



Interoffice Communication

To J. R. Holcomb
From W. D. Stutesman
Date March 19, 1974
Subject Process Design for the Rail Car Vent Recovery System

Attached is the process design for the rail car vent recovery system. A preliminary process design was issued to plant personnel on March 11, 1974 for review. Their comments and suggestions were incorporated, where appropriate, into the final design.

Please proceed with a definitive estimate for the project. Planning and estimate work must be completed and the package sent to CED by April 11, 1974. Quotations are already being obtained on the heat exchangers, the package refrigeration unit, and the control valves. These will be made available to you as they are received.

The cost of the project is expected to exceed \$100,000. Therefore, copies of this design are being sent to R. S. Matthews for review by PED. A copy is also being sent to R. R. Prescott for familiarization purposes to expedite the CED review.

W.D. Stutesman

W. D. Stutesman
Chemical Engineer

bs

cc: RDG-RHG-DEM-JRH(4)-GGD(5)-CEG-JSR
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REVIEWED BY:

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LAKE CHARLES, LOUISIANA

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PURPOSE, BASIS,
PROCESS, DESC.

CWH 000012399

PURPOSE OF DESIGN
RAIL CAR VENT RECOVERY SYSTEM
LAKE CHARLES VCM PLANT

The loading of VCM rail cars results in the venting of vinyl chloride vapors and inert gases. A portion of these rail cars enter the plant containing only nitrogen while many other cars must be purged with nitrogen prior to VCM loading to reduce the residual oxygen content below 100 ppm.

An existing vent recovery system was installed by the plant in 1970. This system was designed to recover VCM from the vent of rail cars in dedicated VCM service (dedicated rail cars contain VCM vapors and do not normally require nitrogen purging). Loading of non-dedicated cars results in little VCM recovery because of the high nitrogen content of the vent gases. The loading of these non-dedicated cars results then, in the venting to the atmosphere of a considerable quantity of vinyl chloride. This is undesirable from environmental, safety and economic standpoints.

The proposed vent recovery system will recover VCM from the vent of non-dedicated rail cars. This system will reduce the vent rate to a maximum of 50 lb/hr. of VCM. The rail car vent recovery system is part of the VCM Plant's hydrocarbon compliance plan as submitted to the Louisiana Air Control Commission. The installation of this system will reduce the plant's vent from this source to a level compatible with our interpretation of the Commission's regulations concerning vents of reactive hydrocarbons.

BASIS OF DESIGN
RAIL CAR VENT RECOVERY SYSTEM
LAKE CHARLES VCM PLANT

The proposed system is designed to recover the VCM from the vents of two nitrogen purged rail cars being loaded with VCM at a maximum total rate of 240 gpm. A maximum VCM vent loss of 50 lbs/hr. is the basis of the design.

The flow rate of 120 gpm per car is the maximum loading rate when all available rail car loading spots (10) are in use. This is the VCM flow rate basis for the system.

Practical operating considerations require the flexibility to load nitrogen purged rail cars at any of the ten loading spots. A new vent header and VCM loading header will be required to tie this refrigerated recovery system into all ten loading spots. As nitrogen purged and dedicated cars (rail cars containing no nitrogen) are loaded simultaneously by the same pumps, a new loading header and flow control system will be required to limit the loading rate to the nitrogen purged car(s) to 240 gpm.

Plant data indicates the temperature of the VCM in the storage spheres varies between 100° F in the summer to 30° F in the winter. The proposed system will meet the required performance criteria at both winter and summer conditions.

The amount of nitrogen in equilibrium with the VCM in the vent stream leaving the rail car varies with the pressure in the rail car and the temperature of the VCM. By maintaining the pressure in the rail car slightly above the vapor pressure of the VCM at the loading temperature, it is possible to recover the required amount of VCM at a higher condensing temperature than would be possible at a higher pressure. Therefore, by varying the system pressure as the VCM temperature changes from day to day, it is possible to greatly reduce the cost of the refrigeration system.

The condensing temperature of -40° F is determined by the winter design condition of 30° F VCM in the storage spheres. Under winter loading conditions the concentration of VCM in the rail car vent is low, and cooling of the rail car vent to -40° F is required to limit the final vent loss to 50 lbs/hr.

The feasibility of compressing the rail car vent and then condensing the VCM at a higher temperature was investigated. It is possible to compress the rail car vent to 225 psig and then condense at a higher temperature with only a slight increase in duty. Although this type of system would result in a lower refrigeration unit cost, it would not reduce the total investment and would result in a substantially greater system complexity and substantially lower system operating reliability. In addition the wide range of inlet temperatures, pressures and compositions would increase the compressor design and operating difficulties. Based on the above information a

Basis of Design
Rail Car Vent Recovery System
Lake Charles VCM Plant
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a pressure controlled refrigeration system was adopted over a compression-refrigeration system as the basis of this design.

The possibility of using the existing compressor, BL-409, for a compression-refrigeration type system was also investigated. However, calculations indicate this compressor is far too large for the rail car loading service. It would be necessary to operate BL-409 at about one-half the minimum recommended operating rate. This type of system then is not a practical solution.

PROCESS DESCRIPTION
RAIL CAR VENT RECOVERY SYSTEM
LAKE CHARLES VCM PLANT

The rail car vent recovery system will reduce the vinyl chloride vented to the atmosphere to 50 lbs/hr. or less. The removal of the VCM from the rail car vent will be effected by cooling the vent stream to -40°F and collecting the VCM condensate. The recovered condensate will be returned to the VCM storage spheres.

Several new equipment items will be required for the new rail car vent recovery system. These are:

NH-1	Refrigerated Vent Condenser
NH-2	Vent and Recovered VCM Heater
NP-1	Refrigerated VCM Return Pump
NPK-1	Package Refrigeration Unit
NST-1	Vent Stack
NT-1	Refrigerated VCM Receiver
NT-2	Vent Stack Knockout Pot

The following is a description of the vent recovery process. A process flow drawing and piping and instrument diagrams are included in Section IX. The material and energy balances for summer and winter operating conditions are shown on Tables 1 to 4 in Section IV.

Prior to loading of the VCM rail cars the dedicated cars are connected to the existing loading header and existing rail car vent line. Non-dedicated rail cars are isolated from the existing loading header and connected to the new rail car loading line. The vent from the non-dedicated cars is connected to the new rail car vent line. All rail cars are then prepared for loading in the usual manner.

The liquid VCM from storage flows to vinyl chloride rail car loading area. VCM flows into the dedicated cars via the existing loading header system. VCM to the non-dedicated rail cars flows through NFIC-1 at 240 gpm (maximum) and then into the rail car(s). The total loading rate to the non-dedicated cars is controlled at 240 gpm or less by NFIC-1.

The vent vapor from the non-dedicated car(s) exits through the new rail car vent line and flows to NH-1, the refrigerated vent condenser. NH-1 cools the vent from ambient temperature (30°F winter design conditions, 100°F summer design conditions) to -40°F , thereby condensing most of the VCM in the vent gases.

Cooling for the refrigerated vent condenser is supplied by NPK-1, the package refrigeration unit. NPK-1 consists of a two stage compression system using R-502 refrigerant. The refrigerant liquid flows on level control to NH-1. R-502 boils at -49°F and the boiling action cools the vent gases in the tubes of NH-1 to -40°F . The refrigerant vapors exit NH-1 and return to the package refrigeration unit. The refrigeration level is controlled on NH-1 by NLC-1 on the shell side of the exchanger.

Process Description
Rail Car Vent Recovery System
Lake Charles VCM Plant
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The cooled vent gas and condensate flow from NH-1 to NT-1, the refrigerated VCM receiver. Here the VCM condensate separates from the gases and is accumulated during the loading operation. The gases exit NT-1 and flow to NH-2, the vent and recovered VCM heater, where they are heated to ambient temperature by low pressure steam on temperature control from NTC-1.

The gases then flow through NPC-1, the back pressure control valve for the system, and then to NT-2, the vent stack knockout pot, where any entrained liquid is separated. NPC-1 controls the pressure of the rail car vent recovery system at the optimum point for maximum VCM recovery. The set point for this control will be set by NTC-2 based on the temperature of the liquid VCM at the discharge of the VCM loading pumps (P-411A, B, C). This cascade control will be set so the NPC-1 set point, in psig, equals the temperature, in °F, of the VCM being loaded.

The gases containing primarily nitrogen and a maximum of 50 lbs/hr. of VCM exit NT-2 and flow to NST-1, the vent stack, where they are vented to the atmosphere 148 feet above ground level. A continuous nitrogen purge is provided for NST-1 to prevent the possibility of explosive VCM-air mixtures.

The existing vent line from T-490 is tied into the line to NH-1 to permit recovery of any VCM vapors vented through the existing dedicated rail car system.

- * Upon completion of the loading operation, NH-2, the vent and recovered VCM heater, is isolated from the vent system and connected to the pumpout system. The recovered VCM from NT-1 is pumped by NP-1, the refrigerated VCM return pump through NH-2. NH-2 heats the VCM to -15° F via low pressure steam on temperature control from NTC-1. The VCM then flows into the existing return line to the storage spheres.



CWH 000012405

TABLE I
EQUIPMENT HEAT AND MATERIAL BALANCE
(Summer Conditions)
RAIL CAR VENT RECOVERY SYSTEM
LAKE CHARLES VCM PLANT

	<u>M.W.</u>	<u>Rate (1)</u> <u>Lb/Hr.</u>	<u>GPM (Scfh)</u>	<u>Temp ° F</u>	<u>Press/psig</u>	<u>Enthalpy (2)</u> <u>BTU/Lb</u>	<u>Heat Flow</u> <u>M BTU/Hr</u>
<u>Tank Car</u>							
<u>In</u>							
VCM from Spheres	62.50	105918	240.0	100	-	-42.0	-4448.6
<u>Out</u>							
Vent Vapor to NH-1	52.36	1924	(13928)	100	100	95.4	183.5
<u>NH-1 Refrigerated Vent Condenser</u>							
<u>In</u>							
Vent Vapor to NH-1	52.36	1924	(13928)	100	100	95.4	183.5
<u>Out</u>							
Vapor-Liquid to NT-1	52.36	1924	-	-40	100	-56.3	-108.3
Refrigeration Duty by NPK-1							291.8
Total		<u>1924</u>					<u>183.5</u>
<u>NT-1 Refrigerated VCM Receiver</u>							
<u>In</u>							
Vapor-Liquid to NT-1	52.36	1924	-	-40	100	-56.3	-108.3
<u>Out</u>							
Vapor to NH-2	29.25	327	(4245)	-40	100	102.1	33.4
Condensed VCM	62.50	<u>1597</u>	<u>3.2 (3)</u>	-40	-	-88.7	<u>-141.7</u>
Total		<u>1924</u>					<u>-108.3</u>

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TABLE I
(Continued)

	M.W.	Rate (1)		Temp ° F	Press/psig	Enthalpy ⁽²⁾ BTU/Lb	Heat Flow M BTU/Hr
		Lb./Hr.	GPM (scfh)				
<u>NH-2 Vent and Recovered VCM Heater (4)</u>							
<u>In</u>							
Vapor to NH-2	29.25	327	(4245)	-40	100	102.1	33.4
Duty from L.P. Steam							11.7
Total		<u>327</u>	<u>(4245)</u>				<u>45.1</u>
<u>Out</u>							
Vent Gas to NT-2	29.25	327	(4245)	100	100	137.9	45.1
<u>NH-2 Vent and Recovered VCM Heater (5)</u>							
<u>In</u>							
Condensed VCM	62.50	25000	50	-40	-	-88.7	-2217.5
Duty from L.P. Steam							162.5
Total		<u>25000</u>	<u>50</u>				<u>-2055.0</u>
<u>Out</u>							
Recovered VCM to Spheres	62.50	25000	50	-15	-	-82.2	-2055.0

Notes:

- (1) Assumed VCM loading rate to non-dedicated cars of 240 gpm
- (2) Enthalpy basis is 0^{BTU}/lb. for nitrogen gas at 0°R and Opsia and for saturated liquid VCM at 100° C.
- (3) Rate of liquid accumulation in NT-1. Pump^{OUT} rate is 50 gpm.
- (4) NH-2 duty to heat vent gases to ambient temperature.
- (5) NH-2 duty to heat recovered VCM to -15° F.

TABLE 2
EQUIPMENT HEAT AND MATERIAL BALANCE
(Winter Conditions)
RAIL CAR VENT RECOVERY SYSTEM
LAKE CHARLES VCM PLANT

	<u>M.W.</u>	<u>Rate (1)</u> <u>Lb/Hr.</u>	<u>GPM (scfh)</u>	<u>Temp ° F</u>	<u>Press/psig</u>	<u>Enthalpy (2)</u> <u>BTU/Lb</u>	<u>Heat Flow</u> <u>M BTU/Hr.</u>
<u>Tank Car</u>							
<u>In</u>							
VCM From Spheres	62.50	112995	240.0	30	-	-66.0	-7457.7
<u>Out</u>							
Vent Vapor to NH-1	46.22	756	(6200)	30	30	87.7	66.3
<u>NH-1 Refrigerated Vent Condenser</u>							
<u>In</u>							
Vent Vapor to NH-1	46.22	756	(6200)	30	30	87.7	66.3
<u>Out</u>							
Vapor-Liquid to NT-1	46.22	756	-	-40	-	-23.1	-17.5
Refrigeration Duty to NPK-1							83.8
Total		<u>756</u>	<u>-</u>				<u>66.3</u>
<u>NT-1 Refrigerated VCM Receiver</u>							
<u>In</u>							
Vapor-Liquid to NT-1	46.22	756	-	-40	-	-23.1	-17.5
<u>Out</u>							
Vapor to NH-2	31.20	266	(3229)	-40	30	97.9	26.0
Condensed VCM	62.50	490	7.8 ⁽³⁾	-40	-	-88.7	-43.5
Total		<u>756</u>	<u>-</u>				<u>-17.5</u>

CWH 000012408

TABLE 2
(Continued)

	<u>M.W.</u>	<u>Rate (1)</u>		<u>Temp ° F</u>	<u>Press/psig</u>	<u>Enthalpy⁽²⁾ BTU/Lb.</u>	<u>Heat Flow M. BTU/Hr.</u>
		<u>Lb/Hr.</u>	<u>GPM (scfh)</u>				
<u>NH-2 Vent and Recovered VCM Heater (4)</u>							
<u>In</u>							
Vapor to NH-2	31.20	266	(3229)	-40	30	97.9	26.0
Duty to L.P. Steam							4.6
Total		<u>266</u>	<u>(3229)</u>				<u>30.6</u>
<u>Out</u>							
Vent Gas to NT-2	31.20	266	(3229)	30	30	115.0	30.6
<u>NH-2 Vent and Recovered VCM Heater (5)</u>							
<u>In</u>							
Condensed VCM	62.50	25000	50	-40	-	-88.7	-2217.5
Duty from L.P. Steam							162.5
Total		<u>25000</u>	<u>50</u>				<u>-2055.0</u>
<u>Out</u>							
Recovered VCM to Spheres		25000	50	-15	-	-82.2	-2055.0

Notes:

- (1) Assumed VCM loading rate to non-dedicated cars of 240 gpm.
- (2) Enthalpy basis is 0 BTU/lb. for nitrogen gas at 0° R and 0 psia and for saturated liquid VCM at 100° C.
- (3) Rate of liquid accumulation in NT-1. Pumpout rate is 50 gpm.
- (4) NH-2 duty to heat vent gases to ambient temperatures.
- (5) NH-2 duty to heat recovered VCM to -15° F.

