Perm-A-Barrier® Wall Membrane

Self-adhesive, rubberized asphalt/polyethylene waterproofing membrane for air and vapor barrier applications

Advantages

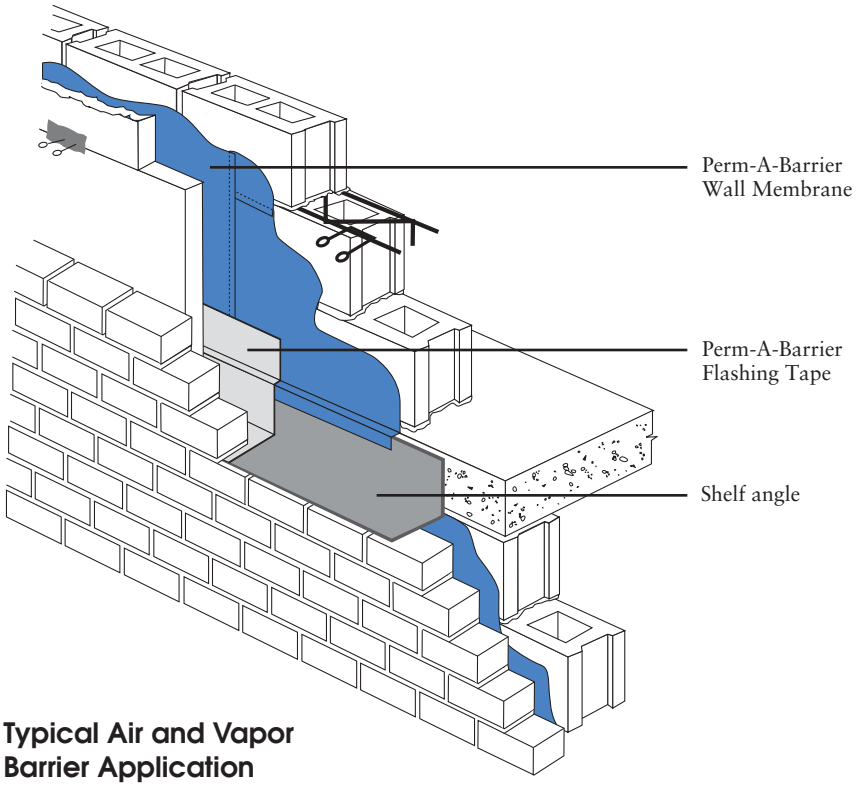
- **Fully bonded** – transmits wind loads directly to the substrate
- **Waterproof and virtually impermeable to moisture** – virtually impermeable to the passage of liquid water and vapor
- **Air tight** – exceeds CCMC requirements for air barrier membranes and complies with Massachusetts State Energy Code
- **Cross laminated film** – provides dimensional stability, high tear strength, puncture and impact resistance
- **Cold applied** – no flame hazard; self-adhesive overlaps ensure continuity
- **Flexible** – accommodates minor settlement and shrinkage movement
- **Controlled thickness** – factory made sheet ensures constant, non-variable site application
- **Aggressive, conformable adhesive** – allows self-sealing around mechanical fasteners
- **Wide application window** –
  - **Perm-A-Barrier® Wall Membrane** surface and ambient temperatures at 5°C (40°F) and above
  - **Perm-A-Barrier System 4000 Wall Membrane** surface and ambient temperatures at -4°C (25°F) and above
  - **Perm-A-Barrier Low Temperature Wall Membrane** surface and ambient temperatures between -4°C (25°F) and 16°C (60°F)

Description

Perm-A-Barrier wall membranes are ideal for protecting the building superstructure from the damaging effects of the elements.

By minimizing air and water vapor flow through the building exterior, Perm-A-Barrier wall membranes:

- Prevent premature deterioration of the building envelope
- Enhance thermal performance of the structure and save energy costs
- Improve comfort for the building occupants



Typical Air and Vapor Barrier Application

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System Components

- **Perm-A-Barrier System 4000 Wall Membrane –** extended temperature range system for use at all temperatures above -4°C (25°F), conveniently packaged with a unique water-based surface conditioner
- **Perm-A-Barrier Wall Membrane** – standard grade for use at temperatures above 5°C (40°F)
- **Perm-A-Barrier Low Temperature Wall Membrane –** low temperature grade for use at temperatures between -4°C (25°F) and 16°C (60°F)
- **Perm-A-Barrier Surface Conditioner –** water-based surface treatment for use with System 4000 on cementitious substrates
- **Perm-A-Barrier WB Primer –** high tack, water-based primer for use with Perm-A-Barrier Wall Membrane and Perm-A-Barrier Low Temperature Wall Membrane on cementitious and exterior gypsum wallboards
- **Bituthene® Primer B2 –** used to prime "green" concrete or damp substrates
- **Bituthene Mastic Trowel Grade** – rubberized asphalt mastic for sealing patches, terminations, brick ties, etc.

Installation

Safety

Perm-A-Barrier products must be handled properly. Vapors from the mastic and solvent-based primer are harmful and flammable. For these products, the best available information on safe handling, storage, personal protection, health and environmental considerations has been gathered. Refer to product label and Material Safety Data Sheet before use. All users should acquaint themselves with this information prior to working with the material. Carefully read detailed precaution statements on the product labels and MSDS before use. MSDSs can be obtained from our web site at www.graceconstruction.com or by contacting us toll free at 866-333-3SBM (3726).

Surface Preparation

Surface must be smooth, clean, dry and free of voids, spalled areas, loose aggregate, loose nails, sharp protrusions or other matter that will hinder the adhesion or regularity of the wall membrane installation. Clean loose dust or dirt from the surface to which the wall membrane is to be applied by wiping with a clean, dry cloth or brush.

If the substrate is damp, allow to dry or use Bituthene Primer B2 to prepare the area to receive the membrane.

Temperature

Perm-A-Barrier System 4000 Membrane and Bituthene Surface Conditioner may be applied only in dry weather when air and surface temperatures are above -4°C (25°F). Perm-A-Barrier Low Temperature Membrane may be applied only in dry weather when air and surface temperatures are between -4°C (25°F) and 16°C (60°F). Perm-A-Barrier Wall Membrane may be applied only in dry weather when air and surface temperatures are above 5°C (40°F).

Application

Conditioning and Priming:
Bituthene System 4000 Surface Conditioner is supplied ready to use. It should not be diluted with water or solvent. Mix and apply a light coating with a portable spray unit, brush or roller. Conditioner will cover 6-8 m^2/L (250-350 ft^2/gal) when applied with a low pressure, portable sprayer. Allow surface conditioner to dry completely before membrane application. The surface conditioner is considered dry when the substrate returns to its original color (minimum 1 hour). To test for dryness, rub small conditioned area by hand. Wet conditioner will ball up under the fingertips. Let dry until conditioner cannot be rubbed off. Condition only areas that can be covered the same day. Conditioned areas not covered the same day should be reconditioned.

Perm-A-Barrier WB Primer is a water-based primer which imparts an aggressive, high tack finish on the treated substrate. It is packaged ready to use and is specifically designed to facilitate tenacious adhesion of Perm-A-Barrier flashing tapes and wall membranes to glass mat surfaces and exterior gypsum boards such as Dens-Glass Gold®. Apply Perm-A-Barrier WB Primer by roller at a coverage rate of 6-8 m^2/L (250-350 ft^2 gal). Allow to dry for a minimum of 1 hour (longer at low temperatures).

Membrane Application

Cut membrane into easily handled lengths. Apply membrane horizontally or vertically to primed substrates receiving post-applied masonry anchors (ties), such as gypsum sheathing.

Apply wall membranes horizontally to the primed blockwork with projecting masonry anchors (ties), beginning at the base of the wall. Each length of the membrane must be installed so that the upper edge runs continuously along the underside of the line of masonry anchors (ties). Subsequent sheets applied above must overlap the sheet below by 51 mm (2 in.) immediately below the line of anchors (ties). Since the membrane width appropriate for this application of 457 mm (18 in.) is wider than the typical spacing between the lines of anchors (ties) 406 mm (16 in.), it will be necessary to cut the membrane at the location of the tie wires projecting from the wall to enable the sheet to be laid in place. End laps that occur in subsequent lengths that follow should maintain a minimum overlap of 51 mm (2 in.). See Figures 1 and 2.

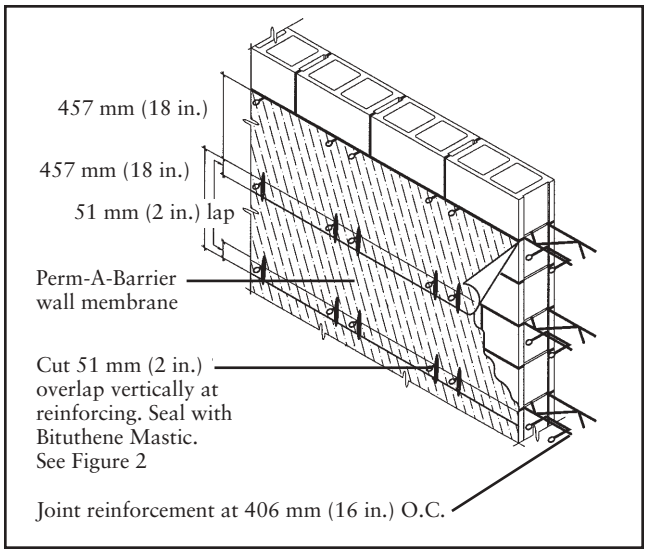

Figure 1: Membrane System Detail

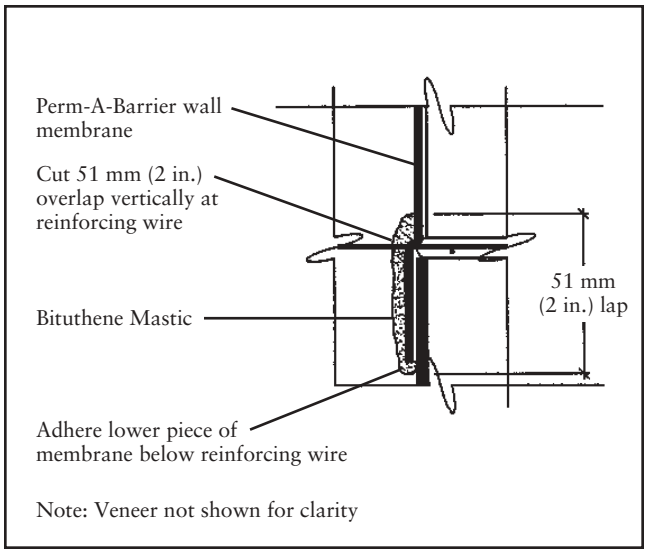

Figure 2: Horizontal Reinforcing

The membrane must be pressed firmly into place with a hand roller or the back of a utility knife as soon as possible, ensuring continuous and intimate contact with the substrate to prevent water from migrating under the membrane.

