S

ENGINEERING CHANGE NOTICE

H

Page 1 of 2

1. ECN 657669

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental ☐	N. E. Wilkins, N1B10000, T5-55, 373-3685	☒ Yes ☐ No	4/4/00
Direct Revision ☒			
Change ECN ☐			
Temporary ☐			
Standby ☐			
Supersedure ☐			
Cancel/Void ☐			

6. Project Title/No./Work Order No.	7. Bldg./Sys./Fac. No.	8. Approval Designator
Thermal Stabilization	PFP/73T/234-5Z	SQ

9. Document Numbers Changed by this ECN (includes sheet no. and rev.)	10. Related ECN No(s).	11. Related PO No.
HNF-SD-CP-SDD-017, Rev. 4	N/A	N/A

12a. Modification Work	12b. Work Package No.	12c. Modification Work Completed	12d. Restored to Original Condition (Temp. or Standby ECNs only)
☐ Yes (fill out Blk. 12b) ☒ No (NA Blks. 12b, 12c, 12d)	N/A	N/A Design Authority/Cog. Engineer Signature & Date	N/A Design Authority/Cog. Engineer Signature & Date

13a. Description of Change

13b. Design Baseline Document? ☒ Yes ☐ No

The referenced document was changed to include two procedures that provide instructions for charge makeup and oxidation of metal items in the HC-21C furnaces.

14a. Justification (mark one)

- Criteria Change ☒
- Design Improvement ☐
- Environmental ☐
- Facility Deactivation ☐
- As-Found ☐
- Facilitate Const. ☐
- Const. Error/Omission ☐
- Design Error/Omission ☐

14b. Justification Details

Pu metal items is a new feed type which will be processed through the HC-21C furnaces.

The USQ for ZO-160-038 A-0 applies.

15. Distribution (include name, MSIN, and no. of copies)

R. A. Burk	T4-20	A. M. Stubbs	T5-55
J. F. Durnil	T5-55	M. D. Talbot	T5-15
K. A. Larkin	T5-55	N. E. Wilkins	T5-55
A. L. Ramble	T5-53	Central Files	B1-07
H. R. Risenmay	T5-55		
R. D. Redekopp	T5-15		
B. D. Skeels	T5-09		
D. R. Speer	T5-50		

RELEASE STAMP

APR 25 2000

DATE:

STA: 5

HANFORD RELEASE

ID: 12

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1): 657669

16. Design Verification Required	17. Cost Impact		18. Schedule Impact (days)
	ENGINEERING	CONSTRUCTION	
☐ Yes	Additional ☐ $ N/A	Additional ☐ $ N/A	Improvement ☐ N/A
☒ No	Savings ☐ $ N/A	Savings ☐ $ N/A	Delay ☐ N/A

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

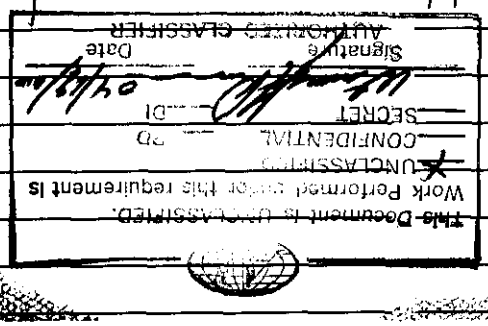
SDD/DD	☐	Seismic/Stress Analysis	☐	Tank Calibration Manual	☐
Functional Design Criteria	☐	Stress/Design Report	☐	Health Physics Procedure	☐
Operating Specification	☒	Interface Control Drawing	☐	Spares Multiple Unit Listing	☐
Criticality Specification	☐	Calibration Procedure	☐	Test Procedures/Specification	☐
Conceptual Design Report	☐	Installation Procedure	☐	Component Index	☐
Equipment Spec.	☐	Maintenance Procedure	☐	ASME Coded Item	☐
Const. Spec.	☐	Engineering Procedure	☐	Human Factor Consideration	☐
Procurement Spec.	☐	Operating Instruction	☐	Computer Software	☐
Vendor Information	☐	Operating Procedure	☒	Electric Circuit Schedule	☐
OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐
FSAR/SAR	☐	IEFD Drawing	☐	Process Control Manual/Plan	☐
Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☒
Radiation Work Permit	☐	Essential Material Specification	☐	Purchase Requisition	☐
Environmental Impact Statement	☐	Fac. Proc. Samp. Schedule	☐	Tickler File	☐
Environmental Report	☐	Inspection Plan	☐	_____	☐
Environmental Permit	☐	Inventory Adjustment Request	☐	_____	☐

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number/Revision
OSD-Z-184-00006	HNF-SD-CP-OCD-040	PFD-Z-190-0004 ZAR-020

21. Approvals

	Signature	Date		Signature	Date
Design Authority			Design Agent		
Cog. Eng.	S H. Ross Ross	4-4-2000	PE		
Cog. Mgr.	R.A. Buck	4/21/00	QA		
QA	DR Groth DR Groth	4-20-00	Safety		
Safety	S.E. Nunn	4-19-2000	Design		
Environ.			Environ.		
Other			Other		
N.E. Wilkins (USQ Screener)		4/4/00			
J.P. King (USQ Evaluator)		4/4/00			



DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

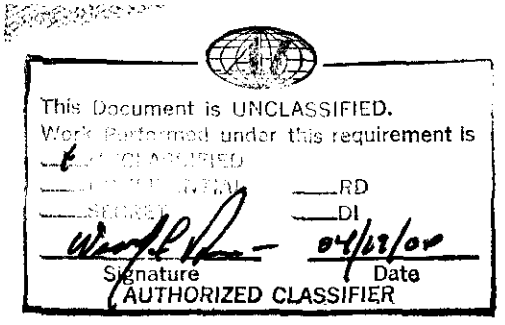
ADDITIONAL

HNF-SD-CP-SDD-017
Revision 5

System Design Description PFP Thermal Stabilization

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200
Fluor Hanford
P.O. Box 1000
Richland, Washington



HNF-SD-CP-SDD-017
Revision 5
ECN 657669

System Design Description PFP Thermal Stabilization

H. R. Risenmay
Fluor Hanford, Inc.

Date Published
April 2000

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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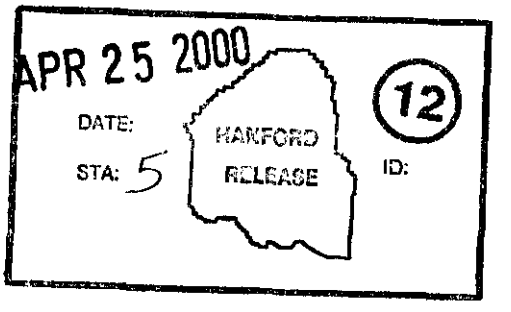
Richland, Washington



Release Approval 4/21/00 Date

Approved for public release; further dissemination unlimited

Total Pages 41

Printed in the United States of America

RECORD OF REVISION	(1) Document Number HNF-SD-CP-SDD-017	Page 1

(2) Title
SYSTEM DESIGN DESCRIPTION PFP THERMAL STABILIZATION

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr.D
2	Complete revision according to ECN 646343 also added supplemental ECN 634441.	H.R.Risenmay	M.W.Gibson
3	Complete revision per ECN 637055.	H.R.Risenmay	M.W.Gibson
4	Revision to include the HA-21I furnaces per ECN 654358.	H.R.Risenmay	P.E.Roege
RS 5	Add two new procedures for metal items per ECN 657669.	H.R. Risenmay H.R. Risenmay 4-21-2000	R. A. Burk RABurk 4/21/00

TABLE OF CONTENTS

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1.0 PURPOSE

The purpose of this document is to provide a system design description (SDD) and design basis for the Plutonium Finishing Plant (PFP) Thermal Stabilization project. The chief objective of the SDD is to document the Structures, Systems, and Components (SSCs) that establish and maintain the facility Safety Envelope necessary for normal safe operation of the facility; as identified in the FSAR, the OSRs, and Safety Assessment Documents (SADs). This safety equipment documentation should satisfy guidelines for the SDD given in WHC-SD-CP-TI-181, Criteria for Identification and Control of Equipment Necessary for Preservation of the Safety Envelope and Safe Operation of PFP.

The basis for operational, alarm response, maintenance, and surveillance procedures are also identified and justified in this document. This document and its appendices address the following elements of the PFP Thermal Stabilization project:

- Functional and design requirements
- Design description
- Safety Envelope Analysis
- Safety Equipment Class
- Operational, maintenance and surveillance procedures

The appendices contain additional data for informational purposes only. The actual data bases and/or supporting documents should be consulted for the most current data.

2.0 SUMMARY

The Thermal Stabilization Project is designed to stabilize the plutonium bearing materials currently stored in gloveboxes and plutonium bearing materials in product storage vaults at the PFP to meet interim storage as defined by DOE-HQ Standard DOE-STD-3013. Stabilizing this material will facilitate long term storage and reduce worker exposure.

The sources of plutonium bearing material for this project are residual materials scraped from glovebox floors, glovebox floor sweepings, vault storage material (both Pu and Pu-U mixtures), and product quality oxide that need further stabilization. These materials accumulated during the production of defense material at the PFP. The plutonium bearing material is currently contained in 1/2 liter capped plastic bottles, called polyjars, small slip-lid cans stored in various gloveboxes, or in cans in the storage vaults. The material will be thermally stabilized in gloveboxes HC-21C (room 230A) and HA-21I (room 235-B) of the 234-5Z building. Processed material, after cooling, will then be packaged in glovebox HC-18M (room 228C), bagged out and canned for interim storage in vaults at the PFP.

