

INTEROFFICE COMMUNICATION

Westlake, Louisiana  
May 25, 1971

TO: R.L. Hyberger

SUBJECT: NITROGEN PURGE FOR OXY RUPTURE DISC  
VENT LINES

Attached is a design to provide a nitrogen purge for the rupture disc outlet lines from the four oxy reactors. Operations has requested this system to minimize corrosion to the vent piping caused by leakage of reactants through the discs and by thermal inbreathing of humid air through the outlet of vent stack VS-390.

The design calls for nitrogen to be bled to each of the eight oxy reactor relief lines through rotameters. The purge rates will only be sufficient to prevent thermal inbreathing of air in order to keep nitrogen costs as low as possible. The separate purge streams will be run through flexible tubing to each vent line and connected to taps which will be made on the vent lines during the upcoming plant outage.

The installed cost of the system will be about \$1,000, and about \$1,000 per year of plant nitrogen will be consumed (based on a purge rate of 452 SCFH).

Please review this design and return all comments to R.H. Gerlach by June 14, 1971.

*C.L. Shaddock, Jr.*  
C.L. Shaddock, Jr.  
Process Engineer

CLS-BS  
cc: LNV-RDG-RHG-GTH-SFP-JDM

APPROVED: *[Signature]*

CCR 000008488

COST ESTIMATE

|    |                                      |            |
|----|--------------------------------------|------------|
| 1. | Rotameters (including needle valves) | \$ 200     |
| 2. | Piping and tubing                    | 300        |
| 3. | Valves, fittings, flanges, etc.      | 150        |
| 4. | Installation labor                   | 200        |
|    | subtotal                             | <u>850</u> |
|    | plus contingency(17.6%)              | <u>150</u> |
|    | TOTAL                                | \$ 1,000   |

### WORK LIST

1. Install rotameters FI-1&2 near the most convenient plant nitrogen connection around R-301. Run a 3/4" Sch. 40 steel inlet line from the connection over to the meters, splitting it into two separate feeders with ball valves and 3/4" x 1/4" reducers at the meter inlets. From the 1/4" needle valve on each meter, run 1/4" flexible S.S. or polyethylene tubing to the proper connection at each vent line and make the required tie-in.

2., 3.,

& 4. Repeat the above for rotameters FI-3&4, FI-5&6, and FI-7&8, respectively. Be careful that the rotameters are matched to the proper lines as indicated on the rotameter specifications.

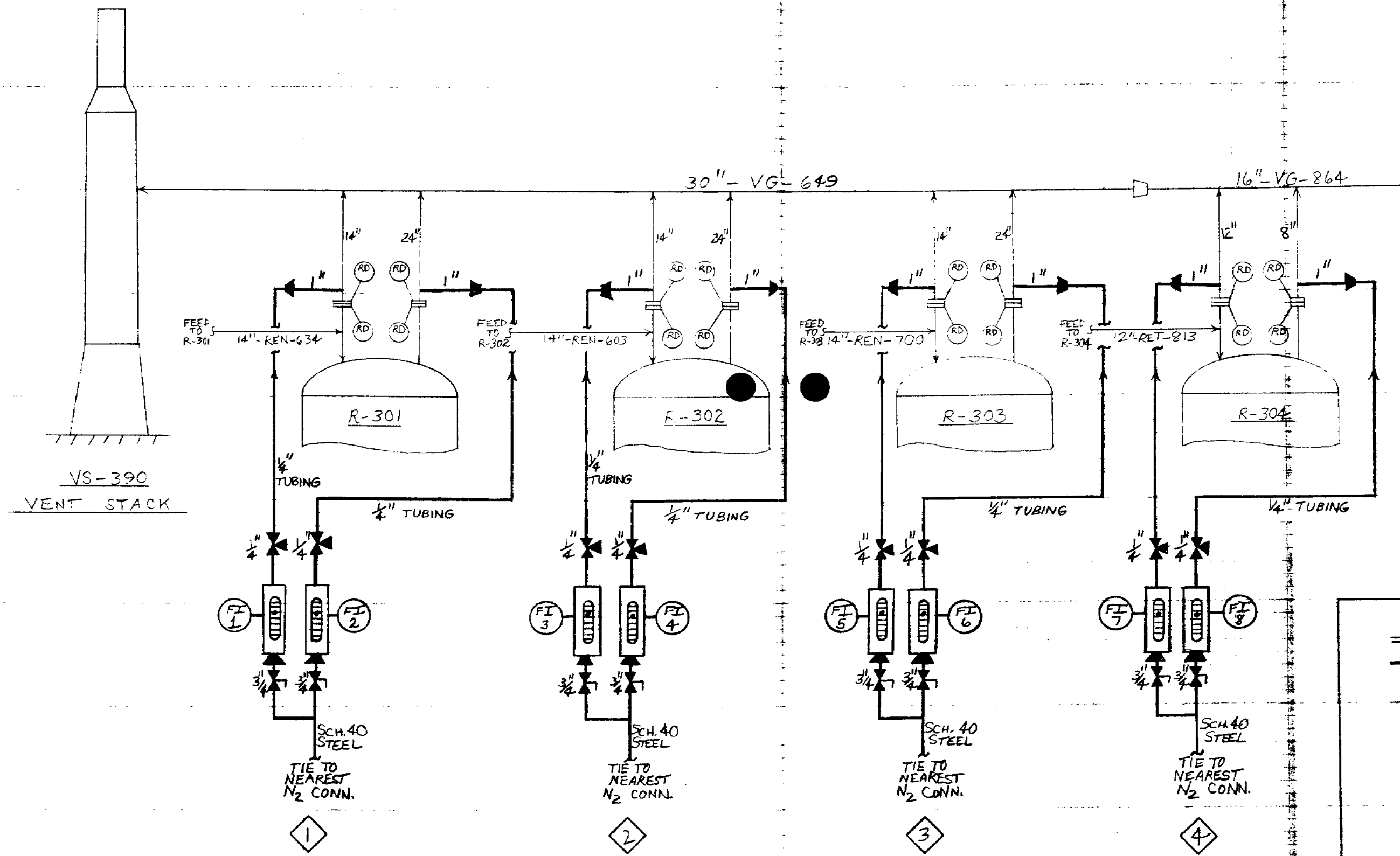
ROTAMETER SPECIFICATIONS  
N<sub>2</sub> PURGING OF OXY RUPTURE DISC VENT LINES

