
SERVICE MANUAL

MCDU 500

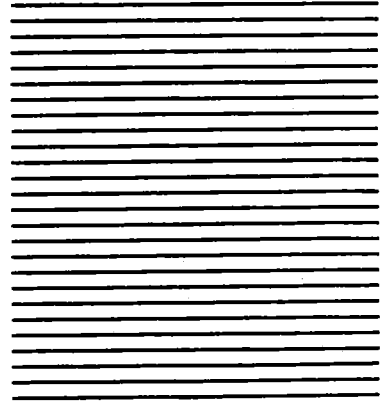
MCDU 400

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TECHNICAL MANUAL

MCDU VESSEL

AUGUST 1989

PREFACE

SECTION 1: Introduction

This section provides a general description and introduction to the MCDU Series Vessels.

SECTION 2: Warranty Statement and Claims Procedure

This section details the items covered under warranty and the procedure for filing a warranty claim.

SECTION 3: Vessel Mounting

This section illustrates the vessel mounting.

SECTION 4: Filling and Pressure Testing

This section details the procedure for filling and pressure testing the MCDU unit.

SECTION 5: Parts Identification and Function

This section contains the detail for all assemblies on the MCDU unit.

SECTION 6: Recommended Replacement Parts

This section covers the recommended spare/repair parts list for the MCDU Vessels.

SECTION 7: Preventative Maintenance

This section details the preventative maintenance checks which should be performed on the MCDU Series Vessels.

SECTION 8: Troubleshooting

This section contains troubleshooting procedures for MCDU Vessels.

SECTION 9: Repairs Under Pressure

This section covers the repairs which can be performed on the vessel while it is under pressure.

SECTION 10: Repairs Empty

This section details the repairs for which the vessel must first be emptied of its contents.

Appendix A: Reliquifying Solid CO₂

This appendix contains recommended practices for reliquifying solid CO₂ (dry ice) in the event the vessel contents freeze.

Appendix B: Schematic

This appendix depicts a schematic diagram of the MCDU vessels.

Appendix C: Abbreviations and Acronyms

This appendix contains all abbreviations and acronyms used throughout this manual.

Appendix D: Vendor Literature

This appendix contains copies of certain vendor literature.

Appendix E: Parts List

This appendix gives a complete listing of all parts used on the tank.

SAFETY SUMMARY

MVE MCDU Series Carbon Dioxide Delivery Vessels consist of a stainless steel inner vessel encased in a stainless steel outer jacket and a plumbing cabinet assembly. The MCDU Series containers operate at medium pressure and are protected from over-pressurization by a series of relief devices.

While these vessels are designed and engineered for safe and reliable operation, it is imperative that all personnel operating or repairing these units carefully read all warnings, notes, and cautions enumerated below and contained in the manual itself.

WARNING: EXCESS CARBON DIOXIDE ACCUMULATION CREATES AN OXYGEN DEFICIENT ATMOSPHERE. EXPOSURE TO SUCH AN OXYGEN DEFICIENT ATMOSPHERE CAN CAUSE UNCONSCIOUSNESS AND CAN LEAD TO SERIOUS OR FATAL INJURY.

WARNING: BEFORE REMOVING ANY FITTINGS OR ASSEMBLIES FROM THE MCDU UNIT, CAREFULLY FOLLOW THE PROCEDURES DETAILED IN THE APPROPRIATE SECTION OF THIS MANUAL. FAILURE TO FOLLOW THE PROCEDURES CONTAINED HEREIN, CAN LEAD TO SERIOUS OR FATAL INJURY.

WARNING: NEVER LOOK DIRECTLY INTO A HOSE OR LINE THAT YOU SUSPECT TO BE PLUGGED. DRY ICE PLUGS COULD BECOME RAPIDLY DISLODGED AND LEAD TO SERIOUS OR FATAL INJURY.

WARNING: USE ONLY REPLACEMENT PARTS APPROVED BY MVE FOR REPAIRS. FAILURE TO DO SO COULD RESULT IN SUBSTANDARD VESSEL PERFORMANCE AND WILL VOID THE FACTORY WARRANTY.

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Appendix A - Reliquifying Solid CO₂

Appendix B - Schematic

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Appendix E - Parts List

SECTION 1

INTRODUCTION

1.1 GENERAL

The MINNESOTA VALLEY ENGINEERING (MVE) Carbon Dioxide Delivery Unit (MCDU) is a lightweight, compact, and self-contained vessel designed for the economical transportation and delivery of carbon dioxide liquid.

The units are designed and engineered for belly mounting on existing delivery vehicles. There are two MCDU series vessels currently in the marketplace. The MCDU-400A and MCDU-500 are operationally equal and differ only in the capacity of the units.

The model designation MCDU means that the vessel is a MVE Carbon Dioxide Delivery Unit. The numerical designation indicates the capacity of the vessel in pounds of carbon dioxide (CO₂).

1.2 PHYSICAL DESCRIPTION

An MVE MCDU Series vessel is designed and engineered for the transport and delivery of liquid CO₂ at 300 psig. Each MCDU vessel is comprised of a stainless steel inner vessel encased in a stainless steel outer jacket. A cabinet mounted on the front of the vessel provides protection and access to the plumbing assembly, CO₂ indicators, and operating valves.

The MCDU Series vessels carry a DOT Exemption (E-9176) for the transport of carbon dioxide. A copy of the DOT Exemption is furnished with each vessel and must be carried on the vehicle at all times. Relief devices on the vessels meet the requirements of CGA Pamphlet 1.2, Safety Relief Devices Standards.

1.3 FEATURES

The MVE MCDU Series vessel is designed to provide a safe, reliable, and economical method for the transport and delivery of liquid CO₂. Important features/components of these vessels include:

- Full stainless steel construction.
- Threaded connect fittings for filling and dispensing of CO₂.
- Contents and pressure gauges to monitor vessel operating conditions.
- A retractable ratchet type hose reel for rewinding the delivery hose.
- A high quality, low maintenance cryogenic ball valve for stopping the flow of CO₂ to the hose reel.

MCDU VESSEL SPECIFICATIONS

	<u>MCDU-400A</u>	<u>MCDU-500</u>
Tank Length	72-5/16"	84-5/16"
Tank Diameter	20"	20"
Cabinet Width	20-5/8"	20-5/8"
Cabinet Height	23-5/8"	23-5/8"
Capacity	400 lbs.	500 lbs.
Tare Weight	525 lbs.	550 lbs.
Full Weight	925 lbs.	1050 lbs.
Design Spec.	DOT 4L-272	DOT 4L-272
MAWP	325 psig	325 psig
Relief Setting	325 psig	325 psig
Rupture Setting	525 psig	525 psig
Hose Relief Setting	375 psig	375 psig

SECTION 2

WARRANTY STATEMENT AND CLAIMS PROCEDURE

2.1 GENERAL

This section covers items which would and would not be covered under the manufacturer's warranty.

2.2 WARRANTY

MVE provides, to the original equipment purchaser, a one year Conditional Materials and Workmanship WARRANTY (90 days on labor) on the MCDU-500 and MCDU-400A. MVE will, at it's option, repair or replace parts, which upon inspection by MVE or it's authorized agent, prove defective.

Items not covered include normal wear and tear, routine maintenance, damage caused by abuse, misuse, and acts of God.

No other WARRANTIES, either expressed or implied, may apply to this equipment without the written consent of an officer of the company.

Items typically covered by WARRANTY (including, but not limited to):

Tank Vacuum

Cabinet

Hose Reel

Contents Gauge

Installation (if performed by MVE - 90 days)

Hose and Hose End (90 days)

Items typically NOT covered by WARRANTY (including, but not limited to):

Installation by Others

Gauge Calibration

Tightening of Bolts and Fasteners

Lubrication

2.3 MVE MCDU WARRANTY PROCEDURE

Parts

Parts used for warranty repair should be ordered from MVE. The equipment owner, or his designee, should maintain a stock of common replacement parts. MVE will ship new parts upon receipt of defective parts.

Labor

MVE will reimburse it's authorized service agent for labor based on the following schedule:

Remove, test, and replace Contents Gauge	- 1/2 hour
Remove, and replace Hose End	- 1/2 hour
Remove and replace Hose	- 1/2 hour
Remove and replace Pressure Gauge	- 1/2 hour
Leak Check Plumbing	- 1/2 hour
Replace Hose Swivel O-Rings	- 1/2 hour
Remove Hose Reel for replacement	- 1 hour
Rebuild Ball Valve	- 1 hour

MVE will pay for labor to repair the MCDU for a period of 90 days after installation if the invoice includes a 5-minute preventative maintenance check which should be completed at the time any repairs are made.

Invoices should be sent to the following:

Minnesota Valley Engineering, Inc.
407 Seventh Street N.W.
New Prague, Minnesota 56071

Attn: Accounts Payable Dept.

WARRANTY CLAIM FORM

Date: _____

EQUIPMENT OWNER: _____

Address: _____

City, State, Zip: _____

SERVICE COMPANY: _____

Address: _____

City, State, Zip: _____

MODEL: _____ Serial Number: _____

Reason for call: _____

Work Performed: _____

Parts Used: _____

Parts used were purchased on MVE Invoice Number: _____

Was problem resolved? _____

PERIODIC MAINTENANCE CHECKLIST

(Circle Appropriate Response)

Mounting Bolts Tight:	O.K.	Work Needed
Door Latch Function:	O.K.	Work Needed
Safety Chain:	O.K.	Work Needed
Hose free from cuts:	Yes	No
Hose Reel Operation	O.K.	Work Needed
Swivel doesn't Leak:	Yes	No
Tank Pressure 280-300 PSI:	Yes	No
DOT Label on Door:	Yes	No

Repairs should be made or scheduled on items needing work.
Return to MVE with invoice.

SECTION 3

VESSEL MOUNTING

3.1 GENERAL

The MCDU Series vessels are mounted "under belly" so as not to limit usable truck space.

3.2 INSTALLATION KIT

The installation kit for the MCDU Series (MVE P/N 97-1307-9) contains all the necessary hardware to mount the MCDU vessel as depicted in Figure 3.1. Strict adherence to the mounting diagram must be observed.

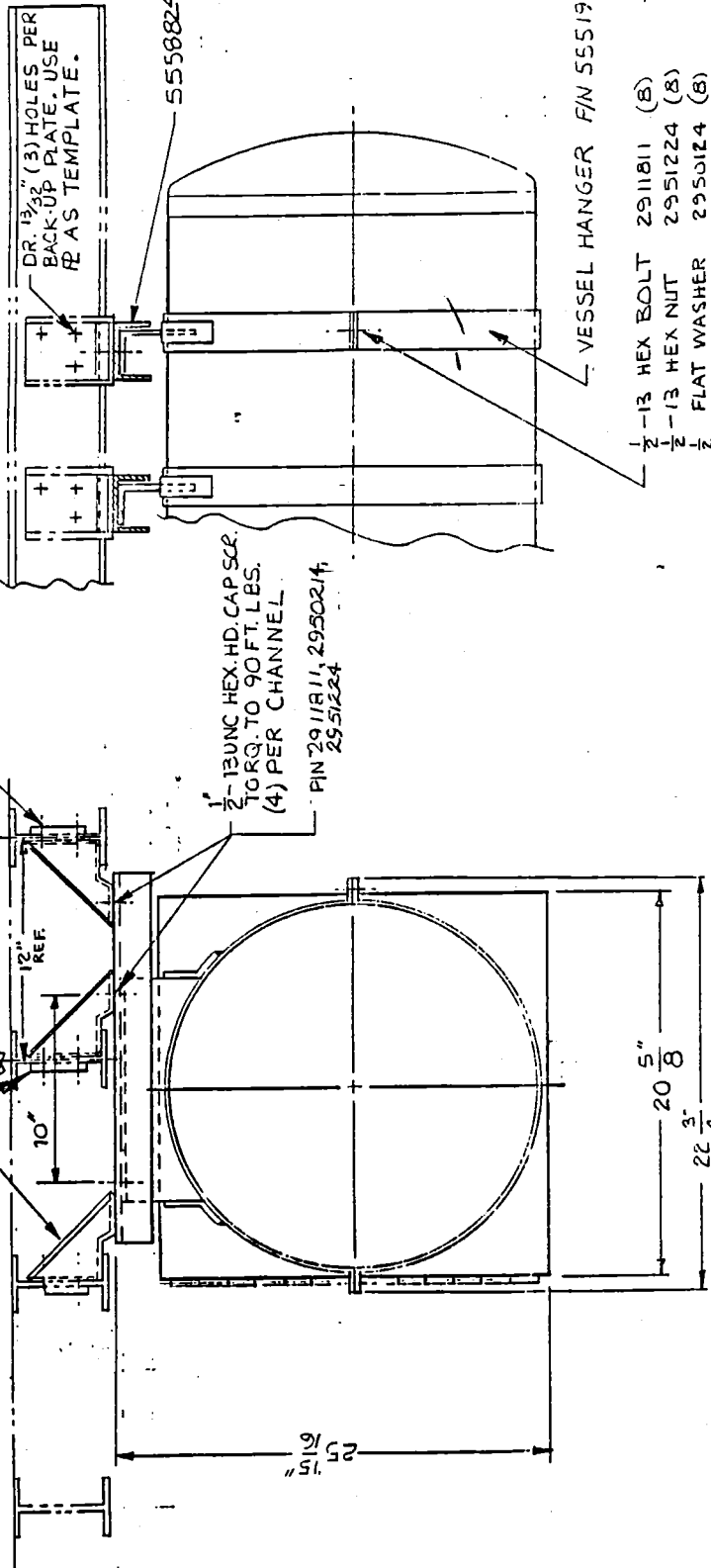
3.3 MOUNTING CONSIDERATION

The Department of Transportation (DOT) has approved the mounting design using two hanger straps. MVE supplies the hardware in the installation kit (MVE P/N 97-1307-9) for four hanger straps to provide an extra margin of safety. MVE recommends that the trailer manufacturer be consulted prior to vessel installation to determine any special design and/or loading considerations.

REMOVE A IRS. 4,2950104

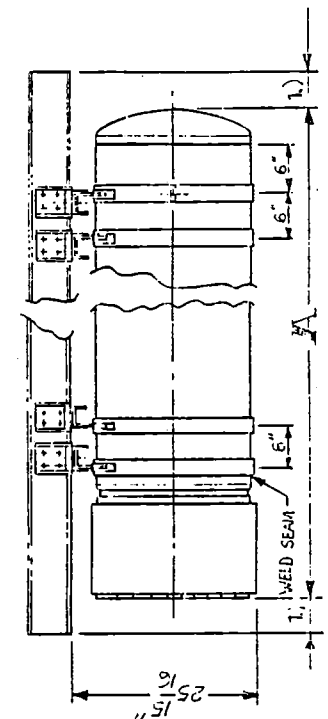
3" - 16UNC HEX. HD. CAP SCR. TORQ. TO 25 FT. LBS. (3) PER BRKT. F/N 2910881, 2910882, 2910883

5552054 (3) PER CHANNEL
12" REF
10"



1" - 13UNC HEX. HD. CAP SCR. TORQ. TO 90 FT. LBS. (4) PER CHANNEL
PIN 2911811, 2950214, 2951224

- 2 - 13 HEX BOLT 2911811 (8)
- 2 - 13 HEX NUT 2951224 (8)
- 2 - 13 FLAT WASHER 2950124 (8)
- TORQUE TO 25 FT LBS



SERIES	NO. OF MTG. BANDS REQ.
400A	4
500	4

NOTES
1) EQUALLY SPACED FROM EACH SIDE.

