ITW Futura Coatings

TECHNICAL SUPPORT REFERENCE HANDBOOK

INDEX

All information used herein was taken from information published by NACE, SSPC, Abrasive Manufacturers & Suppliers, Spray Equipment Manufacturers, etc

SURFACE PREPARATION STANDARDS
CROSS REFERENCE

SSPC	SWEDISH	NACE	DEFINITION
SP 1, Solvent Cleaning	N / A	N / A	Removal of all oil, grease, soil, drawing and cutting compounds, and other soluble contaminants.
SP 2, Hand Tool Cleaning	St 2	N / A	Removal of all loose mill scale, loose rust, loose paint and other loose detrimental foreign matter using non-powered hand tools.
SP 3, Power Tool Cleaning	St 3	N / A	Removal of all loose mill scale, loose rust, loose paint and other loose detrimental foreign matter using power assisted hand tools.
SP 5, White Metal Blast Cleaning	Sa 3	1	Removal of all visible oil, grease, dirt, dust mill scale, rust, paint, oxides, corrosion products and other foreign matter.
SP 6, Commercial Blast Cleaning	Sa 2	3	Removal of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products and other foreign matter except for staining which shall be limited to no more than 33% of each square inch of surface area.
SP 7, Brush-Off Blast Cleaning	Sa 1	4	Removal of all visible oil, grease, dirt, dust, loose mill scale, loose rust and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface.
SP 8, Pickling	N / A	N / A	Removal of all visible mill scale and rust by chemical reaction, electrolysis or both.
SP 10, Near White Blast Cleaning	Sa 2½	2	Removal of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products and other foreign matter except for staining which shall be limited to no more than 5% of each square inch of surface area.
SP 11, Power Tool Cleaning to Bare Metal	N / A	N / A	Removal of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products and other foreign matter using specific power tools to leave a surface profile of no less than 1 mil (25 microns).
SP 12, Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting	N / A	5	Provides requirements for use of high and ultra high pressure water jetting to achieve various degrees of surface cleanliness.
SP 13, Surface Preparation of Concrete	N / A	6	Provides the requirements for surface preparation by mechanical, chemical or thermal methods and is applicable to all types of cementitous surfaces including cast-in-place, concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces.
SP 14, Industrial Blast Cleaning	N / A	8	Removal of all visible oil, grease, dust, and dirt. Traces of tightly adherent mill scale, rust and coating residues are permitted to remain on 10% of each unit area of the surface if they are evenly distributed. Shadows, streaks, and discolorations caused by stains of rust, stains of mill scale and stains of previously applied coating may be present on the remainder of the surface.
SP 15, Commercial Grade Power Tool Cleaning	N / A	N / A	Removal of all visible oil, grease, dirt, rust, coating, oxides, mill scale, corrosion products and other foreign matter. Random staining shall be limited to no more than 33% of each unit of area defined. Staining may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale or stains of previously applied coating. Slight residues of rust and paint may also be left in the bottoms of pits if the original surface is pitted.

Definitions used above have been edited for space, are for reference only and are not intended to replace the actual referenced specification as published by SSPC, NACE or the Swedish Standards.

ABRASIVE / PROFILE COMPARISON

The following comparisons should be used only for approximating the abrasive size required to obtain a specified anchor pattern. The standard metal used to obtain these results was hot rolled steel with tightly adhering mill scale. The resulting depth of anchor pattern will vary with the method used for measuring depths as well as any one of numerous other variables (type and hardness of steel, thickness of mill scale, degree of cleaning specified, etc.). This information can be used for centrifugal wheel as well as pressure blasting. Pressure blasting should be done using 90-100 psi nozzle pressure. The depth of anchor pattern used in this comparison is an average and not a minimum or maximum depth obtainable.

1 Mil Profile

30/60 Mesh Silica Sand
G-80 Steel Grit
S-110 Steel Shot*
80 Mesh Garnet
100 Aluminum Oxide
Clemtex #4
Black Beauty 3060

1½ Mil Profile

16 / 35 Mesh Silica Sand
G-50 Steel Grit
S-170 Steel Shot*
36 Mesh Garnet
50 Grit Aluminum Oxide
Clemtex #3
Black Beauty 3060

2 Mil Profile

16 / 35 Mesh Silica Sand
G-40 Steel Grit
S-230 Steel Shot
36 Mesh Garnet
36 Grit Aluminum Oxide
Clemtex #3
Black Beauty 2040

2½ Profile

8 / 35 Mesh Silica Sand
G-40 Steel Grit
S-280 Steel Shot*
16 Mesh Garnet
24 Grit Aluminum Oxide
Clemtex #2
Black Beauty 2040

3 - 4 Mil Profile

8 / 20 Mesh Silica Sand
G-25 Steel Grit
S-330 or 390 Steel Shot*
16 Mesh Garnet
16 Grit Aluminum Oxide
Clemtex #2
Black Beauty 1240

***Steel shot alone will not give a good angular anchor pattern and should be used in combination with steel grit for best results.**

DEW POINT CALCULATION

FAHRENHEIT

AMBIENT AIR TEMPERATURE

R. H.	20°F	30°F	40°F	50°F	60° F	70°F	80°F	90°F	100°F	110°F	120°F
90%	18°	28°	37°	47°	62°	67°	77°	87°	97°	107°	117°
85%	17°	26°	36°	45°	55°	65°	75°	84°	95°	104°	113°
80%	16°	25°	34°	44°	54°	63°	73°	82°	93°	102°	110°
75%	15°	24°	33°	42°	52°	62°	71°	80°	91°	100°	108°
70%	13°	22°	31°	40°	50°	60°	68°	78°	88°	96°	105°
65%	12°	20°	29°	28°	47°	57°	66°	76°	85°	93°	103°
60%	11°	19°	27°	36°	45°	55°	64°	73°	83°	92°	101°
55%	9°	17°	25°	34°	43°	53°	61°	70°	80°	89°	98°
50%	6°	15°	23°	31°	40°	50°	59°	67°	77°	86°	94°
45%	4°	13°	21°	29°	37°	47°	56°	64°	73°	82°	91°
40%	1°	11°	18°	26°	35°	43°	52°	61°	69°	78°	87°
35%	- 2°	8°	19°	23°	31°	40°	48°	57°	65°	74°	83°
30%	- 6°	4°	13°	20°	28°	36°	44°	52°	61°	69°	77°

CENTIGRADE

AMBIENT AIR TEMPERATURE

R. H.	- 5°C	0°C	5°C	10°C	15°C	20°C	25°C	30°C	35°C	40°C
90%	-6°	- 1°	4°	8°	13°	18°	23°	28°	33°	38°
85%	-7°	- 2°	3°	7°	12°	17°	22°	27°	32°	37°
80%	-8°	- 3°	2°	6°	11°	16°	21°	26°	31°	36°
75%	-8°	- 4°	1°	6°	10°	15°	20°	25°	30°	35°
70%	-9°	- 4°	0°	5°	9°	14°	19°	23°	28°	33°
65%	-10°	- 5°	- 1°	3°	8°	13°	17°	22°	27°	32°
60%	-11°	- 6°	- 2.°	2°	7°	12°	16°	21°	25°	31°
55%	-12°	- 7°	- 3°	1°	6°	10°	15°	19°	24°	29°
50%	-13°	- 8°	- 4°	0°	4°	9°	13°	18°	22°	27°
45%	-14°	- 10°	- 6°	- 2°	3°	7°	12°	16°	20°	25°
40%	-16°	- 11°	- 7°	- 3°	1°	5°	10°	14°	18°	23°
35%	-17°	- 12°	- 9°	- 5°	- 1°	3°	7°	12°	16.°	21°
30%	-19°	- 14°	- 10°	- 7°	- 3°	1°	5°	9°	14°	18°