| Instrument No.                                                                              | FI-1                                          | FI-2                                          | FI-3                                          | FI-4                                          | FI-5                                          | FI-6                                          | FI-7                                          | FI-8                                         |
|---------------------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|----------------------------------------------|
| Service                                                                                     | N <sub>2</sub> to 14" Vent<br>Line from R-301 | N <sub>2</sub> to 24" Vent<br>Line from R-301 | N <sub>2</sub> to 14" Vent<br>Line from R-302 | N <sub>2</sub> to 24" Vent<br>Line from R-302 | N <sub>2</sub> to 14" Vent<br>Line from R-303 | N <sub>2</sub> to 24" Vent<br>Line from R-303 | N <sub>2</sub> to 12" Vent<br>Line from R-304 | N <sub>2</sub> to 8" Vent<br>Line from R-304 |
| Location                                                                                    | Local                                         | Local                                         | Local                                         | Local                                         | Local                                         | Local                                         | Local                                         | Local                                        |
| Material Handled                                                                            | Nitrogen                                      | Nitrogen                                      | Nitrogen                                      | Nitrogen                                      | Nitrogen                                      | Nitrogen                                      | Nitrogen                                      | Nitrogen                                     |
| Pressure, psig, normal-max.                                                                 | 100-125                                       | 100-125                                       | 100-125                                       | 100-125                                       | 100-125                                       | 100-125                                       | 100-125                                       | 100-125                                      |
| Temperature, °F                                                                             | 70                                            | 70                                            | 70                                            | 70                                            | 70                                            | 70                                            | 70                                            | 70                                           |
| Normal Rate, SCFH<br>(Air = 1.0, 60°F, 14.7 psia)                                           | 33                                            | 105                                           | 33                                            | 105                                           | 33                                            | 105                                           | 26                                            | 13                                           |
| Rotameter Mat'l's of Construction                                                           |                                               |                                               |                                               |                                               |                                               |                                               |                                               |                                              |
| Metering Tube                                                                               | Glass                                         | Glass                                         | Glass                                         | Glass                                         | Glass                                         | Glass                                         | Glass                                         | Glass                                        |
| Float                                                                                       | 316 SS                                        | Glass                                         | 316 SS                                        | Glass                                         | 316 SS                                        | Glass                                         | Glass                                         | Glass                                        |
| End Fittings                                                                                | 316 SS                                        | 316 SS                                        | 316 SS                                        | 316 SS                                        | 316 SS                                        | 316 SS                                        | 316 SS                                        | 316 SS                                       |
| Window Shield                                                                               | Clear Plastic                                 | Clear Plastic                                 | Clear Plastic                                 | Clear Plastic                                 | Clear Plastic                                 | Clear Plastic                                 | Clear Plastic                                 | Clear Plastic                                |
| Float Stops                                                                                 | Teflon                                        | Teflon                                        | Teflon                                        | Teflon                                        | Teflon                                        | Teflon                                        | Teflon                                        | Teflon                                       |
| Tube Packing                                                                                | Viton                                         | Viton                                         | Viton                                         | Viton                                         | Viton                                         | Viton                                         | Viton                                         | Viton                                        |
| O-Rings                                                                                     | Viton                                         | Viton                                         | Viton                                         | Viton                                         | Viton                                         | Viton                                         | Viton                                         | Viton                                        |
| Recommended Vendor                                                                          | Brooks                                        | Brooks                                        | Brooks                                        | Brooks                                        | Brooks                                        | Brooks                                        | Brooks                                        | Brooks                                       |
| Meter No.                                                                                   | 1510A-V                                       | 1510A-V                                       | 1510A-V                                       | 1510A-V                                       | 1510A-V                                       | 1510A-V                                       | 1510A-V                                       | 1510A-V                                      |
| Tube No.                                                                                    | 4-65E                                         | 5-65A                                         | 4-65E                                         | 5-65A                                         | 4-65E                                         | 5-65A                                         | 4-65A                                         | 3-65A                                        |
| Connections                                                                                 | 1/4" NPT (Female)                             | 1/4" NPT (Female)                             | 1/4" NPT (Female)                             | 1/4" NPT (Female)                             | 1/4" NPT (Female)                             | 1/4" NPT (Female)                             | 1/4" NPT (Female)                             | 1/4" NPT (Female)                            |
| Extras                                                                                      | ← Downstream 1/4" Needle Valve →              |                                               |                                               |                                               |                                               |                                               |                                               |                                              |
| Range of Recommended<br>Meter, CFH Air @<br>70°F & 14.7 psia                                | 2-18                                          | 5-45                                          | 2-18                                          | 5-45                                          | 2-18                                          | 5-45                                          | 1.2-12                                        | 0.5-6.0                                      |
| Set Point in the Above<br>Range Required to<br>Deliver the Normal Rate<br>at 100 psig, 70°F | 11.6                                          | 37.0                                          | 11.6                                          | 37.0                                          | 11.6                                          | 37.0                                          | 9.2                                           | 4.6                                          |
| Approximate FOB Cost<br>of Recommended Meter<br>(including needle valve)                    | \$20                                          | \$20                                          | \$20                                          | \$20                                          | \$20                                          | \$20                                          | \$20                                          | \$20                                         |

BY CLS, JK DATE  
CHKD. BY DATE

SUBJECT NITROGEN PURGE FOR OXY  
RUPTURE DISC VENT LINES

SHEET NO. 2 OF 2  
JOB NO.



### LEGEND

- NEW
- - - EXISTING
- BALL VALVE
- NEEDLE VALVE
- RD RUPTURE DISC
- ◇ WORK LIST ITEM

CCR 00000840

INTEROFFICE COMMUNICATION

Westlake, Louisiana  
May 25, 1971

CLS FDM  
Here  
are Debs  
comments  
RNL

TO: R.L. Hyberger

SUBJECT: NITROGEN PURGE FOR OXY RUPTURE DISC  
VENT LINES

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Please review this design and return all comments to R.H. Gerlach by June 14, 1971.

C.L. Shaddock, Jr.  
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Process Engineer

CLS-BS  
cc: LNV-RFG-RHG-GTH-SFP-JDM

APPROVED: J. A. D. M. J.

CCR 000008493

PRELIMINARY  
ISSUED FOR COMMENTS

COST ESTIMATE

|    |                                      |            |
|----|--------------------------------------|------------|
| 1. | Rotameters (including needle valves) | \$ 200     |
| 2. | Piping and tubing                    | 300        |
| 3. | Valves, fittings, flanges, etc.      | 150        |
| 4. | Installation labor                   | 200        |
|    | subtotal                             | <u>850</u> |
|    | plus contingency (17.6%)             | <u>150</u> |
|    | TOTAL                                | \$ 1,000   |

CCR 000008494

WORK LIST

PRELIMINARY  
ISSUED FOR COMMENTS

1. Install rotameters FI-1&2 near the most convenient plant nitrogen connection around R-301. Run a 3/4" Sch. 40 steel inlet line from the connection over to the meters, splitting it into two separate feeders with ball valves and 3/4" x 1/4" reducers at the meter inlets. From the 1/4" needle valve on each meter, run 1/4" flexible S.S. or polyethylene tubing to the proper connection at each vent line and make the required tie-in.

2., 3.,

& 4. Repeat the above for rotameters FI-3&4, FI-5&6, and FI-7&8, respectively. Be careful that the rotameters are matched to the proper lines as indicated on the rotameter specifications.

CCR 000008495

**PRELIMINARY**  
**ISSUED FOR COMMENTS**

ROTAMETER SPECIFICATIONS  
N<sub>2</sub> PURGING OF OXY RUPTURE DISC VENT LINES

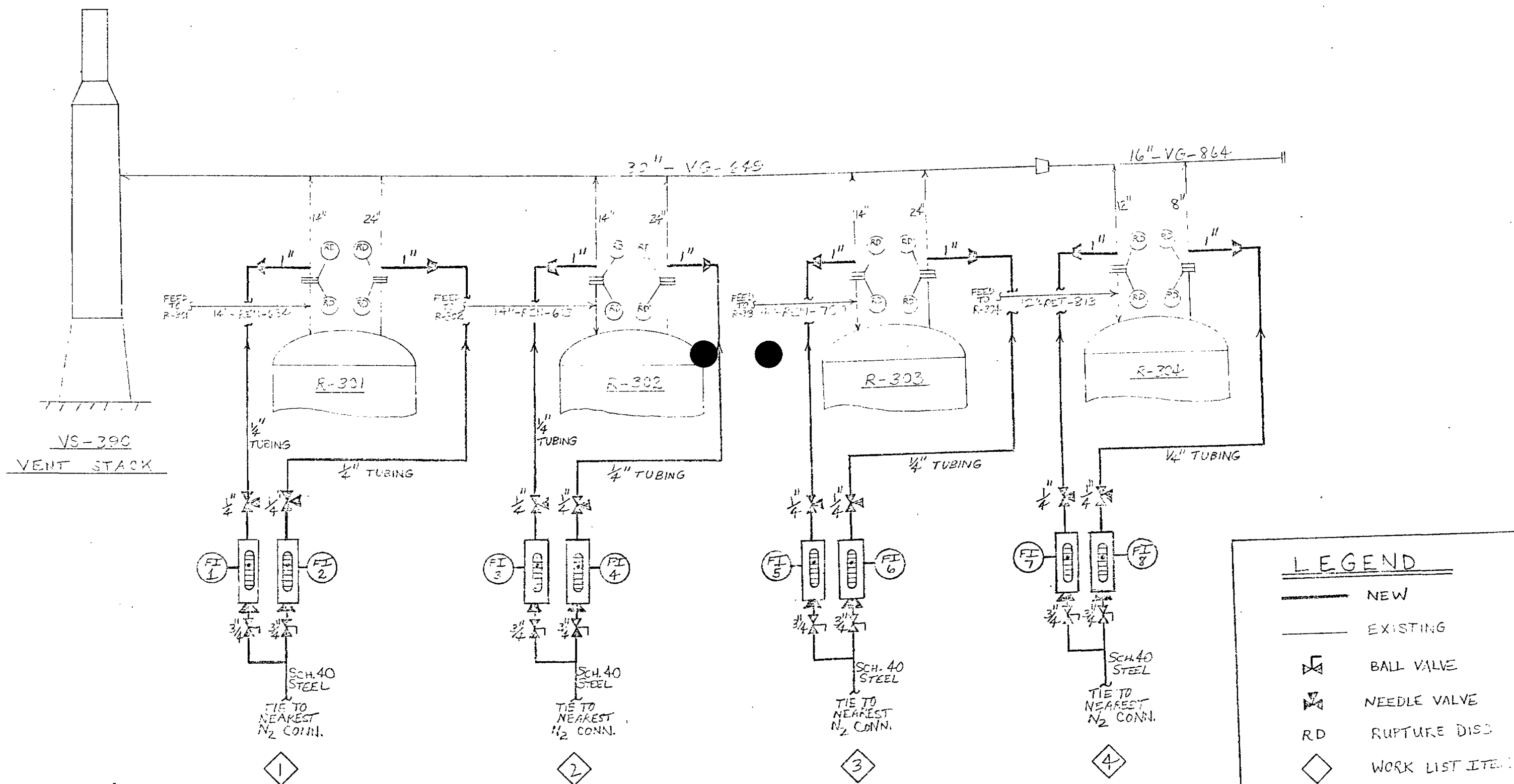
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BY CLS, JR DATE \_\_\_\_\_  
CHKD. BY \_\_\_\_\_ DATE \_\_\_\_\_

