RUPTURE DISC/RELIEF VALVE

PRACTICES MANUAL

CONOCO CHEMICALS COMPANY

ABERDEEN, MS

AUGUST 29, 1983

RUPTURE DISC/RELIEF VALVE

PRACTICES MANUAL

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I. INTRODUCTION

Section 61.65 (b)(4) of the National Emissions Standards for Hazardous Air Pollutant Sources requires that a rupture disc be installed underneath any emergency relief valve in vinyl chloride service, in order to minimize leakage through the relief valve to the atmosphere. In accordance with this requirement, Conoco has installed a large number of rupture discs in vinyl chloride service throughout the plant. In addition to preventing relief valve leakage, rupture discs also serve the vital function of protecting the relief valve from polymer buildup on the relief valve seat, which could hinder the proper functioning of the relief valve in an emergency. In either case, proper functioning of the rupture disc/relief valve combination is essential for plant safety.

This program has been developed because of the importance of maintaining the integrity of rupture discs during their handling and installation. Adherence to the procedures outlined in this manual will help to ensure that the chances of rupture disc/relief valve malfunction will be minimized, and that thorough documentation will be available whenever such a malfunction does occur. This documentation may become extremely critical in the event of a VCM release caused by a premature rupture disc failure or other process upset conditions.

II. RUPTURE DISC ORDERING AND PRE-INSTALLATION CHECKOUT

A. Specification of Rupture Discs

All rupture discs in VCM service are listed on Table 1. The following specifications must be noted on the purchase order when ordering these rupture discs.

1. Disc size (specify).
2. Type S-90.
3. Nickel material.
4. 0% Mfg. range.
5. Burst pressure (specify).
6. Letter of certification required.
7. ASME code stamped (where noted on Table 1.)
8. Test each disc to 90% of rated burst pressure.
9. Replaces lot no. . . (specify).
10. Serially number all discs in the lot.

B. Lot Inspection and Pre-Testing

All new rupture disc lots received at the plant receiving dock must be thoroughly inspected and tested before they are moved to the storeroom. The following procedures are to be used when new rupture disc lots are received at the Plant.

1. When a lot of rupture discs arrives at the receiving dock, use care when unloading the discs from the truck so as not to damage the discs.

2. The receiver must notify Process Engineering that there are new rupture discs at receiving, and a Senior Process Engineer or the Environmental Engineer will count the number of discs in the lot and inspect each individual disc for flaws.

II. RUPTURE DISC ORDERING AND PRE-INSTALLATION CHECKOUT (Continued)

B. Lot Inspection and Pre-Testing (Continued)

3. A flaw is defined as follows:

   a. Any knick or scratch which can be felt.

   b. Any irregularity in the shape of the domed portion of the disc that can be seen with the eye or felt.

   c. A pinhole or scratch which could cause the disc to leak.

   d. A disc without a tag.

   e. A disc that will not fit the pins of a holder.

   f. A disc that is labeled differently than the other discs in the same lot.

4. Flawed discs must be removed from the lot and returned to the manufacturer. Discs which pass inspection are initialed on the box by the inspector.

5. Rupture discs which are to be installed on vessels in VCM service must be approved by lot before they can be placed in the storeroom. One disc from each of these lots must be sent to the maintenance shop and burst using the procedures specified in the destructive testing section of this manual.

6. If any rupture disc does not burst within 5% of its rated burst pressure, the entire lot from which the disc was taken must be returned to the manufacturer. Maintenance must notify receiving in writing that these discs have either passed or failed this test.

7. Rupture discs which pass inspection and testing are ok'd for placement in the storeroom. Rupture disc boxes which have not been initialed are not to be placed in the storeroom.

II. RUPTURE DISC ORDERING AND PRE-INSTALLATION CHECKOUT (Continued)

C. Recordkeeping

Administrative Services must keep a record of rupture disc receiving and inspection data. An example log sheet is attached. This information must be stored in the plant for a period of at least two years.

III. RUPTURE DISC INSTALLATION

A qualified maintenance installation observer must be present during all phases of rupture disc installation (vinyl reactors only). The Mechanical Superintendent will keep an updated list of qualified maintenance installation observers.

A. Installation in Holders

All rupture discs must be installed in the holders according to the manufacturer's specifications. These written specifications come with each rupture disc. The following steps outline the general procedure which is to be used when installing rupture discs in holders:

1. Before a disc is placed in the holder, the disc, the holder and the holder bolts must be inspected for flaws.
2. Flaws are defined as follows:
    a. A disc that has any of the defects listed in Section II (B)(3).
    b. A holder face that is covered with dirt or debris, or is deeply gouged such that it will leak when installed.
    c. Set screws that are galled or cannot be screwed into the holder by hand.

III. RUPTURE DISC INSTALLATION (Continued)

A. Installation in Holders (Continued)

d. A holder with a bite ring that is not 2-5 mils in height, as determined by a feeler gauge. The bite ring must be uniform in height around the holder, and must not be dented at any location.

3. Flawed components must not be installed in the Plant.

4. Place the disc in the holder and hand install the holder bolts. Using a torque wrench, tighten the holder bolts to the torque specified by the manufacturer. This tightening must be performed in at least four passes; i.e. 25%, 50%, 75% and 100% of the final torque. A criss-cross tightening pattern must be used when torquing the bolts.

5. When the installation of the disc in the holder is complete, visually inspect the disc again to see if it has been distorted or otherwise damaged.

6. Rupture discs must not be removed from the holders after installation, otherwise the rupture disc must be discarded.

B. Testing

All reactor rupture discs are to be pressure tested in the maintenance shop to 90% of their rated burst pressure before being installed in the plant. The following testing procedure must be used when pressure testing rupture discs in the maintenance shop.

1. Clean the flanges of the test bench and the faces of the rupture disc holder where the two surfaces meet. Use an abestos gasket between the flange and the holder.

III. RUPTURE DISC INSTALLATION (Continued)

B. Testing (Continued)

2. Install the holder on the test bench and tighten the bolts in a criss-cross pattern, making several passes on each bolt. Torque the bolts to the torque specified for the companion flanges.

3. Warn nearby personnel that a rupture disc is being pressure tested.

4. Using pressurized air, slowly open the test valve and pressurize the space underneath the rupture disc. Increase the pressure to 90% of the rupture disc burst pressure at 72°F.

5. Slowly depressurize the space underneath the rupture disc and remove the assembly from the test bench. If the disc appears to have been distorted or otherwise damaged during the test, do not install the disc in the plant.

6. If a rupture disc bursts prematurely (less than 90% of its rated burst pressure) or is damaged by the test, the disc must be given intact to Process Engineering. Other discs from the same lot must be removed from service, where necessary.

7. The calibration of the test bench pressure gauge must be checked with a dead weight pressure gauge every six months.

III. RUPTURE DISC INSTALLATION (Continued)

C. Installation In The Plant

Rupture disc assemblies must be installed in the plant accordingly:

1. Before installing the holder assembly between the companion flanges, thoroughly clean the flange faces with a putty knife to remove any solid buildup or debris.
2. Check to see that the flange faces are not gouged or otherwise damaged. Place the rupture disc between the flanges, with the bulged-out side of the disc facing the process.
3. On reactors, use asbestos-type gaskets only. Flexatalik gaskets may be used elsewhere in the plant if desired.
4. When tightening the companion flanges, torque the bolts to the manufacturer's specification using a criss-cross tightening pattern. Make at least four passes on each bolt.

