ACB2

US EPA RECORDS CENTER REGION 5
1000480

Administrative Record

Document Number	Date Sent	Date Received	Persons/Organization	File Location
ACB2-01	11-30-2001		Inspection Report letter	ACB2
ACB2-02	11 30-2001		Inspection Report Metal/WASH	ACB2
ACB2-03	2/23/00	2/28/00	and Drawings	
03			Submit Application	ACB2
04	2/18/00	2/24/00	Submit 3 copy of Application	ACB2
05	9/5/00	9/11/00	Addition Info	ACB2
06	9/11/00	9/12/00	Drawing mod	ACB2
07	3/24/00		Class 1 Letter	ACB2
08	3/28/00		Letter To IEPA	ACB2
09	6/21/00	6/28/00	Sub Class 1 Letter	ACB2
10	6/22/00	6/26/00	Letter To IEPA	ACB2
11	1/30/01	2/01/01	IEPA Lt Part B	ACB2

H. Croke USEPA

AC 52-01

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276

THOMAS V. SKINNER, DIRECTOR

217/524-3300

January 30, 2001

CERTIFIED MAIL
7099 3400 0002 1429 3762

Clean Harbors Services, Inc.
Attn: Jim Laubsted
11800 South Stony Island Avenue
Chicago, Illinois 60617

RECEIVED
FEB 01 2001
MNOHWI PERMIT SECTION - WMB
Waste, Pesticides & Toxics Division
U.S. EPA - REGION 5

Re: 0316000051 – Cook County
Clean Harbors Services, Inc.
ILD000608471
Log No. 16-M-44
RCRA Permit File

Dear Mr. Laubsted:

This letter is in response to the request for modification of your RCRA Part B identified in the above referenced log numbers. The Illinois EPA has approved your Class 1 modification request dated December 13, 2000 to change the address and home phone number of the primary emergency coordinator in the contingency plan.

The Illinois EPA has reviewed the information contained in your submittal and has determined that Clean Harbors Services, Inc. (CHSI) may implement this modification. This determination is based upon our review of (1) the RCRA Part B Permit issued to CHSI, (2) the regulations [35 Ill. Adm. Code, Subtitle G] and (3) the information contained in your submittals. Operations must be conducted in accordance with the approved RCRA Part B Permit originally issued to CHSI and all subsequent modifications to the Part B Permit.

Within 35 days after the notification of a final permit decision, the permittee may petition the Illinois Pollution Control Board to contest the issuance of the permit. The petition shall include a statement of the reasons supporting a review, including a demonstration that any issues raised in the petition, were previously raised during the public comment period. In all other respects, the petition shall be in accordance with the requirements for permit appeals as set forth in 35 Ill. Adm. Code Part 105. Nothing in this paragraph is intended to restrict appeal rights under Section 40(b) of the Environmental Protection Act (35 Ill. Adm. Code 705.212(a)).

Since no changes in the permit conditions have resulted from this modification, a revised permit has not been issued; only the cover page of the permit reflecting the approval of this modification is being sent to you. Pursuant to 35 Ill. Adm. Code 703.281(a)(2), a notice of the modification shall be sent to all persons on the facility mailing list, maintained by Illinois EPA per 35 Ill. Adm.

CleanHarbors
SERVICES, INC.
11800 SOUTH STONY ISLAND AVENUE • CHICAGO, IL 60617
(773) 646-6202 • FAX (773) 646-6381
Visit our Website at www.cleanharbors.com

January 30, 2001

Mr. James Blough
U.S. Environmental Protection Agency
RCRA Permit Section, DW-8J
77 West Jackson Boulevard
Chicago, IL 60604-3590

Dear Mr. Blough:

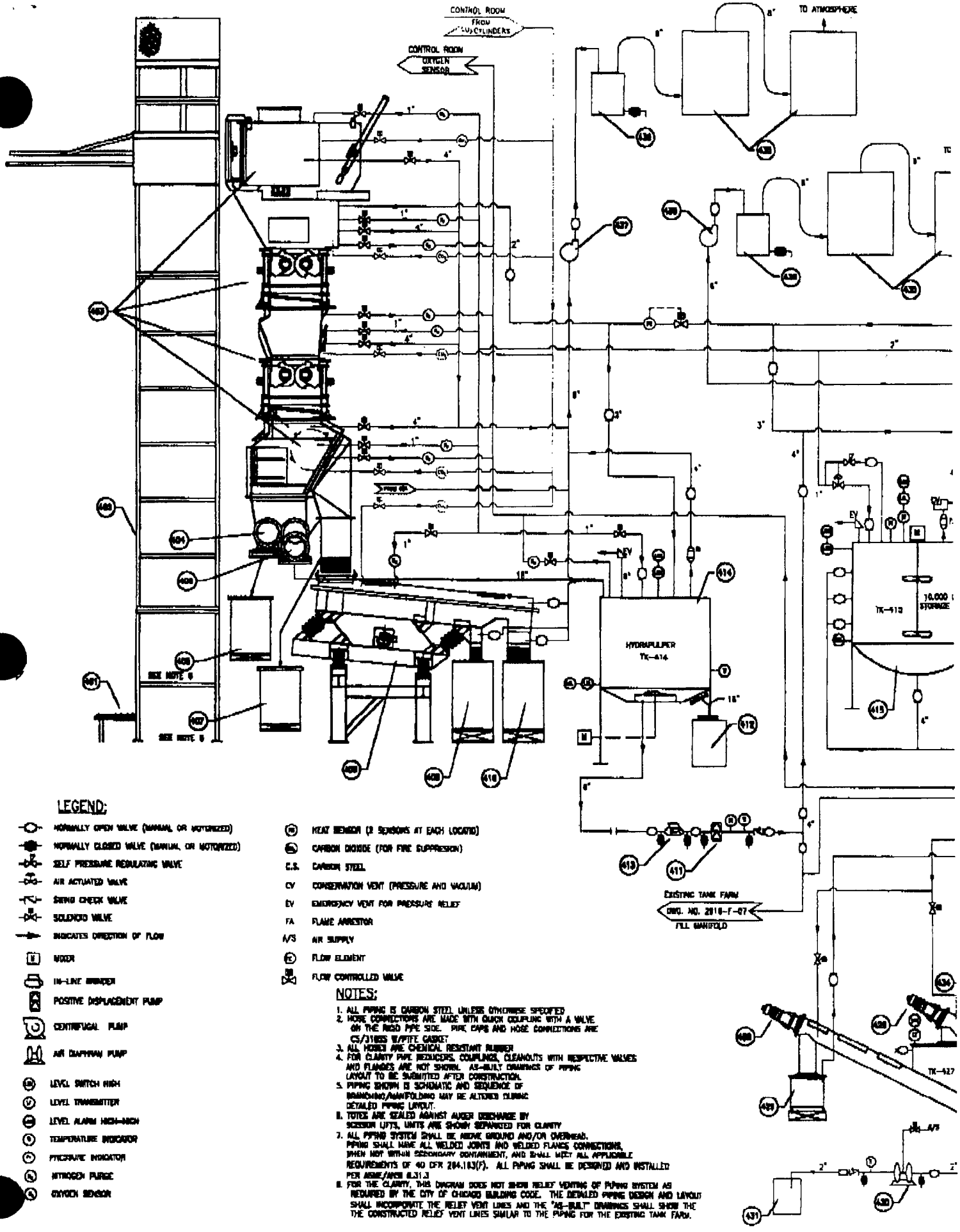
Clean Harbors Services, Inc. (CHSI) is submitting additional information concerning the hazardous waste shredder system permit modification. CHSI is adding vent lines to the carbon adsorption system from the metalwash system. One will connect the washed metal collection tote (Item 429) and the other will connect the sludge collection drum (Item 434). These revised connections are shown on CHSI Drawing No. 4286 (Drawing No. 4630-F-02) which is enclosed.

If you have any questions or require additional information, please contact me at (773) 646-6202, x233.

Sincerely,

James R. Laubsted
Facility Compliance Manager

RECEIVED
JAN 30 2001
MNO - RCRA PERMIT SECTION - WMB
Waste, Pesticides & Toxics Division
U.S. EPA - REGION 5



LEGEND:

- NORMALLY OPEN VALVE (MANUAL OR MOTORIZED)
- NORMALLY CLOSED VALVE (MANUAL OR MOTORIZED)
- SELF PRESSURE REGULATING VALVE
- AIR ACTUATED VALVE
- SWING CHECK VALVE
- SOLENOID VALVE
- INDICATES DIRECTION OF FLOW
- MIXER
- IN-LINE GRINDER
- POSITIVE DISPLACEMENT PUMP
- CENTRIFUGAL PUMP
- AIR DIAPHRAM PUMP
- LEVEL SWITCH HIGH
- LEVEL TRANSMITTER
- LEVEL ALARM HIGH-HIGH
- TEMPERATURE INDICATOR
- PRESSURE INDICATOR
- NITROGEN PURGE
- OXYGEN SENSOR
- HEAT SENSOR (2 SENSORS AT EACH LOCATIO)
- CARBON DIOXIDE (FOR FIRE SUPPRESION)
- C.S. CARBON STEEL
- CV CONSERVATION VENT (PRESSURE AND VACUUM)
- EV EMERGENCY VENT FOR PRESSURE RELIEF
- FA FLAME ARRESTOR
- A/S AIR SUPPLY
- FE FLOW ELEMENT
- FLOW CONTROLLED VALVE

NOTES:

1. ALL PIPING IS CARBON STEEL UNLESS OTHERWISE SPECIFIED
2. HOSE CONNECTIONS ARE MADE WITH QUICK COUPLING WITH A VALVE ON THE RIGID PIPE SIDE. PIPE CAPS AND HOSE CONNECTIONS ARE CS/316SS W/PTFE GASKET
3. ALL HOSES ARE CHEMICAL RESISTANT RUBBER
4. FOR CLARITY PIPE REDUCERS, COUPLINGS, CLEANOUTS WITH RESPECTIVE VALVES AND FLANGES ARE NOT SHOWN. AS-BUILT DRAWINGS OF PIPING LAYOUT TO BE SUBMITTED AFTER CONSTRUCTION.
5. PIPING SHOWN IS SCHEMATIC AND SEQUENCE OF BRANCHING/MANIFOLDING MAY BE ALTERED DURING DETAILED PIPING LAYOUT.
6. TOTES ARE SEALED AGAINST AUGER DISCHARGE BY SCISSOR LIFTS, UNITS ARE SHOWN SEPARATED FOR CLARITY
7. ALL PIPING SYSTEM SHALL BE ABOVE GROUND AND/OR OVERHEAD. PIPING SHALL HAVE ALL WELDED JOINTS AND WELDED FLANGE CONNECTIONS, WHEN NOT WITHIN SECONDARY CONTAINMENT, AND SHALL MEET ALL APPLICABLE REQUIREMENTS OF 40 CFR 264.193(F). ALL PIPING SHALL BE DESIGNED AND INSTALLED PER ASME/ANSI B.31.3
8. FOR THE CLARITY, THIS DIAGRAM DOES NOT SHOW RELIEF VENTING OF PIPING SYSTEM AS REQUIRED BY THE CITY OF CHICAGO BUILDING CODE. THE DETAILED PIPING DESIGN AND LAYOUT SHALL INCORPORATE THE RELIEF VENT LINES AND THE "AS-BUILT" DRAWINGS SHALL SHOW THE THE CONSTRUCTED RELIEF VENT LINES SIMILAR TO THE PIPING FOR THE EXISTING TANK FARM.

Harriet

CleanHarbors
SERVICES, INC.
11800 SOUTH STONY ISLAND AVENUE • CHICAGO, IL 60617
(773) 646-6202 • FAX (773) 646-6381
Visit our Website at www.cleanharbors.com

January 10, 2001

Mr. James Blough
U.S. Environmental Protection Agency
RCRA Permit Section, DW-8J
77 West Jackson Boulevard
Chicago, IL 60604-3590

Dear Mr. Blough:

Clean Harbors Services, Inc. (CHSI) is submitting the additional information you requested concerning the hazardous waste shredding system permit modification.

CHSI intends to use a flame ionization detector (MicroFID or equivalent) to monitor the carbon adsorption systems for when control devices will not reduce the inlet vapor stream by 95%. CHSI reserves the right to use a detection instrument which meets the performance criteria of Reference Method 21 (40 CFR Part 60).

If you have any further questions concerning this application, please contact me at (773) 646-6202, x233.

Sincerely,

James R. Laubsted
Facility Compliance Manager

cc: Robert Tekach, CHSI

ACB2-01

I hereby certify that I, the undersigned am a Professional Engineer, licensed to practice in the State of Illinois. I have reviewed the assessment of Tank T-417 and attest that the tank system has sufficient structural integrity and compatibility with the wastes to be stored or treated to ensure that it will not collapse, rupture or fail. It is acceptable for the storing and treating of hazardous waste. The foundation, structural support, seams and connections are adequately designed incorporating good engineering practices.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Engineer Seal

Amos Turner 11-7-2000

Amos Turner Date

AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF
ILLINOIS

Hoyer-Schlesinger-Turner, Inc.
3074 University Avenue
Highland Park, IL 60035
(847) 681-0470

EXP. DATE 11-30-2001

H-S-T

HOYER-SCHLESINGER-TURNER,Inc.
ENGINEERS-ARCHITECTS
3074 University Ave.
Highland Park,IL 60035
Phone:847-461-0470 Fax:847-266-9829

October 27, 2000

Mr. James R. Laubsted
Facility Compliance Manager
CLEAN HARBORS SERVICES, INC.
11800 S. Stony Island Avenue
Chicago, IL 60617

RE: Inspection Report
Caustic Tank T-417

Dear Mr. Laubsted:

On October 10, 2000 I visually inspected the interior and exterior of Tank T-417.

Tank T-417 is located on the north side of the Bulk Liquid Flammable Storage Tank Farm (Unit 22). The tank was used for storing sodium hydroxide. Tank T-417 is located outdoors. The concrete containment for the tank farm will be modified to provide individual containment for this tank. The containment will be coated with Protecto-Coat 900, 30 mils thick as manufactured by Dudick, Inc. This coating is compatible with hazardous waste diluent or fuel to be stored.

Tank T-417 is a carbon steel vessel fabricated in 1986. Tank T-417 was empty at the time of inspection and was sandblasted by Clean Harbors personnel. The tank will be operated at ambient temperature and under 2" WC pressure from nitrogen blanketing. The tank will be equipped with a conversation vent and vented through a carbon bed.

Tank T-417 stores flammable liquids Class I. Maximum specific gravity of stored liquids is 1.2 and pH may vary from 4 to 10. The tank is constructed from carbon steel. It is 10'6" in diameter and 24"0" high straight side with a sloped bottom. The operating capacity is 15,000 gallons. This tank was built to UL-142 standard.

The internal and external visual inspection did not reveal any defects. The welds around nozzles and tank shell welds inspected from inside the tank were in good condition. The interior top plate did not show signs of rust. There were no other visible defects.

It is not possible to inspect the entire exterior of the tank by visual inspection. The tank is insulated with 2" thick insulation with metal jacket.

On October 12, 2000 Clean Harbors performed NDE-ultrasonic thickness measurements from the interior of the tank. These ultrasonic thickness test results are listed in Appendix TK-417-1.

The top as-built thickness was 0.250 inches. The four latest readings are very close in thickness to the as built thickness. The minimum reading was 0.248 inches which is 101% over the minimum of 0.123 inches recommended by the UL-142 standard.

The wall as-built thickness was 0.375 inches. The twelve latest readings each show minor decreases in thickness. The minimum reading was 0.368 inches which is 120% over the minimum of 0.167 inches recommended by the UL-142 standard.

The bottom as-built thickness was 0.500 inches. The four latest readings each show minor decreases in thickness. The minimum reading was 0.470 inches which is 96% over the minimum of 0.240 inches recommended by the UL-142 standard.

For tank design specifications, nozzle orientation and description, see CHSI Drawing No. 4295.

Structural design for the tank farm foundation, engineering design calculations and containment capacity calculations see CHSI Drawing 4291 and Attachment TK-417-2.

Therefore, I certify that after visual inspection, the tank is structurally sound. No evidence of cracks, bulging, corrosion pits or scales or weld defects were observed. Based on my inspection, the tank can be used for the intended purpose.

Very truly yours,

HOYER-SCHLESINGER-TURNER, INC.

Peter J. Bernes

Peter J. Bernes
Illinois #3659

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes

PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11.30.00

APPENDIX TK-417-1

ULTRA SONIC THICKNESS TESTING
T-417

October 12, 2000

INTERNAL

TOP

East	South	West	North
.250	.252	.252	.248

SHELL

.376	.380	.380	.368
.370	.372	.376	.368
.374	.380	.382	.380

BOTTOM

.470	.484	.500	.488

HOYER-SCHLESINGER-TURNER, INC.

SHEET 1 OF 10
PROJECT NO. 1785-6
DATE 1.22.00
BY P. BERNES, S.E.

PROJECT CLEAN HARBORS - CHICAGO, ILL.
SUBJECT #22 TANK FARM MODIFICATION

DESIGN IS BASED ON LATEST EDITION OF CITY OF CHICAGO BUILDING CODE.

PROJECT CONSIST OF EXISTING TANK FARM MODIFICATION BY RELOCATING EXIST. TANK T-302B TO NEW LOCATION, INSTALLING TWO NEW 10'-6" DIA. DISHED BOTTOM TANKS OF 10,000 GAL. CAPACITY, ONE NEW 7'-0" DIA. DISHED BOTTOM TANK OF 6,000 GAL. CAPACITY AND ADDING NEW DIKE WALLS TO PROVIDE CONTAINMENT FOR EACH TANK SAPARETELY.

ORIGINALLY TANK FOUNDATIONS WERE DESIGNED FOR 15,000G TANKS, BUT ACTUAL CAPACITY IS 10,000 GAL. ONLY. THEREFORE EXIST. TANK FOUNDATIONS ARE ADEQUATE TO SUPPORT RELOCATED TANK T-302B. WALL FOUNDATION DESIGN WAS BASED ON 2000 PSI SOIL BEARING CAPACITY. CONCRETE COMPRESSIVE STRENGTH = 4000 PSI AND REINF. STEEL = 60,000 PSI

ALL WORK TO BE COORDINATED WITH OWNERS PROJECT ENGINEER AND CLEAN HARBORS STANDARD DETAILS

ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST OSHA REQUIREMENTS

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes

PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11.30.00

HOYER-SCHLESINGER-TURNER, INC.

SHEET 1 OF 10

PROJECT CLEAN HARBORS - CHICAGO

PROJECT NO. 1725-6

DATE 1.22.00

SUBJECT F22 TANK FARM MODIFICATION

BY P BERNES

DESIGN IS BASED ON LATEST EDITION OF CITY OF CHICAGO BUILDING CODE.

PROJECT CONSIST OF EXISTING TANK FARM MODIFICATION BY RELOCATING EXIST. TANK T-302B TO NEW LOCATION, INSTALLING TWO NEW 10'-6" DIA. DISHED BOTTOM TANKS OF 10,000 GAL. CAPACITY, ONE NEW 7'-0" DIA. DISHED BOTTOM TANK OF 6,000 GAL. CAPACITY AND ADDING NEW DIKE WALLS TO PROVIDE CONTAINMENT FOR EACH TANK SAPARETELY.

ORIGINALLY TANK FOUNDATIONS WERE DESIGNED FOR 15,000. TANKS, BUT ACTUAL CAPACITY IS 10,000 GAL. ONLY, THEREFORE EXIST. TANK FOUNDATIONS ARE ADEQUATE TO SUPPORT RELOCATED TANK T-302B. WALL FOUNDATION DESIGN WAS BASED ON 2000 P SOIL BEARING CAPACITY. CONCRETE COMPRESSIVE STRENGTH = 4000 PSI AND REINF. STEEL = 60,000 PSI

ALL WORK TO BE COORDINATED WITH OWNER'S PROJECT ENGINEER AND CLEAN HARBORS STANDARD DETAILS

ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST OSHA REQUIREMENTS.

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes

PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11.30.00

HOYER-SCHLESINGER-TURNER, INC.

SHEET 2 OF 10

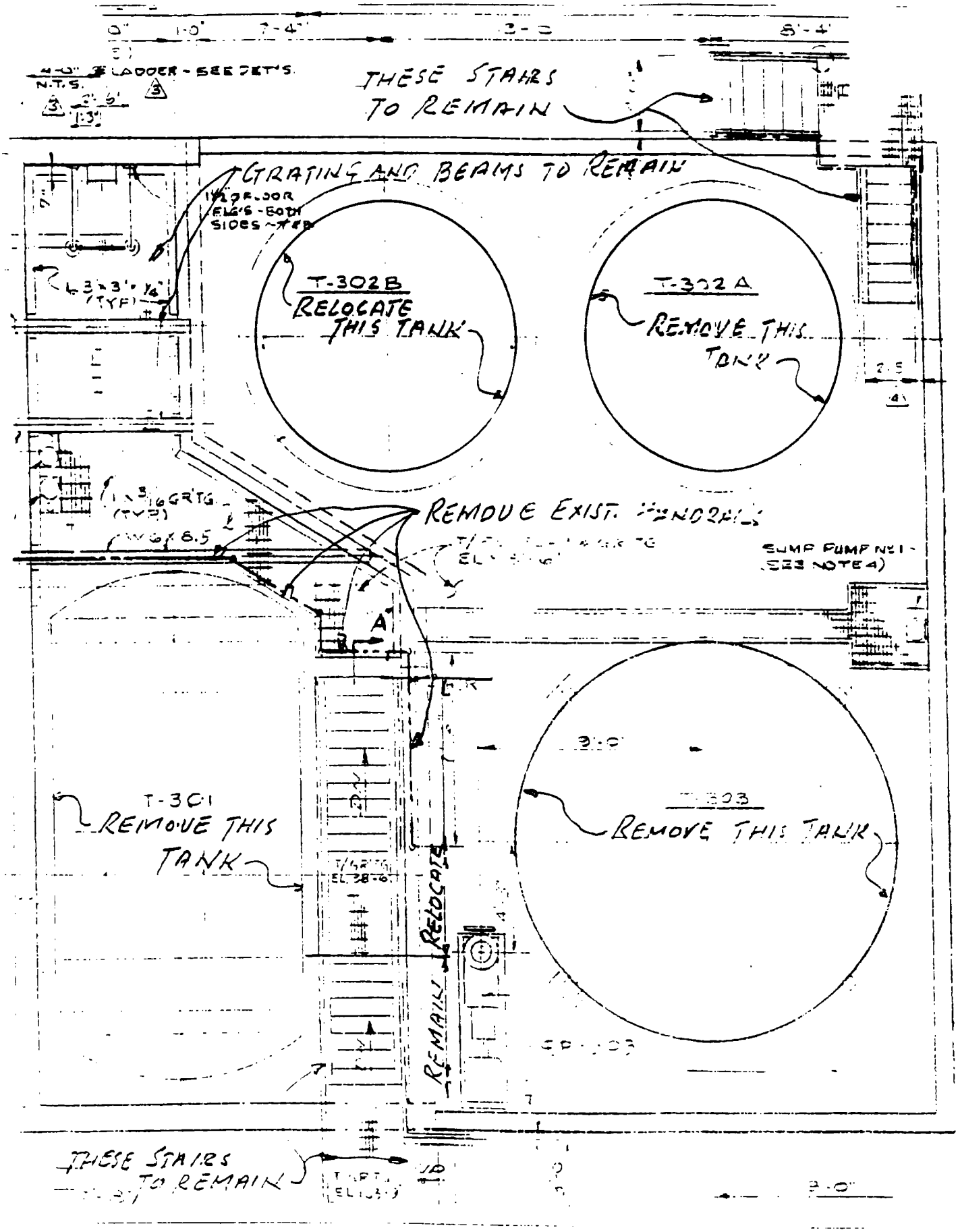
PROJECT CLEAN HARBORS - CHICAGO, ILL.

PROJECT NO. 1785-6

DATE 1.22.90

SUBJECT #22 TANK FARM MODIFICATIONS

BY P. BERNES, S.E.



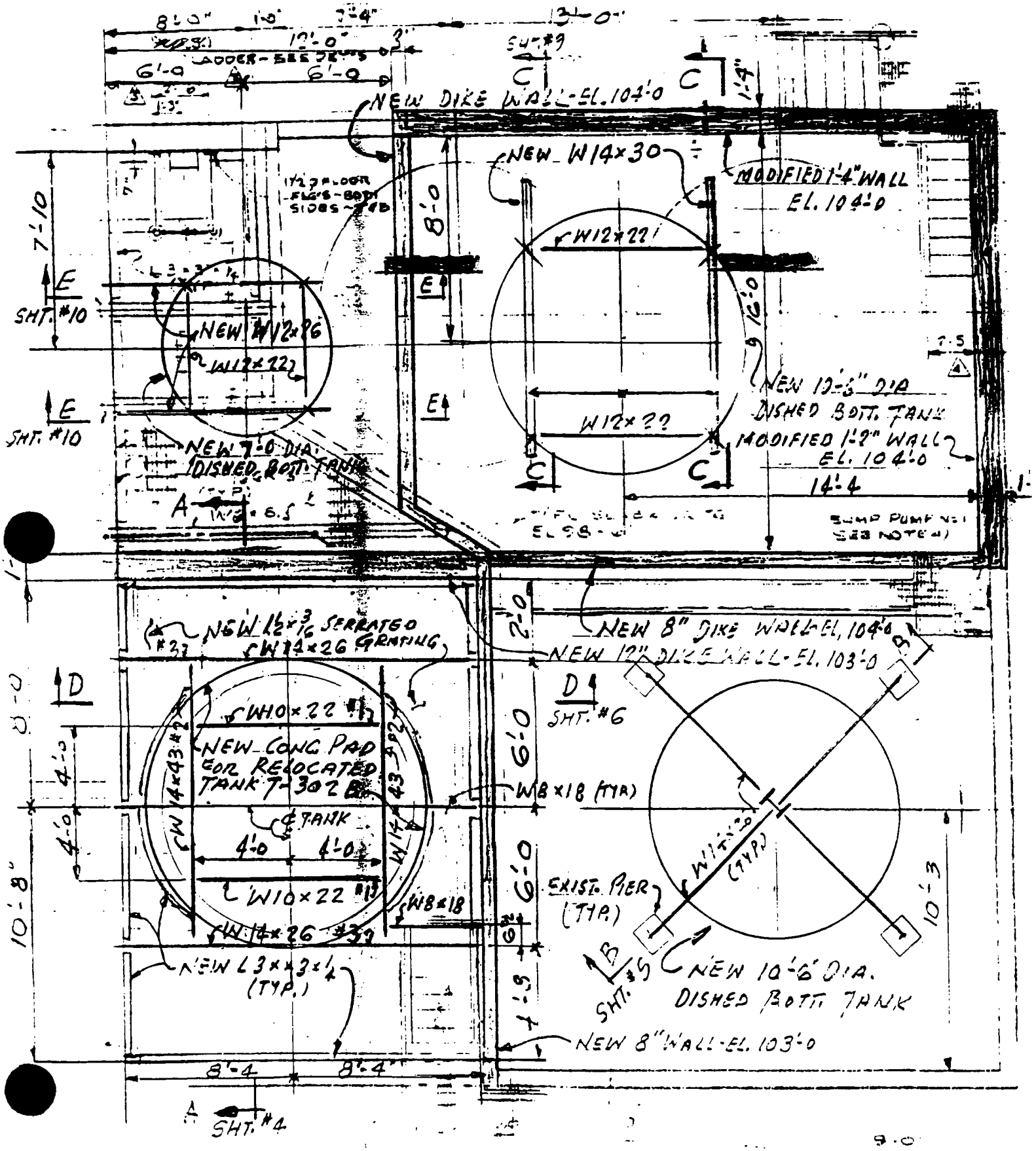
PLAN OF EXISTING TANK FARM DEMO.

HOYER-SCHLESINGER-TURNER, INC.

SHEET 3 OF 10
PROJECT NO. 1735-6
DATE 1.22.00
BY P. BERNES, S.E.

PROJECT CLEAN HARBORS - CHICAGO, ILL.

SUBJECT FOR TANK FARM MODIFICATION



PLAN OF MODIFIED EXIST. TANK FARM

PROJECT CLEAN HARBORS - CHICAGO, ILL.

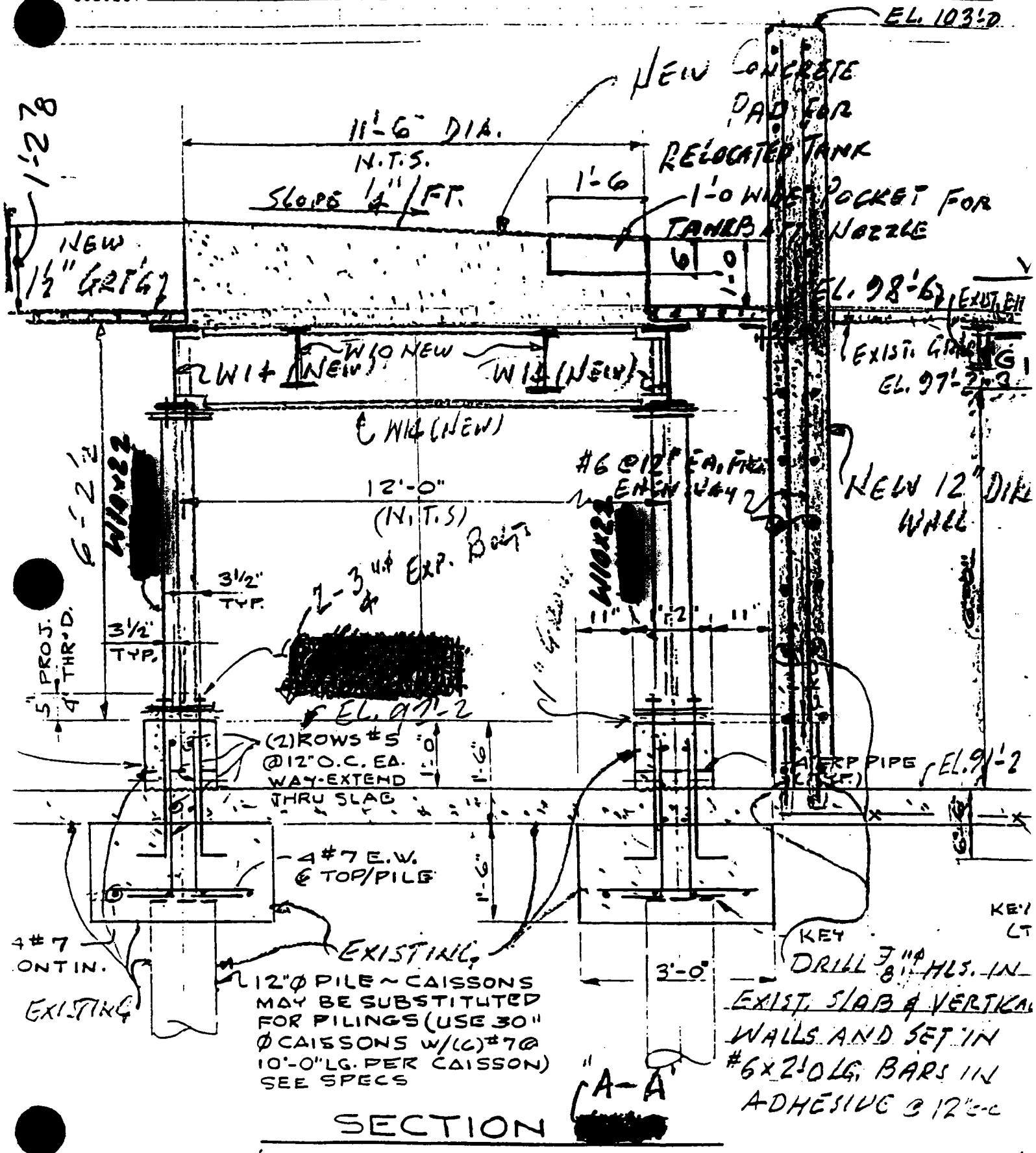
SUBJECT #22 TANK FARM MODIFICATION

SHEET 4 OF 10

PROJECT NO. 1785-6

DATE 1.22.00

BY P. BERNES, S.E.



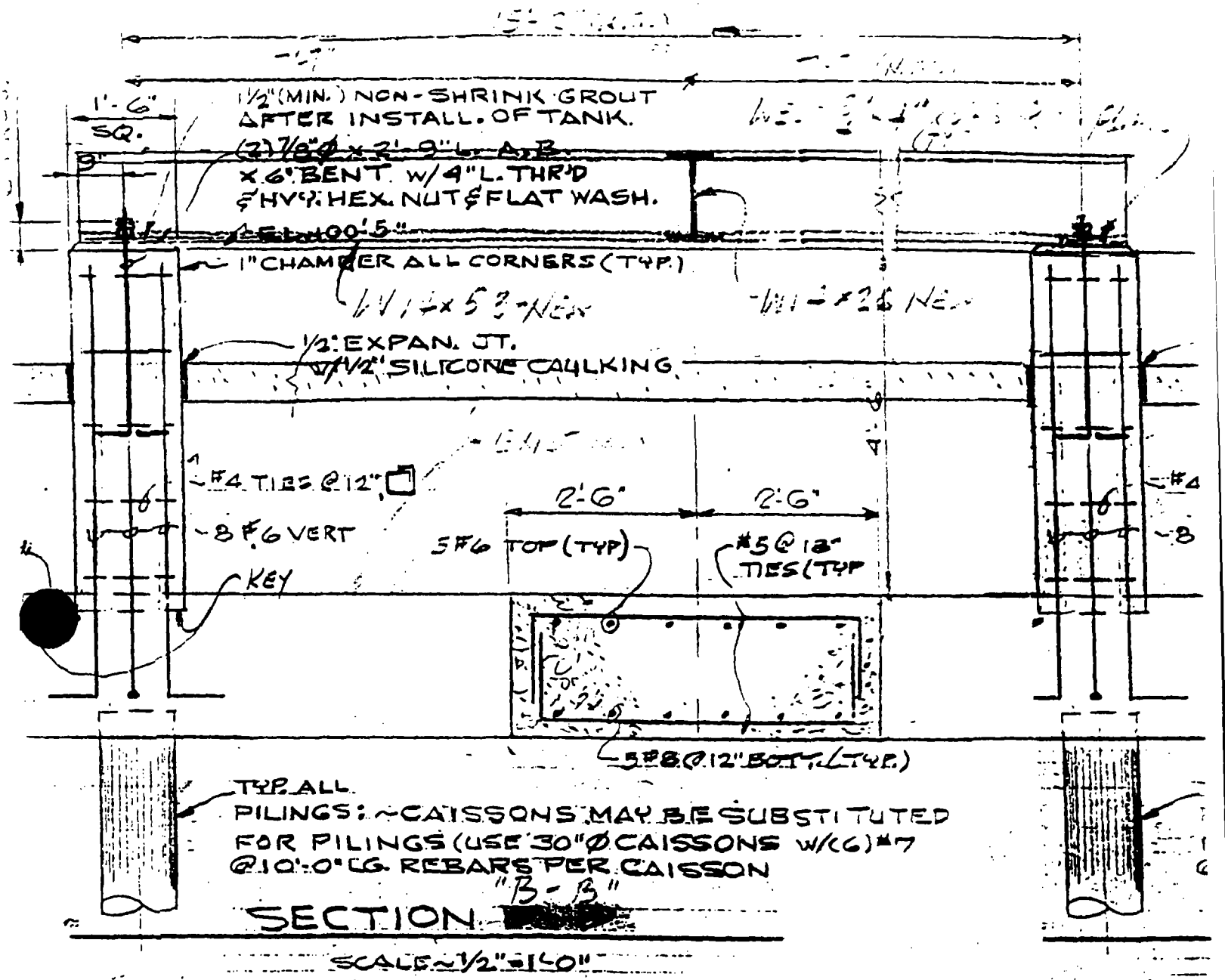
SECTION

SCALE ~ 1/2" = 1'-0"

HOYER-SCHLESINGER-TURNER, INC.

SHEET 5 OF 10
PROJECT NO. [illegible]
DATE 1.22.00
BY P. BERNES, S.E.

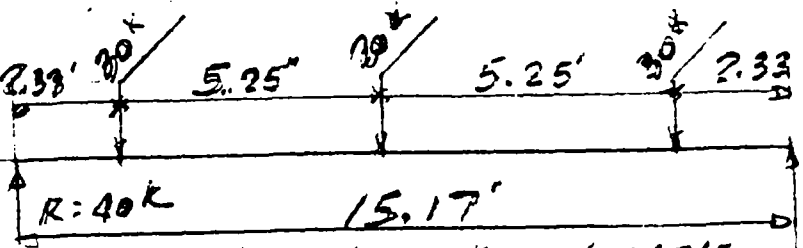
PROJECT [illegible]
SUBJECT #22 TANK [illegible] MODIFICATION



SECTION "B-B"

SCALE ~ ½" = 1'-0"

TOTAL WEIGHT.
FULL = 118^K +
PIPING, COL'S AND
BEAMS = 120^K
PER LEG = 120^K/4 = 30^K



$M_{MAX} = 40^K \times 15.17'/2 - 30^K \times 5.25' = 147'^K$

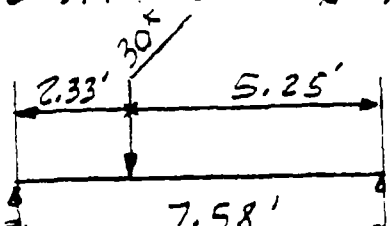
USE W14x53 - $M_R = 156'^K > 147'^K$ O.K.

BEARING = 40^K/16"x8" = .3

$t = \sqrt{\frac{3 \times .3 \times 32}{27}} = .547$

.658" > .547" O.K.

WEB BUCKLING RES. = 5.47 KSI < 9.11 KSI O.K.



$R_L = \frac{30^K \times 5.25'}{7.58'} =$

$= 20^K$

$M_{MAX} = 20^K \times 2.33' = 47'^K$

USE W14x22 - $M_R = 58'^K > 47'^K$

O.K.

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, IL

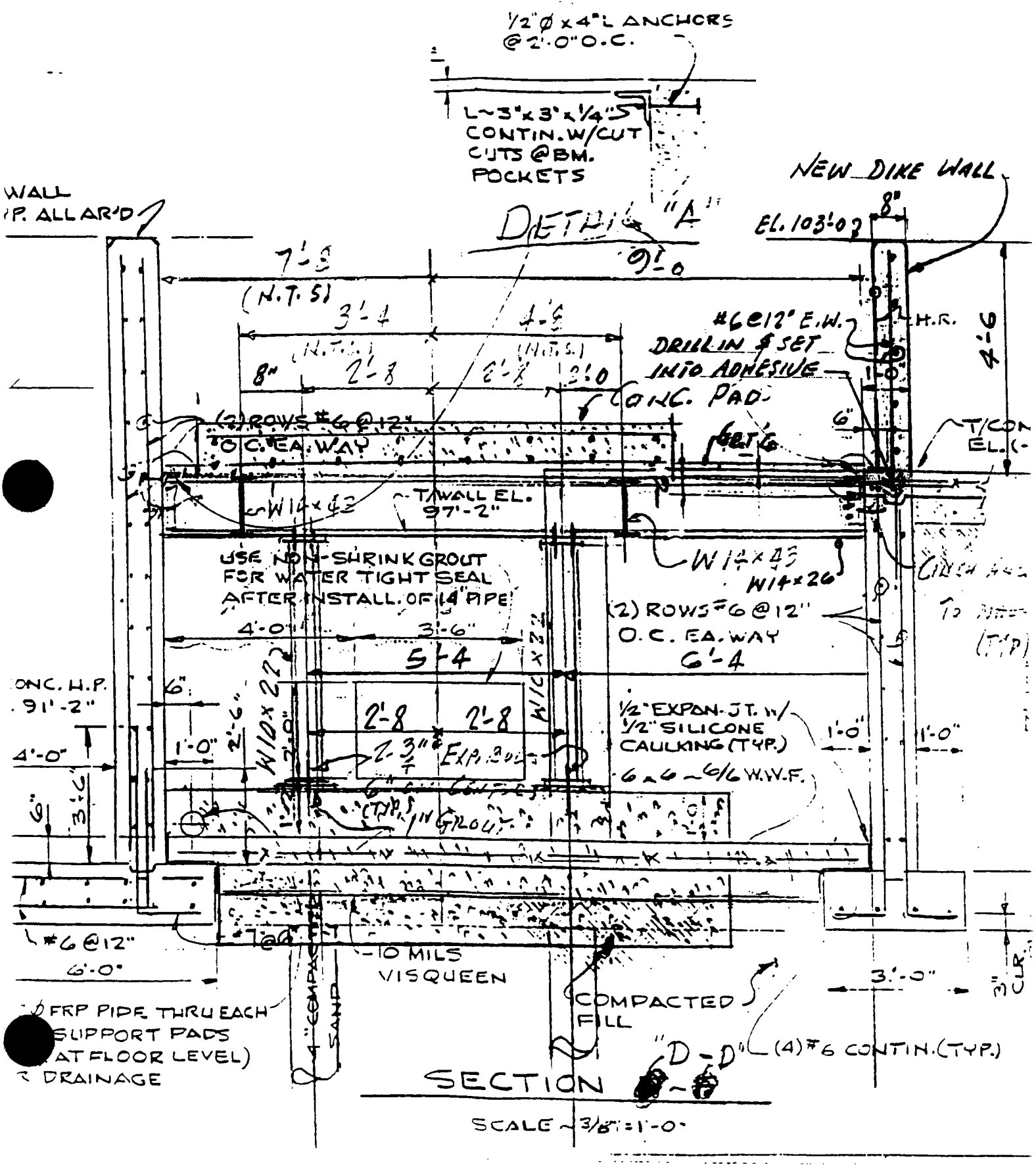
SUBJECT #22 TANK FARM MODIFICATION

SHEET 6 OF 10

PROJECT NO. 1785-6

DATE 1.22.00

BY P. BERNES, S.E.



HOYER-SCHLESINGER-TURNER, INC.

SHEET 7 OF 10
PROJECT NO. 1785-1
DATE 1.22.00
BY P. BERNES, S.E.

PROJECT CLEAN HARBORS - CHICAGO, IL.
SUBJECT #22 TANK FARM MODIFICATION

CONCR. PAD (SEC. "D-D" - SEE SHT. #3 & #6)

a) CALCULATE TOTAL LOAD - PSF. FOR RELOCATED TANK T-302B

CONTENTS = $\frac{10{,}000 \text{ GAL} \times 8.35 \text{ \#/GAL}}{\pi \times 5.25^2}$ = 965 PSF

1/2" THICK BOTT. PL = ONE SQ. FT. = 20 PSF

CONC. PAD = SQ. FT. × 1'-0 HIGH = 150 PSF

TOTAL = 1,135 PSF

b) CALCULATE REINF. REQUIRED (TWO WAY SLAB)

$M = \frac{1.14^{k}/2 \times 8^2}{8} = 4.56^{1k}$

A_s REQ'D = $\frac{4.56^{1k}}{1.76 \times 10} = .26 \text{ IN}^2$

USE #5@12" C-C EA. WAY - TOP & BOTT.

$A_s = .31 \text{ IN}^2 > .26 \text{ IN}^2$ ok.

DESIGN OF SUPPORTING BEAMS & COL'S

a) CALCULATE TOTAL LOAD (SEE SHT'S #3 & #6)

TANK SHELL = $\pi \times 10.5 \times 24 \times 15.3$ PSF = 12,107#

" BOTT PL = $\pi \times 5.25^2 \times 20.4$ PSF = 1,766#

" TOP PL = $\pi \times 5.25^2 \times 10.2$ PSF = 883#

MANWAYS, NOZZLES & PIPING = 2,244#

TANK TOTAL = 17,000#

CONTENTS = 10,000 GAL × 8.35 #/GAL = 83,500#

CONC. PAD = $\pi \times 5.75^2 \times 1.0' \times 150$ PCF = 15,570#

TOTAL = 116,070#

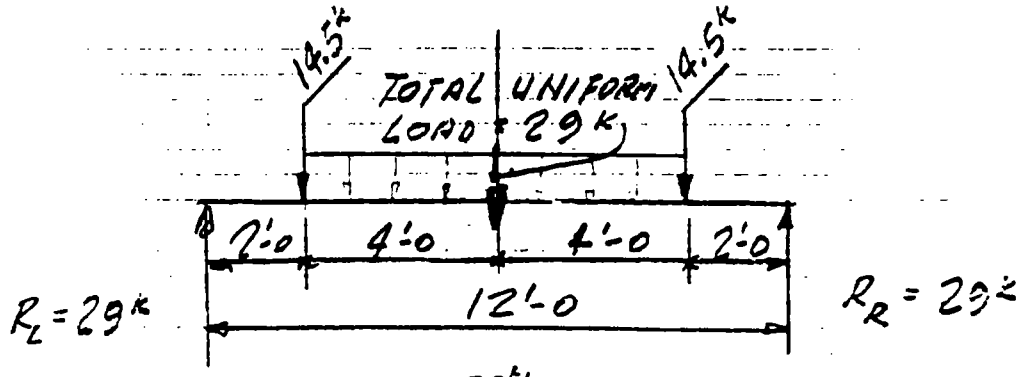
b) DESIGN OF SUPPORTING BEAMS - #1, #2 & #3

BEAM #1

TOTAL UNIFORM LOAD PER BEAM = 116K/4 = 29K

USE W10x22 - ALLOWABLE LOAD = 43K > 29K O.K.

BEAM #2

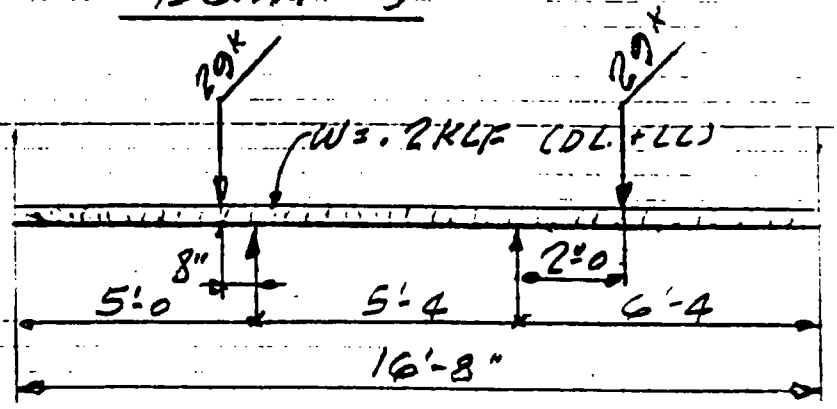


$R_L = R_R = 14.5^K + 29^K/2 = 29^K$

$M_{MAX} = 29^K \times 6' - 14.5^K \times 4' = 203'^K$

USE W14x43 - $M_R = 125'^K > 203'^K$ O.K.

BEAM #3



$M_{MAX} = 29^K \times 2.0' + 6.33' \times .2KLF \times 6.33/2 = 62'^K$

USE W14x26 - $M_R = 77'^K > 62'^K$ O.K.

HOYER-SCHLESINGER-TURNER, INC.

SHEET 9 OF 10

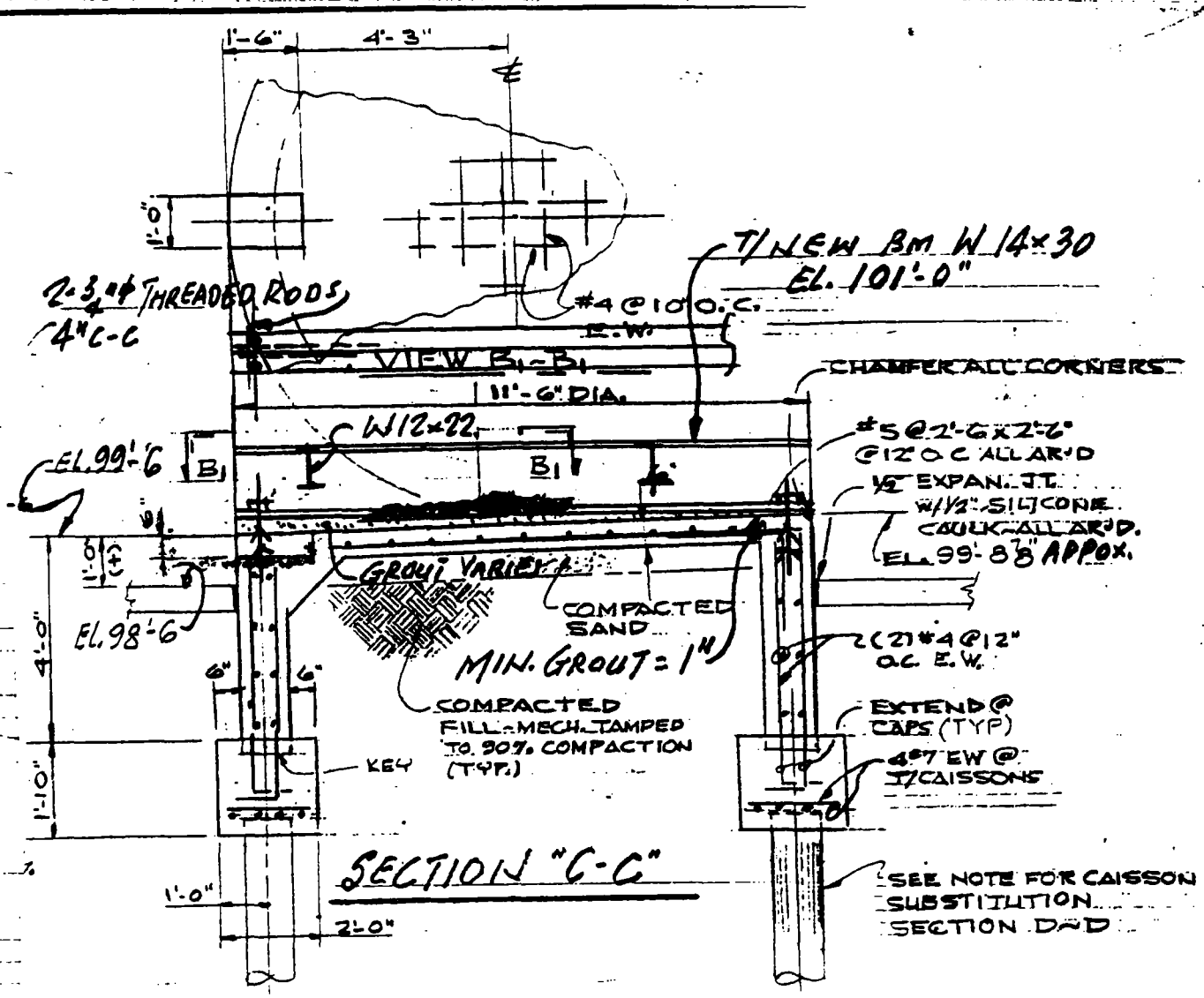
PROJECT CLEAN HARBORS - CHICAGO, ILL.

PROJECT NO. 1785-6

DATE 1.22.00

SUBJECT #22 TANK FARM MODIFICATION

BY R. BERNES, S.E.

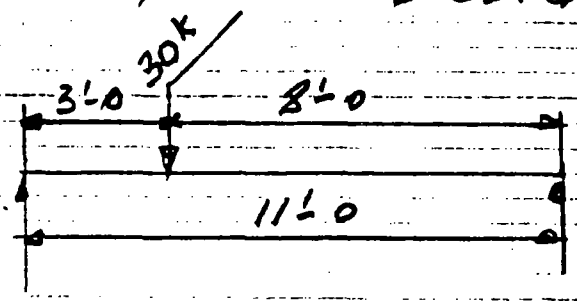


DISHED BOTTOM TANK SUPPORT

BEAM DESIGN

TANK FULL = 118^K
MISC. = 2^K
TOTAL = 120^K

LOAD PER LEG = 120^K/4 = 30^K



$R_L = \frac{30^K \times 8'}{11'} = 21.8^K$

$M_{MAX} = 21.8^K \times 3' = 65.45'^K$

USE W 14×30 $M_R = \frac{22 \times 41.0}{12} = 76.8'^K$

$76.8'^K > 65.45'^K$ O.K.

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, IL.

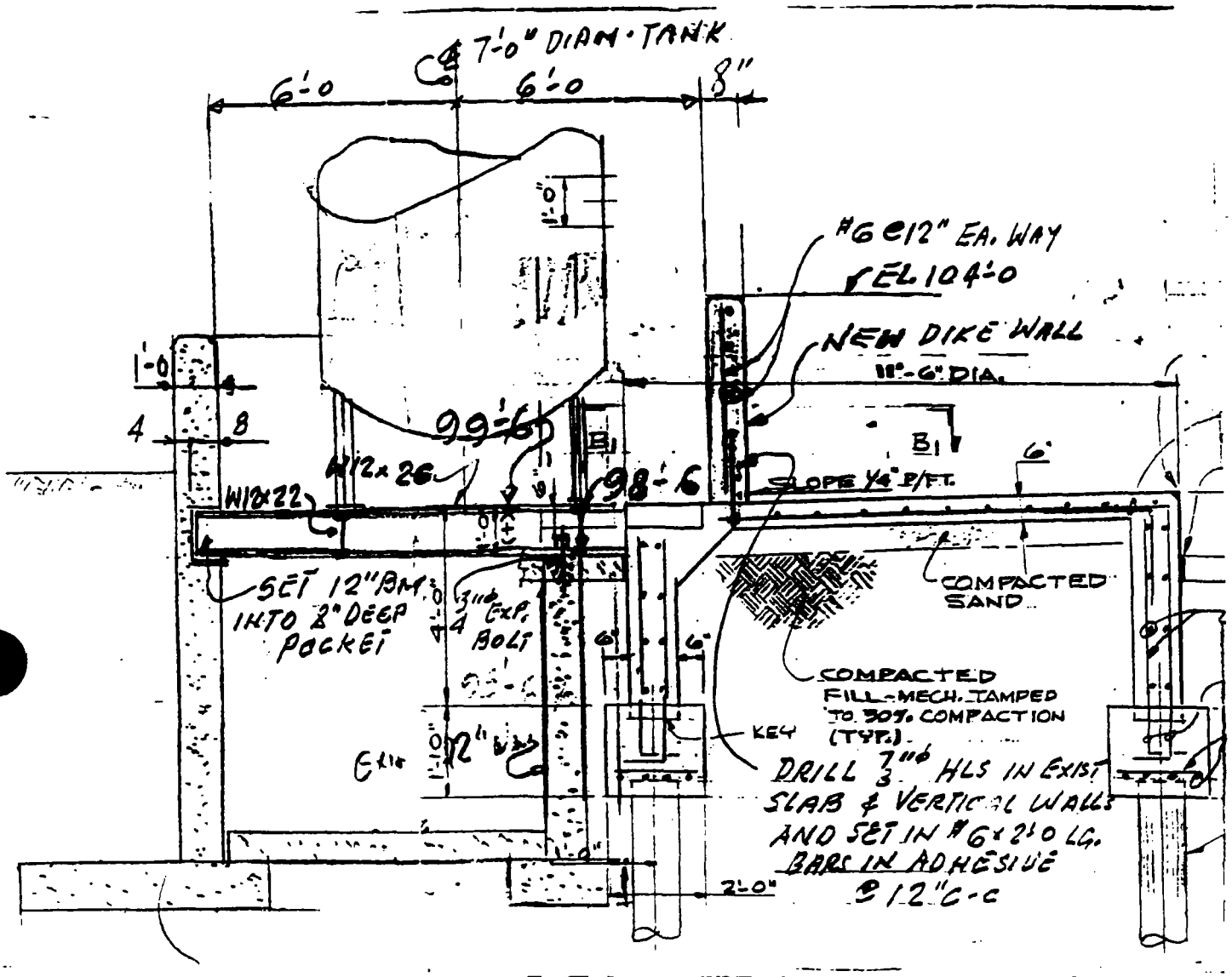
SUBJECT #22 TANK FARM MODIFICATION

SHEET 10 OF 10

PROJECT NO. 1785-6

DATE 1.22.00

BY P. BERNES, S.E.



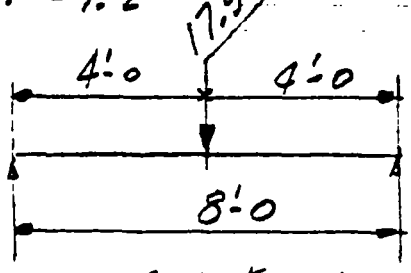
SECTION "E-E"

(SEE SHT. #3)

6,000 GAL. TANK = FULL TANK WEIGHT = 71.58^K

SP. GR. = 1.2 EMPTY VESSEL = 10.17^K

LOAD PER LEG = 71.58^K/4 = 17.90^K



R = 17.90^K x 4 / 8 = 8.95^K

$M_{MAX.}$ = 8.95^K x 4' = 35.80'^{K}

USE W12 x 26 M_n = 63'^{K} > 35.80'^{K} OK

The secondary containment calculations for Unit 42 are included on CHSI Dwg. No. 4287. Ten percent of the total storage capacity of 2035 gallons is 204 gallons. This is less than the largest container of 478 gallons. The net containment of 5,239 gallons exceeds the total storage capacity.

The drum feed roller conveyor and drum lift to the shredder have a carbon steel containment pan below them. The pan is 22 feet long, 5 feet wide and 8 inches high. The drum lift and most of the roller conveyor are located in Unit 24 which is an enclosed building. A portion of the conveyor is located outside of the building, but in Unit 70 which is a contained area. The portion of the conveyor in Unit 70 will be covered by a canopy.

Total waste volume: (18)(55) = 990 gallons
10% = 99 gallons
largest container 478 gallons

Volume of containment: (22)(5)(0.67)(7.48) = 549 gallons

Amos Turner, P.E.
AMOS TURNER, P.E.
November 7, 2000

AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF
ILLINOIS

EXP. DATE 11-30-2001

ACB-02

I hereby certify that I, the undersigned am a Professional Engineer, licensed to practice in the State of Illinois. I have reviewed the minimum tank thickness calculations for Tanks 414, 415, 416, 417, 418, 424 and 427 and the containment calculations for Unit 42 and the containment pan below the drum feed roller conveyor and drum lift. I find that the calculations incorporate good engineering practices.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Engineer Seal

Amos Turner 11.7.2000

Amos Turner Date

AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF
ILLINOIS

EXP. DATE 11-30-2001

Hoyer-Schlesinger-Turner, Inc.
3074 University Avenue
Highland Park, IL 60035
(847) 681-0470

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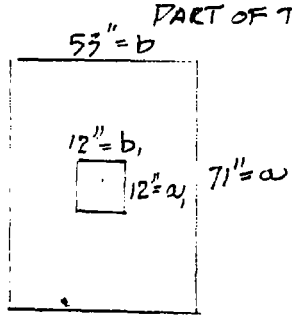
PLATE SIZE CALC (CON'D)

TOP PLATE (CON'D) CHECK THICKNESS CHOSEN FOR TOP LOAD TEST PER UL-142 SECT. 41.1

1000# LOAD OVER 1 FT² AREA AT WEAKEST PART OF TANK TOP

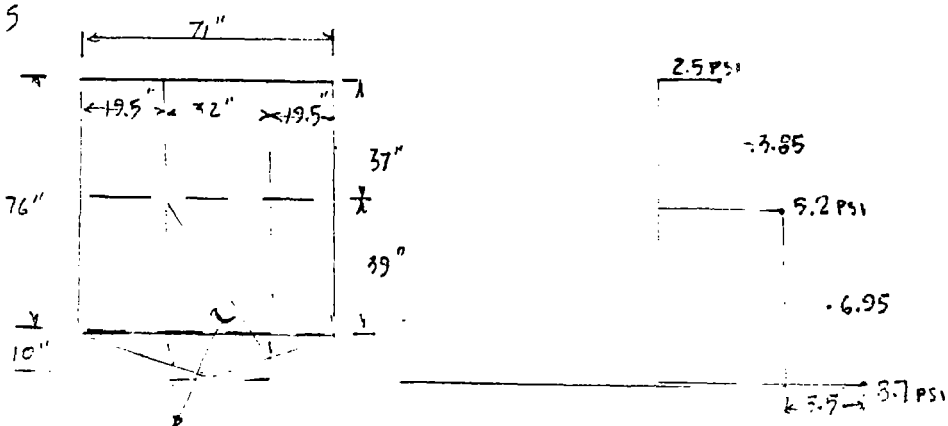


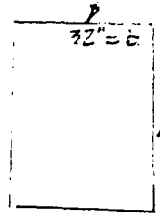
CASE 38 REF. 2

$$t^2 = \frac{\beta W}{23{,}200} = \frac{1.43(1000)}{23{,}200}$$

$t = 0.248''$ vs $0.375''$ AVAIL. O.K.

FOR END PLATES





SAY WORST PANEL

$a/b = 1.53$

FOR 5.2 PSI UNIFORM PRESS

CASE 36, REF. 2

$$t^2 = \frac{\beta p b^2}{23{,}200} = \frac{0.4947(5.2)(32)^2}{23{,}200}$$

$t = 0.31''$

FOR 3.5 TRIANGULAR HYDRO LOAD CASE 39, REF. 2

$$t^2 = \frac{\beta p b^2}{23200} = \frac{.2648(3.5)(32)^2}{23{,}200}$$

$t = .20''$

∴ TOTAL REQ'D $t = .31 + .20 = 0.51$

CLOSE ENOUGH DUE TO CONSERVATIVE LOADING → SAY $0.5'' + 0.125 = 0.625$ USE $5/8''$ PLT

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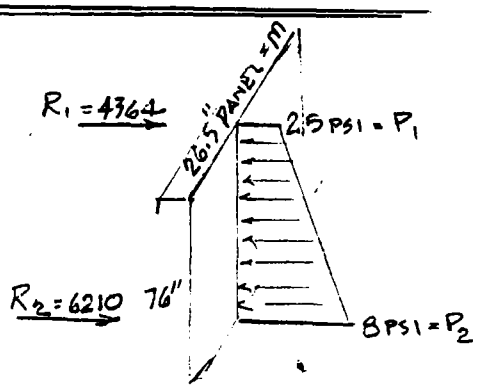
JOB TK-424
SHEET NO. 4 OF 12
CALCULATED BY LFMOUNT DATE 12 SEPT. '00
CHECKED BY DATE
SCALE

STIFFENER SIZE CALS.

FOR VERTICAL SIDE SHELL STIFF. CASE $3D_c$ REF. 1)



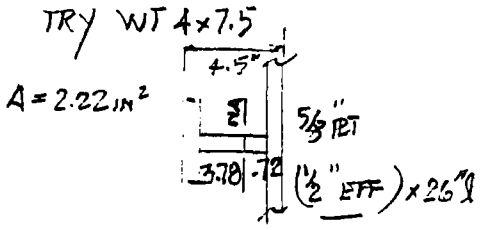
$$M_{OM} = \frac{h^2 m (P_1 + P_2)}{16}$$

$$= \frac{76^2 (26.5)(10.5)}{16}$$

$$= 100{,}448 \text{ IN-LBS}$$

$\therefore$ REQ'D SECT. MOD. $= \frac{100448}{23{,}200} = 4.3 \text{ IN}^3$

TRY WT 4×7.5



PIECE	AREA	d	Ad	Ad^2	I_o
T	2.22	3.5	7.77	27.20	3.28
PLT 1/2×26	13.00	0.25	3.25	0.81	.27
	15.22	0.72 = d	11.02		31.56

$-Ad^2 - 7.89$

23.67 IN^4

$SM_{LESSER} = \frac{23.67}{3.78} = 6.26 > 4.3$ O.K.

FIND REACTIONS @ R_1 & R_2

DUE TO 2.5 PSI UNIFORM LOAD $R_1 = R_2 = \frac{2.5 \times 76 \times 26.5}{2} = 2517.5^{\#}$

DUE TO TRIANGULAR LOAD $R_1 = \frac{5.5(76)26.5}{6} = 1846.2^{\#}$

$R_2 = \frac{5.5(76)26.5}{3} = 3692.3^{\#}$

$\therefore R_1 = 2517.5 + 1846.2 = 4363.7$

$R_2 = 2517.5 + 3692.3 = 6209.8$

10573.5

CK TOTAL LOAD ON PANEL

$\left(\frac{2.5+8}{2}\right) \times 76 \times 26.5 = 10573.5^{\#}$

FOR BOTT. SLOPE STIFF. SPAN = 36.88"

TREAT AS UNIFORM LOADED BEAM (SEE SHT. 2)

$M_{OM} = \frac{wl^2}{8}$ WHERE $w = 8.7 \text{ PSI} \times 26.5 = 230.55 \text{ \#/"}$

$= \frac{230.55(36.88)^2}{8} = 39197 \text{ IN-LBS}$

REQ'D S.M. $= 39197/23200 = 1.69 \text{ IN}^3$

TRY 3×3×1/4 ∠ ON 1/2" PLT

CAL SM $= 3.0 \text{ IN}^3 > 1.69 \text{ IN}^3$ O.K.

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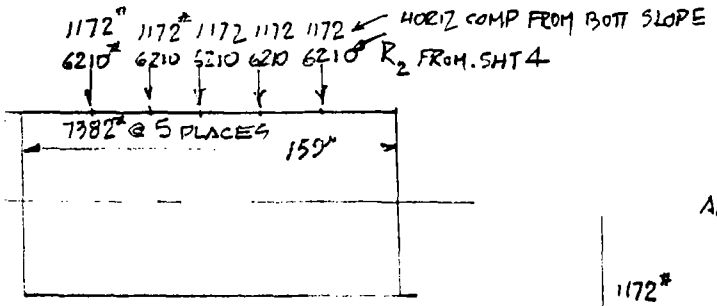
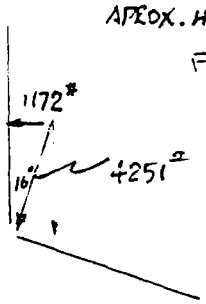
STIFF SIZE CALS. (CON'D)

FOR SIDE ↑ LONG'L. STIFF @ BEND



PLAN AT BOTT. BEND



APPROX. HORIZ COMPONET OF REACTION FROM LOAD ON SLOPED BOTT PLT.

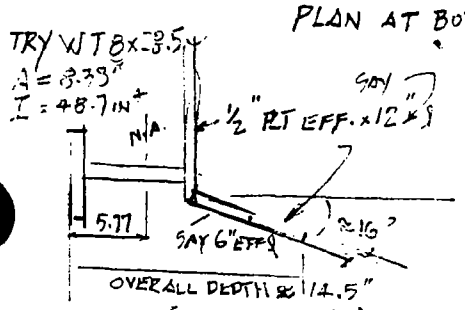
SEE SHT 4

$$\text{REACTION} = \frac{230.55\,\#/\text{IN} \times 36.88''}{2} = 4251\#$$

$$\sin 16^\circ = \frac{\text{HORIZ COMP.}}{4251\#}$$

$$\text{HORIZ COMP} = 4251(.2756) = 1172\#$$

TRY WT8x28.5
A = 8.39"²
I = 48.7 IN⁴

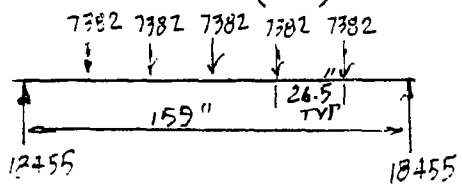


FIND S.M. PROVIDED:

PIECE	AREA	d	Ad	Ad^2	I_o
TEE	8.38	1.94	16.26	31.54	48.7
▯ .5(12)	6.00	8.25	49.5	408.38	—
◺ .5(6)	3.00	11.5	34.5	396.75	—
	17.38	5.77=d	100.26	885.37	
				$-Ad^2$	−578.63
					306.74 IN⁴

GREATER C = 14.5 − 5.77 = 8.73"

$$\therefore \text{S.M. PROVIDED} = \frac{306.74}{8.73} = 35.1\ \text{IN}^3$$



$M_{MAX\ @\ CTR}$

↳ 18455(79.5) − 7382(53) − 7382(26.5)

= 880,304 IN-LBS

$$\text{REQ'D S.M.} = \frac{880304}{23200} = 38\ \text{IN}^3$$

THIS IS O.K SINCE THIS CONSIDERS FULL LENGTH TANK SPAN (159"). IN FACT SUPPORT WILL BE PROVIDED BY I SUPPORT LEG COLUMN AT MID LENGTH.

∴ USE WT8x28.5

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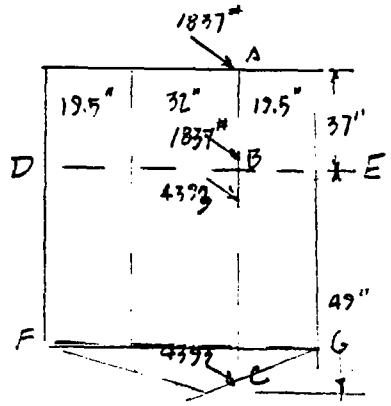
STIFF SIZE. (CON'D)

FOR ENDS



FOR MEMBER A-B PANEL WIDTH $= \frac{32+19.5}{2} = 25.8''$

AVG LOAD = 3.85 PSI (SEE SHT 7)

$w = 3.85(25.8) = 99.3\ \#/''$

$M_{OM} = \frac{wl^2}{8} = \frac{99.3(37)^2}{8} = 16993$ IN-LBS

I/c REQ'D $= \frac{16993}{23{,}200} = 0.73\ IN^3$

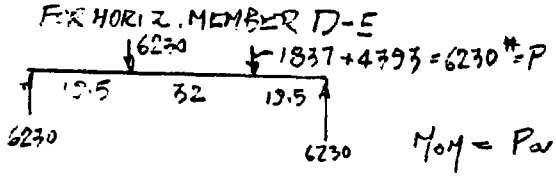
FOR MEMBER B-C

AVG LOAD = 6.95 PSI (SEE SHT 7) $w = 6.95(25.8) = 179.3\ \#/''$

$M = \frac{wl^2}{8} = \frac{179.3(49)^2}{8} = 53812$ IN-LBS

I/c REQ'D $= \frac{53812}{23200} = 2.32\ IN^3$

FOR HORIZ. MEMBER D-E



$M_{OM} = Pa = 6230(19.5) = 121485$ IN-LBS

I/c REQ'D $= \frac{121485}{23{,}200} = 5.24\ IN^3$

FOR HORIZ MEMBER F-G

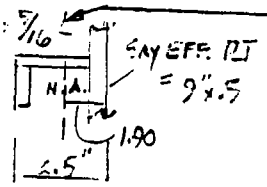
$M_{OM} = 4393(19.5) = 85664$ IN-LBS

I/c REQ'D $= \frac{85664}{23{,}200} = 3.69\ IN^3$

USE ∠ STIFFENERS SO OUTSTANDING LEGS MINIMIZE INTERFERENCES WITH NOZZELS ETC.

