      5. Battens: Battens shall be made of 2 inch (50.8 mm) I.D. nominal, schedule 40 black iron pipe.
      6. Fire line System: The manual fire line release system shall consist of a 1/8 inch (3.2 mm) diameter wire rope, with six fusible links, side mounting pulleys as required, and two fire line release devices, each mounted in enclosures. Devices shall be mounted 5 feet-0 inch (1.54 m) above the stage floor on each side of the proscenium. All other components such as round weight arbors, arbor guards, floor pulleys, etc. required to form a fully functional fire line release system shall be provided.
      7. Lift Cables: The curtain lift cables shall be 1/4 inch (6.4 mm) diameter 7x19 galvanized utility cable as specified. Cables shall be terminated with corresponding cable thimbles and two forged cable clips or a Swage sleeve fitting at each end. The curtain end of each cable shall be attached to the batten using a half pipe clamp.
      8. Drive Cable: The drive cable between the brail hoist and the clew shall be 5/16 inch (7.9 mm) diameter 7x19 galvanized aircraft cable, attached to the clew using a thimble and two forged cable clips.
      9. Safety Chains: Supply one more safety chain than the number of lift cables. The 1/4 inch (6.4 mm) proof coil chains shall be located between lift cables except at the ends where chains shall be 12 inch (304.8 mm) 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.
      10. Half Pipe Clamps:
          1. Pipe clamps shall be made of two strips of 3/16 inch by 2 inch (3.17 mm x 50.8 mm) 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 inch x 1 inch (9.52 mm x 25.4 mm) hex bolt with lock nut above the batten. A 5/8 inch (15.87 mm) 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. (90.7 KG).

\*\* NOTE TO SPECIFIER \*\* Delete if not required for project.

* 1. FIRE CURTAIN SYSTEMS, STRAIGHT LIFT CURTAIN, PROSCENIUM OPENING UP TO 18'T x 34'W
     1. Manual (Arbor/Lattice Track):
        1. General Description:
           1. Furnish and install a manually operated straight lift type, automatically closing fire safety curtain for the proscenium opening indicated on the drawings. Curtain shall lap masonry not less than 18 inch at each side of the proscenium opening and 24 inch at the top of the proscenium opening.
           2. The curtain shall be arranged to comply with the "International Building Code (2006)", American National Standard E1.22-2009, other 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 by gravity due to over-balance of the curtain as specified below. Emergency closing shall occur as specified in NFPA 80 or as required by local codes when the fire line is released or fusible links separate.
        2. Special Conditions: It is the intention of this specification to provide a fully functioning fire safety curtain system. Actual equipment and components shall reflect building conditions and approved construction drawings. All dimensions shall be field verified by the Rigging Contractor.
        3. ZetexPlus Fire Safety Curtain: The curtain shall be fabricated from tightly woven J.R. Clancy ZetexPlus 1210-ZP non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070 inch (1.778 mm) thickness weighing at least 40 ounces per square yard (1.35 KG/sq m). The curtain shall be listed and approved by the State of California Fire Marshall, the NYC Material and Equipment Acceptance Division, and shall bear a certification label from a nationally recognized listing agency. 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 inch (152.4 mm). The bottom pocket shall be equipped with a 3 inch (76.2 mm) yield pad filled with ZetexPlus.
        4. Sides of curtain shall have bronze guides every 18 inch (457.2 mm), securely fastened to a 6 inch (152.4 mm) hem with at least three bolts or rivets, or as required by the governing code.
        5. Guides: Provide 1/4 inch (6.4 mm) wire rope guide at each side of the curtain. These cables shall be attached to a ring at the stage floor level and extend to the roof steel or gridiron where they shall be attached with 3/8 inch x 6 inch (9.525 mm x 152.4 mm) turnbuckles, thimbles, swage sleeves and other fittings as required.
        6. Smoke Pockets: Furnish and install one pair of smoke pockets to extend from the stage floor to a point above the top of the raised curtain or to the height specified in the drawings. Pockets shall consist of a 6 inch (152.4 mm) deep "Z" channel formed from 1/4 inch (6.4 mm) steel plate and a 1/4 inch x 18 inch (6.4 mm x 457.2 mm) steel plate which shall be bolted to the channels on 2 feet-0 inch (609.6 mm) centers. Channels shall be anchored to the walls on 4 feet-0 inch (1.2 m) centers.
        7. Smoke Seal: Provide a smoke seal consisting of a triple layer of folded fabric fastened above the proscenium with a mounting clamp so it rubs the curtain and seals the top of the opening. The fabric shall be Zetex 800 cloth with a minimum weight of 27 ounces per square yard (0.91 KG/sq m).
        8. 12 inch (304.8 mm) Head Block:
           1. The sheave shall be an iron casting with a 12 inch (304.8 mm) outer diameter. The machined rope and cable grooves shall have equal pitch diameters. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
           2. Base angles shall be a minimum 2 inch x 1-1/2 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.35 mm) angle with the short leg turned in. The turned in leg shall be notched to allow clear passage of all cables.
           3. Side plates shall be a minimum of 10-gauge (3.570 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
           4. The block and associated mounting hardware shall have a recommended working load of at least 2,500 lbs. (1,134 KG).
           5. Head blocks shall be grooved for six or eight 1/4 inch (6.4 mm) lift lines and one 3/4 inch (19.05 mm) hand line.
        9. Loft Block:
           1. The sheave shall have an 8-1/2 inch (215.9 mm) 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 inch x 1-1/2 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle.
           3. Side plates shall be a minimum of 12-gauge (2.78 mm) 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. (226.8 KG), and shall be designed for use in either upright or underhung usage.
           5. Loft blocks shall be cast iron sheave grooved for one 1/4 inch (6.35 mm) lift line.
        10. Counterweight Arbor:
            1. Arbor shall be long enough to accommodate counterweights to balance the fire curtain and related equipment.
            2. The arbor top shall be a fabricated weldment of 1/2 inch (12.7 mm) formed steel plate and 7 gauge (4.76 mm) formed side plates. The side plates shall be punched to receive 8 cables, and shall be tied together with a bolt and spacer providing a tie-off point for the hand line.
            3. The arbor bottom shall be 1/2 inch x 3 inch (12.7 mm x 76.2 mm) steel bar with counterweight rests to keep the weights from resting on the arbor inner nuts, and a forged steel eye for the hand line tie off.
            4. The top and bottom of the arbor shall be tied together by means of two 3/4 inch (19.05 mm) steel arbor rods. The arbor rods shall have three nuts at each end, the outermost being a lock nut.
            5. The top and bottom shall have bronze guides to engage the lattice track.
            6. Provide 14 gauge (1.98 mm) spreader plates (two minimum) on arbor rods so they can be spaced between counterweights on 2 feet (609.6 mm) centers. Provide a retaining collar on each rod, each with a 1/4 inch (6.35 mm) set screw with red plastic knob for easy locking. One retaining collar shall be welded to the top spreader plate.
        11. Lattice Track:
            1. The track shall consist of two 2 inch x 2 inch x 1/4 inch (50.8 mm x 50.8 mm x 6.35 mm) angles opposing each other with formed brackets alternating front and back on 2 feet (610 mm) centers. Back brackets shall contain two 9/16 inch (14.29 mm) diameter holes for proper anchorage to wall.
            2. A fabricated steel bracket shall support the bottom of the lattice. Bracket shall have ample clearance for passage of hand line.
        12. Automatic Floor Block:
            1. The cast iron sheave shall have a 12 inch (304.8 mm) outside diameter, and shall be an iron casting, with a groove for a 1 inch (25.4 mm) rope.
            2. The sheave shall be equipped with a 1 inch (25.4 mm) diameter machined steel shaft and two tapered roller bearings.
            3. The tension block shall be held in place and guided by two 3/4 inch (19.05 mm) diameter rods, each equipped with adjustable locking collar to limit sheave travel.
        13. Battens: Battens shall be made of 2 inch I.D. nominal, schedule 40 black iron pipe.
        14. Fire line System: The manual fire line release system shall consist of a 1/8 inch diameter wire rope, with six fusible links, side mounting pulleys as required, and two fire line release devices, each mounted in enclosures. Devices shall be mounted 5 feet (1,524 mm) above the stage floor on each side of the proscenium. All other components such as the fire curtain arbor release, round weight arbors, arbor guards, floor pulleys, etc. required to form a fully functional fire line release system shall be provided.
        15. Hand line:
            1. Hand line shall be 3/4 inch (19.1 mm) in diameter, employing a 3-strand composite construction combining filament and staple/spun polyester wrapped around fibrillated polyolefin.
            2. The hand line shall contain an identifying tape showing the manufacturer's name, phone number, website, and year of manufacture.
            3. The hand line shall contain a red safety/wear indicator that shall become visible as the rope nears the end of its useful life.
            4. The rope shall hold knots well and be easily spliced. Rope shall not be subject to rotting, mildew, or moisture damage nor shall its length be affected by changes in humidity.
            5. Tape ends before cutting. Attach to arbor with two half hitches or bowline and tape end to standing line with electrical tape.
            6. Hand lines shall be SureGrip rope.
        16. Lift Cables: The curtain lift cables shall be 1/4 inch (6.4 mm) diameter 7x19 galvanized utility cable as specified. Cables shall be terminated with corresponding cable thimbles and two forged cable clips or a Swage sleeve fitting at each end. The curtain end of each cable shall be attached to the batten using a half pipe clamp.
        17. Safety Chains: Supply one more safety chain than the number of lift cables. 1/4 inch proof coil chains shall be located between lift cables except at the ends where chains shall be 12 inch 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.
     2. Fire Curtain Hoist:
        1. General Description:
           1. Furnish and install a motorized straight lift type, automatically closing fire safety curtain for the proscenium opening indicated on the drawings. Curtain shall lap masonry not less than 18 inch (457.2 mm) at each side of the proscenium opening and 24 inch (609.6 mm) at the top of the proscenium opening.
           2. The curtain shall be arranged to comply with the "International Building Code (2006)", American National Standard E1.22-2009, other 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 by gravity, with the speed of descent controlled by a hydraulic speed regulator. Emergency closing shall occur as specified in NFPA 80 or as required by local codes when the fire line is released or fusible links separate.
        2. Special Conditions: It is the intention of this specification to provide a fully functioning fire safety curtain system. Actual equipment and components shall reflect building conditions and approved construction drawings. All dimensions shall be field verified by the Rigging Contractor.
        3. ZetexPlus Fire Safety Curtain: The curtain shall be fabricated from tightly woven J.R. Clancy ZetexPlus 1210-ZP non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070 inch (1.8 mm) thickness weighing at least 40 ounces per square yard (1.35 KG/sq m). The curtain shall be listed and approved by the State of California Fire Marshal, the NYC Material and Equipment Acceptance Division, and shall bear a certification label from a nationally recognized listing agency. 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 inch (152.4 mm). The bottom pocket shall be equipped with a 3 inch (76.2 mm) yield pad filled with ZetexPlus.
        4. Sides of curtain shall have bronze guides every 18 inch (457.2 mm), securely fastened to a 6 inch (152.4 mm) hem with at least three bolts or rivets, or as required by the governing code.
        5. Guides: Provide 1/4 inch (6.4 mm) wire rope guide at each side of the curtain. These cables shall be attached to a ring at the stage floor level and extend to the roof steel or gridiron where they shall be attached with 3/8 inch x 6 inch (9.525 mm x 152.4 mm) turnbuckles, thimbles, swage sleeves and other fittings as required.
        6. Smoke Pockets: Furnish and install one pair of smoke pockets to extend from the stage floor to a point above the top of the raised curtain or to the height specified in the drawings. Pockets shall consist of a 6 inch deep "Z" channel formed from 1/4 inch (6.4 mm) steel plate and a 1/4 inch x 18 inch (6.4 mm x 457.2 mm) steel plate which shall be bolted to the channels on 2 feet-0 inch (609.6 mm) centers. Channels shall be anchored to the walls on 4 feet-0 inch (1,219 mm) centers.
        7. Smoke Seal: Provide a smoke seal consisting of a triple layer of folded fabric fastened above the proscenium with a mounting clamp so it rubs the curtain and seals the top of the opening. The fabric shall be Zetex 800 cloth with a minimum weight of 27 ounces per square yard (0.91 KG/sq m).
        8. Fire Curtain Hoist:
           1. Hoist shall consist of a cable drum, coupled to an electric gear motor. Hoist shall have a 1,100lb (500 KG) lifting capacity at a rate of 25 feet per minute (0.13 m/s). The hoist shall be fully enclosed and supplied with a sturdy metal stand or wall brackets.
           2. The cable drum shall be of welded steel construction and carry 75 feet (22.86 m) of 5/16 inch (7.94 mm) diameter 7X19 galvanized utility cable. Twin guards shall keep the cable in the drum groove.
           3. 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 20lbs (9 KG) of tension in the fire line shall be required to hold the full load capacity of the winch.
           4. 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.
           5. Gearmotor:

The motor and helical/bevel gearbox shall be an integrated unit, with the first stage pinion mounted directly on the motor's armature shaft.

Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.

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.

* + - * 1. Rotary Limit Switch:

Rotary limit switch assembly shall have four independently adjustable switch/cam sets. Cams shall be driven by a geared assembly.

Switches shall have snap acting contacts.

Switches shall be mounted within the winch base as to allow for easy adjustment of the switch settings.

Rotary limit switches shall be Ravasi.

* + - * 1. All components in the hoist shall be fully enclosed. Access panels for adjustment and maintenance shall be removable without removing the hoist from service.
        2. Fixed Speed Starter:

The hoist shall be controlled by a UL 508E 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.

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 UL 508E Type 2, non-welding, positive break contactors.

Overcurrent protection shall be provided by an IEC Class 10 overload. Short circuit protection shall be provided by a circuit breaker.

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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

The fire curtain hoist shall be sized to accommodate the fire curtain and all associated hardware. The hoist shall include a push button control station. Emergency lowering speed shall be controlled by a hydraulic speed regulator. Hoist shall meet ANSE E1.22 - 2009 "Entertainment Technology Fire Safety Curtain Systems" or NFPA 80 "Standard for Fire Doors and Other Opening Protectives - 2007".

* + - 1. Control Station: Controls, consisting of up and down pushbuttons and an emergency stop switch, are mounted on the motor starter.
      2. Battens: Battens shall be made of 2 inch (50.8 mm) I.D. nominal, schedule 40 black iron pipe.
      3. Fire line System: The manual fire line release system shall consist of a 1/8 inch (3.2 mm) diameter wire rope, with six UL listed fusible links that release at 165 degree F (74 degree C), side mounting pulleys as required, and two fire line release devices, each mounted in a steel enclosure with acrylic viewing window that contains a positive method to release the fire line. Devices shall be mounted 5 feet (1,524 mm) above the stage floor on each side of the proscenium. All other components such as round weight arbors, arbor guards, floor pulleys, etc. required to form a fully functional fire line release system shall be provided.
      4. Lift Cables: The curtain lift cables shall be 1/4 inch (6.4 mm) diameter 7x19 galvanized utility cable as specified. Cables shall be terminated with corresponding cable thimbles and two forged cable clips or a Swage sleeve fitting at each end. The curtain end of each cable shall be attached to the batten using a half pipe clamp.
      5. Safety Chains: Supply one more safety chain than the number of lift cables. 1/4 inch (6.4 mm) minimum, proof coil chains shall be located between lift cables except at the ends where chains shall be 12 inch (304.8 mm) 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.
    1. Line Shaft Hoist:
       1. General Description:
          1. Furnish and install a motorized straight lift type, automatically closing fire safety curtain for the proscenium opening indicated on the drawings. Curtain shall lap masonry not less than 18 inch (457.2 mm) at each side of the proscenium opening and 24 inch (609.6 mm) at the top of the proscenium opening.
          2. The curtain shall be arranged to comply with the "International Building Code (2006)", American National Standard E1.22-2009, other 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 by gravity, with the speed of descent controlled by a hydraulic speed regulator. Emergency closing shall occur as specified in NFPA 80 or as required by local codes when the fire line is released or fusible links separate.
       2. Special Conditions: It is the intention of this specification to provide a fully functioning fire safety curtain system. Actual equipment and components shall reflect building conditions and approved construction drawings. All dimensions shall be field verified by the Rigging Contractor.
       3. ZetexPlus Fire Safety Curtain: The curtain shall be fabricated from tightly woven J.R. Clancy ZetexPlus 1210-ZP non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070 inch (1.8 mm) thickness weighing at least 40 ounces per square yard (1.35 KG/sq m). The curtain shall be listed and approved by the State of California Fire Marshal, the NYC Material and Equipment Acceptance Division, and shall bear a certification label from a nationally recognized listing agency. 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 inch (152.4 mm). The bottom pocket shall be equipped with a 3 inch (76.2 mm) yield pad filled with ZetexPlus.
       4. Sides of curtain shall have bronze guides every 18 inch (457.2 mm), securely fastened to a 6 inch (152.4 mm) hem with at least three bolts or rivets, or as required by the governing code.
       5. Guides: Provide 1/4 inch (6.4 mm) wire rope guide at each side of the curtain. These cables shall be attached to a ring at the stage floor level and extend to the roof steel or gridiron where they shall be attached with 3/8 inch x 6 inch (9.525 mm x 152.4 mm) turnbuckles, thimbles, swage sleeves and other fittings as required.
       6. Smoke Pockets: Furnish and install one pair of smoke pockets to extend from the stage floor to a point above the top of the raised curtain or to the height specified in the drawings. Pockets shall consist of a 6 inch deep "Z" channel formed from 1/4 inch (6.4 mm) steel plate and a 1/4 inch x 18 inch (6.4 mm x 457.2 mm) steel plate which shall be bolted to the channels on 2 feet-0 inch (609.6 mm) centers. Channels shall be anchored to the walls on 4 feet-0 inch (1,219 mm) centers.
       7. Smoke Seal: Provide a smoke seal consisting of a triple layer of folded fabric fastened above the proscenium with a mounting clamp so it rubs the curtain and seals the top of the opening. The fabric shall be Zetex 800 cloth with a minimum weight of 27 oz. per square yard (0.91 KG/sq m).
       8. Line Shaft Fire Curtain Hoist:
          1. The hoist shall consist of a gearmotor assembly, a drum for each lift line, and interconnecting shafts. The gearmotor assembly shall include a brake release and a hydraulic speed regulator, allowing the curtain to close at a controlled rate of speed when the brake is released by the activation of the fire line. The hoist shall have a minimum1,400 lb (635 KG) lifting capacity at a rate of 25 feet per minute (0.127 m/s).
          2. Gearmotor:

The motor, primary brake and gearbox shall be an integrated unit, with the first stage pinion gear and the primary brake both mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor, primary brake and gear reducer.

Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.

The gear reducer shall be a helical bevel reducer. The gear case shall be cast iron for protection against shock damage. The output shaft(s) 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.

Brakes shall be normally spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall be an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.

* + - * 1. Drums.

Each helical drum shall be supported by a sturdy steel base, holding the elements of the drum assembly in proper alignment. Both ends of each drum shall be supported by a self-aligning flange bearing.

Alternate drums shall be threaded in opposite directions, to keep the batten from "walking" as its elevation changes.

Drums shall be interconnected by shafts with universal joints at each end. Shafts without universal joints are not acceptable.

* + - * 1. Rotary Limit Switches:

Rotary limit switch assemblies shall have two or four independently adjustable switch/cam sets as required. Cams shall be driven by a geared assembly.

Switches shall have snap acting contacts.

Rotary limit switches shall be driven directly or by roller chains. If roller chains are used, sprockets shall be pinned to prevent slipping and sized for maximum usable rotation of switch cams. The input shaft and drive chain shall be fully guarded.

Switches shall be mounted to the hoist base to allow for easy adjustment of the switch settings.

* + - * 1. Fixed Speed Starter:

The traction drive hoist shall be controlled by a UL 508E 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.

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 UL 508E Type 2, non-welding, positive break contactors.

Overcurrent protection shall be provided by an IEC Class 10 overload. Short circuit protection shall be provided by a circuit breaker.

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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

* + - 1. Control Stations: Two control stations shall be provided in wall mounted NEMA 12 enclosures. Each shall contain hold to operate (dead man) Up and Down pushbuttons, and a mushroom head emergency stop pushbutton.
      2. Battens: Battens shall be made of 2 inch (50.8 mm) I.D. nominal, schedule 40 black iron pipe.
      3. Fire line System: The manual fire line release system shall consist of a 1/8 inch (3.2 mm) diameter wire rope, with six fusible links, side mounting pulleys as required, and two fire line release devices, each mounted in a steel enclosure with acrylic viewing window that contains a positive method to release the fire line. Devices shall be mounted 5 feet (1,524 mm) above the stage floor on each side of the proscenium. All other components such as round weight arbors, arbor guards, floor pulleys, etc. required to form a fully functional fire line release system shall be provided.
      4. Lift Cables: The curtain lift cables shall be 1/4 inch (6.4 mm) diameter 7x19 galvanized utility cable as specified. Cables shall be terminated with corresponding cable thimbles and two forged cable clips or a Swage sleeve fitting at each end. The curtain end of each cable shall be attached to the batten using a half pipe clamp.
      5. Safety Chains: Supply one more safety chain than the number of lift cables. 1/4 inch (6.4 mm) minimum, proof coil chains shall be located between lift cables except at the ends where chains shall be 12 inch (304.8 mm) 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.
    1. Traction Drive Hoist .
       1. General Description:
          1. Furnish and install a motorized straight lift type, automatically closing fire safety curtain for the proscenium opening indicated on the drawings. Curtain shall lap masonry not less than 18 inch (457.2 mm) at each side of the proscenium opening and 24 inch (609.6 mm) at the top of the proscenium opening.
          2. The curtain shall be arranged to comply with the "International Building Code (2006)", American National Standard E1.22-2009, other 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 by gravity due to over-balance of the curtain as specified below. Emergency closing shall occur as specified in NFPA 80 or as required by local codes when the fire line is released or fusible links separate.
       2. Special Conditions: It is the intention of this specification to provide a fully functioning fire safety curtain system. Actual equipment and components shall reflect building conditions and approved construction drawings. All dimensions shall be field verified by the Rigging Contractor.
       3. ZetexPlus Fire Safety Curtain: The curtain shall be fabricated from tightly woven J.R. Clancy ZetexPlus 1210-ZP non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070 inch (1.778 mm) thickness weighing at least 40 ounces per square yard (1.35 KG/sq m). The curtain shall be listed and approved by the State of California Fire Marshall, the NYC Material Acceptance and Equipment Acceptance Division, and shall bear a certification label from a nationally recognized listing agency. 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 inch (152.4 mm). The bottom pocket shall be equipped with a 3 inch (76.2 mm) yield pad filled with ZetexPlus.
       4. Sides of curtain shall have bronze guides every 18 inch (457.2 mm), securely fastened to a 6 inch (152.4 mm) hem with at least three bolts or rivets, or as required by the governing code.
       5. Guides: Provide 1/4 inch (6.4 mm) wire rope guide at each side of the curtain. These cables shall be attached to a ring at the stage floor level and extend to the roof steel or gridiron where they shall be attached with 3/8 inch x 6 inch (9.525 mm x 152.4 mm) turnbuckles, thimbles, swage sleeves and other fittings as required.
       6. Smoke Pockets: Furnish and install one pair of smoke pockets to extend from the stage floor to a point above the top of the raised curtain or to the height specified in the drawings. Pockets shall consist of a 6 inch deep "Z" channel formed from 1/4 inch (6.4 mm) steel plate and a 1/4 inch x 18 inch (6.4 mm x 457.2 mm) steel plate which shall be bolted to the channels on 2 feet-0 inch (609.6 mm) centers. Channels shall be anchored to the walls on 4 feet-0 inch (1,219 mm) centers.
       7. Smoke Seal: Provide a smoke seal consisting of a triple layer of folded fabric fastened above the proscenium with a mounting clamp so it rubs the curtain and seals the top of the opening. The fabric shall be Zetex 800 cloth with a minimum weight of 27 oz. per square yard (0.91 KG/sq m).
       8. Traction Style Fire Curtain Hoist:
          1. The hoist shall consist of a traction sheave and a manual clutch with throw out fork, direct coupled and keyed to the output shaft of the gearbox. The entire assembly shall be mounted on a heavy channel base. The hoist shall have a 2,000lb (907.2 KG) lifting capacity at a rate of 25 feet per minute (0.127 m/s).
          2. The iron or steel sheave shall be a minimum diameter of 40 times cable diameter with V-grooves for the number and diameter of lift lines required.
          3. The clutch shall be rated for the applied load. The clutch lever arm shall be kept engaged by tension in the fire line that passes through a pulley in the handle. Release of the clutch is ensured by an overbalance weight acting on the arm.
          4. Gearmotor:

The motor, primary brake and gearbox shall be an integrated unit, with the first stage pinion gear and the primary brake both mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor, primary brake and gear reducer.

Motor shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.

The gear reducer shall be a combination helical/bevel reducer. The gear case shall be cast iron for protection against shock damage. The output shaft(s) 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.

Brakes shall be normally spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall be an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.

* + - * 1. Four direct struck limit switches shall be installed so that they are operated by the fire curtain arbor. These shall provide top and bottom limits of travel as well as overtravel functions. The direct struck limit switches shall be heavy duty, lever operated rotary head units, with positive opening contacts. Direct struck limit switches shall be Telemecanique ZCKJ series or equal.
        2. Fixed Speed Starter:

The traction drive hoist shall be controlled by a UL 508E 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.

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 UL 508E Type 2, non-welding, positive break contactors.

Overcurrent protection shall be provided by an IEC Class 10 overload. Short circuit protection shall be provided by a circuit breaker.

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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

* + - * 1. Control Stations: Two control stations shall be provided in wall mounted NEMA 12 enclosures. Each shall contain hold to operate (dead man) Up and Down pushbuttons, and a mushroom head emergency stop pushbutton.
      1. Loft Block:
         1. The sheave shall have a 12 inch (304.8 mm) pitch diameter, and shall be an iron casting, with a machined groove. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
         2. Base angles shall be a minimum 2 inch x 1-1/2 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle.
         3. Side plates shall be a minimum of 10-gauge (3.57 mm) 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 1400 lbs (635 KG), and shall be designed for use in either upright or underhung usage.
         5. Loft blocks shall have cast iron sheave grooved for one 3/8 inch (9.5 mm) lift line.
      2. Counterweight Arbor:
         1. Arbor shall be long enough to accommodate counterweights to balance the fire curtain and related equipment.
         2. The arbor top shall be a fabricated weldment of 1/2 inch(12.7 mm) formed steel plate and 7 gauge (4.76 mm) formed side plates. The side plates shall be punched to receive 8 cables, and shall be tied together with a bolt and spacer providing a tie-off point for the hand line.
         3. The arbor bottom shall be 1/2 inch x 3 inch (12.7 mm x 76.2 mm) steel bar with counterweight rests to keep the weights from resting on the arbor inner nuts, and a forged steel eye for the hand line tie off.
         4. The top and bottom of the arbor shall be tied together by means of two 3/4 inch (19.1 mm) steel arbor rods. The arbor rods shall have three nuts at each end, the outermost being a lock nut.
         5. The top and bottom shall have bronze guides to engage the lattice track.
         6. Provide 14 gauge (1.98 mm) spreader plates (two minimum) on arbor rods so they can be spaced between counterweights on 2 feet (609.6 mm) centers. Provide a retaining collar on each rod, each with a 1/4 inch (6.4 mm) set screw with red plastic knob for easy locking. One retaining collar shall be welded to the top spreader plate.
      3. Lattice Track:
         1. The track shall consist of two 2 inch x 2 inch x 1/4 inch (50.8 mm x 50.8 mm x 6.4 mm) angles opposing each other with formed brackets alternating front and back on 2 feet centers. Back brackets shall contain two 9/16 inch (14.3 mm) diameter holes for proper anchorage to wall.
         2. A fabricated steel bracket shall support the bottom of the lattice. Bracket shall have ample clearance for passage of hand line.
      4. Battens: Battens shall be made of 2 inch (50.8 mm) I.D. nominal, schedule 40 black iron pipe.
      5. Fire line System: The manual fire line release system shall consist of a 1/8 inch (3.2 mm) diameter wire rope, with six fusible links, side mounting pulleys as required, and two fire line release devices, each mounted in enclosures. Devices shall be mounted 5' (1,524 mm) above the stage floor on each side of the proscenium. All other components such as round weight arbors, arbor guards, floor pulleys, etc. required to form a fully functional fire line release system shall be provided.
      6. Lift Cables: The curtain lift cables shall be 3/8 inch (9.5 mm) diameter 7 x 19 galvanized utility cable as specified. Cables shall be terminated with corresponding cable thimbles and two forged cable clips or a Swage sleeve fitting at each end. The curtain end of each cable shall be attached to the batten using a pipe clamp.
      7. Safety Chains: Supply one more safety chain than the number of lift cables. 1/4 inch (6.4 mm) minimum, proof coil chains shall be located between lift cables except at the ends where chains shall be 12 inch (304.8 mm) 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.
    1. Drum Hoist:
       1. General Description:
          1. Furnish and install a motorized straight lift type, automatically closing fire safety curtain for the proscenium opening indicated on the drawings. Curtain shall lap masonry not less than 18 inch (457.2 mm) at each side of the proscenium opening and 24 inch (609.6 mm) at the top of the proscenium opening.
          2. The curtain shall be arranged to comply with the "International Building Code (2006)", American National Standard E1.22-2009, other 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 by gravity due to over-balance of the curtain as specified below. Emergency closing shall occur as specified in NFPA 80 or as required by local codes when the fire line is released or fusible links separate.
       2. Special Conditions: It is the intention of this specification to provide a fully functioning fire safety curtain system. Actual equipment and components shall reflect building conditions and approved construction drawings. All dimensions shall be field verified by the Rigging Contractor.
       3. ZetexPlus Fire Safety Curtain: The curtain shall be fabricated from tightly woven J.R. Clancy ZetexPlus 1210-ZP non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070 inch (1.778 mm) thickness weighing at least 40 ounces per square yard (1.35 KG/sq m). The curtain shall be listed and approved by the State of California Fire Marshall, the NYC Material Acceptance and Equipment Acceptance Division, and shall bear a certification label from a nationally recognized listing agency. 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 inch (152.4 mm). The bottom pocket shall be equipped with a 3 inch (76.2 mm) yield pad filled with ZetexPlus.
       4. Sides of curtain shall have bronze guides every 18 inch (457.2 mm), securely fastened to a 6 inch (152.4 mm) hem with at least three bolts or rivets, or as required by the governing code.
       5. Guides: Provide 1/4 inch (6.4 mm) wire rope guide at each side of the curtain. These cables shall be attached to a ring at the stage floor level and extend to the roof steel or gridiron where they shall be attached with 3/8 inch x 6 inch (9.525 mm x 152.4 mm) turnbuckles, thimbles, swage sleeves and other fittings as required.
       6. Smoke Pockets: Furnish and install one pair of smoke pockets to extend from the stage floor to a point above the top of the raised curtain or to the height specified in the drawings. Pockets shall consist of a 6 inch deep "Z" channel formed from 1/4 inch (6.4 mm) steel plate and a 1/4 inch x 18 inch (6.4 mm x 457.2 mm) steel plate which shall be bolted to the channels on 2 feet-0 inch (609.6 mm) centers. Channels shall be anchored to the walls on 4 feet-0 inch (1,219 mm) centers.
       7. Smoke Seal: Provide a smoke seal consisting of a triple layer of folded fabric fastened above the proscenium with a mounting clamp so it rubs the curtain and seals the top of the opening. The fabric shall be Zetex 800 cloth with a minimum weight of 27 oz. per square yard (0.91 KG/sq m).
       8. Drum Style Fire Curtain Hoist:
          1. The hoist shall be mounted to allow dual drive lines to travel from either side of the fire curtain centerline, over loft blocks and to the hoist drum.
          2. The hoist shall consist of a cable drum and a manual clutch with throw out fork, direct coupled and keyed to the output shaft of the gearbox. The entire assembly shall be mounted on a heavy channel base. The hoist shall have a 2,000lb (907.2 KG) lifting capacity at a rate of 25 feet per minute (0.127 m/s).
          3. The drum shall be a minimum diameter of 30 times cable diameter with helical grooves for the number and diameter of lift lines required.
          4. The clutch shall be rated for the applied load. The clutch lever arm shall be kept engaged by tension in the fire line that passes through a pulley in the handle. Release of the clutch is ensured by an overbalance weight acting on the arm.
          5. Gearmotor:

The motor, primary brake and gearbox shall be an integrated unit, with the first stage pinion gear and the primary brake both mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor, primary brake and gear reducer.

Motor shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.

The gear reducer shall be a combination helical/bevel reducer. The gear case shall be cast iron for protection against shock damage. The output shaft(s) 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.

Brakes shall be normally spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall be an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.

* + - * 1. Four direct struck limit switches shall be installed so that they are operated by the fire curtain arbor. These shall provide top and bottom limits of travel as well as overtravel functions. The direct struck limit switches shall be heavy duty, lever operated rotary head units, with positive opening contacts. Direct struck limit switches shall be Telemecanique ZCKJ series or equal.
        2. Fixed Speed Starter:

The hoist shall be controlled by a UL 508E 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.

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 UL 508E Type 2, non-welding, positive break contactors.

Overcurrent protection shall be provided by an IEC Class 10 overload. Short circuit protection shall be provided by a circuit breaker.

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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

* + - * 1. Control Stations: Two control stations shall be provided in wall mounted NEMA 12 enclosures. Each shall contain hold to operate (dead man) Up and Down pushbuttons, and a mushroom head emergency stop pushbutton.
      1. Loft Block:
         1. The sheave shall have a 12 inch (304.8 mm) pitch diameter, and shall be an iron casting, with a machined groove. The sheave shall be equipped with a 1 (25.4 mm) diameter shaft and two tapered roller bearings.
         2. Base angles shall be a minimum 2 inch x 1-1/2 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle.
         3. Side plates shall be a minimum of 10-gauge (3.57 mm) 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 1400 lbs (635 KG), and shall be designed for use in either upright or underhung usage.
         5. Loft blocks shall have cast iron sheave grooved for one 3/8 inch (9.5 mm) lift line.
      2. Counterweight Arbor:
         1. Arbor shall be long enough to accommodate counterweights to permit normal motorized operation of the fire curtain and emergency closure without power.
         2. The arbor top shall be a fabricated weldment of 1/2 inch (12.7 mm) formed steel plate and 7 gauge (4.76 mm) formed side plates. The side plates shall be punched to receive 8 cables, and shall be tied together with a bolt and spacer providing a tie-off point for the hand line.
         3. The arbor bottom shall be 1/2 inch x 3 inch (12.7 mm x 76.2 mm) steel bar with counterweight rests to keep the weights from resting on the arbor inner nuts, and a forged steel eye for the hand line tie off.
         4. The top and bottom of the arbor shall be tied together by means of two 3/4 inch (19.1 mm) steel arbor rods. The arbor rods shall have three nuts at each end, the outermost being a lock nut.
         5. The top and bottom shall have bronze guides to engage the lattice track.
         6. Provide 14 gauge (1.98 mm) spreader plates (two minimum) on arbor rods so they can be spaced between counterweights on 2 feet (609.6 mm) centers. Provide a retaining collar on each rod, each with a 1/4 inch (6.4 mm) set screw with red plastic knob for easy locking. One retaining collar shall be welded to the top spreader plate.
      3. Lattice Track:
         1. The track shall consist of two 2 inch x 2 inch x 1/4 inch (50.8 mm x 50.8 mm x 6.4 mm) angles opposing each other with formed brackets alternating front and back on 2 feet centers. Back brackets shall contain two 9/16 inch (14.3 mm) diameter holes for proper anchorage to wall.
         2. A fabricated steel bracket shall support the bottom of the lattice. Bracket shall have ample clearance for passage of hand line.
      4. Battens: Battens shall be made of 2 inch (50.8 mm) I.D. nominal, schedule 40 black iron pipe.
      5. Fire line System: The manual fire line release system shall consist of a 1/8 inch (3.2 mm) diameter wire rope, with six fusible links, side mounting pulleys as required, and two fire line release devices, each mounted in enclosures. Devices shall be mounted 5 feet (1,524 mm) above the stage floor on each side of the proscenium. All other components such as round weight arbors, arbor guards, floor pulleys, etc. required to form a fully functional fire line release system shall be provided.
      6. Lift Cables: The curtain lift cables shall be 3/8 inch (9.5 mm) diameter 7 x 19 galvanized utility cable as specified. Cables shall be terminated with corresponding cable thimbles and two forged cable clips or a Swage sleeve fitting at each end. The curtain end of each cable shall be attached to the batten using a pipe clamp.
      7. Safety Chains: Supply one more safety chain than the number of lift cables. 1/4 inch (6.4 mm) minimum, proof coil chains shall be located between lift cables except at the ends where chains shall be 12 inch (304.8 mm) 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.
  1. FIRE CURTAIN SYSTEMS, STRAIGHT LIFT CURTAIN, PROSCENIUM OPENING UP TO 22'T x 42'W
     1. Manual (Arbor/Lattice Track):
        1. Product: Model F201m Manual Straight Lift Fire Curtain With Smoke Pocket Roller Guide and Metal Edge Curtain Channel.
        2. General Description:
           1. Furnish and install a manually operated straight lift type, automatically closing fire safety curtain for the proscenium opening indicated on the drawings. Curtain shall lap masonry not less than 18 inch at each side of the proscenium opening and 24 inch at the top of the proscenium opening.
           2. The curtain shall be arranged to comply with the "International Building Code (2006)", American National Standard E1.22-2009, other 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 by gravity due to over-balance of the curtain as specified below. Emergency closing shall occur as specified in NFPA 80 or as required by local codes when the fire line is released or fusible links separate.
        3. Special Conditions: It is the intention of this specification to provide a fully functioning fire safety curtain system. Actual equipment and components shall reflect building conditions and approved construction drawings. All dimensions shall be field verified by the Rigging Contractor.
        4. ZetexPlus Fire Safety Curtain: The curtain shall be fabricated from tightly woven J.R. Clancy ZetexPlus 1210-ZP non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070 inch (1.778 mm) thickness weighing at least 40 ounces per square yard (1.35 KG/sq m). The curtain shall be listed and approved by the State of California Fire Marshall, the NYC Material and Equipment Acceptance Division, and shall bear a certification label from a nationally recognized listing agency. 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 inch (152.4 mm). The bottom pocket shall be equipped with a 3 inch (76.2 mm) yield pad filled with ZetexPlus.
        5. Metal Edge Channel:
           1. Fire curtain vertical edges shall have u-shaped, 16 gauge (1.59 mm) steel reinforcement 6 inch (152.4 mm) deep.
           2. Channels shall attach to the curtain using the curtain guide bolts.
           3. Channels are supplied in 5 feet (1.52 m) and 10 feet (3,04 m) long sections and can be field cut.
        6. Smoke Pockets with Track: Furnish and install one pair of smoke pockets to extend from the stage floor to a point above the top of the raised curtain or to the height specified in the drawings. Pockets shall consist of a 6 inch (152 mm) deep "Z" channel formed from 1/4 inch (6.4 mm) steel plate and a 1/4 inch x 18 inch (6.4 mm x 457 mm) steel plate bolted to the channels on 2 feet-0 inch (0.61 m) centers. A 14 ga. (1.98 mm) steel channel track, entirely enclosed except for a slot in the side, shall be bolted to the side of the smoke pocket to carry the guide rollers. Channels shall be anchored to the walls on 4 feet-0 inch (1.22 m) centers.
        7. Smoke Seal: Provide a smoke seal consisting of a triple layer of folded fabric fastened above the proscenium with a mounting clamp so it rubs the curtain and seals the top of the opening. The fabric shall be Zetex 800 cloth with a minimum weight of 27 oz. per square yard (0.91 KG/sq m).
        8. 12 inch (304.8 mm) Head Block:
           1. The sheave shall be an iron casting with a 12 inch (304.8 mm) outer diameter. The machined rope and cable grooves shall have equal pitch diameters. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
           2. Base angles shall be a minimum 2 inch x 1-1/2 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.35 mm) angle with the short leg turned in. The turned in leg shall be notched to allow clear passage of all cables.
           3. Side plates shall be a minimum of 10-gauge (3.570 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
           4. The block and associated mounting hardware shall have a recommended working load of at least 2,500 lbs. (1,134 KG).
           5. Head blocks shall be grooved for six or eight 1/4 inch (6.4 mm) lift lines and one 3/4 inch (19.05 mm) hand line.
        9. Loft Block:
           1. The sheave shall have an 8-1/2 inch (215.9 mm) 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 inch x 1-1/2 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle.
           3. Side plates shall be a minimum of 12-gauge (2.78 mm) 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. (226.8 KG), and shall be designed for use in either upright or underhung usage.
           5. Loft blocks shall be cast iron sheave grooved for one 1/4 inch (6.35 mm) lift line.
        10. Counterweight Arbor:
            1. Arbor shall be long enough to accommodate counterweights to balance the fire curtain and related equipment.
            2. The arbor top shall be a fabricated weldment of 1/2 inch (12.7 mm) formed steel plate and 7 gauge (4.76 mm) formed side plates. The side plates shall be punched to receive 8 cables, and shall be tied together with a bolt and spacer providing a tie-off point for the hand line.
            3. The arbor bottom shall be 1/2 inch x 3 inch (12.7 mm x 76.2 mm) steel bar with counterweight rests to keep the weights from resting on the arbor inner nuts, and a forged steel eye for the hand line tie off.
            4. The top and bottom of the arbor shall be tied together by means of two 3/4 inch (19.05 mm) steel arbor rods. The arbor rods shall have three nuts at each end, the outermost being a lock nut.
            5. The top and bottom shall have bronze guides to engage the lattice track.
            6. Provide 14 gauge (1.98 mm) spreader plates (two minimum) on arbor rods so they can be spaced between counterweights on 2 feet (609.6 mm) centers. Provide a retaining collar on each rod, each with a 1/4 inch (6.35 mm) set screw with red plastic knob for easy locking. One retaining collar shall be welded to the top spreader plate.
        11. Lattice Track:
            1. The track shall consist of two 2 inch x 2 inch x 1/4 inch (50.8 mm x 50.8 mm x 6.35 mm) angles opposing each other with formed brackets alternating front and back on 2 feet centers. Back brackets shall contain two 9/16 inch (14.29 mm) diameter holes for proper anchorage to wall.
            2. A fabricated steel bracket shall support the bottom of the lattice. Bracket shall have ample clearance for passage of hand line.
        12. Automatic Floor Block:
            1. The cast iron sheave shall have a 12 inch (304.8 mm) outside diameter, and shall be an iron casting, with a groove for a 1 inch (25.4 mm) rope.
            2. The sheave shall be equipped with a 1 inch (25.4 mm) diameter machined steel shaft and two tapered roller bearings.
            3. The tension block shall be held in place and guided by two 3/4 inch (19.05 mm) diameter rods, each equipped with adjustable locking collar to limit sheave travel.
        13. Battens: Battens shall be made of 2 inch I.D. nominal, schedule 40 black iron pipe.
        14. Fire line System: The manual fire line release system shall consist of a 1/8 inch diameter wire rope, with six fusible links, side mounting pulleys as required, and two fire line release devices, each mounted in enclosures. Devices shall be mounted 5 feet (1,524 mm) above the stage floor on each side of the proscenium. All other components such as the fire curtain arbor release, round weight arbors, arbor guards, floor pulleys, etc. required to form a fully functional fire line release system shall be provided.
        15. Hand line:
            1. Hand line shall be 3/4 inch (19.1 mm) in diameter, employing a 3-strand composite construction combining filament and staple/spun polyester wrapped around fibrillated polyolefin.
            2. The hand line shall contain an identifying tape showing the manufacturer's name, phone number, website, and year of manufacture.
            3. The hand line shall contain a red safety/wear indicator that shall become visible as the rope nears the end of its useful life.
            4. The rope shall hold knots well and be easily spliced. Rope shall not be subject to rotting, mildew, or moisture damage nor shall its length be affected by changes in humidity.
            5. Tape ends before cutting. Attach to arbor with two half hitches or bowline and tape end to standing line with electrical tape.
            6. Hand lines shall be SureGrip rope.
        16. Lift Cables: The curtain lift cables shall be 1/4 inch (6.4 mm) diameter 7x19 galvanized utility cable as specified. Cables shall be terminated with corresponding cable thimbles and two forged cable clips or a Swage sleeve fitting at each end. The curtain end of each cable shall be attached to the batten using a half pipe clamp.
        17. Safety Chains: Supply one more safety chain than the number of lift cables. 1/4 inch proof coil chains shall be located between lift cables except at the ends where chains shall be 12 inch 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.
     2. Fire Curtain Hoist:
        1. General Description:
           1. Furnish and install a motorized straight lift type, automatically closing fire safety curtain for the proscenium opening indicated on the drawings. Curtain shall lap masonry not less than 18 inch (457.2 mm) at each side of the proscenium opening and 24 inch (609.6 mm) at the top of the proscenium opening.
           2. The curtain shall be arranged to comply with the "International Building Code (2006)", American National Standard E1.22-2009, other 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 by gravity, with the speed of descent controlled by a hydraulic speed regulator. Emergency closing shall occur as specified in NFPA 80 or as required by local codes when the fire line is released or fusible links separate.
        2. Special Conditions: It is the intention of this specification to provide a fully functioning fire safety curtain system. Actual equipment and components shall reflect building conditions and approved construction drawings. All dimensions shall be field verified by the Rigging Contractor.
        3. ZetexPlus Fire Safety Curtain: The curtain shall be fabricated from tightly woven J.R. Clancy ZetexPlus 1210-ZP non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070 inch (1.8 mm) thickness weighing at least 40 ounces per square yard (1.35 KG/sq m). The curtain shall be listed and approved by the State of California Fire Marshal, the NYC Material and Equipment Acceptance Division, and shall bear a certification label from a nationally recognized listing agency. 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 inch (152.4 mm). The bottom pocket shall be equipped with a 3 inch (76.2 mm) yield pad filled with ZetexPlus.
        4. Sides of curtain shall have bronze guides every 18 inch (457.2 mm), securely fastened to a 6 inch (152.4 mm) hem with at least three bolts or rivets, or as required by the governing code.
        5. Metal Edge Channel:
           1. Fire curtain vertical edges shall have u-shaped, 16 gauge (1.6 mm) steel reinforcement 6 inch (152 mm) deep.
           2. Channels shall attach to the curtain using the curtain guide bolts.
           3. Channels are supplied in 5 feet (1.5 m) and 10 feet (305 mm) long sections and can be field cut.
        6. Guides: Provide 1/4 inch (6.4 mm) wire rope guide at each side of the curtain. These cables shall be attached to a ring at the stage floor level and extend to the roof steel or gridiron where they shall be attached with 3/8 inch x 6 inch (9.525 mm x 152.4 mm) turnbuckles, thimbles, swage sleeves and other fittings as required.
        7. Smoke Pockets: Furnish and install one pair of smoke pockets to extend from the stage floor to a point above the top of the raised curtain or to the height specified in the drawings. Pockets shall consist of a 6 inch deep "Z" channel formed from 1/4 inch (6.4 mm) steel plate and a 1/4 inch x 18 inch (6.4 mm x 457.2 mm) steel plate which shall be bolted to the channels on 2 feet-0 inch (609.6 mm) centers. Channels shall be anchored to the walls on 4 feet-0 inch (1,219 mm) centers.
        8. Smoke Seal: Provide a smoke seal consisting of a triple layer of folded fabric fastened above the proscenium with a mounting clamp so it rubs the curtain and seals the top of the opening. The fabric shall be Zetex 800 cloth with a minimum weight of 27 oz. per square yard (0.91 KG/sq m).
        9. Fire Curtain Hoist:
           1. Hoist shall consist of a cable drum, coupled to an electric gear motor. Hoist shall have an 1,100lb (500 KG) lifting capacity at a rate of 25 feet per minute (0.13 m/s). The hoist shall be fully enclosed and supplied with a sturdy metal stand or wall brackets.
           2. The cable drum shall be of welded steel construction and carry 75 feet (22.86 m) of 5/16 inch (7.94 mm) diameter 7X19 galvanized utility cable. Twin guards shall keep the cable in the drum groove.
           3. 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 20lbs (9 KG) of tension in the fire line shall be required to hold the full load capacity of the winch.
           4. 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.
           5. Gearmotor:

The motor and helical/bevel gearbox shall be an integrated unit, with the first stage pinion mounted directly on the motor's armature shaft.

Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.

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.

* + - * 1. Rotary Limit Switch:

Rotary limit switch assembly shall have four independently adjustable switch/cam sets. Cams shall be driven by a geared assembly.

Switches shall have snap acting contacts.

Switches shall be mounted within the winch base as to allow for easy adjustment of the switch settings.

Rotary limit switches shall be Ravasi.

* + - * 1. All components in the hoist shall be fully enclosed. Access panels for adjustment and maintenance shall be removable without removing the hoist from service.
        2. Fixed Speed Starter:

The hoist shall be controlled by a UL 508E 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.

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 UL 508E Type 2, non-welding, positive break contactors.

Overcurrent protection shall be provided by an IEC Class 10 overload. Short circuit protection shall be provided by a circuit breaker.

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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

The fire curtain hoist shall be J.R. Clancy Motorized Fire Curtain Hoist.

* + - 1. Control Station: Controls, consisting of up and down pushbuttons and an emergency stop switch, are mounted on the motor starter.
      2. Battens: Battens shall be made of 2 inch (50.8 mm) I.D. nominal, schedule 40 black iron pipe.
      3. Fire line System: The manual fire line release system shall consist of a 1/8 inch (3.2 mm) diameter wire rope, with six fusible links, side mounting pulleys as required, and two fire line release devices, each mounted in a steel enclosure with acrylic viewing window that contains a positive method to release the fire line. Devices shall be mounted 5 feet (1,524 mm) above the stage floor on each side of the proscenium. All other components such as round weight arbors, arbor guards, floor pulleys, etc. required to form a fully functional fire line release system shall be provided.
      4. Lift Cables: The curtain lift cables shall be 1/4 inch (6.4 mm) diameter 7x19 galvanized utility cable as specified. Cables shall be terminated with corresponding cable thimbles and two forged cable clips or a Swage sleeve fitting at each end. The curtain end of each cable shall be attached to the batten using a half pipe clamp.
      5. Safety Chains: Supply one more safety chain than the number of lift cables. 1/4 inch (6.4 mm) minimum, proof coil chains shall be located between lift cables except at the ends where chains shall be 12 inch (304.8 mm) 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.
    1. Line Shaft Hoist.
       1. General Description:
          1. Furnish and install a motorized straight lift type, automatically closing fire safety curtain for the proscenium opening indicated on the drawings. Curtain shall lap masonry not less than 18 inch (457.2 mm) at each side of the proscenium opening and 24 inch (609.6 mm) at the top of the proscenium opening.
          2. The curtain shall be arranged to comply with the "International Building Code (2006)", American National Standard E1.22-2009, other 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 by gravity, with the speed of descent controlled by a hydraulic speed regulator. Emergency closing shall occur as specified in NFPA 80 or as required by local codes when the fire line is released or fusible links separate.
       2. Special Conditions: It is the intention of this specification to provide a fully functioning fire safety curtain system. Actual equipment and components shall reflect building conditions and approved construction drawings. All dimensions shall be field verified by the Rigging Contractor.
       3. ZetexPlus Fire Safety Curtain: The curtain shall be fabricated from tightly woven J.R. Clancy ZetexPlus 1210-ZP non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070 inch (1.8 mm) thickness weighing at least 40 ounces per square yard (1.35 KG/sq m). The curtain shall be listed and approved by the State of California Fire Marshal, the NYC Material and Equipment Acceptance Division, and shall bear a certification label from a nationally recognized listing agency. 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 inch (152.4 mm). The bottom pocket shall be equipped with a 3 inch (76.2 mm) yield pad filled with ZetexPlus.
       4. Sides of curtain shall have bronze guides every 18 inch (457.2 mm), securely fastened to a 6 inch (152.4 mm) hem with at least three bolts or rivets, or as required by the governing code.
       5. Metal Edge Channel:
          1. Fire curtain vertical edges shall have u-shaped, 16 gauge (1.6 mm) steel reinforcement 6 inch (152 mm) deep.
          2. Channels shall attach to the curtain using the curtain guide bolts.
          3. Channels are supplied in 5 feet (1.5 m) and 10 feet (305 mm) long sections and can be field cut.
       6. Guides: Provide 1/4 inch (6.4 mm) wire rope guide at each side of the curtain. These cables shall be attached to a ring at the stage floor level and extend to the roof steel or gridiron where they shall be attached with 3/8 inch x 6 inch (9.525 mm x 152.4 mm) turnbuckles, thimbles, swage sleeves and other fittings as required.
       7. Smoke Pockets: Furnish and install one pair of smoke pockets to extend from the stage floor to a point above the top of the raised curtain or to the height specified in the drawings. Pockets shall consist of a 6 inch deep "Z" channel formed from 1/4 inch (6.4 mm) steel plate and a 1/4 inch x 18 inch (6.4 mm x 457.2 mm) steel plate which shall be bolted to the channels on 2 feet-0 inch (609.6 mm) centers. Channels shall be anchored to the walls on 4 feet-0 inch (1,219 mm) centers.
       8. Smoke Seal: Provide a smoke seal consisting of a triple layer of folded fabric fastened above the proscenium with a mounting clamp so it rubs the curtain and seals the top of the opening. The fabric shall be Zetex 800 cloth with a minimum weight of 27 oz. per square yard (0.91 KG/sq m).
       9. Line Shaft Fire Curtain Hoist:
          1. The hoist shall consist of a gearmotor assembly, a drum for each lift line, and interconnecting shafts. The gearmotor assembly shall include a brake release and a hydraulic speed regulator, allowing the curtain to close at a controlled rate of speed when the brake is released by the activation of the fire line. The hoist shall have a minimum1,400 lb (635 KG) lifting capacity at a rate of 25 feet per minute (0.127 m/s).
          2. Gearmotor:

The motor, primary brake and gearbox shall be an integrated unit, with the first stage pinion gear and the primary brake both mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor, primary brake and gear reducer.

Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.

The gear reducer shall be a helical bevel reducer. The gear case shall be cast iron for protection against shock damage. The output shaft(s) 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.

Brakes shall be normally spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall be an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.

* + - * 1. Drums:

Each helical drum shall be supported by a sturdy steel base, holding the elements of the drum assembly in proper alignment. Both ends of each drum shall be supported by a self-aligning flange bearing.

Alternate drums shall be threaded in opposite directions, to keep the batten from "walking" as its elevation changes.

Drums shall be interconnected by shafts with universal joints at each end. Shafts without universal joints are not acceptable.

* + - * 1. Rotary Limit Switches:

Rotary limit switch assemblies shall have two or four independently adjustable switch/cam sets as required. Cams shall be driven by a geared assembly.

Switches shall have snap acting contacts.

Rotary limit switches shall be driven directly or by roller chains. If roller chains are used, sprockets shall be pinned to prevent slipping and sized for maximum usable rotation of switch cams. The input shaft and drive chain shall be fully guarded.

Switches shall be mounted to the hoist base to allow for easy adjustment of the switch settings.

* + - * 1. Fixed Speed Starter:

The traction drive hoist shall be controlled by a UL 508E 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.

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 UL 508E Type 2, non-welding, positive break contactors.

Overcurrent protection shall be provided by an IEC Class 10 overload. Short circuit protection shall be provided by a circuit breaker.

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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

* + - 1. Control Stations: Two control stations shall be provided in wall mounted NEMA 12 enclosures. Each shall contain hold to operate (dead man) Up and Down pushbuttons, and a mushroom head emergency stop pushbutton.
      2. Battens: Battens shall be made of 2 inch (50.8 mm) I.D. nominal, schedule 40 black iron pipe.
      3. Fire line System: The manual fire line release system shall consist of a 1/8 inch (3.2 mm) diameter wire rope, with six fusible links, side mounting pulleys as required, and two fire line release devices, each mounted in a steel enclosure with acrylic viewing window that contains a positive method to release the fire line. Devices shall be mounted 5 feet (1,524 mm) above the stage floor on each side of the proscenium. All other components such as round weight arbors, arbor guards, floor pulleys, etc. required to form a fully functional fire line release system shall be provided.
      4. Lift Cables: The curtain lift cables shall be 1/4 inch (6.4 mm) diameter 7x19 galvanized utility cable as specified. Cables shall be terminated with corresponding cable thimbles and two forged cable clips or a Swage sleeve fitting at each end. The curtain end of each cable shall be attached to the batten using a half pipe clamp.
      5. Safety Chains: Supply one more safety chain than the number of lift cables. 1/4 inch (6.4 mm) minimum, proof coil chains shall be located between lift cables except at the ends where chains shall be 12 inch (304.8 mm) 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.
    1. Traction Drive Hoist.
       1. General Description:
          1. Furnish and install a motorized straight lift type, automatically closing fire safety curtain for the proscenium opening indicated on the drawings. Curtain shall lap masonry not less than 18 inch (457.2 mm) at each side of the proscenium opening and 24 inch (609.6 mm) at the top of the proscenium opening.
          2. The curtain shall be arranged to comply with the "International Building Code (2006)", American National Standard E1.22-2009, other 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 by gravity due to over-balance of the curtain as specified below. Emergency closing shall occur as specified in NFPA 80 or as required by local codes when the fire line is released or fusible links separate.
       2. Special Conditions: It is the intention of this specification to provide a fully functioning fire safety curtain system. Actual equipment and components shall reflect building conditions and approved construction drawings. All dimensions shall be field verified by the Rigging Contractor.
       3. ZetexPlus Fire Safety Curtain: The curtain shall be fabricated from tightly woven J.R. Clancy ZetexPlus 1210-ZP non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070 inch (1.778 mm) thickness weighing at least 40 ounces per square yard (1.35 KG/sq m). The curtain shall be listed and approved by the State of California Fire Marshall, the NYC Material Acceptance and Equipment Acceptance Division, and shall bear a certification label from a nationally recognized listing agency. 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 inch (152.4 mm). The bottom pocket shall be equipped with a 3 inch (76.2 mm) yield pad filled with ZetexPlus.
       4. Sides of curtain shall have bronze guides every 18 inch (457.2 mm), securely fastened to a 6 inch (152.4 mm) hem with at least three bolts or rivets, or as required by the governing code.
       5. Metal Edge Channel:
          1. Fire curtain vertical edges shall have u-shaped, 16 gauge (1.6 mm) steel reinforcement 6 inch (152 mm) deep.
          2. Channels shall attach to the curtain using the curtain guide bolts.
          3. Channels are supplied in 5 feet (1.5 m) and 10' (305 mm) long sections and can be field cut.
       6. Guides: Provide 1/4 inch (6.4 mm) wire rope guide at each side of the curtain. These cables shall be attached to a ring at the stage floor level and extend to the roof steel or gridiron where they shall be attached with 3/8 inch x 6 inch (9.525 mm x 152.4 mm) turnbuckles, thimbles, swage sleeves and other fittings as required.
       7. Smoke Pockets: Furnish and install one pair of smoke pockets to extend from the stage floor to a point above the top of the raised curtain or to the height specified in the drawings. Pockets shall consist of a 6 inch deep "Z" channel formed from 1/4 inch (6.4 mm) steel plate and a 1/4 inch x 18 inch (6.4 mm x 457.2 mm) steel plate which shall be bolted to the channels on 2 feet-0 inch (609.6 mm) centers. Channels shall be anchored to the walls on 4 feet-0 inch (1,219 mm) centers.
       8. Smoke Seal: Provide a smoke seal consisting of a triple layer of folded fabric fastened above the proscenium with a mounting clamp so it rubs the curtain and seals the top of the opening. The fabric shall be Zetex 800 cloth with a minimum weight of 27 oz. per square yard (0.91 KG/sq m).
       9. Traction Style Fire Curtain Hoist:
          1. The hoist shall consist of a traction sheave and a manual clutch with throw out fork, direct coupled and keyed to the output shaft of the gearbox. The entire assembly shall be mounted on a heavy channel base. The hoist shall have a 2,000lb (907.2 KG) lifting capacity at a rate of 25 feet per minute (0.127 m/s).
          2. The iron or steel sheave shall be a minimum diameter of 40 times cable diameter with V-grooves for the number and diameter of lift lines required.
          3. The clutch shall be rated for the applied load. The clutch lever arm shall be kept engaged by tension in the fire line that passes through a pulley in the handle. Release of the clutch is ensured by an overbalance weight acting on the arm.
          4. Gearmotor:

The motor, primary brake and gearbox shall be an integrated unit, with the first stage pinion gear and the primary brake both mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor, primary brake and gear reducer.

Motor shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.

The gear reducer shall be a combination helical/bevel reducer. The gear case shall be cast iron for protection against shock damage. The output shaft(s) 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.

Brakes shall be normally spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall be an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.

* + - * 1. Four direct struck limit switches shall be installed so that they are operated by the fire curtain arbor. These shall provide top and bottom limits of travel as well as overtravel functions. The direct struck limit switches shall be heavy duty, lever operated rotary head units, with positive opening contacts. Direct struck limit switches shall be Telemecanique ZCKJ series or equal.
        2. Fixed Speed Starter:

The traction drive hoist shall be controlled by a UL 508E 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.

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 UL 508E Type 2, non-welding, positive break contactors.

Overcurrent protection shall be provided by an IEC Class 10 overload. Short circuit protection shall be provided by a circuit breaker.

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 shall 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.

* + - * 1. Control Stations: Two control stations shall be provided in wall mounted NEMA 12 enclosures. Each shall contain hold to operate (dead man) Up and Down pushbuttons, and a mushroom head emergency stop pushbutton.
      1. Loft Block:
         1. The sheave shall have a 12 inch (304.8 mm) pitch diameter, and shall be an iron casting, with a machined groove. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
         2. Base angles shall be a minimum 2 inch x 1-1/2 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle.
         3. Side plates shall be a minimum of 10-gauge (3.57 mm) 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 1400 lbs (635 KG), and shall be designed for use in either upright or underhung usage.
         5. Loft blocks shall have cast iron sheave grooved for one 3/8 inch (9.5 mm) lift line.
      2. Counterweight Arbor:
         1. Arbor shall be long enough to accommodate counterweights to balance the fire curtain and related equipment.
         2. The arbor top shall be a fabricated weldment of 1/2 inch(12.7 mm) formed steel plate and 7 gauge (4.76 mm) formed side plates. The side plates shall be punched to receive 8 cables, and shall be tied together with a bolt and spacer providing a tie-off point for the hand line.
         3. The arbor bottom shall be 1/2 inch x 3 inch (12.7 mm x 76.2 mm) steel bar with counterweight rests to keep the weights from resting on the arbor inner nuts, and a forged steel eye for the hand line tie off.
         4. The top and bottom of the arbor shall be tied together by means of two 3/4 inch (19.1 mm) steel arbor rods. The arbor rods shall have three nuts at each end, the outermost being a lock nut.
         5. The top and bottom shall have bronze guides to engage the lattice track.
         6. Provide 14 gauge (1.98 mm) spreader plates (two minimum) on arbor rods so they can be spaced between counterweights on 2 feet (609.6 mm) centers. Provide a retaining collar on each rod, each with a 1/4 inch (6.4 mm) set screw with red plastic knob for easy locking. One retaining collar shall be welded to the top spreader plate.
      3. Lattice Track:
         1. The track shall consist of two 2 inch x 2 inch x 1/4 inch (50.8 mm x 50.8 mm x 6.4 mm) angles opposing each other with formed brackets alternating front and back on 2 feet centers. Back brackets shall contain two 9/16 inch (14.3 mm) diameter holes for proper anchorage to wall.
         2. A fabricated steel bracket shall support the bottom of the lattice. Bracket shall have ample clearance for passage of hand line.
      4. Battens: Battens shall be made of 2 inch 50.8 mm) I.D. nominal, schedule 40 black iron pipe.
      5. Fire line System: The manual fire line release system shall consist of a 1/8 inch (3.2 mm) diameter wire rope, with six fusible links, side mounting pulleys as required, and two fire line release devices, each mounted in enclosures. Devices shall be mounted 5 feet (1,524 mm) above the stage floor on each side of the proscenium. All other components such as round weight arbors, arbor guards, floor pulleys, etc. required to form a fully functional fire line release system shall be provided.
      6. Lift Cables: The curtain lift cables shall be 3/8 inch (9.5 mm) diameter 7 x 19 galvanized utility cable as specified. Cables shall be terminated with corresponding cable thimbles and two forged cable clips or a Swage sleeve fitting at each end. The curtain end of each cable shall be attached to the batten using a pipe clamp.
      7. Safety Chains: Supply one more safety chain than the number of lift cables. 1/4 inch (6.4 mm) minimum, proof coil chains shall be located between lift cables except at the ends where chains shall be 12 inch (304.8 mm) 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.
    1. Drum Hoist.
       1. General Description:
          1. Furnish and install a motorized straight lift type, automatically closing fire safety curtain for the proscenium opening indicated on the drawings. Curtain shall lap masonry not less than 18 inch (457.2 mm) at each side of the proscenium opening and 24 inch (609.6 mm) at the top of the proscenium opening.
          2. The curtain shall be arranged to comply with the "International Building Code (2006)", American National Standard E1.22-2009, other 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 by gravity due to over-balance of the curtain as specified below. Emergency closing shall occur as specified in NFPA 80 or as required by local codes when the fire line is released or fusible links separate.
       2. Special Conditions: It is the intention of this specification to provide a fully functioning fire safety curtain system. Actual equipment and components shall reflect building conditions and approved construction drawings. All dimensions shall be field verified by the Rigging Contractor.
       3. ZetexPlus Fire Safety Curtain: The curtain shall be fabricated from tightly woven J.R. Clancy ZetexPlus 1210-ZP non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070 inch (1.778 mm) thickness weighing at least 40 ounces per square yard (1.35 KG/sq m). The curtain shall be listed and approved by the State of California Fire Marshall, the NYC Material Acceptance and Equipment Acceptance Division, and shall bear a certification label from a nationally recognized listing agency. 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 inch (152.4 mm). The bottom pocket shall be equipped with a 3 inch (76.2 mm) yield pad filled with ZetexPlus.
       4. Sides of curtain shall have bronze guides every 18 inch (457.2 mm), securely fastened to a 6 inch (152.4 mm) hem with at least three bolts or rivets, or as required by the governing code.
       5. Metal Edge Channel:
          1. Fire curtain vertical edges shall have u-shaped, 16 gauge (1.6 mm) steel reinforcement 6 inch (152 mm) deep.
          2. Channels shall attach to the curtain using the curtain guide bolts.
          3. Channels are supplied in 5 feet (1.5 m) and 10 feet (305 mm) long sections and can be field cut.
       6. Guides: Provide 1/4 inch (6.4 mm) wire rope guide at each side of the curtain. These cables shall be attached to a ring at the stage floor level and extend to the roof steel or gridiron where they shall be attached with 3/8 inch x 6 inch (9.525 mm x 152.4 mm) turnbuckles, thimbles, swage sleeves and other fittings as required.
       7. Smoke Pockets: Furnish and install one pair of smoke pockets to extend from the stage floor to a point above the top of the raised curtain or to the height specified in the drawings. Pockets shall consist of a 6 inch deep "Z" channel formed from 1/4 inch (6.4 mm) steel plate and a 1/4 inch x 18 inch (6.4 mm x 457.2 mm) steel plate which shall be bolted to the channels on 2 feet-0 inch (609.6 mm) centers. Channels shall be anchored to the walls on 4 feet-0 inch (1,219 mm) centers.
       8. Smoke Seal: Provide a smoke seal consisting of a triple layer of folded fabric fastened above the proscenium with a mounting clamp so it rubs the curtain and seals the top of the opening. The fabric shall be Zetex 800 cloth with a minimum weight of 27 oz. per square yard (0.91 KG/sq m).
       9. Drum Style Fire Curtain Hoist:
          1. The hoist shall be mounted to allow dual drive lines to travel from either side of the fire curtain centerline, over loft blocks and to the hoist drum.
          2. The hoist shall consist of a cable drum and a manual clutch with throw out fork, direct coupled and keyed to the output shaft of the gearbox. The entire assembly shall be mounted on a heavy channel base. The hoist shall have a 2,000lb (907.2 KG) lifting capacity at a rate of 25 feet per minute (0.127 m/s).
          3. The drum shall be a minimum diameter of 30 times cable diameter with helical grooves for the number and diameter of lift lines required.
          4. The clutch shall be rated for the applied load. The clutch lever arm shall be kept engaged by tension in the fire line that passes through a pulley in the handle. Release of the clutch is ensured by an overbalance weight acting on the arm.
          5. Gearmotor:

The motor, primary brake and gearbox shall be an integrated unit, with the first stage pinion gear and the primary brake both mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor, primary brake and gear reducer.

Motor shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.

The gear reducer shall be a combination helical/bevel reducer. The gear case shall be cast iron for protection against shock damage. The output shaft(s) 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.

Brakes shall be normally spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall be an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.

* + - * 1. Four direct struck limit switches shall be installed so that they are operated by the fire curtain arbor. These shall provide top and bottom limits of travel as well as overtravel functions. The direct struck limit switches shall be heavy duty, lever operated rotary head units, with positive opening contacts. Direct struck limit switches shall be Telemecanique ZCKJ series or equal.
        2. Fixed Speed Starter:

The hoist shall be controlled by a UL 508E 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.

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 UL 508E Type 2, non-welding, positive break contactors.

Overcurrent protection shall be provided by an IEC Class 10 overload. Short circuit protection shall be provided by a circuit breaker.

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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

* + - * 1. Control Stations: Two control stations shall be provided in wall mounted NEMA 12 enclosures. Each shall contain hold to operate (dead man) Up and Down pushbuttons, and a mushroom head emergency stop pushbutton.
      1. Loft Block:
         1. The sheave shall have a 12 inch 304.8 mm) pitch diameter, and shall be an iron casting, with a machined groove. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
         2. Base angles shall be a minimum 2 inch x 1-1/2 inch x 1/4 inch(50.8 mm x 38.1 mm x 6.4 mm) angle.
         3. Side plates shall be a minimum of 10-gauge (3.57 mm) 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 1400 lbs (635 KG), and shall be designed for use in either upright or underhung usage.
         5. Loft blocks shall have cast iron sheave grooved for one 3/8 inch (9.5 mm) lift line.
      2. Counterweight Arbor:
         1. Arbor shall be long enough to accommodate counterweights to permit normal motorized operation of the fire curtain and emergency closure without power.
         2. The arbor top shall be a fabricated weldment of 1/2 inch (12.7 mm) formed steel plate and 7 gauge (4.76 mm) formed side plates. The side plates shall be punched to receive 8 cables, and shall be tied together with a bolt and spacer providing a tie-off point for the hand line.
         3. The arbor bottom shall be 1/2 inch x 3 inch (12.7 mm x 76.2 mm) steel bar with counterweight rests to keep the weights from resting on the arbor inner nuts, and a forged steel eye for the hand line tie off.
         4. The top and bottom of the arbor shall be tied together by means of two 3/4 inch (19.1 mm) steel arbor rods. The arbor rods shall have three nuts at each end, the outermost being a lock nut.
         5. The top and bottom shall have bronze guides to engage the lattice track.
         6. Provide 14 gauge (1.98 mm) spreader plates (two minimum) on arbor rods so they can be spaced between counterweights on 2 feet (609.6 mm) centers. Provide a retaining collar on each rod, each with a 1/4 inch (6.4 mm) set screw with red plastic knob for easy locking. One retaining collar shall be welded to the top spreader plate.
      3. Lattice Track:
         1. The track shall consist of two 2 inch x 2 inch x 1/4 inch (50.8 mm x 50.8 mm x 6.4 mm) angles opposing each other with formed brackets alternating front and back on 2 feet centers. Back brackets shall contain two 9/16 inch (14.3 mm) diameter holes for proper anchorage to wall.
         2. A fabricated steel bracket shall support the bottom of the lattice. Bracket shall have ample clearance for passage of hand line.
      4. Battens: Battens shall be made of 2 inch (50.8 mm) I.D. nominal, schedule 40 black iron pipe.
      5. Fire line System: The manual fire line release system shall consist of a 1/8 inch (3.2 mm) diameter wire rope, with six fusible links, side mounting pulleys as required, and two fire line release devices, each mounted in enclosures. Devices shall be mounted 5 feet (1,524 mm) above the stage floor on each side of the proscenium. All other components such as round weight arbors, arbor guards, floor pulleys, etc. required to form a fully functional fire line release system shall be provided.
      6. Lift Cables: The curtain lift cables shall be 3/8 inch (9.5 mm) diameter 7 x 19 galvanized utility cable as specified. Cables shall be terminated with corresponding cable thimbles and two forged cable clips or a Swage sleeve fitting at each end. The curtain end of each cable shall be attached to the batten using a pipe clamp.
      7. Safety Chains: Supply one more safety chain than the number of lift cables. 1/4 inch (6.4 mm) minimum, proof coil chains shall be located between lift cables except at the ends where chains shall be 12 inch (304.8 mm) 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.
  1. FIRE CURTAIN SYSTEMS, STRAIGHT LIFT CURTAIN, PROSCENIUM OPENING UP TO 30'T x 50'W
     1. Manual (Arbor/Lattice Track).
        1. General Description:
           1. Furnish and install a manually operated straight lift type, automatically closing fire safety curtain for the proscenium opening indicated on the drawings. Curtain shall lap masonry not less than 18 inch at each side of the proscenium opening and 24 inch at the top of the proscenium opening.
           2. The curtain shall be arranged to comply with the "International Building Code (2006)", American National Standard E1.22-2009, other 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 by gravity due to over-balance of the curtain as specified below. Emergency closing shall occur as specified in NFPA 80 or as required by local codes when the fire line is released or fusible links separate.
        2. Special Conditions: It is the intention of this specification to provide a fully functioning fire safety curtain system. Actual equipment and components shall reflect building conditions and approved construction drawings. All dimensions shall be field verified by the Rigging Contractor.
        3. ZetexPlus Fire Safety Curtain: The curtain shall be fabricated from tightly woven J.R. Clancy ZetexPlus 1210-ZP non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070 inch (1.778 mm) thickness weighing at least 40 ounces per square yard (1.35 KG/sq m). The curtain shall be listed and approved by the State of California Fire Marshall, the NYC Material and Equipment Acceptance Division, and shall bear a certification label from a nationally recognized listing agency. 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 inch (152.4 mm). The bottom pocket shall be equipped with a 3 inch (76.2 mm) yield pad filled with ZetexPlus.
        4. Metal Edge Channel:
           1. Fire curtain vertical edges shall have u-shaped, 16 gauge (1.59 mm) steel reinforcement 6 inch (152.4 mm) deep.
           2. Channels shall attach to the curtain using the curtain guide bolts.
           3. Channels are supplied in 5 feet (1.52 m) and 10 feet (3,04 m) long sections and can be field cut.
        5. Smoke Pockets with Track: Furnish and install one pair of smoke pockets to extend from the stage floor to a point above the top of the raised curtain or to the height specified in the drawings. Pockets shall consist of a 6 inch (152 mm) deep "Z" channel formed from 1/4 inch (6.4 mm) steel plate and a 1/4 inch x 18 inch (6.4 mm x 457 mm) steel plate bolted to the channels on 2 feet-0 inch (0.61 m) centers. A 14 ga. (1.98 mm) steel channel track, entirely enclosed except for a slot in the side, shall be bolted to the side of the smoke pocket to carry the guide rollers. Channels shall be anchored to the walls on 4 feet-0 inch (1.22 m) centers.
        6. Smoke Seal: Provide a smoke seal consisting of a triple layer of folded fabric fastened above the proscenium with a mounting clamp so it rubs the curtain and seals the top of the opening. The fabric shall be Zetex 800 cloth with a minimum weight of 27 oz. per square yard (0.91 KG/sq m).
        7. 12 inch (304.8 mm) Head Block:
           1. The sheave shall be an iron casting with a 12 inch (304.8 mm) outer diameter. The machined rope and cable grooves shall have equal pitch diameters. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
           2. Base angles shall be a minimum 2 inch x 1-1/2 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.35 mm) angle with the short leg turned in. The turned in leg shall be notched to allow clear passage of all cables.
           3. Side plates shall be a minimum of 10-gauge (3.570 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
           4. The block and associated mounting hardware shall have a recommended working load of at least 2,500 lbs. (1,134 KG).
           5. Head blocks shall be grooved for six or eight 1/4 inch (6.4 mm) lift lines and one 3/4 inch (19.05 mm) hand line.
        8. Loft Block:
           1. The sheave shall have an 8-1/2 inch (215.9 mm) 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 inch x 1-1/2 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle.
           3. Side plates shall be a minimum of 12-gauge (2.78 mm) 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. (226.8 KG), and shall be designed for use in either upright or underhung usage.
           5. Loft blocks shall be cast iron sheave grooved for one 1/4 inch (6.35 mm) lift line.
        9. Counterweight Arbor:
           1. Arbor shall be long enough to accommodate counterweights to balance the fire curtain and related equipment.
           2. The arbor top shall be a fabricated weldment of 1/2 inch (12.7 mm) formed steel plate and 7 gauge (4.76 mm) formed side plates. The side plates shall be punched to receive 8 cables, and shall be tied together with a bolt and spacer providing a tie-off point for the hand line.
           3. The arbor bottom shall be 1/2 inch x 3 inch (12.7 mm x 76.2 mm) steel bar with counterweight rests to keep the weights from resting on the arbor inner nuts, and a forged steel eye for the hand line tie off.
           4. The top and bottom of the arbor shall be tied together by means of two 3/4 inch (19.05 mm) steel arbor rods. The arbor rods shall have three nuts at each end, the outermost being a lock nut.
           5. The top and bottom shall have bronze guides to engage the lattice track.
           6. Provide 14 gauge (1.98 mm) spreader plates (two minimum) on arbor rods so they can be spaced between counterweights on 2 feet (609.6 mm) centers. Provide a retaining collar on each rod, each with a 1/4 inch (6.35 mm) set screw with red plastic knob for easy locking. One retaining collar shall be welded to the top spreader plate.
        10. Lattice Track:
            1. The track shall consist of two 2 inch x 2 inch x 1/4 inch (50.8 mm x 50.8 mm x 6.35 mm) angles opposing each other with formed brackets alternating front and back on 2 feet centers. Back brackets shall contain two 9/16 inch (14.29 mm) diameter holes for proper anchorage to wall.
            2. A fabricated steel bracket shall support the bottom of the lattice. Bracket shall have ample clearance for passage of hand line.
        11. Automatic Floor Block:
            1. The cast iron sheave shall have a 12 inch (304.8 mm) outside diameter, and shall be an iron casting, with a groove for a 1 inch (25.4 mm) rope.
            2. The sheave shall be equipped with a 1 inch (25.4 mm) diameter machined steel shaft and two tapered roller bearings.
            3. The tension block shall be held in place and guided by two 3/4 inch (19.05 mm) diameter rods, each equipped with adjustable locking collar to limit sheave travel.
        12. Battens: Battens shall be made of 2 inch I.D. nominal, schedule 40 black iron pipe.
        13. Fire line System: The manual fire line release system shall consist of a 1/8 inch diameter wire rope, with six fusible links, side mounting pulleys as required, and two fire line release devices, each mounted in enclosures. Devices shall be mounted 5 feet (1,524 mm) above the stage floor on each side of the proscenium. All other components such as the fire curtain arbor release, round weight arbors, arbor guards, floor pulleys, etc. required to form a fully functional fire line release system shall be provided.
        14. Hand line:
            1. Hand line shall be 3/4 inch (19.1 mm) in diameter, employing a 3-strand composite construction combining filament and staple/spun polyester wrapped around fibrillated polyolefin.
            2. The hand line shall contain an identifying tape showing the manufacturer's name, phone number, website, and year of manufacture.
            3. The hand line shall contain a red safety/wear indicator that shall become visible as the rope nears the end of its useful life.
            4. The rope shall hold knots well and be easily spliced. Rope shall not be subject to rotting, mildew, or moisture damage nor shall its length be affected by changes in humidity.
            5. Tape ends before cutting. Attach to arbor with two half hitches or bowline and tape end to standing line with electrical tape.
            6. Hand lines shall be SureGrip rope.
        15. Lift Cables: The curtain lift cables shall be 1/4 inch (6.4 mm) diameter 7x19 galvanized utility cable as specified. Cables shall be terminated with corresponding cable thimbles and two forged cable clips or a Swage sleeve fitting at each end. The curtain end of each cable shall be attached to the batten using a half pipe clamp.
        16. Safety Chains: Supply one more safety chain than the number of lift cables. 1/4 inch proof coil chains shall be located between lift cables except at the ends where chains shall be 12 inch 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.
     2. Line Shaft Hoist.
        1. General Description:
           1. Furnish and install a motorized straight lift type, automatically closing fire safety curtain for the proscenium opening indicated on the drawings. Curtain shall lap masonry not less than 18 inch (457.2 mm) at each side of the proscenium opening and 24 inch (609.6 mm) at the top of the proscenium opening.
           2. The curtain shall be arranged to comply with the "International Building Code (2006)", American National Standard E1.22-2009, other 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 by gravity, with the speed of descent controlled by a hydraulic speed regulator. Emergency closing shall occur as specified in NFPA 80 or as required by local codes when the fire line is released or fusible links separate.
        2. Special Conditions: It is the intention of this specification to provide a fully functioning fire safety curtain system. Actual equipment and components shall reflect building conditions and approved construction drawings. All dimensions shall be field verified by the Rigging Contractor.
        3. ZetexPlus Fire Safety Curtain: The curtain shall be fabricated from tightly woven J.R. Clancy ZetexPlus 1210-ZP non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070 inch (1.8 mm) thickness weighing at least 40 ounces per square yard (1.35 KG/sq m). The curtain shall be listed and approved by the State of California Fire Marshal, the NYC Material and Equipment Acceptance Division, and shall bear a certification label from a nationally recognized listing agency. 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 inch (152.4 mm). The bottom pocket shall be equipped with a 3 inch (76.2 mm) yield pad filled with ZetexPlus.
        4. Sides of curtain shall have steel wheel roller guides every 18 inch (457.2 mm), securely fastened to a 6 inch (152.4 mm) hem with at least three bolts or rivets, or as required by the governing code.
        5. Metal Edge Channel:
           1. Fire curtain vertical edges shall have u-shaped, 16 gauge (1.6 mm) steel reinforcement 6 inch (152 mm) deep.
           2. Channels shall attach to the curtain using the curtain guide bolts.
           3. Channels are supplied in 5 feet (1.5 m) and 10 feet (305 mm) long sections and can be field cut.
        6. Smoke Pockets: Furnish and install one pair of smoke pockets to extend from the stage floor to a point above the top of the raised curtain or to the height specified in the drawings. Pockets shall consist of a 6 inch deep "Z" channel formed from 1/4 inch (6.4 mm) steel plate and a 1/4 inch x 18 inch (6.4 mm x 457.2 mm) steel plate which shall be bolted to the channels on 2 feet-0 inch (609.6 mm) centers. A 14 ga. (1.98 mm) steel channel track, entirely enclosed except for a slot in the side, shall be bolted to the inside of each smoke pocket to carry the guide rollers. Channels shall be anchored to the walls on 4 feet-0 inch (1.2 m) centers.
        7. Smoke Seal: Provide a smoke seal consisting of a triple layer of folded fabric fastened above the proscenium with a mounting clamp so it rubs the curtain and seals the top of the opening. The fabric shall be Zetex 800 cloth with a minimum weight of 27 oz. per square yard (0.91 KG/sq m).
        8. Line Shaft Fire Curtain Hoist:
           1. The hoist shall consist of a gearmotor assembly, a drum for each lift line, and interconnecting shafts. The gearmotor assembly shall include a brake release and a hydraulic speed regulator, allowing the curtain to close at a controlled rate of speed when the brake is released by the activation of the fire line. The hoist shall have a minimum1,400 lb (635 KG) lifting capacity at a rate of 25 feet per minute (0.127 m/s).
           2. Gearmotor:

The motor, primary brake and gearbox shall be an integrated unit, with the first stage pinion gear and the primary brake both mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor, primary brake and gear reducer.

Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.

The gear reducer shall be a helical bevel reducer. The gear case shall be cast iron for protection against shock damage. The output shaft(s) 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.

Brakes shall be normally spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall be an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.

* + - * 1. Drums.

Each helical drum shall be supported by a sturdy steel base, holding the elements of the drum assembly in proper alignment. Both ends of each drum shall be supported by a self-aligning flange bearing.

Alternate drums shall be threaded in opposite directions, to keep the batten from "walking" as its elevation changes.

Drums shall be interconnected by shafts with universal joints at each end. Shafts without universal joints are not acceptable.

* + - * 1. Rotary Limit Switches:

Rotary limit switch assemblies shall have two or four independently adjustable switch/cam sets as required. Cams shall be driven by a geared assembly.

Switches shall have snap acting contacts.

Rotary limit switches shall be driven directly or by roller chains. If roller chains are used, sprockets shall be pinned to prevent slipping and sized for maximum usable rotation of switch cams. The input shaft and drive chain shall be fully guarded.

Switches shall be mounted to the hoist base to allow for easy adjustment of the switch settings.

* + - * 1. Fixed Speed Starter:

The traction drive hoist shall be controlled by a UL 508E 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.

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 UL 508E Type 2, non-welding, positive break contactors.

Overcurrent protection shall be provided by an IEC Class 10 overload. Short circuit protection shall be provided by a circuit breaker.

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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

* + - 1. Control Stations: Two control stations shall be provided in wall mounted NEMA 12 enclosures. Each shall contain hold to operate (dead man) Up and Down pushbuttons, and a mushroom head emergency stop pushbutton.
      2. Battens: Battens shall be made of 2 inch (50.8 mm) I.D. nominal, schedule 40 black iron pipe.
      3. Fire line System: The manual fire line release system shall consist of a 1/8 inch (3.2 mm) diameter wire rope, with six fusible links, side mounting pulleys as required, and two fire line release devices, each mounted in a steel enclosure with acrylic viewing window that contains a positive method to release the fire line. Devices shall be mounted 5 feet (1,524 mm) above the stage floor on each side of the proscenium. All other components such as round weight arbors, arbor guards, floor pulleys, etc. required to form a fully functional fire line release system shall be provided.
      4. Lift Cables: The curtain lift cables shall be 1/4 inch (6.4 mm) diameter 7x19 galvanized utility cable as specified. Cables shall be terminated with corresponding cable thimbles and two forged cable clips or a Swage sleeve fitting at each end. The curtain end of each cable shall be attached to the batten using a half pipe clamp.
      5. Safety Chains: Supply one more safety chain than the number of lift cables. 1/4 inch (6.4 mm) minimum, proof coil chains shall be located between lift cables except at the ends where chains shall be 12 inch (304.8 mm) 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.
    1. Traction Drive Hoist.
       1. General Description:
          1. Furnish and install a motorized straight lift type, automatically closing fire safety curtain for the proscenium opening indicated on the drawings. Curtain shall lap masonry not less than 18 inch (457.2 mm) at each side of the proscenium opening and 24 inch (609.6 mm) at the top of the proscenium opening.
          2. The curtain shall be arranged to comply with the "International Building Code (2006)", American National Standard E1.22-2009, other 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 by gravity due to over-balance of the curtain as specified below. Emergency closing shall occur as specified in NFPA 80 or as required by local codes when the fire line is released or fusible links separate.
       2. Special Conditions: It is the intention of this specification to provide a fully functioning fire safety curtain system. Actual equipment and components shall reflect building conditions and approved construction drawings. All dimensions shall be field verified by the Rigging Contractor.
       3. ZetexPlus Fire Safety Curtain: The curtain shall be fabricated from tightly woven J.R. Clancy ZetexPlus 1210-ZP non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070" (1.778 mm) thickness weighing at least 40 ounces per square yard (1.35 KG/sq m). The curtain shall be listed and approved by the State of California Fire Marshall, the NYC Material Acceptance and Equipment Acceptance Division, and shall bear a certification label from a nationally recognized listing agency. 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 inch (152.4 mm). The bottom pocket shall be equipped with a 3 inch (76.2 mm) yield pad filled with ZetexPlus.
       4. Sides of curtain shall have steel wheel roller guides every 18 inch (457.2 mm), securely fastened to a 6 inch (152.4 mm) hem with at least three bolts or rivets, or as required by the governing code.
       5. Metal Edge Channel:
          1. Fire curtain vertical edges shall have u-shaped, 16 gauge (1.6 mm) steel reinforcement 6 inch (152 mm) deep.
          2. Channels shall attach to the curtain using the curtain guide bolts.
          3. Channels are supplied in 5 feet (1.5 m) and 10 feet (305 mm) long sections and can be field cut.
       6. Smoke Pockets: Furnish and install one pair of smoke pockets to extend from the stage floor to a point above the top of the raised curtain or to the height specified in the drawings. Pockets shall consist of a 6 inch deep "Z" channel formed from 1/4 inch (6.4 mm) steel plate and a 1/4 inch x 18 inch (6.4 mm x 457.2 mm) steel plate which shall be bolted to the channels on 2 feet-0 inch (609.6 mm) centers. A 14 ga. (1.98 mm) steel channel track, entirely enclosed except for a slot in the side, shall be bolted to the inside of each smoke pocket to carry the guide rollers. Channels shall be anchored to the walls on 4 feet-0 inch (1,219 mm) centers.
       7. Smoke Seal: Provide a smoke seal consisting of a triple layer of folded fabric fastened above the proscenium with a mounting clamp so it rubs the curtain and seals the top of the opening. The fabric shall be Zetex 800 cloth with a minimum weight of 27 oz. per square yard (0.91 KG/sq m).
       8. Traction Style Fire Curtain Hoist:
          1. The hoist shall consist of a traction sheave and a manual clutch with throw out fork, direct coupled and keyed to the output shaft of the gearbox. The entire assembly shall be mounted on a heavy channel base. The hoist shall have a 2,000lb (907.2 KG) lifting capacity at a rate of 25 feet per minute (0.127 m/s).
          2. The iron or steel sheave shall be a minimum diameter of 40 times cable diameter with V-grooves for the number and diameter of lift lines required.
          3. The clutch shall be rated for the applied load. The clutch lever arm shall be kept engaged by tension in the fire line that passes through a pulley in the handle. Release of the clutch is ensured by an overbalance weight acting on the arm.
          4. Gearmotor:

The motor, primary brake and gearbox shall be an integrated unit, with the first stage pinion gear and the primary brake both mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor, primary brake and gear reducer.

Motor shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.

The gear reducer shall be a combination helical/bevel reducer. The gear case shall be cast iron for protection against shock damage. The output shaft(s) 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.

Brakes shall be normally spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall be an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.

* + - * 1. Four direct struck limit switches shall be installed so that they are operated by the fire curtain arbor. These shall provide top and bottom limits of travel as well as overtravel functions. The direct struck limit switches shall be heavy duty, lever operated rotary head units, with positive opening contacts. Direct struck limit switches shall be Telemecanique ZCKJ series or equal.
        2. Fixed Speed Starter:

The traction drive hoist shall be controlled by a UL 508E 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.

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 UL 508E Type 2, non-welding, positive break contactors.

Overcurrent protection shall be provided by an IEC Class 10 overload. Short circuit protection shall be provided by a circuit breaker.

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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

* + - 1. Control Stations: Two control stations shall be provided in wall mounted NEMA 12 enclosures. Each shall contain hold to operate (dead man) Up and Down pushbuttons, and a mushroom head emergency stop pushbutton.
      2. Loft Block:
         1. The sheave shall have a 12 inch (304.8 mm) pitch diameter, and shall be an iron casting, with a machined groove. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
         2. Base angles shall be a minimum 2 inch x 1-1/2 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle.
         3. Side plates shall be a minimum of 10-gauge (3.57 mm) 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 1400 lbs (635 KG), and shall be designed for use in either upright or underhung usage.
         5. Loft blocks shall have cast iron sheave grooved for one 3/8 inch (9.5 mm) lift line.
      3. Counterweight Arbor:
         1. Arbor shall be long enough to accommodate counterweights to balance the fire curtain and related equipment.
         2. The arbor top shall be a fabricated weldment of 1/2 inch (12.7 mm) formed steel plate and 7 gauge (4.76 mm) formed side plates. The side plates shall be punched to receive 8 cables, and shall be tied together with a bolt and spacer providing a tie-off point for the hand line.
         3. The arbor bottom shall be 1/2 inch x 3 inch (12.7 mm x 76.2 mm) steel bar with counterweight rests to keep the weights from resting on the arbor inner nuts, and a forged steel eye for the hand line tie off.
         4. The top and bottom of the arbor shall be tied together by means of two 3/4 inch (19.1 mm) steel arbor rods. The arbor rods shall have three nuts at each end, the outermost being a lock nut.
         5. The top and bottom shall have bronze guides to engage the lattice track.
         6. Provide 14 gauge (1.98 mm) spreader plates (two minimum) on arbor rods so they can be spaced between counterweights on 2 feet (609.6 mm) centers. Provide a retaining collar on each rod, each with a 1/4 inch (6.4 mm) set screw with red plastic knob for easy locking. One retaining collar shall be welded to the top spreader plate.
      4. Lattice Track:
         1. The track shall consist of two 2 inch x 2 inch x 1/4 inch (50.8 mm x 50.8 mm x 6.4 mm) angles opposing each other with formed brackets alternating front and back on 2 feet centers. Back brackets shall contain two 9/16 inch (14.3 mm) diameter holes for proper anchorage to wall.
         2. A fabricated steel bracket shall support the bottom of the lattice. Bracket shall have ample clearance for passage of hand line.
      5. Battens: Battens shall be made of 2 inch (50.8 mm) I.D. nominal, schedule 40 black iron pipe.
      6. Fire line System: The manual fire line release system shall consist of a 1/8 inch (3.2 mm) diameter wire rope, with six fusible links, side mounting pulleys as required, and two fire line release devices, each mounted in enclosures. Devices shall be mounted 5 feet (1,524 mm) above the stage floor on each side of the proscenium. All other components such as round weight arbors, arbor guards, floor pulleys, etc. required to form a fully functional fire line release system shall be provided.
      7. Lift Cables: The curtain lift cables shall be 3/8 inch (9.5 mm) diameter 7 x 19 galvanized utility cable as specified. Cables shall be terminated with corresponding cable thimbles and two forged cable clips or a Swage sleeve fitting at each end. The curtain end of each cable shall be attached to the batten using pipe clamp.
      8. Safety Chains: Supply one more safety chain than the number of lift cables. 1/4 inch (6.4 mm) minimum, proof coil chains shall be located between lift cables except at the ends where chains shall be 12 inch (304.8 mm) 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.
    1. Drum Hoist.
       1. General Description:
          1. Furnish and install a motorized straight lift type, automatically closing fire safety curtain for the proscenium opening indicated on the drawings. Curtain shall lap masonry not less than 18 inch (457.2 mm) at each side of the proscenium opening and 24 inch (609.6 mm) at the top of the proscenium opening.
          2. The curtain shall be arranged to comply with the "International Building Code (2006)", American National Standard E1.22-2009, other 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 by gravity due to over-balance of the curtain as specified below. Emergency closing shall occur as specified in NFPA 80 or as required by local codes when the fire line is released or fusible links separate.
       2. Special Conditions: It is the intention of this specification to provide a fully functioning fire safety curtain system. Actual equipment and components shall reflect building conditions and approved construction drawings. All dimensions shall be field verified by the Rigging Contractor.
       3. ZetexPlus Fire Safety Curtain: The curtain shall be fabricated from tightly woven J.R. Clancy ZetexPlus 1210-ZP non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070 inch (1.778 mm) thickness weighing at least 40 ounces per square yard (1.35 KG/sq m). The curtain shall be listed and approved by the State of California Fire Marshall, the NYC Material Acceptance and Equipment Acceptance Division, and shall bear a certification label from a nationally recognized listing agency. 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 inch (152.4 mm). The bottom pocket shall be equipped with a 3 inch (76.2 mm) yield pad filled with ZetexPlus.
       4. Sides of curtain shall have steel wheel roller guides every 18 inch (457.2 mm), securely fastened to a 6 inch (152.4 mm) hem with at least three bolts or rivets, or as required by the governing code.
       5. Metal Edge Channel:
          1. Fire curtain vertical edges shall have u-shaped, 16 gauge (1.6 mm) steel reinforcement 6 inch (152 mm) deep.
          2. Channels shall attach to the curtain using the curtain guide bolts.
          3. Channels are supplied in 5 feet (1.5 m) and 10 feet (305 mm) long sections and can be field cut.
       6. Smoke Pockets: Furnish and install one pair of smoke pockets to extend from the stage floor to a point above the top of the raised curtain or to the height specified in the drawings. Pockets shall consist of a 6 inch deep "Z" channel formed from 1/4 inch (6.4 mm) steel plate and a 1/4 inch x 18 inch (6.4 mm x 457.2 mm) steel plate which shall be bolted to the channels on 2 feet-0 inch (609.6 mm) centers. A 14 ga. (1.98 mm) steel channel track, entirely enclosed except for a slot in the side, shall be bolted to the inside of each smoke pocket to carry the guide rollers. Channels shall be anchored to the walls on 4 feet-0 inch (1,219 mm) centers.
       7. Smoke Seal: Provide a smoke seal consisting of a triple layer of folded fabric fastened above the proscenium with a mounting clamp so it rubs the curtain and seals the top of the opening. The fabric shall be Zetex 800 cloth with a minimum weight of 27 oz. per square yard (0.91 KG/sq m).
       8. Drum Style Fire Curtain Hoist:
          1. The hoist shall be mounted to allow dual drive lines to travel from either side of the fire curtain centerline, over loft blocks and to the hoist drum.
          2. The hoist shall consist of a cable drum and a manual clutch with throw out fork, direct coupled and keyed to the output shaft of the gearbox. The entire assembly shall be mounted on a heavy channel base. The hoist shall have a 2,000lb (907.2 KG) lifting capacity at a rate of 25 feet per minute (0.127 m/s).
          3. The drum shall be a minimum diameter of 30 times cable diameter with helical grooves for the number and diameter of lift lines required.
          4. The clutch shall be rated for the applied load. The clutch lever arm shall be kept engaged by tension in the fire line that passes through a pulley in the handle. Release of the clutch is ensured by an overbalance weight acting on the arm.
          5. Gearmotor:

The motor, primary brake and gearbox shall be an integrated unit, with the first stage pinion gear and the primary brake both mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor, primary brake and gear reducer.