IV. RUPTURE DISC REMOVAL

A. Rupture Disc Changeout

Rupture discs are to be removed from service and changed accordingly:

1. Any rupture disc which fails in service must be changed as soon as possible after it is discovered that the disc has failed.
2. Any rupture disc which is believed to be covered with resin or otherwise damaged must be changed as soon as possible.
3. All rupture discs on reactors must be changed at least once every six months.
4. When a reactor is taken out of service for condenser drilling, the condenser rupture disc guard(s) must be installed over the rupture disc nozzle(s).

IV. RUPTURE DISC REMOVAL (Continued)

A. Rupture Disc Changeout (Continued)

5. Any rupture disc which fails in reactor service must be given to Process Engineering. Use care so as not to damage these discs. Other discs from the same lot must be removed from service, where necessary.

B. Destructive Testing

All rupture discs taken off of vinyl reactors must be burst in the maintenance shop when taken out of service permanently. The following procedures also apply to new rupture discs which are burst when they arrive at the Plant.

1. When removing the holder assembly from the reactor and when transporting the holder assembly to the maintenance shop, use caution so as not to damage the disc or the holder.
2. When destructively testing a vinyl reactor rupture disc, a qualified maintenance installation observer must be present to observe the testing.
3. Install the holder assembly on the test bench and pressurize the disc with air until the disc bursts.
4. If a rupture disc bursts prematurely (less that 90% of its rated burst pressure), the disc must be given to Process Engineering. Use care so as not to damage these discs. Other discs from the same lot must be removed from service, where necessary.

V. RECORDKEEPING

Maintenance must keep a record of all rupture disc installation and testing data. An example log sheet is attached (D-300 reactor). This information must be stored in the plant for a period of at least two years.

VI. TRAINING

All maintenance and engineering personnel involved in this program are to receive annual hands-on training in the installation and handling of rupture discs. Records of all personnel who attend these training sessions are to be kept by maintenance for a period of at least two years.

VII. RELIEF VALVES

All relief valves must be periodically checked to make sure that they will operate properly in an emergency situation.

A. New Relief Valves

All new valves must be tested accordingly:

1. Mount the relief valve on the hydro test bench and pressurize the relief valve until it relieves.
2. After the relief valve opens at its setpoint pressure, check to see that it holds a constant pressure upon reseating and does not leak.
3. If the relief valve does not relieve within 5% of its setpoint pressure, or does not reseat properly after relieving, it must not be installed in the plant.

VII. RELIEF VALVES (Continued)

B. In-Place Testing

Relief valves in service must be tested accordingly:

1. All relief valves in reactor service must be pressure checked every year using the nitrogen test apparatus. This test should be performed immediately before the rupture discs are changed.
2. When using the nitrogen test apparatus, slowly pressurize the space between the rupture disc and the relief valve until the relief valve relieves. If the relief valve opens at less than 95% of its setpoint pressure, take the relief valve out of service for repair. If the relief valve does not open at 105% of its setpoint pressure, top the test and take the relief valve out of service.
3. When the relief valve reseats, check to make sure that it holds pressure without leaking.
4. Following the test, slowly depressurize the space between the rupture disc and the relief valve.
5. Two pressure gauges must be kept on the nitrogen testing apparatus. If the two gauges disagree by more than 5 psig, the gauges must be calibrated against a standard pressure gauge.

C. Recordkeeping

Maintenance must keep a record of all testing and repair done on relief valves.

TABLE 1

RUPTURE DISCS IN VINYL AREAS OF PLANT

STOCK NUMBER	RUPTURE DISC LOCATION	CONOCO VESSEL #	RUPTURE DISC MFG.	RUPTURE DISC TYPE	RUPTURE DISC DESIGN PRES/TEMP. (PSIG/°F)	RV SET PRESSURE (PSIG)	RUPTURE DISC RANGE	MAT'L OF CONST.	IS RD CODE STAMPED	RD & HOLDER SIZE (INCHES)	HOLDER TYPE
AREA #1 - VCM UNLOADING AREA											
0293-V	VCM Sphere #1	93-001	BS&B	S-90	100/72	100	0%	Ni	Yes	6	SRB-7RS
0293-V	VCM Sphere #2	93-001	BS&B	S-90	100/72	100	0%	Ni	Yes	6	SRB-7RS
0352-C	T-201, Surge Tank	45-305	BS&B	S-90	150/150	150	0%	Ni	Yes	2	SRB-7RS
0314-N	W. Bullet #1	89-201	BS&B	S-90	150/72	150	0%	Ni	Yes	6	SRB-7RS
0314-N	W. Bullet #2	89-201	BS&B	S-90	150/72	150	0%	Ni	Yes	6	SRB-7RS
0314-N	E. Bullet #1	89-202	BS&B	S-90	150/72	150	0%	Ni	Yes	6	SRB-7RS
0314-N	E. Bullet #2	89-202	BS&B	S-90	150/72	150	0%	Ni	Yes	6	SRB-7RS
AREA #2 - OLD MODULE REACTORS											
0400-B	D-300 Shell	45-731	BS&B	S-90	200/200	190	0%	Ni	Yes	8	SRB-7RS
0400-B	D-300 Shell	45-731	BS&B	S-90	200/200	190	0%	Ni	Yes	8	SRB-7RS
0436-A	D-300 Shell	45-731	BS&B	S-90	195/200	185	0%	Ni	Yes	6	SRB-7RS
0298-N	D-300 Shell	45-731	BS&B	S-90	185/200	185	0%	Ni	Yes	6	SRB-7RS
0298-M	D-300 Cond	55-320	BS&B	S-90	185/200	185	0%	Ni	Yes	4	SRB-7RS
0400-B	D-400 Shell	45-732	BS&B	S-90	200/200	190	0%	Ni	Yes	8	SRB-7RS
0400-B	D-400 Shell	45-732	BS&B	S-90	200/200	190	0%	Ni	Yes	8	SRB-7RS
0436-A	D-400 Shell	45-732	BS&B	S-90	195/200	185	0%	Ni	Yes	6	SRB-7RS
0298-N	D-400 Cond	55-318	BS&B	S-90	185/200	185	0%	Ni	Yes	6	SRB-7RS
0400-B	D-500 Shell	45-734	BS&B	S-90	200/200	190	0%	Ni	Yes	8	SRB-7RS
0400-B	D-500 Shell	45-734	BS&B	S-90	200/200	190	0%	Ni	Yes	8	SRB-7RS
0436-A	D-500 Shell	45-734	BS&B	S-90	195/200	185	0%	Ni	Yes	6	SRB-7RS
0298-N	D-500 Cond	55-321	BS&B	S-90	185/200	185	0%	Ni	Yes	6	SRB-7RS
0400-B	D-600 Shell	45-735	BS&B	S-90	200/200	190	0%	Ni	Yes	8	SRB-7RS
0400-B	D-600 Shell	45-735	BS&B	S-90	200/200	190	0%	Ni	Yes	8	SRB-7RS
0436-A	D-600 Shell	45-735	BS&B	S-90	195/200	185	0%	Ni	Yes	6	SRB-7RS
0298-N	D-600 Cond	55-322	BS&B	S-90	185/200	185	0%	Ni	Yes	6	SRB-7RS

