

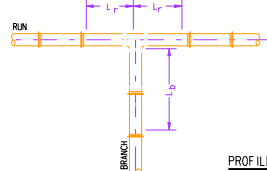
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MECHANICALLY RESTRAINED JOINT DETAILS

Nom. Pipe Size	Branch Size 6"				Branch Size 8"				Branch Size 10"				Branch Size 12"			
	L _r =5'	L _r =10'	L _r =15'	L _r =20'	L _r =5'	L _r =10'	L _r =15'	L _r =20'	L _r =5'	L _r =10'	L _r =15'	L _r =20'	L _r =5'	L _r =10'	L _r =15'	L _r =20'
6"	28"	2'	FJO	FJO	51"	32"	13'	FJO	68"	52"	22'	22'	85"	72"	59"	41"
8"	19"	FJO	FJO	FJO	45"	19"	FJO	FJO	63"	42"	22'	22'	81"	64"	47"	30"
10"	10"	FJO	FJO	FJO	38"	5'	FJO	FJO	57"	31"	5'	FJO	76"	55"	33"	12"
12"	FJO	FJO	FJO	FJO	31"	FJO	FJO	FJO	52"	20"	FJO	FJO	72"	46"	19"	FJO

Nom. Pipe Size	Branch Size 6"				Branch Size 8"				Branch Size 10"				Branch Size 12"			
	L _r =5'	L _r =10'	L _r =15'	L _r =20'	L _r =5'	L _r =10'	L _r =15'	L _r =20'	L _r =5'	L _r =10'	L _r =15'	L _r =20'	L _r =5'	L _r =10'	L _r =15'	L _r =20'
6"	18"	2'	FJO	FJO	34"	21"	8'	FJO	45"	35"	25"	14'	56"	48"	40"	31"
8"	13"	FJO	FJO	FJO	30"	13'	FJO	FJO	42"	28"	15'	FJO	54"	42"	31'	20"
10"	7"	FJO	FJO	FJO	25"	4'	FJO	FJO	38"	21"	4'	FJO	51"	36"	22"	8"
12"	FJO	FJO	FJO	FJO	21"	FJO	FJO	FJO	34"	14'	FJO	FJO	48"	30"	13'	FJO

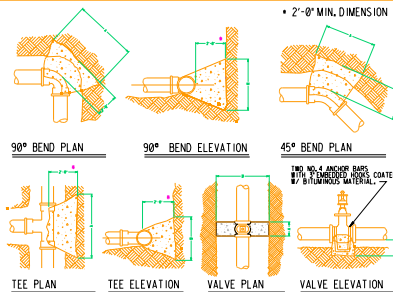
FJO: Restraint required at Fitting Joint Only
L_r: Length of Pipe along the run that is free of Joints



EXAMPLE: FOR AN 8" PVC RUN WITH L_r = 5 FEET (1.5 m) ON AN 8" TEE, RESTRAIN ALL JOINTS ON THE PVC BRANCH THAT ARE LESS THAN 45 FEET (13.7 m) FROM THE FITTING JOINT ALONG THE BRANCH.

PROFILE VIEW SCALE: NTS

THRUST BLOCK DETAILS



BEARING SURFACE AGAINST UNDISTURBED EARTH - MINIMUM DIMENSIONS

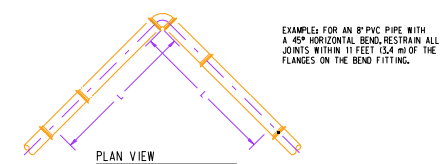
Nom. Pipe Size	90° ELBOW		45° ELBOW		TEES, PLUGS, CAPS	
	A	B	A	B	A	B
4"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"
6"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"
8"	3'-0"	3'-0"	3'-0"	3'-0"	3'-0"	3'-0"
10"	3'-0"	3'-0"	3'-0"	3'-0"	3'-0"	3'-0"
12"	4'-0"	4'-0"	3'-6"	3'-6"	3'-6"	3'-6"

VALUES FOR ALL VALVE ELBOW USE 4" AND 6" FOR ALL NOMINAL PIPE SIZES OF 4" OR LESS. BLOCKING SHALL BE PLACED AGAINST THE BEARING SURFACE ONLY. THE UNDISTURBED EARTH USE 1:4 ROUGH PLUS CONCRETE. THE 'B' DIMENSION FOR VALVES IS BASED ON THE SECONDARY FLANGH WITHIN 12" OF THE VALVE.

