

Equipment and Materials Manufacturers Specifications



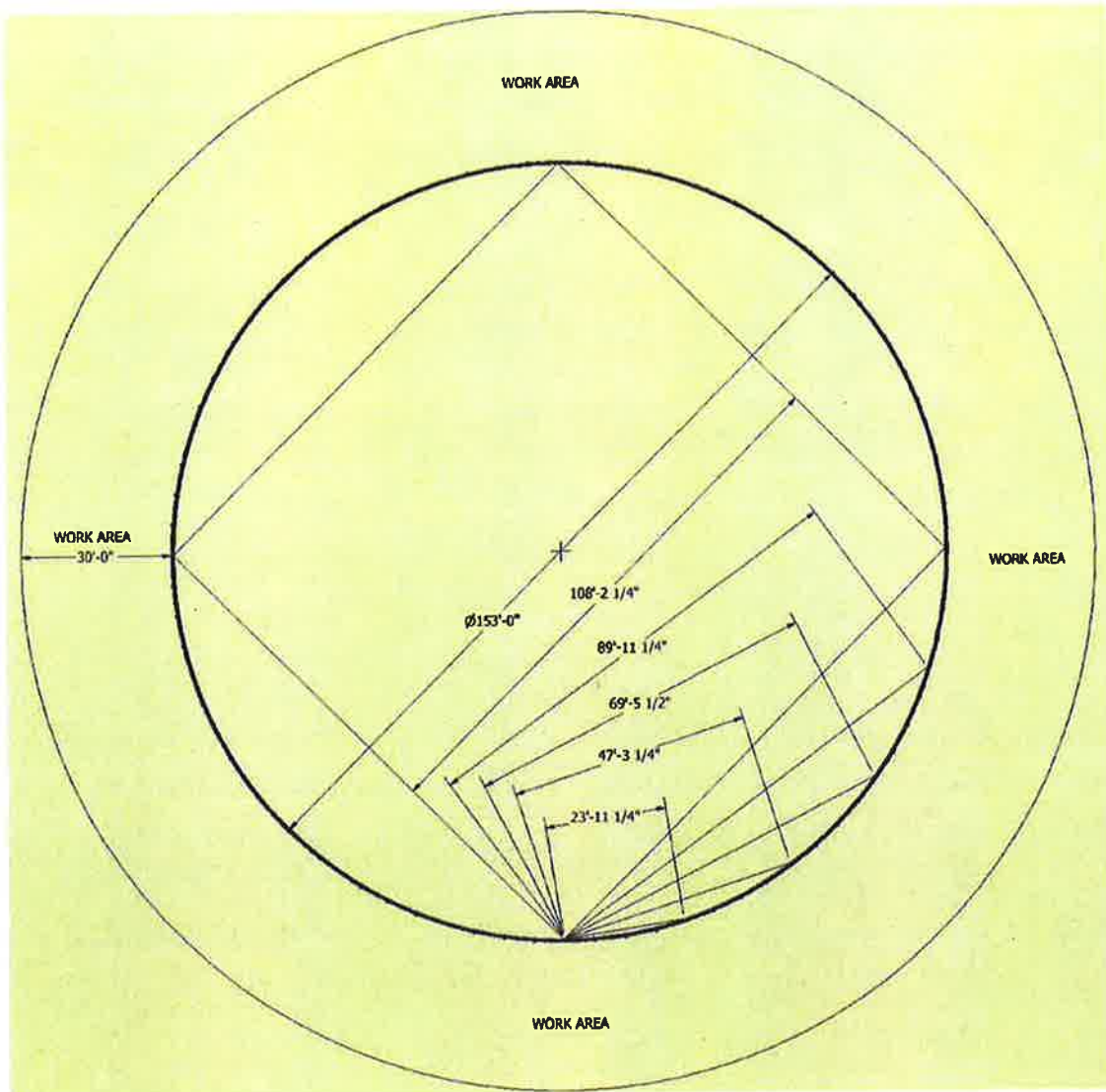
40,000BBL Water Corral Installation Sheet

Corral Site Requirements:

- 213ft Diameter site per 40,000bbl Water Corral
- Over all site must be level to +/- .5in
- Corral ring must be level to +/- .25in
- Soil report must meet ASTM D-698A, 90% or greater

Corral Setup:

- Mark your 153ft diameter circle from center pin
- Mark your 0°(Start point), 90°, 180°, and 270°
- Check your cord lengths periodically (inside corner to inside corner), adjust next panel if needed
- Ensure last panel can fit (pulling together is easier than pushing apart)
- 12" x 12" Sand radius ring is required for inside corral

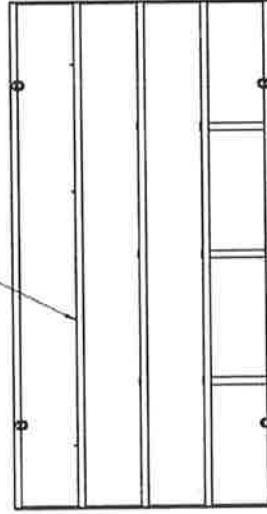


NOTES:

1. REQUIRES A 30FT WORK AREA AROUND CORRAL



D-RING TIE-DOWNS



PANEL SECTION
SCALE 1 / 50

PROTECTIVE RUBBER STRIP
COVERING END SEAMS



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Date : 3/06/2014
Document ID : 14006G
Revision : 0
Project : Evaluation of existing design
Tank #(s) : 40,000 bbl Corral
Diameter : 153'- 1/2"
Shell height : 12' - 4 "
Roof type : Open Top
Client : ETC
Location : Pittsburgh, Pa
PO# :



Standard Properties

1. Gross Tank Geometry

$$D := 153 \cdot \text{ft} + 0.5 \cdot \text{in}$$

Tank diameter

$$H_s := 12 \cdot \text{ft} + 4 \cdot \text{in}$$

Shell height

2. Product Variables

$$DLL := 12 \cdot \text{ft} + 4 \cdot \text{in}$$

Design liquid level

$$V_{\text{nom}} := \frac{\pi}{4} \cdot D^2 \cdot H_s$$

$$V_{\text{nom}} = 40408 \cdot \text{bbl}$$

Nominal volume

$$PSG := 1.2$$

Maximum product specific gravity [assumed for heavy brine]

3. Design Parameters

$$T_{\text{max}} := 200 \cdot \text{F}$$

Maximum design temperature

$$T_{\text{min}} := 5 \cdot \text{F}$$

Minimum design temperature

$$P_{\text{int}} := 0 \cdot \text{psi}$$

Design internal pressure

$$P_{\text{ext}} := 0 \cdot \text{psi}$$

Design external pressure (vacuum)

4. Environmental Variables

A. Temperature Variables

$DMT := 5 \cdot F$

Design metal temperature

B. Wind Variables

$V_{wind} := 90 \cdot mph$

Design wind speed [3-second gust]

$I_{wind} := 1.0$

Wind importance factor

Exposure category (Default = C)

$K_{zt} := 1.0$

Topographic factor (1.0 minimum)

Check windbuckling in corroded condition?

Can windgirders for tanks with a diameter greater than 200 feet be designed using $D = 200$ ft?



5. Shell Design

A. Shell Parameters

$$JE_s := 1.00$$

Shell joint efficiency

☒ Yes

☐ No

Does the client allow shell design using the variable-design-point method for tanks less than 200 feet in diameter?

$$h_s := \left(\frac{6}{6} \right) \cdot \text{ft} + \left(\frac{0}{4} \right) \cdot \text{in}$$

Height of each shell course

$$t_s := \left(\frac{0.25}{0.25} \right) \cdot \text{in}$$

Actual thickness of each shell course

$$CA_s := \left(\frac{0}{0} \right) \cdot \text{in}$$

Corrosion allowance on the shell

Shell Material 1

Shell Material 2

Shell Material 3

A36

None

None

SR1

SR2

SR3

SR4

SR5

SR6

SR7

SR8

☒ Matl 1

☒ Matl 1

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☒ Shell Material Properties

Shell material

Group number

Design stress

Hydrotest stress

Appendix M factor

$$SM = \begin{pmatrix} \text{"A36"} \\ \text{"A36"} \end{pmatrix}$$

$$GRP = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$$

$$SD = \begin{pmatrix} 23200 \\ 23200 \end{pmatrix} \text{psi}$$

$$ST = \begin{pmatrix} 24900 \\ 24900 \end{pmatrix} \text{psi}$$

$$RF = \begin{pmatrix} 1.000 \\ 1.000 \end{pmatrix}$$

B. Shell Thickness Check (API 650)

☒ Shell Thickness

$$t_{smin} = \begin{pmatrix} 0.3125 \\ 0.3125 \end{pmatrix} \cdot \text{in}$$

Minimum required steel plate thickness required by API 650

$$\frac{t_{smin}}{t_s} = \begin{pmatrix} 125.00 \\ 125.00 \end{pmatrix} \cdot \%$$

5. Shell Design

C. Shell Wind Buckling Check

Shell Buckling

$$\frac{H_{tr} - h_{twg}}{H_1} = 69.06\%$$

Wind buckling check.
If value exceed 100%, intermediate windgirders are required.

