

# Highland Hold Down Straps



## Highland Tank Hold Down Straps

Highland Tank Hold Down Straps are designed to secure tanks in areas where water levels may cause a tank to float. They are used for underground tanks or on aboveground tanks in flood zones. These straps are designed to be attached to adequately sized concrete anchoring to counteract the tank's natural buoyant forces.

## Highland Strap Designs

Highland manufactures Hold Down Straps in four different designs to accommodate specific installation requirements.

- Standard
- Safety
- Dead-Man
- Polyester (underground use only)

Coated mild-carbon steel is used in the fabrication of the standard steel strap designs. Stainless or galvanized steel are also available.

The Standard, Safety and Polyester strap designs each have their own tensioning system for securing tanks in place using adjustable turnbuckles. Dead-man straps are adjusted using contractor supplied cables. Neoprene rubber liners for electrical isolation and tank protection are supplied with all steel hold-down straps.

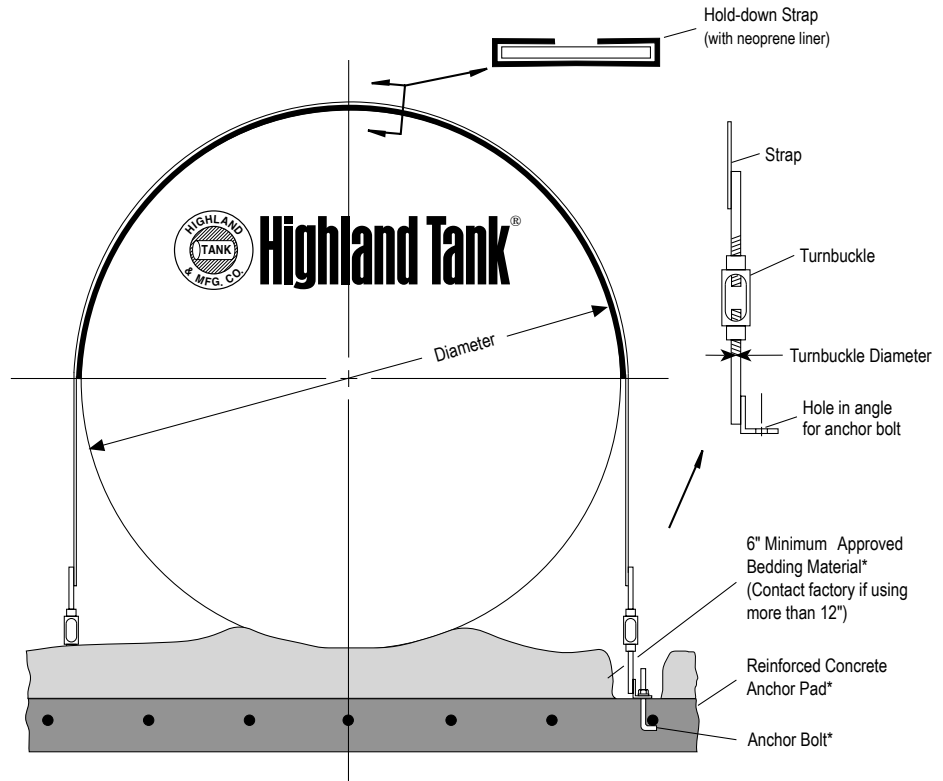
Tank installation instructions should be referenced for specific strap requirements.

### Standard Hold Down Strap

Highland Tank Standard Hold Down Straps are manufactured from mild-carbon steel with an adjustable turnbuckle and angle clip on each end for securing tanks in place. Neoprene rubber liners for electrical isolation and tank protection are supplied with all steel hold down straps.

Standard straps are sized so that when the turnbuckles are completely closed, there will be six (6") inches between the anchor pad and the tank bottom. Turnbuckles can be opened to allow up to twelve (12") inches of clearance.

*The diagrams at right depict a typical installation employing a single concrete anchoring pad.*