TABLE 1

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STOCK NUMBER	RUPTURE DISC LOCATION	CONOCO VESSEL#	RUPTURE DISC MFG.	RUPTURE DISC TYPE	RUPTURE DISC DESIGN PRES/TEMP. (PSIG/°F)	RV SET PRESSURE (PSIG)	RUPTURE DISC RANGE	MAT'L OF CONST.	IS RD CODE STAMPED	RD & HOLDER SIZE (INCHES)	HOLDER TYPE
AREA #2 (cont.)											
0436-E	D-700 Shell	45-755	BS&B	S-90	215/176	205	0%	Ni	Yes	8	SRB-7RS
0436-E	D-700 Shell	45-755	BS&B	S-90	215/176	205	0%	Ni	Yes	8	SRB-7RS
0436-E	D-700 Shell	45-755	BS&B	S-90	215/176	205	0%	Ni	Yes	8	SRB-7RS
0436-E	D-700 Cond	55-356	BS&B	S-90	215/176	205	0%	Ni	Yes	8	SRB-7RS
0436-F	D-700 Cond	55-356	BS&B	S-90	210/175	200	0%	Ni	Yes	8	SRB-7RS
0436-F	D-700 Shell	45-755	BS&B	S-90	210/175	200	0%	Ni	Yes	8	SRB-7RS
0436-C	D-700 Shell	45-755	BS&B	S-90	205/173	195	0%	Ni	Yes	8	SRB-7RS
AREA #3 - NEW MODULE REACTORS											
0400-B	D-741 Shell	45-741	BS&B	S-90	200/200	190	0%	Ni	Yes	8	SRB-7RS
0400-B	D-741 Shell	45-741	BS&B	S-90	200/200	190	0%	Ni	Yes	8	SRB-7RS
0435-Z	D-741 Shell	45-741	BS&B	S-90	190/200	180	0%	Ni	Yes	6	SRB-7RS
0298-N	D-741 Cond	55-328	BS&B	S-90	185/200	175	0%	Ni	Yes	6	SRB-7RS
0400-B	D-742 Shell	45-742	BS&B	S-90	200/200	190	0%	Ni	Yes	8	SRB-7RS
0400-B	D-742 Shell	45-742	BS&B	S-90	200/200	190	0%	Ni	Yes	8	SRB-7RS
0435-Z	D-742 Shell	45-742	BS&B	S-90	190/200	180	0%	Ni	Yes	6	SRB-7RS
0298-N	D-742 Cond	55-329	BS&B	S-90	185/200	175	0%	Ni	Yes	6	SRB-7RS
0400-B	D-743 Shell	45-743	BS&B	S-90	200/200	190	0%	Ni	Yes	8	SRB-7RS
0400-B	D-743 Shell	45-743	BS&B	S-90	200/200	190	0%	Ni	Yes	8	SRB-7RS
0435-Z	D-743 Shell	45-743	BS&B	S-90	190/200	180	0%	Ni	Yes	6	SRB-7RS
0298-N	D-743 Cond	55-330	BS&B	S-90	185/200	175	0%	Ni	Yes	6	SRB-7RS
0400-B	D-744 Shell	45-744	BS&B	S-90	200/200	190	0%	Ni	Yes	8	SRB-7RS
0400-B	D-744 Shell	45-744	BS&B	S-90	200/200	190	0%	Ni	Yes	8	SRB-7RS
0435-Z	D-744 Shell	45-744	BS&B	S-90	190/200	180	0%	Ni	Yes	6	SRB-7RS
0298-N	D-744 Cond	55-331	BS&B	S-90	185/200	175	0%	Ni	Yes	6	SRB-7RS
0436-E	D-745 Shell	45-781	BS&B	S-90	215/176	205	0%	Ni	Yes	8	SRB-7RS
0436-E	D-745 Shell	45-781	BS&B	S-90	215/176	205	0%	Ni	Yes	8	SRB-7RS
0436-E	D-745 Shell	45-781	BS&B	S-90	215/176	205	0%	Ni	Yes	8	SRB-7RS
0436-E	D-745 Cond	55-356	BS&B	S-90	215/176	205	0%	Ni	Yes	8	SRB-7RS
0436-F	D-745 Cond	55-358	BS&B	S-90	210/175	200	0%	Ni	Yes	8	SRB-7RS
0436-F	D-745 Shell	45-781	BS&B	S-90	210/175	200	0%	Ni	Yes	8	SRB-7RS
0436-C	D-745 Shell	45-781	BS&B	S-90	205/173	195	0%	Ni	Yes	8	SRB-7RS

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RUPTURE DISCS IN VINYL AREAS OF PLANT

STOCK NUMBER	RUPTURE DISC LOCATION	CONOCO VESSEL#	RUPTURE DISC MFG.	RUPTURE DISC TYPE	RUPTURE DISC DESIGN PRES/TEMP. (PSIG/°F)	RV SET PRESSURE (PSIG)	RUPTURE DISC RANGE	MAT'L OF CONST.	IS RD CODE STAMPED	RD & HOLDER SIZE (INCHES)	HOLDER TYPE
AREA #4 - OLD MODULE CHARGE & RECOVERY											
0314-O	N.RVCM Receiver	45-011	BS&B	S-90	150/72	150	0%	Ni	Yes	4	SRB-7RS
0314-O	S.RVCM Receiver	45-012	BS&B	S-90	150/72		0%	Ni	Yes	4	SRB-7RS
0314-P	FCVM Receiver	45-013	BS&B	S-90	150/72	150	0%	Ni	Yes	3	SRB-7RS
0314-S	N.FVCM Charge Filter	64-008	BS&B	S-90	300/72	275	0%	Ni	Yes	1	SRB-7RS
0314-S	S.FVCM Charge Filter	64-009	BS&B	S-90	300/72	275	0%	Ni	Yes	1	SRB-7RS
0314-S	RVCM Charge Filter	64-691	BS&B	S-90	300/72	275	0%	Ni	Yes	1	SRB-7RS
0352-C	RVCM Collect Tank	45-005	BS&B	S-90	150/150	150	0%	Ni	Yes	2	SRB-7RS
0314-P	N.RVCM Condenser	55-008	BS&B	S-90	150/72	200	0%	Ni	Yes	3	SRB-7RS
0314-P	S.RVCM Condenser	55-009	BS&B	S-90	150/72	200	0%	Ni	Yes	3	SRB-7RS
0352-A	ERS Inlet Tank	45-026	BS&B	S-90	150/300	150	0%	Ni	Yes	2	SRB-7RS
0352-C	ERS Inter Tank	45-308	BS&B	S-90	150/150	150	0%	Ni	Yes	2	SRB-7RS
0352-C	ERS Outlet Tank	45-342	BS&B	S-90	150/150	150	0%	Ni	Yes	2	SRB-7RS
0314-R	W.Vacuum Pump	72-716	BS&B	S-90	150/72	150	0%	Ni	No	1½	SRB-7RS
0314-R	E.Vacuum Pump	72-751	BS&B	S-90	150/72	150	0%	Ni	No	1½	SRB-7RS
0314-R	W.Recov. Comp.	72-753	BS&B	S-90	150/72	150	0%	Ni	No	1½	SRB-7RS
0314-R	E.Recov. Comp.	72-752	BS&B	S-90	150/72	150	0%	Ni	No	1½	SRB-7RS
0314-O	N.KO Drum	45-027	BS&B	S-90	150/72	150	0%	Ni	No	4	SRB-7RS
0314-O	S.KO Drum	45-028	BS&B	S-90	150/72	150	0%	Ni	No	4	SRB-7RS
0352-B	LRS E.Vacuum Pump	72-709	BS&B	S-90	150/300	250	0%	Ni	Yes	1½	SRB-7RS
0352-B	LRS W.Vacuum Pump	72-710	BS&B	S-90	150/300		0%	Ni	Yes	1½	SRB-7RS
0314-R	N.Seal H_2O Sep.	45-017	BS&B	S-90	150/72	150	0%	Ni	No	1½	SRB-7RS
0314-R	S.Seal H_2O Sep.	45-018	BS&B	S-90	150/72	150	0%	Ni	No	1½	SRB-7RS
0440-G	N.Batch H_2O Stripper	45-802	BS&B	S-90	150/366	150	0%	Ni	Yes	3	SRB-7RS
0440-G	S.Batch H_2O Stripper	45-801	BS&B	S-90	150/366	150	0%	Ni	Yes	3	SRB-7RS
0440-H	LRS E.Recov.Comp.	72-711	BS&B	S-90	150/200	150	0%	Ni	No	1	SRB-7RS
0440-H	LRS W.Recov.Comp.	72-712	BS&B	S-90	150/200	150	0%	Ni	No	1	SRB-7RS

