Interior Finishing Works for Cinemas, Auditoriums and Studios
Lindner's systems for ceilings, floors and walls are geared to one another extremely well for physical, constructional and creative characteristics.

We offer our customers a performance package „all from one source“, and we assume co-ordination of a great number of various building trades.

This provides substantial advantages for building projects such as the interior finishing works of cinemas, auditoriums and studios, because these require a maximum of technical perfection and quality where every detail matters.

To live up to this demand, we always work on continuously improving our products and systems with the aim of obtaining the best possible result for your building project.
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Our product assortment „Interior Finishing Works for Cinemas, Auditoriums and Studios“ covers all products and services involved with equipping cinemas, auditoriums, and TV and sound studios with floors, ceilings and walls. Ranging from the planning of technical realisation to procurement, production and installation as well as initial operation and maintenance, we will assume all the work required.

**Studios**

Interior finishing works of studios differ considerably from usual dry construction work and require specific know-how for their planning and realisation. Thus solutions have to be found that make it possible to accommodate a vast number of cables and built-in ventilation components in the floors, walls and ceilings. This not only has to be realised in the designing but rather the operational sequences for construction also have to be taken into account, which makes it necessary to precisely match the various working steps to one another. In actual practice, it has proven to be very advantageous for clients when the contracting for floors, ceilings and walls is all placed under a single source of control. This way frictional loss can be minimised and co-ordination can be carried out efficiently between interior finishing works, preliminary building works, mechanical services and media equipment.

Of special significance for studios, of course, are the acoustical aspects. Room acoustics and sound insulating are the crucial factors for designing as far as acoustics go. The acoustics have to be influenced such that the best possible speech intelligibility of speakers is guaranteed. To do so, either reverberant or sound-absorbent surfaces, in the form of the cladding of walls or ceilings, have to be arranged in suitable fashion.

To prevent any transmission of noise from adjacent rooms into a broadcast room, studio walls have to have extremely high sound insulation values.

When building studios, it is usually not sufficient to merely meet customary sound insulation requirements (R’w-values). In addition, for such sensible areas there are special requirements in the low-frequency range, which are not taken into account just by meeting single-figure specifications. On top of this, the transmission of vibrations and structure-borne noise as well as footfall noise all have to be effectively prevented.

Installing doors or large-surface glazing requires special solutions to be able to meet the high demands upon function, design and soundproofing in equal manner.

Special attention is, for example, also put on penetrations of installations through partitioning walls and ceilings. To do so, suitable installation shafts are provided, with which technical arrangements are made right from the beginning so as to take inspection work into account expected during the operation of a studio.

**Cinemas and Auditoriums**

Similar to studios, the interior finishing work of cinemas and auditoriums requires extensive specialised knowledge to live up to high technical expectations and high expectations upon the visual effect. For reasons of time and cost, modern cinema centres are usually built as steel structures. The infilling with filler walls and the interior finishing work is then carried out completely in dry construction fashion. With solutions developed at Lindner it is very easy to realise sound insulation values between cinemas of from 65 dB. In addition, there are nearly unlimited possibilities for solutions to make shops, restaurants, cafés, boutiques and cinemas into unique worlds of experience.

With auditorium construction, in addition to the further development of cladding for ceilings and walls, we have developed new solutions in particular in the area of floor constructions. Using a combination of steel supporting structure and high-quality access floor systems, it is now possible to realise a very wide variety of seating wishes at a favourable price.

**All-in-one Consultancy**

Owing to the complexity of the requirements involved, a group of specialists are available to find solutions suitable for our customers which are high in quality and yet affordable. In doing so, they can rely on a great quantity of building projects already realised as well as ultra-modern measuring and simulation technology.

Thus the know-how we have amassed is used effectively and expanded with each new piece of property.

The following documentation provides a brief summary about suitable technical solutions, which have already proven successful for the interior finishing work of many cinemas, auditoriums and studios.
Interior finishing Works for Studios
• Design Example

Fig. 1 Perspective of a studio room using NDR Schwerin as an example.

