

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (continued)

2. Reactor Charge

General Information

Charging the reactor is one of the most critical operations in terms of product quality. Care must be taken to assure that all the raw materials are added in the proper order and amount. Reactors are normally charged automatically by the Modicon after the charge button is pressed, but the lead operator must monitor the charge closely and be able to spot and correct any problems. If the charge must be stopped, it may have to be finished manually by the lead operator. The "A" operator assists in the field as needed and charges the catalyst into the reactor at the proper time.

Procedure

1. When the "A" operator tells the lead operator that the reactor is ready to charge following vacuum break, the lead operator will press the automatic charge start button and record the "charge start" time on the large reactor batch sheet. The lead will monitor the charge as the valves open and close, and as the pumps come on and cut off according to the charge sequence. He will also monitor the flow of materials into the reactor and must be prepared to take corrective action if any abnormalities or deviations from the sequence occur.

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Procedure (Continued)

The pumps and valves for the charge system on the charge panel can be operated by the lead operator at his option without affecting the cutoff points for the raw material being charged (e.g., if one hot water charge pump needs to be cut off, it can be cut off by the lead and then cut back on when needed and the pump will shut down at the end of the charge per the selected formula.)

The normal reactor charge sequence is as follows:

- a. The reactor charge (main dump), hot water charge valve, and "A" hot water pump discharge valve open, and the pump starts. The lead will check to see that water starts flowing into the reactor. If there is no water flow, check the valves to make sure they are open and check the pump to see that it running.

NOTE: If actuated valves give problems during the charge sequence, follow the procedure given in the "Actuated and Automatic Valves" section (Section Q) of this manual.

- b. As water flows into the reactor, the lead will watch the hot water charge temperature to make sure it lines out at the setpoint.

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Procedure (Continued)

This temperature at 40 counts of water is to be recorded on the batch sheet. If the temperature is more than 10° away from the setpoint at 40 counts of water, the pump (and discharge valve) must be shut off prior to putting in the methocel (which starts at 50 counts of water). The Supervisor is to be notified and he will give instructions on how to proceed with the charge. Hot water above 150° will seriously reduce the effectiveness of the methocel and will cause the batch to go coarse. If the hot water is too cold, a long reactor heat-up will result and the batch usually comes out too fine.

- c. At setpoint number one on the water meters (50 counts of water) the methocel charge pump comes on as the pump discharge and reactor colloid charge valves open. Methocel should then begin to flow into the reactor, and this will be checked by the lead operator. If there is no methocel flow, the charge water pump should be shut off prior to the next setpoint (80 counts of water), and the methocel pump and valves should be checked.

NOTE: During the charge sequence, if any pump is cut off for any reason by the lead operator, he must close the pump discharge valve first. This may dead-head

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Procedure (Continued)

the pump momentarily but will prevent reactor pressure from backing into any of the charge systems.

- d. At setpoint number two on the water meter (80 counts) the reactor VCM charge valve(s) and the selected pump discharge and receiver outlet (suction) valves open. The fresh VCM pump will come on a few seconds later if open lights are showing for each of the following valves:

- (1) Reactor charge (main dump) valve.
- (2) "A" VCM charge valve (the farther of the two VCM charge valves from the manifold).
- (3) "B" VCM charge valve (the closer of the two VCM charge valves to the reactor manifold).
- (4) Charge pump discharge valve on the selected pump.
- (5) Receiver outlet valve (suction valve) on the selected pump.

The recovered VCM charge pump discharge valve also opens at 80 counts of water and the selected RVCM charge pump comes on, if the automatic charge is "ON" for the RVCM charge system.

The lead operator will make sure that the fresh and recovered charge pump motor run lights come on and that VCM is flowing according to both total VCM meters and the RVCM charge meter. If VCM flow does not start on either of the meters, check the appropriate pumps to make sure they are running and the valves to make sure they are open.

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Procedure (Continued)

- e. When the methocel meter setpoint is reached, the methocel pump discharge valve and reactor colloid charge valve close and the pump cuts off. "B" charge water pump then comes on and its discharge valve opens. The lead operator will make sure that the methocel cuts off at the proper setpoint and then check to see that "B" charge water pump motor run light comes on.

