

STAGE RIGGING AND DRAPERY SPECIFICATIONS

1.0 GENERAL

1.1 RELATED DOCUMENTS

- A. General Conditions, Supplementary Conditions and General Requirements, are applicable to this section.

1.2 SCOPE OF WORK

- A. The purpose of these specifications is to furnish functional and operational criteria; to outline quantitative requirements; to provide standards of quality in materials and workmanship; and to establish procedures and obligations concerning bidding, fabrication and installation of the stage rigging systems.
- B. All material, equipment and services shall be provided as specified herein and shown on the drawings. These include the preparation and submission of shop drawings for approval by the Architect prior to fabrication or installation; the verification of dimensions, conditions and clearances at the job site, and reporting variations and obstructions to the Architect; the fabrication, delivery and installation in accordance with these specifications and pertinent drawings; and inspection and adjustment of the completed installation.
- C. All bidders shall fully inform themselves of the conditions under which the work is to be performed, the site of the delivery, installation, and all other relevant matters concerning the work to be performed, and the bidder, if awarded the contract, shall not be allowed any extra compensation by reason of any matter or thing concerning which such bidder might fully informed himself prior to the bidding. The Contractor for the work shall visit the site and check and verify all dimensions to coordinate the equipment with the structure and shall furnish any auxiliary steel and incidental items to result in an installation complete in all

details whether or not such incidental items are specifically enumerated herein.

- D. All equipment shall be furnished in strict accordance with the specifications and be installed in complete working order ready for use. The stage equipment contractor shall instruct representatives of the school in proper operation of all equipment furnished as part of his contract. Immediately following the first six month period, subsequent to final approval of the installation, the stage equipment contractor shall make the necessary mechanical adjustments to the rigging items and trimming adjustments to the drapery, as directed by the Architect or his representative. Operating and maintenance manuals shall be provided for all running rigging.
- E. If any bidder for the proposed contract is in doubt as to the true meaning of any part of the drawings, specifications or other proposed contract documents, he may submit to the Architect a written request for interpretation thereof. The bidder submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be only by addendum duly issued. A copy of such addendum will be mailed or delivered to each person receiving contract documents. No request for interpretation will be accepted or a reply given after ten (10) days prior to the date for opening of bids.

### 1.3 WORK IN THIS SECTION

#### A. Counterweight Rigging - main battery

1. Schedule 80 pipe battens - internally spliced
2. Steel cable running lines - adequate length to provide batten travel 5'0" above stage floor to 47'6" above stage floor
3. Cable support and guiding - through designated head blocks and loft blocks
4. 1" premium manila hauling line - extending through rope lock control and over floor block and head block and arbor blocks
5. T-bar style arbors of sufficient length to accommodate counterweight units
6. Locking rail with identification plates and illumination
7. T-bar guide system as specified

B. Tracks

1. Traveler track systems for full width stage drapery travelers and masking legs with connecting accessories

C. Curtains

1. Fire safety curtain - conform to all applicable fire code regulations
2. Stage drapery installed as scheduled, trimmed, and all flameproofed
3. Sky drop - seamless
4. Scrim curtain - seamless

1.4 RELATED WORK IN OTHER SECTIONS

- A. Head block beams, loft block beams, and loading bridge
- B. Conduit, wiring, heat detectors, flow switch, and field electrical connection index light strip
- C. Conduit, wiring, heat detectors, flow switch, and field electrical connecting

1.5 SUBMITTALS

- A. Submit one sepia transparency and three (3) blue line prints of shop drawings to Architect for approval. Obtain approval of drawings prior to proceeding with manufacturing.
- B. Preliminary arrangement drawings including a auxiliary steel detail are to be submitted to the Architect not later than sixty (60) days after award of contract for coordinating the work of other trades in the related areas. Shop and field connections of auxiliary steel items shall be clearly distinguished and complete information on connections to other work shall be given. Following approval of the preliminary drawings and prior to beginning fabrication, this contractor shall submit complete shop drawings of the rigging components including:
  - 1) Mechanical Assembly Drawings
  - 2) Mechanical Detail Drawings

- 3) Mechanical General Layout
  - 4) Component Equipment Drawings
  - 5) Erection Plans and Diagrams
  - 6) Miscellaneous Details and Assembly Drawings
- C. Mechanical assembly drawing shall show detailed sizes, ratings, and weights of all components, equipment, supports, and linkages. Assembly drawings shall show sufficient detail to serve as a basic record for maintenance.
- Assembly drawings shall have a reference listing for all materials, components, equipment, and any special equipment furnished.
- D. Mechanical detail drawings shall show all details necessary for fabrication of all specially designed components, linkages, and supports.
- E. Mechanical general layouts shall show all mechanical equipment locations, connections to building structure, linkages, calculated loads, travels and travel relationship between adjacent installations and between adjacent structure.
- F. Component equipment drawings shall be manufacturer's approved drawings or catalog cuts showing weight dimensions, and capacities of mechanical components.
- G. Erection plans and diagrams shall give relative locations of various members and overall dimensions with reference to the preliminary drawings including auxiliary steel.
- H. Miscellaneous details and assembly drawings shall give lengths, widths, and sizes of all members, connection details, location, type and size of bolts, rivets, welds, and other connections together with materials to be used.
- I. Shop drawings shall be made in conformity with the best modern practice and all design shall reflect a requirement for minimum ongoing institutional maintenance.
- J. Approval rendered on Shop Drawings shall not be considered as a guarantee of measurements of

building conditions. Where drawings are approved, said approval does not mean that drawings have been checked in detail, and does not in any way relieve the Contractor from his responsibility of necessity to furnish material or perform work as required by the Contractor Specifications.

- K. Failure by the Contractor to submit shop drawings in ample time for checking shall not entitle him to an extension of contract time, and no claim for extension by reason of such default will not be allowed.

#### 1.6 GENERAL REQUIREMENTS:

- A. All items included in this specification shall be furnished and installed by a single contractor who shall have sole responsibility for proper operation of all equipment involved.
- B. The Contractor must maintain and operate his own shops and fabricate or assemble all components with the exception of standard hardware materials and equipment. Subletting work at the job site, except for incidental miscellaneous steel work, shall be allowed.
- C. All work done under this contract shall conform to applicable local, state, and national codes, and be performed within labor regulations and union requirements.
- D. The Contractor shall provide insurance covering damages to, or losses of, the equipment during shipment and installation, and covering damages of persons, premises, or equipment which are the result of assembly or installation procedures at the job site.

#### 1.7 QUALIFICATIONS:

- A. The Rigging equipment comprehended herein shall be that of a single Manufacturing Contractor at his direct and undivided responsibility through the design, engineering, fabrication, installation, guarantee, and maintenance phases. Such manufacturing Contractor shall operate his own machining and fabricating facilities; and for the purpose of this contract in the interest of public safety jobbers, dealers, manufacturer's representatives, or other higher or lower tier

sales agents are excluded from consideration.

Materials and equipment which equal or exceed the quality specified as manufactured and installed by any of the following is acceptable for the work comprehended in this Section.

Tiffin Scenic Studios, Inc.  
P.O. Box 39  
Tiffin, Ohio 44883

J.R. Clancy  
7041 Interstate Island Road  
Syracuse, New York 13209

Peter Albrecht Corporation  
325 East Chicago Street  
Milwaukee, Wisconsin 53202

Hoffend and Sons, Inc.  
34 East Main Street  
Honeoye, New York 14471

- B. Other manufacturing contractors desiring consideration for approval as acceptable may so request in accordance with the following: providing such request, including data and samples, reach the Architect with all charges prepaid not less than ten (10) working days prior to the date for receipt of bids in order that appraisal can be made.

Data and samples to be submitted:

1. A current financial statement as prepared by a Certified Public Accountant.
2. A listing of three (3) installations of similar scope to the work herein specified made within the past five (5) years and a list of contacts and telephone numbers.
3. Samples: One (1) loft block  
One (1) head block  
One (1) hand lever steel rope lock  
One (1) automatic safety rope brake  
One (1) arbor

All samples as specified

The Architect reserves the right to test the samples through destruction with the samples or parts being returned to the applicant upon request at his expense.

