Public Input No. 24-NFPA 24-2022 [New Section after 1.2]

1.2.1

Private fire service main systems shall be designed, installed and tested by qualified personnel

Statement of Problem and Substantiation for Public Input

update the scope language to enforce qualified personnel to designs, install and test private fire service main systems

Submitter Information Verification

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Submittal Date:	Wed Jun 01 16:29:32 EDT 2022
Committee:	AUT-PRI

Public Input No. 21-NFPA 24-2022 [New Section after 1.5.3]

1.6 New Technology.

1.6.1

Nothing in this standard shall be intended to restrict new technologies or alternate arrangements, provided the level of safety prescribed by this standard is not lowered.

1.6.2

Materials or devices not specifically designated by this standard shall be utilized in complete accord with all conditions, requirements, and limitations of their listings.

Statement of Problem and Substantiation for Public Input

Many of the NFPA Installation standards (such as NFPA 13, NFPA 13R, NFPA 13D) include the "New Technology Clause." This section makes it clear that new technologies and alternate methods are permitted as long as the level of safety prescribed by the standard is not lowered. This concept is also applicable to NFPA 24 and should be included. The language proposed is from NFPA 13 section 1.7.

Submitter Information Verification

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Submittal Date: Fri May 27 10:03:32 EDT 2022
Committee: AUT-PRI

Public Input No. 19-NFPA 24-2022 [New Section after 3.3.2]

3.3 Automated Inspection and Testing.

The performance of inspections and tests at a distant location from the system or component being inspected or tested through the use of electronic devices or equipment installed for the purpose.

Statement of Problem and Substantiation for Public Input

This proposal seeks to add the definition of Automated Testing and Inspection (extracted from NFPA 13 (2022) section 3.3.9) in support of Public Input 18.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 18-NFPA 24-2022 [New Section after 10.10.2.5.2]	related concept
Public Input No. 20-NFPA 24-2022 [New Section after 3.3.5]	related
Public Input No. 18-NFPA 24-2022 [New Section after 10.10.2.5.2]	
Public Input No. 20-NFPA 24-2022 [New Section after 3.3.5]	

Submitter Information Verification

Submitter Full Name: Roland Asp
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Submittal Date: Fri May 27 09:50:12 EDT 2022
Committee: AUT-PRI

Public Input No. 20-NFPA 24-2022 [New Section after 3.3.5]

3.3.6 Distance Monitoring.

The monitoring of various conditions of a system or component from a distant location from the system or component through the use of electronic devices, meters, or equipment installed for the purpose.

Statement of Problem and Substantiation for Public Input

This proposal seeks to add the definition of Distance Monitoring (extracted from NFPA 13 (2022) section 3.3.57) in support of Public Input 18.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 18-NFPA 24-2022 [New Section after 10.10.2.5.2]	related
Public Input No. 19-NFPA 24-2022 [New Section after 3.3.2]	related
Public Input No. 18-NFPA 24-2022 [New Section after 10.10.2.5.2]	
Public Input No. 19-NFPA 24-2022 [New Section after 3.3.2]	

Submitter Information Verification

Submitter Full Name: Roland Asp
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Submittal Date: Fri May 27 09:55:35 EDT 2022
Committee: AUT-PRI

Public Input No. 25-NFPA 24-2022 [New Section after 3.3.14]

Qualified Personnel.

Competent and capable individual(s) having met the requirements and training for a given field acceptable to the AHJ.

Statement of Problem and Substantiation for Public Input

The definition of Qualified Personnel is needed to ensure consistency and proper levels of quality and life safety in private fire service main systems

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 24-NFPA 24-2022 [New Section after 1.2]	
Public Input No. 26-NFPA 24-2022 [Section No. 4.2.1]	

Submitter Information Verification

Submitter Full Name:	Kenneth Schneider
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Submittal Date:	Wed Jun 01 16:37:24 EDT 2022
Committee:	AUT-PRI

Public Input No. 27-NFPA 24-2022 [New Section after 4.2.1]

Qualified personnel

- Qualified personnel shall meet at least one of the following qualifications:
  - Meets the requirements and training for a given field acceptable to the AHJ.
  - Is certified by a nationally recognized fire protection certification organizational acceptable to the AHJ.
  - Is registered, licensed, or certified by a state or local authority to perform installation of sprinkler systems

Statement of Problem and Substantiation for Public Input

Provides qualification for installation of private fire service main systems

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 26-NFPA 24-2022 [Section No. 4.2.1]	

Submitter Information Verification

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Submittal Date:	Wed Jun 01 16:46:32 EDT 2022
Committee:	AUT-PRI

Public Input No. 26-NFPA 24-2022 [Section No. 4.2.1]

4.2.1

Installation work shall be performed by ~~fully experienced and responsible persons~~ qualified personnel .

Statement of Problem and Substantiation for Public Input

provides consistency across NFPA documents and consistency with NFPA Glossary of Terms

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 25-NFPA 24-2022 [New Section after 3.3.14]	
Public Input No. 27-NFPA 24-2022 [New Section after 4.2.1]	

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Submittal Date:	Wed Jun 01 16:41:00 EDT 2022
Committee:	AUT-PRI

Public Input No. 13-NFPA 24-2022 [Section No. 6.2.1.2]

6.2.1.2

Control valves shall be permitted in the system piping downstream of the fire department connection.

The Air release valve shall be install in the highest point for Main Fire fighting network.

Statement of Problem and Substantiation for Public Input

for huge main fire fighting network we can not release the air from the network & will cause leakage for the piping because of that recommended to install air release valve

Submitter Information Verification

Submitter Full Name: Alaaeldin Mosallam

Organization: Gulf Engineering

Affiliation: Manager of Life Safety & Fire Protection System.

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Submittal Date: Sat Mar 12 05:12:48 EST 2022

Committee: AUT-PRI

Public Input No. 3-NFPA 24-2022 [New Section after 7.3.3.2]

7.3.3.3

Where pumper outlets (traditionally known as 'steamer connections') of 4-inch or larger are provided on a hydrant they shall face the adjacent roadway, fire lane, fire access, or driveway which will be utilized by responding fire apparatus.

Additional Proposed Changes

File Name	Description	Approved
100_3994.JPG	Hydrant Facing Away from Fire Lane - Drive Aisle	
100_3995.JPG	View of Hydrant Facing Into a Vehicle Parking Spot Which Likely Would Be Occupied and Inaccessible During Fire Emergency. Should Be Spun 180-Degrees to Face Fire Lane or Apparatus Drive Aisle	

Statement of Problem and Substantiation for Public Input

Site hydrants, often times considered private hydrants, not abutting public roadways that are in shopping centers, office parks, and industrial / educational campuses are often installed long before building construction is undertaken and there is little attention given to properly orienting the hydrant to what will be the final layout of the driveways, aisles, or parking stalls. This leads to the obvious difficulty shown in the provided photographs should an FD apparatus ever need to connect to the hydrant's pumper outlet to obtain maximum available flows. Attempting to connect to such improperly facing hydrants will result in time delays securing a hydrant fed water supply, the need for increased suction hose lengths, and likelihood of severe hose kinking in making a 180-degree loop back towards the fire apparatus. The other recognized national standard governing fire hydrant installations might well be the AWWA M17 manual and while it covers hydrant installation in detail the only language on this topic uses the phrase '... pumper outlet nozzle should face the street to enable a quick connection to the fire pumper.' As we all know the 'should' term creates a regulatory problem in efforts to enforce. Additionally, these hydrant installations are often subject to local fire codes and ordinances which adopt or reference NFPA 24, not AWWA M17. So there is no pathway for local fire & code officials to get these matters resolved without direct language within NFPA 24 in the hydrants chapter. Given the ease by which most hydrants can be field 'spun' to aim or face the pumper outlet this proposed language would not place an undue financial burden on property owners or installers and would establish what is likely well known in the industry but lacks definitive code language which can be cited by code or fire officials.

Submitter Information Verification

Submitter Full Name:	David Phelan
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Affiliation:	Friend of the Fire Service - Not Representing Any Client, Organization, Entity, Special Interest, Lobbyist, and Not Receiving Compensation for Submission
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Submittal Date: Sat Jan 15 08:33:53 EST 2022
Committee: AUT-PRI


THANK YOU


Cleaners

Public Input No. 8-NFPA 24-2022 [Section No. 10.1.1.3]

10.1.1.3

Steel piping manufactured in accordance with Table 10.1.1.3 that is externally coated and wrapped and internally galvanized shall be permitted to be used between the hose coupling(s) on the fire department connection and the check valve installed in the fire department connection piping.

