Assume $\rho = .08\ \#/FT^3$ (near atm.)

$W = 192\ \#/HR$ MAX.

$C_1 = W^2 \times 10^{-9} = 3.69 \times 10^4 \times 10^{-9} = .000037 = 3.7 \times 10^{-5}$

$$\Delta P_{100} = \frac{C_1 C_2}{\rho}$$

2" Sch 40, $C_2 = 169$

3/4" HOSE, $C_2 = 22{,}000$

1" HOSE, $C_2 = 6{,}000$

$C_1 = 3.7 \times 10^{-5}$

$$\Delta P_{100}\ {}_{3/4"\ HOSE} = \frac{3.7 \times 10^{-5} \mid 22{,}000}{.08} = 10.2\ psi/100' \times 20' = 2.03$$

$$\Delta P_{100}\ {}_{1"\ HOSE} = \frac{3.7 \times 10^{-5} \mid 6000}{.08} =$$

$$\Delta P_{100}\ {}_{2"\ HOSE} = \frac{3.7 \times 10^{-5} \mid 169}{.08} =$$

WORK LIST

Note: Before completing these items, decontaminate the vent fittings with kerosene.

1. Change the 2" flanged connections at the point where the liquid loading hose and spool piece are attached to a hammer-union type of connection.

2.

Westlake, Louisiana
April —, 1971

To: R.D. Gamblin

Subject: Changes in TEL Car Loading System

Attached is a sketch of recommended revisions to the EDC tank car loading and vent recovery piping.

It has been determined that automatic metering equipment cannot be used for TEL cars since its accuracy would not be good enough. The existing system can be improved by adding a bulls-eye and surge pot for level indications and eliminating the heavy vent adapter. The suggested changes will minimize the possibility of TEL contamination to loaders while simplifying loading procedures.

If you are in agreement with these suggestions, please issue them to Maintenance for construction

C.L. Shaddock, Jr.
Process Engineer

cc: LNV-RLH-GTH-RHG-JDM-SFP-RWC-DCS

CCR 000008326

APPROVED:

$$\Delta P_{100} = \frac{.000336 \,|\, W^2 \,|\, f}{d^5 \,|\, \rho}$$

GAS RATE: $\frac{200}{7.48} \,|\, 60 = 1604$ ACFH $\quad \mu = 0.018$ cp

Assume $P_{AVG} = 3$ psig, $T = 80°F$

$$\therefore \rho_{(\text{ASSUMING } N_2)} = \frac{28 \,|\, 14.7+3}{10.73 \,|\, 460+80} = 0.0855 \ \#/FT^3$$

$$\therefore W = 1604 \times .0855 = 137.1 \ \#/HR$$

$$W^2 = 18{,}807$$

$$Re = \frac{6.31 \,|\, W}{d \,|\, \mu} = \frac{6.31 \,|\, 137.1}{0.25 \,|\, .018} = 1.92 \times 10^5$$

($\frac{1}{4}$" TUBING)

$$\therefore f = .028$$

$$d^5_{(\frac{1}{4}" \text{ ID})} = .0009 = (.25)^5$$

$$\therefore \Delta P_{100'} = \frac{.000336 \,|\, .028 \,|\, 18{,}807}{.0009 \,|\, .0855} = 2299 \text{ psi}/100'$$

PRESSURE DROP CALCULATIONS

$N = \frac{200 \mid 60 \mid}{7.48 \mid \mid} = 198\ \#/HR \therefore W = 3.4c$

$\Delta P_{100} = \frac{.000336 \mid f \mid W^2}{d^5 \mid \rho}$ $\quad 3.72 \times 10^{-4}$

$\mu \cong .018$ cp

ρ is ρ_{N_2} at 10 psig, 80°F $\cong 2.1236\ \#/FT^3$

$Re\ 4340$ $f_{\frac{1}{4}''} = .043$ $d^5_{\frac{1}{4}''} = .00141$ (tubing)

$f_{\frac{1}{2}''} =$ $d^5_{\frac{1}{2}''} = 0.0931$ (SCH 40)

