SOURCES OF LEAKS

MOST EMERGENCY RESPONSE INCIDENTS CAN BE RELATED TO "RAIL CAR SECUREMENT".

THIS WOULD INCLUDE LOOSE BOLTS, VALVE PACKING, RUPTURE DISC, AND GENERAL POOR MAINTENANCE ON RAIL CARS.

THE BEST METHODS TO OVERCOME THIS ARE GOOD TRAINING PROGRAMS AS WELL AS GOOD PRETRIP INSPECTIONS.

THE FOLLOWING PAGES LIST A NUMBER OF POTENTIAL LEAK SOURCES ON VARIOUS TYPES OF RAIL CARS, ALSO LISTED ARE SUGGESTED CORRECTIVE ACTIONS AND PRECAUTION MEASURES TO TAKE.

HYDROCHLORIC ACID

TANK CARS USED BY DOW: 103BW
111A 100WS
(RUBBER LINED)

SOURCES OF LEAK	RECOMMENDED ACTION
PRESSURE PLATE	1. TIGHTEN BOLTS
LOADING PORT	1. TIGHTEN BOLTS
RUPTURE DISC ASSEMBLY	1. TIGHTEN BOLTS 2. CHECK DISC
EDUCTION LINE	1. TIGHTEN BOLTS

NOTE:

ALWAYS CHECK FOR PRESSURE BEFORE REMOVING FLANGE FROM EDUCTION LINE.

BLEED PRESSURE OFF SLOWLY AT LOADING PORT.

GENERAL SERVICE TYPE CAR

TANK CAR USED BY DOW CANADA: 111A 100W
103
BOTTOM OUTLET OPTIONAL
SAFETY VALVE OR RUPTURE DISC

SOURCES OF LEAKS	RECOMMENDED ACTION
BOTTOM 4 X 2 ADAPTER	1. TIGHTEN 2. REPLACE GASKET & TIGHTEN
2" VALVE	1. CLOSE 2. TIGHTEN PLUG
2" VALVE PACKING	1. TIGHTEN PACKING NUTS
MANWAY COVER	1. CHECK CAR PRESSURE 2. CHECK GASKET 3. TIGHTEN DOME BOLTS
TOP UNLOADING VALVE	1. CLOSE VALVE 2. TIGHTEN PLUG
AIR INLET VALVE	1. CLOSE VALVE 2. TIGHTEN PLUG
VACUUM RELEASE DEVICE	1. TAP WITH HAMMER TO FREE SPRING 2. PULL UP ON SPRING
FRANGIBLE DISC	1. CHECK CAR FOR PRESSURE 2. REPLACE DISC
SAFETY VALVE	1. CHECK CAR FOR PRESSURE 2. TAP WITH HAMMER TO FREE SPRING
EDUCATION LINE FLANGE	1. TIGHTEN HOLD DOWN PLUGS 2. PULL EDUCTION LINE & CHECK GASKET

CAUTION!

ALWAYS CHECK FOR PRESSURE ON CAR. IF CAR DEPRESSURED, TIGHTEN UP ON SCREWED NIPPLES.

LIQUID CHLORINE SERVICE

TANK CAR USED BY DOW CANADA: 105A 500W

SOURCES OF LEAK	RECOMMENDED ACTION
ANGLE VALVE PACKING	1. TIGHTEN PACKING NUTS
ANGLE VALVE PLUG	1. ENSURE VALVE IS CLOSED 2. TIGHTEN 1" PLUG
FROM BENEATH VALVES	1. TIGHTEN HOLD DOWN NUTS
THROUGH SAFETY VALVE	1. INSTALL PRESSURE GAUGE AND TAKE PRESSURE 2. IF PRESSURE BELOW VALVE SETTING INSTALL SOLVAY KIT "C" 3. THE SOLVAY KIT "C" CAN ALSO BE USED TO STOP LEAKS ON ANGLE VALVES
PRESSURE PLATE FLANGE	1. TIGHTEN HOLD DOWN BOLTS

CAUTION!

IF CAR PRESSURE IS HIGHER THAN SAFETY VALVE SETTING DO NOT INSTALL SOLVAY KIT "C". MOVE CAR TO NEAREST OFF-LOADING POINT.

ANHYDROUS HYDROGEN CHLORIDE

TANK CAR USED BY DOW CANADA: 105A 600W

SOURCES OF LEAK	RECOMMENDED ACTION
SAME AS CHLORINE	SAME AS CHLORINE
PLUS	
MAGNETIC GAUGING DEVICE	1. TIGHTEN CAP
THERMO WELL	1. TIGHTEN CAP
SAMPLE POINT	1. ENSURE VALVE CLOSED
	2. TIGHTEN PLUG
HELLER HOLE	1. CLOSE VALVE
VENT BETWEEN P.S.V. & DISC	

CAUTION!

IF CAR PRESSURE IS HIGHER THAN SAFETY VALVE SETTING DO NOT INSTALL SOLVAY KIT "C". MOVE CAR TO NEAREST OFF-LOADING POINT.

L.P.G.S.

ETHYLENE OXIDE

PROPYLENE OXIDE

METHYL CHLORIDE

VINYL CHLORIDE

ANHYDROUS AMMONIA

TANK CAR USED BY DOW CANADA: 105A 300W

SOURCES OF LEAK	RECOMMENDED ACTION
ANGLE VALVE PACKING	1. TIGHTEN NUTS
BALL VALVE PACKING	1. REMOVE HANDLE
	2. TIGHTEN ALLEN SCREWS
VALVE PLUG	1. ENSURE VALVE IS CLOSED
	2. TIGHTEN PLUG
SAMPLE POINT	1. ENSURE VALVE IS CLOSED
	2. TIGHTEN PLUG
MAGNETIC GAUGE	1. TIGHTEN GAUGE COVER
SAFETY VALVE	1. TAKE PRESSURE ON CAR
	2. IF LOWER THAN VALVE SETTING INSTALL CAPPING DEVICE
THERMO WELL	1. TIGHTEN CAP
BENEATH FLANGES	1. TIGHTEN CAP
PRESSURE PLATE FLANGE	1. TIGHTEN CAP
SLIP TUBE	1. CLOSE VALVE
	2. TIGHTEN PLUG
	3. TIGHTEN PACKING NUT

PATCHING

BY THE TIME AN EMERGENCY RESPONSE TEAM HAS ARRIVED AT THE SITE OF THE DERAILMENT WHICH CONTAINS A LEAKING TANK CAR IT IS USUALLY FOUND THAT THE LIQUID HAS LEAKED OUT TO BELOW THE LEVEL OF THE HOLE. IF THE LIQUID IS STILL LEAKING OUT WHEN THE TEAM ARRIVES AT THE SCENE IT IS SOMETIMES POSSIBLE TO STOP THE LEAK BY DRIVING IN A WOODEN PLUG. THIS OF COURSE WOULD ONLY APPLY TO SMALL HOLES. THE PATCHING OF LARGER HOLES USUALLY REQUIRES A SIGNIFICANT AMOUNT OF TIME AND IT IS USUALLY NOT POSSIBLE TO PREVENT THE INITIAL LEAKAGE OF LIQUID. IN SOME RESPECTS THIS MAKES THE PROBLEM OF PATCHING THE TANK CAR EASIER SINCE ONE DOES NOT HAVE TO WORK AGAINST A LIQUID HEAD AND THE RESULTING PRESSURE.