This diagram shows the essential components of a studio room with „dry“ construction, and fitted into a reinforced concrete skeleton structure. In this example, the partitioning walls are plasterboard and fastened to the structural ceilings so as to be insulated against structure-borne noise. In front of this, the acoustics element is provided in the form of perforated steel sheet cladding. Access is via a high-performance soundproofing double-door system, a visual link to the adjacent room being assured by a slanted double glazing.

The suspended ceiling has a double-shell design. The upper layer (primary ceiling) has soundproofing properties, and the lower layer (secondary ceiling) accommodates light fixtures and built-in ventilation components and also has acoustic purposes.

For a floor construction, an access floor is shown under which installations can be run. Supply lines are made under the door through a soundproof conduit (which can be retrofitted at any time).

In the following the technical possibilities are shown for carrying out interior finishing work for studios with Lindner systems.

Note:
If need be, additional measures should be taken for EMC-shielding. Laboratory test certificates and figures measured at construction sites are available for the components (airborne sound insulation, reverberation times and footfall levels). We can assume the co-ordination and calculation of acoustics. Mechanical service facilities have to fulfil the limit curves demanded.
Components for Studios
• Dry-construction Studio Walls

The illustration above shows a typical situation of two announcer rooms adjacent to one another. The construction of the partition wall runs between the bare ceilings and is made up of a separate post-and-beam structure with a special panelling made of plasterboard panels geared to the soundproofing properties to be obtained. The hollow cavities are filled with an absorbent material with a defined resistance to flow. The wall thickness and materials used are determined on a case-to-case basis, depending on requirements. For reasons of clarity, the wall cladding affecting the acoustics is not shown in this illustration.

For a floor construction, an access floor is shown, the bearing pedestals for which are glued to a footfall decoupling layer on the floor. It might also be necessary to install a floating screed. The system’s materials and dynamic stiffness are dimensioned in each individual case depending on the requirements and the floor covering.

The suspended ceiling consists of a double-layer system. The top layer (primary ceiling) is executed as a plasterboard ceiling. The type of panelling, cavity filling and type of decoupling of structure-borne sound are determined in each individual case.

Beneath this ceiling layer there is a visible ceiling made of metal shown (secondary ceiling), which can accommodate the acoustics element as well as built-in lighting and ventilation components.

* From construction site measurements. Figures measured at construction sites depend on the respective marginal conditions.
**Rooms with Movable Partitioning Walls**

Fig. 3  Announcer/announcer cubicles with prefabricated sandwich walls.

This illustration shows a typical situation of two announcer rooms adjacent to one another in a “room-in-room construction”. The version shown results in more far-reaching decoupling of structure-borne sound with lightweight interior works elements.

The **partitioning wall** consists of a double-shell metal wall made of sandwich elements with finished surface and perforated sheet arranged on the room side. Depending on the room’s acoustic requirements, the perforated sheet is either reflecting or, according to frequency, absorbent, co-ordinated and lined. The cavities are filled with an absorbent material with a defined resistance to flow. Depending on requirements, the wall thickness and materials used are calculated individually. The colour, perforation pattern, modules and axial-type or grid-type construction can all be freely selected. To optimise the installation procedures, this wall system is placed on a base and fastened to the primary (upper) suspended ceiling. The advantage of this is that installation of the mechanical services and of the media equipment as well as of the access floor can be carried out independently of the partitioning wall installation. In addition, the wall elements (which, of course, already have finished surfaces) can be put in at a comparatively late time point. This protects them against damage. The perforated sheet is also provided with a protective foil. The sandwich elements can also be used as wall cladding before solid walls.

For more detailed information on the **floor construction**, see Fig. 2.

The primary ceiling is interrupted in the area of the sandwich elements and executed such that forces from the partitioning wall can be carried away in such fashion as to insulate structure-borne sound. For information on the secondary ceiling, see Fig. 2.

