

FIRE AND EXPLOSION INDEX

MANUFACTURING UNIT LIGHT HYDROCARBON II

PROCESS UNIT PROPYLENE DEHYDRATORS 2C-30 A&B

BACKGROUND INFORMATION FOR PROPYLENE DEHYDRATOR AREA: The 2C-30's are dehydrators for drying propylene from the Well. The vessels are 6 feet 6 inches in diameter and 45 feet in height. The dehydrator are filled with activated alumina as drying medium. 2C-30A is filled with Alcoa 1/4 x 8 mesh F-1 (flakes). 2C-30B is filled with Kaiser 1/4 x 8 mesh A-201 (balls). The bed were last changed out in September of 1983. The beds are filled with 1200cf of alumina. The external void fraction is approximately 0.25. (take from an article by titled Gas Adsorption by James R. Fair. The material of construction of the vessel is SA-212 GR B FBX. The design pressure is 400 PSIG at 650°F. The normal operating conditions are ambient temperature and 300 PSIG.

Volume for the drum is calculated below:

$$V = (\pi r^2 H)$$

$$V = (\pi (3.35)^2 (45)) = 1493 \text{ cf}$$

The volume of alumina was subtracted from the vessel volume.

Material Factor (from Appendix A of Fire & Explosion Index Hazard Classification Guide)

Compound	MF	Hc BTU/LB $\times 10^3$	N _H	N _F	N _R	Flash Point (° F)	Boiling Point (°F)
Propylene	21	19.7	1	4	1	-162	-54

General Process Hazards: (Information)

The only penalty of 0.5 was taken for drainage and control.

Special Process Hazards: (Information)

A penalty of 0.2 for toxic material using the N_H of propylene. No penalty was taken for sub-atmospheric pressure. No penalty was taken for operation in or near flammable range. No penalty was taken for dust explosion. The operating pressure penalty was 0.4836. The set pressure penalty was .6116. A factor of 1.2 for compressed gas was used. The final pressure penalty was .45. A low temperature penalty of .3 was taken. The penalty for quantity of flammable/unstable material was .77. The quantity was calculated with only one dehydrator in service. The flammable penalty was .36. Penalties of 0.1 was taken for both corrosion and erosion and leakage. No penalties were taken for use of fired equipment, hot oil exchange system, or rotating equipment.

Loss Control Credit Factors

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Process Control Credit Factor (C₁)

Emergency Power -0.98

A credit was taken for Emergency Power due to the UPS system.

Cooling -1.0

Explosion Control-1.0

Emergency Shutdown-1.0

Computer Control- 1.0

Inert Gas-1.0

Operating Instructions/Procedure-1.0

Reactive Chemical Review-0.91

A credit was taken for reactive chemical review. Reactive chemical concerns are listed on MOC sheet and plant personal are trained and tested on reactive chemical concerns at LHC II.

Other Process Hazard Analysis- 0.98 for Management of Change Review

Material Isolation Credit Factor (C₂)

Remote Control Valves-1

Dump/Blowdown- 1

Drainage-1

Interlock-1

Fire Protection Credit Factor (C₃)

Leak Detection -.94

LHC II is protected by Bacharach gas detectors. A project is being worked on to evaluate the gas detector system and replace with a more reliable system.

Structural Steel- 1

Fire Water Supply- 0.94 (supply pressure will be approximately 100 psig without pump and 150 psig with pump.)

Sprinkler Systems-.97

A credit was taken for the deluge systems at LHC II.

Water Curtains- 1

No credit was taken for the furnace water curtain due to its height and that furnace 1-6 and 19-25 are unprotected are the lower level.

Foam-1

Hand Extinguishers/Monitors-.97

Cable Protection- 1 (This credit would change after completion of the Instrument Upgrade Project.)

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PF1 = VIEW SPEC      PF4 =                PF7 = PREV RECORD  PF10 =
PF2 =                PF5 =                PF8 = NEXT RECORD  PF11 =
PF3 = BROWSE         PF6 = MENU          PF9 =              PF12 = MAIN MENU
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PF1 = VIEW SPEC      PF4 =                PF7 = PREV RECORD  PF10 =
PF2 =                PF5 =                PF8 = NEXT RECORD  PF11 =
PF3 = BROWSE         PF6 = MENU          PF9 =              PF12 = MAIN MENU
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Equip ID: PSV 2C-30 BA      Eq Desc: SAFETY VALVE #808001      Unit: 00048
Cost Cnctr: 0000063      Criticality: 01      Area: 2C-30      Project: 17
Serial #: 2811-K      Equip Code: _____      Type: 434
Assoc Ser #: _____      Equip Cond: _____      Spec: _____
Parent ID: 2C-30 B      Grid: _____      Fleet MGMT?: _____
Install Dt: _____
MFR Abbrev: ANDRSN      Model #: _____
Model Type: 33310H23/S      Model Size: 2" X H X 3"
GEMTS->      Prod / Process: PRODUCT DISTRIBUTION      2D-30 A/B
      Equip Group / Type : PRESSURE VESSEL/VALVE      PRESSURE R
      * * * SPECIFICATION TEXT * * *
INSPECTION SCHEDULE: 60 MONTHS      VALVE SET PRESSURE: 400 PSIG
OPERATING TEMP: 50 DEG. F      OPERATING PRESSURE: 250 PSIG
BACK PRESSURE: 0      PRODUCT: PROPYLENE VAPORS
MTD Cost: _____      0 YTD Cost: _____      0 LTD Cost: _____
Last PM: _____      Date Installed: _____
# Sel: 0      Last Updated By: NPL0467      Date: 06/06/94
GN-10      < RESET COMPLETE >