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AREA #4 (cont.)											
0440-F	D-300 Catalyst Pot		BS&B	S-90	330/300		0%	Ni	No	4	SRB-7RS
0440-F	D-400 Catalyst Pot		BS&B	S-90	330/300		0%	Ni	No	4	SRB-7RS
0440-F	D-500 Catalyst Pot		BS&B	S-90	330/300		0%	Ni	No	4	SRB-7RS
0440-F	D-600 Catalyst Pot		BS&B	S-90	330/300		0%	Ni	No	4	SRB-7RS
0436-D	D-700 Catalyst Pot	45-778	BS&B	S-90	330/300		0%	Ni	Yes	6	SRB-7RS
0436-B	D-300 AMS Kill Pot		BS&B	S-90	400/720	400	0%	Ni	No	1	SRB-7RS
0436-B	D-400 AMS Kill Pot		BS&B	S-90	400/720	400	0%	Ni	No	1	SRB-7RS
0436-B	D-500 AMS Kill Pot		BS&B	S-90	400/720	400	0%	Ni	No	1	SRB-7RS
0436-B	D-600 AMS Kill Pot		BS&B	S-90	400/720	400	0%	Ni	No	1	SRB-7RS
0436-B	D-700 AMS Kill Pot	45-780	BS&B	S-90	400/720	400	0%	Ni	No	1	SRB-7RS
AREA #5 - NEW MODULE CHARGE & RECOVERY											
0314-P	E.RVCM Receiver	45317	BS&B	S-90	150/72	150	0%	Ni	No	3	SRB-7RS
0314-P	W.RVCM Receiver	89-520	BS&B	S-90	150/72	150	0%	Ni	No	3	SRB-7RS
0314-P	FVCM Receiver	45-745	BS&B	S-90	150/72	150	0%	Ni	No	3	SRB-7RS
0352-C	RVCM Collect Tank	45-764	BS&B	S-90	150/150	150	0%	Ni	Yes	2	SRB-7RS
0352-Z	RVCM Collect Tank	45-764	BS&B	S-90	250/100		0%	Ni	No	1½	SRB-7RS
0352-C	E.RVCM Condenser	55-338	BS&B	S-90	150/150	150	0%	Ni	Yes	2	SRB-7RS
0352-C	W.RVCM Condenser	55-339	BS&B	S-90	150/150	150	0%	Ni	Yes	2	SRB-7RS
0352-B	N.Seal H_2O Sep.	45-763	BS&B	S-90	150/300	150	0%	Ni	Yes	1½	SRB-7RS
0352-B	S.Seal H_2O Sep.	45-762	BS&B	S-90	150/300	150	0%	Ni	Yes	1½	SRB-7RS
0352-B	N.Vacuum Pump	72-902	BS&B	S-90	150/300	150	0%	Ni	Yes	1½	SRB-7RS
0352-B	S.Vacuum Pump	72-901	BS&B	S-90	150/300	150	0%	Ni	Yes	1½	SRB-7RS
0440-H	N.Recov.Compr.	72-905	BS&B	S-90	150/200	150	0%	Ni	No	1	SRB-7RS
0440-H	Mid Recov.Compr.	72-904	BS&B	S-90	150/200	150	0%	Ni	No	1	SRB-7RS
0440-H	S.Recov. Compr.	72-903	BS&B	S-90	150/200	150	0%	Ni	No	1	SRB-7RS
0352-A	N.KO Tank	45-761	BS&B	S-90	150/300	150	0%	Ni	Yes	2	SRB-7RS
0352-A	S.KO Tank	45-760	BS&B	S-90	150/300	150	0%	Ni	Yes	2	SRB-7RS
0352-B	Blowdown Tank	45-319	BS&B	S-90	150/300	150	0%	Ni	No	1½	SRB-7RS
0440-F	D-741 Catalyst Pot		BS&B	S-90	330/300	--	0%	Ni	No	4	SRB-7RS
0440-F	D-742 Catalyst Pot		BS&B	S-90	330/300	--	0%	Ni	No	4	SRB-7RS

RUPTURE DISCS IN VINYL AREAS OF PLANT

STOCK NUMBER	RUPTURE DISC LOCATION	CONOCO VESSEL#	RUPTURE DISC MFG.	RUPTURE DISC TYPE	RUPTURE DISC DESIGN PRES/TEMP. (PSIG/°F)	RUPTURE DISC RV SET PRESSURE (PSIG)	RUPTURE DISC RANGE	RUPTURE DISC MAT'L OF CONST.	RUPTURE DISC IS RD CODE STAMPED	RD & HOLDER SIZE (INCHES)	HOLDER TYPE
0440-F	D-743 Cat. Pot		BS&B	S-90	330/300		0%	Ni	No	4	SRB-7RS
0440-F	D-744 Cat. Pot		BS&B	S-90	330/300		0%	Ni	No	4	SRB-7RS
0436-D	D-745 Cat. Pot	45-784	BS&B	S-90	330/300		0%	Ni	Yes	6	SRB-7RS
0436-B	D-741 AMS Kill Pot		BS&B	S-90	400/720	400	0%	Ni	No	1	SRB-7RS
0436-B	D-742 AMS Kill Pot		BS&B	S-90	400/720	400	0%	Ni	No	1	SRB-7RS
0436-B	D-743 AMS Kill Pot		BS&B	S-90	400/720	400	0%	Ni	No	1	SRB-7RS
0436-B	D-744 AMS Kill Pot		BS&B	S-90	400/720	400	0%	Ni	No	1	SRB-7RS
0436-B	D-745 AMS Kill Pot	45-786	BS&B	S-90	400/720	400	0%	Ni	No	1	SRB-7RS

RUPTURE DISC CHECK-IN

DATE RECEIVED	LOT NUMBER	STOCK NUMBER	DISC SIZE	DESIGN PRESSURE A 72°F	NUMBER OF DISCS	LOT INSPECTED BY	DESTRUCTIVE TEST REQUIRED*	LOT APPROVED (YES, NO)	COMMENTS

* All rupture discs in VCM service.

(Example Copy)

D-300 REACTOR

DTH 000094481

Date Installed On Reactor					
Location					
Lot No.					
Design Pressure At 70° F					
Disc Size					
Installation In Holder Observed By					
Test Pressure					
Tested By					
Test Observed By					
Installed On Reactor By					
Installation On Reactor Observed By					
Date Removed					
Reason For Removal					
Removed By					
Burst Pressure					
Holder No.					

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization

General Information

The polymerization phase of the reactor batch cycle is the phase in which the liquid VCM is converted into solid PVC. This portion of the reactor cycle is mainly accomplished by instrumentation which controls the transfer of heat from the reaction. The lead operator is responsible for monitoring the reactor temperature and pressure and taking corrective action as needed such as venting the reactor if the temperature deviates from the setpoint or if the pressure on the reactor starts rising due to inerts blanketing the condenser. The lead operator must also coordinate the activities of the "A" operator who must sample the reactor if it needs to be sampled or kill the reaction when it has progressed to the point that product quality is satisfactory. Figure 8 (in the Appendix) shows the pressure, temperature, and cooling water curves for a normal polymerization.