* From construction site measurements. Figures measured at construction sites depend on the respective marginal conditions.
This illustration shows a typical **façade situation**. To guarantee sufficient sound insulation against outside noise and to be able to comply with the limit curves for mechanical service installations, it is usually necessary to place a second, interior façade in front of the outside façade. Both constructions have to be designed to be soundproofing. The extent of the requirements is determined by the selection of the glazing systems, e.g. aluminium or wood, the specifications for selecting panes, dimensions, etc. The partitioning of the profiles is selected such that the inner and outer leaves can open. To avoid the formation of condensation, an interval-space heating system is recommended. The two layers are decoupled from structure-borne sound. For details on acoustics elements as well as floor and ceiling constructions, see Figs. 2 & 3.

The advantage of this system is being able to use daylight even for production and announcer areas and not having to put such rooms in interior zones.

If need be, however, such a move should be made. This should be decided considering the arguments in each individual case.
This illustration shows a typical production/announcer situation. A visible link is necessary for production and announcer to be able to harmonise. This consists of a high-quality, usually reflection-reduced, glazing, with special panes executed as double glazing. To avoid flutter echoes, the panes in the illustration above are positioned at defined angles. The frame system consists of extruded aluminium profiles or steel pipes; perforated sheet metal is suitably arranged in the interim space between the panes in a construction that decouples structure-borne sound. The construction of the partition wall is described under Fig. 2.

Here the acoustics element is also shown. It consists of perforated metal shells or of wooden materials, which are perforated, slotted or with a customised design from various specialised manufacturers.

The acoustic characteristics of the wall claddings are designed in each individual case depending on a room’s use, size, reverberation times and for reasons of speech intelligibility, the materials and construction being selected accordingly.

The floor construction is described in Fig. 2. The suspended ceiling is not shown here.

* Wall with glazing; from construction site measurements. Figures measured at construction sites depend on the respective marginal conditions.
This illustration also shows a typical production/announcer situation. The essential details have already been described under Figs. 3 & 5.

In the situation sketched in this case elements of extruded aluminium section with a coat of paint have been used. The design of the corners and edges meet the highest demands upon quality and design. Alternatively, wooden coverings can also be used.

* Wall with glazing; from construction site measurements. Figures measured at construction sites depend on the respective marginal conditions.
High-performance Soundproofing Door Systems

Fig. 7 Double-door system with porthole glazing

This illustration shows a high-performance soundproofed access situation. The construction of the partition wall is described under Fig. 3. In this example the metal door elements are integrated in the acoustic cladding. The imperviousness is achieved through a special lock-and-seal combination and a floor-mounted stopping seal, which is adjustable. To avoid any rattling sounds, the door elements are fitted into the wall construction in a decoupled fashion.

Cladding with wooden materials is possible as is a design with double-leaved elements. T30-certificates are available. The constructional design details are geared to respective installation situation on a case-to-case basis.

* Wall with door; from construction site measurements. Figures measured at construction sites depend on the respective marginal conditions.
To increase the soundproofing of the structural ceiling and to lower foot-fall levels, with interior finishing works for studios one has to take additional measures. Multilayered plasterboard ceilings insulated against structure-borne sound (primary ceilings) are used for this. The height of the suspension and the type of the cavity insulation are calculated in each individual case. If need be, installation lines such as sprinkler tubing can also be run through the ceiling cavity.

Beneath this ceiling, a further ceiling layer (secondary ceiling) is constructed. This ceiling layer is selectively dimensioned to have an acoustic effect (absorbing or reflecting zones, depending on frequency). Metal ceilings with various linings are usually used.

In addition, lighting and ventilation units can also be accommodated and the cavity can be used for conducting air.
• Multifunctional Floor System for Studio Rooms

Fig. 9  Double floor system with electric media and ventilation inserts, combined with a „switchboard attendant design”

Studio rooms generally have an enormous degree of installations. Ideally, the floor cavity is used for this and an access floor with appropriate construction height provided.

This way, ventilation lines as well as electrical and media installations can be run and high soundproofing-relevant requirements met.

The pedestal bases are glued so as to be insulated against structure-borne sound. To separate transmission and facilitate installation, intermediate raised floors can also be used.

