

This drawing is based on a design prepared by the Midwest Plan Service (MWPS) at Iowa State University and modified by NRCS. For more specific details concerning the design, refer to Midwest Plan Service Publication TP-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 318-05. Supplemental design and calculations performed by TeamAg Inc. Jan 2008.

Design Loading:

- 1. Manure load: 65 psf/ft. of depth. With a factor of safety = 1.2.
- 2. Soil backfill loads: 45 psf/ft. of depth with no surcharge and a factor of safety = 1.6.
- This requires the structure backfill to be adequately drained.
- To meet this requirement see backfill details on this sheet.
- 3. Required soil bearing pressure greater than 2000 psf.

Construction Notes:

- 1. Reinforcing steel for footing and walls shall have a tension yield point of $f_y = 60,000$ psi. Refer to Sheet 2 for floor reinforcing steel grades.
- 2. For splice lengths refer to the table on Sheet 2. All bends in reinforcing steel shall have a minimum inside radius of 3 bar diameters.
- 3. All concrete shall 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:
 - Cement shall be Type I or Type II
 - Slump – 3–6" inches without superplasticizing admixtures added
 - Slump – 2–4" inches prior to adding superplasticizing admixtures with a maximum slump of 7.5" after adding superplasticizing admixtures.
 - 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 at rate of 1 gal/150 s.f.
 - unless the manufacturer requires a higher application rate.
 - leaving the forms in place
 - soaking / continuous spray

- 4. Construction joints may be used to ease construction. The location of construction joints shall be approved by the Engineer prior to placing the concrete.
- 5. Refer to manufacturers recommendation for placing waterstop material.
- 6. Backfill shall be brought up uniformly around the tank. The maximum difference in the finished backfill elevations around the tank shall be 4 feet.
- 7. All construction methods shall meet OSHA regulations.
- 8. Installation of this structure shall conform to NRCS Construction Specification 313.
- 9. Additional details may be found in design notes and drawings.

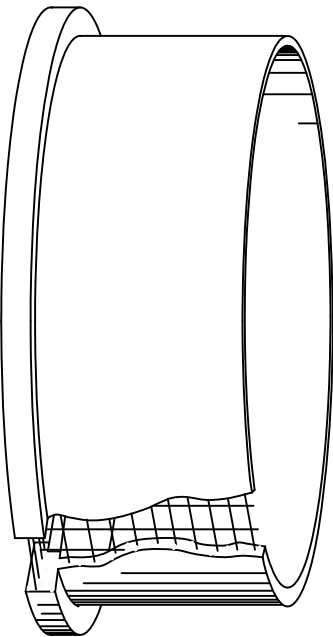
Safety Requirements:

- 1. The tank shall be surrounded by a chain link or woven wire fence(min 4.5' height)
 - 2. Posts shall be attached to the wall with brackets.
 - 3. Gates and safety stops shall be installed at pushoff locations to prevent accidental entry of equipment, people and animals. See PA Standard Drawing PA-039.
 - 4. Warning and Hazard signs shall be erected at the tank stating drowning and/or agitation hazards.
- See PA Standard 313 for types and locations. See NRCS-PA Fact Sheet 4 for examples.

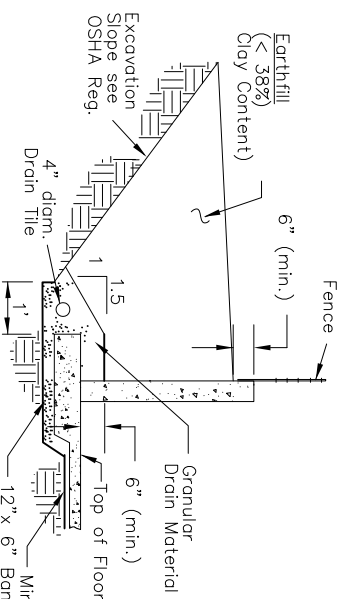
Vehicle Access/Surcharge load

Depending on vehicle weight and location to facility a concrete pad may be required near or on the tank wall. The purpose of the slab is to distribute the loading along the tank wall.

See section labeled "Wall Backfill with Vehicle Surcharge" for additional details.

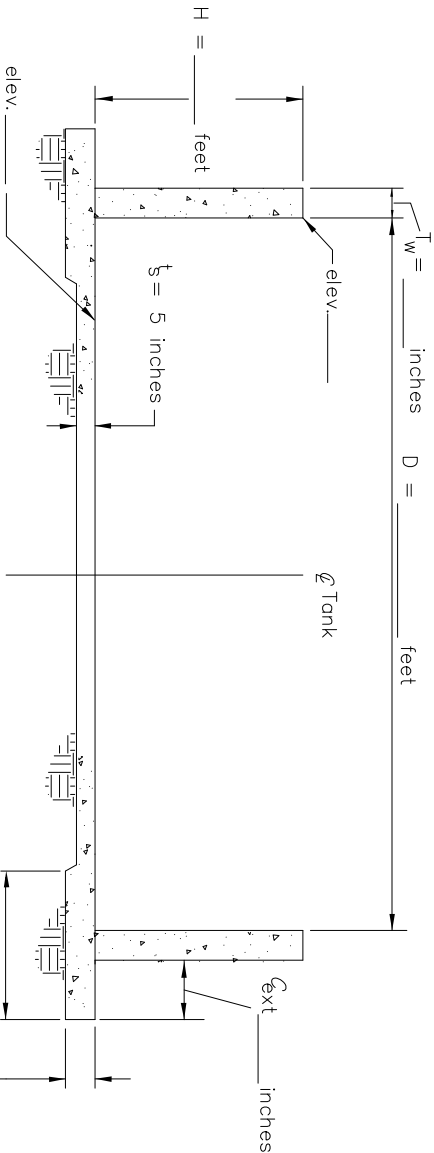


CIRCULAR CONCRETE MANURE TANK



WALL BACKFILL DETAIL-TYPICAL

- 1. Provide a minimum 4 inch diameter perimeter drain tile for wall backfill drainage. Outlet the tile at a location downslope where flow from the outlet may be monitored. Provide heavy wall pipe where backfill cover is < 24".
- 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 shall be clean with maximum 5 percent fines. The maximum particle size shall be 1.5 inches.
- 4. Provide a 12"x6" band of granular drain material under the footing every 50' on center around the tank perimeter as a minimum.
- 5. Provide Min. of 3' of backfill over top of footing for frost protection.