The furnace related equipment installed by the Thermal Stabilization project has been determined not to be Safety Class or Safety Significant based upon the facility safety analysis report HNF-SD-CP-SAR-021and the Safety Equipment List (SEL), HNF-SD-CP-TI-108. However, the gloveboxes, ventilation system, and room Continuous Air Monitors (CAM) are safety significant equipment. No accident has been postulated that would affect on or off-site personnel, however, so there is no requirement for a safety class designation.

3.0 FUNCTIONS AND DESIGN REQUIREMENTS

Reactive Plutonium bearing materials(usually stored in polyjars) and product quality oxide are first sealed into glovebox HC-21A; where packaging is removed and the material is weighed and placed into a carrier called a boat. The boat is then transferred through conveyors HC-2, HC-2/3 airlock, HC-3, HC-4, and HA-28, to glovebox HA-21I or through HC-2 to HC-21C and placed into one of the muffle furnaces.

If the material to be processed originated in the Plutonium Reclamation Facility (PRF) or one of the wet processing gloveboxes, the material potentially contains tributyl phosphate (TBP). The approved processing travelers designate the items to be processed and will also specify when those items require organic analysis. When the analysis shows organic present the amount of organic per furnace batch will be examined to ensure that the 10 gram limit is not exceeded. For this type of material (processed in glovebox HC-21C only), a rotameter is adjusted to provide a specified flow rate of carbon dioxide (CO_2) purge gas into the furnace. The purpose of the CO_2 is to help suppress the lower flammability limit (LFL) of butene gas in the furnace. Butene is generated from the degradation of TBP in the PRF material. The off-gas is removed from the furnace via the 26 inch vacuum system at a specified rate.

The next step involves starting the furnace heating cycle from the control panel for glovebox HC-21C or from the operator display screen for glovebox HA-21I. The operator assures that the emergency stop button for glovebox HC-21C is not depressed and that the furnace door is closed. The operators in room 235B ensure that the emergency stop button is not depressed and that the circuit breaker is not tripped out in the power panel supplying power to the furnaces. The operator then selects the correct cycle program on the controller or computer display screen for the feed material being processed and depresses the manual start switch or clicks on the correct icon on the computer display screen.

The controller has been pre-programmed to ramp and hold the furnace temperature at rates and temperature levels specific to the material being processed. The material is then cooled and transported to glovebox HC-18M via conveyors HC-2, HC-2/3 airlock, HC-3, HC-4, and HA-28, and HC-18BS. In HC-18M the product is ground (if needed), blended, sampled (to verify the Loss on Ignition (LOI) meets vault storage specifications), and packaged in the PUREX slip lid can, or in the Hanford Convenience Can (HCC) and first HCC over-pack can for long term

storage. The packaged material is moved to the HC-18BS glovebox or some other temporary storage glovebox for interim storage while waiting for the results of the sample analysis. Samples are analyzed for moisture content by the analytical labs. After the processed material has been analyzed, it is moved back to HC-18M, bagged out to room 228C, and placed in two hermetically sealed cans. The final can is weighed, security seals applied and either, transported to 175 vault for interim storage before being moved to 2736-ZB or moved directly to 2736-ZB for NDA and storage. Note: Chemical assay may be used in place of NDA.

3.1 PROCESS REQUIREMENTS

Process requirements for Thermal Stabilization specify what types of material may be processed, process conditions for each type, and what specifications the finished product must meet. An important sludge feed criterion is the percent organic in the material. Important finished product criteria are the amount of water in the material (as determined by a percent Loss On Ignition (LOI) analysis or by Supercritical Fluid Extraction, the size of processed particles, and the moisture absorption rate of the material. Process requirements for this system are defined and explained in PFD-Z-109-00004, Thermal Stabilization Process Flow sheet, 234-5Z Building[1] and OSD-Z-184-00006 Thermal Stabilization[2].

3.2 INTERFACES

Materials will be transferred to and from the vaults on a daily basis during normal operations. Vault 175 will be used as a staging area for both feed and product. If the plutonium fluoride material currently stored in vault 174 is removed the CPS posting for this vault could be changed so that feed could be stored in 174. This change is needed to facilitate feed items that do not fit in the vault 175 storage racks.

Off-gas streams from the furnaces in glovebox HC-21C are removed using the 26" vacuum system. Off-gas streams for the furnaces in glovebox HA-21I are filtered by 2 stages of HEPA filters prior to discharging to the E-4 ventilation system via 2 dedicated vacuum pumps (5 inch Hg vacuum system).

Supply air to gloveboxes HC-18M, HC-21A and HC-21C is provided by the E-4 "dry" air supply (Note: The E-4 system no longer supplies dry air, air is supplied at atmospheric humidity). Glovebox exhaust air will exit the gloveboxes through a local HEPA filter before entering the E-4 exhaust system. Glovebox HC-21C is also supplied by the CO_2 system which is located in room 230A. CO_2 is supplied from liquid storage cylinders directly to the furnaces inside the glovebox. The CO_2 is exhausted from the furnaces by the 26" process vacuum system.

The dry air system also supplies the HA-21I glovebox via HA-28 and the glovebox air is evacuated through a HEPA filter into the E-4 system. The HA-21I furnace off gas streams are exhausted by the 5" vacuum system that was installed in the PFP for this purpose.

3.2.1 Power

Power is supplied to glovebox HC-21C and the Thermal Stabilization control panel through junction box JB-HC-21C. The junction box is located underneath HC-21C and is supplied by power panel "B"; part of the Remote Mechanical 'C' (RMC) electrical system. Power for the system is routed first to the control panel and then relayed to furnaces, thermocouples, etc.

Power is supplied to HA-21I through a pull-box, PB-2, on the end of the glovebox. Conduit runs from this box to the Programmable Logic Controller (PLC) rack assembly. Conduit then runs from the PLC rack to panelboard ARS-1 for the furnaces and to panelboard ARS-2 for the other electrical equipment in the glovebox. The conveyors and vacuum pumps will be connected to junction box JB-MCC-B located in the upper level in a clean area.

Power to the balance and grinder in glovebox HC-18M is provided by the outlets located in the glovebox. HC-18M was a maintenance glovebox and has power outlets to operate various maintenance devices. Power is supplied by panel board 120B on the mezzanine near column D9.

3.2.2 Control

All of the instrumentation, controls and alarms for HC-21C have been installed in a control panel which is located in room 230A, facing glovebox HC-21C. A programmable logic controller (PLC) located on the mezzanine in room 235B controls the furnaces and instruments in glovebox HA-21I. The controls and alarms for the PLC associated with HA-21I are available on a computer display screen which is located on a desk next to the control panel in room 230A.

3.2.2.1 Furnace Temperature

Furnace temperature is measured by a thermocouple. The furnaces in glovebox HC-21C have digital temperature controllers with set point programming which will receive input from the thermocouples and, based on a comparison with the set point, send output to a silicon controlled rectifier (SCR). The furnaces in glovebox HA-21I have temperature controllers as part of the programmable logic controller (PLC) with set point programming which will receive input from the thermocouples and, based on a comparison with the set point, send output to a SCR. The SCR uses input from the temperature controller to establish an output amperage to the furnace. A deviation band alarm feature in the temperature controller is interlocked with power to the furnace and will disable the furnace when the measured temperature deviates outside the temperature band.

A redundant thermocouple located in each furnace provides input to a high temperature alarm switch (TAS). To prevent "burning out" furnace heating elements the TAS is interlocked to remove power from the furnace if the temperature exceeds a high set point.[2] The "TASs" for the furnaces in HA-21I are programmed into the PLC.

When a deviation exists or the set point is exceeded the furnace interlock is accompanied by an audible alarm and a lighted window on an annunciator panel for the furnaces in glovebox HC-21C. For the furnaces in glovebox HA-21I a deviation causes an audible alarm from the computer speakers and visual indication on the computer display screen.

3.2.2.2 Glovebox Temperature

The glovebox temperature for HC-21C is measured by three thermocouples placed throughout the glovebox. The measured temperatures are sent to a high temperature select instrument which digitally displays each temperature for several seconds. When the temperature from any one of the three thermocouples reaches a setpoint (set well below the 93 C (200 F) trip point of the Halon system), power is removed from the furnaces. When the set point is exceeded it is accompanied by an audible alarm and a lighted window on the annunciator panel.

The glovebox temperature for HA-21I is measured by three thermocouples

placed throughout the glovebox. The measured temperatures are sent to a high temperature select algorithm programmed into the PLC which displays the high temperature for the glovebox on the operator display screen. When the temperature from any one of the three thermocouples reaches the set-point (set well below the 93 C (200 F) trip point of the dry chemical system), power is removed from all the furnaces in that glovebox. When the set-point is exceeded it is accompanied by an audible alarm from the computer speakers and a visual indication on the computer display screen.

3.2.2.3 Furnace Door Interlock

The furnace door is interlocked to disable power to the furnace if the door is open. When the door is closed a red light on the control console lights up or the door of the furnace on the operator display screen closes, indicating that a heating cycle my be started. If the door is opened during a heating cycle, power to the furnace will be removed. This interlock prevents the furnace from inadvertently being turned on when the door is open.

4.0 SAFETY INTERLOCKS, SET POINTS, AND ALARMS

4.1 SAFETY INTERLOCKS

The safety interlocks described below control power to Furnaces FUR-21C-1 (Furnace # 4) and FUR-21C-2 (Furnace # 5) in glovebox HC-21C, and to Furnaces FUR-21I-1 (Furnace # 1), FUR-21I-2 (Furnace # 2), and FUR-21I-3 (Furnace # 3) in glovebox HA-21I. These interlocks are shown in drawing H-2-815184 SH. 1 & 2, and drawing H-2-99539 SH. 1 respectively.