In areas with great concentrations of installations, instead of the panels, supporting frames are used, on which, for example, control desks or banks of monitors can be placed with open access to the floor cavity.
A great number of possibilities for solutions are available with Lindner systems to meet the acoustic requirements of large television studios operating with audiences. The illustration shows a metal wall cladding, which is placed in front of a solid inner shell decoupled from structure-borne sound. As an alternative, instead of the solid inner shell, plasterboard solutions are also available. (The details are dimensioned in each individual case.)

For the visible cladding, in addition to the perforated metal walls shown, wooden surfaces or metal grating designs can also be used. Absorbers are arranged behind the visible surface to control the acoustics. The absorbing/reflecting properties as well as the position of the respective types are calculated and determined. „Edge absorbers“ are used to avoid undesired reflections in corners. Fire protection requirements are fulfilled.

**Interior Finishing Works for Cinemas, Auditoriums and Studios**

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**• Studio Rooms with Gravity Cooling**

The illustrations above show a new kind of gravity cooling system integrated into the acoustic cladding of a production or announcer cubicle.

There are water cooling systems arranged in the ceiling area behind the ventilation screens, which cool down the air wafting past. This air falls in ducts (→ „stack effect“) constructed behind the acoustic cladding and is then discharged again over the floor through the ventilation grating.

This produces a draft-free, pleasant cooling effect that keeps going simply by gravity and without any additional mechanical facilities. If necessary, two coolers can be arranged over one another, as shown here. Then, in a second cycle, the air is conducted under the system floor where, through linear diffusers, it flows out again upwards.

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**Interior Finishing Works for Cinemas, Auditoriums and Studios**

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Room Acoustics and Speech Intelligibility
• Wall and Ceiling Absorbers

In addition to the acoustic effectiveness of wall cladding, the visual effect is, of course, also of crucial significance. The following shows a few possibilities of realising the design specification of a building while fulfilling the technical demands.

Fig. 13 Metal absorber

The absorbers made of metal and wood shown in Figs. 13 and 14 are for regulating the reverberation time in studios. The acoustics desired are produced by the way they are arranged and constructed.

Fig. 14 Wooden absorber
Interior Finishing Works for Cinemas, Auditoriums and Studios

Subject to technical changes also without notification.

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**Real Estate Property Examples**

- **Reverberation Time, Continuous Sound Level, Reduction of Airborne and Footfall Sound**

Fig. 15  ARD Hauptstadtstudio, Berlin

These illustrations show a typical, interior finishing situation completely executed by Lindner with the insulating values for airborne sound and footfall sound levels measured at the construction site. The continuous noise level in the room was also determined.

Continuous noises are all noises produced when mechanical services and studio equipment systems are switched on. Some typical continuous noises are the background noises caused by air-conditioning systems and the noises from instruments and equipment.

The user specified a maximum continuous sound level for the room appropriate for its use, „NR 10“ in this case. This limit has to fall short of the limit curve applied to the respective room (derived from the internationally known „noise rating“ curves, or „NRs“). Fig. 15 shows the continuous sound level measured for a news studio, the NR 10 actually being fallen short of to a great degree in this case.

As a comparison, the „curve i“ noise rating is also shown here, a requirement common in areas within the British sphere (BBC).

Fig. 16  NDR Studio Schwerin: the reverberation time measured in a voice studio

To obtain good sound quality, the reverberation time has to range above the frequency spectrum within the tolerance zone specified, and the curve should be even, as shown by the measurement of a voice studio in Fig. 16. In addition to this, however, so-called „flutter echoes“ must also be prevented. To do so, the glazing has to, for example, be slanted and other constructional measures taken, which require very much experience.
Cinema and Auditorium Construction
- Design example

Fig. 17 Technical University at Garching

This floor plan shows a typical auditorium constellation with ascending rows of seating. As many as 700 people can be seated on an area of 640 m².

