

Engineering News

ALTEC LANSING

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Technical Letter No. 157

THE "HOW" AND "WHY" OF WRITING ALTEC SPECS

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For the benefit of the Altec Sound Contractors who are not writing specifications, it would be a good idea to review the basic reasons for writing specs.

The writing of specifications are, as we all know, time consuming; so much so—as a matter of fact—that it is understandable why some contractors feel that for the time expended, the dollar return is not adequate. This applies to the poor contractor who spent many, many hours writing a spec only to lose the job in a relatively short period of time to "Mr. Sharpy" down the street.

Because he didn't have to recover any of the dollar cost that went into the writing of the specifications, "Mr. Sharpy" could cut his price to the bone and so he got the job. We all have a "Mr. Sharpy" down our street who depends on this business philosophy for his salvation; but no self respecting Altec Sound Contractor would plan their entire future business on this archaic business "slychology".

The word "archaic" is used for this reason: Any contractor doing business in this manner is going to lose his business to a more aggressive contractor who is looking into the future and concluding that the field of Sound Engineering is becoming a real PROFESSION. In a relatively short period of time the "Sharpy's" will all be gone, and only the Engineering Contractor who has been practicing his profession will be in a position to perform in this now highly sophisticated business.

Ten years ago, we had a handful of contractors who had done something about becoming professionals, and had made a name for themselves in that most important business circle of Architects and Engineers. Today these contractors have a well established business employing fifty or sixty men. These are the goals that should be set by the two, three and four-men organizations of today; then, a decade from now, they will reflect a gigantic growth over that ten-year period. *It can be done—others have proven it can be done!*

Every successful Engineering Contractor has accomplished success by hard work. If you know any of these successful Engineering Contractors, ask them. I am sure they will agree that they did it by writing good, tight specifications.

That word good is very important. It means good engineering, coupled with good sound equipment. You can easily become the "fair-haired boy" in the eyes of the Architects and Engineers, by following this path. What could be better than to have an Engineer call you and say, "we have a job in now, and I need your assistance on it."

Once an Engineer gets in this habit, you have a very good chance of assisting him with all of his specifications. But, remember, he is calling on you because you did a good job for him or one of his engineering friends, so be sure to make this job—and every future job—even better. Keep the Engineer as your best friend. He can be. He should be! You can keep this friendship alive only by delivering a top quality job. This is important because sooner or later, "Mr. Sharpy" is going to wake-up (*that low-bid price is not all that is required*), and he will be knocking on the Engineer's door with all types of wild claims and promises. If the Engineer has faith in you and in the equipment you are writing your specs around, you will not have any trouble from "Mr. Sharpy"—but boy, will he be having trouble trying to bid on jobs where the specs have been carefully worded by you. These specs provide for a sound system that has to meet standards above and beyond "Mr. Sharpy's" capability.

How do you get the Engineer to give you your first chance? Well, this is the problem which will vary from case to case. You may call on an Engineer who believes that a megaphone is adequate for most sound systems, and if you have one with a few tubes with it, it would probably be all right. The Engineer who feels this way is going to be a tough one to convert to your way of thinking; however, when you do bring him around, and prove to him that there is a big difference in various types of sound equipment—when you make him aware of sound—you will find him to be your best booster. He will never-ever again want anything to do with megaphones. Instead he will always insist on the best.

The main thing to do on the cold call is to introduce yourself. Don't be too much of a salesman (generally, Engineers are not impressed with a salesman unless that salesman is knowledgeable). Show him what you have done; show him what Altec has done; use Prestige Photos—which I am sure you all are aware of. Properly used, these are tremendous selling tools. From them the Engineer can glean a lot of good information on what has been done and what is being done. Give the Engineer an Altec Sound Manual, and keep it up-to-date. This is a wonderful excuse for that regular follow-up call. Like anything that is worthwhile, it will take time.

In building the Engineer's confidence, you may be faced with a very serious problem, one which will require some shrewd judgment on your part. That is: A job that is beyond the capability of you and your organization. This is bound to happen sooner or later. When/if it does, please (for your own sake) recognize the problem and face up to the fact that you will require some help. Don't try and bluff your way through because it will come to light eventually. Tell the Engineer that this is a special job with special problems, and you feel that the best solution would be to call in a "consultant". We have some excellent consultants in the country who like the tough jobs, so call them in on it. Many Engineering Contractors have learned the benefits of calling in the consultant; benefits which include a happy Engineer and an excellent sound system to which they may point with pride.

In general, Sound Contractors break down into three basic groups:

1. Contractors who write many and consistently good specs,
2. Contractors who write specs when they have nothing else to do or business is very slow, and
3. Contractors who never write specs, but bid every job on the street.

It is extremely interesting to note that contractors who write specs as part of their everyday business are the most successful, while those who do it every so often (or when things are slow) do a fair job of staying in business. But the ones who never write specs (but bid on every job on the street) do not do as well. As things become more and more professional—and they will—it will become more obvious that these contractors do not have a very bright future. They may manage to stay in business because they are sharp, they can live by their wits, and they manage to substitute junk for good equipment—but sooner or later they will run into an Engineer you have been cultivating. He will not accept substitutes, but will demand that the system go in as specified. One large job under these conditions could put a "Mr. Sharpy" into bankruptcy and FAST.

What are the ground rules for writing good specifications?

Determine the required functions of the system.

Be sure you cover them all because it is impossible to design a system if any one function is not clearly understood.

Draw a simple block diagram of the system.

Be sure of all of the functions are covered by your block diagram. After this is done, the job is well underway. Many contractors write specifications at this point, but, as anyone who has engineered a few systems knows, this is not the time to write your specification because you may overlook one or two details which could prove costly in the end. Even more important—as you do the final engineering on the system, you may be able to come up with an elaborate switching or relay system which will require involved specifications; specifications so complex that they will discourage bids from your competitors.

When you know what is required for a system, it is relatively easy to come up with a price that will cover it. However, if you are not sure, you may be inclined to include a "fudge factor" figure which could lose you the job. This is equally true of your competitors, so be certain all the facts are presented. Do not mislead. Do not give away any design concepts you may have worked out. In short, state the requirements—not how these requirements are attained!

