

CONTROL TECHNOLOGY ASSESSMENT
OF CHEMICAL PROCESSES

Borg-Warner Chemicals
Woodmar Plant
Washington, West Virginia

Preliminary Survey Report
for the Site Visit of
October 19, 1981

Contract No. 210-80-0071

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Submitted to:

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I. INTRODUCTION

A. Summary of Visit

The Woodmar Plant of the Borg-Warner Chemicals Company was visited by representatives of Enviro Control, Inc. to conduct a preliminary survey of the techniques used to control worker exposure to hazardous substances. Participants in the visit included:

Borg-Warner Chemicals

R. N. Roberts, P.E.	Manager, Environments
J. L. Marks, P.E.	Group Manager, Project Engineering
P. J. Olenkiewicz	Process Manager, Environment

National Institute for Occupational Safety and Health

H. Van Wagenen	Project Officer
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Enviro Control, Inc.

J. H. Bochinski	Program Consultant
S. L. Bergh	Chemical Engineer

This less than one day survey involved general discussion of acrylonitrile handling, and associated control equipment and techniques employed. Borg-Warner personnel were cooperative in providing general information on equipment used to control exposures, industrial hygiene concerns, hazards of acrylonitrile, operator training, safety standards and evolution of control techniques. Mr. Roberts indicated that Borg-Warner met all the detailed requirements of the OSHA Acrylonitrile Standards, but had nothing which he considered to be superior control technology.

B. Background Information on Contract

This visit was conducted as part of the Control Technology Assessment of Chemical Process Unit Operations, NIOSH Contract No. 210-80-0071. The purpose of this contract is to identify and assess superior control techniques for limiting worker exposure to hazardous substances during chemical processing. This is being done through visits to industrial facilities. Preliminary surveys are intended to generate

information about the control strategies used at various facilities and will be used to determine which facilities warrant further, in-depth surveys. Information collected from the preliminary and in-depth surveys will be compiled into a control technology reference source to disseminate information on solutions of worker exposure problems in industry.

C. Plant and Process Descriptions

The Woodmar Plant is a large facility producing many products including acrylonitrile-butadiene-styrene resins, methyl methacrylate-butadiene-styrene resins, and other modifier and reinforcing resins used for processing of other polymers. This survey was only concerned with control techniques used to protect workers from exposure to acrylonitrile and acrylonitrile-based compounds. Since no processing areas were observed by the team members, information contained in this report was obtained solely by discussion with the listed plant personnel and predominately added data and sketches submitted to Enviro Control, Inc. subsequent to the plant visit.

II. CONTROL TECHNIQUES

A. Monomer Recovery System

One polymerization process using acrylonitrile at the Woodmar Plant involves a feed tank, two reaction vessels and a hold tank. All four vessels are maintained at moderate temperature and under negative pressure by venting to a monomer recovery system as depicted in Figure 1. The four vessels are connected to a manifold which leads to the monomer recovery system. Gases or vapors evolved within the vessels are collected in the manifold and then drawn through a foam knock-out tank. Water is sprayed on to the incoming gas stream, partially absorbing monomer present. Both the liquid and gas streams from the knock-out tank go to the bottom of a monomer absorber column. The gas passes upward through the packed column where it is contacted with water sprayed in at the top of the