Interlocks for Glovebox HC-21C

General

Power will be removed from both furnaces (FUR-21C-1, FUR-21C-2) when any of the following conditions occur:

1. Emergency Push-Pull Switch (HS-21C-E) is depressed.
2. High Glovebox Temperature is detected (TAS-21C-C).

Interlocks for FUR-21C-1 (Furnace # 4)

In addition to the conditions for the General Interlocks 1 and 2 given above, power will be removed from Furnace #4 (FUR-21C-1) when any of the following conditions occur:

A. High furnace temperature is detected (TAS-21C-A).
B. Deviation between set point and actual furnace temperature is detected (TIC-21C-A).
C. Furnace Door #4 is open (Limit Switch LS-21C-1).

Interlocks for FUR-21C-2 (Furnace # 5)

In addition to the conditions for the General Interlocks 1 and 2 given above, power will be removed from Furnace #5 (FUR-21C-2) when any of the following conditions occur:

A. High furnace temperature is detected (TAS-21C-B).
B. Deviation between set point and actual furnace temperature is detected (TIC-21C-B).
C. Furnace Door #5 is open (Limit Switch LS-21C-2).

Interlocks for Glovebox HA-21I

General

Power will be removed from all three furnaces (FUR-21I-1, FUR-21I-2, FUR-21I-3) when any of the following conditions occur:

1. Emergency Push-Pull Switch (HS-21I-A) is depressed.
2. Emergency shutdown icon on operator display screen is selected.
3. High Glovebox Temperature is detected (TE-21I-7, 8, or 9).

Interlocks for FUR-21I-1 (Furnace # 1)

In addition to the conditions for the General Interlocks 1, 2, and 3 given above, power will be removed from Furnace #1 (FUR-21I-1) when any of the following conditions occur:

A. High furnace temperature is detected (TE-21I-2).
B. Deviation between set point and actual furnace temperature is detected (TE-21I-1).

C. Furnace Door #1 is open (Limit Switch LS-21I-2).

Interlocks for FUR-21I-2 (Furnace # 2)

In addition to the conditions for Interlocks 1, 2, and 3 given above, power will be removed from Furnace #2 (FUR-21I-2) when any of the following conditions occur:

A. High furnace temperature is detected (TE-21I-4).
B. Deviation between set point and actual furnace temperature is detected (TE-21I-3).
C. Furnace Door #2 is open (Limit Switch LS-21I-4).

Interlocks for FUR-21I-3 (Furnace # 3)

In addition to the conditions for Interlocks 1, 2, and 3 given above, power will be removed from Furnace #3 (FUR-21I-3) when any of the following conditions occur:

A. High furnace temperature is detected (TE-21I-6).
B. Deviation between set point and actual furnace temperature is detected (TE-21I-5).
C. Furnace Door #3 is open (Limit Switch LS-21I-6).

4.2 SET POINTS/RANGES

Set points and ranges for furnace temperatures, alarms, etc. have been outlined in OSD-Z-184-00006, the operating specifications document (OSD) for the Thermal Stabilization project[2]. The OSD also identifies off-standard conditions and recovery actions. Specific set points and ranges will not be stated here in order to avoid inconsistencies between this document and the OSD.

4.3 ALARM RESPONSE

Alarms associated with thermal stabilization activities will display on an annunciator panel of the control panel in Room 230A for the furnaces in HC-21C or on the computer display screen for the furnaces in HA-21I. Alarm response operator actions for the Thermal Stabilization process are documented in ZAR-020.

5.0 OPERATION

5.1 OPERATING PROCEDURES

- **ZO-160-032, HC-21C Muffle Furnace Operation.** This procedure provides instructions for stabilizing reactive plutonium bearing solid materials by oxidizing/heating these solids.

- **ZO-160-034, Stabilized Material Handling.** This procedure provides instructions for sieving, mixing, sampling, and packaging of stabilized plutonium bearing solids that have been processed through the muffle furnace.

- **ZO-160-035, Furnace Charge Preparation.** This procedure provides instructions for loading the thermal stabilization boats with material to be processed in the stabilization furnaces.

- **ZO-160-037, HA-21I Muffle Furnace Operation.** This procedure provides instructions for stabilizing inorganic reactive plutonium bearing solid materials by oxidizing/heating these solids.

- ZO-160-038, **Oxidation of Pu Metal in the HC-21C Furnaces.** This procedure provides instructions for stabilizing Pu metal items by oxidizing/heating them.

- ZO-160-039, **Furnace Charge Preparation for Pu Metal.** This procedure provides instructions for loading the thermal stabilization boats when handling Pu metal items.

- **ZAR-020, HC-21C Muffle Furnace Alarms.** This procedure provides instructions for emergency shutdown and alarm responses for HC-21C furnaces in Rooms 230A.

- **ZAR-044, Respond to HA-21I Muffle Furnace Alarms.** This procedure provides instructions for emergency shutdown and alarm responses for the HA-21I furnaces in room 235B.

5.2 OPERATING SPECIFICATIONS DOCUMENT

- ***OSD-Z-184-00006, PFP Operating Specifications Document, Thermal***

Stabilization. This document contains specification limits for feed items, furnace and glovebox temperatures, charge size, and amount of combustible materials in the glovebox. Information detailing detection/control of process variables and recovery actions are also given.

5.3 PROCESS FLOWSHEET DOCUMENT

- **PFD Z-190-00004, Thermal Stabilization Process Flowsheet.** The Process Flowsheet Document (PFD) contains detailed information on process parameters and design. It includes equipment description, process technology, control schemes and set points, off-standard conditions, and safety concerns.[13]

6.0 MAINTENANCE

6.1 MAINTENANCE PROCEDURES

Calibration maintenance activities are initiated using the PM/S system and general calibration procedures. Listed below are specific procedures used in the Thermal Stabilization system.

ZCP-4-001	Dwyer Magnehelic Differential Pressure ~~Gauge~~ Series 2000 and Capsehelic Differential Pressure ~~Gauge~~ Series 4000.
1-ZM-079,	Muffle Furnace Temperature Control System Calibration
1-ZM-131,	HA-21I Muffle Furnace Temperature Control System Calibration
2Z-18364	Balances - Product Handling Verification System 74

6.2 VENDOR INFORMATION FILES

The vendor information (VI) file is compiled to address all of the components installed for Thermal Stabilization of plutonium bearing materials in gloveboxes HA-21I, HC-21A, HC-21C, and HC-18M. The VI file is:

CVI Number	Description

22592	Control Panel Temperature Control System Instrumentation Associated Piping and Valves Furnaces Off-gas Filters CO_2 supply manifold Programmable Logic Controller (PLC) Filter housings Grinder Commercial Can Opener

7.0 SURVEILLANCE

Surveillance of Safety Class and other equipment is controlled and monitored through the Preventative Maintenance/Surveillance System (PM/S). The PM/S is a large database which schedules and documents equipment surveillance . This database also contains historical data (past calibration or functional checks) for the equipment. See Appendix A for a table that lists all System 73T equipment in the PM/S database and the surveillance interval. HA-21I TEs, LSs, and EICs are not included in the PM/S database because the equipment does not require calibration and is not Safety Class or Safety Significant.

8.0 SAFETY

The principal hazards associated with glovebox HA-21I, HC-18M,and HC-21C operations are fire safety, excessive heat, criticality, and radiation. The following section describes the potential hazards associated with thermal stabilization. In addition, glovebox HC-21C was analyzed for a deflagration of butene gas from the decomposition of residual TBP. The analysis was reported in the Addendum to WHC-SD-CP-SAR-021, Thermal Stabilization of Non-Product Quality Oxide Feed Material .

There are no operational safety requirements (OSRs) associated with the PFP Thermal Stabilization System. The equipment installed by the Thermal Stabilization project was determined to be "other equipment important to safety".

Worker safety and accident analysis are documented in the WHC-SD-CP-SAR-021 Addendum, Thermal Stabilization of Non-Product Quality Oxide Feed Material, . The two bounding accident scenarios for the Thermal Stabilization system, are: a fire within the glovebox, and the rapid decomposition of tributyl phosphate (TBP) leading to the formation of combustible gases and deflagration of the gas (glovebox HC-21C only).

Calculated consequences for glovebox fires were found to be within risk acceptance guidelines. The rapid decomposition of TBP leading to the formation of combustible gases was shown to be an incredible event. The probability of a seismically induced deflagration resulting from a design basis earthquake (DBE) and a small earthquake were quantified and shown to be incredible events.

For further detail on safety criteria, see HNF-SD-CP-SAR-021[11], PFP Facility Safety Analysis Document section 9.2.2,WHC-SD-CP-PHA-003, HA-21I HAZOP Study and the WHC-SD-CP-SAR-021, Rev 0-K, Addendum, Thermal Stabilization of Non-Product Quality Oxide Feed Material.

The Thermal Stabilization performed in muffle furnaces in glovebox HA-21I is sufficiently similar to that done in HC-21C that the safety analysis also applies to the new glovebox. Since glovebox HA-21I will not contain TBP there is no possibility of combustible butene gases forming. Therefore, the equipment in glovebox HA-21I also is not Safety Class or Safety Significant.

8.1 FIRE SAFETY

8.1.1 Glovebox Fire

High furnace temperatures and the presence of combustible materials are factors which could lead to a glovebox fire in HA-21I or HC-21C. If such a fire occurs in HC-21C or HC-21A, the Halon fire suppression system is in the glovebox to ensure the fire is extinguished. If such a fire occurs in HA-21I the dry chemical fire suppression system is in the glovebox to extinguish the fire.

8.1.2 Combustible Material

To keep an uncontrolled fire from taking place, combustible material must be kept to a minimum within the gloveboxes. Since high temperatures are involved in this process, extra care must be taken to protect the gloves by using hot mill gloves over the glovebox gloves when touching hot surfaces. Gloves near the furnace must be pulled out of the glovebox and fastened in position before the heating cycle is started.

