

ANALYZER CARRIER GAS BANK SYSTEM

The carrier gas bank system will automatically switch the carrier gas banks to the analyzers. MON-ARC SPECIALTY GASES is responsible for changing out empty banks and resetting regulators.

This system is set up so that the banks will automatically switch at 120* PSI. This is done with check valves and regulator pressure settings.

EXAMPLE: When BANK "A" is on line the bank pressure is approximately 2500* PSI. The output pressure of regulator "A" is 140* PSI. This regulator feeds regulator "C". Regulator "C" has an output of approximately 100* PSI. Check valve "B" keeps regulator "A" from back-pressuring regulator "B". When BANK "A" drops below 120* PSI BANK "B" will come on line because of the check valve arrangement. After BANK "A" is replaced, but before it is put on line, BANK "B" is set at 140* PSI and regulator "A" is set at 120* PSI. This will keep BANK "B" on line and BANK "A" ready when BANK "B" is empty.

ALARMS:

There are four different bank systems for the analyzers, (hydrogen, nitrogen, helium, zero air). Each system has an alarm for low pressure.

EXAMPLE: If BANK "A" drops below 120* PSI, the pressure switch on "A" will actuate; also, BANK "B" will come on line. In this situation there will be **no alarm**. With BANK "A" empty and BANK "B" drops to less than 500* PSI, pressure switch B will actuate causing an alarm. This is a **warning that both banks are near empty. ACTION NEEDS TO BE TAKEN.**

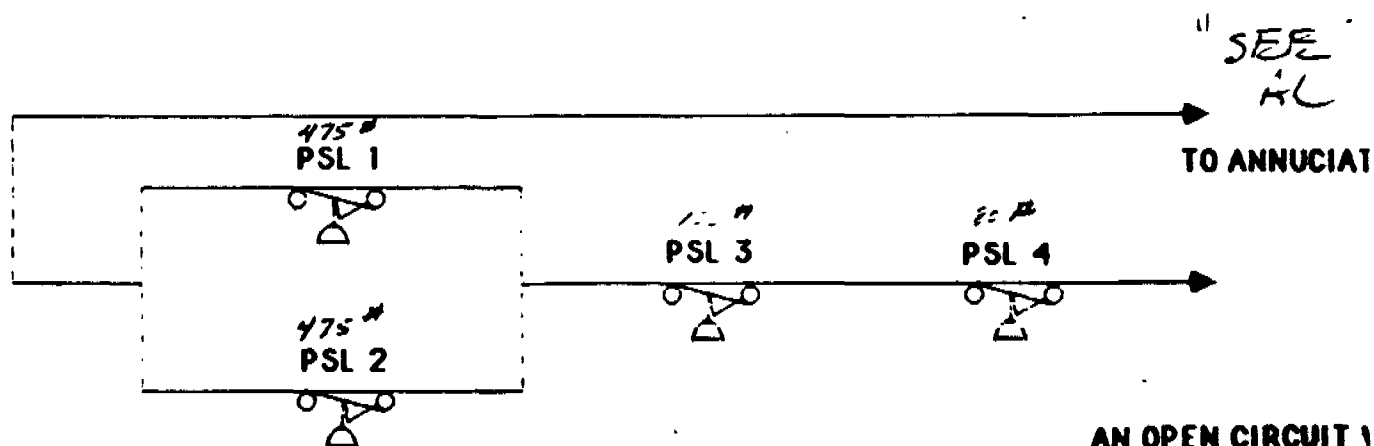
CORRECTIVE ACTION: CONDITION #1:

A) Verify both banks are low by looking at inlet pressure gauge on both regulators A and "B".

- B) Check to insure both banks are in service; valves open.
- C) Call MON-ARC SPECIALTY GASES and tell them you need a bank of carrier gas.
- D) If unable to reach MON-ARC, there is a spare bank of each gas kept at the main instrument shop. A cherry-picker is required for transportation of the bank.

CONDITION #2:

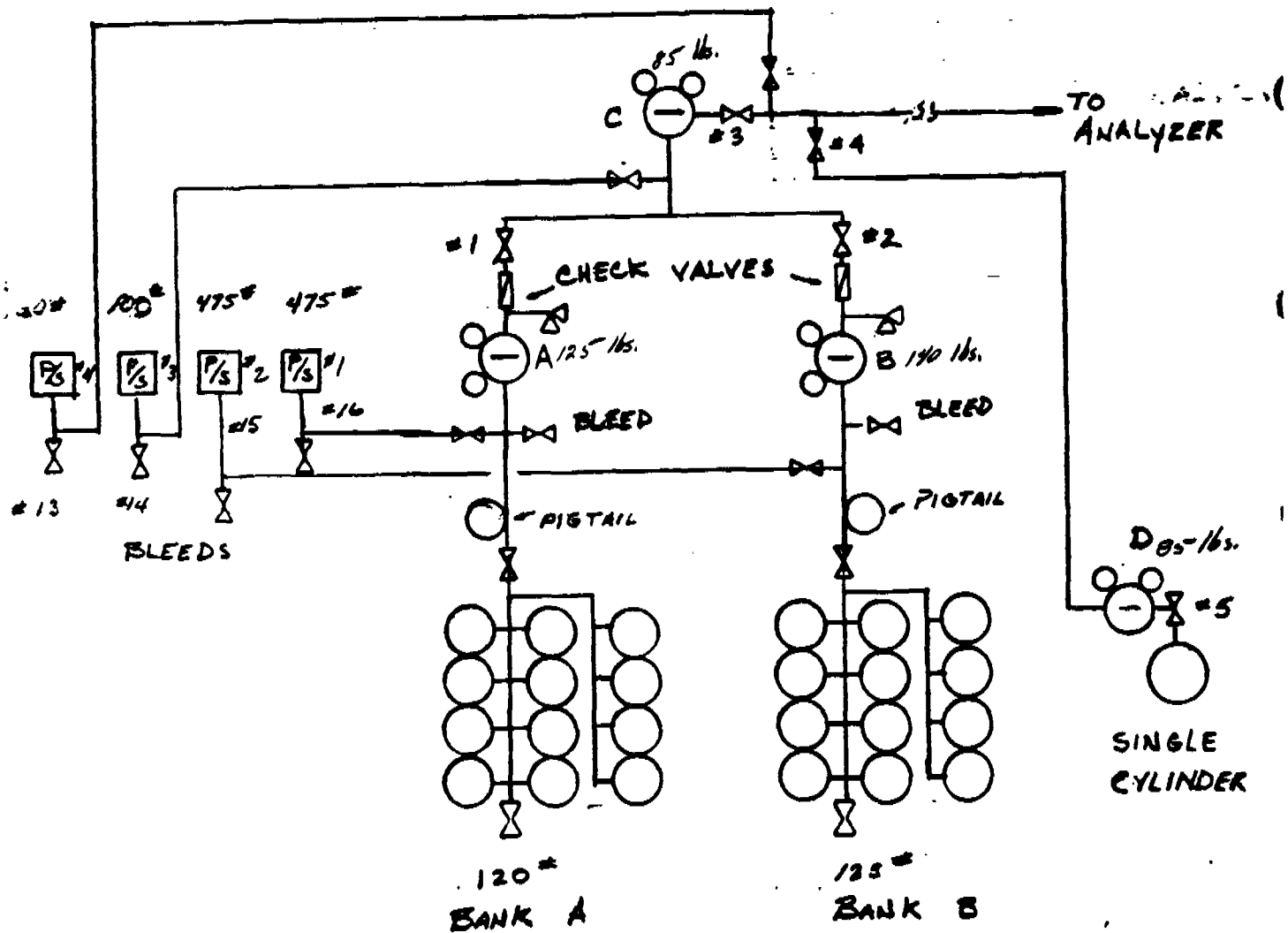
- A) If alarm sounds and both banks have sufficient pressure check the outlet pressure of regulators "A" and "B" (should be 120 - 140* PSI).
- B) Check valves 1 and 2 to insure they are open.
- C) If valves 1 and 2 are open check output pressure of regulator "C". This should be approximately 100 * PSI.
- D) If you cannot restore pressure block valve #3 and open valve #5 at valve #6. Also, open valve on single cylinder. This puts the single cylinder on line which will give you approximately 24 hours of run time.
- E) Notify analyzer person of situation as soon as possible.



NOTE: ALL SWITCHES WILL OPEN ON DECREASING PRESSURE.

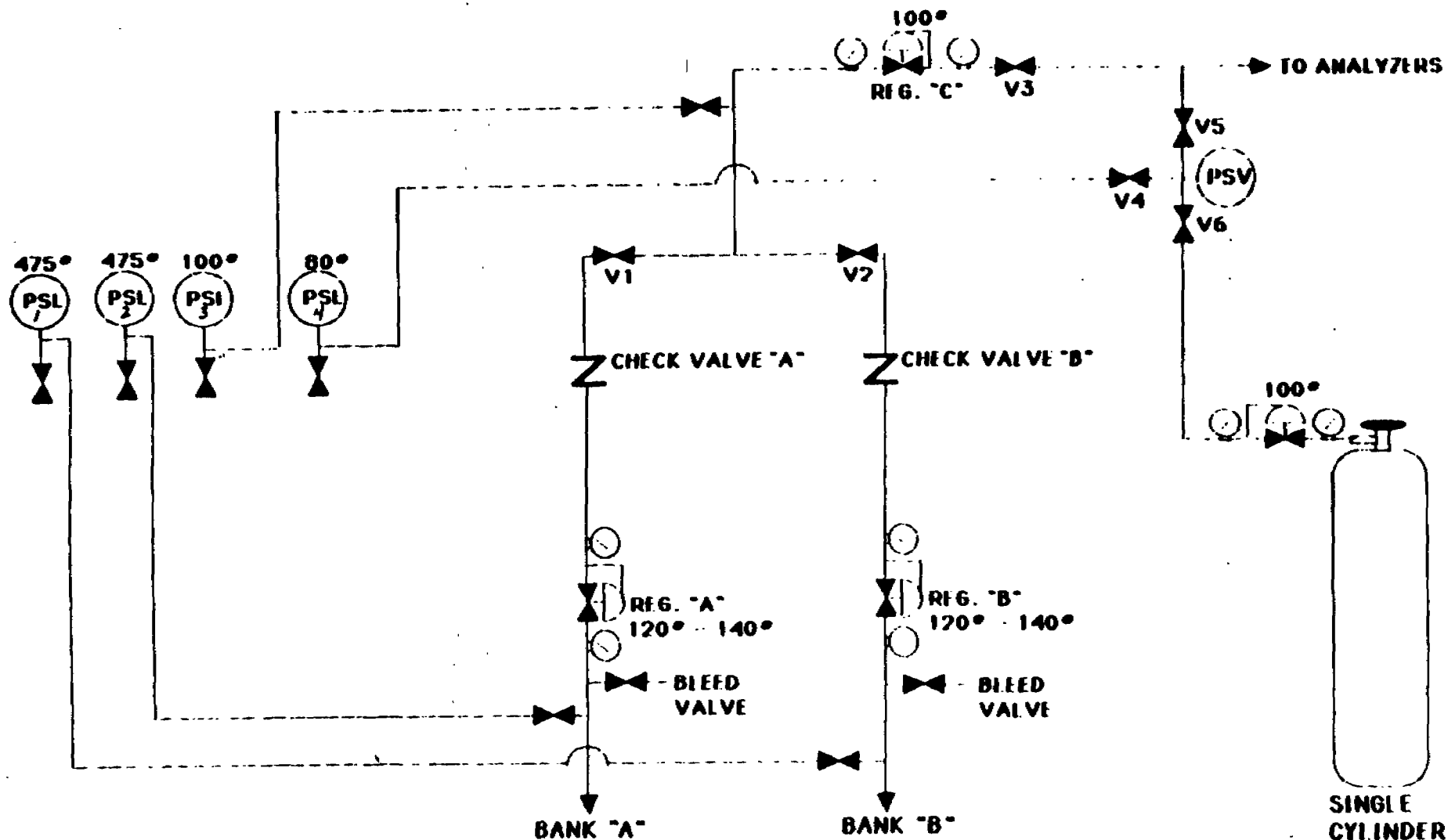
AN OPEN CIRCUIT 1 SOUND THE ALARM

DO 014649
CONFIDENTIAL



CARRIER GAS BANK SYSTEM

DO 014651
CONFIDENTIAL



TYPES OF DRAWINGS

- B1 PIPING AND INSTRUMENT DIAGRAM (P&ID)
- B01 INDEX FLOW SHEET, INDEX & INSTRUCTION,
(LEGEND & REFERENCE SHEET), PLOT PLAN, ETC.
- B2 CIVIL, CONCRETE (FOUNDATION), ETC.
- B3 STRUCTURAL & ARCHITECTURAL
- B4 PIPING
- B5 MECHANICAL
- B6 INSTRUMENTS
- B7 ELECTRICAL
- B8 NON-PROCESS EQUIPMENT (A.C.),
MOD V GRAPHICS & ALARM PANELS
- B9 COMMUNICATION
- B10 HEAT & MATERIAL BALANCE (HMB)
- B11 ALTERNATE SOURCE
- BLA TEMPORARY DRAWING

SIZES OF DRAWINGS

- A 8 1/2' X 11'
- B 22' X 34'
- D 11' X 17'

TYPES OF P&IDS

- 1 ORIGINAL DRAWING (RECORD DOCUMENT
/ AS EXISTS / AS BUILT)
- 2 PROJECT DRAWING (PROPOSED ADDITIONS, TIEPOINT,
PROPOSED MODIFICATIONS, DEMOLITIONS, ETC.)
- 3 DEMO DRAWINGS
 - A) XB1-100-N50-001 (MANUAL)
 - B) B1-X100-N50-001 (ELECTRONIC FOR ARCHIVE)

RHPID3
10/89

DRAWING NUMBERS

1) DRAWING NUMBERS ARE ISSUED BY ENGINEERING RECORDS

A) CONSUELLA ELLIS EXT. 6806

2) CHECK WITH PLANT FOR NUMBERING SYSTEM

A) SOME PLANTS SECTION OFF BY AREAS

B) SOME PLANTS NUMBER BY TRAINS

C) SOME PLANTS USE NEXT NUMBER AVAILABLE

NOTE: TRY TO AVOID USING A,B,C, ETC.

3) DO NOT REUSE VOIDED OR SUPERSEDED DRAWING NUMBERS

A) VOID DRAWINGS BY PERSON AND DATE

B) SUPERSEDE BY NEW DRAWING NUMBER OR NUMBERS

4) PROJECT OR 'P' DRAWINGS

A) AN ORIGINAL P&ID SHOULD BE ISSUED BEFORE 'P' DRAWINGS ARE CREATED

B) ONE (1) 'P' DRAWING IS MADE FOR ALL ON-GOING PROJECTS

C) RECONCILE ALL COMPLETED PROJECTS ON ORIGINAL DRAWING

5) DEMO OR 'X' DRAWINGS

A) USED FOR ONE PROJECT

B) SHOULD BE MANUAL

C) MAKE ELECTRONIC DEMO DRAWINGS UNDER SPECIAL CONDITIONS

NOTE: SEE B.J. JOHNSON EXT. 6976 FOR STORING DEMO DRAWINGS

RJH 10/28/91

ENGINEERING RECORDS DRAWING NUMBER CONVENTION

10-1-91

STANDARD DRAWING NUMBER

B1-1000-N50-001

THIS LETTER DICTATES THE
SIZE OF THE DRAWING.

EXAMPLES: A - 8 1/2" X 11"
B - 22" X 34"
B - 24" X 36"
C - 18" X 24"
C - 20" X 24"
D - 11" X 17"

THIS LETTER AND NUMBER
COMBINATION DICTATES THE
PLANT CODE.

THIS NUMBER DICTATES THE
DISCIPLINE OF THE DRAWING.

EXAMPLES: 01 - INDEXES, FLOW SHEETS
1 - P & ID'S
2 - CIVIL
3 - STRUCTURAL
4 - PIPING
5 - VESSEL
6 - INSTRUMENTATION
7 - ELECTRICAL
8 - MOD V GRAPHICS
9 - COMMUNICATION
10 - HEAT & MATERIAL BALANCE

THIS IS THE ACTUAL DRAWING
NUMBER.

ENGINEERING RECORDS
DRAWING NUMBER CONVENTION

10-1-91

ADDITIONAL LETTERS ACCEPTED TO THE STANDARD

FB4-1000-N50-001

THIS LETTER IS USED
TO INDICATE FIRE
PROTECTION DRAWINGS.

XB1-1000-N50-001

THIS LETTER IS USED
TO INDICATE A DEMOLITION
DRAWING.

B1-1000-N50-001P

THIS LETTER IS USED
TO INDICATE A PROJECT,
PROPOSED, OR PRELIMINARY
DRAWING.

TB4-1000-N50-001

THIS LETTER IS USED TO
INDICATE TRACING OF A
PIPE SPOOL.

MISC ADDITIONS TO THE STANDARD

BLA-1000-N50-001

THESE LETTERS ARE USED
TO INDICATE A TEMPORARY
DRAWING.

P1-1000-N50-001

THIS LETTER IS USED TO
INDICATE A DRAWING IN OUR
DIVISION PLOT PLAN SYSTEM.

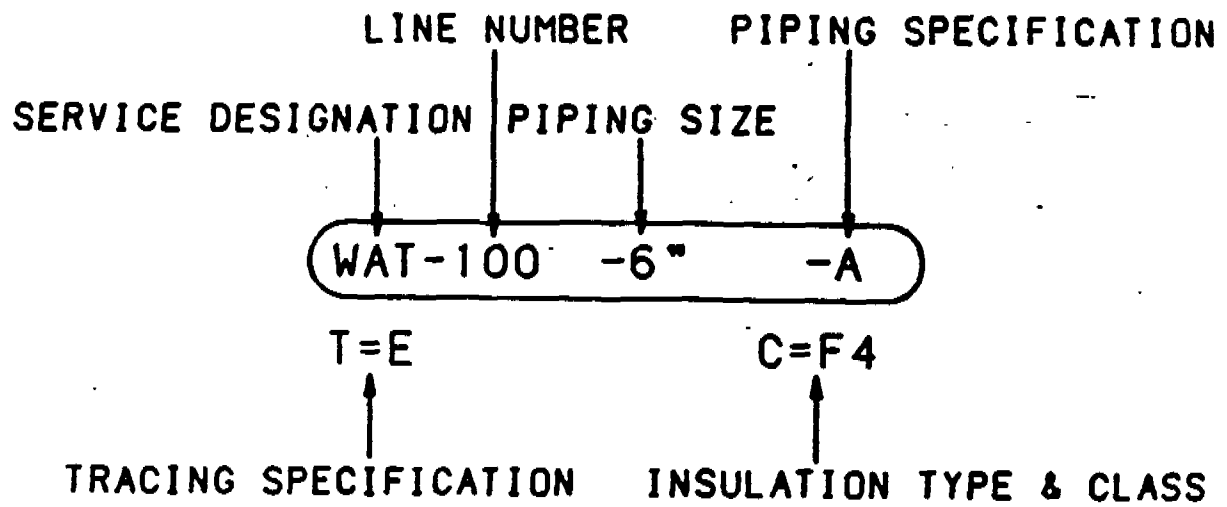
B2-1000AA-N50-001

SINGLE OR DOUBLE
LETTERS ARE ALLOWED TO KEEP
A CERTAIN SEQUENCE OF
DRAWINGS TOGETHER.

SHEET 2 OF 2

DO 014655
CONFIDENTIAL

LINE BUBBLE



LINE SERVICE DESIGNATION

PRO	PROCESS
PW	PROCESS WATER
STM	STEAM
CL2	CHLORINE
CTS	COOLING TOWER WATER SUPPLY
CON	CONDENSATE
HO	HOT OIL
MOH	METHANOL
N2	NITROGEN
CTR	COOLING TOWER WATER RETURN
OM	OIL MIST
VNT	VENT
REF	REFRIGERANT
IA	INSTRUMENT AIR
INH	INHIBITOR
FW	FIREWATER
DW	POTABLE WATER
DRN	DRAIN
SA	SULFURIC ACID

PIPING SPECIFICATIONS

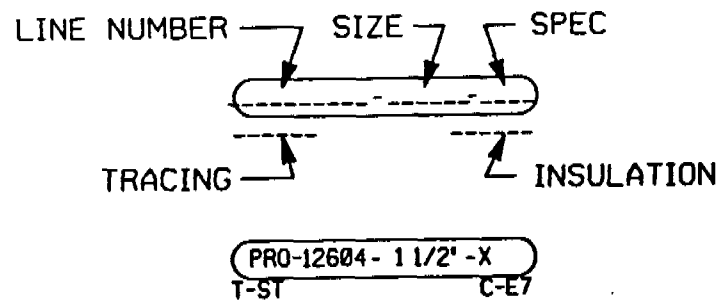
PEC	SERVICE	PRESSURE/TEMP PSIG/ F	ANSI FLANGE RATING PSIG	PIPE MATERIAL
	R-22, A-HCL	400/100 - 384/400	300	A-333
	CRUDE PRODUCT	400/100 - 384/400	300	A-333
	R-22, A-HCL	285/100 - 200/400	150	A-333
	CRUDE PRODUCT	285/100 - 200/400	150	A-333
	CELL EFFLUENT	285/100 - 265/180	150	CS
	ACID	275/100 - 225/212	150	PPL LINED
	ACID	275/100 - 225/212	150	KYNAR LINED
	ACID	275/100 - 175/350	150	TFE LINED
	30° STEAM	285/100 - 170/500	150	CS
	ACID	20" VAC - 25/230	N/A	FRP
	ACID	20" VAC - 25/230	N/A	FRP
	235° STEAM	446/100 - 404/550	300	CS
	FG. PROCESS	445/100 - 445/400	300	CS
	HCL, DTG, MEON	446/100 - 379/650	300	CS
	FG. PROCESS, MEON	285/100 - 200/400	150	CS
	PV, IA, CTS, CTR	212/100 - 212/150	150	CS
	DN	285/100 - 270/150	150	GAL. CS
	N2	285/100 - 200/400	150	CS
	LUBE OIL	230/100 - 160/400	150	SS 304L
	LUBE OIL	600/100 - 415/400	300	SS 304L
	LUBE OIL, A-HCL	600/100 - 400/400	300	MONEL
	R-250 INLET	600/100 - 475/650	300	MONEL
	CONDENSATE	285/100 - 170/500	150	CS/SS
	CONDENSATE	446/100 - 404/550	300	CS/SS
	CRUDE PRODUCT	200/1025	300	INCONEL 600
	H2SO4 96%+	285/100 - 185/400	150	A-20
	CL2 VAPOR	285/100 - 230/400	150	CS
	PROCESS (CORROSIVE)	230/100 - 185/400	150	MONEL
	M-2, M-3, M-4, AHCL	285/100 - 200/400	150	CS
	475° STEAM	673/100 - 501/725	600	CS
	R-22, AHCL	446/100 - 446/400	300	CS
	DELUGE SYSTEM		150	GAL. CS
	QUENCH LIQUID	446/100 - 404/550	300	CS/SS
	FIRE WATER	200/AMB.	150	CS
	DRAIN	100/150	150	PVC
	SPRINKLER		150	GAL. CS

AAHL ANALYSIS ALARM HIGH OR LOW
 ACV ANALYZER CONTROL VALVE
 AE ANALYZER ELEMENT
 AI ANALOG INPUT
 AO ANALOG OUTPUT
 AOV AIR OPERATED VALVE
 AR ANALYSIS RECORDER
 AT ANALYSIS TRANSMITTER
 BMS BURNER MANAGEMENT SYSTEM
 CGA COMBUSTIBLE GAS ALARM
 CGM COMBUSTIBLE GAS MONITOR
 CT CONDUCTIVITY TRANSMITTER
 CV FLOW CONTROL VALVE
 DI DIGITAL INPUT
 DO DIGITAL OUTPUT
 EBV EMERGENCY BLOCK VALVE
 EV ELECTRIC VALVE (SOLENOID)
 EVV EMERGENCY VENT VALVE
 FAH FLOW ALARM HIGH
 FAHL FLOW ALARM HIGH OR LOW
 FAL FLOW ALARM LOW
 FE FLOW ELEMENT
 FFA FLAME FAILURE ALARM
 FFIC RATIO FLOW INDICATING CONTROLLER
 FFS FLAME FAILURE SWITCH
 FI FLOW INDICATOR(LOCAL)
 FIC FLOW INDICATING CONTROLLER
 FR FLOW RECORDER
 FRC FLOW RECORDING CONTROLLER
 FSH FLOW SWITCH HIGH
 FSHL FLOW SWITCH HIGH OR LOW
 FSL FLOW SWITCH LOW
 FT FLOW TRANSMITTER
 GFD GROUND FAULT DETECTOR
 GL GREEN LIGHT
 HBV HAND BLOCK VALVE
 HCV HAND CONTROL VALVE
 HIC HAND INDICATING CONTROLLER
 HOA HAND-OFF-AUTO SWITCH
 HS HAND SWITCH
 HSA HAND SWITCH ALARM
 I/P TRANSDUCER
 I/S CURRENT/SPEED TRANSDUCER
 II CURRENT INDICATOR (AMPS)
 IR CURRENT RECORDER
 IT CURRENT TRANSMITTER
 LAH LEVEL ALARM HIGH
 LAHH LEVEL ALARM HIGH-HIGH
 LAHL LEVEL ALARM HIGH-LOW
 LAL LEVEL ALARM LOW

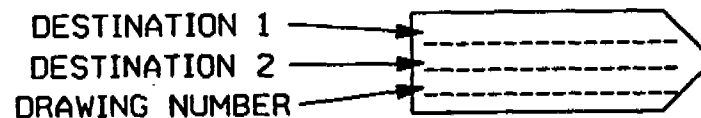
LC LEVEL CONTROLLER
 LCV LEVEL CONTROL VALVE
 LE LEVEL ELEMENT
 LI LEVEL INDICATOR
 LIC LEVEL INDICATING CONTROLLER
 LIT LEVEL INDICATOR TRANSMITTER
 LR LEVEL RECORDER
 LRC LEVER RECORDING CONTROLLER
 LSHH LEVEL SWITCH HIGH-HIGH
 LSHL LEVEL SWITCH HIGH-LOW
 LSL LEVEL SWITCH LOW
 LT LEVEL TRANSMITTER
 PAH PRESSURE ALARM HIGH
 PAHL PRESSURE ALARM HIGH OR LOW
 PAL PRESSURE ALARM LOW
 PB PUSH BUTTON
 PCV PRESSURE CONTROLLER (SELF-CONTAINED)
 PDAH PRESSURE DIFFERENTIAL ALARM HIGH
 PDAHL PRESSURE DIFFERENTIAL ALARM HIGH OR LOW
 PDI PRESSURE DIFFERENTIAL INDICATOR
 PDIC PRESSURE DIFFERENTIAL INDICATING CONTROLLER
 PDR PRESSURE DIFFERENTIAL RECORDER
 PDRC PRESSURE DIFFERENTIAL RECORDING CONTROLLER
 DPT PRESSURE DIFFERENTIAL TRANSMITTER
 PI PRESSURE INDICATOR
 PIC PRESSURE INDICATING CONTROLLER
 PR PRESSURE RECORDER
 PRC PRESSURE RECORDING CONTROLLER
 PSH PRESSURE SWITCH HIGH
 PSL PRESSURE SWITCH LOW
 RL RED LIGHT
 RO RESTRICTING ORIFICE
 SC SPEED CONTROLLER
 SDA SHUTDOWN ALARM
 SG SIGHT GLASS
 SSH SPEED SWITCH HIGH
 SSL SPEED SWITCH LOW
 ST SPEED TRANSMITTER
 TAH TEMPERATURE ALARM HIGH
 TAHL TEMPERATURE ALARM HIGH OR LOW
 TCV TEMPERATURE CONTROL VALVE
 TE TEMPERATURE ELEMENT
 TP TEMPERATURE TRANSMITTER
 TR TEMPERATURE RECORDER
 TSH TEMPERATURE SWITCH HIGH
 TT TEMPERATURE TRANSMITTER
 UA UNIT ALARM
 VAH VIBRATION ALARM HIGH
 VE VIBRATION ELEMENT
 VFD VARIABLE FREQUENCY DRIVE
 VI VIBRATION INDICATOR