In certain applications such as on soffits, ceilings or substrates such as oriented strand board (OSB), backnail the membrane along the side lap prior to installing the next sheet of membrane to ensure positive contact to the substrate.

Apply Bituthene Mastic to seal around the tie wire projections. Fit the Perm-A-Barrier wall membrane tightly around all penetrations through the membrane and seal using Bituthene Mastic.

Continue the membrane into all openings in the wall area, such as windows, doors, etc., and terminate at points that will prevent interior visibility. The installation must be made continuous at all framed openings. Coordinate installation of the Perm-A-Barrier wall membrane with the roofing trade to ensure continuity with the roofing system at this critical transition area.

At the end of each working day, if the wall has been only partially covered, apply a bead of Bituthene Mastic along the top edge of the membrane at its termination to prevent vertical drainage of precipitation from penetrating the end and undermining the membrane adhesion. Tool the Bituthene Mastic to ensure it is worked into the surface. Inspect the membrane before covering and repair any punctures, damaged areas or inadequately lapped seams.

Membrane Repairs

Repairs must be made using Perm-A-Barrier wall membrane sized to extend 150 mm (6 in.) in all directions from the perimeter of the affected area. If repairs are required, carefully cut out affected areas and replace in similar procedure as outlined above. The repair piece must be pressed into place with a hand roller as soon as possible to ensure continuous and intimate contact with the substrate.

Membrane Protection

Perm-A-Barrier wall membranes must be protected from damage by other trades or construction materials.

Storage and Handling Information

All materials must be protected from rain and physical damage. Pallets of Perm-A-Barrier wall membrane must not be double stacked on the job site. Provide cover on top and all sides, allowing for adequate ventilation. Store membrane where temperatures will not exceed 32°C (90°F) for extended periods. All products must be stored in a dry area away from high heat, flames or sparks. Store only as much material at point of use as is required for each day's work.

Limitations

Perm-A-Barrier wall membrane systems must not be applied in areas where they will be permanently exposed to UV light and must be covered within a reasonable amount of time, not to exceed 30 days.

Warranty

Perm-A-Barrier products are warranted to be free of defects in manufacture for a period of 5 years. Material will be provided at no charge to replace any defective product.

Technical Service

Support is provided by full-time technically trained Grace field sales representatives and technical service personnel, backed by a central research and development technical services staff.

Supply

Product	Unit of Sale	Approximate Coverage	Weight	Palletization
Perm-A-Barrier System 4000 Wall Membrane (includes surface conditioner)	1 roll	20.9 m^2 (225 ft^2) per roll 0.9 x 25 m (3 x 75 ft) roll	73 lbs/roll	25 cartons (25 rolls) per pallet
Perm-A-Barrier Wall Membrane	1 roll	20.9 m^2 (225 ft^2) per roll 0.9 x 25 m (3 x 75 ft) roll	67 lbs/roll	25 cartons (25 rolls) per pallet
Perm-A-Barrier Low Temperature Wall Membrane	1 roll	20.9 m^2 (225 ft^2) per roll 0.9 x 25 m (3 x 75 ft) roll	67 lbs/roll	25 cartons (25 rolls) per pallet
Perm-A-Barrier Wall Flashing				
– 305 mm (12 in.)	3 rolls	75 linear ft per roll	25 lbs/roll	25 cartons (75 rolls) per pallet
– 457 mm (18 in.)	2 rolls	75 linear ft per roll	37.5 lbs/roll	25 cartons (50 rolls) per pallet
– 610 mm (24 in.)	1 roll	75 linear ft per roll	55 lbs/roll	35 cartons (35 rolls) per pallet
– 914 mm (36 in.)	1 roll	75 linear ft per roll	75 lbs/roll	25 cartons (25 rolls) per pallet
Bituthene Mastic – 5 gal pail	1 pail	approx. 120 ft^2 at 60 mils	54 lbs/pail	36 pails per pallet
Bituthene Mastic – 30 oz tube	12 tubes	approx. 30 lin. ft x ¼ in. bead	32 lbs/carton	72 cartons (864 tubes) per pallet
Perm-A-Barrier Surface Conditioner – 1 gal jug	4 jugs	6-8 m^2/L (250-350 ft^2/gal)	9 lbs/jug	36 cartons (144 jugs) per pallet
Perm-A-Barrier WB Primer – 5 gal pail	1 pail	6-8 m^2/L (250-350 ft^2/gal)	45 lbs/pail	24 pails per pallet
Bituthene Primer B2 – 5 gal pail	1 pail	6-8 m^2/L (250-350 ft^2/gal)	44 lbs/pail	48 pails per pallet

Physical Properties

Property and Test Method	Perm-A-Barrier System 4000	Perm-A-Barrier Wall Membrane	Perm-A-Barrier Low Temperature	Test Method
Thickness	1 mm (3/64 in.)	1 mm (3/64 in.)	1 mm (3/64 in.)	ASTM D3767 Method A
Minimum tensile strength, membranes	2.8 MPa (400 psi)	2.8 MPa (400 psi)	2.8 MPa (400 psi)	ASTM D412 Die C Modified
Minimum tensile strength, film	34.5 MPa (5000 psi)	34.5 MPa (5000 psi)	34.5 MPa (5000 psi)	ASTM D412 Die C Modified
Minimum elongation, to failure of rubberized asphalt	200%	200%	200%	ASTM D412 Die C Modified
Pliability, at 180° bend over 25 mm (1 in.) mandrel	Pass at -43°C (-45°F)	Pass at -32°C (-25°F)	Pass at -43°C (-45°F)	ASTM D1970
Crack cycling, 3.2 mm (1/8 in.) at -32°C (-25°F)	Unaffected	Unaffected	Unaffected	ASTM C836
Minimum puncture resistance, membrane	178 N (40 lbs)	178 N (40 lbs)	178 N (40 lbs)	ASTM E154
Lap peel adhesion at minimum application temperature	1100 N/m width (6.3 lbs/in.)	700 N/m width (4 lbs/in.)	875 N/m width (5 lbs/in.)	ASTM D1876 Modified
Maximum permeance to water vapor transmission	2.9 ng (0.05 perms/(Pa.s.m^2))	2.9 ng (0.05 perms/(Pa.s.m^2))	2.9 ng (0.05 perms/(Pa.s.m^2))	ASTM E96 Method B
Air permeance of in-place membrane[1]	$8x10^{-5}$ L/s/m^2 ($4x10^{-6}$ cf/min/ft^2)	$1.7x10^{-4}$ L/s/m^2 ($8.5x10^{-5}$ cf/min/ft^2)	$1.7x10^{-4}$ L/s/m^2 ($8.5x10^{-5}$ cf/min/ft^2)	ASTM E283
Air permeance of in-place membrane[2]	No change in air permeance value	No change in air permeance value	No change in air permeance value	ASTM E330
Water absorption (weight gain at 24 hours)	0.1%	0.1%	0.1%	ASTM D570

Footnote:

1. Air permeance measured at a pressure differential of 68 Pa (1/64 in.) Hg.
2. Air permeance measured at a pressure differential of 68 Pa (1/64 in.) Hg after wall being subjected to a negative 3014 Pa (57/64 in.) Hg pressure difference for 10 seconds.

For Technical Assistance call toll free at 866-333-3SBM (3726).

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GRACE Construction Products

Perm-A-Barrier® Wall Flashing

Self-adhesive, rubberized asphalt/polyethylene flashing tapes for cavity wall applications

Advantages

- **Fully bonded** – continuous adhesion to the substrate resists wind loads and prevents water tracking behind the tape
- **Waterproof and virtually impermeable to moisture** – virtually impermeable to the passage of liquid water and vapor
- **Cross laminated film** – provides dimensional stability, high tear strength, puncture and impact resistance
- **Cold applied** – no flame hazard; self-adhesive overlaps ensure continuity
- **Flexible** – accommodates minor settlement and shrinkage movement
- **Controlled thickness** – factory made sheet ensures constant, non-variable site application
- **Aggressive, conformable adhesive** – creates 100% watertight laps and allows self-sealing around mechanical fasteners
- **Unique green color and logo** – highly differentiated on the job site from other flashing types and enables easy identification of damage
- **RIPCORD™ "split release on demand"** – faster application in the straight-aways, ease of membrane positioning in detailed areas
- **Foldless release paper** – fewer edge catches, 180° pull-back, ease of membrane cutting (single cuts) and membrane positioning, quicker one-man installs

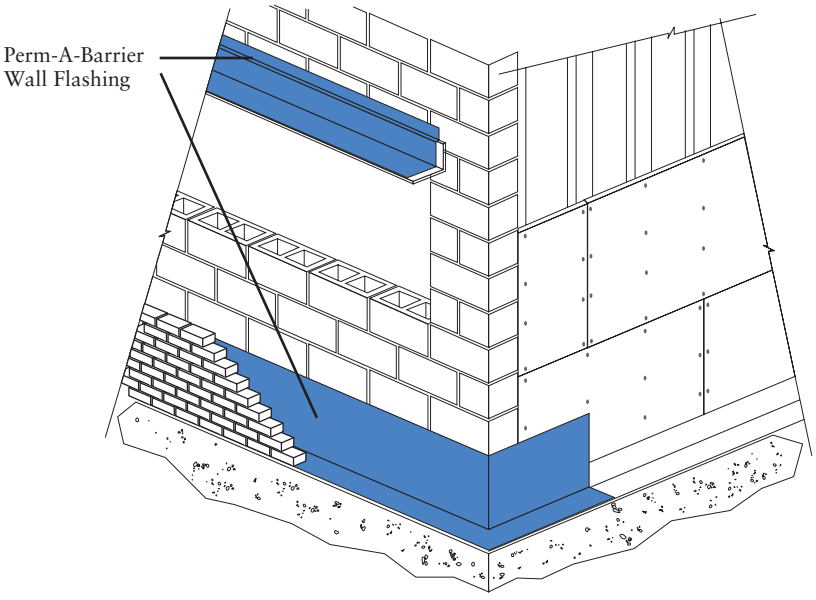
Description

Perm-A-Barrier® wall membranes are ideal for protecting the building superstructure from the damaging effects of the elements. By minimizing air and water vapor flow through the building exterior, Perm-A-Barrier wall membranes:

- Prevent premature deterioration of the building envelope
- Enhance thermal performance of the structure and save energy costs
- Improve comfort for the building occupants

System Components

- **Perm-A-Barrier Wall Flashing** – 1 mm (40 mil) total thickness self-adhesive, cold applied tape consisting of 0.8 mm (32 mils) of rubberized asphalt integrally bonded to a 0.2 mm (8 mil) high density, cross laminated polyethylene film. The rolls are interwound with disposable silicone-coated release sheet
- **Perm-A-Barrier Wall Membranes** – air and vapor barrier membranes for use in cavity wall applications
- **Perm-A-Barrier WB Primer** – high tack, water-based primer for use on exterior wallboards
- **Bituthene® Mastic Trowel Grade** – rubberized asphalt mastic for sealing around penetrations, terminations, brick ties, etc.



