



THE UNIVERSITY
of
WISCONSIN
MADISON

Department of Theatre & Drama
Scenic Studio Standards

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I. STANDARD WOOD FLAT CONSTRUCTION

A. Frame

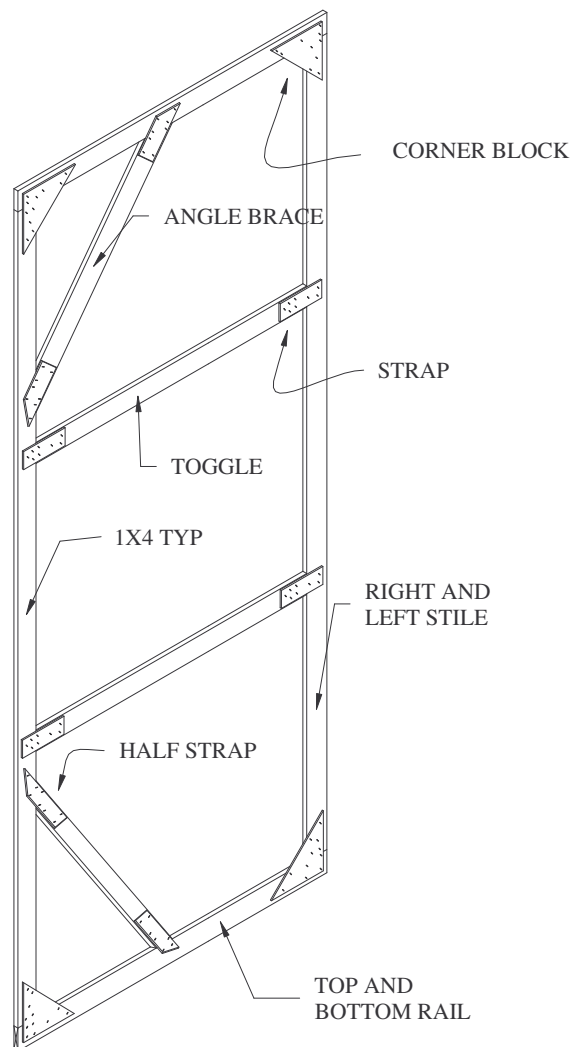
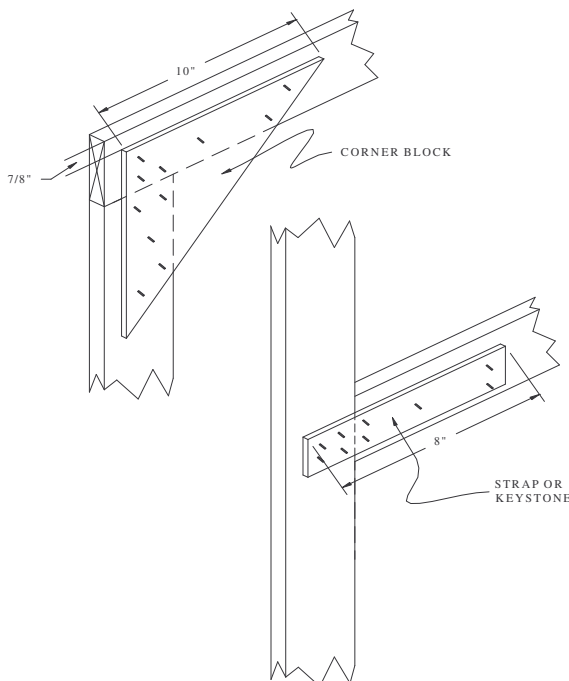
1. FRAMING MEMBERS TO BE 1X3 OR 1X4 #2 PINE ON FACE, JOINED WITH $\frac{1}{4}$ " PLYWOOD GUSSETS, WOOD GLUE AND PNEUMATIC STAPLES.
2. LOCATE TOGGLES 4' -0" O.C., BEGINNING FROM BOTTOM OF UNIT. ADD ADDITIONAL TOGGLES AS REQUIRED FOR SHOW.
3. USE LIGHT WEIGHT MATERIALS SUCH AS PINE OR POPLAR FOR FRAME.

B. Braces

1. BRACE ALL FLATS 4' -0" OR WIDER AT TOP AND BOTTOM.
2. ATTACH AT A 45 DEGREE ANGLE.
3. RUN TO CENTERLINE OF RAIL.
4. ATTACH BOTH BRACES TO SAME STILE.
5. AVOID LARGE PIECES OF $\frac{3}{4}$ " PLY OR OSB WHEN CREATING PROFILES.
6. REDUCE WEIGHT BY CUTTING HOLES IN SOLID PIECES, LEAVING A PERIMETER OF 2 $\frac{1}{2}$ " OF MATERIAL.

C. Squariness

1. CHECK FLAT FOR DIMENSIONS AND SQUARENESS BEFORE ATTACHING GUSSETS.
2. USE THE 3/4/5 RULE TO CHECK FOR SQUARE OF LARGER FLATS.
 - a) NOTE: See Appendix B for flat construction procedure.



D. Gussets

1. TYPES AND SIZES
 - a) Standard material is $\frac{1}{4}$ " AC ply.
 - b) Keystones should measure 2 $\frac{3}{8}$ " x 8".
 - c) Corner Blocks: 10" leg.
 - d) See Appendix A for cutting procedure.
 - e) Do not glue unless flat is a stock unit.
2. ATTACH WITH $\frac{7}{8}$ " WIDE-CROWN STAPLES WITH $\frac{5}{8}$ " LEG.
3. USE STAPLE PATTERNS SHOWN, WITH STAPLES PERPENDICULAR TO GUSSET GRAIN.

4. OBSERVE $\frac{7}{8}$ " KEEPBACK ON ALL GUSSETS FOR SOFT-COVERED FLATS; $1 \frac{1}{8}$ " IF HARD-COVERED.

E. Stiffening

1. USE 1 X 4 PINE - AVOID WARPED OR TWISTED LUMBER.
2. ATTACH WITH L-BRACKETS OR BACK-FLAP HINGES, USING PAN-HEAD SCREWS (NOT FLAT-HEAD). ALTERNATE HARDWARE FROM ONE SIDE OF STIFFENER TO THE OTHER, TO KEEP IT PERPENDICULAR TO THE FLAT.
3. JOIN STIFFENER TO EACH FRAMING MEMBER CROSSED.
4. VERTICAL STIFFENERS:
 - a) Run full height of flat, attaching to both rails, but maintain a 1" keepback from the top and bottom edges.
 - b) One stiffener required for up to 4' wide flat, 2 for 6' flats. For wider flats, use vertical stiffeners with horizontal stiffeners in-between.
 - c) When using one stiffener, locate it approximately at the centerline of the flat; when using two, locate approximately 1' from each side.
5. HORIZONTAL STIFFENERS:
 - a) First two within 1' of top and bottom of flat. Use additional ones as needed to maintain 8-10' spacing.
 - b) Attach to both vertical stiffeners and to flat frame.

F. Covering

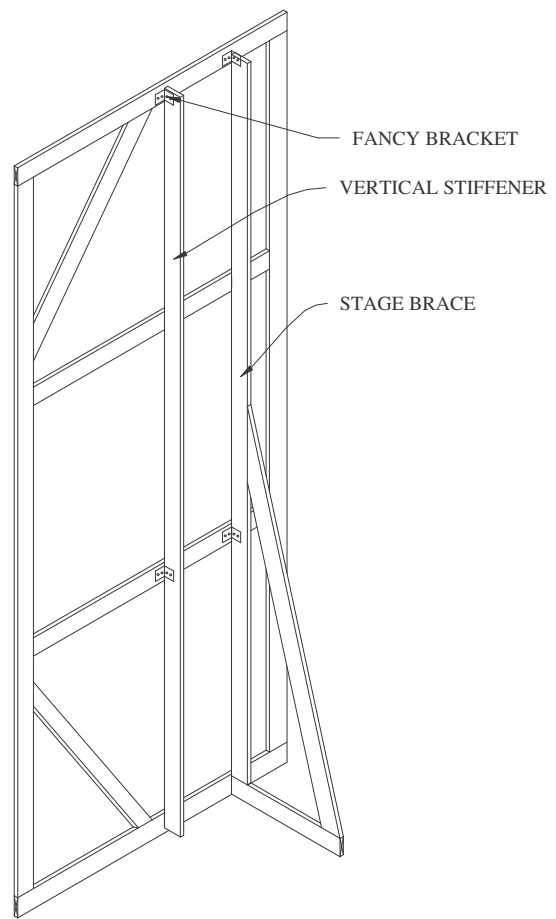
1. STANDARD COVER IS #140 UNBLEACHED NATURAL-COLOR MUSLIN, 81" WIDE.
2. FOR WIDER FLATS, SEW PIECES TOGETHER, USING A 1" ALLOWANCE FLAT SEAM.
3. GLUE MUSLIN TO THE PERIMETER FRAME MEMBERS ONLY (INCLUDED ARE WINDOW, DOOR AND SIMILAR OPENINGS) WITH TEN PARTS WHITE GLUE TO ONE PART WATER.
4. USING A SHARP UTILITY (MATT) KNIFE, TRIM OFF THE EXCESS FABRIC BY CUTTING THE MUSLIN $\frac{1}{8}$ " BACK FROM EDGE (CUT SLIGHTLY INTO LUMBER).
 - a) NOTE: See Appendix C for covering procedure.

