

CIRCULAR CONCRETE MANURE TANK

Safety Considerations:

1. Surround tank by a chain link or woven wire fence if wall height is less than 5 feet above grade.
2. Fence posts must not be cast into the concrete wall.
3. Install safety stops at pushoff locations to prevent accidental entry of equipment.

Unloading Station:

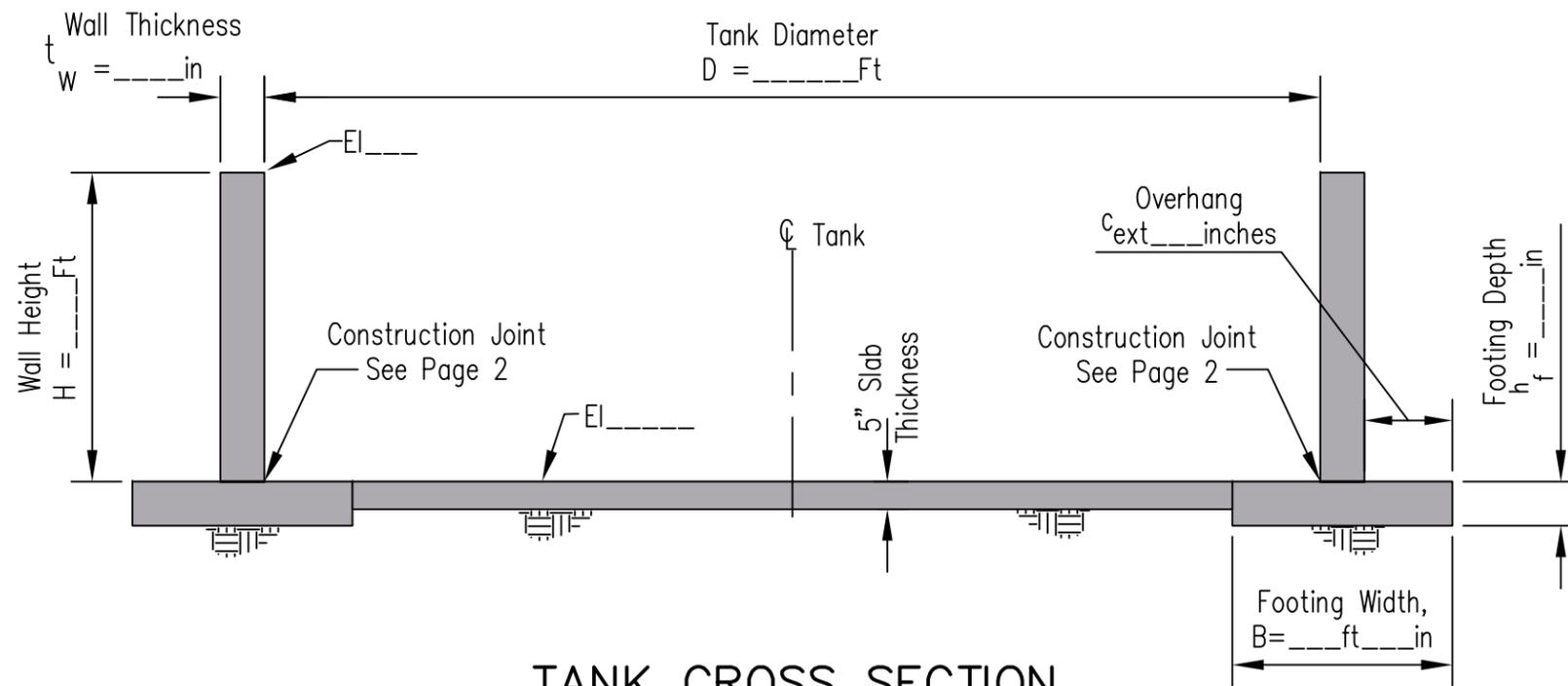
If tractors, heavy tank wagons, or trucks will be driven along the edge of the tank, cast a 6 inch thick concrete slab along the traffic route by the tank. The concrete slab should be large enough to eliminate any wheel loads directly on the natural ground or backfill by the tank. The purpose of the slab is to distribute the loading along the tank wall and prevent mud and erosion. Place each way in the concrete slab reinforcement equivalent to No. 3 bars at 18 inches center to center (place steel at or above the mid-depth of the slab). Granular backfill is required under slab.

