Air Products

Date 7 October 1982

INTEROFFICE
MEMORANDUM

Subject 1982 Meeting of the Vinyl Chloride Safety Association

To Distribution

From J. T. Barr — Regulatory Response
(Location, Organization, or Department)

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J. Kadlec		

The annual meeting of the Vinyl Chloride Safety Association met in Toronto on 23-24 September. Attendance was 47 persons from 27 companies in 9 countries. This was down from the previous year due to business conditions.

The officers elected for next year are:

President	- J. Wallace, Esso Canada
Vice President	- R. Frohreich, Conoco
Secretary	- H. Olsen, Ethyl
Treasurer	- J. Gabbett, Ga. Pacific
Program	- H. Waltemate, BFG

The next meeting will be held in New Orleans in early October, 1983. Subjects to be emphasized will be monitoring equipment, a review of the hazards of closed reactor operation, and a discussion of maintaining food-grade products.

The luncheon speaker on Thursday was J. Weisz, special assistant to the President of BFG. He discussed the reasons for formation of the Vinyl Institute, and its goals. The cause is the dissatisfaction of the industry with present trade association response to the many new local and state attacks on the safety of PVC products, especially pipe and other construction products which are being encouraged by activist groups, the fire community, unions, and competitors. The purpose is to respond vigorously to these problems in a unified manner and he spoke of eliminating unnecessary proliferation of groups active in this area. The Institute will operate as a separate organization with its own staff but generally under the umbrella of the SPI. By-laws, staffing, and other details have been worked out by an ad hoc founding group consisting of BFG, Dow, Conoco, Tenneco, and others. A formal organizational meeting will be held in Chicago on 6 October.

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H. L. WATSON

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TO: Distribution
FROM: J. T. Barr

DATE: 7 October 1982
SUBJECT: 1982 Meeting of the Vinyl Chloride Safety Association

A strong pitch was made for the Safety Association to combine with the Institute. Discussion at a later business meeting indicated little support for this, because of the feeling that the Institute would generally be concerned with commercial and political issues, while the Safety Association was directed at manufacturing safety.

A brief description of the various discussions and reports is attached.

J. T. Barr

JTB/cay
Attachments

REGR1-D

I. True Confessions

A. John Vaughn of ICI described two incidents. In the first, the control room of the VC plant at Runcon had been receiving area monitor alarms from a leaking pump seal for several days. The pump was repaired but a snap-on nitrogen hose used in purging was left connected. The next time the pump was started the hose burst. The operator ignored the area alarm because of its past frequent action, and allowed about 10 tons of VC to escape. It flowed down a slope to the river, but wind blew it back toward the plant, setting off other alarms. Concentrations of 30-40 ppm were seen at 1,000 ft. from the pump and an ice build-up 2 ft. thick formed over a 10 x 40 ft. area of liquid flow, which took 2½ days to melt. The operator and the mechanic who signed off the work order were disciplined.

The second incident was at their Australian plant. A technician removing the actuator on a 4" Mason-Nielan Camflex valve scribed the actuator position on the valve body, but also removed the safety clip, so that when he replaced the device it had rotated 1 spline out of position. When the valve was returned to service it allowed about 1 ton of VC to flow to an open reactor. They no longer service valves in the field, but take them out of the line.

B. Jose Perez described a VC release at the Maricaibo, Venezuela plant. Leakage began on the line into a storage sphere just after restart of the monomer plant. Over 11 hours about 21 tons escaped, despite venting to the flare from the sphere. The cause was poor maintenance and inspection procedures, plus production of wet, acid-containing product (the plant was 6 yrs. old). Control of the leak was hampered by inadequate protective clothing, a poor deluge system, and inability to pump water into the sphere to seal off the VC.

C. Jorge Zarate of PRIMEX gave an update on the storage tank fire which was discussed at the 1977 meeting. Briefly, a mechanic removed the bonnet, rather than just the actuator on a valve on a storage bullet containing VC. The cloud ignited at a nearby plant, and the resulting fire destroyed all 7 storage tanks. Exploding tanks traveled as far as 400 meters, and destroyed the boiler house, laboratory, and other facilities. Fire and acid rain caused widespread damage outside the plant. A major contributor to the damage was undersized relief valves on the tanks which did not relieve adequately under fire conditions. The rebuilt plant has a single storage sphere, with deluge system and insulation, excess check valves and minimum sized piping.

