PC-IOM-1

Platecoil

Installation, Operation and Maintenance Manual

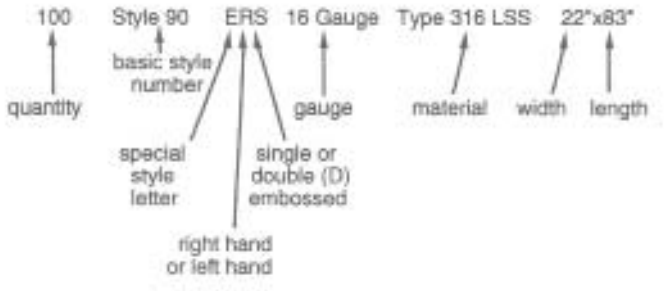
TRANTER®
The heat transfer people

Table of Contents

Standard Platecoil

Ordering Guidelines

Orders must contain a complete description of the PLATECOIL required. The following illustrates the description of a typical order.



The letter codes which are used with the two digit Style numbers indicate the following:

Letter Code	Description
D	Double embossed
S	Single embossed
L	Left hand embossing
R	Right hand embossing
A,B,E,G K, M, etc.	Inlet/Outlet locations and configurations.

Here are some other points to remember:

a. Call out gauge. For single embossed, this applies to both the embossing and the companion plate.
b. For special inlet/outlet pipe lengths, call out each fittings "total pipe length."
c. If PLATECOIL are to be rolled or curved, state whether the length or width dimension is to be curved.
d. Often a simple free-hand sketch accompanying the order, can clarify special details that would be difficult to describe otherwise.
e. Specify desired finish on stainless steel PLATECOIL, i.e. as welded, passivated, or electropolished.

Material Selection

For assistance in detemining what material is best suited for your particular application, refer to the Material Selection Charts found on pages 12-14. Obviously, any material that has previously proven satisfactory in a particular application at your plant, would be a safe choice when the PLATECOIL is to be used for the exact same service.

Size Selection

The amount of surface area required to provide necessary heating or cooling, particularly when Standard Style PLATECOIL are to be used in open tank applications, can quickly be calculated by using the Quick Selection charts found on page 74 and 80. They save engineering time and offer a fast and reliable method for determining what is required to get the job done.

For more complex heat transfer requirements and data on other calculation methods, refer to the Heat Transfer and Fluid Flow Calculations Section beginning on page 66.

Gauge Selection

Maximum recommended operating pressures for PLATECOIL in various gauges are shown on page 16. In addition to this, there are certain other factors that should be considered when selection the gauge of PLATECOIL for a particular application.

1. 14 ga. stainless PLATECOIL are preferable for industrial spray washers and similar equipment having high continuous operating heat load requirements. This heavier gauge has proven very satisfactory for the cyclic operating conditions encountered in these machines.
2. Many metal processing and chemical solutions are corrosive and cause some attack. This is particularly true of a heating unit due to the higher temperatures encountered. Examples are aluminum bright dip and sulphuric acid steel pickling solutions. For such applications the use of 14 or 12 ga. PLATECOIL will extend equipment life.
3. If the PLATECOIL will be in contact with an abrasive slurry a heavier gauge material is preferable.
4. Heavier gauge companions for single embossed PLATECOIL improve flatness and general rigidity. See the flatness standards on page 18.
5. The flat side surfaces of single embossed PLATECOIL can be free of seam weld marks if the companion plate is 3/16" or heavier. These thicknesses are MIG welded and this is done from the embossed side only.

Standard Platecoil

Selection & Operating Data
Standard PLATECOIL (3/4" Pass)
Surface Areas & Weight

Double Embossed Surface Areas

Fig. 2-1 All Styles in Square Feet

Nominal Width Inches	Length in Inches											
	23	29	35	47	59	71	83	95	107	119	131	143
12	4.3	5.4	6.5	8.8	11.1	13.3	15.6	17.8	20.1	22.3	24.6	26.8
18	6.8	8.5	10.3	13.9	17.4	21.0	24.5	28.1	31.6	35.2	38.7	42.3
22	8.0	10.1	12.2	16.4	20.6	24.8	29.0	33.2	37.4	41.6	45.8	50.0
26	9.2	11.7	14.1	18.9	23.8	28.6	33.5	38.3	43.2	48.0	52.9	57.7
29	10.5	13.2	16.0	21.5	27.0	32.5	38.0	43.5	49.0	54.5	60.0	65.5
36	12.9	16.3	19.7	26.5	33.3	40.1	46.9	53.7	60.5	67.3	74.1	80.9
43	15.4	19.5	23.5	31.6	39.7	47.8	55.9	64.0	72.1	80.2	88.3	96.4

Single Embossed Surface Areas

Fig. 2-2 All Styles in Square Feet

Nominal Width Inches	Length in Inches											
	23	**29**	**35**	**47**	**59**	**71**	**83**	**95**	**107**	**119**	**131**	**143**
12	1.9	2.4	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	10.9	11.9
18	3.0	3.8	4.6	6.1	7.7	9.3	10.8	12.4	14.0	15.5	17.1	18.7
22	3.6	4.5	5.4	7.3	9.1	11.0	12.8	14.7	16.5	18.4	20.2	22.1
26	4.1	5.2	6.2	8.4	10.5	12.7	14.8	16.9	19.1	21.2	23.4	25.5
29	4.7	5.9	7.1	9.5	11.9	14.4	16.8	19.2	21.6	24.1	26.5	29.0
36	5.7	7.2	8.7	11.7	14.7	17.7	20.7	23.7	26.7	29.7	32.7	35.7
43	6.8	8.6	10.4	14.0	17.6	21.1	24.7	28.3	31.9	35.4	39.0	42.6

Fig. 2-3 Approx. Net Weights in Pounds; All Styles 14 ga. and 12 ga. Carbon Steel

Nom. Width Inches	Length in Inches																							
	23		**29**		**35**		**47**		**59**		**71**		**83**		**95**		**107**		**119**		**131**		**143**	
	14 ga.	**12 ga.**	**14 ga.**	**12 ga.**	**14 ga.**	**12 ga.**	**14 ga.**	**12 ga.**	**14 ga.**	**12 ga.**	**14 ga.**	**12 ga.**	**14 ga.**	**12 ga.**	**14 ga.**	**12 ga.**	**14 ga.**	**12 ga.**	**14 ga.**	**12 ga.**	**14 ga.**	**12 ga.**	**14 ga.**	**12 ga.**
12	13	18	16	23	19	27	26	37	33	46	40	55	46	65	53	74	60	83	66	93	73	102	80	111
18	20	28	25	36	31	43	41	57	52	72	62	87	72	101	83	116	94	131	104	145	114	160	125	175
22	24	34	30	42	36	51	49	68	61	85	74	103	86	120	98	138	110	154	123	172	135	189	148	207
26	27	38	35	49	42	58	56	79	70	98	85	119	99	139	113	158	128	179	142	199	157	219	171	239
29	31	44	40	55	48	67	64	89	80	111	96	135	112	157	128	180	145	202	161	226	177	248	194	272
36	38	53	48	68	58	82	78	110	98	138	118	166	138	194	159	222	179	250	199	278	219	306	239	334
43	46	64	58	81	70	97	94	131	118	165	141	198	165	231	189	265	213	299	237	331	261	365	285	399

Fig. 2-4 Approx. Net Weights in Pounds; All Styles 16 ga. and 14 ga. Carbon Steel

Nom. Width Inches	Length in Inches																							
	23		**29**		**35**		**47**		**59**		**71**		**83**		**95**		**107**		**119**		**131**		**143**	
	16 ga.	**14 ga.**	**16 ga.**	**14 ga.**	**16 ga.**	**14 ga.**	**16 ga.**	**14 ga.**	**16 ga.**	**14 ga.**	**16 ga.**	**14 ga.**	**16 ga.**	**14 ga.**	**16 ga.**	**14 ga.**	**16 ga.**	**14 ga.**	**16 ga.**	**14 ga.**	**16 ga.**	**14 ga.**	**16 ga.**	**14 ga.**
12	11	13	14	17	16	20	22	27	28	34	33	42	39	48	44	55	50	63	56	70	61	77	67	84
18	17	21	21	27	26	32	34	43	43	54	52	65	61	76	70	87	79	98	87	109	96	120	105	131
22	20	25	25	32	30	38	41	51	51	64	62	77	72	90	83	103	93	116	103	129	114	142	124	155
26	23	29	29	37	35	44	47	59	59	74	71	89	83	104	95	119	107	134	119	149	132	164	143	179
29	26	33	33	42	40	50	53	67	67	84	81	101	94	118	108	135	121	152	135	169	149	186	163	204
36	32	40	41	51	49	61	66	82	83	103	100	124	116	145	133	166	150	188	167	209	184	230	201	251
43	38	48	48	60	59	73	79	98	99	124	119	148	139	173	159	199	179	224	199	249	219	274	239	291

For stainless PLATECOIL approximate shipping weight: Add 50% to above for one PLATECOIL per crate, 30% for two more per crate.
Carbon steel PLATECOIL are not crated.

Standard Platecoil

Handles

One or two handles (Fig. 3-1) are furnished as standard on PLATECOIL Styles 90, 70 and 50. Unless specified, they are not furnished on Styles 80 or 60, or on Single Embossed PLATECOIL.

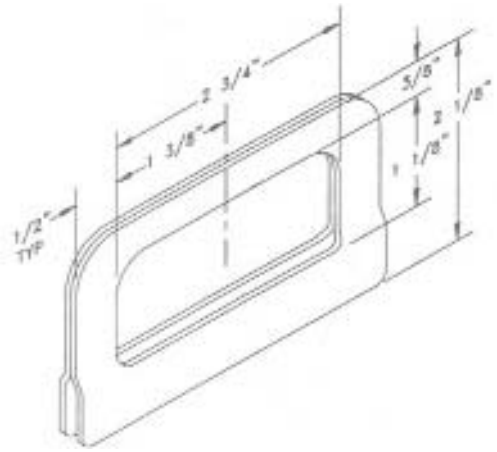


Fig. 3-1

Standard Handle*

See pages 7 through 11 for locations on PLATECOIL. *Normally furnished, however ROD TYPE may be specified at no extra cost. ROD TYPE are furnished whenever a perimeter seal weld is required. Dimensions are basically the same as standard handles.

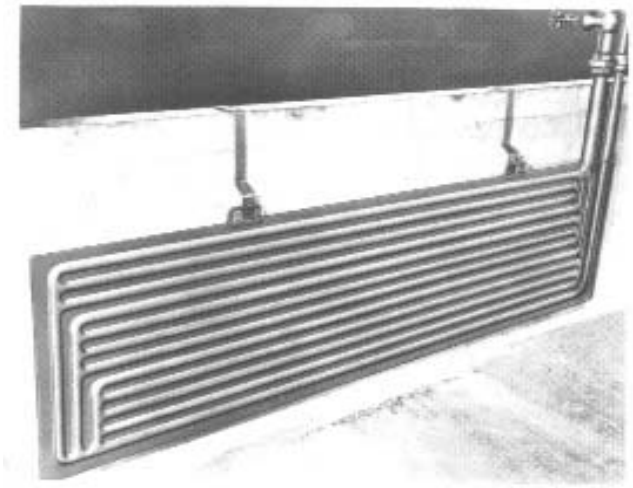


Fig. 3-2

Typical installation in a tank showing the use of QUICK CHANGE PLATECOIL hangers with a Style 90.