Motor shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.

The gear reducer shall be a combination helical/bevel reducer. The gear case shall be cast iron for protection against shock damage. The output shaft(s) 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.

Brakes shall be normally spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall be an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.

* + - * 1. Four direct struck limit switches shall be installed so that they are operated by the fire curtain arbor. These shall provide top and bottom limits of travel as well as overtravel functions. The direct struck limit switches shall be heavy duty, lever operated rotary head units, with positive opening contacts. Direct struck limit switches shall be Telemecanique ZCKJ series or equal.
        2. Fixed Speed Starter:

The hoist shall be controlled by a UL 508E 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.

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 UL 508E Type 2, non-welding, positive break contactors.

Overcurrent protection shall be provided by an IEC Class 10 overload. Short circuit protection shall be provided by a circuit breaker.

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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

* + - 1. Control Stations: Two control stations shall be provided in wall mounted NEMA 12 enclosures. Each shall contain hold to operate (dead man) Up and Down pushbuttons, and a mushroom head emergency stop pushbutton.
      2. Loft Block:
         1. The sheave shall have a 12 inch (304.8 mm) pitch diameter, and shall be an iron casting, with a machined groove. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
         2. Base angles shall be a minimum 2 inch x 1-1/2 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle.
         3. Side plates shall be a minimum of 10-gauge (3.57 mm) 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 1400 lbs (635 KG), and shall be designed for use in either upright or underhung usage.
         5. Loft blocks shall have cast iron sheave grooved for one 3/8 inch (9.5 mm) lift line.
      3. Counterweight Arbor:
         1. Arbor shall be long enough to accommodate counterweights to permit normal motorized operation of the fire curtain and emergency closure without power.
         2. The arbor top shall be a fabricated weldment of 1/2 inch (12.7 mm) formed steel plate and 7 gauge (4.76 mm) formed side plates. The side plates shall be punched to receive 8 cables, and shall be tied together with a bolt and spacer providing a tie-off point for the hand line.
         3. The arbor bottom shall be 1/2 inch x 3 inch (12.7 mm x 76.2 mm) steel bar with counterweight rests to keep the weights from resting on the arbor inner nuts, and a forged steel eye for the hand line tie off.
         4. The top and bottom of the arbor shall be tied together by means of two 3/4 inch (19.1 mm) steel arbor rods. The arbor rods shall have three nuts at each end, the outermost being a lock nut.
         5. The top and bottom shall have bronze guides to engage the lattice track.
         6. Provide 14 gauge (1.98 mm) spreader plates (two minimum) on arbor rods so they can be spaced between counterweights on 2 feet (609.6 mm) centers. Provide a retaining collar on each rod, each with a 1/4 inch (6.4 mm) set screw with red plastic knob for easy locking. One retaining collar shall be welded to the top spreader plate.
      4. Lattice Track:
         1. The track shall consist of two 2 inch x 2 inch x 1/4 inch (50.8 mm x 50.8 mm x 6.4 mm) angles opposing each other with formed brackets alternating front and back on 2 feet centers. Back brackets shall contain two 9/16 inch (14.3 mm) diameter holes for proper anchorage to wall.
         2. A fabricated steel bracket shall support the bottom of the lattice. Bracket shall have ample clearance for passage of hand line.
      5. Battens: Battens shall be made of 2 inch (50.8 mm) I.D. nominal, schedule 40 black iron pipe.
      6. Fire line System: The manual fire line release system shall consist of a 1/8 inch (3.2 mm) diameter wire rope, with six fusible links, side mounting pulleys as required, and two fire line release devices, each mounted in enclosures. Devices shall be mounted 5 feet (1,524 mm) above the stage floor on each side of the proscenium. All other components such as round weight arbors, arbor guards, floor pulleys, etc. required to form a fully functional fire line release system shall be provided.
      7. Lift Cables: The curtain lift cables shall be 3/8 inch (9.5 mm) diameter 7 x 19 galvanized utility cable as specified. Cables shall be terminated with corresponding cable thimbles and two forged cable clips or a Swage sleeve fitting at each end. The curtain end of each cable shall be attached to the batten using a pipe clamp.
      8. Safety Chains: Supply one more safety chain than the number of lift cables. 1/4 inch (6.4 mm) minimum, proof coil chains shall be located between lift cables except at the ends where chains shall be 12 inch (304.8 mm) 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.
  1. FIRE CURTAIN SYSTEMS, STRAIGHT LIFT CURTAIN, PROSCENIUM OPENING GREATER THAN 30'T x 50'W
     1. Line Shaft Hoist:
        1. General Description:
           1. Furnish and install a motorized straight lift type, automatically closing fire safety curtain for the proscenium opening indicated on the drawings. Curtain shall lap masonry not less than 18 inch (457 mm) at each side of the proscenium opening and 24 inch (610 mm) at the top of the proscenium opening.
           2. The curtain shall be arranged to comply with the "International Building Code (2006)", American National Standard E1.22-2009, other 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 by gravity due to over-balance of the curtain as specified below. Emergency closing shall occur as specified in NFPA 80 or as required by local codes when the fire line is released or fusible links separate.
        2. Special Conditions: It is the intention of this specification to provide a fully functioning fire safety curtain system. Actual equipment and components shall reflect building conditions and approved construction drawings. All dimensions shall be field verified by the Rigging Contractor.
        3. ZetexPlus Fire Safety Curtain: The curtain shall be fabricated from tightly woven J.R. Clancy ZetexPlus 1210-ZP non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070 inch (1.8 mm) thickness weighing at least 40 ounces per square yard (1.35 KG/sq m). The curtain shall be listed and approved by the State of California Fire Marshall, the NYC Material Acceptance and Equipment Acceptance Division, and shall bear a certification label from a nationally recognized listing agency. 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 inch (152.4 mm). The bottom pocket shall be equipped with a 6 inch (152.4 mm) yield pad filled with ZetexPlus.
        4. Fire Safety Curtain Frame: The fully framed fire safety curtain shall be designed and fabricated to sustain a minimum uniform wind load of 2 psf, or as indicated by code. The attachment of the curtain to the frame shall be made to facilitate future maintenance and repair. The frame shall remain engaged in its guides and operate under the full range of temperatures and wind conditions.
        5. Each side of the curtain frame shall have two bronze guides, securely fastened to the curtain frame.
        6. Smoke Seal: Provide a smoke seal consisting of a triple layer of folded fabric fastened above the proscenium with a mounting clamp so it rubs the curtain and seals the top of the opening. The fabric shall be Zetex 800 cloth with a minimum weight of 27 ounces per square yard (0.91 KG/sq m).
        7. Line Shaft Fire Curtain Hoist:
           1. The hoist shall consist of a gearmotor assembly, a drum for each lift line, and interconnecting shafts. The gearmotor assembly shall include a brake release and a hydraulic speed regulator, allowing the curtain to close at a controlled rate of speed when the brake is released by the activation of the fire line. The hoist shall have a minimum 1,400lb. (635 KG) lifting capacity at a rate of 25 feet/min (0.127 m/s).
           2. Gearmotor:

The motor, primary brake and gearbox shall be an integrated unit, with the first stage pinion gear and the primary brake both mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor, primary brake and gear reducer.

Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.

The gear reducer shall be a helical bevel reducer. The gear case shall be cast iron for protection against shock damage. The output shaft(s) 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.

Brakes shall be normally spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall be an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.

* + - * 1. Drums:

Each helical drum shall be supported by a sturdy steel base, holding the elements of the drum assembly in proper alignment. Both ends of each drum shall be supported by a self-aligning flange bearing.

Alternate drums shall be threaded in opposite directions, to keep the batten from "walking" as its elevation changes.

Drums shall be interconnected by shafts with universal joints at each end. Shafts without universal joints are not acceptable.

* + - * 1. Rotary Limit Switches:

Rotary limit switch assemblies shall have two or four independently adjustable switch/cam sets as required. Cams shall be driven by a geared assembly.

Switches shall have snap acting contacts.

Rotary limit switches shall be driven directly or by roller chains. If roller chains are used, sprockets shall be pinned to prevent slipping and sized for maximum usable rotation of switch cams. The input shaft and drive chain shall be fully guarded.

Switches shall be mounted to the hoist base to allow for easy adjustment of the switch settings.

* + - * 1. Fixed Speed Starter:

The hoist shall be controlled by a UL 508E 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.

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 UL 508E Type 2, non-welding, positive break contactors.

Overcurrent protection shall be provided by an IEC Class 10 overload. Short circuit protection shall be provided by a circuit breaker.

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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

* + - 1. Control Stations: Two control stations shall be provided in wall mounted NEMA 12 enclosures. Each shall contain hold to operate (dead man) Up and Down pushbuttons, and a mushroom head emergency stop pushbutton.
      2. Fire line System: The manual fire line release system shall consist of a 1/8 inch (3.2 mm) diameter wire rope, with six UL listed fusible links that release at 165 degree F (74 degree C), side mounting pulleys as required, and two fire line release devices, each mounted in a steel enclosure with acrylic viewing window that contains a positive method to release the fire line. Devices shall be mounted 5 feet-0 inch (1,524 mm) above the stage floor on each side of the proscenium. All other components such as round weight arbors, arbor guards, floor pulleys, etc. required to form a fully functional fire line release system shall be provided.
      3. Lift Cables: The curtain lift cables shall be 3/8 inch (9.5 mm) diameter 7 x 19 galvanized utility cable as specified. Cables shall be terminated with corresponding cable thimbles and two forged cable clips or a Swage sleeve fitting at each end. The curtain end of each cable shall be attached to the batten using a pipe clamp.
      4. Battens: Battens shall be made of 2 inch (50.8 mm) I.D. nominal, schedule 40 black iron pipe.
      5. Safety Chains: Supply one more safety chain than the number of lift cables. 1/4 inch (6.4 mm) minimum, proof coil chains shall be located between lift cables except at the ends where the chains shall be 12 inch (304.8 mm) 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.
      6. Smoke Pockets with Track: Furnish and install one pair of smoke pockets to extend from the stage floor to a point above the top of the raised curtain or to the height specified in the drawings. Pockets shall consist of an 8 inch (203 mm) deep "Z" channel formed from 1/4 inch (6.4 mm) steel plate and a 1/4 inch x 18 inch (6.4 mm x 457 mm) steel plate which shall be bolted to the channels on 2 feet-0 inch (610 mm) centers. An angle iron, steel track shall be bolted to the side of the smoke pocket to carry the guides. Channels shall be anchored to the walls on 4 feet-0 inch (1,219 mm) centers.
    1. Traction Drive Hoist.
       1. General Description:
          1. Furnish and install a motorized straight lift type, automatically closing fire safety curtain for the proscenium opening indicated on the drawings. Curtain shall lap masonry not less than 18 inch 457 mm) at each side of the proscenium opening and 24 inch (610 mm) at the top of the proscenium opening.
          2. The curtain shall be arranged to comply with the International Building Code (2015), NFPA 80: Standard for Fire Doors and Other Opening Protectives, other 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 by gravity due to over-balance of the curtain as specified below. When the fire line is released, emergency closing shall occur at an average speed between 6 in/sec (152 mm/sec) and 24 in/sec (610 mm/sec) with the last 8 feet (2.4 m) taking more than 5 seconds.
       2. Special Conditions: It is the intention of this specification to provide a fully functioning fire safety curtain system. Actual equipment and components shall reflect building conditions and approved construction drawings. All dimensions shall be field verified by the Rigging Contractor.
       3. ZetexPlus Fire Safety Curtain: The curtain shall be fabricated from tightly woven J.R. Clancy ZetexPlus 1210-ZP non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070 inch (1.8 mm) thickness weighing at least 40 ounces per square yard (1.35 KG/sq m). The curtain shall be listed and approved by the State of California Fire Marshall, the NYC Material Acceptance and Equipment Acceptance Division, and shall bear a certification label from a nationally recognized listing agency. 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 inch (152.4 mm). The bottom pocket shall be equipped with a 6 inch (152.4 mm) yield pad filled with ZetexPlus.
       4. Fire Safety Curtain Frame: The fully framed fire safety curtain shall be designed and fabricated to sustain a minimum uniform wind load of 2 psf, or as indicated by code. The attachment of the curtain to the frame shall be made to facilitate future maintenance and repair. The frame shall remain engaged in its guides and operate under the full range of temperatures and wind conditions.
       5. Each side of the curtain frame shall have two bronze guides, securely fastened to the curtain frame.
       6. Smoke Seal: Provide a smoke seal consisting of a triple layer of folded fabric fastened above the proscenium with a mounting clamp so it rubs the curtain and seals the top of the opening. The fabric shall be Zetex 800 cloth with a minimum weight of 27 oz. per square yard (0.91 KG/sq m).
       7. Traction Style Fire Curtain Hoist:
          1. The hoist shall consist of a traction sheave and gearmotor assembly. The gearmotor assembly shall consist of a high efficiency gearbox, brake release and hydraulic speed regulator, allowing the curtain to close at a controlled rate of speed when the brake is released. The entire assembly shall be mounted on a heavy channel base. The hoist shall have a lifting capacity sufficient to overcome the out of balance load required to lower the curtain at a rate of 25 feet per minute (0.13 m/s).
          2. The sheave shall be a 20 inch (508 mm) diameter iron or steel sheave, with V-grooves for the number and diameter of lift lines required.
          3. Gearmotor:

The motor, primary brake and gearbox shall be an integrated unit, with the first stage pinion gear and the primary brake both mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor, primary brake and gear reducer.

Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.

The gear reducer shall be a helical bevel reducer. The gear case shall be cast iron for protection against shock damage. The output shaft(s) 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.

Brakes shall be normally spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall be an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.

* + - * 1. Four direct struck limit switches shall be installed so that they are operated by the fire curtain arbor. These shall provide top and bottom limits of travel as well as overtravel functions. The direct struck limit switches shall be heavy duty, lever operated rotary head units, with positive opening contacts. Direct struck limit switches shall be Allen Bradley Bulletin 802T or equal.
        2. Fixed Speed Starter:

The traction drive hoist shall be controlled by a UL 508E 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.

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 UL 508E Type 2, non-welding, positive break contactors.

Overcurrent protection shall be provided by an IEC Class 10 overload. Short circuit protection shall be provided by a circuit breaker.

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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

* + - 1. Control Stations: Two control stations shall be provided in wall mounted NEMA 12 enclosures. Each shall contain hold to operate (dead man) Up and Down pushbuttons, and a mushroom head emergency stop pushbutton.
      2. Loft Block:
         1. The sheave shall have a 16 inch (406.4 mm) pitch diameter, and shall be an iron casting, with a machined groove. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
         2. Base angles shall be a minimum 2 inch x 1-1/2 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle.
         3. Side plates shall be a minimum of 10-gauge (3.57 mm) 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 1,400lb (635 KG), and shall be designed for use in either upright or underhung usage.
         5. Loft blocks shall have a cast iron sheave grooved for one 3/8 inch (9.5 mm) lift line.
      3. Counterweight Arbor:
         1. Arbor shall be long enough to accommodate counterweights to balance the fire curtain and related equipment.
         2. The arbor top shall be a fabricated weldment of 1/2 inch (12.7 mm) formed steel plate and 7 gauge (4.76 mm) formed side plates. The side plates shall be punched to receive 8 cables, and shall be tied together with a bolt and spacer providing a tie-off point for the hand line.
         3. The arbor bottom shall be 1/2 inch x 3 inch (12.7 mm x 76.2 mm) steel bar with counterweight rests to keep the weights from resting on the arbor inner nuts, and a forged steel eye for the hand line tie off.
         4. The top and bottom of the arbor shall be tied together by means of two 3/4 inch (19.1 mm) steel arbor rods. The arbor rods shall have three nuts at each end, the outermost being a lock nut.
         5. The top and bottom shall have bronze guides to engage the lattice track.
         6. Provide 14 gauge (1.98 mm) spreader plates (two minimum) on arbor rods so they can be spaced between counterweights on 2 feet (610 mm) centers. Provide a retaining collar on each rod, each with a 1/4 inch (6.4 mm) set screw with red plastic knob for easy locking. One retaining collar shall be welded to the top spreader plate.
      4. Lattice Track:
         1. The track shall consist of two 2 inch x 2 inch x 1/4 inch (50.8 mm x 50.8 mm x 6.4 mm) angles opposing each other with formed brackets alternating front and back on 2 feet centers. Back brackets shall contain two 9/16 inch (14.3 mm) diameter holes for proper anchorage to the wall.
         2. A fabricated steel bracket shall support the bottom of the lattice. Bracket shall have ample clearance for passage of hand line.
      5. Fire line System: The manual fire line release system shall consist of a 1/8 inch (3.2 mm) diameter wire rope, UL listed fusible links that release at 165 degree F (74 degree C), side mounting pulleys as required, and two fire line release devices, each mounted in a steel enclosure with acrylic viewing window that contains a positive method to release the fire line. Devices shall be mounted 5 feet (1,524 mm) above the stage floor on each side of the proscenium. All other components such as round weight arbors, arbor guards, floor pulleys, etc. required to form a fully functional fire line release system shall be provided.
         1. Fusible links shall be spaced every 15 feet (4.6 m) along the length of the fire line. A fusible link shall be located no more than 7.5 feet (2.3 m) from the vertical rise of the fire line.
      6. Lift Cables: The curtain lift cables shall be 3/8 inch (9.5 mm) diameter 7 x 19 galvanized utility cable as specified. Cables shall be terminated with corresponding cable thimbles and two forged cable clips or a Swage sleeve fitting at each end. The curtain end of each cable shall be attached to the batten using a pipe clamp.
      7. Battens: Battens shall be made of 2 inch (50.8 mm) I.D. nominal, schedule 40 black iron pipe.
      8. Safety Chains: Supply one more safety chain than the number of lift cables. 1/4 inch (6.4 mm) minimum, proof coil chains shall be located between lift cables except at the ends where the chains shall be 12 inch (304.8 mm) 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.
      9. Smoke Pockets with Track: Furnish and install one pair of smoke pockets to extend from the stage floor to a point above the top of the raised curtain or to the height specified in the drawings. Pockets shall consist of a channel 4 inch (102 mm) deeper than the curtain frame and a 1/4 inch x 18 inch (6.4 mm x 457.2 mm) steel plate which shall be bolted to the channels on 2 feet-0 inch (609.6 mm) centers. An angle steel track shall be bolted to the side of the smoke pocket to carry the guides. Channels shall be anchored to the walls on 4 feet-0 inch (1,219 mm) centers or as required to support the curtain.
    1. Drum Hoist.
       1. General Description:
          1. Furnish and install a motorized framed type, automatically closing fire safety curtain for the proscenium opening indicated on the drawings. Curtain shall lap masonry not less than 18 inch (457 mm) at each side of the proscenium opening and 24 inch (610 mm) at the top of the proscenium opening.
          2. The curtain shall be arranged to comply with the "International Building code (2006)", American National Standard E1.22-2009, other 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 by gravity due to over-balance of the curtain as specified below. Emergency closing shall occur as specified in NFPA 80 or as required by local codes when the fire line is released or fusible links separate.
       2. Special Conditions: It is the intention of this specification to provide a fully functioning fire safety curtain system. Actual equipment and components shall reflect building conditions and approved construction drawings. All dimensions shall be field verified by the Rigging Contractor.
       3. ZetexPlus Fire Safety Curtain: The curtain shall be fabricated from tightly woven J.R. Clancy ZetexPlus 1210-ZP non-wire inserted, non-asbestos, non-carcinogenic silica based cloth, 12 x 7 weave of .070 inch (1.8 mm) thickness weighing at least 40 ounces per square yard (1.35 KG/sq m). The curtain shall be listed and approved by the State of California Fire Marshall, the NYC Material Acceptance and Equipment Acceptance Division, and shall bear a certification label from a nationally recognized listing agency. 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 inch (152.4 mm). The bottom pocket shall be equipped with a 6 inch(152.4 mm) yield pad filled with ZetexPlus.
       4. Fire Safety Curtain Frame: The fully framed fire safety curtain shall be designed and fabricated to sustain a minimum uniform wind load of 2 psf, or as indicated by code. The attachment of the curtain to the frame shall be made to facilitate future maintenance and repair. The frame shall remain engaged in its guides and operate under the full range of temperatures and wind conditions.
       5. Each side of the curtain frame shall have two bronze guides, securely fastened to the curtain frame.
       6. Smoke Seal: Provide a smoke seal consisting of a triple layer of folded fabric fastened above the proscenium with a mounting clamp so it rubs the curtain and seals the top of the opening. The fabric shall be Zetex 800 cloth with a minimum weight of 27 oz. per square yard (0.91 KG/sq m).
       7. Drum Style Fire Curtain Hoist:
          1. The hoist shall be mounted to allow dual drive lines to travel from either side of the fire curtain centerline, over loft blocks and to the hoist drum.
          2. The hoist shall consist of a cable drum and a manual clutch with throw out fork, direct coupled and keyed to the output shaft of the gearbox. The entire assembly shall be mounted on a heavy channel base. The hoist shall have a 2,000lb (907.2 KG) lifting capacity at a rate of 25 feet per minute (0.127 m/s).
          3. The drum shall be a minimum diameter of 30 times cable diameter with helical grooves for the number and diameter of lift lines required.
          4. The clutch shall be rated for the applied load. The clutch lever arm shall be kept engaged by tension in the fire line that passes through a pulley in the handle. Release of the clutch is ensured by an overbalance weight acting on the arm.
          5. Gearmotor:

The motor, primary brake and gearbox shall be an integrated unit, with the first stage pinion gear and the primary brake both mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor, primary brake and gear reducer.

Motor shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.

The gear reducer shall be a combination helical/bevel reducer. The gear case shall be cast iron for protection against shock damage. The output shaft(s) 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.

Brakes shall be normally spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall be an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.

* + - * 1. Four direct struck limit switches shall be installed so that they are operated by the fire curtain arbor. These shall provide top and bottom limits of travel as well as overtravel functions. The direct struck limit switches shall be heavy duty, lever operated rotary head units, with positive opening contacts. Direct struck limit switches shall be Telemecanique ZCKJ series or equal.
        2. Fixed Speed Starter:

The hoist shall be controlled by a UL 508E 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.

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 UL 508E Type 2, non-welding, positive break contactors.

Overcurrent protection shall be provided by an IEC Class 10 overload. Short circuit protection shall be provided by a circuit breaker.

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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

* + - 1. Control Stations: Two control stations shall be provided in wall mounted NEMA 12 enclosures. Each shall contain hold to operate (dead man) Up and Down pushbuttons, and a mushroom head emergency stop pushbutton.
      2. Loft Block:
         1. The sheave shall have a 16 inch (406.4 mm) pitch diameter, and shall be an iron casting, with a machined groove. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
         2. Base angles shall be a minimum 2 inch x 1-1/2 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle.
         3. Side plates shall be a minimum of 10-gauge(3.57 mm) 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 1,400lb (635 KG), and shall be designed for use in either upright or underhung usage.
         5. Loft blocks shall have a cast iron sheave grooved for one 3/8 inch (9.5 mm) lift line.
      3. Counterweight Arbor:
         1. Arbor shall be long enough to accommodate counterweights to balance the fire curtain and related equipment.
         2. The arbor top shall be a fabricated weldment of 1/2 inch (12.7 mm) formed steel plate and 7 gauge (4.76 mm) formed side plates. The side plates shall be punched to receive 8 cables, and shall be tied together with a bolt and spacer providing a tie-off point for the hand line.
         3. The arbor bottom shall be 1/2 inch x 3 inch (12.7 mm x 76.2 mm) steel bar with counterweight rests to keep the weights from resting on the arbor inner nuts, and a forged steel eye for the hand line tie off.
         4. The top and bottom of the arbor shall be tied together by means of two 3/4 inch (19.1 mm) steel arbor rods. The arbor rods shall have three nuts at each end, the outermost being a lock nut.
         5. The top and bottom shall have bronze guides to engage the lattice track.
         6. Provide 14 gauge (1.98 mm) spreader plates (two minimum) on arbor rods so they can be spaced between counterweights on 2 feet (610 mm) centers. Provide a retaining collar on each rod, each with a 1/4 inch (6.4 mm) set screw with red plastic knob for easy locking. One retaining collar shall be welded to the top spreader plate.
      4. Lattice Track:
         1. The track shall consist of two 2 inch x 2 inch x 1/4 inch (50.8 mm x 50.8 mm x 6.4 mm) angles opposing each other with formed brackets alternating front and back on 2 feet centers. Back brackets shall contain two 9/16 inch (14.3 mm) diameter holes for proper anchorage to the wall.
         2. A fabricated steel bracket shall support the bottom of the lattice. Bracket shall have ample clearance for passage of hand line.
      5. Fire line System: The manual fire line release system shall consist of a 1/8 inch (3.2 mm) diameter wire rope, with six UL listed fusible links that release at 165 degree F (74 degree C), side mounting pulleys as required, and two fire line release devices, each mounted in a steel enclosure with acrylic viewing window that contains a positive method to release the fire line. Devices shall be mounted 5 feet (1,524 mm) above the stage floor on each side of the proscenium. All other components such as round weight arbors, arbor guards, floor pulleys, etc. required to form a fully functional fire line release system shall be provided.
      6. Lift Cables: The curtain lift cables shall be 3/8 inch (9.5 mm) diameter 7 x 19 galvanized utility cable as specified. Cables shall be terminated with corresponding cable thimbles and two forged cable clips or a Swage sleeve fitting at each end. The curtain end of each cable shall be attached to the batten using a 1/2 inch x 6 inch (12.7 mm x 152.4 mm) turnbuckle and pipe clamp.
      7. Battens: Battens shall be made of 2 inch (50.8 mm) I.D. nominal, schedule 40 black iron pipe.
      8. Safety Chains: Supply one more safety chain than the number of lift cables. 1/4 inch (6.4 mm) minimum, proof coil chains shall be located between lift cables except at the ends where the chains shall be 12 inch (304.8 mm) 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.
      9. Smoke Pockets with Track: Furnish and install one pair of smoke pockets to extend from the stage floor to a point above the top of the raised curtain or to the height specified in the drawings. Pockets shall consist of a 8 inch (203 mm) deep "Z" channel formed from 1/4 inch (6.4 mm) steel plate and a 1/4 inch x 18 inch (6.4 mm x 457.2 mm) steel plate which shall be bolted to the channels on 2 feet-0 inch (609.6 mm) centers. An angle iron, steel track shall be bolted to the side of the smoke pocket to carry the guides. Channels shall be anchored to the walls on 4 feet-0 inch (1,219 mm) centers.
  1. FIRE CURTAIN SYSTEMS, CURTAIN ACCESSORIES
     1. Electrical Fire Line Release:
        1. Product: Sure-Guard II.
        2. The fire curtain shall be equipped with an electro-mechanical fire line release mechanism operated by a Sure-Guard II, 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 fireline at any point and to help prevent accidental release.
        3. 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.
        4. The electrical fire line release shall be UL Listed.
        5. The fire line release system shall be the Sure-Guard II.
     2. 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 degree F (9.4 degree C) in one minute.
        2. Rating: 3.0A at 6 to125 VAC, 1.0 A at 6 to 24VAC, 0.3 A 125 VDC, and 0.1 A VDC.
        3. UL/ULC rating temperature - 135 degree F (57.2 degree C).
        4. UL/ULC maximum temperature at ceiling - 100 degree F (37.8 degree C).

\*\* NOTE TO SPECIFIER \*\* Provide heat resistant border curtains in the sizes, color (tan or black) and quantities listed. Delete if not required.

* + 1. Fire Curtain Systems, Heat Resisting Border:
       1. Heat resistant border curtains shall be fabricated from ZetexPlus 800 fabric, rated for 1,500 degree F (815.6C) continuous temperature. The fabric shall be woven from highly texturized silica yarn with a proprietary high temperature treatment, and a weight of 25.5 oz. per square yard.
       2. Borders shall have a sewn hem on all edges, with webbing, grommets, and ties on 12" (304.8 mm) centers on the top edge.
  1. COUNTERWEIGHT RIGGING

\*\* NOTE TO SPECIFIER \*\* Select blocks and rigging required. Delete types not required.

* + 1. 12 inch Nylon Head Block - Upright.
       1. Type: Single Purchase 12 inch (304.8 mm) Head Block.
       2. The sheave shall be filled nylon, with a 12 inch (304.8 mm) outer diameter. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle with the short leg turned in and notched to allow clear passage of all cables.
       4. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
       5. Mounting clips shall be steel, 3/8 inch (9.5 mm) thick minimum with a welded toe at least as thick as the mounting steel and punched with two oval holes for 1/2 inch (12.7 mm) bolts, flat washers and lock nuts.
       6. The block and associated mounting hardware shall have a recommended working load of at least 3,000 lbs (1,360.8 KG).
       7. Head blocks shall be grooved for six or eight 1/4 inch (6.4 mm) lift lines and one 3/4 inch (19.05 mm) hand line.
    2. 12 Inch Cast Iron Head Block - Upright.
       1. Type: Single Purchase 12 inch (304.8 mm) Head Block:
       2. The sheave shall be an iron casting with a 12 inch (304.8 mm) outer diameter. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.34m) angle with the short leg turned in and notched to allow clear passage of all cables.
       4. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
       5. Mounting clips shall be steel, 3/8 inch (9.5 mm) thick minimum with a welded toe at least as thick as the mounting steel and punched with two oval holes for 1/2 inch (12.7 mm) bolts, flat washers and lock nuts.
       6. The block and associated mounting hardware shall have a recommended working load of at least 3,000 lbs (1,360 KG).
       7. Head blocks shall be grooved for six or eight 1/4 inch (6.4 mm) lift lines and one 3/4 inch (19.1 mm) hand line.
    3. 12 Inch Nylon Head Block - Underhung.
       1. Type: Single Purchase 12 inch (304.8 mm) Head Block:
       2. The sheave shall be filled nylon with a 12 inch (304.8 mm) outer diameter. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle with the short leg turned in.
       4. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
       5. Auxiliary base angles shall be a minimum 2 inch x 1-1/2 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle with the short leg turned in. Angles shall be supplied with punched holes and 1/2 inch (12.7 mm) bolts, flat washers and lock nuts.
       6. The block and associated mounting hardware shall have a recommended working load of at least 2,500 lbs. (1,134 KG).
       7. Head blocks shall be grooved for six or eight 1/4 inch (6.4 mm) lift lines and one 3/4 inch (19.1 mm) hand line.
    4. 12 Inch Cast Iron Head Block, Underhung.
       1. Type: Single Purchase 12 inch (304.8 mm) Head Block:
       2. The sheave shall be an iron casting with a 12 inch (304.8 mm) outer diameter. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle with the short leg turned in.
       4. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
       5. Auxiliary base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle with the short leg turned in. Angles shall be supplied with punched holes and 1/2 inch (12.7 mm) bolts, flat washers and lock nuts.
       6. The block and associated mounting hardware shall have a recommended working load of at least 2,500 lbs (1,1334 KG).
       7. Head blocks shall be grooved for six or eight 1/4 inch (6.4 mm) lift lines and one 3/4 inch (19.1 mm) hand line.
    5. 16 Inch Cast Iron Head Block - Upright.
       1. Type: Single Purchase 16 inch (406.4 mm) Head block .
       2. The sheave shall be an iron casting with a 16 inch (406.4 mm) outer diameter. The sheave shall be equipped with a 1-1/2 inch (38.1 mm) diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 2-1/2 inch (63.5 mm) x 2 inch (50.4 mm) x 1/4 inch (6.4 mm) angle with the short leg turned in and notched to allow clear passage of all cables.
       4. Side plates shall be a minimum of 7-gauge (4.76 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
       5. Mounting clips shall be steel, 3/8 inch (9.5 mm) thick minimum with a welded toe at least as thick as the mounting steel and punched with two oval holes for 1/2 inch (12.7 mm) bolts, flat washers and lock nuts.
       6. The block and associated mounting hardware shall have a recommended working load of at least 3,600 lbs. (1,633 KG).
       7. Head blocks shall be grooved for eight 3/8 inch (9.5 mm) lift lines and one 1 inch (25.4 mm) hand line.
    6. 16 Inch Cast Iron Head Block - Underhung.
       1. Type: Single Purchase 16 inch (406.4 mm) Head block.
       2. The sheave shall be an iron casting with a 16 inch (406.4 mm) outer diameter. The sheave shall be equipped with a 1.5 inch (38.1 mm) diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 2.5 inch x 2 inch x 1/4 inch (63.5 mm x 50.8 mm x 6.4 mm) angle with the short leg turned in.
       4. Side plates shall be a minimum of 7-gauge (4.76 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
       5. Auxiliary base angles shall be a minimum 2.5 inch x 2 inch x 1/4 inch (50.8 mm x 50.8 mm x 6.4 mm) angle with the short leg turned in. Angles shall be supplied with punched holes and 1/2 inch (12.7 mm) bolts, flat washers and lock nuts.
       6. The block and associated mounting hardware shall have a recommended working load of at least 3,600 lbs (1,633 KG).
       7. Head blocks shall be grooved for eight 3/8 inch (9.52 mm) lift lines and one 1 inch (25.4 mm) hand line.

\*\* NOTE TO SPECIFIER \*\*Delete double purchase head blocks not required for manual counterweight rigging.

* + 1. 12 Inch DP, Nylon Head Block - Upright.
       1. Type: Double Purchase 12 inch (304.8 mm) Head Block:
       2. The sheave shall be filled nylon, with a 12 inch (304.8 mm) outer diameter. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle with the short leg turned in and notched to allow clear passage of all cables.
       4. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
       5. Double purchase blocks shall have punched angles and an additional pipe spacer properly placed to provide tie-off points for lift lines so that proper fleet angles into the arbor top sheave are maintained.
       6. Mounting clips shall be steel, 3/8 inch (9.5 mm) thick minimum with a welded toe at least as thick as the mounting steel and punched with two oval holes for 1/2 inch (12.7 mm) bolts, flat washers and lock nuts.
       7. The block and associated mounting hardware shall have a recommended working load of at least 3,000 lbs (1,7360.8 kg).
       8. Head blocks shall be grooved for six or eight 1/4 inch (6.4 mm) lift lines and one 3/4 inch (19.1 mm) hand line.
    2. 12 Inch DP, Cast Head Block - Upright.
       1. Type: Double Purchase 12 inch (30.48cm) Head Block:
       2. The sheave shall be an iron casting with a 12 inch (30.48cm) outer diameter. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 2 inch x 1-1/2 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.35 mm) angle with the short leg turned in and notched to allow clear passage of all cables.
       4. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
       5. Double purchase blocks shall have punched angles and an additional pipe spacer properly placed to provide tie-off points for lift lines so that proper fleet angles into the arbor top sheave are maintained.
       6. Mounting clips shall be steel, 3/8 inch (9.5 mm) thick minimum with a welded toe at least as thick as the mounting steel and punched with two oval holes for 1/2 inch (12.7 mm) bolts, flat washers and lock nuts.
       7. The block and associated mounting hardware shall have a recommended working load of at least 3,000lbs (1,360.8 KG).
       8. Head blocks shall be grooved for six or eight 1/4 inch (6.4 mm) lift lines and one 3/4 inch (19.05 mm) hand line.
    3. 12 Inch DP, Nylon Head Block - Underhung.
       1. Type: Double Purchase 12 inch (304.8 mm) Head Block:
       2. The sheave shall be filled nylon with a 12 inch (304.8 mm) outer diameter. The sheave shall be equipped with a 1 inch diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.35 mm) angle with the short leg turned in.
       4. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
       5. Double purchase blocks shall have punched angles and an additional pipe spacer properly placed to provide tie-off points for lift lines so that proper fleet angles into the arbor top sheave are maintained.
       6. Auxiliary base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle with the short leg turned in. Angles shall be supplied with punched holes and 1/2 inch (12.7 mm) bolts, flat washers and lock nuts.
       7. The block and associated mounting hardware shall have a recommended working load of at least 2,500 lbs (1,134 KG).
       8. Head blocks shall be grooved for six or eight 1/4 inch (6.35 mm) lift lines and one 3/4 inch (19.05 mm) hand line.
    4. 12 Inch DP, Cast Iron Head Block - Underhung.
       1. Type: Double Purchase 12 inch (304.8 mm) Head Block:
       2. The sheave shall be an iron casting with a 12 inch (304.8 mm) outer diameter. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle with the short leg turned in.
       4. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
       5. Double purchase blocks shall have punched angles and an additional pipe spacer properly placed to provide tie-off points for lift lines so that proper fleet angles into the arbor top sheave are maintained.
       6. Auxiliary base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle with the short leg turned in. Angles shall be supplied with punched holes and 1/2 inch (12.7 mm) bolts, flat washers and lock nuts.
       7. The block and associated mounting hardware shall have a recommended working load of at least 2,500 lbs (1,134 KG).
       8. Head blocks shall be grooved for six or eight 1/4 inch (6.4 mm) lift lines and one 3/4 inch (19.05 mm) hand line.
    5. 16 Inch DP, Cast Iron Head Block - Upright.
       1. Type: Double Purchase 16 inch (406.4 mm) Head block .
       2. The sheave shall be iron casting with a 16 inch (406.4 mm) outer diameter. The sheave shall be equipped with a 1.5 inch (38.1 mm) diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 2.5 inch x 2 inch x 1/4 inch (63.5 mm x 50.8 mm x 6.4 mm) angle with the short leg turned in and notched to allow clear passage of all cables.
       4. Side plates shall be a minimum of 7-gauge (4.76 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
       5. Mounting clips shall be steel, 3/8 inch (9.5 mm) thick minimum with a welded toe at least as thick as the mounting steel and punched with two oval holes for 1/2 inch (12.7 mm) bolts, flat washers and lock nuts.
       6. The block and associated mounting hardware shall have a recommended working load of at least 3,600 lbs (1,633.9 KG).
       7. Head blocks shall be grooved for eight 3/8 inch (9.52 mm) lift lines and one 1 inch (25.4 mm) hand line.
    6. 16 Inch DP, Cast Iron Head Block - Underhung.
       1. Type: Double Purchase 16 inch (406 mm) Head block .
       2. The sheave shall be iron casting with a 16 inch (406 mm) outer diameter. The sheave shall be equipped with a 1-1/2 inch (38.1 mm) diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 2-1/2 inch x 2 inch x 1/4 inch (57 mm x 50.8 mm x 6.35 mm) angle with the short leg turned in.
       4. Side plates shall be a minimum of 7-gauge (4.76 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
       5. Double purchase blocks shall have punched angles and an additional pipe spacer properly placed to provide tie-off points for lift lines so that proper fleet angles into the arbor top are maintained.
       6. Auxiliary base angles shall be a minimum 2.5 inch x 2 inch x 1/4 inch (50.8 mm x 50.8 mm x 6.4 mm) angle with the short leg turned in. Angles shall be supplied with punched holes and 1/2 inch (12.7 mm) bolts, flat washers and lock nuts.
       7. The block and associated mounting hardware shall have a recommended working load of at least 3,600 lbs (1,633 KG).
       8. Head blocks shall be grooved for eight 3/8 inch (9.53 mm) lift lines and one 1 inch (25.4 mm) hand line.
    7. 12 Inch WG, Nylon Head Block - Upright.
       1. Type: Wire Guide 12 inch (304.8 mm) Head Block:
       2. The sheave shall be filled nylon, with a 12 inch (304.8 mm) outer diameter. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle with the short leg turned in and notched to allow clear passage of all cables.
       4. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
       5. Blocks used in wire guide systems shall have tie-off points for the guide wires.
       6. Mounting clips shall be steel, 3/8 inch (9.5 mm) thick minimum with a welded toe at least as thick as the mounting steel and punched with two oval holes for 1/2 inch (12.7 mm) bolts, flat washers and lock nuts.
       7. The block and associated mounting hardware shall have a recommended working load of at least 3,000 lbs (1,360 KG).
       8. Head blocks shall be grooved for six or eight 1/4 inch (6.4 mm) lift lines and one 3/4 inch (19.1 mm) hand line.
    8. 12 Inch WG, Cast Iron Head Block - Upright.
       1. Type: Wire Guide 12 inch (304.8 mm) Head Block:
       2. The sheave shall be iron casting with a 12 inch (304.8 mm) outer diameter. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle with the short leg turned in and notched to allow clear passage of all cables.
       4. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
       5. Blocks used in wire guide systems shall have tie-off points for the guide wires.
       6. Mounting clips shall be steel, 3/8 inch (9.5 mm) thick minimum with a welded toe at least as thick as the mounting steel and punched with two oval holes for 1/2 inch (12.7 mm) bolts, flat washers and lock nuts.
       7. The block and associated mounting hardware shall have a recommended working load of at least 3,000 lbs (1,360.8 KG).
       8. Head blocks shall be grooved for six or eight 1/4 inch (6.4 mm) lift lines and one 3/4 inch (19.1 mm) hand line.
    9. 12 Inch WG, Nylon Head Block - Underhung .
       1. Type: Wire Guide 12 inch (304.8 mm) Head Block:
       2. The sheave shall be filled nylon with a 12 inch (304.8 mm) outer diameter. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle with the short leg turned in.
       4. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
       5. Blocks used in wire guide systems shall have tie-off points for the guide wires.
       6. Auxiliary base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle with the short leg turned in. Angles shall be supplied with punched holes and 1/2 inch (12.7 mm) bolts, flat washers and lock nuts.
       7. The block and associated mounting hardware shall have a recommended working load of at least 2,500 lbs (1,134 KG).
       8. Head blocks shall be grooved for six or eight 1/4 inch (6.4 mm) lift lines and one 3/4 inch (19.1 mm) hand line.
    10. 12 Inch WG, Cast Iron Head Block - Underhung.
        1. Type: Wire Guide 12 inch (304.8 mm) Head Block:
        2. The sheave shall be an iron casting with a 12 inch (304.8 mm) outer diameter. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
        3. Base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle with the short leg turned in.
        4. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
        5. Blocks used in wire guide systems shall have tie-off points for the guide wires.
        6. Auxiliary base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle with the short leg turned in. Angles shall be supplied with punched holes and 1/2 inch (12.7 mm) bolts, flat washers and lock nuts.
        7. The block and associated mounting hardware shall have a recommended working load of at least 2,500 lbs (1,134 KG).
        8. Head blocks shall be grooved for six or eight 1/4 inch (6.4 mm) lift lines and one 3/4 inch (19.1 mm) hand line.

\*\* NOTE TO SPECIFIER \*\*Delete staggered sheave head blocks not required for manual counterweight rigging.

* + 1. Staggered Sheave Nylon Head Block.
       1. Type: Staggered Sheave Head Block:
       2. The block sheaves shall have 8.5 inch (215.9 mm) outside diameters, and shall be filled nylon. Each sheave shall be equipped with a 17 mm (.67in) diameter shaft and two sealed, precision ball bearings. Sheaves shall be spaced in the housing so cables align with the hoist drum grooving to eliminate fleet angles.
       3. Base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle punched with a mounting hole pattern for clip attachment.
       4. Side plates shall be a minimum of 12-gauge (2.78 mm) steel, and shall fully enclose the sheaves. Side plates shall be bolted and welded to the base angles for strength.
       5. Auxiliary base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle with the short leg turned in. Angles shall be supplied with punched holes and 1/2 inch (12.7 mm) bolts, flat washers and lock nuts.
       6. The block and associated mounting hardware shall have a minimum recommended working load at least equal to the hoist capacity and associated stresses.

\*\* NOTE TO SPECIFIER \*\* Insert number of sheave grooves required for project.

* + - 1. Head blocks shall have \_\_\_ sheaves grooved for one 1/4 inch (6.4 mm) lift line each.
    1. Staggered Sheave Cast Iron Head Block.
       1. Type: Staggered Sheave Head Block:
       2. The block sheaves shall be iron castings with 8.5 inch (215.9 mm) outside diameters. Each sheave shall be equipped with a 17 mm (.67in) diameter shaft and two sealed, precision ball bearings. Sheaves shall be spaced in the housing so cables align with the hoist drum grooving to eliminate fleet angles.
       3. Base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle punched with a mounting hole pattern for clip attachment.
       4. Side plates shall be a minimum of 12-gauge (2.78 mm) steel, and shall fully enclose the sheaves. Side plates shall be bolted and welded to the base angles for strength.
       5. Auxiliary base angles shall be a minimum 2 inch x 1.5 inch x 1/4 inch (50.8 mm x 38.1 mm x 6.4 mm) angle with the short leg turned in. Angles shall be supplied with punched holes and 1/2 inch (12.7 mm) bolts, flat washers and lock nuts.
       6. The block and associated mounting hardware shall have a minimum recommended working load at least equal to the hoist capacity and associated stresses.

\*\* NOTE TO SPECIFIER \*\* Insert number of sheave grooves required for project.

* + - 1. Head blocks shall have sheaves grooved for one 1/4 inch (6.4 mm) lift line each,.
         1. Number of Sheave Grooves: \_\_\_\_\_\_.

\*\* NOTE TO SPECIFIER \*\*Delete loft blocks not required for manual counterweight rigging.