BASICALLY THERE ARE TWO TYPES OF PATCHING IN PATCHING TECHNIQUES. THE FIRST ARE THOSE WHICH FILL UP THE SPACE MADE BY THE INCIDENT AND THE SECOND ARE THOSE WHICH ACT AS A REPLACEMENT FOR THE DAMAGED WALL ITSELF. LET'S DEAL FIRST WITH THOSE THAT FILL UP THE SPACE MADE BY THE HOLE. OBVIOUSLY THE SIMPLEST TYPE OF PATCH IN THIS CASE IS A WOODEN PLUG DRIVEN INTO THE HOLE. WOODEN PLUGS ARE USEFUL IN THAT THEY ARE RESISTANT, AT LEAST TEMPORARILY, TO MANY CHEMICALS, THEY ARE READILY AVAILABLE AND THEY COME IN A VARIETY OF SIZES. OBVIOUSLY, THERE IS SOME LIMIT TO THE SIZE OF A WOODEN PLUG THAT CAN BE USED BUT UP TO ABOUT 6" WOULD SEEM PRACTICAL. FOR A SMALLER HOLE ANOTHER MATERIAL WHICH HAS BEEN FOUND TO BE VERY USEFUL IS LEAD WOOL. LEAD AGAIN IS A METAL WHICH IS RESISTANT TO MANY CHEMICALS. IT IS FLEXIBLE AND SO CAN BE EASILY POUNDED TO MEET THE CONTOURS OF THE HOLE ITSELF. ANOTHER SYSTEM WHICH WAS FOUND TO BE SUCCESSFUL IN DEALING WITH SMALLER DIAMETER HOLES (UP TO A FOOT) IS TO FORM A PATCH WITH URETHANE FOAM WITHIN A BAG. THIS IS A SYSTEM THAT WILL BE LEMONSTRATED TODAY AND IS SHOWN IN FIGURE 1 OF THE ACCOMPANYING DIAGRAMS. THE BASIC CONCEPT OF THE SYSTEM IS SIMPLY A BAG OR BAGS WITHIN EACH OTHER WHICH

ARE RESISTANT TO THE CHEMICAL IN THE TANK CAR AND A TWO COMPONENT SYSTEM OF CHEMICALS WHICH WHEN MIXED TOGETHER GENERATE A POLYURETHANE FOAM WHICH EXPANDS INSIDE THE BAG MAKING A FIGURE EIGHT SHAPE. THIS SHAPE PREVENTS THE PATCH FROM BEING PUSHED THROUGH IN EITHER DIRECTION. AROUND THE HOLE ITSELF CHLORINE PUTTY OR A SIMILIAR CHEMICALLY RESISTANT CONTOUR FIXING MATERIAL SHOULD BE USED TO PREVENT ANY JAGGED EDGES FROM RIPPING THROUGH THE PLASTIC BAG. THIS TYPE OF A PATCH IS LIMITED IN THE AMOUNT OF PRESSURE THAT CAN BE APPLIED OR CAN BE ALLOWED TO BUILD UP WITHIN THE TANK CAR, SINCE IT DOES NOT HAVE THE STRUCTURAL STRENGTH OF STEEL. IT IS VERY USEFUL FOR MATERIAL HAVING RELATIVELY HIGH BOILING POINTS. SUCH CHEMICALS DO NOT GENERATE GREATER THAN A 20 POUND PER SQUARE INCH PRESSURE INSIDE THE TANK CAR AT NORMAL ROOM TEMPERATURES. IT CAN BE USED TO OFF-LOADED CHEMICALS IN A MANNER NOT GENERATING MORE PRESSURE THAN 20 PSIG. THE VARIETY OF CHEMICALS IN TRANSPORT MAKE IT IMPRACTICAL, TO DESCRIBE ALL THE POSSIBLE COMPOSITIONS OF THE BAG WHICH COULD BE USED. IT IS MORE PRACTICAL FOR THE INDIVIDUALS INVOLVED TO CONSIDER AND GET BAGS OF VARIOUS MATERIALS SO THAT THEY MAY COVER THEIR OWN PRODUCT NEEDS. GENERALLY SPEAKING SOMETHING LIKE A CHLORINATED RUBBER I.E. NEOPRENE PROVIDED IT WAS SUFFICENTLY SUPPLE TO FIT AROUND THE CONTOURS OF THE HOLE WOULD BE USEABLE IN MANY CASES.

THE SECOND MAIN CLASSES OF PATCHES ARE THOSE WHICH ACT AS A REPLACEMENT FOR THE WALL AT THE DAMAGED AREA. THESE COULD BE BROKEN DOWN INTO TWO FURTHER CATEGORIES: FOR SMALL HOLES IT IS USUAL TO USE THE INTERNAL SHELL OF THE TANK CAR AS A SOURCE OF SUPPORT. THIS IS NORMALLY DONE WITH TOGGLE BOLTS AND IT IS EASY TO FABRICATE A TEMPORARY PATCH TO PREVENT FURTHER CONTAMINATION OF THE ENVIRONMENT. AN EXAMPLE OF A TEMPORARY PATCH IS SHOWN IN FIGURE 2. IT IS QUITE OBVIOUS THAT WHILE THIS PATCH ITSELF COULD BE USED TO PREVENT VAPOURS FROM CONTINUOUS LEAKING OUT IT WOULD NOT HAVE SUFFICENT STRENGTH TO ALLOW THE OFF-LOADING OF THE TANK CAR. WHEN THAT IS THE CASE IT IS NECESSARY TO USE SOME VERSION OF THE TOGGLE BOLT SUCH AS FOUND IN FIGURE 3 OR FIGURE 4. IN BOTH THESE CASES THE PATCH REQUIRED MUCH MORE WORK TO INSTALL AND IS MADE UP OF A NUMBER OF DIFFERENT COMPONENTS EACH ATTEMPTING TO DO THE PATCHING JOB. AS YOU WILL SEE IN