Design Loading:

1. Manure load: 65 psf/ft. of depth.
2. Soil backfill loads: 85 psf/ft. of depth with no surcharge or 60 psf/ft. of depth with 120 psf lateral surcharge. This requires the structure backfill to be adequately drained. To meet this requirement see backfill details on page 2.

Construction Notes:

1. Reinforcing steel for footing and walls must have a tension yield point of $f_y = 60,000$ psi. Refer to page 3 for floor reinforcing steel grades.
2. For splice lengths refer to the table on page 4. All bends in reinforcing steel must have a minimum inside radius of 3 bar diameters.
3. All concrete must have a minimum 28 day compressive strength of 4,000 psi. The mix design shall be submitted to NRCS prior to placement. Unless shown otherwise in the construction specifications, the following requirements shall apply:
 - Minimum cement content – 6 bags per Cu. Yd.
 - Slump – 4 inches plus or minus 1 inch.
 - Air content from 5 to 7 percent.
 - Aggregate size – maximum of 1 inch diameter.
 - Construction joints – cleaned prior to subsequent concrete placement.
 - Cure concrete for a minimum of 7 days – acceptable methods are:
 - membrane forming curing compound
 - leaving the forms in place
 - soaking / continuous spray
4. Construction joints must be used to ease construction. The location of construction joints must be approved by the Engineer prior to placing the concrete. See Page 2.
5. Refer to manufacturer recommendation for placing waterstop material.
6. Backfill must be brought up uniformly around the tank. The maximum difference in the finished backfill elevations around the tank is 3 feet.
7. All construction methods must meet OSHA regulations.
8. See Section 302, MWPS 1, "Foundations for Farm Structures", Revised 1987, for tanks with backfill less than frost depth (Section 901, MWPS 1).
9. Installation of this structure must conform to NRCS Construction Specifications.



TANK CROSS SECTION

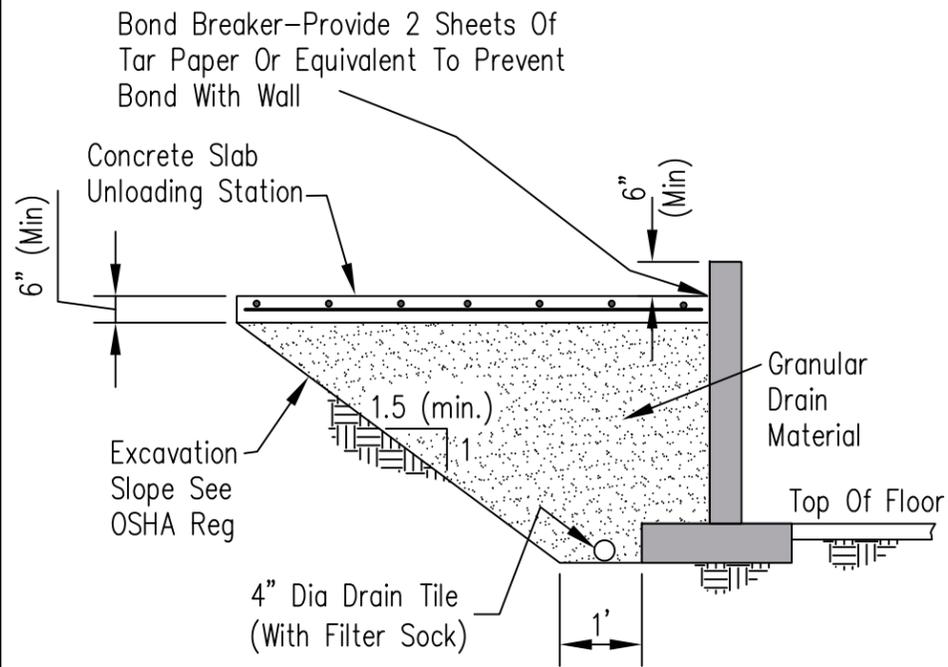
This drawing is based on a design prepared by the MidWest Plan Service (MWPS) at Iowa State University. For more specific details concerning the design refer to MidWest Plan Service Publication TR-9, Circular Concrete Manure Tanks (March 1998). This drawing may be used for tanks which are above or below ground. The design is in accordance with ultimate strength design requirements detailed in ACI 318-95.