G. An alternative covering method

1. WRAP THE MATERIAL AROUND THE FRAME, STAPLING IT TO THE BACK SURFACE.
2. USE THIS METHOD ONLY WHEN THE FLAT WILL NOT BE MOVED (DRAGGED) DURING THE RUN OF A SHOW SINCE THE BOTTOM EDGE WILL FRAY.
3. NO TRIMMING IS REQUIRED, BUT PREPARATION IS IDENTICAL TO SECTION H BELOW.

H. Sizing and Flame-proofing

1. SIZE FRONT SURFACE WITH A STARCH SOLUTION (SEE PECKTAL), NOT REQUIRED

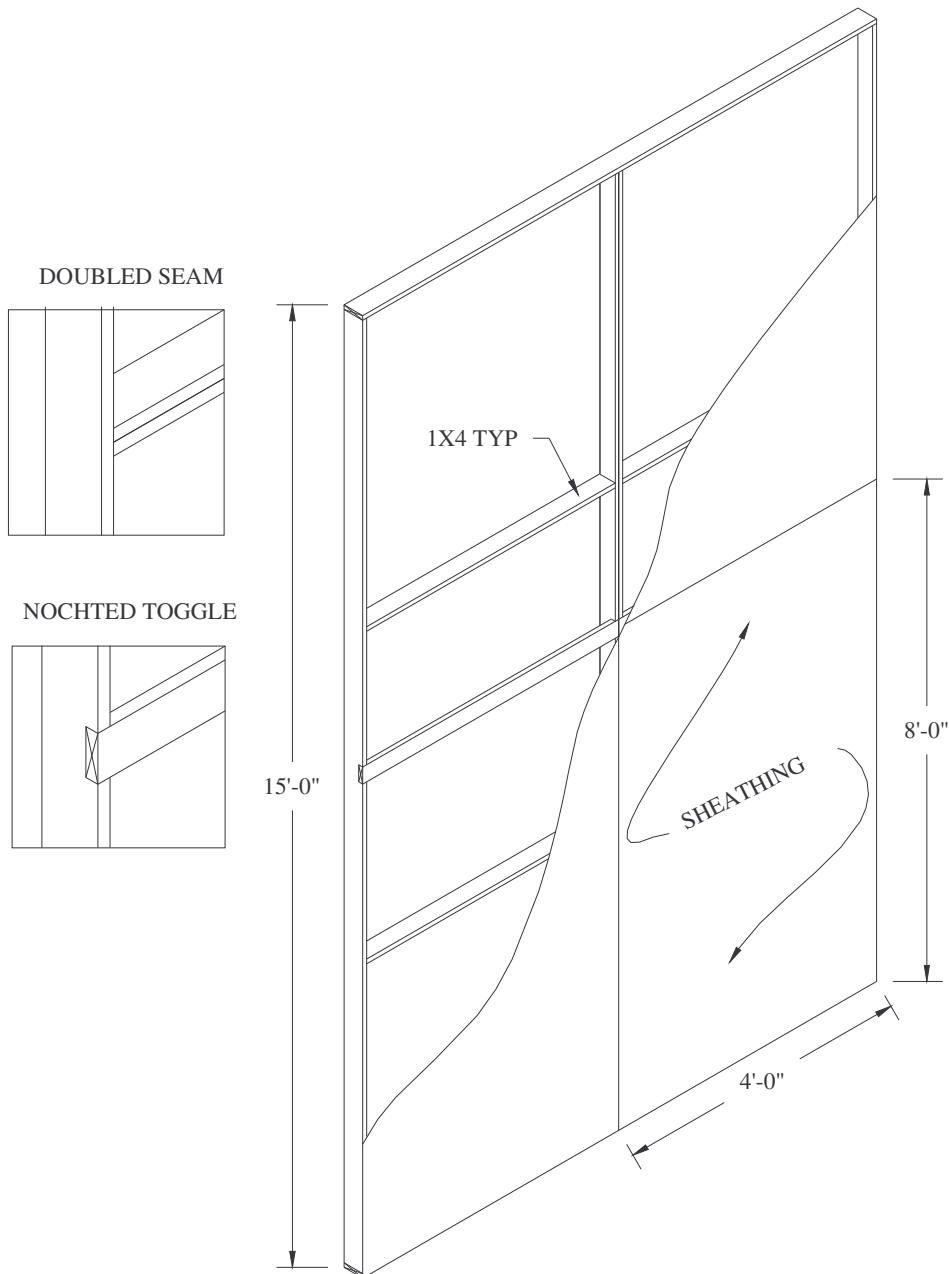


WHEN USING LATEX PAINTS.

2. FLAMEPROOF REAR SIDE OF FLAT USING "STANDARD" SHOP FLAMEPROOFING COMPOUND, COVERING BOTH FABRIC AND LUMBER. MIX FLAME RETARDANT INTO BACKPAINT. NOTE: SEE SECTION VI FOR FLAME RETARDANT INFORMATION.
3. SIZE AND FLAMEPROOF WITH A TWO-PERSON CREW USING THE AIRLESS SPRAY GUN AND BRUSHING THE SOLUTION INTO THE SURFACE. ALLOW TIME FOR COMPLETE DRYING BETWEEN COATS.

I. Storage

1. STORE UN-STIFFENED FLATS PROPERLY TO AVOID WARPAGE: UNITS GO FACE-TO-FACE AND BACK-TO-BACK WITH THE LONGEST EDGE ON THE DECK.
2. KEEP THE STACK AS VERTICAL AS POSSIBLE.



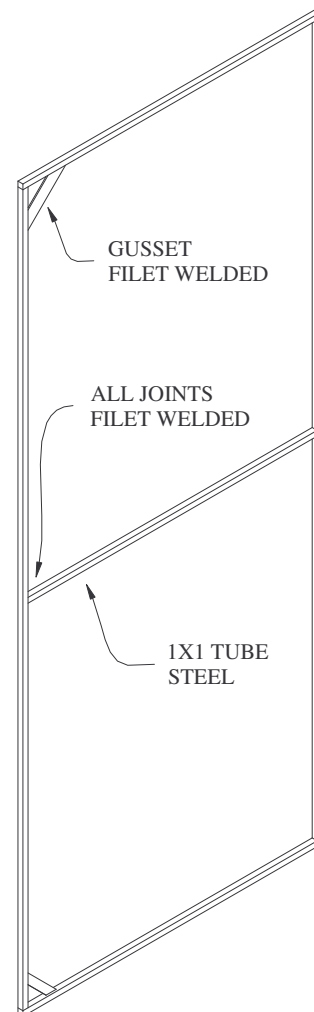
II. ALTERNATIVE FLAT CONSTRUCTION

A. Hollywood or TV Style Flats

1. THE FRAME IS TYPICALLY 1 X 3 OR 1 X 4 ON EDGE, JOINED WITH EITHER 8D COATED NAILS OR 2" DRYWALL SCREWS.
2. THE COVER IS TYPICALLY A THIN PANEL MATERIAL SUCH AS LAUAN OR MASONITE.
3. FASTEN THE COVER USING:
 - a) For 1/4" cover, use 7/8" wide/narrow staples, flush with surface.
 - b) For 1/8" fabric covered material, use glue and 4d box nails or 1/2" "hand" staples driven with the air tacker.
 - c) For 1/8" material without a fabric cover, use glue and 5/8" narrow staples. Staples must not go completely through cover material.
 - d) Support panel joints by:
 - (1) For vertical seams, center the joint on a doubles framing member (sketch #1).
 - (2) For horizontal seams, use a 1 x 3, face up, notched into and flush with the vertical frame members (sketch #2).
 - (3) Use the covering material to square the flat corners. Attach the cover first to one side, and then flush the frame to the adjacent side of the panel. Repeat for remaining pieces. Works best with the flat laid on the floor or a framing table (saw horses are flimsy).
 - (a) Preferred method is same as for standard wood flat. NOTE: See Section I, D and Appendix C.
 - (b) When production needs dictate, glue entire surface. NOTE: See Appendix D.