Blocks shall be assembled with tight sealed and locked connections (no rivets) to permit convenient

dismantling and machined parts shall be unpainted.

The Architect assumes no responsibility for safe delivery of the samples to the following address:

McDonald, Cassell, and Bassett Architects  
2079 West Fifth Avenue  
Columbus, Ohio 43212

All samples are to be shipped prepaid.

- C. The Architect reserves the right to inspect any previous equipment as furnished or installed by any Contractor seeking approval. Also, the right is reserved to reject any applicant for approval who has failed in any respect to comply with every provision of any previous contract, such failure being construed as irresponsibility and the decision of the Architect shall be conclusive and final.
- D. The Owner reserves the right to accept or reject any or all bids. Bids covering uninvited alternate equipment or methods or performing the work will not be considered, such being regarded as non-responsive to the request for bids.

#### 1.8 STANDARDS AND SUBSTITUTIONS:

- A. Throughout this specification, most details on construction, fabrication, and installation methods and techniques are spelled out for various rigging components including but not limited to weights, tolerances, finishes, metallurgical analyses, capacities, anchoring, clamping, alignment, and arrangement; these shall be incorporated in the work without substitution or alterations as requirements of the design intent relating to safety, performance, aesthetics, longevity, and minimal institutional maintenance.
- B. Dimensions listed herein relating to the above categories shall be regarded as actual and not nominal. Only where a dimension is specifically identified as nominal shall an interpretation be such.
- C. In instances where specific requirements for rigging components are more stringent and require precautions, procedures, or refinements exceeding building codes or standards such specific

requirements shall supersede these codes and standards as basic to the design intent for additionally contributing toward equipment performance and personal safety under both normal use as well as abnormal use, abuse, and human error as can responsibility be anticipated.

D. Wherever a named material or equipment is listed (including manufacturer, brand, model, catalog number, etc.) such proprietary mention is used to indicate the quality required by the design. Proprietary brands, models, etc. of other manufactures may be used upon, and only upon, the following conditions:

- 1) That, in the opinion of the Architect (whose decision shall be final) the proposed brand or equipment item is fully equal in design, materials, construction, workmanship, performance, finish, etc. to the item proprietarily named. No compromise in quality level, however small, is acceptable.
- 2) That any bidder desiring to bid on an "approved equal" proprietary product submit to the Architect not less than ten (10) days prior to the date for receipt of bids, complete written specifications descriptions, technical data, and performance criteria of the proposed item(s) he wishes to have considered for acceptance as an "approved equal". Such approval, if granted, will be in the form of a written addendum issued by the Architect and sent to all prospective bidders of record. If the information submitted by a bidder is insufficient in the Architect's opinion for allowing him to reach a decision, such request for "approved equal" consideration will be regarded as non-responsive" and no action whatsoever taken. The full burden of proof remains with the bidder proposing substitution.
- 3) That no oral request for "approved equal" materials will be entertained and no oral response proffered.
- 4) That the Architect assumes no responsibility for the receipt of or the receipt within the time specified of any request for "approved equal" consideration and likewise assumes no



responsibility except a bona fide effort for the issuance (if any) of related addendum in sufficient time prior to the time set for receipt of bids.

- 5) That the Architect in appraising and evaluating materials and/or workmanship for possible "approved equal" certification reserves the right to arrange for whatever testing or investigation procedures he may deem pertinent including but not limited to price and performance data from whatever source he may consider responsible.
- 6) Any bidder who includes in his bid any approved "or equal" substitute equipment, articles, or materials shall also include the additional cost required for all modifications in the contract and the cost for all additional diagrams and drawings the Architect may require for accommodating the "or equal" equipment. The modifications to which reference is made include those affecting other trades and equipment in adjacent and/or contiguous areas such as but not limited to steel framing, masonry, electrical, plumbing, and painting.
- 7) That it be understood the eventual use of materials or installation techniques other than those specified without written approval of the Architect as "approved equal" shall constitute a violation of the contract and that the Architect shall have the right to require the removal of such material or the modification of such installation technique or both, and the replacement thereof with the specified materials or installation techniques or both, at the Contractor's expense.

#### 1.9 WORKMANSHIP:

- A. The installation workmanship shall provide straight, plumb, true, and aligned components throughout. All connections shall be tight fitting with a minimum safety of eight (8) and all arranged in an orderly manner. The mechanical fabrication of the rigging and hardware and the mechanical installation shall possess the necessary properties to withstand stresses of tension compression, flexure, shear, and torsion which may be

anticipated being imposed on one or more of the components; and all shall be related to (1) safety, (2) ease of operation, (3) quietness of operation, and (4) service life. The standards of quality and design covering the equipment and fabrication plus the installation technique required are established on this basis; and the decision of the Architect in determining the acceptability of equipment items, installation technique, and workmanship shall be final.

- B. The rigging contractor shall conform to the best trade practices, fabrication and installing all items in accordance with manufacturer's recommendations and Architect's direction, and consult and coordinate with trades doing adjoining work.
- C. During the course of his work, the rigging contractor shall daily remove to collection points at the job site all loose trash and scrap materials.
- D. Installation shall be complete with all members and materials, and all bolts, nuts, washers, clips, fittings, supports, or other items required for attaching all equipment specified to the existing construction.
- E. The rigging contractor shall do all required cutting, drilling, tapping and fitting to properly install and secure his work in place. Cutting or drilling existing structural work shall have prior approval of the Architect.
- F. The mechanical fabrication and workmanship shall incorporate neat and mechanically acceptable practices such as clean drilled and punched holes without flash, hand smooth finish for all sheared, machined, and cut edges, and proper fit of component and contiguous parts without irregularity where matching is intended. Welding shall meet qualification of A.T.S.C. manual and shall be without spatter and other evidence of poor practice. All moving parts shall have specified tolerances, shaft sizes, bearings, mountings, connections, and accessories coordinated into the work in a manner acceptable to the Architect. No wood construction or equipment shall be incorporated into the work excepting as may be set forth in the specifications.

- G. The fabrication of all equipment shall incorporate only new and unused materials. This includes all metal components in various shapes required such as plate, bar, rod, castings, structurals, stampings, forgings, clamps, bolts, bearings, chain, pipe, sleeves, clips, cable, and all other accessories not mentioned.
- H. The installation cost included in this proposal shall be based upon the use of experienced riggers at the prevailing wage rates for the trade or trades having jurisdiction.

#### 1.10 INSPECTION AND TESTING:

- A. Final inspection shall be made by the Architect, or his appointed representative, within ten (10) days following receipt in writing of notification from the Contractor that the installation is completed. If inspection reveals any detail of construction, fabrication, or installation not in strict accord with the specification and contract requirements, approval and payment will be withheld and Contractor will be given thirty (30) days to replace the rejected items with those conforming to specification requirements. In addition to the final inspection, the Architect or his appointed representative may make preliminary inspection of various equipment components during the course of the installation, and he shall be allowed access to any and all materials at the site for eventual incorporation in the work. Any such preliminary inspection shall not be construed as eliminating the possible rejection of various components during final inspection detailed above.
- B. The completed installation of all rigging equipment, with draperies properly installed, shall be tested and operated for the approval of the Architect.
- C. Any workmanship or materials found to be defective, improperly placed, not in strict conformity with the specifications, or defaced or injured through the action of fire or the elements, through usage by the Contractor or his employees, or from any other cause shall be removed immediately from the premises when directed by the Architect and satisfactory materials or work substituted therefore without delay. This shall include making

good the work of other contractors destroyed or damaged by delivery or installation, or by such removal or replacement. The cost of the above replacements shall be borne by the Contractor responsible for the defective work or material.

- D. In the event that rejected materials cannot be replaced before occupancy and use of the building, the rejected items shall be allowed to remain in use until replaced at no expense to the Owner.
- E. The Architect, or his appointed representative, shall be the sole judge of the quality of materials furnished and the character of the work performed.

