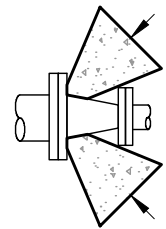
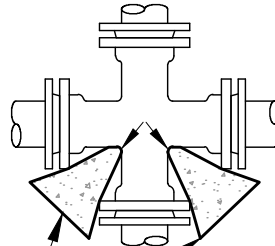
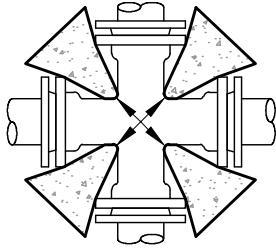
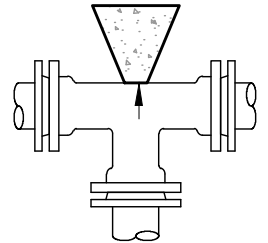
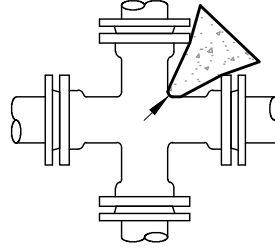
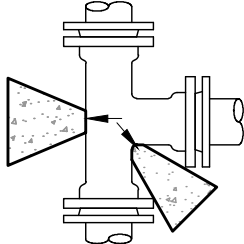
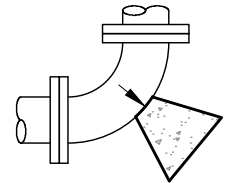
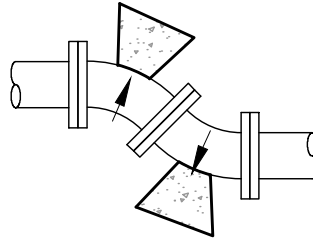


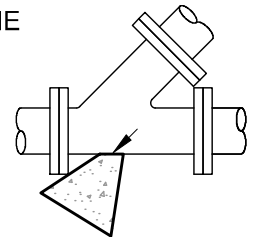
BEARING AREA  
UNDISTURBED SOIL (TYP)



**MINIMUM BEARING AREA  
IN SQ. FT.**

| SIZE OF PIPE | TEES, VALVES,<br>DEAD ENDS | 90° BENDS | 45° BENDS | 22 1/2° BENDS | 11 1/4° BENDS |
|--------------|----------------------------|-----------|-----------|---------------|---------------|
| 4"           | 3.5                        | 5         | 3         | 1.5           | 1             |
| 6"           | 7                          | 10        | 5.5       | 3             | 1.5           |
| 8"           | 12.5                       | 17        | 9.5       | 5             | 2.5           |
| 10"          | 18.5                       | 26        | 14        | 7.5           | 3.8           |
| 12"          | 26                         | 37        | 20        | 10            | 5             |
| 14"          | 35                         | 49        | 26.5      | 13.5          | 7             |
| 16"          | 45                         | 63        | 34        | 17.5          | 9             |

THE AREA OF BEARING PER  
THRUST BLOCK TO EQUAL 1/2 THE  
AREA SPECIFIED FOR THE  
LARGEST PIPE OR FITTING SIZE



**NOTE:**

1. RESTRAINT SIZING IS BASED UPON A MAXIMUM OPERATING PRESSURE OF 150 PSI AND A TEST PRESSURE OF 250 PSI, AND A MINIMUM SOIL BEARING STRENGTH OF 2,000 PSF. OPERATING PRESSURES IN EXCESS OF 150 PSI OR SOILS WITH LESS THAN 2,000 POUND BEARING STRENGTH WILL REQUIRE SPECIAL DESIGN.
2. PIPE SIZE EXCEEDING 16" REQUIRES SPECIAL DESIGN.
3. SIDE WALLS OF THRUST BLOCK SHALL BE FORMED WITH VERTICAL SIDES.
4. DO NOT ENCASE ADJACENT FITTINGS AND BOLTS.
5. DO NOT THRUST AGAINST ADJACENT PIPES.
6. PLACE PE WRAP PRIOR TO INSTALLING BLOCKING.



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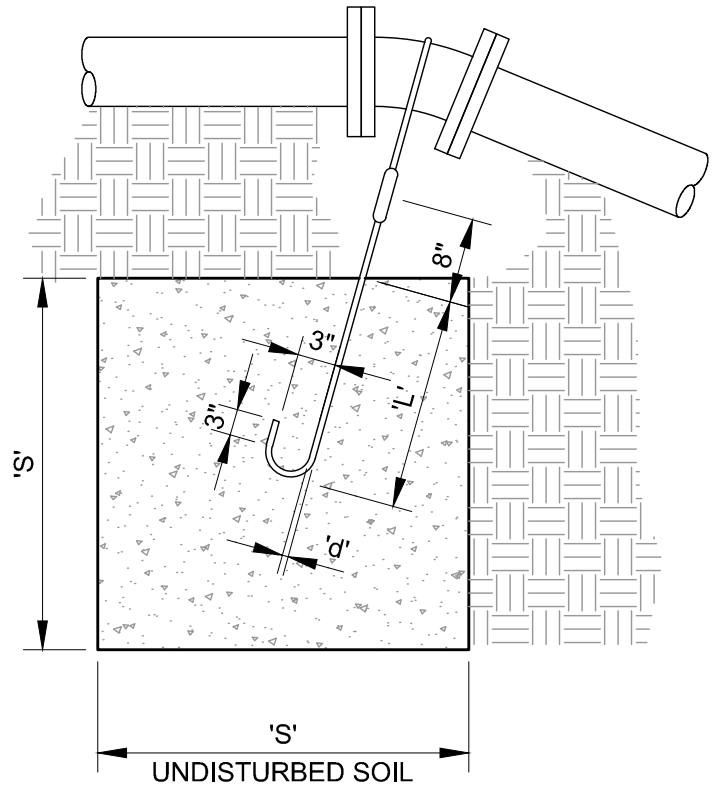
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**DIRECT BEARING  
THRUST BLOCK**

