**Public Broadcasting Sound System Engineering Overview**

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The broadcasting and sound system covers a wide range, from shopping malls, schools, hotels, stations, terminals, squares to venues, theaters, stadiums, etc. are all closely related.

1.1 In civil construction engineering design, broadcasting systems can be divided into the following categories:

A. Public broadcasting systems for public areas (shopping malls, stations, terminals, shopping malls, restaurants, corridors, classrooms, etc.) and parking lots. This type of system is mainly used for voice broadcasting, so clarity is paramount. Moreover, such systems often broadcast background music in peacetime, and can be converted to emergency broadcasts in the event of a disaster or emergency.

B. Broadcast audio system for hotel rooms. Such systems include room audio broadcasts and emergency broadcasts, often delivered by bedside tables located in the guest rooms. The room broadcasts contain a number of freely selectable bands. In the case of emergency broadcasts, room broadcasts are automatically interrupted and automatically switched to emergency broadcasts.

C. Hall sound reinforcement system represented by auditorium, theater and gymnasium.

This is a professional sound reinforcement system, which not only considers electro-acoustic technology problems, but also involves architectural acoustics. Both of them must be balanced and should not be neglected. Such broadcast systems often have comprehensive multi-purpose requirements, which can be used not only for the sound reinforcement of the venue language, but also for performances in the arts. For large-scale live sound systems, the electric power is low. Tens of thousands, more than tens of thousands of watts, it is necessary to use high-powered speakers and power amplifiers, in the system configuration and equipment selection have certain requirements, while paying attention to the load of the power line.

D. Broadcast audio system for conference rooms, lecture halls, etc.

Such systems are generally also systems that are set up for background music and emergency broadcasts provided by public broadcasts, but because of their particularity, conference broadcast systems are often set up separately in conference rooms and lecture halls. For higher requirements or international conference halls, special audiovisual systems such as simultaneous interpretation systems, conference voting systems, and large-screen projection televisions are also required.

As can be seen from the above, the broadcast audio systems for various buildings, hotels and other civil buildings can be basically classified into three types:

The first is the Public Address System (PA), which is a cable broadcast system, which includes background music and emergency broadcast functions. It is usually combined to play background music or other programs, and is converted into an alarm when there is an emergency such as a fire. broadcast. The microphone used for broadcasting in such a system is generally not in the same room as the speaker broadcasted to the public, so there is no problem of acoustic feedback, and the constant pressure transmission is a typical system; the second is the hall sound reinforcement system, such a system The use of professional audio equipment, and requires a high-powered speaker system and amplifier, because the microphone and the speaker for sound reinforcement are in the same hall, there is the problem of acoustic feedback and even howling, and because of the short distance, the system is generally The use of low-impedance direct transmission; the third is a dedicated conference system, although it is also a sound reinforcement system, but has its special requirements, like the sound interpretation system.

1.2 The composition of the broadcast audio system

No matter which kind of broadcast sound system, it can be basically divided into four parts: program source equipment, signal amplification and processing equipment, transmission line and speaker system.

Program source equipment: The program source is usually provided by radio broadcasting, laser phonograph and recording deck, in addition to microphones and electronic musical instruments.

Signal amplification and processing equipment: including mixers, preamplifiers, power amplifiers and various controllers and audio processing equipment. The primary task of this part of the equipment is signal amplification, followed by signal selection. The mixer and preamplifier are similar in function and status (of course, the mixer's functions and performance indicators are higher), their basic functions are to complete the signal selection and preamplification, in addition to the volume and sound effects for various Adjustment and control. In order to better perform frequency equalization and timbre beautification, the graphic equalizer is also separately input. This part is the "control center" of the entire broadcast sound system. The power amplifier amplifies the signal from the preamplifier or the mixer, and then pushes the speaker through the transmission line.

Although the transmission line is simple, it has different requirements depending on the system and the transmission method. For the auditorium, theater, etc., because the distance between the power amplifier and the speaker is not far, the direct feeding method of low resistance and large current is generally adopted, and the transmission line requires a dedicated speaker line. For the public broadcasting system, since the service area is wide and the distance is long, in order to reduce The loss caused by the transmission line often adopts a high-voltage transmission mode. Since the transmission current is small, the transmission line is not required to be high.

Speaker System: The speaker system requires the entire system to be matched, and the choice of its position should be realistic. Auditoriums, theaters, dance halls, sound quality, sound quality requirements, and speakers generally use high-power speakers; and public broadcasting systems, because it is not so high requirements for sound, generally use 3W-6W ceiling speakers.

1.3 Characteristics of the broadcasting system

Background music is abbreviated as BGM. It is the abbreviation of BackGroundMusic. Its main function is to cover up the noise and create a relaxed and harmonious atmosphere. If the listener does not pay attention to it, he can't distinguish the location of the sound source, the volume is small, it is a kind of energy. Create music in a relaxed and pleasant atmosphere.