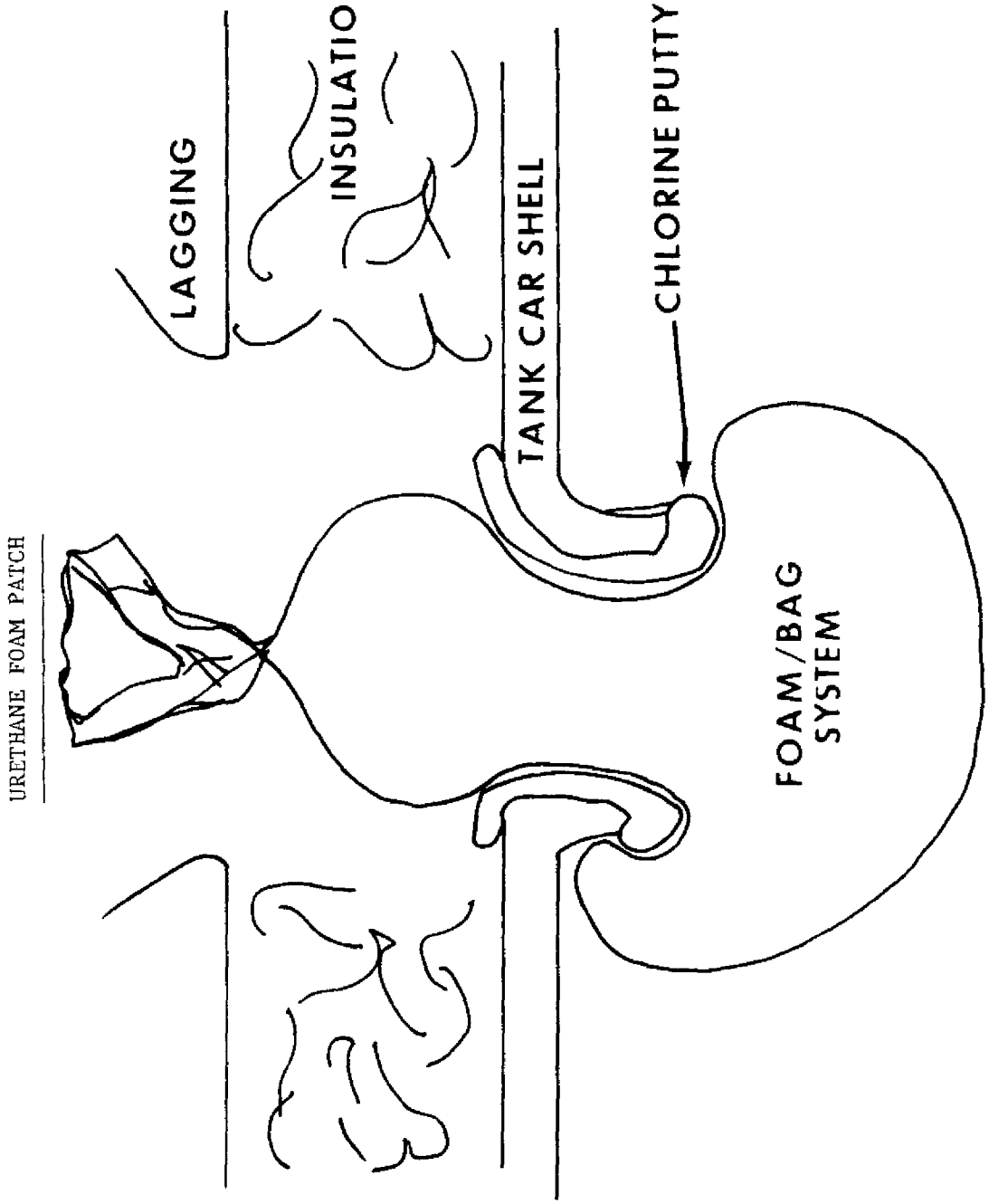
FIGURE 3 THE WOOD PLUG ACTS AS A PATCH; ABOVE IT THERE IS EPOXY RESIN WHICH IS HARDENED INTO PLACE AND ITSELF AGAIN ACTS AS A PATCH, AND A BACKUP FOR THE WOODEN PLUG; AND FINALLY ABOVE IT A TOGGLE BOLT USING THE OUTER SHELL OF THE TANK CARS SUPPORT. IN FIGURE 4 A MUCH LARGER HOLE WAS INVOLVED AT A MUCH MORE DIFFICULT POSITION ON THE TANK CAR. IT WAS NECESSARY TO FABRICATE A STEEL PLATE TO MEET THE CONTOUR OF THIS HOLE. ALL THESE PATCHES HAVE THE SAME CHARACTERISTIC IN THAT THEY USE A TOGGLE BOLT AND THE INTERNAL SHELL OF THE TANK CAR FOR SUPPORT. FOR VERY LARGE HOLES IT IS OBVIOUS THAT A TOGGLE BOLT MAY BE INSUFFICENT IN THAT IT DOES NOT HAVE PROPER SUPPORT. THE ONLY MEANS OF GETTING ANY SORT OF SUPPORT THEN IS TO USE THE EXTERNAL SHELL OF THE TANK CAR OR OTHER TANK CARS IN THE VICINITY TO ATTEMPT TO PUT PRESSURE ON THE PATCH FROM THE OUTSIDE. THE CHARACTERISTIC OF THIS TYPE OF ARRANGEMENT MAKES IT MUCH MORE DIFFICULT TO HOLD THE PATCH IN PLACE SUFFICENTLY TO ALLOW OFF-LOADING. OFF-LOADING WITH THIS TYPE OF A PATCH WILL PROBABLY REQUIRE VACUUM EQUIPMENT TO PULL THE CONTENTS OUT OF THE TANK CAR. THE ADVANTAGE OF THIS IS THAT IT ALSO TENDS TO PULL THE PATCH MORE SNUGLY AGAINST THE SHELL OF THE TANK CAR AND ANY LEAKAGE TENDS TO BE AIR INTO THE TANK CAR RATHER THEN PRODUCTS OUT. FIGURE 5 IS AN EXAMPLE OF THE PATCH USED AT MISSISSAUGA. AS YOU CAN SEE HERE IT WAS NECESSARY TO FILL THE SPACE BETWEEN THE PATCH AND THE CHAINS WITH AN INFLATED VETTER BAG.

WHEN DESIGNING AND APPLYING PATCHES, THERE ARE SEVERAL BASIC GUIDELINES WHICH MUST BE FOLLOWED:

(1) THE SIZE OF THE HOLE TO BE PATCHED IS CRITICAL TO THE LIKELIHOOD OF SUCCESS - I.E. THE LARGER THE HOLE, THE LESS LIKELY THAT A PERFECT SEAL WILL BE ABLE TO BE EFFECTED.

(2) THE TYPE OF PATCH TO BE APPLIED SHOULD BE DEPENDENT ON THE PROCEDURE WHICH IS TO BE USED TO ULTIMATELY UNLOAD THE CONTAINER - I.E. IS THE CONTAINER TO BE UNLOADED BY PRESSURE DIFFERENTIAL; BY PUMP, BY GRAVITY, ETC?

FIGURE 1


URETHANE FOAM PATCH
LAGGING
INSULATION
TANK CAR SHELL
CHLORINE PUTTY
FOAM/BAG
SYSTEM

EMERGENCY CLOSURES FOR RUPTURED VESSELS USING URETHANE FOAMS

A simple, easy to use system for sealing small ruptures in vessels has been developed. Urethane foam (made by shaking two premeasured components together in a plastic bottle) is used to inflate a plastic bag, which has been positioned in the rupture so that a mushroom shaped plug is formed. The vessel can then be pressurized enough to effect transfer of liquid contents to another vessel.

This is the only intended use for this type closure. It is not intended to serve any other purpose or serve as a seal after transfer of liquid contents of a ruptured vessel in an emergency situation. It is assumed that the vessel contents has drained to the lower level of the rupture before use of this closure is attempted.

Previous work at Rocketdyne Division of Rockwell International under contract to the Environmental Protection Agency (Report No. EPA-R2-73-251, May 1973) used urethane foam generated in special equipment to inflate balloons for sealing off flowing liquid streams from ruptured vessels. The present method has the advantage of simplicity of design and use, and can be stored and transported as premeasured components and folded plastic bags for use at any time or place. No mechanical devices are used.

Closure System Description

1. Urethane Foam Formulation

Voranol® 360	84	Polyol Side (216g in 1-qt bottle)
Voranol® 3810	16	
Water	4	
Dabco 33LV	2.10	
DC-197	1.75	
PAPI 135	141.2	Isocyanate Side (290g in 8-oz bottle)

2. Packaging
   The polyol side of the foam formulation may be packaged 216g to a 1-quart narrow mouth polyethylene bottle which also serves as a mixing chamber. For commercial air shipment, 4 batches of polyol mix can be placed in a 1-quart bottle to reduce the number of liquid product packages. Empty bottles, marked with a 216g fill line, can be packaged separately.