This year that plant had a slurry spill when an operator left a valve to the drop header open while lancing a reactor, and the slurry from another reactor backed into the open reactor and onto the floor. The operator was fired and a double check on valve positions is made by a second person before a batch is dropped.

D. Herm Waltemate of BFG described an incident in their Australian VC plant in which 676 tons of VC were spilled in about 5 hours. A mechanic unfamiliar with the job removed the actuator support from the pipe below a valve on a sphere full of VC. The purpose was to replace that pipe section, which had been found corroded at an earlier inspection. The wire mesh cage around the valve was not removed, and in jockeying the pipe section the actuator was bumped, pulling the valve partly open. An attempt to force the valve shut by using a lever on the actuator body broke the arm and the entire contents were lost. The plant was down for scheduled maintenance, so they were able to trip the main power circuit, and avoided ignition. Concentrations of 1% were seen at 300 ft. and 1-2 ppm at 6 miles. The weather was mild, with a 12 mph steady wind. Ice built up as much as 10 ft. thick under the tank and hampered efforts to stop the leak.

A review of contributing factors indicated that what was thought to be an effective work order system failed because:

1) The WO was written by an engineer based on the inspection report and not a field check.

2) The polymerization foreman signed off because the storage area foreman was busy elsewhere.

3) A mechanic rather than an instrument man performed the work.

4) A very large section of line was removed in one piece without taking off the guard in an attempt to save time.

5) The maintenance foreman was out and a lead mechanic was supervising.

6) The valve was not fail safe, air to open, but air to close.

II. Norsk Hydro Epidemiology

S. Kristensen of N-H summarized a recent epidemiology study at their plant. It covered 454 men with more than 10 years' exposure, most of them having been at the plant since the start-up in 1950. The major points can be seen from the table below:

	Expected	Observed
Deaths, all causes	59	50
Deaths, all cancer	20	23
Angio	0	1
Lung	3	5
Melanoma	0.8	4

The study was not controlled for smoking, so the significance of the apparent excess of lung cancer is not clear. The melanoma sites were the nose and chest. The expected cases were estimated on the Norwegian Cancer Registry data, age adjusted.

Based on estimated relative exposures, the data are:

	Total Cancer	Lung	Melanoma
Low	6	2	1
Medium	3	0	0
High	14	3	3

The number of persons in each category was not given. These results are being submitted to a journal. It is the first study that associates melanoma with VC exposure, but the data are far from conclusive.

III. Stress Corrosion Update

Jim Wallace of Esso Canada gave an update on chloride-induced stress corrosion of stainless vessels. The first discussion on this subject can be found in my 1978 report. Experience has shown that predictive equation of 1979 has been fairly accurate for service below pH of 4, but that service life is longer than predicted at high pH. Also, absence of oxygen lengthens the service life.

Attachment I contains a summary of his presentation. Laboratory studies conducted by Esso show little difference in 304 and 316 steels, but plant experience continues to favor 316. Both chloride ion and oxygen are harmful, but pH remains the major factor. There has been no cracking reported in high nickel or mixed metallurgy alloys.

Conoco reported the sudden total failure of a 304 slurry tank. Large cracks appeared over the entire insulated area and a piece over 1.5 ft. long simply fell out. It was found that the mastic used to bond the insulation had high chloride content.

IV. Relief Valve Survey

Bob Laundrie of General Tire passed out summaries of the survey on reactor relief valves made shortly before the meeting. Several companies did not reply in time to have their data included. See Attachment II.

There is considerable variation in the relief area used per unit volume. We are company B and are above average in our sizing. We are still in the minority in not having a vent in the pressure gauge assembly between the rupture disk and the relief valve at the Escambia plant.

V. Construction Safety

D. Matthews of Esso described the system used by them to assure safety during a major expansion of an operating plant. Parallel staffs were used for construction and operation. The Maintenance Superintendent was chairman of a Construction Safety Committee made up of persons of

like responsibility from both groups: the Operating Supervisor and the Construction Manager; the Process Superintendent and the Start-Up Leader; and so on. These met every two weeks to set schedules and resolve conflicts. The job engineers met their peers weekly or more often as needed.

A safety coordinator was in charge of the safety watchers (one to five) and issued all permits and oversaw all testing. All workers had a general Safety Watch Guideline, while the watchers had a thick detailed manual.