After the methocel has been charged into the reactor, the "A" operator will measure the methocel charge tank outage and report it to the lead operator for recording on the batch sheet. The lead will record the "after" outage on the batch sheet and will calculate and record the actual amount of methocel that was charged (counts and inches). If the actual amount of methocel charged (counts or inches) is different from the formula by more than $\frac{1}{2}$ " or 2-3 counts, the Supervisor should be notified and corrective action may be required. If this occurs and is verified by the Shift Supervisor, he should contact the Operations Supervisor and a meter calibration may be required.

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Charge)

2. Reactor Charge (Continued)

Procedure (Continued)

After the methocel charge has been completed, the lead will turn on the methocel transfer pump from the control panel and transfer methocel from the make-up tank to the charge tank. The pump should automatically cut off when the high level alarm is reached, and this will be checked by the lead upon acknowledging the alarm. If the pump does not come on when the lead pushes the start button, it may be because methocel is being made up in the make-up tank and the "A" operator has the switch locked out. The lead should verify this with the "A" operator if the pump does not start.

- f. The lead will continue to monitor the charge as VCM and water flow into the reactor. It may be necessary to cut off one or both hot water charge pumps (after closing the discharge valve) to keep the water from beating the VCM into the reactor. At least 50 counts of water should be left to charge on the hot water charge meter when the VCM reaches its setpoint and cuts off.

NOTE: Slow VCM flow can indicate plugged or partially plugged VCM charge lines or filter packs. If VCM flows start slowing down, the Shift Supervisor should be alerted.

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Procedure (Continued)

Normal times for VCM charge are 8-9 minutes for the small reactors and should be about 13-15 minutes for D-700. These times are to be recorded on the black-board in the Supervisor's office at least once per week.

- g. When the VCM meters reach the setpoint (two meters running in tandem, the first to reach the setpoint cuts off the valves and pump), the pumps should stop as the pump suction and discharge valves close along with "A" reactor VCM charge valve (the one farther from the reactor manifold). "B" reactor VCM charge valve will be closed automatically when charge is completed and the reactor mode selector is moved to "polymerization".

The lead operator will monitor the VCM to make sure it cuts off at the setpoint. He will also record the actual amount of VCM charged according to both VCM meters.

NOTE: If the VCM meters end up more than 10 counts apart, the Shift Supervisor should be notified. This should then be reported to the Operations Supervisor if the condition persists. Reactor particle size may be affected if the correct amount of VCM is not put into the reactors.

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Procedure (Continued)

If the meters have different amounts at the end of charge, this may indicate that one or both of them may not be working properly and VCM calibrations may be necessary.

- h. When the "A" operator sees "A" reactor VCM charge valve close, he will start loading catalyst into the catalyst charge bomb if there have been no charge problems up to that point. If there have been problems and there is a question about the charge, the "A" should check with the lead operator before loading the catalyst. The procedure for charging catalyst is given in a separate section below.
1. After the VCM has gone into the reactor, both hot water charge pumps are used to finished the water charge. "B" hot water pump cuts off as the discharge valve closes five counts before the end of the water charge, and when the final water setpoint is reached, "A" hot water pump cuts off as the discharge valve, reactor hot water charge valve, and reactor charge valve (main dump valve) close. The lead will watch and verify that the water cuts off at the correct setpoint and that the valves close, and will record the actual amount of water charged and the reactor charge temperature on the batch sheet.

DTH 000101364

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (continued)

Procedure (Continued)

2. When the automatic charge sequence has been completed, the lead operator will check the reactor temperature setpoint to make sure it is set correctly and will put the temperature controller in "auto" position.
3. The lead will reset the low amp alarm setpoint to about 20-30 amps below where the amps are running.
4. The lead will advance the reactor to the "polymerization" mode and make sure that "A" VCM charge valve closes.
5. The lead will notify the "A" operator that charge is complete and will record the charge complete time on the batch sheet. The "A" operator can then charge the catalyst.
6. The "A" operator will recheck and report the lip seal flush flow and pressure after completing the catalyst charge.
7. The lead will record on the batch sheet the time when the "A" operator notifies him that the catalyst charge is complete, and will also record the reported lip seal flush pressure.