8.1.3 Glovebox Temperature

Thermocouples independent of the furnace control system monitor the temperature continuously. In both gloveboxes, HA-21I and HC-21C, three thermocouples have been located throughout the glovebox. If the glovebox temperature reaches the set temperature, an interlock in the glovebox temperature monitor removes power to the muffle furnaces in that glovebox. If the glovebox temperature exceeds 93 C (200 F), the Halon or dry chemical fire suppression system is activated for that glovebox.

To avoid overheating the glovebox, the muffle furnace door will be kept closed when the furnace is at higher temperatures.

8.1.4 Flammability of Off-Gas

Feed items that originated in PRF may contain TBP. Butene is one of the decomposition products of TBPwhich in certain concentrations, can be flammable. Combustion of large amounts of butene gas could, in a worst case scenario, cause rupture of the glovebox. It is, however, unlikely that a sufficient quantity of gas could be generated to rupture the glovebox. Four independent barriers in glovebox HC-21C are in place to prevent flammable levels of gas. The four barriers are:

(1) All items originating from PRF (or if origin is uncertain) are sampled for organic content. Feed items with greater than 10 grams organic will be split to remain within the 10 gram limit .

(2) Removal and dilution of any flammable gases by continuous off gas circulation through the furnace at a rate of about 120-125 ft^3/hr.

(3) A cover gas of CO_2 will be introduced into the furnaces in glovebox HC-21C in the temperature regime where flammable gas could be generated. The CO_2 will be fed into the furnaces at a flow rate of about 45-50 ft^3/hr. The amount of CO_2 available will be verified prior to each cycle.

(4) The material will be slowly heated at a ramp rate of 5 C/minute (9 F/min) to 175 C (347 F) and held at this temperature for 1.5 hours. This will assure that all of the TBP has decomposed prior to reaching the auto-ignition temperature of butene (324 C or 615 F).

8.1.5 Plugged Filter

The filter on the exhaust line may become clogged if particulate matter is generated during a heating cycle or if volatile salts accumulate. This reduces the permeability of the filter, thus decreasing the exhaust flow rate and increasing the probability of butene buildup in the furnaces in glovebox HC-21C.

Prior to each heating cycle in glovebox HC-21C, the pressure differential across the ceramic filter and the exhaust flow rate are checked to assure adequate flow rate. If the exhaust flow rate is not adequate (minimum 120 cfh), or the pressure differential is too high, then the ceramic filter needs to be cleaned or replaced before the cycle is run. While plugging the filters is not a safety concern, plugging will reduce efficiency during cool down.

8.2 EXCESSIVE HEAT

8.2.1 Glovebox Windows

The windows in the gloveboxes are made of Lexan. This material will not warp under heat stress and is shatter resistant.[11]

8.2.2 Glovebox Gloves

Boat handling tools and hot mill over-gloves will be used when moving hot material and equipment. This is to protect the glovebox gloves and hence the operator.

8.3 CRITICALITY

Since plutonium is a fissile material, measures are taken to assure prevention of conditions which could lead to a criticality incident. Criticality prevention specifications (CPS) have been prepared for gloveboxes HC-2, HC-2/3 airlock, HC-3, HC-4, HA-28, HA-21I, HC-18M, HC-18BS, HC-21A, and HC-21C to accommodate the Thermal Stabilization process. Limits on plutonium quantities, container volumes, and material spacing are specified in these CPSs and shall be strictly adhered to during operations.

8.4 RADIATION SAFETY

Operations around the gloveboxes are kept to a minimum to minimize exposures. A

control station is located in Room 230A roughly 7 feet from glovebox HC-21C to allow the operator to monitor the operations of this glovebox and still maintain spacing. The control station has an operator display screen that accesses the PLC to control the operations in glovebox HA-21I. The control station is in Room 230A away from this glovebox. Color cameras and monitors allow remote observation of glovebox HA-21I which minimizes operator exposure.

8.4.1 Foaming

Plutonium oxycarbonate (from oxalate) forms an intermediate liquid phase above 100 C (212 F). The material boils at about 180 C (356 F) and could foam over the top of the boat. The temperature is held at a lower temperature of 175 C (347 F) for an hour to allow for the majority of the liquid to be driven off. If material does foam over, a scraper and paint brush may be used to scrape and sweep material from the bottom of the furnace once it has cooled. This material is then mixed with the new feed material for the next heating cycle.

9.0 EQUIPMENT SAFETY CLASS ANALYSIS

None of the system 73T SSC have been designated as Safety Significant or Safety Class because of the low probability of a significant offsite release of hazardous chemicals or radionuclides in any accident scenario of the Thermal Stabilization system.

PFP Safety Class and Safety Significant equipment is listed in the PFP Safety Equipment List, HNF-SD-CP-TI-108 (SEL). Items in the Thermal Stabilization system in gloveboxes HA-21I, HC-18M, HC-21A, and HC-21C which have industrial health and safety or process control functions are discussed below.

9.1 HC-21C GLOVEBOX FURNACE TEMPERATURE CONTROL SYSTEM

Item: Temperature Controllers for Furnaces #1 & #2.

TIC-21C-A, TIC-21C-B

Basis: The temperature controllers ramp power supply to the furnaces. Materials originating in PRF potentially contain TBP which produces butene vapor when it is heated. The heating rate controls the rate of gas vaporization in the Pu bearing material. Uncontrolled heating could create large quantities of butene gas, a

flammable vapor, in a short period of time. A controlled heating rate is one of the engineered barriers which prevents gas concentration in the furnaces in glovebox HC-21C from reaching the flammability point.

Controlled temperature ramp up rates also prevent boil-over of liquid solutions, thus minimizing cleanup and dose rates.

Item: Temperature Elements (Thermocouples) and Alarm Annunciators

TE-21C-5, TE-21C-6, TA-21C-1 (ANN-2), TA-21C-6 (ANN-5)

Basis: Thermocouples for this system are important because they supply the temperature controllers with information. The alarm annunciator is also important because it notifies operators that furnace temperatures are deviating from program parameters and action may be necessary.

9.2 HC-21C GLOVEBOX FURNACE EMERGENCY SHUTDOWN SWITCH (HS-21C-E)

Item: Hand switch for furnace heat emergency stop.

HS-21C-E

Basis: This manual switch removes power from both furnaces. The emergency shutdown switch allows operators to stop a heating cycle to preclude the following: a Halon Fire Suppression System alarm, a butene gas buildup in a furnace, or any other abnormal condition.

9.3 HC-21C GLOVEBOX FURNACE EXHAUST PROVIDED BY 26" PROCESS VACUUM SYSTEM

Item: Differential Pressure Indicators in the furnace off-gas system which measure differential pressure on the off-gas filters.

DPI-21C-1, DPI-21C-2

Basis: The off-gas system is designed to keep butene concentration in the furnaces low. The off-gas filters will remove particulates from this system before gas enters the heat exchangers and continues through the 26" process vacuum system. Filters

clogged with particulate matter could decrease the off-gas flow rate, causing butene vapor to build up in the furnaces. The differential pressure indicators provide an indication of when filters are clogged and need to be cleaned or changed out.

9.4 HC-21C GLOVEBOX FURNACE CO2 SUPPLY SYSTEM

Item: Flow indicators on CO_2 supply system.

FI-21C-3, FI-32C-4

Basis: The CO_2 supply system is an engineered barrier designed to reduce the possibility of butene deflagration in a furnace. The supply system accomplishes this by keeping butene concentration in the furnaces low and by purging the furnace with a non-flammable gas. Flow indicators provide visual verification of the CO_2 flow rate from storage tanks.

Item: Pressure Reducing Valve on CO_2 supply system.

PRV-21C-1

Basis: The pressure reducing valve on the CO_2 supply system must be functioning properly to ensure the necessary flow of CO_2 to the furnaces.

9.5 HC-21C GLOVEBOX HIGH TEMPERATURE CONTROL SYSTEM

Item: Temperature Elements (Thermocouples), High Temperature Select Switch, and Alarm Annunciator

TE-21C-1, TE-21C-2, TE-21C-3, TAS-21C-C, TAH-21C-2 (ANN-3)

Basis: The glovebox high temperature control system ensures that furnace operations do not create high temperatures in the glovebox, thus causing the Halon Fire Suppression System to trip. The high temperature select switch (TAS-21C-C) is wired to an interlock which shuts off power to the furnaces when glovebox temperatures exceed set point limits.

The key component of this system is the high temperature select switch (TAS-21C-C). The switch monitors three thermocouples located in the HC-21C

glovebox and alarms if any one thermocouple exceeds the set point limit. Thermocouples for this system are important because they supply the high temperature select switch with information. The alarm annunciator is also important because it notifies operators that glovebox temperatures are high and that the Halon Release Hold Button (HS-21C-HA) may need to be activated to stop Halon from being released.

9.6 HC-21C GLOVEBOX FURNACES

Item: Furnaces 4 & 5

FUR-21C-1, FUR-21C-2

Basis: If the furnace fails for any reason the only consequence is that it will no longer be usable for stabilization. Power is supplied to the furnace by controllers and interlocks which have their own safety analysis.

Item: Limit switches on Furnaces 4 & 5.

LS-21C-1, LS-21C-2

Basis: These limit switches are located on the furnace doors and indicate whether the furnace door is open or closed. They are interlocked with the power supply such that power cannot reach the furnace if the furnace door is open. These limit switches are important because a furnace door left open during a heating cycle could cause the temperature in the glovebox to rapidly rise and activate the Halon Fire Suppression system. The limit switch also minimizes the risk of material (gloves, rags, etc.) coming in contact with hot furnace surfaces.

9.7 HC-21C CONTROL PANEL HAND SWITCHES

Item: Other Hand switches for process operation.

HS-21C-A, HS-21C-B, HS-21C-C, HS-21C-D

Basis: The other hand switches for manual start/stop of the furnaces are not safety class items because the emergency shutdown switch (HS-21C-E) will remove power from either furnace should these buttons fail.