They aimed for zero defects and completed the job with no incidents. Another expansion on a nearby polyethylene plant had two small valve stem fires and was shut down for two weeks to review their safety procedures.

VI. Radioactive Level Gauges

Joe Serratore of Esso discussed the radioactive level gauges installed on their reactors at this project. These were 500 mC Cs^{137} sources. Attempts to use these gauges on the reactor heads were abandoned because of poor performance due to back scatter from adjacent units, false readings during charging and heat-up due to foam, and excessive downtime due to calibration and maintenance.

ICI stated that they had used these devices successfully and that they had prevented any further overcharging problem. One other company said that it also uses these. Another company said that it had a different type of internal level indicator in use. Three companies said that they had tried but abandoned the devices.

Esso did report successful use of the device as a stop-go indicator for reactor drainage. The receiver was located tight to the bottom nozzle neck so that the signal did not pass through the jacket at that end. Additional procedures are needed to prevent persons from entering the reactor when the source is not fully shielded.

VII. Plant Team Safety Review

M. Tawney of BFG described a company-wide team safety review which was undertaken after the Australian incident described earlier. A Corrective Action Team, consisting of persons from Safety, Engineering, and Manufacturing, with up to 6 persons, has been surveying each plant in a 4-step process:

1) Determine existing hardware and procedures.

2) Define deficiencies and recommend corrective actions.

3) Develop plans and schedules.

4) Follow up on implementation.

Two problems were found that required immediate action; other plans were spread over 6 months-5 years.

Typical actions included:

1) Work order procedure revisions.

2) Plant organization clarification.

3) Standardize vessel inspection procedures.

4) Standardize relief valve inspection schedules.

5) Hardware standardization and revisions.

Specifications taken to prevent a recurrence of the sphere incident in Australia included:

1) Minimize the number of working bottom openings on spheres. There had been up to 9.

2) Install remote actuators on all working lines that are fail safe (closed) quick-acting fire safe. They are not comfortable with just excess flow check valves.

3) Install dual relief valves with locked service valves below.

4) Install a deluge system with continuous monitor activation/alarm.

5) Change the WO procedure to require job release at the site, with an audit function.

This report provoked considerable discussion and a poll by a show of hands was taken on several subjects.

Storage tank inspection:

Internal -	annual	1
	2 years	1
	3 years	2
	5 years	8
	never	2
External -	annual	several

Storage tank fire water protection:

None	0
Hand hose	0
Fixed monitor	11
Deluge	16
Both fixed and deluge	12
Buried tanks	2
Insulate	4

Storage area monitors:

None	0
LEL	13
Chromatograph	15
Both	12

Bottom valves:

Excess flow checks	6
Air operated	15
Electrical	0

Bench test relief valves:

Annually	19
2 years	0
3 years	2
5 years	0

Bottom valve type:

Gate	1
Plug	11
Ball	13
Butterfly	0

Deluge system testing:

Full flow annually	10
Controls only	17

ICI commented that their practice had been to test the control systems only until they tried a full flow test and found that the pipe system collapsed.

VIII. Problems With Computer Systems

J. Gabbett of Georgia-Pacific discussed some of the problems they have encountered with computer control systems. Many of these stem from the reluctance of an operator to be criticized for missing a charging window and the shortcuts taken to avoid this. Forgetting that overrides had been made led to several near serious incidents and one fire. Their computer now cancels an override after 3 minutes.

IX. Cardinal Safety Rules

Goodrich has prepared slide/tape training programs on 4 basic subjects:

Hot Work Permits	16 minutes
Vessel Entry	17 minutes
Lockout Procedure	20 minutes
Forklift Trailer Entry	13 minutes

We were shown the one on hot work permits. It illustrated each of the steps in preparing and complying with their procedure in a simple and detailed manner. These programs can be borrowed from BFG.

They had found that 7 of 11 recent fatalities had involved these 4 procedures. Since inauguration of these training programs, they have had 14 violations, for which 7 men were fired, and the other 7 (and sometimes their supervisors) were disciplined. There have been no incidents in the past quarter.

The Hot Work Permit program dwelt on common sense and job knowledge. It is their general rule that a permit is needed in any Class I, Division 2 area, as defined by Safety, or in any confined area.