Hangers

PLATECOIL "Quick Change" hangers are designed as a convenient, economical means of supporting PLATECOIL at the proper distance from the tank wall. They are constructed of the same material as the PLATECOIL with which they are used.

Two standard hanger models are available. No. 5504 is for use with PLATECOIL of 22 inch width, or less. They are fabricated from 14 ga. carbon steel and 16 ga. stainless steel and other alloys.

No. 8804 is for use with PLATECOIL widths of 26 inches thru 43 inches. They are fabricated from 14 ga. carbon steel and 16 ga. stainless steel and other alloys.

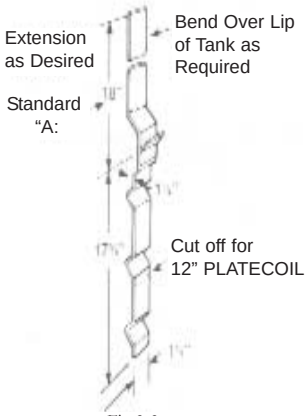


Fig 3-3

Hanger No. 5504-18

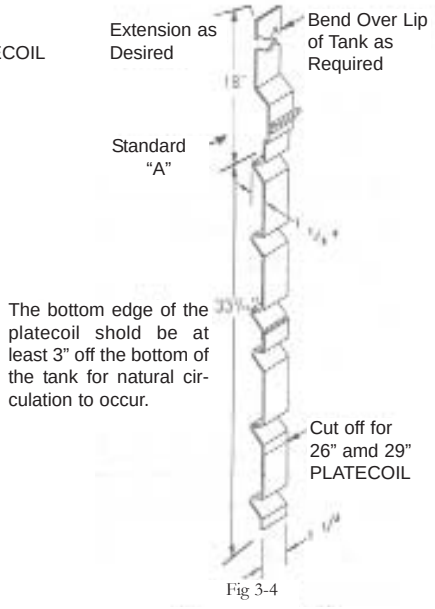


Fig 3-4

Hanger No. 8804-18

Note: The "-18" indicates the standard extension length. If longer extension is required, indicate by changing. i.e., -30 would indicate 12 inches longer than standard, 30" total. Specify material when ordering.

Standard Platecoil

Internal Operating Pressures for Standard (3/4" Pass) PLATECOIL

Fig. 4-1

Gauge		Carbon Steel	304,304L,316,316L,Monel
Double Embossed		PSI	PSI
16		180	250
14		300	330
12		400	400
Single Embossed			
Embosed	Companion	PSI	PSI
16	16	130	160
16	14	145	190
16	12	180	205
16	11	205	240
14	14	190	240
14	12	215	270
14	11 & over	265	290
12	12 & over	265	300

Applicable to Style 70, 80 & 90 MULTI-ZONE and 320 header and Style 50 & 60 serpentine pass.

ASME code pressure ratings are available from the factory upon request.

1. Standard test pressure is 250 psig air under water. For pressures above 250 psig hydrostatic tests are performed.
2. Ratings for carbon steel apply for -20^{O}F to 500^{O}F and are based on a 4 to 1 greater safety factor without corrosion allowance.
3. Ratings for stainless steel and Monel apply up to saturated steam temperature for pressures shown with 5 to 1 or greater safety factor without corrosion allowance.
4. All pressures shown apply for resistance welding and for MIG welding when gauges permit.
5. For #667 header PLATECOIL use 50% of the operating pressures shown.
6. FABRICATION TECHNIQUES MAY PERMIT HIGHER OPERATING PRESSURES IN CERTAIN CASES.

External Pressure Rating for Standard (3/4" Pass) PLATECOIL

For use in pressure vessels and other miscellaneous applications external pressure ratings become important considerations. The values shown in the chart are maximums at room temperature. No safety factor is included. If elevated temperatures are involved, contact the factory.

Fig. 4-2

External Pressure Ratings				
Style	Carbon Steel		Stainless Steel	
	Gauge	External PSI	Gauge	External PSI
Double Embossed	14/14	600	16/16	400
	12/12	1400	14/14	600
Single Embossed	14/12	800	16/14	400
	12/12	1000	14/14	400
	--	--	14/12	800

Volumetric Displacement and Internal Volume of PLATECOIL

Fig. 4-3

	cu in / sq ft nom.	gal / sq ft nom.
Internal Volume		
Double embossed	46	.20
Single embossed	23	.10
Displacement		
Double embossed	64	.28
Single embossed	41	.18

These values are for one sq ft of PLATECOIL based on length x width (do not use total of both side areas) and apply to standard pass PLATECOIL of 14 or 16 gauge construction.

Standard Platecoil

Installation of Clamp-On Platecoil

1. Have a full set of drawings on location for the installation. Identify and mark the Platecoil's with their location on the tank,

2. Be sure that the correct mastic type and quantity has been purchased in line with their maximum operating temperature for the Platecoil and the process fluid. You will need 1 gallon for every 13 ft^2.

Mastic suggested for use with Platecoil	**Tracit #1000**	**Tracit #1100 or HTM-NS-450**	**Tracit #300 or HTM-SM-750**	**Tracit #600A or HTM-1250**
Type	Non-hardening	Non-hardening	Hardening	Hardening
Temperature Limits	200°F	400°F	750°F	1250°F
Waterproof	Yes	Yes	No	No
Use of Aluminum or Copper Tanks	Yes	Yes	Yes	Yes

3. Identify Platecoil when they arrive to the drawings.

4. Layout Platecoil on ground in the same configuration as they will be installed.

5. Weld in bottom support lugs to set Platecoil's on while installing (not supplied by Tranter PHE unless requested).

6. Place Platecoils against tank to mark support lug locations. Plan on starting with Platecoil that have cutouts first. Start at the top for cones and slide the piece all the way up as high as you can and work down from there. Dished head sets are located based on a radius on the head.

7. Weld lugs on marked locations.

8. Apply 1/8" thick layer of mastic using a bricklayer's trowel. The serrated edge makes a perfect 1/8" depth.

9. Set Platecoil's on tank and compress the mastic as much as possible. It should ooze out around all the edges. For extra heavy coils on smaller tanks, a chain wrapped around the tank with a come along works exceptionally well for this step.

10. Bolt Platecoils to each other and/or to the support lugs. Keep in mind that at least one end of each Platecoil needs to have spring loaded tie rods. This allows for thermal expansion.

11. Pipe accordingly. Fluids should be flooded from the bottom. This will keep air from being trapped in the Platecoil and diminishing efficiency. Steam should be piped in at the top of the coil and condensate comes out at the lowest point. DO NOT PIPE STEAM COILS IN SERIES. For more information on steam usage in Platecoil applications, read the Steam Heated Platecoil Units section of the Platecoil IOM.

12. When the Platecoil heats up, do not be alarmed when oils separate out of the mastic and run down the tank. This is normal separation that is expected.

Platecoil Heat Transfer Design Data

PLATECOIL Pressure Drop vs. Flow Rate for Water at 70°F for 3/4" Pass Double Embossed PLATECOIL