WIC WEIGHT INDICATOR CON.
 WT WEIGHT TRANSMITTER CON.
 ZSC LIMIT SWITCH CLOSED
 ZSO LIMIT SWITCH OPEN

TYPICAL LINE BUBBLE



TYPICAL LINE CONTINUATIONS



ON OR OFF PAGE
LEFT OR RIGHT

T-100 A/B
B1-100-N50-001

NON-DIRECTIONAL

STM-40101-24"-X
235 * STM HEADER
B1-401-V51-001

BI-DIRECTIONAL

WELL NO. 21
STORAGE WELL
B1-1021-B60-001

TO AND FROM ADJACENT PAGE
LEFT OR RIGHT

E-101 A/B/C
B1-2505-P45-002

PRO-12604 - 1 1/2" - X

P-101 A/B
B1-2505-P45-002

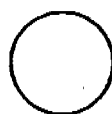
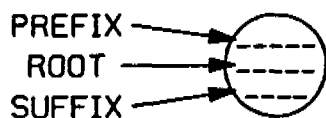
PRO-12604 - 1 1/2" - X
T-B C-B

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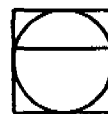
INTERCONNECTING LINE SYMBOLOGY

PROCESS (THIN)	_____
PROCESS (THICK)	_____
ELECTRICAL OR T.C.	-----
INSTR AIR OR PNEUMATIC	+++++
CAPILLARY TUBING	xxxxx
HYDRAULIC SIGNAL LINE	
DATA HIWAY SERIAL LINK	
FIBER OPTIC	ooooo

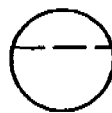
TYPICAL INSTRUMENT TAG



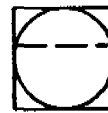
FIELD
MOUNTED



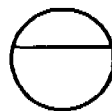
CONTROL ROOM
MICRO DEVICE



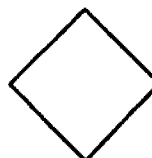
BEHIND CONTROL
ROOM PANEL
MOUNTED



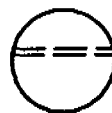
CPU-ROOM
MICRO DEVICE



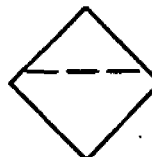
CONTROL ROOM
PANEL MOUNTED



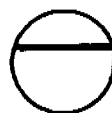
FIELD COMPUTER
DEVICE



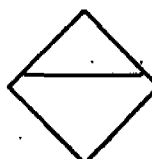
LOCAL FIELD
BEHIND PANEL
MOUNTED



CPU-ROOM COMPUTER
DEVICE



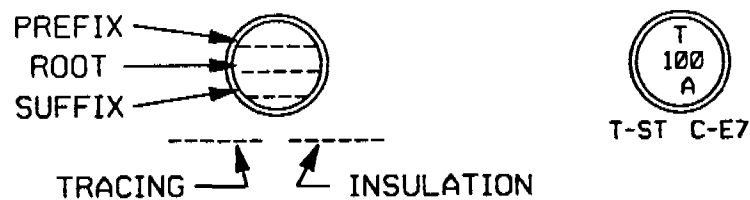
LOCAL FIELD
PANEL MOUNTED



CONTROL ROOM
COMPUTER DEVICE

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TYPICAL EQUIPMENT TAG

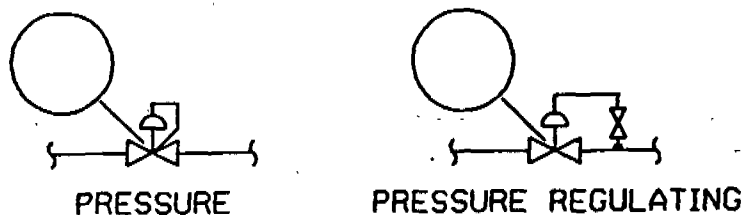
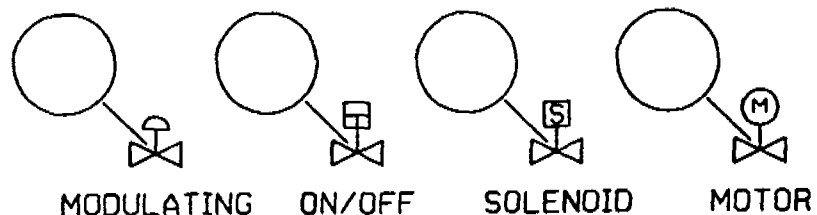


TYPICAL VALVE BODY SYMBOLS

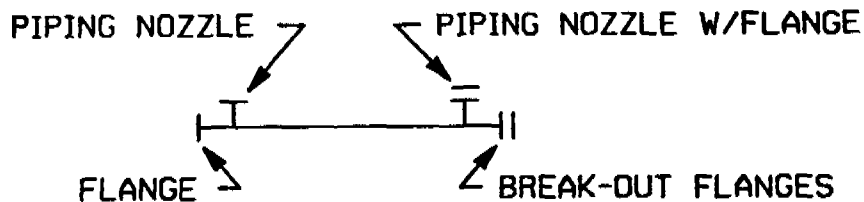
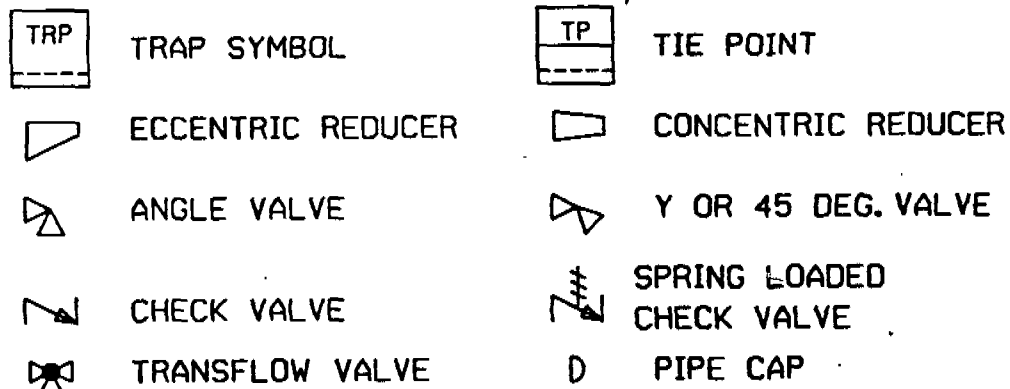
- ⋈ GATE VALVE
- ⋈ DIAPHRAGM VALVE
- ⊠ PLUG VALVE
- ⋈ NEEDLE VALVE
- ⊠ BALL VALVE
- ⊠ GLOBE VALVE
- ⋈ BUTTERFLY VALVE
- ⊠ BARSTOCK VALVE
- ⋈ SLIDE VALVE
- ⋈ 3-WAY VALVE
- ⋈ 4-WAY VALVE
- ⊠ 3-WAY PLUG VALVE
- ⊠ 4-WAY PLUG VALVE
- ⋈ 3-WAY BALL VALVE
- ⋈ 4-WAY BALL VALVE

RHPID6
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TYPICAL CONTROL VALVES



PIPING SYMBOLS



TO PLANT DRAIN
SYSTEM

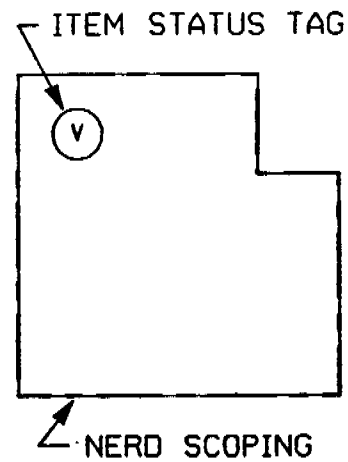
OPEN FLOOR
DRAIN

TRENCH
DRAIN

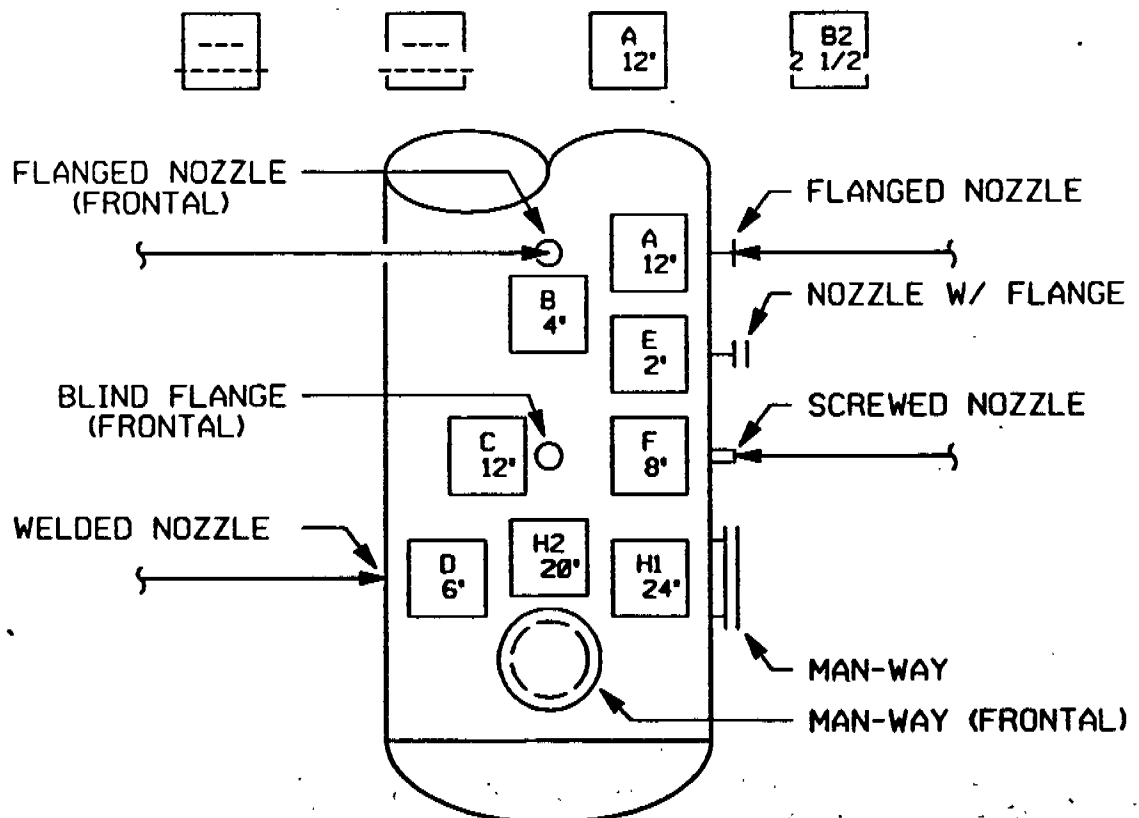
RHPID7
10/89

PACKAGE EQUIPMENT

- (N) NEW
- (E) EXISTING
- (R) RELOCATE
- (D) DOW FURNISHED
- (V) VENDOR FURNISHED
- (F) FUTURE

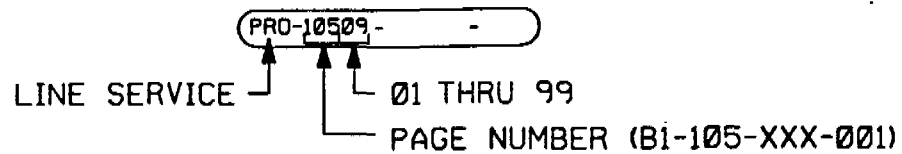


TYPICAL NOZZLES

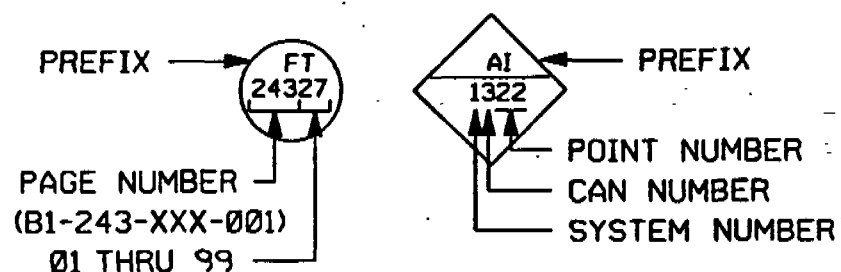


RHPID9
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LINE NUMBERING



INSTRUMENT NUMBERING

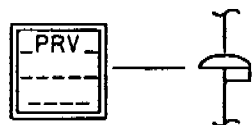


INSTRUMENT SYMBOLS

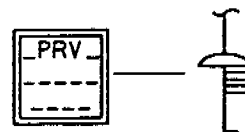
- INSTRUMENT ELEMENT
- THERMOWELL
- ||| RESTRICTING ORIFICE
- ◆ CRITICAL INSTRUMENT HEX
- ⌞ SAMPLER (ANALYZER)
- ⌞ DIAPHRAGM SEAL
- ROTOMETER
- INLINE INSTRUMENT

RHPID10
10/89

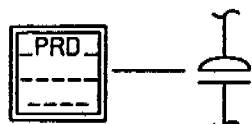
SAFETY EQUIPMENT



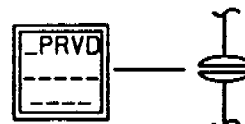
PRESSURE RELIEF VALVE



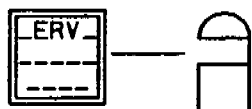
PRV W/ FLAME ARREST



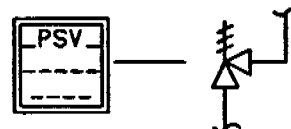
PRESSURE RUPTURE DISK



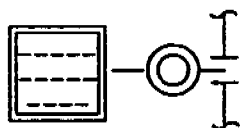
PRESS-VAC RUPTURE DISK



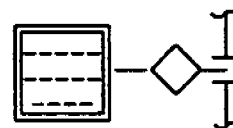
EMERGENCY RELIEF VALVE



PRESSURE SAFETY VALVE

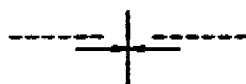


SPECTICLE BLIND

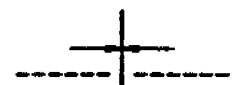
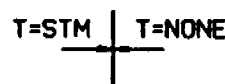


HAMER BLIND

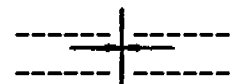
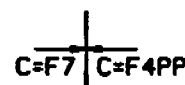
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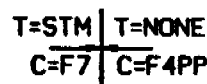
TRACING



INSULATION



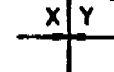
TRACING AND
INSULATION



PS= PS=

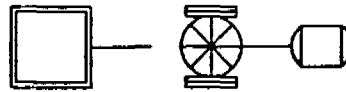
PIPING

PS= PS=

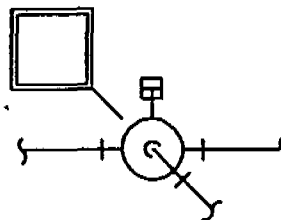


RHPID11
10/89

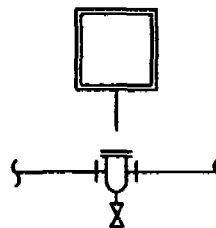
MISCELLANEOUS SYMBOLS



ROTARY VALVE



DIVERTER VALVE



BASKET TYPE STRAINER



TEMP. CONICAL STRAINER



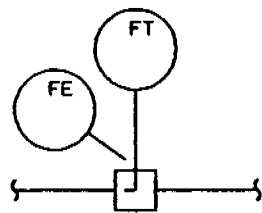
INTERNAL BLEED VALVE



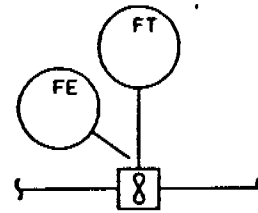
DRIP RING

RHPID8
8/91

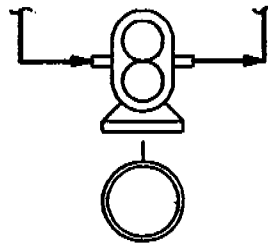
SITE DEVELOPED SYMBOLS



PITOT TUBE



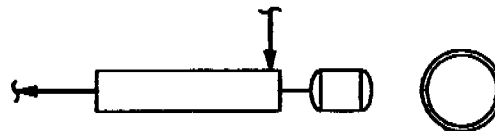
TURBINE METER



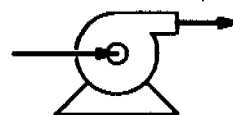
GEAR PUMP



PD PUMPS



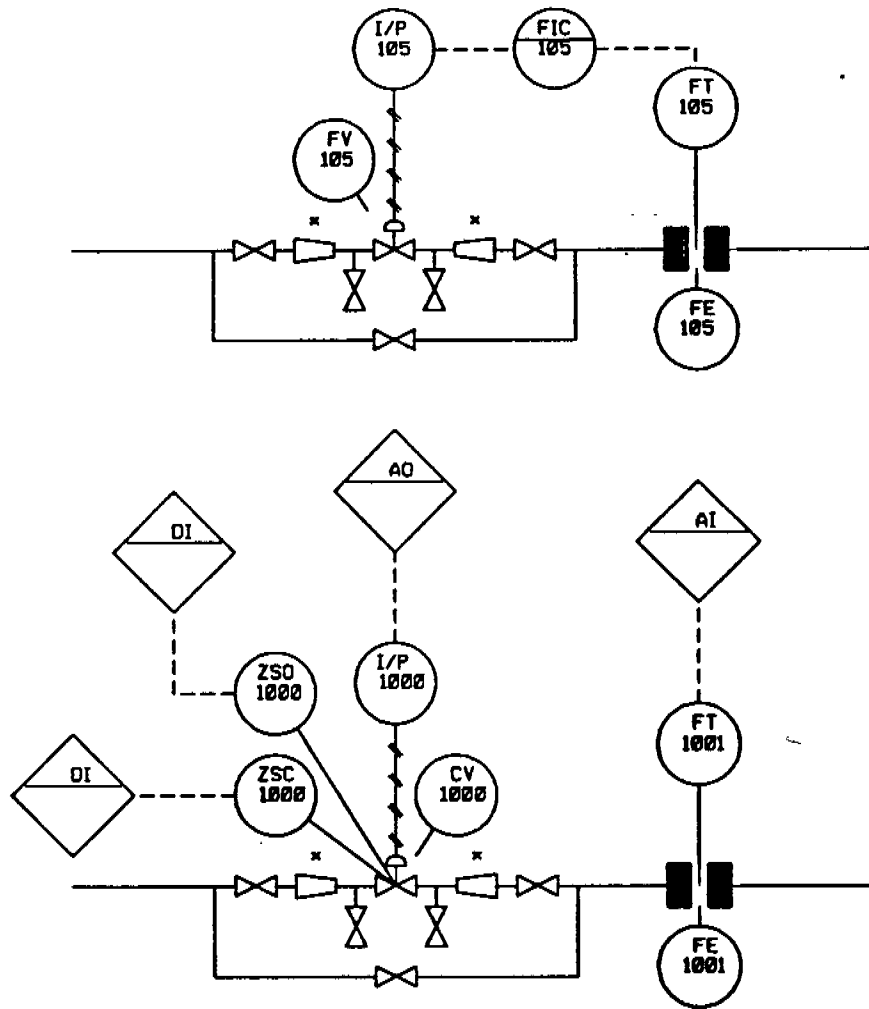
MONO PUMP



BLOWER

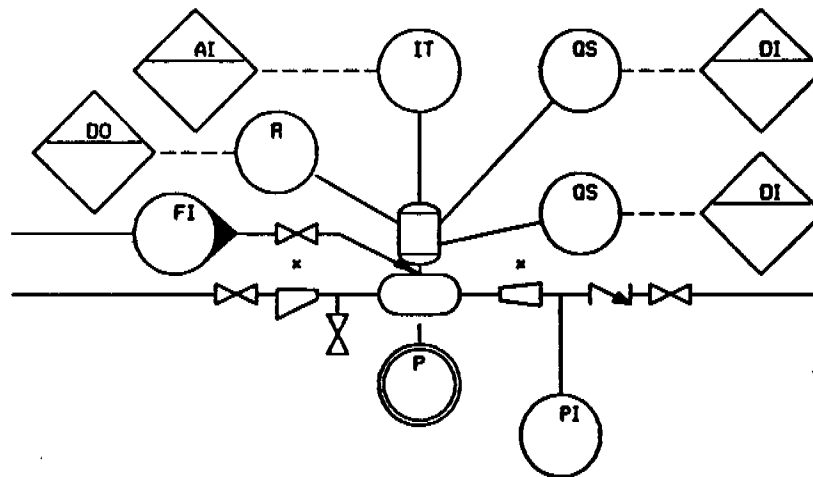
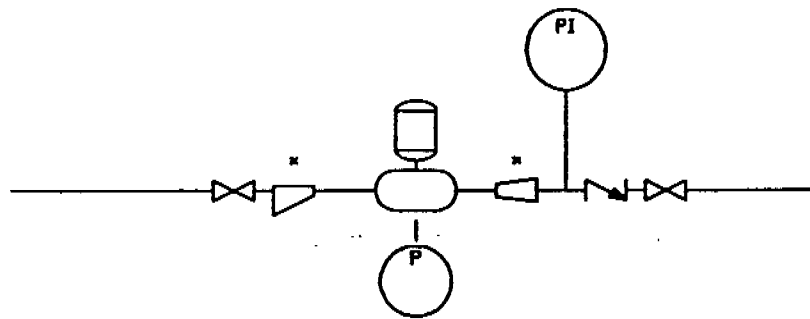
RHPID17
9/91

CONTROL STATION OLD VS MOD V



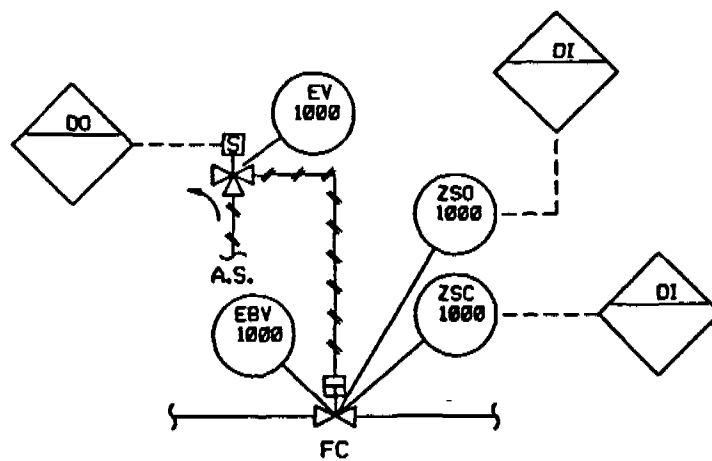
RHPID12
10/89

PUMP STATION OLD VS MOD V



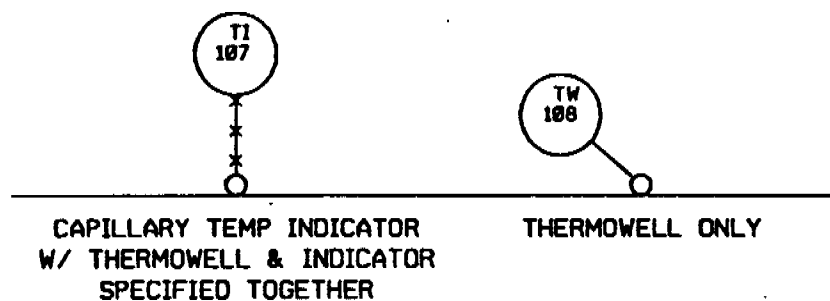
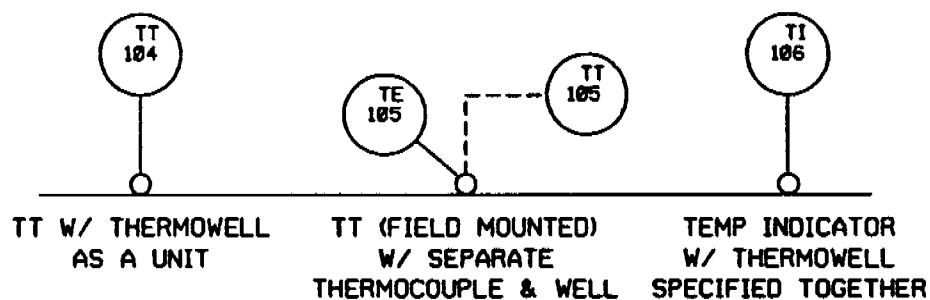
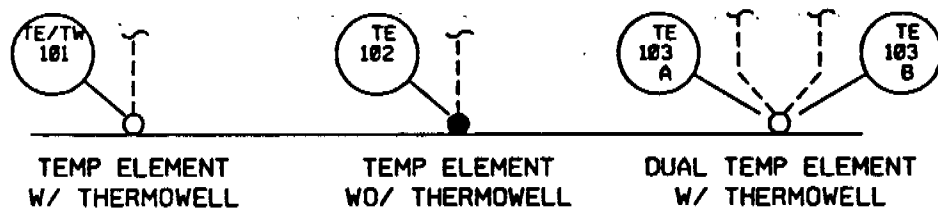
RHPID14
10/89

TYPICAL EBV OR AOV



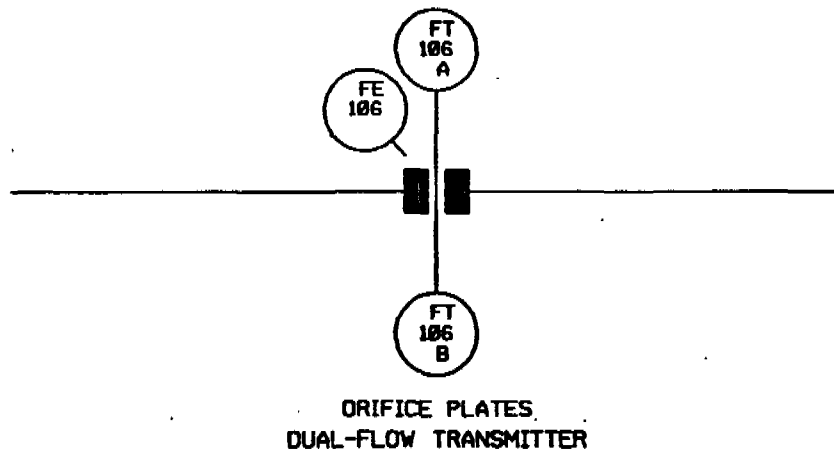
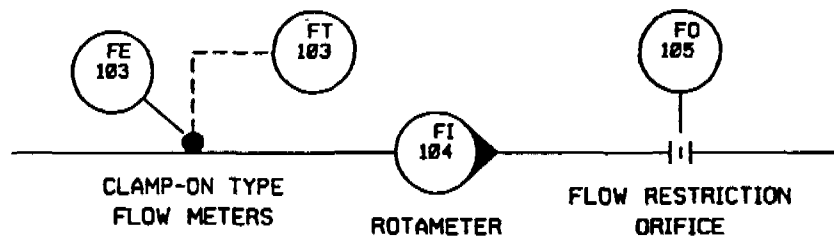
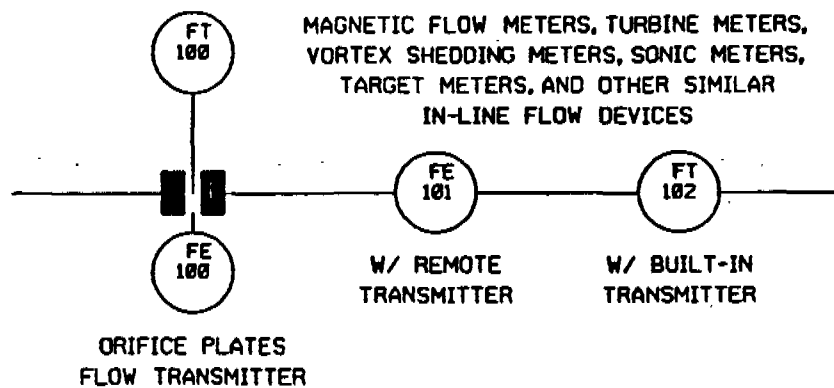
RHPID13
10/89