The seats are arranged in an arc. The pillaring consists of a steel structure combined with Lindner system floor elements.
Building Components for Cinemas and Auditoriums
• Cinema Wall with Supporting Steel Construction

Fig. 18 High-performance sound-insulating cinema wall with supporting steel substructure

This illustration shows a modern cinema hall with a steel skeleton construction. The supporting construction consists of a steel structure clad with plasterboard panels. This is done meeting high sound-insulation and fire-protection requirements.

It is also possible to execute partition walls of this type as high as 12 m and more. Solutions are available for door elements, glazing, presentation cubicles, etc. The auditorium is executed as a staircase-shaped system floor construction.
This horizontal section drawing shows the Lindner cinema partition wall with dry construction and Fire-resistance Class F90.

The unusual thing about this partition wall construction is the acoustic decoupling shown in the illustration in combination with a static coupling. Wall heights as great as 15 m can be constructed as sturdy self-supporting walls with this design method.
This sketch shows the essential components of our interior finishing works in the sphere of interior works for cinemas. The ceiling and wall elements are designed to be acoustically effective, enabling the best possible speech intelligibility; even in combination with solid construction walls.
All the components of an auditorium are shown in this picture. Lighting and ventilation equipment are integrated in the ceiling construction. Separated by high-quality glazing, a control cubicle for visual-effects, lighting and sound can be seen, which has also been realised in dry construction.
Constructions with ascending rows of seating are primarily made in halls for public functions such as at schools, universities, cinemas and theatres.

The pillaring and staircasing of the floor is done by means of a steel construction.

The crucial advantages are that this system can be altered and expanded as desired. It is possible to connect the seating to the substructure in an extremely sturdy and durable fashion.

The system is installed in „dry construction“ manner, i.e., no additional moisture gets into the building — immediately after its installation, the floor is all set for loading.

This system is well suited for floors ventilated from below as scarcely any soiling occurs.

The large vacant cross-sectional area of its cavity can be used to install mechanical services.

The entire floor system is delivered to the construction site completely prefabricated. No cutting or welding is necessary at the construction site. This makes it possible to realise very fast completion times. This system was designed especially for efficient installation at the construction site.

As a supplier of system floors, we have the possibility of combining all of our cavity-type floors and access floors with auditorium construction. The various systems are geared to one another.
The following dimensions should be taken into account when planning the carcass.

The minimum construction height is approx. 350 mm. The dimension from the front edge of the prefabricated step to drop in the structural floor should be $\geq 300$ mm.

Fig. 23  Floor construction with installation situation

The entire construction consists of a substructure and covering panels.

The secondary construction consists of the prefabricated steel profile section elements, which are constructed in an L-shape. These steel brackets are both for producing the overall rigidity of the system and as a bearing surface for the cross profiles arranged on them.

The entire construction is supported by adjustable steel pedestals, which enable exact evening out of height.

With especially high construction heights, building a primary construction with a larger module lends itself as a solution. By doing so, the space beneath can be used.

As supporting panels, both derived timber product panels and mineral fibre element are a possibility.

Mineral panels are primarily used where there are fire protection requirements.

Another advantage of fibre-reinforced mineral matter panels is that, owing to their greater weight per unit area, better acoustic behaviour and thus better walking comfort are provided.

To prevent any creaking sounds whatsoever, the support panels and the substructure are separated from one another by sealing strips.

When connecting to the cavity-type floor, with round halls the auditorium construction should be installed first. With straight designs, connecting to the cavity-type floor can be carried out either before or after installation of the auditorium.
• Planning Instructions

The following design variations are possible, depending on the design of the concrete structural ceiling:

Fig. 24  a) Pillared floor  
Fig. 25  b) Floor on slanted plane

Fig. 26  c) Concrete ribbed floor  
Fig. 27  d) Staircase-type concrete floor
• Seating

The substructure has to be designed according to the way the room's geometry is designed and/or depending on the arrangement of the seating.