D. Splice Bolt Check

$n_{bolt} := 15$	Bolts per splice connection
$d_b := 1.25\text{-in}$	Diameter of bolts
$P_{des} := 150\text{-kip}$	Design strength in tension for A-490 bolt
$\Phi_{pry} := 2.0$	Increase in bolt force due to prying action [conservative estimate]
$P_{head} := \gamma_w \cdot P_{SG-DLL} = 923.82\text{-psf}$	Head pressure at base of shell
$P_{ave} := \frac{1}{2} \cdot P_{head} = 461.91\text{-psf}$	Average pressure on shell
$P_{fb} := \frac{1}{2} \cdot P_{ave} \cdot DLL \cdot D = 435.93\text{-kip}$	Force in each splice plate from circumferential hydrostatic forces
$P_b := \frac{P_{fb}}{n_{bolt}} = 29.06\text{-kip}$	Average pure tensile force in bolt

E. Panel Information

$n_{pl} := 20$	Panels per ring
$w_{tb} := 4\text{-in}$	Square tubing width
$t_{tb} := 0.25\text{-in}$	Tubing thickness
$n_{tb} := 5$	Number of tubes per panel
$F_{ytb} := 46\text{-ksi}$	Yield strength of tubing [A500 Grade B]
$F_{Ultb} := 58\text{-ksi}$	Ultimate strength of tubing [A500 Grade B]

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F. Safety Factor - Bolts

$$SF_{ba} := \frac{P_{des}}{\Phi_{pry} P_b} = 2.6$$

Safety factor for bolt in pure tension compared to allowable tensile strength for the bolts

G. Safety Factor - Panels

$$SF_{pa} := \frac{FA_{comp}}{\sigma_{hoop}} = 3.2$$

Safety factor for hoop stress in panel compared to composite allowable stress of plate and tubing

$$SF_{py} := \frac{FY_{comp}}{\sigma_{hoop}} = 5.0$$

Safety factor for hoop stress in panel compared to composite yield stress of plate and tubing

$$SF_{pu} := \frac{FU_{comp}}{\sigma_{hoop}} = 7.4$$

Safety factor for hoop stress in panel compared to composite ultimate stress of plate and tubing



TECHNICAL DATA SHEET

HDPE 7000 Series, 60 mils

Conductive, Smooth

Solmax, 2801 Boul. Marie-Victorin, Varennes, Qc, Canada, J3X 1P7
Tel.: (450) 929-1234 Fax: (450) 929-2550 www.solmax.com

PROPERTY	TEST METHOD	FREQUENCY ⁽¹⁾	UNIT Imperial	1096676
SPECIFICATIONS				
Thickness (Nominal $\pm 10\%$) (11)	ASTM D-5199	Every roll	mils	60,0
Resin Density	ASTM D-1505	Certified	g/cc	> 0.932
Melt Index - 190/2.16 (max.)	ASTM D-1238	Certified	g/10 min	0,0
Sheet Density (8)	ASTM D-792	1/Batch	g/cc	≥ 0.940
Carbon Black Content (9)	ASTM D-4218	Every 2 rolls	%	2.0 - 3.0
Carbon Black Dispersion	ASTM D-5596	Every 10 rolls	Category	Cat. 1 & Cat. 2
OIT - standard (avg.)	ASTM D-3895	Per formulation	min	100
Tensile Properties (min. avg) (2)	ASTM D-6693	Every 5 rolls		
Strength at Yield			ppi	126
Elongation at Yield			%	12
Strength at Break			ppi	228
Elongation at Break			%	700
Tear Resistance (min. avg.)	ASTM D-1004	Every 10 rolls	lbf	38
Puncture Resistance (min. avg.)	ASTM D-4833	Every 10 rolls	lbf	108
Dimensional Stability	ASTM D-1204	Certified	%	± 2
Stress Crack Resistance (SP-NCTL)	ASTM D-5397	1/Batch	hr	500
Oven Aging - % retained after 90 days	ASTM D-5721	Per formulation		
HP OIT (min. avg.)	ASTM D-5885		%	80
UV Res. - % retained after 1600 hr	ASTM D-7238	Per formulation		
HP-OIT (min. avg.)	ASTM D-5885		%	50
Volume Resistivity (max.)	ASTM D-4496	Every 10 rolls	Ohm•m	10
SUPPLY SPECIFICATIONS (Roll dimensions may vary $\pm 1\%$)				
Roll Dimension - Width			ft	24.6
Roll Dimension - Length			ft	459
Area (Surface/Roll)			sf	11 291
Application (10)			-	Conductive