9.8 HC-21C TEMPERATURE CONTROL ITEMS

Item: Temperature Controller Contactor.

EIC-21C-A, EIC-21C-B

Basis: The temperature controller contactors control furnace power based on input from the temperature controllers. Their failure would result in no power feed to the furnaces; thus, the contactors could not be responsible for a power overload to the furnaces.

Item: Other Temperature Elements (Thermocouples), Alarm Switches, and Annunciators.

TE-21C-4, TE-21C-7, TAS-21C-A, TAS-21C-B, TA-21C-4, TA-21C-7

Basis: These thermocouples, alarm switches, and annunciators are designed to prevent burned out furnace heating elements from running at peak furnace power for an extended period of time. This system is also a redundant source of furnace temperature information and safety. The components are process control safeguards.

9.9 HA-21I GLOVEBOX HIGH TEMPERATURE CONTROL SYSTEM

Item: Temperature Elements (Thermocouples), High Temperature Select Switch (on PLC), and Alarm Annunciator (on PLC)

TE-21I-7, TE-21I-8, and TE-21I-9

Basis: The glovebox high temperature control system ensures that furnace operations do not create high temperatures in the glovebox, thus causing the Dry Chemical Fire Suppression System to trip. The high temperature select switch is part of an interlock on the PLC which shuts off power to the furnaces when glovebox temperatures exceed set point limits.

An algorithm programmed on the PLC monitors three thermocouples located in the HA-21I glovebox and alarms if any one thermocouple exceeds the set point limit.

Item: Limit switches on Furnaces 1, 2, & 3.

LS-21I-2, LS-21I-4, LS-21I-6

Basis: These limit switches are located on the furnace doors and indicate whether the furnace door is open or closed. They are interlocked on the PLC with the power supply such that power cannot reach the furnace if the furnace door is open. These limit switches are important because a furnace door left open during a heating cycle could cause the temperature in the glovebox to rapidly rise and activate the Dry Chemical Fire Suppression system. The limit switch also minimizes the risk of material (gloves, rags, etc.) coming in contact with hot furnace surfaces.

9.10 HA-21I GLOVEBOX FURNACE EMERGENCY SHUTDOWN SWITCH (HS-21I-A)

Item: Hand switch for furnace heat emergency stop.

HS-21I-A

Basis: This manual switch removes power from the furnaces in HA-21I. Use of the emergency shutdown switch causes the circuit breaker in power panel ARS-1 to open shutting off power to the furnaces. This allows operators to stop a heating cycle to preclude the following:

- Dry Chemical Fire Suppression System alarm
- Any other abnormal condition.

9.11 HA-21I GLOVEBOX FURNACES

Item: Furnaces 1, 2, & 3

FUR-21I-1, FUR-21I-2, FUR-21I-3

Basis: If the furnace fails for any reason the only consequence is that it will no longer be usable for stabilization. The usual failure mode is loss of the heating elements. Power is supplied to the furnace via the PLC and related interlocks which have their own safety analysis.

9.12 HA-21I TEMPERATURE CONTROL ITEMS

Item: Temperature Controller Contactor [Silicon Controlled Rectifier (SCR)].

EIC-21I-1, EIC-21I-2, and EIC-21I-3

Basis: The temperature controller contactors control furnace power based on input from the PLC system. Their failure would result in no power feed to the furnaces. Thus the contactors could not be responsible for a power overload to the furnaces.

Item: Other Temperature Elements (Thermocouples), Alarm Switches (on PLC), and Annunciators (on PLC).

TE-21I-2, TE-21I-4, and TE-21I-6

Basis: These thermocouples, alarm switches (PLC), and annunciators (PLC) are designed to prevent burning out furnace heating elements by running at peak furnace power for an extended period of time. This system is also a redundant source of furnace temperature information and safety. The components are process control safeguards.

10.0 REFERENCES

1 PFD-Z-190-00004, Thermal Stabilization Process Flowsheet

2 OSD-Z-184-00006, PFP Operating Specification Document, Thermal Stabilization

3 ZO-160-032, HC-21C Muffle Furnace Operations

4 WHC-SD-CP-OCD-040, Basis Document for Sludge Stabilization

5 WHC-SD-CP-TRP-059, Scrap Stabilization Furnace Test Results, April 5, 1994

6 OSD-Z-184-00013, Special Nuclear Material Storage

7 CSER 94-007, Criticality Safety Engineering Report for Muffle Furnace Operations in Glovebox HC-21I, Room 230C, 234-5Z Building

8 Progress Report NUMEC P-90, Development of Plutonium-Bearing Fuel Materials

9 IM 12840-89-CMK-199. Glovebox Selection for Plutonium Button Oxidation. K.E. Parker to C.M. Kronvall, November 2, 1989

10 Rockwell International Internal Letter from L.E. Edvalson to J.W. Patterson, February 13, 1986

11 HNF-SD-CP-SAR-021, Rev. 1. Plutonium Finishing Plant Final Safety Analysis Report (FSAR).

12 HNF-SD-CP-TI-108 Rev 17. PFP Safety Equipment List.

13 PFD-Z-190-00004. Thermal Stabilization Process Flowsheet, Room 230A, 234-5Z Bldg. Rodgers, L. H. and W. S. Lewis. 6/23/94.

APPENDIX A

SYSTEM 73T PM/S EQUIPMENT LIST

LOOP NUMBER	SEQUENCE NUMBER	INSTRUMENT IDENTIFICATION	FUNCTION	VERIFICATION INTERVAL
BO410	1	TIC-21C-A	TEMPERATURE CONTROLLER FUR-4	12 MONTHS
	2	TR-21C	TEMPERATURE RECORDER, CHANNEL A, FUR-4 TEMPERATURE	12 MONTHS
	3	TE-21C-5	THERMOCOUPLE FOR FUR-4 CONTROLLER, TYPE K	PRE-CAL/CERT
	4	TA-21C-1	DEVIATION ALARM FUR-4, WINDOW 4-B	12 MONTHS
	5	EIC-21C-A	SOLID STATE CONTACTOR FUR-4	PRE-CAL/CERT
	6	HS-21C-A	MANUAL START BUTTON FUR-4	12 MONTHS
	7	HS-21C-B	MANUAL STOP BUTTON FUR-4	12 MONTHS
	8	TAS-21C-A	HIGH TEMPERATURE ALARM SWITCH, FUR-4	12 MONTHS
	A	TE-21C-4	THERMOCOUPLE FOR FUR-4 HIGH TEMPERATURE ALARM, TYPE K	PRE-CAL/CERT
	B	TA-21C-4	HIGH TEMPERATURE ALARM FUR-4, WINDOW 4-A	12 MONTHS
	C	LS-21C-1	DOOR LIMIT SWITCH, FUR-4	12 MONTHS
BO411	1	TIC-21C-B	TEMPERATURE CONTROLLER FUR-5	12 MONTHS
	2	TR-21C	TEMPERATURE RECORDER, CHANNEL B, FUR-5 TEMPERATURE	12 MONTHS
	3	TE-21C-6	THERMOCOUPLE FOR FUR-5 CONTROLLER, TYPE K	PRE-CAL/CERT
	4	TA-21C-6	DEVIATION ALARM FUR-5, WINDOW 6-B	12 MONTHS
	5	EIC-21C-B	SOLID STATE CONTACTOR FUR-5	PRE-CAL/CERT
	6	HS-21C-C	MANUAL START BUTTON FUR-5	12 MONTHS
	7	HS-21C-D	MANUAL STOP BUTTON FUR-5	12 MONTHS
	8	TAS-21C-B	HIGH TEMPERATURE ALARM	12 MONTHS

LOOP NUMBER	SEQUENCE NUMBER	INSTRUMENT IDENTIFICATION	FUNCTION	VERIFICATION INTERVAL
			SWITCH, FUR-5	
	A	TE-21C-7	THERMOCOUPLE FOR FUR-5 HIGH TEMPERATURE ALARM, TYPE K	PRE-CAL/CERT
	B	TA-21C-7	HIGH TEMPERATURE ALARM FUR-5, WINDOW 6-A	12 MONTHS
	C	LS-21C-2	DOOR LIMIT SWITCH, FUR-5	12 MONTHS
B0412	1	HS-21C-E	EMERGENCY STOP BUTTON	12 MONTHS
B0413	1	TAS-21C-C	HIGH TEMPERATURE ALARM SWITCH FOR GLOVEBOX HC-21C	12 MONTHS
	2	TAH-21C-2	HIGH GLOVEBOX TEMPERATURE ALARM, WINDOW 2	12 MONTHS
	3	TE-21C-1	GLOVEBOX THERMOCOUPLE 1, TYPE J	PRE-CAL/CERT
	4	TE-21C-2	GLOVEBOX THERMOCOUPLE 2, TYPE J	PRE-CAL/CERT
	5	TE-21C-3	GLOVEBOX THERMOCOUPLE 3, TYPE J	PRE-CAL/CERT
B0414	1	DPI-21C-1	DIFFERENTIAL PRESSURE INDICATOR, FILTER ON FUR-4	12 MONTHS
	2	FI-21C-1	FLOW INDICATOR, FUR-4 EXHAUST	12 MONTHS
	3	PI-21C-1	VACUUM GAGE	12 MONTHS
	4	PI-21C-2	VACUUM GAGE	12 MONTHS
	5	DPI-21C-3	DIFFERENTIAL PRESSURE INDICATOR ORIFICE ON OFF-GAS FUR-21C-2	12 MONTHS
B0415	1	DPI-21C-2	DIFFERENTIAL PRESSURE INDICATOR, FILTER ON FUR-5	12 MONTHS
	2	FI-21C-2	FLOW INDICATOR, FUR-5 EXHAUST	PRECERT/CAL INDICATION ONLY
	3	DPI-21C-4	DIFFERENTIAL PRESSURE INDICATOR ORIFICE ON OFF-GAS FUR-21C-2	12 MONTHS