Dew Point: *The temperature at which moisture will condense on the surface. No coatings should be applied or cured unless the surface temperature is a minimum of 5°F or 3°C above this point.*

REDUCTION IN SOLIDS CONTENT BY ADDING THINNER

THINNER ADDED

Original Solids Content Before Adding Thinner	2%	5%	7%	10%	12%	15%	17%	20%	25%	30%	35%
100%	98	95	93	91	89	87	85	83	80	77	74
95%	93	90	89	86	85	83	81	79	76	73	70
90%	88	86	84	82	80	78	77	75	72	69	67
85%	83	81	79	77	76	74	73	71	68	65	63
80%	78	76	75	73	71	70	68	67	64	62	59
75%	74	71	70	68	67	65	64	63	60	58	56
70%	69	67	65	64	63	61	60	59	56	54	52
65%	64	62	61	59	58	57	56	54	52	50	48
60%	59	57	56	55	54	52	51	50	48	46	44
55%	54	52	21	50	49	48	47	46	44	42	41
50%	49	48	47	46	45	44	43	42	40	39	37
45%	44	43	42	41	40	39	38	37	36	35	33
40%	39	38	37	36	36	35	34	33	32	31	30
35%	34	33	32	31	31	30	30	29	28	27	26
30%	29	29	28	27	27	26	26	25	24	23	22
25%	24	24	23	23	22	21	21	21	2	19	19

Solids Content After Thinning

VOLUME OF THINNER REQUIRED
TO THIN TO THE PERCENTAGE SHOWN

1 Gallon Kit

%	Oz.	Liter
2	2.6	.08
5	6.5	.19
7	9.0	.27
10	12.8	.38
12	15.4	.46
15	19.2	.57
17	21.8	.64
20	25.6	.76
25	32.0	.95
30	38.4	1.14
35	44.8	1.32

5 Gallon Kit

%	Oz.	Liter
2	13.0	.40
5	32.5	.95
7	45.0	1.35
10	64.0	1.90
12	77.0	2.30
15	96.0	2.85
17	109	3.20
20	128	3.80
25	160	4.75
30	192	5.70
35	224	6.60

5 Liter Kit

%	Liter	Oz.
2	.10	3.5
5	.25	8.5
7	.35	12.0
10	.50	17.0
12	.60	20.5
15	.75	25.5
17	.85	29.0
20	1.00	34.0
25	1.25	42.5
30	1.50	50.5
35	1.75	59.0

20 Liter Kit

%	Liter	Oz.
2	0.4	14.0
5	1.0	34.0
7	1.4	48.0
10	2.0	68.0
12	2.4	82.0
15	3.0	102.0
17	3.4	116.0
20	4.0	136.0
25	5.0	170.0
30	6.0	202.0
35	7.0	236.0

WET FILM THICKNESS REQUIREMENTS

Required Dry Film Thickness
(mils)

% sbv *	2	3	4	5	6	7	8	9	10	11	12	13	14	15	20	25
100%	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	20.0	25.0
95%	2.1	3.2	4.2	5.3	6.3	7.4	8.4	9.5	10.5	11.6	12.6	13.7	14.7	15.8	21.0	26.3
90%	2.2	3.3	4.4	5.6	6.7	7.8	8.9	10.0	11.1	12.2	13.3	14.4	15.6	16.7	22.2	27.8
85%	2.4	3.5	4.7	5.9	7.1	8.2	9.4	10.6	11.8	12.9	14.1	15.3	16.5	17.7	23.5	29.4
80%	2.5	3.8	5.0	6.3	7.5	8.8	10.0	11.3	12.5	13.7	15.0	16.3	17.5	18.8	25.0	31.3
75%	2.7	4.0	5.3	6.7	8.0	9.3	10.7	12.0	13.3	14.6	16.0	17.3	18.7	20.0	26.6	33.3
70%	2.9	4.3	5.7	7.1	8.6	10.0	11.4	12.9	14.3	15.7	17.1	18.6	20.0	21.4	28.5	35.7
65%	3.1	4.6	6.2	7.7	9.2	10.8	12.3	13.9	15.4	16.9	18.5					
60%	3.3	5.0	6.7	8.3	10.0	11.7	13.3	15.0	16.7	18.3						
55%	3.6	5.5	7.3	9.1	10.9	12.7	14.6	16.4	18.2							
50%	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0								
45%	4.4	6.7	8.9	11.1	13.3	15.6	17.8									
40%	5.0	7.5	10.0	12.5	15.0	17.5										
35	5.7	8.6	11.4	14.3	17.1											
30	6.7	10.0	13.3	16.7												
25	8.0	12.0	16.0													

Wet Film Thickness Required.

Example:
Material = 70% Solids
DFT required = 6 mils
Wet film Required = 8.6 mils

* Solids by volume content of material after thinning.

Note: Dry film thickness shown is minimum, no allowance is made for solvent evaporation during application.

THEORETICAL COVERAGE IN SQUARE FEET PER U. S. GALLON

Dry Film Thickness Per Coat
(mils)

% sbv *	2	3	4	5	6	7	8	9	10	11	12	13	14	15	20	40	80
100%	802	535	401	321	267	229	201	178	160	146	135	123	115	107	80	40	20
95%	762	511	381	305	254	218	191	169	152	139	127	117	109	102	76	38	19
90%	722	481	361	289	241	206	181	160	144	131	120	111	104	96	72	36	18
85%	682	455	341	273	227	195	170	152	136	124	114	105	98	91	68	34	17
80%	642	428	321	257	214	183	160	143	128	117	107	98	92	86	64	32	16
75%	602	401	301	241	201	172	150	134	120	109	100	92	86	80	60	30	15
70%	561	374	281	225	187	160	140	125	112	102	94	86	80	75	56	28	14
65%	521	348	261	209	174	149	130	116	104	95	87	80	75	70	52	26	13
60%	481	321	241	193	160	138	120	107	96	88	80	74	69	64	48	24	12
55%	441	294	221	176	147	126	110	98	88	80	74	68	63	59	44	22	11
50%	401	267	201	160	134	115	100	89	80	73	67	62	58	54	40	20	10
45%	361	241	181	144	120	103	90	80	72	66	60	55	52	48	36	18	9
40%	321	214	160	128	107	92	80	71	64	58	54	49	46	43	32	16	8
35%	281	187	140	112	94	80	70	62	56	51	47	43	40	37	28	14	7
30%	241	160	120	96	80	69	60	54	48	44	40	37	35	32	24	12	6
25%	201	134	100	80	67	57	50	45	40	37	33	31	29	27	20	10	5

Theoretical Coverage per Gallon

*** Solids by volume content of material after thinning.**

Note: Dry film thickness shown is minimum, no allowance is made for solvent evaporation during application.

WET FILM THICKNESS REQUIREMENTS

Dry Film Thickness
(microns)

% sbv *	50	75	100	125	150	175	200	225	250	275	300	325	350	375	500	625
100%	50	75	100	125	150	175	200	225	250	275	300	325	350	375	500	625
95%	53	80	105	132	158	184	311	237	263	290	316	342	368	395	526	658
90%	56	83	111	139	167	194	222	250	278	306	333	361	389	417	556	694
85%	59	88	118	147	177	206	235	265	294	324	353	382	412	441	588	735
80%	63	94	125	156	188	219	250	281	313	344	375	406	438	469	625	781
75%	67	100	133	167	200	233	267	300	333	367	400	433	467	500	667	833
70%	71	107	143	179	214	250	286	321	357	393	429	464	500	536	714	893
65%	77	115	154	192	231	269	308	346	385	423	462					
60%	83	125	167	208	250	292	333	375	417	458						
55%	91	136	182	227	273	318	364	409	455							
50%	100	150	200	250	300	350	400	450								
45%	111	167	222	278	333	389	444									
40%	125	188	250	313	375	438										
35	143	214	286	357	429											
30	167	250	333	417												
25	200	300	400													

Wet Film Thickness Required.

