PROPOSAL

PVC REACTOR RELIEF TEST RUN

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Proposal

R&D are requested to test the adequacy of Conoco's simulation of PVC reactor relief systems.

History

The existing Conoco PVC reactor relief system consists of two "Q" orifice relief valves (11.05 square inch relief area each) and an eight-inch double rupture disc (50.2 square inch area) vented to the atmosphere. It is planned to replace the double rupture disc systems with relief valves since the rupture discs can (and have) fail prematurely, resulting in unnecessary atmospheric emissions.

The expansion reactors at both Oklahoma City and Aberdeen are being built with only relief valve protection. Budget designs (totaling $910,000) to modify the existing reactors have been prepared.

To design these systems, PED have recently simulated the reactor relief system. This simulation is complex, involving nonisothermal polymerization kinetics, multiphase, flashing critical flow while working with existing API equations for relief device capacity.

Finally, Conoco's reactor relief area for existing reactors is less than 50 percent of the recommended relief area for an FIA 1970 report and is thought to be less than several other manufacturers.

Proposed Test Run Description

The test run should accomplish the following:

1. Allow comparison of our nonisothermal kinetics model to actual data during runaway conditions.

2. Allow comparison of our critical flow relief valve capacity model to actual data, including both relief valves and equivalent orifices.

3. Allow comparison of our homogeneous, two-phase flow model to actual data giving pressure drop across rupture discs and entrance and exit effects.

The fifty-gallon reactor will be required for this test to provide sufficient reaction mass for scaleup. This test run will require venting VCM to the atmosphere (approximately 130 pounds per run). To minimize the possibility of personnel exposure, the test should be done on the weekend and during favorable weather conditions. It is our understanding that, because of the size of the test, no EPA report is required.

Proposed Test Run Description (Continued)

A proposed schedule of runs is given in Table I.

Data collected should include the following:

Pressure - Reactor
- Inlet of Relief Valve or Orifice
- Exit of Relief Valve or Orifice
- Near End of Relief Header

Temperature - Reactor
- Exit of Relief Valve or Orifice

Since the total relief is expected to last less than two minutes, high speed pressure and temperature measurements are needed. CED have indicated that they have a high speed multitrack tape recorder and some high speed pressure transmitters available.

It is also recommended that the atmospheric relief be recorded on film. This may allow for a qualitative analysis of relief system dynamics.

It should also be considered to sample air downwind of the release to analyze for flammability.

Note that the design calls for the use of the existing rupture disc or a manual vent for a backup method of overpressure control.

TABLE I

LIST OF RUNS

PVC REACTOR RELIEF TEST RUN

A. 1 1/2"-F-2" Relief Valve

The run is to check the accuracy of the simulation and to calibrate the high speed instruments.

B. 1"-E-2" Relief Valve

The run simulates the proposed reactor relief system.

C. "E" Size Orifice

The orifice is to be placed after the rupture disc. The run is to determine the difference in flows between relief valves and orifices of the same size.

D. 1 1/2", Schedule 40 Pipe

The 3.5-foot long pipe is to be connected to a header leading out of the building. This run is to simulate a double disc system.

The above runs should be done using conditions for 5385 resin. Cooling and agitation should be stopped at about 30 percent conversion. An additional run should be done using 5465 resin conditions, as this should produce higher pressures. Also, higher and perhaps lower conversions should be tried to confirm the simulation's results. Additional runs should be done using the "E" orifice relief valve system.

A total of at least six runs is, therefore, requested.

SIMULATION RESULTS

PVC REACTOR RELIEF TEST RUN

Relief System	MAXIMUM REACTOR PRESSURE, PSIG Conversion(1) 10%	30%	50%	70%
"F" Relief Valve	203	203	202	201
"E" Relief Valve	210	208	207	203
"E" Orifice	207	216	225	207
1 1/2", Schedule 40 Pipe	203	-	-	-

(1) Values given are the polymerization conversion when the cooling water fails.

