

**IAPMO IS 33-2019<sup>e1</sup>**



*Industry Standard for*  
**Thrust Blocking for Rubber Gasketed  
and Solvent Cement Joints**



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# Preface

This is the first edition of IAPMO IS 33, Thrust Blocking for Rubber Gasketed and Solvent Cement Joints.

This Standard was developed by the IAPMO Standards Review Committee (SRC) in accordance with the policies and procedures regulating IAPMO industry standards development, Policy S-001, Standards Development Process. This Standard was approved as an IAPMO Industry Standard on January 07, 2019, editorially revised April 2020.

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- (4) *During its development, this Standard was made available for public review, thus providing an opportunity for additional input from stakeholders from industry, academia, regulatory agencies, and the public at large. Upon closing of public review, all comments received were duly considered and resolved by the IAPMO Standards Review Committee.*
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  - (a) *standard designation (number);*
  - (b) *relevant section, table, or figure number, as applicable;*
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  - (d) *rationale for the change.*
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  - (a) *the edition of the standard for which the interpretation is being requested;*
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# ***IAPMO Standards Review Committee***

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# IAPMO IS 33-2019<sup>e1</sup>

## Thrust Blocking for Rubber Gasketed and Solvent Cement Joints

### 1 Scope

#### 1.1 General

- 1.1.1** This Standard specifies requirements for the installation of thrust blocking for ductile iron pipe with elastomeric gasketed joints and fittings and PVC piping with solvent cemented or elastomeric gasketed joints intended for cold water building supply and yard piping.
- 1.1.2** Thrust blocks covered by this standard prevent separation of joints and pipe movement by transferring the resultant thrust force at a bend to the undisturbed soil behind the thrust block. The bearing strength of the soil is expressed in pounds per square foot. Therefore, the area behind the thrust block must engage enough soil area to resist the resultant thrust force at a change in direction.

#### 1.2 Terminology

In this Standard,

- (a) “shall” is used to express a requirement, i.e., a provision that the user is obliged to satisfy to comply with the Standard;
- (b) “should” is used to express a recommendation, but not a requirement;
- (c) “may” is used to express an option or something permissible within the scope of the Standard; and
- (d) “can” is used to express a possibility or a capability.

Notes accompanying sections of the Standard do not specify requirements or alternative requirements; their purpose is to separate explanatory or informative material from the text. Notes to tables and figures are considered part of the table or figure and can be written as requirements.

#### 1.3 Amendments

Proposals for amendments to this Standard will be processed in accordance with the standards-writing procedures of IAPMO.

### 2 Reference Publications

This Standard refers to the following publications, and where such reference is made, it shall be to the current edition of those publications, including all amendments published thereto.

IAPMO/ANSI UPC-1      Uniform Plumbing Code

### 3 Abbreviations

The following abbreviations apply in this Standard:

**PVC** — polyvinyl chloride

### 4 General

#### 4.1 Thrust Blocking for Rubber Gasket Joints

In lines with rubber gasketed joints, thrust blocks shall be installed at all locations including:

- (a) Changes in direction, as at tees and bends
- (b) Changes in size, as at reducers
- (c) Stops, as at dead ends
- (d) Valves, where thrusts may be expected.

**Note:** See examples in Figure 1.

#### 4.2 Sizing

Piping shall be sized in accordance with the applicable code or jurisdictional requirements.

**Note:** For example, Appendix A, "Recommended Rules for Sizing the Water Supply System", or Section 610.0, "Size of Potable Water Piping" of IAPMO/ANSI UPC-1 may be use for sizing pipe.

#### 4.3 Flow Velocity

Flow velocity shall not exceed 8 fps (2.4 m/s) for PVC pipe or 10 fps (3m/s) for other pipe materials.

#### 4.4 Deflection

Elastomeric gasketed pipe may be deflected in accordance with the manufacturer's recommendations provided that it shall not be permanently staked or blocked to maintain this deflection.

#### 4.5 Maximum Working Pressure

The pipe and fitting system shall be designed for the maximum working pressure in accordance with Table 1.

### 5 Thrust Blocking Sizing and Calculations

#### 5.1 Sizes

Thrust block sizes shall be based on the maximum line pressure, pipe size and the safe bearing load of the soil.

#### 5.2 Calculation Examples

##### 5.2.1 Thrust

##### 5.2.1.1 Example 1

From Table 2, *Thrust at Fittings in pounds at 100 psi of Water Pressure*, the thrust for a NPS 4 Dead End Tee at a pressure of 100 psi is 1620 lb.

### 5.2.1.2 Example 2

The thrust for an NPS 4, Dead End Tee, at a pressure of 150 psi is 2430 lb or 1.5 times the thrust found in Table 2.