Designed	Date
Drawn	M. QUINONES
Checked	9/15/16
Approved	

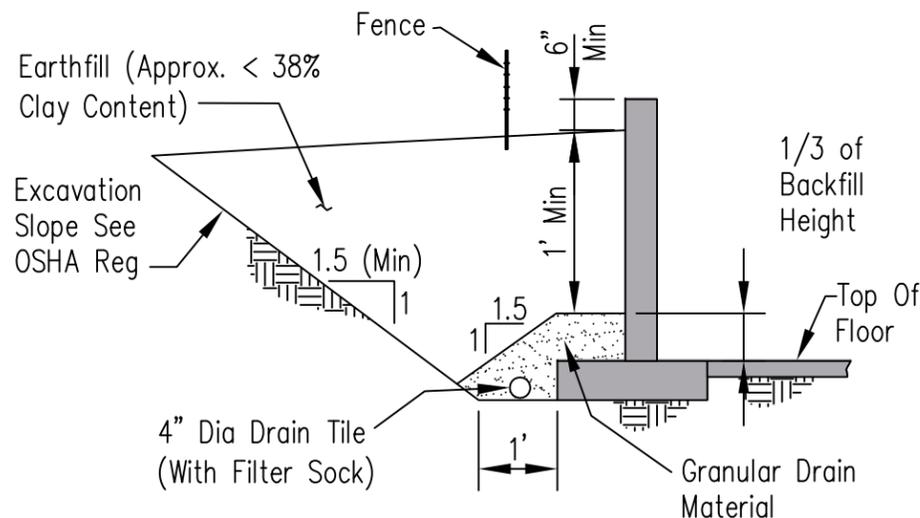
CIRCULAR CONCRETE MANURE TANK



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**WALL BACKFILL DETAIL
UNLOADING STATION**



**WALL BACKFILL DETAIL
TYPICAL**

1. Provide a minimum 4 inch diameter perimeter drain tile for wall backfill drainage. Outlet the tile at a location downstream where flow from the outlet may be monitored.
2. If a high water table is present a special drain design will be required under the tank floor to prevent uplift.
3. To provide adequate drainage, the granular drain material must be Illinois DOT Grad No. CA 7, 8, 11, 12, 13, 14, 15, 16, or FA 1, 2, 4.

Construction Joint Notes

1. A construction joint must be prepared when the concrete pour is not continuous, typically between the floor and wall.
2. Prepare all surfaces that will be in contact with new concrete as per note 5.
3. Let concrete cure at least 12 hours prior to steel tying and form construction for the next pour.
4. New concrete must not be placed until the hardened concrete has cured at least 12 hours.
5. Construction joints must be prepared using one of the following two methods:

Method 1 – Water–Air or Sandblasting. Clean the joint surface of all unsatisfactory concrete, laitance, coating, stains, and debris by sandblasting or high–pressure air–water cutting, or both. Sandblasting can be used after the concrete has gained sufficient strength to resist excessive cutting, and high–pressure air–water cutting can be used as soon as the concrete has hardened sufficiently to prevent the jet from displacing the coarse aggregates. The surface of the concrete in place must be cut to expose clean, sound aggregate, but not so deep as to undercut the edges of larger particles of the aggregate. Cut the surface to at least 1/4” depth. Thoroughly wash the surface to remove all material after cutting.

Method 2 – Mechanical. Clean the joint surface of all unsatisfactory concrete, laitance, coatings, stains, and debris by washing and scrubbing with a wire brush, wire broom, or other means approved by the engineer to expose coarse aggregate without displacing it. The surface must be roughened to at least 1/4” depth.

6. All construction joints must be wetted and standing water removed immediately before new concrete is placed.
7. New concrete must be sufficiently vibrated to ensure good contact into the prepared joint.
8. Keyways or steel plates cannot be substituted for the construction joint methods above.

TABLE OF QUANTITIES

ITEM	AMOUNT	UNITS
Excavation_____	_____	Cu. Yd.
Subgrade Fill_____	_____	Cu. Yd.
Backfill_____	_____	Cu. Yd.
Drain Fill_____	_____	Cu. Yd.
Drain Tile_____	_____	Lin. Ft.
Fence_____	_____	Lin. Ft.
Shear Plate_____	_____	Lin. Ft.
Concrete Chairs_____	_____	Each
Curing Compound_____	_____	Gal.