TABLE 3
COMPONENT MATERIAL BALANCE
 (Summer Conditions)
RAIL CAR VENT RECOVERY SYSTEM
LAKE CHARLES VCM PLANT

Stream No. (2) Stream Name		(1) VCM from Spheres			(2) Railcar Vent Vapor to NH-T			(3) Condensed VCM			(4) Vent Vapors to Atmosphere		
Component	M.W.	Lb/Hr	Lb-M/Hr	Mol %	Lb/Hr	Lb-M/Hr	Mol %	Lb/Hr	Lb-M/Hr	Mol %	Lb/Hr	Lb-M/Hr	Mol %
Vinyl Chl.	62.50	105918	1694.69	100.0	1622	25.96	70.64	1597	25.55	100.0	25	0.41	3.62
Nitrogen	28.02	-	-	-	302	10.79	29.36	-	-	-	302	10.79	96.38
Total		105918	1694.69	100.0	1924	36.75	100.00	1597	25.55	100.0	327	11.20	100.0
Temp, °F			100			100			-40			-40	
Press, psig			-			100			-			100	
Density, lb/ft. 3			55.0			-			62.3			-	
Flow Rate, GPM (SCFH)			240 (1)			(13928)			3.2 (3)			(4245)	

Notes:

- (1) Assumed total VCM loading rate to non-dedicated rail cars, is 240 GPM
- (2) Stream locations are shown on process flow drawing.
- (3) Rate of condensate accumulation in separator. Pumpout rate is 50 gpm.

TABLE 4
COMPONENT MATERIAL BALANCE
(Winter Conditions)
RAIL CAR VENT RECOVERY SYSTEM
LAKE CHARLES VCM PLANT

CWH 000012411

Stream No. (2)	(1)				(2)				(3)				(4)			
Stream Name	VCM from Spheres				Railcar Vent Vapor to NH-1				Condensed VCM				Vent Vapors to Atmosphere			
Component	M.W.	Lb/Hr	Lb-M/Hr	Mol %	Lb/Hr	Lb-M/Hr	Mol %	Lb/Hr	Lb-M/Hr	Mol %	Lb/Hr	Lb-M/Hr	Mol %	Lb/Hr	Lb-M/Hr	Mol %
vinyl chl.	62.50	112995	1807.92	100.0	540	8.64	52.80	490	7.84	100.0	50	0.80	9.2			
Nitrogen	28.02	-	-	-	216	7.72	47.20	-	-	-	216	7.72	90.7			
Total		112995	1807.92	100.0	756	16.36	100.0	490	7.84	100.0	266	8.52	100.0			
Temp, °F			30				30			-40			-40			
Press, psig			-				30			-			30			
Density, lb/ft. 3			58.7				-			62.3			-			
Flow Rate, GPM			240 (1)				(6200)			1.0 (3)			(3229)			
(SCFH)																

Notes:

- (1) Assumed total VCM loading rate to non-dedicated rail cars is 240 gpm.
- (2) Stream locations are shown on process flow drawing.
- (3) Rate of condensate accumulation in separator. Pumpout rate is 50 gpm.

TABLE 5
UTILITY SUMMARY
RAIL CAR VENT RECOVERY SYSTEM
LAKE CHARLES VCM PLANT

Steam, 50 psig, 297° F Supply Conditions

<u>Item No.</u>	<u>Description</u>	<u>Max Lb/Hr.</u>
NH-2	Vent and Recovered VCM Heater	196

Nitrogen, 200 psig, Ambient Supply Conditions

Max continuous purge to NT-2 and NST-1 10 SCFH

Electrical Power (1)

<u>Item No.</u>	<u>Description</u>	<u>Installed Electrical H.P.</u>
NP-1	Refrigerated VCM Return Pump	7.0
NPK-1	Package Refrigeration Unit (2)	190.0
	Total	197.0

Instrument Air

10 Users at 1 SCFH each = 10 SCFH

- (1) installation of switchgear equipment will be required for the listed items.
- (2) Includes electrical power requirements for compressors, air-cooled exchanger motor, oil return pump, and electric oil heater.

CWH 000012412

EQUIPMENT
SPECS.

CWH 000012413

EQUIPMENT SPECIFICATIONS
RAIL CAR VENT RECOVERY SYSTEM
LAKE CHARLES VCM PLANT

Equipment List

NH-1	Refrigerated Vent Condenser
NH-2	Vent and Recovered VCM Heater
NP-1	Refrigerated VCM Return Pump
NPK-1	Package Refrigeration Unit
NST-1	Vent Stack
NT-1	Refrigerated VCM Receiver
NT-2	Vent Stack Knockout Pot

CWH 000012414



ENGINEERING CENTER

PONCA CITY, OKLAHOMA
SPECIFICATION SHEET

PART OF NPL-

A.F.E. NO. _____
DATE 3/5/74 W. O. NO. _____
MADE BY WDS INQ. NO. _____
APP'D BY _____ REQ. NO. _____
B. M. NO. _____ P. O. NO. _____

SHELL & TUBE EXCHANGERS

PLANT LAKE CHARLES VCM PLANT

PROJECT RAIL CAR VENT RECOVERY SYSTEM

1	ITEM NO. & TAG	N4-1 (SUMMER OPER. CONDS.)						SERVICE OF UNIT REFRIGERATED VENT CONDENSER				
2		SHELL SIDE			TUBE SIDE			MANUFACTURER				
3	NOZZLES	NO	SIZE	RATING & FACING	NO	SIZE	RATING & FACING	SIZE	TYPE <u>AKU OF PKU (HORIZ)</u>			
4	INLET	1	2	150 LB. FLG. R.F.	1	3	150 LB. FLG. R.F.	CONNECTED IN	() PARALLEL () SERIES			
5	OUTLET	1	6	150 LB. FLG. R.F.	1	3	150 LB. FLG. R.F.	EFF. SURF. PER UNIT	sq ft			
6	VENT	1	1	150 LB. FLG. R.F.				SHELLS PER UNIT	1	SHELL DIAM	IN.	
7	DRAIN	4	1	150 LB. FLG. R.F.				EFF. SURF. PER SHELL	sq ft			
8	NOZZLE CONN.	2	1	150 LB. FLG. R.F.				NO. TUBES PER SHELL	LENGTH IN.			
9	NOZZLE CONN.	2	1 1/2	150 LB. FLG. R.F.				UNITS REQ'D.	1			
10	CHEM. CLEAN	2	1 1/2	150 LB. FLG. R.F.	2	1 1/2	150 LB. FLG. R.F.	DELIVERY, WEEKS				
11	RELIEF	1	2	150 LB. FLG. R.F.	1	3	150 LB. FLG. R.F.	PRICE, PER UNIT				
12	SLIP-ON NOZZLE FLANGES ALLOWED (YES) (NO)							EST. FREIGHT COST				
13	SLIP-ON END FLANGES ALLOWED (YES) (NO)							TOTAL PRICE				
14	GASKETS: SHELL							DOLLARS PER SQUARE FOOT				
15	CHANNEL							MATERIALS: (MARK SR AND PERCENT XR)				
16	FLOATING-HEAD COVER							ITEM	MAT'L	DEG. F	SPECIFICATION	
17								TUBES	C.S. - 50Tn25 A334 GRI			
18	TEST RING REQUIRED (YES) (NO)							SHELL	C.S. - 50Tn25 A516			
19	SPARE GASKETS REQUIRED (YES) (NO)							SHELL COVER (REM) (INTEG)	SS 15 AN			
20	STACKING HIGH							CHANNEL	ACCEPTABLE			
21	INSULATION THICKNESS IN.							CHANNEL COVER (REM) (INTEG)	ALTERNATE			
22	NO. TUBES OD 3/4 IN.; MIN. THK. .083 IN.							FLOATING-HEAD COVER	MATERIAL			
23	LENGTH FT. PITCH 1 IN. (4) (5)							TUBE SHEETS				
24	SHELL DIAM IN. I.D. MAX BUNDLE DIAM ALLOW IN.							BAFFLES AND SUPPORT PLATES				
25	TRANSVERSE BAFFLE TYPE SPACING IN.							BOLTING: SHELL COVER				
26	PERCENT CUT (VERT.) (HORIZ.) (45 DEG)							CHANNEL				
27	LONG BAFFLE TYPE IMPINGEMENT BAFFLE (YES) (NO)							FLOATING HEAD				
28	TEMA CLASS R YES ASME CODE REQ'D YES							CHANNEL COVER				
29	PERFORMANCE OF ONE UNIT											
30												
31	FLUID CIRCULATED				SHELL SIDE				TUBE SIDE			
32	TOTAL FLUID ENTERING lb/hr				REFRIGERANT 502				VINYL CHLORIDE VAPORS			
33					5801 (SEE NOTE 1)				1924			
34	VAPOR lb/hr				IN OUT				IN OUT			
35	LIQUID lb/hr				5801				1622 25			
36	STEAM lb/hr								1597			
37	WATER lb/hr											
38	NONCONDENSABLES lb/hr								302 302			
39	GRAVITY: SG @ 60°F SG @ TEMP								1.0			
40	MOL. WT: VAPOR				111.64				52.36 29.25			
41	MOL. WT: NONCONDENSABLES								29.02 23.02			
42	VISCOSITY: LIQUID, CP				LIQ. .24 @ 86 F VAP. .013 @ 86 F				VAP. .013 @ 100 F LIQ. .35 @ -40 F			
43	HEAT: LATENT BTU/LB				LT. HT. = 50.2				VAP. SP. = 220 BTU/LB LIQ. SP. = 110 BTU/LB			
44	THERM. COND. BTU/HR-FT-DEG F				VAP. LIQ.				VAP. .0002 @ 100 F LIQ. .001 @ -40 F			
45	TEMPERATURE F				-49 -49				100 -40			
46	OPERATING PRESSURE psig				.4				100			
47	VELOCITY FPS											
48	NO. PASSES				1				1			
49	PRESSURE DROP psi				ALLOW < 1.0 CALC				ALLOW 3.0 (MAX) CALC			
50	FOULING RESISTANCE (MIN.)				.001				.002			
51	PRESSURE, psig				DESIGN 250 TEST				DESIGN 250 TEST			
52	DESIGN TEMPERATURE, DEG. F				125 F - 50				125 F - 50			
53	CORROSION ALLOWANCE: IN.				1/8							
54	MTD (WTO) (CORR) F											
55	TRANSFER RATE: SERVICE				HEAT EXCHANGED, BTU/HR				291,800			
56	WEIGHTS PER SHELL: SHIPPING lb: FULL OF WATER lb: BUNDLE lb:				CLEAN							
57	NOTES THE CALCULATED SERVICE HEAT TRANSFER RATE (OUTSIDE TUBE AREA OR EXTENDED AREA) IS TO BE DECREASED BY 10 PERCENT FOR ALL											
58	DESIGN CALCULATIONS.											
59	SUPPLIER TO COMPLETE FORM BY FURNISHING INFORMATION FOR BLANK SPACES											



ENGINEERING CENTER

PONCA CITY, OKLAHOMA
SPECIFICATION SHEET

PART OF UNIT

A.F.E. NO.

DATE 3/6/74

W.O. NO.

MADE BY WDS

INQ. NO.

APP'D BY

REQ. NO.

B.M. NO.

P.O. NO.