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SIMULATION BASIS

PVC REACTOR RELIEF TEST RUN

VCM Charge, Pounds	148
Water:Monomer Ratio	1.4:1
Catalyst	L-223
Catalyst Charge, Pounds	0.5(1)
Run Temperature, °F	134

	RELIEF SYSTEM DESCRIPTION(2)		
Relief System	RV Area, Sq In	RD Set Point psig	RV Set Point psig
"F" Relief Valve	0.307	200	190
"E" Relief Valve	0.196	200	190
"E" Orifice	0.196	200	-
1 1/2", Schedule 40 Pipe	-	200	-

(1) Polymerization time to 80 percent is 365 minutes.
(2) All systems use 1 1/2-inch inlet and two-inch outlet pipes.

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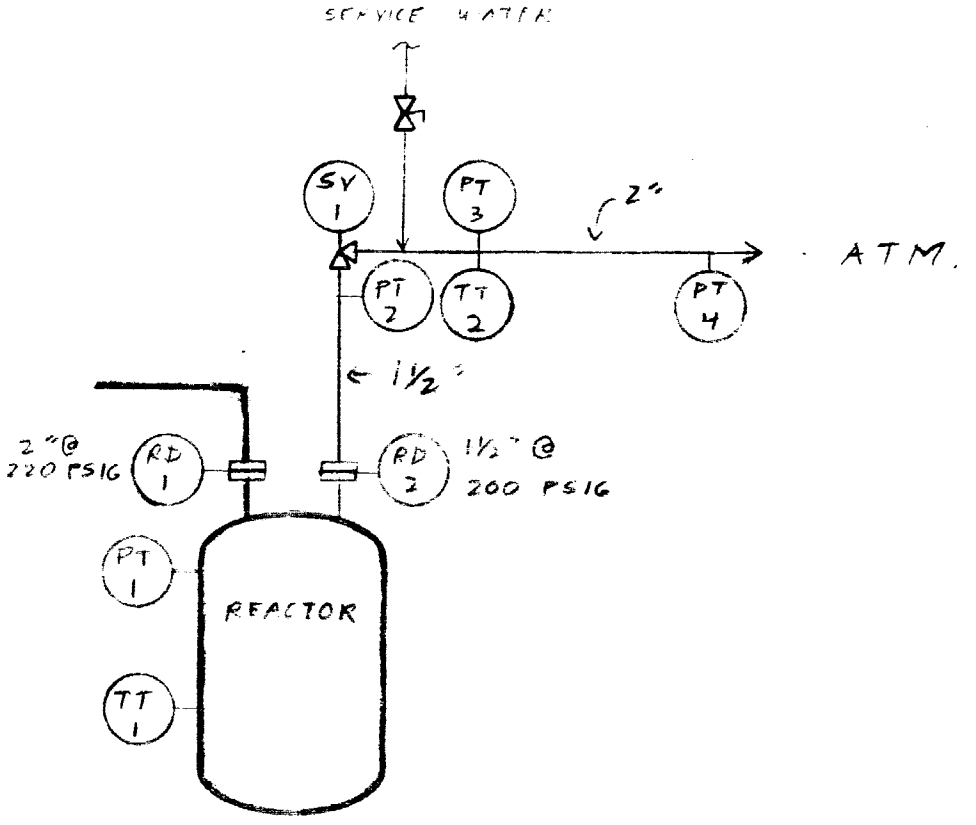
PVC REACTOR RELIEF TEST RUN SCHEMATIC



NEW

EXISTING

BY M.S.W.

NOTES ON 2 OF 2

NOTES FOR SCHEMATIC DIAGRAM

1. Not all details of existing equipment are shown.
2. SV-1 is on the existing 1 1/2-inch flange.
3. RD-1 replaces the existing two-inch RD at 200 psig.
4. PT-2 is to be as close to SV-1 as possible.
5. All PT's are quartz pressure transducers using a 1/2-inch screwed connection.
6. PT-1 and TT-1 may be replaced with existing instruments if their response speed is adequate.
7. PT-3 is to be as close to SV-1 as possible.
8. TT-3 is to be as close to PT-3 as possible.
9. PT-4 is to be close to the end of the pipe.
10. RD-1 may be replaced with a remote-operated valve.
11. All TT's are fine wire thermocouples.
12. SV-1 is E or F orifice, depending on the run.
13. All signals from PT's and TT's go to multitrack tape recorder Z-1.
14. SV-1 outlet piping is new.