STD. PLAN

**561**

| TABLE OF DIMENSIONS                |                             |                                    |                     |  |                                    |
|------------------------------------|-----------------------------|------------------------------------|---------------------|--|------------------------------------|
| SIZE OF PIPE<br>(NOMINAL DIAMETER) | VERTICAL BEND IN<br>DEGREES | CONCRETE BLOCKING<br>IN CUBIC FEET | 'S'                 | 'd'  | 'L'                                |
|                                    |                             |                                    | SIDE OF CUBE - FEET | DIAMETER OF SHANK<br>OR REBAR RODS -<br>INCH | DEPTH OF ROD IN<br>CONCRETE - FEET |
| 4"                                 | 11 1/4                      | 9.5                                | 2.2                 | 5/8"   | 1.5                                |
|                                    | 22 1/2                      | 19.0                               | 2.7                 | 5/8"   | 2.0                                |
| 6"                                 | 11 1/4                      | 20                                 | 2.7                 | 5/8"   | 2.0                                |
|                                    | 22 1/2                      | 40                                 | 3.4                 | 5/8"   | 2.0                                |
| 8"                                 | 11 1/4                      | 34                                 | 3.3                 | 5/8"   | 2.0                                |
|                                    | 22 1/2                      | 68                                 | 4.1                 | 5/8"   | 2.0                                |
| 10"                                | 11 1/4                      | 51                                 | 3.8                 | 5/8"   | 2.0                                |
|                                    | 22 1/2                      | 102                                | 4.7                 | 3/4"   | 3.0                                |
| 12"                                | 11 1/4                      | 72                                 | 4.2                 | 5/8"   | 2.0                                |
|                                    | 22 1/2                      | 143                                | 5.3                 | 3/4"   | 3.0                                |
| 14"                                | 11 1/4                      | 97                                 | 4.6                 | 7/8"   | 3.0                                |
|                                    | 22 1/2                      | 193                                | 5.8                 | 7/8"   | 3.0                                |
| 16"                                | 11 1/4                      | 125                                | 5.0                 | 7/8"   | 3.0                                |
|                                    | 22 1/2                      | 249                                | 6.3                 | 7/8"   | 4.0                                |



### TYPE A RESTRAINT

FOR 11 1/4° - 22 1/2° VERTICAL BENDS

**NOTE:**

1. RESTRAINT SIZING IS BASED UPON A MAXIMUM OPERATING PRESSURE OF 150 PSI AND A TEST PRESSURE OF 250 PSI, AND A MINIMUM SOIL BEARING STRENGTH OF 2,000 PSF. OPERATING PRESSURES IN EXCESS OF 150 PSI OR SOILS WITH LESS THAN 2,000 POUND BEARING STRENGTH WILL REQUIRE SPECIAL DESIGN.
2. PIPE SIZE EXCEEDING 16" REQUIRES SPECIAL DESIGN.
3. SIDE WALLS OF THRUST BLOCK SHALL BE FORMED WITH VERTICAL SIDES.
4. DO NOT ENCASE ADJACENT FITTINGS AND BOLTS.
5. DO NOT THRUST AGAINST ADJACENT PIPES.
6. APPLY WAX TAP COATING SYSTEM TO EXPOSED SHANK AND REBAR RODS, AWWA C217. SYSTEM TO INCLUDE FILLER MATERIAL, TAPE COATING, AND PROTECTIVE OUTER WRAP. DENSO N.A., TRENTON, OR APPROVED EQUAL.
7. SHANK AND REBAR MATERIALS SHALL BE EPOXY COATED AT LEAST 15 MILS THICK.
8. REINFORCEMENT SHALL BE DEFORMED STEEL, ASTM A 615. MINIMUM STRESS YIELD STRENGTH OF STEEL TIE-DOWN BARS IS 70,000 KSI.