B. Metal Flats

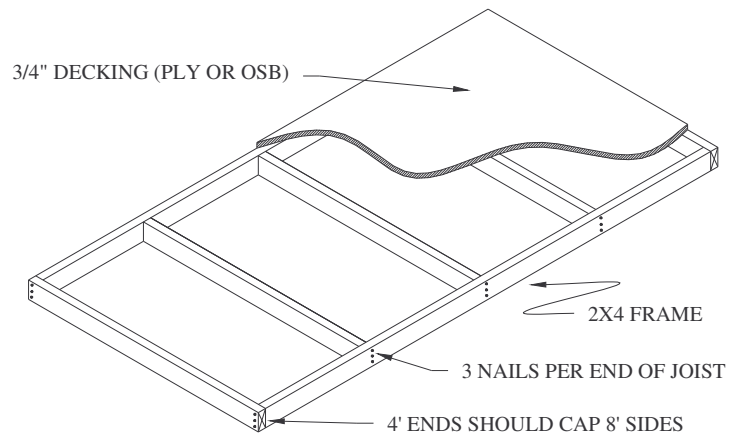
1. DRILL ALL HOLES REQUIRED FOR JOINERY, BRACES, ETC. BEFORE WELDING.
2. USE 1 X 1 TUBE STEEL OR ALUMINUM, WELDED ACCORDING TO DRAWINGS. AVOID FACE WELDS, BUT IF NECESSARY, GRIND THE WELD FLUSH.
3. PREFERRED ADHESIVE FOR COVERING IS 3M NF-30 CONTACT CEMENT; SECOND CHOICE IS 3M SPRAY 77, IF ADEQUATE VENTILATION EXISTS. GLUE ONE END, THEN THE OPPOSITE END, THEN ONE SIDE, AND THEN THE OTHER.



III. STANDARD FRAMED WOOD PLATFORM CONSTRUCTION

A. Frames

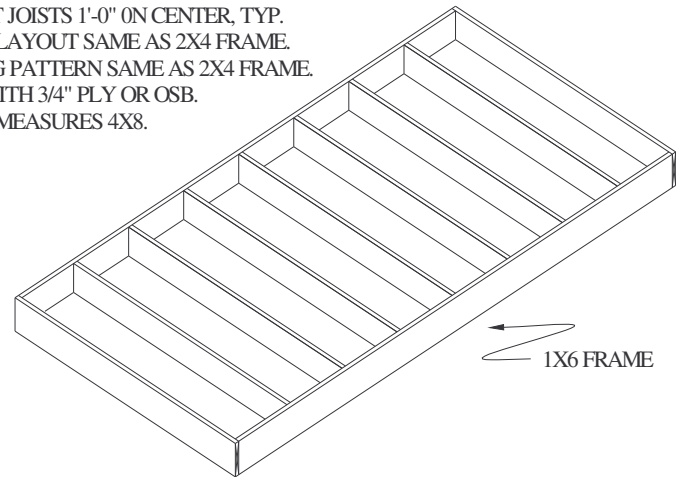
1. USE 2 x 4 SPF (SPRUCE/PINE/FIR) FOR MOST STOCK AND/OR SHOW USES.
2. AT CORNER JOINTS, SHORT FRAME MEMBERS SHOULD OVERLAP LONG PIECE (DWG).
3. 1 x 6 OR 1 x 4 PINE IS AN ACCEPTABLE FRAME TO REDUCE WEIGHT, BUT
 - a) Reinforce all joints with nail blocks or steel brackets.
 - b) Nail block length is equal to the depth of the platform frame and oriented with the end-grain flush to the underside of the deck.
4. FASTENERS
 - a) Join 2 x 4 with 12d common nails, or 3" DWS (or square-drive).
 - b) Join 1 x 6 or 1 x 4 frames with 8d coated nails.
 - c) Use 3 fasteners per joint; blunt nail tips to avoid splits.
 - d) Do not use glue, so pieces can be replaced when damaged.



B. Deck

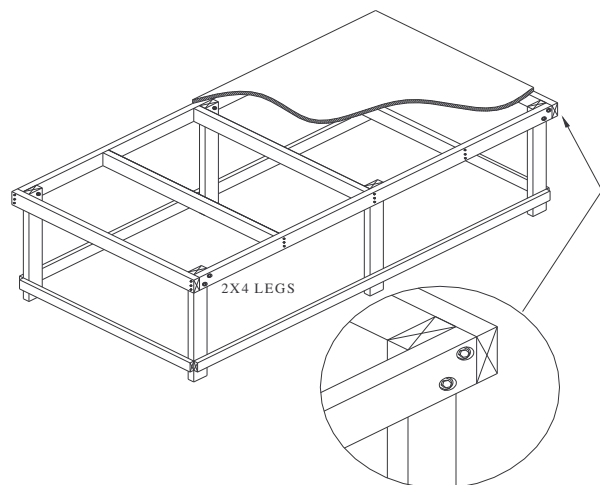
1. STANDARD MATERIAL IS SQUARE-EDGE 3/4" OSB.
2. FASTENERS: USE EITHER
 - a) 8d coated nails 6" o.c. along perimeter and 9" o.c. to interior framing or
 - b) 2" DWS (drywall screws) 9" o.c. along perimeter and 12" o.c. interior. Square drive screws use the DWS pattern.
3. DO NOT GLUE DECK TO FRAME FOR STOCK UNITS.
4. GLUE DECK OF SHOW UNITS ONLY IF ABSOLUTELY NECESSARY.

LAYOUT JOISTS 1'-0" ON CENTER, TYP.
FRAME LAYOUT SAME AS 2X4 FRAME.
NAILING PATTERN SAME AS 2X4 FRAME.
DECK WITH 3/4" PLY OR OSB.
FRAME MEASURES 4X8.



C. Legs

1. MAXIMUM LEG SPACING IS 4' FOR 2 x 4 AND 1 x 6 FRAMED PLATFORMS. FOR 1 x 4 FRAMED UNITS, SPACING LIMIT IS REDUCED TO 2'.
2. TYPICAL LEG IS 2 x 4, BUT 1 x 3 OR 1 x 4 IS ACCEPTABLE IF PROPERLY BRACED. ALSO ALLOWED ARE 1 x 3 AND 1 x 4 "L" LEGS, AND 2 x 4 COMPRESSION LEGS. USE A 4 x 4, OR A DOUBLED 2 x 4 WHEN MINIMAL OR NO BRACING IS ALLOWED.



3. FASTENERS

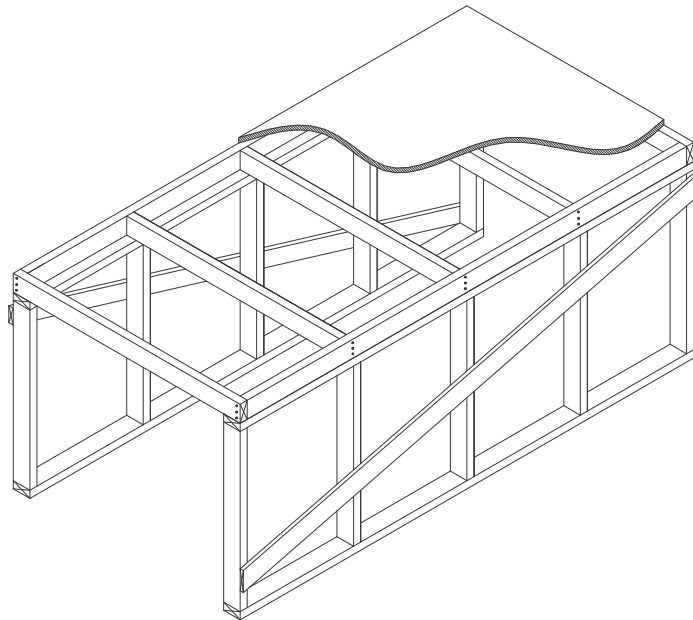
- a) For 2 x 4 framed platforms, attach legs with 2 countersunk $\frac{3}{8}$ " dia. machine (hex) bolts, with washers on both ends. Bolts should be on a diagonal pattern. Countersink with 1 $\frac{1}{8}$ " paddle bit first, then drill a $\frac{7}{16}$ " hole for bolt shank.
- b) For 1 x 6 or 1 x 4 frame, use 3, $\frac{1}{4}$ " FHSB; do not use countersunk hex bolts.
- c) 1 x 3 or 1 x 4 legs up to 16" tall may be either screwed (1 $\frac{1}{4}$ " DWS) or stapled (1 $\frac{1}{2}$ " wide) into the frame using 3-4 fasteners per leg.
- d) Avoid using carriage bolts if possible, but always use torque washers whenever using a carriage bolt.
- e) Screw "L" legs to frame; attach small thickness piece to the piece with greater thickness.
- f) Compression leg requires plywood gusset at least 10" long except when platform is less than 10" tall.