FOR MEMBER D-E I/c REQ'D = 5.24

TRY 6×3½×5/16 ∠ — USE FOR D-E & F-G

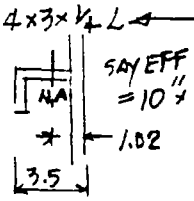


PIECE	AREA	d	Ad	Ad^2	I_o
⊢	2.37	4.5	12.92	58.1	10.9
▯	4.5	.25	1.13	0.3	.1
	7.37	1.90=d	14.05	69.4	

$S.M. = 42.8/4.6 = 9.30\ IN^3 > 5.24$ O.K. $-Ad^2 - 26.6 / 42.8 = I$

FOR MEMBER B-C I/c REQ'D = 2.32 IN³

TRY 4×3×¼ ∠ — USE FOR A-B & B-C



PIECE	AREA	d	Ad	Ad^2	I_o
⊢	1.69	3.3	5.58	18.4	2.77
▯	5.00	.25	1.25	.3	.1
	6.69	1.02	6.83	21.57	

$SM = 14.61/2.48 = 5.89 > 2.32$ O.K. $-Ad^2 - 6.96 / 14.61 = I$

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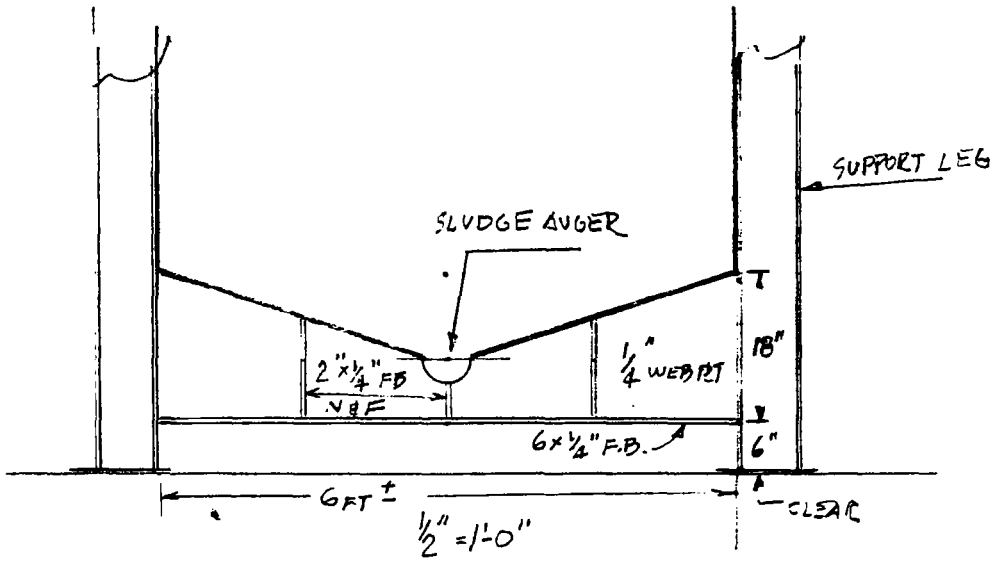
JOB TK-424

SHEET NO. 8 OF 12

CALCULATED BY LFMOUNT DATE 18 SEPT. 00

CHECKED BY _____ DATE _____

SCALE _____



BOTT. SUPPORT @ TANK MID LENGTH

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JOB TK-424
SHEET NO. 9 OF 12
CALCULATED BY L F MOUNT DATE 18 SEPT. 00
CHECKED BY DATE
SCALE

CAPACITY & STEEL WT. ESTIMATE

VOLUME @ 100% FULL:

$13.17' \times 5.92' \times 6.33' = 493.5\ FT^3$

$\frac{.83 \times 5.92}{2} \times 13.17 = 32.4$

$525.9\ FT^3 \times 62.4\ \#/FT^3 \times 2.0 = 65632$ LBS (WT. OF CONTENTS @ 100% FULL)

3934 GALS

EST. STEEL WT:

		LBS.
TOP PLT ½"	$13.33' \times 6.58' \times 20.4\ \#/FT^2$ =	1856
TOP CROSS TIES WT8×20	$5.92' \times 20 \times 2$ =	237
TOP BOUNDING L 4×3×¼	$(13.17 \times 2) + (5.92 \times 2) = 38.2' \times 5.8\ \#/' =$	222
VERT. SIDE PLT (⅝")	$13.17' \times 6.33 \times 25.5 \times 2$ SIDES =	4252
SLOPED BOTT PLT (⅝")	$13.17' \times 3.07' \times 25.5 \times 2$ SIDES =	2062
VERT. SIDE STIFF. WT 4×7.5	$6.33' \times 7.5\ \#/' \times 8$ REQ'D =	350
SLOPED BOTT STIFF. 3×3×¼	$4' \times 4.9\ \#/' \times 8$ REQ'D =	157
BOTT SIDE LONG'L WT 3×28.5	$13.17' \times 28.5 \times 2$ SIDES =	751
END PLT (⅝")	$6.33' \times 5.92' = 37.5\ \square'$	
	$\frac{5.92' \times .83'}{2} = 2.5$	
	$40.0 \times 25.5 \times 2$ ENDS =	2010
END VERT STIFF L 4×3×¼	$6.5' \times 9.8\ \#/' \times 4$ REQ'D =	151
END HORIZ STIFF L 6×3½×5/16	$6.0' \times 9.8\ \#/' \times 4$ REQ'D =	235
BOTT. SUPPORT @ MID LENGTH (SEE SHT. 8)	¼" WEB PLT. $1' \times 6' \times 10.2\ \#/FT^2$	61
	6"×¼" FB $6' \times 5.1\ \#/'$ =	31
	2×¼ FB $5' \times 1.7\ \#/'$ =	8
SLUDGE AUGER PIPE	SAY 6" ϕ SCH 80 $16' \times 28.57\ \#/'$ =	457
METAL AUGER TROUGH	SAY 24" ϕ " $13' \times 125$ =	1625
	STEEL SUB TOTAL THIS SHT.	14525 LBS

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JOB TK-424
SHEET NO. 10 OF 12
CALCULATED BY LFMOUNT DATE 18 SEPT. 00
CHECKED BY DATE
SCALE

WEIGHT EST. (CON'D)

		LBS.
SUB TOTAL FROM SHEET 9	=	14,525
SUPPORT LEGS SAY W8×31 6×8'×31#/'	=	1488
METAL AUGER SCREW:		
6"φ SOLID SHAFT 13'×96.21#/'	=	1251
140 PADDLES @ 15# EA	=	2100
SLUDGE AUGER SCREW ROUGH EST.	≈	1500
		20364 LBS.
ADD 5% FOR MISC. NOZZLES, NUTS/BOLTS, WELD.		36
USE FOR EMPTY TANK WT.	→	22,000 LBS
+		
CONTENTS @ 100% FULL		65600 LBS (FROM SHT. 9)
EST. TOTAL WEIGHT FLOODED	→	87,600 LBS

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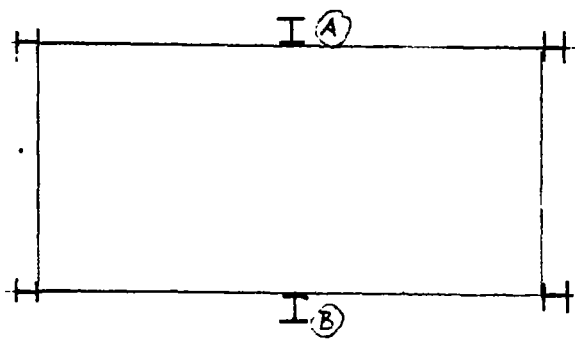
SUPPORT LEG DESIGN



TRY W8x31 (GREQ'D)
$A = 9.13\ in^2$
$S_x = 27.5\ in^3$
$S_y = 9.27\ in^3$
$r_x = 3.47\ in$
$r_y = 2.02\ in$

TOTAL WEIGHT FLOODED = 87600 LBS (FROM SHT. 10)

EST. LOAD TO SUPPORT (A) = $\frac{87600^{\#}}{2} \times .5 = 21900^{\#}$
" " " " (B)

EST LOAD TO EACH CORNER SUPPORT = $\frac{87600^{\#}}{2} \times .25 = 10950^{\#}$

SEISMIC LOAD CONSIDERATIONS

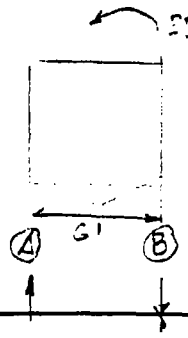
HORIZ LOAD $V = \frac{ZIC}{R_w} \times W$ WHERE $Z = 0.075$ (ASSUME ZONE 1)
$I = 1.0$ FOR TANK
$C = 2.75$
$R_w = 4$ FOR TANKS

$= \frac{0.075(1.0)(2.75)}{4} \times 87600^{\#}$

$= 4517$ LBS

TAKE C.G. OF TANK @ 5' ABV. BASE PLT.

∴ O.T. MOMENT = 4517 (5) = 22585 FT-LBS



ASSUME O.T. MOMENT IS RESISTED BY COLS (A) & (B) ONLY

∴ AXIAL LOAD DUE TO O.T. MOMENT = $\frac{22585}{6} = 3764^{\#}$

TOTAL AXIAL (COMPRESSION) IN MEMBER (A) = 3764
+ 21900 DWT + CONTENTS
25664 = P

$f_a = \frac{P}{A} = \frac{25664}{9.13} = 2811$ PSI

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JOB TK-424
SHEET NO. 12 OF 12
CALCULATED BY LFMOUNT DATE 18 SEPT '00
CHECKED BY _____ DATE _____
SCALE _____

SUPPORT LEG DESIGN (CON'D)

BENDING OF COL. $MOM = \frac{4517 \times 2'}{2 \text{ COLS}} = 4517$ FT-LBS

$f_b = \frac{4517(12)}{9.27 \text{ IN}^3} = 5847$ PSI

WEAK AXIS (CONSERVATIVE)

$Kl/r = \frac{2(24'')}{2.02} = 23.76$

WHERE $F_a = \frac{\left[1 - \frac{(Kl/r)^2}{2C_c^2}\right] F_y}{\frac{5}{3} + \frac{3(Kl/r)}{8C_c} - \frac{(Kl/r)^3}{8C_c^3}}$

$C_c = 126.10$

$= \frac{\left[1 - \overset{.592}{.0018}\right] 36000}{1.67 + .07 - 0}$

$F_a = 20317$ PSI

$\frac{f_a}{F_a} + \frac{f_b}{F_b} \leq 1.0$

$\frac{2811}{20317} + \frac{5847}{23,200}$

$0.14 + .25 = 0.39 \leq 1.0$ O.K.

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(781) 749-5394

6 October 2000

Mr. Agustin Ayon
Clean Harbors Services, Inc.
11800 S. Stony Island Ave.
Chicago, Illinois 60617

Subject: Metal Wash Rinse Tank - 427
Structural Arrangement

Enclosures: 1) Marked up print your dwg. no. 4630-M-16
2) Supporting Calculations (9 shts.)
3) Cardboard plating model

Dear Mr. Ayon,

Enclosures 1),2), & 3) are forwarded herewith for your review and comment. The plate thicknesses shown include 1/8" corrosion allowance.

I had trouble visualizing the intended shape of this tank, thus the model which I hope incorporates the desired features and can be constructed using flat plates. I believe this tank will be difficult to fabricate given the various intersecting surfaces.

I have again followed a somewhat conservative approach in this design due to the intended use which requires support of the bottom auger and a product containing metal pieces. Additional local plate support may be required in way of shell nozzel attachments.

Regarding your preference for angle stiff's in lieu of T's on the Tank 424 design, the WT 4x7.5 vert. side members could be made of 4x4x1/4 angles and the WT 8x28.5 lower horizontal member at the bottom bend could be made of 8x6x1/2 angle with 6" leg pointing down.

Yours truly,

Lee F. Mount

Lee F. Mount

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781

JOB CH CHICAGO METAL RINSE TANK - A27
SHEET NO. 1 OF 9
CALCULATED BY LFMOUNT DATE 4 OCT. '00
CHECKED BY _____ DATE _____
SCALE _____

REF PLAN 4630-M-15

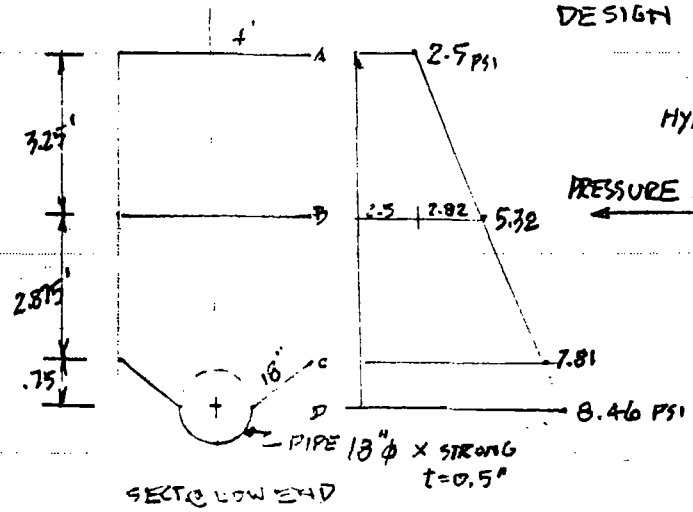
PLATE SIZE CALS.

REFS. 1) LINCOLN ARC WELDING DESIGN OF WELDED STRUCTURES, BLODGETT SECT. 6.5
2) ROARK FORMULAS FOR STRESS & STRAIN
3) AISC MANUAL 8TH ED.

ASSUME ALLOW. STRESS FOR A36 STEEL = 23,200 (PER API 650)

S.G. = 2.0

DESIGN PRESS. = 2.5 PSI



SECT @ LOW END

HYDRO PRESS @ B = $\frac{3.25 \times 62.4 \times 2}{144} = 2.82 + 2.5 = 5.32$ PSI (DESIGN)

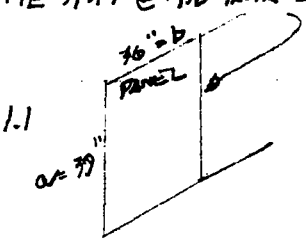
PRESSURE LOADING

@ C = $\frac{6.125 \times 62.4 \times 2}{144} = 5.31 + 2.5 = 7.81$ PSI

@ D = $\frac{6.875 \times 62.4 \times 2}{144} = 5.96 + 2.5 = 8.46$ PSI

FOR VERT SIDE PLATE A-B

ASSUME STIFF @ MID TANK LENGTH



$a/b = \frac{39}{36} = 1.1$

FOR 2.5 PSI UNIFORM PRESS.

CASE 36, REF. 2

$t^2 = \frac{Bpb^2}{23{,}200} = \frac{0.3318 (2.5)(36)^2}{23{,}200}$

$t = 0.22''$

FOR 2.82 TRIANGULAR LOAD

CASE 39, REF. 2

$t^2 = \frac{Bpb^2}{23{,}200} = \frac{0.15 \ldots (36)^2}{23{,}200}$

$t = 0.17''$

$0.22 + 0.17 = 0.39''$

SAY $0.50'' + 0.125$ (CORR. ALLOW) = USE $\frac{5}{8}''$ PLT.

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JOB TK-427
SHEET NO. 2 OF 9
CALCULATED BY L.F MOUNT DATE 4 OCT. '00
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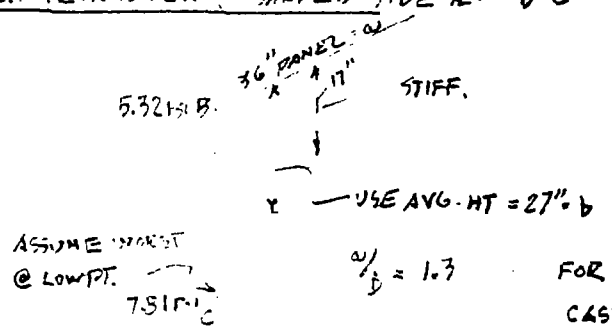
PLATE SIZE CALS (CON'D)

FOR VERT. TRIANGULAR SHAPED SIDE PLT. B-C (APPROX.)

EST LOAD @ 17" STIFF. SAY $\frac{5.32+7.81}{2} \times 36 \times 17 \approx 4000$#

SAY 2000 REACTION @ EA END



FOR 5.32 PSI UNIFORM = P

CASE 36, REF 2

$$t^2 = \frac{\beta P b^2}{23{,}200} = \frac{4146(5.32)(27)^2}{23{,}200}$$

$t = 0.26"$

FOR 2.49 TRIANG. HYDRO = P

CASE 40, REF 2

$$t^2 = \frac{\beta P b^2}{23{,}200} = \frac{0.22(2.49)(27)^2}{23{,}200}$$

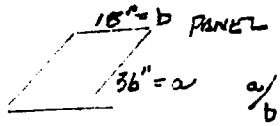
$t = 0.13"$

$\therefore$ REQ'D $t = .26 + .13 = 0.39"$

SAY $0.5" + 0.125"$ (CORR. ALL.) = USE 5/8" PLT.

FOR BOTT SLOPED PLATE C-D (APPROX.)

ASSUME TO BE UNIFORMLY LOADED WITH PRESS = 8.46 PSI (CONSERVATIVE)



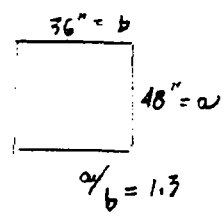
CASE 36, REF 2

$$t^2 = \frac{\beta P b^2}{23{,}200} = \frac{[illegible](8.46)(18^2)}{23{,}200}$$

$t = 0.27"$ [illegible] $.375 + .125$ (CORR. ALL.) = USE 1/2" PLT.

FOR TOP PLATE [illegible] 2 BOLTED SECTIONS

P = 2.5 PSI [illegible] (UNIFORM)



CASE 36, REF 2

$$t^2 = \frac{\beta P b^2}{23{,}200} = \frac{[illegible]}{[illegible]}$$

$t = 0.24"$ [illegible] $.25" + .125$ (CORR.) = USE 3/8" PLT.

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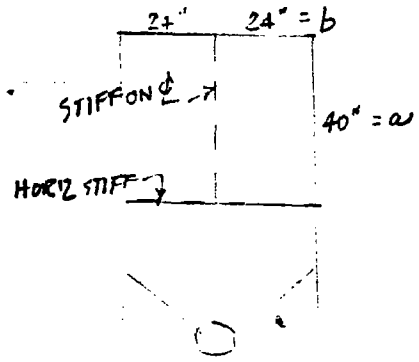
PLATE SIZE CALS. (CON'D)

FOR END PLATES



$a/b = \frac{40}{24} = 1.7$

FOR 2.5 PSI UNIFORM PRESS.
CASE 36, REF 2

$$t^2 = \frac{\beta p b^2}{23{,}200} = \frac{.543(2.5)(24^2)}{23{,}200}$$

$$t = 0.18''$$

FOR 2.82 TRIANGULAR HYDRO
CASE 39, REF 2

$$t^2 = \frac{\beta p b^2}{23{,}200} = \frac{0.29(2.82)(24)^2}{23{,}200}$$

$$t = 0.14''$$

$\therefore$ REQ'D $t = 0.18 + .14 = 0.32''$

→ USE $0.5'' + 0.125 = 5/8''$ RT. TO KEEP SAME AS VERT. SIDES

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JOB TK-427
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CALCULATED BY L F MOUNT DATE 4 OCT. 00
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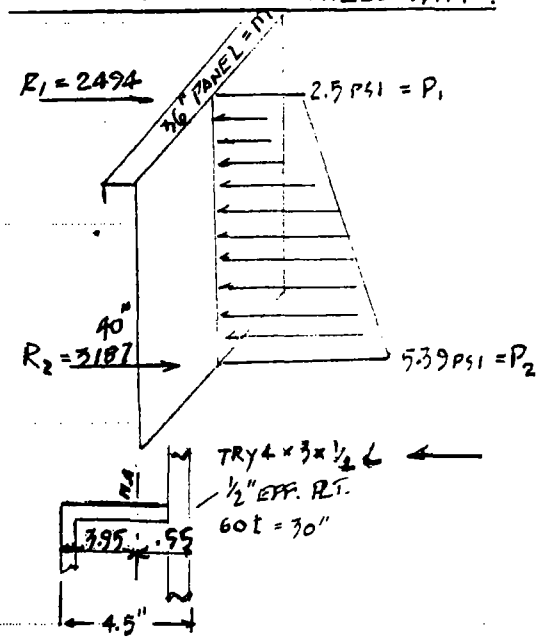
FOR VERTICAL SIDE SHELL STIFF. CASE 3 D_c (REF. 1)



$$M_{OM} = \frac{h^2 m}{16}(P_1 + P_2)$$

$$= \frac{40^2(36)(7.87)}{16} = 28404 \text{ IN-LBS.}$$

$$\therefore \text{REQ'D. SECT. } M_{OM} = \frac{28404}{23{,}200} = 1.22 \text{ IN}^3$$

FIND REACTIONS @ R_1 & R_2

DUE TO 2.5 PSI UNIFORM LOAD $R_1 = R_2 = 1800^{\#}$

DUE TO TRIANGULAR LOAD $R_1 = \frac{2.89 \times 40 \times 36}{6} = 694^{\#}$

$R_2 = \frac{2.89 \times 40 \times 36}{3} = 1387^{\#}$

$\therefore R_1 = 1800 + 694 = 2494^{\#}$

$R_2 = 1800 + 1387 = 3187^{\#}$

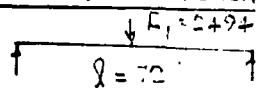
5681

CK TOTAL LOAD ON PANEL $= \frac{2.5 + 5.39}{2} \times 40 \times 36 = 5681^{\#}$

PIECE	AREA	d	Ad	Ad^2	I_o
L	1.69	3.26	5.51	17.96	2.77
PLT	15.0	.25	3.75	.94	.3
	16.69	.55	9.26	21.97	
				$-Ad^2$	5.05
					16.92 IN⁴

$$SM_{LESSER} = \frac{16.92}{3.95} = 4.28 \text{ IN}^3 > 1.22 \text{ REQ'D} \quad \text{O.K.}$$

FOR TOP EDGE BOUNDING ANGLE



$$M_{OM} = \frac{Pl}{4} = \frac{2494(72)}{4} = 44892 \text{ IN LBS}$$

$$SM_{REQ'D} = \frac{44892}{23{,}200} = 1.94 \text{ IN}^3$$

→ TRY 4 x 3 x ½ L on [illegible]

S.M. PROVIDED = 4.14 IN³ > 1.94 O.K.

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FOR LWR SIDE LONG'L. STIFF

R_2 FROM SHT 4 = 3187#
R FROM TRI. PLT STIFF SAY 2000# (FROM SHT 2 CONSERVATIVE)

$l = 72''$

$\therefore P = 3187 + 2000 = 5187^{\#}$

$$MOM = \frac{Pl}{4} = \frac{5187(72)}{4} = 93366 \text{ IN LBS}$$

$$REQ'D\ S.M. = \frac{93366}{23{,}200} = 4.02 \text{ IN}^3$$

USE $4 \times 3 \times \frac{1}{2}''$ L S.M. = 7.6 IN³ > 4.02 IN³ O.K.

FOR TOP CROSS TIE @ MID TANK LENGTH SPAN = 48"

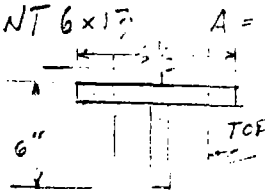
MOM DUE TO 2.5 PSI PRESS

UNIFORM LOAD = 2.5 PSI × 36" = 90 #/" = w

$$MOM = \frac{wl^2}{8} = \frac{90(48)^2}{8} = 25920 \text{ IN-LBS} \quad REQ'D\ SM_{BENDING} = \frac{25920}{23{,}200} = 1.1 \text{ IN}^3$$

TENSILE LOAD = 2494# (FROM SHT 4)

→ TRY WT 6×13 A = 3.82 IN²



SM = 2.40 IN³ T ONLY

FOR T AREA USE $3.82 - [2 \times .75 \times .375]$ (LESS BOLT HOLES)

= 3.25 IN²

$$\therefore f_a = \frac{2494}{3.25} = 767 \text{ PSI}$$

$$f_b = \frac{25920}{2.40} = 10800 \text{ PSI}$$

PER REF 3 FOR [illegible] PRESSES:

$$\frac{f_a}{.6F_y} + \frac{f_b}{[illegible]} \quad [illegible]$$

$$\frac{767}{21600} + \frac{[illegible]}{[illegible]} \quad [illegible] \leq 1.0 \text{ O.K.}$$

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JOB TK-427
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CALCULATED BY LFMOUNT DATE 20CT.'00
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CAPACITY & STEEL WT. ESTIMATE

VOLUME @ 100% FULL:

TOP RECTANGLE $3.92' \times 5.92' \times 3.32' = 77.0\ FT^3$

END AREA @ LOW END

		FT^2
$\frac{4'+1.5'}{2} \times .75'$ HT.	=	2.06
4×2.875	=	11.50
$+ \frac{\pi r^2}{2} = \frac{\pi(.75')^2}{2}$	=	0.88
		14.44 ☐

AREA @ MID LENGTH

$\frac{4+1.5}{2} \times .75'$ HT.	=	2.06
4×1.42	=	5.68
	+	0.88
		8.62 ☐

CLOSE

AVG AREA $= \frac{14.44 + 2.94}{2} = 8.69$ ☐

AREA @ HIGH END

$\frac{4+1.5}{2} \times 0.75'$ HT.	=	2.06
	+	.88
		2.94 ☐

∴ VOL. BELOW TOP RECTANGLE
$= 8.69\ FT^2 \times 5.92' = 51.2\ FT^3$ (SAY 8)

TOTAL VOLUME $= 77.0 + 51.2 = 128.2\ FT^3$

$128.2\ FT^3 \times 62.4\ \#/FT^3 \times 2.0$ (S.G.) $= 15999$ LBS.

959 GALS

WT. OF CONTENTS @ 100% FULL

USE 16,000 LBS

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JOB TK-427
SHEET NO. 7 OF 9
CALCULATED BY LFMOUNT DATE 5 OCT. 00
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SCALE

EST. STEEL WT.

		LBS.
TOP PLT. (3/8") 6.67' × 4.67' × 15.3 #/FT²	=	477
TOP CROSS TIE 4' × 13#/' WTG × 13	=	52
TOP BOUNDING ∠ 4×3×1/4 (6'×2)+(4'×2) = 20' × 5.8#/'	=	116
VERT. SIDE PLT (5/8") TRAPAZOID 4.75' × 6.0' × 25.5#/FT² × 2 SIDES (AVG. HT)	=	1454
SLOPED BOTT PLT (1/2") 1.5' WIDTH × 6.5' L × 20.4 × 2 SIDES	=	398
BOTT. AUGER TROUGH SAY 18"ϕ × STRONG 1/2"t 93#/' / 2 (HALF SECT) × 6.5'	=	302
LWR. BOUNDING ∠ 4×3×1/2 20' × 11.1 #/'	=	222
VERT SIDE STIFF @ MID LENGTH 4×3×1/4 ∠ 5' × 5.8#/' × 2 SIDES	=	58
SLOPED BOTT " " " " " 2' × 5.8#/' × 2 SIDES	=	23
END PLTG (5/8") LOW END 4'×6' = 24 + 1.5×.75/2 × 2 = 1 = 25 ⌀ × 25.5#/FT²	=	638
HIGH END 3.3×4 = 13 + 1 = 14 ⌀ × 25.5#/FT²	=	357
END VERT STIFF ON ⊥ 4×3×1/4 ∠ 3.5' × 5.8#/' × 2 ENDS	=	41
SUPPORT LEGS [illegible] × 15 8.75' × 15#/' × 4	=	525
AUGER ASS [illegible] (ROUGH ESTIMATE) SAY		2000±
		6663 LBS
ADD 5% FOR MISC. FITTINGS, STIFF. WELD	+	337
		7,000# ← USE FOR EMPTY TANK
+ CONTENTS @ 100% FULL		16,000 (FROM SHT. 6)
EST. TOTAL WEIGHT FLOODED ⟹		23,000 LBS

PRODUCT 207-1 NEBS

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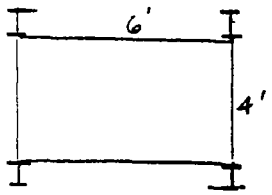
SUPPORT LEG DESIGN



TRY W6x15 $A = 4.43 \text{ in}^2$

$S_x = 9.72 \text{ in}^3$

$S_y = 3.11 \text{ in}^3$

$r_x = 2.56 \text{ in}$

$r_y = 1.46 \text{ in}$

TOTAL WEIGHT FLOODED = 23,000 LBS = W FROM SHT. 7

∴ SAY EA. LEG $= \frac{23,000}{4} = 5750^{\#}$

SEISMIC LOAD CONSIDERATIONS

$$\text{HORIZ. LOAD} Y = \frac{Z\,I\,C}{R_u} \times W$$

WHERE Z = 0.075 (ASSUME ZONE 1)

I = 1.0 FOR TANKS

C = 2.75

R_u = 4 FOR TANKS

$$= \frac{0.075(1)(2.75)}{4} \times 23000^{\#}$$

= 1186 LBS

EST C.G. OF TANK @ 6' ABV. BASE PLT.

∴ O.T. MOMENT = 1186(6) = 7116 FT-LBS

ASSUME O.T. MOMENT IS RESISTED BY 4' COUPLE

∴ AXIAL LOAD DUE TO O.T. MOM. $= \frac{7116}{4 \times 2 \text{ SETS LEGS}} = 890^{\#}$

TOTAL AXIAL (COMPRESSION) = 890#
+5750 DUE TO DWT + CONTENTS
6640#

$$f_a = \frac{6640}{4.43} = 1500 \text{ PSI}$$

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JOB TK-427
SHEET NO. 9 OF 9
CALCULATED BY LFMount DATE 5 OCT. 00
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SUPPORT LEG DESIGN (CON'D)

FOR COLUMN BENDING MOM = 1186# × SAY 5.5' (HIGHEST LEGS) = 6523 FT-LBS / 4 LEGS = 1631 FT-LBS/LEG

$$K\ell/r = \frac{2(66)}{1.46} = 90.4$$

$$\therefore f_b = \frac{1631(12)}{3.11 \text{ IN}^3} = 6293 \text{ PSI}$$

(WEAK AXIS (CONSERVATIVE))

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} \leq 1.0$$

PER REF. 3)

$$\text{WHERE } F_a = \frac{\left[1 - \frac{(K\ell/r)^2}{2C_c^2}\right]F_y}{5/3 + 3\frac{(K\ell/r)}{8C_c} - \frac{(K\ell/r)^3}{8C_c^3}}$$

$C_c = 126.10$ FOR A36 STL

$$= \frac{\left[1 - .26\right]36000}{1.67 + .27 - .05}$$

$F_a = 14095$ PSI

FROM SHT. 9

$$\frac{1500}{14095} + \frac{6293}{23{,}200}$$

$0.11 + 0.27 = 0.38 \leq 1.0$ O.K.

CONCLUDE USE W6x15 FOR LEGS

Minimum Thickness Required for Tanks
ASME Section VIII - Div. 1 Appendix 1

Tanks T - 415 and T - 416 (Assume S.G. = 2.0)
Material of Construction to be Carbon Steel

Maximum Pressure on Tank

$$\frac{62.4 \times 2.0 \times 17.125}{144} = 14.84 \text{ psi}$$

Plus 1 psig Vapor Pressure 1 psi

P = 15.84 psi
Use P= 16.00 psi

Minimum thickness required for shell

$$t = \frac{(P)(Ro)}{(S)(E)+0{,}4(P)} \qquad \frac{1016}{9666.4} = \boxed{0.105"}$$

Where
P=16 psi
Ro=10.583/2 (12)
S=13,800
E=0.7

Minmum thickness required for shell = 0.105"

Tank shell thickness to be 0.5" (0.5">0.105") therefore o.k.

Minimum thickness required ellipsoidal bottom

$$t = \frac{(P)(D)(K)}{2(S)(E)+0{,}2(P)} \qquad \frac{3689.28}{19323.2} = \boxed{0.191"}$$

Where
P=16 psi
D=126
S=13,800
E=0.7
K=1.83

Minmum thickness required for bottom = 0.191"

Tank bottom thickness to be 0.5" (0.5">0.191") therefore o.k.

Tank T - 414 (Assume S.G. = 2.0)

Material of Construction to be Carbon Steel

Maximum Pressure on Tank

$$\frac{62.4 \times 2.0 \times 9.17 =}{144} \qquad 7.95 \text{ psi}$$

Plus 1 psig Vapor Pressure 1 psi

P = 8.95 psi

Use P= 9.00 psi

Minimum thickness required for shell

$$t = \frac{(P)(Ro)}{(S)(E)+0,4(P)} \qquad \frac{486}{9663.6} = \boxed{0.050''}$$

Where P= 9 psi
Ro=9/2 (12)
S=13,800
E=0.70

Minmum thickness required for shell = 0.05"

Tank shell thickness to be 0.25" (0.25">0.05") therefore o.k.

Minimum thickness required ellipsoidal bottom

$$t = \frac{(P)(D)(K)}{2(S)(E)+0,2(P)} \qquad \frac{1778.76}{19321.8} = \boxed{0.092''}$$

Where P=9 psi
D=108
S=13,800
E=0.7
K=1.83

Minmum thickness required for bottom = 0.092"

Tank bottom thickness to be 0.50" (0.50">0.097") therefore o.k.

Tank T - 418 (Assume S.G. = 2.0)

Material of Construction to be 316 Stainless Steel

Minimum Pressure on Tank

$$\frac{62.4 \times 2.0 \times 21.75 =}{144} \qquad 18.85 \text{ psi}$$

Plus 1 psig Vapor Pressure 1 psi

P = 19.85 psi

Use P= 20.00 psi

Minimum thickness required for shell

$$t = \frac{(P)(Ro)}{(S)(E)+0,4(P)} \qquad \frac{845}{15758} = \boxed{0.054"}$$

Where P=20 psi
Ro=7.041667/2 (12)
S=22,500
E=0.70

Minmum thickness required for shell = 0.054"

Tank shell thickness to be 0.25" (0.25">0.054") therefore o.k.

Minimum thickness requiered ellipsoidal bottom

$$t = \frac{(P)(D)(K)}{2(S)(E)+0,2(P)} \qquad \frac{3074.4}{31504} = \boxed{0.097"}$$

Where P=20 psi
D=84
S=22,500
E=0.7
K=1.83

Minmum thickness required for bottom = 0.097"

Tank bottom thickness to be 0.25" (0.25">0.097") therefore o.k.

Tanks T - 417 (Assume S.G. = 2.0)
Material of Construction to be Carbon Steel

Maximum Pressure on Tank

$$\frac{62.4 \times 2.0 \times 24}{144} = 20.80 \text{ psi}$$

Plus 1 psig Vapor Pressure 1 psi

P = 21.80 psi
Use P= 22.00 psi

Minimum thickness requierd for shell

$$t = \frac{(P)(Ro)}{(S)(E)+0,4(P)} \qquad \frac{1386}{9668.8} = \boxed{0.143"}$$

Where
P=22 psi
Ro=10.5/2 (12)
S=13,800
E=0.7

Minmum thickness required for shell = 0.143"

Tank shell thickness = 0.375" (0.375">0.143") therefore o.k.

Building 25	~ Alkaline/Poison/PCB	248
(Unit 25)	~ Acids	136
	~ Flammable	184
	~ Truck Pad	88
	Subtotal	656

C. Proposed/Modified Areas

Building 42	~ Ignitable/Toxic	9
(Unit 42)	Subtotal	9
Shredding Operation	~ Ignitable/Toxic	18
(Unit 24)	Subtotal	18

D. Total -- 2,978 55-gallon drums (163,790 gallons total), or equivalent

V. **FACILITY TOTALS/LICENSE CAPACITY**

A. Containers

2,978	55-gallon drums (162,305 gallons total), or equivalent
29	7,200-gallon bulk highway transporters (208,800 gallons total), or equivalent
2	30,000-gallon railcars (60,000 gallons total), or equivalent
12	30-cubic yard rolloffs (360 cubic yards total), or equivalent

B. Tanks

37 tanks (306,336 gallons total)

5.2.1.3 Building 42: Paint and Paint Related Material Compactor and Storage Area

Item	Number	Time/Quantity		Unit Rate	Item Cost
A. Paint/Paint Related Material Consolidation Preparation (Ignitables and Toxics)					
Labor	1 crew	1 day	1200	$/day	1200
Equipment					
- Vacuum Truck	1 unit	1 day	960	$/day	960
- Miscellaneous	1 unit	1 day	100	$/day	100
Consolidation Subtotal					2260
B. Offsite Transportation/Disposal of Inventory					
Disposal					
- Flammable/Toxic	52 drums	55 gal/dr	3.15	$/gal	9009
- Crushed Drums	52 drums	3 CF/drum	1.68	$/CF	262
- Solids	9 drums	55 gal/dr	5.09	$/gal	2520
Disposal Subtotal					11,791
C. Storage Bay Decontamination					
Labor	1 crew	2 days	1200	$/day	2400
Equipment					
- Steam Cleaner	1 unit	1 day	100	$/day	100
- Miscellaneous	1 unit	1 day	100	$/day	100
Analytical					
- Building 42	1 bay	1 sample	900	$/day	900
Disposal					
- Compactor and Associated Equipment	1 unit	100 CF/unit	1.68	$/CF	168
- Rinsewater	100 gallons	1 unit	1.51	$/gal	151
- Building 42	1 bay	71 gallons	1.51	$/gal	107
Decontamination Subtotal					3926
GRAND TOTAL					17,977

Notes:

1) The containment volume of the Building 42 area is 1,412 gallons. Therefore, the volume of rinsewater is (0.05)(1,412) or 71 gallons.

2) For purposes of closure cost estimation, CHSI shall assume all the drums of solids must be disposed of at a RCRA incinerator. It is assumed that all those drums shall be shipped in their original container.

5.2.3.4 Unit 24: Shredding Operation

Item	Number	Time/Quantity		Unit Rate	Item Cost
A. Tank Consolidation and Disposal					
Labor	1 crew	4 days	1200	$/day	4800
Equipment					
- Vacuum Truck	1 unit	4 days	960	$/day	3840
- Miscellaneous	1 unit	4 days	100	$/day	400
Disposal					
- Hydropulpar Tank	1 tank	3490 gal/tank	3.15	$/gal	10,994
- Flammables/Toxics	18 drums	55 gal/dr	5.09	$/gal	5039
Disposal Subtotal					25,073
B. Process/Handling Area Decontamination					
Labor	1 crew	4 days	1200	$/day	4800
Equipment					
- Steam Cleaner	1 unit	4 days	100	$/day	400
- Miscellaneous	1 unit	4 days	100	$/day	400
Analytical	2 bays	1 sample/bay	900	$/day	1800
Disposal					
- Tank/Equipment	175 gallons	1 tank	1.51	$/gal	264
- Floors/Walls	311 gallons	1 unit	1.51	$/gal	470
Decontamination Subtotal					8134
GRAND TOTAL					33,207

Notes:

1) Per CHSI Dwg. No. 4213, the secondary containment volume of Unit 24 is 6,223 gallons. Therefore, the rinsate volume is (0.05)(6,223) or 311 gallons.

2) The shredding system (tanks, pipelines, etc.) will be adequately decontaminated through a standard wash/rinse procedure, with the amount of rinsewater used/generated per stage based on the volume of the hydropulpar tank. The total rinsewater is (0.05)(3,490) or 175 gallons.

3) For purposes of closure cost estimation, CHSI shall assume all the drums contain solids which must be disposed of at a RCRA incinerator. It is assumed that all drums shall be shipped in their original container.

6.0 Summary of Closure Costs

Using the unit-specific cost estimates calculated in Section 5.1 above, the cost for full closure of the CHSI units in existence as of June 3, 1995 is:

Unit			Unit Cost
5.1.1 Container Storage Units			
5.1.1.1	Unit G1:	Drum Storage Area	40506.
5.1.1.2	Unit R1:	Drum Storage Area	234157.
5.1.1.3	Unit F1:	Lab Pack Pouroff Area	7063.
5.1.1.4	Unit 25:	Container Storage Building	169827.
5.1.1.5	Unit 26:	Ignitable Container Storage Building	70817.
5.1.1.6	Unit 61:	Container Handling Dock	44644.
5.2.1.1	Unit R2:	Drum Storage Area Expansion	118577.
5.1.2 Bulk Solids Storage Units			
5.1.2.1	Unit Q1:	Bulk Container Storage Area	28176.
5.1.2.2	Unit B:	Bulk Solids Storage Pad	63273.
5.1.3 Tank Storage/Processing Units			
5.1.3.1	Unit 43:	Fuels Blending Operation	12498.
5.1.3.2	Unit 16:	Tank Farm	490179.
5.1.4 Transportation Storage/Staging Units			
5.1.4.1	Unit Q:	Truck Unloading Area and Bulking Area	74616.
5.1.4.2	Unit C:	Truck Staging Area	140981.
5.1.4.3	Unit 13:	Railcar Unloading Area	196595.
5.1.4.4	Unit 15:	Truck Unloading Platform	50024.
5.1.4.5	Unit 59:	Truck Staging Area	72857.
5.1.4.6	Unit 62:	Loading/Unloading Area	95967.
5.2.4.1	Unit V:	Truck Loading Dock	73716.
SUBTOTAL			2,004,473.

Using the unit-specific cost estimates calculated in Section 5.2 above, the total cost for full closure of the future CHSI waste management units is:

Unit			Unit Cost
5.2.1 Container Storage Units			
5.2.1.1	Unit R2:	Drum Storage Area Expansion	38814.
5.2.1.2	Unit U:	Lab Pack Repack and Consolidation Area	20294.
5.2.1.3	Building 42:	Paint Compactor Storage	17977.
5.2.2 Bulk Solids Storage Units			
5.2.2.1	Unit Z1:	Rolloff Container for Listed Waste System	12104.
5.2.3 Tank Storage/Processing Units			
5.2.3.1	Unit Y:	Listed Waste Storage Tanks	548819.
5.2.3.2	Unit Z:	Process Building 3	148146.
5.2.3.3	Unit 22:	Tank Farm	151428.
5.2.3.4	Unit 24:	Shredding Operation	33207.
5.2.3.5	Unit 68:	Metalwashing Operation	24235.
5.2.4 Transportation Storage/Staging Units			
5.2.4.2	Unit W:	Truck to Truck Transfer Pad	97669.
5.2.4.3	Unit X:	Listed Waste Loading/Offloading Area	49491.
5.2.4.4	Unit 69:	Truck Loading/Unloading Pad	50073.
SUBTOTAL			1,252,257.

The total cost for full closure of the entire Part B permitted facility (existing plus future hazardous waste management units) is:

5.1	Units in existence as of June 3, 1995	2,004,473.
5.2	Future hazardous waste management units	1,252,257.
	GRAND TOTAL	3,256,730.

Table D-1: Container Management Areas

Type	Container Management Area	Waste Category (See Note 2)	Number/Volume
I. DRUM STORAGE AREAS (55-GALLON DRUMS, OR EQUIVALENT)			
A. Existing Areas			
	Drum Storage Area (Unit G1)	~ Acidic - 1	192
		~ Acidic - 2	96
		~ Alkaline	192
		~ Staging	72
		Subtotal	552
	Drum Storage Area (Unit R1)	~ Oxidizer	96
		~ Reactive	96
		~ Poisons	96
		~ Flammable - 1	160
		~ Flammable - 2	160
		~ Staging (Inbound)	160
		Subtotal	768
	Drum Storage Expansion (Unit R2)	~ Oxidizer	96
		~ Reactive	96
		~ Poisons	96
		Subtotal	288
	Lab Pack Pouroff Station (Unit F1)	~ Alkaline/Acids	8
			8
	Ignitable Container Management Building (Unit 26)	~ Ignitable/PCB	192
		Subtotal	192
	Container Handling Dock (Unit 61)	~ Staging	160
		Subtotal	160
B. Approved/Not Yet Constructed Areas			
	Drum Storage Expansion (Unit R2)	~ Flammable - 3	160
		~ Staging (Outbound)	80
		Subtotal	240
	Lab Pack Repack & Consolidation Area (Unit U)	~ Acid/Alkaline	10
		~ Other	25
		Subtotal	35
	Paint & Paint Related Material Processing Area (Unit 42)	~ Ignitable/Toxic	52
		Subtotal	52

(continued)

Container Management Building	~ Alkaline/Poison	248
(Unit 25)	~ Acids	136
	~ Flammable	184
	~ Truck Pad	88
	Subtotal	656

C. Proposed/Modified Areas

Building 42	~ Ignitable/Toxic	9
(Unit 42)	Subtotal	9
Shredding Operation	~ Ignitable/Toxic	18
(Unit 24)	Subtotal	18

D. Facility Total

-- 2,978 55-Gallon Drums (163,790 gallons total), or equivalent

Table I-1: Closure Units/Maximum Capacity

Hazardous Waste Management Unit		Number/Volume
I. DRUM STORAGE AREAS (BASED ON 55-GALLON DRUMS, OR EQUIVALENT)		
A. Existing Areas		
Indoor Storage Area	~ Acidic - 1	192
Building 2	~ Acidic - 2	96
(Unit G1)	~ Alkaline	192
	~ Staging	72
	Subtotal	552
Outdoor Storage	~ Oxidizer	96
(Unit R1)	~ Reactive	96
	~ Poisons	96
	~ Flammable - 1	160
	~ Flammable - 2	160
	~ Staging (Inbound)	160
	Subtotal	768
Drum Storage Expansion	~ Oxidizer 2	96
(Unit R2)	~ Reactive 2	96
	~ Poisons 2	96
	Subtotal	288
Lab Pack Pour-off Station	~ Alkaline/Acids	8
(Unit F1)	Subtotal	8
Building 26	~ Ignitable	192
(Unit 26)	Subtotal	192
Container Handling Dock	~ Staging	160
(Unit 61)	Subtotal	160
B. Approved/Not Yet Constructed		
Outdoor Storage Expansion	~ Flammable - 3	160
(Unit R2)	~ Staging (Outbound)	80
	Subtotal	240
Lab Pack Building	~ Acid/Alkaline	10
(Unit U)	~ Other	25
	Subtotal	35
Building 42	~ Ignitable/Toxic Paints	52
(Unit 42)	Subtotal	52

(continued)

Building 25	~ Alkaline/Poison	248
	~ Acids	136
	~ Flammable	184
	~ Truck Pad	88
	Subtotal	656

C. Proposed/Modified Areas

Building 42	~ Ignitable/Toxic	9
(Unit 42)	Subtotal	9
Shredding Operation	~ Ignitable/Toxic	18
(Unit 24)	Subtotal	18

D. Total -- 2,978 55-gallon drums (163,790 gallons total), or equivalent

(continued)

Table I-1: Continued

Hazardous Waste Management Unit	Number/Volume
IV. **TANK STORAGE/TREATMENT UNIT**	
A. Existing Tank Storage Units	
Ignitable Liquid Tank Farm	- 9 @ 12,800 gallons - 1 @ 19,600 gallons Total capacity = 134,800 gallons
Fuel Blending Processing System	- 1 dispersion tank @ 1,225 gal. - 1 overflow tank @ 275 gallons Total capacity = 1,500 gallons
B. Approved/Not Yet Construction Tank Storage Units	
Listed Waste Tank Farm	- 6 @ 11,025 gallons - 2 @ 11,025 gallons Total capacity = 88,200 gallons
Listed Wastewater Treatment System	- 1 reactor @ 13,570 gallons - 1 Lamella clarifier @ 1,200 gal. - 1 clarifier collection tank @ 4,100 gallons - 1 sludge conditioning tk @ 3,770 gal. - 2 sand filters @ 750 gallons each - 1 backwash collection tank @ 1,270 gal. - 1 treated effluent tank @ 2,640 gallons - 2 carbon adsportion units @ 1,300 gal. ea. Total capacity = 30,650 gallons
C. Proposed/Modified Tank Storage Units	
Bulk Flammable Liquid Tankfarm	- 2 @ 10,558 gallons - 1 @ 15,547 gallons - 1 @ 6136 gallons Total capacity = 42,799 gallons
Shredding Operation	- 1 @ 3490 gallons
Metalwashing Operation	- 1 @ 3730 gallons - 1 @ 987 gallons Total capacity = 4717 gallons
D. Total -- 306,336 gallons in thirty-seven (37) tanks	

(Continued)

V. **FACILITY TOTALS/LICENSE CAPACITY**

A. Containers

2,978	55-gallon drums (162,305 gallons total), or equivalent
29	7,200-gallon bulk highway transporters (208,800 gallons total), or equivalent
2	30,000-gallon railcars (60,000 gallons total), or equivalent
12	30-cubic yard rolloffs (360 cubic yards total), or equivalent

B. Tanks

37 tanks (306,336 gallons total)

Table 2: Capacity of Existing/Proposed Hazardous Waste Storage/Treatment Units

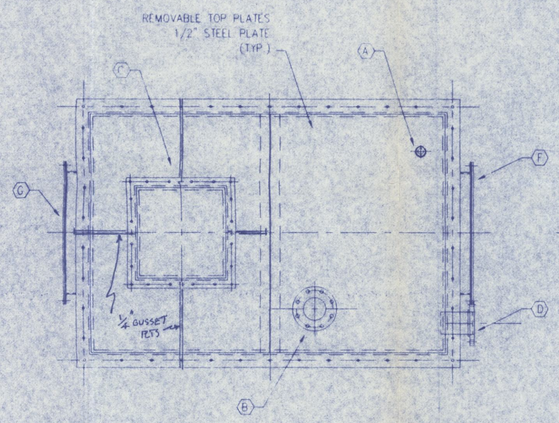
Hazardous Waste Management Unit		Number/Volume
I. DRUM STORAGE AREAS (BASED ON 55-GALLON DRUMS, OR EQUIVALENT)		
A. Existing Areas		
Indoor Storage Area	~ Acidic - 1	192
Building 2	~ Acidic - 2	96
(Unit G1)	~ Alkaline	192
	~ Staging	72
	Subtotal	552
Outdoor Storage	~ Oxidizer	96
(Unit R1)	~ Reactive	96
	~ Poisons	96
	~ Flammable - 1	160
	~ Flammable - 2	160
	~ Staging (Inbound)	160
	Subtotal	768
Drum Storage Expansion	~ Oxidizer - 2	96
(Unit R2)	~ Reactive - 2	96
	~ Poisons - 2	96
	Subtotal	288
Lab Pack Pour-off Station	~ Alkaline/Acids	8
(Unit F1)	Subtotal	8
Building 26	~ Ignitable	192
(Unit 26)	Subtotal	192
Container Handling Dock	~ Staging	160
(Unit 61)	Subtotal	160
B. Approved/Not Yet Constructed		
Outdoor Storage Expansion	~ Flammable - 3	160
(Unit R2)	~ Staging (Outbound)	80
	Subtotal	240
Lab Pack Building	~ Acid/Alkaline	10
(Unit U)	~ Other	25
	Subtotal	35
Building 42	~ Ignitable/toxic	52
(Unit 42)	Subtotal	52

OZZLE SCHEDULE

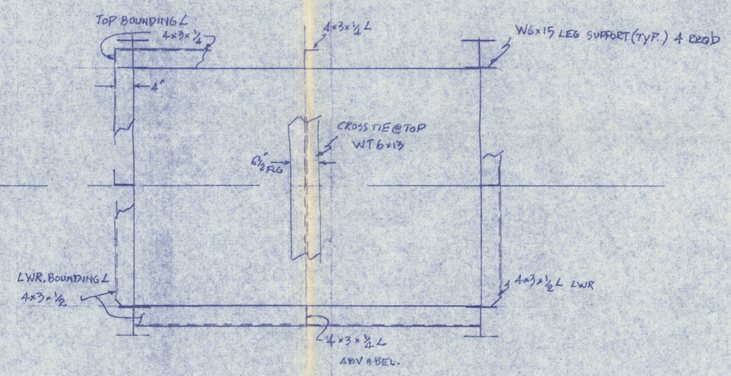
	SERVICE	LOCATION
	VENT	TOP PLATE
	LEVEL CONTROL	TOP PLATE
8"	METAL INLET CONNECTION	TOP PLATE
	LIQUID FILL	SIDE PLATE
	DRAIN	SIDE PLATE
	METAL OUTLET AUGER TROUGH	SIDE PLATE
	SIDE MANWAY	SIDE PLATE

GENERAL NOTES:

1. COMPLETED VESSEL SHALL BE CLEANED OF ALL WELD SPLATTER, SLAG, SCRATCHES, GREASE, OIL AND DIRT.
2. ALL WELDING SHALL BE IN ACCORDANCE WITH STD. WELD DETAILS, AND SHALL BE ACCOMPLISHED BY WELDERS CERTIFIED TO ASME PRESSURE VESSEL CODE, SECTION IX.
3. ALL NOZZLE FLANGES ARE TO BE INSTALLED WITH BOLT HOLES POSITIONED TO STRADDLE MAJOR CENTERLINES.
4. DIMENSIONAL LOCATIONS FOR ALL NOZZLES ARE TO CENTERLINE AND FACE OF FLANGES.
5. EXTERIOR SURFACES SHALL RECEIVE ONE COAT OF RUST INHIBITIVE SHOP PRIMER.
6. NOZZLE ORIENTATION AND ELEVATIONS MAY CHANGE TO SUIT PIPING INSTALLATION.



PLAN



PLAN

DESIGN SPECIFICATIONS

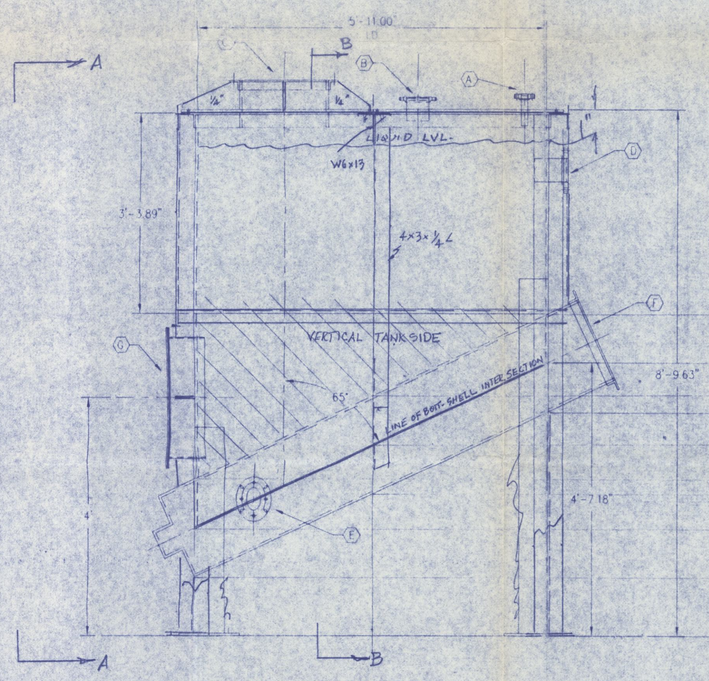
SPECIFIC GRAVITY	2.0
OPERATING PRESSURE	10" W.C
DESIGN PRESSURE	25 psig ?
MIN. DESIGN TEMPERATURE	AMBIENT
MAX. DESIGN TEMPERATURE	200° F
WEIGHTS/VOLUME	
EMPTY VESSEL WEIGHT	~~2,000~~ lbs. 7,000 LBS
LIQUID CAPACITY @ 100% FULL	~~[illegible]~~ lbs. 16,000 LBS
TOTAL WEIGHT (FLOODED)	~~[illegible]~~ lbs. 23,000 LBS
CONSTRUCTION MATERIAL	
TANK AND NOZZLES	CARBON STEEL

ALL TANK PLATING INCLUDES 1/8" CORROSION ALLOWANCE.

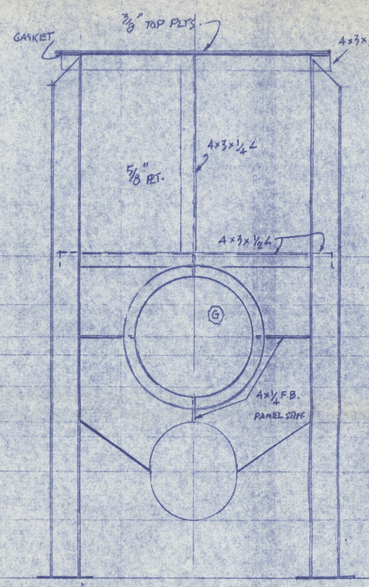
FOR TANK VERT SIDES & ENDS USE 5/8"t

FOR BOTT. SLOPED SECTION USE 1/2"t

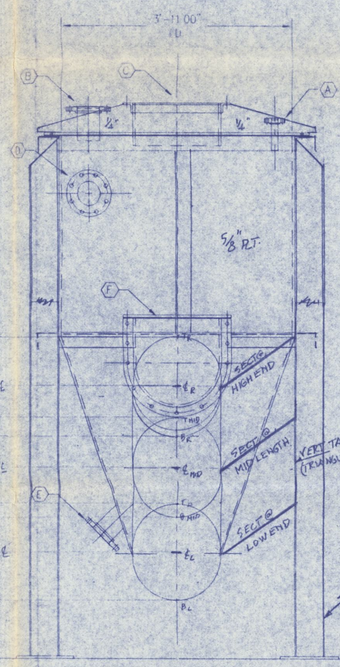
FOR TOP (2 PIECES) USE 3/8"t



ELEVATION



SECT. A-A
3/4" = 1'-0"
@ LOWEND



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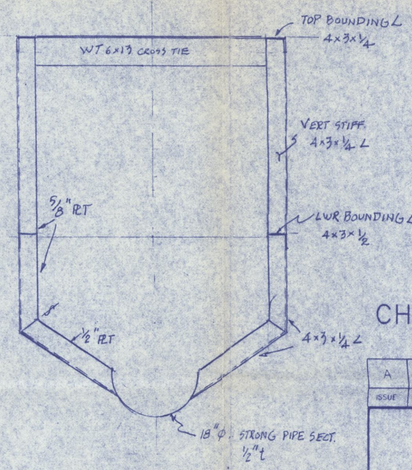


SECT. B-B
3/4" = 1'-0"
@ MIDLENGTH

AMOS TURNER 19471 LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

Amos Turner
EXP. DATE 11-30-2001

MARK UP BY L.F. MOUNT
6 OCT. '00

CHSI DWG. NO. 4298 B

ISSUE	DESCRIPTION	DRAWN	CHKD	APPR	DATE
A	RCRA PERMIT	A.A.A.	A.M.E.		10/16/00

CleanHarbors
ENVIRONMENTAL SERVICES, INC.
1501 Washington Street
Braintree, Massachusetts 02185
Telephone (781) 849-1800

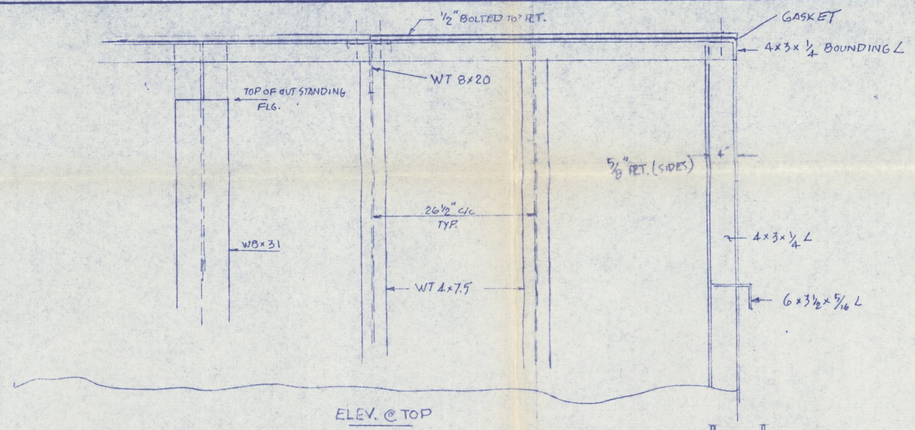
TITLE: CLEAN HARBORS SERVICES, INC.
11800 S. STONY ISLAND AVENUE
CHICAGO, ILLINOIS 60617

METAL WASH RINSE TANK TK-427
VESSEL LAYOUT

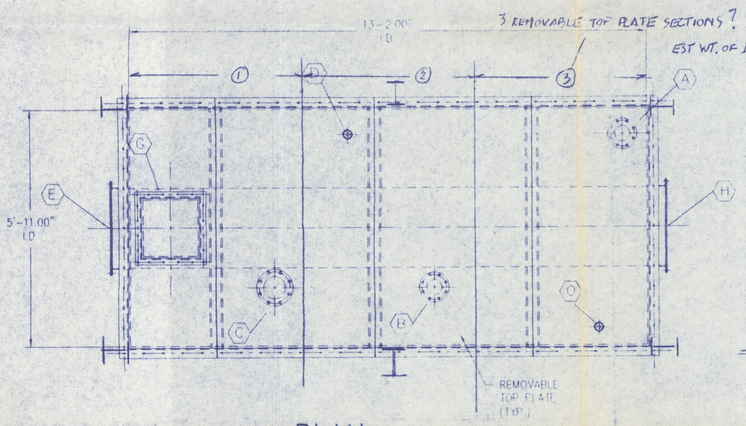
PROJECT NO. CH114630
SCALE 3/4" = 1'-0"
DRAWING NO. 4630-M-16

NOZZLE SCHEDULE

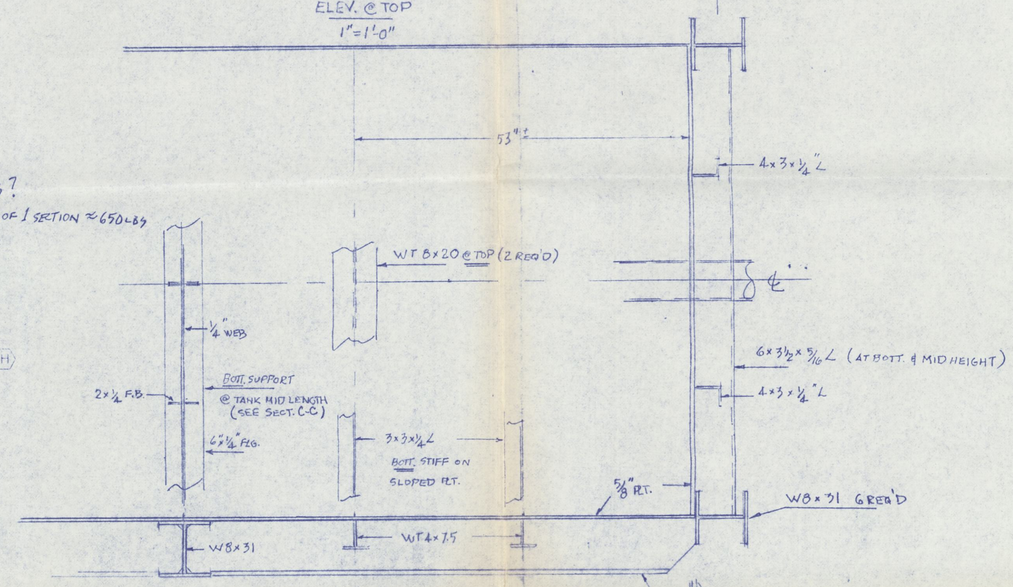
	SERVICE	LOCATION
	FILL DROP TUBE	TOP PLATE
	EMERGENCY VENT	TOP PLATE
	LEVEL SENSOR	TOP PLATE
	NITROGEN SUPPLY	TOP PLATE
	SIDE MANWAY	SHELL
	SAMPLE PORT	SIDE PLATE
18"	METAL INLET CONNECTION	TOP PLATE
	METAL OUTLET AUGER TROUGH	SHELL
	DRAIN	SHELL
	SHAFT SEAL	SIDE PLATE
12"	SLUDGE AUGER ACCESS	AUGER TROUGH
	SLUDGE AUGER TROUGH	AUGER TROUGH
	SLUDGE AUGER DRIVE CONNECTION	AUGER TROUGH
	OXYGEN SENSOR	TOP PLATE

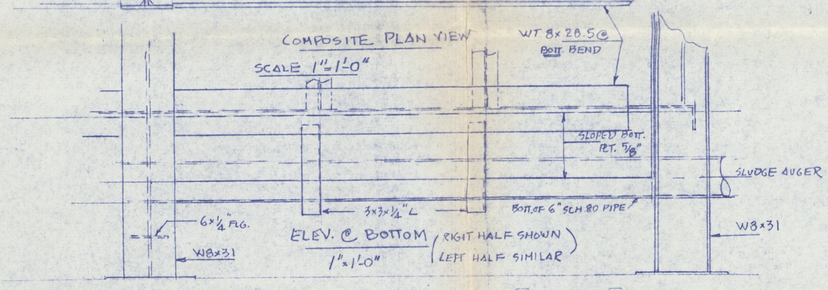


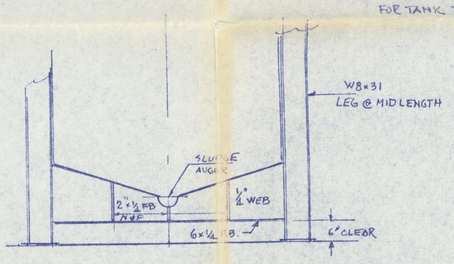
ELEV. @ TOP
1"=1'-0"



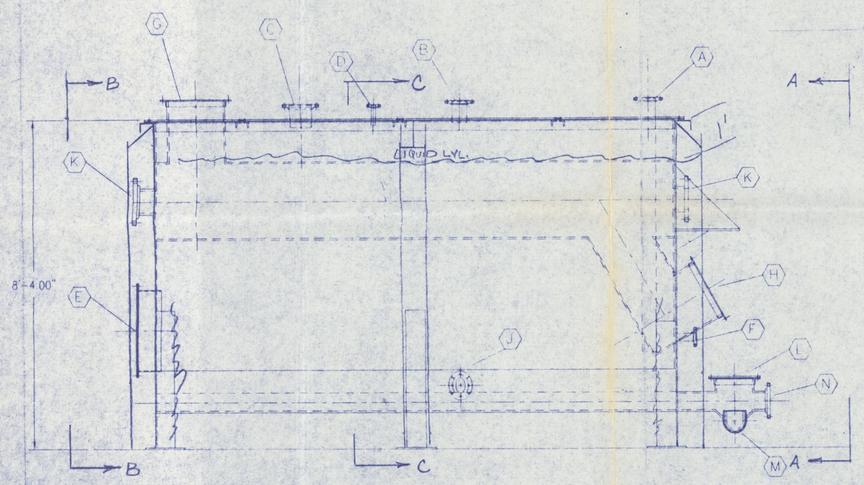
PLAN



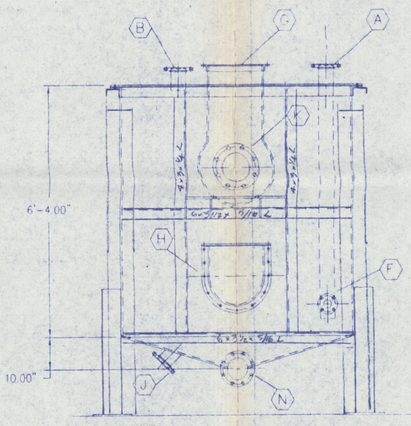




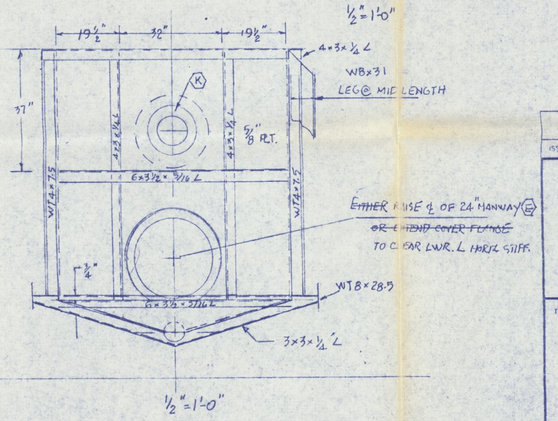
SECT C-C
BOTT. SUPPORT @ TANK MID LENGTH
1/2"=1'-0"



ELEVATION



SECT. A-A



1/2"=1'-0"
SECT. B-B

GENERAL NOTES:

1. COMPLETED VESSEL SHALL BE CLEANED OF ALL WELD SPLATTER, SLAG, SCRATCHES, GREASE, OIL AND DIRT.
2. ALL WELDING SHALL BE IN ACCORDANCE WITH STD. WELD DETAILS, AND SHALL BE ACCOMPLISHED BY WELDERS CERTIFIED TO ASME PRESSURE VESSEL CODE, SECTION IX.
3. ALL NOZZLE FLANGES ARE TO BE INSTALLED WITH BOLT HOLES POSITIONED TO STRADDLE MAJOR CENTERLINES.
4. DIMENSIONAL LOCATIONS FOR ALL NOZZLES ARE TO CENTERLINE AND FACE OF FLANGES.
5. EXTERIOR SURFACES SHALL RECEIVE ONE COAT OF RUST INHIBITIVE SHOP PRIMER.
6. NOZZLE ORIENTATION AND ELEVATIONS MAY CHANGE TO SUIT PIPING INSTALLATION.

