

THE PROJECTION ROOM—ITS LOCATION AND CONTENTS*

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Before selecting the location for the projection room, let us consider the individual factors involved.

(1) *Effect on Screen Image.*—The primary purpose of the projection room is to provide a place from which the screen image can be projected to the best advantage. This requires that:

(a) The projection angle be kept as small as possible, both laterally and vertically. The depth of focus of the projection lens is taxed severely to maintain a sharply defined image over the entire screen area under working conditions. Add to this the buckling of the film at the projector aperture, plus any uneven wear of the aperture tracks and tension shoes, plus the unavoidable lateral projection angle imposed by the spacing necessary between projectors, and the best we can hope for in theater practice falls considerably short of the ideal. Now if we add a vertical projection angle to the already difficult situation, the screen image definition suffers visibly with only a very small vertical angle. Long before the maximum approved limit of 15 degrees is reached, the screen image suffers visibly from distortion as well as from loss of definition. The added depth of focus of the longer E.F. lenses may hold the definition within tolerable limits, but the distortion is unavoidable.

(b) The projection distance should be such that a projection lens with an equivalent focus within normal limits will produce the desired size screen image. The lens must have a speed of $f/2.0$ to match that of modern arc lamp optical systems. Such projection lenses are available in focal lengths from 2 to 5 inches to fit existing projectors. Although $f/2.0$ lenses are also available in focal lengths of 6, 7, and 8 inches, they are too large for standard projectors to accommodate. If longer than 5-inch E.F. lenses are used with standard projectors, speed must be sacrificed, with resultant loss of light efficiency. On the other hand, fast lenses of extremely short E.F. have a lesser depth of focus, and the lateral spacing between projectors at the necessarily short projection distances imposes an undesirably heavy lateral projection angle. For example, a 2-inch E.F. lens will form a screen image 20.5 feet wide at a projection distance of only 50 feet. At this short projection distance, with the recommended spacing of 60 inches between projectors, the lateral projection angle is approxi-

mately $2\frac{1}{2}$ degrees for each projector where two are used; 5 degrees for both outside projectors where 3 are used. Lateral angle is more serious than the same amount of vertical angle, because of the 4 to 3 proportion of the image width to its height. Also, it is impossible to cancel any of the lateral projection angle by tilting the screen. This brings our ideal projection distance to that which will give the desired picture size with an $f/2.0$ projection lens of 5 inch E.F.

(c) The lowest point of the light-beam projected to the screen must have a clearance of at least 6 feet 4 inches above any seating or traffic floor area to prevent interference with the picture. The highest point of the light-beam must be sufficiently below any ceiling obstruction to afford a clear view by the projectionist.

(2) *Accessibility*.—The projection room should be easily accessible from outside the theater without passing through the seating area or other public areas. Under no conditions should the projection room open directly into an audience area without double doors so arranged as to prevent any patron from seeing into the projection room at any time.

(3) *Fire Hazard*.—To reduce the fire and audience panic hazard, and consequently the insurance rates, the projection room should be located outside the fire wall of the theater or within a fire wall of its own.

(4) *Heating and Ventilating*.—Provision must be made for a non-combustible vent duct of ample capacity leading to the open air; also for fresh air in-take not connected with the main air-conditioning system. If unit heaters or steam radiators are placed directly in the projection room they must be covered with wire mesh. A much more satisfactory plan is to place heating coils or radiators in the projection room supply ducts.

(5) *Plumbing*.—Plumbing facilities must be extended to the projection room location, space being allowed immediately adjoining.

(6) *Noise Isolation*.—The projection room noise and mechanical vibration must be kept from the audience area of the theater. While it is possible to do so by employing massive construction and acoustical materials, regardless of the location, the task can be accomplished much less expensively if only the front wall of the projection room is directly exposed to the auditorium.

(7) *Additional Space Immediately Adjoining*.—It is highly desirable that motor-generators, rheostats, rectifiers, and other apparatus necessary to projection, as well as supplies, spare parts, test equip-

ment, tools used only occasionally, and clothes lockers be located as conveniently as possible to the projection room without being placed directly therein.

Considering all these factors, it is obvious that the location of the projection room will necessarily be a compromise in many respects. In making the compromise, it is well to remember that the screen image is what the theater has to sell. The requirements for excellent projection should come first and foremost, even at an added initial cost.

The contents of any projection room should be limited strictly to what is necessary for carrying on the performance with safety, dependability, and excellence. The following should be within the projection room proper:

(1) Fire-proof shutters on all ports, with both automatic and manual controls as described in the SMPE approved plans. (Also NBFU* Pamphlet 40, Sec. 191*e*.)