A specification written as:

one ALTEC 1567A,
one ALTEC 1568A,
one ALTEC A7 speaker system, etc.,

is a snap to bid on. We all like them because they do not require any thinking. But at the same time there is no thinking required on the part of your competitors, so write your specs so the competitor will find it difficult to bid on them.

All Altec catalogue sheets include the Architect's and Engineer's specifications on the rear side of the page. Basically these state specifications and advantages of the unit in the typical specification wording. Now, although we have stated the specs in one way, there is no reason why you cannot re-word them to suit your particular needs—so long as you don't take liberties with the facts. Don't try to change an 18-watt amplifier to a 100-watt unit, but, certainly it would not hurt to add a few of your own words to the specifications.

Do not include the last phrase of the specs. You will note it is always separated from the rest of the spec. This phrase is "This amplifier shall be Altec Lansing Model No. 1570B." These last few words make it very easy for your competitors. In short, make him read every word.

Now the Engineer for whom you are preparing these specs may insist on the phrase, "or equal". In such a case, it is advisable to include the phrase, "The amplifier shall be Altec Lansing model No. 1570B, or approved equal."

Please note the word "approved". At the end of this specification, you should add, "It shall be the responsibility of the contractor, submitting equipment not specifically mentioned in this specification by manufacturer's name and model number and to provide, at the contractor's expense, an independent testing laboratory report stating that the equipment submitted by (manufacturer's name) and (model number) is equal to the Altec Lansing Model No. 1570B." A copy of this report must be submitted to architects, engineer, and owner."

Now you may get some objection from the engineer even though this phrase is there for his—and the owner's—protection. If he feels it is too restricted, then offer a slightly watered-down version of the same thing. For example:

—The architect and/or owner reserve the right to require the contractor, at the contractor's expense, to furnish certified copies of tests conducted by an independent laboratory on any substitutions of equipment.—

You should try to convince your engineer to include another very important phrase placing the sound system specifications under its own heading; not under the Electric Contractor's responsibility. In other words, bid direct to the general contractor. This may be approached from two angles: (1) it will cost the owner less money, or—and this is more important—(2) due to the complex nature of the electronic equipment, it should be installed—not by electricians—but only by electronic technicians. If this can be included, you have won a major victory.

The following list of specification clauses are self-explanatory and will do a great deal toward getting the job for you.

1. The successful bidder shall submit to the architect written proof that he is the authorized factory-trained Sound Contractor and Distributor for assurance of proper installation and a continuing source of knowledgeable advice and service, for the products specified. This shall be in the form of a letter from the manufacturers concerned stating, "The contractor is a fully accredited outlet for their products and is authorized to administer their warranty policies."

The Sound Contractor who is really organized, and has at his disposal a good set of test equipment, should include in his specifications this real "open bid stopper" which is being used by many contractors.

2. The successful bidder shall list the company name, model number and serial number of the following types of test instruments he has available for checking system performance:

- (1) Distortion analyzers.
- (2) Interlocked bandpass filters and graphic level recorders.
- (3) Interlocked sine wave sweep generators and graphic level recorders.
- (4) Oscilloscopes and oscilloscope cameras.
- (5) Audio frequency bridges.
- (6) Calibrated microphone systems.

If, as mentioned above, the successful bidder must supply a list of test instruments; then you should include a section on system performance testing at the end of your specification. The following words will apply, if you have the capability to perform this operation:

It is the responsibility of the contractor to provide a satisfactory system and to substantiate the end result by submitting data obtained as a result of these tests. The contractor will not be responsible for deficiencies related to this system due to room acoustical defects. The specified tests shall be compiled in a survey report form and shall be submitted in duplicate to the owner. Copies of all charts and curves shall be included in the report along with a sufficient explanation of each so that a complete duplication of the method used may be conducted at any later date.

a. Instrumentation to be employed: Sound Level Meter, Wave Analyzer, Graphic Level Recorder, Random Noise Generator, Beat Frequency Oscillator, Impedance Bridge, Calibrated Microphone, Distortion Analyzer, Audio Oscilloscope. Instruments as manufactured by General Radio, Hewlett Packard, Tektronix, and B & K are considered acceptable standards for measurements.

b. Electronic and Acoustical Tests:

Phasing of each portable loudspeaker with reference to its polarized plug and cord.

Phasing of all inputs at and from Jack Panel.

Phasing of all microphone and microphone outlets.

Check and correct, if necessary, phasing of all loudspeaker receptacles and/or connections on job site.

Electronic distortion measurements of all equipment as listed in this specification.

Electronic power measurements vs. frequency response of all equipment as listed in this specification.

Reverberation measurements at $\frac{1}{3}$ octave band widths from 40 to 12,500 cycles.

Spectrum noise survey with all ventilation equipment "on" and "off".

3. The successful bidder shall list all staff members who are licensed professional engineers. Qualifications of personnel responsible for engineering considerations in the assembly and testing of the system shall be listed.

Now, as you can plainly see, this will eliminate much of your competition. It is also interesting to note that there are more and more Engineering Sound Contractors who have licensed professional engineers on their staff. If there is no licensed professional engineer in your organization, please start work in this direction now! Certainly it will be a tremendous "prestige symbol" and will allow you to write extremely "tight" specifications.

You will note on our catalogue sheets there is a notice in a black box which states:

4. We recommend that you obtain Altec products from factory trained authorized Altec Sound Contractors and Distributors. This will assure you of proper installation, a continuing source of knowledgeable advice, service, and quick warranty protection.

Point this out to the Engineer and to the owners, and alert them to the difficulties they may experience if they purchase "boot-legged" equipment which may have passed through several hands. Emphasize that this equipment may not be new equipment. Within the past year there have been several instances where used equipment with the serial numbers removed was actually supplied on a job. The reason is obvious—a contractor who was not an authorized Altec Sound Contractor was awarded a job which the engineer insisted go in as specified. The contractor was placed in this embarrassing situation: He was forced to procure and supply the Altec equipment. Obviously, he was in an area where the Altec Engineering Sound Contractors would not sell him ALTEC equipment—"for credit reasons". So he was forced to pick up some used equipment from a building that had burned down, or had met with some type of unfortunate accident.

Anyone who sells used equipment as new equipment soon will lose the faith and trust of engineers, architects, and owners. To protect the engineer and owner from this type of "shady business practices", the engineer should allow you to include in the specifications the following:

5. The sound contractor shall provide photostatic copies of a dated packing slip for all equipment supplied under this specification with serial numbers of all equipment supplied.

It is a shame that it has become necessary to include such paragraphs in a specification; however, it is for your protection—and for the protection of the owner. I am sure you will agree that the additional work is justified to slow down the "boot-legging" of equipment. This may be the tool you need to nip this problem "in the bud".

6. All equipment and miscellaneous parts required for a complete and properly operating system shall be furnished and installed by the contractor whether or not it has been specifically specified.

In terms of dollars and cents, that phrase could mean anything from \$1.00 to \$500,000 or more. Therefore, knowing full well that your specifications are complete and that your system is properly figured, you need not add a "fudge factor" into your bid. On the other hand, your competitor (that is if he is using his head) will add a "fudge factor" to cover these intangibles, causing his bid price to reflect it by being higher than yours.

7. **SCOPE OF THE WORK:** The work included under these specifications consists of furnishing, installing, finishing and completely testing of equipment for coverage capability and sound level at all seating areas.

8. **WORK BY OTHERS:** The electrical contractor will install all conduit, junction boxes, outlet boxes and conduit will be furnished with pull wire. All necessary 115-volt electrical connections to the amplifiers.

9. **COMPLIANCE WITH CODES, RULES AND REGULATIONS:** All wiring and equipment shall conform to the requirements of the National Board of Fire Underwriters and the current published edition of the National Electrical Code, insofar as it is applicable, and to all applicable local regulations.

10. **QUALITY OF WORKMANSHIP:** The work specified hereinafter shall be done by fully competent workmen, in a thorough manner. All materials furnished by the Sound Contractor shall be new; they shall have been approved by the Underwriters laboratories and shall be listed by them as approved. All work shall be completed to the satisfaction of the Engineer.

11. **SHOP DRAWINGS, MANUALS AND MANUFACTURER'S DESCRIPTIVE MATERIAL:** Shop drawings and manufacturer's descriptive material shall be submitted on each item of equipment or apparatus that the Contractor proposes to furnish. The Engineer's approval for these items shall be obtained in writing before they are purchased from the Suppliers.

Upon completion of the work, the Contractor shall deliver to the Engineer three sets of papers including guarantees, operating instructions and approved shop drawings which show the job as built.

12. **SUBSTITUTIONS:** Where a definite material is specified, it is not the intention to discriminate against the products of other manufacturers, but rather to establish a standard of quality. The Contractor's original proposal shall be based upon the use of materials or specialties of such quality as shall be made through the Engineer in writing. Proposals for substitutions shall be accompanied by samples and complete data, together with credit adjustments in the contract price accruing to the owner as a result of the proposal substitution. All such proposals shall be made within ten (10) days after the date of the Contract. No substitutions will be considered thereafter.

13. It is the responsibility of each bidder to determine exactly how he proposes to meet the performance requirements of the specifications. As a part of his bid, he shall provide the Engineer with complete written descriptions and analyses based on equipment with which he is prepared to meet these requirements. These descriptions shall show how the loudspeakers will be capable of meeting the sound pressure delivered over the seating area requirements. They also will show how the amplifier output power required to drive the loudspeakers was computed, and what the characteristics of the power amplifier will be. They also will show the impedance matching schedules and all other pertinent data.

14. As a broad guide to each bidder, all equipment must be manufactured by one manufacturer and that manufacturer will be solely responsible for the equipment furnished under this contract. Each bidder must furnish the Engineer with a list of jobs of this type to serve as proof of the bidder's capability of completing a satisfactory sound reinforcing system of this type.

15. All equipment must be installed by a distributor who has been an authorized distributor of the product he proposes to use for

..... years or longer and has proven his capabilities as a reliable and successful distributor.

16. **POWER AMPLIFIER:** The Contractor shall furnish and install sufficient power amplifiers to drive the loudspeakers he furnishes so that they will deliver the specified sound pressure level over the seating area. It is the Contractor's responsibility to furnish whatever power amplifier output and capabilities are actually needed to drive the loudspeakers so as to establish the specified sound pressure level at its specified frequency response. However, in no case shall the output power be less than watts.

The power amplifiers furnished shall deliver the required power on steady-state test and not to exceed five percent (5%) third harmonic distortion. They shall be flat within plus or minus 0.5 db from 20 to 20,000 cycles-per-second. Music power rating will not be acceptable. All tubes or solid state devices must be operated at voltages quite consistent with good engineering practice, and not at artificially high, or low, values not typical of units as listed.

17. All wiring shall be continuous. Splices shall be made only at junction boxes or terminal cabinets. All wire and cable junctions in terminal cabinets shall be made on telephone-type blocks with easily visible identification strips designating each circuit. Only rosin core solder shall be used for solder joints.

18. Certain items of equipment are specified herein by manufacturer's type numbers to indicate the quality and functional performance required of the systems and their components. Substitutions of equal equipment beyond the alternatives listed will be permitted, but only with the express permission of the architect and the acoustical consultants, and on the basis of approved laboratory data which proves the equivalence of the proposed substitute in quality and performance.

19. **PERMITS:** The contractor, without additional charge, shall:

a) Obtain all permits necessary for the execution of any work pertaining to the installation, and shall conform in all trades with all local by-laws and codes.

b) Maintain insurance with a reputable insurance company to the full value of the equipment and material on site. The insurance shall cover loss from fire, vandalism and theft and shall be carried until formal acceptance of the completed work. Additional insurance must be maintained to protect the supplier and/or the general contractor against damage claims for personal injury including death which may arise during the performance of the work covered by this specification. Certificates of all insurance shall be filed with the owners and shall be subject to their approval as to the adequacy of protection.

20. **BID PROPOSALS:** The contractor shall inspect the site to determine actual installation conditions before preparing his bid proposal. All bid proposals shall contain a complete and accurate list of all major items of equipment to be used in assembling these sound systems, including all items of equipment specified in this specification, as well as sound contractor's block diagrams indicating the proposed connections of all existing equipment and equipment to be furnished.