SUBJECT NITROGEN PURGE FOR OXY  
RUPTURE DISC VENT LINES

SHEET NO. 2 OF 2  
JOB NO. \_\_\_\_\_

**PRELIMINARY  
ISSUED FOR COMMENTS**



CCR 000008497

from

C. L. SHADDOCK, Jr.

, 19\_\_

To NITROGEN PURGE FOR OXY RD VENTS

2 discs per oxy reactor tied  
into the rocket. Recently  
corrosion caused a pop-on  
outside of disc

CCR 000008498

They want a purge outside—  
pinhole leaks can occur  
without

1" valves to be connected during  
outage. How much of  $N_2$   
~~what~~ do we use

Keep stack velocity quite ~~low~~  
low—only to prevent sucking  
in of air when cold ~~and~~  
~~and~~

from

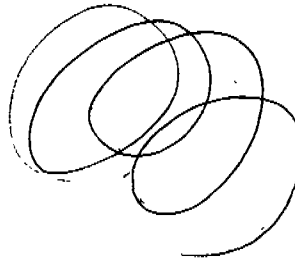
C. L. SHADDOCK, Jr.

\_\_\_\_\_, 19\_\_\_\_

To \_\_\_\_\_

Use high press. N<sub>2</sub> thru tubing  
up to regulator with bypass  
capability

CCR 000008499



$$\rho = .197 \text{ #/ft}^3 \left( \begin{array}{c} .00 \\ \downarrow \\ 0 \end{array} \right) \Delta P_{10}$$

$$\frac{1625 \text{ ft}^3/\text{hr}}{3600 \frac{\text{sec}}{\text{hr}}}$$

Try  $W = 800 \text{ lb/hr}$

$$Re_{x_4} = 1.19 \times 10^5 \quad f_{1/4} = .028 \quad d_{1/4}^5 = .001$$

$$Re_{x_2} = 5.95 \times 10^5 \quad f_{1/2} = .027 \quad d_{1/2}^5 = .0931 \quad \left( \begin{array}{c} \text{Sch} \\ \text{to} \end{array} \right)$$

$$W^2 = 640,000$$

$$\Delta P = \frac{.10 / .028 / 640,000 / .000336}{.197 / .001} + \frac{640,000 / .000336 / .80 / .027}{.197 / .0931}$$

$\Delta P = 3056 + \times$  too high

Assume  $80 \text{ #/hr}$  ( $Cl =$   $\rho = .197$ )

$$Re_{x_4} = 119,000 \quad f = .029$$

$$Re_{x_2} = 59,500 \quad f = .028$$

CCR 000008500

$$\Delta P_{100} = \frac{.10 / .000336 / 6400 / .029}{.197 / .001} + \frac{.80 / .000336 / 6400 / .028}{.093 / .197}$$

31.6 + 2.63

Try  $W = 100 \text{ #/hr}$  (15)

$$\Delta P =$$

$$W = 120 \text{ #/hr} \left( \frac{379}{28} \right) = 1625 \text{ SCFH}$$

.03 fps  
per line  
out  
stack

Try 800 #/hr,  $C_1 = .00063$

$$\therefore \Delta P = \frac{-1}{20 \times 10^6} / .00063$$

$$V_{sonic} = 68.1 \sqrt{K P' \bar{V}}$$

$$V_s = \sqrt{\frac{K g R T}{P}}$$

$$= \sqrt{(1.4)(32.17)(10.73)(530)}$$

$\frac{ft}{sec^2}$        $\frac{psia-ft^3}{lb\ mole-R}$        $R$

$$PV = nRT$$

$$R = \frac{PV}{nT}$$

$$PV = \frac{m}{M} RT$$

$$\therefore P = \frac{PM}{RT}$$

$$R = \frac{PM}{TP}$$

$\frac{lb}{lb-mole-ft^3}$        $\frac{psia-ft^3}{lb-mole-R}$

$$V_s = \sqrt{(1.4)(32.17)(55.2)(530)}$$

$$V_s = \sqrt{1.317 \times 10^6} = 1145 \text{ ft/sec}$$

$$\therefore V = \frac{1145}{\pi (.25)^2} \times \frac{4}{60} = 1.7 \text{ MM SCFH}$$

↓  
#/HR

BUNA-N DIAPHRAGM

## BROOKS ROTAMETERS

① FI-1,3,5 SS mat'ls \$19 each

Type 1510A-V

$\frac{1}{4}$ " CONN'S  
NPT Female

② FI-2,4,6 Type 1355-V Tube # R-6-15-B

TANTALUM BALL FLOAT 14-136 SCFH

SS mat'ls w/ needle valve \$72 + \$14 = \$86

$\frac{1}{8}$ " CONNS'

↑ w/ TANTALUM

or \$95 w/  $\frac{1}{4}$ " CONNS'

③ \$19 ea, same mat'l

1510A-V

$\frac{1}{8}$ " conn's

④ \$19 also

⑦

$$P_0 = 110 \text{ psig} = 134.7 \text{ psia}$$

$$T_0 = 70^\circ \text{F} \quad sg = .966$$

For FI-1, 3, 5:

$$\text{SCFH air equiv} = \frac{32.8}{\sqrt{.966 \times \frac{14.7}{134.7}}} \frac{8.04}{sg_{fl}}$$

$$\therefore \text{SCFH (equiv)} = \frac{32.8}{\sqrt{.8476}} \frac{8.04}{sg_{fl}}$$

For 316 SS float,  $sg_{fl} = 8.04$

$$\text{SCFH equiv} = 10.66$$

~~at Ray After Bath~~

Glass sp gr = 2.2

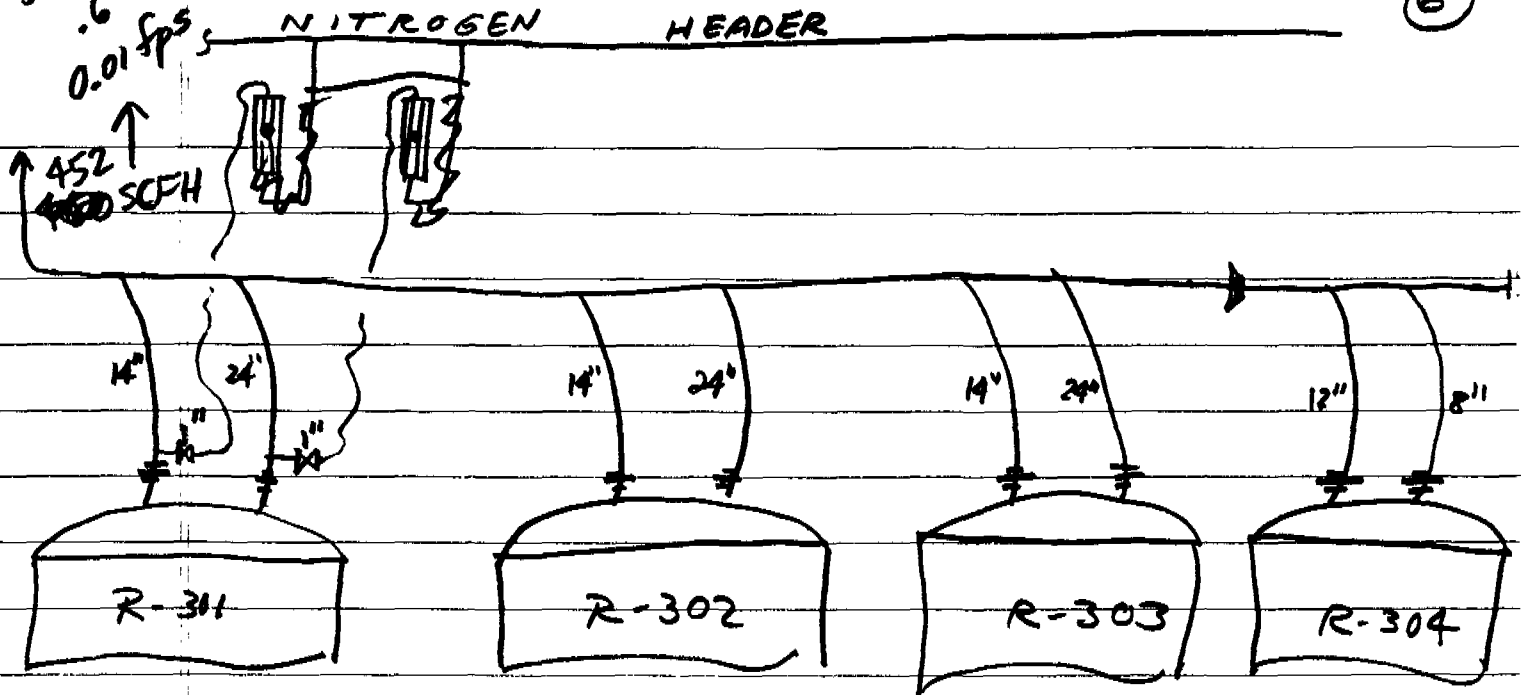
$$\therefore \text{SCFH air} = 32.8 \sqrt{.966}$$