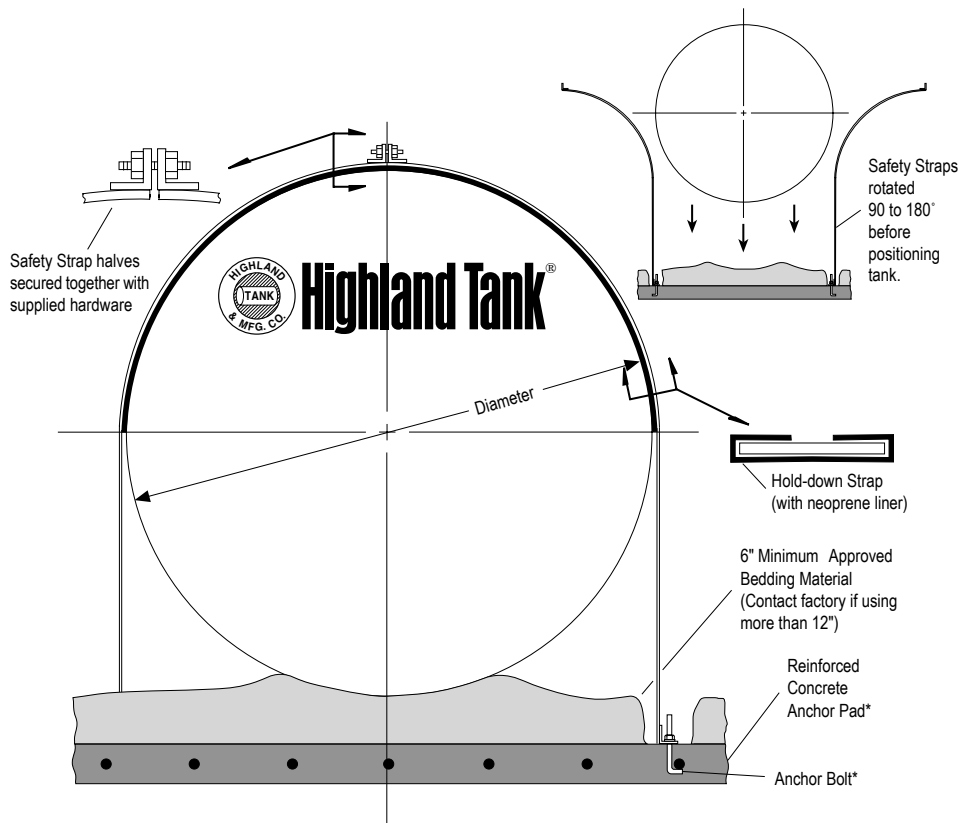
\*Installer supplied equipment

### Safety Hold Down Strap

Highland Tank Safety Hold Down Straps are designed to avoid having installation personnel in the excavation during tank placement. They are manufactured in two pieces and shipped connected with a threaded tie rod at top center.

Safety Hold Down Straps are designed to be installed before placing the tank in the excavation. By loosening the tie rod, the two pieces are separated and each rotated 90° to 180° away from their original position. After positioning the tank, the strap's sides are rotated back toward each other and tightened over the tank with the tie rod and nuts.

*The diagrams at right depict a typical installation that employs a single concrete anchoring pad. Note the position of the straps prior to tank placement.*

