

# Keysight SPECS-FA

Virtual GEM  
for TEL Prober

# Notices

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## About This Product

The Keysight SPECS-FA software was developed to contribute the factory automation of the semiconductor manufacturing for the process monitoring and the parametric test. The SPECS-FA is an extended version of the Keysight SPECS software, and contains the SPECS-FA dedicated frameworks and algorithms, and the Virtual GEM (VGEM) module that was developed as a SECS II compliant solution for semiconductor testers by using the GEM protocol and following TSEM specifications.

The VGEM is fully configurable, allowing you to architect state models, messaging, alarms, and other functionality precisely as needed for your test environment. The State Model defined for the tester, the set of variables maintained, and the collection events inherent to the VGEM are explained in this documentation.



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# Chapter 1. Introduction

Keysight's SPECS-FA includes a virtual GEM (VGEM) software technology that incorporates the GEM protocol with an automated wafer probe test solution. VGEM supports E40/E94 for the Keysight 407x/4082 parametric test system and the TEL P12XL/Precio prober.

VGEM is fully configurable, allowing you to architect state models, messaging, alarms, and other functionality precisely as needed for your test environment. The State Models defined for the tester, the set of variables maintained, and the collection events inherent to the Virtual GEM are explained in this documentation.

## 1.1. Manual History

This is edition 1.

## 1.2. Intended Audience

The User's Guide is intended to provide complete details of VGEM's implementation of the SEMI Standards. It is assumed that the reader is familiar with the SEMI specifications listed below and understands the processes commonly found in a test environment. Familiarity with the SEMI references is essential for a comprehensive understanding. This manual is not intended as a substitute for SEMI Standards training. This documentation assumes that you have installed and configured Keysight's SPECS-FA software.

## 1.3. References

The following Semiconductor Equipment and Materials International Standards were used:

- SEMI E4 - SEMI Equipment Communication Standard 1 - Message Transport (SECS-I)
- SEMI E5 - SEMI Equipment Communication Standard 2 - Message Content (SECS-II)
- SEMI E30 - Generic Model of Communications and Control of SEMI Equipment (GEM)
- SEMI E30.0698 Testing Equipment Specific Equipment Model (TSEM)
- SEMI E37-95 High-Speed SECS Message Services (HSMS) Generic Services
- SEMI E37.1-95 High-Speed SECS Message Services Single-Session Mode (HSME-SS)
- SEMI E39 Object Services
- SEMI E40 Processing Management
- SEMI E87-1000 Provisional Specification for Carrier Management (CMS) - (source of S3F17 messages)
- SEMI E90 Substrate Tracking
- SEMI E94 Control Job Management
- SEMI E148 Specification for Time Synchronization and Definition of the TS-Clock Object

## 1.4. Compliance Statement

This User Guide complies with SEMI documentation standards as detailed in SEMI-E5 and SEMI-E30. SEMI outlines the documentation of general information, stream message summaries, and stream message details [SEMI-E5 Section 8], and is met in Chapter 16.

SEMI outlines GEM documentation compliance in [SEMI-E30 Section 8.4]. In addition to the above requirements, GEM documentation must include a GEM compliance statement (Section 2.6). This documentation also addresses [SEMI-E30 Section 4.2.1.2.4] requirements for variable names, types, units, ranges and descriptions.

VGEM's State Models are documented following the standards set out in the E30, [SEMI-E30 Section 3], using David Harel's Statechart notation. Diagrams, transition table, and state definitions are addressed in Chapter 8.

The E-30 Standard also sets out requirements for documenting collections events [SEMI-E30 Section 4.2.1.1.4], which are covered in Chapter 18.

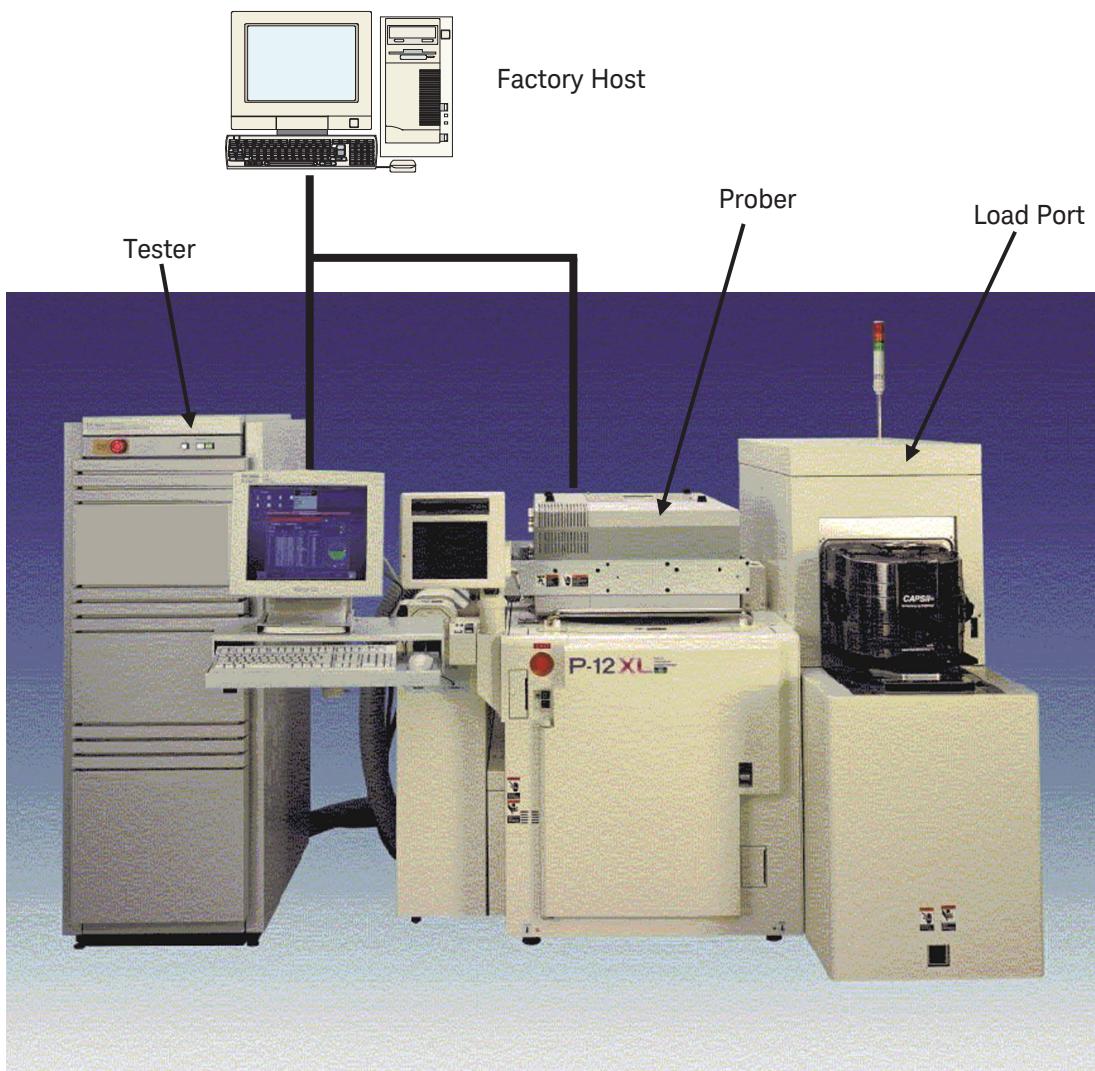
SEMI E40, 87, 90, 94 compliance statements appear in Chapter 2.

## Chapter 2. Overview

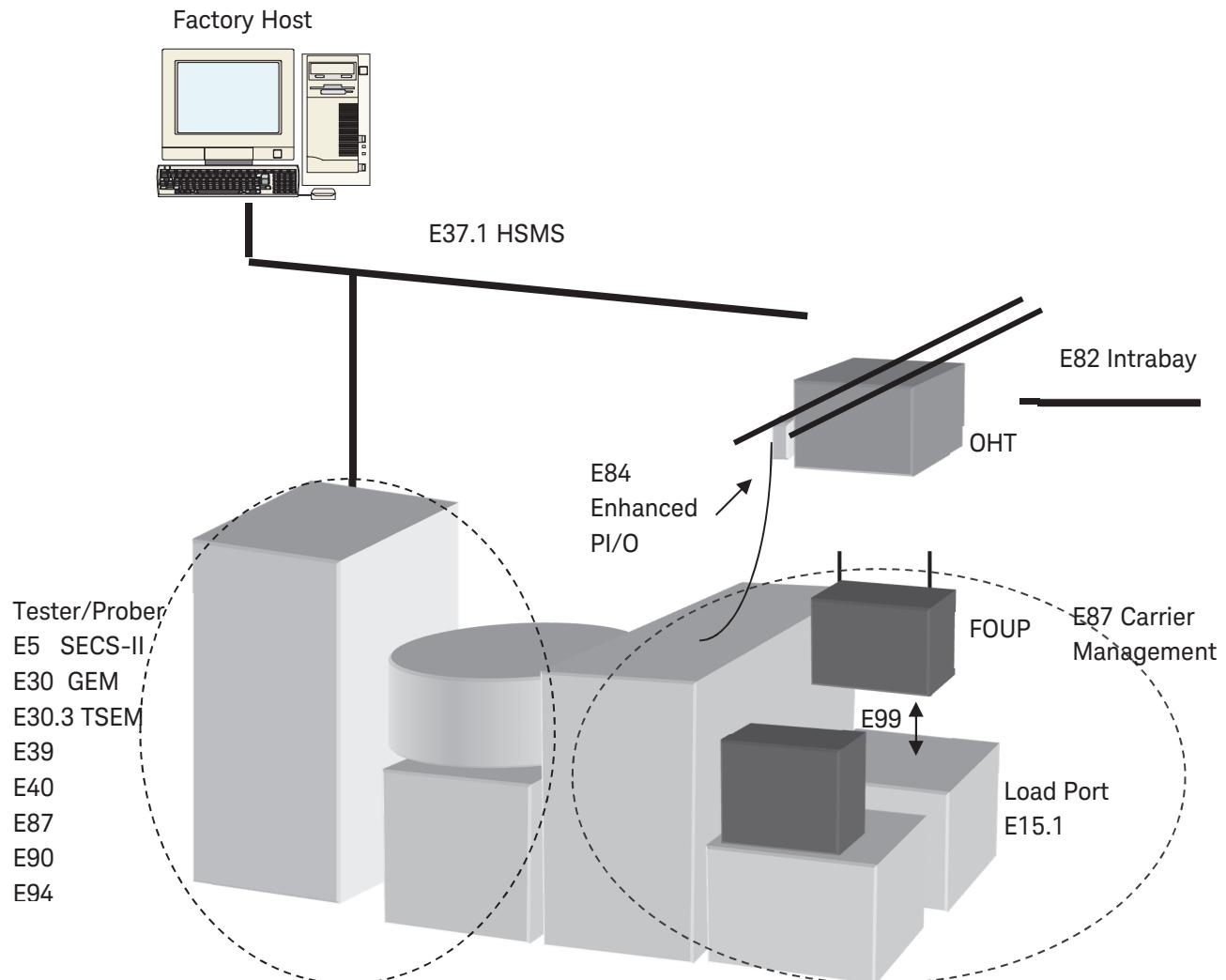
### 2.1. Introduction to Virtual GEM (VGEM) as Included in SPECS-FA

VGEM provides a *single-wire solution* in a production environment for controlling a test system integrated with a prober and a carrier management system. VGEM supports a high level of automation per SEMI standards as typically applied in 300mm fabs. The integration of the test system with the prober and the carrier management system allows for automatic testing of wafers delivered in a carrier (FOUP).

Current VGEM solutions support Keysight's 407x/4082 Parametric Tester with TEL P12XL/Precio Probers.



## 2.2. How the Standards Work Together



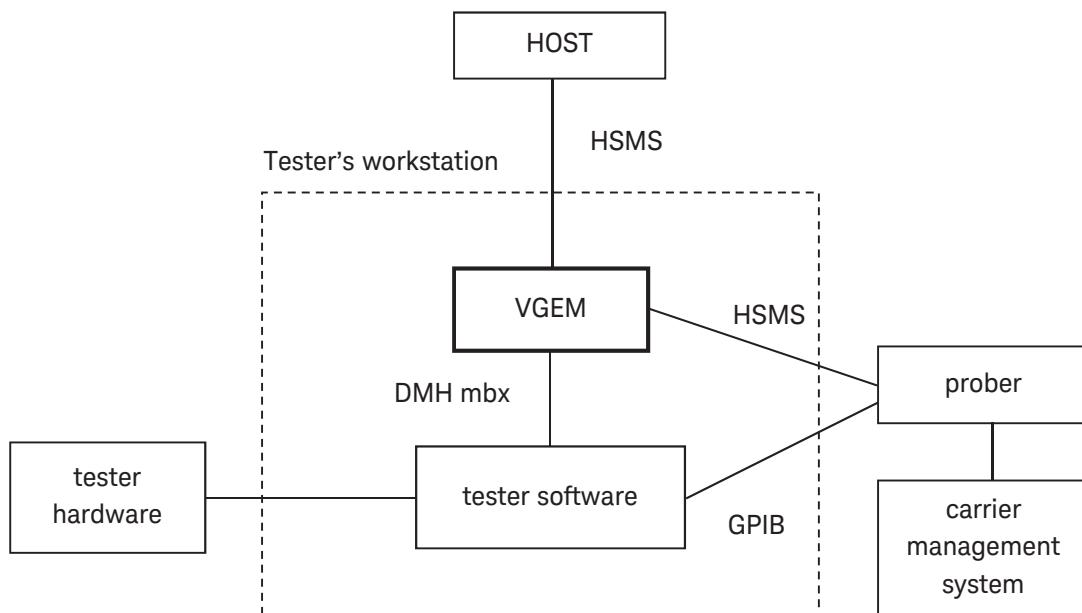
## 2.3. Keysight's VGEM Solution

VGEM is designed to provide a single point of GEM interface that allows a system host to control and receive information about a tester and the prober with which it is associated. VGEM coordinates and controls the flow of processing based on messages from both the tester and the prober.

The system host may send GEM messages to VGEM to control and define parameters either the Tester or the Prober. VGEM discriminates between data items that are managed by the prober, those that belong to the tester or those that are part of VGEM's internal data set.

### 2.3.1. The VGEM Architecture

Figure 2-3. Architectural overview of Keysight's VGEM



### 2.3.2. Interface for Local Control

In addition to supporting of the host's ability to send messages to the equipment and to control the equipment using these messages, VGEM also provides an interface for interaction with the equipment when local control is necessary. The Local Management Panel (LMP) is a configurable tool that displays variables, equipment states, alarms, communications, and control mode information. It allows commands and relevant information to be sent to the equipment by a local operator, including the management of control states, configuration and execution of messages as an alternative to remote commands, the sending of terminal services, and the clearing of alarms.

### 2.3.3. Equipment State Tracking and Reporting

VGEM provides a mechanism for tracking and reporting equipment states. A configurable table defines and validates the states that the equipment will traverse and the event triggers for those states. The host may subscribe to event information using event reports, providing valuable status information on aspects of the test process.

### 2.3.4. Configurable States, Transitions, Events, Event Reports, Alarms, Variables

VGEM provides a default set of commands, variables, events, alarms, and an equipment model based on the SEMI standards. Keysight recognizes that each implementation of the standard is unique, and has provided a solution that is highly configurable. The supported feature set is sufficiently broad and allows easy tailoring to matches your environment.

### 2.3.5. DMH Data Hub

VGEM utilizes a memory-resident database to communicate with the tester equipment, and to manage the formatting and transfer of SECS II messages. This tool is a powerful combination of an in-memory real-time database, a subscription server, a configurable Tcl/Tk interpreter, and a Distributed Message Hub (DMH) server. The synergistic combination of these capabilities is the cornerstone of a new architecture for distributed applications.

When used as a DMH server, a Real-time Data Hub becomes the nexus of an efficient, event-driven, distributed application that is capable of integrating into the fab environment. The Tcl interpreter provides a high-level, dynamically customizable programming environment with comprehensive features. Client processes can easily exchange peer messages, share common data from relational tables, and subscribe and respond in real-time to changes in the application data. Shared application logic can be executed within the Real-time Data Hub process, sharing the same address space with application data tables and SQL command processing logic.

This implementation dramatically reduces the overhead traditionally associated with inter process communications.

For any installation, SECS/GEM compliance is a cooperative effort between the end user and the vendor to define which standards are implemented and how the standards will be applied in that specific factory.

## 2.4. Limitations

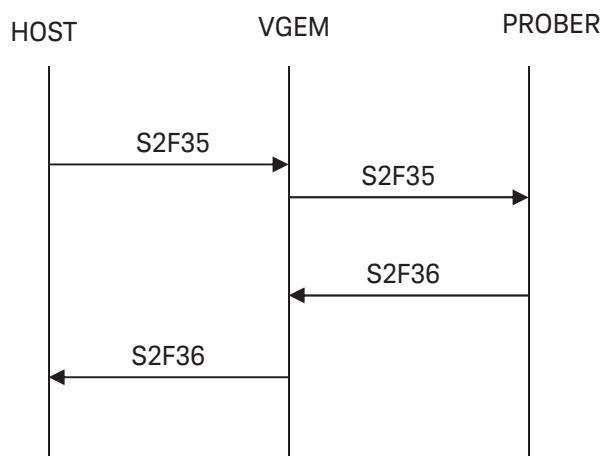
VGEM supports all stream messages related to the status and control of equipment, alarms, data collection, and terminal services. VGEM does not support Stream 4, Material Control functions at this time. Stream 4 support would require a connection with a handler device. Instead, VGEM provides material handling as it is supported by the E87 capability of the prober. Complete documentation of stream message support is included as a chapter in this user guide.

Equipment constants, report definitions, events and alarms are stored in ASCII tables on the tester's workstation. Although changes can be made in these tables to modify the factory defaults (ex. with a text editor), it is important to note that configuration changes from a host system using the SECS protocol are stored in memory at run-time but are not saved to disk after the test system is turned off or VGEM is shutdown.

### 2.4.1. How to handle special case of system initialization on VGEM

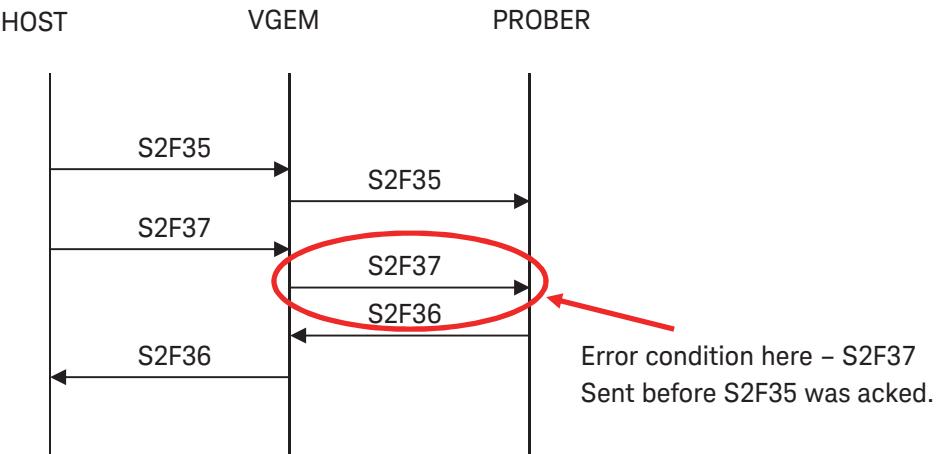
VGEM requires caution when sending an initialization sequence that includes large messages for creating reports and associating reports with CEIDs. Due to the design of VGEM, S2 messages are sent to VGEM and then passed on to the prober in the case where a CEID or VID is required from the prober SECS/GEM system. This is the 'single-wire' solution that VGEM provides.

In order to assure that any message sent to VGEM that contains prober related information is valid; we do not ack the message from the host until the prober has acked the original message. This way if the prober nacks the host message we will pass the nack onto the host. This process usually takes place in a very short time. Refer to the scenario diagram below for reference.



In some cases, if the prober takes a longer time, maybe there are a large number of report associations on an S2F37 message or reports to define, this can cause a problem if the host sends another message with prober related information. In this case we send the prober a message while we are still waiting for the first message to be acknowledged. This causes a

*"GEMPROBER is already waiting on a modal SECS transaction"* error to occur. See the scenario below for an example of this situation.



To avoid this error condition, it is preferred to wait until the response is sent from each message to avoid overrun conditions as shown above. This error condition is most often seen when a very large message such as S2F37 (Enable events) is followed by a quick message such as S2F31 (Set Clock). Since the set clock message is forwarded on to the prober, this message can ‘crash’ with the previous message if sent too soon after the large message. If the host can wait for the response from large S2 messages prior to sending out the next message this will not occur. If the MODAL SECS/GEM error is encountered, it can be often resolved by reordering the initialization sequence. However, if the host does not wait for a response and sends a stream of S2 initialization messages, the problem can be seen depending on the prober firmware response time.

## 2.5. Implementation

VGEM usually runs on the same computer that controls the operation of the tester.

VGEM process accepts messages using two protocols:

- SECS-GEM messages from host systems via a TCP/IP connection (HSMS)
- Messages placed in pre-defined mailboxes by processes in direct communication with the tester.

It accepts messages from three possible sources:

- Tester software using DMH mailboxes
- Factory host or cell controllers (using HSMS, which is the preferred protocol for best performance. Although built-in in the software, SECS-1 is not recommended).
- Prober using HSMS

It also generates:

- SECS-GEM messages to host systems

- Messages to pre-defined mailboxes to control the operation of the tester.
- Adaption and communication of SECS-GEM messages to and from the prober.

## 2.6. GEM Compliance Statement

Fundamental GEM Requirements	Implemented	GEM Compliant
State Models	Yes	Yes
Equipment Processing States	Yes	Yes
Host-Initiated S1, F13/F14 Scenario	Yes	Yes
Event Notification	Yes	Yes
On-line Identification	Yes	Yes
Error Messages	Yes	Yes
Documentation	Yes	Yes
Control (Operator Initiated)	Yes	Yes
Additional Capabilities		
Establish Communications	Yes	Yes
Dynamic Event Report Configuration	Yes	Yes
Variable Data Collection	Yes	Yes
Trace Data Collection	No	No
Status Data Collection	Yes	Yes
Alarm Management	Yes	Yes
Remote Control	Yes	Yes
Equipment Constants	Yes	Yes
Process Program Management	Yes	No
Material Movement	No	No
Equipment Terminal Services	Yes	Yes
Clock	Yes	Yes
Limits Monitoring	No	No
Spooling	Yes	Yes
Control (Host-Initiated)	Yes	Yes

## 2.7. E87 and E90 Compliance

SEMI E87 Provisional specification for Carrier Management (CMS) and E90 (Substrate Tracking) are completely dependent on the Wafer Prober supplier. Please refer to the TEL documentation for E87 and E90 compliance specifications.

## 2.8. Processing Management Compliance Statement

Fundamental PM Requirements	Implemented	PM Compliant
Single Process Job Execution	Yes	Yes
Process Job Milestones	Yes (using E30 events)	Yes (using E30 events)
Process Job Failure Indication	Yes (see Note 1)	No (see Note 1)
Abort Command	Yes	Yes
Process Job Object Implementation	Yes	Yes
Reject Invalid/Incomplete Parameters	Yes	Yes
Reject Unsupported Capabilities	Yes	Yes
Services Implementation (not per Additional)	Yes	Yes
<b>Additional PM Capabilities</b>		
Resource Pre/Post-conditioning	No	No
Stop, Pause and Resume Commands	Yes	Yes
Manual Process Start	Yes	Yes
Process Job Queuing	Yes	Yes
Process Tuning	Yes	Yes
Processing of Materials Groups	Yes	Yes
Multiple Concurrent Process Job	Yes	Yes
Multiple Consecutive Process Job	Yes	Yes
Process Job with No Material	No	No
Event Notification	Yes	Yes
Enhanced Job Creation	Yes	Yes
Multiple Job Creation	Yes	Yes
Duplicate Job Creation	Yes	Yes

Note 1: The Port State Model described in Chapter 8 provides the host the necessary information to determine the success or failure of a process job.

## 2.9. CJM Compliance Statement

Fundamental CJM Requirements	Implemented	CJM Compliant
Control Job Request	Yes	Yes
Control Job State Model	Yes	Yes
Control Job Queue Model	Yes	Yes
Carrier Properties	Yes	Yes
Service Message Implementation	Yes	Yes
Variable Data	Yes (See Note 1)	No (See Note 1)
Events	Yes	Yes
Additional Requirements	Yes	Yes
<b>Additional CJM Capabilities</b>		
Serial Execution of Control Jobs	Yes	Yes
Parallel Execution of Control Jobs	Yes	Yes
Modifying Control Jobs	Yes	Yes
Event Relationships (pause, abort, stop)	Yes	Yes

Note 1: SetUpName variable is not implemented.



## Chapter 3. Running the Virtual GEM in Local Mode

### 3.1. Local Management Panel Overview

In order to provide a method for the user to interact with the tester and prober in local mode, the VGEM module contains a user interface, the Local Management Panel.

The LMP provides two primary functions, the display of various aspects of the system's status, and the management of certain activities by the system.

#### **DISPLAY**

- Display of system status
- Display of the status and contents of each port
- Display of the slot-by-slot progress of testing on each port
- Display of Terminal Services messages from the host or prober
- Display of alarm messages from the tester or prober

#### **MANAGEMENT**

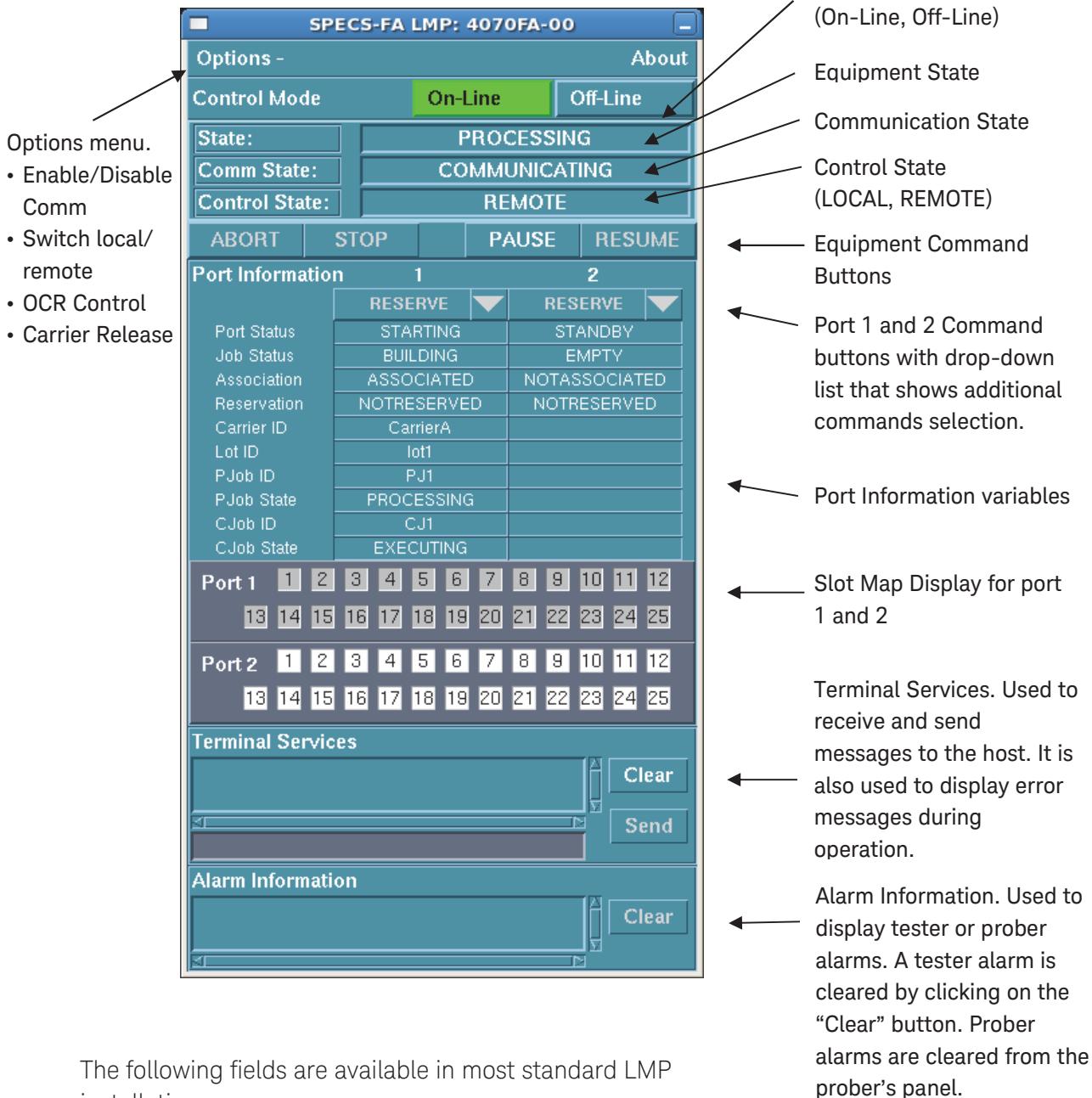
- Management of system control mode and control state
- Management of OCR communication state
- Configuration and execution of messages to the equipment as a local mode alternative to S2F41 remote commands (VGEM 2.x Mode) or S16Fx messages from the host (E40/94 mode. In this mode, LMP allows to create only one process job and control job at a time per port).
- Sending of Terminal Services messages to the host
- Clearing of Alarms
- Verification of carrier ID slot maps in local mode

### 3.1.1. Main Application Window

The main screen of the LMP provides visibility into the details of processing on the tester.

The LMP is configured with field views appropriate to your platform during the installation of the VGEM. In the screen displays included in this document, grayed-in fields contain status data. They are maintained by the system and do not allow user input. Clear fields allow user input.

Figure 3-1. LMP Main Display (Dual-Port Configuration)



The following fields are available in most standard LMP installations:

### 3.1.1.1. Equipment Information

The title bar of the LMP main window indicates the piece of equipment configured for this instance of the LMP.

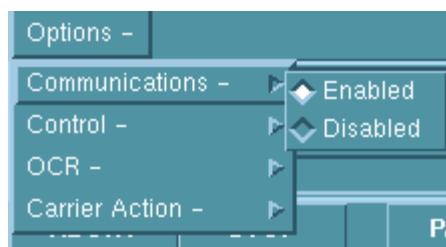
### 3.1.1.2. Equipment State

This is the current state of the equipment. The equipment state corresponds to an appropriate state within the Equipment State Model. If you are in a two-port environment, this value will be "PROCESSING" if either port is active. See Chapter 8 for a complete description of the Equipment State Model.

### 3.1.1.3. Communication State

The Options pull-down menu at the top of the LMP enables the operator to toggle the Communications State between **Enabled** and **Disabled**.

This field shows the communication status as correspondent to the Communication State Model. The button allows the operator to set the Communication State to "Enabled" or "Disabled." While Communication is "Enabled," the Communication State may be either "Communicating" or "NotCommunicating."



### 3.1.1.4. Control State

The control state will show one of five values:

- |                     |   |
|---------------------|---|
| LOCAL:              | The operator controls the equipment, but process messages are sent to the host.                                       |
| REMOTE:             | The host controls the equipment and most local processing is disabled.  |
| Host OFF-LINE:      | The host has requested the interruption of message traffic and all processing must be performed by the operator.      |
| Equipment OFF-LINE: | The equipment has requested the interruption of message traffic and all processing must be performed by the operator. |
| Attempt ON-LINE:    | The equipment is attempting to go on-line. Operator processing is required until this is achieved.                    |

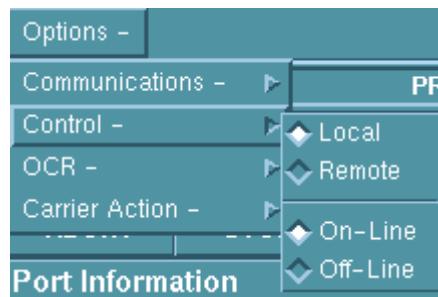
The operator can request a change in control mode using the control mode management radio buttons below the control menu.

### 3.1.1.5. Control Mode Management Pulldown

The Option menu at the top of the LMP has a Control Mode selection that will give you four options. These allow the operator to switch between Local and Remote Mode. Port commands cannot be executed while the system is in Remote mode.

The operator can also switch between ON-LINE and OFF-LINE. While ON-LINE, the operator may move between LOCAL and REMOTE. The operator may manually bring the equipment to "Equipment OFF-LINE" by selecting OFF-LINE. Once the control mode is "Equipment OFF-LINE", the operator can prompt the equipment to "Attempt ON-LINE" by selecting ON-LINE. If the host has caused the equipment to move to "Host OFF-LINE" mode and the operator wishes to "Attempt ON-LINE", the operator must first select OFF-LINE to change the equipment's state to "Equipment OFF-LINE" and then select ON-LINE, as above.

There may be a delay between the time a control mode management selection is made and the time the displayed control mode changes, depending on how quickly the new control mode is achieved. If the system is in any OFF-LINE mode, switching from LOCAL to REMOTE mode will have no effect until the equipment returns to ON-LINE mode.



### 3.1.1.6. Command Buttons

Four command buttons may be available:



**ABORT** - Selecting this button sends a CMD ABORT to the tester. It is available when the equipment is in any PROCESSING state. In VGEM 2.x mode, it is the equivalent of sending S2F41 ABORT.

In E40/94 mode, this button sends a control job abort for the two ports

**STOP** - Selecting this button formats and sends a CMD STOP to the tester. It is available when the equipment is in any PROCESSING state. In VGEM 2.x mode, it is the equivalent of sending S2F41 STOP.

In E40/94 mode, this button sends a control job abort for the two ports. We don't differentiate between ABORT and STOP in this mode.

**RESUME** - Selecting this button formats and sends a CMD RESUME to the tester. Visible only while the equipment is in PAUSED state. In VGEM 2.x mode, it is the equivalent of sending S2F41 RESUME.

In E40/94 mode, this button sends a message to resume all active process jobs.

**PAUSE** - Selecting this button formats and sends a CMD PAUSE to the tester. It is available when the equipment is in any PROCESSING state.

In VGEM 2.x mode, it is the equivalent of sending S2F41 PAUSE.

In E40/94 mode, this button sends a message to pause all active process jobs.

### 3.1.1.7. Port Information

This area of the LMP details port information. The LMP may be configured for dual ports, in which case two ports will be listed. The Port Information region includes:

- Port management buttons that include a drop-down list of valid commands and are only available when the system is in local or any off-line mode.

Variable Details that display the status of variables enabled in your LMP configuration.

Port Information	1	2
	CLOSE-LOT ▼	RESERVE ▼
Port Status	PENDINGCOMPLETE	STANDBY
Job Status	EMPTY	EMPTY
Association	ASSOCIATED	NOTASSOCIATED
Reservation	NOTRESERVED	NOTRESERVED
Carrier ID	CarrierA	
Lot ID	LID111	
PJob ID	PJLocalCarrierA	
PJob State	NONE	
CJob ID	CJLocalCarrierA	
CJob State	EXECUTING	

### 3.1.1.8. Slot Map Display

The slot map provides a visual representation of the slots in a carrier (FOUP) for the associated port. Slot 1 is at the left end of the first row, and slot 25 is at the right of the second row.

Each square will change color to match the changing status of the wafer (if any) in each slot. The colors represent the following status values:

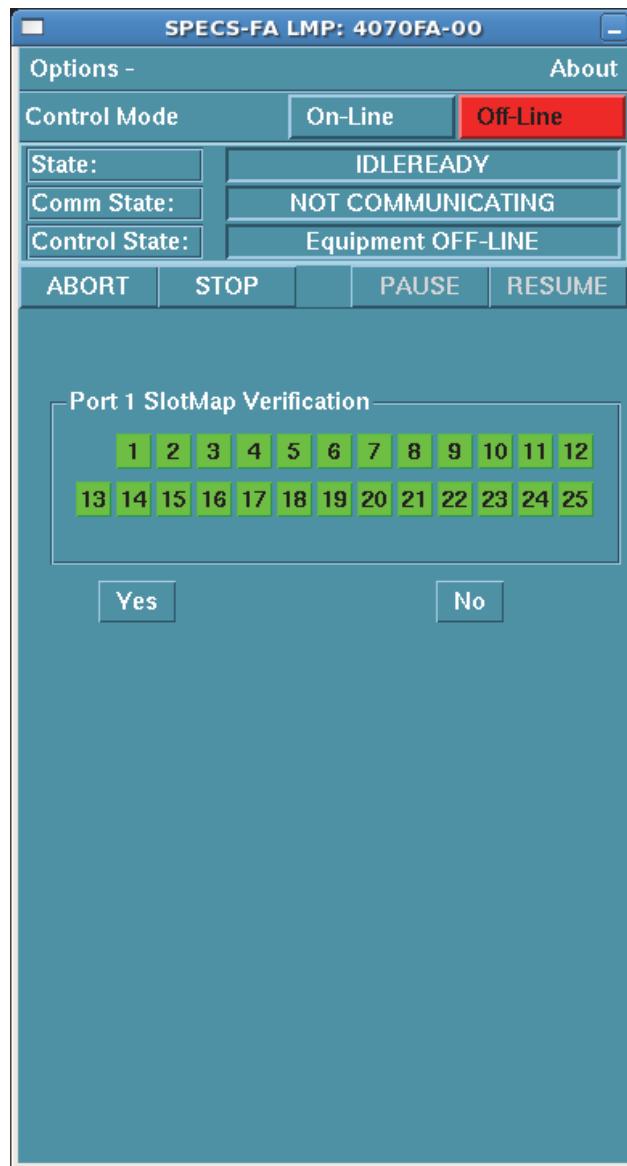
- Green: the wafer has passed testing
- Red: the wafer has failed testing
- Gray: the wafer is awaiting testing
- Yellow: the wafer is undergoing testing
- White: the slot is empty, or the wafer is not to be tested.
- Light Purple: the slot is incorrectly loaded.

Port 1	1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24	25
<hr/>												
Port 2	1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24	25

### 3.1.1.9. Slot Map Verification Window

In local or off-line mode, the operator must verify the contents of the slots in each carrier. The Slot Map Verification Window is prompted by a SlotMapWaitingForHost (or equivalent) messages from the prober.

Figure 3-2. LMP Slot Map Verification Window



The Slot Map Verification Window contains a display of the slots in the carrier in the same format as the Slot Map displayed on the main LMP screen. The slot colors provide more detailed information and are configured to have the following meaning:

- White: the slot is empty.
- Green: a wafer is correctly loaded into the slot.
- Red: the slot contains more than one wafer.

- Purple: a wafer is cross-slotted using this slot.
- Orange: a wafer is in this slot, but its status cannot be identified.
- Yellow: the status of the slot cannot be determined.

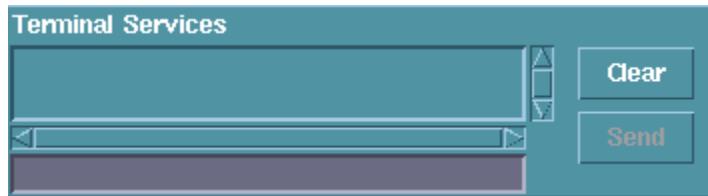
The user may press the YES button to verify the contents of the Slot Map. This will cause a ProceedWithCarrier message to be sent to the prober and will dismiss the Slot Map Verification panel. The user may press the NO button to reject the contents of the Slot Map. A confirmation panel asks the operator, "Are you Sure?".

A YES on this window generates a ProceedWithCarrier message to the prober. A NO generates a CancelCarrier message to the prober. Depending on the prober configuration, equivalent messages may be used.

### 3.1.1.10. Terminal Services Management

This region allows the operator to view Terminal Messages and to send Terminal Services messages to the host. It consists of a list box containing the Terminal Services messages received from the host, prober and tester. The CLEAR button removes the selected Terminal Services message from the list. The SEND button formats a SECS/GEM message with the contents of the field it follows and sends that message to the host. The field will be cleared when the Send button is pressed.

There is no facility on the LMP screen to send a Terminal Services message to the prober.

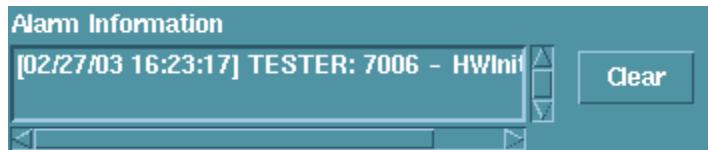


### 3.1.1.11. Alarm Management

This region allows the operator to clear Alarms. It consists of a list box containing the ID numbers and text associated with all alarms that have been set on the tester and/or prober. Each message is prefixed with an identifier of its source.

When any un-cleared alarms from the tester appear in the list, the clear alarm button is available. The clear button is only enabled when there are alarms from the tester. This button will clear the tester alarms and send the appropriate SECS/GEM S5 and S6 messages.

Alarms from the prober will be cleared by the prober, at which time they will disappear from the Alarm list box.



### 3.1.2. Port Commands

The Port Commands drop-down buttons allow the user to send messages to the tester while the system is in local or either off-line mode. The set of messages handled by these buttons depends on the selected mode:

#### **E40/94**

In local mode, multiple process jobs and 1 control job can be created at a time. The process job is created from the Process Job List page and is set in manual start mode so that a START command is required to start processing. Once a process job completes processing, the LMP automatically closes the lot.

The “PJABORT” and “CJABORT” commands allow the user to abort a process job or a control job on port 1 or 2 without stopping processing on the other port. The “ABORT” button on the LMP allows to abort port 1 and 2 at the same time.

