

120-PSI ETS PRECISION MINE REPAIR SEAL  
MSHA SEAL APPROVAL NUMBER 120-75.336.1.07.11.1

120-PSI ETS PRECISION MINE REPAIR SEAL

The Emergency Temporary Standard (ETS), 120-psi, PRECISION MINE REPAIR seal is intended for use in mine openings up to 10 ft high and up to 25 ft. wide. The subject seal was designed to satisfy Federal Register 30 CFR 75.335 (a)(2) 120-psi loading. Listed below is the seal approval information for the subject seal.

**Engineering Design and Analysis**

1. Provide the calculations, material properties, drawings, specifications, and computer modeling information that would explain the design and strength.

*For calculations, material properties, drawing and specifications contact:  
Precision Mine Repair, 705 W. Main St., Ridgeway, IL. 62979, 618-272-7220.*

2. State the maximum size of opening (height and width) in which this seal may be used. Some seals may be designed for a variety of opening sizes and this should be stated. The size should be specified as after loose material is removed.

*This seal can be used for mine openings up to 10.0 ft. high by up to 25 ft. wide.*

3. Provide the "pressure-time" curve to show the rate of loading which the seal has been designed to meet. Seals are to be designed for a dynamic loading unless a less severe loading is justified by the gob and inerting/sampling conditions.

*The pressure-time history curve used for the design was a 120-psi pressure instantaneously applied to the seal for a duration of 250 milliseconds.*

4. Include a registered Professional Engineer's certification that design of the seal is in accordance with current, prudent engineering practices (see section 75.336(a)(1)(ii) of the Emergency Temporary Standard (ETS)).

*As per Federal Register 30 CFR 75.336 (a)(1)(ii), I, Mark E. Bloome, hereby certify that to the best of my knowledge, my design of the ETS, 120-psi, PRECISION MINE REPAIR seal is in accordance with current, prudent, engineering practices.*

120-PSI ETS PRECISION MINE REPAIR SEAL  
MSHA SEAL APPROVAL NUMBER 120-75.336.1.07.11.1

5. Provide a "Seal Design Table". This table will give general information pertaining to the seal. An example of the information required is described in the "preamble" to the ETS.

Maximum Entry Dimensions	No more than 10 feet high by No more than 25 feet wide
Thickness of Seal	No less than 32-inches thick
Specified Minimum Unconfined Compressive Strength of Concrete	No less than 4500-psi
Steel Reinforcement (Typical Each Face, See Construction Drawings for Placement <i>and Specifications for Spacing Tolerances</i> )	No less than 2-inches of clear cover to the faces of seal and 2½ inches clear cover to the sides of the seal. 1 <sup>st</sup> Vertical: #9 bars placed at no more than 12-inch cts and 2½ inches from the mine ribs. Horizontal: #6 bars placed at no more than 12-inch cts and 2½ inches from the mine roof and floor. 2 <sup>nd</sup> Vertical: #5 bars placed at no more than 12-inch cts and 2½ inches from the mine ribs. (1) PMR Welded Wire 3D-Panel
Foundation Anchorage (In-Mine Pull Test Data provided with design calculations)	Roof and Floor: #9 dowels placed at no more than 14-inch cts and at no more than 7 inches from the mine ribs. To develop yield strength of (60 ksi), the hole for each dowel is to be drilled into competent roof and floor strata no less than the depth required from the in-mine pull tests to yield the dowels plus an additional 6 inches. Dowels are to be placed into each hole and anchorage by a Resin Anchoring System with a grouting return equal to or greater than the in-mine pull test results.

6. Provide reference materials used or referred to in the design.

*See the American Concrete Institute 318 Code for Reinforced Concrete Design & TM 5-1300(NAVFAC P-397, AFR 88-22), Structures to Resist the Effects of Accidental Explosions, November 1990.*

7. Explain the time required for the seal to meet design strength.

*The proposed seal shotcrete is considered to reach its design strength of no less than 4500-psi after 3 days. During the curing period, the atmosphere in the sealed area must be monitored daily and maintained inert as specified in 75.335(b)(3) until the seals reach acceptable strength of no less than 4500-psi.*

120-PSI ETS PRECISION MINE REPAIR SEAL  
MSHA SEAL APPROVAL NUMBER 120-75.336.1.07.11.1

**Site Conditions and Preparation**

1. Address the preparation requirements for the site in which the seal is to be built. This would include the preparation of the roof, ribs and floor.