INSTRUMENT LIST

PVC REACTOR RELIEF TEST RUN

Item No.	Service
Pressure Instruments	
PT-1	Reactor Pressure
PT-2	Relief Valve Inlet Pressure
PT-3	Relief Valve Outlet Pressure
PT-4	End of Vent Pipe Pressure
Temperature Transmitters	
TT-1	Reactor Temperature
TT-2	Relief Valve Outlet Temperature
Rupture Discs	
RD-1	Reactor Emergency Relief
RD-2	Reactor Relief for Test
Safety Valve	
SV-1	Reactor Relief for Test
Other Instruments	
Z-1	High Speed Multitrack Recorder for Instruments
Z-2	High Speed Movie Camera for Velocity and Quality Measurements
Z-3 (Optional)	Accelorometer for Measurement of Shock Wave Velocity

conoco

Continental Oil Company
Engineering Center
Ponca City, Oklahoma
Pressure Instruments

SPECIFICATION SHEET
PROJECT NO. _____
A.F.E. NO. _____
DATE 9/26/80 INQ. NO. _____
MADE BY MSW REQ. NO. _____
APP'D. BY _____ P.O. NO. _____

PLANT PONCA CITY, P.O. **PROJECT** PVC REACTOR PEMEX 100 KMT

1	TAG NO	PT-1 THRU 4				
2	SERVICE					
3						
4	INSTRUMENT, TYPE	PRESSURE TRANSM.				
5	LOCATION	(1)				
6	RANGE, PSIG	0-220 (2)				
7	ELEMENT	(3)				
8	TYPE / MATERIAL					
9	LOCATION					
10	TEMPERATURE °F					
11	PRESSURE PSIG					
12	VALVE TYPE					
13						
14	LOCATION					
15	MATERIAL					
16	BODY SIZE / PORT SIZE					
17	PLUG FORM					
18	Δ P / MIN. / NOR. / MAX.					
19	CALC. Cv / VALVE Cv					
20	AIR TO OPEN OR CLOSE					
21	MAX SHUTOFF Δ P					
22	FLUID	VCM-PVC SLURRY				
23	TEMPERATURE °F	200				
24	PRESSURE PSIG MAX	220 (2)				
25	°API (M.W.)					
26	SP. GR. AT STD. COND.					
27	SP. GR. AT P &T	1.4				
28	WEIGHT % VAPOR IN-OUT	MAX 45 %				
29	VISCOSITY AT P &T					
30	RATE, NORMAL					
31	RATE / MAX. / MIN. LB/SEC	3	0			
32	NOTES					

(1) SEE SCHEMATIC DIAGRAM

(2) MAXIMUM MAY NEED TO BE GREATER TO ALLOW FOR SHOCK WAVE EFFECTS.

(3) TO BE DETERMINED.

