

# Conduit

**NEC Articles**

**300, 343, 344, 350,  
352, 356, 358**

**Standard**

**Specifications**

- **8-20.3(5)**
- **9-29.1**



# Ream Pipe



The ends of all conduits, metallic and non-metallic, shall be reamed to remove burrs and rough edges.  
8-20.3(5)

# Threading Galvanized Steel Conduit



# Threading on a Tri-pod



RICAL UNDERGROUND DIV.

8-20.3(5)  
Page 8-75

New Thread Cut Not Square

8-20.3(5)

12 11:10 AM

8-20.3(5) Field cuts shall be made square and true.



8-20.3(5)  
Page 8-75

**Coat New Threads with**  
**Galvanizing Repair Paint**



# Colloidal Copper

# 3-Piece Coupling

8-20.3(5)  
Page 8-75

**Together**



**Apart**



**Slip joints or running threads will not be permitted for coupling metallic conduit. When installing RGS conduit, and a standard coupling cannot be used, an approved 3 piece coupling shall be used.**  
**8-20.3(5)**



## Installing Copper Coat to Threads

i



# Screw It Together

12 11:21 AM

Geared Threader 2.5" to 4"

10 12:37 PM



# Conduit Spacers

28 1:45 PM



Conduit On Bridge



# Conduit In Bridge Rail



**Conduit On Bridge, Deflection**  
**Fittings, & LB's**

# Conduit Bodies



14 1:04PM



14 1:05PM



14 1:05PM



14 1:06PM

# Conduit Fittings



17 1:31PM



14



14 1:08PM



14 1:10PM



14 1:14PM



14 1:14



14 1:11PM

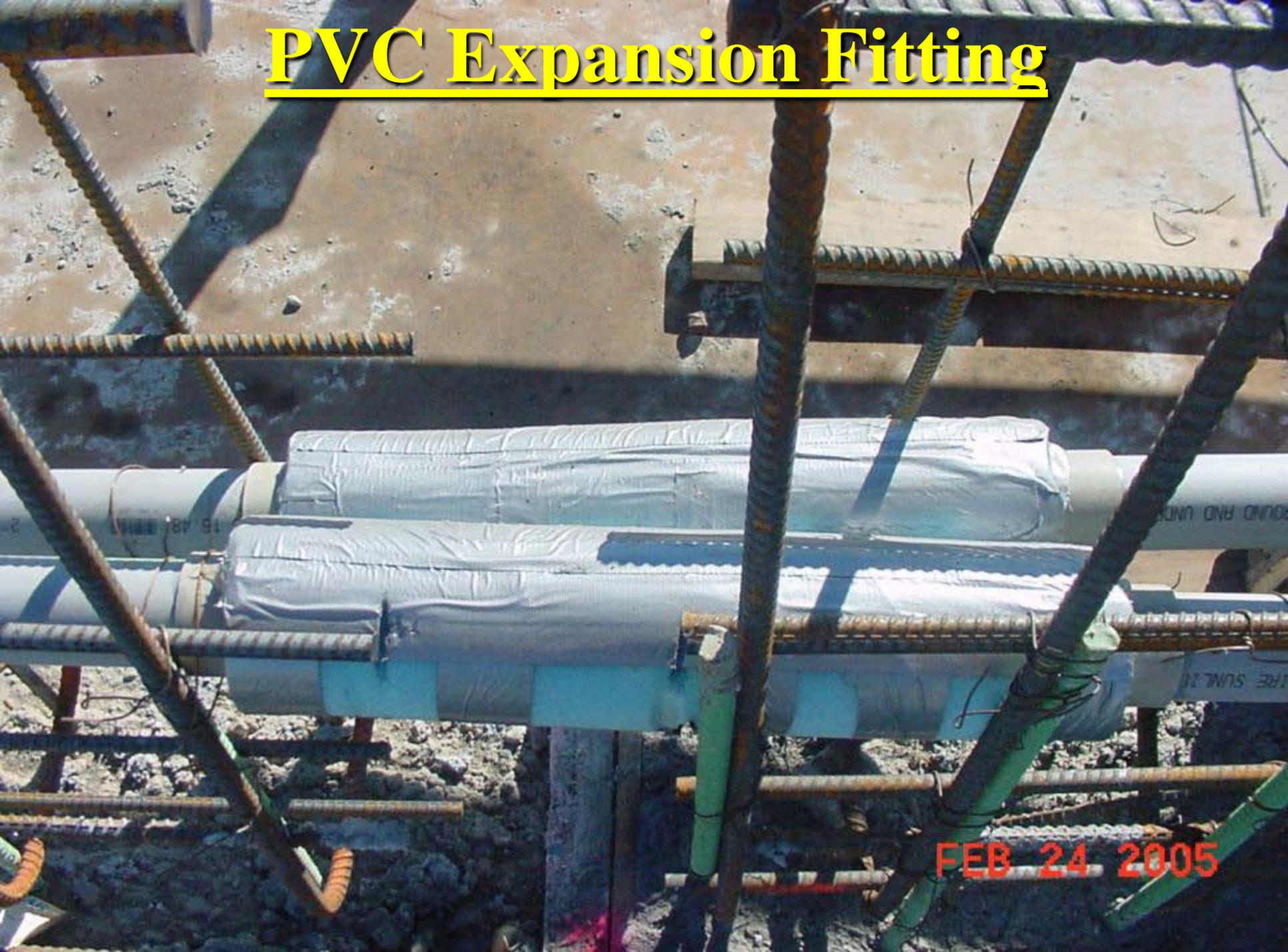
# Expansion (AX) at Bridge End



Barrier Details  
TB Type F

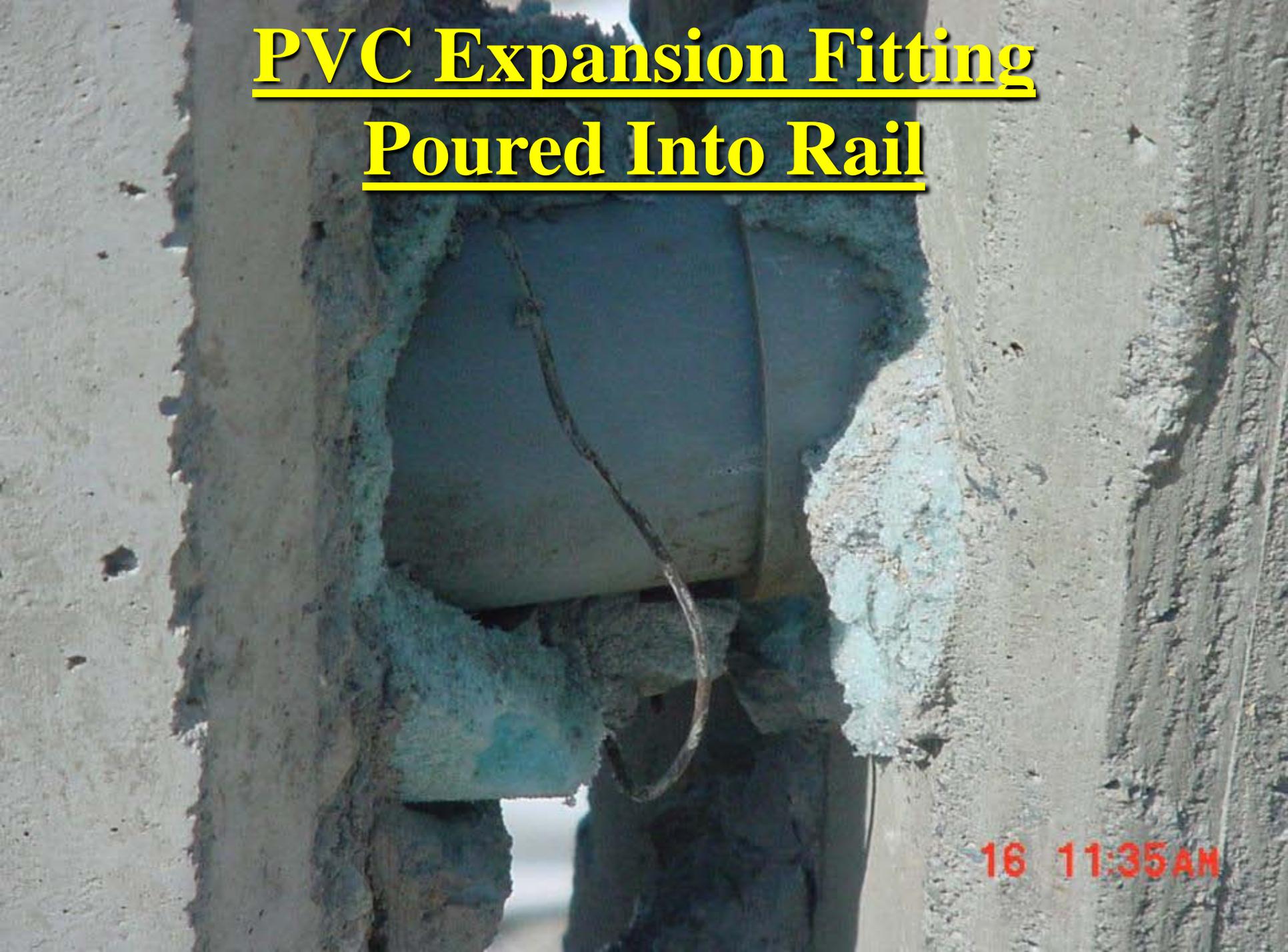
1 3:21 PM

# PVC Expansion Fitting



FEB 24 2005

# PVC Expansion Fitting Poured Into Rail



16 11:35 AM

# Deflection (DX) Fittings





**Deflection Fitting Cut In Half**



**What Is Wrong With This Picture**

10 1:47 PM

# Corrosion Resistant Tape



**Standard Plan J-16B Traffic Barrier detail sheets (Bridge sheets)**

**J-16 B**

# Corrosion Tape



# Mounted Under Bridge



# Suspended Under a Bridge





# 4 Inch Steel on Hangers



# Conduit in the Trench

Conduit ends shall be capped 8-20.3(5)



# Schedule 80 PVC



**Sand**

## Road Crossing 8-20.3(5)

1. The pavement shall be saw cut a minimum of 3-inches deep. The cuts shall be parallel to each other and extend 2 feet beyond the edge of the trench.
2. Pavement shall be removed in an approved manner.
3. Trench depth shall provide 2-foot minimum cover over the conduits.
4. Trench width shall be 4-inches or the conduit diameter plus 2-inches.
5. Trenches located within paved roadway areas shall be backfilled with controlled density fill (CDF) to the bottom of existing pavement. The pavement shall be replaced with paving material that matches the existing pavement.



