ETS-1

CONSOLE OPERATIONS MANUAL

GAS FILL AND SERVICE
GFS

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Contributors

T. J. Nettleton

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GAS FILL AND SERVICE CONSOLE

CONTROL ROOM CONSOLE LAYOUT

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LIST OF ABBREVIATIONS

ASE	Assistant Stand Engineer
ATE	Assistant Test Engineer
CKV	Cooldown Check Valve
CSE	Control System Engineer
CSV	Cooldown Shutoff Valve
CTE	Chief Test Engineer
ECS	Engine Control System
ETC	Engine Test Compartment
FCV	Flow Control Valve
GFS	Gas Fill and Service
GH ₂	Gaseous Hydrogen
GN ₂	Gaseous Nitrogen
He	Helium
LH ₂	Liquid Hydrogen
LN ₂	Liquid Nitrogen
NA	Nitrogen Atomizer
PCV	Pressure/Flow Control Valve
PDV	Pump Discharge Valve
PDVV	Pump Discharge Vent Valve
PFS	Propellant Feed System
PRV	Pressure Regulating Valve
PSV	Pump Shutoff Valve
PT	Pressure Transducer
RL	Remote Loader
RSV	Remote Shutoff Valve
SPO	Setup Panel Operator
TD	Test Director
TPA	Turbopump Assembly
TPCV	Turbine Power Control Valve
TSCS	Test Stand Control System
TSE	Test Stand Engineer
TSS	Test Simulation System
TT	Temperature Transducer

I. INTRODUCTION

The Gas Fill and Service (GFS) console is one of five consoles in the facility operations team; it is used in conjunction with all systems. The GFS provides high pressure gases: GH_2 , GN_2 , He, as well as GN_2 valve actuation and purge.

During the performance of a test, this console controls the flow of all GH_2 , GN_2 , and He as required to pressurize all headers, vessels and dewars.

The GFS console is under strict administrative control to prevent accidental pressurization of a system or release of high pressure gas.

II. PURPOSE

The purpose of this manual is to provide a current source of operational information about the Gas Fill and Service Console. The various subsystems controlled from this console are discussed in detail, including piping and instrumentation diagrams. This manual does not attempt to provide maintenance or checkout information.

Each of the subsystems also includes an operational section that describes the detailed procedure for startup or shutdown of the subsystem. These procedures pertain only to the operations performed at the GFS console and do not describe the operations required of other systems unless exclusively related to the GFS.

An operation of this type is subject to constant revision, both to increase the depth of coverage, and to reflect changes that may occur later in equipment or operating procedure. Each of the GFS operators, as part of his qualification to operate this console, will be required to review and update this manual in light of new information.

III. CONSOLE LAYOUT

The GFS console is located to the right of the AFER. The upper half includes meters which indicate pressures and temperatures. The lower portion of this console includes temperature selectors, pressure selectors, valve controls, and helium compressor controls. The console layout, shown in Figure III-1, is divided vertically into two sections: the left section includes all gas storage vessels, valve controls and pressure selectors; and the right section has headers, vents and compressor controls.

A list of the instrumentation monitored from the GFS console is included in Table III-1.

The piping and instrumentation diagram, Figure III-2, includes all the valves that are controlled from the GFS console as well as the associated instrumentation monitored from the GFS console. All high pressure gases and the actuation gas system for ETS-1 are controlled from the GFS console.

FIGURE III-1

GAS FILL & SERVICE CONSOLE
FOR TRAINING USE ONLY

INSTRUMENT NUMBER	FUNCTION	RANGE
PRESSURES		
32-PI-01	V-3201 GN ₂	0-3000 PSIG
32-PI-02	GN ₂ Distribution Header	0-3000 PSIG
32-PI-03	GH ₂ Distribution Header	0-3000 PSIG
32-PI-04	V-3202 GN ₂	0-3000 PSIG
32-PI-05	He Distribution Header	0-3000 PSIG
32-PI-07	V-3203 GN ₂	0-3000 PSIG
32-PI-10	V-3204 He	0-3000 PSIG
32-PI-13	V-3205 He	0-3000 PSIG
32-PI-16	V-3206 He	0-3000 PSIG
32-PI-441	V-3207 GH ₂	0-3000 PSIG
32-PI-442	V-3208 GH ₂	0-3000 PSIG
32-PI-443	V-3209 GH ₂	0-3000 PSIG
30-PI-96	Plant Air	0-200 PSIG
30-PI-44	Suction C3002B	0-500 PSIG
30-PI-111	Discharge C3002B	0-4000 PSIG
30-PI-43	Suction C3002A	0-500 PSIG
30-PI-110	Discharge C3002A	0-4000 PSIG
32-PI-85	GN ₂ Actuation	0-100 PSIG
30-PI-83	Cooling H ₂ O Pump Discharge	0-100 PSIG
TEMPERATURE		
32-TT-489	V-3201	35-610°R
32-TT-490	V-3202	
32-TT-491	V-3203	
32-TT-492	V-3204	
32-TT-493	V-3205	
32-TT-494	V-3206	
32-TT-484	V-3207	
32-TT-485	V-3208	35-610°R
32-TT-486	V-3209	