Table 10.1.1.3 Steel Piping for Fire Department Connections

Materials and Dimensions	Standard
Black and hot-dipped zinc-coated (galvanized) welded and seamless steel pipe for fire protection use	ASTM A795/A795M
Pipe, steel, black and hot-dipped, zinc-coated, welded and seamless	ASTM A53/A53M
Electric-resistance-welded steel pipe	ASTM A135/A135M

10.1.1.3.1

External coating and wrapping as required by 10.1.1.3 shall be approved.

10.1.1.3.2

The requirements of 10.1.1.3 shall not apply to listed stainless steel piping.

Statement of Problem and Substantiation for Public Input

Stainless steel inherently has corrosion resistance. Stainless steel piping should not require coatings or wraps.

Submitter Information Verification

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Submittal Date: Thu Feb 17 15:45:24 EST 2022
Committee: AUT-PRI

Public Input No. 9-NFPA 24-2022 [New Section after 10.3.5]

10.3.6 Connection of Plain End Pipe

Where plain end pipes, fittings, or appurtenances are connected using couplings, they shall be connected in accordance with 10.3.6.1 through 10.3.6.3.

10.3.6.1 Plain end pipe, fittings, and appurtenances to be joined with couplings shall be dimensionally compatible with the couplings.

10.3.6.2 Plain end pipe, fittings, and appurtenances that are connected as part of a listed assembly shall be permitted to be used.

10.3.6.3 Plain end pipe joined with couplings shall be joined by a listed combination of fittings, gaskets, and couplings.

Statement of Problem and Substantiation for Public Input

This would address NFPA 24 not covering connections of plain end pipe.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 10-NFPA 24-2022 [Section No. 10.4.1.2]	Partner change. Part of change group addressing plain end pipe connections.
Public Input No. 10-NFPA 24-2022 [Section No. 10.4.1.2]	

Submitter Information Verification

Submitter Full Name: Erik Brist

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Submittal Date: Tue Mar 01 09:58:04 EST 2022

Committee: AUT-PRI

Public Input No. 5-NFPA 24-2022 [Section No. 10.4.1.1]

10.4.1.1 Coatings.

All bolted joint accessories shall be cleaned and thoroughly coated with asphalt, bituminous or other corrosion-retarding material after installation.

Statement of Problem and Substantiation for Public Input

Adding bituminous. Contractors are asking what is an acceptable material for coatings.

Submitter Information Verification

Submitter Full Name:	Thomas Wellen
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Submittal Date:	Thu Feb 17 15:18:36 EST 2022
Committee:	AUT-PRI

Public Input No. 10-NFPA 24-2022 [Section No. 10.4.1.2]

10.4.1.2

The requirements of 10.3.5.3 and 10.3.6.3 shall not apply to epoxy-coated fittings, valves, glands, or other accessories.

Statement of Problem and Substantiation for Public Input

Addresses NFPA 24 not addressing the connection of plain end pipe.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 9-NFPA 24-2022 [New Section after 10.3.5]	Partner change. Part of change group addressing plain end pipe connections.
Public Input No. 9-NFPA 24-2022 [New Section after 10.3.5]	

Submitter Information Verification

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Submittal Date: Tue Mar 01 10:04:04 EST 2022
Committee: AUT-PRI

Public Input No. 7-NFPA 24-2022 [Section No. 10.4.1.2]

10.4.1.2

The requirements of 10.3.5.3 shall not apply to stainless steel, epoxy-coated fittings, valves, glands, or other accessories.

Statement of Problem and Substantiation for Public Input

Stainless steel inherently has corrosion resistance. Some water utilities require stainless steel bolts, rods, and nuts. Stainless should not require and additional coating.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 6-NFPA 24-2022 [Section No. 10.6.2.5.1]	

Submitter Information Verification

Submitter Full Name:	Thomas Wellen
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Submittal Date:	Thu Feb 17 15:36:02 EST 2022
Committee:	AUT-PRI

Public Input No. 15-NFPA 24-2022 [Section No. 10.6 [Excluding any Sub-Sections]]

Private fire service mains shall be restrained ~~against movement at~~ to withstand the thrust force at working pressure at changes in direction in accordance with 10.6.1, 10.6.2, or 10.6.3.

Statement of Problem and Substantiation for Public Input

Except for the associated annex sections, there is no requirement in the restraint section to determine the appropriate force to restrain against. We have fielded several questions where pipe was restrained against the test pressures and not the normal working pressure.

Submitter Information Verification

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Submittal Date: Tue May 24 17:20:46 EDT 2022

Committee: AUT-PRI

Public Input No. 6-NFPA 24-2022 [Section No. 10.6.2.5.1]

10.6.2.5.1

The requirements of 10.6.2.5 shall not apply to ~~epoxy~~ stainless steel, epoxy -coated fittings, valves, glands, or other accessories.

Statement of Problem and Substantiation for Public Input

Stainless steel inherently has corrosion resistance. Some water utilities require stainless steel bolts, rods, and nuts. Stainless should not require and additional coating.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 7-NFPA 24-2022 [Section No. 10.4.1.2]	

Submitter Information Verification

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Submittal Date:	Thu Feb 17 15:34:27 EST 2022
Committee:	AUT-PRI

Public Input No. 22-NFPA 24-2022 [Section No. 10.10.2.1.3.2]

10.10.2.1.3.2

~~Suction piping supplying fire pump(s) shall be flushed prior to connecting to the fire pump(s) based on the requirements of NFPA 20.~~

When connected to a fire pump, piping shall be flushed at a flow rate not less than indicated in Table 10.10.2.1.3.2 or at the hydraulically calculated water demand rate of the system, whichever is greater.

Table 10.10.2.1.3.2 Minimum Flow Rates for Flushing Suction Piping

Nominal Pipe Size (in.)	Flow rate (gpm)	Nominal Pipe Size (mm)	Flow Rate (L/min)
1	37	25	140
1½	85	38	330
2	150	50	570
2½	229	65	870
3	330	75	1,250
3½	450	85	1,710
4	590	100	2,240
5	920	125	3,490
6	1,360	150	5,150
8	2,350	200	8,900
10	3,670	250	13,900
12	5,290	300	20,100
14	7,200	350	27,300
16	9,400	400	35,600

[**20** , Table 14.1.1.1]

(A)

Flushing shall occur prior to hydrostatic test. [**20** , 14.1.1.2]

(B)

Where the maximum flow available from the water supply cannot provide the flow rate provided in Table 10.10.2.1.3.2, the flushing flow rate shall be equal to or greater than 150 percent of rated flow of the connected fire pump. [**20** , 14.1.1.3]

(C)

Where the maximum flow available from the water supply cannot provide a flow of 150 percent of the rated flow of the pump, the flushing flow rate shall be the greater of 100 percent of rated flow of the connected fire pump or the maximum flow demand of the fire protection system. [**20** , 14.1.1.3.1]

(D)

A reduced flushing flow capacity in accordance with 10.10.2.1.3.2(C) shall constitute an acceptable test, provided that the flow rate is as much as can be safely achieved and it exceeds the fire protection system design flow rate. [**20** , 14.1.1.3.2]

Statement of Problem and Substantiation for Public Input

Flushing requirements for underground piping should be under the jurisdiction of the AUT-PRI committee. The intent is to extract the requirements from NFPA 20 during the first draft stage and then remove the extract tag at second draft so that NFPA 20 can extract from NFPA 24.

Submitter Information Verification

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Committee:	AUT-PRI

Public Input No. 18-NFPA 24-2022 [New Section after 10.10.2.5.2]

10.10.2.6 Automated Inspection and Testing Devices and Equipment.

10.10.2.6.1 Automated inspection and testing devices and equipment installed on the sprinkler system shall be tested to ensure the desired result of the automated inspection or test is realized.

10.10.2.6.1.1 Automated inspection devices and equipment shall be tested to verify that the image received allows for an effective visual examination of the system or component being inspected.

10.10.2.6.1.2 Automated testing devices and equipment shall be tested to verify that they produce the same action as required by this standard to test a device.

10.10.2.6.1.2.1 The testing shall discharge water where required by this standard and NFPA 25.

10.10.2.7.2 Testing shall verify that failure of automated inspection and testing devices and equipment does not impair the operation of the system unless indicated by an audible and visual trouble signal in accordance with *NFPA 72* or other applicable fire alarm code.

10.10.2.7.3 Testing shall verify that failure of a system or component to pass automated inspection and testing devices and equipment results in an audible and visual trouble signal in accordance with *NFPA 72* or other applicable fire alarm code.