* + 1. 8 Inch Nylon Universal Loft Block.
       1. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter, and shall be filled nylon. The sheave shall be equipped with a 17 mm (.67in) diameter shaft and two sealed, precision ball bearings.
       2. Base angles shall be a minimum 1-1/2 inch x 1-1/2 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle punched with a universal hole pattern for easy installation.
       3. Side plates shall be a minimum of 12-gauge (2.78 mm) 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 750 lbs. (340.2 KG), and shall be designed for use in either upright or underhung usage.
       5. Loft blocks shall be grooved for one 1/4 inch (6.4 mm) lift line.
    2. 8 Inch Nylon Universal Loft Block.
       1. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter, and shall be filled nylon. The sheave shall be equipped with a 17 mm (.67 inch) diameter shaft and two tapered roller bearings.
       2. Base angles shall be a minimum 1.5 inch x 1.5 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle punched with a universal hole pattern for easy installation.
       3. Side plates shall be a minimum of 12-gauge (2.78 mm) 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 750 lbs. (340.2 KG), and shall be designed for use in either upright or underhung usage.
       5. Loft blocks shall be grooved for one 1/4 inch (6.4 mm) lift line.
    3. 8 Inch Cast Iron Universal Loft Block.
       1. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter, and shall be an iron casting, with a machined groove. The sheave shall be equipped with a 17 mm (0.67in.) diameter shaft and two sealed, precision ball bearings.
       2. Base angles shall be a minimum 1-1/2 inch x 1-1/2 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle punched with a universal hole pattern for easy installation.
       3. Side plates shall be a minimum of 12-gauge (2.78 mm) 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. (227 KG) and shall be designed for use in either upright or underhung usage.
       5. Loft blocks shall be grooved for one 1/4 inch (6.4 mm) lift line.
    4. 8 Inch Cast Iron Universal Loft Block.
       1. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter, and shall be an iron casting, with a machined groove. The sheave shall be equipped with a 17 mm (0.67in.) diameter shaft and two tapered roller bearings.
       2. Base angles shall be a minimum 1-1/2 inch x 1-1/2 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle punched with a universal hole pattern for easy installation.
       3. Side plates shall be a minimum of 12-gauge (2.78 mm) 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. (227 KG) and shall be designed for use in either upright or underhung usage.
       5. Loft blocks shall be grooved for one 1/4 inch (6.4 mm) lift line.
    5. 8 Inch Nylon Universal Loft Block - 2 Line.
       1. Loft Block - 2 Line:
       2. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter, and shall be filled nylon. The sheave shall be equipped with a 17 mm (.67in) diameter shaft and two sealed, precision ball bearings.
       3. Base angles shall be a minimum 1-1/2 inch x 1-1/2 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle punched with a universal hole pattern for easy installation.
       4. Side plates shall be a minimum of 12-gauge (2.78 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted to the base angles.
       5. The block and associated mounting hardware shall have a recommended working load of at least 750 lbs. (340.2 KG), and shall be designed for use in either upright or underhung usage.
       6. Loft blocks shall be grooved for two 1/4 inch (6.4 mm) lift lines.
    6. 8 Inch Nylon Universal Loft Block - 2 Line.
       1. Loft Block - 2 Line:
       2. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter, and shall be filled nylon. The sheave shall be equipped with a 17 mm (.67in) diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 1.5 inch x 1.5 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle punched with a universal hole pattern for easy installation.
       4. Side plates shall be a minimum of 12-gauge (2.78 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted to the base angles.
       5. The block and associated mounting hardware shall have a recommended working load of at least 750 lbs. (340.2 KG), and shall be designed for use in either upright or underhung usage.
       6. Loft blocks shall be grooved for two 1/4 inch (6.4 mm) lift lines.
    7. 8 Inch Cast Iron Universal Loft Block - 2 Line.
       1. Loft Block - 2 Line:
       2. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter, and shall be an iron casting, with two machined grooves. The sheave shall be equipped with a 17 mm diameter shaft and two sealed, precision ball bearings.
       3. Base angles shall be a minimum 1-1/2 inch x 1-1/2 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle punched with a universal hole pattern for easy installation.
       4. Side plates shall be a minimum of 12-gauge (2.78 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles.
       5. The block and associated mounting hardware shall have a recommended working load of at least 500 lbs. (226.8 KG) per line and 750 lbs. (340.2 KG) total, and shall be designed for use in either upright or underhung usage.
       6. Loft blocks shall be grooved for two 1/4 inch (6.4 mm) lift lines.
    8. 8 Inch Cast Iron Universal Loft Block - 2 Line.
       1. Loft Block - 2 Line:
       2. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter, and shall be an iron casting, with two machined grooves. The sheave shall be equipped with a 17 mm diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 1.5 inch x 1.5 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle punched with a universal hole pattern for easy installation.
       4. Side plates shall be a minimum of 12-gauge (2.78 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles.
       5. The block and associated mounting hardware shall have a recommended working load of at least 500 lbs. (226.8 KG) per line and 750 lbs. (340.2 KG) total, and shall be designed for use in either upright or underhung usage.
       6. Loft blocks shall be grooved for two 1/4 inch (6.4 mm) lift lines.
    9. 8 Inch Nylon Loft Block, Upright, 4 and 8 Line.
       1. Loft Block - 4 and 8 Line:
       2. The sheave shall have an 8.5 inch (215.9 mm) outside diameter, and shall be filled nylon. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 1.5 inch x 1.5 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle.
       4. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles.
       5. The block and associated mounting hardware shall have a recommended working load of at least 750 lbs. (340.2 KG) per line and 1300 lbs. (589.7 KG) total, and shall be designed for use in either upright or underhung usage.
       6. Loft blocks shall be grooved for 4 or 8 - 1/4 inch (6.4 mm) lift lines.
    10. 8 Inch Cast Iron Loft Block, Underhung, 4 and 8 Line.
        1. Loft Block - 4 and 8 Line:
        2. The sheave shall have an 8.5 inch (215.9 mm) outside diameter, and shall be an iron casting, with machined grooves. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
        3. Base angles shall be a minimum 1.5 inch x 1.5 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle.
        4. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted to the base angles.
        5. The block and associated mounting hardware shall have a recommended working load of at least 500 lbs. (226.8 KG) per line and 1300 lbs. (589.7 KG) total, and shall be designed for use in either upright or underhung usage.
        6. Loft blocks shall be grooved for 4 or 8 - 1/4 inch (6.4 mm) lift lines.
    11. 12 Inch Cast Iron Universal Loft Block.
        1. The sheave shall have a 12 inch (304.8 mm) pitch diameter, and shall be an iron casting, with a machined groove. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
        2. Base angles shall be a minimum 1.5 inch x 2 inch x 3/16 inch (38.1 mm x 50.8 mm x 4.76 mm) angle.
        3. Side plates shall be a minimum of 10-gauge steel (3.57 mm), and shall fully enclose the sheave. Side plates shall be bolted to the base angles.
        4. Loft blocks shall be grooved for one 1/4 inch or 3/8 inch (6.4 mm or 9.52 mm) lift line.
        5. The block and associated mounting hardware shall have a recommended working load of at least 700 lbs. (317.5 KG) for 1/4 inch (6.4 mm) cable or 1050 lbs. (476.3 KG) for 3/8 inch (9.52 mm) cable, and shall be designed for use in either upright or underhung usage.
    12. 16 Inch Steel, Universal Loft Block.
        1. The steel sheave shall have a 16 inch (406.4 mm) diameter with a machined groove. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
        2. Base angles shall be a minimum 2 inch x 2 inch x 1/4 inch (50.8 mm x 50.8 mm x 6.4 mm) angle.
        3. Side plates shall be a minimum of 7-gauge (4.76 mm) 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 1400 lbs (635 KG), and shall be designed for use in either upright or underhung usage.
        5. Loft blocks shall be grooved for one 3/8 inch (9.52 mm) lift line.

\*\* NOTE TO SPECIFIER \*\*Delete 19 series cable loft blocks not required for manual counterweight rigging.

* + 1. 8 Inch Nylon Loft Block, Underhung (19 Series).
       1. Underhung Loft Block:
       2. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter and shall be filled nylon. The sheave shall be equipped with a 17 mm (.67in) diameter shaft and two sealed, precision ball bearings.
       3. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, with a cut-out to grasp the beam flange.
       4. A machined steel 3/4 inch (19.1 mm) drawbolt and steel clip shall grasp the opposing beam flange and allow a 5 inch (127 mm) grip adjustment to accommodate a range of beam sizes.
       5. The block shall have a recommended working load of at least 500 lbs. (226.8 mm).
       6. Loft blocks shall be grooved for one 1/4 inch (6.4 mm) lift line.
    2. 8 Inch Nylon Loft Block, Underhung (19 Series).
       1. Underhung Loft Block:
       2. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter and shall be filled nylon. The sheave shall be equipped with a 17 mm (.67in) diameter shaft and two tapered roller bearings.
       3. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, with a cut-out to grasp the beam flange.
       4. A machined steel 3/4 inch (19.1 mm) drawbolt and steel clip shall grasp the opposing beam flange and allow a 5 inch (127 mm) grip adjustment to accommodate a range of beam sizes.
       5. The block shall have a recommended working load of at least 500 lbs. (226.8 mm).
       6. Loft blocks shall be grooved for one 1/4 inch (6.4 mm) lift line.
    3. 8 Inch Cast Iron Loft Block, Underhung (19 Series).
       1. Underhung Loft Block:
       2. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter and shall be an iron casting with a machined groove. The sheave shall be equipped with a 17 mm (.67in) diameter shaft and two sealed, precision ball bearings.
       3. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, with a cut-out to grasp the beam flange.
       4. A machined steel 3/4 inch (19.1 mm) drawbolt and steel clip shall grasp the opposing beam flange and allow a 5 inch (127 mm) grip adjustment to accommodate a range of beam sizes.
       5. The block shall have a recommended working load of at least 500 lbs. (226.8 mm).
       6. Loft blocks shall be grooved for one 1/4 inch (6.4 mm) lift line.
    4. 8 Inch Cast Iron Loft Block, Underhung (19 Series).
       1. Underhung Loft Block:
       2. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter and shall be an iron casting with a machined groove. The sheave shall be equipped with a 17 mm (.67in) diameter shaft and two tapered roller bearings.
       3. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, with a cut-out to grasp the beam flange.
       4. A machined steel 3/4 inch (19.1 mm) drawbolt and steel clip shall grasp the opposing beam flange and allow a 5 inch (127 mm) grip adjustment to accommodate a range of beam sizes.
       5. The block shall have a recommended working load of at least 500 lbs. (226.8 mm).
       6. Loft blocks shall be grooved for one 1/4 inch (6.4 mm) lift line.
    5. 8 Inch Nylon Loft Block, Underhung (19 Series) - 2 Line.
       1. Underhung Loft Block - 2 Line:
       2. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter, and shall be filled nylon. The sheave shall be equipped with a 17 mm (.67in) diameter shaft and two sealed, precision ball bearings.
       3. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, with a cutout to grasp the beam flange.
       4. A machined steel 3/4 inch (19.1 mm) drawbolt and steel clip shall grasp the opposing beam flange and allow a 5 inch (127 mm) grip adjustment to accommodate a range of beam sizes.
       5. The block shall have a recommended working load of at least 500 lbs. (226.8 mm).
       6. Loft blocks shall be grooved for two 1/4 inch (6.4 mm) lift lines.
    6. 8 Inch Nylon Loft Block, Underhung (19 Series) - 2 Line.
       1. Underhung Loft Block - 2 Line:
       2. The sheave shall have an 8.5 inch (215.9 mm) outside diameter, and shall be filled nylon. The sheave shall be equipped with a 17 mm (.67in) diameter shaft and two tapered roller bearings.
       3. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, with a cutout to grasp the beam flange.
       4. A machined steel 3/4 inch (19.1 mm) drawbolt and steel clip shall grasp the opposing beam flange and allow a 5 inch (127 mm) grip adjustment to accommodate a range of beam sizes.
       5. The block shall have a recommended working load of at least 500 lbs. (226.8 mm).
       6. Loft blocks shall be grooved for two 1/4 inch (6.4 mm) lift lines.
    7. 8 Inch Cast Iron Loft Block, Underhung (19 Series) - 2 Line.
       1. Underhung Loft Block - 2 Line:
       2. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter, and shall be an iron casting, with two machined grooves. The sheave shall be equipped with a 17 mm (.67 inch) diameter shaft and two sealed, precision ball bearings.
       3. Side plates shall be a minimum of 10-gauge steel (3.57 mm), with a cutout to grasp the beam flange.
       4. A machined steel 3/4 inch (19.1 mm) drawbolt and steel clip shall grasp the opposing beam flange and allow a 5 inch (127 mm) grip adjustment to accommodate a range of beam sizes.
       5. The side plates shall be rigidly fastened together with a minimum of three 1/4 inch (6.4 mm) bolts and pipe, two of which prevent cables from escaping the sheave grooves.
       6. The block shall have a recommended working load of at least 500 lbs. (226.8 mm).
       7. Loft blocks shall be grooved for two 1/4 inch (6.4 mm) lift lines.
    8. 8 Inch Cast Iron Loft Block, Underhung (19 Series) - 2 Line.
       1. Underhung Loft Block - 2 Line:
       2. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter, and shall be an iron casting, with two machined grooves. The sheave shall be equipped with a 17 mm (.67in) diameter shaft and two tapered roller bearings.
       3. Side plates shall be a minimum of 10-gauge steel (3.57 mm), with a cutout to grasp the beam flange.
       4. A machined steel 3/4 inch (19.1 mm) drawbolt and steel clip shall grasp the opposing beam flange and allow a 5 inch (127 mm) grip adjustment to accommodate a range of beam sizes.
       5. The side plates shall be rigidly fastened together with a minimum of three 1/4 inch (6.4 mm) bolts and pipe, two of which prevent cables from escaping the sheave grooves.
       6. The block shall have a recommended working load of at least 500 lbs. (226.8 mm).
       7. Loft blocks shall be grooved for two 1/4 inch (6.4 mm) lift lines.
    9. 8 Inch Nylon Loft Block, Underhung (19 Series) - 4 and 8 Line.
       1. Underhung Loft Block - 4 and 8 Line:
       2. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter and shall be filled nylon. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       3. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, with a cut-out to grasp the beam flange.
       4. A machined steel 3/4 inch (19.1 mm) drawbolt and steel clip shall grasp the opposing beam flange and allow a 4 inch (101.6 mm) grip adjustment to accommodate a range of beam sizes.
       5. The side plates shall be rigidly fastened together with a minimum of three 1/4 inch (6.4 mm) bolts and pipe, two of which prevent cables from escaping the sheave grooves.
       6. The block shall have a recommended working load of at least 700 lbs. (317.5 KG).
       7. Loft blocks shall be grooved for 4 or 8 - 1/4 inch (6.4 mm) lift lines.
    10. 8 inch Cast Iron Loft Block, Underhung (19 Series) - 4 and 8 Line.
        1. Underhung Loft Block - 4 and 8 Line:
        2. The sheave shall have an 8.5 inch (215.9 mm) outside diameter, and shall be an iron casting, with machined grooves. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
        3. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, with a cut-out to grasp the beam flange.
        4. A machined steel 3/4 inch (19.05 mm) drawbolt and steel clip shall grasp the opposing beam flange and allow a 4 inch (101.6 mm) grip adjustment to accommodate a range of beam sizes.
        5. The side plates shall be rigidly fastened together with a minimum of three 1/4 inch (6.4 mm) bolts and pipe, two of which prevent cables from escaping the sheave grooves.
        6. The block shall have a recommended working load of at least 700 lbs (317.5 KG).
        7. Loft blocks shall be grooved for 4 or 8 - 1/4 inch (6.4 mm) lift lines.
    11. 12 Inch Cast Iron Loft Block, Underhung (19 Series).
        1. Underhung Loft Block:
        2. The sheave shall have a 12 inch (304.8 mm) outside diameter, and shall be an iron casting, with a machined groove. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
        3. Side plates shall be a minimum of 7-gauge (4.76 mm) steel, with a cut-out to grasp the beam flange.
        4. A machined steel 3/4 inch (19.1 mm) drawbolt and steel clip shall grasp the opposing beam flange and allow a 5 inch (127 mm) grip adjustment to accommodate a range of beam sizes.
        5. The block shall have a recommended working load of at least 675 lbs (306.2 KG).
        6. Loft blocks shall be grooved for one 1/4 inch or 3/8 inch (6.4 mm or 9.52 mm) lift line.

\*\* NOTE TO SPECIFIER \*\*Delete 3/16 inch (4.8 mm) cable loft blocks not required for manual counterweight rigging.

* + 1. 8 Inch Nylon Loft Block.
       1. Underhung Loft Block:
       2. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter and shall be filled nylon. The sheave shall be equipped with a 17 mm (.67in) diameter shaft and two sealed, precision ball bearings.
       3. Side plates shall be a minimum of 10-gauge steel (3.57 mm), with a cut-out to grasp the beam flange.
       4. A machined steel 3/4 inch (19.1 mm) drawbolt and steel clip shall grasp the opposing beam flange and allow a 5 inch (127 mm) grip adjustment to accommodate a range of beam sizes.
       5. The block shall have a recommended working load of at least 500 lbs. (226.8 KG).
       6. Loft blocks shall be grooved for one 3/16 inch (4.76 mm) lift line.
    2. 8 Inch Nylon Loft Block.
       1. Underhung Loft Block:
       2. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter and shall be filled nylon. The sheave shall be equipped with a 17 mm (.67in) diameter shaft and two tapered roller bearings.
       3. Side plates shall be a minimum of 10-gauge steel (3.57 mm), with a cut-out to grasp the beam flange.
       4. A machined steel 3/4 inch (19.1 mm) drawbolt and steel clip shall grasp the opposing beam flange and allow a 5 inch (127 mm) grip adjustment to accommodate a range of beam sizes.
       5. The block shall have a recommended working load of at least 500 lbs. (226.8 KG).
       6. Loft blocks shall be grooved for one 3/16 inch (4.76 mm) lift line.
    3. 8 Inch Nylon Universal Loft Block.
       1. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter, and shall be filled nylon. The sheave shall be equipped with a 17 mm (.67in) diameter shaft and two tapered roller bearings.
       2. Base angles shall be a minimum 1-1/2 inch x 1-1/2 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle punched with a universal hole pattern for easy installation.
       3. Side plates shall be a minimum of 12-gauge steel (2.78 mm), 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. (226.8 KG), and shall be designed for use in either upright or underhung usage.
       5. Loft blocks shall be grooved for one 3/16 inch (4.76 mm) lift line.
    4. 8 inch Nylon Loft Block, Underhung - 8LN.
       1. Underhung Loft Block - 8 Line:
       2. The sheave shall have an 8.5 inch (215.9 mm) outside diameter and shall be filled nylon. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       3. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, with a cut-out to grasp the beam flange.
       4. A machined steel 3/4 inch (19.05 mm) drawbolt and steel clip shall grasp the opposing beam flange and allow a 4 inch (101.6 mm) grip adjustment to accommodate a range of beam sizes.
       5. The side plates shall be rigidly fastened together with a minimum of three 1/4 inch (6.45 mm) bolts and pipe, two of which prevent cables from escaping the sheave grooves.
       6. The block shall have a recommended working load of at least 700 lbs (317.5 KG).
       7. Loft blocks shall be grooved for eight, 3/16 inch (4.76 mm) lift lines.
    5. 8 Inch Nylon Loft Block, Upright, 8LN.
       1. Loft Block - 8 Line:
       2. The sheave shall have an 8.5 inch (215.9 mm) outside diameter, and shall be filled nylon. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       3. Base angles shall be a minimum 1.5 inch x 1.5 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.763 mm) angle.
       4. Side plates shall be a minimum of 10-gauge steel (3.57 mm), and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles.
       5. The block and associated mounting hardware shall have a recommended working load of at least 500 lbs. (226.8 KG) per line and 1300 lbs. (598.7 KG) total load, and shall be designed for use in either upright or underhung usage.
       6. Loft blocks shall be grooved for eight, 3/16 inch (4.763 mm) lift lines.
    6. Idler Assemblies.
       1. Loft block idlers shall be provided to carry the weight of the cables and prevent rubbing against adjacent block side plates. They shall not be installed to carry line loads or to act as deflector or mule blocks.
       2. Idler assemblies shall consist of one or two 3-1/2 inch (88.9 mm) diameter, 3-line filled ABS idler pulleys mounted on the side of the loft block housing.
       3. The sheaves shall have 1/4 inch (6.4 mm) cable grooves and two sealed, precision ball bearings and shall ride on a 1/4 inch (6.4 mm) shaft inserted through the block housing.
       4. A 1/8 inch (3.2 mm) diameter bail shall mount in the housing and captivate the cables in the grooves.
       5. All nuts shall be of the nylon insert self-locking type.

\*\* NOTE TO SPECIFIER \*\*Delete if not required for manual counterweight rigging.

* + 1. Pivot Bracket.
       1. Pivot brackets mount loft blocks to beams with more than 1-1/2 degrees of slope.
       2. They consist of a pair of angles that bolt to the block base angles and a matching pair of angles that mount to the beam with clips. A 3/4 inch (19.1 mm) diameter threaded rod connects the two sets of angle to provide a hinge point.

\*\* NOTE TO SPECIFIER \*\*Delete mule block not required for manual counterweight rigging.

* + 1. 8 Inch Cast Iron Mule Block - 1 and 2 Line.
       1. 8 inch (203 mm) Mule Blocks - 1 and 2 Line.
       2. The sheave shall have an 8-1/2 inch (215.9 mm) outside diameter and shall be an iron casting with a machined groove.
       3. The sheave shall be equipped with a 17 mm (0.67 inch) diameter shaft and two, sealed, precision ball bearings.
       4. Side plates shall be a minimum of 7-gauge (4.76 mm) steel, and shall fully enclose the sheave.
       5. Side plates shall be fillet welded to an 8 inch (203.2 mm) structural steel channel or a 3 gage (6.2 mm) formed channel base. Brace tubes with a minimum size of 2 inch x 2 inch x 3/16 inch (50.8 mm x 50.8 mm x 4.8 mm) shall be welded to both side plates and the channel base for added strength.
       6. There shall be a minimum of four 3/8 inch (9.52 mm) bolts with spacers between the side plates for structural strength and to prevent cables from escaping the sheave grooves.
       7. The block shall have a recommended working load maximum of 500 lbs. (226.8 KG) per line.
       8. Mule blocks shall be grooved for one or two 1/4 inch (6.4 mm) lines.
    2. 8 Inch Cast Iron Mule Block - 1 and 2 Line.
       1. 8 inch (203 mm) Mule Blocks - 1 and 2 Line.
       2. The sheave shall have an 8.5 inch (215.9 mm) outside diameter and shall be an iron casting with a machined groove.
       3. The sheave shall be equipped with a 17 mm (0.67 inch) diameter shaft and two tapered roller bearings.
       4. Side plates shall be a minimum of 7-gauge (4.76 mm) steel, and shall fully enclose the sheave.
       5. Side plates shall be fillet welded to an 8 inch (203.2 mm) structural steel channel or a 3 gage (6.2 mm) formed channel base. Brace tubes with a minimum size of 2 inch x 2 inch x 3/16 inch (50.8 mm x 50.8 mm x 4.8 mm) shall be welded to both side plates and the channel base for added strength.
       6. There shall be a minimum of four 3/8 inch (9.52 mm) bolts with spacers between the side plates for structural strength and to prevent cables from escaping the sheave grooves.
       7. The block shall have a recommended working load maximum of 500 lbs. (226.8 KG) per line.
       8. Mule blocks shall be grooved for one or two 1/4 inch (6.4 mm) lines.
    3. 8 Inch Cast Iron Mule Block - 4 and 8 Line.
       1. 8 inch (203 mm) Mule Blocks - 4 and 8 Line.
       2. The sheave shall have an 8-1/2 inch (215 mm) outside diameter and shall be an iron casting with machined grooves.
       3. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       4. Side plates shall be a minimum of 7-gauge (4.76 mm) steel, and shall fully enclose the sheave.
       5. Side plates shall be fillet welded to an 8 inch (203.2 mm) structural steel channel or a 3 gauge (6.2 mm) formed channel base. Brace tubes with a minimum size of 2 inch x 2 inch x 1/4 inch (50.8 mm x 50.8 mm x 6.35 mm) shall be welded to both side plates and the channel base for added strength.
       6. There shall be a minimum of four 3/8 inch (9.52 mm) bolts with spacers between the side plates for structural strength and to prevent cables from escaping the sheave grooves.
       7. The block shall have a recommended working load of at least 500 lbs. (226.8 KG) per line with a total load not to exceed 2000 lbs. (907.2 KG) using a 90 degree wrap or 1400 lbs. (635.0 kg) using a 180 degree wrap.
       8. Mule blocks shall be grooved for four or eight 1/4 inch (6.4 mm) lines.
    4. 12 Inch Cast Iron Mule Block.
       1. 12 inch (304.8 mm) Mule Blocks:
       2. The sheave shall have a 12 inch (304.8 mm) outside diameter and shall be an iron casting with a machined groove.
       3. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       4. Side plates shall be a minimum of 7-gauge (4.76 mm) steel, and shall fully enclose the sheave.
       5. Side plates shall be fillet welded to an 8 inch (203 mm) structural steel channel or a 3 gauge (6.2 mm) formed channel base. Brace tubes with a minimum size of 2 inch x 2 inch x 1/4 inch (50.8 mm x 50.8 mm x 6.4 mm) shall be welded to both side plates and the channel base for added strength.
       6. There shall be a minimum of four 3/8 inch (9.52 mm) bolts with spacers between the side plates for structural strength and to prevent cables from escaping the sheave grooves.
       7. The block shall have a recommended working load of at least 700 lbs. (317.5 KG) per line.
       8. Total load of a one line block shall not exceed 700 lbs. (317.5 KG) using a 90 degree wrap or 700 lbs. (317.5 KG) using a 180 degree wrap.
       9. Total load of a two line block shall not exceed 1400 lbs. (907.2 KG) using a 90 degree wrap or 1400 lbs. (907.2 KG) using a 180 degree wrap.
       10. Total load of a four line block shall not exceed 2000 lbs. (408.23 KG) using a 90 degree wrap or 1400 lbs. (907.2 KG) using a 180 degree wrap.
       11. Total load of a four line block shall not exceed 2000 lbs. (408.23 KG) using a 90 degree wrap or 1400 lbs. (907.2 KG) using a 180 degree wrap.
       12. Mule blocks shall be grooved for 1, 2, 4, or 8 - 1/4 inch (6.4 mm) lines.
    5. 8 Inch Nylon Mule Block - 2 Line.
       1. 8 inch (203 mm) Mule Blocks - 1 and 2 Line.
       2. The sheave shall have an 8-1/2 inch (209.55 mm) outside diameter and shall be filled nylon.
       3. The sheave shall be equipped with a 17 mm (0.67 inch) diameter shaft and two, sealed, precision ball bearings.
       4. Side plates shall be a minimum of 7-gauge (4.76 mm) steel, and shall fully enclose the sheave.
       5. Side plates shall be fillet welded to an 8 inch (203.2 mm) formed steel channel base. Bracing tubes with a minimum size of 2 inch x 2 inch x 3/16 inch (50.8 mm x 50.8 mm x 4.76 mm) shall be welded to both side plates and the base for added strength.
       6. There shall be a minimum of four 3/8 inch (9.53 mm) bolts with spacers between the side plates for structural strength and to prevent cables from escaping the sheave grooves.
       7. The block shall have a recommended working load of at least 875 lbs. (385.55 KG) per line. Total load not to exceed 1750 lbs. (793.8 KG) for a 90 degree wrap and 1400 lbs. (635.0 KG) for a 180 degree wrap.
       8. Mule blocks shall be grooved for one or two 1/4 inch (6.4 mm) or 3/16 inch (4.76 mm) lines.
    6. 8 Inch Nylon Mule Block - 2 Line.
       1. 8 inch (203 mm) Mule Blocks - 1 and 2 Line.
       2. The sheave shall have an 8-1/2 inch (209.55 mm) outside diameter and shall be filled nylon.
       3. The sheave shall be equipped with a 17 mm (0.67 inch) diameter shaft and two tapered roller bearings.
       4. Side plates shall be a minimum of 7-gauge (4.76 mm) steel, and shall fully enclose the sheave.
       5. Side plates shall be fillet welded to an 8 inch (203.2 mm) formed steel channel base. Bracing tubes with a minimum size of 2 inch x 2 inch x 3/16 inch (50.8 mm x 50.8 mm x 4.76 mm) shall be welded to both side plates and the base for added strength.
       6. There shall be a minimum of four 3/8 inch (9.53 mm) bolts with spacers between the side plates for structural strength and to prevent cables from escaping the sheave grooves.
       7. The block shall have a recommended working load of at least 875 lbs. (385.55 KG) per line. Total load not to exceed 1750 lbs. (793.8 KG) for a 90 degree wrap and 1400 lbs. (635.0 KG) for a 180 degree wrap.
       8. Mule blocks shall be grooved for one or two 1/4 inch (6.4 mm) or 3/16 inch (4.76 mm) lines.
    7. 8 Inch Nylon Mule Block - 4 and 8 Line.
       1. 8 inch (203.2 mm) Mule Block.
       2. The sheave shall have an 8-1/2 inch (209.55 mm) outside diameter and shall be filled nylon.
       3. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       4. Side plates shall be a minimum of 7-gauge (4.76 mm) steel, and shall fully enclose the sheave.
       5. Side plates shall be fillet welded to an 8 inch (203.2 mm) formed steel channel base. Bracing tubes with a minimum size of 2 inch x 2 inch x 3/16 inch (50.8 mm x 50.8 mm x 4.76 mm) shall be welded to both side plates and the base for added strength.
       6. There shall be a minimum of four 3/8 inch (9.525 mm) bolts with spacers between the side plates for structural strength and to prevent cables from escaping the sheave grooves.
       7. The block shall have a recommended working load of at least 875 lbs. (396.9 KG) per 1/4 inch (6.4 mm) line and 525 lbs. (238.1 KG) per 3/16 inch (4.76 mm) line with a total load not to exceed 2000 lbs. (907.2 KG) using a 90 degree wrap or 1400 lbs. (635.0 kg) using a 180 degree wrap.
       8. Mule blocks shall be series grooved for four or eight 1/4 inch (6.4 mm) or 3/16 inch (4.76 mm) lines.

\*\* NOTE TO SPECIFIER \*\*Delete if not required for manual counterweight rigging.

* + 1. Swivel Stand.
       1. The stand consists of a heavy pipe welded to a braced base plate. The plate may be punched for temporary attachment bolts but the base will be welded to the building structure after final alignment.
       2. A swivel is factory welded to mule block. It shall have a tube at one end that fits over the vertical stand member and swivels for alignment. Bolts are for alignment but all connections shall be welded after alignment.

\*\* NOTE TO SPECIFIER \*\*Delete if not required for manual counterweight rigging.

* + 1. Mule Stand.
       1. The stand shall consist of a steel frame that is elevated to the required height and tilted to adjust the mule to the proper angle. The frame may be punched for temporary attachment bolts but the base will be welded to the building structure after final alignment.

\*\* NOTE TO SPECIFIER \*\*Delete if not required for manual counterweight rigging. Delete Guide System Types "J", "A" or "T" not required for project.

* + 1. J-Guide System.
       1. Vertical J's shall be 1-3/4 inch x 1-1/2 inch x 3/16 inch (44.45 mm x 38.1 mm x 4.76 mm) extruded aluminum members.
       2. J-guides shall be held in place by extruded aluminum clips, which are bolted to the wall battens. The clips and J-guide shall be formed so that they lock together in accurate alignment. There shall be no need for holes or slots in the J-guides.
       3. Horizontal wall battens shall be located on centers not to exceed 5 feet (1524 mm). Wall battens shall be 1-3/4 inch x 1-3/4 inch x 3/16 inch (44.45 mm x 44.45 mm x 4.76 mm steel angles with factory punched holes on 2 inch (50.8 mm) centers to allow J-guides to be located on 6 inch, 8 inch (152.4 mm, 203.2 mm) or other centers. (Locations with high seismic activity may require different batten spacing or sizes.).
       4. Wall battens shall be held in place by adjustable wall knees, consisting of a 5/16 inch x 1.5 inch (7.93 mm x 38.1 mm) steel knee and an 11 gauge (3.18 mm) 1 inch x 2 inch (25.4 mm x 50.8 mm) formed, slotted channel to aid in alignment made necessary by irregularities in the wall.
       5. There shall be a top stop batten, a bottom stop batten and a floor batten, all of which shall be made of 1-3/4 inch x 1-3/4 inch x 3/16 inch (44.45 mm x 44.45 mm x 4.76 mm) steel angle. The top and bottom stop battens shall each have a 2 inch x 2 inch (50 mm x 50 mm) hardwood bumper securely bolted to the stop battens by 1/4 inch x 2-1/2 inch (6.4 mm x 63.5 mm) carriage bolts, nuts, and washers.
       6. All other members of the J-guide system shall be assembled using 5/16 inch (7.93 mm) hex head bolts, lock nuts and washers.
    2. A-Guide System.
       1. The A-guides shall be 3.5 inch deep x 2 inch wide x 3/16 inch (88.9 mm x 50.8 mm x 4.76 mm) wall extruded aluminum members.
       2. A-guides shall be held in place by extruded aluminum clips on each leg of the guide. The clips are bolted to the wall battens. The clips and A-guide shall be formed so that they lock together in accurate alignment. There shall be no need for holes or slots in the A-guides.
       3. Horizontal wall battens shall be located on centers not to exceed 5ft (1.52 mm). (Locations with high seismic activity may require different spacing or sizes.) Wall battens shall be 1-3/4 inch x 1-3/4 inch x 3/16 inch (44.45 mm x 44.45 mm x 4.76 mm) steel angles with factory punched holes on 2 inch (50.8 mm) centers to allow A-guides to be located on 6 inch, 8 inch (152.4 mm x 203.2 mm) or other centers.
       4. Wall battens shall be held in place by adjustable wall knees, consisting of a 5/16 inch x 1.5 inch (38.1 mm) steel knee and an 11 gauge (3.18 mm) 1 inch x 2 inch (25.4 mm x 50.8 mm) formed, slotted channel to aid in alignment made necessary by irregularities in the wall.
       5. There shall be a top stop batten, a bottom stop batten and a floor batten, all of which shall be made of 1-3/4 inch x 1-3/4 inch x 3/16 inch (44.45 mm x 44.45 mm x 4.76 mm) steel angle. The top and bottom stop battens shall each have a 2 inch x 2 inch (50.8 mm x 50.8 mm) hardwood bumper faced with 1/4 inch x 2 inch (6.4 mm x 50.8 mm) neoprene securely bolted to the stop battens by 1/4 inch x 2-1/2 inch (6.4 mm x 63.5 mm) carriage bolts, nuts, and washers.
       6. All other members of the A-guide system shall be assembled using 5/16 inch (7.94 mm) hex head bolts, lock nuts and washers.
    3. T-Guide System.
       1. Vertical T-bars shall be 1.5 inch x 1.5 inch x 3/16 inch (38.1 mm x 38.1 mm x4.76 mm) steel members with factory punched mounting holes and slots.
       2. T-bars shall be held in place and properly spaced by "U" shaped spreader plates formed from 1 inch x 3/16 inch (25.4 mm x 4.76 mm) steel, which are bolted to the wall battens.
       3. Horizontal wall battens shall be located on centers not to exceed 5 feet (1524 mm). Wall battens shall be 1-3/4 inch x 1-3/4 inch x 3/16 inch (44.45 mm x 44.45 mm x 4.76 mm) steel angles with factory punched holes on 2 inch (50.5 mm) centers to allow J-guides to be located on 6 inch, 8 inch (152.4 mm, 203.2 mm) or other centers. (Locations with high seismic activity may require different batten spacing or sizes.).
       4. Wall battens shall be held in place by adjustable wall knees, consisting of a 5/16 inch x 1.5 inch (7.93 mm x 38.1 mm) steel knee and an 11 gauge (3.18 mm) 1 inch x 2 inch (25.4 mm x 50.8 mm) formed, slotted channel to aid in alignment made necessary by irregularities in the wall.
       5. There shall be a top stop batten, a bottom stop batten and a floor batten, all of which shall be made of 1-3/4 inch x 1-3/4 inch x 3/16 inch (44.45 mm x 44.45 mm x 4.76 mm) steel angle. The top and bottom stop battens shall each have a 2 inch x 2 inch (50.8 mm x 50.8 mm) hardwood bumper securely bolted to the stop battens by 1/4 inch x 2-1/2 inch (6.35 mm x 63.5 mm) carriage bolts, nuts, and washers.
       6. All other members of the T-bar system shall be assembled using 5/16 inch (7.93 mm) hex head bolts, lock nuts and washers.

\*\* NOTE TO SPECIFIER \*\* Available for J-Guide, A-Guide and T-Bar types. Delete arbors not required.

* + 1. Arbor: FrontLoader Front Loading Arbor - Single Purchase.
       1. Arbor shall be of specified length, or long enough to accommodate counterweights to balance its pipe batten and related equipment, whichever is longer.
       2. The arbor shall be comprised of a series of sloped shelves within individually accessible compartments at 24 inch (6100 mm) increments.
       3. Each arbor compartment shall be designed to accommodate ANSI E1.4.1 compliant counterweight bricks 13-3/4 inches (349 mm) deep.
       4. Arbor models available shall include for 6 inch (152 mm) wide bricks with a minimum guide spacing of 8 inches (203 mm) center to center, and models for 4 inch (102 mm) wide bricks with a minimum guide spacing of 6 inches (152 mm) center to center based on project requirements.
       5. Arbor heights available shall include 6 feet (1829 mm) tall, 8 feet (2438 mm) tall, or 10 feet (3048 mm) tall (nominal) based on project requirements.
       6. Compartment latching mechanism shall be a two stage rotary latch system designed to comply with the strength requirements of SAE J839 and FMVSS 206.
       7. The pivot axial load shall meet or exceed 120 lb-in (13.55 N-m) torque.
       8. Arbor housing shall be constructed of formed 12-gauge steel sheet.
       9. Arbor gates shall be constructed of resistance welded bar in a grid (mesh) configuration.
       10. Each 24 inch (6100 mm) tall (nominal) arbor gate shall be attached onto the arbor with two hinges rated for a minimum of 400 lbs (181 kg) hanging static load each.

\*\* NOTE TO SPECIFIER \*\* Available for J-Guide, A-Guide and T-Bar types. Delete arbors not required.

* + 1. Arbor: FrontLoader Front Loading Arbor - Double Purchase.
       1. Arbor shall be of specified length, or long enough to accommodate counterweights to balance its pipe batten and related equipment, whichever is longer.
       2. The arbor shall be comprised of a series of sloped shelves within individually accessible compartments at 24 inch (6100 mm) increments.
       3. Each arbor compartment shall be designed to accommodate ANSI E1.4.1 compliant counterweight bricks 13-3/4 inches (349 mm) deep.
       4. Arbor models available shall include for 6 inch (152 mm) wide bricks with a minimum guide spacing of 8 inches (203 mm) center to center, and models for 4 inch (102 mm) wide bricks with a minimum guide spacing of 6 inches (152 mm) center to center based on project requirements.
       5. Arbor heights available shall include 6 feet (1829 mm) tall, 8 feet (2438 mm) tall, or 10 feet (3048 mm) tall (nominal) based on project requirements.
       6. Compartment latching mechanism shall be a two stage rotary latch system designed to comply with the strength requirements of SAE J839 and FMVSS 206.
       7. The pivot axial load shall meet or exceed 120 lb-in (13.55 N-m) torque.
       8. Arbor housing shall be constructed of formed 12-gauge steel sheet.
       9. Arbor gates shall be constructed of resistance welded bar in a grid (mesh) configuration.
       10. Each 24 inch (6100 mm) tall (nominal) arbor gate shall be attached onto the arbor with two hinges rated for a minimum of 400 lbs (181 kg) hanging static load each.

\*\* NOTE TO SPECIFIER \*\* Available for J-Guide, A-Guide and T-Bar types. Delete arbors not required.

* + 1. Arbor: J/T-Guide Single Purchase Arbor.
       1. Arbor shall be of specified length, or long enough to accommodate counterweights to balance its pipe batten and related equipment, whichever is longer.
       2. The arbor top shall be a 1/4 inch (6.4 mm) steel plate formed into a channel with 3 inch (76 mm) sides and punched to receive 8 cables. A bolt and spacer shall tie the legs together and provide a tie-off point for the hand line. The front of the arbor top shall carry a 1-1/2 inch (38 mm) high white set number.
       3. The arbor bottom shall be of similar construction, with counterweight rests to keep the weights from resting on the inner arbor rod nuts.
       4. The top and bottom of the arbor shall be tied together by means of two 3/4 inch steel arbor rods and a 3/8 inch x 3 inch (9.5 mm x 76 mm) steel back plate. The arbor rods shall have three nuts at each end, the outermost being a lock nut.
       5. Two guide assemblies shall be provided, each comprised of UHMW plates between steel backup plates or molded plastic shoe assemblies with stiffening ribs and lock tabs, secured to the arbor by means of two 3/8 inch (9.5 mm) hex head bolts and lock nuts.
       6. Provide 12-gauge (2.78 mm) spreader plates (two minimum) on arbor rods so they can be spaced between counterweights on 2 foot centers. Provide a retaining collar on each rod, each with a 1/4 inch (6.4 mm) set screw with red plastic knob for easy locking. The front retaining collar shall be welded to the top spreader plate.
       7. Provide labels on the steel back plates showing the proper locations for the spreader plates.

\*\* NOTE TO SPECIFIER \*\* Available for J-Guide, A-Guide and T-Bar types. Delete if not required.

* + 1. Arbor: J/T- Guide Single Purchase Arbor (Seismic).
       1. Spreader plates shall be captured by the arbor rods and the back bar. They are located as normal with additional plates added inside at the arbor top and bottom. The top and bottom plates are held in place using the inner arbor rod nuts.
       2. The spreader plates are 7 Ga. (4.7 mm) thick minimum and notched to ride around the edges of tee or J-guides without rubbing. This keeps the arbors attached to the guides, even if the arbor guide shoes are damaged during a seismic event.
       3. The bottom spreader plate shall be equipped with counterweight rests to keep the weights from resting on the inner arbor rod nuts.
    2. Arbor: J/T-Guide Double Purchase Arbor.
       1. Arbor shall be of specified length, or long enough to accommodate counterweights to balance its pipe batten and related equipment, whichever is longer.
       2. The arbor top shall be a fabricated weldment of 1/2 inch (12.7 mm) steel plate and 7 gauge (4.76 mm) formed side plates. These shall enclose an 8-1/2 inch (215.9 mm) outside diameter cast sheave with grooves as required. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       3. The arbor bottom shall be a fabricated weldment of 1/2 inch (12.7 mm) formed steel plate and 10 gauge (3.57 mm) formed side plates, with counterweight rests to keep the weights from resting on the inner arbor rod nuts. The side plates shall enclose an 8" (203.2 mm) outside diameter cast sheave with a groove for a 3/4 inch (19.05 mm) hand line. The sheave shall be equipped with a 17 mm (0.67 inch) diameter shaft and two sealed, precision ball bearings.
       4. The top and bottom of the arbor shall be tied together by means of two 3/4 inch (19.05 mm) steel arbor rods and a 3/8 inch x 3 inch (9.52 mm x 76.2 mm) steel back plate. The arbor rods shall have three nuts at each end, the outermost being a lock nut.
       5. Two guide assemblies shall be provided, each comprised of UHMW plates between steel backup plates or molded plastic shoe assemblies with stiffening ribs and lock tabs, secured to the arbor by means of two 3/8 inch (9.52 mm) hex head bolts and lock nuts.
       6. Provide 12-gauge (2.78 mm) spreader plates (two minimum) on arbor rods so they can be spaced between counterweights on 2ft (609.6 mm) centers. Provide a retaining collar on each rod, each with a 1/4 inch (6.4 mm) set screw with red plastic knob for easy locking. The front retaining collar shall be welded to the top spreader plate.
       7. Provide labels on the steel back plates showing the proper locations for the spreader plates.

\*\* NOTE TO SPECIFIER \*\* Available for J-Guide, A-Guide and T-Bar types. Delete locking rails not required for guide system.

* + 1. Locking Rail: J/T-Guide Locking Rail.
       1. Rope locks and index cards shall be mounted on a formed steel angle no smaller than 3-1/2 inch x 5 inch x 1/4 inch (88.9 mm x 127 mm x 6.4 mm).
       2. The onstage edge of the rail shall be sloped and punched to receive formed clips which hold index cards centered on the installed sets. Provide one numbered plastic write-on card for each installed set.
       3. Stanchions made from 1/2 inch x 3 inch (12.7 mm x 76.2 mm) flat bar shall be provided on 5 feet (1.52m) (maximum) centers.
       4. The entire locking rail shall be designed and installed to withstand a minimum up load of 500 pounds per foot (226.8 KG per 304.8 mm) per AISC standards.
    2. Locking Rail: J/T-Guide, DP Locking Rail.
       1. Rope locks and index cards shall be mounted on a formed steel angle no smaller than 3-1/2 inch x 5 inch x 1/4 inch (88.9 mm x 127 mm x 6.35 mm).
       2. The onstage edge of the rail shall be sloped and punched to receive formed clips which hold index cards centered on the installed sets. Provide one numbered plastic write-on card for each installed set.
       3. Stanchions made from 1/2 inch x 3 inch (12.7 mm x 76.2 mm) flat bar shall be provided on 5 feet (1.52m) (maximum) centers.
       4. A 3 inch X 2 inch X 1/4 inch (76.2 mm x 50.8 mm x 6.4 mm) angle located on the rear of the stanchions shall be punched and furnished with anchor shackles for tying off the ends of the double purchased handlines.
       5. The entire locking rail shall be designed and installed to withstand a minimum up load of 500 pounds per foot (226.8 KG per 304.8 mm) per AISC standards.
    3. Locking Rail: Gallery Locking Rail.
       1. Rope locks and index cards shall be mounted on a formed steel angle no smaller than 3-1/2 inch x 5 inch x 1/4 inch (88.9 mm x 127 mm x 6.4 mm).
       2. The onstage edge of the rail shall be sloped and punched to receive formed clips which hold index cards centered on the installed sets. Provide one numbered plastic write-on card for each installed set.
       3. Stanchions made from 2 inch (50.8 mm) steel square tube shall be provided on 5 feet (1.54m) (maximum) centers. They shall be long enough to anchor to the edge of the gallery. A continuous 3 inch x 2 inch x 1/4 inch (76.2 mm x 50.8 mm x 6.35 mm) angle shall help anchor the rail to the gallery and serve as a kick rail. Expanded metal mesh shall be provided between the stanchions.

\*\* NOTE TO SPECIFIER \*\* Available for J-Guide, A-Guide and T-Bar types. The entire locking rail shall be designed and installed to withstand a minimum up load of 500 pounds per foot (226.8 KG per 304.8 mm) per AISC standards. Delete outrigger bracket if not required.

* + 1. Outrigger Brackets:
       1. Angle iron outrigger brackets shall be made of 3/16 inch x 1-3/4 inch x 1-3/4 inch (4.76 mm x 44.45 mm x 44.45 mm) angle and spaced not more than 10ft (304.8 mm) apart. The brackets shall be attached to the wall battens of the arbor guide system so that the batten is located 10ft (304.8 mm) above the gallery or stage floor. The brackets shall include clamps for attaching the batten.
       2. The outrigger batten shall be made from 1.5 inch (38.1 mm) I.D., schedule 40 pipe extending the full length of the locking rail. Specifications are the same as other battens.

\*\* NOTE TO SPECIFIER \*\* Available for J-Guide, A-Guide and T-Bar types. Delete compensating chain system if not required.

* + 1. Compensating Chain System:
       1. A compensating chain system shall be provided to balance the transfer of weight of the lift lines from the batten to the arbor as counterweight sets are raised and lowered.
       2. Roller chain is attached to the bottom of the arbor and to a T-Bar wall batten at the midpoint of the T-Bar battery. The T-Bars are spaced away from the wall battens so the chain travels in the space between the arbor back bars and the wall battens. Size the chain so that weight is added to the arbor to balance the cable weight added to the batten as the batten is lowered.