ALT. ② Type 1555 w/ valve & 27 in Aluminum  
welder insert

② FI-2, 4, 6: TYPE

36 ft/min  
 .6 ft/min  
 0.01 sps

6



| METER No. | REACTOR | VENT LINE SIZE | N <sub>2</sub> RATE SET (NORMAL) SCFH | (CFH AT 70°F. ROTAMETER RANGE) |
|-----------|---------|----------------|---------------------------------------|--------------------------------|
| FI-1      | R-301   | 14"            | 32.8                                  | 5-50                           |
| FI-2      | "       | 24"            | 104.8                                 | 13-130                         |
| FI-3      | R-302   | 14"            | 32.8                                  | 5-50                           |
| FI-4      | "       | 24"            | 104.8                                 | 13-130                         |
| FI-5      | R-303   | 14"            | 32.8                                  | 5-50                           |
| FI-6      | "       | 24"            | 104.8                                 | 13-130                         |
| FI-7      | R-304   | 8"             | 13.1                                  |                                |
| FI-8      | "       | 12"            | 26.2                                  |                                |

CCR 000008504

Std 1/4" CONNS. TOTAL = 452 OUT ROCKET SCFH

① FI-1, 3, & 5 to be Brooks Type 1510 - Tube No 5-65 w/ Glass Ball Float 5-45 SCFH

② FI-2, 4, & 6 to be Brooks Type 1510 - Tube No 5-65 w/ Glass Ball Float 13-130 SCFH

③ FI-7 to be Brooks Type 1510 4-65B w/ SS FLOAT 2-18 SCFH

④ FI-8 to be Brooks Type 1510 Use 5-65A

# N<sub>2</sub> PURGE CALCULATIONS

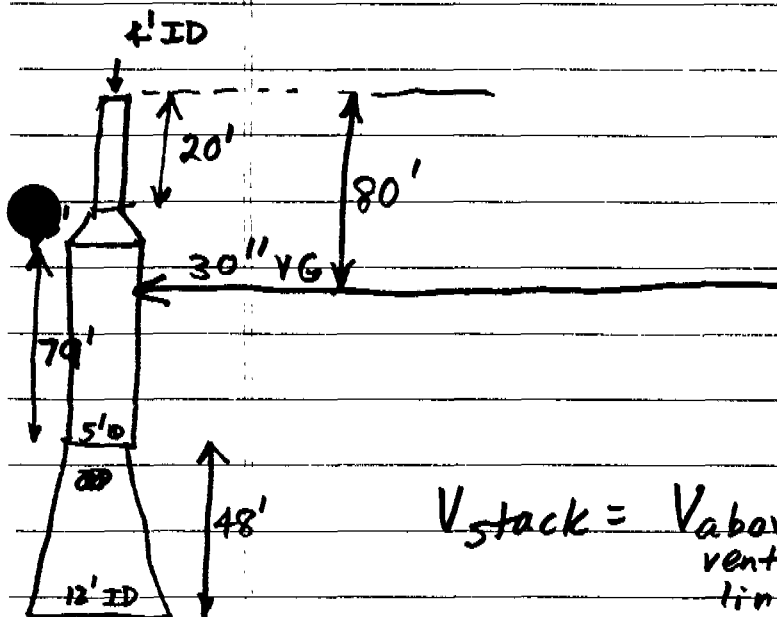
## Oxy RD VENTS

①

R-301, 2, & 3 have 14" & 24" RD vents feeding a 30" VG hdr, while R-304 has an 8" & 12" combination feeding this header. The 30" header feeds into the rocket, VS-300.

VS-300

150' TALL



$$V_{stack} = V_{above \text{ vent line}} + V_{below \text{ line}}$$

$$V = \pi \left[ \frac{2^2}{4} (20) + \frac{(2.5)^2}{4} (79) \right] + \pi \left( \frac{3}{8} \right) \left( 2^2 + (2 \times 2.5) + 2.5^2 \right) + \pi \left( \frac{48}{3} \right) \left( 6^2 + (6 \times 2.5) + 2.5^2 \right)$$

1802

SMALL CONE 48  
LARGE CONE 2816

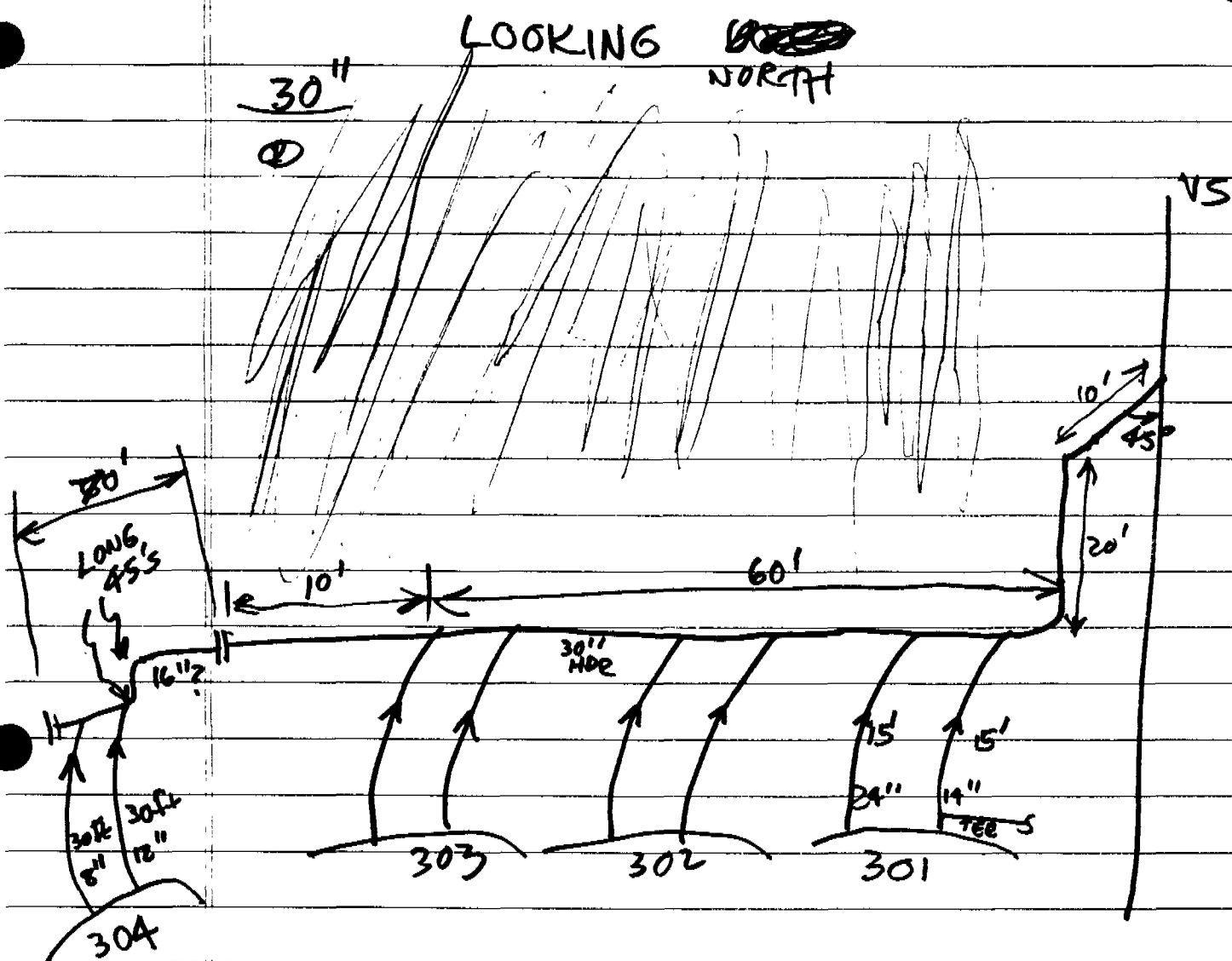
$$\therefore V_s = 4726 \text{ ft}^3$$

### VOLUME IN LINES

(A) 30" VG hdr

(CCR 000008505)

②



Area  
per lin ft

---

8" - .3474 sq ft  
12" - .7773 " <sup>sq</sup>  
16" - 1.2272 " <sup>sq</sup>  
14" - .9394 " <sup>sq</sup>  
24" - 2.7921 " <sup>sq</sup>  
30" - 4.906 " <sup>sq</sup>

$$V_{\text{lines}} = \left[ 100 \text{ ft} \times 4.906 \frac{\text{ft}^2}{\text{ft}} \right] + \left[ 45 \text{ ft} \times 2.7921 \frac{\text{ft}^2}{\text{ft}} \right] + \left[ 70 \times 1.2272 \right] \\ + \left[ 45 \times .9394 \right] + \left[ 30 \times .7773 \right] + \left[ .3474 \times 30 \right]$$

$$\therefore V_{\text{lines}} = 778 f + 3$$

$$\therefore V_{\text{total}} = V_{\text{stack, lines}} = 5504 \text{ ft}^3$$

(3)

Assume a  $10^\circ\text{F/hr}$  ( $\Delta T$ )

$\therefore$  At 1 ATM,  ~~$\Delta v =$~~

$$\left. \begin{array}{l} 100^\circ\text{F} - 14.10 \text{ ft}^3/\# \\ 90^\circ\text{F} - 13.85 \text{ ft}^3/\# \end{array} \right\} \Delta v = .25 \text{ ft}^3/\#$$

$$\therefore \% \Delta v = \frac{.25 \times 100}{13.85} = 1.77\%$$

$$\text{From } 60-50^\circ\text{F}, \% \Delta v = \frac{(13.089 - 12.787) \times 100}{12.787} = 2.36\%$$

$$\text{From } 40-30^\circ\text{F}, \% \Delta v = \frac{(12.58 - 12.33) \times 100}{12.58} = 1.987\%$$

$\therefore$  Use 2.5%  $\Delta$  VOLUME/HR

$$\therefore \Delta V = (.025)(5504 \text{ ft}^3) = 138 \text{ SCFH}$$

MAX INBREATH  
AT  $10^\circ\text{F/hr}$

$$V_{\text{STACK}} = \frac{138 \text{ ft}^3/\text{HR}}{3600 \text{ SEC/HR} \times 12.56 \text{ ft}^2} = .003 \text{ ft/sec}$$

$$\therefore \text{ANNUAL COST} = \frac{\$.025}{100 \text{ SCFH}} \times \frac{138 \times 24 \times 365 \text{ SCFH}}{\text{YR}} = \$302/\text{YR}$$

CCR 000008507

~~Proportion~~ Proportion the 138 SCFH to the areas of the respective vents

$$\begin{array}{l} R-1, 2, \& 3 \quad A = 3.732 \text{ ft}^2 \\ \quad \quad \quad (14'' + 24'') \end{array} \quad \bigg/ \quad \begin{array}{l} R-4 \quad A = 1.125 \text{ ft}^2 \\ \quad \quad \quad (8'' + 12'') \end{array}$$

④

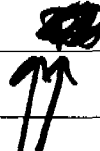
$$A_{4'ID \text{ stack}} = 12.56 \text{ ft}^2$$

$$\therefore A_{1,2,3,4} = 3(3.732) + 1.125 = 12.321 \text{ ft}^2$$

TO EQUALIZE VELOCITIES,

$$V_{N_2 \text{ FROM 1,2, or 3}} = \frac{3.732}{12.321} \times 138 = 42 \text{ SCFH}$$

$$V_{\text{FROM 4}} = \frac{1.125}{12.321} \times 138 = 12 \text{ SCFH}$$

|                                                                                    |                                                                                    |                                                                                    |                                                                                     |          |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------|
|  |  |  |  |          |
| R-1                                                                                | R-2                                                                                | R-3                                                                                | R-4                                                                                 | TOTAL    |
| 42 SCFH                                                                            | 42                                                                                 | 42                                                                                 | 12                                                                                  | 138 SCFH |

CCR 000008508

$$V_{\substack{R-1 \\ \text{or 2} \\ \text{or 3}}} = \frac{42 \text{ SCFH}}{3600 \times 3.732} = .003 \text{ fps}$$

$$V_{R-4} = \frac{12}{1.125 \times 3600} = .003 \text{ fps}$$

This says the Area of the 4' ID vent stack is  $\approx$  SAME AS TOTAL AREA FROM THE REACTOR VENT LINES

R-301,2, or 3 INDIVIDUAL LINE CAPACITIES

$$\left\{ \begin{array}{l} 14'' \text{ line: } \frac{.9394}{3.732} \times 42 = 10.5 \text{ SCFH, SAY 10} \\ 24'' \text{ line: } 42 \times \frac{10}{10.5} = 32 \text{ SCFH} \end{array} \right.$$

$$\left\{ \begin{array}{l} R-304 \text{ LINES } 8'' : \frac{.3474}{1.125} \times 12 = 3.7, \text{ say 4 SCFH} \\ 12'' : 8 \text{ SCFH} \end{array} \right.$$

FLOW INSTRUMENT SPECIFICATIONS  
NITROGEN PURGE FOR OXY RUPTURE DISC VENT LINES

|                                     |                                                         |                                                         |                                          |                                         |
|-------------------------------------|---------------------------------------------------------|---------------------------------------------------------|------------------------------------------|-----------------------------------------|
| Instrument No.                      | FI-1, 3, & 5 <sup>(1)</sup>                             | FI-2, 4, & 6 <sup>(2)</sup>                             | FI-7 <sup>(3)</sup>                      | FI-8 <sup>(4)</sup>                     |
| Service                             | Nitrogen Purge to 24" Vent Lines from R-301, 302, & 303 | Nitrogen Purge to 14" Vent Lines from R-301, 302, & 303 | Nitrogen Purge to 12" Vent Line on R-304 | Nitrogen Purge to 8" Vent Line on R-304 |
| Instrument Type                     | Flow Indicator                                          | Flow Indicator                                          | Flow Indicator                           | Flow Indicator                          |
| Location                            | Local                                                   | Local                                                   | Local                                    | Local                                   |
| Element, Type                       | Rotameter                                               | Rotameter                                               | Rotameter                                | Rotameter                               |
| Materials of Construction           | Glass                                                   | Tantalum                                                | 316 S.S.                                 | Glass                                   |
| Float                               | 316 S.S.                                                | 316 S.S.                                                | 316 S.S.                                 | 316 S.S.                                |
| Body & Needle Valve                 | Nitrogen                                                | Nitrogen                                                | Nitrogen                                 | Nitrogen                                |
| Material Handled                    | 100-125                                                 | 100-125                                                 | 100-125                                  | 100-125                                 |
| Pressure, psig, normal-max.         | 70                                                      | 70                                                      | 70                                       | 70                                      |
| Temperature, °F                     | 33                                                      | 105                                                     | 26                                       | 13                                      |
| Normal Rate, SCFH (60°F, 14.7 psia) |                                                         |                                                         |                                          |                                         |

- Notes: (1) 3 separate meters - each to be Brooks Type 1510A-V (or equivalent) with type tube, float, and 1/4" NPT female connections. Downstream 1/4" needle valve to be supplied by vendor. With standard mat'ls. of construction
- (2) 3 separate meters - each to be Brooks Type 1510A-V (or equivalent) with type tube, float, and 1/4" NPT female connections.
- (3)
- (4)

CCR 000008509

$$70^{\circ}\text{F} = 530^{\circ}\text{R}$$

$$114.7 \text{ psia}$$

$$(A) \text{ Sizing Factor} = \sqrt{\frac{14.7}{P_0} \times \frac{T_0^{1.0}}{530} \times \frac{8.047^{1.0}}{\text{sg float}} \times \frac{SG^{1.967}}{1.0}}$$

$$\therefore SF_{316 \text{ SS}} = \underline{.352}$$

$$(B) \text{ } SF_{\text{GLASS}} = \frac{1.838}{1.673}$$

2.20

70.7 glass

Try 100 eq ft of Sch 40  $\frac{1}{2}$ "

$$d^5 = .0931$$

$$P_{AVG} = .197 \text{ #/ft}^3$$

CALCULATE  $\Delta P_{100'}$  of  $\frac{1}{4}$ " tubing at  
105 SCFH air (14.7, 70°F)

$$\Delta P_{100'} = \frac{.000336}{\frac{d^5}{P}} \times \frac{1}{W^2} = 10 \text{ psi/100'}$$

Annotations:  
-  $d^5$  is labeled with  $.000976$   
-  $P$  is labeled with  $.0724$   
-  $W^2$  is labeled with  $.035$  and  $60$

~~For 33 SCFH,  $\frac{1}{4}$ "~~

# → TRIPLE THE N<sub>2</sub> RATES

⑤

For N<sub>2</sub> @ 100 psig, AMBIENT °F:  $\left[ \frac{0.1282 \text{ ACFM}}{\text{SCFM}} \right]$

$$V_{\text{TOT}} = \frac{138 \times 3 \text{ SCFH} / .1282 \text{ ACF}}{60 \frac{\text{SCFM}}{\text{SCFH}}} = 0.885 \text{ CFM OF 100 PSIG N}_2$$

~~ANALYSIS~~

R-301

R-302

R-303

R-304

Use 1/4" SS TUBING FOR 100 PSIG N<sub>2</sub> TO ALL ROTAMETERS

Size outlet lines from rotameters to individual tie points for 100' of x" line, with no more than 5psi/100' - ASSUME 0psig, AMB. °F ON ROTAMETER OUTLET.

For R-301, 302, 303

(A) 70 SCFH N<sub>2</sub> to 14" lines

~~3.27~~  
(333 SCFH)  
.56 SCFM

3.2754

(B) 32 SCFH N<sub>2</sub> to 24" lines

~~1.67~~  
(100 SCFH)  
(1.67 SCFM)

Use 1/4" SS TUBING FOR ALL LINES

$$C_2(\frac{1}{4}" \text{ tubing}) \approx 20 \times 10^6$$

$$W = \frac{2.9 \text{ sec} \times 120 \text{ SCFH} \times 60 \text{ min} \times 28 \#}{3.795 \text{ F} \times \text{note}} = 8.86 \frac{\#}{\text{HR}}$$

$$Re_{\frac{1}{4}" \text{ tubing}} = \frac{6.31 W}{d \mu} = 12,423$$

$\swarrow \quad \uparrow$   
 $0.25 \quad .018$

$$f = .036$$

$$\Delta P_{100'} = \frac{.000336 / .036}{.001 / .0738} \times \frac{(8.86)^2}{100'} = 12.9 \text{ psi}$$

$\uparrow \quad \uparrow$   
 $d^5 \quad \text{P at T \& P}$

$$\text{FOR } \frac{1}{2}" \quad d^5 = .0313$$

$$Re = 6000 \quad f = .038$$

$$\Delta P_{100'} = \frac{.000336 / .038}{.0313 / .0738} \times 78.5 = 0.43 \text{ psi}/100'$$

CCR 000008513

What is  $W$  at  $\Delta P_{100} = 80 \text{ psi}/100'$  of

~~Flow~~

Try 10 eq' ft of  $\frac{1}{4}''$   $\Delta P_{\text{tot}} = 125 \text{ psi max}$   
+ 80 eq ft of  $\frac{1}{2}''$

~~Flow~~

$$\Delta P_{\text{tot}} = \Delta P_{\frac{1}{4}''} + \Delta P_{\frac{1}{2}''} = 0.10 \Delta P_{100'}^{\frac{1}{4}''} + 0.80 \Delta P_{100'}^{\frac{1}{2}''}$$

~~Flow~~

$$125 = \left[ 0.10 f_{\frac{1}{4}''} \right] W^2$$

Assume  $W = 10,000 \text{ #/HR}$

$$\therefore C_1 = 0.10$$

$$C_2 = 20 \times 10^6$$

$$C_2 = 93,500$$

$$P \approx P_{25 \text{ psig}} = .197 \text{ #/ft}^3 \quad 15,228 \quad .00063 \quad .00063$$

$$\Delta P = \frac{0.10 / 20 \times 10^6}{.197} + \frac{0.10 / 93,500}{.197}$$

③

$$VOLUME \cong 125 \text{ FT}^3$$

! MAX  $\Delta V = 2\%/\text{hr}$  for previous design  
(30°F ↓ in 1 hr)

$$Q_{\text{max}} = \frac{3 \times .02}{\text{hr}} \times 125 \text{ FT}^3 = 7.5 \text{ SCFH } N_2 \text{ req'd}$$

(SAFETY FACTOR OF 3.0)

0.033

AT 100 PSIG, 60°F, SIZING FACT = 0.36

0.01 ft/sec

! EQUIV FLOW = 2.7 SCFH AIR  
AT 100 PSIG 70°F

$$V_{\text{8" ID STACK}} = \frac{7.5 \text{ FT}^3/\text{HR}}{3600 \text{ SEC}} \div 3474 \text{ FT}^2 = 0.0055 \text{ FPS}$$

↑  
3.0 safety factor

Using incremental  $N_2$  cost of \$.25/1000 SCF)

(A) 3.0 SAFETY FACTOR →

$$COST/YEAR = \frac{$.25}{1000 \text{ SCF}} \times \frac{7.5 \text{ SCF}}{\text{HR}} \times \frac{365 \times 24 \text{ HR}}{\text{YR}} = \$16.43/\text{YR}$$

(B) RAISING  $N_2$  to .01 FPS ⇒ \$29.57/YR ≈ \$30/YR

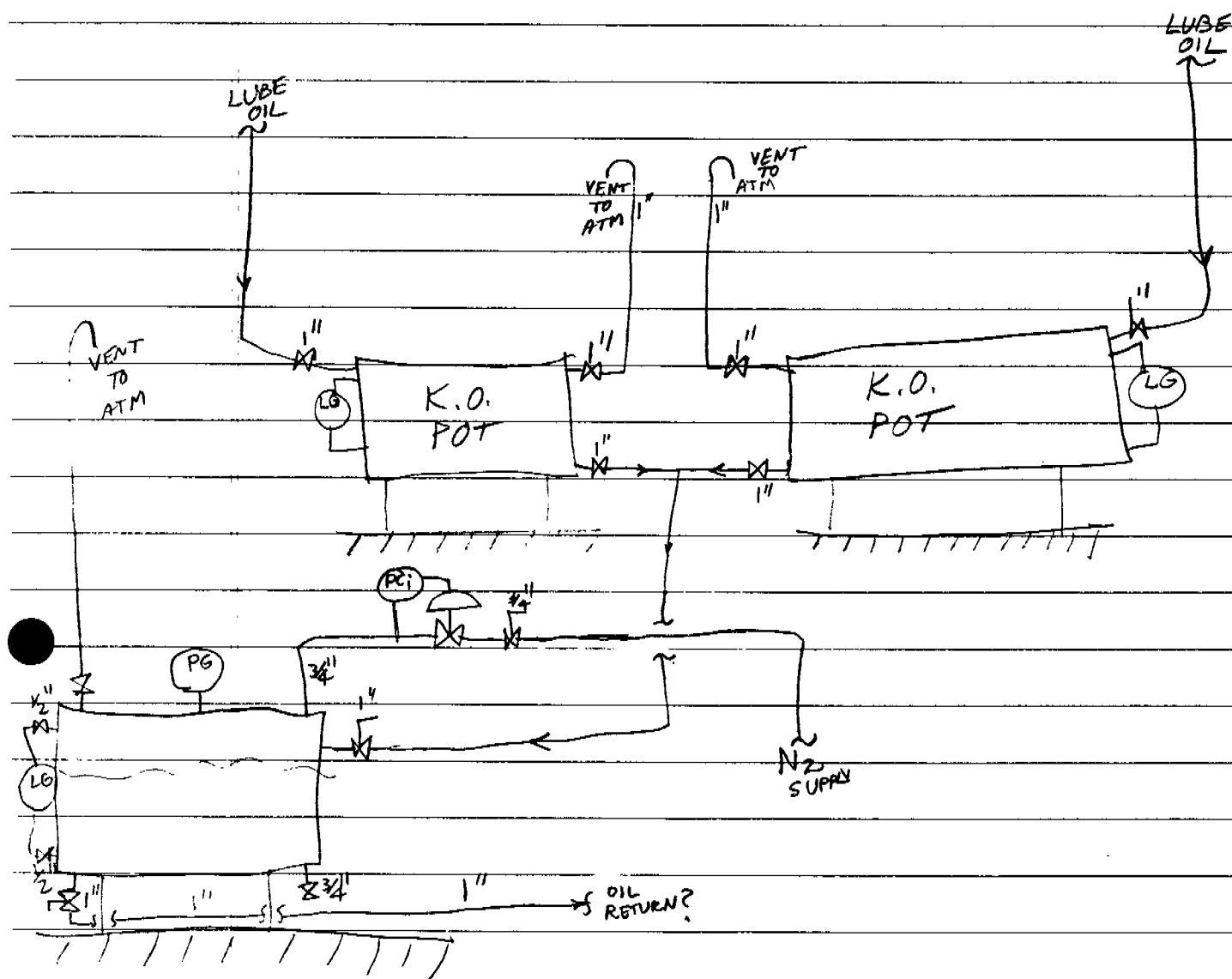
3-65A Glass

$$\left\{ \begin{array}{l} 13.5 \text{ SCFH } N_2 \text{ (14.7 psia 60°F)} \\ 4.86 \text{ SCFH equiv air} \end{array} \right.$$

ABRAHAMSON

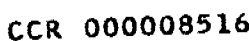
1" N<sub>2</sub> line available at tee conn.  
 @ 10-20 psig from pots

(1)



ALL 3 WILL TIE INTO RV STACK UP HCL  
 COLUMN.