Example:
Material = 70% Solids
DFT required = 150 microns
Wet film Required = 214 microns

* Solids by volume content of material after thinning.

Note: Dry film thickness shown is minimum, no allowance is made for solvent evaporation during application.

THEORETICAL COVERAGE IN SQUARE METERS PER LITER

Dry Film Thickness Per Coat
(microns)

% sbv *	25	50	75	100	125	150	175	200	225	250	275	300	325	350	500	1000	2000
100%	40	20	13.3	10	8.0	6.7	5.7	5.0	4.4	4.0	3.6	3.3	3.1	2.9	2.0	1.0	0.5
95%	38	19	12.6	9.5	7.6	6.4	5.4	4.8	4.2	3.8	3.4	3.1	3.0	2.8	1.9	.95	.48
90%	36	18	12	9.0	7.2	6.1	5.1	4.5	4.0	3.6	3.2	3.0	2.8	2.6	1.8	.90	.45
85%	34	17	11.3	8.5	6.8	5.7	4.9	4.3	3.7	3.4	3.1	2.8	2.6	2.5	1.7	.85	.43
80%	32	16	10.5	8.0	6.4	5.4	4.6	4.0	3.5	3.2	2.9	2.6	2.5	2.3	1.6	.80	.40
75%	30	15	10	7.5	6.0	5.0	4.3	3.8	3.3	3.0	2.7	2.5	2.3	2.2	1.5	.75	.38
70%	28	14	9.3	7.0	5.6	4.7	4.0	3.5	3.1	2.8	2.5	2.3	2.2	2.0	1.4	.70	.35
65%	26	13	8.7	6.5	5.2	4.4	3.7	3.3	2.9	2.6	2.3	2.2	2.2	1.9	1.3	.65	.33
60%	24	12	8.0	6.0	4.8	4.0	3.4	3.0	2.6	2.4	2.2	2.0	1.9	1.7	1.2	.60	.30
55%	22	11	7.3	5.5	4.4	3.7	3.1	2.8	2.4	2.2	2.0	1.8	1.7	1.6	1.1	.55	.28
50%	20	10	6.7	5.0	4.0	3.4	2.9	2.5	2.2	2.0	1.8	1.7	1.6	1.5	1.0	.50	.25
45%	18	9	6.0	4.5	3.6	3.0	2.6	2.3	2.0	1.8	1.6	1.5	1.4	1.3	.09	.45	.23
40%	16	8	5.3	4.0	3.2	2.7	2.3	2.0	1.8	1.6	1.4	1.3	1.2	1.2	0.8	.40	.20
35%	14	7	4.7	3.5	2.8	2.3	2.0	1.8	1.5	1.4	1.3	1.2	1.1	1.0	0.7	.35	.18
30%	12	6	4.0	3.0	2.4	2.0	1.7	1.5	1.3	1.2	1.1	1.0	0.9	.87	0.6	.30	.15
25%	10	5	3.3	2.5	2.0	1.7	1.4	1.3	1.1	1.0	0.9	.83	.78	.73	0.5	.25	.13

Theoretical Coverage per Liter

* Solids by volume content of material after thinning.

Note: Dry film thickness shown is minimum, no allowance is made for solvent evaporation during application.

COATING COVERAGE CALCULATIONS

Theoretical Coverage:

$$\text{ft}^2 \text{ / US gal} = \frac{\% \text{ SBV / 100 x 1604}}{\text{dft (mils)}}$$

$$\text{m}^2 \text{ / liter} = \frac{\% \text{ SBV / 100 x 1000}}{\text{dft (microns)}}$$

Practical Coverage:

$$\text{Theoretical Coverage} - \frac{\text{Theoretical Coverage x \% loss}}{100}$$

Film Thickness:

Wet to Dry

$$\frac{\text{wft x \% SBV}}{100}$$

Dry to wet

$$\frac{\text{dft x 100}}{\% \text{ SBV}}$$

% Solids by Volume and Wet Film Thickness Adjustments Due To Thinning.

$$W = X \div (1 + Y) \qquad A = Z \div W$$

A = adjusted WFT required for thinned material
W = adjusted % solids by volume due to thinning
X = original materials % solids by volume
Y = % thinner added
Z = required dry film thickness

EXAMPLES OF WATER BLAST CLEANING RATES*

Square Feet per Hour

Surface Condition	Water Only - W Sand Injection - S	0 -2000 psi @ 5 gpm	3000 - 6000 psi @ 6 - 8 gpm	10,000 psi @ 10 gpm
Easy to clean, dusty settlement, flaky flat surface, light oil or grease	W	150	350	500
	S	200	450	650
Average rusty surface, angles and piping.	W	75	200	250
	S	100	225	350
Heavily corroded surface rust scale, irregular shapes.	W	20	75	125
	S	25	100	175

* Water Blast surfaces comparable to SSPC-SP 6. Abrasive cleaned surface comparable to SSPC-SP 10

Note: The speed of cleaning is dependent upon the highest manageable working pressure and volume of water. Depending on surface condition, water blasting compares favorably with dry or wet sandblasting.

ABRASIVE and AIR CONSUMPTION

Nozzle Size	60 psi	70 psi	80 psi	90 psi	100 psi	
3/16" (5 mm)	30 171 7	33 196 7.5	38 216 8.5	41 238 9.5	45 264 10	Air (cfm) Sand (lbs / hr) H.P.
¼" (6 mm)	54 312 12	61 354 13.5	68 408 15	74 448 16.5	81 494 18	Air (cfm) Sand (lbs / hr) H.P. *
5/16" (8 mm)	89 534 20	101 604 22.5	113 672 25.2	126 740 28	137 812 30.5	Air (cfm) Sand (lbs / hr) H.P.
3/8" (10 mm)	126 764 28	143 864 32	161 960 36	173 1052 385	196 1152 44	Air (cfm) Sand (lbs / hr) H.P.
7/16" (11 mm)	170 1032 38	194 1176 43.5	217 1312 48.5	240 1448 53.5	254 1584 56.5	Air (cfm) Sand (lbs / hr) H.P.
½" (13 mm)	224 1336 50	252 1512 56	280 1680 62.5	309 1856 69	338 2024 75	Air (cfm) Sand (lbs / hr) H.P.
5/8" (16 mm)	356 2140 80	404 2422 90	452 2690 100	504 2973 112	548 3250 122	Air (cfm) Sand (lbs / hr) H.P.
¾" (19 mm)	504 3056 112	572 3456 127	644 3840 143	692 4208 154	784 4608 175	Air (cfm) Sand (lbs / hr) H.P.

* Electric motor horsepower required to produce the indicated cfm.

EXAMPLES OF ABRASIVE CLEANING RATES (1)

ABRASIVE	CONSUMPTION lbs / ft²	PRODUCTION ft² / hr	COMMENTS
Silica Sand - 16 / 40 mesh	2.6	285	1 ½ mil profile, dusty
Crushed Flint - 12 / 30 mesh	3.6	161	3 mil profile
Coal Slag - 16 / 40 mesh	3.2	230	2 ½ mil profile
Copper Slag - 16 / 40 mesh	3.1	262	2 mil profile
Garnet - 36 Grit*	3.6	213	1 ½ mil profile, very little dust.
Aluminum Oxide - 36 Grit*	3.1	275	1 ½ mil profile, very little dust.
Steel Grit - G-40*	5.5	184	2 ½ mil profile, no dust.

