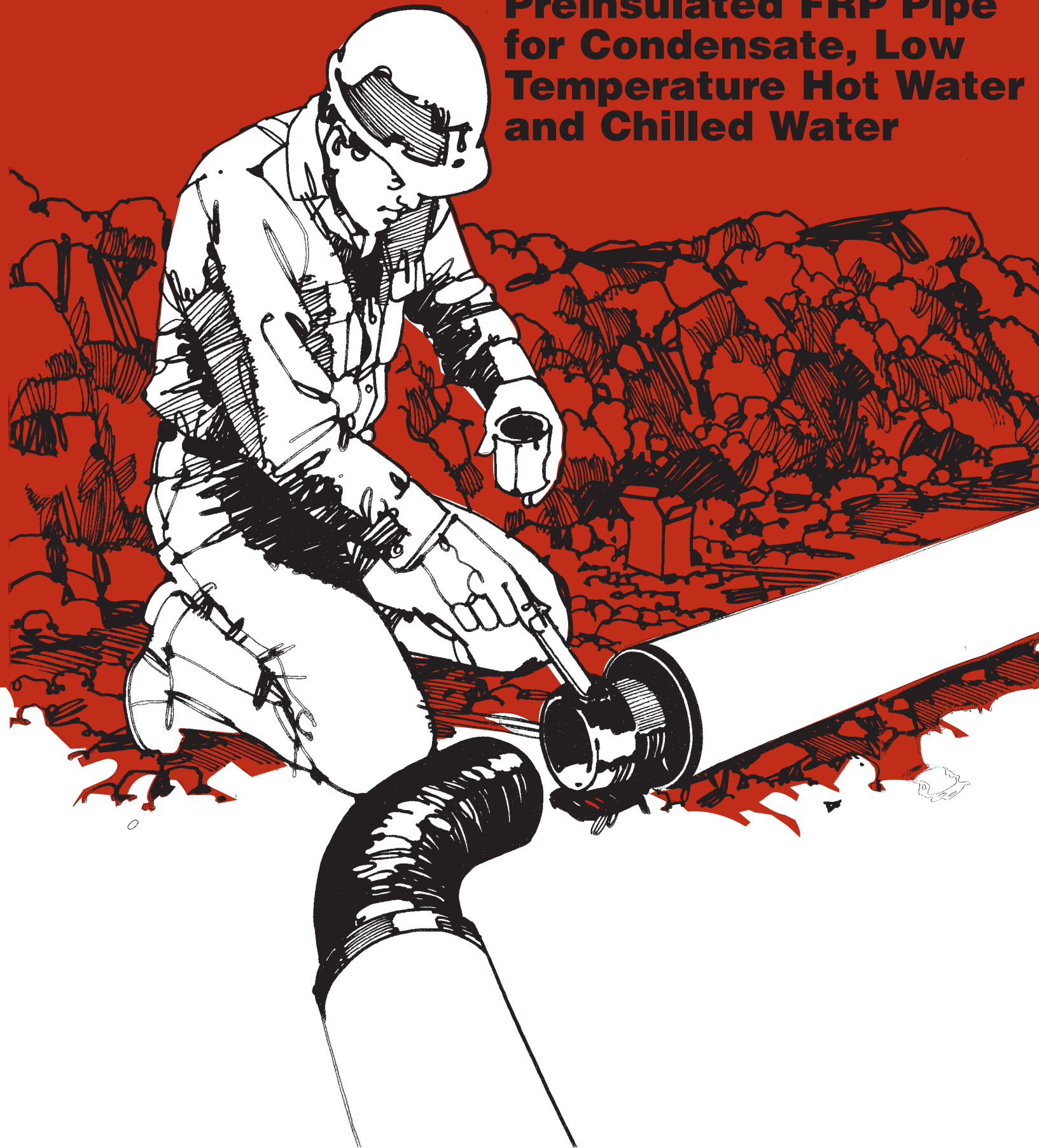


DUAL-GARD 250

**Preinsulated FRP Pipe
for Condensate, Low
Temperature Hot Water
and Chilled Water**



Preinsulated Piping System for Buried Hot and Chilled Water, Domestic Hot Water and Condensate Lines to 250°F.