Concrete (4000 psi)			
Wall Footing	_____	Sq. Ft.	_____ Cu. Yd.
Tank Floor Slab	_____	Sq. Ft.	_____ Cu. Yd.
Wall	_____	Lin. Ft.	_____ Cu. Yd.
Other: _____	_____	_____	_____ Cu. Yd.
Total Concrete			_____ Cu. Yd.

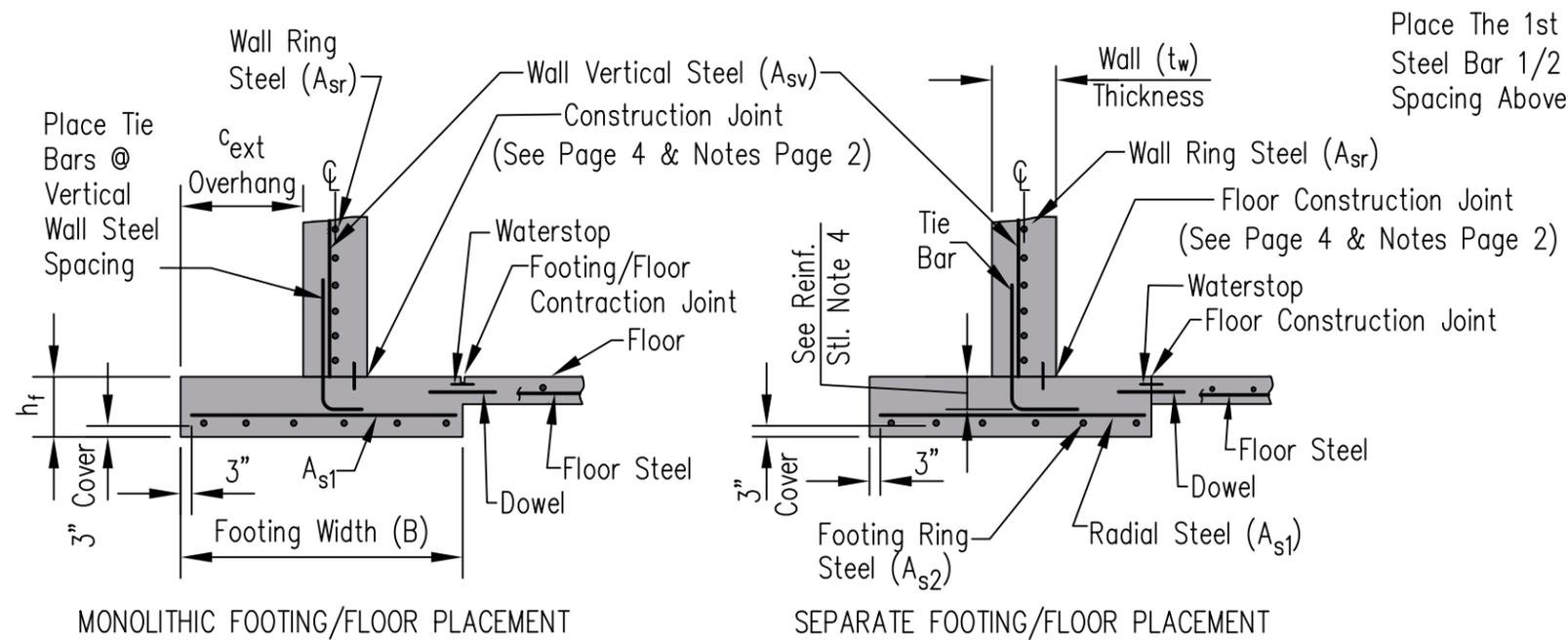
Steel Reinforcement (Grade 60 Only)					
Mark	Size	Spacing	Quantity	Length	Total Length
A _{s1}	_____	_____	_____	_____	_____
A _{s2}	_____	_____	_____	_____	_____
A _{sv}	_____	_____	_____	_____	_____
A _{sr}	_____	_____	_____	_____	_____
Tie Bars	_____	_____	_____	_____	_____

FLOOR STEEL (Grade_____)					
Mark	Size	Spacing	Floor Area	Conversion Factor (See Page 3)	Total Length
Floor Steel	_____	_____	_____	_____	_____
Total Length Of #3 Bars =			_____ Feet	_____	_____ Lb.
Total Length Of #4 Bars =			_____ Feet	_____	_____ Lb.
Total Length Of #5 Bars =			_____ Feet	_____	_____ Lb.