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PF1 = VIEW SPEC      PF4 =          PF7 = PREV RECORD  PF10 =
PF2 =                PF5 =          PF8 = NEXT RECORD  PF11 =
PF3 = BROWSE         PF6 = MENU      PF9 =          PF12 = MAIN MENU
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PF1 = VIEW SPEC      PF4 =          PF7 = PREV RECORD  PF10 =
PF2 =                PF5 =          PF8 = NEXT RECORD  PF11 =
PF3 = BROWSE         PF6 = MENU      PF9 =          PF12 = MAIN MENU
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FIRE & EXPLOSION INDEX



AREA/COUNTRY	DIVISION	LOCATION	DATE
USA	Louisiana	Plaquemine	June 19, 1995
SITE	MANUFACTURING UNIT	PROCESS UNIT	
Louisiana	Light Hydrocarbon II	Propylene Econimizer (2D-120)	
PREPARED BY:	APPROVED BY: (Superintendent)	Building NO.	
Holly Reed	?	B4801	
REVIEWED BY: (Management)	REVIEWED BY: (Technology Center)	REVIEWED BY: (Safety & Loss Prevention)	
?	?	?	
MATERIALS IN PROCESS UNIT			
Propylene			
STATE OF OPERATION		BASIC MATERIAL(S) FOR MATERIAL FACTOR	
☐ DESIGN ☐ START UP ☒ NORMAL OPERATION ☐ SHUTDOWN		Propylene	
MATERIAL FACTOR (See Table 1 or Appendices A or B) Note requirements when unit temperatures over 140 °			21
1. General Process Hazards		Penalty Factor Range	Penalty Factor Used (1)
Base Factor		1.00	1.00
A. Exothermic Chemical Reactions		0.30 to 1.25	0.00
B. Endothermic Processes		0.20 to 0.40	0.00
C. Material Handling and Transfer		0.25 to 1.05	0.00
D. Enclosed or Indoor Process Units		0.25 to 0.90	0.00
E. Access		0.20 to 0.35	0.00
F. Drainage and Spill Control		0 gallons	0.25 to 0.50
General Process Hazards Factor (F1)		1.50	
2. Special Process Hazards			
Base Factor		1.00	1.00
A. Toxic Material(s)		0.20 to 0.80	0.20
B. Sub-Atmospheric Pressure (< 500 mm Hg)		0.50	0.00
C. Operation In or Near Flammable Range ☐ INERTED ☒ NOT INERTED			
1. Tank Farms Storage Flammable Liquids		0.50	0.00
2. Process Upset or Purge Failure		0.30	0.00
3. Always in Flammable Range		0.80	0.00
D. Dust Explosion (See Table 3)		0.25 to 2.00	0.00
E. Pressure (See Figure 2)		Operating Pressure 300 psig Relief Setting 220 psig	0.78
F. Low Temperature		0.20 to 0.30	0.00
G. Quantity of Flammable/Unstable Material		Quantity 33,620 lb Hc = 19,700 BTU/lb	
1. Liquids or Gases in Process (See Figure 3)			1.21
2. Liquids or Gases in Storage (See Figure 4)			0.00
3. Combustible Solids in Storage, Dust in Process (See Figure 5)			0.00
H. Corrosion and Erosion		0.10 to 0.75	0.10
I. Leakage - Joints and Packing		0.10 to 1.50	0.00
J. Use of Fired Equipment (See Figure 6)			0.00
K. Hot Oil Heat Exchange System (See Table 5)		0.15 to 1.15	0.00
L. Rotating Equipment		0.50	0.00
Special Process Hazards Factor (F2)		3.27	
Process Unit Hazards Factor (F1 x F2) = F3		4.90	
Fire and Explosion Index (F3 x MF = F&EI)		103	

(1) For no penalty use 0.00.