GENERAL NOTES

- MECHANICALLY RESTRAINED JOINTS SHALL BE USED FOR RESTRAINING NEW WATER LINES.
 - CONCRETE THRUST BLOCKING WILL BE USED WHERE SPECIFICALLY IDENTIFIED ON THE PLANS AT ALL VALVES, AT ALL FIRE HYDRANTS, AND WHERE REQUIRED MECHANICAL JOINT RESTRAINT DISTANCES ARE GREATER THAN FIELD CONDITIONS ALLOW.
 - ALL CONNECTIONS AT FITTINGS SHALL BE RESTRAINED.
 - ALL MECHANICALLY RESTRAINED JOINTS SHALL HAVE A MINIMUM PIPE LENGTH OF 20 FEET EACH SIDE OF JOINT. ANY PIPE JOINTS LESS THAN 20 FT. WILL REQUIRE ENGINEERING REVIEW.
 - IN NO CASE SHALL DRY CONCRETE THRUST BLOCKING BE USED FOR JOINT RESTRAINT.
 - SPECIAL CONSIDERATION MAY BE REQUIRED TO MEET CERTAIN FIELD CONDITIONS. RESTRAINT LENGTHS MAY EXTEND INTO EXISTING WATER MAINS, REQUIRING RESTRAINED FITTINGS TO BE PLACED AT EXISTING WATERLINE JOINTS FOR THE LENGTH SPECIFIED IN THE TABLES ON THIS SHEET.
 - DESIGN ASSUMPTIONS FOR MECHANICALLY RESTRAINED JOINTS FOR SITUATIONS DIFFERING FROM THESE ASSUMPTIONS CONSULT THE DESIGN ENGINEER.
- SAFETY FACTOR: 1.5 TO 1.
PRESSURE: 150 psi (1034 kPa) (FIRE LINES REQUIRE 200 psi (1379 kPa))
SOIL TYPE: GM - SILTY GRAVELS
TRENCH TYPE: 4 Per ANNA C680
PIPE BEDDED IN 4 INCHES OF SAND, COMPACTED TO 80% TO TOP OF PIPE
BURIAL DEPTH: 3' (0.9 m) TO TOP OF PIPE

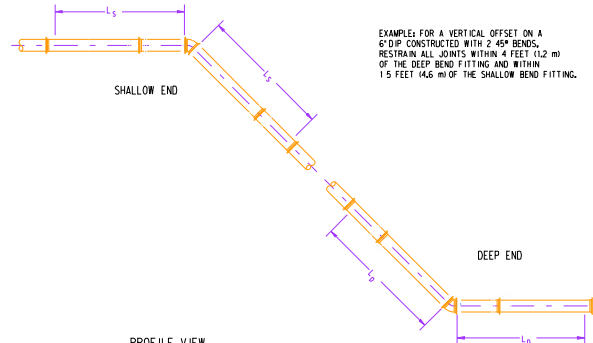
Nom. Pipe Size	Bend Angle			Restrained Length, L, Feet
	11 1/2°	22 1/2°	45°	
6"	2'	4'	8'	20"
8"	3'	5'	11'	26"
10"	3'	6'	13'	31"
12"	4'	7'	15'	36"



EXAMPLE: FOR AN 8" PVC PIPE WITH A 45° HORIZONTAL BEND, RESTRAIN ALL JOINTS WITHIN 11 FEET (3.4 m) OF THE FLANGES ON THE BEND FITTING.