Therefore, there are two effects of background music. One is to cover up the environmental noise psychologically, and the other is to create an atmosphere that suits the indoor environment. It is widely used in hotels, hotels, restaurants, shopping malls, hospitals, office buildings and so on. The music should be lyrical or relaxed, and the intense music is not appropriate.

Background music is not stereo, but mono music. This is because stereo requirements can distinguish the sound source orientation and have a sense of depth, while background music is not conscious to hear where the sound comes from, and does not want The location of the sound source is felt, and the sound source is required to be concealed, and the volume is lighter, so as not to affect the two people's opposite speech.

1.4 Features of the fire broadcast function

Fire broadcasts are activated when an accident occurs (so it is closely related to personal safety) and fire broadcasts have the following characteristics:

The fire alarm signal should have the highest priority in the system, and it can cut off the status of background music and calling people. It should be easy for the fire alarm personnel to operate.

Transmission cables and speakers should be fire resistant.

In the case of AC power outage, the alarm broadcast should also be implemented.

Second, the general order of public broadcasting engineering design

The term "public broadcasting" as used herein refers to a sound transmission of a cable transmission, which is commonly used in shopping malls, public venues, buildings, and communities, for background music broadcasting, paging broadcasting, and forced insertion of forcible broadcasting.

The design of this type of public broadcasting project is usually carried out in the following order:

1. First of all, we should consider the selection and configuration of broadcast speakers.

2. Selection of broadcast power amplifier

3. Broadcast partition

Shopping mall public address system structure

The structure of the public broadcasting system of the shopping mall consists of four parts: broadcasting power amplifier, audio input/output, sound equipment, and intelligent broadcasting. The four are organically integrated into a unified public address system. The structure is designed to take into account the needs of the mall and the construction cost of the system.

Third, the selection and configuration of broadcast speakers

1. Selection of broadcast speakers In principle, different types of broadcast speakers should be used depending on the environment.

For example, in a room with a ceiling ceiling, an embedded, back coverless ceiling speaker should be used. This type of speaker has a simple structure, is relatively inexpensive, and is easy to construct. The main disadvantage is that there is no back cover and it is easy to be bitten by insects and rats. In a room with only a suspended ceiling and no ceiling (such as an open-air shopping mall), a ceiling-mounted tubular speaker or a ceiling speaker with a rear cover should be used. Since the ceiling is equivalent to an infinite baffle, the use of a speaker without a back cover in the presence of a ceiling does not cause an acoustic short circuit. When there is no ceiling, the situation is very different. If you still use a ceilingless speaker without a back cover, the effect will be very poor. In this case, hoisting speakers should be used in principle. However, if the investment is too large, a ceiling speaker with a rear cover can also be used. The rear cover with the rear cover ceiling speaker not only has the general mechanical protection effect, but also plays a role in preventing the acoustic short circuit to a certain extent.

In ceiling-free rooms (such as underground parking lots), wall-mounted speakers or indoor sound columns should be used.

Outdoors, an outdoor sound column or horn should be used. This type of sound column and horn not only has a rainproof function, but also a large volume. Since the outdoor environment is empty and there is no reverberation effect, it is necessary to select a variety with a loud volume.

In gardens and grasslands, grass speakers should be used. These speakers are rainproof, sleek, and the volume and sound quality are more elegant.

In the halls with high decoration and high ceilings, it is advisable to use hoisting speakers with elegant shapes and harmonious tones. In the case of high fire protection requirements, fire-resistant speakers should be used. This type of speaker is fully sealed and its outlet is mated to the flame-retardant sleeve.

2. Broadcast speaker configuration

In principle, the broadcast speakers are arranged in the broadcast service area in a uniform and decentralized manner. The degree of dispersion should be such that the signal-to-noise ratio in the service area is not less than 15 dB.

Generally, the noise floor of a high-grade office corridor is about 48 to 52 dB, the noise floor of a super mall is about 58 to 63 dB, and the noise floor of a busy section is about 70 to 75 dB. Considering the accident, the scene may be very confusing, so for the need of emergency broadcasting, even if the broadcasting service area is an office building, the noise floor should not be estimated too low. For this reason, as a general consideration, in addition to the bustling and lively places, it is possible to roughly consider the noise floor as 65 to 70 dB (except in special cases). According to this calculation, the sound pressure level of the broadcast coverage area should be above 80 to 85 dB.

Since broadcast speakers are typically distributed, the sound pressure level of the broadcast coverage area can be approximated as a contribution from a single broadcast speaker. According to the relevant electroacoustic theory, the sound pressure level SPL of the speaker coverage area has the following relationship with the sensitivity level LM of the speaker, the electric power P fed to the speaker, and the distance r between the listening point and the speaker:

SPL=LM+10lgP-20lgrdB(1)

The sensitivity level of the ceiling speaker is between 88 and 93 dB; the rated power is 3 to 10 W. At a frequency of 90 dB/8 W, the sound pressure level at 8 m from the speaker is about 81 dB. The above calculations do not consider the contribution of the early reflection sound group. Indoors, the contribution of early reflections and adjacent speakers can increase the sound pressure level by about 2 to 3 dB.

