DISTRIBUTION FOR NTO-M-16846

NTO:

J. L. Beeman
V. R. Davis
F. L. DiLorenzo
C. R. Dippel
H. Henze
C. L. Hopkins
J. E. Janne
S. N. Kemp
R. E. Lightle
B. S. Maxon
L. W. McClellan
R. J. McConnell
H. N. Miller
J. R. Miller
J. W. Mitchell
W. R. Morris
L. E. Musselman
J. M. Pilant
A. J. Powell
J. W. Sadler
H. G. Simens
C. K. Soppet
R. G. Staker
D. D. VanderMeer
A. M. Vetere
W. D. Wayne
P. D. Zarembo
NTO File
ETO File

NRO:

R. M. Beattie
J. O. Bradfute
D. Buden
W. E. Durkee (3) ✓
B. Mandell
J. B. Philipson
C. M. Rice
P. W. Rowe
W. A. Sutter
E. A. Sheridan
W. L. Winegar
M. K. Wright (WANL Rep. at SACTO)

WANL:

P. W. Davison
R. E. Lochbaum (3)

SNPO-C/NRDS:

C. R. Howard
S. McManus

Document No.: NTO-R-0119

Date: September 11, 1967

MASTER

FILE COPY
NRO

DISTRIBUTION OF THIS DOCUMENT UNLIMITED **Technical Document Center**

X-11437

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

TO: C. K. Soppet

FROM: B. S. Maxon

SUBJECT: Test Prediction Report for ETC Helium (PCV-449)
Purge System Checkout

DISTRIBUTION: See Attached List

DATE: September 11, 1967
NTO-M-16846
BSM:JKE:eo

The Test Prediction Report, NTO-R-0119, for the ETC Helium (PCV-449) Purge System Checkout has been prepared by ETO Test Engineering, Operations Analysis Group, primarily for use at ETS-1 and is submitted for your information.

B. S. Maxon
B. S. Maxon, Supervisor
ETO Operations Analysis

Approved:

S. N. Kemp
S. N. Kemp, Manager
ETO Test Engineering

Attachment - 1

NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Energy Research and Development Administration, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

TEST PREDICTION REPORT
FOR
ETC HELIUM (PCV-449) PURGE SYSTEM CHECKOUT

NTO-R-0119

Submitted by:
ETO Test Engineering
Operations Analysis Group

Approved: Boyd S. Maxon
B. S. Maxon, Supervisor
ETO Operations Analysis Group

Approved: S. N. Kemp
S. N. Kemp, Manager
ETO Test Engineering

September 11, 1967

DISTRIBUTION OF THIS DOCUMENT UNLIMITED

TABLE OF CONTENTS

<u>SECTION</u>		<u>PAGE</u>
	LIST OF FIGURES AND TABLE	ii
	REFERENCES.	iii
1.0	INTRODUCTION	1
2.0	TEST DESCRIPTION	1
3.0	SYSTEM DESCRIPTION	1
4.0	SYSTEM STEADY-STATE PREDICTIONS	5

LIST OF FIGURES

<u>NUMBER</u>		<u>PAGE</u>
3.1	ETC HELIUM PURGE SYSTEM ISOMETRIC	2
3.2	Cv CHARACTERISTICS OF PCV-449	4
4.1	ETC HELIUM PURGE SYSTEM STEADY-STATE PERFORMANCE MAP (One Bottle)	6
4.2	ETC HELIUM PURGE SYSTEM STEADY-STATE PERFORMANCE MAP (Two Bottles).	7
4.3	ETC HELIUM PURGE SYSTEM STEADY-STATE PERFORMANCE MAP (Three Bottles).	8
4.4	HELIUM FLOWRATE AS FUNCTION OF PCV-449 POSITION (Two Bottles.	9
4.5	PCV-449 STEP RESPONSE CHARACTERISTICS UNDER NO FLOW CONDITION	10

LIST OF TABLES

<u>NUMBER</u>		<u>PAGE</u>
3.1	ETC He PURGE SYSTEM DATA, 1, 2, AND 3 BOTTLES . . .	3

REFERENCES:

1. NRO-7830:3384, "Demanded Helium Purge Flow to Prevent Air Intrusion in ETS-1 Duct", B. Misra, 18 August 1967.
2. NTO-Mpl6836, "Evaluation of PCV-449 to Provide He Purge Flow to ETC in the Event the Steam Generators Shutdown", B. S. Maxon/H. W. Brandt, 18 August 1967.

1.0 INTRODUCTION

The ETC Helium Purge System is being provided to prevent air back flow into the NES Duct in the event of loss of steam flow during engine testing (Ref. 1.2).