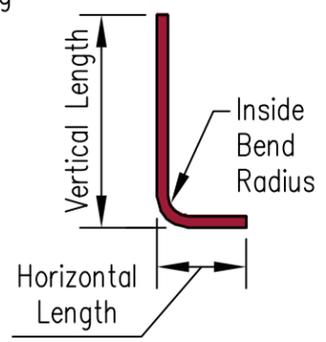
Date _____
 Designed _____
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 Checked _____
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CIRCULAR CONCRETE MANURE TANK

United States Department of Agriculture
 Natural Resources Conservation Service



Place The 1st Horiz. Wall Ring Steel Bar 1/2 The Specified Spacing Above The Footing.



TIE BAR DIMENSIONS		
Bar Size *	#4	#5
Vertical Length	34"	40"
Horizontal Length	8"	11"
Inside Bend Radius	1 1/2"	1 7/8"
Total Length	42"	51"

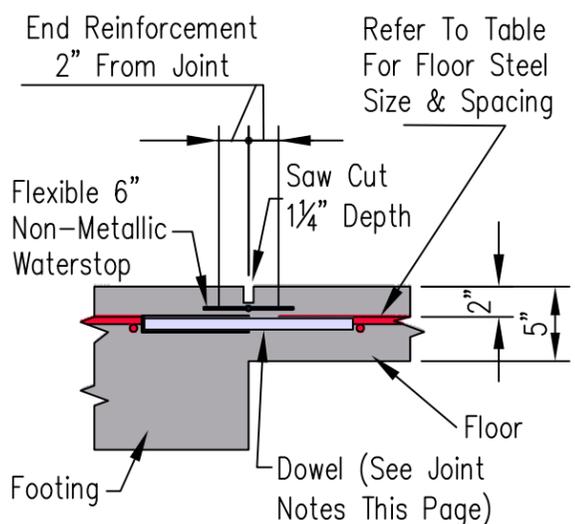
* Use the same bar size as A_{sv}

TIE BAR CONFIGURATION

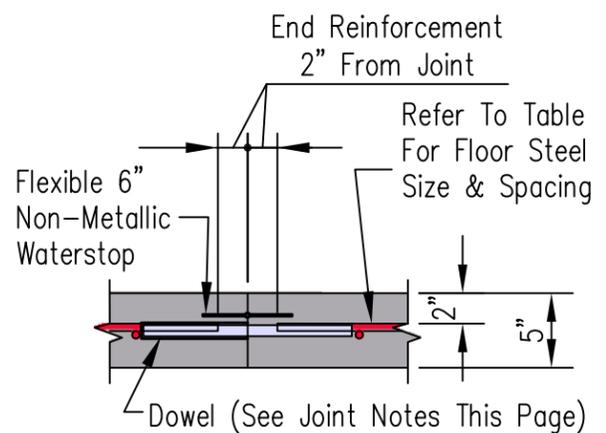
Reinforcing Steel Notes:

1. Allowable steel tensile stress = 2/3 of f_y.
2. Coefficient of subgrade drag = 1.5.
3. 5 inch concrete slab, unit weight = 150 pcf.
4. Tie bar development length = 6.5 inch min for 10 inch thick footing, 8.3 inch min for 12 inch thick footing.

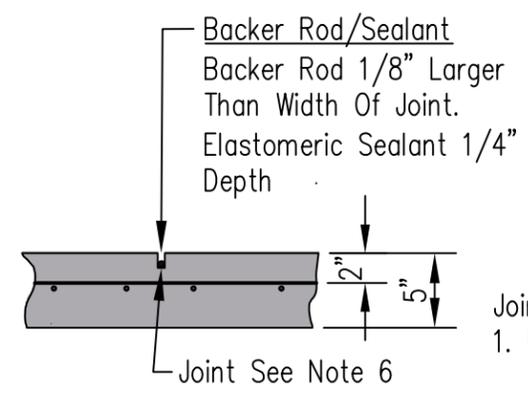
WALL TO RING FOUNDATION DETAILS



FOOTING/FLOOR CONTRACTION JOINT



FLOOR CONSTRUCTION JOINT



FLOOR CONTROL JOINT

FLOOR STEEL			
Steel Used	Grade 40 Control Joint Spacing	Grade 60 Control Joint Spacing	Conversion Factor Lin. ft/ft ²
#3@18" C.C.	40'	60'	1.404
#3@15" C.C.	50'	75'	1.684
#3@12" C.C.	60'	90'	2.105
#4@18" C.C.	75'	110'	1.422
#4@12" C.C.	110'	120'	2.133