DESIGN SPECIFICATIONS

SPECIFIC GRAVITY	2.0
OPERATING PRESSURE	10" W.C.
DESIGN PRESSURE	2.5 psi
MIN. DESIGN TEMPERATURE	AMBIENT
MAX. DESIGN TEMPERATURE	200° F
WEIGHTS/VOLUME	
EMPTY VESSEL WEIGHT	~~9,000~~ lbs. 22,000 LBS
LIQUID CAPACITY @ 100 % FULL	~~50,000~~ lbs. 65,600 LBS
TOTAL WEIGHT (FLOODED)	~~59,000~~ lbs. 87,600 LBS
CONSTRUCTION MATERIAL	
TANK AND NOZZLES	CARBON STEEL

ALL TANK PLATING INCLUDES 1/8" CORROSION ALLOWANCE

FOR TANK SIDES, ENDS, & BOTTOM USE 5/8" t

FOR TANK TOP USE 1/2" t

MARK UP BY L.F. MOUNT
20 SEPT. '00

AMOS TURNER 19471 LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

CHSI DWG. NO. 4297B EXP. DATE 11-30-200

ISSUE	DESCRIPTION	DRWN	CHKD	APPR.	DATE
A	RCRA PERMIT	A.A.A.	A.M.E.		07/18/0

CleanHarbors
ENVIRONMENTAL SERVICES, INC.
1501 Washington Street
Braintree, Massachusetts 02185
Telephone (781) 849-1800

TITLE
CLEAN HARBORS SERVICES, INC.
11800 S. STONY ISLAND AVENUE
CHICAGO, ILLINOIS 60617

METAL WASH TANK TK-424
VESSEL LAYOUT

PROJECT NO CH114630
SCALE 1/2" = 1'-0"
DRAWING NO 4630-M-14

B-16-M-39

XC

AC B2-03

CleanHarbors
ENVIRONMENTAL SERVICES, INC.
11800 SOUTH STONY ISLAND AVENUE • CHICAGO, IL 60617
(773) 646-6202 • FAX (773) 646-6381
Visit our Website at www.cleanharbors.com

Certified Mail #Z345454080

February 23, 2000

Mr. Mark A. Schollenberger, P.E.
Illinois Environmental Protection Agency
Bureau of Land - Permit Section
1021 North Grand Avenue East
Springfield, IL 62794-9276

Dear Mr. Schollenberger:

Clean Harbors Services, Inc. (CHSI) is submitting the original certification and Part A signatures for the Class 3 Permit Modification Request to add a bulk flammable liquid tank farm, addition of a truck loading/unloading pad for two trucks, addition of a hazardous waste shredding system and addition of a metalwashing system.

If you have any questions regarding this submittal, please contact me at (773)646-6202.

Sincerely,

James R. Laubsted
Facility Compliance Manager

RECEIVED
FEB 28 2000
IEPA-BOL
PERMIT SECTION

VI. CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature 1/25/00 Date

Stephen H. Moynihan, Senior Vice President
Clean Harbors Services, Inc.

Signature 2/22/00 Date

Anthony G. Ianello, Executive Director
Illinois International Port District

Please print or type with ELITE type (12 characters per inch) in the unshaded areas only

Form Approved, OMB No. 2050-0034 Expires 10/31/99
GSA No. 0248-EPA-OT

EPA I.D. Number *(Enter from page 1)*	Secondary ID Number *(Enter from page 1)*
IL D000608471	

XV. Map

Attach to this application a topographic map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in this map area. See instructions for precise requirements.

XVI. Facility Drawing

All existing facilities must include a scale drawing of the facility (see instructions for more detail).

XVII. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas (see instructions for more detail).

XVIII. Certification(s)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Owner Signature	Date Signed
Name and Official Title (Type or print) Anthony G. Ianello, Executive Director, IL International Port District - Owner	
Owner Signature	Date Signed 2/22/00
Name and Official Title (Type or print)	
Operator Signature	Date Signed 1/25/00
Name and Official Title (Type or print) Stephen H. Moynihan, Senior Vice President, Clean Harbors Services, Inc.	
Operator Signature	Date Signed
Name and Official Title (Type or print)	

XIX. Comments

See Attached Sheet

Note: Mail completed form to the appropriate EPA Regional or State Office. (Refer to instructions for more information)

B-16-M-39

XC

AE 2-04

CleanHarbors
ENVIRONMENTAL SERVICES, INC.
11800 SOUTH STONY ISLAND AVENUE • CHICAGO, IL 60617
(773) 646-6202 • FAX (773) 646-6381
Visit our Website at www.cleanharbors.com

Via United Parcel Service

February 18, 2000

RECEIVED
FEB 22 2000
IEPA-BOL
PERMIT SECTION

Mr. Mark A. Schollenberger, P.E.
Illinois Environmental Protection Agency
Bureau of Land - Permit Section
1021 North Grand Avenue East
Springfield, IL 62794-9276

Dear Mr. Schollenberger:

Clean Harbors Services, Inc. (CHSI) is submitting one original and three copies of a Class 3 Permit Modification Request for authorization to add a bulk flammable liquid tank farm, addition of a truck loading/unloading pad for two trucks, addition of a hazardous waste shredding system and addition of a metalwashing system.

In accordance with 35 IAC 703.283(b), CHSI has notified each person by mail on the facility's mailing list to announce this modification request. A copy of the notice and facility mailing list are enclosed. In addition, CHSI shall publish a public notice on February 21, 2000 in the Daily Southtown to announce a 60-day public comment period and the date, time and location of a public meeting to be held by CHSI. These required notices will be completed within seven days of the submittal date of this modification request. Proof of the published notice will be submitted to the Agency shortly after publication.

The original certification and Part A signatures will be submitted after the Illinois International Port District signatures are obtained. The tank assessment for Tk-417 will be submitted under separate cover.

If you have any questions regarding this modification request, please contact me at (773)646-6202.

Sincerely,

James R. Laubsted

James R. Laubsted
Facility Compliance Manager

LEGAL NOTICE

Notice is hereby given to all interested persons that Clean Harbors Services, Inc. (CHSI), a wholly-owned subsidiary of Clean Harbors, Inc. and a permitted hazardous waste treatment, storage, and disposal (TSD) facility located at 11800 South Stony Island Avenue in Chicago, IL has filed a Class 3 Permit Modification with the Illinois Environmental Protection Agency (IEPA) for authorization to add a bulk flammable liquid tank farm, addition of a truck loading/unloading pad for two trucks, addition of a hazardous waste shredding system and addition of a metalwashing system. CHSI currently operates under a RCRA Part B permit issued by the IEPA on September 30, 1993. This Class 3 Permit Modification will result in an increase in the facility's permitted container (truck) storage capacity of 14,400 gallons and tank storage capacity of 51,006 gallons.

Pursuant to 35 IAC 703.283(b), CHSI announces a 60 day comment period beginning February 22, 2000 and ending April 22, 2000 during which all interested parties have the opportunity to review the modification request and to submit written comments to the IEPA. CHSI will hold an informational public meeting open to all interested persons to discuss the proposed modification. The meeting will be held on Monday, March 20, 2000 from 7:00-9:00 P.M. at Olive-Harvey College, 10001 S. Woodlawn Avenue, Chicago, IL.

Copies of the modification request are available for review during normal business hours at CHSI's business office at 11800 S. Stony Island Avenue, Chicago, IL, Olive-Harvey College at 10001 S. Woodlawn Avenue, Chicago, IL or at IEPA's office in Springfield, IL. A copy of CHSI's compliance history during the life of its existing permit is available from IEPA. Additional information on the modification request is available by contacting Mr. James R. Laubsted at CHSI, 11800 S. Stony Island Avenue, Chicago, IL 60617, or at (773)646-6202. Information regarding application viewing time and place, CHSI's existing permit, applicable regulatory requirements, permit modification procedures, and CHSI's compliance history may be obtained from Mara McGinnis, IEPA, 1021 North Grand Avenue East, Springfield, IL 62794-9276 or at (217)524-3300.

CleanHarbors
ENVIRONMENTAL SERVICES, INC.
11800 SOUTH STONY ISLAND AVENUE • CHICAGO, IL 60617
(773) 646-6202 • FAX (773) 646-6381
Visit our Website at www.cleanharbors.com

NOTICE

To: Facility Mailing List Addresses

Re: Notice of Class 3 Modification

Notice is given to all interested persons that Clean Harbors Services, Inc. (CHSI), a wholly-owned subsidiary of Clean Harbors, Inc. and a permitted hazardous waste treatment, storage and transfer facility located at 11800 S. Stony Island Avenue in Chicago, IL has filed a Class 3 Permit Modification with the Illinois Environmental Protection Agency for authorization to add a bulk flammable liquid tank farm, addition of a truck loading/unloading pad for two trucks, addition of a hazardous waste shredding system and addition of a metalwashing system.

Pursuant to 35 IAC 703.282, CHSI announces a 60-day comment period beginning February 22, 2000 and ending April 22, 2000 during which all interested parties have the opportunity to review the modification request and submit written comments to the IEPA. CHSI will hold an informational public meeting open to all interested persons to discuss the proposed modification. The meeting will be held on March 20, 2000 from 7:00-9:00 P.M. at Olive-Harvey College, 10001 S. Woodlawn Avenue, Chicago, IL.

Copies of the modification request are available for review during normal business hours at CHSI's business office at 11800 S. Stony Island Avenue in Chicago, IL and at IEPA's office in Springfield, IL. A copy of the application is also available at the Olive-Harvey College Library. A copy of CHSI's compliance history during the life its existing permit is available from IEPA. Information regarding application viewing time and place, CHSI's existing permit, applicable regulatory requirements, permit modification procedures and CHSI's compliance history may be obtained from Ms. Mara McGinnis, IEPA, 1021 North Grand Avenue East, Springfield, IL 62794-9276 or at (217) 524-3300.

This notice is provided to you as an addressee on the CHSI mailing list maintained by IEPA. A copy of the notice will appear in the Daily Southtown by February 22, 2000.

If you have any further questions regarding this notice or the proposed modification, please contact me at (773)646-6202.

Sincerely,

James R. Laubsted
Facility Compliance Manager

CleanHarbors®
ENVIRONMENTAL SERVICES, INC.
11800 SOUTH STONY ISLAND AVENUE • CHICAGO, IL 60617
(773) 646-5111 • FAX (773) 646-0026

September 5, 2000

Mr. Mark A. Schollenberger, P.E.
Illinois Environmental Protection Agency
Bureau of Land - Permit Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

RECEIVED
SEP 11 2000
IEPA-BOL
PERMIT SECTION

Dear Mr. Schollenberger:

This letter is to provide additional information to the Class 3 permit modification request to add a bulk flammable liquid tankfarm, addition of a truck loading/unloading pad for two trucks, addition of a hazardous waste shredding system and addition of a metalwashing system.

Minimum thickness calculations for tanks which are newly permitted under this modification will be submitted under separate cover when the P.E. certification is completed.

Also enclosed is Appendix D-10 which should have been included as Attachment 34 in the original application.

CHSI has modified Drawing No. 4630-M-17 (CHSI DWG. NO. 4287) adding note 7 reflecting concrete piers which must be relocated and secondary contanment calculations. The floor arrangement of waste containers has not changed. This drawing is included, but Professional Engineer certified copies will be sent under separate cover.

The application incorrectly stated secondary containment calculations for Unit 68 were included in Attachment 20. These calculations are on Drawing No. 4630-M-17 (CHSI DWG. NO. 4287.

In Attachment 32 of the application, CHSI described removing covers from containers as they are loaded onto the elevator for the shredding operation. For clarification, the covers are removed to remove the drum lid rings. The drums are then closed with the cover or a plastic covering to control emissions.

A P.E. certification that the tanks in the existing tankfarm are suitable for use with the new shredder will be

sent under separate cover.

The water based fire system in Building 42 will be upgraded to a foam/water system under this modification.

The shredding system can take containers larger than 55-gallons including drums, cubic yard boxes, and plastic tote tanks (including those with wire mesh). The shredding system will not handle tote tanks made entirely of metal.

Enclosed are Drawing Nos. 4630-F-02 and 2916-F-08 highlighting points for Subpart BB and CC monitoring. Several tables detailing monitoring requirements are also included.

P.E. assessment of the existing tank Tk-417 will be included under separate cover.

If you have any further questions concerning this letter, please contact me at (773) 646-6202, x233.

Sincerely,

James R. Laubsted
Facility Compliance Manager

RECEIVED
SEP 11 2000
IEPA-BOL
PERMIT SECTION

CleanHarbors
ENVIRONMENTAL SERVICES, INC.
11800 SOUTH STONY ISLAND AVENUE • CHICAGO, IL 60617
(773) 646-5111 • FAX (773) 646-0026

September 5, 2000

Mr. Mark A. Schollenberger, P.E.
Illinois Environmental Protection Agency
Bureau of Land - Permit Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

RECEIVED
SEP 1 1 2000
PERMIT SECTION

Dear Mr. Schollenberger:

This letter is to provide documentation to the Illinois Environmental Protection Agency that The Illinois International Port District has reviewed the Clean Harbors Services, Inc.'s September 5, 2000 additional information to the Class 3 Permit Modification Request to add a bulk flammable liquid tankfarm, addition of a truck loading/unloading pad for two trucks, addition of a hazardous waste shredding system and addition of a metalwashing system.

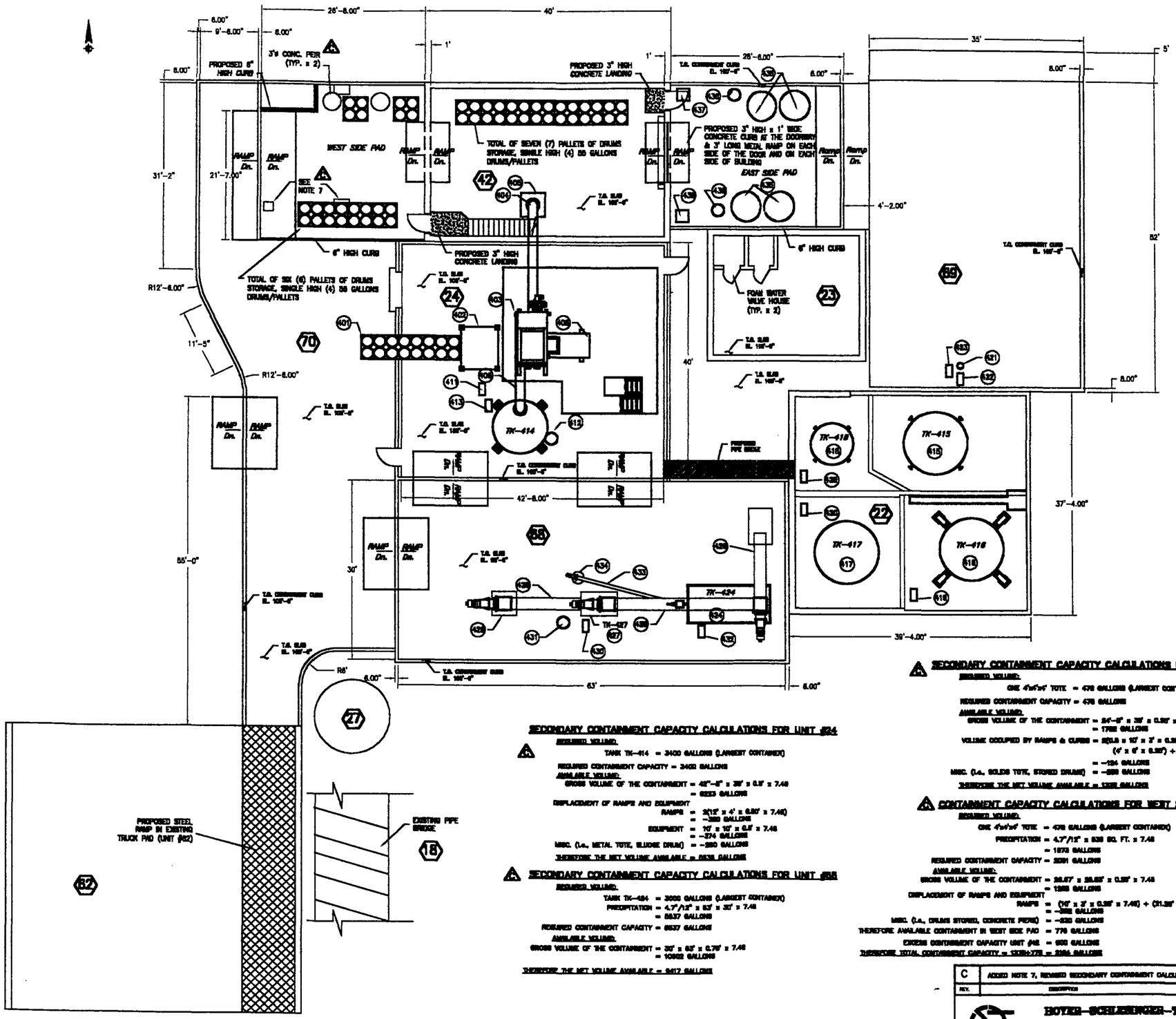
As site owner of the property Clean Harbors Services, Inc. leases, the Illinois International Port District does not object to this Class 3 Permit Modification Request.

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

James R. Laubsted
Facility Compliance Manager
Clean Harbors Services, Inc.

Anthony G. Ianello
Executive Director
Illinois International
Port District



ITEM NO.	QTY.	DESCRIPTION
401	1	DRUM FEED ROLLER CONVEYOR
402	1	DRUM LIFT
403	1	DUAL SHREDDER PACKAGE UNIT CONTAINING AIRLOCK CHAMBER, DRUM RAM, PRIMARY SHREDDER WITH HYDRAULIC RAM, SECONDARY SHREDDER AND ROTARY MAGNET
404	1	NON-DISPERSABLE SOLIDS AUGER
405	1	4'x4' NON-DISPERSABLE SOLIDS COLLECTION HOPPER W/SCISSOR LIFT OR EQUAL
406	1	DISPERSABLE LIQUIDS/SOLIDS AUGER
407	1	4'x4' DEBRIS COLLECTION TOTE/HOPPER W/SCISSOR LIFT OR EQUAL
408	1	VIBRATORY SHAKER SCREEN-MODEL KSMRO-36-HOOT
409	1	SLUDGE COLLECTION DRUM W/SCISSOR LIFT OR EQUAL
410	1	METAL COLLECTION DRUM W/SCISSOR LIFT OR EQUAL
411	1	200 GPM POSITIVE DISPLACEMENT PUMP
412	1	NON-DISPERSABLE DEBRIS COLLECTION DRUM
413	1	200 GPM GRINDER PUMP
414	1	3400 GALLONS HYDRAULIFER TK-414
415	1	10,000 GALLONS BLENDED WASTE STORAGE TANK TK-415
416	1	10,000 GALLONS BLENDED WASTE STORAGE TANK TK-416
417	1	15,000 GALS. DILUENT WASTE STORAGE TANK TK-417
418	1	6,000 GALS. METAL WASH SOLVENT TANK TK-418
419	1	150 GPM BLENDED WASTE TRANSFER PUMP
420	1	150 GPM DILUENT FEED/TRANSFER PUMP
421	1	INLINE STRAINER
422	1	200 GPM RECEIVING PUMP
423	1	DRUM WASTE CONSOLIDATION PUMP
424	1	3,000 GALS. METAL WASH TANK TK-424
425	1	100 GPM METAL WASH SOLVENT FEED PUMP
426	1	METAL WASH METAL FEED AUGER
427	1	600 GALS. RINSE TANK TK-427
428	2	METAL TRANSFER AUGERS
429	1	4'x4' WASHED METAL COLLECTION TOTE W/SCISSOR LIFT OR EQUAL
430	1	50 GPM RINSATE TRANSFER PUMP
431	1	RINSATE COLLECTION DRUM
432	1	150 GPM BRINE SOLUCHE - TRANSFER PUMP
433	1	SLUDGE TRANSFER AUGER
434	1	SLUDGE COLLECTION DRUM W/SCISSOR LIFT OR EQUAL
435	4	1000 lbs. GRANULATED ACTIVATED CARBON VESSELS
436	2	SMOKE-OUT DRUMS
437	1	300 SCFM BLOWER
438	1	200 SCFM BLOWER
439	1	150 GPM DILUENT FEED/TRANSFER PUMP LOCATED IN EXISTING TANK FARM (SEE CHSI DWG. NO 4283)

NOTES:

1. BUILDING #42 AND THE TWO ADJOINING CONCRETE PADS ARE EXISTING.
2. WEST END CONCRETE PAD AND THE BUILDING FLOOR WILL BE SEALED AS NECESSARY AND COATED WITH PROTECTO-CRETE 500, TROWEL APPLIED VINYL ESTER COATING, AS MANUFACTURED BY DUDICK, INC. OR EQUIVALENT.
3. STORAGE AREAS WILL BE USED FOR THE STORAGE OF CONTAINERS LIKE FLEX BINS AND 55 GALLON DRUMS.
4. ITEM NO.S 408 & 410 ARE NOT SHOWN. THEY ARE LOCATED UNDER ITEM NO. 408
5. ITEM NO. 407 IS NOT SHOWN IT IS LOCATED UNDERNEATH ITEM NO. 403
6. CONTAINMENT CAPACITY CALCULATIONS:

   UNIT #86 SEE CHSI DWG. NO. 4282
   UNIT #82 SEE CHSI DWG. NO. 4281

7. REMOVE EXISTING PIPE RACK CONCRETE PIERS TO BE RELOCATED AS SHOWN

SECONDARY CONTAINMENT CAPACITY CALCULATIONS FOR UNIT #24

REQUIRED VOLUME:

TANK TK-414 = 3400 GALLONS (LARGEST CONTAINER)

REQUIRED CONTAINMENT CAPACITY = 3400 GALLONS

AVAILABLE VOLUME:

GROSS VOLUME OF THE CONTAINMENT = 42'-8" x 26' x 0.5' x 7.48
= 6233 GALLONS

DISPLACEMENT OF RAMPS AND EQUIPMENT

RAMPS = 2(12' x 4' x 0.50' x 7.48)
= -359 GALLONS

EQUIPMENT = 10' x 10' x 0.5' x 7.48
= -374 GALLONS

MISC. (i.e., METAL TOTE, SLUDGE DRUM) = -280 GALLONS

THEREFORE THE NET VOLUME AVAILABLE = 5218 GALLONS

SECONDARY CONTAINMENT CAPACITY CALCULATIONS FOR UNIT #86

REQUIRED VOLUME:

TANK TK-424 = 3000 GALLONS (LARGEST CONTAINER)

PRECIPITATION = 4.7"/12" x 63' x 37' x 7.48
= 5537 GALLONS

REQUIRED CONTAINMENT CAPACITY = 5537 GALLONS

AVAILABLE VOLUME:

GROSS VOLUME OF THE CONTAINMENT = 30' x 63' x 0.75' x 7.48
= 10922 GALLONS

THEREFORE THE NET VOLUME AVAILABLE = 5417 GALLONS

SECONDARY CONTAINMENT CAPACITY CALCULATIONS FOR UNIT #42

REQUIRED VOLUME:

ONE 4'x4'x4' TOTE = 476 GALLONS (LARGEST CONTAINER)

REQUIRED CONTAINMENT CAPACITY = 476 GALLONS

AVAILABLE VOLUME:

GROSS VOLUME OF THE CONTAINMENT = 84'-8" x 38' x 0.50' x 7.48
= 1788 GALLONS

VOLUME OCCUPIED BY RAMPS & CURBS = 2(0.5 x 10' x 2' x 0.50') +
(4' x 6' x 0.50') + (4' x 3' x 0.50') x (7.48)
= -134 GALLONS

MISC. (i.e., SOLIDS TOTE, STORED DRUMS) = -350 GALLONS

THEREFORE THE NET VOLUME AVAILABLE = 1328 GALLONS

CONTAINMENT CAPACITY CALCULATIONS FOR WEST SIDE PAD

REQUIRED VOLUME:

ONE 4'x4'x4' TOTE = 476 GALLONS (LARGEST CONTAINER)

PRECIPITATION = 4.7"/12" x 638 SQ. FT. x 7.48
= 1873 GALLONS

REQUIRED CONTAINMENT CAPACITY = 2351 GALLONS

AVAILABLE VOLUME:

GROSS VOLUME OF THE CONTAINMENT = 26.67' x 26.67' x 0.50' x 7.48
= 1396 GALLONS

DISPLACEMENT OF RAMPS AND EQUIPMENT

RAMPS = (10' x 2' x 0.50' x 7.48) + (21.33' x 5.67' x 0.50' x 7.48)
= -532 GALLONS

MISC. (i.e., DRUMS STORED, CONCRETE PIERS) = -320 GALLONS

THEREFORE AVAILABLE CONTAINMENT IN WEST SIDE PAD = 776 GALLONS

EXCESS CONTAINMENT CAPACITY UNIT #42 = 600 GALLONS

THEREFORE TOTAL CONTAINMENT CAPACITY = 1376+776 = 2152 GALLONS

REV.	DESCRIPTION
C	ADDED NOTE 7, REVISED SECONDARY CONTAINMENT CALCULATIONS

BOYER-SCHLESINGER-TURNER, INC.
CONSULTING-ENGINEERS
205 WEST ADAMS STREET CHICAGO, ILLINOIS 60606
PHONE: 726-0

DO NOT SCALE

08/28/00

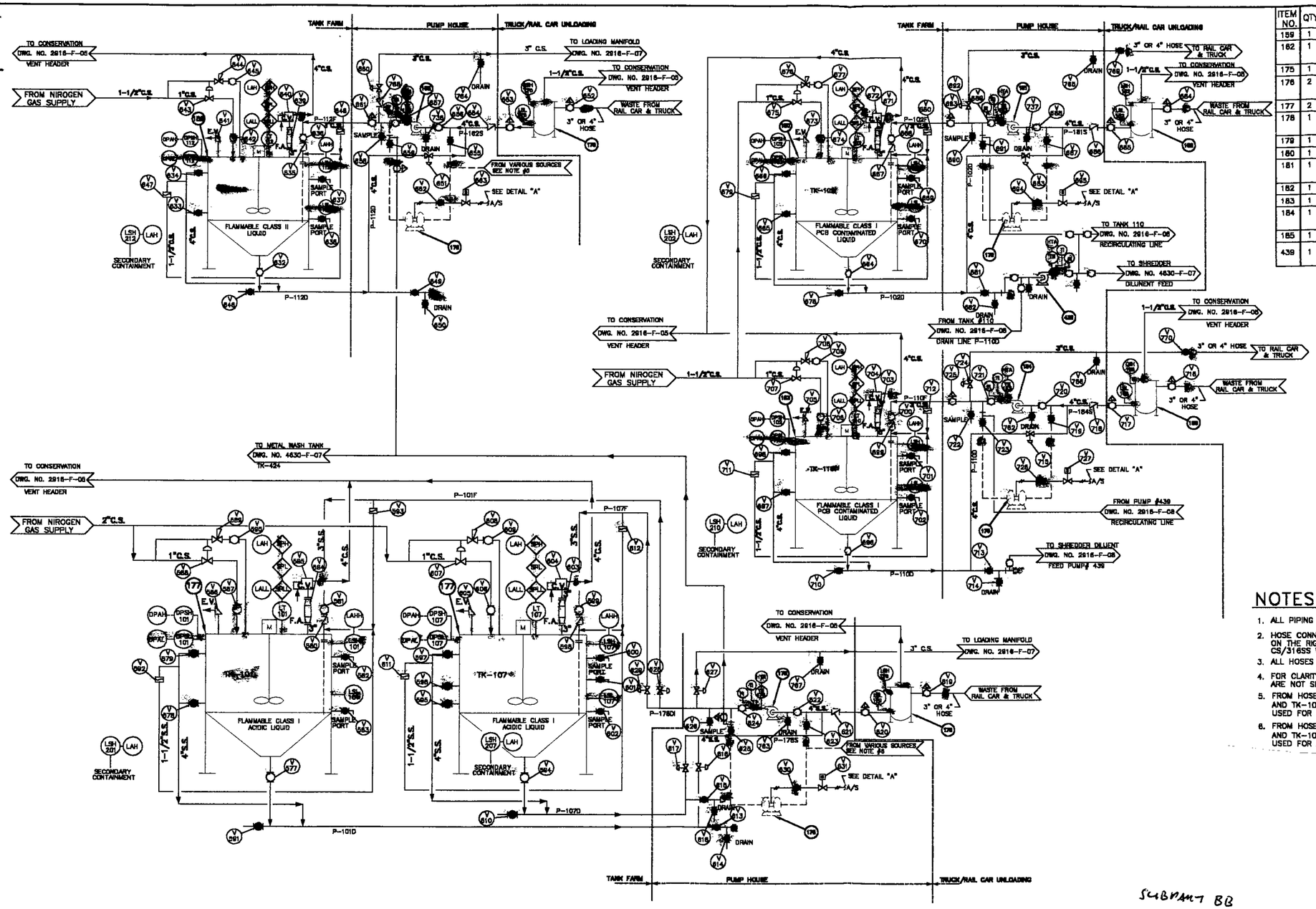
CHSI DWG. NO. 4287

REV.	DESCRIPTION	DRN.	CHKD.	APPR.	DATE
C	RCRA PERMIT	A.A.A.	A.M.L.		08/28/00
B	RCRA PERMIT	A.A.A.	A.M.L.		08/08/00
A	RCRA PERMIT	A.A.A.	A.M.L.		08/08/00

CleanHarbors
ENVIRONMENTAL SERVICES, INC.
1501 Washington Street
Braintree, Massachusetts 02185
Telephone (781) 848-1800

TITLE: CLEAN HARBORS SERVICES, INC.
11800 S. STONY ISLAND AVE.
CHICAGO, ILLINOIS 60617
SHREDDING PROCESS EQUIPMENT LAYOUT

PROJECT NO. CH114630
SCALE 1/8"=1'-0"
DRAWING NO. 4630



ITEM NO.	QTY.	DESCRIPTION
159	1	19,600 GAL. IGNITABLE WASTE STORAGE TANK – TK-112
162	1	200 GPM RECEIVING PUMP. HORIZONATAL CENTRIFUGAL PUMP WITH OPEN IMPELLER. IRON CONSTRUCTION. DOUBLE MECH SEAL WITH BARRIER FLUID.
175	1	STRAINER FOR TRANSFER PUMP, ITEM #162
176	2	200 GPM PORTABLE TRANSFER PUMP. AIR OPERATED DOUBLE DIAPHRAGM PUMP. CAST IRON HOUSING WITH VITON DIAPHRAGMS.
177	2	12,800 GAL. ACIDIC/IGNITABLE WASTE STORAGE TANK (TK-101 & TK-107)
178	1	200 GPM RECEIVING PUMP. HORIZONATAL CENTRIFUGAL PUMP WITH OPEN IMPELLER. SS316 CONSTRUCTION. DOUBLE MECH SEAL WITH BARRIER FLUID.
179	1	STRAINER FOR TRANSFER PUMP, ITEM #178
180	1	12,800 GAL. PCB WASTE STORAGE TANK – TK-102
181	1	200 GPM RECEIVING PUMP. HORIZONATAL CENTRIFUGAL PUMP WITH OPEN IMPELLER. IRON CONSTRUCTION. DOUBLE MECH SEAL WITH BARRIER FLUID.
182	1	STRAINER FOR TRANSFER PUMP, ITEM #181
183	1	12,800 GAL. PCB WASTE STORAGE TANK – TK-110
184	1	200 GPM RECEIVING PUMP. HORIZONATAL CENTRIFUGAL PUMP WITH OPEN IMPELLER. IRON CONSTRUCTION. DOUBLE MECH SEAL WITH BARRIER FLUID.
185	1	STRAINER FOR TRANSFER PUMP, ITEM #184
439	1	150 GPM DILUENT FEED/TRANSFER PUMP FOR PROPOSED SHREDDING SHREDDING SYSTEM

NOTES:

1. ALL PIPING IS CARBON STEEL UNLESS OTHERWISE SPECIFIED.
2. HOSE CONNECTIONS ARE MADE WITH QUICK COUPLING WITH A VALVE ON THE RIGID PIPE SIDE. [illegible] AND [illegible] ARE CS/316SS W/PTFE GASKET.
3. ALL HOSES ARE CHEMICAL RESISTANT REINFORCED RUBBER.
4. FOR CLARITY [illegible] AND [illegible] CONNECTIONS ARE NOT SHOWN.
5. FROM HOSE CONNECTION OF DRAIN MANIFOLD OF TANKS #TK-101, TK-107, TK-109 AND TK-103 THRU TK-106. FOR TANK TO TANK TRANSFER. THIS CONNECTION TO BE USED FOR ADDITION OF ANTIFOAM AND IMULSIFIER AGENTS INTO THE TANK.
6. FROM HOSE CONNECTION OF DRAIN MANIFOLD OF TANKS #TK-112, TK-109 AND TK-103 THRU TK-106. FOR TANK TO TANK TRANSFER. THIS CONNECTION TO BE USED FOR ADDITION OF ANTIFOAM AND IMULSIFIER AGENTS INTO THE TANK.

LEGEND

- HAND OPERATED ON-OFF VALVE (NORMALLY OPEN)
- HAND OPERATED ON-OFF VALVE (NORMALLY CLOSED)
- HAND OPERATED ON-OFF VALVE WITH REMOTE POSITION INDICATOR
- SWING CHECK VALVE
- AIR ACTUATED VALVE
- SOLENOID VALVE
- SELF PRESSURE REGULATING VALVE
- M — MIXER
- INDICATES DIRECTION OF FLOW
- HOSE CONNECTION

AOV	AIR OPERATED VALVE
A/S	AIR SUPPLY
C.V.	CONSERVATION VENT (PRESSURE & VACUUM)
E.V.	EMERGENCY VENT FOR PRESSURE RELIEF
F.A.	FLAME ARRESTER
C.S.	CARBON STEEL
S.S.	STAINLESS STEEL
DPSH	DIFFERENTIAL PRESSURE SWITCH L-LOW & H-HIGH
DPAL	LOW PRESSURE ALARM
DPAH	HIGH PRESSURE ALARM
LAH	LEVEL ALARM HIGH
LAHH	LEVEL ALARM HIGH-HIGH
LALL	LEVEL ALARM LOW-LOW
LSH	LEVEL SWITCH HIGH
LSL	LEVEL SWITCH LOW
LT	LEVEL TRANSMITTER – CONTINUOUS
	SET POINT – LL (LOW-LOW LEVEL) – L (LOW LEVEL) – H (HIGH LEVEL)
TI	TEMPERATURE INDICATOR
HTA	HIGH TEMPERATURE ALARM
	SAFETY PRESSURE RELIEF
	SAFETY PRESSURE RELIEF VALVE
	PORTABLE AIR OPERATED DOUBLE DIAPHRAGM PUMP
	CENTRIFUGAL PUMP
PI	PRESSURE INDICATOR

SUBPART BB

SUBPART CC

REV.#	REVISION NOTES
1	ADDED PIPING CONNECTION FOR PROPOSED SHREDDING PROCESS AREA AND PUMP #439
0	AS BUILT
C	ADDE PRESSURE INDICATORS. DRAIN VALVES. REVISE NITROGEN SUPPLY PIPING SIZE
B	ADDED SAFETY RELIEF INFO., ADDED "HTA" AND RELOCATED "TI", REVISED LEGEND, CORRECTED VALVE DESIGNATIONS, IDENTIFIED VALVES WITH POSITION INDICATORS, ADDED PIPE NUMBERS, ADDED SECOND SAMPLE PORT PER TANK, ADDED CHECK VALVE IN TANK FILL LINE, REVISED N2 SUPPLY

HOYER-SCHLESINGER-TURNER, INC.
CONSULTING-ENGINEERS
300 WEST ADAMS STREET CHICAGO, ILLINOIS 60606
PROJECT 1798-1

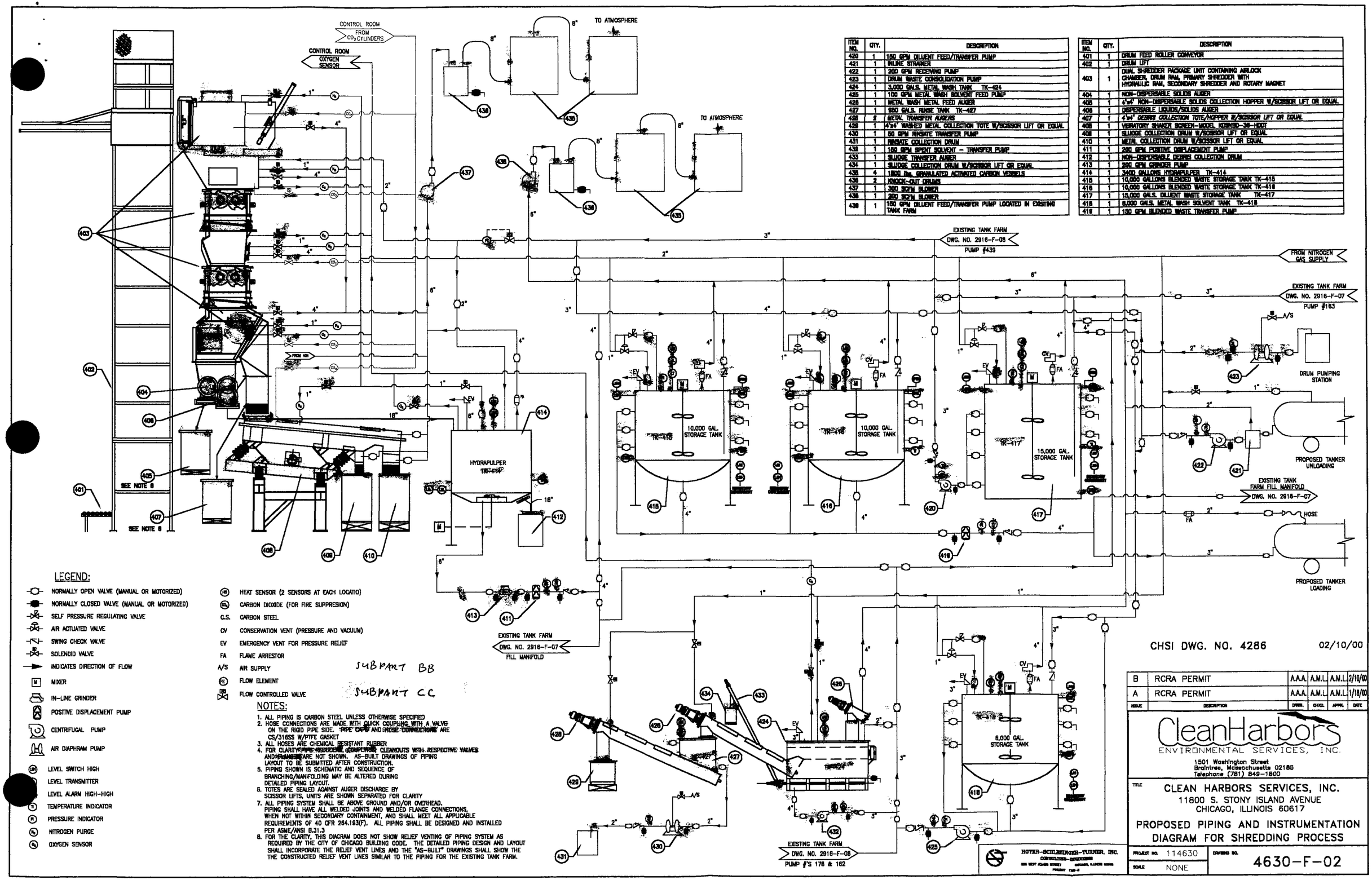
CHSI DWG. NO. 4207 02/9/00

ISSUE	DESCRIPTION	DRWN.	DSGN.	APPR.	DATE
1	SEE REVISION NOTE 1	A.A.A.	A.M.L.		2/9/00
0	AS BUILT	B.H.P.	B.H.P.		7-31-98
C	SEE REVISION NOTE C				
B	SEE REVISION NOTE B				
A	RCRA PART B MODIFICATION				

CleanHarbors
ENVIRONMENTAL SERVICES, INC.
1501 WASHINGTON STREET
Braintree, Massachusetts 02184
Telephone (781) 849-1200/1800

TITLE
CLEAN HARBORS SERVICES, INC.
11800 S. STONY ISLAND AVENUE
CHICAGO, ILLINOIS 60617
PROCESS FLOW, PIPING & INSTRUMENTATION DIAGRAM – TANK FARM OPERATION
SHEET 5 OF 5

PROJECT NO. GW-5404
DRAWING NO. 2916-F-08
SCALE NONE



ITEM NO.	QTY.	DESCRIPTION
420	1	150 GPM DILUENT FEED/TRANSFER PUMP
421	1	INLINE STRAINER
422	1	200 GPM RECEIVING PUMP
423	1	DRUM WASTE CONSOLIDATION PUMP
424	1	3,000 GALS. METAL WASH TANK TK-424
425	1	100 GPM METAL WASH SOLVENT FEED PUMP
426	1	METAL WASH METAL FEED AUGER
427	1	550 GALS. RINSE TANK TK-427
428	2	METAL TRANSFER AUGERS
429	1	4'x4' WASHED METAL COLLECTION TOTE W/SCISSOR LIFT OR EQUAL
430	1	80 GPM RINSATE TRANSFER PUMP
431	1	RINSATE COLLECTION DRUM
432	1	150 GPM SPENT SOLVENT – TRANSFER PUMP
433	1	SLUDGE TRANSFER AUGER
434	1	SLUDGE COLLECTION DRUM W/SCISSOR LIFT OR EQUAL
435	4	1800 lbs. GRANULATED ACTIVATED CARBON VESSELS
436	2	KNOCK-OUT DRUMS
437	1	300 SCFM BLOWER
438	1	200 SCFM BLOWER
439	1	150 GPM DILUENT FEED/TRANSFER PUMP LOCATED IN EXISTING TANK FARM

ITEM NO.	QTY.	DESCRIPTION
401	1	DRUM FEED ROLLER CONVEYOR
402	1	DRUM LIFT
403	1	DUAL SHREDDER PACKAGE UNIT CONTAINING AIRLOCK CHAMBER, DRUM RAM, PRIMARY SHREDDER WITH HYDRAULIC RAM, SECONDARY SHREDDER AND ROTARY MAGNET
404	1	NON-DISPERSABLE SOLIDS AUGER
405	1	4'x4' NON-DISPERSABLE SOLIDS COLLECTION HOPPER W/SCISSOR LIFT OR EQUAL
406	1	DISPERSABLE LIQUIDS/SOLIDS AUGER
407	1	4'x4' DEBRIS COLLECTION TOTE/HOPPER W/SCISSOR LIFT OR EQUAL
408	1	VIBRATORY SHAKER SCREEN-MODEL NO.RDSD-36-HDDT
409	1	SLUDGE COLLECTION DRUM W/SCISSOR LIFT OR EQUAL
410	1	METAL COLLECTION DRUM W/SCISSOR LIFT OR EQUAL
411	1	200 GPM POSITIVE DISPLACEMENT PUMP
412	1	NON-DISPERSABLE DEBRIS COLLECTION DRUM
413	1	200 GPM GRINDER PUMP
414	1	3400 GALLONS HYDRAPULPER TK-414
415	1	10,000 GALLONS BLENDED WASTE STORAGE TANK TK-415
416	1	10,000 GALLONS BLENDED WASTE STORAGE TANK TK-416
417	1	15,000 GALS. DILUENT WASTE STORAGE TANK TK-417
418	1	8,000 GALS. METAL WASH SOLVENT TANK TK-418
419	1	150 GPM BLENDED WASTE TRANSFER PUMP

LEGEND:

- NORMALLY OPEN VALVE (MANUAL OR MOTORIZED)
- NORMALLY CLOSED VALVE (MANUAL OR MOTORIZED)
- SELF PRESSURE REGULATING VALVE
- AIR ACTUATED VALVE
- SWING CHECK VALVE
- SOLENOID VALVE
- INDICATES DIRECTION OF FLOW
- M — MIXER
- IN-LINE GRINDER
- POSITIVE DISPLACEMENT PUMP
- CENTRIFUGAL PUMP
- AIR DIAPHRAM PUMP
- LSH — LEVEL SWITCH HIGH
- LT — LEVEL TRANSMITTER
- LAH — LEVEL ALARM HIGH-HIGH
- TI — TEMPERATURE INDICATOR
- PI — PRESSURE INDICATOR
- N_2 — NITROGEN PURGE
- O_2 — OXYGEN SENSOR
- HS — HEAT SENSOR (2 SENSORS AT EACH LOCATIO)
- CO_2 — CARBON DIOXIDE (FOR FIRE SUPPRESION)
- C.S. — CARBON STEEL
- CV — CONSERVATION VENT (PRESSURE AND VACUUM)
- EV — EMERGENCY VENT FOR PRESSURE RELIEF
- FA — FLANE ARRESTOR
- A/S — AIR SUPPLY
- FE — FLOW ELEMENT
- FCV — FLOW CONTROLLED VALVE

SUBPART BB

SUBPART CC

NOTES:

1. ALL PIPING IS CARBON STEEL UNLESS OTHERWISE SPECIFIED
2. HOSE CONNECTIONS ARE MADE WITH QUICK COUPLING WITH A VALVE ON THE RIGID PIPE SIDE. PIPE CAPS AND HOSE CONNECTIONS ARE CS/316SS W/PTFE GASKET
3. ALL HOSES ARE CHEMICAL RESISTANT RUBBER
4. FOR CLARITY ~~PIPE REDUCERS, COUPLINGS, CLEANOUTS WITH RESPECTIVE VALVES AND FLANGES~~ ARE NOT SHOWN. AS-BUILT DRAWINGS OF PIPING LAYOUT TO BE SUBMITTED AFTER CONSTRUCTION.
5. PIPING SHOWN IS SCHEMATIC AND SEQUENCE OF BRANCHING/MANIFOLDING MAY BE ALTERED DURING DETAILED PIPING LAYOUT.
6. TOTES ARE SEALED AGAINST AUGER DISCHARGE BY SCISSOR LIFTS, UNITS ARE SHOWN SEPARATED FOR CLARITY
7. ALL PIPING SYSTEM SHALL BE ABOVE GROUND AND/OR OVERHEAD. PIPING SHALL HAVE ALL WELDED JOINTS AND WELDED FLANGE CONNECTIONS, WHEN NOT WITHIN SECONDARY CONTAINMENT, AND SHALL MEET ALL APPLICABLE REQUIREMENTS OF 40 CFR 264.193(F). ALL PIPING SHALL BE DESIGNED AND INSTALLED PER ASME/ANSI B.31.3
8. FOR THE CLARITY, THIS DIAGRAM DOES NOT SHOW RELIEF VENTING OF PIPING SYSTEM AS REQUIRED BY THE CITY OF CHICAGO BUILDING CODE. THE DETAILED PIPING DESIGN AND LAYOUT SHALL INCORPORATE THE RELIEF VENT LINES AND THE "AS-BUILT" DRAWINGS SHALL SHOW THE THE CONSTRUCTED RELIEF VENT LINES SIMILAR TO THE PIPING FOR THE EXISTING TANK FARM.

CHSI DWG. NO. 4286 02/10/00

ISSUE	DESCRIPTION	DRWN.	CHKD.	APPR.	DATE
B	RCRA PERMIT	A.A.A.	A.M.L.	A.M.L.	2/10/00
A	RCRA PERMIT	A.A.A.	A.M.L.	A.M.L.	1/18/00

CleanHarbors
ENVIRONMENTAL SERVICES, INC.
1501 Washington Street
Braintree, Massachusetts 02185
Telephone (781) 849-1800

TITLE
CLEAN HARBORS SERVICES, INC.
11800 S. STONY ISLAND AVENUE
CHICAGO, ILLINOIS 60617

PROPOSED PIPING AND INSTRUMENTATION DIAGRAM FOR SHREDDING PROCESS

HOYER-SCHLESINGER-TURNER, INC.
CONSULTING ENGINEERS
300 WEST ADAMS STREET CHICAGO, ILLINOIS 60606
PROJECT 1126-2

PROJECT NO. 114630
SCALE NONE
DRAWING NO. 4630-F-02

Table 3.1
RCRA Air Emissions Regulations
Subpart BB Compliance Requirements by Equipment Type
Summary for Clean Harbors Services, Inc.

Source	Service	Emissions Limit	Equipment Specification	Work Practice	Repair Requirements
Pump	Light Liquid	No Detectable Emissions 10,000 ppm by volume or 500 ppmv for "No Detectable Emissions Service"	Dual Seals, Closed Vent	Monthly Monitoring and Weekly Inspection or Weekly Inspection and monitor w/in 5 days if Evidence of leak	First Attempt w/in 5 Days Completed w/in 15 Days
	Heavy Liquid	No Detectable Emissions 10,000 ppmv	Dual Seals, Closed Vent	Monitor w/in 5 days if Evidence of Leak is Found	First Attempt w/in 5 days Completed w/in 15 days
Valve	Gas & Light Liquid	No Detectable Emissions 10,000 ppmv or 500 ppmv for "No Detectable Emissions Service"		Monthly Monitoring and Weekly Inspection or Test for Compliance Annually	First Attempt w/in 5 days Completed w/in 15 days
	Heavy Liquid	No Detectable Emissions 10,000 ppmv		Monitor w/in 5 days if Evidence of Leak is Found	First Attempt w/in 5 Days Completed w/in 15 Days
Pressure Relief Device	Gas	No Detectable Emissions 500 ppmv	Closed Vent	Monitor w/in 5 days if Pressure Release event	Return to No Detectable Emissions w/in 5 Days
	Light & Heavy Liquids	No Detectable Emissions 10,000 ppmv	Closed Vent	Monitor w/in 5 days if Evidence of Leak is Found	First Attempt w/in 5 Days Completed w/in 15 Days
Flange/ Connector	Gas, Light & Heavy Liquids	No Detectable Emissions 10,000 ppmv		Monitor w/in 5 Days if Evidence of Leak is Found	First Attempt w/in 5 Days Completed w/in 15 Days
Compressor	Gas	No Detectable Emissions 500 ppmv or Barrier Fluid Sensor	Seal System with Barrier Fluid or Closed Vent	Check Sensors Daily or Check Alarms Monthly	First Attempt w/in 5 Days Completed w/in 15 Days
Sampling Connection	Gas, Light & Heavy Liquids	Collect purged fluids during sampling event	Place in tank or container	None	Re-close after sampling
Open Ended Line	Gas, Light & Heavy Liquids	No Detectable Emissions (Refer to Specific Equipment Standards)	Cap, Plug, Flange or Second Valve	Monitor if Evidence of Leak is Found (Refer to Specific Equipment Standards)	Refer to Specific Equipment Standards

Revision Date: December 6, 1996

Key:

No Detectable Emissions: As monitored with calibrated Flame Ionization Detector (FID). See Appendix E for methods.

No Detectable Emissions Service: Defined as Specific Equipment designed to operate with no detectable emissions.
For Pumps this requires (1) No Shaft Penetration of Housing, (2) No Detectable Emissions at 500 ppm level, and (3) Tested for Emissions Annually
Diaphragm Pumps are designated as No Detectable Emissions Service. Gear Pumps and Centrifugal Pumps are not.

Light Liquid: As defined in text, Section 5.1.1. Generally any organic liquid with a vapor pressure above that of kerosene.

Heavy Liquid: As defined in text, Section 5.1.1. Generally, all organic liquids which are not light liquids.

ppmv: parts per million by volume as measured with a calibrated instrument. See Appendix E for methods.

Inspection means: Visually inspect all mating surfaces, sealing surfaces, and openings for indications of leakage.
Visually inspect all connectors, fasteners and closure caps for proper installation.
Listen for sounds which might indicate leakage. Be aware of odors and smells which might indicate leakage.

Monitoring Means: Testing for the presence of volatile organic compounds using a calibrated instrument. The testing procedures and Calibration procedures are contained in Appendix E.

Table 3.2
RCRA Air Emissions Regulations
Subpart CC - Compliance Requirements for Affected Facilities

Organic Threshold: Greater than or equal to 500 ppm by weight volatile organic (VO) concentration as determined by generator knowledge or by US EPA reference method 25D or other method identified in 40 CFR 265.1084(a)(3)(iii). The VO concentration is determined at the point of waste origination (POWO) for each individual waste stream. For a generator, POWO is the point at which a solid waste is defined as a hazardous waste. For a TSD, POWO is the point at which the hazardous waste enters the facility.

Surface Impoundments: Subpart CC requires that surface impoundments used to manage hazardous wastes be operated with covers which vent to an emissions control device. All material transfers into and out of the Surface Impoundment are to be made through "Closed Systems". All liquid transfers by pump are to be completed using "Submerged fill" techniques.

Tank Standards: EPA has established two levels of air controls for tanks. Under Level 1, fixed-roof tanks may operate without emission control devices (e.g., carbon absorption units) and without periodic air monitoring for leak detection, provided that certain restrictions regarding tank design/operation and maximum organic vapor pressure limits are met. Any tank that does not qualify for Level 1 controls must comply with the Level 2 control standards. Level 2 requires more sophisticated emission control techniques (e.g., floating roofs, control devices) and mandatory periodic air monitoring for leak detection.

LEVEL 1 TANK CONTROL REQUIREMENTS

- A fixed roof tank that meets maximum organic vapor pressure (MOVP) limits and other specific operating parameters may be operated under Level 1 controls. For example, a fixed roof tank with a design capacity of less than 75 cubic meters (19,815 gallons) is eligible for Level 1 controls provided that: the MOVP of waste placed into the tank is less than 76.7 kilopascals (11.12 psia); the waste is not heated; and the tank is not being used for stabilization.
- The tank must be equipped with closure devices that are designed to form a continuous barrier over the entire surface area of waste in the tank, or be connected to a closed vent system connected to a control device (e.g. carbon absorption system).
- Initial and annual visual inspections must be conducted to ensure that there are no visible cracks, holes, gaps, or other open spaces between the roof section joints or between the interface of the roof edge and tank wall.
- Level 1 tanks do not require a closed vent system and air emissions control device.

LEVEL 2 TANK CONTROL REQUIREMENTS

- The tank meets one of the five (5) allowed designs: a tank that is vented through a closed vent system to a control device; a fixed roof tank with an internal floating roof; a tank with an external floating roof; a pressure tank; or a tank located inside an enclosure that is vented through a closed vent system to an enclosed combustion control device.
- For a typical fixed roof tank subject to Level 2 controls, the tank would require organic vapors to be routed through a closed vent systems to a control device (e.g., carbon adsorption) that provides a minimum organic removal efficiency of 95%.

Container Standards: All containers of less than 26 gallons design capacity are exempt from Subpart CC. There are three levels of emission controls for containers depending on the design capacity of the container, whether or not the container is being used "in light material service", and whether or not the container is used for a stabilization treatment process. The term "in light material service" means that the container is used to manage a material for which both of the following apply: (1) The vapor pressure of one or more of the organic constituents in the material is greater then 0.3 kilopascals (0.044 psia) at 20 degrees C; and (2) The total concentration of the pure organic constituents having a vapor pressure greater than 0.3 kilopascals (0.044 psia) at 20 degrees C is equal to or greater than 20 percent by weight.

LEVEL 1 CONTROLS

Containers with a design capacity of 26 to 119 gallons; and containers with a design capacity exceeding 119 gallons and containing a hazardous waste that is not "in light material service". For a non-DOT container with a capacity greater than 119 gallons, the facility must maintain a copy of the procedure used to determine that the container is not "in light material service". Under Level 1, the container must be one of the following:

1. A U.S. DOT container;
2. A container that is equipped with a cover and closure devices that form a continuous barrier over the container openings such that when secured, there are no visible holes, gaps, or other open spaces into the interior of the container. The cover may be a separate cover (e.g., lid on a drum, tarp on a rolloff) or may be an integral part of the container structural design (e.g., a portable tank); or
3. The container must be an open-top container in which an organic-vapor suppressing barrier is placed on or over the hazardous waste such that no hazardous waste is exposed to the atmosphere (e.g., a vapor suppressing foam).
   - All covers and closure devices must be composed of materials that are suitable to minimize waste exposure to the atmosphere and maintain equipment integrity for as long as it is in service.
   - All covers and closure devices must be secured and closed at all times, except when adding or removing waste or other materials, or performing routine activities other than transfer operations.
   - Visual inspection of covers and closure devices for visible cracks, holes, gaps, or other open spaces into the interior of the container is required within 24 hours after acceptance at a RCRA treatment, storage, and disposal facility.

LEVEL 2 CONTROLS

Containers with a design capacity exceeding 119 gallons and containing a waste that is "in light material service". Under Level 2, the container must be one of the following:

1. A U.S. DOT container;
2. A container that operates with "no detectable organic emissions" as determined through the monitoring of all closures using a photoionization detector or similar instrument; or
3. A container that has been demonstrated within the preceding 12 months to be vapor-tight using Method 27 in 40 CFR 60 Appendix A.
   - Containers managed under Level 2 controls must meet the same operating and inspection requirements as Level 1 containers.
   - Transfers in/out of a Level 2 container must be conducted in a manner that minimizes exposure of hazardous waste to the atmosphere. Examples of acceptable loading procedures include submerged fill, vapor balancing, or vapor recovery.

LEVEL 3 CONTROLS

Containers with a design capacity greater than 26 gallons which are used in a stabilization treatment process. Under Level 3, the container must be one of the following:

1. A container that is vented directly through a closed-vent system to a control device operating in accordance with 40 CFR 264.1086(e)(2)(ii); or
2. A container that is vented into an enclosure which is exhausted through a closed-vent system to a control device in accordance with 40 CFR 264.1086(e)(2)(i) and (e)(2)(ii).

Closed Vent Systems:	Level 2 Tank controls and Level 3 container controls require a closed vent systems be used to control the emissions of organic vapors. The closed vent systems shall be designed and operated with no detectable organic emissions (500 ppmv relative to background), and shall not be bypassed. If a bypass is installed, it shall be either locked and sealed, or continuously monitored.
Control Devices/ Carbon Absorption:	Level 2 Tank controls and Level 3 container controls require that organic vapor control devices provide a minimum removal efficiency of 95% by weight. Continuous monitoring is required except for carbon systems which require periodic monitoring. The 95% removal efficiency requirement for carbon bed system also includes emissions during the regeneration or destruction of the used carbon bed. Subpart CC further requires spent carbon be managed in an appropriately permitted facility.
Solidification/ Stabilization:	Waste stabilization and solidification activities involving hazardous wastes with a VO concentration of 500 ppmw or greater require Level 3 container controls.
Other Subpart CC Regulated Activities:	The requirements of Subpart CC can be extended to Subpart X Miscellaneous equipment at the discretion of the US EPA Regional Administrator. The specific requirements would be determined by the permitting engineer or the Regional Administrator.
Inspection Means:	Visually inspect all mating surfaces, sealing surfaces and openings for indications of leakage. Visually inspect all connectors, fasteners and closure caps for proper installation.
Monitoring Means:	Testing for the presence of organic compounds using a calibrated instrument. The testing procedures and calibration procedures are contained in Appendix E.

Table 5.1
RCRA Air Emissions Regulations
Subpart BB Compliance Requirements for Affected Equipment (see note a)
Clean Harbors Services, Inc.

Item (see note b)	Substantive Requirement (see note c)	Recordkeeping/Reporting Requirement
A. Pumps in Light Liquid Service	1. Monthly LDAR (see note d) - 264.1052 2. Weekly Visual Inspection - 264.1052(a)(2) (see note e)	3. Tag Leaking Sources only - 264.1064(c) 4. Record Dates, Repair Attempts, and Reasons for Delay of Repair - 264.1064(d)
Pumps in No Detectable Emissions Service	1. Designed and operated under certain conditions - 264.1052(e)(1),(2) 2. Tested for "no detectable emissions" on an annual basis - 264.1052(e)(3)	3. Record results of compliance tests 264.1064(g)
B. Compressors (General)	1. Installation of Seal System - 264.1053(a)-(d) 2. Monthly Inspection of Seals - 264.1053(e)	3. Record Seal System Design Criterion 264.1064(j) 4. Same as A3 and A4
C. Pressure Relief Devices in Gas Service (General)	1. Designed and Operated (see note f) for no detectable emissions - 264.1054(b) 2. Tested for No Detectable Emissions after each Over Pressure Release event - 264.1054(b)	3. Record Results of Compliance Test 264.1064(g)
D. Sampling Connection Systems (General)	1. Designed and Operated Under Certain Conditions 265.1055(a),(b)	2. Record Design Criterion - 264.1064(e)
E. Open Ended Valves or Lines	1. Cap Open Ended Lines - 264.1056(a)(1) 2. Operational Requirements - 264.1056(a)(2), (b), (c)	
F. Valves in Gas/Vapor or Light Liquid Service	1. Monthly LDAR - 264.1057(a)-(e)	2. Same as A3, A4
Valves on Gas/Vapor or Light Liquid Service (Unsafe to Monitor)	1. Monitoring during Safe to Monitor Times 264.1057(g)(2)	2. Maintain Record of Monitoring Plan and Explain Why Valve is Unsafe to Monitor - 264.1064(h)(1)
H. Valves in Gas/Vapor or Light Liquid Service (Difficult to Monitor)	1. Annual Monitoring - 264.1057(h)(3)	2. Maintain Record of Monitoring Schedule and Explain why Valve is Difficult to Monitor - 264.1064(h)(2)
I. Pressure Relief Devices in Liquid Service and Flanges and Other Connectors	1. LDAR within 5 days if evidence of leakage is discovered - 264.1058(a)	2. Same as A3, A4
J. Closed Vent Systems and Control Devices (General)	1. Designed and Operated under Certain Conditions - 264.1033, 264.1060 2. Tested Annually for No Detectable Emissions - 264.1033(j)(2) 3. Operate Closed Vent Systems and Control Devices when Emissions are Vented to Them - 264.1033(k)	4. Same as D2 5. Same as C3 6. Report Exceedances Semiannually - 264.1036(a)(2), 264.1065(a)(4)
K. Closed Vent Systems and Devices (Carbon Canisters not Regenerated on Site)	1. Designed and Operated Under Certain Conditions - 264.1033(b) 2. Monitor Control Devices and Replace Carbon Upon Breakthrough - 264.1033(h) 3. Same as J3	4. Same as D2 5. Record Monitoring and Maintenance Activities - 264.1035(c)(7), 264.106 6. Report Exceedances and Missed Maintenar Semiannually - 264.1065(a)(4)

Revision Date: December 6, 1996

requirements presented in this table are those for the equipment covered by Subpart BB. The base table is drawn from th ocument "Hazardous Waste TSDF, Technical Guidance Document for RCRA Air Emissions Standards for Process Vents and Equipmen ", EPA 450/3-89-021, July 1990.

c. Each source covered by Subpart BB is listed and the requirements for that source are annotated mainly by indicating the substantive requirements for that source, the citation for those requirements, the associated recordkeeping/reporting requireme and their citation.

c. The substantive requirements are summarized and a reference to the exact regulatory language is provided if more detail is needed.

d. LDAR means 'leak detection and repair'. This generally includes the use of a portable monitor to detect leaks and then, for those pieces of equipment that are leaking, repair of the leak. Delay of Repair is general to all sources and is presented separately in Table 5.2. Two Relevant thresholds are in place. For Pressure Relief Devices, and for Compressors in "no Detect Emissions' service, the Leak Determination Threshold is 500 ppmv. For all other equipment covered under Subpart BB, the releva threshold is 10,000 ppmv.

e. Inspection generally means visual inspection of seal areas as well as seal-barrier fluid system integrity. Inspection inclu repair of leaking seals and seal/barrier fluid systems.

f. Designed and operated generally means that specific equipment or designs are allowed if they are used in ways that results i emission reductions that are at least equivalent to the general requirements.

Table 6.1
Subpart CC Affected Equipment Other Than Containers
Clean Harbors Services, Inc.

Inspection and Monitoring Requirements

Affected Equipment	Difficult to Inspect	Performance Requirements	Inspection Requirements	Monitoring Requirements
Tanks Tank Farm Pegasus System	No	Level 2 Controls	Initially and every 12 months	None
Closed Vent Systems Tank Farm Pegasus System	No	Level 2 Controls GAC: 95% organic removal	Initially and every 12 months	Initially and every 12 months
Waste Stabilization	No	Process waste with VO less than 500 ppm	Not Required	Not Required

Key:

VO: Volatile Organic concentration as determined using EPA method 25D, or other analytical method per 40 CFR 265.1084(a)(3)

Inspection means: Visually inspect all mating surfaces, sealing surfaces, and openings for indications of leakage. Visually inspect all connectors, fasteners and closure caps for proper installation.

Monitoring Means: Testing for the presence of volatile organic compounds using a calibrated instrument. The testing procedures and Calibration procedures are contained in Appendix C & D.

Table 6.2

RCRA Air Emissions Subpart CC
Inspection, Leak Detection, and Transfer Requirements for Containers

I. LEVEL 1 CONTAINERS

A. Inspection Requirements

1. Inspection of covers and closure devices is required within 24 hours after a non-RCRA empty container is accepted at the facility.
2. Any container remaining at the facility for 1 year or more must be re-inspected.
3. During an inspection, the facility must inspect the container and its cover and closure devices to check for visible cracks, holes, gaps, or other open spaces into the interior of the container.
4. Recordkeeping of inspections is not required for containers.
5. If a defect is detected during an inspection, the first effort at repair must be within 24 hours of detection, and completed as soon as possible but within 5 calendar days.
6. If the repair cannot be completed within 5 days, then the waste must be removed from the container. The container cannot be reused until the defect is repaired.

B. Leak Detection & Air Monitoring

1. Air monitoring for containers is not required at time of receipt or re-shipment.

C. Waste Transfer Requirements

1. No submerged fill or other transfer techniques required.

II. LEVEL 2 CONTAINERS

A. Inspection Requirements

1. Inspection of covers and closure devices is required within 24 hours after a non-RCRA empty container is accepted at the facility.
2. Any container remaining at the facility for 1 year or more must be re-inspected.
3. During an inspection, the facility must inspect the container and its cover and closure devices to check for visible cracks, holes, gaps, or other open spaces into the interior of the container.
4. Recordkeeping of inspections is not required for containers.
5. If a defect is detected during an inspection, the first effort at repair must be within 24 hours of detection, and completed as soon as possible but within 5 calendar days.
6. If the repair cannot be completed within 5 days, then the waste must be removed from the container. The container cannot be reused until the defect is repaired.

B. Leak Detection & Air Monitoring

1. Air monitoring for containers is not required at time of receipt.
2. Prior to shipment, non-DOT containers must be monitored for NDOE, unless the container is demonstrated to be "vapor-tight" within previous 12 months.

C. Waste Transfer Requirements

1. Transfers in/out of a Level 2 container must be conducted in a manner that minimizes exposure of hazardous waste to the atmosphere. Examples of acceptable loading procedures include submerged fill, vapor balancing, or vapor recovery.

Appendix D-10, Data Sheet #1

Chemical Compatibility Chart

Note: The existing container storage areas are coated with epoxy-based and vinylester-based resin sealants manufactured by Transcoat, Inc. Transcoat, Inc. is no longer in business, and manufacturer's chemical compatibility chart is not available. In determining that the the existing sealant was compatible with the waste intended to be stored, the professional engineer reviewing the CHCI Part B relied upon a corrosion resistance chart provided by Dudick Corrosion-Proof, Inc. which manufactures resin systems which are similar to the Transcoat, Inc. materials. A copy of the Dudick corrosion resistence chart is included.

Dudick

Chemical Resistance

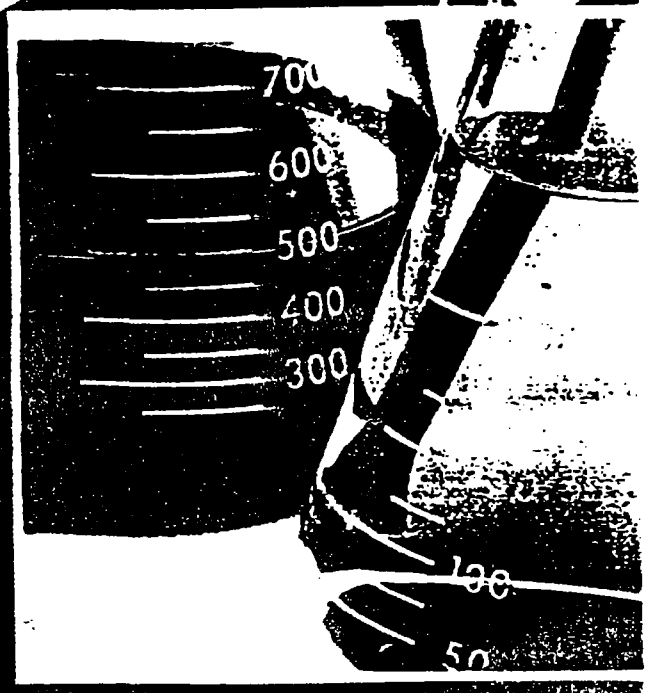
Corrosion Resistant Monolithics

Alka

3

NaCl

800



Organic

O_3

How to Use the Corrosion Guide

The corrosion resistant properties described in this Guide have been determined either by analysis (the typical ability of a resin to resist attack by a specific chemical substance), by testing, or by actual field performance experience. Thus, the ratings shown are useful in helping a potential user make a preliminary evaluation for further investigation.

Since most installations involving hostile chemical environments also involve dynamic processes which can vary widely from industry to industry and plant to plant, it is always necessary to consult the Dudick Corrosion-Proof factory for guidance before making a final selection.

This is especially critical when a chemical is not listed or where a combination of chemicals are present. Thorough testing in the Dudick laboratory using the actual chemicals under simulated processing or storage conditions is the only way to assure satisfactory in-use performance.

To simplify the information presentation, this Guide provides temperature limit data (page 12) and Chemical performance characteristics in separate charts. If an anticipated condition is not covered, please consult a Dudick Corrosion-Proof representative or the factory for additional information or to arrange an appropriate performance test.