According to the above approximate calculation, in the venue where the ceiling is not higher than 3 m, the ceiling speakers can be uniformly arranged at a distance of 5 to 8 m. If only background music is considered without considering emergency broadcast, the distance can be increased to 8-12 m. In addition, the fire accident design and installation specification (hereinafter referred to as “the specification”) applicable to mainland China has the following rigid rules: “The number of speakers in public places such as walkways, halls, restaurants, etc. should be guaranteed from any part of this floor. Recently, the walking distance of a speaker is no more than 15m. Speakers should be provided at the intersection of the walkway and at the corner. The last speaker at the end of the walkway is no more than 8m away from the wall.

There is basically no early reflection sound group in outdoor places, and the effective coverage of a single broadcast speaker can only take the lower limit calculated above. Since the distance corresponding to the lower limit is very short, a sound column composed of a plurality of speakers should be used in principle. For each doubling of the signal electrical power fed to a group of speakers (eg, a sound column) (provided the group is acceptable), the sound pressure level can be increased by 3 dB. Please note the meaning of "double". It is doubled from 1 to 2; it is doubled from 2 to 4. In addition, for every 1 time increase in distance, the sound pressure level will drop by 6dB. According to the above rules, it is not difficult to estimate the arrangement distance of the outdoor sound column. For example, taking the CS-540 outdoor sound column as an example, its rated power is 40W, which is more than 4 times that of a single ceiling speaker. Therefore, its effective coverage distance is more than twice that of a single ceiling speaker. In fact, this distance can be larger. Because the sensitivity of the column is higher than that of a single ceiling speaker (about 3 to 6 dB higher), and for every 6 dB increase, the distance can be doubled. In other words, the coverage distance of 540 columns can reach more than 20m. However, the radiation angle of the sound column is relatively narrow, and is effective only about 60 to 90 degrees (horizontal angle) in front of it. The specific calculation can still be obtained by equation (1).

Fourth, the selection of broadcast power amplifier

Broadcast amplifiers are different from HI-FI amplifiers. Its main feature is its 70V and 100V constant voltage output terminals. This is because broadcast lines are usually quite long and must be transmitted with high voltage to reduce line losses.

The most important indicator of a broadcast amplifier is the rated output power. How much rated output power should be used, depending on the total power of the broadcast speakers. For the broadcast system, as long as the total power of the broadcast speaker is less than or equal to the rated power of the power amplifier, and the voltage parameters are the same, it can be arbitrarily matched, but considering the line loss, aging and other factors, the power margin should be left as appropriate. According to the requirements of the 'Specifications', the capacity of the power amplifier equipment (equivalent to the rated output power) should generally be calculated as follows:

P=K1?K2?ΣP0(2)

P-amplifier output total electric power (W)

P0 - maximum power per broadcast at the same time (equivalent to partition)

P0=Ki?Pi

Pi-i-zone speaker rated capacity

Ki-i-th partition requires coefficients at the same time:

Service broadcast room program, take 0.2 ~ 0.4

Background music system, take 0.5 ~ 0.6

Business broadcast, take 0.7~0.8

Fire accident broadcast, take 1.0

K1-line attenuation compensation coefficient: 1.26~1.58

K2-aging coefficient: 1.2 to 1.4

Therefore, if it is a background music system, the rated output power of the broadcast power amplifier should be about 1.3 times the total power of the broadcast speaker.

However, all public address systems should, in principle, be able to carry out emergency broadcasts of disasters. Therefore, the system must be equipped with an emergency broadcast amplifier. According to the "Specifications", the rated output power of the emergency broadcast power amplifier should be 1.5 times the sum of the speaker capacity in the three partitions with the largest capacity of the broadcast speaker.

Fifth, the broadcast partition

A public address system is usually divided into several areas, with managers (or pre-programs) deciding which areas must broadcast, those areas to be suspended, those areas to be inserted into emergency broadcasts, and so on.

The partitioning scheme depends in principle on the needs of the customer. Generally refer to the following rules:

1. Buildings are usually divided into floors. Shopping malls and amusement parks are usually divided by departments. Sports venues are usually divided into stands, residential quarters, residential quarters, resorts usually divided by property management, and so on.

2. The administrative department and the public place should be divided into districts.

3. It is necessary to set the area of the important department or the broadcast speaker volume to be arbitrarily adjusted by the on-site personnel.

In short, the partition is for ease of management. Any part that needs to be treated separately should be divided into different zones. However, in each zone, the total power of the broadcast speakers should not be too large and must be compatible with the capacity of the partitioner and amplifier.