The first checkout of the ETC Helium Purge System will be conducted to determine whether the basic transient and steady-state characteristics of the system are adequate to meet the helium flow requirements given in Reference 1. For this checkout, the ETC will not be closed.

2.0 TEST DESCRIPTION

This test will be performed with helium bottles V-3204 and V-3205 on line and pressurized to approximately 2400 psia.

PCV-449 will be stepped open to 2.5% and held until a steady-state condition is established and then closed. The above procedure will be repeated for valve positions of 5, 7.5, 10, 15, and 20%. The valve will be held at a minimum steady-state to conserve on helium.

3.0 SYSTEM DESCRIPTION

Figure 3.1 is an isometric drawing of the ETC helium purge line from PCV-449 inlet to the ten inch pipe that exhausts into the ETC approximately 3.5 ft. below the top shield. The figure also shows the location of instrumentation associated with the system.

Table 3.1 lists the pertinent helium purge system data. The table lists K values for flow out of 1, 2, or 3 helium pressure vessels to FE-415 inlet.

Figure 3.2 is a plot of Cv versus valve position for PCV-449 from 0 to 25%. As noted, the curve is based on test data from NEPN-1 and NEP-III-1. The valve has an equal percentage plug with a maximum Cv of 1720 at 100%. PCV-449 is a hydraulically actuated 12 inch block type 90° valve with flow over the plug.

NOT TO SCALE

FIGURE 3.1

TABLE 3.1

ETC He PURGE SYSTEM DATA

1, 2, and 3 Bottles

FROM	TO	K		(3) L/A	(2) ft ³ /s
		(d = 5.189)	d = 10.126		
1. V-3204	FE-415 Inlet	42.0 (1)	-	3,619	74.9
V-3204 and V-3205	FE-415 Inlet	30.5	-	3,619	74.9
V-3206, V-3204, V-3205	FE-415 Inlet	24.2 (1)	-	3,619	74.9
2. FE-415 Inlet	Expansion 6" x 10" (Inlet)	1.68	-	258.6	7.2
3. Expansion 6" x 10" (Inlet)	T.B. Tee 12" x 10" x 12" (Inlet)	.417	-	13.7	2.13
4. T.B. Tee 12" x 10" x 12" (Inlet)	PCV-449 Inlet	.155	-	6.8	2.12
5. PCV-449 Inlet	PCV-449 Outlet	.218	-	-	-
6. PCV-449 Outlet	Bottom of Top Shield (12" x 10")	.682	.9898	112.3	35.1
Bottom of Top Shield (12" x 10")	ETC Inlet Pipe 10"	.1388		2.82	1.4

(1) FEP Test Data

(2) Includes Branch Lines

(3) Main Flow Line Only

PCV-449 POSITION
%

- NEP-III-1
- NEPN-1

FIGURE 3.2

4.0 SYSTEM STEADY-STATE PREDICTIONS

4.1 PCV-449 SYSTEM STEADY-STATE FLOW CHARACTERISTICS

Figures 4.1, 4.2, and 4.3 are the predicted Helium Purge System steady-state performance maps for one, two and three pressure vessels, respectively. These predictions are based on a temperature of 530°R.

Figure 4.4 illustrates helium flowrate versus PCV-449 valve position for bank pressures of 2500, 2200, 2000, 1500, and 1000 psia with V-3204 and V-3205 on line.

It is to be noted that the expected helium flowrate for PCV-449 positions of 2.5, 5, 7.5, 10, 15, and 20% are 27, 32.5, 38, 43, 53, and 61 pps, respectively, for maximum bank pressure of 2500 psi.

4.2 PCV-449 RESPONSE DATA (No Flow Condition)

Figure 4.5 illustrates PCV-449 step response characteristics under no flow conditions based on a test conducted on 30 August 1967. It is to be noted that PCV-449 started to open 50 milliseconds after the command started to increase, or 39 milliseconds after the command became positive. The valve opened at a maximum slew rate of 219%/second with a slight overshoot.

ETC (He) PURGE SYSTEM STEADY-STATE PERFORMANCE MAP

FIGURE 4.1

One Bottle

ETC (He) PURGE SYSTEM STEADY-STATE PERFORMANCE MAP

Two Bottles:

V-3204
V-3205

FIGURE 4.2

ETC (He) PURGE SYSTEM STEADY-STATE PERFORMANCE MAP

Three Bottles

FIGURE 4.3

Two Bottles
V-3204, V-3205

FIGURE 4.4

PCV-449 Step Response Characteristics.

Data taken from PCV-449 no-load performance test performed on 30 August 1967.