Noise Control with Sheald*

Sheald continuous cast lead sheet is a more effective sound barrier than any other conventional building material. It has not only the high density which is a basic requirement for any good sound barrier, but also natural limpness, good damping capacity and impermeability. Sheald is the only construction material which possesses this ideal combination of properties.

Density is of prime importance in a sound barrier, since sound vibrations are reduced in intensity in overcoming the inertia of the barrier. The sound insulating properties of a material, however, are dependent not only on density but also on bending stiffness. If a barrier is too stiff it can lose much of the advantage it gains by being dense, since stiffness increases much more rapidly than weight as the thickness of a barrier is increased. Natural limpness greatly aids sound insulating qualities making it possible for acoustical barriers containing Sheald to be lighter and thinner than other barriers of equal sound transmission class. Conversely, barriers containing Sheald give a better sound transmission class than other barriers of equal weight.

Sheald may also eliminate resonance effects or displace them to frequencies out of the range of interest. Figure 1, below, illustrates the elimination of "Coincidence Dips" associated with the natural frequency of vibration of the single skin barrier.

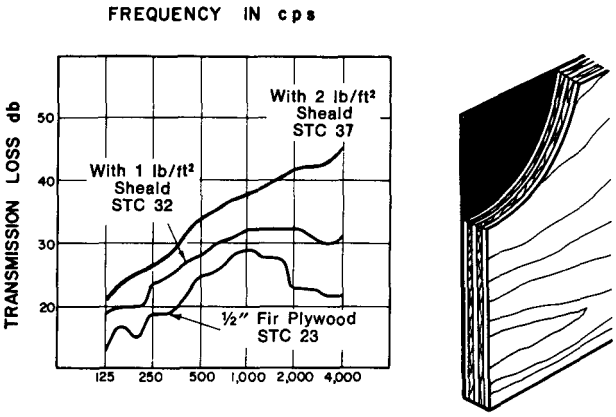


FIGURE I — ½" PLYWOOD

SHEALD DATA

Sheald is used for sound insulation, and conforms to ASTM B29-55 and GSA Specifications HP2-1957.

TABLE I — SHEALD WEIGHTS AND SIZES

SHEET WEIGHT (lbs/sq. ft.)	SHEET THICKNESS (inches)	STANDARD SIZES OF COILED SHEET (feet)
½	1/128	Special order normally 3 ft. wide
1	1/64	3 x 36
2	1/32	3 x 18
3	3/64	3 x 12

36" wide coils up to 3,000 lbs each and narrower slit coils up to 85 lbs per inch of width are available for production orders.

*SHEALD is a trademark of The Canada Metal Co.

MATERIAL COST

The' value of lead as an acoustical barrier has been recognized for many years, but its use was restricted due to the high cost of rolling the sheet to the thin gauges generally required. The recent development of Sheald continuous cast thin lead sheet has significantly reduced the cost and made its use economically attractive.

INSTALLATION COST

An outstanding feature of Sheald is the ease with which it can be installed. It can be cut with scissors or knife, bent and dressed by hand and fastened with nails, staples or adhesive. Installation costs are considerably lower than those of stiffer materials like gypsum board. The use of Sheald plenum barriers is steadily increasing due to lower cost and higher efficiency.

DESIGN CRITERIA

General

Effective sound control, incorporated in original design, is a small part of the overall building cost and far less expensive than remedial action after construction. The privacy requirements of the various areas of a building should be established during preliminary design.

Distinguish carefully between areas that require absorptive treatment and those that require sound insulation treatment. Absorption is the prevention of sound reflection and, unlike sound insulation, requires lightweight, porous materials. The sound insulating properties of these materials are negligible.

Background Noise

It is generally desirable to have the ambient noise level of a room as high as possible, without letting it become a distraction in itself. The ambient noise has the beneficial effect of masking sound originating outside the room. Background noise levels are generally designed in accordance with the data given in Table II.

TABLE II - **NOISE CRITERIA FOR DIFFERENT TYPES OF OFFICES**

Typical Applications	Noise Criteria Curve
Executive offices and conference rooms for 50 people.	NC 20 to 30
Private or semi-private offices, reception rooms and small conference rooms for 20 people.	NC 30 to 35
Medium-sized offices and industrial business offices.	NC 35 to 40
Large engineering and drafting rooms, etc.	NC 40 to 50
Secretarial areas (typing), accounting areas (business machines), blueprint rooms, etc.	NC 50 to 55
Not recommended for any type of office.	above NC 55

Transmission Loss Requirements

Transmission loss requirements will vary-according to the occupancy of a room and of adjacent areas, and also according to the background noise level. Table III gives recommended sound transmission class requirements based on these factors. The recommended STC ratings are based on a minimum room width of 10 ft. and may require adjustment if dimensions are significantly different.