SHELL & TUBE EXCHANGERS

PLANT LAKE CHARLES VCM PLANT

PROJECT RAIL CAR VENT RECOVERY SYSTEM

1	ITEM NO. & TAG 114-1 (WINTER OPER. CONDS.)							SERVICE OF UNIT REFRIGERATED VENT CONDENSER			
2	SHELL SIDE				TUBE SIDE			MANUFACTURER			
3	NOZZLES	NO	SIZE	RATING & FACING	NO	SIZE	RATING & FACING	SIZE	TYPEAKU-BRO (HORIZ) R-11		
4	INLET	1	2	150 LB FIG R.F.	1	3	150 LB FIG R.F.	CONNECTED IN	() PARALLEL	() SERIES	
5	OUTLET	1	6	150 LB FIG R.F.	1	3	150 LB FIG R.F.	EFF. SURF. PER UNIT, sq ft			
6	VENT	1	1	150 LB FIG R.F.				SHELLS PER UNIT	1	SHELL DIAM IN.	
7	DRAIN	4	1	150 LB FIG R.F.				EFF. SURF. PER SHELL, sq ft			
8	LEVEL CONN	2	1	150 LB FIG R.F.				NO. TUBES PER SHELL	LENGTH	IN.	
9	LEVEL CONN	2	1 1/2	150 LB FIG R.F.				UNITS REQ'D	1		
10	CHEM CLEAN	2	2	150 LB FIG R.F.	2	1 1/2	150 LB FIG R.F.	DELIVERY, WEEKS			
11	RELIEF	1	3	150 LB FIG R.F.	1	3	150 LB FIG R.F.	PRICE, PER UNIT			
12	SLIP-ON NOZZLE FLANGES ALLOWED (YES) (NO)							EST. FREIGHT COST			
13	SLIP-ON END FLANGES ALLOWED (YES) (NO)							TOTAL PRICE			
14	GASKETS: SHELL							DOLLARS PER SQUARE FOOT			
15	CHANNEL							MATERIALS: (MARK SR AND PERCENT XRI)			
16	FLOATING-HEAD COVER							ITEM	MAT'L	DEG. F	SPECIFICATION
17								TUBES	C.S. - 50% 125	135	A334 GR. 1
18	TEST RING REQUIRED (YES) (NO)							SHELL	C.S. - 50% 125	135	A-516
19	SPARE GASKETS REQUIRED (YES) (NO)							SHELL COVER (REM) (INTEG)			
20	STACKING HIGH							CHANNEL	SS	15	AN
21	INSULATION THICKNESS IN.							CHANNEL COVER (REM) (INTEG)	ACCEPTABLE		
22	NO. TUBES OD 3/4 IN.: MIN. THK. .083 IN.							FLOATING-HEAD COVER	ALTERNATE		
23	LENGTH FT. PITCH IN. (A) (B) (C)							TUBE SHEETS	MATERIAL		
24	SHELL DIAM IN. 60 MAX BUNDLE DIAM ALLOW IN.							BAFFLES AND SUPPORT PLATES			
25	TRANSVERSE BAFFLE TYPE SPACING IN.							BOLTING: SHELL COVER			
26	PERCENT CUT (VERT.) (HORIZ.) (45 DEG)							CHANNEL			
27	LONG BAFFLE TYPE IMPINGEMENT BAFFLE (YES) (NO)							FLOATING HEAD			
28	TEMA CLASS R YES ASME CODE REQ'D YES							CHANNEL COVER			
29	PERFORMANCE OF ONE UNIT										
30					SHELL SIDE			TUBE SIDE			
31	FLUID CIRCULATED				REFRIGERANT 502			VINYL CHLORIDE VAPORS			
32	TOTAL FLUID ENTERING, lb/hr				1666 (SEE NOTE 1)			756			
33					IN			OUT			
34	VAPOR, lb/hr				—			540			
35	LIQUID, lb/hr				1666			—			
36	STEAM, lb/hr				—			470			
37	WATER, lb/hr				—			—			
38	NONCONDENSABLES, lb/hr				—			216			
39	GRAVITY: 2.5 SG TEMP				—			1.0			
40	MOL. WT: VAPOR				—			111.64			
41	MOL. WT: NONCONDENSABLES				—			46.22			
42	VISCOSITY: LIQUID, CP				12.24 @ 86 F			28.22			
43	HEAT: LATENT BTU/LB				12.24 @ 86 F			35.02			
44	THERM. COND: 1.2 VAP. LIQ.				12.24 @ 86 F			35.02			
45	TEMPERATURE F				-49			30			
46	OPERATING PRESSURE psig				.4			30			
47	VELOCITY FPS				—			—			
48	NO. PASSES				—			—			
49	PRESSURE DROP psi				ALLOW 4 1.0 CALC			ALLOW 3.0 (MAX) CALC			
50	FOULING RESISTANCE (MIN.)				.001			.002			
51	PRESSURE, psig				DESIGN 250 TEST			DESIGN 250 TEST			
52	DESIGN TEMPERATURE, DEG. F				125 F - 50			125 F - 50			
53	CORROSION ALLOWANCE: IN.				1/8			—			
54	MTD (WTD) (CORR) F				—			—			
55	TRANSFER RATE SERVICE				CLEAN			HEAT EXCHANGED, BTU/HR 83,800			
56	WEIGHTS PER SHELL: SHIPPING				lb: FULL OF WATER			lb: BUNDLE			
57	NOTES: THE CALCULATED SERVICE HEAT TRANSFER RATE (OUTSIDE TUBE AREA OR EXTENDED AREA) IS TO BE DECREASED BY 10 PERCENT FOR ALL										
58	DESIGN CALCULATIONS.										
59	SUPPLIER TO COMPLETE FORM BY FURNISHING INFORMATION FOR BLANK SPACES										

4-421-S

SHEET 2 OF 3 REV.

CWH 000012416

SHELL AND TUBE EXCHANGER SPECIFICATIONS
RAIL CAR VENT RECOVERY SYSTEM
LAKE CHARLES VCM PLANT

Item No. NH-1

Service Refrigerated Vent Condenser

Notes:

1. Summer operating conditions are shown on Sheet 1 of 3.
Winter operating conditions are shown on Sheet 2 of 3.
2. Exchanger tube size, length, and pitch may be adjusted
for optimum exchanger design.
3. Vent Gas Composition - Summer Conditions

	<u>Vent Gas In</u>	<u>Vent Gas Out</u>
VCM	70.64 Mol %; 1622 lbs/hr.	3.62 Mol %; 25 lbs/hr.
Nitrogen	29.36 Mol %; 302 lbs/hr.	96.38 Mol %; 302 lbs/hr.

4. Vent Gas Composition - Winter Conditions

	<u>Vent Gas In</u>	<u>Vent Gas Out</u>
VCM	52.80 Mol %; 540 lbs/hr.	9.28 Mol %; 50 lbs/hr.
Nitrogen	47.20 Mol %; 216 lbs/hr.	90.72 Mol %; 216 lbs/hr.

CWH 000012417

Instrument List
 Rail Car Vent Recovery System
 Lake Charles VCM Plant
 Page 2

Inst. No.	Type	Location	Element		Remarks
			Type	Location	
NRV-1	Relief Valve	Line VCA-1	Spring	Line VCA-1	Thermal Relief
NRV-2	Relief Valve	Line VCA-7	Spring	Line VCA-7	Thermal Relief
NRV-3	Relief Valve	NH-1	Spring	NH-1	Shell Side
NRV-4	Relief Valve	NH-1	Spring	NH-1	Tube Side
NRV-5	Relief Valve	NT-1	Spring	NT-1	
NRV-6	Relief Valve	Line VCA-8	Spring	Line VCA-8	Thermal Relief
NRV-7	Relief Valve	NH-2	Spring	NH-2	Shell Side
NRV-8	Relief Valve	NH-2	Spring	NH-2	Tube Side
NRV-9	Relief Valve	Line VCA-9	Spring	Line VCA-9	Thermal Relief

THESE
 ITEMS
 HAVE
 BEEN
 REMOVED

SHELL AND TUBE EXCHANGER SPECIFICATIONS
RAIL CAR VENT RECOVERY SYSTEM
LAKE CHARLES VCM PLANT

Item No. NH-2

Service Vent and Recovered VCM Heater

Notes:

1. Summer operating conditions are shown on Sheet 1 of 4 and winter conditions on Sheet 2 of 4. Heating requirements for VCM pumpout are shown on Sheet 3 of 4. Exchanger must perform satisfactorily at all conditions.
2. Exchanger is to be provided with a shell side expansion joint.
3. Exchanger tube size, length, and pitch may be adjusted for optimum exchanger design.
4. Vent Gas Compositions

	<u>Summer Conditions</u>	<u>Winter Conditions</u>
VCM	3.62 Mol %; 25 lbs/hr.	9.28 Mol %; 50 lbs/hr.
Nitrogen	96.38 Mol %; 302 lbs/hr.	90.72 Mol %; 216 lbs/hr.

5. Exchanger may be Brown Fintube or Type BEM or AEL.

CWH 000012419



ENGINEERING CENTER

PONCA CITY, OKLAHOMA
SPECIFICATION SHEET

A.F.E. NO. _____
DATE 3/6/74 W. O. NO. _____
MADE BY WDS I.N.O. NO. _____
APP'D BY _____ R.E.O. NO. _____
B. M. NO. _____ P. O. NO. _____

SHELL & TUBE EXCHANGERS.

PLANT LAKE CHARLES VCM PLANT PROJECT RAIL CAR VENT RECOVERY SYSTEM

1	ITEM NO. & TAG	SHELL SIDE				TUBE SIDE				SERVICE OF UNIT			
2		SHELL SIDE				TUBE SIDE				MANUFACTURER			
3	NOZZLES	NO	SIZE	RATING & PACING	NO.	SIZE	RATING & PACING	NO.	SIZE	RATING & PACING	NO.	SIZE	RATING & PACING
4	INLET	1	2	150 LB FLG R.F.	1	2	150 LB FLG R.F.	1	2	150 LB FLG R.F.	1	2	150 LB FLG R.F.
5	OUTLET	1	2	150 LB FLG R.F.	1	2	150 LB FLG R.F.	1	2	150 LB FLG R.F.	1	2	150 LB FLG R.F.
6	VENT	1	3/4	150 LB FLG R.F.	1	3/4	150 LB FLG R.F.	1	3/4	150 LB FLG R.F.	1	3/4	150 LB FLG R.F.
7	DRAIN	1	1	150 LB FLG R.F.	1	1	150 LB FLG R.F.	1	1	150 LB FLG R.F.	1	1	150 LB FLG R.F.
8	TEMP. CORR.												
9	PRESS. CORR.												
10	CHEM. CLEAN												
11	RELIEF	1	2	150 LB FLG R.F.	1	2	150 LB FLG R.F.	1	2	150 LB FLG R.F.	1	2	150 LB FLG R.F.
12	SLIP-ON NOZZLE FLANGES ALLOWED (YES) (NO)												
13	SLIP-ON END FLANGES ALLOWED (YES) (NO)												
14	GASKETS: SHELL												
15	CHANNEL												
16	FLOATING-HEAD COVER												
17	TEST RING REQUIRED (YES) (NO)												
18	SPARE GASKETS REQUIRED (YES) (NO)												
19	STACKING HIGH												
20	INSULATION THICKNESS IN.												
21	NO. TUBES OD 3/4 IN. MIN. THK. .083 IN.												
22	LENGTH FT. PITCH 1 IN. (SEE NOTE 1)												
23	SHELL DIAM IN. 10.00 MAX. BUNDLE DIAM ALLOW IN.												
24	TRANSVERSE BAFFLE TYPE SPACING IN.												
25	PERCENT CUT (VERT.) (HORIZ.) (45 DEG)												
26	LONG BAFFLE TYPE IMPINGEMENT BAFFLE (YES) (NO)												
27	TEMA CLASS R YES ASME CODE REQ'D YES												
28	PERFORMANCE OF ONE UNIT												
29	SHELL SIDE												
30	TUBE SIDE												
31	FLUID CIRCULATED 50 LB. STEAM VENT GAS VAPORS												
32	TOTAL FLUID ENTERING, lb/hr 12.8 327 (SEE NOTE 1)												
33	IN OUT IN OUT												
34	VAPOR, lb/hr 25 25												
35	LIQUID, lb/hr 12.8 12.8												
36	STEAM, lb/hr 12.8 12.8												
37	WATER, lb/hr 12.8 12.8												
38	NONCONDENSABLES, lb/hr 302 302												
39	GRAVITY: SG @ 60°F TEMP 1.0 1.0												
40	MOL. WT: VAPOR 18.02 18.02												
41	MOL. WT: NONCONDENSABLES 29.25 29.25												
42	VISCOSITY: LIQUID, CP 1.0 1.0												
43	HEAT: LATENT BTU/LB 1000 1000												
44	THERM. COND. BTU/HR-FT-DEG F 1.0 1.0												
45	TEMPERATURE F 297 297												
46	OPERATING PRESSURE psig 50 100												
47	VELOCITY FPS 1 1												
48	NO. PASSES 1 1												
49	PRESSURE DROP psi ALLOW 10 CALC 10 10												
50	FOULING RESISTANCE (MIN.) 0.0005 0.0005												
51	PRESSURE, psig DESIGN 170 TEST 300 170 300												
52	DESIGN TEMPERATURE, DEG. F 350 350												
53	CORROSION ALLOWANCE: IN. 1/16 1/16												
54	MTD (WTD) (CORR) F 11,700 11,700												
55	TRANSFER RATE: SERVICE CLEAN												
56	WEIGHTS PER SHELL: SHIPPING lb; FULL OF WATER lb; BUNDLE lb;												
57	NOTES: THE CALCULATED SERVICE HEAT TRANSFER RATE (OUTSIDE TUBE AREA OR EXTENDED AREA) IS TO BE DECREASED BY 10 PERCENT FOR ALL												
58	DESIGN CALCULATIONS.												
59	SUPPLIER TO COMPLETE FORM BY FURNISHING INFORMATION FOR ALL SPACES SHEET 1 OF 4 REV												