**CDF**

# Conduit Placed in Foundation



# Mechanical Seals Required in Cabinet Conduits

- **NW Region Special Provisions 8-20.3(5)**
  - All conduits entering pad mounted cabinets and all conduits entering ITS hubs shall be sealed with an approved mechanical plug at both ends of the conduit run. Conduit duct seal will not be accepted. Pad mounted cabinets shall include, but not be limited to, service, signal controller, data station, CCTV, ramp meter, environmental sensor station, gate controller, cable terminal, and transformer cabinets.
- **Approved products**
  - Tyco Electronics TDUX
  - Tyco Electronics Jackmoon Triplex Duct Plug
  - O-Z/Gedney Conduit Sealing Bushing



# T-DUX Seals



SEP 30 2008

# TDUX by Tyco Electronics

**tyco**

Electronics

**TDUX**

**Inflatable Sealing System for Telephone Cable Ducts for Underground Applications**

## TELECOM OUTSIDE PLANT

TDUX is a unique inflatable wraps and duct seal systems permanently sealing telephone cable ducts, preventing leakage of water from the duct into exchange vaults or manholes. It has been developed for use in conjunction with plastic, concrete or steel ducts in all feed-through systems. It is suitable for use with polyethylene or lead-sheathed cables.

### Features

- Fast and easy to install, even in congested structures.
- Very flexible and reliable wrap around sealing system.
- Independent of duct or cable quality.
- Wide application cable range with one size.
- Seal in vacuum jacketed ducts with one of more cables.
- Can be installed while water is flowing out of the duct.
- Water and airtight up to 50 kPa.
- Environmentally friendly and non-toxic.
- Resistant to chemical and bacteria.
- Easy and fast removal.
- Different sizes are available, sealing a wide variety of ducts and cables.



**tyco**

Electronics

**TDUX**

**Inflatable Sealing System for Telephone, CATV, and Fiber Optic Cable Ducts**

## TELECOM OUTSIDE PLANT

The TDUX inflatable duct sealing system wraps around cables in the ducts of manholes or exchange vaults. The product effectively seals telephone cable ducts, stopping or preventing water from leaking into the manhole or vault.

The TDUX duct sealing system is suitable for use with polyethylene or lead sheath cables in the plastic, concrete, or steel ducts of wall feed-through systems. It permits cable movement while retaining its sealing properties. The TDUX system has been tested in severe environmental conditions, and is airtight up to 7 psi (50kPa). The TDUX system is water-tight in depths up to 16 ft. (5m).

The product can be easily and quickly installed, even in flowing water. The TDUX system is inflated with air or CO<sub>2</sub> gas, and conforms to the irregular geometry of cables and ducts. With an optional accessory kit, it can even be used in square ducts. The TDUX system is easy to remove, as well, even in adverse field conditions.

Standard kits accommodate a wide range of cable diameters, as well as empty ducts and ducts with multiple cables. TDUX is environmentally friendly: no hazardous chemicals are used to create the seal. It is made from chemical- and bacteria-resistant materials, and will provide a reliable, durable, long-lasting seal.



# Triplex and Quadplex Plugs by Tyco Electronics “Jackmoon”



## Specialty Duct Plugs

Specialty Duct Plugs

Ducts for other specialty or custom wiring applications

Specialty duct plugs are used in applications where standard duct plugs are not available. They are used to seal holes in ducts of various sizes and materials. They are available in a variety of materials, including stainless steel, aluminum, and brass. They are also available in a variety of shapes and sizes to fit different duct configurations.

Specialty duct plugs are used in a variety of applications, including:
 

- Sealing holes in ducts of various sizes and materials.
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## Triplex and Quadplex Plugs

High-Power Sealing Devices for Double-Circuit Applications



# O-Z/Gedney Conduit Sealing Bushing

RA18 Cable Terminators & Conduit Sealing Bushings RA18

## Conduit Sealing Bushings

### Type CSB Series

**1 Segmental Design (Figure 1):** Segmental pressure discs and slit neoprene sealing ring produce a come-apart design which allows the sealing bushing to be installed without having to thread it along the cable or allows installation around cables already pulled. (Include Catalog Number "SEG" to catalog number. Contact your local representative for price and availability.)

**2 Double Sealing Ring:** A second neoprene sealing ring may be added for cable support applications. Add suffix "G2" to catalog number. Contact your local representative for price and availability.

**3 Close/Short Nipples:** Short nipples which can be screwed into conduit tube or couplings. Seal fittings are then installed in the open ends of these nipples. To specify a fitting complete with nipple add "N" after Catalog Number. (Example: CSBG-200P-N).

**4 Type GL Cabinet Adapter (Figure 2):** For use with sealing bushings when exposed wires enter cabinets. Hot dip galvanized malleable or ductile iron is standard, aluminum if specified. Adapter assembly includes special smooth bore nipple, gasket and locknut. Type GL Cabinet Adapters must be ordered separately. See table for catalog numbers.

Thread length on special smooth bore nipples will accommodate 1/4" thick cabinet or structure on Type CSBG (specify if thicker than 1/4"), and up to 3/4" thickness on Types CSBE & CSB.