\*\* NOTE TO SPECIFIER \*\* Available for J-Guide, A-Guide and T-Bar types. Delete floor block not required for guide system.

* + 1. Floor Block: Tension Floor Block.
       1. 10 inch (254 mm) Tension Floor Block:
       2. The cast iron sheave shall have a 10 inch (254 mm) outside diameter and shall be an iron casting with a machined groove for a 3/4 inch (19.1 mm) rope.
       3. The sheave shall be equipped with a 17 mm (0.67inch) diameter shaft and two sealed, precision ball bearings.
       4. Side plates shall be a minimum of 3/16 inch (4.67 mm) steel plate.
       5. The block shall have a minimum weight of 40 lbs. (18.1 KG) to properly tension the hand line.
       6. A plastic kick tab shall be provided for adjustment of the rope tension.
       7. The floor block shall be held in place and guided in the T-bar, J-bar, or A-bar guides by two guide shoe assemblies, each consisting of two guides and one spacer made of 5/16 inch (7.94 mm) thick steel plates. Each guide shall be secured to the housing by means of two 3/8 inch (9.52 mm) hex head bolts and nuts.
    2. Floor Block: Tension Floor Block.
       1. 12 inch (304.8 mm) Tension Floor Block:
       2. The cast iron sheave shall have a 12 inch (304.8 mm) outside diameter and shall be an iron casting with a machined groove for a 3/4 inch (19.05 mm) rope.
       3. The sheave shall be equipped with a 17 mm (0.67inch) diameter shaft and two sealed, precision ball bearings.
       4. Side plates shall be a minimum of 3/16 inch (4.763 mm) steel plate.
       5. The block shall have a minimum weight of 48 lbs. (21.8 KG) to properly tension the hand line.
       6. A plastic kick tab shall be provided for adjustment of the rope tension.
       7. The floor block shall be held in place and guided in the T-bar, J-bar, or A-bar guides by two guide shoe assemblies, each consisting of two guides and one spacer made of 5/16 inch (7.94 mm) thick steel plates. Each guide shall be secured to the housing by means of two 3/8 inch (9.52 mm) hex head bolts and nuts.

\*\* NOTE TO SPECIFIER \*\* Available for J-Guide, A-Guide and T-Bar types. Wire guides can be used to guide the travel path of counterweight arbors in place of J/T-guides or lattice tracks at much reduced cost under certain conditions. We do not recommend using wire guides with over 30ft (90.14m) of travel because the guides allow the arbors to move and twist too much. High tension in the guide wires keeps the arbors from swaying but greatly increases the loads placed in the building structure. If there are a number of guide wires present, the loads can become high enough to cause structural failure in the system. Lightly tensioned guides reduce building stress but allow the arbors to sway. This is OK if the arbors are far enough away from other arbors or obstructions to eliminate the possibility of collisions that can cause damage or falling counterweights. Delete if not required for project.

* + 1. Wire Guide - Arbor.
       1. Arbor shall be of specified length, or long enough to accommodate counterweights to balance its pipe batten and related equipment, whichever is longer.
       2. The arbor top shall be a fabricated weldment of 1/2 inch (12.7 mm) steel plate and 7 gauge (4.76 mm) formed side plates. The side plates shall be punched to receive 8 cables, and shall be tied together with a bolt and spacer providing a tie-off point for the hand line.
       3. The arbor bottom shall be 1/2 inch x 3 inch (12.7 mm x 76.2 mm) steel bar with counterweight rests to keep the weights from resting on the inner arbor rod nuts, and a forged steel eye for the hand line tie off.
       4. The top and bottom of the arbor shall be tied together by means of two 3/4 inch (19.05 mm) steel arbor rods. The arbor rods shall have three nuts at each end, the outermost being a lock nut.
       5. The top and bottom shall have smoothed and rounded 3/8 inch (9.52 mm) holes for 1/4 inch (6.4 mm) diameter guide wires located on 15 inch (381 mm) centers.
       6. Provide 12-gauge (2.78 mm) spreader plates (two minimum) on arbor rods so they can be spaced between counterweights on 2ft (609.6 mm) centers. Provide a retaining collar on each rod, each with a 1/4 inch (6.4 mm) set screw with red plastic knob for easy locking. The front retaining collar shall be welded to the top spreader plate.
       7. The arbor shall be guided by 1/4 inch (6.35 mm) diameter wire ropes when installed. The guides shall be tensioned with turnbuckles tightened to prevent excessive play in the arbor travel but not so tight as to over stress the attachment points of the cables.
    2. Wire Guide - Locking Rail.
       1. Rope locks and index cards shall be mounted on a formed steel angle no smaller than 3-1/2 inch x 5 inch x 1/4 inch (88.9 mm x 127 mm x 6.4 mm).
       2. The onstage edge of the rail shall be sloped and punched to receive formed clips which hold plastic write-on index cards centered on the installed sets. Provide one numbered plastic write-on card for each installed set.
       3. Stanchions made from 1/2 inch x 3 inch (12.7 mm x 76.2 mm) flat bar and 3 inch (76.2 mm) channel shall be provided on 5 feet (1.52m) (maximum) centers. A 4 inch (101.6 mm) Channel shall be mounted along the stanchions to provide a lower bumper for wire guided counterweight arbors.
       4. Two angles on the stanchions shall be provided to support 855M floor blocks.
       5. The entire locking rail shall be designed and installed to withstand a minimum up load of 500 pounds per foot (226.8 KG per 304.8 mm) per AISC standards.

\*\* NOTE TO SPECIFIER \*\* Available for J-Guide, A-Guide and T-Bar types. Delete floor blocks not required for project.

* + 1. Floor Block: Nylon Wire Guide Floor Block.
       1. The sheave shall have an 8 inch (203.2 mm) outside diameter and shall be filled nylon. The sheave shall be equipped with a 17 mm (0.67 inch) diameter shaft and two sealed, precision ball bearings.
       2. Base angles shall be a minimum 1.5 inch x 1.5 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle.
       3. Side plates shall be a minimum of 12-gauge steel (2.78 mm), and shall fully enclose the sheave.
       4. Base angles shall incorporate tie off points for guide wires.
    2. Floor Block: Wire Guide Floor Block.
       1. The sheave shall have an 8 inch (203.2 mm) outside diameter and shall be an iron casting with a machined groove for a 3/4 inch (19.05 mm) rope. The sheave shall be equipped with a 17 mm diameter shaft and two sealed, precision ball bearings.
       2. Base angles shall be a minimum 1.5 inch x 1.5 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle.
       3. Side plates shall be a minimum of 12-gauge (2.78 mm) steel, and shall fully enclose the sheave.
       4. Base angles shall incorporate tie off points for guide wires.
    3. Floor Block: Nylon Fixed Combination Floor Block.
       1. The sheave shall have an 8 inch (203.2 mm) outside diameter and shall be filled nylon. The sheave shall be equipped with a 17 mm (0.67 inch) diameter shaft and two sealed, precision ball bearings.
       2. Side plates shall be a minimum of 12-gauge (2.78 mm) steel, and shall fully enclose the sheave.
       3. The included rope lock shall consist of an ASTM A536 ductile iron housing, cams and handle. The cams shall compress the rope, not bend it over a tight radius corners that reduce its strength. The housing shall allow the use of a standard padlock to hold the handle in its closed position. There shall be a rubber bumper in the housing to silence the handle when it is opened.
       4. Adjustment for rope shall be from 5/8 inch to 1 inch (15.87 mm to 25.4 mm) by means of a 1/2 inch (12.7 mm) nylon tipped, socket head adjustment screw with lock nut at the rear of the housing.
       5. The handle shall be 9 inch (228.6 mm) long with a nylon powder or vinyl dip coating. The handle shall be installed so that it passes two degrees past vertical to lock the hand line. A coated, oval, welded steel ring shall be provided as a safety lock. The outer end of the handle shall be slotted to accommodate a safety padlock.
       6. The rope lock and floor block shall be mounted to a 1/2 inch x 4 inch (12.7 mm x 101.6 mm) formed steel frame, which incorporates tie off points for guide wires.
    4. Floor Block: Fixed Combination Floor Block.
       1. The sheave shall have an 8 inch (203.2 mm) outside diameter and shall be an iron casting with a machined groove for a 3/4 inch (19.1 mm) rope. The sheave shall be equipped with a 17 mm (0.67 inch) diameter shaft and two sealed, precision ball bearings.
       2. Side plates shall be a minimum of 12-gauge steel (2.78 mm), and shall fully enclose the sheave.
       3. The rope lock shall consist of an ASTM A536 ductile iron housing, cams and handle. The cams shall compress the rope, not bend it over tight radius corners that reduce its strength. The housing shall allow the use of a standard padlock to hold the handle in its closed position. There shall be a rubber bumper in the housing to silence the handle when it is opened.
       4. Adjustment for rope shall be from 5/8 inch to 1 inch (15.87 mm to 25.4 mm) by means of a 1/2 inch (12.7 mm) nylon tipped, socket head adjustment screw with lock nut at the rear of the housing.
       5. The handle shall be 9 inch (228.6 mm) long with a nylon powder or vinyl dip coating. The handle shall be installed so that it passes two degrees past vertical to lock the hand line. A coated, oval, welded steel ring shall be provided as a safety lock. The outer end of the handle shall be slotted to accommodate a safety padlock.
       6. The rope lock and floor block shall be mounted to a 1/2 inch x 4 inch (12.7 mm x 101.6 mm) formed steel frame, which incorporates tie off points for guide wires.
    5. Floor Block: Adjustable Combination Floor Block.
       1. The sheave shall have a 10 inch (254 mm) outside diameter and shall be an iron casting with a machined groove for a 3/4 inch (19.1 mm) rope. The sheave shall be equipped with a 17 mm (0.67inch) diameter shaft and two sealed, precision ball bearings. The shaft shall be fitted with a locking handle, allowing the sheave to be moved to adjust rope tension.
       2. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, shall fully enclose the sheave, and shall have a slot allowing a minimum of 5 inch (1.52m) of sheave position adjustment.
       3. The rope lock shall consist of an ASTM A536 ductile iron housing, cams and handle. The cams shall compress the rope, not bend it over tight radius corners that reduce its strength. The housing shall allow the use of a standard padlock to hold the handle in its closed position. There shall be a rubber bumper in the housing to silence the handle when it is opened.
       4. Adjustment for rope shall be from 5/8 inch to 1 inch (15.87 mm to 25.4 mm) by means of a 1/2 inch (12.7 mm) nylon tipped, socket head adjustment screw with lock nut at the rear of the housing.
       5. The handle shall be 9 inch (228.6 mm) long with a nylon powder or vinyl dip coating. The handle shall be installed so that it passes two degrees past vertical to lock the hand line. A coated, oval, welded steel ring shall be provided as a safety lock. The outer end of the handle shall be slotted to accommodate a safety padlock.
       6. The rope lock and floor block shall be mounted to a 1/2 inch x 4 inch (12.7 mm x 101.6 mm) formed steel frame, which incorporates tie off points for guide wires.
    6. Floor Block: Adjustable Combination Floor Block.
       1. The sheave shall have a 12 inch (304.8 mm) outside diameter and shall be an iron casting with a machined groove for a 3/4 inch (19.1 mm) rope. The sheave shall be equipped with a 17 mm (0.67 inch) diameter shaft and two sealed, precision ball bearings. The shaft shall be fitted with a locking handle, allowing the sheaved to be moved a minimum of 5 inch (1.52m) to adjust rope tension.
       2. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, shall fully enclose the sheave, and shall have a slot allowing a minimum of 8 inch (203.2 mm) of sheave position adjustment.
       3. The rope lock shall consist of an ASTM A536 ductile iron housing, cams and handle. The cams shall compress the rope, not bend it over tight radius corners that reduce its strength. The housing shall allow the use of a standard padlock to hold the handle in is closed position. There shall be a rubber bumper in the housing to silence the handle when it is opened.
       4. Adjustment for rope shall be from 5/8 inch to 1 inch (15.87 mm to 25.4 mm) by means of a 1/2 inch (12.7 mm) nylon tipped, socket head adjustment screw with lock nut at the rear of the housing.
       5. The handle shall be 9 inch (228.6 mm) long with a nylon powder or vinyl dip coating. The handle shall be installed so that it passes two degrees past vertical to lock the hand line. A coated, oval, welded steel ring shall be provided as a safety lock. The outer end of the handle shall be slotted to accommodate a safety padlock.
       6. The rope lock and floor block shall be mounted to a 1/2 inch x 4 inch (12.7 mm x 101.6 mm) formed steel frame, which incorporates tie off points for guide wires.

\*\* NOTE TO SPECIFIER \*\* Available for J-Guide, A-Guide and T-Bar types. Delete if not required for project.

* + 1. Lattice Track Arbor.
       1. Arbor shall be of specified length, or long enough to accommodate counterweights to balance its pipe batten and related equipment, whichever is longer.
       2. The arbor top shall be a fabricated weldment of 1/2 inch (12.7 mm) formed steel plate and 7 gauge (4.76 mm) formed side plates. The side plates shall be punched to receive 8 cables, and shall be tied together with a bolt and spacer providing a tie-off point for the hand line.
       3. The arbor bottom shall be 1/2 inch x 3 inch (12.7 mm x 76.2 mm) steel bar with counterweight rests to keep the weights from resting on the inner arbor rod nuts, and a forged steel eye for the hand line tie off.
       4. The top and bottom of the arbor shall be tied together by means of two 3/4 inch (19.05 mm) steel arbor rods. The arbor rods shall have three nuts at each end, the outermost being a lock nut.
       5. The top and bottom shall have UHMW or bronze guides to engage the lattice track.
       6. Provide 12-gauge (2.78 mm) spreader plates (two minimum) on arbor rods so they can be spaced between counterweights on 2 feet-0 inch (610 mm) centers. Provide a retaining collar on each rod, each with a 1/4 inch (6.4 mm) set screw with red plastic knob for easy locking. One retaining collar shall be welded to the top spreader plate.

\*\* NOTE TO SPECIFIER \*\* Available for J-Guide, A-Guide and T-Bar types. Delete bottom bracket if not required for project.

* + 1. Bottom Bracket: Lattice Track and Bracket.
       1. Lattice Track:
          1. The track shall consist of two 2 inch x 2 inch x 1/4 inch (50.8 mm x 50.8 mm x 6.35 mm) angles opposing each other with 1/4 inch x 2 inch (6.35 mm x 50.8 mm) formed brackets alternating front and back on 2 feet-0 inch (50.8 mm) centers. Back brackets shall contain two, 9/16 inch (14.3 mm) diameter holes for anchorage to wall.
          2. All connections shall be made with 3/8 inch (9.52 mm) hex bolts and lock nuts.
       2. Lattice Track Bracket:
          1. A fabricated steel bracket shall support the bottom of the lattice track. Bracket shall have ample clearance for passage of hand line.
    2. Bottom Bracket: Lattice Track and Spring Bracket.
       1. Lattice Track:
          1. The track shall consist of two 2 inch x 2 inch x 1/4 inch (50.8 mm x 50.8 mm x 6.4 mm) angles opposing each other with 1/4 inch x 2 inch (6.35 mm x 50.8 mm) formed brackets alternating front and back on 2 inch (50.8 mm) centers. Back brackets shall contain two, 9/16 inch (14.3 mm) diameter holes for anchorage to wall.
          2. All connections shall be made with 3/8 inch (9.52 mm) hex bolts and lock nuts.
       2. Lattice Track Spring Bracket:
          1. A fabricated steel bracket with integral compression springs shall support the bottom of the lattice track, prevent abrupt stops, and limit arbor travel. The springs shall be braced and guarded for safety. Bracket shall have ample clearance for passage of hand line.

\*\* NOTE TO SPECIFIER \*\* Delete floor clock not required for project.

* + 1. Floor Block: Sliding Tension Block.
       1. 12 inch (304.8 mm) Sliding Tension Block:
       2. The cast iron sheave shall have a 12 inch (304.8 mm) outside diameter, and shall be an iron casting, with a machined groove for a 3/4 inch (19.05 mm) rope.
       3. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two tapered roller bearings.
       4. The tension block shall be held in place and guided by two 3/4 inch (19.05 mm) diameter rods.
    2. Floor Block: Sliding Tension Block.
       1. 16 inch (406.4 mm) Tension Block:
       2. The cast iron sheave shall have a 16 inch (406.4 mm) outside diameter and shall be an iron casting with a machined groove for a 1 inch (25.4 mm) rope.
       3. The sheave shall be equipped with a 1 inch (25.4 mm) diameter shaft and two, tapered roller bearings.
       4. The tension block shall be held in place and guided by two 3/4 inch (19.1 mm) diameter rods, each equipped with adjustable locking collar to limit sheave travel.
       5. The sliding tension block shall be J.R. Clancy No. 6CR-1618.

\*\* NOTE TO SPECIFIER \*\* Delete index light(s) not required for project.

* + 1. Single Circuit: Index Light.
       1. Each index light unit shall consist of a sheet steel housing containing lamp sockets mounted 24 inch (609.6 mm) apart and wired on a single circuit with leads and junction box at either end. Sockets shall be suitable for 60 Watt, type ' A' lamps.
       2. Units shall be constructed so as to light the locking rail and prevent light from spilling on stage. The exterior of the index strip light shall be painted a matte black; the interior shall be white. Units shall be supplied in five and ten foot sections.
       3. Index strip lights shall be UL Listed.
    2. Dual Circuit: Index Light - 2 Circuits.
       1. Each index light unit shall consist of a sheet steel housing containing lamp sockets mounted 12 inch (304.8 mm) apart and wired alternately on two circuits with leads and junction box at either end. Sockets shall be suitable for 60 Watt, type ' A' lamps.
       2. Units shall be constructed so as to light the locking rail and prevent light from spilling on stage. The exterior of the index strip light shall be painted a matte black; the interior shall be white. Units shall be supplied in five and ten foot sections.
       3. Index strip lights shall be UL Listed.

\*\* NOTE TO SPECIFIER \*\* Delete rope lock not required for project.

* + 1. Rope Lock.
       1. The rope lock shall consist of an ASTM A536 ductile iron housing, cams and handle. The cams shall compress the rope, not bend it over tight radius corners that reduce its strength. The housing shall allow the use of a standard padlock to hold the handle in its closed position.
       2. In order to reduce noise during operation, there shall be a rubber bumper in the housing to silence the handle when it is opened. The dogs that grip the rope shall be machined to fit closely to reduce noise and not use washers.
       3. Adjustment for rope shall be from 5/8 inch to 1 inch (15.9 mm to 25.4 mm) by means of a 0.5 inch (12.7 mm) nylon tipped, socket head adjustment screw with lock nut at the rear of the housing.
       4. The handle shall be 9 inch (228.6 mm) long with a nylon powder or vinyl dip coating. The handle shall be installed so that it passes two degrees past vertical to lock the hand line.
       5. A coated, oval, welded steel ring shall be provided as a safety lock.
       6. The rope lock shall mount to the locking rail with four 3/8 inch (9.5 mm) hex bolts and lock nuts.
    2. SureLock Rope Lock.
       1. In order to reduce the possibility of accidents caused by out of balance sets, the rope lock shall not open if there is an out of balance condition exceeding 50 lbs. (23 KG) in either direction. A visual indicator shall be provided on the front of the unit showing if the set is balanced, batten heavy, or arbor heavy.
       2. The rope lock shall consist of an ASTM A536 ductile iron housing, cams and handle. There shall be rubber bumpers in the housing to silence the handle when it is opened. The body of the rope lock shall accommodate a padlock, securing the handle in the closed position.
       3. Adjustment for rope shall be from 5/8 inch to 1 inch (15.87 mm to 25.4 mm) by means of a 0.5 inch (12.7 mm) nylon tipped, socket head adjustment screw with lock nut at the rear of the housing.
       4. The handle shall be 9 inch (228.6 mm) long with a nylon powder, or vinyl dip, coating. The handle shall be installed so that it passes two degrees past vertical to lock the hand line. The cam at the lower end of the handle shall be equipped with a steel roller to eliminate sliding friction and promote ease of use.
       5. A coated, oval, welded steel ring shall be provided as a safety lock.
       6. The rope lock shall mount to the locking rail with four 3/8 inch (9.52 mm) hex bolts and lock nuts.
    3. EuroLock Rope Lock.
       1. The rope lock shall consist of two steel side plates, two fixed tension wheels, and one tension wheel that translates horizontally as the handle using the handle.
       2. The handle shall include latching mechanism that automatically latches when the handle closes.
       3. Adjustment for rope shall be from 3/4 inch to 1 inch (19.05 mm to 25.4 mm).
       4. The rope lock shall mount to the locking rail with four 3/8 inch (9.52 mm) hex bolts and lock nuts.

\*\* NOTE TO SPECIFIER \*\* Delete batten not required for project.

* + 1. Pipe Batten.
       1. All battens shall be 1.5 inch (38.1 mm) nominal diameter, schedule 40 pipe in lengths as shown on the drawings or Bill of Materials. All joints shall be spliced with 18 inch (457.2 mm) long sleeves with 9 inch (228.6 mm) extending into each pipe and held by two 3/8 inch (9.52 mm) hex bolts and lock nuts on each side of the joint.
       2. Each end shall be covered with a bright yellow, closed end, soft vinyl safety cap at least 4 inch (101.6 mm) in length.
    2. Truss Battens.
       1. Two pipe truss battens shall be in lengths as shown on the drawings or Bill of Materials. Truss battens shall be formed from two 1-1/2 inch (38.1 mm) nominal diameter, schedule 40 pipes, spaced 12 inch (304.8 mm) apart by 1/4 inch by 2 inch (6.4 mm x 50.8 mm) flat bars located a maximum of 5 ft (1.52m) apart and welded between the pipes. All joints shall be spliced with 18 inch (457.2 mm) long sleeves with 9 inch (228.6 mm) extending into each pipe and held by two 3/8 inch (9.52 mm) hex bolts and lock nuts on each side of the joint.
       2. Each end shall be covered with a bright yellow, closed end, soft vinyl safety cap at least 4 inch (101.6 mm) in length.

\*\* NOTE TO SPECIFIER \*\* Delete termination not required for project.

* + 1. Turnbuckles and Pipe Clamp.
       1. Turnbuckles: Turnbuckles.
          1. Turnbuckles shall be drop forged and galvanized, and conform to ASTM F1145 Type 1, Grade 1 standard. Turnbuckles shall be moused after adjustment to prevent loosening.
       2. Pipe Clamps: Pipe Clamps.
          1. Full Pipe Clamps:
          2. Pipe clamps shall be made of two strips of 12 Ga. (2.780 mm) by 2 inch (50.8 mm) hot rolled steel formed to encompass and clamp the pipe batten to prevent its rotation. Corners shall be rounded.
          3. There shall be a 3/8 inch x 1 inch (9.525 mm x 25.4 mm) hex bolt with lock nut above and below the batten. A 5/8 inch (15.875 mm) hole in the top of each clamp half allows the attachment of cable, chain, or other fittings.
          4. Full pipe clamps shall have a manufacturer's recommended load rating of at least 750 lbs (340.2 KG).
    2. Trim Chains: Trim Chains.
       1. Trim chains shall be 36 inch (914.4 mm) long, made of 1/4 inch (6.4 mm) plated, grade 30 Proof Coil chain. Connection between the end link and the lifting cable shall be made with a thimble and copper Nicopress sleeve. Chains shall be wrapped one and one half turns around the batten and attached back to the thimble at the end of the lift line with a 1/4 inch (6.4 mm) forged shackle. Adjustment is made by connecting the shackle into a link along the return side of the chain.
       2. Trim chains shall have a recommended working load of at least 750 lbs (340 KG).
    3. Trim Chains: Alloy Trim Chains.
       1. Trim chains shall be 36 inch (914 mm) long, made of 7 mm, Grade 63, hardened alloy chain meeting OSHA 1910.184(e)(5). The chain shall have a RWL of 3,250 lbs(1,474 KG), shall be manufactured in the United States and have a black finish to eliminate glare. Each link is marked with the manufacturer's code and every 10th link has date code for traceability.
       2. Connection between the end link and the lifting cable shall be made with a thimble and copper Nicopress sleeve.
       3. Chains shall be wrapped one and one half turns around the batten and attached back to the thimble at the end of the lift line with a 1/4 inch to 3/8 inch (6.4 mm to 9.5 mm) forged shackle. Adjustment is made by connecting the forged shackle into a link along the return side of the chain.
       4. Trim chains shall have a recommended working load of at least 750lbs (340.2 KG). when attached to 1/4 inch(6.4 mm), 7x19 GUC.
    4. Batten Trim Plate:
       1. Screw Pin Shackles: Shackles are u-shaped fittings with holes at each end to accommodate a pin to connect a rope, cable, or chain to another device. The pin has a head at one end and a thread at the other that screws into the body of the shackle. Shackle shall be from a U.S. manufacturer, and shall be moused after final trim adjustment.
       2. Trim Plate Assembly: Trim plate assembly consists of a batten clamp and plate punched with holes to receive 3/8 inch (9.52 mm) hardware, and 1/4 inch (6.35 mm) screw pin shackles.
          1. The plate shall be punched with five trim holes and one pick point hole to receive 3/8 inch (9.52 mm) hardware.
          2. The trim holes shall be positioned to allow for 1/2 inch (12.7 mm) variations in trim height.
          3. Trim plate assembly shall be able to support up to 500 lbs. (226.8 KG) per pick point.
          4. Trim plate assembly shall have the ability to be adjusted without the use of tools.
    5. Batten Trim Clamp:
       1. Batten trim clamps shall consist of two pipe clamps, each made of two strips of 12-gauge (2.78 mm) by 2" (50.8 mm) hot rolled steel formed to encompass and clamp the pipe batten to prevent its rotation. Corners shall be rounded. There shall be a 3/8" x 1" (9.52 mm x 25.4 mm) hex bolt with lock nut above and below the batten. A 5/8" hole (15.87 mm) in the top of one clamp half allows the attachment of cable, chain, or other fittings. The other clamp shall be fitted with a Nylon or aluminum grooved spacer with a minimum 2" (50.8 mm) diameter.
       2. Line adjustment shall be made by loosening the end clamp and sliding it along the batten or by adjusting the turnbuckle if so equipped.
       3. Trim clamps shall have a recommended working load of at least 700 lbs. (317.5 KG).
    6. Lift Cables:
       1. All lift cables shall be 7 x 19 construction, galvanized utility cable, sized as required, and with breaking strengths as follows:
          1. 1/8 inch (3.17 mm) diameter - 2,000 lbs. (907 KG).
          2. 3/16 inch (4.77 mm) diameter - 4,200 lbs. (1,905 KG).
          3. 1/4 inch (6.35 mm) diameter - 7,000 lbs. (3,175 KG).
          4. 5/16 inch (7.94 mm) diameter - 9,800 lbs. (4445 KG).
          5. 3/8 inch (9.52 mm) diameter - 14,400 lbs. (6,532 KG).
       2. Damaged or deformed cable shall not be used. All wire rope rigging shall be installed so as to prevent abrasion of the wire rope against any part of the building construction or other equipment.
    7. Cable Fittings:
       1. Cable clips shall conform to wire rope manufacturer's recommendations as to size, number, and method of installation. Clips shall be drop forged, made in the United States per Federal Specification FF-C-450, Type 1, Class 1. Under no circumstances may malleable cable clips be used in suspension or lifting lines.
       2. Swaged sleeve fittings shall be copper Nicopress. Aluminum sleeves are not permitted. Swaged fittings shall be installed per the fitting manufacturer's instructions, using the appropriate tools, and checked with the appropriate Nicopress "Go - No go" gauge.
       3. Eyes shall be formed over galvanized steel, wire rope thimbles of correct size. It is grooved to support the rope or cable and prevent kinking and deformation.
       4. Anchor shackles are u-shaped fittings with holes at each end to accommodate a pin used to connect a rope, cable, or chain to another device or hanging point. The pin has a head at one end and a cotter pin at the other end, a thread that screws into the body of the shackle, or a thread, nut and cotter pin at the other end.

\*\* NOTE TO SPECIFIER \*\* Delete counterweights not required, or select 'not required' option if they are not required.

* + 1. Counterweight:
       1. Standard 4 Inch Counterweight:
          1. Counterweights shall be 4 inches wide x 13-3/4 inches (349.25 mm) long, with U-shaped cutouts for the arbor rods. Counterweights shall be flame or laser cut steel. Each piece shall be free from slag and sharp edges. The thickness of counterweights shall not vary more than 3/16 inch (4.76 mm) from nominal dimension.
          2. Opposite corners shall be notched for ease of handling. Alternate weights when stacking to provide finger holds when loading arbors.
          3. Provide 25 percent of weight 2 inches (50.8 mm) thick and 75 percent of weight 1 inch (25.4 mm) thick for ease of balancing.
       2. Standard 6 Inch Counterweight:
          1. Counterweights shall be 6 inches wide x 13-3/4 inches (349.25 mm) long, with U-shaped cutouts for the arbor rods. Counterweights shall be flame or laser cut steel. Each piece shall be free from slag and sharp edges. The thickness of counterweights shall not vary more than 3/16 inch (4.76 mm) from nominal dimension.
          2. Opposite corners shall be notched for ease of handling. Alternate weights when stacking to provide finger holds when loading arbors.
          3. Provide 25 percent of weight 2 inches (50.8 mm) thick and 75 percent of weight 1 inch (25.4 mm) thick for ease of balancing.
       3. FrontLoader 4 Inch Counterweight:
          1. Counterweights shall be 4 inches wide x 13-3/4 inches (349.25 mm) long, with handle cutout for ease of loading. Counterweights shall be flame or laser cut steel. Each piece shall be free from slag and sharp edges. The thickness of counterweights shall not vary more than 3/16 inch (4.76 mm) from nominal dimension.
          2. Provide 80 percent of weight 1.5 inches (38.1 mm) thick and 20 percent of weight 1 inch (25.4 mm) thick for ease of balancing.
       4. FrontLoader 6 Inch Counterweight:
          1. Counterweights shall be 6 inches wide x 13-3/4 inches (349.25 mm) long, with handle cutout for ease of loading. Counterweights shall be flame or laser cut steel. Each piece shall be free from slag and sharp edges. The thickness of counterweights shall not vary more than 3/16 inch (4.76 mm) from nominal dimension.
          2. Provide 80 percent of weight 1.5 inches (38.1 mm) thick and 20 percent of weight 1 inch (25.4 mm) thick for ease of balancing.
       5. Counterweight: Not required.

\*\* NOTE TO SPECIFIER \*\* Delete ropes not required for project.

* + 1. Hand Line - Suregrip.
       1. Hand line shall be 3/4 inch (19.05 mm) in diameter, employing a 3-strand composite construction combining filament and staple/spun polyester wrapped around fibrillated polyolefin.
       2. The hand line shall contain an identifying tape showing the manufacturer's name, phone number, website, and year of manufacture.
       3. The hand line shall contain a red safety/wear indicator that becomes visible as the rope nears the end of its useful life.
       4. The rope shall hold knots well, be easily spliced and be dense enough to allow it to be clamped in a rope lock without damage. Rope shall not be subject to rotting, mildew, resistance to UV, or moisture damage, nor shall its length be affected by changes in humidity.
       5. Tape ends before cutting. Attach to arbor with two half hitches or bowline and tape end to standing line with electrical tape.
       6. Hand lines shall be SureGrip rope.
    2. Hand Line - Multiline II.
       1. Hand line shall employ a 3-strand composite construction combining filament and staple/spun polyester wrapped around fibrillated polyolefin.
       2. The rope shall hold knots well, be easily spliced and be dense enough to allow it to be clamped in a rope lock without damage.
       3. Rope shall not be subject to rotting, mildew, resistance to UV, or moisture damage, nor shall its length be affected by changes in humidity.
       4. Tape ends before cutting. Attach to arbor with two half hitches or bowline and tape end to standing line with electrical tape.
       5. Hand lines shall be Multiline II rope.
    3. Hand Line - Stage-Set-X.
       1. Hand lines shall have a parallel filament core constructed of high-tenacity filament polyester. The core shall remain firm and round under all load conditions, and be dense enough to allow it to be clamped in a rope lock without damage. The core shall be wrapped in polyester tape to provide the core with protection against external damage and wear. The braided polyester outer jacket shall be constructed of spun polyester for good gripping.
       2. The rope shall hold knots well, be easily spliced. Rope shall not be subject to rotting, mildew, resistance to UV, or moisture damage, nor shall its length be affected by changes in humidity.
       3. Tape ends before cutting. Attach to arbor with two half hitches or bowline and tape end to standing line with electrical tape.
       4. Hand lines shall be Stage-Set-X rope.

\*\* NOTE TO SPECIFIER \*\* Delete if not required for project.

* + 1. Mobile Capstan Hoist.
       1. The capstan hoist shall have a capacity of 1500 lbs (680.4 KG) and an operating speed of approximately 35 fpm (0.17 mps). It shall consist of a structural steel, castered frame with a 4 inch (101.6 mm) tread diameter, cast iron capstan drum, directly coupled to the output of the gearbox.
       2. The motor, primary brake, and gearbox shall be an integrated unit, with the first stage pinion gear mounted directly on the motor's armature shaft. No couplings will be permitted between the motor and gear reducer.
       3. Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.
       4. The gear reducer shall be a combination Helical/Worm reducer. The gear case shall be cast iron for protection against shock damage. The output shaft(s) 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.
       5. The primary brake shall be an integral part of the motor, mounted directly on the motor's armature shaft. Brakes shall be spring applied, direct acting, electrically released, and equipped with a manual release.
       6. The mobile dolly base shall be equipped with stationary casters in front and swivel casters in the rear. A 3 inch x 3 inch x 3/8 inch (76.2 mm x 76.2 mm x 9.52 mm) angle in front shall engage the reaction bar in the locking rail. A forged cleat permits cable tieoff and a hook provides storage for power and control cables. A side opening gate block shall protrude into the locking rail.
       7. The unit shall incorporate a full voltage reversing starter with overload, a footswitch to control motion, and an Up / Down direction selector. Unit will be equipped with 40 feet of type SO power cord with a locking electrical connector and mating receptacle.
       8. Mobile capstan hoist with 150 ft (45.7m) of 3/4 inch (19.1 mm) SureGrip rope with a latching hook spliced in one end.
    2. Capstan Reaction Bar:
       1. Mobile Capstan Reaction Bar:
       2. The capstan hoist shall engage a bar welded to the front of the locking rail stanchion the full width of the joint on the top and bottom.
       3. The reaction bar shall be a 4 inch x 4 inch x 1/4 inch steel tube, in the vertical orientation, painted to match the locking rail.
    3. Production Lighting Distribution:
       1. This assembly shall consist of an extruded aluminum wireway, 2-1/2 inch (63.5 mm) x 3-3/8 inch (85.7 mm) in cross section, and in lengths up to twenty feet. It shall contain a terminal strip for feed wire extending to outlets (flush mount or pigtail), as specified.
       2. Connector strip housing shall be fabricated of black extruded aluminum wireway with interlocking cover sections to exceed UL 1573 standards. Housing shall be inherently rustproof.
       3. Connector strip shall have an electrostatic paint finish in black, with outlets identified by 2 inch (50.8 mm) high die-cut circuit identification numbers on the vertical surface of the strip.
       4. The strip shall contain 125 degrees Celsius XLP wiring of the proper sizes and quantities to connect the individual outlets to the terminal blocks in up to sixteen 20 Amp circuits.
       5. The terminal blocks shall be molded barrier type with screw lugs suitable for connecting incoming wire. Terminal blocks can accept up to #10 gauge wire.
       6. Connector strips shall be supplied with 1/8 inch (3.18 mm) thick by 1-1/2 inch (38.1 mm) steel C-channel mounting brackets. Brackets shall be 60 inch (1.524 m) on centers. U-bolts shall be supplied to grip up to 2 inch (50.8 mm) O.D. standard steel pipe.
       7. The entire assembly shall be listed and labeled by Underwriters Laboratories.
       8. Options available shall be color, LED indicator lights, low voltage raceway, custom circuit identification, and DMX input/output.
       9. Refer to lighting drawings for circuit quantities and locations.

\*\* NOTE TO SPECIFIER \*\* Delete if not required for project.

* 1. HELIOS HOIST
     1. The hoist shall be specifically designed for lifting loads in theatres and other places of public assembly. It shall have a compact design with all required components integrated into its structure. All components shall be designed to properly support the required loads.
        1. Hoist shall be compliant with ANSI E1.6-1 - 2012 Entertainment TechnologyPowered Hoist Systems.
        2. Hoist shall accommodate 60' of vertical batten travel.
        3. Seven Lift Lines: 3/16 inch (4.76 mm) diameter, 7x19 galvanized utility cable.
        4. Units shall be available for 208, 230, or 460 VAC 60 Hz (230, 380, 400, 415 VAC 50 Hz) power, without the need for transformers.
        5. Structural backbone for mitigating horizontal loads and loft block mounting shall be available and optional.
        6. Provide battens, fittings, and related equipment as shown on the drawings and as required for a functional system.
     2. Models:

\*\* NOTE TO SPECIFIER \*\* Delete models not required for project.

* + - 1. 018-H0220:
         1. Speed: 20 Feet Per Minute.
         2. Total Capacity: 2000 Pounds.
      2. 018-H1212:
         1. Speed: 120 Feet Per Minute.
         2. Total Capacity: 1200 Pounds.
      3. 018-H1217:
         1. Speed: 120 Feet Per Minute.
         2. Total Capacity: 1750 Pounds.
      4. 018-H1812:
         1. Speed: 180 Feet Per Minute.
         2. Total Capacity: 1200 Pounds.
    1. Gearmotor and Primary Brake:
       1. The motor, primary brake, and gearbox shall be an integrated unit from a single manufacturer. For enhanced reliability, a continuous shaft shall link the brake, motor armature, and the first stage pinion gear without the use of couplings.
       2. Motors shall be totally enclosed fan cooled (TEFC) per NEMA MG1. Motors shall have a minimum service factor of 1.0.
       3. The gear reducer shall employ helical gearing. The gear case shall be cast iron, aluminum is not allowed, for protection against shock damage and to provide noise reduction. The output shaft shall have triple lip oil seals to prevent leaks.
       4. The integral electro-magnetic brake shall be spring applied and electrically released, with a minimum retarding torque of 200 percent of motor full load torque. Brakes with a lower retarding torque shall not be permitted.
       5. Fixed speed hoists shall incorporate a cast iron flywheel fan for soft starts and stops.
    2. Secondary Brake:
       1. For added security, a spring applied and electrically released load brake shall be located on the drum. The brake controller shall apply the brake if the speed exceeds the commanded speed, the maximum speed, or if it detects a failure in the integrity of the shafting and gearbox.
    3. Drum:
       1. Drum shall be designed to accommodate up to seven 3/16 inch (4.7 mm) lift lines.
       2. Each lift line shall be contained on both sides with a steel side plate extending over the top diameter of the cable.
       3. The maximum allowable fleet angle for the cables exiting the drum shall be one degree and the hoist design shall prevent fleet angles of greater than one degree.
    4. Slack Line Detection:
       1. Mechanism for detecting slack on any cable shall be provided. If slack is detected this system shall enter a fault state until the slack in the line is corrected.
    5. Compression Tube:
       1. The hoist shall incorporate a rectangle, tubular-shaped, aluminum extrusion capable of supporting the entire static load of the hoist assembly plus the live load.
       2. The compression tube shall be attached to the structure at points no farther than 12 feet-0 inch (4.57 m) center to center.
       3. The compression tube shall negate the hoist transferring horizontal forces into the structure.
       4. Tube shall be providing mounting capabilities for loft blocks to be positioned anywhere along the tube.
    6. Loft Blocks:
       1. 3/16 inch (4.7 mm) grooved blocks shall be designed to be placed anywhere along the compression tube or directly to the bottom of the building steel as shown in the drawings.
    7. Rotary Limit Switches:
       1. Rotary limit switch assemblies shall have four gear-driven, independently adjustable switch/cam sets. Switches shall have snap acting contacts.
       2. Rotary limit switches shall be driven by roller chains. Sprockets shall be pinned to prevent slipping and sized for maximum usable rotation of switch cams. The input shaft and drive chain shall be fully guarded if a cover is needed per ANSI E1.6-1.
       3. Switches shall be mounted to the winch base to allow for easy adjustment of the switch settings.
    8. Motor Controllers:
       1. For fire and electrical safety, motor controllers shall conform to the NEC (NFPA 70), be built in accordance with UL 508E, and be "touch safe" per IEC 60204-1 "Protection against direct contact" rules.
       2. Controllers shall provide over current, overload, and phase loss protection.
       3. Operation of the system key switch shall disconnect power to all starters and drives.
       4. A maintenance pendant shall be provided for direct control of the hoists during setup and for maintenance. It shall contain Up and Down pushbuttons, an Overtravel Bypass switch, and a key operated On/Off switch.
    9. Emergency Stop System:
       1. The emergency stop system shall meet NFPA-79 (Electrical Standards for Industrial Machinery) and directly remove power by means of electromechanical components, using a UL508E Type 2, non-welding, positive break contactors.
       2. The emergency stop circuit shall be a normally closed circuit or a supervised circuit that provides the same or greater level of reliability and security. Its operation shall not depend on software or semiconductors.
       3. Resetting the emergency stop circuit shall not initiate motion.
       4. For hoists running at more than 50 fpm, a Category 1 controlled stop per NFPA-79 (Electrical Standards for Industrial Machinery) shall be provided. This provides a rapid ramp to a stop, and then removes power to reduce shock loading.
    10. Load Sensing:
        1. Load information shall be obtained from solid state load cell on the hoist frame. The load sensing system shall be able to accommodate changing loads, such as the weight of power and/or data control cables which change with elevation, without false tripping.
    11. Power and Control Wiring:
        1. Integral power and control cables shall be provided with each hoist. Cables shall be eight feet long, with one end directly connected to the hoist assembly.
        2. Power cables shall be a properly rated SO cable, with a NEMA L series locking connector. Control cables shall have a connector with a steel body and a positive locking lever.
        3. Power and control raceways or boxes (configured as determined by the hoist manufacturer) shall be provided, complete with connectors that mate with those provided on the cables.

\*\* NOTE TO SPECIFIER \*\* Delete if not required for project.

* 1. POWERLIFT HOIST
     1. Models:

\*\* NOTE TO SPECIFIER \*\* Delete models not required for project.

* + - 1. Model 018-P0225F:
         1. Speed: 20 Feet Per Minute.
         2. Total Capacity: 2,500 Pounds.
      2. Model 018-P0225V:
         1. Speed: 0-20 Feet Per Minute.
         2. Total Capacity: 2,500 Pounds.
      3. Model 018-P1212V:
         1. Speed: 0-120 Feet Per Minute.
         2. Total Capacity: 1,250 Pounds.
      4. Model 018-P1217V:
         1. Speed: 0-120 Feet Per Minute.
         2. Total Capacity: 1,750 Pounds.
      5. Model 018-P1225V:
         1. Speed: 0-120 Feet Per Minute.
         2. Total Capacity: 2,500 Pounds.
      6. Model 018-P1812V:
         1. Speed: 0-180 Feet Per Minute.
         2. Total Capacity: 1,200 Pounds.
      7. Model 018-P1817V:
         1. Speed: 0-180 Feet Per Minute.
         2. Total Capacity: 1,750 Pounds.
    1. Drum:
       1. The hoist shall use a moving single layer drum to minimize hoist size and wire rope wear. The drum shall move along its axis as it rotates, keeping the cable takeoff points on the drum aligned with the head block sheaves incorporated in the hoist (zero fleet angle design). This shall be accomplished by the drum sliding on its axle and the motor shall remain stationary.
       2. The drum shall be helically grooved to accept a single layer of cable accommodating the entire travel distance plus three dead wraps per cable. Drums that utilize multiple layers of cable shall not be allowed.
       3. The hoist drum diameter shall not change along its long axis.
       4. Cables shall be retained by a copper swage stop sleeve inside the drum. The cable retention system shall allow replacement of lift lines in situ. Cables shall be factory installed on the drum and color coded for ease of field installation.
       5. Preloaded chase rollers shall be provided to retain lift lines in their grooves.
       6. The pitch diameter of all drums shall meet or exceed the wire rope manufacturer's minimum recommended D:d ratio. Load bearing wire rope groove profiles shall meet the recommendations of the "Wire Rope Technical Board".
       7. The drum shall be positively driven to move along its axle to maintain a zero-fleet angle with the grooves in the drum and the head block sheaves. The drum and axle shall be permanently lubricated.
    2. Gearmotor and Brakes:
       1. The motor, brakes, and gearbox shall be an integrated unit from a single manufacturer. For enhanced reliability, a continuous shaft shall link the brake, motor armature, and the first stage pinion gear without the use of couplings. Design of transmission components between the load and the brakes shall comply with ANSI E1.6-1 and EN 17206.
       2. Motors shall be totally enclosed fan cooled (TEFC) per NEMA MG1.
       3. The gear reducer shall employ helical gearing. The gear case shall be cast iron, aluminum is not allowed, for protection against shock damage and to provide noise reduction. The output shaft shall have triple lip oil seals to prevent leaks.
       4. The integral electro-magnetic brakes shall be spring applied and electrically released.
       5. Fixed speed hoists shall incorporate a cast iron flywheel fan for soft starts and stops.
       6. The brake controller shall apply the brake if the speed exceeds the commanded speed, the maximum speed.
    3. Headblock, Blocks and Sheaves:
       1. Hoist shall be constructed so that at least one wire rope lift line can exit the machine at the rear of the hoist and the hoist can be located above the batten.
       2. Sheaves:
          1. All load bearing sheaves, both internal and external, shall have a minimum 26:1 D:d ratio to meet the wire rope manufacturer's recommendations. Sheave grooves shall be deeper than the cable diameter for cable protection. The sheave shall be equipped with a minimum 12 mm diameter machined steel shaft and two sealed, precision ball bearings. Spacers shall positively retain the cable.
       3. Head Block:
          1. Head block sheaves shall be mounted between 12-gauge steel (2.78 mm) minimum side plates that fully enclose the sheaves.
       4. Loft Blocks:
          1. The block and associated mounting hardware shall have a recommended working load of at least 500 lbs. (226.6 KG).
          2. External loft blocks shall be provided with idlers to support ongoing lift lines with an individual groove for each lift line to prevent tangling. The use of un-grooved idler drums is known to cause tangling and jams and is not allowed.
    4. Wire Rope and Cable Fittings:
       1. Wire Rope Lift Cables:
          1. All lift cables shall be 3/16 inch (4.77 mm) diameter 7 x 19 construction, galvanized utility cable, with a breaking strength of 4,200 lbs. (1,905 KG).
          2. Damaged or deformed cable shall not be used. All wire rope rigging shall be installed so as to prevent abrasion of the wire rope against any part of the building construction or other equipment.
       2. Cable Fittings:
          1. Swaged sleeve fittings shall be copper Nicopress. Aluminum sleeves are not permitted. Swaged fittings shall be installed per the fitting manufacturer's instructions, using the appropriate tools, and checked with the appropriate Nicopress "Go - No go" gauge. Swage tool used and number of crimps required shall be recorded and provided to the user with user's manual
          2. Eyes shall be formed over galvanized steel, wire rope thimbles of correct size. It is grooved to support the rope or cable and prevent kinking and deformation.
       3. Inspection of Wire Rope:
          1. Wire rope terminations within hoist must be able to be inspected for excessive wear and damage per ANSI E1.47. Hoists that prevent the visual inspection of terminations shall not be permitted.
    5. Limit Switches:
       1. Hoists shall have positively actuated limit switches for normal end of travel indication. These switches shall open the control circuit in the drive or starter to stop any further movement in the direction of travel.
       2. Positively actuated limit switches shall be provided for over travel indication. These shall use a separate circuit that is redundant to the normal end of travel switches, and positively disconnects power from the hoist.
       3. An override mechanism to allow resetting of the overtravel limits shall be included.
       4. Limit switches shall be adjustable from the motor end of the hoist and set to match actual site conditions.
       5. Computer controlled systems shall also have software limits utilizing solid state encoders, in addition to the two levels of mechanically actuated limit switches.
    6. Emergency Stop:
       1. The emergency stop system shall meet NFPA-79 (Electrical Standards for Industrial Machinery) and directly remove power either by means of electromechanical components, using a UL 508E Type 2, non-welding, positive break contactors or through the utilization of functional safety elements within the feature set of the VFD.
       2. The emergency stop circuit shall be a normally closed circuit or a supervised circuit that provides the same or greater level of reliability and security. Its operation shall not depend on software or semiconductors.
       3. Resetting the emergency stop circuit shall not initiate motion.
       4. For hoists running at more than 25 fpm, a Category 1 controlled stop per NFPA-79 (Electrical Standards for Industrial Machinery) shall be provided. This provides a rapid ramp to a stop, and then removes power to reduce shock loading.
    7. Load Sensing:
       1. Load information shall be obtained from a load cell and located to sense the torque at the motor and the drum.
       2. The load sensing system shall be able to accommodate changing loads, such as the weight of power and/or data control cables which change with elevation, without false tripping.
       3. The load sensing system shall prevent the hoist from being operated while over the maximum capacity of the hoists. In the event of an overload while in travel the hoist shall be able to move down to resolve the overload.