The calculation is as follows:

- (a) The thrust from Table 2, for an NPS 4, Dead End Tee, at 100 psi, is 1,620 lb.
- (b) The actual pressure of the system is 150 psi.
- (c) Divide the actual pressure by the table pressure or 150 psi/100 psi is 1.5.
- (d) Multiply the thrust from Table 2, for an NPS 4, Dead End Tee, at 100 psi, times the ratio of the actual/table pressure, or 1.5 times 1620 lb for a thrust of 2430 lb.

### 5.2.1.3 Example 3

From Table 3, *Thrust at Fittings in Newtons at 689 kPa of Water Pressure*, the thrust for a DN 125, 90° Bend, at a pressure of 689 kPa is 15,757 N.

### 5.2.1.4 Example 4

The thrust for a DN 125, 90° Bend, at a pressure of 861 kPa is 19,469 N or 1.25 times the force in Table 3.

The calculation is as follows

- (a) The thrust from Table 3, for a DN 127, 90° Bend at a pressure of 689 kPa, is 15,575 N
- (b) The actual pressure of the system is 861 kPa.
- (c) Divide the actual pressure by the table pressure or 861 kPa/689 kPa or 1.25.
- (d) Multiply the thrust from Table 2, for a DN 125, 90° Bend, at a pressure of 689 kPa times, the ratio of the actual/table pressure, or 1.25 times 15,757 N for a thrust of 19,469 N.

**Note:** 1000 N is equal to 1 kN for a thrust of 19.469 kN.

## 5.2.2 Thrust Block Bearing Area

The thrust block bearing area is determined by dividing the thrust by the safe bearing load of the soil.

**Note:** See examples in Figure 2

### 5.2.2.1 Example 5

From Table 4, *Safe Bearing Loads of Various Soils* the safe bearing load of sand is 2000 lb/ft<sup>2</sup>.

### 5.2.2.2 Example 6

The thrust block bearing area for an NPS 4, Dead End Tee, at a pressure of 100 psi in sand is 0.81 ft<sup>2</sup>.

The calculation is as follows

- (a) From Table 2, *Thrust at Fittings in pounds at 100 psi of Water Pressure*, the thrust for a 4 in Dead End Tee at a pressure of 100 psi is 1620 lb
- (b) From Table 4 the safe bearing load of sand is 2000 lb/ft<sup>2</sup>.
- (c) Divide the thrust by the safe bearing load of sand, or 1620 lb/2000 lb/ft<sup>2</sup> for a thrust block bearing area of 0.81 ft<sup>2</sup>.

### 5.2.2.3 Example 7

The thrust block bearing area for an NPS 4, Dead End Tee at a pressure of 150 psi in sand is 1.22 ft<sup>2</sup>.

The calculation is as follows:

- (a) The thrust for an NPS 4, Dead End Tee, at a pressure of 150 psi was found in Example 2 to be 2430 lb.
- (b) The soil type is sand and the safe bearing load of sand from Table 4 is 2000 lb/ft<sup>2</sup>.
- (c) The required bearing area of the thrust block is determined by dividing the thrust by the safe bearing load or 2430 lb/2000 lb/ft<sup>2</sup> for a thrust block bearing area of 1.22 ft<sup>2</sup>.

### 5.2.2.4 Example 8

The thrust block bearing area for a DN 125, 90° Bend, at a pressure of 861 kPa in Soft Clay is 2.82 m<sup>2</sup>

The calculation is as follows:

- (a) The thrust for a DN 125, 90° Bend at a pressure of 861 kPa was found in Example 4 to be 19,469 N.
- (b) The soil condition is soft clay and the safe bearing load of soft clay from Table 4 is 48 kPa or 48,000 N/m<sup>2</sup>.  
**Note:** 1 kPa = 1 kN/m<sup>2</sup> = 1000 N/m<sup>2</sup>
- (c) The required block bearing area is determined by dividing the thrust by the safe bearing load or 19,469 N/48,000 N/m<sup>2</sup> for a thrust block bearing area of 0.4 m<sup>2</sup>.

## 6 Testing Requirements

### 6.1 Rubber Gasketed Joints

Properly sized thrust blocks, either permanent or temporary, shall be installed at all required points before testing. When concrete thrust blocks are installed, wait at least 24 hours before pressure testing.

### 6.2 Solvent Cement Joints

The entire system shall be purged before testing to eliminate all solvent cement vapors and air. The system shall not be pressurized until the joints have cured (set) at least as long as recommended by the manufacturer. If the manufacturers recommendation is not available the cure times in Table 5 shall apply. Systems with solvent cement joints shall be pressure tested filled with water or other fluid. CAUTION: Water Test Only.