TEMPERATURE DEVICES

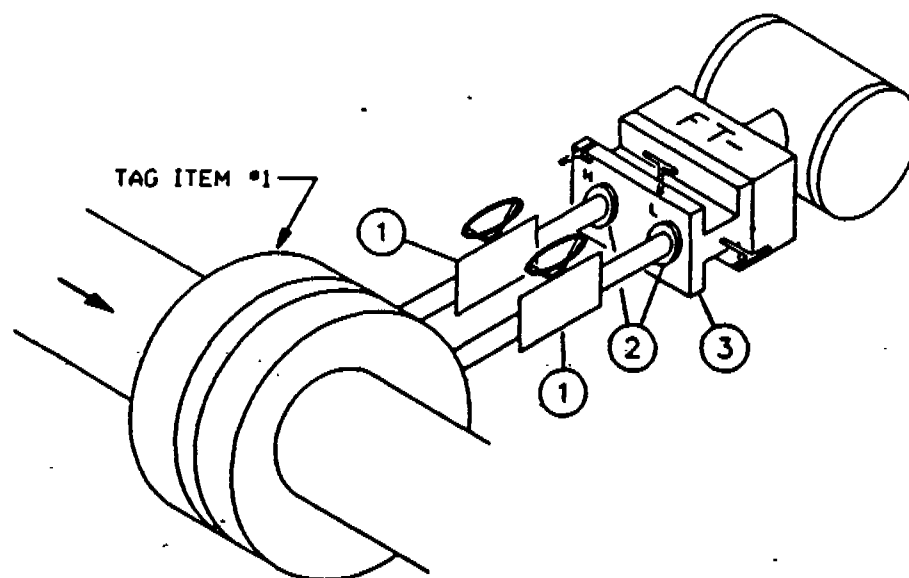


RHPID15
10/89

IN-LINE FLOW DEVICES



RHPID16
10/89

MATERIAL LIST

- ① TBV ½" NPT-?????
- ② ROSEMOUNT MOUNTING ADAPTOR,????
- ③ HUBER MAGNUM SERIES S22 DBL. FLG. WITH MOUNTING BRACKET
- ④
- ⑤

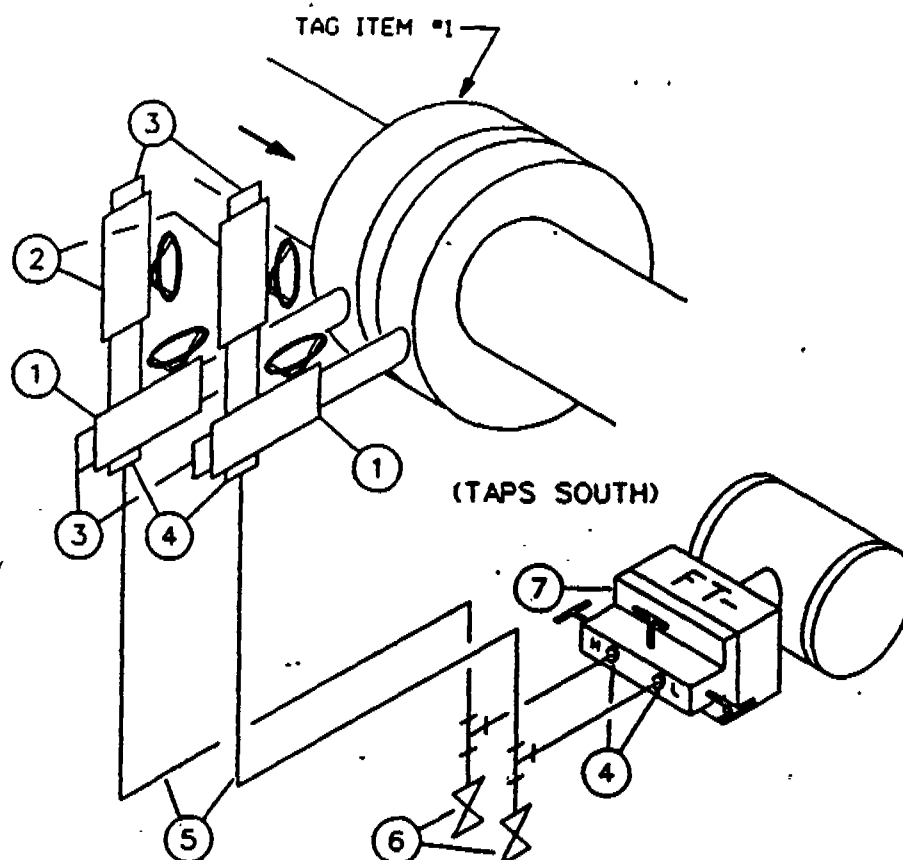
NOTES:

- 1. ALL PIPE, FITTINGS & VALVES SHALL CONFORM TO PIPE SPECS.
- 2. SUPPORT TUBING CONTINUOUSLY FROM PROCESS TO TRANSMITTER.
(3" FIBERGLASS CHANNEL EXTREN 500)
- 3. TUBING SHALL SLOPE FROM PROCESS TO INSTR. A MINIMUM OF ¼" PER FOOT. DO NOT TRAP.

DO 014676
CONFIDENTIAL

SPEC. BY	HPS	THE DOW CHEMICAL COMPANY				S/N NO.	S901-76656
CHECKED:	??	VINYL II				BLOCK 66	INSTRUMENT
APP'D:		FLOW TRANSMITTER DETAIL					INSTALLATION
DATE:	3/16/89	REVISION DATE	A		B	DETAIL NO.	DETAIL
						A6-1077	

SCHEMATIC OF



MATERIAL LIST

- | | |
|--------------------------------------|---|
| (1) TBV 1/2" NPT-77777 | (6) ALL TUBE VALVES TO BE SWAGELOK M44S6 BALL VALVE |
| (2) TBV 1/2" NPT-77777 | (7) HUBER MAGNUM SERIES S21 SNG. FLG. WITH MOUNTING BRACKET |
| (3) 1/2" MALE PLUG | (8) |
| (4) 3/8" T x 1/2" NPT MALE CONNECTOR | (9) |
| (5) ALL TUBING TO BE 3/8" MONEL | (10) |
| (5) ALL TUBE FITTINGS TO BE MONEL | |

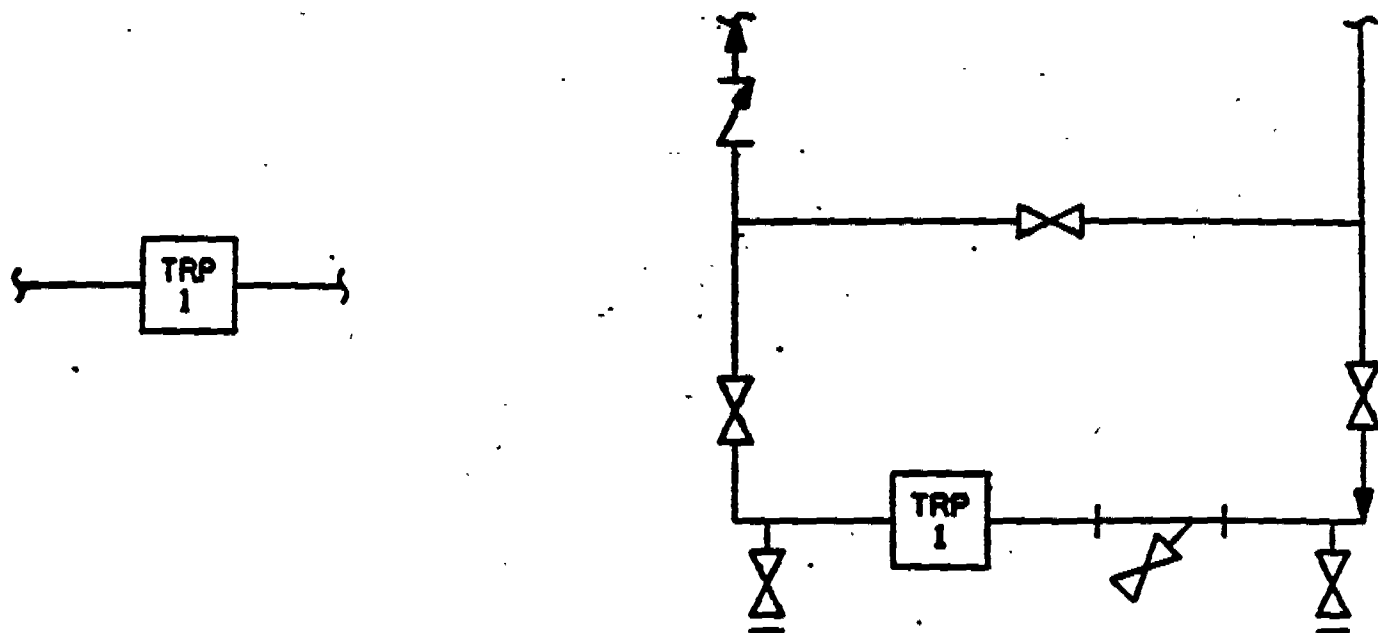
NOTES:

- ALL PIPE, FITTINGS & VALVES SHALL CONFORM TO PIPE SPECS.
- SUPPORT TUBING CONTINUOUSLY FROM PROCESS TO TRANSMITTER. (3" FIBERGLASS CHANNEL EXTREN 500)
- TUBING SHALL SLOPE FROM PROCESS TO INSTR. A MINIMUM OF 1/4" PER FOOT. DO NOT TRAP.

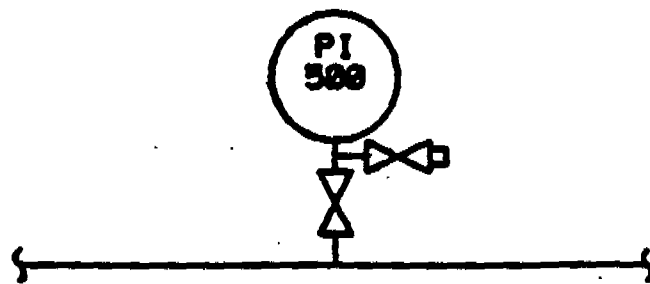
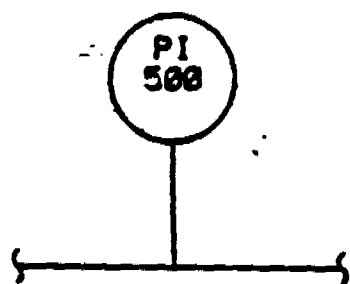
DO 014677
CONFIDENTIAL

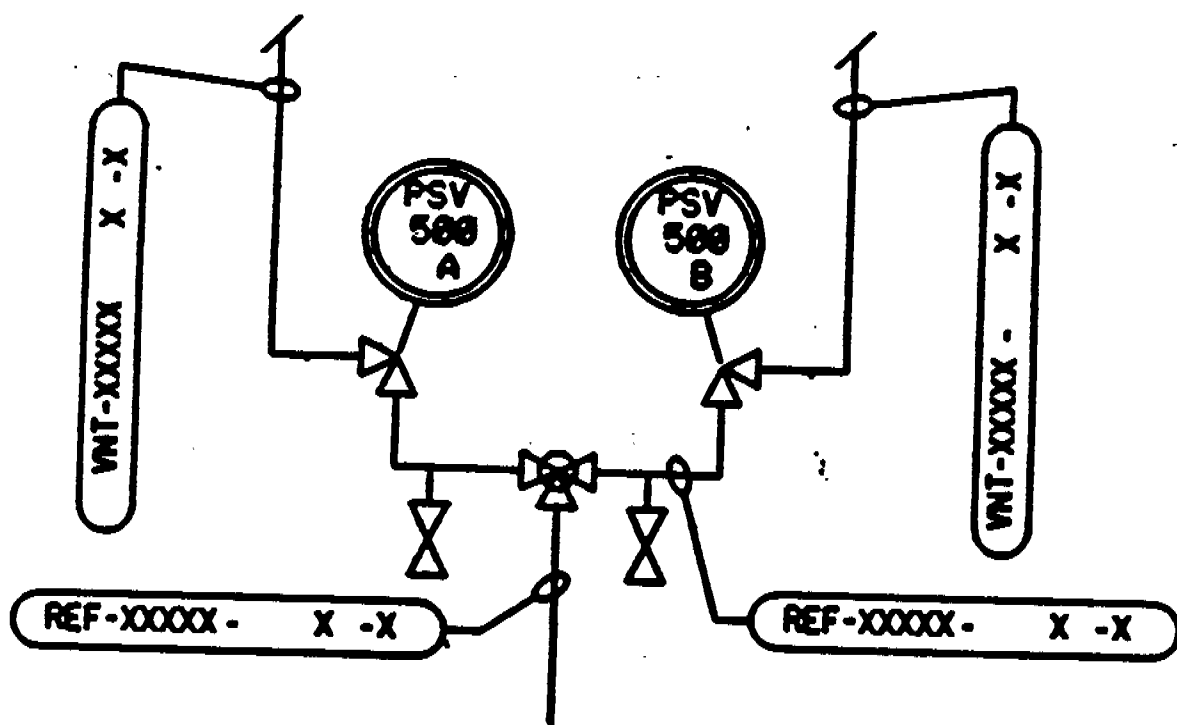
SPEC. BY	HPS	THE DOW CHEMICAL COMPANY				S/W NO.	S901-76920
CHECKED:	??	VINYL II	BLOCK 66			INSTRUMENT	
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DATE:	3/16/89	REVISION DATE	A		B	DETAIL NO.	
						A6-1071	

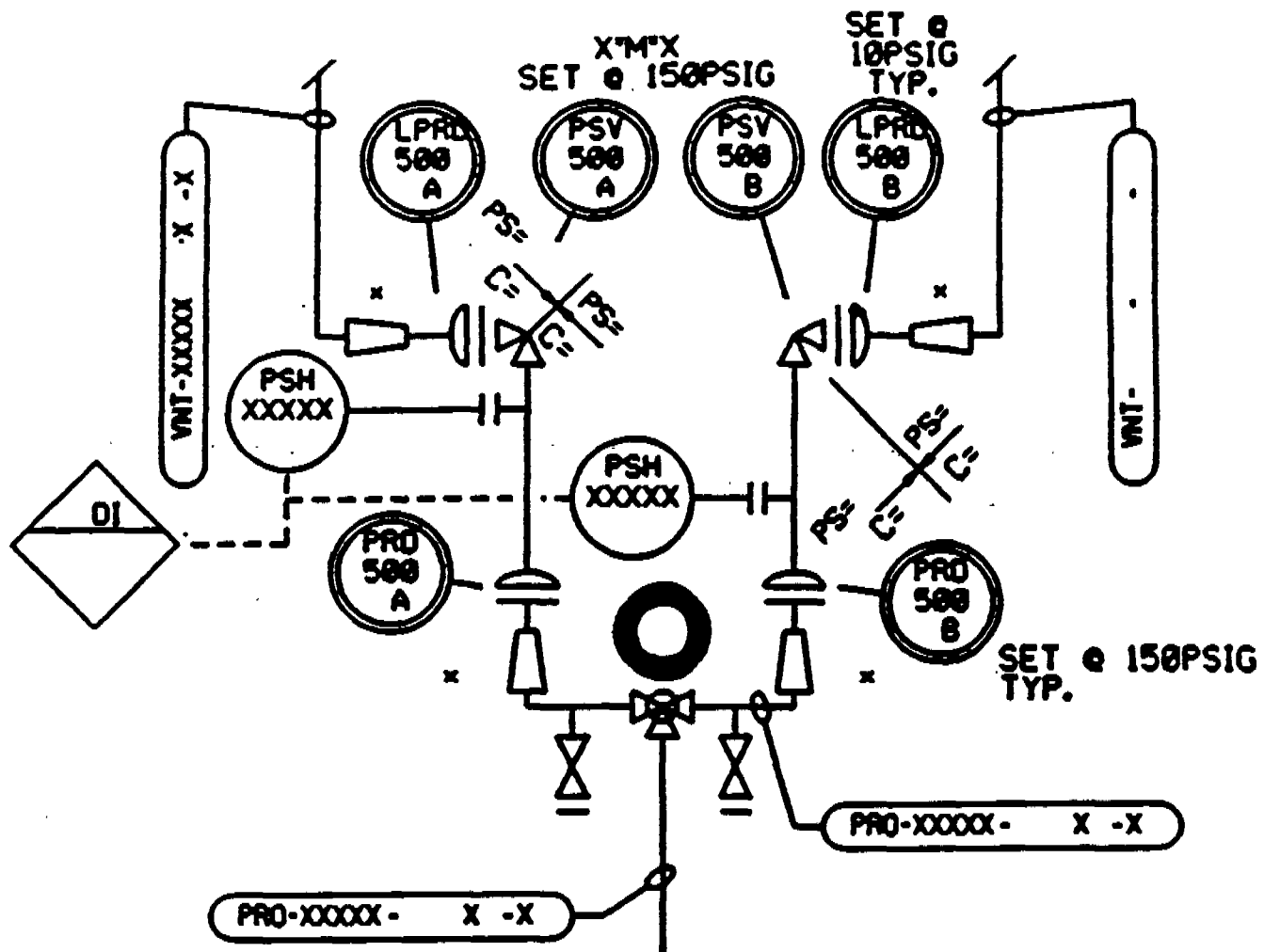
TYPICAL INSTALLATIONS

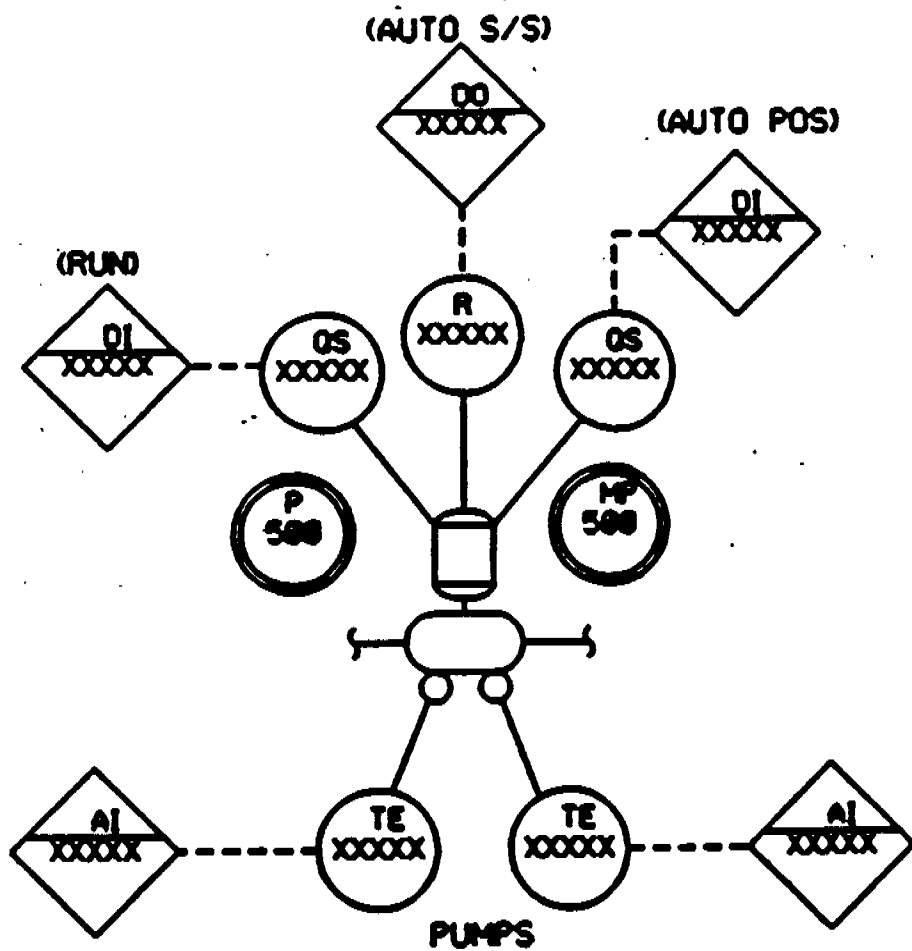


**NOTE: STRAINER USED IF NOT
INTERNAL TO TRAP**









**USE & CARE OF PORTABLE
COMBUSTIBLE GAS
&
OXYGEN METERS**

I. REASONS FOR HAVING THESE METERS

- A. DIVISION HAS 23 PLANTS WITH PIPES, VESSELS, AND CONTAINERS WITH FLAMMABLE, EXPLOSIVE AND NON-LIFE SUPPORTING ATMOSPHERES.
- B. EMPLOYEES MUST ENTER OR OTHERWISE BE EXPOSED TO THESE ATMOSPHERES FROM TIME TO TIME.
- C. METERS ARE USED TO ASCERTAIN THE CONDITION OF THE ENVIRONMENT TO WHICH WE ARE GOING TO EXPOSE OUR PEOPLE.
- D. LET'S US KNOW WHETHER IT'S SAFE TO OPERATE EQUIPMENT.

III. ABOUT THE METER (actually two meters in one)

A. OXYGEN -

ELECTROCHEMICAL FUEL CELL THAT DEVELOPS A VOLTAGE WHICH IS PROPORTIONAL TO THE OXYGEN CONCENTRATION OF THE GAS PASSING THROUGH THE CELL. THE CELL IS DEPLETED OR USED UP AS OXYGEN MEASUREMENTS ARE MADE.

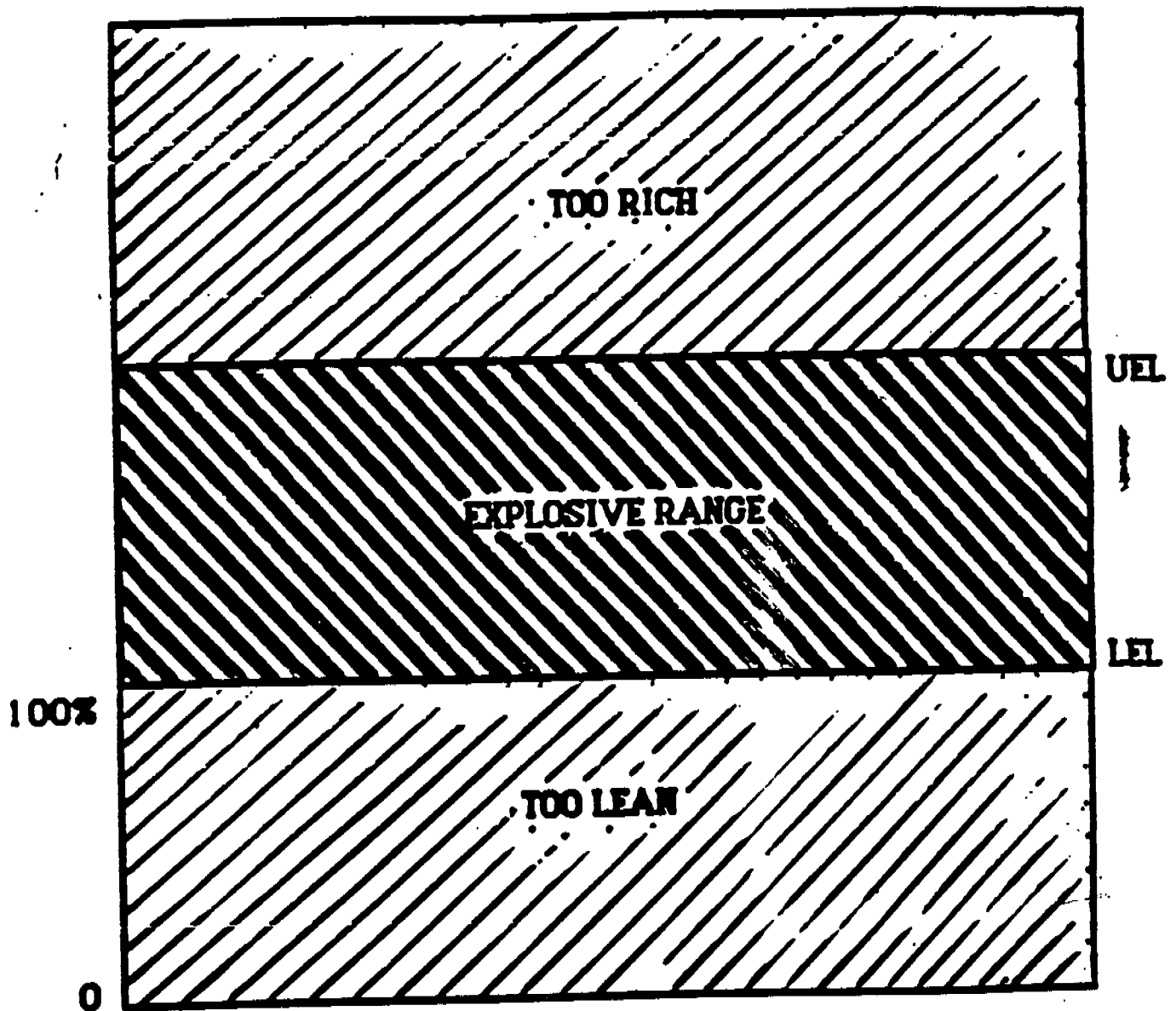
B. COMBUSTIBLE -

CATALYTIC BEAD IN CELL WHOSE TEMPERATURE IS CHANGED BY THE AMOUNT OF COMBUSTIBLE GAS IN THE SAMPLE. AS THE TEMPERATURE IS CHANGED, ITS' RESISTANCE CHANGES, UNBALANCING ONE LEG OF A WHEATSTONE BRIDGE CIRCUIT COMPARED TO A SECOND BEAD WITHOUT CATALYST THAT WILL NOT REACT TO THE COMBUSTIBLE GAS. THIS TYPE OF CELL REQUIRES SOME OXYGEN (10%) FOR SUCCESSFUL OPERATION.

IV. TERMS

- A. LEL (LOWER EXPLOSIVE LIMIT -** The least concentration of a combustible gas in air that will ignite.
- B. VAPOR DENSITY -** The weight of a gas as compared to air.
- C. OXYGEN DEFICIENT OR RICH ATMOSPHERE -**
The combustible gas sensor requires at least 10% oxygen and a maximum of 25% oxygen to work accurately

LOWER EXPLOSIVE LIMIT (LEL)



OXYGEN DEFICIENT ATMOSPHERES & *YOU*

OXYGEN % IN AIR (APPROX. 21% NORMAL)

AT REST SIGNS & SYMPTOMS

12 - 18%

BREATHING & PULSE RATE INCREASED;
COORDINATION POOR.

10 - 12%

DEEP, FAST RESPIRATION; GIDDINESS;
POOR JUDGEMENT; LIPS BLUE.

8 - 10%

NAUSEA; VOMITING; INABILITY TO
MOVE FREELY; UNCONSCIOUSNESS;
ASHEN FACE.

6 - 8%

8 MINUTES - 100% FATAL
6 MINUTES - 50% FATAL
4 MINUTES - ALL RECOVER WITH
TREATMENT

4%

COMA IN 40 SECONDS; CONVULSIONS;
RESPIRATION CEASES.

0%

INDIVIDUAL IMMEDIATELY BECOMES
UNCONSCIOUS; WILL RECOVER ONLY IF
GOOD AIR IS IMMEDIATELY AVAILABLE

WARNING: THE WARNING SYMPTOMS OF AN ATMOSPHERE DEFICIENT IN OXYGEN ARE COMPLETELY INADEQUATE AND, ALTHOUGH, A TRAINED OBSERVER MAY, WHEN ALERT, RECOGNIZE THE INCREASE IN PULSE AND RATE OF BREATHING IN TIME TO RETURN TO GOOD AIR, THE AVERAGE INDIVIDUAL FAILS TO RECONIZE THE DANGER UNTIL HE IS TOO WEAK TO SAVE HIMSELF, ESPECIALLY WHERE THE RETURN TO GOOD AIR INVOLVES CLIMBING STAIRS OR A LADDER.