Procedure

1. After the reactor charge procedures are all completed, Steam continues to be added to the reactor jacket to expedite heating of the reactor contents to run temperature. The lead operator will monitor the reactor temperature and pressure during heat-up and shut off the steam to the jacket when the reactor temperature ~~in the reactor~~ is within ~~2~~ 3-4 of the setpoint.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Procedure (Continued)

2. The lead operator will record the heat-up time on the batch sheet when the reactor reaches the setpoint. The heat-up time is the time from when the reactor charge was completed until the time that the temperature setpoint is reached. Heat-up time should be close to one hour on the small reactors (D-300 through D-600) and about 30 minutes on D-700. If the heat-up times vary more than 15 minutes from this standard, the Shift Supervisor should be notified and the particle size should be watched. Heat-up times more than 15 minutes shorter than the standard may indicate that the reactor charge temperature was too high or that the reaction is progressing too fast. Either condition may alter particle size significantly. Heat-up times more than 15 minutes longer than the standard may also cause the particle size to be undesirable. Long heat-ups may be caused by no steam on the reactor jacket, cooling water leaking through the automatic cooling water valve, or by the cooling water valve opening before the temperature reaches setpoint. No flow or not enough steam flow to the reactor jacket can be verified by the "A" operator by checking the steam valves and lines. If the "A" operator cannot correct the problem, the Shift Supervisor should be notified and maintenance may be necessary.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Procedure (Continued)

The latter two conditions can be temporarily corrected by locking out the cooling water valve manually or valving off the automatic valve with a manual valve.

NOTE: If the reactor cooling water is manually valved off or locked out, a potentially dangerous situation is created because as the reactor reaches the temperature setpoint the cooling water for heat transfer control is not in automatic. The lead operator must monitor the reactor temperature very closely to make sure the controller is put back in automatic as soon as the setpoint temperature is attained. A maintenance work order should be made out and this situation corrected as soon as possible, if it occurs.

Slow reactor heat-up may also be caused by weak or not enough initiator. This can be determined by checking and comparing initiator loadings or subsequent batches.

3. The lead operator will continue to monitor the reaction temperature and pressure as the polymerization continues. The run pressure that the reactor lines out on is to be recorded on the batch sheet. It is usually necessary to vent the inerts from the condenser to the recovery system shortly after run temperature is reached.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Procedure (Continued)

Inerts blanketing the condenser becomes evident by the cooling water flow rising and the reactor temperature overshooting the setpoint causing the reactor pressure to rise. The inerts should be vented, as a general rule, if the temperature overshoots the setpoint by $2^{o}F$ and if the cooling water flow is rising quickly and is within one or two roots of the normal maximum cooling water flow.

If the reactor and/or weather conditions prevail that make inert-venting a certainty, it is usually best to go ahead and vent the reactor as soon as the temperature setpoint is reached. This prevents excessive inerts buildup in the condenser and helps ~~keep from~~ prevent excessive venting later during ~~the~~ polymerization.

The reactor may require venting several times during polymerization. Several short vents are preferable and will do more good than long vents. During a long vent, the VCM tends to channel through the condenser and will be vented out of the reactor much faster than inerts will. If the vent is stopped and the inerts are allowed to "regroup" to the top of the condenser, they can then be more easily vented out of the reactor.

The procedure for venting a reactor is given in this section beginning on page ~~XX~~ 7.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Procedure (Continued)

4. If any abnormalities in pressure, temperature, or reactor motor amperage are detected by the lead operator, the "A" operator may be instructed to sample the reactor and examine the resin to make sure it is not going coarse. The reactor sampling procedure is given in this section beginning on page ~~XX~~ 10a.

Some of the conditions which may warrant reactor sampling include:

a. The first batches after changing batch size.

b. The batches following a coarse batch or a batch that had a very high 60 mesh particle size result.

c. Test run batches.

d. Batches with abnormal charge temperatures or heat-up times.

e. Batches that had abnormalities during charging.

f. Batches that show abnormal changes in agitator motor amperage (either high or low) during polymerization.

g. Batches that have sudden changes in reactor temperature or pressure, especially in the last few hours of polymerization. Pressure cycling toward the end of a batch often signals a batch that is about to go coarse.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Procedure (Continued)

The Shift Supervisor should be notified if any of these conditions develop and the reactor should be sampled immediately. If a batch is suspected to be going coarse, methocel should be added to the reactor to keep the particle size from worsening. Tests have shown that addition of extra methocel after two hours at run temperature will not cause a batch to have finer particle size but it will prevent a batch from getting coarser. If it ~~becomes~~ is necessary to sample a reactor, the batch should first be sampled one hour after the reactor reaches heat-up (the run temperature) and then it should be resampled every 30 minutes to every hour (according to the Supervisor's instructions) until the batch is killed.

5. As the normal polymerization reaches about 75% conversion of VCM to PVC, the reactor pressure begins to decrease. The lead operator will instruct the "A" operator to kill the reactor when it is 3-5 pounds before reaching the pressure drop specified on the reactor panel. By the time the reactor is killed, it will have reached the specified pressure drop. Reactor normal kill procedures are given in this section, beginning on page ~~XX.~~ 11

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Procedure (Continued)

Other specified conditions that may require killing the reactor include if a reactor temperature run away (rise above setpoint) or maximum run time is reached. These guidelines are specified on the control room panel.

Abnormal conditions during polymerization may also require early or emergency killing of a reactor. These will be discussed under troubleshooting in this section of the manual, beginning on page ~~XX.~~ 16

6. The reactor "A" operator will notify the lead operator when he completes killing the reactor. The lead operator will record on the batch sheet the time when the reaction was killed and the pressure of the reactor when kill is completed. The reactor is then ready for recovery.

Reactor Venting Procedure

1. Check the reactor conditions as given under the polymerization procedure, step 3 on page ~~XX~~ 3 to make sure the reactor needs to be vented.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Reactor Venting Procedure (Continued)

2. Turn on the large reactor recovery system if it is not running. At least one seal water pump, both recirculation knockout tank pumps, and one compressor must be running while venting a reactor. If the recovery system is already running, shut off whatever is feeding the recovery system (for example, if another reactor is recovering, close the condenser and recovery valves on that reactor).

NOTE: It is not recommended to vent inerts while another reactor is in the vacuum-hold period of recovery. This may cause the batch that is recovering to have high residuals. However, inerts must be vented if necessary to prevent overpressuring of the reactor that needs venting. If it becomes necessary to vent a reactor while another reactor is recovering, make sure that both valves on the reactor that is recovering are shut (condenser and recovery) and pull the recovery header back down to the vacuum that the recovering reactor has attained prior to re-opening the valves and finishing the recovery. A recovering reactor should also be held at vacuum five minutes longer than the usual holding time if the inerts had to be vented during the vacuum-held period of the recovery.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Reactor Venting Procedure (Continued)

3. Put the recovery pressure controller in manual and close the automatic valve. This prevents slugging the recovery system when high pressure is vented into it, and also reduces foaming during the vent.

4. Put the reactor to be vented in the emergency mode. This deactivates the Modicon interlock controls and any of the reactor valves ~~to~~ may be opened.

5. Open the reactor condenser and recovery valves.

6. Put the recovery pressure controller in automatic. This will let the valve slowly open and feed the inerts into the recovery system until the controller setpoint pressure is reached.

7. When the recovery pressure controller has been put in automatic and the reactor condenser and recovery valves open (it usually takes several seconds for the condenser valve to open), close the valves. Do not leave the values open for more than about 5 seconds.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Reactor Venting Procedure (Continued)

8. Monitor the reactor conditions and if temperature control on the reactor is not yet restored after about a minute, repeat the procedure starting at step 3.

