AMERICAN INSTITUTE OF ORGANBUILDERS

Guidelines for Fine Organbuilding

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Preamble

1.01 Organbuilders and technicians are the individual representatives of an historic and artistic profession held in high esteem for centuries. It is incumbent on each individual within the profession to act in a moral and ethical manner toward both clients and colleagues.

All work, from sales, design, building, and installation, through tuning and maintenance, should be accomplished so as to bring credit to all members of the worldwide organbuilding community.

Materials

2.01 **Selection.** In general, materials should be chosen for their stability, permanence, and appropriateness for the performance required of them in both the long and short terms.

2.02 **Solid Woods.** Due to wide and frequent temperature and humidity variations caused by the use of central heat and air conditioning systems in American buildings, solid woods should be carefully chosen and fully seasoned. Woods that have been strictly air dried should be used with great care, especially in small parts, wood pipes, or thinly milled panels.

2.03 **Laminates.** Plywood or laminated solid woods of appropriate species, with a minimum of voids in both the face and body plies and glued with non-water-soluble glues may be substituted for solid woods, especially in situations where an equivalent solid panel might be prone to splitting or warping.

2.04 **Fiberboards.** Use of fiberboards (MDF, particle boards, etc.) that rely on a high ratio of resins to wood solids, or composition boards (Masonite, etc.), should be avoided in structural applications such as support members and windchest frames. These materials may be used in appropriate nonstructural areas.

2.05 **Leathers.** Leathers used within the organ for pneumatic mechanisms, gasketing, or hinging should be of a type appropriate to the application and graded specifically for pipe organ use. Tanning procedures should be such as to give a reasonable service life under normal conditions.

2.06 **Other Materials.** Other materials, whether natural or synthetic, should be of proven longevity and reliability, and should be used in a manner appropriate to their characteristics.

Electrical

3.01 **General.** All electrical wiring within the organ should appear neat and professional.

3.02 **Wiring Codes.** Low-voltage power supplies, wiring, busing, and overload protection should conform without exception to the wiring code currently in effect in the jurisdiction in which the organ is being installed, or, if no other code has precedence, to the most recent revision of Article 650 of the NFPA National Electrical Code.

The retention in older organs of electrical equipment not meeting current code standards is not recommended for reasons of reliability, safety, and potential product liability.

Blower motors, controllers, and wiring should conform to NEMA and/or IEC standards; wiring of console switches should conform to the pertinent sections of the applicable electrical code.

(NEMA = National Electrical Manufacturer Association; IEC = International Electrotechnical Commission)

Each technician or builder should be familiar with the legal requirements in each installation's locale regarding licensing for both low- and high-voltage electrical work, and abide by same.

Structures

4.01 **Building Frames.** Building frames may be constructed of wood or steel, at the discretion of the builder. It is recommended that all loads should have direct vertical support as the primary load-bearing structure, with such support rated to carry twice the anticipated load (a 100% safety factor). Should direct vertical support not be possible, secondary supports should be provided to ensure the safety factor. A floor frame is desirable to distribute high point loads.

Building frames should be assembled with bolts, screws, or other positive tensioning devices, and be well braced to limit sway and provide maximum stability. In areas with high earthquake activity, design of bracing and general load factors should be carefully considered, with attention given to the requirements of local building codes; consultation with a structural engineer is recommended.

4.02 **Expression.** Expression shutters may be of solid or laminated design, and made of wood, composition board, metal, or glass. Thickness and overlap shall be determined by the individual builder according to his or her artistic preference regarding sound restrictive capability, and shutters may be mounted vertically or horizontally. The frame should be solidly constructed to prevent distortion and binding of the shades. Shutters should be mounted and designed to open as near to 90° as possible in order to minimize sound restriction when in the full open position.

Shutters should be mounted using ball bearings, or other low-friction bearing devices, for ease of operation regardless of the type of actuation or the size and weight of the individual shades.

Actuation may be by mechanical, electric, or pneumatic means, and may affect the shutters individually or collectively as a set. They should operate with a minimum amount of noise.

4.03 **Casework.** The organ case, decorative front, or grille, if included, should be made of the finest materials, assembled using joinery techniques of the highest quality to ensure strength and stability. Surfaces should be carefully sanded, stained, sealed, and finished to minimize expansion and contraction. It is desirable that samples be submitted by the builder for the approval of the client.