$f_{\frac{3}{4}''} =$ $d^5_{\frac{3}{4}''} = 0.3799$

$Re_{1''} = 17,350$ $f_{1''} = .030$ $d^5_{1''} = 1.27$

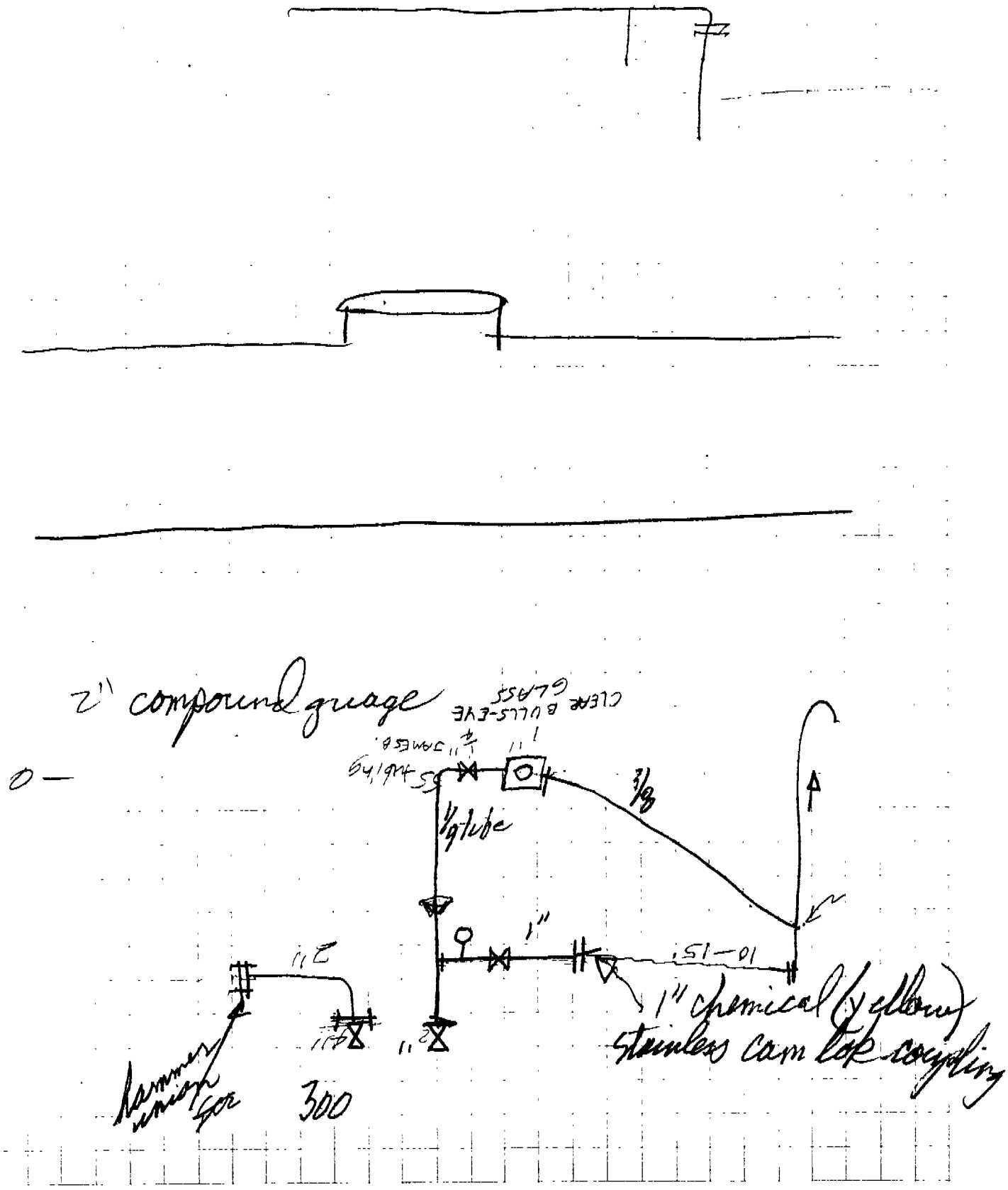
$Re_{1\frac{1}{2}''} = 26,000$ $f_{1\frac{1}{2}''} = .028$ $d^5_{1\frac{1}{2}''} = 10.82$