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Construction Products

Installation

Safety

Perm-A-Barrier products must be handled properly. Vapors from the mastic and solvent-based primer are harmful and flammable. For these products, the best available information on safe handling, storage, personal protection, health and environmental considerations has been gathered. Refer to product label and Material Safety Data Sheet before use. All users should acquaint themselves with this information prior to working with the material. Carefully read detailed precaution statements on the product labels and MSDS before use. MSDSs can be obtained from our web site at www.graceconstruction.com or by contacting us toll free at 866-333-3SBM (3726).

Preparatory Work

Apply Perm-A-Barrier Wall Flashing and accessories only in fair weather when air and surface temperatures are above -4°C (25°F).

Wherever wall flashing is to be applied, the surface must be smooth, clean, dry and free of voids, spalled areas, loose substrate, loose nails, sharp protrusions or other matter that will hinder the adhesion or uniformity of the wall flashing installation. Clean loose dust or dirt from the surface by wiping with a clean dry cloth or a brush.

Conditioning and Priming

Use Perm-A-Barrier WB Primer to enhance adhesion on dusty cementitious substrates. Perm-A-Barrier WB Primer is a water-based primer which imparts an aggressive, high tack finish on the treated substrate. It is specifically designed to facilitate tenacious adhesion of Perm-A-Barrier Wall Flashing, Perm-A-Barrier Wall Membrane, Grace underlayments and Grace Vycor® Self-Adhered Flashings to various substrates including Dens-Glass Gold® (refer to relevant product data sheets). It will cover approximately 6-8 m^2/L (250-350 ft^2/gal) when applied with a roller. A synthetic, 13 mm (½ in.) nap roller has been found to be very successful. A moderately thick coating should be applied and rolled out evenly. A properly applied coating will have uniform coverage and leave a tacky finish to the surface when dry.

Apply primer in dry weather with ambient and substrate temperatures above -4°C (25°F). Surface must be dry and clean, free from frost, dirt, grease, oil or other contaminants. Failure to remove excessive dust may result in compromised adhesion of the membrane. Allow primer to dry completely before application of the flashing.

In cooler or humid conditions, priming may be done in advance. If primed surface is exposed for more than 7 days, or if significant dust or dirt accumulates on the surface, re-prime with a thin coat of Perm-A-Barrier WB Primer.

The drying time could vary from 15 minutes (> 32°C (<90°F), windy, under the sun) to 3 hours (cold and no wind), depending on the weather condition. For 32°C (90°F) or greater, 45 minutes to one hour; 10°C (50°F) to 32°C (90°F), 1-3 hours; less than 10°C (50°F) 3 hours or more.

Bituthene Primer B2 is used to prime "green" concrete or damp substrates. Apply to clean surface at a coverage rate of 6-8 m^2/L (250-350 ft^2/gal). Allow primer to dry completely (approximately 1 hour dependent on weather condition) before application of wall flashing.

Flashing Application

Pre-cut Perm-A-Barrier Wall Flashing to easily handled lengths. Peel release paper from roll to expose rubberized asphalt and carefully position flashing against substrate. RIPCORD, a "split release on demand" feature embedded in the membrane, also makes Perm-A-Barrier Wall Flashing easy to position in detailed areas. Press firmly into place with a steel hand roller or the back of a utility knife as soon as possible, fully adhering the flashing to the substrate to prevent water from migrating under the Perm-A-Barrier Wall Flashing. Form end dams at horizontal flashing terminations to prevent water entry. Overlap adjacent pieces 51 mm (2 in.) and roll overlap with a steel hand roller.

Apply a bead of Bituthene Mastic along all laps, seams, top edges, cuts and penetrations and trowel into place. Lay or trim edges of Perm-A-Barrier Wall Flashing 13 mm (1/2 in.) back from the face of the masonry. No reglet is necessary when installing Perm-A-Barrier Wall Flashing to vertical surfaces. Complete installation instructions and details are available upon request.

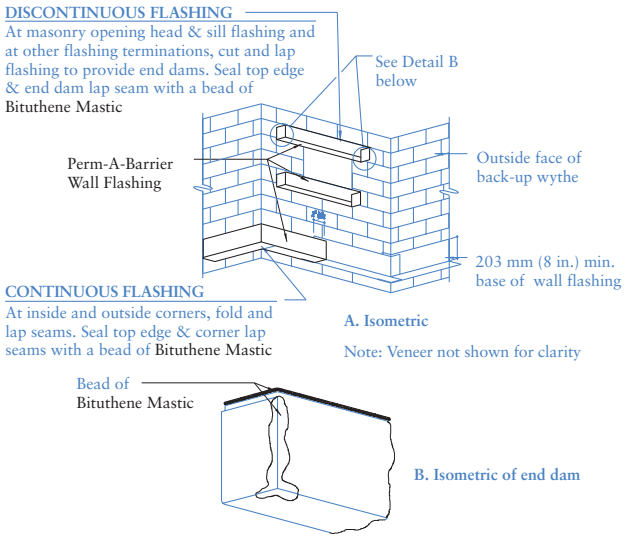
If wrinkles develop, carefully cut out affected area and replace in similar procedure outlined above. The repair piece must be pressed into place with a hand roller as soon as possible to ensure continuous and intimate contact with the substrate.

Protection

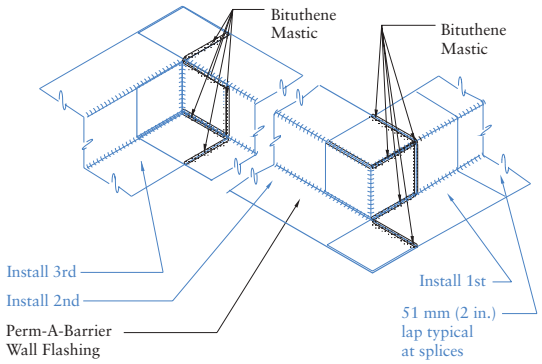
Perm-A-Barrier Wall Flashing must be protected from damage from other trades or construction materials.

Storage and Handling Information

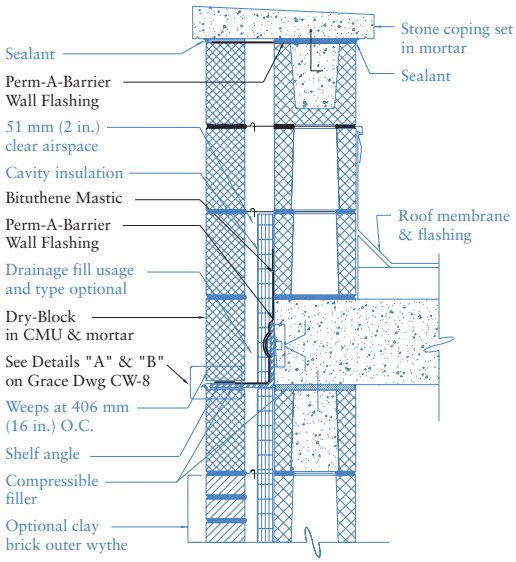
All materials must be protected from rain and physical damage. Pallets of Perm-A-Barrier Wall Flashing must not be double stacked on the job site. Provide cover on top and all sides, allowing for adequate ventilation. Store wall flashing where temperatures will not exceed 32°C (90°F) for extended periods. All products must be stored in a dry area away from high heat, flames or sparks. At point of use, store only as much material as is required for each day's work.



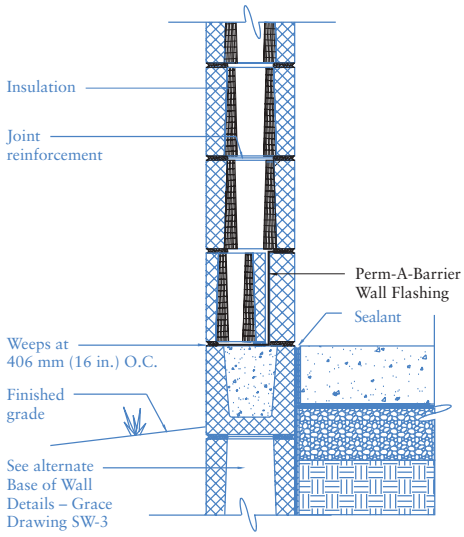
Through-wall Flashing Details



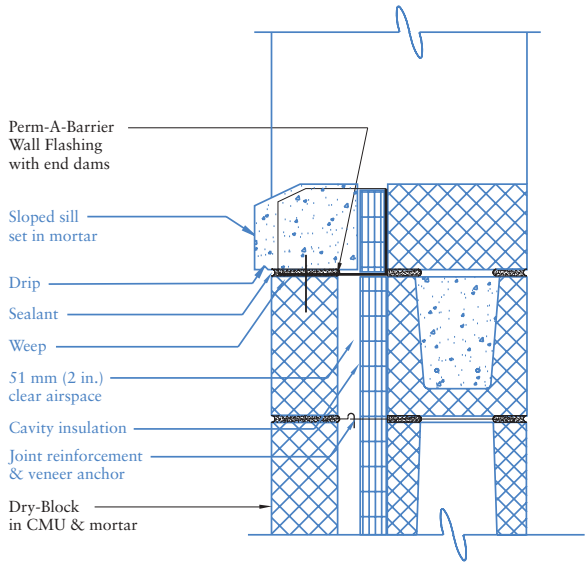
Perm-A-Barrier Flashing Details at Inside and Outside Corners