NOTE: Several short vents are more effective than one long vent. If the reactor is allowed to vent too long, VCM in the reactor will channel through the condenser and out of the reactor and inerts will not be removed. Closing the valves and allowing the inerts to gather back into the top of the condenser and then re-venting will dispose of the inerts more efficiently. Long vents also may cause fine particle size because of the amount of VCM removed from the reactor.

9. When the temperature control on the reactor has been restored as indicated by the cooling water flow, temperature, or pressure dropping and returning to normal, turn off the reactor emergency mode switch and the reactor should return to the polymerization mode. Recheck all reactor ~~activated~~ actuated valves to make sure they are closed.

10. Turn off the recovery system compressor(s) and pumps after it has pulled the pressure out of the recovery header, or go back to recover~~ing~~ operations that were in process before venting.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Reactor Sampling Procedure

It may become necessary to sample the reactor during polymerization as instructed in Polymerization Procedure No. 4, page ~~XX.~~ 5 The reactor sampling cart must be used to sample the reactor unless the Shift Supervisor gives specific approval not to use it. The sampling cart allows reactor samples to be taken from the reactor and the residual VCM in the sample is recovered by the recovery system, minimizing operator exposure. The cart has a sampling bomb (small vessel) and relief bomb (larger vessel) on it with a rupture disc between the two bombs rated at 300 psig. The following steps should be taken to sample the reactor:

Start next page here →

1. Check to make sure (etc.)

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Reactor Sampling Procedure (Continued)

1. Check to make sure the sampling bomb is totally drained, then close the drain valve.

2. Add ½ pint of AMS to the sampling bomb, using the kill bucket. The relief bomb will already contain ½ pint of AMS. The AMS in the relief bomb should be changed out on a weekly basis.

3. Close all valves on both bombs except the valves to the pressure gauges.

4. Flush the reactor sample connection by opening the valve and flushing with the HPSW connected to the sample line. Then shut off the HPSW and let the line drain.

5. Attach the sample hose to the reactor sample connection using the Weco fitting. Use the wrench chained to the ~~platform~~ sample cart to tighten the fitting.

6. Open the 1" valve in the reactor sample line and the 1" valve on the sample hose.

7. Open the sample bomb hose valve.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Reactor Sampling Procedure (Continued)

8. Open the reactor sampling ram valve using the local switch. When the pressure in the bomb reaches 120 psig, close the ram valve, the valve in the line, and the hose valve at the Weco fitting. Do not close the sample hose valve at the sample bomb. Blocking in the hose with the reactor contents may over-pressure and rupture the hose.

9. Check the pressure on the HPSW header. If the pressure is above 200 psig, open the HPSW line to the reactor and then the sampling ram valve, and flush the sample line for about 30 seconds, then close the sampling ram valve using the local switch. Do not flush the sampling line for more than one minute.

10. Close the HPSW valve. Open the valve in the line and the hose valve at the Weco fitting. Slightly open the HPSW valve and flush the hose into the bomb. Flush for about 10 seconds, then close the HPSW valve in the line and the hose valve at the Weco fitting.

11. Disconnect the sample hose at the Weco fitting using the wrench to loosen the fitting.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Reactor Sampling Procedure (Continued)

12. Move the sampling ~~system~~ cart to the emission recovery system hook-up station. In the new module, this is located at the west end of the reactor structure near reactors 742 and 743 near ground level. In the old module, this is located west of T-701 near ground level.

13. Connect the sample hose to the emission recovery hook-up station with the Weco fitting. Open the sample hose valve and the emission recovery line valves and pull a vacuum on the sample bomb.

14. When the sample bomb is pulled down to at least 10 inches of mercury vacuum, close the bomb hose valve first, then the emission recovery valve nearest the bomb and finally the second emission recovery line valve.

15. Disconnect the hose connection at the Weco fitting and break the vacuum on the sample bomb by opening the AMS funnel valve.

16. Move the sampling cart ~~apparatus~~ to a drain location near the emission recovery hook-up station. The drain is located at the northeast corner of D-742 reactor structure in the new module and directly west of T-701 at ground level in the old module.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Reactor Sampling Procedure (Continued)

17. Open the bomb drain valve slightly and let liquid AMS drain off, then fully open the valve. Obtain a resin sample in a one gallon sample bucket. The bucket should be filled at least 2/3 full.

18. Connect a water hose to the sample bomb water hose connection and rinse the bomb through the drain valve.

19. Close the bomb drain valve, open the sample hose valves and flush the sample hose.

20. Shut off water to the sample bomb and disconnect the water hose. Open the drain valve and allow the bomb to drain completely.

21. The sample bomb is now ready for reuse.

To obtain a reactor sample without using the sample cart, the "A" operator must perform the folowing steps:

1. Clear the area downwind of the sample point.
2. Connect and put on a fresh air mask.
3. Flush HPSW through the sample line to flush it out.
4. Flush HPSW into the reactor per procedure step number 9 (above), except do not close the ram valve.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Reactor Sampling Procedure (Continued)

5. Shut off the HPSW, open the sample valve and let the reactor contents be blown to the ground until enough resin is blown out for a sample.

6. Shut the sample valve and flush the sample line again per step number 9 (above).

7. Close the HPSW flush.

NOTE: The Shift Supervisor must give approval to sample a reactor without the reactor sampling cart. ~~The reac~~ The reactor sample should be closely examined by the "A" operator. If resin particles that are stringy and stuck together or gritty resin particles which are harder and larger than most are observed, contact the lead operator and Shift Supervisor immediately. The batch may need to be killed and methocel added if these conditions exist and it is going coarse. Coarse batch procedures are given in Section R of this manual.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Methocel Addition Procedure

It may become necessary to add methocel to the reactor during polymerization for a variety of reasons. These may include if the batch is going coarse or if other batches running at the same time come up coarse or with high 60 mesh particle size results. The following procedure will be followed to add methocel to a charged reactor that is in the polymerization mode:

1. Check to make sure that no other reactor is charging. Methocel ~~should~~ must only be added to one reactor at a time.

2. Reset the methocel charge counter on the control panel to zero, by pushing the button below the counter readout.

3. Start the methocel charge pump and open the pump discharge valve.

4. Put the reactor in the ~~emergency~~ EMERGENCY mode.

5. Open the colloid valve on the reactor.

NOTE: Steps 3-5 will momentarily deadhead the methocel charge pump but will eliminate the risk of getting VCM and the reactor contents back through the methocel charge line and tank. The colloid charge valve on the reactor must be opened last when putting methocel into the reactor and closed first when the desired amount has been put into the reactor.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Methocel Addition Procedure (Continued)

6. When the specified amount of methocel has been added to the reactor, close the colloid charge valve. It may take two people (one to watch the meter and one to open and close the colloid charge valve) to perform this operation if a small amount of methocel is added to one of the reactors that are not close to the charge panel and methocel counter readout.

7. Take the reactor out of the "Emergency" mode.

8. Shut off the methocel pump and discharge valve.

9. Record on the batch sheet how much additional methocel was added to the reactor. This should be recorded in the top right hand corner under the actual methocel charge section of the sheet.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Reactor Normal Kill Procedure

NOTE: The chemicals used to kill the reactor are irritating to smell and should not be allowed to come in contact with the skin. Disposable plastic gloves must be worn while killing a reactor. If any of the kill solution splashes on a person, the affected area of skin should immediately be flushed. Medical attention should be sought if there is any burning sensation or reddening of the skin.

1. When told to kill a reactor, the "A" operator will put on disposable plastic gloves to prepare for handling the kill solution.