## 7 Identification

A label shall be fastened to the main electrical meter panel stating, "This structure has a nonmetallic water service".

**Table 1**  
**Maximum Working Pressure for**  
**Pipe and Fitting System Design**  
 (See Section 4.5)

| Maximum Working Pressure<br>kPa (psi) | Sizes        |            | Pipe        | Fittings    |
|---------------------------------------|--------------|------------|-------------|-------------|
|                                       | NPS          | DN         |             |             |
| 1103 kPa (160 psi)                    | 1/2 to 8     | 15 to 200  | SDR 26      | Schedule 40 |
|                                       |              |            |             | Schedule 80 |
| 1379 kPa (200 psi)                    | 1/2 to 4     | 15 to 100  | SDR 21      | Schedule 40 |
|                                       | 1/2 to 8     | 15 to 200  |             | Schedule 80 |
| 1724 kPa (250 psi)                    | 1/2 to 3     | 15 to 80   | SDR 17      | Schedule 40 |
|                                       | 1/2 to 8     | 15 to 200  |             | Schedule 80 |
| 2172 kPa (315 psi)                    | 1/2 to 1-1/2 | 15 to 40   | SDR 13.5    | Schedule 40 |
|                                       | 1/2 to 4     | 15 to 100  |             | Schedule 80 |
| 1103 kPa (160 psi)                    | 5 to 8       | 125 to 200 | Schedule 40 | Schedule 40 |
| 1517 kPa (220 psi)                    | 2 to 4       | 50 to 100  | Schedule 40 | Schedule 40 |
|                                       |              |            |             | Schedule 80 |
| 2206 kPa (320 psi)                    | 1/2 to 1-1/2 | 15 to 40   | Schedule 40 | Schedule 40 |
|                                       |              |            |             | Schedule 80 |
| 1103 kPa (160 psi)                    | 5 to 8       | 125 to 200 | Schedule 80 | Schedule 40 |
| 1517 kPa (220 psi)                    | 2 to 4       | 50 to 100  | Schedule 80 | Schedule 40 |
| 2206 kPa (320 psi)                    | 1/2 to 1-1/2 | 15 to 40   | Schedule 80 | Schedule 40 |
| 1724 kPa (250 psi)                    | 5 to 8       | 125 to 200 | Schedule 80 | Schedule 80 |
| 2206 kPa (320 psi)                    | 1/2 to 4     | 15 to 100  | Schedule 80 | Schedule 80 |

**Table 2**  
**Thrust at Fittings in pounds at 100 psi of Water Pressure**

(See Sections 5.2.1.1, 5.2.1.2, and 5.2.2.2)

| Pipe Size<br>NPS | 90°<br>Bends | 45°<br>Bends | 22-1/2°<br>Bends | Dead Ends<br>and<br>Tees |
|------------------|--------------|--------------|------------------|--------------------------|
| 1-1/2            | 415          | 225          | 115              | 295                      |
| 2                | 645          | 350          | 180              | 455                      |
| 2-1/2            | 935          | 510          | 260              | 660                      |
| 3                | 1395         | 755          | 385              | 985                      |
| 3-1/2            | 1780         | 962          | 495              | 1260                     |
| 4                | 2,295        | 1245         | 635              | 1620                     |
| 5                | 3,500        | 1900         | 975              | 2,490                    |
| 6                | 4,950        | 2,710        | 1385             | 3,550                    |
| 8                | 8,300        | 4,500        | 2,290            | 5,860                    |
| 10               | 12,800       | 6,900        | 3,540            | 9,050                    |
| 12               | 18,100       | 9,800        | 5,000            | 12,800                   |

**Table 3**  
**Thrust at Fittings in Newtons (N) at 689 kPa of Water Pressure**

(See Sections 5.2.1.3, and 5.2.1.4)

| Pipe Size<br>DN | 90°<br>Bends | 45°<br>Bends | 22-1/2°<br>Bends | Dead Ends and<br>Tees |
|-----------------|--------------|--------------|------------------|-----------------------|
| 40              | 1847         | 1000         | 515              | 1315                  |
| 50              | 2870         | 1560         | 800              | 2025                  |
| 65              | 4160         | 2270         | 1160             | 3940                  |
| 80              | 6210         | 3360         | 1715             | 4385                  |
| 90              | 7925         | 4280         | 2205             | 5610                  |
| 100             | 10,215       | 5540         | 2815             | 7210                  |
| 125             | 15,575       | 8455         | 4340             | 11,080                |
| 150             | 22,030       | 12,060       | 6165             | 15,800                |
| 200             | 36,935       | 20,025       | 10,190           | 26,080                |
| 250             | 56,960       | 30,705       | 15,755           | 40,275                |
| 300             | 80,545       | 43,610       | 22,250           | 56,960                |