TABLE III - RECOMMENDED TRANSMISSION LOSS FOR DIFFERENT TYPES OF OFFICES

Typical Applications	Hearing Conditions	Sound Transmission Class (STC)	
		Background NC-25	Background NC-35
Privacy not required. Partitions used only as space dividers.	Normal speech can be understood quite easily and distinctly through the wall.	35 or less	30 or less
Suitable for dividing noncritical areas. Provides fair degree of freedom from distraction.	Loud speech can be understood fairly well. Normal speech can be heard but not easily understood.	35 to 40	30 to 35
Provides good degree of freedom from distraction. Suitable for junior executives, engineers, etc.	Loud speech can be heard but not easily intelligible. Normal speech can be heard only faintly, if at all.	40 to 45	35 to 40
Provides a confidential degree of speech privacy. Suitable for doctors, lawyers, senior executives, etc.	Loud speech can be heard faintly but not understood. Normal speech is inaudible.	45 to 50	40 to 45
Suitable for isolating noisy areas containing typewriters, telex, computers, etc., from private offices.	Very loud sounds, such as loud singing, brass musical instruments or a radio at full volume can be heard only faintly or not at all.	50 or more	45 or more

Selection of Sound Barriers

The performance of a sound barrier is designated by its Sound Transmission Class (STC). This designation has largely superseded Sound Transmission Loss (STL) as a method of classification, and is definitely preferable to it. It is based on the performance of a construction over sixteen specified frequencies and not, as the case of STL, on the average performance. STC is, therefore, a better guide to performance than STL and should always be considered when selecting a sound barrier.

See Tables IV and V for STC ratings of typical constructions with and without Sheald.

Installed barriers frequently fall short of their laboratory ratings due to the disparity between laboratory and field conditions. Make an allowance of at least 5 db., when choosing a movable partition, to compensate for this disparity. In the case of suspended acoustical ceilings, increase this allowance to 7-10 db., since ceilings are tested in the laboratory without light fixtures or air returns. It is often economically advantageous to choose an inexpensive low transmission loss ceiling and treat the ceiling above critical areas with a Sheald plenum barrier or ceiling blanket.

Doors should be either solid core or Sheald lined, properly gasketed with closed cell foam and fitted with drop seals. Avoid using doors in common partitions, and space doors to adjacent offices as far apart as possible.

Acoustical Leaks

Failure to eliminate leaks around doors and perimeter joints will seriously affect the performance of an acoustical barrier.

Proper installation of acoustical barriers is of prime importance and particular attention should be paid to the following points:

- Provide an acoustical barrier at partition line of continuous perimeter convectors Sheald can be used effectively in this area).
- Avoid back-to-back electrical fixtures or wall cabinets.
- Minimize use of glazed areas; if required, specify double glazing.
- Avoid common ventilation ducts serving more than one area.
- Caulk all possible sources of acoustical leaks at junctures, etc.

TABLE IV -
TYPICAL STC RATINGS -WALLS AND DOORS

FRAME OR CORE	ONE FACE	OTHER FACE	STC
Wood Stud Walls			
2″ x 4″ wood studs	½″ gypsum board	½″ gypsum board	37
2″ x 4″ wood studs	½″ gypsum board 1 lb. Sheald (stapled)	½″ gypsum board	41
Steel Stud Walls			
1⅝″ steel studs	½″ gypsum board	½″ gypsum board	36
1⅝″ steel studs Fiberglass in cavity	½″ gypsum board 1 lb. Sheald*	½″ gypsum board	47
2½″ steel studs	½″ gypsum board	½″ gypsum board	37
2½″ steel studs Fiberglass in cavity	½″ gypsum board 1 lb. Sheald*	½″ gypsum board	48
Steel Office Partitions			
Paper honeycomb core	22 ga. steel	22 ga. steel	35
Fiberglass core	22 ga. steel	22 ga. steel	38
Fiberglass core	22 ga. steel 1 lb. Sheald*	22 ga. steel	43
Fiberglass core	22 ga. steel 2 lb. Sheald*	22 ga. steel	46
Fiberglass core	22 ga. steel 3 lb. Sheald*	22 ga. steel	52
Doors			
Hollow core wood	⅛″ plywood	⅛″ plywood	21
Hollow core wood Fiberglass in cavity	⅛″ plywood 1 lb. Sheald*	⅛″ plywood 1 lb. Sheald*	42
Hollow core wood Fiberglass in cavity	¼″ plywood 1 lb. Sheald*	¼″ plywood 1 lb. Sheald*	38
Hollow metal	20 ga. steel	20 ga. steel	29
Hollow metal Fiberglass in cavity	20 ga. steel 2 lb. Sheald*	20 ga. steel	39