D. Stud Wall Legging System

1. USE 2 X 4 STUDS WITH SINGLE 2 X 4 TOP AND BOTTOM PLATES.
2. LOADING REQUIREMENTS GENERALLY DICTATE STUDS PLACED ON 2' -0" CENTERS. DO NOT EXCEED 3' -0" BETWEEN STUDS.
3. STUDS AND PLATES ARE JOINED WITH MINIMUM 2, 12D COMMON OR AIR NAILS PER JOINT.
4. FOR RIGIDITY, USE $\frac{1}{2}$ " OR $\frac{3}{4}$ " PLY GUSSETS AT THE CORNERS AND APPROXIMATELY EVERY 10', SCREWED TO THE STUD AND PLATE ON THE FACE OF THE STUD WALL. USE 2" DRYWALL OR SQUARE DRIVE SCREWS.
5. DIAGONAL BRACING IS NORMALLY REQUIRED FOR BOTH SINGLE WALL BRACING OR BRACING A SERIES OF FRAMES. USE 1 X 3 OR 1 X 4.
6. TO JOIN A PLATFORM TO A STUD WALL, LAG ($\frac{1}{4}$ " X 3") OR SCREW (3" DWS) THE TOP PLATE OF STUD WALL INTO THE UNDERSIDE OF THE PLATFORM FRAME.
7. TO FASTEN THE BOTTOM PLATE TO FLOOR, USE 10D DOUBLE-HEAD NAILS OR 3" DWS.

E. Bracing

1. USE 1 X 3 OR 2 X 4 FOR BRACING AND RIBBONS DEPENDING ON FACING REQUIREMENTS. 1 X 3 PROVIDES ADEQUATE STRENGTH.
2. RIBBONS RUN AROUND THE PLATFORM LEGS AT APPROXIMATELY 2" ABOVE THE BOTTOM OF THE LEG. ALSO JOIN MIDDLE LEGS WITH RIBBONS. IDEALLY EACH LEG IS BRACED IN TWO DIRECTIONS.
3. NO BRACING IS REQUIRED FOR PLATFORMS UP TO 18" IN HEIGHT. RIBBON ALL LEGS GREATER THAN 18" HIGH; WHEN OVER 30", ADD CROSS BRACING.
4. ATTACH BRACING WITH PROPER SIZED DOUBLE-HEAD NAILS OR 2-3" DWS TO PERMIT EASY DISASSEMBLY. FASTENERS MUST NOT



INTERFERE WITH FACING. DO NOT STAPLE.

5. WHEN SEVERAL PLATFORMS ARE CONNECTED, RIBBONS AND BRACING MAY SPAN SEVERAL PLATFORMS, EACH PLATFORM NEED NOT BE DONE INDIVIDUALLY.
6. ATTACHING EACH LEG TO THE STAGE FLOOR REDUCES THE NEED FOR RIBBONS, DEPENDING ON THE LOADING CHARACTERISTICS OF THE SHOW.
7. WHEN PLATFORMING EXTENDS WALL TO WALL (I.E. THE HEMSLEY), RIBBONS ARE NOT REQUIRED.

F. Joining Platforms

1. USE $\frac{1}{8}$ " ETHAFOAM SHEET BETWEEN WOOD PLATFORMS TO PREVENT SQUEAKS. LIGHTLY STAPLE THE ETHAFOAM TO ONE PLATFORM. WOOD/METAL JOINTS ALSO NEED ETHAFOAM, BUT JOINTS BETWEEN TWO METAL PLATFORMS.
2. CLAMPING PLATFORMS
 - a) Use c-clamps or $\frac{3}{8}$ " hex bolts; spacing is the same.
 - b) Use 2 for a 4' joint, three per 8'. Tape clamp handles so they don't rattle as people walk on the stage. Fold over the end of the tape to provide a "handle" with which to take it off.
 - c) The surface of adjoining platforms must be flush. Adjust leg height or use shims under legs to accomplish this.

G. Facing

1. USE $\frac{1}{4}$ " AC PLY, MASONITE OR LUAN SECURED TO THE PLATFORM FRAME AT THE TOP AND TO NAILING STRIPS ALONG THE FLOOR (OR RIBBONS, IF USED). CORNER AND BUTT JOINTS BETWEEN ADJOINING PIECES OF FACING MUST BE SUPPORTED BEHIND WITH A NAILING BLOCK.
2. FACING SHOULD BE FLUSH WITH THE FLOOR AND +/- $\frac{1}{16}$ " BELOW THE TOP SURFACE. THIS WILL ALLOW FOR IRREGULARITIES IN THE STAGE.
3. TO PREVENT BREAKAGE OF THE FACING WHEN PEOPLE STEP OFF THE PLATFORM, EITHER:
 - a) Chamfer the top of the facing material (15-45 degrees), or
 - b) Install facing flush and square to top of platform, then put surface layer of masonite (or other material) over facing.
 - c) Use edge (or nosing) molding at the edge of the stage.

H. Railings

1. STANDARD HEIGHT IS 3'-0" FOR ALL HORIZONTAL SURFACES; 32" ON STAIRS (MEASURED AT FRONT OF STEP).
2. USE 1" SQUARE STEEL TUBE, 2 X 3 OR 2 X 4, UNLESS SPECIFIED OTHERWISE BY DESIGN DRAWINGS.
3. RAILINGS MUST BE SOLID, WELL BRACED, AND SMOOTH. GRIND OR SAND AWAY ANY SPLINTERS OR BURRS. NOTE: SEE SECTION V,F FOR SUGGESTED RAILING.