ENGINEERING CENTER

PONCA CITY, OKLAHOMA
SPECIFICATION SHEET

A.F.E. NO. _____

DATE 3/6/74

MADE BY WDS

APP'D BY _____

B.M. NO. _____

W.O. NO. _____

INO. NO. _____

REQ. NO. _____

P.O. NO. _____

SHELL & TUBE EXCHANGERS

PLANT LAKE CHARLES VCM PLANT

PROJECT RAIL CAR VENT RECOVERY SYSTEM

ITEM NO. & TAG		SHELL SIDE				TUBE SIDE				SERVICE OF UNIT		
		NO.	SIZE	RATING & FACING	NO.	SIZE	RATING & FACING					
1	NH-2 (WINTER OPER. COND.)										VENT AND RECOVERED VCM HEATER	
2	MANUFACTURER											
3	NOZZLES	NO.	SIZE	RATING & FACING	NO.	SIZE	RATING & FACING	SIZE	TYPE SEE NOTE 5 (HORIZ) (VERT)			
4	INLET	1	2	150LB. FLG. R.F.	1	2	150LB. FLG. R.F.	CONNECTED IN	() PARALLEL () SERIES			
5	OUTLET	1	2	150LB. FLG. R.F.	1	2	150LB. FLG. R.F.	EFF. SURF. PER UNIT	sq ft			
6	VENT	1	3/4	6000LB. G.P.L.G.				SHELLS PER UNIT	1	SHELL DIAM	IN.	
7	DRAIN	1	1	150LB. FLG. R.F.				EFF. SURF. PER SHELL	sq ft			
8	TEMP. CONN.							NO. TUBES PER SHELL	LENGTH IN.			
9	PRESS. CONN.							UNITS REQ'D.	/			
10	CHEM. CLEAN				2	1 1/2	150LB. FLG. R.F.	DELIVERY, WEEKS				
11	RELIEF	1	2	150LB. FLG. R.F.	1	2	150LB. FLG. R.F.	PRICE, PER UNIT				
12	SLIP-ON NOZZLE FLANGES ALLOWED (YES) (NO)							EST. FREIGHT COST				
13	SLIP-ON END FLANGES ALLOWED (YES) (NO)							TOTAL PRICE				
14	GASKETS: SHELL							DOLLARS PER SQUARE FOOT				
15	CHANNEL							MATERIALS: (MARK SR AND PERCENT XR)				
16	FLOATING-HEAD COVER							ITEM	MAT'L	DEG. F	SPECIFICATION	
17								TUBES				
18	TEST RING REQUIRED (YES) (NO)							SHELL				
19	SPARE GASKETS REQUIRED (YES) (NO)							SHELL COVER (REM) (INTEG)				
20	STACKING HIGH							CHANNEL	SS	15	AN	
21	INSULATION THICKNESS IN.							CHANNEL COVER (REM) (INTEG)	ACCEPTABLE			
22	NO. TUBES OD 3/4 IN.: MIN. THK. .083 IN.							FLOATING-HEAD COVER	ALTERNATE			
23	LENGTH FT. PITCH 1 IN. () () ()							TUBE SHEETS	MATERIAL			
24	SHELL DIAM IN. 10 D. MAX BUNDLE DIAM ALLOW IN.							BAFFLES AND SUPPORT PLATES				
25	TRANSVERSE BAFFLE TYPE SPACING IN.							BOLTING: SHELL COVER				
26	PERCENT CUT (VERT.) (HORIZ.) (45 DEG)							CHANNEL				
27	LONG BAFFLE TYPE IMPINGEMENT BAFFLE (YES) (NO)							FLOATING HEAD				
28	TEMA CLASS R YES ASME CODE REQ'D YES							CHANNEL COVER				
29	PERFORMANCE OF ONE UNIT											
30												
31	FLUID CIRCULATED				SHELL SIDE				TUBE SIDE			
32	TOTAL FLUID ENTERING, lb/hr				50 LB. STEAM				VENT GAS VAPORS			
33					5.0				266 (SEE NOTE 1)			
34	VAPOR, lb/hr				IN OUT				IN OUT			
35	LIQUID, lb/hr								50 50			
36	STEAM, lb/hr				5.0							
37	WATER, lb/hr				5.0							
38	NONCONDENSABLES, lb/hr								216 216			
39	GRAVITY: () SG @ () TEMP				.98							
40	MOL. WT: VAPOR				18.02				31.20 31.20			
41	MOL. WT: NONCONDENSABLES				—				28.02 28.02			
42	VISCOSITY: LIQUID, CP				VAP. 0.15 @ 297 F				VAP. 0.15 @ -40 F			
43	HEAT: LATENT "Y" SP. "X"				VAP. 115 @ 297 F				VAP. 115 @ 30 F			
44	THERM. COND. "Y" SP. "X"				VAP. 126 @ 297 F				VAP. 126 @ 30 F			
45	TEMPERATURE F				297 297				-40 30			
46	OPERATING PRESSURE psig				50				30			
47	VELOCITY FPS											
48	NO. PASSES				1				1			
49	PRESSURE DROP psi				ALLOW 10 CALC				ALLOW 1.0 CALC			
50	FOULING RESISTANCE (MIN.)				.0025				.001			
51	PRESSURE, psig				DESIGN 170 TEST				DESIGN 300 TEST			
52	DESIGN TEMPERATURE, DEG. F				350				350			
53	CORROSION ALLOWANCE: IN.				1/8							
54	MTD (WTOI) (CORR) F								HEAT EXCHANGED, BTU/HR 4,600			
55	TRANSFER RATE: SERVICE				CLEAN							
56	WEIGHTS PER SHELL: SHIPPING lb:				FULL OF WATER lb:				BUNDLE lb:			
57	NOTES: THE CALCULATED SERVICE HEAT TRANSFER RATE (OUTSIDE TUBE AREA OR EXTENDED AREA) IS TO BE DECREASED BY 10 PERCENT FOR ALL DESIGN CALCULATIONS											
58	DESIGN CALCULATIONS											
59	SUPPLIER TO COMPLETE FORM BY FURNISHING INFORMATION FOR BLANK SPACES											

CW 00012421



ENGINEERING CENTER

PONCA CITY, OKLAHOMA
SPECIFICATION SHEET

A.F.E. NO. _____

DATE 3/6/74

MADE BY WDS

APP'D BY _____

B. M. NO. _____

W. O. NO. _____

INO. NO. _____

REQ. NO. _____

P. O. NO. _____

SHELL & TUBE EXCHANGERS.

PLANT LAKE CHARLES VCM PLANT

PROJECT RAIL CAR VENT RECOVERY SYSTEM

1	ITEM NO. & TAG <u>NH-2 PUMP-OUT SERVICE</u>						SERVICE OF UNIT <u>VENT AND RECOVERED VCM HEATER</u>			
2	SHELL SIDE			TUBE SIDE			MANUFACTURER			
3	NOZZLES	NO.	SIZE	RATING & FACING	NO.	SIZE	RATING & FACING	SIZE	TYPE <u>SEE NOTE 5 (HORIZ)</u>	
4	INLET	1	2	150 LB. FLG. R.F.	1	2	150 LB. FLG. R.F.	CONNECTED IN	() PARALLEL () SERIES	
5	OUTLET	1	2	150 LB. FLG. R.F.	1	2	150 LB. FLG. R.F.	EFF. SURF. PER UNIT	sq ft	
6	VENT	1	3/4	150 LB. FLG. R.F.				SHELLS PER UNIT	1	SHELL DIAM
7	DRAIN	1	1	150 LB. FLG. R.F.				EFF. SURF. PER SHELL	sq ft	
8	TEMP. COHN							NO. TUBES PER SHELL	LENGTH	
9	PRESS. COHN							UNITS REQ'D.	1	
10	CHEM. CLEAN				2	1 1/2	150 LB. FLG. R.F.	DELIVERY, WEEKS		
11	RELIEF	1	2	150 LB. FLG. R.F.	1	2	150 LB. FLG. R.F.	PRICE, PER UNIT		
12	SLIP-ON NOZZLE FLANGES ALLOWED (YES) (NO)							EST. FREIGHT COST		
13	SLIP-ON END FLANGES ALLOWED (YES) (NO)							TOTAL PRICE		
14	GASKETS: SHELL							DOLLARS PER SQUARE FOOT		
15	CHANNEL							MATERIALS: (MARK SR AND PERCENT XRI) TEMP		
16	FLOATING HEAD COVER							ITEM		
17								TUBES		
18	TEST RING REQUIRED <u>NO</u>							SHELL		
19	SPARE GASKETS REQUIRED (YES) (NO)							SHELL COVER (REM) (INTEG)		
20	STACKING HIGH							CHANNEL		
21	INSULATION THICKNESS IN.							CHANNEL COVER (REM) (INTEG)		
22	NO. TUBES OD 3/4 IN.: MIN. THK. .083 IN.							FLOATING HEAD COVER		
23	LENGTH FT. PITCH 1 IN. <u>1</u>							TUBE SHEETS		
24	SHELL DIAM IN. 10.0							BAFFLES AND SUPPORT PLATES		
25	TRANSVERSE BAFFLE TYPE SPACING							BOLTING: SHELL COVER		
26	PERCENT CUT (VERT.) (HORIZ.) (45 DEG)							CHANNEL		
27	LONG BAFFLE TYPE IMPINGEMENT BAFFLE (YES) (NO)							FLOATING HEAD		
28	TEMA CLASS R YES ASME CODE REQ'D YES							CHANNEL COVER		
29	PERFORMANCE OF ONE UNIT									
30										
31	FLUID CIRCULATED									
32	TOTAL FLUID ENTERING, lb/hr									
33	IN OUT									
34	VAPOR, lb/hr									
35	LIQUID, lb/hr									
36	STEAM, lb/hr									
37	WATER, lb/hr									
38	NONCONDENSABLES, lb/hr									
39	GRAVITY: <u>SG @ TEMP</u>									
40	MOL. WT: VAPOR									
41	MOL. WT: NONCONDENSABLES									
42	VISCOSITY: LIQUID, CP									
43	HEAT: LATENT BTU/LB									
44	THERM. COND: VAP. LIQ.									
45	TEMPERATURE F									
46	OPERATING PRESSURE psig									
47	VELOCITY FPS									
48	NO. PASSES									
49	PRESSURE DROP psi									
50	FOULING RESISTANCE (MIN.)									
51	PRESSURE, psig									
52	DESIGN TEMPERATURE, DEG. F									
53	CORROSION ALLOWANCE, IN.									
54	MTD (WTD) (CORR) F									
55	TRANSFER RATE: SERVICE									
56	WEIGHTS PER SHELL: SHIPPING lb; FULL OF WATER lb; BUNDLE lb;									
57	NOTES: THE CALCULATED SERVICE HEAT TRANSFER RATE (OUTSIDE TUBE AREA OR EXTENDED AREA) IS TO BE DECREASED BY 10 PERCENT FOR ALL DESIGN CALCULATIONS.									
58	DESIGN CALCULATIONS.									
59	SUPPLIER TO COMPLETE FORM BY FURNISHING INFORMATION FOR BLANK SPACES									

4-421-S

CWH 000012422

SHEET 3 OF 4 REV. _____



ENGINEERING CENTER

PONCA CITY, OKLAHOMA
SPECIFICATION SHEET

"SEAL-LESS"
CENTRIFUGAL PUMPS

A.F.E. NO. 3144

DATE 11-11-74

MADE BY RDM

APP'D BY _____

B.M. NO. _____

W. O. NO. _____

INO. NO. _____

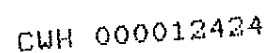
REQ. NO. _____

P. O. NO. _____

PLANT LOCATION LAKE CHARLES, LA. PROJECT RAIL CAR VENT RECOVERY SYSTEM
VCM PLANT

1	APPLICABLE TO: ESTIMATE () PURCHASE ()				VENDOR			
2	ITEM NO. <u>NP-1</u>				MANUFACTURER			
3	SERVICE <u>REFRIGERATED VCM RETURN PUMP</u>				SIZE AND TYPE			
4					STAGES			
5	MOTOR DRIVE () TURBINE ()				RPM			
6					ROTATION FACING CPLG.			
7	OPERATING CONDITIONS				DESIGN EFF.			
8	LIQUID <u>VINYL CHLORIDE</u> U.S. gpm at PT, NOR. <u>50</u> DES <u>50</u>				DESIGN B.H.P.			
9					MAX. B.H.P.			
10	PT F <u>-40</u> DISCH PRESS., psig <u>154</u>				HP DRIVER			
11	SP GR at PT <u>1.0</u> SUCT PRESS., psig MAX <u>199</u> DES <u>40</u>				DESIGN DIA. IMP.			
12	VAP PRESS. at PT, psia <u>4.15</u> DIFF PRESS., psi <u>105</u>				MAX. DIA. IMPELLER			
13	VIS at PT, <u>0.35 cP</u> DIFF HEAD, ft <u>342</u>				N.P.S.H. REQ. IN			
14	CORR/EROS caused by <u>NONE</u> NPSH AVAIL., ft <u>11</u>				FT. FLUID PUMPED			
15	HYD. H.P. = <u>3.06</u>							
16	CONSTRUCTION				MFRS. BEARING No.			
17	CASING MOUNTING (CENTERLINE) (FOOT) (BRACKET) (VERTICAL)				RADIAL			
18	SPLIT (AXIAL) (RADIAL)				THRUST			
19	TYPE (SINGLE VOLUTE) (DOUBLE VOLUTE) (DIFFUSER)							
20	TAPPED OPENINGS (VENT) (DRAIN) (GAGE CONNS.)				PACKING OR SEAL			
21	NOZZLES SIZE ASA RATING FACING POSITION				FLUSHING, GPM			
22	SUCTION <u>3</u> <u>150"</u> <u>RF</u>							
23	DISCHARGE <u>2</u> <u>150"</u> <u>RF</u>							
24	MATERIAL CODE-EXTERNAL CASING INTERNAL PARTS				MATERIAL EXCEPTIONS BY VENDOR			
25	I-CAST IRON INTERNALS CODE I B S C X							
26	B-BRONZE IMPELLER I B (S) C <u>A334 GR.1 OR A516</u>							
27	S-STEEL INNER CASE PARTS I I (S) C <u>A334 GR.1 OR A-516</u>							
28	C-11-13% Cr. SLEEVE (PACKED) Cr Cr Af Af							
29	A-ALLOY SLEEVE (SEAL) C C C C (SEE REMARKS							
30	H-HARDENED WEAR PARTS I B Cr Cr <u>BELOW</u>)							
31	F-FACED SHAFT S S S S							
32	X-							
33	MOTOR DRIVER BY TURBINE DRIVER BY				WATER COOLING			
34	ITEM NO. MTD BY				BEARINGS			
35	HP RPM FRAME				STUFF BOX			
36	MFR				PEDESTAL			
37	OR COMPANY APP'D, EQUAL				GLAND			
38	TYPE ELEC. INSUL				TOTAL C.W. REQ.			
39	ENC <u>TEFC</u> * TEMP RISE C				COUPLING, MFR.			
40	VOLTS/PHASE/CYCLES <u>440/3/60</u>				COUPLING, TYPE			
41	BEARINGS LUBE				GUARD			
42	FULL LOAD AMPS				MECH. SEAL, MFR.			
43					MECH. SEAL, TYPE			
44	REMARKS: <u>1. AS AN ALTERNATE, QUOTE PUMP OF ALL</u>				PACKING			
45	<u>STAINLESS STEEL CONSTRUCTION.</u>							
46	<u>2. PUMP IS TO BE "SEAL-LESS" TYPE ONLY.</u>				DELIVERY, WEEKS			
47					PUMP PRICE			
48	PUMP IS TO BE MANUFACTURED IN ACCORDANCE WITH THE FOLLOWING STANDARDS.				DRIVER PRICE			
49					EST. FREIGHT			
50	() INDICATES ITEM CHANGED ON LATEST REVISION.				TOTAL PRICE			
* <u>LAKE CHARLES CHEMPUMP IS INHERENTLY A TEFC ENCLOSURE.</u>								
QUOTATION WILL NOT BE CONSIDERED IF SUPPLIER DOES NOT COMPLETE RIGHT HAND COLUMN.								
SHEET <u>1</u> OF <u>1</u> REV. <u>1</u>								