10.10.2.7.4 Testing shall verify that failure of automated inspection and testing devices and equipment results in an audible and visual trouble signal in accordance with *NFPA 72* or other applicable fire alarm code.

Statement of Problem and Substantiation for Public Input

This proposal seeks to bring in the concept Automated Testing into NFPA 24. This is the language found in section 29.2.7 in NFPA 13. As the concept of automated testing has been included in other installation standards such as NFPA 13, there is no reason that this concept should not also be included in NFPA 24.

An additional PI has been submit to extract the definition of Automated testing from NFPA 13 into NFPA 24

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 19-NFPA 24-2022 [New Section after 3.3.2]	
Public Input No. 20-NFPA 24-2022 [New Section after 3.3.5]	
Public Input No. 19-NFPA 24-2022 [New Section after 3.3.2]	
Public Input No. 20-NFPA 24-2022 [New Section after 3.3.5]	

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Submittal Date:	Fri May 27 09:37:40 EDT 2022
Committee:	AUT-PRI

Public Input No. 16-NFPA 24-2022 [Section No. 12.2.1]

12.2.1*

Aboveground piping for private fire service mains shall not pass through hazardous areas and shall be located so that it is protected from mechanical and fire damage.

A.12.2.1

Protection should be provided in any area of a structure or building that poses a degree of hazard greater than that normal to the general occupancy of the building or structure. These areas include areas for the storage or use of combustibles or flammables; toxic, noxious, or corrosive materials; and heat-producing appliances.

Statement of Problem and Substantiation for Public Input

This proposal seeks to add the annex text associated with a similar section found in NFPA 13 (2022). In NFPA 13 this Annex section is found in A.16.4.3 and reads: "Protection should be provided in any area of a structure or building that poses a degree of hazard greater than that normal to the general occupancy of the building or structure. These areas include areas for the storage or use of combustibles or flammables; toxic, noxious, or corrosive materials; and heat-producing appliances."

If accepted this language will be extracted from NFPA 13 into a new annex section (A.12.2.1) in NFPA 24 and can be considered a correlation between NFPA 13 and NFPA 24 on the same subject. The annex note has also been submitted as PI#17.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 17-NFPA 24-2022 [New Section after A.10.10.2.3.1]	Related PI
Public Input No. 17-NFPA 24-2022 [New Section after A.10.10.2.3.1]	

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Submittal Date: Fri May 27 09:07:40 EDT 2022

Committee: AUT-PRI

Public Input No. 12-NFPA 24-2022 [Section No. A.10.4.1.3]

A.10.4.1.3

Gray cast iron is not considered galvanically dissimilar to ductile iron. Rubber gasket joints (unrestrained push-on or mechanical joints) are not considered connected electrically. Metal thickness should not be considered a protection against corrosive environments. In the case of cast iron or ductile iron pipe for soil evaluation and external protection systems, see Appendix A of AWWA C105/A21.5, *Polyethylene Encasement for Ductile-Iron Pipe Systems*.

A stainless steel in-building riser can connect to dissimilar metallic materials such as ductile iron or black steel. The product performance of many installations has not reported any instances of system failures or corrosion.

Statement of Problem and Substantiation for Public Input

There are questions during installations of stainless steel in-building risers connected to dissimilar materials whether a dielectric union is required. A dielectric union is not required with this product as there are no instances of failure in these connections due to corrosion.

Submitter Information Verification

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Submittal Date:	Thu Mar 03 10:02:21 EST 2022
Committee:	AUT-PRI

Public Input No. 1-NFPA 24-2021 [Section No. A.10.6.1]

A.10.6.1

The use of concrete thrust blocks is one method of restraint, provided that stable soil conditions prevail and space requirements permit placement. Successful blocking is dependent on factors such as location, availability and placement of concrete, and possibility of disturbance by future excavations.

Resistance is provided by transferring the thrust force to the soil through the larger bearing area of the block so that the resultant pressure against the soil does not exceed the horizontal bearing strength of the soil. The design of thrust blocks consists of determining the appropriate bearing area of the block for a particular set of conditions. The parameters involved in the design include pipe size, design pressure, angle of the bend (or configuration of the fitting involved), and the horizontal bearing strength of the soil.

Table A.10.6.1(a) gives the nominal thrust at fittings for various sizes of ductile iron and PVC piping. Figure A.10.6.1(a) shows an example of how thrust forces act on a piping bend.

Table A.10.6.1(a) Thrust at Fittings at ~~100 psi~~ 225 psi (~~6~~ 15 .~~9~~ 5 bar) Water Pressure for Ductile Iron and PVC Pipe {{NOTE: ALL Values in the Table will need to be revised test pressure of 225 psi}}

Nominal Pipe Diameter in. (mm)	Total Pounds (Newtons)										
	Dead End		90 Degree		45 Degree		22½ Degree		11¼ Degree		
	lbf	N	lbf	N	lbf	N	lbf	N	lbf	N	
4 (100)	1,810	8,051	2,559	11,383	1,385	6,161	706	3,140	355	1,579	
6 (150)	3,739	16,632	5,288	23,522	2,862	12,731	1,459	6,490	733	3,261	
8 (200)	6,433	28,615	9,097	40,465	4,923	21,899	2,510	11,165	1,261	5,609	
10 (250)	9,677	43,045	13,685	60,874	7,406	32,944	3,776	16,796	1,897	8,438	
12 300)	13,685	60,874	19,353	86,086	10,474	46,591	5,340	23,753	2,683	11,935	1
14 (350)	18,385	81,781	26,001	115,658	14,072	62,595	7,174	31,912	3,604	16,031	1
16 (400)	23,779	105,774	33,628	149,585	18,199	80,953	9,278	41,271	4,661	20,733	2
18 (450)	29,865	132,846	42,235	187,871	22,858	101,677	11,653	51,835	5,855	26,044	2
20 (500)	36,644	163,001	51,822	230,516	28,046	124,755	14,298	63,601	7,183	31,952	3
24 (600)	52,279	232,548	73,934	328,875	40,013	177,987	20,398	90,735	10,249	45,590	4
30 (750)	80,425	357,748	113,738	505,932	61,554	273,806	31,380	139,585	15,766	70,131	7
36 (900)	115,209	512,475	162,931	724,753	88,177	392,231	44,952	199,956	22,585	100,463	10
42 (1,050)	155,528	691,823	219,950	978,386	119,036	529,498	60,684	269,936	30,489	135,622	13
48 (1,200)	202,683	901,579	286,637	1,275,024	155,127	690,039	79,083	351,779	39,733	176,741	18

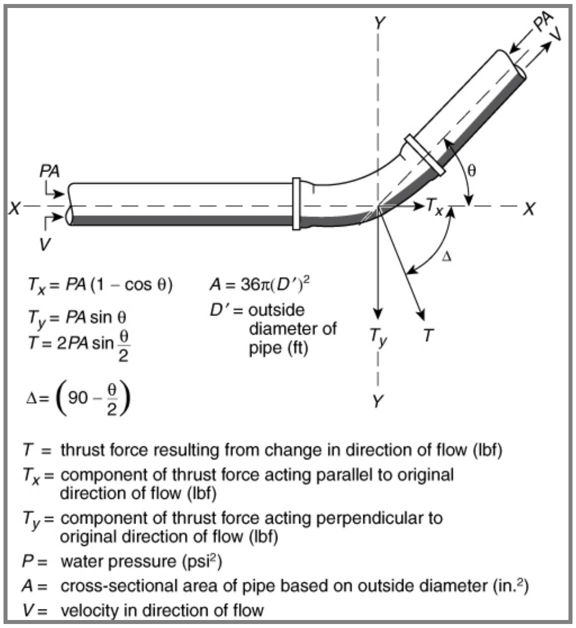
Notes:

(1) For SI units, 1 lb = 0.454 kg; 1 in. = 25 mm.