#### **VGEM 2.x**

Remote Command (RCMD) messages that the host sends to the GEM module in remote mode (S2F41 equivalent).

#### VGEM 2.x Mode Port Commands

Button	Description	Valid States (for one-port testers)	Valid States (for dual-port testers)
RESERVE			
CANCEL-RES			
PP-SELECT	Displays the PP-SELECT Command Parameters window (see below).	Port in STANDBY, or PENDINGCOMPLETE, or PENDINGCLOSE. CarrierID must be in CarrierIDVerificationOK and SlotMap must be in SlotmapVerificationOK. The other port cannot be in SETTINGUP.	Selected port in STANDBY, or PENDINGCOMPLETE, or PENDINGCLOSE. CarrierID must be in CarrierIDVerificationOK and SlotMap must be in SlotmapVerificationOK. The other port cannot be in SETTINGUP.
CANCEL-MEAS	Allows the operator to abort a lot before it has begun processing.	Port in READY	Selected port in READY
START	Formats and sends a CMD START to the tester.	Port in READY	Selected port in READY
CLOSE-LOT	Indicates that a retest will not be required and the tester should proceed by issuing an EVENT LotComplete	Port in PENDINGCOMPLETE or PENDINGCLOSE	Selected port in PENDINGCOMPLETE or PENDINGCLOSE

Button	Description	Valid States (for one-port testers)	Valid States (for dual-port testers)
RETEST	Indicates that the current lot is to be retested using the same recipe.	Port in PENDINGCOMPLETE	Selected port in PENDINGCOMPLETE

## E40/94 Mode Port Commands

Button	Description	Valid States (for one-port testers)	Valid States (for dual-port testers)
RESERVE	Sends a S3F25 ReserveAtPort message to the prober	E87 NOT RESERVED	
CANCEL-RES	Sends a S3F25 CancelReservationAtPort message to the prober	E87 RESERVED	
PJCJCREATE	Displays the Process Job List (see below).	Port in STANDBY, or PENDINGCOMPLETE, or PENDINGCLOSE. CarrierID must be in CarrierIDVerificationOK and SlotMap must be in SlotmapVerificationOK.	Selected port in STANDBY, or PENDINGCOMPLETE, or PENDINGCLOSE. CarrierID must be in CarrierIDVerificationOK and SlotMap must be in SlotmapVerificationOK. The other port cannot be in SETTINGUP.
RELEASE	Sends a S3F17 Carrier Action Request message with the Undock command to the prober.	Port in STANDBY, JobStatus in EMPTY, and Association in ASSOCIATED.	
PJABORT	Allows the operator to abort a lot before it has begun processing or during processing.	Port in READY and WORKING state.	Selected port in READY and WORKING state.
START	Formats and sends a CMD START to the tester.	Port in READY	Selected port in READY
CLOSE-LOT	Indicates that a retest will not be required and the tester should proceed by issuing an EVENT LotComplete	Port in PENDINGCOMPLETE or PENDINGCLOSE	Selected port in PENDINGCOMPLETE or PENDINGCLOSE

### 3.1.3. Port Commands with parameters

The port command data panel (like PJCJCREATE) allows the operator to select the values of the parameters that appear in a port command message. The formatted message can then be sent to the tester.

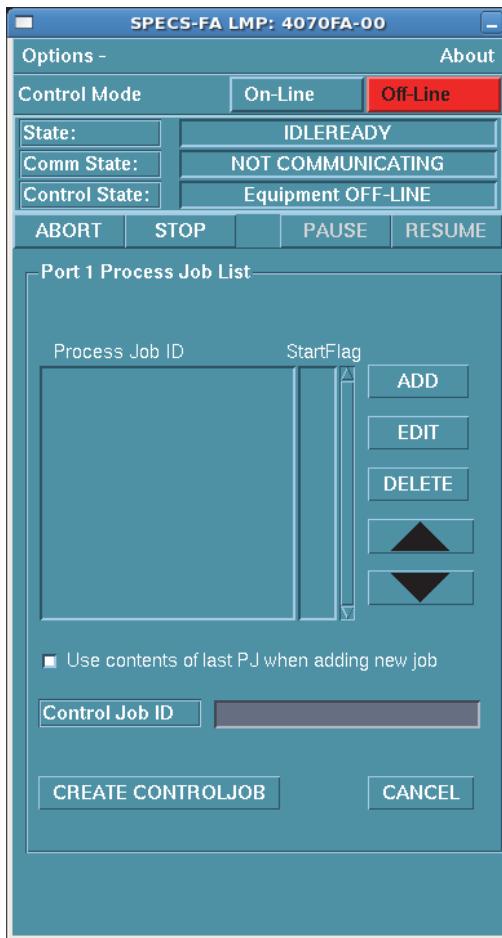
The Port Id appears at the top of the screen. Its value is always sent as a parameter in the port message.

If no procedure has been defined for a parameter, a data field will be associated with the parameter to allow the user to enter the value of that parameter manually. If a procedure has been defined for a parameter, then a button will be associated with the parameter. This button will have a pull-down list associated with it. When the user presses the button, the procedure will be invoked to generate the list of items that populate the pull-down list, or, if only one item appears in the list, to make that item the current value for the parameter.

In some cases, the contents of a pull-down menu will depend on values selected by the operator for other data items. Each time the operator enters a new value into a data field or selects a new item from the pull-down list, the values of all parameters dependent on the changed parameter value will be cleared. The operator must then select new values for those parameters.

Some parameters may be defined as "optional". This means that the tester will accept them in the remote command but does not require their presence. Optional parameters appear with a gray background; required parameters appear with a light green background.

Figure 3-3. Example of a port command with parameters (PJCJCREATE)



### 3.1.3.1. Process Job List (PJCJCREATE)

After selecting the PJCJCREATE command, Process Job List page (Figure 3-3) shows for operators to create process jobs and a control job.

- ADD - Selecting this button changes the page for operator to enter the parameter values for creating a process job (PJCREATE).
- EDIT - Selecting this button changes the page for operator to modify the parameter values for the selected process job.
- DELETE - Selecting this button removes the selected process job.
- Control Job ID field - Control job ID field that the operator must enter to create a control job.
- CREATE CONTROL JOB - Selecting this button creates a control job including the multiple process jobs listed on this page.

### 3.1.3.2. PJCREATE Command Parameter fields

The fields available depend on your VGEM configuration. The default values as shown in the Figure 3-4 are:

Field	Contents
ProcessJobID	Process job ID in the control job to be processed.
LotID	ID of the Lot to be processed.
RecipeID	Recipe ID to be used, which is equivalent to the process program (PPExecName) in VGEM 2.x.
DieSpecFileName	Name of the Die Spec File to be used.
WaferSpecFileName	Name of the Wafer Spec File to be used.
ProbeSpecFileName	Name of the Probe Spec File to be used.
OperatorID:	Her/his operator ID.
LimitFileName	Name of the Limit File to be used.
ProberRecipeFileName	Name of the Prober Recipe File to be used.
ProductID	ID of the Product to be processed.
TestPlanName	Name of the Test Plan to be used.
MaterialList	List of wafers to be tested from a pop-up screen.
StartFlag	Start flag (0 to 8; default 1).
DieTestSpecNames	Pairs of names of Die Spec Files and Test Spec Files to be used during processing.
TestSpecFileName	Name of the Test Spec File to be used.

The operator may enter a value in both the DieSpecFileName and the TestSpecFileName fields and leave the DieTestSpecNames field blank. Alternatively, she/he may enter a set of pairs of Die and Test Spec File Names in the DieTestSpecNames field and leave the Die Spec File Name and Test Spec File Name fields blank. Any other combination of data in these fields is invalid and will cause an error to be displayed when the SEND button is pressed (see below).

Figure 3-4. Example of a PJCJCREATE command parameters



### 3.1.3.3. Wafer Selection Panel

The Wafer Selection Panel allows the operator to select wafers for testing. Wafers with a white box next to them may be selected or named in this window. This window is accessible by clicking on the MaterialList button on the PJCREATE page.



## 3.2. Alternative LMP Configurations

Your LMP may be configured to include OCR state management options and the display of slot maps in Local Mode.

### 3.2.1. OCR Management

The Options pull-down menu at the top of the LMP displays the OCR State and allows the operator to manage the current OCR communication state.

The menu options are:

#### **OFF SLOT**

OCR is not used. Slot number is used as a wafer ID.

#### **OFF HOST**

OCR is not used. Information downloaded from host is used as wafer ID. In case of offline control state, wafer ID is given as 'STRING+slot number'. (\*1) This mode is available only when host downloads information including wafer ID.

#### **ON SLOT**

OCR is used to read the wafer ID. In case of reading failure, wafer ID is given as 'FA\_FAIL\_SUBLOTID+slot number'.

#### **ON KEYINPUT**

OCR is used to read the wafer ID. In case of reading failure, operator is called and inquired to input wafer ID manually.

#### **ON HOST**

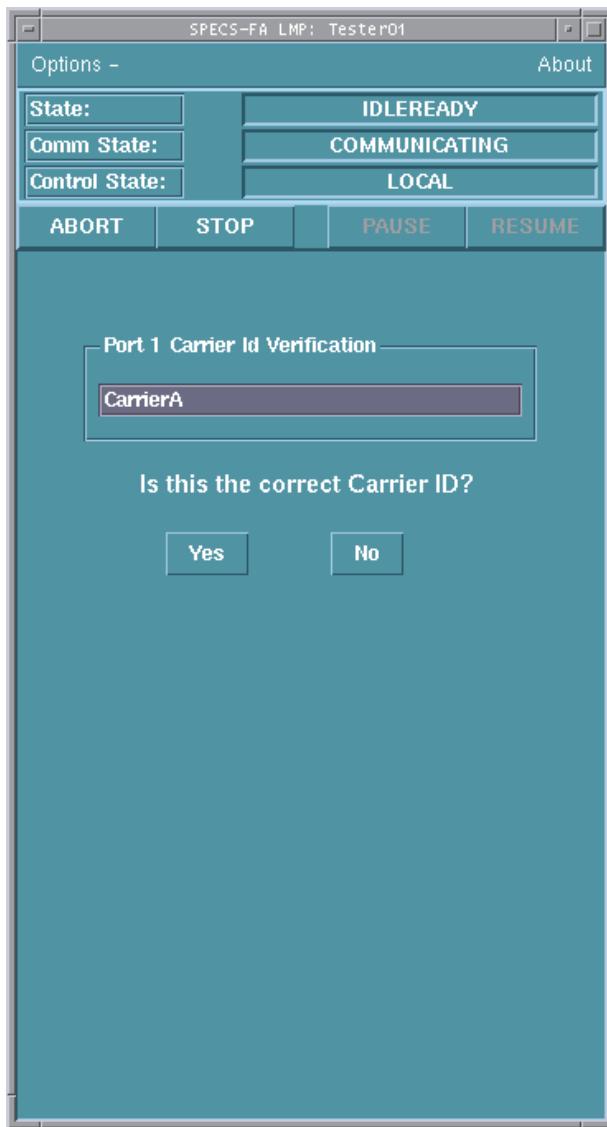
OCR is used to read the wafer ID. In case of reading failure and the control state is on-line remote or on-line local, information downloaded from host computer is used as wafer ID. In case of reading failure and the control state is offline, then the wafer ID is given as 'FA\_FAIL\_SUBLOTID+slot number'.

The operator can select from the pull-down menu a new state, which will call a procedure that sends a CHANGE-OCR-STATE message to the tester. While the VGEM will accept this command in any state, it will not be implemented until the equipment finishes its current activity. The equipment will respond back once the state change has been completed.

ON HOST and OFF HOST may not be available in all installations.

### 3.2.2. Carrier ID Verification Window

The Carrier ID verification window allows the operator to verify or select a Carrier ID.



The window will ask you to confirm an existing CarrierID or to enter one if one does not already exist. The following table documents under which conditions you will see the carrier verification window. The Display Flag is set in the defaults.ini file, using 'VGEM SHOWBLANKCARRIER'.

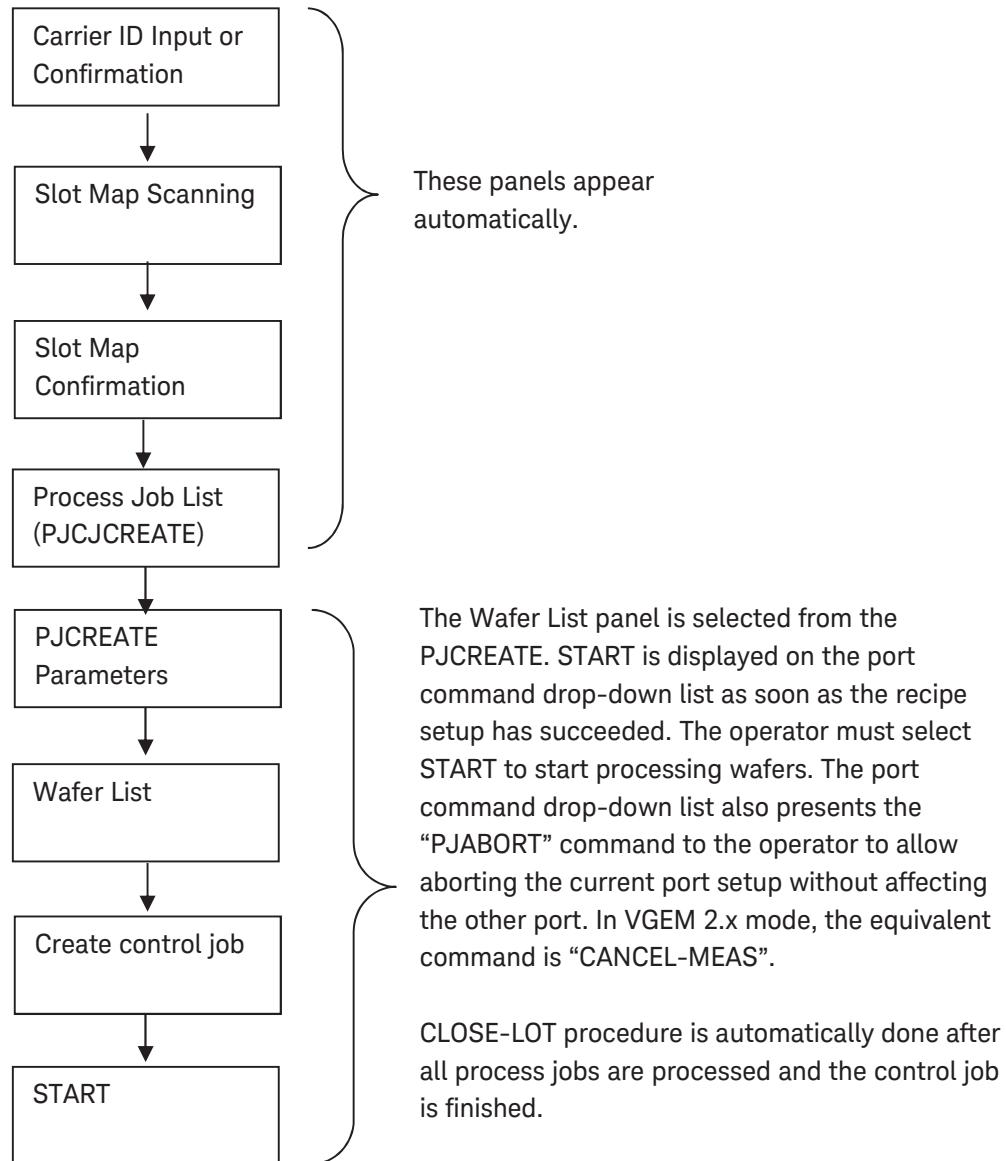
Host in Charge	Bind in Process	CarrierID from Prober	Display Flag	Action
Y	Y	Matches Bind CarrierID	NA	No window
Y	Y	Does not match Bind CarrierID and not blank	NA	Window with Prober CarrierID
Y	Y	Blank	Y	Window prompts for CarrierID

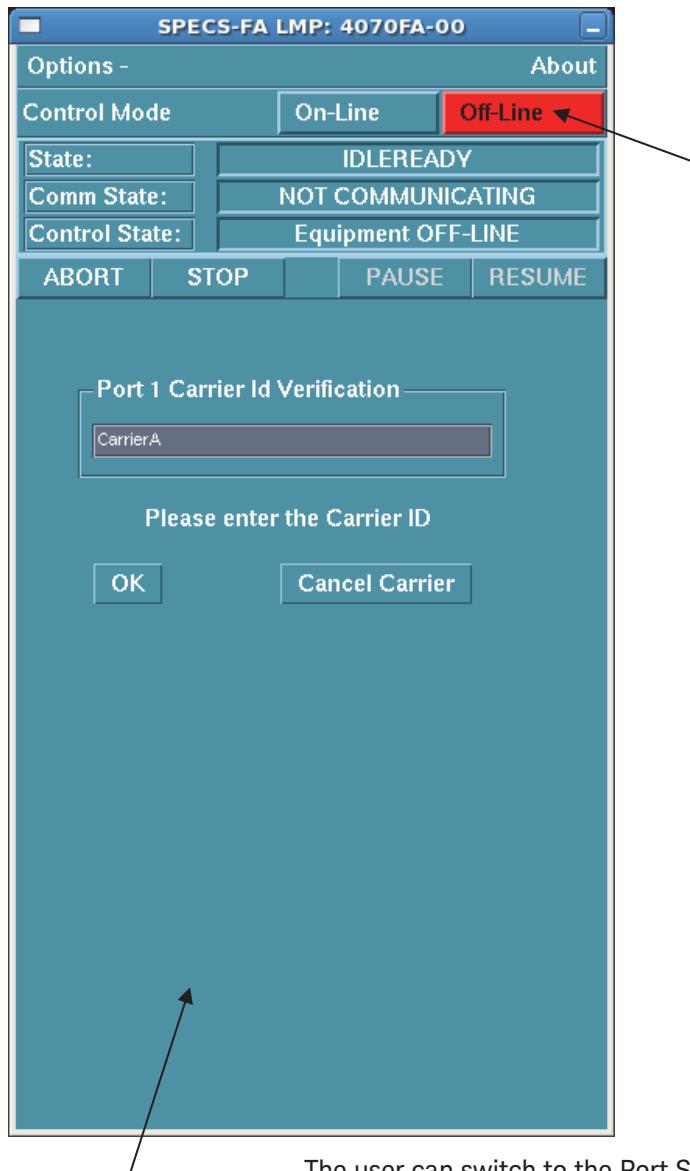
Host in Charge	Bind in Process	CarrierID from Prober	Display Flag	Action
Y	Y	Blank	N	No window
Y	N	Blank	Y	Window prompts for CarrierID
Y	N	Blank	N	No window
Y	N	Not Blank	NA	No Window
N	Y	Matches Bind CarrierID	NA	No Window
N	Y	Does not match Bind CarrierID and not blank	NA	Window with Prober CarrierID
N	Y	Blank	NA	Window prompts for CarrierID
N	N	Blank	NA	Window prompts for CarrierID
N	N	Not Blank	NA	Window with Prober CarrierID

### 3.3. Using the LMP to process a FOUP in local mode

In SPECS-FA, the LMP was redesigned to always present the next logical process step to the operator. The Carrier ID, the Slot Map, PJCJCREATE and Wafer List windows now appear as panels within the main LMP window.

Normal sequence of panels presented to the operator

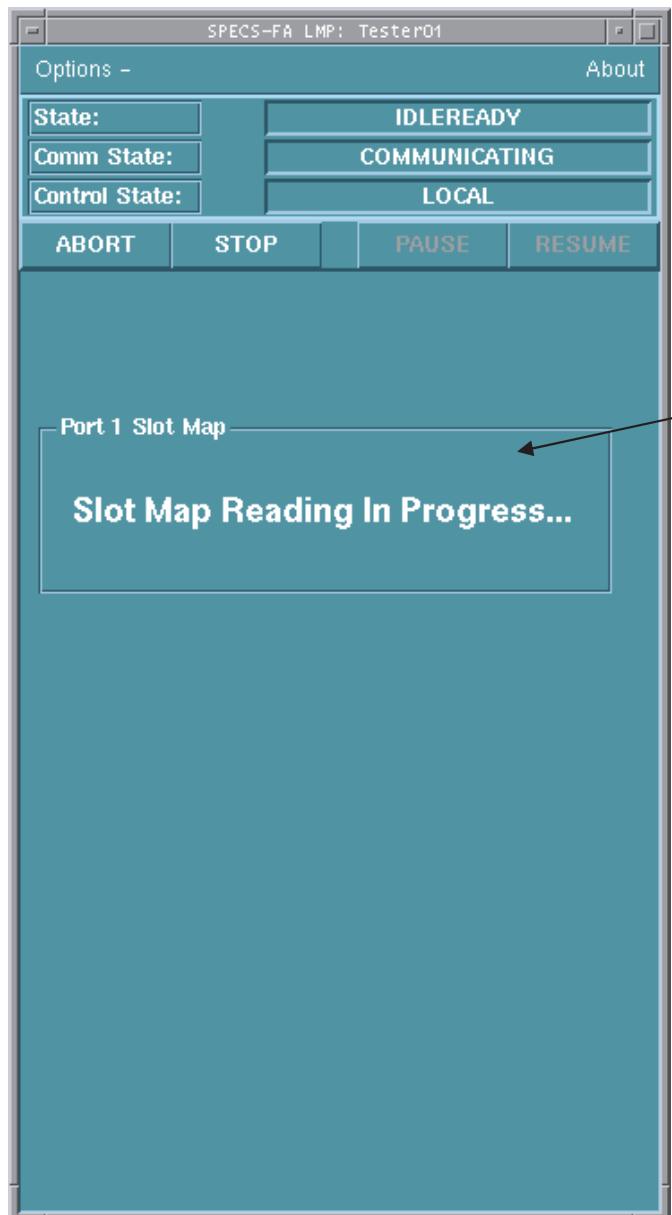




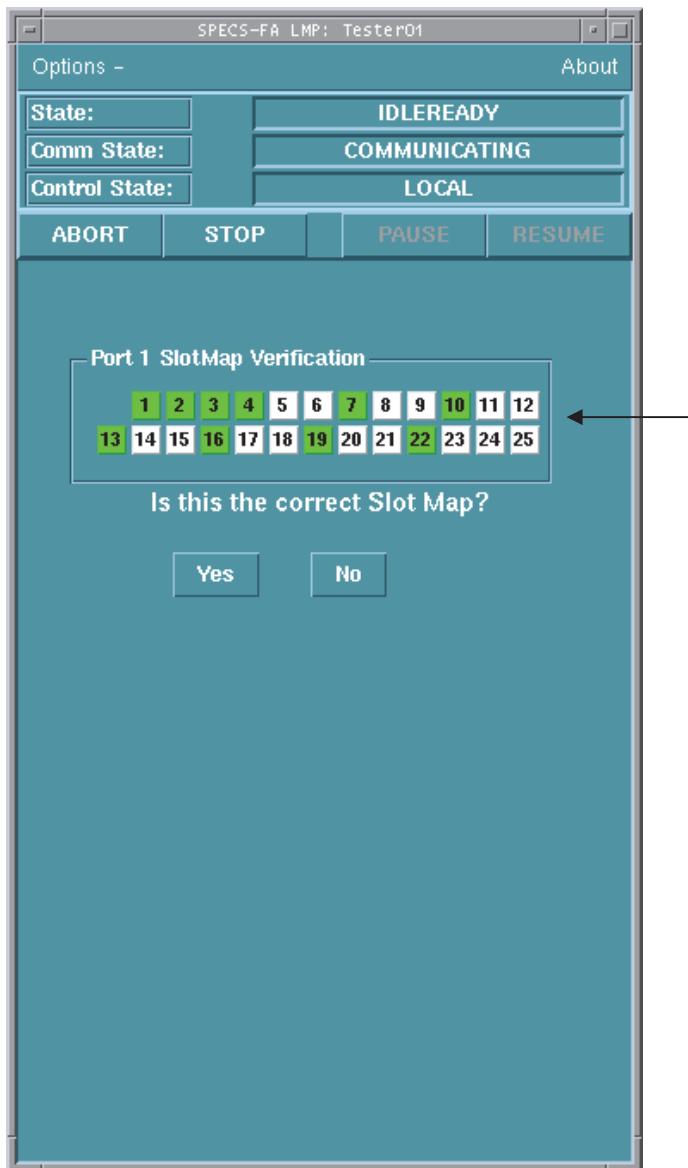
If a terminal services message is displayed when a user panel covers the Port Status window, the State display text will turn yellow. If an alarm is also set, the State background will turn red.

**View Port 1**  
**View Port 2**  
**View Port Status**

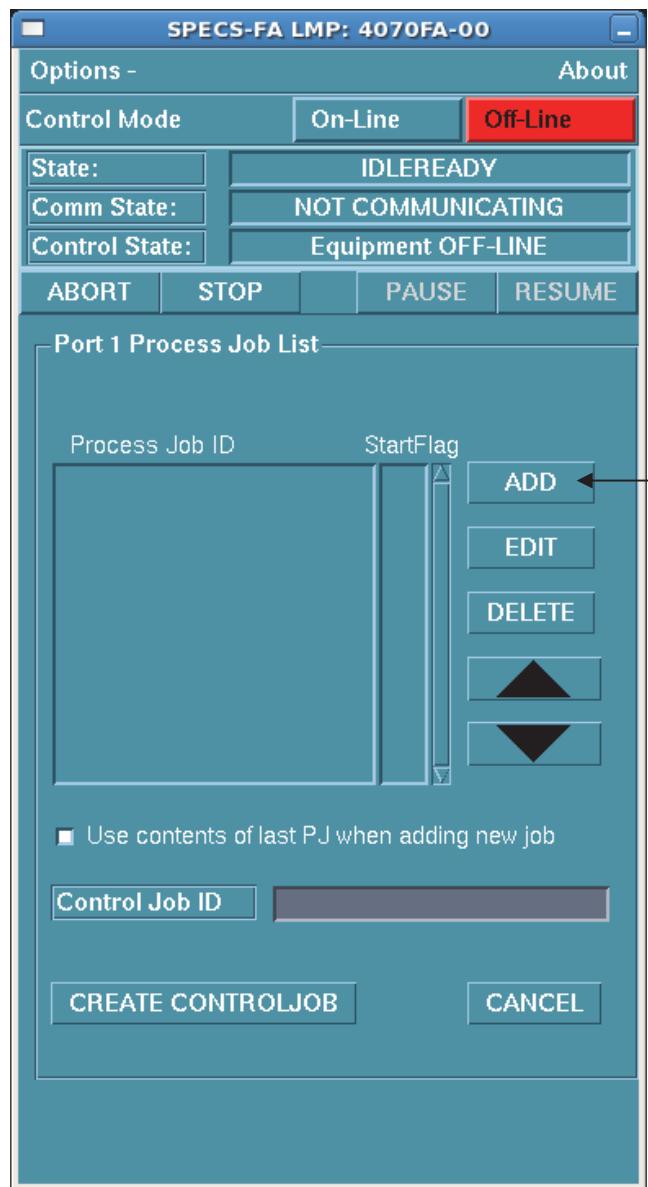
The user can switch to the Port Status panel by clicking on the right-mouse button. A small pop-up menu will appear and allow switching between a user panel on port 1, 2 or the Port Status.



This panel informs the operator that the equipment is reading the slot map. A typical slot map scanning takes several seconds.

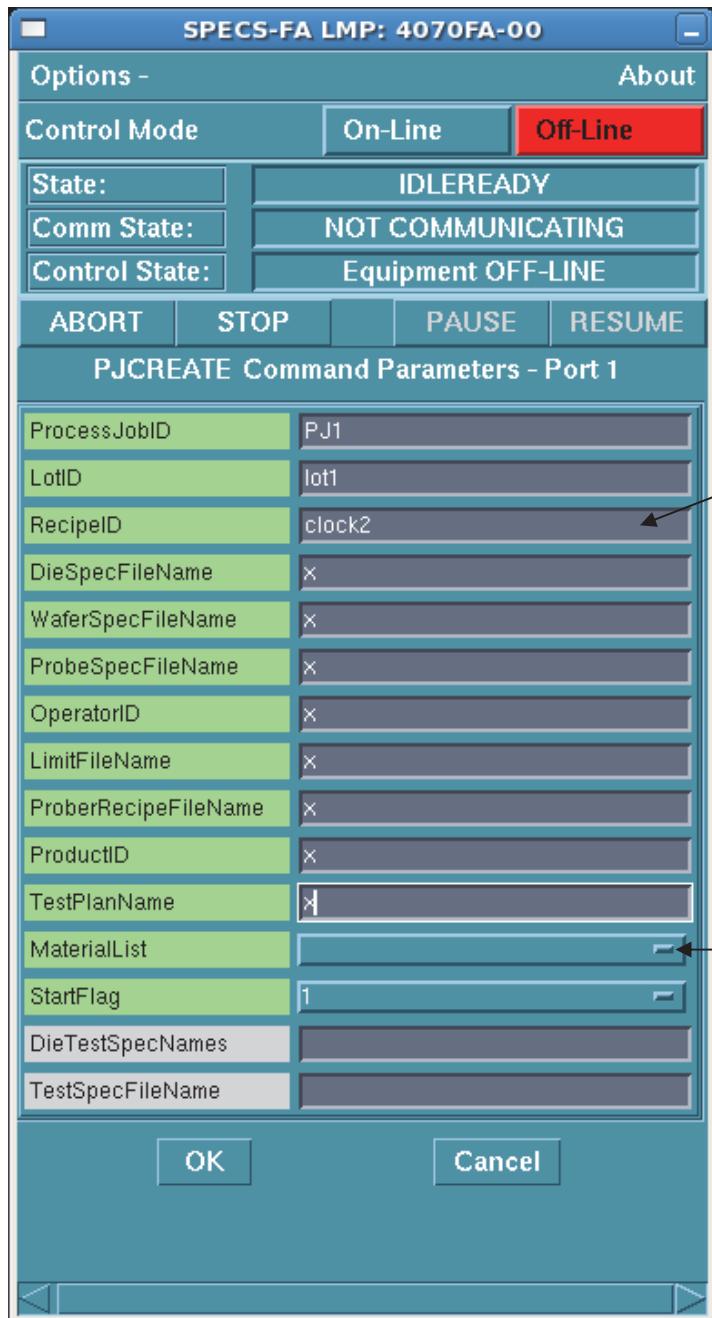


This panel requests the operator to confirm the slotmap. Slots displayed in green contain good wafers as reported by the prober. White slots are empty.



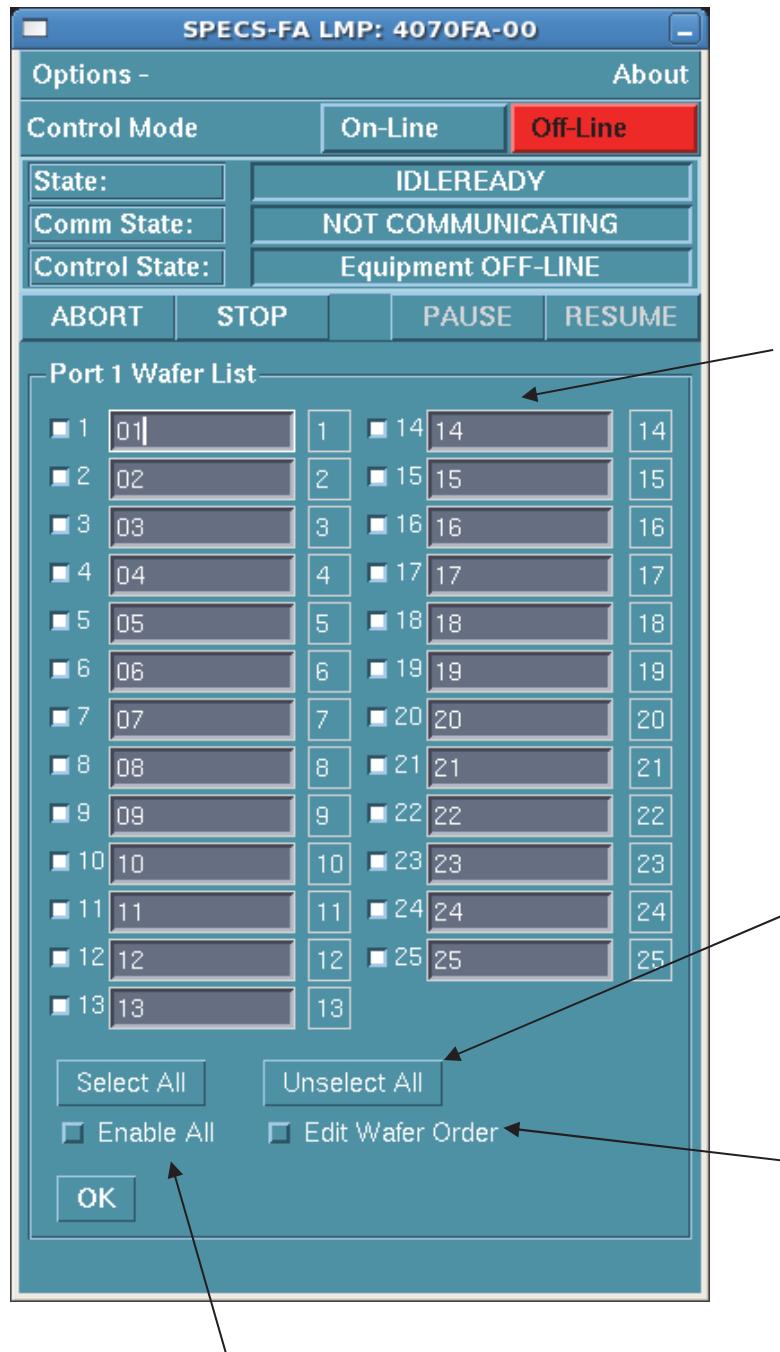
This panel shows the process job list.

Clicking the ADD button shows the parameter entry page of PJCREATE.  
See next page.



This panel appears after the user has selected the ADD or EDIT button in the Process Job List page. The parameters list is configurable by editing the parameters.csv table. It is expected that the end-user will customizable this list (this implies a customization of the SPECS framework).

The Wafer List Panel is selected from this button. See next page.

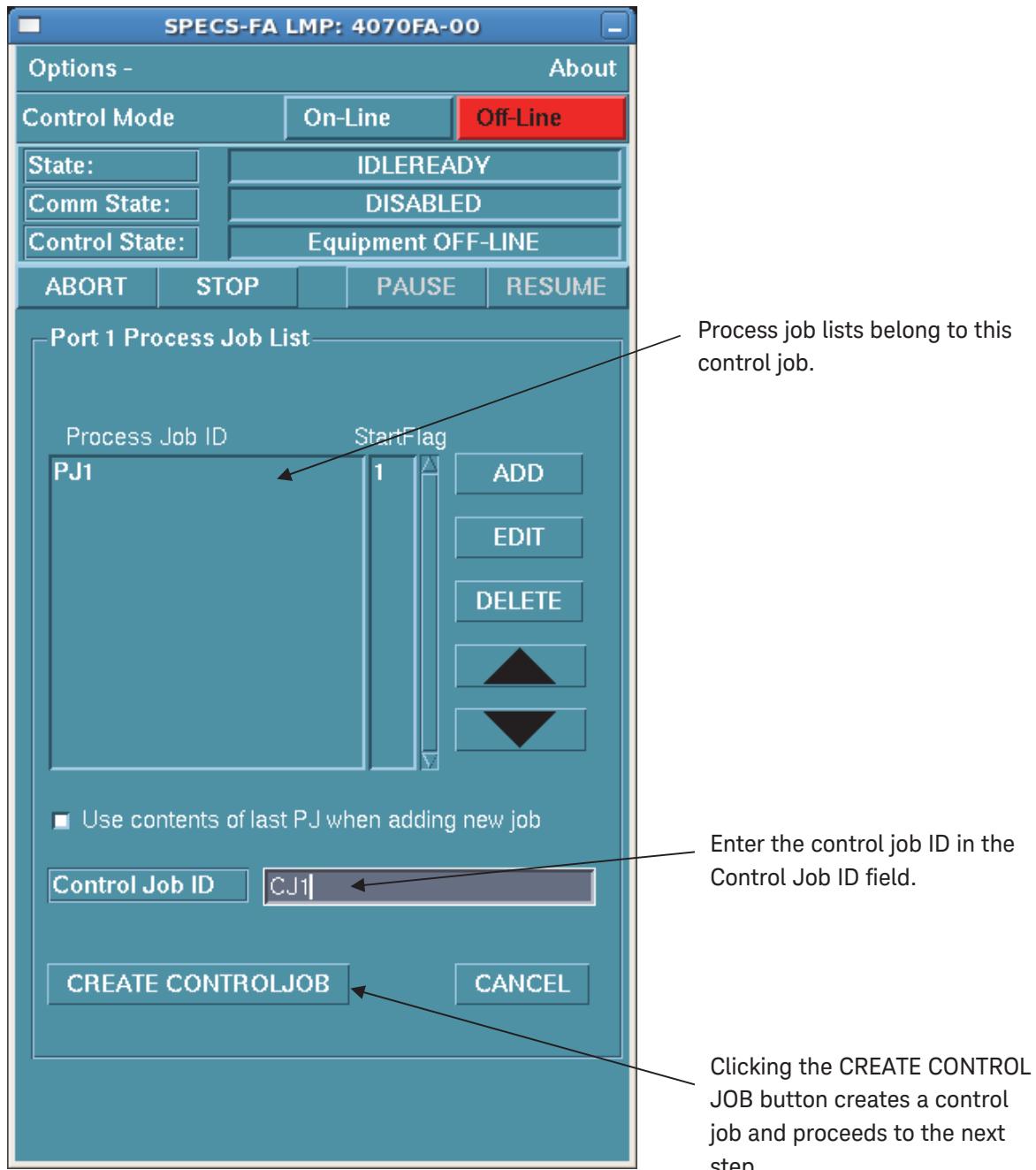


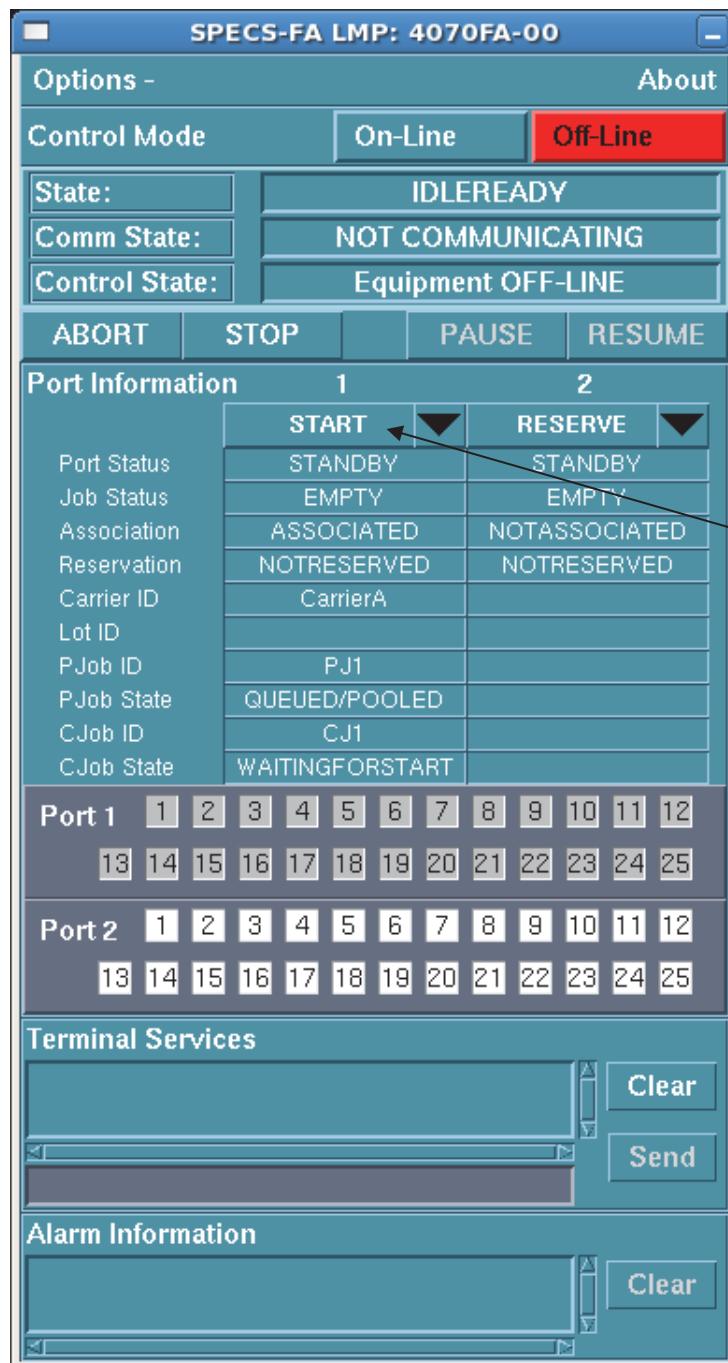
This panel is selected from the PJCREATE panel. It allows the operator to select a list of wafers. A wafer is selected by clicking on the toggle button placed on the left of each slot entry. By default, the good wafers identified in the slot map are selected.

The “Select All” button allows to select all wafers. The “Unselect All” button unselects all wafers.

The “Edit Wafer Order” allows the operator to specify a random order when creating the wafer list. When this button is not selected, the wafer list is ordered from the lowest slot number to the highest.