   PAPI 135 is packaged in 8-oz narrow mouth polyethylene bottles. Four bottles containing 290g of PAPI 135 each can be placed in one special air shipment package.

3. Closure Bag
   Polyethylene bags with flat measurements of 14-in x 21-in with 4 mil film thickness are used with the foam charges indicated above. Where a better gas seal is desired, a thin coating of Silastic 732 RTV may be applied to the outside of the bag to help seal off folds in the neck of the closure.

Procedure for Using Foam Closure System

This procedure is to be followed after all necessary safety precautions have been taken. These will depend to a large extent upon the vessel contents and its location. Minimum personal protective equipment is face shield and rubber gloves. Avoid contact with PAPI 135 and uncured foam which contains PAPI 135. Spills on the skin should be wiped off immediately and washed with soap and water as soon as practical. If water is not readily available, the exposed area may be cleansed with a rag wet with the Polyol Side of the foam mix.

1. Assemble materials to be used. These are:
   1 polyethylene bag
   1 qt. bottle containing 216g of Polyol Side
   1-8 oz. bottle containing 290g of PAPI 135

2. Plan every move and placement of all materials before taking any action. This will minimize hazardous exposure time and will probably insure a better seal.

3. Place the bag into the rupture so that a sealing neck will form near the mid point of the bag.

4. Pour the PAPI 135 into the quart bottle and shake vigorously until a slight pressure build-up is detected by your thumb which is used to seal the bottle. (Do not use the bottle screw cap!)

5. Pour the contents of the quart bottle into the polyethylene bag.

6. Hold the bag in position and twist the neck of the bag once or twice to form a seal.

7. As the bag begins to inflate, untwist the bag neck to allow air to escape.

8. As the bag fills with foam and continues to expand, adjust the internal bag pressure by either twisting the neck more or untwisting to give a larger bag volume.

9. The expanded bag may be firmly seated in the rupture by pulling on the twisted bag neck as the foam solidifies.

10. Gas pressure may be applied after 4 to 5 minutes, but should be done slowly, giving the foam time to build strength. The following pressurization schedule may be used as a guide:

Foam Age, min.	Vessel Pressure, psig.
4-6	2-3
6-15	3-5
15-20	5-10
> 20	> 10 (as required)

This type seal can normally be expected to hold about 20 psig, depending upon the size and shape of the rupture. One seal in a 18.6 in^2 hole in a ½ in. boiler plate blind flange was tested at 45 psig without failure. Small gas leaks are normal and should not be a problem where the only objective is to pressure transfer the liquid contents of the vessel.

Should excessive leaks or seal failure occur, simply cut through the neck and push the mushroom shaped plug into the vessel, then install a new closure.

FIGURE 2

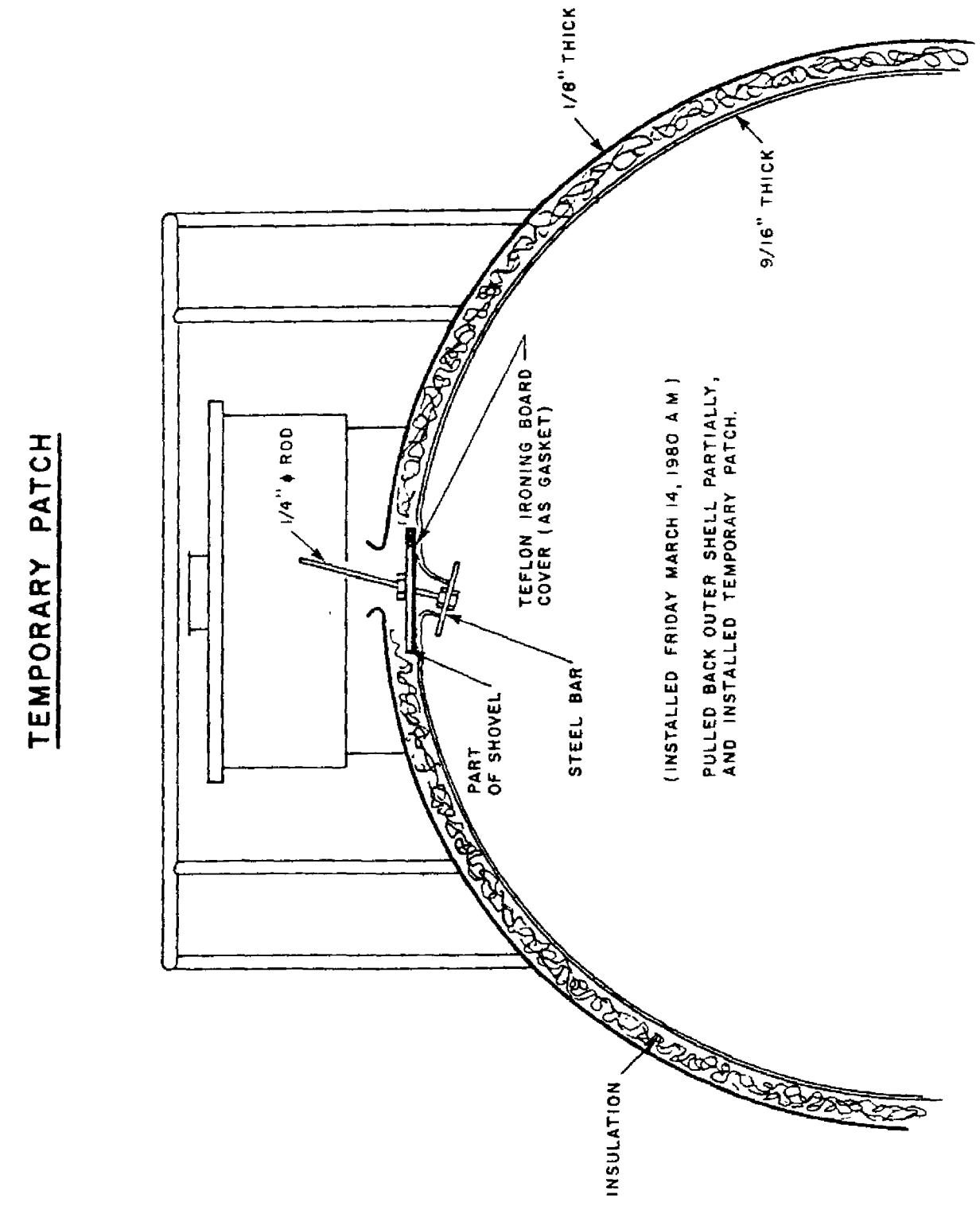
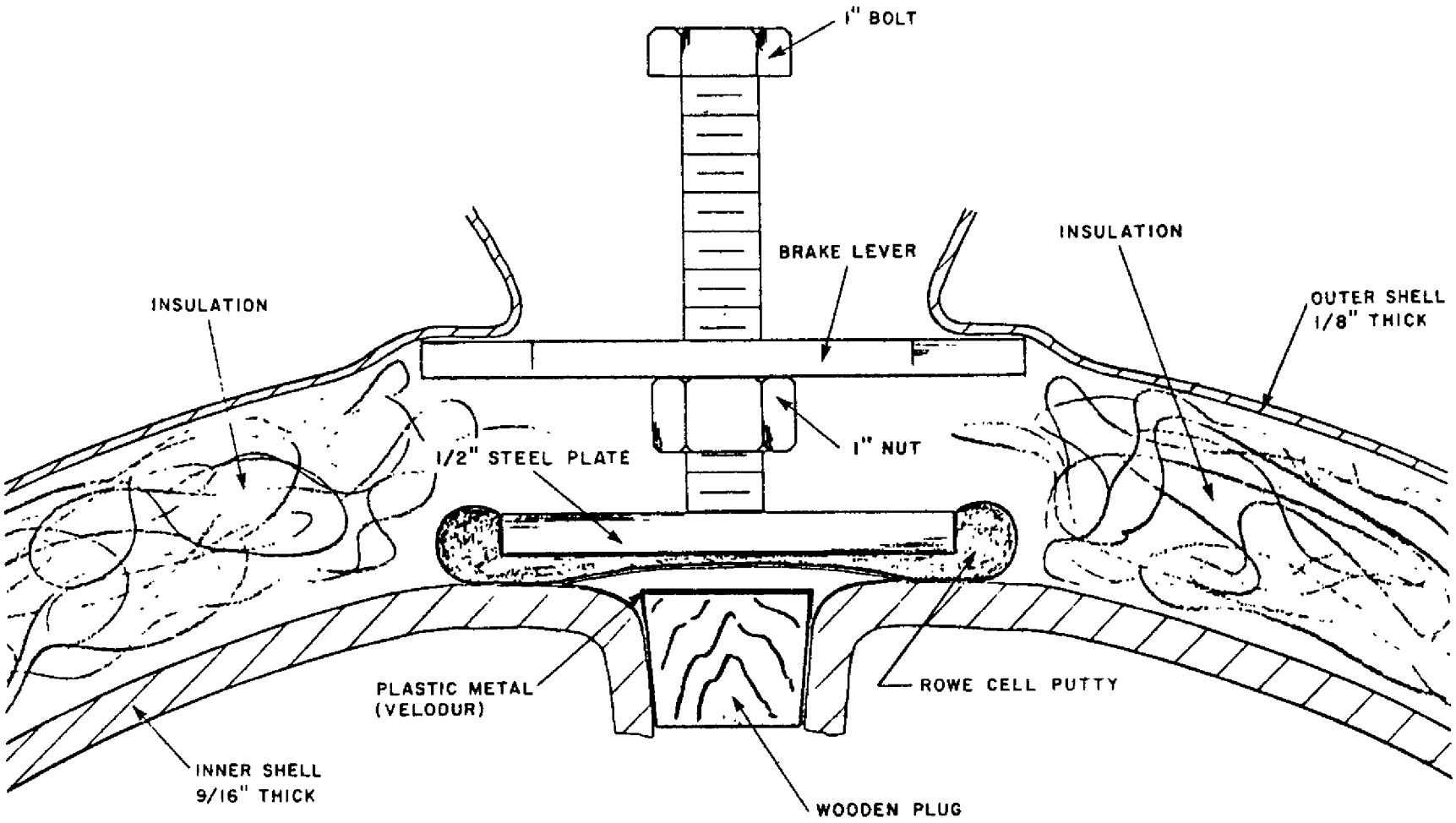