TABLE V — CEILINGS

Suspended Acoustical Ceilings		Sound Transmission Loss*
T-bar grid (suspended 30″)	Low density ceiling panels	21 db**
T-bar grid (suspended 30″)	Low density ceiling panels with 1 lb. Sheald plenum barrier between areas.	41 db**
T-bar grid (suspended 30″)	Low density ceiling panels with 1 lb. Sheald blanket over both areas.	36 db**
Mechanical Room Ceilings (field test)		
Slab only		34 db
With vibration isolated ceiling, 2 lb. Sheald and ½″ gypsum board.		52 db

MOVABLE PARTITIONS

DESIGN CRITERIA -Walls

Avoid construction details that needlessly stiffen the wall. The effectiveness of Sheald for noise control is derived from its mass and limpness. When rigidly bonded to a stiff wall, Sheald will lose much of its effectiveness.

Provide an inner air space when wall thickness allows. The same weight of materials properly split into two layers will give better acoustical performance than a single solid wall.

Avoid tying the two faces of a double wall together so that they act as one. Staggered studs will improve performance of a wall.

Hollow cores in walls can act as resonating chambers unless filled with an absorptive material such as fiberglass.

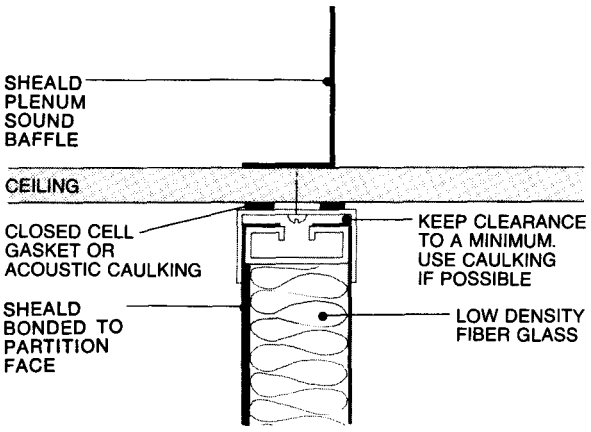
Use rubber-based contact adhesives for bonding Sheald to other surfaces. This type of adhesive helps to dampen panel vibrations. Sheald is free from oil and grease and does not require cleaning prior to lamination with other materials.

The use of Sheald, at least as heavy as the substrate, will usually eliminate the coincidence dip found in all other conventional panel materials.

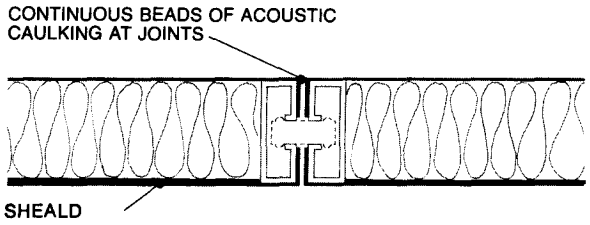
Thin filler panels between partitions or columns and exterior walls or window mullions can be source of serious acoustical leaks, unless properly designed. Sheald lined filler panels are most satisfactory in this area.

Columns, service cores, etc., occurring in treated walls should also be treated to preserve the STC rating. See details.

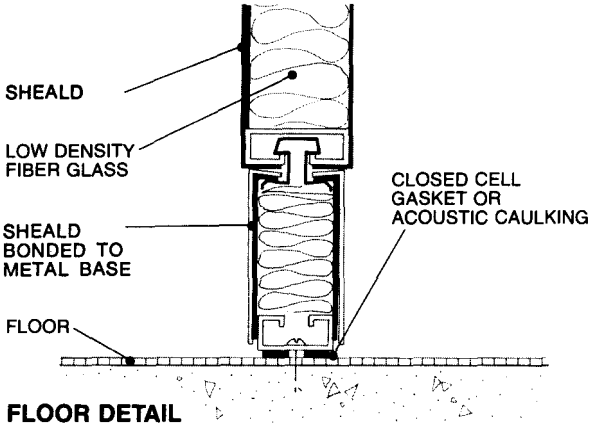
In the case of solid or masonry walls, Sheald should be applied to nailing strips (1" x 2" or 2" x 2") which can be finished with gypsum board, plywood or other suitable facing.