\*\* NOTE TO SPECIFIER \*\* Delete if not required .

* + 1. Optional Continuous Beam:
       1. The hoist shall integrate with an optional rectangle, tubular-shaped, aluminum extrusion capable mitigating horizontal loads on the building structure
       2. Continuous beam shall provide mounting capabilities for loft blocks to be positioned anywhere along the beam.
    2. Hoist Controller:
       1. Hoist shall be compatible with all JR Clancy control systems.
       2. Power and Control Wiring:
          1. Integral power and control cables shall be provided with each hoist. Cables shall be eight feet long, with one end directly connected to the hoist assembly.
          2. Power cables shall be a properly rated SO cable, with a NEMA L series locking connector. Control cables shall include positive locking connectors.
          3. Power and control raceways or boxes (configured as determined by the hoist manufacturer) shall be provided, complete with connectors that mate with those provided on the cables.
       3. Maintenance Pendant:
          1. Provide one maintenance pendant to be used during installation and delivered to owner at project completion.
          2. Maintenance pendant shall consist of up and down operators that illuminate when the hoist is on an end of travel limits, an indicator light for when an overtravel limit has been struck and an operator to bypass the end of travel limit.
          3. Pendant shall be compatible with all PowerLift hoists in the system.
    3. Testing:
       1. Hoist shall be tested to ensure proper operation of motor, limit switches and wiring prior to leaving the manufacturing facility.
       2. After hoist has been installed on site, and in accordance with ANSI E1.6-1 hoist shall undergo a static, dynamic and emergency stop test at 100% of the rated load. In addition, each load securing device shall be tested independently at 100% of the rated load.
    4. General:
       1. Systems that do not comply with ANSI E1.6-1 shall not be considered acceptable.

\*\* NOTE TO SPECIFIER \*\* Delete if not required for project.

* 1. POWERLITE HOIST
     1. Models:

\*\* NOTE TO SPECIFIER \*\* Delete models not required for project.

* + - 1. Model 018-P0220F:
         1. Speed: 20 Feet Per Minute.
         2. Total Capacity: 2,000 Pounds.
      2. Model 018-P1212V:
         1. Speed: 0-120 Feet Per Minute.
         2. Total Capacity: 1,200 Pounds.
    1. Drum:
       1. The hoist shall use a moving single layer drum to minimize hoist size and wire rope wear. The drum shall move along its axis as it rotates, keeping the cable takeoff points on the drum aligned with the head block sheaves incorporated in the hoist (zero fleet angle design). This shall be accomplished by the drum sliding on its axle and the motor shall remain stationary.
       2. The drum shall be helically grooved to accept a single layer of cable accommodating the entire travel distance plus three dead wraps per cable. Drums that utilize multiple layers of cable shall not be allowed.
       3. The hoist drum diameter shall not change along its long axis.
       4. Cables shall be retained by a copper swage stop sleeve inside the drum. The cable retention system shall allow replacement of lift lines in situ. Cables shall be factory installed on the drum and color coded for ease of field installation.
       5. Preloaded chase rollers shall be provided to retain lift lines in their grooves.
       6. The pitch diameter of all drums shall meet or exceed the wire rope manufacturer's minimum recommended D:d ratio. Load bearing wire rope groove profiles shall meet the recommendations of the "Wire Rope Technical Board".
       7. The drum shall be positively driven to move along its axle to maintain a zero-fleet angle with the grooves in the drum and the head block sheaves. The drum and axle shall be permanently lubricated.
    2. Gearmotor and Brakes:
       1. The motor, brakes, and gearbox shall be an integrated unit from a single manufacturer. For enhanced reliability, a continuous shaft shall link the brake, motor armature, and the first stage pinion gear without the use of couplings. Design of transmission components between the load and the brakes shall comply with ANSI E1.6-1 and EN 17206.
       2. Motors shall be totally enclosed fan cooled (TEFC) per NEMA MG1.
       3. The gear reducer shall employ helical gearing. The gear case shall be cast iron, aluminum is not allowed, for protection against shock damage and to provide noise reduction. The output shaft shall have triple lip oil seals to prevent leaks.
       4. The integral electro-magnetic brakes shall be spring applied and electrically released.
       5. Fixed speed hoists shall incorporate a cast iron flywheel fan for soft starts and stops.
       6. The brake controller shall apply the brake if the speed exceeds the commanded speed, the maximum speed.
    3. Headblock, Blocks and Sheaves:
       1. Hoist shall be constructed so that at least one wire rope lift line can exit the machine at the rear of the hoist and the hoist can be located above the batten.
       2. Sheaves:
          1. All load bearing sheaves, both internal and external, shall have a minimum 26:1 D:d ratio to meet the wire rope manufacturer's recommendations. Sheave grooves shall be deeper than the cable diameter for cable protection. The sheave shall be equipped with a minimum 12 mm diameter machined steel shaft and two sealed, precision ball bearings. Spacers shall positively retain the cable.
       3. Head Block:
          1. Head block sheaves shall be mounted between 12-gauge steel (2.78 mm) minimum side plates that fully enclose the sheaves.
       4. Loft Blocks:
          1. The block and associated mounting hardware shall have a recommended working load of at least 500 lbs. (226.6 KG).
          2. External loft blocks shall be provided with idlers to support ongoing lift lines with an individual groove for each lift line to prevent tangling. The use of un-grooved idler drums is known to cause tangling and jams and is not allowed.
    4. Wire Rope and Cable Fittings:
       1. Wire Rope Lift Cables
          1. All lift cables shall be 3/16 inch (4.77 mm) diameter 7 x 19 construction, galvanized utility cable, with a breaking strength of 4,200 lbs. (1,905 KG).
          2. Damaged or deformed cable shall not be used. All wire rope rigging shall be installed so as to prevent abrasion of the wire rope against any part of the building construction or other equipment.
       2. Cable Fittings:
          1. Swaged sleeve fittings shall be copper Nicopress. Aluminum sleeves are not permitted. Swaged fittings shall be installed per the fitting manufacturer's instructions, using the appropriate tools, and checked with the appropriate Nicopress "Go - No go" gauge. Swage tool used and number of crimps required shall be recorded and provided to the user with user's manual
          2. Eyes shall be formed over galvanized steel, wire rope thimbles of correct size. It is grooved to support the rope or cable and prevent kinking and deformation.
       3. Inspection of Wire Rope:
          1. Wire rope terminations within hoist must be able to be inspected for excessive wear and damage per ANSI E1.47. Hoists that prevent the visual inspection of terminations shall not be permitted.
    5. Limit Switches:
       1. Hoists shall have positively actuated limit switches for normal end of travel indication. These switches shall open the control circuit in the drive or starter to stop any further movement in the direction of travel.
       2. Positively actuated limit switches shall be provided for over travel indication. These shall use a separate circuit that is redundant to the normal end of travel switches, and positively disconnects power from the hoist.
       3. An override mechanism to allow resetting of the overtravel limits shall be included.
       4. Limit switches shall be adjustable from the motor end of the hoist and set to match actual site conditions.
       5. Computer controlled systems shall also have software limits utilizing solid state encoders, in addition to the two levels of mechanically actuated limit switches.
    6. Emergency Stop:
       1. The emergency stop system shall meet NFPA-79 (Electrical Standards for Industrial Machinery) and directly remove power either by means of electromechanical components, using a UL 508E Type 2, non-welding, positive break contactors or through the utilization of functional safety elements within the feature set of the VFD.
       2. The emergency stop circuit shall be a normally closed circuit or a supervised circuit that provides the same or greater level of reliability and security. Its operation shall not depend on software or semiconductors.
       3. Resetting the emergency stop circuit shall not initiate motion.
       4. For hoists running at more than 25 fpm, a Category 1 controlled stop per NFPA-79 (Electrical Standards for Industrial Machinery) shall be provided. This provides a rapid ramp to a stop, and then removes power to reduce shock loading.
    7. Load Sensing:
       1. Load information shall be obtained from a load cell and located to sense the torque at the motor and the drum.
       2. The load sensing system shall be able to accommodate changing loads, such as the weight of power and/or data control cables which change with elevation, without false tripping.
       3. The load sensing system shall prevent the hoist from being operated while over the maximum capacity of the hoists. In the event of an overload while in travel the hoist shall be able to move down to resolve the overload.

\*\* NOTE TO SPECIFIER \*\* Delete if not required .

* + 1. Optional Continuous Beam:
       1. The hoist shall integrate with an optional rectangle, tubular-shaped, aluminum extrusion capable mitigating horizontal loads on the building structure
       2. Continuous beam shall provide mounting capabilities for loft blocks to be positioned anywhere along the beam.
    2. Hoist Controller:
       1. Hoist shall be compatible with all JR Clancy control systems.
       2. Power and Control Wiring:
          1. Integral power and control cables shall be provided with each hoist. Cables shall be eight feet long, with one end directly connected to the hoist assembly.
          2. Power cables shall be a properly rated SO cable, with a NEMA L series locking connector. Control cables shall include positive locking connectors.
          3. Power and control raceways or boxes (configured as determined by the hoist manufacturer) shall be provided, complete with connectors that mate with those provided on the cables.
       3. Maintenance Pendant
          1. Provide one maintenance pendant to be used during installation and delivered to owner at project completion.
          2. Maintenance pendant shall consist of up and down operators that illuminate when the hoist is on an end of travel limits, an indicator light for when an overtravel limit has been struck and an operator to bypass the end of travel limit.
          3. Pendant shall be compatible with all PowerLite hoists in the system.
    3. Testing:
       1. Hoist shall be tested to ensure proper operation of motor, limit switches and wiring prior to leaving the manufacturing facility.
       2. After hoist has been installed on site, and in accordance with ANSI E1.6-1 hoist shall undergo a static, dynamic and emergency stop test at 100% of the rated load. In addition, each load securing device shall be tested independently at 100% of the rated load.
    4. General:
       1. Systems that do not comply with ANSI E1.6-1 shall not be considered acceptable.

\*\* NOTE TO SPECIFIER \*\* Delete if not required for project.

* 1. VARION HOIST
     1. Each hoist unit shall have the capacity to raise and lower the specified load at the specified speed.
        1. Hoist Characteristics:
           1. Speed: 15 fpm (.076 mps) average over full travel range.
           2. Hoist Gross Capacity: 1,500 lbs. (680kg).
           3. Lifting Capacity: 1,000 lbs. (454kg) with full drum assuming 500 lbs. (227kg) of batten, cable management and production lighting distribution.
           4. Travel: up to 50 feet (15.24 m).
           5. # of Lift Lines: up to 5.
           6. Lift Line Diameter: 3/16 inch (4.76 mm).
        2. Construction:
           1. Hoist shall be mounted to a frame constructed of aluminum and steel, holding the elements of the hoist in proper alignment.
           2. Drum shall be directly connected to the output of the integrated motor-brake-gear reducer unit.
     2. Gearmotor:
        1. Motor, primary brake, and gearbox shall be an integrated unit, with the first stage pinion gear mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor and gear reducer.
        2. Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.
        3. The gear reducer shall be a combination helical/worm reducer. The gear case shall be cast iron for protection against shock damage. The gearing service factor shall be a minimum of 1.0 with a mechanical strength service factor of 1.25.
     3. Primary Brake:
        1. The primary brake shall be an integral part of the motor, mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor and primary brake.
        2. Brakes shall be spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall be an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.
        3. The brake shall be released by energizing the coil simultaneously with the motor winding to provide fail-safe braking in case of power failure.
     4. Shafts and Keys:
        1. Shafts shall be designed to accommodate the applied loads (including shock and bending loads) in accordance with ANSI B 106.1 m, "Design of Transmission Shafting.".
        2. All connections shall be keyed, using keys designed to accommodate the applied loads. Keys shall be in accordance with ANSI B 17.1, "Keys and Key Seats.".
     5. Pile-Up Drum:
        1. Drum shall have a slotted construction so that the cable winds on top of itself in multiple layers.
        2. The width of the slot shall be consistent throughout its depth to ensure the cable stacks evenly. The slot shall have sufficient depth for the entire travel, plus three dead wraps, and overtravel.
        3. The drum shall be direct coupled and keyed to the output shaft of the gear box.
        4. Drum construction shall be steel of at least 1/2 inch (12.7 mm) thick. The drum sides shall be of sufficient thickness to withstand the forces applied by the cable.
        5. Cables shall enter the drum through holes drilled from the base of the slots at a 45 degree angle and shall be retained by a copper stop sleeve.
     6. Hoist Mounting Criteria:
        1. Hoist and Frame shall be mounted anywhere along the compression tube backbone.
        2. Center of hoist drum shall be placed within 3 feet-0 inch (0.91 m) of attachment to structure.
     7. Rotary Limit Switches:
        1. Rotary limit switch assemblies shall have four gear-driven, independently adjustable switch/cam sets. Switches shall have snap acting contacts.
        2. Rotary limit switches shall be driven by roller chains. Sprockets shall be pinned to prevent slipping and sized for maximum usable rotation of switch cams. The input shaft and drive chain shall be fully guarded if a cover is needed per ANSI E1.6-1.
        3. Switches shall be mounted to the winch base to allow for easy adjustment of the switch settings.
     8. Overspeed Brake:
        1. A secondary overspeed brake shall be supplied in addition to the primary brake on the motor. This brake shall be located on the low speed output shaft of the gearbox.
        2. This brake shall be factory set to apply itself at 125 percent of the maximum rated hoist speed.
        3. The overspeed brake shall not require either electricity or pressure from an external source for operation.
     9. Compression Tube:
        1. The hoist shall incorporate a rectangle, tubular-shaped, aluminum extrusion capable of supporting the entire static load of the hoist assembly plus the live load.
        2. The compression tube shall be attached to the structure at points no farther than 15 feet-0 inch (4.57 m) center to center.
        3. The compression tube shall negate the hoist transferring horizontal forces into the structure.
        4. Tube shall be providing mounting capabilities for loft blocks to be positioned anywhere along the tube.
     10. Overload Sensing:
         1. Overload sensing shall be included in the hoist as standard equipment.
         2. The sensor shall be a mechanical means of detecting an overload condition which sends an electrical signal to the motor controller.
         3. If an overload condition occurs, the sensor shall prevent the movement of the hoist until the load is returned to a proper weight.
     11. Blocks
         1. 3/16 inch grooved blocks shall be designed to be placed anywhere along the compression tube.
  2. TITAN HOIST
     1. The hoist shall be specifically designed for lifting loads in theatres and other places of public assembly. It shall have a compact design with all required components integrated into its structure. Hoists shall have integrated safety covers.
        1. The hoist shall incorporate a sturdy frame and adjustable mounting clips for easy mounting, either horizontally or vertically, on beams centered up to 12 feet-0 inch (3.6 m) apart. No external strengthening members shall be required.
        2. Characteristics: The hoist shall have the following characteristics:
           1. Speed and lifting capacity to specific applications with speeds up to 400 fpm (2 mps) and maximum capacity of 3000 lbs. (1360 kg).
           2. Travel: Up to 98 feet (30 m).
           3. Lift Lines: 9 at 1/4 inch (6.35 mm) diameter, 7x19 galvanized utility cable.
           4. Units shall be available for all standard 60 Hz and 50 Hz power sources without the need for transformers.
        3. The hoist shall use a moving drum to minimize hoist size and wire rope wear. The drum shall move along its axis as it rotates, keeping the cable takeoff points on the drum aligned with the head block sheaves incorporated in the hoist (zero fleet angle design).
        4. Hoists shall be designed such that multiple units can be mounted 16 inch (406.4 mm) on center, or 8 inch (203.2 mm) on center if hoists are alternated on stage left and right.
        5. Hoists shall not be used to lift humans.
     2. Gearmotor and Primary Brake:
        1. The motor, primary brake and gearbox shall be an integrated unit from a single manufacturer. For enhanced reliability, a continuous shaft shall link the brake, motor armature, and the first stage pinion gear without the use of couplings.
        2. Motors shall be totally enclosed fan cooled (TEFC) per NEMA MG1. Motors shall have a minimum service factor of 1.0.
        3. The gear reducer shall employ helical gearing. The gear case shall be cast iron for protection against shock damage and to provide noise reduction. The output shaft shall have triple lip oil seals to prevent leaks.
        4. The primary brake shall be spring applied and electrically released, with a minimum retarding torque of 150 percent of motor full load torque.
     3. For added security, a spring applied and electrically released electro-magnetic load brake shall be located between the output shaft of the gearbox and the drum. The brake controller shall apply the brake if the speed exceeds the commanded speed, the maximum speed, or if it detects a failure in the integrity of the shafting and gearbox.
        1. SureBrake II as manufactured by JR Clancy.
     4. Drum:
        1. The drum shall be helically grooved to accept a single layer of cable accommodating the entire travel distance plus a minimum of three dead wraps per cable.
        2. Cables shall be retained by a copper swage stop sleeve inside the drum. The cable retention system shall allow replacement of lift lines in situ.
        3. Preloaded chase rollers shall be provided to retain lift lines in their grooves.
        4. The pitch diameter of all drums shall meet or exceed the wire rope manufacturer's minimum recommended D/d ratio. Load bearing wire rope groove profiles shall meet the recommendations of the Wire Rope Technical Board.
        5. The drum shall be positively driven to move along its axle to maintain a zero fleet angle with the head block sheaves. The axle shall be permanently lubricated.
     5. Sheaves:
        1. All load bearing sheaves shall have a minimum 26:1 D:d ratio to meet the wire rope manufacturer's recommendations. Sheave grooves shall be deeper than the cable diameter for cable protection. The sheave shall be equipped with a machined steel shaft and two sealed, precision ball bearings. Spacers shall positively retain the cable.
     6. Loft Blocks:
        1. Loft blocks shall have 12-gauge (2.7 8 mm) steel (minimum) side plates that shall fully enclose the sheave. Side plates shall be bolted to the base angles. Base angles shall be a minimum 1-1/2 inch x 1-1/2 inch x 3/16 inch (38.1 mm x 38.1 mm x 4.8 mm) angle punched with a universal hole pattern for easy installation. There shall be a minimum of seven 1/4 inch (6.4 mm) bolts with spacers between the side plates, four of which prevent cables from escaping the sheave grooves.
        2. The block and associated mounting hardware shall have a recommended working load of at least 750 lbs. (340 kg), and shall be designed for upright or underhung use.
        3. Loft blocks shall be provided with idlers to support ongoing lift lines with an individual groove for each lift line to prevent tangling or abrasion.
     7. Limit Switches:
        1. Hoists shall have positively actuated limit switches for normal end of travel indication. These switches shall open the control circuit in the drive or starter to stop any further movement in the direction of travel.
        2. Positively actuated limit switches shall be provided for over travel indication. These shall use a separate circuit that is redundant to the normal end of travel switches, and positively disconnects power from the hoist, using a UL 508E Type 2, non-welding, positive break contactor.
        3. An override mechanism to allow resetting of the over travel limits shall be included in the drive cabinet.
        4. Limit switches shall be set to match actual site conditions.
        5. Computer controlled systems shall also have software limits utilizing solid state encoders, in addition to the two levels of mechanically actuated limit switches.
     8. Motor Controllers:
        1. For fire and electrical safety, motor controllers shall conform to the NEC (NFPA 70), be built in accordance with UL Standard UL 508E, and be "touch safe" per IEC 204-1 "Protection against direct contact" rules.
        2. Controllers shall provide over current, overload, and phase loss protection.
        3. Operation of the system key switch shall disconnect power to all starters and drives.
        4. A maintenance pendant shall be provided for direct control of the hoists during setup and for maintenance. It shall contain Up and Down pushbuttons, an Overtravel Bypass switch, and a key operated On / Off switch.
     9. Emergency Stop System.
        1. The emergency stop system shall meet SIL 3 or NFPA-79 (Electrical Standards for Industrial Machinery) and directly remove power by means of electromechanical components, using a UL 508E Type 2, non-welding, positive break contactors.
        2. The emergency stop circuit shall be a normally closed circuit or a supervised circuit that provides the same or greater level of reliability and security. Its operation shall not depend on software or semiconductors.
        3. Resetting the emergency stop circuit shall not initiate motion.
        4. For hoists running at more than 50 fpm (0.254 mps), a Category 1 controlled stop per NFPA-79 (Electrical Standards for Industrial Machinery) shall be provided. This provides a rapid ramp to a stop, and then removes power to reduce shock loading.
     10. Load Monitoring:
         1. Load information shall be obtained from dual solid state load cells on the hoist. The load monitoring system shall be able to accommodate dynamic loads, such as cable weight that changes during batten travel, without false tripping.
         2. Load monitoring requires the use of a control console.
     11. Installation supervision and commissioning of the motorized rigging system shall be performed by a factory authorized and trained technician.

\*\* NOTE TO SPECIFIER \*\*Delete if not required for the project.

* 1. POWERASSIST HOIST
     1. The single axis hoist shall be used to motorize counterweight rigging sets.
        1. The hoist shall be of a compact design with all required components integrated into its structure. It shall be floor mounted in place of a floor block and rope lock. Its starter and control mount to the locking rail.
        2. The hoist assembly shall be less than 12 inch (305 mm) wide, and be able to automate a set that is located between counterweight sets on 6 inch (152.4 mm) centers or greater.
        3. Single axis hoists shall have a speed of 25 fpm (0.13 mps) with a total line set capacity of 2,000 lbs. (907 kg). The hoist shall handle an out of balance load equal to 50 percent of the set capacity. The counterweight arbor shall be permanently loaded to 50 percent of the set capacity. The counterweight in the arbor shall be banded in place, and a method to impede the installation of additional counterweight provided. A sign shall be provided warning the user not to adjust the weight in the arbor.
        4. All components shall be designed to properly support the required loads.
        5. Motor, Gearbox and Brake:
           1. A motor, gear reducer and primary brake shall be provided. Motors shall be totally enclosed fan cooled (TEFC) per NEMA MG1.
           2. The gearmotor shall have a minimum service factor of 1.0 and be provided with seals to effectively prevent leaks.
           3. Brakes shall be spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall be an electro-magnetic unit with a minimum retarding torque of 200 percent of motor full load torque. The brake shall be released by energizing the coil simultaneously with the motor winding to provide fail-safe braking in case of power failure.
        6. Drive Medium:
           1. The drive medium shall allow the use of a counterweight set head block without modification and shall be positively driven in a manner that shall allow repeatable positioning.
           2. The drive medium shall have a minimum design factor of 10:1.
           3. Roller chains shall have a double leaf construction. UHMW chain guides shall be provided to ensure positive engagement of chain and sprockets, even with slack in the drive chain.
           4. The portion of the drive medium that runs on the head block shall operate at the same pitch diameter as the lift lines so that they operate at the same speed, to avoid excessive cable wear and "jumping" caused by differing speeds.
        7. Limit Switches:
           1. Rotary limit switch assemblies shall have four gear-driven, independently adjustable switch/cam sets. Switches shall have snap acting contacts.
           2. Rotary limit switches shall be driven directly or by roller chains. If roller chains are used, sprockets shall be pinned to prevent slipping and sized for maximum usable rotation of switch cams. The input shaft and drive chain shall be fully guarded.
           3. Switches shall be mounted to the winch base to allow for easy adjustment of the switch settings.
        8. Fixed Speed Motor Controllers:
           1. For fire and electrical safety, motor controllers shall conform to the NEC (NFPA 70), be built in accordance with UL 508E, and be "touch safe" per IEC 60204-1 "Protection against direct contact" rules.
           2. Controllers 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 overload limit switch shall open the line contactor and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.
           3. The controller shall be sized to match the hoist motor horsepower. Overload and overcurrent protection shall conform to UL and NEC requirements.
        9. Control Station:
           1. Control stations shall be contained in the hoist assembly, and contain hold to operate (dead man) Up and Down pushbuttons for each hoist. A key operated On / Off switch shall be provided.
           2. A red, mushroom head emergency stop pushbutton shall be provided, which shall disconnect power to the winch through a circuit meeting NFPA-79 (Electrical Standards for Industrial Machinery) requirements.
           3. A "Service" indicator shall be provided to alert the user when regular system service is required.
           4. Panel components (pushbuttons, key switches, switches, indicators, E-stop switches, and the like) shall be industrial grade units.

\*\* NOTE TO SPECIFIER \*\* The following chart indicates standard line shaft hoist characteristics. Delete standard line shaft hoists if not required for the project.  
Fixed Speed: 20 fpm / 1000 pounds (0.1 m/s / 454 kg).  
Fixed Speed: 20 fpm / 1250 pounds (0.1 m/s / 567 kg).  
Fixed Speed: 20 fpm / 1600 pounds (0.1 m/s / 726 kg).  
Fixed Speed: 20 fpm / 2150 pounds (0.15 m/s / 975 kg).  
Fixed Speed: 20 fpm / 2500 pounds (0.1 m/s / 1184 kg).  
Variable Speed: 0 - 110 fpm / 1300 pounds (0 - 0.56 m/s / 590 kg).  
Variable Speed: 0 - 140 fpm / 1950 pounds (0 - 0.71 m/s / 885 kg).  
Variable Speed: 0 - 240 fpm / 2300 pounds (0 - 1.2 m/s / 1043 kg).  
Lift Line:1/4 inch (6.35 mm); 3/16 inch (4.8 mm).  
Drum Diameter: 7-1/2 inches (190 mm); 5-1/2 inches (140 mm).  
Max. Load/Line: 750 pounds (341 kg); 500 pounds (227 kg).

* 1. POWERLINE HOIST

\*\* NOTE TO SPECIFIER \*\* Controls shall be added for a complete system.

* + 1. The line shaft type hoist shall have the ability to raise and lower the specified load at the specified speed. All components shall be designed to properly support the required loads.
       1. The hoist shaft shall incorporate a sturdy frame and field adjustable mounting clips for easy mounting.

\*\* NOTE TO SPECIFIER \*\* Delete cable size not required.

* + - * 1. Lift Line Diameter: 1/4 inch (6.35 mm) 8 inch drums (2.3 mm)5 mm.
        2. Lift Line Diameter: 3/16 inch (4.8 mm) 6 inch drums8 mm (152 mm drums).
      1. Construction:
         1. The integrated motor - brake - gear reducer unit and associated components, drum, shall be supported by a sturdy steel base, holding the elements of the hoist in proper alignment.
         2. A 4 inch x 4 inch (102 mm x102 mm) rectangular steel backbone shall be provided to support the PowerLine hoist. Backbones shall be continuous, or non-continuous, to meet the specific requirements of the specific application. The backbone shall accommodate spans between mounting steel members up to 12 feet (3.65 m) with a maximum deflection of L/180.
         3. Gearmotors shall be able to mount parallel or perpendicular to the plane of the mounting steel.
         4. Lift lines shall be able to exit parallel or perpendicular to the plane of the mounting steel.
      2. Gearmotor:
         1. Motor, primary brake, and gearbox shall be an integrated unit, with the first stage pinion gear mounted directly on the motor's armature shaft. No coupling shall be permitted between the motor and gear reducer.
         2. Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.
         3. The gear reducer shall be a combination helical/worm or helical/bevel reducer. The gear case shall be cast iron for protection against shock damage. The input and output shafts 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.

\*\* NOTE TO SPECIFIER \*\* Other configurations: There are other motor / brake configurations. Please contact us for more information.

* + - 1. Primary Brake:
         1. The primary brake shall be an integral part of the motor, mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor and primary brake.
         2. Brakes shall be spring applied, direct acting, electrically released, and equipped with a manual release as backup. The brake shall an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.
         3. The brake shall be released by energizing the coil simultaneously with the motor winding to provide fail-safe braking in case of power failure.
      2. Shafts, Keys, and Couplings:
         1. Drums shall be interconnected by commercial transmission shafts with universal joints at each end. The use of solid couplings and bar, pipe, or square tubes as shafts are not permitted.
         2. Shafts shall be designed to accommodate the applied loads (including shock and bending loads) in accordance with ANSI B106.1 m, "Design of Transmission Shafting".
         3. All connections shall be keyed, using keys designed to accommodate the applied loads. Keys shall be in accordance with ANSI B17.1, "Keys and Key Seats".
         4. Universal joints shall accommodate the applied loads, including shock and bending loads, and shall accommodate the possible parallel and angular misalignments caused during manufacturing, assembly, and installation, as well as by structural tolerances and structural or equipment deflections.
      3. Bearings:
         1. Bearings shall be selected to accommodate the applied loads and speeds with a minimum L10 life of 2,000 hours.
      4. Helical Drums:
         1. Winding drums shall be designed to properly support the required loads.
         2. Drums shall be helically grooved to accept a single layer of cable accommodating the entire travel distance plus three dead wraps. The drum diameter shall meet or exceed the wire rope manufacturer's minimum recommended D/d ratio.
         3. Drum construction shall be of the all welded type, including a continuous drum shaft. Cables shall enter the drum through key slots machined from root of the cable groove through the tubing wall at a 45 degree angle and shall be retained by a Copper swage stop sleeve inserted through the end of the slot from the outside. Cables shall have a minimum of three dead wraps on the drum. In order to prevent unbalanced operation, drum assemblies that exceed 20 rpm shall be straightened to a maximum total indicated run out (T.I.R.) of 0.005 inch (0.127 mm).
         4. Each end of the drum shall be supported by either the output shaft of the gearbox or an appropriately sized bearing mounted in the side steel plate that fully captures the drum shaft.
         5. Alternate drums shall be threaded in opposite directions, to keep the batten from "walking" as its elevation changes.
         6. Side plates shall hold four keepers designed to prevent cross winding of the lift lines on the drums.
         7. Tread pressures shall not exceed allowable radial bearing pressures as specified in the Wire Rope User Manual.
         8. Drums shall have capacity for termination on either end so lift lines can come off in either direction.
      5. Limit Switches:
         1. The hoist shall have four gear-driven, independently adjustable switch/cam sets. Switches shall have snap acting contacts.
         2. Rotary limit switches shall be driven directly or by roller chains. If roller chains are used, sprockets shall be pinned to prevent slipping and sized for maximum usable rotation of switch cams. The input shaft and drive chain shall be fully guarded.
         3. Switches shall be mounted to the winch base to allow for easy adjustment of the switch settings.
    1. Secondary Brake:

\*\* NOTE TO SPECIFIER \*\* Delete either electric or overspeed brake.

* + - 1. Electric Brake:
         1. A secondary load brake shall be supplied in addition to the primary brake on the motor. This brake shall be located on the low speed output shaft of the gearbox or directly fixed to the hoist drum. The brake shall be sufficient to stop and hold the load.
         2. This brake shall be normally applied and require a source of power to release the brake.
         3. Control of the secondary brake shall be integrated with the primary brake to ensure the proper sequence of application and release between the brakes.
      2. Overspeed Brake:
         1. A secondary overspeed load brake shall be supplied in addition to the primary brake on the motor. This brake shall be located on the low speed output shaft of the gearbox or directly fixed to the hoist drum.
         2. This brake shall be factory set to apply itself at 125 percent of the maximum rated hoist speed (50 rpm minimum). The friction lining is mechanically set against the drum to grip when the arms extend to lock into the drum and bring the hoist to a halt.
         3. The overspeed brake shall not require either electricity or pressure from an external source for operation.

\*\* NOTE TO SPECIFIER \*\* Select required starter and delete one not needed.

* + 1. Fixed Speed Starters:
       1. Each fixed speed hoist shall be controlled by a UL 508E compliant, 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 60204-1 "Protection against direct contact" rules.
       2. The NEMA/IEC 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 UL 508E 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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.
    2. Variable Speed Drive:
       1. Motor controllers shall be solid state flux vector controllers, designed for hoisting duty, and rated for the motor to be controlled. The controller shall incorporate closed loop feedback using a solid state position encoder mounted on the motor shaft to identify the speed and position of motor shaft in order to provide the greatest accuracy and performance. Each controller shall incorporate a microprocessor to provide direct control of torque and shaft position. The controller shall provide an essentially infinite speed range, including the ability to produce full torque at zero speed.
       2. The motor controller enclosure shall be NEMA 12 with a hinged, latching cover. The interior of the cabinet shall be "touch safe" per IEC 60204-1 "Protection against direct contact" rules.
       3. A brake contactor shall be provided. The controller shall not release the hoist brake until the drive has developed the full rated torque.
       4. Controllers shall provide controlled deceleration and braking of rapidly descending loads.
       5. Each controller shall contain a line contactor. This contactor shall be controlled by the E-stop and overtravel limit switches, providing a redundant means of removing power from the hoist.
       6. Controllers 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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the cabinet to allow override of the overtravel limits for resetting purposes.
       7. Each controller shall incorporate overcurrent protection in the form of properly rated fuses (per UL 198C guidelines) or circuit breakers.
       8. Controllers shall incorporate all required contactors, relays, and interface electronics required by the control system. Controllers shall provide under voltage, over voltage, instantaneous over current, overload, and over temperature indication. Properly labeled, screw clamp terminals shall be provided for all field connections, including limit switches and other peripheral devices.

\*\* NOTE TO SPECIFIER \*\* Delete if not required for project.

* + 1. Load Monitoring:
       1. Load information shall be obtained from solid state load cells mounted between the base of the hoist and the gear motor.
          1. The cell shall accommodate total hoist loads or changing loads depending on the functions included in the supplied controls.

\*\* NOTE TO SPECIFIER \*\* Optional - If desired delete cable roller type not required for project.

* + 1. Cable Roller:
       1. Fixed Cable Roller.
          1. Provide an adjustable roller to keep lift lines in the grooves of the drum and prevent them from becoming crossed. Light pressure on the cables keeps the lines from becoming slack.
          2. The roller shall be large enough in diameter for rigidity, have a bearing in each end so it shall rotate and ride on an adjustable shaft.
       2. Sprung Cable Roller:
          1. Provide an adjustable roller to keep lift lines in the grooves of the drum and prevent them from becoming crossed. Light pressure on the cables keeps the lines from becoming slack.
          2. The roller shall be large enough in diameter for rigidity, have a bearing in each end so it shall rotate and ride on an adjustable shaft.
          3. The shaft is spring mounted so crossed cables or jams shall cause a cable to jump from its groove and trip a limit switch, stopping the hoist.

\*\* NOTE TO SPECIFIER \*\* Optional - If desired delete cable roller type not required for project.

* + 1. Slack Line Detection:
       1. Charged Bar.
       2. Provide an electrically isolated bar that grounds the control when a cable escapes from its groove. When a line touches and grounds the bar it activates a contact in the controller that does one of the following as wired or programmed:
          1. Engages the emergency stop and halts all motion.
          2. Stops motion and prevent further motion in the same direction.
          3. Signals the PLC and waits for further instruction.
  1. SELF-CLIMBING HOIST
     1. The self-climbing truss type hoist shall have the ability to raise and lower the specified load at the specified speed. All components shall be designed to properly support the required loads.
        1. The truss shall be up to 50 ft long, with an integral lifting hoist.
        2. The system shall be built inside of 12 inch x 18 inch plated truss.
        3. Hoist will have two, three, or four lift lines depending on capacity, lift line spacing and truss length.
           1. Contact manufacturer for specific requirements.
        4. Standard hoist drums shall have 35 feet of available travel.
     2. Gear Case:
        1. The gear assembly shall be a helical unit as manufactured by SEW Eurodrive. It shall be equipped with an integral brake-motor which is flange mounted to the unit. The first stage pinion gear shall be mounted directly to the motor rotor shaft.
        2. The gearcase shall be constructed of cast iron for durability. The output shaft must have a double lip oil seal to prevent leakage. The gearing must have at least a 1.0 minimum service factor and a 1.25 mechanical strength factor.
        3. The motor shall be totally enclosed and fan cooled (TEFC). The motor must attain at least an NEMA service factor of 1.0.
        4. The four-pole motor shall operate at 208 volts, 3 phase.
     3. Gearmotor:
        1. Motor, primary brake, and gearbox shall be an integrated unit, with the first stage pinion gear mounted directly on the motor's armature shaft. No coupling shall be permitted between the motor and gear reducer.
        2. Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.
        3. The gear reducer shall be a combination helical/worm or helical/bevel reducer. The gear case shall be cast iron for protection against shock damage. The input and output shafts 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.
     4. Primary Brake:
        1. The primary brake shall be an integral part of the motor, mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor and primary brake.
        2. Brakes shall be spring applied, direct acting, electrically released, and equipped with a manual release as backup. The brake shall an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.
        3. The brake shall be released by energizing the coil simultaneously with the motor winding to provide fail-safe braking in case of power failure.
     5. Shafts, Keys, and Couplings:
        1. Drums shall be interconnected by commercial transmission shafts with universal joints at each end. The use of solid couplings and bar, pipe, or square tubes as shafts are not permitted.
        2. Shafts shall be designed to accommodate the applied loads (including shock and bending loads) in accordance with ANSI B106.1 m, "Design of Transmission Shafting".
        3. All connections shall be keyed, using keys designed to accommodate the applied loads. Keys shall be in accordance with ANSI B17.1, "Keys and Key Seats".
        4. Universal joints shall accommodate the applied loads, including shock and bending loads, and shall accommodate the possible parallel and angular misalignments caused during manufacturing, assembly, and installation, as well as by structural tolerances and structural or equipment deflections.
     6. Bearings:
        1. Bearings shall be selected to accommodate the applied loads and speeds with a minimum L10 life of 2,000 hours.
     7. Helical Drums:
        1. Winding drums shall be designed to properly support the required loads.
        2. Drums shall be helically grooved to accept a single layer of cable accommodating the entire travel distance plus three dead wraps. The drum diameter shall meet or exceed the wire rope manufacturer's minimum recommended D/d ratio.
        3. Drum construction shall be of the all welded type, including a continuous drum shaft. Cables shall enter the drum through key slots machined from root of the cable groove through the tubing wall at a 45 degree angle and shall be retained by a Copper swage stop sleeve inserted through the end of the slot from the outside. Cables shall have a minimum of three dead wraps on the drum. In order to prevent unbalanced operation, drum assemblies that exceed 20 rpm shall be straightened to a maximum total indicated run out (T.I.R.) of 0.005 inch (0.127 mm).
        4. Each end of the drum shall be supported by either the output shaft of the gearbox or an appropriately sized bearing mounted in the side steel plate that fully captures the drum shaft.
        5. Alternate drums shall be threaded in opposite directions, to keep the batten from "walking" as its elevation changes.
        6. Side plates shall hold four keepers designed to prevent cross winding of the lift lines on the drums.
        7. Tread pressures shall not exceed allowable radial bearing pressures as specified in the Wire Rope User Manual.
        8. Drums shall have capacity for termination on either end so lift lines can come off in either direction.
     8. Limit Switches:
        1. Rotary limit switch assemblies shall have four gear-driven, independently adjustable switch/cam sets. Switches shall have snap acting contacts.
        2. Rotary limit switches shall be driven directly or by roller chains. If roller chains are used, sprockets shall be pinned to prevent slipping and sized for maximum usable rotation of switch cams. The input shaft and drive chain shall be fully guarded.
        3. Switches shall be mounted to the winch base to allow for easy adjustment of the switch settings.
     9. Overspeed Brake:
        1. Two secondary overspeed load brakes shall be supplied in addition to the primary brake on the motor. The brakes shall be located on each end of the hoist.
        2. This brake shall be factory set to apply itself at 125 percent of the maximum rated hoist speed (50 rpm minimum). The friction lining is mechanically set against the drum to grip when the arms extend to lock into the drum and bring the hoist to a halt.
        3. The overspeed brake shall not require either electricity or pressure from an external source for operation.
     10. Pantograph Cable Management:
         1. Pantograph shall accommodate up to (64) 12 Ga conductors and up to (2) data cables.
            1. Up to (8) 8 conductor flat cables. Maximum capacity of (25) 120 Volt, 20 amp circuits utilizing (1) 12 Ga ground conductor for every (2) 20 amp circuits.
            2. Data Cable:

\*\* NOTE TO SPECIFIER \*\* Delete data cable not required for project.

Data cable shall be DMX.

Data cable shall be CAT5.

* + - 1. Pantograph shall be constructed with a physical barrier between the power supply and data cables within the channel.
      2. The pantograph shall consist of a series powder coated aluminum channels hinged to each other to allow the entire distance of travel required by the batten, up to a 52 feet (15.8 m) fully extended length.
      3. The top arm shall be connected to a moving trolley.
      4. Pantograph fully retracted height shall be no greater than 25 inch (635 mm) vertical.
      5. Pantograph shall mount to a 1.5 inch (38 mm) schedule 40 pipe batten.
      6. Pantograph shall travel at a maximum speed of 30 feet per minute (9 meters per second).
      7. System includes power and data strain reliefs for top and bottom.
      8. System shall include grid junction box to be installed by electrical contractor.
  1. PERFORMER HOIST
     1. General:
        1. The hoist shall be specifically designed for lifting loads in theatres and other places of public assembly. It shall have a compact design with all required components integrated into its structure.
        2. The hoist shall incorporate a sturdy frame and adjustable mounting clips for easy mounting.
        3. Characteristics: The hoist shall have the following characteristics:
           1. Speed and lifting capacity shall be up to 480 FPM (2.4mps) and 400lbs (180kg), or up to 590 FPM (3mps) and 220 LBS (100kg)
           2. Travel: Up to 100 feet (30 m)
           3. Lift Lines: 1 at 1/4 inch (6.4mm) diameter or 5mm, 7x19 galvanized utility cable
           4. Units shall be available for all standard 60 Hz and 50 Hz power sources without the need for transformers.
        4. The hoist shall use a moving drum to minimize hoist size and wire rope wear. The drum shall move along its axis as it rotates, keeping the cable takeoff points on the drum aligned with the head block sheaves incorporated in the hoist (zero fleet angle design).
     2. Gearmotor and Primary Brake:
        1. The motor, primary brake and gearbox shall be an integrated unit from a single manufacturer. For enhanced reliability, a continuous shaft shall link the brake, motor armature, and the first stage pinion gear without the use of couplings.
        2. Motors shall be totally enclosed fan cooled (TEFC) per NEMA MG1. Motors shall have a minimum service factor of 1.0.
        3. The gear reducer shall employ helical gearing. The gear case shall be cast iron for protection against shock damage and to provide noise reduction. The output shaft shall have triple lip oil seals to prevent leaks.
        4. The primary brake shall be spring applied and electrically released, with a minimum retarding torque of 150 percent of motor full load torque.
     3. SureBrake II: For added security, a spring applied and electrically released electro-magnetic load brake shall be located between the output shaft of the gearbox and the drum. The brake controller shall apply the brake if the speed exceeds the commanded speed, the maximum speed, or if it detects a failure in the integrity of the shafting and gearbox.
     4. Drum:
        1. The drum shall be helically grooved to accept a single layer of cable accommodating the entire travel distance plus a minimum of three dead wraps per cable.
        2. Cables shall be retained by metal clip and screw tapped into drum.
        3. Preloaded chase rollers shall be provided to retain lift lines in their grooves.
        4. The pitch diameter of all drums shall meet or exceed the wire rope manufacturer's minimum recommended D/d ratio. Load bearing wire rope groove profiles shall meet the recommendations of the Wire Rope Technical Board.
        5. The drum shall be positively driven to move along its axle to maintain a zero fleet angle with the head block sheaves. The axle shall be permanently lubricated.
     5. Sheaves:
        1. All load bearing sheaves shall have a minimum 26:1 D:d ratio to meet the wire rope manufacturer's recommendations. Sheave grooves shall be deeper than the cable diameter for cable protection. The sheave shall be equipped with a machined steel shaft and two sealed, precision ball bearings. Spacers shall positively retain the cable.
     6. Loft Blocks:
        1. Loft blocks shall have 12-gauge (2.78mm) steel (minimum) side plates that shall fully enclose the sheave. Side plates shall be bolted to the base angles. Base angles shall be a minimum 1-1/2" x 1-1/2" x 3/16" (38.1mm x 38.1mm x 4.8mm) angle punched with a universal hole pattern for easy installation. There shall be a minimum of seven 1/4" (6.4mm) bolts with spacers between the side plates, four of which prevent cables from escaping the sheave grooves.
        2. The block and associated mounting hardware shall have a recommended working load of at least 500 lbs. (226.8kg), and shall be designed for upright or underhung use.
        3. Loft blocks shall be provided with idlers to support ongoing lift lines with an individual groove for each lift line to prevent tangling or abrasion.
     7. Limit Switches:
        1. Hoists shall have positively actuated limit switches for normal end of travel indication. These switches shall open the control circuit in the drive or starter to stop any further movement in the direction of travel.
        2. Positively actuated limit switches shall be provided for over travel indication. These shall use a separate circuit that is redundant to the normal end of travel switches, and positively disconnects power from the hoist, using a UL580E Type 2, non-welding, positive break contactor.
        3. An override mechanism to allow resetting of the over travel limits shall be included in the drive cabinet.
        4. Limit switches shall be set to match actual site conditions.
        5. Computer controlled systems shall also have software limits utilizing solid state encoders, in addition to the two levels of mechanically actuated limit switches.
     8. Motor Controllers:
        1. For fire and electrical safety, motor controllers shall conform to the NEC (NFPA 70), be built in accordance with UL Standard 508, and be "touch safe" per IEC 204-1 "Protection against direct contact" rules.
        2. Variable speed controllers
           1. Variable speed controllers shall be solid state flux vector drives designed for hoisting duty. Each controller shall incorporate closed loop feedback using a solid state position encoder mounted on the motor shaft to provide the greatest accuracy and performance. The controller shall provide an essentially infinite speed range, including the ability to produce full torque at zero speed. The use of open loop drives is prohibited.
           2. Power wiring between vector drives and motors shall be shielded to reduce electrical noise.
           3. Dynamic braking resistors are provided to dissipate heat during stopping.
        3. Controllers shall provide over current, overload, and phase loss protection.
        4. Operation of the system key switch shall disconnect power to all starters and drives.
        5. A maintenance pendant shall be provided for direct control of the hoists during setup and for maintenance. It shall contain Up and Down pushbuttons, an Overtravel Bypass switch, and a key operated On / Off switch.
     9. Emergency Stop System:
        1. The emergency stop system shall meet SIL 3 or NFPA-79 (Electrical Standards for Industrial Machinery) and directly remove power by means of electromechanical components, using a UL580E Type 2, non-welding, positive break contactors
        2. The emergency stop circuit shall be a normally closed circuit or a supervised circuit that provides the same or greater level of reliability and security. Its operation shall not depend on software or semiconductors.
        3. Resetting the emergency stop circuit shall not initiate motion.
        4. For hoists running at more than 50 fpm (0.254mps), a Category 1 controlled stop per NFPA-79 (Electrical Standards for Industrial Machinery) shall be provided. This provides a rapid ramp to a stop, and then removes power to reduce shock loading.
     10. Load Monitoring:
         1. Load information shall be obtained from dual solid state load cells on the hoist. The load monitoring system shall be able to accommodate dynamic loads, such as cable weight that changes during batten travel, without false tripping.
         2. Load monitoring requires the use of a control console.
     11. Installation supervision and commissioning of the motorized rigging system shall be performed by a factory authorized and trained technician.