*Each seal is required to be located at least 10 feet from the corner of any pillar. The roof and floor are to be scaled to competent strata prior to placement of the seal. All loose material is to be removed from the seal location for a distance of 3 feet on each side of the seal. Surfaces upon which shotcrete is to be placed will be free from debris, oil, standing or running water, and unsound material.*

2. If keying or hitching is required, describe the requirements and the process.

*Not applicable.*

3. If steel reinforcement is used which requires grouting into the roof, rib, or floor, explain the requirements. For example, specify pull-testing requirements to confirm anchorage.

*To develop yield strength of 60 ksi, the hole for each dowel is to be drilled into competent roof and floor strata no less than the depth required from the in-mine pull tests to yield the dowels plus an additional 6 inches. Dowels are to be placed into each hole and anchorage by a Resin Anchoring System with a grouting return equal to or greater than the in-mine pull test results.*

**Construction Specifications**

1. A comprehensive set of construction specifications which establish:
  - Minimum requirements for the conditions at the seal location, including strata strength, configuration and site preparation;
  - Quality and strength requirements for each material involved in constructing the seal; and
  - Details of the size and configuration of the seal and its structural elements.

*For a comprehensive set of construction specifications contact Precision Mine Repair, 705 W. Main St. Ridgeway, IL 62979. (618) 272-7220.*

2. Actions to be taken to prevent water accumulation and to divert water from seal construction sites.

*A water trap(s) will be installed as required by MSHA. Each coal company will select the location(s) for the water trap(s) and submit same as part of their submittal to the MSHA District office. Typically the water trap pipe(s) will be as shown in Figures #1 & 2.*

120-PSI ETS PRECISION MINE REPAIR SEAL  
MSHA SEAL APPROVAL NUMBER 120-75.336.1.07.11.1

2. Storage conditions of materials to be used to construct the seal; addressing moisture, heat, shelf life, etc.

*All materials are to be stored in such a manner as to avoid contamination and deterioration. All cementitious materials are to be stored in weather-tight areas or containers. All hardened material is to be discarded. No aggregates are to be stored directly on ground unless a sacrificial layer is left undisturbed. No reinforcing bars or accessories are to be placed directly on the ground.*

3. If forms are used, the type, methods of support and limits of deflection to ensure the seal is adequate to support the construction loads.

*All formwork is to be designed, engineered and constructed in accordance with the methodology of ACI 347 and ACI 506.2. All forms are to be capable of withstanding the pressures resulting from placement of shotcrete with minimal deflection and are to be properly aligned and adequately supported.*

**Quality Control during Construction**

1. Address the sampling and testing of materials to be used to ensure that the seal meets the design requirements. The number of samples to be taken and tested should ensure the seal material, as constructed in the mine, meets the requirements of the professional engineer's design.

*Each coal company will have the contractor construct one test panel prior to beginning work and one for each seal set or every 50 cubic yards placed, whichever is less per ASTM C1140 methods.*

2. The testing of the samples should be conducted by certified personnel.

*Test Panels are to be molded, cured and tested in accordance with ASTM C1140. Each test panel shall be of sufficient size to produce a minimum of 6 core samples with minimum diameter of 3.75 inches and in accordance with ASTM C1140.*

120-PSI ETS PRECISION MINE REPAIR SEAL  
MSHA SEAL APPROVAL NUMBER 120-75.336.1.07.11.1

**Air Sampling Pipes**

1. Each seal is required to have at least two air sampling pipes installed through it to provide for air sampling behind the seal after construction. The location of these pipes can be described on the drawing in the "Engineering Design and Analysis" section of the submittal.