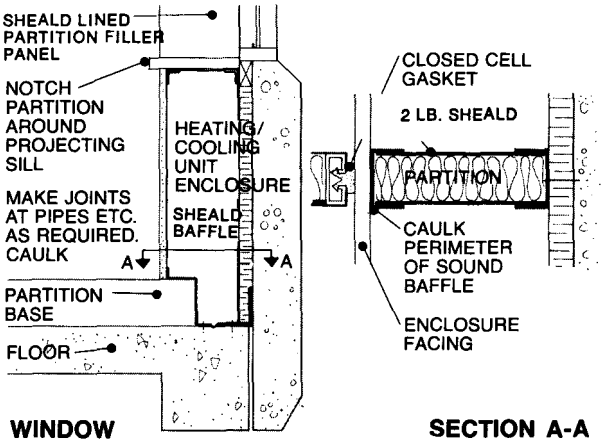
CEILING DETAIL



PARTITION JOINT



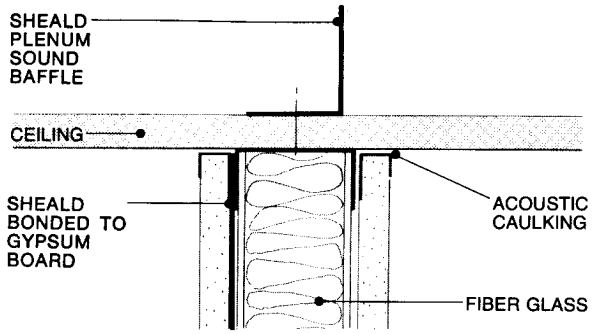
FLOOR DETAIL



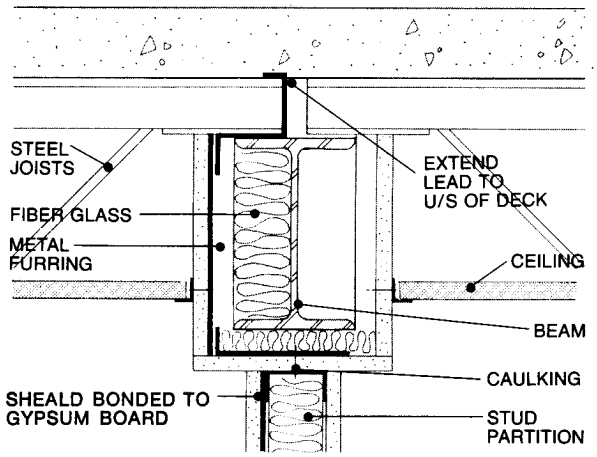
WINDOW WALL DETAIL ELEVATION

SECTION A-A THROUGH ENCLOSURE

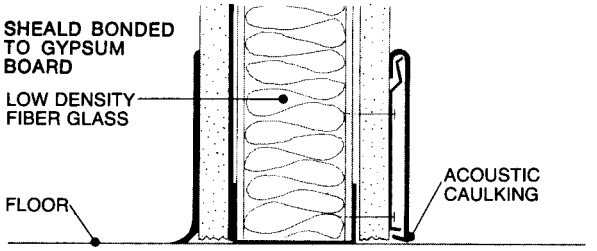
STUD PARTITIONS



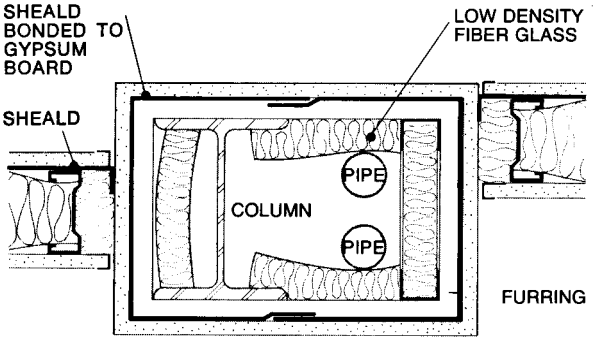
CEILING



CEILING BEAM

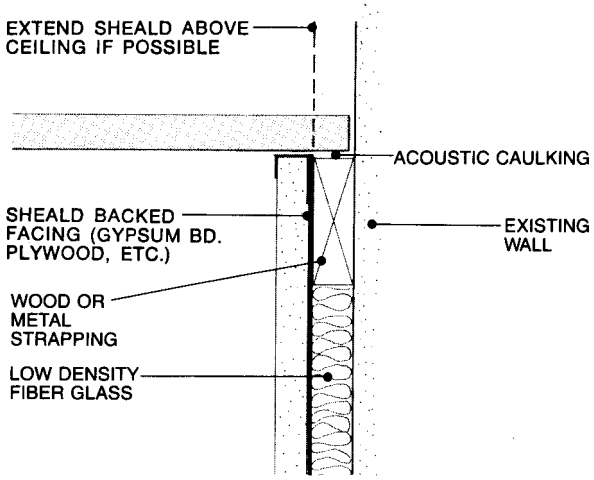


FLOOR

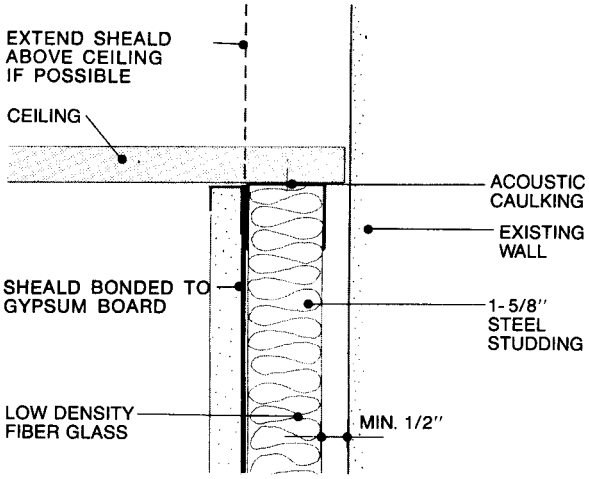


COLUMN/SERVICE ENCLOSURE

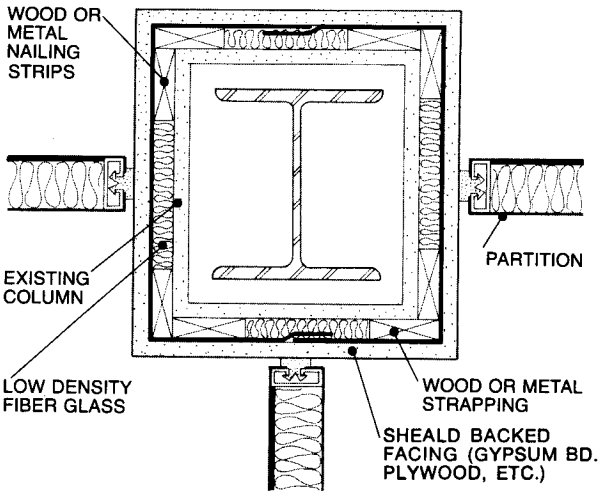
EXISTING WALLS



EXISTING WALL



EXISTING WALL (Alternate Method)



EXISTING COLUMN

DESIGN CRITERIA - **Ceilings**

Sheald provides two efficient solutions to "over the ceiling" noise problems created by suspended ceiling design.

Sheald Plenum Barriers

The Sheald plenum barrier is an acoustical continuation of a partition above the suspended ceiling. Thin Sheald sheet is easily cut and fitted