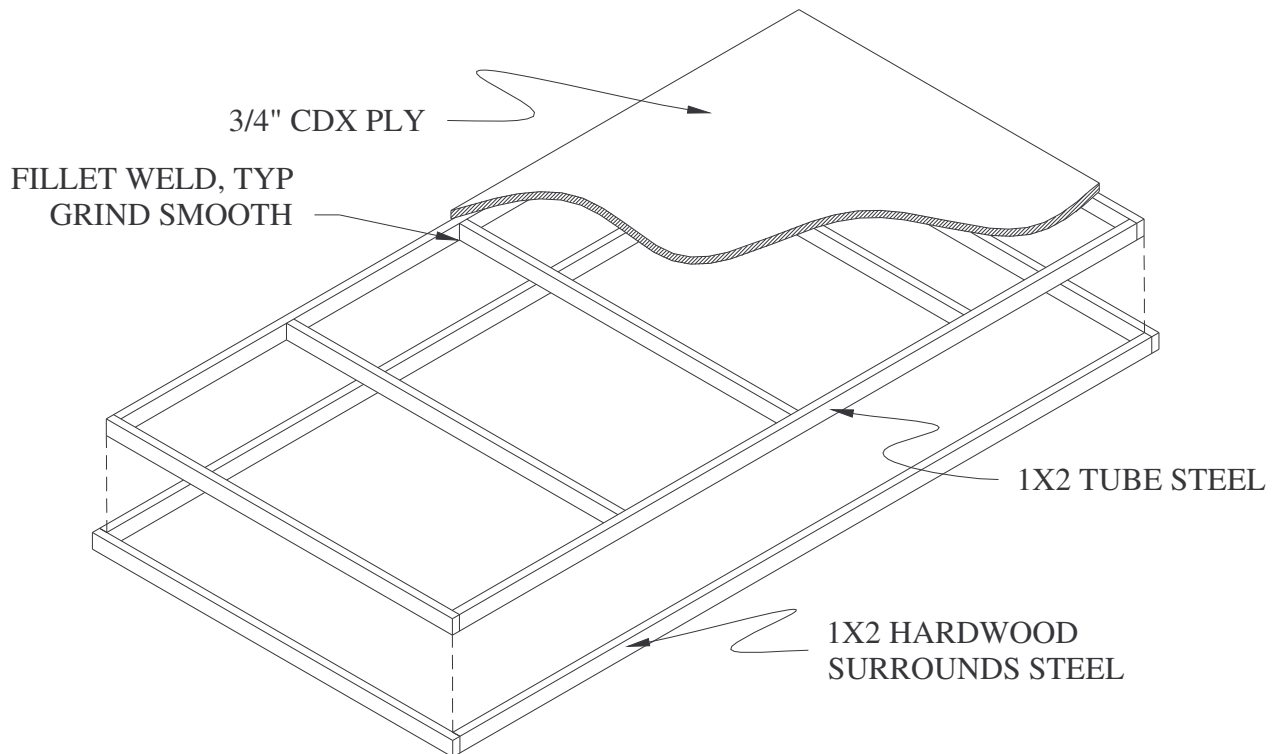
I. Soundproofing

1. TWO EFFECTIVE METHODS ARE:
 - a) Use a sheet of $\frac{1}{2}$ " sound insulation board between the frame and the deck. Increase deck fastener length: nail size to 10d; screw size to 3" DWS.
 - b) Top the platform with a 2nd deck of $\frac{5}{8}$ " or $\frac{3}{4}$ " particleboard or MDF (Medium Density Fiberboard). The extra weight is effective.
2. AVOID USING FIBERGLASS AND OTHER IRRITATING AND FLAMMABLE MATERIALS.
3. USE A STRIP OF $\frac{1}{8}$ " ETHAFOAM BETWEEN PLATFORMS TO INHIBIT SQUEAKING.

IV. ALTERNATIVE PLATFORM CONSTRUCTION

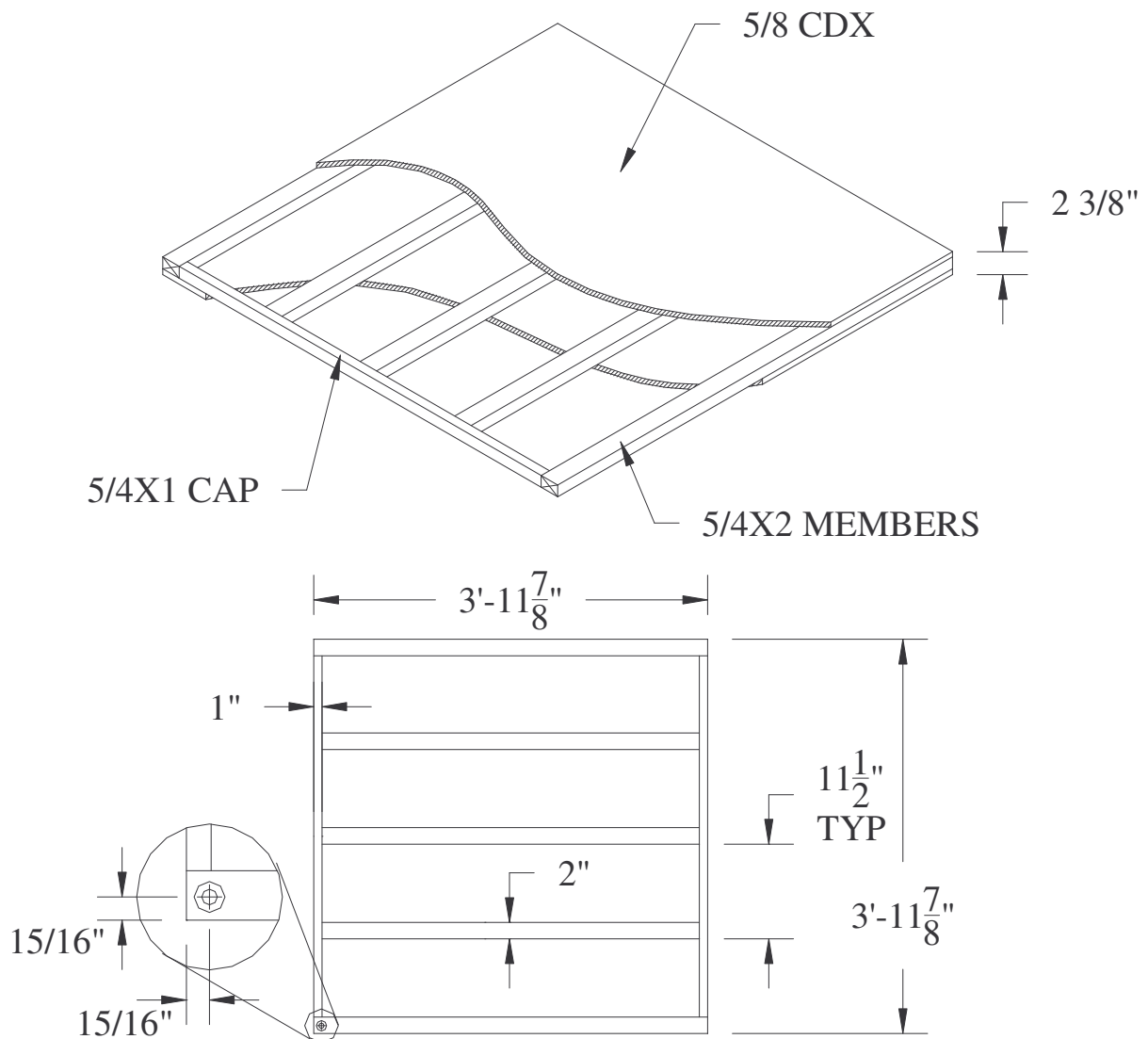
A. Metal-framed Platforms

1. FRAME SHALL BE 1" X 2" 16 GA. TUBE STEEL (2" DIMENSION VERTICAL) OR 1/8" X 2" X 2" ANGLE IRON (OR EQUIVALENT).
2. STOCK UNITS ARE TO MATCH SPECIFICATIONS OF "4010" PLATFORMS REGARDING JOINERY, LEG SOCKETS, ROTOLOCKS, WOOD EDGING AND DECK ATTACHMENT AND CORNER PROTECTION.
3. SHOW UNITS MUST HAVE AT LEAST TWO FACES OF EACH PIECE OF STEEL WELDED.
4. FRAMING SPACING MUST NOT EXCEED A 2' X 4' MODULE TO PROPERLY SUPPORT A 3/4" THICK DECK.
5. DECK SHOULD BE ATTACHED WITH PLY-METAL TEK SCREWS, 9" OC FOR THE PERIMETER, 12" O.C. INTERIOR.
6. FOR 1" X 1" TUBE STEEL LEGS, MINIMUM WALL THICKNESS IS 16 GA.
7. 1" X 1" LEGS MUST USE STOCK PLATFORM FEET, WHICH TYPICALLY ARE ANCHORED INTO THE DECK BELOW WITH AT LEAST ONE SCREW PER LEG.
8. ALL STANDARDS FOR BRACING IN SECTION III. E., APPLY TO METAL PLATFORMS.



B. Triscuit Platform Construction

1. STRESS SKIN CONSTRUCTION THAT TYPICALLY USES $\frac{5}{8}$ " CDX PLY SKINS TOP AND BOTTOM WITH $\frac{5}{4}$ X 2" (ON FACE) FRAME SANDWICHED IN-BETWEEN FOR AN OVERALL $2 \frac{3}{8}$ " HEIGHT.
2. STANDARD FRAMING PATTERN AND DIMENSIONS ARE SHOWN IN FIGURE.
3. SHOW PLATFORMS CAN BE OF VARYING COMBINATIONS OF MATERIALS AND DIMENSIONS PROVIDED THE $2 \frac{3}{8}$ " HEIGHT IS MAINTAINED, AND THE SKINS ARE SUPPORTED ON 12" CENTERS.
4. GLUE ALL CONTACTING SURFACES GENEROUSLY, USING A BRUSH OR APPLICATOR; FASTEN WITH $1 \frac{1}{2}$ " WIDE STAPLES 6" O.C., AND ALLOW TO DRY FOR 48 HOURS WHILE FULLY WEIGHTED.
5. STACK UNITS WHILE DRYING. PLACE 6, 5-GALLON PAILS ON STOP OF THE STACK, EACH PAIL FILLED $\frac{3}{4}$ FULL WITH SAND.