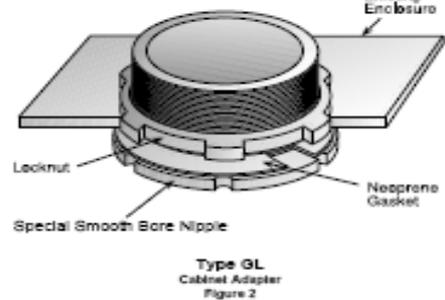
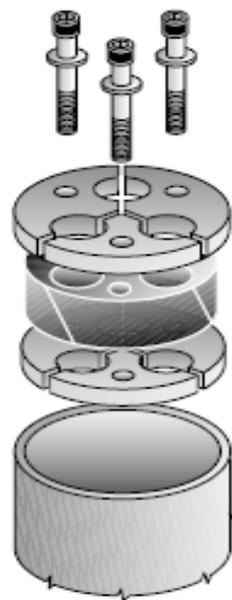
These fittings are designed for use in schedule 40 rigid conduit. For use with IMC or EMT, a short nipple of Rigid Conduit should be used to accommodate the Conduit Sealing Bushing.

Blank fittings are intended as abandonment and future use devices only. DO NOT FIELD DRILL.

**Dimensional Data:**  
See Page RA19

Conduit Size	Catalog Number
1 1/2"	GL150
2"	GL200
2 1/2"	GL250
3"	GL300
3 1/2"	GL350
4"	GL400
5"	GL500
6"	GL600

Type CSBE Segmental Design Figure 1



Existing Conduit or GL Cabinet Adapter

Existing Enclosure

Type GL Cabinet Adapter Figure 2

RA17 Cable Terminators & Conduit Sealing Bushings RA17

## Conduit Sealing Bushings

For Use with Cable in Rigid Steel Conduit and Rigid Aluminum Conduit

### Type CSB Series

**Type CSBE:** Seals against pressure from the outside of the fitting and to provide some support for the cables when fitting is used in vertical position as shown in illustration.

**Type CSBI:** Seals against fluids or gases that are inside a conduit and prevents them from entering an enclosure.

**Type CSBG:** Provides all the features of Types CSBE and CSBI and in addition prevents the sealing bushing from moving out of the end of the conduit should the internal pressure be high or if the fitting is used on conduit in an inverted position. The Type CSBG fittings are capable of sealing against gas or fluid pressure of 100 psig, (non-segmented) Type CSBI and CSBE - 50 psig (non-segmented.) Can also be supplied with Lay-In-Lug grounding wire connector, see page GA14.

**Use:**  
• These conduit Sealing Bushings are used for sealing the ends of conduit in applications involving higher static gas or fluid pressures than can be handled by standard sealing bushings.  
• For use with IMC or EMT, a short nipple of Rigid Conduit should be used to accommodate the Conduit Sealing Bushing. For Schedule 40 PVC Conduit, contact your local representative.

**Features:**  
• The complete assembly is provided with 1 or multiple holes to accommodate the size and number of cables which emerge from the conduit. When the fitting is in place and the screws are tightened, the neoprene sealing ring is compressed between the metal plates and is forced against the inside wall of the conduit and also against the cable insulation to effect a complete seal at the conduit end.

• Blank fittings are available. These are intended as abandonment devices only. Do not field drill.  
• Consult your local representative for all other applications.  
• These fittings are simple to install. They eliminate the special preparation of the end of the conduit or the compounding of the conduit thread which is required on other types of sealing fittings used to seal against high pressures.

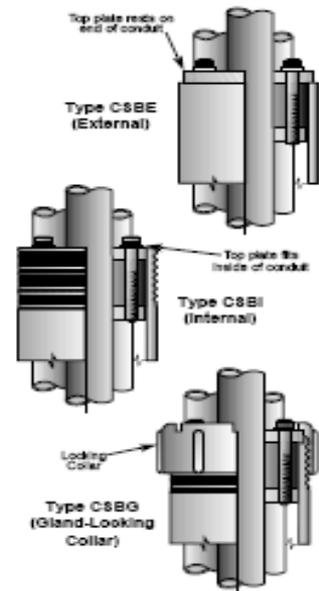
**Materials:**  
Slotted PVC coated steel discs, neoprene sealing ring and stainless steel socket head cap screws and washers. Locking collars on type CSBG are hot dipped galvanized malleable or ductile iron.

**Optional Materials:**  
Also available with aluminum or brass/bronze pressure discs (Metal Plates) on Type CSBI and CSBE bushings. To specify, substitute suffix "A" or "B" for "P" in catalog number. (Example: CSBI-200A-1) Locking Collar and Pressure Discs are also available in Aluminum or Bronze on Type CSBG Bushings. (Example (CSBG-200A-1) Consult your local representative for price and availability.

**Alternate Construction:**  
Segmented Design - Segmental pressure discs and slit-neoprene sealing ring produce a come-apart design which allows the sealing bushing to be installed without having to thread it along the cable or allows installation around cables already pulled.

Also available with slit neoprene sealing ring and one piece pressure discs.

**Third Party Certification:**  
UL Listed E-11857  
Type CSBG with aluminum pressure discs is Listed by Underwriters Laboratories, Inc. as an outlet bushing, service entrance seal or service head.