around pipes, ducts, etc., and is more economical than other barrier materials. If return air is not ducted, a hole should be cut above the corridor partition to allow return air to escape into the open plenum.

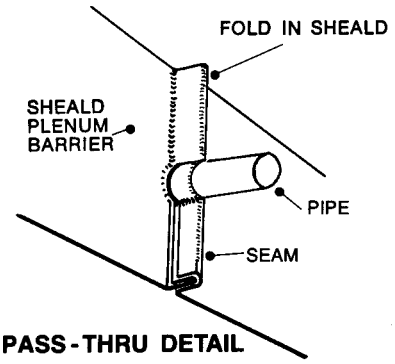
The Sheald plenum barrier usually costs less than the Sheald blanket because less material is required.

Where the plenum barrier joins a masonry wall, the Sheald should be fastened through a cleat or batten strip to the masonry, and be sealed with caulking.

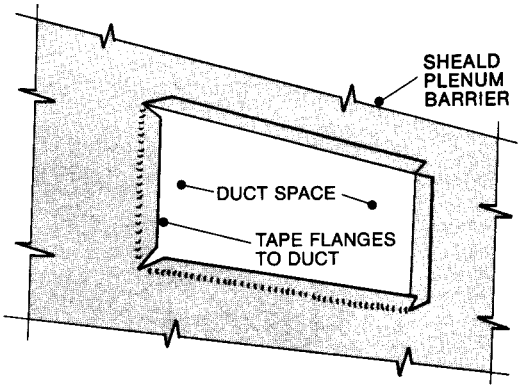
Sheald Ceiling Blanket

The Sheald ceiling blanket can be used if the plenum space is badly cluttered with pipes, ducts, etc.

Adjacent sheets of Sheald should be overlapped by 2" and the blanket should be extended 4' beyond the perimeter of the area requiring treatment. If return air is not ducted the ceiling grilles can be covered with hoods or cross-talk silencers.