21. **SHOP DRAWINGS:** The contractor shall prepare drawings of loudspeaker mounting arrangements. These drawings must be approved by the Architect before the contractor commences installation.

22. **INSTALLATION:** The contractor shall supply all hardware, wire, conduit, etc., required for the installation of the sound equipment in accordance with specifications and needed to provide completed usable sound systems.

23. All equipment except portable equipment shall be firmly held in place. This shall include loudspeakers, conduit, amplifiers, cables, etc. Fastenings and supports shall be adequate to support their loads with a safety factor of at least three. All switches, connector jacks, outlets, etc., shall be clearly, logically and permanently marked during installation.

24. The contractor must take such precautions as are necessary to prevent and guard against electro-magnetic and electro-static hum, to supply adequate ventilation; to install the equipment so as to provide reasonable safety for the operator.

25. Care shall be exercised in wiring, so as to avoid damage to the cables and to the equipment. All joints and connections shall be made with rosin-core solder or with mechanical connectors approved by the acoustical consultant. All wiring shall be executed in strict adherence to standard broadcast practices.*

*Excerpted from "Recommended Wiring Practices", Broadcast Audio Equipment for AM, FM Television (4th edition), Radio Corporation of America, Camden, New Jersey, 1959.

26. A qualified engineer, approved by the architect and acoustical engineer, and employed by the manufacturer of the main loudspeaker components, shall exercise engineering supervision over the entire installation and shall inspect the installation at least twice prior to acceptance testing.

27. Re-entrant, diffraction, or folded horn loudspeakers (because of inherent "peaky" frequency response on-axis or off-axis and lack of directional control) shall not be acceptable.

28. The contractor shall be located within 25 miles of the job site for assurance to the owner that 24 hour service and maintenance can be provided for the sound system.

29. The contractor must be an authorized distributor of the manufacturer of the equipment which he is quoting. He must be in a position to call on the manufacturer for advice and guidance.

30. The contractor must be factory-trained through annual attendance at schools conducted by the manufacturer for the purpose of instructing the contractor in the very latest and best sound engineering practices.

31. All major components of the system shall be of the same prime manufacture. Re-labeled equipment of other manufacture will not be accepted.

32. Contractor shall submit a "Certificate of Completion" on a factory-originated form to assure that the system has passed all tests and is in proper operating condition.

Of course, there are a number of specification clauses which are fairly standard and which should be included with all of your specifications—for your own protection.

Understand—the engineer and anyone concerned with a job prefers a "tight" specification for a number of reasons. It is interesting to note that there is a difference between a "tight" specification and a "restrictive" specification. The specification which only names the manufacturer and model number (with no "or equals" included) is a "restrictive" specification. A specification that outlines design objectives, installation procedures, the type of talent required to perform the work, the qualifications of the sound contractor (in regard to both his experience with sound systems and his background as a good solid businessman) are not "restrictive". A "tight" specification is one which requires that professional people bid, obtain, and perform the job in the best professional manner.

Your submittal is an extremely important function of getting a job. Please remember the low bid is not—and should not be—the deciding factor. Some of our sound contractors are spending many dollars in this area to assure themselves of success; not only in getting the job, but in keeping it.

In preparing the original specifications, a numbering sequence must be followed for ease of identifying paragraphs; this is for references as well as for future changes or addendums. Naturally, a Table of Contents calling out the paragraph number, title or paragraph, and page number also must be included with the specification.

A simple numbering system which is generally used would be as follows:

1. Main Section

1.1 sub (first paragraph)

1.2 sub (second paragraph)

1.3 sub (third paragraph)

1.1.1 sub-sub (first paragraph)

1.1.2 sub-sub (second paragraph)

1.1.3 sub-sub (third paragraph)

1.1.4 sub-sub (fourth paragraph)

1.1.1.1 sub-sub-sub (first paragraph)

1.1.1.2 sub-sub-sub (second paragraph) etc.

Naturally, all specifications will vary dependent upon the particular job or project. The following example is typical of a medium size job and contains areas that should be covered by most specifications.

1. SCOPE OF WORK

2. MATERIALS AND EQUIPMENT

3. CONTRACTOR SUBMITTALS

3.1 Bid proposals

3.2 Shop drawings

4. PERMITS

5. INSTALLATION

6. EXECUTION OF WORK

7. FUNCTIONAL AND PERFORMANCE REQUIREMENTS

7.1 Basic system functional requirements

7.2 Additional requirements

7.3 Performance requirements

8. OUTLINE DESCRIPTION OF THE SYSTEM

8.1 Central loudspeaker system

8.2 Distributed loudspeaker system

8.3 Amplifier and input equipment

9. MICROPHONES AND ACCESSORIES

9.1 Omnidirectional dynamic microphones

9.2 Cardioid dynamic microphones

9.3 Cardioid condenser microphones

9.4 Microphone lines and cables

9.5 Microphone floor stands

9.6 Desk stands

10. CONTROL AND AMPLIFIER EQUIPMENT

10.1 Mixer preamplifier

10.2 Room one volume control attenuator

10.3 Power amplifier

10.4 Fixed equalization

10.5 Narrow band equalization

10.6 Frequency shift feed back stabilizer

10.7 Time delay unit

10.8 Patching facilities

11. LOUDSPEAKER AND ASSOCIATED EQUIPMENT

11.1 Location and orientation of loudspeakers

11.2 Theatre type loudspeaker clusters

11.3 Distributed loudspeaker systems

11.4 Distribution lines

12. MISCELLANEOUS EQUIPMENT

12.1 Switching equipment

12.2 Audio transformer

13. TEST AND ADJUSTMENT

13.1 Initial adjustments

13.2 Equipment test

13.3 Adjustment

14. GUARANTEE AND SERVICE

The two typical specifications on SOUND SYSTEMS which follow will serve as samples. It is not intended that these specifications be applied exactly as they are written. Specifications will vary from job to job. But these sample specifications can suggest some of the many features and functions that a modern professional ALTEC Sound System can have and they will provide a model format for wording sound specifications.

Specification 1 will apply to many fine restaurants, the public rooms of hotels and, with some additions or deletions, will do an excellent job as a sample of a typical outline for such use. Many restaurant and hotel operators will like the many functions outlined in Specification 1, but such men probably never would think of them without guidance from you.