RV VENT LINE IS AN 8" LINE GOING TO TOP OF HCL COLUMN



Circulate:

~~JDM~~  
CLS

*Do you agree? Did GT get a copy? Is a regulator necessary? JDM*

SENDER:

WRITE MEMO. REMOVE "FILE AND FOLLOW-UP COPY." SEND OTHER COPIES WITH CARBON INTACT.



WRITE IT - DON'T SAY IT!

CON-O-NOTE®

RECEIVER:

WRITE REPLY. REMOVE CARBON. KEEP "RECEIVER'S COPY." RETURN OTHER COPY TO SENDER.

SUBJECT

Rotameter for Snuffing  $N_2$  to 8" Vent from Refrig. RV's  
(from BL-501)

DATE

6-3-71

1-51X3

TO: Bob Hyberger

FROM: C.L. Shaddock, Jr.

Dept.

MEMO

Recommendation is a Brooks Model 1510A-V with the 3-65A Glass Float & Tube. Meter is equipped with a  $\frac{1}{4}$ " needle valve on the downstream connection, & std construction of structural members is 316 S.S. - std. rating is 200 psig, 200 °F. Connections are  $\frac{1}{4}$ " NPT Female. Cost of the meter & needle valve is about \$20. Meter should be installed on the 1"  $N_2$  snuffing line at ground level.

SIGNED

C.L. Shaddock, Jr.

DATE

REPLY

*Need at least 1 scfm rating. No regulator req'd, GTH got the back copy JDM*

SIGNED

RECEIVER'S COPY

CCR 000008517

Circulate:

~~DB~~

~~JDM~~

CLS

*Do you agree? Did GTH  
get a copy? Is a regul-  
ator necessary? R/H*

SENDER:

WRITE MEMO. REMOVE "FILE AND  
FOLLOW-UP COPY." SEND OTHER  
COPIES WITH CARBON INTACT.



WRITE IT - DON'T SAY IT!

CON-O-NOTE®

RECEIVER:

WRITE REPLY. REMOVE CARBON.  
KEEP "RECEIVER'S COPY."  
RETURN OTHER COPY TO SENDER.

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(from BL-501)

DATE

6-3-71

1-51X3

Bob Hyberger

C.L. Shaddock, Jr.

Dept.

M  
E  
M  
O

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are  $\frac{1}{4}$ " NPT Female. Cost of the meter & needle valve is  
about \$20. Meter should be installed on the 1"  $N_2$  snuffing line at  
ground level.

SIGNED

C.L. Shaddock, Jr.

DATE

Need at ground + acfm rating. No regulator req'd, GTH got the backing up

*JDM*

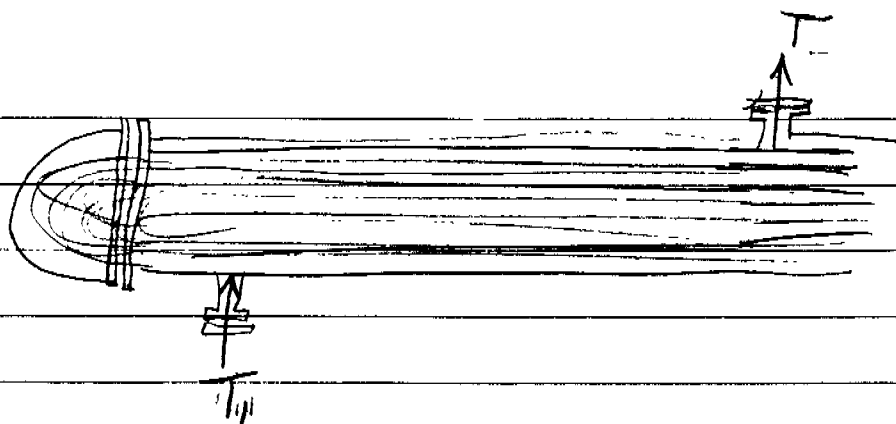
R  
E  
P  
L  
Y

SIGNED

RECEIVER'S COPY

CCR 000008517

$$q = \dot{m}_{STM} \lambda_{STM} = \dot{m}_{FL} \lambda_{FL}$$



$$\rho = \frac{PM}{RT} = \frac{(75 + 14.7)(62.5)}{(10.73)(460 + 200)} = 0.79 \text{ #/ft}^3$$

$$\mu = .0138 \text{ cp}$$

$$W = 26.75 \times 60 \times 0.79 = 1268 \text{ #/hr} \quad \therefore W^2 = 1.61 \times 10^6$$

$$C = .0016$$

$$\Delta P_{100} = \frac{3.36 \times 10^{-4}}{d^5} \left| \frac{W^2}{\rho} \right| f$$

$$\text{Try } 1'' \text{ Sch 40: } Re = \frac{6.31 \times 1268}{1 \times .0138} = 580 \times 10^3$$

$$\Delta P_{100} = \frac{C_1 C_2}{\rho} = \frac{5950 \times .0016}{.79} = 12 \text{ psi}$$

$$f_{1''} = \quad C_{2,1''} = 5950$$

$$\text{Use } 1\frac{1}{2}'' \quad \therefore C_2 = 627$$

$$\therefore \Delta P_{100} = \frac{627}{5950} \times 12 = 1.26 \text{ psi/100} \times 5 = \frac{6.3}{500}$$

$$Re_{1\frac{1}{2}} = 387 \times 10^3 \quad f_{1\frac{1}{2}} = .02$$

$$\therefore \Delta P_{100} = 1.26$$

$$3''$$

INTEROFFICE COMMUNICATION

Westlake, Louisiana  
May 25, 1971

TO: R.L. Hyberger

SUBJECT: NITROGEN PURGE FOR OXY RUPTURE DISC  
VENT LINES

Attached is a design to provide a nitrogen purge for the rupture disc outlet lines from the four oxy reactors. Operations has requested this system to minimize corrosion to the vent piping caused by leakage of reactants through the discs and by thermal inbreathing of humid air through the outlet of vent stack VS-390.

The design calls for nitrogen to be bled to each of the eight oxy reactor relief lines through rotameters. The purge rates will only be sufficient to prevent thermal inbreathing of air in order to keep nitrogen costs as low as possible. The separate purge streams will be run through flexible tubing to each vent line and connected to taps which will be made on the vent lines during the upcoming plant outage.

The installed cost of the system will be about \$1,000, and about \$1,000 per year of plant nitrogen will be consumed (based on a purge rate of 452 SCFH).

Please review this design and return all comments to R.H. Gerlach by June 14, 1971.

*C.L. Shaddock, Jr.*  
C.L. Shaddock, Jr.  
Process Engineer

CLS-BS  
cc: LNV-RDG-RHG-GTH-SFP-JDM

APPROVED: *J. L. D. M. JH*

CCR 000008519

PRELIMINARY  
ISSUED FOR COMMENTS

COST ESTIMATE

|    |                                      |            |
|----|--------------------------------------|------------|
| 1. | Rotameters (including needle valves) | \$ 200     |
| 2. | Piping and tubing                    | 300        |
| 3. | Valves, fittings, flanges, etc.      | 150        |
| 4. | Installation labor                   | 200        |
|    | subtotal                             | <u>850</u> |
|    | plus contingency(17.6%)              | <u>150</u> |
|    | TOTAL                                | \$ 1,000   |

CCR 000008520

WORK LIST

PRELIMINARY  
ISSUED FOR COMMENTS

1. Install rotameters FI-1&2 near the most convenient plant nitrogen connection around R-301. Run a 3/4" Sch. 40 steel inlet line from the connection over to the meters, splitting it into two separate feeders with ball valves and 3/4" x 1/4" reducers at the meter inlets. From the 1/4" needle valve on each meter, run 1/4" flexible S.S. or polyethylene tubing to the proper connection at each vent line and make the required tie-in.

2., 3.,

& 4. Repeat the above for rotameters FI-3&4, FI-5&6, and FI-7&8, respectively. Be careful that the rotameters are matched to the proper lines as indicated on the rotameter specifications.