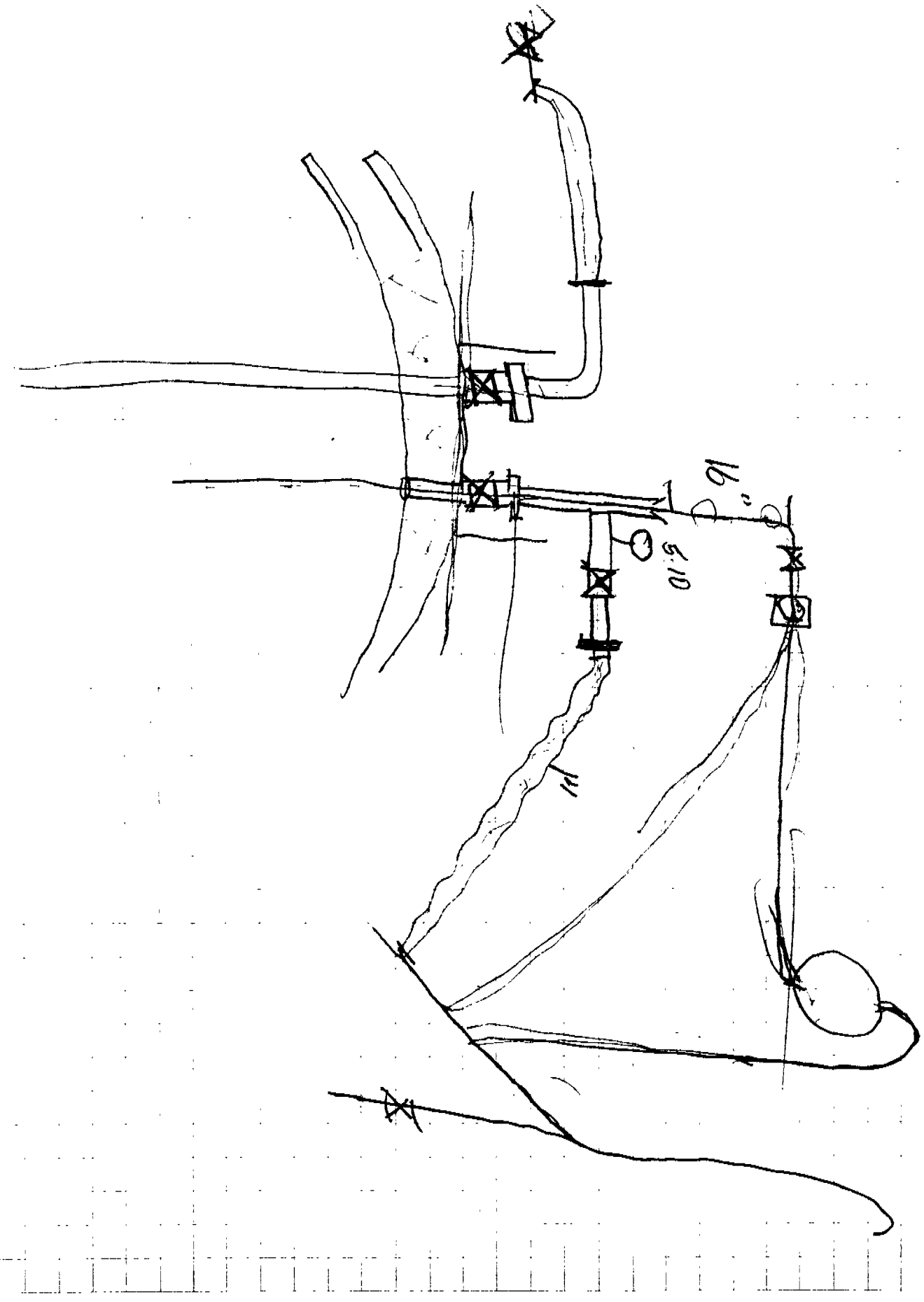
$Re_{2''} = 34,700$ $f_{2''} = .026$ $d^5_{2''} = 37.72$

ΔP_{100} ($\frac{1}{4}$" TUBING) $= \frac{.000336 \mid 39,200 \mid .043 \mid 10}{.0009 \mid .793 \mid 1^5} =$ [illegible] psi

Assume P = 10 psig

CCR 000008328


2" compound guage
CLEAR BULLS-EYE GLASS
1/4" TAMCO
1/4 tube
3/8
1"
1" Chemical (yellow) Stainless cam lok coupling
Hammer union for 300