The new ALTEC Revocon Remote Volume Control will find application in most sound systems properly designed for this type of installation.

Specification 2 covers a Church job and would have to be enlarged or condensed dependent upon the Church job out for bid. Most Ministers might be inclined to object if a multicellular horn is visible in the church, but their congregation wants to hear. If they can hear, they will be satisfied. Any loudspeaker installed in the church sanctuary should be "built-in" to fit the decor of the church; therefore, multicellular horns and their applications to the church job will present no problem. While all auditorium jobs are best served from a single sound source, often it is necessary to operate a few cone speakers at low level (with a time delay device) under large overhanging balconies or soffits.

In Arena-type buildings, speakers around the perimeter of the vomitory are seldom satisfactory and you should inform those concerned with such buildings that a central sound source is the best answer to good sound.

In the Church, Auditorium, Arena, Meeting Hall, etc., modern stereophonic reproduction will emphasize further the deliverance of the sermon and message, it will enhance the rendition of the anthems and music, and will prove a valuable adjunct to any sound system.

Therefore, it should be seriously considered in these types of installations. Many such system requirements demand a remote control for the volume level of the sound system. The ALTEC "REVOCON", Remote Volume Control System permitting full control of the system volume, is a necessary feature in the modern sound system.

Baseball Park, Football Stadium, etc., installations always are faced with a varying ambient background crowd noise. The ALTEC "NOALA" (noise-operated automatic level adjustment) should be included as a must in this type of system.

In a large manufacturing concern it is necessary that the highest degree of reliability and freedom from "down time" be incorporated into the system. The ALTEC "SEQR" should be written into these specifications. Because of the varying background noise, this type of system lends itself to the use of "NOALA", either on a plant wide basis or departmentalized depending on the individual requirements of the installation.

It is important in the writing of Sound System Specifications that full complete thought be given to the problems involved in the type of systems under consideration. If your client is a Church, the require-

ments for microphones alone would vary from one denomination to another. The Catholic and Episcopal churches will usually require a minimum of three microphones; one on the Altar, one on the Pulpit for delivery of the sermon and one on the Lectern for the reading of the Scripture—usually by an assistant and, in some cases, by lay people. In the Lutheran Church, a fourth microphone is usually required for the Baptismal Font.

In a Baptist Church, the average requirement is for one microphone on the Altar or Pulpit and another at the Baptismal Pool. Methodist Churches usually require only one on the Pulpit.

Each denomination varies and within some denominations there may be different conditions and demands from various parts of the country and from different dioceses.

The location of loudspeakers in any system is of utmost importance. In any large room or area, a central source—such as a cluster or group of speakers—is best. Where there is background music and the system is of the low level type, generally the Contractor is faced with the question: "How far apart should these speakers be located?" There is no one single formula to answer this, but a good rule of thumb—when using a speaker having a wide angle of distribution like the ALTEC 755C—is to anticipate that the distance between speaker centers will be approximately the same as the distance between the ceiling to the floor. For paging systems in noisy areas, the speakers should be mounted in a pattern with all horns facing the same direction and on about 40' centers. Again, this is a typical dimension and, in actual practice, the many facets of building design and construction such as walls and partitions, the location of machinery, ambient noise, etc., must be considered. One thing which cannot be stressed too strongly with the building people is the need for acoustical treatment. Optimum performance for music reproduction in a large auditorium or field house requires that the reverberation time not exceed 1.9 seconds. Good results in music quality can be achieved with a reverberation time of less than one second. Contrast this with the fact that many auditoriums with a reverberation time of 3, 4, 5 or more seconds have been helped by the installation of sound equipment. But, consider what could have been done if the room or area also had been naturally improved by acoustic treatment.

Also, it is recommended that specifications include the quantity of microphones and loudspeakers of each type, and where they will be used or installed.

A schedule of microphones and loudspeakers should be a part of the written specifications. Their locations can be set forth in the written specification and/or on accompanying Block Diagram.

Whenever loudspeakers are installed out-of-doors or where they may be subjected to moisture, every effort should be made to guard against damage by dampness. Whenever multicellular horns are used out-of-doors, the Altec 30546 45-degree weather-proof throat adapter should be included, and when 511A sectoral horns are used out-of-doors, the Altec 30547 90-degree adapter should be included.

In the following specifications, the matter of 70-volt matching transformers are mentioned; however the exact specifications are not spelled out because the selection of proper transformers may vary in accordance with the amount of audio power delivered to each respective speaker.

It is important, however, when multicellular or sectoral horns are used at high powers and without crossover networks, that the loudspeakers be given "bottom end" protection. For this purpose we recommend Altec 15045A 100-watt 70-volt transformer which has a built-in high-pass filter. Full details on the 70-volt matching transformers will be found in the transformer bulletin.

We trust that the foregoing will help to invoke your thinking along the proper lines in the establishment of parameters for the preparation of Sound System Specifications.

No pre-established specification will apply to every proposal because each sound installation is as individual in character as the building owner, architect, consulting engineer or the sound contractor. If, however, the above data together with the attached sample specifications has guided your thinking in the direction intended, all of us working as a team will reach our goal: THE BEST SOUND SYSTEM FOR EVERY INSTALLATION.

SAMPLE ARCHITECT SPECIFICATION #1

SOUND SYSTEM SPECIFICATIONS FOR — Palm Tree Restaurant & Lounge located at Brassknuckles, Arizona. John Doe and Associates, Architects and Engineers, 100 America Street, Anywhere, U.S.A.

Provide and install a complete centralized Sound Distribution System as described herein, together with all other apparatus, conduit, wire, outlet boxes, material and labor necessary to provide a complete operating system performing all of the services and functions described herein. Conduit, wire and outlet boxes may/shall be installed by electrical contractor but all sound equipment must be supplied by, installed by, checked out by, and guaranteed by a factory authorized Sound Engineering Contractor. The system shall not be of the "so

called" PA system or equipment type, but shall be designed to promulgate the original sound in its original tenor and timbre.