Catalyst Charge Procedure

The reactor "A" will charge the catalyst through the catalyst bomb according to the procedure given below.

NOTE: The catalysts which the plant uses are known as organic peroxides. Certain organic peroxides decompose rapidly (explode) when exposed to heat and/or on impact.

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Catalyst Charge Procedure (Continued)

Skin irritation can also result from contact with the liquid. The catalyst should be kept below 20°F at all times and care should be taken to keep storage freezers closed. Plastic gloves are required to be worn at all times when handling catalyst bottles. Because of the properties of the catalysts, flushing them down the drain is to be avoided unless necessary. Thus, before loading the catalyst bomb, the "A" operator should make sure that the reactor being charged is ready for the catalyst before loading it into the bomb. Costs of the catalyst are also quite high, ranging from \$30-33 per gallon (1982 cost).

The addition of initiator to a charged reactor must be done carefully since small variations in quantity charged can cause large deviations in the duration and control of polymerization.

1. Prepare for catalyst handling by putting on disposal plastic gloves.
2. Obtain the appropriate number of bottles of catalyst from the chest freezer located in the reactor unit.

III. OPERATING PROCEDURE (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Catalyst Charge Procedure (Continued)

3. Transport the catalyst bottles to the catalyst bomb on the reactor which is being charged.
4. 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).

NOTE: It is the "A" 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 valve (it should be open).
5. Close the bomb drain valve.
6. When the reactor "A" VCM charge valve closes at the end of the VCM charge, pour the appropriate amount of catalyst into the bomb. Make sure the bottles are well drained.

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Catalyst Charge Procedure (Continued)

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

7. Close the bomb funnel valve.
8. Close the bomb vent valve.
9. The "A" operator should now wait for the panel operator to indicate that the reactor charge is complete.
10. When the reactor charge is complete, slowly open the valve which supplies high pressure service water to the catalyst bomb.
11. Be sure that the valve which separates the bomb from the pressure gauge is open.
12. 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 no VCM is allowed to get back into the initiator injection pot. When a small amount of VCM is mixed with a large amount of initiator, an extremely fast reaction takes place giving off heat and pressure.

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Catalyst Charge Procedure (Continued)

To guard against this situation, the operator must know that there is adequate water supply and pressure on the bomb before charging catalyst. The reactor catalyst injection ram valve must never be opened unless the bomb is fully pressurized and the inlet HPSW valve is open.

13. Open the catalyst injection ram valve for 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.
14. Allow 50 gallons (5 rounds) of water to pass through the high pressure service water 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 charging or killing a reactor.

DTH 000101369

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Catalyst Charge Procedure (Continued)

15. Close the catalyst injection ram valve and then close the high pressure service water supply valve (must be in the specified order).
16. Notify the lead operator that the catalyst charge is complete. The lead will record the time on the batch sheet.
17. Open the bomb drain valve and then slowly and carefully open the bomb vent valve. Then open the funnel valve.
18. Make sure the bomb is draining by checking the drain outlet. If the bomb did not drain, it will contain small amounts of catalyst which may be hazardous. Check the drain by flushing it if it does not appear to be working.
19. Return any unused bottles or portions of bottles of catalyst to the catalyst freezer immediately. The empty bottles must be cut with a safety knife so they cannot be used anymore and placed in the appropriate dumpster. This dumpster should be kept away from under the reactors due to the hazard of residual initiator in the bottles causing a fire.

DTH 000101370

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Catalyst Charge Procedure (Continued)

NOTE: During the entire catalyst charging procedure, the "A" operator must remain at the catalyst bomb used. Failure to follow the above procedures could result in the loss of the reactor contents to the atmosphere.

20. If a problem with the reactor charge should develop between the end of the VCM charge and when catalyst is injected, the catalyst will need to be dumped to the sewer if the decision is made to abort the charge.