Fig. 6-1

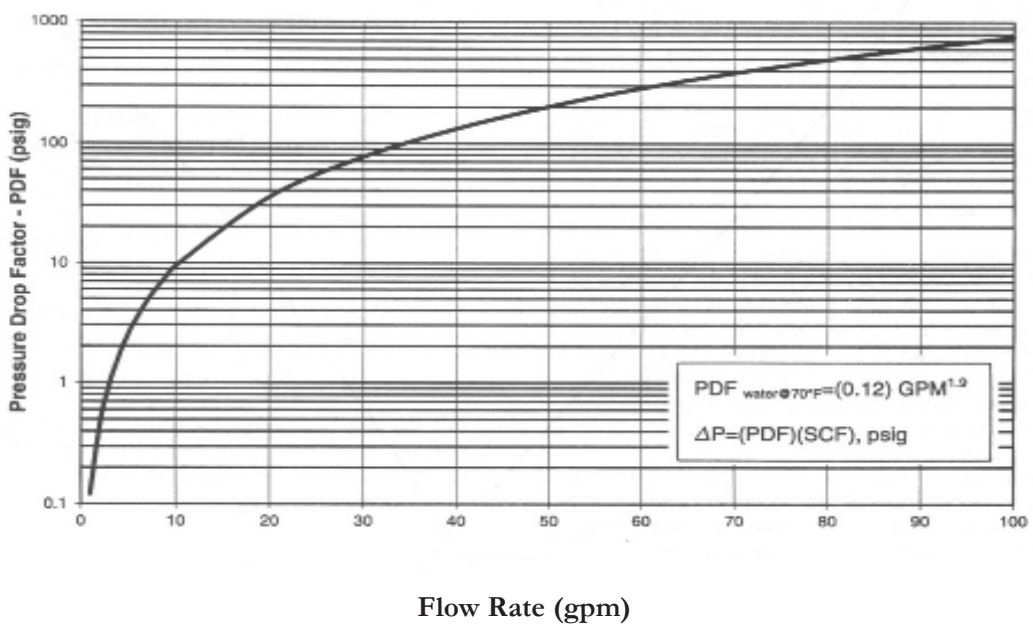


Fig. 6-2

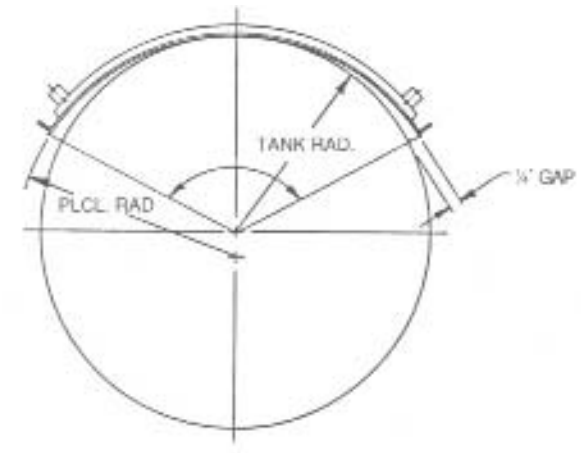
Size Correction Factors - SCF											
Size (in)	90/70	80	60/50	Size (in)	90/70	80	60/50	Size (in)	90/70	80	60/50
12x23	0.12	0.06	0.3	22x71	0.17	0.04	1.1	29x119	0.21	0.04	2.0
12x29	0.13	0.06	0.4	22x83	0.18	0.04	1.1	29x131	0.23	0.04	2.2
12x35	0.13	0.06	0.4	22x95	0.19	0.04	1.3	29x143	0.24	0.04	2.3
12x47	0.14	0.06	0.5	22x107	0.20	0.04	1.4	36x23	0.15	0.06	0.9
12x59	0.16	0.06	0.5	22x119	0.22	0.04	1.5	36x29	0.16	0.07	1.0
12x71	0.17	0.06	0.6	22x131	0.23	0.04	1.6	36x35	0.12	0.02	1.1
12x83	0.18	0.06	0.6	22x143	0.24	0.05	1.8	36x47	0.14	0.02	1.3
12x95	0.19	0.06	0.7	26x23	0.13	0.06	0.6	36x59	0.15	0.02	1.5
12x107	0.21	0.06	0.7	26x29	0.13	0.04	0.7	36x71	0.16	0.03	1.7
12x119	0.22	0.06	0.8	26x35	0.13	0.04	0.8	36x83	0.17	0.03	1.9
12x131	0.23	0.06	0.9	26x47	0.14	0.04	1.0	36x95	0.19	0.03	2.1
12x143	0.25	0.06	0.9	26x59	0.15	0.04	1.1	36x107	0.20	0.03	2.3
18x23	0.12	0.05	0.5	26x71	0.16	0.04	1.2	36x119	0.21	0.03	2.5
18x29	0.13	0.05	0.6	26x83	0.18	0.04	1.4	36x131	0.22	0.03	2.7
18x35	0.13	0.05	0.6	26x95	0.19	0.04	1.5	36x143	0.24	0.03	2.9
18x47	0.14	0.05	0.6	26x107	0.20	0.04	1.6	43x23	0.15	0.06	1.1
18x59	0.15	0.05	0.7	26x119	0.22	0.04	1.8	43x29	0.16	0.07	1.2
18x71	0.17	0.05	0.8	26x131	0.23	0.04	1.9	43x35	0.12	0.02	1.3
18x83	0.18	0.05	1.0	26x143	0.24	0.04	2.1	43x47	0.13	0.02	1.5
18x95	0.19	0.05	1.1	29x23	0.14	0.06	0.7	43x59	0.15	0.02	1.8
18x107	0.21	0.05	1.1	29x29	0.13	0.03	0.8	43x71	0.16	0.02	2.0
18x119	0.22	0.05	1.2	29x35	0.13	0.03	0.9	43x83	0.17	0.02	2.3
18x131	0.23	0.05	1.3	29x47	0.14	0.03	1.1	43x95	0.18	0.02	2.5
18x143	0.24	0.05	1.5	29x59	0.15	0.03	1.2	43x107	0.20	0.02	2.8
22x23	0.11	0.04	0.6	29x71	0.16	0.03	1.4	43x119	0.21	0.02	3.0
22x29	0.12	0.04	0.6	29x83	0.18	0.03	1.5	43x131	0.22	0.02	3.2
22x35	0.13	0.04	0.6	29x95	0.19	0.03	1.7	43x143	0.23	0.02	3.5
22x47	0.14	0.04	0.8	29x107	0.20	0.03	1.9				
22x59	0.15	0.04	0.9								

For single embossed, multiply above chart by 7. Shadow boxes indicate 320 headers.

Platecoil Accessories and Optional Features

PLATECOIL's unique design versatility allows it to be curved and/or rolled to specific radii. Both single and double embossed units can be furnished with either dimension curved. Normal tolerances are:

Angle of Coverage O	Radius Tolerance
0-30^{O}	+2", -0
31^{O}-60^{O}	+1", -0
61^{O}-90^{O}	+3/4", -0
91^{O}-110^{O}	+1/2", -0
111^{O}-180^{O}	+1/4", -0



When PLATECOIL is clamped to the outside of a tank, using Tranter's standard mounting lugs, the PLATECOIL radius is designed to allow a 1/4" gap at the ends of the PLATECOIL. Tranter PHE, Inc. has developed this method to ensure proper fit-up at installation. The PLATECOIL radius is selected using individual PLATECOIL dimensions and the tank radius.

Standard 3/4" Pass PLATECOIL Curving Limits

Fig. 7-1 (Minimum Radii)

Style	Single Embossed*	Double Embossed
50 & 60 Serpentine	4"	8"
Multi-Zone & No. 320	6"	9"
Header No. 667 Header	8"	10"

*Companion plate may be on either inside or outside of curvature. Specify when ordering.

Platecoil Accessories and Optional Features

Mountign Lugs

PLATECOIL mounting lugs are used exclusively for mounting purposes. Standard lugs are illustrated in Fig. 8-1 and adaptations and attachment locations are shown in Fig. 8-2. These lugs are generally used as follows:

L-1E - Used on end or side of PLATECOIL for clamping them tightly to tanks or vessels, the usual lug spacing on the side is 30 inches. Generally the PLATECOIL are single embossed and rolled.

L-2F - Foot type support for PLATECOIL installed on end.

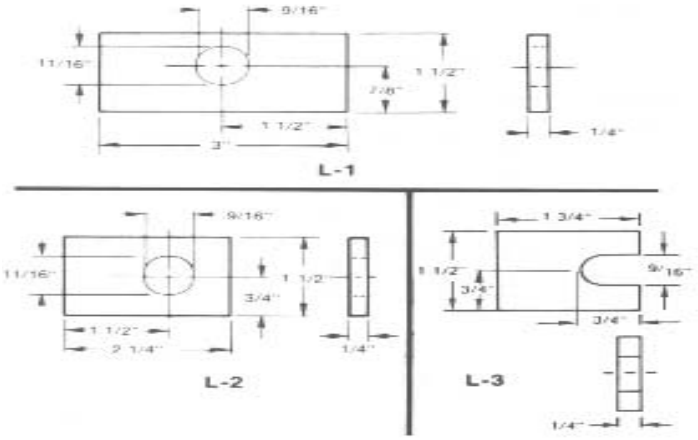
L-2FX - Same as L-2F except a 3 inch leg is added (height can be varied) to provide clearance above tank bottoms, especially in agitated tanks.

L-2S - Generally used to attach flat PLATECOIL to flat or nearly flat surfaces

L-3S - Generally used to attach PLATECOIL to dished heads.

Lug Dimensions

Fig. 8-1



Standard Mounting Dimensions for All Lugs on Ends of PLATECOIL

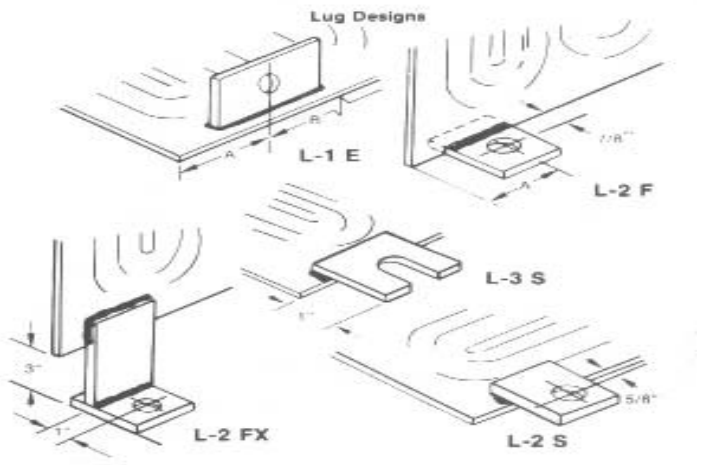
Fig. 8-2

PLATECOIL width	A Dim. See Fig 24-2	B Dim. C/L of Lugs
12" 2 Lugs/End	4"	4
18" 2 Lugs/End	4 1/8	10 1/2
22" 2 Lugs/End	4 1/8	14
26" 2 Lugs/Ends	4 7/8	16
29" 2 Lugs/Ends	5 9/16	18
36" 3 Lugs/Ends	5	13*
43" 3 Lugs/Ends	5 7/16	16*

*Three lugs on these widths, third lug on C/L of PLATECOIL, B dim, doesn't apply to lugs on sides.

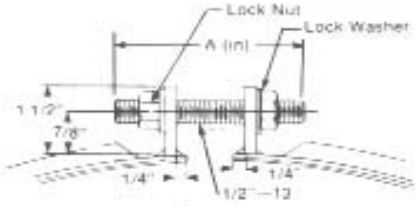
Lug Dimensions

Fig. 8-3



The Rod Assemblies

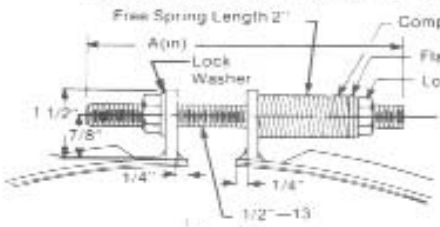
Standard tie rod assemblies are available with or without springs. In cases where thermal expansion or contraction may be appreciable, the spring loaded tie rods help maintain maximum contact.



A	GAP
4	1.5
6	3.5
8	5.5
10	7.5
12	9.5
14	11.5
16	13.5

Fig. 8-4

Installed View L-1 E Lugs with Tie Rod Assembly



A	GAP
6	1.5
8	3.5
10	5.5
12	7.5
14	9.5
16	11.5

Fig. 8-5

Installed View L-1 E Lugs with Spring Loaded Tie Rod Assembly

Platecoil Accessories and Optional Features

Cone Shaped PLATECOIL

Usually at least 2 PLATECOIL sections are supplied for cones up to 3' major dia. More sections required for larger sizes.

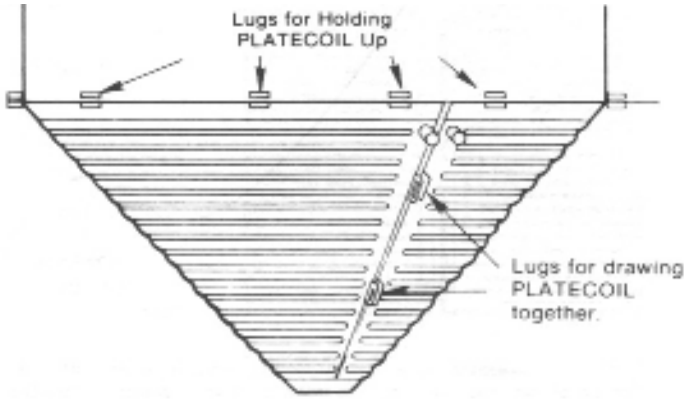
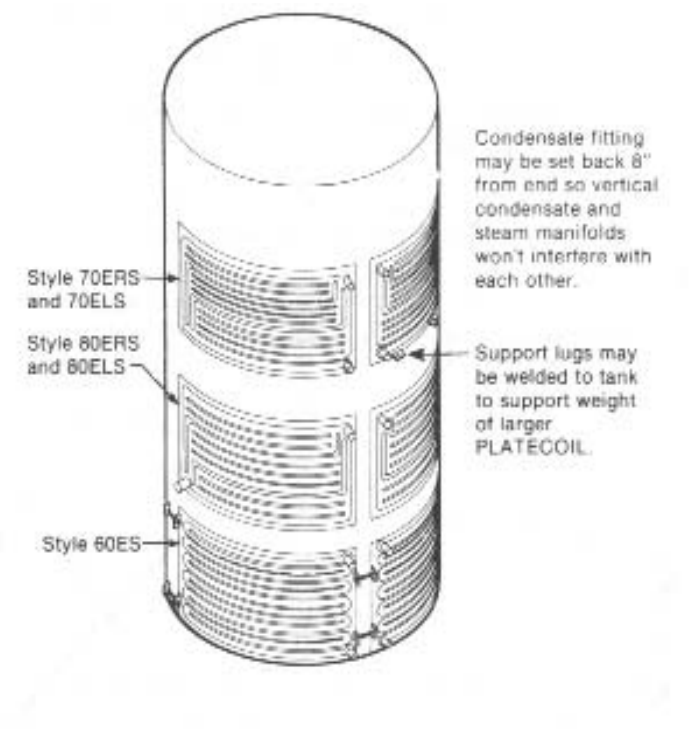