CWH 000012423



EQUIPMENT SPECIFICATIONS
RAIL CAR VENT RECOVERY SYSTEM
LAKE CHARLES VCM PLANT

Item No.: NPK-1

Service: Package Refrigeration Unit

Description:

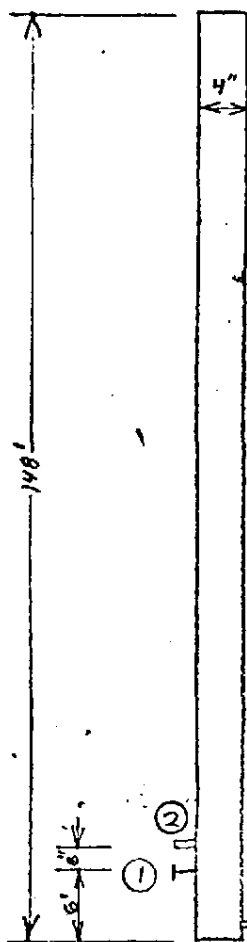
The package refrigeration unit is to supply refrigerant to a condenser at approximately -49°F . The refrigerant will be used to cool and partially condense a vent gas stream to -40°F . The inlet vent gas temperature will vary from $+100^{\circ}\text{F}$ (summer) to $+30^{\circ}\text{F}$ (winter) depending upon ambient temperature conditions. The system is to consist of a two stage compression system utilizing R-502 refrigerant or equivalent.

System Requirement:

1. Duty Requirements: Winter duty = 7.0 tons (83,800 BTU/hr)
Summer duty = 24.3 tons (291,800 BTU/hr)
Design duty = 30.0 tons (360,000 BTU/hr)
2. System is to be designed for intermittent service (approximately 8 hours/day) with fast simple startup and shutdown procedures. Provisions, such as a hot gas bypass loop, should be provided to permit system protection under zero load conditions.
3. As no cooling water is available, the system is to use air cooled exchanger(s) as required. Air cooled exchanger design conditions are:
93 $^{\circ}\text{F}$ Dry Bulb
80 $^{\circ}\text{F}$ Wet Bulb.
4. A fully automatic oil return and regulation system must be included in the design. Oil will be returned to the system via three 1-inch drawoff points located on the shell side of the condenser. Provisions to observe oil return flow, to separate oil and refrigerant, to heat oil, and to return oil to crankcase automatically as required are to be part of the package refrigeration unit.
5. System should provide for continuous heating in the oil reservoir and in the crankcase to maintain a constant oil viscosity during the shutdown periods.

Equipment Specifications
Rail Car Vent Recovery System
Lake Charles VCM Plant
Page 2

6. System should be so designed as to make liquid carryover to the compressor suctions impossible. Liquid knockout pots must be provided for all streams returning to compressor suction.
7. Electric Power Available: 440 volt
3 phase
60 cycle
8. Totally enclosed fan cooled enclosures are to be provided for all motors.
9. This item is to be supplied as a skid-mounted unit ready for installation and operation.
10. Vendor should supply a recommended spare parts list (if any are recommended.)
11. Vendor may include a proposal on NH-1 as an addendum to this design.



SEE NOTE 1

NOZZLE SCHEDULE

MARK NO.	NO. REQ.	SIZE	TYPE	SERVICE
1	1	4	FLG	PROCESS INLET
2	1	3/4	CPLG	SAMPLE TAP
3	1	1	CPLG	DRAIN

NOTES

1. STACK TO BE 4 IN. PIPE UNLESS LARGER DIAMETER REQUIRED BY STRUCTURAL CONSIDERATIONS.
2. STACK IS TO BE SUPPORTED AS REQUIRED BY GUY WIRES.
3. IF STACK IS LARGER THAN 4 IN. PIPE, A 4 IN. TIP ON TOP WILL BE REQUIRED FOR VENT GAS DISPERSION.
4. STACK OUTLET TO BE PROVIDED WITH FLAPPER & STRING
5. ALTERNATE MATERIAL OF CONSTRUCTION: SS IS ACCEPTABLE
6. BOTTOM OF STACK TO HAVE A SEALED END

CIF

DESIGN DATA

OPERATING TEMPERATURE, °F
DESIGN TEMPERATURE, °F
MATERIAL OF CONSTRUCTION

AMBIENT
100 MAX, -50 MIN
C.S. A-516
OR EQUIV.

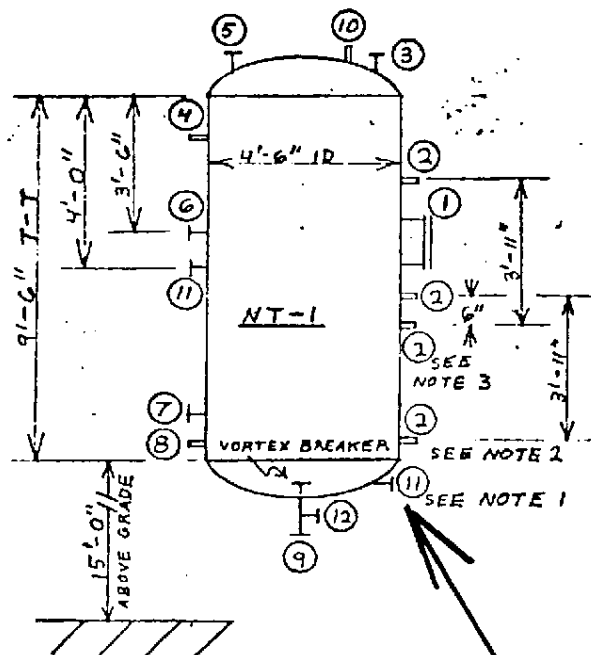
NST-1

VENT STACK

RAIL CAR VENT RECOVER
SYSTEM

CONOCO VCM PLANT

CWH 000012427



CNH 000012428

NOZZLE SCHEDULE

MARK NO.	NO. REQ	SIZE	TYPE	SERVICE
1	1	18	FLG	MANWAY W/COVER & DAVIT
2	4	3/4	CPLG	LEVEL GAUGE
3	1	1	FLG	VENT
4	1	3/4	CPLG	PRESSURE GAUGE
5	1	2	FLG	VAPOR OUTLET
6	1	3	FLG	PROCESS INLET
7	1	2	FLG	UTILITY CONNECTION
8	1	1	CPLG	TEMPERATURE GAUGE
9	1	3	FLG	LIQUID OUTLET
10	1	3/4	CPLG	PRESSURE CONTROLLER
11	2	2	FLG	LEVEL ALARM
12	1	2	FLG	DRAIN

NOTES

1. LOCATE LOW LEVEL ALARM AS CLOSE TO BOTTOM AS POSSIBLE
LOW LEVEL SHUT-OFF SWITCH TO BE PROVIDED TO SHUTDOWN NP-1
2. BOTTOM LEVEL GAUGE TO BE LOCATED AS CLOSE TO BOTTOM
TANGENT LINE AS IS PRACTICAL
3. TWO OVERLAPPING LEVEL GAGES WILL BE REQUIRED
4. ALTERNATE MATERIAL: 304SS WITH +
1/16" CORROSION ALLOWANCE

DESIGN DATA

OPERATING TEMPERATURE, °F	-40
DESIGN TEMPERATURE, °F	100 MAX, -50 MIN
OPERATING PRESSURE, PSIG	100
DESIGN PRESSURE, PSIG	180
INSULATION	5" CELLULAR GLASS OR EQUIVALENT
MATERIAL OF CONSTRUCTION	A-516 C.S. SEE NOTE 4
CORROSION ALLOWANCE	1/8"

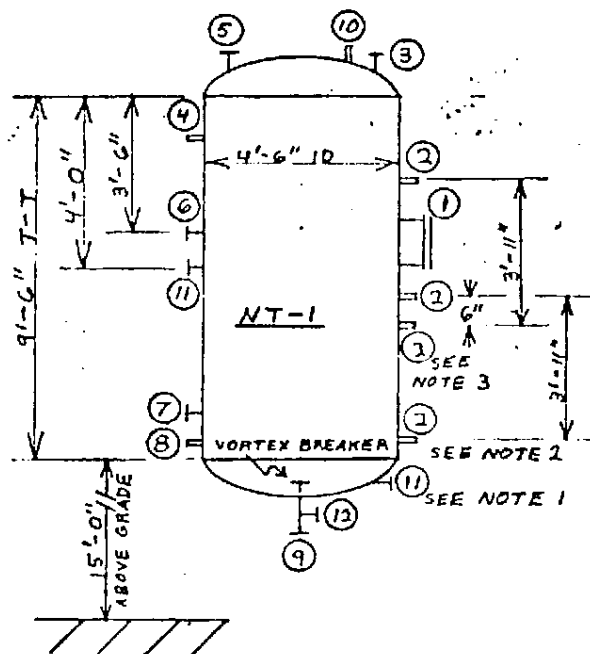
NT-1

REFRIGERATED VCM RECEIVER

RAIL CAR VENT RECOVERY SYSTEM

CONOCO VCM PLANT

LAKE CHARLES, LA.



NOZZLE SCHEDULE

MARK NO.	NO. REQ	SIZE	TYPE	SERVICE
1	1	18	FLG	MANWAY W/COVER & DAVIT
2	4	3/4	CPLG	LEVEL GAUGE
3	1	1	FLG	VENT
4	1	3/4	CPLG	PRESSURE GAUGE
5	1	2	FLG	VAPOR OUTLET
6	1	3	FLG	PROCESS INLET
7	1	2	FLG	UTILITY CONNECTION
8	1	1	CPLG	TEMPERATURE GAUGE
9	1	3	FLG	LIQUID OUTLET
10	1	3/4	CPLG	PRESSURE CONTROLLER
11	2	2	FLG	LEVEL ALARM
12	1	2	FLG	DRAIN

NOTES

1. LOCATE LOW LEVEL ALARM AS CLOSE TO BOTTOM AS POSSIBLE
LOW LEVEL SHUT-OFF SWITCH TO BE PROVIDED TO SHUTDOWN NP-1
2. BOTTOM LEVEL GAUGE TO BE LOCATED AS CLOSE TO BOTTOM
TANGENT LINE AS IS PRACTICAL
3. TWO OVERLAPPING LEVEL GAGES WILL BE REQUIRED
4. ALTERNATE MATERIAL: 304 SS WITH
1/16" CORROSION ALLOWANCE

DESIGN DATA

OPERATING TEMPERATURE, °F -40
 DESIGN TEMPERATURE, °F 100 MAX, -50 MIN
 OPERATING PRESSURE, PSIG 100
 DESIGN PRESSURE, PSIG 180
 INSULATION 5" CELLULAR GLASS OR EQUIVALENT
 MATERIAL OF CONSTRUCTION A-516 C.S. SEE NOTE 4
 CORROSION ALLOWANCE 1/8"

NT-1

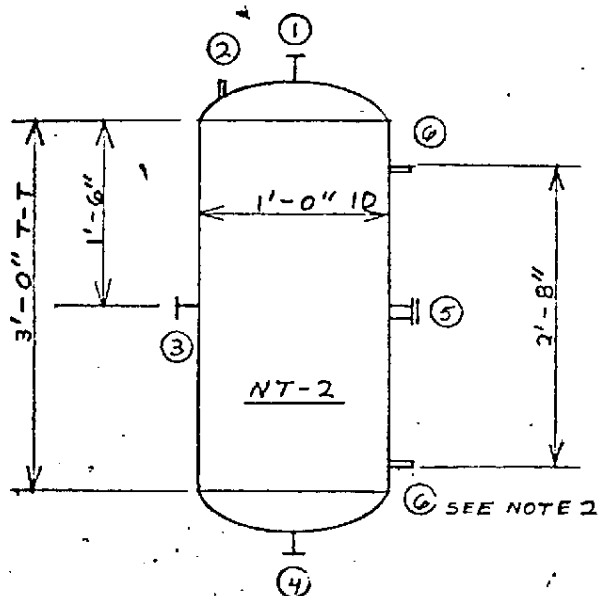
REFRIGERATED VCM RECEIVER

RAIL CAR VENT RECOVERY SYSTEM

CONOCO VCM PLANT

LAKE CHARLES, LA.