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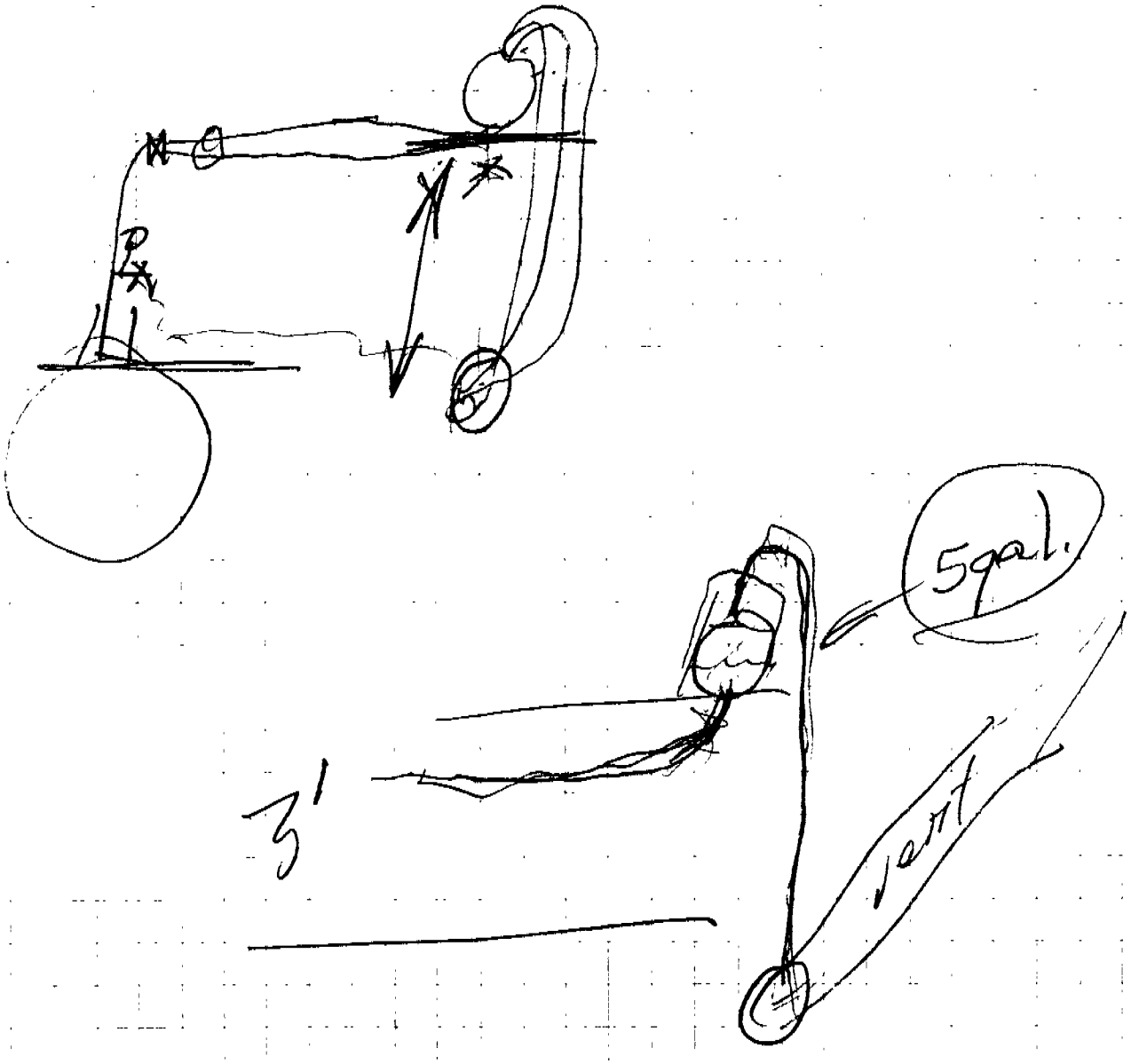