**TO ORDER SPECIFY:**  
1 Catalog Number  
2 Conduit Size  
3 Number of Cables  
4 Outside Diameters of Cables  
5 Segmented, if Required

Conduit Size	Max. Diameter of Wire Permitted - Inches				Type CSBE Catalog Number		Type CSBI Catalog Number		Type CSBG Catalog Number	
	1 Wire	2 Wires	3 Wires	4 Wires	One to Four Wires	Blank	One to Four Wires	Blank	One to Four Wires	
1 1/2"	.78	.49	.53	.44	CSBE-150P-0	CSBE-150P-1	CSBI-150P-0	CSBI-150P-1	CSBG-150P-0	CSBG-150P-1
2"	1.02	.77	.71	.61	CSBE-200P-0	CSBE-200P-1	CSBI-200P-0	CSBI-200P-1	CSBG-200P-0	CSBG-200P-1
2 1/2"	1.32	.96	.89	.78	CSBE-250P-0	CSBE-250P-1	CSBI-250P-0	CSBI-250P-1	CSBG-250P-0	CSBG-250P-1
3"	1.69	1.20	1.13	.96	CSBE-300P-0	CSBE-300P-1	CSBI-300P-0	CSBI-300P-1	CSBG-300P-0	CSBG-300P-1
3 1/2"	2.13	1.32	1.32	1.13	CSBE-350P-0	CSBE-350P-1	CSBI-350P-0	CSBI-350P-1	CSBG-350P-0	CSBG-350P-1
4"	2.57	1.83	1.51	1.26	CSBE-400P-0	CSBE-400P-1	CSBI-400P-0	CSBI-400P-1	CSBG-400P-0	CSBG-400P-1
5"	3.45	2.00	1.88	1.63	CSBE-500P-0	CSBE-500P-1	CSBI-500P-0	CSBI-500P-1	CSBG-500P-0	CSBG-500P-1
6"	4.32	2.51	2.38	2.13	CSBE-600P-0	CSBE-600P-1	CSBI-600P-0	CSBI-600P-1	CSBG-600P-0	CSBG-600P-1

†Blank fittings are intended as abandonment and future use devices only. Blank fittings cannot be field drilled.