PLAN VIEW SCALE: NTS

Nom. Pipe Size	22 1/2° Bend		45° Bend	
	Deep End L _r , Feet	Shallow End L _r , Feet	Deep End L _r , Feet	Shallow End L _r , Feet
6"	2'	11'	4'	23'
8"	3'	14'	6'	30'
10"	3'	17'	7'	36'
12"	4'	20'	8'	42'

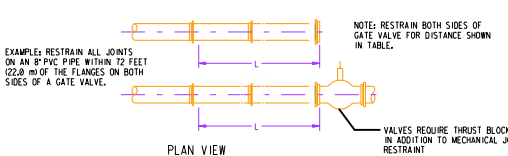


EXAMPLE: FOR A VERTICAL OFFSET ON A 6" D'P CONSTRUCTED WITH 2' 45° BENDS, RESTRAIN ALL JOINTS WITHIN 4 FEET (1.2 m) OF THE DEEP BEND FITTING AND WITHIN 1.5 FEET (0.46 m) OF THE SHALLOW BEND FITTING.

PROFILE VIEW SCALE: NTS

Nom. Pipe Size	Restrained Length, L	
	4"	6"
4"	39"	6'
6"	55"	8'
8"	72"	10'
10"	86"	12'
12"	102"	14'

These Lengths May be Used Where Enough New Pipe Exists to Install the Restraint Joints Along a Straight Pipe Run.



EXAMPLE: RESTRAIN ALL JOINTS ON AN 8" PVC PIPE WITHIN 72 FEET (22.0 m) OF THE FLANGES ON BOTH SIDES OF A GATE VALVE.

NOTE: RESTRAIN BOTH SIDES OF GATE VALVE FOR DISTANCE SHOWN IN TABLE.

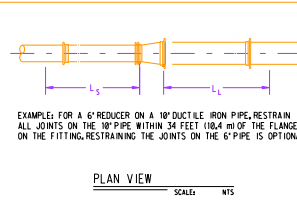
VALVES REQUIRE THRUST BLOCKING IN ADDITION TO MECHANICAL JOINT RESTRAINT

PLAN VIEW SCALE: NTS

Nom. Pipe Size	22 1/2° Bend		45° Bend	
	Deep End L _r , Feet	Shallow End L _r , Feet	Deep End L _r , Feet	Shallow End L _r , Feet
6"	2'	7'	4'	15'
8"	2'	9'	5'	19'
10"	3'	11'	6'	23'
12"	3'	13'	7'	27'

Nominal Pipe Size	Unobstructed Straight Run Length, Feet		Restrained Straight Run Length, Feet	
	(L _r) Small Pipe Size	(L _r) Large Pipe Size	(L _r) L small	(L _r) L large
6" x 4"	FJO	28"	6" x 4"	18"
8" x 4"	FJO	52"	8" x 4"	33"
8" x 6"	FJO	30"	8" x 6"	19"
10" x 6"	FJO	53"	10" x 6"	34"
10" x 8"	FJO	29"	10" x 8"	18"
12" x 8"	FJO	54"	12" x 8"	34"
12" x 10"	FJO	50"	12" x 10"	32"

FJO: Restraint required at Fitting Joint Only



EXAMPLE: FOR A 6" REDUCER ON A 10" DUCTILE IRON PIPE, RESTRAIN ALL JOINTS ON THE 10" PIPE WITHIN 34 FEET (10.4 m) OF THE FLANGE ON THE FITTING. RESTRAINING THE JOINTS ON THE 6" PIPE IS OPTIONAL.

PLAN VIEW SCALE: NTS

U.S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

SANDIA NATIONAL LABORATORIES

WATER LINE THRUST RESTRAINT DETAILS

PROJECT NO.	REV	DATE	DESCRIPTION	DRN	ESD	APM

CIVIL WORK

DATE: 9/24/96

FILE NAME: WU5005STD

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