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SHEET 1 OF 1 REV. _____

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PONCA CITY OKLAHOMA

SPECIFICATION SHEET

TEMPERATURE INSTRUMENTS

A F E NO. ____ W O NO. ____
DATE 9/26/80 INQ NO. ____
MADE BY MSW REQ NO. ____
APP'D BY WRS P O NO. ____
B M NO. ____

PLANT PONCA CITY - R & D PROJECT PVC REACTOR RELIEF TEST RUN

1	TAG NO.	TT-1 & TT-2			
2	SERVICE				
3					
4	INSTRUMENT TYPE	TEMP TRANS.			
5	LOCATION	(1)			
6	RANGE °F	0-200			
7	ELEMENT, TYPE	(2)			
8	LOCATION				
9	TEMPERATURE °F				
10	PRESSURE PSIG				
11	VALVE TYPE				
12					
13	LOCATION				
14	MATERIAL				
15	BODY SIZE / PORT SIZE				
16	PLUG FORM				
17	ΔP / MIN. / NOR / MAX.				
18	CALC. Cv / VALVE Cv				
19	AIR TO OPEN OR CLOSE				
20	MAX. SHUTOFF ΔP				
21	FLUID	VCM - PVC SLURRY			
22	TEMPERATURE °F MAX	200			
23	PRESSURE PSIG MAX	220 (3)			
24	°API (M. W.)				
25	SP. GR. AT STD. COND.				
26	SP. GR. AT P. & T.				
27	WEIGHT % VAPOR IN--OUT	1.4 MAX 45.2			
28	VISCOSITY AT P & T				
29	RATE, NORMAL				
30	RATE LB/SEC				
31	MAX / MIN	3 / 0			
32	NOTES:				

(1) SEE SCHEMATIC DIAGRAM

(2) TO BE DETERMINED

(3) PRESSURE MAY EXCEED 220 PSIG DUE TO THE SHOCK WAVE

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SHEET 1 OF ____ REV. ____

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SPECIFICATION SHEET

A.F.E. NO. _____
DATE 9/26 W. O. NO. _____
MADE BY MSW INQ. NO. _____
APP'D BY WRK REQ. NO. _____
B. M. NO. _____ P. O NO. _____

PLANT PONCA CITY RYD PROJECT PVC REACTOR RELIEF TEST RUN

ITEM NO SERVICE	RD-1 AND RD-2	
	RD-1	RD-2
DESCRIPTION	SINGLE DISC ASSEMBLY	
CONNECTIONS	TWO INCH 300-POUND RF	ONE AND ONE-HALF INCH 300-POUND RF
HOLDER	EXISTING	SRB-7RS SAFETY HEAD (1) WITH PRESSURE GAUGE AND CHECK VALVE 316 SS INSERT TYPE
DISC MATERIAL	NICKEL	
BURST PRESSURE	220 PSIG	200 PSIG
BURST TEMPERATURE	200°F	170°F
FLUID	PVC-VCM-H$_2$O	
	EQUIVALENT	

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SHEET 1 OF 1 REV. _____

F-270-9A

CONOCO

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SPECIFICATION SHEET

RELIEF VALVES

A.F.E. NO. _____

DATE 9/26/80 W.O. NO. _____

MADE BY MCM INQ. NO. _____

APP'D BY WRE REQ. NO. _____

B.M. NO. _____ P.O. NO. _____

PLANT SO GAL NCAL TOX PROJECT RELIEF TEST RUN

	GENERAL					
1	ITEM NO. & TAG	SV-1	SV-1			
2	RELIEVES EQUIPMENT NO.					
3	MANUFACTURER	CONSOLIDATED	CONSOLIDATED			
4	MODEL NO.	1905-30Fc (1)	1905-30Ec (1)			
5						
	SERVICE CONDITIONS					
6	FLUID	VCM-H2O PVC	VCM-H2O-PVC			
7	STATE	FLASHING	SLURRY			
8	REQUIRED CAPACITY					
9	MOL. WT. / SP. GR.					
10	VISCOSITY					
11	COMPRESSIBILITY FACTOR					
12	DESIGN PRESS. OF EQUIPMENT					
13	PRESS OPERATING / RELIEVING					
14	TEMP FLOWING / RELIEVING					
15	BACK PRESSURE	5#	5#			
16	DIFFERENTIAL SET PRESSURE					
17	ACCUMULATION %					
18	BLOW DOWN %					
19						
	BASIS OF SELECTION					
20	CODE REQUIREMENT					
21	FIRE EXPOSED AREA					
22	FIRE INSULATION THICKNESS					
23	OTHER BASIS					
24						
	DESIGN DETAILS					
25	DESIGN TYPE	BELLOWS	BELLOWS			
26	SEAT TYPE					
27	BONNET (OPEN OR CLOSED)	CLOSED	OPEN			
28	INLET SIZE, RATING, FACING	1½"-150 RF	1"-150 RF			
29	OUTLET SIZE, RATING, FACING	1"-150 RF	2"-150 RF			
30	CALCULATED AREA					
31	ORIFICE LETTER / ACTUAL AREA	F / 0.307	E / .196			
	MATERIALS					
32	BODY / BONNET	CS / CS	CS / CS			
33	SEAT & DISK	SS	SS			
34	GUIDE & RING	SS	SS			
35	SPRING	CS	CS			
36	BELLOWS	SS	SS			
	ACCESSORIES					
37	LIFTING LEVER (PLAIN OR PACKED)	NO	NO			
38	GAG	NO	NO			
39	CODE STAMP					
40	CAP (SCREWED OR BOLTED)					
41	OTHER					DTH 000069733