*Each coal company will select the locations for the two air sampling pipes and submit same as part of their submittal to the MSHA District office. Typically the air sampling pipes will be as shown in Figures #1 & 2. The inby ends of the two pipes are to be no more than 12 inches from the roof. All pipes are to be supported by hangers or on cribbing.*

2. The material may be metallic (if grounded) and have a diameter that will allow representative samples to be drawn for future analysis.

*Each coal company will specify the material, diameter, and lengths of the sampling pipes, and submit same as part of their submittal to the MSHA District office. All conductive material pipes are to be grounded.*

3. One sampling pipe shall extend approximately 15 feet into the sealed area and the second pipe shall extend into the center of the first connecting crosscut inby the seal.

*Each coal company will provide this information in its submittal to the MSHA District office. The sampling pipes shall be equipped with generic ball shut-off valves with a no less than 240-psi rating and have fittings to facilitate taking gas sample. Both shut off valve are to be closed except during gas sampling, so to comply with the 120-psi requirements.*

**Water Drainage System**

1. Address the location of the drainpipe. The lowest elevation seal in a set must have a drainage system. Show a typical pipe installation on a drawing.

*Each coal company will provide this information in its submittal to the MSHA District office. Typically the water drainage system will be as shown in Figures #1 & 2.*

2. Address the material of which the drain is constructed.

*Each coal company will provide this information in its submittal to the MSHA District office.*

120-PSI ETS PRECISION MINE REPAIR SEAL  
MSHA SEAL APPROVAL NUMBER 120-75.336.1.07.11.1

3. Address the dimensions of the pipe(s) and the closest allowable spacing if multiple pipes are required.

*Each coal company will provide this information in its submittal to the MSHA District office. If more than one drainage pipe is installed in a seal, the horizontal distance between the pipes is not to be less than 3 feet. No vertical or horizontal rebars are to be cut, moved or removed to install a pipe. All pipes are to be installed as low as practical to minimize the depth of water impounded by the seal.*

4. Describe the method to prevent air exchange through the drainage system.

*Each seal is to be installed at least 10 feet from the corner of any pillar to reduce air leakage around the seal. If air communications is detected using smoke tubes, the perimeter of the seal outby side will be required to be sealed with a MSHA approval sealant with flame spread index of less than 25.*

**Other Criteria**

1. The information supplied here would be specific to the seal design that is being submitted which has not been supplied in the previous list of information.

*This seal design is to be placed in an area with competent roof and floor strata. Any loose roof, floor or rib material is to be removed or reinforced prior to seal installation. To develop yield strength of (60 ksi), the hole for each dowel is to be drilled into competent roof and floor strata no less than the depth required from the in-mine pull tests to yield the dowels plus an additional 6 inches. Dowels are to be placed into each hole and anchorage by a Resin Anchoring System with a grouting return equal to or greater than the in-mine pull test results.*

*If poor ground conditions (e.g. severe cutter roof, bedding separation, rib sloughage, etc.) are present, then remediation or an alternate location is to be selected for the seal(s). If water accumulation is possible at the seal location, then the portion of the floor strata adversely affected by water is to be removed to expose competent strata. Due note removal of incompetent strata will increase the span. The design span will be based on the prepared roof to floor height.*

*The reinforced shotcrete seals may only be subjected to a maximum deformation equal to ¼ inch (that is, the vertical deformation of the seal itself). As a result, for seals located in areas with very strong roof and floor rock, such as sandstone and limestone, the maximum entry convergence allowed will be no more than ¼ inch. However, where convergence occurs at a seal location due to floor heave as a result of the floor fracturing or deforming and displacing about the seal, then the seal is acceptable with*

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*respect to convergence as long as the floor heave does not cause structural distress to the seal, such as evidenced by spalling or excessive cracking of the shotcrete. Floor heave material will need to be excavated as necessary to prevent interference with the function and integrity of the water drainage system pipe(s).*