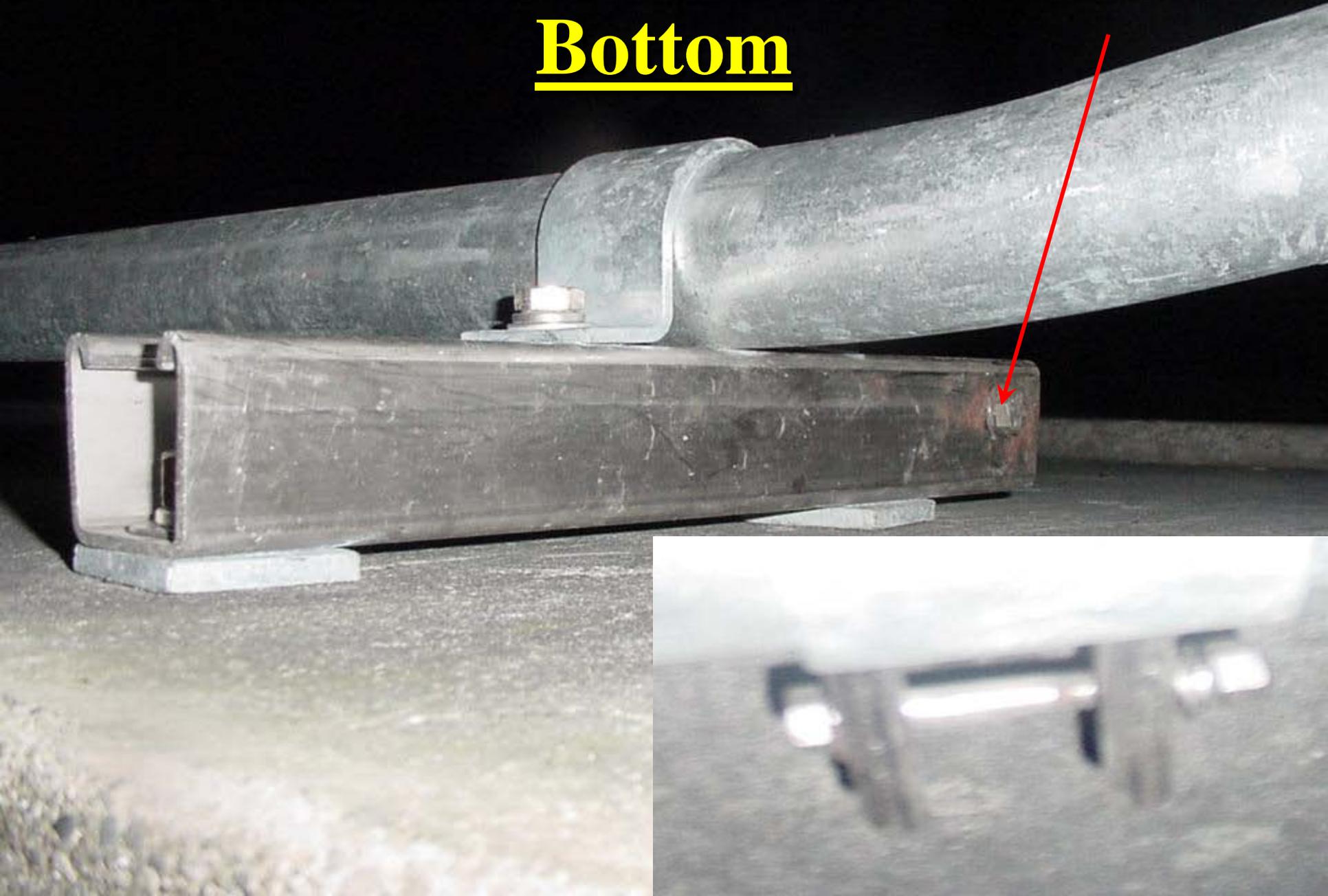
# Innerduct Plugs



# Innerduct Nipple



# Unistrut on Bridge With Bolt in Bottom



# Conduit on Unistrut



10 9:04 AM

# Conduit on Unistrut



# Surface Mounted Conduit

- Stainless Steel Struts
- Stops placed in each end of the struts
- SS or galvanized two hole straps
- Minimum 1-inch between straps
- Minimum 1-inch from strap to end of strut
- Maximum of 5 foot between struts
- Struts 1-foot longer than needed for future
- No surface mounted PVC

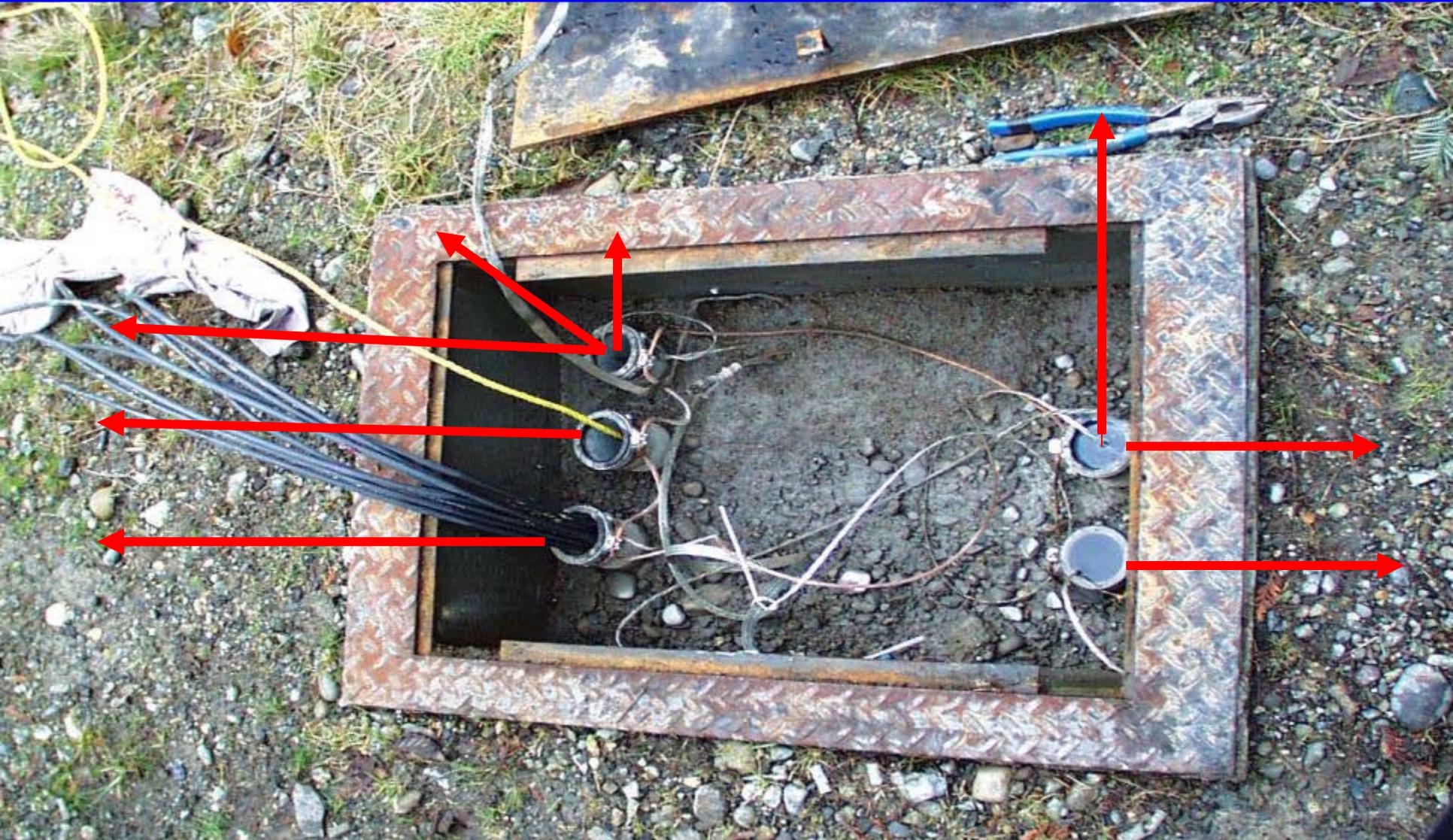
# SS Two Hole Strap



**Conduit clamps shall be two hole type straps, stainless steel or hot dip galvanized, except in marine environments, where type 316 stainless steel shall be used. 9-29.1**

# Conduit Placement

Conduits shall enter from the direction of the run and within 3-inches of the wall nearest its entry.