TEMPORARY PATCH
1/8" THICK
9/16" THICK
1/4" ϕ ROD
TEFLON IRONING BOARD COVER (AS GASKET)
PART OF SHOVEL
STEEL BAR
(INSTALLED FRIDAY MARCH 14, 1980 A M)
PULLED BACK OUTER SHELL PARTIALLY, AND INSTALLED TEMPORARY PATCH.
INSULATION

FIGURE 3

FINAL PATCH



·INSTALLED SATURDAY MARCH 15, 1980
·INSTALLED BACK-UP PLATE/BAR SUNDAY MARCH 16, 1980

FIGURE 4

LOOS B.C. PATCH

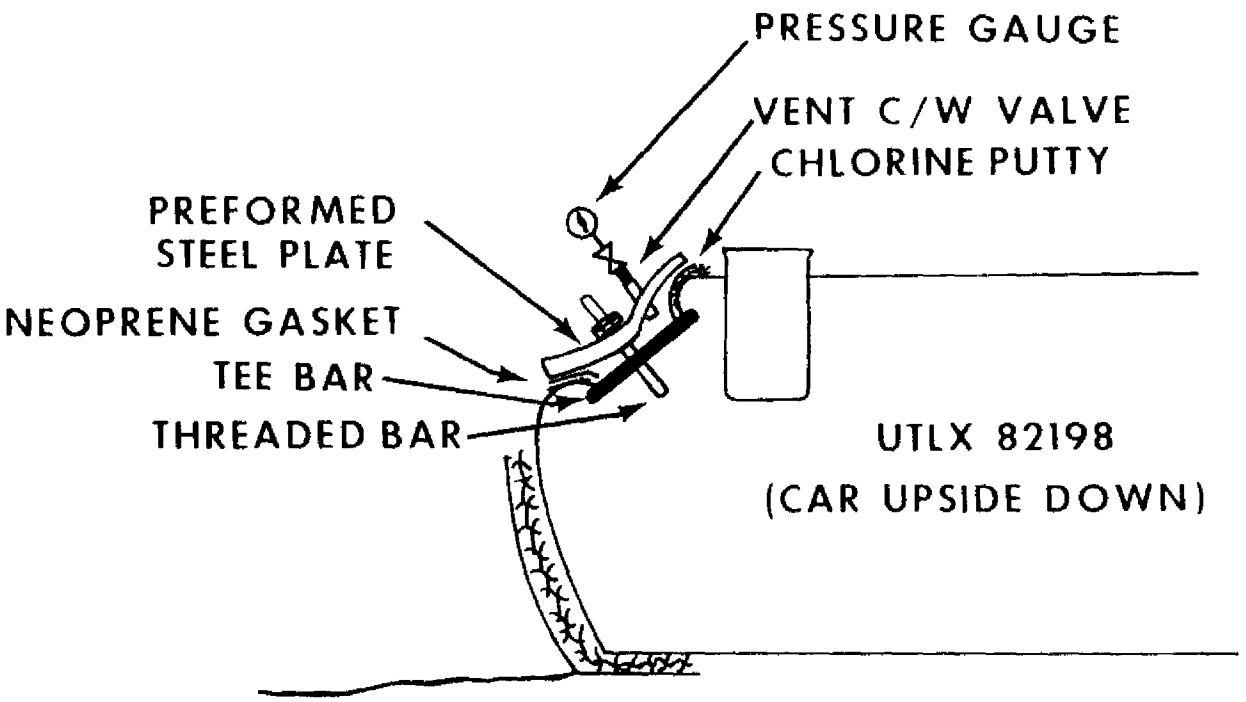
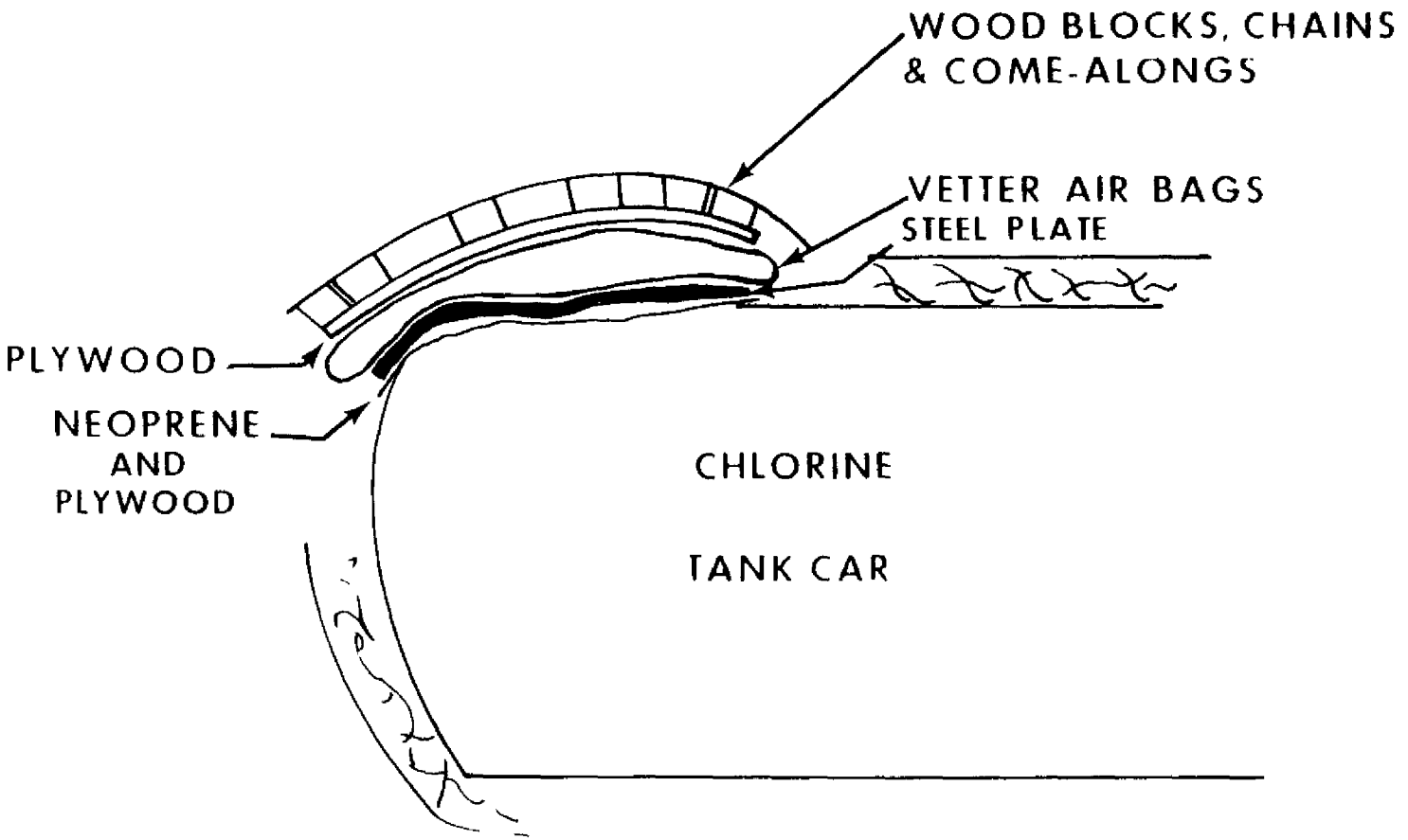