#### 1.11 PRODUCT SAFETY AND GUARANTEE

- A. The safety parameters set forth in this section of the specifications are intended to reflect safeguards and precautions related not only to normal use of the equipment under ideal operating and loading conditions but, additionally to anticipate equipment misuse, human error, and misjudgment.
- B. Pursuant to the above and as "a condition precedent" for minimizing product liability claim before they occur, each bidder by signature affixed to his proposal form as an essential contract requirement attests as follows reflecting mandates of the Consumer Product Safety Commission:
  - 1) He has not on previous stage rigging work under his contractual responsibility within the preceeding five-year period substituted cast iron components for supporting or carrying static or dynamic overhead loads under stresses of tension and/or impact where malleable iron or steel was specified for such components. The loadbearing components include but are not limited to arbor top or bottom members and hook clamps for attaching single or head blocks to the rigging steel.
  - and/or
  - 2) He has reported all such breach of contract infractions as listed above to the Consumer Product Safety Commission as required by the Act (Public Law 92-573) and has either replaced or remodeled such work or reimbursed the

Owner(s) in suitable amount for allowing such replacement or remodeling being done by others and all as approved by the Commission.

- C. The work shall be fully guaranteed - with exception of normal wear - for a period of one (1) year after final acceptance and payment. Any items showing evidence of defective materials or workmanship (including installation workmanship) in opinion of the Architect shall be replaced within thirty (30) days after notification, and without cost to the Owner.

## 2.0 PRODUCTS

### 2.1 FABRICS

- A. All fabrics of their various kinds and colors shall each be from one and the same dye lot. All colors and designs are to be as selected by the Architect. When materials of one (1) color exceed limit of one (1) dye lot, the balance must be identically matched with the original lot. No "run of the mill" usage of colors will be acceptable.
- B. All combustible fabrics shall be chemically flameproofed by immersion for compliance with all applicable codes. Spray method of flameproofing is unacceptable. This contract shall furnish flameproofing certificates giving name of flameproofing chemical used, identification of flameproofer, method of flameproofing used, and date.
- C. 28-ounce Memorable Velour and 16 ounce Princess velour shall be in stock color as furnished by K-M Fabrics, Inc. Box 7379, Branwood Station, Greenville, South Carolina 29610.
- D. Lining fabric shall be black Denim as furnished by Valley Forge Fabrics, 19 West 44th Street, New York, New York 10036.
- E. Fabric for cyclorama to be seamless muslin in stock color as furnished by Frankel Associates, Inc., 1122 Broadway, New York, New York 10010 .
- F. Fabric or scrim curtain to be seamless sharkstooth scrim as furnished by Frankel Associates, Inc., 1122 Broadway, New York, New York 10010.

- G. Fire safety curtain to be style CSC-GIPC 100% non-asbestos 24 ounces per square yard as furnished by Canvas Specialty Company., 4891 Sykesville Road, Eldersburg, Maryland 21784.

## 2.2 TRACKS - TRAVELERS AND LEGS

- A. Traveler and leg tracks shall be made from not lighter than 13 gauge (.095) steel with double parallel raceway and have 1-1/4" standard black steel pipe backbone full length attached to track on approximately 5'0" centers with die formed steel clamps. Single carriers are to be double-wheel style and masters of four-wheel construction, all incorporating end-stacking links and resilient rubber tube silencer spacers with 1/4" wall thickness and an outside diameter of approximately 3/4" to allow free travel for full 1/2" diameter operating line.

Carrier wheels shall operate on individual ball-bearing assemblies each wheel and have nylon tread. The diameter of the carrier wheels is to be 1-3/4". Operating line shall be No. 16 (1/2" diameter) with cable center and the end sheaves and floor sheaves shall be 5" diameter and operate on ball-bearings. All traveler tracks shall overlap a minimum of 3'0" at center stage and all tracks shall have suitable center stage sag pick-ups to remove slack from horizontal operating lines. Side plates of floor blocks shall be slotted to permit vertical equipment of sheave to remove slack in operating line. Block shall be provided with locking handle to permit sheave adjustment without resort to wrenches or other hand tools and vertical adjustment shall be a minimum of 6". Floor blocks shall incorporate a quick release mechanism with a positive action spring plunger locking device to prevent disengaging unless released - floor plate to be countersunk for flat head screws. Key-hole sliding type connections are not acceptable. Track assemblies shall attach to counterweight battens by means of snatch chains of 1/4" proof coil chain with forged steel swivel type snap attached to last link one (1) end and a 3/8" forged sling link attached to last chain link at other end with a forged repair link. Snatch chains shall be located on 7'0" centers, be 30" long, and to each include a 7/16" safety bolt.

## 2.3 CHAINS, CABLES, ROPES, AND CONNECTIONS

A. Chains:

1. Weighting chain for bottom hems where required to be No. 8 jack chain - cadmium plated
2. Batten connection trim chains 38" long, made from 1/4" plated proof coil chain, and forged steel swivel design bolt snap 750 pound safe load with forged "missing link" connection. Trimmers to have 3/8" safety bolt and nut and be secured to the running line thimble with safety type 14" anchor shackles (forged) having forged pin with hitch pin clip.
3. Fire safety curtain batten support chains (extra short link style) shall be 7/0 welded twist link chain of proper length to maintain top batten elevation when curtain is fully lowered. Chain connections shall be made with suitable shackles to forged clamps at batten and to hanging points.

B. Cables:

1. Counterweight running lines shall be 1/4" 7x19 galvanized aircraft cable.
2. Fire safety curtain running lines and side guide wires shall be 1/4" 7x19 galvanized aircraft cable.

C. Rope:

1. Counterweight and hauling lines shall be 1" diameter - 4 strand standard lay with a colored streamer or tape to indicate premium construction - Columbian Rope Company, American Manufacturing, or Plymouth Cordage.
2. Heavy duty galvanized rope thimbles to be provided at each connection - attachment to any device with clove hitch and half hitch.
3. Free ends of rope shall be whipped and separately stopped to standing part with Scotch No. 33 electrical tape.

D. Connections:

1. Counterweight running line connections shall be

made using Nicopress oval sleeves, as furnished by the National Telephone Supply Company, applied in conformity with manufacturer's instructions. Both ends of all running lines shall terminate with heavy patterns 1/4" thimbles. Cable connections at arbor shall be

with safety type 1/4" anchor shackles (forged) having lock clip.

2. Fire safety curtain running line connections shall be made by using 1/4" forged cable clips (two (2) each connection) with heavy thimbles. Clue connection to have 1/2" forged jaw and eye turnbuckles with locknuts. Batten end of running lines to connect to steel batten clamps.
3. Cable ends to be properly taped.

#### 2.4 PIPE AND PIPE BATTENS

- A. Counterweight battery - 1-1/2" I.D. Schedule 80 black
- B. Fire safety top and bottom battens - 1-1/2" I.D. Schedule 40 galvanized
- C. Lighting support battens - 1-1/2" I.D. Schedule 40 black
- D. Track backbone
  1. Traveler and leg tracks - 1-1/4" I.D. Schedule 40 black
- E. Sky drop and scrim weighting pipes - 3/4" I.D. Schedule 40 galvanized
  1. Each batten shall incorporate full batten sections with only one (1) partial section permitted.
  2. Internal tight fitting sleeve spliced joints 18" long equally spaced each side of joint and held with four (4) roll pins. Sleeve splice member to be 5/32" wall steel tube.
  3. Counterweight battens shall have end caps and numeral plaques.



## 2.5 SHEAVE CASTINGS

- A. All sheave castings shall be semi-steel and comply with ASTM specification A48-62, Class 30A. Castings shall have a tensile strength of 30,000 psi and a minimum transverse strength of 1,000 pounds deemed to be in the public interest of safety.

Two (2) test bars poured in conformity with the above referenced ASTM specification shall be submitted to the Architect on request together with a notarized statement attesting that the bars as furnished were poured from the same melt as the sheaves incorporated in the work. If more than one melt is required as production procedure - two (2) test bars shall be furnished from each melt.