Fig. 9-1

Clamp-on Arrangements for Vertical Tanks

Fig. 9-2



Clamp-on Arrangements for Horizontal Tanks

Fig. 9-3

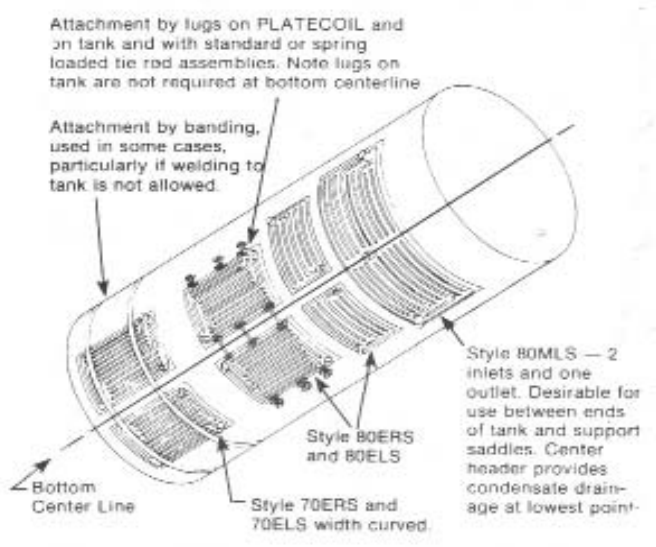
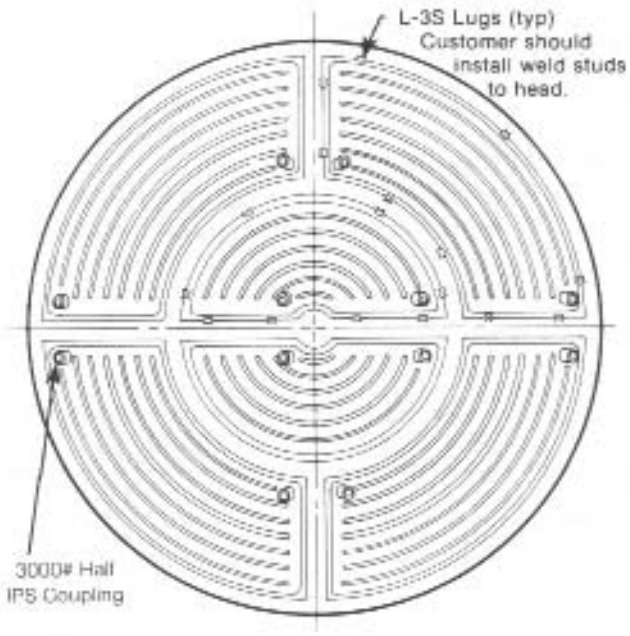


Fig. 9-4



Custom Platecoil Fabrications

Clamp-On PLATECOIL Application Data

Heat Transfer Mastics

The thermal resistance of the air gaps between clamp-on PLATECOIL and tank surfaces may be reduced by the use of a heat transfer mastic, applied at the time of installation. This will provide improved performance by increasing the overall coefficients of heat transfer as shown in Fig. 10-1.

Fig. 10-1

Average Overall Heat Transfer Rates U = Btu/hr sq ft F For Clamp-on PLATECOIL

WATER AND SOLVENTS	Heating	Cooling
With heat transfer mastic	30-40	20-30
Without heat transfer mastic	15-25	20-30
VISCOUS PRODUCTS	Heating	Cooling
With heat transfer mastic	10-20	5-12
Without heat transfer mastic	6-12	3-8
AIR AND GASES	Heating	Cooling
With heat transfer mastic	1-3	1-3
Without heat transfer mastic	1-3	1-3

By applying the mastic to the tank at the time of installation, its thickness can be generally controlled to fill voids and low spots with less at weld beads or high points. The purpose is to eliminate air gaps, and only as much as is needed to do this should be used. The strong PLATECOIL and lug construction facilities pulling the PLATECOIL tightly into the mastic and with the consistency of these products any excess can generally be squeezed out.

Non-hardening mastics are preferable for long range maximum heat transfer. However, non-hardening mastics are not available for higher temperature requirements.

Following is a basic summary of data on several mastics. Note the temperature limits. Heat transfer mastic can be purchased from Tranter or from the manufacturer listed below:

Fig. 10-2 Heat Transfer Mastics

Moderate Temperature Applications		
Mastic suggested for use with PLATECOIL	Tracit *#1000	Tracit #1100
Type	Non-Hardening	
Temperature Limits	Up to 200°F	Up to 400°F
Waterproof	Yes	Yes
Use on aluminum or copper tanks	Yes	Yes

*Note: Tracit #1000 is only recommended for cooling applications or where the ambient temperature conditions do not exceed 200°F.

Curing — None required. PLATECOIL may be installed as soon as mastic is in place and heat can be applied at once.

High Temperature Application		
Mastic suggested for use with PLATECOIL	Tracit #300	Tracit #600A
Type	Hardens, but stays flexible enough to absorb metal expansion and contraction	
Temperature Limits	Up to 750°F	Up to 1250°F
Waterproof	Yes	Yes
Use on aluminum or copper tanks	Yes	Yes

Curing — None required. PLATECOIL may be installed as soon as mastic is in place and heat can be applied at once.

Coverage based on 1/8" average thickness = 13 sq. ft/gal.

Platecoil Materials Selection and Fabrication Techniques

PLATECOIL Material Selection Charts

Material selection charts are presented here to assist in determining the most suitable material for various environments.

The first chart (Fig. 11-1) is a practical listing of Common Metal Finishing Solution. Many of these involve complex mixtures of chemicals so they are presented separately. The materials shown are generally used for the solutions shown.

Some ratings shown in the general material selection chart are the result of laboratory rests conducted by suspending samples of the material in the solution. Therefore, they are not subject to the high temperatures often encountered when heating with PLATECOIL. In addition, operating conditions may present many variables such as aeration, solution contaminants, and galvanic action which may alter the ratings given. The metallurgical departments of each of the suppliers of the materials listed have either given or approved the ratings assigned, but because of the points mentioned above, the ratings should be considered as only a guide.

In no instance, for either chart, should the ratings be considered as the basis for a guarantee of PLATECOIL life.

Fig. 11-1
Material Selection Guide for Common Metal Finishing Solutions

SOLUTION	PREFERRED MATERIAL	POSSIBLE
1. Aluminum Bright Dip (If sulphuric acid is not present)	316L SS	347SS
2. Aluminum Anodizing Hot Seal Tank	316L SS	304SS
3. Brass Plating	Carbon Steel	
4. Bronze Plating	Carbon Steel	
5. Caustic or Alkali Cleaner (5% and below)	Carbon Steel	
6. Caustic or Alkali Cleaning to 15%	Monel	Stress relieved Carbon Steel

(Material Selection Guide for Common Metal Finishing Solutions, Cont'd)

SOLUTION	PREFERRED MATERIAL	POSSIBLE
7. Caustic Paint Stripper 15-30%	Nickel or Monel	Stressed relieved Carbon Steel
8. Chromic Acid Rinse (below 130F & 0.5%)	Carbon Steel	
9. Sulphate Type Chromium Plating	Titanium	
10. Cyanide Cadium Plating	Carbon Steel	
11. Cyanide Zinc Plating	Carbon Steel	
12. Cyanide Copper Plating	Carbon Steel	316L SS
13. Dichromate Seal Tank	Carbon Steel	
14. Dye for Coloring Anodized Aluminum	316L SS	
15. Dye Seal Tank	316L SS	
16. Fluoboratre Copper Plating	None	
17. Galvanizing Flux (Zinc Ammonium Chloride)	Titanium	
18. Nickel Plating (all but high Fluorine types)	Titanium	
19. Electroless Nickel	316L SS is suitable but it will scale	
20. Phosphatizing	316L SS (electro polished)	
21. Sulphuric Acid Anodizing 72F	316L SS	Cathodically Connected (see Fig 53-2)
22. Sulphuric acid Copper Plating	C-20 or Alloy 20Cb-3	316L SS
23. Sulphuric Acid Pickling of Steel parts (no Chlorides)	Alloy 20Cb-3 or Alloy 825 (with caution)	
24. Sulphuric Acid Pickling with Copper Sulphate (non-ferrous parts)	316L SS or Alloy 20Cb-3	
25. White Brass Alloy Plating	Carbon Steel	

Platecoil Materials Selection and Fabrication Techniques

General Materials Selection Charts

Fig. 12-1

Key to Materials
1. Carbon Steel
2. 316L Stainless Steel
3. Alloy 825
4. Monel
5. Nickel
6. Alloy 20Cb-3
7. Alloy B-2
8. Alloy C-276
9. Titanium

NOTE: Pitting may occur particularly if scale is allowed to build up.

CP=Chemically Pure

Fully resistant is less than .0044 inches per year.