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LOSS CONTROL CREDIT FACTORS

1. Process Control Credit Factor (C1)

Feature	Credit Factor Range	Credit Factor Used (2)	Feature	Credit Factor Range	Credit Factor Used (2)
a. Emergency Power	0.98	0.98	f. Inert Gas	0.94 to 0.96	1.00
b. Cooling	0.97 to 0.99	1.00	g. Operating Instructions/Procedures	0.91 to 0.99	1.00
c. Explosion Control	0.84 to 0.88	1.00	h. Reactive Chemical Review	0.91 to 0.96	0.98
d. Emergency Shutdown	0.96 to 0.99	1.00	i. Other Process Hazard Analysis	0.91 to 0.96	0.98
e. Computer Control	0.93 to 0.99	1.00			

C1 Value (3) 0.941

2. Material Isolation Credit Factor (C2)

Feature	Credit Factor Range	Credit Factor Used (2)	Feature	Credit Factor Range	Credit Factor Used (2)
a. Remote Control Valves	0.96 to 0.98	1.00	c. Drainage	0.91 to 0.97	1.00
b. Dump/Blowdown	0.96 to 0.98	1.00	d. Interlock	0.98	1.00

C2 Value (3) 1.000

3. Fire Protection Credit Factor (C3)

Feature	Credit Factor Range	Credit Factor Used (2)	Feature	Credit Factor Range	Credit Factor Used (2)
a. Leak Detection	0.94 to 0.98	0.98	f. Water Curtains	0.97 to 0.98	1.00
b. Structural Steel	0.95 to 0.98	1.00	g. Foam	0.92 to 0.97	1.00
c. Fire Water Supply	0.94 to 0.97	0.94	h. Hand Extinguishers/Monitors	0.93 to 0.96	0.97
d. Special Systems	0.91	1.00	i. Cable Protection	0.94 to 0.98	1.00
e. Sprinkler Systems	0.74 to 0.97	0.97			

C3 Value (3) 0.867

Loss Control Credit Factor = C1 x C2 x C3 (3) = 0.816

PROCESS UNIT RISK ANALYSIS SUMMARY

1. Fire and Explosion Index (F&EI)	(See Front)	103	
2. Radius of Exposure	(Figure 7)	86	ft
3. Area of Exposure		23436	sq.ft.
4. Value of Area of Exposure (1994 Dollars).....			\$MM 21.43
5. Damage Factor	(Figure 8)	0.73	
6. Base Maximum Probable Property Damage - (Base MPPD) [4 x 5]			\$MM 15.73
7. Loss Control Credit Factor	(See Above)	0.82	
8. Actual Maximum Probable Property Damage - (Actual MPPD) [6 x 7]			\$MM 12.83
9. Maximum Probable Days Outage - (MPDO)	(Figure 9)	96	days
10. Business Interruption - (BI)			\$MM 67.12

(2) For no credit factor enter 1.00

(3) Product of all factors used

Refer to "Fire & Explosion Index Hazard Classification Guide" (Form #471-00001) for details

BACK OF FORM C-22380 Rev/01-94 (471-00036) - (FIE-7 System Ver-2.1 - 8/31/94)

Print Date: 7/12/95

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FIRE & EXPLOSION INDEX - DATA AND COMMENTS

Material Factor

Material is From Database
Material Name - Propylene
Base Material Factor = 21
Adjusted Material Factor = 21
Heat of Combustion (BTU/lb) = 19700
Nh = 1
Nf = 4
Nr = 1
Flash Point (°F) = -162
Boiling Point (°F) = -54
Process Unit Temperature (°F) = 120
Exotherm Temperature (°F) = 1000000
Autoignition Temperature (°F) = 861

Data For User Specified Material

General Process Hazards

- A. Exothermic Chemical Reactions
Process Unit NOT A REACTOR and/or NO EXOTHERM occurs (Penalty=0)
Comme 0
- B. Endothermic Processes
Process Unit NOT A REACTOR ==> Penalty=0
Comme 0
- C. Material Handling and Transfer
None of the following situations apply (Penalty=0)
Comme 0
- D. Enclosed or Indoor Process Units
Process is NOT ENCLOSED (Penalty=0)
Comme 0
- E. Access
Access determined adequate for emergency equipment (Penalty=0)
Comme 0
- F. Drainage and Spill Control
Flat, undiked area which allows spills to spread out (Penalty=0.50)
Comme 0

Special Process Hazards

- A. Toxic Material(s)
Equals two tenths of the Nh
- B. Sub-Atmospheric Pressure (< 500 mm Hg)
Greater than 500 mmHg (Penalty=0)
Comme 0
- C. Operation In or Near Flammable Range
Process will not reach the flammable range (Penalty=0).
Comme 0
- D. Dust Explosion
Process does not include dusts (Penalty=0)
Comme 0
- E. Pressure
Comme 0
- F. Low Temperature
Temperatures remain safely above the ductile/brittle
Comme 0
- G. Quantity of Flammable/Unstable Material
In Process
Comme 0
- H. Corrosion and Erosion
Corrosion rates below 0.5 mm/yr WITH risk of pitting and/or
Comme 0
- I. Leakage - Joints and Packing
Leakage of flammable/combustibles is insignificant
Comme 0
- J. Use of Fired Equipment
DOES NOT exist in the plant with the Process Unit
Comme 0
- K. Hot Oil Heat Exchange System
Process does not use a hot oil exchange system, or the hot oil
Comme 0
- L. Rotating Equipment
No rotating equipment deemed to be a hazard (No Penalty)
Comme 0