FIGURE 5

MISSISSAUGA DERAILMENT



TRANSFERRING

The need to transfer product at accident scenes is usually caused by one of the following reasons:

(1) The original container has been badly damaged and cannot be made safe to travel to the original consignee or for return to the shipper.

(2) The original container has sustained damage which would make it unsafe to lift it back on its running gear or onto another vehicle while it is loaded.

Whereas these are valid reasons for initiating field transfers, it must be kept in mind that conditions at emergency scenes are often far from ideal and the controlled conditions which can be assured at shipper locations. Therefore, decisions to initiate field transfers should not be made lightly and must properly consider all of the hazards and potential hazards present.

If a field transfer is to be made, the following must be considered:

(1) The physical and chemical properties of the product
- is it flammable? - need grounding, bonding and continuity
- is it corrosive? - need special materials of construction
- does it have a high vapour pressure? - need pressure rated equipment
- does it have a high freezing point or is it viscous? - may need to warm prior to transfer

(2) What motive force will be used for the transfer?

- gravity?
- pump?
- pressure differential?

(3) Must have suitable containers in which to transfer

- of proper materials of construction
- of proper size
- of proper pressure rating
- adequately vented during transfer

(4) Must minimize exposure to people and the environment during the transfer operation.

- only necessary personnel in the vicinity
- proper instrumentation
- proper block and bleed valving
- adequate level, transfer rate indication
- proper protective clothing
- proper emergency safety equipment present in the event of an accident - i.e. eye wash showers, fire extinguishers, etc.
- proper emergency communication system.

(5) Must ensure proper cleanup/completion

- no safety hazards left at site
- new container properly identified and sealed for travel
- proper disposal of clingage from damaged container
- proper cleaning of protective equipment

Transferring techniques demonstrated:

- pressure rail car to pressure truck via pressure differential
- non pressure rail car to non pressure rail car via truck pump
- etc.
- etc.

(3) ADDITIONAL HANDOUTS

FIELD TRANSFERRING OF PRODUCTS

THE FOLLOWING PAGES INCLUDE DIAGRAMS ON THE TYPICAL WAY IN WHICH ONE HOOKS UP TANK CARS TO OTHER TANK CARS OR TANK TRUCKS IN A FIELD SITUATION.

A NUMBER OF PAGES LIST SOURCES OF MOTIVE FORCE FOR THE TRANSFER (I.E. COMPRESSORS, NITROGEN, AIR PUMPS). EACH OF THESE INDICATE SOME OF THE ADVANTAGES AND DISADVANTAGES OF THE SOURCES AND PRECAUTIONS THAT NEED TO BE TAKEN. ALSO INCLUDED ARE SEVERAL DIAGRAMS WHICH SHOW HOW THE FIELD TRANSFERS HAVE BEEN MADE BY DOW CHEMICAL COMPANY. BECAUSE OF THE VARIETY OF CHEMICALS THAT ARE HANDLED IT IS IMPRACTICAL FOR US TO LIST THE TYPES OF HOSES OR PUMPS THAT ONE SHOULD CONSIDER HAVING AVAILABLE FOR FIELD TRANSFER, IT WOULD SEEM THAT THE BEST SOURCE OF THIS INFORMATION WOULD BE PEOPLE WITHIN YOUR OWN OPERATING UNITS WHO NORMALLY LOAD OR OFF-LOAD THE PRODUCT.

C O M P R E S S O R

ADVANTAGES

Enclosed Loading Loop

Portable

DISADVANTAGES

Availability
Ignition Source
Internal Pressure on Damaged Vessel
Needs Power Source

SOURCE

Multiple Choice

NEEDS

(a) Operator
(b) Pressure Relief Valves
(c) Pressure Gauges on Vessels

PRECAUTIONS

1. Do not Overpressure
2. Inspect for Longitudinal Scrapes or Gouges
3. Do Not Allow Liquid into Compressor
4. Do Not Block in Discharge or Suction While Operating

N I T R O G E N

ADVANTAGES: Dry and inert

DISADVANTAGES:
Availability
Cryogenic
Internal stress on vessel
Car left with N2 pressure on it

SOURCE:
Truck
Cylinders

NEEDS:
(a) Operator must be in attendance
(b) Outlet has thermometer
(c) Or low temperature alarm
(d) Check valve at receiving vessel
(e) Pressure reducing regulator
(f) Pressure relief safety valve on vessel
(g) Pressure gauge on receiving vessel

PRECAUTIONS:
1. Nitrogen as a liquid or cold gas causes freeze burn of skin and eyes.
2. Do not touch frosted pipe or valve.
3. Do not over pressure
4. Do not get liquid into line or vessel.
5. Inspect for longitudinal scrapes or gouges.
6. Do not allow leaks in enclosed spaces.