In addition, and in further conformity with the above referenced ASTM specification, the Architect reserves the right to request the removal of up to two (2) sheaves selected at random from the installation for purpose of analysis.

The Contractor shall arrange for such sheave removal as the Architect may direct and shall include the cost of such removal in his proposal together with the cost of replacing any sheaves removed under this procedure.

The costs for the laboratory test shall be paid by the Owner and the test shall be performed by a laboratory selected by the Owner.

If the tests reveal a quality level below the Standards of the above ASTM specification, all sheaves will be rejected and new test bars and sheaves shall be furnished by the Contractor until conformity is ascertained. The Contractor shall be responsible for the cost of all subsequent laboratory tests beyond those of the initial equipment. The laboratory shall remain as selected by the Owner.

## 2.6 MULTI-GROOVE BLOCK

- A. As a safety consideration, all shafting used in construction of head blocks and mule blocks shall be Stressproof DG&P steel with full headed construction for bearing against side plates to minimize oil-canning at this load concentration

area. Shafts with drilled holes and bent wire keepers engaging holes inside plates are not acceptable.

## 2.7 COUNTERWEIGHT EQUIPMENT

- A. Head block for the main battery of counterweight systems shall carry one (1) heavy duty semi-steel sheave having 12" pitch diameter grooved for cable and manila. Sheave to be machine turned and bored and have lathe cut grooves for 1/4" cable with wide well rounded throats. The boring tolerances shall conform with bearing manufacturer's instructions and are subject to micrometer check by Owner. Cable grooves shall be stub-gauged and contain 1/64 tolerance. In addition, sheave shall contain one (1) lathe cut groove for 1" diameter manila hauling line with 1/16" width tolerance and sufficient depth to prevent manila line extending beyond sheave perimeter. This groove shall be centered (odd grooved excepted) between cable grooves. Sheave shall operate on Timken tapered roller bearings on 1-1/2" diameter Stréssproof steel shaft. To prevent shaft from turning, it shall be headed and keyed to one of the side plates forming the block housing using 1/4" key. Opposite end of shaft shall be threaded to properly fit slotted half nut with keeper to hold adjustment. The number of cable grooves shall be as listed hereinafter under schedule of equipment. Hub diameter of sheave shall be 5" minimum to allow adequate support for the bearing.

Side plates shall be 1/4" steel plate and base angles shall be 2" x 2" x 3/8". Base shall contain a minimum of four (4) crossbolts 1/2" diameter with spacers, and in addition plates shall be welded to base angles. The off-stage end of base shall have a steel clip made from 1/2" x 4" flat bar with spacer to accommodate the head beam flange thickness. The steel clip is to be welded and bolted to the base angles. The on-stage end of the base angles shall be provided with an adjustable 1/2" x 4" steel clamp off-set to compensate for flange thickness and bear full width of base assembly and hold to position with two (2) 1/2" bolts. Head block assembly shall be mounted on the upper side of the head beams. All anchoring to beams shall be made without drilling the head beams or without welding auxiliary steel to the beam assembly. Side plates shall be of sufficient size

to accommodate a minimum of three (3) crossbolts with spacers so arranged to prevent cables or manila escaping the grooves under severe snubbing shock and have oil holes for bearing lubrication.

- B. Loft blocks for the counterweight systems shall carry 8" diameter high duty semi-steel uncored sheave fully machined and bored. The weight of the machined sheave exclusive of the bearing assembly shall be not less than five and one-half (5-1/2) pounds to indicate heavy duty design.

Grooves shall be machine cut to approximately double depth of the cable diameter and be stub gauged at the floor or tread to provide between 1/64" and 1/32" clearance tolerance in accordance with Federal Specification RR-R-571a.

The cable shall be supported in the groove through 135 to 150 degrees of its circumference above which the walls of the groove shall slope at approximately 12 degrees to provide wide and well-rounded throats. Slot type grooves are unacceptable. The face of the sheave after machining shall not be less than 1" wide.

The sides of the rim perimeter after machining shall vary not more than 1/16" from a fixed plane perpendicular to the true axis of the sheave and no point of the floor or tread of the groove shall vary more than the same amount with the true sheave axis. Groove surfaces shall be smooth and free of irregularities, tool marks, and shall be unpainted.

Sheaves shall operate on Timken precision tapered roller bearings incorporating stationary cones and rotating cups. The sheave hubs are to be of sufficient diameter for receiving the bearing and provide a minimum of 5/8" peripheral support against static and dynamic loads. The hub is to be bored within the tolerances established by Timken engineering data for proper press fit of the cups without need for further cup clamping devices. Boring tolerances of sheaves selected at random by the Owner are subject to inspection and Contractor shall furnish labor to remove and disassemble up to four (4) blocks for this purpose and again restore to operation if approved.

The Timken bearings for complying with the

stationary cone-rotating cup requirements are to be of the style incorporating solid cones or Timken precision spacers to provide solid cone effect (Timken No. 05062 cones with X2S spacer and No. 05185D cup. The Intent is:

- a. Provide tight clamping between the side plates against cone rotation on the shaft.
- b. Eliminate bearing pre-loads or loose fits and maintain the close precision running clearance between cones and cups as designed into the bearing by the manufacturer.
- c. Eliminate sliding action of rollers associated with loose fit and which action is responsible for abrasive wear.
- d. Provide means to absorb the tension described below for avoiding cyclic stressing and resulting shaft fatigue.
- e. Prevent "oil canning" or bowing of the side plates while providing a diaphragm stiffening effect through tight lash-up at the critical center shaft load concentration point of the block assembly.

Center shaft shall be SAE Grade 5 steel not less than 15/32" diameter of headed construction with two (2) threads extending beyond a lock type hexagon full nut. The lash-up shall be tightened with sufficient torque to slightly exceed the elastic range of the steel in order to prevent cyclic stressing of the shaft over many years of service.

NOTE: Assemblies with two (2) independent bearings (individual cone and cup each side of sheave) allowing possibility of the cones rotating and depending on the side plates with their inherent flexure for maintaining bearing running clearance throughout the handling and mishandling during the long projected life of the equipment are not acceptable.

The block housings (side plates) with oil hole each plate at bearing location shall be 10 Gauge steel

with two (2) support angles 1-1/2" x 1-1/2" x 3/16". The support angles shall be welded to the side plates and have the necessary well overhang to accommodate the clamping listed below.

A minimum of five (5) spacer bolts including one at top and one at side containing cable in the sheave groove are required.

At the load end of the support angles provide a malleable hook clamp bolted to position for engaging the well channel flange. At opposite end of support angles provide an off-set plate bearing on underside of both base angles connected by 3/8" bolt through steel saddle across vertical angle legs at top. The use of bent steel straps attached to spacers is specifically excluded.

- C. Arbors for counterweight system to be straight lift style rigid frame design fabricated top, bottom from 3" 7.1# ship channel with 3/4" diameter tie rods. Backbone shall be of 1/2" x 3" flat bar. Rods shall be threaded both ends and have a total of twelve (12) full nuts, four (4) inside and eight (8) outside with one (1) of the eight (8) at top and one (1) at bottom being nut eyes for use with bull line. Each arbor shall include two (2) spreader plates of 10 Gauge steel 3" wide and two (2) cast iron (not pipe or conduit) lock collars with heavy wall and boss with latter drilled and tapped for 1/4" thumb screws.

Backing plate to be 3/16" thick and each shoe assembly to be attached to backbone with two (2) bolts 3/8" diameter.

Length of arbors to be 8'0" clear between top and bottom members.

In addition, there shall be four (4) arbors for the feed cable pick-up lines. Arbors to be of tubular design with shoes as described above.