X. Vent Prevention System

C. Loechelt of Ethyl described the vent prevention system shown in Attachment III. If an unusual incident requires venting, valve 1 ahead of the vacuum compressor closes and the bypass opens. If the amount is too great for the gasholder, valve 3 also closes and the excess vapor is retained in the KO pot. The sequence can be initiated by an over-pressure as shown by detail A.

The system simply is to buy time for the recovery system to catch up with demand. There are two in operation in their plant. One is about half the size of a reactor, the other is about equal. One is agitated, the other is not. The system has been successful so far, but most tests have involved small amounts such as those resulting from an overcharge.

XI. Angio Registry

John Stafford of ICI discussed the registry of worldwide angiosarcoma cases which he has been maintaining. His count is now up to 100, with 2 still alive, but one of these (Italian) is not typical, and thus is doubtful.

Job descriptions of the cases are as follows:

Reactor cleaners	42
Other poly workers	28
Maintenance	2
Management/Research	3
Other PVC	2
PVC unknown	17
Monomer	3
Other	2

He does not see a decrease in the rate of occurrence of these cases, especially in Europe. The last date of first exposure is 1964, so we do not know the effect of steps taken in that decade because of AOL. He notes that there is only one case of both AOL and angio. It may be that later cases may show longer latency and thus spread out the future reports, but he points out that we can expect only a few dozen more cases at most, and not hundreds.

He has searched for some relationship between cases other than the clustering seen to occur at a few plants, but has not found any. There is no correlation between size of plant and cases, or latency and date of exposure. There may be a weak correlation between date of start-up and clusters, especially in the U.S., where there are no cases in plants started after 1957, but there are several other old plants with no cases.

John retires next year and it is not certain who may continue the registry after that. A copy of the full report is available in my office if anyone is interested.

XII. EPA Enforcement

Four companies were represented which had received Sec. 114 letters from EPA Region VI on emergency releases. A typical copy of this very extensive reporting demand is available.

Georgia Pacific sent in a 26-lb reply prepared by outside counsel.

BFG noted that some releases were not included in the list. They sent in a 6" report for Plaquamine. They also expect a similar letter for Louisville.

PPG sent in a 5" report, claiming record retention limits on those over 2 yrs. old.

Ethyl sent in a "full box" reply in 1981, and have had some discussions with Region VI.

In addition, Pantosote received a similar letter from Region II at their Passaic plant.

XIII. APCI Presentations

Tony Santay described the VC exposure risk study done for the 15 gal. reactor at Trexlertown Labs as an example of the risk assessment - hazard review studies done by us.

The writer presented an update of regulatory actions on items of interest to the VC/PVC industry. See Attachment IV for an outline. The general terms of the settlement with EPA at Calvert City also were described.

CHLORIDE STRESS CRACKING REVIEW

1978 VCMSA MEETING - PREDICTIVE EQUATION FOR STRESS CRACKING TIME PRESENTED SHOWING 316 CRACKING TIME FOUR TIMES THAT FOR 304: INDUSTRY SURVEY STARTED.

1979 VCMSA MEETING - GOOD SURVEY RESPONSE - RESULTS REVIEWED.
- CONCLUSIONS:

AT PH VALUES <4 - PRECICTED TIMES REASONABLY ACCURATE.

AT PH VALUES >4 - BETTER RESISTANCE TO STRESS CRACKING THAN PREDICTED.

IN ABSENCE OF OXYGEN - BETTER RESISTANCE TO STRESS CRACKING THAN PREDICTED.

ATTACHMENT I

1980 ECC SLOW STRAIN TESTS ON STAINLESS STEEL IMMERSED IN SLURRY WATER AT 90°C.

CONCLUSIONS - TABLE 1

	STEEL	HEAT TREATMENT	PH
WORST	304	SENSITIZED (800°C, SLOW COOL)	4.3
	316	SENSITIZED	4.3
	304	SENSITIZED	7.2
	316	SENSITIZED	7.2
	316	NON-SENSITIZED	4.3
	304L	EITHER	4.3
	316L	EITHER	4.3

OVERALL - LITTLE DIFFERENCE BETWEEN 304 AND 316.
SENSITIZING IMPORTANT - MAY BE CAUSED BY WELDING.
PH IMPORTANT.
LOW CARBON GRADES SUPERIOR.