(2) To determine thrust at pressure other than ~~100 psi~~ 225 psi (~~6~~ 15 .~~9~~ 5 bar), multiply the thrust obtained in the table by the ratio of the pressure to ~~100 psi~~ 225 psi (~~6~~ 15 .~~9~~ 5 bar). For example, the thrust on a 12 in. (305 mm), 90-degree bend at ~~125 psi~~ 200 psi (13. 8 ~~.6~~ bar) is ~~19,353~~ XX × ~~125~~ 200 /~~100~~ 225 = ~~24~~ XX ,~~191 lb~~ XXX lb (~~10~~ XX ,~~973 kg~~ XXX kg). {{NOTE: Correct the formula based on updated Tabular

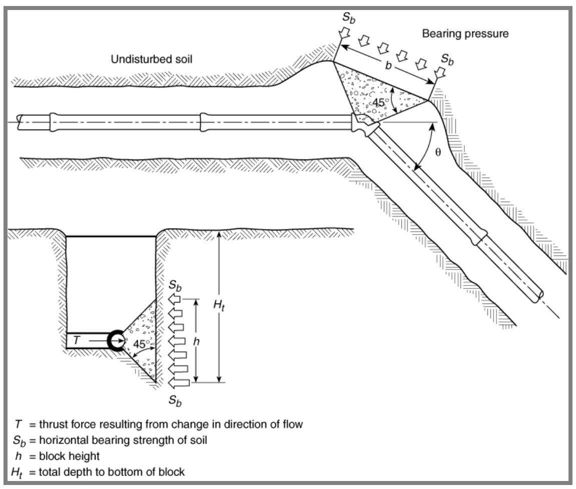
values}}

Figure A.10.6.1(a) Thrust Forces Acting on Bend.



Thrust blocks are generally categorized into two groups — bearing and gravity blocks. Figure A.10.6.1(b) depicts a typical bearing thrust block on a horizontal bend.

Figure A.10.6.1(b) Bearing Thrust Block.



The following are general criteria for bearing block design:

(1) The bearing surface should, where possible, be placed against undisturbed soil.

(2) Where it is not possible to place the bearing surface against undisturbed soil, the fill between the bearing surface and undisturbed soil should be compacted to at least 90 percent Standard Proctor density.

(3) Block height (h) should be equal to or less than one-half the total depth to the bottom of the block (H_t) but not less than the pipe diameter (D).

(4) Block height (h) should be chosen so that the calculated block width (b) varies between one and two times the height.

(5) Gravity thrust blocks can be used to resist thrust at vertical down bends. In a gravity thrust block, the weight of the block is the force providing equilibrium with the thrust force. The design problem is then to calculate the required volume of the thrust block of a known density. The vertical component of the thrust force in Figure A.10.6.1(c) is balanced by the weight of the block. For required horizontal bearing block areas, see Table A.10.6.1(b).

The required block area (A_b) is as follows:

$$A_b = (h)(b) = \frac{T(S_f)}{S_b}$$ **[A.10.6.1a]**

where:

A_b = required block area (ft^2)

h = block height (ft)

b = calculated block width (ft)

T = thrust force (lbf)

S_f = safety factor (usually 1.5)

S_b = bearing strength (lb/ft^2)

Then, for a horizontal bend, the following formula is used:

$$b = \frac{2(S_f)(P)(A)\sin\left(\frac{\theta}{2}\right)}{(h)(S_b)}$$ **[A.10.6.1b]**

where:

b = calculated block width (ft)

S_f = safety factor (usually 1.5 for thrust block design)

P = water pressure ($lb/in.^2$)

A = cross-sectional area of pipe based on outside diameter

h = block height (ft)

S_b = horizontal bearing strength of soil (lb/ft^2)($in.^2$)

A similar approach can be used to design bearing blocks to resist the thrust forces at locations such as tees and dead ends. Typical values for conservative horizontal bearing strengths of various soil types are listed in Table A.10.6.1(c).

Figure A.10.6.1(c) Gravity Thrust Block.

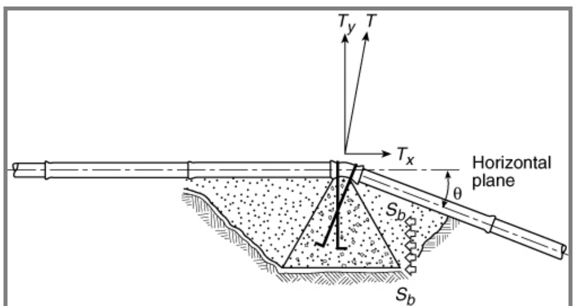


Table A.10.6.1(b) Required Horizontal Bearing Block Area at 225 psi (15.5 bar) {{NOTE: Update Tabular

values based on a test pressure of 225 psi}}

Nominal Pipe Diameter	-	Bearing Block Area	-	Nominal Pipe Diameter	-	Bearing Block Area	-	Nominal Pipe Diameter	-	Bearing Block Area

in.	mm	-	ft²	m²	-	in.	mm	-	ft²	m²	-	in.	mm	-	ft²	m²
3	80	-	2.6	0.24	-	12	300	-	29.0	2.7	-	24	600	-	110.9	10.3
4	100	-	3.8	0.35	-	14	350	-	39.0	3.6	-	30	750	-	170.6	15.8
6	150	-	7.9	0.73	-	16	400	-	50.4	4.7	-	36	900	-	244.4	22.7
8	200	-	13.6	1.3	-	18	450	-	63.3	5.9	-	42	1050	-	329.9	30.6
10	250	-	20.5	2	-	20	500	-	77.7	7.2	-	48	1200	-	430.0	39.9

Notes:

(1) Although the bearing strength values in this table have been used successfully in the design of thrust blocks and are considered to be conservative, their accuracy is totally dependent on accurate soil identification and evaluation. The ultimate responsibility for selecting the proper bearing strength of a particular soil type must rest with the design engineer.

(2) Values listed are based on a 90-degree horizontal bend, an internal pressure of ~~100 psi~~ 225 psi (~~6~~ 15 ~~.9~~ 5 bar), a soil horizontal bearing strength of 1000 lb/ft^2 (4880 kg/m^2), a safety factor of 1.5, and ductile iron pipe outside diameters.

(a) For other horizontal bends, multiply by the following coefficients: for 45 degrees, 0.541; for 22½ degrees, 0.276; for 11¼ degrees, 0.139.

(b) For other internal pressures, multiply by ratio to ~~100 psi~~ 225 psi (~~6~~ 15 ~~.9~~ 5 bar).

(c) For other soil horizontal bearing strengths, divide by ratio to 1000 lb/ft^2 (4880 kg/m^2).

(d) For other safety factors, multiply by ratio to 1.5.

Example: Using Table A.10.6.1(b), find the horizontal bearing block area for a 6 in. (150 mm) diameter, 45-degree bend with an internal pressure of ~~150 psi~~ 200 psi (~~10~~ 13 ~~.3~~ 8 bar). The soil bearing strength is 3000 lb/ft^2 (14850 kg/m^2), and the safety factor is 1.5.

From Table A.10.6.1(b), the required bearing block area for a 6 in. (150 mm) diameter, 90-degree bend with an internal pressure of ~~100 psi~~ 225 psi (~~6~~ 15 ~~.9~~ 5 bar) and a soil horizontal bearing strength of 1000 psi (70 bar) is ~~7~~ X ~~.9 ft~~ X ft ^{2} (0.~~73 m~~ XX m ^{2}). {{NOTE: Adjust based on corrected Tabulated values.}}

For example:

$$Area = \frac{7.9\ \text{ft}^2 (0.541)\left(\frac{150}{100}\right)}{\left(\frac{3000}{1000}\right)} = 2.1\ \text{ft}^2$$

In lieu of the values for soil bearing strength shown in Table A.10.6.1(c), a designer might choose to use calculated Rankine passive pressure (P_p) or other determination of soil bearing strength based on actual soil properties.

Table A.10.6.1(c) Horizontal Bearing Strengths

Soil	Bearing Strength (S_b)	
	lb/ft^2	kN/m^2
Muck	0	0
Soft clay	1000	48
Silt	1500	72
Sandy silt	3000	145
Sand	4000	190
Sand clay	6000	285

Soil	Bearing Strength (S_b)	
	lb/ft^2	kN/m^2
Hard clay	9000	430

Note: Although the bearing strength values in this table have been used successfully in the design of thrust blocks and are considered to be conservative, their accuracy is totally dependent on accurate soil identification and evaluation. The ultimate responsibility for selecting the proper bearing strength of a particular soil type must rest with the design engineer.

It can be easily shown that $T_y = PA \sin \theta$. The required volume of the block is as follows:

$$V_g = \frac{S_f PA \sin \theta}{W_m} \quad \text{[A.10.6.1c]}$$

where:

V_g = block volume (ft^3)

S_f = safety factor

P = water pressure (psi)

A = cross-sectional area of pipe interior

W_m = density of block material (lb/ft^3)

In a case such as the one shown, the horizontal component of thrust force is calculated as follows:

$$T_x = PA(1 - \cos \theta) \quad \text{[A.10.6.1d]}$$

where:

T_x = horizontal component of thrust force

P = water pressure (psi)

A = cross-sectional area of pipe interior

The horizontal component of thrust force must be resisted by the bearing of the right side of the block against the soil. Analysis of this aspect follows the same principles as the previous section on bearing blocks.