* These abrasives are normally reused.

(1) Newly fabricated steel using a 3/8" I. D. nozzle and 100 psi to a SSPC-SP 10.

EXAMPLES OF CLEANING PRODUCTION RATES

METHOD	PRODUCTION RATE	ABRASIVE USED
SSPC-SP 1	500 ft³ / hr	1 gallon / hr
SSPC-SP 2	250-350 ft³ / hr	4 units / day
SSPC SP 3	100 ft³ / hr	2 units / day
SSPC-SP 5 *	1000 ft³	10,000 lbs.
SSPC-SP 6 *	2500 ft³	8000 lbs.
SSPC-SP 7 *	5200 ft³	7000 lbs.
SSPC-SP 10 *	1500 ft³	12,500 lbs.

* Per a 3 person crew day on lightly rusted steel, using 30 / 40 mesh, medium hardness abrasive, 3/8" nozzle at 80 psi.

AVERAGE AREA COATED PER DAY*

Method	Square Feet
Brush	650
Roller	1,200 - 2,600
Conventional Spray	4,000 - 8,000
Airless Spray	6,000 - 10,000

CONVENTIONAL vs. AIRLESS SPRAY*

	Conventional	Airless
Coverage, ft² / day	4,000 - 8,000	6,000 - 10,000
Overspray, %	20 to 40	10 to 15
Portability	Fair	Excellent
Direct Drive Units	No	Yes
Hoses	3	2
Masking	Considerable	Moderate
Penetration of corners and voids	Fair	Good
Thinning required	Usually	Sometimes
Film build per coat	Lower	Higher
Moisture (compressor)	Possible	None
Versatility	More	Less
Clogging Problems	Slight	Possible
Safety	Excellent	Poor

* Per person

Temperature Conversion

°F	°C	°F	°C	°F	°C
Zero	-17.8	41	5	82	27.8
1	-17.2	12	5.6	83	28.3
2	-16.7	43	6.1	84	28.9
3	-16.1	44	6.7	85	29.4
4	-15.6	45	7.2	86	30
5	-15	46	7.8	87	30.5
6	-14.4	47	8.3	88	31.1
7	-13.9	48	8.9	89	31.7
8	-13.3	49	9.4	90	32.2
9	-12.8	50	10	91	32.8
10	-12.2	51	10.6	92	33.3
11	-11.7	52	11.1	93	33.9
12	-11.1	53	11.7	94	34.4
13	-10.6	54	12.2	94	35
14	-10	55	12.8	96	35.6
15	-9.4	56	13.3	97	36.1
16	-8.9	57	13.9	98	36.7
17	-8.3	58	14.4	99	37.2
18	-7.8	59	15	100	37.8
19	-7.2	60	15.6	110	43
20	-6.7	61	16.1	120	49
21	-6.1	62	16.7	130	54
22	-5.6	63	17.2	140	60
23	-5	64	17.8	150	66
24	-4.4	65	18.3	160	71
25	-3.9	66	18.9	170	77
26	-3.3	67	19.4	180	82
27	-2.8	68	20	190	88
28	-2.2	69	20.6	200	93
29	-1.7	70	21.1	210	99
30	-1.1	71	21.7	220	104
31	-0.6	72	22.2	230	110
32	Zero	73	22.8	240	116
33	0.6	74	23.3	250	121
34	1.1	75	23.9	300	149
35	1.7	76	24.4	350	177
36	2.2	77	25	400	204
37	2.8	78	25.6	450	232
38	3.3	79	26.1	500	260
39	3.9	80	26.7	750	399
40	4.4	81	27.2	1000	538

CONVERSION FACTORS

Length

From	To	Multiply by
inches	centimeters	2.54
centimeters	inches	0.04
feet	centimeters	30.48
feet	meters	0.3048
centimeters	feet	0.03281
meters	feet	3.2808
mils	microns	25.0
microns	mils	0.04

Area

From	To	Multiply by
ft^2	m^2	0.0929
m^2	ft^2	10.764

Volume

From	To	Multiply by
US gal	liter	3.785
US gal	Imp gal	0.833
liter	US gal	0.264
liter	Imp gal	0.22
Imp gal	US gal	1.2
Imp gal	liter	4.55

Area / Volume

From	To	Multiply by
ft^2 / US gal	m^2 / liter	0.0245
ft^2 / US gal	m^2 / Imp gal	0.112
m^2 / liter	ft^2 / US gal	40.76
m^2 / liter	ft^2 / Imp gal	48.93
m^2 / Imp gal	m^2 / liter	0.2197

Weight

From	To	Multiply by
pounds	kilograms	0.4536
kilograms	pounds	2.2046
long tons	pounds	2240
short tons	pounds	2000
long tons	short tons	1.12
short tons	long tons	0.8928

Pressure

From	To	Multiply by
psi	kg / cm^2	0.0703
kg / cm^2	psi	14.223

Temperature

From	To	Calculate
Celsius	Fahrenheit	$\frac{C° \times 9}{5} + 32$
Fahrenheit	Celsius	$\frac{(F° - 32) \times 5}{9}$

Film Thickness

From	To	Calculate
Wet	Dry	wft x % sbv
Dry	Wet	dft ÷ % sbv

VOC

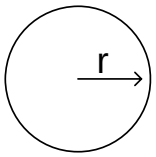
VOC of added thinner =	Density of thinner x % thinning / 100
VOC of the mixture =	VOC as supplied + VOC of the thinner added
lbs / gal VOC =	VOC of mixture / total volume of the mix. (1 gal + % thinner added / 100)

DECIMAL & METRIC EQUIVALENTS OF FRACTIONS

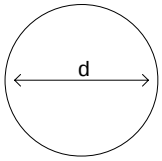
Fraction	Inches	mm	Fraction	Inches	mm
1/64	.015625	.39688	33/64	.5156	13.09688
1/32	.03125	.97375	17/32	.5312	13.49375
3/64	.046875	1.19063	35/64	.5468	13.89063
1/16	.0625	1.5875	9/16	.5625	14.2875
5/64	.078125	1.98438	37/64	.5781	14.68438
3/32	.09375	2.38175	19/32	.5937	15.08125
7/64	.109375	2.77813	39/64	.6093	15.47813
1/8	.125	3.175	5/8	.675	15.875
9/64	.140625	3.57188	41/64	.6406	16.27188
5/32	.15625	3.9687	21/32	.6562	16.66875
11/64	.171875	4.36563	43/64	.6718	17.06563
3/16	.1875	4.7625	11/16	.6875	17.4625
13/64	.203125	5.15938	45/64	.7031	17.85938
7/32	.21875	5.55625	23/32	.7187	18.25625
15/64	.234375	5.95313	47/64	.7343	18.65313
¼	.250	6.35	¾	.750	19.05
17/64	.2656	6.74688	49/64	.7656	19.44688
9/32	.2812	7.14375	25/32	.7812	19.84375
19/64	.2968	7.54063	51/64	.7968	20.24063
5/16	.3125	7.9375	13/16	.8125	20.6375
21/64	.3281	8.33438	53/64	.8281	21.03438
11/32	.3437	8.73125	27/32	.8437	21.43125
23/64	.3593	9.12813	55/64	.8593	21.8281
3/8	.375	9.525	7/8	.875	22.225
25/64	.3906	9.92188	57/64	.8906	22.62188
13/32	.4062	10.31875	29/32	.9062	23.01875
27/64	.4218	10.71563	59/64	.9218	23.41563
7/16	.4375	11.11250	15/16	.9375	23.8125
29/64	.4531	11.50938	61/64	.9531	24.2093
15/32	.4687	11.90625	31/32	.9687	24.60625
31/64	.4843	13.30313	63/64	.9843	25.00313
1/2	.500	12.7	1	1.0	25.4