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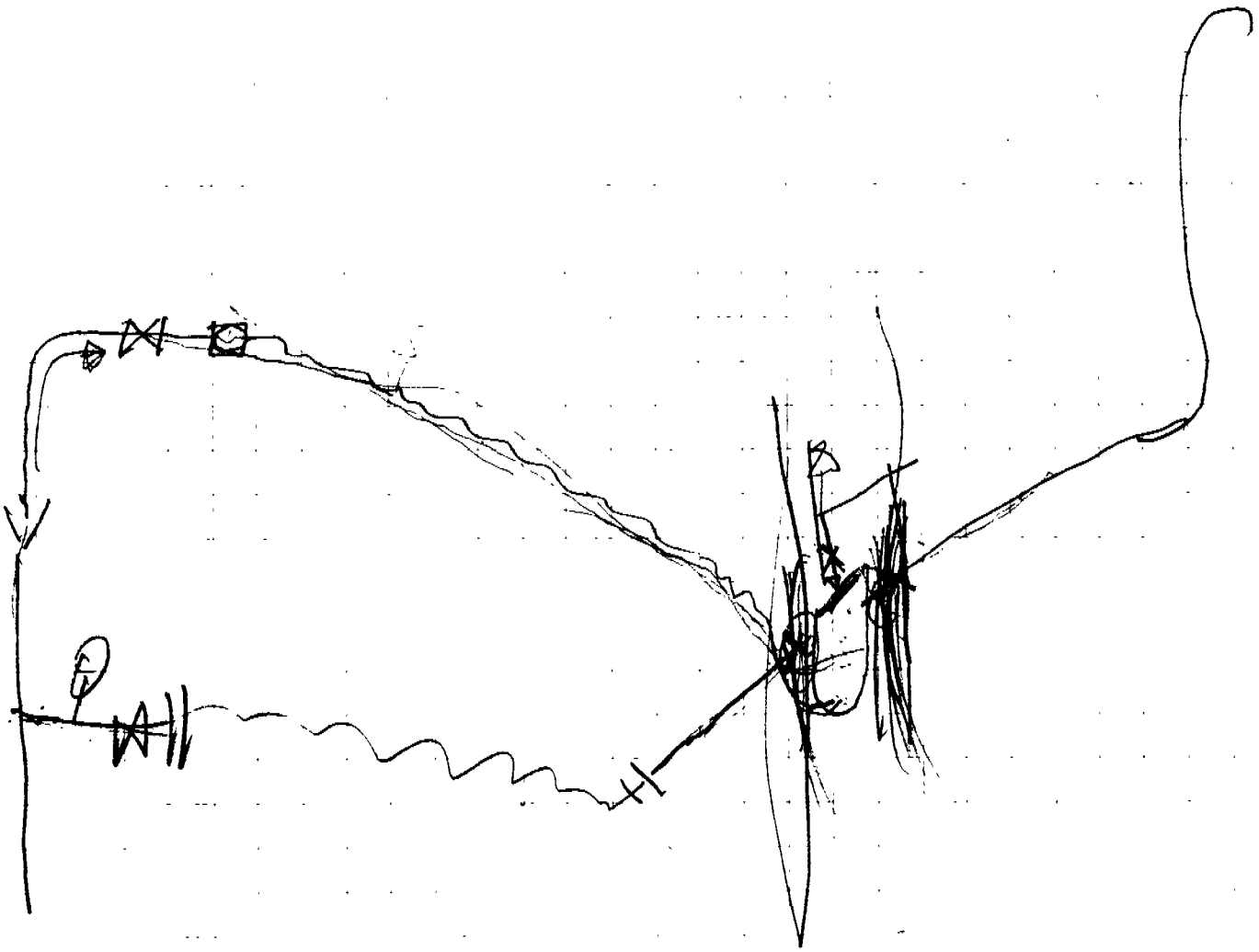
13-2-11 PB



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13-2-21-PB

Organic Lead Hazards and Controls

Tetraethyl and tetramethyl lead (TEL and TML) are organic lead compounds used as an additive in gasoline to improve the antiknock quality. Both of these chemicals and any mixtures or blends containing them present certain serious health hazards if handled without specific engineering and protective equipment controls. It is the purpose of this writeup to outline the potential hazards of these compounds and to familiarize those involved with the protective controls necessary.

Health Hazards.

Antiknock compounds, as they are used in refineries never contain pure TEL or TML. In addition to TEL and TML, these compounds contain EDC (ethylene dichloride), EDB (ethylene dibromide), kerosene, and toluene. They are in liquid form and are handled in totally enclosed systems.

Organic lead, to affect health must get inside the body. Inhalation of vapors, ingestion into the digestive system, and direct absorption of the liquid through the skin are the methods by which entry into the body is possible. The main concern in our plant will be the residual vapors in the empty tank cars we will be filling with EDC.

The effect of organic lead on the human body will depend on the exposure. This material is a powerful poison and can produce mild lead intoxication or death depending on the amount taken into the system. It can cause disability to the central nervous system and degeneration of the brain and other internal organs.

Protective Controls Necessary.

In order to prevent the entry of lead into the body, there will be specific safety precautions and practices established. Due to the hazardous nature of the material, there will be no deviation from the prescribed procedure or protective equipment required.

The residual vapor in the car will be the main hazard associated with this operation. Physical equipment in the form of an elevated vent stack will take care of the bulk of these vapors. The required use of full face breathing air masks by all personnel in the area during loading will assure that inhalation of organic lead vapors will not occur.

It must be understood by all concerned that cannister type gas masks or pocket respirators are not a substitute for hose line breathing equipment in providing the necessary protection. This protective requirement applies not only to the operators doing the actual loading but to any observers or visitors who might be in the immediate area.

During the actual loading, chain barricades will be placed to isolate that particular portion of the loading rack. This is to insure that others do not enter the area inadvertently.