- D. Take-up blocks for the main battery of counterweight system shall carry 12" diameter heavy duty uncored semi-steel sheaves machine turned and bored. The grooving shall be cut for 1" manila with 1/16" width tolerance and of sufficient depth to prevent manila line extending beyond sheave perimeter. Block housing shall be 1/4" plate with

toe kick tab and two (2) vulcanized fiber shoes attached to 1/4" thick backing plate for engaging T-bar. (See details of shoes as listed under Arbors, following). Sheave shall operate on 1" diameter shaft and be equipped with oilite bushings. Location of sheave in block housing shall allow manila line leaving bottom rope lock without excessively dragging the lock assembly. Weight of tack-up block shall be not less than forty-five (45) pounds to hold a suitable tension on operating line. The toe kick tab shall extend at least flush with face of locking rail.

- E. Hand lever rope locks for counterweight systems as specified to be all steel construction with gripping shoes a minimum of 6" long operating through double toggle action for permitting compression on line throughout entire length of shoes. Provision shall be incorporated to allow adjusting the shoe clearance to compensate for stretch and reduced diameter of the manila line.

Internal concave surfaces of shoes to have rounded lands. The operating handle shall be of round configuration for comfortably fitting hand grasp. Length of hand lever shall be 6" and arranged with toggle action such that throw in closed staying position is approximately 3-1/2 degrees beyond center for avoiding use of separate keeper link.

Side plates of lock housing shall be minimum of 3/8" thick cold finished steel all designed for holding capacity of one thousand (1,000) pounds and a snubbing capacity of stopping within three (3) feet of free falling load of two hundred fifty (250) pounds through eight (8) feet of drop at either the arbor or batten end of the system. Size of housing shall be adequate for entirely enclosing the mechanism at the sides, approximately 8" x 8-1/4".

Unit shall be provided with a Corbin plunger type tumbler lock allowing locking in the closed position against use by unauthorized personnel. The plunger shall permit locking without use of key -- all locks to be keyed alike.

- F. Safety rope brakes for all counterweight systems as specified shall be of automatic type positively preventing release when out-of-balance condition exists which is in excess of the physical strength

strength of the operator(s) to overcome by manually hauling on the purchase line. This indicates that only when a counterweight system is in balance, or under control, shall it be possible to disengage the automatic safety braking and snap the accessory in place.

The intent for occasionally disengaging the automatic safety features and resorting to hand lever operation is to permit smooth snubbing of a balanced system such as during Rehearsal and Production and after the equipment has been balanced and approved by those in authority at which time they may, at their discretion, temporarily permit the safety disengaging means being made available and snapped in place for optional use.

A further intent for the temporary use of the automatic safety disengaging accessory may occur during hanging heavy drapery or hard sets (during set-up) where the loading is progressive as these items are flown from the stage elevation and do not impose their full weight on the system until fully flown. The reverse of this condition exists when striking, and in either situation the hand lever manual operation shall permit a temporary take-over from the automatic safety operation but only through the use of the small accessory dispensed with discretion by those in authority.

A required safety feature of the accessory permitting the optional disengaging of the automatic safety features shall be a positive means through a panic button not less than 2" diameter and in conspicuous color and conveniently located for quickly (not more than (2) seconds) re-engaging the automatic safety feature of the brake should an uncontrollable out-of-balance condition develop while the unit is in the manual phase. In addition, an alternate means shall be designed into the equipment such as depressing the foot treadle for likewise re-engaging the automatic safety features as a second panic release.

The braking capacity for the automatic safety equipment described in this heading shall be 1,000 pounds static load on 1" diameter, four (4) strand premium manila purchase line through steel shoes 6" minimum length for distributing pressure and minimizing abrasion on the line, and 400 pounds

static load through the hand lever under alternate manual operation. The construction of the units shall incorporate only steel and brass throughout without cast iron or malleable iron components.

Convenient means shall be provided for manually adjusting and holding the shoe clearance to compensate from time to time for wear, stretch, and resulting reduction in diameter of the manila purchase line. Such adjustment shall be designed to make impossible the misalignment of the compression surfaces of the shoes relating to their full 6" length remaining parallel to and in contact with the purchase line.

As a final precaution to prevent use of the equipment by unauthorized personnel - each unit shall be equipped with a Corbin or equal tumbler type lock (not padlock) fitting into the assembly and requiring a key to open as the initial procedure for attempted operation of the automatic safety equipment regardless of the balanced condition of the system at the time.

The proper test procedure to determine the acceptability of the automatic safety rope brake for attaining the requirements listed above is as follows.

With a typical counterweight system incorporating a batten at one end and a counterweight arbor at the other, or a simulated system incorporating two (2) arbors or weight carrying cradles, and in either case with the rope brake arranged to receive 1" diameter manila between the two (2) ends of the system, proceed as follows:

1. With system in balance and with minimum weight throughout, open safety brake by depressing foot treadle and operate the system through two (2) or three (3) cycles to determine free running.
2. With system remaining in balanced, operate at normal speed for a distance of approximately ten (10) feet and release foot treadle which should stop the system abruptly. Repeat this ten (10) foot travel distance and treadle release with system being operated in opposite direction.



3. Load one side of system with approximately eighty (80) pounds.
4. Depress foot treadle. This should and must not release the rope brake and system should remain static.
5. With foot treadle remaining depressed, grasp whichever side of manila line has lifting effect on the overload and with necessary manpower exert sufficient pull (approximately eighty (80) pounds) to overcome the out-of-balance condition. Rope brake should release automatically, and the operator therefore now has control of the load through his hand grasp on the manila line. This inability to release the system until in balance indicates the preventive feature of the system "running away" should the brake be capable of being opened by inadvertence or otherwise when an out-of-balance condition exists greater than can be manually overcome through pull on the operating line in typical fashion.
6. With hand-over-hand action on manila line, allow load to descend a few feet (keeping manual control of manila line) and then release foot treadle. Brake should now again engage the manila and hold the system static with hand grasp released.
7. Repeat five (5) above and raise load to allow a minimum of twenty (20) feet below load for downward travel.
8. With foot treadle remaining depressed, let go hand grasp on manila line and allow load to free fall approximately ten (10) feet at which point step back (releasing foot treadle) and system should stop abruptly.
9. The stepping back here relates to the reaction of a person who, realizing some inability to manually control a system

and sensing his difficulty, instinctively "detaches" himself from the mechanism or devices by stepping away - thereby locking the system in the sense of a "dead-man" fall safe control.

10. Again depress foot treadle and, after a few seconds delay to determine brake is holding satisfactorily, proceed with necessary manpower to raise the load to the position prior to the free fall in (7) above and release foot treadle - thereby holding system static.
11. Increase the load on the heavy side of the system by an additional five hundred (500) pounds.
12. Repeat (4) above - system must again remain static.
13. Load the light side of the system with approximately five hundred (500) pounds. This will obviously bring the system back to within eighty (80) pounds of balancing.
14. Repeat (5) and (6) above.
15. Beginning with (3) above, proceed again through (14) as outlined but substituting the beginning eighty (80) pounds of imbalance on the opposite side of the system related to first portion of test since it is imperative that the safety features apply in both directions -- i.e., with the system overloaded or underloaded intermittently on either of the two (2) sides.
16. The final phase of test is to determine that static holding capacity is 1,000 pounds minimum. Proceed by unloading each side successively while opposite side is loaded to carry one thousand (1,000) pounds.
17. Allow each side thus carrying this one thousand (1,000) pound imbalance to remain undisturbed for at least two (2) hours. This will determine whether

manila is under proper compression related to fibers gradually shifting within the weaving construction or lay of the manila line to a rearrangement creating decreased diameter and resulting slip through.

In addition to the above procedure for a determination relating to the automatic safety features, the following sequence shall be carried out for testing the snubbing and holding performance of the integral hand lever equipment and the panic transfer from hand lever operation back to automatic operation.

1. With the system in balance and minimum weight throughout, depress the foot lever and snap in place the roller lever or other accessory (but including panic button) thereby disengaging the automatic braking feature. The system should now run freely in either direction with foot removed from foot treadle.
2. Push hand lever forward to its locked position.
3. Load one (1) side of the system with approximately eighty (80) pounds.
4. Release hand lever gradually (with one hand) and allow manila to slip through the shoes and the load to fall at a reasonable pace then snub the system by pushing the lever forward.