TANK DIMENSIONS

WALL BACKFILL with VEHICLE SURCHARGE

- 1. Agitation and unloading equipment (<8k axle load) at wall requires a 12" thick stone pad. Backfill under pad to be placed in uniform 6 inch lifts and mechanically compacted.
- 2. Heavy agitation and unloading equipment (>8k axle load) at wall requires a concrete pad. Pad to set on top of wall, in notch or on support pilars meeting Standard Drawing PA-068. Backfill under pad to be placed in uniform 6 inch lifts and mechanically compacted.
- Option: A concrete pad may be deleted for equipment loads (>8k to 15k axle load) if the following reinforcement is added. Single mat requires (6) extra horizontal #6 bars @ 4"o.c. starting at top of wall and change vertical steel spacing to 6". Double mat requires (5) horizontal #6 bars @ 4" o.c. each face, starting at top of wall with no change in vertical steel. In all cases extend steel changes 12' beyond opening, on both sides.
- 3. Manure being pushed directly into tank requires a concrete pad. Pad to be set on top of wall or in notch. Pad shall meet Standard Drawing PA-068 or PA-040. Backfill under pad to be placed in uniform 6 inch lifts and mechanically compacted.
- 4. If heavy tank wagons or loaded trucks are driven near the tank wall (within a distance equal to the tank wall or fill height) a concrete slab is required. Slab to be 6" thick with #4 bars at 18" both ways. Backfill under pad shall be granular (GP, GW, SP, SW, GM, GC or equal). It shall be placed in uniform 6 inch lifts and mechanically consolidated.

*** ADDITIONAL DRAWING USAGE INFORMATION ***

- 1. Pg. 3 of PA-083 is the steel schedule. Select 1 of 32 options. Pages 3.01-3.32 Use next larger tank size for steel spacing, sizing, and wall thickness for intermediate diameters.
- 2. Kicker walls can NOT be used on this tank design.
- 3. Depth Options are 8, 10, 12 & 14 feet.
- 4. Diameter range up to 200 feet.
- 5. Backfill elevation must not vary more than 4 feet.
- 6. These drawings are "Concurred with by NRCS" for meeting Practice Standard 313, however they require additional review and approval by NRCS Engineering prior to their use for a site specific project. All other users do so at their own risk and agree to indemnify, defend and hold harmless NRCS against any claims, liability, and expense arising from such use.
- 7. The use of these drawings for liquid manure storage requires approval by a PA Registered Engineer.



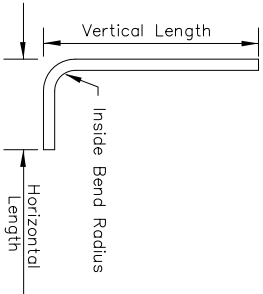
COUNTY, PENNSYLVANIA

PENNSYLVANIA ROUND TANK (No Ramp)

Designed	NRCS, MWPS, Pereverzoff	Date	
Drawn	WAC, Hartz, PJV	8/08 & 10/13	
Checked			
Approved by			

Revision 1	10/13	PJV	Revision 3	6/20	TWP
Changes on safety, Drawing usage and Changes on Vehicle Surcharge and wall backfill notes					
to at least 0.5% for bottom 1/4 of tank wall. Change reflected in tank specific horizontal Asr steel schedules (sheet 3).					
1/4 Fonts revised					

File No.	PA-083-3.dwg
Drawing No.	PA-083-3
Sheet	1 of 3



DOWEL BAR DIMENSIONS (A_{sd})		
Bar Size	#4	#5
Vertical Length	26 in.	30 in.
Horizontal Length	See Note 2	8 in.
Inside Bend Radius	1-1/2 in.	1-7/8 in.
Total Length	36 in.	38 in.

1. Use the same bar size as A_{sv}
2. Find in appropriate PA 083-3.01 thru 3.32 that matches tank depth and diameter.

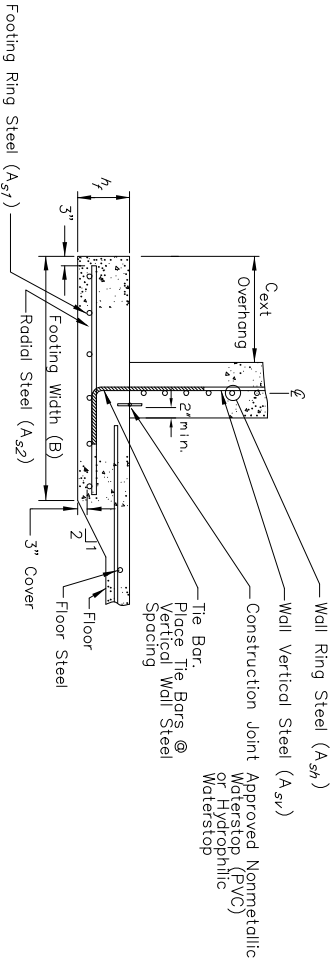
DOWEL BAR CONFIGURATION

** NOTE: Dowel bars shall be the same size and spacing as A_{sv}

FOOTING DIMENSION & STEEL (A_{s1} & A_{s2})

Wall Height H (ft)	Wall Thickness T_w (in)	Footing Width B (in)	Footing Depth h_f (in)	Overhang C_{ext} (in)	Rebar Parallel To Wall Ring Steel A_{s1}	Rebar Perpendicular To Wall Radial Steel A_{s2}
8, 10, 12	8	20	12	6	3-#4 Rebar	Use #4 Rebar placed at Vertical Wall Steel (A_{sv}) spacing. For spacing greater than 9 inches use #5 bars, or #4 bars placed at 1/2 (A_{sv}) spacing.
8, 10, 12	10	24	12	7	3-#4 Rebar	
10	12	24	12	6	3-#4 Rebar	
12	12	30	12	8	3-#4 Rebar	
14	10, 12	30	12	8	3-#4 Rebar	

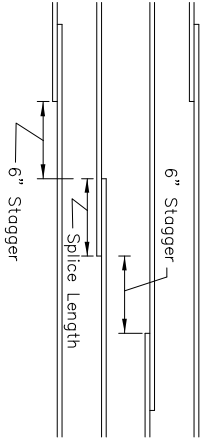
1. Required soil bearing pressure shall be at least 2,000 psf.
2. Place ring steel 3 inches above the footing bottom.
3. Place radial steel on top of ring steel.