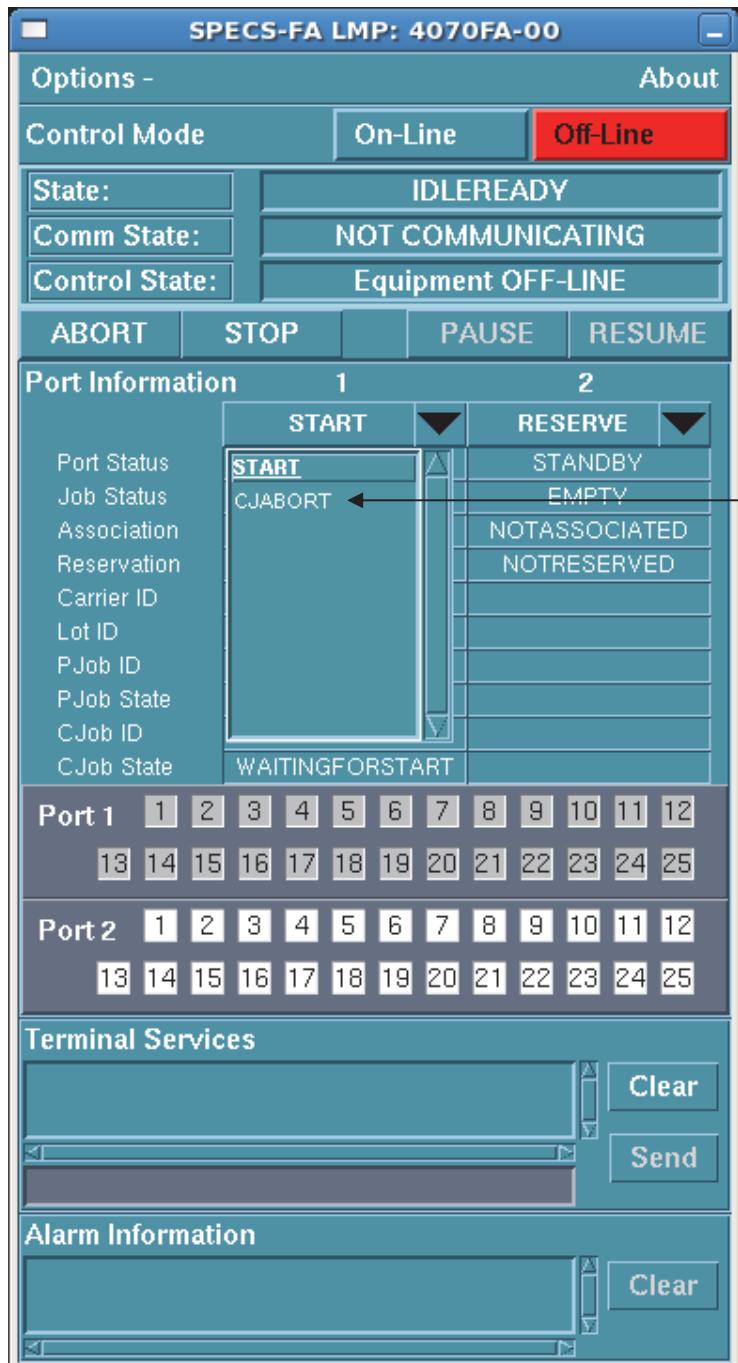
The “Enable All” button allows enable “orphan” wafers that are not part of the slotmap.



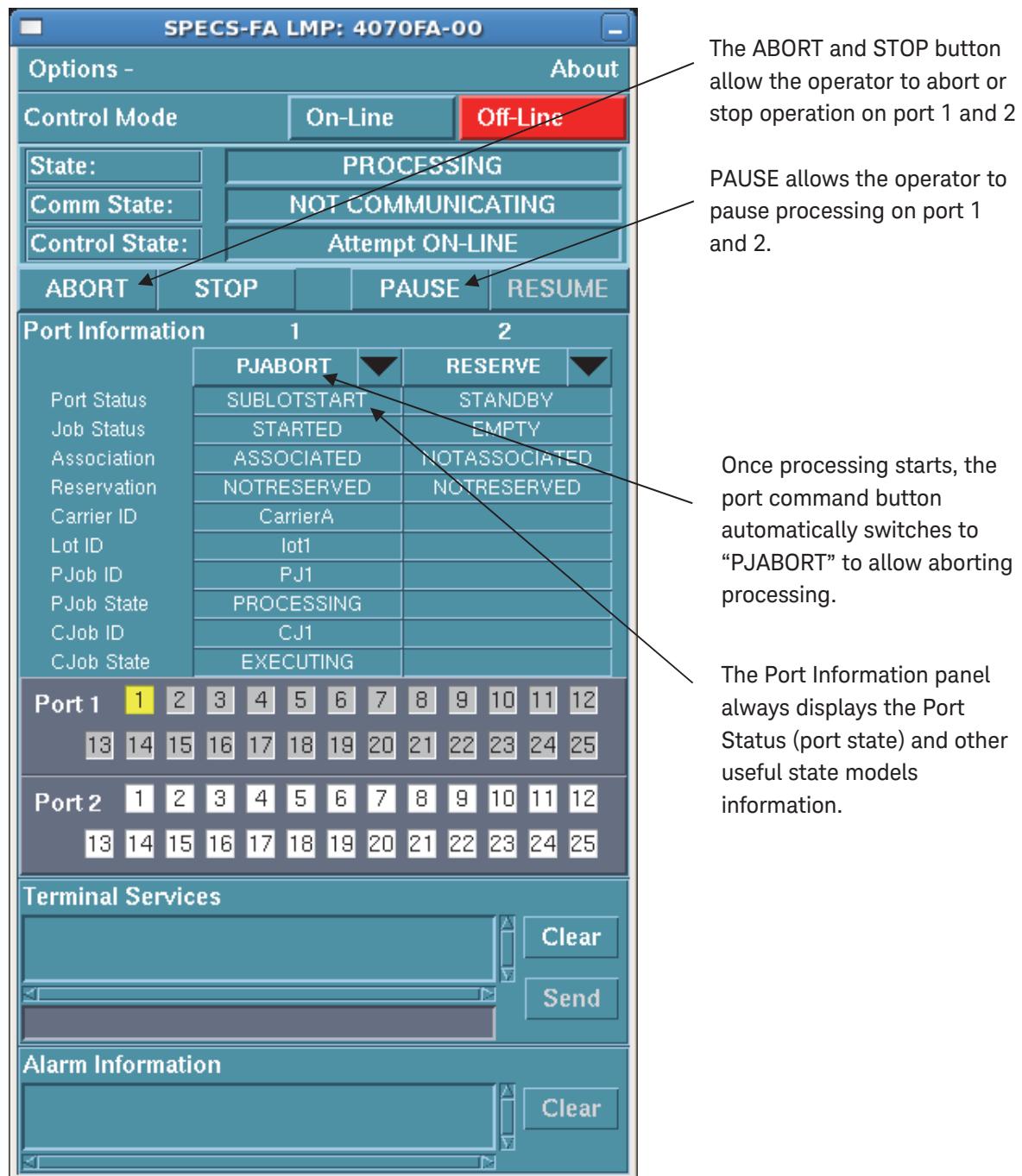


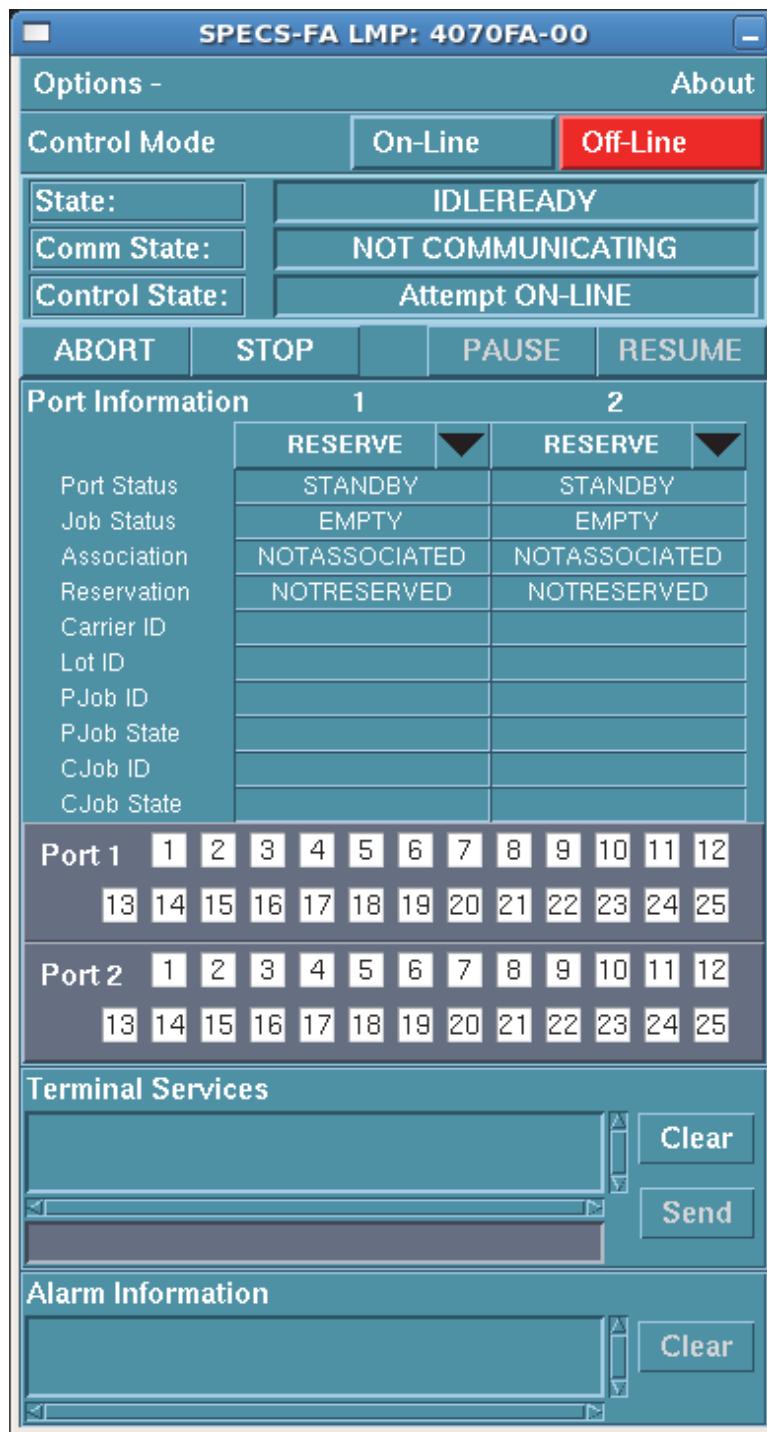
Once the setup has been successfully verified, we go back to the Port Status window. As shown in this example, the port 1 command button now displays the "START" command.

The operator must click on "START" to start processing.



The operator has an option at this point to cancel the START command by selecting the "CJABORT" command (control job abort). CJABORT is selected from the drop-down list. Once the selection has been confirmed, the operator must click on the button.





Once all the process jobs complete, the control job automatically finishes to make the FOUP undock from the load port of the prober.

### 3.4. How to customize the LMP

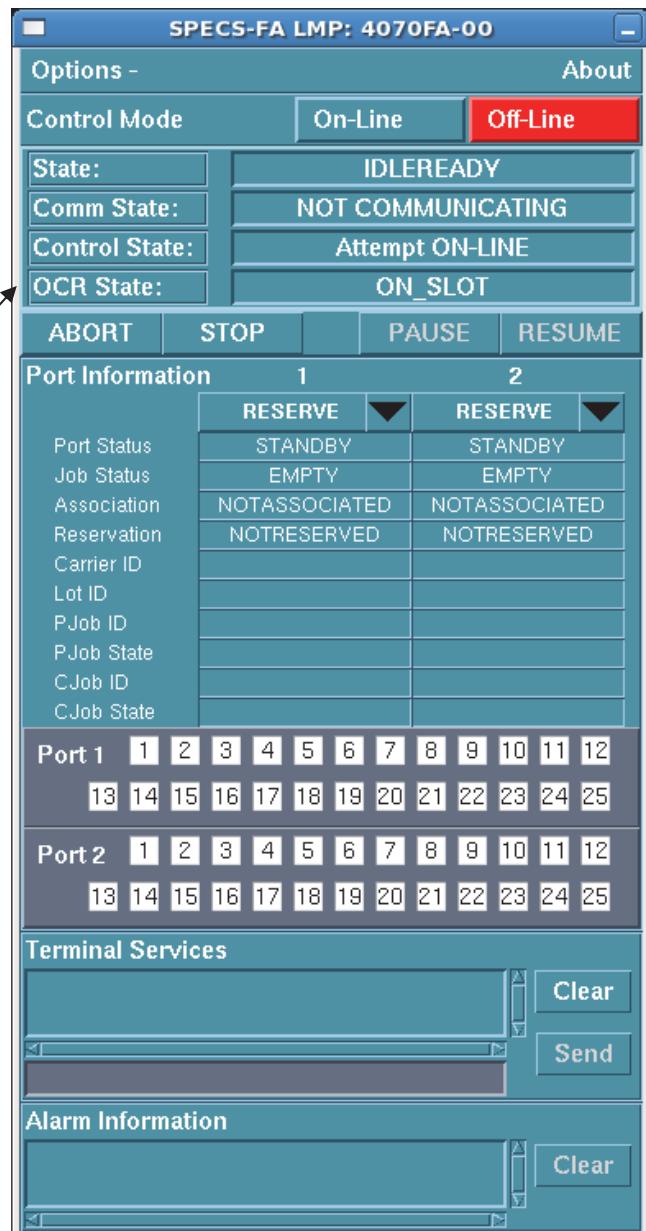
This section explains how to customize the Local Management Panel.

The LMP display can be configured by modifying the LMP\_configuration.csv file. We recommend to use the factory defaults except for setting the single or dual port configuration and the OCR display.

DualPort 0 = single port configuration  
DualPort 1 = dual port configuration

ShowOCRState 0 = don't show OCR state  
ShowOCRState 1 = show OCR state

The default setting of OCR state is defined by the setting of 'VGEM CurrentOCRState' parameter of the 'defaults.ini' file in the /opt/SPECS\_FA/dmh/vgem directory.





## Chapter 4. How to Implement a E40/E94 Host Interface

### 4.1. Overview

The chapter describes how Keysight has implemented an E40/E94 host interface within the context of the SEMI Automation Standards as related to material movement and testing in a 300 mm Fab. It is not meant as a comprehensive training text for factory host interfaces and assumes a strong knowledge of the SEMI Standards referenced as well as a comprehension of basic factory automation.

### 4.2. The 300 mm Fab and SEMI Standards

Within a 300 mm FAB, the purpose of SEMI Standards is to standardize the connectivity between the tools when moving carriers (FOUP) from one process tool to another. There are standards for hardware and software. The key concept is that of a processing tool. A processing tool is a tool that performs a manufacturing process step (or steps).

For instance, in 300mm fabs, the industry has standardized on a type of protective wafer carrier called a Front-Opening Unified Pod (FOUP). FOUPs can be moved around using automatic guided vehicles (AGV) or overhead transports (OHT). The E84 Standard defines the hardware protocol handshaking between the system that delivers a FOUP (AGV or OHT) and the load port attached to the tool that processes the wafers.

The E87 Standard defines how to manage a carrier (FOUP). It defines the services, objects and state models used to bind a carrier to a port, verify its identification and slot map, and release it after processing has completed.

The E90 Standard defines the tracking of substrates (wafers) inside the processing equipment. In the case of the TEL prober, it allows tracking the location of each wafer inside the prober, from the carrier slot map to the main chuck.

E94 (Control Job) and E40 (Process Job) define the services, state models and objects used to control the process tool and track it.

E5/E37/E30 define the communication protocol (SECS/GEM) used to carry the services described in E40, E87, E90, E94, etc.

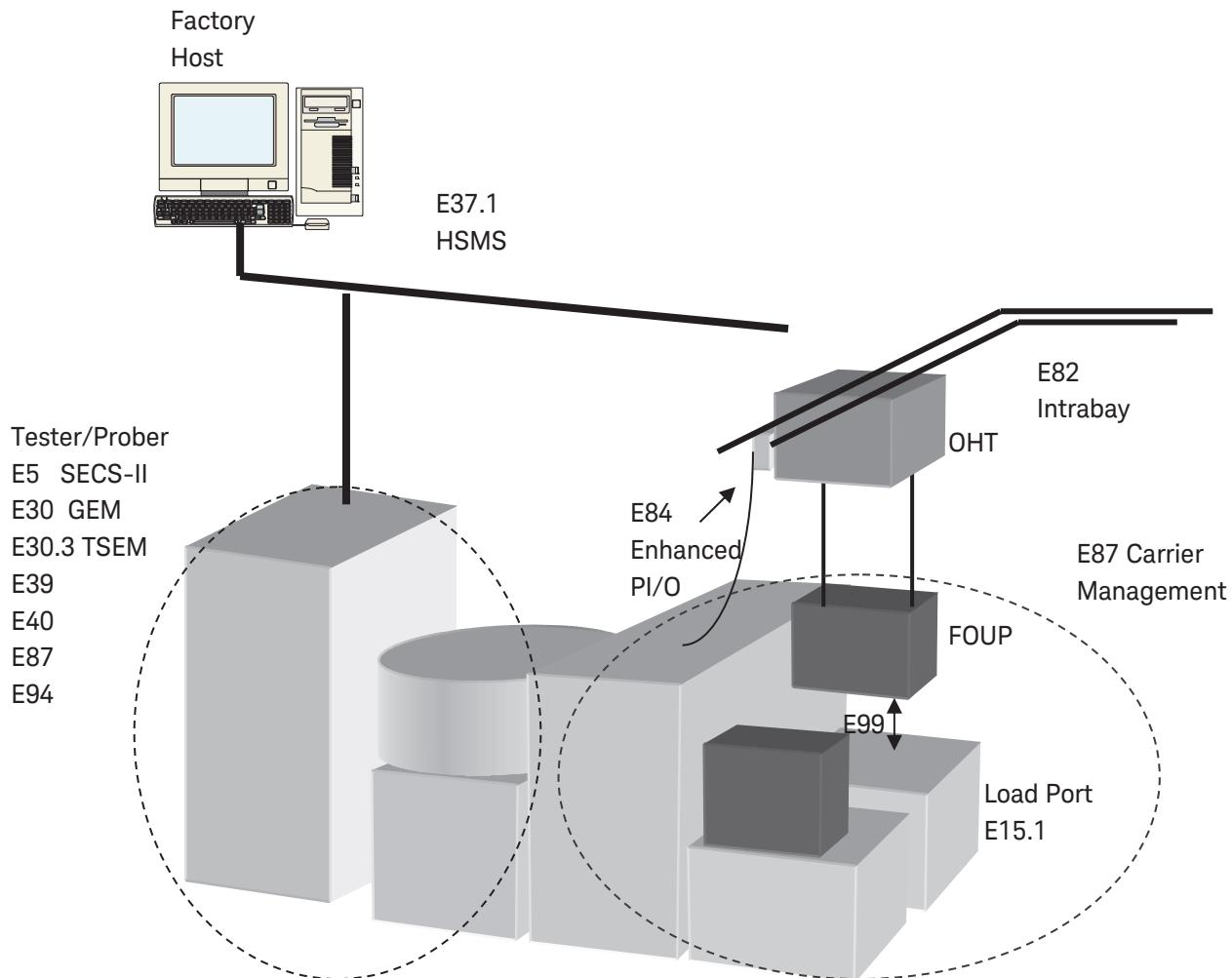
#### 4.2.1. The Keysight Parametric Test System

In a test environment, the concept of a processing tool challenges most popular definitions of tester and prober. Within the 300 mm / SEMI Standards context, the single processing tool consist of the Keysight Parametric Test System and the TEL Wafer Prober with its associated Load Port(s) as shown in Figure 4-1.

This is because it requires the combination of both the Keysight tester and the TEL prober to perform the test process. While the tester does the actual testing, the prober provides the means to move the material (wafers/Die) to and from the test site while the Load Port moves material (FOUPs) into and out of the “process tool”.

Keysight has recognized the need for a comprehensive “single wire” interface to the test tool and has developed the SPECS-FA software using Keysight’s virtual GEM technology to provide such an interface for the factory Host Controller. This has been a joint development effort with TEL.

Figure 4-1.



### 4.3. The SEMATECH 300mm Scenarios

SEMAtech has published useful 300 mm scenarios for fixed and internal buffer equipment. Although VGEM supports the creation of a process job and control job prior to the FOUP arrival, this user's guide will focus on the SEMATECH fixed buffer base scenarios.

The SEMATECH 300mm scenarios can be obtained at the following URL:

<http://www.sematech.org/public/resources/ia/>

### 4.4. High-Level View of the Processing Flow

This section will put in perspective the E40/E94 implementation with the other relevant SEMI Standards.

1. E87- Host sends a S3F17 Bind command to VGEM. This means that a port is bound to a Carrier ID specified by the host and is reserved for future operation.

E87- Material (FOUP) arrives at the port. The Carrier ID is read and compared with the ID provided earlier on the Bind command. If there is a match, a collection event id like CID Equipment Verify OK is sent to the host. Then the slot map is read and compared with the slot map provided on the Bind command. If there is a match, a collection event ID SMAP Equipment Verify OK is sent to the host.

The E87 defines scenarios and commands for exception cases when the carrier id or the slot map does not match the values provided on the Bind command.

2. As shown in the 300 mm SEMATECH scenario, the host will create the process jobs and control job after the material has been verified.

E40 – Host sends S16F3 or S16F11 or S16F13 or S16F15 to create one or more process jobs.

E39 – Host sends S14F9 to create a Control Job object.

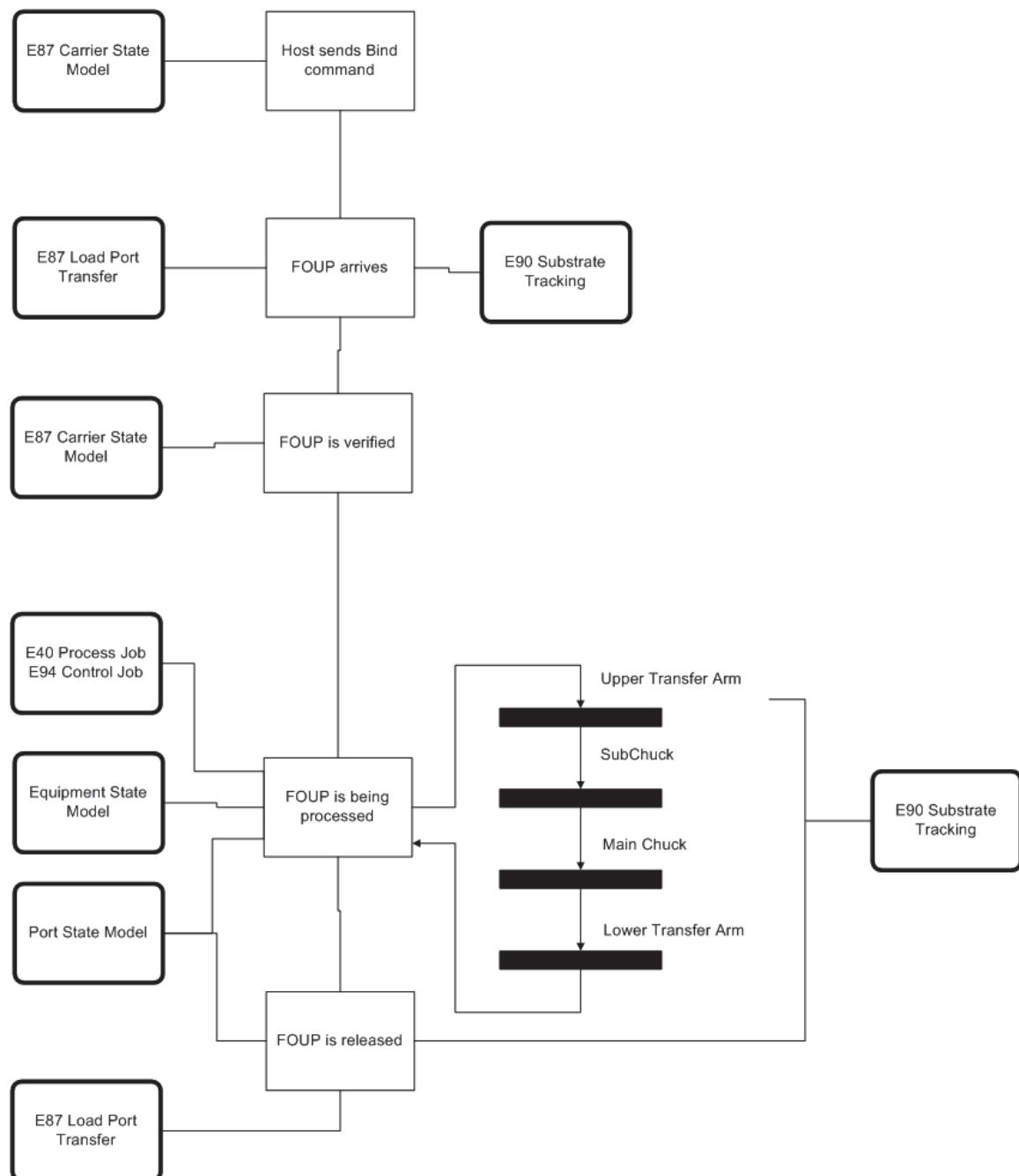
The Control Job gets SELECTED and goes into the EXECUTING state. The first process job in its list goes into the SETTING UP state.

3. E40/E94, E87, E90 - Processing starts.
4. E40/E94, E87, E90 - Processing completes. Process Jobs and Control job are deleted.
5. E87 – The host sends a S3F17 CarrierRelease to VGEM. The FOUP is released and is ready to be removed from the load port.

Chapter 14 provides the detailed E40/E94 scenarios.

Figure 4-2

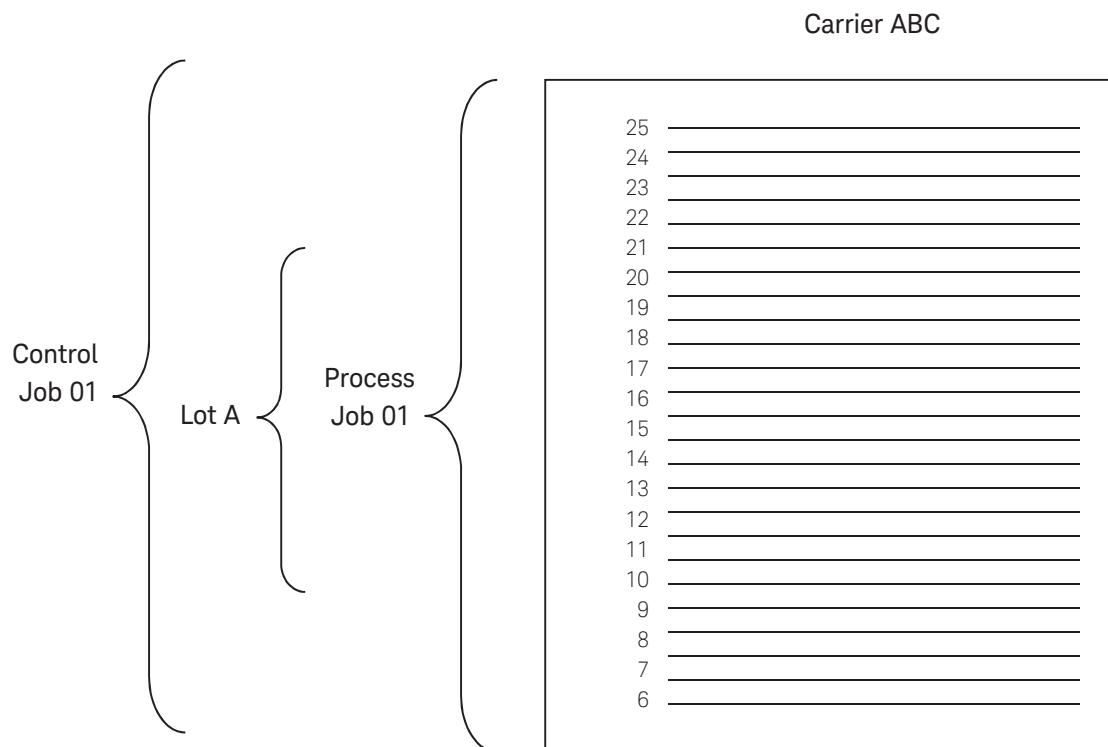
State Models relationship when processing a carrier



#### 4.5. One Control Job and One Process Job per Carrier, Same Lot

In this scenario, 1 process job controlled by 1 control job processes all the wafers in the carrier with the same test recipe. All wafers belong to the same lot.

As soon as a carrier is loaded on the load port and has been verified, the control job starts executing the process job. Once all wafers have completed processing, the Port state goes into “PENDING COMPLETE”. Since there are no more jobs, the control job completes processing and the carrier is released from the load port.



Let's see how this scenario translates into SECS messages between the host and VGEM.

For this example, let's assume that the system is equipped with a carrier id reader and that we want to use the Bind scenario. The E87 Bind service allows the host to bind a port to a carrier ID, in other words, reserve the port for future processing on a given carrier.

If the port is ready to load, the host is allowed to send a S3F17 Bind command to VGEM.

Reading the status variable 75559 LP1PortTransferState (port 1) and 75591 LP2PortTransferState (port 2) can determine the state of the port.

### ***Getting the load port transfer state***

Example for reading the load port transfer state of port 1:

```
S1F3 <L
    <U4 75559>
    >

S1F4 <L
    <U1 state>
    >
```

Where state can be:

- 0 = OUT OF SERVICE
- 1 = TRANSFER BLOCKED
- 2 = READY TO LOAD
- 3 = READY TO UNLOAD

Another way for the host to determine the state of the port is to use CEID 14008, which indicates that the port is ready to load (normally, this CEID will be associated with a report that contains the port ID (1 or 2), which is variable 1370).

### ***Sending a Bind command***

If the load port transfer state is "READY TO LOAD", the port reservation state is NOT RESERVED and the port association state is NOT ASSOCIATED, the host is allowed to bind the port.

Example of a Bind command (note that the ContentMap and SlotMap attributes are used by VGEM to create a wafer list):

```
S3F17 <L:5
    <U4 1>                      /* DATAID */
    <A "Bind">                   /* Carrier Action */
    <A "CarrierA">              /* Carrier ID */
    <U1 1>                      /* Port ID 1 or 2 */
    <L:1
        <L:2
            <A "ContentMap">      /* Content Map attribute */
            <L:25
                <L:2
                    <A "lot1234">    /* lot ID */
```

```

        <A "wafer01">      /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer02">      /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer03">      /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer04">      /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer05">      /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer06">      /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer07">      /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer08">      /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer09">      /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer10">      /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer11">      /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer12">      /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer13">      /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer14">      /* wafer ID */
>
<L:2

```

```

        <A "lot1234">      /* lot ID */
        <A "wafer15">     /* wafer ID */
    >
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer16">     /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer17">     /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer18">     /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer19">     /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer20">     /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer21">     /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer22">     /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer23">     /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer24">     /* wafer ID */
>
<L:2
    <A "lot1234">      /* lot ID */
    <A "wafer25">     /* wafer ID */
>
>
<L:2
    <A "SlotMap">       /* Slot Map attribute */
<L:25
    <U1 3>              /* 1 = empty, 3 = wafer present */
    <U1 3>
    <U1 3>
```

```
<U1 3>
>
>
>
>
>
>
>
>
S3F18 <L:2
    <U1 0>                      /* 0 = Command has been performed */
    <L:0 >
>
```

Note: A return code 0 or 4 is usually OK on S3F17 Carrier Action. 4 means that the action will be performed later and confirmed with a CEID.

#### *A FOUP is loaded on the port*

When a FOUP is loaded on the port, VGEM will report to the host several Collection Event IDs.

14006 is sent immediately, indicating that the load port transfer state is blocked. If the Carrier ID read by the equipment matches the Carrier ID supplied on the Bind command, VGEM will send the 14506 CEID (ID VERIFICATION OK).

After 14506 has been sent by VGEM, the equipment will read the slot map. If it matches the slot map supplied on the Bind command, VGEM will send the 14513 CEID.

See the Chapter 8 State Models in the VGEM User's Guide to obtain a description of the various Carrier ID and Slot Map scenarios, like when the Carrier ID reading failed.

#### *Creating a Process Job*

After verification of the carrier ID and slot map, the host can create process jobs on the equipment.

There are several ways of creating a process job. The following services are supported by VGEM:

Service	SECS Message
---------	--------------

PRJobCreate	S16F3
PRJobCreateEnh	S16F11
PRJobDuplicateCreate	S16F13
PRJobMultiCreate	S16F15

Example for PRJobCreateEnh:

```

S16F11 <L:7
    <U4 1>                      /* data ID */
    <A "1234">                  /* process job ID */
    <B 0xD>                      /* MF (material format) = 13 (carrier) */
    <L:1
        <L:2
            <A "CarrierA">          /* carrier Id */
            <L:2
                <U1 1>              /* slot ID */
                <U1 2>              /* slot ID */
            >
        >
    >
    <L:3
        <U1 2>                      /* recipe with variable tuning */
        <A "clock1">
    <L:9
        <L:2
            <A "OperatorID">
            <A "1">
        >
        <L:2
            <A "ProberRecipeFileName">
            <A "TEST01">
        >
        <L:2
            <A "TestPlanName">
            <A "demo">
        >
        <L:2
            <A "LimitFileName">
            <A "1">
        >
        <L:2
            <A "WaferSpecFileName">
            <A "1">
        >
        <L:2
            <A "ProbeSpecFileName">
            <A "1">
        >
        <L:2
            <A "TestSpecFileName">
            <A "1">
        >

```

```

<L:2
  <A "ProductID">
  <A "1">
>
<L:2
  <A "DieSpecFileName">
  <A "1">
>
>
<TF TRUE>          /* autostart */
<L:1                /* pause event list of CEID */
  <U4 5703>
>
>

S16F12 <L:2
  <A:4 "1234">
  <L:2
    <TF 1>
    <L:0 >
  >
>

```

*It is important to note that in the VGEM environment, a process job cannot span more than 1 carrier. It can however specify one or more wafers to process.*

See Chapter 5, section 5.7 – Process Job Creation for details on the process job parameters and the various scenarios supported by VGEM.

For each process job created, VGEM will send a collection event ID 5901. See section 5.4 – Process Job Events for details.

### ***Creating a Control Job***

Process Jobs defined in a Control Job must exist prior to the creation of the Control Job.

A Control Job is created with the E39 S14F9 service.

```

S14F9 <L:3
  <A "Equipment">          /* objspec */
  <A "ControlJob">          /* objtype */
  <L:6
    <L:2
      <A "ObjID">
      <A "ControlJob001">
    >
    <L:2
      <A "ProcessingCtrlSpec">
      <L:1
        <L:3
          <A "1234">          /* process job ID */
          <L:1                /* optional control rule */
          <L:2                /* used in Adaptive Test Scenario 15.1.21 */
        <L:2
      >
    >
  >

```

```

        <A "StartFlag">
          <U1 1>           /* Execution Level ranges from 0 to 8 */
        >
        >
        <L:0 >             /*output rule is always empty */
      >
    >
  >
<L:2
  <A "CarrierInputSpec">
  <L:1
    <A "CarrierA">
  >
  >
<L:2
  <A "ProcessOrderMgmt">
    <U1 0>           /* only LIST is supported */
  >
<L:2
  <A "StartMethod">
    <TF TRUE>
  >
<L:2
  <A "PauseEvent">
    <L:1
      <U4 5704>
    >
    >
  >
>
S14F10 <L:3
  <A "OBJSPEC">
  <L:6
    <L:2
      <A "ObjID">
      <A "ControlJob001">
    >
    <L:2
      <A "ProcessingCtrlSpec">
        <L:1
          <L:3
            <A "1234">           /* process job ID */
            <L:1>                 /* optional control rule */
              <L:2
                <A "StartFlag">
                  <U1 1>           /* Execution Level ranges from 0 to 8 */
                >
              >
            <L:0 >             /* output rule is always empty */
          >
        >
      >
    >
  <L:2
    <A "CarrierInputSpec">
    <L:1

```

```

        <A "CarrierA">
    >
<L:2
    <A "ProcessOrderMgmt">
        <U1 0>          /* only LIST is supported */
    >
<L:2
    <A "StartMethod">
        <TF 1>
    >
<L:2
    <A "PauseEvent">
        <L:1
            <U4 5704>
        >
    >
<L:2
    <U1 0>
    <L:0 >
    >
>

```

### *Processing starts*

Once the process job and control job have been successfully created, and material has been verified, the Control Job (on port 1 or 2 where the first FOUP arrived) gets SELECTED and goes into the EXECUTING state.

In this state, the Control Job will start the first job specified by the ProcessingCtrlSpec list.

Let's examine in details what happens when a Process Job is started. When a Process Job is created, it is put in the QUEUED/POOLED state. As soon as the Control Job goes into the EXECUTING state, the first Process Job in the list goes into the SETTING UP state.

At this point, the recipe parameters are verified by the equipment. If there is a setup failure caused by invalid parameters, VGEM will send a CEID 5164 (Port State Model PPBadCompile event) to the host. Data Variable 1395 can be attached in a report with event 5164 to report why the recipe setup failed.

After a setup failure, the port state goes back to STANDBY. All the process jobs and control job associated to the port are self-aborted and deleted from VGEM. The host can decide to recreate the process jobs and control job or to release the FOUP with a S3F17 CarrierRelease message to VGEM.

### *Processing is complete*

Processing completes on a given port when the associated Control Job completes processing of all its Process Jobs.

CEID 5907 is sent to the host when the Process Job is deleted from the VGEM.

CEID 5813 is sent to the host when the Control Job is deleted from the VGEM. The VGEM will also send CEID 14519 (Carrier Access Complete) and 13004 (Port 1 Access End) or 13104 (Port 2 Access End).

The Equipment state model goes into the RELEASING state.

#### ***Carrier is released***

Since the VGEM maintains several state models and consequently will send multiple CEIDs, it is recommended to use 13004 or 13104 as the trigger to use before releasing a carrier.

The CarrierRelease service is used to release the carrier.

```
S3F17 <L:5
    <U4 1>                  /* DATAID */
    <A "CarrierRelease">      /* Carrier Action */
    <A "CarrierA">           /* Carrier ID */
    <U1 1>                   /* Port ID 1 or 2 */
    <L:0 >
```

After the carrier is released, the VGEM will send CEID 14009 (Load Port Ready to Unload).

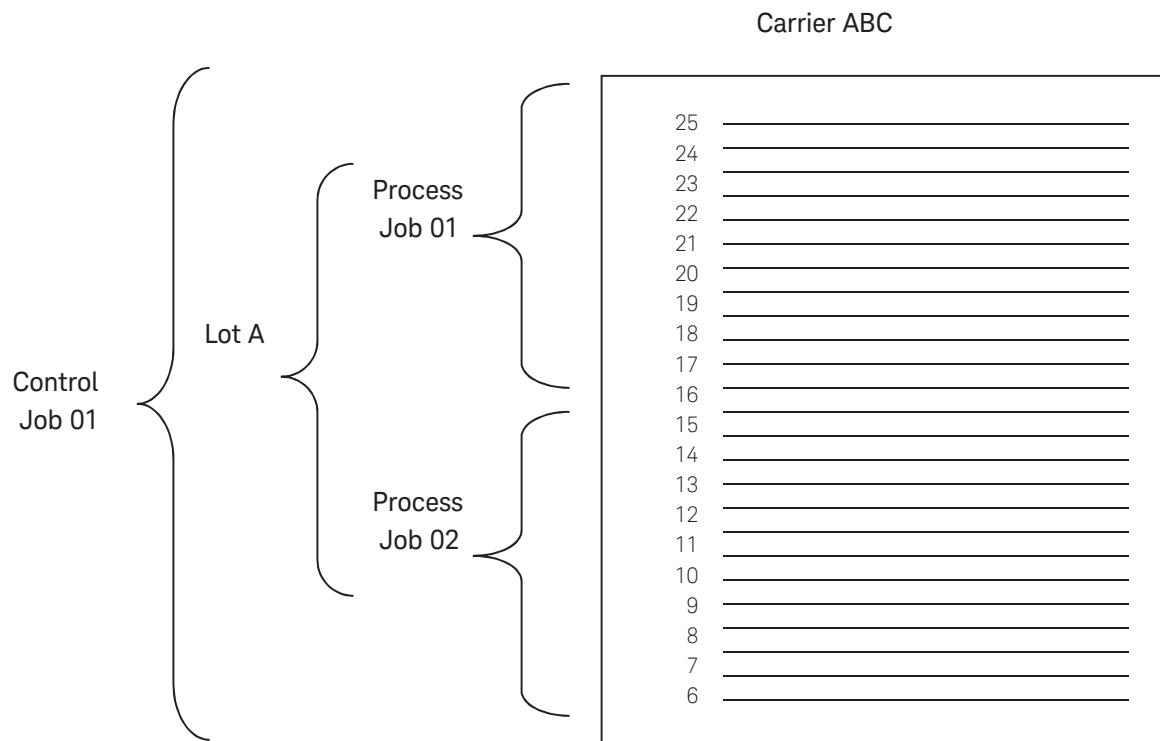
As soon as the FOUP is removed from the port, the VGEM will send the CEID 14008 (Load Port Ready to Load).

#### 4.6. One Control Job and Multiple Process Jobs per Carrier, Same Lot

In this scenario, 2 process jobs controlled by 1 control job process all the wafers in the carrier with the same test recipe. All wafers belong to the same lot.

As soon as a carrier is loaded on the load port, the control job starts executing the first process job in its list of process jobs. Once the first process job has completed processing, the Port state goes into “PENDINGCOMPLETE”. The first job is deleted and the second job starts executing. On the second job, the Port state model goes through the RESETUP, REREADY, STARTING, SUBLOTSTART, etc....sequence.

After the 2 process jobs complete processing, the control job completes processing and the carrier is released from the load port.