TABLE III-1 INSTRUMENTATION MONITORED FROM GFS CONSOLE
(Sheet 1 of 2)

PRESSURE SWITCH LAMP	FUNCTION	RANGE
30-FA-02	Water Flow C-3002B	
30-PA-02	Suction Pressure C-3002B	
30-LS-13	▲ P V-3004 Surge Tank	
30-FA-01	Water Flow C-3002A	
30-PA-01	Suction Pressure C-3002A	
30-PDA-09	Discharge Pressure C-3002A	
30-LS-12	▲ P V-3003 Surge Tank	
27-PDA-115	He Supply to Compressors	

TABLE III-1 INSTRUMENTATION MONITORED FROM GFS CONSOLE
(Sheet 2 of 2)

GFS CONSOLE CONTROL
P & I DIAGRAM
FOR TRAINING USE ONLY

FIGURE III - 2

IV. PRESSURIZATION OF GN₂ VESSELS

A. Vessel Pressurization

The GN₂ vessel pressurization system is shown schematically in Figure IV-1.

The GN₂ vessels are pressurized to 2500 psig by the Paul LN₂ converter located at the LN₂ dewar, or by a pumper truck from the fill station. These two methods may be used individually or together.

When using the pumper truck or the Paul converter, fill line vent valve 32-RSV-195 will be closed; valves 32-RSV-207, 32-RSV-208 and 32-RSV-209 will be open. Control of pressurization is maintained from the GFS console. The pumper is operated from the fill station. The LN₂ converter, after starting, is automatic and will shut down when the discharge pressure reaches 2500 psig.

When using LN₂ dewar V-3601 and the Paul LN₂ converter, the dewar is pressurized through RSV-273 from the GN₂ vessels. V-3601 pressure is controlled by PRV-108 and monitored on P-181. GN₂ vessel pressure is monitored on P-01, P-04, P-07.

B. Pressurization Procedure

The following procedure is used to pressurize the LN₂ dewar:

1. Verify that 36-RSV-327 is closed.
2. Verify that 36-RSV-326 is closed.
3. Close 36-RL-108 continuous vent.
4. Open 36-RSV-325.
5. Open 32-RSV-273.
6. Open one or more of the following: RSV-02, RSV-07, or RSV-12.
7. Adjust RL-108 pressure to attain the desired dewar pressure (P-181).

C.P. CONSOLE		CONTROLS FER.	
36 RSV 325		36 RSV 327	
CLOSE	OPEN	CLOSE	OPEN
36 RL 108		36 RL 108	
PRESS		CONT. VENT	
36 RSV 326		36 RL 108	
CLOSE	OPEN	MOM. VENT	

GN₂ VESSEL PRESSURIZATION SUBSYSTEM
FOR TRAINING USE ONLY

FIGURE IV-1

V. HIGH PRESSURE GN₂ SUBSYSTEMS

The GN₂ subsystems are shown schematically in Figure V-1. This system has many functions and each function affects other systems. These functions will be briefly discussed.

The pressure for the subsystems is provided through a normally pressurized header. This header is between the high pressure storage vessels and RSV-245 and RSV-273. Pressure is maintained through normally open valves RSV-02 and RSV-12. Pressurization of the downstream header is accomplished by equalizing pressures across RSV-273 and then opening RSV-245. Pressure is monitored on P-02 on the GFS console.