CMH 000012429



MARK NO.	NO. REQ.	SIZE	TYPE	SERVICE
1	1	4	FLG	PROCESS OUTLET
2	1	1	CPLG	VENT
3	1	4	FLG	PROCESS INLET
4	1	1	CPLG	DRAIN
5	1	8	FLG	HANDHOLE W/COVER
6	2	3/4	CPLG	LEVEL GAUGE

NOTE: 1. VESSEL MAY BE FABRICATED FROM 12 IN. C.S. (A-516) PIPE OR SS PIPE

2. BOTTOM LEVEL GAUGE CONNECTION TO BE LOCATED AS CLOSE TO BOTTOM TANGENT LINE AS IS PRACTICAL

3. ALTERNATE MATERIAL OF CONSTRUCTION: SS IS ACCEPTABLE

CWH 000012430

DESIGN DATA

OPERATING TEMPERATURE, °F AMBIENT
 DESIGN TEMPERATURE, °F 100 MAX, -50 MIN
 OPERATING PRESSURE, PSIG 0
 DESIGN PRESSURE, PSIG 200
 MATERIAL OF CONSTRUCTION A-516 C.S.
 CORROSION ALLOWANCE 1/8"

NT-2

VENT STACK K.O. DRUM

RAIL CAR VENT RECOVERY SYSTEM

CONOCO VCM PLANT

PIPING
SCHEDULE

PROCESS PIPING SCHEDULE
PROCESS ENGINEERING DEPARTMENT

Date 2-22-74 Made By WPS
Project RAIL CAR VENT RECOVER. SYSTEM
Plant LAKE CHARLES VCM PLANT

Line Designation	Service		V L	Flow Rate Lb/Hr	Normal		At T and P		Press Drop PSI/ 100'	Velocity Ft/Sec	Remarks
	From	To			°F	PSIG	Lb/CF	Visc Cp			
4 - VCA-1	VCM Loading Head	RAIL CARS	L	105918	100	-	55.1	0.16	1.09	6.0	C.S. LINE
3 - VCA-2	RAIL CAR	NH-1	V	1924	100	100	1.0	0.013	.09	10.4	C.S. LINE
3 - VCA-3	NH-1	NT-1	V	1924	-40	100	-	-	.03	2.5	A-516 C.S. OR 304 S.S.
2 - VCA-4	NT-1	NH-2	V	327	-40	100	0.1	0.018	.23	40.9	A-516 C.S. OR 304 S.S.
4 - VCA-5	NH-2	NT-2	V	327	100	-	0.1	0.018	-	-	A-516 C.S. OR 304 S.S.
4 - VCA-6	NT-2	NST-1	V	327	100	-	0.1	0.018	-	-	A-516 C.S. OR 304 S.S.
3 - VCA-7	NT-1	NP-1	L	25000	-40	-	62.3	0.35	.25	2.2	A-516 C.S. OR 304 S.S.
2 - VCA-8	NP-1	NH-2	L	25000	-40	-	62.3	0.35	1.82	4.8	A-516 C.S. OR 304 S.S.
2 - VCA-9	NH-2	P-490 DISCH.	L	25000	-15	-	62.3	0.35	1.82	4.8	A-516 C.S. OR 304 S.S.
3 - VCA-10	T-490 PCV	LINE VCA-2	V	-	-	-	-	-	-	-	A-516 C.S. OR 304 S.S.
4 - VCA-11	NRV-5	LINE VCA-5	V	-	-40	-	-	-	-	-	A-516 C.S. OR 304 S.S.
3 - VCA-12	NRV-8	LINE VCA-5	V	-	-40	-	-	-	-	-	A-516 C.S. OR 304 S.S.
2 - RX-1	NPK-1	NH-1	L	5801	-50	-	76.1	0.24	.09	0.9	A-516 C.S. OR 304 S.S.
6 - RX-2	NH-1	NPK-1	V	5801	-50	-	0.4	0.013	.06	21.0	A-516 C.S. OR 304 S.S.
1 - RX-3	NH-1	NPK-1 (OIL DRAIN)	L		-50	-					A-516 C.S. OR 304 S.S.
1 - RX-4	NH-1	NPK-1 (OIL DRAIN)	L		-50	-					A-516 C.S. OR 304 S.S.
1 - RX-5	NH-1	NPK-1 (OIL DRAIN)	L		-50	-					A-516 C.S. OR 304 S.S.

CWH 000012432

PROCESS PIPING SCHEDULE
PROCESS ENGINEERING DEPARTMENT

Date 2-22-74 Made By WDS
Project RAIL CAR VENT RECOV. SYSTEM
Plant LAKE CHARLES VCM PLANT

[illegible]

INSTRUMENT
SPECS.

INSTRUMENT LIST
RAIL CAR VENT RECOVERY SYSTEM
LAKE CHARLES VCM PLANT

Inst. No.	Type	Location	Element		Remarks
			Type	Location	
IFIC-1	Flow Indicating Controller	Line VCA-1	Orifice	Line VCA-1	4" C.V. Fails Closed
ILC-1	Level Control	Line RX-1	Ext. Float	NH-1	2" C.V.
IPC-1	Pressure Control	Line VCA-5	Bourdon Tube	NT-1	2" C.V. Fails Open
ITC-1	Temperature Control	Line SL-1	Filled Bulb	Line VCA-5	2" C.V. Fails Closed
ITC-2	Temperature Control	Line VCA-1	Filled Bulb	Line VCA-1	Resets NPC-1
FI-1	Flow Indicator	Line N-1	Rotameter	Line N-1	--
LA-1	High Level Alarm	NT-1	Float	NT-1	Local Alarm Sounds
LA-2	Low Level Alarm	NT-1	Float	NT-1	Local alarm sounds and shuts off NP-1
TG-1	Temperature Gauge	Line VCA-2	Bimetallic	Line VCA-2	
TG-2	Temperature Gauge	Line RX-1	Bimetallic	Line RX-1	
TG-3	Temperature Gauge	Line RX-2	Bimetallic	Line RX-2	
TG-4	Temperature Gauge	NT-1	Bimetallic	NT-1	
TG-5	Temperature Gauge	Line VCA-5	Bimetallic	Line VCA-5	
TG-6	Temperature Gauge	Line VCA-1	Bimetallic	Line VCA-1	
LG-1	Level Gauge	NH-1	Reflex	NH-1	
LG-2	Level Gauge	NT-1	Reflex	NT-1	
LG-3	Level Gauge	NT-1	Reflex	NT-1	
LG-4	Level Gauge	NT-2	Reflex	NT-2	
PG-1	Pressure Gauge	Line RX-1	Bourdon Tube	Line RX-1	
PG-2	Pressure Gauge	Line RX-2	Bourdon Tube	Line RX-2	
PG-3	Pressure Gauge	NT-1	Bourdon Tube	NT-1	
PG-4	Pressure Gauge	Line VCA-8	Bourdon Tube	Line VCA-8	

CWH 000012435

RE-DO EX. LG ON EX. V.O. PUT

I SHOULD PURCHASE NLG-2 & 3



ENGINEERING CENTER
PONCA CITY, OKLAHOMA
SPECIFICATION SHEET
FLOW INSTRUMENTS

A.F.E. NO. _____
DATE 2-28-74 W.O. NO. _____
MADE BY DEM INQ. NO. _____
APP'D BY _____ REQ. NO. _____
B.M. NO. _____ P.O. NO. _____

PLANT LAKE CHARLES VCM PLANT PROJECT RAIL CAR VENT RECOVERY SYSTEM

1	TAG NO.	<u>NFIC-1</u>		<u>FIG-473</u>	<u>BUYING NEW FROM FIELD</u>
2	SERVICE	<u>VINYL CHLORIDE</u>			
3		<u>LIQUID</u>			
4	INSTRUMENT TYPE	<u>Flow Indicating Contr.</u>		<u>TRANS. 1/2" 4P CELL</u>	
5	LOCATION	<u>LOCAL</u>		<u>45 L. IND. CONTR.</u>	
6	ELEMENT TYPE	<u>ORIFICE</u>			
7	LOCATION	<u>LINE VCA-1</u>			
8	LINE SIZE, IN.	<u>4</u>	<u>40</u>		
9	BORE, IN.	<u>2.665</u>			
10	RANGE, IN. H ₂ O	<u>0 - 200</u>			
11	METER FACTOR	<u>FULL RANGE - 400 gpm</u>			
12	VALVE TYPE	<u>EC BODY</u>			
13		<u>Eq. PERCENT.</u>			
14	LOCATION	<u>LINE VCA-1</u>			
15	MATERIAL	<u>CARBON STEEL</u>			
16	BODY SIZE	<u>4" 4 3/8"</u>			
17	PLUG FORM	<u>FULL SIZE TRIM</u>			
18	ΔP MIN	<u>0</u>	<u>10</u>	<u>170</u>	
19	CALC CN	<u>73</u>	<u>16 @ 60%</u>		
20	AIR TO OPEN OR CLOSE	<u>CLOSE ON AIR FAIL.</u>			
21	MAX. SHUTOFF ΔP	<u>200 PSIG</u>			
22	FLUID	<u>VINYL CHLORIDE LIQ.</u>			
23	TEMPERATURE OF	<u>60</u>			
24	PRESSURE PSIG	<u>100</u>			
25	ϕ API (M.W.)	<u>(62.50)</u>			
26	SP. GR. AT STD. COND.	<u>0.92</u>			
27	SP. GR. AT P. & T.	<u>0.92</u>			
28	CP/CV AT T. & P.	<u>1.18</u>	<u>-</u>		
29	VISCOSITY AT P. & T.	<u>0.20 cp.</u>			
30	RATE NORMAL	<u>240 gpm</u>			
31	RATE MAX	<u>400 gpm</u>	<u>0</u>		
32	NOTES	<u>FLOW INDICATOR TO BE LOCATED IN EACH LOADING SHACK</u>			

CWH 000012436



ENGINEERING CENTER
PONCA CITY, OKLAHOMA
SPECIFICATION SHEET
LIQUID LEVEL INSTRUMENTS

A.F.E. NO. _____
DATE 2-28-74 W. O. NO. _____
MADE BY DET INQ. NO. _____
APP'D BY _____ REQ. NO. _____
B. M. NO. _____ P. O. NO. _____

PLANT LAKE CHARLES VCM PLANT PROJECT RAIL CAR VENT RECOVERY SYSTEM

1	TAG NO.	<u>NLC-1</u>		(PART OF LIFTING PACKAGE)	
2	SERVICE	<u>R-502 REFRIGERANT</u>			
3					
4	INSTRUMENT TYPE	<u>LEVEL CONTROLLER</u>			
5	LOCATION	<u>LOCAL</u>			
6	ELEMENT TYPE	<u>EXT. FLOAT</u>			
7	LOCATION	<u>NH-1</u>			
8	RANGE, INCHES	<u>12 IN.</u>			
9	INTERFACE	<u>VAPOR / LIQUID</u>			
10	UPPER DENSITY, LB./CU. FT.	<u>0.4</u>			
11	LOWER DENSITY, LB./CU. FT.	<u>76.1</u>			
12	TEMPERATURE °F	<u>-50</u>			
13	PRESSURE PSIG	<u>0</u>			
14	VALVE TYPE	<u>EC BODY</u>			
15		<u>LINEAR</u>			
16	LOCATION	<u>LINE RX-1</u>			
17	MATERIAL	<u>304 SS</u>			
18	BODY SIZE	PORT SIZE	<u>2</u>	<u>2 5/16</u>	
19	PLUG FORM	<u>FULL SIZE TRIM</u>			
20	ΔP	MIN.	NOR.	MAX.	
21	CALC. CV	VALVE CV		<u>15.3 @ 100%</u>	
22	AIR TO OPEN OR CLOSE	<u>CLOSE ON AIR FAIL.</u>			
23	MAXIMUM SHUTOFF ΔP	<u>220 PSIG</u>			
24	FLUID	<u>R-502 REFRIGERANT</u>			
25	TEMPERATURE °F	<u>-50</u>			
26	PRESSURE PSIG	<u>0</u>			
27	°API (H.W.)	<u>(111.6)</u>			
28	SP. GR. AT STD. COND.	<u>-</u>			
29	SP. GR. AT P. & T.	<u>1.22</u>			
30	WEIGHT % VAPOR IN-OUT	<u>0 - 100</u>			
31	VISCOSITY AT P. & T.	<u>.24 cp.</u>			
32	RATE, NORMAL	<u>5801 LBS/HR</u>			
33	RATE:				
34	MAX.	MIN.	<u>-</u>	<u>0 LBS/HR</u>	
35	NOTES:				

INSTRUMENT CONNECTIONS ON 'NH-1' ARE 150 LB. R.F. SIZE 1 1/2 IN.
VALVE SIZE TO BE CONFIRMED BY REFRIGERATION SYSTEM VENDOR

CWH 000012437



ENGINEERING CENTER

PONCA CITY, OKLAHOMA

SPECIFICATION SHEET

PRESSURE INSTRUMENTS

A.F.E. NO. _____

DATE 2-28-74

W. O. NO. _____

MADE BY PGM

INO. NO. _____

APP'D BY _____

REQ. NO. _____

B. M. NO. _____

P. O. NO. _____

PLANT LAKE CHARLES VCM PLANT PROJECT RAIL CAR VENT RECOVERY SYSTEM

1	TAG NO.	<u>NPC-1 PIC-496 (FLOWING FROM FISHER)</u>		
2	SERVICE	<u>VCM-N₂ VAPOR</u>		
3				
4	INSTRUMENT TYPE	<u>PRESSURE CONT.</u>		
5	LOCATION	<u>LOCAL</u>		
6	RANGE, PSIG	<u>0-150</u>		
7	ELEMENT			
8	TYPE	MATERIAL	<u>Bour. Tube 304 SS</u>	
9	LOCATION	<u>NT-1</u>		
10	TEMPERATURE °F	<u>-40</u>		
11	PRESSURE PSIG	<u>100 psig</u>		
12	VALVE TYPE	<u>EE BODY 57 EE</u>		
13		<u>Equal. Percent.</u>		
14	LOCATION	<u>LINE VCA-5</u>		
15	MATERIAL	<u>304 SS</u>		
16	BODY SIZE	PORT SIZE	<u>2 1</u>	
17	PLUG FORM	<u>MICRO-FLUTE</u>		
18	ΔP	MIN.	NOR.	MAX.
		<u>0</u>	<u>100</u>	<u>250</u>
19	CALC. CV	VALVE CV	<u>50 70-50%</u>	
20	AIR TO OPEN OR CLOSE	<u>OPEN ON AIR FAIL.</u>		
21	MAX. SHUTOFF ΔP	<u>250 psig</u>		
22	FLUID	<u>N₂ VCM VAPOR</u>		
23	TEMPERATURE °F	<u>100</u>		
24	PRESSURE PSIG	<u>100</u>		
25	°API (M. W.)	<u>(30)</u>		
26	SP. GR. AT STD. COND.	<u>1.03</u>		
27	SP. GR. AT P. & T.	<u>-</u>		
28	WEIGHT % VAPOR IN-OUT	<u>100-100</u>		
29	VISCOSITY AT P. & T.	<u>.018</u>		
30	RATE, NORMAL	<u>327 Lbs/Hr</u>		
31	RATE	MAX.	MIN.	
		<u>28700 SCFH</u>	<u>0</u>	
32	NOTES	<u>@ 70-62.5</u>		

Instrument Connection is $\frac{3}{4}$ in CPLG (600016)
NPC-1 TO BE RESET BY NTC-2 SUCH THAT THE SET
PRESSURE, IN PSIG, EQUALS THE FLOWING TEMPERATURE
OF THE VCM, IN °F.