TECHNICAL DATA SHEET

HDPE 7000 Series, 40 mils

Black, Smooth

Solmax, 2801 Boul. Marie-Victorin, Varennes, Qc, Canada, J3X 1P7
Tel.: (450) 929-1234 Fax: (450) 929-2550 www.solmax.com

PROPERTY	TEST METHOD	FREQUENCY ⁽¹⁾	UNIT Imperial	1000986
SPECIFICATIONS				
Thickness (Nominal $\pm 10\%$) (11)	ASTM D-5199	Every roll	mils	40,0
Resin Density	ASTM D-1505	Certified	g/cc	> 0.932
Melt Index - 190/2.16 (max.)	ASTM D-1238	Certified	g/10 min	0,0
Sheet Density (8)	ASTM D-792	1/Batch	g/cc	≥ 0.940
Carbon Black Content (9)	ASTM D-4218	Every 2 rolls	%	2.0 - 3.0
Carbon Black Dispersion	ASTM D-5596	Every 10 rolls	Category	Cat. 1 & Cat. 2
OIT - standard (avg.)	ASTM D-3895	Per formulation	min	100
Tensile Properties (min. avg) (2)	ASTM D-6693	Every 5 rolls		
Strength at Yield			ppi	85.7
Elongation at Yield			%	12
Strength at Break			ppi	154.2
Elongation at Break			%	700
Tear Resistance (min. avg.)	ASTM D-1004	Every 10 rolls	lbf	24
Puncture Resistance (min. avg.)	ASTM D-4833	Every 10 rolls	lbf	72
Dimensional Stability	ASTM D-1204	Certified	%	± 2
Stress Crack Resistance (SP-NCTL)	ASTM D-5397	1/Batch	hr	500
Oven Aging - % retained after 90 days	ASTM D-5721	Per formulation		
HP OIT (min. avg.)	ASTM D-5885		%	80
UV Res. - % retained after 1600 hr (10)	GRI-GM-11	Per formulation		
HP-OIT (min. avg.) (11)	ASTM D-5885		%	50
SUPPLY SPECIFICATIONS (Roll dimensions may vary $\pm 1\%$)				
Roll Dimension - Width	-		ft	0,9
Roll Dimension - Length	-		ft	780
Area (Surface/Roll)	-		sf	17 394

NOTES

1. Testing frequency based on standard roll dimensions and one batch is approximately 180,000 lbs (or one railcar).
2. Machine Direction (MD) and Cross Machine Direction (XMD or TD) average values should be on the basis of 5 specimens each direction.
8. Correlation table is available for ASTM D792 vs ASTM D1505. Both methods give the same results.
9. Correlation table is available for ASTM D1603 vs ASTM D4218. Both methods give the same results.
10. Condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. Condensation at 60°C.
11. The minimum average thickness is $\pm 10\%$ of the nominal value.

* All values are nominal test results, except when specified as minimum or maximum.

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**SKAPS TRANSNET™ (TN)
HDPE GEONET 220**

SKAPS TRANSNET™ Geonet consists of SKAPS GeoNet made from HDPE resin.