Additional Proposed Changes

File Name	Description	Approved
NFPA_24_PC_2.pdf	NFPA 24_PC_2	

Statement of Problem and Substantiation for Public Input

NOTE: This Public Input appeared as “Reject but Hold” in Public Comment No. 2 of the (A2021) Second Draft Report for NFPA 24 and per the Regs. at 4.4.8.3.1.

The current criteria in the Annex is based on a water pressure of 100 psi with examples of how to adjust the values based on differing water pressures. Since the design of a thrust block most be capable of managing the internal water pressure under all conditions, the appropriate pressure for such design would always be the hydrostatic test pressure since it is 200 psi or 50 psi in excess of the maximum working pressure whichever is greater. To design a thrust block and not anticipate the forces applied during the hydrostatic test would be a mistake. Similar to what is done with steel straps for restraint the design should be based on this maximum pressure of 225 psi with adjustments being appropriate where that is down to 200 psi or upwards of 225 psi where the working pressure exceeds 175 psi.

Submitter Information Verification

Submitter Full Name:	TC on AUT-PRI
Organization:	NFPA
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City:	
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Submittal Date:	Wed Jul 14 13:32:31 EDT 2021
Committee:	AUT-PRI

Public Comment No. 2-NFPA 24-2020 [Section No. A.10.6.1]

A.10.6.1

The use of concrete thrust blocks is one method of restraint, provided that stable soil conditions prevail and space requirements permit placement. Successful blocking is dependent on factors such as location, availability and placement of concrete, and possibility of disturbance by future excavations.

Resistance is provided by transferring the thrust force to the soil through the larger bearing area of the block so that the resultant pressure against the soil does not exceed the horizontal bearing strength of the soil. The design of thrust blocks consists of determining the appropriate bearing area of the block for a particular set of conditions. The parameters involved in the design include pipe size, design pressure, angle of the bend (or configuration of the fitting involved), and the horizontal bearing strength of the soil.

Table A.10.6.1(a) gives the nominal thrust at fittings for various sizes of ductile iron and PVC piping. Figure A.10.6.1(a) shows an example of how thrust forces act on a piping bend.

Table A.10.6.1(a) Thrust at Fittings at ~~100 psi~~ 225 psi (~~6~~ 15 .~~9~~ 5 bar) Water Pressure for Ductile Iron and PVC Pipe {{NOTE: ALL Values in the Table will need to be revised test pressure of 225 psi}}

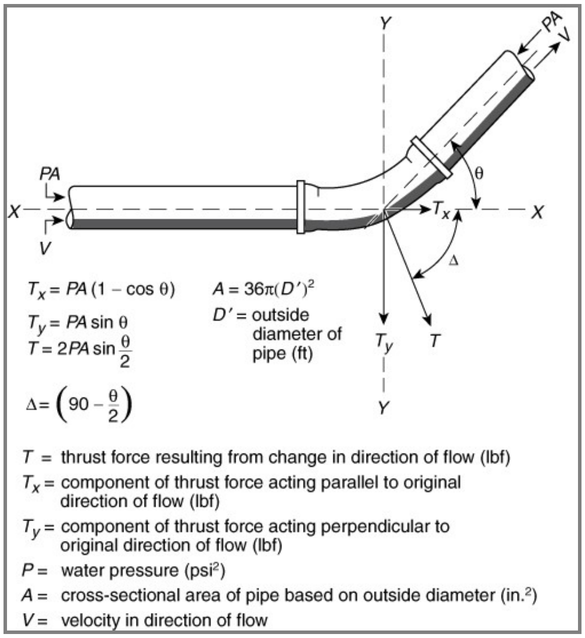
Nominal Pipe Diameter in. (mm)	Total Pounds (Newtons)										
	Dead End		90 Degree		45 Degree		22 1/2 Degree		11 1/4 Degree		5 1/4 Degree
	lbf	N	lbf	N	lbf	N	lbf	N	lbf	N	lbf
4 (100)	1,810	8,051	2,559	11,383	1,385	6,161	706	3,140	355	1,579	162
6 (150)	3,739	16,632	5,288	23,522	2,862	12,731	1,459	6,490	733	3,261	334
8 (200)	6,433	28,615	9,097	40,465	4,923	21,899	2,510	11,165	1,261	5,609	575
10 (250)	9,677	43,045	13,685	60,874	7,406	32,944	3,776	16,796	1,897	8,438	865
12 300)	13,685	60,874	19,353	86,086	10,474	46,591	5,340	23,753	2,683	11,935	1,224
14 (350)	18,385	81,781	26,001	115,658	14,072	62,595	7,174	31,912	3,604	16,031	1,644
16 (400)	23,779	105,774	33,628	149,585	18,199	80,953	9,278	41,271	4,661	20,733	2,126
18 (450)	29,865	132,846	42,235	187,871	22,858	101,677	11,653	51,835	5,855	26,044	2,670
20 (500)	36,644	163,001	51,822	230,516	28,046	124,755	14,298	63,601	7,183	31,952	3,277
24 (600)	52,279	232,548	73,934	328,875	40,013	177,987	20,398	90,735	10,249	45,590	4,675
30 (750)	80,425	357,748	113,738	505,932	61,554	273,806	31,380	139,585	15,766	70,131	7,191
36 (900)	115,209	512,475	162,931	724,753	88,177	392,231	44,952	199,956	22,585	100,463	10,302
42 (1,050)	155,528	691,823	219,950	978,386	119,036	529,498	60,684	269,936	30,489	135,622	13,907
48 (1,200)	202,683	901,579	286,637	1,275,024	155,127	690,039	79,083	351,779	39,733	176,741	18,124

Notes:

(1) For SI units, 1 lb = 0.454 kg; 1 in. = 25 mm.

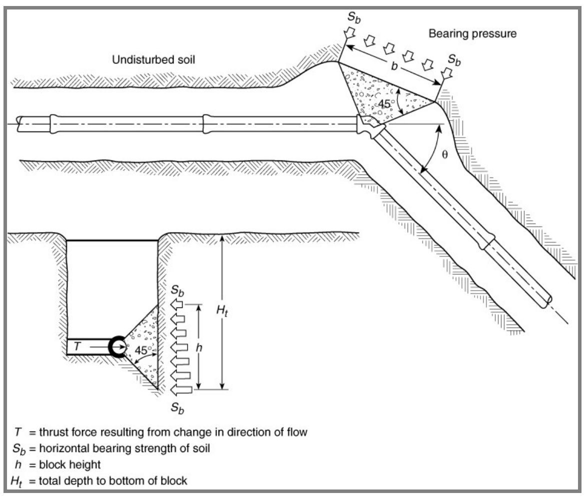
(2) To determine thrust at pressure other than ~~100 psi~~ 225 psi (~~6~~ 15 .~~9~~ 5 bar), multiply the thrust obtained in the table by the ratio of the pressure to ~~100 psi~~ 225 psi (~~6~~ 15 .~~9~~ 5 bar). For example, the thrust on a 12 in. (305 mm), 90-degree bend at ~~125 psi~~ 200 psi (13. 8 ~~.6~~ bar) is ~~19~~ XX ,~~353~~ XXX × ~~125~~ 200 /~~100~~ 225 = ~~24~~ XX ,~~191 lb~~ XXX lb (~~10~~ XX ,~~973 kg~~ XXX kg). {{NOTE: Correct the formula based on updated Tabular values}}

Figure A.10.6.1(a) Thrust Forces Acting on Bend.



Thrust blocks are generally categorized into two groups — bearing and gravity blocks. Figure A.10.6.1(b) depicts a typical bearing thrust block on a horizontal bend.

Figure A.10.6.1(b) Bearing Thrust Block.



The following are general criteria for bearing block design:

(1) The bearing surface should, where possible, be placed against undisturbed soil.

(2) Where it is not possible to place the bearing surface against undisturbed soil, the fill between the bearing surface and undisturbed soil should be compacted to at least 90 percent Standard Proctor density.

(3) Block height (h) should be equal to or less than one-half the total depth to the bottom of the block (H_t) but not less than the pipe diameter (D).

(4) Block height (h) should be chosen so that the calculated block width (b) varies between one and two times the height.

(5) Gravity thrust blocks can be used to resist thrust at vertical down bends. In a gravity thrust block, the weight of the block is the force providing equilibrium with the thrust force. The design problem is then to calculate the required volume of the thrust block of a known density. The vertical component of the thrust force in Figure A.10.6.1(c) is balanced by the weight of the block. For required horizontal bearing block areas, see Table A.10.6.1(b).