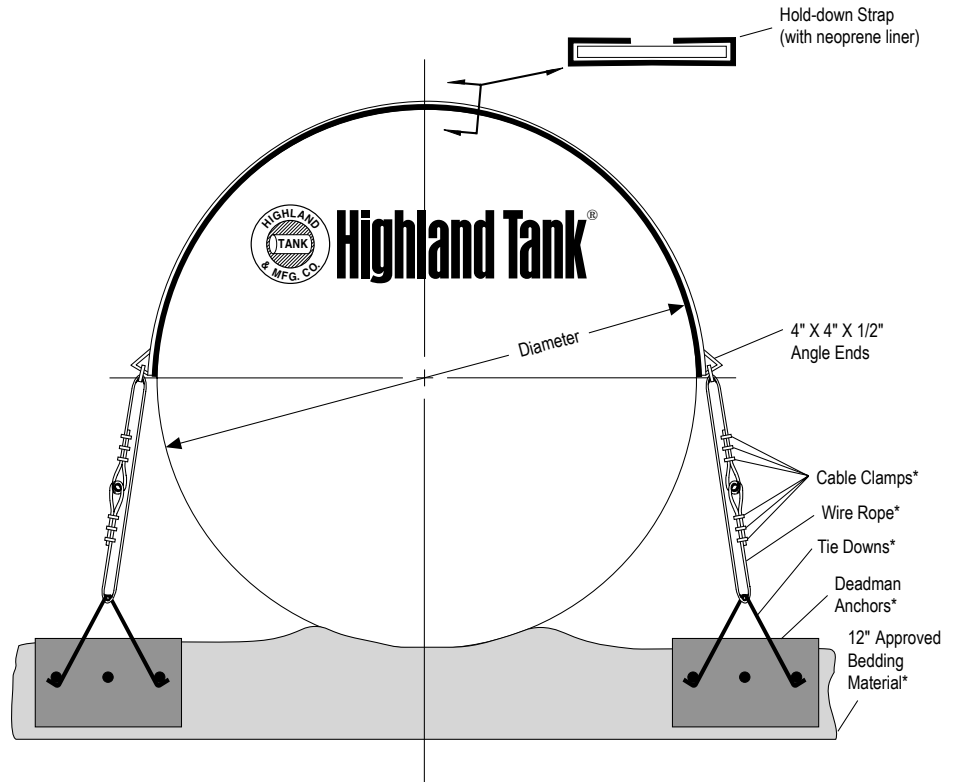


\*Installer supplied equipment

### Deadman Hold Down Strap

Highland Tank Deadman Hold Down Straps are designed and fabricated in various sizes to fit to the curvature of the tank. Each Deadman Strap is provided with holes in the angle clips on each side for attaching cables (installer supplied) between the deadman anchors and the straps that secure the tank in place.

The diagram at right depicts a typical installation that employs deadman concrete anchors. Steel cable and cable clamps are shown to illustrate one method of connecting the deadman straps to the reinforced concrete deadman anchors. Other methods are readily available and should be specified by your engineer.



\*Installer supplied equipment

### Polyester Hold Down Strap

Hold-down Straps are made from 3" wide 100% polyester webbing. Highland's Polyester Straps are fabricated with a large reinforced loop at each end for connecting to your concrete anchors. Included with each strap is a length of 1/2" diameter wire rope and six cable clamps for attaching the strap to one side of your concrete anchoring. A hook-to-hook turnbuckle is used for attaching the strap to the anchoring on the other side of the tank.

#### No need for strap liners!

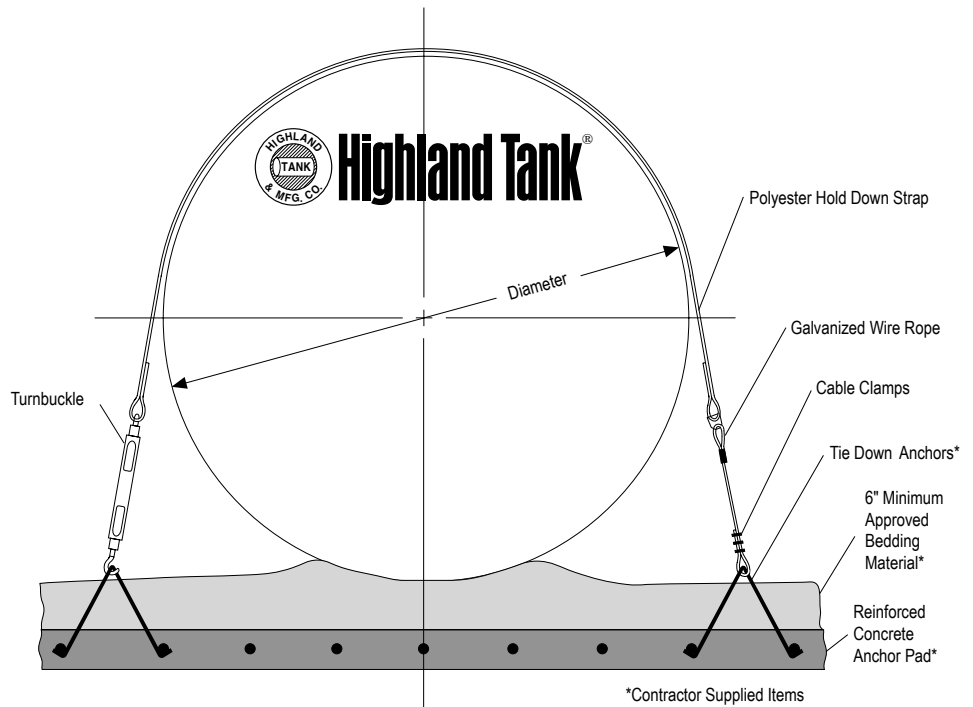
There are no metallic components in the strap system that can make contact with the tank.

Polyester straps are also available without the cable, clamps, and turnbuckles, for use with deadman anchors.

The diagram at right depicts a typical installation employing a single concrete anchoring pad.

*Intended for underground use only. Polyester Hold Down Straps are available for tank diameters 3'2" to 10'0". For installations with diameters larger than 10'0", see Highland's steel Hold Down Strap Systems*

### The latest innovation from the nation's leading tank manufacturer!



\*Contractor Supplied Items

\*Installer supplied equipment

## Anchor Pad and Hold Down Strap Specifications

The chart below gives specific information about hold down straps manufactured by Highland Tank. The chart lists the dimensional sizes of the tanks for reference. Also included in the chart are the strap material specifics, recommended quantities to be used and anchor bolt information. Contractor-supplied anchor bolts must be sized according to this chart for proper fit at installation.