Special Note

All technical data and recommendation presented here are believed to be reliab at the time of publication. Because fiel conditions can vary significantly, all dat should be considered only as suggestio of possible applications. Dudick Corrosi Proof, Inc. assumes no responsibility fo results obtained or damages incurred fr any use whether or not the use resulte from the recommendations in this Guid Any recommendations or technical adv rendered is not to be taken as a license operate under or intended to suggest tr infringement of any existing patent. Lia ity, if any, is limited to replacement of products.

Temperature/Chemical Resistance Key

Indicator	Definition	Indicator	Definition	Indicator	Definition
I	Material will withstand constant flow or immersion service	1	Good to the maximum temperature of the product	NR	Not recommended
S	Material is suitable for intermittent or Spillage service	2	High Temperature Service to 160° F (71° C)	NI	No information available
F	Material will tolerate fumes only	3	Moderate Temperature Service to 140° F (60° C)	PV	Performance varies with conditions. Consult Dudick for recommendations or testin
		4	Warm Temperature Service to 100° F (37° C)		

Example

Each grid block in the Guide shows all the information which is available on the product for the use shown. Thus, a block which shows I2. indicates that the product is capable of providing immersion service up to 160° F. Similarly, a block which shows F1 indicates the material will tolerate temperatures t the maximum capability shown in the Temperature Limits c (page 12), but that it is designed for exposure only to fume

Note: Temperature Limits chart is on page 12.

Dudick

Key

- Material will withstand constant flow or immersion service
- Material is suitable for intermittent or Spillage service
- Material will tolerate fumes only

	Light Duty Linings/Coatings						Toppings		Heavy Duty Linings			
	Protecto-Coat						Protecto-Crete		Protecto-Flake			
	300	600	700	800	900	1000	300	800	600	700	800	900
Acetaldehyde	NR	PV	PV	PV	F4	NR	S4	NR	NR	NR	NR	NR
Acetic Acid (0-10%)	F4	4	4	4	4	S1	S1	S1	3	3	3	3
Acetic Acid (10-50%)	NR	S1	F3	S1	S1	F1	S4	S3	4	F3	4	4
Acetic Acid (50-100%)	NR	S3	PV	S3	S3	NR	NR	S3	PV	PV	PV	S4
Acetic Anhydride	NR	S4	S4	S4	S4	PV	S4	S4	S4	S4	S4	S4
Acetone	NR	NR	NR	F4	NR	NR	S4	S4	NR	NR	NR	NR
Acetyl Chloride	F4	PV	PV	PV	PV	PV	S4	S4	PV	PV	PV	PV
Acrylic Acid	F4	PV	PV	PV	PV	PV	NR	S4	4	4	4	4
Acrylonitrile	NR	NR	NR	NR	NR	PV	NR	NR	NR	NR	NR	PV
Adipic Acid	4	4	4	4	4	PV	S4	S4	4	4	4	4
Alcohol (Ethyl)	S4	4	4	4	4	4	S1	S1	1	1	1	1
Alcohol (Methyl)	NR	PV	PV	PV	F4	S4	S4	S1	4	4	4	4
Allyl Chloride	NR	NR	NR	NR	NR	PV	NR	S1	PV	NR	PV	S4
Alum	4	4	4	4	4	1	S1	S1	3	3	3	2
Aluminum Bromide	F4	4	4	4	4	F1	S4	S1	1	1	1	1
Aluminum Chloride	4	4	4	4	4	1	S3	S1	1	1	1	1
Aluminum Fluoride*	S4	S1	S1	S1	S1	NR	S1	S1	4	4	4	4
Aluminum Hydroxide	S4	F4	NR	F4	S4	S4	S1	S1	4	NR	3	3
Aluminum Sulfate	S4	4	4	4	4	1	S1	S4	3	3	3	2
Ammonia (Dry)	S4	F1	NR	F1	F1	F1	S1	S1	3	NR	3	3
Ammonium Chloride	S4	4	4	4	4	1	S1	S1	1	1	1	1
Ammonium Fluoride*	S4	4	4	4	4	NR	S1	S2	3	3	3	3
Ammonium Hydroxide	4	F4	NR	F4	S4	1	S1	S1	2	NR	2	2
Ammonium Nitrate	4	4	4	4	4	1	S1	S1	1	1	1	1
Ammonium Persulfate	4	4	4	4	4	1	S1	S1	1	1	1	1
Ammonium Sulfate	4	4	4	4	4	1	S1	S1	1	1	1	1
Ammonium Sulfide	4	4	4	4	4	1	S1	S1	1	1	1	1
Ammonium Sulfite	4	4	4	4	4	F1	S1	S1	1	1	1	1
Amyl Acetate	NR	S4	NR	S4	S4	NR	NR	NR	PV	NR	F4	F4
Amyl Alcohol	F4	S1	S3	S1	S1	NR	S3	S3	4	4	4	4
Aniline	NR	S4	S4	S4	S4	NR	NR	NR	NR	4	4	4
Aniline Hydrochloride	F4	S4	S4	S4	S4	F4	S3	S3	4	4	4	4
Antimony Chloride	S4	4	4	4	4	1	S1	S1	1	1	1	1
Aqua Regia	NR	F4	F4	F4	F4	NR	NR	NR	NR	NR	NR	NR
Arsenic Acid	F4	4	4	4	4	S4	S1	S1	3	3	3	PV
Barium Acetate	S4	S4	S4	S4	S4	F4	S4	S3	4	4	4	4
Barium Chloride	4	4	4	4	4	1	S1	S1	1	1	1	1
Barium Hydroxide	4	S3	NR	S3	S2	1	S1	S4	4*	NR	4*	3*
Barium Sulfide	4	4	4	4	4	1	S1	S1	1	1	1	1
Benzaldehyde	PV	NR	NR	NR	NR	NR	PV	PV	PV	NR	NR	PV
Benzene	NR	PV	PV	PV	NR	NR	S4	S4	NR	NR	NR	S4
Benzene Sulfonic Acid	F4	4	4	4	4	F4	S4	S1	1	1	1	1
Benzene Sulfonic Chloride	F4	4	4	4	4	F4	S4	S1	1	1	1	1
Benzoic Acid	S4	4	4	4	4	F4	S1	S1	1	1	1	1
Benzoyl Chloride	NR	NR	PV	NR	PV	NR	NR	NR	NR	PV	NR	PV
Black Liquor	S4	S1	NR	S1	S1	1	S1	S3	1	NR	1	1
Bleach(5.5%)*	F4	PV	PV	PV	1	F1	NR	S4	NR	NR	NR	1
Boric Acid	4	4	4	4	4	1	S1	S1	2	2	2	2
Bromine, Wet Gas	NR	NR	NR	NR	NR	NR	NR	NR	F4	F4	F4	F4
Bromine Water (5%)	NR	S4	S4	S4	S4	S4	NR	S4	4	4	4	4
Butadiene	PV	PV	PV	PV	PV	NR	S4	S4	PV	PV	PV	PV
Butanol	NR	S4	S4	S4	S4	NR	S4	S1	3	3	3	3
Butyl Acetate	NR	NR	NR	NR	F4	NR	S4	NR	NR	NR	NR	PV
Butyl Carbitol	PV	PV	PV	PV	F4	PV	S4	PV	4	4	4	4
Butyl Cellosolve	NR	PV	NR	NR	S4	NR	NR	NR	NR	NR	NR	S4
Butyric Acid	NR	F4	F4	F4	F3	NR	NR	NR	3	3	3	3
Cadmium Platinid (Cyanide)	S4	S1	NR	S1	S1	S1	S1	S3	3	NR	3	3
Calcium Bisulfite	S4	4	4	4	3	1	S3	S1	1	1	1	1

1 Good to the maximum temperature of the product
2 High temperature service to 160°F (71°C)
3 Moderate temperature service to 140°F (60°C)
4 Warm temperature service to 100°F (37°C)

PV Performance varies with conditions. Consult Bedick for recommendations or testing
NR Not recommended
NI No information available

Linings/Toppings					Toppings/Linings						Tied Vessel Linings				Grouts
Protecto-Glass 300	600	700	800	900	Protecto-Line 100	300	600	700	800	900	Protecto-Seal 300	600	700	800	Grouts 100
S4	NR	NR	NR	NR	S4	S4	S4	S4	S4	S4	NR	NR	NR	NR	S4
S4	3	4	3	3	S3	S3	3	4	3	3	S3	3	3	3	S4
NR	4	F3	4	4	S4	NR	4	S1	4	4	S4	4	F3	4	NR
NR	PV	PV	PV	S4	NR	NR	S1	S1	PV	S4	NR	PV	PV	PV	NR
NR	S4	S4	S4	S4	S4	NR	S1	S3	S1	S1	NR	S4	S4	S4	NR
S4	NR	NR	NR	NR	S1	S4	S4	S4	S4	S4	S4	NR	NR	NR	S4
S4	NR	PV	PV	S4	S3	S4	S4	S4	S4	S4	S4	PV	PV	PV	NR
NR	4	4	4	4	PV	NR	4	4	4	4	NR	4	4	4	NR
NR	NR	NR	NR	S4	NR	NR	NR	NR	NR	PV	NR	NR	NR	NR	S4
S4	4	4	4	4	4	S4	4	4	4	4	S4	4	4	4	NR
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S4	4	4	4	4	4	S4	4	4	4	4	S4	4	4	4	S4
NR	PV	NR	F4	S4	NR	NR	S4	NR	PV	S4	NR	PV	NR	PV	NR
S1	3	3	3	1	3	S1	3	3	3	2	S1	3	3	3	S1
S4	1	1	1	1	S1	S4	1	1	1	1	S4	1	1	1	S1
S1	1	1	1	1	4	S1	1	1	1	1	S1	1	1	1	S1
S1	4	4	4	PV	4	S1	1	1	1	1	S1	4	4	4	S4
S4	3	NR	3	2	1	S1	3	NR	1	1	S1	4	NR	3	S1
S1	3	3	3	1	3	S1	3	3	3	2	S1	3	3	3	S1
S1	3	NR	3	PV	1	S1	3	S4	3	3	S1	3	NR	3	F1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	3	3	3	3	1	S1	1	NR	1	1	S1	3	3	3	S4
S1	3	NR	3	3	1	S1	3	NR	2	2	S1	2	NR	2	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	1	1	1	1	4	S1	1	1	1	1	S1	1	1	1	S4
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S4	S4	NR	S4	S4	S4	S4	PV	NR	S4	S4	S4	PV	NR	F4	S4
S3	4	4	4	4	S1	S3	4	4	4	4	S3	4	4	4	S1
NR	NR	4	4	4	NR	NR	NR	4	4	4	NR	NR	4	4	NR
S3	4	4	4	4	3	S3	4	4	4	4	S3	4	4	4	S3
S1	1	1	1	1	3	S1	1	1	1	1	S1	1	1	1	S1
NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	F4	NR	NR	NR	NR	NR
S1	3	3	3	PV	PV	S1	1	1	1	1	S1	3	3	3	S1
S4	4	4	4	3	S3	S4	4	4	4	4	S4	4	4	S4	S4
S1	1	1	1	1	3	S1	1	1	1	1	S1	1	1	1	S1
S1	4	NR	4	4	1	S1	3	NR	3	3	S1	4	NR	4	S1
S1	1	1	1	1	4	S1	1	1	1	1	S1	1	1	1	S1
PV	PV	NR	NR	PV	PV	PV	PV	NR	NR	PV	PV	PV	NR	NR	PV
S4	4	NR	4	4	4	S4	S4	NR	S4	S4	S4	NR	NR	NR	S4
S4	1	1	1	1	S1	4	1	1	1	1	S4	1	1	1	S4
S4	1	1	1	1	NR	S4	1	1	1	1	S4	1	1	1	S4
S1	1	1	1	1	3	S1	1	1	1	1	S1	1	1	1	S1
NR	NR	PV	NR	PV	4	NR	NR	PV	NR	PV	NR	NR	PV	NR	PV
S1	3	NR	3	3	1	S1	3	NR	1	1	S1	1	NR	1	S1
NR	NR	NR	4	1	NR	NR	NR	NR	NR	1	NR	NR	NR	NR	NR
S1	3	3	3	3	3	S1	3	3	3	3	S1	2	2	2	S1
NR	NR	NR	NR	F4	NR	NR	F4	F4	F4	F4	NR	F4	F4	F4	NR
NR	4	4	4	4	NR	NR	4	4	4	4	NR	4	4	4	NR
PV	PV	PV	PV	PV	PV	PV	PV	PV	PV	PV	PV	PV	PV	PV	S4
S4	3	3	3	3	3	S4	4	3	3	3	S4	3	3	3	S1
S4	NR	NR	NR	PV	4	S4	NR	NR	NR	PV	S4	NR	NR	NR	S4
S4	4	4	4	4	4	S4	4	4	4	S4	S4	4	4	4	S4
NR	NR	NR	NR	S4	S4	NR	S4	S4	NR	S4	NR	NR	NR	NR	NR
NR	3	3	3	3	NR	NR	4	3	3	3	NR	3	3	3	NR
S1	3	NR	3	3	1	S1	3	NR	3	3	S1	3	NR	3	S2
S4	1	1	1	1	3	S4	1	1	1	1	S4	1	1	1	S1

Dudick

Key

Material will withstand constant flow or immersion service
Material is suitable for intermittent or Spillage service
Material will tolerate fumes only

Protection	Light Duty Linings/Coatings						Toppings		Heavy Duty Linings			
	300	600	700	800	900	1000	300	800	600	700	800	900
Calcium Carbonate	I4	I4	I4	I4	I3	I1	S1	S4	I3	I3	I3	I3
Calcium Chloride	I4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1
Calcium Hydroxide*	I4	I4	NR	I4	I3	I1	S1	S3	I3	NR	I3	I3
Calcium Hypochlorite (5%)*	F4	F4	F4	F4	S4	F4	S4	S3	NR	NR	NR	NR
Calcium Nitrate	I4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1
Caprylic Acid	NR	I4	I4	I4	I4	NR	NR	NR	I4	I4	I4	I4
Carbon Disulfide	NR	S4	S4	S4	S4	NR	S4	NR	F4	F4	F4	F4
Carbon Tetrachloride	F4	S4	S4	S4	S3	NR	S3	S3	I4	I4	I4	I4
Castor Oil	I4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1
Chloracetic Acid	NR	F4	F4	F4	F4	F1	NR	S4	F3	F3	F3	F3
Chlorat	NR	NR	S4	NR	NR	NR	S4	NR	NR	S4	NR	NR
Chlorine Dioxide	NR	S4	S4	S4	S3	NR	NR	S3	I4	I3	I4	I3
Chlorine Gas (Dry)	NR	F4	F3	F4	F3	NR	NR	S4	I4	I1	I4	I3
Chlorine Gas (Wet)	NR	NR	F4	NR	F4	NR	NR	S2	F4	F1	F4	F4
Chlorine Water (Saturated)	NR	S4	S3	S4	S3	S4	S4	S2	I4	I1	I4	I4
Chlorobenzene	NR	NR	NR	NR	S4	NR	S4	NR	NR	NR	NR	S4
Chloroform	NR	NR	NR	NR	NR	NR	S4	NR	NR	NR	NR	NR
Chlorophenol	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Chlorosulfonic Acid	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Chlorotoluene	NR	S4	NR	S4	S4	NR	NR	S4	I4	NR	NR	PV
Chromic Acid (10%)	F4	S4	S3	S4	S4	S4	S4	S4	I4	I3	I4	I4
Chromic Acid (40%)	NR	S4	S3	S4	S4	S4	S4	S4	I4	I3	I4	PV
Chromic Chloride	S4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1	I1
Citric Acid	F4	I4	I4	I4	I4	S1	S4	S1	I1	I1	I1	I1
Copper Plating (Cyanide)	S3	S4	NR	S4	S3	S1	S2	S4	I4	NR	I4	I3
Copper Plating (Acid)	S4	S3	S3	S3	S3	S1	S2	S1	I1	I1	I1	I1
Copper Salts	S3	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1	I1
Corn Oil	S3	I4	I4	I4	I4	I1	S3	S1	I1	I1	I1	I1
Corn Starch	S1	I4	NR	I4	I4	I4	S1	S1	I1	NR	I1	I1
Corn Sugar	S1	I4	NR	I4	I4	I4	S1	S1	I1	NR	I1	I1
Cottonseed Oil	S3	I4	I4	I4	I4	I1	S3	S1	I1	I4	I1	I1
Cresol	NR	NR	NR	NR	PV	NR	NR	NR	NR	NR	NR	PV
Cresylic Acid	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Crude Oil	PV	I4	I4	I4	I4	PV	PV	S1	I1	I1	I1	I1
Detergent Sulfonated	PV	I4	PV	I4	I4	PV	PV	PV	I1	PV	I1	I1
Dextrose	S3	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1
Dibutyl Phthalate	I4	I4	I4	I4	I4	I1	S1	S1	I3	I3	I3	I3
Dichloro Acetic Acid (20%)	NR	I4	I4	I4	I4	F1	NR	S3	I4	I4	I4	I4
Diesel Fuel	S4	I4	I4	I4	I4	S3	S1	S1	I1	I1	I1	I1
Diethylamine (100%)	NR	NR	NR	NR	PV	NR	NR	NR	NR	NR	NR	PV
Dimethyl Formamide	NR	NR	NR	NR	PV	NR	NR	NR	I4	NR	NR	PV
Esters, Fatty Acids	PV	I4	S4	I4	I4	PV	PV	PV	I3	I4	I3	I3
Ethyl Acetate	NR	NR	NR	NR	NR	F1	S4	S4	NR	NR	NR	NR
Ethyl Alcohol	S4	I4	I4	I4	I4	I4	S1	S1	I1	I1	I1	I1
Ethylamine	NR	NR	NR	NR	PV	NR	PV	PV	NR	NR	NR	PV
Ethylchloroformate	NR	NR	NR	NR	PV	NR	NR	NR	PV	PV	NR	PV
Ethyl Ether	NR	NR	NR	NR	PV	NR	S4	S4	PV	NR	PV	PV
Ethylene Dichloride	NR	NR	NR	NR	NR	NR	NR	NR	PV	NR	NR	NR
Ethylene Glycol	I4	I4	I4	I4	I4	I4	S1	S1	I1	I1	I1	I1
Ethylene Oxide	NR	PV	PV	PV	PV	PV	PV	S1	PV	PV	PV	PV
Ethyl Sulfate	PV	PV	PV	PV	PV	PV	S4	NR	I4	F4	I4	I4
Ferric Chloride	S4	I4	I4	I4	I4	I1	S1	NR	I1	I1	I1	I1
Ferric Sulfate	S4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1
Ferrous Chloride	S4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1
Ferrous Sulfate	S4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1
Fluoboric Acid*	PV	S4	S4	S4	S4	PV	S4	S4	I2	I2	PV	I2
Fluorine Gas*	NR	NR	NR	NR	NR	NR	PV	PV	NR	NR	PV	PV
Fluosilicic Acid*	PV	S4	S4	S4	S4	PV	S4	S4	I2	I2	PV	I2

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4 Warm Temperature Service to 100°F (37°C)

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NR Not recommended
NI No information available

Linings/Toppings					Toppings/Linings						Tiled Vessel Linings				Grouts
Protecto-Glass					Protecto-Lin						Protecto-Sa				Grouts
300	600	700	800	900	100	300	600	700	800	900	300	600	700	800	100
S1	3	3	3	2	1	S1	3	3	3	2	S1	3	3	3	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	3	NR	3	2	1	S1	3	NR	3	2	S1	3	NR	3	S1
S4	NR	NR	4	4	NR	S4	NR	NR	4	4	S4	NR	NR	NR	S4
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
NR	4	4	4	4	NR	NR	4	4	4	4	NR	4	4	4	NR
S4	F4	F4	F4	F4	F4	S4	F4	F4	F4	F4	S4	F4	F4	F4	NR
S3	4	4	4	4	4	S3	4	4	4	4	S3	4	4	4	S1
S1	1	1	1	1	3	S1	1	1	1	1	S1	1	1	1	S3
NR	S4	S4	S4	S4	NR	NR	F3	F3	F3	F3	NR	F3	F3	F3	S4
S4	NR	NR	NR	NR	4	S4	NR	S4	NR	NR	S4	NR	S4	NR	S4
NR	4	3	4	4	NR	NR	4	3	4	4	NR	4	3	4	NR
NR	4	1	4	4	NR	NR	4	1	4	4	NR	4	1	4	NR
NR	F4	F1	F4	F4	NR	NR	F4	F4	F4	F4	NR	F4	F1	F4	NR
S4	4	3	4	4	NR	S4	4	1	4	4	S4	4	1	4	NR
S4	NR	NR	4	S4	4	S4	NR	NR	NR	S4	S4	NR	NR	NR	NR
S4	NR	NR	NR	NR	NR	S4	NR	NR	NR	NR	S4	NR	NR	NR	S4
NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
S4	4	NR	4	PV	4	S4	4	NR	NR	PV	S4	4	NR	NR	S4
S4	4	3	4	4	NR	S4	4	3	4	3	S4	4	3	4	S4
S4	4	3	4	PV	NR	S4	4	3	4	PV	S4	4	3	4	NR
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	1	1	1	1	2	S1	1	1	1	1	S1	1	1	1	S2
S4	4	NR	4	3	2	S4	4	NR	4	3	S4	4	NR	4	S1
S2	1	1	1	1	3	S2	1	1	1	1	S2	1	1	1	S3
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S3	1	1	1	1	4	S3	1	1	1	1	S3	1	1	1	S4
S1	1	NR	1	1	1	S1	1	NR	1	1	S1	1	NR	1	S1
S1	1	NR	1	1	1	S1	1	NR	1	1	S1	1	NR	1	S1
S3	1	4	1	1	4	S3	1	4	1	1	S3	1	4	1	S4
NR	NR	NR	NR	PV	NR	NR	NR	NR	NR	PV	NR	NR	NR	NR	NR
NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
PV	1	1	1	1	PV	PV	1	1	1	1	PV	1	1	1	PV
PV	1	PV	1	1	PV	PV	1	PV	1	1	PV	1	PV	1	PV
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	3	3	3	3	2	S1	3	3	3	3	S1	3	3	3	S1
NR	4	4	4	4	NR	NR	4	4	4	4	NR	4	4	4	S4
S1	1	1	1	1	2	S1	1	1	1	1	S1	1	1	1	S1
NR	NR	NR	NR	PV	NR	NR	NR	NR	NR	PV	NR	NR	NR	NR	NR
NR	4	NR	4	PV	NR	NR	4	NR	NR	PV	NR	4	NR	NR	NR
PV	4	4	4	3	PV	PV	3	4	3	3	PV	3	4	3	PV
S4	PV	NR	NR	NR	S4	S4	PV	NR	NR	S4	S4	NR	NR	NR	S4
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
PV	NR	NR	NR	PV	NR	PV	NR	NR	NR	PV	PV	NR	NR	NR	NR
S4	PV	PV	PV	PV	NR	S4	PV	PV	PV	PV	S4	PV	PV	NR	NR
S4	PV	NR	PV	PV	PV	S4	PV	NR	PV	PV	S4	PV	NR	PV	S4
PV	PV	NR	PV	S4	PV	PV	PV	NR	NR	S4	PV	PV	NR	NR	NR
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S4	PV	PV	PV	PV	PV	S4	PV	PV	PV	PV	S4	PV	PV	PV	PV
S4	4	F4	4	4	4	S4	4	F4	4	4	S4	4	F4	4	PV
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S4	1	1	PV	1	NR	S4	1	1	1	1	S4	2	2	PV	S4
PV	NR	NR	PV	PV	NR	PV	NR	NR	PV	PV	PV	NR	NR	PV	NR
S4	4	4	PV	4	PV	S4	2	2	2	2	S4	2	2	PV	S4

Key

Material will withstand constant flow or immersion service
Material is suitable for intermittent or Spillage service
Material will tolerate fumes only

Duaick

	Light Duty Linings/Coatings						Coatings		Heavy Duty Linings			
	Protecto Coat						Protecto Seal		Protecto Seal			
	300	600	700	800	900	1000	300	800	600	700	800	900
Formaldehyde	F4	I4	I4	I4	I4	F4	S1	S1	I1	I1	I1	I1
Formic Acid	NR	S4	S4	S4	S4	PV	NR	S4	I4	I4	I4	I4
Fuel Oil 1 & 2	S4	I4	I4	I4	I4	NR	S1	S1	I1	I3	I1	I1
Furfural	NR	S4	S4	S4	S4	PV	PV	PV	NR	PV	PV	PV
Furfuryl Alcohol	PV	S4	S4	S4	S4	S4	S1	S1	I4	I4	I4	I4
Gasoline	I4	I4	I4	I4	I4	I4	S1	S1	I1	I1	I1	I1
Glucose	I4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1
Gluconic Acid (50%)	PV	F4	S4	F4	S4	PV	PV	S4	S4	I4	S4	I4
Glycol	I4	I4	I4	I4	I4	I4	S1	S1	I1	I1	I1	I1
Glycolic Acid	NR	S4	S4	S4	S4	F1	S4	S4	I3	I3	I3	I3
Gold Plating (Cyanide)	S4	S1	NR	S1	S1	S1	S1	S4	I4	NR	I4	I3
Grape Juice	I3	I3	I3	I3	I3	I1	S1	S1	I1	I1	I1	I1
Green Liquor	S4	I4	NR	I4	I3	I1	S1	S3	I1	NR	I1	I1
Heptane	S4	S1	S1	S1	S1	I4	S1	S1	I2	I2	I2	I2
Heptanoic Acid	PV	S4	S4	S4	S4	F1	PV	I3	I3	I3	I3	I3
Hexane	F4	S1	S1	S1	S1	I4	S1	S1	I2	I2	I2	I2
Hydrazine (35%)	PV	NR	NR	NR	NR	NR	S4	S4	NR	NR	NR	NR
Hydraulic Fluid	PV	PV	PV	PV	I3	PV	S1	S1	PV	PV	PV	I1
Hydrindic Acid (20%)	F4	S4	S4	S4	S4	S1	PV	S4	I4	I4	I4	I4
Hydrobromic Acid (20%)	F4	S4	S4	S4	S4	S1	PV	S4	I4	I3	I4	I4
Hydrocarbons (Aliphatic)	PV	I4	I4	I4	I4	I1	S1	S4	I1	I1	I1	I1
Hydrocarbons (Aromatic)	PV	PV	PV	PV	F4	NR	S4	S4	PV	PV	PV	I1
Hydrochloric Acid (1-25%)	F4	S3	S3	S3	S3	F1	S4	S4	I1	I3	I1	I1
Hydrochloric Acid (25-37%)	NR	F3	F3	F3	F3	F1	S4	S4	PV	PV	PV	I2
Hydrofluoric Acid (1-10%)*	NR	F3	NR	NR	F3	NR	NR	NR	NR	NR	NR	NR
Hydrofluoric Acid (10-53%)*	NR	F4	NR	NR	F4	NR	NR	NR	NR	NR	NR	NR
Hydrofluosilicic Acid*	F4	F3	NR	NR	F3	PV	NR	NR	I2	I2	PV	NR
Hydrogen Bromide	PV	PV	PV	PV	F1	PV	PV	S4	PV	PV	PV	I4
Hydrogen Peroxide (30%)	NR	PV	PV	PV	F4	PV	NR	S4	PV	PV	PV	I4
Hydrogen Sulfide	S4	I4	I4	I4	I3	I1	S1	S1	I1	I1	I1	I1
Hypochlorous Acid	NR	NR	NR	NR	F3	NR	NR	NR	NR	NR	NR	NR
Iodine	NR	F4	F4	F4	F3	F1	PV	S4	I4	I4	I4	I3
Insecticides	PV	PV	PV	PV	F4	PV	PV	S3	PV	PV	PV	I3
Isophorone	PV	PV	PV	PV	PV	PV	S4	PV	I4	I4	I4	I4
Isopropyl Acetate	NR	NR	NR	NR	NR	PV	S4	NR	PV	NR	PV	S4
Isopropyl Alcohol	S4	PV	PV	PV	S4	PV	S1	S1	I1	I1	I1	I1
Isopropyl Amine	PV	PV	PV	PV	F4	NR	PV	NR	PV	I4	PV	S4
Isopropyl Ether	S4	PV	PV	PV	F4	NR	S4	S4	I4	I4	I4	I4
Jet Fuel	I4	I4	I4	I4	I4	F1	S1	S1	I1	I1	I1	I1
Kaolin	I1	PV	NR	PV	I1	I1	I1	I1	PV	NR	PV	I1
Kerosene	I4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1
Lasso Herbicide (10%)	PV	S4	S4	S4	S4	F4	PV	S4	I4	I4	I4	I4
Lactic Acid (1-20%)	F4	I4	I4	I4	I4	S1	S4	S1	I1	I1	I1	I1
Lactic Acid (20%-Con)	NR	S4	S4	S4	I4	S1	NR	S4	I4	I3	I3	I3
Lauric Acid	PV	I4	I4	I4	I3	S1	NR	S1	I1	I1	I1	I1
Lead Acetate	I4	I4	I4	I4	I3	F1	S1	S1	I1	I1	I1	I1
Linseed Oil	S3	I1	I1	I1	I1	I1	S4	S1	I1	I1	I1	I1
Magnesium Sulfate	I1	I1	I1	I1	I1	I1	S1	S1	I1	I1	I1	I1
Maleic Acid	S3	S3	S3	S3	S1	S1	S1	S4	I3	I3	I3	I1
Manganese Salts	I4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1
Mercury Salts	I4	I4	S4	I4	I4	I1	S1	S1	I1	S1	I1	I1
Methyl Alcohol	NR	PV	PV	PV	F4	S4	S4	S1	I4	I4	I4	I4
Methyl Acetate	NR	NR	NR	NR	F4	PV	S3	S4	PV	NR	PV	PV
Methylene Chloride	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Methyl Chloride	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Methyl Ethyl Ketone	NR	NR	NR	NR	NR	NR	PV	NR	PV	NR	PV	NR
Methyl Isobutyl Ketone	NR	NR	NR	NR	NR	NR	S4	S4	PV	NR	PV	NR
Milk Products	I1	I1	I1	I1	I1	I1	S1	S1	I1	I1	I1	I1

1 Good to the maximum temperature of the product
2 High temperature service to 160°F (71°C)
3 Moderate temperature Service to 140°F (60°C)
4 Warm temperature Service to 100°F (37°C)

PV Performance varies with conditions. Consult Sudick for recommendations or testing
NR Not recommended
NI No information available

Linings/Toppings					Toppings/Linings						Tied Vessel Linings				Grouts
Protecto-Glass					Protecto-Line						Protecto-Seal				Grouts
300	600	700	800	900	100	300	600	700	800	900	300	600	700	800	100
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
NR	4	4	4	4	NR	NR	4	4	4	4	NR	4	4	4	NR
S1	4	4	4	3	1	S1	1	3	1	1	S1	1	3	1	S1
PV	PV	PV	PV	PV	PV	PV	NR	PV	PV	PV	PV	NR	PV	PV	PV
S1	4	4	4	4	4	S1	4	4	4	4	S1	4	4	4	S4
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	1
PV	S4	S4	S4	S4	PV	PV	S4	4	4	4	PV	S4	4	S4	
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S4	3	3	3	3	NR	S4	3	3	3	3	S4	3	3	3	NR
S1	4	NR	4	3	1	S1	4	NR	4	3	S1	4	NR	4	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	1	NR	1	1	1	S1	1	NR	1	1	S1	1	NR	1	S1
S1	3	3	3	3	1	S1	3	3	3	3	S1	2	2	2	S1
PV	3	3	3	3	PV	PV	3	3	3	3	PV	3	3	3	PV
S1	3	3	3	3	1	S1	2	2	2	2	S1	2	2	2	S1
S4	NR	NR	NR	NR	4	S4	NR	NR	NR	NR	S4	NR	NR	NR	S4
PV	PV	PV	PV	1	1	PV	PV	PV	PV	1	PV	PV	PV	PV	
PV	4	4	4	4	NR	PV	4	4	4	4	PV	4	4	4	NR
PV	4	3	4		NR	PV	4	3	4	4	PV	4	3	4	NR
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S4	PV	PV	4	1	4	S4	PV	PV	4	1	S4	PV	PV	PV	F4
S4	3	3	3	3	4	S4	3	3	3	3	S4	3	3	3	S4
S4	PV	PV	PV	4	S4	S4	PV	PV	S3	S3	S4	PV	PV	PV	S4
S4	NR	NR	NR	NR	PV	S4	4	4	2	2	S4	NR	NR	NR	NR
NR	NR	NR	NR	NR	PV	NR	4	4	S4	S4	NR	NR	NR	NR	NR
S4	2	2	PV	2	PV	S4	2	2	2	2	S4	2	2	PV	S4
S4	PV	PV	PV	S4	PV	PV	PV	PV	S4	S4	PV	PV	PV	PV	S4
PV	PV	PV	PV	4	PV	PV	PV	PV	S1	S1	PV	PV	PV	PV	S4
S1	1	1	1	1	2	S1	1	1	1	1	S1	1	1	1	S3
NR	NR	NR	NR	S3	NR	NR	PV	4	4	3	NR	NR	NR	NR	NR
PV	4	4	4	3	PV	PV	4	4	4	3	PV	4	4	4	S4
S4	PV	PV	PV	3	S1	S4	PV	PV	S1	S1	PV	PV	PV	PV	S4
S4	4	4	4	4	4	S4	4	4	4	4	S4	4	4	4	S4
S4	PV	NR	PV	4	PV	S4	PV	NR	S4	4	S4	PV	NR	PV	NR
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S3
S4	PV	4	PV	4	S3	S4	PV	4	4	4	PV	PV	4	PV	S4
S4	4	4	4	4	4	S4	4	4	4	4	S4	4	4	4	S4
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S2
S1	PV	NR	PV	1	1	PV	PV	NR	1	1	1	PV	NR	PV	1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S2
S4	4	4	4	4	4	S4	4	4	3	3	PV	4	4	4	S4
S4	1	1	1	1	S4	S4	1	1	1	1	S4	1	1	1	NR
NR	4	3	3	3	NR	NR	4	3	3	3	NR	4	3	3	NR
PV	1	1	1	1	S4	PV	1	1	1	1	PV	1	1	1	S3
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S4	1	1	1	1	PV	S4	1	1	1	1	S4	1	1	1	S4
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S
S3	3	3	3	1	2	S3	3	3	3	1	S3	3	3	3	S3
S1	1	1	1	1	1	1	1	1	1	1	S1	1	1	1	S1
S1	1	S1	1	1	1	S1	1	S1	1	1	S1	1	S1	1	S1
S4	4	4	4	4	4	S4	4	4	4	4	S4	4	4	4	S4
S4	PV	NR	PV	PV	PV	S4	PV	NR	S3	S3	S4	PV	NR	PV	PV
NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
S4	PV	NR	PV	NR	4	S4	PV	NR	S4	S4	S4	PV	NR	PV	NR
S4	PV	NR	4	NR	4	S4	PV	NR	S4	S4	S4	PV	NR	PV	NR
S1	1	1	1	1	1	1	1	1	1	1	S1	1	1	1	S1

Dudick

Key

Material will withstand constant flow or immersion service
Material is suitable for intermittent or Splashe service
Material will tolerate fumes only

	Light Duty Linings/Coatings						Coatings		Heavy Duty Linings			
	300	600	700	800	900	1000	300	800	600	700	800	900
Mineral Oil	I4	I4	S4	I4	I4	S4	S1	S1	I1	I1	I1	I1
Molasses	I1	I1	I1	I1	I1	I1	S1	S1	I1	I1	I1	I1
Naphalene	S4	S4	S4	S4	S3	S4	S4	S4	I4	I4	I4	I3
Naphtha	S4	I4	I4	I4	I3	I4	S1	S1	I3	I1	I1	I1
Naphthenic Acid	PV	I4	I4	I4	PV	PV	S4	PV	I4	I4	I4	PV
Nickel Chloride	S4	S4	S4	S4	S4	S4	S1	S1	I1	I3	I1	I1
Nickel Plating (Bright)	S4	S4	S4	S4	S4	I4	S1	S1	I1	I1	I1	I1
Nickel Salts	S4	I4	I4	I4	I3	I4	S1	S1	I1	I1	I1	I1
Nitric Acid (5%)	S4	S3	S3	S3	S3	S4	S4	S1	I3	I1	I3	I2
Nitric Acid (10%)	S4	S3	S3	S3	S3	S4	S4	S1	I3	I2	I3	I2
Nitric Acid (20%)	NR	F4	F4	F4	F4	NR	NR	S2	I4	I3	I4	I4
Nitric Acid (40%)	NR	F4	F4	F4	F4	NR	NR	S4	I4	I4	I4	I4
Nitric Acid (60%)	NR	NR	NR	NR	F4	NR	NR	S4	S4	S4	S4	S4
Nitric Acid (Conc.)*	NR	NR	NR	NR	F4	NR	NR	NR	NR	F4	NR	F4
Nitrobenzene	NR	NR	NR	NR	NR	NR	PV	NR	PV	PV	PV	PV
Nitrous Acid	NR	PV	PV	PV	PV	PV	PV	S3	I3	I1	I3	I2
Octanoic	F4	S4	NR	S4	S3	PV	PV	S3	I4	NR	I4	I4
Oils (Animal)	I1	I1	I1	I1	I1	I1	S1	S1	I1	I1	I1	I1
Oils (Mineral)	I1	I1	I1	I1	I1	I1	S1	S1	I1	I1	I1	I1
Oils (Vegetable)	I1	I1	I1	I1	I1	I1	S1	S1	I1	I1	I1	I1
Oleic Acid	NR	I4	I4	I4	I3	NR	S4	S1	I1	I1	I2	I1
Oxalic Acid (Sat'd)	S4	I4	I4	I4	I3	S1	S1	S1	I3	I1	I1	I1
Ozone	PV	PV	PV	PV	I2	S3	S1	S1	PV	S4	PV	S4
Palmitic Acid	PV	S4	PV	S4	S3	PV	PV	S4	I1	PV	I1	I1
Pentachlorethane	PV	PV	PV	PV	S1	PV	S1	S4	PV	PV	PV	S1
Perchloric Acid	NR	PV	PV	PV	F4	PV	S1	S1	PV	PV	PV	PV
Perchlorethylene	NR	NR	NR	NR	F4	NR	S4	S4	I4	I4	PV	S4
Phenol (0%-10%)	NR	PV	PV	PV	F4	NR	S4	S2	PV	NR	PV	PV
Phenol (85%)	NR	NR	NR	NR	F4	NR	PV	PV	NR	NR	NR	PV
Phosphoric Acid (Conc.)	NR	S3	S3	S3	S1	NR	NR	S1	I1	I1	I1	I1
Phosphorous Oxychloride	NR	PV	PV	PV	F4	PV	S4	S4	PV	F4	PV	PV
Phosphorous Trichloride	NR	PV	PV	PV	F4	PV	S4	PV	PV	F4	PV	PV
Phthalic Acid	PV	S1	PV	S1	S1	PV	PV	S1	I1	PV	I1	I1
Potassium Bichromate	S4	I4	I4	I4	I4	S4	S4	S1	I4	I1	I4	I1
Potassium Bromate	S4	I4	I4	I4	I4	I4	S4	S1	I4	I4	I4	I4
Potassium Bromide	S4	I4	I4	I4	I4	I4	PV	S1	I1	I1	I1	I1
Potassium Carbonate	I4	PV	PV	PV	I4	I4	S1	S1	I4	NR	I4	I4
Potassium Chlorate	S4	I4	I4	I4	I4	I4	S1	S1	I1	I1	I1	I1
Potassium Chloride	I4	I4	I4	I4	I3	I4	S1	S1	I1	I1	I1	I1
Potassium Cyanide	S4	I4	I4	I4	PV	I4	S1	S1	I1	I1	I1	I1
Potassium Hydroxide (10%)*	I4	S1	NR	S1	I4	I4	S1	S1	I4	NR	I4	I4
Potassium Hydroxide (Conc.)*	S4	NR	NR	NR	S4	S1	S1	S1	NR	NR	NR	NR
Potassium Nitrate	I4	I4	I4	I4	I3	I1	S1	S1	I1	I1	I1	I1
Potassium Permanganate	I4	I4	I4	I4	I3	S1	S1	S1	PV	I1	I1	I1
Potassium Peroxide	S4	S4	S4	S4	PV	F4	S1	PV	I4	PV	I4	I4
Potassium Persulfate	S4	I4	I4	I4	I3	S1	S1	S1	I1	I1	I1	I1
Potassium Sulfate	I4	I4	I4	I4	I3	I1	S1	S1	I1	I1	I1	I1
Pulpstock Chlorinated	NR	NR	S1	NR	S4	NR	NR	S4	NR	I1	NR	NR
Propionic Acid	NR	NR	NR	NR	F4	NR	PV	PV	PV	NR	NR	PV
Propylene Glycol	NR	I3	I3	I3	I3	I4	S4	S4	I4	I4	I4	I3
Pyridine	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Salicylic Acid	S1	I4	I4	I4	I4	I4	S1	S1	I1	I1	I1	I1
Seawater	I1	I1	I1	I1	I1	I1	S1	S1	I1	I1	I1	I1
Silver Nitrate	S1	S1	S1	S1	S1	PV	S1	S1	I1	I1	I1	I1
Sodium Acetate	I4	I4	I4	I4	I4	I4	S1	S1	I1	I1	I1	I1
Sodium Bicarbonate	I4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1
Sodium Bisulfate	I4	I4	I4	I4	I4	I4	S1	S1	I1	I1	I1	I1
Sodium Bisulfite	I4	I4	I4	I4	I4	I4	S1	S1	I1	I1	I1	I1

1 Good to the maximum temperature of the product
2 High temperature service to 160°F (71°C)
3 Moderate Temperature Service to 140°F (60°C)
4 Warm Temperature Service to 100°F (37°C)

PV Performance varies with conditions. Consul Sudick for recommendations or testing
NR Not recommended
NI No information available

Linings/Toppings					Toppings/Linings						Tied Vessel Linings				Grouts
Protecto-Glass	300	600	700	800	900	Protecto-Line	100	300	600	700	800	900	Protecto-Line	300	600	700	800	Grouts	100
S1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	S1	S1
S1	1	1	1	1	1	1	1	1	1	1	1	1	S1	1	1	1	1	S1	S1
S4	4	4	4	3	4	S4	4	4	4	4	3	S4	4	4	4	4	S4	S4	S4
S4	3	1	1	1	1	1	S4	3	1	1	1	S4	3	1	1	3	S4	S4	S4
PV	4	4	4	4	4	4	PV	4	4	4	PV	PV	4	4	4	4	PV	PV	PV
S1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	S1	S1	S1
S3	1	1	1	1	1	1	S3	1	1	1	1	S3	1	1	1	1	S3	S3	S3
S1	1	1	1	1	1	1	1	1	1	1	1	S1	1	1	1	1	S1	S1	S1
S4	3	1	1	1	1	NR	S4	3	1	3	1	S4	3	4	3	3	NR	NR	NR
S4	3	2	1	1	NR	S4	3	2	3	2	S4	3	2	3	NR	NR	NR	NR	NR
NR	4	3	4	3	NR	NR	4	3	4	3	NR	4	3	4	NR	NR	NR	NR	NR
NR	4	4	4	4	NR	NR	4	4	4	4	NR	4	4	4	NR	NR	NR	NR	NR
NR	S4	S4	S4	S4	NR	NR	S1	S1	S1	S1	NR	S4	S4	S4	NR	NR	NR	NR	NR
NR	NR	F4	NR	F4	NR	NR	NR	NR	NR	F4	NR	NR	F4	NR	NR	NR	NR	NR	NR
PV	PV	PV	PV	PV	PV	PV	PV	PV	PV	F4	PV	PV	PV	PV	PV	PV	PV	PV	PV
PV	3	1	3	1	PV	PV	3	1	3	1	PV	3	1	3	NR	NR	NR	NR	NR
PV	4	NR	4	PV	PV	PV	4	NR	4	4	PV	4	NR	4	PV	PV	PV	PV	PV
S4	1	1	1	1	1	1	1	1	1	1	S4	1	1	2	S3	S3	S3	S3	S3
S1	1	1	1	1	1	1	1	1	1	1	S1	1	1	2	S1	S1	S1	S1	S1
S3	1	1	1	1	1	1	1	1	1	1	S3	1	1	2	S1	S1	S1	S1	S1
S4	1	1	1	1	1	NR	S4	1	1	2	S4	1	1	2	NR	NR	NR	NR	NR
S1	3	1	1	1	PV	S1	3	1	1	1	S1	3	1	1	S1	S1	S1	S1	S1
S1	PV	S4	S4	S4	S1	S1	PV	S4	2	1	S1	PV	S4	PV	NR	NR	NR	NR	NR
PV	1	PV	1	1	PV	PV	1	PV	1	1	PV	1	PV	1	S4	S4	S4	S4	S4
S4	PV	PV	PV	PV	PV	S1	PV	PV	PV	S1	S4	PV	PV	PV	NR	NR	NR	NR	NR
NR	PV	PV	PV	PV	PV	S1	PV	PV	PV	PV	NR	PV	PV	PV	S4	S4	S4	S4	S4
S4	4	4	PV	PV	4	S4	4	4	PV	4	S4	4	4	PV	S4	S4	S4	S4	S4
S4	PV	NR	PV	PV	PV	S4	PV	NR	S2	S2	S4	PV	NR	PV	NR	NR	NR	NR	NR
PV	NR	NR	NR	PV	NR	PV	NR	NR	F4	S4	PV	NR	NR	NR	NR	NR	NR	NR	NR
NR	1	1	1	1	NR	NR	1	1	1	1	NR	1	1	1	S4	S4	S4	S4	S4
S4	PV	F4	PV	PV	3	S4	PV	F4	PV	PV	S4	PV	F4	PV	S4	S4	S4	S4	S4
S4	PV	F4	PV	PV	3	S4	PV	F4	PV	PV	S4	PV	F4	PV	NR	NR	NR	NR	NR
S4	1	PV	1	1	PV	PV	1	PV	1	1	S4	1	PV	1	S4	S4	S4	S4	S4
S4	4	1	1	1	4	S4	4	1	4	1	S4	4	1	4	S3	S3	S3	S3	S3
S4	4	4	4	4	PV	S4	1	1	1	1	S4	4	4	4	S4	S4	S4	S4	S4
S4	1	1	1	1	PV	S4	1	1	1	1	S4	1	1	1	S4	S4	S4	S4	S4
S1	4	NR	4	4	1	S1	4	NR	4	4	S1	4	NR	4	S1	S1	S1	S1	S1
S1	1	1	1	1	3	S1	1	1	1	1	S1	1	1	1	S1	S1	S1	S1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1	S1	S1	S1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1	S1	S1	S1	S1
S1	4	NR	4	4	1	S1	4	NR	4	4	S1	4	NR	4	S1	S1	S1	S1	S1
S1	NR	NR	NR	NR	1	S1	NR	NR	NR	4	S1	NR	NR	NR	S1	S1	S1	S1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1	S1	S1	S1	S1
S1	PV	1	1	1	1	S1	PV	1	1	1	S1	PV	1	1	S1	S1	S1	S1	S1
S1	4	PV	4	4	PV	S1	4	PV	4	4	S1	4	PV	4	S3	S3	S3	S3	S3
S1	F1	F1	F1	F1	PV	S1	1	1	1	1	S1	1	1	1	S1	S1	S1	S1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1	S1	S1	S1	S1
NR	NR	1	NR	NR	NR	NR	NR	1	NR	NR	NR	NR	1	NR	NR	NR	NR	NR	NR
PV	PV	NR	NR	PV	NR	PV	PV	NR	NR	PV	PV	PV	NR	NR	NR	NR	NR	NR	NR
4	4	4	4	3	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4
NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
S1	1	1	1	1	3	S1	1	1	1	1	S1	1	1	1	S1	S1	S1	S1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1	S1	S1	S1	S1
S1	1	1	1	1	S1	S1	1	1	1	1	S1	1	1	1	S1	S1	S1	S4	S4
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1	S1	S1	S1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1	S1	S1	S1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1	S1	S1	S1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1	S1	S1	S1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1	S1	S1	S1	S1

Key

Material will withstand constant flow or immersion service
Material is suitable for intermittent or Spillage service
Material will tolerate fumes only

ons. Cons
testing

CK

	Light Duty Linings/Coatings						Topings		Heavy Duty Linings				Grouts
	Protecto-Coat 300	600	700	800	900	1000	Protecto-Crete 300	800	Protecto-Flake 600	700	800	900	
ate	I4	4	I4	4	4	1	S1	S1	I1	1	I1	1	
nate	I4	PV	PV	PV	4	1	S1	S4	I3	PV	4	3	
ate	PV	4	4	4	4	4	S1	S1	I1	1	I1	I1	
ce	I1	1	I1	1	1	1	S1	S1	I1	1	1	1	
te (50%)	NR	S4	S4	S4	S3	S4	S4	S4	4	4	4	3	
nate	S4	4	I4	I4	3	S4	S1	S1	PV	1	PV	1	
de	S4	I4	I4	I4	3	I4	S1	S1	I1	I1	I1	1	
nate	S4	I4	I4	I4	3	4	S1	S1	PV	I4	I4	3	
de*	S4	NR	NR	NR	4	PV	S4	S4	NR	NR	NR	NR	
xide (10%)*	I4	S1	NR	S1	I1	I1	S1	S1	I4	NR	I4	I1	
xide (50%)*	S4	NR	NR	NR	I1	I1	S1	S4	NR	NR	NR	I1	
nionte (3%)*	F4	NR	NR	S4	S4	F1	S3	S1	NR	NR	I4	3	
nionte (17%)*	NR	NR	NR	PV	S4	NR	S4	S4	NR	NR	PV	S4	
de	I4	4	I4	4	4	1	S4	NR	PV	NR	PV	S4	
onate	S4	I4	I4	I4	4	1	S1	S1	I1	1	I1	I1	
ate	I4	I4	I4	I4	4	I1	S1	S1	I1	I1	I1	I1	
de	I4	PV	PV	PV	4	I1	S1	S1	I4	PV	I4	I4	
te	I4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1	
ate	I4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1	
sulfate (Hypo)	I4	I4	I4	I4	I3	S1	S1	S1	I1	I1	I1	I1	
	PV	I4	I4	I4	I3	I1	PV	S1	I1	I1	I1	I1	
	S4	PV	PV	PV	I4	PV	S4	S1	I2	2	I2	I2	
	I4	PV	PV	PV	I4	PV	S3	S3	I4	I4	I4	I4	
	I1	I1	I1	I1	I1	I1	S1	S1	I1	I1	I1	I1	
r (Paper)	I4	I4	PV	I4	I4	I1	S1	S1	I1	PV	I1	I1	
ce	F1	S4	S4	S4	S4	I1	S1	S1	F4	I1	I1	I1	
ce	F4	PV	PV	PV	PV	S1	S1	S1	I4	I4	I4	I4	
(2%-20%)	S4	S2	S2	S2	S2	S2	S3	S1	I1	I1	I1	I1	
(20%-50%)	F4	S2	S2	S2	S2	F1	S4	S1	I3	I3	I3	I2	
(50%-70%)	F4	F3	F3	F3	F2	F4	NR	NR	I4	4	I4	2	
(70%-80%)	NR	PV	PV	PV	F4	NR	NR	NR	PV	PV	PV	4	
(80%-98%)	NR	PV	PV	PV	F4	NR	NR	NR	NR	NR	NR	NR	
id	S4	I4	4	4	I4	S4	S1	S1	I1	1	1	1	
	I4	4	I4	4	4	1	PV	S1	I1	1	1	1	
	PV	I4	I4	I4	4	PV	PV	S4	I1	I1	I1	1	
	I4	I4	I4	I4	3	S1	S1	S1	I1	I1	I1	I1	
hane	PV	NR	NR	NR	F4	NR	S4	NR	PV	PV	PV	PV	
ride	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	
rachloride	F4	I4	I4	I4	I3	S4	S1	S1	I1	I1	I1	I1	
	NR	NR	NR	NR	F4	NR	PV	NR	I4	PV	4	PV	
ronic Acid	S3	I4	I4	I4	I3	S4	S1	S1	I1	I1	I1	I1	
ic Acid (20%)	NR	F4	F4	F4	4	F4	NR	S1	I4	4	4	4	
ene	NR	NR	NR	NR	F4	NR	PV	NR	PV	NR	PV	PV	
osphate	I4	4	NR	I4	4	4	S1	S4	I3	NR	I3	3	
	S4	PV	PV	PV	F4	NR	S1	NR	PV	PV	PV	PV	
ctants	PV	4	I4	I4	I4	PV	S1	S1	I1	I1	1	I1	
ons	I4	I4	I4	I4	4	4	S1	S1	I1	I1	I1	1	
	F4	I1	I1	I1	1	4	S1	S1	I1	I1	1	1	
ed & demineralized	I4	4	I4	I4	4	I4	S1	S1	I1	1	1	I1	
r (Paper)	I4	4	PV	4	3	4	S1	S1	1	PV	1	1	
oil)	NR	NR	NR	NR	NR	NR	PV	NR	4	PV	4	4	
	I4	4	I4	4	3	4	S1	S1	I1	1	1	1	
id Sulfate)	S3	I4	4	4	3	S1	S1	S1	I1	1	1	1	

Temperature Limits

Product	Substrate				Notes
Series (Chemical Property)	F°	C°	F°	C°	
Protecto-Coat	*Metal*		*Concrete/Steel*		
300 (Adduct Cured Epoxy)	100	37[1]	100	37[1]	Steel: Constant Flow: Steel Dry or Intermittent Spills: 200°F (93°C) to 350°F (96°C)
600 (Bisphenol Polyester)	130	54	130	54	Concrete: Constant Flow
700 (Halogenated Polyester)	130	54	130	54	
800 (Vinyl Ester)	130	54	130	54	
900 (High Molecular Weight Vinyl Ester)	130	54	130	54	
1000 (Coal Tar)	130	54	130	54	
Protecto-Crete	*Metal*		*Concrete*		
300 (Adduct Cured Epoxy)	Not Recommended		300	150[3]	[3] Intermittent Spills, otherwise maximum temperature is 150°F
800 (Vinyl Ester)	Not Recommended		250	120	
Protecto-Flake	*Metal*[4]		*Concrete*		
600 (Bisphenol Polyester)	180	83	160	71	[4] Metal: Immersion: Dry Metal: 250°F (121°C)
700 (Halogenated Polyester)	180	83	160	71[4]	
800 (Vinyl Ester)	180	83	160	71	
900 (High Molecular Weight Vinyl Ester)	180	83	160	71	
Protecto-Glass	*Metal*[5]		*Concrete*		
300 (Adduct Cured Epoxy)	150	65	250	121	[5] Steel: Constant Flow
600 (Bisphenol Polyester)	160	71	140	60	
700 (Halogenated Polyester)	160	71	140	60	
800 (Vinyl Ester)	160	71	140	60	
Protecto-Line	*Metal*[6]		*Concrete*[7]		
100 (Amine Cured Epoxy)	180	82	160	71	[6] Steel: Constant Flow and Immersion
300 (Adduct Cured Epoxy)	160	71	160	71	[7] Concrete: Constant Flow
600 (Bisphenol Polyester)	160	71	160	71	
700 (Halogenated Polyester)	160	71	160	71	
800 (Vinyl Ester)	160	71	160	71	
900 (High Molecular Weight Vinyl Ester)	160	71	160	71	
Protecto-Seal	*Metal*[8]		*Tile/Concrete*[8]		
300 (Adduct Cured Epoxy)	160	71	160	71	[8] Steel Tile: Constant Flow and Immersion
600 (Bisphenol Polyester)	180	83	180	83	
700 (Halogenated Polyester)	180	83	180	83	
800 (Vinyl Ester)	180	83	180	83	
Grouts	*Metal*		*Concrete*		
100 (Amine Cured Epoxy)	Not Applicable		160	71	
600 (Bisphenol Polyester)*	Not Applicable		160	71[9]	[9] Grout 600-700 pours not to exceed 2 inches in depth
700 (Halogenated Polyester)*	Not Applicable		160	71[9]	

* *Note:* For more information on Grouts 600 and 700 please consult with a Dudick technical representative.

Products

There is a Dudick Corrosion-Proof product to protect virtually any area of a plant and any piece of production, storage or handling equipment from the corrosive effects of moisture and chemical attack.

Seven standard product lines are available and each offers a range of products developed to meet the special requirements encountered in most manufacturing or processing environments. However, any product in any system can be modified to tailor the physical, mechanical, environmental or application properties to the unique needs of a specific application.

A series of catalogs is available describ the specific properties of each product each of these systems. Of course, our factory personnel are available to work with your architect, or plant managem engineering, and maintenance personn to recommend a standard or custom fo mulated Dudick Corrosion-Proof produ that meets your exact performance an durability requirements.

1.

Protecto-Coat, a series of high-build, glass-flake filled coatings for fast economical application by brush, roller or spray. Corrosion protection can range from mild atmospheric exposures to immersion, depending on the resin base and the finished DFT.

2.

Protecto-Crete, an unreinforced monolithic floor topping of amine addu cured epoxy. It is several times stronge than concrete and resistant to dilute chemical spills.

3.

Protecto-Flake, a series of heavily glass-flake filled, trowel applied tank linings especially suitable for continuous immersion in high concentrations at high temperature. Two fire retardant grades are available as standard products in this system, as well as offering FDA approval for food contact.

4.

Protecto-Glass systems use the ongina glass mat reinforcement principal to achieve good corrosion resistance to a broad range of chemical elements inclu ing oxidizing agents and hot alkalis.

5.

Protecto-Line, a reinforced monolithic vessel lining or floor topping system offering FDA approval. A variety of resins, reinforcing fabrics and curing agents provide chemical resistance ranging from mild ambient exposures to hot spills of strong acids.

6.

Protecto-Seal, a series of reinforced til chest relining products developed espe cially for the needs of the pulp and pa industry. A choice of epoxy, polyester vinyl ester resin formulations provides chemical protection from pH 1-14.

Grouts provide the superior corrosion p tection and high compressive strength permanently anchor heavy equipment.

APPENDIX D-10, DATA SHEET #2

TECHNICAL SPECIFICATION FOR COATING SYSTEMS
MANUFACTURER'S RECOMMENDATION AND CHEMICAL COMPATIBILITY CHART

Dudick

Dudick, Inc.
Corrosion-Proof Products
1818 South Wason Drive
P.O. Box 2550
Streetsboro, Ohio 44241

216-562-1970
FAX 216-562-7638

November 27, 1991

Clean Harbors
722 East Lincoln Parkway
Exton, PA 19341

Attn: Mr. Bhupendra Patel

Subj: Concrete Floor Topping Project at
Chicago, Illinois Facility

Dear Mr. Patel:

Per our recent conversation, Dudick Inc. is pleased to confirm our recommendation to line this concrete floor area subject to heavy fork lift traffic and splash and spillage of methylene chloride, methyl chloride, chloroform, chlorophenol as well as all of the chemicals recommended in our applicable chemical resistance guide at ambient temperatures.

It is our understanding that the subject area will be cleaned within 24 hours after the spillage of the above chemicals.

Product Recommendation: Protecto-Crete 900

Protecto-Crete 900 is an unreinforced, monolithic floor topping system. This system is a heavy aggregate filled novolac epoxy based vinyl ester that is trowel applied at 1/4" on floors and 1/8" thick on walls to achieve a strongly bonded topping with excellent physical and mechanical strength and chemical resistance. An optional sealer coat may be applied for greater chemical resistance.

Enclosed please find a technical data bulletin detailing our Protecto-Crete 900 system.

Should you have any questions, please contact our manufacturer's representative listed below or this office directly.

Cordially yours,

Jay Kapasi

Jay Kapasi
District Sales Manager

JK:sea

cc: Tony Oswald
Steve Carrier

Dudick Inc.

Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Streetsboro, Ohio 44241

216-562-1970
FAX No. 216-562-7638

Protecto-Crete 800/900

TROWEL-APPLIED, UNREINFORCED HIGH-DENSITY VINYL ESTER FLOOR TOPPING 1/4" (6.3 mm)

Protecto-Crete 800 is a high-performance vinyl ester floor topping designed for heavy truck traffic and abrasion resistance combined with excellent resistance to a variety of acids and caustics.

Protecto-Crete 900, in addition, will resist many of the organic solvents.

RECOMMENDED APPLICATIONS

- Food Processing Floors
- Plating Room Floors
- Pickling Room Floors
- Truck Loading Platforms
- Chemical Storage
- Dike Areas
- Aisleways
- Chemical Laboratories

CHEMICAL RESISTANCE

- Organic Acids
- Inorganic Acids
- Alkali Solutions
- Solvents (900 only)
- Oils
- Salts

A complete listing of substances and concentrations tested is available on request.

PHYSICAL PROPERTIES

Compressive Strength ASTM C579	11,000 PSI
Tensile Strength ASTM D638	1,800 PSI
Density	140 lbs./ft.^{3}
Flexural Strength ASTM C580	3,600 PSI
Thermal Shock Resistance	40°F-160°F

SPECIFICATIONS

Topping shall be a 1/4" thick unreinforced Bisphenol-A/Novolac vinyl ester material as manufactured by Dudick Inc. applied over primed concrete using a plasterer's trowel or screed. Application and installation shall be according to the manufacturer's recommendations.

THE PROTECTO-CRETE 800/900 SYSTEM

The Protecto-Crete 800/900 System uses a primer and a heavily aggregate-filled vinyl ester topcoat to achieve a strongly bonded monolithic topping with excellent physical and mechanical strength and chemical resistance.

Primer: The blasted or etched concrete surface must be primed to provide the "wetting out" required for good bonding. Priming is achieved with Primer 27 and Protecto-Crete 800/900 should be applied while the primer is still tacky.

Topoat: The aggregate-filled, Protecto-Crete 800/900 topcoat develops a cured strength two to three times that of the concrete base to which it is applied to provide exceptional durability and prolong the life of the substrate from corrosion and mechanical abuse.

Pour the Protecto-Crete mix into a wheelbarrow and transport to each workman's area. Dump directly onto the primed concrete.

The mix should be spread with a plasterer's trowel or with (3-4 ft.) wood screeds. Final finish with a trowel.

To terminate work, square cut the topping and start with the next work period butting to this edge. Permanent terminating lines should be made into saw cuts in the concrete.

Allow Protecto-Crete to cure overnight before subjecting the area to foot traffic.

Allow to cure 1-2 days at 70°F before permitting truck traffic.

Pot Life and Cure Cycles:

Protecto-Crete 800/900		
Temperature	Pot Life	Cure Time
50°F	50-60 Min.	72 Hrs.
75°F	30-40 Min.	48 Hrs.
90°F	20-30 Min.	24 Hrs.

Do not attempt to store mixed material. Residual material should be properly disposed of at the end of each work period.

Recommended application temperatures should be between 50°F and 110°F substrate temperature.

Application of Protecto-Crete 800/900 in direct sunlight may lead to blistering, pinholes, or wrinkling in the floor topping due to outgassing of air in the concrete and high substrate temperatures.

CLEANING

Clean tools and equipment with S-10 Cleaning Solvent.

SHIPPING

The S-10 Cleaning Solvent is a red label item with a flash point of 52°F (PMCC). The Hardener is classified as Organic Peroxide and carries a yellow warning label. Protecto-Crete liquids are red label items and classified flammable.

STORAGE

Warning: All Dudick products classified by DOT labels as either white, yellow or red labels, must not mixed or stored together as an explosive reaction may occur.

Protecto-Crete Liquid and Hardener are flammable and an oxidizer, respectively, and should be stored in a cool, dry place, away from open flame, sparks and other hazards. Protecto-Crete 800/900 ingredients are stable for 3 months when properly stored under 75°F. Excessive heat may cause premature gelling and reduce available working time (pot life).

SAFETY

M.S.D.S. - Sheets must always be read before using products. Protecto-Crete systems are intended for application by experienced, professional personnel. Dudick Inc. can supply Protecto-Crete Systems supervision to help determine that the surface has been properly prepared, the ingredients correctly mixed, and the materials properly and safely applied.

If Protecto-Crete materials are to be applied by your own personnel or by a third-party contractor, please be sure that they are aware of the following safety precautions:

• Exposure to vinyl ester resins and hardeners may cause severe dermatitis reactions in some people. Cleanliness of the skin and clothing is critical and must be of paramount concern.

• Safety glasses, gloves, and suitable protective clothing must be worn at all times.

Dudick

Chemical Resistance

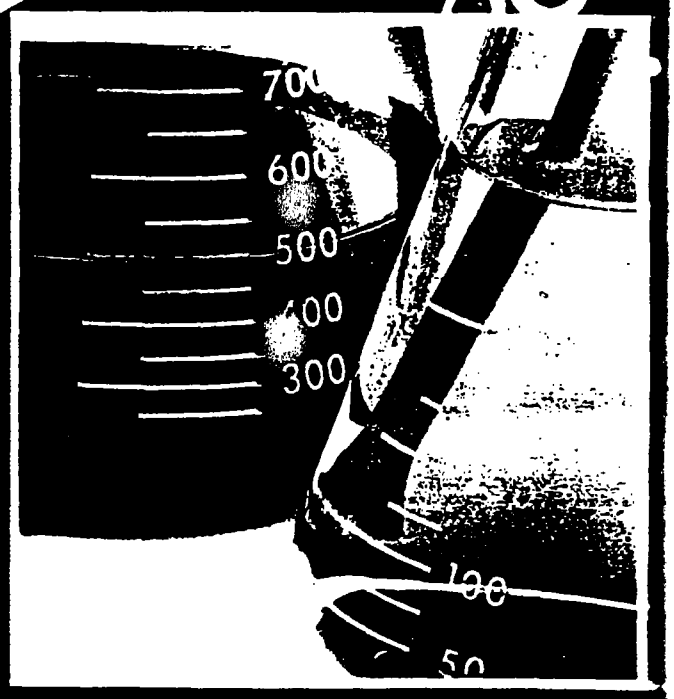
Corrosion Resistant Monolithics

Alka

NaCl

3

80%



Organic

O_3

How to Use the Corrosion Guide

The corrosion resistant properties described in this Guide have been determined either by analysis (the typical ability of a resin to resist attack by a specific chemical substance), by testing, or by actual field performance experience. Thus, the ratings shown are useful in helping a potential user make a preliminary evaluation for further investigation.

Since most installations involving hostile chemical environments also involve dynamic processes which can vary widely from industry to industry and plant to plant, it is always necessary to consult the Dudick Corrosion-Proof factory for guidance before making a final selection.

This is especially critical when a chemical is not listed or where a combination of chemicals are present. Thorough testing in the Dudick laboratory using the actual chemicals under simulated processing or storage conditions is the only way to assure satisfactory in-use performance.

To simplify the information presentation, this Guide provides temperature limit data (page 12) and Chemical performance characteristics in separate charts. If an anticipated condition is not covered, please consult a Dudick Corrosion-Proof representative or the factory for additional information or to arrange an appropriate performance test.

Special Note

All technical data and recommendations presented here are believed to be reliable at the time of publication. Because field conditions can vary significantly, all data should be considered only as suggestions of possible applications. Dudick Corrosion-Proof, Inc. assumes no responsibility for results obtained or damages incurred from any use whether or not the use resulted from the recommendations in this Guide. Any recommendations or technical advice rendered is not to be taken as a license to operate under or intended to suggest the infringement of any existing patent. Liability, if any, is limited to replacement of products.

Temperature/Chemical Resistance Key

Indicator	Definition
I	Material will withstand constant flow or immersion service
S	Material is suitable for intermittent or Spillage service
F	Material will tolerate fumes only

Indicator	Definition
1	Good to the maximum temperature of the product
2	High Temperature Service to 160° F (71° C)
3	Moderate Temperature Service to 140° F (60° C)
4	Warm Temperature Service to 100° F (37° C)

Indicator	Definition
NR	Not recommended
NI	No information available
PV	Performance varies with conditions. Consult Dudick for recommendations or testing

Example

Each grid block in the Guide shows all the information which is available on the product for the use shown. Thus, a block which shows I2, indicates that the product is capable of providing immersion service up to 160° F. Similarly, a block which shows F1 indicates the material will tolerate temperatures to the maximum capability shown in the Temperature Limits chart (page 12), but that it is designed for exposure only to fumes.

Note: Temperature Limits chart is on page 12.