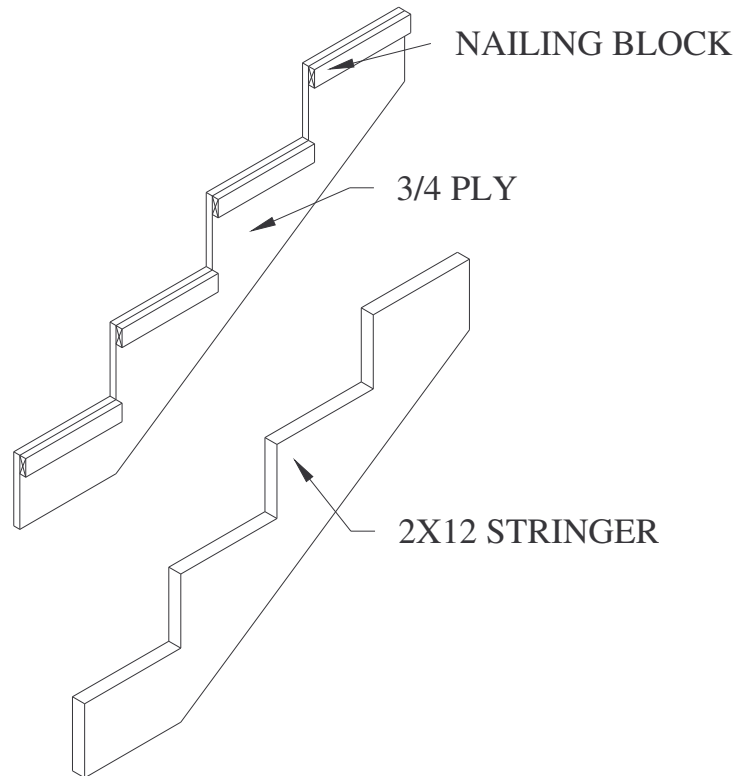


V. STAIR CONSTRUCTION

Unless specified otherwise by design dwgs, construct as follows:

A. Stringers

1. 24" O.C. MAXIMUM SPACING UNLESS RISE IS STRUCTURAL. **SEE SECTION V.D.**
2. USE 3/4" AC PLY (OSB IS NOT ACCEPTABLE) WITH 1 X 2 NAILING BLOCKS ON THE INSIDE FACE (AVOID 1 X 12 AND 2 X 12). GLUE ALL SURFACES. STAPLE STRIPES WITH 1 1/4" NARROW STAPLES. SEE FIGURE ON RIGHT.
3. FOR 2-3 STEP UNITS, STRINGERS SHOULD BE CUT FROM SOLID PIECE OF PLY (I.E. STRINGER ALSO FORMS LEG) PICTURED BELOW.
4. UNITS HAVING FOUR OR MORE STEPS SHOULD BE CUT FROM A 1'-0" PLYWOOD STRIP UNLESS THE TREAD/RISER COMBINATION REQUIRES A WIDER STRINGER.



B. Treads

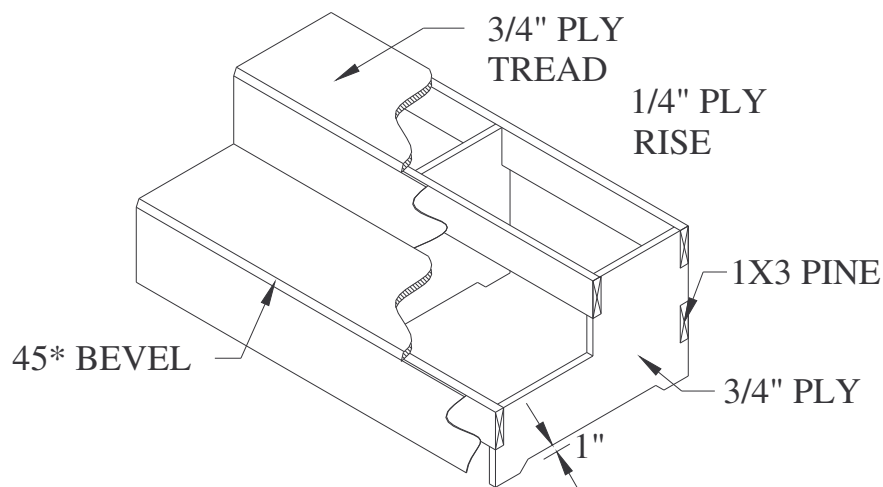
1. USE SINGLE OR DOUBLE THICKNESS OF 3/4" PLYWOOD OR OSB.
2. NAIL INTO BLOCKS WITH 6D-8D COATED NAILS OR 2"-3" DWS. GLUE ALL SURFACES.

C. Legs/Bracing

1. USE 1 X 4 OR 2 X 4 LEGS BOLTED IN A DIAGONAL PATTERN, SECTION III.C.3.
2. LEGS HIGHER THAN 1'6" MUST BE RIBBONED TO EACH OTHER AND TO THE LOWER END OF THE STRINGER. LEGS HIGHER THAN 3'0" SHOULD HAVE DIAGONAL BRACES PLUS THE RIBBON.
3. FASTEN BRACING/RIBBONS WITH DWS OR DOUBLEHEAD NAILS.

D. Riser Facings

1. USE 1/4" AC PLYWOOD FOR RISER. THESE SPECIFICATIONS APPLY TO BOTH INDEPENDENT AND



DEPENDENT STAIRS.

2. IF RISER IS 1X OR $\frac{1}{2}$ " - $\frac{3}{4}$ " PLYWOOD, STRINGER SPACING CAN BE EXPANDED TO 3'0".
3. FACING SPECIFICATIONS IN THE SECTION ON PLATFORMING FACING APPLY HERE AS WELL.
4. OBSERVE STRINGER CUTOUTS AS SHOWN IN BOTH ILLUSTRATIONS ABOVE, PARTICULARLY WITH REGARD TO HOW 1 X 3 IS LET INTO STRINGER.

E. Railings for escape stairs

1. RAILING HEIGHT IS 32", MEASURED AT FRONT OF STEP.
2. USE 2 X 3, 2 X 4 OR 1" SQUARE STEEL TUBE FOR BOTH POSTS AND RAILING.
3. THE POST IS ATTACHED TO THE STRINGER WITH TWO HEX BOLTS WITH WASHERS BOTH ENDS OR OTHER EQUALLY SECURE METHOD.
4. THE RAILING IS ATTACHED TO THE POST AS SHOWN ABOVE RIGHT, USING 2, 3" DWS SUNK $\frac{1}{8}$ " BELOW THE SURFACE, ITS TOP SURFACE CONTINUOUS, ROUNDED AND SANDED SMOOTH.

VI. FLAME-RETARDING PROCEDURES

A. Cellulose-based material (wood, paper, muslin, etc.)

1. USE STANDARD COMPOUND, SPARTAN 742, USING THIS FORMULA: DILUTE 1 PART SOLUTION TO 3 PARTS WATER AND/OR PAINT.
2. MIX FLAME-RETARDANT INTO BACK PAINTS. TREAT BOTH FABRIC AND WOOD WITH SOLUTION. THIS INCLUDES PLATFORMS AND LEGGING SYSTEMS.

B. None-cellulose materials

1. RAW STYROFOAM AND BEADBOARD SHOULD BE TREATED WITH A MIXTURE OF FLEX GLUE AND POTTERS CLAY, MIXED APPROXIMATELY TWO PARTS GLUE TO ONE PART CLAY. APPLY IN THIN COATS TO AVOID CRACKING. 2-3 COATS ARE REQUIRED. USE GLUE RATHER THAN WATER TO THIN SOLUTION.
2. STYROFOAM AND BEADBOARD COVERED WITH CHEESECLOTH DO NOT NEED GLUE/CLAY MIXTURE. USE FLAM-RETARDANT IN PAINT.

C. Synthetic fabrics

1. TREAT WITH FLAMORT CP. DILUTE NO MORE THAN 1:1 WITH WATER.

VII. DROP AND SCRIM CONSTRUCTION

A. Top edge

1. 3 1/2" JUTE WEBBING, SEWN TO REAR OF HEMMED FABRIC. #3 GROMMETS AT CORNERS AND 12" OC. CL OF GROMMETS 1" FROM TOP OF DROP, OR
2. DOUBLE 1 X 3 OR 1 X 4 BATTEN, STRAIGHT LUMBER! STAPLE FABRIC TO FIRST BATTEN, SCREW 2ND TO 1ST WITH 1 1/4" DWS. DRILL 7/8" DIAM. HOLES EVERY 8-10' FOR PICKS. LOCATE HOLES IN THE MIDDLE OF THE BATTEN.