The operation under these conditions simulates non-automatic safety equipment since only by controlling the handle position is the overweight prevented from falling.

5. After operating under the hand lever option for perhaps five or ten cycles to gain familiarity with the performance, snub the system with the loaded side raised a minimum of twenty (20) feet to allow this distance available for downward travel.
6. Push hand lever to its locked position.

7. Increase the load on the heavy side by approximately 320 pounds which will now total 400 pounds and which is static design capacity for the hand lever manual equipment.
8. With the four hundred (400) pound load poised, test the panic button operation by releasing the hand lever and as load starts falling quickly push the panic button which immediately transfers the unit to automatic operation and arrests the falling load.

The panic button feature here demonstrates that should a system be allowed to become unbalanced while the safety features are disengaged (through permission to use the special accessory for such operation) the re-engaging of the safety braking can be activated almost instantly and the falling load arrested before crashing.

- G. Steel counterweights shall have "U" shaped slot cut on each end to rest on the bottom member of the arbor without bearing on the nut locking the tie rods at this location. Weights shall be 2" thick by 5" wide and 13-1/2" long with 2% to be 1" thick. All weights shall be smooth and without sharp edges for ease of handling.
- H. Locking rail shall be approximately 22'0" long located on stage floor. Rail shall incorporate standards on 5'0" centers each bolted to the floor with two (2) 3/4" threaded studs or machine bolts and shields. Locking rail standards to be made of 3" 4.1 pound channel and 1/2" x 3" flat stock with bracing and cross-bracing of 2" x 2" x 1/4" angle. The locking rail shall have slanting index strip of 3/16" x 3" steel plate with metal card holders and cards and with three (3) horizontal angles full length plus bracing. The angles supporting the steel index strip shall be 2-1/2" x 2-1/2" x 1/4" and the remaining two (2) angles supporting the steel hand lever rope brakes and automatic rope brakes shall be 2-1/2" x 2-1/2" x 1/2". The on-stage bracing member to have nylon shoes for guiding foot treadle extension bar where automatic rope brakes occur. The vertical leg of the

off-stage angle supporting the rope brakes shall be punched with 5/8" holes 1'0" on center for attaching loose pin shackles to receive snatch block for over-hauling any of the counterweight systems. Two (2) P-1000 Unistrut channels will be attached to the locking rail stands to support the foot treadle guides for the automatic rope brakes.

Bottom arbor stop shall be made of 1/2" x 4" x 7" angle approximately 25'0" long supported at each locking rail standard.

All connections in fabrication of locking rail shall be made with not less than 1/2" diameter bolts with full nuts to withstand upward thrust of 1,000 pounds at any point throughout length.

- I. The T-bar guides for main battery of counterweight systems shall be 1-1/2" x 1-1/2" x 3/16" steel spaced 6" on centers from front to back of stage extending from stage floor to head beams, a distance of approximately 53'0". The T-bar guides shall be held parallel by spreader "U" plates 1" wide connected with 3/8" bolts to wall battens. For connecting spreader plates to T-bars use 5/16" hex head bolts with hex nuts. Horizontal wall battens extending full rigging depth shall be located on 5'0" spacing from stage floor to head beam elevation. Battens are to be 2" x 2" x 3/16" steel angle supported on 5'0" spacing by means of 1/4" x 2" angle wall by 5'0" long where required.

Knees are to be attached to side wall with lag bolts in wood blocking. Blocking to be by others. All joints in T-bar shall be smooth and all aligned vertically plumb for proper operation without irregularities. T-bars shall be painted with aluminum paint. A floor batten shall be provided for supporting and aligning the bottom of the T-bar assembly and shall be 3" x 2-1/2" x 1/4" steel angle.

- J. Two (2) index light strip 22'0" long with 12" deep baffle and outlets on 1'6" centers shall be supported from an outrigger batten by means of steel hangers presenting a smooth surface to facilitate scenery stacking. The outrigger batten shall be 1-1/4" ID steel pipe, steel spliced and located 11'0" above the stage floor. Batten to extend full length of index light and be supported 6'0" on center by means of steel outrigger brackets

of 2" x 2" x 1/4" angle welded and diagonally braced and securely anchored to side wall or to T-bar supports. The vertical plane of the outrigger to be 2'0" on stage from the operating side of the locking rail. The index light shall hang directly below the batten and be wired and connected to electric supply through a dimmer switch by the electrical contractor. Dimmers for each strip to be adjacent to light on proscenium wall.

- K. Pipe battens shall be 1-1/2" diameter Schedule 80 black pipe and no fence or structural pipe shall be incorporated in the work. Pipe shall be new and without surface contamination and pipe shall be without threads excepting a one end for pipe cap with plaque as listed hereinbefore.

All battens shall be spliced with internal sleeves 18" long made from tubing having 5/32" wall thickness. Sleeves shall be arranged to extend equally into each pipe section being joined and held with two (2) 1/4" rivets or roll pins each pipe end. The fit of the splice tube inside the pipe shall not be less than the tolerance for a clearance fit. Length of battens shall be as indicated in equipment schedule.

The batten travel shall be from 5'0" above the stage floor to an elevation of approximately 1'0" below the gridiron when arbors are resting on the locking rail crash bar. The maximum top elevation of the battens shall in no event allow the cable connections being closer than 4" from fouling the well channels.

- L. Numbering identification of each counterweight system shall begin with front curtain as number one and proceed toward rear. Numbering shall appear on cards at index strip, in 2-1/2" x 3" metal plaques attached to T-bar spreader clips at loading bridge, and 2" metal discs attached to threaded pipe caps for fitting ends of battens adjacent to operating side of stage. Plaques and discs shall be painted black with white numerals 1-1/2" high and with lacquer protective coat.

- M. Rigging and General Notes: All counterweight systems shall be rigged to allow battens to reach 5'0" above stage floor when arbors are at a maximum height with the intent that when arbors are resting

on crash bar the battens are at their maximum possible heights. All anchoring of wall knees shall be made by use of machine bolts and shields in lieu of lag bolts or toggle bolts. All auxiliary steel shall be painted one shop coat of red lead and one (1) subsequent field coat in color as determined by the Owner. All rigging, including locking rail assembly, shall be painted mahogany enamel and touched up after installation. All welded connections shall be painted with red lead prior to field coat. Assembly of all blocks shall be by means of tight fitting and locked connection to present smooth surface without impediment toward fouling running lines and other moving parts.

Any mule blocks required for lines clearing any and all interferences otherwise preventing clear running with acceptable fleet angles shall be furnished as part of this contract at no change in price.

Any and all auxiliary steel as may be required for support of rigging equipment shall be furnished and erected as this Contractor's responsibility with no change in contract price.

All auxiliary steel shall be painted to match existing colors.

## 2.8 MAIN BATTERY COUNTERWEIGHT LISTING

### Equipment required:

Eighteen (18) five-line systems each with:

One (1) 12" pitch diameter five-line head block

Five (5) 8" diameter one-line loft blocks

One (1) 12" diameter take-up block

One (1) counterweight arbor

One (1) hand lever steel rope lock (all keyed alike)

One (1) pipe batten 1-1/2" I.D. Schedule 80 by 50'0" and I.D. plates with end caps

110'0" of 1" manila hauling line

510'0" of 1/4" 7x19 galvanized aircraft  
hoisting cable

1,000 pounds slotted steel counterweights

Nicopress fittings all cable connections

Rope thimbles at manila connections

Five (5) trim chains complete

NOTE: Sets 18, 19, 20, and 21 are to be back  
muled. Set 21 is to have 9' radius curves on  
the batten ends as shown on the drawings.