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LOSS CONTROL CREDIT FACTORS - DATA AND COMMENTS

Process Control Credit Factor (C1)

- a) Emergency Power
Automatic switch to emergency power for CRITICAL SERVICES
Comme 0
- b) Cooling
No credit (Factor=1.0)
Comme 0
- c) Explosion Control
No credit (Factor=1.0)
Comme 0
- d) Emergency Shutdown
No credit (Factor=1.0)
Comme 0
- e) Computer Control
No credit (Factor=1.0)
Comme 0
- f) Inert Gas
No credit (Factor=1.0)
Comme 0
- g) Operating Instructions/Procedures
Comme 0
- h) Reactive Chemical Review
Reactive Chemical reviews done only on an occasional basis
Comme 0
- i) Other Process Hazard Analysis
Management of Change Review (Factor=0.98)
Comme 0

Material Isolation Credit Factor (C2)

- a) Remote Control Valves
No credit (Factor=1.0)
Comme 0
- b) Dump/Blowdown
No credit (Factor=1.0)
Comme 0
- c) Drainage
No credit (Factor=1.0)
Comme 0
- d) Interlock
No credit (Factor=1.0)
Comme 0

Fire Protection Credit Factor (C3)

- a) Leak Detection
Gas detectors alarm and identify a zone only (Factor=0.98)
Comme 0
- b) Structural Steel
No credit (Factor=1.0)
Comme 0
- c) Fire Water Supply
Firefighting water can be supplied for 4 hours at 100 psig (7)
Comme 0
- d) Special Systems
No credit (Factor=1.0)
Comme 0
- e) Sprinkler Systems
Deluge system protects process (Factor=0.97)
Comme 0
- f) Water Curtains
No credit (Factor=1.0)
Comme 0
- g) Foam
No credit (Factor=1.0)
Comme 0
- h) Hand Extinguishers/Monitors
The process is protected by monitor guns (Factor=0.97)
Comme 0
- i) Cable Protection
No credit (Factor=1.0)
Comme 0

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ALTERNATE FORM FOR SINGLE CHAMBER COMPLETELY SHOP-FABRICATED VESSELS ONLY

1. Manufactured by AMF BEAIRD, INC., SHREVEPORT, LOUISIANA
(Name and address of Manufacturer)

2. Manufactured for THE DOW CHEMICAL COMPANY, HOUSTON, TEXAS
(Name and address of Purchaser)

3. Type Horiz. Vessel No. (148993) (Mfrs. Serial) (State & State No.) Natl. Bd. No. Yr. Built 1967

4. SHELL: Matl. SA-212-B-Flu T.S. 70,000 Nom. 1-3/16 Corr. 1/16 In. Diam. 9 Ft. 0 In. Length 29 Ft. 8 In.
(Kind and Spec. No.) (Fig. or F.B. & Spec. Min. T.S.) (Heads 1/16)

5. SEAMS: Long Dbl. Butt H.T. No X.R. Spot Sectioned No Efficiency 85 %
(Welded, Dbl. Single, Lap, Butt) (Yes or No) (Spot or Complete) (Yes or No)
Girth Dbl. Butt H.T. No X.R. Spot Sectioned No No. of Courses 4

6. HEADS: (a) Material SA-212-B-Flu T.S. 70,000 (b) Material T.S.
Location (Top, bottom, ends) Thickness Crown Radius Knuckle Radius Elliptical Ratio Conical Apex Angle Hemispherical Radius Flat Diameter Side to Pressure (Convex or Concave)
(a) Ends 1" Min. 211 Concave
(b) _____
If removable, bolts used _____ Other fastening _____ (Describe or Attach Sketch)

7. Constructed for max. allowable working press.² 300 psi. at max. temp. 450 °F. Min. temp. (when less than -20°) _____ °F. Hydrostatic or Pneumatic or Test Combination Press. 483 psi.