LOOP NUMBER	SEQUENCE NUMBER	INSTRUMENT IDENTIFICATION	FUNCTION	VERIFICATION INTERVAL
B0416	1	FI-21C-3	ROTAMETER, CO_2 SUPPLY FUR-21C-1	PRECERT/CAL INDICATION ONLY
	2	FI-21C-4	ROTAMETER, CO_2 SUPPLY FUR-21C-2	PRECERT/CAL INDICATION ONLY
	3	PRV-21C-1	PRESSURE REDUCING VALVE, CO_2 SUPPLY	12 MONTHS
BO417	1	DPI-21I-1	DIFFERENTIAL PRESSURE INDICATOR, FILTER ON FUR-21I-1	ONE TIME FUNCTIONAL CHECK
	2	DPI-21I-4	DIFFERENTIAL PRESSURE INDICATOR, ORIFICE ON FUR-21I-1	ONE TIME FUNCTIONAL CHECK
BO418	1	DPI-21I-2	DIFFERENTIAL PRESSURE INDICATOR, FILTER ON FUR-21I-2	ONE TIME FUNCTIONAL CHECK
	2	DPI-21I-5	DIFFERENTIAL PRESSURE INDICATOR, ORIFICE ON FUR-21I-2	ONE TIME FUNCTIONAL CHECK
	3	DPI-21I-6	DIFFERENTIAL PRESSURE INDICATOR, ORIFICE ON FUR-3	ONE TIME FUNCTIONAL CHECK
	4	PI-74-1	VACUUM INDICATOR FOR HEADER	ONE TIME FUNCTIONAL CHECK

APPENDIX B

SYSTEM DRAWING LIST

THERMAL STABILIZATION IN GLOVEBOXES HA-21I, HC-21C, HC-18M, AND HC-21A		
Drawing Number	Index No.	Title
H-2-824345, Sht. 1	7501	THERMAL STABILIZATION INSTALLATION PARTS LIST
H-2-824345, Sht. 2	7501	THERMAL STABILIZATION INSTALLATION DETAILS
H-2-824345, Sht. 3	7501	THERMAL STABILIZATION INSTALLATION PLAN AND DETAILS
H-2-824345, Sht. 4	7501	THERMAL STABILIZATION INSTALLATION ELEVATIONS AND DETAILS
H-2-824345, Sht. 5	7501	THERMAL STABILIZATION INSTALLATION WIRING DIAGRAM
H-2-824345, Sht. 6	7501	THERMAL STABILIZATION INSTALLATION POWER DETAILS
H-2-824345, Sht. 7	7501	THERMAL STABILIZATION INSTALLATION PLAN AND DETAILS
H-2-99537, Sht. 1	7501	HA-21I SLUDGE STABILIZATION GLOVEBOX ARRANGEMENT
H-2-99537, Sht. 2	7501	HA-21I SLUDGE STABILIZATION GLOVEBOX ARRANGEMENT
H-2-99539	7501	HA-21I THERMAL STABILIZATION P & ID
H-2-99540, Sht 1	7501	SERVICE PIPING HA-20MB & HA21I ARRANGEMENT
H-2-99540, Sht 2	7501	SERVICE PIPING HA-20MB & HA21I ARRANGEMENT
H-2-99540, Sht 3	7501	SERVICE PIPING HA-20MB & HA21I ARRANGEMENT
H-2-99540, Sht 4	7501	SERVICE PIPING HA-20MB & HA21I ARRANGEMENT
H-2-99540, Sht 5	7501	SERVICE PIPING HA-20MB & HA21I ARRANGEMENT
H-2-99540, Sht 6	7501	SERVICE PIPING HA-20MB & HA21I ARRANGEMENT
H-2-99541	7501	6" VACUUM P & I D THERMAL STABILIZATION
H-2-81310 SH. 1	7501	GLOVEBOX HC-21C FURNACE CONTROL CONSOLE ARRANGEMENT

THERMAL STABILIZATION IN GLOVEBOXES HA-21I, HC-21C, HC-18M, AND HC-21A		
Drawing Number	Index No.	Title
H-2-81310 SH. 2	7501	GLOVEBOX HC-21C FURNACE CONTROL CONSOLE PANEL LAYOUTS
H-2-81310 SH. 3	7301	GLOVEBOX HC-21C FURNACE CONTROL PANEL LADDER DIAGRAM
H-2-81310 SH. 4	7301	GLOVEBOX HC-21C FURNACE #4 CONTROL CONSOLE WIRING DIAGRAM
H-2-81310 SH. 5	7301	GLOVEBOX HC-21C FURNACE #5 CONTROL CONSOLE WIRING DIAGRAM
H-2-81310 SH. 6	7301	GLOVEBOX HC-21C FURNACE CONTROL PANEL, MISCELLANEOUS
H-2-140584 SH.1	4700/8518	SLUDGE STABILIZATION ROOMS 230A/230B ARRANGEMENT
H-2-140584 SH.2	4700/8518	SLUDGE STABILIZATION ROOMS 230A/230B PLAN
H-2-140584 SH.3	4700/8518	SLUDGE STABILIZATION ROOMS 230A/230B MEZZANINE PLAN
H-2-140584 SH.4	4700/8518	SLUDGE STABILIZATION ROOMS 230A/230B SECTION & DETAILS
H-2-140585 SH.1	4700/8518	HC-21C & HC-21A SLUDGE STABILIZATION GLOVEBOX ARRANGEMENT
H-2-140585 SH.2	4700/8518	HC-21C & HC-21A SLUDGE STABILIZATION GLOVEBOX ARRANGEMENT
H-2-140585 SH.3	4700/8518	HC-21C & HC-21A SLUDGE STABILIZATION GLOVEBOX ARRANGEMENT
H-2-140588	3902	SLUDGE STABILIZATION MUFFLE FURNACE TOOLS
H-2-815184 SH.1	7004	SLUDGE STABILIZATION P&ID
H-2-815184 SH.2	7004	GLOVEBOX HC-21C SLUDGE STABILIZATION P&ID
H-2-815184 SH.3	7004	GLOVEBOX HC-21A SLUDGE STABILIZATION P&ID

APPENDIX C

MASTER COMPONENT INDEX LIST
PFP THERMAL STABILIZATION SYSTEM

Thermal Stabilization System Master Component Index						
SYS No.	CID	DESCRIPTION	DRAWING	VENDOR MFGR	COMPONENT DATA	CVI NO.
73T	CV-21C-1	CHECK VALVE ON CO_2 INLET TO FURNACE 4	H-2-815184 SH. 2 H-2-140584	NUPRO	MODEL# SS-CHS8-1	22592 SUPP 11
73T	CV-21C-2	CHECK VALVE ON CO_2 INLET TO FURNACE 5	H-2-815184 SH. 2 H-2-140584	NUPRO	MODEL# SS-CHS8-1	22592 SUPP 11
73T	DPI-21C-1	DIFFERENTIAL PRESSURE INDICATOR, OFF-GAS FILTER 4	H-2-815184 SH. 2 H-2-140585	DWYER	MODEL# 4215	22592 SUPP 12
73T	DPI-21C-2	DIFFERENTIAL PRESSURE INDICATOR, OFF-GAS FILTER 5	H-2-815184 SH. 2 H-2-140585	DWYER	MODEL# 4215	22592 SUPP 12
73T	EIC-21C-A	CONTACTOR	H-2-815184 SH. 2 H-2-81310	EUROTHERM	MODEL# 831	22592 SUPP 2
73T	EIC-21C-B	CONTACTOR	H-2-815184 SH. 2 H-2-81310	EUROTHERM	MODEL# 831	22592 SUPP 2
73T	F-21C-1	OFF-GAS FILTER, FURNACE 4	H-2-815184 SH. 2 H-2-140586	PALL ADVANCED SEPARATION SYSTEMS	MODEL# C-23-40-DCSC	22592 SUPP 13
73T	F-21C-2	OFF-GAS FILTER, FURNACE 5	H-2-815184 SH. 2 H-2-140586	PALL ADVANCED SEPARATION SYSTEMS	MODEL# C-23-40-DCSC	22592 SUPP 13
73T	FI-21C-1	FLOW INDICATOR, OFF-GAS AFTER HX-	H-2-815184 SH. 2 H-2-140584	DWYER	MODEL# RMC-103, 20-200 SCFH, 0" FNPT	22592 SUPP