(2) A switch controlling the auditorium lights. Provision must be made also for turning these lights on from at least one other convenient point in the building. (NBFU, Sec. 191*j*.)

(3) Fire extinguishers of types using water or water solutions, such as soda and acid, calcium chloride, pump tank, and loaded stream. (NBFU, Sec. 144.) It seems that there is room for argument on this point. Water extinguishers are dangerous to use on electrical equipment, besides being themselves a source of extensive damage to such equipment. Carbon tetrachloride or compressed carbon dioxide extinguishers would seem much more appropriate for location inside the projection room. If the water types must be provided, it is the author's opinion that they should be located just outside the projection room, and be used only after the projectionist is outside. If such procedure does not satisfy local fire authorities, however, it can not, of course, be followed.

An interesting fact is that the NBFU does not recommend the use of fire extinguishers by the projectionist at all. Section 218 of NBFU Pamphlet 40 states: "*Procedure in Case of Fire.*—In the event of film fire in a projector or elsewhere in a projection or rewind room, the projectionist should immediately shut down the projection machine and arc lamps, operate the shutter release at the nearest point to him, turn on the auditorium lights, leave the pro-

* National Board of Fire Underwriters.

jection room, and notify the manager of the theater or building." If such procedure is followed, why should there be any hand extinguishers at all inside the projection room?

(4) *Waste Receptacles*.—(a) A suitable container for keeping scrap film under water, separate from waste paper and other rubbish. (NBFU, Sec. 183.)

(b) A metal container for hot carbon stubs. This should have a funnel-shaped cover with an opening only large enough to admit the largest diameter carbon used.

(c) If we adhere strictly to regulations, there would be no need for a receptacle for other waste material, because in Sec. 191f the NBFU states: "No combustible material of any sort whatever shall be permitted or allowed to be within such enclosure (projection room), except the films used in the operation of the machine, and film cement." Such a condition would indeed be ideal from a fire-hazard standpoint, if it could be maintained; but in actual practice there will almost inevitably be waste material of various sorts to be disposed of. There are available on the market cans suitable for such material.

(5) A work-table or bench of metal or other non-combustible material, *not* provided with racks or shelves underneath, which might be used for keeping film or other materials. (NBFU, Sec. 117.)

(6) Such tools as are necessary for changing carbons and making minor adjustments or repairs during the performance. These should be permanently located as conveniently as possible to the place where they will be most frequently used.

(7) Two good flashlights. One may burn out when needed in a hurry, or may be in use in an adjoining room. An approved portable trouble-lamp with metal guard, such as a "Reel-Lite," is good for long repair jobs, but should never be used around machinery in operation, and should not take the place of the flashlights.

(8) Two or more projectors and arc lamps. Sound equipment including a double-channel amplifier, all of NBFU approved design and manufacture.

(9) An enclosed metal cabinet for supplies and spare parts most likely to be needed during a performance.

(10) All controls necessary to operate the projection equipment, including associated apparatus not located in the projection room proper, such as rectifying equipment, ventilating fans, effect lighting, stage curtains used for motion picture presentation, *etc.*

(11) A house phone or other means of communication between projection room, auditorium, and manager's office.

(12) No film other than that actually in projectors or being threaded. This requires, of course, that there be an adjoining room for rewinding, inspection, and storage.

(13) One or more qualified projectionists, who shall not be minors. (NBFU, Sec. 217.) To operate a projection room with minimum fire hazard and first-class screen results requires that at least two projectionists be on duty at all times. Large theaters using more than two projectors, spotlights, effect machines, *etc.*, in the projection room must have more men in proportion to the additional equipment.

This outline covers only what must be in the projection room proper. Even for the one-man room, there is need for adjoining space to accommodate rectifying equipment, shipping cans, a complete stock of supplies and spare parts, oil cans, tools and test equipment not ordinarily used during a performance, a work-bench with vise, clothes lockers, books, records, and any other items necessary to the operation of the projection room, but which need not and should not be inside the projection room proper.

FACTORS AFFECTING SOUND QUALITY IN THEATERS

ADOLPH GOODMAN

During the past ten years a great deal of technical progress has been achieved in recording technic, and in recording and reproducing apparatus, so that today these advances should be reflected in greater entertainment value of the motion picture. In spite of such improvements there is much to be desired in the final presentation in theaters, mainly because there is a lack of proper coördination between the various phases that go to make up the ultimate sound as heard by the audience.

In this discussion, we shall point out the factors that must be considered and how they affect each other from the standpoint of the presentation in the theater. Assuming that the sound-track on the film is a faithful record of the original sounds, final results that the theater patrons hear depend upon the following five important, closely related factors: