



## Steel Hold-Down Straps

HT-1063

Highland Tank steel Hold Down Straps are primarily designed to secure storage and process vessels to permanent anchoring in underground installations. They can also be used in aboveground applications. Even when completely full of liquid, steel vessels may float if groundwater is present in the area. Straps are designed to work in conjunction with adequately sized concrete anchoring to counteract the tank's natural buoyant forces.

### Highland Strap Designs

Highland manufactures Steel Hold-Down Straps in three different designs to accommodate specific installation requirements: Standard, Safety and Dead-Man

For safety and shipping purposes, on tanks larger than 8'-0" in diameter, Highland Tank will only supply safety style steel hold-down straps.

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

Each strap design uses adjustable turnbuckles as the tensioning system for securing tanks in place. Neoprene rubber liners for electrical isolation and tank protection are supplied with all steel hold-down straps.

# Standard Hold-Down Straps

Manufactured from mild-carbon steel with an adjustable turnbuckle and angle clip on each end, they are a reliable choice for securing tanks to concrete anchors either underground or aboveground. 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.

Maximum diameter for standard steel straps is 7'-0".



## Standard Strap Installation

Standard one-piece hold-down straps are not available for tanks above 8' diameter. Refer to specific installation instructions for straps supplied.

Standard hold-down straps are installed after the vessel has been placed and supported by backfill to prevent movement.

Prepare straps with neoprene liners at a convenient location. Secure liners to straps with non-metallic tape to prevent shifting during installation. Open turnbuckles to maximum capacity for fitting to vessel. Confirm strap locations on approved drawing prior to installation and place straps accordingly.

Straps must be mechanically lowered into position being careful to prevent any sharp edges of straps from scratching the tank surface. If scratches do occur, repair according to manufacturer's instructions.

Lower strap into excavation positioning angled plate over anchor bolt. Secure strap in place with supplied washers and nuts. Secure the vessel in place by tightening turnbuckles evenly being careful to prevent vessel from turning or rolling from side to side. This may require multiple personnel or multiple trips from side to side.

Recheck tightness of all straps prior to backfilling excavation.

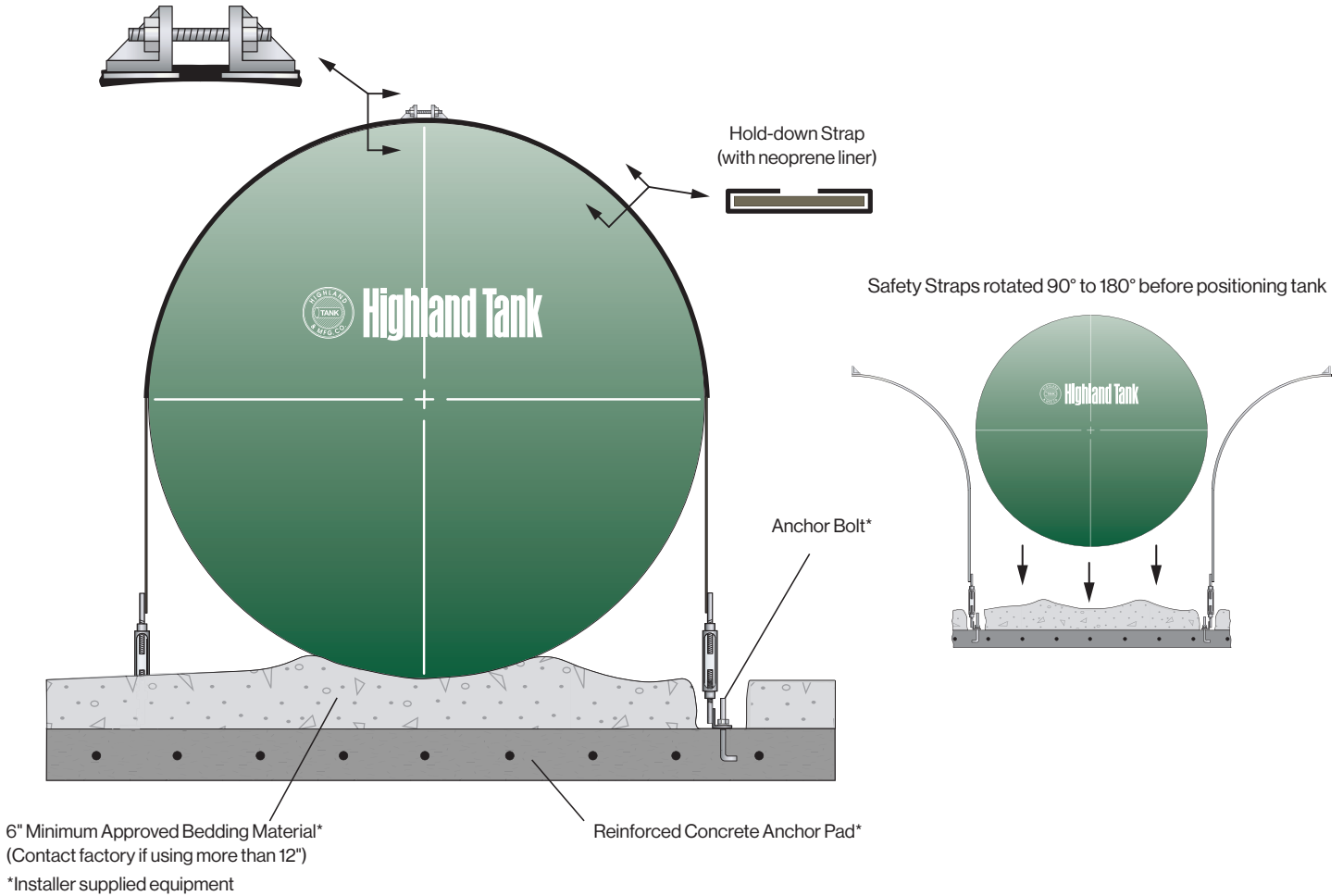


**Highland Tank**

# Safety Hold-Down Straps

Designed to minimize 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 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.



## Safety Strap Installation

Safety hold-down straps are available for all tank diameters and are the style provided for all tanks above 8' diameter. Refer to specific installation instructions for straps supplied.

Safety hold-down straps can be attached to anchors before the vessel has been placed in the excavation. Prepare straps with neoprene liners at a convenient location. Secure liners to straps with non-metallic tape to prevent shifting during installation. Open turnbuckles to maximum capacity for fitting to vessel. Confirm strap locations on approved drawing prior to installation and place straps accordingly.

Straps should be mechanically lowered into position. Lower strap positioning angled plates over anchor bolts. Secure strap in place with supplied washers and nuts. Check dimensions at center for clearance and tightening prior to placement of tank and adjust as necessary. Rotate strap 90° to 180° away from where vessel will be placed.

After the vessel has been placed and supported by backfill to prevent movement, rotate straps back toward each other to align angle top plates. Position plates so that threaded rod can be inserted and loosely fastened with washers and nuts. Position gap between angle plates as close to top center-line as possible. Secure the vessel in place by tightening nut at top center being careful to prevent vessel from turning or rolling from side to side.

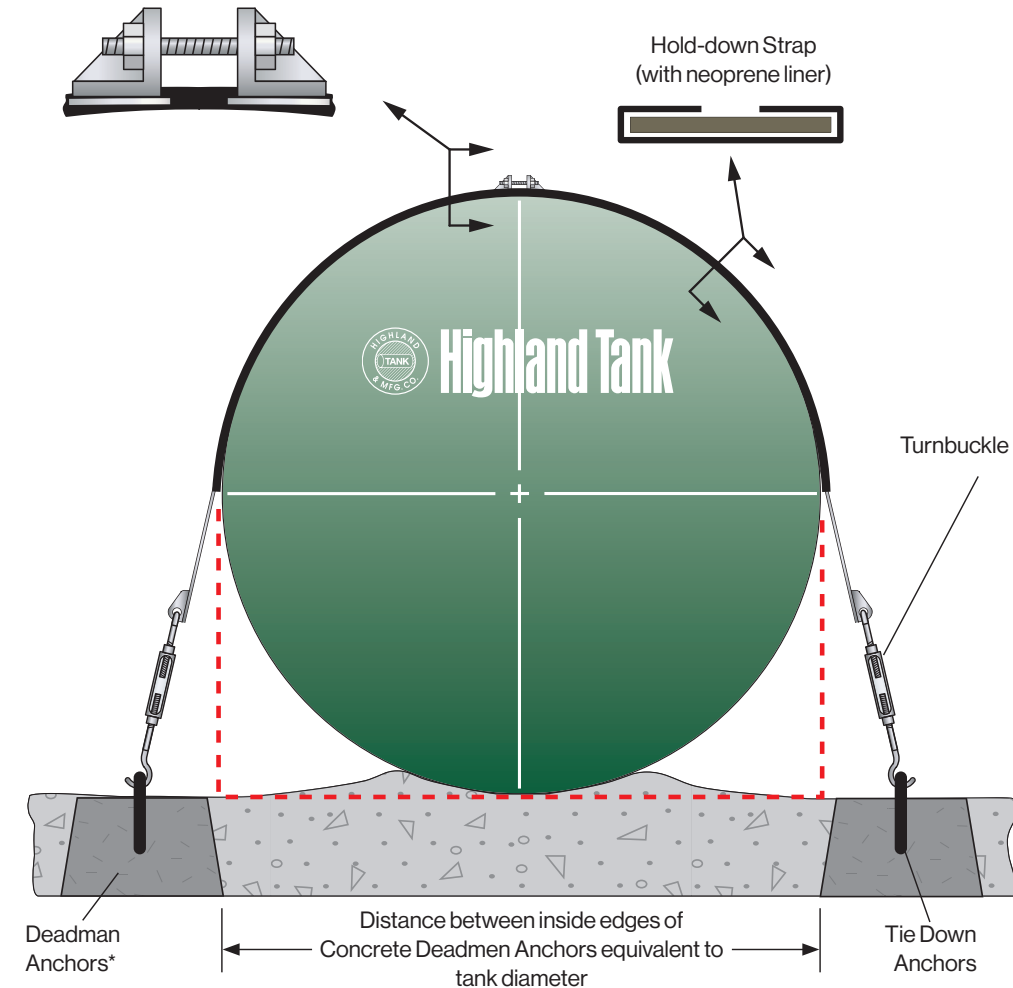
Additional adjustments may be required to the turnbuckles. This may require multiple personnel or multiple trips from side to side in the excavation. Recheck tightness of all straps prior to backfilling the excavation.

# Deadman Hold-Down Straps

Designed and fabricated to fit the curvature of Highland's standard tanks, they are fabricated from mild carbon steel and employ neoprene rubber liners for electrical isolation and tank protection. Deadman straps are provided with holes in the angle clips on each side for attaching cables or turnbuckles (installer supplied) between the deadman anchors and the straps that secure the tank in place.

Top of deadman anchors are to be installed level with bottom of tank. Fill area between deadmen with 12" or 18" approved bedding material\*.

Diagram depicts a typical installation employing Highland Tank's Concrete Deadman Anchors. Hook-to-hook turnbuckles are shown to illustrate one method of connecting the deadman straps to the concrete deadman anchors. Other methods are readily available and should be specified by your engineer.



\*Installer supplied equipment

## Deadman Strap Installation

Deadman hold-down straps are installed after the vessel has been placed and supported by backfill to prevent movement.

Prepare straps with neoprene liners at a convenient location. Secure liners to straps with non-metallic tape to prevent shifting during installation. Open turnbuckles to maximum capacity for fitting to vessel. Confirm strap locations on approved drawing prior to installation and place straps accordingly. Lower straps into position being careful to prevent any scratching of the tank surface. If scratches or damage occurs, repair according to manufacturer's instructions.

Position angled top plate so that threaded rod can be inserted and loosely fastened with washers and nuts. Position gap between angle plates as close to top center-line as possible.

Attach hook-to-hook turnbuckles to strap ends and deadman anchor tie-downs. Secure the vessel in place by tightening turnbuckles evenly being careful to prevent vessel from turning or rolling from side to side. This may require multiple personnel or multiple trips from side to side.

Recheck tightness of all straps prior to backfilling excavation.

# Strap Sizing Details

## Hold-Down Strap Specifications

The chart at right provides suggested recommendations for the quantity of steel hold-down straps that should be used with tanks manufactured by Highland Tank. Physical sizes of Highland's tanks are listed for reference.

Also included in the chart are the strap material specifics. Contractor-supplied anchor bolts must be sized according to this chart for proper fit during installation.

## General Notes

Highland recommends tank tie-down systems be designed by a licensed professional engineer.

All hold-down systems that include pads or anchors below a tank and grade-level pads above a tank should be sized by a licensed professional engineer.

Hold-down strap details listed apply to for the following styles of Highland's 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.

Tank Capacity Gallons	Nominal Tank Dimensions		Recommended Quantity	Size W x T	Hold-Down Strap Bolt Hole	
	Diameter	Length			Diameter*	Strength
240	3'2"	4'0"	2	2" x 1/4"	1"	10,400
300	3'2"	5'0"	2	2" x 1/4"	1"	10,400
500	4'0"	5'5"	2	3" x 1/4"	1"	10,400
1,000	4'0"	10'9"	2	3" x 1/4"	1"	10,400
1,000	5'4"	6'0"	2	3" x 1/4"	1"	10,400
1,500	5'4"	9'0"	2	3" x 1/4"	1"	10,400
2,000	5'4"	12'0"	2	3" x 1/4"	1"	10,400
2,500	5'4"	15'0"	2	3" x 1/4"	1"	10,400
3,000	5'4"	18'0"	2	3" x 1/4"	1"	10,400
4,000	5'4"	24'0"	2	3" x 1/4"	1"	10,400
4,000	6'0"	19'0"	2	3" x 3/8"	1-1/4"	20,000
4,000	8'0"	10'8"	2	3" x 3/8"	1-1/4"	20,000
5,000	6'0"	23'10"	2	3" x 3/8"	1-1/4"	20,000
5,000	8'0"	13'4"	2	3" x 3/8"	1-1/4"	20,000
6,000	6'0"	28'8"	2	3" x 3/8"	1-1/4"	20,000
6,000	8'0"	16'0"	2	3" x 3/8"	1-1/4"	20,000
8,000	8'0"	21'4"	3	3" x 3/8"	1-1/4"	20,000
8,000	10'0"	14'0"	2	4" x 1/2"	1-1/2"	30,400
10,000	8'0"	26'8"	4	3" x 3/8"	1-1/4"	20,000
10,000	10'0"	17'0"	2	4" x 1/2"	1-1/2"	30,400
12,000	8'0"	32'0"	4	3" x 3/8"	1-1/4"	20,000
12,000	10'0"	20'6"	3	4" x 1/2"	1-1/2"	30,400
15,000	8'0"	40'0"	5	3" x 3/8"	1-1/4"	20,000
15,000	10'0"	25'6"	3	4" x 1/2"	1-1/2"	30,400
20,000	10'0"	34'0"	4	4" x 1/2"	1-1/2"	30,400
20,000	10'6"	31'0"	4	4" x 1/2"	1-1/2"	30,400
25,000	10'6"	38'9"	5	4" x 1/2"	1-1/2"	30,400
30,000	10'6"	46'6"	6	4" x 1/2"	1-1/2"	30,400
40,000	12'0"	47'6"	8	4" x 1/2"	1-1/2"	30,400
50,000	12'0"	59'6"	10	4" x 1/2"	1-1/2"	30,400
60,000	13'-0"	60'-6"	12	4" x 1/2"	1-1/2"	30,400

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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