The required block area (A_b) is as follows:

$$A_b = (h)(b) = \frac{T(S_f)}{S_b}$$ **[A.10.6.1a]**

where:

A_b = required block area (ft^2)

h = block height (ft)

b = calculated block width (ft)

T = thrust force (lbf)

S_f = safety factor (usually 1.5)

S_b = bearing strength (lb/ft^2)

Then, for a horizontal bend, the following formula is used:

$$b = \frac{2(S_f)(P)(A)\sin\left(\frac{\theta}{2}\right)}{(h)(S_b)}$$ **[A.10.6.1b]**

where:

b = calculated block width (ft)

S_f = safety factor (usually 1.5 for thrust block design)

P = water pressure ($lb/in.^2$)

A = cross-sectional area of pipe based on outside diameter

h = block height (ft)

S_b = horizontal bearing strength of soil (lb/ft^2)($in.^2$)

A similar approach can be used to design bearing blocks to resist the thrust forces at locations such as tees and dead ends. Typical values for conservative horizontal bearing strengths of various soil types are listed in Table A.10.6.1(c).

Figure A.10.6.1(c) Gravity Thrust Block.

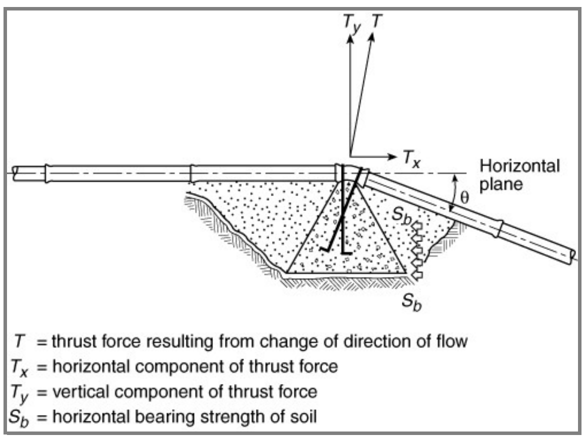


Table A.10.6.1(b) Required Horizontal Bearing Block Area at 225 psi (15.5 bar) {{NOTE: Update Tabular values based on a test pressure of 225 psi}}

Nominal Pipe Diameter	
_	
Bearing Block Area	Nominal Pipe Diameter
_	
Bearing Block Area	Nominal Pipe Diameter
_	
Bearing Block Area	

in.		**mm**	
ft^2	**m^2)**	**in.**	**mm**
ft^2	**m^2**	**in.**	**mm**
	ft^2		**m^2**
3	80		
2.6	0.24	12	300
29.0	2.7	24	600
	110.9		10.3
4	100		
3.8	0.35	14	350
39.0	3.6	30	750
	170.6		15.8
6	150		
7.9	0.73	16	400
50.4	4.7	36	900
	244.4		22.7
8	200		
13.6	1.3	18	450
63.3	5.9	42	1050
	329.9		30.6
10	250		
20.5	2	20	500
77.7	7.2	48	1200
	430.0		39.9

Notes:

(1) Although the bearing strength values in this table have been used successfully in the design of thrust blocks and are considered to be conservative, their accuracy is totally dependent on accurate soil identification and evaluation. The ultimate responsibility for selecting the proper bearing strength of a particular soil type must rest with the design engineer.

(2) Values listed are based on a 90-degree horizontal bend, an internal pressure of ~~100 psi~~ 225 psi (~~6~~ 15 .~~9~~ 5 bar), a soil horizontal bearing strength of 1000 lb/ft ^{2} (4880 kg/m^2), a safety factor of 1.5, and ductile iron pipe outside diameters.

(a) For other horizontal bends, multiply by the following coefficients: for 45 degrees, 0.541; for 22½ degrees, 0.276; for 11¼ degrees, 0.139.

(b) For other internal pressures, multiply by ratio to ~~100 psi~~ 225 psi (~~6~~ 15 .~~9~~ 5 bar).

(c) For other soil horizontal bearing strengths, divide by ratio to 1000 lb/ft^2 (4880 kg/m^2).

(d) For other safety factors, multiply by ratio to 1.5.

Example: Using Table A.10.6.1(b), find the horizontal bearing block area for a 6 in. (150 mm) diameter, 45-degree bend with an internal pressure of ~~150 psi~~ 200 psi (~~10~~ 13 .~~3~~ 8 bar). The soil bearing strength is 3000 lb/ft^2 (14850 kg/m^2), and the safety factor is 1.5.

From Table A.10.6.1(b), the required bearing block area for a 6 in. (150 mm) diameter, 90-degree bend with an internal pressure of ~~100 psi~~ 225 psi (~~6~~ 15 .~~9~~ 5 bar) and a soil horizontal bearing strength of 1000 psi (70 bar) is ~~7~~ X .~~9 ft~~ X ft ^{2} (0.~~73 m~~ XX m ^{2}). {{NOTE: Adjust based on corrected Tabulated values.}}

For example:

$$Area = \frac{7.9 \text{ ft}^2 (0.541)\left(\frac{150}{100}\right)}{\left(\frac{3000}{1000}\right)} = 2.1 \text{ ft}^2$$

[A.10.6.1c] {{

In lieu of the values for soil bearing strength shown in Table A.10.6.1(c), a designer might choose to use calculated Rankine passive pressure (P_p) or other determination of soil bearing strength based on actual soil properties.

Table A.10.6.1(c) Horizontal Bearing Strengths

Soil	**Bearing Strength (S_b)**	
	lb/ft ^{2}	**kN/m ^{2}**
Muck	0	0
Soft clay	1000	48
Silt	1500	72
Sandy silt	3000	145
Sand	4000	190
Sand clay	6000	285
Hard clay	9000	430

Note: Although the bearing strength values in this table have been used successfully in the design of thrust blocks and are considered to be conservative, their accuracy is totally dependent on accurate soil identification and evaluation. The ultimate responsibility for selecting the proper bearing strength of a particular soil type must rest with the design engineer.

It can be easily shown that $T_y = PA \sin \theta$. The required volume of the block is as follows:

$$V_g = \frac{S_f PA \sin \theta}{W_m}$$

[A.10.6.1d]

where:

V_g = block volume (ft^3)

S_f = safety factor

P = water pressure (psi)

A = cross-sectional area of pipe interior

W_m = density of block material (lb/ft^3)

In a case such as the one shown, the horizontal component of thrust force is calculated as follows:

$$T_x = PA(1 - \cos\theta)$$ **[A.10.6.1e]**

where:

T_X = horizontal component of thrust force

P = water pressure (psi)

A = cross-sectional area of pipe interior

The horizontal component of thrust force must be resisted by the bearing of the right side of the block against the soil. Analysis of this aspect follows the same principles as the previous section on bearing blocks.

Statement of Problem and Substantiation for Public Comment

The current criteria in the Annex is based on a water pressure of 100 psi with examples of how to adjust the values based on differing water pressures. Since the design of a thrust block most be capable of managing the internal water pressure under all conditions, the appropriate pressure for such design would always be the hydrostatic test pressure since it is 200 psi or 50 psi in excess of the maximum working pressure whichever is greater. To design a thrust block and not anticipate the forces applied during the hydrostatic test would be a mistake. Similar to what is done with steel straps for restraint the design should be based on this maximum pressure of 225 psi with adjustments being appropriate where that is down to 200 psi or upwards of 225 psi where the working pressure exceeds 175 psi.

Related Item

- X

Submitter Information Verification

Submitter Full Name: Tracey Bellamy
Organization: Telgian Corporation
Street Address:
City:
State:
Zip:
Submittal Date: Wed Mar 04 16:18:32 EST 2020
Committee: AUT-PRI

Committee Statement

Committee Action: Rejected but held
Resolution: The technical committee needs more time to review and discuss the submitter's data.

Public Input No. 14-NFPA 24-2022 [Section No. A.10.6.1]

A.10.6.1

The use of concrete thrust blocks is one method of restraint, provided that stable soil conditions prevail and space requirements permit placement. Successful blocking is dependent on factors such as location, availability and placement of concrete, and possibility of disturbance by future excavations.

Resistance is provided by transferring the thrust force to the soil through the larger bearing area of the block so that the resultant pressure against the soil does not exceed the horizontal bearing strength of the soil. The design of thrust blocks consists of determining the appropriate bearing area of the block for a particular set of conditions. The parameters involved in the design include pipe size, design pressure, angle of the bend (or configuration of the fitting involved), and the horizontal bearing strength of the soil.

Table A.10.6.1(a) gives the nominal thrust at fittings for various sizes of ductile iron and PVC piping. Figure A.10.6.1(a) shows an example of how thrust forces act on a piping bend.