8. SAFETY OR RELIEF VALVE OUTLETS: Number 1 Size 3" Location Top of tank in shell

9. NOZZLES:
Purpose (Inlet, Outlet, Drain) Number Diam. or Size Type Material Thickness Reinforcement Material How Attached
(1) 1-1/2" 300# Long Weld Neck Flg. SA-181-I Welded
(2) 2" (1) 3" (1) 6" 300# Slip on Flgs. SA-181-I Welded
(3) 10" (1) 18" 300# Slip on Flgs. SA-181-I Welded
See Attached Sheet

10. INSPECTION OPENINGS: Manholes, No. 1 Size 18" Location End of tank in head
Handholes, No. _____ Size _____ Location _____
Threaded, No. _____ Size _____ Location _____

11. SUPPORTS: Skirt _____ Lugs _____ Legs _____ Other (2) Saddles Attached Welded to tank
(Yes or No) (Number) (Number) (Describe) (Where & How)

12. REMARKS: One 108" I.P. x 35' 2-1/8" O.A. Length 13,703 W.G. Storage Tank, per Beaird
Dwg. Order 148993

(Brief description of purpose of the vessel as Air Tank, Water Tank, L.P.G., Etc.—State Contents.
¹ If postweld heat-treated.
² List other internal or external pressures with coincident temperature when applicable)

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME Code for Unfired Pressure Vessels. 1965 Edition

Date 7-5 19 67 Signed AMF BEAIRD, INC. By W.D. Thomas
(Manufacturer)

Certificate of Authorization Expires December 31, 1970

CERTIFICATE OF SHOP INSPECTION

VESSEL MADE BY AMF BEAIRD, INC. at SHREVEPORT, LOUISIANA

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State of N. B. and employed by THE COMMERCIAL UNION INSURANCE COMPANY of NEW YORK have inspected the pressure vessel described in this manufacturer's data report on 7-5 19 67, and state that to the best of my knowledge and belief, the manufacturer has constructed this pressure vessel in accordance with the applicable sections of the ASME Boiler and Pressure Vessel Code.

By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this manufacturer's data report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 7-5 19 67

F. A. Zonkel
Inspector's Signature

Commissions _____

Natl. Board or State and No. _____

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05/30/95 10:46

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PF1 = VIEW SPEC      PF4 =                PF7 = PREV RECORD    PF10 =
PF2 =                PF5 =                PF8 = NEXT RECORD      PF11 =
PF3 = BROWSE         PF6 = MENU           PF9 =                PF12 = MAIN MENU
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DO A 031352
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103 COMMAND ==> _____

INQUIRE FIXED EQUIPMENT

05/30/95 10:47

Equip ID: PSV 2D-120 B Eq Desc: SAFETY VALVE #803052 Unit: 00048
Cost Center: 0000063 Criticality: 01 Area: 71DECK Project: 17
Serial #: 34852 M6 Equip Code: _____ Type: 434
Loc Ser #: _____ Equip Cond: _____ Spec: _____
Parent ID: 2D-120 Grid: _____ Fleet MGMT?: _____
Install Dt: _____

MFR Abbrev: CROSBY Model #: _____
Model Type: JO-35A Model Size: 2 1/2" X J X 4"
GEMTS-> Prod / Process: REFRIGERATION 2TK-120 SYS
Eqp Group / Type : PRESSURE VESSEL/VALVE PRESSURE R

*** SPECIFICATION TEXT ***
INSPECTION SCHEDULE: 60 MONTHS

VALVE SET PRESSURE: 300 PSIG

OPERATING TEMP: 100 DEG. F

OPERATING PRESSURE: 220 PSIG

BACK PRESSURE: 0

PRODUCT: PROPYLENE VAPORS

MTD Cost: 0 YTD Cost:

974 LTD Cost:

1316

Last PM:

Date Installed:

Sel: 0 Last Updated By: U432414

Date: 10/30/89

GN-10

< RESET COMPLETE >

PF1 = VIEW SPEC

PF4 =

PF7 = PREV RECORD

PF10 =

PF2 =

PF5 =

PF8 = NEXT RECORD

PF11 =

PF3 = BROWSE

PF6 = MENU

PF9 =

PF12 = MAIN MENU

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FIRE & EXPLOSION INDEX

DOW

AREA/COUNTRY	DIVISION	LOCATION	DATE
USA	Louisiana	Plaquemine	7/5/95
SITE	MANUFACTURING UNIT	PROCESS UNIT	
Louisiana	Light Hydrocarbon II	Acetylene Reactors (2R-1 A/B)	
PREPARED BY:	APPROVED BY: (Superintendent)	BUILDING	
Holly Reed	?	B4801	
REVIEWED BY: (Management)	REVIEWED BY: (Technology Center)	REVIEWED BY: (Safety & Loss Prevention)	
?	?	?	
MATERIALS IN PROCESS UNIT			
Ethylene, Ethane, Methane, Hydrogen, Acetylene			
STATE OF OPERATION		BASIC MATERIAL(S) FOR MATERIAL FACTOR	
☐ DESIGN ☐ START UP ☒ NORMAL OPERATION ☐ SHUTDOWN		Ethylene	
MATERIAL FACTOR (See Table 1 or Appendices A or B) Note requirements when unit temperatures over 140 °F			24
1. General Process Hazards			
Base Factor			1.00
A. Exothermic Chemical Reactions			0.30 to 1.25
B. Endothermic Processes			0.20 to 0.40
C. Material Handling and Transfer			0.25 to 1.05
D. Enclosed or Indoor Process Units			0.25 to 0.90
E. Access			0.20 to 0.35
F. Drainage and Spill Control 0 gallons			0.25 to 0.50
General Process Hazards Factor (F1)			1.80
2. Special Process Hazards			
Base Factor			1.00
A. Toxic Material(s)			0.20 to 0.80
B. Sub-Atmospheric Pressure (< 500 mm Hg)			0.50
C. Operation in or Near Flammable Range ☐ INERTED ☒ NOT INERTED			
1. Tank Farms Storage Flammable Liquids			0.50
2. Process Upset or Purge Failure			0.30
3. Always in Flammable Range			0.80
D. Dust Explosion (See Table 3)			0.25 to 2.00
E. Pressure (See Figure 2) Operating Pressure 350 psig Relief Setting 475 psig			0.60
F. Low Temperature			0.20 to 0.30
G. Quantity of Flammable/Unstable Material Quantity 6,158 lb Hc = 20,800 BTU/lb			
1. Liquids or Gases in Process (See Figure 3)			0.22
2. Liquids or Gases in Storage (See Figure 4)			0.00
3. Combustible Solids in Storage, Dust in Process (See Figure 5)			0.00
H. Corrosion and Erosion			0.10 to 0.75
I. Leakage - Joints and Packing			0.10 to 1.50
J. Use of Fired Equipment (See Figure 6)			0.00
K. Hot Oil Heat Exchange System (See Table 5)			0.15 to 1.15
L. Rotating Equipment			0.50
Special Process Hazards Factor (F2)			2.23
Process Unit Hazards Factor (F1 x F2) = F3			4.01
Fire and Explosion Index (F3 x MF = F&EI)			96

(1) For no penalty use 0.00.

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LOSS CONTROL CREDIT FACTORS

1. Process Control Credit Factor (C1)

Feature	Credit Factor Range	Credit Factor Used (2)	Feature	Credit Factor Range	Credit Factor Used (2)
a. Emergency Power	0.98	0.98	f. Inert Gas	0.94 to 0.98	1.00
b. Cooling	0.97 to 0.99	1.00	g. Operating Instructions/Procedures	0.91 to 0.99	0.97
c. Explosion Control	0.84 to 0.88	1.00	h. Reactive Chemical Review	0.91 to 0.98	0.91
d. Emergency Shutdown	0.96 to 0.99	1.00	i. Other Process Hazard Analysis	0.91 to 0.98	0.96
e. Computer Control	0.93 to 0.99	1.00			

C1 Value (3) 0.848

2. Material Isolation Credit Factor (C2)

Feature	Credit Factor Range	Credit Factor Used (2)	Feature	Credit Factor Range	Credit Factor Used (2)
a. Remote Control Valves	0.96 to 0.98	1.00	c. Drainage	0.91 to 0.97	1.00
b. Dump/Blowdown	0.96 to 0.98	1.00	d. Interlock	0.98	1.00

C2 Value (3) 1.000

3. Fire Protection Credit Factor (C3)

Feature	Credit Factor Range	Credit Factor Used (2)	Feature	Credit Factor Range	Credit Factor Used (2)
a. Leak Detection	0.94 to 0.98	0.98	f. Water Curtains	0.97 to 0.98	1.00
b. Structural Steel	0.95 to 0.98	1.00	g. Foam	0.92 to 0.97	1.00
c. Fire Water Supply	0.94 to 0.97	0.94	h. Hand Extinguishers/Monitors	0.93 to 0.98	0.97
d. Special Systems	0.91	1.00	i. Cable Protection	0.94 to 0.98	1.00
e. Sprinkler Systems	0.74 to 0.97	0.97			

C3 Value (3) 0.867

Loss Control Credit Factor = C1 x C2 x C3 (3) = 0.738

PROCESS UNIT RISK ANALYSIS SUMMARY

1. Fire and Explosion Index (F&EI)	(See Front)	96		
2. Radius of Exposure	(Figure 7)	81	ft	
3. Area of Exposure		20493	sq.ft.	
4. Value of Area of Exposure (1994 Dollars).....			\$MM	18.74
5. Damage Factor	(Figure 8)	0.74		
6. Base Maximum Probable Property Damage - (Base MPPD) [4 x 5]			\$MM	13.83
7. Loss Control Credit Factor	(See Above)	0.73		
8. Actual Maximum Probable Property Damage - (Actual MPPD) [6 x 7]			\$MM	10.16
9. Maximum Probable Days Outage - (MPDO)	(Figure 9)	84	days	
10. Business Interruption - (BI)			\$MM	58.47

(2) For no credit factor enter 1.00

(3) Product of all factors used

Refer to "Fire & Explosion Index Hazard Classification Guide" (Form #471-00001) for details

BACK OF FORM C-22380 Rev/01-84 (471-00036) - (FIE-7 System Ver-2.1 - 8/31/84)