PERMA-PIPE® / RICWIL® DUAL-GARD 250® is a complete factory insulated and jacketed underground piping system for the distribution of chilled and low-temperature hot water and condensate up to 250°F.

DUAL-GARD 250 consists of a fiberglass reinforced plastic service pipe, (150 psig max.) insulated with rigid, foamed in place, polyurethane foam which is encased and sealed in a rugged PVC jacket.

PERMA-PIPE / RICWIL DUAL-GARD 250 is an extremely efficient distribution system requiring minimum installation worry --- with no field insulating required.

SERVICE PIPE: DUAL-GARD 250 is furnished with a FRP pressure service pipe that is made of chemically resistant epoxy resins reinforced with fiberglass filament. It incorporates a special corrosion-resistant reinforcement on its inner surface. The liner cannot separate because it has the same coefficient of expansion as the other components. FRP pipe will not rot, rust or corrode and is impervious to electric environments. Its glassy smooth liner walls cut pressure losses by nearly 50% and its "new pipe" interior is maintained for the life of the pipe. FRP pipe can be furnished to comply with military specification MIL-P-28584.

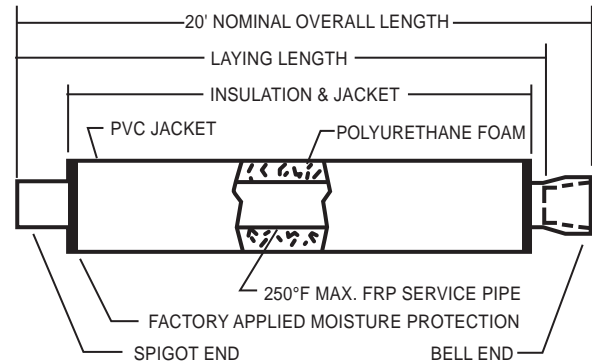
NOTE: Where a corrosion inhibitor is required to prevent attack on steel components of the piping system, morpholine is recommended. Other amine additives, such as cyclohexylamine, may cause degradation of the pipe liner if used in concentrations in excess of 1,000 parts per million.

INSULATION: Foamed in place, polyurethane foam completely fills the annular space between the pipe and outer jacket and has the lowest thermal conductivity of any commercial insulation. 90% to 95% closed cell structure provides high resistance to water absorption. 2.0 lb/ft³ nominal density and coefficient of thermal conductivity ("K" factor) of .16 Btu-in/hr-lb/ft² - °F at 73°F.

PVC OUTER JACKET: Type 1 Polyvinyl Chloride provides tough yet flexible vapor barrier to protect insulation. It is durable and corrosion resistant and is strong enough so that the system can withstand H-20 loading with 2 feet of cover. The flexibility of PVC permits deflection without cracking, splitting or damage to the waterproof integrity of the outer jacket.

PIPE JOINTS: DUAL-GARD 250 utilizes a bell and spigot FRP service pipe and joints are bonded with a special resin/catalyst adhesive to form a permanent pressure tight bond. Insulation of field joints is optional.

TYPICAL UNIT



Schedule of Units

Pipe Sizes (in)	Jacket Sizes (in)	Weight Per Unit (lb)
2	5	35
3	6	55
4	8	90
6	10	125
8	12	170
10	14	225
12	16	250

Other combinations and sizes available on request.

END SEAL: A vapor seal is factory applied to both ends of the pipe insulation to assure moisture protection at field joints.

COUPLING: Each length of pipe is furnished with a bell at one end and a spigot at the other end for easy field joining. All elbows, tees and couplings for the DUAL-GARD 250 system are bell end and are joined in the same manner as the service pipe. Concrete anchor blocks are required at changes in direction (vertical and horizontal), tees, bends and at changes in size and terminals such as plugs, flanges or valves without insulation or jacketing.

PRESSURE-TEMPERATURE RATING: PERMA-PIPE / RICWIL DUAL-GARD 250 is rated at 150 psig continuous working pressure through a temperature range of 40°F to 250°F.