EXPLOSIMETER LIMITATIONS-- IT CAN'T DO IT ALL

Instruments by design and application, have specific limitations. The Explosimeter is no exception. The following information indicates these areas, and it's imperative that anyone operating an explosimeter **know** and **understand** them before using them in the field.

1. The explosimeter is a tool to assist in the planning and preparation of some jobs (hot work, vessel entry, etc.). It does not replace preparation, planning, and common sense, and should not be regarded as a guarantee that a job is safe.
2. The explosimeter cannot measure or detect chemical irritation and/or toxicity.
3. The explosimeter is designed to process certain **gaseous** or "**dry**" vapor samples **only**. It **should not** be used on liquids, solids, dusts, mists, or "wet" vapors.
4. The explosimeter is designed for use over a temperature range of 10 - 110° F. If a unit is to be used in a area where the ambient temperature is 110° F or above, the explosimeter should be first checked and calibrated under similar conditions. Make sure the area used to check the meter is known to be free of combustibles. Sample temperatures should be the same as the explosimeter, otherwise, condensation of the sample vapors may occur causing false readings.
5. The explosimeter is designed to detect the presence of flammable gas or vapors **in air**; it will not work on such gases in inert atmospheres.
6. The explosimeter should not be used to check for flammable mixtures which contain less than 10% or more than 25% oxygen.

7. There are some gases which affect the accuracy of, or damage, the oxygen sensor. Strong acid gases (HCl, sulfuric, etc.) may damage the oxygen sensor by permanently changing the pH in the electrochemical cell.
8. Some gases or vapors, even though non-flammable, may result in explosive readings if sampled.

Helium, because it is lighter than air, has a cooling effect on the sensor causes a negative response.

Argon tends to insulate the sensor and cause an increase in the meter's response.

Many **Freons** decompose upon contact with the sensor and cause an explosive reading.

9. **Tetraethyl lead, silicones, and many sulfur compounds** will poison the catalytic activity of the combustible sensor causing incomplete combustion and lower explosive readings or no response at all.
10. Keying portable radios within 10 feet of the explosimeter can cause false readings on the explosimeter.

PRE-USE CALIBRATION CHECK OF BIO MARINE 902 & GASTECH GX-3
COMBUSTIBLE GAS/O₂ MONITORS

1. CHECK UNITS WITH HOSE & PROBE CONNECTED..
2. CHECK FILTER & WATER TRAP. SHOULD BE CLEAN AND DRY.
3. CHECK BATTERY VOLTAGE. NEVER CALIBRATE ANY METER WHILE PLUGGED INTO THE CHARGER.
4. CHECK PUMP FLOW AND ALARM.
5. CHECK OXYGEN READING IN AIR. SHOULD BE 21%. IF NOT, ADJUST TO READ 21%.
6. CHECK COMBUSTIBLE GAS ZERO. IF NOT ZERO, ADJUST TO READ ZERO.
7. INTRODUCE CALIBRATION GAS (2.5% METHANE IN AIR). COMBUSTIBLE GAS METER SHOULD GO UPSCALE TO 2.5% ON BIO MARINE UNITS OR TO 55% LEL ON GASTECH UNITS. IF READING IS INCORRECT, ADJUST WITH GAS SPAN POT TO OBTAIN PROPER READING. THE SPAN POT FOR BIO MARINE UNITS IS LOCATED ON TOP CONTROL PANEL. THE SPAN POT FOR THE GASTECH GX-3 UNIT IS LOCATED IN THE FRONT CHAMBER, SPAN POT #3.
8. IF UNITS CANNOT BE ADJUSTED PROPERLY, OR IF YOU FEEL THE UNIT IS NOT OPERATING CORRECTLY, DO NOT USE IT. TAG THE UNIT AND SEND IT TO THE CENTRAL INSTRUMENT SHOP FOR A THOROUGH CHECKOUT AND REPAIR.

PRE-USE CALIBRATION CHECK OF GASTECH 1214SMP
COMBUSTIBLE GAS/O₂ MONITOR

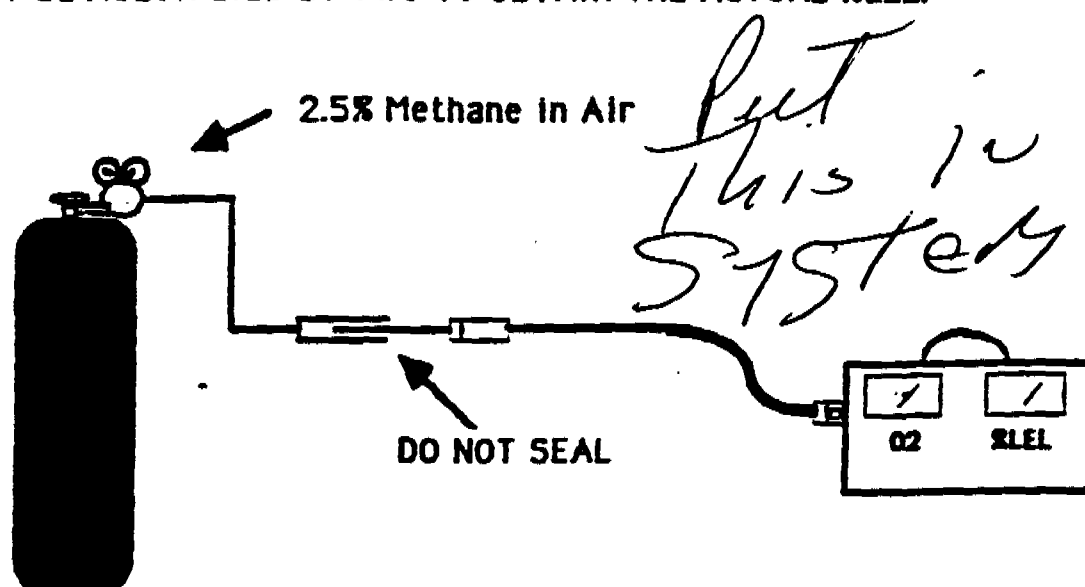
1. CHECK UNITS WITH HOSE & PROBE CONNECTED.
2. CHECK FILTER & WATER TRAP. SHOULD BE CLEAN AND DRY.
3. PRESS RED "POWER" SWITCH TO TURN UNIT ON. THE STATEMENT "GASTECHTOR ON - TAKE TO GAS FREE AREA" WILL SOUND AND DISPLAY WILL BLINK. THE UNIT DISPLAY WILL CONTINUE TO BLINK FOR A TWO MINUTE WARM-UP PERIOD.
4. AFTER THE TWO MINUTE WARM-UP PERIOD HAS ELAPSED, THE STATEMENT "PRESS ADJUST BUTTON" WILL SOUND. PRESS THE BLACK ADJUST BUTTON. UNIT SHOULD THEN READ 20.9% O₂ and 0 COMBUSTIBLES. ANYTIME THE ADJUST BUTTON IS PRESSED THEREAFTER, THE UNIT WILL DISPLAY THE NUMBER OF BATTERY HOURS REMAINING.
5. CHECK PUMP FLOW.
6. INTRODUCE CALIBRATION GAS (2.5% METHANE IN AIR). METER SHOULD READ 55% LEL. IF NOT, ADJUST SPAN POT LOCATED ON SIDE OF UNIT AND MAKE METER READ 55%.
7. IF UNIT CANNOT BE ADJUSTED PROPERLY, OR IF YOU FEEL THE UNIT IS NOT OPERATING CORRECTLY, DO NOT USE IT. TAG THE UNIT AND

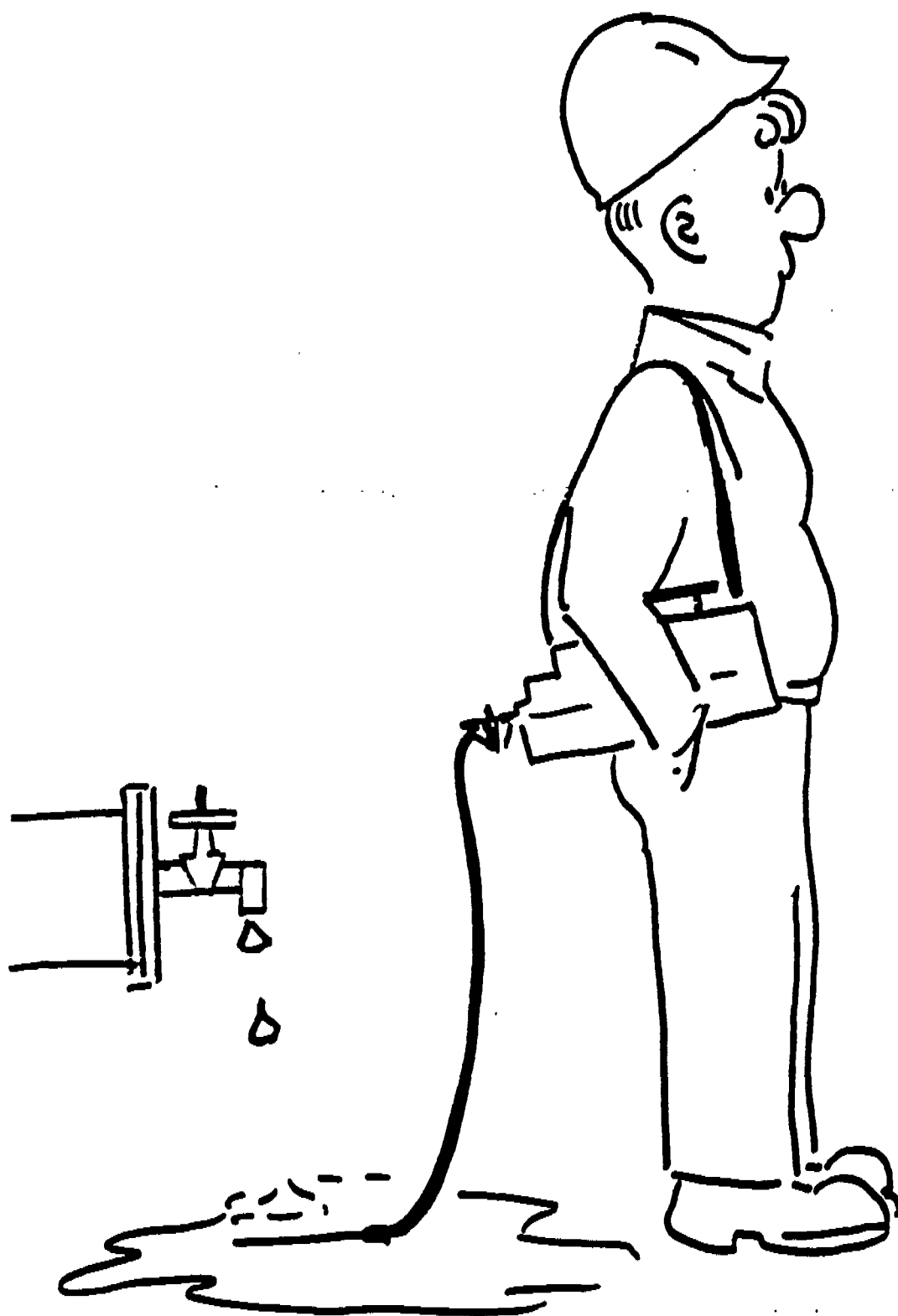
DO 014690
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CHECKING FOR COMBUSTIBLE GAS IN INERT BACKGROUND USING SPECIAL FITTING ON STANDARD EXPLOSION METER

1. Calibrate unit without special fitting using 2.5% Methane in air cal. gas. Combustibles should read 55% LEL. If not, adjust span so that meter does read 55% LEL. Oxygen should read 21%.
2. Put special fitting on unit and introduce cal. gas again (2.5% Methane in air). Combustibles should read approximately 27.5% LEL. Oxygen should read 21%.
3. Put 2.5% Methane in Nitrogen in unit. Combustibles should read about 27.5% LEL. Oxygen should read approximately 10.5%.
4. THE UNIT IS NOW READY TO BE USED.
5. After a line has been checked with a standard (without fitting) meter and the line has less than 10% oxygen, you would then use the special meter (with fitting) and check the line for combustibles.
6. Always be aware of your oxygen reading when using the meter with the fitting on it. Your oxygen reading can tell you many things. For example, the oxygen reading taken without the fitting must differ from oxygen reading taken with the fitting in place.

NOTE: ANY COMBUSTIBLE GAS READING OBSERVED WHILE USING THE UNIT MUST BE MULTIPLIED BY TWO TO OBTAIN THE ACTUAL %LEL.



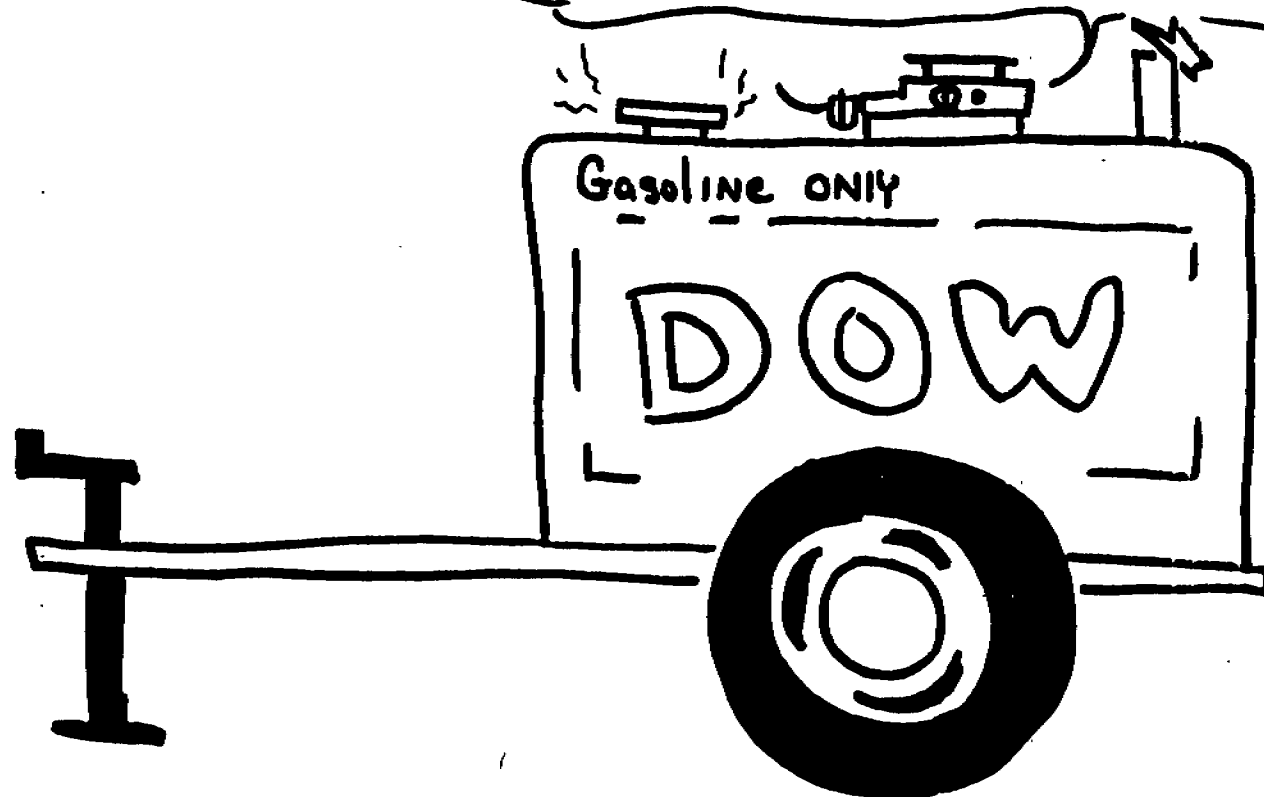


METERS ARE NOT DESIGNED TO
TAKE LIQUID SAMPLES

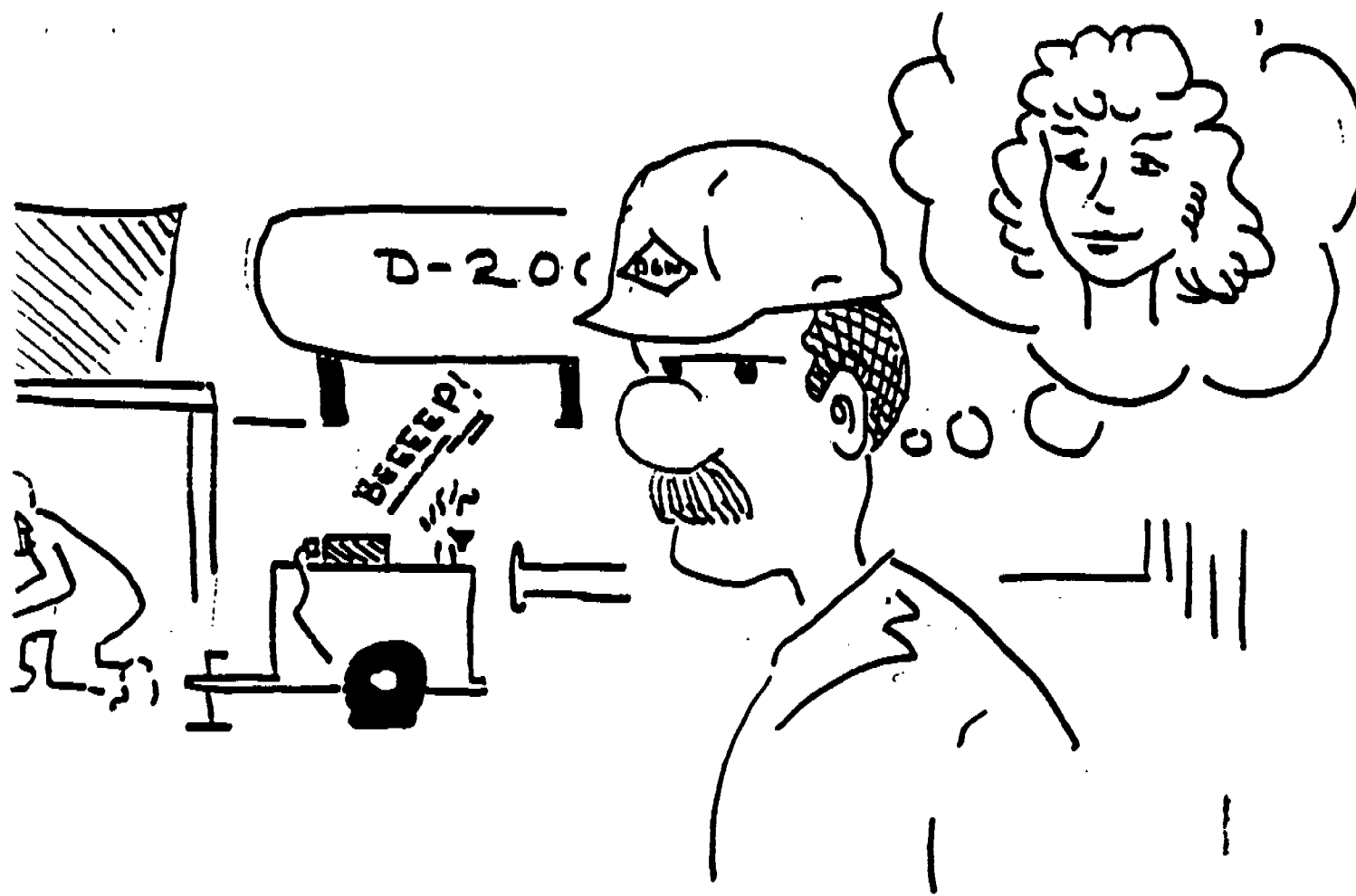


METERS SHOULD NOT BE USED TO
MEASURE COMBUSTIBLE GAS IN
ATMOSPHERES THAT ARE OXYGEN
DEFICIENT

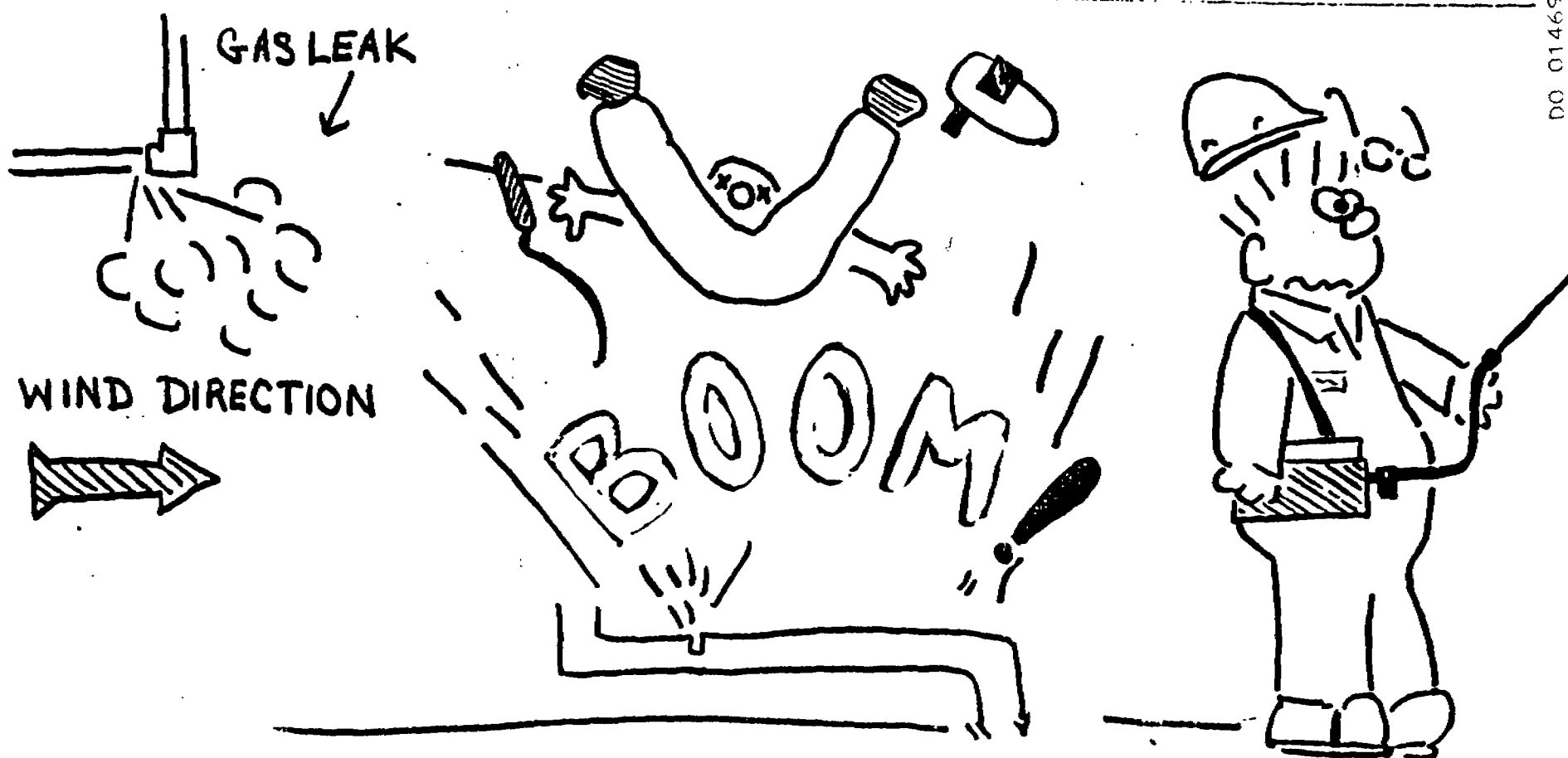
GAS TECT-ORR CRAZEEE
TAKE TO BLASSS AREA



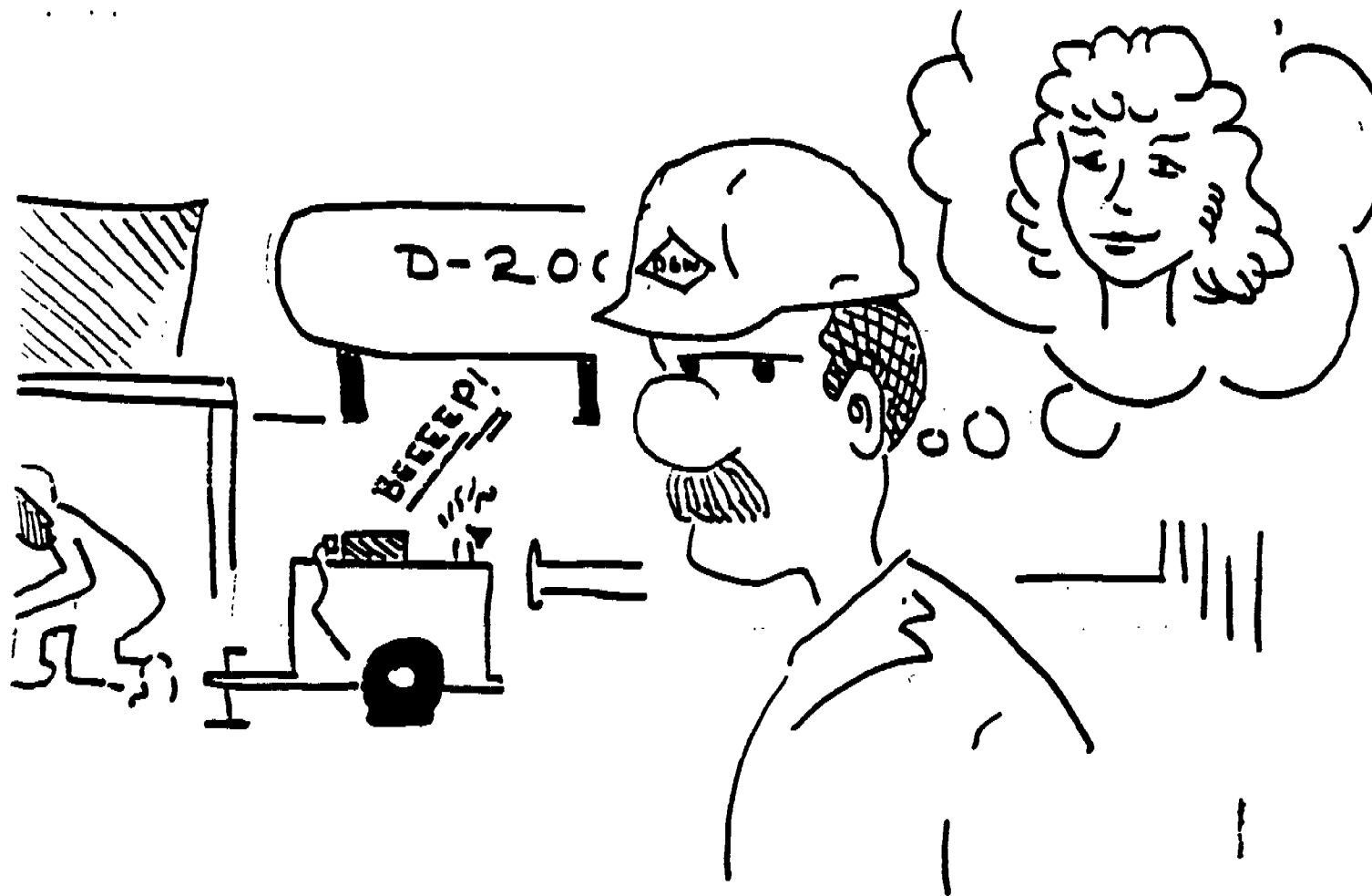
TETRA ETHYL LEAD OR SILICON
COMPOUNDS POISON COMBUSTIBLE
GAS SENSORS



BE ALERT!



WHEN ACTING AS SAFETY OBSERVER
ALWAYS LOOK FOR POTENTIAL HAZARDS
FROM SURROUNDING AREAS



BE ALERT!