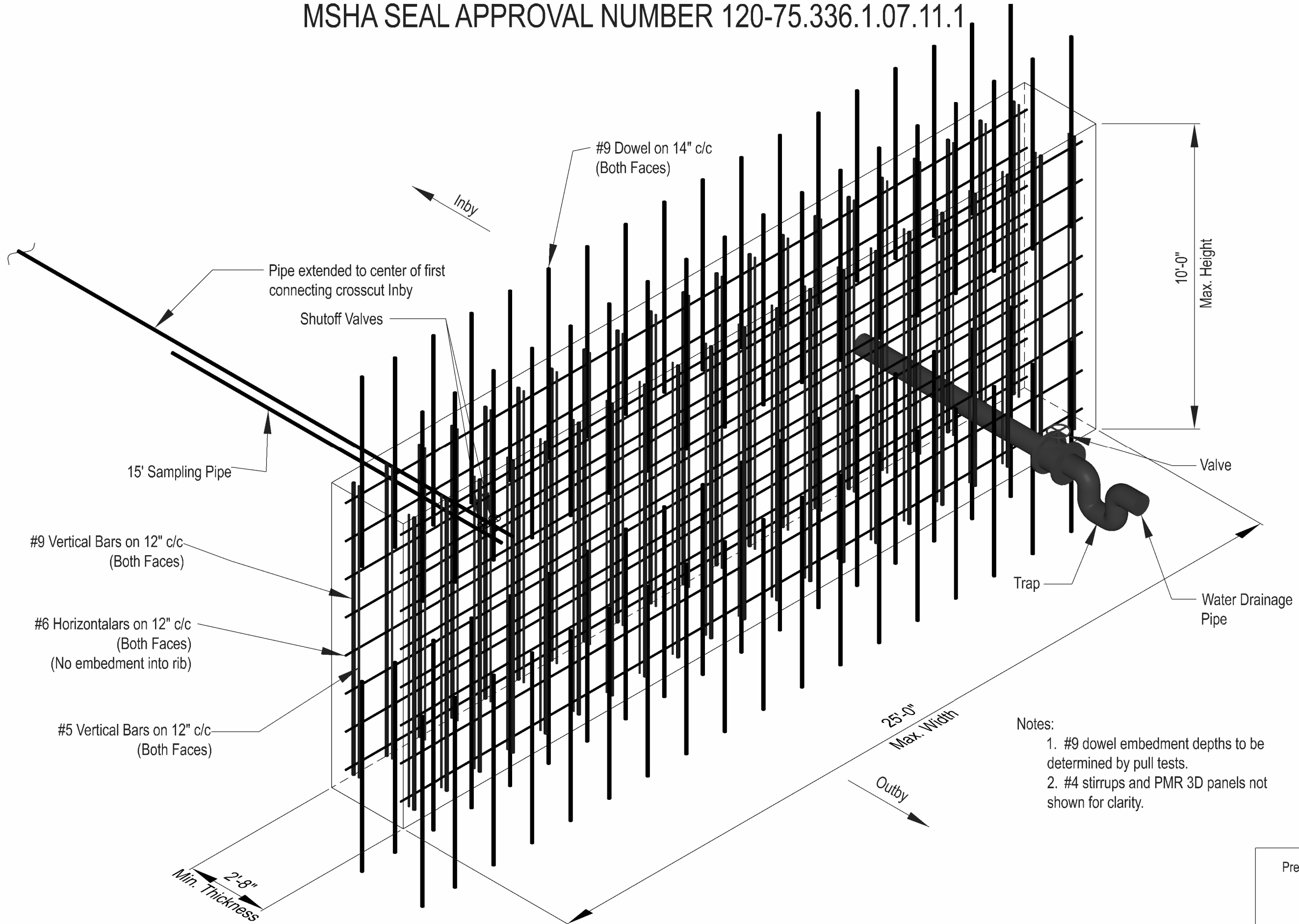
**Contact Information**

The name of the company and mailing address, and the name and telephone number of the contact person:

*Mr. Harry Riddle  
Precision Mine Repair  
705 W. Main Street  
Ridgeway, IL 62979  
618-272-7220*

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## MSHA SEAL APPROVAL NUMBER 120-75.336.1.07.11.1