\*\* NOTE TO SPECIFIER \*\* Delete if not required for project.

* 1. CUSTOM LINE SHAFT HOIST

\*\* NOTE TO SPECIFIER \*\* Controls shall be added for a complete system.

* + 1. General: Each hoist unit shall have the capacity to raise and lower the specified load at the specified speed.
       1. The hoist shaft shall incorporate a sturdy frame and field adjustable mounting clips for easy mounting.

\*\* NOTE TO SPECIFIER \*\* Delete cable size not required for project.

* + - * 1. Lift Line Diameter Cable Size: 3/16 inch (4.8 mm).
        2. Lift Line Diameter Cable Size: 1/4 inch (6.4 mm).
        3. Lift Line Diameter Cable Size: 5/16 inch (7.9 mm).
        4. Lift Line Diameter Cable Size: 3/8 inch (9.5 mm).
      1. Construction:
         1. The integrated motor - brake - gear reducer unit and associated components, which may include a helical drum, shall be supported by a sturdy steel base, holding the elements of the winch in proper alignment.
         2. Each helical drum shall be supported by a sturdy steel base, holding the elements of the drum assembly in proper alignment. Both ends of each drum shall be supported by a self-aligning flange bearing.
         3. Alternate drums shall be threaded in opposite directions, to keep the batten from moving left and right as cables wrap on the drum.
         4. Drums shall be interconnected by shafts with universal joints at each end.
         5. Side plates shall have three keepers designed to prevent cross winding of lift lines on the drums.
      2. Gearmotor:
         1. Motors, primary brakes, and gearboxes shall be an integrated unit, with the first stage pinion gear mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor and gear reducer. Exceptions shall be permitted only when special gearing or torque requirements cannot be met with an integrated unit.
         2. Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.
         3. The gear reducer shall be a combination helical/worm or helical/bevel reducer. The gear case shall be cast iron for protection against shock damage. The output shaft(s) 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.
      3. Primary Brake:
         1. The primary brake shall be an integral part of the motor, mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor and primary brake.
         2. Brakes shall be spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.
         3. The brake shall be released by energizing the coil simultaneously with the motor winding to provide fail-safe braking in case of power failure.
      4. Shafts, Keys, and Couplings:
         1. Shafts shall be designed to accommodate the applied loads (including shock and bending loads) in accordance with ANSI B 106.1 m, "Design of Transmission Shafting",.
         2. All connections shall be keyed, using keys designed to accommodate the applied loads. Keys shall be in accordance with ANSI B 17.1, "Keys and Key Seats.".
         3. Couplings shall be chosen to accommodate the applied loads, including shock and bending loads. Couplings shall accommodate the possible parallel and angular misalignments caused during manufacturing, assembly, and installation, as well as by structural tolerances and structural or equipment deflections.
         4. In the case of line shaft hoists, the couplings in the shafts between the drums shall be universal joints in order to compensate for misalignment and deflections.
         5. Only couplings made of steel and with steel to steel contact surfaces shall be used.
      5. Bearings:
         1. Bearings shall be selected to accommodate the applied loads and speeds.
         2. The use of self-aligning flange bearings is preferred. The use of other bearing types shall be in accordance with good engineering practice. Pillow blocks may be used only where they are subject to compressive forces only.
      6. Helical Drums:
         1. Winding drums shall be designed to properly support the required loads.
         2. Drums shall be helically grooved to accept a single layer of cable accommodating the entire travel distance plus three dead wraps. The drum diameter shall meet or exceed the wire rope manufacturer's minimum recommended D/d ratio.
         3. Drum construction shall be of the all welded type. Cables shall enter the drum through holes drilled from root of the cable groove through the tubing wall at a 45 degree angle and shall be retained by a Copper swage stop sleeve. In order to prevent unbalanced operation, drum assemblies that exceed 20 rpm shall be straightened to a maximum total indicated run out (T.I.R.) of 0.005 inch (0.127 mm).
         4. Each end of the drum shall be supported by either the output shaft of the gearbox or an appropriately properly sized self-aligning flange mounted in a steel plate that fully captures the drum shaft.

\*\* NOTE TO SPECIFIER \*\* Add Either a Fixed Speed Starter or a Variable Speed Drive. Delete drive not required.

* + - 1. Fixed Speed Starters:
         1. Each fixed speed hoist shall be controlled by a UL 508E 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 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 UL 508E 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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.
         5. Touch safe protection, a line contactor, and override spring return switch for overtravel limits are mandatory for safety.
      2. Variable Speed Drive:
         1. Motor controllers shall be solid state flux vector controllers, designed for hoisting duty, and rated for the motor to be controlled. The controller shall incorporate closed loop feedback using a solid state position encoder mounted on the motor shaft to identify the speed and position of motor shaft in order to provide the greatest accuracy and performance. Each controller shall incorporate a microprocessor to provide direct control of torque and shaft position. The controller shall provide an essentially infinite speed range, including the ability to produce full torque at zero speed.
         2. The motor controller enclosure shall be NEMA 12 with a hinged, latching cover. The interior of the cabinet shall be "touch safe" per IEC 204-1 "Protection against direct contact" rules.
         3. A brake contactor shall be provided. The controller shall not release the hoist brake until the drive has developed the full rated torque.
         4. Controllers shall provide controlled deceleration and braking of rapidly descending loads. Dynamic braking resistor shall be provided to dissipate heat during stopping.
         5. Each controller shall contain a line contactor. This contactor shall be controlled by the E-stop and overtravel limit switches, providing a redundant means of removing power from the winch.
         6. Controllers 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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the cabinet to allow override of the overtravel limits for resetting purposes.
         7. Each controller shall incorporate overcurrent protection in the form of properly rated fuses (per UL 198C guidelines) or circuit breakers.
         8. Controllers shall incorporate all required contactors, relays, and interface electronics required by the control system. Controllers shall provide under voltage, over voltage, instantaneous over current, overload, and over temperature indication. Properly labeled, screw clamp terminals shall be provided for all field connections, including limit switches and other peripheral devices.
         9. Touch safe protection, a line contactor, and override spring return switch for overtravel limits are mandatory for safety.
    1. Limit Switch:

\*\* NOTE TO SPECIFIER \*\* Delete limit switch not required.

* + - 1. Rotary Limit Switches.
         1. Rotary limit switch assemblies shall have four gear-driven, independently adjustable switch/cam sets. Switches shall have snap acting contacts.
         2. Rotary limit switches shall be driven directly or by roller chains. If roller chains are used, sprockets shall be pinned to prevent slipping and sized for maximum usable rotation of switch cams. The input shaft and drive chain shall be fully guarded.
         3. Switches shall be mounted to the winch base to allow for easy adjustment of the switch settings.
      2. Direct Struck Limit Switch:
         1. Direct struck limit switches shall be heavy duty, lever operated rotary head units.
         2. Switches shall have positive opening contacts.
         3. Direct struck limit switches shall be Telemecanique ZCKJ series or Allen Bradley Bulletin 802T. .
    1. Secondary Brake:

\*\* NOTE TO SPECIFIER \*\* Delete secondary brakes not required.

* + - 1. Electric Brake:
         1. A secondary load brake shall be supplied in addition to the primary brake on the motor. This brake shall be located on the low speed output shaft of the gearbox or directly fixed to the hoist drum. The brake shall be sufficient to stop and hold the load.
         2. This brake shall be normally applied and require a source of power to release the brake.
         3. Control of the secondary brake shall be integrated with the primary brake to ensure the proper sequence of application and release between the brakes.
      2. Overspeed Brake:
         1. A secondary overspeed load brake shall be supplied in addition to the primary brake on the motor. This brake shall be located on the low speed output shaft of the gearbox or directly fixed to the hoist drum.
         2. This brake shall be factory set to apply itself at 125 percent of the maximum rated hoist speed (50 rpm minimum). The friction lining is mechanically set against the drum to grip when the arms extend to lock into the drum and bring the hoist to a halt.
         3. The overspeed brake shall not require either electricity or pressure from an external source for operation.
      3. Caliper Load Brake:
         1. A secondary load brake shall be supplied in addition to the primary brake on the motor. The brake flange shall be located on the low speed output shaft of the gearbox or directly fixed to the hoist drum. The brake caliper(s) shall be sufficient to stop and hold the load.
         2. This brake shall be normally applied and require a source of power (air or electric) to release the brake.
         3. Control of the secondary brake shall be integrated with the primary brake to ensure the proper sequence of application and release between the brakes.
    1. Load Monitoring:
       1. Load information shall be obtained from solid state load cells mounted between the base of the hoist and the gear motor.
          1. The cell shall accommodate total hoist loads or changing loads depending on the functions included in the supplied controls.

\*\* NOTE TO SPECIFIER \*\* Optional - If desired delete cable roller type not required for project .

* + 1. Cable Roller:
       1. Fixed Cable Roller:
          1. Provide an adjustable roller to keep lift lines in the grooves of the drum and prevent them from becoming crossed. Light pressure on the cables keeps the lines from becoming slack.
          2. The roller shall be large enough in diameter for rigidity, have a bearing in each end so it shall rotate and ride on an adjustable shaft.
       2. Sprung Cable Roller:
          1. Provide an adjustable roller to keep lift lines in the grooves of the drum and prevent them from becoming crossed. Light pressure on the cables keeps the lines from becoming slack.
          2. The roller shall be large enough in diameter for rigidity, have a bearing in each end so it shall rotate and ride on an adjustable shaft.
          3. The shaft is spring mounted so crossed cables or jams shall cause a cable to jump from its groove and trip a limit switch, stopping the hoist.

\*\* NOTE TO SPECIFIER \*\* Delete if not required for project.

* + 1. Slack Line Detection:
       1. Charged Bar:
       2. Provide an electrically isolated bar that grounds the control when a cable escapes from its groove. When a line touches and grounds the bar it activates a contact in the controller that does one of the following as wired or programmed:
          1. Engages the emergency stop and halts all motion.
          2. Stops motion and prevent further motion in the same direction.
          3. Signals the PLC and waits for further instruction.

\*\* NOTE TO SPECIFIER \*\* Delete if not required for project.

* 1. DRUM HOIST
     1. Drum Hoist:

\*\* NOTE TO SPECIFIER \*\* Controls shall be added for a complete system.

* + - 1. General: Each hoist unit shall have the capacity to raise and lower the specified load at the specified speed.

\*\* NOTE TO SPECIFIER \*\* Delete cable sizes not required for project.

* + - * 1. Lift Line Diameter Cable Size: 3/16 inch (4.8 mm).
        2. Lift Line Diameter Cable Size: 1/4 inch (6.4 mm).
        3. Lift Line Diameter Cable Size: 5/16 inch (7.9 mm).
        4. Lift Line Diameter Cable Size: 3/8 inch (9.5 mm).
      1. Construction:
         1. All hoists shall be supported by a sturdy steel base, holding the elements of the hoist in proper alignment.
         2. A helical drum shall be directly connected to the output of the integrated motor - brake - gear reducer unit. The outboard end of the drum shall be supported by a self-aligning flange bearing.
      2. Gearmotor:
         1. Motors, primary brakes, and gearboxes shall be an integrated unit, with the first stage pinion gear mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor and gear reducer.
         2. Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.
         3. The gear reducer shall be a combination helical/worm or helical/bevel reducer. The gear case shall be cast iron for protection against shock damage. The output shaft(s) 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.
      3. Primary Brake:
         1. The primary brake shall be an integral part of the motor, mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor and primary brake.
         2. Brakes shall be spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.
         3. The brake shall be released by energizing the coil simultaneously with the motor winding to provide fail-safe braking in case of power failure.
      4. Shafts, Keys, and Couplings:
         1. Shafts shall be designed to accommodate the applied loads (including shock and bending loads) in accordance with ANSI B 106.1 m, "Design of Transmission Shafting",.
         2. All connections shall be keyed, using keys designed to accommodate the applied loads. Keys shall be in accordance with ANSI B 17.1, "Keys and Key Seats.".
         3. Couplings shall be chosen to accommodate the applied loads, including shock and bending loads. Couplings shall accommodate the possible parallel and angular misalignments caused during manufacturing, assembly, and installation, as well as by structural tolerances and structural or equipment deflections.
         4. Only couplings made of steel and with steel to steel contact surfaces shall be used. Solid couplings shall not be permitted.
      5. Bearings:
         1. Bearings shall be selected to accommodate the applied loads and speeds.
         2. The use of self-aligning flange bearings is preferred. The use of other bearing types shall be in accordance with good engineering practice. Pillow blocks may be used only where they are subject to compressive forces only.
      6. Helical Drums:
         1. Winding drums shall be designed to properly support the required loads.
         2. Drums shall be helically grooved to accept a single layer of cable accommodating the entire travel distance plus three dead wraps. The drum diameter shall meet or exceed the wire rope manufacturer's minimum recommended D/d ratio.
         3. Drum construction shall be of the all welded type. Cables shall enter the drum through key slots machined from root of the cable groove through the tubing wall at a 45 degree angle and shall be retained by a Copper swage stop sleeve inserted through the end of the slot from the outside. Cables shall have a minimum of three dead wraps on the drum. In order to prevent unbalanced operation, drum assemblies that exceed 20 rpm shall be straightened to a maximum total indicated run out (T.I.R.) of 0.005 inch (0.127 mm).
         4. Each end of the drum shall be supported by either the output shaft of the gearbox or an appropriately sized, self-aligning flange bearing.

\*\* NOTE TO SPECIFIER \*\* Add Either a Fixed Speed Starter or a Variable Speed Drive. Delete drive not required.

* + - 1. Fixed Speed Starters:
         1. Each fixed speed hoist shall be controlled by a UL 508E compliant, 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 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 UL50808E 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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

\*\* NOTE TO SPECIFIER \*\* Delete drive if not required.

* + - 1. Variable Speed Drive:
         1. Motor controllers shall be solid state flux vector controllers, designed for hoisting duty, and rated for the motor to be controlled. The controller shall incorporate closed loop feedback using a solid state position encoder mounted on the motor shaft to identify the speed and position of motor shaft in order to provide the greatest accuracy and performance. Each controller shall incorporate a microprocessor to provide direct control of torque and shaft position. The controller shall provide an essentially infinite speed range, including the ability to produce full torque at zero speed.
         2. The motor controller enclosure shall be NEMA 12 with a hinged, latching cover. The interior of the cabinet shall be "touch safe" per IEC 204-1 "Protection against direct contact" rules.
         3. A brake contactor shall be provided. The controller shall not release the hoist brake until the drive has developed the full rated torque.
         4. Controllers shall provide controlled deceleration and braking of rapidly descending loads.
         5. Each controller shall contain a line contactor. This contactor shall be controlled by the E-stop and overtravel limit switches, providing a redundant means of removing power from the winch.
         6. Controllers 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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the cabinet to allow override of the overtravel limits for resetting purposes.
         7. Each controller shall incorporate overcurrent protection in the form of properly rated fuses (per UL 198C guidelines) or circuit breakers.
         8. Controllers shall incorporate all required contactors, relays, and interface electronics required by the control system. Controllers shall provide under voltage, over voltage, instantaneous over current, overload, and over temperature indication. Properly labeled, screw clamp terminals shall be provided for all field connections, including limit switches and other peripheral devices.
      2. Hoists shall be UL or ETL marked as meeting "UL 1340 Standard for Hoists".
    1. Limit Switch:

\*\* NOTE TO SPECIFIER \*\* Delete limit switch not required.

* + - 1. Rotary Limit Switches:
         1. Rotary limit switch assemblies shall have four gear-driven, independently adjustable switch/cam sets. Switches shall have snap acting contacts.
         2. Rotary limit switches shall be driven directly or by roller chains. If roller chains are used, sprockets shall be pinned to prevent slipping and sized for maximum usable rotation of switch cams. The input shaft and drive chain shall be fully guarded.
         3. Switches shall be mounted to the winch base to allow for easy adjustment of the switch settings.
      2. Direct Struck Limit Switch.
         1. Direct struck limit switches shall be heavy duty, lever operated rotary head units.
         2. Switches shall have positive opening contacts.
         3. Direct struck limit switches shall be Telemecanique ZCKJ series or Allen Bradley Bulletin 802T.
    1. Secondary Brake:

\*\* NOTE TO SPECIFIER \*\* Delete secondary brakes not required.

* + - 1. Electric Brake:
         1. A secondary load brake shall be supplied in addition to the primary brake on the motor. This brake shall be located on the low speed output shaft of the gearbox or directly fixed to the hoist drum. The brake shall be sufficient to stop and hold the load.
         2. This brake shall be normally applied and require a source of power to release the brake.
         3. Control of the secondary brake shall be integrated with the primary brake to ensure the proper sequence of application and release between the brakes.
      2. Overspeed Brake:
         1. A secondary overspeed load brake shall be supplied in addition to the primary brake on the motor. This brake shall be located on the low speed output shaft of the gearbox or directly fixed to the hoist drum.
         2. This brake shall be factory set to apply itself at 125 percent of the maximum rated hoist speed (50 rpm minimum). The friction lining is mechanically set against the drum to grip when the arms extend to lock into the drum and bring the hoist to a halt.
         3. The overspeed brake shall not require either electricity or pressure from an external source for operation.
      3. Caliper Load Brake:
         1. A secondary load brake shall be supplied in addition to the primary brake on the motor. The brake flange shall be located on the low speed output shaft of the gearbox or directly fixed to the hoist drum. The brake caliper(s) shall be sufficient to stop and hold the load.
         2. This brake shall be normally applied and require a source of power (air or electric) to release the brake.
         3. Control of the secondary brake shall be integrated with the primary brake to ensure the proper sequence of application and release between the brakes.

\*\* NOTE TO SPECIFIER \*\* Delete if not required for project.

* + 1. Load Monitoring:
       1. Load Monitor:
          1. Load information shall be obtained from solid state load cells mounted between the base of the hoist and the gear motor.
          2. The cell shall accommodate total hoist loads or changing loads depending on the functions included in the supplied controls.

\*\* NOTE TO SPECIFIER \*\* Optional - If desired delete cable roller type not required for project.

* + 1. Cable Roller:
       1. Fixed Cable Roller:
          1. Provide an adjustable roller to keep lift lines in the grooves of the drum and prevent them from becoming crossed. Light pressure on the cables keeps the lines from becoming slack.
          2. The roller shall be large enough in diameter for rigidity, have a bearing in each end so it shall rotate and ride on an adjustable shaft.
       2. Sprung Cable Roller:
          1. Provide an adjustable roller to keep lift lines in the grooves of the drum and prevent them from becoming crossed. Light pressure on the cables keeps the lines from becoming slack.
          2. The roller shall be large enough in diameter for rigidity, have a bearing in each end so it shall rotate and ride on an adjustable shaft.
          3. The shaft is spring mounted so crossed cables or jams shall cause a cable to jump from its groove and trip a limit switch, stopping the hoist.

\*\* NOTE TO SPECIFIER \*\* Delete if not required for project.

* + 1. Slack Line Detection:
       1. Charged Bar.
       2. Provide an electrically isolated bar that grounds the control when a cable escapes from its groove. When a line touches and grounds the bar it activates a contact in the controller that does one of the following as wired or programmed:
          1. Engages the emergency stop and halts all motion.
          2. Stops motion and prevent further motion in the same direction.
          3. Signals the PLC and waits for further instruction.

\*\* NOTE TO SPECIFIER \*\* Delete if not required for project.

* 1. PILE-UP DRUM HOIST
     1. General: Each hoist unit shall have the capacity to raise and lower the specified load at the specified speed.
        1. General: Each hoist unit shall have the capacity to raise and lower the specified load at the specified speed.

\*\* NOTE TO SPECIFIER \*\* Delete cable sizes not required for project.

* + - * 1. Lift Line Diameter Cable Size: 3/16 inch (4.8 mm).
        2. Lift Line Diameter Cable Size: 1/4 inch (6.4 mm).
        3. Lift Line Diameter Cable Size: 5/16 inch (7.9 mm).
        4. Lift Line Diameter Cable Size: 3/8 inch (9.5 mm).
      1. Construction:
         1. All hoists shall be supported by a sturdy steel base, holding the elements of the hoist in proper alignment.
         2. A drum shall be directly connected to the output of the integrated motor - brake - gear reducer unit. The outboard end of the drum shall be supported by a self aligning flange bearing.
      2. Gearmotor:
         1. Motors, primary brakes, and gearboxes shall be an integrated unit, with the first stage pinion gear mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor and gear reducer. Exceptions shall be permitted only when special gearing or torque requirements cannot be met with an integrated unit.
         2. Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.
         3. The gear reducer shall be a combination helical/worm reducer. The gear case shall be cast iron for protection against shock damage. The output shaft(s) 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.
      3. Primary Brake:
         1. The primary brake shall be an integral part of the motor, mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor and primary brake.
         2. Brakes shall be spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.
         3. The brake shall be released by energizing the coil simultaneously with the motor winding to provide fail-safe braking in case of power failure.
      4. Shafts, Keys, and Couplings:
         1. Shafts shall be designed to accommodate the applied loads (including shock and bending loads) in accordance with ANSI B 106.1 m, "Design of Transmission Shafting",.
         2. All connections shall be keyed, using keys designed to accommodate the applied loads. Keys shall be in accordance with ANSI B 17.1, "Keys and Key Seats.".
         3. Couplings shall be chosen to accommodate the applied loads, including shock and bending loads. Couplings shall accommodate the possible parallel and angular misalignments caused during manufacturing, assembly, and installation, as well as by structural tolerances and structural or equipment deflections.
         4. Only couplings made of steel and with steel to steel contact surfaces shall be used. Solid couplings shall not be permitted.
      5. Bearings:
         1. Bearings shall be selected to accommodate the applied loads and speeds.
         2. The use of self-aligning flange bearings is preferred. The use of other bearing types shall be in accordance with good engineering practice. Pillow blocks may be used only where they are subject to compressive forces only.
      6. Pile Up Drum (Yo-Yo Drum):
         1. Drum shall have a slotted construction so that the cable winds on top of itself in a single layer.
         2. The width of the slot shall be consistent throughout its depth to ensure the cable stacks evenly. The slot shall have sufficient depth for the entire travel, plus three dead wraps, and overtravel.
         3. The drum shall be direct coupled and keyed to the output shaft of the gear box.
         4. A self-aligning flange bearing shall support the outboard end of the shaft.
         5. Drum construction shall be of steel or ASTM A48 Class 30 grey iron castings. The drum sides shall be of sufficient thickness to withstand the forces applied by the cable.
         6. Cables shall enter the drum through holes drilled from the base of the slots at a 45 degree angle and shall be retained by a Copper swage stop sleeve.

\*\* NOTE TO SPECIFIER \*\* Add Either a Fixed Speed Starter or a Variable Speed Drive Delete fixed or variable speed.

* + - 1. Fixed Speed Starters:
         1. Each fixed speed hoist shall be controlled by a UL 508E compliant, 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 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 UL 508E 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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.
      2. Variable Speed Drive:
         1. Motor controllers shall be solid state flux vector controllers, designed for hoisting duty, and rated for the motor to be controlled. The controller shall incorporate closed loop feedback using a solid state position encoder mounted on the motor shaft to identify the speed and position of motor shaft in order to provide the greatest accuracy and performance. Each controller shall incorporate a microprocessor to provide direct control of torque and shaft position. The controller shall provide an essentially infinite speed range, including the ability to produce full torque at zero speed.
         2. The motor controller enclosure shall be NEMA 12 with a hinged, latching cover. The interior of the cabinet shall be "touch safe" per IEC 204-1 "Protection against direct contact" rules.
         3. A brake contactor shall be provided. The controller shall not release the hoist brake until the drive has developed the full rated torque.
         4. Controllers shall provide controlled deceleration and braking of rapidly descending loads.
         5. Each controller shall contain a line contactor. This contactor shall be controlled by the E-stop and overtravel limit switches, providing a redundant means of removing power from the winch.
         6. Controllers 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 overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the cabinet to allow override of the overtravel limits for resetting purposes.
         7. Each controller shall incorporate overcurrent protection in the form of properly rated fuses (per UL 198C guidelines) or circuit breakers.
         8. Controllers shall incorporate all required contactors, relays, and interface electronics required by the control system. Controllers shall provide under voltage, over voltage, instantaneous over current, overload, and over temperature indication. Properly labeled, screw clamp terminals shall be provided for all field connections, including limit switches and other peripheral devices.
    1. Limit Switch:

\*\* NOTE TO SPECIFIER \*\* Delete limit switch not required.

* + - 1. Rotary Limit Switches:
         1. Rotary limit switch assemblies shall have four gear-driven, independently adjustable switch/cam sets. Switches shall have snap acting contacts.
         2. Rotary limit switches shall be driven directly or by roller chains. If roller chains are used, sprockets shall be pinned to prevent slipping and sized for maximum usable rotation of switch cams. The input shaft and drive chain shall be fully guarded.
         3. Switches shall be mounted to the winch base to allow for easy adjustment of the switch settings.
      2. Direct Struck Limit Switch:
         1. Direct struck limit switches shall be heavy duty, lever operated rotary head units.
         2. Switches shall have positive opening contacts.
         3. Direct struck limit switches shall be Telemecanique ZCKJ series or Allen Bradley Bulletin 802T.
    1. Secondary Brake:

\*\* NOTE TO SPECIFIER \*\* Delete secondary brake not required.

* + - 1. Electric Brake:
         1. A secondary load brake shall be supplied in addition to the primary brake on the motor. This brake shall be located on the low speed output shaft of the gearbox or directly fixed to the hoist drum. The brake shall be sufficient to stop and hold the load.
         2. This brake shall be normally applied and require a source of power to release the brake.
         3. Control of the secondary brake shall be integrated with the primary brake to ensure the proper sequence of application and release between the brakes.
      2. Overspeed Brake:
         1. A secondary overspeed load brake shall be supplied in addition to the primary brake on the motor. This brake shall be located on the low speed output shaft of the gearbox or directly fixed to the hoist drum.
         2. This brake shall be factory set to apply itself at 125 percent of the maximum rated hoist speed (50 rpm minimum). The friction lining is mechanically set against the drum to grip when the arms extend to lock into the drum and bring the hoist to a halt.
         3. The overspeed brake shall not require either electricity or pressure from an external source for operation.
      3. Caliper Load Brake:
         1. A secondary load brake shall be supplied in addition to the primary brake on the motor. The brake flange shall be located on the low speed output shaft of the gearbox or directly fixed to the hoist drum. The brake caliper(s) shall be sufficient to stop and hold the load.
         2. This brake shall be normally applied and require a source of power (air or electric) to release the brake.
         3. Control of the secondary brake shall be integrated with the primary brake to ensure the proper sequence of application and release between the brakes.

\*\* NOTE TO SPECIFIER \*\* Optional. Delete if not required for project.

* + 1. Load Monitoring:
       1. Load Monitor:
          1. Load information shall be obtained from solid state load cells mounted between the base of the hoist and the gear motor.
          2. The cell shall accommodate total hoist loads or changing loads depending on the functions included in the supplied controls.

\*\* NOTE TO SPECIFIER \*\* Optional. Delete if not required for project.

* 1. MOTORIZED RIGGING ACCESSORIES
     1. Pipe Batten.
        1. All battens shall be 1.5 inch (38.1 mm) nominal diameter, schedule 40 pipe in lengths as shown on the drawings or Bill of Materials. All joints shall be spliced with 18 inch (457.2 mm) long sleeves with 9 inch (228.6 mm) extending into each pipe and held by two 3/8 inch (9.52 mm) hex bolts and lock nuts on each side of the joint.
        2. Each end shall be covered with a bright yellow, closed end, soft vinyl safety cap at least 4 inch (101.6 mm) in length.
     2. Truss Battens.
        1. Two pipe truss battens shall be in lengths as shown on the drawings or Bill of Materials. Truss battens shall be formed from two 1-1/2 inch (38.1 mm) nominal diameter, schedule 40 pipes, spaced 12 inch (304.8 mm) apart by 1/4 inch by 2 inch (6.4 mm x 50.8 mm) flat bars located a maximum of 5 ft (1.52m) apart and welded between the pipes. All joints shall be spliced with 18 inch (457.2 mm) long sleeves with 9 inch (228.6 mm) extending into each pipe and held by two 3/8 inch (9.52 mm) hex bolts and lock nuts on each side of the joint.
        2. Each end shall be covered with a bright yellow, closed end, soft vinyl safety cap at least 4 inch (101.6 mm) in length.

\*\* NOTE TO SPECIFIER \*\* Delete termination not required for project.

* + 1. Turnbuckles and Pipe Clamp.
       1. Turnbuckles: Turnbuckles.
          1. Turnbuckles shall be drop forged and galvanized, and conform to ASTM F1145 Type 1, Grade 1 standard. Turnbuckles shall be moused after adjustment to prevent loosening.
       2. Pipe Clamps: Pipe Clamps.
          1. Full Pipe Clamps:
          2. Pipe clamps shall be made of two strips of 12 Ga. (2.780 mm) by 2 inch (50.8 mm) hot rolled steel formed to encompass and clamp the pipe batten to prevent its rotation. Corners shall be rounded.
          3. There shall be a 3/8 inch x 1 inch (9.525 mm x 25.4 mm) hex bolt with lock nut above and below the batten. A 5/8 inch (15.875 mm) hole in the top of each clamp half allows the attachment of cable, chain, or other fittings.
          4. Full pipe clamps shall have a manufacturer's recommended load rating of at least 750 lbs (340.2 KG).
    2. Trim Chains: Trim Chains.
       1. Trim chains shall be 36 inch (914.4 mm) long, made of 1/4 inch (6.4 mm) plated, grade 30 Proof Coil chain. Connection between the end link and the lifting cable shall be made with a thimble and copper Nicopress sleeve. Chains shall be wrapped one and one half turns around the batten and attached back to the thimble at the end of the lift line with a 1/4 inch (6.4 mm) forged shackle. Adjustment is made by connecting the shackle into a link along the return side of the chain.
       2. Trim chains shall have a recommended working load of at least 750 lbs (340 KG).
    3. Trim Chains: Alloy Trim Chains.
       1. Trim chains shall be 36 inch (914 mm) long, made of 7 mm, Grade 63, hardened alloy chain meeting OSHA 1910.184(e)(5). The chain shall have a RWL of 3,250 lbs(1,474 KG), shall be manufactured in the United States and have a black finish to eliminate glare. Each link is marked with the manufacturer's code and every 10th link has date code for traceability.
       2. Connection between the end link and the lifting cable shall be made with a thimble and copper Nicopress sleeve.
       3. Chains shall be wrapped one and one half turns around the batten and attached back to the thimble at the end of the lift line with a 1/4 inch to 3/8 inch (6.4 mm to 9.5 mm) forged shackle. Adjustment is made by connecting the forged shackle into a link along the return side of the chain.
       4. Trim chains shall have a recommended working load of at least 750lbs (340.2 KG). when attached to 1/4 inch(6.4 mm), 7x19 GUC.
    4. Batten Trim Plate:
       1. Screw Pin Shackles: Shackles are u-shaped fittings with holes at each end to accommodate a pin to connect a rope, cable, or chain to another device. The pin has a head at one end and a thread at the other that screws into the body of the shackle. Shackle shall be from a U.S. manufacturer, and shall be moused after final trim adjustment.
       2. Trim Plate Assembly: Trim plate assembly consists of a batten clamp and plate punched with holes to receive 3/8 inch (9.52 mm) hardware, and 1/4 inch (6.35 mm) screw pin shackles.
          1. The plate shall be punched with five trim holes and one pick point hole to receive 3/8 inch (9.52 mm) hardware.
          2. The trim holes shall be positioned to allow for 1/2 inch (12.7 mm) variations in trim height.
          3. Trim plate assembly shall be able to support up to 500 lbs. (226.8 KG) per pick point.
          4. Trim plate assembly shall have the ability to be adjusted without the use of tools.
    5. Batten Trim Clamp:
       1. Batten trim clamps shall consist of two pipe clamps, each made of two strips of 12-gauge (2.78 mm) by 2 inch (50.8 mm) hot rolled steel formed to encompass and clamp the pipe batten to prevent its rotation. Corners shall be rounded. There shall be a 3/8 inch x 1 inch (9.52 mm x 25.4 mm) hex bolt with lock nut above and below the batten. A 5/8 inch (15.87 mm) hole in the top of one clamp half allows the attachment of cable, chain, or other fittings. The other clamp shall be fitted with a Nylon or aluminum grooved spacer with a minimum 2 inch (50.8 mm) diameter.
       2. Line adjustment shall be made by loosening the end clamp and sliding it along the batten or by adjusting the turnbuckle if so equipped.
       3. Trim clamps shall have a recommended working load of at least 700 lbs. (317.5 KG).
    6. Lift Cables:
       1. All lift cables shall be 7 x 19 construction, galvanized utility cable, sized as required, and with breaking strengths as follows:
          1. 1/8 inch (3.17 mm) diameter - 2,000 lbs. (907 KG).
          2. 3/16 inch (4.77 mm) diameter - 4,200 lbs. (1,905 KG).
          3. 1/4 inch (6.35 mm) diameter - 7,000 lbs. (3,175 KG).
          4. 5/16 inch (7.94 mm) diameter - 9,800 lbs. (4445 KG).
          5. 3/8 inch (9.52 mm) diameter - 14,400 lbs. (6,532 KG).
       2. Damaged or deformed cable shall not be used. All wire rope rigging shall be installed so as to prevent abrasion of the wire rope against any part of the building construction or other equipment.
    7. Cable Fittings:
       1. Cable clips shall conform to wire rope manufacturer's recommendations as to size, number, and method of installation. Clips shall be drop forged, made in the United States per Federal Specification FF-C-450, Type 1, Class 1. Under no circumstances may malleable cable clips be used in suspension or lifting lines.
       2. Swaged sleeve fittings shall be copper Nicopress. Aluminum sleeves are not permitted. Swaged fittings shall be installed per the fitting manufacturer's instructions, using the appropriate tools, and checked with the appropriate Nicopress "Go - No go" gauge.
       3. Eyes shall be formed over galvanized steel, wire rope thimbles of correct size. It is grooved to support the rope or cable and prevent kinking and deformation.
       4. Anchor shackles are u-shaped fittings with holes at each end to accommodate a pin used to connect a rope, cable, or chain to another device or hanging point. The pin has a head at one end and a cotter pin at the other end, a thread that screws into the body of the shackle, or a thread, nut and cotter pin at the other end.
    8. Emergency Stop Circuit:
       1. The emergency stop system shall meet NFPA-79 (Electrical Standards for Industrial Machinery) and directly remove power by means of electromechanical components, using a UL 508E Type 2, non-welding, positive break contactors.
       2. The emergency stop circuit shall be a normally closed circuit or a supervised circuit that provides the same or greater level of reliability and security. Its operations shall not depend on software or semiconductors.
       3. Resetting the emergency stop circuit shall not initiate motion.
       4. Emergency Stop switches shall all look similar and operate in an identical manner. All fixed and portable control panels shall include an emergency stop operator. Additional switches shall be provided as shown or required for safety.

\*\* NOTE TO SPECIFIER \*\* optional. Delete if not required for project.

* + 1. Production Lighting Distribution:
       1. This assembly shall consist of an extruded aluminum wireway, 2-1/2 inch (63.5 mm) x 3-3/8 inch (85.7 mm) in cross section, and in lengths up to twenty feet. It shall contain a terminal strip for feed wire extending to outlets (flush mount or pigtail), as specified.
       2. Connector strip housing shall be fabricated of black extruded aluminum wireway with interlocking cover sections to exceed UL 1573 standards. Housing shall be inherently rustproof.
       3. Connector strip shall have an electrostatic paint finish in black, with outlets identified by 2 inch (50.8 mm) high die-cut circuit identification numbers on the vertical surface of the strip.
       4. The strip shall contain 125 degrees Celsius XLP wiring of the proper sizes and quantities to connect the individual outlets to the terminal blocks in up to sixteen 20 Amp circuits.
       5. The terminal blocks shall be molded barrier type with screw lugs suitable for connecting incoming wire. Terminal blocks can accept up to #10 gauge wire.
       6. Connector strips shall be supplied with 1/8 inch (3.18 mm) thick by 1-1/2 inch (38.1 mm) steel C-channel mounting brackets. Brackets shall be 60 inch (1.524 m) on centers. U-bolts shall be supplied to grip up to 2 inch (50.8 mm) O.D. standard steel pipe.
       7. The entire assembly shall be listed and labeled by Underwriters Laboratories.
       8. Options available shall be color, LED indicator lights, low voltage raceway, custom circuit identification, and DMX input/output.
       9. Refer to lighting drawings for circuit quantities and locations.
    2. Cable Reel:
       1. Frame:
          1. The frame shall be of formed and welded construction fabricated of heavy steel plate suitable for use under severe operating conditions.
          2. Bearings shall be oversized, precision ball-type or roller-type, self-aligning, sealed, and pre-lubricated.
          3. Gears, if needed, shall be used in lieu of chain and sprocket.
          4. The frame and spool shall have a mechanical spool lock for safety and repair when multiple springs are required.
       2. Spool:
          1. The spool flanges shall have a formed offset near the outer periphery to stiffen the disk and to assist in directing the cable onto the spool.
          2. For increased protection and to assist directing the cable onto the spool, the spool shall have outer hoop guides.
          3. The spool drum diameter shall be field adjustable to allow a change in reel capacity if cable diameter or the application is changed.
          4. The spool main shaft shall be heavy-duty cast iron.
       3. Springs:
          1. All main springs shall be used in parallel sequence to insure continual operation if one spring should fail. All springs shall be encased in individual canisters with broken spring indicator and not weigh more than 60 lbs. each.
          2. Springs shall be mounted outside the spool for easy replacement.
          3. Springs hubs shall be designed with back-winding feature to prevent breakage if spool is back-wound.
       4. Collector:
          1. Collector shall be a complete component with rings and brushes as one unit.
          2. Collector enclosure shall be NEMA rated.
          3. Collector to be mounted outboard of the spool for easy removal without removing the cable from the spool.
          4. Collector rings shall be fabricated of copper or sintered copper with high-temperature lead wire.
          5. Brushes shall be metallic-type containing 80-90 percent copper with graphite as a lubricant.
       5. Paint finish shall be baked-on polyester finish, 1.5 to 2.0 mils thick.

\*\* NOTE TO SPECIFIER \*\* Delete if not required for project.

* + 1. Pantograph Cable Management:
       1. Pantograph shall accommodate up to (64) 12 Ga conductors and up to (2) data cables.
          1. Up to (8) 8 conductor flat cables. Maximum capacity of (25) 120 Volt, 20 amp circuits utilizing (1) 12 Ga ground conductor for every (2) 20 amp circuits.
          2. Data Cable:

\*\* NOTE TO SPECIFIER \*\* Delete data cable not required for project.

Data cable shall be DMX.

Data cable shall be CAT5.

* + - 1. Pantograph shall be constructed with a physical barrier between the power supply and data cables within the channel.
      2. The pantograph shall consist of a series powder coated aluminum channels hinged to each other to allow the entire distance of travel required by the batten, up to a 52 feet (15.8 m) fully extended length.
      3. The top arm shall be connected to a moving trolley.
      4. Pantograph shall fit between lift lines spacing greater than 8 feet -6 inch (2591 mm) and less than 11 feet - 0 inch (3353 mm).
      5. Pantograph fully retracted height shall be no greater than 25 inch (635 mm) vertical.
      6. Pantograph shall mount to a 1.5 inch (38 mm) schedule 40 pipe batten.
      7. Pantograph shall travel at a maximum speed of 30 feet per minute (9 meters per second).
      8. System includes power and data strain reliefs for top and bottom.
      9. System shall include grid junction box to be installed by electrical contractor.
  1. MOTION CONTROL SYSTEM
     1. Motion Control System:

\*\* NOTE TO SPECIFIER \*\* Delete model not required for project and corresponding description.

* + - 1. Push Button Wall Mounted Controller.
      2. Push Button Pendant.
      3. Vantis Pendant Controller.
      4. Vantis Wall Controller.
      5. Vantis Mobile Console.
      6. Vantis Desk Console.

\*\* NOTE TO SPECIFIER \*\* Delete products not required for project.

* + 1. Push Button Control Station.
       1. Control stations shall be wall mounted NEMA 1 enclosures, containing hold-to-run Up and Down pushbuttons for each hoist. A key operated On / Off switch with green LED indicating "Power On" shall be provided.
       2. A red, mushroom head emergency stop pushbutton shall be provided, which shall disconnect power to the hoist through a circuit meeting NFPA-79 (Electrical Standards for Industrial Machinery) requirements.
       3. A "Service" indicator shall be provided to alert the user when regular system service is required.
       4. Panel components including pushbuttons, key switches, switches, E-stop switches, and the like shall be industrial grade, heavy-duty components with 7/8 inch (22 mm) operators. Indicators shall be 5/16 inch (8 mm) minimum diameter.
       5. Panel components shall be Telemecanique / Square D ZB series or Allen Bradley Bulletin 800 mR.
    2. Push Button Pendant Control.
       1. Control pendants shall consist of a safety yellow pendant, Telemecanique XAC series or equal, and a wall mounted receptacle station. The pendant shall be provided with 25 feet (7.62 m) control cable with strain relief at both ends, and a latching connector with a metal body.
       2. The pendant shall contain hold-to-run Up and Down pushbuttons for the hoist.
       3. A red, mushroom head emergency stop pushbutton shall be provided, which shall disconnect power to the hoist through a circuit meeting NFPA-79 (Electrical Standards for Industrial Machinery) requirements.
       4. Panel components shall be Telemecanique ZA2 series or equal.
    3. VANTIS Pendant Controller:
       1. Controller shall include a 30 foot long cable to enable user to move around the stage.
          1. Systems that require the user to initiate motion or make axes selections at a stationary controller shall not be accepted.
          2. Enclosure

Controller shall be housed in a sturdy aluminum enclosure and anodized black.

* + - * 1. Touchscreen

Controller shall have a 3.5" color touchscreen.

* + - * 1. Operators

Controller shall include an illuminated "GO" button with hold-to-run operation.

Controller shall include a hard wired ESTOP operator.

Controller shall include a dial for operation of variable speed axis and also functions as a user input device.

* + - 1. Operation:
         1. The controller shall be wholly contained within a hand-held pendant with the ability to control up to 8 axes.
         2. The controller shall have the ability to control both fixed and variable speed machines.
         3. Controller shall have two methods of initiating motion:

Jog Mode

User can select one or more axis in a single direction at default speed including UP, DOWN, OPEN, and CLOSE.

Axis that OPEN and CLOSE cannot be operated at the same time as AXIS that move UP and DOWN

Targeting:

Axis with targeting capabilities shall have four user programmable targets in addition to end of travel targets.

Targets shall be named A, B, C, and D for each axis

Multiple axes can be moved to its own target at the same time.

* + - * 1. Variable Speed:

When operating one axis that has variable speed capabilities the speed can be controlled by rotating the dial. The speed shall be displayed on the touchscreen in the form of a speedometer. Speed adjustment shall be in increments of 5% of axis max speed.

* + - * 1. Load Sensing:

The controller shall protect against overload and provide a method for load learning on axes with load sensing capabilities.

* + - * 1. Log-in/User Profiles:

System shall remain locked until a registered pin is entered.

System shall enable or disable certain functions depending on which user/pin has been entered.

Functions that can be tailored by user include:

Target recording

Disable a specific axis or axes

Load sensing options

Systems that do not provide user specific capabilities shall not be accepted.

* + - * 1. Dynamic Feedback:

The system shall provide the user a clear indication of which sets are selected

The system shall provide the user a clear indication of the direction in which each selected set will travel when the "GO" button is pressed.

System shall indicate when an axis is at a target or end of travel.

Orchestra shell axes shall provide the user feedback as to whether the shell is stored or deployed.

* + - * 1. Constraints:

The system shall be able to limit or lock out travel based on various conditions including shell deployment and axis position. A factory authorized technician is required to enable access to these features.

* + - 1. Receptacle:
         1. The pendant shall connect to the system vie a wall mounted receptacle.
         2. The receptacle shall be a single connector.

Systems requiring multiple connectors shall not be accepted.

* + - * 1. A key switch shall be included on the receptacle to prevent unauthorized use.
    1. VANTIS Wall Controller:
       1. Enclosure: Available as either of the following.
          1. Wall Mount - Inside a 24" H x 24" W x 9.5" D enclosure.
          2. Rack Mount - Standard 6U 19" rack mount.
       2. Touchscreen:
          1. Controller shall have a 10.1" 1920 x 1200 color touchscreen.
       3. Operators:
          1. Controller shall include an illuminated "GO" button with hold-to-run operation.
          2. Controller shall include a hard wired ESTOP operator.
          3. Controller shall include a speed wheel for selection of speed while variable speed machine.
          4. Controller shall include (2) USB-C ports.
          5. Controller shall include a Remote Operator Pendant receptacle.
       4. Front Panel shall be able to tilt to reduce glare and improve visibility.
       5. \*\*NOTE TO SPECIFER\*\* Optional. Delete if not required.
       6. Remote Operator Pendant:
          1. Remote Operator Pendant shall provide the ability to initiate motion that has been set on the Wall Controller.
          2. Remote Operator Pendant shall include a 30 foot cable.
          3. Remote Operator Pendant shall include an illuminated "GO" button with hold-to-run operation.
          4. Remote Operator Pendant shall include a hard wired ESTOP operator.
       7. Operation:
          1. Capabilities:

The controller shall have the ability to control up to (24) machines.

The controller shall have the ability to control both fixed and variable speed machines.

The controller shall be specifically designed to control overhead hoists, acoustic banners, travelers, and stage lifts. Additional machine types can be controlled as specified.

* + - * 1. Log-in/User Profiles:

System shall remain locked until a registered pin is entered.

System shall enable or disable certain functions depending on which user is logged in.

Systems that do not provide user specific capabilities shall not be accepted.

* + - * 1. Basic Operation:

Each machine shall be depicted with a button that shows machine name and current position.

Machine selection shall be made via user touch input of the machine name button. System shall clearly indicate which machines are selected.

UP and DOWN buttons will be available to move one or more machines in a single direction.

Anytime a machine is selected with an end position, the end position shall be clearly shown on the machine's button.

* + - * 1. Targets:

A target is a stored position for a single machine.

Controller shall have (8) user recordable targets per machine (A-H).

Each target may be given a unique name by the user.

* + - * 1. Presets:

A preset is a group of machines with stored positions for each machine. Selecting a preset will select all machines in the preset and load the stored positions.

Preset Record: System shall allow the user to record presets by taking a snapshot of selected machines. System shall allow users to build presets using stored targets and custom positions

* + - * 1. Variable Speed:

For variable speed machines, speed can be controlled by rotating the speed wheel. The speed shall be displayed on the touchscreen in the form of a speedometer. Speed adjustment shall be in increments of 5% of machine max speed.

* + - * 1. Load Sensing:

The controller shall protect against overload and provide a method for load learning on machines with load sensing capabilities.

Load Learning:

System shall guide user through the load learn process to ensure the load window is set properly.

In the event of a load fault system shall guide the user to correct the error via on-screen instruction and adjust load window as required.

* + - * 1. Dynamic Feedback:

The system shall provide the user a clear indication of which machines are selected.

The system shall provide the user a clear indication of the direction in which each selected machine will travel when the "GO" button is pressed.

System shall indicate when a machine is at a target or end of travel

Orchestra shell ceiling machines shall provide the user feedback as to whether the shell is stored or deployed.

* + - * 1. Constraints:

The system shall be able to limit or lock out travel based on various conditions, including shell deployment and machine position. A factory authorized technician is required to enable access to these features.

* + - * 1. Travel Adjust

System shall allow the user to set temporary travel limits to accommodate the attachment of equipment to the moving machinery.

Travel limits shall be available for both directions of travel.

* + - 1. Settings:
         1. Machine Setting:

User shall be able to disable a machine.

User shall be able to adjust acceleration, deceleration, and speed within factorable allowable ranges.

* + - * 1. Machine Groups:

System shall provide the ability to group two or more machines together.

Group types include:

Locked Groups:

Machines must travel together at all times.