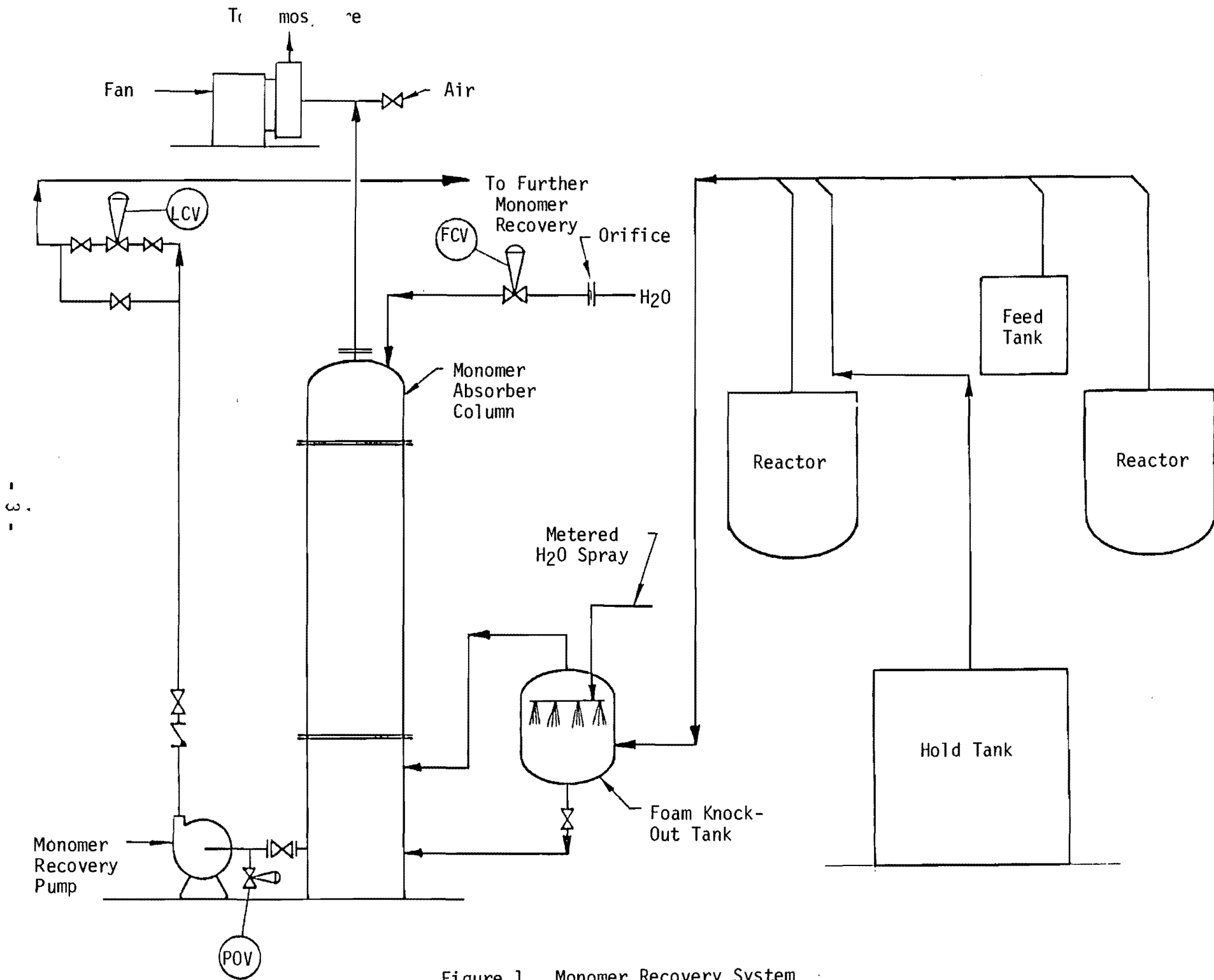


Figure 1. Monomer Recovery System

column. Essentially all residual monomer in the gas stream will be absorbed by the water. The cleaned gas exits the column at the top, drawn out by a fan, and is exhausted to the atmosphere. The water, containing absorbed monomer, collects in the bottom of the column along with liquid from the knock-out tank. The combined liquid is pumped to further processing to recover monomer for reuse in the process. This system prevents acrylonitrile monomer (or other monomers) from entering the workplace during operation of the process or during cleaning of residual monomer left in vessels after a reaction cycle is complete.

B. Reactor and Hold Tank Agitator Shaft Seals

Both the reactor used to polymerize acrylonitrile into ABS resin and the reaction product hold tank have top-entering agitators. Vapors of acrylonitrile (or other substances) are prevented from escaping the vessels by shaft sealing devices. Figures 2, 3, and 4 depict the reactor vessel agitator shaft seal and Figures 5, 6, and 7 depict the hold tank agitator shaft seal. The two seals, similar in design, consist of two interlocking pieces of nylon surrounding the shaft. The nylon construction allows the seals to fit tightly against the shaft to minimize leakage without the need for lubrication.

C. Personal Protective Equipment

To prevent possible skin or eye contact with acrylonitrile, employees are provided with and must wear personal protective equipment when doing certain jobs. Employees are trained to use and maintain the personal protective equipment assigned to them and management is responsible for enforcing its use. The type of equipment required for the various jobs involving acrylonitrile is detailed in Tables 1 and 2.