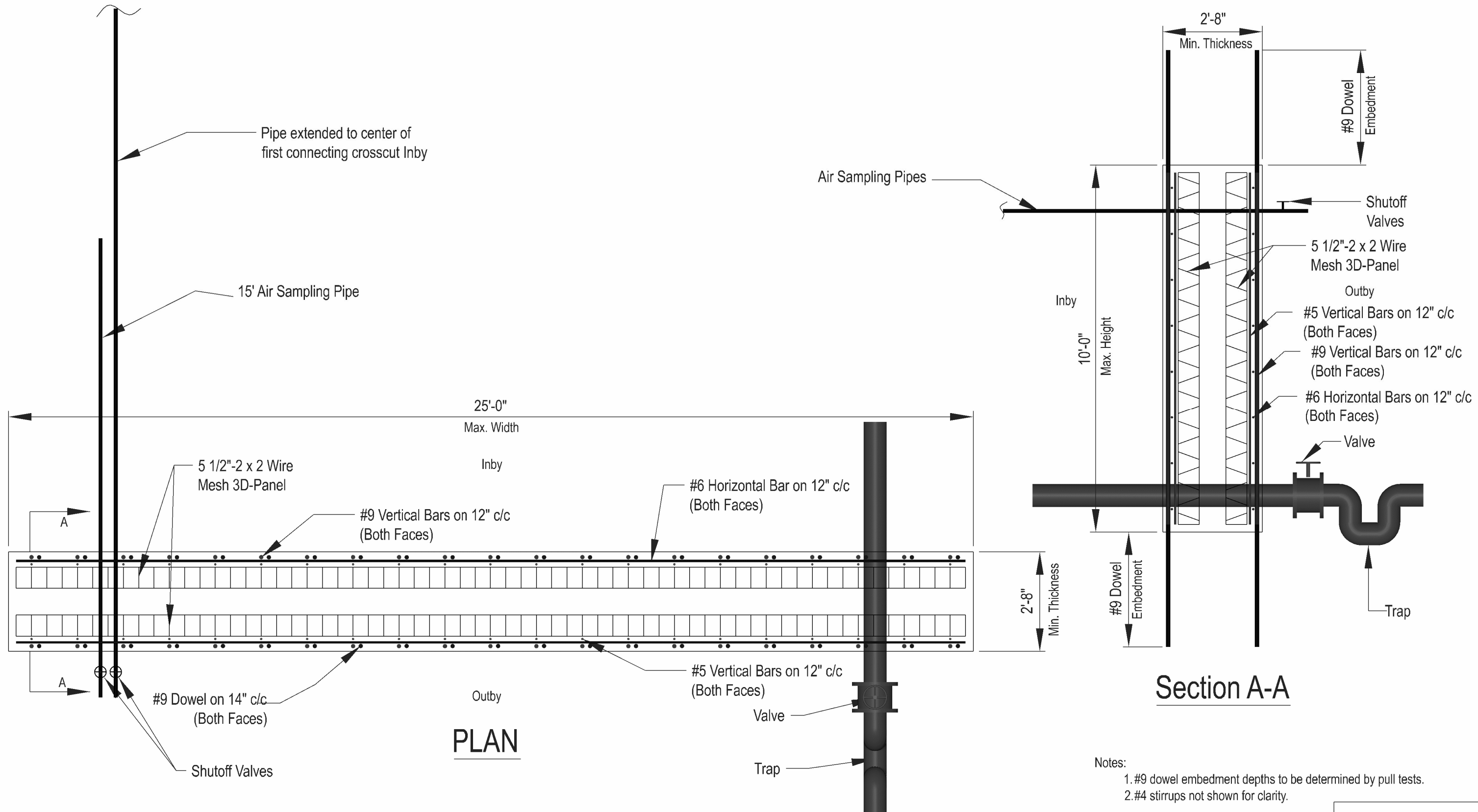
- Notes:
1. #9 dowel embedment depths to be determined by pull tests.
  2. #4 stirrups and PMR 3D panels not shown for clarity.

Precision Mine Repair  
120 PSI  
Isometric View  
Figure #1



# PRECISION MINE REPAIR SEAL

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Precision Mine Repair  
120 PSI  
Plan & Section View  
Figure #2