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U. S. Department of Labor

Mine Safety and Health Administration

P.O. Box 25367

Denver, Colorado 80225-0367

Coal Mine Safety and Health  
District 9



May 14, 1990

R. W. Olsen  
President  
Soldier Creek Coal Company  
P. O. Box I  
Price, UT 84501

RE: Soldier Canyon Mine  
ID No. 42-00077  
Roof Control and Ventilation System  
and Methane and Dust Control Plans

Dear Mr. Olsen:

The enclosed plan amendment dated April 9, 1990, consisting of a cover letter and pages 1 through 9, and pages 28 through 52, is approved in accordance with 30 CFR Sections 75.220(a)(1), 75.316, and 77.1900. This is a site specific rock tunnel development plan and shall terminate upon completion of the project.

A copy of this approval should be made available to the miners and reviewed with all miners affected by this plan.

Sincerely,

*For* John M. DeMichiei  
District Manager

Enclosure

**RECEIVED**

MAY 31 1990

DIVISION OF  
OIL, GAS & MINING

U. S. Department of Labor

Mine Safety and Health Administration  
P.O. Box 25367  
Denver, Colorado 80225-0367  
Coal Mine Safety and Health  
District 9



May 14, 1990

R. W. Olsen  
President  
Soldier Creek Coal Company  
P. O. Box I  
Price, UT 84501

RE: Soldier Canyon Mine  
ID No. 42-00077  
Nonpermissible Blasting Unit  
Permit 30 CFR 75.1321

Dear Mr. Olsen:

The enclosed plan amendment dated April 9, 1990, consisting of a cover letter and pages 10 through 27, requesting permission to use a nonpermissible blasting unit and to blast more than 20 boreholes in a round, is approved in accordance with 30 CFR 75.1321. This is a site specific rock tunnel development permit and shall terminate upon completion of the project, or on May 1, 1991, whichever date comes first.

A copy of this approval should be made available to the miners and reviewed with all miners affected by this plan.

Sincerely,

A handwritten signature in cursive script, reading "John M. DeMichiei".

John M. DeMichiei  
District Manager

Enclosure

AYLOR  
- W. Denning

VCH 40-10  
FILES-MAIL/BONES

SC<sup>3</sup>

SOLDIER CREEK COAL CO.

Telephone (801) 637-6360

\*  
P.O. Box 1  
Price, Utah 84501

April 9, 1990

Mr. John M. DeMichiei  
District Manager  
Mine Safety & Health Administration  
Post Office Box 25367  
Denver, CO 80225-0367



Re: Soldier Creek Coal Company  
Soldier Canyon Mine, ID No. 42-00077  
Mine Portal Development Plan

Dear Mr. DeMichiei:

Soldier Creek Coal Company, on behalf of Centennial Development Company, is pleased to submit the enclosed Mine Portal Development Plan for final approval. This plan has been appropriately revised, following your May 7th meeting with Jef Johnson and Ron Skow. This plan shall also supersede all previously submitted plans and amendments concerning the proposed mine portal work.

Please contact me if you have any questions regarding this matter.

Sincerely,

SOLDIER CREEK COAL COMPANY

R.W. Olsen  
President

RWO/sm

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Handwritten initials and signature

SOLDIER CANYON MINE

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SECTION 1.0

IDENTIFICATION

MINE IDENTIFICATION

Soldier Canyon Mine  
ID No. 42-00077  
12 miles northeast of  
Wellington, Utah  
Carbon County off County  
Road 53.

MINE OPERATOR

Soldier Creek Coal  
P.O. Box I  
Price, Utah 84501

CONTRACTOR

Centennial Development Company  
3808 South West Temple  
P.O. Box 151065  
Salt Lake City, Utah 84115  
I.D. No. W-50

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SECTION 2.0

SCOPE OF WORK

Centennial Development Company has been contracted to extend three existing rock portal entries located at the Soldier Canyon Mine. The proposed development work will be administered under Centennial's I.D. No. W-50.

The existing entries have each been developed for 20 lineal feet and supported with steel-arch sets. The proposed development for this project is to excavate and support each entry an additional 50-150 feet and include the first set of connecting cross-cuts. Shelter holes will be provided at 105 feet in by the portal. The shelter hole dimensions will be five feet deep x four feet wide x six feet high. See the sketch on the following page.

The work will be performed in accordance with coal mine regulations. Excavation will be accomplished by conventional drill, blast, and muck methods.

Work associated with this project will be performed by the contractor. A licensed electrician will be subcontracted to make the required surface connections.

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SECTION 3.0

EQUIPMENT INVENTORY

Surface

1. 8-foot x 40-foot combination office-shop van
2. 2-1/2 cubic yard FEL
3. 650 c.f.m. electric compressors (2 each)
4. Electric water pump

Underground

1. Ventilation - One permissible electric fan
2. Drilling - Gardner-Denver two-boom jumbo and pneumatic stopers or jacklegs
3. Haul dump - Permissible two-cubic Wagner LHD and pneumatic crawler loader

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SECTION 4.0

DRILLING PROCEDURES

Prior to drilling the face, the roof will be supported and the face and ribs inspected. Any unsafe conditions such as misfires, scaling and so on will be corrected before the next round of drilling commences.

Drilling will be accomplished using a two-boom drill jumbo or hand-held jackleg drills. Water will be supplied to each drill via an electric pump located on the surface.

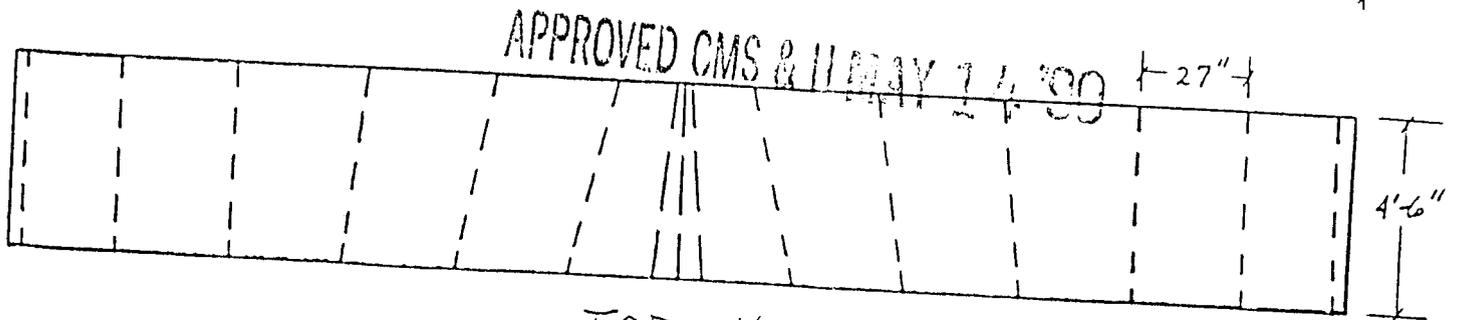
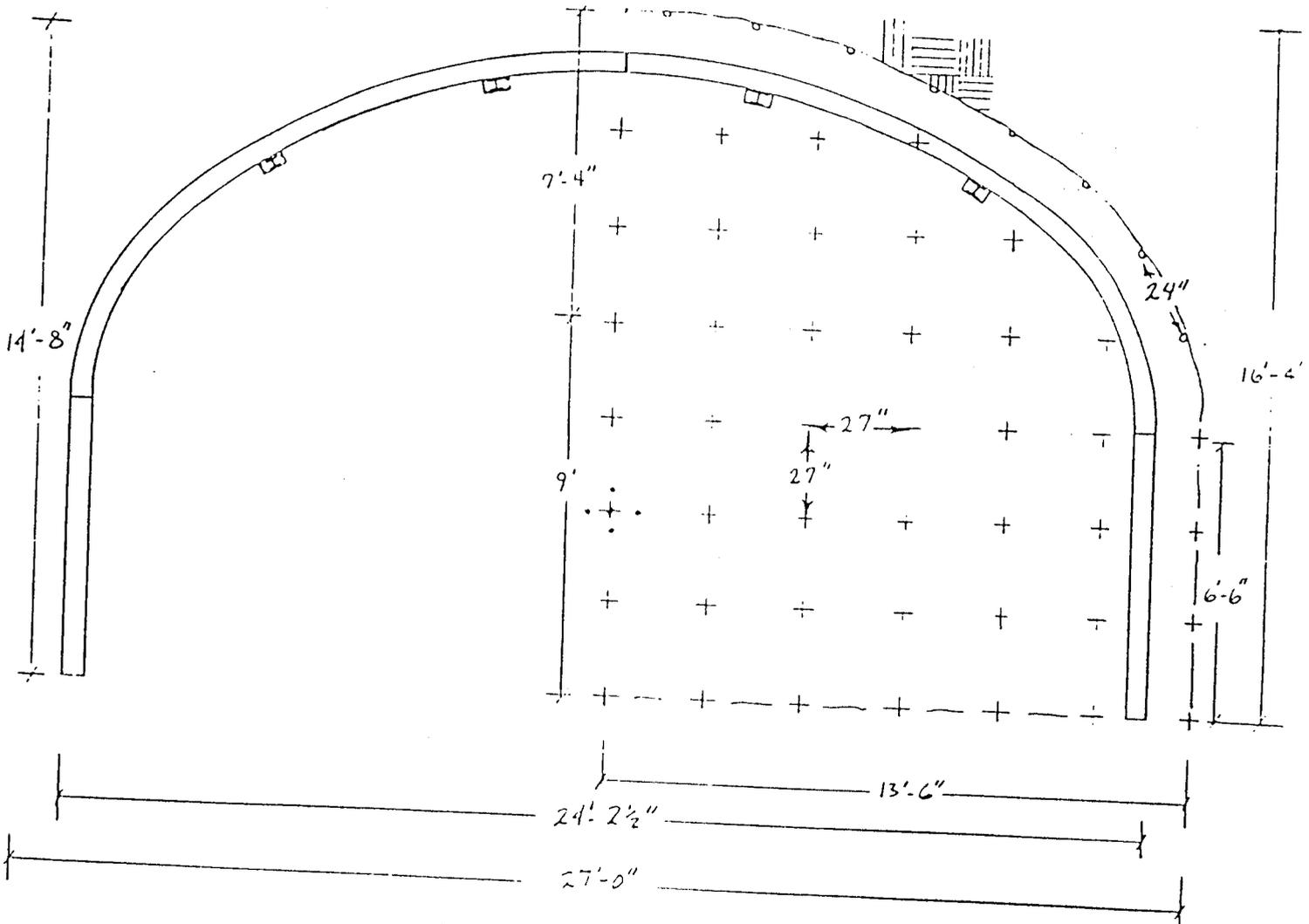
A diagram showing a typical drill pattern is included.

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DEILL PATTERN

FRONT VIEW

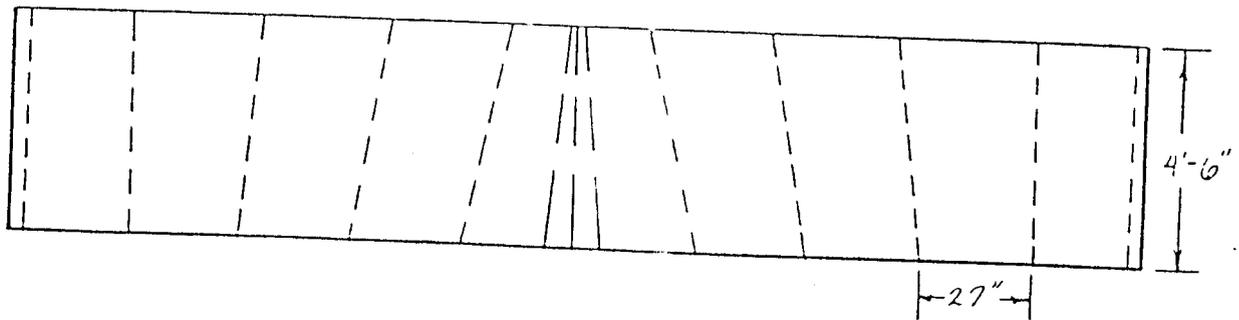
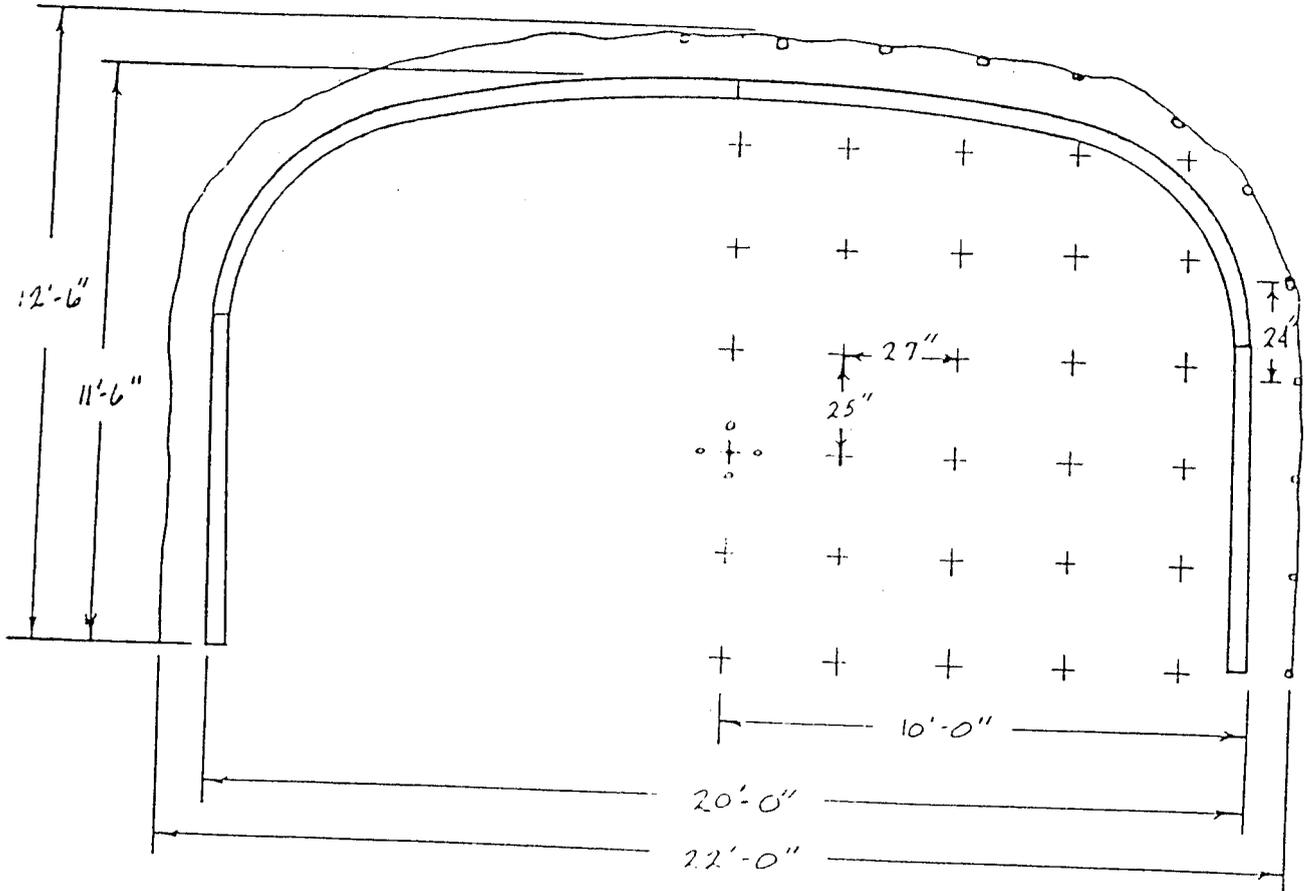


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TOP VIEW  
SCALE = 1/4" = 1'-0"

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DRILL PATTERN  
FRONT VIEW



TOP VIEW  
SCALE 1/4" = 1'-0"

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SECTION 5.0

MUCKING PROCEDURES

Underground blast rock will be loaded and trammed by a permissible two-cubic yard Wagner LHD or air-powered Eimco 634 from the face and temporarily deposited near the portals. These units will comply with the Schedule 31 requirements. The operator will not proceed past the last row of permanent support. On the surface a rubber-tired front-end loader will transfer the blast rock from the portals to the designated stockpile area on surface. (Copies of each unit's specifications are enclosed.)