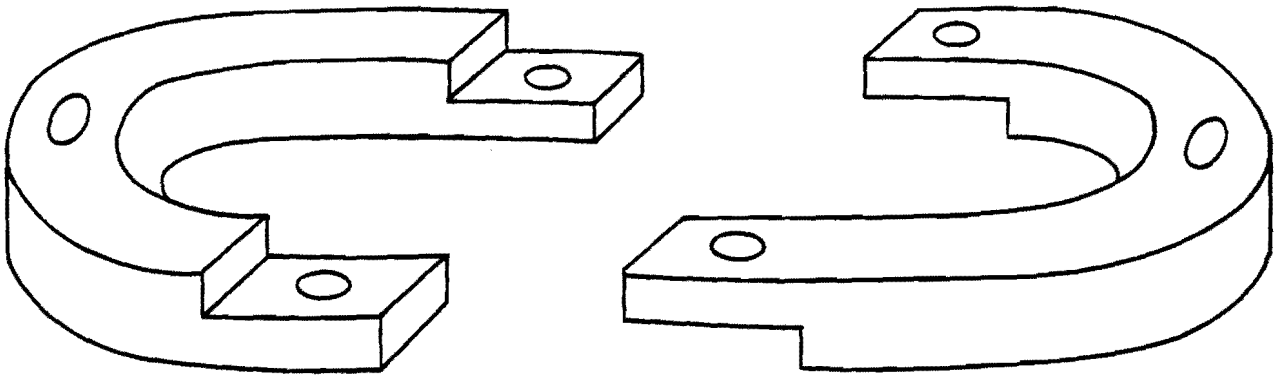
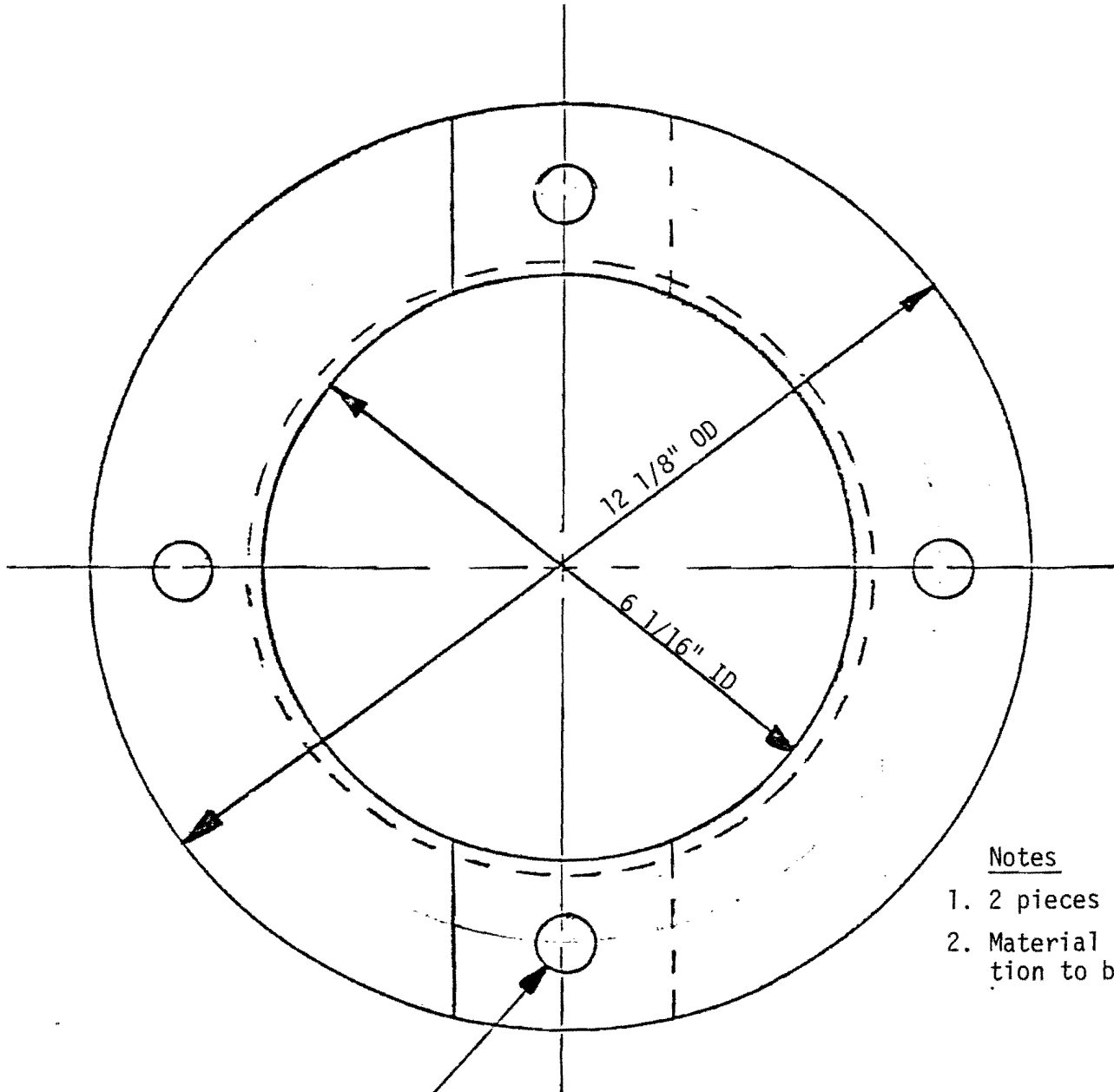
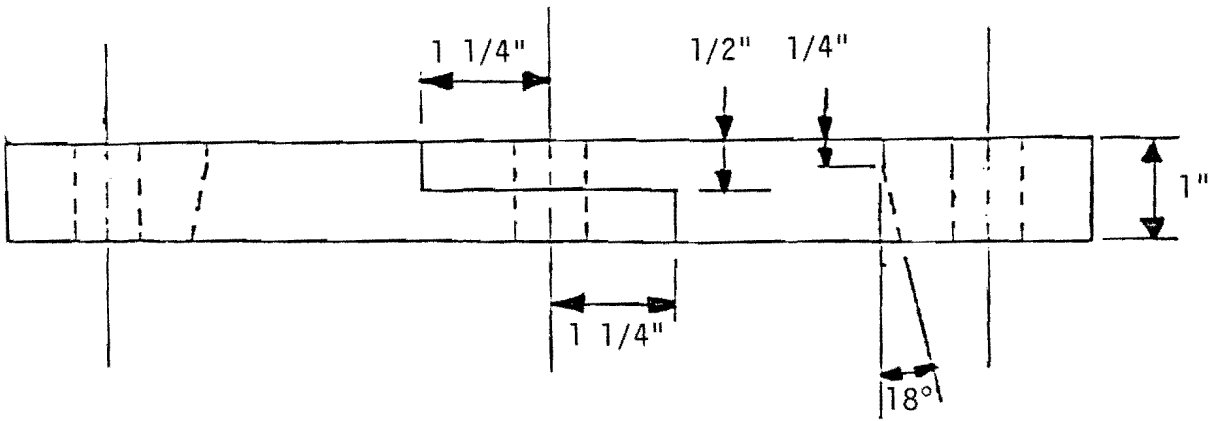