REV	DATE	BY	DESCRIPTION
D	7/11/53	JCK	QTY CORRECTIONS
C	7/11/53	JCK	CHG. MOUNTING PLATES
B	7/11/53	JCK	CHG. PIN 3211574 WITH 5558824
A	7/11/53	JCK	CHG. CRANE NO. OF STRAPS

DATE	APPROVED	DESIGNED	QUANTITY	REVISION
7/11/53	JCK	JCK	1	1
7/11/53	JCK	JCK	1	2
7/11/53	JCK	JCK	1	3

MINNESOTA VALLEY ENGINEERING
NEW PRAGUE, MINNESOTA 55051

TITLE: VESSEL INSTALLATION
DRAWING NO: C-22655 REV: -F
SCALE: N/A SHEET: 1 OF 1

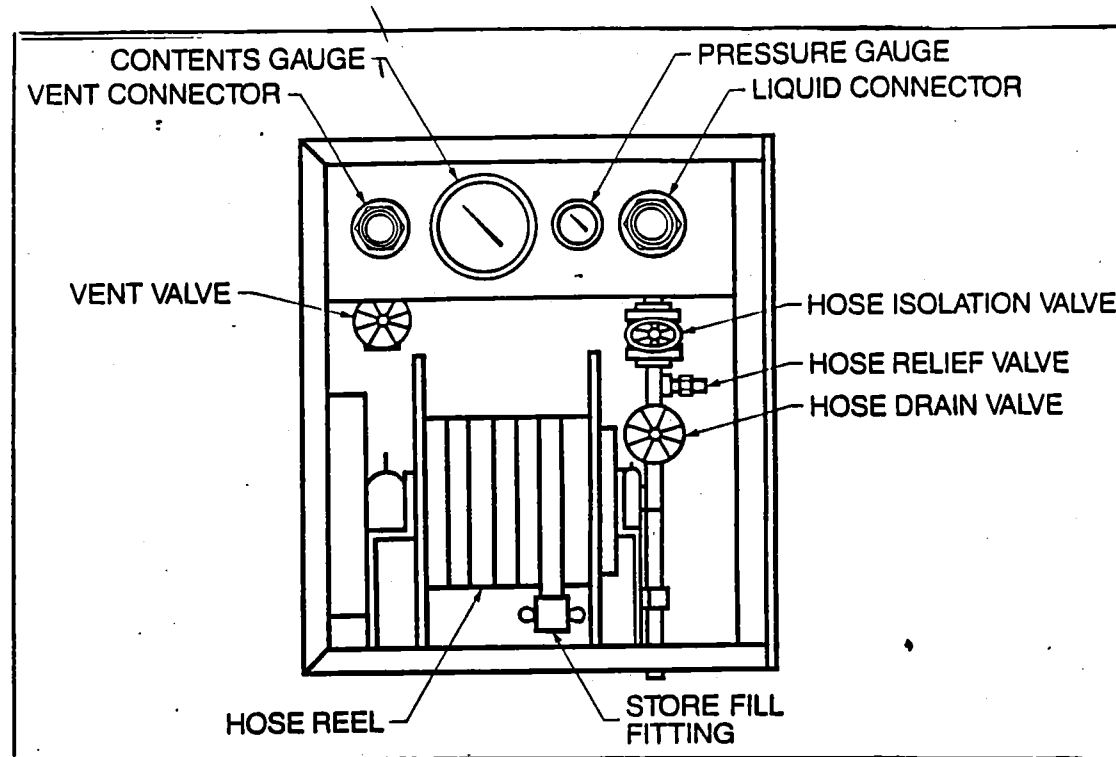
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SECTION 4

FILLING AND PRESSURE TESTING

4.1 GENERAL

In performing any of these repairs detailed in Section 9 of this manual, the contents of the MCDU vessel must be emptied. In order to pressure test the repair, the vessel can be refilled using the bulk storage tank or pressurized using another MCDU unit.



4.2 MCDU FILLING PROCEDURE

In order to properly fill the MCDU unit, valves V-1, V-2, and V-3 should be positioned as follows:

Hose Isolation Valve	V-1 Open
Hose Drain Valve	V-2 Closed
Vent Valve	V-3 Closed

After determining that the above valves are positioned correctly, follow the steps listed below to fill the MCDU vessel.

- 4.2.1 Visually inspect the liquid fill and vent connections (C-2 and C-3) for foreign objects, moisture, or debris. Wipe with a clean, dry cloth.

- 4.2.2 Visually inspect the liquid fill line from the bulk storage receiver. Wipe off fitting.
- 4.2.3 Clip the safety chain hook into the slot located above the liquid fill connection.
- 4.2.4 Connect the liquid fill line from the bulk storage receiver to the liquid fill connection on the MCDU vessel.

NOTE: If at any time during the filling process it becomes evident that a leak still exists, discontinue the filling process and follow the appropriate repair procedure.

- 4.2.5 Visually inspect the vent line from the bulk storage receiver. Wipe off fitting.
- 4.2.6 Clip the safety chain hook into the slot located directly above the vent connection.
- 4.2.7 Connect the vent line from the bulk storage receiver to the vent connection on the MCDU vessel.

NOTE: The emergency shut off valve is located behind the McFill Panel.

- 4.2.8 Observe the contents gauge (G-2). When the desired product level is achieved, reverse steps 1 through 7 to discontinue the filling process. A normal fill should take from five to ten minutes once the hoses are connected.

4.3 FIELD PRESSURE

In the event that the MCDU is empty and the location of the problem is not apparent, the MCDU unit can be pressurized from another MCDU unit. Follow the steps listed below to field pressurize the MCDU vessel.

- 4.3.1 Unreel the delivery hose (HR-1) from the empty MCDU vessel.
- 4.3.2 Connect the delivery hose from the empty MCDU vessel to the vent connection (C-3) on the full MCDU vessel.
- 4.3.3 Use a soap solution to bubble test the empty MCDU vessel, and determine the problem location.
- 4.3.4 Disconnect the delivery hose (HR-1) from the full MCDU and follow the appropriate procedure for repairing the problem.

SECTION 5

PARTS IDENTIFICATION AND FUNCTIONS

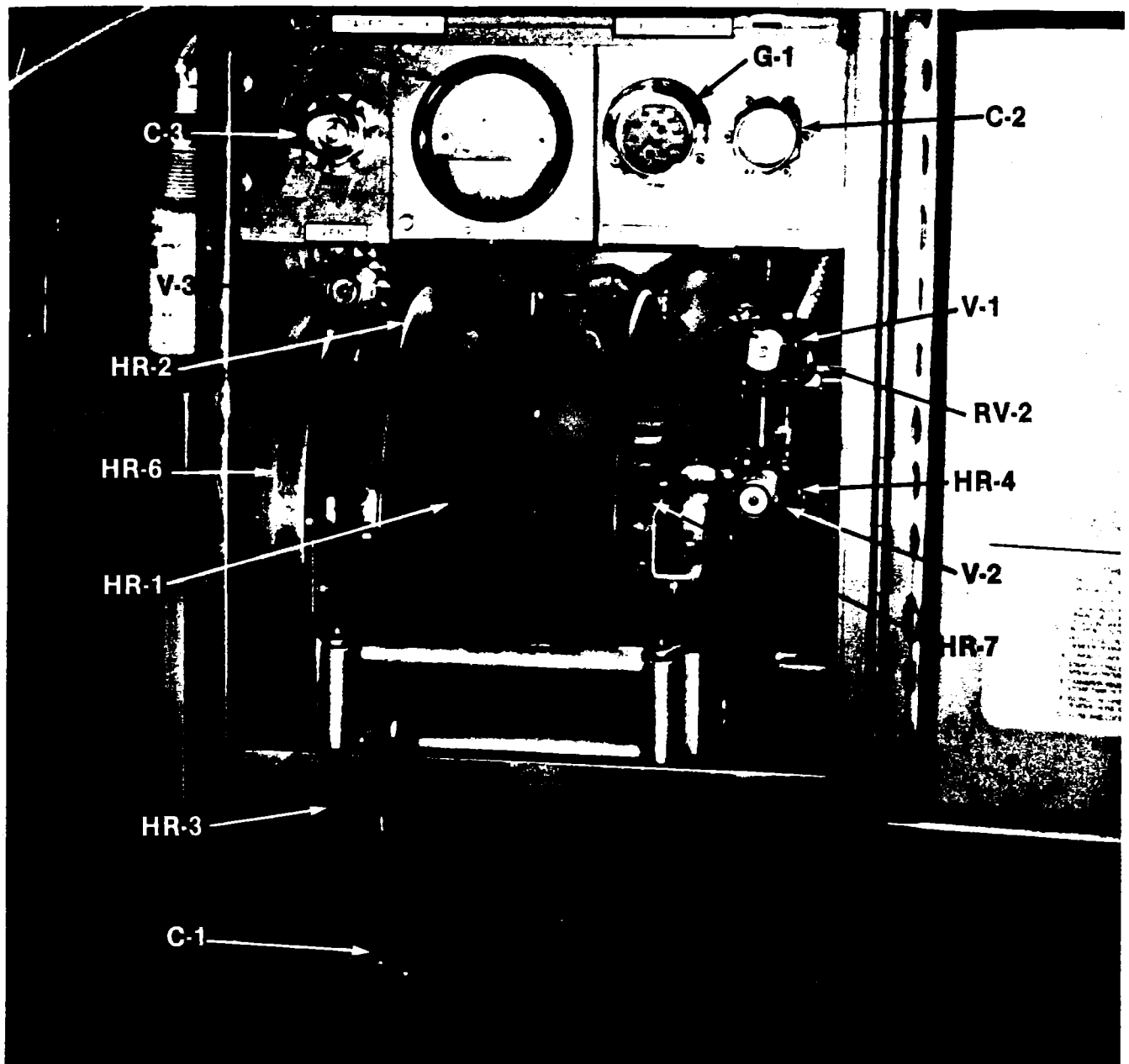
5.1 GENERAL

The information contained in this section will be helpful in locating problem parts and ordering replacement parts.

5.2 IDENTIFICATION TABLE

Table 5.1 correlates part numbers and callouts with the figures presented in this section.

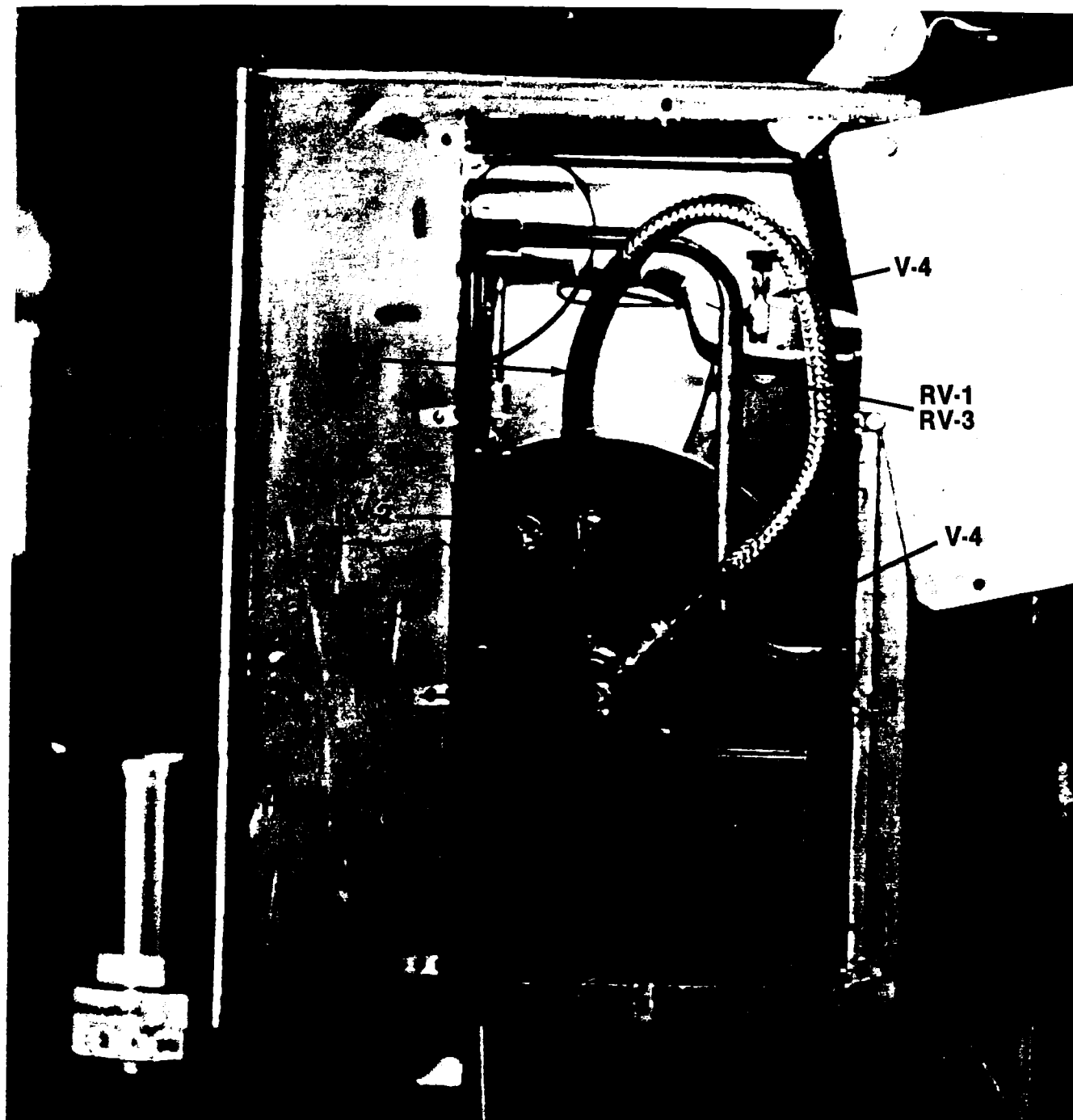
Figure 5-1 Front View



ITEM	DESCRIPTION
C-1	Quick Coupling ¾" Fem.
C-2	Quick Coupling 1" Male
C-3	Quick Coupling ¾" Male
G-1	Pressure Gauge 0-400 PSIG
G-2	Contents Gauge
HR-1	Delivery Hose 35'
HR-2	Retractable Hose Reel
HR-3	Wrench Assembly