CALCULATING SQUARE FEET FOR VARIOUS SHAPES

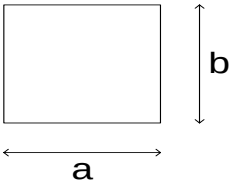
Area of a circle = πr^2
(π = 3.1416)



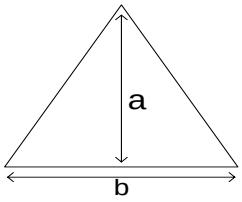
Circumference = πd
(π = 3.1416)



Area of a Square or Rectangle = a x b

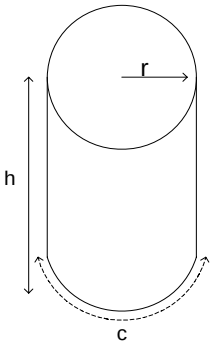


Area of a Triangle = ½a x b



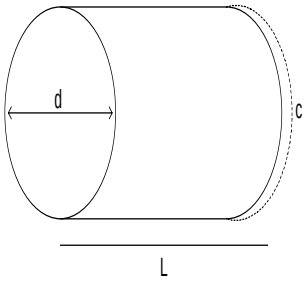
TANK

- **Calculate the area of both ends by multiplying 3.1416 times the radius (r) squared.**
- **Calculate the area of the side by multiplying the circumference (c) by the height (h).**
- **Add all together to obtain total square feet**



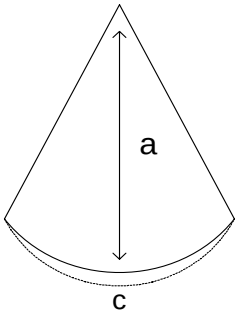
PIPE

- **Calculate the circumference (c) by multiplying the diameter (d) by 3.1416.**
- **Calculate the area by multiplying the circumference (c) by the length (L)**



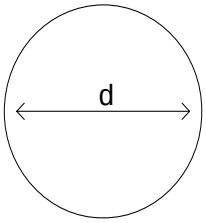
Domed Roof

- **Calculate the area of the base by multiplying 3.1416 times the radius (r) squared.**
- **Calculate the area of the cone by multiplying the circumference (c) of the base times ½ the slant height (a).**
- **Add the square foot area of the base to the area of the cone for total square foot area.**



Spheres

Surface Area = πd^2
(π = 3.1416)



SURFACE AREA PER TON OF STEEL
for
DIFFERENT TYPES OF CONSTRUCTION

Type of Construction	Average ft² per ton of steel
Light	300 to 500
Medium	150 to 300
Heavy	100 to 150
Extra heavy	50 to 100

Note: The average for industrial plants is approximately 200 to 250 ft² per ton.

SQUARE FOOT PER TON OF STEEL

Thickness of steel
(inches)

	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1	1 1/2	2
ft² / ton	800	533	400	320	267	200	160	133	114	100	67	50

SURFACE AREA OF PIPE
&
FT² / LINEAR FT

Diameter	O. D. (in)	I. D. (in)	ft² / ft O. D.	ft² / ft I. D.
¼"	0.540	0.364	0.141	0.096
½"	0.840	0.622	0.219	0.168
¾"	1.050	0.824	0.276	0.216
1"	1.315	1.049	0.344	0.275
1½"	1.900	1.610	0.497	0.422
2"	2.375	2.067	0.622	0.541
2½"	2.875	2.469	0.753	0.647
3"	3.500	3.068	0.916	0.804
4"	4.600	4.026	1.178	1.053
5"	5.563	5.047	1.456	1.32
6"	6.625	6.065	1.734	1.59
8"	8.625	7.981	2.258	2.07
10"	10.750	10.020	2.814	2.62
12"	12.750	12.000	3.35	3.14
18"	18.000	17.250	4.71	4.52
24"	24.000	23.250	6.28	6.09
36"	36.000	35.250	9.42	9.23
48"	48.000	47.250	12.57	12.40
60"	60.000	59.250	15.71	15.53

SQUARE FEET OF AREA AND GALLONS / FT OF DEPTH IN TANKS

Diameter (ft)	Circumference (ft)	Area / ft²	Gallons / ft of depth
5.0	15.708	19.635	146.88
5.5	17.279	23.758	177.72
6.0	18.850	28.274	211.51
6.5	20.420	33.183	248.23
7.0	21.991	38.485	287.88
7.5	23.562	44.179	330.48
8.0	25.133	50.265	376.01
8.5	26.704	56.745	424.48
9.0	28.274	63.617	475.89
9.5	29.845	70.882	530.24
10.0	31.416	78.540	587.52
10.5	32.987	86.590	647.74
11.0	34.558	95.033	710.90
11.5	36.128	103.87	776.99
12.0	37.699	113.10	846.03
12.5	39.270	122.72	918.00
13.0	40.841	132.73	992.91
13.5	42.412	143.14	1070.80
14.0	43.982	153.94	1151.50
14.5	45.553	165.13	1235.30
15.0	47.124	176.71	1321.90
15.5	48.695	188.69	1411.50
16.0	50.265	201.06	1504.10
16.5	51.836	213.82	1599.50
17.0	53.407	226.98	1697.90
17.5	54.978	240.53	1799.30
18.0	56.549	254.47	1903.60
18.5	58.119	268.80	2010.80
19.0	59.690	283.53	2120.90
19.5	61.261	298.65	2234.00
20.0	62.832	314.16	2350.10
20.5	64.403	330.06	2469.10
21.0	65.973	346.46	2591.00
21.5	67.544	363.05	2715.80
22.0	69.115	380.13	2843.60
22.5	70.686	397.61	2974.30
23.0	72.257	415.48	3108.00
23.5	73.827	433.74	3244.60
24.0	75.398	452.39	3384.10
24.5	76.969	471.44	3526.60
25.0	78.540	490.87	3672.00
25.5	80.111	510.71	3820.30
26.0	81.681	530.93	3971.60
26.5	83.252	551.55	4125.90
27.0	84.823	572.56	4283.00
27.5	86.394	593.96	4443.10
28.0	87.965	615.75	4606.20
28.5	89.535	637.94	4772.10
29.0	91.106	660.52	4941.00
29.5	92.677	683.49	5112.90
30.0	94.248	706.86	5287.70
30.5	95.819	730.62	5465.40

Total area = circumference x length + area of the two ends (one end if an open top tank).

APPROXIMATE FT² / LINEAR FOOT & PER TON FOR STEEL MEMBERS

SIZE	WEIGHT	FT² / FT	FT² / TON
24 WF (24 x 14)	160	8.9	110
	145	8.8	121
	130	8.7	135
24 WF (24 x 12)	120	8.1	133
	110	8.0	144
	100	8.0	160
24 WF (24 x 9)	94	7.1	149
	84	7.0	167
	76	7.0	184
21 WF (21 x 13)	142	7.9	111
	127	7.9	124
	112	7.8	139
21 WF (21 x 9)	95	6.5	135
	82	6.5	159
21 WF (21 x 8¼)	73	6.3	173
	68	6.3	185
	62	6.2	200
18 WF (18 x 11 ¾)	114	7.0	123
	105	7.0	133
	96	7.0	146
18 WF (18 x 8¾)	85	6.0	141
	77	6.0	156
	70	5.9	169
	64	5.9	184
18 WF (18 x 7½)	60	5.5	183
	55	5.5	200
	50	5.5	220
16 WF (16 x 11½)	96	6.6	137
	88	6.5	148
16 WF (16 x 8½)	78	5.6	144
	71	5.5	155
	64	5.5	172
	58	5.5	190