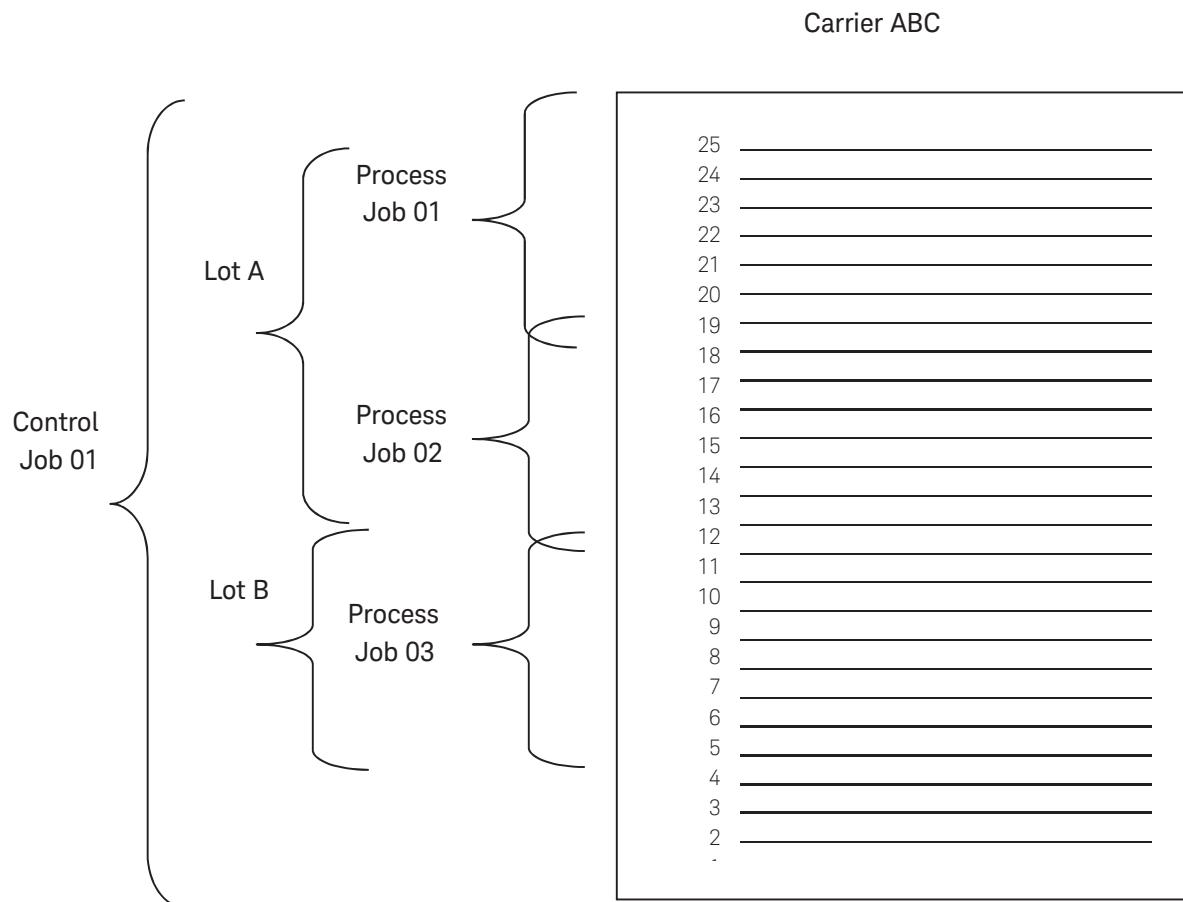
## 4.7. One Control Job and Multiple Process Jobs per Carrier, Multiple Lots

In this scenario, we have 3 process jobs controlled by 1 control job. Process Job 01 and 02 belongs to the same lot A. Process Job 03 belongs to Lot B.

As soon as a carrier is loaded on the load port, the control job starts executing the first process job (01) in its list of process jobs. Once the first process job has completed processing, the Port state goes into “PENDINGCOMPLETE”. The first job is deleted and the second job (02) starts executing. On the second job, the Port state model goes through the RESETUP, REREADY, STARTING, SUBLOTSTART, etc....sequence since it is part of the same lot.

Once process job 02 completes, the VGEM will make the decision in the PENDINGCOMPLETE state as to what should be the next step. Since the next process job (03) belongs to a different lot (B), the port state model will transition to LOTCOMPLETE and from there, to RESETUP, REREADY, STARTING, LOTSTART, etc....

After the 3 process jobs complete processing, the control job completes processing and the carrier is released from the load port.



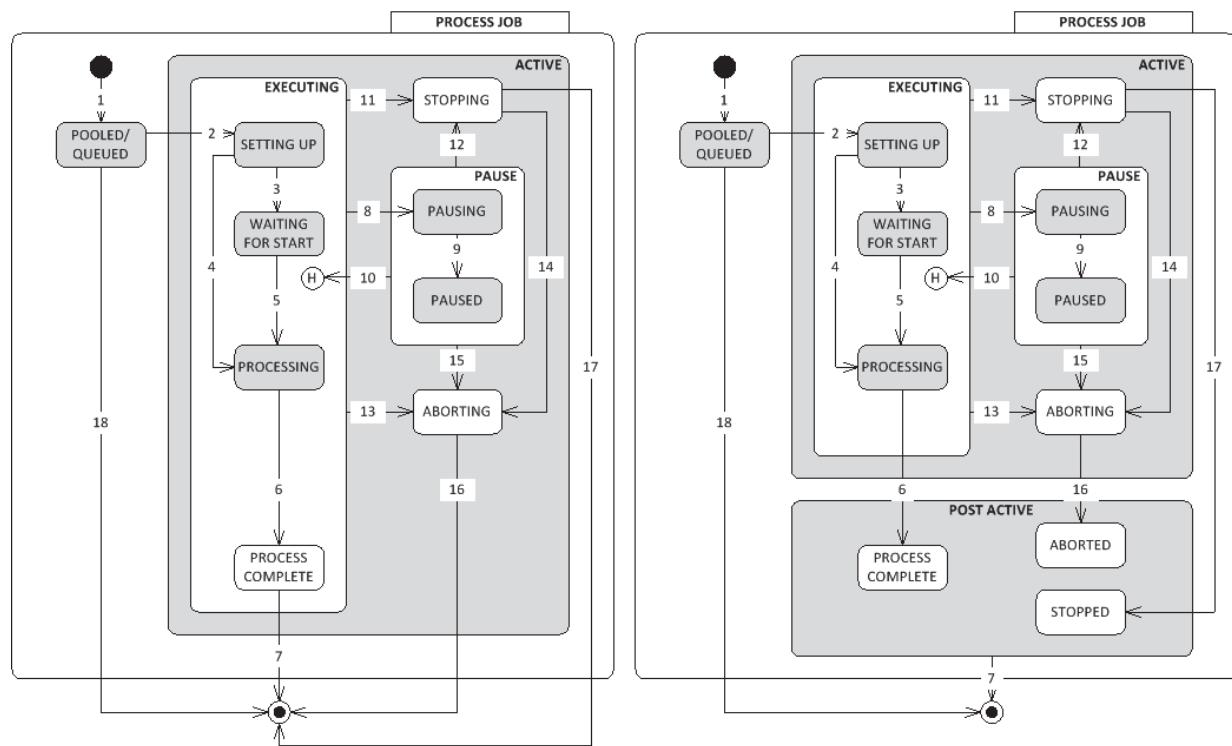
# Chapter 5. Process Management

## 5.1. Process Management – SEMI E40

As stated in the SEMI E40 Standard, process management is concerned with the processing of material by a processing resource. The description of SEMI E40 in this chapter applies to SPECS-FA and the TEL P12XL/Precio prober.

A Process Job contains a single recipe, which combines the tester and prober instructions to test a specific list of wafers in a carrier. VGEM supports the 2 recipe methods defined in the E40 Standard (Recipe only and Recipe with Variable Tuning).

Figure 5-1. Process Job State Model



Note: The process job state model (SEMI E40-0705E or later) is effective by setting the VGEM parameter "VGEM JobDeleteEvent" to "CarrierTerminated" in the /opt/SPECS\_FA/dmh/vgem/defaults.ini file.

Table 5-1.a. Process Job State Transition Table (SEMI E40-0701 or before)

#	Current State	Trigger	New State	Action (s)
1	No state	VGEM accepts a Process Job create request.	QUEUED / POOLED	VGEM places the job in the queue/pool VGEM acknowledges the process job creation.
2	QUEUED / POOLED	A carrier has arrived on the load port and the carrier ID and slot map have been verified (either by the host or the equipment).	SETTING UP	VGEM removes the job from the queue/pool. PR Job Setup event is triggered. All resource preconditioning is performed when job material arrives all material preparation is performed.
3	SETTING UP	The carrier is ready for testing and VGEM is ready to start the process job and PRProcessStart attribute is not set.	WAITING FOR START	PR Job Waiting for Start event is triggered.
4	SETTING UP	Carrier is ready for testing. PRProcessStart attribute is set.	PROCESSING	PR Job Processing event is triggered. Testing starts. Note 1
5	WAITING FOR START	Job Start directive.	PROCESSING	PR Job Processing event is triggered. 2- Testing starts. Note 2
6	PROCESSING	Wafers specified in the process job have completed testing.	PROCESS COMPLETE	PR Job Processing Complete event is triggered. The tester/prober perform all required resource post-conditioning. Await carrier departure. Note 3
7	PROCESS COMPLETE	Wafers have returned to their original slot location.	No state	PR Job Complete event is triggered. The process job is deleted. Note 4
8	EXECUTING	VGEM initiated a process pause action. It received a PAUSE command or initiated an internal pause.	PAUSING	VGEM pauses at the first convenient time.
9	PAUSING	VGEM paused the job.	PAUSED	None.
10	PAUSE	VGEM resumed the job.	EXECUTING	VGEM resumes the activity that was paused.

11	EXECUTING	VGEM initiated a process stop action. It received a STOP command or initiated an internal stop.	STOPPING	VGEM stops the current execution activity at the first convenient time.
12	PAUSE	VGEM initiated a process stop action. It received a STOP command or initiated an internal stop.	STOPPING	VGEM stops the current execution activity at the first convenient time.
13	EXECUTING	VGEM initiated a process abort action. It received an ABORT command or initiated an internal abort.	ABORTING	VGEM terminates the current execution immediately.
14	STOPPING	VGEM initiated a process abort action. It received an ABORT command or initiated an internal abort.	ABORTING	VGEM terminates the current execution immediately.
15	PAUSE	VGEM initiated a process abort action. It received an ABORT command or initiated an internal abort.	ABORTING	VGEM terminates the current execution immediately.
16	ABORTING	Abort procedure is complete.	No state	PR Job Complete event is triggered. Process Job is deleted.
17	STOPPING	Stop procedure completed	No state	PR Job Complete event is triggered. Process Job is deleted.
18	QUEUED / POOLED	CANCEL, ABORT, or STOP command received	No state	VGEM removes the process job from the queue/pool. PR Job Complete event is triggered. VGEM deletes the process job.

Note 1 Actual Event trigger is AutoStart event. i.e. process job was created with auto start flag. PRJobProcessing is a milestone, not supported by VGEM.

Note 2 Actual Event trigger is Manual Start command. PRJobProcessing is a milestone, not supported by VGEM.

Note 3 Actual Event trigger is Process Complete event. PRJobProcessingComplete is a milestone, not supported by VGEM.

Note 4 Actual Event trigger is Process Job Deleted event. PRJobComplete is a milestone, not supported by VGEM.

Table 5-1.b. Process Job State Transition Table (SEMI E40-0705E or later)

#	Current State	Trigger	New State	Action (s)
1	No state	VGEM accepts a Process Job create request.	QUEUED / POOLED	VGEM places the job in the queue/pool VGEM acknowledges the process job creation.
2	QUEUED / POOLED	A carrier has arrived on the load port and the carrier ID and slot map have been verified (either by the host or the equipment).	SETTING UP	VGEM removes the job from the queue/pool. PR Job Setup event is triggered. All resource preconditioning is performed when job material arrives all material preparation is performed.
3	SETTING UP	The carrier is ready for testing and VGEM is ready to start the process job and PRProcessStart attribute is not set.	WAITING FOR START	PR Job Waiting for Start event is triggered.
4	SETTING UP	Carrier is ready for testing. PRProcessStart attribute is set.	PROCESSING	PR Job Processing event is triggered. Testing starts. Note 1
5	WAITING FOR START	Job Start directive.	PROCESSING	PR Job Processing event is triggered. 2- Testing starts. Note 2
6	PROCESSING	Wafers specified in the process job have completed testing.	PROCESS COMPLETE	PR Job Processing Complete event is triggered. The tester/prober perform all required resource post-conditioning. Await carrier departure. Note 3
7	Any POST ACTIVE substate	Job material departs from the equipment, or the process job becomes extinct because the process job is replaced but another process job that specifies the same material when no control job is used.	(Extinction)	PR Job Complete event is triggered. The process job is deleted. Note 4
8	EXECUTING	VGEM initiated a process pause action. It received a PAUSE command or initiated an internal pause.	PAUSING	VGEM pauses at the first convenient time.
9	PAUSING	VGEM paused the job.	PAUSED	None.

#	Current State	Trigger	New State	Action (s)
10	PAUSE	VGEM resumed the job.	EXECUTING	VGEM resumes the activity that was paused.
11	EXECUTING	VGEM initiated a process stop action. It received a STOP command or initiated an internal stop.	STOPPING	VGEM stops the current execution activity at the first convenient time.
12	PAUSE	VGEM initiated a process stop action. It received a STOP command or initiated an internal stop.	STOPPING	VGEM stops the current execution activity at the first convenient time.
13	EXECUTING	VGEM initiated a process abort action. It received an ABORT command or initiated an internal abort.	ABORTING	VGEM terminates the current execution immediately.
14	STOPPING	VGEM initiated a process abort action. It received an ABORT command or initiated an internal abort.	ABORTING	VGEM terminates the current execution immediately.
15	PAUSE	VGEM initiated a process abort action. It received an ABORT command or initiated an internal abort.	ABORTING	VGEM terminates the current execution immediately.
16	ABORTING	Abort procedure is complete.	ABORTED	PR Job Complete event is triggered.
17	STOPPING	Stop procedure completed	STOPPED	PR Job Complete event is triggered.
18	QUEUED / POOLED	CANCEL, ABORT, or STOP command received	No state	VGEM removes the process job from the queue/pool. PR Job Complete event is triggered. VGEM deletes the process job.

Note: This process job state transition table is effective by setting the VGEM parameter “VGEM JobDeleteEvent” to “CarrierTerminated” in the /opt/SPECS\_FA/dmh/vgem/defaults.ini file.

Note 1 Actual Event trigger is AutoStart event. i.e. process job was created with auto start flag. PRJobProcessing is a milestone, not supported by VGEM.

Note 2 Actual Event trigger is Manual Start command. PRJobProcessing is a milestone, not supported by VGEM.

Note 3 Actual Event trigger is Process Complete event. PRJobProcessingComplete is a milestone, not supported by VGEM.

Note 4 Actual Event trigger is Process Job Deleted event. PRJobComplete is a milestone, not supported by VGEM.

## 5.2. Process Job Object Definition

Table 5-2. Process Job Attributes

Attribute Name	Definition	Access	SECS Format
ObjID	Process Job ID	RO	Text (A)
ObjType	The Object Type	RO	Text set to “PROCESSJOB” (A)
PauseEvent	List of event identifiers that cause the equipment to automatically transition to the PAUSING/PAUSED states when one of the listed events is triggered.	RO	<p>List of: EventID  <math>&lt;L, n</math>  <math>&lt;U4 EVENT\_ID1&gt;</math>  <math>&lt;U4 EVENT\_ID2&gt;</math>  <math>&lt;U4 EVENT\_IDn&gt;</math>  <math>&gt;</math></p> <p>Event ID corresponds to any CEIDs that appear in the VGEM Port state model (51xx). It can also be Event ID 5703 (PJPAUSEREQUEST). This special event is used in the adaptive test scenarios (see section on Adaptive Testing).</p>
PRJobState	A unique sub-state of the job according to the process job state model.	RO	<p>Enumerated (U1):</p> <ul style="list-style-type: none"> <li>0 = QUEUED/POOLED</li> <li>1 = SETTING UP</li> <li>2 = WAITING FOR START</li> <li>3 = PROCESSING</li> <li>4 = PROCESS COMPLETED</li> <li>5 = EXECUTING</li> <li>6 = PAUSING</li> <li>7 = PAUSE</li> <li>8 = STOPPING</li> <li>9 = ABORTING</li> </ul>
PRMtNameList	List of identifiers of the material being processed.	RO	<p>List of: PRMtName</p> <p>List of carriers and associated wafer slots. Note: only 1 carrier is allowed. VGEM does not allow a process job to span multiple carriers.</p> <p>Ex.</p> <pre> &lt;L   &lt;L     &lt;A "CarrierA"&gt;     &lt;L       &lt;U1 1&gt; /* slot ID */       &lt;U1 2&gt; /* slot ID */     &gt;   &gt; &gt; </pre>

Attribute Name	Definition	Access	SECS Format
PRMtlType	Identifies the type of material being processed.	RO	Enumerated – Only supports value of 13 (0x0D) = Quantities in carriers.
PRProcessStart	Indicates that the processing resource starts processing immediately when ready.	RO	Boolean: TRUE = Automatic Start FALSE = Manual Start
PRRecipeMethod	Indication of recipe specification type, whether using is applied and which method is used.	RO	Enumerated (U1) Fixed as: 1 = Recipe Only 2 = Recipe with variables
RecID	Identifier of the recipe applied.	RO	Text (A)
RecVariableList	List of variables supporting a recipe method.	RO	List of RecipeVariable Ex. <L <L <A "ProberRecipe"> <A "TEST01"> > <L <A "TestPlanName"> <A "demo"> > >

Note: ObjID and ObjType have a maximum size of 32 characters. All other attributes are limited to 10000 characters (internal database uses a string representation of the object data).

Table 5-3 lists the data identifiers.

Table 5-3. Data Identifiers

Data Identifier	Description	Form
PRMtlName	Textual identifier of the material being processed	Text
RecipeVariable	Variables supporting a recipe method	Structure composed of : RecipeVarName RecipeVarValue
RecipeVarName	The name of the recipe variable	Text
RecipeVarValue	Value of the recipe variable	Depends on variable.

### 5.3. Process Job Messaging Services

Table 5-4 lists the services necessary to create and control a process job.

Table 5-4. E40 Services

Stream/Function	Service/Command Name	Description
S16,F3	PRJobCreate	This service creates a single process job on the equipment. VGEM assigns the process job ID.
S16,F5	PRJob Command Request Command: “STARTPROCESS” “PAUSE” “RESUME” “CANCEL” “ABORT” “STOP”	Starts a process job. Processing of process jobs is suspended. Processing of process jobs suspended is resumed. Process jobs are canceled. Aborts a process job. Stopping process job is requested.
S16,F11	PRJobCreateEnh	This service creates a single process job on the equipment. The host assigns the process job ID.
S16,F13	PRJobDuplicateCreate	This service creates one or more process jobs that share the same recipe parameters. Each process job can be assigned a different list of wafers to process for a given carrier.
S16,F15	PRJobMultiCreate	This service is used to generate more than one process jobs. Each job is generated with a unique method. If there is more than one lot of process group for a carrier, this message is helpful to create all the jobs for the carrier.
S16,F17	PRJobDequeue	Used to remove one or more than one jobs from the waiting queue.
S16,F19	PRGetAllJobs	Get a list of the jobs and their states for all jobs which have not completed.
S16,F21	PRGetSpace	Get the number of jobs which can currently be created in VGEM.
S16,F23	PRJobSetRecipeVariable	This message is used to send a request to modify the setting of variable parameter lists of recipes. This request will fail unless the specified job becomes at least any of the waiting queue/spool, paused and waiting for start states.
S16,F25	PRJobSetStartMethod	This message is used to set the process job start method (manual or automatic).

## 5.4. Process Job Events

Table 5-5 lists the events occurring when a state transition is made in the Process Job state model. In the case where a PRJobCommand service is used to trigger a transition, the command name is listed.

Table 5-5.a. Process Job Events (SEMI E40-0701 or before)

Command/Event Name	CEID	Description
Event QueuedPooled	5901	NONE → QUEUED/POOLED
Event SettingUp	5902	QUEUED/POOLED → SETTING UP
Event WaitingForStart	5903	SETTING UP → WAITING FOR START
Event AutoStart	5904	SETTING UP → PROCESSING
Command ManualStart	5905	WAITING FOR START → PROCESSING
Event ProcessComplete	5906	PROCESSING → PROCESS COMPLETE
Event ProcessJobDeleted	5907	PROCESS COMPLETE → NONE
Command ProcessJobPause	5908	EXECUTING → PAUSING
Event ProcessJobPaused	5909	PAUSING → PAUSED
Event ProcessJobResumed	5910	PAUSE → EXECUTING
Command ProcessJobStop	5911	EXECUTING → STOPPING
Command ProcessJobAbort	5913 5914 5915	EXECUTING → ABORTING STOPPING → ABORTING PAUSE → ABORTING VGEM stops the current execution activity at the first convenient time.
Event ProcessJobAborted	5916	ABORTING → NONE
Command ProcessJobStop	5911 5912	EXECUTING → STOPPING PAUSE → STOPPING
Event ProcessJobStopped	5917	STOPPING → NONE
Event PjCancel Event PJAbort Event PJStop	5918	QUEUED/POOLED → NONE

Table 5-5.b. Process Job Events (SEMI E40-0705E or later)

Command/Event Name	CEID	Description
Event QueuedPooled	5901	NONE → QUEUED/POOLED
Event SettingUp	5902	QUEUED/POOLED → SETTING UP
Event WaitingForStart	5903	SETTING UP → WAITING FOR START
Event AutoStart	5904	SETTING UP → PROCESSING
Command ManualStart	5905	WAITING FOR START → PROCESSING
Event ProcessComplete	5906	PROCESSING → PROCESS COMPLETE

Event ProcessJobDeleted	5907 5921 5922	PROCESS COMPLETE → NONE ABORTED → NONE STOPPED → NONE
Command ProcessJobPause	5908	EXECUTING → PAUSING
Event ProcessJobPaused	5909	PAUSING → PAUSED
Event ProcessJobResumed	5910	PAUSE → EXECUTING
Command ProcessJobStop	5911	EXECUTING → STOPPING
Command ProcessJobAbort	5913 5914 5915	EXECUTING → ABORTING STOPPING → ABORTING PAUSE → ABORTING VGEM stops the current execution activity at the first convenient time.
Event ProcessJobAborted	5919	ABORTING → ABORTED
Command ProcessJobStop	5911 5912	EXECUTING → STOPPING PAUSE → STOPPING
Event ProcessJobStopped	5920	STOPPING → STOPPED
Event PjCancel Event PJAbort Event PJStop	5918	QUEUED/POOLED → NONE

Note: This process job event lists are effective by setting the VGEM parameter “VGEM JobDeleteEvent” to “CarrierTerminated” in the /opt/SPECS\_FA/dmh/vgem/defaults.ini file.

Table 5-6. Recipe Tuning CEIDs (following S16F23)

Command/Event Name	CEID	Description
Event Recipe_Tuned_OK	5701	Parameters tuning on S16F23 was successful.
EVENT Recipe_Tuned_Failed	5702	Parameters tuning on S16F23 failed.

## 5.5. Data Variables (DVVAL)

Table 5-7 lists the Data Variables that VGEM can report on specific CEIDs.

Table 5-7. Data Variables

Var ID	Var ID's SECS Type	Variable Name	Description	Value's SECS type
1352	U4	PJPauseReason	The reason a pause request was issued by equipment to VGEM. Ex. Number of die measured is equal to 5. NDIE+VALUE=5	A
1353	U4	PJPauseValue	The parameter value that caused a pause request issued by equipment to VGEM.	A
1751	U4	PJ_ObjID	Process Job attribute ObjID.	A
1752	U4	PJ_PauseEvent	Process Job attribute PauseEvent.	L
1753	U4	PJ_PRJobState	Process Job attribute PRJobState.	U1
1754	U4	PJ_PRMtlNameList	Process Job attribute PRMtlNameList.	L
1755	U4	PJ_PRMtlType	Process Job attribute PRMtlType.	B
1756	U4	PJ_PRProcessStart	Process Job attribute PRProcessStart.	BOOL
1757	U4	PJ_PRRRecipeMethod	Process Job attribute PRRRecipeMethod.	U1
1758	U4	PJ_RecID	Process Job attribute RecID.	A
1759	U4	PJ_RecVariableList	Process Job attribute RecVariableList.	L

Note: All variables have a maximum of 20000 characters (internal database uses a string representation for any data types).

## 5.6. Status Variables (SV)

Table 5-8. Status Variables

Var ID	Var ID's SECS Type	Variable Name	Description	Value's SECS type
2465	U4	PJStateList	List of the current state of all process jobs.	<L, n <U1 state> . . . >

Note: All variables have a maximum of 20000 characters (internal database uses a string representation for any data types).

## 5.7. Process Job Creation

This section explains in details how to create a process job with Recipe Method 1 or Recipe Method 2, as defined in the E40 standard.

Important requirements and limitations in the SPECS-FA environment:

1. A process job cannot span more than 1 carrier.
2. VGEM uses the slot list, provided in the PRMtlNameList, to build the wafer list. However, in order to construct a complete wafer list for SPECS-FA, the E87 S3F17 Bind or ProceedWithCarrier messages must include the E87 ContentMap and SlotMap. The ContentMap associates a lot ID with a wafer ID for each slot in the FOUP and the SlotMap defines the actual list of wafers present in the FOUP.

### 5.7.1. Recipe only (Recipe Method 1)

In this mode, SPECS-FA will use the recipe ID defined in the S16F3, F11, F13, or F15 message.

Typically, the recipe ID will correspond to an entry defined in the recipe.txt file that was previously created on the tester's workstation. This file contains the necessary information to process the designated wafers.

/opt/SPECS/usr/tpl/FA\_recipe2.rec:

Example (partial representation):

#RECIPE	KEY	PRODUCT	PROCESS	STEP	Prober	RCP	WAF	DIE	.....
clock1		CMS300	CMOS	LOT1	CMS300		FA300A	FA300A	.....
clock2		CMS300	CMOS	LOT1	CMS300		FA300A	FA300A	.....
clock3		CMS300	CMOS	LOT1	CMS300				.....
clock4		CMS300	CMOS	LOT1	CMS300				.....

Example of a process job using Recipe Method 1:

```
S16F11 <L:7
    <U4 1>                      /* data ID */
    <A "1234">                  /* process job ID */
    <B 0xD>                      /* MF (material format) = 13 */
    <L:1
        <L:2
            <A "CarrierA">      /* carrier ID */
            <L:2
                <U1 1>          /* slot ID */
                <U1 2>          /* slot ID */
            >
        >
    >
    <L:3
        <U1 1>
        <A "clock2">          /* recipe ID */
        <L:0 >                  /* recipe variable list (empty) */
    >
    <TF TRUE>                   /* autostart */
```

```
<L          /* CEID lists of pause event */  
<U4 5703>  
>  
>
```

In the above example, a process job is created with S16F11. The recipe ID is “clock2” and refers to the “clock2” entry in the /opt/SPECS\_FA/usr/tpl/FA\_recipe2.rec recipe file.

### 5.7.2. Recipe with Variable Tuning (Recipe Method 2) and Adaptive Testing

In this mode, SPECS-FA will use the recipe ID defined in the S16F3, F11, F13 or F15 message. Depending on the SPECS-FA configuration, the tunable parameters can overwrite the values defined in FA\_recipe2.rec or be taken directly from the SECS message without reading a recipe file.

For a complete description of recipe tuning and adaptive testing, refer to Chapter 7.



## Chapter 6. Control Job Management

### 6.1. Control Job Management – SEMI E94

As stated in the SEMI E94 standard, control jobs provide a supervisory level of control for process jobs on material processing equipment. One benefit of using control jobs is that they can be used to reduce the message traffic between the host and the equipment since some of the host control is shifted on the equipment.

A Control Job specifies one or more Process Jobs that are kept in a queue that determines the order of execution.

### 6.2. Control Job State Model

Figure 6-1. Control Job State Model

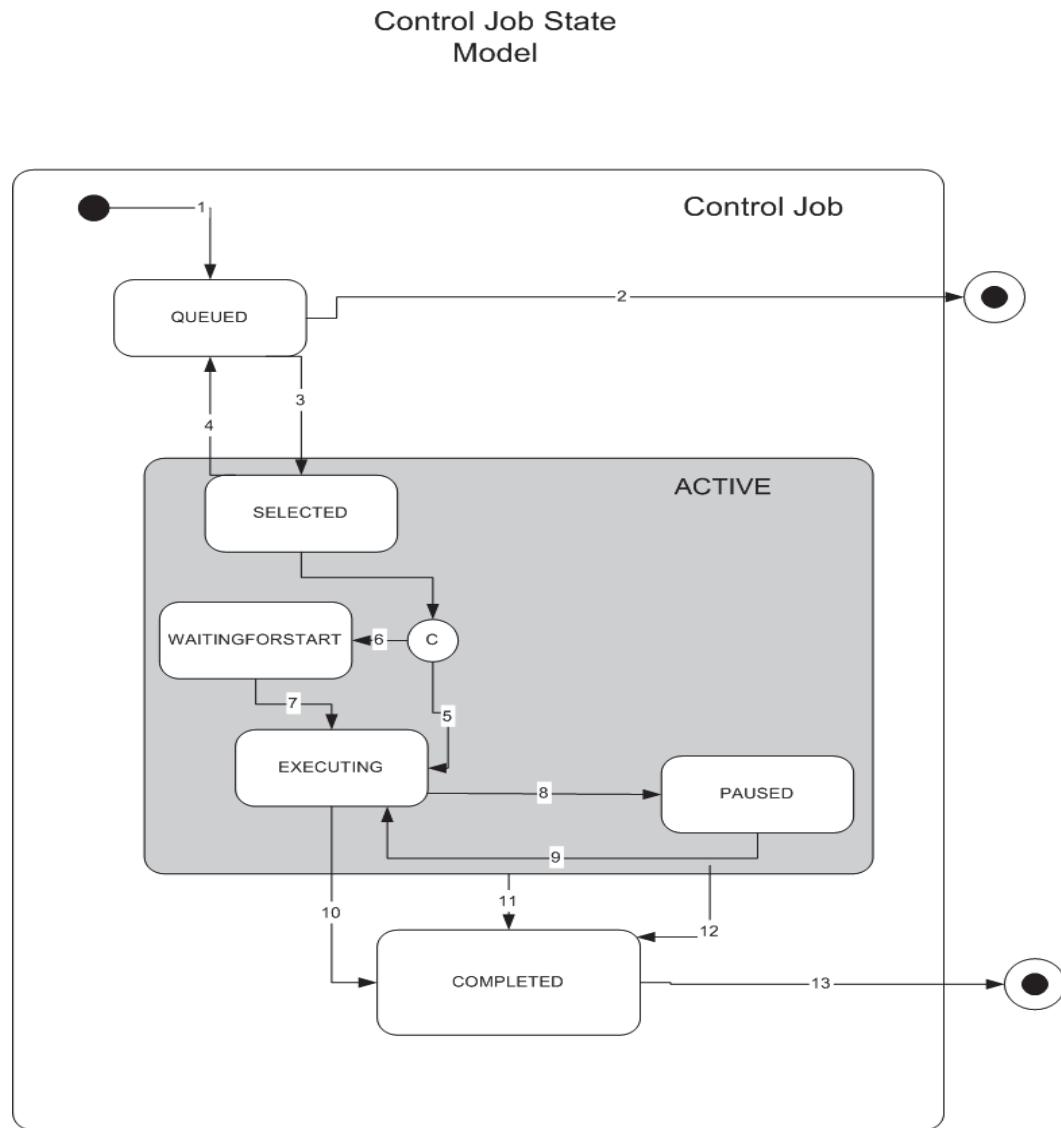


Table 6-1. Control Job State Transition Table

#	Current State	Trigger	New State	Actions	Comments
1	No state	VGEM receives Create command from host.	QUEUED	VGEM creates Control Job and put it at the tail end of a control job queue.	If job queue is full, the Job Create request is rejected.
2	QUEUED	VGEM has received Cancel, Abort or Stop command from host or operator through operator console	No state	VGEM de-queues and terminates the job. VGEM sends a ControlJobCanceled event to the host.	If other control jobs are waiting behind the canceled job in the queue, they are shifted forward to fill in the gap after the de-queuing of the canceled control job.
3	QUEUED	VGEM has the capacity to begin work on the next control job.	SELECTED	VGEM selects and de-queues the job at the head of the queue. Send a "Selected" event to the host.	The carrier may not be present on the load port.
4	SELECTED	VGEM has received a "De-select" command from the host and materials for the control job have not arrived yet.	QUEUED	The De-selected job moves to the head of the job queue and the job that was at the head becomes the SELECTED job.	The command shall be rejected if the resources for the job at the head of queue are not available. See the Queue model.
5	SELECTED	Carrier for the first process job arrives or in the case where the first (or only) process job does not require material, this transition shall be taken as soon as the processing resource for that process job becomes available. The StartMethod attribute in the Control Job is set for Auto.	EXECUTING	VGEM sends the "Execution began" event to the host.	Process Jobs associated with a carrier will not initiate until the identifier and substrate slotmap for the carrier have been verified.

#	Current State	Trigger	New State	Actions	Comments
6	SELECTED	Same as for transition 5 except that the “StartMethod” attribute in the control job is set for user start.	WAITING FOR START	VGEM sends a “JobWaiting for Start” event to host and/or operator.	
7	WAITING FOR START	User START command received.	EXECUTING	VGEM sends the “Execution began” event to the host.	Process Jobs associated with a carrier will not initiate until the identifier and substrate slotmap for the carrier have been verified.
8	EXECUTING	VGEM has received Pause message from host or operator through operator console or a Control Job. PauseEvent has occurred.	PAUSED	VGEM sends a “Paused” event to the host.	Process Job which have not started can be modified in this state.
9	PAUSED	VGEM has received a “Resume” message from host or operator through operator console.	EXECUTING	VGEM commences initiating process jobs. VGEM sends a “Resumed” event to the host.	
10	EXECUTING	All the Process Jobs specified for the Control Job have completed.	COMPLETED	VGEM sends a “Completed” event to the host.	It may include post processing completion.
11	ACTIVE	VGEM has received a “CJStop” message from host or operator through operator console or all the process jobs under the Control Job have been stopped and material processing is stopped.	COMPLETED	VGEM sends a “Completed” event to the host.	

#	Current State	Trigger	New State	Actions	Comments
12	ACTIVE	VGEM has received “CJAbort” command from host or operator through operator console or all the process jobs under the Control Job have been aborted and material processing is aborted.	COMPLETED	VGEM sends “Aborted” message to the host.	
13	COMPLETED	Normal with material: Material associated with this ControlJob has been removed from the equipment. EXCEPTION: For equipment that requires reuse of specified material such as wafer “fillers”, departure of this type of material is not required for the ControlJob to be deleted.	No state	Control Job is deleted.	VGEM deletes the control job after all process jobs have completed.

### 6.3. Control Job Object Definition

Table 6-2. Control Job Object Attributes

Attribute Name	Definition	Access	SECS Format
ObjID	Control Job ID as defined by the host.	RO	Text (A)
ObjType	Object Type.	RO	Text (A) set to “ControlJob”
CurrentPRJob	Holds the identifiers for any currently running process jobs, even if job is paused.	RO	List of: PRJobID Ex. <L, 1 <A “1234”> >
DataCollectionPlan	Identifier for a data collection plan to be used during execution of the control job. <i>Note: VGEM does not currently use this attribute.</i>	RW	Text (A)  Note: this attribute should be empty.
CarrierInputSpec	A list of carrierID for material that will be used by the ControlJob.	RW	List of CarrierID Ex. <L, 1 <A “CarrierA”> > Note: VGEM limits this list to 1 CarrierID.
MtrlOutSpec	Maps material from source to destination after processing. <i>Note: VGEM does not currently use this attribute.</i>	RW	List of Structure: SourceMap DestinationMap Note: this attribute should be an empty list.
MtrlOutByStatus	List structure which maps locations or Carriers where processed material will be placed based on material status. <i>Note: VGEM does not currently use this attribute.</i>	RW	List of structure: Destination MaterialStatus Note: this attribute should be an empty list.

Attribute Name	Definition	Access	SECS Format
PauseEvent	Identifier of a list of events on which the Control Job shall PAUSE.	RW	<p>List of: EventID  <math>\langle L, n \rangle</math>  <math>\langle U4\ EVENT\_ID1 \rangle</math>  <math>\langle U4\ EVENT\_ID2 \rangle</math>  <math>\langle U4\ EVENT\_IDn \rangle</math>  <math>\rangle</math></p> <p>Event ID corresponds to any CEIDs that appear in the VGEM Port state model (51xx). It can also be Event ID 5704 (CJPAUSEREQUEST). This special event is used in the adaptive test scenarios (see section on Adaptive Testing).</p>
ProcessingCtrlSpec	A list of structures that defines the process jobs and rules for running each that will be run within this control job.	RW	<p>List of Structure:</p> <ul style="list-style-type: none"> <li>PRJobID</li> <li>ControlRule</li> <li>OutputRule</li> </ul> <p>Note: ControlRule is used with Adaptive Test #4. If using other scenarios, the ControlRule should be left empty (<math>\langle L \rangle</math>).</p> <p>See the section that describes the Adaptive Test scenarios.</p> <p>ControlRule is defined as a start flag which controls the execution of the process job based on the ExecuteAttribute and ExecutionLevel.</p> <p>ControlRule:</p> <pre> &lt;L   &lt;L     &lt;A "StartFlag"&gt;     &lt;U1 ExecutionLevel&gt;   &gt; &lt;L   &gt; </pre> <p>ExecutionLevel varies from 0 to 8. It is used along with the ExecuteAttribute, which can be set to "EQ" (equal), "LE" (lower or equal) and "GE" (greater than or equal).</p> <p>ExecuteAttribute and ExecutionLevel are defined inside VGEM as DVVALs and are set by SPECS-FA at run-time.</p> <p>Example :</p> <pre> &lt;L   &gt; </pre>

			<pre> &lt;L   &lt;A "1234"&gt; &lt;L   &lt;L     &lt;A "StartFlag"&gt;     &lt;U1 1&gt;   &gt; &gt; &lt;L&gt; &gt; &lt;L   &lt;A "5678"&gt; &lt;L   &lt;L     &lt;A "StartFlag"&gt;     &lt;U1 1&gt;   &gt; &gt; &lt;L&gt; &gt; &gt; </pre> <p>In this example, the host sets the ExecutionLevel to 1 for each process jobs.</p> <p>If the DVVAL ExecutionLevel is 1 and the ExecuteAttribute is “EQ”, all the jobs (1234 and 5678) will be executed. See section 1.4.5 (Data Variables) for more details on these variables set by SPECS-FA.</p> <p>Note: VGEM does not currently support the OutputRule. It should defined as an empty list.</p> <p>The Control Rule is explained in more details in the Adaptive test scenarios #4-1 and #4-2.</p>
ProcessOrderMgmt	Define the method for the order in which process jobs are initiated. <b>Note:</b> <i>only the LIST method is supported</i>	RW	Enumeration (U1) 1 = ARRIVAL 2 = OPTIMIZE 3 = LIST
StartMethod	A logical flag that determines if the Control Job can start automatically. A user start may come through either the host connection or the operator console.	RO	Boolean: TRUE – AUTO FALSE – User Start

Attribute Name	Definition	Access	SECS Format
State	The current state of the Control Job.	RO	Enumerated (U1) 0 = QUEUED 1 = SELECTED 2 = WAITING FOR START 3 = EXECUTING 4 = PAUSED 5 = COMPLETED

Note: ObjID and ObjType have a maximum size of 32 characters. All other attributes are limited to 10000 characters (internal database uses a string representation of the object data).

Table 6-3. Data Identifier

Data Identifier	Description	Form
CarrierID	The identifier of a carrier that is the source or destination for substrates.	Text
ControlRule	Provides additional job control functionality. It is equipment dependent. It may be used to modify processing based on processing results. Use of this attribute is not required for equipment, which does not support it.	List of Structure: RuleName RuleValue
PRJobID	A process job identifier as defined by SEMI E40. Host must supply same name in the ProcessingCtrlSpec as when it requested creation of process job. Note: SEMI E40 process jobs link material to a recipe.	See SEMI E40.
RuleValue	The value used by the equipment for execution of a control rule.	U1 ExecutionLevel, which ranges from 0 to 8. See Adaptive Testing Scenario #4 for details.
RuleName	Identifier of a control rule.	Text “StartFlag”

## 6.4. Control Job Messaging Services

Table 6-4 lists the services necessary to create, delete and control a Control Job.

Table 6-4. Control Job Messaging Services

Stream/Function	Service/Command Name	Description
S14,F9 with Object Type = ControlJob	Object Create (ControlJob object)	Host uses this service to request VGEM to create a control job.
S16,F27 Specifies a control job command enum value	1 = CJStart 2 = CJPause 3 = CJResume 4 = CJCancel 5 = CJDeselect 6 = CJStop 7 = CJAbort 8 = CJHOQ	A request to start a control job. Processing of Control Job is suspended. Transition of the Control Job state from PAUSED to EXECUTING is requested. The deletion of a job from waiting queue is requested. To request a Control Job to be deselected; it will no longer be the next job to run. The termination of Control Job is requested. Control Job is aborted. Set Control Job to the Head Of Queue.  * VGEM supports the Action parameter on CJCancel, CJStop and CJAbort. Action is type U1 where 0=SAVEJOBS and 1=REMOVEJOBS.