1. GN₂ Actuation and Purge System. All GN₂ actuation and purge gas for the facility is provided by the high pressure GN₂ system. The gas is supplied from the normally pressurized portion of the GN₂ header (1-GN-8"). This pressure flows thru a 1½" line to a regulator, 32-PRV-30, where it is reduced to 1000 psig. This pressure is monitored at P-85 on the GFS console. The pressure is further reduced as required for valve actuation and for purging. The pressure must be maintained near 1000 psig to assure normal valve operation unless lower pressures are approved by the Test Director.

2. Vessel and Dewar Pressurization. The vessels and dewars listed on the following page are pressurized from the high pressure GN₂ systems.

All systems are isolated from the main header by hand valves.

V-2801 LO₂ Dewar

V-3401 Propane Tank

V-3601 LN₂ Dewar

3. GN₂ Subsystems. GN₂ is also supplied to the following systems through RSV-273 and RSV-245.

N₂ Mixing Station

Steam Generator

Test Stand Purges

High Pressure GN₂ Downstream of Header

HIGH PRESSURE GN₂ SUBSYSTEMS
FOR TRAINING USE ONLY

FIGURE V-1

VI. HELIUM SUPPLY SYSTEM

The helium system, controlled from the GFS console, normally includes three vessels (V-3204, V-3205, V-3206) and the associated piping, valves and instrumentation. The helium system piping and instrumentation diagram is shown in Figure VI-1. Each vessel has a block valve and bypass valve. The fill and vent valves for each vessel will be covered in another section. The helium supply serves primarily for purge of LH_2 systems. It can also be used for LH_2 dewar pressurization. However, this is avoided if at all possible, due to the limited supply and high cost of helium. Helium may be used only as required by a Test Plan and for leak checks of hydrogen or helium systems, and then only with the permission of the Facility Operations Shift Supervisor.

Pressurization of the helium manifold is accomplished by first opening one or more of the vessel bypass valves, RSV-17, RSV-22, and RSV-27. After pressure has equalized in the manifold, the block valves RSV-16, RSV-21, and RSV-26 are then opened, and bypass valves are closed. If header pressure is then required, the header bypass valve RSV-54 is opened. Pressure is monitored on P-05 at the GFS console. When pressure has equalized, RSV-53 is opened. This same system is used to pressurize the 2" purge header by opening bypass valve RSV-275 and, after equalization, opening RSV-247.

It should again be stressed that during a Facility or Engine Test all actions are on command from the TD. The operator must be aware that all anomalies must be reported immediately since the GFS console provides all facility high pressure gas.

VII. PRESSURIZATION OF He VESSELS

A. Helium Vessel Pressurization

The helium vessel pressurization subsystem is shown schematically in Figure VII-1. This system serves only for pressurization of the helium vessels.

The system consists of a transport trailer with a capacity of approximately 120,000 scf @ 2700 psig, two Corblin compressors, and the storage vessels. The controls for the compressors are located on the GFS right panel. The GFS operator will operate his console in conjunction with a check list and an operator in the facility. All operations will be per check list and the operator must completely understand this check list. The GFS console operation and secure phase for the helium vessel pressurization is included below. This operator manual does not include the check list or detailed drawings.

B. Pressurization Procedure

1. Console Operation

- a. Perform setup check list.
- b. Open H₂O cooling valves (not shown in Figure VII-1) 30-SV-66, 30-SV-67. When water flow is established, 30-FA-02 and 30-FA-01 will light.
- c. Open 30-RSV-60.
- d. Open 30-RSV-61.
- e. Start compressors.

2. Secure Operation

- a. Stop compressors.
- b. Close fill valves.
- c. Open vent valves 30-RSV-263 and 30-RSV-264.
- d. Open vent valves 30-RSV-205 and 30-RSV-206.
- e. Open vent valve 32-RSV-19.
- f. Close 30-RSV-66 and 30-RSV-67.
- g. Close vent valves 30-RSV-205, 30-RSV-206, 30-RSV-263, 30-RSV-264, and 32-RSV-19.

HELIUM VESSEL PRESSURIZATION
SUBSYSTEM
FOR TRAINING USE ONLY

FIGURE VII-1

VIII. GASEOUS HYDROGEN SUPPLY SYSTEM

The high pressure GH_2 system normally has three vessels, V-3207, V-3208, V-3209. Each vessel has a bypass, block, and fill valves. These vessels do not have remotely operated vent valves and must be vented manually or through FS-3801. Figure VIII-1 is the gaseous hydrogen system piping and instrumentation diagram.