SIZE	WEIGHT	FT² / FT	FT² /TON
16 WF (16 x 7)	50	5.1	204
	45	5.0	222
	40	5.0	250
	36	5.0	278
14 WF (14 x 16)	426	8.5	40
	398	8.5	43
	370	8.5	46
	342	8.5	50
	314	8.5	54
	287	8.0	56
	264	8.0	61
	246	8.0	65
	237	8.0	68
	228	8.0	70
	219	7.9	72
	211	7.9	75
	202	7.9	78
	193	7.9	82
	184	7.9	86
	176	7.7	87
	167	7.7	92
	158	7.7	97
	150	7.7	103
	142	7.7	108
14 WF (14 x 14½)	136	7.3	107
	127	7.3	115
	119	7.3	123
	111	7.3	132
	103	7.3	142
	95	7.3	154
	87	7.3	168
14 WF (14 x 12)	84	6.4	152
	78	6.3	162
14 WF (14 x 10)	74	5.7	154
	68	5.7	168
	61	5.7	187
14 WF (14 x 8)	53	5.0	189
	48	5.0	208
	43	4.9	228

APPROXIMATE FT² / LINEAR FOOT & PER TON FOR STEEL MEMBERS

SIZE	WEIGHT	FT² / FT	FT² / TON
14 WF (14 x 16 ¾)	38	4.6	242
	34	4.6	271
	30	4.6	307
12 WF (12 x 12)	190	6.6	69
	161	6.5	81
	133	6.4	96
	120	6.3	105
	106	6.2	117
	99	6.2	125
	92	6.2	135
	85	6.1	144
	79	6.1	154
	72	6.1	169
	65	6.0	185
12 WF (12 x 10)	58	5.4	186
	53	5.3	200
12 WF (12 x 8)	50	4.7	188
	45	4.7	209
	40	4.7	235
12 WF (12 x 6½)	36	4.2	233
	31	4.2	271
	27	4.2	311
10 WF (10 x 10)	112	5.4	96
	100	5.3	106
	89	5.2	117
	77	5.2	124
	72	5.1	142
	66	5.1	155
	60	5.1	170
	54	5.0	185
	49	5.0	204
10 WF (10 x 8)	45	4.4	196
	39	4.3	221
	33	4.3	261
10 WF (10 x 5¾)	29	3.6	248
	25	3.6	288
	21	3.6	343

SIZE	WEIGHT	FT² / FT	FT² / TON
8 WF (8 x 8)	67	4.3	128
	58	4.2	145
	48	4.1	171
	40	4.1	205
	35	4.0	229
	31	4.0	258
8 WF (8 x 6 ½)	28	3.5	250
	24	3.5	292
8 WF (8 x 5¼)	20	3.1	310
	17	3.1	365
6 WF (6 x 6)	25	3.1	248
	20	3.0	300
	15.5	3.0	387
5 WF (5 x 5)	18.5	2.5	270
	16	2.5	313
4 WF	13	2	308

I - BEAMS

SIZE	WEIGHT	FT² / FT	FT² / TON
24 I	120	6.7	112
	106	6.6	125
	100	6.4	128
	90	6.4	142
	80	6.3	158
20 I	95	5.7	120
	85	5.7	134
	75	5.5	147
	65.4	5.4	165
18 I	70	5.1	148
	54.7	5.0	183
15 I	50	4.4	176
	42.9	4.3	200
12 I	50	3.8	152
	40.8	3.8	186
	35	3.7	211
	31.8	3.7	233

APPROXIMATE FT² / LINEAR FOOT & PER TON FOR STEEL MEMBERS

I - BEAMS (cont.)

SIZE	WEIGHT	FT² / FT	FT² / TON
10 I	35	3.3	189
	25.4	3.2	252
8 I	23	2.7	322
	18.4	2.7	402
7 I	20	2.5	250
	15.3	2.4	314
6 I	17.25	2.2	255
	12.5	2.1	336
5 I	14.75	1.9	258
	10	1.8	360
4 I	9.5	1.6	337
	7.7	1.6	416
3 I	7.5	1.3	347
	5.7	1.3	456

CHANNELS

SIZE	WEIGHT	FT² / FT	FT² / TON
18	58	4.4	152
	51.9	4.4	172
	45.8	4.3	188
	42.7	4.3	201
15	50	3.7	148
	40	3.7	185
	33.9	3.6	212
13	50	3.6	144
	31.8	3.5	220
12	30	3.1	207
	25	3.0	240
	20.7	3.0	290
10	30	2.7	180
	25	2.6	208
	20	2.6	260
	15.3	2.5	327

SIZE	WEIGHT	FT² / FT	FT² / TON
9	20	2.4	240
	15	2.3	307
	13.4	2.3	343
8	18.75	2.2	235
	13.75	2.1	305
	11.5	2.1	365
7	14.75	1.9	258
	12.25	1.9	310
	9.8	1.9	388
6	13	1.7	262
	10.5	1.7	324
	8.2	1.6	390
5	9.0	1.5	333
	6.7	1.4	418
4	7.25	1.2	331
	5.4	1.2	444
3	6	1	333
	5	1	400
	4.1	1	488

ANGLES - EQUAL LEG

SIZE	WEIGHT	FT² / FT	FT² / TON
8 x 8 x ½	26.4	2.7	205
6 x 6 x 5/16	12.5	2.0	320
5 x 5 x 5/16	10.3	1.7	330
4 x 4 x ¼	6.6	1.3	394
3½ x 3½ x ¼	5.8	1.2	414
3 x 3 x 3/16	3.71	1.0	539
2½ x 2¼ x 3/16	3.07	0.8	521
2 x 2 x 1/8	1.65	0.7	848
1¼ x 1¼ x 1/8	1.23	0.5	813
1 x 1 x 1/8	0.8	0.3	750

APPROXIMATE FT² / LINEAR FOOT & PER TON FOR STEEL MEMBERS

ANGLES - UNEQUAL LEG

SIZE	WEIGHT	FT² / FT	FT² / TON
8 x 6 x ½	23	2.3	200
8 x 4 x ½	19.6	2.0	204
7 x 4 x 3/8	13.6	1.8	265
6 x 4 x 5/16	10.3	1.7	330
6 x 3½ x 5/16	9.8	1.6	327
5 x 3½ x 5/16	8.7	1.4	322
5 x 3 x ¼	6.6	1.3	394
4 x 3½ x ¼	6.2	1.25	403
4 x 3 x ¼	5.8	1.17	403
3½ x 3¼	5.4	1.08	400
3 x 2½ x ¼	4.5	0.92	409
3 x 2 x 3/16	3.07	0.83	541
2½ x 2½ x 3/16	2.75	0.75	545
2½ x 1½ x 3/16	2.44	0.67	549
2 x 1½ x 1/8	1.44	0.58	806
1½ x 1½ x 3/16	1.67	0.31	371
1 x ¾ x 1/8	0.7	0.15	429
1 x 5/8 x 1/8	0.64	0.14	438

FLAT PLATE *

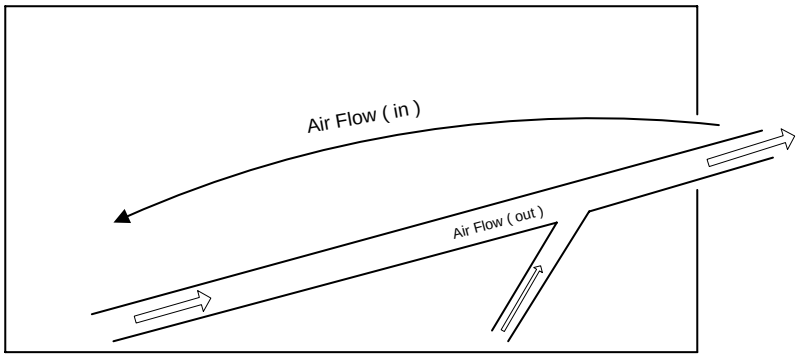
(1 side only x 1 ft wide)