For safety purposes, the catalyst should not be kept in in the catalyst bomb for longer than 5-10 minutes after being put in the bomb. If the decision is made to abort the charge and dump the catalyst, the "A" operator must flush the catalyst bomb with voluminous amounts of water after dumping the catalyst and should run hoses into the sewer to flush it out for several minutes.

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Troubleshooting

1. Most of the problems that come up during charging were discussed in the operating procedure as the possibility for the problem was presented. The "A" operator must be responsive to the lead operator in checking valves and must be able to get actuated valves open or closed as needed. This should be done in accordance with the procedures in Section Q of this manual.
2. Automatic Charge System Malfunctions - There are times when all conditions have been satisfied for the automatic charge system and it still will not operate. If this occurs, the lead operator will have to charge the reactor manually. In this case, the panel operator will have to start and stop all pumps and open and close all valves just as the automatic charge system would.
3. There are times when the automatic charge system will fail in the middle of a charge. In some cases all equipment and valves associates with the charge will shut down and close respectively. At other times, some equipment will continue to operate and valves will remain open but other equipment will not operate and the associated valves will not open or close.

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Troubleshooting (Continued)

In both cases, the panel operator can complete the charge. Again, the charge must be completed just as it would have been completed by the automatic charge.

Any malfunctions of the automatic charging system should be reported to the Shift Supervisor and corrective maintenance action should be taken as soon as possible, if necessary.

3. Charging after false charge or power failure - When charging after a false charge or power failure, the lead operator should be especially careful in monitoring the amounts that go into the reactor. Usually when false charging, the Modicon setpoints are not satisfied because only a small amount of VCM, water and methocel are put into the reactor. This sometimes causes the following charge to be shorted because the meters will cut off when the setpoints that were in effect for the false charge are reached. The lead will have to finish the charge manually and there should be no abnormality with the batch. The setpoints also get messed up during a power failure if a charge is going on or there is a power blink during a charge. Some things to watch for are pumps to come on that have already cut off, such as the methocel pump.

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Troubleshooting (Continued)

The best rule for resuming a charge that experiences a power blink is to shut off all the "AUTO" charge switches and finish the charge manually, without the automatic charge system. On the first charge after a power failure, the lead should also be especially careful to make sure the power outage did not affect the charge sequence.

4. VCM Charging Slow - When the fresh or recovered VCM is very sluggish during charge, this may sometimes be caused by filters on either system plugging. The "A" operator should keep pressure gauges installed and in good operating condition around the filter packs so that he can tell when a filter pack is plugging. The problem may be resolved by bypassing the filter pack, but this may only be done with the Shift Supervisor's approval. This should be noted in the Supervisor's logbook and by the lead operator on the batch sheet. Bypassing the filters can cause gels in the product charged and also increase the formation of PVC buildup in the receivers and charge lines.
- Bypassing the recovered VCM filter pack should only be done if absolutely necessary (e.g., if the RVCM receivers are full).

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Troubleshooting (Continued)

If the Supervisor approves, it is usually better to charge little or no recovered VCM until the filters can be changed rather than bypass the recovered VCM filter pack. The RVCM charge system is the primary source of polymer buildup because it contains residual amounts of initiated monomer in or on the resin that the filters normally remove, enhancing PVC buildup in the tanks and lines.

5. Severe Weather - During the severe weather conditions such as lightning storms, severe rainstorms, or wind, the lead operator should consult with the Shift Supervisor prior to charging a reactor. Many times when these conditions exist, the Supervisor may give word to space the reactors out and only have one or two in polymerization at any time so that the reactions can be more quickly killed and controlled should a power failure occur. Severe weather warrants extreme caution in plant operation and no reactors should be charged if the weather is so severe that there is a significant chance of power outages in the area.

6. Cold Weather - Special precautions must be taken by the operators to keep the plant running under very cold weather conditions.

DTH 000101375

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Troubleshooting (Continued)

These procedures are outlined in the cold weather operator checklist in Appendix E. These procedures should be undertaken if the temperature drops below freezing for more than 12 hours. It is important to implement these procedures ahead of time if possible because once the weather gets very cold, other miscellaneous operating problems will usually consume every operator's time and efforts. Some main points that are worthy of special attention for the lead and "A" reactor operators are as follows:

a. Keep fluids moving in pipes and lines where possible.