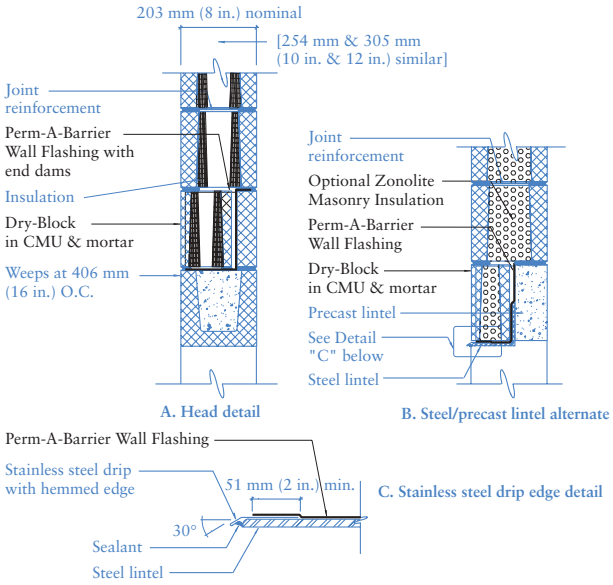
Parapet Detail



Base of Wall Detail



Sill Detail



Masonry Opening Head Flashing

Supply

Product	Unit of Sale	Approximate Coverage	Weight	Palletization
Perm-A-Barrier Wall Flashing				
– 305 mm (12 in.)	3 rolls	75 linear ft per roll	22.5 lbs/roll	25 cartons (75 rolls) per pallet
– 457 mm (18 in.)	2 rolls	75 linear ft per roll	33.7 lbs/roll	25 cartons (50 rolls) per pallet
– 610 mm (24 in.)	1 roll	75 linear ft per roll	49.7 lbs/roll	35 cartons (35 rolls) per pallet
– 914 mm (36 in.)	1 roll	75 linear ft per roll	67.7 lbs/roll	25 cartons (25 rolls) per pallet
Bituthene Mastic – 5 gal pail	1 pail	approx. 120 ft^2 at 60 mils	54 lbs/roll	36 pails per pallet
Bituthene Mastic – 30 oz tube	12 tubes	approx. 30 linear ft x ¼ in. bead	32 lbs/carton	72 cartons (864 tubes) per pallet
Perm-A-Barrier WB Primer – 5 gal pail	1 pail	6-8 m^2/L (250-350 ft^2/gal)	45 lbs/pail	24 pails per pallet

Physical Properties

Property	Typical Value	Test Method
Color	Green with repeated logo imprint	
Thickness	1 mm (40 mil)	ASTM D3767, Method A
Low temperature flexibility	Unaffected at -43°C (-45°F)	ASTM D1970
Tensile strength, membrane	8300 kPa (1200 psi) minimum	ASTM D412, Die C Modified
Elongation, ultimate failure of rubberized asphalt	200% minimum	ASTM D412
Lap adhesion at minimum application temperature	875 N/m (60 lbs/ft) width	ASTM D1876 Modified
Adhesion to concrete at minimum application temperature	875 N/m (60 lbs/ft) width	ASTM D903
Puncture resistance, membrane	178 N (40 lbs) minimum MD	ASTM D781
	356 N (80 lbs) minimum MD	ASTM E154
Tear resistance, initiation	58 N (13 lbs) minimum MD	ASTM D1004
Tear resistance, propagation	40 N (9 lbs) minimum MD	ASTM D1938
Permeance	2.9 ng/m^2sPa (0.05 perms) maximum	ASTM E96, Method B
Water absorption	0.1% maximum	ASTM D570

Limitations

Perm-A-Barrier Wall Flashing must not be applied in areas where it will be exposed to sunlight permanently and must be covered within a reasonable amount of time, not to exceed 30 days.

Warranty

Perm-A-Barrier products are warranted to be free of defects in manufacture for a period of 5 years. Material will be provided at no charge to replace any defective product.

Technical Services

Support is provided by full-time, technically trained Grace Construction Products representatives and technical service personnel, backed by a central research and development staff.

For Technical Assistance call toll free at 866-333-3SBM (3726).

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GRACE Construction Products

Perm-A-Barrier®

Surface Conditioner

Description

Perm-A-Barrier® Surface Conditioner is a water-based latex surface treatment that is specifically formulated to bind site dust and concrete efflorescence, thereby providing a suitable surface for the adhesion of Perm-A-Barrier Wall Flashing. The use of Perm-A-Barrier Surface Conditioner is required for dirty or dusty surfaces or surfaces having irregular or rough textures. Perm-A-Barrier Surface Conditioner imparts an aggressive high tack finish to the treated substrate.

Perm-A-Barrier Surface Conditioner prepares the substrate surface which promotes good initial adhesion and, more importantly, excellent permanent adhesion of the Perm-A-Barrier Wall Flashing.

Perm-A-Barrier Surface Conditioner complies with existing and anticipated Volatile Organic Compound (VOC) environment regulations.

Use

Perm-A-Barrier Surface Conditioner is used to condition all structural concrete, masonry or wood surfaces on which Perm-A-Barrier Wall Flashing is to be applied. Sufficient Surface Conditioner should be applied to condition the substrate to a dust-free state, suitable for the application of Perm-A-Barrier Wall Flashing.

Perm-A-Barrier Surface Conditioner can be used in vertical and horizontal applications above -4°C (25°F).

Application

Perm-A-Barrier Surface Conditioner is packaged ready-to-use and imparts an aggressive, high tack finish to the treated substrate. Perm-A-Barrier Surface Conditioner will cover approximately 7.2 m^2/L (300 ft^2/gal) when applied with a low pressure portable sprayer. Perm-A-Barrier Surface Conditioner may also be applied by brush or roller. Allow Perm-A-Barrier Surface Conditioner to dry completely (approximately 1 hour, dependent on weather conditions) before application of flashing. Excess surface conditioner will not improve the adhesion of the flashing. The Perm-A-Barrier Surface Conditioner is considered dry when the substrate returns to its original color.

Allow Perm-A-Barrier Surface Conditioner to dry one hour or until substrate returns to its original color. At low temperature or in high humidity conditions, drying time may be longer. Perm-A-Barrier Surface Conditioner is clear when dry. In general, conditioning should be limited to what can be covered within 24 hours. In circumstances where longer dry times may prevail, substrates may be conditioned in advance. Substrates should be reconditioned if significant dirt or dust accumulates.

Before Perm-A-Barrier Surface Conditioner dries, tools should be cleaned with water. After the surface conditioner dries, tools should be cleaned with mineral spirits. Mineral spirits is a combustible liquid which should be used in accordance with manufacturer's recommendations. Do not use solvents to clean hands or skin.

Safety, Storage and Handling

Perm-A-Barrier Surface Conditioner is non-flammable. Refer to product label and Material Safety Data Sheet before use. For further information, contact your local Grace representative.

Performance Properties

Property	Typical Value
Solvent Type	Water
Flash Point	>60°C (140°F)
VOC Content	Not to exceed 163 g/L
Application Temperature	-4°C (25°F) and above
Freeze-Thaw Stability	5 Cycles (Minimum)
Freezing Point (as packaged)	10°C (14°F)

For Technical Assistance call us toll free at 866-333-3SBM (3726).

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GRACE Construction Products

SIEMENS

Submittal Sheet
Document No. 154-042
January, 23, 2004

SED2 Variable Frequency Drives

Description

The SED2 variable frequency drives are designed specifically for HVAC applications. The SED2 supports a wide variety of digital and analog I/O for diverse control capability. Built-in PID features control pumps and fans, and an integral system protocol can interface P1/N2 networks. Using the SED2 multi-level parameter access, operators can quickly pinpoint relevant data.

Product Numbers

Your Product Number:	S	E	D	2	-					/			X		
Example Product Number:	S	E	D	2	-	0	.	7	5	/	2	2	X		

Model:
SED2-

kW:
0.37, 0.55, 0.75, 1.1, 1.5, 2.2, 3, 4, 5.5, 7.5, 11, 15, 18.5, 22, 30, 37, 45, 55, 75, 90
(uses 2 to 4 spaces plus a divider "/")

Voltage:
2 = 200 to 240
3 = 380 to 480
4 = 500 to 600

NEMA:
2 (IP 20)
1 NEMA Type 1
5 NEMA Type 12 (IP 54) *

Other:
X include with all part #'s

(leave blank)

* Available with Voltage Codes 3 and 4.

Example shown:
SED2-0.75/22X =
SED2 only, 0.75 kW (1hp), 200V to 240V, open type IP20.

Features

- Built-in SBT P1 and JCI N2 (Metasys®) building automation system protocols for easy network integration
- LON Interface and Modbus Interface optional
- Low harmonics design reduces noises and interference eliminates need for filters/reactors in most installations
- Built-in PID for fast and accurate pressure control
- Pump staging for open loop, constant pressure, and constant flow-type applications
- Multi-level program access
- Belt failure detection with or without an external sensor
- Service mode for applications requiring continuous, uninterruptible operation
- Accepts a wide variety of digital and analog I/O types, including direct Ni 1000 RTD sensor level inputs
- One common interface throughout all power ranges
- Optional Advanced Operator Panel for uploading/downloading parameters
- Full form C relay contacts for digital outputs

Frame Sizes

SED2 IP20 and NEMA Type 1 frame sizes and power ranges are as follows:

HP	.5	.7	1	1.5	2	3	4	5	7.5	10	15	20	25	30	40	50	60	75	100	125
kW	.37	.5	.75	1.1	1.5	2.2	3	4	5.5	7.5	11	15	19	22	30	37	45	55	75	90
240V	A			B			C				D			E		F				
480V	A				B			C				D			E		F			
575V		C											D			E		F		

SED2 IP54/NEMA Type 12 frame sizes and power ranges are as follows:

HP	.5	.7	1	1.5	2	3	4	5	7.5	10	15	20	25	30	40	50	60	75	100	125
kW	.37	.5	.75	1.1	1.5	2.2	3	4	5.5	7.5	11	15	19	22	30	37	45	55	75	90
480V				B			C						D			E				
575V					C															

Technical Data

Table 1. Drive Specifications.

Drive Specifications	Description
Input voltage and power ranges (3-phase)	200V to 240V, 3 ac±10%. 1/2 hp to 60 hp
	380V to 480V, 3 ac ±10% 1/2 hp to 125 hp
	500V to 600V, 3 ac ±10% 1 hp to 125 hp
Input frequency	47 Hz to 63 Hz
Output frequency	0 Hz to 150 Hz
Power factor	≥0.9
VFD degree of efficiency	96% to 97%
Switch-on current	Less than nominal input current
Auxiliary supply 24V	Glavanically separated, unregulated auxiliary supply (18V to 32V) 100 mA
Overload capacity	110% for 60 seconds
Control method	Linear, parabolic and programmable V/f; and flux current control low-power mode
PWM frequency	2k Hz to 16k Hz (adjustable in 2k Hz increments)
Fixed frequencies	15 programmable
Skip frequency bands	4 programmable
Setpoint resolution	0.01 Hz digital
	0.01 Hz serial
	10 bit analog
Digital inputs (sink/source)	6: fully programmable and scalable isolated digital inputs, switchable
Analog inputs	2: 0 to 10 Vdc, 0/4 to 20 mA, can also be configured as digital inputs or Ni 1000 input
Relay outputs	2: configurable 30 Vdc/5A (resistive), 250 Vac/2A (inductive)
Analog outputs	2: programmable (0/4 mA to 20 mA, or 0 Vdc to 10 Vdc)
Serial interface	RS-485 transmission rate: Up to 38.4k baud Protocols: USS, P1 and N2
Protection level	IP20
	NEMA Type 1 with protective shield and gland plate installed
	IP54/NEMA Type 12
Temperature ranges	Operating: 14°F to 104°F (–10°C to 40°C)
	Storage: –40°F to 158°F (–40°C to 70°C)
Humidity	95% rh, non-condensing
Operational altitudes	Up to 3280 ft (1000m) above sea level without derating
Protection features	Under-voltage
	Over-voltage
	Overload
	Ground fault
	Short circuit
	Stall prevention
	Locked motor
	Motor overtemperature I^2t, PTC
	Over-temperature
	Parameter PIN protection
Standards	UL, cUL, CE, C-tick
CE conformity	Conformity with EC Low Voltage Directive 73/23/EEC

Table 2. Output Ratings.