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Non-Permissible Shot-Firing Unit Application

In accordance with 30 CFR 75.1321(a), Soldier Creek Coal Company is requesting permission to use a non-permissible shot-firing unit during the extension of three existing rock portal entries.

We are requesting approval to use the VME 450 large capacity blasting unit (the technical data sheet for this unit is attached).

If a coal seam is encountered all blasting procedures will comply with 30 CFR Section 75.1300 .

75.1321-(a)(1)            The name and address of the mine:

Soldier Canyon Mine  
c/o Soldier Creek Coal Company  
R. W. Olsen, President  
P.O. Box I  
Price, UT 84501

75.1321-(a)(2)            The active workings in the mine in which such units will be used and the approximate number of shots to be fired.

The non-permissible shot-firing unit shall be used in the extension of three existing rock portal entries.

The approximate number of shots to be fired shall be 100.

75.1321-(a)(3)            The period during which such units are to be used:

May 1, 1990 to May 1, 1991

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75.1321-(a)(4)

The nature of the development or construction for which they will be used:

Three existing portal entries have previously been developed for 20 lineal feet. The proposed extension will develop the entries each an additional 50 to 150 feet. The excavation will be in interbedded siltstone and sandstone.

75.1321-(a)(5)

A plan, proposed by the operator to protect miners in the mine from the hazards of methane and other explosive gases during each multiple shot:

A permissible surface-mounted fan, rigid-vent pipe, and spiral-wound flexible vent bag will be used to minimize any hazards arising from methane liberation or other airborne gaseous or particulate contaminants.

The approved mine plan for the Soldier Canyon Mine, specifically addressing the ventilation and dust control procedures of the rock portal extensions, shall be strictly adhered to.

75.1321-(a)(6)

A statement of the specific hazards anticipated by the operator in blasting for overcasts, undercasts, track grading, brushing of roof, boomholes, or other unusual blasting situations such as coal beds of abnormal thickness.

No identifiable hazards other than those normally associated with normal everyday operation of tunnel excavation are anticipated.

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75.1321-(a)(7)

The method to be employed in the use of non-permissible shot-firing units to avoid the dangers anticipated during development or construction which will insure the protection of injuries to the miners exposed to such underground blasting:

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All Federal regulations and company safeguards, as well as any additional safeguards designated by the District Manager, shall be strictly adhered to. A copy of the company safeguards is attached.

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SECTION 6.0

BLASTING PROCEDURES

Typical rounds will consist of approximately 100 bore holes, actual number of holes will be determined by the on-shift supervisor, according to prevailing rock conditions. All rounds will be charged, primed, stemmed, and wired under the direction of a certified person.

Blasts will be initiated by a non-permissible VME 450 blasting unit, manufacturer's specifications enclosed. This non-permissible blasting unit will not ever be taken underground. Blasting stock to be used will be a product such as the Ireco-gel B permissible explosives. The detonators to be used will be Ireco Millidets with bronze shells. Bore holes will be charged in a continuous train, with detonator at the back of the hole. An inert stemming material will be used in the collar portion of the drill hole. A maximum of six pounds of stock per hole will be used.

Circuits will be wired in series and/or series in parallel. The series will be equally balanced. A galvanometer will be used to test for continuity of circuits.

Blasting cable will be an 18-gauge duplex copper wire at the face. A #12-2 stranded wire trunk line will be installed from the face to the surface. The cable will be kept well insulated and will be of an adequate length to allow the shot to be initiated from a protected area.

All connections will be made securely. Connections will be kept out of water and free from contact with roof, rib, and floor. Connections will be made immediately before the shot and cable ends will remain shunted until this time.

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The #12-2 stranded wire trunk line cable ends will remain shunted until ready to attach to the blast initiating device. Immediately after the shot has been fired, the cable will be disconnected from the blasting device and the ends shunted.

The face blasting cable will be a two-conductor 18/2 cable. The cable will be a maximum of 250 feet long and no shorter than 100 feet.

The person in charge, who is experienced in the use of explosives will examine the blasted round for misfires. The atmosphere will be tested for oxygen and methane content. Scaling bars of adequate length will be used to remove unconsolidated material from the roof and rib. After the hazards have been remedied, or if no hazards are found, the muck pile will be watered down to allay dust and blasting gases as required.

All persons employed by the contractor on this project who will be directed to transport explosives will be trained prior to performing this task.

If a coal seam is encountered all blasting procedures will comply with 30 CFR Section 75.1300 .

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SAFEGUARDS FOR NON-PERMISSIBLE BLASTING

1. The VME 450 shot-firing unit will have a capacity adequate to fire all charges in a round. Specifications enclosed.
2. The shot-firing unit will be properly maintained and tested to insure compliance with the rated capacity, and records will be kept and available for inspections.
3. The shot-firing unit will be used only by a certified person who is thoroughly familiar with the plans and safeguards required to protect the workmen.
4. All safeguards and these company rules and permit pertaining to the use of acceptable shot-firing units will be posted in a conspicuous place on the surface.
5. Adequate precautions will be taken to assure that combustible materials are cleaned up and removed, in and surrounding the area to be blasted.
6. An examination will be made by a certified person immediately after blasting to determine that ventilation system was not disrupted as a result of the blasting.
7. Only Ireco bronze shell Millidets will be used. These delays will give the ability to delay the successive horizons from 25 milliseconds to a maximum duration of 3,500 milliseconds for the entire round.

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8. Prior to blasting, all persons shall be withdrawn to outside the mine. The shot firer will be out of the mine.
9. The handling, transportation, and storage of the explosives and detonators shall be done in accordance with all applicable regulations in Parts 15, 16, 17, and 75, 30 CFR.
10. A maximum of six pounds of explosives will be used in any hole and a minimum of 24 inches of free hole will be maintained at the collar of each hole for stemming. Maximum number of holes to be fired in one round will not exceed 100.
11. Stemming will consist of permissible dummies.
12. Bore holes shall not be charged while any other work is being done at the face, and the shot or shots shall be fired before any other work is done in the zone of danger from blasting except that which is necessary to safeguard the employees.
13. Only non-metallic tamping bars shall be used for charging and tamping bore holes.
14. The leg wires of electric detonators shall be kept shunted until ready to connect to the firing cable.
15. The roof and ribs of working places shall be tested before and after each shot or group of multiple shots.

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16. Ample warning shall be given before shots are fired. Care shall be taken to ascertain that all personnel have been withdrawn from all three underground entries to a safe area on the surface and are in the clear. All shots will be initiated outside the mine at a safe distance on surface.
17. Blasting cable shall be:
  - a. Well insulated and as long as may be necessary to permit blasting from the surface.
  - b. Shot-circuited at the battery end until ready to attach to the blasting unit.
  - c. Staggered as to length or the ends kept well separated when attached to the detonator leg wires.
  - d. Kept clear of power wires and all other possible sources of active or stray electric current.
  - e. Face blasting cable will be 2-conductor, 18-gauge, 18/2 cable, a maximum of 250 feet long and a minimum of 100 feet. A blasting trunk line of #12-2 stranded wire will be used from the blasting box to the face.

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18. Misfires:

- a. Where misfires occur with electric detonators, a waiting period of at least fifteen minutes shall elapse before anyone returns to the shot. After such failure, the blasting cable shall be disconnected from the source of power and the battery ends short-circuited before electric connections are examined.
- b. Explosives shall be removed from a misfired charge by washing the stemming and the charge from the bore hole with water, or by inserting and firing a new primer after the stemming has been washed out.
- c. A very careful search of the working place shall be made after blasting a misfired hole, to recover any undetonated explosive.
- d. The handling of a misfired shot shall be under the direct supervision of the mine foreman or a competent person designated by him.

19. Typical drilling patterns are shown in the attached drawings (SH. 1 and 2). The actual drilling pattern utilized may vary with the site specific ground conditions encountered.

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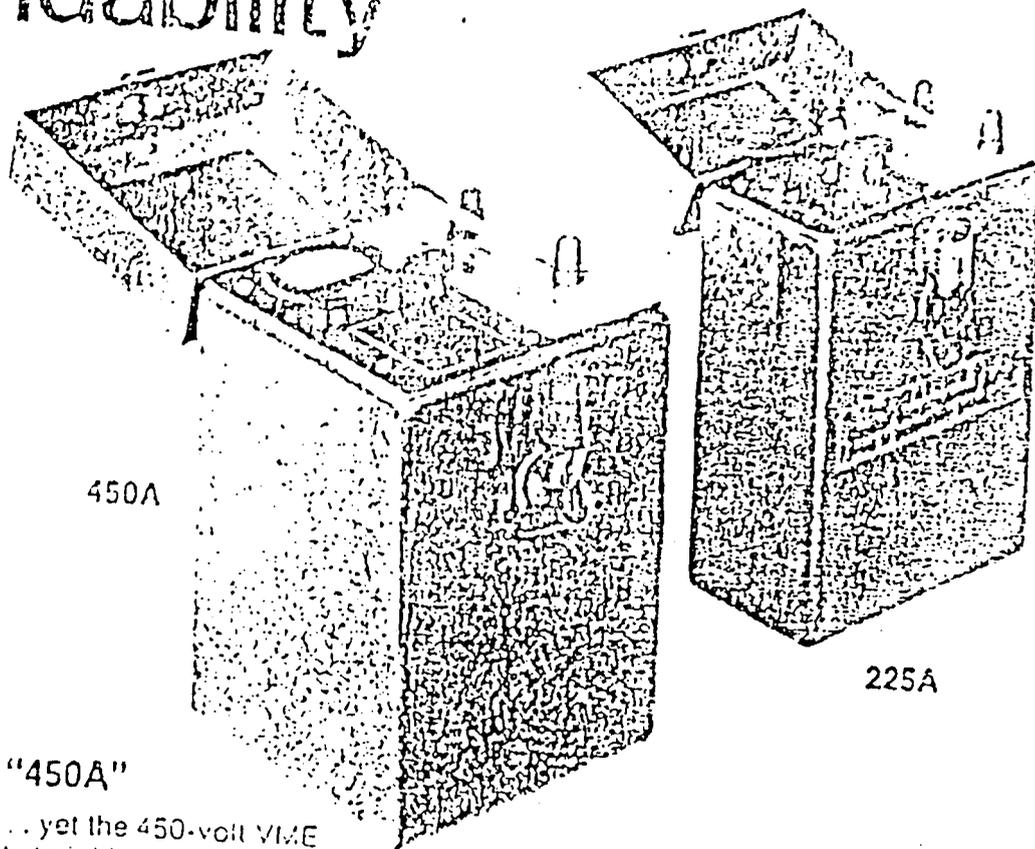
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20. Safety signals for blasting shall be as follows:
- a. At approximately thirty (30) minutes before the scheduled time of the blast there will be five (5) long horn blasts. After hearing five (5) long horn blasts, all persons in the effected area shall begin removal of equipment and material to a safe place.
  - b. At approximately ten (10) minutes before the scheduled blast time all persons shall remove themselves to a safe place and all traffic will be stopped until after the shot has been fired.
  - c. Just before the shot has been set off, a single long horn blast will be sounded and will continue until the shot has been fired.
  - d. After the shot has gone off, there will be three (3) short horn blasts indicating that it is safe to continue with normal operations.
21. No personnel will enter the mine for a minimum of fifteen (15) minutes or until all noxious or poisonous gases have cleared.

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# Two lightweight models with field-proven dependability



## THE POWERFUL "450A"

It weighs only 14.5 lbs. . . yet the 450-volt VIME "450A" has the capacity to initiate 1005 (Group I) electric detonators in 15 series of 67 caps each. True, not many blasts are that large. But this excess capacity gives you extra assurance in detonation—a margin of safety over many current leakage and grounding problems which, without this excess power, could result in misfires.

The "450A" features a large, easy-to-read voltmeter which indicates battery condition. It functions when the safety-lock button is depressed. If the meter indicator is in the red, batteries should be replaced.

| SPECIFICATIONS        |                  | MODEL "450A"                |                   |
|-----------------------|------------------|-----------------------------|-------------------|
| Weight: 14.5 lbs.     |                  | Size: 10" x 6 1/2" x 6 1/4" |                   |
| CERTIFIED CAPACITIES* |                  |                             |                   |
| Straight Series       | Secondary Series | Straight Parallel           | Parallel Series   |
| 100                   | 100              | 33                          | 1005<br>(15 x 67) |

## THE COMPACT "225A"

Weighing only 8 lbs., the 225-volt "225A" has the power to initiate 180 (Group I) electric detonators in five series of 36 caps each. It's a lightweight, dependable workhorse for jobs where the conditions are not severe enough to require heavyweight capacity.

The "225A" has an indicator lamp which shines brightly when the safety-lock button is depressed. If the lamp does not glow immediately, the battery should be replaced.