SPECIAL NOTE: It is important that flash tanks or other piping arrangements and accessories be used at high pressure drip points to prevent the Dual-Gard 250 condensate lines being subjected to steam. Condensate pumped directly from vented condensate receivers requires no special accessories.

BENEFITS OF DUAL-GARD 250

- **Experience** PERMA-PIPE's staff has concentrated on the design, manufacture and insulation techniques of preinsulated factory-fabricated piping systems for many years.
- **Single Source for Entire System** Give PERMA-PIPE one purchase order and receive a complete preinsulated system including service pipe, thermal insulation and protective jacketing.
- **Non-Corrosive** The entire Dual-Gard 250 system is completely inert. Therefore it is immune to corrosion. The insulation at both

ends of each unit is protected with factory applied moisture protection to maintain the watertight integrity of the system.

- **Fast Installation** One delivery brings all preinsulated piping materials, resulting in less material handling and fewer storage problems. Large crews and heavy equipment are not required for field installation. Economy is enhanced by the Dual-Gard 250 units' long length and light weight. An 8 inch pipe unit weighs only 170 lb.
- **Reduced Field Cost** Preinsulated eliminates field insulating and jacketing and with the bell and spigot joining system, field joint

labor is kept to a minimum.

- **Quality Control** All DUAL-GARD 250 units are thoroughly inspected at the factory and arrive at the job site with all insulation protected from the elements. Insulation remains dry and efficient throughout shipping, storage and installation.
- **Maximum System Efficiency** Extruded PVC or filament wound FRP jacket provides a positive moisture barrier that maintains a dry, efficient insulation over the life of the system. Polyurethane foam insulation with its low "K" factor, along with the jacket material, assures minimum system heat gain or loss.

TYPICAL HEAT GAIN / LOSS DATA

Service pipe size (nominal) (in)	2	3	4	6	8	10	12
Jacket size (nominal) (in)	4	6	8	10	12	14	16
*Heat gain at $\Delta T 30^{\circ}\text{F}$	3.9	4.3	4.1	5.7	7.0	8.5	10.8
*Heat loss at $\Delta T 150^{\circ}\text{F}$	19.3	21.7	20.5	28.4	35.0	42.7	54.0
†Insulation thickness (in)	1.00	1.26	1.77	1.69	1.69	1.65	1.47

*Gain / Loss expressed in Btu-in/hr-ft²-°F

†Other insulation thickness are available.

EASY FIELD INSTALLATION

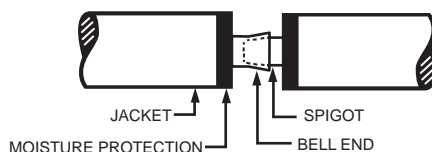
For complete installation instructions see installation manual

UNLOADING/HANDLING/STORAGE:

DUAL-GARD 250 units are shipped carefully braced. Store field joint materials indoors, protected from weather until needed. Carefully unload units. Check against packing list during off loading. Units can be stockpiled or distributed along trenches. Stack carefully, never exceeding stacked height of 6 feet. Keep units off ground during storage. Prevent dirt or water from entering the pipe. Avoid damage to pipe ends.

TRENCHING: Keep trench narrow, but allow sufficient width for proper tamping. Trench bottom should be smooth and free of sharp objects. When the trench bottom is unstable, the trench width should be at least five jacket diameters. The bottom should be stabilized by overexcavating for at least 1.5 diameters and replaced with stable materials for bedding and side fill. When the trench bottom is hard rock or hard shell, a stable material at least 6 inches thick should be placed over the overexcavated bottom.

ASSEMBLY



SANDING: Sand outer surface of pipe; also lightly sand socket of fitting immediately prior to applying adhesive.

CLEANING: Use clean dry cloth to remove all dust from surfaces to be bonded, including 1/2 inch of pipe interior. Oil, grease and other foreign matter must be removed by resanding.

APPLYING ADHESIVE: Mix special resin/catalyst adhesive thoroughly, following directions on the

kit. Apply liberally to sanded area of pipe. Apply light, uniform layer to inside of fitting bell to pipe stop and end of pipe.