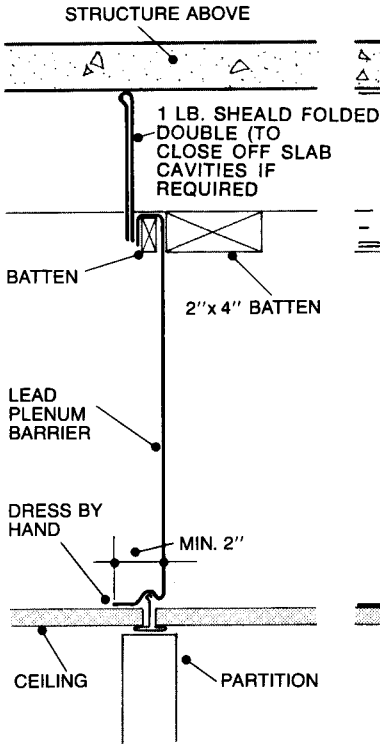


PIPE PASS-THRU DETAIL

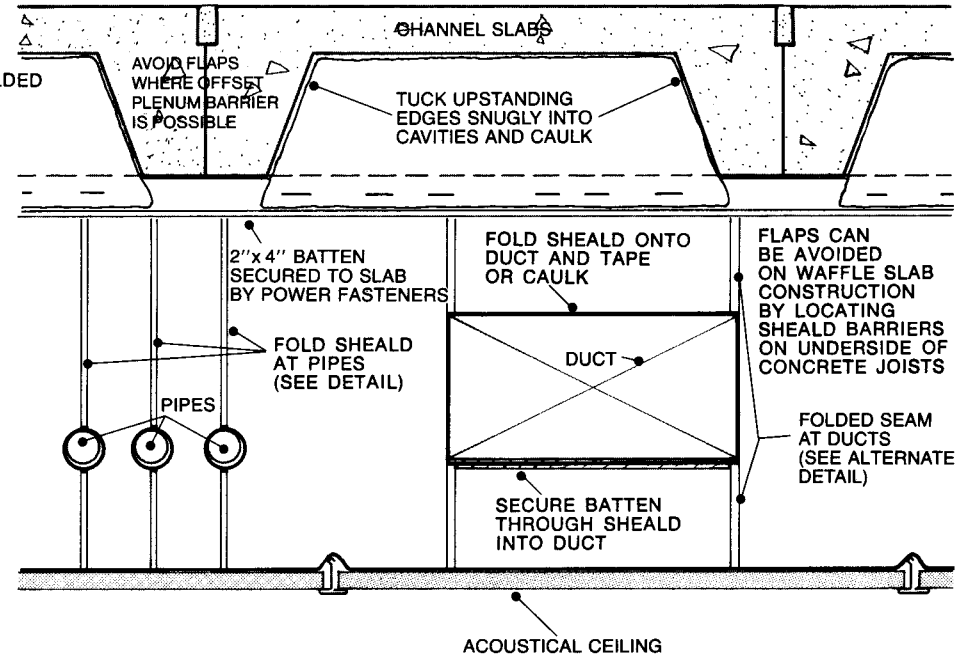


ALTERNATE METHOD CUT-OUT FOR DUCTS

SHEALD PLENUM BARRIER DETAILS



CROSS SECTION



LONGITUDINAL SECTION AND BARRIER ELEVATION

High Transmission Loss Ceilings

High transmission loss ceilings provide a solution to problems involving transmission of sound and vibration from heavy mechanical equipment on upper floors. These floors are often adjacent to prime rental areas, requiring low ambient noise levels.

Two pound Sheald is commonly used for this application. It is attached to the gypsum lath or board using staples or adhesive, before installation. The lath or board is attached to drywall furring channels with self-tapping, self-drilling, drywall screws. Sheald should lap over the joints.

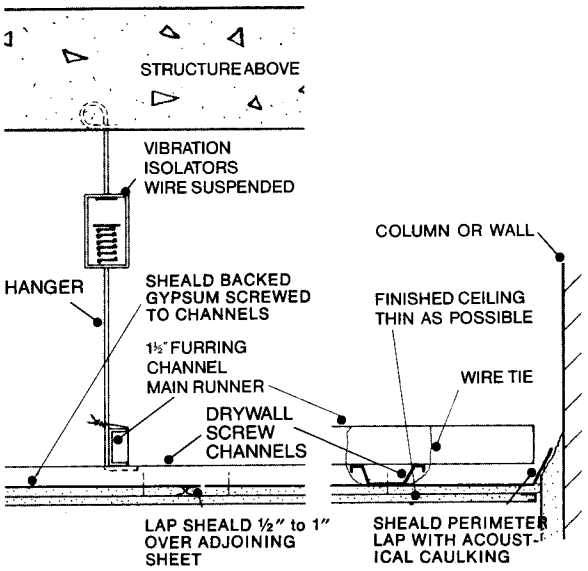
Spring and rubber vibration isolators are recommended on all hangers.