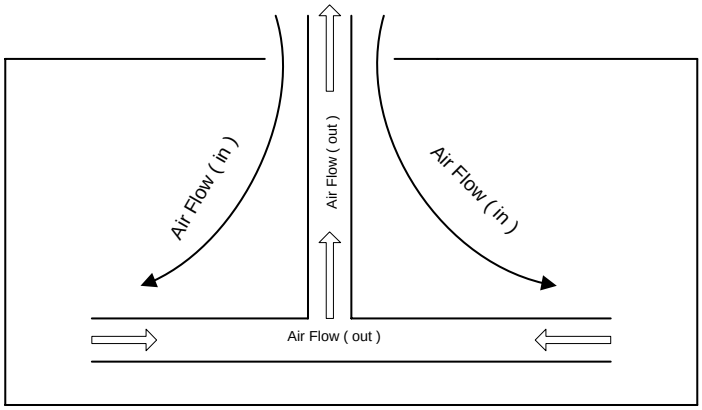
SIZE	WEIGHT	FT² / FT	FT² / TON
1/16	2.55	1	784
1/8	5.10	1	392
3/16	7.65	1	261
¼	10.2	1	196
3/8	15.3	1	131
½	20.4	1	98
5/8	25.5	1	78
¾	30.6	1	65
7/8	35.7	1	56
1	40.8	1	49

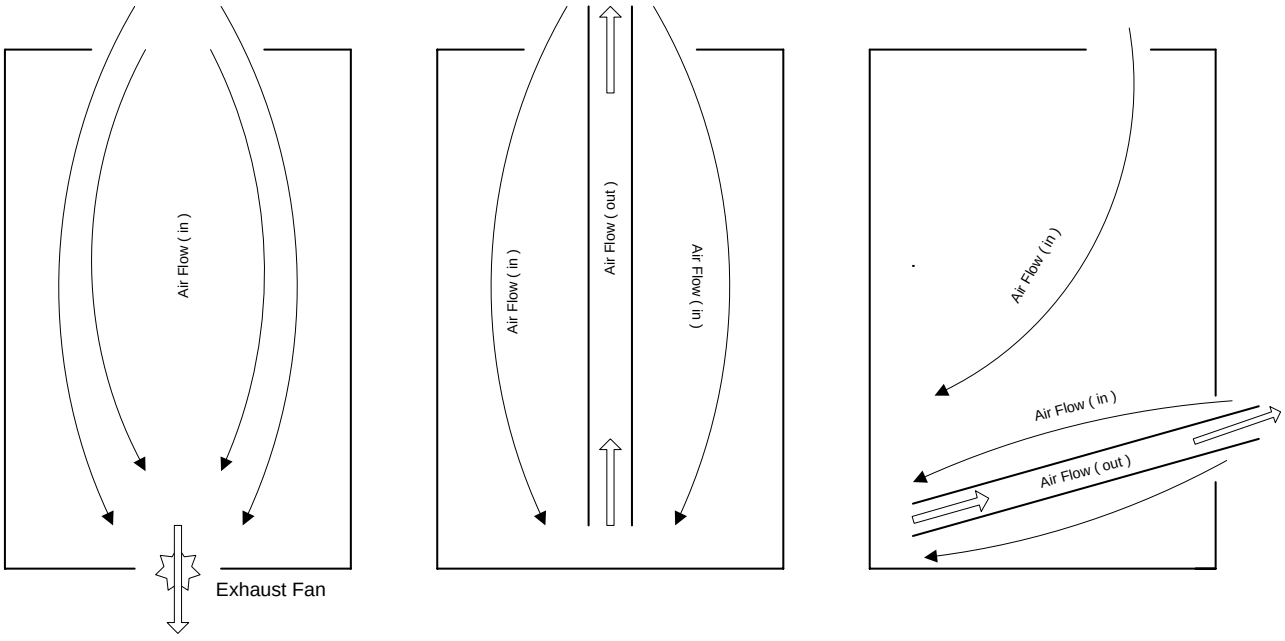
* Double the above numbers for both sides of the plate.

HOW TO VENTILATE TANKS

Various arrangements of ventilating designs to ensure proper circulation of air and the removal of combustible or toxic gases.







HEAT CALCULATION CHART

Thousands of BTU / hr needed to raise the temperature the number of degrees shown	Thousands of cubic feet to be heated													
	5	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100*	*200*	*300*	*400*
10°F	7	14	28	42	56	70	84	98	112	126	140	280	420	560
20°F	14	28	56	84	112	140	168	196	224	252	280	560	840	1120
30°F	21	42	84	126	268	210	252	294	336	378	420	840	1260	1680
40°F	28	56	112	168	214	280	336	392	448	504	560	1120	1680	2240
50°F	35	70	140	210	280	350	420	490	560	630	700	1400	2100	2800
60°F	42	84	168	252	336	420	504	588	672	756	840	1680	2520	3360
70°F	49	98	196	294	392	490	588	686	784	882	980	1960	2940	3920
80°F	56	112	224	336	448	560	672	784	896	908	1120	2240	3360	4480
90°F	63	126	252	378	504	630	766	882	1008	1034	1260	2520	3780	5040

Example: **For an area that is 265,000 ft³ and at an ambient temperature of 20°F which you wish to raise by 30°F to a total room temperature of 50°F, you would use the 30°F column above and calculate as indicated:**

200,000	840,000
60,000	252,000
5,000	21,000
265,000 ft³	1,113,000 total BTU / hour

RECOMMENDED VENTILATION FOR VARIOUS SIZED TANKS

Size of Tank Gallons	Volume (ft³)	Ft³ of solvent vapor to make 1% by volume	Gallons of coating used to make 1% by volume of solvent vapor in air	Air changes per hour needed to keep solvent to 1% by volume	Gallons of coatings sprayed in 1 hour	Minutes required to change air to keep solvent to 1% by volume[1]	Recommended suction fan to keep air far below any explosive limit (ft³ / min)	Recommended changes of air in minutes to keep solvent fumes far below explosive limit
5,000	668	6.7	.26	19.30	5	3	1,000	40 seconds
10,000	1,336	13.4	.52	9.60	5	6	2,000	40 seconds
25,000	3,342	33.4	1.30	3.80	10	8	2,000	1.7 minutes
50,000	6,684	66.8	2.60	3.80	10	16	3,000	2.2 minutes
100,000	13,378	133.6	5.20	1.90	10	31	5,000	2.7 minutes
250,000	33,420	334.2	13.00	0.77	20	40	10,000	3.3 minutes
400,000	53,500	535.0	20.80	0.48	20	62	10,000	5.4 minutes
Barrels								
13,500	75,800	758.0	29.40	0.34	50	35	25,000	3.0 minutes
27,000	151,600	1516.0	58.80	0.26	50	70	35,000	4.3 minutes
50,000	280,000	2800.0	108.30	0.14	50	130	50,000	5.6 minutes

(1) This data is based on a specific coating. To obtain the gallons required of any coating to make 1% by volume of solvent vapor in air:

a) Multiply the % solvents by volume by the ft³ of solvent vapor per gallon. (If there is more than 1 solvent multiply the percentage of each by the ft³ of vapor per gallon then add them together. This will give the ft³ of solvent vapor per gallon of coating.)
b) Divide the ft³ of solvent vapor to make 1% by volume by the ft³ of solvent vapor per gallon of coating. This will give the gallons of coating required to make 1% by volume of solvent vapor in air.