Figure 2. Schematic of Shaft Seal for Reactor Agitator

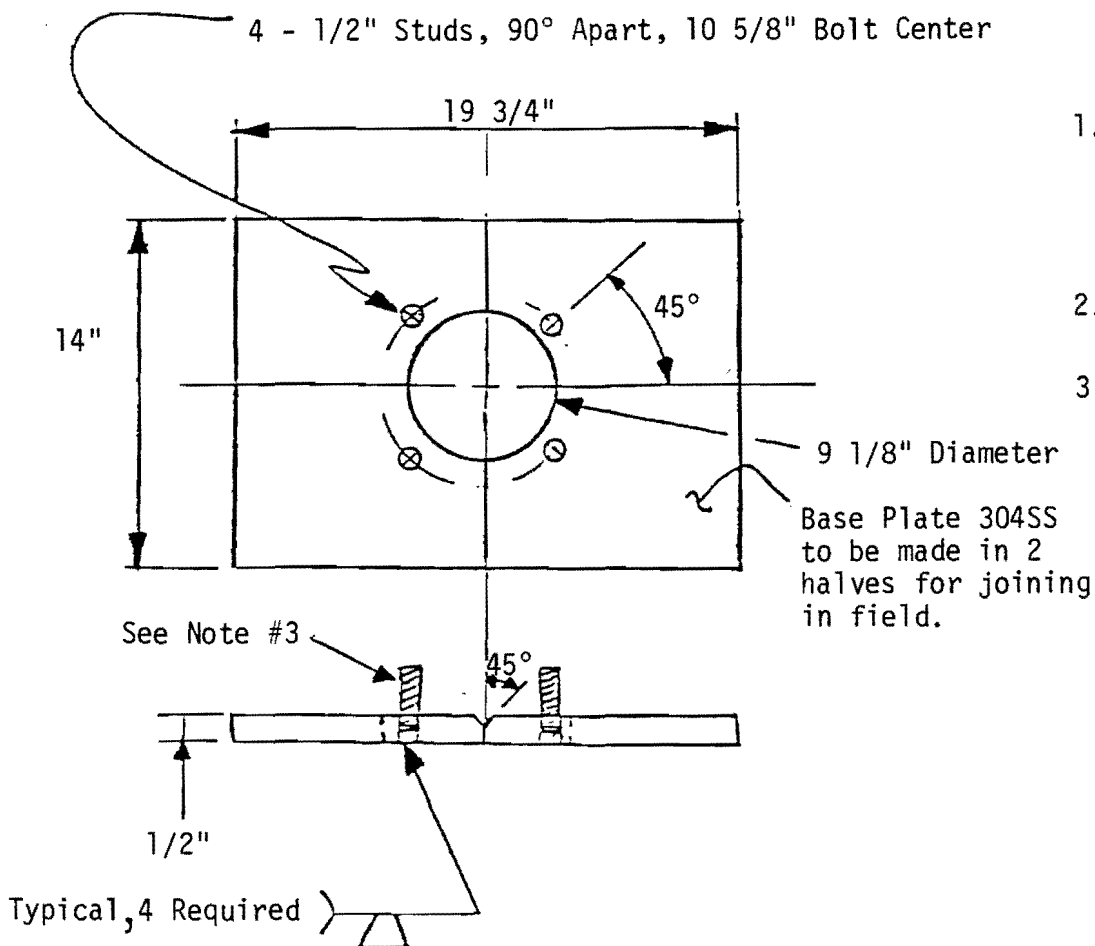
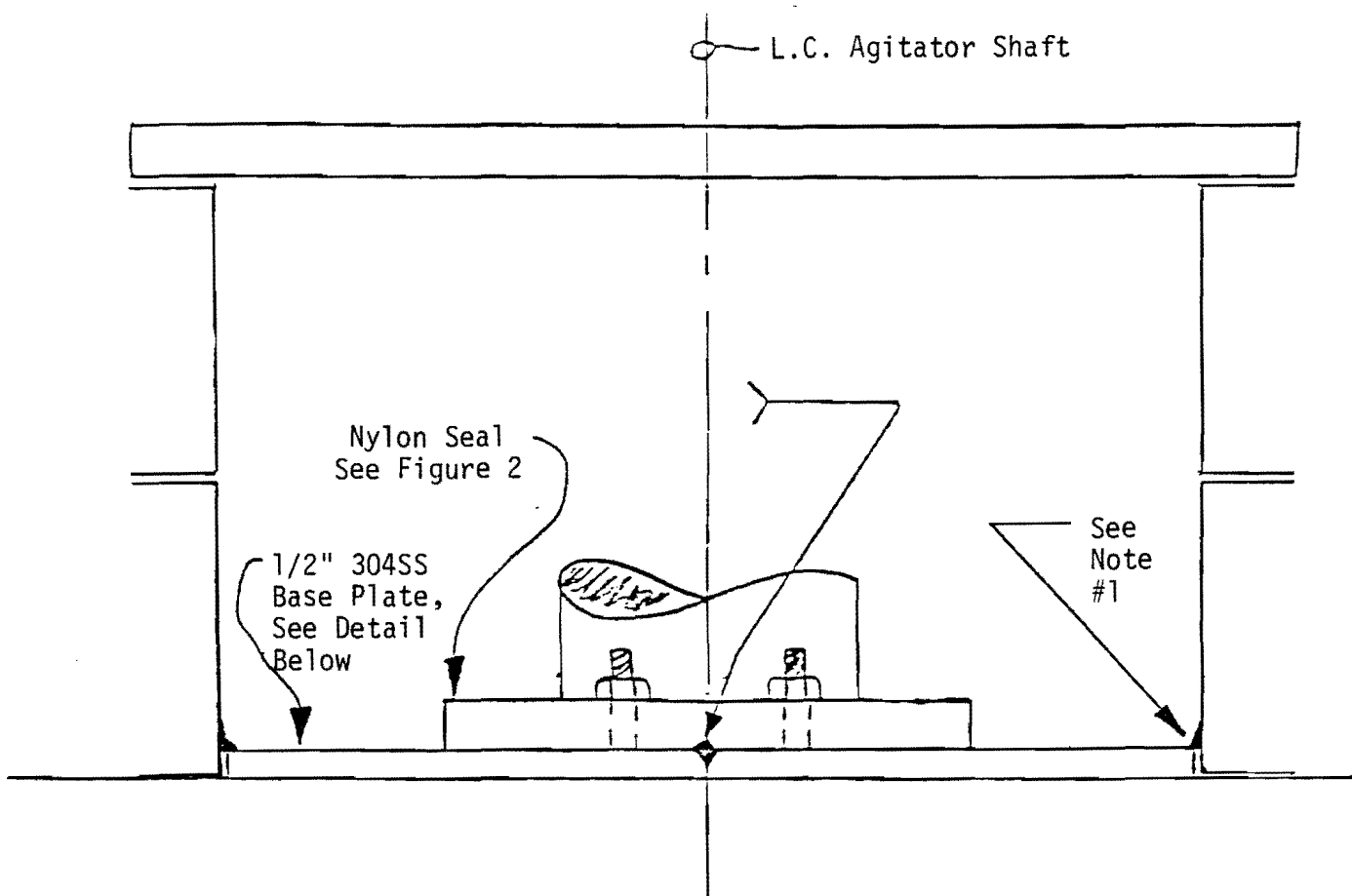