Joint Notes:

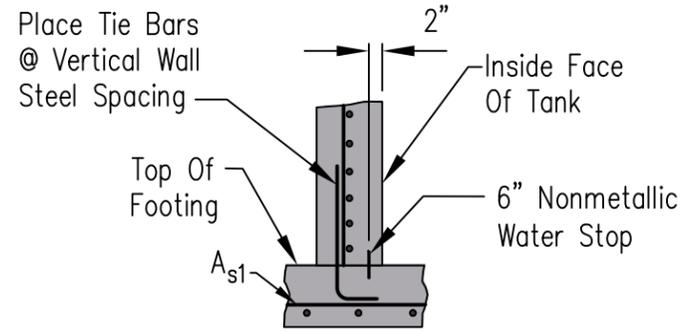
1. Use the floor construction joint if the slab is poured in more than one section.
2. 5/8 inch diameter by 12 inches long smooth dowel bar, half of bar length coated to prevent bond at 12 inches C to C.
3. Dowels must be parallel to concrete slab and each other.
4. Dowels must be perpendicular to joint.
5. Dowels must not be in contact with floor steel (slab thickness may be increased at joint to accommodate dowel bars).
6. Saw the control joints to create a rectangular grid in the floor slab (the longer side of each section, excluding the slab/footing joint, must not be more than 1.5 times the length of the shorter side). Use maximum control joint spacing as listed in table.

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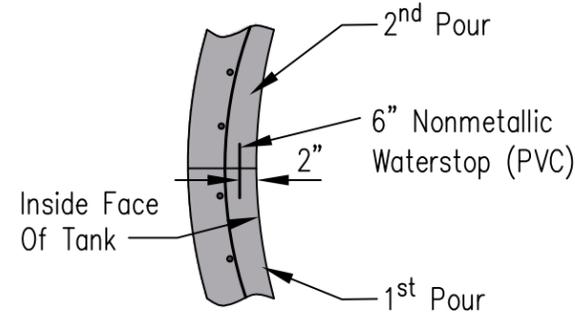
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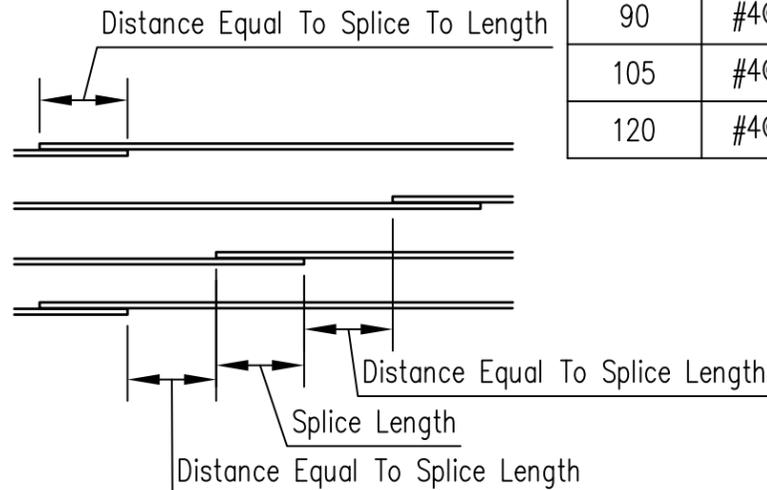
WALL TO FOOTING CONSTRUCTION JOINT



PLAN VIEW

TYPICAL WALL JOINT DETAIL

SPLICE LENGTHS	
Bar Size	Min Splice Length (In Inches)
Vertical & Footing Bars	
#3	19
#4	25
#5	31
Ring Steel Bars	
#4	32
#5	40



