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ETHYL CORPORATION



INTER-OFFICE

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TO: ALL R&D LABORATORY AND PILOT PLANT EMPLOYEES AND OTHER R&D "ACCIDENT PREVENTION MANUAL" HOLDERS

FROM: Len Guretsky, Jr.

SUBJECT: Revision of Section I-M

Section I-M of the R&D "Accident Prevention Manual" has been revised. Please remove the old I-M Section now and replace it with the revised 2-page I-M Section attached. It is important that you read and familiarize yourself with the new revision.

L. Guretsky, Jr.

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Attach.

E-01027

ETC 14813

M. Pressure Equipment & Operations

The R&D Department maintains a special facility which is designed to carry out reactions involving pressures much greater than atmospheric. The facility is staffed with experienced, qualified personnel who are knowledgeable in the safe operation of pressure equipment. Any operation involving pressures exceeding 1000 psi must be carried out in this facility. Also, any reactions which are not well characterized should be carried out in this facility. The greatest hazard in a pressure reaction is the possibility of an overpressurization or detonation where the reactor itself fails before safe venting of the system is possible via a rupture disc (or relief valve). All new high pressure reactions and set-ups must be approved by the technical supervisor and the safety engineer.

Reactions involving pressures greater than 300 psi but less than 1000 psi and which are well characterized can be carried out in a regular laboratory or pilot plant on a scale not to exceed two liters. When in doubt, conduct the initial experiments in the high pressure laboratory. The engineer or chemist carrying out the reaction is responsible for assuring that adequate precautions and safety measures are taken to avoid the possibility of a runaway decomposition causing catastrophic failure. The following are key factors which must be considered in all pressure operations in a laboratory or pilot plant facility.

1. Pressure rating of the reactor. This is initially provided by the manufacturer or design engineer. With age, the pressure rating may decrease, so the reactor should be tested periodically to assure that it is still safe at the intended pressure. Personnel at the high pressure laboratory can arrange a hydrostatic test to confirm the pressure rating of the reactor.

2. Rupture disc or safety (relief) valve. Every pressure reactor must be equipped with a pressure relief system (rupture disc or safety relief valve) to allow automatic safe venting of the system before the pressure exceeds the limits of the reactor. In no case should the relief device be rated (or set) at more than maximum allowable working pressure (design pressure). The disc must be sized to permit an adequate venting rate if a disc rupture occurs. The line to the pressure relief device should be inspected periodically to detect pluggage. Never use a pressure reactor without a relief device. A pressure reactor without a pressure relief device is a bomb.

3. Vent Line. A vent line should be connected to the pressure relief device to provide safe discharge of the reactor contents should excessive pressure be developed in the reactor. The vent line must be properly sized to permit an adequate venting rate if the disc ruptures. The vent line should be run to a high point outside the building or up into the duct of an efficient hood. If the line is run into a hood duct, it must be determined that the capacity of the hood is adequate to exhaust the contents of the reactor. Never direct the vent line toward the equipment or the work area. The vent line must be of ample size to handle the volume of material in the reactor and must be secured in such fashion to avoid a whipping action when the contents are discharged.

4. Materials of Construction. The reactor must be constructed from a metal or alloy which is not subject to attack by the reaction medium. Acids corrode mild steel and thereby quickly lower the pressure rating of mild steel reactors. Chlorides cause stress corrosion cracking in stainless steel reactors. Caustic embrittles mild steel and stainless steel and will cause catastropic failure of mild and stainless steel pressure reactors. Pressure reactors are available in mild steel, stainless steel, monel, nickel, inconel, Hastelloy, titanium and other alloys. The same consideration applies to rupture discs and pressure tubing.

5. History of Use. A log should be kept of all reactions conducted in a particular reactor as well as all inspections, alterations and hydrostatic tests.

6. Manual Control of Pressure. Pressure reactions can easily get out of control. When this occurs, several means are available to slow the reaction and relieve the pressure. These include: (1) cutting off the heat; (2) cooling; (3)cutting off the feed gases or reactants, (4) manual venting; (5) stopping agitation.

7. Other Considerations. Feed lines to the reactor should possess adequate strength and chemical resistance. Check valves should be used as necessary to prevent an accidental back-flow of foreign material into the feed systems. Metal pressure reactors are to be preferred. Always determine that the reactor is designed for the pressure and temperature expected. Most alloys have critical temperature limits and the alloy used should be compatible with the temperature of operation. The corrosion engineer can advise on temperature limitations of different alloys, although the manufacturer usually provides such information. Work on the smallest scale possible until confidence is developed that the reaction is safe. Do not overload the reactor. Normally the liquid/solid loading should not exceed 75%. Allow for thermal expansion of any liquid phases so that excessive pressure buildup from liquid expansion does not occur. Modifications of pressure reactors should be made only by experienced personnel. Improper drilling of the head of a pressure reactor can cause it to fail at pressures well below its design pressure.

Glass equipment can be used at slightly elevated pressures, but it is not recommended. If glass is used, a protective shield should be employed. In fact, it is advisable to use a protective shield with a metal reactor. If a reaction is carried out in a sealed glass tube, the tube should be surrounded by a properly vented metal tube. The glass tube should be cooled and wrapped in cloth before opening.

When in doubt, ask someone who is experienced with high pressure operations. And remember -- all new high pressure set ups must be approved by the supervisor and the safety engineer.