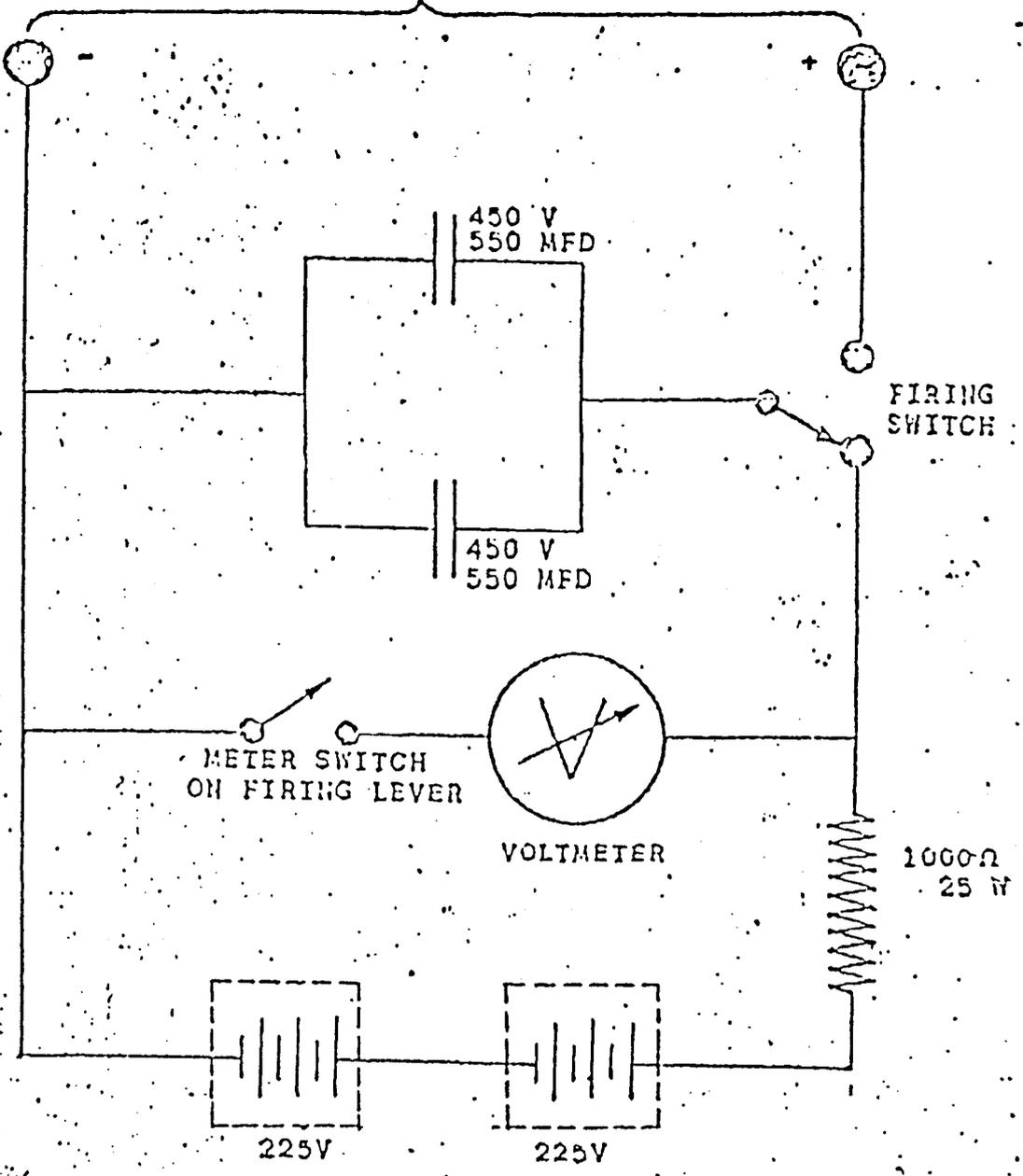
| SPECIFICATIONS        |                  | MODEL "225A"                |                 |
|-----------------------|------------------|-----------------------------|-----------------|
| Weight: 8 lbs.        |                  | Size: 10" x 5 1/2" x 6 1/4" |                 |
| CERTIFIED CAPACITIES* |                  |                             |                 |
| Straight Series       | Secondary Series | Straight Parallel           | Parallel Series |
| 50                    | 50               | 10                          | 180<br>(5 x 36) |

\*Capacities are based on a 100% state of charge and are subject to variation due to battery age and temperature.

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\*Capacities are based on a 100% state of charge and are subject to variation due to battery age and temperature.

OUTPUT 450 VOLTS

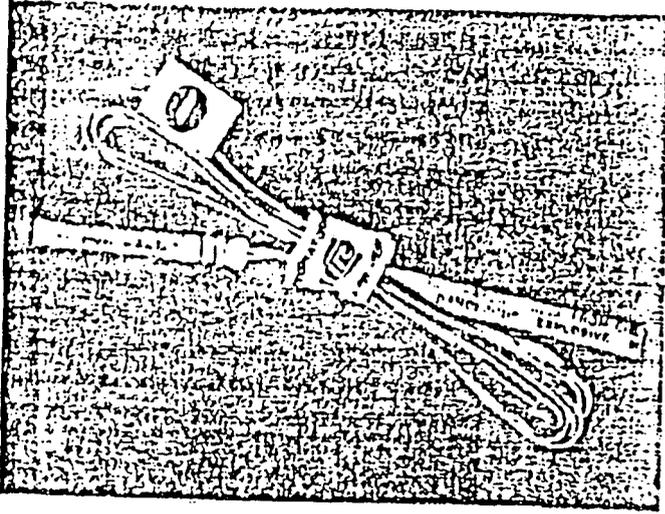


VME BLASTER  
MODEL 450

## MILLIDET<sup>2</sup> Millisecond Delay Electric Detonators

MILLIDET is a No. 8 strength, millisecond delay electric detonator featuring 21 controlled delay periods ranging from 12 to 1,500 milliseconds. The MILLIDET Detonator is available with either an aluminum or bronze shell and is static-resistant and waterproof.

When used correctly, MILLIDET Detonators reduce vibration and concussion, improve fragmentation and displacement, and reduce backbreak and endbreak in quarries, open-pit mines, underground mining operations, coal strips, shafts, tunnels and heavy construction projects.



### Advantages

**Static Resistant.** MILLIDET Detonators provide outstanding resistance to accidental detonation by static electricity and to premature detonation by stray electrical current and current induced by radio-frequency (RF) energy.

**Electrical Shunting.** Using an exclusive IRECO method, the Ireshunt™ provides positive contact between wires, completely shields the legwire ends from possible stray currents, and provides corrosion protection to the wires.

**Polyolefin-Insulated Legwires.** Polyolefin insulated copper or copper-clad iron legwires offer superior dielectric strength, excellent resistance to abrasion and cuts, good flexibility at below zero temperatures, and high tensile strength to MILLIDET detonators. Copper wires are of extra strength to provide superior resistance to field breakage.

**Color-Coded.** MILLIDET Detonators are furnished with color-coded legwires of copper (green and yellow) or copper-clad iron (dark green and white). Tags display the delay period in easy-to-read numbers.

The MILLIDET is not electrically compatible with the IREDET \*Super\* Detonator, and must not be wired into a series with that device.

| Delay Period (ms) | Approximate Delay Time (ms) | Approximate Delay Time (ms) |
|-------------------|-----------------------------|-----------------------------|
| 1                 | 12                          | 2.01                        |
| 2                 | 25                          | 2.01                        |
| 3                 | 50                          | 2.01                        |
| 4                 | 75                          | 2.11                        |
| 5                 | 100                         | 2.06                        |
| 6                 | 135                         | 2.21                        |
| 7                 | 170                         | 2.26                        |
| 8                 | 205                         | 2.37                        |
| 9                 | 240                         | 2.20                        |
| 10                | 280                         | 2.26                        |
| 11                | 320                         | 2.26                        |
| 12                | 360                         | 2.28                        |
| 13                | 400                         | 2.35                        |
| 14                | 450                         | 2.45                        |
| 15                | 500                         | 2.37                        |
| 16                | 550                         | 2.47                        |
| 17                | 600                         | 2.47                        |
| 18                | 700                         | 2.26                        |
| 19                | 800                         | 2.26                        |
| 20                | 900                         | 2.26                        |
| 21                | 1,200                       | 2.26                        |
| 22                | 1,500                       | 2.26                        |

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# IRECO Incorporated



## Recommended Minimum Firing Currents

|                           |                            |
|---------------------------|----------------------------|
| Series wiring             | 1.5 amps DC or 3 amps AC   |
| Parallel wiring           | 1 amp AC or DC per cap     |
| Series in-parallel wiring | 2 amps AC or DC per series |

## Maximum Recommended Firing Current

10 amps

## Average Resistance (ohms) for MILLIDET Detonators

| Leg Wire Length | No. 23 AWG Copper Wire |       | No. 23 AWG Copper-Clad Iron Wire |
|-----------------|------------------------|-------|----------------------------------|
|                 |                        |       |                                  |
| 8               |                        |       |                                  |
| 10              | 1.85                   |       | 2.90                             |
| 12              | 1.90                   |       | 3.25                             |
| 14              | 2.00                   |       | 3.60                             |
| 16              | 2.05                   |       | 4.00                             |
| 20              | 2.15                   |       | 4.30                             |
| 24              | 2.30                   |       | 5.00                             |
|                 | 2.50                   |       | 5.70                             |
|                 | No. 21 AWG Copper Wire |       |                                  |
| 30              |                        | 2.25  |                                  |
| 40              |                        | 2.50  |                                  |
| 50              |                        | 2.80  |                                  |
| 60              |                        | 3.00  |                                  |
| 70              |                        | 3.20  |                                  |
| 80              |                        | 3.55  |                                  |
| 100             |                        | 4.05  |                                  |
| 120             |                        | 4.55  |                                  |
| 150             |                        | 5.35  |                                  |
| 200             |                        | 6.60  |                                  |
| 250             |                        | 7.90  |                                  |
| 300             |                        | 9.20  |                                  |
| 350             |                        | 10.45 |                                  |
| 400             |                        | 11.75 |                                  |

NOTE: Some wire lengths are non-standard. Check with Ireco Customer Service prior to ordering. Copper-clad iron wires are non-standard in all lengths.

## Transportation, Storage and Handling

MILLIDET detonators must be transported, stored and handled in compliance with federal, state and local laws.

## Product Disclaimer

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IRECO disclaims any warranties with respect to this product. The safety or suitability thereof, and the results to be obtained, with this product are implied. INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND, OR ANY OTHER WARRANTY. Buyers and users assume all risk, responsibility and liability, whatsoever, from any and all injuries (including death), losses, or damages to persons or property arising from the use of this product. Under no circumstances shall IRECO be liable for special, consequential or incidental damages or for punitive profits.

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The Explosives Technology Company

## IRECOAL<sup>®</sup> D Non-Nitroglycerin Permissible Dynamites (Formerly Hercoal™)

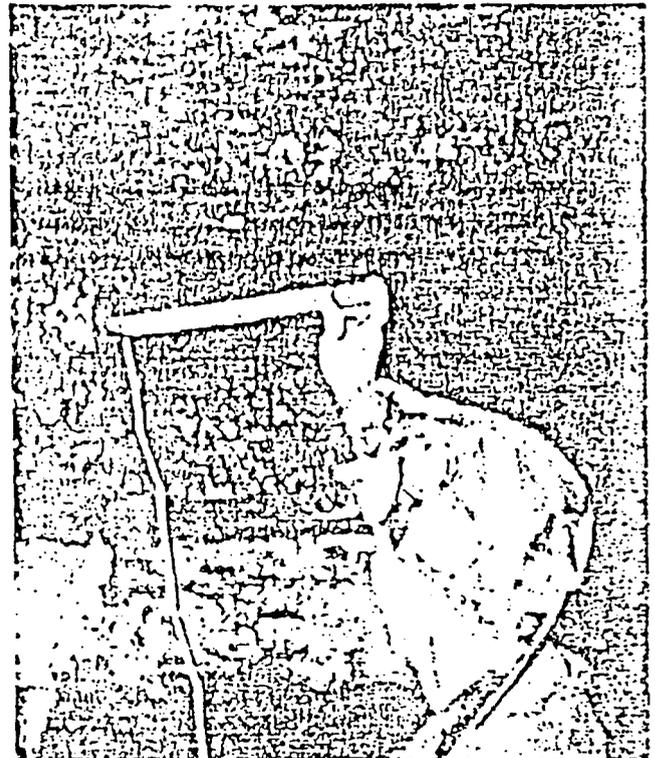
IRECOAL D 328, 330, 340 and 378 were developed primarily for use in underground coal mines. They offer the relatively high strength and detonation velocity required to produce excellent results in various conditions encountered in conventional sections (machine cut) of bituminous coal mines. IRECOAL D 328 and 330 are particularly effective in mines shooting off the solid. IRECOAL D 378 is a semi-gelatin formulation, offering better water resistance, rate and bulk strength than the other IRECOALS, which are ammonium nitrate dynamite types. IRECOAL D 340 is a high stick count powder and is especially well suited for soft seam conventional mines.

### Advantages

**Non-Headache Producing.** Powder headaches are eliminated with IRECOAL D.

**Fumes.** Afterblast fumes and smoke are at a minimum.

**Firm Packages.** Paper shells provide easy handling and loading.



### Properties

| IRECOAL D | Diameter (mm) | Length (mm) | Weight (g) | Stick Weight (kg) | Detonation Velocity (m/s) | Detonation Pressure (kg/cm <sup>2</sup> ) |
|-----------|---------------|-------------|------------|-------------------|---------------------------|---|
| 328       | 25            | 120         | 185        | 1.85              | 3,000                     | 27.5                                      |
| 330       | 25            | 120         | 185        | 1.85              | 3,000                     | 27.5                                      |
| 340       | 25            | 120         | 185        | 1.85              | 3,000                     | 27.5                                      |
| 378       | 25            | 120         | 185        | 1.85              | 3,000                     | 27.5                                      |

IRECO disclaims any warranties with respect to this product, the safety or suitability thereof, or the results to be obtained, whether express or implied, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND/OR ANY OTHER WARRANTY. Buyers and users assume all risk, responsibility and liability whatsoever from any and all injuries (including deaths), losses, or damages to persons or property arising from the use of this product. Under no circumstances shall IRECO be liable for special, consequential or incidental damages, or for any loss of profit.

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# IRECO Incorporated



## Characteristics

|  |  |
|--|--|
| Minimum Diameter   | 1 inch   |
| Water Resistance, IRECOAL D 328, 330, 340<br>IRECOAL D 378 | Poor<br>Fair   |
| Fume Class, IRECOAL D 328<br>IRECOAL D 330, 340, 378       | IME I*<br>Passes Permissible requirements  |
| Shell Marking To Designate Permissible                     | Convolute Shell: Solid 1/4" black band on both sides of grade printing.<br>Tube Shell: Solid 1/4" "Barber Pole" stripe full length of shell. |

\*IME Class I is a more stringent fume class than Permissible requirements. Therefore D328 is also within Permissible requirements.

## Packaging, IRECOAL D

Both convolute and spiral tube construction shells are available. Convolute shells will be supplied unless spiral tube shells are specifically requested with the order. Dimensions and nominal count per 50-lb case are as follows.

| Diameter x Length<br>(inches) | Nominal Count per 50 lb Case |         |         |
|-------------------------------|------------------------------|---------|---------|
|                               | 328 and 330                  | 340     | 378     |
| 1 x 8                         | 166-176                      | 202-212 | 163-175 |
| 1-1/8 x 8                     | 144-153                      | 176-185 | 141-151 |
| 1-1/4 x 8                     | 117-124                      | 142-150 | 114-122 |
| 1-1/2 x 8                     | 81-86                        | 99-105  | 80-86   |
| 1-3/4 x 8                     | 60-63                        | 73-77   | 59-62   |
| 2 x 8                         | 46-48                        | 56-59   | 45-47   |
| 1-1/8 x 12                    | 98-103                       | 118-125 | 95-101  |
| 1-1/4 x 12                    | 79-84                        | 96-101  | 76-81   |
| 1-1/2 x 12                    | 55-58                        | 66-70   | 52-57   |
| 1-3/4 x 12                    | 40-42                        | 49-52   | 40-42   |
| 2 x 12                        | 31-32                        | 37-39   | 31-32   |
| 1-1/8 x 16                    | 75-79                        | 88-93   | 71-75   |
| 1-1/4 x 16                    | 61-64                        | 72-76   | 57-61   |
| 1-1/2 x 16                    | 42-44                        | 50-53   | 40-43   |
| 1-3/4 x 16                    | 31-32                        | 37-39   | 30-31   |
| 2 x 16                        | 24-25                        | 28-30   | 23-24   |

Note: The above is for count information only. Some sizes are non standard (i.e. produced only to special order) and may involve a surcharge. Some of these products are also available in king-size cartridges of 20 and 24 inches length. Consult your sales representative to determine availability.

## Transportation, Storage and Handling

IRECOAL D must be transported, stored and handled in compliance with federal, state and local laws.