WALL TO RING FOUNDATION DETAIL

Note: MONOLITHIC FOOTING/FLOOR PLACEMENT. Use of joints requires Design Engineer approval

SPLICING DETAIL FOR WALL AND FOOTING RING STEEL



SPICE LENGTHS FOR ALL BARS		
Bar Size	Min. Splice Lengths	
#3	18 inches	
#4	25 inches	
#5	32 inches	
#6	38 inches	

FLOOR STEEL (A_s)

DISTANCE BETWEEN JOINTS	FOR 5" THICK FLOOR	
	A_s	EXAMPLE
$\leq 50'$	.058	6x6-W2.9xW2.9 (6 ga.)
$>50' \leq 75'$	.09	#3 @ 15" both ways
$>75' \leq 110'$	.13	#4 @ 18" both ways
$>110' \leq 170'$	.20	#4 @ 12" or #5 @ 18" both ways
$>170' \leq 220'$	.26	#4 @ 9" or #5 @ 15" both ways
$>220' \leq 275'$	.31	#5 @ 12" both ways

*For other combinations of slab thickness (t) and diameter or distance (D) determine A_s (end area of steel, in²) as shown below and use the USDA NRCS Standard Drawing ES-46 to select bar size and spacing that meets or exceeds the computed end area of steel or refer to ACI 330R as per Title 210 NEM Part 536, Section 536.22 A.

$$A_s = 0.0002265(D)(t)$$

_____ COUNTY, PENNSYLVANIA

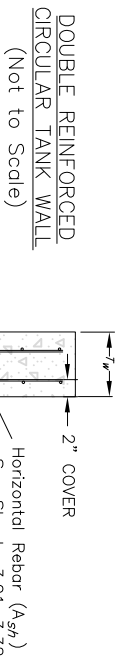
PENNSYLVANIA ROUND TANK (No Ramp)



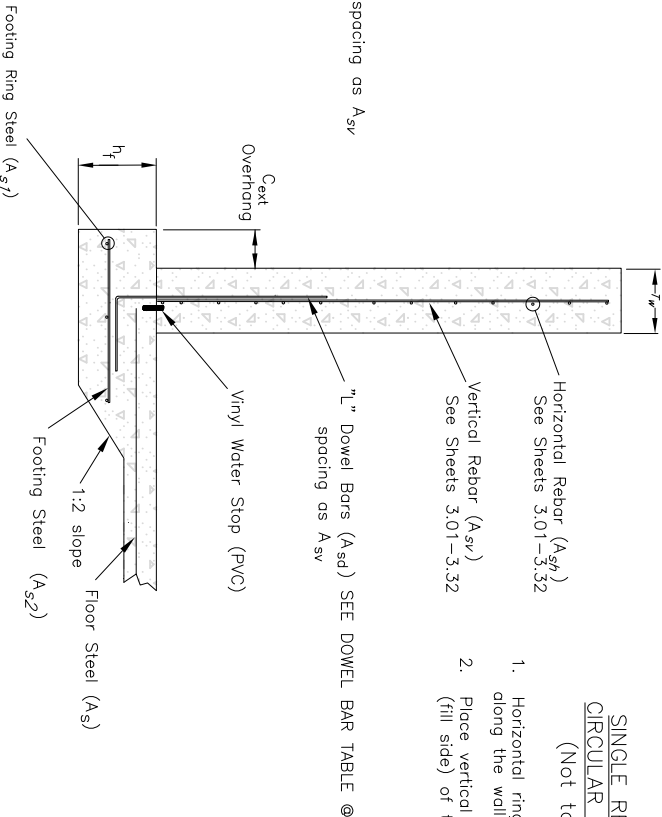
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PA-083-r3.dwg

Drawing No.
PA-083-r3

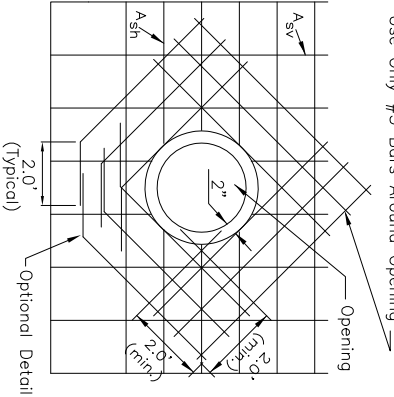
Sheet **2** of **3**



1. Horizontal ring steel to be located outside of vertical steel and have 2" of cover from each face.



1. Horizontal ring steel shall be located along the wall centerline.
2. Place vertical steel on the outside (fill side) of the ring steel.



1. Cut all vertical and ring steel 2 inches from opening.
2. For each ring steel bar interrupted by the opening, install a #5 bar around each side of the opening. A minimum of 2 - #5 bars are to be used along each side.
3. Bar spacing shall not be closer than 3 inches C - C and not farther apart than A_{sv} spacing.
4. The diagonal bars to dowels when pipe is near the floor.

DETAIL OF PIPE PROTRUDING THROUGH A WALL

Note: All pipes above floor require additional support or special fill to prevent shearing from fill settlement. See additional conditions or project notes for requirements.