NOTES: (1) FE EQUIVALENT

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.

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SUPPLIER TO COMPLETE FORM BY FURNISHING INFORMATION FOR BLANK SPACES

SHEET 1 OF 1 REV. _____

4-436-S

REV. 12-8-80

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SPECIFICATION SHEET

ORIFICE PLATES & FLANGES

INCLUDING DATA FOR BORE CALCULATION

A.F.E. NO. _____ W.O. NO. _____

DATE 9/26/80 INQ. NO. _____

MADE BY MSN REQ. NO. _____

APP'D BY WRP P.O. NO. _____

B.M. NO. _____

PLANT COAL REACTOR PROJECT REACTOR RELIEF TEST RUN

	GENERAL SPECIFICATION					
	ORIFICE PLATES			ORIFICE FLANGES		
	MAKE TO AGA-ASME STANDARD		OTHER	RATING & FACING		
	PLATE MATERIAL:	316S.S.	OTHER	TYPE:	WELD NECK	OTHER
	RTJ RING MAT'L & TYPE			MAT'L:	STEEL	OTHER
	BORE MAXIMUM RATE		NEAREST 1/8"	TAP SIZE	1/2" NPT	OTHER
	STAMP TO ISA STANDARD		OTHER	FLANGES BY		

TAG NO.		OR-1
LINE NO.		
SERVICE CONDITIONS		
FLUID		YGM-EYL-H2O
FLOW UNITS		LBS/SEC
MAXIMUM FLOW		7
NORMAL FLOW		—
FLOW PRESSURE-PSIG		220 (1)
FLOW TEMPERATURE °F		700
S. G. @ 60°F &	PSIA	
S. G. @ F. T. &	PSIA	1.11
SUPERCOMP. FACTOR @ O. P.		
VAPOR GAS MOL WT		62.5
VISCOSITY. CP @ F. T.		
STEAM QUALITY. %		
STEAM SUPERHEAT °F		
MEASURING STATION DATA		
ACTUAL ORIFICE I. D., INS.		0.4996
LINE FLANGE I. D., INS.		2
SEAL S. G. @ 60°F		
MANOMETER TYPE		
DIFF. RANGE INS H_2O DRY		
STATIC RANGE, PSIA		
CHART OR SCALE RANGE		
CHART MULTIPLIER		

DTH 000069734

NOTES: (1) PRESSURE MAY EXCEED THIS FIGURE DUE TO SHOCK WAVES

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INSTRUMENT SOCIETY OF AMERICA

SHEET 1 OF 1 REV

4-444-S

ENGINEERING CENTER
PONCA CITY, OKLAHOMA
SPECIFICATION SHEET

A.F.E. NO. _____
DATE 9/26/80 W.O. NO. _____
MADE BY MSW INQ. NO. _____
APP'D BY WRF REQ. NO. _____
B.M. NO _____ P.O. NO. _____

PLANT 7 CVIL REACTOR PROJECT REACTOR RELIEF TEST RUN

ITEM NO 2-1
SERVICE HIGH SPEED MULTI-TRACK RECORDER

TO BE CONNECTED TO PT-1 THRU PT-4 AND TT-1 AND TT-2. THIS WILL ALLOW LATER ANALYSIS OF THE TEST RUNS. 2-3 MAY ALSO BE CONNECTED. REQUIREMENTS TO BE SET BY CED.

DTH 000069735

9/29/80

SHEET 1 OF 1 REV _____

F-270-9A