Table A.10.6.1(a) Thrust at Fittings at 100 psi (6.9 bar) Water Pressure for Ductile Iron and PVC Pipe

22 1/2 - 11 1/4 - 5 1/8

A.6.6.1

The use of concrete thrust blocks is one method of restraint, provided that stable soil conditions prevail and space requirements permit placement. Successful blocking is dependent on factors such as location, availability and placement of concrete, and possibility of disturbance by future excavations.

Resistance is provided by transferring the thrust force to the soil through the larger block bearing area of the block so that the resultant pressure against the soil does not exceed the horizontal bearing strength of the soil. The design of thrust blocks consists of determining the appropriate block bearing area of the block for a particular set of conditions. The parameters involved in the design include pipe size, design pressure, angle of the bend (or configuration of the fitting involved), and the horizontal bearing strength of the soil.

Table A.6.6.1(a) gives the nominal thrust at fittings for various sizes of ductile-iron and PVC piping. Figure A.6.6.1(a) shows an example of how thrust forces act on a piping bend.

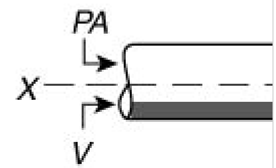
Table A.6.6.1(a) Thrust at Fittings at 100 psi (6.9 bar) Water Pressure for Ductile Iron and PVC Pipe

Nominal Pipe	**Total Pounds (Newtons)**	**22 1/2 Degree**	**11 1/4 Degree**	**5 1/8 Degree**			
				lbf	**N**	**lbf**	**N**
				4 (100)	**1,810**	**8,051**	**2,559**
				6 (150)	**3,739**	**16,632**	**5,288**
				8 (200)	**6,433**	**28,615**	**9,097**
				10 (250)	**9,677**	**43,045**	**13,685**
				12 (300)	**13,685**	**60,874**	**19,353**
				14 (350)	**18,385**	**81,781**	**26,001**
				16 (400)	**23,779**	**105,774**	**33,628**
				18 (450)	**29,865**	**132,846**	**42,235**
				20 (500)	**36,644**	**163,001**	**51,822**
				24 (600)	**52,279**	**232,548**	**73,934**
				30 (750)	**80,425**	**357,748**	**113,738**
				36 (900)	**115,209**	**512,475**	**162,931**
				42 (1,050)	**155,528**	**691,823**	**219,950**
				48 (1,200)	**202,683**	**901,579**	**286,637 1**

(1)

(2) To determine thrust at pressur the ratio of the pressure to 100 ps at 125 psi (

Figure A.6.6.1(a



$T_x = PA (1 - \cos$

$T_y = PA \sin \theta$

$T = 2PA \sin \frac{\theta}{2}$

$\Delta = \left(90 - \frac{\theta}{2}\right)$

T = thrust force

T_x = component direction of

T_y = component original dire

P = water press

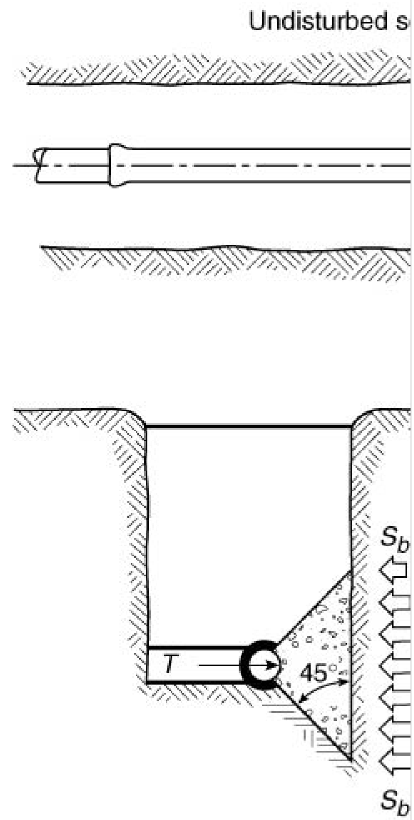
A = cross-sectic

V = velocity in d

Diameter [in. (mm)]	Dead End	90 Degree	45 Degree

Thrust blocks are generally categ depicts a typical l

Figure A.6.6



T = thrust force resulting from ch
S_b = horizontal bearing strength c
h = block height
H_t = total depth to bottom of block

The follow

(1) The bearing surfac

(2) Where it is not possible to bearing surface and undist

(3) Block height *(h)* should be (

(4) Block height *(h)* should be c

(5) Gravity thrust blocks can be weight of the block is the f then to calculate the required of the thrust force in Figure

The re

A

S

Then, for

b = calcula

S_f = safety f

P = water p

A = cross-s

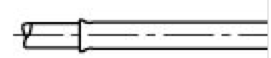
h = block h

S_b = horizon

A similar approach can be used
tees and dead ends. Typical value

I

Figure A.6.



T = thrust force r

T_x = horizontal co

T_y = vertical comp

S_b = horizontal be

Table A.6

Nominal Pipe Diameter . [in. (mm)]	Block Bearing Area . [ft 2 (m 2)]
3 (80)	2.6 (0.24)
4 (100)	3.8 (0.35)
6 (150)	7.9 (0.73)
8 (200)	13.6 (1.3)
10 (250)	20.5 (2)

(1) Although the bearing strength blocks and are considered to identification and evaluation. Th particula

(2) Values listed are based on a 90 horizontal bearing strength of

(a) For other horizontal bends

(b) For other in

(c) For other soil horizont

(d) Fo

Example : Using Table A.6.6.1(b) degree bend with an internal pr

From Table A.6.6.1(b), the requir an internal pressure of 100 ps

$$Area = \frac{7.9}{}$$

In lieu of the values for soil beari calculated Rankine passive pr

Tab

Soil

Soil

Muck

Soft clay

Silt

Sandy silt

Sand

Sandy clay

Hard clay

Note: Although the bearing str
thrust blocks and are considered
identification and evaluation. Th
particul

It can be easily shown tha

V

S

W

In a case such as the one sho

T_x

T x

F

A

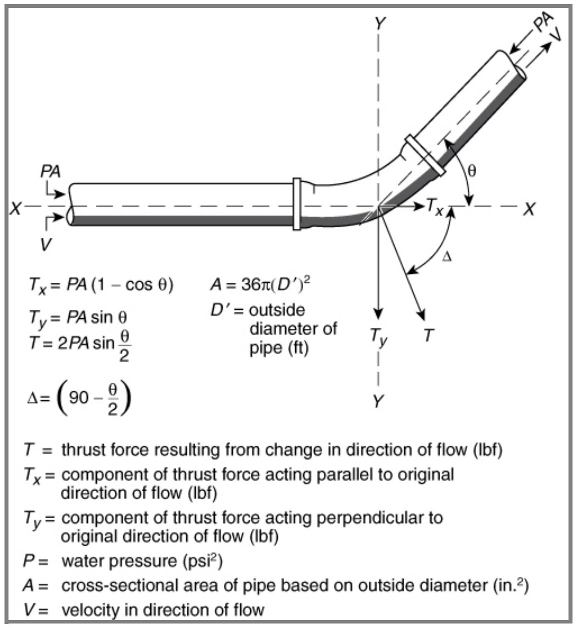
The horizontal component of th
against the soil. Analysis of this

Notes:

(1) For SI units, 1 lb = 0.454 kg; 1 in. = 25 mm.

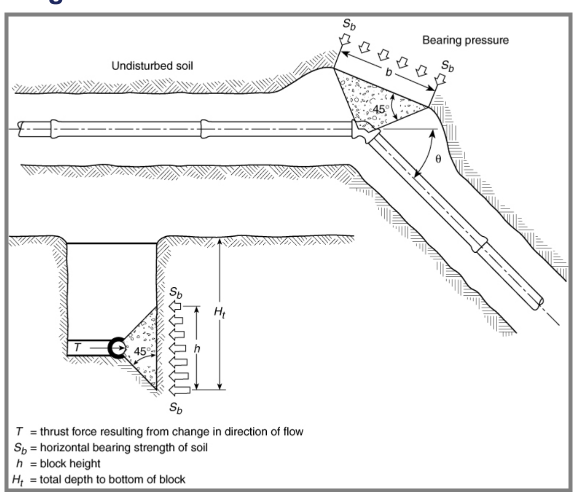
(2) To determine thrust at pressure other than 100 psi (6.9 bar), multiply the thrust obtained in the table by the ratio of the pressure to 100 psi (6.9 bar). For example, the thrust on a 12 in. (305 mm), 90-degree bend at 125 psi (8.6 bar) is 19,353 × 125/100 = 24,191 lb (10,973 kg).