CONCLUSIONS - THE STRESS CRACKING WAS DUE TO HEAT SENSITIZATION AT THE WELDS AND BEGAN INTERGRANULARLY.

1981 - A SECOND SERIES OF TESTS WAS RUN IN WHICH BOTH PH AND CHLORIDE WERE VARIED.

- RESULTS WERE AS SHOWN GRAPHICALLY.

CONCLUSIONS - INCREASING THE PH FROM 3 TO 7 DRAMATICALLY IMPROVED CRACK RESISTANCE IN THIS TEST ON EITHER 316 OR 304.

1982 - THE CURRENT SURVEY RECEIVED LESS RESPONSE. ANSWERS ARE SHOWN IN TABLE 2. THE RESULTS SHOW LESS COHESION, BUT GIVE THE FOLLOWING INDICATION:

- ITEMS 4A, 4B, 4C UNDER SIMILAR MILD VAPOR CONDITIONS AGAIN SHOWED 304 INFERIOR TO 316 OR 316L. CONCENTRATION OF LIQUID MUST BE SUSPECTED THOUGH NOT DECLARED.

- ITEM 5 (316 CLAD) FAILED IN 1/3 PREDICTED TIME, BUT HIGH TEMPERATURE SURGES OCCURRED.

- ITEM 6 WOULD NOT HAVE BEEN EXPECTED TO FAIL UNLESS THE CHLORIDE WAS VERY HIGH.

- ITEM 7 WAS ALSO PREMATURE.

FINAL CONCLUSIONS

THE WEIGHT OF EVIDENCE STILL INDICATES THAT:

- 316 IS BETTER THAN 304.
- LOW CARBON GRADES ARE BETTER THAN NORMAL, ESPECIALLY NEAR WELDS.
- NEUTRAL PH IS BETTER THAN ACID.

TABLE 2

1982 STRESS CRACKING SURVEY

	MATERIAL (C=CLAD)	TEMPERATURE °C/°F	CHLORIDE PPM	CALENDER YEARS	ACTUAL A YEARS	EXPECTED E YEARS	A/E	PH	COMMENTS
1.	304	71/160	?	16	4.8			3.6	SLURRY TANK
2.	304	120/233	?	5	5				FLUID BED DRIER PANELS
3.	304	199/390	?	12	7.2			9-10	SPRAY DRIER
4A.	304	30/86	10	10	10	70	0.14	?	VAPOR PHASE (EVAPORATION) UNSPECIFIED PLANT
5.	316C	82/180	25	1.2	0.84	2.7	0.3	3-4	STRIP DRUMS IN WELDS
6.	316L	115/239	?	1	0.75			8-10	EXCHANGER
7.	316 (Ti)	60/140	20	>5	>1.5	15	>0.1	4-5	UNSPECIFIED PLANT LIQUID AND VAPOR.
8.	321	60/140	20	>20	>6	3.6-14		4-5	AS 7.
9.	410	82/180	25	1.3	1	?			AGITATOR BOLTS
UNCRACKED									
4B.	316	30/86	10	10	10	100+		?	AS FOR 4A.
4C.	316L	30/86	10	10	10	100+		?	AS FOR 4A.