2. Pour the specified amount of Naugard, AMS, and antifoam into the marked 5 gallon bucket and transport it to the catalyst bomb (which is also referred to as the kill bomb). The amounts of raw materials to be used are posted in the control room panel and should be checked by the "A" operator at the first of the shift, and any changes noted. The specified amounts may total more than 5 gallons, so the operator will have to divide the amounts accordingly to make sure the correct amount of each ingredient is put into the kill bomb.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Reactor Normal Kill Procedure (Continued)

It is recommended that the Naugard and AMS be mixed together in the bucket because AMS will thin out the very viscous Naugard making the solution easier to pour. For best results the AMS should be put in the bucket first and Naugard poured into the ~~into~~ bucket and mixed with the AMS.

The 5 gallon buckets used for killing are ~~one~~ marked at one gallon intervals to facilitate adding the proper amount of each raw material. Resin quality will be affected if the proper amounts are not added by every operator every time. The kill solution bucket must not be used for calcium stearate addition because the calcium stearate will coat the sides of the bucket and cover the marks. Notify the Shift Supervisor (and Operations Supervisor) if a marked bucket is not available and one will be supplied as soon as possible.

3. Check the positions of the following valves:
   a. The valve at the base of the bomb funnel (it should be open).
   b. The valve which separates the bomb from the pressure gauge (it should be open and the gauge should be showing no pressure).

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Reactor Normal Kill Procedure (Continued)

NOTE: It is the operator's responsibility to change out any defective pressure gauges. Gauges on catalyst bombs should be changed out immediately if they have malfunctioned.

c. The bomb drain valve (it should be open).

d. The valve which supplies high pressure service water to the bomb (it should be closed).

e. The bomb vent drain valve.

4. Close the bomb ~~drain~~ valve.

NOTE: AMS is highly reactive in the presence of the catalysts used in the plant. Make sure that the bomb is drained and that no initiator remains in it prior to putting the kill solution in the bomb.

5. Pour the bucket of kill solution into the bomb. Make sure that all the materials are added (Naugard, AMS, and antifoam) in the proper amounts.

NOTE: Be careful not to splash the kill solution. If any kill solution gets on your skin, flush immediately with water.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Reactor Normal Kill Procedure (Continued)

6. Close the bomb funnel valve.

7. Close the bomb vent valve.

8. Slowly open the valve which supplies high pressure service water to the catalyst bomb.

9. Be sure that the valve which separates the bomb from the pressure gauge is open and allow the pressure in the bomb to increase to at least 200 psig and wait for the HPSW water meter to stop counting.

NOTE: Extreme caution must be exercised by the "A" operator to be sure that the reactor contents are not allowed to get back into the kill bomb. To guard against this situation, the operator must know that there is is adequate water supply and pressure on the bomb before killing the reactor. The reactor catalyst ram valve must never be opened unless the bomb is fully pressurized and the inlet HPSW valve is open.

10. Open the catalyst injection ram valve for the reactor, which separates the reactor from the catalyst bomb system. This is done with a local hand switch at the catalyst bomb. The catalyst bomb pressure should drop to about 150 psig.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Reactor Normal Kill Procedure (Continued)

11. Allow 50 gallons (5 rounds) of water to pass through the high pressure service meter.

NOTE: When the HPSW pressure on the bomb reaches 150 psig, a pressure switch activates a timer which gives the lead operator an alarm in the control room after 5 minutes. If the HPSW is cut off within 5 minutes, the alarm is de-activated. This is to give warning if the HPSW is left going into the reactor and is designed to prevent hydraulically filling the reactor when adding material through the catalyst bomb. ~~charging or killing a reactor~~. The reactor "A" operator must remain at the kill bomb used while killing a reactor. Failure to do so ~~follow this instruction~~ could result in the loss of a reactor contents to the atmosphere.

12. Close the catalyst injection Ram valve and then close the high pressure service water supply valve (must be in the specified order).

13. Notify the lead operator that the reactor is killed. The lead will record the time and reactor pressure on the batch sheet.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Reactor Normal Kill Procedure (Continued)

14. Open the bomb drain valve and then slowly and carefully open the bomb vent valve, then open the funnel valve.

15. Make sure the bomb is draining by checking the drain outlet. If the bomb did not drain, it may contain amounts of kill solution which may be hazardous. Check the drain by flushing it if it does not appear to be working.

Troubleshooting

As discussed in the operating procedures for this section, there are numerous abnormal situations which can arise. In almost every case the corrective measure will be the addition of some amount of AMS through the catalyst (kill) bomb or the Emergency AMS Addition System. The reactors are equipped with pressure relief mechanisms which provide for reactor venting at excessive pressures. Safety discs on the small reactors are set at 185 psig (minimum) and safety discs on the D-700 are set at 205 psig (minimum). Although relief of excessive reactor pressure is necessary to avoid equipment failure, control should be restored as soon as possible after any such relief to avoid fire and personnel exposure hazards.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Troubleshooting (Continued)

1. Coarse Batch - If a coarse batch is detected and found to be going coarse (upon sampling) the batch should immediately be killed with five gallons of AMS and the usual amount of antifoam and Naugard. Fifty (50) gallons of methocel should also be added to the reactor (see procedure on page ~~XX~~ 109) and steps should be taken as given in the Coarse Batch Procedures section of this manual, Section R.

   The lead operator should record on the batch sheet why the batch was killed early (using the "Comments" section at the bottom of ~~this~~ the sheet), and that fifty gallons of methocel were added.

2. Long Reaction Time - This may be caused by low initiator levels, weak intiator, long heat-up times, or low reactor temperature setting. Maximum run times are given on the control panel for each product. If the run time gets within an hour of this maximum, the batch must be sampled by the "A" operator. If it reaches the maximum poly time, the batch should be killed with the normal amount of kill solution and recovered per normal procedures.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Troubleshooting (Continued)

3. Simultaneous Temperature and Pressure Drop - This is usually caused by the cooling water valves staying wide open. Even though the valve position and flow in the control room show that the valves and flow are normal, an instrument malfunction can occur, especially in freezing weather. The "A" operator should check the valves and throttle the manual cooling water valves if the automatic valves are staying wide open, until the problem is found and corrected.

4. Hydraulically Full Reactor - This occurs when too much of an ingredient is charged or an excessive continuous water source is allowed to enter the reactor during polymerization. A hydraulically full reactor has no place to relieve the closed-in pressure so the pressure will rise uncontrollably. The pressure rise on a hydraulically full reactor may be so fast that it cannot be stopped. The following guidelines may be used to control a hydraulically full reactor if the pressure rise is caught in time. These are in order of priority such that if the first step does not control the pressure rise, the second one should be tried, etc. The Shift Supervisor should be notified as soon as this condition is noticed.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Troubleshooting (Continued)

a. If the reactor pressure rises very rapidly with only a small rise or no rise in the reactor temperature, a hydraulically full reactor should be suspected. The lead operator should immediately vent the reactor to the recovery system by opening the reactor recovery and condenser valves (it is preferable to put the recovery pressure controller in manual and close the valve first per the venting procedure. Depending upon the rate of pressure rise in this situation, this part of the procedure may be bypassed under these conditions only). If the reactor is vented and the pressure drops immediately, this is a further indication that the reactor may be hydraulically full.

b. The lead operator can put the emergency full cooling on the reactor and have the "A" operator shut off the lip seal and sprayhead flush flows. This will attempt to lower the reactor pressure and keep it from filling up more.

c. Equalize the reactor ~~auto~~ into an ~~on~~ evacuated reactor through the recovery line on top or through the dump line on bottom, if an evacuated reactor is available. The receiving reactor must have been properly evacuated prior to equalization. Equalization through the recovery line should be used if necessary to prevent reactor overpressuring but may cause pluggage at low spots in the line due to resin carryover.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Troubleshooting (Continued)

The recovery pressure control valve or knockout tank inlet valve should be ~~closed~~ closed to prevent feeding the reactor through the recovery system. Equalization through the dump lines on bottom requires that the ~~automatic slurry dump box~~ emergency Sweco valve ~~automatic level control valve~~ automatic be closed. ~~This can be accomplished by pinning out the pumps and opening HPSW into the suction~~ line ~~which will overflow the dump box and keep the valve closed~~.