The design should complement the architecture and decoration of the building; detailed drawings should be submitted by the builder for the approval of the client prior to commencement of construction. The console cabinet should be considered as casework, and similarly designed and executed.

Console and Action

5.01 **Dimensions.** Console dimensions and arrangement of controls should conform in general to recommendations published by the American Guild of Organists. Exceptions are:

(a) an historic restoration, where the original console arrangement and dimensioning is to be preserved;
(b) an instrument built as a strict reproduction of a specific historical model;
(c) an instrument emulating a general historical style.

For keyboard compasses other than 61/32, or for non-AGO key dimensions, it is recommended, for consistency in manual/pedal relationship, that manual D27 be placed above pedal D15.

5.02 **Materials.** Keyboards may be made with clear wood bodies, either solid or laminated, or with metal bodies. Playing surfaces may be of bone, hardwood, or durable plastic; stop controls should be made of complementary materials. All moving parts should be of proper mass, adequately bushed for precise movement and good tactile response under normal climatic conditions in the installation's locale.

The use of new ivory or other materials originating from endangered species is proscribed.

5.03 **Controls.** All console controls should be clearly and adequately identified as to their function, if not immediately obvious.

5.04 **Operation.** Actions of all types should provide firm, crisp touch at the keyboard with adequate repetition, and reliable, precise response of the pipe valves. Stop actions should function quickly and with a minimum of noise. Registrational aids should be positive in operation, and include the capability to be disabled to allow operation of stops in case of malfunction.

5.05 **Electric Action.** Electric action contacts should be of the striking, wiping, self-cleaning type with redundant contacts. Both contacting surfaces should be made of silver alloy or should be gold plated; other materials may be used only if appropriate to the specific application. Encapsulated magnetic reed switches, or opto-electronic devices, may be employed wherever appropriate. All types of contact devices should be rated with at least 100% current-carrying overcapacity.

Electrical or electronic devices, including solid-state control systems, solenoids, relays, and switches, should be of high quality and reliability, and have proven design overcapacity.

5.06 **Mechanical Action.** All action components and assemblies should be engineered and fabricated of permanent materials, commensurate in design and loading capacity with the stresses they are to bear.

Action runs should be of durable, dimensionally-stable materials, guided and braced to prevent sagging, deformation, whipping, or excess friction. Each complete divisional action group should have at least one manual adjustment point per note for ease of fractional adjustment to take up normal wear.

Where possible, self-adjusting mechanisms may be incorporated into the action design to automatically compensate for normal, seasonal climatic changes.

Windchests

6.01 **General.** Windchests should be constructed and finished in such a way that the casual lay observer is as impressed with the craftsmanship as if looking at the normally visible parts of the organ.

Windchests should be constructed for good structural fit and airtight-ness. The frames should be substantial enough to support the weight of the chest itself, the weight of the pipe work and racking, and the weight of service personnel who may need to stand on the chest. Chest frames should engage their supporting bearers in such a way that all loads have direct vertical support or sufficient secondary support to ensure a 100% safety factor.

Windchest frames should be made of clear solid wood. All joints should be made using proven joinery techniques, and glued with a non-water-soluble glue. Veneer-core or lumber-core plywood may be used for bungs, toeboards, or rackboards at the builder's discretion.

Removable bungs or panels should be provided at all places where access to working parts is required. Such panels should be gasketed with cork, leather, or neoprene, and securely fastened to the frame; removal of such panels in the course of normal maintenance should not compromise the structural integrity of the windchest assembly.

Electrical cables within the windchests should be provided with guide strips and/or standoffs to keep the wiring away from moving parts and to provide strain relief.

Windchest action parts, both internal and external, should be neatly made, mounted in a neat and orderly fashion, and sealed with lacquer, shellac, or other sealer that controls moisture absorption under normal climatic conditions in the place of installation.

6.02 **Slider Windchests.** The channel grid should be made with a solid or laminated wood external bearing frame and internal structural dividers; nonstructural dividers may be made of solid wood, plywood, or composition board. The top and bottom tables of the grid may be of voidless plywood, clear solid wood, or suitable composition material.

Cross-sectional areas of the note channels, pallet sizes, and pallet boxes should be of adequate size and be determined with reference to the pipe scaling, mouth widths, and voicing techniques regularly used by the individual builder.