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Key

- Material will withstand constant flow or immersion service
- Material is suitable for intermittent or spillage service
- Material will tolerate fumes only

	Light Duty Linings/Coatings						Topings		Heavy Duty Linings			
	Protecto-Coat						Protecto-Crete		Protecto-Flake			
	300	600	700	800	900	1000	300	800	600	700	800	900
Acetaldehyde	NR	PV	PV	PV	F4	NR	S4	NR	NR	NR	NR	NR
Acetic Acid (0-10%)	F4	4	4	4	4	S1	S1	S1	3	3	3	3
Acetic Acid (10-50%)	NR	S1	F3	S1	S1	F1	S4	S3	4	F3	4	4
Acetic Acid (50-100%)	NR	S3	PV	S3	S3	NR	NR	S3	PV	PV	PV	S4
Acetic Anhydride	NR	S4	S4	S4	S4	PV	S4	S4	S4	S4	S4	S4
Acetone	NR	NR	NR	F4	NR	NR	S4	S4	NR	NR	NR	NR
Acetyl Chloride	F4	PV	PV	PV	PV	PV	S4	S4	PV	PV	PV	PV
Acrylic Acid	F4	PV	PV	PV	PV	PV	NR	S4	4	4	4	4
Acrylonitrile	NR	NR	NR	NR	NR	PV	NR	NR	NR	NR	NR	PV
Adipic Acid	4	4	4	4	4	PV	S4	S4	4	4	4	4
Alcohol (Ethyl)	S4	4	4	4	4	4	S1	S1	1	1	1	1
Alcohol (Methyl)	NR	PV	PV	PV	F4	S4	S4	S1	4	4	4	4
Allyl Chloride	NR	NR	NR	NR	NR	PV	NR	S1	PV	NR	PV	S4
Alum	4	4	4	4	4	1	S1	S1	3	3	3	2
Aluminum Bromide	F4	4	4	4	4	F1	S4	S1	1	1	1	1
Aluminum Chloride	4	4	4	4	4	1	S3	S1	1	1	1	1
Aluminum Fluoride*	S4	S1	S1	S1	S1	NR	S1	S1	4	4	4	4
Aluminum Hydroxide	S4	F4	NR	F4	S4	S4	S1	S1	4	NR	3	3
Aluminum Sulfate	S4	4	4	4	4	1	S1	S4	3	3	3	2
Ammonia (Dry)	S4	F1	NR	F1	F1	F1	S1	S1	3	NR	3	3
Ammonium Chloride	S4	4	4	4	4	1	S1	S1	1	1	1	1
Ammonium Fluoride*	S4	4	4	4	4	NR	S1	S2	3	3	3	3
Ammonium Hydroxide	4	F4	NR	F4	S4	1	S1	S1	2	NR	2	2
Ammonium Nitrate	4	4	4	4	4	1	S1	S1	1	1	1	1
Ammonium Persulfate	4	4	4	4	4	1	S1	S1	1	1	1	1
Ammonium Sulfate	4	4	4	4	4	1	S1	S1	1	1	1	1
Ammonium Sulfide	4	4	4	4	4	1	S1	S1	1	1	1	1
Ammonium Sulfite	4	4	4	4	4	F1	S1	S1	1	1	1	1
Amyl Acetate	NR	S4	NR	S4	S4	NR	NR	NR	PV	NR	F4	F4
Amyl Alcohol	F4	S1	S3	S1	S1	NR	S3	S3	4	4	4	4
Aniline	NR	S4	S4	S4	S4	NR	NR	NR	NR	4	4	4
Aniline Hydrochloride	F4	S4	S4	S4	S4	F4	S3	S3	4	4	4	4
Antimony Chloride	S4	4	4	4	4	1	S1	S1	1	1	1	1
Aqua Regia	NR	F4	F4	F4	F4	NR	NR	NR	NR	NR	NR	NR
Arsenic Acid	F4	4	4	4	4	S4	S1	S1	3	3	3	PV
Barium Acetate	S4	S4	S4	S4	S4	F4	S4	S3	4	4	4	4
Barium Chloride	4	4	4	4	4	1	S1	S1	1	1	1	1
Barium Hydroxide	4	S3	NR	S3	S2	1	S1	S4	4*	NR	4*	3*
Barium Sulfide	4	4	4	4	4	1	S1	S1	1	1	1	1
Benzaldehyde	PV	NR	NR	NR	NR	NR	PV	PV	PV	NR	NR	PV
Benzene	NR	PV	PV	PV	NR	NR	S4	S4	NR	NR	NR	S4
Benzene Sulfonic Acid	F4	4	4	4	4	F4	S4	S1	1	1	1	1
Benzene Sulfonic Chloride	F4	4	4	4	4	F4	S4	S1	1	1	1	1
Benzoic Acid	S4	4	4	4	4	F4	S1	S1	1	1	1	1
Benzoyl Chloride	NR	NR	PV	NR	PV	NR	NR	NR	NR	PV	NR	PV
Black Liquor	S4	S1	NR	S1	S1	1	S1	S3	1	NR	1	1
Bleach(5.5%)*	F4	PV	PV	PV	1	F1	NR	S4	NR	NR	NR	1
Boric Acid	4	4	4	4	4	1	S1	S1	2	2	2	2
Bromine, Wet Gas	NR	NR	NR	NR	NR	NR	NR	NR	F4	F4	F4	F4
Bromine Water (5%)	NR	S4	S4	S4	S4	S4	NR	S4	4	4	4	4
Butadiene	PV	PV	PV	PV	PV	NR	S4	S4	PV	PV	PV	PV
Butanol	NR	S4	S4	S4	S4	NR	S4	S1	3	3	3	3
Butyl Acetate	NR	NR	NR	NR	F4	NR	S4	NR	NR	NR	NR	PV
Butyl Carbitol	PV	PV	PV	PV	F4	PV	S4	PV	4	4	4	4
Butyl Cellosolve	NR	PV	NR	NR	S4	NR	NR	NR	NR	NR	NR	S4
Butyric Acid	NR	F4	F4	F4	F3	NR	NR	NR	3	3	3	3
Cadmium Plating (Cyanide)	S4	S1	NR	S1	S1	S1	S1	S3	3	NR	3	3
Calcium Bisulfite	S4	4	4	4	3	F1	S3	S1	1	1	1	1

*May need synthetic fabric, carbon fillers or HP-201 topcoat. Consult a Dudick Corrosion-Proof, Inc. technical representative for more complete information on

1 Good to the maximum temperature of the product
2 High temperature service to 160°F (71°C)
3 Moderate temperature service to 140°F (60°C)
4 Warm temperature service to 100°F (37°C)

Performance varies with conditions. Consult factory for recommendations or testing
NR Not recommended
PV No information available

Linings/Toppings					Toppings/Linings						Tied Vessel Linings				Grouts
Protecto-Glass 300	600	700	800	900	Protecto-Line 100	300	600	700	800	900	Protecto-Seal 300	600	700	800	Grouts 100
S4	NR	NR	NR	NR	S4	S4	S4	S4	S4	S4	NR	NR	NR	NR	S4
S4	3	4	3	3	S3	S3	3	4	3	3	S3	3	3	3	S4
NR	4	F3	4	4	S4	NR	4	S1	4	4	S4	4	F3	4	NR
NR	PV	PV	PV	S4	NR	NR	S1	S1	PV	S4	NR	PV	PV	PV	NR
NR	S4	S4	S4	S4	S4	NR	S1	S3	S1	S1	NR	S4	S4	S4	NR
S4	NR	NR	NR	NR	S1	S4	S4	S4	S4	S4	S4	NR	NR	NR	S4
S4	NR	PV	PV	S4	S3	S4	S4	S4	S4	S4	S4	PV	PV	PV	NR
NR	4	4	4	4	PV	NR	4	4	4	4	NR	4	4	4	NR
NR	NR	NR	NR	S4	NR	NR	NR	NR	NR	PV	NR	NR	NR	NR	S4
S4	4	4	4	4	4	S4	4	4	4	4	S4	4	4	4	NR
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S4	4	4	4	4	4	S4	4	4	4	4	S4	4	4	4	S4
NR	PV	NR	F4	S4	NR	NR	S4	NR	PV	S4	NR	PV	NR	PV	NR
S1	3	3	3	1	3	S1	3	3	3	2	S1	3	3	3	S1
S4	1	1	1	1	S1	S4	1	1	1	1	S4	1	1	1	S1
S1	1	1	1	1	4	S1	1	1	1	1	S1	1	1	1	S1
S1	4	4	4	PV	4	S1	1	1	1	1	S1	4	4	4	S4
S4	3	NR	3	2	1	S1	3	NR	1	1	S1	4	NR	3	S1
S1	3	3	3	1	3	S1	3	3	3	2	S1	3	3	3	S1
S1	3	NR	3	PV	1	S1	3	S4	3	3	S1	3	NR	3	F1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	3	3	3	3	1	S1	1	NR	1	1	S1	3	3	3	S4
S1	3	NR	3	3	1	S1	3	NR	2	2	S1	2	NR	2	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	1	1	1	1	4	S1	1	1	1	1	S1	1	1	1	S4
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S4	S4	NR	S4	S4	S4	S4	PV	NR	S4	S4	S4	PV	NR	F4	S4
S3	4	4	4	4	S1	S3	4	4	4	4	S3	4	4	4	S1
NR	NR	4	4	4	NR	NR	NR	4	4	4	NR	NR	4	4	NR
S3	4	4	4	4	3	S3	4	4	4	4	S3	4	4	4	S3
S1	1	1	1	1	3	S1	1	1	1	1	S1	1	1	1	S1
NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	F4	NR	NR	NR	NR	NR
S1	3	3	3	PV	PV	S1	1	1	1	1	S1	3	3	3	S1
S4	4	4	4	3	S3	S4	4	4	4	4	S4	4	4	S4	S4
S1	1	1	1	1	3	S1	1	1	1	1	S1	1	1	1	S1
S1	4	NR	4	4	1	S1	3	NR	3	3	S1	4	NR	4	S1
S1	1	1	1	1	4	S1	1	1	1	1	S1	1	1	1	S1
PV	PV	NR	NR	PV	PV	PV	PV	NR	NR	PV	PV	PV	NR	NR	PV
S4	4	NR	4	4	4	S4	S4	NR	S4	S4	S4	NR	NR	NR	S4
S4	1	1	1	1	S1	4	1	1	1	1	S4	1	1	1	S4
S4	1	1	1	1	NR	S4	1	1	1	1	S4	1	1	1	S4
S1	1	1	1	1	3	S1	1	1	1	1	S1	1	1	1	S1
NR	NR	PV	NR	PV	4	NR	NR	PV	NR	PV	NR	NR	PV	NR	PV
S1	3	NR	3	3	1	S1	3	NR	1	1	S1	1	NR	1	S1
NR	NR	NR	4	1	NR	NR	NR	NR	NR	1	NR	NR	NR	NR	NR
S1	3	3	3	3	3	S1	3	3	3	3	S1	2	2	2	S1
NR	NR	NR	NR	F4	NR	NR	F4	F4	F4	F4	NR	F4	F4	F4	NR
NR	4	4	4	4	NR	NR	4	4	4	4	NR	4	4	4	NR
PV	PV	PV	PV	PV	PV	PV	PV	PV	PV	PV	PV	PV	PV	PV	S4
S4	3	3	3	3	3	S4	4	3	3	3	S4	3	3	3	S1
S4	NR	NR	NR	PV	4	S4	NR	NR	NR	PV	S4	NR	NR	NR	S4
S4	4	4	4	4	4	S4	4	4	4	S4	S4	4	4	4	S4
NR	NR	NR	NR	S4	S4	NR	S4	S4	NR	S4	NR	NR	NR	NR	VR
NR	3	3	3	3	NR	NR	4	3	3	3	NR	3	3	3	VR
S1	3	NR	3	3	1	S1	3	NR	3	3	S1	3	NR	3	S2
S4	1	1	1	1	3	S4	1	1	1	1	S4	1	1	1	S1

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Key

Material will withstand constant flow or immersion service
Material is suitable for intermittent or Splillage service
Material will tolerate fumes only

Chemical	Light Duty Linings, Coatings						Coatings		Heavy Duty Linings			
	300	600	700	800	900	1000	300	800	600	700	800	900
Calcium Carbonate	I4	I4	I4	I4	I3	I1	S1	S4	I3	I3	I3	I3
Calcium Chloride	I4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1
Calcium Hydroxide*	I4	I4	NR	I4	I3	I1	S1	S3	I3	NR	I3	I3
Calcium Hypochlorite (5%)*	F4	F4	F4	F4	S4	F4	S4	S3	NR	NR	NR	NR
Calcium Nitrate	I4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1
Caprylic Acid	NR	I4	I4	I4	I4	NR	NR	NR	I4	I4	I4	I4
Carbon Disulfide	NR	S4	S4	S4	S4	NR	S4	NR	F4	F4	F4	F4
Carbon Tetrachloride	F4	S4	S4	S4	S3	NR	S3	S3	I4	I4	I4	I4
Castor Oil	I4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1
Chloracetic Acid	NR	F4	F4	F4	F4	F1	NR	S4	F3	F3	F3	F3
Chloral	NR	NR	S4	NR	NR	NR	S4	NR	NR	S4	NR	NR
Chlorine Dioxide	NR	S4	S4	S4	S3	NR	NR	S3	I4	I3	I4	I3
Chlorine Gas (Dry)	NR	F4	F3	F4	F3	NR	NR	S4	I4	I1	I4	I3
Chlorine Gas (Wet)	NR	NR	F4	NR	F4	NR	NR	S2	F4	F1	F4	F4
Chlorine Water (Saturated)	NR	S4	S3	S4	S3	S4	S4	S2	I4	I1	I4	I4
Chlorobenzene	NR	NR	NR	NR	S4	NR	S4	NR	NR	NR	NR	S4
Chloroform	NR	NR	NR	NR	NR	NR	S4	NR	NR	NR	NR	NR
Chlorophenol	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Chlorosulfonic Acid	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Chlorotoluene	NR	S4	NR	S4	S4	NR	NR	S4	I4	NR	NR	PV
Chromic Acid (10%)	F4	S4	S3	S4	S4	S4	S4	S4	I4	I3	I4	I4
Chromic Acid (40%)	NR	S4	S3	S4	S4	S4	S4	S4	I4	I3	I4	PV
Chromic Chloride	S4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1	I1
Citric Acid	F4	I4	I4	I4	I4	S1	S4	S1	I1	I1	I1	I1
Copper Plating (Cyanide)	S3	S4	NR	S4	S3	S1	S2	S4	I4	NR	I4	I3
Copper Plating (Acid)	S4	S3	S3	S3	S3	S1	S2	S1	I1	I1	I1	I1
Copper Salts	S3	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1	I1
Corn Oil	S3	I4	I4	I4	I4	I1	S3	S1	I1	I1	I1	I1
Corn Starch	S1	I4	NR	I4	I4	I4	S1	S1	I1	NR	I1	I1
Corn Sugar	S1	I4	NR	I4	I4	I4	S1	S1	I1	NR	I1	I1
Cottonseed Oil	S3	I4	I4	I4	I4	I1	S3	S1	I1	I4	I1	I1
Cresol	NR	NR	NR	NR	PV	NR	NR	NR	NR	NR	NR	PV
Cresylic Acid	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Crude Oil	PV	I4	I4	I4	I4	PV	PV	S1	I1	I1	I1	I1
Detergent Sulfonated	PV	I4	PV	I4	I4	PV	PV	PV	I1	PV	I1	I1
Dextrose	S3	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1
Dibutyl Phthalate	I4	I4	I4	I4	I4	I1	S1	S1	I3	I3	I3	I3
Dichloro Acetic Acid (20%)	NR	I4	I4	I4	I4	F1	NR	S3	I4	I4	I4	I4
Diesel Fuel	S4	I4	I4	I4	I4	S3	S1	S1	I1	I1	I1	I1
Diethylamine (100%)	NR	NR	NR	NR	PV	NR	NR	NR	NR	NR	NR	PV
Dimethyl Formamide	NR	NR	NR	NR	PV	NR	NR	NR	I4	NR	NR	PV
Esters, Fatty Acids	PV	I4	S4	I4	I4	PV	PV	PV	I3	I4	I3	I3
Ethyl Acetate	NR	NR	NR	NR	NR	F1	S4	S4	NR	NR	NR	NR
Ethyl Alcohol	S4	I4	I4	I4	I4	I4	S1	S1	I1	I1	I1	I1
Ethylamine	NR	NR	NR	NR	PV	NR	PV	PV	NR	NR	NR	PV
Ethylchlorotormate	NR	NR	NR	NR	PV	NR	NR	NR	PV	PV	NR	PV
Ethyl Ether	NR	NR	NR	NR	PV	NR	S4	S4	PV	NR	PV	PV
Ethylene Dichloride	NR	NR	NR	NR	NR	NR	NR	NR	PV	NR	NR	NR
Ethylene Glycol	I4	I4	I4	I4	I4	I4	S1	S1	I1	I1	I1	I1
Ethylene Oxide	NR	PV	PV	PV	PV	PV	PV	S1	PV	PV	PV	PV
Ethyl Sulfate	PV	PV	PV	PV	PV	PV	S4	NR	I4	F4	I4	I4
Ferric Chloride	S4	I4	I4	I4	I4	I1	S1	NR	I1	I1	I1	I1
Ferric Sulfate	S4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1
Ferrous Chloride	S4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1
Ferrous Sulfate	S4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1
Fluoboric Acid*	PV	S4	S4	S4	S4	PV	S4	S4	2	2	PV	2
Fluorine Gas*	NR	NR	NR	NR	NR	NR	PV	PV	NR	NR	PV	PV
Fluosilicic Acid*	PV	S4	S4	S4	S4	PV	S4	S4	2	2	PV	2

*May need synthetic fabric, carbon fillers or HP 201 topcoat. Consult a Dudick Corrosion-Proof, Inc. technical representative for more complete information on these products.

Good to the maximum temperature of the product
High temperature service to 160°F (71°C)
Moderate Temperature Service to 140°F (60°C)
Warm Temperature Service to 100°F (37°C)

Performance varies with conditions. Consult Quick for recommendations or testing
Not recommended
No information available

Linings/Toppings					Toppings/Linings						Tied Vessel Linings				Grouts
Protecto-Clad	300	600	700	800	900	Protecto-Mat	100	300	600	700	800	900	Protecto-Seal	300	600	700	800	Protecto-Grouts	100
S1	3	3	3	2		I1	S1	3	3	3	2		S1	3	3	3		S1
S1	1	1	1	I1		1	S1	1	1	1	1		S1	1	1	1		S1
S1	3	NR	I3	I2		I1	S1	3	NR	3	2		S1	3	NR	I3		S1
S4	NR	NR	4	4		NR	S4	NR	NR	I4	4		S4	NR	NR	NR		S4
S1	1	1	1	1		I1	S1	1	I1	I1	1		S1	1	I1	I1		S1
NR	4	4	4	4		NR	NR	4	4	4	4		NR	4	4	4		NR
S4	F4	F4	F4	F4		F4	S4	F4	F4	F4	F4		S4	F4	F4	F4		NR
S3	I4	I4	I4	4		I4	S3	4	4	4	4		S3	4	I4	I4		S1
S1	I1	I1	I1	I1		I3	S1	1	I1	I1	1		S1	1	I1	I1		S3
NR	S4	S4	S4	S4		NR	NR	F3	F3	F3	F3		NR	F3	F3	F3		S4
S4	NR	NR	NR	NR		I4	S4	NR	S4	NR	NR		S4	NR	S4	NR		S4
NR	4	3	I4	I4		NR	NR	I4	I3	I4	4		NR	4	I3	I4		NR
NR	4	1	4	I4		NR	NR	4	I1	4	4		NR	4	1	4		NR
NR	F4	F1	F4	F4		NR	NR	F4	F4	F4	F4		NR	F4	F1	F4		NR
S4	4	3	4	4		NR	S4	4	I1	4	I4		S4	4	I1	4		NR
S4	NR	NR	I4	S4		I4	S4	NR	NR	NR	S4		S4	NR	NR	NR		NR
S4	NR	NR	NR	NR		NR	S4	NR	NR	NR	NR		S4	NR	NR	NR		S4
NR	NR	NR	NR	NR		NR	NR	NR	NR	NR	NR		NR	NR	NR	NR		NR
NR	NR	NR	NR	NR		NR	NR	NR	NR	NR	NR		NR	NR	NR	NR		NR
S4	I4	NR	I4	PV		I4	S4	I4	NR	NR	PV		S4	I4	NR	NR		S4
S4	I4	I3	I4	I4		NR	S4	I4	I3	I4	I3		S4	I4	I3	I4		S4
S4	I4	I3	I4	PV		NR	S4	I4	I3	I4	PV		S4	I4	I3	I4		NR
S1	I1	I1	I1	I1		I1	S1	I1	I1	I1	I1		S1	I1	I1	I1		S1
S1	I1	I1	I1	I1		I2	S1	I1	I1	I1	I1		S1	I1	I1	I1		S2
S4	I4	NR	I4	I3		I2	S4	I4	NR	I4	I3		S4	I4	NR	I4		S1
S2	I1	I1	I1	I1		I3	S2	I1	I1	I1	I1		S2	I1	I1	I1		S3
S1	I1	I1	I1	I1		I1	S1	I1	I1	I1	I1		S1	I1	I1	I1		S1
S3	I1	I1	I1	I1		I4	S3	I1	I1	I1	I1		S3	I1	I1	I1		S4
S1	I1	NR	I1	I1		I1	S1	I1	NR	I1	I1		S1	I1	NR	I1		S1
S1	I1	NR	I1	I1		I1	S1	I1	NR	I1	I1		S1	1	NR	I1		S1
S3	I1	I4	I1	I1		I4	S3	I1	I4	I1	I1		S3	I1	I4	I1		S4
NR	NR	NR	NR	PV		NR	NR	NR	NR	NR	PV		NR	NR	NR	NR		NR
NR	NR	NR	NR	NR		NR	NR	NR	NR	NR	NR		NR	NR	NR	NR		NR
PV	1	I1	1	1		PV	PV	I1	I1	I1	1		PV	1	1	I1		PV
PV	I1	PV	I1	I1		PV	PV	1	PV	I1	I1		PV	1	PV	I1		PV
S1	I1	I1	I1	I1		I1	S1	I1	I1	I1	I1		S1	1	I1	I1		S1
S1	I3	I3	I3	I3		I2	S1	I3	I3	I3	I3		S1	I3	I3	I3		S1
NR	I4	I4	I4	I4		NR	NR	I4	I4	I4	I4		NR	I4	I4	I4		S4
S1	I1	I1	I1	I1		I2	S1	I1	I1	I1	I1		S1	I1	I1	I1		S1
NR	NR	NR	NR	PV		NR	NR	NR	NR	NR	PV		NR	NR	NR	NR		NR
NR	I4	NR	I4	PV		NR	NR	I4	NR	NR	PV		NR	I4	NR	NR		NR
PV	I4	I4	I4	I3		PV	PV	I3	I4	I3	I3		PV	3	I4	I3		PV
S4	PV	NR	NR	NR		S4	S4	PV	NR	NR	S4		S4	NR	NR	NR		S4
S1	I1	I1	I1	I1		I1	S1	I1	I1	I1	I1		S1	I1	I1	I1		S1
PV	NR	NR	NR	PV		NR	PV	NR	NR	NR	PV		PV	NR	NR	NR		NR
S4	PV	PV	PV	PV		NR	S4	PV	PV	PV	PV		S4	PV	PV	NR		NR
S4	PV	NR	PV	PV		PV	S4	PV	NR	PV	PV		S4	PV	NR	PV		S4
PV	PV	NR	PV	S4		PV	PV	PV	NR	NR	S4		PV	PV	NR	NR		NR
S1	I1	I1	I1	I1		I1	S1	I1	I1	I1	I1		S1	I1	I1	I1		S1
S4	PV	PV	PV	PV		PV	S4	PV	PV	PV	PV		S4	PV	PV	PV		PV
S4	I4	F4	I4	I4		I4	S4	I4	F4	I4	I4		S4	I4	F4	I4		PV
S1	I1	I1	I1	I1		I1	S1	I1	I1	I1	I1		S1	I1	I1	I1		S1
S1	I1	I1	I1	I1		I1	S1	I1	I1	I1	I1		S1	I1	I1	I1		S1
S1	I1	I1	I1	I1		I1	S1	I1	I1	I1	1		S1	1	I1	I1		S1
S1	I1	I1	I1	I1		I1	S1	I1	I1	I1	I1		S1	I1	I1	I1		S1
S4	I1	I1	PV	I1		NR	S4	I1	I1	I1	1		S4	2	2	PV		S4
PV	NR	NR	PV	PV		NR	PV	NR	NR	PV	PV		PV	NR	NR	PV		NR
S4	I4	4	PV	I4		PV	S4	2	2	2	2		S4	2	2	PV		S4

Dudick

Key

Material will withstand constant flow or immersion service
Material is suitable for intermittent or splashed service
Material will tolerate fumes only

	Light Duty Linings/Coatings						Floorings		Heavy Duty Linings			
	Protecto-Coat 300	600	700	800	900	1000	Protecto-Coat 300	800	Protecto-Coat 600	700	800	900
Formaldehyde	F4	4	4	4	4	F4	S1	S1	1	1	1	1
Formic Acid	NR	S4	S4	S4	S4	PV	NR	S4	4	4	4	4
Fuel Oil 1 & 2	S4	4	4	4	4	NR	S1	S1	1	3	1	1
Furfural	NR	S4	S4	S4	S4	PV	PV	PV	NR	PV	PV	PV
Furfuryl Alcohol	PV	S4	S4	S4	S4	S4	S1	S1	4	4	4	4
Gasoline	4	4	4	4	4	4	S1	S1	1	1	1	1
Glucose	4	4	4	4	4	1	S1	S1	1	1	1	1
Gluconic Acid (50%)	PV	F4	S4	F4	S4	PV	PV	S4	S4	4	S4	4
Glycol	4	4	4	4	4	4	S1	S1	1	1	1	1
Glycolic Acid	NR	S4	S4	S4	S4	F1	S4	S4	3	3	3	3
Gold Plating (Cyanide)	S4	S1	NR	S1	S1	S1	S1	S4	4	NR	4	3
Grape Juice	3	3	3	3	3	1	S1	S1	1	1	1	1
Green Liquor	S4	4	NR	4	3	1	S1	S3	1	NR	1	1
Heptane	S4	S1	S1	S1	S1	4	S1	S1	2	2	2	2
Heptanoic Acid	PV	S4	S4	S4	S4	F1	PV	3	3	3	3	3
Hexane	F4	S1	S1	S1	S1	4	S1	S1	2	2	2	2
Hydrazine (35%)	PV	NR	NR	NR	NR	NR	S4	S4	NR	NR	NR	NR
Hydraulic Fluid	PV	PV	PV	PV	3	PV	S1	S1	PV	PV	PV	1
Hydrindic Acid (20%)	F4	S4	S4	S4	S4	S1	PV	S4	4	4	4	4
Hydrobromic Acid (20%)	F4	S4	S4	S4	S4	S1	PV	S4	4	3	4	4
Hydrocarbons (Aliphatic)	PV	4	4	4	4	1	S1	S4	1	1	1	1
Hydrocarbons (Aromatic)	PV	PV	PV	PV	F4	NR	S4	S4	PV	PV	PV	1
Hydrochloric Acid (1-25%)	F4	S3	S3	S3	S3	F1	S4	S4	1	3	1	1
Hydrochloric Acid (25-37%)	NR	F3	F3	F3	F3	F1	S4	S4	PV	PV	PV	2
Hydrofluoric Acid (1-10%)*	NR	F3	NR	NR	F3	NR	NR	NR	NR	NR	NR	NR
Hydrofluoric Acid (10-53%)*	NR	F4	NR	NR	F4	NR	NR	NR	NR	NR	NR	NR
Hydrofluosilicic Acid*	F4	F3	NR	NR	F3	PV	NR	NR	2	2	PV	NR
Hydrogen Bromide	PV	PV	PV	PV	F1	PV	PV	S4	PV	PV	PV	4
Hydrogen Peroxide (30%)	NR	PV	PV	PV	F4	PV	NR	S4	PV	PV	PV	4
Hydrogen Sulfide	S4	4	4	4	3	1	S1	S1	1	1	1	1
Hypochlorous Acid	NR	NR	NR	NR	F3	NR	NR	NR	NR	NR	NR	NR
Iodine	NR	F4	F4	F4	F3	F1	PV	S4	4	4	4	3
Insecticides	PV	PV	PV	PV	F4	PV	PV	S3	PV	PV	PV	3
Isophorone	PV	PV	PV	PV	PV	PV	S4	PV	4	4	4	4
Isopropyl Acetate	NR	NR	NR	NR	NR	PV	S4	NR	PV	NR	PV	S4
Isopropyl Alcohol	S4	PV	PV	PV	S4	PV	S1	S1	1	1	1	1
Isopropyl Amine	PV	PV	PV	PV	F4	NR	PV	NR	PV	4	PV	S4
Isopropyl Ether	S4	PV	PV	PV	F4	NR	S4	S4	4	4	4	4
Jet Fuel	4	4	4	4	4	F1	S1	S1	1	1	1	1
Kaolin	1	PV	NR	PV	1	1	1	1	PV	NR	PV	1
Kerosene	4	4	4	4	4	1	S1	S1	1	1	1	1
Lasso Herbicide (10%)	PV	S4	S4	S4	S4	F4	PV	S4	4	4	4	4
Lactic Acid (1-20%)	F4	4	4	4	4	S1	S4	S1	1	1	1	1
Lactic Acid (20%-Con)	NR	S4	S4	S4	4	S1	NR	S4	4	3	3	3
Lauric Acid	PV	4	4	4	3	S1	NR	S1	1	1	1	1
Lead Acetate	4	4	4	4	3	F1	S1	S1	1	1	1	1
Linseed Oil	S3	1	1	1	1	1	S4	S1	1	1	1	1
Magnesium Sulfate	1	1	1	1	1	1	S1	S1	1	1	1	1
Maleic Acid	S3	S3	S3	S3	S1	S1	S1	S4	3	3	3	1
Manganese Salts	4	4	4	4	4	1	S1	S1	1	1	1	1
Mercury Salts	4	4	S4	4	4	1	S1	S1	1	S1	1	1
Methyl Alcohol	NR	PV	PV	PV	F4	S4	S4	S1	4	4	4	4
Methyl Acetate	NR	NR	NR	NR	F4	PV	S3	S4	PV	NR	PV	PV
Methylene Chloride	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Methyl Chloride	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Methyl Ethyl Ketone	NR	NR	NR	NR	NR	NR	PV	NR	PV	NR	PV	NR
Methyl Isobutyl Ketone	NR	NR	NR	NR	NR	NR	S4	S4	PV	NR	PV	NR
Milk Products	1	1	1	1	1	1	S1	S1	1	1	1	1

*May need synthetic fabric, carbon fillers or HP 201 topcoat. Consult a Dudick Corrosion-Proof, Inc. technical representative for more complete information on these products.

1 Good to the maximum temperature of the product
2 High temperature service to 160°F (71°C)
3 Moderate temperature service to 140°F (60°C)
4 Warm temperature service to 100°F (37°C)

PV Performance varies with conditions. Consult Dudick for recommendations or testing
NR Not recommended
NI No information available

Linings/Toppings					Toppings/Linings						Lined Vessel Linings				Grouts
Protecto-Glass 300	600	700	800	900	Protecto-Line 100	300	600	700	800	900	Protecto-Seal 300	600	700	800	Grouts 100
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
NR	4	4	4	4	NR	NR	4	4	4	4	NR	4	4	4	NR
S1	4	4	4	3	1	S1	1	3	1	1	S1	1	3	1	S1
PV	PV	PV	PV	PV	PV	PV	NR	PV	PV	PV	PV	NR	PV	PV	PV
S1	4	4	4	4	4	S1	4	4	4	4	S1	4	4	4	S4
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	1
PV	S4	S4	S4	S4	PV	PV	S4	4	4	4	PV	S4	4	S4	
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S4	3	3	3	3	NR	S4	3	3	3	3	S4	3	3	3	NR
S1	4	NR	4	3	1	S1	4	NR	4	3	S1	4	NR	4	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	1	NR	1	1	1	S1	1	NR	1	1	S1	1	NR	1	S1
S1	3	3	3	3	1	S1	3	3	3	3	S1	2	2	2	S1
PV	3	3	3	3	PV	PV	3	3	3	3	PV	3	3	3	PV
S1	3	3	3	3	1	S1	2	2	2	2	S1	2	2	2	S1
S4	NR	NR	NR	NR	4	S4	NR	NR	NR	NR	S4	NR	NR	NR	S4
PV	PV	PV	PV	1	1	PV	PV	PV	PV	1	PV	PV	PV	PV	
PV	4	4	4	4	NR	PV	4	4	4	4	PV	4	4	4	NR
PV	4	3	4		NR	PV	4	3	4	4	PV	4	3	4	NR
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S4	PV	PV	4	1	4	S4	PV	PV	4	1	S4	PV	PV	PV	F4
S4	3	3	3	3	4	S4	3	3	3	3	S4	3	3	3	S4
S4	PV	PV	PV	4	S4	S4	PV	PV	S3	S3	S4	PV	PV	PV	S4
S4	NR	NR	NR	NR	PV	S4	4	4	2	2	S4	NR	NR	NR	NR
NR	NR	NR	NR	NR	PV	NR	4	4	S4	S4	NR	NR	NR	NR	NR
S4	2	2	PV	2	PV	S4	2	2	2	2	S4	2	2	PV	S4
S4	PV	PV	PV	S4	PV	PV	PV	PV	S4	S4	PV	PV	PV	PV	S4
PV	PV	PV	PV	4	PV	PV	PV	PV	S1	S1	PV	PV	PV	PV	S4
S1	1	1	1	1	2	S1	1	1	1	1	S1	1	1	1	S3
NR	NR	NR	NR	S3	NR	NR	PV	4	4	3	NR	NR	NR	NR	NR
PV	4	4	4	3	PV	PV	4	4	4	3	PV	4	4	4	S4
S4	PV	PV	PV	3	S1	S4	PV	PV	S1	S1	PV	PV	PV	PV	S4
S4	4	4	4	4	4	S4	4	4	4	4	S4	4	4	4	S4
S4	PV	NR	PV	4	PV	S4	PV	NR	S4	4	S4	PV	NR	PV	NR
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S3
S4	PV	4	PV	4	S3	S4	PV	4	4	4	PV	PV	4	PV	S4
S4	4	4	4	4	4	S4	4	4	4	4	S4	4	4	4	S4
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S2
S1	PV	NR	PV	1	1	1	PV	NR	1	1	1	PV	NR	PV	1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S2
S4	4	4	4	4	4	S4	4	4	3	3	PV	4	4	4	S4
S4	1	1	1	1	S4	S4	1	1	1	1	S4	1	1	1	NR
NR	4	3	3	3	NR	NR	4	3	3	3	NR	4	3	3	NR
PV	1	1	1	1	S4	PV	1	1	1	1	PV	1	1	1	S3
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S4	1	1	1	1	PV	S4	1	1	1	1	S4	1	1	1	S4
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S
S3	3	3	3	1	2	S3	3	3	3	1	S3	3	3	3	S3
S1	1	1	1	1	1	1	1	1	1	1	S1	1	1	1	S1
S1	1	S1	1	1	1	S1	1	S1	1	1	S1	1	S1	1	S1
S4	4	4	4	4	4	S4	4	4	4	4	S4	4	4	4	S4
S4	PV	NR	PV	PV	PV	S4	PV	NR	S3	S3	S4	PV	NR	PV	PV
NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
S4	PV	NR	PV	NR	4	S4	PV	NR	S4	S4	S4	PV	NR	PV	NR
S4	PV	NR	4	NR	4	S4	PV	NR	S4	S4	S4	PV	NR	PV	NR
S1	1	1	1	1	1	1	1	1	1	1	S1	1	1	1	S1

Dudick

Key

Material will withstand constant flow or immersion service
Material is suitable for intermittent or spillage service
Material will tolerate fumes only

	Light Duty Linings/Coatings						Topings		Heavy Duty Linings			
	300	600	700	800	900	1000	300	800	600	700	800	900
Mineral Oil	4	4	S4	4	4	S4	S1	S1	1	1	1	1
Molasses	1	1	1	1	1	1	S1	S1	1	1	1	1
Naphalene	S4	S4	S4	S4	S3	S4	S4	S4	4	4	4	3
Naphtha	S4	4	4	4	3	4	S1	S1	3	1	1	1
Naphthenic Acid	PV	4	4	4	PV	PV	S4	PV	4	4	4	PV
Nickel Chloride	S4	S4	S4	S4	S4	S4	S1	S1	1	3	1	1
Nickel Plating (Bright)	S4	S4	S4	S4	S4	4	S1	S1	1	1	1	1
Nickel Salts	S4	4	4	4	3	4	S1	S1	1	1	1	1
Nitric Acid (5%)	S4	S3	S3	S3	S3	S4	S4	S1	3	1	3	2
Nitric Acid (10%)	S4	S3	S3	S3	S3	S4	S4	S1	3	2	3	2
Nitric Acid (20%)	NR	F4	F4	F4	F4	NR	NR	S2	4	3	4	4
Nitric Acid (40%)	NR	F4	F4	F4	F4	NR	NR	S4	4	4	4	4
Nitric Acid (60%)	NR	NR	NR	NR	F4	NR	NR	S4	S4	S4	S4	S4
Nitric Acid (Conc.)*	NR	NR	NR	NR	F4	NR	NR	NR	NR	F4	NR	F4
Nitrobenzene	NR	NR	NR	NR	NR	NR	PV	NR	PV	PV	PV	PV
Nitrous Acid	NR	PV	PV	PV	PV	PV	PV	S3	3	1	3	2
Octanoic	F4	S4	NR	S4	S3	PV	PV	S3	4	NR	4	4
Oils (Animal)	1	1	1	1	1	1	S1	S1	1	1	1	1
Oils (Mineral)	1	1	1	1	1	1	S1	S1	1	1	1	1
Oils (Vegetable)	1	1	1	1	1	1	S1	S1	1	1	1	1
Oleic Acid	NR	4	4	4	3	NR	S4	S1	1	1	2	1
Oxalic Acid (Sat'd)	S4	4	4	4	3	S1	S1	S1	3	1	1	1
Ozone	PV	PV	PV	PV	2	S3	S1	S1	PV	S4	PV	S4
Palmitic Acid	PV	S4	PV	S4	S3	PV	PV	S4	1	PV	1	1
Pentachlorethane	PV	PV	PV	PV	S1	PV	S1	S4	PV	PV	PV	S1
Perchloric Acid	NR	PV	PV	PV	F4	PV	S1	S1	PV	PV	PV	PV
Perchlorethylene	NR	NR	NR	NR	F4	NR	S4	S4	4	4	PV	S4
Phenol (0%-10%)	NR	PV	PV	PV	F4	NR	S4	S2	PV	NR	PV	PV
Phenol (85%)	NR	NR	NR	NR	F4	NR	PV	PV	NR	NR	NR	PV
Phosphoric Acid (Conc.)	NR	S3	S3	S3	S1	NR	NR	S1	1	1	1	1
Phosphorous Oxychloride	NR	PV	PV	PV	F4	PV	S4	S4	PV	F4	PV	PV
Phosphorous Trichloride	NR	PV	PV	PV	F4	PV	S4	PV	PV	F4	PV	PV
Phthalic Acid	PV	S1	PV	S1	S1	PV	PV	S1	1	PV	1	1
Potassium Bichromate	S4	4	4	4	4	S4	S4	S1	4	1	4	1
Potassium Bromate	S4	4	4	4	4	4	S4	S1	4	4	4	4
Potassium Bromide	S4	4	4	4	4	4	PV	S1	1	1	1	1
Potassium Carbonate	4	PV	PV	PV	4	4	S1	S1	4	NR	4	4
Potassium Chlorate	S4	4	4	4	4	4	S1	S1	1	1	1	1
Potassium Chloride	4	4	4	4	3	4	S1	S1	1	1	1	1
Potassium Cyanide	S4	4	4	4	PV	4	S1	S1	1	1	1	1
Potassium Hydroxide (10%)*	4	S1	NR	S1	4	4	S1	S1	4	NR	4	4
Potassium Hydroxide (Conc.)*	S4	NR	NR	NR	S4	S1	S1	S1	NR	NR	NR	NR
Potassium Nitrate	4	4	4	4	3	1	S1	S1	1	1	1	1
Potassium Permanganate	4	4	4	4	3	S1	S1	S1	PV	1	1	1
Potassium Peroxide	S4	S4	S4	S4	PV	F4	S1	PV	4	PV	4	4
Potassium Persulfate	S4	4	4	4	3	S1	S1	S1	1	1	1	1
Potassium Sulfate	4	4	4	4	3	1	S1	S1	1	1	1	1
Pulpstock Chlorinated	NR	NR	S1	NR	S4	NR	NR	S4	NR	1	NR	NR
Propionic Acid	NR	NR	NR	NR	F4	NR	PV	PV	PV	NR	NR	PV
Propylene Glycol	NR	3	3	3	3	4	S4	S4	4	4	4	3
Pyridine	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Salicylic Acid	S1	4	4	4	4	4	S1	S1	1	1	1	1
Seawater	1	1	1	1	1	1	S1	S1	1	1	1	1
Silver Nitrate	S1	S1	S1	S1	S1	PV	S1	S1	1	1	1	1
Sodium Acetate	4	4	4	4	4	4	S1	S1	1	1	1	1
Sodium Bicarbonate	4	4	4	4	4	1	S1	S1	1	1	1	1
Sodium Bisulfate	4	4	4	4	4	4	S1	S1	1	1	1	1
Sodium Bisulfite	4	4	4	4	4	4	S1	S1	1	1	1	1

*May need synthetic fabric, carbon fillers or HP 201 topcoat. Consult a Dudick Corrosion-Proof, Inc. technical representative for more complete information on these products.

1 Good to the maximum temperature of the product
2 Fair temperature service to 160°F (71°C)
3 Moderate Temperature Service to 140°F (60°C)
4 Warm Temperature Service to 100°F (37°C)

Performance varies with conditions. Consult Dudick for recommendations or testing
NR Not recommended
NI No information available

Linings/Toppings					Toppings/Linings						Lined Vessel Linings				Grouts
Protecto Gel					Protecto Line						Epoxy				Epoxy
300	600	700	800	900	100	300	600	700	800	900	300	600	700	800	100
S1	1	1	1	1	1	1	1	1	1	1	1	1	4	1	S1
S1	1	1	1	1	1	1	1	1	1	1	S1	1	1	1	S1
S4	4	4	4	3	4	S4	4	4	4	3	S4	4	4	4	S4
S4	3	1	1	1	1	S4	3	1	1	1	S4	3	1	3	S4
PV	4	4	4	4	4	PV	4	4	4	PV	PV	4	4	4	PV
S1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	S1
S3	1	1	1	1	1	1	S3	1	1	1	S3	1	1	1	S3
S1	1	1	1	1	1	1	1	1	1	1	S1	1	1	1	S1
S4	3	1	1	1	NR	S4	3	1	3	1	S4	3	4	3	NR
S4	3	2	1	1	NR	S4	3	2	3	2	S4	3	2	3	NR
NR	4	3	4	3	NR	NR	4	3	4	3	NR	4	3	4	NR
NR	4	4	4	4	NR	NR	4	4	4	4	NR	4	4	4	NR
NR	S4	S4	S4	S4	NR	NR	S1	S1	S1	S1	NR	S4	S4	S4	NR
NR	NR	F4	NR	F4	NR	NR	NR	NR	NR	F4	NR	NR	F4	NR	NR
PV	PV	PV	PV	PV	PV	PV	PV	PV	PV	F4	PV	PV	PV	PV	NR
PV	3	1	3	1	PV	PV	3	1	3	1	PV	3	1	3	NR
PV	4	NR	4	PV	PV	PV	4	NR	4	4	PV	4	NR	4	PV
S4	1	1	1	1	1	1	1	1	1	1	S4	1	1	2	S3
S1	1	1	1	1	1	1	1	1	1	1	S1	1	1	2	S1
S3	1	1	1	1	1	1	1	1	1	1	S3	1	1	2	S1
S4	1	1	1	1	NR	S4	1	1	2	1	S4	1	1	2	NR
S1	3	1	1	1	PV	S1	3	1	1	1	S1	3	1	1	S1
S1	PV	S4	S4	S4	S1	S1	PV	S4	2	1	S1	PV	S4	PV	NR
PV	1	PV	1	1	PV	PV	1	PV	1	1	PV	1	PV	1	S4
S4	PV	PV	PV	PV	PV	S1	PV	PV	PV	S1	S4	PV	PV	PV	S4
NR	PV	PV	PV	PV	PV	S1	PV	PV	PV	PV	NR	PV	PV	PV	NR
S4	4	4	PV	PV	4	S4	4	4	PV	4	S4	4	4	PV	S4
S4	PV	NR	PV	PV	PV	S4	PV	NR	S2	S2	S4	PV	NR	PV	S4
PV	NR	NR	NR	PV	NR	PV	NR	NR	F4	S4	PV	NR	NR	NR	NR
NR	1	1	1	1	NR	NR	1	1	1	1	NR	1	1	1	NR
S4	PV	F4	PV	PV	3	S4	PV	F4	PV	PV	S4	PV	F4	PV	S4
S4	PV	F4	PV	PV	3	S4	PV	F4	PV	PV	S4	PV	F4	PV	S4
S4	1	PV	1	1	PV	PV	1	PV	1	1	S4	1	PV	1	NR
S4	4	1	1	1	4	S4	4	1	4	1	S4	4	1	4	S3
S4	4	4	4	4	PV	S4	1	1	1	1	S4	4	4	4	S4
S4	1	1	1	1	PV	S4	1	1	1	1	S4	1	1	1	S4
S1	4	NR	4	4	1	S1	4	NR	4	4	S1	4	NR	4	S1
S1	1	1	1	1	3	S1	1	1	1	1	S1	1	1	1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	4	NR	4	4	1	S1	4	NR	4	4	S1	4	NR	4	S1
S1	NR	NR	NR	NR	1	S1	NR	NR	NR	4	S1	NR	NR	NR	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	PV	1	1	1	1	S1	PV	1	1	1	S1	PV	1	1	S1
S1	4	PV	4	4	PV	S1	4	PV	4	4	S1	4	PV	4	S3
S1	F1	F1	F1	F1	PV	S1	1	1	1	1	S1	1	1	1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
NR	NR	1	NR	NR	NR	NR	NR	1	NR	NR	NR	NR	1	NR	NR
PV	PV	NR	NR	PV	NR	PV	PV	NR	NR	PV	PV	PV	NR	NR	NR
4	4	4	4	3	4	4	4	4	4	3	4	4	4	4	4
NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
S1	1	1	1	1	3	S1	1	1	1	1	S1	1	1	1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	1	1	1	1	S1	S1	1	1	1	1	S1	1	1	1	S4
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	1	1	1	1	1	S1	1	1	1	1	S1	1	1	1	S1
S1	1	1	1	1	1	1	1	1	1	1	S1	1	1	1	S1

CK

Key

Material will withstand constant flow or immersion service
Material is suitable for intermittent or spillage service
Material will tolerate fumes only

...ns. Consult ...esting

	Light Duty Linings/Coatings						Coatings		Heavy Duty Linings				Grouts
	Protecto-Coat 300	600	700	800	900	1000	Protecto-Crete 300	800	Protecto-Flake 600	700	800	900	
...te	I4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1	
...hate	I4	PV	PV	PV	I4	I1	S1	S4	I3	PV	I4	I3	
...ate	PV	I4	I4	I4	I4	I4	S1	S1	I1	I1	I1	I1	
...te	I1	I1	I1	I1	I1	I1	S1	S1	I1	I1	I1	I1	
...te (50%)	NR	S4	S4	S4	S3	S4	S4	S4	I4	I4	I4	I3	
...hate	S4	I4	I4	I4	I3	S4	S1	S1	PV	I1	PV	I1	
...de	S4	I4	I4	I4	I3	I4	S1	S1	I1	I1	I1	I1	
...omate	S4	I4	I4	I4	I3	I4	S1	S1	PV	I4	I4	I3	
...ide*	S4	NR	NR	NR	I4	PV	S4	S4	NR	NR	NR	NR	
...xide (10%)*	I4	S1	NR	S1	I1	I1	S1	S1	I4	NR	I4	I1	
...xide (50%)*	S4	NR	NR	NR	I1	I1	S1	S4	NR	NR	NR	I1	
...hlorite (5%)*	F4	NR	NR	S4	S4	F1	S3	S1	NR	NR	I4	I3	
...hlorite (17%)*	NR	NR	NR	PV	S4	NR	S4	S4	NR	NR	PV	S4	
...de	I4	I4	I4	I4	I4	I1	S4	NR	PV	NR	PV	S4	
...hate	S4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1	
...te	I4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1	
...de	I4	PV	PV	PV	I4	I1	S1	S1	I4	PV	I4	I4	
...te	I4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1	
...ate	I4	I4	I4	I4	I4	I1	S1	S1	I1	I1	I1	I1	
...sulfate (Hypo)	I4	I4	I4	I4	I3	S1	S1	S1	I1	I1	I1	I1	
	PV	I4	I4	I4	I3	I1	PV	S1	I1	I1	I1	I1	
	S4	PV	PV	PV	I4	PV	S4	S1	I2	I2	I2	I2	
	I4	PV	PV	PV	I4	PV	S3	S3	I4	I4	I4	I4	
	I1	I1	I1	I1	I1	I1	S1	S1	I1	I1	I1	I1	
...r (Paper)	I4	I4	PV	I4	I4	I1	S1	S1	I1	PV	I1	I1	
...ce	F1	S4	S4	S4	S4	I1	S1	S1	F4	I1	I1	I1	
...ce	F4	PV	PV	PV	PV	S1	S1	S1	I4	I4	I4	I4	
...(2%-20%)	S4	S2	S2	S2	S2	S2	S3	S1	I1	I1	I1	I1	
...(20%-50%)	F4	S2	S2	S2	S2	F1	S4	S1	I3	I3	I3	I2	
...(50%-70%)	F4	F3	F3	F3	F2	F4	NR	NR	I4	I4	I4	I2	
...(70%-80%)	NR	PV	PV	PV	F4	NR	NR	NR	PV	PV	PV	I4	
...(80%-98%)	NR	PV	PV	PV	F4	NR	NR	NR	NR	NR	NR	NR	
...a	S4	I4	I4	I4	I4	S4	S1	S1	I1	I1	I1	I1	
	I4	I4	I4	I4	I4	I1	PV	S1	I1	I1	I1	I1	
	PV	I4	I4	I4	I4	PV	PV	S4	I1	I1	I1	I1	
	I4	I4	I4	I4	I3	S1	S1	S1	I1	I1	I1	I1	
...hane	PV	NR	NR	NR	F4	NR	S4	NR	PV	PV	PV	PV	
...ride	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	
...rachloride	F4	I4	I4	I4	I3	S4	S1	S1	I1	I1	I1	I1	
	NR	NR	NR	NR	F4	NR	PV	NR	I4	PV	I4	PV	
...onic Acid	S3	I4	I4	I4	I3	S4	S1	S1	I1	I1	I1	I1	
...ic Acid (20%)	NR	F4	F4	F4	I4	F4	NR	S1	I4	I4	I4	I4	
...ene	NR	NR	NR	NR	F4	NR	PV	NR	PV	NR	PV	PV	
...osphate	I4	I4	NR	I4	I4	I4	S1	S4	I3	NR	I3	I3	
	S4	PV	PV	PV	F4	NR	S1	NR	PV	PV	PV	PV	
...ctants	PV	I4	I4	I4	I4	PV	S1	S1	I1	I1	I1	I1	
...ns	I4	I4	I4	I4	I4	I4	S1	S1	I1	I1	I1	I1	
	F4	I1	I1	I1	I1	I4	S1	S1	I1	I1	I1	I1	
...ed & demineralized	I4	I4	I4	I4	I4	I4	S1	S1	I1	I1	I1	I1	
...r (Paper)	I4	I4	PV	I4	I3	I4	S1	S1	I1	PV	I1	I1	
...ol)	NR	NR	NR	NR	NR	NR	PV	NR	I4	PV	I4	I4	
	I4	I4	I4	I4	I3	I4	S1	S1	I1	I1	I1	I1	
Sulfate)	S3	I4	I4	I4	I3	S1	S1	S1	I1	I1	I1	I1	

*May need synthetic fabric, carbon fillers or HP-201 topcoat. Consult a Dudick Corrosion-Proof, Inc. technical representative for more complete information on these products.

Temperature Limits

Product	Substrate				Notes
Series (Chemical Property)	F°	C°	F°	C°	
Protecto-Coat	*Metal*		*Concrete/Steel*		
300 (Adduct Cured Epoxy)	100	77	100	77	Steel: Constant Flow; Steel Dry or Intermittent Spills: 200°F (93°C) to 350°F (96°C)
600 (Bisphenol Polyester)	130	54	130	54	
700 (Halogenated Polyester)	130	54	130	54	Concrete: Constant Flow
800 (Vinyl Ester)	130	54	130	54	
900 (High Molecular Weight Vinyl Ester)	130	54	130	54	
1000 (Coal Tar)	130	54	130	54	
Protecto-Crete	*Metal*		*Concrete*		
300 (Adduct Cured Epoxy)	Not Recommended		300	150[3]	[3] Intermittent Spills, otherwise maximum temperature is 150°F
800 (Vinyl Ester)	Not Recommended		250	120	
Protecto-Flake	*Metal*[4]		*Concrete*		
600 (Bisphenol Polyester)	180	83	160	71	[4] Metal: Immersion; Dry Metal: 250°F (121°C)
700 (Halogenated Polyester)	180	83	160	71[4]	
800 (Vinyl Ester)	180	83	160	71	
900 (High Molecular Weight Vinyl Ester)	180	83	160	71	
Protecto-Glass	*Metal*[5]		*Concrete*		
300 (Adduct Cured Epoxy)	150	65	250	121	[5] Steel: Constant Flow
600 (Bisphenol Polyester)	160	71	140	60	
700 (Halogenated Polyester)	160	71	140	60	
800 (Vinyl Ester)	160	71	140	60	
Protecto-Line	*Metal*[6]		*Concrete*[7]		
100 (Amine Cured Epoxy)	180	82	160	71	[7] Steel: Constant Flow and Immersion
300 (Adduct Cured Epoxy)	160	71	160	71	
600 (Bisphenol Polyester)	160	71	160	71	Concrete: Constant Flow
700 (Halogenated Polyester)	160	71	160	71	
800 (Vinyl Ester)	160	71	160	71	
900 (High Molecular Weight Vinyl Ester)	160	71	160	71	
[illegible]	*Metal*[8]		*Tile/Concrete*[8]		
300 (Adduct Cured Epoxy)	160	71	160	71	[8] Steel Tile: Constant Flow and Immersion
600 (Bisphenol Polyester)	180	83	180	83	
700 (Halogenated Polyester)	180	83	180	83	
800 (Vinyl Ester)	180	83	180	83	
Grouts	*Metal*		*Concrete*		
100 (Amine Cured Epoxy)	Not Applicable		160	71	
600 (Bisphenol Polyester)*	Not Applicable		160	71[9]	* Grout 600-700 pours not to exceed 2 inches in depth
700 (Halogenated Polyester)*	Not Applicable		160	71[9]	

* ***Note:*** For more information on Grouts 600 and 700, please consult with a Dudick technical representative.

Products

There is a Dudick Corrosion-Proof product to protect virtually any area of a plant and any piece of production, storage or handling equipment from the corrosive effects of moisture and chemical attack.

Seven standard product lines are available and each offers a range of products developed to meet the special requirements encountered in most manufacturing or processing environments. However, any product in any system can be modified to tailor the physical, mechanical, environmental or application properties to the unique needs of a specific application.

A series of catalogs is available describing the specific properties of each product in each of these systems. Of course, our factory personnel are available to work with your architect, or plant management engineering, and maintenance personnel to recommend a standard or custom formulated Dudick Corrosion-Proof product that meets your exact performance and durability requirements.

1.

Protecto-Coat, *a series of high-build, glass-flake filled coatings for fast economical application by brush, roller or spray. Corrosion protection can range from mild atmospheric exposures to immersion, depending on the resin base and the finished DFT.*

2.

Protecto-Crete, *an unreinforced monolithic floor topping of amine adduct cured epoxy. It is several times stronger than concrete and resistant to dilute chemical spills.*

3.

Protecto-Flake, *a series of heavily glass-flake filled, trowel applied tank linings especially suitable for continuous immersion in high concentrations at high temperature. Two fire retardant grades are available as standard products in this system, as well as offering FDA approval for food contact.*

4.

Protecto-Glass systems use the original glass mat reinforcement principal to achieve good corrosion resistance to a broad range of chemical elements including oxidizing agents and hot alkalis.

5.

Protecto-Line, *a reinforced monolithic vessel lining or floor topping system offering FDA approval. A variety of resins, reinforcing fabrics and curing agents provide chemical resistance ranging from mild ambient exposures to hot spills of strong acids.*

6.

Protecto-Seal, *a series of reinforced tile chest relining products developed especially for the needs of the pulp and paper industry. A choice of epoxy, polyester or vinyl ester resin formulations provides chemical protection from pH 1-14.*

Grouts *provide the superior corrosion protection and high compressive strength to permanently anchor heavy equipment.*

APPENDIX D-10, DATA SHEET #3

TECHNICAL SPECIFICATIONS FOR CARBOMASTIC SYSTEM
MANUFACTURED BY CARBOLINE COMPANY

carboline

CARBOMASTIC® #14

3 mil exposed

350 HANLEY INDUSTRIAL COURT • ST. LOUIS, MO. 63144 • 314-644-1000

SELECTION DATA

GENERIC TYPE: Epoxy-coal tar. Part A and Part B mixed prior to application.

GENERAL PROPERTIES: A heavy duty, high build, epoxy-coal tar coating for the protection of steel and concrete in immersion service. Can be applied at thicknesses up to 12 mils (305 microns) per coat. Cures to a hard, smooth finish. Simple 1:1 mixing ratio. Both components have low viscosity resulting in easy mixing.

RECOMMENDED USES: Lining for tanks, piping, trenches, sumps and as heavy duty maintenance coating for steel and concrete — splash, spillage and fumes. Widely used for protection of offshore structures, marine installations, and pilings. Also as lining for barges and tankers carrying sour crude, petroleum products and salt water ballast. Recommended for concrete and steel surfaces in sewage treatment plants, paper mills, chemical plants, etc. Excellent protection for underground surfaces.

NOT RECOMMENDED FOR: Immersion in aromatic or ketone solvents; strong oxidizing acids.

CHEMICAL RESISTANCE GUIDE:

Exposure	Immersion	Splash and Spillage	Fumes
Acids	Very Good	Excellent	Excellent
Alkalies	Very Good	Excellent	Excellent
Solvents	Good	Very Good	Very Good
Salt	Excellent	Excellent	Excellent
Water	Excellent	Excellent	Excellent

TEMPERATURE RESISTANCE: (Non-immersion)
Continuous: 200°F (93°C)
Non-continuous: 250°F (121°C)
For immersion, temperature depends on exposure, but maximum is 130°F (54°C)

FLEXIBILITY: Fair

WEATHERING: Good (chalks)

ABRASION RESISTANCE: Very Good

SUBSTRATES: Apply to properly prepared concrete, steel or others as recommended.

TOPCOAT REQUIRED: None required. May be topcoated with Carboline antifouling paints as directed. Coal tar bleedthrough is likely with most topcoats.

COMPATIBILITY WITH OTHER COATINGS: Obtain specific recommendation before applying over old coatings. Coating is self-priming. Can also be applied over thin film inorganic zincs, catalyzed epoxies or others as recommended. Acceptable primers for steel are Carbo Weld ® 11 or Carbomastic #3. For concrete an epoxy surfacer may be necessary.

SPECIFICATION DATA

THEORETICAL SOLIDS CONTENT OF MIXED MATERIAL:

	By Volume
Carbomastic #14	75% ± 1%

RECOMMENDED DRY FILM THICKNESS PER COAT: 8 mils (205 microns)

THEORETICAL COVERAGE PER MIXED GALLON*
1203 mil sq. ft. (29.4 sq.m/1 @ 25 microns)
150 sq. ft. at 8 mils (3.7 sq.m/1 @ 205 microns)

*NOTE: Material losses during mixing and application will vary and must be taken into consideration when estimating job requirements.

SHELF LIFE: 2 years

COLORS: Black and Dark Red only

GLOSS: High initially, becomes flat

ORDERING INFORMATION

Prices may be obtained from Carboline Sales Representative or Main Office. Terms — Net 30 days.

SHIPPING WEIGHT:

	2's	10's
Carbomastic #14	28 lbs. (12.7 kgs.)	135 lbs. (61.3 kgs.)
Carbomastic Thinner	9 lbs. in 1's (4.1 kgs.)	45 lbs. in 5's (20.4 kgs.)
Surface Preparation #1	9 lbs. in 1's (4.1 kgs.)	45 lbs. in 5's (20.4 kgs.)

FLASH POINT: (Pensky-Martens Closed Cup)

Carbomastic #14 Part A	78°F (26°C)
Carbomastic #14 Part B	58°F (14°C)
Carbomastic Thinner	73°F (23°C)
Surface Preparation #1	60°F (16°C)

May 77-Replaces Oct. 76N

To the best of our knowledge the technical data contained herein are true and accurate at the date of issuance and are subject to change without prior notice. User must contact Carboline to verify correctness before specifying or ordering. No guarantee of accuracy is given or implied. We guarantee our products to conform to Carboline quality control. We assume no responsibility for coverage, performance or injuries resulting from use. Liability, if any, is limited to replacement of products. Prices and cost data if shown, are subject to change without prior notice. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY THE SELLER, EXPRESS OR IMPLIED, STATUTORY, BY OPERATION OF LAW, OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

APPLICATION INSTRUCTIONS

These instructions are not intended to show product recommendations for specific service. They are issued as an aid in determining correc surface preparation, mixing instructions, and application procedure. It is assumed that the proper product recommendations have been made These instructions should be followed closely to obtain the maximum service from the materials.

SURFACE PREPARATIONS: Remove any oil or grease from surface to be coated with clean rags soaked in Carboline Thinner #2 or Toluol.

Steel: For immersion service, dry abrasive blast to a White Metal finish in accordance with SSPC-SP 5-63 to a degree of cleanliness in accordance with NACE #1 to obtain a 2 to 3 mil (50-75 micron) blast profile. For Non-immersion, dry abrasive blast to a Commercial finish in accordance with SSPC-SP 6-63 to a degree of cleanliness in accordance with NACE #3 to obtain a 2 to 3 mil (50-75 micron) blast profile. Acceptable for non-immersion SSPC-SP 3-63, power tool cleaning.

Concrete: Do not coat concrete treated with hardening solutions unless test patch indicates satisfactory adhesion. Do not apply coating unless concrete has cured at least 28 days @ 75°F (24°C) and 50% RH or equivalent time. Apply to properly prepared concrete that was acid etched or sweep sandblasted.

MIXING: Mix separately, then combine and mix in the following proportions.

	2 Gal. Kit	10 Gal Kit
Carbomastic #14 Part A	1 Gal.	5 Gals.
Carbomastic #14 Part B	1 Gal.	5 Gals.

Thin up to 25% by volume with Carbomastic Thinner.

POT LIFE: 8 hours at 75°F (24°C) and less at higher temperatures. Pot life ends when coating loses body and begins to sag.

APPLICATION TEMPERATURES:

	Material	Surfaces
Normal	65-85°F (18-29°C)	60-95°F (16-35°C)
Minimum	55°F (13°C)	50°F (10°C)
Maximum	90°F (32°C)	120°F (49°C)

	Ambient	Humidity
Normal	60-90°F (16-32°C)	20-75%
Minimum	50°F (10°C)	0%
Maximum	120°F (49°C)	85%

Special thinning and application techniques may be required above or below normal conditions.

SPRAY: Use adequate air volume for correct operation. Hold gun 8-10 inches from the surface and at a right angle to the surface.

Use a 50% overlap with each pass of the gun. On irregular surfaces, coat the edges first, making an extra pass later.

NOTE: The following equipment has been found suitable, however, equivalent equipment may be substituted.

Conventional: Use 1/2" I.D. Mat'l. Hose.

Mfr. & Gun	Fluid Tip	Air Cap
Binks #18 or #62	67	67 PB
DeVilbiss P-MBC or JGA	D	64
	approx .086" I.D.	approx 11 cfm @ 30 psi

Airless: Use 1/2" I.D. Mat'l. Hose.

Mfr. & Gun*	Pump
Graco 207-300	Bulldog 30:1
Binks Model 520	Jupiter 80
Either of the above (DeVilbiss)	Huskie

*Revers-A-Clean tip is recommended. Use a .031" tip with 2400 psi.

BRUSH: Use medium bristle brush. Use full brush to apply – avoid rebrushing.

DRYING TIMES:

Between coats:	50°F (10°C)	72 hours
	60°F (16°C)	36 hours
	75°F (24°C)	18 hours
	90°F (32°C)	8 hours

In sunlight, topcoat within 36 hours or wipe surface with Carboline Surface Preparation #1, to insure good adhesion of next coat.

Final cure: For immersion. Half the time for non-immersion.	60°F (16°C)	10 days
	75°F (24°C)	7 days
	90°F (32°C)	3 days

Force curing is suggested for all tank linings.

If final cure is attained and recoat is necessary, special surface preparation may be necessary. Excessive film thickness or conditions of poor ventilation require longer dry times. Excessive humidity or condensation on the surface during curing may result in a surface haze or blush. This should be removed by water washing before recoating. In extreme cases, this can interfere with the cure of the coating.

CLEAN UP: Use Carboline Thinner #2 or Xylol.

STORAGE CONDITIONS:

Temperature: 45-110°F (7-43°C) Humidity: 0-100%

For more detailed information please consult specific Carboline Application Guides.

CAUTION: CONTAINS FLAMMABLE SOLVENTS. KEEP AWAY FROM SPARKS AND OPEN FLAMES. IN CONFINED AREAS WORKMEN MUST WEAR FRESH AIRLINE RESPIRATORS. HYPERSENSITIVE PERSONS SHOULD WEAR GLOVES OR USE PROTECTIVE CREAM. ALL ELECTRIC EQUIPMENT AND INSTALLATIONS SHOULD BE MADE AND GROUNDED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. IN AREAS WHERE EXPLOSION HAZARDS EXIST, WORKMEN SHOULD BE REQUIRED TO USE NONFERROUS TOOLS AND TO WEAR CONDUCTIVE AND NONSPARKING SHOES.

350 HANLEY INDUSTRIAL COURT carboline ST. LOUIS, MO. 63144 • 314-644-10(

product data sheet

carboline®

CARBOMASTIC® #3

5 mil primer

350 HANLEY INDUSTRIAL COURT • ST. LOUIS, MO. 63144 • 314-644-1000

SELECTION DATA

GENERIC TYPE: Epoxy-coal tar. Part A and Part B mixed prior to application.

GENERAL PROPERTIES: A unique heavy duty high build epoxy-coal tar primer containing inhibiting pigments. Designed to give maximum protection against sub-film corrosion of steel. Has simple one to one mixing ratio and long pot life. Excellent chemical resistance including immersion service. Can be used over power-tool cleaned surfaces in non-immersion service. Brown color provides application contrast when used with black epoxy-coal tar topcoats. Easily applied by conventional or airless spray at recommended 8 mil (205 microns) thickness. May be used as a primer or topcoat depending upon service.

RECOMMENDED USES: Carbomastic #3 is generally used as a prime coat under Carbomastic #14 for an epoxy-coal tar system. Uses would include: heavy duty maintenance coatings in water, brine, caustic and acid environments, lining for water, brine and crude oil storage tanks. Having outstanding resistance to H_2S, it is widely used in water and sewage plants and pulp and paper mills. Also used on off-shore drilling structures and marine installations. Excellent protection against severe splash and spillage of acids and alkalies.

NOT RECOMMENDED FOR: Immersion in aromatic or ketone solvents; strong oxidizing exposures.

CHEMICAL RESISTANCE GUIDE:

Exposure	Immersion	Splash and Spillage
Acids	Very Good	Excellent
Alkalies	Excellent	Excellent
Solvents	Good	Very Good
Salt	Excellent	Excellent
Water	Excellent	Excellent

TEMPERATURE RESISTANCE: (non-immersion)

Continuous	200°F (93°C)
Non-continuous	280°F (138°C)

Temperature resistance in immersion depends upon the composition of the immersion solution.

FLEXIBILITY: Fair

WEATHERING: Good (chalks).

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ABRASION RESISTANCE: Good

SUBSTRATES: Apply to properly prepared steel or other metallic surfaces as recommended.

TOPCOAT REQUIRED: Carbomastic #14 is typically used.

COMPATIBILITY WITH OTHER COATINGS: Designed as a primer for application directly to the substrate. May be applied over catalyzed epoxies, phenolics or others as recommended.

SPECIFICATION DATA

THEORETICAL SOLIDS CONTENT OF MIXED MATERIAL:

	By Volume
Carbomastic #3	76 ± 1%

RECOMMENDED DRY FILM THICKNESS PER COAT:
8 mils (205 microns)

THEORETICAL COVERAGE PER MIXED GALLON:*
1219 mil sq. ft. (29.8 sq.m/1 @ 25 microns)
152 sq. ft. at 8 mils (3.7 sq.m/1 @ 205 microns)

*NOTE: Material losses during mixing and application will vary and must be taken into consideration when estimating job requirements.

SHELF LIFE: 2 years

COLORS: Brown only

ORDERING INFORMATION

Prices may be obtained from Carboline Sales Representative or Main Office. Terms — Net 30 days.

SHIPPING WEIGHT:

	2's	10's
Carbomastic #3	36 lbs. (16.3 kgs)	155 lbs. (70.4 kgs)
Carbomastic Thinner	9 lbs in 1's (4.1 kgs)	45 lbs in 5's (20.4 kgs)

FLASH POINT: (Pensky-Martens Closed Cup)

Carbomastic #3 Part A	57°F (14°C)
Carbomastic #3 Part B	94°F (34°C)
Carbomastic Thinner	73°F (23°C)

To the best of our knowledge the technical data contained herein are true and accurate at the date of issuance and are subject to change without prior notice. User must contact Carboline to verify correctness before specifying or ordering. No guarantee of accuracy is given or implied. We guarantee our products to conform to Carboline quality control. We assume no responsibility for coverage, performance or injuries resulting from use. Liability, if any, is limited to replacement of products. Prices and cost data if shown, are subject to change without prior notice. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY THE SELLER, OR BY OPERATION OR LAW, OR OTHERWISE INCLUDING

APPLICATION INSTRUCTIONS

These instructions are not intended to show product recommendations for specific service. They are issued as an aid in determining correct surface preparation, mixing instructions, and application procedure. It is assumed that the proper product recommendations have been made. These instructions should be followed closely to obtain the maximum service from the materials.

SURFACE PREPARATIONS: Remove any oil or grease from surface to be coated with clean rags soaked in Carboline Thinner #2 or Toluol.

Steel: For immersion service, dry abrasive blast to a White Metal finish in accordance with SSPC-SP 5-63 to a degree of cleanliness in accordance with NACE #1 to obtain a 2 to 3 mil (50-75 microns) blast profile.
For Non-Immersion service, dry abrasive blast to a Commercial Blast finish in accordance with SSPC-SP 6-63 to a degree of cleanliness in accordance with NACE #3 to obtain a 2 to 3 mil blast profile. Power tool cleaning is acceptable for non-immersion; SSPC-SP3.

MIXING: Mix separately, then combine and mix in the following proportions:

	2 Gal Kit	10 Gal Kit
Carbomastic #3 Part A	1 Gal.	5 Gals.
Carbomastic #3 Part B	1 Gal.	5 Gals.

Thin up to 25% by volume with Carbomastic Thinner.