System will select entire group whenever any machine in the group is selected.

If any machine within the group faults all will stop motion.

If at any point machines' position deviates from required tolerance all machines will stop motion. System shall guide the user in correcting the fault.

Offset Group:

If at any point machines' position deviates from required tolerance all machines will stop motion. System shall guide the user in correcting the fault.

Fault Group:

If any machine within the group faults all will stop motion.

* + - * 1. User Settings:

System shall allow machine access to be tailored by user.

System shall allow the ability to restrict variable speed control by user.

System shall allow the ability to restrict preset/target record by user.

System shall allow the ability to restrict system settings by user.

System shall allow the ability to restrict machine settings by user.

* + - * 1. System Settings:

User can adjust units of measure to the following:

Weight: Kilograms, Pounds.

Position: Feet-Inches, Decimal Feet, Decimal Inches, Decimal Meters, Millimeters.

User can adjust screen brightness.

Maximum Machines:

System can be configured to limit the number of machines that can move at one time. Limits can be specific to type of machines.

System shall have a location to record date of last inspection and provide the user with a reminder when the next inspection is recommended.

* + - * 1. Log File:

System shall record all actions taken on the console in a log file which can be viewed either on the console or exported to assist in remote.

* + 1. VANTIS Mobile Console:
       1. Enclosure: 15" w x 3-7/8" d x 9-1/2" h
          1. Handheld console allows operator to move around the stage to see moving equipment
       2. Touchscreen:
          1. Console shall have a 12" 1920 x 1200 color touchscreen.
       3. Operators:
          1. Console shall include illuminated "GO" and "STOP" buttons
          2. Console shall include a 3 position hold to run (HTR) toggle including:

Released (HTR Off) which prevents movement

Pressed lightly (HTR On) which allows movement

Pressed tightly (HTR Off) which prevents movement

* + - * 1. Console shall include a hard wired ESTOP operator.
        2. Console shall include a joystick for jogging as well as adjustment of speed while variable speed machines are in motion.
        3. Console shall include USB-C ports for the connecting of accessories such as a mouse, keyboard or USB key.
      1. Operation:
         1. Capabilities:

The console shall have the ability to control up to (35) machines.

The console shall have the ability to control both fixed and variable speed machines.

The console shall be specifically designed to control overhead hoists, acoustic banners, travelers, and stage lifts. Additional machine types can be controlled as specified.

* + - * 1. Log-in/User Profiles:

System shall include 3 standard user profiles including

Admin (allows access to all user capabilities)

Rigger (allows access to most user capabilities)

Operator (allows access to the most basic user capabilities)

System shall allow the creation of additional unique user IDs and passwords

Unique IDs can be tailored to restrict/allow specific capabilities

System shall remain locked until a registered pin is entered.

System shall enable or disable certain functions depending on which user is logged in.

Systems that do not provide user specific capabilities shall not be accepted.

* + - * 1. Basic Operation:

Each machine shall be depicted with a button that shows machine name and current position.

Machine selection shall be made via user touch input of the machine name button. System shall clearly indicate which machines are selected.

UP and DOWN (IN and OUT) buttons will be available to move one or more machines in a single direction.

Anytime a machine is selected with an end position, the end position shall be clearly shown on the machine's button.

* + - * 1. Targets:

A target is a stored position for a single machine.

Console shall have (8) user recordable targets per machine (A-H).

Each target may be given a unique name by the user.

A user may create a single use custom target

A user may create a single use relative target that allows the machine to move a specific amount of travel above or below the machine's current position.

* + - * 1. Presets:

A preset is a group of machines with stored positions for each machine. Selecting a preset will select all machines in the preset and load the stored positions.

Preset Record: System shall allow the user to record presets by using current position of selected machines. System shall allow users to build presets using stored targets and custom positions.

* + - * 1. Variable Speed:

For variable speed machines, speed can be controlled by toggling the joystick when or prior to a machine in motion. The speed shall be displayed on the touchscreen in the form of a speedometer. Speed adjustment shall be in increments of 5% of machine max speed.

* + - * 1. Load Sensing:

The Console shall protect against machine overload and provide a method for load learning on machines with load sensing capabilities.

Load Learning:

System shall guide user through the load learn process to ensure the load operation window is set properly.

In the event of a load fault, system shall guide the user to correct the error via on-screen instruction and adjust load operation window as required.

* + - * 1. Dynamic Feedback:

The system shall provide the user a clear indication of which machines are selected.

The system shall provide the user a clear indication of the direction in which each selected machine will travel when the "GO" button is pressed.

System shall indicate when a machine is at a target or end of travel

Orchestra shell ceiling machines shall provide the user feedback as to whether the shell is stored or deployed.

* + - * 1. Constraints:

The system shall be able to limit or lock out travel based on various conditions, including shell deployment and machine position. A factory authorized technician is required to enable access to these features.

* + - * 1. Travel Adjust:

The system shall allow the user to set temporary soft limits to accommodate the attachment of equipment such as scenery, soft goods and SO cable in order to avoid collision or damage to the equipment.

Travel soft limits shall be available for both directions of travel.

* + - 1. Settings:
         1. Machine Setting:

User shall be able to disable a machine's operation from the control console.

Specified users shall be able to adjust acceleration, deceleration, and speed within factory allowable ranges.

Specified users shall be able to disable load faulting on a machine

* + - * 1. Machine Groups:

System shall provide the ability to group two or more machines together.

User will be able to apply a specific name and color to a group

Group types include:

Locked Groups:

Machines within a locked group must travel together at all times.

The console will select all machines within the locked group whenever any machine in the group is selected.

If any machine within the locked group faults, all machines within the group will stop motion.

If at any point a machines' position deviates from specified tolerance within the locked group, all machines will stop motion. The console shall guide the user in correcting the fault.

Fault Group:

Machines can travel independently within a fault group.

Machines can be selected individually within a fault group.

If any machine within a fault group faults, all machines within the group will stop motion. The console shall guide the user in correcting the fault.

* + - * 1. User Settings:

System shall allow machine access to be tailored by user.

System shall allow the ability to restrict variable speed control by user.

System shall allow the ability to restrict preset/target record by user.

System shall allow the ability to restrict system settings by user.

System shall allow the ability to restrict machine settings by user.

* + - * 1. Application Settings:

User can adjust units of measure to the following:

Weight: Kilograms, Pounds.

Position: Feet-Inches, Decimal Feet, Decimal Inches, Decimal Meters, Millimeters.

User can adjust screen brightness.

Maximum Machines:

System can be configured to limit the number of machines that can move at one time. Limits can be specific to type of machines.

* + - * 1. About:

System will have an about page denoting the following:

Venue name

Project Location

Project number

Project name

Consultant (if applicable)

Installer of theatrical equipment

Wenger Service phone number

Date of last inspection

Inspector Name

Inspector company

System shall have a reminder when the next inspection is recommended.

* + - * 1. Log File:

The system shall record all actions in a log file which can be viewed either on the console or exported to assist in remote troubleshooting.

* + - * 1. Show Setting:

Users can create New Shows

Users can Open previously saved shows on the hard drive or USB

Users can delete previously saved shows

Users can save previously saved shows as a new name

* + - * 1. Sequences:

User can save, delete or manage cued sequences

Sequences are imported from Show Mode when creating a new cue

* + - 1. Show Mode:
         1. Cueing:

The user can create an unlimited number of cues per show

Users can delete, duplicate, rename, renumber, and reorganize cues as needed

Users can disable cues

Users must load a cue and engage the hold to run for a cue to execute with the "go" button

Time Calculation / Motion Profiles within a cue

Users can adjust the speed and velocity of each variable machine within a cue

The user may enter a new speed within the allowable speed range of that machine within a cue.

The time field will update to display the amount of time required to implement the machine's movement.

The user may enter a new time for a machine execute its movement within a cue.

The speed and velocity field will update based on the allowable speed range of that machine.

If the time/speed entered by the user is not possible, the console will default to the closest time/speed.

Delays:

Users may add a delay to a machine's motion within a cue

Top of Show Snapshot (Time/Speed reference point):

Users will be able to create a reference point to calculate Time/Speed for all machines before they are utilized in a cue.

Once a machine has been written in a cue, Time/Speed in subsequent cues will be calculated based on a machine's last recorded position.

The reference point is automatically recorded when a New Show is created based on all the machines' current locations.

The user may change the reference point by

Moving each machine into their desired position and recording a new Snapshot

Going into the Snapshot builder and manually typing in each machine's required position

Cue Linking:

Auto-Load:

Users can link cues in succession that will automatically load once the initial cue has been executed.

Users can trigger the linked cue before the previous cue has completed.

The user will need to engage the hold to run in order to execute the linked cue.

Auto-Follow:

Users can link cues in succession that will automatically load once the initial cue has been executed. The linked cues will automatically run once the initial cue has completed or based on timing/location of a specified machine.

Users can trigger the linked cue before the previous cue has completed.

The user will need to engage the hold to run in order to execute the linked cue including any delay that has been loaded into the auto-follow.

Recover Cue:

Users will be able to reset all machines to their position prior to a cue to allow a cue to be executed out of show order

Recovering a cue can be achieved by moving all machines at once or individually to avoid collision.

Warnings/Notes:

Users will be able to create and display unique notes for each cue

Users will be able to create unique warnings for each cue that display when a cue is loaded. Users will have to acknowledge the warning before a cue loads.

* + 1. VANTIS Desk Console:
       1. Enclosure: 17" w x 26" d x 2 3/4" h (without touch screen)
       2. Touchscreen:
          1. Console shall have a 22" 1920 x 1080 color touchscreen.
       3. Operators:
          1. Console shall include illuminated "GO" and "STOP" buttons
          2. Console shall include a 3 position hold to run (HTR) toggle including:

Released (HTR Off) which prevents movement

Pressed lightly (HTR On) which allows movement

Pressed tightly (HTR Off) which prevents movement

* + - * 1. Console shall include a hard wired ESTOP operator.
        2. Console shall include a joystick for jogging as well as adjustment of speed while variable speed machines are in motion.
        3. Console shall include USB-C ports for the connecting of accessories such as a mouse, keyboard or USB key.
      1. Operation:
         1. Capabilities:

The console shall have the ability to control up to (35) machines.

The console shall have the ability to control both fixed and variable speed machines.

The console shall be specifically designed to control overhead hoists, acoustic banners, travelers, and stage lifts. Additional machine types can be controlled as specified.

* + - * 1. Log-in/User Profiles:

System shall include 3 standard user profiles including

Admin (allows access to all user capabilities)

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Operator (allows access to the most basic user capabilities)

System shall allow the creation of additional unique user IDs and passwords

Unique IDs can be tailored to restrict/allow specific capabilities

System shall remain locked until a registered pin is entered.

System shall enable or disable certain functions depending on which user is logged in.

Systems that do not provide user specific capabilities shall not be accepted.

* + - * 1. Basic Operation:

Each machine shall be depicted with a button that shows machine name and current position.

Machine selection shall be made via user touch input of the machine name button. System shall clearly indicate which machines are selected.

UP and DOWN (IN and OUT) buttons will be available to move one or more machines in a single direction.

Anytime a machine is selected with an end position, the end position shall be clearly shown on the machine's button.

* + - * 1. Targets:

A target is a stored position for a single machine.

Console shall have (8) user recordable targets per machine (A-H).

Each target may be given a unique name by the user.

A user may create a single use custom target

A user may create a single use relative target that allows the machine to move a specific amount of travel above or below the machine's current position.

* + - * 1. Presets:

A preset is a group of machines with stored positions for each machine. Selecting a preset will select all machines in the preset and load the stored positions.

Preset Record: System shall allow the user to record presets by using current position of selected machines. System shall allow users to build presets using stored targets and custom positions.

* + - * 1. Variable Speed:

For variable speed machines, speed can be controlled by toggling the joystick when or prior to a machine in motion. The speed shall be displayed on the touchscreen in the form of a speedometer. Speed adjustment shall be in increments of 5% of machine max speed.

* + - * 1. Load Sensing:

The Console shall protect against machine overload and provide a method for load learning on machines with load sensing capabilities.

Load Learning:

System shall guide user through the load learn process to ensure the load operation window is set properly.

In the event of a load fault, system shall guide the user to correct the error via on-screen instruction and adjust load operation window as required.

* + - * 1. Dynamic Feedback:

The system shall provide the user a clear indication of which machines are selected.

The system shall provide the user a clear indication of the direction in which each selected machine will travel when the "GO" button is pressed.

System shall indicate when a machine is at a target or end of travel

Orchestra shell ceiling machines shall provide the user feedback as to whether the shell is stored or deployed.

* + - * 1. Constraints:

The system shall be able to limit or lock out travel based on various conditions, including shell deployment and machine position. A factory authorized technician is required to enable access to these features.

* + - * 1. Travel Adjust:

The system shall allow the user to set temporary soft limits to accommodate the attachment of equipment such as scenery, soft goods and SO cable in order to avoid collision or damage to the equipment.

Travel soft limits shall be available for both directions of travel.

* + - 1. Settings:
         1. Machine Setting:

User shall be able to disable a machine's operation from the control console.

Specified users shall be able to adjust acceleration, deceleration, and speed within factory allowable ranges.

Specified users shall be able to disable load faulting on a machine

* + - * 1. Machine Groups:

System shall provide the ability to group two or more machines together.

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Machines can travel independently within a fault group.

Machines can be selected individually within a fault group.

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* + - * 1. User Settings:

System shall allow machine access to be tailored by user.

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System shall allow the ability to restrict system settings by user.

System shall allow the ability to restrict machine settings by user.

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User can adjust units of measure to the following:

Weight: Kilograms, Pounds.

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User can adjust screen brightness.

Maximum Machines:

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System will have an about page denoting the following:

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Project number

Project name

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Date of last inspection

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Inspector company

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Cue Linking

Auto-Load

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Users can trigger the linked cue before the previous cue has completed.

The user will need to engage the hold to run in order to execute the linked cue.

Auto-Follow

Users can link cues in succession that will automatically load once the initial cue has been executed. The linked cues will automatically run once the initial cue has completed or based on timing/location of a specified machine.

Users can trigger the linked cue before the previous cue has completed.

The user will need to engage the hold to run in order to execute the linked cue including any delay that has been loaded into the auto-follow.

Recover Cue

Users will be able to reset all machines to their position prior to a cue to allow a cue to be executed out of show order

Recovering a cue can be achieved by moving all machines at once or individually to avoid collision.

Warnings/Notes

Users will be able to create and display unique notes for each cue

Users will be able to create unique warnings for each cue that display when a cue is loaded. Users will have to acknowledge the warning before a cue loads.

\*\* NOTE TO SPECIFIER \*\* Delete if not required for project.

* 1. STAGE CURTAINS AND TRACKS
     1. Tracks:

\*\* NOTE TO SPECIFIER \*\* Delete track not required for project.

* + - 1. Product: 280 Track.
      2. Product: 170 Track.
      3. Product: 140 Curved Track.
      4. Product: 142 Walk Along Track.
      5. Product: 500 Curved Track.
      6. Product: Roller Chain Track.
      7. Product: Curtain Machine (Standard).
      8. Product: Curtain Machine (HD).

\*\* NOTE TO SPECIFIER \*\* Delete products not required for project.

* + 1. Stage Curtains:
       1. Description and Sizes: As shown on drawings.
       2. Fabric Types:

\*\* NOTE TO SPECIFIER \*\* Delete fabric types not required for project.

* + - * 1. Fabric: 32 oz. Imperial Velour, 100 percent polyester IFR velour, KM Fabrics, standard color to be selected.
        2. Fabric: 25 oz. Charisma Velour, 100 percent polyester IFR velour, KM Fabrics, standard color to be selected.
        3. Fabric: 20 oz. Crescent Velour, 100 percent polyester IFR velour, KM Fabrics, color - black.
        4. Fabric: PD Cloth, 100 percent polyester IFR, Dazian, color - black.
        5. Fabric: Seamless Sharkstooth Scrim, 100 percent Cotton.

\*\* NOTE TO SPECIFIER \*\* Delete colors not required for project.

Color: White.

Color: Blue.

Color: Black.

* + - * 1. Fabric: Seamless Trevira Muslin, 100 percent polyester IFR, color - white.
      1. Flame Resistance:
         1. All Polyester fabrics are woven from fibers that are inherently flame retardant for the life of the fabric. These curtains never need to be re-treated for flame retardancy.
         2. 100 percent cotton fabrics are to be chemically mill treated by an immersion process. This process lasts approximately 5 years and then shall be re-done for flame retardancy according to the requirements of the National Fire Protection Association's NFPA #701 together with dry cleaning.
         3. A Certificate of Flame Resistance is to be provided for each fabric supplied. The certificates shall be issued by the fabric manufacturer or converter. Certificates issued by the supplier or fabricator are not acceptable.
         4. Each curtain is to be labeled with a permanent tag giving the flame retardancy information and providing a suggested date for testing, if applicable.
      2. Fabrication:
         1. General: Curtains are to be fabricated in the sizes and fabrics shown in the curtain schedule. Curtains are to be stitched with thread matching the color of the curtain using a single needle lock stitched. No less than full widths of fabric are to be used in leg curtains. All fabrics with a grain or pile shall have all strips running in the same direction.
         2. Fullness: Fullness as listed in the Curtain Schedule is to be in addition to allowances for seams, side hems and turn backs.
         3. Pleats: Where fullness is indicated in the Curtain Schedule, pleats shall be box type on 12 inch (305 mm) centers. Valances and borders are to have their pleats arranged to conceal the seams.
         4. Top Finish: 3-1/2 inch (89 mm) jute webbing or 3 inch (76 mm) Poly webbing shall be double stitched to the top of the curtain with 2 inch (50.8 mm) of face fabric turned under the webbing. Brass rustproof grommets shall be inserted in pleat centers (12 inch (305 mm)) centers on flat curtains.
         5. Track-mounted curtains shall be supplied with plated wire S-hooks or CCF-2 curtain to carrier snap hooks. Batten-mounted curtains are to be supplied with 36 inch (914 mm) braided #4 cotton tie lines. Tie lines shall be black or white to best match the curtains with the center line in an alternate color to aid in hanging curtains.
         6. Bottom Hems:

Valances and borders shall have 4 inch (102 mm) bottom hems.

All full height curtains shall have 6 inch (152 mm) bottom hems complete with separate interior chain pockets filled with #8 plated jack chains. Chain pockets shall be stitched so that the chain shall ride 2 inch (51 mm) above the finished bottom edge of the curtain.

Scrims, drops and cycloramas shall have an additional strip of webbing with ties on 12 inch (305 mm) centers sewn to the back of the hem and shall be furnished with a 3/4 inch (19 mm) pipe batten, threaded and coupled every 10 feet-0 inch (305 mm).

* + - * 1. Side Hems:

All lined traveler curtains shall have 1/2 width of face fabric turned back at the leading edge.

All other side hems shall be 2 inch (51 mm).

* + - * 1. Lining: Lining, if required in the above listing, shall conform to the following requirements.

Lining shall be in the same fullness as face fabric.

Lining shall finish 2 inch (51 mm) shorter than face fabric.

Lining shall be attached to the face fabric along the sides and bottom hems by 4 inch (102 mm) twill tape.

* + 1. Heavy Duty Curtain Track:
       1. 280 HD Curtain Track.
       2. Track shall be of 14 ga (1.980 mm) galvanized construction, entirely enclosed except for the slot in the bottom. Each section of track less than 20 ft (6,096 mm) shall be in one continuous piece. Splice clamps shall be permitted for section lengths over 20 ft (6,096 mm).
       3. Carriers shall be constructed of nylon, supported from two heavy-duty polyethylene wheels held in the ball bearing by a nickel-plated steel rivet. Each carrier shall be equipped with a free-moving swivel and sufficient trim chain to accommodate a curtain S-hook. Each carrier shall have a back-pack. Rubber washers shall be provided between each back-pack and carrier to reduce noise.
       4. The Master Carrier block shall be constructed of plated steel having two cable clips to clamp the cord to the carrier. Four wheels in pairs identical to the single carrier above shall support the block.
       5. Live and dead end pulleys shall be adjustable, equipped with oil-impregnated sleeve bearing wheels on adequately guarded plated steel housings. End stops at each track end and one adjustable, demountable floor pulley shall be furnished. Stretch-resistant, fiberglass center operating cord shall be 3/8 inch (9.5 mm) in diameter.
       6. Track shall be rigged for bi-parting operation with a 36 inch (914.4 mm) center overlap. Hanging clamps shall be provided for suspension at 6 ft (1,829 mm) foot maximum intervals.
    2. Medium Duty Curtain Track:
       1. 170 (171-N,171-R,172, 260) MD Curtain Track.
       2. Track shall be of 14 ga (1.980 mm) galvanized construction, entirely enclosed except for the slot in the bottom. Each section of track less than 20 ft (6,096 mm) shall be in one continuous piece. Splice clamps shall be permitted for section lengths over 20 ft (6,096 mm).
       3. Carriers shall be constructed of plated steel, supported from two heavy-duty polyethylene wheels (171-N,171-R utilize nylon-tired ball-bearing and neoprene-tired ball-bearing respectively) attached to the carrier body by a nickel-plated steel rivet. Each carrier shall be equipped with a free-moving plated steel swivel to accommodate a curtain S-hook. Back-Pack guides are available as an option with all system models. Rubber washers shall be provided between each back-pack and carrier to reduce noise.
       4. The Master Carrier block shall be constructed of plated steel having two tension type cable clamps to secure the cord to the carrier. Four wheels in pairs identical to the single carrier above shall support the block.
       5. Live and dead end pulleys shall be adjustable, equipped with oil-impregnated sleeve bearing wheels on adequately guarded plated steel housings. End stops at each track end and one adjustable floor pulley (detachable as an option) shall be furnished. Stretch-resistant, fiberglass center operating cord shall be 3/8 inch (9.5 mm) in diameter for hand operated track systems and 3/16" (4.76 mm) in diameter wire center cable with woven polyester covers shall be used for motorized operations.
       6. Track shall be rigged for bi-parting operation with a 36 inch (914.4 mm) center overlap. Hanging clamps shall be provided for suspension at 6 ft (1,829 mm) foot maximum intervals.
    3. Curved Curtain Track:
       1. 140 Curved Curtain Track.
       2. Track shall be 11 ga (3.180 mm) extruded aluminum I-beam construction consisting of a center rib and top, intermediate and bottom flanges.
       3. Each curtain carrier shall be spaced on 12 inch (304.8 mm) centers and shall be of steel construction to include two nylon-tired ball bearing wheels rolling on two separate parallel treads. Each carrier shall contain a free moving plated swivel to accommodate curtain snap hook. Two rubber bumpers shall be attached to each carrier to function as noise reducers.
       4. Live and dead end pulleys shall be equipped with sleeve bearing wheels adequately guarded. A tension floor pulley shall be supplied. Stretch resistant operating cord shall have fiberglass center and shall be of 1/4 inch (6.4 mm) diameter, extra quality yarn or 3/16 inch (4.7 mm) diameter, wire center with woven polyester cover on motorized tracks.
       5. Curves shall be formed on the job. Spindles and idlers equipped with ball bearings shall be provided as necessary for hand line management on curves.
       6. A 1.5 inch (38.1 mm) I.D. stiffening batten shall be used to support suspended curved track. Track shall be rigidly supported from ceiling clamps or hanging clamps on four foot maximum centers.
    4. Walk Along Curtain Track:
       1. 142 Walk Along Curtain Track.
       2. Track shall be 11 ga (3.18 mm) extruded aluminum I-beam construction consisting of a center rib and top, intermediate and bottom flanges.
       3. Each curtain carrier shall be spaced on 12 inch (304.8 mm) centers and shall be of steel construction to include two nylon-tired ball bearing wheels rolling on two separate parallel treads. Each carrier shall contain a free moving plated swivel to accommodate curtain snap hook. Two rubber bumpers shall be attached to each carrier to function as noise reducers.
       4. Curves shall be formed on the job.
       5. A 1.5 inch (38.1 mm) I.D. stiffening batten to support suspended curved track shall be provided. Track shall be rigidly supported from ceiling clamps or hanging clamps on four foot maximum centers.
    5. Heavy Duty Curved Curtain Track:
       1. 500 HD Curved Curtain Track shall be 7 gauge (4.76 mm) extruded aluminum I-beam construction consisting of a center rib and top, intermediate and bottom flanges.
       2. Curtain carriers shall be spaced on 12 inch (304.8 mm) centers and shall be of steel construction to include two nylon-tired ball bearing wheels rolling on two separate parallel treads with rubber strips and a free moving plated swivel and trim chain to accommodate curtain snap hook. Master carriers shall contain two additional wheels and pull rope clamps.
       3. Live and dead end pulley blocks shall be equipped with 5 inch (127 mm) diameter sleeve bearing wheels adequately guarded.
       4. Nylon cable guides shall be furnished for the purpose of guiding the operating cable along the contour of the factory formed curved track channel. Stretch resistant operating cord shall be 3/16 inch (4.76 mm) diameter extruded nylon with wire center for motorized operation.
       5. Curves shall be factory formed to a minimum radius of 2 ft (609.6 mm). A 1.5 inch (38.1 mm) I.D. stiffening batten shall be used to support suspended curved track.
       6. Track shall be opened and closed by motorized curtain machine.
       7. Track shall be rigidly supported from ceiling clamps or hanging clamps on 5 feet (1,524 mm) maximum centers.
    6. Roller Chain Track:
       1. SURETRACK Roller Chain Track.
       2. Tracks shall be motorized and shall consist of a roller chain riding in a UHMW lined track channel. The assembly can be constructed in straight and gently curved sections. Sharp bends can be made using chain sprockets mounted in bearing assemblies. Bends can have a minimum radius of 2 inch (50.8 mm).
       3. The roller chain forms an endless loop. Tabs are attached to the links on 12 inch (304.8 mm) centers so curtains do not stack when stored. Bi-part operation is possible by placing one panel on each side of the chain loop while a single panel shall reverse when the back of the chain loop is revealed so curtains can be double faced.
       4. Curtain storage is provided by incorporating several runs of parallel channels that can be as close as 4 inch (102 mm) apart.
       5. The drive motor can be incorporated at any point along the track assembly and limit switches can be either track mounted or rotary driven by the motor.
       6. The motor, brake, and gearbox shall be an integrated unit. No couplings shall be permitted between the motor and gear reducer. Brakes shall be spring applied, direct acting and electrically released. The brake shall be an AC/DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.
       7. An adjustable sprocket provides chain tensioning.
    7. Standard Curtain Machine.
       1. Standard Curtain Machine.
       2. Curtain machines shall be fully automatic type equipped a motor connected through a V-belt to the gear unit. A grooved cable drum shall be located on the output shaft of the gearbox. Drum shall deliver a cable speed of 86 fpm (0.437 mps) and shall hold sufficient cable for 45 ft (13.7 m) of cable travel.
       3. Mechanism shall include a magnetic contactor to provide reversing action at any point along the travel. Two three-button control switch units shall be provided: One mounted on the unit; and one for remote control.
       4. A limit switch assembly shall be mounted integrally with gear unit. A safety guard shall be over the V-belt drive and limit switch chain drive.
       5. The machine shall be equipped with disconnect switch, automatic overload protective breaker, and an emergency hand crank for conversion to hand operation.
       6. The entire mechanism shall be mounted on heavy base.
    8. Heavy Duty Curtain Machine:
       1. HD Curtain Machine.
       2. Curtain machines shall be fully automatic type equipped a motor connected directly to the gear unit. A grooved cable drum shall be located on the output shaft of the gearbox and supported by an outboard bearing to support and align extended shaft. Cable tension device shall automatically remove slack from cable and retain cable within drum grooves. Drum shall deliver a cable speed of 72 fpm (0.36 mps) and shall hold sufficient cable for 90 ft (27.43 m) of cable travel.
       3. Mechanism shall include a magnetic contactor to provide reversing action at any point along the travel. Two three-button control switch units shall be provided: One mounted on the unit; and one for remote control.
       4. A limit switch shall be driven from output drive shaft of gear reduction unit.
       5. The machine shall be equipped with disconnect switch, automatic overload protective breaker, and an emergency hand crank for conversion to hand operation.
       6. The entire mechanism shall be mounted on heavy base.
  1. ROPE AND DEAD HUNG RIGGING
     1. Wire Tension Grid:
        1. General:
           1. The wire grid shall be designed for a live load capacity of 10 psf (48.82 ksm). The maximum tension in any one line shall not exceed 650 lbs (295 kg). The support frame shall be designed so that compression loads caused by tension in the cables do not exceed 5000 lbs (2,257.9 kg) in any member. Wire ropes shall be supported on not more than 5 feet (1,524 mm) centers. The galvanized utility cable mesh shall not deflect more than two inches under a maximum concentrated load of 250 lbs (113.4 kg). The live load on any one grid hanger pipe shall not exceed 500 lbs (226.8 kg). There shall be no horizontal loads imposed upon the building by the design of the grid except for sway braces to add lateral stability.
           2. The total live load and the weight of the grid shall be transmitted through the hangers to the building steel overhead. The building steel is not a part of this work, except for specific auxiliary steel clearly called out in these specifications or related drawings.
           3. The wire rope grid shall be fabricated and installed in accordance with best trade practices.
           4. Standards of workmanship, design, and fabrication for structural steel shall be AISC Code of Standard Practice and ASTM A36.
           5. Coordinate work with other trades doing adjoining work to assure proper fit, and installation.
        2. Materials And Components:
           1. All materials shall be new and of best quality. Fittings and fasteners shall be painted or galvanized and shall conform to applicable industry requirements and codes.
           2. Structural steel shall be ASTM Grade A-36.
           3. Pipe shall be in accordance with ASTM A53.
           4. Wire Rope and Fittings:

Wire rope shall be 7 x 19 galvanized utility cable of diameters and construction as hereinafter specified and/or shown on the drawings.

Swaged sleeve fittings shall be copper Nicopress.

Other fittings, clips, thimbles as indicated and/or required shall be galvanized and conform to wire rope manufacturer's recommendations. All cable clips shall be drop forged.

Bolts, nuts, washers as required for complete fabrication and installation.

* + - * 1. Galvanized hardware and items of non-corrosive metal shall not be shop painted. All other metal work under this section shall have one coat of approved shop paint after fabrication.
        2. Workmanship:

Fabricate metal work in accordance with standards of first class workmanship with ornamental work free of blemishes like tool marks, burrs, scars and abrasions. All edges shall be smooth. All points, welds and intersections shall be properly made and fitted to provide a uniform finish.

All connection points shall be welded and ground smooth.

Make proper provisions for expansion and contraction without causing undue stresses or deformation.

Provide slotted holes, as needed, in steel members which require accurate alignment.

Fit abutting surfaces closely.

Accurately align and adjust various frame members before final anchoring.

Erect metal work level, plumb, square and in proper alignment with adjacent work.

* + - * 1. Welding:

Execute welding in shop and field in accordance with standards of American Welding Society. All welders shall be qualified in accordance with standard qualification procedure of American Welding Society.

Control welding sequence and technique to minimize secondary stresses and distortions.

Net effective weld lengths shall be indicated on the shop drawings and approved before fabrication and installation.

* + - * 1. Grid Construction:

Support structure shall be fabricated of tubes and other structural steel, suspended from 1.5 inches (38.1 mm) I.D. pipe hangers.

Woven wire mesh tension grid shall be fabricated of 1/8 inch (3.17 mm) wire rope attached to, and supported by, the steel support structure. Grid cables shall be woven in an over and under pattern. Cables are threaded through holes drilled on 2 inches centers in the structural perimeter members.

One end of each cable shall be secured with a 1/8 inch (3.17 mm) Nicopress stop sleeve; the other with a swaged threaded stud fitting which is used to adjust tension in the cables during assembly.

* + 1. Pipe Grid:
       1. Pipe grids shall be constructed from lengths of 1.5 inches (38.1 mm) nominal I.D. schedule 40 iron pipe. All joints shall be sleeve spliced with 18 inches (457.2 mm) long sleeves with 9 inches (228.6 mm) into each pipe and held by two 3/8 inch (9.5 mm) hex bolts and lock nuts on each side of the joint. Grids shall be installed as indicated on the drawings with pipes intersecting on four foot by four-foot centers.
       2. Intersecting pipes shall be joined with a Cross Grid Clamp or by an approved equal. The cross grid clamp shall have a recommended working load of at least 1,500 lbs (680 kg). U-bolts are not acceptable.
       3. Each pipe shall terminate just off the wall. Internally sleeved wall plates shall securely brace the grid against the wall once it is in place. Supply sufficient braces to prevent lateral movement of the pipe grid.
       4. The grid shall be rigidly hung from the overhead steel structures on centers not exceeding 8 feet in either direction using 1/4 inch (6.4 mm), 7x19 galvanized utility cable ending in 6 inches x 3/8 inch (152.4 mm x 9.5 mm) forged turnbuckles attached to pipe clamps or connector strip hanging brackets. At each hanging point the cable shall attach to the overhead structure with an appropriate fitting. Cables shall be formed over thimbles of correct size and fastened with two forged cable clips or Nicopress sleeves. Turnbuckles shall be safetied with tie wire after final trim.
    2. Fixed Pipe Batten:
       1. All battens shall be 1-1/2 inches (38.1 mm) nominal diameter, schedule 40 pipe in lengths as shown on the drawings or Bill of Materials. All joints shall be spliced with 18 inches (457.2 mm) long sleeves with 9 inches (228.6 mm) extending into each pipe and held by two 3/8 inch (9.5 mm) hex bolts and lock nuts on each side of the joint.
       2. Each end shall be covered with a bright yellow, closed end, soft vinyl safety cap at least 4 inches (101.6 mm) in length.
       3. The batten shall be hung from the overhead steel structure on ten foot maximum centers using 1/4 inch (6.4 mm), 7x19 galvanized utility cables ending in 6 inches x 3/8 inch (152.4 mm x 9.5 mm) forged turnbuckles attached to pipe clamps. At each hanging point the cable shall attached to the overhead structure with a beam clamps or other appropriated fitting. Cables shall be formed over thimbles of the correct size and fastened with two forged cable clips or Nicopress sleeves. All turnbuckles are to be safetied with tie wire after final trimming.
    3. Rope Rigging:
       1. Single Pin Rail:
          1. The pin rail shall consist of a 3.5 inches (88.9 mm) I.D., schedule 40 pipe with 4 inches (101.6 mm) channel legs welded to the pipe on 4 feet (1,219 mm) centers maximum. The center of the pin rail shall be 3 feet-10 inches (914.4 mm) above the floor. Holes shall be located on 12 inches (304.8 mm) centers for belaying pins.
          2. The legs shall end at an angle or plate bracket as required and shall be bolted or welded to the floor in a manner suitable to the design load and structure.
       2. Double Pin Rail:
          1. The pin rail shall consist of two 3.5 inches (88.9 mm) I.D., schedule 40 pipes mounted parallel to each other, offset both vertically and horizontally, supported by 4 inches (101.6 mm) channel legs welded to the pipe on 4feet (1,219 mm) centers maximum. Holes shall be located on 12 inches (304.8 mm) centers for belaying pins.
          2. The legs shall end at an angle or plate bracket as required and shall be bolted or welded to the floor in a manner suitable to the design load.
    4. Belaying Pins:
       1. Wood:
          1. Pins shall be 21 inches (533.4 mm) long by 1-5/32 inches (29.37mm) in diameter with a shoulder and handgrip at the top.
          2. Belaying pins shall be machine turned from hardwood and shall fit 1-1/4 inches (31.75 mm) diameter holes in the pin rail.
       2. Steel:
          1. Pins shall be 21 inches (533.4 mm) long by 1-1/16 inches (26.98 mm) in diameter with a shoulder and handgrip at the top and shall fit 1-5/32 inches (29.37 mm) diameter holes in the pin rail.
    5. Rope Blocks:
       1. Single Line:
          1. Nylon: Underhung Loft Block.

The sheave shall have an 8 inches (203.2 mm) outside diameter, and shall be filled nylon. The sheave shall be equipped with a 17 mm (0.67 inch) diameter shaft and two sealed, precision ball bearings.

Side plates shall be a minimum of 10-gauge (3.57 mm) steel, with a cut-out to grasp the beam flange.

A machined steel 3/4 inch (19.1 mm) drawbolt and steel clip shall grasp the opposing beam flange and allow a 5 inches (127 mm) grip adjustment to accommodate a range of beam sizes.

The block shall have a recommended working load of at least 300 lbs. (136.1 kg).

Loft blocks shall be grooved for one 3/4 inch (19.1 mm) rope line.

* + - * 1. Cast: Underhung Loft Block.

The sheave shall have an 8 inches (203.2 mm) outside diameter, and shall be an iron casting, with a machined groove. The sheave shall be equipped with a 17 mm (0.67 inch) diameter shaft and two sealed, precision ball bearings.

Side plates shall be a minimum of 10-gauge steel (3.57 mm), with a cut-out to grasp the beam flange.

A machined steel 3/4 inch (19.1 mm) drawbolt and steel clip shall grasp the opposing beam flange and allow a 5 inches (127 mm) grip adjustment to accommodate a range of beam sizes.

The block shall have a recommended working load of at least 300 lbs. (136.1 kg).

Loft blocks shall be grooved for one 3/4 inch (19.1 mm) rope line.

* + - * 1. Nylon: Universal Loft Block.

The sheave shall have an 8 inches (203.2 mm) outside diameter, and shall be filled nylon. The sheave shall be equipped with a 17 mm (0.67 inch) diameter shaft and two sealed, precision ball bearings.

Base angles shall be a minimum 1-1/2 inches x 1-1/2 inches x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle punched with a universal hole pattern for easy installation.

Side plates shall be a minimum of 12-gauge steel (2.78 mm), and shall fully enclose the sheave. Side plates shall be bolted to the base angles.

The block and associated mounting hardware shall have a recommended working load of at least 300 lbs. (136.1 kg), and shall be designed for use in either upright or underhung usage.

Loft blocks shall be grooved for one 3/4 inch (19.1 mm) rope line.

* + - * 1. Cast: Universal Loft Block.

The sheave shall have an 8 inches (203.2 mm) outside diameter, and shall be an iron casting, with a machined groove. The sheave shall be equipped with a 17 mm (0.67 inch) diameter shaft and two sealed, precision ball bearings.

Base angles shall be a minimum 1-1/2 inches x 1-1/2 inches x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle punched with a universal hole pattern for easy installation.

Side plates shall be a minimum of 12-gauge steel (2.78 mm), and shall fully enclose the sheave. Side plates shall be bolted to the base angles.

The block and associated mounting hardware shall have a recommended working load of at least 750 lbs. (340.2 kg), and shall be designed for use in either upright or underhung usage.

Loft blocks shall be grooved for one 3/4 inch (19.1 mm) rope line.

* + - 1. Multi Line:
         1. Nylon: Underhung Loft Block.

The sheaves shall have an 8 inches (203.2 mm) outside diameter, and shall be filled nylon. The block shall be equipped with a 17 mm (0.67 inch) diameter shaft and two sealed, precision ball bearings per sheave.

The block housing shall have side plates between each sheave and on the outside. Side plates shall be a minimum of 10-gauge steel (3.570 mm), with a cut-out to grasp the beam flange.

Two machined steel 3/4 inch (19.1 mm) drawbolts and steel clips shall grasp the opposing beam flange and allow a 4 inches (101.6 mm) grip adjustment to accommodate a range of beam sizes.

The block shall have a recommended working load of at least 600 lbs (272.2 kg).

Loft blocks shall have two to five sheaves grooved for 3/4 inch (19.1 mm) rope.

* + - * 1. Cast: Underhung Loft Block.

The sheaves shall have an 8 inches (203.2 mm) outside diameter, and shall be iron castings with machined grooves. The block shall be equipped with a 17 mm (0.67 inch) diameter shaft and two sealed, precision ball bearings per sheave.

The block housing shall have side plates between each sheave and on the outside. Side plates shall be a minimum of 10-gauge (3.57 mm) steel, with a cut-out to grasp the beam flange.

Two machined steel 3/4 inch (19.1 mm) drawbolts and steel clips shall grasp the opposing beam flange and allow a 4 inches (101.6 mm) grip adjustment to accommodate a range of beam sizes.

The block shall have a recommended working load of at least 600 lbs (272.1 kg).

Loft blocks shall have two to five sheaves grooved for 3/4 inch (19.1 mm) rope.

* + - * 1. Nylon: Universal loft Block.

The sheaves shall have an 8 inches (203 mm) outside diameter, and shall be filled nylon. The block shall be equipped with a 17 mm (0.67 inch) diameter shaft and two sealed, precision ball bearings per sheave.

Base angles shall be a minimum 1-1/2 inches x 1-1/2 inches x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle with the base angles turned in and notched to allow close mounting centers.

The block housing shall have side plates between each sheave and on the outside. Side plates shall be a minimum of 12-gauge (2.78 mm) steel, and shall fully enclose the sheave. Side plates shall be bolted to the base angles.

The block and associated mounting hardware shall have a recommended working load of at least 600 lbs (272.2 kg), and shall be designed for use in either upright or underhung usage.

Loft blocks shall have with two to five sheaves grooved for 3/4 inch (19.1 mm) rope.

* + - * 1. Cast: Universal loft Block.

The sheaves shall have an 8-1/2 inches (209.55 mm) outside diameter, and shall be iron castings with machined grooves. The block shall be equipped with a 17 mm (0.67 inch) diameter shaft and two sealed, precision ball bearings per sheave.

Base angles shall be a minimum 1-1/2 inches x 1-1/2 inches x 3/16 inch (38.1 mm x 38.1 mm x 4.76 mm) angle with the base angles turned in and notched to allow close mounting centers.

The block housing shall have side plates between each sheave and on the outside. Side plates shall be a minimum of 12-gauge (2.78 mm) steel, and shall fully enclose the sheaves. Side plates shall be bolted to the base angles.

The block and associated mounting hardware shall have a recommended working load of at least 600 lbs (272. 2kg), and shall be designed for use in either upright or underhung usage.

Loft blocks shall have two to five sheaves grooved for 3/4 inch (19.1 mm) rope.

* + - 1. Pivot Bracket:
         1. Pivot brackets mount loft blocks to beams with more than 1-1/2 degrees of slope.
         2. They consist of a pair of angles that bolt to the block base angles and a matching pair of angles that mount to the beam with clips. A 3/4 inch (19.1 mm) diameter threaded rod connects the two sets of angle to provide a hinge point.
    1. Rope:
       1. SureGrip Hand Line:
          1. Hand line shall be 3/4 inch (19.05 mm) in diameter, employing a 3 strand composite construction combining filament and staple/spun polyester wrapped around fibrillated polyolefin.
          2. The hand line shall contain an identifying tape showing the manufacturer's name, phone number, website, and year of manufacture.
          3. The hand line shall contain a red safety/wear indicator that becomes visible as the rope nears the end of its useful life.
          4. The rope shall hold knots well, be easily spliced and be dense enough to allow it to be clamped in a rope lock without damage. Rope shall not be subject to rotting, mildew, resistance to UV, or moisture damage, nor shall its length be affected by changes in humidity.
          5. Tape ends before cutting. Attach to arbor with two half hitches or bowline and tape end to standing line with electrical tape.
       2. Multiline II Hand Line:
          1. Hand line shall employ a 3 strand composite construction combining filament and staple/spun polyester wrapped around fibrillated polyolefin.
          2. The rope shall hold knots well, be easily spliced and be dense enough to allow it to be clamped in a rope lock without damage.
          3. Rope shall not be subject to rotting, mildew, resistance to UV, or moisture damage, nor shall its length be affected by changes in humidity.
          4. Tape ends before cutting. Attach to arbor with two half hitches or bowline and tape end to standing line with electrical tape.
       3. Hand Line: Stage Set X.
          1. Hand lines shall have a parallel filament core constructed of high tenacity filament polyester. The core shall remain firm and round under all load conditions, and be dense enough to allow it to be clamped in a rope lock without damage. The core shall be wrapped in polyester tape to provide the core with protection against external damage and wear. The braided polyester outer jacket shall be constructed of spun polyester for good gripping.
          2. The rope shall hold knots well, be easily spliced. Rope shall not be subject to rotting, mildew, resistance to UV, or moisture damage, nor shall its length be affected by changes in humidity.
          3. Tape ends before cutting. Attach to arbor with two half hitches or bowline and tape end to standing line with electrical tape.
    2. Sand Bags:
       1. Sand bags shall be of ballistic Nylon construction, with a forged safety snap, and a Velcro closure. Grommets and a tie line shall prevent accidental opening of the Velcro. Sand bags shall be black.

1. EXECUTION
   1. EXAMINATION
      1. Examine installation areas and mounting surfaces with Installer present, for compliance with manufacturer's installation tolerances including required clearances, floor level, location of blocking and anchoring reinforcements, and other existing conditions that may affect installation or performance.
      2. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
      3. Proceed with installation only after correction of unsatisfactory conditions.
   2. PREPARATION
      1. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
   3. INSTALLATION - GENERAL
      1. Install manufactured units in accordance with manufacturer's recommendations, approved submittals, and in proper relationship with adjacent construction.
      2. Clean exposed surfaces. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
   4. INSTALLATION OF RIGGING SYSTEMS
      1. 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.
      2. 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.
      3. Standards: Installation practices shall be in accordance with OSHA Safety and Health Standards and all local codes. All welding shall be performed in full compliance with the latest edition of the Structural Welding Code (ANSI/AWS D1.1).
      4. 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.
      5. Attachments: All equipment shall be securely attached to the building structure.
   5. INSPECTION AND TESTING OF RIGGING SYSTEMS
      1. Inspection: During the installation of equipment the Rigging Contractor shall arrange for access as necessary for inspection of equipment by the Owner's representatives.
      2. 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.
      3. Completion Testing: Upon completing the installation, the Rigging Contractor shall notify the Owner or Owner's Representative, who shall 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 Owner's 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 shall 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 percent WLL in both the ascending and descending directions.
            1. Demonstrate that all over travel limit switches have been correctly set for the actual field conditions of the specific project.
            2. If it applies to the project, demonstrate that all position encoders have been correctly set for the actual field conditions of the specific project.
         3. Provide written recommendations to the Owner for necessary repairs or changes not included in the warranty. Provide a copy to the rigging equipment Manufacturer and in the Operations Manual.
      4. The Owner or Owner's 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.
      5. 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 owner to demonstrate and explain the operation and maintenance of the systems.
      6. Signage with basic operating instructions and warnings shall be posted in the area where the equipment shall be operated. Signage shall be in conformance with ANSI-Z535.
   6. RIGGING SYSTEMS, FOLLOW-UP INSPECTION
      1. The Contractor shall return to site 12 months and 24 months after system turnover and provide the following services:
         1. Inspection in accordance with ANSI E1.4-1 Entertainment Technology - Manual Counterweight Rigging Systems, ANSI E1.6-1 Entertainment Technology - Powered Hoist Systems, and ANSI E1.47 - Recommended Guidelines for Entertainment Rigging System Inspections.
         2. Make all required adjustments.
         3. Correct all warranty items and provide a written report to the Owner and Manufacturer.
         4. Provide written recommendations to the Owner and Manufacturer for necessary repairs or changes not included in the warranty.
         5. Conduct a rigging operation and safety class.
         6. Subsequent to the 24 month inspection, provide a written proposal for the following year's inspection.
   7. FIELD QUALITY CONTROL
      1. Inspect installed work to verify compliance with requirements.
         1. Verify that electrical work complies with manufacturer's submittals and written installation requirements.
         2. Perform installation and startup checks as recommended by manufacturer.
         3. Prepare inspection reports and submit to Architect.
   8. DEMONSTRATION
      1. Train Owner's personnel to adjust, operate, and maintain equipment. Turn over keys, tools, and operation and maintenance instructions to Owner.
   9. CLEANING AND PROTECTION
      1. Repair or replace defective work as directed by Architect upon inspection.
      2. Clean surfaces. Touch up marred finishes, or replace damaged components that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by manufacturer.
      3. Protect installed products from damage, abuse, dust, dirt, stain, or paint until completion of project. Do not permit use during construction.

END OF SECTION