Voltage (±10%)	Product Number			Output Rating		Output Current Max (amps)	Frame Size
	IP20	NEMA Type 1	IP54/NEMA Type 12	HP	kW		
208V to 240V (3-Phase)	SED2-0.37/22X	SED2-0.37/21X	—	0.5	0.37	2.3	A
	SED2-0.55/22X	SED2-0.55/21X	—	0.75	0.55	3.0	A
	SED2-0.75/22X	SED2-0.75/21X	—	1.0	0.75	3.9	A
	SED2-1.1/22X	SED2-1.1/21X	—	1.5	1.1	5.5	B
	SED2-1.5/22X	SED2-1.5/21X	—	2.0	1.5	7.4	B
	SED2-2.2/22X	SED2-2.2/21X	—	3.0	2.2	10.4	B
	SED2-3/22X	SED2-3/21X	—	4.0	3.0	13.6	C
	SED2-4/22X	SED2-4/21X	—	5.0	4.0	17.5	C
	SED2-5.5/22X	SED2-5.5/21X	—	7.5	5.5	22.0	C
	SED2-7.5/22X	SED2-7.5/21X	—	10.0	7.5	28.0	C
	SED2-11/22X	SED2-11/21X	—	15.0	11.0	42.0	D
	SED2-15/22X	SED2-15/21X	—	20.0	15.0	54.0	D
	SED2-18.5/22X	SED2-18.5/21X	—	25.0	18.5	68.0	D
	SED2-22/22X	SED2-22/21X	—	30.0	22.0	80.0	E
	SED2-30/22X	SED2-30/21X	—	40.0	30.0	104.0	E
	SED2-37/22X	SED2-37/21X	—	50.0	37.0	130.0	F
	SED2-45/22X	SED2-45/21X	—	60.0	45.0	154.0	F
380V to 480V (3-Phase)	SED2-0.37/32X	SED2-0.37/31X	—	0.5	0.37	1.2	A
	SED2-0.55/32X	SED2-0.55/31X	—	0.75	0.55	1.6	A
	SED2-0.75/32X	SED2-0.75/31X	—	1.0	0.75	2.1	A
	SED2-1.1/32X	SED2-1.1/31X	SED2-1.1/35X	1.5	1.1	3.0	A *
	SED2-1.5/32X	SED2-1.5/31X	SED2-1.5/35X	2.0	1.5	4.0	A *
	SED2-2.2/32X	SED2-2.2/31X	SED2-2.2/35X	3.0	2.2	5.9	B
	SED2-3/32X	SED2-3/31X	SED2-3/35X	4.0	3.0	7.7	B
	SED2-4/32X	SED2-4/31X	SED2-4/35X	5.0	4.0	10.2	B
	SED2-5.5/32X	SED2-5.5/31X	SED2-5.5/35X	7.5	5.5	13.2	C
	SED2-7.5/32X	SED2-7.5/31X	SED2-7.5/35X	10.0	7.5	18.4	C
	SED2-11/32X	SED2-11/31X	SED2-11/35X	15.0	11.0	26.0	C
	SED2-15/32X	SED2-15/31X	SED2-15/35X	20.0	15.0	32.0	C
	SED2-18.5/32X	SED2-18.5/31X	SED2-18.5/35X	25.0	18.5	38.0	D
	SED2-22/32X	SED2-22/31X	SED2-22/35X	30.0	22.0	45.0	D
	SED2-30/32X	SED2-30/31X	SED2-30/35X	40.0	30.0	62.0	D
	SED2-37/32X	SED2-37/31X	SED2-37/35X	50.0	37.0	75.0	E
	SED2-45/32X	SED2-45/31X	SED2-45/35X	60.0	45.0	90.0	E
	SED2-55/32X	SED2-55/31X	SED2-55/35X	75.0	55.0	110.0	F
	SED2-75/32X	SED2-75/31X	SED2-75/35X	100.0	75.0	145.0	F
	SED2-90/32X	SED2-90/31X	SED2-90/35X	125.0	90.0	178.0	F
500V to 600V (3-Phase)	SED2-0.75/42X	SED2-0.75/41X	—	1.0	0.75	1.4	C
	SED2-1.1/42X	SED2-1.1/41X	SED2-1.1/45X	1.5	1.1	2.1	C
	SED2-1.5/42X	SED2-1.5/41X	SED2-1.5/45X	2.0	1.5	2.7	C
	SED2-2.2/42X	SED2-2.2/41X	SED2-2.2/45X	3.0	2.2	3.9	C
	SED2-3/42X	SED2-3/41X	SED2-3/45X	4.0	3.0	5.4	C
	SED2-4/42X	SED2-4/41X	SED2-4/45X	5.0	4.0	6.1	C
	SED2-5.5/42X	SED2-5.5/41X	SED2-5.5/45X	7.5	5.5	9.0	C
	SED2-7.5/42X	SED2-7.5/41X	SED2-7.5/45X	10.0	7.5	11.0	C
	SED2-11/42X	SED2-11/41X	SED2-11/45X	15.0	11.0	17.0	C
	SED2-15/42X	SED2-15/41X	SED2-15/45X	20.0	15.0	22.0	C
	SED2-18.5/42X	SED2-18.5/41X	SED2-18.5/45X	25.0	18.5	27.0	D
	SED2-22/42X	SED2-22/41X	SED2-22/45X	30.0	22.0	32.0	D
	SED2-30/42X	SED2-30/41X	SED2-30/45X	40.0	30.0	41.0	D
	SED2-37/42X	SED2-37/41X	SED2-37/45X	50.0	37.0	52.0	E
	SED2-45/42X	SED2-45/41X	SED2-45/45X	60.0	45.0	62.0	E
	SED2-55/42X	SED2-55/41X	SED2-55/45X	75.0	55.0	77.0	F
	SED2-75/42X	SED2-75/41X	SED2-75/45X	100.0	75.0	99.0	F
	SED2-90/42X	SED2-90/41X	SED2-90/45X	125.0	90.0	125.0	F

* IP54/NEMA Type 12 drives start at Frame Size B.

Accessories

Gland Plates (included with NEMA Type 1):

- ❑ SED2-GL-A Gland Plate, Frame A
- ❑ SED2-GL-B Gland Plate, Frame B
- ❑ SED2-GL-C Gland Plate, Frame C

Protection Shield (included with NEMA Type 1):

- ❑ SED2-PS-A Protection Shield, Frame A
- ❑ SED2-PS-B Protection Shield, Frame B
- ❑ SED2-PS-C Protection Shield, Frame C
- ❑ SED2-PS-DE Protection Shield, Frame D, E

Operator Panel:

- ❑ SED2-BOP1 Basic Operator Panel (included with all SED2s)
- ❑ SED2-AOP1 Advanced Operator Panel

BOP/AOP Door Mounting Kits:

- ❑ SED2-DOOR-KIT1 BOP/AOP Single Inverter Door Mounting Kit
- ❑ SED2-DOOR-KIT2 AOP Multi-Inverter Door Mounting Kit

LON Interface Option

- ❑ SED2-LONI/F

Modbus Interface Cable

- ❑ SED2-MODBUS1 Converts VFD's USS bus to Modbus RTU

Typical Specifications

SED2 shall provide control of fan and pump HVAC applications. A wide range of I/O allows for simple control solutions, with integral P1 and N2 protocols embedded for full control capabilities.

Dimensions

Table 3. Overall Dimensions for IP20 SED2 VFDs in Inches (Millimeters).

Frame Size	Height	Width	Depth	Weight lb (kg)
A	6.8 (173)	2.9 (73)	5.9 (149)	2.9 (1.3)
B	8.0 (202)	5.9 (149)	6.8 (172)	7.5 (3.4)
C	9.6 (245)	7.3 (185)	7.7 (195)	12 (5.5)
D	20.5 (520)	10.8 (275)	9.6 (245)	35 (16)
E	25.6 (650)	10.8 (275)	9.6 (245)	44 (20)
F	33.5 (850)	13. (350)	12.6 (320)	116 (53)

Table 4. Overall Dimensions for NEMA Type 1 SED2 VFDs Assembled with Protective Shield and Gland Plate in Inches (Millimeters).

Frame Size	Height	Width	Depth	Weight lb (kg)
A	9.1 (231)	2.9 (73)	5.9 (149)	3.2 (1.5)
B	11.8 (300)	5.9 (149)	6.8 (172)	8.3 (3.8)
C	13.8 (351)	7.3 (185)	7.7 (195)	13.6 (6.2)
D	24.6 (625)	10.8 (275)	9.6 (245)	37.5 (17)
E	29.7 (754)	10.8 (275)	9.6 (245)	46.4 (21)
F	54.5 (1384)	16.0 (406)	14.0 (356)	200 (91)

Table 5. Overall Dimensions for IP54/NEMA Type 12 SED2 VFDs in Inches (Millimeters).

Frame Size	Height	Width	Depth	Weight lb (kg)
B	15.2 (385)	10.6 (270)	10.6 (268)	10 (22)
C	23.9 (606)	13.8 (350)	11.2 (284)	42 (19)
D	27.0 (685)	14.2 (360)	13.9 (353)	77 (35)
E	34.8 (885)	14.2 (360)	17.8 (453)	105 (48)
F	45.3 (1150)	17.7 (450)	18.6 (473)	178 (81)

Wiring Diagrams

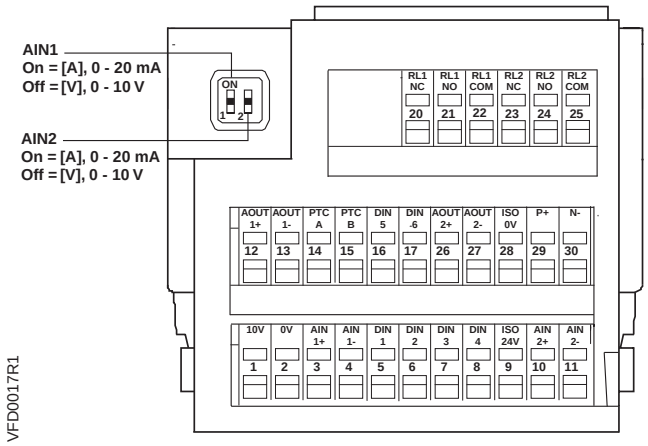

Figure 1. SED2 Control Terminals.