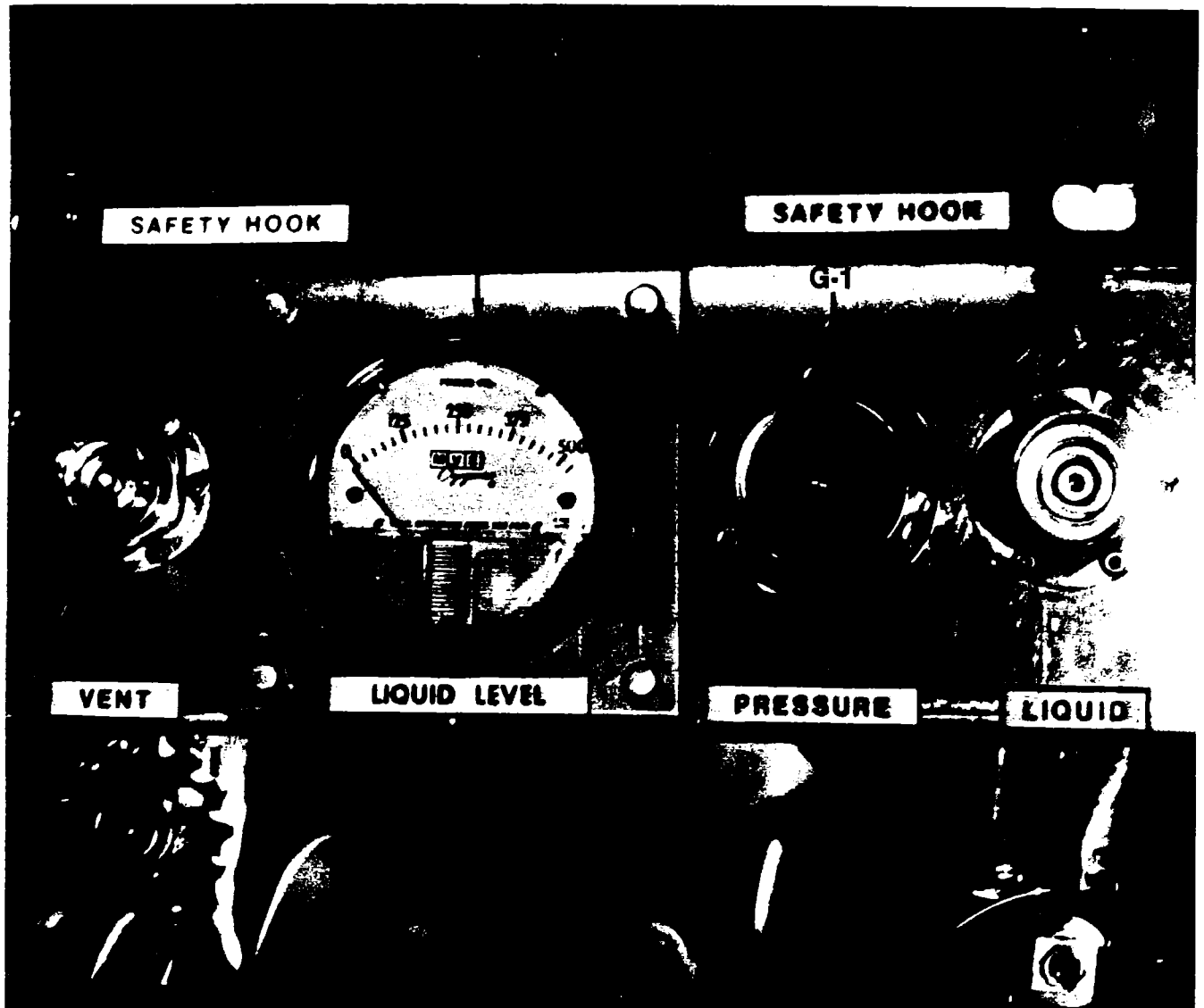
ITEM	DESCRIPTION
HR-4	Hose Reel Swivel
HR-6	Hose Reel Ratchet Spring
HR-7	Hose Reel Ratchet Stop Spring
RV-2	Hose Relief 375 PSIG
V-1	Hose Isolation Valve
V-2	Hose Drain Valve
V-3	Vent Valve

Figure 5-2 Side View (Access Panel Removed)



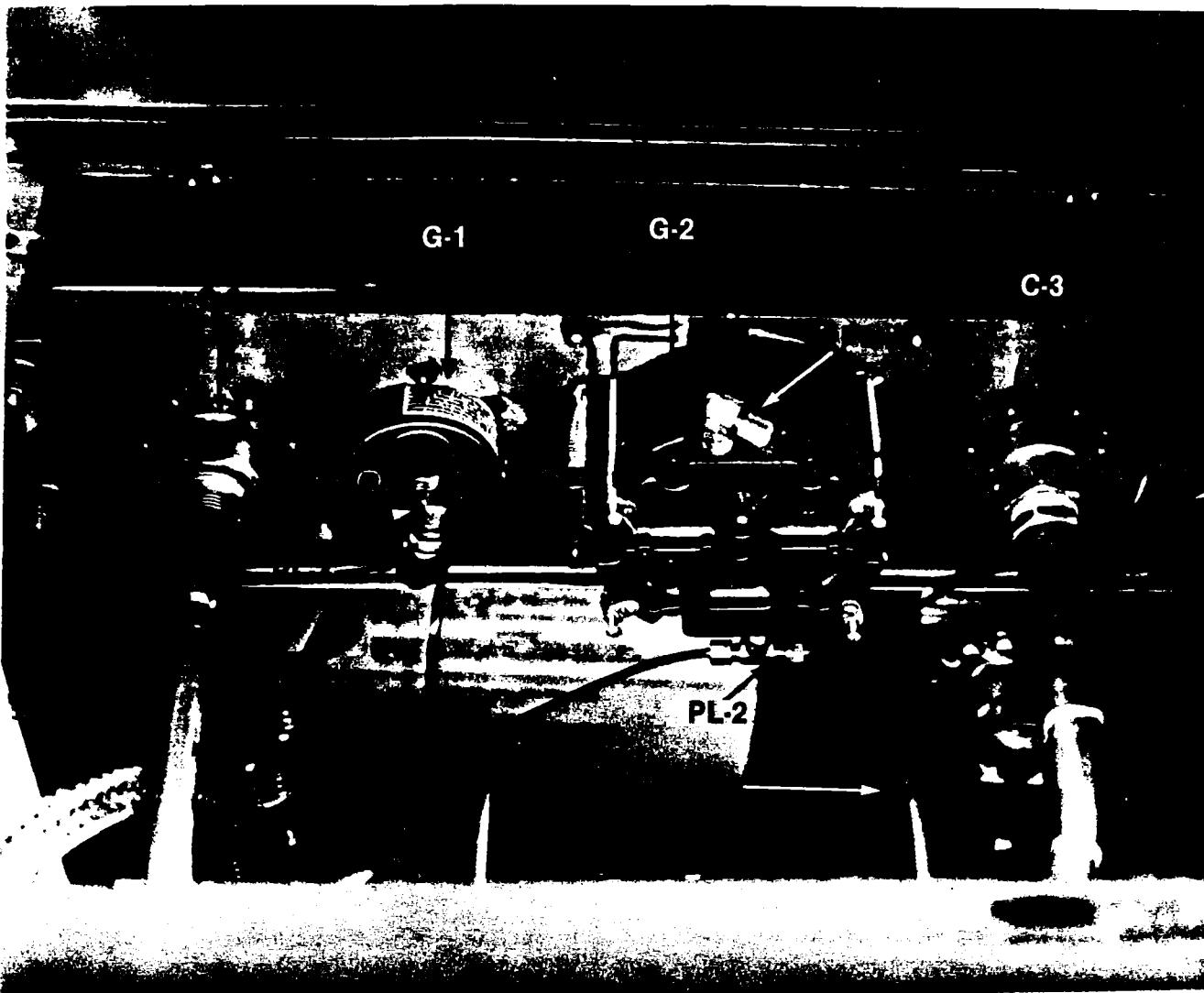
ITEM	DESCRIPTION
HR-2	Retractable Hose Reel
HR-4	Hose Reel Swivel
HR-5	Feeder Hose
RV-1	Inner Vessel Relief 325 PSIG
RV-2	Hose Relief 375 PSIG
RV-3	Safety Burst Disc 525 PSIG
V-4	Gauge Calibration Valve

Figure 5-3 Gauge Panel



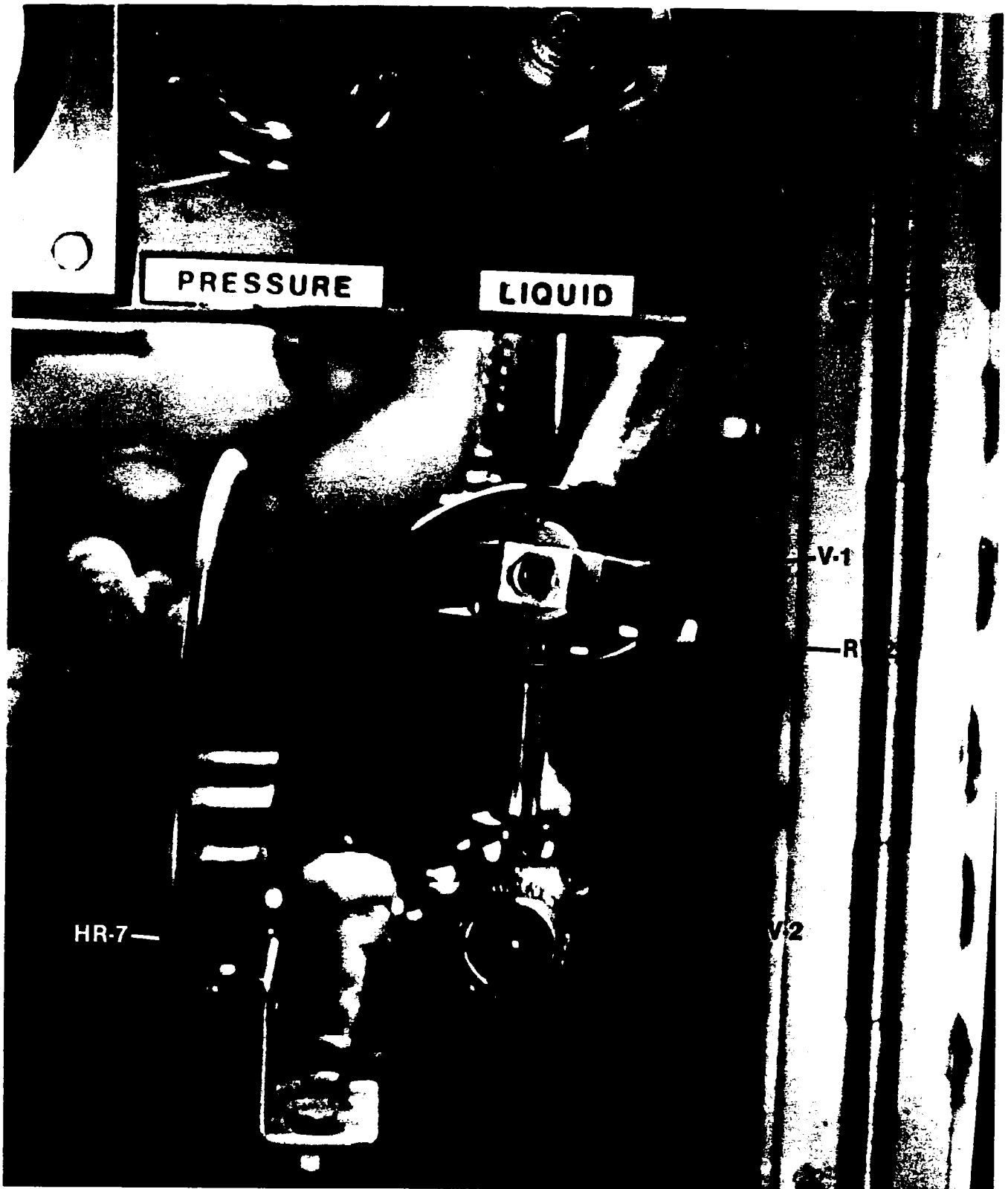
ITEM	DESCRIPTION
C-2	Quick Coupling 1" Male
C-3	Quick Coupling 3/4" Male
G-1	Pressure Gauge 0-400 PSIG
G-2	Contents Gauge

Figure 5-4 Back of Gauge Panel (Top Panel Removed)



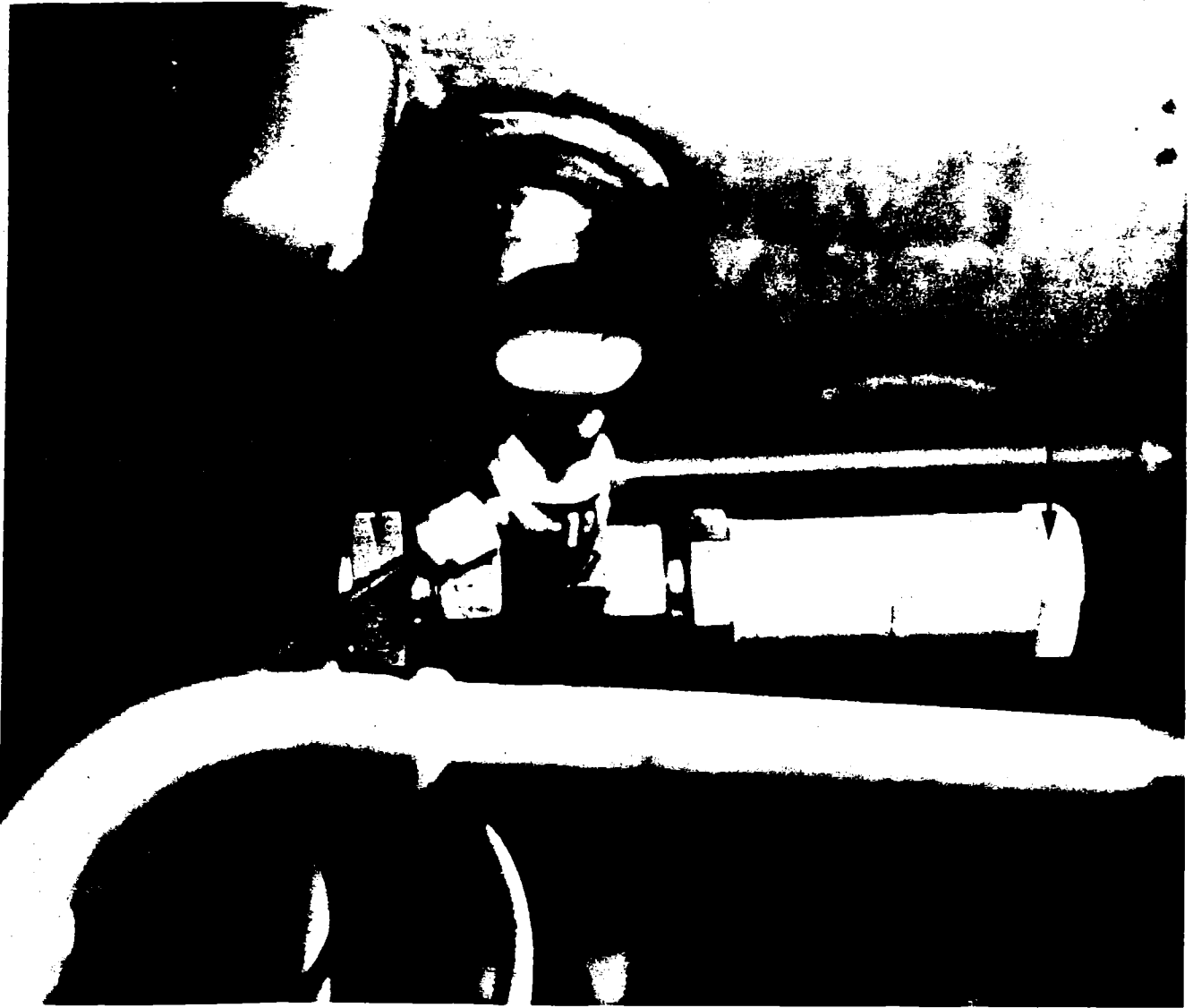
ITEM	DESCRIPTION
C-2	Quick Coupling 1" Male
C-3	Quick Coupling 3/4" Male
G-1	Pressure Gauge 0-400 PSIG
G-2	Contents Gauge
PL-1	1/8" Gauge Lines
PL-2	Tee 1/8" ODT x 1/4" MPT
PL-3	Fem. Elbow 90D 1/4" FPT
PL-4	Male Conn. 1/8" ODT x 1/4" MPT
PL-5	Male Elbow 1/4" MPT x 1/8" ODT

Figure 5-5 Hose Isolation and Drain Valves



ITEM	DESCRIPTION
HR-7	Hose Reel Ratchet Stop Spring
RV-2	Hose Relief 375 PSIG
V-1	Hose Isolation Valve
V-2	Hose Drain Valve