In doing so, there are the following possibilities:

Fig. 28  a) Straight arrangement

Fig. 29  b) Segmented arrangement

Fig. 30  c) Round arrangement
Fig. 31  Ventilation panels

By arranging ventilation panels appropriately, Lindner access floors can create air-conditioned zones and thus an even exchange of air quantities. In addition to ventilation aspects, statics-related characteristics of ventilating floors are also taken into account.

The ventilation elements are available with damping baffles or a quantity control system.

Fig. 32  Swirl diffusers

Swirl diffusers in the risers are best suited to get sufficient quantities of air between the rows of seating. This is the place where they are least visible and there are no negative effects on the statics of the support panel.

Fig. 33  Electrical outlets

In many areas of access floors, a possibility has to be provided for connecting electric lines directly (telephone, computer, etc). Installing electrical outlets makes this possible, because all the lines can be installed in the floor cavity.

Electrical outlets are available both in round and rectangular designs.
**• System Accessories**

**Fig. 34 Electric wall sockets**
To connect electric lines, electric sockets are frequently required also between the rows of seats.
These can be installed either recessed in the floor or on the risers.

**Fig. 35 Stairway lights**
For safety reasons or as an orientation aid, it is advisable to provide lights in areas with steps.

**Fig. 36 Fascia**
In the areas with access floors, three different types of partitioning can be arranged to satisfy various requirements.

1. Ventilation fascia
2. Fire protection fascia
3. Soundproofing fascia

The partitioning is made up of single- or multiple-shell constructions. Mineral wool, plasterboard and aerated concrete, depending on requirements.

**Fig. 37 Inspection openings**
A special inspection frame with a format of 600 mm x 600 mm is available for openings necessary for inspections in the floor.

The frame construction provides a sturdy base for the panels.

Upon request, any other formats as well as covering-separation rails are available made of high-grade steel or aluminium and fastened to the transition profile so as to be adjustable in height.
Platform constructions are required for presentations, announcements or for accommodating screens in cinemas.

The support panels basically consist of derived timber product panels; but when there are requirements upon the building materials class, mineral floor panels can also be used.

Platforms are available as standard in heights of 90 mm to 1600 mm.

For the front cladding, powder-coated perforated sheeting is available as an option. The perforated sheeting can be made with any perforation and all colours, as desired.

Platform constructions are available both in straight and in curved shapes.
• Air-conditioning

It is easy to accommodate installations in Lindner auditorium constructions. Owing to the air space being closed without any joints, the cavity is ideal to use to ventilate, cool or heat the space above it.

At defined places in the cavity, warm or cold air is blown in, supplying the entire cross-sectional area with air and then flowing out at any places.

In theatres and assembly rooms, the supply air is also frequently blown out of special backs of seats or out of the seat mounting.

Fig. 39  Sectional view of system

Fig. 40  Swirl diffuser

When a pressurised floor is made, before it is laid, the structural floor has to be provided with a two-component sealing agent.

The support panels should be provided with a special coating.

A suitable marginal strip has to be installed for all the wall connections as well as the components that open so as to prevent any leakage from developing.
Fire Protection

In accordance with building-related legal regulations, there are frequently requirements upon building materials’ behaviour in fire.

These are:

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With regard to the building materials classes, we can offer the following systems:

a) Auditorium construction with support panels made of derived timber product panels (B2/B1)
b) Auditorium construction with support panels made of mineral fibre-reinforced support panels (A2)
c) Auditorium construction with a base layer made of flooring screed (A1)

In cases with requirements upon the fire resistance rating, this can be obtained by using System b) or c).

Sound protection

Lindner floor constructions meet very high acoustic requirements, of course.

To avoid the development of noise, the support panels are separated from the substructure by a special bearing surface tape.

Upon request it is also possible to separate the entire floor construction from the bare floor (acoustic decoupling) so as to prevent any direct transmission of structure-borne sound.

The decoupled version is primarily used with rooms situated one over the other when walking noises are to be prevented from the upper room.

Owing to the varying local circumstances at construction sites, it is usually necessary to plan various building projects individually. For these special cases, a team of experts from our „Interior Finishing Works for Cinemas, Auditoriums and Studios“ department is available for questions relating to soundproofing.