CALCULATE THE PRESSURE DROP IN FLUID HOSE

$$P = \frac{0.0273 \times QVL}{D^4}$$

P = Pressure drop in psi
Q = Flow rate in gallons per minute (gpm)
L = length of hose (in feet)
D^4 = Tube, pipe or hose factor (4^{th} power of diameter in inches)

D^4 Factors

¼" = 0.0039	¾" = 0.34
3/8" = 0.020	7/8" = 0.59
½" = 0.062	1" = 1.00

PRESSURE LOSS IN HOSE

Lubrication only at the tool - No line lubricator

Hose length and I. D.	cfm free air	Line pressure psi 60	80	100	120
50 feet ¾ in	60	3.1	2.4	2.0	---
	80	5.3	4.2	3.5	2.9
	100	8.1	6.4	5.2	4.5
	120		9.0	7.4	6.3
	140		12.0	9.9	8.4
	160			12.7	10.8
	180				13.6
	200				16.6
50 feet 1 in	120	2.7	2.1		
	150	4.1	3.2	2.7	2.3
	180	5.8	4.6	3.8	3.2
	210	7.7	6.1	4.0	4.3
	240		7.9	6.5	5.5
	270		9.8	8.1	6.9
	300		12.0	9.9	8.4
	330			11.8	10.0
	360			13.9	11.9
	390				13.8
	420				15.9
50 feet 1¼ in	200	2.4			
	250	3.7	2.9	2.4	2.0
	300	5.2	4.1	3.4	2.9
	350	7.0	5.5	4.5	3.8
	400	8.9	7.0	5.8	4.9
	450		8.8	7.3	6.2
	500		10.8	8.9	7.6
	550			10.7	9.1
	600			12.6	10.7
	650			14.6	12.4
	700				14.3
50 feet 1½ in	300	2.1			
	400	3.7	2.9	2.4	2.0
	500	5.6	4.4	3.7	3.1
	600	8.0	6.3	5.2	4.4
	700		8.5	7.0	5.9
	800		10.9	9.0	7.7
	900			11.2	9.5
	1000			13.6	11.6
	1100				14.0

PRESSURE LOSS IN HOSE

Lubrication only at the tool - No line lubricator

Hose length and I. D.	cfm free air	Line pressure psi 60	80	100	120
50 feet 2 in	600	1.9			
	800	3.2	2.5	2.1	
	1000	5.0	3.9	3.2	2.7
	1200	7.0	5.5	4.5	3.8
	1400	9.3	7.4	6.1	5.2
	1600		9.6	7.9	6.7
	1800		12.1	9.9	8.4
	2000			12.2	10.4
	2200			14.6	12.5
	2400				14.7
50 feet 2½ in	1000	1.7			
	1500	3.7	2.9	2.4	2.0
	2000	6.5	5.1	4.2	3.6
	2500	10.0	7.9	6.5	5.5
	3000		11.2	9.3	7.9
	3500			12.4	10.6
	4000				13.7
50 feet 3 in	2000	2.5	2.0		
	2500	3.9	3.0	2.5	2.1
	3000	5.5	4.4	3.6	3.1
	3500	7.5	5.9	4.9	4.1
	4000	9.8	7.6	6.3	5.3
	4500		9.6	7.9	6.7
	5000		11.7	9.6	8.2
	5500			11.5	9.8
	6000			13.6	11.5
	6500				13.5
	7000				15.6
50 feet 4 in	5000	1.9			
	6000	2.7	2.1	1.7	
	7000	3.6	2.8	2.3	2.0
	8000	4.7	3.7	3.0	2.6
	9000	5.9	4.6	3.8	3.2
	10000	7.2	5.7	4.7	4.0
	11000	8.7	6.8	5.6	4.8
	12000		8.41	6.7	5.7
	13000		9.4	7.8	6.6
	14000			9.0	7.6
	15000				8.7
	16000				9.8

Safety Colors

The occupational Safety and Health Act (OSHA) became law in April 1971 and requires that all industries color mark physical hazards, safety equipment locations and fire and other protective equipment.
The color code established by the American National Standards Institute (ANSI) and adopted by OSHA for use in hazardous area should supplement other precautionary measures. However, the use of color warnings should not supersede elimination of hazardous conditions whenever possible.

Safety Yellow	The basic color used either alone or with alternate black stripes to mark areas where the employee may be injured by stumbling, falling. Tripping or liable to head injury by bumping. Also used with black in a checkerboard pattern to identify areas where there may be eye hazard due to welding, grinding, handling of materials, etc.
Safety Blue	The basic color used to denote “caution”. Used to mark electrical controls and equipment under repair. Blue tags with white lettering reading “do not start” should be displayed conspicuously on the starting switch or power source of machinery equipment.
Safety Orange	The basic color used to identify dangerous parts of equipment or machinery where the worker may be seriously injured or electrocuted. Also emphasizes such hazards when enclosure doors are open or when gear, belt or other guards around moving equipment are open or removed, exposing unguarded hazards.
Safety Red	The basic color for the identification of fire protection equipment and apparatus, danger and stopping.
Safety Green	The basic color for designating “safety” and the location of first aid equipment, other than fire fighting equipment.
Safety Purple	The basic color for designating radiation hazards. Yellow should be used in combination with purple markers such as tags, labels, signs and floor markings.
Traffic Lines (White or Yellow)	Used to mark aisle ways, facilities for good housekeeping, etc.

PIPING IDENTIFICATION COLORS

The use of color on piping provides easy identification for training of personnel. Good practice calls for pipe lines inside buildings to be painted the same color as their adjacent surface, but to be identified by color bands and legends on areas adjacent to valves, couplings, and where pipes pass through walls. Legends should be brief, informative and simple. Direction of liquid flow should be identified with arrows.

Exterior or interior pipe lines may also be painted with a solid color as suggested and using the legend on valves, etc. Valves, flanges or couplings should be painted to identify contents. Sprinkler heads should never be painted. The following color combinations are suggestions taken from:

Scheme, for Identification of Piping – American Standards Association Bulletin A-13-1947

Identification of Piping Systems – Safe Practices Pamphlet No. 88 of National Safety Council, Inc.

	Band	***Legend Letters***	
Water Lines – Fire Protection	Safety Red	White	Includes sprinkler systems and other fire protection water lines.
Water Lines – Safe Materials	Safety Green	Black	Includes materials involving little to no hazard to life or property in their handling. Also includes materials at low pressures and temperatures, which are neither toxic nor poisonous and will not produce fires or explosions.
Steam Lines	Safety Orange	Black	For line carrying steam only.
Hazardous gasses & Liquids – Dangerous Materials	Safety Yellow	Black	Includes materials which are hazardous to life or property, because they are easily ignited, toxic, corrosive at high temperatures and pressures or are poisonous or product poisonous gases.
Protec Materials – Other Than Fire Protection	Safety Blue	White	Includes materials which are piped through plants and are needed to prevent or minimize the hazard of dangerous materials. Includes certain special antidote gases to counteract poisonous fumes.
Radiation Hazards	Safety Purple	Safety Yellow	Includes piping for radioactive materials.
Electric Conduits	Black	Safety Yellow	For electric conduits only.

Included in the above scheme are fittings, valves. And pipe coverings, but supports, brackets, and other accessories are not included. Pipes are defined as conduits for the transport of gases, liquids, semi-liquids or plastics, but not solids carried in air or gas.

Recommended Size of Color Band and Legend

Outside Pipe Diameter	Width of Color Band	Size of Legend Letters
Up to 2 1/2 “	8”	¾”
3 to 6”	12”	1 1/16”
7 – 10”	24”	2 ½”
Over 10”	32”	3 ½”

It is suggested that the colors and sizes of legend letters stenciled on the piping job for identification on material conveyed should conform to the above table of dimensions.