Revision	1	10/13 P JV	Revision 2	3/19 TWP	Revision 3	6/20 TWP
As1 and As2 locations						
Revised footer steel for 14' joint clarification						
Formula added to calculate						
As						

Results for the 8'x60' circular tank

Circular Tank:

Tank Diameter = 60 ft

Tank Wall thickness = 8 in (actual)

Tank Height = 8 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}		
Bar #	Spacing	Distance from finished floor (ft - in)
1	3	0' 3"
2	5	0' 8"
3	5	1' 1"
4	5	1' 6"
5	5	1' 11"
6	5	2' 4"
7	5	2' 9"
8	6	3' 3"
9	12	4' 3"
10	12	5' 3"
11	12	6' 3"
12	12	7' 3"
13	6	7' 9"

Vertical Steel shall be #4 @ 12" O.C. = A_{sv}

Dowels "L" bars shall be #4 @ 12" O.C. with a horizontal leg of 6" and a vertical leg of 26"



Natural Resources Conservation Services
United States Department of Agriculture

County, PA
ROUND TANK DETAIL
PA-083 Revised
Page 3.02

Designed PA NRCS 05/2020

Drawn Peters 05/2020

Revisions _____

Checked _____

Approved _____

Results for the 8'x80' circular tank

Circular Tank:

Tank Diameter = 80 ft

Tank Wall thickness = 8 in (actual)

Tank Height = 8 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}

Bar #	Spacing (in)	Distance from finished floor (ft – in)
1	3	0' 3"
2	5	0' 8"
3	5	1' 1"
4	5	1' 6"
5	5	1' 11"
6	5	2' 4"
7	5	2' 9"
8	6	3' 3"
9	12	4' 3"
10	12	5' 3"
11	12	6' 3"
12	12	7' 3"
13	6	7' 9"

Vertical Steel shall be #4 @ 12" O.C. = A_{sv}

Dowels "L" bars shall be #4 @ 12" O.C. with a horizontal leg of 6" and a vertical leg of 26"

 Natural Resources Conservation Services United States Department of Agriculture	County, PA ROUND TANK DETAIL PA-083 Page 3.03	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 8'x100' circular tank

Circular Tank:

Tank Diameter = 100 ft

Tank Wall thickness = 8 in (actual)

Tank Height = 8 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}

Bar #	Spacing (in)	Distance from finished floor (ft – in)
1	3	0' 3"
2	5	0' 8"
3	5	1' 1"
4	5	1' 6"
5	5	1' 11"
6	5	2' 4"
7	5	2' 9"
8	6	3' 3"
9	12	4' 3"
10	12	5' 3"
11	10	6' 1"
12	10	6' 11"
13	10	7' 9"

Vertical Steel shall be #4 @ 12" O.C. = A_{sv}

Dowels "L" bars shall be #4 @ 12" O.C. with a horizontal leg of 6" and a vertical leg of 26"

 Natural Resources Conservation Services United States Department of Agriculture	County, PA ROUND TANK DETAIL PA-083 Page 3.04	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 8'x120' circular tank

Circular Tank:

Tank Diameter = 120 ft

Tank Wall thickness = 8 in (actual)

Tank Height = 8 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}

Bar #	Spacing (in)	Distance from finished floor (ft – in)
1	3	0' 3"
2	5	0' 8"
3	5	1' 1"
4	5	1' 6"
5	5	1' 11"
6	5	2' 4"
7	5	2' 9"
8	6	3' 3"
9	8	3' 11"
10	10	4' 9"
11	9	5' 6"
12	9	6' 3"
13	9	7' 0"
14	9	7' 9"

Vertical Steel shall be #4 @ 12" O.C. = A_{sv}

Dowels "L" bars from tank to footing shall be #4 @ 12" O.C. with a horizontal leg of 6" and a vertical leg of 26"

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Results for the 8'x140' circular tank

Circular Tank:

Tank Diameter = 140 ft

Tank Wall thickness = 10 in (actual)

Tank Height = 8 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}

Bar #	Spacing (in)	Distance from finished floor (ft – in)
1	3	0' 3"
2	4	0' 7"
3	4	0' 11"
4	4	1' 3"
5	4	1' 7"
6	4	1' 11"
7	4	2' 3"
8	4	2' 7"
9	6	3' 1"
10	10	3' 11"
11	8	4' 7"
12	8	5' 3"
13	6	5' 9"
14	6	6' 3"
15	6	6' 9"
16	6	7' 3"
17	6	7' 9"

Vertical Steel shall be #4 @ 12" O.C. = A_{sv}

Dowels "L" bars shall be #4 @ 12" O.C. with a horizontal leg of 8" and a vertical leg of 26"

 Natural Resources Conservation Services United States Department of Agriculture	County, PA ROUND TANK DETAIL PA-083 Page 3.06	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 8'x160' circular tank

Circular Tank:

Tank Diameter = 160 ft

Tank Wall thickness = 10 in (actual)

Tank Height = 8 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}

Bar #	Spacing (in)	Distance from finished floor (ft – in)
1	3	0' 3"
2	4	0' 7"
3	4	0' 11"
4	4	1' 3"
5	4	1' 7"
6	4	1' 11"
7	4	2' 3"
8	4	2' 7"
9	4	2' 11"
10	8	3' 7"
11	8	4' 3"
12	6	4' 9"
13	6	5' 3"
14	6	5' 9"
15	6	6' 3"
16	6	6' 9"
17	6	7' 3"
18	6	7' 9"

Vertical Steel shall be #4 @ 12" O.C. = A_{sv}

Dowels "L" bars from tank to footing shall be #4 @ 12" O.C. with a horizontal leg of 8" and a vertical leg of 26"

 Natural Resources Conservation Services United States Department of Agriculture	County, PA ROUND TANK DETAIL PA-083 Page 3.07	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 8'x180' circular tank

Circular Tank:

Tank Diameter = 180 ft

Tank Wall thickness = 10 in (actual)

Tank Height = 8 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #5 rebar = A_{sh}		
Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	6	0' 9"
3	6	1' 3"
4	6	1' 9"
5	6	2' 3"
6	6	2' 9"
7	6	3' 3"
8	10	4' 1"
9	10	4' 11"
10	10	5' 9"
11	8	6' 5"
12	8	7' 1"
13	8	7' 9"

Vertical Steel shall be #4 @ 12" O.C. = A_{sv}

Dowels "L" bars from tank to footing shall be #4 @ 12" O.C. with a horizontal leg of 8" and a vertical leg of 26"

 Natural Resources Conservation Services United States Department of Agriculture	County, PA ROUND TANK DETAIL PA-083 Page 3.08	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 8'x200' circular tank

Circular Tank:

Tank Diameter = 200 ft

Tank Wall thickness = 12 in (actual)

Tank Height = 8 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}

Steel shown in table must be placed in each face of the wall

Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	6	0' 9"
3	6	1' 3"
4	6	1' 9"
5	6	2' 3"
6	6	2' 9"
7	6	3' 3"
8	12	4' 3"
9	12	5' 3"
10	8	5' 11"
11	8	6' 7"
12	8	7' 3"
13	6	7' 9"

Vertical Steel shall be #4 @ 12" O.C. in each face = A_{sv}

Dowels "L" bars from tank to footing shall be #4 @ 12" O.C. at the interior mat of steel.