The system from the GFS console consists of three vessels and one 6" header with bypass valve 32-RSV-274 and block valve 32-RSV-246.

This system provides pressure to V-3801, LH_2 dewar V-5002, high pressure dewar V-5001, run tank, and other GH_2 systems. Header pressure is monitored on P-03 at the GFS console. Pressurization of the run header is accomplished by opening one or more vessel bypass valves RSV-515, RSV-519, RSV-523. After pressure has equalized, block valves RSV-516, RSV-520, RSV-524 are opened, and the bypass valves are closed. The header bypass RSV-274 is then opened and pressure is monitored at P-03. When the header pressure has equalized, RSV-246 is opened, and RSV-274 is closed.

IX. PRESSURIZATION OF GH_2 VESSELS

The LH_2 supply comes from either dewar V-3801 or a transport trailer, and is converted to GH_2 by a Cosmodyne pump and vaporizer system shown in Figure IX-1. The GFS console is manned during the converter operation. Normally, pressurization will be achieved by use of a LH_2 trailer since the time involved and clean up of systems upon completion of pumping is reduced.

FIGURE IX-1

X. SUMMATION OF GFS OPERATIONS

There are several basic rules that must be followed when operating this console. This facility console provides high pressure gas for all facility operations, all dewar and vessel pressurization, and purges. The operator must keep in mind that the duration of a particular test will be limited by the pressures available, and that most valve actuation pressure is supplied from this console. Therefore, any question or anomaly must be reported to the TD immediately. A loss of gas could terminate a test prematurely, or loss of actuation pressure would cause immediate termination. P-85 actuation pressure should be monitored continuously during all operations.

XI. VALVES AND PIPING

The GFS console includes stop/start controls for the helium compressors and RSV valves used for vent and fill operations. Table XI-1 lists the RSV valves, valve size, line number and valve function.

VALVE NO.	LINE NO. AND SIZE	FUNCTION
32-RSV-01	103-GN-4"	V-3201 Block
32-RSV-02	103-GN-3/4"	V-3201 Bypass
32-RSV-03	104-GN-3/4"	V-3201 Vent
32-RSV-06	109-GH-4"	V-3202 Block
32-RSV-07	109-GH-3/4"	V-3202 Bypass
32-RSV-08	110-GN-3/4"	V-3202 Vent
32-RSV-11	106-GN-4"	V-3203 Block
32-RSV-12	106-GN-3/4"	V-3203 Bypass
32-RSV-13	107-GN-3/4"	V-3203 Vent
32-RSV-16	112-GH-4"	V-3204 Block
32-RSV-17	112-GH-3/4"	V-3204 Bypass
32-RSV-18	113-GH-3/4"	V-3204 Vent
32-RSV-19	102-He-1"	He Fill Vent
32-RSV-21	104-He-4"	V-3205 Block
32-RSV-22	104-He-3/4"	V-3205 Bypass
32-RSV-23	105-He-3/4"	V-3205 Vent
32-RSV-24	1-He-1"	He Header Vent
32-RSV-26	115-He-4"	V-3206 Block
32-RSV-27	115-He-3/4"	V-3206 Bypass
32-RSV-28	116-He-3/4"	V-3206 Vent
32-RSV-29	1-GN-1"	GN Header Vent
32-RSV-193	106-GH-1"	H ₂ Fill Vent
32-RSV-194	1-GH-1"	H ₂ Header Vent
32-RSV-195	100-GN-2"	N ₂ Fill Vent
32-RSV-207	102-GN-1"	V-3201 Fill
32-RSV-208	108-GN-1"	V-3202 Fill
32-RSV-209	105-GN-1"	V-3203 Fill
32-RSV-210	111-He-1"	V-3204 Fill
32-RSV-211	103-He-1"	V-3205 Fill
32-RSV-212	114-He-1"	V-3206 Fill
32-RSV-53	106-He-6"	He Header Block
32-RSV-54	106-He-1/2"	He Header Bypass

TABLE XI-1 RSV VALVES CONTROLLED FROM GFS CONSOLE
(Sheet 1 of 2)