Pallets may be of kiln-dried, fine-grain, solid wood, laminated wood, or metal, and fitted with corrosion-resistant springs. Pallets should be gasketed with felt-and-leather or leather alone. Actuation may be mechanical, electropneumatic, or electromechanical.

Sliders may be made of wood, metal, dimensionally stable reinforced plastic, or suitable composition board. Self-compensating slider-seals and rings of proven durability may be used to avoid the development of runs and/or pressure variation due to uncontrolled leakage. Slider actuation may be mechanical, electropneumatic, or electromagnetic, or by a dual mechanical/ electric action. The slider action should have positive travel limitation and be quiet in operation.

6.03 **Electromechanical Windchests.** Windchest frames and toeboards should be of proper cross-section to carry any additional weight of the electromechanical valve units. Sufficient internal bracing should be provided to prevent sagging or deformation of the windchest.

All-electric valve units should be made with a rigid steel frame, plated to resist corrosion. The armature hinge should be precision fitted to ensure free operation without binding or excess vibration. The coils should be wound around a magnetic iron core to prevent the buildup of residual magnetism over the life of the unit.

Valves should be made of leather or felt-and-leather mounted on a fiberboard, hard leather, or light metal disc, and adjustable for proper travel and seating. Toeboard expansion chambers and/or flyback diodes may be used to aid pipe speech and prevent bouncing.

Return wires and individual stop and note wires should be of adequate capacity to prevent excessive voltage drop under the most severe conditions of use. Individual wire connections to the coil terminals should be pigtailed to prevent breakage due to vibration.

6.04 **Electropneumatic Windchests.** All wood portions that contain action channels should be made of kiln-dried, clear solid wood or voidless plywood. All borings and channels should be shellac-dipped, or otherwise sealed, to prevent air loss through the grain of the wood. All channels should be properly sized to provide prompt action under all normal conditions.

All meeting surfaces where channels are to be carried across a joint should be gasketed and the fastening screws provided with springs to prevent air leakage and compensate for dimensional changes caused by the normal variation of climatic conditions.

The windchest valves should be self-adjusting and equipped with self-centering corrosion-resistant springs. Toeboard expansion chambers may be used to aid the pipe speech. The primary magnets should be of proper power and capacity for the wind pressure, and made with a self-cleaning armature valve.

Wind System

7.01 **Blowers.** Electric blowers should be of sufficient capacity to provide an adequate supply of pressure air for both pipework and mechanism under normal playing conditions and assuming minimal system leakage.

Manual wind supply by means of feeder bellows may be provided as an adjunct to the electric blower, or as the sole wind source in historical reproductions.

Blowers should be installed in an appropriate enclosure with such silencing devices and static regulators as needed to ensure quiet operation.

The blower should be located as close to the organ as possible, and should draw air directly from the organ area or from the room in which the organ is housed, to minimize temperature differences.

7.02 **Reservoirs.** Reservoirs may be of the folded or diaphragm (schwimmer) type, and should be of such size as to supply the full demand of air required under normal playing conditions.

Each reservoir should be provided with a valve of appropriate type (curtain, poppet, pallet, etc.) attached to the moving top, to regulate the flow of air from the main supply trunk. The reservoir may be fitted with weights, springs, or a combination thereof, to maintain a stable working pressure.

Removable panels should be gasketed with cork, leather, or neoprene. Joints should be appropriately scaled on the inside to prevent leakage due to drying and shrinkage of the materials over the service life of the unit.

7.03 **Tremulants.** Tremulants may be of the exhaust, pressure, inertial, or fan type, as appropriate to the type of wind regulating system.

Tremulants other than the fan type should provide an even pulsation within the wind supply under normal playing conditions. Speed and depth of pulsation should be adjustable to suit the taste of the builder and/or organist. The tremulant should be muffled for quiet operation.

7.04 **Wind Conductors.** Wind conductors should be designed with sufficient cross-sectional area to allow good wind flow without significant pressure drop or resonance waves under normal playing conditions.

Solid wind conductors may be made of soldered galvanized metal, plywood, solid wood, preformed PVC plastic containing UV inhibitors to retard deterioration, or any combination of the above. Each run may be provided with a flexible section to reduce transmission of vibration, as well as to accommodate normal expansion and contraction of materials.