Vinyl Chloride Safety Association

PVC REACTOR PRESSURE SAFETY RELIEF FACILITIES

COMPANY	A		B				C		D	
REACTOR VOLUME, USG	3500	7400	3750	6000	25,000	25,000	4000	6000	?	?
SAFETY VALVES (RV)										
Number	1	1	1	1	3	4	1	1	1	1
Inlet Size	6	6	4	6	8	8	3	3	12	12
Outlet Size	10	10	6	8	10	10	4	4	16	16
Orifice Area/Type, in^2	16/R	16/R	6.4/B	11.0/Q	26/T	26/T	3/-	3/-	69/W	69/W
Set Pressure, psig	275	275	220	220	180	200	200	200	230	270
RUPTURE DISCS (RD)										
Series w/SV	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Number	1	1	1	1	1	1	1	1	1	1
Type	SCRD	SCRD	-	-	-	SCRD FSB	DV	DV	KBA	KBA
Size, dia.in.	6	6	4	4	16	18	4	4	12	12
Material	Ni	Ni	Ni	Ni	Ni	Ni	SS	SS	SS	SS
Supplier	FIKE	FIKE	FIKE	FIKE	FIKE	BSB	BSB	BSB	Continental	
Model	BT	BT	SD	SD	SD	SSB	DV	DV	-	-
Set Pressure/Temp. ^{o}F.	332/72	264/72	220/72	220/72	188/72	190/72	205/72	205/72	-	-
Set Pressure/Temp. ^{o}F.	318/190	251/180	218/212	218/212	178/212	-	194/132	194/132	230/184	270/18
RUPTURE DISC LEAK DETECTION										
Pressure Guage	Y	Y	Y	Y	Y	Y	N	N	Y	Y
Vent w/Valve	N	N	N	N	N	N	Y	Y	-	-
Free Vent	N	N	N	N	N	N	N	N	-	-
Exc.Flow Valve	Y	Y	N	N	N	Y	N	N	-	-
Telltale Ind.	N	N	N	N	N	N	N	N	-	-
Other	N	N	-	-	P.Switch	P.Switch	-	-	-	-
REACTOR NOZZLES FOR SAFETY RELIEF										
Nozzles, No.	1	1	1	1	1	1	1	1	2	2
Size	6	6	4	4	16	18	4	4	12	12

Robert W. Laundrie
xd 9/13/82

COMPANY	E	F	G		H			I	J
REACTOR VOLUME, USG	75,600	7,250	13,000	800	3600	10,600	10,600	26,000	26,000
SAFETY VALVES (RV)									
Number	2	2	-	-	-	1	-	-	3
Inlet Size	4/6	5	-	-	-	4	-	-	10
Outlet Size	6/10	8	-	-	-	6	-	-	14
Orifice Area/Type, in^2	3.2/14.7	10.5/Q	-	-	-	6.4/FF	-	-	200
Set Pressure, psig	203/232	285	-	-	-	240	-	-	240/247/254
RUPTURE DISCS (RD)									
Series w/SV	Y	Y	N	N	N	Y	N	N	Y
Number	1	1	4	2	2	1	1	4	1
Type	RVB	?	RVB	RVB	RVB	MP	MW	RVB	RVB
Size, dia.in.	6	6	6	6	6	3	12	12	16
Material	Ni	SS	Ni	Ni	SS	Al	Al	SS	Ni
Supplier	Johnson Matthey	BSB	BSB	BSB	Marston/ Excelsior	M/E	M/E	Elfab-Hughes	BSB
Modal	C	SJO	S-90-II	S-90-II	Maxivent	2195	2195	RK-76	?
Set Pressure/Temp.^{o}F.	-	276/72	-	-	-	-	-	225/203	-
Set Pressure/Temp.^{o}P.	228/176	256/175	232/176	232/176	235/212	229/158	273/158	250/207	232/158
RUPTURE DISC LEAK DETECTION									
Pressure Guage	Y	Y	Y	Y	-	-	-	-	-
Vent w/Valve	Y	N	N	N	-	-	-	-	-
Free Vent	N	N	N	N	-	-	-	-	-
Exc. Flow Valve	N	N	Y	Y	-	-	-	-	-
Telltale Indicator	N	N	N	N	-	-	-	-	-
Other	-	N	N	N	P.Switch	P.Switch	-	P.Switch	P.Switch
REACTOR NOZZLES FOR SAFETY RELIEF									
Nozzles, No.	2	1	2	2	2	2	2	1	1
Size	6/6	6	8	6	6	6	3/12	12	16

COMPANY	K	
REACTOR VOLUME USG	4000	2000
SAFETY VALVES (RV)		
Number	-	-
Inlet Size	-	-
Outlet Size	-	-
Orifice Area/Type, in^2	-	-
Set Pressure, psig	-	-
RUPTURE DISCS (RD)		
Series w/SV	N	N
Number	2	2
Type	BV	BV
Size, dia.in.	3	2
Material	S	S
Supplier	BSB	BSB
Model	?	?
Set Pressure/Temp.^{o}F.	248/72	248/72
Set Pressure/Temp.^{o}F.	233/182	248/182
RUPTURE DISC LEAK DETECTION		
Pressure Guage	N	N
Vent w/Valve	N	N
Free Vent	Y	Y
Exc. Flow Valve	N	N
Telltale Indicator	N	N
Other	-	-
REACTOR NOZZLES FOR SAFETY RELIEF		
Nozzles, No.	1	2
Size	6	2