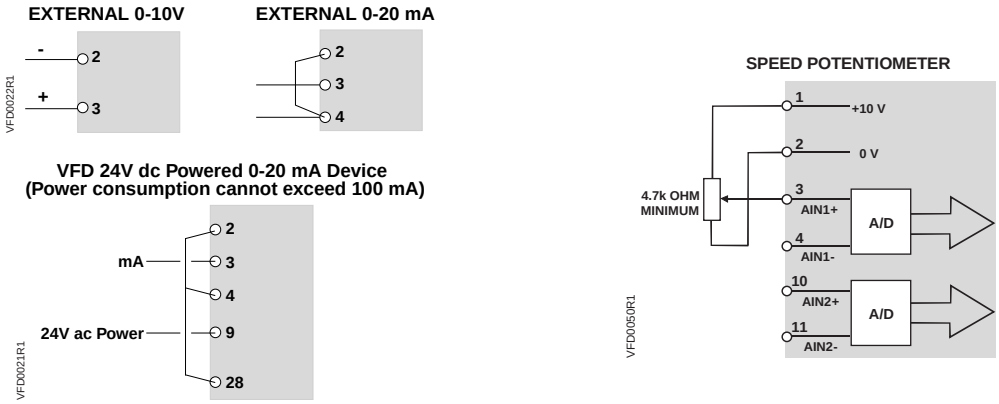

Figure 2. Typical Analog Inputs 1 and 2.

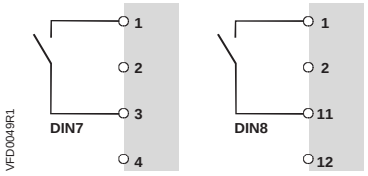

Figure 3. Typical Analog Inputs 1 and 2 as Digital Inputs 7 and 8.

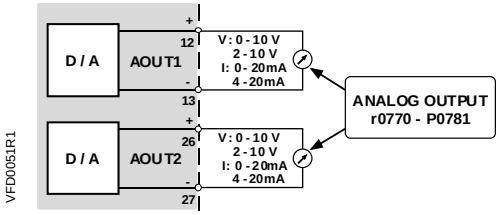

Figure 5. Typical Analog Outputs 1 and 2.

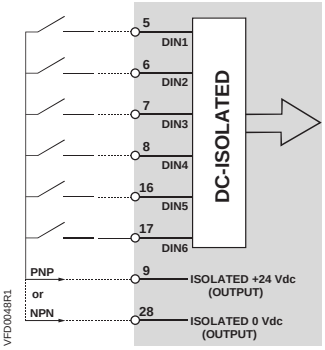

Figure 4. Typical Digital Inputs 1 through 6.

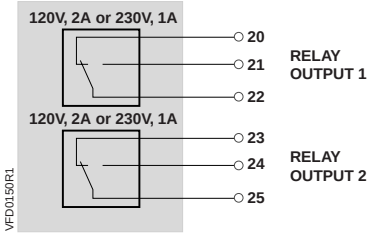

Figure 6. Typical Digital Outputs 1 and 2.

Table 6. Order Worksheet.

Item	Qty.	Designation	Part Number	Description

Siemens Building Technologies, Inc.
1000 Deerfield Parkway
Buffalo Grove, IL 60089-4513
U.S.A.

Your feedback is important to us. If you have comments about this document, please send them to **technical.editor@siemens.com**

Modified Coils

Modified coils are ⅝-inch and 1-inch tube coils with reduced face areas. Use them with internal face-and-bypass dampers or in low-capacity applications.

Hot-Deck Coils

Hot-deck coils are used in the hot decks of multizone units and are available in all types of one-row and two-row heating coils with ⅝-inch and 1-inch tubes.

Air-to-Air, Fixed-Plate Heat Exchanger

An air-to-air, fixed-plate heat exchanger is used to reclaim exhaust-air energy as well as to provide dehumidified ventilation air to a space at room-neutral temperature. It is a sensible-energy-recovery device that consists of alternate layers of aluminum plates that are separated and sealed to form passages for the outdoor and exhaust air streams. This design minimizes cross-contamination and relies on thermal conduction to induce heat transfer. It is also easy to clean and service.

The fixed-plate surface is uniquely designed to equalize uneven entering airflow as the air travels through the heat exchanger. Air can enter the module on any side except the bottom, where there are drain pans to catch condensate.

An optional Trane frost-protection damper discourages icing, permitting exchanger operation at ambient temperatures as low as -20ºF. A factory-applied PVC (polyvinyl chloride) coating is available for high-temperature (140º–400ºF) or corrosive applications.

Application considerations:

- The heat exchanger module is available as a custom option for M-Series air handlers in 10 unit sizes ranging from 3 to 30. Two heat exchanger options per size and three plate-spacing options per heat exchanger for most unit sizes give substantial performance flexibility.
- Recovery is limited to primarily sensible energy; effectiveness typically ranges from 50 to 70 percent or about equal to an eight-row coil loop.
- The M-Series heat exchanger has a pressure drop of 0.6 to 1.0 in. wg per side.
- A frost-protection damper is required if the outdoor air drops below the frost formation point (typically around 20ºF, but possibly as high as 32ºF).
- Optional face-and-bypass dampers can bypass exhaust air through the exchanger to provide capacity control.
- The maximum pressure differential between the two air streams in the heat exchanger is 6 in. wg.
- Factory coatings are available for high temperature and/or corrosive air streams.
- If located directly downstream of a fan, put a 90-degree discharge plenum or diffuser module between the fan and the exchanger.
- Do *not* apply fixed-plate heat exchanger modules in systems where toxic or harmful gases must be isolated from the supply air stream.

Diffuser

A diffuser module consists of pressure-equalizing baffles that are designed to provide even airflow across components downstream of a fan. The diffuser module is typically used immediately downstream of a centrifugal fan in a blow-thru filter, coil, or silencer application.

Figure 39. Diffuser module

Discharge Plenum

Before leaving the air handler, supply air can be ducted to a discharge plenum module. The rapid air-stream expansion as it passes into the plenum reduces turbulence and creates an acoustical end reflection that dampens low-frequency sound. Two configurations enable supply-duct connections from any side:

- *Vertical-mounted* plenum modules mount atop an adjacent module. Openings can be factory- or field-cut.
- *Horizontal-mounted* plenum modules mount on the front of an adjacent module. Openings can be factory- or field-cut.

NOTE: All discharge plenum modules are available with 2-inch, insulated casing walls of solid or

Performance Data

Evaporator Flow Rates

Table 3. Minimum/maximum evaporator flow rates (GPM)

Shell Size	Bundle Size	One Pass			Two Pass			Three Pass		
		SBCU	TECU	IECU	SBCU	TECU	IECU	SBCU	TECU	IECU
EVSZ	EVBS	Min / Max	Min / Max	Min / Max	Min / Max	Min / Max	Min / Max	Min / Max	Min / Max	Min / Max
032S	200	216 / 1187	230 / 1237	143 / 1050	108 / 593	115 / 618	72 / 525	72 / 396	77 / 412	48 / 350
032S	230	242 / 1331	258 / 1388	165 / 1212	121 / 666	129 / 694	83 / 606	81 / 444	86 / 463	55 / 404
032S	250	267 / 1465	284 / 1527	177 / 1293	134 / 733	142 / 764	88 / 646	89 / 488	95 / 509	59 / 431
032S/L	280	304 / 1672	324 / 1743	201 / 1474	152 / 836	162 / 871	101 / 737	102 / 557	108 / 581	67 / 491
032S/L	320	340 / 1868	362 / 1947	229 / 1676	170 / 934	181 / 973	115 / 838	114 / 623	121 / 649	76 / 559
032S/L	350	— / —	— / —	251 / 1838	— / —	— / —	126 / 919	— / —	— / —	84 / 613
050S	320	340 / 1868	362 / 1947	232 / 1696	170 / 934	181 / 973	116 / 848	114 / 623	121 / 649	77 / 565
050S	360	383 / 2105	399 / 2194	254 / 1858	192 / 1052	200 / 1097	127 / 929	128 / 702	133 / 731	85 / 619
050S	400	424 / 2332	442 / 2431	284 / 2080	212 / 1166	221 / 1215	142 / 1040	142 / 777	148 / 810	95 / 693
050S/L	450	482 / 2652	503 / 2764	322 / 2363	241 / 1326	252 / 1382	161 / 1181	161 / 884	108 / 921	108 / 788
050S/L	500	535 / 2941	558 / 3066	361 / 2646	268 / 1470	279 / 1533	181 / 1323	178 / 980	186 / 1022	121 / 882
050S/L	550	— / —	— / —	397 / 2908	— / —	— / —	198 / 1454	— / —	— / —	132 / 969
080S	500	535 / 2941	558 / 3066	361 / 2646	268 / 1470	279 / 1533	181 / 1323	178 / 980	186 / 1022	121 / 882
080S	560	602 / 3312	628 / 3453	400 / 2928	301 / 1656	314 / 1726	200 / 1464	201 / 1104	210 / 1151	133 / 976
080S	630	676 / 3715	704 / 3872	452 / 3312	338 / 1857	352 / 1936	226 / 1656	226 / 1238	235 / 1291	151 / 1104
080S/L	710	758 / 4169	790 / 4346	517 / 3756	379 / 2084	395 / 2173	259 / 1878	253 / 1390	264 / 1449	171 / 1252
080S/L	800	861 / 4736	898 / 4937	576 / 4221	431 / 2368	449 / 2469	288 / 2110	288 / 1579	300 / 1646	192 / 1407
080S/L	890	— / —	— / —	642 / 4706	— / —	— / —	321 / 2353	— / —	— / —	214 / 1569
142M/L	890	863 / 4746	900 / 4948	645 / 4726	432 / 2373	450 / 2474	323 / 2363	288 / 1582	300 / 1649	215 / 1575
142M/L	980	966 / 5314	1008 / 5540	716 / 5251	483 / 2657	504 / 2770	358 / 2625	322 / 1771	336 / 1847	239 / 1750
142M/L	1080	1075 / 5912	1121 / 6163	807 / 5917	538 / 2956	561 / 3082	404 / 2959	358 / 1971	374 / 2054	269 / 1972
142M/L/E	1220	1208 / 6645	1260 / 6927	895 / 6564	604 / 3323	630 / 3464	448 / 3282	403 / 2215	420 / 2309	299 / 2188
142M/L/E	1420	1345 / 7398	1402 / 7712	1041 / 7634	673 / 3699	701 / 3856	521 / 3817	449 / 2466	468 / 2571	347 / 2545
210L	1610	1318 / 7244	1373 / 7551	1146 / 8402	659 / 3622	687 / 3775	573 / 4201	440 / 2415	458 / 2517	382 / 2801
210L	1760	1471 / 8090	1534 / 8433	1286 / 9432	736 / 4045	767 / 4216	643 / 4716	490 / 2697	512 / 2811	429 / 3144
210L	1900	1634 / 8987	1704 / 9369	1421 / 10421	817 / 4494	852 / 4684	711 / 5211	545 / 2996	568 / 3123	474 / 3474
210L	2100	1802 / 9906	1878 / 10326	1509 / 11067	901 / 4953	939 / 5163	755 / 5534	601 / 3302	626 / 3442	503 / 3689
250E	2300	1948 / 10710	2030 / 11165	1640 / 11930	974 / 5355	1015 / 5583	820 / 5965	650 / 3570	677 / 3722	547 / 3977
250E	2500	2145 / 11794	2236 / 12295	1790 / 13060	1073 / 5897	1118 / 6147	895 / 6530	715 / 3931	746 / 4098	597 / 4353
210D	1610	1373 / 7550	1403 / 7719	1148 / 8421						
210D	1850	1623 / 8927	1659 / 9126	1311 / 9613		Not Applicable			Not Applicable	
210D	2100	1870 / 10282	1911 / 10511	1471 / 10784						
250D	2100	1877 / 10325	1919 / 10555	1471 / 10784						
250D	2300	2030 / 11164	2075 / 11413	1628 / 11935		Not Applicable			Not Applicable	
250D	2500	2235 / 12294	2285 / 12568	1782 / 13066						
250M	2100	1877 / 10325	1919 / 10555	1471 / 10784						
250M	2300	2030 / 11164	2075 / 11413	1628 / 11935		Not Applicable			Not Applicable	
250M	2500	2235 / 12294	2285 / 12568	1782 / 13066						
250X	2100	1877 / 10325	1919 / 10555	1471 / 10784						
250X	2300	2030 / 11164	2075 / 11413	1628 / 11935		Not Applicable			Not Applicable	
250X	2500	2235 / 12294	2285 / 12568	1782 / 13066						