## 6.5. Control Job Events

Table 6-5 lists the events occurring when a state transition is made in the Control Job state model.

Table 6-5. Control Job Events

Command/Event Name	CEID	Description
CJEVENT Queued	5801	NONE → QUEUED
CJCMD ControlJobCancel CJCMD ControlJobAbort CJCMD ControlJobStop	5802	QUEUED → NONE
CJEVENT ControlJobSelected	5803	QUEUED → SELECTED
CJCMD ControlJobDeselected	5804	SELECTED → QUEUED
CJEVENT AutoStart	5805	SELECTED → EXECUTING
CJEVENT WaitingForStart	5806	SELECTED → WAITINGFORSTART
CJCMD ManualStart	5807	WAITINGFORSTART → EXECUTING
CJCMD ControlJobPause	5808	EXECUTING → PAUSE
CJCMD ControlJobResume	5809	PAUSED → EXECUTING
CJEVENT ControlJobCompleted	5810	EXECUTING → COMPLETED
CJCMD ControlJobStop	5811	ACTIVE → COMPLETED
CJCMD ControlJobAbort	5812	ACTIVE → COMPLETED
CJEVENT ControlJobDeleted	5813	COMPLETED → NONE

## 6.6. Data Variables (DVVAL)

Table 6-6 lists the Data Variables that VGEM can report on specific CEIDs.

Table 6-6. Data Variables (DVVAL)

Var ID	ID TSN	Variable Name	Description	Value TSN
1022	U4	CJPauseReason	The reason a control job pause request was issued by equipment to VGEM.	A
1023	U4	CJPauseValue	The parameter value that caused a control job pause request from equipment to VGEM.	A
1182	U4	ExecuteAttribute	<p>Attributes sets by SPECS-FA:</p> <p>“EQ”: VGEM will execute the process job’s StartFlag which value is equal to the current ExecutionLevel</p> <p>“LE”: VGEM will execute the process job’s StartFlag which value is less or equal to the current ExecutionLevel</p> <p>“GE”: VGEM will execute the process job’s StartFlag which value is greater or equal to the current ExecutionLevel</p> <p>Ex. If ExecuteAttribute is “EQ” and ExecutionLevel is 1, only the process jobs which have the StartFlag equals to 1 will be executed.</p> <p>“StartFlag” is a parameter defined in the control rule.</p>	A
1184	U4	ExecutionLevel	<p>Value which determines the execution of a process job based on its StartFlag setting in the Control Rule. ExecutionLevel varies from 0 to 8.</p> <p>VGEM uses the ExecutionLevel and the ExecuteAttribute values to determine if a process job must be executed. See ExecuteAttribute.</p>	A
1740	U4	CJ_ObjID	Control Job Attribute ObjID.	A
1741	U4	CJ_CurrentPRJob	Control Job Attribute CurrentPRJob.	L
1742	U4	CJ_DataCollectionPlan	Control Job Attribute DataCollectionPlan.	A
1743	U4	CJ_CarrierInputSpec	Control Job Attribute CarrierInputSpec.	L

1744	U4	CJ_MtrlOutSpec	Control Job Attribute MtrlOutSpec.	L
1745	U4	CJ_MtrlOutByStatus	Control Job Attribute MtrlOutByStatus.	L
1746	U4	CJ_PauseEvent	Control Job Attribute PauseEvent.	L
1747	U4	CJ_ProcessingCtrlSpec	Control Job Attribute ProcessingCtrlSpec.	L
1748	U4	CJ_ProcessOrderMgmt	Control Job Attribute ProcessOrderMgmt.	U1
1749	U4	CJ_StartMethod	Control Job Attribute StartMethod.	TF
1750	U4	CJ_State	Control Job Attribute State.	U1

Note: All variables have a maximum of 20000 characters (internal database uses a string representation for all data types).

## 6.7. Status Variables (SV)

Table 6-7 lists the Status Variables that VGEM can report on specific CEIDs.

Table 6-7. Status Variables (SV)

Var ID	ID TSN	Variable Name	Description	Value TSN
2096	U4	CJ_QueueAvailableSpace	Indicates the number of jobs which the queue can accept.	U2
2097	U4	CJ_QueuedCJobs	This is an ordered list of control jobs currently in the queue. The first job in the list is the job at the head of the queue.	L of text

Note: All variables have a maximum of 20000 characters (internal database uses a string representation for all data types).

# Chapter 7. Adaptive Testing

## 7.1. Introduction

Adaptive Test allows the user to change test flow and test attributes at run-time to minimize test time. The results of a previous test can be used to determine the next test to run.

For example, a user may start testing with a list of sample wafers. During processing, the tester can be paused and the results analyzed. Depending on the test results, the user may decide to change the test plan/limit file or the wafers/DIE/modules to be tested. These changes are called “recipe tuning”. Once the recipe has been tuned, testing can resume. Test flow and test attributes are part of the “test recipe”.

For example, after an initial sample of wafers or DIE are tested, processing is paused while the results of the testing are analyzed. If the results are better than expected, the test “recipe” can be tuned to eliminate extensive testing. The same applies if the test results are less than acceptable. In such cases, modifications to the “recipe” may include increasing the process jobs to be run, modifying the limits files, increasing the number of wafers to be tested or changing the DIE/modules to be tested.

SPECS-FA supports several types of adaptive testing in the context of SEMI Standards E40 & E94.

There are two major types of adaptive testing.

### **Host-driven Adaptive Test**

In this mode, the host will manage and control all of the test flow and attributes. The host is responsible for defining the initial test conditions, analyzing the results and applying the appropriate recipe tuning at run-time.

### **Tester-driven Adaptive Test**

In this mode, the host will create a list of process jobs and a control job which will define a control rule for each process job. The control rule defines an initial start flag which is compared at run-time with a “global” execution level to decide whether to execute the process job or not. The execution level is modified by SPECS-FA at run-time based on the test results.

You will find in this section several Adaptive Test Scenarios which are supported by SPECS-FA. These scenarios can be customized by an Keysight Applications Engineer to meet your specific requirements.

## 7.2. Host-driven Adaptive Test

The host-driven Adaptive Test mode consists of 3 major scenarios;

- Adaptive Testing while processing a wafer
- Adaptive Testing between wafers
- Adaptive Testing between process jobs

The host will start executing a pre-defined test, pause it after certain conditions are met, analyze the tests results, tune the recipe and resume testing. This sequence may be repeated several times during testing.

The following correspond to the adaptive test scenarios 15.1.18 through 15.1.20 in Chapter 15.

### **A - Adaptive Testing while processing a wafer**

This scenario allows for changing the test flow without unloading and reloading the current wafer. Here is a typical test sequence:

1. Start test with a list of sample DIE on a wafer.
2. After completing the test, pause and judge the test results.
3. If recipe tuning is necessary, modify the test recipe according to the test results. Abort the wafer or specify more DIE or more modules to test etc.
4. Resume the test.

### **B - Adaptive Testing between wafers**

A test recipe can also be changed between wafers in a process job. The parameters tuned in the current recipe will be effective at the start of the next wafer.

1. Start test for sample wafers.
2. After completing the test, pause and judge the test.
3. If recipe tuning is necessary, modify test recipe according to the test results. Abort the lot or test more wafers or change TestPlan etc.
4. Resume the test.

### **C - Adaptive Testing between process jobs**

In this scenario, a control job will be paused before executing the next process job.

1. Start test for one or more process jobs.
2. After completing the test, pause and judge the test.
3. If recipe tuning is necessary, modify the next process job recipe parameters according to the test results. The host can also modify the process job list order and content (add, delete jobs) and the recipe information for each process job.

4. Resume the test.

### 7.2.1. Pause Event Generation

SPECS-FA provides a mechanism to generate a pause during test to allow the host to analyze the test results. In host driven adaptive test scenarios 15.1.18, 15.1.19 and 15.1.20, the host specifies a list of Collection Event IDs (CEID) in the PauseEvent list parameter when creating a process job or a control job.

When a CEID defined in the PauseEvent list is generated, the tester will pause automatically.

Any CEIDs specified in the Port state model can be listed in PauseEvent. However, it is recommended to use the following 2 special CEIDs, since they allow generation of a pause on specific test conditions.

EVENT PJPauseRequest (5703)  
 EVENT CJPauseRequest (5704)

When this method is selected, SPECS-FA framework sends VGEM an EVENT PJPauseRequest (CEID 5703) or CJPauseRequest (5704). The host must include 5703 or 5704 in the Process Job PauseEvent list or Control Job PauseEvent list if it wants the tester to pause when a pause condition is reached.

The EVENT PJPauseRequest (5703) is associated with DVVAL PJPauseReason 1352 and DVVAL PJPauseValue 1353. PJPauseReason can be NDIE, DFND, CDIE, THLD, NWAF, WFND, CWAF or THLW. PJPauseValue contains the value (such as a number of dies like 5) that triggered the pause condition. (See IWCondition and BWCondition below).

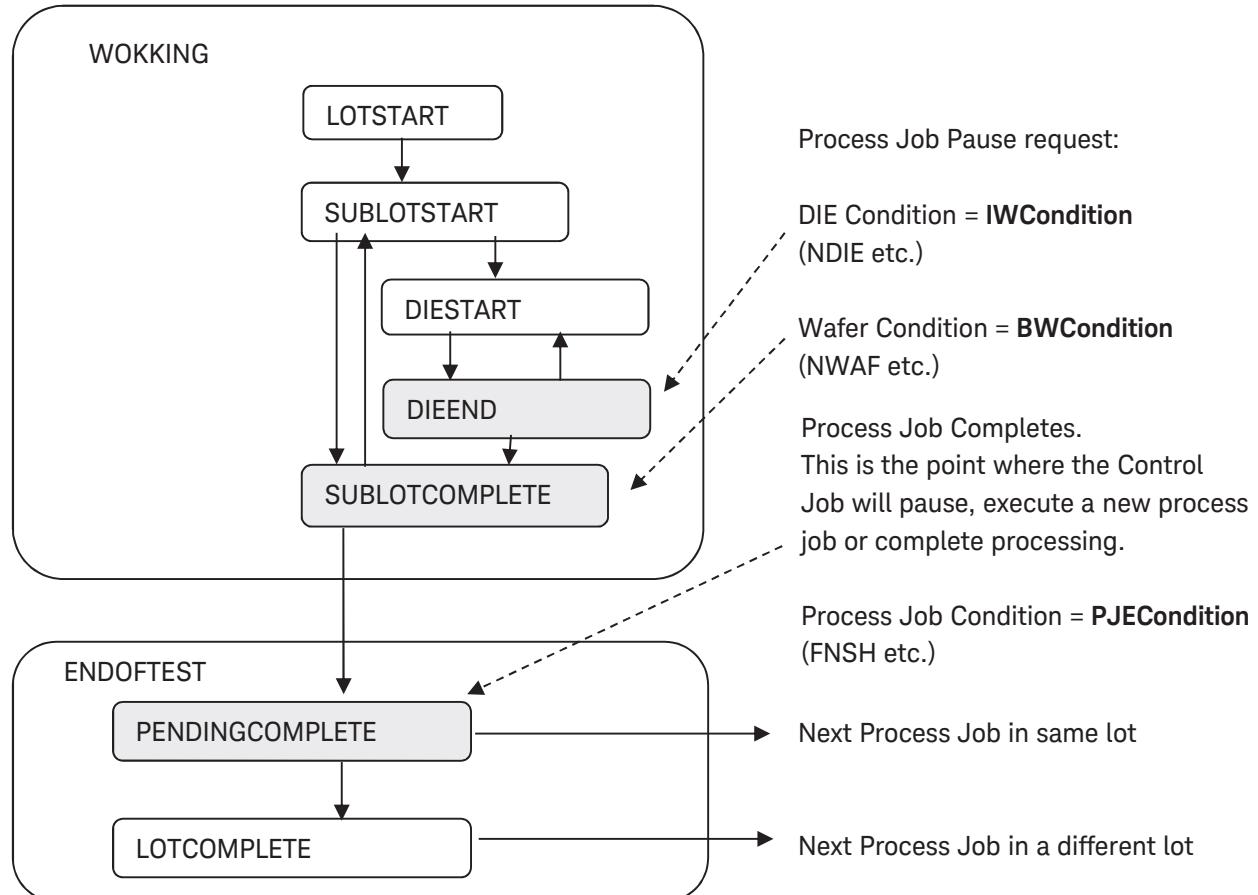
The EVENT CJPauseRequest (5704) is associated with DVVAL CJPauseReason 1022 and DVVAL CJPauseValue 1023. CJPauseReason can be FNSD, FFND, PFLT (see PJECondition below).

CJPauseValue contains the value that triggered the pause condition.

Using a regular CEID like 5153 (SubLotComplete) forces the tester to pause after every wafer, which is a less efficient mechanism.

### Where a Process Job or Control Job Pause Request will occur in the Port State Model

The following diagram shows a partial representation of the Port State Model that is fully described in Chapter 8. This diagram highlights the states where a process job or control job pause request occurs.



Note that the host can set multiple pause conditions in the same process job (in other words, IWCondition, BWCondition and PJECondition can be specified in the same S16Fx message).

When using scenario 15.1.18, the host can select one of the followings conditions to pause a test while testing a wafer:

Parameter	Description
IWCondition	Pause condition when processing a wafer: NONE = no pause. NDIE = pause after completing test for specified number of DIE. DFND = pause after finding a failed die. CDIE = pause after completing test for the specified die. THLD = pause if fail ratio for sample die is over the the specified threshold level.
IWNumOfDies	Number of DIE. Used when IWCondition is NDIE or THLD.
IWDieLabel	Die label. Used when IWCondition is CDIE.
IWJudgeRule	Judgment rule (LT,LE,EQ,GE or GT). Used when IWCondition is THLD.

IWJudgeTLevel	Threshold level for judgment. Used when IWCondition is THLD.
---------------	--

SPECS-FA framework reports EVENT PJPauseRequest (5703) to the host if the selected pause condition is satisfied. It then pauses to allow the host to analyze the test results and tune the recipe by using S16F23 PRJobSetRecipeVariables.

If the S16F23 recipe tuning is successful, an EVENT Recipe\_Tuned\_OK (5701) is sent.

If it fails, EVENT Recipe\_Tuned\_Failed (5702) is sent.

After successfully tuning the recipe, the host can resume testing by sending S16F5 PJResume. Note that S16F23 recipe tuning is not mandatory; the host can skip this message and resume testing right after the tester has paused.

When using scenario 15.1.19, the host can select one of the followings conditions to pause a test in between wafers:

Parameter	Description
BWCondition	Pause condition in between wafers. NONE = no pause. NWAF = pause after completing test for specified number of wafers. WFND = pause after finding a failed wafer. CWAF = pause after completing testing for the specified wafer. THLW = pause if fail ratio for sample wafers is over the specified threshold level. ALLW = pause after testing each wafer. LSTW = pause after testing the last wafer.
BWNumOfWafs	Number of wafers. Used when BWCondition is NWAF or THLW.
BWWaferID	Wafer ID. Used when BWCondition is CWAF.
BWJudgeRule	Judgment rule (LT,LE,EQ,GE,GT). Used when BWCondition is THLW.
BWJudgeTLevel	Threshold level for judgment. Used when BWCondition is THLW.

When using scenario 15.1.20, the host can select one of the followings conditions to pause a test in between process jobs:

Parameter	Description
PJECondition	Pause condition for end of process job. NONE = no pause. FNSH = always pause after completing a process job. FFND = pause after completing a process job if one or more wafers failed. PFLT = pause after completing a process job if the process job failed.
PJEJudgeRule	Judgment rule (LT,LE,EQ,GE,GT). Used when BWCondition when PJECondition is PFLT.
PJEJudgeTLevel	Threshold for judgment. Used when PJECondition is PFLT.

## 7.2.2. Tunable Recipe Parameters

In *host driven adaptive test scenarios* 15.1.18, 15.1.19 and 15.1.20, the host can change some parameters like the slot or die list to be tested when tuning the recipe.

There are two groups of recipe parameters.

- Parameters directly specified by the host.
- Parameters defined in the SPECS recipe file which resides on the tester's workstation. These parameters must be created in advance with the SPECS Recipe Editor.

### 7.2.2.1. Parameters that are directly specified by the host

- Parameters which can be used when creating a process job.
- Parameters which can be used when tuning a recipe (S16,F23).
- Pause Condition Parameters.

In the following table, you will find a list of all default parameters that can be defined when creating a process job using S16, F3, F11, F13 and F15. The S16,F23 column specifies if this parameter can be tuned with S16,F23 after the process job has started processing.

Note: DieTestSpecnames, TestSpecFileName, and DieSpecFileName have a maximum size of 255 x 128 characters (128 maximum names, each name having a maximum of 255 characters). All other parameters have a maximum of 255 characters.

Parameter	Description	S16,F23
TestPlanName	Test Plan Name	YES
SlotList	New list of slots containing valid wafers to be tested. This parameter allows to redefine the original SlotList specified by the Process Job PRMtlNameList attribute. Format: "slot_number,slot_number ...." Ex. "4,10,12" Up to 25 slots can be specified in the list. <i>Important note: Using this parameter will cause all the wafers to be unloaded and reloaded again on the prober. For optimum performance, only specify the SlotList parameter in the S16F23 message when you need to change the wafer list.</i>	YES
DieTestSpecnames	Die-Test Spec Name Pair, Max 128	YES
TestSpecFileName	Test Spec File Names, Max 128	YES
DieSpecFileName	Test Spec File Names, Max 128	YES
WaferSpecFileName	Wafer Spec File Name	YES
ProbeSpecFileName	Probe Spec File Name	YES
LimitFileName	Limit File Name	YES
ProberRecipeFileName	Prober Recipe File Name	NO

Parameter	Description	S16,F23
MeasLibName	Measurement Library Name	NO
DeviceLibName	Device Library Name *	NO
RecipeFName	Recipe File Name. The recipe editor will create this Recipe File. This recipe file format is customizable.	YES
TestCondFName	Test Condition File Name. This file contains Adaptive Test Tuning Parameter information DieLabel : DieLabel List to be tested. Max 256 DieType : DieType List to be tested. Max 256 Module : Module List to be tested. Max 256 TCO : Test Constant File List. Max 16	YES
CondLevel	Test Condition Level. Points to an entry in the LEVEL column in the TestCondFName file. Example: For instance, the “SAMPLE” level specifies the die labels A and B for recipe “clock1”. The die labels are associated with a specific XY location on the wafer. See the SPECS documentation for more details on this feature. <pre>PRODUCT  LEVEL    TCO  LimitFile  DieLabel .... clock1    SAMPLE          A,B</pre>	YES
WaferTest	Values: “Abort” SPECS-FA will abort the wafer. “Retest” SPECS-FA will retest the same wafer with the same recipe or with a new test plan without unloading the wafer. “Cont” Continue testing. See next section “How Recipe Tuning Affects The Test Plan” for more details.	YES
AdaptiveMethod	Adaptive Test Mode for SPECS: PAUSE = SPECS sends a PJPauseRequest or CJPauseRequest when a pause condition is detected (ex. Like IWCondition is NDIE, IWNumberOfDies =5 and the SPECS just completed testing the 5 <sup>th</sup> die.) EXLVL = SPECS will judge the test results and modify the DVVAL ExecutionLevel and ExecuteAttribute at run-time. The hosts set the initial ExecutionLevel in the Control Rule. The ExecutionLevel and ExecuteAttribute variables are used by VGEM to decide whether to execute the next process job or not.	YES

Parameter	Description	S16,F23
IWCondition	Pause condition when processing a wafer: NONE = no pause. NDIE = pause after completing test for specified number of die. DFND = pause after finding a failed die. CDIE = pause after completing test for the specified die. THLD = pause if fail ratio for sample die is over the the specified threshold level.	YES
IWNumOfDies	Number of dies. Used when IWCondition is NDIE or THLD.	YES
IWDieLabel	Die label. Used when IWCondition is CDIE.	YES
IWJudgeRule	Judgment rule (LT,LE,EQ,GE or GT). Used when IWCondition is THLD.	YES
IWJudgeTLevel	Threshold level for judgment. Used when IWCondition is THLD.	YES
BWCondition	Pause condition in between wafers. NONE = no pause. NWAF = pause after completing test for specified number of wafers. WFND = pause after finding a failed wafer. CWAF = pause after completing testing for the specified wafer. THLW = pause if fail ratio for sample wafers is over the specified threshold level. ALLW = pause after testing each wafer. LSTW = pause after testing the last wafer.	YES
BWNumOfWafs	Number of wafers. Used when BWCondition is NWAF or THLW.	YES
BWWafID	Wafer ID. Used when BWCondition is CWAF.	YES
BWJudgeRule	Judgment rule (LT, LE, EQ, GE, GT). Used when BWCondition is THLW.	YES
BWJudgeTLevel	Threshold level for judgment. Used when BWCondition is THLW.	YES
PJECondition	Pause condition for end of process job. NONE = no pause. FNSH = always pause after completing a process job. FFND = pause after completing a process job if one or more wafers failed. PFLT = pause after completing a process job if the process job failed.	YES
PJEJudgeRule	Judgment rule (LT, LE, EQ, GE, GT). Used when BWCondition when PJECondition is PFLT.	YES
PJEJudgeTLevel	Threshold for judgment. Used when PJECondition is is PFLT.	YES

\*Note concerning default parameters values and when they are reset.

#### At start-up:

RecipeFName is set the value defined in /opt/SPECS\_FA/dmh/vgem/defaults.ini (VGEM RecipeFile /opt/SPECS/usr/tpl/FA\_recipe2.rec). WaferTest is set to "Cont". All other parameters are null ("").

#### After a process job completes:

IWCondition, BWCondition, TestCondFName and CondLevel are reset so that they have no effect on the next process job. The host is responsible for creating the next process job with the proper adaptive test parameters.

#### **After a lot completes :**

PJECondition and AdaptiveMethod are reset so that they have no effect on the next lot. The host is responsible for creating the next process jobs with the proper adaptive test parameters.

#### **WaferTest value after tuning:**

WaferTest is reset to “Cont” after completing its action (Abort or Retest) on the current wafer.

#### **7.2.2.2. How recipe tuning affects the test plan**

If the following parameters are changed by S16,F23, SPECS-FA framework rebuilds the test plan from the scratch.

- TestPlanName
- DieTestSpecnames
- TestSpecFileName
- DieSpecFileName
- WaferSpecFileName
- RecID parameter (recipe ID) used in S16F3,11,13,15

The following parameters, if tuned, do not require rebuilding the test plan:

- SlotList
- LimitFilename
- TestConditionFileName
- WaferAbort
- Pause Condition Parameters

#### **7.2.2.3. Where do we resume testing after recipe tuning?**

1. After the process job is paused set by IWCondition:

“SlotList” parameter is not specified in S16F23 Recipe Tuning Message

**WaferTest = Abort**

Abort the current wafer. SPECS re-starts from the next wafer with current test plan or new/tuned test plan.

**WaferTest = Retest**

Retest the current wafer from the beginning with current test plan or new/tuned test plan.

**WaferTest = Cont**

If new test plan is created by recipe tune, the new test plan starts from the current wafer. This is the same as Retest with new test plan. If the test plan is simply tuned (or not tuned =current test plan), the test re-starts from the next die.

“SlotList” parameter is specified in S16F23 Recipe Tuning Message

WaferTest parameter will be ignored. The test starts from the first wafer specified by SlotList with the current test plan or new/tuned test plan.

2. After the process job is paused by BWCondition:

“SlotList” parameter is not specified in S16F23 Recipe Tuning Message

**WaferTest = Abort**

Abort the current wafer. SPECS re-starts from the next wafer with current test plan or new/tuned test plan.

**WaferTest : Retest**

Retest the current wafer from the beginning with current recipe or new/tuned recipe.

**WaferTest : Cont**

Same as Abort.

“SlotList” parameter is specified in S16F23 Recipe Tuning Message

WaferTest parameter will be ignored. The test starts from the first wafer specified by SlotList with the current test plan or new/tuned test plan.

3. After the control job is paused by PJECondition:

SPECS will ignore the WaferTest parameter.

## **SPECS Measurement Data File**

When testing is resumed, if no tuning is done (current test plan is used), the current Data File is used for storing the following test. If a new test plan is created or the current test plan is tuned, SPECS creates a new Data File after testing resumes (the current Data File is closed and a new Data File is created for the following test).

### **7.2.2.4. Parameters defined in the SPECS recipe file which resides on the tester’s workstation**

SPECS-FA provides a sample recipe file stored at the following location:

"/opt/SPECS/usr/tpl/FA\_recipe2.rec"

It is expected that the end-user will need to customize this file to meet specific test requirements. Each “Recipe Key” in the recipe file points to the information needed to build a SPECS Test Plan.

SPECS-FA Sample Recipe File has the following items.

- Recipe key (RECIPE KEY)
- Product ID (PRODUCT)
- Process (PROCESS)
- Lot ID (STEP)
- Prober Recipe File (Prober RCP)
- WaferSpecFileName (WAF)
- DieSpecFileName (DIE)
- ModuleSpecFileName (MOD)
- TestSpecFileName (TST)
- ProbeSpecFileName (PRB)
- LimitSpecFileName (LMS)
- TestPlanConstantFileName (TCO)
- TestPlanName (TPL)
- LimitFileName (Limit File)
- MeasLibNames (MEASLIBS)

Relationship between the Process Job's Recipe Id and the Recipe File

The Recipe ID parameter specified by the process job corresponds to a “Recipe Key” entry in the recipe file. If a process job uses recipe tuning, the tuning parameters will overwrite the default values specified in the recipe file.

### 7.2.3. Usage Scenario Examples

Selectable Measurement Library and Adaptive Test while processing a wafer.

In the following example, the AdaptiveMethod is set to PAUSE. The IWCondition is set to NDIE and IWNumOfDies is set to 5.

SPECS-FA starts testing and issues an event PJPauseRequest (CEID 5703) after completing testing for the first 5 dice on the first wafer. EVENT PJPauseRequest can be associated with DVVAL PJPauseReason (1352) and DVVAL PJPauseValue (1353), which in this case contains the following strings:

```
PJPauseReason = "NDIE"
PJPauseValue  = "5"
```

The host receives CEID 5703 with the PJPauseReason and the process job pauses (CEIDs 5908 and 5909 are sent).

In our example, process job is created with S16F11:

```
S16F11 <L:7
      <U4 1>          /* data ID */
      <A "1234">       /* process job ID */
      <B 0xD>          /* MF (material format) = 13 */
      <L:1
      <L:2
```

```

<A "CarrierA">          /* carrier ID */
<L:5
  <U1 1>                  /* slot ID */
  <U1 7>                  /* slot ID */
  <U1 11>                 /* slot ID */
  <U1 19>                 /* slot ID */
  <U1 23>                 /* slot ID */
>
>
>
<L:3
  <U1 2>                  /* recipe with variable tuning */
  <A "clock1">            /* recipe ID */
<L:16
  <L:2
    <A "MeasLibName">
    <A "measlib_a">
  >:2
  <L
    <A "DeviceLibName">
    <A "devicelib_a">
  >
  <L:2
    <A "TestCondFName">
    <A "/opt/SPECS/usr/tpl/FA_TEST_SAMPLE.rec">
  >
  <L:2
    <A "CondLevel">
    <A "SAMPLE">
  >
  <L:2
    <A "IWCondition">
    <A "NDIE">
  >
  <L:2
    <A "IWNumOfDies">
    <A "5">
  >
  <L:2
    <A "AdaptiveMethod">
    <A "PAUSE">
  >
  <L:2
    <A "OperatorID">
    <A "1">
  >
  <L:2
    <A "ProberRecipeFileName">
    <A "MAS/MAS/CMS300">
  >
  <L:2
    <A "TestPlanName">
    <A "demo">
  >
  <L:2

```

```

<A "LimitFileName">
<A "1">
>
<L:2
  <A "WaferSpecFileName">
  <A "1">
>
<L:2
  <A "ProbeSpecFileName">
  <A "1">
>
<L:2
  <A "TestSpecFileName">
  <A "1">
>
<L:2
  <A "ProductID">
  <A "1">
>
<L:2
  <A "DieSpecFileName">
  <A "1">
>
>
>
<TF TRUE>          /* autostart */
<L:1              /* CEID lists of pause event */
  <U4 5703>        /* PJPauseRequest */
>
>

```

At this point, the equipment is paused and the host can send a S16F23 PRJobSetRecipeVariables command to tune some parameters:

```

S16F23 <L:2
  <A "1234">
  <L:4
    <L:2
      <A "SlotList">      /* test all the wafers */
      <A
"2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25">
    >
    <L:2
      <A "WaferSpecFileName">
      <A "2">
    >
    <L:2
      <A "IWCondition">
      <A "NONE">
    >
    <L:2
      <A "CondLevel">
      <A "FULLTEST">
    >

```

```
>  
>
```

Once the parameters are tuned correctly, EVENT Recipe\_Tuned\_OK is sent (CEID 5701 is sent. If there is a failure, EVENT Recipe\_Tuned\_Failed is sent – CEID 5702).

If EVENT Recipe\_Tuned\_OK – 5701 is received, the host can send S16F5 PJ Resume to VGEM to resume testing:

```
S16F5 <L:4  
      <U4 1>          /* data ID */  
      <A "1234">      /* process job ID */  
      <A "RESUME">  
      <L:0 >  
>
```

If EVENT Recipe\_Tuned\_Failed was received, the host can decide to abort the current control job or process job.

### 7.3. Tester driven Adaptive Test

The tester driven Adaptive Test scenario relies on the concept of an “execution level” associated to each process job and a control rule specified at the time a control job is created.

This scenario corresponds to scenarios 15.1.21 and 15.1.22 in Chapter 15.

The AdaptiveMethod parameter must set to “EXLVL” in the process job.

The Control Job’s ProcessingCtrlSpec attribute is set with the S14F9 message, using the parameter “StartFlag” in the control rule list:

```
<L:2
  <A "ProcessingCtrlSpec">
  <L:3
    <A "1234">
    <L
      /* optional control rule */
      /* (used in Adaptive Test Scenario 15.1.17) */
    <L
      <A "StartFlag">
      <U1 1>          /* Execution Level ranges from 0 to 8 */
    >
    >
    <L:0 >            /*output rule is always empty */
  >
>
```

The “ExecutionLevel” is used along with the “ExecuteAttribute” to define an operator to compare the process job’s StartFlag with the ExecuteLevel as defined by SPECS-FA at run-time.

As shown in the Adaptive Test scenarios 15.1.21 and 15.1.22, the ExecutionLevel (DVVAL 1184) and ExecuteAttribute (DVVAL 1182) variables are set on EVENT PendingComplete (5124) by SPECS-FA.

ExecutionLevel: 0, 1, 2, 3, 4, 5, 6, 7, 8

ExecuteAttribute: GE (greater than or equal to), EQ (equal to), LE (less than or equal to).

The execution level consists in 9 different levels ranging from 0 to 8. If a process job’s Control Rule is set to execution level ‘0’, it is not executed. And if the current execution level is set to ‘3’ and “ExecuteAttribute” is set to “EQ”, process jobs which have been set to execution level ‘3’ are executed.

For example:

Fail Ratio of Pre-Test : Execution Level

≤ 5% :	0 (don’t execute process jobs)
≤ 10% :	2
≤ 20% :	3
> 20% :	4

```
PJ1 : ExecLevel=1 : Sampling Test : Wafer #1, #2, #3, #4, #5  
PJ2 : ExecLevel=2 : Sampling Test : Wafer #6 to #25  
PJ3 : ExecLevel=3 : Medium Test : Wafer #1 to #25  
PJ4 : ExecLevel=4 : Full Test : Wafer #1 to #25  
  
CJ1 : PJ1,PJ2,PJ3,PJ4
```

In the above example, the host creates process jobs PJ1, PJ2, PJ3, PJ4 and create the control job CJ1 for Cassette-001.

Since process job PJ1 has an execution level equal to 1 and appears at the top of the process job queue, it is executed first. After completing PJ1, SPECS-FA framework checks PJ1's test results and then decides on a new execution level. If fail ratio is 3%, it is set the Execution Level to '0' to avoid running additional process jobs and complete the control job. If fail ratio is 15%, the Execution Level is set to '3' that directs the process job PJ3 to be executed next.

In *tester driven adaptive test* scenarios, SPECS-FA framework uses only ExecutionLevel and ExecuteAttribute parameters to change the adaptive test scenario. Under this scenario, complicated tuning for test parameters is not impossible but more difficult to implement.

# Chapter 8. State Models

## 8.1. State Model Notation

State models provide visual representation of the behavior of equipment from a host perspective. They provide information on the states a system may take, event that prompt changes of that state, and the composition of states. The state models presented here use the "Statechart" notation developed by David Harel. (Harel, David and Politi, Michal Modeling Reactive Systems with Statecharts. New York, McGraw-Hill, 1998.)

### 8.1.1. States

States are depicted as rectilinear boxes with rounded corners. The name of the state is contained within the box, and complies with standard naming conventions.

Figure 8-1. State Box



States may be subdivided into substates to define a hierarchy, expanding the expression of more complex behavior. Substates may be AND substates and OR substates. Substates may also be parents of further nested substates. A parent state may have two or more OR substates, but only one of them is active for any given time. (A motor may be 'on' or 'off' but never both.)

Parent states may also be divided into sets roughly corresponding to subsystems. These AND substates represent parallelism, with every AND state of an active parent state considered active. Exiting on of a set of AND substates requires the exit of all others. In some Statecharts, this may be depicted as a transition arrow shown from one substate with the implications that all are exited.

Leaf states are substates that do not have child states. Transitions within a state model are always between two leaf states.

### 8.1.2. Transitions

Transitions are depicted as single-headed arrows, with triggers as labels. Transitions are unidirectional, so whereas a reverse transition may be applicable, it is always drawn as a separate transition.

Figure 8-2. Transition Arrow



### 8.1.3. Entry Points, Conditional, and History States

Default entry points are depicted as solid circles with a line indicating which OR State is initially active when there is not an explicit chose.

Figure 8-3. Entry Circle



State diagrams begin with an entry point, often moving into a conditional state. Conditional states, depicted by a "C" enclosed in a circle serve to abbreviate potentially complex entrances into a state.

Figure 8-4. Conditional Circle



An entrance to a state ending in an "H" enclosed in a circle indicates that the OR substate entered is the one active the last time the parent was active. (The last time the car was running, the radio was turned 'on.') This symbol extends further to the lowest level substates defined. In the absence of a 'last time,' the default entry is used.

Figure 8-5. History Circle



For a fuller exploration of State Charts, refer to A.5 of SEMI E30 or to David Harel's "Modeling Reactive Systems with Statecharts." Processing States

## 8.2. State Model Summary

VGEM maintains many state models, including those specified in the SEMI E5 and E30.3, E87, E40 and E94. SEMI E90 (Substrate Tracking) is entirely maintained by the TEL prober (in this case, VGEM simply reports the E90 CEIDs to the host by adding 10000 to the prober's CEID).

### 8.2.1. State Model Summary Table

State Category	Supported States	SEMI Reference
Processing	Equipment	TSEM
Processing	Port	TSEM
Processing Management	Process Job	SEMI-E40
Control Job Management	Control Job	SEMI-E94
Carrier Management	Carrier ID	SEMI-E87
Carrier Management	Carrier Slot Map	SEMI-E87
Carrier Management	Access Mode	SEMI-E87
Carrier Management	Load Port Reservation	SEMI-E87
Carrier Management	Load Port Carrier/Association	SEMI-E87
Carrier Management	Load Port Transfer	SEMI-E87
Substrate Tracking	Substrate and Substrate Location	SEMI-E90 (see chapter 13 for all details)
Control	Control	SEMI-E5
Communications	Communication	SEMI-E5
Alarms	Alarm	SEMI-E5
Spooling	Spooling	SEMI-E5

State model changes are triggered by messages from the various entities that may be communicating with the VGEM. Messages are validated against the current state and disallowed if invalid conditions exist. These validations are detailed in the transition tables following each of the state models in this chapter.

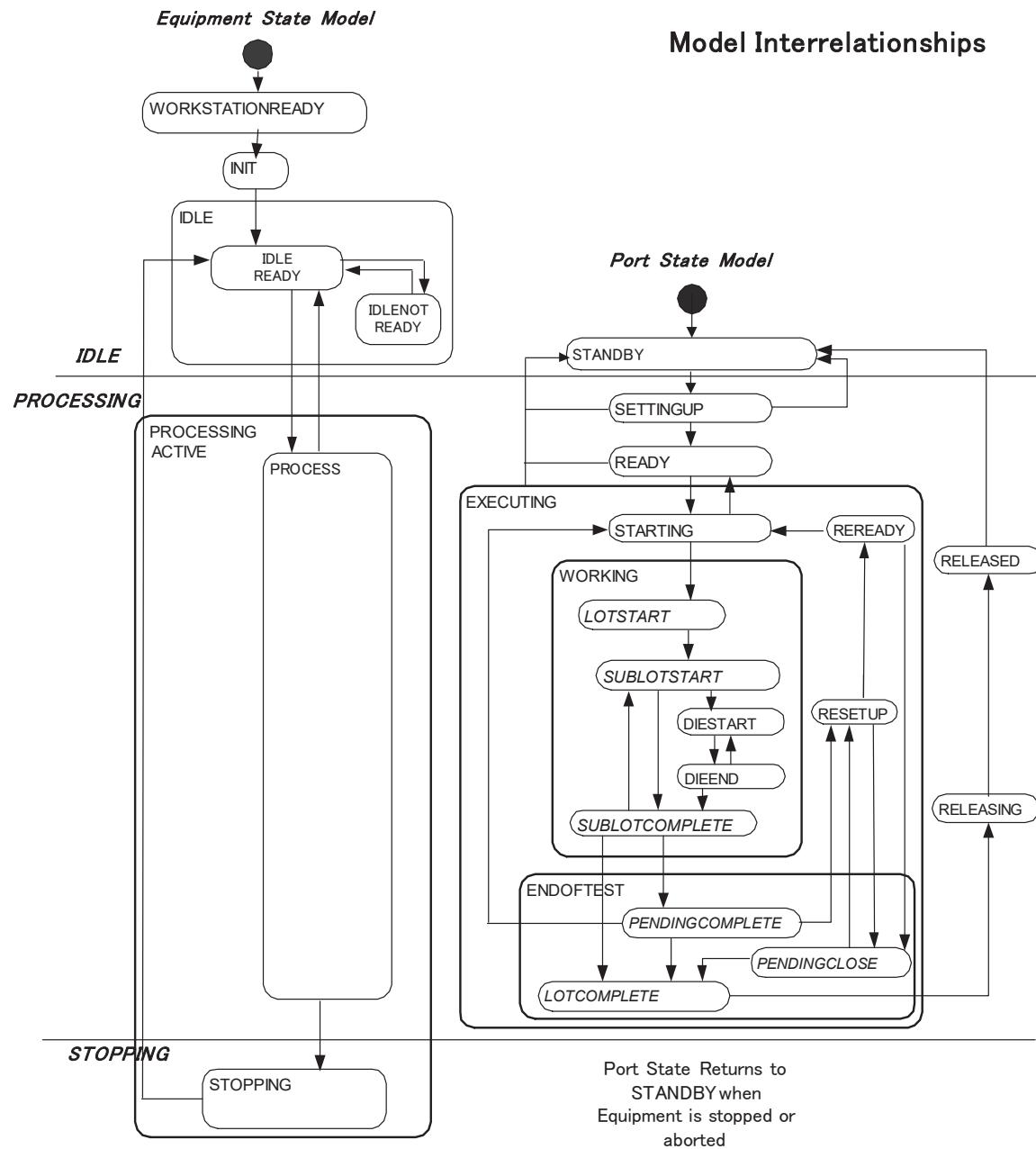
### 8.3. Processing States

The Equipment State Model and the Port State Model document the behavior of the equipment while performing its primary function. The processing state models for the VGEM follow the TSEM standard, an extension of the GEM processing state model. The GEM model is generic for all semiconductor equipment, while the TSEM is specific for semiconductor testing equipment. The term equipment (as in "equipment model") is used to refer to the Keysight tester.

Section 8.4 describes the relationship between the Control Job and Process Job state models and the Equipment and Port state models. The Equipment and Port state models define states not addressed in E40 and E94 such as alarms conditions or low-level processing states such as DIELSTART.

The equipment and port state models are related to one another, as shown on the following timeline. When the equipment sits in IDLE, the ports are in the state STANDBY. The equipment's PROCESSING ACTIVE states correspond to the port's SETTINGUP, READY, and EXECUTING states. If either of the ports are executing, the equipment remains in PROCESSING ACTIVE. When both ports have returned to STANDBY, the equipment can then return to IDLE.