IRECOAL D 328, 330, 340, and 378 are permissible only if used in accordance with the Code of Federal Regulations (30 CFR 15.19), which, in addition to more general rules, requires that the explosive:

1. Is stored in surface magazines under conditions that tend to maintain original product character, and is used within 48 hrs after being taken underground.
2. Remains in its original cartridge wrapper throughout storage and use.
3. Is initiated with a copper or copper based alloy shell commercial electric detonator (not cap and fuse) of at least No. 6 strength.

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IRECOAL D 328, 330 and 340 are for use under light water conditions. They should not be used in wet vertical holes or where running water is present, such as in shaft work. IRECOAL D 378 may be used in water conditions, but should not be exposed to 10 ft. of water depth for more than 8 hours.

# Technical Data

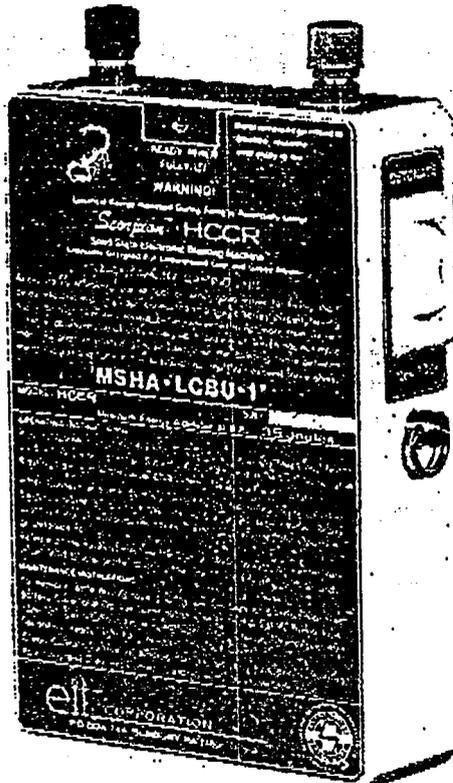


\* IF A COAL SEAM IS ENCOUNTERED THIS BLASTING UNIT WILL BE USED.

7/1 5-8-90

## SCORPION® HCCR

- An MSHA\* Accepted Large Capacity Solid State Electronic Shot Blaster For Use In Underground Coal & Gassy Mines
- †\*Acceptance No. MSHA-LCBU-1



### GENERAL INFORMATION:

**NOTE: This machine does not require a variance for use in underground, gassy mines!**

A specially designed large capacity blaster for use on large shots which are beyond the capacity of permissible blasting machines, in coal and other gassy mine environments. The 35 joules energy output of the SCORPION HCCR permits the blasting of large overhead roof burdens. The use of this machine on these large shots does not require a variance from mine inspectors. The SCORPION HCCR is designed to detonate up to 150 short delay iron leg wire electric

detonators (based on a resistance of six ohms per detonator) in a circuit pattern of six single series of 25 short delay electric detonators connected in parallel across the leading lines.

Above ground or in a non-gassy, non-critical environment, the unit will

detonate up to ten series of 50 two ohm copper leg wire electric detonators through not more than 3 ohms of leading-in line resistance.

The unit is constructed of rugged molded polyurethane and is electric shock, dust, moisture and tamper resistant. It will float on water and forced submersion for several hours does not impair its operation or usefulness.

The SCORPION HCCR is powered by four alkaline "D" cells which are readily replaceable by the removal of four screws on the back cover of the unit.

\*Mine Safety & Health Administration  
 †Also Approved Pennsylvania DEE  
 The HCCR is an MSHA accepted blasting machine for large capacity shots in coal and other gassy mines. Approval No. : MSHA-LCBU-1.

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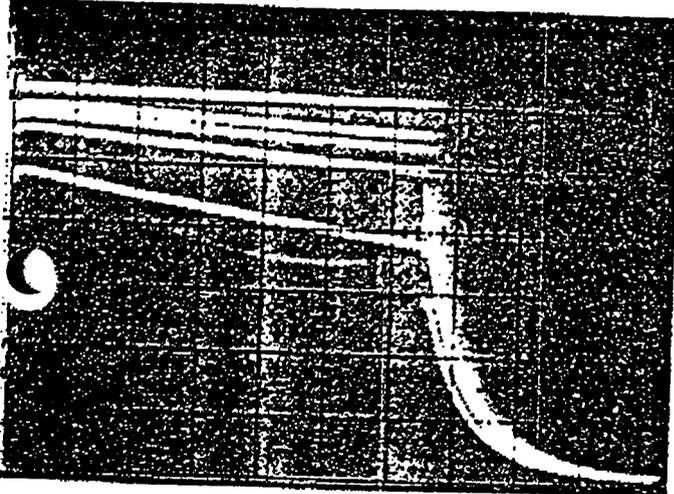
# MSHA ACCEPTANCE #MSHA-100

| <b>Mechanical:</b> |   |
|--------------------|---|
| Case Material:     | HD Urethane   |
| Case Size:         | 6" W x 2" D x 9" H<br>(15.24 cm W x 5.8 cm D x 22.86 cm H)    |
| Weight:            | 4 Lbs. (1.82 kg)  |
| Shipping Weight:   | 6 Lbs. (2.72 kg)  |
| External Fittings: | Leather Shoulder Strap  |
| Resistant To:      | Water, Dust, Vapor, Elec. Shock<br>Gasoline, Oils & Tampering |

- Special Features:**
- Accepted under MSHA criteria for large capacity blasting units
  - 5 - 8 ms Internal Firing Shunt
  - Neon Ready Light
  - Rocker Switch Activation

| <b>Electrical:</b>      |   |
|-------------------------|---|
| Type of Circuitry:      | Solid State Electronic                            |
| Firing Circuit Control: | SCR (silicon controlled rectifier)                |
| Shunt Circuit:          | SCR   |
| Firing Voltage:         | 445 VDC Minimum                                   |
| Energy Discharge:       | 35.0 (+) Joules                                   |
| Power Source:           | 4 Ea. Alkaline Dry Cells<br>("D" cells, NEDA 13A) |
| Battery Voltage:        | 4 x 1.5V (6V Total)                               |
| HV Source:              | Solid State Electronic Inverter                   |
| Energy Storage:         | Capacitor, Single Electrolytic, HD                |

**Firing Capacity:**  
 For underground coal or gassy mines:  
 One (1) series of 145 ohms total resistance, or a maximum of six (6) series of 145 ohms each in parallel across leading lines.



| <b>Typical Discharge:</b> |                   |
|---------------------------|-------------------|
| 1)                        | thru Open Circuit |
| 2)                        | thru 350 Ohms     |
| 3)                        | thru 250 Ohms     |
| 4)                        | thru 150 Ohms     |
| 5)                        | thru 50 Ohms      |
| Vertical: 100V/Div        |                   |
| Horizontal: 1 ms/Div      |                   |

**Important Notice to Purchasers and Users:**  
 The products described in this catalog may be used in a variety of applications. All statements, technical information and recommendations are based on tests we believe to be reliable, but their accuracy or completeness are not guaranteed. Before using a product, Buyer should review applicable codes and standards such as U.L., NEMA, OSHA, MSHA, and others for recommended practices and safety standards in the proper use of the products, particularly where personal injury hazards may be present. Buyer shall determine the suitability of the product for his intended use and Buyer and User assume all risk and liability of every kind in connection with such use. Any other statement or recommendation shall not be binding or have any force unless in a separate written agreement signed by officers of Seller and Manufacturer.

**WARRANTY NOTICE**

Purchaser's exclusive remedy for any goods having defects in materials or workmanship and for any damages including consequential damages caused thereby will be a refund of the purchase price or replacement of such defective goods returned to the Seller within ninety (90) days after receipt thereof by the Purchaser. Either (i) Purchaser's failure to allow Seller a reasonable opportunity to inspect, test or sample the goods prior to their return to Seller, or (ii) Purchaser's failure to give written notice of the defects to Seller within ninety (90) days after receipt of the goods, constitutes a waiver by Purchaser of all claims in respect to goods furnished hereunder. THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED, WHICH EXTEND BEYOND THE FACE HEREOF.

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SECTION 7.0

SAFETY PROGRAM

Centennial Development Company regards the health and safety of its employees as the number one priority on all construction projects and will establish and maintain a safety and healthy work environment for its employees.

This is achieved by the use of properly maintained equipment, a full understanding of tasks and hazards involved, thorough education and training, and the full cooperation of all employees in adherence to safety regulations and policies.

As a key element in the safety program the project superintendent will be certified as a mine foreman and will also be an MSHA certified instructor for:

- First Aid
- Mine Rescue
- Part 48, Title 30 CFR
- Part 75, Title 30 CFR
- Part 77, Title 30 CFR

Project responsibilities and additional safety procedures:

- Coordinating with the Soldier Creek Coal Company's mine safety staff.
- Complying with Federal, State, Soldier Creek, and Centennial Safety Regulations.
- Implementing and conducting project safety program.
- Making regular inspections of contractor work areas.
- Maintaining all required records.

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- Providing contractor employee training.
- Directing the use of personal safety gear such as safety glasses, disposable respirators, and ear plugs.
- Conducting an effective Smoker Control Program consisting of posting "No Smoking signs at appropriate areas and conducting searches at irregular intervals at least once a week.

Employee training will be provided by Greg Federber (College of Eastern Utah) prior to any on-site work. Copies of each employee's training record will be kept on-site for inspection.

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SECTION 8.0VENTILATION

As the proposed rock portal entries are extended from their existing position, a permissible surface-mounted fan, creating a blowing ventilation system, will be provided. The accompanying ventilation schematic shows the fan location, air-flow directions and regulator locations.

The permissible-electric fan will be a Spendrup Model 160-30, approval Number 2G-2974A (or equivalent). The fan will provide the air through 30-inch diameter spiral-wound vent tubing and single-blade volume regulators. Controls will be installed as required. The ventilation will be checked, tested, and recorded as required.

The air flow and quantities will vary from entry to entry depending on the work being performed in each. For instance, when mucking is being done by the Wagner LHD, 11,000 c.f.m. will be regulated into that entry (see accompanying ventilation requirement sheet and Section 5.0 for the Wagner LHD unit specifications). The other two entries where diesel equipment will not be used in performing the drill and load cycles will be provided with a minimum of 3,000 c.f.m. to each entry.

Therefore, a total of 17,000 c.f.m. will be provided to the entry system. Calculations for various system pressures and a fan curve are provided for your review.

Fan Data

|              |  |
|--------------|--|
| Fan          | Spendrup 170-19-V (or equivalent)  |
| Fan Type     | Axial, reversible  |
| Fan Diameter | 28 inches  |
| Length       | 37 inches  |
| R.P.M.       | 3550   |
| H.P.         | 50   |
| Electric     | 460-volt, 3-phase, 60 Hertz  |
| Capacity     | 17,000 c.f.m. at approximately 4.18 inches of water gage, total pressure, at the longest run (worst case). |

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When blasting, the vent tubing will be set back from the face fifty (50) feet. After the blast no person will enter the mine for a minimum of fifteen (15) minutes or until all noxious or poisonous gases have cleared.

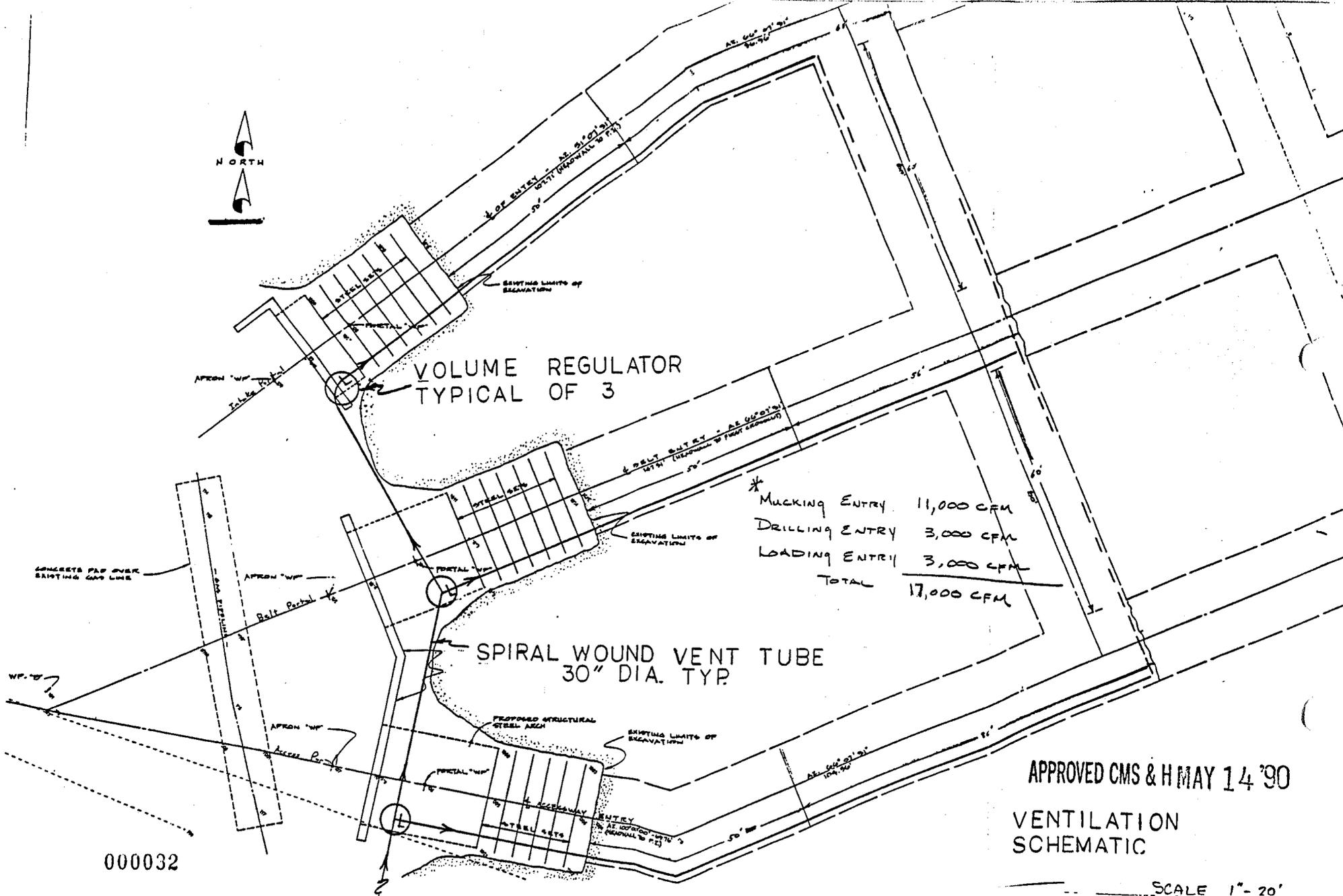
All of the applicable provisions of Soldier Canyon's mine ventilation plan and CFR 30 Section 75.316 shall be followed.

Sufficient ventilation will be provided which will meet or exceed the amount specified on the equipment approval plate.

During idle shifts the fan will be turned off. Before any working shift, the auxiliary fan will operate a minimum of fifteen minutes prior to the pre-shift examination.