CWH 000012438



ENGINEERING CENTER
PONCA CITY, OKLAHOMA
SPECIFICATION SHEET
TEMPERATURE INSTRUMENTS

A.F.E. NO. _____
DATE 2-28-74 W.O. NO. _____
MADE BY DEA INQ. NO. _____
APP'D BY _____ REQ. NO. _____
B.M. NO. _____ P.O. NO. _____

PLANT LAKE CHARLES VCM PLANT PROJECT RAIL CAR VENT RECOVERY SYSTEM

1	TAG NO.	NTC-1 (2)	NTC-2		
2	SERVICE	50 PSIG STEAM	VCM LIQUID		
3					
4	INSTRUMENT TYPE	TEMP. CONTROLLER	TEMP. CONTROLLER		
5	LOCATION	LOCAL	LOCAL		
6	RANGE °F	-20 TO 100	20 TO 120		
7	ELEMENT, TYPE	FILLED BULB	FILLED BULB		
8	LOCATION	LINE VCA-5	LINE VCA-1		
9	TEMPERATURE °F	-20 TO 100	20 TO 120		
10	PRESSURE PSIG	100	100		
11	VALVE TYPE	ES BODY	SEE NOTE 1		
12		EQUAL PERCENT.			
13	LOCATION	LINE SL-1			
14	MATERIAL	CARBON STEEL			
15	BODY SIZE	2	3/4		
16	PLUG FORM	MICRO-FORM			
17	ΔP	MIN. 0	NOR. 5	MAX. 50	
18	CALC. CV	VALVE CV	5.8	4.8	60%
19	AIR TO OPEN OR CLOSE	CLOSE ON AIR FAIL.			
20	MAX SHUTOFF ΔP	50			
21	FLUID	50 PSIG STEAM			
22	TEMPERATURE °F	297			
23	PRESSURE PSIG	50			
24	°API (M.W.)	(18.02)			
25	SP. GR. AT STD. COND.	0.62			
26	SP. GR. AT P & T.				
27	WEIGHT % VAPOR IN-OUT	100-100			
28	VISCOSITY AT P & T	.015			
29	RATE, NORMAL	175			
30	RATE				
31	MAX	MIN	580	0	
32	NOTES				

1. NTC-2 RESETS NPC-1 SUCH THAT THE SET PRESSURE IN PSIG EQUALS THE VCM TEMPERATURE, IN °F

(2) RE-USE SALVAGED CONTROLLER.

CWH 000012439



ENGINEERING CENTER

PONCA CITY, OKLAHOMA

SPECIFICATION SHEET

LIQUID LEVEL INSTRUMENTS

A.F.E. NO. _____

DATE 2-28-74

W. O. NO. _____

MADE BY DEM

INQ. NO. _____

APP'D BY _____

REQ. NO. _____

B. M. NO. _____

P. O. NO. _____

PLANT LAKE CHARLES VCM PLANT PROJECT RAIL CAR VENT RECOVERY SYSTEM

1	TAG NO.	NLA-1	NLA-2		
2	SERVICE	VINYL CHLORIDE	VINYL CHLORIDE		
3		LIQUID	LIQUID		
4	INSTRUMENT TYPE	HIGH LEVEL ALARM	LOW LEVEL ALARM		
5	LOCATION	LOCAL	LOCAL		
6	ELEMENT TYPE	FLOAT	FLOAT		
7	LOCATION	NT-1	NT-1		
8	RANGE, INCHES	ON - OFF	ON - OFF		
9	INTERFACE	VAPOR/LIQUID	VAPOR/LIQUID		
10	UPPER DENSITY, LB./CU. FT.	0.1	0.1		
11	LOWER DENSITY, LB./CU. FT.	62.3	62.3		
12	TEMPERATURE °F	-40	-40		
13	PRESSURE PSIG	100	100		
14	VALVE TYPE	NONE	NONE		
15					
16	LOCATION				
17	MATERIAL				
18	BODY SIZE				
19	PORT SIZE				
20	PLUG FORM				
21	ΔP	MIN.	NOR.	MAX.	
22	CALC. Cv				
23	VALVE Cv				
24	AIR TO OPEN OR CLOSE				
25	MAXIMUM SHUTOFF ΔP				
26	FLUID				
27	TEMPERATURE °F				
28	PRESSURE PSIG				
29	ρAPI (M.W.)				
30	SP. GR. AT STD. COND.				
31	SP. GR. AT P. & T.				
32	WEIGHT % VAPOR IN-OUT				
33	VISCOSITY AT P. & T.				
34	RATE, NORMAL				
35	RATE:				
36	MAX.				
37	MIN.				
38	NOTES:				

- (1) FLOAT MATERIAL TO BE A-516 C.S. OR 304SS.
- (2) VESSEL CONNECTIONS ARE 2IN 150 LB FLG R.F.
- (3) HIGH AND LOW LEVEL ALARMS ON NT-1 TO SOUND LOCAL ALARM. THE SAME SOUND DEVICE MAY BE USED FOR BOTH ALARMS.
- (4) LOW LEVEL ALARM TO ACTIVATE PUMP NP-1 SHUT-DOWN AUTOMATICALLY

CWH 000012440



ENGINEERING CENTER

PONCA CITY, OKLAHOMA

SPECIFICATION SHEET

TEMPERATURE GAUGES

A.F.E. NO. _____

DATE 3/9/74

W.O. NO. _____

MADE BY YDS

INO. NO. _____

APP'D BY _____

REQ. NO. _____

B.M. NO. _____

P.O. NO. _____

PLANT LAKE CHARLES VCM PLANT

PROJECT RAIL CAR VENT RECOVERY SYSTEM

1	TAG		INSTRUMENT	OPERATING	
2	NO.	SERVICE	RANGE OF (1)	TEMP. OF	LOCATION
3	NTG-1	VCM+NITROGEN VAPOR	20 TO 120	AMBIENT	LINE VCA-2
4	NTG-2	P-502 LIQUID	-80 TO 120	-80 TO 120	LINE PX-1
5	NTG-3	P-502 VAPOR	-80 TO 120	-80 TO 120	LINE PX-2
6	NTG-4	VCM LIQUID	-80 TO 120	-80 TO 120	NT-1
7	NTG-5	(VCM LIQUID) & (N ₂ + VCM VAPOR)	-80 TO 120	-80 TO 120	LINE VCA-5
8	NTG-6	VCM LIQUID	20 TO 120	AMBIENT	LINE VCA-1
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
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39					

(1) ALL GAUGE ELEMENTS TO BE BIMETALLIC UNLESS OTHERWISE NOTED.

CWH 000012441

SHEET 1 OF 1 REV _____

FLOW INDICATOR SPECIFICATION
RAIL CAR VENT RECOVERY SYSTEM
LAKE CHARLES VCM PLANT

Tag No.	NFI-1
Type	Rotameter
Location	Line N-1
Stream Material	Nitrogen
Stream Pressure, psig	200
Stream Temperature, ° F	Ambient
Indicator Type	Visual Rotameter with Wheel Control (1)
Material	C.S.
Normal Flow SCFH	0-10
Line Size	1 in.
Connection	150 lb. Flg. R.F. 1/4" NPT @ 4 1/2" CENTER (SIDE INLET & OUTLET)

Note: (1) Rotameter is to be Brooks Instrument Company Sho-Rate Rotameter with ~~1-65~~ metering tube or equivalent.

3-633

LEVEL GAUGE SPECIFICATIONS
RAIL CAR VENT RECOVERY SYSTEM
LAKE CHARLES VCM PLANT

(PART OF MRP 1)
FIELD USE

(RE-USE EX. V.C.
OR EX. V.C. FOR)

Item No. Location	NLG-1 NH-1	NLG-2 NT-1	NLG-3 NT-1	NLG-4 NT-2
Upper Fluid	R-502 Vapor	VCM, N ₂ Vapor	VCM, N ₂ Vapor	VCM, N ₂ Vapor
Lower Fluid	R-502 Liquid	VCM Liquid	VCM Liquid	VCM Liquid
Operating Temp. ° F	-50	-40	-40	Ambient
Design Temp. ° F Max	100	100	100	100
Min	-50	-50	-50	-50
Operating Press., psig	0.4	30 to 100	30 to 100	0
Design Press., psig	250	125	125	125
Type Glass	Reflex	Reflex	Reflex	Reflex
Length (Approx.)	32 in.	47 in.	47 in.	32 in.
Material	SS	SS	SS	SS
Connection	1 in. FLG	3/4 in. CPLG	3/4 in. CPLG	3/4 in. CPLG

V151BLL

CUH 000012443



ENGINEERING CENTER

PONCA CITY, OKLAHOMA
SPECIFICATION SHEET
PRESSURE GAUGES

A.F.E. NO. _____
DATE 3/9/74 W.O. NO. _____
MADE BY YDS INQ. NO. _____
APP'D BY _____ REQ. NO. _____
B.M. NO. _____ P.O. NO. _____

PLANT LAKE CHARLES VCM PLANT PROJECT RAIL CAR VENT RECOVERY SYSTEM

1	TAG		INSTRUMENT	OPERATING	OPERATING	
2	NO.	SERVICE	RANGE, PSIG	PRESS, PSIG	TEMP, OF	LOCATION
3	<u>NPG-1</u>	<u>R-502 LIQUID</u>	<u>0-10</u>	<u>0.4 INTEL</u>	<u>-50</u>	<u>LINE RX-1</u>
4	<u>NPG-2</u>	<u>R-502 VAPOR</u>	<u>0-10</u>	<u>0.4 INTEL</u>	<u>-50</u>	<u>LINE RX-2</u>
5	<u>NPG-3</u>	<u>VCM VAPOR</u>	<u>0-100</u>	<u>30-100</u>	<u>-40</u>	<u>NT-1</u>
6	<u>NPG-4</u>	<u>VCM LIQUID</u>	<u>0-400</u>	<u>154-225</u>	<u>-40</u>	<u>LINE YCA-8</u>
7						
8						
9						
10						
11						
12						
13						
14						
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NOTES

1. TO BE PROVIDED WITH OVER-PRESSURE PROTECTION.
ELEMENT MAY BE EXPOSED TO PRESSURE UP TO 250 PSIG.

CWH 000012444

QUOTATION WILL NOT BE CONSIDERED IF SUPPLIER DOES NOT COMPLETE RIGHT HAND COLUMN.

SHEET 1 OF 1 REV



ENGINEERING CENTER.

PONCA CITY, OKLAHOMA

SPECIFICATION SHEET

RELIEF VALVES

PLANT LAKE CHARLES VCM PLANT PROJECT RAIL CAR VENT RECOVERY SYSTEM

THESE VALVES HAVE BEEN INSPECTED

A.F.E. NO. _____
DATE 2-28-74 W.O. NO. _____
MADE BY DEM I.N.O. NO. _____
APP'D BY _____ REQ. NO. _____
B.M. NO. _____ P.O. NO. _____

GENERAL		NRV-1	NRV-2	NRV-3	NRV-4
1	ITEM NO. & TAG	NRV-1	NRV-2	NRV-3	NRV-4
2	RELIEVES EQUIPMENT NO.	LINE VCA-1	LINE VCA-7	NH-1	NH-1
3	MANUFACTURER				
4	MODEL NO.				
5					
SERVICE CONDITIONS					
6	FLUID	VINYL CHLORIDE	VCM	R-502 REFRIG.	VCM, N ₂ VAPOR
7	STATE	LIQUID	LIQUID	LIQUID	VAPOR
8	REQUIRED CAPACITY	1570 ⁴⁰ /HR	1570 ⁴⁰ /HR	-	29300 ⁴⁰ /HR
9	MOL. WT.	62.5	62.5	111.6	62.5
	SP. GR.	0.88	1.00	1.22	2.15
10	VISCOSITY	0.16	.35	0.24	0.018
11	COMPRESSIBILITY FACTOR	1.18	-	-	1.18
12	DESIGN PRESS. OF EQUIPMENT	-	-	250	250
13	PRESS. OPERATING	100	100	0	100
	RELIEVING				
14	TEMP. FLOWING	100	-40	-50	-40
	RELIEVING				
15	BACK PRESSURE	5 psig	5 psig	5 psig	5 psig
16	DIFFERENTIAL SET PRESSURE	150 psig	200 psig	250 psig	250 psig
17	ACCUMULATION	%			
18	BLOW DOWN	%			
19					
BASIS OF SELECTION					
20	CODE REQUIREMENT	1			X
21	FIRE EXPOSED AREA			X	
22	INSULATION THICKNESS				
23	OTHER BASIS	THERMAL RELIEF	THERMAL RELIEF		
24					
DESIGN DETAILS					
25	DESIGN TYPE	FLANGED	FLANGED	FLANGED	FLANGED
26	SEAT TYPE	SPRING	SPRING	SPRING	SPRING
27	BONNET (OPEN OR CLOSED)	OPEN	OPEN	OPEN	OPEN
28	INLET SIZE, RATING, FACING	1" 150 LB R.F.	1" 150 LB R.F.	2" 150 LB R.F.	3" 150 LB R.F.
29	OUTLET SIZE, RATING, FACING	2" 150 LB R.F.	2" 150 LB R.F.	3" 150 LB R.F.	4" 150 LB R.F.
30	CALCULATED AREA				
31	ORIFICE LETTER	D	D	J	K
	ACTUAL AREA	.110	.110	1.287	1.838
MATERIALS					
32	BODY	C.S.	C.S.	A-516 SS	A-516 SS
	BONNET	C.S.	C.S.	A-516 SS	A-516 SS
33	SEAT & DISK	C.S.	A-516 OR SS	A-516 OR SS	A-516 OR SS
34	GUIDE & RING	C.S.	A-516 OR SS	A-516 OR SS	A-516 OR SS
35	SPRING	C.S.	SS	SS	SS
36	BELLOWS	C.S.	SS	SS	SS
ACCESSORIES					
37	LIFTING LEVER (PLAIN OR PACKED)				
38	GAG				
39	CODE STAMP	YES	YES	YES	YES
40	CAP (SCREWED OR BOLTED)	BOLTED	BOLTED	BOLTED	BOLTED
41	OTHER				

NOTES:

MANUFACTURER SHALL VERIFY SELECTION OF ORIFICE SIZE AND MATERIALS.
VALVES SHALL MEET DIMENSION REQUIREMENTS OF API RP-526.
VALVES SHALL MEET TEST REQUIREMENTS OF API RP-527.

