

NOTES

RESTRAINING REQUIREMENTS FOR 4", 6" AND 8" WATER MAINS:

1. BEARING AREAS SHOWN ARE BASED ON 150 PSI SERVICE PRESSURE, 1500 PSF SOIL BEARING CAPACITY, AND SAFETY FACTOR OF 1.25. BLOCKING AREAS NEED TO BE MODIFIED WHERE FIELD CONDITIONS DIFFER.
2. "MINOR CONCRETE" PER SECTION 90 OF THE CALTRANS STANDARDS, WITH 3/4" AGGREGATE, SHALL BE USED FOR THRUST BLOCKS AND WINGWALLS. CONCRETE SHALL BE POURED AGAINST UNDISTURBED SOIL AND BARE PIPE.
3. FOR ADDITIONAL WATER MAIN OFFSET AND JOINT DEFLECTION DESIGN REQUIREMENTS, SEE W-15. FOR ADDITIONAL THRUST BLOCK AND WINGWALL DESIGN REQUIREMENTS, SEE W-14A.
4. FIELD LOK GASKETS SHALL BE USED, INSTEAD OF THRUST BLOCKS, FOR RESTRAINING WATER MAINS WITH LESS THAN STANDARD COVER (PER W-12), AND WATER MAINS WITHIN STEEL CASINGS.
5. CONCRETE RESTRAINTS SHALL BE CURED FOR A MINIMUM OF 7 DAYS (OR REACH A MINIMUM 75% OF THE FINAL CURE STRENGTH) PRIOR TO INSTALLATION OF OFFSET ON EXISTING WATER FACILITIES, OR ACTIVATION OF NEW WATER FACILITIES.

MINIMUM REQUIRED TOTAL BEARING AREAS (IN SQ. FT.) FOR THRUST BLOCKS AND WINGWALLS FOR 4", 6" AND 8" WATER MAINS			
TYPE OF FITTING	MAIN SIZE		
	4"	6"	8"
11-1/4° ELL	1	1	2
22-1/2° ELL	1	2	3
45° ELL	2	3	5
90° ELL	3	5	9
CROSS OR TEE	2	4	7
DEAD END	2	4	7

RESTRAINING REQUIREMENTS FOR 12" AND LARGER WATER MAINS:

1. RESTRAINING FORCES SHOWN ARE BASED ON 150 PSI SERVICE PRESSURE, 1500 PSF SOIL BEARING CAPACITY, AND SAFETY FACTOR OF 1.5. RESTRAINING FORCES NEED TO BE MODIFIED WHERE FIELD CONDITIONS DIFFER.
2. WINGWALL DESIGNS SHALL INCORPORATE RESTRAINING FORCES, SOIL BEARING CAPACITIES, AND WATER MAIN DEPTH. WINGWALLS SHALL BE DESIGNED AND STAMPED BY A LICENSED CIVIL ENGINEER, AND SHALL BE REVIEWED AND APPROVED BY THE WATER DIVISION PRIOR TO INSTALLATION.
3. FOR ADDITIONAL WATER MAIN OFFSET AND JOINT DEFLECTION DESIGN REQUIREMENTS, SEE W-15. FOR ADDITIONAL THRUST BLOCK AND WINGWALL DESIGN REQUIREMENTS, SEE W-14A.
4. "MINOR CONCRETE" PER SECTION 90 OF THE CALTRANS STANDARDS, WITH 3/4" AGGREGATE, SHALL BE USED FOR WINGWALLS AND SHALL BE INCORPORATED AS PART OF THE ENGINEERED DESIGN. CONCRETE SHALL BE POURED AGAINST UNDISTURBED SOIL AND BARE PIPE.
5. FIELD LOK GASKETS SHALL BE USED, INSTEAD OF THRUST BLOCKS, FOR RESTRAINING JOINTS OF 12" AND LARGER WATER MAINS. RESTRAINED LENGTHS FOR PIPE SIZES LARGER THAN 12" SHALL BE DETERMINED BY THE ENGINEER AND APPROVED BY THE CITY.
6. CONCRETE RESTRAINTS SHALL BE CURED FOR A MINIMUM OF 7 DAYS (OR REACH A MINIMUM 75% OF THE FINAL CURE STRENGTH) PRIOR TO INSTALLATION OF OFFSET ON EXISTING WATER FACILITIES, OR ACTIVATION OF NEW WATER FACILITIES.

MINIMUM RESTRAINED LENGTH "L" (IN FEET)				
BEND ANGLE	PIPE SIZE			
	4"	6"	8"	12"
11-1/4° ELL	7	10	14	20
22-1/2° ELL	14	21	28	41
45° ELL	28	43	57	85
90° ELL	36	54	72	108
DEAD END	36	54	72	108

MINIMUM REQUIRED RESTRAINING FORCE (IN 1,000 PSI INCREMENTS) FOR ENGINEERED WINGWALL DESIGN FOR 12" AND LARGER WATER MAINS

TYPE OF FITTING	MAIN SIZE				
	12"	16"	20"	24"	30"
11-1/4° ELL	5	9	14	20	40
22-1/2° ELL	10	18	28	40	70
45° ELL	20	35	55	80	130
90° ELL	36	64	100	150	230
CROSS OR TEE	26	46	71	110	160
DEAD END	26	46	71	110	160

CITY OF NAPA

PUBLIC WORKS - WATER DIVISION

WATER MAIN RESTRAINT DETAILS

DATE REVISED DECEMBER 2015

CHECKED *[Signature]*

APPROVED *[Signature]*

SCALE NONE

W - 14B

DWG NO.