



TABLE 2: MINIMUM RESTRAINED DISTANCE "D" REQUIRED FOR ELIMINATION OF THRUST BLOCKS

PIPE SIZE	ELIMINATION OF THRUST BLOCKS (FT)			REDUCTION ALLOWED (CU. YRDS.) FROM TABLE 1 PER 10' OF "D" (RESTRAINED DISTANCE)
	11.25°	22.5°	45°	
4"	8	17	34	0.15
6"	11	23	48	0.22
8"	15	31	64	0.29
10"	18	37	77	0.37
12"	22	44	91	0.44
14"	25	50	104	0.51
16"	28	56	117	0.59
18"	31	62	130	0.67
20"	34	69	143	0.75
24"	40	81	168	0.90

TABLE 1: TOTAL CONCRETE REQUIRED (CU. YRDS.)

PIPE SIZE	ANGLE		
	11.25°	22.5°	45°
4"	0.1	0.3	0.5
6"	0.3	0.5	1.1
8"	0.4	0.9	1.9
10"	0.7	1.3	2.8
12"	0.9	1.9	4.0
14"	1.3	2.6	5.3
16"	1.6	3.3	6.9
18"	2.1	4.2	8.7
20"	2.5	5.1	10.6
24"	3.6	7.3	15.2

NOTES

- ALL DOWNWARD CONCAVE BENDS MUST EITHER BE CONNECTED TO A CONCRETE THRUST BLOCK AT LEAST AS LARGE AS INDICATED IN TABLE 1, BE CONNECTED TO RESTRAINED PIPE FOR THE MINIMUM DISTANCE GIVEN IN TABLE 2, OR A COMBINATION OF THE TWO. EXAMPLE OF COMBINATION: 45 DEGREE BEND IN 16" PIPE 16' FROM ANOTHER CONCAVE DOWNWARD BEND AND 4 STICKS (18' EACH) FROM NEAREST UNRESTRAINED JOINT- IF NOT RESTRAINED, THE VOLUME OF THE REQUIRED THRUST BLOCK WOULD BE 6.9 CU. YRDS. AS GIVEN BY TABLE 1. HOWEVER SINCE THERE IS A RESTRAINED LENGTH "D" = $(1/2 \times 16') + (4 \times 18') = 80'$ THE SIZE OF THE BLOCK CAN BE REDUCED. THIS REDUCTION IS GIVEN BY THE LAST COLUMN OF TABLE 2 TO BE 8 x 0.59 CU. YRDS. = 4.7 CU. YRDS. SO THAT THE BLOCK NEEDS TO BE ONLY 6.9 - 4.7 = 2.2 CU. YRDS.
- THRUST BLOCKS SHALL BE POURED SO THAT JOINTS OF FITTINGS, INCLUDING ALL NUTS AND FOLLOWERS, REMAIN ACCESSIBLE.
- CENTER OF MASS OF THRUST BLOCK MUST BE BELOW PIPE AND CONNECTED TO PIPE WITH TWO STEEL STRAPS. EACH STRAP IS TO HAVE A CROSS-SECTIONAL AREA OF AT LEAST 1/2 SQUARE INCH PER 4 CUBIC YARDS OF CONCRETE. IF STRAPS ARE NOT STAINLESS, PIPE AND STRAPS SHALL BE ISOLATED FROM DIRECT CONTACT WITH A PLASTIC INSULATOR.
- REGARDLESS OF SIZE OF THRUST BLOCK, WATER PIPE JOINTS AT ANGLE MUST BE RESTRAINED.
- CONCRETE THRUST BLOCKS SHALL BE 2500 P.S.I. AND ARE BASED ON 150 P.S.I. WATER PRESSURE. ALL OTHER CONDITIONS ARE SUBJECT TO THE ENGINEER'S REVIEW AND APPROVAL.
- DEDUCTION D IS ALLOWED ONLY WHEN CONDITIONS LISTED IN NOTE 5 ARE MET, ENTIRE SECTION D IS BURIED AT LEAST 5' DEEP, AND PIPE IS BEDDED IN CLEAN SAND FOR ENTIRE LENGTH OF D.
- THIS STANDARD APPLIES TO DOWNWARD CONCAVE ELBOWS. UPWARD CONCAVE ELBOWS SHALL HAVE THRUST BLOCKS AS SHOWN ON STANDARD 414B.
- FIELD-LOCK GASKETS, MEGA-LUG COUPLINGS, AND FORD UNIFLANGE COUPLINGS ARE THE ONLY APPROVED MEANS OF RESTRAINING JOINTS.
- RESTRAINED LENGTHS USED IN PLACE OF THRUST BLOCKS IN STANDARDS 414A AND 414B MAY NOT OVERLAP.

SCALE: NTS	DATE: 8/25/99	CITY AND BOROUGH OF JUNEAU, ALASKA DOWNWARD CONCAVE THRUST BLOCK	
DRAWN BY: TAD	CHECKED BY: STAFF		
APPROVED BY: <i>[Signature]</i>	REVISED: 8/14/2011	STANDARD 414A	