 MINIMUM SAFETY EQUIPMENT REQUIRED IN C. M. P. ACID AREAS

	WALK - THRU	OPEN LINES BLEED DOWN
C-202 BTMS.	SLICKER SUIT / GOGGLES / RUBBER BOOTS, GLOVES	FULL ACID SUIT
E-212	SAME AS ABOVE	SAME AS ABOVE
H2SO4 T/C RACK (CAR CONNECTED)	SAME AS ABOVE	SAME AS ABOVE
T-900	SAME AS ABOVE	SAME AS ABOVE
C-650	SAME AS ABOVE	SAME AS ABOVE
C-202 DECKS	GOGGLES	FULL ACID SUIT
H2SO4 T/C RACK (CAR NOT CONNECTED)	GOGGLES	GOGGLES (EXCEPT H2SO4)
C-210	GOGGLES	SLICKER SUIT / GOGGLES / RUBBER BOOTS, GLOVES
C-200 / C-201 BTMS.	GOGGLES	SAME AS ABOVE
P-301'S	GOGGLES	SAME AS ABOVE
C-610 / R-600	GOGGLES	SAME AS ABOVE

 SAMPLES.

C-200 / C-201	SLICKER SUIT / GOGGLES / RUBBER BOOTS, GLOVES
C-610	SAME AS ABOVE
C-650	FULL ACID SUIT
H2SO4 T/C	FULL ACID SUIT
C-202 BTMS.	FULL ACID SUIT

* CONTRACTORS IN ACID AREAS FOLLOW A DIFFERENT SET OF PROCEDURES.
(SEE PROCEDURE FOR CONTRACTORS WORKING IN ACID AREAS.)

revised: 2/91
JRC/DRD

DO 014698
CONFIDENTIAL

CHLORINATED METHANES
SAFE JOB PROCEDURE

Department: CMP

Job Title: R-250 PROBLEM SOLVING

Scope: GENERAL INFORMATION ON POSSIBLE PROBLEMS AND CORRECTIVE MEASURES

1. POSSIBLE CAUSES OF HIGH INLET PRESSURE ON R-250A

- A. The reactor is carboning up causing a large pressure drop making it more difficult to run the same loads. (May need to cut the reactor rates and run in this condition until the reactor can be recharged)
- B. Excessive load on the reactor. (Cut Rates)
- C. Liquid methanol carryover from E-256 into E-245, causing flashing in E-245 which results in pressure swings. (Check the reactor temperature profile, carrying over liquid can cause the reactor and oil temperature's to decrease. Also check the methanol flow meters, as they are swing badly that will indicate flashing across the flow meters.

2. POSSIBLE CAUSES OF HIGH DIFFERENTIAL PRESSURE ON R-250A

- A. Reactor bed carboning up causing a high inlet pressure and a high differential pressure reading stable.
 - a. Increase rates
 - a. Reduce reactor

3. POSSIBLE CAUSES WHY THE MEDH LOW PRESSURE SWITCH ACTIVATED.

- A. E-256 methanol pump tripped off line. When activated it energized the auxiliary pump.
 - a. Have someone check pumps and reset switchgear. or repair.
- B. Recirculation valve on pumps is opened to much for the load you are attempting to run.
 - a. Cut the recirculation valve back
- C. Excessive rates on both R-250's. (cut rates)

CONTINUATION FROM #2

D. Switch Malfunctioned.

- a. If the auxillary pump activated, did the switch clear.
- b. Check TDC group 77, mech flow transmitter and see if the incoming flow is still stable.
- c. Check E-256 level and valve output. Has the valve output started increasing trying to maintain level, if not the switch is probably bad
- d. Contact instrument personnel to repair

E. C-210 has to be shutdown/R-213

a. In event of C-210 shutdown do the following

1. Lower the column recycle temperature to decrease the overhead temperatures of the quench column. Have the overhead temp no greater than 25 deg C.

2. If necessary, will have to adjust the recycle flow to the quench column to control the temperature of the overheads.

F. LEVELS RISING AND INCREASING SLOWLY INCREASING.

a. Check system is functioning properly.

1. Check the flow to the thro. from E-259 should be about 200-400 gpm/hr.
2. Check C-210 drain temperature. See if it's running at its normal temperature.
3. Check E-207 R-12 level. May be to low (increase)
Make sure the reflux flow is coming from C-850 bottoms.
4. Check E-207 R-12 level may be to low (increase)
Blow down the level transmitter it may be full of oil causing a miscellaneous reading.
5. Check E-259 level transmitter. If this trans is indicating a level and E-259 is actually empty, we will be blowing back to C-350 (this is just as if the system wasn't on line)

G. Increase in M1 from C-240.

- a. Check C-240 overhead temperature. Make sure it is running normal. If not goto "b"
- b. Check D-240 R-12 level. Should be running approx 35%.

CONTINUATION FROM #5

- C. Someone may have increased the N2 seal purges on K-350. Check and make sure its at a normal rate.
- D. A piece of equipment which contain N2 due to padding or purging has just been placed in service.
- E. N2 ESW's on the R-250's are leaking by. Manually block them in.

6. POSSIBLE REASONS WHY THE INDEPENDANT HIGH LEVEL ALARM ACTIVATED ON E-256.

- A. It is actually true.
 - a. Immediately cut back you level in E-256 monitoring the pressure. We don't want to take a chance of pumping liquid into the reactor. See at what level the alarm clears.
 - b. Check both level transmitters see if they agree. Should be running approx 25-30%. If they are both running within their normal range and agree the switch may be bad. However; if the control transmitter is reading within its normal range and the redundant level indication (group 118) is reading high, the switch is probably right. NOTE: you can carry over liquid in this vessel at a 50% level indication.
 - c. Check the methanol flow meters. If they are swinding then you are most likely passing liquid across the flow orifice.
 - d. Check the reactor and oil temps. If the, are falling, this could indicate liquid methanol.
 - e. Have the level transmitters checked by instrument personnel.
- B. If all the above checks OK then have instrument personnel check the switch.

7. POSSIBLE REASONS WHY THE ADIBATIC TEMPERATURES SLOWLY INCREASING.

- A. When the isothermic section of the reactor starts to carbon up it degrades the amount of reaction that takes place in the top section therefore; the reaction increase in the bottoms section. With more reaction there is more heat. (INCREASE THE OIL TEMPERATURE A FEW DEGREES HOTTER THAN NORMAL. THIS WILL HELP BRING THE REACTION BACK UP INTO THE ISOTHERMIC SECTION).
- B. If the Inlet OIL TEMPERATURE is too low it will cause the isothermic section of the reactor to run at a cooler rate which will not be sufficient to react the HCL and MECH. As in item (A) the majority of the reaction will take place in the bottom of the reactor. (INCREASE THE OIL TEMPERATURE TO ITS NORMAL OPERATING LEVEL)
- C. Excessive rates can cause the bottoms temperature to increase (LOWER THE RATES ON THE REACTOR TO REDUCE TEMPERATURE)

8. POSSIBLE CAUSES OF LOW INLET AND REACTOR TEMPERATURES.

A. Liquid in the inlet line

- a. Check E-256 level, it may be carrying over liquid (see item# 11)

B. Lost heat transfer in superheaters.

- a. Check oil temperature to superheaters and also check control temperature. (IF THE OIL TEMPERATURE IS OPERATING BELOW NORMAL CONDITION INCREASE)
- b. Low oil flow to the reactor due to low setpoint setting, control valve problems, transmitter problems and pump problem.

If the transmitter were to drift high it would cause the valve output to decrease, thus decreasing the actual oil flow through the reactor. Check the total oil flow transmitter to the reactors and do some calculation to see if the number is close within a reasonable limit.

The pump pressure should be between 50-70 pounds depending on inlet pressure.

9. LOW INLET LINE TEMPERATURE'S CAN INCREASE THE CORROSION RATE.

A. ALL PLACING LOW THE REACTOR FLOW IS SWINGING.

- a. E-256 level is carrying over liquid.

- a. see item # 11

B. Transmitter is malfunctioning

- a. Blow the high and low level legs of the transmitter down and see if after blowing down it quits swinging. If not have instrument personnel check.

10. POSSIBLE REASONS THE LOW LEVEL ALARM ACTIVATES ON E-256.

A. E-256 level is actually low.

- a. Check the pressure control valve. If the level is actually lower than normal the valve output on the steam valve will be higher than normal, for any given feed rate. The pressure may be falling. If the exchanger goes empty the steam valve will go wide open trying to control pressure and the pressure will continue to fall.

CONTINUATION OF ITEM #10

- b. Check the redundant transmitter on E-256 which is located in group 118 on the TDC. See if the level indication agree's with the control transmitter. If so than the transmitter is probably ok. If not have instrument personnel check the transmitter.
- c. The level setpoint may be set to low. (increase)
- d. The P-255 tripped off line or the recirculation valve on the pump is open to much for the feed rate you are trying to run (there is a MECH header low pressure switch which will activated if the pressure gets low and it will enegize the auxillary P-255).

11. POSSIBLE REASONS E-256 PRESSURE SLOWLY DECREASING AND STEAM VALVE WINDING UP.

A. See item # 10 a.

12. POSSIBLE REASONS THE MODICON KEEPS YOU FROM GOING ON HEAT UP.

A. The modicon permissives haven't been met

a. If HCL flow was greater than 3000# hr or the HCL control valve output wasn't at "ZERO" when the "HCL ADV" switch was set to the open position and the reset button was hit.

b. If "a" was ok, however; once the modicon opened the HCL ADV, the operator failed to reach the minimum HCL or M1 flow required in the time frame (120 sec) allowed (HCL=120)(M1=500).

c. When using the HCL heatup or M1 and the flow falls below the minimum setpoints.

B. The "ADV" has malfunctioned. Check the air to the ADV, If ok, have instrument personnel check transmitter.

C. Faulty HCL ADV SWITCH on the board. Have instrument personnel check.

D. Fault in the program. If items "Aa,B & C" are ok contact modicon personnel.

BASIC PUMP MODULE

Reviewed

2-12-91 ORC

PURPOSE: This module is to familiarize you with the Basic Operation and maintenance of a pump. On completion of this module, you have a basic understanding of how a pump operates and the necessary maintenance required for proper pump operation.

RESOURCE: (Pump Pilot Course, Human Resource, Pump manual)

REQUIRED LEVEL OF PERFORMANCE: 100%

OBJECTIVES:

1. Explain the operation, function, maintenance and instrumentation on the following.
 - A. Seal
 - B. Coupling
 - C. Coupling Guard
 - D. Seal Flush
 - E. Motor + Starter
 - F. Recirc. Flows
 - G. Lubrication
 - H. Impeller
2. Physically locate and explain the function and operation of a start/stop station and the corresponding switchgear, including auto or remote start/stop and variable speed on any given pump.
3. Explain and special safety hazards associated with the equipment.
4. Explain what the major causes of bearing failure are, and how these conditions can be eliminated.
5. Explain what the major causes of seal failure are, and how these conditions can be eliminated.
6. Demonstrate checking and adding oil to any given pump.
7. Demonstrate how to properly locate all pump parts at the cellulose warehouse using the pump parts book.
8. Demonstrate the proper procedure for taking a pump out of service and checking it for maintenance.
9. Complete a simplified drawing of the oil mist system.
10. Explain the function of the oil mist system and how it operates.
11. Explain how you would determine what type oil is used for the oil mist system.
12. Explain why rotation is checked on a pump after the motor has been changed out or the electrical system has been worked on.
13. Explain the following.
 - A. Mag Drive Pump
 - B. Can Pump
 - C. Centrifical Pump
 - D. In Lin Pump
14. Explain the difference between a Mag Drive Pump and a Canned Pump.

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DIFFERENCES BETWEEN CAN AND MAG DRIVE PUMPS

Both canned pumps and magnetic drive pumps have moving parts and sleeve bearings, which are lubricated by pumping fluid through them. They both lose efficiency because of the can.

Magnetic drive pumps use conventional, exterior mounted motors, where as canned pump motors are an integral part of the pump.

The canned pump motor is subject to the heat of the pumped fluid and the motor also adds heat to the pump.

In a mag drive pump the only barrier between the fluid and the moving parts is a non-magnetic can. In a can pump the motor shell provides containment since there are no moving parts outside of the can. This allows the can pump to be used with a higher pressure application.

The can motor is considered safer for critical application. Although the mag drive pump can be made thicker to retain high pressure, it further reduces electrical efficiency.

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MAGNETIC DRIVE PUMPS

Magnetic drive pump looks like a regular conventional pump, but their operating principles and design are quite different.

The main and most distinct difference is that magnetic drive pumps are sealless - no mechanical seals as in conventional pumps. In magnetic drive pumps, a conventional motor drives a magnet which in turn drives another magnet that is attached to the back end of the pump shaft. The two magnets are separated by a non-magnetic can (shroud). This shroud, which is usually .020-.080" thick, is the only protection you have of maintaining the liquid within the pump or preventing an environmental incident. For this reason, the shroud should be monitored at all times. Nearly all malfunctions can be detected by monitoring the liquid temperature in the shroud area. Approximately 3-5% of the pumped fluid is required to lubricate the shaft sleeve bearings and remove heat in the magnet area.

The main reasons for magnetic drive pump failures are:

1. running dry/cavitation
2. dead heading
3. solids in the fluid
4. permanently greased anti-friction bearings

The magnetic drive pumps are equipped with two thermocouples to show signs of these problems. The front thermocouple measures the temperature of the recirculated fluid used to lubricate the bearings and remove heat from the magnet area. This thermocouple will protect us in the event we dead head the pump, start the pump with the suction blocked or anything else that will cause this fluid to heat up. The back thermocouple monitors the temperature of the bearings or misalignment problems. These temperature points should normally run about 10-15 deg c above the inlet fluid temperature with the alarm set at 20 c above the inlet temperature; therefore as the ambient temperature changes or during seasonal changes we may have to adjust the alarm setpoint. The most important thing is that if you get the alarm 20 c above the inlet temperature, you must react quickly.

The recirculated fluid serves a very vital function to the operation of the pump. As indicated above, its purpose is to lubricate the shaft sleeve bearings and remove heat in the magnet area. There is a minimum flow required to remove the necessary heat from the pump. This is the reason for the automatic recirculation valve on P-259B. If someone blocks in the discharge, the automatic recirculation valve automatically bypasses a designed amount of fluid to remove the heat. If this is also blocked in, you will wreck the pump.

TROUBLE SHOOTING

If you get an alarm 20 deg c above the inlet temperature, immediatly investigat to try to determine the problem.

1. Look at the discharge pressure guage to make sure the pump is not cavitating. If it is, immediatly shut the pump down and correct the problem.
2. Listen closely for any noise. This is also an indication of cavitation or the pump may be running dry.
3. Check to make sure that everything is lined up properly. Check the pump recirculation first.
4. Feel the pump by hand to see if it is truly running hotter than normal; however, if both temperature points increased, the instruments are probably correct.
5. If all else fails, call maintenance tech to check for vibration or excessive rubbing problems.

The main point to remember is that you need to take action as soon as you get an alarm.

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CANNED MOTOR PUMPS

A canned motor pump is a sealless centrifugal pump. In the pump the motor rotor is connected to the pump shaft and enclosed in a non-magnetic "can". This assembly is then inserted into the motor stator. The magnetic stator drives the rotor, just as with a conventional motor. Since the can is imposed within the magnetic field, the motor efficiency is reduced.

The rotor and all the bearings and moving parts of a canned motor pump are inside the can and exposed to the pumping fluid. This requires a sleeve-type bearing that must be lubricated by the fluid.

Canned motor bearing especially the rear bearings can get quite hot. Heat is generated by bearing friction as well as by the totally enclosed motor. To prevent flashing or decomposition of the lubricant and premature bearing failure, canned pumps must provide a positive flow of pumping fluid through the bearings. In some applications the fluid may have to be cooled or filtered before entering the bearings.

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BASIC PUMP MODULE RESOURCES

ITEM

DEFINITION

ADAPTER - A mechanical piece used to permit assembly of two other parts or for a spacer.

ADAPTER,BEARING - A cylindrical piece used to mount a bearing on a shaft.

ADAPTER,TUBING - A cylindrical piece used to connect discharge case to enclosing tube.

BASE - A metal pedestal to support a pump.

BASE PLATE - A metal plate on which the pump and motor are mounted.

BEARING,INBOARD - The bearing farthest from the coupling of a pump.

BEARING,OUTBOARD - The bearing nearest the coupling of a pump.

BEARING,JOURNAL THRUST - A removable cylindrical piece mounted on the shaft and which turns in the bearing.

BOWL - The enclosure within which the impeller rotates.

CAN,ROTOR - A thin cylindrical part that separates the motor rotor from the pumped fluid.(can pumps)

CAN,STATOR - A thin cylindrical, non-magnetic part that separates a stator core assembly from the pumped fluid.(can pumps)

CASING - The portions of the pump which includes the impeller chamber and volute.

CAVATION - When the pressure at the inlet drops too low then bubbles form and absorb heat. As these bubbles move out to the higher pressure the bubbles collapse. This collapse can be quite violent and can cause severe damage.

COUPLING- A device which is used to connect the motor to the pump.

COUPLING GUARD - A protective shield which is placed around/over a coupling.

COUPLING KEY - A rectangular piece of metal used to prevent the shaft from rotating inside a coupling half.

DO 014709
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DEFLECTOR - A flange or collar around a shaft, rotating with it to prevent passage of liquid,grease,oil or heat along the shaft.

DISCHARGE CASE - A guide for liquid flow from the bowl to the pump

column.

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FRAME - The part of the pump which the bowl and bearing housing are assembled to and houses the rotating unit.

GASKET - material such as garlock or teflon of proper shape and characteristics for the use in joints and between flanges to prevent leakage.

GASKET, BOWL - A gasket (garlock, teflon) that is used to seal the joint between the main pump body and the bowl.

GASKET, IMPELLER - A material used (teflon) to seal the joint (space) between the end of the pump shaft sleeve and the impeller.

GLAND - A follower which compresses packing in a stuffing box or retains the stationary element of a mechanical seal.

HOUSING, BEARING - A body in which the pump bearings are mounted.

HOUSING, STATOR - A body in which the stator is mounted. (elec)

IMPELLER - The bladed member of the rotating assembly of the pump which imparts the principal force to the liquid pumped.

IMPELLER KEY - a rectangular piece of metal used to prevent the impeller from rotating relative to the shaft.

LOCKWASHER - A device used to prevent loosening of a nut.

OILERS - A device/sightglass which is used on the bearing housing of a pump to maintain a level of oil in the bearing housing.

OIL SEALS - A device used in the bearing housing of a pump to seal the oil in and keep it from escaping to atmosphere.

OIL MIST SYSTEM - A system which supplies a fine oil mist through tubing into the bearing housing of a pump. This type system eliminates the use of oilers on a pump.

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RELIEF VALVE - A mechanism to control the maximum pressure that the pump can put out.

ROTOR ASSEMBLY - A rotating assembly of an electrical machine containing laminations and conductors, interaction with a stator core assembly produces torque.

SEAL - A device used to prevent the flow of a liquid from the pump suction/stuffing box to the atmosphere.

SEAL, MECHANICAL - A device flexibly mounted on the shaft in or on the stuffing box and having a smooth face held against the stationary sealing face.

SEAL, MECHANICAL COMPONENTS - A compression unit, hard face (rotating units) and a carbon (stationary unit)

STATOR CORE ASSEMBLY - The fixed assembly of an electrical machine containing lamination and windings which creates magnetic fields.

STRAINER - A device used to prevent large objects from entering a pump. (usually wire mesh screen type)

STUFFING BOX - A portion of the casing through which the shaft extends and the packing and a gland or a mechanical seal is placed to prevent leakage.

TEST VALVE - A device to control the flow through the test pipe.

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BASIC PUMP MODULE RESOURES

MECHANICAL SEALS

Pumps handling hazardous or expensive liquids, or liquids where the necessary leakage from the stuffing box is objectionable, are often furnished with a mechanical seal.

A mechanical seal consists of a rotating element and a stationary element. The sealing faces are highly lapped surfaces (extreamly flat) on materials selected for there low coefficient of friction and their resistance to corrosion by the liquid being pumped. The faces have a minute running clearance and normally run with a very thin film of liquid. In addition, there must be means of loading the seal and providing flexibility. This is accomplished by the use of springs and shaft packing or with a flexible member of some organic material.

Mechanical seals are more widly used than shaft packing because they require less maintenance and hold leakage to a minimum.

The stationary seal ring is usually made of carbon. The rotating seal ring unit is comprized of a compression ring (springs) and a seal ring (hard face) and the seal ring is faced with a special metal where it comes into contact with the stationary unit (carbon). The compression unit is held in place on the shaft by allen screws. This allows the compression unit and the seal ring to move freely on the shaft.

The entire sealing unit operates by the springs pushing against the compression ring and compress the flexible (O) ring against the shaft and seal ring against the carbon to prevent leakage at this point.

There are some applications which require a seal flush to cool down the seal. Excessive heat will cause the seal to lose its load carrying capacity. Also if the liquid contains solid corrosive material a seal flush will keep the seal faces clean.

Seal typically fail because the carbon weares out. How ver there are other causes of seal failure such as EXCESSIVE HEAT, SHAFT MISALIGNMENT, PUMP MISALIGNMENT, BAD PUMP BEARINGS, PUMP CAVITATION AND DIRTY SERVICE.

HEAT causes a variety of problems that are not always obvious. When a teflon chevron ring (a ring inside the rotating seal ring used for sealing against the shaft) gets hot it will get soft and extrude into parts of the seal and cause the seal ring to lock on the shaft, then the seal is no longer able to move on the shaft and compensate for wear. Excessive heat will cause some acids to become very corrosive. Loss of a seal flush will cause the seal to overheat. Running a pump dry will cause the sealing faces to lose its film of liquid between them and overheat and cause excess friction and damage to the seal.

DIRTY SERVICE will cause the small springs to become clogged and will lose its ability to move on the shaft and compensate for wear. The abrasive particles may cause a grinding action on the shaft. If the stuffing box is small the solids will build up and prevent the fluid from reaching them.

BAD BEARINGS, SHAFT MISALIGNMENT AND PUMP MISALIGNMENT cause the seal to separate slightly allowing for uneven wear of the carbon and rotating seal ring thus resulting in leakage.

BASIC PUMP MODULE

TANDEM SEALS

Tandem seals are a specially designed seal for use in pumps where fluid problems exist. In our case they are mostly installed on equipment which contains METHYL CHLORIDE which has a one hundred pound reportable.

Tandem seals consist of two bellows seals with one gland. The inside seal has an oil flush which cools and lubricates the seal. The oil (cp 6000) which lubricates the seal comes from an external oil pot located next to the pump. The oil enters the seal where it comes in contact with pumping paddles which are built into the seal itself. The pumping paddles help move the oil through the seal and back to the oil pot. If the inside seal should start to leak the product will enter the oil and then the oil pot. It will cause the pressure on the pot to increase. This is one good indication that the inside seal has blown. If this should occur, depressure the oil pot to the throx and block it back in. Monitor the time in which it takes for the pot to repressure back up. If it pressures back up fairly fast, the pump needs to be taken down and the seal repaired.

Seal failure will result if the oil flow to the seal is lost. If the oil pot goes empty, the seal will run dry and overheat. If the oil level is too high it will become harder for the oil to circulate through the pump because of the extra head pressure (the oil returns to the pot about midway). Therefore it is very important that we maintain the proper oil level in the oil pot.

If oil needs to be added to the oil pot, it is best to swap pumps and shut the pump down before adding oil. This will keep from running the seal without an oil flush.

Use only CP-6000 in the oil pots for these seals. Do not use any type of regal oil. Standard regal oils are hydrocarbon based and will react with the HCL to form carbon. This carbon can get between the seal faces and cause the seal to fail.

The following pumps have tandem seal installed on them.

P-252 A&B	T-851
P-256 A&B	T-850
P-511	BLOCK 43
P-513	BLOCK 43
P-803 A&B	T-104'S
P-804 A&B	C-850 REFLUX

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BASIC PUMP MODULE RESOURCES

IMPELLER

Centrifugal force is the force of spinning. When an object is spun in a circle, it pushes (outward from/inward towards) the center of the circle. One way to increase the energy of a liquid is to whirl the liquid around in a circle. When it is spun around it pushes (inward to the center/outward from the center) of the circle. This outward force is called centrifugal force.

This is how a centrifugal pump operates. The liquid enters through the suction piping into the eye of the spinning impeller, the impeller whirls the liquid around in a circle. The liquid is forced from the center to the outside of the impeller. As the liquid starts to move to the outside of the impeller it picks up velocity as the liquid moves from the tips of the impeller into the case, its velocity is decreased and that sudden decrease in velocity causes an increase in the pressure.

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DO 014715
CONFIDENTIAL

COOLING TOWER 1020
SAFETY

PURPOSE: TO FAMILIARIZE YOU WITH THE BASIC SAFETY KNOWLEDGE REQUIRED WHILE OPERATING A COOLING TOWER AND RECIRCULATING COOLING WATER SYSTEM.

RESOURCES: P&ID'S, EXPERIENCED PERSONNEL, PRESSURE VESSEL DATA SHEETS

REQUIRED LEVEL OF PERFORMANCE: 100% CORRECT

OBJECTIVES:

1. State the hazards of the following chemicals
 - A. HCL
 - B. Chlorine
 - C. Treatment Chemicals
 2. State the procedure to be followed in the case of inhalation of the following gases.
 - A. Chorine
 - B. HCL
 3. State the reasons the following areas are restricted. Also explain the restrictions.
 - A. Tower Internal Walkway
 - B. Fan Shroud Area
 - C. Chemical Addition Area
 - D. Acid Injection Area
 - E. Chlorine Injector
 4. State the hazards to plant personel in the cooling tower area created by the following.
 - A. Wet Surface
 - B. Ice
 - C. Rotating Equipment
-

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COOLING TOWER 1020
PROCESS FAMILIARIZATION
TANKS AND VESSELS

PURPOSE: TO FAMILIARIZE YOU WITH THE PURPOSE, DESIGN, AND OPERATION OF MAJOR TANKS AND VESSELS IN YOUR AREA. UPON COMPLETION, YOU WILL BE ABLE TO POINT OUT (ON A BLANK DRAWING) THE INTERNAL AND EXTERNAL COMPONENTS (FLANGES, TAPS, BAFFLES, ETC) AND EXPLAIN THEIR FUNCTIONS.

RESOURCES: P&ID'S, EXPERIENCED PERSONNEL, PRESSURE VESSEL DATA SHEETS

REQUIRED LEVEL OF PERFORMANCE: 100% CORRECT

OBJECTIVES:

1. Locate the following tanks and vessels in your area and explain their purpose. Include inlet and outlet service flows, destinations and product content (shell & tube).
 - A. T-1020 (HCL SUPPLY TANK)
 - B. T-1021 (TREATMENT CHEMICALS TANK)
 - C. CL-1020 (CHLORINATOR)
 - D. V-1020 (FILTER)
 - E. CT-1020 (COOLING TOWER)
 2. Draw a simplified diagram of the equipment listed above and label the parts in their appropriate location.
 3. List all the places we will supply cooling tower water to.
 4. What is the purpose of the 8" line that ties into the cooling water return header.
 5. What is the purpose of the 3" line that comes off of the return header and ties into the permitted outfall line.
 6. State the purpose of the vent line on T-1020.
 7. State where T-1020 gets its feed from.
 8. State the purpose of the 3" line off the top of T-1020 to the permitted outfall.
-

COOLING TOWER 1020
COOLING SYSTEM FUNCTIONS

PURPOSE: To Familiarize you with how a cooling tower functions
as a thermal management system to reject heat

RESOURCES: Experienced Personnel, Operating Manuals

REQUIRED LEVEL OF PERFORMANCE: 100% CORRECT

OBJECTIVES:

1. State how a cooling tower rejects heat.
 2. State the definitions of the following terms
 - A. Blowdown
 - B. Evaporative losses
 - C. Induced Draft
 - D. Fouling
 - E. Scale
 - F. PH
 3. State the reason for blowdown of a cooling water system.
 4. Describe the effect of CL2 as a biocide with respect to the PH of the system.
-

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COOLING TOWER 1020
PROCESS FAMILIARIZATION
VALVE OPERATION

PURPOSE: TO FAMILIARIZE YOU WITH THE LOCATION, TYPE, OPERATION AND PURPOSE OF ALL VALVES USED IN YOUR AREA. CONTROL VALVE OPERATION WILL BE COVERED IN "CONTROL AND SENSING SCHEMES" SECTION.