26" vertical leg, 6" horizontal leg

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		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 10'x40' circular tank

Circular Tank:

Tank Diameter = 40 ft

Tank Wall thickness = 8 in (actual)

Tank Height = 10 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}

Bar #	Spacing (in)	Distance from finished floor (ft – in)
1	3	0' 3"
2	5	0' 8"
3	5	1' 1"
4	5	1' 6"
5	5	1' 11"
6	5	2' 4"
7	5	2' 9"
8	5	3' 2"
9	5	3' 7"
10	8	4' 3"
11	12	5' 3"
12	12	6' 3"
13	12	7' 3"
14	12	8' 3"
15	12	9' 3"
16	6	9' 9"

Vertical Steel shall be #4 @ 12" O.C. = A_{sv}

Dowels "L" bars shall be #4 @ 12" O.C. with a horizontal leg of 6" and a vertical leg of 26"

 Natural Resources Conservation Services United States Department of Agriculture	_____ County, PA ROUND TANK DETAIL PA-083 Page 3.10	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 10'x60' circular tank

Circular Tank:

Tank Diameter = 60 ft

Tank Wall thickness = 8 in (actual)

Tank Height = 10 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}

Bar #	Spacing (in)	Distance from finished floor (ft – in)
1	3	0' 3"
2	5	0' 8"
3	5	1' 1"
4	5	1' 6"
5	5	1' 11"
6	5	2' 4"
7	5	2' 9"
8	5	3' 2"
9	5	3' 7"
10	5	4' 0"
11	9	4' 9"
12	10	5' 7"
13	10	6' 5"
14	10	7' 3"
15	12	8' 3"
16	12	9' 3"
17	6	9' 9"

Vertical Steel shall be #4 @ 12" O.C. = A_{sv}

Dowels "L" bars shall be #4 @ 12" O.C. with a horizontal leg of 6" and a vertical leg of 26"

 Natural Resources Conservation Services United States Department of Agriculture	<i>County, PA</i> ROUND TANK DETAIL PA-083 Page 3.11	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
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		Approved _____

Results for the 10'x80' circular tank

Circular Tank:

Tank Diameter = 80 ft

Tank Wall thickness = 8 in (actual)

Tank Height = 10 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}

Bar #	Spacing (in)	Distance from finished floor (ft – in)
1	3	0' 3"
2	5	0' 8"
3	5	1' 1"
4	5	1' 6"
5	5	1' 11"
6	5	2' 4"
7	5	2' 9"
8	5	3' 2"
9	5	3' 7"
10	8	4' 3"
11	9	5' 0"
12	9	5' 9"
13	10	6' 7"
14	10	7' 5"
15	10	8' 3"
16	10	9' 1"
17	8	9' 9"

Vertical Steel shall be #4 @ 12" O.C. = A_{sv}

Dowels "L" bars shall be #4 @ 12" O.C. with a horizontal leg of 6" and a vertical leg of 26"

 Natural Resources Conservation Services United States Department of Agriculture	County, PA	Designed <u>PA NRCS</u> <u>05/2020</u>
	ROUND TANK DETAIL	Drawn <u>Peterz</u> <u>05/2020</u>
	PA-083	Revisions _____
	Page 3.12	Checked _____
		Approved _____

Results for the 10'x100' circular tank

Circular Tank:

Tank Diameter = 100 ft

Tank Wall thickness = 10 in (actual)

Tank Height = 10 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}

Bar #	Spacing (in)	Distance from finished floor (ft – in)
1	3	0' 3"
2	4	0' 7"
3	4	0' 11"
4	4	1' 3"
5	4	1' 7"
6	4	1' 11"
7	4	2' 3"
8	4	2' 7"
9	4	2' 11"
10	4	3' 3"
11	4	3' 7"
12	6	4' 1"
13	8	4' 9"
14	8	5' 5"
15	8	6' 1"
16	8	6' 9"
17	8	7' 5"
18	8	8' 1"
19	10	8' 11"
20	10	9' 9"

Vertical Steel shall be #4 @ 10" O.C. = A_{sv}

Dowels "L" bars shall be #4 @ 10" O.C. with a horizontal leg of 8" and a vertical leg of 26"

 Natural Resources Conservation Services United States Department of Agriculture	County, PA ROUND TANK DETAIL PA-083 Page 3.13	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 10'x120' circular tank

Circular Tank:

Tank Diameter = 120 ft

Tank Wall thickness = 10 in (actual)

Tank Height = 10 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}

Bar #	Spacing (in)	Distance from finished floor (ft – in)
1	3	0' 3"
2	4	0' 7"
3	4	0' 11"
4	4	1' 3"
5	4	1' 7"
6	4	1' 11"
7	4	2' 3"
8	4	2' 7"
9	4	2' 11"
10	4	3' 3"
11	4	3' 7"
12	6	4' 1"
13	8	4' 9"
14	8	5' 5"
15	8	6' 1"
16	8	6' 9"
17	6	7' 3"
18	6	7' 9"
19	6	8' 3"
20	6	8' 9"
21	6	9' 3"
22	6	9' 9"

Vertical Steel shall be #4 @ 10" O.C. = A_{sv}

Dowels "L" bars from tank to footing shall be #4 @ 10" O.C. with a horizontal leg of 8" and a vertical leg of 26"

 Natural Resources Conservation Services United States Department of Agriculture	_____ County, PA ROUND TANK DETAIL PA-083 Page 3.14	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 10'x140' circular tank

Circular Tank:

Tank Diameter = 140 ft

Tank Wall thickness = 10 in (actual)

Tank Height = 10 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #5 rebar = A_{sh}		
Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	6	0' 9"
3	6	1' 3"
4	6	1' 9"
5	6	2' 3"
6	6	2' 9"
7	6	3' 3"
8	6	3' 9"
9	6	4' 3"
10	10	5' 1"
11	10	5' 11"
12	10	6' 9"
13	10	7' 7"
14	10	8' 5"
15	9	9' 2"
16	7	9' 9"