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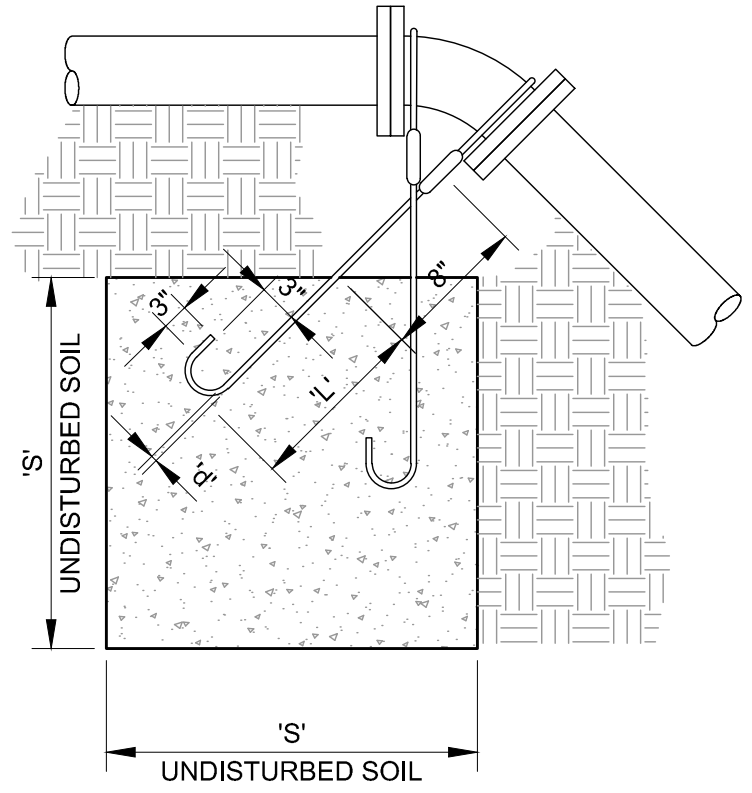
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## TIE-DOWN THRUST RESTRAINTS

STD. PLAN

**562-A**



**TYPE B RESTRAINT**  
FOR 45° VERTICAL BENDS

**NOTE:**

1. RESTRAINT SIZING IS BASED UPON A MAXIMUM OPERATING PRESSURE OF 150 PSI AND A TEST PRESSURE OF 250 PSI, AND A MINIMUM SOIL BEARING STRENGTH OF 2,000 PSF. OPERATING PRESSURES IN EXCESS OF 150 PSI OR SOILS WITH LESS THAN 2,000 POUND BEARING STRENGTH WILL REQUIRE SPECIAL DESIGN.
2. PIPE SIZE EXCEEDING 16" REQUIRES SPECIAL DESIGN.
3. SIDE WALLS OF THRUST BLOCK SHALL BE FORMED WITH VERTICAL SIDES.
4. DO NOT ENCASE ADJACENT FITTINGS AND BOLTS.
5. DO NOT THRUST AGAINST ADJACENT PIPES.
6. APPLY WAX TAP COATING SYSTEM TO EXPOSED SHANK AND REBAR RODS, AWWA C217. SYSTEM TO INCLUDE FILLER MATERIAL, TAPE COATING, AND PROTECTIVE OUTER WRAP. DENSO N.A., TRENTON, OR APPROVED EQUAL.
7. SHANK AND REBAR MATERIALS SHALL BE EPOXY COATED AT LEAST 15 MILS THICK.
8. REINFORCEMENT SHALL BE DEFORMED STEEL, ASTM A 615. MINIMUM STRESS YIELD STRENGTH OF STEEL TIE-DOWN BARS IS 70,000 KSI.

**TABLE OF DIMENSIONS**

| SIZE OF PIPE<br>(NOMINAL DIAMETER) | VERTICAL BEND IN<br>DEGREES | CONCRETE BLOCKING<br>IN CUBIC YARDS | 'S'<br>SIDE OF CUBE - FEET | 'd'<br>DIAMETER OF SHANK<br>OR REBAR RODS -<br>INCH | 'L'<br>DEPTH OF ROD IN<br>CONCRETE - FEET |
|------------------------------------|-----------------------------|-------------------------------------|----------------------------|---|---|
| 4"                                 | 45                          | 1.4                                 | 3.4                        | 5/8"  | 2.0                                       |
|                                    |                             |                                     |                            | 5/8"  |   |
| 6"                                 | 45                          | 2.8                                 | 4.3                        | 5/8"  | 2.5                                       |
|                                    |                             |                                     |                            | 5/8"  |   |
| 8"                                 | 45                          | 4.9                                 | 5.1                        | 5/8"  | 3.0                                       |
|                                    |                             |                                     |                            | 5/8"  |   |
| 10"                                | 45                          | 7.3                                 | 5.9                        | 5/8"  | 4.0                                       |
|                                    |                             |                                     |                            | 5/8"  |   |
| 12"                                | 45                          | 10.4                                | 6.8                        | 3/4"  | 4.0                                       |
|                                    |                             |                                     |                            | 3/4"  |   |
| 14"                                | 45                          | 14.0                                | 7.3                        | 3/4"  | 4.0                                       |
|                                    |                             |                                     |                            | 3/4"  |   |
| 16"                                | 45                          | 18.1                                | 7.9                        | 3/4"  | 4.0                                       |
|                                    |                             |                                     |                            | 3/4"  |   |



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**TIE-DOWN  
THRUST RESTRAINTS**

STD. PLAN

**562-B**