RESOURCES: PLANT FLOW SHEETS, EXPERIENCED PERSONNEL, PICS DISPLAY

REQUIRED LEVEL OF PERFORMANCE: 100% CORRECT

OBJECTIVES:

1. PHYSICALLY LOCATE, OPERATE (AS APPLICABLE), AND STATE THE FUNCTION OF ALL VALVES IN THE COOLING TOWER AREA.

- A. AO(512) T-1020 LEVEL CONTROL VALVE-
- B. AO(511) VALVE TO OUTFALL OR TO T-510
- C. AO(502) PROCESS H2O MAKE UP
- D. DO(513) HCL SUPPLY TO T-1020
- E. DO(504) 3 WAY VALVE TO OUTFALL OR T-510

2. GIVEN ANY VALVE, STATE IF OPENED OR CLOSED.

3. MANUAL VALVES ASSOCIATED WITH CT-1020 ARE AS FOLLOWING:

CL-1020 (CHLORINATOR)

- A. DOUBLE BLOCK AND BLEED ON CTW TO CL-1020.
- B. CHLORINE TO CL-1020.

T-1020 (HCL)

- A. B/V UPSTREAM OF AOV ON INLET LINE TO T-1020.
- B. DOUBLE BLOCK AND BLEED UPSTREAM OF LCV OR FCV TO CT-1020.
- C. MANUAL BYPASS AROUND LCV.

T-1021 (TREATMENT CHEMICAL)

- A. 2" DRAIN UNDER TANK.
- B. (2) B/V UPSTREAM OF P-1021.
- C. (1) BLEED VALVE AT P-1021.

COOLING TOWER (CT-1020)

- A. (3) SUCTION B/V TO P-1020 A,B,& C.
 - B. (3) DISCHARGE B/V ON P-1020 A,B, & C.
 - C. B/V ON RECIRCULATION.
 - D. B/V ON RETURN COOLING WATER HIGH & LOW POINT TIE-IN TO CT-1020.
 - E. B/V OFF COOLING TOWER WATER RETURN TO CL-1020.
 - F. 3" B/V UPSTREAM FCV TO THE OUTFALL.
-

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COOLING TOWER 1020
PROCESS FAMILIARIZATION
MECHANICAL EQUIPMENT

PURPOSE: TO FAMILIARIZE YOU WITH THE FUNCTION, LOCATION, AND MAINTENANCE OF THE MECHANICAL EQUIPMENT IN YOUR AREA. UPON COMPLETION, YOU WILL BE ABLE TO PHYSICALLY LOCATE AND STATE THE FUNCTION AND MAINTENANCE REQUIREMENTS OF ALL MECHANICAL EQUIPMENT IN YOUR AREA.

RESOURCES: EXPERIENCED PERSONNEL, EQUIPMENT MANUALS, DATA SHEETS

REQUIRED LEVEL OF PERFORMANCE: 100% CORRECT

OBJECTIVES:

1. PHYSICALLY LOCATE AND EXPLAIN THE OPERATION AND FUNCTION OF THE FOLLOWING:

- A. P-1022
- B. P-1020 A/B/C (DO(502), DO(512) & DO(522))
- C. FA-1020 A/B (DO(501) & DO(511))

2. EXPLAIN HOW THE FANS ARE CONTROLLED. (AO(501) & AO(521))

3. PHYSICALLY LOCATE THE FOLLOWING ON THE ABOVE LISTED PUMPS.

- A. FIELD SWITCH
- B. MAIN SWITCH GEAR
- C. SUCTION AND DISCHARGE BLOCK VALVES
- D. BLEED
- E. SEAL PURGE (IF APPLICABLE)
- F. TEMPERATURE TRANS (IF APPLICABLE)

4. PHYSICALLY LOCATE THE FOLLOWING ON THE ABOVE LISTED FANS ITEM#1

- A. FIELD SWITCH
- B. MAIN SWITCH GEAR
- C. VIBRATION TRANSMITTER/PROBE

5. STATE HOW THE FANS ARE CONTROLLED.

COOLING TOWER 1020
PROCESS FAMILIARIZATION
CONTROL AND SENSING SCHEMES

PURPOSE: TO GIVE YOU A GOOD UNDERSTANDING OF THE CONTROL AND SENSING SCHEMES THE CT-1020 AREA, INCLUDING LOCATION AND PURPOSE OF KEY INSTRUMENTATION.

RESOURCES: P&ID'S, EXPERIENCED PERSONNEL

REQUIRED LEVEL OF PERFORMANCE: 100% CORRECT

OBJECTIVES:

1. EXPLAIN THE FUNCTION OF THE FOLLOWING CONTROLLERS AND HOW THEY OPERATE.
 - A. AO(512) T-1020 LEVEL CONTROL VALVE
 - B. AO(511) VALVE TO OUTFALL OR TO T-510
 - C. AO(502) PROCESS H2O MAKE UP
 - D. DO(513) HCL SUPPLY TO T-1020
 - E. DO(504) 3 WAY VALVE TO OUTFALL OR T-510

 2. PHYSICALLY LOCATE THE FOLLOWING INSTRUMENTATION AND EXPLAIN THEIR FUNCTION. ALSO, STATE THE CONTROL VALVE THEY ARE ASSOCIATED WITH.
 - A. AI(506) T-1020 LEVEL
 - B. AI(516) T-1021 LEVEL
 - C. AI(504,514) CT-1020 SUMP LEVEL
 - D. AI(581) AIR INLET TEMP. FOR FAN CT-1020 A
 - E. AI(591) AIR INLET TEMP. FOR FAN CT-1020 B
 - F. AI(583) PROCESS H2O RETURN TEMP.
 - G. AI(592) CT-1020 SUMP TEMP.
 - H. AI(505) CT-1020 RETURN HEADER ORGANIC ANALYZER
 - I. AI(526) FLOW TO OUTFALL
 - J. AI(512) PROCESS H2O MAKE UP FLOW TO CT-1020
 - K. AI(503,513,523) P-1020 A/B/C AMPS
 - L. AI(515) CT-1020 PH ANALYZER
 - M. AI(525) CT-1020 PUMP DISCHARGE PRESSURE
 - ? N. AI(521) T-1020 LEVEL

 3. DRAW A DETAILED DIAGRAM OF THE SYSTEM, INCLUDING ALL CONTROLLERS AND INSTRUMENTATION IN ITEMS #1 AND #2
-

COOLING TOWER 1020
CONTROL AND SENSING SCHEMES
(MOD V OPERATIONS)

PURPOSE: TO GIVE YOU A GOOD UNDERSTANDING OF THE MOD CONTROL AND SENSING SCHEMES THE CT-1020 AREA. UPON COMPLETION YOU SHOULD BE ABLE TO START UP THE SYSTEM USING THE MOD AND EXPLAIN WHAT TAKES PLACE IN EACH STEP.

RESOURCES: P&ID'S, EXPERIENCED PERSONNEL

REQUIRED LEVEL OF PERFORMANCE: 100% CORRECT

OBJECTIVES:

1. WITHOUT USING THE ENGLISH LANGUAGE, BE ABLE TO SUMMARIZE WHAT OCCURS IN EACH STEP, USING THE STEPPING DIAGRAM.
 2. START UP CT-1020 ON THE MOD AND EXPLAIN WHAT IS TAKING PLACE.
 3. EXPLAIN ANY GIVEN ALARM.
 4. USING THE MOD DEMONSTRATE ENERGIZING A FAN
 5. DEMONSTRATE HOW TO SHUT THE SYSTEM DOWN USING THE MOD
 6. CHANGE ANY GIVEN SETPOINT.
 7. USING THE MOD DEMONSTRATE HOW TO SWAP MP-1020'S.
 8. BE ABLE TO ANSWER ALL THE QUESTIONS ON THE COOLING TOWER SIMULATION SCRIPT
-

COOLING TOWER 1020
PROCESS FAMILIARIZATION
AREA HAZARDS & PROTECTIVE MEASURES

PURPOSE: TO FAMILIARIZE YOU WITH THE HAZARDS AND PROTECTIVE MEASURES TO REDUCE THOSE HAZARDS IN YOUR AREA.

RESOURCES: S&LP, EXPERIENCED PERSONNEL, SAFETY PROCEDURES

REQUIRED LEVEL OF PERFORMANCE: 100% CORRECT

OBJECTIVES:

1. STATE THE CHEMICAL HAZARDS ASSOCIATED WITH CT-1020, CL-1020, T-1020 & T-1021
 2. STATE THE HAZARDS OF ROTATING EQUIPMENT
 3. STATE THE ELECTRICAL HAZARDS ASSOCIATED WITH CT-1020.
 4. STATE ENVIRONMENTAL PROBLEMS AND ACTIONS TO BE TAKEN IN EVENT OF THE FOLLOWING SPILLS:
 - A. HCL
 - B. CHLORINE
 - C. TREATMENT CHEMICALS
 5. STATE THE PROTECTIVE EQUIPMENT REQUIREMENTS FOR MAINTENANCE ON THE FOLLOWING.
 - A. HCL TANK AND LINES
 - B. CL2 LINES
 - C. CHEMICAL ADDITION LINES
-

COOLING TOWER 1020
PROCESS FAMILIARIZATION
OPERATING DISCIPLINE

PURPOSE: TO GIVE YOU A GOOD UNDERSTANDING OF OPERATING PARAMETERS OF THE MAJOR EQUIPMENT IN YOUR AREA. THE PROBLEMS ASSOCIATED WITH THE PROCESS BEING OUT OF OPERATING PARAMETERS.

RESOURCES: EXPERIENCED PERSONNEL, OPERATING MANUALS, MOD 5 PROGRAM

REQUIRED LEVEL OF PERFORMANCE: 100% CORRECT

OBJECTIVES:

1. STATE THE NORMAL OPERATING PARAMETERS OF THE FOLLOWING.

- A. AI(506) T-1020 LEVEL
- B. AI(516) T-1021 LEVEL
- C. AI(504,514) CT-1020 SUMP LEVEL
- D. AI(581) AIR INLET TEMP. FOR FAN CT-1020 A
- E. AI(591) AIR INLET TEMP. FOR FAN CT-1020 B
- F. AI(592) CT-1020 SUMP TEMP.
- G. AI(505) CT-1020 RETURN HEADER ORGANIC ANALYZER
- H. AI(526) FLOW TO OUTFALL
- I. AI(515) CT-1020 PH ANALYZER
- J. CONDUCTIVITY
- K. HCL CONCENTRATION
- L. CALCIUM

2. STATE THE RESULTS OF HIGH OR LOW PARAMETERS AND THE RESULTS IF IT REMAINS HIGH OR LOW. STATE WHAT ACTION YOU WOULD TAKE TO BRING THESE BACK TO WITHIN NORMAL OPERATING PARAMETERS.

3. EXPLAIN HOW HIGH COOLING TOWER TEMPERATURE AFFECTS PLANT OPERATIONS AND EFFICIENCY.

4. EXPLAIN WHAT THE FOLLOWING IS USED FOR AND THEIR PARAMETERS.

- A. HCL
- B. PHOSPHATE (38K)
- C. CL2

5. LIST THE TRIPS FOR THE FOLLOWING EQUIPMENT: SEE MOD 5 CODE

- A. FA-1020 A/B/C
 - B. CT-1020
-

COOLING TOWER 1020
SPECIAL SKILLS

PURPOSE: TO ALLOW YOU TO DEMONSTRATE YOUR ABILITY TO PERFORM
TASKS IN A LOGICAL AND SAFE SEQUENCE, USING
ESTABLISHED JOB PROCEDURES.

RESOURCES: PROCEDURES, EXPERIENCED PERSONNEL, LAB SAMPLE PROCEDURE

REQUIRED LEVEL OF PERFORMANCE: 100% CORRECT

OBJECTIVES:

1. GIVEN ANY OF THE FOLLOWING JOB PROCEDURES/CHECKLIST
DEMONSTRATE/SIMULATE IN THE FIELD COMPLETING EACH TASK IN A
LOGICAL SAFE MANNER.
 - A. ADDING BETZ CHEMICAL (38K) TO CT-1020
 - B. UNLOADING BETZ TRUCKS CONTAINING COOLING TOWER CHEMICALS
 - C. MAKING A COOLING TOWER ENTRY
 - D. DEMONSTRATE LINING UP SYSTEM FOR START UP
 - E. DEMONSTRATE SWAPPING PUMPS (FIELD)
 - F. LINE UP T-1021
 - G. DEMONSTRATE STARTING AND STOPPING A FAN
 - H. ADJUST CL2 FLOW TO CL-1020
 - I. ADJUST 38K TO COOLING TOWER WATER SMALL METERING PUMP
 2. DEMONSTRATE RUNNING THE FOLLOWING SAMPLES FOR THE COOLING TOWER
SYSTEM.
 - A. PHOSPHATE
 - B. CL2
 - C. PH
 - D. CONDUCTIVITY
 - E. CALCIUM
 3. LIST THE STEPS (IN SEQUENCE) NECESSARY TO MAKE THE FOLLOWING
EQUIPMENT READY FOR MAINTENANCE:
 - A. COOLING TOWER 1020
 - B. FA-1020 A/B/C
 - C. P-1022
 - D. P-1020 A/B/C
 4. DEMONSTRATE THE PROPER PROCEDURE FOR CLEARING THE PROCESS LINES
FOR MAINTENANCE.
 - A. HCL LINES
 - B. CL2 LINES
-

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COOLING TOWER 1020
OPERATIONS ROUTINE CHECKLISTS

PURPOSE: TO FAMILIARIZE AND ALLOW YOU TO DEMONSTRATE COMPLETING
ROUTINE CHECKLISTS IN YOUR AREA.

RESOURCES: EXPERIENCED PERSONNEL, ROUND SHEETS, OPERATING MANUALS

REQUIRED LEVEL OF PERFORMANCE: 100% CORRECT

OBJECTIVES:

1. DEMONSTRATE MAKING A ROUND USING CT-1020 ROUND SHEET, EXPLAINING
EACH ITEM AND ITS IMPORTANCE.
-

DO 014726
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COOLING TOWER 1020
OPERATIONS
CAPACITY & EFFICIENCY

PURPOSE: TO FAMILIARIZE YOU WITH THE CAPACITY AND EFFICIENCY IN
THE COOLING TOWER AREA.

REQUIRED LEVEL OF PERFORMANCE: 100% CORRECT

OBJECTIVES:

1. STATE HOW EACH OF THE FOLLOWING AFFECT EFFICIENCY.

- A. HEADER LEAK
 - B. SLUDGE BUILD UP IN THE SUMP
 - C. PITCH ON THE FAN BLADE
 - D. 30 DEGREE OUTSIDE TEMPERATURE DROP OR RISE
 - E. EXCESS COOLING TOWER BLOWDOWN
-

COOLING TOWER 1020
OPERATIONS
EMERGENCY PROCEDURES

PURPOSE: TO FAMILIARIZE YOU WITH EMERGENCY CONDITIONS AND PROCEDURES
IN THIS AREA.

RESOURCES: EMERGENCY STARTUP & SHUTDOWN PROCEDURES, PLANT PERSONNEL,

REQUIRED LEVEL OF PERFORMANCE: 100% CORRECT

OBJECTIVES:

1. GIVEN AN EMERGENCY SITUATION AND SHUTDOWN PROCEDURE IN THIS AREA, SIMULATE (IN SEQUENCE) SHUTTING THE AREA DOWN. EXPLAIN WHAT IS OCCURRING IN EACH STEP. INCLUDE PRECAUTIONARY MEASURES SUCH AS WASHING OUT AND PURGING EQUIPMENT. YOU WILL BE TESTED ON THE FOLLOWING:
 - A. LOSE FA-1020 A
 - B. LOSE P-1020
 - C. FIRE
 - D. LOW WATER LEVEL IN SUMP
 2. YOUR AREA HAS JUST EXPERIENCED A POWER FAILURE. EXPLAIN YOUR ACTIONS. (POWER IS STILL OFF). YOUR ANSWER SHOULD BE STEP-BY-STEP.
-

COOLING TOWER 1020
PROBLEM ANALYSIS

PURPOSE: TO ALLOW YOU TO DEMONSTRATE YOUR ABILITY TO HANDLE
ABNORMAL SITUATIONS (UPSETS) WHEN THEY OCCUR IN YOUR AREA.

RESOURCES: PROCEDURES, EXPERIENCED PERSONNEL, OPERATING MANUALS

REQUIRED LEVEL OF PERFORMANCE: 100% CORRECT

OBJECTIVES:

1. LIST THE SEQUENCE OF STEPS YOU WOULD TAKE IF THE FOLLOWING
CONDITION WERE TO OCCUR.

- A. ORGANICS APPEAR IN SAMPLE
 - B. PH LOW OR HIGH
 - C. CHLORINE IS TOO HIGH OR LOW
 - D. CONDUCTIVITY IS TOO HIGH
 - E. PHOSPHATE IS TOO HIGH OR TOO LOW
 - F. PLUGGED CHLORINATOR
-

12/91 GR/CB

CT1020MD.IPT

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CONTRACTOR
MINIMUM SAFETY EQUIPMENT REQUIRED IN C.M.P. ACID AREAS

AREA	MEASUREMENTS WALK - THRU	WORKING ON
C-202 BTMS.	SLICKER SUIT / GOGGLES / RUBBER BOOTS, GLOVES	FULL ACID SUIT
E-212	SAME AS ABOVE	SAME AS ABOVE
H2SO4 T/C RACK	SAME AS ABOVE	SAME AS ABOVE
T-900	SAME AS ABOVE	SAME AS ABOVE
C-650	SAME AS ABOVE	SAME AS ABOVE
C-210	SAME AS ABOVE	SLICKER SUIT / GOGGLES / RUBBER BOOTS, GLOVES
C-200 / C-201 BTMS.	GOGGLES	SAME AS ABOVE
C-202 DECKS	GOGGLES	FULL ACID SUIT
P-301'S	GOGGLES	SLICKER SUIT / GOGGLES / RUBBER BOOTS, GLOVES
C-510 / R-600	GOGGLES	SAME AS ABOVE

- * A FULL ACID SUIT IS REQUIRED TO DO ANY TYPE OF WORK ON GROUND LEVEL AROUND H2SO4 ACID PUMPS. ANY DEVIATION FROM THIS REQUIRES PLANT SUPT. APPROVAL.
- * TO DO WORK ON INSTRUMENTATION ^(electrical) IN AREAS REQUIRING A FULL ACID SUIT TO BE WORN, THE THIN RUBBER GLOVES ARE PERMITTED.

revised: 10/90
L. London

James,
Review & note any
changes that's need

[Signature]

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II. OBJECTIVES

- A. TO HAVE YOU BECOME VERY FAMILIAR WITH THE OPERATION OF THE COMBUSTIBLE GAS/ OXYGEN METERS. ALSO, TO MAKE YOU AWARE OF THE METERS' LIMITATIONS.**
- B. TO BECOME PROFICIENT AT TEACHING OTHERS WHAT THEY NEED TO KNOW TO OPERATE THE METERS CORRECTLY.**

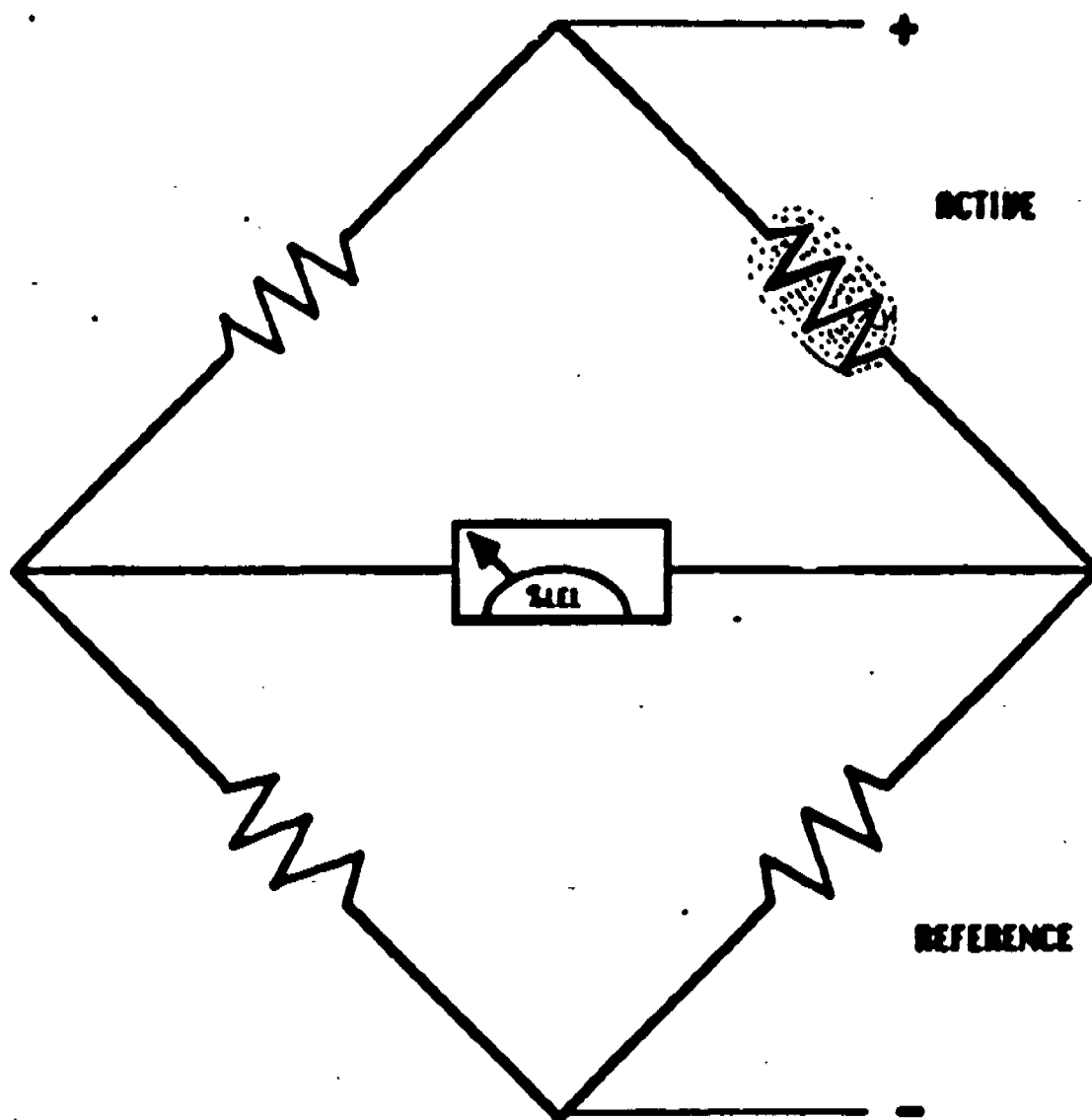
III. ABOUT THE METER (actually two meters in one)

A. OXYGEN -

ELECTROCHEMICAL FUEL CELL THAT DEVELOPS A VOLTAGE WHICH IS PROPORTIONAL TO THE OXYGEN CONCENTRATION OF THE GAS PASSING THROUGH THE CELL. THE CELL IS DEPLETED OR USED UP AS OXYGEN MEASUREMENTS ARE MADE.

B. COMBUSTIBLE -

CATALYTIC BEAD IN CELL WHOSE TEMPERATURE IS CHANGED BY THE AMOUNT OF COMBUSTIBLE GAS IN THE SAMPLE. AS THE TEMPERATURE IS CHANGED, ITS RESISTANCE CHANGES, UNBALANCING ONE LEG OF A WHEATSTONE BRIDGE CIRCUIT COMPARED TO A SECOND BEAD WITHOUT CATALYST THAT WILL NOT REACT TO THE COMBUSTIBLE GAS. THIS TYPE OF CELL REQUIRES SOME OXYGEN (10%) FOR SUCCESSFUL OPERATION.



IV. TERMS

A. LEL (LOWER EXPLOSIVE LIMIT - The least concentration of a combustible gas in air that will ignite.

B. VAPOR DENSITY - The weight of a gas as compared to air.

C. OXYGEN DEFICIENT OR RICH ATMOSPHERE -
The combustible gas sensor requires at least 10% oxygen and a maximum of 25% oxygen to work accurately.

OXYGEN DEFICIENT ATMOSPHERES & YOU

OXYGEN % IN AIR (APPROX. 21% NORMAL)

AT REST SIGNS & SYMPTOMS

12 - 18%

BREATHING & PULSE RATE INCREASED;
COORDINATION POOR.

10 - 12%

DEEP, FAST RESPIRATION; GIDDINESS;
POOR JUDGEMENT; LIPS BLUE.

8 - 10%

NAUSEA; VOMITING; INABILITY TO
MOVE FREELY; UNCONSCIOUSNESS;
ASHEN FACE.

6 - 8%

8 MINUTES - 100% FATAL
6 MINUTES - 50% FATAL
4 MINUTES - ALL RECOVER WITH
TREATMENT

4%

COMA IN 40 SECONDS; CONVULSIONS;
RESPIRATION CEASES.

0%

INDIVIDUAL IMMEDIATELY BECOMES
UNCONSCIOUS; WILL RECOVER ONLY IF
GOOD AIR IS IMMEDIATELY AVAILABLE

WARNING: THE WARNING SYMPTOMS OF AN ATMOSPHERE DEFICIENT IN OXYGEN ARE COMPLETELY INADEQUATE AND, ALTHOUGH, A TRAINED OBSERVER MAY, WHEN ALERT, RECOGNIZE THE INCREASE IN PULSE AND RATE OF BREATHING IN TIME TO RETURN TO GOOD AIR, THE AVERAGE INDIVIDUAL FAILS TO RECONIZE THE DANGER UNTIL HE IS TOO WEAK TO SAVE HIMSELF, ESPECIALLY WHERE THE RETURN TO GOOD AIR INVOLVES CLIMBING STAIRS OR A LADDER.

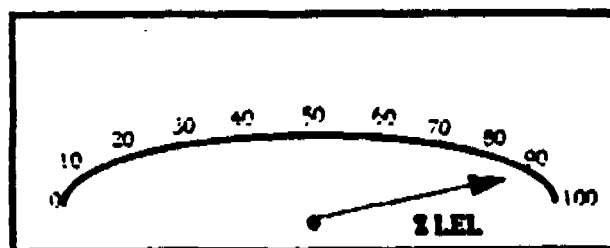
LEAN MIXTURE -

meter hand rises to a reading



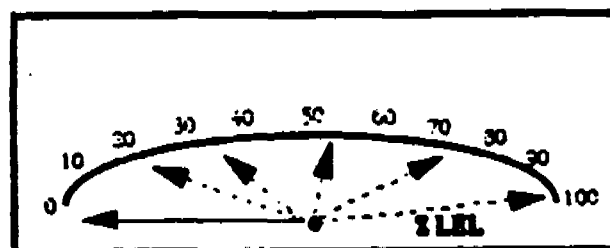
EXPLOSIVE MIXTURE -

**meter hand rises to reading in
alarm zone (20% and above)**



RICH MIXTURE -

**meter hand goes full scale and
then falls to zero or below**



PRE-USE CALIBRATION CHECK OF BIO MARINE 902 & GASTECH GX-3
COMBUSTIBLE GAS/O₂ MONITORS

1. CHECK UNITS WITH HOSE & PROBE CONNECTED.
2. CHECK FILTER & WATER TRAP. SHOULD BE CLEAN AND DRY.
3. CHECK BATTERY VOLTAGE. NEVER CALIBRATE ANY METER WHILE PLUGGED INTO THE CHARGER.
4. CHECK PUMP FLOW AND ALARM.
5. CHECK OXYGEN READING IN AIR. SHOULD BE 21%. IF NOT, ADJUST TO READ 21%.
6. CHECK COMBUSTIBLE GAS ZERO. IF NOT ZERO, ADJUST TO READ ZERO.
7. INTRODUCE CALIBRATION GAS (2.5% METHANE IN AIR). COMBUSTIBLE GAS METER SHOULD GO UPSCALE TO 2.5% ON BIO MARINE UNITS OR TO 55% LEL ON GASTECH UNITS. IF READING IS INCORRECT, ADJUST WITH GAS SPAN POT TO OBTAIN PROPER READING. THE SPAN POT FOR BIO MARINE UNITS IS LOCATED ON TOP CONTROL PANEL. THE SPAN POT FOR THE GASTECH GX-3 UNIT IS LOCATED IN THE FRONT CHAMBER, SPAN POT #3.
8. IF UNITS CANNOT BE ADJUSTED PROPERLY, OR IF YOU FEEL THE UNIT IS NOT OPERATING CORRECTLY, DO NOT USE IT. TAG THE UNIT AND SEND IT TO THE CENTRAL INSTRUMENT SHOP FOR A THOROUGH CHECKOUT AND REPAIR.