Corrosive Media	Temperature Degrees F	Fully Resistant	Satisfactory Resistant	Slightly Resistant	Non Resistant
Acetic Acid 80-100%	Boiling	3,6,8,9	2,7	4,5	1
Alcohol - Ethyl		2,3,4,5,9	1		
Aluminum Chloride	70	7	3,4,5,6,8,9	2*	1
Aluminum Hydroxide Saturated		2,3,4,5	9		
Aluminum Sulphate 10% Saturated	Boiling Boiling	3,6,8 3,6,8	2,4,9 2,4,9	5 5	1 1
Aluminum Hydroxide		2,3,5,6,7,8,9	1		4
Ammonia (All Conc.) Dry	Boiling Boiling	1,2,3,9 2,3,9	5 4,5,7,8		4
Ammonium Sulphate 10% Saturated	Boiling Boiling	3,6,8,9 3,6,8,9	2*,4 2*,4	5 5	1 1
Ammonium Sulphate (Conc.)	Boiling	2*,3,6	4,8,9	5	1,7
Aniline 3% Conc. Crude	70 70	2,3,6,7,8,9 2,3,6,7,8,9	1,5 5		
Asphalt		2,3,4,5,9	1		
Barium Chloride 5% Saturated	70 70	3,6*,8,9 3,6*,7	2*,4,5,7 2*,4,5,8,9		1 1
Beer (All Conc. & Temp)		2,3,5,7,8,9	4		1
Benzene	70	2,3,4,5,9	1,7,8		
Borax 5%	Hot	2,3,4,9	1,5,7,8		
Boric Acid (Conc.)	Boiling	2*,3,6,7,8	4,5		1
Calcium Brine Adulterated with Sodium Chloride	70	2*,3,5,6*,7,9	4,8		1
Calcium Chloride Dilute Conc. Saturated	70 70 212	2*,3,4,5,6*,7,8,9 2*,3,5,6*,7,8,9 2*,3,6*,7,8	 4 4,5,9		1 1 1
Calcium Hydroxide 50%	Boiling	2,3,4,5,7,8,9			1
Carbonic Acid Pheol CP Raw	72 Boiling Boiling	2,3,5,9 2,3,5 2,3,5	 4 4		 1 1
Carbon Dioxide Dry Wet		2,3,4,5,7,8,9 2,3,9	 4,5		
Carbonated Water		2,3,4,5,6,7,8,9			
Carbon Disulphide		2,3,9	4,5		
Carbon Tetrachloride Pure (dry) Aqueous Solution 5-10%	Boiling 70	2,3,4,5,6,7,8,9 3,4,5,9	1		
Chlorinated Water Saturated	70	8,9	2,6	3*,4,5	1,7
Chlorine Gas Dry Moist Moist	70 70 212	2,3,4,5,6,7,8 8,9 9	1 8	 2	9 1,3,4,5,6,7 2,3,4,5,6,7
Chromic Acid CP 0.5% free of SO_3 CP 10% free of SO_3	130 Boiling	1,3,8,9 9	2	6 3,6	4,5,7 1,2,4,5,7,8
CP 50% free of SO_3 CP 50% free of SO_3	70 Boiling	3,8,9	2	6 3,6	4,5,7 1,2,4,5,7,8
Commercial 50% (contains SO_3)	70 Boiling	3,8,9	2	6 3,6	4,5,7 1,2,4,5,7,8
Citric Acid 10% 50%	Boiling Boiling	2,3,6,7,8,9 2,3,6,7,8,9	4,5 4,5		1 1
Copper Chloride 10%	Boiling	8,9			2,3,4,5
Copper Cyanide 5% Saturated	 Boiling	9 2,3,6,7,8,9	1 4,5		
Copper Nitrate 50%	Hot	2,3,6,9			1,4,5,7
Copper Sulphate (Sat.) (Blue Vitriol)	Boiling	2,3,6,8,9		4	1,5
Creosote (coal tar)	Hot	2,3,9	1,5	4	
Cupric Chloride		9	2*,8		1,3,4,5,6,7
Dowthem	Hot	2,3,4,5	1		
Dyes	190	2	4,5		
Esters		2,3,4,5,9			
Ether	70	2,3,4,5,7,8,9	1		
Ethylene Glycol Conc.	70	2,3,4,5,7,8,9	4,5		1
Fats	to 500	2,3,6,9	4,5		1
Ferric Chloride 1% 1% 5%	70 Boiling 70	9 9 8,9	2*	3*,5,8 2,8 2,3*	1,4,6,7 1,3,4,5,6,7 1,4,5,6,7
Ferric Nitrate to 5% Aerated	70	2,3,8,9			1,4,5,7
Ferrous Chloride Saturated	70	7,8,9	3,4,5	2	
Fluorine	70	5 dry only	3,4 dry only, 7,8		1,2,9
Fluoborate Plating Sol.			3,6	2,5	
Formaldehyde 40%	70 Boiling	2*,3,5,6,7,8,9 2*,3,6,9	1,4 1,4,5,7,8		

*Coupon testing important to check for possible presence of ferric or cupric ions.

(a) Aeration will have very detrimental effect on Monel
(b) May be fully resistant when oxidizing inhibitors are present.
(c) Both 316L SS and Alloy 20Cb-3 may be subject to stress corrosion cracking.
(d) Titanium may be subject to Hydrogen embrittlement under certain conditions.
(e) Titanium may be full resistant under certain conditions while it may react violently with others. Consult Manufacturers and USE CAUTION IN TESTING
(f) Small traces of chlorides, particularly in sulphuric acid steel pickling solutions may cause excessive pitting.
(h) Provided no moisture is present.
In no instance should be the ratings be considered as the basis for a guarantee of PLATECOIL life.

Platecoil Materials Selection and Fabrication Techniques

General Materials Selection Chart (contd.)

Fig. 13-1

Key to Materials
1. Carbon Steel
2. 316L Stainless Steel
3. Alloy 825
4. Monel
5. Nickel
6. Alloy 20Cb-3
7. Alloy B-2
8. Alloy C-276
9. Titanium

NOTE: Pitting may occur particularly if scale is allowed to build up.

CP=Chemically Pure

Fully resistant is less than .0044 inches per year.

Corrosive Media	Temperature Degrees F	Fully Resistant	Satisfactory Resistant	Slightly Resistant	Non Resistant
Freon		2,3,4,5,9	1		
Fruit Juices	Hot	2,3,5,9	4		1
Fuel Oil	Hot	2,3,4,5,7,8,9	1		
Glue	Hot	2,3,4,5,7,8,9			1
Glucose	70	3,5,9	4		
Hydrolic Acid 1:85	70	7*,8*,9*	2,4(a),5		1,3,6
	Boiling	7*	8 to 122*,9(b)	4(a),5	1,2,3,6
Diluted 1:10	70	7*,8*	4(a),5	2	1,3,6
Diluted 1:10	Boiling	7	8 to 122*	9(b)	1,2,3,4(a),5,6
Vapors	70		4(a),5	2	1,3,6
Vapors	212		4(a),5		1,2,3,6
Hydrofluoric Acid	70		3,4,5	2,6,7,8	1
Vapors	212		4	3,5	1,2,6,7,8,9
Hydrogen		2,3,4,5,7,8,9(d)			
Hydrogen Peroxide	70	2,3,6,8	5,7	4,9	1
	Boiling	8	2,3,5,6,7	9	1
Hydrogen Sulphide Dry	70	2,3,6,9	1,4,5,7,8		
Wet	70	3,6,9	2,4,5,7,8		1
Iodine Dry	70	2,3,5,6	8		1
Moist	70		8		1,2,3,4,5,6
Lacquers & Lacquer Solvents		3,4,5,9			1
Magnesium Chloride 1 & 5 %	70	2*,3,6*,7,8 to 122*,9	4,5		1
1 & 5%	Hot	7,8 to 122*.9	3*,4,6*(c)	2(c),5	1
Magnesium Chloride 10-50%	Boiling	6*(c), 7,8 to 122*,9	2*(c),3*	4,5*	
Magnesium Sulfate	70	2,3,6,7,8,9	1,4,5		
	Hot	2,3,6,7,8,9	4	5	1
Mercury (liquid)	70 & 125	2,3,9	5,7,8	4	
Methyl Alcohol (Methanol)	70	2,3,4,5,7,8,9	1		
	Hot	2,4,5,7,8,9			1
Milk (Fresh or Sour)		3,7,8,9		4,5	1
(Hot or Cold)		2,3,7,8,9		4,5	1
Molasses		2,3,4,5,7,8,9	1		
Mixed Acids % by wt.					
50% Sulphuric +50% Nitric	140	2,3,9			1,4,5
	200		2,9	3	1,4,5
75% Sulphuric +25% Nitric	140	2,3,9			1,4,5
	200		2,3,9		1,4,5
	Boiling			2,3,9	1,4,5
	315		9		
70% Sulphuric +10% Nitric					
+20% Water	140	2,3,9			1,4,5
	200		2,3,9		1,4,5
	Boiling			3,9	12,4,5
	335		9		
Naphtha	70	2,3,4,5,7,8,9	1		
Nickel Chloride Solutions	70	2*,3,7,8,9		5	1,4
Nickel Sulphate Solution	70	2*,3,9	4,5,8		1
Diluted	70				
Nitric Acid	70	2,3,6,9	8		1,4,5,7
Diluted	Boiling	2,3,6,9	8 to 150*		1,4,5,7
Diluted 1:10	70	2,3,6,9	8		1,4,5,7
Diluted 10%	Boiling	2,3,6,9	8 to 150*		1,4,5,7
Conc.	70	2,3,6,9			1,4,5,7
	Boiling	9	2,3,6		1,4,5,7
Fuming	70	2,3,6,9			1,4
	Boiling	9(e)	6		1,4,5,7
Nitrous Acid 5%	70	2,3,9	7		1,4,5,7
Oil Crude, Asphalt Base	Hot	2,3,4,9	1,5	1	
Paraffin Base	70	2,3,4,5,9	1	1	
Oil Lubricating, Lt. or Hvy.		2,3,4,5,9	1		
Oil Mineral, Hot or Cold		1,2,3,4,5,9			
Oil Vegetable, Hot or Cold		2,3,4,5,9	1		1
Oxalic Acid	70	2,3,4,6	5,7,8		1
	Boiling		3,4,7,8	2,5,6	1,9
25%	Boiling		3,4,7,8	2,5,6	1,9
50%	Boiling		3,6,7,8	2,4,5	1,9
Paraffin, Hot or Cold		2,3,4,5,7,8,9	1		
Petroleum		2,3,4,5,7,8,9		1	
Phosphoric Acid 1%	70	2,3,6,7,8,9	4,5		1
1%	Boiling	2,3,6,7,8		4,5	1
10%	Boiling	2,3,6,7,8	9	4,5	1
45%	Boiling	2,3,6,7,8		4,9	1,5
80%	140	2,3,6,7,8		9	1,4,5
80%	230	3,6,7,8		2,9	1,4,5
Photographic Developers all have reducing properties, hydroquinone amidol, ferrous, potassium, oxalate	70	2*,3,7,8,9	5	4	
	Boiling	2*,3,7,8,9	5	4	
Potassium Chloride 1%	70	2*,3,5,6*,7,8,9	4		1
	Boiling	2*,3,6*,8,9	4,5,7		1
5%	70	2*,3,5,6*,7,8,9	4		1
	Boiling	2*,3,6*,8,9	4,5,7		1
Potassium Dichromate 25%	Boiling	2*,3,6,9	8	5	1,4
Potassium Hydroxide (Caustic Potash) 27%	Boiling	2,3,4,5,6	7,8,9		1
50%	Boiling	3,4,5,6	2,7,8,9		1
	Melting				
	675	4,5,6	3,7,8		1,2
Potassium Nitrate (Salt Peter) 50%	70	2,3,6	4,5,8		
50%	Boiling	2,3,6	4,5,8		

In no instance should the ratings be considered as the basis for a guarantee of PLATECOIL life.

Platecoil Materials Selection and Fabrication Techniques

General Materials Selection Chart (contd.)