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|                 |            |
|-----------------|------------|
| * MUCKING ENTRY | 11,000 CFM |
| DRILLING ENTRY  | 3,000 CFM  |
| LOADING ENTRY   | 3,000 CFM  |
| TOTAL           | 17,000 CFM |

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VENTILATION SCHEMATIC

SCALE 1" = 20'

000032

SECTION 9.0

RESPIRABLE DUST SUPPRESSION

|                  |   |
|------------------|---|
| Drilling         | Water will be supplied to each drill machine. All drilling will be wet.                                       |
| Mucking          | After each blast the muck pile, entries, and surface travelways will be wet down or kept in a damp condition. |
| Ventilation      | Each entry will be adequately ventilated. (See Section 8.0.)  |
| Safety Equipment | Dust respirators will be provided.  |

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## SECTION 10.0

### ROOF AND RIB SUPPORT

The existing mine portals shall be excavated from their present location using short rounds and controlled blasting techniques. Initial roof support shall consist of steel sets installed on 4-foot centers. If ground conditions improve, where steel sets are no longer required, the roof support will consist of 5-foot resin bolts on 4-foot x 4-foot centers. Mats and/or chain link fencing shall also be installed, if required. With improved ground condition the depth of the rounds may be lengthened from 4.5 feet to 6.5 feet per blast round. Blast rounds will not exceed 6.5 feet.

The sequence of temporary to permanent roof support is as follows.

The back and ribs will be checked and scaled while under existing roof support. The previous two existing steel sets will be equipped with a set of temporary steel slide booms for temporary roof support. The steel slide booms, spaced along the crown, will then be extended, positioned, and blocked with fire proofed timber from underneath the existing steel sets. This will provide immediate support and prevent air slacking and caving conditions. Three conceptual drawings of the slide booms are enclosed and entitled " Temporary Roof Support"; Plan view, Section A-A, and Sections B-B/C-C.

The steel arch system is described as follows.

A Dosco four-piece steel arch system will initially be utilized for permanent roof support. Dimensions for the North Intake Entry are shown on drawing RSJ 6-inch x 5-inch. Dimensions for the Center Belt Entry and South Access Entry will be scaled down as shown on drawings No. RSJ 5-inch x 4-1/2 inch.

Arches are to be placed on approximately four-foot centers. Each individual arch shall be connected to the preceding arch with tie rods, and properly blocked in accordance with the manufacturer's specifications. All timber blocking used will be flame proof treated. Data sheets on the flame proofing are included.

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Where arches are being installed, the entry shall be advanced at a rate that would facilitate the installation of one arch only (no more than five feet from the last arch). Installation of the arch shall then be accomplished with workmen remaining under the previously installed arch or temporary installed support.

The bolting system is described as follows.

The roof bolting support system for improved ground conditions will consist of 7/8-inch x 5-foot resin bolts placed on 4-foot x 4-foot centers. These bolts shall be installed with 6-inch x 6-inch x 3/16-inch bearing plates. Roof mats and/or chain link fencing shall also be installed. The bolts will be manufactured by Mikco Industries of Helper, Utah. They shall meet the ASTM F 432-88 specification. Bolts shall be installed in 1 3/8-inch holes drilled by jackleg or stoper drills. A typical roof bolting pattern is shown in the drawing entitled "Roof Support For 14 x 24 Entry". Dupont Fasloc 1 1/4-inch diameter Polyester Resin H cartridges shall be used. There will be sufficient resin to fully enclose the total bolt length. Rib control measures shall also be taken. The method of rib control shall be 5-foot split set bolts placed on a spot pattern. The split set bolts shall be as manufactured by Ingersoll Rand Series SS-39. Split set bolts will not be used for roof support. Mats and/or chain link fencing shall also be installed if conditions warrant. Bolt and resin specifications are enclosed.

Bolts will be tested in accordance with 75.204.

Bolt holes will be drilled, using drill jumbo and/or jackleg drills. Temporary roof supports during bolting will be provided by installing roof jacks or using the steel-slide booms. We are in the process of installing a set of hydraulic cylinders on our Gardner-Denver two-boom drill jumbo. This would allow the jumbo to also remotely install temporary roof support. A conceptual drawing of the jumbo is enclosed and entitled "Drill Slide & Remote Temporary Roof Jack Combination".

The typical roof bolting pattern shown in the drawing "Roof Support For 14 x 24 Entry" illustrates the minimum plan, and this drawing assumes the best conditions.

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The sequence would involve the installation of temporary supports from either rib toward the center with the centermost support being the last installed. This would allow the miner to be in a supported area at all times using a permanent support and the rib at first then maintaining a position where a permanent support and a jack or boom are protecting him at all other times.

Jacks would be pre-set near the proper height, this will insure the least exposure possible required to position the jack. The tightening procedure would be performed using a ratchet handle long enough to allow the miner to work from under permanent supports.

Drilling would be performed from right rib to the left, left rib to the right, or both sides to the center. To perform this operation, the miner would stand in a position as near the permanent support as possible while collaring the hole. The miner would then stand under permanent support during the drilling procedure.

The entire row of bolts would have to be installed before any one would be allowed to remove a temporary support or advance to the next row. This work will always be performed within five feet of the installed permanent support or rib.

To advance the temporary supports, the supports nearest the ribs would be moved first in the same manner described earlier. Each temporary support would be advanced moving from the ribs toward the center of the entry. A ratchet long enough to allow the miner to stay under permanent supports would be used while installing and relieving tension on the jack.

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One or more types of temporary support may be installed at one time depending on existing conditions encountered. See the drawings entitled "Temporary Roof Support" - Plan View, Section A-A, Section B-B/C-C and drawing "Drill Slide and Remote Temporary Roof Jack Combination".

Roof Support Materials

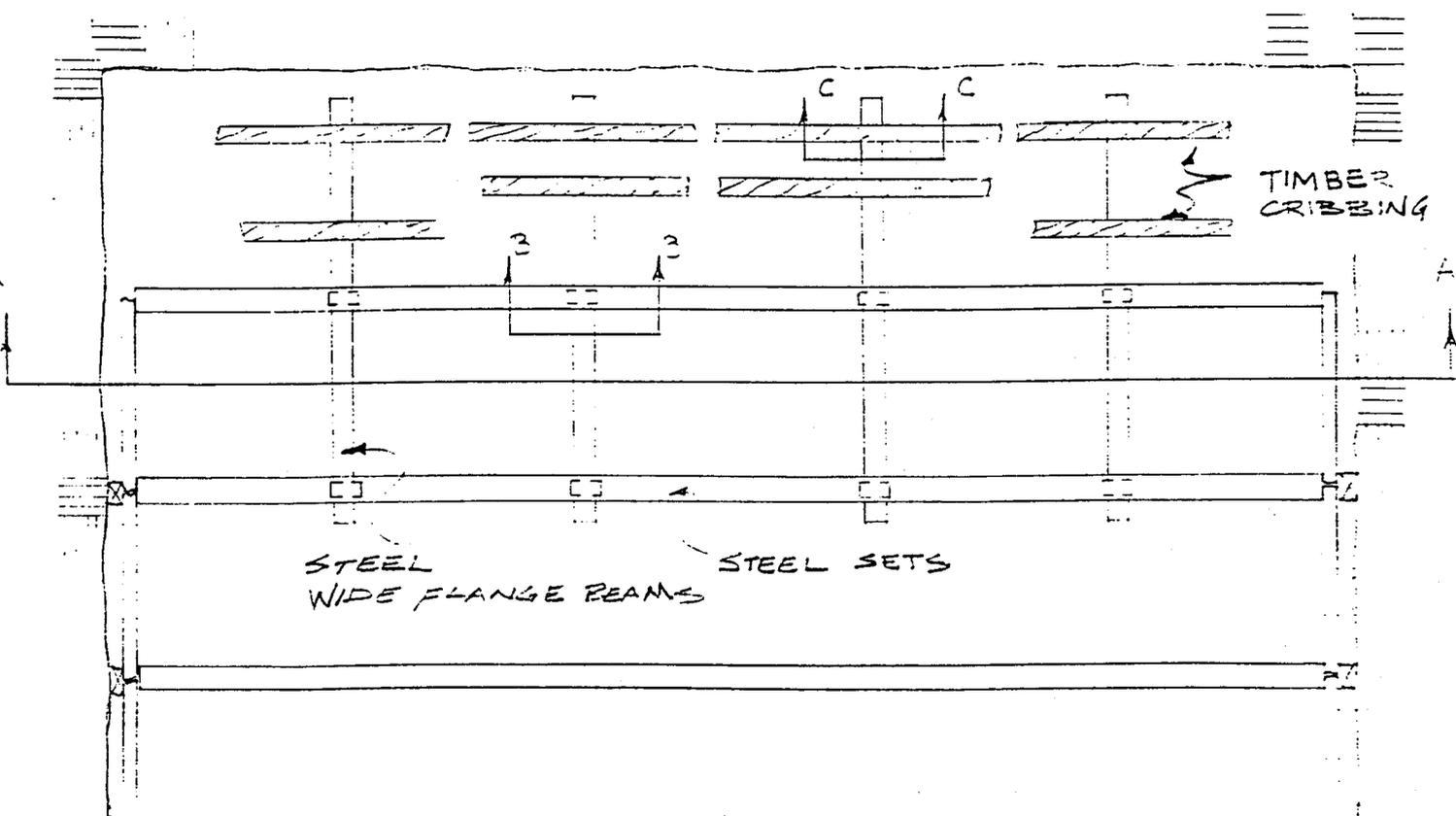
Diameter - 7/8 inch  
Length - 5-foot minimum  
Steel - ASTM F 432-88  
Hole Diameter - 1 3/8 inches  
Bearing Plates - 6-inch x 6-inch x 3/16-inch  
Anchorage - Resin Grouted Dupont Fasloc 1 1/4 H  
cartridges.  
Data sheets are included.

All of the applicable provisions of Soldier Canyon's approved Roof Control Plan shall be followed.

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SOLDIER CREEK PORTALS  
TEMPORARY ROOF SUPPORT



PLAN VIEW

APPROVED CMS & H MAY 14 '90

000038

CALCULATIONS AND DESIGN DATA

PREPARED BY

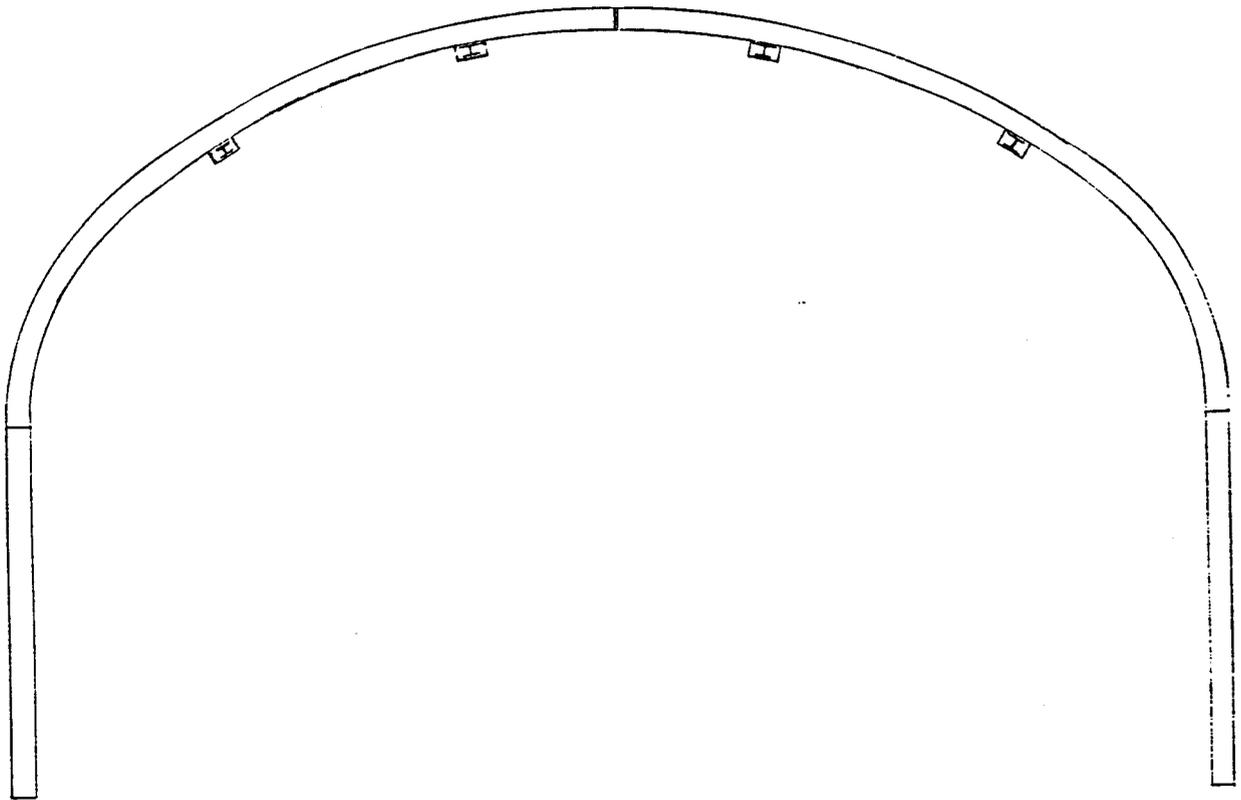
SUBJECT

SOLDIER CREEK PORTALS  
TEMPORARY ROOF SUPPORT

DATE

SHEET

OF



SECTION A-A

APPROVED CMS & H MAY 14 '90

000039

CALCULATIONS AND DESIGN DATA

PREPARED BY

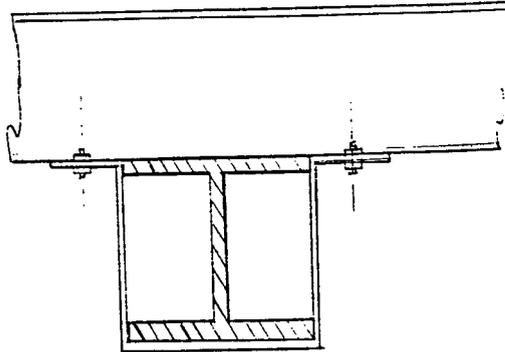
SUBJECT

SOLDIER CREEK PORTALS  
TEMPORARY ROOF SUPPORT

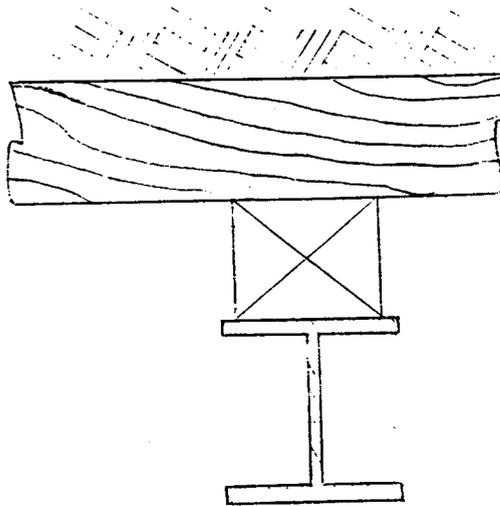
DATE

SHEET

OF



SECTION B-B



SECTION C-C

APPROVED CMS & H MAY 7 1900

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PROPOSED  
ENTRY  
CONTINUATION  
TYP. OF 3