1. FUNCTIONS

- 1.1 Microphone pickup at main entrance.
- 1.2 Microphone pickup at cocktail lounge bar.
- 1.3 Microphone pickup in banquet room.
- 1.4 Microphone pickup at office.
- 1.5 Provisions for FM-AM program reception.
- 1.6 Provisions for reproducing phonograph records.
- 1.7 Provisions for feeding output of sound distribution paging system to banquet rooms.
- 1.8 Provisions for monitoring the program at the amplifier cabinet location. Monitoring to be both aural and visual.
- 1.9 Provisions for remote controlling and mixing microphones on stage-bar lounge system.

2. EQUIPMENT. GENERAL

In order to provide for the performance of the above functions the following equipment shall be furnished.

- 2.1 Microphones to be furnished on stands complete with accessories. See Par. 6.
- 2.2 Phonograph reproducer. See Par. 3.1.
- 2.3 FM-AM Tuner. See Par. 3.1.
- 2.4 Monitor Speaker. See Par. 3.1.
- 2.5 V.U. Meter Panel. See Par. 3.1.
- 2.6 Compressor Amplifier for paging system. See Par. 3.1.
- 2.7 Power Amplifier Equipment for paging system. See Par. 3.1.
- 2.8 Power Amplifier Equipment for banquet room. See Par. 4.
- 2.9 Power Amplifier Equipment for stage-bar lounge. See Par. 5.
- 2.10 Remote Volume Control System. See Par. 5.2.
- 2.11 Loudspeakers and accessories. See Par. 7.

3. EQUIPMENT. DETAILED SPECIFICATIONS

3.1 The power amplifier for the paging system (main distribution system) shall be mounted in a cabinet of metal or a relay track according to the owner's desires. The cabinet shall be of metal construction and of approximately 12 gauge material. The cabinet shall be finished in Dark Green finish.

There shall be housed in the cabinet all components such as the microphone preamplifier-mixer amplifier, equipped with a VU Meter, Phonograph Changer and Reproducer unit, AM-FM Tuner, System Tone Control facilities, Monitor Speaker, Compressor type amplifier, Audio Power Amplifier and Primary Power Distribution unit.

INSERT SPECIFICATIONS

OF 1567A Preamplifier Unit

The cabinet also shall include a four-speed record changer complete with variable reluctance pickup. Provisions shall include the proper facilities for the reproduction of both 33- $\frac{1}{2}$ RPM and 78 RPM recordings. The pickup unit shall include a 1 mil. stylus or needle for 33- $\frac{1}{2}$ RPM reproduction and a 3 mil. needle for 78 RPM reproduction. This may be accomplished by using separate interchangeable pickup heads or by the use of a single "turn over" type cartridge. This unit shall be of the Collaro, Garrard or approved equal.

INSERT SPECIFICATIONS

OF 316A AM-FM Tuner

At the top of the panel mounting space in the cabinet shall be located a monitor speaker having the following specifications.

INSERT SPECIFICATIONS

OF 1553A Monitor Panel

The cabinet system shall incorporate a Compressor Type amplifier in order to automatically compensate for the difference in strength or "level" of talkers using the various microphone inputs of this system.

INSERT SPECIFICATIONS

OF 436C Compressor

The power amplifier shall be of the rack mounting type and shall produce 80 watts of audio power with not more than 2% total harmonic distortion over the frequency range of 60 to 20,000 cycles.

INSERT SPECIFICATIONS

OF 1569A Power Amplifier

Also included in this cabinet shall be a Power (primary line) Distribution Unit.

INSERT SPECIFICATIONS

of 1554A Power Distribution Panel

It shall be necessary that the control facilities of the system be such as to permit the paging by microphone to be at a higher "level" than the phonograph or radio program sources.

4. EQUIPMENT FOR BANQUET ROOM. DETAILED SPECIFICATIONS

4.1 Provide a separate power amplifier for the banquet room which shall be located locally and shall be used for program material originating in the banquet rooms. This amplifier shall be of the portable or "base" type and shall be on a "tea cart" type stand or table for ease of portability from one banquet room to

another. The output of this amplifier shall connect to the speakers in the banquet rooms by means of a suitable jack mounted in a panel on the wall in each banquet room. This jack panel shall also contain a switch permitting the disconnection of the program material from the main system (paging system). See Block Diagram, which is a part of these specifications, for added details on this facility.

INSERT SPECIFICATIONS
of 342B or 352A Power Amplifier

5. EQUIPMENT FOR STAGE BAR (Lounge).
DETAILED SPECIFICATIONS

5.1 Provide a separate power amplifier for amplifying program material originating in the Bar-Lounge. This program material shall be of the same type and have the same features and facilities as the unit in paragraph 4 excepting that it shall not require a portable cart or stand but shall be mounted permanently as specified by the owners.

5.2 Provide a Remote Volume Control System—"REVOCON"—for this system. The Remote Volume Control Slave Network shall be a passive-type network which does not deteriorate or alter any of the characteristics of performance of the original amplifier circuit. Operating voltages for the "REVOCON" System shall be furnished by a separate DC Power Supply.

INSERT SPECIFICATIONS
1571B, 1572A, 1573A, and 1574A

6. MICROPHONES

6.1 Provide microphones in the quantity as specified in the attached microphone schedule. The Type "A" microphone for paging functions shall be complete with desk type stands and "Press to Page" switches mounted in the stand. These microphones shall be complete with necessary cords and plugs and shall comply with the following specifications.

INSERT SPECIFICATIONS
Of 682A Microphone, 26A Desk Stand
and 7A Switch

6.2 Provide microphones as outlined in the microphone schedule attached. These microphones shall be of the "cardioid" type and be complete with floor stands and necessary cable and plugs. They are referred to on the schedule as "Type B" microphones.

INSERT SPECIFICATIONS
of 685A Microphone

7. LOUSPEAKERS

7.1 Provide "Type A" Loudspeakers in accordance with the speaker schedule attached and which schedule is a part of these specifications. These speakers shall carry a rating of not less than 14 watts and shall be mounted in ceiling-type housings as manufactured by Lowell Manufacturing Co. or approved equal, and the speakers must be of the highest quality. So-called radio or TV-type speakers, regardless of size, shall not be acceptable.

