MECHANICALLY RESTRAINED JOINT DETAILS

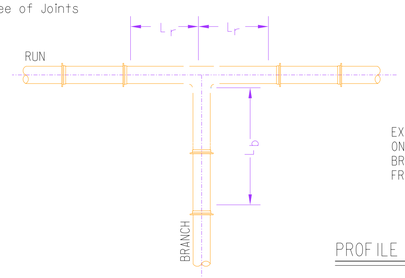
TEES - PVC PIPE

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'
	Restrained Length L_b, Feet for a Specified L_r															
6"	28'	2'	FJO	FJO	51'	32'	13'	FJO	68'	52'	37'	22'	85'	72'	59'	47'
8"	19'	FJO	FJO	FJO	45'	19'	FJO	FJO	63'	42'	22'	2'	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

TEES - DUCTILE IRON PIPE

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'
	Restrained Length L_b, Feet for a Specified L_r															
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

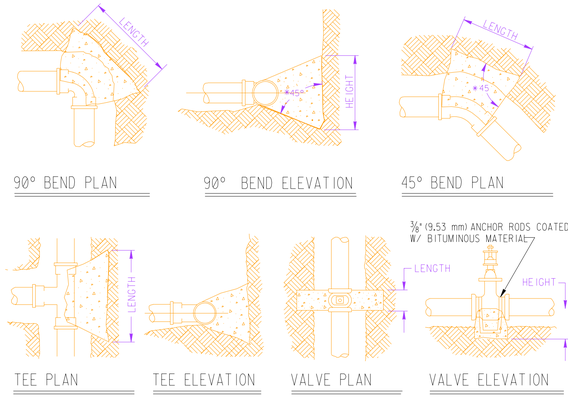
FJO: Restraint required at Fitting Joint Only
L_r = Length of Pipe along the run that is free of Joints



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 (19.2 m) FROM THE FITTING JOINT ALONG THE BRANCH.

PROFILE VIEW
SCALE: NTS

THRUST BLOCK DETAILS



90° BEND PLAN
90° BEND ELEVATION
45° BEND PLAN
TEE PLAN
TEE ELEVATION
VALVE PLAN
VALVE ELEVATION

BEARING SURFACE AGAINST UNDISTURBED EARTH. - MINIMUM DIMENSIONS

NOM. PIPE SIZE	90° BEND		45° BEND		TEES, PLUGS, CAPS, HYDRANTS & VALVES	
	LENGTH	HEIGHT	LENGTH	HEIGHT	LENGTH	HEIGHT
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"	2' - 0"	2' - 0"	2' - 0"	2' - 0"
10"	4' - 0"	4' - 0"	3' - 0"	3' - 0"	3' - 0"	3' - 0"
12"	4' - 0"	4' - 0"	3' - 6"	3' - 6"	3' - 0"	3' - 0"

• UNDISTURBED EARTH ONLY. FOR DISTURBED EARTH USE TIE RODS PLUS THRUST BLOCKS.

2'-0", 3'-0", 3'-6", 4'-0"

GENERAL NOTES

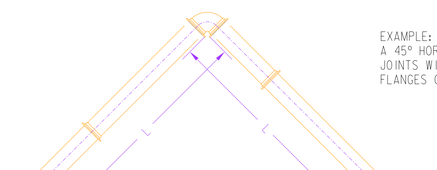
1. MECHANICALLY RESTRAINED JOINTS SHALL BE USED FOR RESTRAINING NEW WATER LINES.
2. CONCRETE THRUST BLOCKING WILL BE USED WHERE SPECIFICALLY IDENTIFIED ON THE PLANS AT ALL VALVES, AT ALL FIRE HYDRANTS, AND WHERE REQUIRED MECHANICAL JOINT RESTRAINT DISTANCES ARE GREATER THAN FIELD CONDITIONS ALLOW.
3. ALL JOINTS AT FITTINGS SHALL BE RESTRAINED.
4. 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
5. IN NO CASE SHALL DRY CONCRETE THRUST BLOCKING BE USED FOR JOINT RESTRAINT.
6. SPECIAL CONSIDERATION MAY BE NEEDED 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.
7. DESIGN ASSUMPTIONS FOR MECHANICALLY RESTRAINED JOINTS: FOR SITUATIONS DIFFERING FROM THESE ASSUMPTIONS CONSULT THE DESIGN ENGINEER OR EBBA IRON SALES, INC. AT 1-800-433-171 6.
   SAFETY FACTOR: 1.5 TO 1.
   PRESSURE: 150 psi (1034 kPa) (FIRELINES REQUIRE 200 psi (1379 kPa)
   SOIL TYPE: GM - SILTY GRAVELS
   PIPE: AS NOTED
   TRENCH TYPE 4 Per AWWA C600
   PIPE BEDDED IN 4 INCHES OF SAND, COMPACTED TO 80% TO TOP OF PIPE)
   BURIAL DEPTH: 3' (0.9 m) TO TOP OF PIPE