SUPPLIER TO COMPLETE FORM BY FURNISHING
INFORMATION FOR BLANK SPACES

CWH 000012445

SHEET 1 OF 3 REV. _____



ENGINEERING CENTER

PONCA CITY, OKLAHOMA

SPECIFICATION SHEET

RELIEF VALVES

THREE ITEMS HAVE
BEEN PURCHASED

A.F.E. NO.

DATE 2-28-74

W.O. NO.

MADE BY DEM

IND. NO.

APP'D BY

REQ. NO.

D. M. NO.

P. O. NO.

PLANT LAKE CHARLES VCM PLANT PROJECT RAIL CAR VENT RECOVERY SYSTEM

GENERAL		NRV-5	NRV-6	NRV-7	NRV-8
1	ITEM NO. & TAG	NRV-5	NRV-6	NRV-7	NRV-8
2	RELIEVES EQUIPMENT NO.	NT-1	LINE VCA-8	NH-2	NH-2
3	MANUFACTURER				
4	MODEL NO.	RIPTURE			
5		DISC			
SERVICE CONDITIONS					
6	FLUID	N ₂ VCM VAPOR	LIQUID VCM	50 psia steam	VCM VAPOR
7	STATE	VAPOR	LIQUID	VAPOR	VAPOR
8	REQUIRED CAPACITY	29300 LB/HR	1570 LB/HR		
9	MOL. WT.	62.5	62.5	18.02	62.5
	SP. GR.	2.15	1.00	0.62	2.15
10	VISCOSITY	.018	0.35	.015	0.018
11	COMPRESSIBILITY FACTOR VAPOR	1.18	1.18		1.18
12	DESIGN PRESS. OF EQUIPMENT	180 psia		100 psia	300 psia
13	PRESS. OPERATING	100	250	50	250
14	TEMP. FLOWING	-40	-40	297	-15
15	BACK PRESSURE	5 psia	5 psia	5 psia	5 psia
16	DIFFERENTIAL SET PRESSURE	180 psia	300 psia	100 psia	250 psia
17	ACCUMULATION				
18	BLOW DOWN				
19					
BASIS OF SELECTION					
20	CODE REQUIREMENT	X		X	X
21	FIRE EXPOSED AREA				
22	INSULATION THICKNESS				
23	OTHER BASIS		THERMAL RELIEF		
24					
DESIGN DETAILS					
25	DESIGN TYPE	FLANGED	FLANGED	FLANGED	FLANGED
26	SEAT TYPE	SPRING	SPRING	SPRING	SPRING
27	BONNET (OPEN OR CLOSED)	OPEN	OPEN	OPEN	OPEN
28	INLET SIZE, RATING, FACING	3" 150LB. R.F.	1" 150LB. R.F.	2" 150LB. R.F.	2" 150LB. R.F.
29	OUTLET SIZE, RATING, FACING	4" 150LB. R.F.	2" 150LB. R.F.	3" 150LB. R.F.	3" 150LB. R.F.
30	CALCULATED AREA				
31	ORIFICE LETTER	K	D	J	J
	ACTUAL AREA	1.838	.110	1.287	1.287
MATERIALS					
32	BODY	A-516 OR SS	A-516 OR SS	C.S.	A-516 OR SS
33	SEAT & DISK	A-516 OR SS	A-516 OR SS	C.S.	A-516 OR SS
34	GUIDE & RING	A-516 OR SS	A-516 OR SS	C.S.	A-516 OR SS
35	SPRING	SS	SS	C.S.	SS
36	BELLOWS	SS	SS	C.S.	SS
ACCESSORIES					
37	LIFTING LEVER (PLAIN OR PACKED)				
38	GAG				
39	CODE STAMP	YES	YES	YES	YES
40	CAP (SCREWED OR BOLTED)	BOLTED	BOLTED	BOLTED	BOLTED
41	OTHER				

NOTES:

MANUFACTURER SHALL VERIFY SELECTION OF ORIFICE SIZE AND MATERIALS.
VALVES SHALL MEET DIMENSION REQUIREMENTS OF API RP-526.
VALVES SHALL MEET TEST REQUIREMENTS OF API RP-527.

SUPPLIER TO COMPLETE FORM BY FURNISHING

CWH 000012446

SHEET 2 OF 3 REV



ENGINEERING CENTER.

PONCA CITY, OKLAHOMA

SPECIFICATION SHEET

RELIEF VALVES

THIS ITEM HAS BEEN
PURCHASED.

A.F.E. NO.

DATE 3/22/74

W. O. NO.

MADE BY DEM

INO. NO.

APP'D BY

REQ. NO.

B. M. NO.

P. O. NO.

PLANT LAKE CHARLES VCM PLANT PROJECT RAIL CAR VENT RECOVERY SYSTEM

1	GENERAL		RV-477					
2	ITEM NO. & TAG		NRV-9					
3	RELIEVES EQUIPMENT NO.		LINE VCA-9					
4	MANUFACTURER							
5	MODEL NO.							
6	SERVICE CONDITIONS							
7	FLUID		VCM LIQUID					
8	STATE		LIQUID					
9	REQUIRED CAPACITY		1570 L/HR					
10	MOL. WT.		62.5					
11	SP. GR.		2.82					
12	VISCOSITY		2.16					
13	COMPRESSIBILITY FACTOR VAPOR		1.18					
14	DESIGN PRESS. OF EQUIPMENT							
15	PRESS. OPERATING		RELIEVING 150					
16	TEMP FLOWING		RELIEVING -15					
17	BACK PRESSURE		5 PSIG					
18	DIFFERENTIAL SET PRESSURE		250					
19	ACCUMULATION		S					
20	BLOW DOWN		S					
21	BASIS OF SELECTION							
22	CODE REQUIREMENT							
23	FIRE EXPOSED AREA							
24	INSULATION THICKNESS							
25	OTHER BASIS		THERMAL RELIEF					
26	DESIGN DETAILS							
27	DESIGN TYPE		FLANGED					
28	SEAT TYPE		SPRING					
29	BONNET (OPEN OR CLOSED)		OPEN					
30	INLET SIZE, RATING, FACING		1" 150LB R.F.					
31	OUTLET SIZE, RATING, FACING		2" 150LB R.F.					
32	CALCULATED AREA							
33	ORIFICE LETTER		D					
34	ACTUAL AREA		.110					
35	MATERIALS							
36	BODY		C.S.					
37	BONNET		C.S.					
38	SEAT & DISK		C.S.					
39	GUIDE & RING		C.S.					
40	SPRING		C.S.					
41	BELLWS		C.S.					
42	ACCESSORIES							
43	LIFTING LEVER (PLAIN OR PACKED)							
44	GAG							
45	CODE STAMP		YES					
46	CAP (SCREWED OR BOLTED)		BOLTED					
47	OTHER							

NOTES:

MANUFACTURER SHALL VERIFY SELECTION OF ORIFICE SIZE AND MATERIALS.
VALVES SHALL MEET DIMENSION REQUIREMENTS OF API RP-526.
VALVES SHALL MEET TEST REQUIREMENTS OF API RP-527.

SUPPLIER TO COMPLETE FORM BY FURNISHING
INFORMATION FOR BLANK SPACES

CWH 000012447

SHEET 3 OF 3 REV.

WORK
LIST

CWH 00001244B

WORK LIST DESCRIPTION
RAIL CAR VENT RECOVERY SYSTEM
LAKE CHARLES VCM PLANT

The following work list is provided as a guide for planning and estimating purposes only. Although it may be used for construction planning, it is not intended as a final work list for construction of this system.

1. Install the new VCM loading header and flow control system (4-VCA-1, NFIC-1) and the ten new loading lines from the header to the rail car loading spots.
2. Install the new rail car vent header (3-VCA-2) and the ten new connections to the existing vent header. Install the line and instrumentation to NH-1.
3. Install the new vent stack, NST-1.
4. Install the new vent stack knockout pot, NT-2.
5. Install piping between NT-2 and NST-1 (4-VCA-6).
6. Install the new refrigerated VCM receiver, NT-1, and its associated instrumentation.
7. Install the new refrigerated VCM return pump, NP-1, and its associated instrumentation.
8. Install the new refrigerated vent condenser, NH-1 with its associated instrumentation.
9. Install piping between NH-1 and NT-1 and associated instrumentation (3-VCA-3).
10. Install the Vent and Recovered VCM heater, NH-2, and its instrumentation.
11. Install piping between NT-1 and NH-2 with instrumentation. (2-VCA-4)
12. Install piping and instrumentation between NH-2 and NT-2. (4-VCA-5)
13. Install piping and instrumentation between NT-1 and NP-1. (3-VCA-7)
14. Install piping and instrumentation between NP-1 and NH-2. (2-VCA-8)
15. Install piping and instrumentation between NH-2 and P-490 discharge. (2-VCA-9)

Work List Description
Rail Car Vent Recovery System
Lake Charles VCM Plant
Page 2

16. Install piping and instrumentation between T-490 and line 3-VCA-2 (3-VCA-10).
17. Install the new package refrigeration unit, NPK-1.
18. Install all inter-connecting piping between NH-1 and NPK-1 (2-RX-1, 6-RX-2, 1-RX-4, 1-RX-5) with all associated instrumentation.

OPERATING
GUIDELINES

CWH 000012451

OPERATING GUIDELINES
RAIL CAR VENT RECOVERY SYSTEM
LAKE CHARLES VCM PLANT

A. Tank Car Venting - Preliminary Actions

1. Package Refrigeration Unit should be started up at least one hour before start of VCM loading.
2. Check liquid levels in T-490 and NT-1. Levels should be near bottom.
3. Set NPC-1 on automatic so its pressure in PSIG is equal to the temperature in °F of the VCM being loaded (NTC-2).
4. The pressure set point of PC on T-490 should be greater than NPC-1. This should be checked.
5. Set NTC-1 at the ambient air temperature.
6. Check NFI-1 to see if a N₂ flow of about 2 SCFH is being maintained.
7. Turn on H-490 fan.
8. Open 4" valve upstream of H-490. Open the two 3" valves downstream of H-490.
9. Open 3" valve upstream of NH-1. Open 3" valve between NH-1 and NT-1. These valves should remain open.
10. Open 2" valve between NT-1 and NH-2.
11. Open three 2" valves between NH-2 and NT-2. (Control valve bypass closed.)
12. Open 2" valve between steam header and NH-2.
13. Insure that NP-1 discharge is blocked in and that line from NH-2 to P-490 discharge is blocked in.

B. Tank Car Venting - Loading Procedure

1. Connect vent line swing arms to rail cars and VCM loading swing arms.
2. Open the 2" valves at the rail cars so the dedicated cars are tied into the existing vent header to H-490 and the nitrogen purged cars are tied into the new VCM loading header and loaded through NFIC-1. NFIC-1 should be set at 240 gpm maximum.

CWH 000012452

Operating Guidelines
Rail Car Vent Recovery System
Lake Charles VCM Plant
Page 2

3. Turn on P-411 pumps and fill rail cars as per normal procedure.

C. Recovery System Isolation

1. After completion of loading, close rail car vents.
2. Connect N₂ to bleed line. Purge through the line for approximately 5 seconds.
3. Close the bleed valve and the 2" valve below it. Remove the N₂ line, then open the bleed and remove the vent swing arm after line is depressurized.
4. Disconnect VCM loading arms using normal procedure.
5. Raise set points on NPC-1 and PC on T-490 to 125 psig.
6. Close 4" valve upstream of H-490. Close two 3" valves downstream of H-490.
7. Turn off H-490 fan and NPK-1.

D. Refrigerated VCM Return

1. Sample the recovered VCM in T-490 and NT-1 and determine whether it can be returned to storage or needs to be reworked.
2. Pump out T-490 as per present operating procedure.
3. Close the 3" valve upstream of NH-1. Close the 3" valve between NH-1 and NT-1. Close the 2" valve between NT-1 and NH-2. Close the 2" valve at the outlet of NH-2 between NH-2 and NT-2.
4. Set NTC-1 at -15° F.
5. Open the two 2" valves between NH-2 and P-490 discharge.
6. Open first 2" valve upstream of NH-2 in line 2-VCA-8.
7. Open the 3" valve between NT-1 and NP-1.

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8. Crack 2" discharge valve on NP-1 and start pump. Open valve as pump begins to operate.
9. Pump NT-1 until empty. Turn off NP-1.
10. Close 2" valve on discharge of NP-1 and 3" valve on suction of NP-1.
11. Close the two 2" valves between NH-2 and discharge of P-490.
12. Close the first 2" valve upstream of NH-2 in line 2-VCA-8.
13. Open the 2" valve between NT-1 and NH-2.
14. Pressure N₂ through the valve downstream of NH-2 to force the condensed VCM from NH-2 to NT-1.
15. Turn off the N₂ flow and open the 2" valve between NH-2 and NT-2.
16. Reset NTC-1 at the ambient air temperature.

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