COMPANY	L	M	N			O			
REACTOR VOLUME USG	?	5000	5300	6600	9250	3750	?	?	35,000
SAFETY VALVES (RV)									
Number	1	1	-	1	1	1	1	1	2
Inlet Size	3	6	-	4	4	4	-	-	6
Outlet Size	4	8	-	6	6	6	-	-	8
Orifice Area/Type, in^2	1.8/K	O/?	-	-/3.6	P/ 6.3	?	-	-	Q/11
Set Pressure, psig	180	200	-	200	188	200	-	-	185
RUPTURE DISCS (RD)									
Series w/SV	y	Y	N	Y	Y	Y	N	N	Y
Number	1	1	1	1	2	1	2	2	2
Type	RVB	-	BV	BV	DV/BV	?	?	?	Composite
Size, dia.in.	3	6	4	4	4	4	4	4	6
Material	SS	Ni	Ni	Ni	Ni/TFE/SS	NiTFE	SS	SS	SS
Supplier	Continent.	Frangible	BSB	BSB	BSS	Fike	BSB	BSB	OSACO
Model	ZAP	40559	-	-	-	?	S90 BV	S90 BV	COV
Set Pressure/Temp.°F.	-	205/72	210/72	210/72	208/72 198/72	205/72	240/72	240/72	198/72
Set Pressure/Temp.°F	180/170	200/170	-	-	197/169 190/169	194/200	230/230	230/230	-
RUPTURE DISC LEAK DETECTION									
Pressure Guage	Y	Y	-	Y	Y	Y	Y	Y	Y
Vent w/Valve	Y	N	-	N	N	N	_	-	N
Free Vent	-	N	-	N	N	N	_	-	N
Exc. Flow Valve	Y	N	-	N	N	N	_	-	N
Telltake Indicator	-	Y	-	N	N	N	_	-	Y
Other	-	N		N	N	N	1/4" SS w 5 psig RV		-
REACTOR NOZZLES FOR SAFETY RELIEF									
Nozzles, No.	1	1	1	1	1	1	2	2	?
Size	3	6	4	4	6	2	4	4	?

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xd 9/21/82

COMPANY	P			Q								
REACTOR VOLUME USG	4000	20,000		18,000			32,000			21,000		
SAFETY VALVES (RV)												
Number	1	2	2	1	1	2	1	2	4	1	1	2
Inlet Size	6	6	6	6	6	8	8	8	8	6	6	8
Outlet Size	10	10	10	8	8	10	10	10	10	10	10	10
Orifice Area/Type, in^2	16/-	11/-	11/-	11/Q	11/Q	26/T	26/T	26/T	26/T	16/Q	16/Q	26/Q
Set Pressure, psig	180	200	200	185	195	200	195	200	205	175	180	190
RUPTURE DISCS (RD)												
Series w/SV	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Number	1	1	1	1	1	1	1	1	1	1	1	1
Type	D	RVB	RVB	RVB	RVB	RVB	RVB	RVB	RVB	RVB	RVB	RVB
Size, dia.in.	6	8	6	6	6	6	8	8	8	6	6	8
Material	SS	SS	SS	Ni	Ni	Ni	Ni	Ni	Ni	Ni	Ni	Ni
Supplier	BS	Continental		BSB	BSB	BSB	BSB	BSB	BSB	BSB	BSB	BSB
Model	BV	KBA	KBA	S90	S90	S90	S90	S90	S90	S90	S90	S90
Set Pressure/Temp.°F.	204/72	-	237/72	-	-	-	-	-	-	-	-	-
Set Pressure/Temp.°F.	180/212	225/200	210/200	185/166	195/170	200/172	205/173	210/175	215/176	185/200	190/200	190/20(
RUPTURE DISC LEAK DETECTION												
Pressure Guage	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Vent w/Valve	-	-	-	N	N	N	N	N	N	N	N	N
Free Vent	-	-	-	N	N	N	N	N	N	N	N	N
Exc. Flow Valve	-	-	-	Y	Y	Y	Y	Y	Y	Y	Y	Y
Telltale Indicator	-	-	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-
REACTOR NOZZLES FOR SAFETY RELIEF												
Nozzles, No.	2	3	3	2	2	2	?	?	7	2	2	2
Size	6/8	6/8	6/8	6	8	8	?	?	8	6	6	8
				Design P = 200 psig			Design P = 200 psig					