ASSEMBLY: Insert pipe slowly into fitting or coupling, as far as possible. DO NOT TWIST. After manual inspection, pipe should be tapped all the way to the fitting stop. Use back stop on fitting. Place a wooden block across pipe end and tap pipe into place with heavy hammer. DO NOT HAMMER ON FITTING.

CURING: Electric heating blankets are furnished and must be used to obtain a properly cured joint on DUAL-GARD 250 systems. The heat blankets will cure joints in one hour. Add 15 minutes to cure cycle for fitting joints.

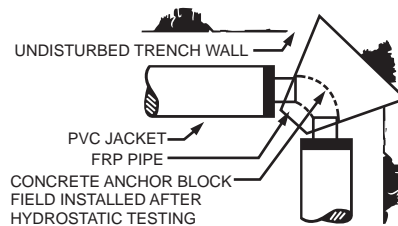
PRELIMINARY BACKFILLING:

Immediately after the system is installed in the ditch, a partial backfill shall be made in the middle of each unit, leaving the joints exposed for the hydrostatic test inspection.

PRESSURE AND LEAK TESTING:

Test line at specified test pressures. Do not exceed 225 psig.

ANCHOR BLOCKING



DUAL-GARD 250 with FRP service pipe is a chemical weld joining system. Anchor blocks are used to resist movement in the pipe line by transferring the forces due to thermal stress to solid, undisturbed soil. For this reason, the bearing capacity (pounds per square foot)

of the soil is important.

Anchor blocks are required at changes in direction, such as tees and bends, vertical and horizontal; changes in size, such as reducers and at dead ends, such as plugs and valves. Fittings should not be insulated or jacketed when poured in anchor blocks.

The size and type of anchor blocks to be used are determined by pipe size, type of soil, and type of fitting to be blocked. The following table is for estimating pounds of force.

FORCE DUE TO THERMAL STRESS IN POUNDS (LBS)

SIZE (in)	AT END OR TEES	90° ELBOW	45° ELBOW
2	2,300	3,250	1,760
3	3,300	4,670	2,520
4	5,600	7,900	4,270
6	8,300	11,700	6,350
8	12,000	17,000	9,200
10	15,000	21,200	11,500
12	17,900	25,400	13,700

Computed for Total Range through 250° F

SAFE BEARING LOADS. The safe bearing loads given in the following table are for horizontal forces where the depth of cover over the conduit (jacket) exceeds 2 feet.

SOIL	LB PER SQ FT
*Muck, Peat, Etc.....	0
Soft Clay.....	1,000
Sand.....	2,000
Sand and Gravel.....	3,000
Sand and Gravel Cemented with Clay..	4,000
Hard Shale.....	10,000

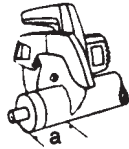
* In muck or peat, all forces are resisted by piles or tie rods to solid foundations or by removal of muck or peat and replacement with ballast of sufficient stability to resist forces.

EXAMPLE: With a resultant force of 7,900 lb for a 4" x 90° elbow and a trench in soft clay soil (bearing capacity of 1,000 lb/ft²) an anchor block would be required with the following bearing area against undisturbed soil:

$$\frac{7,900}{1,000} = 7.9 \text{ sq ft}$$

FINAL BACKFILLING: After hydrostatic testing primary backfill of selected earths should be hand placed and hand tamped to a 12 inch minimum over the top of the jacket. Remainder of the backfill should be free of large rocks over six inches in diameter, frozen earth or foreign matter. The backfill operation now can be completed by any convenient means. Do not use wheeled or tracked vehicles for tamping.

A. Depending upon field conditions alterations can be made by cutting either end of the unit. Determine the amount which the standard unit is to be shortened. Using this figure, measure back from the end of pipe to a point on the outer jacket and mark. Cut completely through.



B. Measure back a dimension equal to factory-bare pipe end and cut through jacket only. Use care to avoid cutting inner pipe. Split jacket and polyurethane. Remove and discard.