Flexible wind conductors may use rubberized fabric or leather sleeves, paper/foil hose, or rubber hose with reinforcing metal coils. The use of thin plastic hose ("dryer hose") should be avoided. All flexible lines should be kept as short as possible to prevent unsteadiness and turbulence within the system, and should be adequately supported to prevent movement.

Wind conductor runs should be as direct as possible for good flow characteristics, and routed neatly so as to allow good access within the organ. All runs should be protected to prevent damage due to normal passage of personnel through the organ during installation and maintenance.

Pipework

8.01 **General.** All pipework should be manufactured of materials appropriate to the tonal characteristics desired by the individual builder. The highest quality of construction should be maintained.

All pipes should be firmly supported and racked in order to preclude the danger of falling, bending, or breaking. Upright racks should be provided in addition to toe racks for pipes more than 1.2 to 1.5 meters (4 to 5 feet) in length or for pipes of delicate construction (i.e., thin-scaled strings or reeds). When upright racks are used, especially for exposed pipes, they should be carefully constructed and firmly secured to avoid the chance of collapse or of detachment from the pipes.

Large pipes with miters should be specially racked in order to reduce the chance of deformation or collapse. Miters should include integral bracing in the structure of the pipe in order to ensure stability.

Any old pipework to be incorporated into a new or rebuilt instrument, either in original or altered form, should be repaired and/or reworked in order to function as well and last as long as new pipes. All old pipes should be clearly described as such in the contract specifications.

8.02 **Metal Flue Pipes.** Metal pipes may be made of antimonial lead, various tin-lead alloys, zinc, copper, brass, or aluminum, with securely soldered, welded, or brazed seams. Plain zinc, where used, should be given a protective coating to prevent oxidation. Scales, mouth widths, toe treatments, and tuning devices shall be determined by the individual builder commensurate with the tonal results desired.

Pipes may be fitted with various tuning devices such as scrolls or sleeves (tuning slides), or may be cut to length and coned. Scrolls on larger pipes, especially of zinc or copper, should be felted to prevent vibration and noise. Tuning sleeves should be made of coke tin or aluminum of adequate gauge to securely grip the pipe body without excess looseness, but neither should they be so tight as to deform the pipe body. Larger sleeves may be fitted with coil spring tensioners.

8.03 **Wood Flue Pipes.** Wood pipes should be made of solid, clear, knot-free wood, of species and thickness suitable for such use. All seams should be airtight, and the pipes should have sealer applied to both inside and outside surfaces. Mitered pipes should be provided with bracing as needed to prevent splitting of miter joints over time. The blocks (languids) of wood pipes may have their exposed end-grain sealed.

Stoppers, where fitted, may be made of solid wood or plywood, and should be made in such a manner that expansion and contraction will not split the seams of the pipe body. Packing for the stoppers should be air-tight, and fashioned from appropriate materials.

Open pipes may be provided with tuning slides, flaps, gates, or other methods of tuning adjustment.

Old pipes should be carefully checked for soundness of all joints, cracks in the materials, and stability of tuning devices.

8.04 **Reed Pipes.** Reed pipes should be constructed with materials and methods similar to those of metal or wood flue pipes. Particular attention should be given to the structural attachment of the resonator to the block in order to prevent opening of the joint should the resonators move out of vertical alignment over the passage of time. Resonators may be fitted with various tuning devices or cut to length. Wedges should be closely fitted to hold reed tongues securely in place.

Basic standards of racking should be followed more closely in the case of reed pipes because of their particular construction. Generally, the resonators of pipes more than 1 meter (3 feet) in length, or 1.5 meters (5 feet) in the case of pipes of French double-block construction, should be provided with upright racks. These racks may be of the full-circle, partial-circle, scallop, or straight variety. Hooks, twill tape or other ties should be provided if the rack itself cannot restrain movement of the resonator out of the vertical in all axes.

Old pipes should be thoroughly checked for soundness of materials and joints, condition of wedges, corrosion of tongues and wires, and stability of tuning devices.

Tonal Matters

9.01 **General.** By their nature, pipe organs are individual creations whose character is a direct result of the training and experience of the organbuilder and his or her interaction with each client.

The tonal design of the organ should be such that the organ will function properly for its intended artistic purpose. A stoplist with four or more stops should include at least one temperament tuning stop.