INSERT SPECIFICATIONS
of 401B Speaker

All speakers shall operate on a 70-volt (constant voltage type) distribution system and each speaker shall be equipped with a high quality Matching Transformer having not less than three steps of adjustment. The transformers shall be of such quality that at rated power the frequency range shall not vary more than 1 db (copy from specs) and the insertion loss shall not exceed (copy from specs) db for the most unfavorable combinations of impedances.

7.2 Provide "Type B" loudspeakers in accordance with the speaker schedule attached. These speakers shall be mounted in bass reflex type enclosures mounted in accordance with the owner's request and the constructions specifications of this project. Speakers of a construction that does not meet the specifications following shall not be acceptable under these specifications.

The 70-volt transformers used for these speakers shall be of such quality that at rated power the frequency shall not vary more than 1 db from (copy from specs) and the insertion loss shall not exceed (copy from specs) db for the most unfavorable combinations of impedance.

INSERT SPECIFICATIONS
on 50B Speaker

NOTE: The block schematic diagram attached to these specifications becomes part of these specifications and shall be equally considered with the written specifications by all bidders.

8. OUTLETS. Provide where shown on the construction drawings all microphone, primary power and other outlets where required.

9. WIRING. The installers shall install and provide all conduits, ducts, outlet boxes, connectors, pull boxes and wire necessary to provide a completely operating system according to the intent of these specifications. All lines shall be tested for continuity and freedom from grounds and shorts.

Care must be exercised to accomplish conduit runs with a minimum of bends. No more than two 90 degree bends in a run will be permissible without the insertion of pull boxes.

All microphone circuits shall be run using accepted microphone cable of two-conductor shielded type with outer jacket of rubber.

No splices will be permitted in any run of cable in the microphone circuits. At all conduit ends no less than 26" of microphone cable shall be left protruding, for ease of final hookup.

Speaker circuits may be installed using number 16 AWG twisted pair cable, however, where circuit runs over 250 feet, then number 14 AWG twisted pair must be used. Conduit sizes shall be of proper size according to established wiring practices.

No splices in the speaker circuits will be permitted unless such splices occur within a pull box and in which case the splice must be securely soldered and insulated with 3M plastic tape.

Provide at each power amplifier rack or cabinet two 25 ampere, 115 volt, 60 cycle power circuits. These circuits shall terminate in standard duplex receptacles. Provide in each power circuit a fuse box and fuses, located adjacent to the rack or cabinet (in addition to any fuses or circuit breakers that may be provided at the load distribution centers, etc.)

10. GENERAL Manufacturer. All sound equipment described herein shall be the product of one manufacturer of established reputation and experience who shall have produced similar apparatus for a period of at least ten years and who shall be able to refer to similar installations now rendering satisfactory service. Specialized products such as microphones, loudspeaker units, 70-volt matching transformers, radio tuners, etc., which are not actually manufactured by the Sound System manufacturer, but are procured from other outside manufacturing sources and simply relabeled with the Sound System manufacturer's brand name, will not be acceptable under the above requirement that "all sound equipment shall be the product of one manufacturer...."

Information Accompanying Bids: Bids shall be accompanied by descriptive literature, illustrations and full details of functions and operations.

Guarantee. The manufacturer or its agents shall guarantee the equipment herein described and specified with the exception of tubes, pilot lights, fuses to be free from defects of material and workmanship under normal use and service. Their obligation under this guarantee is limited to the replacing of parts thereunder which shall within ninety days (90) after installation be returned to the original manufacturer, and shall, upon his examination, be found defective. The guarantee shall be in accordance with that of EIA.

Operating Instructions shall be provided together with necessary circuit and wiring diagrams and other information necessary for installation, service, maintenance and operation of the equipment.

MICROPHONE SCHEDULE

- 1 Type "A" for Main Entrance Paging
- 1 Type "A" for Office Paging
- Type "B" for Dining Rooms Use
- Type "B" for Bar-Lounge Entertainment Use

SPEAKER SCHEDULE

- Type "A" for Waiting Room
- Type "A" for Coffee Shop
- Type "A" for Private Rooms
- Type "A" for Corridors
- Type "A" for Dining Rooms
- Type "B" for Bar-Lounge
- Type "C" for Patio and Gardens
- Type "C" for Parking Attendant and Parking Lot

SAMPLE ARCHITECT SPECIFICATION #2

SOUND SYSTEM SPECIFICATIONS FOR Christian Church
Located at Everywhere, U.S.A.

John Doe and Associates, Architects and Engineers,
100 America Street, Anywhere, U.S.A.

Provide and install a complete Centralized Sound Distribution System as described herein, together with all other apparatus, conduit, wire, outlet boxes, material and labor necessary to provide a complete operating system performing all of the services and functions described herein. Conduit, wire and outlet boxes may/shall be installed by electrical contractor but all sound equipment must be supplied by, installed by, checked out by, and guaranteed by a factory authorized Sound Engineering Contractor.

1. FUNCTIONS

- 1.1 Microphone pickup at Altar
- 1.2 Microphone pickup at Pulpit
- 1.3 Microphone pickup at Lectern
- 1.4 Microphone pickup at Baptismal Font
- 1.5 Provisions for remote control and mixing of microphones

2. EQUIPMENT. GENERAL

In order to provide for the performance of the above functions, the following equipment shall be furnished.

- 2.1 Microphones and stands. See Par. 4
- 2.2 Power Amplifier and Control System. See Par. 3.1
- 2.3 Remote Volume Control System. See Par. 3.2
- 2.4 Loudspeakers for Sanctuary. See Par. 5.1
- 2.5 Loudspeakers for Chapel, Nursery and Lobby. See Par. 5.2

3. EQUIPMENT. DETAILED SPECIFICATIONS

3.1 The control, input devices, power amplifier, and other components of the amplifier system shall be mounted in a louvered cabinet. The cabinet shall be of metal construction and of approximately 12 gauge material. The finish of the cabinet shall be Dark Green.

The microphone mixer-preamplifier unit shall have five positions, four positions to be equipped with plug-in transformers having no less than 60 db magnetic shielding. The fifth position shall be for high level inputs that may be desired at a later date and under separate contract. The unit shall include separate bass and treble tone controls and a master volume control. The preamplifier unit shall include a V.U. meter for visual monitoring.