Three (3) six-line systems (lighting) each with:

One (1) 12" pitch diameter seven-line head  
block

One (1) 8" diameter one-line head block for  
feed cable pick-up line

Six (6) 8" diameter one-line loft blocks

One (1) 12" diameter take-up block

One (1) counterweight arbor

One (1) idler arbor (tubular style)

One (1) automatic safety rope brake (all keyed  
alike)

One (1) pipe batten 1-1/2" I.D. Schedule 80 by  
50 with end caps and I.D. plates

One (1) pipe batten 1-1/2" I.D. Schedule 40 by  
46'0" (for supporting lighting instruments)

110'0" of 1" manila hauling line

650'0" of 1/4" 7x19 galvanized aircraft  
hoisting cable

1,000 pounds slotted steel counterweights

Nicopress fittings all cable connections

Rope thimbles at manila connections



Five (5) trim chains complete

One (1) feed cable pick-up cradle

The following items, as listed and described hereinbefore, are common to the entire battery of counterweight systems.

One (1) locking rail at stage floor level in one (1) section approximately 22'0" long

Forty-five (45) T-bar guides 53'0" each with necessary clips, wall battens, etc. as described hereinbefore

Two (2) index light with scenery stacking batten by 25'0" long

All incidental items required including auxiliary steel connections, and required accessories to provide a properly aligned installation free from defects in workmanship and materials without claim for extra materials even though no specifically listed herein.

## 2.9 TRACK SYSTEMS

Traveler tracks to be complete with 1-1/4" pipe backbone attached with forged steel support clamps on 5'0" centers and have snatch chains on 7'0" centers - all as listed previously including end-stacking links, 1/2" diameter cable center operating line, quick release floor blocks, sag pick-up eyes, etc. Five (5) track systems required.

House curtain - two (2) sections - each 26'6"  
Total 53'0" make to 50'0"

Speaker Curtain - two (2) sections - each 26'6"  
Total 66'0" make to 63'0"

Mid-stage - two (2) sections - each 26'6"  
Total 66'0" make to 63'0"

Rear curtain - two (2) sections - each 26'6"  
Total 53'0" make to 50'0"

All track systems to have single carriers on 1'0" centers.

2.10 FIRE SAFETY CURTAIN  
ONE SECTION BRAIL TYPE

A. Curtain Construction:

1. Curtain shall be in one (1) piece approximately 25'4" high by 47'0" wide to lap proscenium opening 1'-6" at each side. Top and bottom battens shall be as previously specified.
2. Top clamps for support chains shall be hot forged steel, designed to fit around the batten and top pocket with no holes in the curtain other than for two (2) bolts 5/8" diameter each clamp. Bottom clamps for running line connections to be of steel construction designed to permit full contact of yield pad with stage floor.
3. Curtain shall be fabricated from Palmglas or equal fabric (non asbestos) weighing approximately 1.5 pounds per square yard with unbroken vertical strips full height. Sewing shall be double stitched throughout using thread of same or greater strength than yarn of the cloth. Top and bottom shall have double thickness 6" pockets for receiving pipe battens. In addition, side hems to be 6" and bottom of curtain shall have a 3" minimum diameter yield pad packed with non-flammable filler.
4. Each vertical edge of curtain shall contain brass spool guides on 1'6" centers securely held by formed galvanized metal straps attached with a minimum of three (3) stove bolts or rivets each strap. To provide brailing action in raising cycle of curtain, steel "D" rings are to be secured to curtain on 18" vertical centers to coincide with the side guide placement. A vertical row of "D" rings shall be positioned 18" from each vertical edge with seven (7) additional rows equally spaced across the remainder of the curtain width.

B. Operating Equipment:

1. Fire safety curtain rigging shall utilize nine

(9) running lines of 1/4" 7x19 galvanized steel construction. Spacing of running lines to be as listed for the brailing "D" rings. In addition, a work line of 3/8" 7x19 galvanized steel cable is required.

2. Nine (9) single blocks: each block shall carry an 8" diameter heavy duty semi-steel uncored sheave, machine turned and bored. The grooves shall be double depth of the cable diameter and have wide well-rounded throats. Tolerance of grooving for 1/4" cable shall be 1/64" as recommended by cable manufacturer and grooves shall be stub gauged. The machining of the sheaves shall allow the sides of the rim perimeter to vary not more than 1/16" from a fixed plane perpendicular to the true axis of the sheave, and no point of the tread or floor of the groove shall vary concentrically more than 1/16" with the true axis of the sheave. The surface of all grooves shall be smooth and uniform in cross section and free of all irregularities and imperfections. Sheaves shall operate on Timken tapered roller bearings on 9/16" Grade 5 steel shaft which shall have headed end and lock type nut at threaded end with fit of sheave to allow not more than .125" each side between the side plates. Angle bases for loft blocks shall be 2 x 2 x 1/4 and side plates shall be 3/16 steel of sufficient size to accommodate top and side spacers located to prevent cable escaping the groove. A minimum of six (6) spacers shall be incorporated in each block assembly including three (3) at base angles. Spacers to be 3/8 pipe with 3/8" bolts. Loft blocks shall be bolted to auxiliary wall bracket steel with 1/2" bolts.
3. One (1) multiple groove head block for reversing horizontal plane of running lines to cable clew connection. Mule block shall contain 12" diameter semi-steel uncored sheave machine groove with cable grooves for 1/4" cable having well-rounded throats. Cable grooves shall be stub gauged and contain 1/64" tolerance. Sheave shall operate on Timken tapered roller bearings on 1" diameter Stressproof steel shaft and with fit of sheave to allow not more than .125" clearance with side between the side plates. To prevent shaft from turning, it shall be keyed under headed end to one of the side plates forming the block housing. Opposite end of shaft shall be vertical plane. Side plates shall be 1/4" steel of sufficient size to accommodate a

minimum of three (3) 1/2" bolts and pipe spacers so arranged to prevent cable escaping the grooves. Base angles to be 1/2" angles with leg size to be sufficient to support both side plates and arranged to bolt to wall bracket members with total four (4) 3/4" diameter bolts.

4. Nine (9) support chains (extra short link style) shall be attached to auxiliary steel elevation and to top batten. Chain shall be 7/0 welded twist link style and connections shall be made with forged shackles to forged clamps.
5. Winch system for curtain operation to be hand crank operated style designed to accommodate the total curtain and batten weight. A hand brake device shall be incorporated with brake handle controlled by foot treadle linkage to overcome the weight being applied through the fire line mechanism. As an integral part of the winch system a hydraulic speed control device shall be provided to govern the free fall phase of the curtain operation.
6. Cable clew to be steel construction having triple tongue design for spacing connection points of running lines and single tongue opposite side for work line. Tongue stock thickness is to fill a minimum of 80 percent of throat in turnbuckle jaws for load distribution on pin. The clew design shall also incorporate two (2) brass spools arranged for engaging guide wires allowing the clew to operate in a vertical attitude for occupying minimal space between loft blocks. Two (2) No. 9 guide wires shall be anchored to mounting brackets attached to the auxiliary steel wall bracket members and connected by turnbuckles at one end and shackles at the other end.

The vertical clew travel distance shall allow bottom batten travel from the stage floor when curtain is full down to a sufficient distance above the proscenium to be clear of sight line.

7. Auxiliary steel wall brackets for support loft blocks, head block, and mule block to consist of 2 x 2 x 3/8 angle welded and diagonally cross braced with 3" 4.1 channel. Bracket assemblies to be anchored by through wall bolting using four (4) 3/4" bolts or studs and thrust plates on opposite side for each bracket.

### C. Emergency Descent Release System

1. The emergency operation of the curtain shall be made automatic by an electric signal from rate of temperature rise detection devices rated at fifteen (15) to twenty (20) degrees Fahrenheit per minute. Total four (4) approved temperature detection devices rated at fifteen (15) to twenty (20) degrees Fahrenheit per minute. Total four (4) approved temperature detection mechanisms shall be provided of which one (1) shall be at each side of the proscenium opening and two (2) at the top of the proscenium arranged symmetrically to the right and left of the stage centerline. In addition, the descent of the curtain may be manually activated by mechanical releasing devices located one (1) on each side of the proscenium at the stage floor level. Heat detectors by others.
2. A fire line secured by the releasing devices shall be 1/8" 7x19 galvanized aircraft cable fused at six (6) points and shall parallel the vertical edges of the proscenium opening to above rigging height where it shall bend horizontally with necessary deflectors across stage. Fusible links shall not pass through any sheaves. The fire line shall be deaded off at each end in the releasing devices at each side of the proscenium and shall be tensioned by means of any appropriately calculated weight suspended on wall bracketed blocks and designed to accommodate stretch in fire line.