Vertical Steel shall be #4 @ 10" O.C. = A_{sv}

Dowels "L" bars shall be #4 @ 10" O.C. with a horizontal leg of 8" and a vertical leg of 26"

 Natural Resources Conservation Services United States Department of Agriculture	County, PA ROUND TANK DETAIL PA-083 Page 3.15	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 10'x160' circular tank

Circular Tank:

Tank Diameter = 160 ft

Tank Wall thickness = 10 in (actual)

Tank Height = 10 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #5 rebar = A_{sh}		
Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	6	0' 9"
3	6	1' 3"
4	6	1' 9"
5	6	2' 3"
6	6	2' 9"
7	6	3' 3"
8	6	3' 9"
9	6	4' 3"
10	8	4' 11"
11	10	5' 9"
12	8	6' 5"
13	8	7' 1"
14	8	7' 9"
15	8	8' 5"
16	8	9' 1"
17	8	9' 9"

Vertical Steel shall be #4 @ 10" O.C. = A_{sv}

Dowels "L" bars shall be #4 @ 10" O.C. with a horizontal leg of 8" and a vertical leg of 26"

 Natural Resources Conservation Services United States Department of Agriculture	County, PA ROUND TANK DETAIL PA-083 Page 3.16	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 10'x180' circular tank

Circular Tank:

Tank Diameter = 180 ft

Tank Wall thickness = 10 in (actual)

Tank Height = 10 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #5 rebar = A_{sh}		
Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	6	0' 9"
3	6	1' 3"
4	6	1' 9"
5	6	2' 3"
6	6	2' 9"
7	6	3' 3"
8	6	3' 9"
9	6	4' 3"
10	6	4' 9"
11	6	5' 3"
12	8	5' 11"
13	8	6' 7"
14	8	7' 3"
15	6	7' 9"
16	6	8' 3"
17	6	8' 9"
18	6	9' 3"
19	6	9' 9"

Vertical Steel shall be #4 @ 9" O.C. = A_{sv}

Dowels "L" bars shall be #4 @ 9" O.C. with a horizontal leg of 8" and a vertical leg of 26"

 Natural Resources Conservation Services United States Department of Agriculture	_____ County, PA ROUND TANK DETAIL PA-083 Page 3.17	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 10'x200' circular tank

Circular Tank:

Tank Diameter = 200 ft

Tank Wall thickness = 12 in (actual)

Tank Height = 10 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}

Steel shown in table must be placed in each face of the wall

Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	6	0' 9"
3	6	1' 3"
4	6	1' 9"
5	6	2' 3"
6	6	2' 9"
7	6	3' 3"
8	6	3' 9"
9	6	4' 3"
10	6	4' 9"
11	6	5' 3"
12	6	5' 9"
13	10	6' 7"
14	8	7' 3"
15	8	7' 11"
16	8	8' 7"
17	8	9' 3"
18	6	9' 9"

Vertical Steel shall be #4 @ 12" O.C. in each face = A_{sv}

Dowels "L" bars from tank to footing shall be #4 @ 12" O.C. at the interior mat of steel.

26" vertical leg, 6" horizontal leg

 Natural Resources Conservation Services United States Department of Agriculture	_____ County, PA ROUND TANK DETAIL PA-083 Page 3.18	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 12'x40' circular tank

Circular Tank:

Tank Diameter = 40 ft

Tank Wall thickness = 8 in (actual)

Tank Height = 12 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}

Bar #	Spacing (in)	Distance from finished floor (ft – in)
1	3	0' 3"
2	5	0' 8"
3	5	1' 1"
4	5	1' 6"
5	5	1' 11"
6	5	2' 4"
7	5	2' 9"
8	5	3' 2"
9	5	3' 7"
10	5	4' 0"
11	9	4' 9"
12	10	5' 7"
13	10	6' 5"
14	10	7' 3"
15	12	8' 3"
16	12	9' 3"
17	12	10' 3"
18	12	11' 3"
19	6	11' 9"

Vertical Steel shall be #4 @ 12" O.C. = A_{sv}

Dowels "L" bars shall be #4 @ 12" O.C. with a horizontal leg of 6" and a vertical leg of 26"

 Natural Resources Conservation Services United States Department of Agriculture	_____ County, PA ROUND TANK DETAIL PA-083 Page 3.19	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 12'x60' circular tank

Circular Tank:

Tank Diameter = 60 ft

Tank Wall thickness = 10 in (actual)

Tank Height = 12 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}		
Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	4	0' 7"
3	4	0' 11"
4	4	1' 3"
5	4	1' 7"
6	4	1' 11"
7	4	2' 3"
8	4	2' 7"
9	4	2' 11"
10	4	3' 3"
11	4	3' 7"
12	4	3' 11"
13	4	4' 3"
14	5	4' 8"
15	6	5' 2"
16	9	5' 11"
17	9	6' 8"
18	10	7' 6"
19	10	8' 4"
20	12	9' 4"
21	12	10' 4"
22	12	11' 4"
23	5	11' 9"

Vertical Steel shall be #4 @ 10" O.C. = A_{sv}

Dowels "L" bars shall be #4 @ 10" O.C. with a horizontal leg of 8" and a vertical leg of 26"

 Natural Resources Conservation Services United States Department of Agriculture	County, PA ROUND TANK DETAIL PA-083 Page 3.20	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 12'x80' circular tank

Circular Tank:

Tank Diameter = 80 ft

Tank Wall thickness = 10 in (actual)

Tank Height = 12 ft

$f_y = 60,000$ psi $f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}		
Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	4	0' 7"
3	4	0' 11"
4	4	1' 3"
5	4	1' 7"
6	4	1' 11"
7	4	2' 3"
8	4	2' 7"
9	4	2' 11"
10	4	3' 3"
11	4	3' 7"
12	4	3' 11"
13	4	4' 3"
14	4	4' 7"
15	6	5' 1"
16	6	5' 7"
17	6	6' 1"
18	6	6' 7"
19	6	7' 1"
20	8	7' 9"
21	8	8' 5"
22	10	9' 3"
23	10	10' 1"
24	10	10' 11"
25	10	11' 9"

Vertical Steel shall be #4 @ 9" O.C. = A_{sv}

Dowels "L" bars shall be #4 @ 9" O.C. with a horizontal leg of 8" and a vertical leg of 26"