INSERT SPECIFICATIONS of 1567A Preamplifier

The cabinet system shall incorporate a Compressor type amplifier in order to automatically compensate for the difference in strength or "level" of talkers using the system.

INSERT SPECIFICATIONS for 436C Compressor

The power amplifier shall be of the rack mounting type and shall produce 40 watts of audio power with not more than 2% total harmonic distortion over the entire frequency range of 40 to 20,000 cycles.

INSERT SPECIFICATIONS for 1568A Amplifier

Also include in this cabinet a Power Distribution Panel.

INSERT SPECIFICATIONS for 1554A Power Distribution Panel

3.2 Provide a Remote Volume Control System—"REVOCON"—for this system. The Remote Volume Control Slave Network shall be a passive type network which does not deteriorate or alter any of the characteristics of performance of the original amplifier circuit. Operating voltages for the "REVOCON" System shall be furnished by a separate DC Power Supply.

INSERT SPECIFICATIONS for 1571B, 1572A, 1573A, and 1574A

4. MICROPHONES

4.1 Provide two type "A" microphones employing the "cardioid" principle of pickup. One for the Pulpit and one for the Lectern. The microphones shall be mounted on desk type stands having uprights long enough to bring the microphone in close proximity to the "talker's" lips, yet not hide his face from the congregation.

INSERT SPECIFICATIONS

for M30 Condenser, Cardioid Microphone and 26A Desk Stand

4.2 Provide one type "B" microphone for the Altar which shall conform to the following specifications. This microphone shall be mounted on a desk stand same as described in Par. 4.1 above.

INSERT SPECIFICATIONS for 684A Microphone

4.3 Provide one type "C" microphone for the Baptismal Font which shall be of the lavalier type and shall conform to the following specifications.

INSERT SPECIFICATIONS for 686A Microphone

5. LOUDSPEAKERS

5.1 Provide for the Sanctuary of the Church a speaker system type "A" so designed as to complement the voice frequencies of the spectrum, one which has a natural "horn cut-off" at 500 cycles. This unit shall be composed of a multicellular horn, with compression driver and cross-over network. The low side of the network shall not be utilized in this system and shall be installed with a resistive load on the low side.

INSERT SPECIFICATIONS for 1505B Horn, 288C Driver and N500C Network

5.2 Type "B" speakers having a rating of at least 15 watts shall be installed in the ceiling of the Chapel to care for over-flow crowds, in the ceiling of the Nursery, in the Lobby equally spaced as indicated on the construction drawings. All speakers under this section of the specifications shall be ceiling mounted in mountings manufactured by Lowell Manufacturing Co. or approved equal. The speakers shall have the following specifications.

INSERT SPECIFICATIONS for 755C Speaker

NOTE: All speakers or speaker systems shall be furnished with proper matching transformers as the constant voltage, 70-volt type of distribution shall be used.

These transformers shall be of highest quality having not less than three steps of adjustment. The transformers shall be of such quality that at rated power, the frequency range shall not vary more than 1 db from (copy from specs) and the insertion loss shall not exceed (copy from specs) _____ db for the most unfavorable combinations of impedances.

NOTE: The Block Schematic Diagram attached to these specifications becomes part of these specifications and shall be equally considered with the written specifications by all bidders.

6. **OUTLETS.** Provide where shown on the construction drawings all microphone, primary power and other outlets where required.

7. **WIRING.** The installers shall install and provide all conduits, ducts, outlet boxes, connectors, pull boxes and wire necessary to provide a complete operating system according to the intent of these specifications. All lines shall be tested for continuity and freedom from grounds and shorts.

Care must be exercised to accomplish conduit runs with a minimum of bends. No more than two 90-degree bends in a run will be permissible without the insertion of pull boxes.

All microphone circuits shall be run using accepted microphone cable of two-conductor shielded type with outer jacket of rubber.

No splices will be permitted in any run of cable in the microphone circuits. At all conduit ends no less than 26" of microphone cable shall be left protruding, for ease of final hookup.

Speaker circuits may be installed using number 16 AWG twisted pair cable, however, where circuit runs over 250 feet, then number 14 AWG twisted pair must be used. Conduit sizes shall be of proper size according to established wiring practices.

No splices in the speaker circuits will be permitted unless such splices occur within a pull box and in which case, the splice must be securely soldered and insulated with 3M plastic tape.

Provide at each power amplifier rack or cabinet two 25 ampere, 115 volt, 60 cycle power circuits. These circuits shall terminate in standard duplex receptacles. Provide in each power circuit a fuse box and fuses, located adjacent to the rack or cabinet (in addition to any fuses or circuit breakers that may be provided at the load distribution centers, etc.)

8. **GENERAL Manufacturer.** All sound equipment described herein shall be the product of one manufacturer of established reputation and experience who shall have produced similar apparatus for a period of at least ten years and who shall be able to refer to similar installations now rendering satisfactory service. Specialized products such as microphones, loudspeaker units, 70-volt matching transformers, radio tuners, etc., which are not actually manufactured by the Sound System manufacturer, but are procured from other outside manufacturing sources and simply relabeled with the Sound System manufacturer's brand name, will not be acceptable under the above requirement that "all sound equipment shall be the product of one manufacturer..."

Information Accompanying Bids. Bids shall be accompanied by descriptive literature, illustrations and full details of functions and operations.

Guarantee. The manufacturer or its agents shall guarantee the equipment herein described and specified with the exception of tubes, pilot lights, fuses to be free from defects of material and workmanship under normal use and service. Their obligation under this guarantee is limited to the replacing of parts thereunder which shall within ninety days (90) after installation be returned to the original manufacturer, and shall, upon his examination, be found defective. The guarantee shall be in accordance with that of EIA.

Operating Instructions shall be provided together with necessary circuit and wiring diagrams and other information necessary for installation, service, maintenance and operation of the equipment.

MICROPHONE SCHEDULE

- 2 type "A" for Pulpit and Lectern
- 1 type "B" for Altar
- 1 type "C" for Baptismal Font

SPEAKER SCHEDULE

- 1 type "A" for Sanctuary
- _____ type "B" for Chapel, Nursery, Lobby, _____