4 - 9/16" Diameter
Holes 90° Apart
10 5/8" Bolt Center

Notes

1. 2 pieces required
2. Material of construction to be nylon

Figure 3. Shaft Seal for Reactor Agitator



Notes

1. Level base plate and tack weld to channel; seal all around base plate with silicone caulk.
2. Weld 2 halves of base plate in field.
3. 4 - 304 SS studs, 2" long required.

Figure 4. Details of Shaft Seal for Reactor Agitator

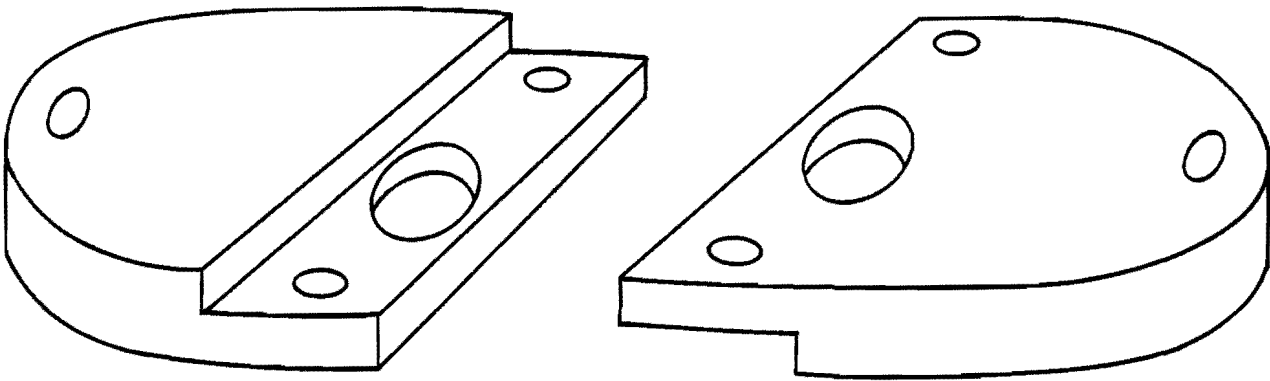


Figure 5. Schematic of Shaft Seal for Hold Tank Agitator

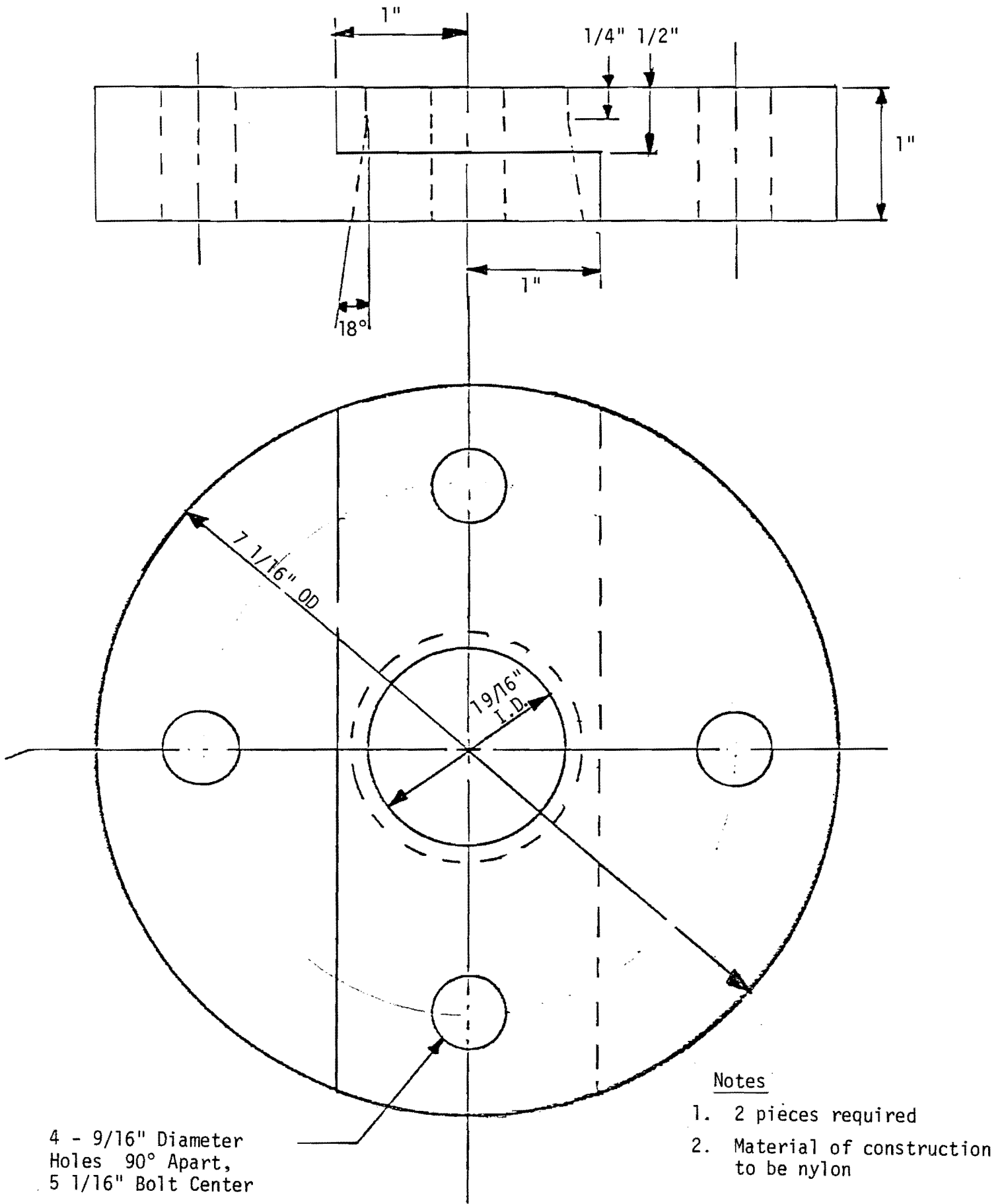
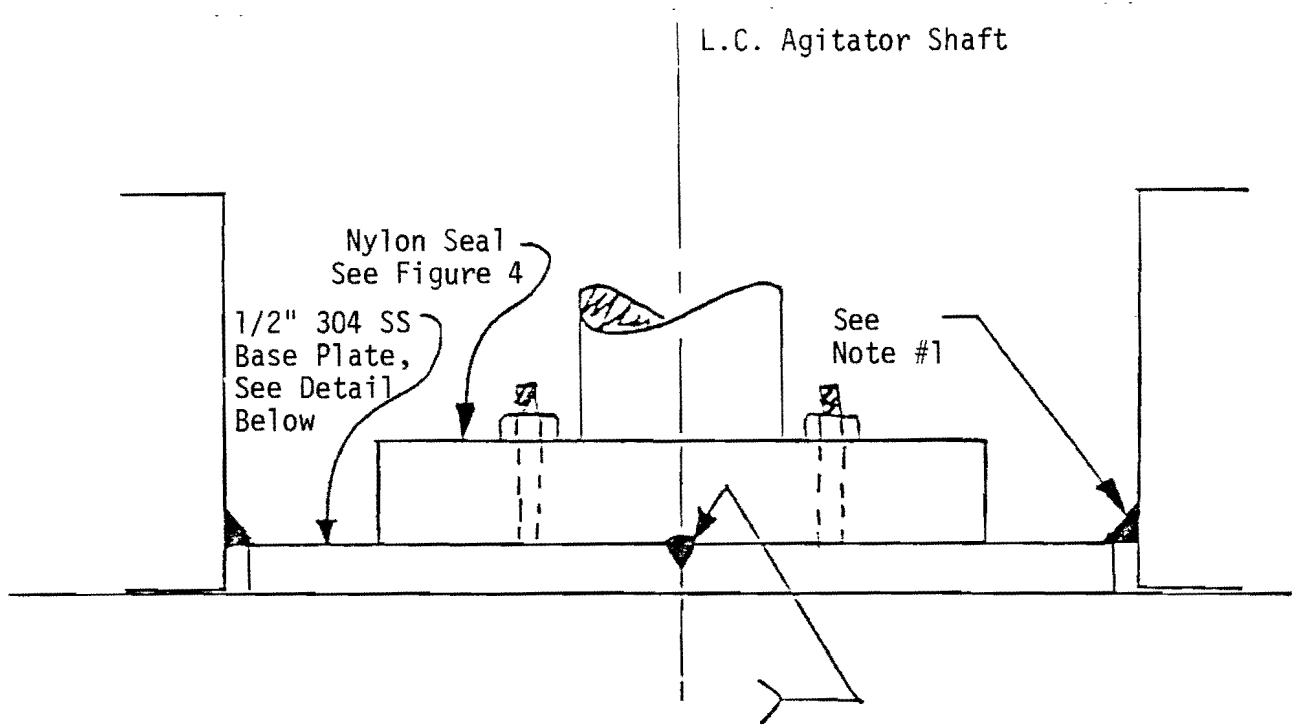