Figure 5-6 Relief Devices



ITEM	DESCRIPTION
RV-1	Inner Vessel Relief 325 PSIG
RV-3	Safety Burst Disc 525 PSIG
V-4	Gauge Calibration Valve

TABLE 5.1

PARTS IDENTIFICATION AND FUNCTIONS

ITEM	PART NUMBER	DESCRIPTION	QTY	FUNCTION	REFERENCE FIGURE	REPAIR PROCEDURE
MCDU-400A MCDU-500						
C-1	65-1146-2	Quick Coupling 3/4" Fem.	1	Allow Rapid Connection Of Fill Hose	5.1	9.7
C-2	65-1145-2	Quick Coupling 1" Male	1	Liquid Fill Connections	5.1,5.3,5.4	10.3
C-3	65-1143-2	Quick Coupling 3/4" Male	1	Vent Connection	5.1,5.3,5.4	10.3
V-1	17-1528-2	Ball valve 1/2"	1	Hose Isolation Valve	5.1, 5.5	10.7
V-2	55-6782-9	Hose Drain Assembly (use Valve 17-1001-2)	1	Hose Drain Valve	5.1, 5.5	
V-3	17-1002-2	Globe valve 3/8"	1	Vent Valve	5.1	
V-4	17-1616-2 10-1207-2	Valve - 1/4 MPT X 1/4 FPT Elbow - 1/8 X 1/4 MPT	2 2	Allows calibration of Contents Gauge	5.2, 5.6	
RV-1	18-1140-2	Relief Valve 325 psig	1	Safety Valve to protect Tank From overpressurization	5.2, 5.6	10.4
RV-2	18-1139-2	Relief Valve 375 psig	1	Safety Valve to protect Hose From Overpressurization	5.1, 5.2, 5.5	9.4
RV-3	19-1066-2	Safety Burst Disc 525 psig (550 psig)	1	Safety device to protect Inner tank	5.2, 5.6	10.5
G-1	20-1242-9	Pressure Gauge 0-400 psig	1	Indicates Tank Pressure	5.1, 5.3, 5.4	9.3
G-2	20-1270-9	Contents Gauge MCDU-400A	1	Indicates Tank Content	5.1, 5.3, 5.4	9.2
G-2	20-1269-9	Contents Gauge MCDU-500	1	Indicates Tank Content	5.1, 5.3, 5.4	9.2
HR-1	37-1108-7	Delivery Hose 35'	1	Delivery Hose	5.1	9.8
HR-2	37-1121-9	Retractable Hose Reel	1	Allows extension and rewinding of delivery hose	5.2	9.9, 9.10
HR-3	97-1168-9	Wrench Assembly	1	Simplifies connection at fill box	5.1	
HR-4	37-1146-9	Hose Reel Swivel	1	Allows hose reel to turn freely	5.1, 5.2	9.6

TABLE 5.1

PARTS IDENTIFICATION AND FUNCTIONS

ITEM	PART NUMBER	DESCRIPTION	QTY	FUNCTION	REFERENCE FIGURE	REPAIR PROCEDURE
MCDU-400A MCDU-500						
HR-5	37-1145-9	Feeder Hose	1	Transfers CO2 from tank to delivery hose	5.2	9.5
HR-6	37-1147-9	Hose Reel Ratchet Spring	1	Provides tension to Retract Hose Reel	5.1	9.10
HR-7	37-1148-9	Hose Reel Ratchet Stop Spring	2	Allows locking of hose reel while extended	5.1, 5.5	
PL-1	28-1134-6	1/8" Nylon Gauge Lines	1	Connects Phase Line to Contents Gauge	5.4	9.2, 9.3
PL-2	10-1208-2	Tee 1/8" ODT X 1/4" MPT	1	Connects Phase Line to Contents Gauge	5.4	9.2, 9.3
PL-3	12-1040-2	Fem. Elbow 90D 1/4" FPT	1	Connects Phase Line To Pressure Gauge	5.4	9.2, 9.3
PL-4	10-1209-2	Male Conn. 1/4" MPT X 1/8" ODT	1	Connects Phase Line to Pressure Gauge	5.4	9.2, 9.3
PL-5	10-1209-2	Male Conn. 1/4" MPT X 1/8" ODT	1	Connects Phase Line to Contents Gauge	5.4	9.2, 9.3
DL-1	43-1075-1	Door Latch	1	Allows secure closing of cabinet door	Not Shown	
L-1	38-1680-9	DOT Label	1	Identify Contents	Not Shown	
L-2	38-1682-9	Filling Procedure Label	1	Indicates Fill Procedure	Not Shown	

SECTION 6

RECOMMENDED REPLACEMENT PARTS

6.1 GENERAL

This section contains recommended spare and repair parts data for MCDU Series vessels. MVE recommends that an inventory, based on the number of units in the field, be kept at the service facility. When ordering parts, always specify complete part number along with nomenclature as identified in the Recommended Replacement Parts List (Table 6.1).

6.2 RECOMMENDED REPLACEMENT PARTS LIST

Table 6.1 details the recommended replacement parts list based on the quantity of units in the field.

TABLE 6.1

RECOMMENDED REPLACEMENT PARTS LIST

ITEM	PART NUMBER	DESCRIPTION	FUNCTION	REFERENCE FIGURE	QTY PER 10 UNITS
		MCDU-400A MCDU-500			
C-1	65-1146-2	Quick Coupling 3/4" Fem.	Allow Rapid Connection Of Fill Hose	5.1	3
C-2	65-1145-2	Quick Coupling 1" Male	Liquid Fill Connections	5.1,5.3,5.4	1
C-3	65-1143-2	Quick Coupling 3/4" Male	Vent Connection	5.1,5.3,5.4	1
V-1	17-1528-2	Ball Valve 1/2"	Hose Isolation Valve	5.1, 5.5	
V-2	55-6782-9	Hose Drain Assembly (uses valve 17-1001-2)	Hose Drain Valve	5.1, 5.5	
V-3	17-1002-2	Globe Valve 3/8"	Vent Valve	5.1	
V-4	17-1529-2 10-1207-2	Valve - 1/4 MPT X 1/4 FPT Elbow - 1/4 MPT X 1/8 ODT	Allows calibration of Contents Gauge	5.2, 5.6	
RV-1	18-1140-2	Relief Valve 325 psig	Safety Valve to protect Tank From overpressurization	5.2, 5.6	1
RV-2	18-1139-2	Relief Valve 375 psig	Safety Valve to protect Hose From Overpressurization	5.1, 5.2, 5.5	2
RV-3	19-1066-2	Safety Burst Disc 550 psig	Safety device to protect Inner tank	5.2, 5.6	1
G-1	20-1242-9	Pressure Gauge 0-400 psig	Indicates Tank Pressure	5.1, 5.3, 5.4	1
G-2	20-1270-9	Contents Gauge MCDU-400A	Indicates Tank Content	5.1, 5.3, 5.4	1
G-2	20-1269-9	Contents Gauge MCDU-500	Indicates Tank Content	5.1, 5.3, 5.4	1
HR-1	37-1108-7	Delivery Hose 35'	Delivery Hose	5.1	2
HR-2	37-1121-9	Retractable Hose Reel	Allows extension and rewinding of delivery hose	5.2	
HR-3	97-1168-9	Wrench Assembly	Simplifies connection at fill box	5.1	
HR-4	37-1146-9	Hose Reel Swivel	Allows reel to turn	5.1, 5.2	1
HR-5	37-1145-9	Feeder Hose	Transfers CO2 from tank to delivery hose	5.2	1

TABLE 6.1

RECOMMENDED REPLACEMENT PARTS LIST

ITEM	PART NUMBER	DESCRIPTION	FUNCTION	REFERENCE FIGURE	QTY PER 10 UNITS
		MCDU-400A MCDU-500			
HR-6	37-1147-9	Hose Reel Tension Spring	Provides tension to Retract Hose Reel	5.1	
HR-7	37-1148-9	Hose Reel Ratchet Stop Spring	Allows locking of Hose Reel while extended	5.1, 5.5	2
PL-1	28-1134-6	1/8" Nylon Gauge Lines	Connects Phase Line to Contents Gauge	5.4	5 ft.
PL-2	10-1208-2	Tee 1/8" ODT X 1/4" MPT	Connects Phase Line to Contents Gauge	5.4	
PL-3	12-1040-2	Fem. Elbow 90D 1/4" FPT	Connects Phase Line To Pressure Gauge	5.4	
PL-4	12-1209-2	Male Conn. 1/4"MPT X 1/8" ODT	Connects Phase Line to Pressure Gauge	5.4	
PL-5	10-1209-2	Male Conn. 1/4"MPT X 1/8" ODT	Connects Phase Line to Contents Gauge	5.4	
DL-1	43-1075-1	Door Latch	Allows secure closing of Cabinet door	Not Shown	
REPAIR KIT					
RK-1	37-1149-9	Hose Reel Swivel Repair Kit	Replaces Hose Reel O-Rings		2
RK-2	17-1530-9	Hose Isolation Valve Repair Kit	Replaces Worn Seals and Washers in Valve		2
RK-3	97-1575-9	Hose Blowdown and Vent Valve Kit	Replaces worn Seals and Washers in Valve		2

When converting from the Dwyer Contents Gauge to the Orange Research Gauge, order P/N 55-7666-1 mounting plate for 3-1/2" Gauge.

SECTION 7

PERIODIC MAINTENANCE

7.1 GENERAL

This section contains the periodic and preventative maintenance which should be performed at the specified intervals (Table 7.1 and 7.2) to maintain vessel integrity.

7.2 PLUMBING CABINET

Check the plumbing cabinet for damage, and the access panel to be sure it is secure. If the cabinet is damaged, call MVE if it appears that the unit cannot be operated. If the access panel is not secure, tighten accordingly.

7.3 DOOR LATCH ALIGNMENT

Check the alignment of the door and the operation of the latch. If the latch must be adjusted, loosen the four retaining bolts, and adjust as necessary. Using a light oil, such as WD-40, oil the hinge and latch and wipe off any excess oil.

7.4 PRESSURE AND CONTENTS GAUGES

Check the pressure gauge. It should read between 250 and 300 psi. It will indicate if there are any large leaks. If the pressure gauge is below 250 psi, use a soap solution and bubble test the entire unit.

Check the contents gauge. If the registered content is in the reasonable range, it is probably okay. If in doubt, calibrate the contents gauge using the following procedure.

- 7.4.1 Close isolation valves V-4.
- 7.4.2 Loosen the retaining nuts on both phase lines at the isolation valve and allow sufficient time for gauge to zero.
- 7.4.3 Tighten the phase line retaining nuts and open valves V-4.
- 7.4.4 Leak check the retaining nuts.

7.5 QUICK CONNECTS

Check quick connects (Hose C-1, Check C-2, Vent C-3) for wear and thread damage. Replace if necessary.

NOTE: MVE recommends the quick connect C-1 be replaced every six (6) months.

TABLE 7.1 PERIODIC MAINTENANCE CHECKLIST		
ITEM	REFERENCE FIGURE	REPAIR PROCEDURE
Quick Connect Fittings C-1 - C-3	5.1, 5.3, 5.4	9.7, 10.3
Valves V-1 to V-4	5.1, 5.2, 5.5, 5.6	10.6, 10.7
Relief Devices RV-1 to RV-3	5.1, 5.2, 5.5, 5.6	9.4, 10.4, 10.5
Gauge Operation G-1, G-2	5.1, 5.3, 5.4	7.4
Hose Reel HR-1 to HR-8	5.1, 5.2, 5.5	9.5, 9.6, 9.8 9.9, 9.10
Phase Lines & Connections PL-1 to PL-5	5.4	9.2, 9.3
Door Latch DL-1	Not Shown	7.3
Door Hinge	Not Shown	7.3
Door Alignment	Not Shown	7.3
Inspection Panel	5.2	7.2
Plumbing Cabinet	5.1, 5.2	7.2
Labels		

TABLE 7.2		MCDU PREVENTIVE MAINTENANCE SCHEDULE			
ITEM	INTERVAL			REFERENCE	REPAIR
	90D	180D	1 YR.	FIGURE	PROCEDURE
Delivery Hose	I		R	5.1, 5.3, 5.4	9.8
Quick Connect C-1		R		5.1	9.7
Fasteners	I			5.1, 5.2, 5.5, 5.6	
Hinge, Door, Latch Hose Reel		L		5.1, 5.2, 5.5	7.7
Gauge Calibration		C			7.4.1- 7.4.5

R - Replace
I - Inspect and Replace/Repair as necessary
L - Lubricate
C - Calibrate

SECTION 8

TROUBLESHOOTING

8.1 GENERAL

Table 8.1 provides basic troubleshooting guidelines and references the Repair Procedure for diagnosing and repairing vessel problems.

TABLE 8.1

MCDU TROUBLESHOOTING GUIDE

PROBLEM	CAUSE	REPAIR PROCEDURE
Hose Reel won't retract	Reel overextended	Carefully release locking mechanism by hand
	Reel not properly lubricated	Lubricate reel using low temperature grease
Valve leaking	Packing nut loose	Tighten Packing Nut
	Defective valve	10.6, 10.7
Pressure or contents gauge inoperable	Gauge line kinked	Replace Gauge Line
	Defective gauge	9.2, 9.3
	Tank contents frozen	Appendix A
Fill lines from mother tank won't connect	Fitting threads damaged	10.3
Liquid or vent connection frosted	Tank overfilled	Open vent valve until gas only comes out
	Threaded connection leak	10.3
Hose reel swivel leaks	Threaded connection not properly sealed	9.6
	Swivel O-Rings worn	9.6
Vent or hose blow down valve won't release pressure	Tank empty	Fill Tank
	Line blocked by solid CO ₂	Close valve and allow to thaw
	Tank contents frozen	Appendix A
Delivery hose fitting pops upon disconnection	Sealing gasket on fitting worn	9.7
Relief valve venting	Tank pressure above relief valve setting	Vent tank to 300 PSIG
	Defective relief valve	10.4

TABLE 8.1		MCDU TROUBLESHOOTING GUIDE	
PROBLEM	CAUSE	REPAIR PROCEDURE	
Fill connections leak after disconnection	Internal valves not properly seated.	Connect and disconnect fitting a couple of times to seat valve	
	Sealing gasket on fitting worn	9.7	
Frost on outer shell of tank	Tank vacuum bad	Call factory for service instructions	

SECTION 9

REPAIR UNDER PRESSURE

9.1 GENERAL

The repair procedures contained in this section can be performed without emptying the MCDU vessel. Please pay close attention to all notes, warnings, and cautions contained in this section, and in the safety summary section before attempting to make repair.

NOTE: On all repairs, use the following guidelines:

1. Use Loctite #242 Service Removable thread sealant on all fasteners, nuts, screws, and bolts.
2. Use Loctite #569 Service Removable thread sealant on all pipe threads.
3. Use a soap solution to leak check all components after servicing.
4. If threaded fittings won't break loose, lightly heat the threads to break the seal. DO NOT OVERHEAT!

9.2 CONTENTS GAUGE (G-2)

The contents gauge is a differential pressure sensor. High and low ports are clearly marked on the gauge body. The low side senses the pressure in the vapor space and the high side senses the vapor pressure plus the weight of the liquid column. The gauge reads the difference between the two pressures. When hooking the phase lines to the gauge, pay careful attention to hooking up the valve on the top of the tank to the low side and the valve at the bottom of the tank to the high side. To remove/replace this gauge, use the following procedure:

- 9.2.1 Close the isolation valves (V-4).
- 9.2.2 Remove the four bolts from the gauge panel shock mount.
- 9.2.3 Gently pull the entire assembly forward.
- 9.2.4 Remove the phase lines (PL-1) and note where the lines were attached.
- 9.2.5 Remove the fittings (PL-2 and PL-5) from the gauge.
- 9.2.6 Remove the four mounting screws from the gauge.