Note: The minimum evaporator water velocity is 1.5 ft/sec for IECU tubes and 2.0 ft/sec for all other tubes. For a variable evaporator water flow system, the minimum GPME is generally not applicable at full load, and may be limited by other factors such as glycol. Confirm actual minimum and maximum flows for each selection before operating near flow boundaries.

Performance Data

Evaporator Flow Rates

Table 3 (Continued). Minimum/maximum evaporator flow rates (Liters/Second)

Shell Size EVSZ	Bundle Size EVBS	One Pass SBCU Min / Max	One Pass TECU Min / Max	One Pass IECU Min / Max	Two Pass SBCU Min / Max	Two Pass TECU Min / Max	Two Pass IECU Min / Max	Three Pass SBCU Min / Max	Three Pass TECU Min / Max	Three Pass IECU Min / Max
032S	200	14 / 75	14 / 78	9 / 66	7 / 37	8 / 39	5 / 33	5 / 25	5 / 26	3 / 22
032S	230	16 / 84	16 / 88	11 / 76	8 / 42	8 / 44	5 / 38	6 / 28	6 / 29	4 / 25
032S	250	17 / 92	18 / 96	11 / 82	9 / 46	9 / 48	6 / 41	6 / 31	6 / 32	4 / 27
032S/L	280	20 / 105	20 / 110	13 / 93	10 / 53	10 / 55	7 / 47	7 / 35	7 / 37	4 / 31
032S/L	320	22 / 118	22 / 123	15 / 106	11 / 59	12 / 61	7 / 53	8 / 39	8 / 41	5 / 35
032S/L	350	— / —	— / —	16 / 116	— / —	— / —	8 / 58	— / —	— / —	6 / 39
050S	320	22 / 118	22 / 123	15 / 107	11 / 59	12 / 61	8 / 54	8 / 39	8 / 41	5 / 36
050S	360	24 / 133	26 / 138	16 / 117	12 / 66	13 / 69	8 / 59	8 / 44	9 / 46	6 / 39
050S	400	27 / 147	28 / 153	18 / 131	14 / 74	14 / 77	9 / 66	9 / 49	10 / 51	6 / 44
050S/L	450	31 / 167	32 / 174	22 / 149	16 / 84	16 / 87	10 / 75	10 / 56	11 / 58	7 / 50
050S/L	500	34 / 186	36 / 193	23 / 167	17 / 93	18 / 97	12 / 83	12 / 62	12 / 64	8 / 56
050S/L	550	— / —	— / —	25 / 183	— / —	— / —	13 / 92	— / —	— / —	9 / 61
080S	500	34 / 186	36 / 193	23 / 167	17 / 93	18 / 97	12 / 83	12 / 62	12 / 64	8 / 56
080S	560	38 / 209	40 / 218	25 / 185	19 / 104	20 / 109	13 / 92	13 / 70	14 / 73	9 / 62
080S	630	43 / 234	45 / 244	29 / 209	22 / 117	22 / 122	14 / 104	14 / 78	15 / 81	10 / 70
080S/L	710	48 / 263	50 / 274	33 / 237	24 / 131	25 / 137	16 / 118	16 / 88	17 / 91	11 / 79
080S/L	800	54 / 299	57 / 311	37 / 266	28 / 149	28 / 156	18 / 133	18 / 100	19 / 104	12 / 89
080S/L	890	— / —	— / —	41 / 297	— / —	— / —	20 / 148	— / —	— / —	14 / 99
142M/L	890	55 / 299	57 / 312	41 / 298	28 / 150	29 / 156	21 / 149	18 / 100	19 / 104	14 / 99
142M/L	980	61 / 335	63 / 349	45 / 331	31 / 168	32 / 175	23 / 166	20 / 112	22 / 116	15 / 110
142M/L	1080	68 / 373	71 / 389	51 / 373	34 / 186	36 / 194	26 / 187	23 / 124	24 / 130	17 / 124
142M/L/E	1220	76 / 419	80 / 437	57 / 414	38 / 210	40 / 218	28 / 207	26 / 140	27 / 146	19 / 138
142M/L/E	1420	85 / 467	89 / 487	66 / 482	43 / 233	44 / 243	33 / 241	28 / 156	30 / 162	22 / 161
210L	1610	84 / 457	87 / 476	73 / 530	42 / 228	44 / 238	36 / 265	28 / 152	29 / 159	24 / 177
210L	1760	86 / 510	97 / 532	81 / 595	47 / 255	49 / 266	41 / 297	31 / 170	32 / 177	27 / 198
210L	1900	104 / 567	108 / 591	90 / 657	52 / 283	54 / 296	45 / 329	35 / 189	36 / 197	30 / 219
210L	2100	114 / 625	119 / 651	95 / 698	57 / 312	60 / 326	48 / 349	38 / 208	40 / 217	32 / 233
250E	2300	123 / 676	128 / 704	104 / 752	62 / 338	64 / 352	52 / 376	41 / 235	43 / 235	35 / 250
250E	2500	136 / 744	142 / 776	113 / 824	68 / 372	71 / 388	57 / 411	46 / 248	48 / 259	38 / 274
210D	1610	87 / 476	89 / 487	72 / 531						
210D	1850	102 / 563	105 / 576	83 / 606		Not Applicable			Not Applicable	
210D	2100	118 / 649	121 / 663	93 / 680						
250D	2100	118 / 651	121 / 666	93 / 680						
250D	2300	128 / 704	131 / 720	103 / 753		Not Applicable			Not Applicable	
250D	2500	141 / 775	144 / 793	112 / 824						
250M	2100	118 / 651	121 / 666	93 / 680						
250M	2300	128 / 704	131 / 720	103 / 753		Not Applicable			Not Applicable	
250M	2500	141 / 775	144 / 793	112 / 824						
250X	2100	118 / 651	121 / 666	93 / 680						
250X	2300	128 / 704	131 / 720	103 / 753		Not Applicable			Not Applicable	
250X	2500	141 / 775	144 / 793	112 / 824						

Note: The minimum evaporator water velocity is 0.457 m/sec for IECU tubes and 0.610 m/sec for all other tubes. For a variable evaporator water flow system, the minimum GPME is generally not applicable at full load, and may be limited by other factors such as glycol. Confirm actual minimum and maximum flows for each selection before operating near flow boundaries.

Performance Data

Condenser Flow Rates

Table 4. Minimum/maximum condenser flow rates (GPM)

Shell Size CDSZ	Bundle Size CDBS	Two Pass SBCU Min / Max	Two Pass TECU Min / Max	Two Pass IECU Min / Max
032S	230	214 / 784	209 / 767	218 / 798
032S/L	250	239 / 877	234 / 857	245 / 899
032S/L	280	267 / 980	261 / 958	273 / 1000
032S/L	320	295 / 1083	289 / 1059	306 / 1121
050S	360	336 / 1233	329 / 1205	347 / 1272
050S/L	400	378 / 1388	370 / 1357	391 / 1434
050S/L	450	426 / 1563	417 / 1528	441 / 1616
050S/L	500	473 / 1733	462 / 1695	490 / 1797
080S	500	473 / 1733	462 / 1695	490 / 1797
080S	560	529 / 1940	517 / 1896	548 / 2010
080S/L	630	595 / 2182	582 / 2133	614 / 2252
080S/L	710	673 / 2466	657 / 2411	689 / 2525
080S/L	800	756 / 2770	739 / 2708	774 / 2838
142L	890	853 / 3126	833 / 3056	876 / 3211
142L	980	948 / 3477	927 / 3399	975 / 3575
142L	1080	1060 / 3885	1036 / 3798	1091 / 3999
142L	1220	1185 / 4344	1158 / 4246	1217 / 4463
142L	1420	1335 / 4896	1305 / 4786	1407 / 5160
210L	1610	1331 / 4881	1301 / 4771	1495 / 5483
210L	1760	1473 / 5402	1440 / 5280	1655 / 6069
210L	1900	1615 / 5923	1579 / 5790	1812 / 6645
210L	2100	1760 / 6454	1721 / 6309	1964 / 7200
250L	2100	1760 / 6454	1721 / 6309	1950 / 7140
250L	2300	1935 / 7094	1891 / 6934	2140 / 7840
250L	2500	2113 / 7749	2066 / 7575	2330 / 8530
			One Pass	
210D	1610	2543 / 9324	2602 / 9541	2998 / 10991
210D	1760	2814 / 10320	2880 / 10560	3318 / 12165
210D	1900	3086 / 11315	3158 / 11578	3632 / 13319
210D	2100	3363 / 12330	3441 / 12617	3936 / 14432
250D	2100	3363 / 12330	3441 / 12617	3931 / 14412
250D	2300	3696 / 13552	3782 / 13868	4317 / 15829
250D	2500	4038 / 14804	4131 / 15149	4698 / 17226
250M	2100	3363 / 12330	3441 / 12617	3931 / 14412
250M	2300	3696 / 13552	3782 / 13868	4317 / 15829
250M	2500	4038 / 14804	4131 / 15149	4698 / 17226
250X	2100	3363 / 12330	3441 / 12617	3931 / 14412
250X	2300	3696 / 13552	3782 / 13868	4317 / 15829
250X	2500	4038 / 14804	4131 / 15149	4698 / 17226

Note: The minimum/maximum condenser water velocity is 3 / 11 ft/sec, and may be limited by other factors such as glycol. Confirm actual minimum and maximum flows for each selection before operating near flow boundaries.