B. Sides

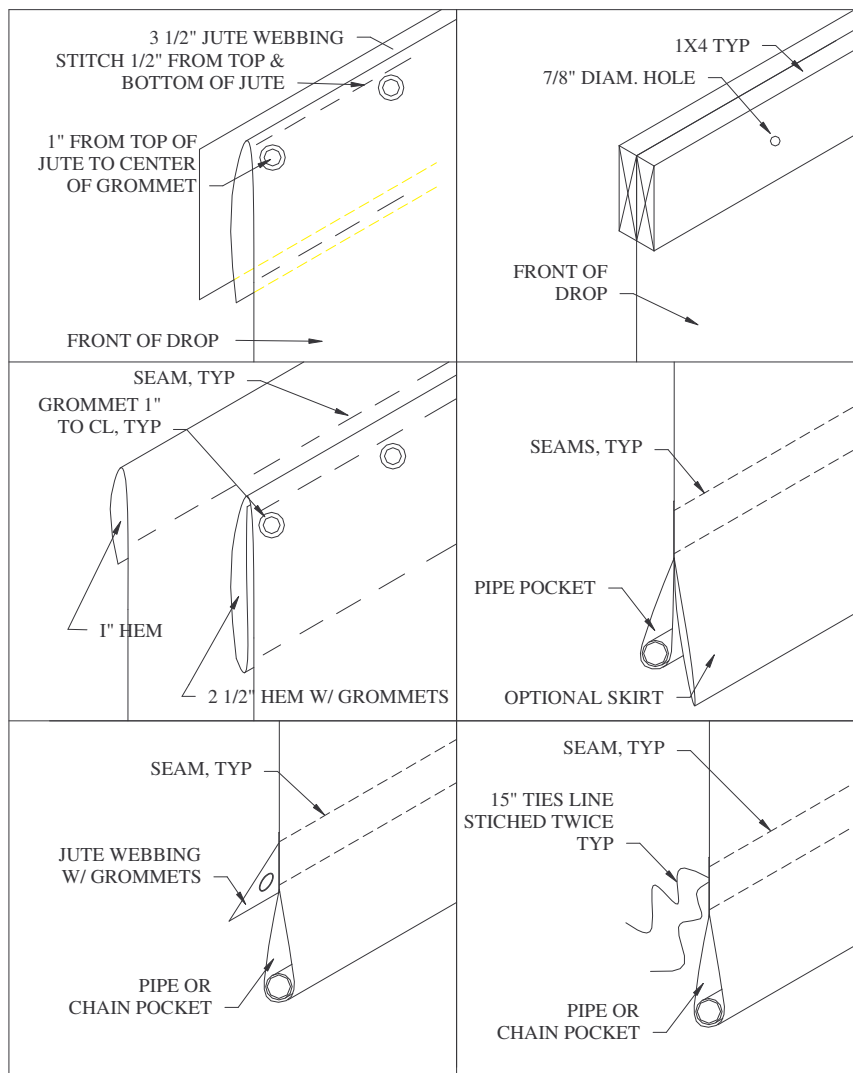
1. 1" HEM IF NO SIDE GROMMETS; 2 1/2" WITH EXTRA MUSLIN ADDED IF GROMMETED.

C. Seams

1. ARE FLAT SEAMS, 1" SEAM ALLOWANCE, WITH EQUAL THREAD TENSION BOTH SIDES.

D. Bottom

1. HAS SEVERAL ALTERNATIVES:
 - a) Pipe pocket without skirt. Used when bottom of drop doesn't show. Must accommodate minimum 1" ID pipe. Pocket requires 6" of material. (G4.1)
 - b) Pipe pocket with skirt. Pocket requires 7 1/2" of material. (G4.2)
 - c) Chain pocket or skirt, with ties or grommets every foot. (G4.3) Useful for curved drops.
 - d) Double batten. (G1.2) Used when drop must be anchored to floor.



VIII. MISCELLANEOUS CONSTRUCTION AND MATERIAL NOTES

A. Nailing

1. BASE NAIL SELECTION ON:
 - a) Type(s) of wood being joined.
 - b) Lumber dimensions.
 - c) If it must be removed easily.
 - d) Length: Nail to be 3 times the thickness of the thinnest member being joined, i.e. nailing $\frac{3}{4}$ " ply to a 2 x 4 requires an 8d nail.
2. CHOOSE AN ANGLE BETWEEN 10-15 DEGREES OFF PERPENDICULAR FOR MAXIMUM HOLDING POWER WHEN NAILING INTO END GRAIN (I.E.: PLATFORM FRAMING).
3. AVOID TOENAILING UNLESS IT PROMOTES STRENGTH AND IS READILY ACCOMPLISHED. IF NECESSARY, THE NAIL SHOULD BE AT NO GREATER ANGLE THAN 30 DEGREES WITH RESPECT TO THE WORK. DO NOT TOENAIL SET PIECES AND PLATFORMS TOGETHER OR TO THE STAGE FLOOR.

B. Joining plastic foam to foam or other materials

1. USE A MASTIC PANEL ADHESIVE. DAB MASTIC ON 12-16" CENTERS; DO NOT SPREAD IT OVER THE ENTIRE SURFACE. FOR FAST TACK, APPLY MASTIC, JOIN SURFACES AND PRESS TIGHT. THEN REMOVE THE TOP SURFACE, ALLOWING BOTH SURFACES TO AIR DRY FOR 5-10 MINUTES, BEFORE REJOINING.
2. USE CONTACT ADHESIVE (3M FASTBOND NF-30). APPLY ADHESIVE TO BOTH SURFACES AND ALLOW BOTH TO DRY BEFORE ASSEMBLING, USUALLY 20-30 MINUTES. USE WOOD DOWELS, WAX PAPER, VISQUEEN, OR EQUAL TO PREVENT SURFACES FROM COMING IN CONTACT DURING ALIGNMENT. ELIMINATE AIR POCKETS.

C. Joining no-foam materials

1. USE CONSTRUCTION MASTIC WHEN ONE OR BOTH MATERIALS ARE NON-POROUS.
2. USE WHITE OR YELLOW GLUE IF BOTH ARE POROUS.
3. CHOOSE FLEX OR RIGID WHITE GLUE BASED ON THE FLEXIBILITY OF THE MATERIALS; I.E. USE FLEX GLUE ON SOFT GOODS, RIGID GLUE ON WOOD, ETC.

D. Joining wood to metal

1. USE "TEK" SCREWS WITHOUT PILOT HOLE FOR IN STEEL UP TO 16 GAUGE.
2. IF STEEL IS THICKER, PRE-DRILL PILOT HOLE. THE SCREW SHOULD BE LONG ENOUGH TO ALLOW DRILL TIP TO PASS THROUGH ENTIRE THICKNESS OF STEEL (ONE WALL IN THE CASE OF TUBE STEEL).

E. Caster Plates

1. USING THE FOLLOWING MATERIALS:
 - a) 2 x 6 fir on face, joined by $\frac{3}{4}$ " ply or OSB gussets (12" leg min.) placed on underside of plate.
 - b) Attach casters to gusset using at least 2, $\frac{5}{16}$ " - $\frac{3}{8}$ " x 2" lag screws.

F. Foot irons

1. USE $\frac{1}{4}$ " OR $\frac{5}{16}$ " LAG SCREWS FOR FIXED UNIT. FLOOR DEPTH IS 1 $\frac{1}{2}$ ".
2. IF UNIT MUST MOVE REPEATEDLY, USE THREADED INSERTS (BOLTS OR STAGE SCREWS).

G. Recycling

1. DO NOT GLUE MATERIALS FOR SHOW VS. STOCK SCENERY TOGETHER UNLESS LOADING REQUIREMENTS MAKES IT NECESSARY.

H. Material preparation for paint

1. POLYSTYRENE SHEETS (VACUFORM) AND ETHAFOAM (ROD OR SHEET). USE:
 - a) Full strength flexglue; NF-30 contact adhesive; or a 1:2 wash coat of white shellac
 - b) (1 part shellac to 2 parts alcohol).