9.2.7 Pull the gauge out of the shock mount bracket.

To replace the gauge, reverse steps 9.2.1 through 9.2.7.

NOTE: Make sure to orient fittings (PL-2 and PL-5) correctly and be sure the shock mount pad is in place.

9.3 PRESSURE GAUGE (G-1)

The pressure gauge is liquid filled to protect the gauge from over-the-road vibration. The pressure gauge senses internal tank pressure and is connected to a tee (PL-2) on the low port of the contents gauge (G-2). To remove/replace the pressure gauge, use the following procedure:

9.3.1 Close the low pressure isolation valve (V-4) at the top of the tank.

9.3.2 Remove the three screws holding the pressure gauge to the gauge panel.

9.3.3 Gently pull the gauge forward.

9.3.4 Remove the phase line retaining nut and remove the phase line.

9.3.5 Remove fittings (PL-3 and PL-4) from the gauge.

To replace the gauge, reverse steps 9.3.1 through 9.3.5.

9.4 HOSE RELIEF VALVE (RV-2)

The hose relief valve protects the delivery hose from overpressurization in the event that the hose isolation valve is closed and the hose is not drained. To remove/replace the hose relief valve, use the following procedure:

9.4.1 Remove the side access panel.

9.4.2 Close the hose isolation valve (V-1).

9.4.3 Open the hose drain valve (V-2) and allow sufficient time for the pressure to bleed-off.

9.4.4 Remove the relief valve (RV-2).

To replace the relief valve (RV-2), reverse steps 9.4.1 through 9.4.3.

9.5 STAINLESS FEEDER HOSE (HR-5)

The stainless feeder hose is used to supply liquid CO₂ from the tank to the hose reel. To remove/replace the feeder hose, use the following procedure:

- 9.5.1 Remove the side access panel.
 - 9.5.2 Close the hose isolation valve (V-1).
 - 9.5.3 Open the hose drain valve (V-2).
 - 9.5.4 Remove the feeder hose (HR-5).
- NOTE: Use back up wrenches whenever possible.

To replace the stainless feeder hose, reverse steps 9.5.1 through 9.5.4.

- NOTE: Use teflon tape on the threads of the flare fittings.

9.6 HOSE REEL SWIVEL (HR-4)

The hose reel swivel allows the hose reel to turn freely. In the event that a leak is detected in the hose reel swivel, the seals in the swivel are the most probable cause. The seals in the swivel can be replaced using the hose reel swivel Rebuild Kit (MVE P/N 37-1149-9) and the following procedure:

- 9.6.1 Remove the side access panel.
- 9.6.2 Close the hose isolation valve (V-1).
- 9.6.3 Open the drain valve (V-2).
- 9.6.4 Remove the snap ring on the end of the swivel.
- 9.6.5 Pull the swivel off of the hose reel axle.
- 9.6.6 Remove the four "O-Rings" from the swivel axle and discard.
- 9.6.7 Use a clean, dry, lint-free cloth to clean the swivel axle and the inside of the swivel.
- 9.6.8 Install the new "O-Rings".
- 9.6.9 Use a light food-grade oil to lubricate the new "O-Rings".
- 9.6.10 Gently push the swivel onto the swivel axle.
- 9.6.11 Replace the snap ring.

9.6A To remove the entire swivel (HR-4) assembly, follow the procedure listed below:

- 9.6A.1 Remove the side access panel.
- 9.6A.2 Close the hose isolation valve (V-2).
- 9.6A.3 Open the hose drain valve (V-2).
- 9.6A.4 Disconnect the stainless feeder hose (HR-5).
- 9.6A.5 Unscrew swivel from hose reel (HR-2).
- 9.6A.6 Unscrew the short nipple from the hose reel (HR-2).

To install the new swivel, reverse steps 9.6A.1 through 9.6A.6.

9.7 QUICK CONNECT (C-1).

The quick connect coupling (C-1) located at the end of the delivery hose is used to connect to the fitting at the store. The quick connect can be replaced using the following procedure:

- 9.7.1 Close hose isolation valve (V-1).
- 9.7.2 Open hose drain valve (V-2).
- 9.7.3 Remove the quick connect fitting (C-1) from the delivery hose (HR-1).

To install a new quick connect, reverse steps 9.7.1 through 9.7.3.

9.8 DELIVERY HOSE (HR-1)

The 35 foot delivery hose (HR-1) is used to transfer CO₂ from the delivery vessel (MCDU) to the restaurant unit. In the event the hose becomes unusable, it can be replaced using the following procedure:

- 9.8.1 Close the hose isolation valve (V-1).
- 9.8.2 Open the hose drain valve (V-2).
- 9.8.3 Fully unwind the delivery hose (HR-1) and lay straight out.
- 9.8.4 Remove the delivery hose from the hose reel (HR-2).

- 9.8.5 Remove the quick connect (C-1) from the delivery hose.

To replace the delivery hose, reverse steps 9.8.1 through 9.8.5.

9.9 HOSE REEL (HR-2)

The hose reel (HR-2) is a retractable ratchet type reel for the storage of the delivery hose. In the event that the hose reel must be removed, follow the procedure below:

- 9.9.1 Close the hose isolation valve (V-1).
- 9.9.2^F Open the hose drain valve (V-2).
- 9.9.3 Disconnect the stainless feeder hose (HR-5).
- 9.9.4 Remove the handwheels from valves V-2 and V-3.
- 9.9.5 Remove the entire hose reel swivel assembly (HR-4).
- 9.9.6 Remove the four bolts from the base plate of the hose reel.
- 9.9.7 Lift the hose reel out of the cabinet.

To replace the hose reel, reverse steps 9.9.1 through 9.9.6.

9.10 HOSE REEL SPRING TENSION ADJUSTMENT

It may become necessary to adjust the spring tension on the hose reel retract mechanism. To do this, perform the following procedure:

- 9.10A **SPRING RELAXED (C-1 NOT ATTACHED).**
- 9.10A.1 Attach the delivery hose (HR-1) to the pipe elbow on the hose reel drum (through rollers).
- 9.10A.2 Lay the hose straight out on a clean floor.
- 9.10A.3 Wind the hose reel backwards by the rim until all of the hose is on the reel.
- 9.10A.4 Grab the end of the hose and pull it out about two or three feet until the reel locks.
- 9.10A.5 Reel the end of the hose behind the hose reel and reach under the reel and grab the hose.

9.10A.6 Repeat steps 9.10A.4 and 9.10A.5 three or four times until all the hose will retract from the fully extended position.

9.10B SPRING UNDER TENSION (C-1 ATTACHED).

9.10B.1 Close the hose isolation valve (V-1).

9.10B.2 Open the hose drain valve (V-2).

9.10B.3 Remove the quick connect (C-1) from the end of the hose.

9.10B.4 Perform steps 9.10A.4 through 9.10A.6.

SECTION 10

REPAIRS EMPTY

10.1 GENERAL

Repairs covered in this section can be performed only after the vessel has been emptied.

WARNING: DO NOT ATTEMPT ANY REPAIRS COVERED IN THIS SECTION UNTIL THE VESSEL HAS BEEN COMPLETELY EMPTIED. FAILURE TO EMPTY THE VESSEL PRIOR TO REPAIR COULD RESULT IN SUBSTANTIAL DAMAGE OR PERSONAL INJURY.

NOTE: While performing all repairs covered in this section, the vent valve (V-3) should be left open.

10.2 EMPTYING THE MCDU

Use the following procedure to empty the MCDU vessel before performing any repairs detailed in this section.

WARNING: CO₂ DISPLACES OXYGEN AND DOES NOT SUPPORT LIFE. FAILURE TO MAINTAIN ADEQUATE VENTILATION DURING THE EMPTYING PROCESS CAN CAUSE RAPID SUFFOCATION.

10.2.1 Close the hose isolation valve (V-1).

10.2.2 Open the hose drain valve (V-2).

10.2.3 Screw a 3/4" male quick connect (spare C-3) into the hose end quick connect (C-1).

10.2.4 Aim the hose outside and secure the fitting (C-1 and C-3) to a rigidly immovable object such as a concrete pillar.

CAUTION: BE SURE TO AIM THE HOSE AWAY FROM PERSONNEL OR HIGHLY TRAVELED AREAS.

CAUTION: DURING PERIODS OF HIGH HUMIDITY, THE CO₂ EXPELLED FROM THE MCDU VESSEL WILL FORM A DENSE CLOUD. DO NOT WALK INTO THE CLOUD.

10.2.5 Close the hose drain valve (V-2).

10.2.6 Open the hose isolation valve (V-1) and allow sufficient time for the contents to be completely emptied.

10.3 MALE QUICK CONNECTS (C-2 and C-3)

Both fill fittings (C-2 and C-3) can be removed/replaces using the same process.

10.3.1 Empty MCDU (See 10.2).

10.3.2 Be sure the pressure gauge indicates zero pressure.

10.3.3 Remove the six (6) retaining screws.

NOTE: The nuts for the retaining ring screws are spot welded to the back of the instrument panel.

10.3.4 Remove the retaining ring.

10.3.5 Remove the quick connect fitting.

To replace the quick connects, reverse steps 10.3.1 through 10.3.5.

10.4 RELIEF VALVE (RV-1)

The relief valve (RV-1) is set to bleed-off excess pressure at 325 psi. It is a weep type relief. This device is the primary relief mechanism to prevent vessel overpressurization. The relief valve (RV-1) is a reclosing type relief and will automatically close when the inner tank pressure drops below 325 psi. To remove/replace the relief valve, use the following procedure:

10.4.1 Empty MCDU (See 10.2).

10.4.2 Be sure the pressure gauge indicates zero pressure.

10.4.3 Remove the relief valve.

NOTE: Be sure to use a back up wrench. It may be necessary to lightly heat the threads to remove the relief valve.

The relief valve can be replaced by reversing steps 10.4.1 through 10.4.3.

10.5 BURST DISC (RV-3)

The burst disc is the secondary relief mechanism. The burst disc will rupture in the event that the primary relief device (RV-1) becomes defective and fails to open. The burst disc is a non-reclosing type and must be replaced if the disc ruptures. Use the following procedure:

- 10.5.1 Empty the MCDU (See 10.2).
 - 10.5.2 Be sure the pressure gauge indicates zero pressure.
 - 10.5.3 Remove the rupture disc.
- NOTE: Be sure to use a back up wrench. It may be necessary to lightly heat the threads to remove the burst disc.

10.6 VALVE REBUILDING (V-2 and V-3)

The vent valve and hose drain valve are globe valves and can be rebuilt using the rebuild kit (MVE P/N 97-1575-9). Use the following procedure to rebuild the globe valves (See figure 10.1).

- 10.6.1 Empty the MCDU (See 10.2).
- 10.6.2 Be sure the pressure gauge indicates zero pressure.
- 10.6.3 Remove the handwheel assembly from the valve.
- 10.6.4 Discard the handwheel assembly.
- 10.6.5 Remove the valve bonnet and discard.
- 10.6.6 Remove the gasket, stem, seat assembly, and bushing, and discard.
- 10.6.7 Reverse steps 10.6.1 through 10.6.6 to build valve.

NOTE: When tightening the bonnet nut, make sure the stem and seat assembly are aligned and turned in all the way.

10.7 VALVE REBUILDING (V-1)

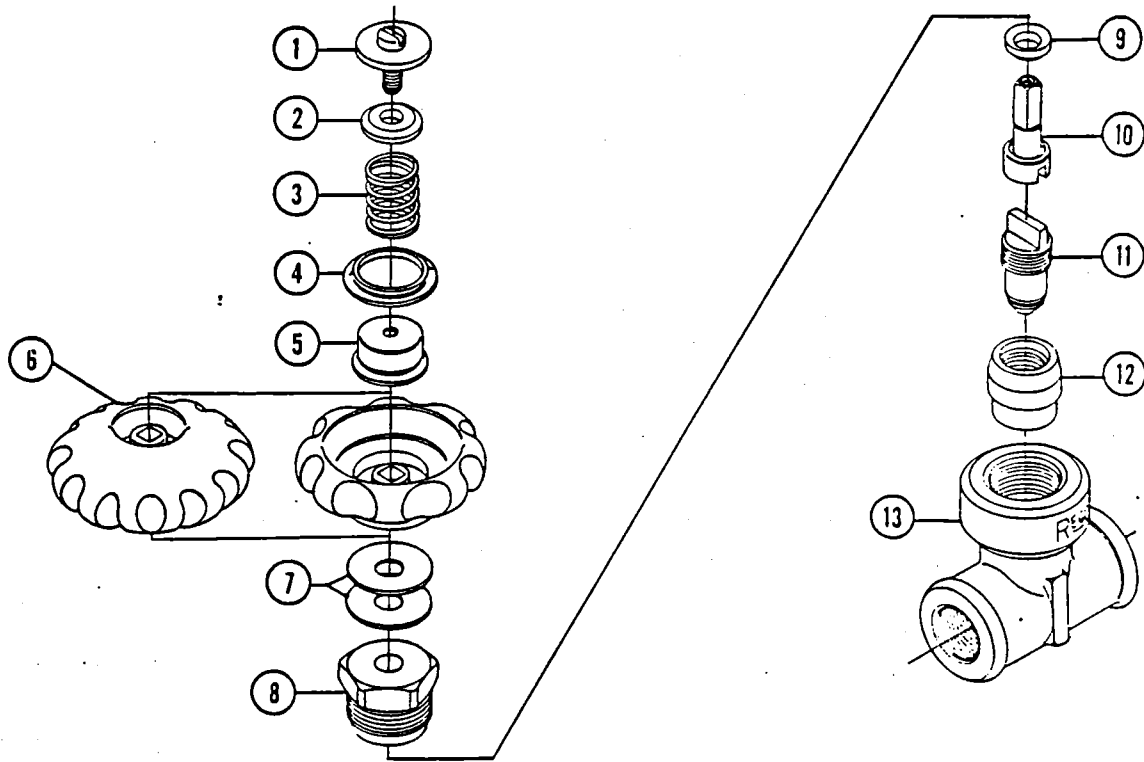
The hose isolation valve (V-1) is a flange type cryogenic ball valve. If this valve leaks, the hose reel and liquid assembly cannot be isolated from the vessel. If the packing nut leaks, the leak can be checked by tightening the packing nut 1/4 turn. To rebuild the hose isolation valve, use the rebuild kit (MVE P/N 17-1530-9) and the following procedure (See figure 10.2).

- 10.7.1 Empty the MCDU (See 10.2).
- 10.7.2 Be sure the pressure gauge indicates zero pressure.

- 10.7.3 Align the stem flats with the valve body.
- 10.7.4 Remove the body bolts.
- 10.7.5 Remove the center section.
- 10.7.6 Remove body seals from the end plates.
- 10.7.7 Rotate the stem flats perpendicular to the valve body and remove the seats and ball.
- 10.7.8 If it is necessary to replace the stem seal, remove the handle nut, lockwasher handle, packing nut, stop and follower in that order. Lower the stem into the body cavity and remove the stem seal assembly.