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NOTE: ~~It is not desirable to equalize through the dump lines unless the~~ automatic control valve ~~is blanked to prevent leakage of VCM to the atmosphere.~~

d. Vent the full reactor into a recovered but not dumped reactor that is in the pressure drop or any stage of recovery (after shutting down the recovery system).

e. Vent the full reactor into a reactor that is in polymerization mode that has lined out on temperature and pressure.

5. Temperature and Pressure Run-Away - Operational or mechanical conditions can exist such that loss of reactor temperature and pressure control can occur.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Troubleshooting (Continued)

5. Temperature and Pressure ~~Run-Away~~ Runaway (Continued)

When this loss of control occurs, some means of restoring control must be established. One such situation which can occur is a "~~Run-Away~~ runaway" or a "Heat ~~K~~ kick". As discussed in the polymerization section, a certain amount of ~~initiator~~ catalyst is added to each batch. This amount of ~~initiator~~ catalyst varies from one season to another due to a variation in the cooling water temperature. The colder the cooling water the more ~~initiator~~ catalyst which can be used. The more ~~initiator~~ catalyst used the faster the reaction and the shorter the polymerization time. The plant normally adjusts ~~initiator~~ catalyst amounts in half gallon increments. Sometimes half gallon increments are not accurate enough and an excess of initiator is charged for a given cooling water temperature. When this happens the reaction will proceed normally except at some point during polymerization the temperature (and possibly the pressure) will begin to rise above the normal run conditions, not responding to increases in cooling water flow. The following guidelines should be used to control a run-away reaction:

a. The lead operator will try to vent the reactor using the venting procedure. If venting will not turn the runaway pressure or temperature) the reactor will need to be "bumped".

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Troubleshooting (Continued)

5. Temperature and Pressure ~~Run-Away~~ Runaway (Continued)

The lead operator will tell the "A" operator to "bump" the reactor. This means that a small amount of AMS, approximately one pint to one quart, is to be injected into the reactor through the catalyst bomb. The "A" operator will give bumping a reactor highest priority over any other task he is performing during normal operations. No Naugard or AMS is added to the reactor when it is bumped. The "A" operator will pour one pint to one quart of AMS into the kill bucket (just enough to entirely cover the bottom of the bucket) and will charge it into the reactor per the Reactor Normal Kill Procedure in this manual, beginning with step number 3 on page ~~XX~~ 11.

c. Bumping the reactor will normally restore control of the reactor. If the reactor temperature (and pressure) should continue to rise, the lead operator will have the "A" operator bump the reactor again. Unless word is given to kill the reaction, AMS should not be added in more than one quart increments for runaway reactions. This is because the AMS will carryover into the recovered VCM through the recovery system ~~and the recovered VCM~~ and will affect particle size control of subsequent batches charged.

III. OPERATING MANUAL (CONTINUED)

C. Polymerization (Continued)

Troubleshooting (Continued)

5. Temperature and Pressure ~~Run-Away~~ Runaway (Continued)

NOTE: The lead operator should closely monitor any reaction that has been bumped or killed early to make sure it does not "take-off" or begin to ~~run-away~~ runaway again. This will require further action steps by the lead or "A" operator.

6. Reactor Early Kill - If reactor ~~run-away~~ runaway cannot be controlled or under various other abnormal conditions such as a plugged condenser, it may become necessary to completely kill a reactor that has been initiated (catalyst has been added). The Shift Supervisor must approve or give word to kill the reaction if the normal polymerization endpoints (pressure drop, maximum poly time, specified temperature ~~run-away~~ runaway at the end of a batch) are not reached. The lead operator will tell the "A" operator to kill the reactor with 5 gallons of AMS and the normal amount of Naugard and ~~a~~antifoam. The lead operator must be careful to differentiate between "kill the reactor" (which implies normal kill procedures) and the early kill situation where more AMS is added than normal kill procedures. The additional AMS is added to insure that the reaction is completely killed and because during the reaction there is more initiated monomer or catalyst in the reactor than at the end of the reaction.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Troubleshooting (Continued)

6. Reactor Early Kill (Continued)

Reactions that are killed early will almost always have ~~con-~~ un-
~~siderable~~ undesirable quality characteristics, ~~and~~ A gallon slurry sample should be taken when the batch is dumped, and sent to the lab for analysis. The lead operator will note on the batch sheet that the batch was killed early with 5 gallons of AMS and the batch should be dumped separate (to isolated blend tanks) if at all possible. It will then be blended into the large blend tanks according to the quality results on the slurry sample.

7. Emergency AMS Kill - If the temperature or pressure reaches the given Emergency AMS kill parameters given on the control room panel, the batch must be immediately killed with the Emergency AMS Kill System. The system and procedure is described separately below.

8. Agitator Kicks Off or Power Failure - If the reactor agitator kicks off during polymerization, a low amperage alarm will sound. The lead operator should immediately try to restart the agitator with the agitator on/off switch on the reactor panel as the low amperage alarm is acknowledged and notify the Shift Supervisor. If the agitator does not re-start, the lead will have the "A" operator to check the reactor agitator motor breaker and ~~re-set~~ reset it immediately.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Troubleshooting (Continued)

8. Agitator Kicks Off or Power Failure (Continued)

Most power failures are of short duration (seconds to a few minutes) and the reactor pressure does not have time to build to a dangerous level. The lead operator should re-start the agitator as soon as power is restored.

Both of these situations may necessitate the use of the Emergency AMS Kill System, per the Shift Supervisor's instructions. Emergency AMS Kill System Procedures are described separately in the following section of this manual. Power Failure Procedures are described in Section S of the Operating Procedures in this manual.

Emergency AMS Kill Procedure

Mechanical failures may occur during reactor polymerization which may result in loss of reaction control. Most of the time the mechanical failures that lead to this situation take the form of an overall plant power failure or a reactor agitator motor failure. Any condition that causes a loss of reactor agitation during polymerization may necessitate the use of the Emergency AMS Kill System. Loss of the reactor agitator very rapidly reduces heat tranfer in the reactors which may cause the reactor temperature and pressure to rise uncontrollably.

III. OPERATING PROCEDURES (CONTINUED)

C. Polymerization (Continued)

Emergency AMS Kill Procedure (Continued)

The Emergency AMS Kill System nozzles must be tested on every reactor on a weekly basis, according to the notice on the control panel. Both the manual and automatic injection nozzles must be checked and inspected by the Shift Supervisor. This can be done while the reactor is rinsing. Further testing procedures should be set up on a regular basis for testing the operability of each AMS kill pot. These procedures are given in Section T of manual.

1. The Emergency Kill System should be activated under the following circumstances, according to the Shift Supervisor's instructions.
   a. Extended loss of cooling water to a reactor in the polymerization mode.
   b. Extended loss of agitation to a reactor in the polymerization mode. When agitation is lost, it is important to kill the reaction as soon as possible. The reactor contents will continue to swirl for about four minutes after the agitator is shut down, and AMS injection during this period is much more effective.
   c. Any circumstances considered by the Supervisor to represent a significant chance of over-pressuring the reactor or affecting the safe operation of the plant.