Thermal Stabilization System Master Component Index						
SYS No.	CID	DESCRIPTION	DRAWING	VENDOR MFGR	COMPONENT DATA	CVI NO.
		1			PORTS	12
73T	FI-21C-2	FLOW INDICATOR, OFF-GAS AFTER HX-2	H-2-815184 SH. 2 H-2-140584	DWYER	MODEL# RMC-103, 20-200 SCFH, 0" FNPT PORTS	22592 SUPP 12
73T	FI-21C-3	FLOW INDICATOR, CO_2 TO FURNACE 4	H-2-815184 SH. 2 H-2-140584	DWYER	MODEL# RMB-52-SSV, 5-50 SCFH, 0" FNPT PORTS	22592 SUPP 12
73T	FI-21C-4	FLOW INDICATOR, CO_2 TO FURNACE 5	H-2-815184 SH. 2 H-2-140584	DWYER	MODEL# RMB-52-SSV, 5-50 SCFH, 0" FNPT PORTS	22592 SUPP 12
73T	FUR-21C-1	MUFFLE FURNACE 4	H-2-815184 SH. 2 H-2-140585	THERMOLYN	MODEL# FA1630	22592 SUPP 4
73T	FUR-21C-2	MUFFLE FURNACE 5	H-2-815184 SH. 2 H-2-140585	THERMOLYN	MODEL# FA1630	22592 SUPP 4
73T	HS-21C-A	HAND SWITCH, START FURNACE 4	H-2-815184 SH. 2 H-2-81310	GENERAL ELECTRIC	MODEL# CR104PBT11G1S2, 120 VAC, GREEN	22592
73T	HS-21C-B	HAND SWITCH, STOP FURNACE 4	H-2-815184 SH. 2 H-2-81310	GENERAL ELECTRIC	MODEL# CR104PBT11R1S2, 120 VAC, RED	22592
73T	HS-21C-C	HAND SWITCH, START FURNACE 5	H-2-815184 SH. 2 H-2-81310	GENERAL ELECTRIC	MODEL# CR104PBT11G1S2, 120 VAC, GREEN	22592
73T	HS-21C-D	HAND SWITCH, STOP FURNACE 5	H-2-815184 SH. 2 H-2-81310	GENERAL ELECTRIC	MODEL# CR104PBT11R1S2, 120 VAC, RED	22592
73T	HS-21C-E	HAND SWITCH, FURNACE EMERGENCY STOP	H-2-815184 SH. 2 H-2-81310	ALLEN BRADLEY	PART# 800T-FXP16RA5	22592 SUPP 6
73T	HS-21C-HA	HAND SWITCH, HALON RELEASE HOLD BUTTON	H-2-815184 SH. 2 H-2-140584	GENERAL ELECTRIC	PART# CN101J-250F RED PUSH BUTTON, 600V, 10 A	22592

Ethanol Stabilization System Master Component Index						
SYS No.	EID	DESCRIPTION	DRAWING	VENDOR MFGR	COMPONENT DATA	ECN/VI NO
73T	LS-21C-1	LIMIT SWITCH, FURNACE 4 DOOR	H-2-815184 SH. 2	THERMOLYN	COMPONENT OF FURNACE 1	22592 SUPP 4
73T	LS-21C-2	LIMIT SWITCH, FURNACE 5 DOOR	H-2-815184 SH. 2	THERMOLYN	COMPONENT OF FURNACE 2	22592 SUPP 4
73T	PRV-21A-1	PRESSURE REGULATING VALVE,	H-2-815184 SH. 3 H-2-140584	CONCOA	MODEL# 0405-3001, 0-100 PSI, 1/4" FNPT PORTS	22592 SUPP 11
73T	PRV-21A-2	PRESSURE REGULATING VALVE,	H-2-815184 SH. 3 H-2-140584	CONCOA	MODEL# 0405-3001, 0-100 PSI, 1/4" FNPT PORTS	22592 SUPP 11
73T	PRV-21C-1	PRESSURE REGULATING VALVE,	H-2-815184 SH. 2 H-2-140584	BYRNE SPECIALTY GASES	COMPONENT OF CO_2 MANIFOLD, MODEL# LC-4-2	22592 SUPP 10
73T	TAS-21C-A	TEMPERATURE ALARM SWITCH,	H-2-815184 SH. 2 H-2-81310	EUROTHERM	MODEL# 93, TEMP ALARM, T/C INPUT, MANUAL RESET	22592 SUPP 5
73T	TAS-21C-B	TEMPERATURE ALARM SWITCH,	H-2-815184 SH. 2 H-2-81310	EUROTHERM	MODEL# 93, TEMP ALARM, T/C INPUT, MANUAL RESET	22592 SUPP 5
73T	TAS-21C-C	TEMPERATURE HIGH SELECT ALARM SWITCH, HC-21C GLOVEBOX	H-2-815184 SH. 2 H-2-81310	OMEGA	MODEL# CN101J-250F, 6-CHANNEL, T/C INPUTS, MANUAL RESET	22592 SUPP 7
73T	TE-21C-1	THERMOCOUPLE,	H-2-815184 SH. 2 ECN# 605466	OMEGA	MODEL# 4JX20PP	22592
73T	TE-21C-2	THERMOCOUPLE,	H-2-815184 SH. 2 ECN# 605466	OMEGA	MODEL# 4JX20PP	22592
73T	TE-21C-3	THERMOCOUPLE,	H-2-815184 SH. 2 ECN# 605466	OMEGA	MODEL# 4JX20PP	22592
73T	TE-21C-4	THERMOCOUPLE	H-2-815184 SH. 2 ECN# 605466	OMEGA	MODEL# 4KX20PP	22592
73T	TE-21C-5	THERMOCOUPLE	H-2-815184 SH. 2	OMEGA	MODEL# 4KX20PP	22592

Thermal Stabilization System Master Component Index						
SYS No.	CID	DESCRIPTION	DRAWING	VENDOR MFGR	COMPONENT DATA	CM NO.
			ECN# 605466			
73T	TE-21C-6	THERMOCOUPLE	H-2-815184 SH. 2 ECN# 605466	OMEGA	MODEL# 4KX20PP	22592
73T	TE-21C-7	THERMOCOUPLE	H-2-815184 SH. 2 ECN# 605466	OMEGA	MODEL# 4KX20PP	22592
73T	TE-21A-1	RTD IN HC-21A GLOVEBOX	H-2-140584 SH 4	OMEGA	MODEL # PR-13-2-100-3/16-6-E	22592
73T	TI-21A-1	TEMPERATURE INDICATOR AND ALARM FOR HC-21A GLOVEBOX	H-2-140584 SH 4	OMEGA	MODEL # DP461-RTD	22592
73T	TIC-21C-A	TEMPERATURE INDICATOR CONTROLLER, FURNACE 4	H-2-815184 SH. 2 H-2-81310	EUROTHERM	MODEL# 818P15	22592 SUPP 1
73T	TIC-21C-B	TEMPERATURE INDICATOR CONTROLLER, FURNACE 5	H-2-815184 SH. 2 H-2-81310	EUROTHERM	MODEL# 818P15	22592 SUPP 1
73T	TR-21C	TEMPERATURE RECORDER	H-2-815184 SH. 2 H-2-140584	TIGRAPH	MODEL# 200, 2-CHANNEL	22592 SUPP 8
73T	V-21A-1	ARGON ISOLATION VALVE TO ROOM 230B	H-2-815184 SH. 3 H-2-16475	EXISTING		
73T	V-21A-2	GLOBEVALVE FOR ARGON ISOLATIONTO HOSE	H-2-815184 SH. 2 H-2-140584	WALWORTH	MODEL# 3095, 1/2", CL150	22592 SUPP 12
73T	V-21A-10	ARGON ISOLATION GLOBE VALVE	H-2-16475			22592 SUPP
73T	V-21A-11	BALL VALVE, 2 WAY, 1/2" SWAGELOCK ENDS	H-2-140584, SH 1	WHITEY	MODEL # SS45S8	22592 SUPP
73T	V-21C-1	NEEDLE VALVE, CO_2 SUPPLY TO	H-2-815184 SH. 2	WHITEY	MODEL# SS-IRS8-SH	22592 SUPP

Thermal Stabilization System Master Component Index						
SYS No	TAG ID	DESCRIPTION	DRAWING	VENDOR MFGR	COMPONENT DATA	CAT NO
		FURNACE 4	H-2-140584			11
73T	V-21C-2	NEEDLE VALVE, CO_2 SUPPLY TO FURNACE 5	H-2-815184 SH. 2 H-2-140584	WHITEY	MODEL# SS-IRS8-SH	22592 SUPP 11
73T	V-21C-3	GLOBE VALVE, CO2 SUPPLY AFTER FI-21C-3	H-2-815184 SH. 2 H-2-140584	LADISH CO.	MODEL# 7251, 0", CL200, RENEWABLE DISK	22592 SUPP 11
73T	V-21C-4	GLOBE VALVE, CO2 SUPPLY AFTER FI-21C-4	H-2-815184 SH. 2 H-2-140584	LADISH CO.	MODEL# 7251, 0", CL200, RENEWABLE DISK	22592 SUPP 11
73T	V-21C-5	BALL VALVE, AFTER DPI-21C-2	H-2-815184 SH. 2 H-2-140584	WHITEY	MODEL# SS-83T54-SH 2 WAY, 1/4" ODT	22592 SUPP 12
73T	V-21C-6	BALL VALVE, BEFORE DPI-21C-2	H-2-815184 SH. 2 H-2-140584	WHITEY	MODEL# SS-83T54-SH 2 WAY, 1/4" ODT	22592 SUPP 12
73T	V-21C-7	BALL VALVE, AFTER DPI-21C-1	H-2-815184 SH. 2 H-2-140584	WHITEY	MODEL# SS-83T54-SH 2 WAY, 1/4" ODT	22592 SUPP 12
73T	V-21C-8	BALL VALVE, BEFORE DPI-21C-1	H-2-815184 SH. 2 H-2-140584	WHITEY	MODEL# SS-83T54-SH 2 WAY, 1/4" ODT	22592 SUPP 12
73T	V-21C-9	GLOBE VALVE, BEFORE FI-21C-3 & FI-21C-4	H-2-815184 SH. 2 H-2-140584	LADISH CO.	MODEL# 7251, 0", CL200, RENEWABLE DISK	22592 SUPP 11
73T	V-21C-10	VALVE, SEPARATES 26" VACUUM SYSTEM AND 73T	H-2-815184 SH. 2 H-2-96418	EXISTING		22592 SUPP 11
73T	V-21C-11	VALVE, 3-WAY ISOLATES FI-21C-1	H-2-815184 SH. 2 H-2-96418	WHITEY	3 WAY BALL, 1/2" SS-45S8	22592 SUPP 11
73T	V-21C-12	VALVE, 3-WAY ISOLATES FI-21C-1	H-2-815184 SH. 2 H-2-96418	WHITEY	3 WAY BALL, 1/2" SS-45S8	22592 SUPP 11