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Print Date: 7/13/95

FIRE & EXPLOSION INDEX - DATA AND COMMENTS

Material Factor

Material is From Database

Material Name - Ethylene

Base Material Factor = 24

Adjusted Material Factor = 24

Heat of Combustion (BTU/lb) = 20600

Nh = 1

Nf = 4

Nr = 2

Flash Point (°F) = Gas

Boiling Point (°F) = -156

Process Unit Temperature (°F) = 140

Exotherm Temperature (°F) = 1000000

Autoignition Temperature (°F) = 842

Data For User Specified Material

General Process Hazards

- A. Exothermic Chemical Reactions
REACTOR with MILD EXOTHERM (Penalty=0.30)
Comme 0
- B. Endothermic Processes
Process Unit NOT A REACTOR ==> Penalty=0
Comme 0
- C. Material Handling and Transfer
None of the following situations apply (Penalty=0)
Comme 0
- D. Enclosed or Indoor Process Units
Process is NOT ENCLOSED (Penalty=0)
Comme 0
- E. Access
Access determined adequate for emergency equipment (Penalty=0)
Comme 0
- F. Drainage and Spill Control
Flat, undiked area which allows spills to spread out (Penalty=0.50)
Comme 0

Special Process Hazards

- A. Toxic Material(s)
Equals two tenths of the Nh
- B. Sub-Atmospheric Pressure (< 500 mm Hg)
Greater than 500 mmHg (Penalty=0)
Comme 0
- C. Operation In or Near Flammable Range
Process will not reach the flammable range (Penalty=0)
Comme 0
- D. Dust Explosion
Process does not include dusts (Penalty=0)
Comme 0
- E. Pressure
Comme 0
- F. Low Temperature
Temperatures remain safely above the ductile/brittle
Comme 0
- G. Quantity of Flammable/Unstable Material
In Process
Comme 0
- H. Corrosion and Erosion
Corrosion rates below 0.5 mm/yr WITH risk of pitting and/or
Comme 0
- I. Leakage - Joints and Packing
Minor leakage likely at pump and gland seals (Penalty=0.10)
Comme 0
- J. Use of Fired Equipment
DOES NOT exist in the plant with the Process Unit
Comme 0
- K. Hot Oil Heat Exchange System
Process does not use a hot oil exchange system, or the hot oil
Comme 0
- L. Rotating Equipment
No rotating equipment deemed to be a hazard (No Penalty)
Comme 0

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LOSS CONTROL CREDIT FACTORS - DATA AND COMMENTS

Process Control Credit Factor (C1)

- a) Emergency Power
Automatic switch to emergency power for CRITICAL SERVICES
Comme 0
- b) Cooling
No credit (Factor=1.0)
Comme 0
- c) Explosion Control
No credit (Factor=1.0)
Comme 0
- d) Emergency Shutdown
No credit (Factor=1.0)
Comme 0
- e) Computer Control
No credit (Factor=1.0)
Comme 0
- f) Inert Gas
No credit (Factor=1.0)
Comme 0
- g) Operating Instructions/Procedures
1. Startup, 2. Routine Shutdown, 3. Normal operating conditions, 9. Maintenance procedures (two)
Comme 0
- h) Reactive Chemical Review
Reactive Chemical program is a continuing part of operations
Comme 0
- i) Other Process Hazard Analysis
Management of Change Review (Factor=0.98)
Comme 0

Material Isolation Credit Factor (C2)

- a) Remote Control Valves
No credit (Factor=1.0)
Comme 0
- b) Dump/Blowdown
No credit (Factor=1.0)
Comme 0
- c) Drainage
No credit (Factor=1.0)
Comme 0
- d) Interlock
No credit (Factor=1.0)
Comme 0

Fire Protection Credit Factor (C3)

- a) Leak Detection
Gas detectors alarm and identify a zone only (Factor=0.98)
Comme 0
- b) Structural Steel
No credit (Factor=1.0)
Comme 0
- c) Fire Water Supply
Firefighting water can be supplied for 4 hours at 100 psig (7)
Comme 0
- d) Special Systems
No credit (Factor=1.0)
Comme 0
- e) Sprinkler Systems
Deluge system protects process (Factor=0.97)
Comme 0
- f) Water Curtains
No credit (Factor=1.0)
Comme 0
- g) Foam
No credit (Factor=1.0)
Comme 0
- h) Hand Extinguishers/Monitors
The process is protected by monitor guns (Factor=0.97)
Comme 0
- i) Cable Protection
No credit (Factor=1.0)
Comme 0