POT LIFE: 6 hours at 75°F (24°C) and less at higher temperatures. Pot life ends when coating loses body and begins to sag.

APPLICATION TEMPERATURES:

	Material	Surfaces
Normal	65-80°F (18-27°C)	65-85°F (18-27°C)
Minimum	50°F (10°C)	50°F (10°C)
Maximum	90°F (32°C)	120°F (49°C)

	Ambient	Humidity
Normal	65-85°F (18-29°C)	NA
Minimum	50°F (10°C)	0%
Maximum	120°F (49°C)	85%

Special thinning and application techniques may be required above or below normal condition.

SPRAY: Use adequate air volume for correct operation. Hold gun 8-10 inches from the surface and at a right angle to the surface.

Use a 50% overlap with each pass of the gun. On irregular surfaces, coat the edges first, making an extra pass later.

NOTE: The following equipment has been found suitable, however, equivalent equipment may be substituted.

Conventional: Use 1/2" I.D. Mat'l. Hose.

Mfr. & Gun	Fluid Tip	Air Cap
Binks #18 or #62	67	67 PB
DeVilbiss P-MBC or JGA	D	64
	approx .086" I.D.	approx 11 cfm @ 30 psi

Airless: Use 1/2" I.D. Mat'l. Hose.

Mfr. & Gun	Pump*
DeVilbiss JGB-507	QHA-508
Graco 205-591	President 30:1 or Bulldog 30:1
Binks Model 500	Mercury 5C

*Teflon packings are recommended and available from pump manufacturer. Use a .026" tip with 2400 psi.

BRUSH OR ROLLER: Apply with clean, short-bristled brush and avoid rebrushing.

DRYING TIMES: (at recommended thickness)

Between coats: (Note 2)
4 days @ 50°F (10°C)
48 hours @ 60°F (16°C)
24 hours @ 75°F (24°C)
12 hours @ 90°F (32°C)

Final cure:*

Immersion service:		Non-immersion service:
14 days @ 50°F (10°C)	or	4 days @ 50°F (10°C)
7 days @ 75°F (24°C)		2 days @ 75°F (24°C)
4 days @ 90°F (32°C)		1 day @ 90°F (32°C)

*If Final cure is attained and recoat is necessary, special surface preparation may be required.

NOTE 1: Excessive humidity or condensation on surface during curing may result in a surface haze, or blush, which must be washed off with water before recoating.

NOTE 2: If exposed to sunlight for more than 36 hours wipe with Carboline Surface Preparation #1 before topcoating.

CLEAN UP: Use Carboline Thinner #2 or xylol.

STORAGE CONDITIONS:

Temperature: 45-110°F (7-43°C) Humidity: 0-100%

For more detailed information please consult specific Carboline Application Guides.

CAUTION: CONTAINS FLAMMABLE SOLVENTS. KEEP AWAY FROM SPARKS AND OPEN FLAMES. IN CONFINED AREAS WORKMEN MUST WEAR FRESH AIRLINE RESPIRATORS. HYPERSENSITIVE PERSONS SHOULD WEAR GLOVES OR USE PROTECTIVE CREAM. ALL ELECTRIC EQUIPMENT AND INSTALLATIONS SHOULD BE MADE AND GROUNDED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. IN AREAS WHERE EXPLOSION HAZARDS EXIST, WORKMEN SHOULD BE REQUIRED TO USE NONFERROUS TOOLS AND TO WEAR CONDUCTIVE AND NONSPARKING SHOES.

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Master Builders Technologies Corrosion Resistance Guide

CEILCOTE® CORROSION CONTROL PRODUCTS

Monolithic Linings

Monolithic Flooring

Heavy-Duty Coatings

Master Builders Technologies

Introduction

Over 340 corrosive environments are classified by their effect on CEILCOTE CORROSION CONTROL PRODUCTS, as determined by laboratory test and field experience.

Many applications are complicated by mixtures of chemicals and unexpected temperature fluctuations during operation. There may also be difficult conditions during product installation.

For these reasons, it is wise to consult Master Builders Technologies before final material selection in questionable situations.

How to use this guide

Example: A steel tank for electroplating using acid-copper solution at 160°F. Select the best combination of materials to protect the tank interior and exterior, floor and trenches.

1. Tank Lining

Locate "Copper Plating, Acid" in the left hand column. Since the tank interior may be subjected to possible impact from falling parts, this should be a heavy duty polyester lining. All of these are rated A-1, so you have a choice of Ceilcrete, Flakeline 100 Series or Ceilcote Lining System. Flakeline could be ruled out if there will actually be impact or abrasion. Choice between a Ceilcrete or a Ceilcote Lining series product will depend on economy or customer preference.

2. Tank Exterior

Refer to the columns under "Light Duty Linings." All are rated A-1 except Flakeline 600, rated A-2. Any of these products can be used, since those rated suitable for immersion are more than enough for spillage. Therefore, we use either one of the two lower cost products — Flakeline 300 or 600. Also refer to the CeilGard section of the chart.

3. Floor and Trenches

Consider first that the floor is subjected to spills (2) and the trench to immersion (1). Consider also that spills cool rapidly; the floor protection may see 140°F. or less. One of the Ceilcretes would be the best protection. However, if the housekeeping will be good and spills infrequent, you may select Corocrete T, which is good to 120°F., and is more economical.

For trench lining, consider that when a tank is emptied, preferably through a pipe from tank to trench, there may be exposure to 160°F. You, therefore, require a heavy duty lining; one of the Ceilcretes would be most economical.

Key to Chemical Resistant Chart

Rating	Meaning
A	Good to maximum temperature of product. In many cases, the maximum temperature recommendation varies for the type of substrate or type of service. See the temperature limit chart (opposite page).
B	Good to 180°F. (83°C.)
C	Good to 140°F. (60°C.)
D	Good to 120°F. (49°C.)
E	Good to 100°F. (38°C.)

Rating "E" is used for ambient temperature conditions.

1. Immersion, constant flow or condensing vapors. This condition applies to tanks, stacks, trenches, and floors with frequent spills that are not washed frequently or which have poor drainage.
2. Occasional splash or spillage applies to tank exteriors, walls, and floors that are not washed to dilute and remove spills.
3. Fumes that are not likely to condense.

T Varies with conditions and requires testing. This rating is given when we think the product will work, but have no test or service data.

N Not recommended. There are many cases where products rated N can be used for short term exposures or very dilute solutions. Such conditions are frequently found in chemical waste disposal operations. These require consultation with Master Builders Technologies experts.

Comments on ratings and product use

1. A product rated C-1 (140°F. immersion) can be assumed to rate a higher temperature for spillage.
2. Flakeline 222HT
   To achieve its maximum temperature rating of 150°F., Flakeline 222HT must be applied in three coats on steel, to a thickness of 45 to 75 mils.
3. Any product rated T or N for exposure to a strong, volatile solvent like Ethyl Acetate, Ethyl Ether or Methylene Chloride (one of the most difficult) could be suitable for splash and spill service because the solvents evaporate so quickly.
4. A Light duty lining such as Flakeline 252, rated A-1 (good to 130°F.) in a weak solvent like Hexane, can actually be used at much higher temperature if there is no water present.
5. Flakeline 200 Series rated E-1 (to 100°F.) in aqueous solutions will be satisfactory, in most cases, if the temperature outside the tank reaches 10°F-20°F higher than this during the day.
6. Resin Topcoats. — ΔT — (Delta T) is the difference between the vessel contents and the outside temperature. There is evidence that resin topcoats on Flakeline 100 Series can fail by blistering if the ΔT is higher than 90°F. As a general rule, we rate the top coated Flakeline at 160°F.
7. Sealants are rated only for spillage service. In many cases they can also be used in immersion service.
8. For aggressive conditions in concrete vessels, use an electrically conductive primer so the lining can be spark tested for voids.
9. Flooring is rated for temperature resistance on the basis of the first column: Frequent or Severe Spills. Constant flow over a floor, or puddles in floors, are considered immersion service.
10. Flakeline 100 Series linings are not recommended for concrete surfaces simply because it is impossible to test the thickness with a magnetic gauge. Thickness of other linings is easier to control.

Product Temperature Limits
(Wet Service unless indicated Dry)

Linings	Steel Substrate Immersion, Constant Flow or Condensing Temperatures °F. Approx. °C.		Concrete Substrate Immersion, Constant Flow or Condensing Temperatures °F Approx. °C	
Ceilcrete® Series	160	71	180	83
Coroline® Series Except 505.2	160	71	180	83
Coroline® 505.2	160	71	160	71
Ceilcote Lining Series Except 68	160	71	160	71
Ceilcote Lining 68	140	60	140	60
Flakeline® 100 Series	200	93	—	—
CeilLine 80	160	71	—	—
Heavy-Duty Coatings	**Steel Substrate Immersion or Condensing Vapor °F Approx. °C**		**Steel Substrate (Dry Service) °F Approx. °C**	
Flakeline® 222HT & 282	150	83	350	176
Flakeline® 200 Series (Except 222HT & 282)	130	83	300	148
Flakeline® 300 Series	120	49	220	105
Flakeline® 600 Series and Flaketar™	120	49	220	105
Floor Toppings	**Frequent or Severe Spills °F Approx. °C**		**Occasional Splash, Spill or Rinse °F Approx. °C**	
Ceilcrete®	160	71	300	148
Coroline® Series	170	76	300	148
Ceilcote 681 Floor/Corocrete T	170	76	250	121
Ceilcote 682 Floor	180	83	250	121
Ceilcote 683 Floor/Corocrete SL	140	60	200	93
Ceilcote 685 Floor	180	83	250	148
Corocrete SR	140	60	200	93
Polyesters, Vinyl Esters. Refer to Following charts	**Rating (1) Immersion, Constant Flow Frequent Spillage, Condensing Vapors.**		**Ratings (2 and 3) Dry and Non-Condensing Vapors Occasional Spills, Rinse.**	
211-212	130°F	49°C	180°	83°C
232	130°F	49°C	250°	121°C
242	130°F	49°C	250°	121°C
251-252	130°F	49°C	250°	121°C
300-350	120°F	49°C	180°	83°C
222HT	150°F	66°C	400°	204°C
Epoxies	**Rating (1) Immersion, Constant Flow Frequent Spillage, Condensing Vapors.**		**Ratings (2 and 3) Dry and Non-Condensing Vapors Occasional Spills, Rinse.**	
650HB/FDA	120°F	49°C	250°F	121°C
661	120°F	49°C	225°F	107°C
600	120°F	49°C	225°F	107°C
615/620	Not Recommended		250°F/300°F	121°C/149°C
630	170°F	77°C	300°F	149°C
Urethanes	**Rating (1) Immersion, Constant Flow Frequent Spillage, Condensing Vapors.**		**Ratings (2 and 3) Dry and Non Condensing Vapors Occasional Spills, Rinse.**	
470	Not Recommended		250°F	121°C
480	Not Recommended		250°F	121°C
Expansion Joint Sealants	**Immersion or Condensing Vapors °F Approx. °C**		**Occasional Splash Spill or Rinse °F Approx. °C**	
Ceilcote EJ3 & 4	140	60	200	93
Ceilcote EJ10	120	49	180	83
Ceilcote EJ11	—	—	—	—

Notes on chemicals in Corrosion Chart

NOTE: 1 Lab tested at ambient temperature or at temperature rated. For higher temperatures, Master Builders Technologies should be consulted.

NOTE: 2 Requires carbon filler for Ceilcretes and Corolines, resin topcoats for Flakelines and CeilLine 80, a synthetic veil for the Ceilcote Lining Series.

NOTE: 3 Linings for Potassium or Sodium Chlorate are limited to 160°F. Coroline and Flakeline 100 Series are rated C-1, since there is no letter designation for 160°F. They are actually good for 160°F.

NOTE: 4 A lining for Bright Nickel plating tanks must be approved by the supplier of the bath salts. For wastes, this is not required.

Selecting the right floor system.

To help you determine the best floor system for your process environment, we have rated the performance of each system under a complete range of service conditions.

It may be necessary to combine materials or alter standard specifications to meet your requirements. Such versatility is built into Master Builders Technologies floor materials. Consult Master Builders Technologies concerning your specific application.

	WEAR			THERMAL			NEW/OLD CONCRETE					CHEMICAL SPILLAGE								SPECIALIZED AREAS					CONDITIC		
	Heavy Truck Traffic	Occasional Truck Traffic	Foot Traffic Only	Thermal Shock 110°F to 40°F	Thermal Shock 220°F to 40°F	Thermal Shock 130°F to -20°F	Hairline Cracking	Mild Cracking Cure Stress Relief	Construction Joint Cracking	Eroded Aggregate Exposed	Powdery Poorly Cured Surface	Mineral Acids Concentrated	Caustics	Aromatic Solvents	Chlorinated Solvents	Aliphatic Solvents	Fats and Oils	Organic Acids	Sanitary	Trenches	Foundations	Coolers and Freezers	Laboratories	Low Temp. Cu	Damp S	Mi
Ceilcote 681 Floor: *Unreinforced Topping, Traffic.* Aggregate-filled ⅛" to ¼" topping. High wear resistance, durability, and chemical resistance; convenient floor-patching maintenance material. Meets current USDA requirements.	E	E	E	G	F	G	F	F	N	E	N	F	G	E	F	F	E	G	F	G	N	N	G	F	E	E	E
Ceilcote 682 Floor: *Fiberglass Reinforced, Sanitary.* 100-mil floor. Epoxy resin modified for maximum cleanability, chemical, and thermal-shock resistance. Meets current USDA requirements.	F	G	E	E	E	E	E	E	E	E	G	F	G	E	G	G	E	E	G	E	N	N	E	E	E	E	F
Ceilcote 683 Floor: *Light Duty.* Semi-self-leveling 55-mil coating. Epoxy resin modified for maximum cleanability and chemical resistance. Meets current USDA and MID requirements.	F	G	E	G	F	G	G	F	N	G	N	F	G	E	G	G	E	E	G	E	N	N	F	E	E	E	E
Ceilcote 685 Floor: *Heavy Duty.* Fiberglass-reinforced 3/16" floor. Epoxy resin modified for maximum wearability, chemical, and thermal-shock resistance. Meets current USDA requirements.	E	E	E	E	G	G	G	G	F	E	G	F	G	E	G	G	E	E	G	G	N	E	E	F	E	E	F
Ceilcrete Series: Fiberglass Reinforced, Floor and Immersion. Fiberglass-reinforced 5/32" lining. Polyester resin modified for maximum chemical resistance. Available with: Silica filler — standard applications. Carbon filler — conductive or special corrosive environments. Abrasion-resistant filler — extreme slurries.	G	E	E	E	F	G	G	G	N	E	F	E	E	G	E	E	E	E	E	G	E	E	F	F	F	F	F
Corotine Series (505M 505.2 are USDA Approved) Fiberglass-reinforced 5/32" lining. Epoxy resins modified for maximum chemical resistance. Available with: Silica filler — standard applications. Carbon filler — conductive or special corrosive environments. Abrasion-resistant filler — extreme slurries.	G	E	E	E	G	G	G	F	N	E	F	F	G	E	E	E	E	E	G	G	E	E	F	F	N	F	F
Corocrete F: *Underlayment, Restoration (USDA Approved)* Aggregate filled ⅛"-6" polymer concrete. Ease of placement, rapid-setting and compatible with most Ceilcote systems.	E	E	E	G	F	G	F	F	N	E	N	N	F	G	N	N	F	F	F	N	N	N	G	N	F	F	E
Corocrete T: *Unreinforced Topping, Traffic (USDA Approved)* Aggregate filled ⅛" topping. High wear resistance, durability and moderate chemical resistance.	E	E	E	G	F	F	F	F	N	E	F	N	G	G	F	N	G	G	F	G	N	N	N	N	F	F	G
Corocrete SL: *Medium Duty, Cleanable.* Semi-self-leveling 55 mil topping. Modified for maximum cleanability and chemical resistance. Skid resistant or smooth finish available. Meets current USDA and MID requirements.	N	F	E	G	F	G	G	F	N	F	N	F	G	E	G	G	E	E	G	E	N	N	F	E	E	E	E
Corocrete SR: *Personnel Safety Floor.* Two coat roller applied skid resistant system. Nominal 40-60 mils. Incorporates alumina grit for maximum wear and slip resistance.	G	E	E	G	F	G	G	F	N	G	F	N	F	G	F	F	G	G	F	G	N	E	F	F	N	N	G
Corocrete CS: *Concrete Sealer.* A low viscosity, one component system for use on virtually all new concrete surfaces where dusting is a problem. Ideal for warehouse applications.	G	E	E	G	F	G	N	N	N	G	E	F	G	G	G	G	G	G	F	G	E	E	G	F	N	N	E

E = Excellent G = Good F = Fair N = Not recommended

Master Builders Technologies

	Ceilcote 80	Corrosite 505, 510, 505 & 505-2	Corrosite 505M	Corrosite 550	Ceilcote 2500 International	Ceilcote 2500 U.S.A.	Ceilcote 5500	Ceilcote 6400	Ceilcote 6850	Flakeline 103	Flakeline 161	Flakeline 164	Flakeline 180	Ceilcote Lining 25	Ceilcote Lining 61	Ceilcote Lining 64	Ceilcote Lining 69	Ceilcote Lining 74	Ceilcote Lining 652	Flakeline 211/212	Flakeline 222HT	Flakeline 232
Acetaldehyde 100%	T	T	T	N	N	T	T	T	T	N	N	N	T	N	N	N	N	T	N	N	T	T
Acetic Acid - 10%	A1	T	T	T	C1	A1	A1	A1	A1	C1	B1	C1	A1	C1	A1	C1	N	A1	C1	A1	A1	A1
Acetic Acid - 10-50%	A1	N	N	N	D1	C1	C1	D1	A1	D1	C1	D1	C1	D1	C1	D1	N	A1	D1	A1	C1	A1
Acetic Acid 50% to (Glacial) 100%	D1	N	N	N	T	D1	D1	T	D1	T	D1	T	D1	T	D1	T	N	D1	T	E2	A2	A2
Acetic Anhydride	D1	N	N	N	E1	D1	D1	D1	D1	D1	D1	D1	D1	E1	D1	E1	N	D1	E1	D2	E1	E1
Acetone - 100%	C2	C2	C2	D2	N	C2	C2	N	C2	N	C2	N	C2	N	C2	N	N	C2	N	N	C2	D2
Acetone - 10%	C1	A1	C1	D1	E1	C1	C1	D1	A1	D1	C1	N	C1	E1	C1	N	E2	A1	E1	T	A1	A1
Acetyl Chloride - 100%	T	T	T	N	N	T	T	N	T	N	T	N	T	N	T	N	N	T	N	N	T	T
Acrylic Acid - 100%	D1	N	N	N	E1	D1	D1	D1	D1	D1	D1	D1	D1	E1	D1	D1	N	D1	E1	E2	A2	A2
Acrylonitrile	T	N	N	N	N	N	N	N	T	N	N	N	T	N	N	N	N	T	N	N	T	T
Adipic Acid - 25%	C1	C1	D1	D1	D1	C1	C1	D1	C1	C1	D1	D1	C1	D1	C1	D1	T	C1	D1	D1	C1	D1
Allyl Alcohol[1]	D1	E1	E1	T	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	T	D1	D1
Allyl Chloride	T	T	T	N	N	T	T	N	T	N	N	N	T	N	T	N	N	T	N	N	T	T
Alum (Saturated Solution)	C1	C1	C1	D1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	A1	C1	C1	D1	C1	D1
Aluminum Bromide	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	A1	A1
Aluminum Chloride	A1	A1	A1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Aluminum Nitrate (Saturated)	A1	A1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Aluminum Sulfate	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	A1	C1	C1	A1	A1	A1
Ammonia (Wet Gas)	C1	A1	A1	A1	C1	C1	C1	N	C1	B1	C1	N	C1	C1	C1	N	A1	C1	C1	N	A1	A1
Ammonium Chloride	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Ammonium Cocoamonolyte[1] - 30%	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	T	C1	C1	T	C1	D1
Ammonium Fluoride - 10%[2]	C1	A1	C1	C1	A1	A1	A1	A1	A1	C1	C1	C1	C1	C1	C1	C1	A1	C1	C1	A1	A1	A1
Ammonium Hydroxide - 20%	D1	C1	C1	C1	D1	D1	D1	N	D1	N	N	N	N	D1	D1	N	E1	E1	D1	N	N	E1
Ammonium Lauryl Sulfate[1] - 30%	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	A1	D1	D1	A1	A1	A1
Ammonium Nitrate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Ammonium Persulfate	A1	D1	D1	D1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Ammonium Sulfate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Ammonium Sulfide	A1	A1	A1	A1	A1	A1	A1	D1	A1	A1	A1	D1	A1	A1	A1	D1	A1	A1	A1	A1	A1	A1
Ammonium Sulfite	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Ammonium Xylene Sulfonate[1] - 40%	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	A1	C1	C1	A1	D1	D1
Amyl Acetate[1]	D1	T	T	T	E1	D1	D1	D1	D1	D1	D1	D1	D1	E1	D1	D1	N	D1	T	N	D1	D1
Amyl Alcohol	N	D1	D1	D1	C1	C1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	D1	A1	A1	A1
Aniline	D1	N	N	N	N	T	T	E1	D1	N	T	E1	D1	N	T	E1	N	D1	N	N	D1	D1
Aniline Hydrochloride	A1	C1	C1	D1	C1	C1	C1	N	A1	D1	T	T	A1	C1	T	N	T	A1	C1	T	C1	A1
Anodizing-Chromic			See Chromic Acid - 10%																			
Anodizing-Sulfuric			See Sulfuric Acid - 20-50%																			
Antimony Chloride (tri)	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	E1	E1	E1
Aqua Regia	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Arsenous Acid	C1	T	T	T	D1	D1	D1	D1	C1	C1	A1	A1	C1	C1	A1	A1	T	C1	C1	D1	C1	D1
Barium Chloride	A1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Barium Hydroxide	C1	A1	A1	A1	C1	C1	C1	E1	C1	C1	C1	E1	C1	C1	C1	E1	A1	C1	C1	N	C1	D1
Barium Sulfide	C1	A1	A1	C1	C1	C1	C1	E1	C1	C1	C1	E1	C1	C1	C1	E1	A1	C1	C1	E1	C1	D1
Benzal Chloride	T	D1	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Benzaldehyde	E1	T	T	T	N	T	T	N	E1	N	T	N	E1	N	T	N	N	E1	N	N	E1	E1
Benzene (Benzol)	D1	D1	D1	T	N	E1	D1	E1	D1	N	D1	E1	D1	N	E1	E1	N	D1	N	N	D1	D1
Benzene Sulfonic Acid 50-100%	C1	T	T	T	C1	C1	C1	D1	C1	B1	C1	D1	C1	C1	C1	D1	N	C1	C1	A1	C1	A1
Benzene Thiol	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Benzyl Alcohol[1]	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	D1	T	D1	D1	D1	T	T	D1	T	T	D1	D1
Benzoic Acid (Saturated)	A1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Benzoyl Chloride	T	D1	D1	D1	T	T	T	N	T	T	T	N	T	T	T	N	T	T	T	T	T	T
Benzyl Chloride[1]	D1	D1	T	T	N	T	T	N	D1	N	T	N	D1	N	T	N	N	D1	N	N	D1	D1
Black Liquor (Paper)	C1	A1	A1	C1	C1	C1	C1	C1	C1	C1	C1	N	C1	C1	C1	N	A1	C1	C1	N	C1	D1
Boric Acid (Saturated)	A1	C1	C1	C1	A1	A1	A1	A1	A1	B1	A1	D1	A1	A1	A1	D1	A1	A1	A1	A1	A1	A1
Bromine, Wet Gas	D1	N	N	N	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	N	D1	D1	T	D1	D1
Bromine, Dry Gas	D3	N	N	N	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	N	D3	D3	T	D3	D3
Bromine Water - 5%	D1	N	N	N	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	N	D1	D1	T	D1	D1
Butanol Normal	D1	C1	C1	C1	D1	C1	C1	D1	C1	D1	C1	D1	D1	D1	C1	D1	T	D1	D1	A1	C1	A1
Butyl Acetate	E1	E1	E1	T	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	T	E1	E2	N	E1	E1

CEILCOTE Corrosion Control Products

	Flakeline 241/242	Flakeline 251/252	Flakeline 252 Intermediate	Flakeline 261/262	Flakeline 282	Flakeline 300	Flakeline 600 & Flakeline 661	Ceilcote 681/685 Concrete T	Ceilcote 682/683 Concrete SL	Ceilcote 695	Ceilcote 2500 U.S.A.	Ceilcote 2500 Int.	Ceilcote 5500	Ceilcote 6400	Ceilcote 6650	Corroline 505/510	Ceilcote EJ10	Ceilcote EJ11	Ceilcote EJ3.4
Acetaldehyde 100%	N	D2	N	N	D2	N	N	N	E2	D2	D2	N	D2	N	D2	D2	N	N	N
Acetic Acid - 10%	A1	A1	A1	A1	A1	A1	N	D2	D2	A2	A2	A2	A2	A2	A2	D2	D2	E2	D2
Acetic Acid - 10-50%	D1	A1	D1	D1	C1	D2	N	N	N	A2	A2	A2	A2	A2	A2	N	D2	T	T
Acetic Acid 50% to (Glacial) 100%	D2	A2	D2	D2	A2	N	N	N	N	A2	C2	D2	A2	D2	A2	N	N	N	N
Acetic Anhydride	E2	D2	D2	D2	E1	E2	N	N	N	A2	D2	D2	D2	D2	D2	N	T	N	T
Acetone - 100%	N	E2	N	N	C2	N	N	N	D2	C2	E2	N	E2	E2	C2	C2	N	N	N
Acetone - 10%	E1	A1	E1	D1	A1	E2	E2	D2	D2	A2	A2	A2	A2	A2	A2	A2	T	T	T
Acetyl Chloride - 100%	N	T	N	T	T	N	N	D1	T	T	T	T	T	T	T	T	N	T	N
Acrylic Acid - 100%	E2	A2	E2	E2	A2	E2	N	N	N	A2	C2	D2	C2	D2	A2	N	N	T	N
Acrylonitrile	N	N	N	N	T	N	N	N	N	T	T	N	T	N	T	N	N	T	N
Adipic Acid - 25%	D1	D1	D1	D1	C1	D2	T	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	E2	D2
Allyl Alcohol	D1	D1	D1	D1	D1	E1	T	D2	D2	A2	A2	A2	A2	A2	A2	D2	T	E2	T
Allyl Chloride	N	T	N	T	T	N	N	N	T	D2	T	N	T	T	D2	T	T	T	T
Alum (Saturated Solution)	D1	D1	D1	D1	C1	D2	D2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Aluminum Bromide	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	E2	D2
Aluminum Chloride	A1	A1	A1	A1	A1	A1	E1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Aluminum Nitrate (Saturated)	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Aluminum Sulfate	A1	A1	A1	A1	A1	E1	E1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Ammonia (Wet Gas)	A1	A1	A1	N	A1	N	E1	A2	A2	A2	A2	A2	A2	D2	A2	A2	D2	E2	T
Ammonium Chloride	A1	A1	A1	A1	A1	E1	E1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Ammonium Cocoamonolyte - 30%[1]	D1	D1	D1	D1	C1	T	T	T	T	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Ammonium Fluoride - 10%[2]	A1	A1	A1	A1	A1	D2	D2	E2	D2	A2	A2	A2	A2	A2	A2	A2	D2	E2	D2
Ammonium Hydroxide - 20%	E1	E1	E1	N	E1	N	E1	A2	A2	A2	A2	A2	A2	D2	A2	A2	D2	E2	T
Ammonium Lauryl Sulfate - 30%[1]	A1	A1	A1	A1	A1	A1	D2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Ammonium Nitrate	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Ammonium Persulfate	A1	A1	A1	A1	A1	A1	A2	D2	D2	A2	A2	A2	A2	A2	A2	D2	D2	D2	D2
Ammonium Sulfate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Ammonium Sulfide	A1	A1	A1	E1	A1	A2	E1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Ammonium Sulfite	A1	A1	A1	A1	A1	A1	E1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Ammonium Xylene Sulfonate - 40%[1]	D1	D1	D1	D1	D1	D1	T	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Amyl Acetate[1]	T	D1	D1	D1	D1	N	T	T	T	D2	D2	D2	D2	D2	D2	D2	N	N	N
Amyl Alcohol	A1	A1	A1	A1	A1	A1	A2	D2	D2	A2	A2	A2	A2	A2	A2	A2	D2	E2	T
Aniline	N	T	N	E1	D1	N	N	N	N	D2	T	N	T	D2	D2	N	N	E2	N
Aniline Hydrochloride	D1	D1	D1	N	C1	T	T	T	T	A2	A2	A2	A2	A2	A2	D2	T	T	T
Anodizing-Chromic			See Chromic Acid - 10%																
Anodizing-Sulfuric			See Sulfuric Acid - 20-50%																
Antimony Chloride (tri)	E1	E1	E1	E1	E1	T	T	E2	E2	D2	D2	D2	D2	D2	D2	E2	D2	C2	D2
Aqua Regia	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Arsenous Acid	D1	D1	D1	D1	C1	D1	T	T	T	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Barium Chloride	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Barium Hydroxide	D1	D1	D1	E1	C1	D2	D1	A2	A2	A2	A2	A2	A2	D2	A2	A2	D2	E2	T
Barium Sulfide	D1	D1	D1	E1	C1	D2	D1	A2	A2	A2	A2	A2	A2	D2	A2	A2	D2	E2	D2
Benzal Chloride	T	T	T	T	T	T	N	T	T	T	T	T	T	T	T	D2	N	E2	T
Benzaldehyde	N	T	N	N	E1	N	N	T	T	D2	T	T	T	T	D2	T	T	N	T
Benzene (Benzol)	N	D1	N	D1	D1	D2	N	D2	D2	D2	D2	N	D2	D2	D2	D2	N	T	N
Benzene Sulfonic Acid 50-100%	A1	A1	A1	A1	C1	E1	T	T	T	A2	A2	A2	A2	A2	A2	T	T	T	T
Benzene Thiol	N	N	N	N	N	N	N	N	N	T	T	N	N	N	N	N	N	T	N
Benzyl Alcohol[1]	D1	D1	D1	T	D1	D1	T	T	T	D2	D2	D2	D2	T	D2	D2	T	D2	T
Benzoic Acid (Saturated)	A1	A1	A1	A1	A1	A1	E1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	E2	D2
Benzoyl Chloride	T	T	T	N	T	T	T	T	T	T	T	T	T	N	T	D2	T	T	T
Benzyl Chloride[1]	N	T	N	N	D1	N	T	T	T	D2	T	T	T	T	D2	D2	N	T	N
Black Liquor (Paper)	D1	D1	D1	N	C1	N	E1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	T	T
Boric Acid (Saturated)	A1	A1	A1	A1	A1	E1	E1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Bromine, Wet Gas	D1	D1	D1	D1	D1	T	N										N	D2	N
Bromine, Dry Gas	D3	D3	D3	D3	D3	T	N										N	D2	N
Bromine Water - 5%	D1	D1	D1	D1	D1	T	N	N	N	A2	A2	A2	A2	A2	A2	N	N	D2	N
Butanol Normal	A1	A1	A1	A1	A1	E1	T	D2	D2	A2	A2	A2	A2	A2	A2	A2	T	D2	T
Butyl Acetate	E2	E1	E1	E1	E1	E2	T	T	T	D2	D2	D2	D2	D2	D2	D2	N	N	N

KEY TO CHEMICAL RESISTANCE CHART

Rating Descriptions

- A Good to Maximum Temperature of Product
- B Good to 180 °F (71 °C) Maximum
- C Good to 140 °F (60 °C)
- D Good to 120 °F (37 °C) Ambient
- E Good to 100 °F (37 °C)

Rating Descriptions

- 1 Immersion or Constant Flow or Condensing Vapor
- 2 Occasional Splash or Spill
- 3 Fumes Only, Not Condensing
- N Not Recommended

Rating Descriptions

- T Varies With Conditions. May Require Test. Consult Master Builders Technologies for Recommendations.

Master Builders Technologies

	Celine 80	Coroline 505/510/503 & 503 2	Coroline 505M	Coroline 550	Cellcrete 2500 International	Cellcrete 2500 U.S.A.	Cellcrete 5500	Cellcrete 6400	Cellcote 6650	Flakeline 103	Flakeline 161	Flakeline 164	Flakeline 180	Cellcote Lining 25	Cellcote Lining 61	Cellcote Lining 64	Cellcote Lining 68	Cellcote Lining 74	Cellcote Lining 652	Flakeline 211/212	Flakeline 222HT	Flakeline 232
Butyl Acrylate[1]	T	N	N	N	N	T	T	N	T	N	T	N	T	N	T	N	T	T	N	N	E1	E1
Butyl Amine	T	N	N	N	N	N	N	N	T	N	N	N	T	N	N	N	N	T	N	N	T	T
Butyl Carbitol[1]	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	T	D1	D1
Butyl Carbitol Acetate[1]	E1	D1	T	N	N	T	T	E1	E1	N	T	E1	E1	N	T	E1	N	E1	N	N	E1	E1
Butyl Cellosolve[1]	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	T	D1	D1
Butyl Cellosolve Acetate[1]	E1	D1	T	N	T	E1	E1	E1	E1	T	E1	E1	E1	T	E1	E1	N	E1	T	N	E1	E1
Butyl Ether[1]	D1	T	T	T	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	T	C1	D1
Butyl Acid Levulinic[1]	D1	D1	T	T	D1	D1	D1	T	D1	D1	D1	T	D1	D1	D1	T	N	D1	D1	T	D1	D1
Butyric Acid - 100%[1]	D1	N	N	N	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	N	D1	D1	T	D1	D1
Cadmium Plating - Cyanide	C1	A1	A1	A1	C1	C1	C1	N	C1	C1	C1	N	C1	C1	C1	N	A1	C1	C1	N	A1	A1
Calcium Bisulfite	A1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Calcium Chloride	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Calcium Hydroxide[4]	C1	A1	A1	A1	C1	C1	C1	D2	C1	C1	C1	D2	C1	C1	C1	D2	A1	C1	C1	D2	C1	A1
Calcium Hypochlorite - 5%[2]	D1	N	N	N	D1	D1	D1	D1	D1	D1	D1	D1	D1	E1	C1	C1	N	A1	A1	N	D1	D1
Calcium Nitrate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Caprylic Acid (Octanoic Acid)[1]	A1	N	N	N	C1	C1	C1	C1	A1	C1	C1	C1	A1	C1	C1	C1	N	A1	C1	E1	C1	D1
Carbolic Acid (Phenol) - 88%	E1	N	N	N	N	N	N	N	E1	N	N	N	E1	N	N	N	N	E1	N	N	E1	E1
Carbon Bisulfide (Oil) Fumes (Wet)	C1	D1	D1	D1	D1	E1	E1	N	C1	D1	E1	N	C1	D1	E1	N	T	C1	N	N	C1	A1
Carbon Tetrachloride	C1	C1	C1	D1	E1	C1	C1	C1	A1	E1	C1	C1	C1	E1	C1	C1	A1	A1	E2	T	A1	D1
Castor Oil	C1	D1	D1	D1	A1	A1	A1	A1	A1	C1	C1	C1	C1	A1	A1	A1	E1	A1	A1	D1	A1	D1
Cellosolve[1]	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	D1	C1	D1
Cellosolve Acetate[1]	D1	D1	T	T	N	E1	E1	E1	D1	N	E1	E1	D1	N	E1	E1	T	D1	N	N	D1	D1
Chloroacetic Acid - 1-20%[1]	B1	N	N	N	C1	A1	A1	D1	A1	C1	B1	D1	B1	C1	A1	D1	N	A1	C1	D1	D1	D1
Chloroacetic Acid - 20-50%[1]	D1	N	N	N	E1	D1	D1	E1	D1	E1	D1	D1	D1	E1	D1	D1	N	D1	E1	T	D1	D1
Chloroacetic Acid - 50-100%[1]	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E2	E2
Chlorine Dioxide Solution	C1	N	N	N	A1	A1	A1	D1	C1	A1	A1	D1	C1	A1	A1	D1	N	C1	C1	T	A1	A1
Chlorine Gas - Dry	A3	N	N	N	A3	A3	A3	A3	A3	B3	B3	B3	B3	A3	A3	A3	N	A3	A3	D3	A3	A3
Chlorine Gas - Wet	A3	N	N	N	A3	A3	A3	A3	A3	B3	B3	B3	B3	A3	A3	A3	N	A3	A3	N	A3	A3
Chlorine Water - Saturated	A1	N	N	N	A1	A1	A1	A1	A1	B1	B1	B1	B1	A1	A1	A1	N	A1	A1	E1	A1	A1
Chlorobenzene (Mono)[1]	D1	D1	D1	T	N	E1	E1	N	D1	N	E1	N	D1	N	E1	N	N	D1	N	T	D1	D1
Chlorobutane[1]	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	T	D1	D1
Chloroform	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E2	E2
Chlorophenol	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Chlorosulfonic Acid	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Chlorotoluene[1]	D1	D1	E1	T	N	E1	E1	N	D1	N	E1	N	D1	N	E1	N	N	D1	N	N	D1	D1
Chromic Acid - 10%	A1	N	N	N	N	N	N	A1	A1	N	N	B1	E1	N	N	A1	N	E1	N	N	E1	E1
Chrome Plating 20-48 oz/gal[2]	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	C1	N	T	N	D2	D2	D2
Chromic Chloride	A1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Citric Acid	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Copper Plating - Cyanide	D1	A1	A1	A1	D1	D1	D1	D1	D1	D1	D1	D1	D1	C1	C1	N	A1	C1	C1	N	D1	D1
Copper Plating - Acid	A1	D1	D1	D1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Corn Oil	A1	D1	D1	D1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Cottonseed Oil	A1	D1	D1	D1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Cresol (Cresylic Acid)[1]	T	N	N	N	N	T	T	N	T	N	T	N	T	N	T	N	N	T	N	N	T	T
Cresylic Acid[1]	T	N	N	N	N	T	T	N	T	N	T	N	T	N	T	N	N	T	N	N	T	T
Cumene[1]	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	N	D1	D1	D1	D1	D1
Cyclohexane[1]	C1	C1	C1	C1	D1	A1	A1	C1	A1	D1	B1	C1	C1	D1	A1	C1	T	C1	D1	D1	C1	D1
Cyclohexanone[1]	D1	D1	D1	T	E1	D1	D1	T	D1	E1	D1	T	D1	E1	D1	T	N	D1	E1	T	D1	D1
Cymene[1]	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	A1	D1	D1	T	D1	D1
Dextrose	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Dibromopropane Phosphate[1]	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	T	E1	E1	E1	E1	E1
Dibutyl Phthalate	C1	A1	A1	A1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	T	C1	C1	D1	A1	D1
Dichloro Acetic Acid - 20%[1]	D1	N	N	N	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	N	D1	D1	D1	D1	D1
Diethanolamine[1]	D1	N	N	N	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	D1	D1	D1
Diethylene Chloroformate[1]	T	T	T	T	N	T	T	N	T	N	T	N	T	N	T	N	N	T	N	N	E2	E2
Diethylketone - 100%[1]	E1	T	T	T	N	T	T	T	E1	N	T	T	E1	N	T	T	N	E1	N	N	E1	E1
Dimethylaminopropylamine	T	N	N	N	N	N	N	N	T	N	N	N	T	N	N	N	N	T	N	N	T	T
Dimethyl Aniline	D1	T	T	T	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	D1	D1	D1

[1] Lining Series

CEILCOTE Corrosion Control Products

	Fluteline 241/242	Fluteline 251/252	Fluteline 252 Intermediate	Fluteline 261/262	Fluteline 282	Fluteline 300	Fluteline 600 Flowcoat 631	Ceilcote 681/683 Concrete T	Ceilcote 682/683 Concrete SL SM	Ceilcote 695	Ceilcote 2500 U.S.A.	Ceilcote 2500 Intermediate	Ceilcote 5500	Ceilcote 6400	Ceilcote 6650	Caroline 503/510	Ceilcote EJ10	Ceilcote EJ11	Ceilcote EJ3,4
	JOINT LININGS							FLOOR TOPPINGS									SEALANTS		
Butyl Acrylate[1]	N	T	N	T	E1	N	N	N	T	D2	T	N	T	N	D2	N	N	D2	N
Butyl Amine	N	N	N	N	T	N	N	N	N	T	N	N	T	N	T	N	N	T	N
Butyl Carbitol[1]	D1	D1	D1	D1	D1	T	T	D2	D2	C2	C2	C2	C2	C2	C2	A2	N	D2	T
Butyl Carbitol Acetate[1]	N	E1	N	E1	E1	N	N	T	T	C2	D2	N	D2	D2	C2	C2	N	T	N
Butyl Cellosolve[1]	D1	D1	D1	D1	D1	T	T	T	D2	C2	D2	D2	D2	D2	D2	D2	N	E2	N
Butyl Cellosolve Acetate[1]	T	E1	T	E1	E1	N	N	N	E2	D2	D2	T	D2	D2	C2	C2	N	T	T
Butyl Ether[1]	D1	D1	D1	D1	C1	T	N	T	D2	C2	D2	D2	D2	D2	D2	D2	N	T	T
Butyl Acid Levulinic[1]	D1	D1	D1	T	D1	T	N	T	T	D2	D2	D2	D2	T	D2	D2	T	T	T
Butyric Acid - 100%[1]	D1	D1	D1	D1	D1	T	N	N	N	D2	D2	D2	D2	D2	D2	T	T	T	T
Cadmium Plating - Cyanide	A1	A1	A1	N	A1	N	A1	A2	A2	A2	A2	A2	A2	N	A2	A2	D2	E2	D2
Calcium Bisulfite	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Calcium Chloride	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Calcium Hydroxide[2]	A1	A1	A1	A2	A1	A2	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Calcium Hypochlorite - 5%[2]	D1	D1	D1	D1	D1	N	N	T	T	D2	D2	D2	D2	D2	D2	T	T	D2	T
Calcium Nitrate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Capryic Acid (Octanoic Acid)[1]	D1	D1	D1	D1	D1	D1	N	N	T	C2	C2	C2	C2	C2	C2	N	T	T	T
Carbolic Acid (Phenol) - 88%	N	N	N	N	E1	N	N	N	N	D2	N	N	N	N	D2	N	N	E2	N
Carbon Bisulfide (Di) Fumes (Wet)	N	E1	D1	N	C1	N	N	N	N	D2	D2	N	D2	N	C2	D2	N	D2	N
Carbon Tetrachloride	D1	D1	D1	D1	A1	A2	A2	D2	D2	C2	C2	D2	C2	D2	C2	A2	N	E2	N
Castor Oil	D1	D1	D1	D1	A1	T	T	T	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	T
Cellosolve[1]	D1	D1	D1	D1	A1	T	T	D2	D2	C2	C2	D2	C2	D2	C2	C2	N	E2	T
Cellosolve Acetate[1]	N	E1	N	E1	D1	N	N	N	T	D2	D2	T	D2	D2	D2	C2	N	N	N
Chloroacetic Acid - 1-20%[1]	D1	D1	D1	D1	D1	E1	N	N	T	A2	A2	C2	A2	C2	A2	T	T	T	T
Chloroacetic Acid - 20-50%[1]	E1	D1	E1	D1	D1	N	N	N	N	C2	C2	D2	C2	D2	C2	N	N	T	N
Chloroacetic Acid - 50-100%[1]	N	E2	N	N	E2	N	N	N	N	E2	E2	T	E2	T	E2	N	N	T	N
Chlorine Dioxide Solution	A1	A1	A1	A1	A1	N	N	N	N	A2	A2	A2	A2	A2	A2	N	T	E2	N
Chlorine Gas - Dry	A3	A3	A3	A3	A3	E3	N										T	E2	N
Chlorine Gas - Wet	A3	A3	A3	A3	A3	E3	N										T	E2	N
Chlorine Water - Saturated	A1	A1	A1	A1	A1	E2	N	N	T	A2	A2	A2	A2	A2	A2	N	T	E2	N
Chlorobenzene (Mono)[1]	N	D1	N	N	D1	T	N	N	T	D2	D2	N	D2	N	D2	D2	N	E2	N
Chlorobutane[1]	D1	D1	D1	D1	D1	T	T	T	T	D2	D2	D2	D2	D2	D2	D2	T	T	T
Chloroform	N	E2	N	N	E2	N	N	N	T	E2	T	N	T	N	E2	T	N	E2	N
Chlorophenol	N	N	N	N	N	N	N	T	T	E2	T	T	T	T	T	E2	N	T	N
Chlorosulfonic Acid	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E2	N
Chlorotoluene[1]	N	D1	N	N	D1	N	N	N	T	D2	D2	N	D2	N	D2	D2	N	T	N
Chromic Acid - 10%	N	N	N	A1	E1	N	E2	D2	D2	A2	A2	A2	A2	A2	A2	C2	D2	T	N
Chrome Plating 20 - 48 oz/gal[2]	N	N	N	D2	D2	N	N	N	N	D2	D2	D2	D2	C2	D2	N	N	T	N
Chromic Chloride	A1	A1	A1	A1	A1	A1	A1	D2	A2	A2	A2	A2	A2	A2	A2	A2	A2	T	D2
Citric Acid	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	C2	E2	C2
Copper Plating - Cyanide	D1	D1	D1	N	D1	N	D1	A2	A2	C2	C2	C2	C2	C2	C2	A2	D2	E2	D2
Copper Plating - Acid	A1	A1	A1	A1	A1	A1	A2	D2	D2	A2	A2	A2	A2	A2	A2	C2	C2	T	N
Corn Oil	A1	A1	A1	A1	A1	A1	T	C2	A2	A2	A2	A2	A2	A2	A2	A2	T	D2	D2
Cottonseed Oil	A1	A1	A1	A1	A1	A1	T	C2	A2	A2	A2	A2	A2	A2	A2	A2	T	D2	D2
Cresol (Cresylic Acid)[1]	N	T	N	N	N	N	N	N	N	T	T	N	T	N	T	N	N	E2	N
Cresylic Acid[1]	N	T	N	N	N	N	N	N	N	T	T	N	T	N	T	N	N	E2	N
Cumene[1]	D1	D1	D1	D1	D1	D2	N	T	T	D2	D2	D2	D2	D2	D2	D2	N	T	T
Cyclohexane[1]	D1	D1	D1	D1	D1	D1	T	C2	C2	C2	C2	C2	C2	C2	C2	C2	N	E2	D2
Cyclohexanone[1]	E1	D1	E1	T	D1	T	N	T	E2	D2	D2	E2	D2	D2	D2	A2	N	N	N
Cymene[1]	D1	D1	D1	D1	D1	T	T	T	D2	D2	D2	D2	D2	D2	D2	D2	N	T	T
Dextrose	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Dibromopropane Phosphate[1]	E1	E1	E1	E1	E1	E1	T	D2	D2	D2	D2	D2	D2	D2	D2	D2	T	T	T
Dibutyl Phthalate	D1	D1	D1	D1	A1	D1	T	D2	D2	A2	A2	A2	A2	A2	A2	A2	T	E2	T
Dichloro Acetic Acid - 20%[1]	D1	D1	D1	D1	D1	D2	N	N	N	D2	D2	D2	D2	D2	D2	T	T	T	T
Diethanolamine[1]	D1	D1	D1	D1	D1	D1	T	N	N	D2	D2	D2	D2	D2	D2	T	T	T	T
Diethylene Chloroformate[1]	N	E2	N	N	E2	N	N	N	D2	D2	D2	D2	D2	D2	D2	D2	T	T	T
Diethylketone - 100%[1]	N	T	N	T	T	N	N	T	T	D2	D2	N	D2	N	D2	D2	N	N	N
Dimethylaminoethylamine	N	N	N	T	T	N	N	N	N	T	T	N	T	N	T	N	N	T	N
Dimethyl Aniline	D1	D1	D1	D1	D1	D1	N	N	T	D2	D2	D2	D2	D2	D2	T	N	T	T

KEY TO CHEMICAL RESISTANCE CHART

Rating Description
- A Good to Maximum Temperature of Product
- B Good to 180 °F (71 °C) Maximum
- C Good to 140 °F (60 °C)
- D Good to 120 °F (37 °C) Ambient
- E Good to 100 °F (37 °C)

Rating Description
- 1 Immersion or Constant Flow or Condensing Vapor
- 2 Occasional Splash or Spill
- 3 Fumes Only, Not Condensing
- N Not Recommended

Rating Description
- * Varies With Conditions May Require Test. Consult Master Builders Technologies for Recommendation

Master Builders Technologies

	Celine 80	Corcline 505;510;505.2 505.6	Corcline 505M	Corcline 550	Celcrete 2500 International	Celcrete 2500 U.S.A.	Celcrete 5500	Celcrete 6400	Celcrete 6650	Flakeline 103	Flakeline 161	Flakeline 164	Flakeline 180	Celcote Lining 25	Celcote Lining 61	Celcote Lining 64	Celcote Lining 68	Celcote Lining 74	Celcote Lining 652	Flakeline 211/212	Flakeline 222HT	Flakeline 232
Dimethyl Carbamoyl Chloride[1]	E1	E1	E1	T	E1	E1	E1	T	E1	E1	E1	T	E1	E1	E1	T	T	E1	E1	T	E1	E1
Dimethyl Carbonyl Chloride[1]	T	E1	E1	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Dimethyl Formamide[1]	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	T	N	N	T	T
Dimethyl Sulfoxide[1]	T	T	T	N	E1	E1	E1	T	T	E1	E1	T	T	E1	E1	T	T	T	T	N	T	T
Dinitro Benzene[1]	T	E1	T	T	E1	T	T	E1	T	E1	T	E1	T	E1	T	E1	T	T	T	T	T	T
Dinitro Toluene[1]	T	E1	T	T	E1	T	T	E1	T	E1	T	E1	T	E1	T	E1	T	T	T	T	T	T
Dodecyl Alcohol (Lauryl)[1]	A1	D1	D1	T	C1	C1	C1	D1	A1	C1	C1	D1	A1	C1	C1	D1	E2	A1	C1	T	A1	D1
Ethoxy Ethanol[1]	E1	E1	T	E2	T	E1	E1	T	E1	T	E1	T	E1	T	E1	T	N	E1	T	T	E1	E1
Ethoxylated Nonyl Phenol[1]	T	C1	T	T	T	T	T	D1	T	T	T	D1	T	T	T	D1	T	T	T	T	E2	E2
Ethyl Acetate	E1	T	N	N	N	T	T	N	E1	N	T	N	E1	N	T	N	N	E1	N	N	E1	E1
Ethyl Acrylate	T	E1	N	N	N	T	T	N	T	N	T	N	T	N	T	N	N	T	N	N	T	T
Ethyl Alcohol	C1	C1	T	T	C1	C1	C1	D1	C1	C1	C1	D1	C1	C1	C1	D1	D2	C1	C1	E1	C1	D1
Ethylamine	T	N	N	N	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Ethyl Bromide	N	T	T	N	N	T	T	N	N	N	T	N	N	N	T	N	N	N	N	N	N	N
Ethyl Chloride	E1	T	T	N	T	D1	D1	E1	E1	T	D1	E1	E1	T	D1	E1	N	E1	T	T	E1	E1
Ethyl Chloroformate	T	T	T	N	N	T	T	N	T	N	T	N	T	N	T	N	T	T	N	N	T	T
Ethyl Ether	T	T	T	T	N	T	T	N	T	N	T	N	T	N	T	N	T	T	N	T	E2	E2
Ethyl Hexyl Acrylate	T	E2	T	T	T	T	T	T	T	T	T	T	T	T	T	T	N	T	T	T	T	T
Ethylene Dichloride	E1	E1	N	N	N	T	T	N	E1	N	T	N	E1	N	T	N	N	E1	N	T	E1	E1
Ethylene Glycol	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Ethylene Oxide (Dilute)	T	N	N	N	N	E1	E1	N	T	N	E1	N	T	N	E1	N	N	T	N	N	T	T
Ethyl Sulfate[1]	E1	E1	T	T	T	T	T	E1	E1	T	T	E1	E1	T	T	E1	N	E1	E1	T	E1	E1
Ferric Chloride	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Ferric Sulfate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Fluosilicic Acid* - 25%	N	T	T	T	C1	C1	C1	C1	C1	N	N	N	N	E1	E1	E1	T	E1	E1	N	N	N
Formaldehyde	C1	D1	D1	D1	D1	C1	C1	C1	C1	D1	C1	C1	C1	D1	C1	C1	A2	C1	C1	A1	A1	A1
Formic Acid	D1	N	N	N	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	N	D1	T	T	D1	D1
Furfural to 10%	E1	T	T	T	E1	E1	E1	T	E1	E1	E1	T	E1	E1	E1	T	T	E1	E1	T	E1	E1
Furfuryl Alcohol	E1	D1	D1	T	T	E1	E1	E1	E1	T	E1	E1	E1	T	E1	E1	T	E1	T	T	E1	E1
Gasoline																						
Aviation	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Diesel	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Jet Fuel	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Premium Unleaded	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Unleaded	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Glucose	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Glycerine	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Glycolic Acid to 70%	D1	T	N	N	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	D1	D1	D1
Gold Plating (Cyanide)	D1	A1	A1	A1	D1	D1	D1	N	D1	D1	D1	N	D1	D1	D1	N	A1	D1	D1	N	D1	D1
Grape Juice	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Green Liquor (Paper Ind)	C1	A1	A1	A1	C1	C1	C1	N	C1	C1	N	C1	C1	C1	C1	N	A1	C1	C1	N	C1	A1
Heptane	A1	A1	A1	A1	C1	A1	A1	A1	A1	C1	A1	A1	A1	C1	A1	A1	A1	A1	C1	A1	A1	A1
Hexane	A1	A1	A1	A1	D1	A1	A1	D1	A1	D1	A1	D1	A1	D1	A1	C1	A1	A1	C1	D1	A1	A1
Hydrazine - 35%	N	E1	T	T	T	T	T	N	N	T	T	N	N	T	T	N	T	N	N	N	N	N
Hydrazine Hydrate	T	E1	T	T	T	T	T	N	T	T	T	N	T	T	T	N	T	T	T	T	T	T
Hydroiodic Acid - 20%	C1	T	T	T	C1	C1	C1	T	C1	C1	C1	T	C1	C1	C1	T	T	C1	C1	D2	C1	D1
Hydrobromic Acid - 20%	A1	T	T	T	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Hydrobromic Acid - 48%	C1	N	N	N	C1	C1	C1	A1	C1	C1	C1	A1	C1	C1	C1	A1	N	C1	C1	A1	C1	A1
Hydrochloric Acid - 10%	A1	E1	D2	D2	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	E2	A1	A1	A1	A1	A1
Hydrochloric Acid - 20%	A1	D2	D2	D2	A1	A1	A1	A1	A1	B1	B1	B1	B1	A1	A1	A1	D2	A1	A1	A2	A1	A2
Hydrochloric Acid - 37%	D2	N	N	N	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	N	D1	D1	E2	E2	E2
Hydrofluoric Acid - 1-10%[2]	D2	E1	E1	E1	D1	D1	D1	D1	D1	D2	D2	D2	D2	D1	D1	D1	E2	D1	D1	D2	D2	D2
Hydrofluoric Acid - 20%[2]	E2	E2	E2	E2	D1	D1	D1	D1	D1	E2	E2	E2	E2	D2	D2	D2	N	D2	D2	D2	D2	D2
Hydrofluoric Acid - 21 - 48%[2]	N	N	N	N	E1	E1	E1	E1	E1	N	N	N	N	E1	E1	E1	N	E1	E1	N	N	N
Hydrofluosilicic Acid 10%[2]	E1	C1	C1	C1	A1	A1	A1	A1	A1	E1	E1	E1	E1	A1	A1	A1	E2	A1	A1	E1	E1	E1
Hydrofluosilicic Acid - 35%[2]	D2	D2	D2	D2	D1	D1	D1	D1	D1	D2	D2	D2	D2	D1	D1	D1	T	D1	D1	D2	D2	D2
Hydrogen Peroxide - 30%	C1	T	T	T	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	E2	C1	C1	T	C1	D1
Hydrogen Sulfide Gas	A1	A1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Hypo (Photographic Solution)	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	D1	A1	A1	A1	A1	A1	A1
Hypochlorous Acid	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	T	T	N	N	N
Iodine, Crystals & Vapor	C1	T	T	T	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	T	C1	C1	D1	C1	D1
Isooctylthioglycolate[1]	D1	T	T	T	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	T	D1	D1

CEILCOTE Corrosion Control Products

	Flakeline 241/242	Flakeline 251/252	Flakeline 252 Intermediate	Flakeline 281/282	Flakeline 282	Flakeline 300	Flakeline 800 & Flakeline 851	Ceilcote 681/683 Concrete T	Ceilcote 682/683 Concrete SL Set	Ceilcote 695	Ceilcote 2500 USA	Ceilcote 2500 International	Ceilcote 5500	Ceilcote 6400	Ceilcote 6650	Coroline Series	Ceilcote EJ10	Ceilcote EJ11	Ceilcote EJ3/EJ4
Dimethyl Carbamoyl Chloride[1]	E1	E1	E1	E1	E1	T	N	T	D2	C2	C2	C2	C2	D2	C2	D2	T	T	T
Dimethyl Carbonyl Chloride[1]	T	T	T	T	T	N	N	T	T	D2	D2	D2	D2	D2	D2	D2	T	T	T
Dimethyl Formamide[1]	N	T	N	T	T	N	N	N	T	T	T	N	T	T	T	T	N	T	N
Dimethyl Sulfoxide[1]	D2	E1	E1	T	T	N	N	N	T	T	D2	D2	D2	T	T	T	N	T	N
Dinitro Benzene[1]	T	T	E1	E1	T	T	N	T	T	D2	D2	D2	D2	D2	D2	D2	T	T	T
Dinitro Toluene[1]	T	T	E1	E1	T	T	N	T	T	D2	D2	D2	D2	D2	D2	D2	T	T	T
Dodecyl Alcohol (Lauryl)[1]	D1	D1	D1	D1	A1	D2	T	D2	D2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Ethoxy Ethanol[1]	T	E1	T	T	E1	T	T	E2	E2	D2	D2	D2	D2	D2	D2	D2	T	T	T
Ethoxylated Nonyl Phenol[1]	T	T	T	E1	T	T	T	T	T	D2	D2	D2	D2	D2	D2	C2	T	T	T
Ethyl Acetate	N	E2	N	N	E1	N	N	T	E2	D2	D2	T	D2	N	D2	D2	N	N	N
Ethyl Acrylate	N	T	N	N	E2	N	N	N	T	D2	T	N	T	N	D2	D2	N	N	N
Ethyl Alcohol	D1	D1	D1	D1	C1	E1	E2	D2	C2	C2	C2	C2	C2	D2	C2	C2	E2	D2	E2
Ethylamine	T	T	T	T	T	N	N	N	N	T	T	T	T	T	T	N	N	T	N
Ethyl Bromide	N	N	N	N	N	N	N	N	T	T	T	T	T	T	T	T	N	T	N
Ethyl Chloride	T	D1	T	D1	T	E2	N	T	T	D2	D2	T	D2	D2	D2	T	N	T	N
Ethyl Chloroformate	N	T	N	N	T	N	N	N	D2	D2	D2	D2	D2	D2	D2	D2	T	T	T
Ethyl Ether	E2	D2	E2	E2	D2	N	N	N	D2	D2	D2	D2	D2	D2	D2	D2	N	T	T
Ethyl Hexyl Acrylate	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	D2	N	T	T
Ethylene Dichloride	N	T	N	N	E1	N	N	N	N	D2	D2	N	D2	N	D2	D2	N	T	N
Ethylene Glycol	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Ethylene Oxide (Dilute)	N	E1	N	N	T	N	N	N	D2	D2	D2	D2	D2	D2	D2	D2	T	T	T
Ethyl Sulfate[1]	E1	T	T	E1	E1	T	T	T	D2	D2	T	T	T	D2	D2	D2	T	T	T
Ferric Chloride	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Ferric Sulfate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Fluosilicic Acid* - 25%	N	N	N	N	N	N	N	D2	D2	C2	C2	C2	C2	C2	C2	T	C2	C2	E2
Formaldehyde	A1	A1	A1	A1	A1	A1	D2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Formic Acid	T	D1	D1	D1	D1	T	N	N	N	D2	D2	D2	D2	D2	D2	N	N	E2	N
Furfural to 10%	E1	E1	E1	T	E1	T	T	T	T	E2	E2	E2	E2	E2	E2	T	T	E2	T
Furfuryl Alcohol	T	E1	T	E1	E1	T	N	D2	D2	D2	D2	T	D2	D2	D2	D2	T	D2	T
Gasoline																			
Aviation	N	A1	A1	A1	A1	A1	D2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2
Diesel	N	A1	A1	A1	A1	A1	D2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2
Jet Fuel	N	A1	A1	A1	A1	A1	C2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2
Premium Unleaded	A1	A1	A1	A1	A1	A1	D2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2
Unleaded	A1	A1	A1	A1	A1	A1	E1	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2
Glucose	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Glycerine	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Glycolic Acid to 70%	D1	D1	D1	D1	D1	D2	N	D2	D2	A2	A2	A2	A2	A2	A2	T	T	T	T
Gold Plating (Cyanide)	D1	D1	D1	D1	D1	N	A2	A2	A2	A2	A2	A2	A2	E2	A2	A2	A2	T	A2
Grape Juice	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Green Liquor (Paper Ind)	A1	A1	A1	N	A1	N	A1	A2	A2	A2	A2	A2	A2	E2	A2	A2	A2	T	T
Heptane	A1	A1	D1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	N	T	E2
Hexane	A1	A1	D1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	N	D2	E2
Hydrazine - 35%	N	T	T	N	N	T	T	T	D2	T	T	T	T	N	T	D2	T	T	T
Hydrazine Hydrate	T	T	T	N	T	T	N	N	T	T	T	T	T	N	T	D2	T	T	T
Hydriodic Acid - 20%	D1	D1	D1	D1	C1	N	N	N	T	C2	C2	C2	C2	T	C2	T	D2	T	T
Hydrobromic Acid - 20%	A1	A1	A1	A1	A1	A1	N	N	T	A2	A2	A2	A2	A2	A2	T	T	T	N
Hydrobromic Acid - 48%	A1	A1	A1	A1	A1	A2	N	N	N	A2	A2	A2	A2	A2	A2	T	T	T	N
Hydrochloric Acid - 10%	A1	A1	A1	A1	A1	A2	D2	D2	C2	A2	A2	A2	A2	A2	A2	C2	D2	D2	D2
Hydrochloric Acid - 20%	A2	A2	A2	A2	A1	D2	D2	D2	D2	A2	A2	A2	A2	A2	A2	D2	D2	D2	N
Hydrochloric Acid - 37%	D2	D2	D2	D2	D2	E2	N	N	E2	D2	D2	D2	D2	D2	D2	D2	N	D2	N
Hydrofluoric Acid - 1-10%[2]	D2	D2	D2	D2	N	N	D2	N	D2	C2	C2	C2	C2	C2	C2	D2	D2	D2	N
Hydrofluoric Acid - 20%[2]	D2	D2	D2	D2	N	N	N	N	N	D2	D2	D2	D2	D2	D2	E2	T	D2	N
Hydrofluoric Acid 21-48%[2]	N	N	N	N	N	N	N	N	N	E2	E2	E2	E2	E2	E2	N	N	T	N
Hydrofluosilicic Acid 10%[2]	E1	E1	E1	E1	N	E2	E2	N	D2	A2	A2	A2	A2	A2	A2	C2	D2	D2	T
Hydrofluosilicic Acid - 35%[2]	D1	D1	D1	D1	N	T	T	N	E2	C2	C2	C2	C2	C2	C2	D2	D2	D2	T
Hydrogen Peroxide - 30%	D1	D1	D1	D1	C1	D2	D2	D2	D2	C2	C2	C2	C2	C2	C2	D2	T	D2	D2
Hydrogen Sulfide Gas	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Hypo (Photographic Solution)	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Hypochlorous Acid	N	N	N	N	N	N	N	N	N	N	N	N	N	N	T	N	N	T	N
Iodine, Crystals & Vapor	D1	D1	D1	D1	C1	D1	T	T	T	C2	C2	C2	C2	C2	C2	T	T	T	T
Isooctylthioglycolate[1]	D1	D1	D1	D1	D1	D1	T	T	T	D2	D2	D2	D2	D2	D2	T	T	T	T

KEY TO CHEMICAL RESISTANCE CHART

Rating Description
- A Good to Maximum Temperature of Product
- B Good to 180 °F (71 °C) Maximum
- C Good to 140 °F (60 °C)
- D Good to 120 °F (37 °C) Ambient
- E Good to 100 °F (37 °C)

Rating Description
- 1 Immersion or Constant Flow or Condensing Vapor
- 2 Occasional Splash or Spill
- 3 Fumes Only, Not Condensing
- N Not Recommended

Rating Description
- * Varies With Conditions. May Require Test. Consult Master Builders Technologies for Recommendation.

