

FOR RADIANT HEATING WITH GYPSUM PLASTER

GENERAL

The purpose of these recommendations is to explain the proper use of gypsum plaster assemblies when used with radiant heating. Gypsum plaster can be satisfactorily used in conjunction with radiant heating installations, however, certain precautions must be taken to minimize the possibility of such things as cracking due to thermal shock, shadowing under pipes due to unequal rate of drying, or calcination of the gypsum plaster due to over heating. These recommendations are intended to provide information which should help avoid such difficulties.

TYPES OF RADIANT HEATING SYSTEMS

Hot water systems in which the heat conducting mediums, such as pipes, are embedded in the plaster installation.

Electrical systems where a series of cables are embedded in the plaster installation.

Systems in which the heating elements are located behind the lath and plaster.

SPECIFICATIONS

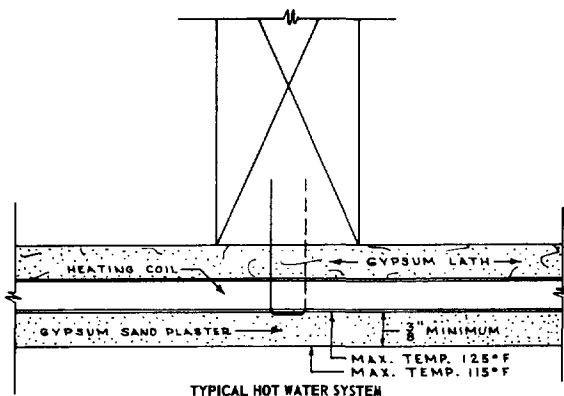
Gypsum lath, metal lath, and gypsum plaster shall be applied in accordance with the requirements of ASA A42.1, "Standard Specifications for Gypsum Plastering" and ASA A42.4, "Standard Specifications for Interior Lathing and Furring", except as herein modified. Only sand aggregates shall be used. Perlite and vermiculite have far greater resistance to heat flow and should not be used (see Design Data).

HOT WATER SYSTEMS

A hot water type of heating system is one in which hot water is circulated through a series of radiant heating coils that are embedded in the plaster and may be used with either gypsum or metal lath as the plaster base.

In systems where hot water conducting elements are embedded in the gypsum plaster, the surface temperature of the plaster shall not exceed 115°F. This condition shall be met by requiring the circulating water temperatures in the pipes, in contact with the gypsum plaster, not to exceed 125°F.

The heating elements shall be suspended from and supported by the framing members and not the lath.



All inspections and testing of the heating system shall be completed before application of the gypsum plaster. Do not use the heating system for temporary heating of

the building during plastering operation. Portable heaters or ventilating units should be provided.

The heating system shall not be used or put into operation until the plaster is thoroughly dry. When the heating system is put into operation the temperature rise in the heating elements should not exceed 5°F. per 24 hour period until the maximum temperature of 125°F has been reached.

Application of Plaster

A minimum thickness of 3/8" of gypsum plaster over the heating elements is required, however, the total thickness of the plaster shall be not less than 1/2" over gypsum lath and 5/8" over metal lath when measured from the face of the lath.

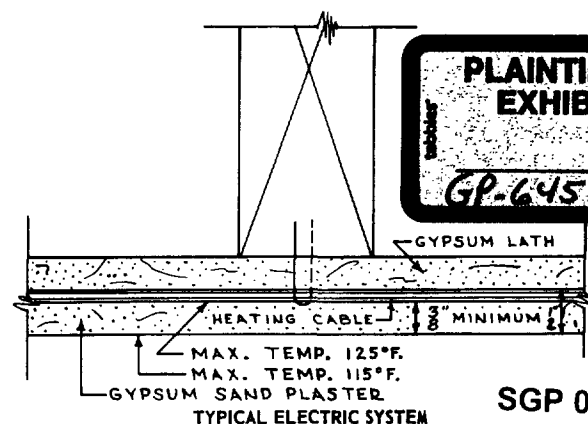
Where more than 1/2" thickness of plaster is required over the face of gypsum lath, plastering shall be done by the three coat method including the finish coat. Where the three coat method is used, the scratch coat shall be thoroughly cross raked and shall dry at least over night before the brown coat is applied. Where metal lath is used, there shall be at least a one day interval between scratch and brown coat application. Thicker than usual base coat applications require longer drying time before the finish coat can be applied. Where very thick applications are required, the plaster shall be applied in four coats, including the finish coat. To avoid shadowing under pipes the base coat should be almost dry before the finish coat application. If the base coat is completely dry, it may be wetted down to reduce suction for the finish coat application.

ELECTRIC SYSTEMS

An electric heating system is one in which a series of radiant electric cables are embedded in the plaster ceiling. The plaster base should be a non-metallic, fire resistant material.