# Fractured Fin Back Form



# Minimal Bends Are Better



**The conduit has to be installed near the back of the box.**

# PVC in Cast in Place Bridge Rail



FEB 24 2005

FEB 24 2005

# Directional Boring Machine





# Directional Boring “Drill Heads”



**Directional Indicator  
Inserts here**

# Reamer



12 11:37 AM

# Pick Your Spot and Drill



# Vacuum Trailer Picks up Bentonite Slurry





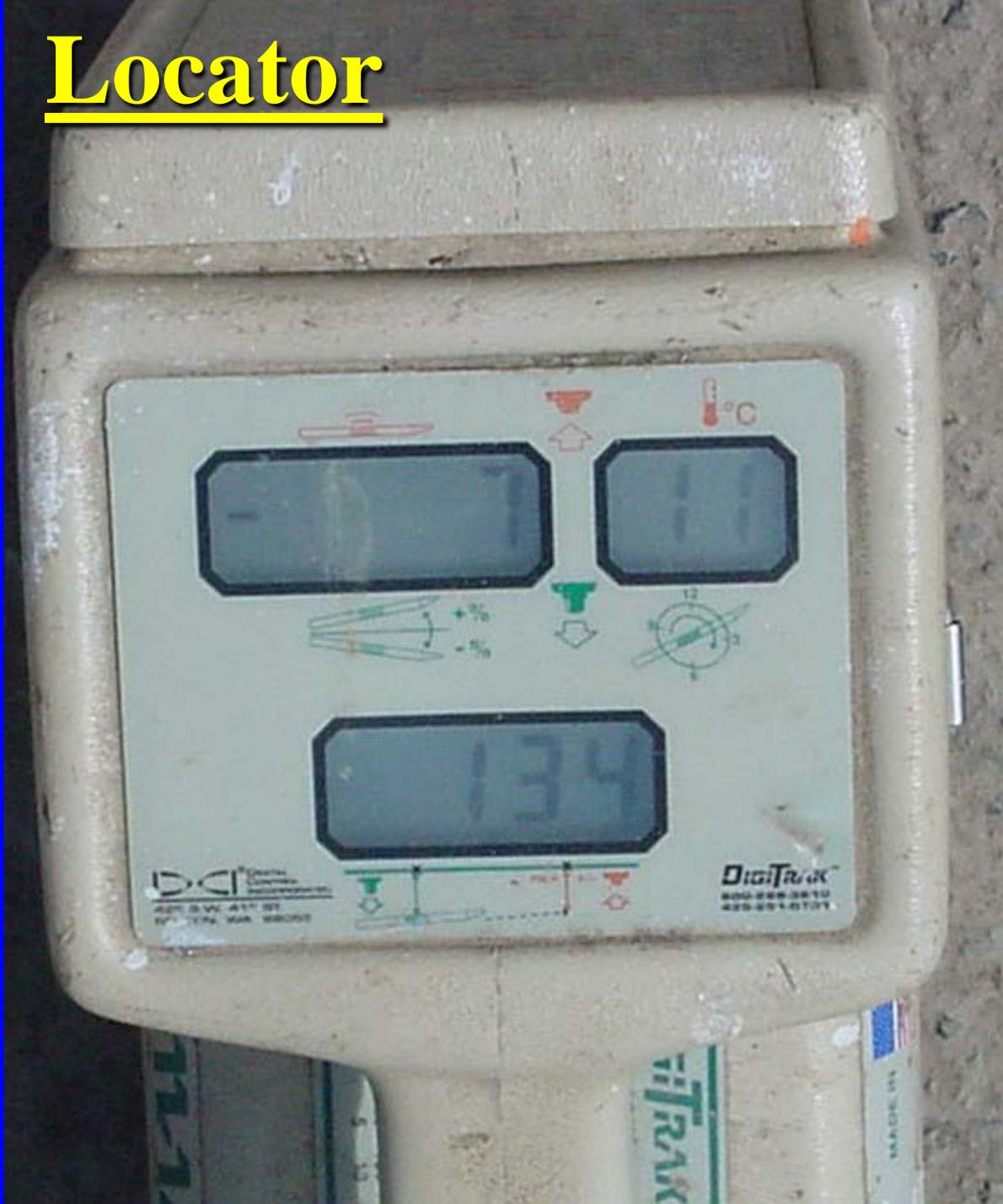
**Locator Finds Drilling Head**  
**Location**