 Natural Resources Conservation Services United States Department of Agriculture	County, PA ROUND TANK DETAIL PA-083 Page 3.21	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 12'x100' circular tank

Circular Tank:

Tank Diameter = 100 ft

Tank Wall thickness = 10 in (actual)

Tank Height = 12 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #5 rebar = A_{sh}		
Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	6	0' 9"
3	6	1' 3"
4	6	1' 9"
5	6	2' 3"
6	6	2' 9"
7	6	3' 3"
8	6	3' 9"
9	6	4' 3"
10	6	4' 9"
11	10	5' 7"
12	10	6' 5"
13	10	7' 3"
14	10	8' 1"
15	10	8' 11"
16	10	9' 9"
17	12	10' 9"
18	12	11' 9"

Vertical Steel shall be #4 @ 8" O.C. = A_{sv}

Dowels "L" bars shall be #4 @ 8" O.C. with a horizontal leg of 8" and a vertical leg of 26"

 Natural Resources Conservation Services United States Department of Agriculture	County, PA ROUND TANK DETAIL PA-083 Page 3.22	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 12'x120' circular tank

Circular Tank:

Tank Diameter = 120 ft

Tank Wall thickness = 10 in (actual)

Tank Height = 12 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #5 rebar = A_{sh}		
Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	6	0' 9"
3	6	1' 3"
4	6	1' 9"
5	6	2' 3"
6	6	2' 9"
7	6	3' 3"
8	6	3' 9"
9	6	4' 3"
10	6	4' 9"
11	6	5' 3"
12	6	5' 9"
13	8	6' 5"
14	8	7' 1"
15	8	7' 9"
16	8	8' 5"
17	10	9' 3"
18	10	10' 1"
19	10	10' 11"
20	10	11' 9"

Vertical Steel shall be #5 @ 10" O.C. = A_{sv}

Dowels "L" bars from tank to footing shall be #5 @ 10" O.C. with a horizontal leg of 8" and a vertical leg of 30"

 Natural Resources Conservation Services United States Department of Agriculture	_____ County, PA ROUND TANK DETAIL PA-083 Page 3.23	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 12'x140' circular tank

Circular Tank:

Tank Diameter = 140 ft

Tank Wall thickness = 10 in (actual)

Tank Height = 12 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #5 rebar = A_{sh}		
Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	6	0' 9"
3	6	1' 3"
4	6	1' 9"
5	6	2' 3"
6	6	2' 9"
7	6	3' 3"
8	6	3' 9"
9	6	4' 3"
10	6	4' 9"
11	6	5' 3"
12	6	5' 9"
13	8	6' 5"
14	8	7' 1"
15	8	7' 9"
16	8	8' 5"
17	8	9' 1"
18	8	9' 9"
19	8	10' 5"
20	8	11' 1"
21	8	11' 9"

Vertical Steel shall be #5 @ 10" O.C. = A_{sv}

Dowels "L" bars from tank to footing shall be #5 @ 10" O.C. with a horizontal leg of 8" and a vertical leg of 30"

 Natural Resources Conservation Services United States Department of Agriculture	_____ County, PA ROUND TANK DETAIL PA-083 Page 3.24	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 12'x160' circular tank

Circular Tank:

Tank Diameter = 160 ft

Tank Wall thickness = 12 in (actual)

Tank Height = 12 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}

Steel shown in table must be placed in each face of the wall

Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	6	0' 9"
3	6	1' 3"
4	6	1' 9"
5	6	2' 3"
6	6	2' 9"
7	6	3' 3"
8	6	3' 9"
9	6	4' 3"
10	6	4' 9"
11	10	5' 7"
12	10	6' 5"
13	10	7' 3"
14	9	8' 0"
15	9	8' 9"
16	9	9' 6"
17	9	10' 3"
18	9	11' 0"
19	9	11' 9"

Vertical Steel shall be #4 @ 12" O.C. in each face = A_{sv}

Dowels "L" bars from tank to footing shall be #4 @ 12" O.C. at the interior mat of steel. 26" vertical leg, 10" horizontal leg.

 Natural Resources Conservation Services United States Department of Agriculture	_____ County, PA ROUND TANK DETAIL PA-083 Page 3.25	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 12'x180' circular tank

Circular Tank:

Tank Diameter = 180 ft

Tank Wall thickness = 12 in (actual)

Tank Height = 12 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}

Steel shown in table must be placed in each face of the wall

Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	6	0' 9"
3	6	1' 3"
4	6	1' 9"
5	6	2' 3"
6	6	2' 9"
7	6	3' 3"
8	6	3' 9"
9	6	4' 3"
10	6	4' 9"
11	6	5' 3"
12	6	5' 9"
13	8	6' 5"
14	8	7' 1"
15	8	7' 9"
16	8	8' 5"
17	8	9' 1"
18	8	9' 9"
19	8	10' 5"
20	8	11' 1"
21	8	11' 9"

Vertical Steel shall be #4 @ 12" O.C. in each face = A_{sv}

Dowels "L" bars from tank to footing shall be #4 @ 12" O.C. at the interior mat of steel. 26" vertical leg, 10" horizontal leg.

 Natural Resources Conservation Services United States Department of Agriculture	County, PA ROUND TANK DETAIL PA-083 Page 3.26	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 12'x200' circular tank

Circular Tank:

Tank Diameter = 200 ft

Tank Wall thickness = 12 in (actual)

Tank Height = 12 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #5 rebar = A_{sh}

Steel shown in table must be placed in each face of the wall

Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	10	1' 1"
3	10	1' 11"
4	10	2' 9"
5	10	3' 7"
6	10	4' 5"
7	12	5' 5"
8	12	6' 5"
9	12	7' 5"
10	12	8' 5"
11	10	9' 3"
12	10	10' 1"
13	10	10' 11"
14	10	11' 9"

Vertical Steel shall be #4 @ 12" O.C. in each face = A_{sv}

Dowels "L" bars from tank to footing shall be #4 @ 12" O.C. at the interior mat of steel. 26" vertical leg, 10" horizontal leg.