Design loading should obtain minimum static hanger extension of 1".

Perimeter and other penetrations must be fully caulked.

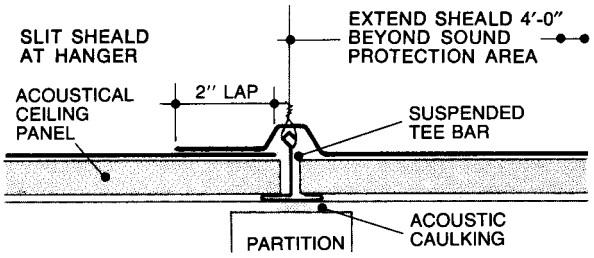
The Sheald barrier should be turned up or down perimeter walls and be caulked or taped.

As an alternative, the ceiling may be installed as an intermediate barrier between the slab and the suspended acoustical ceiling.

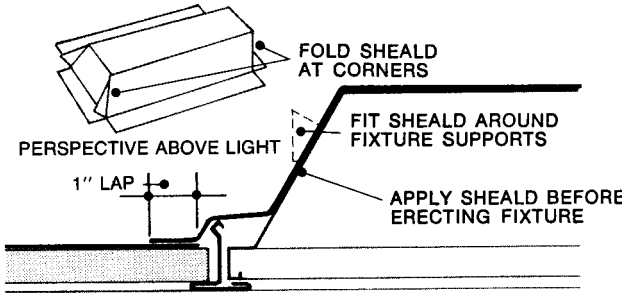


HIGH TRANSMISSION LOSS CEILING

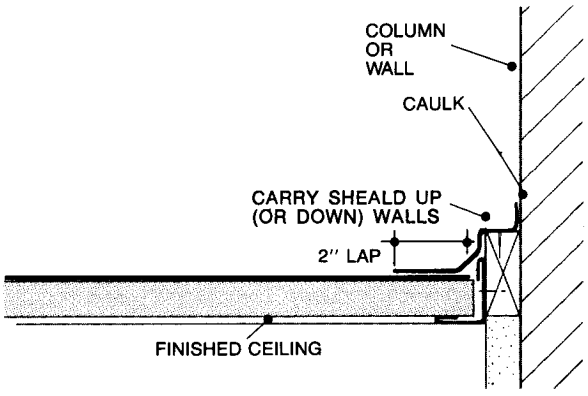
SHEALD BLANKET BARRIER DETAILS



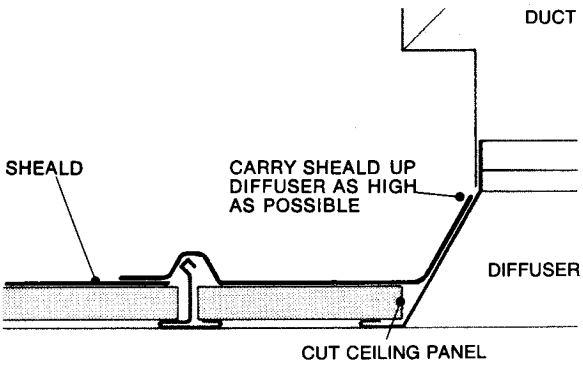
PARTITION AT CEILING



LIGHT FIXTURE



CEILING-WALL JUNCTURE



DIFFUSER

SPECIFICATION

The following specification clauses are for insertion in the applicable section of the Architect's or Engineer's Specification. Only those clauses relating to the application of Sheald for sound control are included and these should be collated with the erection instructions for the specific wall or ceiling system.

MATERIALS

Sheald: Con-cast soft lead sheet weighing 1 lb.; 2 lb.; 3 lb.; per square foot. Conforms to ASTM Specification B-29-55 and CSA Specification HP2-1957 (See Notes 1 and 2).

Fiberglass: 1 lb. density (per cu. ft.) fiberglass blanket, thickness to fill core (or stud) space.

Acoustical Caulking: Non-hardening, non-skinning, synthetic rubber caulking.

Adhesive: Rubber-based contact adhesive.

WALLS

Movable Partitions: Partition faces shall be 22 ga. steel (minimum) with stiffeners staggered on opposite sides at 12" o.c. Apply Sheald to backside of one face. Cut Sheald to fit between stiffeners, and bond in place using adhesive. Loosely pack core space with fiberglass.