Master Builders Technologies

	Ceilcote 80	Corrosite 505/510/505-2/505-6	Corrosite 505M	Corrosite 550	Ceilcote 2500 International	Ceilcote 2500 U.S.A.	Ceilcote 5500	Ceilcote 6400	Ceilcote 6650	Flakeline 103	Flakeline 161	Flakeline 164	Flakeline 180	Ceilcote Lining 25	Ceilcote Lining 61	Ceilcote Lining 64	Ceilcote Lining 68	Ceilcote Lining 74	Ceilcote Lining 652	Flakeline 211/212	Flakeline 222HT	Flakeline 232
Isophorone[1]	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E2	E1	E1	D2	E1	E1
Isopropyl Acetate	E1	T	T	T	N	T	T	T	E1	N	T	T	E1	N	T	T	N	E1	N	N	E2	E2
Isopropyl Alcohol	C1	C1	C1	D1	D1	C1	C1	C1	C1	D1	C1	C1	C1	D1	C1	C1	D2	C1	D1	D1	C1	D1
Isopropyl Ether	T	E1	T	T	N	T	T	T	T	N	T	T	T	N	T	T	T	T	N	D2	E2	E2
Jet Fuel JP-4	A1	A1	A1	A1	D1	A1	A1	D1	A1	D1	A1	D1	A1	D1	A1	D1	D2	A1	D1	A1	A1	A1
Kerosene	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Ketchup	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Lactic Acid 1-20%	A1	T	T	T	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	A1	A1
Lactic Acid Concentrated	A1	N	N	N	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Lard	A1	E1	E1	E1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Lauric Acid	A1	T	T	T	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Lead Acetate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Lecithin[1]	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1
Levulinic Acid (Saturated)	A1	D1	D1	D1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	A1	D1
Linseed Oil	A1	D1	D1	D1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	A1	A1
Lithium Hydroxide - 10%[2]	N	A1	A1	A1	D1	D1	D1	N	D1	N	N	N	N	D1	D1	N	N	D1	D1	N	N	N
Lithium Hydroxide (Saturated)[2]	N	A1	A1	A1	C1	C1	C1	N	C1	N	N	N	N	C1	C1	N	N	C1	C1	N	N	N
Maleic Acid	A1	N	N	N	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Malic Acid[1]	C1	C1	C1	T	C1	C1	C1	D1	C1	C1	C1	D1	C1	C1	C1	D1	T	C1	C1	A1	C1	A1
Mercury and Salts	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Methanol 100%	N	D2	D2	D2	N	E1	E1	N	N	N	E1	N	N	N	E1	N	E2	N	N	E2	E2	E2
Methyl Acetate	T	T	N	N	N	T	T	N	T	N	T	N	T	N	T	N	N	T	N	N	E2	E2
Methylamyl Alcohol[1]	E1	E1	T	T	N	E1	E1	E1	E1	N	E1	E1	E1	N	E1	E1	T	E1	E1	T	E1	E1
Methylene Chloride	E2	E2	N	N	N	N	N	N	E2	N	N	N	E2	N	N	N	N	E2	N	N	E2	E2
Methyl Chloride	E1	N	N	N	N	N	N	N	E2	N	N	N	E2	N	N	N	N	E2	N	N	E2	E2
Methyl-Ethyl Ketone	E1	E2	E2	T	N	E2	E2	N	E1	N	E2	N	E1	N	E2	N	N	E1	N	N	E1	E1
Methyl Oleate[1]	D1	E1	T	T	E1	E1	E1	E1	D1	E1	E1	E1	D1	E1	E1	E1	T	D1	E1	E1	D1	D1
Methyl Isobutyl Ketone[1]	E1	E1	E1	T	N	T	T	N	E1	N	T	N	E1	N	T	N	N	E1	N	N	E1	E1
Milk - Fresh & Sour	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Molasses	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Naphtha - Aliphatic	A1	A1	C1	C1	C1	A1	A1	A1	A1	C1	A1	A1	A1	C1	A1	A1	A1	A1	A1	A1	A1	A1
Naphtha, Aromatic (Coal Tar)	C1	D1	D1	D1	T	D1	D1	D1	C1	T	D1	D1	C1	T	D1	D1	T	C1	T	T	C1	D1
Naphthalene (in Benzene)	D1	D1	D1	T	N	D1	D1	E1	D1	N	D1	E1	D1	N	D1	E1	T	D1	N	D2	D1	D1
Naphthenic Acid[1]	D1	D1	D1	D1	T	D1	D1	T	D1	T	D1	T	D1	T	D1	T	T	D1	T	D1	D1	D1
Nickel Plating, Bright[4]	A1	C1	C1	T	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A2	A1	A1	A1	A1	A1
Nitric Acid - 5%	A1	E2	E2	E2	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Nitric Acid - 10%	B1	E2	E2	E2	C1	C1	C1	A1	A1	C1	C1	B1	B1	C1	C1	B1	N	C1	C1	D1	A1	A1
Nitric Acid - 25%	C1	N	N	N	D1	D1	D1	C1	C1	D1	D1	C1	C1	D1	D1	C1	N	C1	D1	D2	C1	D1
Nitric Acid - 40%	C1	N	N	N	D1	D1	D1	C1	C1	D1	D1	C1	C1	D1	D1	C1	N	D1	D1	E2	D2	D2
Nitric Acid - 60%	D1	N	N	N	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	N	D1	N	N	D2	D2
Nitric Acid - 73%	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E2	E2
Nitrilotrethanol[1]	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E2	E1	E1	T	E1	E1
Nitrobenzene	E1	E1	T	T	N	T	T	T	E1	N	T	T	E1	N	T	T	N	E1	N	N	E1	E1
Nitromethane	T	T	T	T	E1	T	T	N	T	E1	T	N	T	E1	T	N	T	T	T	T	D2	D2
Octanoic Acid			See Caprylic Acid																			
Octanol[1]	E1	E1	T	T	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	T	E1	E1	E1	E1	E1
Oils																						
Sour Crude Petroleum	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Animal	A1	T	T	T	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	A1	A1
Mineral	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Vegetable	A1	D1	D1	D1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	A1	A1
Oleic Acid	A1	N	N	N	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Oleum			See Sulfuric Acid																			
Oxalic Acid (Saturated)	A1	T	T	T	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	A1	A1
Para Xylene	D1	D1	T	T	N	D1	D1	E1	D1	N	D1	E1	D1	N	D1	E1	T	D1	N	N	D1	D1
Pelargonic Acid[1]	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E2	E1	E1	E1	E1	E1
Pentachloroethane	E1	N	N	N	T	T	T	T	E1	T	T	T	E1	T	T	T	N	E1	N	N	E1	E1

CEILCOTE Corrosion Control Products

	Flakeline 241/242	Flakeline 251/252	Flakeline 252 Intermediate	Flakeline 261/262	Flakeline 282	Flakeline 300	Flakeline 600, Flakeline 681	Ceilcote 681/685, Concrete T	Ceilcote 682/683, Concrete SL 30	Ceilcote 695	Ceilcote 2500 U.S.A.	Ceilcote 2500 Intermediate	Ceilcote 5500	Ceilcote 6400	Ceilcote 6650	Corrolite 505/510	Ceilcote EJ10	Ceilcote EJ11	Ceilcote EJ13/EJ4
Isophorone[1]	E1	E1	E1	E1	E1	T	T	E2	E2	D2	D2	E2	D2	D2	D2	D2	T	T	T
Isopropyl Acetate	N	E2	N	T	E2	N	N	E2	D2	D2	D2	D2	D2	D2	D2	D2	N	N	N
Isopropyl Alcohol	D1	D1	D1	D1	C1	E1	D2	C2	A2	A2	A2	A2	A2	C2	A2	A2	D2	D2	D2
Isopropyl Ether	N	E2	N	E2	E2	T	N	E2	D2	D2	D2	D2	D2	D2	D2	D2	T	T	T
Jet Fuel JP-4	D1	A1	D1	D1	A1	A1	D1	C2	A2	A2	A2	A2	A2	A2	A2	A2	N	D2	D2
Kerosene	A1	A1	A1	A1	A1	A1	A1	C2	A2	A2	A2	A2	A2	A2	A2	A2	N	D2	D2
Ketchup	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Lactic Acid 1-20%	A1	A1	A1	A1	A1	A1	T	T	D2	A2	A2	A2	A2	A2	A2	T	T	D2	T
Lactic Acid Concentrated	A1	A1	A1	A1	A1	A2	N	N	N	A2	A2	A2	A2	A2	A2	N	N	D2	N
Lard	A1	A1	A1	A1	A1	A1	D2	D2	D2	A2	A2	A2	A2	A2	A2	D2	N	D2	T
Lauric Acid	A1	A1	A1	A1	A1	A1	N	N	T	A2	A2	A2	A2	A2	A2	T	N	T	T
Lead Acetate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	T	A2
Lecithin[1]	A1	A1	A1	A1	A1	A1	D1	D2	D2	D2	D2	D2	D2	D2	D2	D2	A2	E2	A2
Levulinic Acid (Saturated)	A1	A1	A1	A1	A1	A1	T	T	D2	A2	A2	A2	A2	A2	A2	D2	D2	E2	D2
Linseed Oil	A1	A1	A1	A1	A1	A1	T	D2	D2	A2	A2	A2	A2	A2	A2	D2	N	D2	T
Lithium Hydroxide[4] - 10%	N	N	N	N	N	N	E1	A2	A2	A2	A2	A2	A2	N	A2	A2	E2	E2	E2
Lithium Hydroxide[4] (Saturated)	N	N	N	N	N	N	E1	A2	A2	A2	A2	A2	A2	N	A2	A2	D2	D2	D2
Maleic Acid	A1	A1	A1	A1	A1	A1	N	N	N	A2	A2	A2	A2	A2	A2	N	T	T	T
Malic Acid[1]	A1	A1	A1	A1	A1	A1	T	D2	C2	A2	C2	C2	C2	D2	A2	C2	D2	E2	D2
Mercury and Salts	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Methanol 100%	E2	D2	E2	E2	E2	E2	E2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	E2	D2
Methyl Acetate	N	E2	N	N	D2	N	N	D2	D2	D2	D2	D2	D2	D2	D2	D2	N	N	N
Methylamyl Alcohol[1]	E1	E1	N	E1	E1	T	T	T	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2
Methylene Chloride	N	N	N	N	E2	N	N	N	N	E2	E2	N	N	N	E2	E2	N	E2	N
Methyl Chloride	N	N	N	N	E2	N	N	N	N	E2	N	N	N	N	E2	N	N	T	N
Methyl-Ethyl Ketone	N	E2	N	N	E1	N	N	T	D2	D2	D2	D2	D2	D2	D2	D2	N	N	N
Methyl Oleate[1]	E1	E1	E1	E1	D1	E1	T	T	D2	D2	D2	D2	D2	D2	D2	D2	N	T	T
Methyl Isobutyl Ketone[1]	N	T	N	N	E1	N	N	N	D2	D2	D2	N	D2	N	D2	D2	N	N	N
Milk - Fresh & Sour	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Molasses	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Naphtha - Aliphatic	A1	A1	A1	A1	A1	A1	A1	C2	C2	A2	A2	C2	A2	A2	A2	A2	N	D2	E2
Naphtha, Aromatic (Coal Tar)	T	D1	T	D1	C1	T	T	D2	D2	A2	C2	D2	C2	D2	C2	C2	N	D2	E2
Naphthalene (in Benzene)	N	D1	N	E1	D1	E2	E2	T	D2	C2	C2	N	C2	D2	C2	C2	N	E2	N
Naphthenic Acid[1]	T	D1	T	T	D1	D2	T	E2	E2	C2	D2	T	D2	T	D2	C2	N	T	T
Nickel Plating, Bright[4]	A1	A1	A1	A1	A1	A1	E2	D2	C2	A2	A2	A2	A2	A2	A2	A2	A2	T	E2
Nitric Acid - 5%	A1	A1	A1	A1	A1	A2	E2	E2	E2	A2	A2	A2	A2	A2	A2	D2	D2	E2	N
Nitric Acid - 10%	D1	D1	D1	D1	A1	D2	N	N	N	A2	B2	B2	B2	A2	A2	D2	D2	E2	N
Nitric Acid - 25%	D2	D2	D2	D2	C1	E2	N	N	N	B2	C2	C2	C2	B2	B2	N	T	E2	N
Nitric Acid - 40%	D2	E1	E1	D1	D1	E2	N	N	N	C2	C2	C2	C2	B2	C2	N	T	E2	N
Nitric Acid - 60%	E2	E2	E2	D2	D2	N	N	N	N	D2	D2	D2	D2	D2	D2	N	T	E2	N
Nitric Acid - 73%	N	N	N	N	E2	N	N	N	N	E2	N	N	N	N	N	N	N	E2	N
Nitrilotriethanol[1]	E1	E1	E1	E1	E1	T	T	D2	D2	D2	D2	D2	D2	D2	D2	D2	T	T	T
Nitrobenzene	N	T	N	T	E1	N	N	N	T	E2	T	N	T	T	E2	E2	N	E2	T
Nitromethane	T	T	E1	N	T	T	T	T	T	E2	D2	T	T	E2	T	E2	N	N	T
Octanoic Acid			(see Caprylic Acid)																
Octanol[1]	E1	E1	E1	E1	E1	E1	T	T	T	D2	D2	D2	D2	D2	D2	D2	T	N	T
Oils																			
Sour Crude Petroleum	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	N	E2	A2
Animal	A1	A1	A1	A1	A1	A1	T	E2	E2	A2	A2	A2	A2	A2	A2	D2	N	E2	A2
Mineral	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	N	E2	A2
Vegetable	A1	A1	A1	A1	A1	A1	T	D2	D2	A2	A2	A2	A2	A2	A2	C2	N	E2	A2
Oleic Acid	A1	A1	A1	A1	A1	A1	N	N	N	A2	A2	A2	A2	A2	A2	N	N	T	D2
Oleum			See Sulfuric Acid																
Oxalic Acid (Saturated)	A1	A1	A1	A1	A1	A1	T	A2	A2	A2	A2	A2	A2	A2	A2	T	A2	D2	A2
Para Xylene	N	D1	N	E1	D1	N	N	D2	D2	A2	D2	D2	D2	D2	D2	D2	N	E2	N
Pelargonic Acid[1]	E1	E1	E1	E1	E1	E1	T	T	D2	C2	C2	C2	C2	C2	C2	D2	N	T	N
Pentachloroethane	N	N	N	N	E1	N	N	E2	N	E2	E2	E2	E2	T	E2	E2	N	E2	N

KEY TO CHEMICAL RESISTANCE CHART

Rating Description
- A Good to Maximum Temperature of Product
- B Good to 180 °F (71 °C) Maximum
- C Good to 140 °F (60 °C)
- D Good to 120 °F (37 °C) Ambient
- E Good to 100 °F (37 °C)

Rating Description
- 1 Immersion or Constant Flow or Condensing Vapor
- 2 Occasional Splash or Spill
- 3 Fumes Only, Not Condensing
- N Not Recommended

Rating Description
- T Varies With Conditions. May Require Test. Consult Master Builders Technologies for Recommendation.

Master Builders Technologies

	Celtite 80	Corotite 505/510/505.2/505.6	Corotite 505M	Corotite 550	Celcrete 2500 International	Celcrete 2500 U.S.A.	Celcrete 5500	Celcrete 6400	Celcrete 6650	Flakelite 103	Flakelite 161	Flakelite 164	Flakelite 180	Celcote Lining 25	Celcote Lining 61	Celcote Lining 64	Celcote Lining 68	Celcote Lining 74	Celcote Lining 652	Flakelite 211/212	Flakelite 222HT	Flakelite 232
Perchloric Acid - 30%	E1	N	N	N	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	N	E1	E1	N	E1	E1
Perchloroethylene	D1	D1	D1	D1	E1	D1	D1	D1	D1	E1	D1	D1	D1	E1	D1	D1	T	D1	D1	E2	D1	D1
Phenol - 5%	C1	N	N	N	N	E1	E1	C1	C1	N	E1	C1	C1	N	E1	C1	N	C1	N	N	D1	D1
Phenol - 85%	E1	N	N	N	N	N	N	N	E1	N	N	N	E1	N	N	N	N	E1	N	N	E1	E1
Phenol Sulfonic Acid - 65%	N	N	N	N	T	T	T	T	N	T	T	T	N	T	T	T	N	E1	N	N	N	N
Phosphoric Acid - 20%	A1	N	N	N	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Phosphoric Acid - 85%	A1	N	N	N	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Phosphorous Oxychloride[1]	T	C1	T	T	N	N	N	E1	T	N	N	E1	T	N	N	E1	T	T	N	N	T	T
Phosphorous Trichloride[1]	T	C1	T	T	N	T	T	N	T	N	T	N	T	N	T	N	T	T	N	N	N	N
Picric Acid - 10% in Alcohol	D1	T	T	T	E1	D1	D1	E1	D1	E1	D1	E1	D1	E1	D1	D1	T	D1	E1	T	D1	D1
Polyacrylic Acid - 50%[1]	D1	D1	T	T	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	T	D1	D1	D1	D1	D1
Potassium Acetate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Potassium Bichromate	A1	T	T	T	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	A1	A1
Potassium Bromide	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Potassium Carbonate - 25%	C1	A1	A1	A1	C1	C1	C1	E1	C1	C1	C1	E1	C1	C1	C1	E1	A1	C1	C1	E2	C1	A1
Potassium Chlorate[2]	C1	C1	C1	C1	A1	A1	A1	T	A1	C1	C1	T	C1	A1	A1	A1	A1	A1	A1	A2	A1	A1
Potassium Chloride	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Potassium Cyanide	C1	A1	A1	A1	C1	C1	C1	T	C1	C1	C1	T	C1	C1	C1	T	A1	C1	C1	N	C1	A1
Potassium Fluoride[2]	C1	A1	A1	A1	A1	A1	A1	A1	A1	C1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Potassium Hydroxide - 10%[2]	D1	A1	A1	A1	D1	D1	D1	N	D1	D1	D1	N	D1	D1	D1	N	A1	D1	D1	N	D1	D1
Potassium Hydroxide - 50%[2]	C1	A1	A1	A1	C1	C1	C1	N	C1	C1	C1	N	E1	E1	C1	N	C1	C1	C1	N	C1	A1
Potassium Nitrate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Potassium Permanganate	A1	T	T	T	A1	A1	A1	C1	A1	A1	A1	C1	A1	A1	A1	C1	T	A1	A1	A1	A1	A1
Potassium Persulfate	A1	T	T	T	A1	A1	A1	D1	A1	A1	A1	D1	A1	A1	A1	D1	T	A1	A1	A1	A1	A1
Potassium Sulfate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Propanediol[1]	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1
Propionic Acid - 100%[1]	D1	N	N	N	E1	D1	D1	T	D1	E1	D1	T	D1	E1	D1	T	N	D1	E1	T	D1	D1
Propylene Glycol	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Pyridine	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Rayon Spin Liquor	A1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	D1	A1	A1	A1	A1	A1
Salicylaldehyde[1]	E1	T	T	T	N	E1	E1	E1	E1	N	E1	E1	E1	N	E1	E1	T	E1	N	D2	E1	E1
Salicylic Acid	C1	C1	C1	T	C1	C1	C1	T	C1	C1	C1	T	C1	C1	C1	T	T	C1	C1	D2	C1	D1
Salt Brine	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Silicon Tetrachloride[1]	T	T	T	T	N	E1	E1	N	T	N	E1	N	T	N	E1	N	T	T	N	N	T	T
Sodium Acetate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Bicarbonate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Bisulfate	C1	A1	A1	A1	C1	C1	C1	N	E1	E1	E1	N	E1	C1	C1	N	C1	C1	C1	N	E1	E1
Sodium Bisulfite	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Bromate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Carbonate - Sat'd[2]	C1	A1	A1	A1	C1	C1	C1	N	E1	E1	E1	N	E1	C1	C1	N	C1	C1	C1	N	E1	E1
Sodium Chloride	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Chlorite - Sat'd	D1	N	N	N	D1	C1	C1	C1	D1	D1	C1	C1	D1	D1	C1	C1	N	D1	D1	A2	A1	A1
Sodium Chromate[2]	A1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	A1	A1
Sodium Chlorate[2]	C1	C1	C1	C1	A1	A1	A1	A1	A1	C1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Cyanide - 15%	A1	A1	A1	A1	C1	A1	A1	D1	A1	C1	B1	D1	A1	C1	A1	D1	A1	A1	C1	B1	A1	A1
Sodium Dichromate	A1	D1	D1	D1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Fluoride[2]	C1	A1	A1	A1	A1	A1	A1	A1	A1	C1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Hydrosulfide - 45%[2]	C1	A1	A1	A1	A1	A1	A1	C1	A1	C1	C1	D1	C1	A1	A1	C1	A1	A1	A1	E1	A1	A1
Sodium Hydroxide - 10%[2]	E1	A1	A1	A1	D1	D1	D1	N	N	N	N	N	N	D1	D1	N	D1	D1	D1	N	E1	E1
Sodium Hydroxide - 50%[2]	E1	A1	A1	A1	C1	C1	C1	N	N	N	N	N	N	C1	C1	N	A1	C1	C1	N	C1	A1
Sodium Hypochlorite - 3%[2]	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	D1	D1	D2	D2	D2
Sodium Hypochlorite - 17%[2]	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	D1	D1	N	D2	D2
Sodium Lauryl Sulfate - 20%	C1	C1	C1	C1	D1	D1	D1	D1	C1	D1	D1	D1	C1	D1	D1	D1	E1	C1	D1	D2	C1	D1
Sodium Oxalate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Peroxide - Peroxide Bleach[1]	A1	A1	A1	A1	A1	A1	A1	T	A1	A1	A1	T	A1	A1	A1	T	A1	A1	A1	T	A1	A1
Sodium (Acid) Phosphate	A1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Phosphate (Tri)	D1	A1	A1	A1	C1	C1	C1	N	C1	E1	E1	N	E1	A1	A1	N	E1	C1	C1	N	E1	E1

CEILCOTE Corrosion Control Products

	Flakeline 241/242	Flakeline 251/252	Flakeline 252 Intermediate	Flakeline 281/282	Flakeline 282	Flakeline 300	Flakeline 600/Flakeline 631	Ceilcote 681/683 Concrete T	Ceilcote 682/683 Concrete SL	Ceilcote 695	Ceilcote 2500 U.S.A.	Ceilcote 2500 International	Ceilcote 5500	Ceilcote 6400	Ceilcote 6650	Corrolite 505/510	Ceilcote EJ10	Ceilcote EJ11	Ceilcote EJ3/EJ4
Perchloric Acid - 30%	E1	E1	E1	E1	E1	D2	N	T	T	D2	D2	D2	D2	D2	D2	T	T	T	N
Perchloroethylene	E2	D1	E2	D1	D1	E2	E2	E2	D2	D2	D2	E2	D2	D2	D2	C2	N	T	T
Phenol - 5%	N	E1	N	E1	D1	N	N	N	N	B2	D2	T	D2	B2	B2	N	N	E2	T
Phenol - 85%	N	N	N	N	N	N	N	N	N	D2	N	N	N	N	D2	N	N	E2	N
Phenol Sulfonic Acid - 65%	N	T	T	T	E1	N	N	N	N	D2	T	T	T	T	D2	N	N	D2	N
Phosphoric Acid - 20%	A1	A1	A1	A1	A1	A1	E2	D2	D2	A2	A2	A2	A2	A2	A2	N	D2	E2	D2
Phosphoric Acid - 85%	A1	A1	A1	A1	A1	A1	N	N	N	A2	A2	A2	A2	A2	A2	N	T	E2	T
Phosphorous Oxychloride[1]	N	N	N	N	T	N	E2	E2	E2	T	N	N	N	N	T	C2	T	T	T
Phosphorous Trichloride[1]	N	T	N	N	T	N	E2	E2	E2	T	T	N	T	N	N	C2	T	T	T
Picric Acid - 10% in Alcohol	T	D1	E1	E1	D1	N	N	N	T	C2	C2	D2	C2	D2	D2	T	D2	D2	D2
Polyacrylic Acid - 50%[1]	D1	D1	D1	D1	D1	D1	T	T	T	D2	D2	D2	D2	D2	D2	D2	D2	T	T
Potassium Acetate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	E2	A2
Potassium Bichromate	A1	A1	A1	A1	A1	A1	T	E2	E2	A2	A2	A2	A2	A2	A2	C2	D2	E2	D2
Potassium Bromide	A1	A1	A1	A1	A1	A1	A1	A2	C2	A2	A2	A2	A2	A2	A2	A2	A2	E2	A2
Potassium Carbonate - 25%	A1	A1	A1	E1	A1	E2	A1	A2	A2	A2	A2	A2	A2	D2	A2	A2	A2	D2	E2
Potassium Chlorate[1]	A1	A1	A1	T	A1	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2	A2	A2	D2	A2
Potassium Chloride	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Potassium Cyanide	A1	A1	A1	T	C1	N	E1	A2	A2	A2	A2	A2	A2	D2	A2	A2	A2	D2	A2
Potassium Fluoride[1]	A1	A1	A1	A1	N	N	D2	D2	C2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Potassium Hydroxide - 10%[2]	D1	D1	D1	N	D1	N	A1	A2	A2	C2	C2	C2	C2	N	C2	A2	C2	E2	N
Potassium Hydroxide - 50%[2]	A1	A1	A1	N	A1	N	A1	A2	A2	C2	C2	C2	C2	N	C2	A2	C2	E2	N
Potassium Nitrate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	E2	A2
Potassium Permanganate	A1	A1	A1	A1	A1	A1	T	D2	D2	A2	A2	A2	A2	A2	A2	D2	D2	E2	D2
Potassium Persulfate	A1	A1	A1	A1	A1	A1	T	C2	C2	A2	A2	A2	A2	C2	A2	D2	D2	E2	D2
Potassium Sulfate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Propanediol[1]	D1	D1	D1	D1	D1	D1	D1	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	E2	D2
Propionic Acid - 100%[1]	E1	D1	E1	T	D1	T	N	N	N	D2	D2	D2	D2	T	D2	N	N	T	N
Propylene Glycol	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Pyridine	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Rayon Spin Liquor	A1	A1	A1	A1	A1	A1	E2	D2	D2	A2	A2	A2	A2	A2	A2	C2	D2	E2	D2
Salicylaldehyde[1]	D2	E1	E1	E1	E1	E2	T	T	D2	D2	D2	N	D2	D2	D2	T	T	T	T
Salicylic Acid	D1	D1	D1	T	C1	D2	T	D2	D2	C2	C2	C2	C2	C2	C2	C2	C2	E2	C2
Salt Brine	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Silicon Tetrachloride[1]	N	E1	N	N	T	N	T	T	T	D2	D2	D2	D2	D2	D2	T	T	T	T
Sodium Acetate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	T	A2
Sodium Bicarbonate	E1	E1	E1	N	E1	N	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Bisulfate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Bisulfite	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Bromate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Carbonate - Sat'd[2]	E1	E1	E1	N	E1	N	A1	A2	A2	A2	A2	A2	A2	D2	A2	A2	A2	D2	D2
Sodium Chloride	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Chlorite - Sat'd	D1	D1	D1	D1	D1	N	N	T	T	C2	B2	C2	B2	B2	C2	T	D2	D2	D2
Sodium Chromate[3]	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Chlorate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Cyanide - 15%	A1	A1	A1	A1	A1	D2	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Dichromate	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Fluoride[2]	A1	A1	A1	A1	E1	E2	E2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	T	A2
Sodium Hydrosulfide - 45%[2]	A1	A1	A1	E1	A1	E2	A2	C2	A2	A2	A2	A2	A2	A2	A2	C2	A2	D2	T
Sodium Hydroxide - 10%[2]	E1	D1	D1	N	E1	N	D1	A2	A2	C2	C2	C2	C2	N	C2	A2	N	D2	A2
Sodium Hydroxide - 50%[2]	E1	E1	E1	N	E1	N	E1	A2	A2	C2	C2	C2	C2	N	C2	A2	N	D2	A2
Sodium Hypochlorite - 3%[2]	D2	D2	D2	D2	N	N	N	N	D2	D2	D2	D2	D2	D2	D2	N	D2	E2	N
Sodium Hypochlorite - 17%[2]	D2	D2	D2	D2	N	N	N	N	N	N	N	N	N	N	N	N	N	E2	N
Sodium Lauryl Sulfate - 20%	D1	D1	D1	D1	C1	D2	A2	C2	C2	A2	C2	A2	C2	C2	A2	B2	D2	E2	D2
Sodium Oxalate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	T	A2
Sodium Peroxide - Peroxide Bleach[1]	A1	A1	A1	T	A1	T	D1	A2	A2	A2	A2	A2	A2	D2	A2	A2	A2	D2	N
Sodium (Acid) Phosphate	A1	A1	A1	A1	A1	A1	D1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Phosphate (Tri)	E1	E1	E1	N	E1	N	E1	A2	A2	A2	A2	A2	A2	N	A2	A2	A2	A2	A2

KEY TO CHEMICAL RESISTANCE CHART

Rating Descriptions

- A Good to Maximum Temperature of Product
- B Good to 180 °F (71 °C) Maximum
- C Good to 140 °F (60 °C)
- D Good to 120 °F (37 °C) Ambient
- E Good to 100 °F (37 °C)

Rating Descriptions

- 1 Immersion or Constant Flow or Condensing Vapor
- 2 Occasional Splash or Spill
- 3 Fumes Only, Not Condensing
- N Not Recommended

Rating Descriptions

- T Varies With Conditions. May Require Test. Consult Matter Builders Technologies for Recommendations.

Master Builders Technologies

	Celline 80	Corcelline Series	Corcelline 5050M	Corcelline 550	Celcrete 2500 International	Celcrete 2500 U.S.A.	Celcrete 5500	Celcrete 6400	Celcrete 6650	Flakeline 103	Flakeline 161	Flakeline 164	Flakeline 180	Celcote Lining 25	Celcote Lining 61	Celcote Lining 64	Celcote Lining 68	Celcote Lining 74	Celcote Lining 652	Flakeline 211/212	Flakeline 222HT	Flakeline 232
Sodium Polymethacrylate[1]	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1
Sodium Sulfate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Sulfide (Saturated)[2]	A1	A1	A1	A1	A1	A1	A1	E1	A1	A1	A1	E1	A1	A1	A1	E1	A1	A1	A1	E1	A1	A1
Sodium Sulfite	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Tartrate	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sodium Thiosulfate (Hypo)	A1	A1	A1	A1	C1	A1	A1	T	A1	C1	A1	T	A1	C1	A1	T	A1	A1	A1	A1	A1	A1
Soybean Oil	A1	T	T	T	A1	A1	A1	T	A1	A1	A1	T	A1	A1	A1	T	A1	A1	A1	A1	A1	A1
Stearic Acid	A1	N	N	N	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Styrene	D1	D1	D1	D1	N	E1	E1	N	D1	N	E1	N	D1	N	E1	N	T	D1	N	E2	D1	D1
Sugar	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sulfamic Acid - 25%	C1	T	T	T	C1	C1	C1	A1	C1	C1	C1	C1	C1	C1	C1	A1	T	C1	C1	A1	A1	A1
Sulfite Liquor (Paper)	A1	A1	A1	A1	A1	A1	A1	D1	A1	A1	A1	D1	A1	A1	A1	D1	A1	A1	A1	A1	A1	A1
Sulfur Dioxide (Wet)	A1	C1	C1	D1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Sulfur Trioxide (Wet)	A1	D1	D1	E1	A1	A1	A1	A1	A1	B1	B1	B1	A1	A1	A1	A1	E2	A1	A1	A1	A1	A1
Sulfuric Acid - 10%	A1	D1	E1	E1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	E2	A1	A1	A1	A1	A1
Sulfuric Acid - 25%	A1	E2	E2	E2	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Sulfuric Acid - 50%	A1	D2	D2	D2	A1	A1	A1	A1	A1	B1	B1	B1	B1	A1	A1	A1	N	A1	A1	A1	A1	A1
Sulfuric Acid - 70%	C1	N	N	N	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	N	C1	C1	A2	D1	E1
Sulfuric Acid - 75%	D1	N	N	N	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	N	E1	E1	D2	E1	E1
Sulfuric Acid - 93-98%	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E2	E2
Tall Oil	A1	B1	B1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A2	A1	A1	A1	A1	A1
Tartaric Acid	A1	T	T	T	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A2	A1	A1	A1	A1	A1
Tetrachloroethane[1]	D1	E1	E1	T	N	E1	E1	N	D1	N	E1	N	D1	N	E1	N	N	D1	N	N	D1	D1
Tetrachloroethylene[1]	See Perchloroethylene																					
Tetrahydrofuran	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E2	E2
Tetrahydrofurfuryl Alcohol[1]	E1	T	T	T	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	T	E1	E1	T	E1	E1
Thionyl Chloride	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Thionyl Chloride - Water Sol'n	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Tin Plating (Fluoborate)	See Fluoboric Acid																					
Tin Plating (Stannate)	See Sodium Hydroxide																					
Toluol (Toluene)	E1	E1	T	T	N	E1	E1	E1	E1	N	E1	E1	E1	N	E1	E1	E2	E1	N	N	E1	E1
Toluene Sulfonic Acid	A1	T	T	T	A1	A1	A1	D1	A1	A1	A1	D1	A1	A1	A1	D1	T	A1	A1	T	A1	A1
Toluidine[1]	T	T	T	T	N	E1	E1	N	T	N	E1	N	T	N	E1	N	N	T	N	N	T	T
Triethylamine[1]	E1	T	T	T	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	N	E1	E1	T	E1	E1
Triethylenetetramine[1]	T	T	T	T	E1	E1	E1	E1	T	E1	E1	E1	T	E1	E1	E1	N	E1	N	T	T	T
Triethyl Phosphite[1]	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	T	E1	E1	E1	E1	E1
Trichloroacetic Acid - 20%	A1	N	N	N	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	N	A1	A1	A1	A1	A1
Trichlorobenzene (1,2,4-)[1]	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	T	E1	E1	T	E1	E1
Trichloroethane[1]	E1	E1	E1	T	N	E1	E1	N	E1	N	E1	N	E1	N	E1	N	N	E1	N	N	E1	E1
Trichloroethylene	E2	E1	T	T	N	E1	E1	N	E1	N	E1	N	E1	N	E1	N	N	E2	N	N	E2	E2
Tricresyl Phosphate 100%	C1	C1	C1	C1	T	T	T	T	C1	T	T	T	C1	T	T	T	D2	C1	C1	T	C1	D1
Trisodium Phosphate (Sat'd)[2]	C1	A1	A1	A1	A1	A1	A1	E1	A1	C1	C1	E1	C1	A1	A1	E1	A1	A1	A1	D2	A1	A1
Turpentine	A1	D1	D1	D1	C1	C1	C1	D1	A1	C1	C1	D1	A1	C1	C1	D1	T	A1	C1	E1	A1	A1
Urea Solutions	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Vinegar	A1	E1	E1	E1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	E1	A1	A1	A1	A1	A1
Vinyl Chloride	T	T	T	N	N	T	T	N	N	N	T	T	N	T	N	N	N	T	N	N	E2	E2
Water, Distilled & Demineralized	A1	A1	A1	A1	A1	A1	A1	A1	A1	B1	B1	B1	B1	A1	A1	A1	A1	A1	A1	A1	A1	A1
White Liquor (Paper)	C1	A1	A1	A1	A1	A1	A1	N	A1	C1	C1	N	C1	A1	A1	N	A1	A1	A1	N	A1	A1
Wine	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
Xylol (Xylene)	D1	D1	T	T	N	D1	D1	E1	D1	N	D1	E1	D1	N	D1	E1	E2	D1	N	N	D1	D1
Zinc Plating - Acid Fluoborate	See Fluoboric Acid																					
Zinc Plating - Cyanide	See Sodium Hydroxide 10%																					
Zinc Plating - Acid Sulfate	A1	C1	C1	C1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	E1	A1	A1	A1	A1	A1

CEILCOTE Corrosion Control Products

	Flakeline 241/242	Flakeline 251/252	Flakeline 252 International	Flakeline 281/282	Flakeline 282	Flakeline 300	Flakeline 600, Flakeline 651	Ceilcote 681/685, Concrete T	Ceilcote 682/683, Concrete SL 36	Ceilcote 695	Ceilcote 2500 U.S.A.	Ceilcote 2500 International	Ceilcote 5500	Ceilcote 6400	Ceilcote 6850	Corroline Series	Ceilcote EJ10	Ceilcote EJ11	Ceilcote EJ13/EJ4
Sodium Polymethacrylate[1]	D1	D1	D1	D1	D1	D1	D1	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	E2	D2
Sodium Sulfate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Sulfide (Saturated)[2]	A1	A1	A1	E1	A1	E2	A2	A2	A2	A2	A2	A2	A2	D2	A2	A2	D2	D2	D2
Sodium Sulfite	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Tartrate	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sodium Thiosulfate (Hypo)	A1	A1	A1	T	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Soybean Oil	A1	A1	A1	A1	A1	A1	A2	D2	C2	A2	A2	A2	A2	A2	A2	D2	N	D2	D2
Stearic Acid	A1	A1	A1	A1	A1	A1	N	D2	D2	A2	A2	A2	A2	A2	A2	D2	N	T	D2
Styrene	N	E1	N	N	D1	E2	E2	D2	D2	D2	D2	N	D2	N	D2	D2	N	E2	N
Sugar	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Sulfamic Acid - 25%	A1	A1	A1	A1	A1	A1	T	T	T	A2	A2	B2	B2	A2	B2	D2	D2	E2	D2
Sulfite Liquor (Paper)	A1	A1	A1	D1	A1	A1	A2	A2	A2	A2	A2	A2	A2	C2	A2	A2	A2	E2	A2
Sulfur Dioxide (Wet)	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2	D2
Sulfur Trioxide (Wet)	A1	A1	A1	A1	A1	A1	E1	E2	E2	A2	A2	A2	A2	A2	A2	C2	D2	D2	N
Sulfuric Acid - 10%	A1	A1	A1	A1	A1	A1	E2	D2	D2	A2	A2	A2	A2	A2	A2	C2	D2	D2	N
Sulfuric Acid - 25%	A1	A1	A1	A1	A1	A2	N	E2	E2	A2	A2	A2	A2	A2	A2	D2	D2	D2	N
Sulfuric Acid - 50%	A1	A1	A1	A1	A1	A2	N	E2	E2	A2	A2	A2	A2	A2	A2	D2	D2	D2	N
Sulfuric Acid - 70%	E1	E1	E1	E1	E1	E2	N	N	N	A2	A2	A2	A2	A2	A2	N	D2	D2	N
Sulfuric Acid - 75%	E1	E1	E1	E1	E1	D2	N	N	N	B2	C2	C2	C2	B2	C2	N	E2	D2	N
Sulfuric Acid - 93-98%	N	N	N	N	E2	N	N	N	N	D2	N	N	N	N	N	N	N	E2	N
Tall Oil	A1	A1	A1	A1	A1	A1	E2	C2	C2	A2	A2	A2	A2	A2	A2	A2	N	T	D2
Tartaric Acid	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Tetrachloroethane[1]	N	E1	N	N	D1	N	N	N	T	D2	E2	N	D2	E2	D2	D2	N	T	N
Tetrachloroethylene[1]		See Perchloroethylene																	
Tetrahydrofuran	N	N	N	N	E2	N	N	N	N	E2	N	N	N	N	E2	N	N	N	N
Tetrahydrofurfuryl Alcohol[1]	E1	E1	E1	E1	E1	T	T	D2	D2	D2	D2	D2	D2	D2	D2	D2	T	T	T
Thionyl Chloride	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	T	N
Thionyl Chloride - Water Sol'n	N	N	N	N	N	N	N	N	N	T	N	N	N	N	T	T	N	T	N
Tin Plating (Fluoborate)		See Fluoboric Acid																	
Tin Plating (Stannate)		See Sodium Hydroxide																	
Toluol (Toluene)	N	E1	N	E1	E1	N	E2	E2	E2	D2	D2	D2	D2	D2	D2	D2	N	E2	N
Toluene Sulfonic Acid	A1	A1	A1	D1	A1	N	T	D2	D2	A2	A2	A2	A2	C2	A2	D2	T	T	T[*]
Toluidine[1]	N	E1	N	N	T	N	N	T	T	T	D2	N	D2	N	T	T	N	T	N
Triethylamine[1]	E1	E1	E1	E1	E1	T	T	N	T	D2	D2	D2	D2	D2	D2	T	T	T	T
Triethylenetetramine[1]	N	E1	E1	E1	T	T	N	N	T	D2	D2	D2	D2	D2	D2	T	T	T	T
Triethyl Phosphite[1]	E1	E1	E1	E1	E1	E1	T	D2	D2	D2	D2	D2	D2	D2	D2	D2	T	T	T
Trichloroacetic Acid - 20%	A1	A1	A1	A1	A1	A1	N	N	N	A2	A2	A2	A2	A2	A2	N	D2	T	T
Trichlorobenzene (1,2,4-)[1]	E1	E1	E1	E1	E1	T	T	D2	D2	D2	D2	D2	D2	D2	D2	D2	N	T	T
Trichloroethane[1]	N	E1	N	N	E1	N	N	D2	D2	D2	D2	N	D2	N	D2	D2	N	E2	N
Trichloroethylene	N	E2	N	N	E2	N	N	N	E2	D2	D2	N	D2	D2	D2	D2	N	E2	N
Tricresyl Phosphate 100%	C1	T	T	T	A1	T	E2	E2	E2	C2	E2	E2	E2	E2	C2	C2	T	T	T
Trisodium Phosphate (Sat'd)[2]	A1	A1	A1	E1	A1	D2	A1	A2	A2	A2	A2	A2	A2	C2	A2	A2	C2	D2	C2
Turpentine	A1	A1	A1	D1	A1	E1	T	D2	D2	A2	C2	C2	C2	D2	A2	A2	N	E2	T
Urea Solutions	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Vinegar	A1	A1	A1	A1	A1	A1	E2	D2	D2	A2	A2	A2	A2	A2	A2	B2	D2	D2	D2
Vinyl Chloride	N	E2	N	N	E2	N	N	N	N	E2	E2	N	E2	N	E2	E2	N	T	N
Water, Distilled & Demineralized	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
White Liquor (Paper)	A1	A1	A1	N	A1	N	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	T	D2
Wine	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	D2	A2
Xylol (Xylene)	N	D1	N	E1	D1	N	N	D2	D2	D2	D2	D2	D2	D2	D2	D2	N	E2	N
Zinc Plating - Acid Fluoborate		See Fluoboric Acid																	
Zinc Plating - Cyanide		See Sodium Hydroxide 10%																	
Zinc Plating - Acid Sulfate	A1	A1	A1	A1	A1	A1	D1	C2	C2	A2	A2	A2	A2	A2	A2	A2	A2	D2	D2

KEY TO CHEMICAL RESISTANCE CHART

Rating Description

- A Good to Maximum Temperature of Product
- B Good to 180 °F (71 °C) Maximum
- C Good to 140 °F (60 °C)
- D Good to 120 °F (37 °C) Ambient
- E Good to 100 °F (37 °C)

Rating Description

- 1 Immersion or Constant Flow or Condensing Vapor
- 2 Occasional Splash or Spill
- 3 Fumes Only, Not Condensing
- N Not Recommended

Rating Description

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Master Builders Technologies

	CelkGard® 650 HB	CelkGard 650 HB/FDA	CelkGard 615, 620	CelkGard 630	CelkGard 470	CelkGard 430
Acetic Acid - 10%	N	N	N	N	D2	C2
Acetone - 10%	E2	E2	E2	E1	D2	D2
Acetone - 100%	E2	E2	E2	E1	E2	D2
Alum	D2	D2	C2	B1	C2	B2
Aluminum Chloride	D2	D2	C2	C1	C2	B2
Aluminum Sulfate	D2	D2	C2	C1	C2	E2
Ammonia Anhydrous Liquid	D2	D2	C2	E1	B2	B2
Ammonia Aqua	D2	D2	D2	C2	B2	B2
Ammonia Wet Gas	D2	D2	D2	C2	B3	B3
Ammonium Chloride	D2	D2	A2	B2	C2	E2
Ammonium Hydroxide - 20%	D2	D2	A2	C2	B2	B2
Ammonium Nitrate	D2	D2	A2	C2	C2	E2
Ammonium Sulfate	D2	D2	A2	C2	C2	E2
Aniline	N	N	N	N	N	N
Benzene	E2	E2	D2	E1	D2	E1
Benzoic Acid	D2	D2	C2	B2	B2	B2
Benzyl Chloride	N	N	N	C2	D2	D2
Black Liquor (Paper)	D2	D2	C2	C1	C2	B2
Bleach	N	N	N	C2	C2	B2
Boric Acid	D2	D2	D2	C2	B2	B2
Bromine Water - 5%	N	N	N	C2	C2	B2
Butanol	D2	D2	C2	D1	C2	C2
Butyl Cellosolve	D2	D2	C2	D1	C2	C2
Butyl Cellosolve Acetate	D2	D2	C2	D1	C2	C2
Cadmium Plating (Cyanide)	A2	A2	A2	C2	C2	B2
Calcium Bisulfite	A2	A2	A2	C1	B2	B2
Calcium Chloride	A2	A2	D2	C2	C2	E2
Calcium Hydroxide	A2	A2	C2	C1	C2	C2
Calcium Hydrochlorite 5%	N	N	N	N	C2	C2
Calcium Nitrate	D2	D2	C2	C1	C2	A2
Carbon Bisulfide Fumes	E2	E2	D2	C2	D2	C2
Carbon Tet	E2	E2	E2	E1	C2	B2
Cellosolve	D2	D2	D2	D1	C2	C2
Chlorine Gas (Wet)	N	N	N	N	N	N
Chlorine Water	N	N	E2	C2	N	N
Chlorobenzene	D2	D2	D2	D1	C2	C2
Chloroform	N	N	N	N	N	N
Chromic Acid - 10%	N	N	N	E2	C2	C2
Chrome Plating	N	N	N	D2	N	N
Chromic Chloride	D2	D2	C2	C1	C2	C2
Citric Acid	D2	D2	D2	C2	C2	C2
Copper Plating (Cyanide)	E2	D2	C2	C2	C2	C2
Copper Plating (Acid)	N	N	D2	C2	C2	C2
Dextrose	E1	D1	C2	C1	C2	C2
Ethanol	C2	C2	C2	D1	C2	C2
Ethyl Acetate	E2	E2	D2	C2	E2	E2

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CEILCOTE Corrosion Control Products

	CeilGard 650 HB	CeilGard 650 HB FDA	CeilGard 615/620	CeilGard 630	CeilGard 470	CeilGard 490
Ethylene Dichloride	N	N	N	N	N	N
Ethylene Glycol	D2	D2	D2	C1	C2	C2
Ferric Chloride	D2	D2	C2	C1	C2	C2
Ferric Sulfate	D2	D2	C2	C1	D2	C2
Fertilizer - Dry	A3	A3	A3	B3	D2	C2
Fertilizer - Liquid	D2	C2	C2	C1	C2	C2
Formaldehyde	D2	D2	D2	D1	C2	C2
Gasoline - Aviation	C2	C2	C2	C1	C2	C2
Gasoline - Diesel	C2	C2	C2	C1	D2	D2
Gasoline - Jet Fuel	D2	D2	C2	C1	D2	C2
Gasoline - Prem. Unleaded	D2	D2	C2	D1	C2	C2
Gasoline - Unleaded	E2	E2	E2	C1	C2	C2
Glycerine	D1	D1	B2	B1	C2	D1
Green Paper Liquor	D2	D2	A2	C1	C2	C2
Hexane	E1	E1	C2	C1	D2	C2
HCL - 1-10%	E2	E2	D2	C2	C2	C2
Hydrofluosilicic Acid	A2	A2	A2	C2	C2	C2
Hydrogen Peroxide - 30%	A2	A2	A2	C2	C2	C2
H_2S - Wet	E2	E2	E2	B2	D2	C2
Hypo (Photographic Liquid)	D1	D1	A2	C1	C2	C2
IPA	D2	D2	A2	C1	C2	C2
JP4 Jet Fuel	D2	D2	C2	C1	D2	C2
Kerosene	D1	D1	C2	B1	C2	C2
Lactic Acid - 1-10%	D2	D2	D2	B2	C2	C2
MeOH	C2	C2	C2	C2	C2	C2
MEK	D2	D2	D2	C2	D2	C2
MIBK	D2	D2	D2	C2	D2	C2
MICK	D2	D1	D2	C1	C2	C2
Molasses	E1	D1	C2	C1	C2	A2
Muriatic Acid	N	N	N	N	N	N
Naptha (Aliphatic)	D1	D1	E1	C1	D2	D2
Naptha (Aromatic)	D2	D2	D2	C1	C2	C2
Nitric Acid - 5%	E2	E2	E2	D2	C2	C2
Nitric Acid - 10%	N	N	E2	D2	C2	C2
Nitrobenzene	E2	E2	D2	C2	E2	E2
Oil, Animal	D2	D2	C2	C1	C2	C2
Oil, Mineral	E1	E1	C2	C1	C2	D2
Petroleum, Sour Crude	D2	C2	C2	C1	C2	D2
Oil, Vegetable	D2	D1	C2	C1	C2	D2
Para Xylene	E2	E2	D2	C1	N	N
Perchloroethylene	E2	D2	D2	C1	N	E2
Phenol - 5%	N	N	N	D2	N	D2
Phenol - 85%	N	N	N	D2	N	N
Phosphonic Acid - 20%	N	N	N	D2	C2	C2
Phosphonic Acid - 85%	N	N	N	E2	N	N
Potassium Bichromate	D2	D2	C2	B2	C2	C2

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Master Builders Technologies

	CelkGard 650 HB	CelkGard 650 HB, FDA	CelkGard 615/620	CelkGard 630	CelkGard 470	CelkGard 450
Potassium Chloride	E1	E1	C2	C1	C2	C2
Potassium Hydroxide - 10%	A2	A2	A2	C1	C2	C2
Potassium Hydroxide - 50%	A2	A2	A2	C1	D2	C2
Propylene Glycol	E1	D1	A2	C1	C2	A2
Rayon Soin Liquor	N	N	C2	B2	C2	C2
Salt Brine	D1	D1	B2	C1	C2	C2
Sodium Bicarb	E1	D1	C2	C1	C2	A2
Sodium Bisulfate	D2	D2	C2	C2	C2	C2
Sodium Carbonate	D1	D1	C2	C1	C2	A2
Sodium Chlorate	D1	D1	A2	C1	C2	C2
Sodium Chloride	E1	E1	C2	C1	D2	C2
Sodium Chromate	D2	D2	C2	C2	C2	C2
Sodium Dichromate	C2	C2	C2	C2	C2	C2
Sodium Hydroxide - 10%	C2	E1	C2	C1	C2	C2
Sodium Hydroxide - 50%	C2	E1	C2	C1	D2	C2
Sodium Hypochlorite - 3%	N	N	N	N	C2	C2
Sodium Phosphate - 25%	C2	E1	C2	C2	C2	A2
Sodium Sulfate	C2	D1	C2	C1	C2	C2
Sodium Sulfide	C2	C2	C2	C1	C2	C2
Sodium Sulfite*	C2	C2	C2	C1	C2	A2
Sodium Thiosulfate	C2	D1	C2	C1	C2	C2
Styrene	E2	E2	D2	D1	C2	C2
Sugar	E1	D1	C2	C1	C2	C2
Sulfur Dioxide (Wet) Sulfurous Acid	E2	D2	D2	C2	C2	C2
Sulfur Trioxide (Wet)	E2	E2	E2	C2	D2	C2
Sulfuric Acid - 10%	N	N	N	D2	D2	D2
Sulfuric Acid - 25%	N	N	N	D2	D2	D2
Sulfuric Acid - 50%	N	N	N	E2	N	N
Sulfuric Acid - 70%	N	N	N	N	N	N
Sulfuric Acid - 75%	N	N	N	N	N	N
Sulfuric Acid - 93-98%	N	N	N	N	N	N
Tall Oil	D2	D2	C2	C2	C2	C2
Toluene	E2	D2	D2	D1	C2	C2
Trichloroethane	E2	E2	C2	D1	E2	D2
Trichlorothylene	E2	E2	E2	D1	E2	D2
Tricresyl Phosphate	E1	E1	C2	C1	C2	C2
Trisodium Phosphate	E1	D1	C2	C1	C2	C2
Turpentine	E1	D1	C2	B1	C2	D2
Urea	D2	D2	C2	C1	C2	C2
Vinegar	E2	D2	D2	D2	D2	C2
Water, Distilled	E1	D1	C2	C1	D2	A2
White Liquor - Paper	C2	C2	C2	C1	C2	C2
Wine	E1	E1	A2	D1	C2	C2
Xylol	E2	D2	C2	D1	C2	C2
Zinc Plating (Acid Sulfate)	D2	D2	D2	C2	D2	C2

KEY TO CHEMICAL RESISTANCE CHART

Rating Description
- A Good to Maximum Temperature of Product
- B Good to 180 °F (71 °C) Maximum
- C Good to 140 °F (60 °C)
- D Good to 120 °F (37 °C) Ambient
- E Good to 100 °F (37 °C)

Rating Description
- 1 Immersion or Constant Flow or Condensing Vapor
- 2 Occasional Splash or Spill
- 3 Fumes Only, Not Condensing
- N Not Recommended

Rating Description
- * Varies With Conditions. May Require Test. Consult Master Builders Technologies for Recommendation.

Solving corrosion problems for industry, worldwide

Master Builders Technologies

From floors to stacks, Ceilcote corrosion control products from Master Builders, helps hundreds of industries solve their toughest corrosion problems.

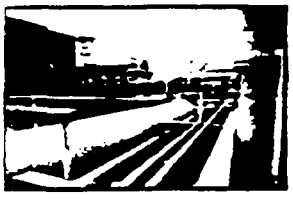
Master Builders Technologies is industry's partner in corrosion problem-solving. As the pioneer and technological leader in polymer linings, coatings, flooring and grout, we have become an increasingly important factor in the cost-effective operation of hundreds of industrial plants and processes.

Our corrosion-fighting products are state-of-the-art. Proven products such as Ceilcrete, Brutem, Ceilcote, Coroline, Tarpon Flake, Concresive, Poly Plus and Flakeline are unsurpassed in solving industry's toughest corrosion problems.

Master Builders Technologies product and service base has expanded in both scope and reach. We tap a tremendous range of company assets to meet our customers' needs, from special formulations through skilled installation, anywhere in the World.

Protective Coatings

Our family of Coatings for metal, concrete and other substrates solves corrosion problems by the hundreds. These easy to apply coatings include polyesters, epoxies, coal tar epoxies, urethanes, phenolics, epoxy novolaks and specialized formulations that will cure below freezing.



Nowhere else will you find such a wide range of protection from atmospheric corrosion.

Monolithic Linings

The corrosive environments encountered in many industries we serve vary widely in the demands they make on linings. Pickling tanks require one type; flocculation tanks another. The oil and gas industry requires protection for facilities aboveground, belowground and underwater. An electric utilities gas desulfurization system may require five different lining types.

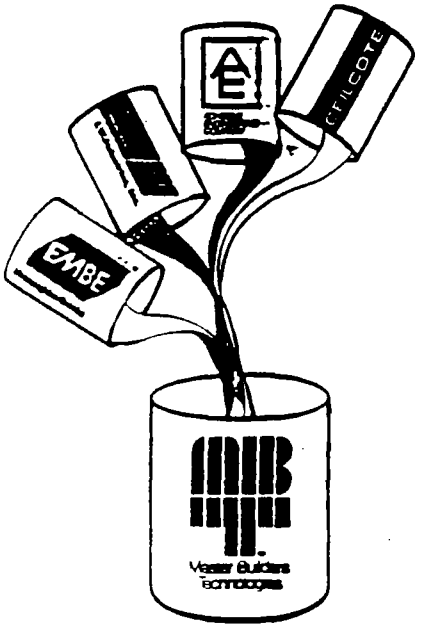
But so long as the corrosion problem can be solved by a polymer-based lining — and the exceptions are rare — Master Builders Technologies has the solution.

Our linings are monolithic, without seams or joints. They form a continuous, protective barrier against corrosion. They are made of epoxy, polyester and other special polymers. They adhere to carbon steel, alloy and concrete surfaces.

They provide excellent resistance to permeation, chemicals, abrasion and, of course, corrosion. They have immersion temperature resistance to 200 degrees F. and dry temperature resistance to 400 degrees F. They cure quickly, are easy to maintain and provide long, cost-effective service life. Today, millions of square feet of Master Builders Technologies linings protect industrial installations worldwide.

Flooring Systems

Our flooring systems supply specialized materials which solve the specific corrosion problems found in a wide range of industries, from utilities turbine rooms to pharmaceutical plants. Our floors protect concrete from attack by acids, alkalis and chemicals of all kinds — including water and lubricating oils. They are further specialized to solve problems of abrasion and skid resistance and heavy traffic. From light-duty concrete sealers to heavy-duty trowel-applied systems, Master Builders Technologies provides the answers.



YOUR BEST DEFENSE AGAINST CORROSION

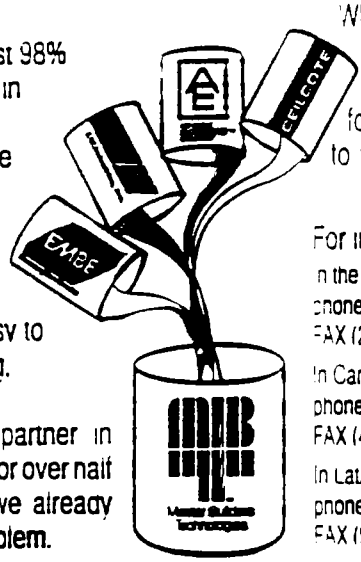
Ceilcote® Corrosion Control Products offer a broad spectrum of solutions to your corrosion problems in moderate to the most aggressive chemical environments. Whether subjected to chemical immersion, spillage, fumes, or environmental corrosion, our range of polymer linings, floorings and coatings form a continuous protective barrier against corrosion.

Highly engineered fillers combined with flake, mat or fabric reinforcement, and a full range of polymer-based matrix systems optimize resistance to permeation and chemical attack.

Special formulations resist 98% sulfuric acid, bridge cracks in concrete, resist abrasion/mechanical abuse, and cure below freezing.

Our systems protect metal or concrete surfaces, cure quickly to minimize downtime, are easy to maintain and provide a long, cost-effective service life.

We've been industry's partner in corrosion problem-solving for over half a century. Chances are, we already have a solution to your problem.



Whatever your needs, you can rely on Ceilcote Corrosion Control Products for cost effective answers to your specific problems.

For immediate attention call:

In the U.S.A.
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FAX (216) 831-6460

In Canada
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FAX (416) 741-7925

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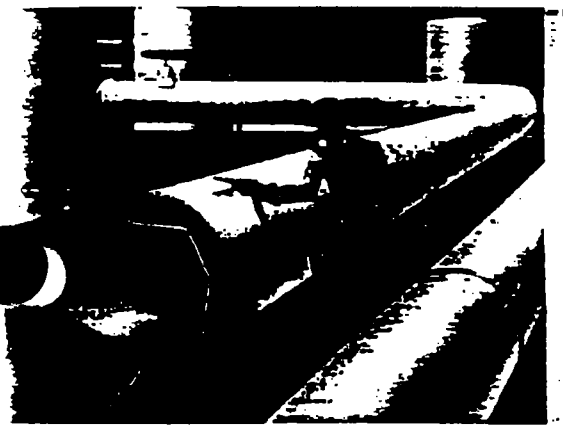
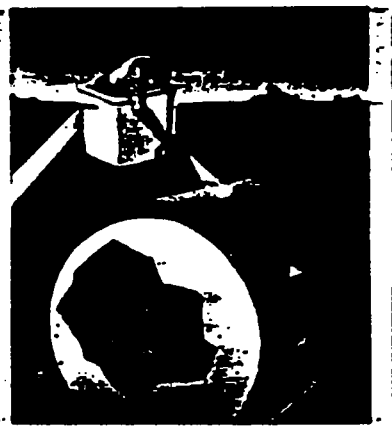
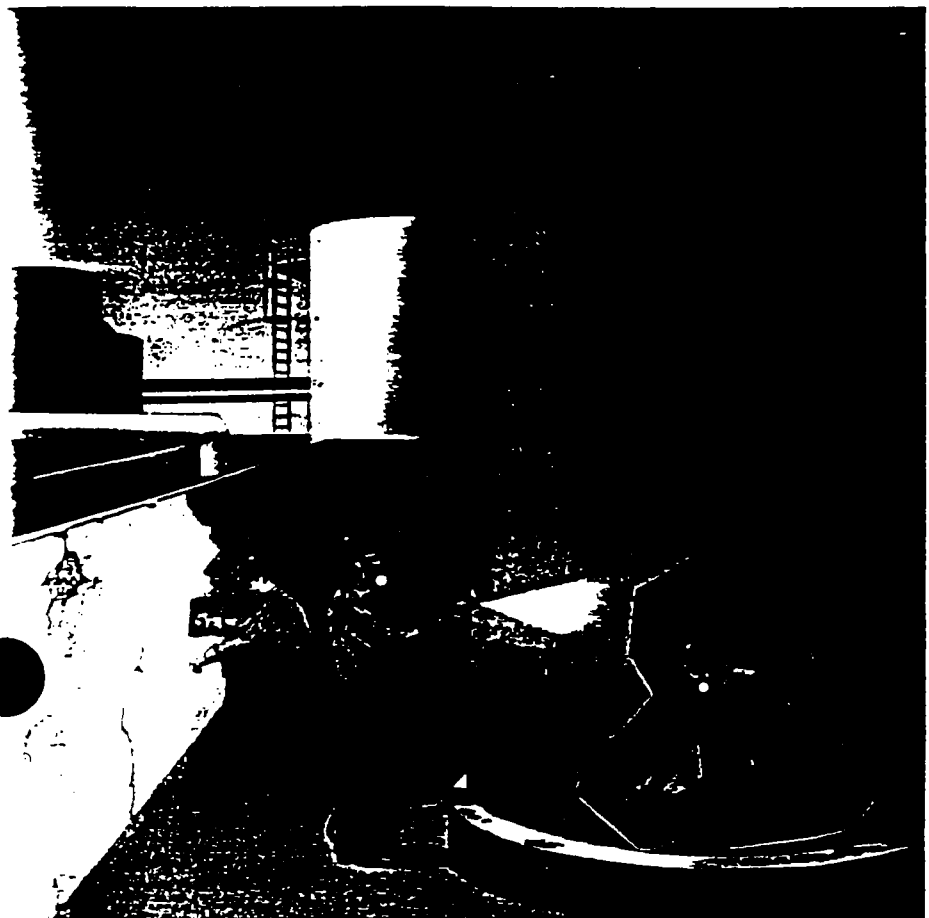
FAX (905) 395-7903.







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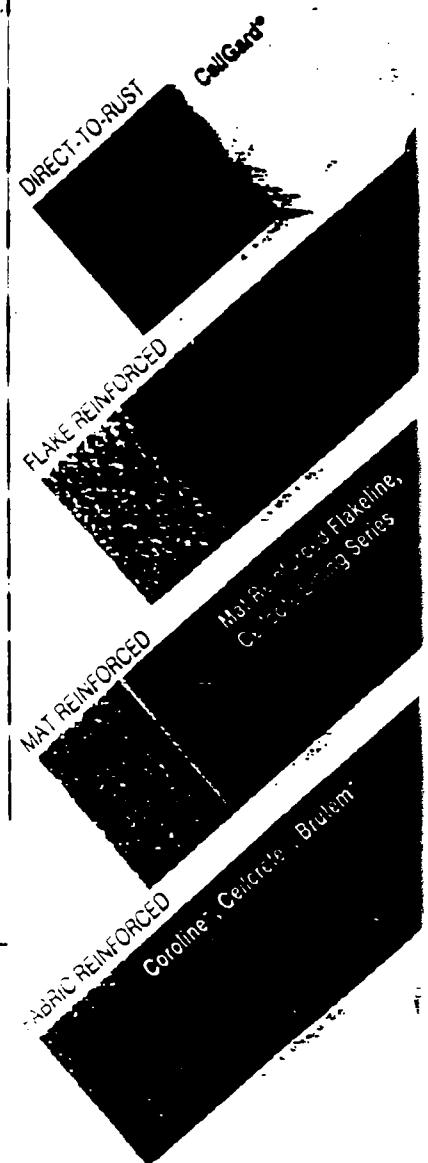
APPLYING TECHNOLOGICAL LEADERSHIP TO PROBLEM SOLVING



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APPENDIX D-10, DATA SHEET #5

CHEMICAL COMPATIBILITY CHART
FUTURA COATINGS

GEOTHANE

GEOMEMBRANE CONTAINMENT SYSTEMS

AND

TANK LINING SPECIFICATION

FUTURA COATINGS, I
9200 LATTY AVEN
HAZELWOOD (ST. LOUIS) M

FUTURA COATINGS, INC.
GEOTHANE CONTAINMENT SYSTEMS
AND
TANK LINING SPECIFICATION

PREFACE

This is intended as a basic guide for owners, specifiers, and engineers in the preparation of more detailed specifications governing the application of elastomeric, spray-applied, Geothane memorane lining and covering systems. An effort has been made within this specification to outline the qualities and application parameters desired as part of the total membrane system.

The suggested dry film thickness of a Futura Geothane System is based on a 50 mil dry film thickness. This will provide adequate thickness for chemical resistance and resistance to mechanical damage and weatherability. In applications where mechanical damage is not a concern, the memorane may be reduced to 35 mils dry film thickness. Longevity of service is directly proportional to the total membrane thickness. As a result, many engineers, architects and owners are specifying thicknesses as great as 100 mils to obtain maximum longevity.

In addition to the geomembrane lining or cover, your containment system may also include: The sub-structure that supports the liner, the anchor system that holds the liner and cover in place, and substrate vent systems that allow gas to escape from beneath the liner or cover. Since construction or installation of all these items can affect the performance of the final containment system, these items are also addressed:

Appendix #1 "Chemical Resistance of Geothane Elastomeric Coatings" outlines the general chemical resistance of these materials. Futura Coatings, Inc. may require a representative sample of the waste material for evaluation particularly where non-recommended chemicals are contained in the affluent in trace amounts.

SCOPE

This specification covers the general installation of Geothane 520 and/or Geothane 5020 materials in the following applications:

Geomembrane Lining Systems - Earthen Basins or Reservoirs
Lining Steel Tanks
Lining Concrete Basins or Tanks
Repair of Failed Plastic Basin Liners
Environmental Covers

For other applications or specific project information not covered in this Specification Guideline, contact Futura's Technical Services Department.

1.0 GENERAL REQUIREMENTS

1.1 For an earthen reservoir a complete geo-technical survey shall be conducted to determine the suitability of the proposal site. This survey will detect the presence of organic wastes, other decomposing material, and soil instability that can be detrimental to liner performance. Once the suitability of the site has been established, proceed with the development of an excavation plan based on the overall containment structure design.

1.2 The substrate must be dry prior to application of coating. The type of surface preparation will depend on the nature of the substrate as covered in Section 3.0.

.3 Application Temperatures

Geothane 520 - 45°F Minimum and Rising
Geothane 5020 - 35°F Minimum and Rising

1.4 Installer shall be experienced in this line of work and shall be conversant with both material application and surface preparation.

The installer shall provide all labor, materials, equipment, and incidentals required to provide a complete geomembrane system as indicated on drawings and specified in this manual.

The installer shall provide certification from the manufacturer that he is an approved contractor having demonstrated by previous experience his ability to do the work. Installers without the required previous experience certification shall obtain factory technical assistance.

1.5 Coating materials shall be stored in a cool dry environment and shall not be used past their stated shelf life. All materials shall be delivered to the jobsite in unopened new containers bearing the manufacturer's original label. All materials will be stacked in a neat and orderly fashion by type and component. Empty containers will be neatly stacked for count verification by the designated project inspector. Containers may not be removed from the project without the approval of the inspector.

Fabric materials must be covered and protected from the weather until ready for installation. Fabric must remain dry prior to and during installation.

1.6 Application of coatings shall not take place if threatening weather prevails. Caution should be demonstrated when the dew point approaches 5 degrees of the existing temperature.

0 MATERIALS

2.1 Substrate Primer
A primer may be recommended for one or more of the following reasons: To penetrate porosity, tie-up loose materials, block moisture, and provide maximum adhesion to the subsequent topcoat.

Primer is to be selected on the basis of substrate:

TABLE 1

SURFACE/SUBSTRATE	PRIMER RECOMMENDATION
Earth	None. A supporting geotextile fabric is used. See Table 2.
Concrete, Masonry	Futura-Bond 307 or Futura-Bond 502
Steel	Futura-Bond 300
PVC Linings	Futura-Bond 313
Other Sheet Lining Systems	Consult Futura

NOTE: The application instructions on the data sheet for each primer are to be followed particularly in relation to application and recoat schedules.

.2 Fabric Selection
Selection of the fabric for the membrane depends on the type and condition of the substrate and on the end use of the system. Many substrates such as mild steel or concrete may not require any fabric. For geomembrane linings or environmental covers the following may be used as a guide.

TABLE 2

TYPE OF SERVICE	SUPPLIER	GRADE (WEIGHT OZS/SQ. YARD)	MAX. ROLL WIDTH IN FEET	MIN. THICKNESS OF GEOTHANE 520/5020
Light Duty	Hoechst Celanese(1)	Trevira 1112 (3.4 oz)	15	35 mils
Heavy Duty	Hoechst Celanese(1)	Trevira 1125 (7.1 oz)	15	50 mils
	Phillips (2)	Rufon E-6-N (6.0 oz)	15	50 mils

(1) Hoechst Celanese Corp., P.O. Box 5887, Spartanburg, SC 29304
(2) Phillips Fiber Corp., Box 66, Greenville, SC 29602

Where animals may cause damage to the membrane, the Geothane 520/5020 thickness should be increased by 50% and the exposed areas covered with a layer of soil or river sand for additional protection.

2.3 The protective waterproofing topcoat shall consist of a two component, elastomeric membrane and shall be either Geothane 520 or Geothane 5020. It shall be manufactured by Futura Coatings, Inc., St. Louis, MO and shall conform in every respect to the following physical properties:

PHYSICAL PROPERTIES	TEST METHOD	TYPICAL RESULTS Unsupported 520	Unsupported 5020	Supported 520	Supported 5020
Solids Content	Calculated	100%	100%	Consult Futura for current information. Different fabric and variations in weight will produce different values	
Tensile Strength	ASTM D-412 (Die C, AT 20 in./min.)	800 PSI	1500 PSI		
Elongation at 77°F (25°C)	ASTM D-412 (Die C, at 20 in./min.)	300%	320%		
Tear Resistance	ASTM D-1938 Split Tear	50 ± 5 PLI	85 ± 5 PLI		
Low Temperature Flexibility	ASTM D-1737, 1/2" mandrel bend at -55°F (-47°C)	Passes	Passes		
High Temperature Resistance	ASTM D-573 Continuous	200°F	200°F		
	Intermittent	250°F	275°F		
Abrasion Resistance	ASTM C-501 CS-17 wheel 1000 rev., 1000 gr. weight	23 mg. loss	21 mg. loss		
Weatherability	ASTM G-23 (QUV Weathering)	After 2000 hours of exposure There was no evidence of checking, cracking, or loss of flexibility			

3.0 SURFACE PREPARATION

3.1 Earthen

The basin shall be excavated to required dimensions with smooth compacted surfaces. Slopes should preferably be no steeper than 4:1, especially if the liner will be covered with a layer of earth or other material. If space is limited, a slope as steep as 3:1 is acceptable for exposed membranes; however, the danger of earth instability and sliding under the liner is increased.

All surfaces in contact with the liner must be free of sharp stones, sticks, and other debris that can

cture or tear the liner. This may mean that earth removal, sifting and replacement will be required to ure proper surface conditions. A layer of sand or other fine material can be used if the native soil is suitable. Sterililze areas of potentially harmful plant life.

A 12 by 18 inch anchor trench around the perimeter of the excavation is required to secure the liner. If the excavation is to contain liquid, this anchor trench must be above the water line.

See Appendix 2 for typical design.

3.2 CONCRETE

Any surface contamination of dirt, oil, or grease shall be removed by scrubbing with a power broom, scraping, solvent wiping, washing and/or brush blasting.

If specified, surfaces shall then be acid-etched with a 15% solution of muriatic acid to remove laitances and impurities. After foaming action has stopped, the surface must be rinsed with copious quantities of water.

All surfaces shall be thoroughly clean and dry prior to priming.

The specified primer shall be applied according to manufacturer's specifications.

Any expansion joints or stress cracks shall be properly prepared and filled with Futura-Caulk 515. Consult data sheet on caulking for complete application information.

After has cured, Geothane 520/5020 shall be applied according to specifications.

3 STEEL

Welds shall be inspected and weld spatter removed with a grinding tool. Steel surfaces are to be sandblasted to white metal (SSPC-SP5). The anchor pattern shall have a 3-4 mil profile. Profile to be determined by a Zormco Model 101/45 Roughness Gauge or equal. Particular attention shall be given to welds, inside corners, and pockets to insure thorough cleaning. All surfaces shall be completely free of oil, grease, dirt, rust scale, and foreign matter. The cleaned surface shall have a gray-white, uniform metallic color and each square inch of surface shall be free of all visible residues, discolorations, staining, mill scale, rust, and weld spatter. Remove all dust and grit by vacuuming the surface. Avoid touching the surface with hands, contaminated rags, or dirty clothing. The primer must be applied immediately after surface preparation or before humidity and temperature cause a rust bloom to form on the surface. If rust bloom should occur, the steel surface must be reblasted to original white metal appearance. The specified primer shall be applied according to manufacturer's specifications. Particular care shall be taken to follow "Recoat Schedule" indicated for the specific primer used. After primer has cured, Geothane 520/5020 shall be applied according to specification.

3.4 OTHER SUBSTRATES

Consult Futura for specific recommendation when bonding to surfaces such as PVC, Hypalon, CPE, etc.

4.0 LINER INSTALLATION

4.1 The fabric rolls shall remain covered and protected from weather until ready for installation. Only fabric panels for each day's spraying shall be spread.

4.2 The fabric panels shall be overlapped 6 inches and anchored in place. See Appendix 3 for anchoring method. Care should be taken that the fabric is positioned to conform to subgrade irregularities without being so taut as to place undue stress on the liner. Excessive wrinkles must be avoided. Steps shall be taken to avoid more than three layers of fabric in any area. See Appendix 4 for detail of coating application method used at the overlap area. Fabric extending beyond the basin into the anchoring trench must be completely coated with Geothane 520/5020 to minimum recommended film thickness. Air pockets are

not acceptable and should be eliminated while coating is still uncured. Areas of incompletely coated fabric are not acceptable.

For estimating purposes, calculate the coating thickness at the lap areas to be double the normal recommended film thickness.