Fig. 14-1

Corrosive Media	Temperature Degrees F	Fully Resistant	Satisfactory Resistant	Slightly Resistant	Non Resistant
Potassium Sulphate 1% 5%	70 70	2,3,6,7,8 2,3,6,7,8	1,4,5 1,4,5		
Rosin (molten)		2,3,4,5,7,8,9			1
Salt Brine 3%	70	2*,3,6*,7,8,9			1
Sea Water	70	2*,3,4*,5*,6*,7,8,9			1
Silver Chloride		8,9			1,2,7
Shellac		2,3,4,5,9		1	
Silver Nitrate 10%		2,3,9	7,8	4,5	1
Soap	70	2,3,4,55,7,8,9	1		
Sodium Bicarbonate Baking Soda all Conc. 5%	 70 150	 2,3,5,6,7,8,9 2,3,5,6,7,8,9	 4 4	 1 1	
Sodium Carbonate (Soda Ash) 5% 50%	Boiling Boiling	2,3,5,7,8,9 2,3,5,7,8,9	1,4 1,4		
Sodium Chloride (Sat.) Cold at 212	70 Boiling Hot	2*,3,4,5,9 2*,9 9	6,7,8 3,4,5,6,7,8 2*,3,4,5,6,7,8		1 1 1
Sodium Cyanide	70	2,3,9	1,4,5		
Sodium Hydroxide 1-5% 20%	130 230	1,2,3,4,5,6,7,9 2,3,4,5,6,9	1,8 7,8		 1
34% 34%	212 Boiling	2,3,4,5,6 4,5,6	7,8,9 2,7,8,9		1 1
Sodium Sulphate (Gauber's Salt) all Conc.	 Hot	 2,3,6,7,8,9	 4,5		 1
Starch Solution		2,3,5,9	1,4		
Stearic Acid	70 350	2,3,5,6 3,5,6,7,8,9	4 2,4	1	 1
Sugar Solution	Hot	2,3,5,9	4		1
Sulphur, Molten	265	1(h),9	4,5		
Sulphur Dioxide Gas Moist	70	2,3,6,8 to 158,9			1,4,5
Sulphuric Acid Diluted 1:20	70 Boiling	2,3,6,7,8	4,5,9(g) 3,7	 2,4,6(f),8,9(g)	1 1,5
1:10	70 180 Boiling	2,3,6,7*,8*	4 3(f),6(f),7* 7*	5,9(g) 4,8*,9(g) 3(f),4,8*,9(f),6(f)	1 1,2,5 1,2,5
1:1	70 Boiling	2,3,6,7*,8*	4 7*	5,9(g) 3(f),4,8*,9(g)	1 1,2,5,6(f)
Conc. (93-98%)	70 212 300	2,3,6,7*,8*	1,5	4,9(g) 2,3(f),5,6(f),9(g) 9(g)	 1,4,7*,8* 1,2,3(f),4,5,6(f),7*,8*
Fuming (11% free SO3) (60% free SO3) (60% free SO3)	212 70 160	 2,8* 2	2 8*	 1 1	1,4,8* 4 4
Sulphurous Acid Saturated	70	2,3,6,8		5	1,4,7
Sweet Water	Hot	2,3,5			
Tartaric Acid 10%	70	2,3,6,7,8,9	4,5		1
Toluene or Toluol	70	2,3,4,5		1	
Trichlorethylene Dry	70 Boiling	2,3,4,5,6,8,9 2,3,4,5,6,8,9	7 1,7		
Tri Sodium Phosphate 35%	70	2,3,7,8,9	4,5	1	
Turpentine Oil	95	2,3,4,5,7,8	1		
Varnish	70 Hot	2,3,4,5,7,8 2,3,4,5,7,8			 1
Vegetable Juices		2,3,5,6,7,8,9	4		
Vinegar	Hot	2,3,6,9	4,5		1
Water	Hot Oily Salt	2,3,5,7,8,9 2,3,5,9 3,5,7,8,9	1,4 1,4 2*,4		
Whiskey		2,3,5,9		4	1
White Liquor		2,3,6	5	1	
Wood Pulp		2,3,9	8-105 degrees	1	
Wort		2,3,5			1
Yeast		2,3,5			
Zinc Chloride Solution Sp. Grav. 2.05 1.09 78 Degree Be	100 100 Boiling 95	 6*,7,9 6*,7,9 6*,7,9	 2*,3,4,5,8 2*,3*,4,8 2*,3*,4,5,8	 5	 1 1 1
Zinc Cyanide Solution	70	2,3	1,5		
Zinc Sulphate (White Vitriol) to 50%		2,3,6	4,7,8	5	1

Key to Materials
1. Carbon Steel
2. 316L Stainless Steel
3. Alloy 825
4. Monel
5. Nickel
6. Alloy 20Cb-3
7. Alloy B-2
8. Alloy C-276
9. Titanium

NOTE: Pitting may occur particularly if scale is allowed to build up.

CP=Chemically Pure

Fully resistant is less than .0044 inches per year.

*Coupon testing important to check for possible presence of ferric or cupric ions.
(a) Aeration will have very detrimental effect on Monel
(b) May be fully resistant when oxidizing inhibitors are present.
(c) Both 316L SS and Alloy 20Cb-3 may be subject to stress corrosion cracking.
(d) Titanium may be subject to Hydrogen embrittlement under certain conditions.
(e) Titanium may be full resistant under certain conditions while it may react violently with others. Consult Manufacturers and USE CAUTION IN TESTING
(f) Small traces of chlorides, particularly in sulphuric acid steel pickling solutions may cause excessive pitting.
(h) Provided no moisture is present.
In no instance should be the ratings be considered as the basis for a guarantee of PLATECOIL life.

Guidelines

Welded Products Installation and Operation Guidelines

The nature of and the compact size of Tranter Platecoil heat exchangers greatly facilitates the installation of the unit. There are, however, several items which should be addressed prior to connecting your unit.

WARNING: To prevent the over-pressurization of the unit, a safety relief valve should be installed in the piping in the vicinity of the equipment. Safety relief, if required, is to be provided by the user.

1. Make sure all piping is flushed prior to connecting the unit.

2. Make provisions for thermal expansion and/or vibration, if necessary. Never expose the unit to pulsations or excessive cyclic pressure or temperature changes. It is also important that no vibrations are transferred to the heat exchanger. If there is a risk of this, install vibration absorbers. For large connection diameters it is advised that an expansion joint be used in the pipeline.

3. Install unit so that piping and heat exchanger can be drained. Units must be vertical mounted as shown for 2-phase operation (see graphics on pages 11 - 14).

4. Isolation valves in the piping are recommended.

5. Provisions for back-flushing and/or chemical in-place cleaning are recommended.

6. Filters are recommended if there are solids in the process fluid.

7. Refer to the data nameplate mounted on the unit for the maximum pressure and temperature for which unit is designed. Provisions for monitoring pressure drop and temperatures are recommended. Install so unit will operate full of liquid. Trapped air will diminish the heat transfer coefficient.

8. For use in condensing applications such as steam, be sure unit is oriented for gravity drainage of condensate. Good steam practices (i.e. steam trap below the unit, vacuum breakers, etc.) should be followed. A sample steam schematic is shown (page 7). Platecoil's will not be warranted if the schematic is not followed.

9. No process fluid, such as water, should be allowed to freeze inside any of the Platecoil units either during operation or when inoperative such as shut downs, storage, etc.

The Platecoil is an all-welded product that is a very simplified plate heat exchanger, that by its nature requires little or no maintenance. It can, however, as with any heat exchanger, plug or have scale form on the heat transfer surface. Provisions for eliminating or correcting these problems are best provided for during the installation as noted above.

If there are any questions about installation, chemical cleaning or recommended strainer or screen sizes for filter, be sure to consult the representative or manufacturer.

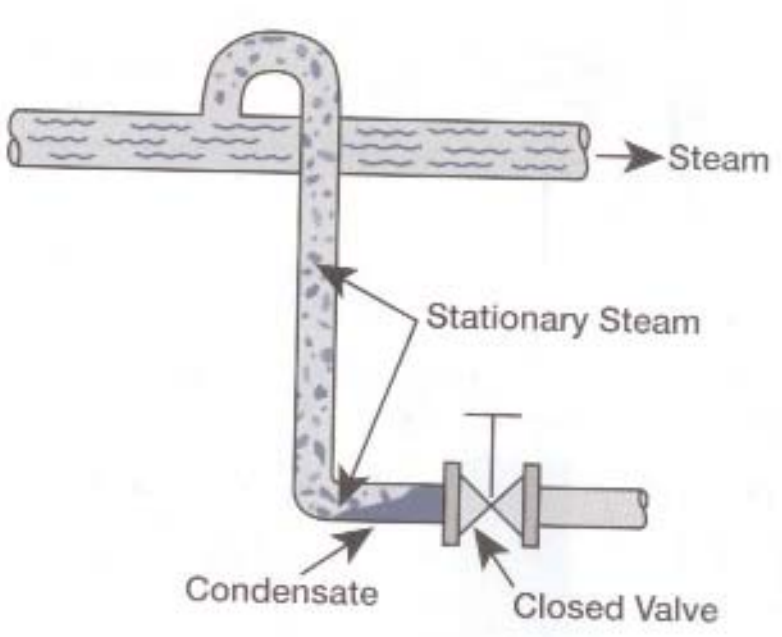
Avoiding Problems

Water Hammer and Other Deformations Caused By Wet Steam

A high moisture content in steam destined for condensation in a heat exchanger can easily result in formation of pools of water at critical points, exposing the system to water hammer.

One such critical point exists ahead of the control valve when the valve is located ahead of the inlet to the heat exchanger.

When the valve is closed, the stationary steam in front of it is liable to condense (see graphic). Heat losses due to radiation and faulty insulation can also increase the rate of condensation.



When the valve is closed, condensation of steam on the plates of the heat exchanger produces a vacuum or negative pressure inside it.

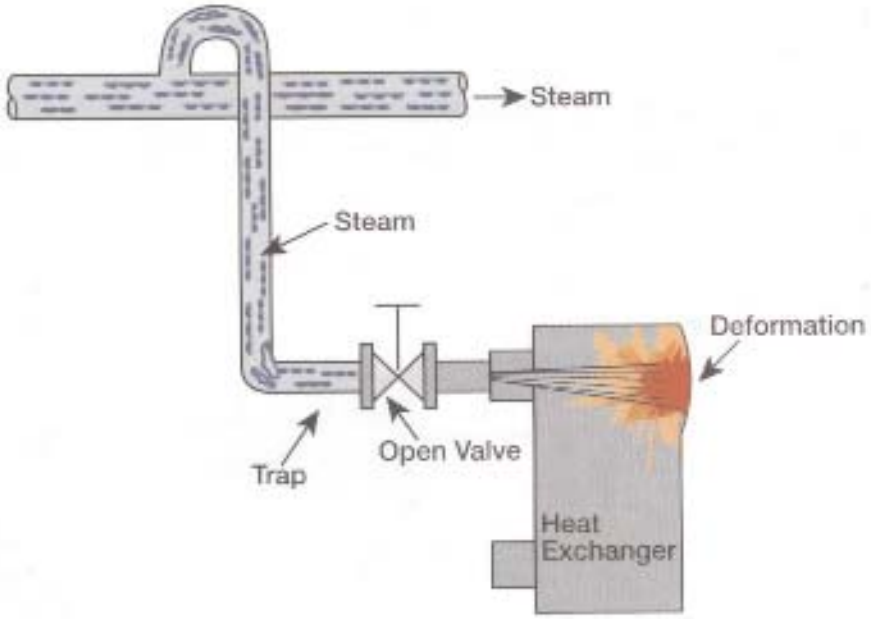
When the valve opens again to admit more steam, the differential pressure causes a sudden acceleration in the steam flow, pulling the accumulated water into the heat exchanger at high velocity.