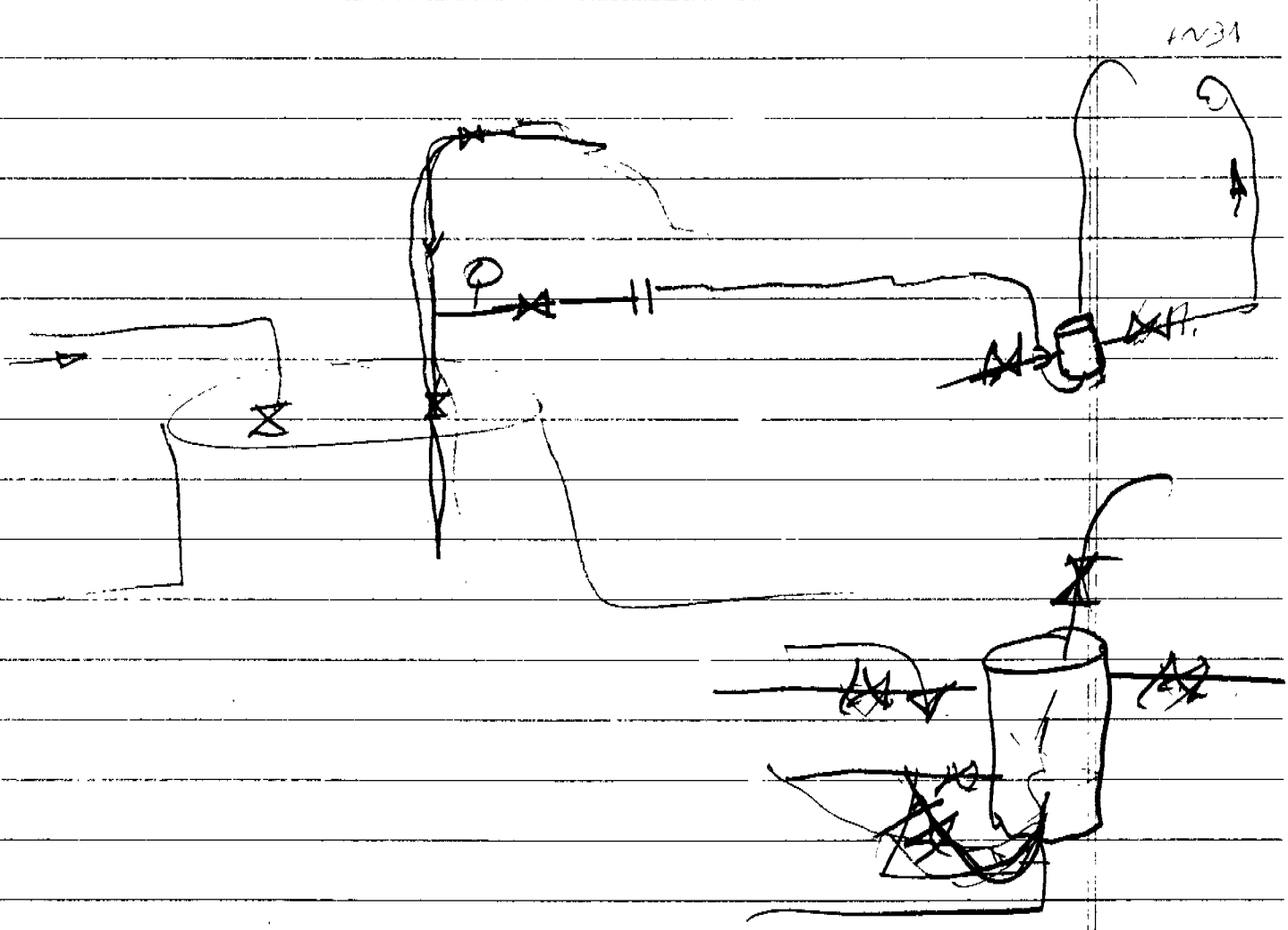
Personal hygiene is another factor that requires control, if this operation is to be carried out with maximum protection. Hands and face are to be washed with soap and water immediately after completion of loading or before eating or smoking. The PVC gloves used should also be washed and dried after each use.

Entry of lead compounds by ingestion also present a potential hazard. To control this, there will be no eating or the use of chewing gum or tobacco in any form in the loading rack area while loading is going on. Those people involved in the loading will not carry any food, gum or tobacco in any form to the area while loading. Organic lead has a tendency to be absorbed readily in tobacco. This not only includes cigarettes, but chewing tobacco, snuff, etc.

Prior to starting this operation, lead levels in the body of those to be directly involved will be checked by urinalysis. These tests will be repeated periodically for control purposes.

In these urinalyses, a small amount of lead will always be detected. This is due to the fact that the human body has small amounts of lead in it. It is necessary for the proper balance of body chemistry, just as the presence of iron, vitamins and other minerals is required for good health.

Extreme fear and anxiety about the hazards of a material or job may actually create accident situations, just as apathy and ignorance can. This presentation of the degree of hazard connected with limited TEL exposure is intended to create respect for the potential hazards and confidence in the fact that the operation can be done with safety. The purpose has not been to generate fear and apprehension.



from

S. F. PITTS _____,19____

To_____

DUPX 28073

Gal. Cap 27875

232484 lbs

DUPX 28081

Gal Cap 27915

232151

Brooks ... [illegible]

[illegible] [illegible] ... [illegible]

(A.)