Figure 6. Shaft Seal for Hold Tank Agitator



Notes

1. Level base plate and tack weld to channel; seal all around base plate with silicone caulk.
2. Join two halves of base plate in field.
3. 4 - 1/2" 304 SS studs, 2" long required.

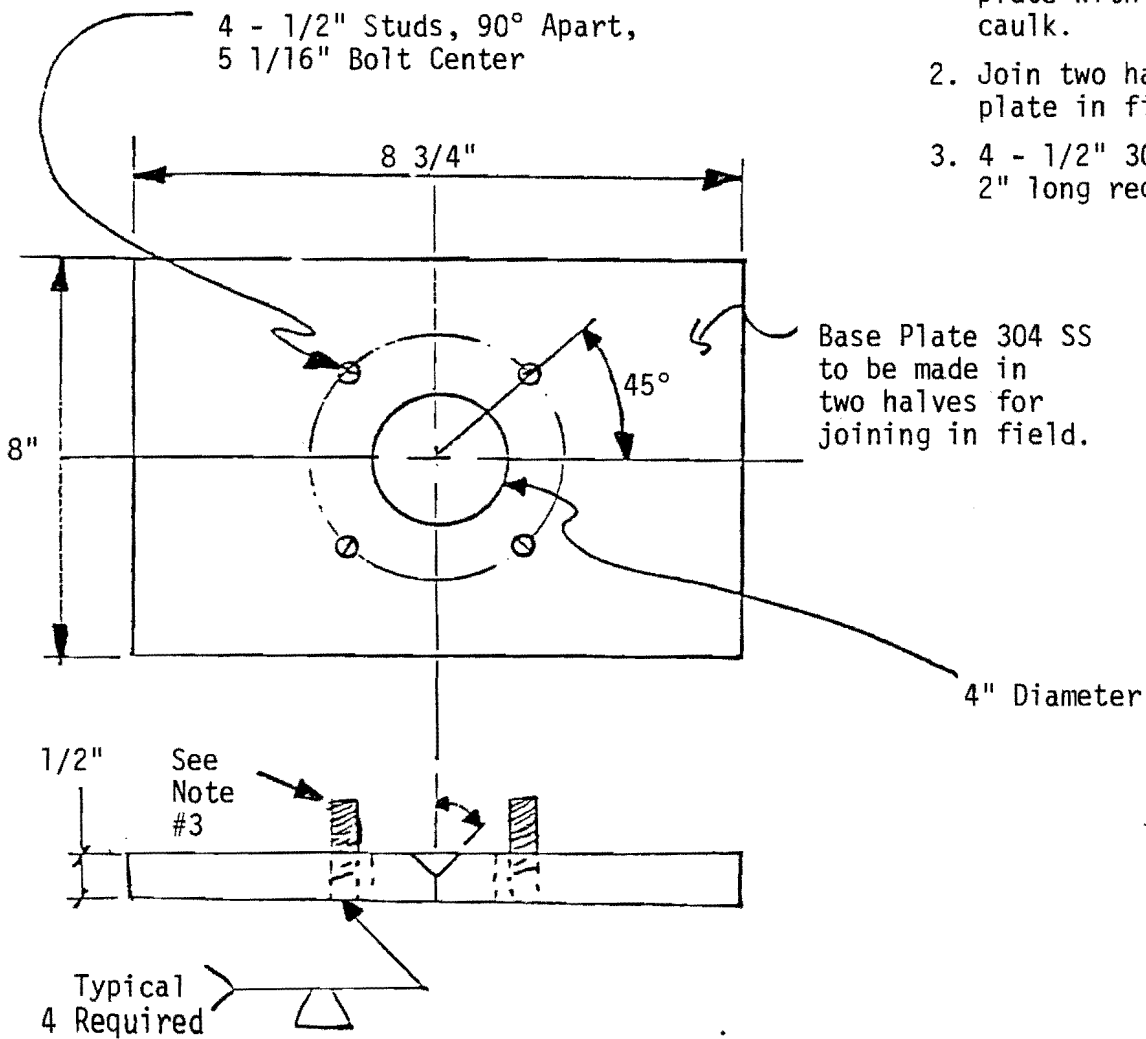


Figure 7. Details of Shaft Seal for Hold Tank Agitator

Table 1. Protective Clothing and Equipment Required When Working with Acrylonitrile in the Tank Farm

Jobs	Protective Equipment						
	Rubber Suit	Rubber Boots	Rubber Gloves	Face Shield	Air Line Respirator	Half Mask Organic Cartridge	Rubber Apron
Reactor Sampling			X				X
Cleaning Acrylonitrile Strainers	X	X	X	X		X	
Filling Drum with Acrylonitrile	X	X	X	X		X	
Cleaning Reactor	X	X	X	X		X	
Hookup and Disconnect		X	X	X		X	X
Line Pump Disconnect	X	X	X	X		X	
Storage Tank Inspection	X	X	X	X	X		

Table 2. Protective Clothing and Equipment Required When Working With Acrylonitrile in Resin Manufacturing

Jobs - Plant Personnel	Protective Equipment							
	Rubber Rain Pants	Rubber Rain Coat	Rubber Boots	Rubber Gloves	Face Shield	Air Line Respirator	Half Mask Organic Cartridge	Rubber Apron
Tank Sampling				X			X	X
Reactor Sampling				X				X
Hold Tank Sampling				X			X	X
Monomer Sampling			X	X	X		X	X
Reactor Cleaning	X	X	X	X		X		
Hold Tank Cleaning	X	X	X	X		X		
Tank Cleaning	X	X	X	X		X		
Tank Measuring				X		X	X	
Tank Fill						X		
Inspect and Clean Basket				X				X
Clean Strainers	X	X	X	X				
Clean Tank Sump - Dry			X	X				
Clean Tank Sump - Vat	X	X	X	X			X	
Clean Process Waste Trench	X		X	X				
Concentration Sampling				X				
Jobs - Contractors								
Cleaning Reactor	X		X	X	X			
Cleaning Latex Piping	X	X	X	X			X	
Hold Tank Cleaning	X	X				X		
Work in Vessels Containing Liquid Acrylonitrile	X	X	X	X		X		
Vacuum Clean Tank Sump	X	X	X	X				
Tank Cleaning	X	X	X	X				

D. Work Practices

The company has a work practices program to help prevent exposure to acrylonitrile and other hazards. The considerations that make the program effective are:

- Training of operators and maintenance personnel--operators are trained for each operation and task they will encounter during plant operation. It is the Foreman's and Plant Inspector's responsibility to make certain the person being trained fully understands the job procedures, modes of release of chemical substances and potential hazards involved, and control techniques to be used.
- Documented training material for each job classification.
- Plant safety standards that address:
 - health hazards of chemicals
 - mode of emission of chemicals
 - control technique to be used
- Management follow-up and monitoring to ensure consistent application of work practices by the various plant operators

Specific aspects of the program include:

- A training program geared specifically to hazards of acrylonitrile and methods to be used in handling the chemical.
- A special physical given to employees involved with acrylonitrile in addition to the yearly general physical offered to all employees.
- Posting of industrial hygiene sampling results showing individual employees exposure to specific chemicals.
- A Risk Management Committee composed of a cross-section of hourly and management personnel and the plant safety supervisor to discuss various aspects of plant safety and get inputs from the operators on proposed plant equipment changes.