Thermal Stabilization System Master Component Index						
SYS NO.	EQUIP ID	DESCRIPTION	DRAWING	VENDOR MFGR	COMPONENT DATA	CVI NO.
73T	V-21C-13	VALVE, ISOLATES PI-21C-1	H-2-815184 SH. 2 H-2-96418	WHITEY	2 WAY BALL, 1/4" NPT SS-62TF4	22592 SUPP 11
73T	V-21C-14	VALVE ISOLATES PI-21C-2	H-2-815184 SH. 2 H-2-96418	WHITEY	2 WAY BALL, 1/4" NPT SS-62TF4	22592 SUPP 11
73T	V-21C-15	VALVE, 3-WAY ISOLATES FI-21C-2	H-2-815184 SH. 2 H-2-96418	WHITEY	3 WAY BALL, 1/2" SS-45S8	22592 SUPP 11
73T	V-21C-16	VALVE, 3-WAY ISOLATES FI-21C-2	H-2-815184 SH. 2 H-2-96418	WHITEY	3 WAY BALL, 1/2" SS-45S8	22592 SUPP 11
73T	DPI-21C-3	DPI ACROSS FO-21C-1	H-2-815184 SH. 2 H-2-96418	DWYER	GAGE, 0-8"H2O, 1/8" FNPT, #2008	22592 SUPP 11
73T	DPI-21C-4	DPI ACROSS FO-21C-2	H-2-815184 SH. 2 H-2-96418	DWYER	GAGE, 0-8"H2O, 1/8" FNPT, #2008	22592 SUPP 11
73T	FO-21C-1	ORIFICE FOR OFF GAS FOR FUR-21C-1	H-2-815184 SH. 2 H-2-96418			
73T	FO-21C-2	ORIFICE FOR OFF GAS FOR FUR-21C-2	H-2-815184 SH. 2 H-2-96418			
73T	PI-21C-1	PRESS INDICATOR FOR 26" VAC SUPPLY (230A)	H-2-815184 SH. 2 H-2-96418	ASHCROFT	GAGE, 0-30" HG 3KA16978-017	22592 SUPP 11
73T	PI-21C-2	PRESS INDICATOR FOR 26" VAC SUPPLY (263)	H-2-815184 SH. 2 H-2-96418	ASHCROFT	GAGE, 0-30" HG 3KA16978-017	22592 SUPP 11
73T	DPI-21I-1	DIFFERENTIAL PRESSURE INDICATOR, OFF-GAS FILTER F-21I-1	H-2-99537 SH. 1	DWYER	MODEL# 2150	22592
73T	DPI-21I-2	DIFFERENTIAL PRESSURE	H-2-99537 SH. 1	DWYER	MODEL# 2150	22592

Pneumatic Stabilization System Master Component Index						
SYS No.	TAG	DESCRIPTION	DRAWING	VENDOR MFGR	COMPONENT DATA	CVI NO.
		INDICATOR, OFF-GAS FILTER F-21I-2				
73T	DPI-21I-3	DIFFERENTIAL PRESSURE INDICATOR, OFF-GAS FILTER F-21I-3	H-2-99537 SH. 1	DWYER	MODEL# 2150	22592
73T	DPI-21I-4	DIFFERENTIAL PRESSURE INDICATOR, 9/32" FLOW ORIFICE FO-21I-1	H-2-99539 SH. 1	DWYER	MODEL# 2006	22592
73T	DPI-21I-5	DIFFERENTIAL PRESSURE INDICATOR, 9/32" FLOW ORIFICE FO-21I-2	H-2-99539 SH. 1	DWYER	MODEL#2006	22592
73T	DPI-21I-6	DIFFERENTIAL PRESSURE INDICATOR, 9/32" FLOW ORIFICE FO-21I-3	H-2-99539 SH. 1	DWYER	MODEL#2006	22592
73T	EIC-21I-1	CONTACTOR	H-2-99539 SH. 1	EUROTHERM	MODEL# 831	22592
73T	EIC-21I-2	CONTACTOR	H-2-99539 SH. 1	EUROTHERM	MODEL# 831	22592
73T	EIC-21I-2	CONTACTOR	H-2-99539 SH. 1	EUROTHERM	MODEL# 831	22592
73T	F-21I-1	OFF-GAS FILTER, FURNACE FUR-21I-1	H-2-99539 SH. 1	PALL ADVANCED SEPARATION SYSTEMS	MODEL# C-23-40-DCSC	22592
73T	F-21I-2	OFF-GAS FILTER, FURNACE FUR-21I-2	H-2-99539 SH. 1	PALL ADVANCED SEPARATION SYSTEMS	MODEL# C-23-40-DCSC	22592

Effluent Stabilization System Master Component Index						
SYS No.	[illegible]	[illegible]	DRAWING	VENDOR MFGR	COMPONENT DATA	CAT NO.
73T	F-21I-3	OFF-GAS FILTER, FURNACE FUR-21I-3	H-2-99539 SH. 1	PALL ADVANCED SEPARATION SYSTEMS	MODEL# C-23-40-DCSC	22952
73T	FUR-21I-1	MUFFLE FURNACE 1	H-2-99539 SH. 1	THERMOLYN	MODEL# FA1630-61	22592
73T	FUR-21I-2	MUFFLE FURNACE 2	H-2-99539 SH. 1	THERMOLYN	MODEL# FA1630-61	22592
73T	FUR-21I-3	MUFFLE FURNACE 3	H-2-99539 SH. 1	THERMOLYN	MODEL# FA1630-61	22592
73T	LS-21I-1	LIMIT SWITCH, FURNACE FUR-21I-1 DOOR	H-2-99538 SH. 1	THERMOLYN	COMPONENT OF FURNACE 1	22592
73T	LS-21I-2	LIMIT SWITCH, FURNACE FUR-21I-2 DOOR	H-2-99538 SH. 1	THERMOLYN	COMPONENT OF FURNACE FUR-21I-2	22592
73T	LS-21I-3	LIMIT SWITCH, FURNACE FUR-21I-3 DOOR	H-2-99538 SH. 1	THERMOLYN	COMPONENT OF FURNACE FUR-21I-3	22592
73T	TE-21I-2	THERMOCOUPLE,	H-2-99539 SH. 1	OMEGA	MODEL# 4JX20PP	22592
73T	TE-21I-3	THERMOCOUPLE,	H-2-99539 SH. 1	OMEGA	MODEL# 4JX20PP	22592
73T	TE-21I-4	THERMOCOUPLE,	H-2-99539 SH. 1	OMEGA	MODEL# 4KX20PP	22592
73T	TE-21I-5	THERMOCOUPLE,	H-2-99539 SH. 1	OMEGA	MODEL# 4KX20PP	22592
73T	TE-21I-6	THERMOCOUPLE,	H-2-99539 SH. 1	OMEGA	MODEL# 4KX20PP	22592
73T	TE-21I-7	THERMOCOUPLE,	H-2-99539 SH. 1	OMEGA	MODEL# 4KX20PP	22592
73T	TE-21I-8	THERMOCOUPLE,	H-2-99539 SH. 1	OMEGA	MODEL# 4KX20PP	22592

Ethernet Stabilization System Master Component Index						
SYS No.	I.D.	DESCRIPTION	DRAWING	VENDOR MFGR	COMPONENT DATA	QA NO.
73T	TE-21I-9	THERMOCOUPLE,	H-2-99539 SH. 1	OMEGA	MODEL# 4KX20PP	22592
73T	V-21I-1	BALL VALVE, AFTER FO-21I-1	H-2-99539 SH. 1	WHITEY	MODEL# SS-45S8-A ANGLE, 1/2" ODT	22592
73T	V-21I-4	NEEDLE VALVE, BEFORE FO-21I-1	H-2-99539 SH. 1	WHITEY	MODEL# SS-18VS8-A 1/2" ODT	22592
73T	V-21I-2	BALL VALVE, AFTER FO-21I-2	H-2-99539 SH. 1	WHITEY	MODEL# SS-45S8-A ANGLE, 1/2" ODT	22592
73T	V-21I-5	NEEDLE VALVE, BEFORE FO-21I-2	H-2-99539 SH. 1	WHITEY	MODEL# SS-18S8-A 1/2" ODT	22592
73T	V-21I-3	BALL VALVE, AFTER FO-21I-3	H-2-99539 SH. 1	WHITEY	MODEL# SS-45S8-A ANGLE, 1/2" ODT	22592
73T	V-21I-6	NEEDLE VALVE, BEFORE FO-21I-3	H-2-99539 SH. 1	WHITEY	MODEL# SS-18S8-A 1/2" ODT	22592
73T	V-21I-7	BALL VALVE, BEFORE DPI-21IB-1	H-2-99539 SH. 1	WHITEY	MODEL# SS-83TS4-SH, 2WAY, 1/4" ODT	22592
73T	V-21I-8	BALL VALVE, AFTER DPI-21I-1	H-2-99539 SH. 1	WHITEY	MODEL# SS-83TS4-SH, 2WAY, 1/4" ODT	22592
73T	V-21I-9	BALL VALVE, BEFORE DPI-21I-2	H-2-99539 SH. 1	WHITEY	MODEL# SS-83TS4-SH, 2WAY, 1/4" ODT	22592
73T	V-21I-10	BALL VALVE, AFTER DPI-21I-2	H-2-99539 SH. 1	WHITEY	MODEL# SS-83TS4-SH, 2WAY, 1/4" ODT	22592
73T	V-21I-11	BALL VALVE, BEFORE DPI-21I-3	H-2-99539 SH. 1	WHITEY	MODEL# SS-83TS4-SH, 2WAY, 1/4" ODT	22592
73T	V-21I-12	BALL VALVE, AFTER DPI-21I-3	H-2-99538 SH. 1	WHITEY	MODEL# SS-83TS4-SH, 2WAY, 1/4" ODT	22592