VALVE NO.	LINE NO. AND SIZE	FUNCTION
32-RSV-245	1-GN-8"	GN ₂ Header Block
32-RSV-246	1-GH-6"	GH ₂ Header Block
32-RSV-247	106-He-2"	2" He Header Block
32-RSV-270	10-He-3/4"	He Purge Bypass
32-RSV-273	1-GN-1/2"	GN ₂ Header Bypass
32-RSV-274	1-GH-1/2"	GH ₂ Header Bypass
32-RSV-275	1-He-1/2"	2" He Header Bypass
32-RSV-314	10-He-2"	He Purge Block
32-RSV-514	124-GH-1"	V-3207 Fill
32-RSV-515	123-GH-3/4"	V-3207 Bypass
32-RSV-516	123-GH-6"	V-3207 Block
32-RSV-518	121-GH-1"	V-3208 Fill
32-RSV-519	120-GH-3/4"	V-3208 Bypass
32-RSV-520	120-GH-6"	V-3208 Block
32-RSV-522	118-GH-1"	V-3209 Fill
32-RSV-523	117-GH-3/4"	V-3209 Bypass
32-RSV-524	117-GH-6"	V-3209 Block

TABLE XI-1 RSV VALVES CONTROLLED FROM GFS CONSOLE
(Sheet 1 of 2)

XII. REMOTE SHUTOFF VALVES

A. Indication Lamp Logic

The GFS console contains command switches for numerous RSV's. All of these valves utilize the same indication logic. The command switch is a two-position pushbutton type, and the switch lens face has three sections of illumination shown in Figure XII-1. The upper half of the lens face is the command indication. The lower right quarter of the lens face indicates the energized valve position regardless of whether the RSV is normally closed or normally open. Likewise, the lower left quarter indicates the de-energized valve position.

1. Command Indication

- a. With the RSV command to change from its de-energized valve position to its energized valve position, the ORANGE command light comes on.
- b. With the RSV commanded to its de-energized valve position, the ORANGE command light is off, and the GREEN command light is on.
- c. If the ORANGE command light is off, depressing the command pushbutton switch causes the ORANGE command light to come on and commands the valve to its energized position.
- d. Depressing the pushbutton switch a second time extinguishes the ORANGE command light and commands the valve to return to its de-energized position.

2. De-Energized RSV Position Indication

- a. With the valve in its de-energized position, the GREEN valve position light is on.
- b. When the valve is commanded to its energized position by depressing the command switch, the ORANGE valve position light comes on after the valve has moved 10%, and remains on until the valve is returned to its de-energized position.
- c. While the valve is traveling to its energized position, both the ORANGE and GREEN valve position lights are on.
- d. The GREEN valve position light is extinguished when the valve reaches 90% of its full energized position.

3. Energized RSV Indication

- a. With the valve in its energized position, the ORANGE valve position light is on.
- b. When the valve is commanded to its de-energized position by depressing the command switch a second time, the GREEN valve position light will turn on after the valve has moved 10%, and remain on until the valve is energized again.
- c. While the valve is traveling to its de-energized position, both the GREEN and ORANGE valve position lights are on.
- d. The ORANGE valve position light will remain on until the valve is within 10% of its fully de-energized position.

4. Abnormal Conditions

- a. If the ORANGE command light is off and neither valve position light remains on, the limit switch or light bulbs are likely causes.
- b. If the GREEN command lamp is on and GREEN valve position lamp is off and the ORANGE command lamp is on, the valve is abnormally held in its energized position.
- c. If the ORANGE and GREEN valve position lamps and GREEN command light are on, the valve is neither fully open nor fully closed.
- d. If the ORANGE command lamp and GREEN valve position lamp are on, the valve is abnormally held in its de-energized position.

5. Command Switch Activation. The position of the command switch cannot be determined by inspection when the power is off, thus care must be exercised when CONTROL POWER is turned on and off.

The condition of the demand switch can be determined by selecting the INDICATOR TEST position. When the INDICATOR TEST is on, the condition of the command switch is given by the command indicator ORANGE or GREEN light. If one or both of these lamps are on, a command will go to the valve to change position when control power is turned on. In order to remove this command the operator needs only to press the switch, the command lights will then return to GREEN.

Because of the logic used for the GFS RSV's, extreme caution must be exercised when turning on and off the control power.

CAUTION

ANY VALVE WITH A COMMAND SIGNAL ON IT WILL REVERSE POSITION WHEN THE POWER IS SWITCHED TO THE OFF POSITION.

LAMP LOGIC - The command switch lens face has three sections of illumination.