9.02 **Winding.** Wind pressures should be reasonably stable when the keys are initially depressed and as they remain depressed. There should be no adverse pressure drop in the course of normal playing when additional keys are depressed on the same manual, in order to ensure that one can tune in a satisfactory manner.

9.03 **Pipe Placement.** Pipe placement on the windchest, or in an offset location, should be such that there is space for the pipes to speak properly and that there is enough room for tuning access. Each pipe should be fitted so that it sits firmly in its toe seat and can be turned freely at all times.

If the caps of stopped pipes are soldered or glued in place during final tonal finishing, the tuning ears should be positioned as close as possible to 90° in relation to the mouth after final regulation and tuning have been completed.

9.04 **Scaling and Voicing.** Design of the pipe scales should result in individual voices of distinctive tone color which will combine into controlled, natural ensembles.

Voicing should be done in a careful, workmanlike manner using accepted techniques. Flue pipes in general should be regulated for proper speech, neither unduly slow nor fast, to suit the attack characteristic of the windchest valve. Mixtures should have the breaks scaled and voiced for smooth transition; in general, there should be no breaks greater than one octave. Reeds should have no slow, fast, or after speech; when resonators go from fractional- to full-length, or have multiple breaks in length or shape, the transition in speech and color should be as smooth as possible.

Each organ should be tonally finished by qualified personnel in its final location after mechanical installation is complete. The pipes of each individual stop should be meticulously regulated for uniformity of character, strength, and attack. The stops, and then the divisions, should be balanced with each other in the context of the room's acoustics from the average standpoint of the listener. The full ensemble should provide satisfying sound pressure levels within the listening area without any distortion.

In church instruments, particular attention should be given to the role of the organ in the accompaniment of solo vocalists, choral ensembles, and congregational singing.

All aspects of tonal design and execution should result in a distinctive and musical sound which will invite the listener to emotionally and intellectually participate in the musical performance.

Installation

10.01 The mechanical installation should be professional in appearance in all respects. Adequate access for safe maintenance should be provided, with all windlines, cables, and action runs protected against inadvertent damage. All structural parts and assemblies should be secure against shifting or accidental displacement. Adequate access ladders should be provided for safe access to all levels of the interior portions of the organ.

The installation is to be carried out in a good, workmanlike manner, and with the least possible inconvenience to the client. Each client should be made aware, in advance, of the need by the installers to restrict or deny access by the public to the worksite for reasons of safety as well as for efficiency of operations.

Adequate safety procedures should be followed at all times: all hazards should be clearly marked using appropriate warning flags or placards for the benefit of both workers and others.

The worksite should be kept clean and in reasonably neat order. Cleanup procedures should be adopted for the close of each working day. When the building is to be open to the general public, the working area should be conspicuously cordoned off, and all parts and materials arranged in an orderly manner.

At the conclusion of the installation, the worksite and surrounding areas should be left clean and orderly, with any incidental damage to the client's property properly and completely repaired.

In general, the installation, from start to finish, should reflect a high level of concern for the sensibilities and the property of others, as well as for the good public image of the organbuilding profession.

Legal Notices

11.01 These guidelines are solely intended by the American Institute of Organbuilders as a compendium of organbuilding practices which are currently in use by various organbuilders in North America and which are generally perceived to reflect good quality.

The information presented in this publication should not be construed to be an exhaustive reference of organbuilding procedures and is not intended to be utilized for comparison or judgement of the work of any organbuilding firms or individuals.

The American Institute of Organbuilders assumes no liability whatsoever that the work of any of its members or their firms may be in accordance with any or all of these guidelines.

The American Institute of Organbuilders does not warrant nor guarantee the quality, suitability, or fitness of organs designed, built, or installed by it members, their firms or others in accordance with the guidelines stated in this publication.

These guidelines may be subject to alteration by action of the Institute in order to reflect ongoing changes within the organ building profession.

Formulated by the Committee on Guidelines of the American Institute of Organbuilders:
Joseph Chapline, Randall S. Dyer, Stephen L. Emery, Allan J. Ontko (Chair),
Richard W. Ratcliffe, Edward E. Schurig, Pieter A. Visser

PO Box 1695, Grass Valley CA 95945
www.pipeorgan.org
execsec@pipeorgan.org