SPLICING DETAIL FOR WALL AND FOOTING RING STEEL

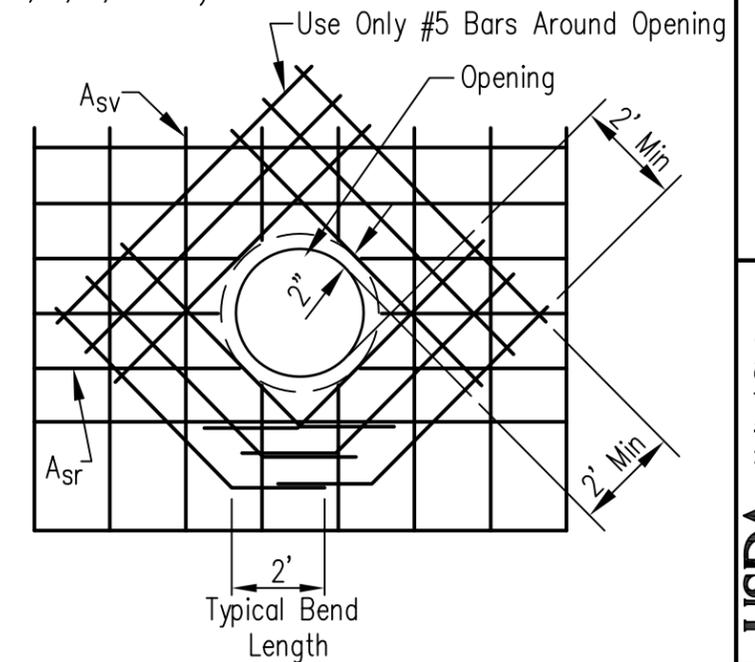
WALL STEEL REINFORCEMENT								
Wall Height	8 Ft. (8" T _w)		10 Ft. (8" T _w)		12 Ft. (10" T _w)		14 Ft. (10" T _w)	
Tank Dia. In Feet	Ring Steel A _{sr}	Vertical Steel A _{sv}	Ring Steel A _{sr}	Vertical Steel A _{sv}	Ring Steel A _{sr}	Vertical Steel A _{sv}	Ring Steel A _{sr}	Vertical Steel A _{sv}
30	#4@12"	#4@12"	#4@12"	#4@12"	#4@9"	#4@11"	#4@8"	#4@11"
45	#4@12"	#4@12"	#4@10"	#4@12"	#4@9"	#4@11"	#4@7"	#4@11"
60	#4@12"	#4@12"	#4@8"	#4@11"	#4@6"	#4@10"	#5@8"	#5@12"
75	#4@12"	#4@12"	#4@8"	#4@10"	#4@6"	#4@8"	#5@7"	#5@10"
90	#4@8"	#4@12"	#4@7"	#4@9"	#4@6"	#4@8"	#5@7"	#5@9"
105	#4@8"	#4@12"	#4@7"	#4@8"	#5@8"	#5@9"	#5@6"	#5@8"
120	#4@6"	#4@12"	#4@6"	#4@8"	#5@8"	#5@9"	#5@6"	#5@7"

NOTES:

1. For tank sizes not listed use the steel spacing & wall thickness from the next larger tank size (maximum height is 14 feet, maximum diameter 120 feet).
2. Locate ring steel along the wall centerline.
3. Place vertical steel on the outside of the ring steel.
4. See Midwest Plan Service, Publication TR-9, Circular Concrete Manure Tanks (March 1998) for alternative ring steel placement. (Tables 4, 5, 6, and 7).

RING FOUNDATION						
FOOTING DIMENSIONS AND STEEL						
Wall Height H	Tank Diameter D	Footing Width B	Footing Depth h _f	Overhang C _{ext}	Radial Steel A _{s1}	Ring Steel A _{s2}
8'-0"	All	2'-6"	10"	12"	Place A _{s1} at vertical wall steel (A _{sv}) spacing. For spacing greater than 9" use #5 bars, otherwise use #4 bars (#5 bars could be replaced with #4 at 1/2 A _{sv} spacing).	#4@8"
10'-0"	All	3'-0"	12"	14"		#4@6"
12'-0"	All	4'-0"	12"	14"		#4@6"
14'-0"	All	5'-0"	12"	15"		#4@6"

1. For tanks 10 feet and deeper, required soil bearing pressure is at least 2,000 psf; tanks less than 10 feet require 1,500 psf.
2. Place ring steel 3 inches above the footing bottom.
3. Place radial steel on top of ring steel.



1. Cut all vertical and ring steel 2 inches from opening.
2. For each steel ring steel bar interrupted by the opening, install one #5 bar around each side of the opening. A minimum 2 - #5 bars are to be along each side.
3. Bars spacing must not be closer than 3 inches C-C and not farther apart than A_{sr} spacing.

DETAIL OF PIPE PROTRUDING THROUGH A WALL

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