Under such conditions the kinetic energy of the water can be very great-equal to that of a rifle bullet in a small volume of water. This can result in heavy wear and other mechanical damage in the heat exchanger, causing it to leak.

Avoiding Problems

Example of the kind of damage that can occur is shown at right.

The tendency for water to collect increases with increasing water content in the steam. To avoid this, drainage must be provided at critical points in the steam distribution system, e.g. before stop valves. Add a trap joint before the valve where shown on low pressure steam applications and on non-continuous process systems.



Back Flushing and Strainers

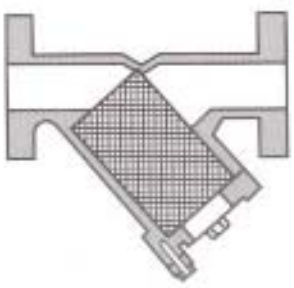
Often, when fibers or large particulates are present, back flushing of the unit proves to be very beneficial.
This is accomplished by either of the following methods:
1. Flush the unit with clean water in reverse flow to the normal operating direction.

2. Arrange piping and valves so the unit may be operated in reverse flow mode on the product side for fixed periods of time. This method is particularly well suited for steam-to-product units.

3. The use of strainers is recommended in supply lines ahead of the exchanger when the stream contains significant solids or fibers. This will reduce the requirements for back flushing.

Strainers

If any of the media contains particles larger than 1mm, we recommend that a strainer be installed before the exchanger with a size of 16 - 20 mesh (number of openings per inch). The particles could otherwise block the channels, causing bad performance, increased pressure drop and risk of freezing.



Installation and Maintenance Tips

Steam Heated PLATECOIL Positioning, Piping, Trapping

The inherent flexibility of PLATECOIL design permits a wide variety of satisfactory installation procedures. However, to insure maximum efficiency, there are a few precautions that should be observed.

1. Individual PLATECOIL of Multi-Zone, or parallel pass design, present no problems when installed in the conventional manner. The condensate line may be extended any reasonable distance vertically provided the steam pressure is in excess of 1 psig for each 2 feet of vertical lift.

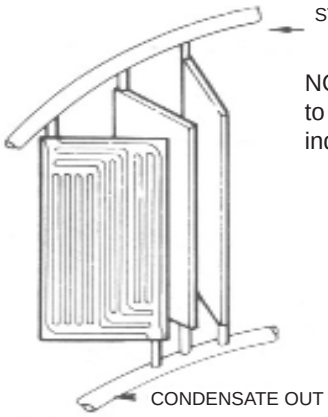
   This is with the proviso that the PLATECOIL size not exceed approximately 50 sq ft for steam to watery solutions if steam pressure is below 15 psig.

2. Individual PLATECOIL of Serpentine pass design installed in the conventional manner are in some instances used with steam, particularly in the smaller sizes and with low U valves. A rough calculation of the condensate in gpm will indicate whether or not flooding will be a problem.

3. Style 80 PLATECOIL may be installed in a flat position. This should be avoided if sediment may be deposited on the upper surface. Elevation above the tank bottom should be sufficient to allow free circulation of the liquid. The inlet side should be elevated at least 1" for improved condensate drainage.

Summary

Ideally, each PLATECOIL should be individually trapped. However, several reasonable adjacent PLATECOIL of equal size, as shown in Fig. 18-4, may be connected to a single trap provided all the condensate flows by gravity to a common low point. Never attempt to lift condensate through more than one riser to a single trap. Float and Thermostatic (F & T) type traps are typically best suited for PLATECOIL applications. Consult with a steam system expert to ensure the system design is proper



NOTE: The sketches shown here are to illustrate positioning only and do not indicate bracing often required.

Fig. 18-1

Style 80 should be used when vertically banked PLATECOIL are installed in processing tanks.

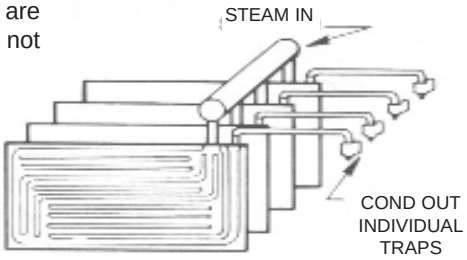


Fig. 18-3

Style 70 are generally used for banks. If Style 90 are used, each should be trapped indicidually.

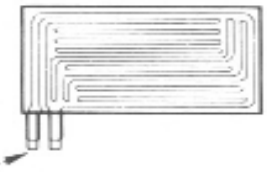


Fig. 18-2

Installations of *Multi-Zone* styles with the pipe fittings down are not recommended unless the condensate fitting is used for the steam inlet.

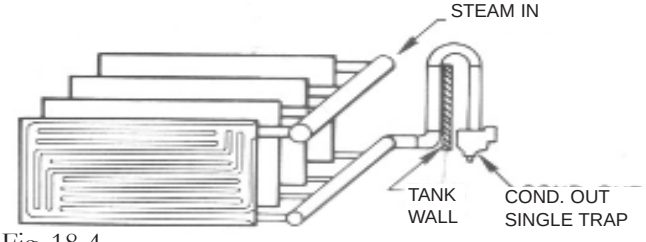


Fig. 18-4

Condensate must flow to a common low point before lifting.

Installation and Maintenance Tips

Protection Against Electrochemical Corrosion

Electrochemical corrosion involves the flow of electric current from one metallic surface (anode) through an electrolyte where there is a difference in potential and a complete electrical circuit. Except under unusual conditions, corrosion occurs at the anodic surface.

Electrochemical corrosion occurring between two dissimilar metals in contact in an electrolyte is called galvanic corrosion. The International Nickel Company has developed a Glavanic Series (see Fig. 19-1) which gives a realistic indication of what to expect in industrial applications. Metals grouped together are usually safe to use in contact with each other. The coupling of metals from two different groups may result in the galvanic corrosion of the one nearest anodic end of the series. The farther apart the metals, the greater the galvanic action.

Corrosion resistance on some metals can be enhanced by creating a passive film on the surface of the metal. Stainless Steel PLATECOIL can be passivated for this reason.

Galvanic corrosion can be controlled by coating, inhibition, cathodic protection or electrical insulation. Generally, insulating the PLATECOIL from the electrical circuit is the most economical means of protecting PLATECOIL or the metal it is coupled with from this type of corrosion.

One form of electrochemical corrosion is caused by electrolytic solutions carrying stray currents. These are occasionally found in metal plating and aluminum anodizing processes. Stray currents can also reach other types of tanks through piping, floors and tank walls. Fig. 19-2 illustrates a typical insulated PLATECOIL installation in a plating tank. The principal objective is to isolate the PLATECOIL from all metallic contacts.

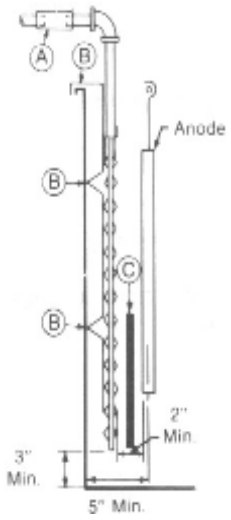
Galvanic Series of Metals and Alloys

Fig. 19-1

Corroded End (Anodic or Least Noble)
Magnesium
Zinc
Beryllium
Aluminum Alloys
Cadium
Mild Steel, Cast Iron
Low Alloy Steel
Austenitic Nickel Cast Iron
Aluminum Bronze
Naval Brass, Yellow Brass, Red Brass
Tin
Copper
Pb-Sn Solder (50/50)
Admiralty Brass, Aluminum Brass
Manganese Bronze
Silicon Bronze
Tin Bronzes (G & M)
Stainless Steel - Types 410, 416
Nickel Silver
90-10 Copper-Nickel
80-20 Copper Nickel
Stainless Steel- Type 430
Lead
70-30 Copper-Nickel
Nickel-Aluminum Bronze
Nickel-Chromium Alloy 600
Silver Braze Alloys
Nickel 200
Silver
Stainless Steel - Types 302,304,321
Nickel-Copper Alloys 400, K-500
Stainless Steel - Types316, 317
Alloy "20" Stainless Steels, cast and wrought
Nickel-Iron-Chromium Alloy 825
Ni-Cr-Mo-Cu-Si Alloy B
Titanium
Ni-Cr-Mo Alloy C
Platnium
Graphite
Protect End (Cathodic Nickel Co.)

Suggested Method of Installing PLATECOIL In Current Carrying Solutions

Fig. 19-2



A. USE INSULATING JOINTS in both pipelines.
B. INSULATE HANGERS from metallic contact with tank.
C. INSULATING CURTAIN (P.V.C.) may be used to prevent currents passing from the anode through the PLATECOIL. Be sure to allow for free circulation of the solution under the curtain.

Notes

1. In the case of cyanide copper plating solutions the chloride content should be low and the pH high (about 13) for good plating. These conditions also contribute to a more economical PLATECOIL life.

2. In sulphuric acid anodizing solutions the PLATECOIL may be made a part of the cothodic area. In such cases the proper electrical contact with the anodizing circuit is necessary.

Cleaning

Plate Cleaning Tips

1. Do not use hydrolic acids, or water containing in excess of 300 ppm chlorides with stainless steel.

2. Do not use phosphoric or sulfamic acid for cleaning titanium plates.

3. Limit cleaning solution concentration to 4% in strength, with temperatures not exceeding 140^{O}F unless otherwise specified.

General guidelines for cleaning are tabulated below. Please refer to notes (1) through (3) above for precautions.

Type of Fouling	Suggested Cleaners
Calcium Sulphate, Silicates Calcium Carbonate	Citric, Nitric, Phosphoric or Sulfamic Acid 10% Nitric Acid (1 Volume concentrated Nitric Acid with specific gravity 1.41 to 9 volmes of water), Oakite 131.
Alumina, Metal Oxides, Silt	Citric, Nitric, Phosphoric or Sulamic Acid (to improve cleaning and detergent to acid)
Barnacles, Mussels, Seaweed, Wood Chips	Back flush per cleaning-in-place procedure
Biological Growth	Sodium carbonate or sodium hydroxide.