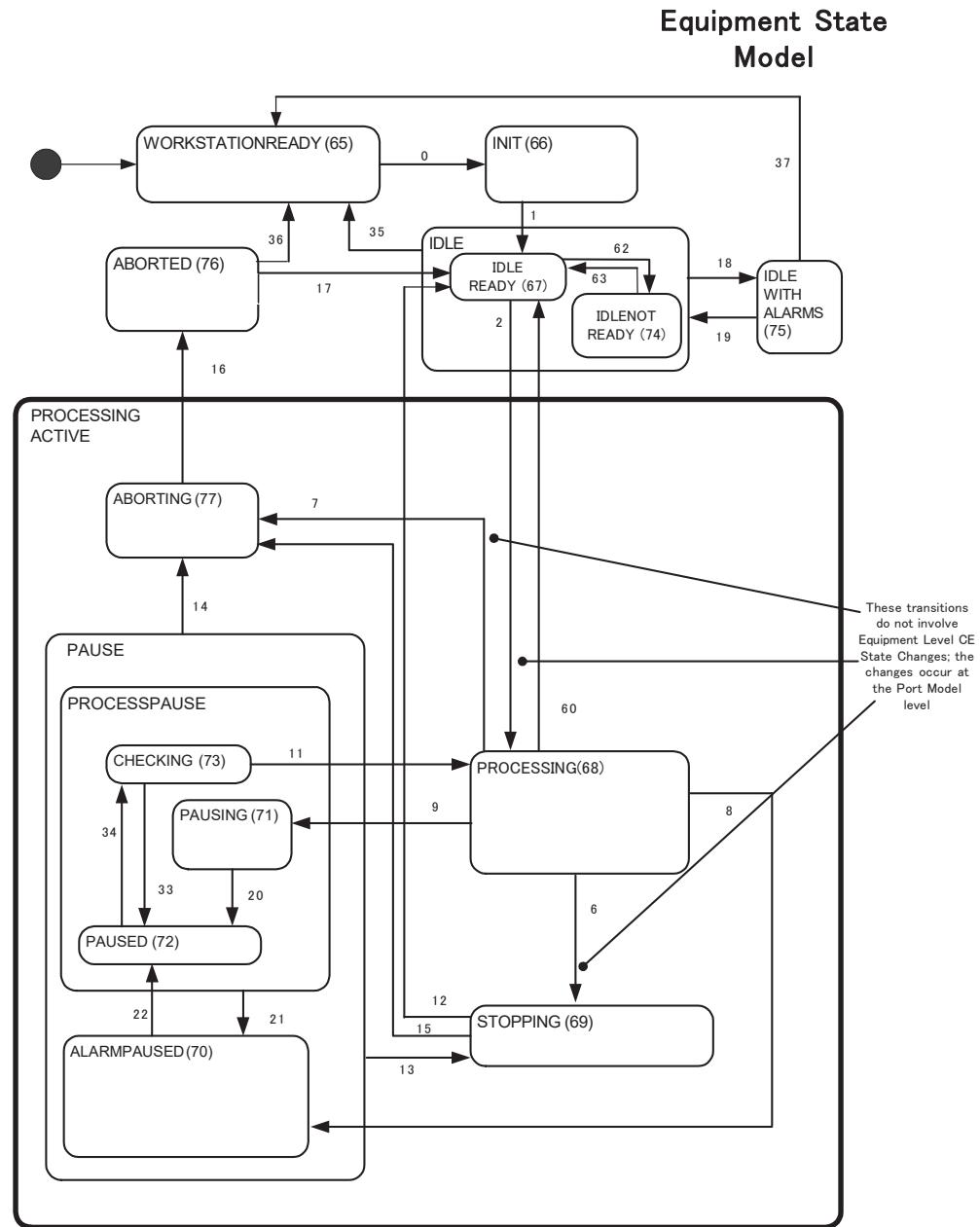
Figure 8-6. Equipment and Port State Model Timeline



### 8.3.1. Equipment State Model

The following State Model shows the relationship between parent states and substates in the Equipment State.

Figure 8-7. Equipment State Model



Note: Each transition in the equipment state model corresponds to a Collection Event ID = transition number + 5000.

### 8.3.2. Equipment State Transition Table

All descriptions of S2F41 Commands in this table refer to the VGEM Compatibility Mode, which allows the software to execute in VGEM 2.x mode and accept S2F41 commands to process wafers. The default configuration as it ships from the factory is E40/94 mode. The Compatibility Mode is set in /opt/SPECS\_FA/dmh/vgem/defaults.ini by the “VGEM CompatibilityMode” flag. If it is set to 1, VGEM will run in VGEM 2.x mode. The default is 0, E40/94 mode.

Table 8-1. Equipment State Transitions

#	Current State	Triggers	New State	Comments	Transition CEIDs
0	WORKSTATIONREADY	EVENT StartInit	INIT		5000
1	INIT	EVENT InitComplete	IDLEREADY	All tester initialization is complete with no alarms or error conditions.	5001
6	PROCESSING	CMD STOP (VGEM 2.x mode based on S2F41)	STOPPING	The tester has received a STOP command.	5006
7	PROCESSING	CMD ABORT (VGEM 2.x mode based on S2F41)	ABORTING	The VGEM is waiting for the equipment to send the message indicating that it has aborted. There may be a significant delay before the equipment responds with an EVENT Aborted.	5007
8	PROCESSING	ALARM	ALARMPAUSE	An alarm occurs. An error condition occurs which requires feedback.	5008
9	PROCESSING	CMD PAUSE (VGEM 2.x mode based on S2F41) or S16F5 Process Job PAUSE command	PAUSING	The tester has received a PAUSE command. The VGEM is waiting for the equipment to send the message indicating that it has passed. There may be a significant delay before the equipment responds with an EVENT Paused.	5009
11	CHECKING	EVENT Resumed	PROCESSING	Parameter checking (by the tester) completes successfully. This event will not affect the port state. Whenever the equipment is placed in PAUSING, the port state will not change.	5011

#	Current State	Triggers	New State	Comments	Transition CEIDs
12	STOPPING	EVENT Stopped	IDLEREADY	The tester cleanup is complete, and the tester is free of alarms. IDLEREADY means that both ports are in STANDBY (nothing is wrong) or processing was stopped by a S2F41 STOP or ABORT command.	5012
13	PAUSE	CMD STOP (VGEM 2.x mode based on S2F41)	STOPPING	The tester has received a STOP command from the host via S2F41 STOP.	5013
14	PAUSE	CMD ABORT (VGEM 2.x mode based on S2F41)	ABORTING	The tester has received an ABORT command.	5014
15	STOPPING	CMD ABORT (VGEM 2.x mode based on S2F41)	ABORTING	The tester has received an ABORT command. Time spent in the ABORTING state is extremely brief, before transitioning through the ABORTED to IDLEREADY state.	5015
16	ABORTING	EVENT Aborted	ABORTED	ABORTED is always a pass-through state. Unsafe conditions have been resolved where possible. Time spent in the ABORTED state is extremely brief, before transitioning to the IDLEREADY state.	5016
17	ABORTED	EVENT Aborted	IDLEREADY	Used as a pass-through state. See transition 16.	5017
18	IDLE	ALARM	IDLEWITHALARMS	An alarm is set.	5018
19	IDLEWITHALARMS	EVENT AlarmCleared	IDLE	All alarms have been cleared. If the equipment goes into IDLEWITHALARMS, the host will send a S2F41 RESUME. The VGEM will return to the state the equipment was in prior to the Alarm message.	5019
20	PAUSING	EVENT Paused	PAUSED	The tester has completed processing the current unit(s) and achieved a "safe" condition. The tester has been paused via a host S2F41 PAUSE command. The tester is always told what to do from this state via an S2F41 remote command.	5020

#	Current State	Triggers	New State	Comments	Transition CEIDs
21	PROCESSPAUSE	ALARM	ALARMPAUSED	An alarm is set. The machine has picked up an error condition and will wait in the ALARMPAUSED state until told what to do.	5021
22	ALARMPAUSED	EVENT AlarmCleared	PAUSED	The VGEM received an Alarm Clear Event. The tester will transition to the PAUSED state to await a host S2F41 remote command.	5022
33	CHECKING	EVENT Paused	PAUSED	Error detected in a new parameter setting.	5033
34	PAUSED	CMD RESUME (VGEM 2.x mode based on S2F41) or S16F5 Process Job RESUME	CHECKING	A RESUME command was received from the host via S2F41 RESUME.	5034
35	IDLE	EVENT Reset	WORKSTATIONREADY	The operator has stopped the tester executive. This will cause the tester to re-do any initialization it feels is necessary.	5035
36	ABORTED	EVENT Reset	WORKSTATIONREADY	The operator has aborted the tester executive.	5036
37	IDLEWITHALARMS	EVENT Reset	WORKSTATIONREADY	An ABORT has been received from the host via S2F41 ABORT. This will facilitate forcing the equipment to re-initialize while the host and VGEM continue running (i.e. host and interface do not need to re-establish communications).	5037
60	PROCESSING		IDLEREADY	IDLEREADY state will be the state of the equipment when both ports are in STANDBY.	5060
62	IDLEREADY	EVENT IdleNotReady	IDLENOTREADY	Tester uses state IDLENOTREADY to perform diagnostic tests.	5062
63	IDLENOTREADY	EVENT IdleReady	IDLEREADY	Tester has completed diagnostic testing.	5063

#	Current State	Triggers	New State	Comments	Transition CEIDs
1 35	INIT	EVENT Reset	WORKSTATIO NREADY	A reset event has been sent from the tester. This event is usually as a result of a CMD Reset from the Operator or Host. It transitions to WORKSTATIONREADY, invoking pass through transitions as necessary.	
7 16 17 35	PROCESSING	EVENT Reset	WORKSTATIO NREADY	A reset event has been sent from the tester. This event is usually as a result of a CMD Reset from the Operator or Host. It transitions to WORKSTATIONREADY, invoking pass through transitions as necessary.	5007 5016 5017 5035
0 1 18	WORKSTATIO NREADY	ALARM	IDLEWITHALARMS	An alarm has been issued from the equipment during tester initialization.	5000 5001 5018
1 18	INIT	ALARM	IDLEWITHALARMS	An alarm has been issued from the equipment during tester initialization.	5001 5018
14 16 36	PAUSE	EVENT Reset	WORKSTATIO NREADY	A reset event has been sent from the tester. This event is usually as a result of a CMD Reset from the Operator or Host. It transitions to WORKSTATIONREADY, invoking pass through transitions as necessary.	5014 5016 5036
12 35	STOPPING	EVENT Reset	WORKSTATIO NREADY	A reset event has been sent from the tester. This event is usually as a result of a CMD Reset from the Operator or Host. It transitions to WORKSTATIONREADY, invoking pass through transitions as necessary.	5012 5035
16 36	ABORTING	EVENT Reset	WORKSTATIO NREADY	A reset event has been sent from the tester. This event is usually as a result of a CMD Reset from the Operator or Host. It transitions to WORKSTATIONREADY, invoking pass through transitions as necessary.	5016 5036

### 8.3.3. Equipment State Definitions

#### **ABORTED**

All activity is suspended as a result of an ABORT command. All alarm and abort conditions must be cleared and verified by an operator before exit from this state.

#### **ABORTING**

(PROCESSINGACTIVE substate) The tester has received an ABORT command. All activity is suspended. The tester is taking appropriate action to bring itself and material to a "safe" state where possible. Unit or lot data may be invalid or not available.

#### **ALARMPAUSED**

(PAUSE substate) An alarm has occurred in the PROCESSING, CHECKING, PAUSING, or PAUSED states, and the tester is waiting for the alarm to be cleared.

#### **CHECKING**

(PROCESSPAUSE substate) The tester verifies that updates made to the process program are valid. This is a similar procedure to that which is done in SETTING UP. At the successful completion of verification, a transition is made to the process state, based on the process model condition table.

#### **IDLE**

(Parent state) Awaiting a command. IDLE is free of ALARMS and error conditions. A program may or may not be loaded in the execution space during this state. Because IDLE is a parent state, the equipment will be only able to stop in one of IDLE's substates. There is never a transition to IDLE.

#### **IDLENOTREADY**

The tester is moved to IDLENOTREADY to perform continuity and diagnostic tests.

#### **IDLEREADY**

The tester is ready to begin processing and is awaiting a START command.

#### **IDLEWITHALARMS**

An alarm has occurred in the IDLE parent state, and the tester is waiting for all alarms to be cleared.

#### **INIT**

Tester initialization is occurring.

#### **PAUSE**

(Parent state) The tester has received an alarm or PAUSE command. As a parent state, the equipment never transitions to PAUSE, but into one of its substates.

### **PAUSED**

(PROCESSPAUSE substate) The PROCESSING state has been suspended, and the tester is waiting for a command (RESUME, STOP, or ABORT). In this state, the operator may correct error conditions and modify some conditions of the current process program selection.

### **PAUSING**

(PROCESSPAUSE substate) The current state will be suspended at the completion of the current unit(s), if any, and the tester will be brought to a 'safe place.'

### **PROCESSING**

(PROCESSINGACTIVE substate) This state is the parent of those substates that exist in the Port State Model and refer to the preparation and execution of a process program.

### **PROCESSPAUSE**

(PAUSE substate and parent state) The tester is free of alarm conditions in the PAUSE state. As a parent state, the equipment never transitions to PROCESSPAUSE, but into one of its substates.

### **STOPPING**

(PROCESSINGACTIVE substate) The tester has completed a process program or has been instructed to stop processing and shall do so at the next opportunity. All necessary clean-up is completed within this state with regard to material, data, control system, etc. Data is preserved. Any error condition is cleared before exiting from this state.

### **WORKSTATIONREADY**

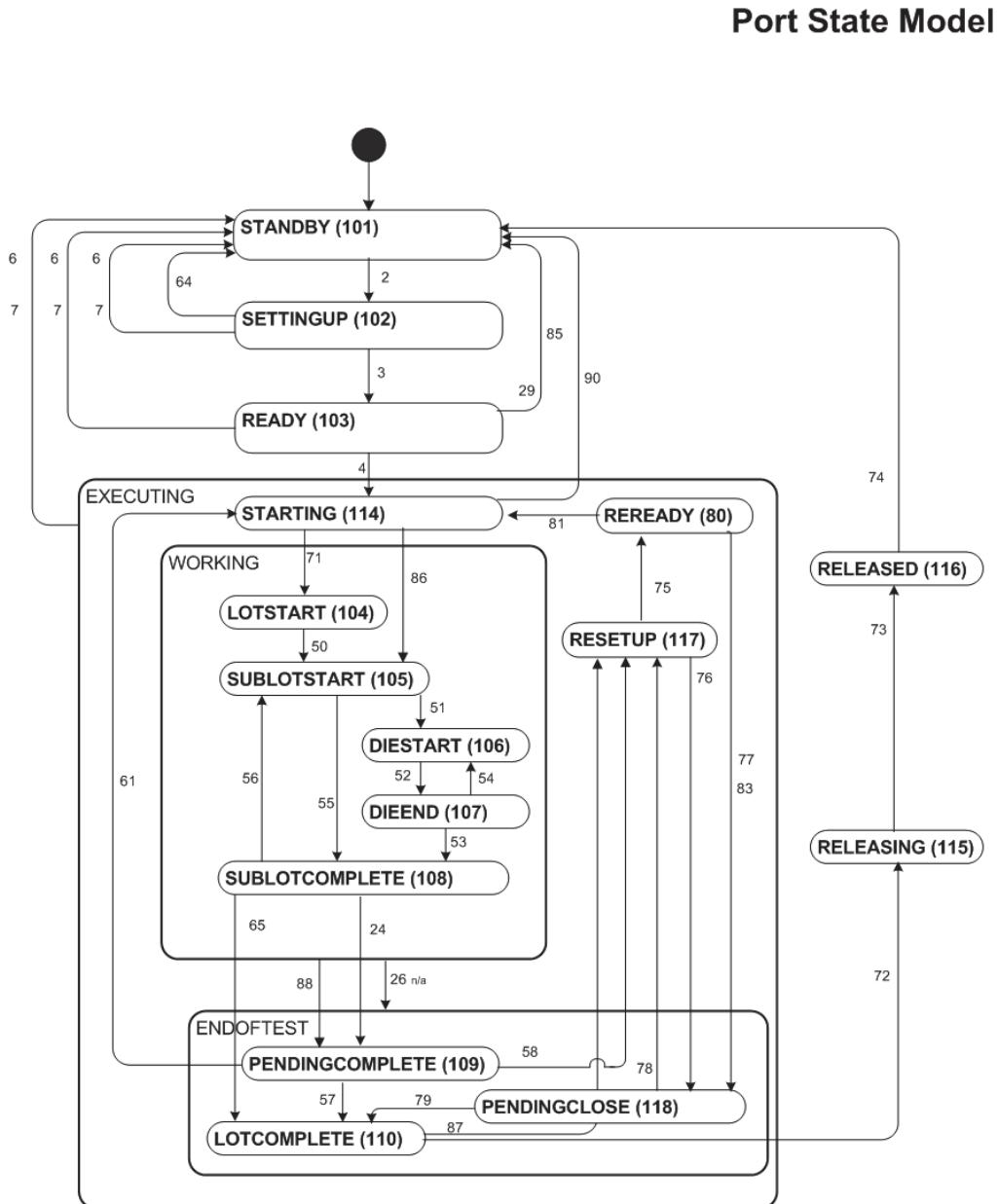
The tester workstation is running and ready for tester initialization. The START remote command is valid in this state. Note: SmarTest passes through this state to IDLEREADY.

### 8.3.4. Port State Model

The port state model supports multiple port activity. One port state model will be maintained for each port.

Note: Transition 26 is ambiguously defined in the TSEM. Because the sub-states have been added to the ENDOFTEST parent state, the transition is not used in the VGEM baseline design.

Figure 8-8. Port State Model



Note: Each transition in the port state model corresponds to a Collection Event ID = transition number + 5100

### 8.3.5. Port State Transition Table

Table 8-2. Port State Transitions

#	Current State	Triggers	New State	Comments	Transition CEIDs
2	STANDBY	CMD PP-SELECT (VGEM 2.x mode based on S2F41) or Process Job has transitioned from QUEUED/POOLED state to SETTING UP.	SETTINGUP	The host or operator has executed a PP-SELECT command (VGEM 2.x mode). In E40/94 mode, the Control Job has executed the next process job at the top of the its job queue.	5102
3	SETTINGUP	EVENT RecipeVerified	READY	All PP-SELECT activity has completed and the tester is ready to receive a START command (VGEM 2.x mode). In E40/94 mode, if the process job is in manual mode, it will wait in "WAITING FOR START" for a S16F5 Process Job STARTPROCESS. If the process job is in auto mode, processing will start immediately and VGEM will not wait in the READY state.	5103
4	READY	CMD START (VGEM 2.x mode based on S2F41) or S16F5 Process Job STARTPROCESS	STARTING	The host or operator has executed a START command (VGEM 2.x mode). In E40/94 mode, if the process job is in manual mode, it will wait in "WAITING FOR START" for a S16F5 Process Job STARTPROCESS. If the process job is in auto mode, processing will start immediately and VGEM will not wait in the READY state.	5104
6	ALL	CMD STOP (VGEM 2.x mode based on S2F41)	STANDBY	The tester has received an abort command.	5106
7	ALL	CMD ABORT (VGEM 2.x mode based on S2F41)	STANDBY	The tester has received a stop command.	5107

#	Current State	Triggers	New State	Comments	Transition CEIDs
24	SUBLOTCOMPLETE	EVENT PendingComplete	PENDINGCOMPLETE	The processing of the current lot has completed normally. The lot may be retested or closed.	5124
29	READY	EVENT LotCancel, ProberRecipeFail, CMD CANCEL-MEAS (VGEM 2.x mode based on S2F41)	STANDBY	Processing of the lot has been cancelled.	5129
50	LOTSTART	EVENT SubLotStart	SUBLOTSTART	A subplot is a wafer. The tester has started operations to test a wafer.	5150
51	SUBLOTSTART	EVENT DieStart	DIESTART	Testing of the first die on the current subplot has begun.	5151
52	DIESTART	EVENT DieEnd	DIEEND	Testing of a die on the current subplot has completed.	5152
53	DIEEND	EVENT SubLotComplete	SUBLOTCOMPLETE	Testing of all dies on the current subplot has completed.	5153
54	DIEEND	EVENT DieStart	DIESTART	Testing of a subsequent die on the current subplot has begun.	5154
55	SUBLOTSTART	EVENT SubLotComplete	SUBLOTCOMPLETE	Processing of the current wafer has been completed.	5155
56	SUBLOTCOMPLETE	EVENT SubLotStart	SUBLOTSTART	The next wafer in the foup is being started	5156
57	PENDINGCOMPLETE	CMD CLOSE-LOT, (VGEM 2.x mode based on S2F41) or in E40/94 mode, EVENT LotComplete	LOTCOMPLETE	The tester has reported the completion of the lot. In E40/94 mode, VGEM does not require a S2F41 CLOSE-LOT command from the host. VGEM decides to close the lot if there are no more process jobs in the queue for the current lot. EVENT LotComplete from the tester performs this transition.	5157

#	Current State	Triggers	New State	Comments	Transition CEIDs
58	PENDINGCOMPLETE	CMD PP-SELECT (VGEM 2.x mode based on S2F41)	RESETUP	The host or LMP executed a new PP-SELECT command. In E40/94 mode, the Control Job executes the next process job in the queue that belongs to the current lot.	5158
61	PENDINGCOMPLETE	CMD RETEST, EVENT LotStart (VGEM 2.x mode based on S2F41)	STARTING	The host or operator has requested the RETEST of the lot.	5161
64	SETTINGUP	EVENT PPBadCompile	STANDBY	The tester cannot compile the recipe for this wafer test. In E40/94 mode, the process job failed its setup and is self-aborted. All the process jobs in the queue and the control job associated with the current port are also aborted by VGEM.	5164
65	SUBLOTCOMPLETE	EVENT LotComplete (VGEM 2.x mode based on S2F41)	LOTCOMPLETE	The tester has completed processing of the current lot. LOTCOMPLETE is a pass through state in this case.	5165
71	STARTING	EVENT LotStart	LOTSTART	The tester has reported that processing of the lot has started.	5171
72	LOTCOMPLETE	EVENT LotComplete (VGEM 2.x mode based on S2F41) or in E40/94, all process jobs have completed.	RELEASING	The tester has reported the completion of processing of the lot. In E40/94 mode, VGEM sends an internal message to the tester (CLOSE-CASSETTE) to perform this transition after all process jobs have completed.	5172
73	RELEASING	Prober CEID 4009 (ReadyToUnload)	RELEASED	The prober has reported the completion of processing on the port.	5173
74	RELEASED	Prober CEID 4008 (ReadyToLoad)	STANDBY	The prober has reported the clearing of the port.	5174

#	Current State	Triggers	New State	Comments	Transition CEIDs
75	RESETUP	EVENT RecipeVerified	REREADY	The tester has validated the new PP-SELECT.  In E40/94, the process job has successfully completed its setup. If the process job is in manual mode, it will wait in “WAITING FOR START” for a S16F5 Process Job STARTPROCESS. If the process job is in auto mode, processing will start immediately and VGEM will not wait in the READY state.	5175
76	RESETUP	EVENT PPBadCompile	PENDINGCLOSE	The tester has rejected the new PP-SELECT.  In E40/94 mode, the process job failed its setup and is self-aborted. All the process jobs in the queue and the control job associated with the current port are also aborted by VGEM.	5176
77	REREADY	EVENT LotCancel (VGEM 2.x mode based on S2F41)	PENDINGCLOSE	The tester has reported the cancellation of the new run.	5177
78	PENDINGCLOSE	CMD PP-SELECT (VGEM 2.x mode based on S2F41)	RESETUP	The host or LMP has executed a PP-SELECT command.	5178
79	PENDINGCLOSE	CMD CLOSE-LOT (VGEM 2.x mode based on S2F41)	LOTCOMPLETE	The host or LMP has executed the CLOSE-LOT command.  In E40/94 mode, VGEM does not require a S2F41 CLOSE-LOT command from the host. VGEM decides to close the lot if there are no more process jobs in the queue for the current lot. EVENT LotComplete from the tester performs this transition.	5179

#	Current State	Triggers	New State	Comments	Transition CEIDs
81	REREADY	CMD START	STARTING	The host or operator has requested the START of the lot. In E40/94, the process job has successfully completed its setup. If the process job is in manual mode, it will wait in "WAITING FOR START" for a S16F5 Process Job STARTPROCESS. If the process job is in auto mode, processing will start immediately and VGEM will not wait in the READY state.	5181
83	REREADY	CMD PJABORT (S16F5 Process Job ABORT) or CMD CJABORT (S16F27 Control Job ABORT)	PENDINGCLOSE	The host has sent a S16F5 ABORT command or a S16F27 Control Job ABORT command. A Control Job or Process Job ABORT terminates the current process job in the RESETUP state and moves the state to PENDINGCLOSE. Control Job ABORT actually aborts all its process jobs so that PENDINGCLOSE will be a quick transition state since the FOUP is expected to be released in this case. Process Job ABORT only affects the current job. If there is another process job in the queue, it will be executed from the PENDINGCLOSE state. If the Control Job is paused, VGEM will wait in PENDINGCLOSE before resuming processing. Note that all these commands are port specific and that they don't affect processing on the other port in dual-port mode.	5183

#	Current State	Triggers	New State	Comments	Transition CEIDs
85	READY	CMD PJABORT (S16F5 Process Job ABORT) or CMD CJABORT (S16F27 Control Job ABORT)	STANDBY	The host has sent a S16F5 ABORT command or a S16F27 Control Job ABORT command. A Control Job or Process Job ABORT terminates the current process job in the READY state and moves the state to STANDBY. Control Job ABORT aborts all its process jobs. Process Job ABORT only affects the current job. If there is another process job in the queue, it will be executed from the STANDBY state. If the Control Job is paused, VGEM will wait in STANDBY before resuming processing. Note that all these commands are port specific and that they don't affect processing on the other port in dual-port mode.	5185
86	STARTING	EVENT SUBLOTSTART	SUBLISTART	The tester is executing a new process job from the same lot as the previous process job.	5186
87	LOTCOMPLETE	CMD PP-SELECT	RESETUP	The tester is executing a new process job from a different lot.	5187

#	Current State	Triggers	New State	Comments	Transition CEIDs
88	WORKING	CMD PJABORT (S16F5 Process Job ABORT) or CMD CJABORT (S16F27 Control Job ABORT)	PENDINGCOMPLETE	The host has sent a S16F5 PJ ABORT command or a S16F27 Control Job ABORT command. A Control Job or Process Job ABORT terminates the current process job in the WORKING state and moves the state to PENDINGCOMPLETE. Control Job ABORT actually aborts all its process jobs so that PENDINGCOMPLETE will be a quick transitional state since the FOUP is expected to be released in this case. Process Job ABORT only affects the current job. If there is another process job in the queue, it will be executed from the PENDINGCOMPLETE state. If the Control Job is paused, VGEM will wait in PENDINGCOMPLETE before resuming processing. Note that all these commands are port specific and that they don't affect processing on the other port in dual-port mode.	5188
90	STARTING	CMD PJABORT (S16F5 Process Job ABORT) or CMD CJABORT (S16F27 Control Job ABORT)	STANDBY	The host has sent a S16F5 ABORT command or a S16F27 Control Job ABORT command.	5190

### 8.3.6. Port State Definitions

#### DIEEND

The tester has completed operations to test a die.

#### DIESTART

The tester has started operations to test a die.

#### ENDOFTEST

The parent state in which testing has finished, awaiting instructions for next action.

### **EXECUTING**

The parent state for execution of normal processing.

### **LOTCOMPLETE**

The tester has completed the testing of a lot. LOTCOMPLETE is a pass thru state.

### **LOTSTART**

A START command has been received from the host, and an EVENT LOTSTART from the tester. The tester will begin to test.

### **PENDINGCLOSE**

The adaptive test failed its setup or was cancelled. The lot may be tested with a different recipe or completed and removed from the equipment.

### **PENDINGCOMPLETE**

Used as a waiting state for direction to either retest wafers or complete the lot.

### **PROCESSINGACTIVE**

The parent state in all processing is performed.

### **READY**

All setup activity has completed successfully and the tester is waiting for a START command from the host.

### **RELEASED**

The prober has completed its release of the lot on the port and the carrier may be removed.

### **RELEASING**

Processing has completed on the lot on the port and the prober is completing its release process.

### **REREADY**

This state is active after a RecipeVerified is issued from the RESETUP state. The tester is waiting for a START command from the host.

### **RESETUP**

The system is setting up the recipe for an adaptive test of the lot on the port.

### **SETTINGUP**

Equipment has received a PP-SELECT command from the host and is verifying the recipe and other setup information.

### **STANDBY**

When the system is initialized, the port model begins here. It is also used when a lot is completed or an error or aborting condition has occurred which requires the tester to be reset

### **STARTING**

The tester has been notified of a job start but the job has not started yet.

### **SUBLOTCOMPLETE**

The tester has completed a wafer test.

### **SUBLOTSTART**

The tester has started operations to test a wafer.

### **WORKING**

The parent state in which all testing is conducted.

#### **8.3.7. State Enumeration Table**

Table 8-3. State Enumerations

Type	State Name	Enumeration
Equip	PAUSE	-
Equip	PROCESSPAUSE	-
Equip	WORKSTATIONREADY	65
Equip	INIT	66
Equip	IDLEREADY	67
Equip	PROCESSING	68
Equip	STOPPING	69
Equip	ALARMPAUSED	70
Equip	PAUSED	72
Equip	CHECKING	73
Equip	IDLENOTREADY	74
Equip	IDLEWITHALARMS	75
Equip	ABORTED	76
Equip	ABORTING	77
Port	ENDOFTEST	-
Port	EXECUTING	-
Port	PROCESSINGACTIVE	-

Type	State Name	Enumeration
Port	WORKING	-
Port	STANDBY	101
Port	SETTINGUP	102
Port	READY	103
Port	LOTSTART	104
Port	SUBLOTSTART	105
Port	DIESTART	106
Port	DIEEND	107
Port	SUBLOTCOMPLETE	108
Port	PENDINGCOMPLETE	109
Port	LOTCOMPLETE	110
Port	STARTING	114
Port	RELEASING	115
Port	RELEASED	116
Port	RESETUP	117
Port	PENDINGCLOSE	118
Port	REREADY	119

The port state and equipment states can be obtained from the following status variables:

- SV 2490 PortState1 (port #1)
- SV 2510 PortState2 (port #2)
- SV 2690 ProcessState (equipment state)

## 8.4. E40/94 State Models Relationship with Equipment and Port State Models

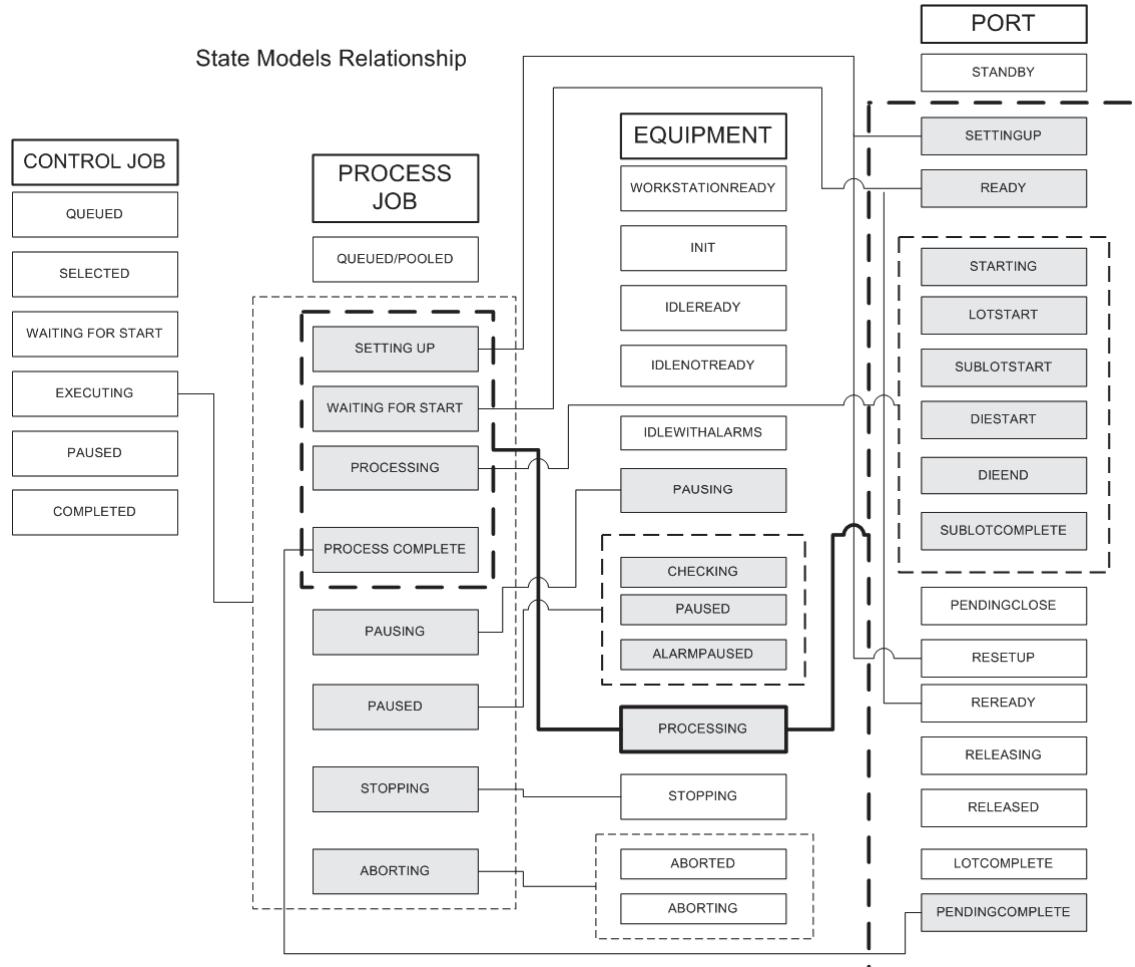
Until SPECS-FA 3.0 came out, the E30.3 TSEM state model (Equipment) was used to describe the behavior of the tester. The Port State model was created to represent the activity on each port (1 and 2) with a better resolution (down to the die start and die end events).

In SPECS-FA 3.0 or later, the Equipment and Port State models are still used to maintain the compatibility with previous releases of SPECS-FA and to provide state information that is not covered by the SEMI E40/E94 standards.

The Process Job state model is very close to the Equipment State Model since both state models track high-level states such as processing, pausing, aborting etc. However, it overlaps with the Port state model for the set up and start of a process job.

Figure 8-9 describes the relationship between the E94 Control Job, E40 Process Job, the Equipment and Port State model.

Figure 8-9. State Models Relationship



### 8.4.1. Equipment State Model

The Equipment state model is modeled after the SEMI E30.3 TSEM state model.

As soon as a process job enters the “SETTING UP” state, the Equipment state model goes into the “PROCESSING” state. As shown in Figure 8-9, the Process Job “SETTING UP” state is equivalent to the Port “SETTINGUP” state. Same thing can be applied for the “WAITING FOR START” and “READY” states.

### 8.4.2. Port State Model

The Port state model offers a better granularity of the processing on port 1 and 2. It also provides two states that track the release of the carrier after processing is completed (RELEASING –ready for a S3F17 Carrier Release and RELEASED – when the carrier is removed from the port).

Figure 8-9 shows the relationship between the process job state model and the port state model. It is very important to understand that when a process job completes, the port state model falls into the PENDINGCOMPLETE state. If there is another process job in the queue that belongs to the same lot, it is executed and the port state moves to RESETUP, REREADY and back into SUBLOTSTART. If the next process job belongs to a different lot, the port state model moves to LOTCOMPLETE and then to RESETUP, REREADY, STARTING, LOTSTART, SUBLOTSTART etc.

Once all process jobs have completed, the Port state moves from “PENDINGCOMPLETE” to “LOTCOMPLETE” to “RELEASING”. A S3F17 CarrierRelease from the host releases the carrier and then moves the state to “RELEASED”. Once an operator or an automatic guided vehicle removes the carrier from the port, the Port state goes back to “STANDBY”.

#### **Notes on new transitions:**

Transition 5188 will occur when the host aborts the current process job. If there is another process job in the queue, it is executed and the Port state model will transition from PENDINGCOMPLETE to RESETUP.

Transition 5188 will also occur when the host aborts the current control job. In this case, the current process job is aborted and if there is any process job in the queue, they are also aborted. The port state model transitions from PENDINCOMPLETE to LOTCOMPLETE, RELEASING, RELEASED and will finally come back to STANDBY. The other port is not affected.

Transition 5186 allows for running process jobs that belong to the same lot. Transition 5187 allows for executing the next process job in the queue that belongs to a different lot than the previous process job.

### 8.4.3. Parallel execution of Control Jobs

In the SPECS-FA environment, up to 2 Control Jobs can be EXECUTING at any time since the system can be configured with 2 ports. This means that the host can create a Control Job for each port and they will execute in parallel. Additional Control Jobs will be put in the queue.

Each Control Job can control up to 25 Process Jobs.

Aborting a control job aborts the current control job and its process jobs on the associated port and does not affect the other port. Aborting also destroys the current control job and its associated process jobs objects.

If there are no control jobs in the queue for the current carrier, the port state will move to LOTCOMPLETE, then to RELEASING and wait for the carrier to be released.

Pausing a control job does not pause the current process job. However, it pauses in between process jobs and wait for an S16F27 CJResume command from the host before executing the next process job in the queue (when a Control Job pauses, the port state is PENDINGCOMPLETE).

#### 8.4.4. Parallel execution of Process Jobs

In the SPECS-FA environment, up to 2 process jobs can be in the PROCESSING state at any time since the system can be configured with 2 ports. If a process job is actively processing a wafer, the other job on the second port is allowed to go as far as the port STARTING state. Since multiple process jobs can be used to process a carrier, the second port will only start processing wafers when the first port completes the processing of all wafers in the carrier (in other words, when all process jobs complete in the control job associated with the current carrier).

Since a carrier contains up to 25 wafers and the system can be dual-port, up to 50 process jobs can be created at any time on the system (1 process job per wafer).

Aborting a process job aborts the current process job on the associated port and does not affect the other port. The current process job object is destroyed.

When a process job is aborted, the port state moves to PENDINGCOMPLETE. If there are other jobs in the control job queue, the control job will execute the next job in the queue. If the next process job is in the same lot, the port state will move from PENDINGCOMPLETE to RESETUP. If the next process job is in a different lot, the port state will move to LOTCOMPLETE and then to RESETUP.

If there are no more jobs, the port state will move to LOTCOMPLETE, then to RELEASING and wait for the carrier to be released.

Pausing a process job pauses the specified process job. An S16F5 PRJob Resume command is required to resume processing.

## 8.5. Carrier Management States

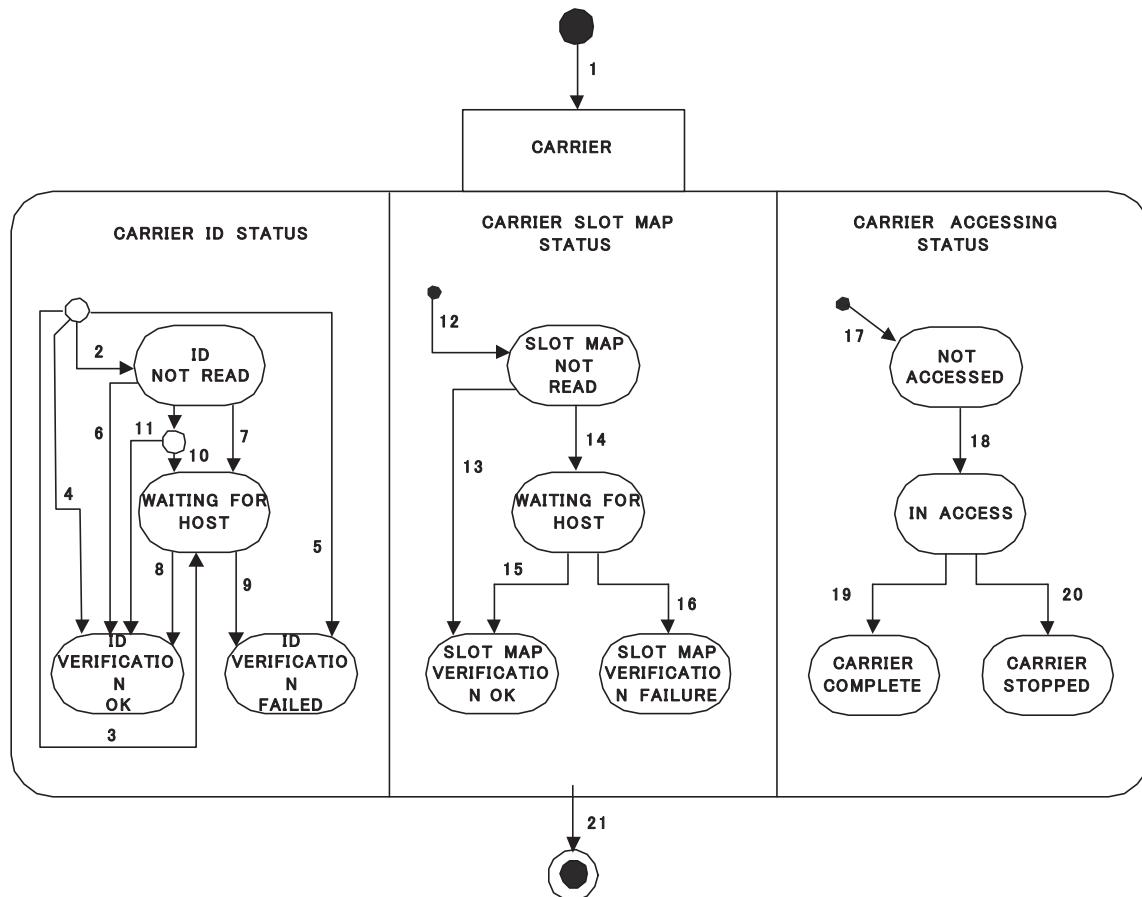
The purpose of the Carrier State Model is to define the host's view of a carrier. The VGEM will maintain three separate state models for each carrier object instantiated: Carrier ID, Carrier Slot Map and Carrier Accessing. These state models will be used to track the state of the carriers in the system.

All probers currently interacting with this software will be of the fixed buffer type, meaning that there will be at most two carriers known to the system at any time. The prober may also support Carrier State Models.

### 8.5.1. Carrier State Model

The following State Model shows the relationship between parent states and substates in the Carrier State.