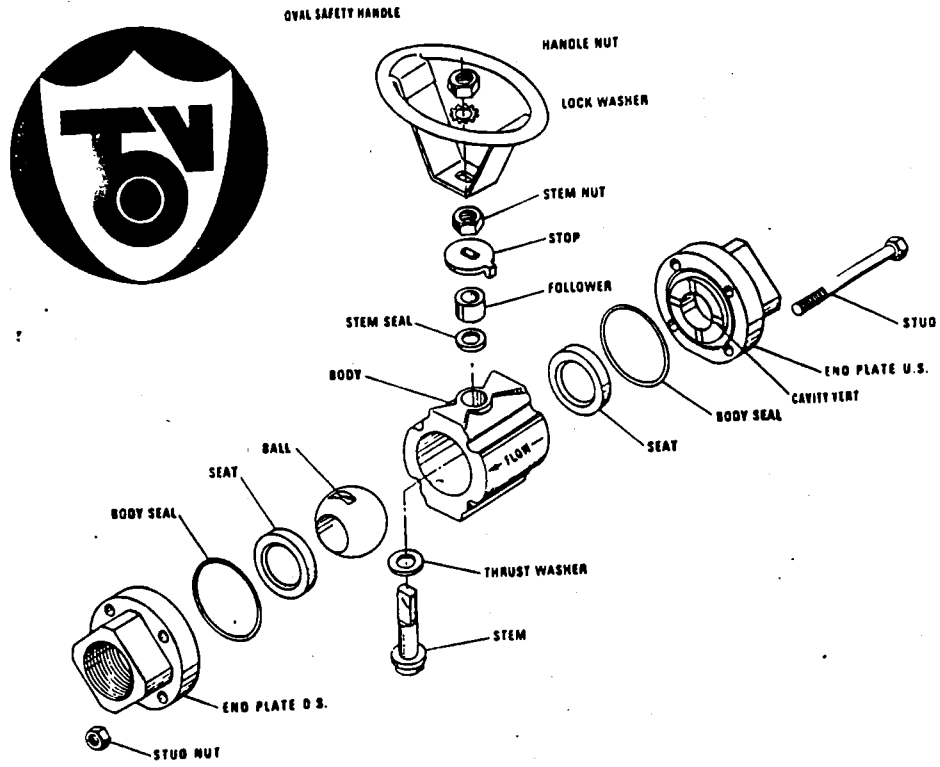
To rebuild and replace the hose isolation valve, use the repair kit (MVE P/N 17-1530-9) and reverse steps 10.7.1 through 10.7.8.

Figure 10.1 Globe Valve Exploded View

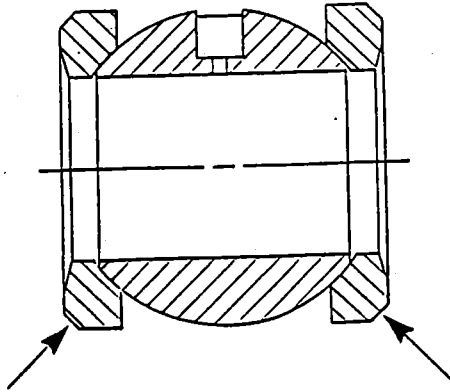


Key No.	Description
1	Screw & Washer
2	Washer
3	Spring
4	Washer
5	Seal
6	Handwheel
7	Washer
8	Bonnet
9	Gasket
10	Stem
11	Seat Assembly
12	Bushing
13	Body

Figure 10.2 Ball Valve Exploded View



Detail of Ball and Seats



Install Seats with these chamfers towards end plates

RELIQUIFYING SOLID CO₂

A-1 GENERAL

CO₂ liquid must be under its own vapor pressure of at least 60.4 psi to exist in the liquid state. It cannot exist as liquid in open air. At lower pressures, it flashes to gas and solid.

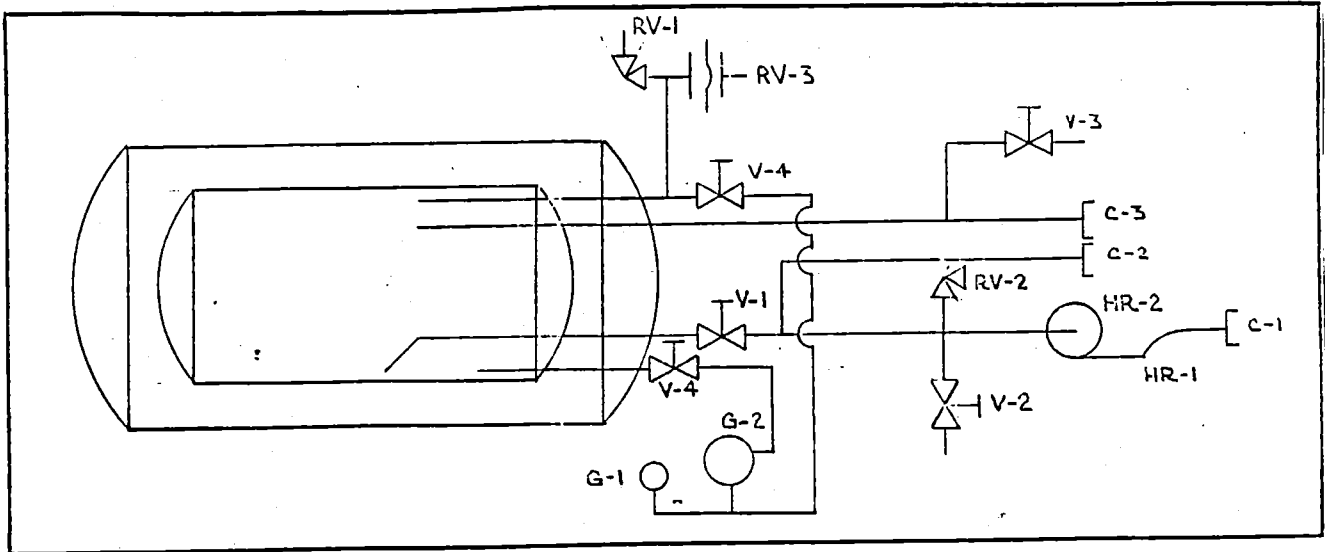
When the pressure is at 60.4 psi, and the temperature is -69.9°F, the liquid has turned to a solid and is said to be at its triplepoint. At the triplepoint, CO₂ can exist as a liquid, gas, or solid. If the pressure is reduced from the triplepoint, the liquid flashes to gas and snow. If the temperature is reduced, the liquid freezes.

A-2 RELIQUIFYING SOLID CO₂

There may be an occasion when the liquid CO₂ in the MCDU could freeze (i.e. blow rupture disc). If you suspect a vessel has frozen CO₂, it can be reliquified using the following procedure:

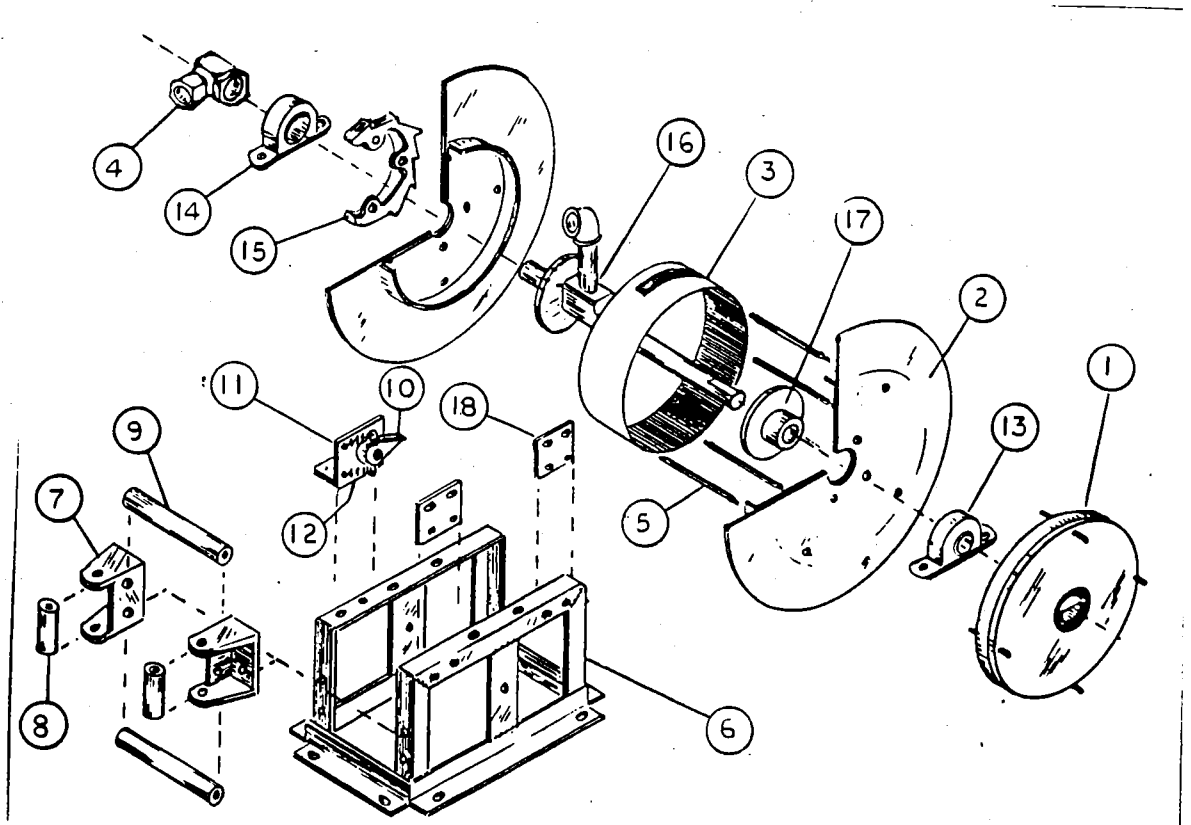
- A.2.1 Locate and repair the source of the pressure loss.
- A.2.2 The key to reliquifying solid CO₂ is to get pressure and liquid into the vessel as soon as possible. If the liquid line is blocked, introduce liquid through the vent connections.
- A.2.3 The unit can be returned to service after having been repressurized a couple of times.

MCDU VESSEL SCHEMATIC



- C-1 Quick Coupling 3/4" Female
- C-2 Quick Coupling 1" Male
- C-3 Quick Coupling 3/4" Male
- V-1 Hose Isolation Valve
- V-2 Hose Drain Valve
- V-3 Vent Valve
- V-4 Gauge Calibration Valve
- HR-1 Delivery Hose
- HR-2 Hose Reel
- G-1 Pressure Gauge
- G-2 Contents Gauge
- RV-1 Tank Relief Valve - 325 PSIG
- RV-2 Hose Relief Valve - 375 PSIG
- RV-3 Burst Disc - 525 PSIG

DURO HOSE REEL REPAIR PARTS



ITEM NO	MVE P.N.	DESCRIPTION
1	37-1147-9	Motor Spring Assy.
2	-	Reel Disc with Support
3	-	Reel Drum
4	37-1146-9	Swivel Joint 1/4" x 3/8"
5	-	Reel Drum Tie Rods (set)
6		Mounting Base
7*		Roller Castings each
8*		Short Side Roller each
9*		Long Roller each
10	37-1158-9	Locking Cam
11	37-1159-9	Locking Cam Assembly
12	37-1148-9	Locking Cam Springs each
13		Bearing Pillow Block 1 1/4"
14		Bearing Pillow Block 1 1/2"
15		Locking Ring
16		Main Axle
17		Axle Flange
18		Spring Gusset each

*Included in P.N. 37-1162-9

CATALOG NUMBER NOMENCLATURE

XXXX XX BASIC CAT. NO.	- X PORTING STYLE	X WETTED PARTS	- X.X GAUGE DIA.	- X GAUGE STYLE	- X SWITCH
1516DG	-1 (In-Line)	-A (Alum.)	-2.0 (2")	L (Bezel Case)	-13 (1 amp/50 watt-SPST)
1516DS	-4 (Back)	-B (303 Stain.)	-2.5 (2½")	B (Machined Case)	-13-13 (two -13 switches)
1516DGS	-5 (Bottom)	-C (316 Stain.)	-3.5 (3½")	F (Drilled Flange)	-14 (3 watt-SPDT)
		-D (PVC)	-4.5 (4½")	C (C-Clamp)	-14-14 (two -14 switches)
		-E (Nav. Br.)	-6.0 (6")		-10 (10A/115V/60HZ-DPDT relay)

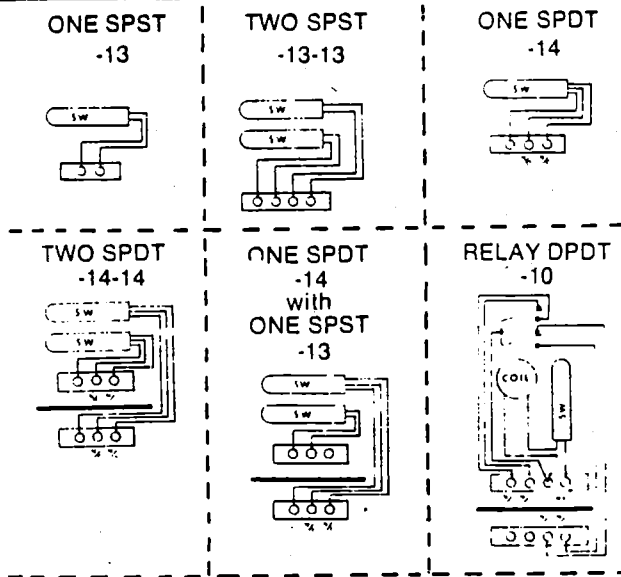
SWITCH ADJUSTMENT

SWITCH UNITS. On Switch and Indicating Switch models, reed switches are located adjacent to the pressure chamber and are actuated when the piston magnet field interacts at a preset point with the reed switch armature. Reed switch set points are adjustable.

NOTE: This instrument will provide $\pm 2\%$ accuracy full scale.

The reed switch set points are field adjustable points. On Indicating Switches, the reed switches can be adjusted over the top 80% of the gauge range. On Switch models the reed switches can be adjusted over the range shown on the nameplate.

To change the reed switch setting, remove the switch enclosure from the top of the instrument. This will expose the switch adjusting screw or screws. Each reed switch has its own adjusting screw for independent adjustment. Turn screw clockwise to increase set point or turn counterclockwise to reduce set point. Turn until new actuation point is reached. Replace electrical cover. Relays will always have one adjustable reed switch which triggers the relay.



SWITCH WIRE COLOR CODE

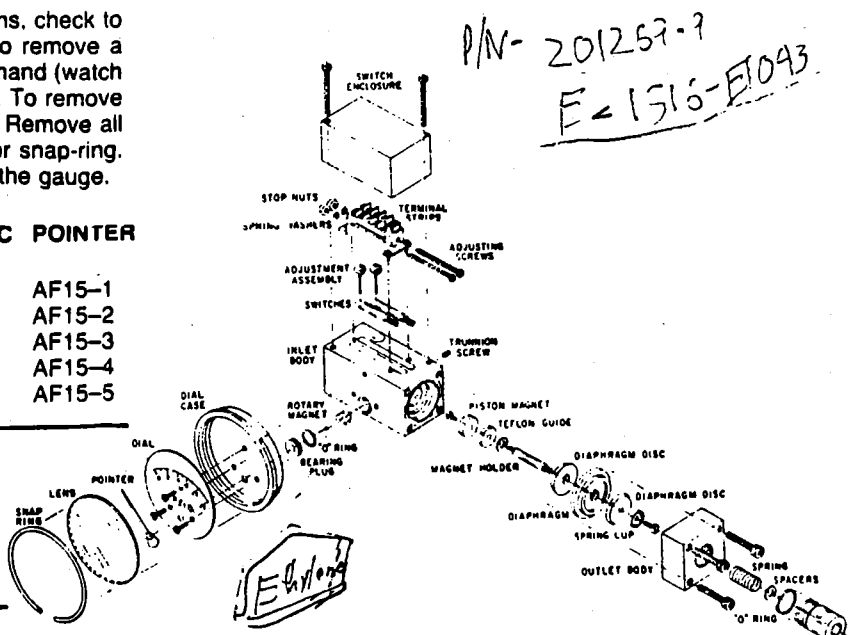
- 3 SPST white and white
- .4 SPDT green (N/C); red (N/O); blue (common)

REPLACEMENT PARTS

LENS REPLACEMENT. To replace a broken glass lens, check to see if the lens is held on by a bezel or snap-ring. To remove a bezel, which is a pressed on cover, either twist off by hand (watch out for the broken glass) or pry off with a screwdriver. To remove a snap-ring, pry out the ring with a small screwdriver. Remove all glass chips, insert new lens and re-install the bezel or snap-ring. With snap-rings, locate the ring joint at the bottom of the gauge.