EXISTING  
ENTRY  
TYP. OF 3

PLAN VIEW  
PORTAL DETAIL

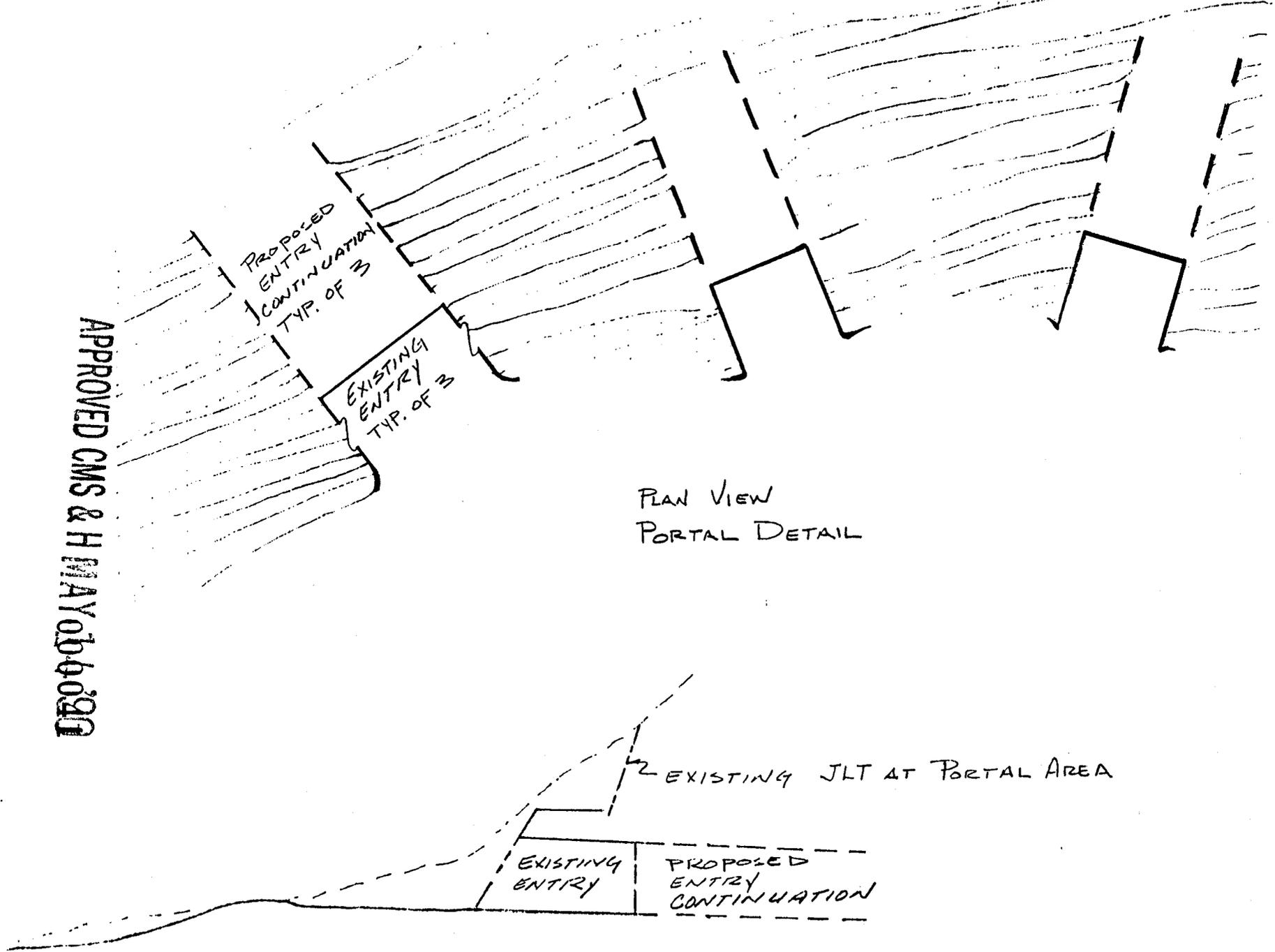
EXISTING JLT AT PORTAL AREA

EXISTING  
ENTRY

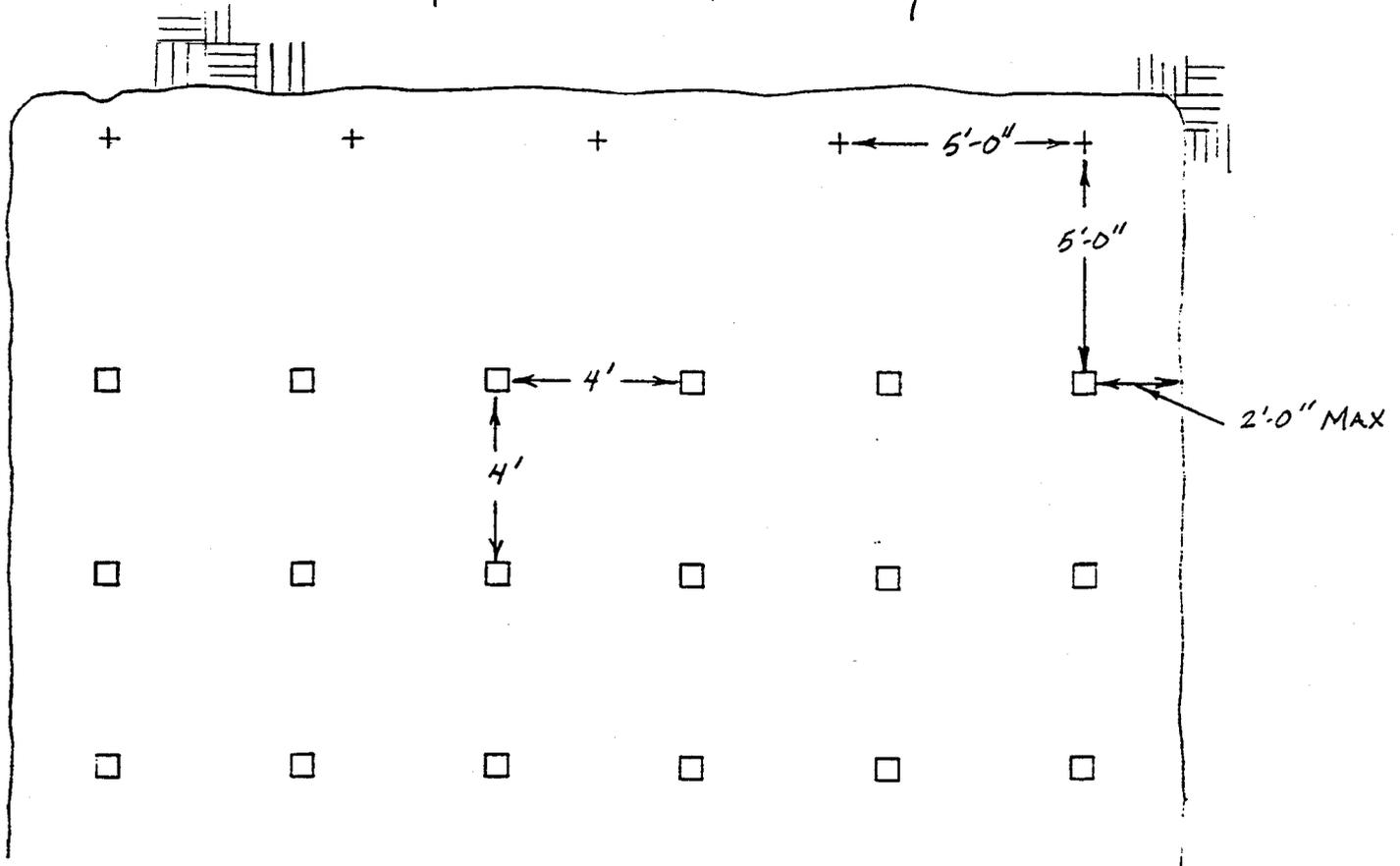
PROPOSED  
ENTRY  
CONTINUATION

CROSS SECTION

PORTAL DETAIL



INTAKE ENTRY  
 ROOF SUPPORT  
 FOR 14' x 24' ENTRY



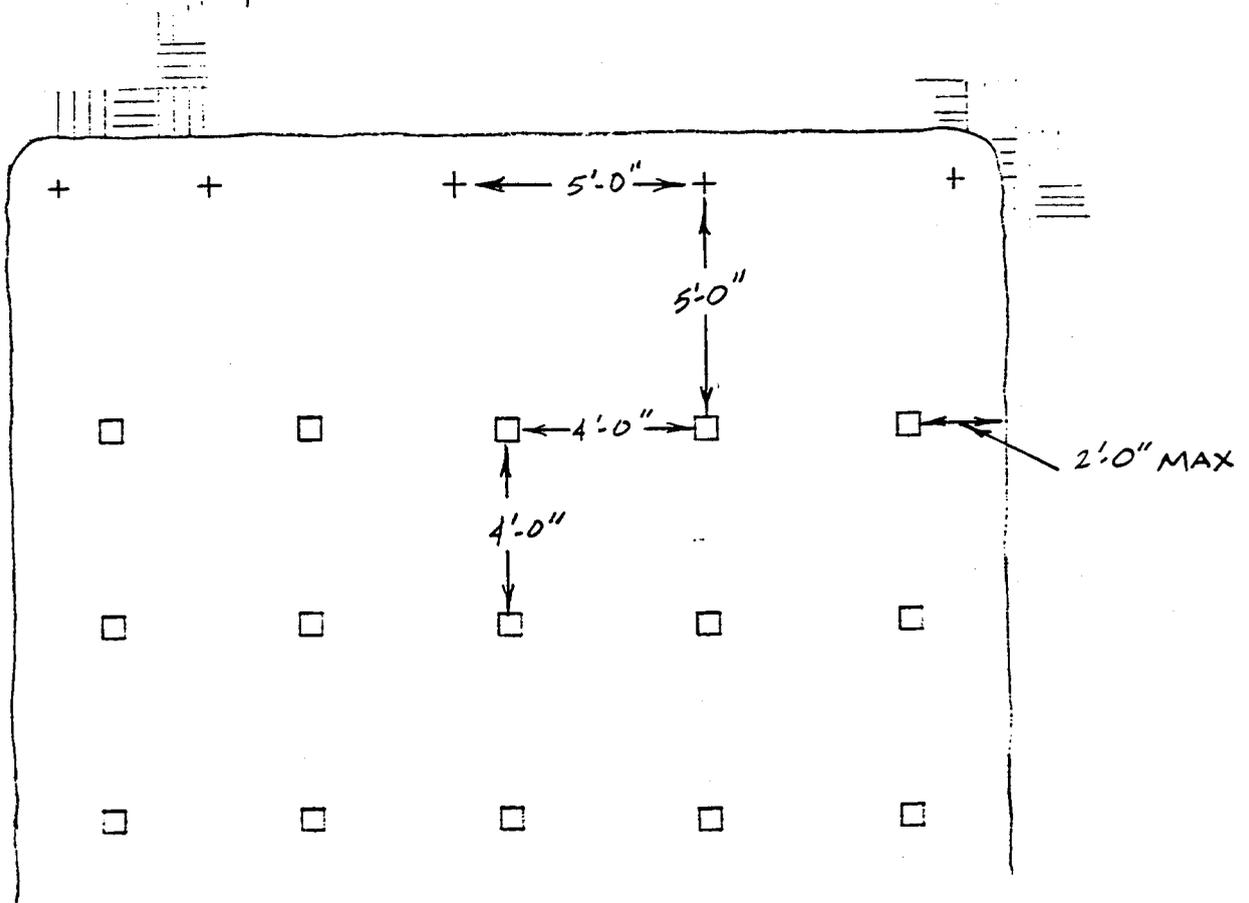
+ TEMPORARY ROOF SUPPORT

□ ROOF BOLT INSTALLED

- SEQUENCE OF BOLT INSTALLATION MAY VARY.
- TEMPORARY ROOF SUPPORT IS SPACED AT 5 FT FROM PERMANENT SUPPORT TO FACILITATE MAT INSTALLATION IF REQUIRED.

APPROVED CMS & H MAY 14 '90 000042

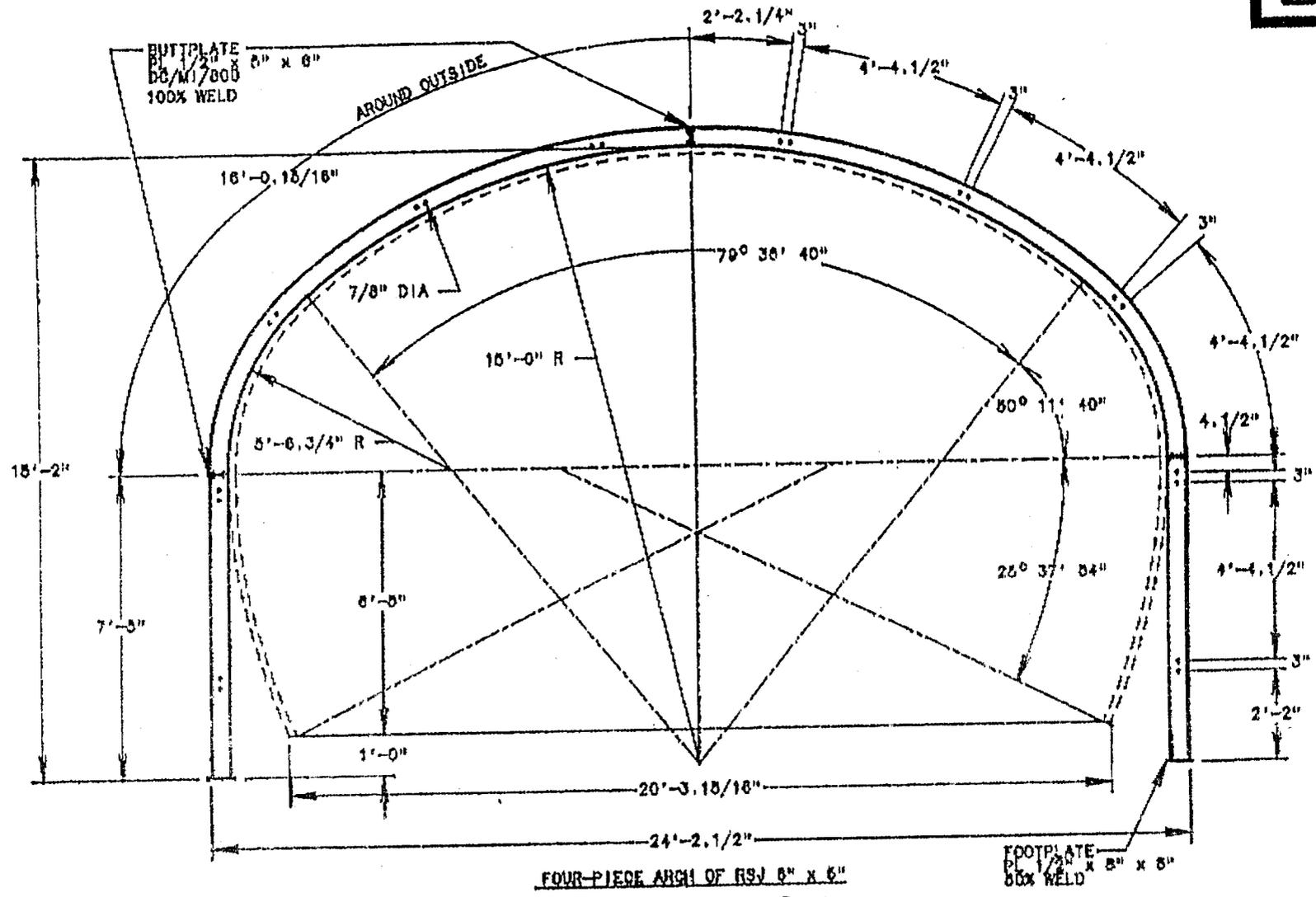
BELT & ACCESS ENTRIES  
 Roof Support  
 FOR 11' x 20' ENTRIES



- + TEMPORARY ROOF SUPPORT
- ROOF BOLT INSTALLED

- SEQUENCE OF BOLT INSTALLATION MAY VARY.
- TEMPORARY ROOF SUPPORT IS SPACED AT 5 FT FROM PERMANENT SUPPORT TO FACILITATE MAT INSTALLATION IF REQUIRED.