PRE-USE CALIBRATION CHECK OF GASTECH 1214SMP
COMBUSTIBLE GAS/O₂ MONITOR

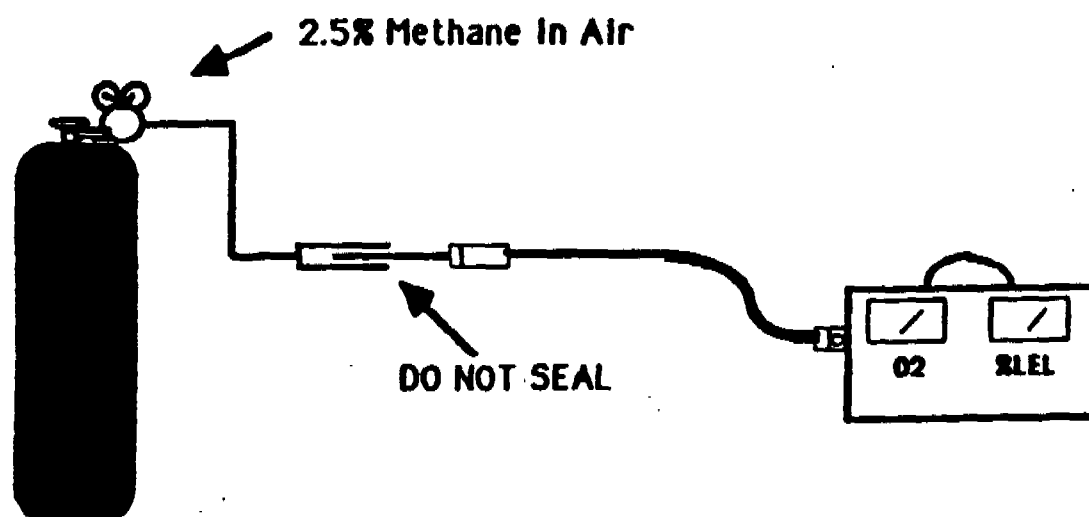
1. CHECK UNITS WITH HOSE & PROBE CONNECTED.
2. CHECK FILTER & WATER TRAP. SHOULD BE CLEAN AND DRY.
3. PRESS RED "POWER" SWITCH TO TURN UNIT ON. THE STATEMENT "GASTECHTOR ON - TAKE TO GAS FREE AREA" WILL SOUND AND DISPLAY WILL BLINK. THE UNIT DISPLAY WILL CONTINUE TO BLINK FOR A TWO MINUTE WARM-UP PERIOD.
4. AFTER THE TWO MINUTE WARM-UP PERIOD HAS ELAPSED, THE STATEMENT "PRESS ADJUST BUTTON" WILL SOUND. PRESS THE BLACK ADJUST BUTTON. UNIT SHOULD THEN READ 20.9% O₂ and 0 COMBUSTIBLES. ANYTIME THE ADJUST BUTTON IS PRESSED THEREAFTER, THE UNIT WILL DISPLAY THE NUMBER OF BATTERY HOURS REMAINING.
5. CHECK PUMP FLOW.
6. INTRODUCE CALIBRATION GAS (2.5% METHANE IN AIR). METER SHOULD READ 55% LEL. IF NOT, ADJUST SPAN POT LOCATED ON SIDE OF UNIT AND MAKE METER READ 55%.
7. IF UNIT CANNOT BE ADJUSTED PROPERLY, OR IF YOU FEEL THE UNIT IS NOT OPERATING CORRECTLY, DO NOT USE IT. TAG THE UNIT AND SEND IT TO THE CENTRAL INSTRUMENT SHOP FOR A THOROUGH CHECKOUT

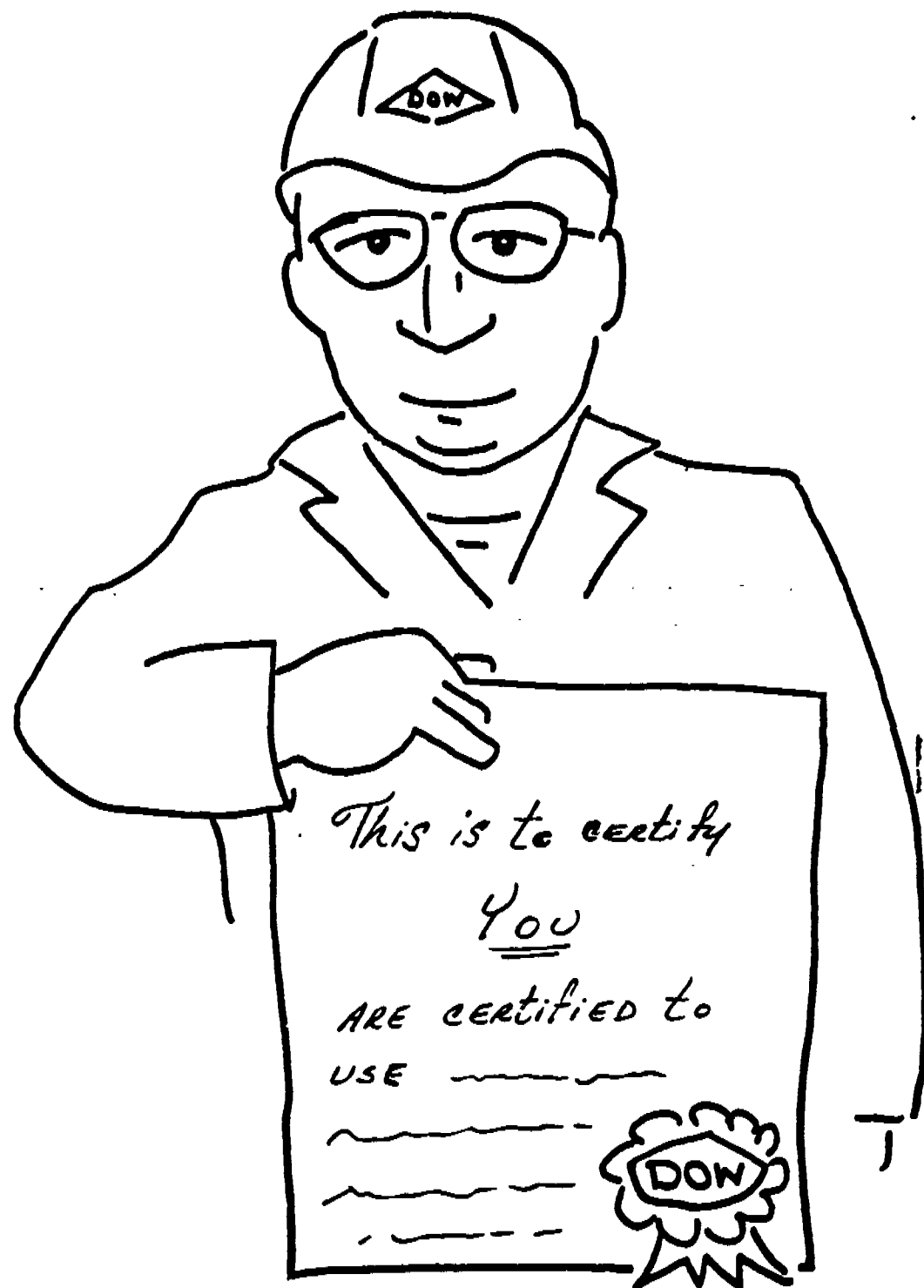
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CHECKING FOR COMBUSTIBLE GAS IN INERT BACKGROUND USING SPECIAL FITTING ON STANDARD EXPLOSION METER

1. Calibrate unit without special fitting using 2.5% Methane in air cal. gas. Combustibles should read 55% LEL. If not, adjust span so that meter does read 55% LEL. Oxygen should read 21%.
2. Put special fitting on unit and introduce cal. gas again (2.5% Methane in air). Combustibles should read approximately 27.5% LEL. Oxygen should read 21%.
3. Put 2.5% Methane in Nitrogen in unit. Combustibles should read about 27.5% LEL. Oxygen should read approximately 10.5%.
4. THE UNIT IS NOW READY TO BE USED.
5. After a line has been checked with a standard (without fitting) meter and the line has less than 10% oxygen, you would then use the special meter (with fitting) and check the line for combustibles.
6. Always be aware of your oxygen reading when using the meter with the fitting on it. Your oxygen reading can tell you many things. For example, the oxygen reading taken without the fitting must differ from oxygen reading taken with the fitting in place.

NOTE: ANY COMBUSTIBLE GAS READING OBSERVED WHILE USING THE UNIT MUST BE MULTIPLIED BY TWO TO OBTAIN THE ACTUAL %LEL.





ONLY TRAINED AND CERTIFIED
PERSONNEL ARE ALLOWED TO
USE

BOY, THIS ONE LOOKS NEW, I KNOW
IT'S GOOD!

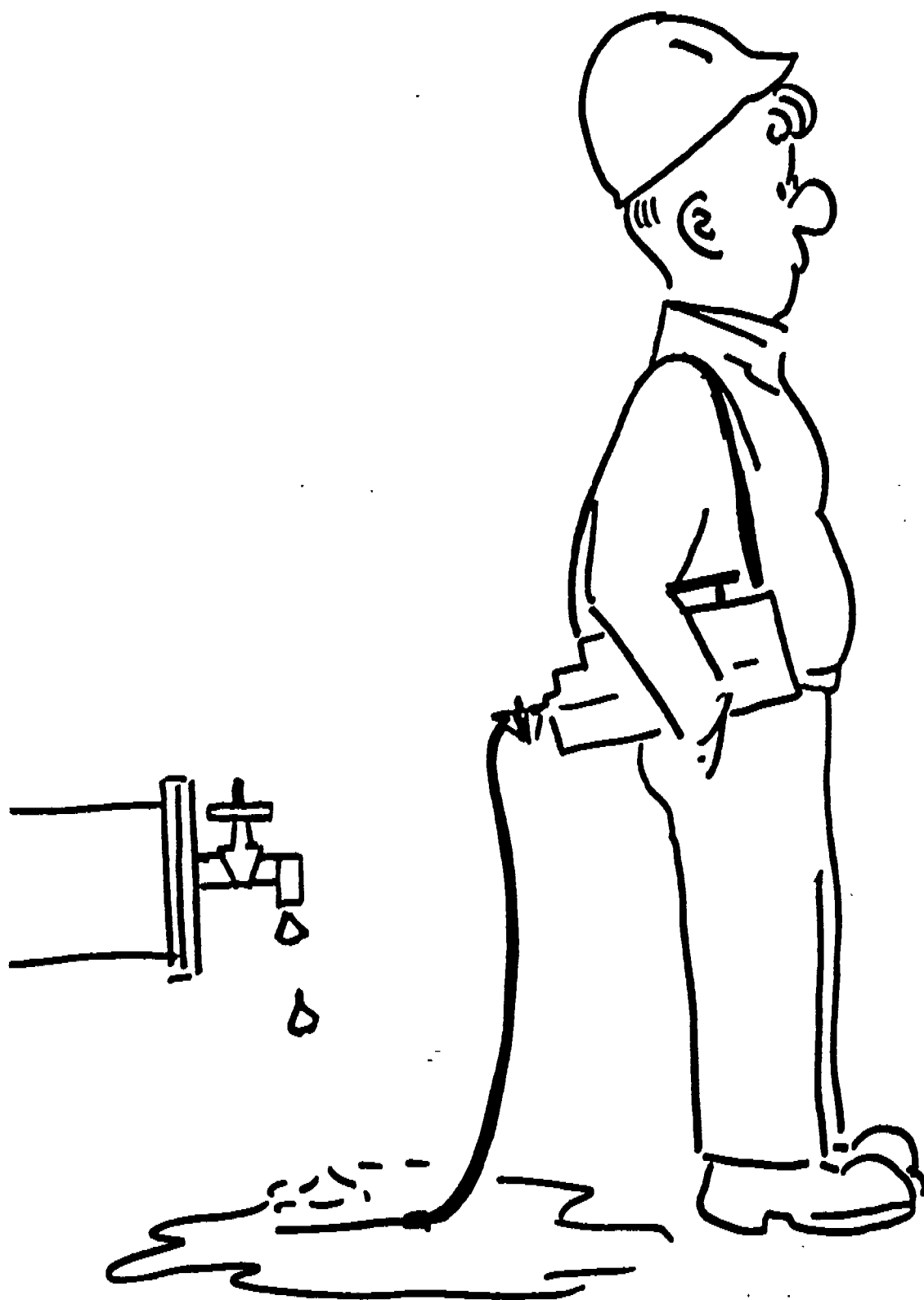


THE ONLY WAY TO TELL IF
AN EXPLOSIMETER IS GOOD IS TO
PASS A CALIBRATED GAS THRU IT

MAN! WHAT IS THAT STUFF?

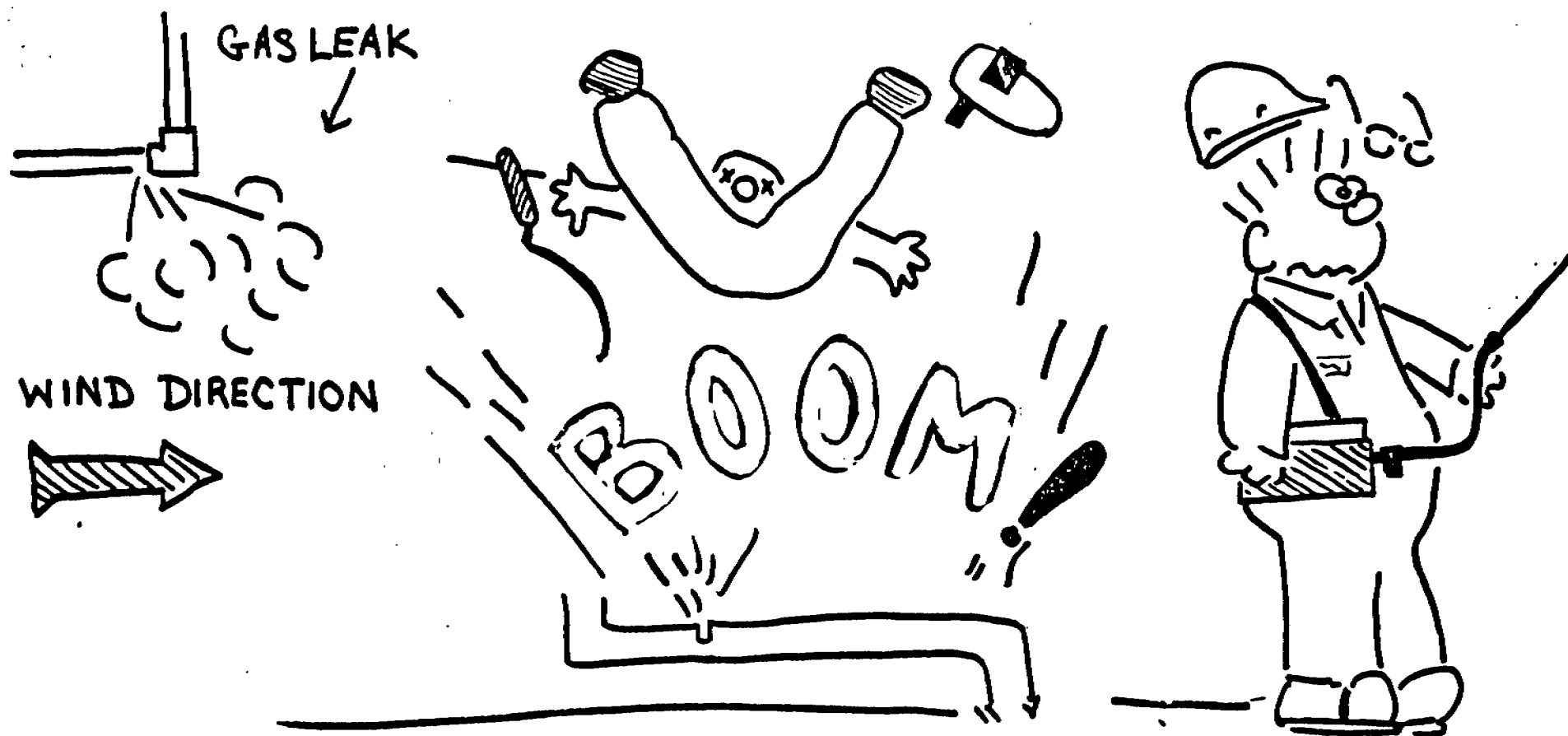


PERSONNEL CHOSEN AS SAFETY
OBSERVERS SHOULD BE FAMILIAR
WITH COMPOUNDS FOUND IN THE
PLANT AND PLANT PRODUCTS
... ARE THEY
FLAMMABLE? HEAVIER OR LIGHTER
THAN AIR? TOXIC? CORROSIVE



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METERS ARE NOT DESIGNED TO
TAKE LIQUID SAMPLES

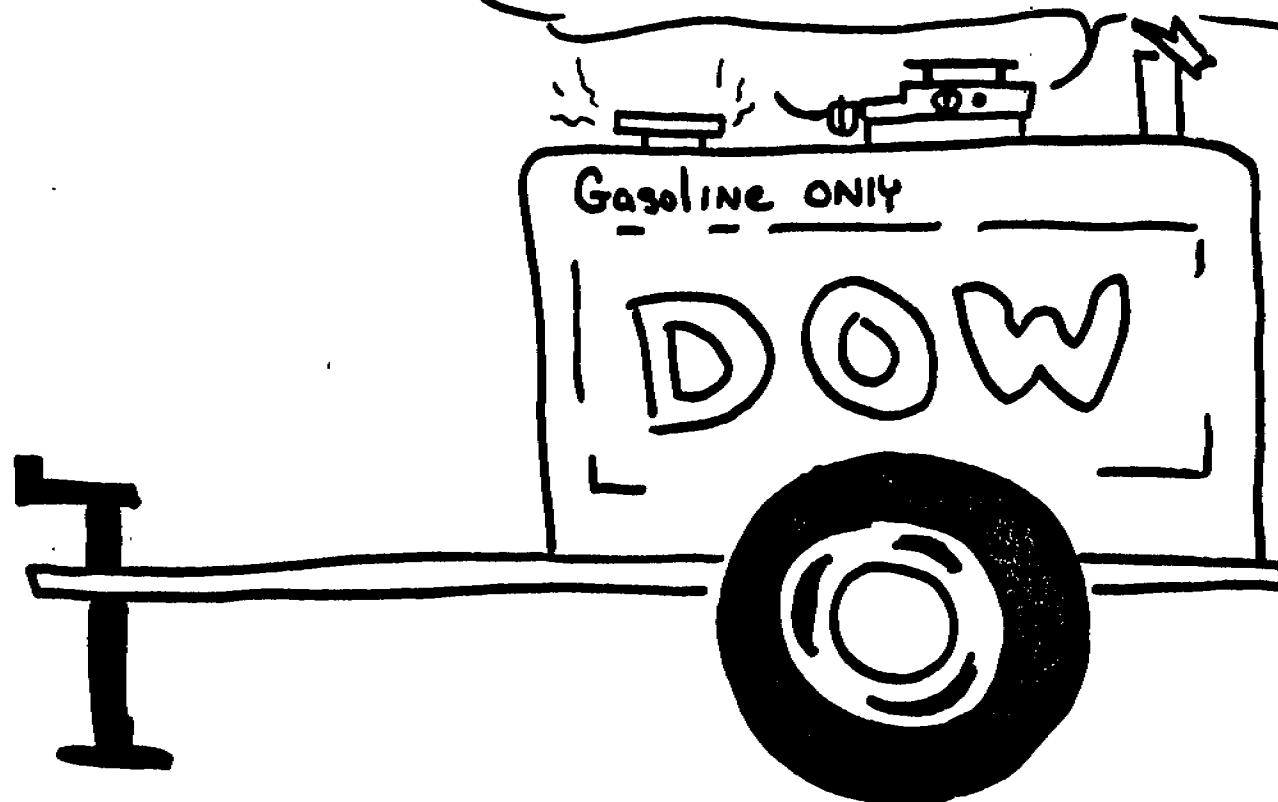


WHEN ACTING AS SAFETY OBSERVER
ALWAYS LOOK FOR POTENTIAL HAZARDS
FROM SURROUNDING AREAS

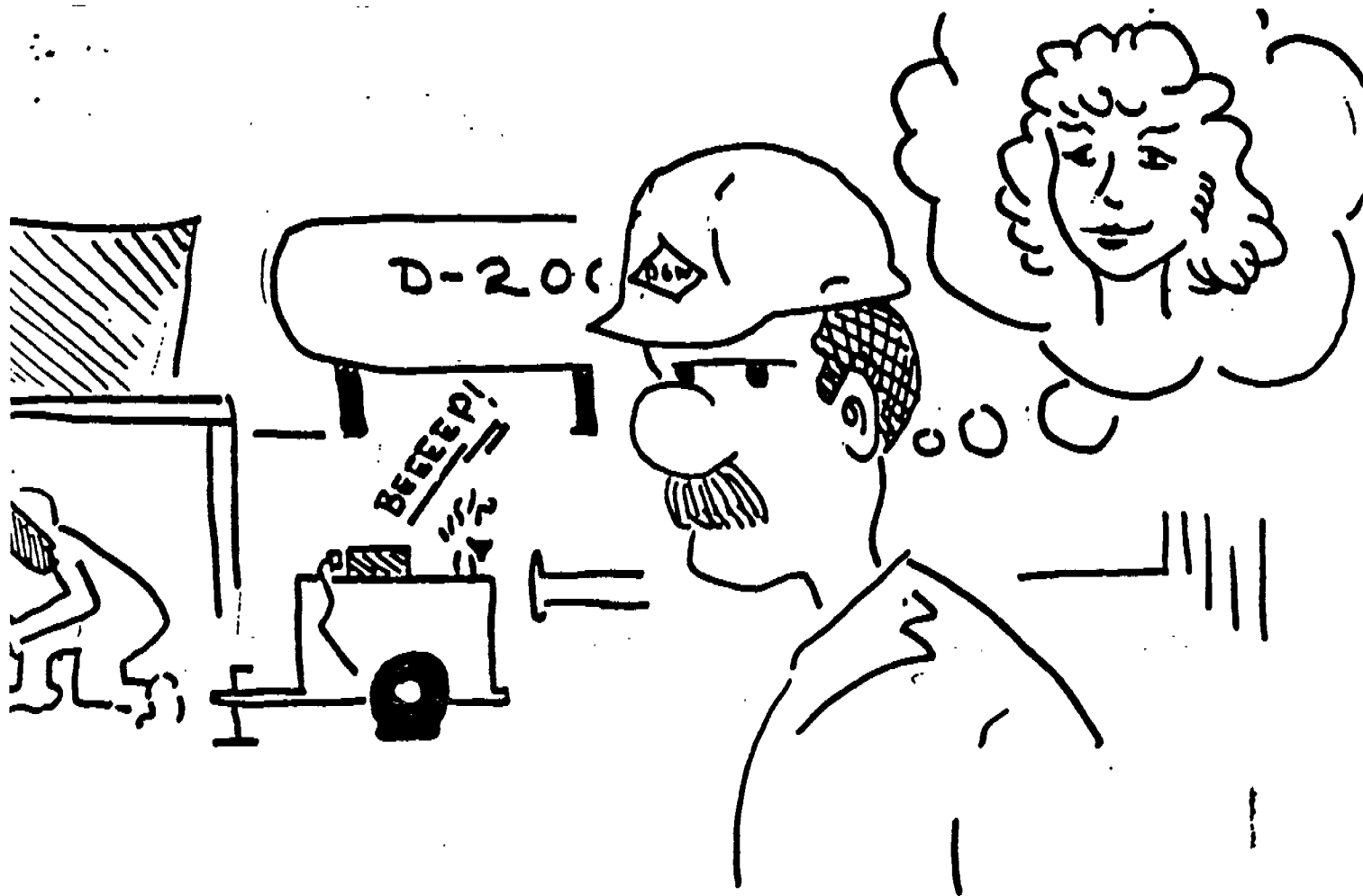


METERS SHOULD NOT BE USED TO
MEASURE COMBUSTIBLE GAS IN
ATMOSPHERES THAT ARE OXYGEN
DEFICIENT

GAS TECT-ORR CRAZEEE
TAKE TO BLASSS AREA



TETRA ETHYL LEAD OR SILICON
COMPOUNDS POISON COMBUSTIBLE
CAR SENSORS



BE ALERT!