GAUGE DIA.	CHROME BEZEL	BLACK BEZEL	GLASS LENS	PLASTIC LENS	POINTER
2"	M1-2	M1-1	GG1-1	GG2-1	AF15-1
2½"	M2-2	M2-1	GG1-2	GG2-2	AF15-2
3½"	M4-2	M4-1	GG1-3	GG2-3	AF15-3
4½"	M5-2	M5-1	GG1-4	GG2-4	AF15-4
6"	—	—	GG1-5	GG2-5	AF15-5

	END CAP O-RING(S)	DIAPHRAGM
Buna N	BB1-1A	AE11-A
Viton	BB1-1B	AE11-B
Teflon	BB1-1F	



EDDM

POINTER REPLACEMENT. Remove bezel or snap ring (see LENS REPLACEMENT) and clean out glass chips. Remove old pointer with pointer puller or two small screwdrivers opposite each other under pointer hub. Pry off evenly being careful not to

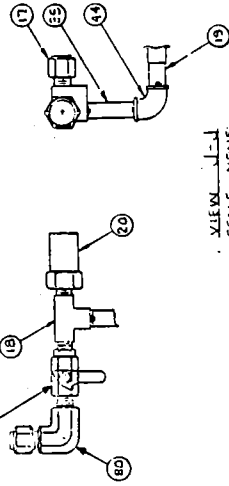
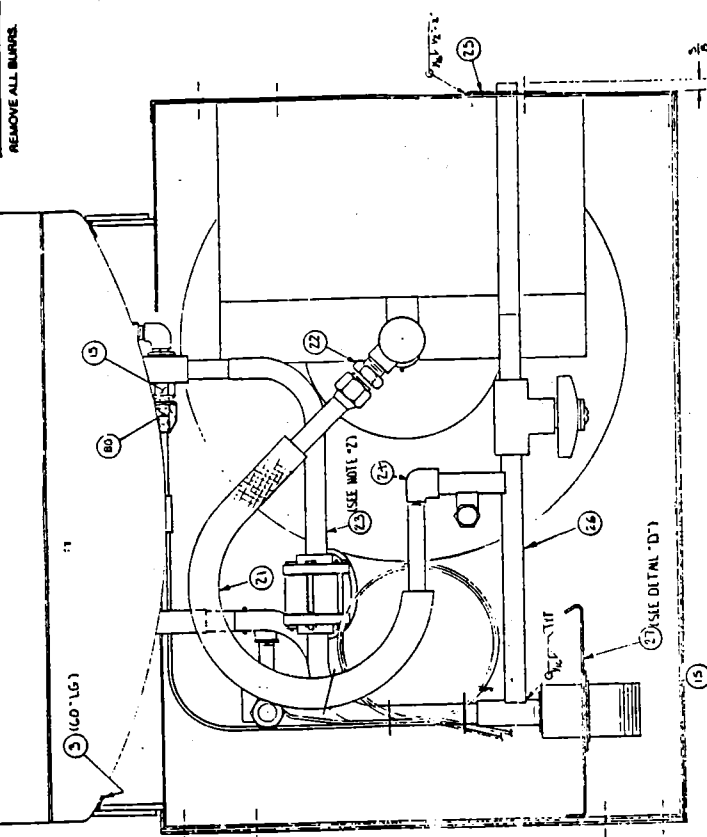
bend the pointer shaft. Install new pointer dead on zero. **NOTE:** Gauges with a zero peg must have the pointer set at a reference pressure (preferable midscale) to offset the preload against the zero peg. Re-install lens.

NOTE: When ordering replacement parts, identify instrument catalog number from the nameplate. Identify parts required and quantity.

PARTS LIST

To use the attached information, use drawing D-25801 while looking at the actual tank to determine the part in question. The number in the circle corresponds to the "SEQ NO." on the "Indented Bill." The MVE part number is listed under the "Component Item No." The Description details what the part is.

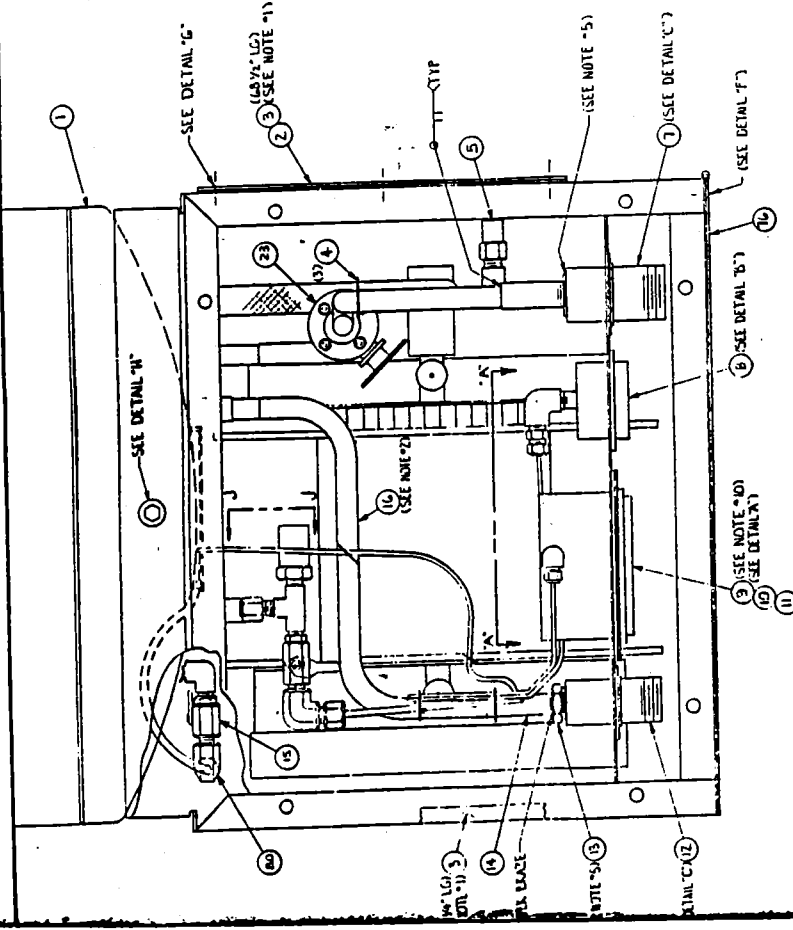
REMOVE ALL BARRS.



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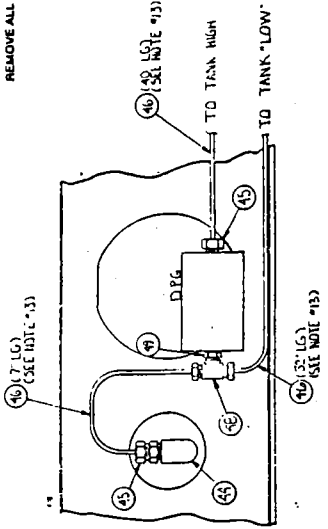
NO.	DESCRIPTION	DATE	BY
1	ISSUED FOR ASSEMBLY	8/1/63	...
2
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TANK	FINAL P.N.	REV.
MCDU-660A	5/17/75	H
MCCU-550	5/11/75	H

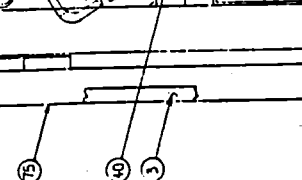
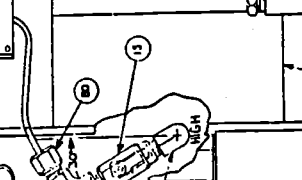
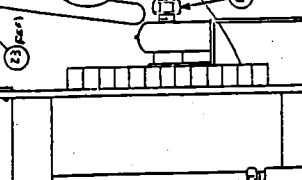
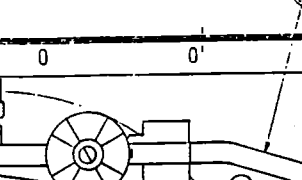
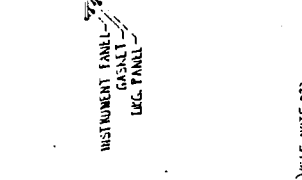
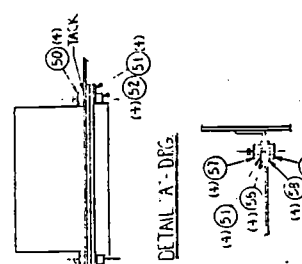
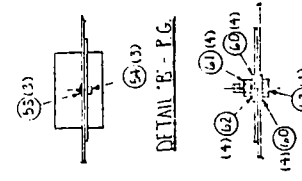
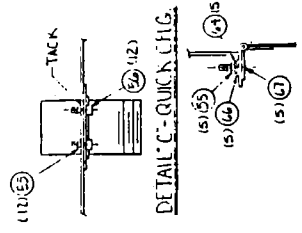


NOTE:
 1. WRENCH STRIP ALONG ALL EDGES OF THE TOP PANEL & ACCESS PANEL.
 2. ALSO ALONG THE INSIDE EDGES TO BE INSTALLED AT ASSY.
 3. LENGTH OF BENT TUBES SHALL BE AS SHOWN IN DETAIL 'C'.
 4. PLACE TUBES IN POSITION WITH ITEM #11 ON INSIDE OF DOOR.
 5. PLACE TUBES IN POSITION WITH ITEM #12 TO BACK HEAD & ONE TO FRONT OF DOOR.
 6. SEAL WITH A TUBING SEALANT OF LOG # 100 & TWO JOINTS OF TEFLOON TAPE.
 7. CHECK FOR LEAKS WITH LEAK DETECTOR OR BUBBLE LEAKING CHECK WAFER #409.
 8. TUBING TO BE LEAK TESTED AT 200 PSI.
 9. ITEM #13 - CHECK CONTACT WAFER TO BE INSTALLED BEFORE ITEM #37. QUICK COUPLER.
 10. ITEM #14 - PRESS GAUGE PER SPI #118.
 11. ITEM #15 - PRESS GAUGE PER SPI #261.
 12. ITEM #16 - PRESS GAUGE PER SPI #262.
 13. ITEM #17 - PRESS GAUGE PER SPI #263.
 14. ITEM #18 - PRESS GAUGE PER SPI #264.
 15. ITEM #19 - PRESS GAUGE PER SPI #265.
 16. ITEM #20 - PRESS GAUGE PER SPI #266.
 17. ITEM #21 - PRESS GAUGE PER SPI #267.
 18. ITEM #22 - PRESS GAUGE PER SPI #268.
 19. ITEM #23 - PRESS GAUGE PER SPI #269.
 20. ITEM #24 - PRESS GAUGE PER SPI #270.
 21. ITEM #25 - PRESS GAUGE PER SPI #271.
 22. ITEM #26 - PRESS GAUGE PER SPI #272.
 23. ITEM #27 - PRESS GAUGE PER SPI #273.
 24. ITEM #28 - PRESS GAUGE PER SPI #274.
 25. ITEM #29 - PRESS GAUGE PER SPI #275.
 26. ITEM #30 - PRESS GAUGE PER SPI #276.
 27. ITEM #31 - PRESS GAUGE PER SPI #277.
 28. ITEM #32 - PRESS GAUGE PER SPI #278.
 29. ITEM #33 - PRESS GAUGE PER SPI #279.
 30. ITEM #34 - PRESS GAUGE PER SPI #280.
 31. ITEM #35 - PRESS GAUGE PER SPI #281.
 32. ITEM #36 - PRESS GAUGE PER SPI #282.
 33. ITEM #37 - PRESS GAUGE PER SPI #283.
 34. ITEM #38 - PRESS GAUGE PER SPI #284.
 35. ITEM #39 - PRESS GAUGE PER SPI #285.
 36. ITEM #40 - PRESS GAUGE PER SPI #286.
 37. ITEM #41 - PRESS GAUGE PER SPI #287.
 38. ITEM #42 - PRESS GAUGE PER SPI #288.
 39. ITEM #43 - PRESS GAUGE PER SPI #289.
 40. ITEM #44 - PRESS GAUGE PER SPI #290.
 41. ITEM #45 - PRESS GAUGE PER SPI #291.
 42. ITEM #46 - PRESS GAUGE PER SPI #292.
 43. ITEM #47 - PRESS GAUGE PER SPI #293.
 44. ITEM #48 - PRESS GAUGE PER SPI #294.
 45. ITEM #49 - PRESS GAUGE PER SPI #295.
 46. ITEM #50 - PRESS GAUGE PER SPI #296.
 47. ITEM #51 - PRESS GAUGE PER SPI #297.
 48. ITEM #52 - PRESS GAUGE PER SPI #298.
 49. ITEM #53 - PRESS GAUGE PER SPI #299.
 50. ITEM #54 - PRESS GAUGE PER SPI #300.