CCR 000008521

**PRELIMINARY**  
ISSUED FOR COMMENTSROTAMETER SPECIFICATIONS  
N<sub>2</sub> PURGING OF OXY RUPTURE DISC VENT LINES

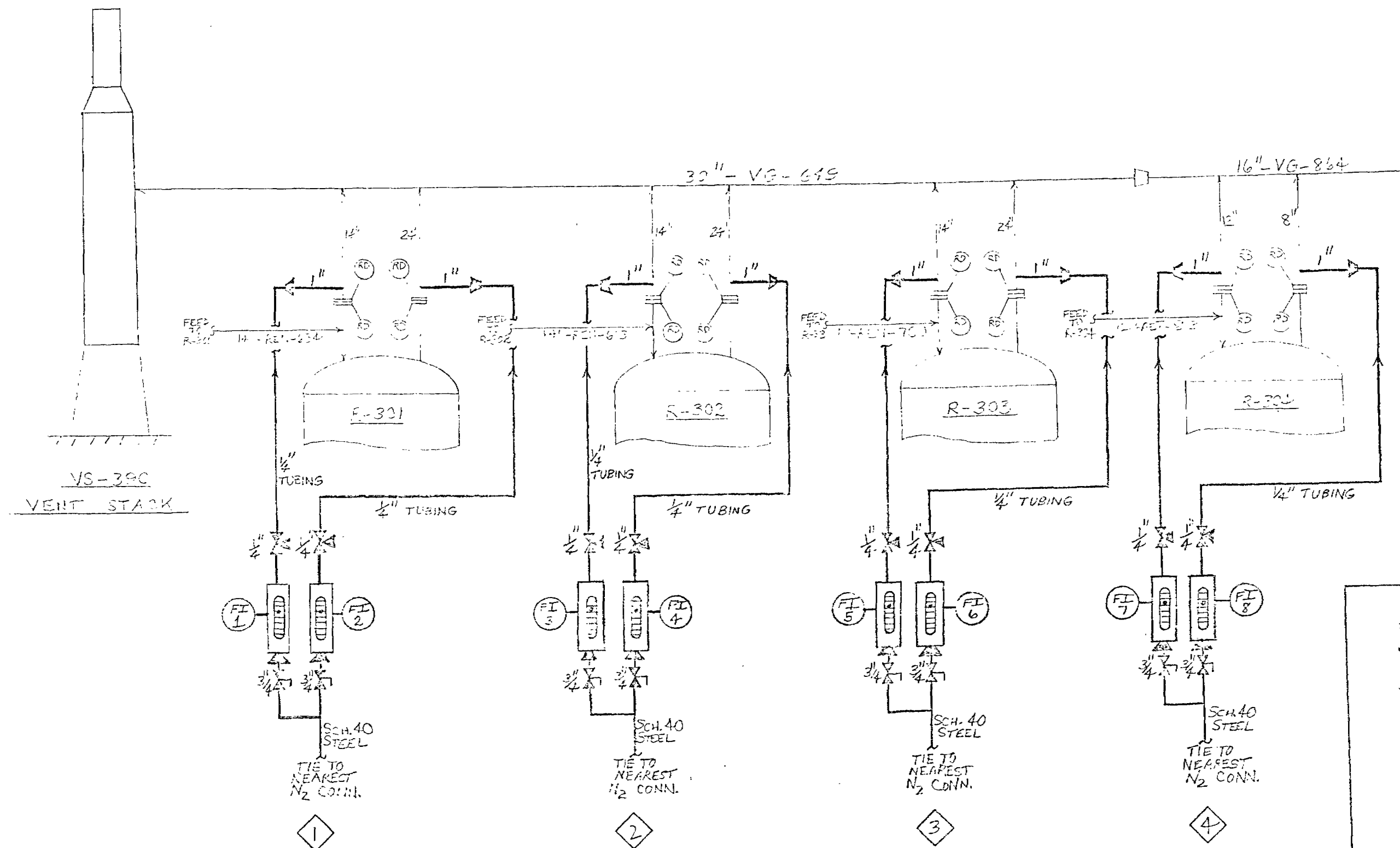
| Instrument No.                                                                              | FI-1                                          | FI-2                                          | FI-3                                          | FI-4                                          | FI-5                                          | FI-6                                          | FI-7                                          | FI-8                                         |
|---------------------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|----------------------------------------------|
| Service                                                                                     | N <sub>2</sub> to 14" Vent<br>Line from R-301 | N <sub>2</sub> to 24" Vent<br>Line from R-301 | N <sub>2</sub> to 14" Vent<br>Line from R-302 | N <sub>2</sub> to 24" Vent<br>Line from R-302 | N <sub>2</sub> to 14" Vent<br>Line from R-303 | N <sub>2</sub> to 24" Vent<br>Line from R-303 | N <sub>2</sub> to 12" Vent<br>Line from R-304 | N <sub>2</sub> to 8" Vent<br>Line from R-304 |
| Location                                                                                    | Local                                         | Local                                         | Local                                         | Local                                         | Local                                         | Local                                         | Local                                         | Local                                        |
| Material Handled                                                                            | Nitrogen                                      | Nitrogen                                      | Nitrogen                                      | Nitrogen                                      | Nitrogen                                      | Nitrogen                                      | Nitrogen                                      | Nitrogen                                     |
| Pressure, psig, normal-max.                                                                 | 100-125                                       | 100-125                                       | 100-125                                       | 100-125                                       | 100-125                                       | 100-125                                       | 100-125                                       | 100-125                                      |
| Temperature, °F                                                                             | 70                                            | 70                                            | 70                                            | 70                                            | 70                                            | 70                                            | 70                                            | 70                                           |
| Normal Rate, SCFH<br>(Air = 1.0, 60°F, 14.7 psia)                                           | 33                                            | 105                                           | 33                                            | 105                                           | 33                                            | 105                                           | 26                                            | 13                                           |
| Rotameter Matls of Construction                                                             |                                               |                                               |                                               |                                               |                                               |                                               |                                               |                                              |
| Metering Tube                                                                               | Glass                                         | Glass                                         | Glass                                         | Glass                                         | Glass                                         | Glass                                         | Glass                                         | Glass                                        |
| Float                                                                                       | 316 SS                                        | Glass                                         | 316 SS                                        | Glass                                         | 316 SS                                        | Glass                                         | Glass                                         | Glass                                        |
| End Fittings                                                                                | 316 SS                                        | 316 SS                                        | 316 SS                                        | 316 SS                                        | 316 SS                                        | 316 SS                                        | 316 SS                                        | 316 SS                                       |
| Window Shield                                                                               | Clear Plastic                                 | Clear Plastic                                 | Clear Plastic                                 | Clear Plastic                                 | Clear Plastic                                 | Clear Plastic                                 | Clear Plastic                                 | Clear Plastic                                |
| Float Stops                                                                                 | Teflon                                        | Teflon                                        | Teflon                                        | Teflon                                        | Teflon                                        | Teflon                                        | Teflon                                        | Teflon                                       |
| Tube Packing                                                                                | Viton                                         | Viton                                         | Viton                                         | Viton                                         | Viton                                         | Viton                                         | Viton                                         | Viton                                        |
| O-Rings                                                                                     | Viton                                         | Viton                                         | Viton                                         | Viton                                         | Viton                                         | Viton                                         | Viton                                         | Viton                                        |
| Recommender Vendor                                                                          | Brooks                                        | Brooks                                        | Brooks                                        | Brooks                                        | Brooks                                        | Brooks                                        | Brooks                                        | Brooks                                       |
| Meter No.                                                                                   | 1510A-V                                       | 1510A-V                                       | 1510A-V                                       | 1510A-V                                       | 1510A-V                                       | 1510A-V                                       | 1510A-V                                       | 1510A-V                                      |
| Tube No.                                                                                    | 4-65B                                         | 5-65A                                         | 4-65B                                         | 5-65A                                         | 4-65B                                         | 5-65A                                         | 4-65A                                         | 3-65A                                        |
| Connections                                                                                 | 1/4" NPT (Female)                             | 1/4" NPT (Female)                             | 1/4" NPT (Fem.)                               | 1/4" NPT (Fem.)                               | 1/4" NPT (Fem.)                               | 1/4" NPT (Fem.)                               | 1/4" NPT (Fem.)                               | 1/4" NPT (Fem.)                              |
| Extras                                                                                      | ← Downstream 1/4" Needle Valve →              |                                               |                                               |                                               |                                               |                                               |                                               |                                              |
| Range of Recommended<br>Meter, CFH Air @<br>70°F ± 14.7 psia                                | 2-18                                          | 5-45                                          | 2-18                                          | 5-45                                          | 2-18                                          | 5-45                                          | 1.2-12                                        | 0.5-6.0                                      |
| Set Point in the Above<br>Range Required to<br>Deliver the Normal Rate<br>at 100 psig, 70°F | 11.6                                          | 37.0                                          | 11.6                                          | 37.0                                          | 11.6                                          | 37.0                                          | 9.2                                           | 4.6                                          |
| Approximate FOB Cost<br>of Recommended Meter<br>(including needle valve)                    | \$20                                          | \$20                                          | \$20                                          | \$20                                          | \$20                                          | \$20                                          | \$20                                          | \$20                                         |

BY CLS, JR DATE \_\_\_\_\_  
CHKD. BY \_\_\_\_\_ DATE \_\_\_\_\_

SUBJECT NITROGEN PURGE FOR OXY  
RUPTURE DISC VENT LINES

SHEET NO. 2 OF 2  
JOB NO. \_\_\_\_\_

PRELIMINARY  
ISSUED FOR COMMENTS



### LEGEND

- NEW
- EX STING
- ⊞ BALL VALVE
- ⊞ NEEDLE VALVE
- RD RUPTURE DISC
- ◇ WORK LIST ITE

CCR 000008523