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Equip ID: PSV 2R-1 AA Eq Desc: SAFETY VALVE #803094 Unit: 00048
C t Center: 0000063 Criticality: 10 Area: PURIF Project: 17
Serial #: 34857-M3 Equip Code: _____ Type: 434
Loc Ser #: _____ Equip Cond: _____ Spec: _____
Parent ID: 2R-1 A Grid: _____ Fleet MGMT?: _____
Install Dt: _____
MFR Abbrev: CROSBY Model #: _____
Model Type: JO-35 A Model Size: 4" X P X 6"
GEMTS-> Prod / Process: DISTILLATION C2H2 REACTO
Eqp Group / Type : PRESSURE VESSEL/VALVE PRESSURE R
* * * SPECIFICATION TEXT * * *
INSPECTION SCHEDULE: 60 MONTHS VALVE SET PRESSURE: 475 PSIG
OPERATING TEMP: 200 DEG. F OPERATING PRESSURE: 350 PSIG
BACK PRESSURE: 0 PRODUCT: ETHYLENE VAPOR
MTD Cost: 0 YTD Cost: 0 LTD Cost: 1935
Last PM: Date Installed: _____
Sel: 0 Last Updated By: U432414 Date: 10/10/89
GN-10 < RESET COMPLETE >

PF1 = VIEW SPEC PF4 = PF7 = PREV RECORD PF10 =
PF2 = PF5 = PF8 = NEXT RECORD PF11 =
PF3 = BROWSE PF6 = MENU PF9 = PF12 = MAIN MENU

Menu

Equip ID: PSV 2R-1 AB Eq Desc: SAFETY VALVE #804322 Unit: 00048
Cost Center: 0000063 Criticality: 10 Area: PURIF Project: 17
Serial #: 4785-C Equip Code: _____ Type: 434
Loc Ser #: _____ Equip Cond: _____ Spec: _____
Parent ID: 2R-1 A Grid: _____ Fleet MGMT?: _____
Install Dt: _____

MFR Abbrev: ANDRSN

Model #:

Model Type: 32310P 46

Model Size: 4" X 6"

GEMTS-> Prod / Process: DISTILLATION C2H2 REACTO

Eqp Group / Type : PRESSURE VESSEL/VALVE PRESSURE R

* * * SPECIFICATION TEXT * * *

INSPECTION SCHEDULE: 60 MONTHS

VALVE SET PRESSURE: 475 PSIG

OPERATING TEMP: 200 DEG. F

OPERATING PRESSURE: 350 PSIG

BACK PRESSURE: 0

PRODUCT: ETHYLENE VAPOR

MTD Cost: 0 YTD Cost:

0 LTD Cost:

280

Last PM:

Date Installed:

Sel: 0 Last Updated By: U431990

Date: 06/06/94

GN-10 < RESET COMPLETE >

PF1 = VIEW SPEC

PF4 =

PF7 = PREV RECORD

PF10 =

PF2 =

PF5 =

PF8 = NEXT RECORD

PF11 =

PF3 = BROWSE

PF6 = MENU

PF9 =

PF12 = MAIN MENU

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05/30/95 12:26

```
PF1 = VIEW SPEC      PF4 =          PF7 = PREV RECORD  PF10 =
PF2 =                PF5 =          PF8 = NEXT RECORD  PF11 =
PF3 = BROWSE         PF6 = MENU      PF9 =          PF12 = MAIN MENU
```

DO A 031360
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Equip ID: PSV 2R-1 BB Eq Desc: SAFETY VALVE #804323 Unit: 00048
Cost Center: 0000063 Criticality: 10 Area: PURIF Project: 17
Serial #: 4786-C Equip Code: _____ Type: 434
Loc Ser #: _____ Equip Cond: _____ Spec: _____
Parent ID: 2R-1 B Grid: _____ Fleet MGMT?: _____
Install Dt: _____
MFR Abbrev: ANDRSN Model #: _____
Model Type: 32310P 46 Model Size: 4" X 6"
GEMTS-> Prod / Process: DISTILLATION C2H2 REACTO
 Eqp Group / Type : PRESSURE VESSEL/VALVE PRESSURE R
 * * * SPECIFICATION TEXT * * *
INSPECTION SCHEDULE: 60 MONTHS VALVE SET PRESSURE: 475 PSIG
OPERATING TEMP: 200 DEG. F OPERATING PRESSURE: 350 PSIG
BACK PRESSURE: 0 PRODUCT: ETHYLENE VAPOR
MTD Cost: 0 YTD Cost: 0 LTD Cost: 249
Last PM: Date Installed: _____
Sel: 0 Last Updated By: U431990 Date: 06/06/94
GN-10 < RESET COMPLETE >

PF1 = VIEW SPEC PF4 = PF7 = PREV RECORD PF10 =
PF2 = PF5 = PF8 = NEXT RECORD PF11 =
PF3 = BROWSE PF6 = MENU PF9 = PF12 = MAIN MENU

DO A 031361
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05/30/95 12:30

```
PF1 = VIEW SPEC      PF4 =          PF7 = PREV RECORD  PF10 =
PF2 =                PF5 =          PF8 = NEXT RECORD  PF11 =
PF3 = BROWSE         PF6 = MENU      PF9 =          PF12 = MAIN MENU
```

DO A 031362
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