2. BEAD BOARD (WHITE FOAM) AND STYROFOAM (BLUE OR PINK FOAM)
 - a) Flexglue, glue/clay mixture and/or cheesecloth; or Fastbond Contact Adhesive. See Section VI. regarding fire retardants.
3. CARDBOARD CORES – COVER WITH MUSLIN OR CHEESECLOTH AND FLEXGLUE.
4. STEEL
 - a) First clean with denatured alcohol, Simple Green or equivalent.
 - b) Prime with 1:2 wash coat of white shellac or manufactured metal primer.
5. PLYWOOD OR OSB
 - a) Cover with 2 coats of 1:2 white shellac wash coat or
 - b) One coat of full strength pigmented shellac (i.e.: BIN)

All stock platforming will require resurfacing and facing, the cost of which must be included in all estimates.

Current shop material price lists are available from the shop supervisor. Use these and current Fish Building Supply catalog as resource guides. Consult Dennis or Chuck for additional information.

During strikes remove all hardware and fasteners, including stock scenery and lumber to be re-used. Do not remove nails and staples from material that is to be discarded. Hinges, doorknobs and latches should be removed from doors, before storing.

I. Knot Knowledge

1. BOWLINE, CLOVE HITCH, HALF HITCH, SHEETBEND, SQUARE, GASKET (FOR SECURING A COIL OF ROPE), PRUSSIC (FOR SECURING AN OUT-OF-WEIGHT PURCHASE LINE)

J. Stock lumber dimensions

1. 1 x 2: ¾" x 1 ½" 2 x 2: 1 ½" x 1 ½"
2. 1 x 3: ¾" x 2 ½" 2 x 3: 1 ½" x 2 ½"
3. 1 x 4: ¾" x 3 ½" 2 x 4: 1 ½" x 3 ½"
4. 1 x 6: ¾" x 5 ½" 2 x 6: 1 ½" x 5 ½"
5. 1 x 8: ¾" x 7 ¼" 2 x 8: 1 ½" x 7 ¼"
6. 1 x 10: ¾" x 9 ¼" 2 x 10: 1 ½" x 9 ¼"
7. 1 x 12: ¾" x 11 ¼" 2 x 12: 1 ½" x 11 ¼"
 - a) All widths from the lumberyard may vary up to ⅛" from these measurements.
 - b) 1 x 2, 2 x 2, 1 x 3 and 2 x 3 should be ripped from wider stock in our studio rather than ordered from the yard, in order to get consistent measurements. Avoid using twisted, warped, or cupped lumber. It is nearly impossible to take these defects out of the material in any standard form of scenery construction.

IX. APPENDIX TO STANDARD STUDIO PROCEDURES

A. Cutting keystones and cornerblocks

1. RIP KEYSTONES 2 $\frac{3}{8}$ " WIDE FROM $\frac{1}{4}$ " ACX PLY ON PANEL SAW (2 PEOPLE), THEN CUT TO 8" LONG ON RADIAL ARM SAW, STACKING STRIPS 4 HIGH. USE MARK ON SAW FENCE RATHER THAN STOP-BLOCK TO PREVENT BINDING.
2. FOR CORNERBLOCKS, RIP 7" WIDE X 8' LONG STRIPS FROM $\frac{1}{4}$ " ACX PLY. SET RADIAL ARM SAW ON 45 DEGREE CUT. STACK PIECES 2 HIGH. CUT FIRST SIDE AS SHOWN AT RIGHT. FLIP PIECES OVER, ALIGN FIRST CUT WITH BLADE CUT-LINE ON TABLE, AND MAKE SECOND CUT. FLIP STACK AND REPEAT, CONTINUING UNTIL STRIP IS USED.

B. Building a wood flat

1. START WITH SNAP LINE ON FLOOR OR FRAMING TABLE. USE 6D DUPLEX NAILS TO NAIL FIRST BOARD TO FLOOR ALONG THIS LINE (USUALLY LONGEST EDGE OF FLAT). THIS ASSURES EDGE OF FLAT WILL BE STRAIGHT. PUT NAILS WITHIN THE $\frac{7}{8}$ " KEEP BACK ZONE.
2. SQUARE ADJACENT SIDES TO THE FIRST PIECE, USING FRAMING SQUARE FIRST AND THEN 3-4-5 (OR MULTIPLE) TRIANGLE. NAIL TO FLOOR AS ABOVE, AND CHECK FOR STRAIGHT EDGE WITH SNAP LINE. PULL BOWED EDGES TO LINE AND NAIL.
3. ADD 4TH EDGE, CHECK FOR STRAIGHT LINE WITH SNAP LINE.
4. CHECK OVERALL SQUARENESS OF FLAT BY MEASURING DIAGONALS. DIAGONALS MUST BE THE SAME FOR FLAT TO BE SQUARE (TOLERANCE IS $\frac{1}{8}$ " - $\frac{3}{16}$ "). ADJUST AS NECESSARY TO MAKE THEM EQUAL.
5. LOCATE AND NAIL TO FLOOR ALL TOGGLES, WINDOW/DOOR FRAMING AND BRACES.
6. VERIFY THAT DIMENSIONS ARE CORRECT BEFORE STAPLING FRAME TOGETHER. ENTIRE FLAT SHOULD BE NAILED TO FLOOR BEFORE ANY PIECES ARE STAPLED.
7. WHEN BUILDING SEVERAL FLATS, USE ANGLE IRON, SCREWED TO THE FLOOR, TO MAKE A LARGE FRAMING SQUARE.
8. NOTE: FOR STAPLING SPECIFICATIONS, SEE SECTION I.

C. Covering a wood flat

1. WORK IN A STANDING POSITION WHENEVER POSSIBLE
2. LAY FLAT (FACE UP) ON TABLE OR SAW HORSES, CONNECTED WITH LONG BOARDS (SEE SKETCH).
3. BE CAREFUL TO ALLOW ENOUGH SAG – FLATS 4' OR WIDER SHOULD HAVE MUSLIN SAGGING APPROXIMATELY $\frac{3}{4}$ " BETWEEN TOGGLES. NARROWER FLATS SHOULD BE PROPORTIONALLY MORE TAUT.
4. CUT MUSLIN COVER 2-3" LARGER IN ALL DIRECTIONS.
5. AFTER POSITIONING MUSLIN, STRETCH USING STAPLES DRIVEN HALFWAY IN FOR EASY REMOVAL. STAPLES GO APPROXIMATELY 18" O.C. AND ARE ON INSIDE FACE OF STILES AND RAILS. SEE DRAWING.
6. STRETCH MUSLIN USING FOLLOWING PATTERN (SEE SKETCH): STEPS 1-4 ARE SINGLE STAPLES, 5-8 INDICATE DIRECTION TO WORK TOWARD CORNERS TO AVOID WRINKLES IN CORNER. PULL FABRIC ON BIAS (DIAGONAL).
7. GLUE FLAPS DOWN USING SOLUTION OF UNDILUTED WHITE GLUE. IF DIFFICULT TO SPREAD, DILUTE TO NO MORE 10 PARTS GLUE TO 1 PART WATER. SOLUTION SHOULD FEEL TACKY AND NOT RUNNY. USE LIBERAL AMOUNTS OF GLUE, SPREAD QUICKLY.
8. SMOOTH OUT WRINKLES AND REMOVE STAPLES.
9. POUNCE GLUED EDGES WITH WHITING BAG (NOT REQUIRED FOR FLATS PAINTED WITH LATEX PAINT).
10. ALLOW THE GLUE TO DRY OVERNIGHT BEFORE TRIMMING.

D. Covering a hard surface with fabric

1. PROCEED AS WITH REGULAR WOOD FLAT, SECTION APPENDIX C.
2. GLUE FABRIC TO ENTIRE SURFACE. TECHNIQUE IS:
3. PREPARE GLUE MIXTURE 10:1, GLUE: WATER; GET OLD ROLLER, ROLLER PAN AND GLUE BRUSH.
4. LAY FABRIC ON SURFACE AND FOLD BACK 1ST 2'.
5. ROLL GLUE ON WOOD, BRUSHING EXTRA ON EDGES.
6. FOLD FABRIC BACK ONTO GLUE-APPLIED AREA, BEING CAREFUL TO SMOOTH OUT ALL WRINKLES.
7. FROM OTHER END OF UNIT, ROLL FABRIC UP ONTO GLUED AREA.
8. SPREAD GLUE AS ABOVE, FOR 1-2'.
9. ROLL MATERIAL ONTO THIS AREA, BEING CAREFUL TO SMOOTH OUT ALL WRINKLES. REPEAT IN 2' INCREMENTS UNTIL FLAT IS COVERED.