PUMPS

ELECTRIC START

ADVANTAGES:
Higher volume
Higher discharge pressure
Allows closed transfer loop

DISADVANTAGES:
Source of ignition
Leaking seals
Power source
May not be self-priming

SOURCE: Multiple Choice

NEEDS:
(a) Generator
(b) Electrician
(c)

PRECAUTIONS:
Electric Shock
Ignition Source

P U M P S

T R U C K

ADVANTAGES: Availability
Self-priming

DISADVANTAGES: Ignition Source
Not portable (Road access required)

SOURCE: Common carriers

NEEDS: (a) Operator

PRECAUTIONS: Positive displacement pump DO NOT VALVE off discharge while pump running.

V A C U U M

T R U C K

ADVANTAGES: Availability

DISADVANTAGES: Source of ignition
Discharge vapour to atmosphere
Not portable (Road access required)

SOURCE: Multiple Choice

NEEDS: Operator

PRECAUTIONS: Exothermic reactions
Compatibility of materials of contruction

A I R

ADVANTAGES: Access to

DISADVANTAGES:
Wet
Supports Combustion
Internal stress on vessel
Car left with air pressure on it

SOURCE:
Rail Engine
Train line
Tank truck
Portable compressor

NEEDS:
(a) Operator in attendance
(b) Pressure regulator
(c) Check valve at receiving vessel
(d) Pressure relief safety valve
(e) Pressure gauge on receiving vessel
(f) Bleed valve
(g) Proper fittings (i.e.) Gladhands

PRECAUTIONS:
1. Do not use air on flammable material
2. Do not use wet air on Hygroscopic material
3. Do not use air on Pyrophoric material
4. Do not over-pressure
5. Watch for longitudinal scrapes or cracks

PUMPS

AIR OPERATED

ADVANTAGES:
- Intrinsically safe
- Capacity
- Portability
- Self-priming
- Lifts material
- Allows closed transfer loop

DISADVANTAGES:
- Product range
- Need air supply
- Freezes air
- Discharge pressure

SOURCE:	Manufacturer	Distributor
	Warren-Rupp	R.N.G.
	Graco	Howard Martin Co.
	Canadian Doff Norton	L & K Equipment, London

NEEDS:
(a) Air Supply
(b)