Due to its rapid cure, Geothane 5020 is not recommended for spraying of lap areas. Geothane 520 provides adequate working time and needed wetting of fabric.

At the end of the workday, approximately two feet of fabric shall be left uncoated to form a joint for the following day's work.

See complete data sheet on Geothane 520/5020 for recoat and final cure schedules.

4.3 Smoking shall not be allowed on liner and footwear may only be soft, rubber soled shoes.

4.4 Contractor shall take precautions to protect liner during any subsequent back-filling operation.

4.5 In earth excavations installation of liner over organic waste or other decomposing material should be avoided due to gas development under liner. If the liner must be installed where gassing is a concern, a vent system should be installed. One method of venting is to slope the bottom of the excavation upward toward the sides. This allows rising gas to flow to the edge of the memorane where it escapes through vent flaps placed above the waterline on the slope. A 4 to 6 inch base of loose fill may be used under membrane to facilitate gas migration. Typically simple flap vents placed at 50 foot intervals are used. See Appendix 5 for typical design.

5.0 ENVIRONMENTAL COVER INSTALLATION

Environmental covers can be assembled on the containment structure or on an adjacent flat area free of sharp objects or irregularities that can damage the membrane. Assembly instructions are the same as liner instructions earlier discussed and as available in Geothane 520/5020 Data Sheet.

6.0 REPAIR OF SHEET LINING

6.1 Geothane 520 is an excellent patch and repair material for damaged PVC and other plastic/rubber sheet linings. For torn, cracked areas, as well as lengths of failed seam, use the following procedure: Power wash the repair area and solvent wipe/mop the area to be coated with a high-flash, aromatic naptha. Substrate shall be clean and dry. After applying a 25-35 mil coat of Geothane 520, lay in a section of geotextile fabric and overcoat with an additional 40-60 mils of Geothane 520. Immersion areas require a 20% increase in millage. Fabric/Coating shall run a minimum of 18 inches onto sound sheet lining. To repair certain types of sheet lining Futura may recommend the use of a primer and/or roughing up the existing liner to improve adhesion. Consult Futura for further details.

7.0 INSPECTION

7.1 Cure Test

Each coat of Geothane 520 or Geothane 5020 shall be checked in several areas for cure, after 24 hours or more at 50°F (10°C) or higher, by comparing the coating toughness with a standard test strip supplied by Futura. Sticky, uncured coating indicates an improper mixing ratio of the two coating components. Any such area shall be deemed unsatisfactory and repaired at the contractor's expense, in accordance with Futura's instructions.

7.2 Following project completion, a detailed inspection shall be conducted by either a representative of the coatings manufacturer or a private testing laboratory experienced in evaluating polyurethane coatings.

This inspection may include random slit sampling of the coating membrane to confirm thickness, adhesion, and cure. A minimum number of these samples shall be made by the inspector. Sample areas shall be repaired with new fabric and coating at contractor's expense.

Visual inspection shall confirm adherence to good detail practices at projections, trenches, laps, as well surface texture.

///

This guide provides general instructions for the installation of Futura liners and covers. However, the responsibility for proper liner or cover installation lies with the installer or purchaser and not with Futura Coatings. Although we cannot be responsible for the manner of installation, we wish to provide any assistance you require to complete your installation successfully.

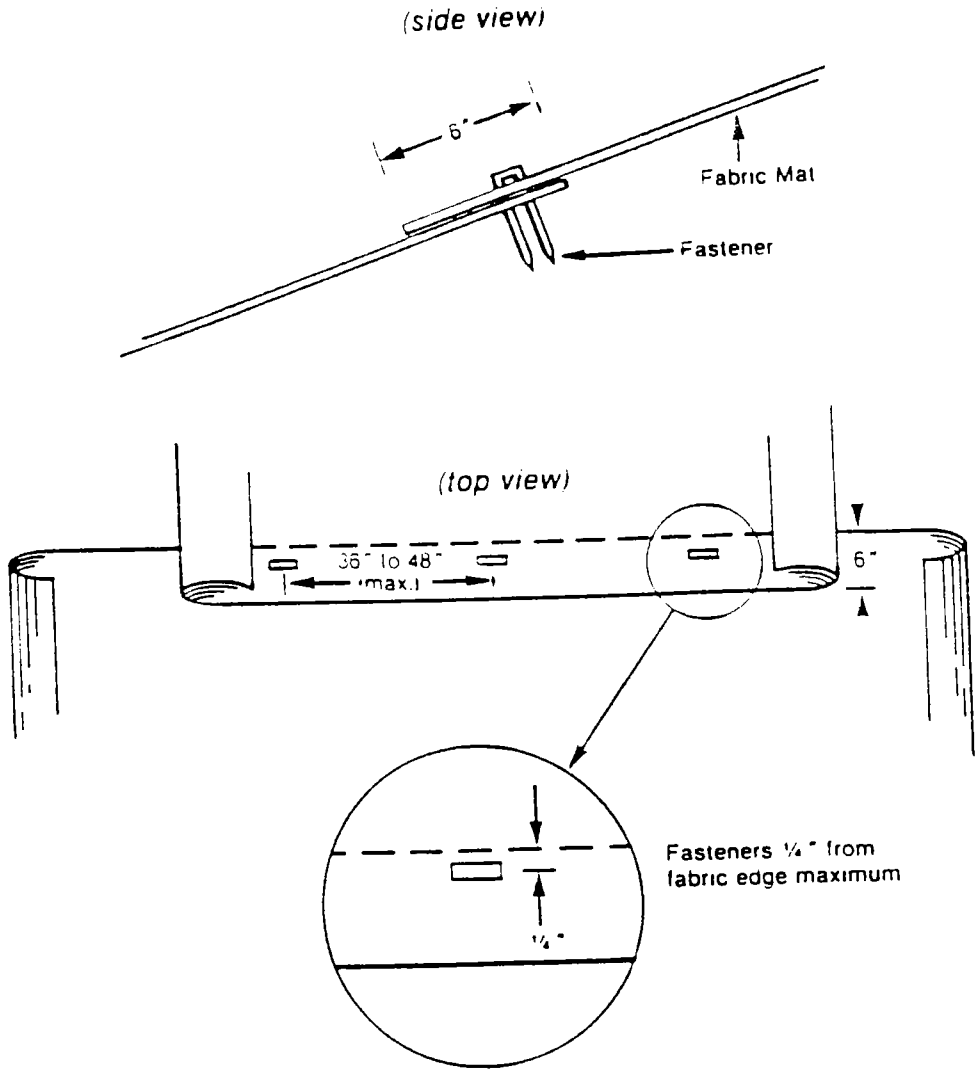
CHEMICAL RESISTANCE OF MEMBRANE LINING SYST

	520	5020
ACIDS		
5% ACETIC ACID	3	3
5% HYDROCHLORIC ACID	3	3
10% HYDROCHLORIC ACID	3	2
35% HYDROCHLORIC ACID	1	1
5% SULFURIC ACID	3	3
25% SULFURIC ACID	3	2
50% SULFURIC ACID	3	2
80% SULFURIC ACID	1	0
5% NITRIC ACID	3	3
20% NITRIC ACID	2	1
5% PHOSPHORIC ACID	3	3
20% PHOSPHORIC ACID	3	3
85% PHOSPHORIC ACID	1	3
10% OXALIC ACID	3	1
ALKALI		
15% SODIUM HYDROXIDE	3	3
50% SODIUM HYDROXIDE	3	3
10% AMMONIA HYDROXIDE	3	3
25% AMMONIA HYDROXIDE	3	3
SALTS		
50% AMMONIA NITRATE	3	3
50% AMMONIA SULFATE	3	3
10% SODIUM CHLORIDE	3	3
50% POTASSIUM NITRATE	3	3
SOLVENTS		
ACETONE, MEK	0	0
BUTANOL	0	3
ETHANOL	0	2
XYLOL, TOLUOL	0	3
MINERAL SPIRITS	0	3
MISCELLANEOUS		
SODIUM HYPOCHLORITE	3	3
COOKING OIL	3	3
MOTOR OIL	3	3
WATER	3	3
GASOLINE	1	3
BRINE	3	3

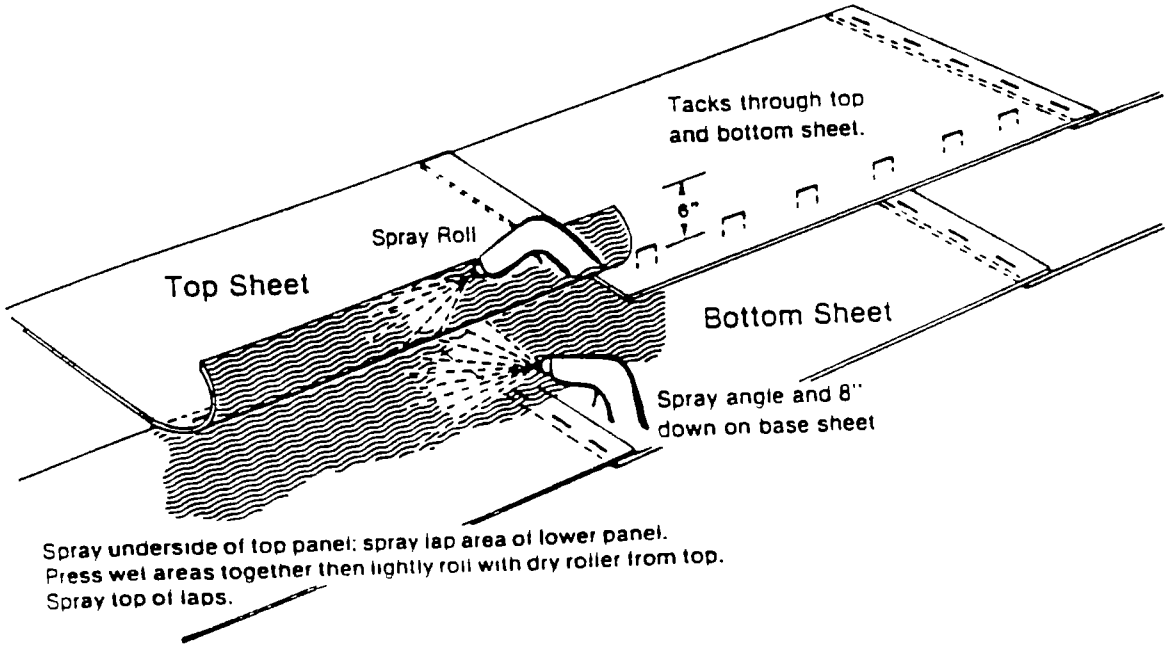
0 Do not recommend exposure
1 Short term exposure (poor resistance)
2 Moderate exposure
3 Long term exposure (Room temperature test fc 30 days)

APPENDIX 3

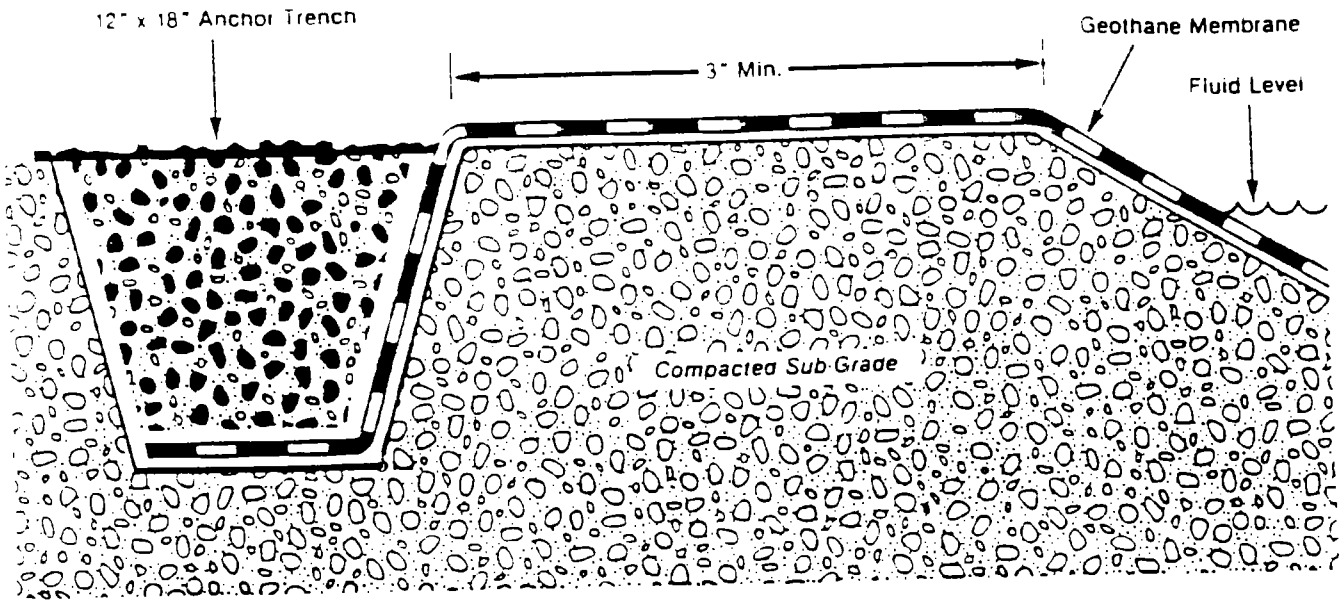
Detail of Fabric Overlap



APPENDIX 4

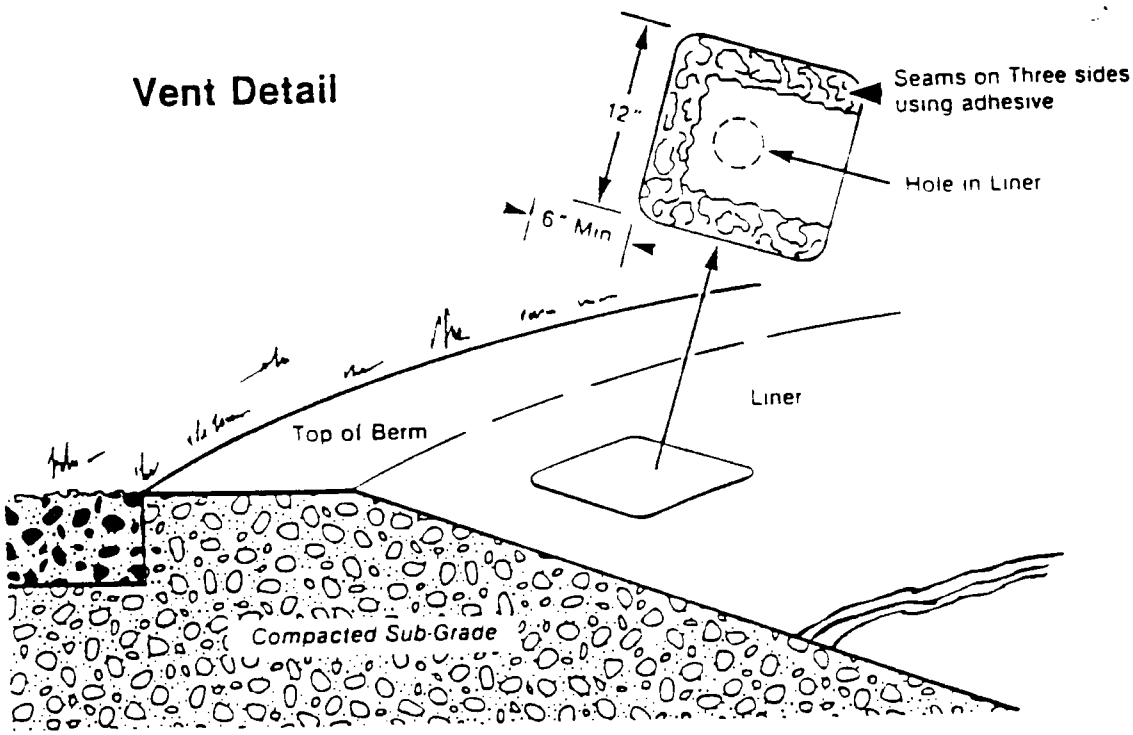


Anchor Trench Detail



APPENDIX 5

Vent Detail



WHERE URETHANE COATINGS
TECHNOLOGY IS CREATED

FUTURA COATINGS INC

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880601

D-13

Sonneborn

SONOLASTIC®

NP 1

07900

SEALANTS

elastomeric, one component

SONNEBORN
OCTOBER 1989
(Supersedes September 1988)

DESCRIPTION

Sonolastic NP 1 is a one component urethane non-sag gun grade sealant designed for a wide range of sealing and caulking applications in active exterior joints. Sonolastic NP 1 requires no mixing, is self-priming and with appropriate surface preparation, it can bond to many materials such as concrete and masonry, aluminum and wood without a primer.*

Sonolastic NP 1, after it has cured, produces a flexible long lasting joint, with extraordinary adhesion, cohesion and elasticity that resists deterioration caused by weather, stress, movement, water and many chemicals.

*See section on Priming on the following page.

COMPLIANCE

Sonolastic NP 1 complies with Federal Specification TT-S-00230C, Type II, Class A; ASTM-C-920, Type S, Grade NS, Class 25, use NT, M and A. Canadian Specification CAN/CGSB2-19.13-M87, Classifications C-2-40-A-N and MCG-2-25-A-N. CGSB Qualification No. 81026. It has been approved by the United States Department of Agriculture (USDA) for use in meat and poultry areas.

COLORS

A complete line of standard colors are available. Colors include white, off-white, limestone, stone, tan, aluminum gray, medium bronze, special bronze, redwood tan and black.

USE

Sonolastic NP 1 is used to provide a positive seal for active joints. Among the many and varied applications for new construction and remedial work are:

- Expansion wall joints
- Curtain wall construction
- Panel walls
- Precast units
- Aluminum/wood window frames

Typical applications include exterior perimeter sealing of curtain wall panel, caulking and sealing fascia, parapets and other structural components. Its use is indicated wherever a high performance, one component sealant is dictated.

Sonolastic NP 1 is a gun grade low modulus sealant, which will give maximum performance if joints are properly placed and designed and if joint surfaces are structurally sound and clean.

COVERAGE

The following table indicates the number of linear feet filled by

LINEAR FEET PER GALLON

Joint Depth (Inches)	Joint Width (Inches) ¼	⅜	½	⅝	¾	⅞	1
¼	308	205	154	122			
⅜				82	68	58	51
½					51	44	38

LINEAR METERS PER GALLON

Joint Depth (mm)	Joint Width (mm) 6.4	9.5	12.7	15.9	19.0	22.2	25.4
6.4	93.9	62.5	46.9	37.2			
9.5				25.0	20.7	17.7	15.5
12.7					15.5	13.4	11.6

NOTE: 12 cartridges are approximately one gallon.

JOINT DESIGN

To a large extent, the design of the joint depends upon a variety of factors such as the maximum expansion and contraction of the surface materials due to thermal change. Where possible, Sonolastic NP 1 should be applied when the joint is at its median opening so as to obtain the greatest efficiency with subsequent joint movement.

The dimensions of the joint to be sealed must be established in relation to service conditions. The number of joints and joint width should be designed not to exceed ±25% maximum movement. The joint width may be determined by calculating the change in size of the joint between the high and low temperature extremes and multiplying the change by a factor of 4.

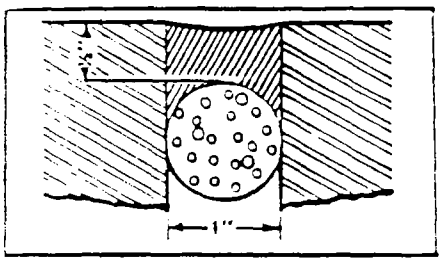
For example, if it is determined that a joint will open and close ¼" between temperature extremes, the joint width should be four times the ¼" or 1" minimum. The depth of the sealant should be ½ the width of the joint, with a maximum depth of ½" and a minimum of ¼". Minimum joint width should be ¼". (See Table 1 below.)

Table 1. Joint Width and Sealant Depth

Joint Width (inches)	(millimeters)	Sealant Depth at Midpoint (inches)	(millimeters)
¼ to ½	(6.4 to 12.7)	¼	(6.4)
½ to 1	(12.7 to 25.4)	¼ to ½	(9.5 to 12.7)
1 to 2	(25.4 to 50.8)	½	(12.7)

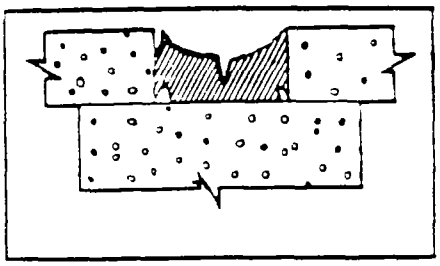
In deep joints, the sealant depth should be controlled by the use of joint fillers or backup materials. The backup material must be non-impregnated and compressible, such as Sonofoam Backer-Rod or Sonofoam Soft Backer-Rod. Where the depth of the joint does not permit use of Sonofoam Backer-Rod, a bond breaker (polyethylene strip) must be used to prevent three point bonding. (See Figures 1A, 1B and 1C on the next page.)

Figure 1A



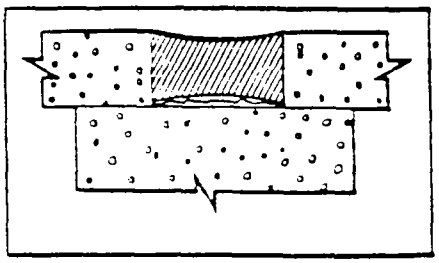
Proper Depth Control

Figure 1B



Joints without Bond Breaker

Figure 1C



Joints with Bond Breaker

The effect on the sealant with and without bond breakers is illustrated in Figures 1B and 1C.

To maintain recommended sealant depth, Sonofoam Backer-Rod is installed by compressing and rolling it into joint channel without stretching lengthwise. Backer-Rod should be about ⅛" (3.2 mm) larger in diameter than the width of the joint to allow for compression. Sonofoam Soft Backer-Rod should be approximately 25% larger in diameter than the joint width. Sonofoam becomes an integral part of the joint -sealant does not adhere and no separate bond breaker is required.

INSTALLATION

Preparatory Work (Cleaning): Surface to receive sealant must be structurally sound, dry, clean, free of dirt, moisture, loose particles, oil, grease, asphalt, tar, paint, wax, rust, waterproofings, curing and parting compounds, membrane materials, etc.

Masonry: Concrete, stone and other masonry must be cleaned where necessary by grinding, sandblasting or wire brushing to expose sound surface free of contamination and laitance.

Wood and Painted Wood: Cut back weathered or treated surfaces or dry rot until you reach clean, sound wood. Sonolastic NP 1 will adhere to most new and old, dry, oil-free wood. Whenever possible, paint should be scraped away to bare wood, although Sonolastic NP 1 will adhere to most paints. If removal is impractical, a test application should be made to determine proper adhesion. Consult Sonneborn Technical Services for wood substrates that are coated or have a baked-on enamel or plastic finish.

Metal: Scale, rust and coatings must be removed to expose bright metal. Protective coatings should be removed with solvent and all chemical residue or film removed. Aluminum window frames are frequently coated with a clear lacquer (usually of acrylic or methacrylate composition). Such lacquer must be removed prior to the application of Sonolastic NP 1. Lacquer is best removed by wiping the window frames with a clean cloth moistened with methyl ethyl ketone (MEK).

In addition to lacquer coatings referred to above, a variety of other protective coatings or finishes are frequently specified. Such finishes could interfere with the bond (adhesion) of the sealant. When a protective coating has been specified on metal it is recommended that Sonneborn Technical Service be contacted prior to sealant application.

Priming: While Sonolastic NP 1 is generally considered a non-priming sealant, special circumstances or substrates (i.e. certain protective coatings on aluminum) may require the use of primer. It is the responsibility of the user to check the adhesion of the cured sealant on typical test joints at the project site prior to and during the application of the sealant. Consult Sonneborn Technical Service for additional information as necessary. For water immersion conditions, priming is required on concrete and most other substrates. Where water immersion is anticipated use Primer No. 733.

Full strength primer is applied with a brush or clean cloth. A light uniform coating is sufficient for most surfaces; however, porous surfaces require a somewhat heavier but not excessive coat. Allow primer to dry prior to application of sealant.

Depending on temperature and humidity, primer will be tack-free in 15-30 minutes and ready for sealant. Priming and sealing must be done on the same work day. Consult Sonneborn Technical Service for information regarding primers on other surfaces.

Important: Never use filler impregnated with oil, asphalt, tar or any migratory saturant. Oil base caulking compounds and butyl caulking compounds should not come in contact with Sonolastic NP 1.

APPLICATION

Sonolastic NP 1 is a single component (one part) system and comes ready-to-use. It is applied by professional caulking gun loaded at the job site or directly from the catridge. Sonolastic NP 1 maintains excellent gunnability over a broad temperature range and is readily gunnable even at low temperatures. Joints should be filled from the deepest point to the surface by holding a properly sized nozzle against the back of the joint.

Proper tooling assures the correct bead configuration and a neat joint. Equally important, it assures maximum adhesion to the sides of the joint. "Dry" tooling is recommended, but if necessary, dampen tool with water or Reducer 990. DO NOT use soapy water to tool. Avoid overtooling of sealant.

Application-Temperature: Field experience recommends that all caulking and sealing should be performed when temperatures are above 40°F (5°C) in order to avoid application to moisture laden surfaces. Moisture on substrates will adversely affect adhesion.

Application may proceed as low as 20°F (-6°C) if there is complete assurance that substrates to receive NP 1 are completely dry, free of moisture and clean as described elsewhere herein.

Precautions: Prior to use, unopened containers should be protected from heat and direct sunshine. In cool or cold weather, store containers where temperature approximates 75°F (25°C) for at least 24 hours before using in order to facilitate application. Containers should not be opened until necessary preparatory work has been completed.

CURE RATE

Cure of Sonolastic NP 1 will vary with temperature and humidity. Under nominal conditions (75°F [25°C] and 50% R.H.). Sonolastic NP 1 will have a heavy skin overnight to 24 hours. In a typical joint of ½" width by ¼" depth, Sonolastic NP 1 is functional in three days and approximates full cure in about a week.

BACKING MATERIALS

In deep joints, sealant depth should be controlled with Sonofoam Backer-Rod. Other caulks should not be used as fillers. Sonofoam Backer-Rod should not be primed. Car should be taken to insure that Backer-Rod is not punctured.

CLEAN-UP

Immediately after use and before sealant has cured, equipment may be cleaned with xylene or Reducer 990. The cured sealant may be removed by cutting with a sharp edged tool; thin films removed by abrading.

PACKAGING

Sonolastic NP 1 is available in 1/12 gallon cartridges (0.32 liters), 30 cartridges to a carton.

SHELF LIFE

Sonolastic NP 1, one year at 75°F (25°C) temperature and 50% relative humidity.

SUGGESTED SPECIFICATION

The following short form guide specification is provided for the convenience of the specification writer and user. It covers the general procedures necessary for proper installation of Sonolastic NP 1.

Scope: Furnish and install as specified. All joints requiring sealant must be inspected by the contractor. It is the responsibility of the applicator to install the sealant in a manner which insures the optimum performance of materials used.

Materials: Sealant material shall be 100% urethane base Sonolastic NP 1 as manufactured by Sonneborn. Colors are to be selected by owner/architect. Material shall comply with Federal Specification TT-S-00230C, Type II, Class A; ASTM C-920, Type S, Grade NS, Class 25, Use NT, M, A. Backup material must be used to control the depth of sealant and shall be Sonofoam Backer-Rod or Sonofoam Soft Backer-Rod as supplied by Sonneborn. Material shall be stored in strict accordance with the manufacturer's instructions.

Preparation: Joint surfaces must be structurally sound, dry, clean, free of dirt, moisture, loose particles, oil, grease, asphalt, tar, paint, wax, rust, release agents, etc. Sonofoam Backer-Rod shall be installed so as to maintain a suitable width to depth ratio as recommended by the manufacturer. Minimum joint width shall be ¼". Minimum joint depth shall be ¼".

Priming: For water immersion conditions, priming is required. Use Sonneborn Primer No. 733.

Sealant Application: Application shall be by cartridge-type gun, or air pressure equipment. All caulking and sealing shall be performed when temperatures are above 40°F in order to avoid application to moisture laden surfaces. Sealant should be tooled immediately to assure maximum adhesion and neat joint appearance.

Clean-up: Exposed surfaces shall be cleaned, free of excess sealant or other soiling due to sealing operations. Surfaces shall be cleaned as work progresses and before sealant begins to cure.

SUMMARY OF TYPICAL CHARACTERISTICS OF CURED SEALANT

PROPERTY	TEST METHOD	VALUE (Average)
Tensile Strength	ASTM D412	200 psi
Elongation (Ultimate)	ASTM D412	1000%
Hardness - Shore A	Shore Durometer	33±3
Shrinkage		Nil
Weatherometer	Atlas Xenon Arc	No elastomeric property change after 3000 hour
Low Temperature Flexibility	ASTM D746	-40°F
Service Temperature Range		-40°F to 180°F
Expected Life		Up to 20 years

WARNING

CONTAINS: chlorinated paraffin, toluene diisocyanate and aliphatic hydrocarbon solvent.

May cause injury to eyes following repeated or prolonged contact. May cause skin irritation. Do not get on skin or in eyes. If contact occurs, flush affected areas thoroughly with water. Remove and wash contaminated clothing before reuse.

May cause respiratory irritation or intoxication with headache, nausea and central nervous system depression. Chronic inhalation of vapors may cause injury to the kidneys or central nervous system. Avoid inhalation of vapor or mist. If inhaled, remove to fresh air. If breathing is difficult, give oxygen. If not breathing, administer artificial respiration. Swallowing liquid may cause irritation to mouth and throat.

Liquid aspirated into lungs may cause severe pulmonary injury. Do not take internally. If ingested, DO NOT induce vomiting.

SEEK MEDICAL ATTENTION FOR ALL OVEREXPOSURES.
USE ONLY WITH ADEQUATE VENTILATION.
KEEP OUT OF REACH OF CHILDREN.
STORE AWAY FROM SOURCES OF IGNITION.

LIMITED WARRANTY NOTICE

Every reasonable effort is made to apply ChemRex Inc. exacting standards both in the manufacture of our products and in the information which we issue concerning these products and their use. We warrant our products to be of good quality and will replace or, at our election, refund the purchase price of any products proved defective. Satisfactory results depend not only upon quality products but also upon many factors beyond our control. Therefore, except for such replacement or refund, CHEMREX INC. MAKES NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF FITNESS OR MERCHANTABILITY, RESPECTING ITS PRODUCTS, and CHEMREX INC. shall have no other liability with respect thereto. Any claim regarding product defect must be received in writing within one (1) year from the date of shipment. No claim will be considered without such written notice or after the specified time interval. User shall determine the suitability of the products for the intended use and assume all risks and liability in connection therewith. Any authorized change in the printed recommendations concerning the use of our products must bear the signature of the ChemRex Inc. Technical Services Manager.

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Houston, TX 77055
713/869-1446

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Hayward, CA 94545
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Sonneborn

SONOFOAM CLOSED CELL (CC) BACKER-ROD

JOINT FILLER AND BACKING FOR ELASTOMERIC SEALANTS (GRAY)

DESCRIPTION

Sonofoam Closed Cell (CC) Backer-Rod is a resilient polyethylene foam, designed for use with cold applied joint sealants and becomes an integral part of the joint sealing system. It is extruded to various diameters to accommodate a range of joint widths. Its use as a back-up material provides the proper shaping of the sealant without bonding to the Sonofoam, permitting the sealant to stretch and recover with joint movement.

USE

Sonofoam is the ideal back-up material for cold applied sealants where a joint filler is necessary prior to application of the sealants. Joint fillers have two major functions: (1) to control the depth of the sealant in proper relation to joint width; and (2) to provide a backing against which the sealant is applied and filling the joint from the bottom forcing the sealant to the sides of the joint. Among the many types of joints in which Sonofoam is used are:

- Metal Panels
- Pre-Cast Panels
- Expansion Joints
- Perimeter of Windows
- Perimeter of Door Frames
- Coping Joints
- Glazing Joints
- Floor, Deck Joints

ADVANTAGES

1. Lightweight
2. Resilient - accepts joint movement.
3. Closed cell structure - low moisture absorption.
4. Non-impregnated, non-staining and non-bleeding.
5. Inert and compatible with cold applied sealants.
6. Round - gives the proper joint sealant configuration.
7. No bond breaker required. Sealants will not adhere.
8. Economical
9. Installs easily and quickly.

INSTALLATION

Sonofoam must be held in the joint under compression at the time of installation. The diameter of the rod should be 1/8" larger than the width of the joint for joint widths up to 3/4", for 3/4" wide joints use 1" diameter rod.

Sonofoam Backer-Rod may be easily installed with the use of a blunt probe or a plain faced roller, forcing the rod to the desired depth. A template or roller gauge may be used as a guide to control the depth at which the rod is placed. Do not puncture, fold or crease backer-rod. Follow sealant manufacturer's suggestions for joint sealant width and depth ratio.

JOINT SEALING

Follow suggestions for joint sealant application as directed by sealant manufacturer. Where priming of the joint is necessary, primer should be applied to the joint surfaces after Sonofoam is placed in the joint. Do not prime Sonofoam.

PACKAGING

Common sizes of Sonofoam Backer-Rod are wound on reels and packaged in cartons. Approximate weight 15 lb./carton. 1½" and 2" in 7 ft. length packaged in cartons. Approximate weight 35 lbs./carton.

TYPICAL PROPERTIES

Composition	Extruded closed cell, polyethylene foam
Color	Gray
Odor	None
Water Absorption	0.5% by volume
Compression-Deflection	8 psi @ 25%
Tensile Strength	25 psi

ESTIMATING SONOFOAM BACKER-ROD REQUIREMENTS

Joint Width	Rod Diameter	Sealant Depth	Footage per Carton
3/16" or less	1/4"	1/4"	6,400*
1/4"	3/8"	1/4"	3,600**
3/8"	1/2"	1/4"	2,500
1/2"	5/8"	1/4"	1,550
5/8"	3/4"	1/4"	1,100
3/4"	1"	3/8"	550
1"	1 1/4"	1/2"	400
1 1/8"	1 1/2"	—	770***
1 5/8"	2"	—	525***

*Twin Packs 3,200 ft./reel.
**Twin packs 1,800 ft./reel.
***Supplied in 7 ft. length.

SONNEBORN
JUNE 1989
(Supersedes April 1989)

LIMITED WARRANTY NOTICE

Every reasonable effort is made to apply ChemRex Inc. exacting standards both in the manufacture of our products and in the information which we issue concerning these products and their use. We warrant our products to be of good quality and will replace or, at our election, refund the purchase price of any products proved defective. Satisfactory results depend not only upon quality products but also upon many factors beyond our control. Therefore, except for such replacement or refund CHEMREX INC. MAKES NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF FITNESS OR MERCHANTABILITY, RESPECTING ITS PRODUCTS, and CHEMREX INC. shall have no other liability with respect thereto. Any claim regarding product defect must be received in writing within one (1) year from the date of shipment. No claim will be considered without such written notice or after the specified time interval. User shall determine the suitability of the products for the intended use and assume all risks and liability in connection therewith. Any authorized change in the printed recommendations concerning the use of our products must bear the signature of the ChemRex Inc. Technical Manager.

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Product Data

CENTRON 270

Description:

Moisture cured Polyurethane Aromatic, A.S.T.M. Type II

Features:

* Single package, ready to use
* High gloss, transparent
* Outstanding abrasion resistance
* Excellent, flexibility and resilience
* Fast dry, low temperature cure 15°F
* Outstanding chemical resistance

Uses:

* Concrete Floor Sealer
* Wood Floor Finish
* Abrasion Resistant Barrier
* Protective Glaze Finish

Product Credentials:

* A.S.T.M. Type II, Clear
* Complies Chapt. 121.2514 F.D.A. for use in food plants as non-toxic when dry and fully cured.

Relevant Publications:

* Centron Concrete Floor Sealer
* Centron Polyurethane Sealers
* Centron 270 Series Technical Publication
* Centron 270 M.S.D.S. Data Sheet
* Centron 270 Test Data

Physical Properties:

* Color:	Waterwhite Clear
* Solids:	30% by volume
* W.P.G.:	7.90 lbs.
* Viscosity:	44 Ku @ 77°F
* Flash Point:	81°F T.C.C.
* Package:	Single
* Container:	5 gallon, 55 gallon drum

Storage and Handling:

Store inside a clean, dry room zoned for flammable products: temp. 40°F-90°F. Use ground clamps and avoid sparks or electrical discharge.
Shelf Life: 6 months from date manufacture

Solvents and Diluents:

* Thinning and Reduction: Use Centron 270 Solvent P.U.G.
* Clean up: Use Xylol or M.E.K.

Accessories:

* Centron 270 Catalyst
* Centron 200-430 Surfactant
* Centron 270 Retard Solvent

Basic System:

* General Service
  First Coat: 30% reduction Centron 270
  Second Coat: Full strength Centron 270 Roller Application

* Maximum Gloss, Smooth Surface
  First Coat: 30% reduction Centron 270
  Second Coat: 30% reduction Centron 270
  Third Coat: 30% reduction Centron 270 Lambswool Application

Slip Resistance:

Flat glossy floors are slippery when wet. Aluminum oxide, grit, or silica sand may be broadcast into wet Centron 270. Remove surplus and topcoat within 24 hours.

TRIPLE G COATINGS INC warrants that the Product shall conform to its standard specifications in effect at time of shipment. TRIPLE G COATINGS INC MAKES NO OTHER WARRANTY EXPRESS OR IMPLIED, WITH RESPECT TO THE PRODUCT AND DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND OF FITNESS FOR A PARTICULAR PURPOSE. Any liability of TRIPLE G COATINGS INC arising out of the safe, use or application of its Product shall be limited to replacement of the Product used.

TRIPLE G COATINGS INC. 1724 Bannard Street Riverton, N.J. 08077

These instructions are not intended to show product recommendations for specific service. They are issued as an aid in determining correct surface preparation, mixing instructions, and application procedure. It is assumed that the proper product recommendations have been made. These instructions should be followed closely to obtain the maximum service from the materials.

To the best of our knowledge the technical data contained herein are true and accurate at the date of issuance and are subject to change without prior notice. User must contact TRIPLE G COATINGS INC. to verify correctness before specifying or ordering. No guarantee of [illegible] implied. We guarantee our products to conform to TRIPLE G COATINGS INC. quality control. We assume no responsibility [illegible] coverage performance or injuries resulting from use. Liability, if any, is limited to replacement of products. Prices and cost data listed herein are subject to change without prior notice. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY THE SELLER EXPRESS OR IMPLIED, STATUTORY, BY OPERATION OF LAW OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Preparation Methods: Refer to individual job specification

* Steel: Not recommended, use Centron 201, 332 Primers.
* Concrete: Sandblast, vacuum blast, acid etch, degrease, detergent and/or solvent clean and dry. Prepared surface should equal medium sandpaper.
* Wood: Power sand, degrease, strip and remove all existing finish, stains and unsound wood.
* Basic: The surface must be structurally sound, clean, dry, and free of intervening barriers to block or interfere with penetration and adhesion.
* Old Paint: Sand, degrease, clean and dry. Test apply and inspect for solvent attack, lifting and wrinkling.

Application Methods: Refer to individual job specification

* Brush: Natural fiber or solvent resistant synthetic.
* Roller: Short-medium nap roller, solvent resistant.
* Lambswool: Special applicator, solvent reduce 30%, thin coats.
* Spray: Air pressure or airless spray. Refer to publication.

Application Parameters

* Environment:	15°F-100°F at 90%-20% R.H.
* Coverage:	480 mil ft./gal.
Recommended Coverage:	350-400 sq. ft./gal., per coat. 4 mils wet and 1.2 mils dry film thickness.
* Mix Ratio:	N/A ready to use.
* Induction Time:	N/A
* Dry Time:	Laboratory determined at 77°F and 50% R.H. Tack Free: 2 hours; nail hard: 2-3 hours; Light Duty: 12 hours Recoat Time: 2-3 hours, never exceed 24 hours. Final cure for service: 5-7 days.
* Repairs:	Clean, degrease and scuff sand till dull. Solvent wipe and reapply with first coat reduced 30% with Centron 270 Solvent P.U.

Safety Precautions

Refer to M.S.D.S. Data Sheet
Refer to Centron M.C.U. Safety Publication
Read Project Specifications

Waste Disposal

Remove and dispose of in accordance with M.S.D.S. Data Sheet, and local, state and federal Environmental Protection Agency and Department of Environmental Protection regulations.

Appearance and Acceptance

.e cured dry finish should be smooth, glossy and hard. A minimum of surface defects, bubbles or cratering should be observed. The finish should be well bonded to the concrete floor with no delamination, peeling or voids.

CAUTION: CONTAINS FLAMMABLE SOLVENTS. [illegible] OPEN FLAMES IN CONFINED AREAS. WORKMEN MUST WEAR FRESH AIRLINE RESPIRATORS. HYPERSENSITIVE PERSONS SHOULD WEAR GLOVES OR USE PROTECTIVE CREAM. ALL ELECTRIC EQUIPMENT AND INSTALLATIONS SHOULD BE MADE AND GROUNDED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE IN AREAS WHERE EXPLOSION HAZARDS EXIST. WORKMEN SHOULD BE REQUIRED TO USE NONFERROUS TOOLS AND TO WEAR CONDUCTIVE AND NONSPARKING SHOES.

MATERIAL SAFETY DATA SHEET

NPCA 1-82

FOR COATINGS, RESINS AND RELATED MATERIALS

Section I

MANUFACTURER'S NAME: TRIPLE G COATINGS INC.

DATE OF PREP: 7/85

STREET ADDRESS: 1714 Bannard Street

Riverton, N.J. 08077

EMERGENCY TELEPHONE NO: 609-829-1575

INFORMATION TELEPHONE NO: 609-829-1575

Polyurethane

MANUFACTURERS CODE IDENTIFICATION: CENTRON

PRODUCT NAME: CENTRON 270

Section II—HAZARDOUS INGREDIENTS

INGREDIENT	PERCENT	[illegible]	VAPOR PRESSURE	TOXICITY DATA
Xylene	60	100 ppm	9.5 mm Hg	
Unreacted Toluene Diisocyanate	less than 1.0	0.005	0.1 mm Hg	

Section III—PHYSICAL DATA

BOILING RANGE: of Solvent 280-288°F

VAPOR DENSITY: HEAVIER LIGHTER THAN AIR

EVAPORATION RATE: FASTER X SLOWER THAN ETHER

PERCENT VOLATILE BY VOLUME: 66

WEIGHT PER GALLON: 8.0 lbs.

Section IV—FIRE AND EXPLOSION HAZARD DATA

FLAMMABILITY CLASSIFICATION: OSHA FLAMMABLE; DOT FLAMMABLE

FLASH POINT: 77°F

LEL: 1.0%

EXTINGUISHING MEDIA

FOAM | ALCOHOL FOAM | X CO | X DRY CHEMICAL | X WATER FOG | OTHER

UNUSUAL FIRE AND EXPLOSION HAZARDS

Keep away from heat, sparks and open flame.

Section V—HEALTH HAZARD DATA

EFFECTS OF OVEREXPOSURE Inhalation - irritation of the nose, throat, and eyes; possible narcosis. May be accompanied by coughing, choking or difficult breathing. Asthma-like breathing may be delayed reaction. Causes skin and eye discomfort by defatting action. May cause lung irritation and allergic reaction.

EMERGENCY AND FIRST AID PROCEDURES Remove patient to fresh air. Remove saturated clothing and wash skin with soap and water. Flush eyes with clean water for 15 minutes - see a physician.

Section VI—REACTIVITY DATA

STABILITY UNSTABLE X STABLE CONDITIONS TO AVOID

INCOMPATIBILITY (Materials to avoid) Avoid contact with strong oxidizing agents

HAZARDOUS DECOMPOSITION PRODUCTS

Usual products of combustion - CO, CO_2, and possibly oxides of nitrogen.

HAZARDOUS POLYMERIZATION MAY OCCUR X WILL NOT OCCUR

Section VII—SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED Remove sources of ignition. Provide ventilation and/or respiratory protection.

WASTE DISPOSAL METHOD Large spills may be picked up with non-sparking tools, small spills with absorbent material. Residues may be decontaminated with water/alcohol or ammonia solutions. Dispose of in accordance with federal state and local regulations.

Section VIII—SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION Approved masks or respirators for organic vapors and particulate matter as necessary. If spraying in poorly ventilated area, positive pressure air supplied masks are recommended.

VENTILATION

PROTECTIVE GLOVES Neoprene rubber

EYE PROTECTION Goggles or side shield spectacles

OTHER PROTECTIVE EQUIPMENT Eye wash station should be available.

Section IX—SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING Avoid prolonged skin contact. Do not breathe spray mist. Store away from heat, sparks and open flame.

OTHER PRECAUTIONS Ground containers while pouring and limit free fall to a few inches to prevent static sparks. Emptied containers may retain hazardous properties. Do not cut or weld on or near the container.

TRIPLE G COATINGS

1714 Bannard Street
Riverton NJ 08077
609/829-1675
TLX 244993

CENTRON 270 SPECIFICATIONS AND PERFORMANCE DATA

Physicals:

Solids:	30% by volume 40% by weight
Weight per Gallon:	7.90 lbs.
Viscosity:	44 Ku @ 77°F
Color:	Water-white clear (Gardner #1)
% Free T.D.I.:	Less than 1.0 max.
% Free M.D.I.	Less than 1.0 max.
Flash Point:	80°F T.C.C.

Film Properties:

Dry Time:	50% R.H. @ 77°F
Tack Free:	2 hours
Hard Dry:	6-8 hours
Coverage:	480 mil feet per gallon
Sward Hardness	
24 hours:	24
1 week:	26

Taber Abrasion (average weight loss, CS17 wheel, 1,000 gram weight, 1,000 cycles)

Loss:	10 mg.
Tensile Strength:	greater than 3500 psi
Elongation:	100%
Impact Resistance:	160 inch pounds
Mandrel Wrap:	passes 1/8" wrap

Product Data

CENTRON 416 CLEAR

Description:

A two part, odorless, clear, aliphatic novolac coating.

Features:

* Aliphatic Novolac Resins
* Solventless, Odorless, Non-Toxic
* Outstanding Chemical Resistance
* Flexural, Hard, Impact Resistant
* Monolithic, Non-Porous
* Water Clear, Transparent
* Variable Thickness, 4-125 mils
* Clear or Colored Quartz Matrix
* Installation at 40°F-100°F.

Uses:

* Clear, Transparent Floor Finish
* Resurfacing or Restoring Floors
* Colored Quartz Floor System
* Installation during normal working hours without toxic jeopardy
* Odorless floor coating, safe odorless repairs or recoating
* Improving worn epoxy floors
* Underlayment for Centron 280 Polyurethane Floor Systems

Product Credentials:

* Complies with F.D.A. Chapt. 121.2514 for use in food plants. Film is non-toxic when dry and fully cured.

Relevant Publications:

* Centron 416 M.S.D.S. Publication
* Centron 416 Spray Recommendation
* Centron 416 Floor Coatings

Physical Properties:

* Color: Transparent, Clear
* Solids: 100% N.V.
* W.P.G.: 9.8 lbs. mixed
* Viscosity: 85 Ku, Mixed
* Flash Point: N/A
* Package: Two Package, Part A & Part B
* Container: Kits, Total 4 Gallons
  3 Gallons of Part B +
  1 Gallon of Part A

Storage and Handling:

Store inside a clean, dry room zoned for flammable products; temp. 50°F-90°F. Use ground clamps and avoid sparks or electrical discharge.

Shelf Life:

12 months from date of manufacture.

Solvents and Diluents:

* Thinning and Reduction: Use M.E.K.
* Clean-Up: Use M.E.K.

Accessories: N/A

Basic System:

* General Concrete Floor Sealer
  Smooth Glossy
  First Coat: 4-6 mils
  Second Coat: 8-10 mils (optional)

* Textured, Slip Resistant, Colored Floor
  First Coat: 10 mils
  Non-Skid: Colored Quartz
  Second Coat: 15 mils

REV: 11/86

TRIPLE G COATINGS INC warrants that the Product shall conform to its standard specifications in effect at time of shipment TRIPLE G COATINGS INC MAKES NO OTHER WARRANTY EXPRESS OR IMPLIED WITH RESPECT TO THE PRODUCT AND DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND OF FITNESS FOR A PARTICULAR PURPOSE Any liability of TRIPLE G COATINGS INC arising out of the sale use or application of its Product shall be limited to replacement of the Product used

These instructions are not intended to show product recommendations for specific service. They are issued as an aid in determining correct surface preparation, mixing instructions, and application procedure. It is assumed that the proper product recommendations have been made. These instructions should be followed closely to obtain the maximum service from the materials.

To the best of our knowledge the technical data contained herein are true and accurate at the date of issuance and are subject to change without prior notice. User must contact TRIPLE G COATINGS INC. to verify correctness before specifying or ordering. No [illegible] implied. We guarantee our products to conform to TRIPLE G COATINGS INC. [illegible] We assume [illegible] performance or [illegible] results from use [illegible] any is limited to replacement of products [illegible] and cost data [illegible] without prior notice. NO OTHER WARRANTY OR GUARANTEE OR ANY KIND IS MADE BY THE SELLER EXPRESS OR IMPLIED STATUTORY BY OPERATION OR LAW OR OTHERWISE INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Preparation Method: Refer to individual job specification.

* Steel: S.S.P.C. 1, 2, 3 and S.S.P.C. 6 - Commercial Sandblast to a 1.5 - 2 mil profile. Recommended S.S.P.C. - 10 for immersion.
* Concrete: Sandblast, vacuum blast, acid etch, degrease, detergent and/or solvent clean and dry. Prepared surface should equal medium sandpaper.
* Wood: Power sand, degrease, strip and remove all existing finish, stains and unsound wood.
* Basic: The surface must be structurally sound, clean, dry and free of intervening barriers to block or interfere with penetration and adhesion.
* Old Paint: Sand, degrease, clean and dry. Test apply and inspect for softening, attack, lifting and wrinkling. Overall adhesion will be limited to the adhesion of the old paint or coating.

Application Methods: Refer to individual job specification.

* Brush: Natural fiber or solvent resistant synthetic.
* Roller: Short-medium nap roller, solvent resistant.
* Lambswool: Not recommended for solventless application. Add 10-15% M.E.K.
* Spray: Air pressure or airless spray. Refer to publication.

Application Parameters:

Environment:	40°F-100°F @ 90%-20% R.H.
Coverage:	1,604 mil feet per gallon.
* Recommended Coverage:	160 sq. ft./gallon, per coat. (Standard Film). 10 mils wet and dry.
* Mix Ratio:	3:1 by volume. Pot Life: 60 minutes @ 77°F.
* Induction Time:	Not required. Mix well for 4 minutes.
* Dry Time:	Laboratory determined @ 77°F and 50% R.H. Tack Free: 8 hours; Nail Hard: 18 hours. Hard: 24 hours; Full Cure: 5 days.
* Repairs:	Clean, degrease and sand rough to a texture of medium grit sandpaper. Solvent wipe clean, reapply.

Safety Precautions:

Centron 416 M.S.D.S. Data Sheet
Read Project Specifications

Waste Disposal:

Remove and dispose of in accordance with M.S.D.S. Data Sheet, and local, state and federal Environmental Protection Agency and Department of Environmental Protection Regulations.

Appearance and Acceptance:

The cured dry finish should be smooth, glossy and hard. Centron 416 should be well bonded with no bubbles, wrinkles or surface defects. Non-skid texture for floors creates a finish commensurate with size and type of material. Refer to floor data.

CAUTION: CONTAINS FLAMMABLE SOLVENTS. KEEP AWAY FROM SPARKS AND OPEN FLAMES. IN CONFINED AREAS WORKMEN MUST WEAR FRESH AIRLINE RESPIRATORS. HYPERSENSITIVE PERSONS SHOULD WEAR GLOVES OR USE PROTECTIVE CREAM. ALL ELECTRIC EQUIPMENT AND INSTALLATIONS SHOULD BE MADE AND GROUNDED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. IN AREAS WHERE EXPLOSION HAZARDS EXIST WORKMEN SHOULD BE REQUIRED TO USE NONFERROUS TOOLS AND TO WEAR CONDUCTIVE AND NONSPARKING SHOES.

MATERIAL SAFETY DATA SHEET

NPCA 1-82

FOR COATINGS, RESINS AND RELATED MATERIALS

(Approved by U.S. Department of Labor, Essentially Similar to Form OSHA 20)

Section I

MANUFACTURER'S NAME: Triple G Coatings, Inc.

DATE OF PREP: 12/86

STREET ADDRESS: 1714 Bannard Street

CITY, STATE, AND ZIP CODE: Riverton, New Jersey 08077

EMERGENCY TELEPHONE NO: 609-829-1575

INFORMATION TELEPHONE NO: 609-829-1575

PRODUCT CLASS: Epoxy

MANUFACTURERS CODE IDENTIFICATION: Centron 416 Part A

TRADE NAME: Centron 416 Part A

Section II—HAZARDOUS INGREDIENTS

INGREDIENT	PERCENT	OCCUPATIONAL EXPOSURE LIMITS	VAPOR PRESSURE	TOXICITY DATA
Epoxy Resin Hardener			N.A.	

Section III—PHYSICAL DATA

BOILING RANGE: Not Applicable

VAPOR DENSITY: X HEAVIER

LIGHTER THAN AIR

EVAPORATION RATE: ☐ FASTER X SLOWER THAN ETHER

PERCENT VOLATILE BY VOLUME: nil

WEIGHT PER GALLON: 7.9 lbs.

Section IV—FIRE AND EXPLOSION HAZARD DATA

FLAMMABILITY CLASSIFICATION: OSHA COMBUSTIBLE; DOT COMBUSTIBLE

FLASH POINT: 286°F C.C.

LEL: Not Determined

EXTINGUISHING MEDIA

X FOAM ☐ ALCOHOL FOAM X CO_2 X DRY CHEMICAL ☐ WATER FOG ☐ OTHER

UNUSUAL FIRE AND EXPLOSION HAZARDS

Toxic fumes will be evolved when this material is involved in a fire. Self contained breathing apparatus should be available for fire fighters. Cool fire exposed containers with water.

N.A. = Not Applicable

ECTS OF OVEREXPOSURE:
TE: Will cause burns to skin and eyes. High concentration of vapors can cause severe irritation of eyes and respiratory tract. Liquid causes severe damage to mucous membranes swallowed.
IC: Prolonged or repeated exposure may cause asthma and skin sensitization or other rgic response.

GENCY AND FIRST AID PROCEDURES:
ES: Immediately flush with large amounts of water for at least 15 minutes lifting upper lids occasionally. GET IMMEDIATE MEDICAL ATTENTION. If a physician is not immediately available, continue flushing with water.
IN: Immediately flush skin with water for at least 15 minutes while removing contaminated clothing and shoes. Launder clothing before re-use and discard contaminated leather article Get medical attention if swelling or redness occurs.
HALATION: Remove to fresh air if effects occur and administer oxygen if necessary. GET MEDICAL ATTENTION if effects persist.
GESTION: DO NOT INDUCE VOMITING. Vomiting will cause further damage to the throat. Dilute by giving water or milk to drink if victim is conscious. GET MEDICAL ATTENTION IMMEDIATELY.

Section VI - REACTIVITY DATA

BILITY: Stable under normal storage conditions.
COMPATIBILITY: Avoid contact with strong oxidizing agents, mineral acids (e.g. H_2SO_4, HCI), and epoxy resins under uncontrolled conditions.
ARDOUS DECOMPOSITION PRODUCTS: CO (Carbon Monoxide), CO_2 (Carbon Dioxide), NO_x (Oxides of Nitrogen).

Section VII - SPILL OR LEAK PROCEDURES

MATERIAL IS SPILLED: Avoid contact with material. Persons not wearing appropriate protect equipment (see below) should be excluded from the area of spill until clean-up is complete. spill at source, dyke area to prevent spreading, pump liquid to salvage tank. Remaining may be taken up on clay, diatomaceous earth or other absorbent and shoveled into l containers.
STE DISPOSAL METHOD: Dispose of as hazardous waste in accordance with Federal, State and cal regulations.

Section VIII - SPECIAL PROTECTION INFORMATION

SPIRATORY PROTECTION: NIOSH approved respiratory protection required in the absence of oper environmental control. For emergencies, a self-contained breathing apparatus, or a ll-face respirator is recommended.
NTILATION: Breathing of vapors must be avoided. Ventilation must be sufficient to control pors. This material should be confined as far as possible within sealed or covered equipmen which case normal ventilation should be adequate. Special (local) ventilation will be eded in areas where vapors are expected to be vented.
ND PROTECTION: Impervious gloves, neoprene or rubber.
E PROTECTION: Splash proof goggles or safety spectacles with side shields.
HER PROTECTIVE EQUIPMENT: Clean, body-covering clothing. Further safety equipment (apron, otwear, etc.) should be used as necessary to prevent contact with material.

Section IX - SPECIAL PRECAUTIONS

- Prevent all skin and eye contact.
- Avoid breathing vapors.
- Re-seal part used containers.
- Ensure that all containers are properly labelled to prevent accidental ingestion.
- Wash with soap and water before eating, drinking, smoking or using toilet facilities.
- Observe conditions of good industrial hygiene and safe working practice.

MATERIAL SAFETY DATA SHEET

NPCA 1-82

FOR COATINGS, RESINS AND RELATED MATERIALS

Approved by U.S. Department of Labor Information Similar to Form OSHA 20

Section I

MANUFACTURER'S NAME: Triple G Coatings, Inc.

DATE OF PREP: 12/86

STREET ADDRESS: 1714 Bannard Street

CITY, STATE AND ZIP CODE: Riverton, New Jersey 08077

EMERGENCY TELEPHONE NO: 609-829-1575

INFORMATION TELEPHONE NO: 609-829-1575

PRODUCT CLASS: Epoxy

MANUFACTURER'S CODE IDENTIFICATION: Centron 416 Part B

TRADE NAME: Centron 416 Part B

Section II—HAZARDOUS INGREDIENTS

INGREDIENT	PERCENT	OCCUPATIONAL EXPOSURE LIMITS	VAPOR PRESSURE	TOXICITY DATA
O-Cresyl Glycidyl Ether CAS No. 26447-14-3				
Epichlorohydrin CAS No. 106-89-8				
Alkyl Phenol CAS No. 25154-52-3				
Epichlorohydrin-Polyglycol Reaction Product CAS No. 9072-62-2				
Titanium Dioxide CAS No. 13463-67-7				

Section III—PHYSICAL DATA

BOILING RANGE: Not Applicable

VAPOR DENSITY: X HEAVIER ☐ LIGHTER THAN AIR

EVAPORATION RATE: ☐ FASTER X SLOWER THAN ETHER

PERCENT VOLATILE BY VOLUME: nil

WEIGHT PER GALLON: 9.8 lbs.

Section IV—FIRE AND EXPLOSION HAZARD DATA

FLAMMABILITY CLASSIFICATION: OSHA COMBUSTIBLE; DOT COMBUSTIBLE

FLASH POINT:

LEL: Not Determined

EXTINGUISHING MEDIA

X FOAM ☐ ALCOHOL FOAM X CO_2 X DRY CHEMICAL ☐ WATER FOG ☐ OTHER

UNUSUAL FIRE AND EXPLOSION HAZARDS

None

Section V- HEALTH HAZARD DATA

ECTS OF OVEREXPOSURE:
TE: Will cause burns to skin and eyes. High concentration of vapors can cause severe itation of eyes and respiratory tract. Liquid causes severe damage to mucous membranes swallowed.
IC: Prolonged or repeated exposure may cause asthma and skin sensitization or other allergic response.

ERGENCY AND FIRST AID PROCEDURES:
ES: Immediately flush with large amounts of water for at least 15 minutes lifting upper lids occasionally. GET IMMEDIATE MEDICAL ATTENTION. If a physician is not immediately available, continue flushing with water.
IN: Immediately flush skin with water for at least 15 minutes while removing contaminated clothing and shoes. Launder clothing before re-use and discard contaminated leather articles Get medical attention if swelling or redness occurs.
HALATION: Remove to fresh air if effects occur and administer oxygen if necessary. GET MEDICAL ATTENTION if effects persist.
GESTION: DO NOT INDUCE VOMITING. Vomiting will cause further damage to the throat. Dilute by giving water or milk to drink if victim is conscious. GET MEDICAL ATTENTION IMMEDIATELY.

Section VI - REACTIVITY DATA

ABILITY: Stable under normal storage conditions.
COMPATIBILITY: Avoid contact with strong oxidizing agents, mineral acids (e.g. H_2SO_4, HCI), and epoxy resins under uncontrolled conditions.
ZARDOUS DECOMPOSITION PRODUCTS: CO (Carbon Monoxide), CO_2 (Carbon Dioxide), NO_x (Oxides of Nitrogen).

Section VII - SPILL OR LEAK PROCEDURES

MATERIAL IS SPILLED: Avoid contact with material. Persons not wearing appropriate protecti quipment (see below) should be excluded from the area of spill until clean-up is complete. pill at source, dyke area to prevent spreading, pump liquid to salvage tank. Remaining may be taken up on clay, diatomaceous earth or other absorbent and shoveled into sposal containers.
STE DISPOSAL METHOD: Dispose of as hazardous waste in accordance with Federal, State and cal regulations.

Section VIII - SPECIAL PROTECTION INFORMATION

SPIRATORY PROTECTION: NIOSH approved respiratory protection required in the absence of oper environmental control. For emergencies, a self-contained breathing apparatus, or a ll-face respirator is recommended.
NTILATION: Breathing of vapors must be avoided. Ventilation must be sufficient to control pors. This material should be confined as far as possible within sealed or covered equipment which case normal ventilation should be adequate. Special (local) ventilation will be eded in areas where vapors are expected to be vented.
ND PROTECTION: Impervious gloves, neoprene or rubber.
E PROTECTION: Splash proof goggles or safety spectacles with side shields.
HER PROTECTIVE EQUIPMENT: Clean, body-covering clothing. Further safety equipment (apron, otwear, etc.) should be used as necessary to prevent contact with material.

Section IX - SPECIAL PRECAUTIONS

Prevent all skin and eye contact.
Avoid breathing vapors.
Re-seal part used containers.
Ensure that all containers are properly labelled to prevent accidental ingestion.
Wash with soap and water before eating, drinking, smoking or using toilet facilities.
bserve conditions of good industrial hygiene and safe working practices.

RECEIVED
SEP 1 1 2000
PERMIT SECTION

CleanHarbors®
SERVICES, INC.
11800 SOUTH STONY ISLAND AVENUE • CHICAGO, IL 60617
(773) 646-6202 • FAX (773) 646-6381
Visit our Website at www.cleanharbors.com

September 11, 2000

Mr. Mark A. Schollenberger, P.E.
Illinois Environmental Protection Agency
Bureau of Land - Permit Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Dear Mr. Schollenberger:

Enclosed is modified Drawing No. 4630-M-17 (CHSI DWG. NO. 4287) with the Professional Engineer certification. Also enclosed is a P.E. certification that the tanks in the existing tankfarm are suitable for use with the new shredder.

If you have any questions concerning these enclosures, please contact me at (773) 646-6202.

Sincerely,

James R. Laubsted
Facility compliance Manager

SEP 14 2000
EPA-BOL
INSPECTION

I hereby certify that I, the undersigned am a Professional Engineer, licensed to practice in the State of Illinois. Tanks 101, 102, 107, 110 and 112 are currently used for hazardous waste fuel storage, lean waters, and acidic wastewaters. Under the proposed modifications, these tanks could also be used for chlorinated solvents, diluent and ignitable waste storage from shredding operations. I have reviewed the structural integrity and suitability of the existing tanks, ancillary equipment and secondary containment. These modifications were designed under my direct supervision and the design incorporates good engineering practices.

Tanks 101, 102, 107, 110 and 112 are suitable for intended use. The materials of construction for the tanks are compatible with the hazardous wastes intended to be stored/processed. The tanks are designed to be structurally sound for their usage of ignitable waste, diluent and chlorinated solvents. These tanks are aboveground on concrete foundations. No tank component is in contact with the soil or water. The tanks are not subjected to loadings caused by vehicular traffic.

The ancillary equipment was constructed and installed according to ANSI/ASME B31.3-1987, Chemical Plant and Refinery Piping. The materials of construction are compatible with the hazardous wastes intended to be stored/processed.

The structural design for the tankfarm foundation is suitable for intended use. Existing walls, floors, piers, foundations, and containment slabs are designed for intended load and will maintain structural integrity without failure. The secondary containment is provided with a 30 to 40 mil coat of Protecto-Coat 900 or equivalent in accordance with the manufacturer's recommendations. After careful consideration of all stored chemicals and discussion with the coating manufacturer representative, this was selected as the most suitable coating. Technical specifications are listed in Appendix D-10.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Engineer Seal

Amos Turner 9-9-2000

Amos Turner Date

Hoyer-Schlesinger-Turner, Inc.
3074 University Avenue
Highland Park, IL 60035
(847)681-0470

AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

EXP. DATE 11-30-2001

B-16-M-39

KC

CleanHarbors
SERVICES, INC.
11800 SOUTH STONY ISLAND AVENUE • CHICAGO, IL 60617
(773) 646-6202 • FAX (773) 646-6381
Visit our Website at www.cleanharbors.com

Certified Mail # Z345454146

March 3, 2000

Mr. Mark A. Schollenberger, P.E.
Illinois Environmental Protection Agency
Bureau of Land - Permit Section
1021 North Grand Avenue East
Springfield, IL 62794-9276

Dear Mr. Schollenberger:

Clean Harbors Services, Inc. (CHSI) is submitting documentation of publication in a large local newspaper to announce the 60-day public comment period and the day, date and location of the public meeting to be held by CHSI. This notice is in reference to the Class 3 permit modification request to add a bulk flammable liquid tank farm, addition of a truck loading/unloading pad for two trucks, addition of a hazardous waste shredding system and addition of a metalwashing system. Enclosed is the certificate of publication of the legal notice.

If you have any questions regarding this modification, please contact me at (773)646-6202.

Sincerely,

James R. Laubsted
Facility Compliance Manager

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11800 SOUTH STONY ISLAND AVENUE • CHICAGO, IL 60617
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Certified Mail #Z345454152

March 24, 2000

Mr. Mark A. Schollenberger, P.E.
Illinois Environmental Protection Agency
Bureau of Land - Permit Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Dear Mr. Schollenberger:

Clean Harbors Services, Inc. (CHSI) is submitting a Class 1 permit modification for the facility's RCRA Part B permit concerning when waste prequalification procedures can be waived for off-site emergency response actions. The permit requires an incident number be issued for the emergency event. When originally permitted, the incident number was considered to be an IEMA number. CHSI is modifying this to include FPN/ CERCLA numbers as an incident number also. USEPA Region V is the listed generator of the waste.

Illinois International Port District approval will be sent under separate cover.

CHSI shall in accordance with 35 IAC 703.281(a)(2), notify all persons on the facility's mailing list within 90 days.

If you have any questions regarding this modification, please contact me at (773)646-6202.

Sincerely,

James R. Laubsted
Facility Compliance Manager

CleanHarbors
SERVICES, INC.
11800 SOUTH STONY ISLAND AVENUE • CHICAGO, IL 60617
(773) 646-6202 • FAX (773) 646-6381
Visit our Website at www.cleanharbors.com

ACB2-08

March 28, 2000

Mr. Mark A. Schollenberger, P.E.
Illinois Environmental Protection Agency
Bureau of Land - Permit Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Dear Mr. Schollenberger:

This letter is to provide documentation to the Illinois Environmental Protection Agency that The Illinois International Port District has reviewed the Clean Harbors Services, Inc.'s March 24, 2000 Class 1 Permit Modification Request to modify when waste prequalification procedures can be waived for off-site emergency response actions. CHSI is modifying this to include FPN/CERCLA numbers as an incident number also.

As site owner of the property Clean Harbors Services, Inc. leases, the Illinois International Port District does not object to this Class 1 Permit Modification Request.

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

James R. Laubsted
Facility Compliance Manager
Clean Harbors Services, Inc.

Anthony G. Ianello
Executive Director
Illinois International
Port District

CleanHarbors
ENVIRONMENTAL SERVICES, INC.
11800 SOUTH STONY ISLAND AVENUE • CHICAGO, IL 60617
(773) 646-6202 • FAX (773) 646-6381
Visit our Website at www.cleanharbors.com

Certified Mail #Z345454131

June 21, 2000

Mr. Mark A. Schollenberger, P.E.
Illinois Environmental Protection Agency
Bureau of Land - Permit Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Dear Mr. Schollenberger:

Clean Harbors Services, Inc. (CHSI) is submitting a Class 1 permit modification to modify the existing Dispersion Tank in the fuel blending system. This tank has shown abrasion on the bottom shell due to the mixers. CHSI is replacing the bottom shell but increasing the thickness from 3/8 inch to 1/2 inch. The existing shell is still above minimum thickness requirements.

Illinois International Port District approval will be sent under separate cover.

CHSI shall in accordance with 35 IAC 703.281(a)(2), notify all persons on the facility's mailing list within 90 days.

If you have any questions regarding this modification, please contact me at (773)646-6202.

Sincerely,

James R. Laubsted
Facility Compliance Manager

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June 22, 2000

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Mr. Mark A. Schollenberger, P.E.
Illinois Environmental Protection Agency
Bureau of Land - Permit Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Dear Mr. Schollenberger:

This letter is to provide documentation to the Illinois Environmental Protection Agency that The Illinois International Port District has reviewed the Clean Harbors Services, Inc.'s June 21, 2000 Class 1 Permit Modification Request to modify the existing Dispersion Tank in the fuel blending system. CHSI is replacing the bottom shell, but increasing the thickness from 3/8 inch to 1/2 inch.

As site owner of the property Clean Harbors Services, Inc. leases, the Illinois International Port District does not object to this Class 1 Permit Modification Request.

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

James R. Laubsted
Facility Compliance Manager
Clean Harbors Services, Inc.

Anthony G. Ianello
Executive Director
Illinois International
Port District