Erect movable partition using acoustic caulking or closed cell gaskets to seal all joints between panels and around perimeter. Exposed caulking not permitted. Loosely pack all voids with fiberglass. Apply Sheald to recessed bases and over other voids.

Drywall or Plaster Stud Walls: Bond Sheald with adhesive to backside of gypsum board or lath before erection. Loosely pack stud spaces with fiberglass. Install gypsum board or lath; screw or nail to studs. Lap Sheald onto adjoining walls, ceiling and floor where possible. Seal all possible sound leaks with acoustic caulking. Exposed caulking not permitted.

Tape and fill joints, or apply plaster, according to manufacturer's directions.

Existing Walls: Apply wood or metal strapping to walls at 16" or 24" o.c. Bond Sheald with adhesive to backside of wall panels before erection. Loosely pack space between strapping with fiberglass. Erect wall panels and screw or nail to strapping. Lap Sheald onto adjoining walls, ceiling and floor where possible. Seal all possible sound leaks with acoustic caulking. Exposed caulking not permitted.

Closure Panels: Partitions terminating on window mullions shall have closure panels constructed to match the partition. Closure panel thickness shall be (as detailed) to suit mullion width. Include Sheald backing and fiberglass core to maintain same STC rating as partition. Seal joints as per partition.

Provide sound baffles in heating/cooling unit enclosures, blind pockets, etc. as required for a complete seal between rooms having Sheald lined partitions. Close off space with 1 lb. Sheald secured in place and lap onto adjoining surfaces if possible sealing at edges with acoustic caulking. Make cutouts for pipes, etc., as accurate as possible and seal with caulking. Loosely pack core space between the Sheald with fiberglass.

Install second sheet of Sheald similar to first sheet.

CEILINGS

Plenum Barriers: Provide Sheald plenum barriers above partitions where shown on drawing (or in specifications).

Fasten continuous blocking to slab, positioned so Sheald will drape onto ceiling directly over the partition. If slab is uneven, apply acoustic caulking between blocking and slab.

Cut Sheald sufficiently long to drape at least 2" onto the ceiling surface. Fold upper edge over batten and attach to continuous blocking. If ceiling is uneven, tape or dress lower edge to ceiling surface.

When vertical joints are necessary, join adjacent sheets with folded, lock seams.

Make cutouts to accommodate ducts, conduit, pipes or beams passing through the plenum barriers, in accordance with "Sheald Plenum Barriers & Ceiling Blankets:' Tape flaps tight to object passing through.

Where blocking is fastened transversely to one-way concrete joist construction, channel slabs, etc., cut flaps of Sheald folded double to fit dimensions of cavities and staple to battens. Fit upstanding flaps tightly into cavities. Caulk as required for complete seal.

Sheald Ceiling Blanket: Provide Sheald ceiling blanket over rooms where shown on drawings (or in specifications).

Lay Sheald, without adhesive, progressively as the ceiling is erected. Lap joints 2" and dress by hand. Carry Sheald sheet up diffusers, and over any obstacles such as ceiling runners, etc. (See Note 3).

Bond Sheald, using adhesive, to light fixtures before installation. Leave 2" lap on all edges. Lap ceiling blanket over laps of light fixtures.

Extend the sheet 4' beyond area tb be treated, carry sheet min. 6" up walls and secure in place. Caulk as required for effective seal.

High Transmission Loss Ceiling: The suspension system shall consist of 3/16" or 1/4" rod or wire hangers and 1½" furring channels as for normal suspended plaster ceiling except:

- Vibration isolators shall be used on each hanger.
- Drywall furring channels shall be attached to the main furring runners (spaced to suit the lath ordrywall finish).

Erect the lath with Sheald attached and fasten to drywall furring channels using self-drilling, self-tapping drywall screws. Butt lath together without gaps and ensure the Sheald properly laps onto the adjacent lath.

Use plaster stops at perimeter of ceiling and around columns. Turn Sheald up walls at least 4". Caulk as required for effective seal. Exposed caulking not permitted.

Apply plaster, acoustical tile or other suitable finish to underside of gypsum lath as required. Plaster finish should be as thin as possible.

SPECIFICATION NOTES

1. Weight of Sheald specified depends upon the performance desired and upon the type of construction involved. Tables IV and V give ratings for various types of construction.
2. See Table I for weights and sheet sizes available.
3. Where gypsum wallboard ceilings are being erected, the Sheald can be bonded to the wallboard before erection, as specified under "High Transmission Loss Ceilings" on Page 6.