C. Apply moisture-protective seal in accordance with DUAL-GARD 250 Installation Manual. All necessary materials furnished by PERMA-PIPE.

D. Remove glassy surface resin from pipe areas to be bonded by shaving outer surface with the pipe shaving tool to bare fiberglass. Newly shaved end of service pipe is now ready for joining procedure.



Note:

Pipe shaving tool and heating blanket are available from PERMA-PIPE. All other tools to be supplied by the installing contractor.

PERMA-PIPE® / RICWIL® DUAL GARD 250® – GUIDE SPECIFICATION

1.0 GENERAL

1.1 Underground piping system shall be PERMA-PIPE/RICWIL Dual-Gard 250 and shall consist of nominal 20 foot long units of fiberglass reinforced plastic (FRP) (RTRP) pipe insulated with rigid polyurethane foam, sealed with a PVC outer jacket and protected on each end with a moisture barrier.

2.0 MATERIALS

2.1 Pipe shall be FRP Pressure Service Pipe which is made of chemically resistant epoxy resins reinforced with fiberglass filament. (FRP pipe can be furnished to comply with Military Specification MIL-P-28584.)

2.2 Insulation shall be a rigid 90% to 95% closed cell polyurethane with a nominal 2.0 lb/ft³ density and a coefficient of thermal conductivity (K) 0.16 Btu-in/hr-ft² at 73°F.

2.3 Jacket shall be ASTM 1784 Polyvinyl Chloride (PVC) with a minimum wall thickness of .060 inches.

3.0 JOINTS

3.1 Unit ends shall be bell and spigot and be joined with a special two component adhesive supplied in kits containing the proper proportion of resin/catalyst.

3.2 Fittings shall be filament wound bell x bell, made of the same material as that of the service pipe and are to be joined in a similar manner as the pipe and in accordance with the DUAL-GARD 250 Installation Manual.

4.0 INSTALLATION AND TESTING

4.1 All pipes, fittings and accessories shall be installed in accordance with the manufactures recommendations. The service of a factory-trained field service instructor shall be present during the critical stages of the installation and testing.

4.2 All steel piping adjoining this system shall be anchored at or near the point of connection to avoid any external forces on the FRP service pipe. The contractor

shall pour concrete anchor blocks at every change of direction after testing the pipe. The anchor blocks are to be sized in accordance with forces resulting from thermal stresses, existing soil conditions and with the engineer's approval.

4.3 Immediately after the system has been installed in the ditch, a partial backfill shall be made in the middle of each unit, leaving the joints exposed for inspection during the hydrostatic tests. Hydrostatic tests of ___psig shall be required for a period of four hours. No leakage shall be allowed.

4.4 After hydrostatic testing, final backfill of selected earth shall be placed and hand tamped 12 inch minimum over the top of the jacket. Remainder backfill shall be free of large boulders, rocks over 6 inch in diameter, frozen earth or foreign matter. The backfill operation shall now be complete by any convenient means. Do not use wheeled or tracked vehicles for tamping.

PERMA-PIPE® will provide design service and assistance to engineers, owners and contractors. Field instruction for installation personnel will be provided to teach proper handling and to show supervisory personnel assembly techniques that should be practiced during installation.

PERMA-PIPE® warrants its products to be free from defects in material and workmanship. Claims for shortage or apparent defects in material must be made within 15 days after delivery or before installation, whichever occurs first. **With respect to latent defects, PERMA-PIPE® will replace or repair any materials which prove defective within a period of one year after shipment, provided the materials have been properly installed, operated and have not been damaged by neglect or abuse. PERMA-PIPE® shall not be liable for consequential damages and liability is expressly limited to the replacement or repair of materials. The PERMA-PIPE® warranty is exclusive and in lieu of all others.**

The full terms and conditions of the PERMA-PIPE® warranty are set forth on each PERMA-PIPE® proposal.

PRICES WILL BE SUPPLIED UPON REQUEST. TECHNICAL DETAILS AND PRICES ARE SUBJECT TO CHANCE WITHOUT NOTICE.

PERMA-PIPE®

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