 Natural Resources Conservation Services United States Department of Agriculture	_____ County, PA	Designed <u>PA NRCS</u> <u>05/2020</u>
	ROUND TANK DETAIL	Drawn <u>Peters</u> <u>05/2020</u>
	PA-083	Revisions _____
	Page 3.27	Checked _____
		Approved _____

Results for the 14'x120' circular tank

Circular Tank:

Tank Diameter = 120 ft

Tank Wall thickness = 10 in (actual)

Tank Height = 14 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #5 rebar = A_{sh}		
Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	6	0' 9"
3	6	1' 3"
4	6	1' 9"
5	6	2' 3"
6	6	2' 9"
7	6	3' 3"
8	6	3' 9"
9	6	4' 3"
10	6	4' 9"
11	6	5' 3"
12	6	5' 9"
13	6	6' 3"
14	6	6' 9"
15	6	7' 3"
16	6	7' 9"
17	6	8' 3"
18	6	8' 9"
19	8	9' 5"
20	8	10' 1"
21	8	10' 9"
22	10	11' 7"
23	10	12' 5"
24	10	13' 3"
25	6	13' 9"

Vertical Steel shall be #5 @ 8" O.C. = A_{sv}

Dowels "L" bars from tank to footing shall be #5 @ 8" O.C. 30" vertical leg, 8" horizontal leg.

 Natural Resources Conservation Services United States Department of Agriculture	County, PA ROUND TANK DETAIL PA-083 Page 3.28	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 14'x140' circular tank

Circular Tank:

Tank Diameter = 140 ft

Tank Wall thickness = 12 in (actual)

Tank Height = 14 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}

Steel shown in table must be placed in each face of the wall

Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	6	0' 9"
3	6	1' 3"
4	6	1' 9"
5	6	2' 3"
6	6	2' 9"
7	6	3' 3"
8	6	3' 9"
9	6	4' 3"
10	6	4' 9"
11	6	5' 3"
12	6	5' 9"
13	6	6' 3"
14	8	6' 11"
15	8	7' 7"
16	8	8' 3"
17	8	8' 11"
18	8	9' 7"
19	8	10' 3"
20	10	11' 1"
21	10	11' 11"
22	10	12' 9"
23	12	13' 9"

Vertical Steel shall be #4 @ 12" O.C. in each face = A_{sv}

Dowels "L" bars from tank to footing shall be #4 @ 12" O.C. at the interior mat of steel. 26" vertical leg, 10" horizontal leg.

 Natural Resources Conservation Services United States Department of Agriculture	_____ County, PA ROUND TANK DETAIL PA-083 Page 3.29	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 14'x160' circular tank

Circular Tank:

Tank Diameter = 160 ft

Tank Wall thickness = 12 in (actual)

Tank Height = 14 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}

Steel shown in table must be placed in each face of the wall

Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	6	0' 9"
3	6	1' 3"
4	6	1' 9"
5	6	2' 3"
6	6	2' 9"
7	6	3' 3"
8	6	3' 9"
9	6	4' 3"
10	6	4' 9"
11	6	5' 3"
12	6	5' 9"
13	8	6' 5"
14	8	7' 1"
15	8	7' 9"
16	8	8' 5"
17	8	9' 1"
18	8	9' 9"
19	8	10' 5"
20	8	11' 1"
21	8	11' 9"
22	8	12' 5"
23	8	13' 1"
24	8	13' 9"

Vertical Steel shall be #4 @ 10" O.C. in each face = A_{sv}

Dowels "L" bars from tank to footing shall be #4 @ 10" O.C. at the interior mat of steel. 26" vertical leg, 10" horizontal leg.

 Natural Resources Conservation Services United States Department of Agriculture	County, PA ROUND TANK DETAIL PA-083 Page 3.30	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 14'x180' circular tank

Circular Tank:

Tank Diameter = 180 ft

Tank Wall thickness = 12 in (actual)

Tank Height = 14 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #4 rebar = A_{sh}

Steel shown in table must be placed in each face of the wall

Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	6	0' 9"
3	6	1' 3"
4	6	1' 9"
5	6	2' 3"
6	6	2' 9"
7	6	3' 3"
8	6	3' 9"
9	6	4' 3"
10	6	4' 9"
11	6	5' 3"
12	8	5' 11"
13	8	6' 7"
14	8	7' 3"
15	6	7' 9"
16	6	8' 3"
17	6	8' 9"
18	6	9' 3"
19	6	9' 9"
20	6	10' 3"
21	6	10' 9"
22	6	11' 3"
23	6	11' 9"
24	6	12' 3"
25	6	12' 9"
26	6	13' 3"
27	6	13' 9"

Vertical Steel shall be #4 @ 9" O.C. in each face = A_{sv}

Dowels "L" bars from tank to footing shall be #4 @ 9" O.C. at the interior mat of steel. 26" vertical leg, 10" horizontal leg.

 Natural Resources Conservation Services United States Department of Agriculture	County, PA ROUND TANK DETAIL PA-083 Page 3.31	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
		Checked _____
		Approved _____

Results for the 14'x200' circular tank

Circular Tank:

Tank Diameter = 200 ft

Tank Wall thickness = 12 in (actual)

Tank Height = 14 ft

$f_y = 60,000$ psi

$f_c = 4,000$ psi

Horizontal Steel = #5 rebar = A_{sh}

Steel shown in table must be placed in each face of the wall

Bar #	Spacing (in)	Distance from finished floor (ft - in)
1	3	0' 3"
2	10	1' 1"
3	10	1' 11"
4	10	2' 9"
5	10	3' 7"
6	10	4' 5"
7	10	5' 3"
8	12	6' 3"
9	10	7' 1"
10	10	7' 11"
11	10	8' 9"
12	10	9' 7"
13	10	10' 5"
14	10	11' 3"
15	10	12' 1"
16	10	12' 11"
17	10	13' 9"

Vertical Steel shall be #4 @ 9" O.C. in each face = A_{sv}

Dowels "L" bars from tank to footing shall be #4 @ 9" O.C. at the interior mat of steel. 26" vertical leg, 10" horizontal leg.

 Natural Resources Conservation Services United States Department of Agriculture	County, PA ROUND TANK DETAIL PA-083 Page 3.32	Designed <u>PA NRCS</u> <u>05/2020</u>
		Drawn <u>Peters</u> <u>05/2020</u>
		Revisions _____
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