Cleaning

Installation, Maintenance and Field Repair

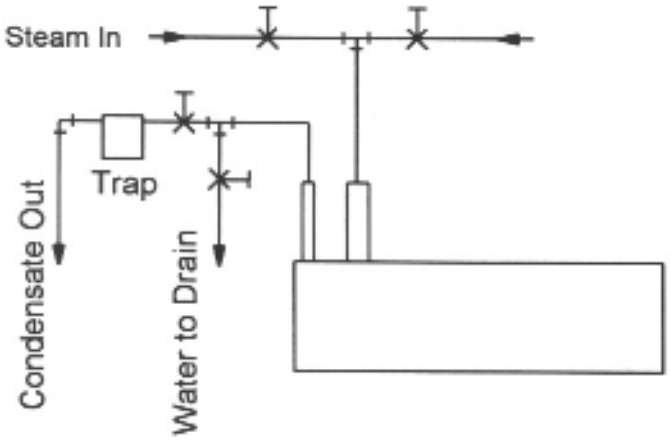
Electropolishing stainless steel PLATECOIL units will generally reduce scaling problems. Some scales may be removed with special equipment designed for *high pressure water spraying*. Pressures up to 1,000 psi can be employed. This, however, will not remove the most stubborn phosphate-type scales.

An alternative *cold water shock method* for scale removal is described below.

The use of hammers and chisels to remove scale is not recommended. PLATECOIL units can be damaged beyond repair by such treatment. PLATECOIL products are rugged, but are not designed to withstand severe blows. If, in emergencies, this method is necessary, the careful use of a lead or fiber mallet is the least apt to cause damage.

Scale Removal from PLATECOIL Units by Cold Water Shock Method

The scale removal method described below has been used very satisfactorily with some PLATECOIL unit installations. In a Tranter test, eight pounds of scale (approximately 40%) dropped from an 18" X 95" PLATECOIL unit during one shock operation. This consisted of five-cycles between steam and water and took about five minutes.



Cold (Tap) Water In.
Pipe size no smaller than
PLATECOIL unit steam inlet.

Procedure

1. Install cold water tie-in piping and an outlet to the drain from the condensate line, ahead of the trap.
2. Install four valves as shown. The "T" in the steam line should be of the lever operating type, such as Walworth #1736 or a single 3-way, 3-port valve in place of the "T" (Walworth #1730 or equal). When using several PLATECOIL products (such as in a washer), the water piping may be connected to each unit or to all the units in parallel. If a parallel circuit is used, be sure the supply line is large.
3. Conduct the cleaning operation at any time when the solution is hot.
   a. Set the valves in the condensate line to cut out the trap.
   b. Close the steam valve and open the water valve: *in this order.*
   c. Let water flow for about 30 seconds. *Only* the initial hit of cold water is beneficial.
   d. Reverse the valves to cause steam flow, and repeat the procedure about 5 times.
   e. Repeat daily, weekly or as determined best for the conditions. Cleaning may not be complete on any given day, but the heaviest scale should come off each time.

Note: *Due to the high shock forces imposed, this method is suggested only for 14 gauge or heavier PLATECOIL units.*

Cleaning

Cleaning and Maintaining PLATECOIL

It is important to establish regular cleaning schedules. This is necessary to obtain proper heat transfer rates from the PLATECOIL. Lime scale deposits, for example, conduct only 1/30th of the heat of an equivalent thickness of metal.

PLATECOIL's basic design can be brushing in place to simplify cleaning. Some scales can be removed reasonably well by this process. It is suggested that this method always be tired before removing the PLATECOIL and permitting the scale to dry and harden. When brushing stainless PLATECOIL, a bristle or stainless steel brush should be used. Do not use a plain steel wire brush as steel particles will be embedded in the surface.

Some scales, particularly those encountered in the operation of some phosphatizing processes in metal finishing, may require chemical cleaning. For these cases it is most desirable to consult one of the concerns who supply metal finishing chemicals. Separate cleaning tanks are frequently set up. By using spare PLATECOIL and suitable chemicals in a Separate cleaning tank, a systematic cleaning program can be established without down time.

When chemically cleaning stainless PLATECOIL, caution should be observed regarding the use of acids containing chlorides or fluorides. These acids may be satisfactory if used cold, if properly inhibited and/or if properly rinsed off after use. Chlorides and fluorides can severely attack stainless. Extreme corrosion may occur, for example, if the tank is filled with such an acid and then the PLATECOIL is use for heating it to hasten the cleaning process. Sulfamic acid type cleaners may be considerably less dangerous.

The use of hammers and chisels to remove scale is not recommended. PLATECOIL can be damaged beyond repair by such treatment. PLATECOIL are rugged structural units but are not designed to withstand severe blows. If in emergencies this method is necessary, a lead or fiber mallet carefully used is the least apt to cause damage.

Some scales may be removed by use of special equipment designed for high pressure water spraying. Pressures up to 600 psi can be employed. This, however, will not remove the most stubborn phosphate type scales.

Electropolishing will generally reduce the scaling problems encountered with stainless PLATECOIL.

Cleaning

Cleaning-In-Place (CIP)

Cleaning-in-place is the preferred cleaning method when especially corrosive liquids are processed in a Welded Product PHE unit. Install drain piping to avoid corrosion of the plates due to residual liquids left in the unit after an operation cycle.

To prepare the unit for cleaning, follow the procedures listed below:

1. Drain both sides of the unit. If it is not possible to drain, force liquids out of the unit with flush water.

2. Flush the unit on both sides with warm water at approximately 110ºF until the effluent water is clear and free of the process fluid.

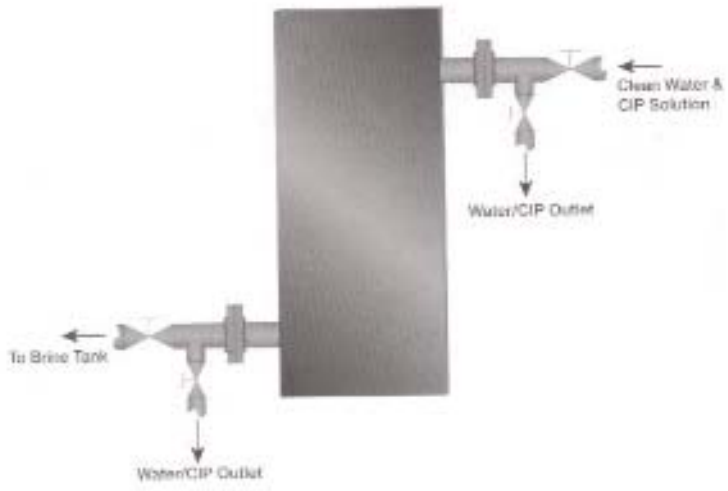
3. Drain the flush water from the unit and connect CIP pump.

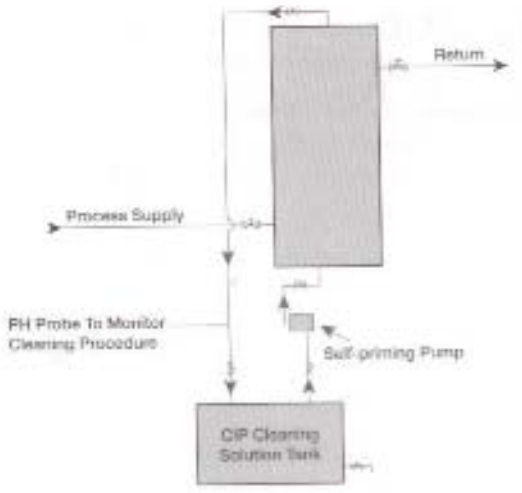
4. For thorough cleaning it is necessary to flow CIP solution bottom to top to insure wetting of all surfaces with cleaning solution. When cleaning multiple pass units it will be necessary to reverse flow for at least half the cleaning time to wet all surfaces.

5. For optimum cleaning, use the maximum flow rate of water, rinse or CIP solution that the CIP nozzle size will allow (2" at 260 GPM, 1" at 67 GPM). A CIP operation will be most effective if performed on a regularly scheduled basis and before the unit is completely fouled.

6. Flush thoroughly with clean water after CIP cleaning.

If brine is used as a cooling medium, completely drain the fluid from the unit and flush the unit with cold water prior to any cleaning operation. Corrosion will be kept at a minimum if all traces of brine are eliminated before using hot CIP solutions on either side of the heat exchanger.





Field Repair

Field Repair of PLATECOIL

Through accidental damage, etc., PLATECOIL may occasionally need repair. Some leaks may be repaired and the following welding procedures are suggested.

1. Carbon Steel PLATECOIL: SMAW (open arc) welding is the conventional method. A 1/8" diameter, all position, AC or DC, reverse polarity coated electrode of AWS Class E-60 or E-70 should be used. Extreme care should be exercised to avoid burning through the material. The oxy-acetylene gas torch method can sometimes be used. However, PLATECOIL that have been in use for some time may have deposits from the process on the surface so that the repair point becomes easily contaminated and a leak proof assembly is difficult to obtain.

2. Stainless Steel PLATECOIL: For type 316L, SMAW welding is the conventional method. A 3/32" diameter electrode, AC-DC typical class E-316L AWS 5.4 is recommended. If TIG (heli arc) welding is used, a 1/16" diameter bare rod, typical class E-316L, AWS 5.9 is recommended. Repairing type 304L with either the MIG ro TIG process requires E-308L AWS 5.9. All stainless steel welds should be interrupted regularly and the area promptly water quenched. It is important to do this so that the metal temperature cannot exceed 800 degrees for more than 2 minutes to minimize carbide precipitation.

3. Cleanliness of the Weld Area is important. The base metal in the weld area must be free from slag, scale, oil and grease. The edges and general area should be wire brushed and cleaned with a suitable solvent where possible. A clean stainless steel brush should be used as a final preparation in the repairing of stainless steel. A general wire brushing on the completed repair makes a satisfactory surface finish.

Returned Material

Units or parts are not to be returned without first sending notification to the factory. Parts accepted for credit are subject to a service charge plus all transportation charges. Any items authorized for return must be adequately packed to reach Tranter PHE, Inc., at the address shown below without damage.

Damaged Shipments

Tranter, Inc.'s equipment is carefully packaged at the factory to protect it against the normal hazards of shipment. If Tranter, Inc. equipment should arrive in a damaged condition, the customer must file a damage report with the carrier. A copy of this claim should be sent to:

Tranter, Inc.
ATTN: All-Welded Department
1900 Old Burk Highway
Wichita Falls, TX 76306

Additional Information

For any additional information concerning the operation, care or maintenance of your Welded Plate PHE, feel free to contact our Welded Product technical specialists at the address indicated above or call (940) 723-7125. Our FAX number is (940) 723-5131.

Warranty

Tranter, Inc. offers a 12-month warranty from the date of installation, but in no case longer than 18 months from the date of delivery. The warranty covers only manufacturing and material defects.

Disclaimer

Units are to be used strictly in accordance with operating pressures and temperatures shown on the drawing. For further information, please consult Tranter, Inc. or your local Tranter PHE representative.

At the forefront of heat exchanger technology for over 60 years.

TRANTER®
The heat transfer people

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