Figure 8-10. Carrier State Model



### 8.5.1.1. CarrierID Status Transition Table

Table 8-4. CarrierID State Transitions

#	Current State	Transition CEIDs	New State	Comments
1	NONE	CEID 14501 (Carrier Create)	CARRIER	A Carrier Object is instantiated.
2	NONE	CEID 14502 (CID Not Read)	IDNOTREAD	Carrier ID not read.
3	NONE	CEID 14503 (CID Waiting for Host)	IDWAITINGFORHOST	No bind, Carrier ID read successfully. Waiting for host verification.
4	NONE	CEID 14504 (CID Verify OK)	IDVERIFICATIONOK	After CEID 14531 (CID Waiting for Host No Object) or CEID 14530 (CID Read Fail) is sent to the host, the host will normally send a ProceedWithCarrier.
5	NONE	CEID 14505 (CID Verify Fail)	IDVERIFICATIONFAILED	After CEID 14531 (CID Waiting For Host No Object) is sent to the host, the host sends a CancelCarrier or CancelCarrierAtPort.
6	IDNOTREAD	CEID 14506 (CID Equip. Verify OK)	IDVERIFICATIONOK	The prober has reported its verification of the Carrier ID.
7	IDNOTREAD	CEID 14507 (CID Host Verify Wait)	IDWAITINGFORHOST	The prober has reported a new Carrier ID for host verification (Waiting for Host). CEID 14530 (CID Read Fail) is sent before CEID 14507.
8	IDWAITINGFOR HOST	CEID 14508 (CID Verification OK)	IDVERIFICATIONOK	The prober has reported the verification of a Carrier ID.
9	IDWAITINGFOR HOST	CEID 14509 (CID Verification Fail)	IDVERIFICATIONFAIL	The prober has reported the failure to verify a Carrier ID.
10	IDNOTREAD	CEID 14510 (CID Host Verify Wait)	IDWAITINGFORHOST	Waiting for host to confirm the Carrier ID.
11	IDNOTREAD	CEID 14511 (CID Equip. Verify OK)	IDVERIFICATIONOK	Since the BypassIDRead is set to true, no ProceedWithCarrier is required.
21	CARRIER OBJECT	CEID 14521 (Carrier Object Terminated)	NO CARRIER OBJECT	Carrier object has been deleted.

CID: Carrier Identifier (ID)

### 8.5.1.2. CarrierID Status Definitions

#### **IDNOTREAD**

This is a substate of CARRIERIDSTATUS. This state is active whenever the CarrierID has not been read by the equipment.

#### **IDVERIFICATIONFAILED**

This is a substate of CARRIERIDSTATUS and is active when the CarrierID has verification by the host with the CancelCarrier Service. This is a final state.

#### **IDVERIFICATIONOK**

This is a substate of CARRIERIDSTATUS and is active as soon as the CARRIERID has been accepted by either successful verification by the equipment or the host, or by bypassing ID read because a CarrierID reader is not available and the BypassReadID variable is set to true. This is a final state.

#### **IDWAITINGFORHOST**

This is a substate of CARRIERIDSTATUS and is active during the period of time when the CarrierID has been read by the equipment successfully or unsuccessfully and has not yet been verified.

Table 8-5. Carrier ID State Enumerations

Type	State Name	Enumeration
CarrierID	IDNOTREAD	0
CarrierID	IDWAITINGFORHOST	1
CarrierID	IDVERIFICATIONOK	2
CarrierID	IDVERIFICATIONFAILED	3

The Carrier ID status can be obtained from the Carrier object attribute CarrierIDStatus.

Use S14F1 GetAttribute to retrieve the attribute contents.

### 8.5.1.3. TEL P12XL Carrier ID Scenarios

Idx	BIND/ NO BIND	CID Reader	Read Pass/Fail	BypassIDRead True/False	Cmd	CEID (After Bind)	CEID (CarrierID Read)	CED (After S3F17)	Results	Comment
1	NO BIND	No	—	True	PWC	—	4531	4501, 4504, 4512, 4517		Goto SlotMap Read Sequence
2	NO BIND	No	—	True	CC	—	4531	4501, 4505, 4512, 4517		Waiting for “CarrierRelease”
3	NO BIND	No	—	True	CCA	—	4531	—		Waiting for “CarrierRelease”
4	NO BIND	No	(cannot read)	False	PWC	—	4531	4501, 4504, 4512, 4517		Goto SlotMap Read Sequence
5	NO BIND	No	(cannot read)	False	CC	—	4531	4501, 4505, 4512, 4517		Waiting for “CarrierRelease”
6	NO BIND	No	(cannot read)	False	CCA	—	4531	—		Waiting for “CarrierRelease”
7	NO BIND	Yes	—	True	PWC	—	4531	4501, 4504, 4512, 4517		Goto SlotMap Read Sequence
8	NO BIND	Yes	—	True	CC	—	4531	4501, 4505, 4512, 4517		Waiting for “CarrierRelease”
9	NO BIND	Yes	—	True	CCA	—	4531	—		Waiting for “CarrierRelease”
10	NO BIND	Yes	Pass	False	PWC	—	4501, 4503, 4512, 4517	4508		Goto SlotMap Read Sequence
11	NO BIND	Yes	Pass	False	CC	—	4501, 4503, 4512, 4517	4509		Waiting for “CarrierRelease”
12	NO BIND	Yes	Pass	False	CCA	—	4501, 4503, 4512, 4517	4509		Waiting for “CarrierRelease”

Idx	BIND/ NO BIND	CID Reader	Read Pass/Fail	BypassIDRead True/False	Cmd	CEID (After Bind)	CEID (CarrierID Read)	CEID (After S3F17)	Results	Comment
13	NO BIND	Yes	Fail	False	PWC	–	4530	4501, 4504, 4512, 4517		Goto SlotMap Read Sequence
14	NO BIND	Yes	Fail	False	CC	–	4530	4501, 4504, 4512, 4517		Waiting for “CarrierRelease”
15	NO BIND	Yes	Fail	False	CCA	–	4530	–		Waiting for “CarrierRelease”
* 16	BIND	No	(cannot read)	False	PWC	4501, 4502, 512, 4517	4510	4508		Goto SlotMap Read Sequence
* 17	BIND	No	(cannot read)	False	CC	4501, 4502, 4512, 4517	4510	4509		Waiting for “CarrierRelease”
* 18	BIND	No	(cannot read)	False	CCA	4501, 4502, 4512, 4517	4510	4509		Waiting for “CarrierRelease”
19	BIND	No	–	True	–	4501, 4502, 4512, 4517	4511	–		Goto SlotMap Read Sequence
20	BIND	Yes	–	True	–	4501, 4502, 4512, 4517	4511	–		Goto SlotMap Read Sequence
21	BIND	Yes	Pass (EQ. Verify OK)	False	–	4501, 4502, 4512, 4517	4506	–		Goto SlotMap Read Sequence
22	BIND	Yes	Pass (EQ. Verify NG)	False	PWC	4501, 4502, 4512,45 17	4521, 4501, 4503, 4512, 4517	4508		Goto SlotMap Read Sequence

Idx	BIND/ NO BIND	CID Reader	Read Pass/Fail	BypassIDRead True/False	Cmd	CEID (After Bind)	CEID (CarrierID Read)	CEID (After S3F17)	Results	Comment
23	BIND	Yes	Pass (EQ. Verify NG)	False	CC	4501, 4502, 4512, 4503, 4517	4521, 4501, 4512, 4517	4509		Waiting for “CarrierRelease”
24	BIND	Yes	Pass (EQ. Verify NG)	False	CCA	4501, 4502, 4512, 4503, 4517	4521, 4501, 4503, 4512, 4517	4509		Waiting for “CarrierRelease”
25	BIND	Yes	Fail	False	PWC	4501, 4502, 4512, 4517	4530, 4507	4508		Goto SlotMap Read Sequence
26	BIND	Yes	Fail	False	CC	4501, 4502, 4512, 4517	4530, 4507	4509		Waiting for “CarrierRelease”
27	BIND	Yes	Fail	False	CCA	4501, 4502, 4512, 4517	4530, 4507	4509		Waiting for “CarrierRelease”

\*: These scenarios are not supported by current firmware of TEL Prober.

PWC: ProceedWithCarrier

4501: Carrier Object Initial Transition

4508: CID HOST Verify OK

CC: CancelCarrier

4502: CID NOT READ

4509: CID HOST Verify Fail

CCA:CancelCarrierAtPort

4503: CID Waiting For HOST

4510: No CID HOST Verify Wait

4504: CID Verify OK

4511: No CID EQ. Verify OK

4505: CID Verify Fail

4521: Carrier Object Terminate

4506: ID verification OK by Eq.

4530: Carrier ID Read Fail

4507: Waiting For HOST

4531: ID Waiting For Host NoObject

#### 8.5.1.4. Carrier Slot Map Transition Table

Table 8-6. SlotMap State Transitions

#	Current State	Transition CEIDs	New State	Comments
12	NONE	CEID 14512 (SlotMapNotRead)	SLOTMAPNOTREAD	
13	SLOTMAPNOTREAD	CEID 14513 (SlotEqVerifyOK)	SLOTMAPVERIFICATIONOK	The prober has reported its verification of its slotmap.
14	SLOTMAPNOTREAD	CEID 14514 (SlotMapHostVerifyWait)	SLOTMAPWAITINGFORHOST	The prober has reported the verification of the slotmap for host verification.
15	SLOTMAPWAITINGFORHOST	CEID 14515 (SlotMapVerifyOK)	SLOTMAPVERIFICATIONOK	The prober has reported the verification of a slot map following a ProceedWithCarrier.
16	SLOTMAPWAITINGFORHOST	CEID 14516 (SlotMapVerifyFail)	SLOTMAPVERIFICATIONFAILURE	The prober has reported the failure to verify a slot map following a CancelCarrier or CancelCarrierAtPort.

#### 8.5.1.5. Carrier Slot Map Scenarios

IDX	Bind/No Bind	Read PASS/FAIL	Cmd	CEID	After Cmd
1	Bind	PASS	-	14513	-
2	Bind	FAIL	PWC	14514	14515
3	Bind	FAIL	CC	14514	14516
4	Bind	FAIL	CCA	14514	14516
5	No Bind	PASS	PWC	14514	14515
6	No Bind	FAIL	CC	14514	14516
7	No Bind	FAIL	CCA	14514	14516

#### 8.5.1.6. Slot Map State Definitions

##### **SLOTMAPNOTREAD**

This is a substate of CARRIERSLOTMAPSTATUS and is the default entry state. It is active when the Carrier is first loaded at the equipment until the Slot Map has been read successfully by the equipment at the Substrate Port.

##### **SLOTMAPVERIFICATIONFAIL**

This is a substate of CARRIERSLOTMAPSTATUS and is active when the Slot Map has been read by the equipment and has failed verification by the host. This is a final state.

##### **SLOTMAPVERIFICATIONOK**

This is a substate of CARRIERSLOTMAPSTATUS and is active as soon as the Slot Map has been verified. This is a final state.

### **SLOTMAPWAITINGFORHOST**

This is a substate of CARRIERSLOTMAPSTATUS and is active when the equipment is waiting for input from the host.

Table 8-7. Slot Map Status State Enumerations

Type	State Name	Enumeration
SlotMap	SLOTMAPNOTREAD	0
SlotMap	SLOTMAPWAITINGFORHOST	1
SlotMap	SLOTMAPVERIFICATIONOK	2
SlotMap	SLOTMAPVERIFICATIONFAIL	3

The Carrier Slot Map status can be obtained from the Carrier object attribute SlotMapStatus.

Use S14F1 GetAttribute to retrieve the attribute contents.

#### **8.5.1.7. Carrier Accessing Transition Table**

Table 8-8. Carrier Access State Transitions

#	Current State	Triggers	New State	Comments
17	NONE	CEID 14517	NOTACCESSED	
18	NOTACCESSED	Carrier Action ProceedWithCarrier, CEID 14518 (CarrierAccessInAccess)	INACCESS	The prober has reported the accessing of a Carrier.
19	INACCESS	CEID 14519 (CarrierAccessComplete)	CARRIERCOMPLETE	The prober has reported the completing of a Carrier.
20	INACCESS	CEID 14520 (CarrierAccessStopped)	CARRIERSTOPPED	The prober has reported the stopping of a Carrier.

### 8.5.1.8. Carrier Accessing State Definitions

#### **CARRIERCOMPLETE**

This is a substate of CARRIERACCESSINGSTATUS and is active when the access by the equipment to the carrier has been finished, and the carrier should be moved out. This is a final state.

#### **CARRIERSTOPPED**

This is a substate of CARRIERACCESSINGSTATUS and is active when the access by the equipment to the carrier has been stopped abnormally, and the carrier should be moved out. This is a final state.

#### **INACCESS**

This is a substate of CARRIERACCESSINGSTATUS and is active when access by the equipment to the carrier has been started but has not finished, and the carrier should not be moved out.

#### **NOTACCESSED**

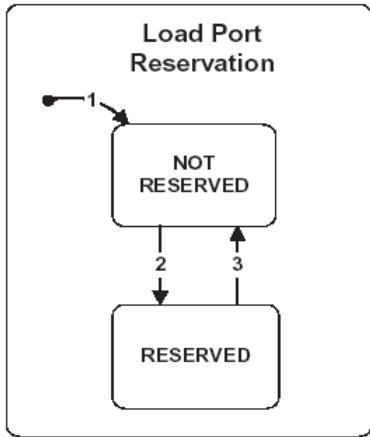
This is a substate of CARRIERACCESSINGSTATUS and is active when access by the equipment to the carrier has not been started. The carrier cannot be moved out.

Table 8-9. Carrier Accessing State Enumerations

Type	State Name	Enumeration
CarrierAccess	NOTACCESSED	0
CarrierAccess	INACCESS	1
CarrierAccess	CARRIERCOMPLETE	2
CarrierAccess	CARRIERSTOPPED	3

The Carrier Accessing status can be obtained from the Carrier object attribute CarrierAccessingStatus. Use S14F1 GetAttribute to retrieve the attribute contents.

### 8.5.2. Load Port Reservation State Model



#### 8.5.2.1. Load Port Reservation Transition Table

Table 8-10. Reservation State Transitions

#	Current State	Transition CEIDs	New State	Comments
2	NOTRESERVED	Carrier Action Bind S3F25 ReserveAtPort	RESERVED	The prober has reported the reservation of a Port to a Carrier.
3	RESERVED	Carrier Action CancelBind, CEID 14506 (CarrierIDEqVerifyOK), CEID 14507 (CarrierIDHostVerifyWait), CEID 14513 (SlotEqVerifyOK), CEID 14514 (SlotMapWaitingForHost), CEID 14518 (CarrierAccessInAccess) S3F25 CancelReservationAtPort	NOTRESERVED	The prober has reported the unreservation of a Port from its Carrier.

#### 8.5.2.2. Load Port Reservation State Definitions

##### **NOTRESERVED**

A substate of LOAD PORT RESERVATION, this state is active when there is no reservation existing at the load port.

##### **RESERVED**

A substate of LOAD PORT RESERVATION, this state is active when there is a reservation for future activity at the load port. When in this state, the access mode for a load port may not be changed.

Table 8-11. Load Port Reservation State Enumerations

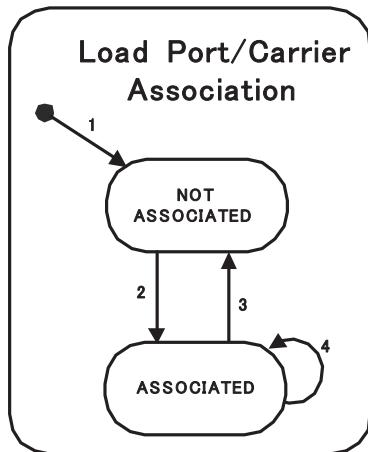
Type	State Name	Enumeration
Reservation	NOTRESERVED	1
Reservation	RESERVED	2

The Load Port Reservation state can be accessed from the following status variables:

75560 LP1LoadPortReservationState

75592 LP2LoadPortReservationState

### 8.5.3. Load Port/Carrier Association State Model



#### 8.5.3.1. Load Port/Carrier Association Transition Table

Table 8-12. Association State Transitions

#	Current State	Triggers	New State	Comments
2	NOTASSOCIATED	Carrier Action Bind, CEID 14506 (CarrierIDEqVerifyOK), CEID 14507 (CarrierIDHostVerifyWait), CEID 14513 (SlotEqVerifyOK), CEID 14514 (SlotMapWaitingForHost), CEID 14518 (CarrierAccessInAccess)	ASSOCIATED	The prober has reported the association of a Port to a Carrier.
3	ASSOCIATED	Carrier Action CancelBind, CEID 14521 (CarrierObjectTerminated)	NOTASSOCIATED	The prober has reported the disassociation of a Port from a Carrier.

### 8.5.3.2. Load Port/Carrier Association State Definitions

#### **ASSOCIATED**

A substate of LOADPORT/CARRIERASSOCIATION. A CarrierID has been associated with this load port. The load port is not available for a new carrier association.

#### **NOTASSOCIATED**

A substate of LOADPORT/CARRIERASSOCIATION. There is no carrier association present for this load port.

Table 8-13. Load Port/Carrier State Enumerations

Type	State Name	Enumeration
Association	NOTASSOCIATED	0
Associated	ASSOCIATED	1

The Load Port/Carrier state can be accessed from the following status variables:

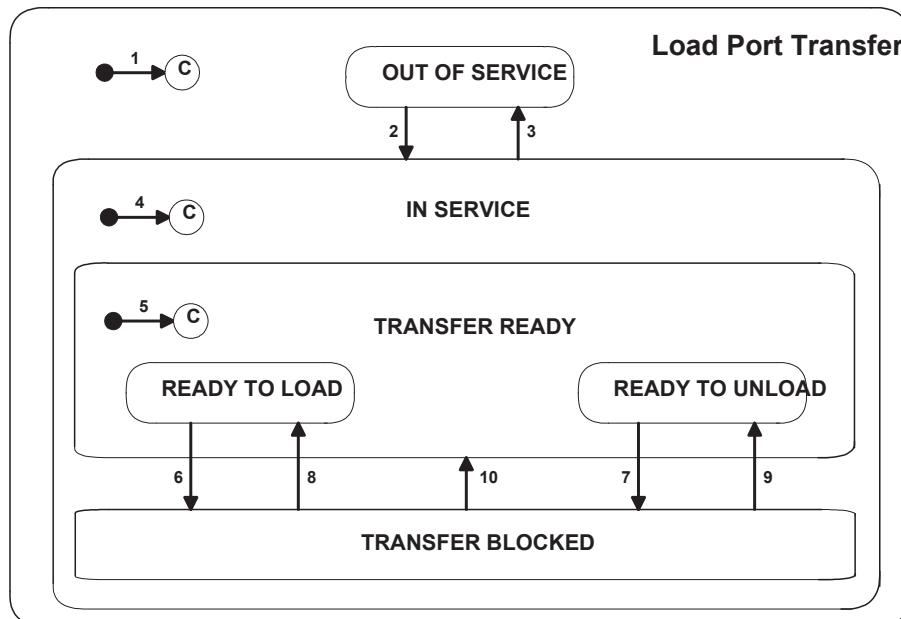
SV 75556 LP1AssociationState

SV 75588 LP2AssociationState

### 8.5.4. Load Port Transfer State Model

The Load Port Transfer State Model represents the state for the host to manage the load port, however, it does not represent physical state of the load port directly.

Figure 8-11. Load Port Transfer State Model



### 8.5.4.1. Load Port Transfer State Transition Table

Table 8-14. Load Port Transfer State Transitions

#	Current State	Transition CEIDs	New State	Comments
1	Entry into LOAD PORT TRANSFER	System reset.	OUT OF SERVICE or IN SERVICE	
2	OUT OF SERVICE	ChangeServiceStatus with a value of IN SERVICE, CEID 14002	IN SERVICE	The load port is allowed to be used for carrier transfer.
3	IN SERVICE	ChangeServiceStatus with a value of OUT OF SERVICE, Prober has detected failure on the load port. CEID 14003	OUT OF SERVICE	The load port is not allowed to be used for carrier transfer. Attempted usage of the load port for carrier transfer after the state transition results in an alarm.
4	IN SERVICE	ChangeServiceStatus, System reset. CEID 14004	TRANSFER READY or TRANSFER BLOCKED	Default entry into IN SERVICE. The state is TRANSFER BLOCKED if the carrier or load port is not available for carrier transfer. Otherwise, the state is TRANSFER READY.
5	TRANSFER READY	ChangeServiceStatus with a value of IN SERVICE, System reset, CEID 14005 If a transfer fails, this transition is activated by transition #10.	READY TO LOAD or READY TO UNLOAD	Default entry into TRANSFER READY. If a carrier is present, the state is READY TO UNLOAD. Otherwise, the state is READY TO LOAD.
6	READY TO LOAD	Carrier Loading handoff has started, CEID 14006	TRANSFER BLOCKED	
7	READY TO UNLOAD	Carrier Unloading handoff has started, CEID 14007	TRANSFER BLOCKED	
8	TRANSFER BLOCKED	Carrier Unloading handoff has completed, CEID 14008	READY TO LOAD	
9	TRANSFER BLOCKED	Processing for the carrier has completed, and the carrier shall be unloaded. CEID 14009	READY TO UNLOAD	
10	TRANSFER BLOCKED	The transfer was unsuccessful, and the carrier was not loaded or unloaded, CEID 14010	TRANSFER READY	The sub-state of TRANSFER READY which is determined by transition #5.

### 8.5.4.2. Load Port Transfer State Definitions

#### **OUT OF SERVICE**

Transfer to/from this load port is disabled. A transition to IN SERVICE is required to continue using this load port of transfers.

#### **IN SERVICE**

Transfer to/from this load port is enabled. A transition to OUT OF SERVICE disables the load port for transfer use.

#### **TRANSFER READY**

A substate of IN SERVICE. The load port is available for carrier transfer. The transfer can either be manual or automated, and can be a load or an unload. This state contains two sub-states, which are used depending on whether or not a carrier is present on the load port (READY TO LOAD and READY TO UNLOAD).

#### **READY TO LOAD**

A substate of TRANSFER READY. When transitioning to the TRANSFER READY state, if a carrier is not present on the specified load port, this is the active sub-state. In this state, the load port is available to be loaded with an external carrier.

#### **READY TO UNLOAD**

A substate of TRANSFER READY. When transitioning to the TRANSFER READY state, if a carrier is present on the specified load port, this is the active sub-state. In this state, the load port is available for unloading of a carrier from the load port to material handling.

#### **TRANSFER BLOCKED**

The carrier transfer state is neither READY TO LOAD nor READY TO UNLOAD. Because of load port related activity being performed by the equipment, transfer is not available to/from this load port at this time.

Table 8-15. Load Port Transfer State Enumerations

Type	State Name	Enumeration
PortTransfer	OUT OF SERVICE	0
PortTransfer	TRANSFER BLOCKED	1
PortTransfer	READY TO LOAD	2
PortTransfer	READY TO UNLOAD	3

The Load Port Transfer state can be obtained from the following status variables:

SV 75559 LP1PortTransferState

SV 75591 LP2PortTransferState

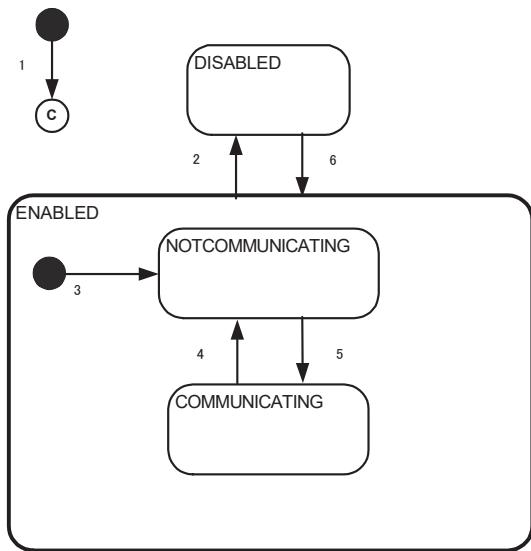
## 8.6. Communication State

The Communications State Model defines the equipment in relation to the existence or absence of a communications link with the host. There are two primary communication states, DISABLED and ENABLED. The state ENABLED includes two substates, NOT COMMUNICATING or COMMUNICATING.

### 8.6.1. Communication State Model

The following State Model shows the relationship between parent states and substates in the Communication State.

Figure 8-12. Communication State Model



### 8.6.2. Communications State Transition Table

#	Current State	Trigger	New State	Comments
1	Entry to COMMUNICATIONS	System Initialization.	System default	May be set to ENABLED or DISABLED
2	DISABLED	Operator switches from DISABLED to ENABLED.	ENABLED	SECS-II commands are enabled
3	Entry to ENABLED	Any entry into ENABLED state.	NOT COMMUNICATING	
4	NOT COMMUNICATING	S1F13/F14	COMMUNICATING	Communications established
5	COMMUNICATING	Communication failure	NOT COMMUNICATING	Discards pending messages. These messages may be spooled.
6	ENABLED	Operator switches	DISABLED	Communications prohibited.

#	Current State	Trigger	New State	Comments
		from ENABLED to DISABLED.		Pending messages are discarded and cannot be spooled.

### 8.6.3. Communications State Definitions

#### **COMMUNICATING**

(ENABLED substate) Communications have been successfully established. This state remains active until the operator switches to DISABLED or a communications failure occurs. In the latter case the equipment moves to NOTCOMMUNICATING and tries to reestablish communications.

When transitioning from COMMUNICATING to NOTCOMMUNICATING due to a communication failure, spooling may be activated. Please refer to Section 5.8 of this user guide for more information on activation conditions.) If it is activated, messages sent to the host will be saved until communications are re-established. Once the host is On-Line, the spool can only be deactivated by requesting the contents of the spool or by purging it.

#### **DISABLED**

In this state SECS-II communication with a host computer is non-existent. If an operator switches from ENABLED to DISABLED, all communication cease immediately. Pending messages are discarded, and cannot be spooled. DISABLED is a possible system default.

#### **ENABLED**

ENABLED is the parent state for both COMMUNICATING and NOTCOMMUNICATING. In this state communications between the host and equipment are possible.

#### **NOTCOMMUNICATING**

(ENABLED substate) While communications are possible, they have not been successfully established. The equipment will periodically send an S1,F13 to attempt to establish communications. All messages aside from S1,F13/F14 are discarded. This is a possible system default.

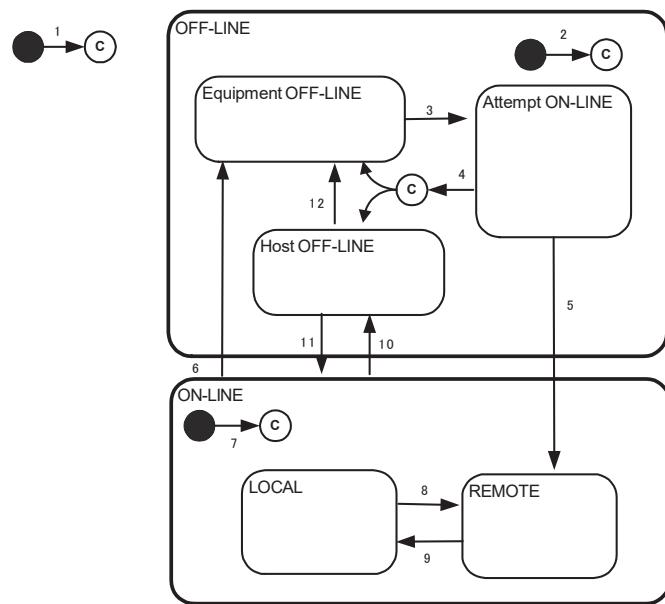
## 8.7. Control State

The Control State Model defines the level of cooperation between the host and equipment. While the COMMUNICATION model defines the ability for the host and equipment to exchange messages, the CONTROL model addresses the equipment's responsibility to act upon messages received.

### 8.7.1. Control State Model

The following State Model shows the relationship between parent states and substates in the Control State.

Figure 8-13. Control State Model



### 8.7.2. Control State Transition Table

#	Current State	Trigger	New State	Comments	Transition CEID
1	(Undefined)	Entry into CONTROL state.	CONTROL	Equipment may be configured to default to ON-LINE or OFF-LINE	
2	(Undefined)	Entry into OFF-LINE	OFF-LINE	Equipment may be configured to default into any OFFLINE substate.	
3	EQUIPMENT OFF-LINE	Operator switches to ON-LINE	ATTEMPT ON-LINE	An S1,F1 is sent any time an ATTEMPT ON-LINE is activated	

#	Current State	Trigger	New State	Comments	Transition CEID
4	ATTEMPT ON-LINE	S1,F0	New state conditional on configuration	This may be due to a communication failure, reply timeout, or receipt of S1,F0. Configuration may be set to EQUIPMENT OFF-LINE or HOST OFF-LINE.	
5	ATTEMPT ON-LINE	Equipment receives expected S1,F2 from host.	ON-LINE	Host is notified of transition to ON-LINE at transition 7.	
6	ON-LINE	Operator switches to OFF-LINE	EQUIPMENT OFF-LINE	"Equipment OFF-LINE" event occurs. Event reply will be discarded while OFF-LINE is active.	4000
7	(Undefined)	Entry into ON-LINE state.	ON-LINE	"Control State LOCAL" or "Control State REMOTE" event occurs. Event reported based on actual ON-LINE substate activated.	4001 or 4002
8	LOCAL	Operator sets LMP to REMOTE	REMOTE	"Control State REMOTE" event occurs.	4002
9	REMOTE	Operator sets LMP to LOCAL	LOCAL	"Control State LOCAL" event occurs.	4001
10	ON-LINE	Equipment accepts "Set OFF-LINE" message from host (S1,F15).	HOST OFF-LINE	"Equipment OFF-LINE" event occurs.	
11	HOST OFF-LINE	Equipment accepts host request to go ON-LINE 9S1, F17).	ON-LINE	Host is notified of transition to ON-LINE in transition 7.	4000
12	HOST OFF-LINE	Operator switched to OFF-LINE.	EQUIPMENT OFF-LINE	"Equipment OFF-LINE" event occurs.	

### 8.7.3. Control State Definitions

#### **ATTEMPT ON-LINE**

(OFF-LINE substate) In this state, the equipment has responded to an operator instruction to attempt to go into the ON-LINE state. Note that while in this state, the equipment does not respond to the operator switching to OFF-LINE or ON-LINE.

#### **EQUIPMENT OFF-LINE**

(OFF-LINE substate) The equipment maintains the OFF-LINE states, and waits for operator instructions to attempt to go ON-LINE.

#### **HOST OFF-LINE**

(OFF-LINE substate) While the HOST OFF-LINE is active, the operator intends for the equipment to be ON-LINE. The Host, however, has not agreed. This may be due to a failed attempt to go ON-LINE or to obey a host's request for the equipment to go OFF-LINE. While active, the equipment shall positively respond to any host request to go ON-LINE.

#### **LOCAL**

(ON-LINE substate) In the LOCAL state, operation of the equipment is implemented by direct action of an operator. All operations commands are made available through the LMP. When in the LOCAL state, the host is only prevented from sending remote commands. All other actions should still be available from the host.

#### **OFF-LINE**

When this state is active, the operation of the equipment is performed by the operator at the operator console. In this state, the equipment will only respond to those messages used for the establishing communications or a host request to activate to ON-LINE. OFF-LINE is the parent to three substates: ATTEMPT ON-LINE, EQUIPMENT OFF-LINE, and HOST OFF-LINE.

#### **ON-LINE**

When ON-LINE is active, SECS-II messages may be exchanged and acted upon. ON-LINE is the parent of two substates: LOCAL and REMOTE.

#### **REMOTE**

(ON-LINE substate) When in this state, the host has access to, through the communication interface, and can fully operate the equipment. When in the REMOTE state, the operator may still execute some commands such as STOP or ABORT.

## 8.8. Alarm State

Alarms indicate that there is a problem with the tester or prober. These are handled according to the GEM specification using Stream 5 messages. The equipment may issue alarms whenever an abnormal situation occurs that may endanger people, equipment or material being processed. Tester alarms are cleared locally on the SPECS operation panel after proper modifications, or clicking the [Clear] button on the Alarm Information field of the LMP also clear the alarm. Prober alarms are displayed on the LMP, but must be cleared on the prober. Then the host sends command to resume, abort, or stop to decide proper next actions. Operator can also decide the next action by clicking the [RESUME], [ABORT], or [STOP] button on the LMP.

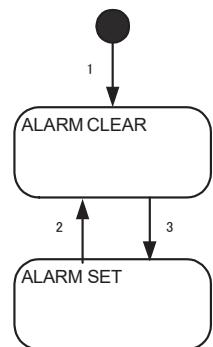
The following Alarm features are supported in VGEM:

- Enabling alarms (initialization)
- Enabling/disabling alarms (during process)
- Validating alarms
- Listing prober and tester alarms
- Setting alarms
- Clearing alarms
- Sending alarms to LMP/host
- Handling invalid alarms

### 8.8.1. Alarm State Model

The following State Model shows the relationship between parent states and substates in the Alarm State.

Figure 8-14. Alarm State Model



### 8.8.2. Alarm State Transition Table

Current Alarm State	Current Equipment State	Trigger	New Alarm State	New Equipment State	Message to host
Alarm Clear	PROCESSING	Alarm is detected on the equipment and an Alarm message is sent. VGEM receives that message, validates and sets the alarm.	Alarm Set	ALARMPAUSED	S5F1 Alarm Set S6F11 CEID 5008
	WORKSTATIONREADY, INIT, or IDLE			IDLEWITHALARMS	S5F1 Alarm Set S6F11 CEID 5018
	PROCESSPAUSE	An ALARM is detected from the tester.		ALARMPAUSED	S6F11 CEID 5021
Alarm Set	ALARMPAUSED	The operator initiates the clear of a tester alarm by pressing the Clear button on the LMP. The tester may also send an ALARMCLEARED message to VGEM.	Alarm Clear	PAUSED	S5F1 Alarm Clear S6F11 CEID 5022
Alarm Set	IDLEWITHALARMS	The operator initiates the clear of a tester alarm by pressing the Clear button on the LMP.	Alarm Clear	Previous state (WORKSTATIONREADY, INIT, IDLEREADY, or IDLENOTREADY)	S5F1 Alarm Clear S6F11 CEID 5019
Alarm Set	IDLEWITHALARMS	The tester sends a RESET Event message.	Alarm Clear	WORKSTATIONREADY	S5F1 S6F11 CEID 5037
Alarm Set	ALARMPAUSED	The tester sends a RESET Event message.	Alarm Clear	WORKSTATIONREADY	S5F1 S6F11 CEID 5014 S6F11 CEID 5016 S6F11 CEID 5036

Note: The equipment may send a S6F11 or S6F13 message depending on the ECV AnnotatedEventsReports.

### 8.8.3. Alarm State Definitions

#### **Alarm Set**

This state indicates that hazardous conditions exist within the equipment.

#### **Alarm Clear**

This state indicates that the hazardous condition for the alarm does not exist.

### 8.8.4. Alarm Configuration Matrix

Table 8-16 shows the default alarm configuration regarding the tester in the SPECS-FA. Refer to the manual of the TEL prober for the alarm configuration on the prober.

Table 8-16. Alarm Configuration (only for tester)

ALID	Alarm
7000	CustomAlarm
7002	EquipNotResponding
7006	HWInitError
7008	OCRIDError
7012	ProberSetup
7016	WaferHandling
7018	DiagFail
7020	UnexpectedMaterial
7100	ProbecdAlarm
7102	ProbecdAlarm
7104	ProbecdAlarm

## 8.9. Spooling State

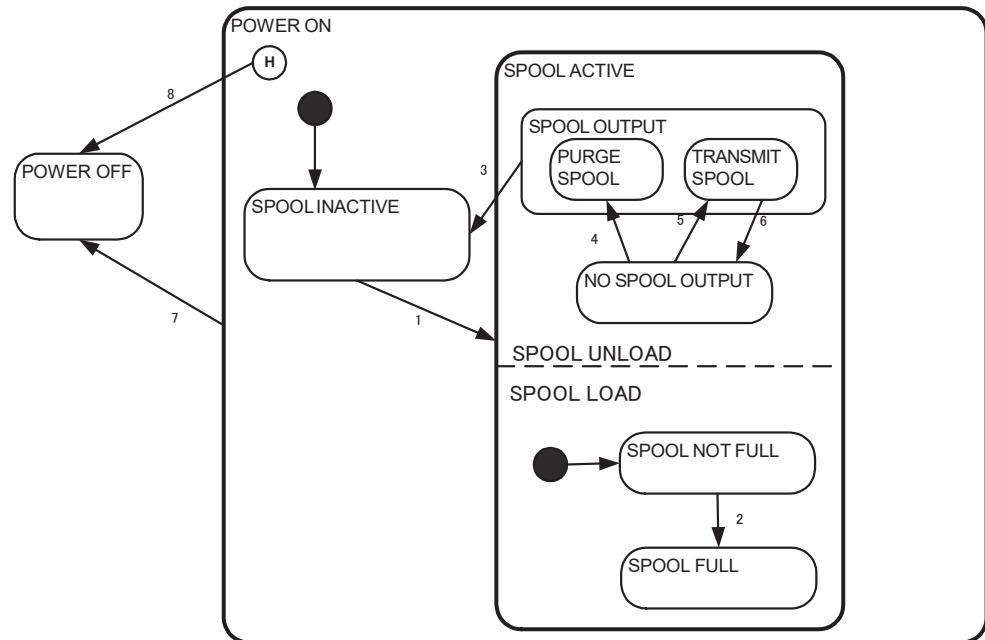
Spooling allows the equipment to queue messages intended for the host during periods of communications failure, preventing them from being lost. These messages are sent to the host when communications are restored and the host makes a request for them. Once the host is ON-LINE, the spool can be deactivated by requesting the contents of the spool or by purging it.

Note: VGEM is installed with spooling disabled. ECV 3060 SpoolWhenNoComm is set to 0 by default. In order to enable spooling, the host must set this constant to 1.

### 8.9.1. Spooling State Model

The following State Model shows the relationship between parent states and substates in the Spooling State.

Figure 8-15. Spooling State Model



### 8.9.2. Spooling State Transition Table

#	Current State	Trigger	New State	Action	Comments
1	SPOOL INACTIVE	Communication State changed from COMMUNICATING to NOTCOMMUNICATING.	SPOOL ACTIVE	Spool count values are initialized to zero, any open transactions with the host are aborted, the current time is set and an alert is sent to the operator.	Each AND State enters its default state. The message that could not be sent is queued. (CEID 4080)
2	SPOOL NOT FULL	Message generated which will not fit into spool area.	SPOOL FULL	Spool Full Time is set to current time and operator is alerted that spool is full.	The message that did not fit is dealt with after the transition.
3	SPOOL OUTPUT	Spool area emptied	SPOOL INACTIVE	Spooling processes are disabled. Operator is alerted that the spooling has been terminated.	The collection event Spooling Deactivated has occurred. Transition from the AND substate Spool Unload component occurs. (CEID 4081)
4	NO SPOOL OUTPUT	S6,F23 received w/RSCD=1	PURGE SPOOL		Begins purging process.
5	NO SPOOL OUTPUT	S6,F23 received w/RSCD=0	TRANSMIT SPOOL		Begins message transmission from spool.
6	TRANSMIT SPOOL	Communications failure or MaxSpoolTransmit reached	NO SPOOL OUTPUT	Spool transmission process suspended.	If there is a communications failure, the event Spool Transmit Failure has occurred. (CEID 4083)
7	POWER ON	Equipment power source discontinued.	POWER OFF		Spooling context has been maintained in non-volatile storage prior to this transition.
8	POWER OFF	Equipment power is restored.	POWER ON	Spooling context restored from non-volatile memory.	Spooling continues if it was active prior to Power down. If TRANSMIT SPOOL were active, transition #6 is expected to follow

#	Current State	Trigger	New State	Action	Comments
					since communications state is initially NOTCOMMUNICATIN G.

### 8.9.3. Spooling State Definitions

#### **NO SPOOL OUTPUT**

(SPOOL UNLOAD substate) In this passive substate, no messages are removed from the spool.

#### **POWER OFF**

The equipment has no power (e.g., communications failure or power is set to off).

#### **POWER ON**

The equipment has power.

#### **PURGE SPOOL**

(SPOOL OUTPUT substate) The equipment discards all messages in the spool, and sets spool counts to zero.

#### **SPOOL ACTIVE**

All SECS-II messages enabled for spooling are held in the spool area. All others (with the exception of Stream 1) are discarded. This state has two components: SPOOL UNLOAD and SPOOL LOAD, each of which are broken into substates.

#### **SPOOL INACTIVE**

This is the normal operating mode. No spooling occurs and SECS-II messages are transmitted normally.

#### **SPOOL FULL**

(SPOOL LOAD substate) This state indicates that all of the available area for spooling is used. Choices are controlled by the Boolean equipment constant "OverWriteSpool."

#### **SPOOL NOT FULL**

(SPOOL LOAD substate) As appropriate SECS-II messages are directed to the spool area, the equipment "writes" the messages to the end of the spool. Counts are incremented each time a message is added.

#### **SPOOL LOAD**

Here messages are entered into the spool area. The default entry substate is SPOOL NOT FULL.

### **SPOOL OUTPUT**

(SPOOL UNLOAD substate) In this active substate, messages are removed from the spool. It is the parent state for TRANMIST SPOOL and PUGE SPOOL.

### **SPOOL UNLOAD**

This component SPOOL ACTIVE deals with the movement of messages out of the spool. It has two substates: SPOOL OUPUT and NO SPOOL OUPUT.

### **TRANSMIT SPOOL**

(SPOOL OUTPUT substate) Messages are sent to the host. When communications are re-established, the oldest messages are sent first. As each message is successfully transmitted, it is removed from the spool and the counts are decremented accordingly.