APPROVED CMS & H MAY 14 000043



FOUR-PIECE ARCH OF RSJ 6" X 5"

APPROVED CMS & H MAY 14, 1990  
 000044

|  |                 |        |              |
|--|-----------------|--------|--------------|
| <b>THE DOSCO CORPORATION</b><br>P.O. Box 324<br>Subsection of Rt. 609 & 704<br>Abingdon, Virginia 24210 (703) 626-4157 |                 |        |              |
| <b>FOUR-PIECE ARCH OF RSJ 6" X 5"</b>  |                 |        |              |
| DATE   | DR. BY          | CHK BY | SCALE        |
| 11-29-89   | JAS             |        | 1/4" = 1'-0" |
| REF NO.  | / SOLDIER CREEK |        |              |
| DWG NO.  | DC/AS/1500 A    |        |              |

Important Notice: Any and all design, plans, drawings, specifications, advice relative to perfection and safety conditions, and all other technical and engineering services which we may have furnished or may hereafter furnish with reference to this matter or the project to which it relates are furnished solely for your review and approval and the review and approval of your engineers. We make no representation or warranty with respect to the accuracy or suitability of any of such documents, advice, or services, nor shall we have any liability of any kind of nature with respect hereto, whether or not so reviewed and approved by you or your engineers.

Important Notice: This print and all information shown herein is the property of The Dosco Corporation, its confidential and is not to be made available to other than the party(ies) to whom it was originally supplied, and its furnished with the clear understanding that neither it, nor any part, is to be copied in any manner nor used to the disadvantage of the above company. It is returnable immediately on demand.

SEPT. 20, 1969

REF. : DC/AS/1500A

ARCH LOAD CALCULATIONS : (ARCH OF RS 16X5 @ 25" GR. 60)

|         |   |                           |
|---------|---|---------------------------|
| WHERE : | $f_y$ - YIELD STRENGTH OF MATERIAL =      | 60000 P.S.I.              |
|         | $f_a$ - ALW. STRESS (.75 $f_y$ ) =        | 45000 P.S.I.              |
|         | $A$ - AREA OF SECTION =                   | 7.38 IN. <sup>2</sup>     |
|         | $Z$ - SECTION MODULUS =                   | 14.56 IN. <sup>3</sup>    |
|         | $c$ - DIST. BETWEEN BLKG. PTS. =          | 24 IN.                    |
|         | $R_1$ - OUTSIDE RADIUS (ROOF BEAM) =      | 166 IN.                   |
|         | $R_2$ - OUTSIDE RADIUS (LEG BEAM) =       | 72.75 IN.                 |
|         | $S$ - RIB SPACING =                       | 4 FT.                     |
|         | $h_1$ - RISE BETWEEN BLKG. PTS. ( $R_1$ ) |                           |
|         | $h = .5\sqrt{(4c^2) - (c^2)}$ =           | 0.3875004209 IN.          |
|         | $h_2$ - RISE BETWEEN BLKG. PTS. ( $R_2$ ) | 0.9565157640 IN.          |
|         | $W$ - OUTSIDE WIDTH OF ARCH =             | 24.2 FT.                  |
|         | $W_m$ - UNIT WEIGHT OF MATERIAL =         | 160 LBS./FT. <sup>3</sup> |
|         | $T_a$ - ALLOWABLE THRUST                  |                           |
|         | $H_p$ - VERTICAL LOAD IN FT. OF ROCK      |                           |

ALLOWABLE THRUST OF ARCH : (ROOF BEAM)

$$T_a = \frac{f_a \cdot A \cdot Z}{Z + (.85 \cdot h \cdot A)} = \underline{263450.92642 \text{ LBS. ALLOWABLE THRUST}}$$

ALLOWABLE THRUST OF ARCH : (LEG BEAM)

$$T_a = \frac{f_a \cdot A \cdot Z}{Z + (.85 \cdot h \cdot A)} = \underline{231039.55668 \text{ LBS. ALLOWABLE THRUST}}$$

USE LOWER OF ABOVE ALLOWABLE THRUST FIGURES WHEN CALCULATING ARCH CAPACITY

VERTICAL LOAD RATING IN FEET OF COVER :

$$H_p = \frac{T_a}{5 \cdot R \cdot W_m} = \underline{26.845339450 \text{ FEET OF COVER}}$$

ABOVE CALCULATIONS ASSUME RIBS TO BE BLOCKED ON 24" CENTERS AND SET ON 4 FT. SPACING

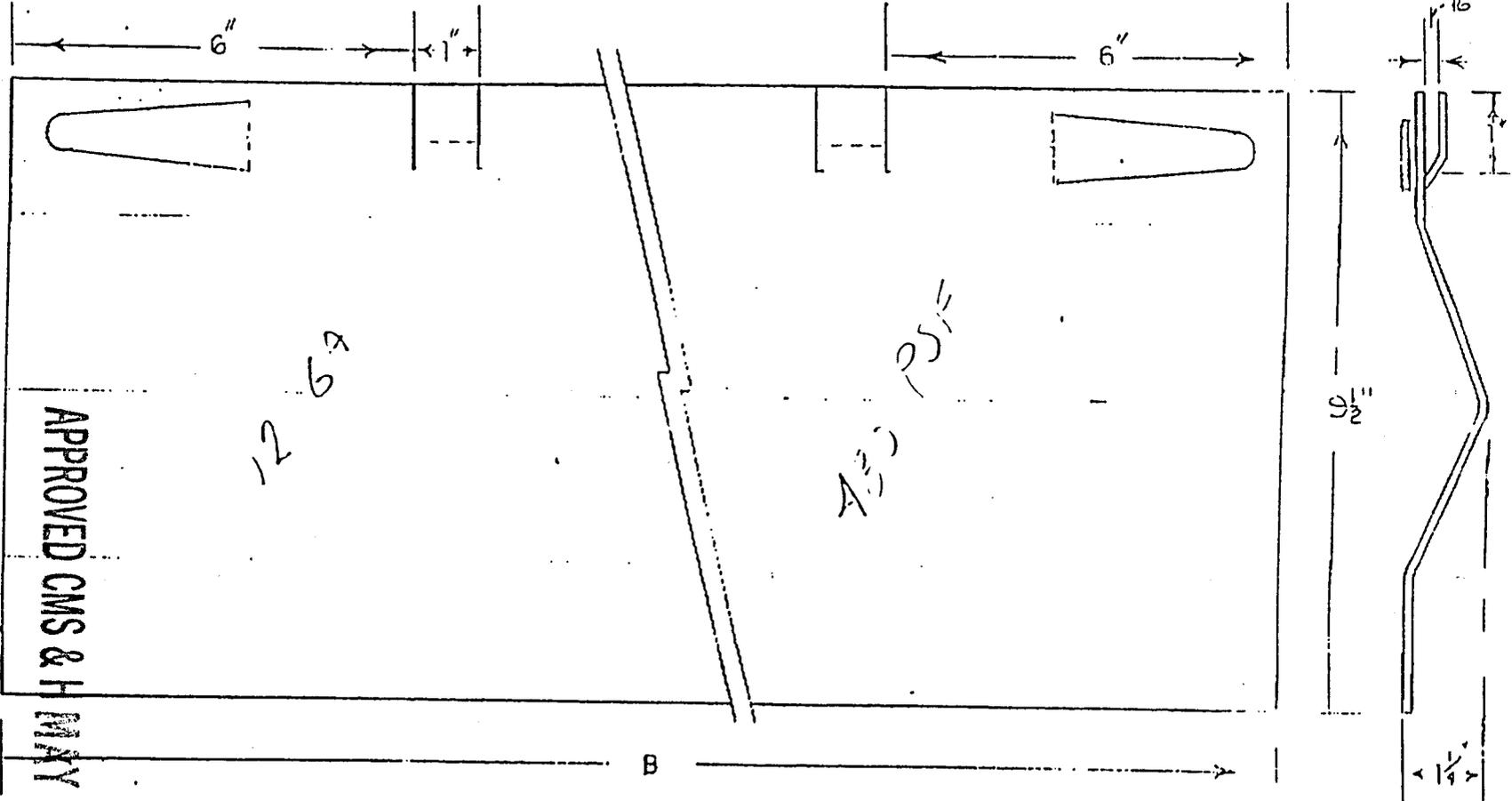
CALCULATIONS BY : M. WALKER, SR. DESIGN ENGINEER

~~APPROVED~~ *MS* ~~24~~ *MAY 14 '90*

000045

GAUGE & FINISH TO SUIT SPECIFICATION.

Important Notice: Any and all designs, plans, drawings, specifications, or other technical and engineering services which we may have furnished or may hereafter furnish with reference to this matter or the project to which it relates are furnished solely for your review and approval and the review and approval of your engineers. We make no representation or warranty with respect to the accuracy or sufficiency of any of such documents, advice or services, nor shall we have any liability of any kind or nature with respect hereto, whether or not so reviewed and approved by you and your engineers.



12 GA. LAGGING

AREA OF SECTION = 1.64 IN.<sup>2</sup> SECT. MODULUS = .386 IN.<sup>3</sup> MOMENT OF INERTIA = .211 IN.<sup>4</sup>

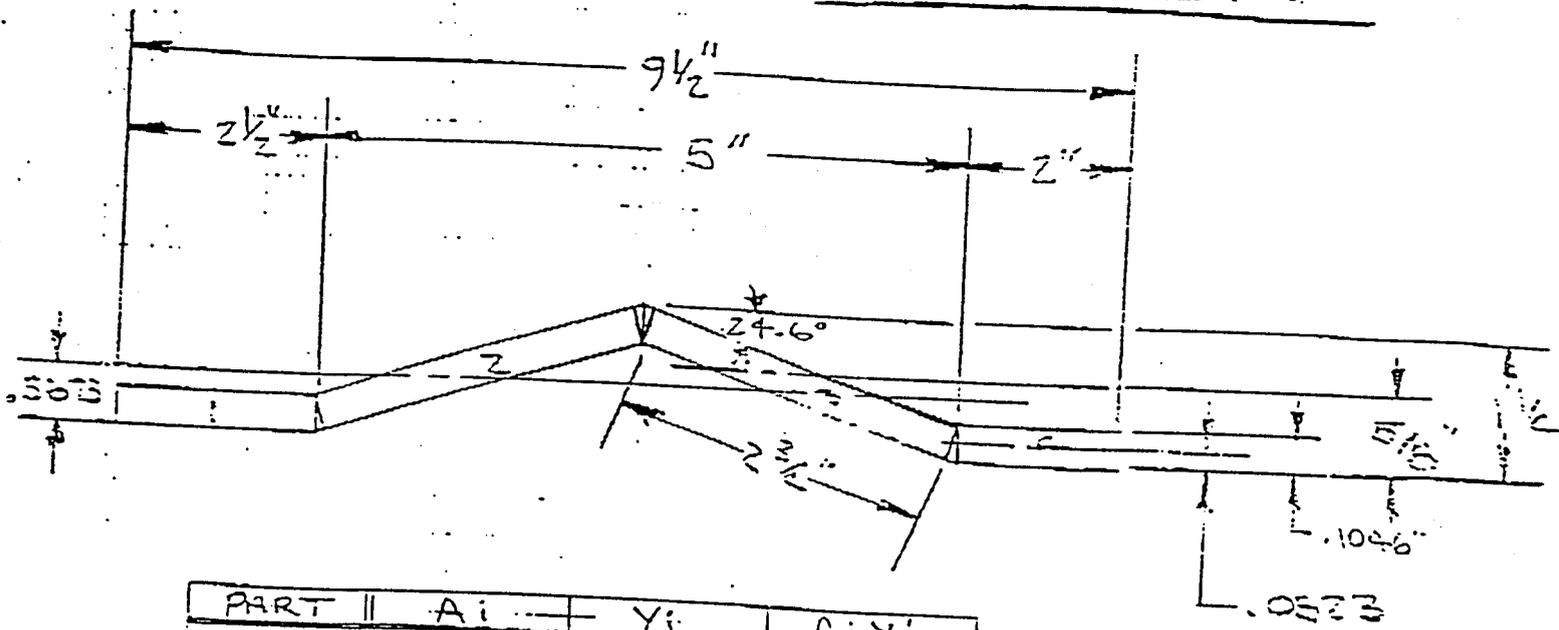
12 GA. LAGGING

AREA OF SECTION = 1.05 IN.<sup>2</sup> SECT. MODULUS = .879 IN.<sup>3</sup> MOMENT OF INERTIA = .139 IN.<sup>4</sup>

Box 206-J  
Section of Route 609 & 704  
ROSDEN, VIRGINIA 24210

(703) 628-4157

12 GA. LAGGING



| PART | A <sub>i</sub> | Y <sub>i</sub> | A <sub>i</sub> Y <sub>i</sub> |
|------|----------------|----------------|-------------------------------|
| 1    | .2615          | .0523          | .0137                         |
| 2    | .2876          | .625           | .1798                         |
| 3    | .2876          | .625           | .1798                         |
| 4    | .2092          | .0523          | .0109                         |
|      | 1.0459         |                | .3842                         |

$$\bar{Y} = \frac{\sum A_i Y_i}{A_T} = \frac{.3842}{1.0459} = .3673''$$

$$I_1 = \frac{bh^3}{12} = \frac{2.5 \times 1.046^3}{12} = .000238$$

$$I_{33} = \frac{bd}{12} (d^2 \cos^2 \alpha + b^2 \sin^2 \alpha)$$

$$= \frac{2.75 \times 1.046}{12} (.1046^2 \cos^2 25^\circ + 2.5^2 \sin^2 25^\circ)$$

$$= .02697$$

$$I_4 = \frac{bh^3}{12} = \frac{2 \times 1.046^3}{12} = .000191$$

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TUNNELLING CHINES  
 CONTINUOUS MINERS  
 ROOF SUPPORTS & OVERCASTS

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 DON, VIRGINIA 24210

12 GA.

$$\begin{aligned}
 I_T &= I_1 + A_1 d_1^2 + I_2 + A_2 d_2^2 + I_3 + A_3 d_3^2 + I_4 + A_4 d_4^2 \\
 &= .000233 + (.2615 \times .315^2) + .02697 + (.2876 \times .2577^2) + .02697 + \\
 &\quad (.2876 \times .2577^2) + .000191 + (.2092 \times .315^2) \\
 &= .000233 + .02595 + .02697 + .019099 + .02697 + .019099 + .000191 + \\
 &= .139277 \qquad \qquad \qquad .000191
 \end{aligned}$$

$$Z = \frac{I}{Y} = \frac{.139277}{.3673} = .379 \text{ IN.}^3$$

$$S = \frac{WL}{8Z} \quad \therefore \quad W = \frac{8ZS}{L}$$

$$W = \frac{8 \times .379 \times 24000}{48} = 1516 \text{ LBS.}$$

$$\text{LOAD PSF} = \frac{1516}{3.167} = 480 \text{ PSF}$$

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Important Notice: Any and all designs, plans, drawings, specifications, advice relative to geological and safety conditions, and all other technical and engineering services which we may have furnished or may hereafter furnish with reference to this matter or the project to which it relates are furnished solely for your review.