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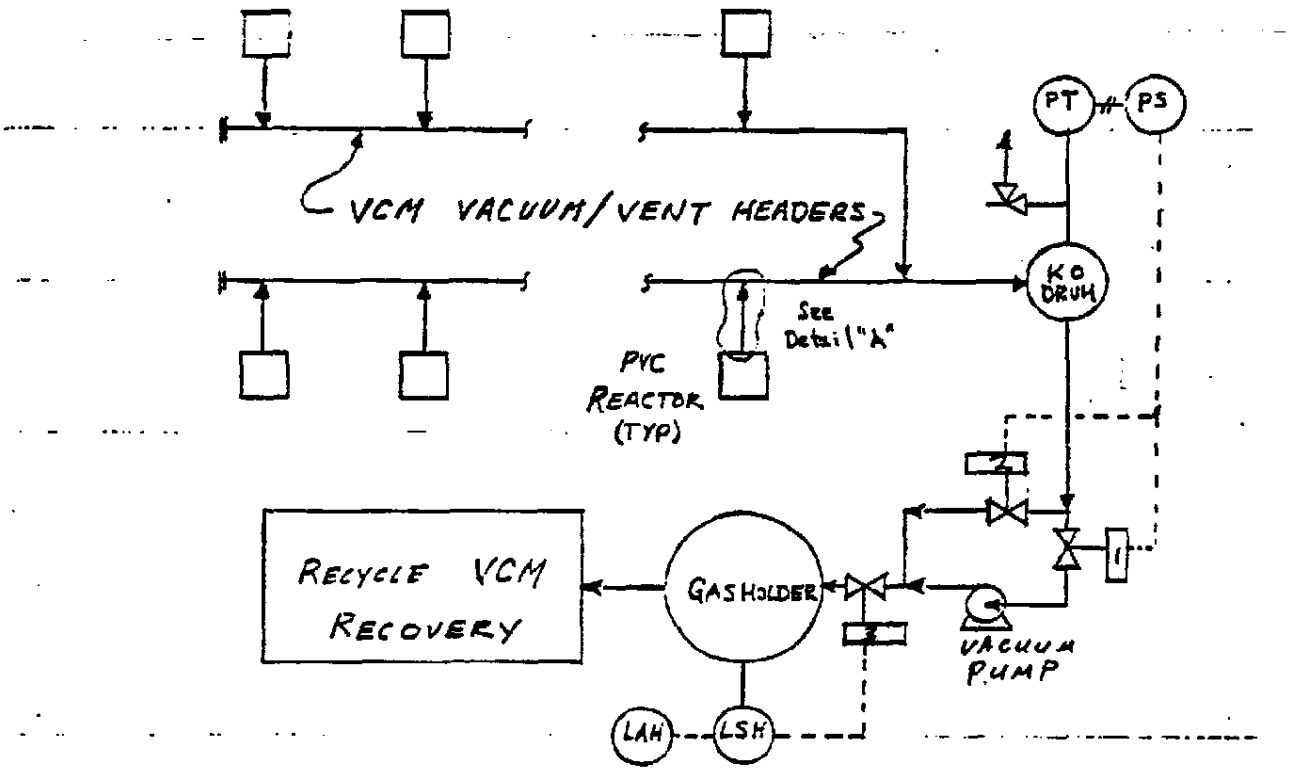
xd 9/21/82

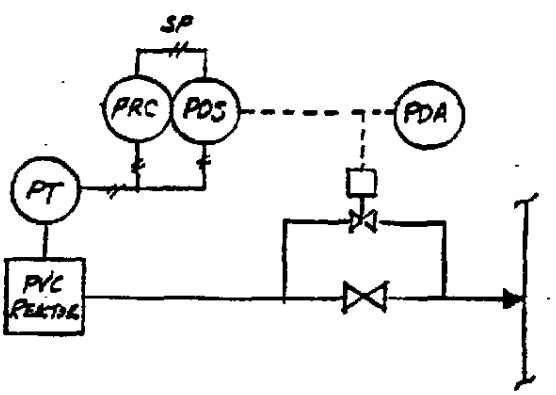
ATTACHMENT II

PVC REACTOR

VENT PREVENTION SYSTEM



DETAIL "A"



CPL
VCSA
9/24/82