1ea - L-Turbine 2" - 150# FLGD, ASA $580.00

1ea - STL Vane (Steel), 2" - 150# FLGD 55.00

1ea - Digitrol ... ATC 2000.00

1ea - Model 7FSA 2" - 150# Control Valve 433.00

+ ½% ... $3098.00

(B.) 1ea - Model [illegible] ... $570.00

[illegible]

1ea [illegible]

1ea [illegible] - 150# [illegible]

1ea [illegible]

+ ½% on meter ...

[illegible] 9 3

[illegible] 172.

1ea Model [illegible]

7 8 A - [illegible]

1ea [illegible]

SS

+ ½% on meter ...

CCR 000008337

CCR 000008338

INFORMATION TO VENDOR:

(1) Loading EDC into tank cars which are contaminated with TEL; rate is 150-200 gpm. Line Size: 2"

(2) Must load (80°F, $\rho = 10.25 \frac{\#}{gal}$, $\mu = 0.8$ cp) a batch not less than 275,000#'s nor more than 279,825#'s (26,829 gall. min. to 27,300 gallons max.) - Avg is 277,413#'s or 27,065 gallons - ±% dev. from avg can be ±.87% max at 80°

(3) Temp can vary from 32-80°F. (Makes ρ vary from 10.60 down to 10.25 #/gal & μ vary from 1.13 @ 32° up to 0.80 @ 80°F).

(4) Want a meter within max of 0.50% or better. Counter with automatic shutoff, straightening vanes, strainer, turbine meter, flow rate indicator
Rockwell Series "L" Turbo Meter
~~Houston, Tex.~~ Call Brooks; Ray Zellner
713-526-8366

(5) Get price, delivery - SS internals

A ΔT of 20°F gives

$$\Delta\rho = \frac{.007153 \text{ lb} / 20°F}{\text{gall.} / °F} = -.143 \text{ \#/gall at } 20°F \text{ rise}$$

IF METERING TEMP IS:	ρ_T	$\frac{(\rho_T - 0.143)}{\rho_{T+20}}$	for V_T = 275,000 #'s	$V_{T+20} = V_T\left(\frac{\rho_T}{\rho_{T+20}}\right)$
T = 32°F	10.60	10.457	25,943	26,298
T = 60°F	10.40	10.257	26,442	26,811
T = 80°F	10.25	10.107	26,829	27,208

ALL ARE UNDER ALLOWABLE 27,300 GALLONS

% EXPANSION AT 20°F RISE	vs	LOADING TEMP
13.675 %	13½-14½ % ΔVolume at 20°F rise	32°F
13.942 %		60°F
14.148 %		80°F

ON A MASS BASIS,

98% V = 27,300 gall

Loading Temp, °F	MINIMUM EDC LOAD #'s	MAXIMUM EDC WEIGHT LOAD (TO EQUAL 98% V
32	275,000	289,380
60	275,000	283,920
80	275,000	279,825
104	275,000	275,293

ASSUME THAT WE LOAD THE AVG OF THE 2:

μ_{EDC}, cp	LOADING TEMP, °F	AVG #'s LOADED	MAX ALLOW. DEVIATION #'s	% MAX ALLOW ERROR IN METER
1.13 cp	32	282,190	7,190.0	2.55%
0.92 cp	60	279,460	4,460.0	1.60%
0.79 cp	80	277,412.5	2,412.5	0.87%
0.68 cp	104	275,146.5	146.5	0.05%

TAKING BROOKS-OVAL PD FLOWMETER AS AN EXAMPLE, THE LOWEST POSSIBLE % ERROR IS (FOR EDC, WATER, SOLVENTS AROUND 0.7 to 1.0 cp) ABOUT 0.80 %.

SALES EDC PUMP (P-452)

RUNS AROUND 250 gpm @ 72 FT HP

$$\therefore t \approx \frac{\text{AVG} \approx 26{,}500 \text{ gallons}}{200 \text{ gal/min}} \Big/ \frac{\text{hr}}{60 \text{ min}} \cong 2.21 \text{ hrs}$$

→ A BROOKS-OVAL 6" MODEL 32 METER (177-1190 GPM) would take ≈ 0.2 psi ΔP @ 250 gpm of 1cp fluid.

→ However the best accuracy (250 gpm at 21% of max cp) would be 0.8-1.8%.

AN ALTERNATE WOULD BE A BROOKS

150-250

(8)

Minimum Outage for cars with flammable liquids with VAP PRESS ≤ 16 PSIA (1.3 PSIG) can be 2.0% of container volume.