Performance Data

Condenser Flow Rates

Table 4 (Continued). Minimum/maximum condenser flow rates (Liters/Second)

Shell Size CDSZ	Bundle Size CDBS	Two Pass SBCU Min / Max	Two Pass TECU Min / Max	Two Pass IECU Min / Max
032S	230	13 / 49	13 / 48	14 / 50
032S/L	250	15 / 55	15 / 54	15 / 57
032S/L	280	17 / 62	16 / 60	17 / 63
032S/L	320	19 / 68	18 / 67	19 / 71
050S	360	21 / 78	21 / 76	22 / 80
050S/L	400	24 / 88	23 / 86	25 / 90
050S/L	450	27 / 99	26 / 96	28 / 102
050S/L	500	30 / 109	29 / 107	31 / 113
080S	500	30 / 109	29 / 107	31 / 113
080S	560	33 / 122	33 / 120	35 / 127
080S/L	630	38 / 138	37 / 135	39 / 142
080S/L	710	42 / 156	41 / 152	43 / 159
080S/L	800	48 / 175	47 / 171	49 / 179
142L	890	54 / 197	53 / 193	55 / 203
142L	980	60 / 219	58 / 214	62 / 226
142L	1080	67 / 245	65 / 240	69 / 252
142L	1220	75 / 274	73 / 268	77 / 282
142L	1420	84 / 309	82 / 302	89 / 326
210L	1610	84 / 308	82 / 301	94 / 346
210L	1760	93 / 341	91 / 333	104 / 383
210L	1900	102 / 374	100 / 365	114 / 419
210L	2100	111 / 407	109 / 398	124 / 454
250L	2100	111 / 407	109 / 398	123 / 450
250L	2300	122 / 447	119 / 437	135 / 494
250L	2500	133 / 489	130 / 478	147 / 538
			One Pass	
210D	1610	160 / 588	164 / 602	189 / 693
210D	1760	178 / 651	182 / 666	209 / 767
210D	1900	195 / 714	199 / 730	229 / 840
210D	2100	212 / 778	217 / 796	248 / 910
250D	2100	212 / 778	217 / 796	248 / 909
250D	2300	233 / 855	239 / 875	272 / 998
250D	2500	255 / 934	261 / 956	296 / 1087
250M	2100	212 / 778	217 / 796	248 / 909
250M	2300	233 / 855	239 / 875	272 / 998
250M	2500	255 / 934	261 / 956	296 / 1087
250X	2100	212 / 778	217 / 796	248 / 909
250X	2300	233 / 855	239 / 875	272 / 998
250X	2500	255 / 934	261 / 956	296 / 1087

Note: The minimum/maximum condenser water velocity is 0.914/3.35 m/sec, and may be limited by other factors such as glycol. Confirm actual minimum and maximum flows for each selection before operating near flow boundaries.

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GMD/W20 Series Carbon Dioxide Transmitters for Demand Controlled Ventilation Applications

Features/Benefits

- Versatile transmitters
- Duct and wall mount models
- Incorporates Vaisala CARBOCAP® Sensor - the silicon-based NDIR sensor
- Excellent long-term stability
- Negligible temperature dependence
- Ease of installation
- Five year recommended calibration interval

Vaisala CARBOCAP® Carbon Dioxide Transmitter Series GMD/W20 are designed for use in ventilation related applications.

The duct mounted Vaisala CARBOCAP® Carbon Dioxide Transmitter Series GMD20 and wall mounted Vaisala CARBOCAP® Carbon Dioxide Transmitter Series GMW20 are specially designed for Demand Controlled Ventilation (DCV). They are easy to install and require almost no maintenance. The recommended calibration interval is five years.

Vaisala CARBOCAP® technology

The GMD/W20 Series Transmitters use the silicon-based Vaisala CARBOCAP® Sensor. The simple structure and reference measurement capabilities make this Single-Beam, Dual-Wavelength NDIR sensor extremely stable and reliable.

The temperature and flow dependence of Vaisala CARBOCAP® Sensor is negligible. In addition, the measurement accuracy of the sensor is not affected by dust, water vapor or most chemicals.

Versatile transmitters

The GMD/W20 series transmitters can be used independently, or they can be incorporated into building energy management systems. The series consists of duct mount units GMD20 and GMD20D and wall mount units GMW21/D and GMW22/D. Version D has a display. The variety of wall mount series sizes makes them easy to install for most standard junction boxes.

The duct units' compact sensor head design requires only a small hole in a ventilation duct, thereby minimizing the risk of leaking gaskets and measurement errors.

In addition to the standard 0...20 mA, 4...20 mA and 0...10 V outputs, there are three other options: two LonWorks® interfaces and a relay output. The relay output is standard with the display units.

Improve indoor air quality with minimum energy costs

The use of the GMD/W20 series transmitters ensures the best possible control of air quality and results in considerable savings in energy consumption, maintenance and recalibration costs.

Temperature option

The GMA20T temperature module, an option with the GMW21 wall mount unit, combines both CO_2 and temperature measurement into one transmitter. The GMA20T has an output of 0...10 V corresponding to a temperature range of 0...+50 °C (+32...122 °F).

Technical Data

Carbon dioxide

Measurement range	0...2000 ppm (nominal; can be calibrated for other ranges: 0...5000 ppm, 0...10,000 ppm, 0...20,000 ppm)
Accuracy at +25 °C (77 °F) against certified factory references	<± [30 ppm + 2.0% of reading] (incl. repeatability and calibration uncertainty)
Non-linearity	<±1 %FS
Temperature dependence of output (typical value)	0.15 %FS /°C
Long-term stability	<5 %FS /5 years
Response time (0 ...63% response)	1 minute

Temperature (optional with wall model)

Output signal	0...10V
Corresponding measurement range	0...+50 °C (32...+122 °F)
Accuracy (@+25 °C)	±0.5 °C (±0.9 °F)
Warm up time	30 min
Sensor	Semiconductor IC

General

Output signals	0...20 mA or 4...20 mA and 0..10 V
Resolution of analog outputs	0.5 %FS
Optional outputs	relay LonWorks® interface RS232 (with serial COM adapter for maintenance purposes)
Recommended external load:	
current output	max. 500 Ohm
voltage output	min. 1 kOhm
Power supply	nominal 24 VDC/VAC (18...30 VDC)
Power consumption	<2.5 W
Warm-up time	1 minute, 15 minutes full specification
Operating temperature range	-5...+45 °C (+23...113 °F)
Operating humidity range	0...85 %RH non-condensing
Air flow range (GMD20)	0...10m/s
Housing material	ABS plastic
Housing classification (electronics housing GMD20)	IP65 (NEMA 4)
Weight:	
GMD20 (D)	140 g (170 g)
GMW21 (D)	100 g (130 g)
GMW22 (D)	90 g (120 g)

Accessories and options

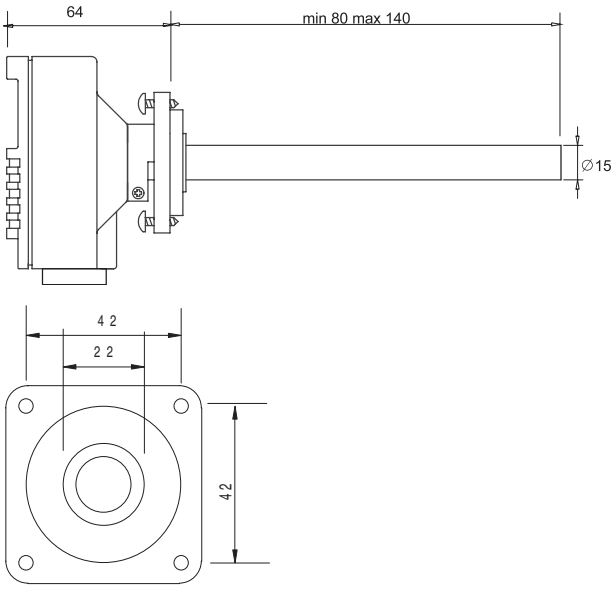
GMI21	display and relay option for GMD/W21/22
GMR20	relay output option
GML20	LonWorks® module with CO_2 signal (Not available when display option is added.)
GML20T	LonWorks® module with both CO_2 signal and temperature signals (Not available when display option is added.)
19222GM	calibration software kit (disk and serial COM adapter)
GMA20T	Analog temperature module for GMW21 (Not available when display option is added.)
GM70 w/pump option	hand-held CO_2 meter for field verification

The GMD/W20 Transmitters comply with EMC standard EN61326-1:1997 + Am1:1998 + Am2:2001; Generic Environment

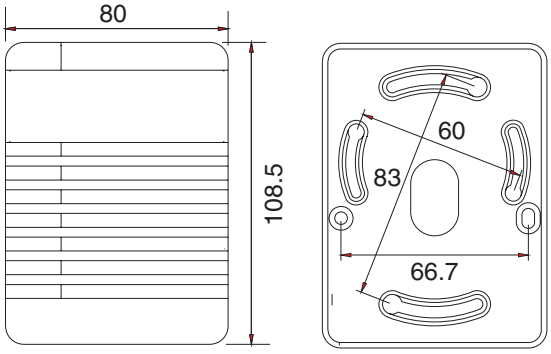
Dimensions

Dimensions in mm

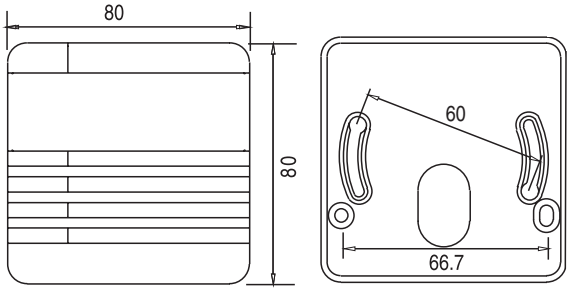
GMD20 and GMD20D



GMW21 and GMW21D



GMW22 and GMW22D



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