Property	Test Method	Unit	Required Value	Qualifier
Geonet				
Thickness	ASTM D 5199	mil.	220±20	Range
Carbon Black	ASTM D 4218	%	2 to 3	Range
Tensile Strength	ASTM D 7179	lb/in	45	Minimum
Melt Flow	ASTM D 1238 ³	g/10 min.	1	Maximum
Density	ASTM D 1505	g/cm ³	0.94	Minimum
Transmissivity ¹	ASTM D 4716	m ² /sec.	2x10 ⁻³	MARV ²

Notes:

1. Transmissivity measured using water at 21 ± 2°C (70 ± 4°F) with a gradient of 0.1 and a confining pressure of 10000 psf between stainless steel plates after 15 minutes. Values may vary between individual labs.
2. MARV is statistically defined as mean minus two standard deviations and it is the value which is exceeded by 97.5% of all the test data.
3. Condition 190/2.16

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TECHNICAL DATA SHEET

LLDPE 7000 Series, 40 mils

Black, Smooth

Solmax, 2801 Boul. Marie-Victorin, Varennes, Qc, Canada, J3X 1P7
Tel.: (450) 929-1234 Fax: (450) 929-2550 www.solmax.com

PROPERTY	TEST METHOD	FREQUENCY ⁽¹⁾	UNIT Imperial	1020228
SPECIFICATIONS				
Thickness (Nominal $\pm 10\%$) (11)	ASTM D-5199	Every roll	mils	40,0
Thickness (min. avg.)	ASTM D-5199	Every roll	mils	36,0
Resin Density	ASTM D-1505	Certified	g/cc	< 0.926
Melt Index - 190/2.16 (max.)	ASTM D-1238	Certified	g/10 min	0,0
Sheet Density (8)	ASTM D-792	1/Batch	g/cc	≤ 0.939
Carbon Black Content (9)	ASTM D-4218	Every 2 rolls	%	2.0 - 3.0
Carbon Black Dispersion	ASTM D-5596	Every 10 rolls	Category	Cat. 1 & Cat. 2
OIT - standard (avg.)	ASTM D-3895	Per formulation	min	100
Tensile Properties (min. avg) (2)	ASTM D-6693	Every 5 rolls		
Strength at Break			ppi	152
Elongation at Break			%	800
2% Modulus (max.)	ASTM D-5323	Per formulation	ppi	2 400
Tear Resistance (min. avg.)	ASTM D-1004	Every 10 rolls	lbf	20
Puncture Resistance (min. avg.)	ASTM D-4833	Every 10 rolls	lbf	56
Dimensional Stability	ASTM D-1204	Certified	%	± 2
Multi-Axial Tensile (min.)	ASTM D-5617	Per formulation	%	30
Oven Aging - % retained after 90 days	ASTM D-5721	Per formulation		
STD OIT (min. avg.)	ASTM D-3895		%	35
HP OIT (min. avg.)	ASTM D-5885		%	60
UV Res. - % retained after 1600 hr	ASTM D-7238	Per formulation		
HP-OIT (min. avg.)	ASTM D-5885		%	35
SUPPLY SPECIFICATIONS (Roll dimensions may vary $\pm 1\%$)				
Roll Dimension - Width			ft	0,9
Roll Dimension - Length			ft	780
Area (Surface/Roll)			sf	17 394



Sales Office:
Engineered Synthetic Products, Inc.
Phone (205)981-1900
Fax (205)981-1901
www.espgeosynthetics.com

Geotextile Product Description Sheet

Mustang-10 Nonwoven Geotextile

Mustang-10 is a needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, which are formed into a random network for dimensional stability. Mustang-10 resists ultraviolet deterioration, rotting, biological degradation, naturally encountered basics and acids. Polypropylene is stable within a pH range of 2 to 13. Mustang-10 conforms to the physical property values listed below:

PROPERTY	TEST METHOD	UNIT	M.A.R.V. (Minimum Average Roll Value)
Grab Tensile	ASTM D 4632	lbs	225
Grab Elongation	ASTM D 4632	%	50
Trapezoid Tear Strength	ASTM D 4533	lbs	90
CBR Puncture Resistance	ASTM D 6241	lbs	600
Permittivity*	ASTM D 4491	sec ⁻¹	1.26
Water Flow*	ASTM D 4491	gpm/ft ²	100
AOS*	ASTM D 4751	US Sieve (mm)	80 (.180)
UV Resistance	ASTM D 4355	%/hrs	70/500

* At the time of manufacturing. Handling, storage, and shipping may change these properties.

PACKAGING	
Roll Dimensions (W x L) – ft	15 x 1200
Square Yards Per Roll	2000
Estimated Roll Weight - lbs	1065

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SKAPS Industries, 316 S. Holland Dr., Pendergrass, GA 30567, Phone (706) 693-3440, Fax (706) 693-3450, Email: Info@skaps.com

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