TEL CAR LOADING

(1)

JDM's Comments

(1) EDC need to make
↓
TEL, Deposit from Orange to New Jr — on return to NJ, we file with EDC (public)

(2) They use a dip tube in the car - some TEL is in the car; however - car [illegible] used to measure levels - TEL is toxic & spills are hard to clean.

[illegible] is how to fill car within 5000 gallon - accurately - must hit a min. to avoid freight & max due to weight limitation

a) Car padded with N_2 to get initial level
b) A dip pipe [illegible] (dip tube) is used to [illegible] level - precise to many inches from [illegible] level

[illegible] they don't want to vent N_2 thru [illegible]
[illegible] No spillage desired

Cars have tare wt & volume, gross weight incoming is measured also.

Very Accurate PD Meter - should be preset to trip off & trip must be fail-safe.

CCR 000008343

Only one loading spot available now.
Ø 2-3 hrs to load.

Get allowable max & min wts from Sid.

No allowable leaks in system.

Sid Pitts' Comments

(1) Want to Shoot for 275,000# EDC weight in cars.

(2) 300# flanged conn's

PROCEDURE FOR LOADING

(1) Make Connections. Dip leg is on vapor valve.
(2) Open ball valve (vapor valve on car) & shove dip leg down into car.
(3) Turn on Pump & open up liq valve
(4) When pressure builds up to 5-10 psig on PI, the valve on legs of tee to vent stack is cracked to maintain 5-10 psig in car.
(5A) Dip leg has clear Polyethylene tube - Near end of pumping the ½" tubing valve on dip leg is opened - the tubing tees back into the vent gas flex hose line.

(5B) When finished, shut off dip. header valve on loading line & bleed pressure down out vent stack through vapor valves to vent stack. (5)

(6) Loaders wear breathing masks when up on platform - must wear PVC gloves - no cigarettes etc in pockets.

(7) Adapters washed in kerosene.

(8) Pull dip leg up to clear the car valve - then block in car valve

CCR 000008345

→ Product weight minimum of 275,000 # to avoid freight charges

→ Car will be vented (just as now) through vent stack. Therefore we will run around atmospheric. We should use a slight N_2 purge.

→ Any matl must be disposed of as contaminant.

→ SV's set at 213 psig - Tank cars tested to 300 psig

→ Car had LT WT OF 194,600 #'s

Water Capacity 27,857 gallons

Total allowable wt 525,000 #'s
237 tons

About 292,000 should be max capacity.

Should be about 17,000 #'s variance ~~to~~ from min EDC load to max load,

Should be no more than 10,000 #'s

275-285,000 #'s ED- must bat between these values

94% of full

Error =

Check with Bill Howell as to what % full (max, by volume EDC can be loaded into cars.

CALCULATIONS

① LT. WEIGHT OF CAR: 194,600 #'s

② EDC DENSITIES (#/GAL) | TEL DENSITIES (#/GAL)

	EDC		TEL	
(40 °C) (72°F) MAXIMUM ΔT POSSIBLE IN TANK SALES OR TANK CAR	32 °F (0 °C)	ρ = 10.60 #/GALL	32°F (0°C)	ρ =
	60 °F (15.56°C)	ρ = 10.40 #/GALL	60°F (15.56 °C)	ρ =
	80 °F (26.67°C)	ρ = 10.250 #/GALL	80°F (26.67 °C)	ρ =
	104°F (40 °C)	ρ = 10.084 #/GALL	104°F (40 °C)	ρ =

13.75 #/gall avg

*DENSITY OF EDC APPEARS TO VARY AS A STRAIGHT LINE FUNCTION BETWEEN -50 & 150°C.

$$\frac{\Delta\rho}{\Delta T} = \frac{.007153 \text{ lb}}{\text{gallon} - °F}$$

TEL Density ≈ 1.65 × 8.334 = 13.75 #/gal at 60°F

Car Volume = 27,857 gallons at overflow

∴ 98% max allowable vol EDC = 27,300 gallons

Minimum 275,000 #'s of EDC to be added:
(Assumes delivered car is empty)

Metering Temp, °F	Gallons Minimum (to equal 275,000 #)
32	25,943 gallons
60	26,442 gallons
80	26,829 gallons
104	27,271 gallons

How much ΔT would have to be added from Lake Charles, La to New Jersey to get a volume expansion that would short volume over 27,300 gallons

If total allowable wt of car & liq is 525,000 #'s,

Max Liq = 525,000 # − 194,600 # (empty car wt.) = 330,400 # EDC ; so no problems will occur with excess weight.