## Series SS-39

### Split Set® Stabilizers.

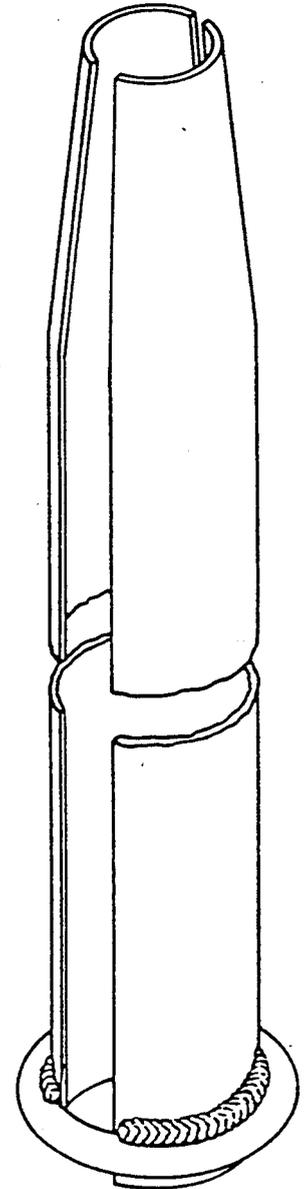
### What they are and how they work.

The patented Split Set friction rock stabilizer is a long steel tube with a slot running its full length. The upper end is tapered for ease of insertion in a drilled hole. The lower end has a welded ring flange to hold a roof plate.

A hole of slightly smaller diameter than the Split Set tube is drilled into the rock roof or rib, to a depth of at least 2 in. (50 mm) greater than the tube length. The tapered end of the tube is inserted into the hole; as it is forced in, the hole acts as a die, compressing the tube and partially closing the slot.

Compression of the Split Set tube creates a spring-like action with a radial force extending substantially along the entire contact length. This force acts between the steel and the rock to provide friction which prevents the rock layers from separating and results in the holding force of the stabilizer.

Galvanized stabilizers are also available.

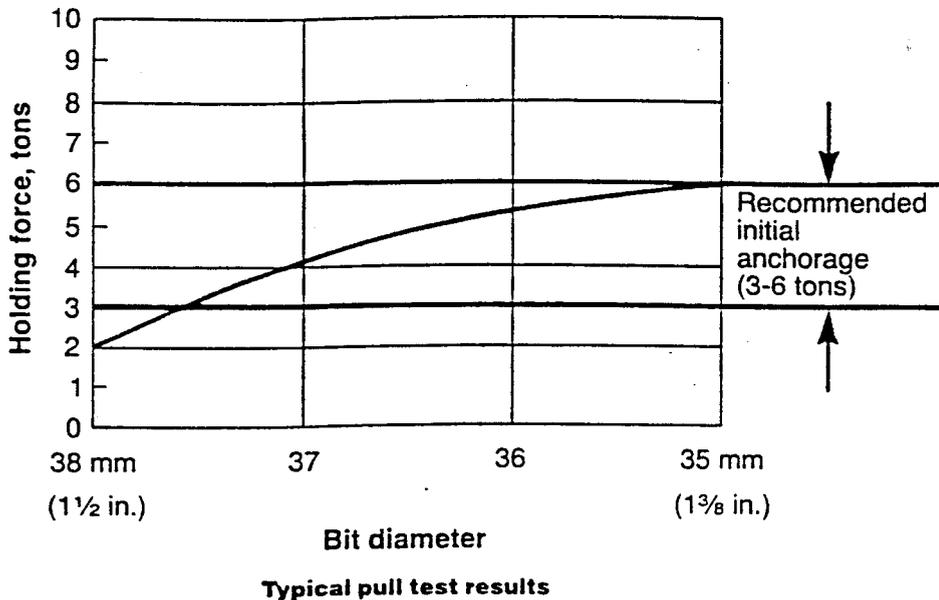


| Description    | Length            | Standard          |           | Galvanized        |           |
|----------------|-------------------|-------------------|-----------|-------------------|-----------|
|                |                   | Weight            | Comm. No. | Weight            | Comm. No. |
| Split Set tube | 30 in. (762 mm)   | 3.1 lb. (1.4 kg)  | 90320235  | 3.3 lb. (1.5 kg)  | 90322454  |
| Split Set tube | 36 in. (914 mm)   | 3.7 lb. (1.7 kg)  | 72243447  | 4.0 lb. (1.8 kg)  | 90321423  |
| Split Set tube | 42 in. (1067 mm)  | 4.3 lb. (2.0 kg)  | 90321332  | 4.6 lb. (2.2 kg)  | 90322462  |
| Split Set tube | 48 in. (1219 mm)  | 4.9 lb. (2.2 kg)  | 72243454  | 5.2 lb. (2.4 kg)  | 90321225  |
| Split Set tube | 60 in. (1524 mm)  | 6.1 lb. (2.7 kg)  | 72225287  | 6.5 lb. (3.0 kg)  | 90321233  |
| Split Set tube | 66 in. (1676 mm)  | 6.7 lb. (3.0 kg)  | 90320664  | 7.2 lb. (3.3 kg)  | 90322082  |
| Split Set tube | 72 in. (1829 mm)  | 7.3 lb. (3.3 kg)  | 72221310  | 7.8 lb. (3.6 kg)  | 90321241  |
| Split Set tube | 84 in. (2134 mm)  | 8.5 lb. (3.9 kg)  | 72236128  | 9.1 lb. (4.1 kg)  | 90321449  |
| Split Set tube | 96 in. (2438 mm)  | 9.7 lb. (4.4 kg)  | 72243462  | 10.4 lb. (4.7 kg) | 90321258  |
| Split Set tube | 108 in. (2743 mm) | 10.9 lb. (5.0 kg) | 90320656  | 11.7 lb. (5.3 kg) | 90322421  |
| Split Set tube | 120 in. (3048 mm) | 12.1 lb. (5.5 kg) | 90320649  | 12.9 lb. (5.9 kg) | 90322439  |

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drill percussive time required to drive the stabilizer versus the holding force obtained. With a given hammer and at a constant air pressure, installation time is a fairly sensitive measure of the holding force at which the stabilizer has been installed.

For example: actual percussive time of approximately 12-15 seconds with a 75-mm (3 in.) bore rock drill running at 6 bar (90 psig) generally translates to a friction force in the range of 3-6 tons. In a tight hole where driving time could be 25-40 seconds, the slip load with the same hammer might be 7-8 tons. Conversely, in a hole which is too loose, the tube can be driven in 5-6 seconds, with an anchorage of only 1-3 tons.

Establishing this data is important as it allows you later to make quick spot checks on the installation around the mine, ensuring that proper installation techniques are being used.

### Interpreting test data

After the pull tests are completed, draw a curve giving the relationship between the stabilizer's holding force and the bit size used for this particular rock.

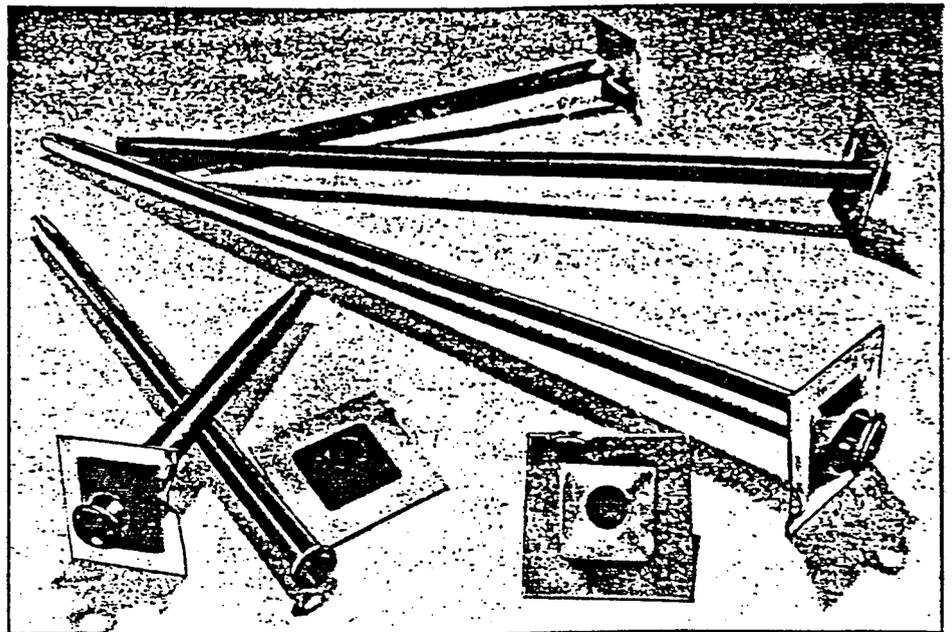
Typical pull test results for 1.5 m (5 ft.) stabilizers are shown above, but your curve may be different because of geological conditions.

Using the curve, determine the bit size to be used for Split Set stabilizer installation in that rock formation. In rock where gauge wear is not significant, choose a new bit with the diameter giving the desired holding force. Where gauge wear is a serious problem, use the test curve to establish the largest bit size that gives lowest recommended holding force; this should then be the new bit size.

As the gauge wears with use, the hole will become successively smaller and holding force will in-

crease to the point where either the bit is scrapped, or the equipment can't drive the stabilizer into the hole.

Using the test data, establish one further curve—the actual



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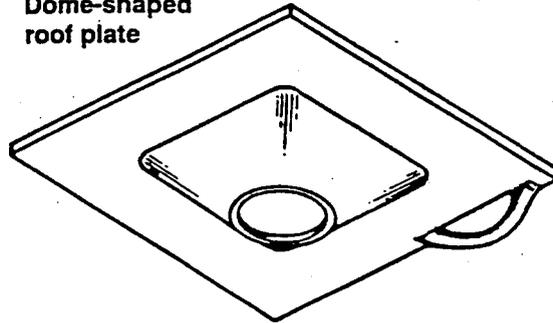
**Roof plates**

Roof plates are used to distribute the axial load of the Split Set stabilizer over a larger area of the roof and to contain roof sluffing.

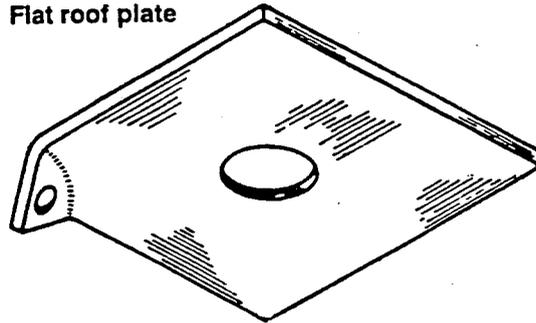
These plates slide over the stabilizers and are installed between the stabilizer flange and roof or rib surface.

The patented Ingersoll-Rand domed roof plate uniquely combines high-strength with light weight. It is an integral component of the Split Set system. Flat plates are also available.

**Dome-shaped roof plate**



**Flat roof plate**



**Description**

Dome-shaped roof plate, carbon steel  
Flat roof plate, carbon steel

**Dimensions**

6 x 6 x .16 in. (150 x 150 x 4 mm)  
5 x 5 x .16 in. (125 x 125 x 4 mm)  
5 x 5 x 1/4 in. (125 x 125 x 6 mm)  
6 x 6 x 1/4 in. (150 x 150 x 6 mm)

**Weight**

1.6 lb. (0.7 kg)  
1.1 lb. (0.5 kg)  
1.5 lb. (0.7 kg)  
2.2 lb. (1.0 kg)

**Comm. No.**

90320243  
90321514\*  
90320003\*  
90320623\*

\*Not available in USA.

**Utility hanger**

Ingersoll-Rand makes short versions of the Split Set stabilizer for use as utility hangers.

They can be used for hanging light loads such as electric cable, ventilation pipe, air line, water line, etc. They also are used to connect overlapping sections of mesh screen which holds back loose roof rock.

The maximum load capacity of the hanger is rated at 1 ton (.9 metric tons).

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| Description    | Length          | Standard         |           | Galvanized       |           |
|----------------|-----------------|------------------|-----------|------------------|-----------|
|                |                 | Weight           | Comm. No. | Weight           | Comm. No. |
| Utility hanger | 18 in. (457 mm) | 1.9 lb. (0.8 kg) | 90320631  | 2.0 lb. (0.9 kg) | 90321431  |
| Utility hanger | 24 in. (610 mm) | 2.5 lb. (1.1 kg) | 90321324  | 2.7 lb. (1.2 kg) | 90321654  |

## Application Engineering Service

The Split Set stabilizer is a unique rock stabilization and support system. It interacts with the rock differently from other roof bolts. For this reason Ingersoll-Rand offers a free application engineering service to assist you in the selection of the proper Split Set configuration for your needs. We will also assist in determining the best way to

use your existing equipment for the job, the best drilling procedure, and appropriate tools and accessories for your equipment and space limitations.

We urge you to take advantage of this service. Our sales representative will be pleased to make the arrangements.

## Installation equipment for Split Set stabilizers

Split Set rock stabilizers require percussive or vibrating insertion equipment. Many mines having air-powered or percussive machinery like jackdrills, stopers, or jumbo-mounted drifters will need only inexpensive driver tools

for Split Set insertion. Rotary roof bolters can be fitted with a vibrating drill box which can be used for both drilling and stabilizer insertion.

## Selecting the drilling procedure

An initial installed anchorage of 3 to 6 tons (2.7 to 5.4 metric tons) is generally recommended regardless of tube length. A drilling procedure should be selected which provides this anchorage in the existing rock conditions but is compatible with the equipment and space limitations on site.

The desired anchorage can often be obtained with drill bits in a range of 1 $\frac{3}{8}$  to 1 $\frac{1}{2}$  in. (35-38 mm) diameter with a 5 ft. (1524 mm) long tube. Drill the hole 2 in. (50 mm) longer than the tube. With longer Split Set tubes it may be desirable to use a stepped hole with the outer part of the hole at a larger diameter than the inner part. If space is

a problem, the outer part of the hole may have a clearance bore diameter of 1 $\frac{5}{8}$  in. (41 mm) which will permit hand insertion. However, the inner part of the hole must be sufficiently tight to assure the desired anchorage.

In some cases with extremely soft, weak rock a smaller 1 $\frac{1}{4}$  in. (32 mm) bit may give proper results. There may also be special cases in which a higher initial anchorage objective is desired.

The initial testing to select the drilling procedure should be verified by pull-testing the installed tubes. This requires pull collars, a spacer and pull-test equipment. (See the Test Equipment section.)

## Drilling the bore hole

When the drilling procedure has been selected, it should be carefully followed. The installed anchorage should be

periodically verified by a pull test. This should also be verified if a geological change is encountered.

## Inserting the stabilizer

A driver tool of the proper length and compatible with the available machinery should be selected. (See section on Driver Tools.) If there are space or machine stroke limitations, this may require a short driver tool to start and a long one to finish. An offset driver tool is also available for stopers, to permit initial driving from a low pick-up position to a height where standard driver tools can be used.

The flanged end of the tube together with the roof plate should be mounted on the driver tool and the tapered end of the tube guided into the bore hole. While maintaining machine thrust, turn on the percussor and drive the tube home. Once the plate is snug between the flange and the roof, do not continue to impact the tube. (Installation instructions are shipped with stabilizers.)

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