## General Notes

Anchor pad sizes listed below are only intended as a guide. Highland recommends tank tie-down systems be designed by a licensed professional engineer.

Supplemental hold down restraints such as grade-level pads should be sized according to tank installation specifications. Standard, Safety, Deadman and NEW Nylon hold down straps are available from

Highland Tank. Please contact any plant location for more information. Specifications shown are recommended for the following tanks:

- Single-wall
- Double-wall steel (Type I)
- Double-wall steel/thermoplastic

Please contact Highland Tank for specifications on hold down straps for Double-wall (Type II) tanks.

Capacity Gal.	Tank Dimensions		Required Quantity	Hold Down Strap Size W x T	Centerline Spacing	Anchor Bolt Size Dia.
	Dia.	Length				
240	3'2"	4'0"	2	2" x 1/4"	2'0"	3/4"
300	3'2"	5'0"	2	2" x 1/4"	2'6"	3/4"
500	4'0"	5'5"	2	3" x 1/4"	2'9"	3/4"
1,000	4'0"	10'9"	2	3" x 1/4"	5'4"	3/4"
1,000	5'4"	6'0"	2	3" x 1/4"	3'0"	3/4"
1,500	5'4"	9'0"	2	3" x 1/4"	4'6"	3/4"
2,000	5'4"	12'0"	2	3" x 1/4"	6'0"	3/4"
2,500	5'4"	15'0"	2	3" x 1/4"	7'6"	3/4"
3,000	5'4"	18'0"	2	3" x 1/4"	9'0"	3/4"
4,000	5'4"	24'0"	2	3" x 1/4"	12'0"	3/4"
4,000	6'0"	19'0"	2	3" x 3/8"	9'6"	1"
4,000	8'0"	10'8"	2	3" x 3/8"	5'3"	1"
5,000	6'0"	23'10"	2	3" x 3/8"	11'11"	1"
5,000	8'0"	13'4"	2	3" x 3/8"	6'8"	1"
6,000	6'0"	28'8"	2	3" x 3/8"	14'4"	1"
6,000	8'0"	16'0"	2	3" x 3/8"	9'0"	1"
8,000	8'0"	21'4"	3	3" x 3/8"	7'2"	1"
8,000	10'0"	14'0"	2	4" x 1/2"	7'0"	1-1/4"
10,000	8'0"	26'8"	4	3" x 3/8"	6'8"	1"
10,000	10'0"	17'0"	2	4" x 1/2"	8'6"	1-1/4"
12,000	8'0"	32'0"	4	3" x 3/8"	8'0"	1"
12,000	10'0"	20'6"	3	4" x 1/2"	6'10"	1-1/4"
15,000	8'0"	40'0"	5	3" x 3/8"	8'0"	1"
15,000	10'0"	25'6"	3	4" x 1/2"	8'6"	1-1/4"
20,000	10'0"	34'0"	4	4" x 1/2"	8'6"	1-1/4"
20,000	10'6"	31'0"	4	4" x 1/2"	7'9"	1-1/4"
25,000	10'6"	38'9"	5	4" x 1/2"	7'9"	1-1/4"
30,000	10'6"	46'6"	6	4" x 1/2"	7'9"	1-1/4"
40,000	12'0"	47'6"	8	4" x 1/2"	6'8"	1-1/4"
50,000	12'0"	59'6"	10	4" x 1/2"	6'8"	1-1/4"

Anchor pad sizes listed above are only intended as a guide.

In calculating this information, the following assumptions were made:

- 1 - A single-wall UL-58 Highland STI-P3 tank is used.
- 2 - The groundwater table is above the tank.
- 3 - The tank is empty
- 4 - Gross buoyant force is calculated by multiplying tank capacity by 8.33 pounds.
- 5 - The yield stress of all steel is  $F_y = 36$ ksi.
- 6 - The allowable stress on steel in tension is  $f_e = .6 X F_y = 21.6$  ksi.
- 7 - All straps are located and tightened to produce uniform loading upon each strap.
- 8 - All straps are vertical at the point of anchorage.
- 9 - A factor of 2 is used for the anchor strap design.
- 10 - The weight of the submerged concrete is 80 pounds per cubic foot.
- 11 - The weight of submerged "soil cover" is 40 pounds per cubic foot.

Note:

This information is provided as a service to our customers to assist with budgetary considerations. Highland Tank accepts no liability for the use of this information nor any consequential circumstances. Underground tank tie down systems should be designed by a licensed structural engineer for the particular soil and installation conditions at your specific site. The information provided is valid only for hold down straps provided by Highland Tank.



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