This may involve prepumping RVCM to the fresh receiver a little at the time every 30 minutes to every hour (be sure not to put VCM transfer in "AUTO" when charging and have the fresh receiver fill up), pumping up VCM from the tank farm a little at the time periodically, and flushing water and methocel to the sewer through an empty reactor manifold periodically. The "A" operator will need to keep process water stations draining in the unit and keep HPSW flushing through the catalyst bomb and charge bomb lines to prevent freezing.

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Troubleshooting (Continued)

Care should also be taken to keep water out of the DOP systems and to keep them warm (but not too hot -- 100°F is a good maximum). Steam tracing in the units will also need to be operable and all leaks should be repaired or tagged with maintenance work orders turned in.

- b. Keep water out of the RVCM and fresh VCM receivers - VERY IMPORTANT - Although VCM will not freeze until below 0°F, any water that gets in the cold VCM will freeze very rapidly and can cause extensive downtime. The lead should keep water drained from the receivers and make sure that they are very thoroughly drained prior to attempting a charge.
- c. If conditions are severe enough, one reactor may be set aside for false charging VCM periodically to keep the fluid in the charge lines from freezing. If this is set up, the lead will be responsible for keeping a tabulation sheet on how much material went into the false charged reactor. The maximum amount that should be put in the small reactors under these conditions is 1400 counts and the maximum for D-700 is 2600 counts (both figures are about 80% of reactor capacity).

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

2. Reactor Charge (Continued)

Troubleshooting (Continued)

7. RVCN High Levels - The lead operator must keep up with the amount of recovered VCM in the RVCN receivers and notify the Shift Supervisor if they get too full. There should always be enough room left for a normal recovery to occur so that a reactor can be emptied and charged with a 50% (or more if necessary) RVCN charge. This situation does not normally occur unless there is a major upset and an entire reactor or reactors must be recovered, greatly increasing the amount of RVCN in the receivers. The main point is not to allow a bottleneck to occur such that there are no reactors to charge RVCN into and not enough room to recover a reactor so that it can be charged with the excess RVCN.
8. Reactor High Pressure Alarm - Reactor high pressure when charging may indicate that the reactor is hydraulically full. If the reactor high pressure alarm should come on when charging a reactor, the lead operator will immediately move the reactor mode switch to "polymerization" which will close all the reactor valves (except steam to the jacket) and will shut down the charge. The lead will then monitor the reactor pressure per the panel indication and if it is still rising will tell the "A" operator to shut off the lip seal and rinse flush going into the reactor.

III. OPERATING PROCEDURES CONTINUED

B. Charge (Continued)

2. Reactor Charge (Continued)

Troubleshooting (Continued)

At 145 psig, if the pressure is still rising, the lead operator will put the reactor in the "Emergency" mode and vent the reactor to the recovery system by opening the condenser and recovery valves. Before resuming the charge, the Shift Supervisor should be notified and the reason for the alarm should be corrected.

9. No Automatic Charge "READY" Light - If there is no automatic charge "READY" light when the lead operator is ready to charge the reactor, he should recheck the five conditions which must be met to activate the light (Section III B. 1., Procedure No. 5). If the reactor selector switch is in the correct position and only one reactor is in the charge mode, the problem may be that either the fresh VCM receiver or hot water tank level is low.

NOTE: DO NOT reset the meters to see if a charge light will come on if any VCM or water has already entered the reactor. This will change the charge amounts and may affect the batch quality.

DTH 000101379

III. OPERATING PROCEDURES (CONTINUED)

B. Charge (Continued)

Troubleshooting (Continued)

If the only problem is that the tank levels are low but there is enough to make the charge, the reactor can still be charged automatically after the water is started. The lead will turn on "A" hot water charge pump and open the discharge valve and then open the reactor charge (main dump) and hot water charge valves. Once the water is going into the reactor, the lead will press the automatic charge "START" switch, and the reactor charge will be finished automatically.