# Locator

Headed down 7  
degrees

Spade at 11  
o clock

134 inches deep



# Universal Joint Attached to Conduit Ready to Pull It Back





Multiple Conduits in Same Bore

22:15:52 PM



**Connect 4 HDPE Conduits**

**1 - Three Inch  
3 - Two Inch  
HDPE Conduits**



**Space can be a Challenge**

28 11:28 AM

# A Tough Bore



SR 18 from Military Rd. Bridge

Direction  
Of  
Bore

Directional  
Boring  
Machine



# Pulling Back With Reamer



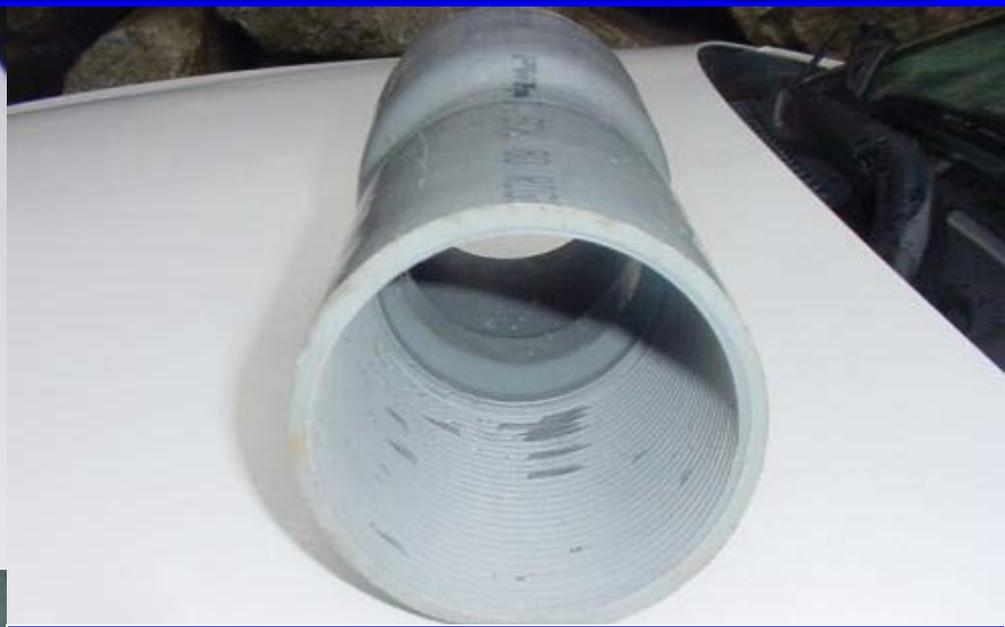
# HDPE



# HDPE Schedule 80

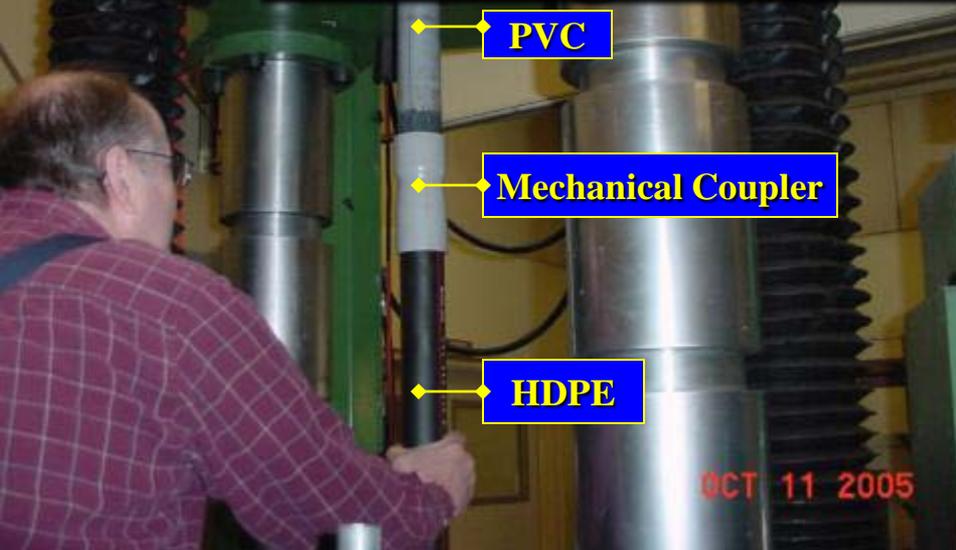
...LIC CONDUIT UNDERGROUND (HIGH DENSITY POLYETHYLENE) -- 4" IPS - SCHEDULE 80 - 7 -- C

# HDPE to PVC Mechanical Coupler



**No glue is allowed when installing the adaptors on the HDPE. Glue will soften the threads in the coupler and they will be flattened during installation. It will not be tight. Water based pulling lubricant may be used.**

# Testing Mechanical Coupler



**Top left - Set up for the test.**

**Top right - Parts after failure.**

**Bottom - Max pull at 700 lbs.  
Pulled apart at 700 lbs.**

# Innerduct in Trench, CDF, Ribbon



# Conduit Fill For New Work

(WSDOT design standard)



**26% Conduit Fill  $\rightarrow$  1 1/2" Conduit  
Conductors  $\rightarrow$  4 - #2  
 $= 0.532 \text{ in}^2$**



**Adjustment factors for more than three conductors. (310.15(B)(2)(a))**

# Conduit Fill For Adding to Existing Conduit

40% Conduit Fill  $\rightarrow$  1 1/2" Conduit  
Conductors  $\rightarrow$  4 - #2, 2 - #4, and 2 - #8  
 $= 0.838 \text{ in}^2$

Chapter 9 Table 1 Over 2 conductors NEC is 40%.

Adjustment factors for more than three conductors. (310.15(B)(2)(a))

# Conduit Fill At 60%

(NEC Charter 9 Note 4 to Table 1)

(Nipples not longer than 24")

60% Conduit Fill  $\rightarrow$  1 1/2"  
Conduit Conductors  $\rightarrow$  5 - #2,  
2 - #4, 2 - #6, 3 - #8, 1 - #10,  
and 1 - #12 = 1.232 in<sup>2</sup>

**Use for nipple fill only.** Adjustment factors for more than three conductors would apply as per NEC (310.15(B)(2)(a).