Tension of fire line to be adequate to maintain winch brake arm in closed position and fire line shall be reeved through mule block on winch brake arm to apply force in upward direction. Fire line shall also be reeved through wall-mounted mule blocks to lead fire line from brake arm block through vertical and horizontal transitions to release device.

### D. Smoke Pockets

1. Two (2) smoke pockets fabricated from 12" 20.7 structural channel and 1/4" x 18" HRS plate shall be furnished and installed. Height of each pocket shall be approximately 34'0".
2. Channel shall be arranged with leg inside the pocket and with face plate welded to the up-stage flange and with edge of plate flush with channel

web. Edge of face plate (both on-stage and off-stage) shall be hand smooth.

3. Bottom of each smoke pocket to have 1" diameter round bar dead-off for guide cable with strain transmitted through 3/8" forged turnbuckles to the pocket assembly. Guide cable shall not be attached to wood floor or concrete floor.
4. Location of pockets shall be such as to allow the on-stage edge of the face plate being located approximately 6" off-stage from the proscenium opening and with approximately 1'0" of curtain extending into the pocket.
5. Smoke pockets shall be attached to proscenium wall with 3/8" x 2" flat bar angle brackets welded to the web of the pockets on 3'0" centers having short leg 3-1/2" long and wall leg 10" long. Pockets shall be anchored to the wall by means of 5/8" diameter machine bolts and shields. Lead or plastic type anchoring devices will not be acceptable.
6. Pockets shall be painted dull flat black inside and out and touched up after installation.

## 2.11 STAGE DRAPERY

### A. Sewing and fabrication instructions

All drapery as removed from bolts shall be tabled across an inspection window for detecting weaving flaws and imperfections which shall be cut out and not incorporated in the finished work.

Fabric panels shall run full height of the various sections without horizontal seams and be box pleated at the top in fullness as listed exclusive of turnback facings. Plaits shall be on face side of drapery and reinforced across top with 3-1/2" BFM jute webbing. Webbing shall be sewn on top of drapery with four (4) runs of stitching with dual runs 1-1/2" apart using industrial style sewing machine and no less H30 heavy industrial thread. Grommets shall be so located that no horizontal stitching is cut or severed and shall be located on each plait on approximately 1'0" centers.

Each upper corner of each traveler section shall

have double grommets precisely arranged to fit double chains of master carriers regardless of whether drapery section is used right or left stage.

All lining for stage drapery items shall be attached to face material by adjustable black snap tape 3/4" wide and approximately 10" long, in two (2) 5" sections arranged to be concealed from face side. Tape sections are to be located at approximately 36" spacing at bottom and 10" at sides. Attach tapes to edge of vertical face backs and top of bottom hem with mates attached to edge of lining. Note: lining is not to be sewn to face fabric except across top. Bottom hem of lining for full length drapery items shall be 10" to allow for subsequent shrinkage.

All lining shall contain the same fullness as the face fabric backed and have side hems 2" wide. The finished height of the lining shall be approximately 4" less than the face fabric for remaining concealed from face side.

Bottom edge of both face fabric and lining shall be within one-quarter (1/4) inch parallel with top edge of drapery for true hanging across full width.

Prior to sewing the bottom hem, the otherwise completed drapery sections shall be hung full height to their finished width and allowed to hang unmolested for two (2) weeks minimum after which the bottom shall be scribed and hemmed to the finished height specified.

After the sewing is completed, the drapery shall be folded at the vertical seams in approximately 3'0" wide increments and allowed to lay full length until transported to the installation site for promptly hanging to various tracks and battens.

Operating side of traveler and lag sections shall have heavy canvas pouch with strain relief chains for carrying floor block when drapery is flown.

B. Items and sizes:

1. Front curtain, tormentors, and valance to be made of flameproofed Memorable Velour, in stock color as selected.

3. Side masking legs (four (4) legs) to be made of flameproofed Princess velour in stock color to be selected

Fullness 50% box plaited

Bottom hem 5" deep with No. 8 cadmium plated jack chain weighting in separate pocket inside

3-1/2" jute webbing at top

Brass grommets and plated steel S-hooks on 1'0" centers across top

6" side hems

Finished size each leg 25'0" high by 6'0" wide

4. Three (3) masking borders - each made of flameproofed Princess velour in stock color to be selected

Fullness 50% - box plaited

Bottom hem 3" deep - no chain weighting

3-1/2" BFM jute webbing at top

Brass grommets and cotton tie lines on 1'0" centers across top

2" side hems

Finished size each border 13'0" deep by 50'0" wide

5. Olio, Mid-stage and rear traveler to be made of flameproofed Princess velour in stock color to be selected - in two (2) equal sections

Fullness 50% - box plaited

Bottom hem 5" deep with No. 8 cadmium plated jack chain weighting in separate pocket inside hem

3-1/2" jute webbing at top



contact between floor and masking frame.

3. Masking frames shall be 2'0" wide around entire frame perimeter and be attached to the frame with outriggers and clamps and with all connections and bolt heads concealed without any distortion to frame covering. The masking frames are to be made from 1 x 3 clear straight pine using corner block and keystones. The top and bottom masking frames to run full screen width plus the side frame overhand with the side frames tight fitting between. Frames shall be covered taut and wrinkle free with black flameproofed Memorable Velour return tacked all around and with flat surface throughout free from projection and seams. There shall be only four (4) interruptions in the velour surface, these being at joining points of the vertical and horizontal frames. The inside edge of the masking frames shall overlap the white surface 1/2" all around and the clamping of the masking frames to the screen frame shall allow not more than 1" space maximum.
4. The landing pad supports shall be not less than 5/8" diameter threaded rod with adjustment and locking potential arranged without distorting and masking frames. The top hanging supports shall likewise be arranged to prevent distortion of the top masking frames.

#### HEMP SET EQUIPMENT

2.13

- A. Head blocks shall carry five (5) 8" diameter semi-steel uncored sheaves machine turned and bored. Each sheave shall contain one (1) lathe cut groove for 5/8" diameter manila with 1/16" width tolerance and sufficient depth to prevent manila line extending beyond rim perimeter. Steel center shaft shall be 1/2" diameter and have oilite bushing. Angle bases for head blocks shall be 1-1/2" x 2-1/2" x 3/16" and side plates and separators shall be 10 gauge of sufficient size to accommodate top and side spacers. A minimum of six (6) spacers shall be incorporated in each block assembly including three (3) at base angles. Bases

to be provided with 3/8" bolts and steel clips for attaching to rope set head block well. In addition, two (2) steel clips with J-bolts shall be provided for clamping to gridiron floor channels when required.

Five (5) head blocks required.

- B. Loft blocks shall carry 8" diameter semi-steel uncored sheaves machine turned and bored. Machining, center shaft, bushing, side plates, base angles, and connections shall be as described above for head blocks.

Twenty-five (25) loft blocks required.

- C. Sand bag trim clamps shall be five (5) line style with threaded adjustments and provisions for attaching sand bag snap hook.

Total five (5) required.

- D. Wood belaying pins to be 21" overall length with 1-1/8" diameter shank and shaped top with 1-1/2" diameter at the shoulder.

Total ten (10) required.

- E. Manila to be 5/8" diameter premium quality.

Total required two (2) 1,200 foot coil.

- F. Sand bags to be No. 4 Army Duck reinforced with 3/8" diameter rope with long splice to join two (2) ends forming saddle at 90 degree increments around the bag. Each bag to have heavy duty steel hook with large eye and keeper at one end and eye at other end.

Five (5) 50 pound sand bags.

Five (5) 100 pound sand bags.