Figure A.10.6.1(a) Thrust Forces Acting on Bend.



Thrust blocks are generally categorized into two groups — bearing and gravity blocks. Figure A.10.6.1(b) depicts a typical bearing thrust block on a horizontal bend.

Figure A.10.6.1(b) Bearing Thrust Block.



The following are general criteria for bearing block design:

(1) The bearing surface should, where possible, be placed against undisturbed soil.

(2) Where it is not possible to place the bearing surface against undisturbed soil, the fill between the bearing surface and undisturbed soil should be compacted to at least 90 percent Standard Proctor density.

(3) Block height (*h*) should be equal to or less than one-half the total depth to the bottom of the block (H_t) but not less than the pipe diameter (*D*).

(4) Block height (*h*) should be chosen so that the calculated block width (*b*) varies between one and two times the height.

(5) Gravity thrust blocks can be used to resist thrust at vertical down bends. In a gravity thrust block, the weight of the block is the force providing equilibrium with the thrust force. The design problem is then to calculate the required volume of the thrust block of a known

density. The vertical component of the thrust force in Figure A.10.6.1(c) is balanced by the weight of the block. For required horizontal bearing block areas, see Table A.10.6.1(b).

The required block area (A_b) is as follows:

$$A_b = (h)(b) = \frac{T(S_f)}{S_b} \quad \text{[A.10.6.1a]}$$

where:

A_b = required block area (ft^2)

h = block height (ft)

b = calculated block width (ft)

T = thrust force (lbf)

S_f = safety factor (usually 1.5)

S_b = bearing strength (lb/ft^2)

Then, for a horizontal bend, the following formula is used:

$$b = \frac{2(S_f)(P)(A)\sin\left(\frac{\theta}{2}\right)}{(h)(S_b)} \quad \text{[A.10.6.1b]}$$

where:

b = calculated block width (ft)

S_f = safety factor (usually 1.5 for thrust block design)

P = water pressure (lb/in.^{2})

A = cross-sectional area of pipe based on outside diameter

h = block height (ft)

S_b = horizontal bearing strength of soil (lb/ft^2)(in.^{2})

A similar approach can be used to design bearing blocks to resist the thrust forces at locations such as tees and dead ends. Typical values for conservative horizontal bearing strengths of various soil types are listed in Table A.10.6.1(c).

Figure A.10.6.1(c) Gravity Thrust Block.

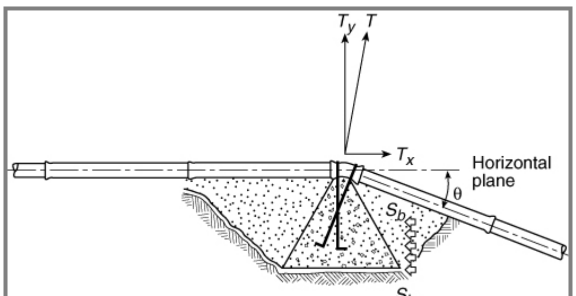


Table A.10.6.1(b) Required Horizontal Bearing Block Area

Nominal Pipe	Bearing Block	Nominal Pipe	Bearing Block	Nominal Pipe	Bearing Block

Diameter			Area			Diameter			Area			Diameter			Area	
in.	mm	-	ft^2	m^2	-	in.	mm	-	ft^2	m^2	-	in.	mm	-	ft^2	m^2
3	80	-	2.6	0.24	-	12	300	-	29.0	2.7	-	24	600	-	110.9	10.3
4	100	-	3.8	0.35	-	14	350	-	39.0	3.6	-	30	750	-	170.6	15.8
6	150	-	7.9	0.73	-	16	400	-	50.4	4.7	-	36	900	-	244.4	22.7
8	200	-	13.6	1.3	-	18	450	-	63.3	5.9	-	42	1050	-	329.9	30.6
10	250	-	20.5	2	-	20	500	-	77.7	7.2	-	48	1200	-	430.0	39.9

Notes:

(1) Although the bearing strength values in this table have been used successfully in the design of thrust blocks and are considered to be conservative, their accuracy is totally dependent on accurate soil identification and evaluation. The ultimate responsibility for selecting the proper bearing strength of a particular soil type must rest with the design engineer.

(2) Values listed are based on a 90-degree horizontal bend, an internal pressure of 100 psi (6.9 bar), a soil horizontal bearing strength of 1000 lb/ft^2 (4880 kg/m^2), a safety factor of 1.5, and ductile iron pipe outside diameters.

(a) For other horizontal bends, multiply by the following coefficients: for 45 degrees, 0.541; for 22½ degrees, 0.276; for 11¼ degrees, 0.139.

(b) For other internal pressures, multiply by ratio to 100 psi (6.9 bar).

(c) For other soil horizontal bearing strengths, divide by ratio to 1000 lb/ft^2 (4880 kg/m^2).

(d) For other safety factors, multiply by ratio to 1.5.

Example: Using Table A.10.6.1(b), find the horizontal bearing block area for a 6 in. (150 mm) diameter, 45-degree bend with an internal pressure of 150 psi (10.3 bar). The soil bearing strength is 3000 lb/ft^2 (14850 kg/m^2), and the safety factor is 1.5.

From Table A.10.6.1(b), the required bearing block area for a 6 in. (150 mm) diameter, 90-degree bend with an internal pressure of 100 psi (6.9 bar) and a soil horizontal bearing strength of 1000 psi (70 bar) is 7.9 ft^2 (0.73 m^2).

For example:

$$Area = \frac{7.9\ \text{ft}^2 (0.541)\left(\frac{150}{100}\right)}{\left(\frac{3000}{1000}\right)} = 2.1\ \text{ft}^2$$

In lieu of the values for soil bearing strength shown in Table A.10.6.1(c), a designer might choose to use calculated Rankine passive pressure (P_p) or other determination of soil bearing strength based on actual soil properties.

Table A.10.6.1(c) Horizontal Bearing Strengths

Soil	Bearing Strength (S_b)	
	lb/ft^2	kN/m^2
Muck	0	0
Soft clay	1000	48
Silt	1500	72
Sandy silt	3000	145
Sand	4000	190
Sand clay	6000	285

Soil	Bearing Strength (S_b)	
	lb/ft^2	kN/m^2
Hard clay	9000	430

Note: Although the bearing strength values in this table have been used successfully in the design of thrust blocks and are considered to be conservative, their accuracy is totally dependent on accurate soil identification and evaluation. The ultimate responsibility for selecting the proper bearing strength of a particular soil type must rest with the design engineer.

It can be easily shown that $T_y = PA \sin \theta$. The required volume of the block is as follows:

$$V_g = \frac{S_f PA \sin \theta}{W_m} \quad \textbf{[A.10.6.1c]}$$

where:

V_g = block volume (ft^3)

S_f = safety factor

P = water pressure (psi)

A = cross-sectional area of pipe interior

W_m = density of block material (lb/ft^3)

In a case such as the one shown, the horizontal component of thrust force is calculated as follows:

$$T_x = PA(1 - \cos \theta) \quad \textbf{[A.10.6.1d]}$$

where:

T_x = horizontal component of thrust force

P = water pressure (psi)

A = cross-sectional area of pipe interior

The horizontal component of thrust force must be resisted by the bearing of the right side of the block against the soil. Analysis of this aspect follows the same principles as the previous section on bearing blocks.

Statement of Problem and Substantiation for Public Input

Block area, bearing area, block bearing area, and bearing block area were not used consistently throughout the annex note.
Block bearing area is the most appropriate as it relates to the side of the block that is against the undisturbed soil.

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Committee:	AUT-PRI

Public Input No. 17-NFPA 24-2022 [New Section after A.10.10.2.3.1]

A.12.2.1

Protection should be provided in any area of a structure or building that poses a degree of hazard greater than that normal to the general occupancy of the building or structure. These areas include areas for the storage or use of combustibles or flammables; toxic, noxious, or corrosive materials; and heat-producing appliances.T

Statement of Problem and Substantiation for Public Input

This is the proposed annex note associated with Public Input No. 16.
This proposal seeks to add the annex text associated with a similar section found in NFPA 13 (2022). In NFPA 13 this Annex section is found in A.16.4.3

If accepted this language will be extracted from NFPA 13 into a new annex section (A.12.2.1) in NFPA 24 and can be considered a correlation between NFPA 13 and NFPA 24 on the same subject.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 16-NFPA 24-2022 [Section No. 12.2.1]	Related proposal

Submitter Information Verification

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