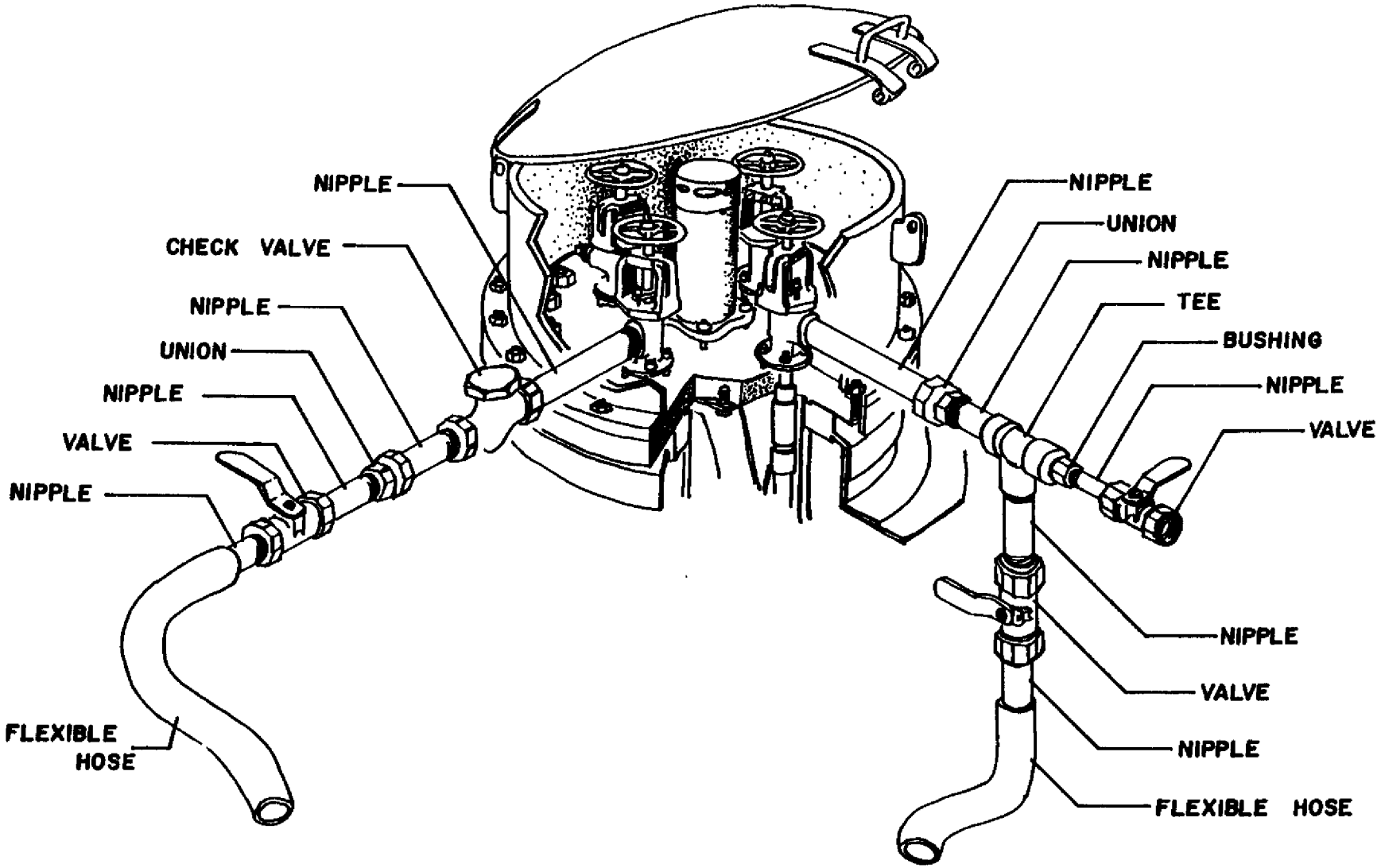
PRECAUTIONS: Add alcohol to air

OTHER CONSIDERATIONS WHEN TRANSFERRING

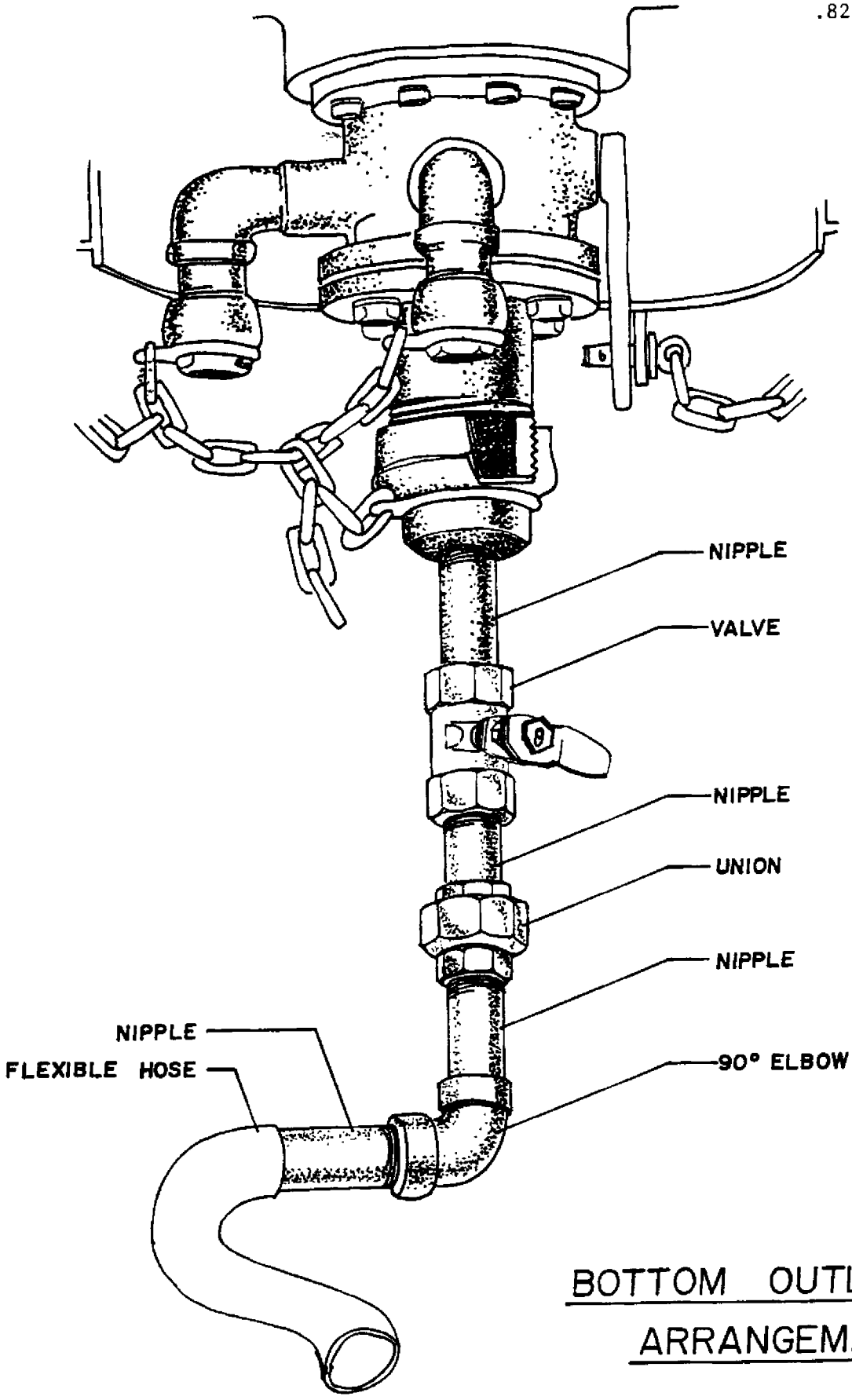
EJECTORS	Air operated H_2O operated Steam operated
FLARE STACKS	Watch for flashback Use check valve or flame arrestor
PIPE & FITTINGS	Avoid cast iron
HOSES	Should be bonded Should be equipped with valves
VALVES	Packing compatible
FLAMMABLES	1. Use dip pipe to load 2. Ground equipment 3. Avoid sparks
CORROSIVES	Scrubbing or neutralizing agents

EXCESS FLOW VALVES - Car must be in upright condition

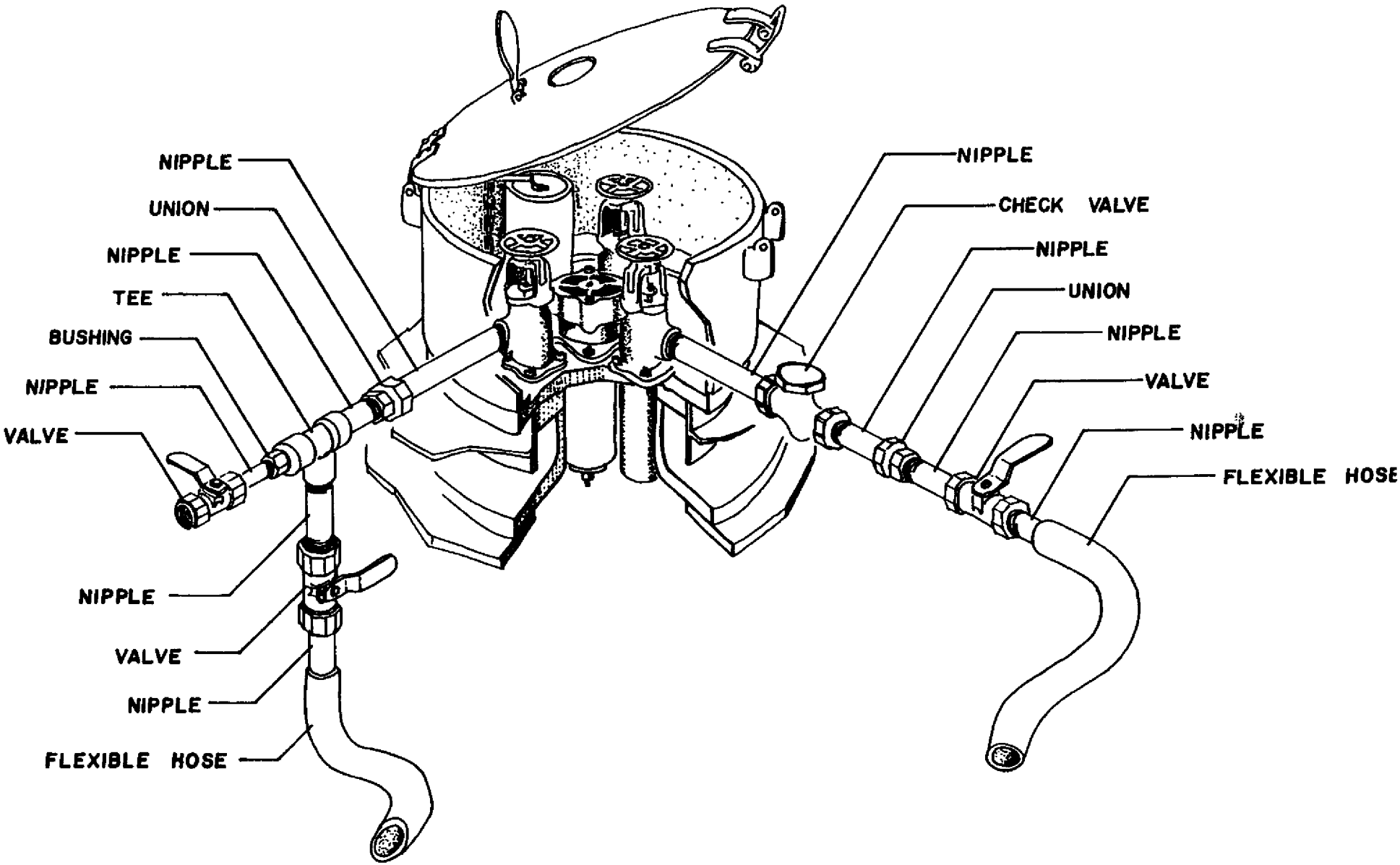
COMPATABILITY	All products react in various ways with certain hose liners and metals. Check your products requirement for transfer equipment.



CHLORINE DOME ARRANGEMENT



BOTTOM OUTLET ARRANGEMENT



LPG DOME ARRANGEMENT

UNLOADING DAMAGED CAR