HORIZONTAL BENDS - PVC PIPE

Nom. Pipe Size	Bend Angle			
	11 1/8	22½°	45°	90°
	Restrained Length, L, Feet			
6"	2'	4'	8'	20'
8"	3'	5'	11'	26'
10"	3'	6'	13'	31'
12"	4'	7'	15'	36'

HORIZONTAL BENDS - DUCTILE IRON PIPE

Nom. Pipe Size	Bend Angle			
	11 1/8	22½°	45°	90°
	Restrained Length, L, Feet			
6"	2'	3'	7'	17'
8"	2'	4'	9'	22'
10"	3'	5'	11'	26'
12"	3'	6'	12'	30'



EXAMPLE: FOR AN 8" PVC PIPE WITH A 45° HORIZONTAL BEND, RESTRAIN ALL JOINTS WITHIN 11 FEET (4.3 m) OF THE FLANGES ON THE BEND FITTING.

PLAN VIEW
SCALE: NTS

VERTICAL OFFSETS PVC PIPE

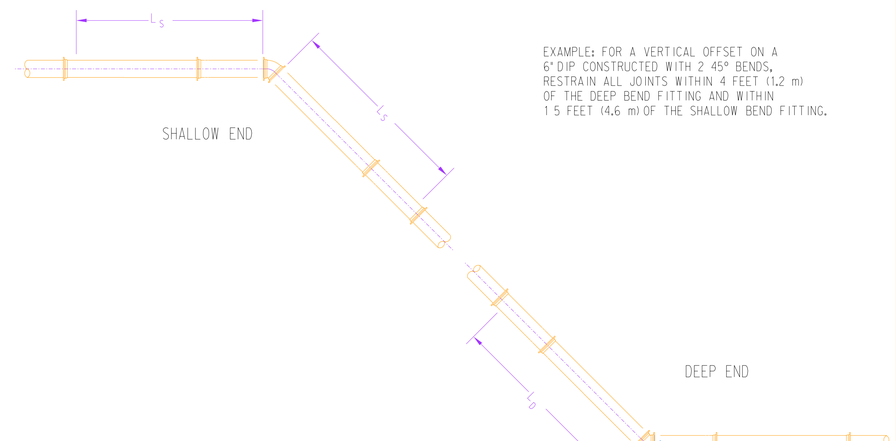
Additional Design Parameters
Shallow end depth = 3.0'
Deep end depth = 6.0'

Nom. Pipe Size	22½° Bend		45° Bend	
	Restrained Length			
	Deep End L_D, Feet	Shallow End L_S, Feet	Deep End L_D, Feet	Shallow End L_S, Feet
6"	2'	11'	4'	23'
8"	3'	14'	16'	30'
10"	3'	17'	7'	36'
12"	4'	20'	8'	42'

VERTICAL OFFSETS DUCTILE IRON PIPE

Additional Design Parameters
Shallow end depth = 3.0'
Deep end depth = 6.0'

Nom. Pipe Size	22½° Bend		45° Bend	
	Restrained Length			
	Deep End L_D, Feet	Shallow End L_S, Feet	Deep End L_D, Feet	Shallow End L_S, Feet
6"	2'	7'	4'	15'
8"	2'	9'	5'	19'
10"	3'	11'	6'	23'
12"	3'	13'	7'	27'



EXAMPLE: FOR A VERTICAL OFFSET ON A 6" DIP CONSTRUCTED WITH 2 45° BENDS, RESTRAIN ALL JOINTS WITHIN 4 FEET (1.2 m) OF THE DEEP BEND FITTING AND WITHIN 1 5 FEET (4.6 m) OF THE SHALLOW BEND FITTING.