TANK	FINAL P.N.	REV.
MCDU-660A	5/17/75	H
MCCU-550	5/11/75	H



VIEW "A-A"



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DETAIL "A" - D.F.G.
INSTRUMENT PANEL TO CABINET

DETAIL "B" - P.G.
INSTRUMENT PANEL TO CABINET

DETAIL "C" - QUICK L.I.G.
INSTRUMENT PANEL TO CABINET

DETAIL "D" - PANEL TO CABINET
INSTRUMENT PANEL TO CABINET

DETAIL "E" - INSTRUMENT PANEL TO CABINET
INSTRUMENT PANEL TO CABINET

DETAIL "F" - INSTRUMENT PANEL TO CABINET
INSTRUMENT PANEL TO CABINET

DETAIL "G" - INSTRUMENT PANEL TO CABINET
INSTRUMENT PANEL TO CABINET

DETAIL "H" - CABINET SPA TO TANKS
INSTRUMENT PANEL TO CABINET

DATE	BY	AS NOTED

NO.	REV.	DATE	BY	REASON FOR CHANGE

DATE	BY	AS NOTED

DATE	BY	AS NOTED

DATE	BY	AS NOTED

DATE	BY	AS NOTED

ITEM TYPE 1 LOW LEVEL 01
 UNIT MEAS EA PLANNER 360

QTY 1.000

DESCRIPTION FNL, MCDU-500
 CHGR DRAW D-25801-H
 STANDARD BATCH QUANTITY

PARENT ITEM NO.
 9917299

RELATIVE LEVEL	SEQ NO.	COMPONENT ITEM NO.	DESCRIPTION	DRAWING NUMBER	QUANTITY PER	ITEM UM	OPT NO.	FIRST LT	EFFECTIVE DATES
									FROM TO
..1	0027	5567901	INSTRUMENT PANEL	B-25799-C	1.000	EA	2		
..2	6110301		SHEET, .075x48x120 SS		.028	EA	4		
..1	0026	5567719	PLUMBING S/A, LIQUID	B-25798-C	1.000	EA	2		
..2	0003	1210792	WASH FLUSH 1.000IPT± .50RPT	B-23504-A	1.000	EA	4		
..2	0004	1211451	ELROW 90D .250IPT 150% SS		1.000	EA	4		
..2	0007	1310931	HALF NIPPLE 3/8"MPI±1/2"LG		1.000	EA	4		
..2	0002	3310031	PIPE, 3/8"MN SCH 10 SS WLD		.599	FT	4		
..2	0001	5567811	H NIP, 1/2"MPI±2-1/2"LS MOD	A-25797-A	1.000	EA	2		
..2	1310771		HALF NIPPLE .500MPI±2.500"LG		1.000	EA	4		
..2	0006	5567329	VALVE, 3/8"RPT±3/8"PS "00	A-25798-B	1.000	EA	2		
..3	1710012		VALVE 3/8"RPT±3/8" SCH10±2-1/8	B-14226	1.000	EA	4		
..2	0005	5567861	H NIP, 3/8"MPI±2-1/2"LS MOD	A-25793-A	1.000	EA	2		
..3	1311411		HALF NIPPLE .375"MPI±2.500"LG		1.000	EA	4		
..1	0011	5576661	PANEL, DIFF OF ORANGE RESEARCH	A-27411-B	1.000	EA	2		
..2	6110411		SHEET, .105x42x120 SS		.009	EA	4		
..1	0023	5597179	LIQUID FILL 5/A	A-32445-A	1.000	EA	2		
..2	0001	1715282	GALL VALVE, 3/8"PS SOCKET WELD		1.000	EA	4		
..2	0003	5597181	TUBE, 3/8"PS	A-32446-A	1.000	EA	2		
..3	3310031		PIPE, 3/8"MN SCH 10 SS WLD		.724	FT	4		
..2	0002	5597191	TUBE, 3/8"PS	A-32447-A	1.000	EA	2		
..3	3310031		PIPE, 3/8"MN SCH 10 SS WLD		.838	FT	4		
..1	0012	6511432	QUICK COUPLING .750" MALE		1.000	EA	4		
..1	0007	6511452	QUICK COUPLING 1.000" MALE		1.000	EA	4		
..1	0037	6511462	QUICK COUPLING 3/4" FEMALE		1.000	EA	4		
..1	0001	9612729	I/O, MCDU-500	D-22602-E	1.000	EA	1		
..2	0001	1210311	CPLG REDUCER .250MPI± .125MPI		1.000	EA	4		
..2	0002	1910631	RPD ASSY 1.500 25PSI SS	B-13847-C	1.000	EA	4		
..2	0004	2411281	HEAD, 20"OD 12GA MIN STD FED	D-20615-D	1.000	EA	2		
..3	2411281L		HEAD, 20"OD 12GA MIN STD FED	VEID SVCE	1.000	EA	3		
..3	6111481		SHEET, .105x24.000xCOIL SS		17.539	L8	4		5 25-8/01/85
..2	0003	2412941	HEAD, 18"OD .122 MIN ASME 2:1	B-23032-B	1.000	EA	2		
..3	2412041L		HEAD, 18"OD .122 MIN ASME 2:1	VEND SVCE	1.000	EA	3		5
..3	6111931		STRIP, .135MIN±23.50±23.50 SS	ECO ±.3932	1.000	EA	4		10
..2	0020	3014945	WARRANTY SEAL, 1"RPD ASSY	A-20799-B	1.000	EA	4		
..2	0007	3910666	CAP, VINYL PLASTIC PLUG	B-10299-A	1.000	EA	4		
..2	0002	3910696	PUMP OUT CAP	A-17618	1.000	EA	4		
..2	0010	5510421	NOZZLE, 5/16"ODT 2-5/8"LG	A-9649-2-B	1.000	EA	2		
..3	2711371		TUBE, .500"OD .081W SS WLD		.224	FT	4		35
..2	0014	5513771	STAP-HOLD DOWN, TUBE	A-16840-35	2.000	EA	2		
..3	6110241		SHEET, .059x42x120 SS		.002	EA	4		
..2	0016	5517331	STUD, 1"OD SUPPORT	A-12829	2.000	EA	2		
..3	2710591		TUBE, 1.000"OD .083W SS WLD		.416	FT	4		
..2	0017	5517341	PAD, SUPPORT	A-12830-A	2.000	EA	2		
..3	6010031		PLATE, .250±.48.000±.95.000 SS		.012	EA	4		
..2	0018	5529194	GUSSET, SUPPORT	A-13540-A	6.000	EA	2		
..3	6710394		PLATE, .250±.48.000±120.000 CS		.012	EA	4		
..2	0019	5542553	TUBE, .750"OD 5.500"LG		1.000	EA	2		
..3	6910323		TUBE, .750"OD .065 SDR	A-22259-A	.450	FT	4		

PARENT ITEM NO. 9917299 DESCRIPTION: ENL. MCOU=500 ENGR DRAM D-25801-H STANDARD BATCH QUANTITY 1.000
 QTY 1 ITEM TYPE 1 LOW LEVEL 01 UNIT MEAS EA PLANNER 360

RELATIVE LEVEL	SEQ NO.	COMPONENT ITEM NO.	DESCRIPTION	ENGINEERING DRAWING NUMBER	QUANTITY PER	ITEM UM	TYP NO.	OPT	FIRST LT	EFFECTIVE DATES
									OP SEQ ADJ	FROM TO
.1	0080	1012072	M ELBOW 90D .12500T* .250NPT	B-18409	2.000	EA	4			
.1	0048	1012082	TEE .12500T* .12500T* .125NPT	B-18404	1.000	EA	4			
.1	0045	1012092	M CONNECTOR .12500T* .250NPT	B-18395	2.000	EA	4			10/01/89
.1	0045	1012822	M CONNECTOR .12500T* .250NPT		2.000	EA	4			
.1	0022	1110122	M CONNECTOR .50000T* .500NPT	B-18400	1.000	EA	4			10/01/89
.1	0049	1210012	BUSHING HEX .125SERI* .250NPT		1.000	EA	4			
.1	0044	1210402	ELBOW 90D .250FPT BRASS		2.000	EA	4			
.1	0024	1210412	F PIPE ELBOW 90D .375FPT		1.000	EA	4			
.1	0042	1210462	STREET ELBOW 90D .250NPT		1.000	EA	4			
.1	0041	1211722	STREET ELBOW 45D .375NPT		1.000	EA	4			
.1	0018	1211902	CROSS .250FPT MODIFIED	A-21424	1.000	EA	4			
.1	0013	1212062	BUSHING HEX .375SERI* .750NPT		1.000	EA	4			
.1	0081	1310102	HEX NIPPLE .500NPT*1.875*LG		1.000	EA	4			
.1	0035	1310131	NIPPLE .250NPT*2.000*LG		1.000	EA	4			
.1	0019	1310951	HALF NIPPLE .250NPT*1.000*LG		1.000	EA	4			
.1	0042	1710022	VALVE 3/8" FPT*3/8" SCHL0*3-3/8	B-19226-B	1.000	EA	4			
.1	0015	1716162	VALVE ISOLATION 1/4"NPT*1/4FPT		2.000	EA	4			
.1	0005	1811392	PV .375PSI 1/4"NPT	D-17531	1.000	EA	4			
.1	0020	1811402	RV 325PSI 1/4"NPT		1.000	EA	4			2/01/88
.1	0017	1910562	RPD ASSY .250NPT 550PSI BRASS	B-17551	1.000	EA	4			
.1	0008	2012622	PG-2-1/2" DIAL 0-400PSI #63MM		1.000	EA	4			
.1	0009	2012599	DIFF PG 3-1/2" DIAL 0-500 CO2	B-27413-A	1.000	EA	4			
.1	0046	2911346	TUBE .125"OD .031W NYLON		6.583	FT	4			
.1	0054	2910391	SHCS 6-32*1/2"LG 18-8 SS		3.000	EA	4			
.1	0077	2910131	SHCS 8-32*5/8"LG 18-8 SS		3.000	EA	4			
.1	0056	2910211	SHCS 10-24*1/2"LG 18-8 SS		12.000	EA	4			
.1	0052	2910231	SHCS 1/4-20*3/4"LG 18-8 SS		4.000	EA	4			
.1	0059	2910491	HHMS 1/4-20*3/4"LG 19-3 SS		4.000	EA	4			
.1	0051	2910601	SPLIT LOCKWASHER 1/4 1P-9 SS		8.000	EA	4			
.1	0062	2910811	SPLIT LOCKWASHER 5/16 18-3 SS		10.000	EA	4			
.1	0050	2910851	FLEXLOC NUT THIN 1/4-20 19-8SS		4.000	EA	4			
.1	0055	2910861	FLEXLOC NUT THIN 10-24 18-3 SS		17.000	EA	4			
.1	0063	2910751	HHCS 5/16-18*1"LG 18-8 SS		4.000	EA	4			
.1	0070	2910761	HHCS 5/16-18*1-1/4"LG 18-8 SS		6.000	EA	4			
.1	0066	2910991	FLAT WASHER #10 18-8 SS		5.000	EA	4			
.1	0064	2911371	SPLIT LOCKWASHER #10 18-3 SS		5.000	EA	4			
.1	0067	2911101	FHM5 10-24*7/8"LG 18-8 SS		5.000	EA	4			
.1	0031	2912025	POP PIVET 1/8*1/4"LG ALUM		4.000	EA	4			
.1	0058	2950984	FLAT WASHER 1/4 CS		8.000	EA	4			
.1	0060	2950974	FLAT WASHER 5/16 CS		20.000	EA	4			
.1	0057	2951104	LOCK NUT 2-WAY 1/4-20 CS		4.000	EA	4			
.1	0061	2952071	LOCK NUT 5/16-18 18-3 SS		10.000	EA	4			
.1	0079	2952081	LOCK NUT 8-32 18-8 SS		3.000	EA	4			
.1	0069	2952164	RCPT, CAP FASTNER #12 SOUTHCO		18.000	EA	4			
.1	0068	2952174	SCREW-CAP-FASTNER #12 SOUTHCO		18.000	EA	4			
.1	0078	2952331	FLAT WASHER #8 18-8SS		3.000	EA	4			
.1	0053	2952411	LOCK NUT #6-32 18-8SS		3.000	EA	4			
.1	0033	3711287	FLEX HOSE .500NPT* .750NPT*35EI	A-21703-B	1.000	EA	4			

INDENTED BILL

MINI V Y ENG

PARENT ITEM NO.
9917299

DESCRIPTION FWL, MCDU-500
ENGR OPAM 0-25801-H
STANDARD BATCH QUANTITY

QTY 1 ITEM TYPE 1 LOW LEVEL 01
UNIT MEAS EA PLANNER 360

1.000

RELATIVE LEVEL	SEQ NO.	COMPONENT ITC# NO.	DESCRIPTION	ENGINEERING DRAWING NUMBER	QUANTITY PER	ITEM UM	TYP NO.	OPT NO.	FIRST LT ADJ	EFFECTIVE DATES FROM
.01	0039	3711219	HOSE REEL, MCDU-600/500	ECD # 2853	1.000	EA	4			
.01	0021	3711459	FLEX HOSE ASSY, 3/8"ID	A-25795-A	1.000	EA	4			
.01	0032	3811191	PLATE, DNT-4L	A-9891-E	1.000	EA	4			
.01	0034	3814336	LABEL, LIQUID 2#5/8	A-19746	1.000	EA	4			
.01	0043	3814346	LABEL, VENT 2#5/8	A-19947	1.000	EA	4			
.01	0033	3814356	LABEL, PRESSURE 3#5/8	A-19948	1.000	EA	4			
.01	0030	3815229	LABEL, LIQUID LEVEL 3-3/4#5/8	A-22193	1.000	EA	4			
.01	0029	3815936	LABEL, SAFETY HOOK	A-24091-A	2.000	EA	4			
.01	0072	3816809	LABEL, CO2 DDI-E-9L76	C-25750-A	2.000	EA	4			
.01	0071	3816826	LABEL, FILL INSTRUCTIONS	C-25802-A	1.000	EA	4			
.01	0077	3816966	LABEL, OPEN VALVE	A-25808-A	1.000	EA	4			
.01	0004	4610379	CABLE IIE		3.000	EA	4			
.01	0003	4710089	WEATHER STRIP .125"THK*.500"WH		24.042	FT	4			
.01	0010	4710637	GASKET, DIFF PG	A-25791-A	1.000	EA	4			
.01	0075	5553051	CABINET S/A, MCDU	C-22911-B	1.000	EA	2			
.002	0004	5553041	ANGLE, CABINET FRAME	B-22933-C	1.000	EA	2			
.003		6110411	SHEET, .105#42#120 SS		.008	EA	4			
.002	0002	5553071	CABINET, BACK	C-22912-A	1.000	EA	2			
.003		6110511	SHEET, .135#30#120 SS	ECR #002767	.200	EA	4			
.002	0003	5553081	RING-ROLLED, 19-1/8"OD	B-22913	1.000	EA	2			
.003		6210371	FLAT, .187#2.000#SS ANNEALED		4.958	FT	4			
.002	0006	5553101	STRIKE PLATE	A-23079-A	1.000	EA	2			
.003		6110411	SHEET, .105#42#120 SS		.001	EA	4			
.002	0005	5567931	BRACKET, PANEL	A-25789-A	2.000	EA	2			
.003		6110411	SHEET, .105#42#120 SS		.004	EA	4			
.002	0001	5567921	CABINET, FRAME	C-25800-R	1.000	EA	2			
.003		6110381	SHEET, .105#49#146 SS		.250	EA	4			
.01	0076	5553111	DOOR S/A, CABINET	C-23109-D	1.000	EA	2			
.002	0004	2910371	RH'S 8-32#1/2"LG 1#-8 SS		4.000	EA	4			
.002	0005	2911091	SPLIT LOCKWASHER #8 1#-8 SS		4.000	EA	4			
.002	0006	2952981	LOCK NUT 8-32 1#-8 SS		4.000	EA	4			
.002	0007	2952331	FLAT WASHER #8 1#-8 SS		4.000	EA	4			
.002	0003	4310751	HANDLE DOOR LOCK		1.000	EA	4			
.002	0002	4510331	HINGE, DOOR MCDU		1.000	EA	4			
.002	0001	5553121	DOOR, CABINET		1.000	EA	2			
.003		6110301	SHEET, .075#48#120 SS		.125	EA	4			
.01	0028	5553341	CABINET, TOP	D-22916-B	1.000	EA	2			
.002		6110241	SHEET, .059#42#120 SS		.071	EA	4			
.01	0036	5567801	TUBE, 3/8"PS HOSE DRAIN	A-25786-A	1.000	EA	2			
.002		3310031	PIPE, 3/8"NOY SCH 10 SS WLD		.760	FT	4			
.01	0002	5567841	PANEL, SIDE	A-25790-A	1.000	EA	2			
.002		6110221	SHEET, .059#50#120 SS		.040	EA	4			
.01	0014	5567861	H NIP, 3/8"HT#2-1/2"LG MCDU	A-25793-A	1.000	EA	2			
.002		1311411	HALF NIPPLE .375"HT#2.500"LG		1.000	EA	4			
.01	0016	5567871	TUBE, 3/8"PS FULL TRYCOCK	A-25794-A	1.000	EA	2			
.002		3310031	PIPE, 3/8"NOY SCH 10 SS WLD		1.442	FT	4			
.01	0025	5567891	DISC, 2-1/2"OD#11/16"ID	A-25797-A	1.000	EA	2			
.002		6110141	SHEET, .048#36#120 SS		.001	EA	4			



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