1. Green command power OFF - indicates that valve is commanded to its de-energized position.
2. Orange command power ON - indicates that valve is commanded to its energized position.
3. Green valve position light ON - indicates that valve is in its de-energized position.
4. Orange valve position light ON - indicates that valve is in its energized position.
5. Orange and Green valve position lights ON - indicates that valve is traveling between positions; either Open to Close, or Close to Open.

SWITCH LOGIC

1. With Orange command light OFF, depressing command pushbutton switch commands valve to its energized position.
2. With Orange command light ON, depressing command pushbutton switch commands the valve to its de-energized position.

B. RSV Pneumatic Actuation

All the RSV's in the GFS are pneumatically actuated with GN_2 . The actuation gas pressure will position the RSV according to GN_2 flow thru the four-way solenoid pilot valve, Figure XII-2. When there is either a power failure or actuation gas failure, the RSV is returned to its normal position by a compression spring.

The normal positioning spring will cause the RSV to have an opening characteristic that is different from the closing characteristics. The valve will not move from its normal position until P_1 has vented to a pressure well below P_2 due to the spring force. The operation of the RSV will be much slower when traveling from CLOSE to OPEN than when moving from OPEN to CLOSE. Figure XII-3 is a graph of the expected change of valve position with respect to time. Note that the stroke will not be linear in either case due to the changing spring load as a function of valve position.

VALVE ACTUATOR ASSEMBLY

TYPICAL RSV ZERO LOAD ACTUATOR CHARACTERISTICS
(NORMALLY CLOSED VALVE)
FOR TRAINING USE ONLY

FIGURE XII-3

D. RSV Control

Actuation of an RSV requires that five separate and independent conditions occur at the same time:

1. Console control power supply ON
2. Actuation gas supply available to four-way solenoid pilot valve
3. Solenoid valve operate switch in the OPERATE position
4. 28 vdc relay power supply ON
5. Console command switch ON

Figure XII-5 indicates the principle components in the RSV control circuit. The console control power is activated by the CONTROL POWER switch on the GFS console. The facility personnel will activate the actuation gas supply, the 28 vdc relay power, and the safety switch prior to operator activation of the GFS console. After the console is active the RSV may be exercised by operating the proper console switch. When the RSV switch is placed in the ON position, relay K is picked up, and if the safety switch is in the OPERATE position, current will flow to the four-way solenoid valve allowing actuating gas to move the RSV to the open or close position.

FIGURE XII-4

XIII. CONSOLE SETUP AND SHUTDOWN PROCEDURE

The first step in setting up the GFS console is to switch to the INDICATOR TEST position which provides power to check the console lamps. The lamps are checked by visual observation. All green console lamps should be lighted, and any lamp that is not should be replaced before proceeding. After the operator is assured that all lights are functioning properly, the INDICATOR POWER switch may be switched to ON. All command lamps should be GREEN. Any demand light that comes on ORANGE indicates that when CONTROL POWER is turned on the operate relay will be activated, and that particular RSV will be actuated. Under these conditions, the operator must depress the valve switch to remove the demand. After all demands have been removed, the CONTROL POWER switch may be activated.

Shutdown of the console is performed in essentially the reverse order of the setup. Any valve with a demand signal must be deactivated prior to turning off the CONTROL POWER.

APPENDIX A

List of sources of information for more detailed study.

ETS-1 SOP's:

NTO-I-0016 Fill Operations LN_2
NTO-I-0096 Fill Operations LO_2
NTO-I-0045 V-3801 Fill LH_2
NTO-I-0062 GH_2 Header Pressurization and Secure
NTO-I-0030 Pressurization and Secure GN_2 Header
NTO-I-0017 Pressurization of He HP Vessels
NTO-I-0051 Pressurization and Secure of Helium Actuation
and Purge Header
NTO-I-0054 Setup of 38 Area GH_2 and LH_2 for Pressurization V-3801
NTO-I-0053 Setup of 27 and 38 Area He Purge System
NTO-I-0060 Activation of 27 and 38 Areas Instrument Gas Purge
NTO-I-0061 38 Area Secure
NTO-I-0056 Setup of SVB-5
NTO-I-0063 Normal and Emergency Actuation Systems Setup
NTO-I-0057 FS-3801 Setup
Paul Chem Handbook LN_2 Converter
Cosmodyne Handbook LH_2 Pump and Vaporizer
Corblyn Handbook He Compressors