Where gypsum lath and plaster are used, the surface temperature of the plaster shall not exceed 115°F. This condition shall be met by requiring the temperature of the wire insulation in contact with the plaster not to exceed 125°F.

Electric heating elements may be securely attached to the gypsum lath in accordance with the cable manufacturer's recommendations.



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All inspections and testing of the heating system shall be completed before application of the gypsum plaster.

Never use the heating system for temporary heating of the building during the plastering operation. Portable heaters or ventilating units should be provided.

The heating system shall not be used or placed into operation until the plaster is thoroughly dry. When the heating system is placed into operation, temperature rise through the heating elements should not exceed 5°F. per 24 hour period until the maximum temperature of 125°F. has been reached.

Application of Plaster

A minimum thickness of 3/8" gypsum plaster over the heating elements is required, however, the total thickness of the plaster shall be not less than 1/2" when measured from the face of the lath.

Where more than 1/2" thickness of plaster is required, the plaster shall be applied by the three coat method including the finish coat. Where the three coat method is used the scratch coat shall be thoroughly cross raked and shall dry at least over night before the brown coat is applied. Thicker than usual base coat applications require longer drying time before the finish coat can be applied. To avoid shadowing under cables, the base coat should be almost dry before the finish coat application. If the base coat is completely dry, it may be wetted down to reduce suction for the finish coat application.

OTHER SYSTEMS

Where the heating system is located behind the lath and plaster installation, the recommendations for the hot water or the electrical heating system, whichever is applicable, shall be complied with. *The temperature of the gypsum lath or plaster adjacent to the heat source shall not exceed 125°F.*

The heating system should not be placed into operation until the plaster is thoroughly dry. When the heating system is put into operation the temperature rise should not exceed 5°F. per 24 hour period until the maximum temperature of 125°F has been reached.

Never use the heating system for temporary heating of the building during the plastering operation. Portable heaters or ventilating units should be provided.

DESIGN DATA

It is the responsibility of the architect to prepare and correlate complete plans and specifications. The limitations and characteristics of the materials which are to be used in the structure should be taken into consideration. Then, it is the responsibility of the heating engineer to properly design the radiant heating system to work effectively with these materials.

Be certain that the job specifications are followed. Substitutions in materials might change the rate of heat flow, which in turn might give results that would make the entire installation unsatisfactory.

The following design data is recommended for use in calculating the heat transmission coefficient (U) for gypsum products:

HEAT TRANSMISSION CHARACTERISTICS

Description	Conductivities or Conductances		Resistance (R)	
	k (per inch thickness)	C (thickness as given)	1/k	1/C
Air Spaces				
*Bounded by ordinary materials (Horizontal or Vertical)		1.10		0.91
*One air space faced with aluminum foil				
Heat Flow Upward or Horizontally		0.46		2.17
Heat Flow Downward		0.15		6.51
Gypsum lath, 3/8"		4.11		0.24
Gypsum lath, 1/2"		3.00		0.33
Gypsum lath, 3/8" with 1/2" sand plaster		2.4		0.42
Metal lath and 3/4" sand plaster		4.40		0.23
Plastering Mixes, per 1" thickness:				
Gypsum sand				
100:200 lbs.	5.51		0.18	
100:300 lbs.	5.60		0.17	
Gypsum perlite				
100 lb: 2 cu. ft.	1.64		0.60	
100 lb: 3 cu. ft.	1.31		0.76	
Gypsum vermiculite				
100 lb: 2 cu. ft.	1.74		0.57	
100 lb: 3 cu. ft.	1.42		0.70	

*—3/4" or more in width.

THERMAL EXPANSION COEFFICIENTS

Type of Plaster	Inches per Inch per Degree Fahrenheit
Gypsum Sanded Plaster	0.000005 to 0.000009
Gypsum Vermiculite Plaster	
Gypsum Perlite Plaster	
Gypsum Wood Fiber Plaster	0.000009 to 0.000015
Specific Heat of Gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$)	0.26

DENSITIES (Dry, Set Plaster)

(Plaster mix—1 part gypsum: 2 to 3 parts aggregate)

Gypsum—Sanded Plaster	100 to 110 pounds per cu. ft.
Gypsum—Vermiculite Plaster	40 to 50 pounds per cu. ft.
Gypsum—Perlite Plaster	

DECORATION

Decoration of the finish plaster including sizing or sealing, shall not proceed until the heating system has been test operated for a minimum of 24 hours. The system should then be turned off and decorating of the gypsum plaster performed. Do not decorate the plaster while the heating is being tested, or is in operation. It is also recommended that where texture finishes are used, such finishes be allowed to thoroughly set or dry prior to the operation of the heating system.