SPECIFICATIONS CATALOG

PROFILES 10 - 2000

PROFILE #: DETERMINANT #: DESCRIPTION: LOW SPEC: HIGH SPEC:

102

C-202

1 DIMETHYL ETHER
2 METHYL CHLORIDE
3 METHANOL

103

C-613

1 DIMETHYL ETHER
2 METHYL CHLORIDE
3 METHANOL
4 WT% HCL

109

1 METHYLENE CHLORIDE
2 VINYLIDENE CHLORIDE
3 TRANS
4 M4 CARBON TET
5 CHLOROFORM
6 AMYLENE
7 CIS
8 BROMINE
9 A-DI

110

C-344 BTMS

1 PPM HCL 10.00 20.00

111

C-552 SH

1 PPM HCL 10.00
2 PPM WATER 80.00
3 METHANE 10.00
4 ETHYLENE 2.00
5 ETHANE 2.00
6 ACETYLENE 2.00
7 DIMETHYL ETHER 12.00
8 METHYL CHLORIDE 980000.0 1020000.
9 VINYL CHLORIDE 25.00
10 METHANOL 10.00
11 METHYLENE CHLORIDE 50.00
12 ETHYL CHLORIDE 50.00
13 FREON 12 1.00
14 PROPANE/BUTANE

112

C-522 REA-112

1 METHYLENE CHLORIDE 980000.0 1020000.
2 ETHYL CHLORIDE 5.00
3 METHYL BROMIDE 5.00
4 VINYLIDENE CHLORIDE 50.00
5 ALLYL CHLORIDE 5.00
6 TRANS 60.00

SPECIFICATIONS CATALOG

PROFILES 10 - 2000

PROFILE #: DETERMINANT #: DESCRIPTION: LOW SPEC: HIGH SPEC:

PROFILE #	DETERMINANT #	DESCRIPTION	LOW SPEC	HIGH SPEC	
112	7	<u>1-105-10700</u> TCE		1.00	
	8	CHLOROFORM		50.00	80.0
	9	M1/U1		5.00	15.0
	10	A-DI/M4		5.00	
113		<u>C-102-4700</u>			
	1	METHYLENE CHLORIDE		.0050	
	2	A-DI		.0025	
	3	CHLOROFORM			
	4	CIS		.0100	.0250
	5	M4	2.0000	10.0000	
114	1	PPM CHLORINE	600.00	1500.00	
	2	METHYLENE CHLORIDE		.0200	.0150
	3	A-DI			
	4	CHLOROFORM			
	5	CIS		.0005	
	6	M4			
115		<u>7-102</u>			
	1	METHYLENE CHLORIDE		.0200	.0150
	2	A-DI			
	3	CHLOROFORM			
	4	CIS		.0005	
	5	M4			
	6	PPM CHLORINE	600.00	1500.00	
116	1	PPM WATER		20.00	
	2	PPM HCL		5.00	
117	1	METHYLENE CHLORIDE	0.00	50.00	
	2	VINYLDENE CHLORIDE	0.00	10.00	
	3	TRANS	6.00	10.00	
	4	M4 CARBON TET	0.00	200.00	
	5	CHLOROFORM	980000.0	1020000.0	
	6	AMYLENE			
	7	CIS	0.00	30.00	40.0
	8	BRCLME	150.00	250.00	
	9	A-DI	0.00	25.00	
	10	PPM WATER	0.00	25.00	
	11	PPM HCL		10.00	5.0
	12	PPM CHLORINE			
118	1	METHYLENE CHLORIDE			

SPECIFICATIONS CATALOG

PROFILES 10 - 2000

PROFILE #: DETERMINANT #: DESCRIPTION:

LOW SPEC: HIGH SPEC:

113

C-896 BTMS

2 TRANS
3 A-DI
4 CHLOROFORM
5 TCE
6 METHYL CHLORIDE
7 VINYL CHLORIDE
8 CIS
9 EDC
10 M4
11 B-TRI
12 UNSYM-TET
13 SYM-TET

1.8000 1.001

119

1 PPM WATER
2 PPM HCL

80.00
7.00

120

2-1-1
1 WT% HCL
2 DIMETHYL ETHER
3 METHYL CHLORIDE
4 METHANOL

18 to 23

121

2-1-1
1 WT% HCL
2 DIMETHYL ETHER
3 METHYL CHLORIDE
4 METHANOL

18 to 23

122

2-1-1
1 METHYL CHLORIDE
2 METHANOL
3 METHYLENE CHLORIDE
4 M4 CARBON TET
5 CHLOROFORM
6 WT% HCL

1 ppm

5 ppm

123

2-1-1
1 DIMETHYL ETHER
2 METHYL CHLORIDE
3 METHANOL

DME 95 ppm

124

2-1-1
1 WT% H2SO4
2 DIMETHYL ETHER
3 METHYL CHLORIDE
4 METHANOL

40% - 45%

SMPLP01

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UNIT

SAMPLE POINTS

DISPLAY
UNIT CODE PROFILE

1 CMP

2	C202 BTMS	1	2	102
3	C610 REFLUX	1	3	103
10	C 840 BTMS	1	10	110
11	C 850 OVH	1	11	111
12	C 802 REFLUX	1	12	112
13	C 802 BTMS	1	13	113
14	T 803 A	1	14	114
15	T 803 B	1	15	115
16	C 803 BTMS	1	16	116
17	C 806 OVH	1	17	117
18	C 806 BTMS	1	18	118
19	M1 FORWARD	1	19	119
20	C 200	1	20	120
21	C 201	1	21	121
22	C 610 BTMS	1	22	122
23	C 650 BTMS	1	23	123
24	D 650	1	24	124
25	C 210 BTMS	1	25	125
26	T 104 A	1	26	126
27	T 104 B	1	27	127
28	T 814	1	28	128
29	T 511	1	29	129
30	T 514	1	30	130
31	T 804 A	1	31	131
32	T 804 B	1	32	132
33	T 100	1	33	133
34	T 101	1	34	134
35	T 103	1	35	135
36	T 1050	1	36	136
37	T 810	1	37	137
38	T 808	1	38	138
39	T 805	1	39	139
40	T 806 A	1	40	140
41	T 806 B	1	41	141
42	T 102	1	42	142
43	T 303	1	43	143
44	T 1010	1	44	144
45	T 251	1	45	145
46	D 455	1	46	146
47	M1 TRUCKS	1	47	147
49	M2 TRUCKS	1	49	149
50	R 750 CONDENSATE	1	50	150
51	M3 TRUCKS	1	51	151
53	M2 BARGES	1	53	153
54	M3 BARGES	1	54	154
55	METHANOL BARGES	1	55	155
56	CH0 STANDARD	1	56	156
57	CH1 STANDARD	1	57	157
58	CH2 STANDARD	1	58	158
59	CH3 STANDARD	1	59	159

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DISPLAY

UNIT

SAMPLE POINTS

UNIT CODE PROFILE

1 CMP

1 CMP

60	CH4 STANDARD	1	60	160
61	M1 R/C HEEL SAMPLE 1	1	61	161
62	M1 R/C HEEL SAMPLE 2	1	62	162
63	M1 R/C HEEL SAMPLE 3	1	63	163
64	M1 R/C HEEL SAMPLE 4	1	64	164
65	M1 R/C HEEL SAMPLE 5	1	65	165
66	M1 R/C HEEL SAMPLE 6	1	66	166
67	CH5 STANDARD	1	67	167
68	CH6 STANDARD	1	68	168
69	CH7 STANDARD	1	69	169
70	CH8 & 9 STANDARD	1	70	170
71	M1 R/C FNL SAMPLE 1	1	71	171
72	M1 R/C FNL SAMPLE 2	1	72	172
73	M1 R/C FNL SAMPLE 3	1	73	173
74	M1 R/C FNL SAMPLE 4	1	74	174
75	M1 R/C FNL SAMPLE 5	1	75	175
76	M1 R/C FNL SAMPLE 6	1	76	176
78	CH10 STANDARD	1	78	178
79	CH11 STANDARD	1	79	179
80	CH11 STANDARD B	1	80	0
81	M2 R/C FNL SAMPLE 1	1	81	181
82	M2 R/C FNL SAMPLE 2	1	82	182
83	M2 R/C FNL SAMPLE 3	1	83	183
84	M2 R/C FNL SAMPLE 4	1	84	184
91	M3 R/C FNL SAMPLE 1	1	91	191
92	M3 R/C FNL SAMPLE 2	1	92	192
93	M3 R/C FNL SAMPLE 3	1	93	193
94	M3 R/C FNL SAMPLE 4	1	94	194
95	M3 R/C FNL SAMPLE 5	1	95	195
96	M3 R/C FNL SAMPLE 6	1	96	196
99	RECHARGE H2O MACHINE	1	99	200

SPECIFICATIONS CATALOG

PROFILES 10 - 2000

PROFILE #: DETERMINANT #: DESCRIPTION:

LOW SPEC: HIGH SPEC:

102

1 DIMETHYL ETHER
2 METHYL CHLORIDE
3 METHANOL

103

1 DIMETHYL ETHER
2 METHYL CHLORIDE
3 METHANOL
4 WT% HCL

109

1 METHYLENE CHLORIDE
2 VINYLIDENE CHLORIDE
3 TRANS
4 M4 CARBON TET
5 CHLOROFORM
6 AMYLENE
7 CIS
8 BROMINE
9 A-DI

110

1 PPM HCL 10.00 20.00

H₂O
30.0

111

1 PPM HCL 10.00
2 PPM WATER 80.00
3 METHANE 10.00
4 ETHYLENE 2.00
5 ETHANE 2.00
6 ACETYLENE 2.00
7 DIMETHYL ETHER 10.00
8 METHYL CHLORIDE 980000.0 1020000.
9 VINYL CHLORIDE 25.00
10 METHANOL 10.00
11 METHYLENE CHLORIDE 50.00
12 ETHYL CHLORIDE 50.00
13 FREON 12 1.00
14 PROPANE/BUTANE

112

1 METHYLENE CHLORIDE 980000.0 1020000.
2 ETHYL CHLORIDE 5.00
3 METHYL BROMIDE 5.00
4 VINYLIDENE CHLORIDE 50.00
5 ALLYL CHLORIDE 5.00
6 TRANS 60.00

SPECIFICATIONS CATALOG

PROFILES 10 - 2000

PROFILE #: DETERMINANT #: DESCRIPTION: LOW SPEC: HIGH SPEC:

112

7	TCE	1.00	
8	CHLOROFORM	50.00	
9	M1/V1	5.00	
10	A-DI/M4	5.00	

80.
15.

113

1	METHYLENE CHLORIDE	.0050	
2	A-DI	.0025	
3	CHLOROFORM		
4	CIS	.0100	
5	M4	2.0000	10.0000

.0250

114

1	PPM CHLORINE	600.00	1500.00
2	METHYLENE CHLORIDE		.0200
3	A-DI		
4	CHLOROFORM		
5	CIS		.0005
6	M4		

.0150

115

1	METHYLENE CHLORIDE		.0200
2	A-DI		
3	CHLOROFORM		
4	CIS		.0005
5	M4		
6	PPM CHLORINE	600.00	1500.00

.0150

116

1	PPM WATER		20.00
2	PPM HCL		5.00

117

1	METHYLENE CHLORIDE	0.00	50.00
2	VINYLDENE CHLORIDE	0.00	10.00
3	TRANS	6.00	10.00
4	M4 CARBON TET	0.00	200.00
5	CHLOROFORM	980000.0	1020000.0
6	AMEYLENE		
7	CIS	0.00	30.00
8	BROLME	150.00	250.00
9	A-DI	0.00	25.00
10	PPM WATER	0.00	25.00
11	PPM HCL		10.00
12	PPM CHLORINE		

40.0

5.0

118

1	METHYLENE CHLORIDE		
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SPECIFICATIONS CATALOG

PROFILES 10 - 2000

PROFILE #: DETERMINANT #: DESCRIPTION:

LOW SPEC: HIGH SPEC:

113

2 TRANS
3 A-D1
4 CHLOROFORM
5 TCE
6 METHYL CHLORIDE
7 VINYL CHLORIDE
8 CIS
9 EDC
10 M4
11 B-TRI
12 UNSYM-TET
13 SYM-TET

1.8000 1.000

119

1 PPM WATER
2 PPM HCL

80.00
7.00

120

1 WT% HCL
2 DIMETHYL ETHER
3 METHYL CHLORIDE
4 METHANOL

18 to 23

121

1 WT% HCL
2 DIMETHYL ETHER
3 METHYL CHLORIDE
4 METHANOL

18 to 23

122

1 METHYL CHLORIDE
2 METHANOL
3 METHYLENE CHLORIDE
4 M4 CARBON TET
5 CHLOROFORM
6 WT% HCL

1 ppm

5 ppm

123

1 DIMETHYL ETHER
2 METHYL CHLORIDE
3 METHANOL

ONE 75 ppm

124

1 WT% H2SO4
2 DIMETHYL ETHER
3 METHYL CHLORIDE
4 METHANOL

40% - 45%

SPECIFICATIONS CATALOG

PROFILES 10 - 2000

PROFILE #: DETERMINANT #: DESCRIPTION:

LOW SPEC: HIGH SPEC:

125

1

WT% HCL

? Ricky Jack

126

1

METHANE

10.00

2

ETHYLENE

5.00

3

ETHANE

5.00

4

ACETYLENE

10.00

5

DIMETHYL ETHER

10.00

6

METHYL CHLORIDE

980000.0

1020000.

7

VINYL CHLORIDE

50.00

8

METHANOL

50.00

9

METHYLENE CHLORIDE

50.00

✓ 10

ETHYL CHLORIDE

50.00

11

FREON 12

1.00

12

PROPANE/BUTANE

13

PPM WATER

80.00

14

PPM HCL

7.00

15

VISUAL APPEARANCE

W/W

W/W

127

1

METHANE

10.00

2

ETHYLENE

5.00

3

ETHANE

5.00

4

ACETYLENE

10.00

5

DIMETHYL ETHER

10.00

6

METHYL CHLORIDE

980000.0

1020000.

7

VINYL CHLORIDE

50.00

8

METHANOL

50.00

9

METHYLENE CHLORIDE

50.00

10

ETHYL CHLORIDE

50.00

11

FREON 12

1.00

12

PROPANE/BUTANE

13

PPM WATER

80.00

14

PPM HCL

7.00

15

VISUAL APPEARANCE

W/W

W/W

128

1

METHANE

10.00

2

ETHYLENE

5.00

3

ETHANE

5.00

4

ACETYLENE

10.00

5

DIMETHYL ETHER

10.00

6

METHYL CHLORIDE

980000.0

1020000.

7

VINYL CHLORIDE

50.00

8

METHANOL

50.00

9

METHYLENE CHLORIDE

50.00

10

ETHYL CHLORIDE

50.00

SPECIFICATIONS CATALOG

PROFILES 10 - 2000

PROFILE #: DETERMINANT #: DESCRIPTION: LOW SPEC: HIGH SPEC:

128

11	FREON 12		1.00
12	PROPANE/BUTANE		
13	PPM WATER		80.00
14	PPM HCL		7.00
15	VISUAL APPEARANCE	W/W	W/W

129

1	METHANE		10.00
2	ETHYLENE		5.00
3	ETHANE		5.00
4	ACETYLENE		10.00
5	DIMETHYL ETHER		10.00
6	METHYL CHLORIDE	980000.0	1020000.
7	VINYL CHLORIDE		50.00
8	METHANOL		50.00
9	METHYLENE CHLORIDE		50.00
10	ETHYL CHLORIDE		50.00
11	FREON 12		1.00
12	PROPANE/BUTANE		
13	PPM WATER		80.00
14	PPM HCL		7.00
15	VISUAL APPEARANCE	W/W	W/W

130

1	METHANE		10.00
2	ETHYLENE		5.00
3	ETHANE		5.00
4	ACETYLENE		10.00
5	DIMETHYL ETHER		10.00
6	METHYL CHLORIDE	980000.0	1020000.
7	VINYL CHLORIDE		50.00
8	METHANOL		50.00
9	METHYLENE CHLORIDE		50.00
10	ETHYL CHLORIDE		50.00
11	FREON 12		1.00
12	PROPANE/BUTANE		
13	PPM WATER		80.00
14	PPM HCL		7.00
15	VISUAL APPEARANCE	W/W	W/W

131

1	M1/V1		.0005
2	METHYL BROMIDE		.0030
3	ETHYL CHLORIDE		.0100
4	PROPYLENE OXIDE		.0001
5	VINYLDIENE CHLORIDE		.0100
6	METHYLENE CHLORIDE	98.0000	102.0000

SPECIFICATIONS CATALOG

PROFILES 10 - 2000

PROFILE #: DETERMINANT #: DESCRIPTION: LOW SPEC: HIGH SPEC:

131

7	TRANS		.0200
8	A-DI		.0010
9	CHLOROFORM		.0100
10	CYCLOHEXANE	.0250	.0350
11	TCE		.0001
12	PPM WATER		75.00
13	PPM HCL		5.00
14	COLOR READING		5.
15	VISUAL APPEARANCE	Clear	Clear

132

1	MI/V1		.0005
2	METHYL BROMIDE		.0030
3	ETHYL CHLORIDE		.0100
4	PROPYLENE OXIDE		.0001
5	VINYLDIENE CHLORIDE		.0100
6	METHYLENE CHLORIDE	98.0000	102.0000
7	TRANS		.0200
8	A-DI		.0010
9	CHLOROFORM		.0100
10	CYCLOHEXANE	.0250	.0350
11	TCE		.0001
12	PPM WATER		75.00
13	PPM HCL		5.00
14	COLOR READING		5.
15	VISUAL APPEARANCE	Clear	Clear

1	MI/V1		.0005
2	METHYL BROMIDE		.0030
3	ETHYL CHLORIDE		.0100
4	PROPYLENE OXIDE		.0001
5	VINYLDIENE CHLORIDE		.0100
6	METHYLENE CHLORIDE	98.0000	102.0000
7	TRANS		.0200
8	A-DI		.0010
9	CHLOROFORM		.0100
10	CYCLOHEXANE	.0200	.0400
11	TCE		.0001
12	PPM WATER		75.00
13	PPM HCL		5.00
14	COLOR READING		5.
15	VISUAL APPEARANCE	Clear	Clear

133

1	MI/V1		.0005
2	METHYL BROMIDE		.0030

SPECIFICATIONS CATALOG

PROFILES 10 - 2000

PROFILE #: DETERMINANT #: DESCRIPTION: LOW SPEC: HIGH SPEC:

114

3	ETHYL CHLORIDE		.0100
4	PROPYLENE OXIDE	.4000	.6000
5	VINYLDENE CHLORIDE		.0100
6	METHYLENE CHLORIDE	97.0000	1015.000
7	TRANS		.0200
8	A-DI		.0010
9	CHLOROFORM		.0100
10	CYCLOHEXANE	.0200	.0400
11	TCE		.0001
12	PPM WATER		75.00
13	PPM HCL		5.00
14	COLOR READING		5.
15	VISUAL APPERANCE	Clear	Clear

136

1	M1/V1		.0005
2	METHYL BROMIDE		.0030
3	ETHYL CHLORIDE		.0100
4	PROPYLENE OXIDE	1.5000	1.8000
5	VINYLDENE CHLORIDE		.0100
6	METHYLENE CHLORIDE	96.5000	100.0000
7	TRANS		.0200
8	A-DI		.0010
9	CHLOROFORM		.0100
10	CYCLOHEXANE	.0200	.0400
11	TCE		.0001
12	PPM WATER		75.00
13	PPM HCL		5.00
14	COLOR READING		5.
15	VISUAL APPERANCE	Clear	Clear

139

1	METHYLENE CHLORIDE		
2	ETHYL CHLORIDE		
3	METHYL BROMIDE		
4	VINYLDENE CHLORIDE		
5	TRANS		
6	CHLOROFORM		
7	M1/V1		
8	AMYLENE		
9	PPM WATER		75.00
10	COLOR READING		5.
11	VISUAL APPERANCE	Clear	Clear
12	PPM HCL		5.00

137

1	M1/V1		.0005
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 DO 014758
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SPECIFICATIONS CATALOG

PROFILES 10 - 2000

PROFILE #: DETERMINANT #: DESCRIPTION: LOW SPEC: HIGH SPEC:

137

2	METHYL BROMIDE		.0030
3	ETHYL CHLORIDE		.0100
4	PROPYLENE OXIDE	.4000	.6000
5	VINYLDENE CHLORIDE		.0100
6	METHYLENE CHLORIDE	98.0000	102.0000
7	TRANS		.0200
8	A-DI		.0010
9	CHLOROFORM		.0100
10	CYCLOHEXANE	.0200	.0400
11	TCE		.0001
12	PPM WATER		75.00
13	PPM HCL		5.00
14	COLOR READING		5.
15	VISUAL APPERANCE	Clear	Clear

138

1	M1701		.0005
2	METHYL BROMIDE		.0030
3	ETHYL CHLORIDE		.0100
4	PROPYLENE OXIDE	1.5000	1.8000
5	VINYLDENE CHLORIDE		.0100
6	METHYLENE CHLORIDE	96.5000	100.0000
7	TRANS		.0200
8	A-DI		.0010
9	CHLOROFORM		.0100
10	CYCLOHEXANE	.0200	.0400
11	TCE		.0001
12	PPM WATER		75.00
13	PPM HCL		5.00
14	COLOR READING		5.
15	VISUAL APPERANCE	Clear	Clear

139

1	M1701		.0005
2	METHYL BROMIDE		.0030
3	ETHYL CHLORIDE		.0100
4	PROPYLENE OXIDE		.0001
5	VINYLDENE CHLORIDE		.0100
6	METHYLENE CHLORIDE	98.0000	102.0000
7	TRANS		.0200
8	A-DI		.0010
9	CHLOROFORM		.0100
10	CYCLOHEXANE	.0200	.0400
11	TCE		.0001
12	PPM WATER		75.00
13	PPM HCL		5.00
14	COLOR READING		5.

 DO 014759
 CONFIDENTIAL

SPECIFICATIONS CATALOG

PROFILES 10 - 2000

PROFILE #: DETERMINANT #: DESCRIPTION: LOW SPEC: HIGH SPEC:

134

DETERMINANT #	DESCRIPTION	LOW SPEC	HIGH SPEC
15	VISUAL APPEARANCE	Clear	Clear

140

1	METHYLENE CHLORIDE		200.00
2	VINYLDENE CHLORIDE		100.00
3	TRANS		20.00
4	M4 CARBON TET		250.00
5	CHLOROFORM	980000.0	1020000.0
6	AMYLENE	10.00	20.00
7	CIS		80.00
8	BROLME		300.00
9	A-DI		100.00
10	PPM WATER		50.00
11	PPM HCL		10.00
12	COLOR READING		10.
13	VISUAL APPEARANCE	Clear	Clear

141

1	METHYLENE CHLORIDE		200.00
2	VINYLDENE CHLORIDE		100.00
3	TRANS		20.00
4	M4 CARBON TET		250.00
5	CHLOROFORM	980000.0	1020000.0
6	AMYLENE	10.00	20.00
7	CIS		80.00
8	BROLME		300.00
9	A-DI		100.00
10	PPM WATER		50.00
11	PPM HCL		10.00
12	COLOR READING		10.
13	VISUAL APPEARANCE	Clear	Clear

142

1	METHYLENE CHLORIDE		200.00
2	VINYLDENE CHLORIDE		20.00
3	TRANS		20.00
4	M4 CARBON TET		250.00
5	CHLOROFORM	980000.0	1020000.0
6	AMYLENE	10.00	20.00
7	CIS		80.00
8	BROLME		300.00
9	A-DI		100.00
10	PPM WATER		50.00
11	PPM HCL		10.00
12	COLOR READING		10.
13	VISUAL APPEARANCE	Clear	Clear

143

1	METHYLENE CHLORIDE		200.00
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DO 014760
CONFIDENTIAL

SPECIFICATIONS CATALOG

PROFILES 10 - 2000

PROFILE #: DETERMINANT #: DESCRIPTION: LOW SPEC: HIGH SPEC:

143

2	VINYLDENE CHLORIDE		100.00
3	TRANS		20.00
4	M4 CARBON TET		250.00
5	CHLOROFORM	980000.0	1020000.
6	AMYLENE	10.00	20.00
7	CIS		80.00
8	BRLME		300.00
9	A-DI		100.00
10	PPM WATER		50.00
11	PPM HCL		10.00
12	COLOR READING		10.
13	VISUAL APPERANCE	Clear	Clear

144

1	METHYLENE CHLORIDE		200.00
2	VINYLDENE CHLORIDE		100.00
3	TRANS		20.00
4	M4 CARBON TET		250.00
5	CHLOROFORM	980000.0	1020000.
6	AMYLENE	10.00	20.00
7	CIS		80.00
8	BRLME		300.00
9	A-DI		100.00
10	PPM WATER		50.00
11	PPM HCL		10.00
12	COLOR READING		10.
13	VISUAL APPERANCE	Clear	Clear

145

1	ETHANOL		.0100
2	METHANOL		
3	PPM WATER		200.00
4	PPM HCL		15.00

146

1	ETHANOL		.0100
2	METHANOL		
3	PPM WATER		200.00
4	PPM HCL		15.00

147

1	METHANE		10.00
2	ETHYLENE		5.00
3	ETHANE		5.00
4	ACETYLENE		10.00
5	DIMETHYL ETHER		10.00
6	METHYL CHLORIDE	980000.0	1020000.

SPECIFICATIONS CATALOG

PROFILES 10 - 2000

PROFILE #: DETERMINANT #: DESCRIPTION: LOW SPEC: HIGH SPEC:

147

7	VINYL CHLORIDE	50.00	
8	METHANOL	50.00	
9	METHYLENE CHLORIDE	50.00	
10	ETHYL CHLORIDE	50.00	
11	FREON 12	1.00	
12	PROPANE/BUTANE		
13	PPM WATER	80.00	
14	PPM HCL	7.00	
15	VOL % NITROGEN	2.00	
16	VISUAL APPEARANCE	5.	7.
17	SHIPPED ?		
18	SEAL NUMBER		
19	SEAL NUMBER		
20	SEAL NUMBER		
21	SEAL NUMBER		

149

1	M1/U1	.0005	
2	METHYL BROMIDE	.0030	
3	ETHYL CHLORIDE	.0100	
4	PROPYLENE OXIDE	.0001	
5	VINYLDIENE CHLORIDE	.0100	
6	METHYLENE CHLORIDE	98.0000	102.0000
7	TRANS	.0200	
8	A-DI	.0010	
9	CHLOROFORM	.0100	
10	CYCLOHEXANE	.0200	.0400
11	TCE	.0001	
12	PPM WATER	75.00	
13	PPM HCL	5.00	
14	COLOR READING	5.	
15	VISUAL APPEARANCE	Clear	Clear
16	SHIPPED ?		
17	SEAL NUMBER		
18	SEAL NUMBER		
19	SEAL NUMBER		
20	SEAL NUMBER		
21	TRAILER #		

150

1	PPM SULFITE
2	PPM PHOSPHATE
3	CONDUCTIVITY READING

151

1	METHYLENE CHLORIDE	200.00
2	VINYLDIENE CHLORIDE	100.00

SPECIFICATIONS CATALOG

PROFILES 10 - 2000

PROFILE #: DETERMINANT #: DESCRIPTION: LOW SPEC: HIGH SPEC:

151

3	TRANS		20.00
4	M4 CARBON TET		250.00
5	CHLOROFORM	980000.0	1020000.
6	AMYLENE	10.00	20.00
7	CIS		80.00
8	BROLME		300.00
9	A-DI		100.00
10	PPM WATER		50.00
11	PPM HCL		10.00
12	COLOR READING		10.
13	VISUAL APPERANCE	Clear	Clear
14	SHIPPED ?		
15	SEAL NUMBER		
16	SEAL NUMBER		
17	SEAL NUMBER		
18	SEAL NUMBER		

152

1	M1/V1		.0005
2	METHYL BROMIDE		.0030
3	ETHYL CHLORIDE		.0100
4	PROPYLENE OXIDE		.0001
5	VINYLDENE CHLORIDE		.0100
6	METHYLENE CHLORIDE	98.0000	102.0000
7	TRANS		.0200
8	A-DI		.0010
9	CHLOROFORM		.0100
10	CYCLOHEXANE	.0200	.0400
11	TOT		.0001
12	PPM WATER COMP 1		
13	PPM WATER COMP 2		
14	PPM WATER COMP 3		
15	PPM HCL COMP 1		
16	PPM HCL COMP 2		
17	PPM HCL COMP 3		
18	COLOR COMP 1		
19	COLOR COMP 2		
20	COLOR COMP 3		
21	VISUAL APPERANCE	Clear	Clear
22	SHIPPED ?		
23	BARGE ID #		

154

1	METHYLENE CHLORIDE	200.00
2	VINYLDENE CHLORIDE	100.00
3	TRANS	20.00
4	M4 CARBON TET	250.00

SPECIFICATIONS CATALOG

PROFILES 10 - 2000

PROFILE #:	DETERMINANT #:	DESCRIPTION:	LOW SPEC:	HIGH SPEC:
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154

5	CHLOROFORM	980000.0	1020000.
6	AMYLENE	10.00	20.00
7	CIS		80.00
8	BROLME		300.00
9	A-DI		100.00
10	PPM WATER COMP 1		
11	PPM WATER COMP 2		
12	PPM WATER COMP 3		
13	PPM HCL COMP 1		
14	PPM HCL COMP 2		
15	PPM HCL COMP 3		
16	COLOR COMP 1		
17	COLOR COMP 2		
18	COLOR COMP 3		
19	VISUAL APPEARANCE	Clear	Clear
20	SHIPPED ?		
21	BARGE ID #		

155

1	ETHANOL		.0100
2	METHANOL		
3	PPM WATER COMP 1		
4	PPM WATER COMP 2		
5	PPM WATER COMP 3		
6	PPM HCL COMP 1		
7	PPM HCL COMP 2		
8	PPM HCL COMP 3		
9	COLOR COMP 1		
10	COLOR COMP 2		
11	COLOR COMP 3		
12	BARGE ID #		

156

1	METHYLENE CHLORIDE
2	A DI
3	CHLOROFORM
4	CIS
5	M4

157

1	METHYLENE CHLORIDE
2	VINYLDENE CHLORIDE
3	TRANS
4	M4 CARBON TET
5	CHLOROFORM
6	AMYLENE
7	CIS