PROFILE VIEW
SCALE: NTS

DEAD ENDS GATE VALVES OR END CAPS PVC PIPE

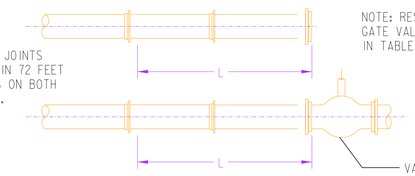
Nom. Pipe Size	Restrained Length L
4"	39'
6"	55'
8"	72'
10"	86'
12"	102'

DEAD ENDS GATE VALVES OR END CAPS DUCTILE IRON PIPE

Nom. Pipe Size	Restrained Length L
4"	25'
6"	35'
8"	46'
10"	55'
12"	65'

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 (25.9 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

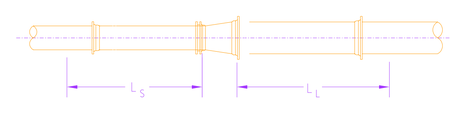
REDUCER PVC PIPE

Nominal Pipe Size	Unobstructed Straight Run Length, Feet Restrained	
	(L_S) Small Pipe Side	(L_L) Large Pipe Side
6" X 4"	FJO	28'
8" X 4"	FJO	52'
8" X 6"	FJO	30'
10" X 6"	FJO	53'
10" X 8"	FJO	29'
12" X 8"	FJO	54'
12" X 10"	FJO	50'

FJO: Restraint required at Fitting Joint Only

REDUCER DUCTILE IRON PIPE

Nominal Pipe Size	Unobstructed Straight Run Length, Feet Restrained	
	(L_S) L small	(L_L) L large
6" X 4"	FJO	18'
8" X 4"	FJO	33'
8" X 6"	FJO	19'
10" X 6"	FJO	34'
10" X 8"	FJO	18'
12" X 8"	FJO	34'
12" X 10"	FJO	32'



EXAMPLE: FOR A 6" REDUCER ON A 10" PVC PIPE, RESTRAIN ALL JOINTS ON THE 10" PIPE WITHIN 53 FEET (18.9 m) OF THE FLANGE ON THE FITTING. RESTRAINING THE JOINTS ON THE 6" PIPE IS OPTIONAL.

PLAN VIEW
SCALE: NTS

OLD FILE NAME: 101628/A01

CAD DRAWING
FILE NAME: WU5005STD.dgn
REFERENCE FILES:

REV	DATE	DESCRIPTION	DWN	CKD	APP
3	9/10/02	REVISED NOTES	DMR	DMR	
2	6/15/01	UDS MODS	EG	FL	
1	10/99	REVISED	MAJ	DR	
E	7/1/03	MODS	ELG	JM	

P.O. OR W.O.
PROJECT NO.

U.S. DEPARTMENT OF ENERGY
KIRTLAND AREA OFFICE — ALBUQUERQUE, NEW MEXICO

SANDIA NATIONAL LABORATORIES
ALBUQUERQUE, NEW MEXICO; LIVERMORE, CALIFORNIA; TONOPAH, NEVADA

WATER LINE THRUST RESTRAINT DETAILS

P.O. OR W.O.	
PROJECT NO.	CN6758
DRAWN BY	JAK
CHECKED BY	MSH
APPROVED BY	
DATE	9/24/96
SEQ.	

CIVIL WORK — STANDARD
SIZE D+ — DRAWING NO./SHEET WU5005STD

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