## Chapter 9. Remote Commands

Remote commands refer to the specific command in the Host Command Send stream and function (S2F41) message from the host. There is a standard set of commands per the TSEM standard (E30-3 Section 10). In addition to that set, VGEM supports several custom commands.

All the following S2F41 commands are available in VGEM 2.x mode. In E40/94 mode, only S2F41 RUN-DIAGNOSTICS is accepted. VGEM will nack all other commands.

### 9.1. Remote Commands Summary

Table 9-1. Remote Commands Summary

Command Name	Valid Equip States	Valid Port States	Parameter Name(s)
ABORT	STOPPING, PROCESSING, PAUSE		none
CANCEL-MEAS	PROCESSING	REREADY, READY	PortID
CHANGE-OCR-STATE	PROCESSING	all, REREADY	RequestedOCRState
CLOSE-LOT	PROCESSING	PENDINGCOMPLETE, PENDINGCLOSE	PortID
PAUSE	PROCESSING		none
PP-SELECT	PROCESSING, IDLEREADY	STANDBY, PENDINGCOMPLETE, PENDINGCLOSE	See PP-Select details below
RESUME	PAUSED		none
RETEST	PROCESSING	PENDINGCOMPLETE	PortID, WaferList
RUN-DIAGNOSTICS	IDLEREADY	STANDBY	none
START	PROCESSING	REREADY, READY	PortID
STOP	PROCESSING, PAUSE		none

While most remote commands are supported by VGEM, the following are not: -CALIBRATE, -DISABLE-SITE, -ENABLE-SITE, -RESET-SITE-CNT.

## 9.2. Remote Command Descriptions

### 9.2.1. ABORT

An ABORT is issued when processing needs to be ceased immediately. Processing will be terminated for each port that is currently in the processing state. An ABORT is a valid command for the STOPPING, PROCSESING and PAUSE states. The syntax for this command is:

```
S2F41 <L:2
    <A "ABORT">
    <L:0 >
>
```

### 9.2.2. CANCEL-MEAS

The purpose of the CANCEL-MEAS command is to abort a lot before it has begun processing, while the port it is on is in the READY state. The syntax for this command is:

```
S2F41 <L:2
    <A "CANCEL-MEAS">
    <L:1
        <L:2
            <A "PortID">
            <A "port">
        >
    >
>
```

### 9.2.3. CHANGE-OCR-STATE

The CHANGE-OCR-STATE commands will drive the change of state for optical character recognition. Valid values are: OFF SLOT, OFF HOST, ON SLOT, ON KEYINPUT, and ON HOST. While VGEM will accept this remote command in any state, it will not be implemented until the equipment finishes its current activity. The equipment will report back once the state change has been made.

The syntax for this command is:

```
S2F41 <L:2
    <A "CHANGE-OCR-STATE">
    <L:1
        <A "RequestedOCRState">
        <A "OCRState">
    >
>
```

#### 9.2.4. CLOSE-LOT

This command is valid when a port has reached the PENDINGCOMPLETE state. It indicates that a RETEST will not be required and the tester should proceed by issuing an EVENT LotComplete and returning the port to the STANDBY state. The syntax for this command is:

```
S2F41 <L:2
    <A "CLOSE-LOT">
    <L:1
        <L:2
            <A "PortID">
            <A "port">
        >
    >
>
```

#### 9.2.5. PAUSE

This command is valid when the equipment state is PROCESSING. It indicates that the tester should cease operations and wait for either a RESUME or ABORT command. The syntax for this command is:

```
S2F41 <L:2
    <A "PAUSE">
    <L:0 >
>
```

## 9.2.6. PP-SELECT

The PP-SELECT command indicates to the tester which process program (recipe) is to be used for the lot that is about to be tested. The tester is expected to verify the indicated recipe. Because of the customization required, the following section has been devoted to the possible parameters associated with the PP-SELECT command.

### 9.2.6.1. PP-SELECT Details

The PP-SELECT uses the S2F41 structure. It is depicted below using Tcl-SECS notation (TSN) where the listing properties of the Tcl language are used to implement the SECS II syntactical lists. Please refer to Chapter 11 of this user guide for details on the variables used to store the parameter values. An example of syntax for this command is:

```
S2F41 <L:2
    <A "PP-SELECT">
    <L:14
        <L:2
            <A "DieSpecFileName">
            <A "diespec">
        >
        <L:2
            <A "DieTestSpecNames">
            <A "dietestspec">
        >
        <L:2
            <A "WaferSpecFileName">
            <A "waferspec">
        >
        <L:2
            <A "LimitFileName">
            <A "limitfile">
        >
        <L:2
            <A "LotID">
            <A "lotID">
        >
        <L:2
            <A "OperatorID">
            <A "operator">
        >
        <L:2
            <A "PPExecName">
            <A "recipe">
        >
        <L:2
            <A "ProbeSpecFileName">
            <A "probespec">
        >
        <L:2
            <A "ProberRecipeFileName">
            <A "proberrecipe">
        >
        <L:2
```

```

<A "ProductID">
<A "productID">
>
<L:2
  <A "PortID">
  <A "port">
>
<L:2
  <A "TestPlanName">
  <A "testplan">
>
<L:2
  <A "WaferList">
  <A "waferlists">
>
<L:2
  <A "TestSpecFileName">
  <A "testspec">
>
>
>

```

### 9.2.6.2. PP-SELECT Parameter Default Configuration Table

Table 9-2. PP-SELECT Details

Variable Name	Variable Name
DieSpecFileName	ProbeSpecFileName
DieTestSpecNames	ProberRecipeFileName
LimitFileName	ProductID
LotID	TestPlanName
OperatorID	TestSpecFileName
PPExecName	WaferList
PortID	WaferSpecFileName

### 9.2.7. RESUME

The RESUME command is used to return the tester to the state it was in when either an ALARM occurred or a PAUSE command was received. This command is only valid for the PAUSED state. It is the responsibility of the host or operator to ensure the conditions are safe to return to the PROCESSING state. The RESUME command will trigger a transition from the PAUSED state to the CHECKING state.

The syntax for this command is:

```
S2F41 <L:2
    <A "RESUME">
    <L:0 >
    >
```

### 9.2.8. RETEST

The RETEST command is valid when the tester is in the PENDINGCOMPLETE state. It indicates that the current lot is to be retested using the exact same recipe. It will cause the tester to issue a LotStart Event. This event will trigger the transition from PENDINGCOMPLETE to LOTSTART. The syntax for this command is:

```
S2F41 <L:2
    <A "RETEST:>
    <L:2
        <L:2
            <A "PortID">
            <A "port">
        >
        <L:2
            <A "WaferList:>
            <A "waferlists">
        >
    >
    >
```

### 9.2.9. RUN-DIAGNOSTICS

The RUN-DIAGNOSTICS command functions just like the RUN-CONTINUITY command (see above), except that it is used to initiate a diagnostic self-test on the tester. The syntax for this command is:

```
S2F41 <L:2
    <A "RUN-DIAGNOSTICS">
    <L:1
        <L:2
            <A "SelectTest">
            <A "selecttest">
        >
    >
    >
```

### 9.2.10. START

The START command is only valid when a port is in the READY state. The host sends the START command to tell the tester to start testing for the current lot of the specified port ID. When the tester receives the START command, it will follow with the EVENT LotStart message. The syntax for this command is:

```
S2F41 <L:2
    <A "START">
    <L:1
        <L:2
            <A "PortID">
            <A "port">
        >
    >
>
```

### 9.2.11. STOP

The STOP command is valid when the tester is in the PROCESSING state or PAUSE parent state. When the tester receives the STOP command, it will transition to the STOPPING state. The syntax for this command is:

```
S2F41 <L:2
    <A "STOP">
    <L:0 >
>
```



# Chapter 10. Carrier Actions

Carrier Actions are carrier management functions or methods that may be provided by either a request message, which always requires a response, or a notification message that does not require a response.

## 10.1. Carrier Action Summary

The following carrier actions are supported by the prober. Bind, CancelBind, CancelCarrier, CancelCarrierAtPort, and so on are supported by the VGEM in Carrier Action Syntax:

Table 10-1. Carrier Action Summary

Command Name
Bind
CancelBind
CancelCarrier
CancelCarrierAtPort
CarrierRelease
ProceedWithCarrier
CarrierReCreate

## 10.2. Carrier Action Syntax

The syntax for S3,F17 (Carrier Action Request) is:

```
S3F17 <L:5
    <U2 DATAID>
    <A CARRIERACTION>
    <A CARRIERID>
    <U1 PORTID>
    <L:n
        <L:2
            <A "attributeName">
            <dataType attributeValue>
        >
        . . . . . /* for all attributes */
    >
    >
```

ProceedWithCarrier can have the following attributes: ContentMap, SlotMap and Usage.

## 10.3. Carrier Action Descriptions

### 10.3.1. Bind

The Bind action is used to associate a CarrierID with a load port. The Bind can contain a PropertiesList of carrier object attributes that are supplied by the host. A Carrier object is instantiated when this action is used successfully. The Bind action will be rejected if the carrier specified has already been instantiated through a Bind, Carrier Notification or a Carrier event from the prober. The Bind action also triggers a transition in the Load Port Reservation state model from NOTRESERVED to RESERVED.

### 10.3.2. CancelBind

The CancelBind request is used to cancel the association between a port and a CarrierID. The carrier object is destroyed when this action is used successfully. The CancelBind action also triggers a transition in the Load Port Reservation state model from RESERVED to NOTRESERVED.

### 10.3.3. CancelCarrier

The CancelCarrier request is used to stop a carrier. If the carrier is at a load port, then it shall be returned to the load/unload location of the load port and made ready for unload. If the carrier is at an internal location the carrier will return to an internal buffer location. A subsequent CarrierOut request is required for the production equipment to move the carrier to the external load port. The production equipment shall reject this service if issued after substrates have been removed for processing.

### 10.3.4. CancelCarrierAtPort

CancelCarrierAtPort is used to abort any carrier at a designated port. This action can be used when the carrierID of the carrier at the designated port is unknown.

### 10.3.5. CarrierRelease

The CarrierRelease request is used to tell the equipment that the carrier is ready to be moved away from the read or write position. Equipment shall deny the request if the LocationID and CarrierID are mismatched.

### 10.3.6. ProceedWithCarrier

The ProceedWithCarrier action is sent by the host to indicate that the carrier operations may continue. When using host based verification it is used by the host to indicate to the production equipment that the verification of CarrierID and/or the Carrier Slot Map is correct. For successful production equipment based verification the production equipment shall not require this message before proceeding with the carrier. For failed production equipment based verification the production equipment shall require either a CancelCarrier or ProceedWithCarrier action.

### 10.3.7. CarrierReCreate

CarrierReCreate request is used to re-create the carrier object specified by the service. This will allow a repeated introduction of the same carrier on the load port. After the service is issued, the prober will treat the carrier occupying the respective load port identically to one that was physically removed and replaced, deleting the original carrier and then re-instantiating it.

## 10.4. Carrier Object Attribute Definitions

Table 10-2. Carrier Object Attributes

Attribute Name	Default Value	Datatype	Description
ObjType	Carrier	A	Object type=CARRIER.
ObjID		A	Object identifier (carrier ID).
Usage		A	The type of material contained in the carrier (i.e., TEST; DUMMY; PRODUCT; FILLER; etc).
PortID		A	
Capacity	25	U1	Maximum number of substrates in carrier.
SubstrateCount	0	U1	The number of substrates currently in the carrier.
CarrierIDStatus	1	U1	Current state of the carrier ID verificaiton.
CarrierAccessingStatus	1	U1	The current accessing state of the carrier by the equipment.
ContentMap		L	List of lot and substrate identifiers corresponding to slot 1 to n.
LocationID		A	Identifier of current location.
SlotMap		L	List of slot status as provided by the host until a succesfulslot map read-then as read by the equipment.
SlotMapStatus	1	U1	Current state of the slot map verificaiton.



# Chapter 11. Port Actions and Access Mode

## 11.1. Port Actions Summary

The TEL prober supports the following port actions:

Table 11-1. Port Action Summary

Command Name	Description
ReserveAtPort	Changes the Load Port Reservation state model from NOT RESERVED to RESERVED.
CancelReservationAtPort	Changes the Load Port Reservation state model from RESERVED to NOT RESERVED
“OUT OF SERVICE”	Changes the Load Port Transfer State from “IN SERVICE” to “OUT OF SERVICE”.
“IN SERVICE”	Changes the Load Port Transfer State from “OUT OF SERVICE” to “OUT IN SERVICE”.

### 11.1.1. Port Actions Syntax

The syntax for S3,F25 (Port Action Request) is:

```
S3F25 <L:3
    <A PORTACTION>
    <U1 PORTID>
    <L:0 >
    >
```

Reply for S3,F25 is S3,F26 (Port Action Acknowledge):

```
S3F26 <L:2
    <UI CAACK>
    <L:n
        <L:2
            <A ERRCODE>
            <A ERRTEXT>
        >
        . . . . .
    >
    >
```

Example for “ReservedAtPort” on port 1:

```
S3F25 <L:3
    <A “ReserveAtPort”>
    <U1 1>
    <L:0 >
    >

S3F26 <L:2
    <U1 4>
```

```
<L:0 >
>
4 = Acknowledge command will be performed with completion signal later by an event.

S6F11 <L:3
    <U4 DATAID>
    <U4 14302>      ← Load Port Reservation State AUTO
    <L:0 >
    >
```

## 11.2. Access Mode Summary

The host requests the equipment to change the Access Mode for the specified load ports.

### 11.2.1. Access Mode Syntax

The syntax for S3,F27 (Change Access) is:

```
S3F27 <L:2
    <U1 ACCESSMODE>
    <L:2
        <U1 1>
        <U1 2>
    >
>
```

Reply for S3,F27 is S3,F28 (Change Access Acknowledge):

```
S3F28 <L:2
    <UI CAACK>
    <L:n
        <L:3
            <U1 PORTID>
            <A ERRCODE>
            <A ERRTEXT>
        >
    >
>
```

Where,

ACCESSMODE: 0 = MANUAL

1 = AUTO

PORTID: 1 to 2

Example for ACCESSMODE = AUTO on port 1:

```
S3F27 <L:2
    <U1 1>
    <L:1
        <U1 1>
    >
>

S3F28 <L:2
    <U1 4>
    <L:0 >
>

S6F11 <L:3
    <U4 DATAID>
    <U4 14202>      ← ACCESSMODE AUTO (if ACCESSMODE was MANUAL)
    <L:0 >
>
```



## Chapter 12. Process Program Management

### 12.1. Overview

The functions in this stream are used to manage and transfer process programs. Process programs are the equipment-specific descriptions that determine the procedure to be conducted on the material by a single piece of equipment. Methods are provided to transfer programs as well as establish the link between the process program and the material to be processed with that program.

### 12.2. VGEM Implementation

VGEM supports the following stream 7 functions:

Primary Message	Description	Response Message	Description
S7,F1	Process Program Load Inquire	S7,F2	Process Program Load Grant
S7,F3	Process Program Send	S7,F6	Process Program Acknowledge
S7,F5	Process Program Request	S7,F6	Process Program Data
S7,F17	Delete Process Program Send	S7,F18	Delete Process Program Acknowledge
S7,F19	Current EPPD Request	S7,F20	Current EPPD Data

The host can set an Equipment Constant Variable (ECV) to send S7 messages to the tester or the prober. This is ECV 3140 (RecipeOwner) where a value equals to 1 will direct the messages to the tester and a value equals to 2 directs the messages to the prober.

VGEM allows for binary or text files to be downloaded via the stream 7 functions. For instance, if the host wishes to download a binary file, it must encode it as a series of bytes as shown in the following example:

```
S7F3 <L:2
    <A "test.o">
    <B:10 0x02 0x14 0x01 0x06 0x05 0x31 0x13 0xCC 0x00 0x00>
>
```

If the file is text (ASCII), it can be downloaded as the following:

```
S7F3 <L:2
    <A "clock1">
    <A "first line" 0x0A "second line" 0x0A    "third line" 0x0A>
>
```

Binary files uploaded with S7F5 from the tester will be encoded as a list of bytes, exactly like when downloading with S7F3. Text files will be returned as a string with embedded control characters like when downloading with S7F3.

```
S7F5 <A "README.TXT">
S7F6 <L:2
    <A "README.TXT">
```

```
<A "file contents.....">
>

S7F5 <A "test.o">

S7F6 <L:2
    <A "test.o">
    <B:10 0x02 0x14 0x01 0x06 0x05 0x31 0x13 0xCC 0x00 0x00>
>
```

### 12.2.1. SPECS-FA Configuration for Stream 7 Functions

#### 12.2.1.1 Using the RecipePath directory

SPECS-FA defines a status variable (SV) 2725 (RecipePath) that specifies the directory where the host can download, upload, delete and obtain a list of the current process programs.

The location of this directory is normally specified in the vgem/defaults.ini configuration file as per the following:

```
VGEM RecipePath /tmp/tester_recipes
```

Before sending stream 7 messages to VGEM, the host must first specify the recipient of these messages by setting the ECV 3140 as followed:

```
S2F15 <L:1
    <L:2
        <U4 3140>
        <U1 1>          /* 1=tester access, 2=prober access */
    >
>
```

Before requesting a list of files in the directory specified by SV 2725 RecipePath using S7F19, the host can specify a mask. ECV 3145 (RecipeDirMask) is used to specify a file extension like “txt”, which instructs VGEM to return all the files with this extension. Just use the extension name and don’t specify the ‘.’ or other wildcard characters like ‘\*’. This feature only applies to SPECS-FA Process Program files.

```
S2F15 <L:1
    <L:2
        <U4 3145>      /* ECID */
        <A "txt">       /* ECV */
    >
>
```

The default mask is “ALL”, which means that all the files in the RecipePath directory will be returned to the host.

#### 12.2.1.2 Using the Master Recipe File

If ECV 3145 (RecipeDirMask) is set to “RECIPELIST”, VGEM will use the Master Recipe File located under /opt/SPECS/usr/tpl/FA\_recipe2.rec. In this mode, only S7F19 (Directory Request) and S7F5 (Recipe Upload) are accepted.

The location of the master recipe file is defined by the parameter VGEM RecipeFile (default to /opt/SPECS/usr/tpl/FA\_recipe2.rec) in /opt/SPECS\_FA/dmh/vgem/defaults.ini. When the host sends a directory request (S7F19), VGEM returns a list of all recipes defined in FA\_recipe2.rec. If the host sends a recipe upload command (S7F5), VGEM returns the data associated with the recipe in the FA\_recipe2.rec file.

### 12.2.2. Prober Configuration

If the host wishes to send stream 7 messages directly to the prober, it must first set the ECV 3140 RecipeOwner as followed:

```
S2F15 <L:1
    <L:2
        <U4 3140>
        <U1 2>
    >
>
```

After setting this constant, the host will be able to interact directly with the prober.

Example how to download a binary file to the prober:

Note that the path and file name specified in the S7Fx message must be 46 characters. If the name is less than 46 characters, the string must be padded with spaces up to 46 characters as shown below:

```
S7F3 <L:2
    <A "MAS/MAS/DUMMY"      ">
    <B:42 0xFF 0xFF
        0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF
        0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF
        0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF
        0xFF 0xFF>
    >
```

Refer to the manual of the TEL prober for more information on the prober's recipe directory structure.

# Chapter 13. Substrate Tracking (E90)

## 13.1. Overview

This chapter describes how the SEMI E90 Substrate Tracking specification is implemented in VGEM when connected to a TEL prober.

The purpose of the E90 standard is to provide the standard services of equipment to track substrates (wafers in our case) in manufacturing equipment. This standard defines the concepts and behaviors for the information management of substrates, as well as the messages/services.

## 13.2. VGEM Implementation

VGEM provides access to the TEL E90 objects, Collection Event IDs (CEIDs) and variables. This section does not replace the TEL documentation but explains how the TEL E90 data has been mapped into the VGEM database.

### **Object Services**

The stream 14 functions F1 (GetAttributes) and F3 (SetAttributes) are directly routed to the TEL prober without any special processing in VGEM. VGEM uses the object name such as “Substrate” and “SubstLoc” to determine if the host request must be passed down directly to the prober or be processed by VGEM (like the Carrier object, which is internal to VGEM).

### **CEIDs and Data Variables**

In the VGEM database, the prober Collection Event IDs and variables IDs (DVVAL, SV and ECV) are mapped with a 10000 factor added to the prober ID. The E90 CEIDs and variables follow this convention.

When using the VGEM data mapping, the host is able to create E90 reports exactly like if they were created on the TEL prober

### 13.2.1. Substrate Object

Substrate object shall be created when the slot map of the carrier is verified; when the carrier Slot Map Verification Status (SEMI E87 Carrier Management) comes to SLOT MAP VERIFICATION OK.

### **Substrate Identification**

Each substrate is identified by the substrate ID; the substrate ID is assigned with the combination of the carrier ID and the slot number (CarrierID.nn; nn is the slot number.).

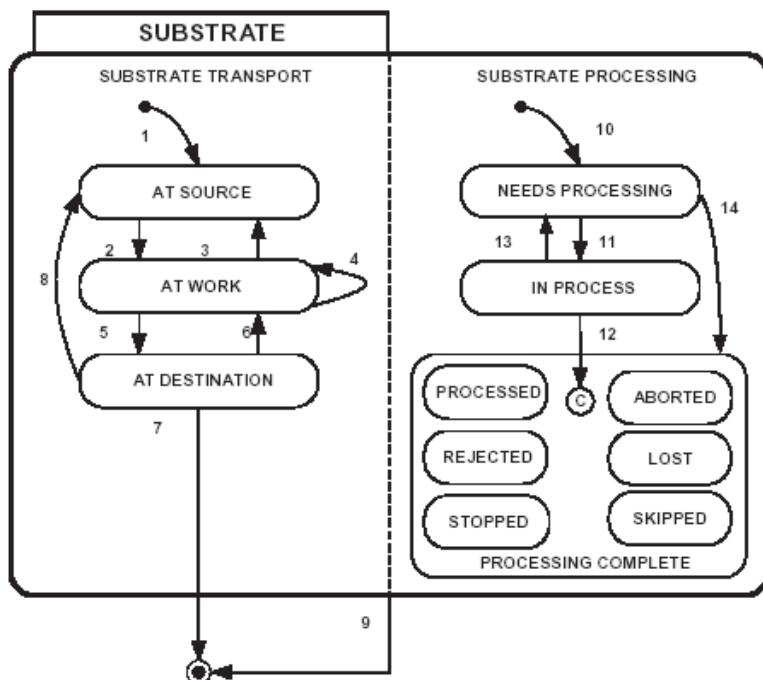
The substrate also can be specified Substrate Name to identify the substrate. The Substrate Name is an attribute of the substrate object; the attribute can be given as the Contents Map attribute of the carrier which has been used to load the substrate, or it can be set with the data read from Wafer ID reader.

The substrate can be specified Lot ID to track the substrate as a member of a Lot.

Attribute Name	Definition	Access	Format
LotID	Lot Identifier	RW	Text (Max 30 characters)
Material Status	Substrate Processing Criteria	RO	TEL Prober does not support
ObjID	Object ID	RO	Text = Substrate ID (Max. 32 characters)
ObjType	Object Type	RO	Text = "Substrate"
SubstDestination	Carrier Substrate Location at which the substrate shall be returned from the equipment	RO	Text (Max. 40 characters); null if the substrate shall return to the same location of the source
SubstHistory	History of locations visited	RO	List of structures consisting of SubstLocID,TimeIn, TimeOut
SubstLocID	Current substrate location. Initial value is set to SubstSource	RO	Text (Max. 40 characters)
SubstProcState	Substrate Processing State	RO	Enumerated: 0 = NEEDS PROCESSING 1 = IN PROCESS 2 = PROCESSED 3 = ABORTED 4 = STOPPED 5 = REJECTED
SubstSource	Carrier Substrate Location at which the substrate is supplied initially to the equipment	RO	Text (Max. 40 characters)
SubstState	Substrate Transport State	RO	Enumerated: 0 = AT SOURCE 1 = AT WORK 2 = AT DESTINATION
SubstType	Type of substrate; only WAFER is applied	RO	Enumerated: 0 = WAFER
SubstUsage	Usage of the substrate; use of this information is equipment dependent option.	RO	Enumerated: 0 = PRODUCT 1 = TEST 2 = FILLER 3 = CLEANING

### 13.2.2. Substrate State Model

The following figure shows the E90 Substrate state model. Note that the current TEL implementation does not reflect all the state transitions shown in the E90 standard. See the section “Collection Event IDs” in this chapter for a list of transitions that have been implemented.



### 13.2.3. Substrate Location Object

#### Substrate Location Identification

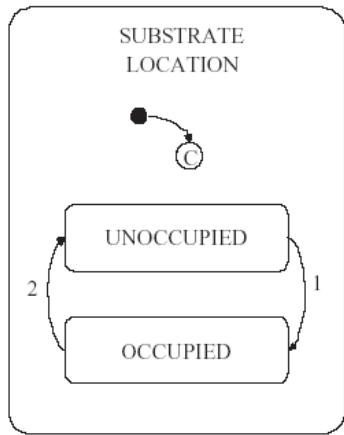
The Substrate Location is classified to Equipment Substrate Location and Carrier Substrate Location.

The Equipment Substrate Location is the material location on the equipment resource; the location shall be specified by the equipment design. (The specification of the equipment shall be confirmed.) The Carrier Substrate Location is the material location of a carrier (i.e. slot).

Attribute Name	Definition	Access	Format
ObjID	Object Identifier; specified by the equipment design	RO	Text equal to Substrate Location ID (Max. 40 characters)
ObjType	Object Type	RO	Text = “SubstLoc”
SubstID	Substrate Identifier relevant to the location	RO	Text (Max. 40 characters)
SubstLocState	Substrate Location State	RO	Enumerated: 0 = UNOCCUPIED 1 = OCCUPIED

#### 13.2.4. Substrate Location State Model

The following figure shows the E90 Substrate Location state model. See the section “Collection Event Ids” in this chapter for a list of transitions that have been implemented.



### 13.2.5. Data Variables (DVVAL)

The following table lists the Data Variables as reported by the TEL prober on specific CEIDs (see next section “Collection Event IDs”). Note that VGEM adds 10000 to the original TEL variable ID. Therefore, when the host creates reports, it must use the VGEM variable ID (Ex. SubstProcState has the VGEM id 202520 from a host perspective).

VGEM Var ID	TEL Var ID	ID TSN	Variable Name	Description	Value TSN
202513	192513	U4	LotID	LotID relevant to the event. Conforms to JobID	A30
202514	192514	U4	SubstDestination	Destination Substrate Location Carrier ID + “_” + Slot No. Notes: If null, the substrate shall return the same location as the source.	A40
202515	192515	U4	SubstHistory	History of locations visited List of SubstLocID, TimeIn, Timeout. TimeIn, TimeOut are timestamps A16 $L, n$ 1..L, 3 1..<SubstLocID1> 2..<TimeIn1> 3..<TimeOut1> $n..L, 3$ 1.. <SubstLocIDn> 2.. <TimeInn> 3.. <TimeOutn>	L
202516	192516	U4	SubstID	Substrate ID relevant to the event Default: CarrierID + “.” + SlotNo	A40
202517	192517	U4	SubstLocID	Substrate Location ID relevant to the event A material location which is capable of holding a substrate in the equipment. CarrierID + “_” + SlotNo, “Unknown”, “UpperTransferArm”, “LowerTransferArm”, “SubChuck”, “MainChuck”, “SingleWaferLoadTray”	A40
202518	192518	U4	SubstLocState	Substrate location state relevant to the event Enumerated as: 0 = UNOCCUPIED 1 = OCCUPIED	U1

VGEM Var ID	TEL Var ID	ID TSN	Variable Name	Description	Value TSN
202520	192520	U4	SubstProcState	SUBSTRATE PROCESSING state relevant to the event Enumerated as: 0 = NEEDS PROCESSING 1 = IN PROCESS 2 = PROCESSED 3 = ABORTED 4 = STOPPED 5 = REJECTED	U1
202522	192522	U4	SubstSource	Source Substrate Location relevant to the event CarrierID + “_” + SlotNo	A40
202523	192523	U4	SubstState	SUBSTRATE TRANSPORT state relevant to the event Enumerated as: 0 = AT SOURCE 1 = AT WORK 2 = AT DESTINATION	U1
202524	192524	U4	SubstType	Substrate type relevant to the event Enumerated as: 0 = WAFER	U1
202525	192525	U4	SubstUsage	Substrate Usage relevant to the event Enumerated: 0 = PRODUCT 1 = TEST 2 = FILLER 3 = CLEANING Indicates how the substrate is used. Notes: Default; PRODUCT	U1

### 13.2.6. Collection Event IDs (CEID)

The following table lists the CEIDs reported by the TEL prober for the Substrate state model and the Substrate Location state model. Note that VGEM reports these CEIDs to the host with a factor 10000 added to the original TEL CEID. Therefore, when the host creates reports, it must use the VGEM CEID.

VGEM's CEID	TEL's CEID	Description
15002	5002	AT SOURCE to AT WORK
15003	5003	AT WORK to AT SOURCE
15004	5004	AT WORK to AT WORK
15005	5005	AT WORK to AT DESTINATION
15006	5006	AT DESTINATION to AT WORK
15007	5007	AT DESTINATION to Extinction
15008	5008	AT DESTINATION to AT SOURCE
15009	5009	SUBSTRATE to Extinction
15020	5020	No state to NEEDS PROCESSING
15021	5021	NEEDS PROCESSING to IN PROCESS
15022	5022	IN PROCESS to PROCESSING COMPLETE
15023	5023	IN PROCESS to NEEDS PROCESSING
15024	5024	IN PROCESS to IN PROCESS
15025	5025	NEEDS PROCESSING to PROCESSING COMPLETE
15051	5051	Into OCCUPIED state
15052	5052	Into UNOCCUPIED state

### 13.2.7. S14 Messages Examples

This section covers several examples that demonstrate E90 object access from the host.

#### Getting the Substrate Object Attributes

In this example, the host requests a specific Substrate object attribute for the object named “CarrierA.01” (Carrier ID is CarrierA. The Substrate object is in slot 1). The requested attribute is “SubstProcState” which returns the current Substrate state transition:

```
0 = NEEDS PROCESSING
1 = IN PROCESS
2 = PROCESSED
3 = ABORTED
4 = STOPPED
5 = REJECTED
```

```
S14F1 <L:5
    <A "1" >                  /* OBJSPEC */
    <A "Substrate">           /* OBJTYPE */
    <L:1
        <A "CarrierA.01">     /* OBJID */
    >
    <L:0 >                   /* filter */
    <L:1
        <A "SubstProcState">  /* attribute. Empty list returns all */
    >
>
```

```
S14F2 <L:2
    <L:1
        <L:2
            <A "CarrierA.01">
            <L:1
                <L:2
                    <A "SubstProcState">
                    <U1 0>
                >
            >
        >
    <L:1
        <U1 0>
    >
>
```

#### Setting the Substrate Object Attributes

```
S14F3 <L:4
    <A "1">
    <A "Substrate">
    <L:1
        <A "CarrierA.01">
    >
```

```
<L:1
  <L:2
    <A "LotID">
    <A "12345">
  >
>
>

S14F4 <L:2
  <L:1
    <L:1
      <L:2
        <A "CarrierA.01">
        <L:1
          <L:2
            <A "LotID">
            <A "12345">
          >
        >
      >
    >
  <L:2
    <U1 0>
    <L:0 >
  >
>
```



## Chapter 14. TS-Clock Object

TS-Clock object is defined by the SEMI E148, Specification for Time Synchronization and Definition of the TS-Clock Object, and implemented the following capabilities on the SPECS-FA environment:

- Synchronizing with a time server that is connected via LAN.
- The TS-Clock object utilizing NTP (network time protocol) feature, which are defined by the RFC 1305 and are used by most of the computer system via LAN.

This section describes on how to use the TS-Clock object on the SPECS-FA environment.

### 14.1. VGEM Implementation

VGEM implements the TS-Clock object communicating with the NTPD (NTP daemon) in the Linux system. The TS-Clock object is created on the start-up of VGEM, and polls the NTPD at a certain interval to update the values of TS-Clock attributes.

Only a TS-Clock object can exist in the VGEM, and is treated as a special object.

### 14.2. TS-Clock Object

The TS-Clock is created when the parameter “VGEM TSClockCreated” is set to “TRUE” in the /opt/SPECS\_FA/dmh/vgem/defaults.ini file.

The following table shows the attributes of TS-Clock object.

Attribute Name	Description	Access	Form
ObjType	Object type	RO	Text="TS-Clock"
ObjID	Object identifier	RO	Text="TS-Clock"
DateTime	Current date and time	RO	Text
UseTimeSync	Enable or disable network time synchronization	RW	Boolean: 0=disable, 1=enable
Offset	Total offset to the time synchronization clock. (milliseconds)	RO	Float
TimeServers	Time servers IP addresses	RW	Lists of text
TimeSyncInterval	Synchronization interval (seconds)	RO	Integer (16-bit), unsigned
LastSyncTime	This is the time when the equipment clock was last synchronized.	RO	Text
LastSyncTimeServer	IP address of time server used to synchronize last.	RO	Text
Status <sup>1</sup>	The NTP system status word that appears in the status field of the response to a read variables command with a zero association identifier.	RO	Integer (16-bit), unsigned

1: Refer to “System Status Word” of Event Message and Status Words at the following URL:  
<http://www.eecis.udel.edu/~mills/ntp/html/decode.html#sys>

### 14.3. S14 Message Example

The following Semiconductor Equipment and Materials International Standards were used:

- Retrieving a TS-Clock attribute with S14,F1 Get Attributes
- Enabling TS-Clock time synchronization with S14,F3 Set Attributes
- Retrieving multiple TS-Clock attributes with S14,F1 Get Attributes
- Setting time synchronization servers with S14,F3 Set Attributes

Note that you cannot use S14,F9 Create Object Request to create the TS-Clock object, because it is allowed to be created only when the VGEN starts up.

#### 14.3.1. Retrieving a TS-Clock Attribute with S14,F1 Get Attributes

The following example retrieves the attribute “DateTime” of the TS-Clock object:

```
S14F1 <L:5
    <A "1">
    <A "TS-Clock">
    <L:1
        <A "TS-Clock">
    >
    <L:0
    >
    <L:1
        <A "DateTime">
    >
>

S14F2 <L:2
    <L:1
        <L:2
            <A:8 TS-Clock>
            <L:1
                <L:2
                    <A:8 DateTime>
                    <A:28 2013-12-24T13:51:56.41+09:00>
                >
            >
        >
    <L:2
        <U1:1 0>
        <L:0
        >
    >
>
```

### 14.3.2. Enabling TS-Clock Time Synchronization with S14,F3 Set Attributes

The following example enabling TS-Clock time synchronization:

```
S14F3 <L:4
    <A "1">
    <A "TS-Clock">
    <L:1
        <A "TS-Clock">
    >
    <L:1
        <L:2
            <A "UseTimeSync">
            <TF 1>
        >
    >
    >

S14F4 <L:2
    <L:1
        <L:2
            <A:8 TS-Clock>
            <L:1
                <L:2
                    <A:11 UseTimeSync>
                    <TF:1 1>
                >
            >
        >
    <L:2
        <U1:1 0>
        <L:0
        >
    >
    >
```

### 14.3.3. Retrieving multiple TS-Clock attributes with S14,F1 Get Attributes

The following example retrieves the multiple attributes of the TS-Clock object:

```

S14F3 <L:5
    <A "1">
    <A "TS-Clock">
    <L:1
        <A "TS-Clock">
    >
    <L:0
    >
    <L:8
        <A "DateTime">
        <A "UseTimeSync">
        <A "Offset">
        <A "TimeServers">
        <A "TimeSyncInterval">
        <A "LastSyncTime">
        <A "LastSyncTimeServer">
        <A "Status">
    >
>

S14F2 <L:2
    <L:1
        <L:2
            <A:8 TS-Clock>
            <L:8
                <L:2
                    <A:8 DateTime>
                    <A:28 2014-01-15T14:45:47.80+09:00>
                >
                <L:2
                    <A:11 UseTimeSync>
                    <TF:1 1>
                >
                <L:2
                    <A:6 Offset>
                    <F4:1 0.925>
                >
                <L:2
                    <A:11 TimeServers>
                    <L:1
                        <A:14 146.208.97.195>
                    >
                >
                <L:2
                    <A:16 TimeSyncInterval>
                    <U4:1 64>
                >
                <L:2
                    <A:12 LastSyncTime>
                    <A:29 2014-01-15T14:42:19.979+09:00>
                >

```

```
<L:2
  <A:18 LastSyncTimeServer>
  <A:14 146.208.97.195>
  >
<L:2
  <A:6 Status>
  <U4:1 1604>
  >
  >
  >
  >
<L:2
  <U1:1 0>
  <L:0
  >
  >
  >
```

#### 14.3.4. Setting Time Synchronization Servers with S14,F3 Set Attributes

The following example specifies time servers for TS-Clock time synchronization:

```
S14F3 <L:4
    <A "1">
    <A "TS-Clock">
    <L:1
        <A "TS-Clock">
    >
    <L:1
        <L:2
            <A "TimeServers">
            <L:2
                <A "ntp1.us.vetroff.net">
                <A "time.awyeah.net">
            >
        >
    >
>

S14F4 <L:2
    <L:1
        <L:2
            <A:8 TS-Clock>
            <L:1
                <L:2
                    <A:11 TimeServers>
                    <L:2
                        <A:23 ntp1.us.vetroff.net>
                        <A:23 time.awyeah.net>
                    >
                >
            >
        >
    <L:2
        <U1:1 0>
        <L:0
        >
    >
>
```

# Chapter 15. Scenarios

## 15.1. Scenario Diagrams

SEMI E-30 defines a scenario as “a group of SECS-II messages arranged in a sequence to perform a capability.”

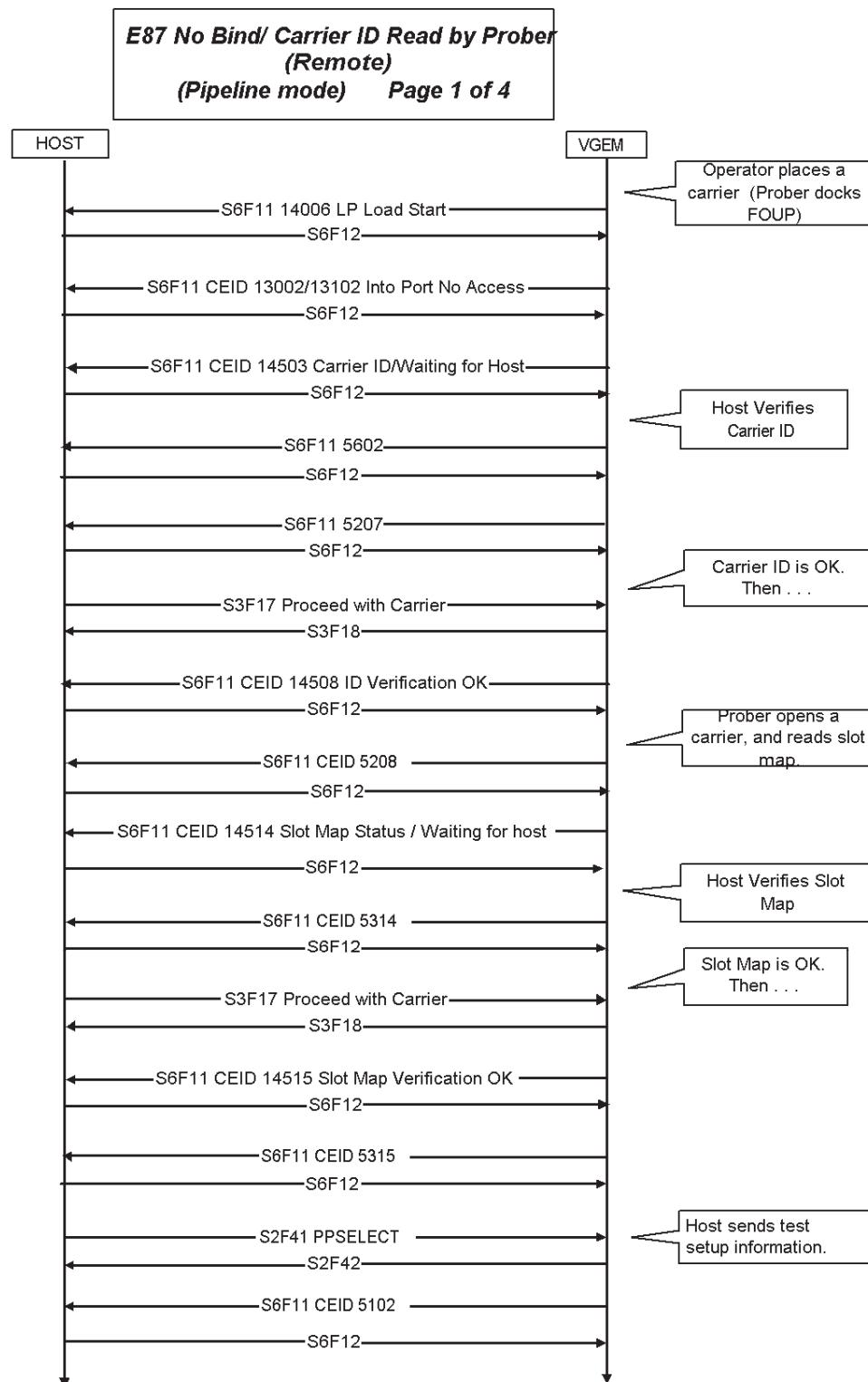
This section provides scenario diagrams for the SEMI Standards and commands described in other sections of this manual. For compatibility purposes, the applicable SPECS-FA software revisions are also included with the Section number.

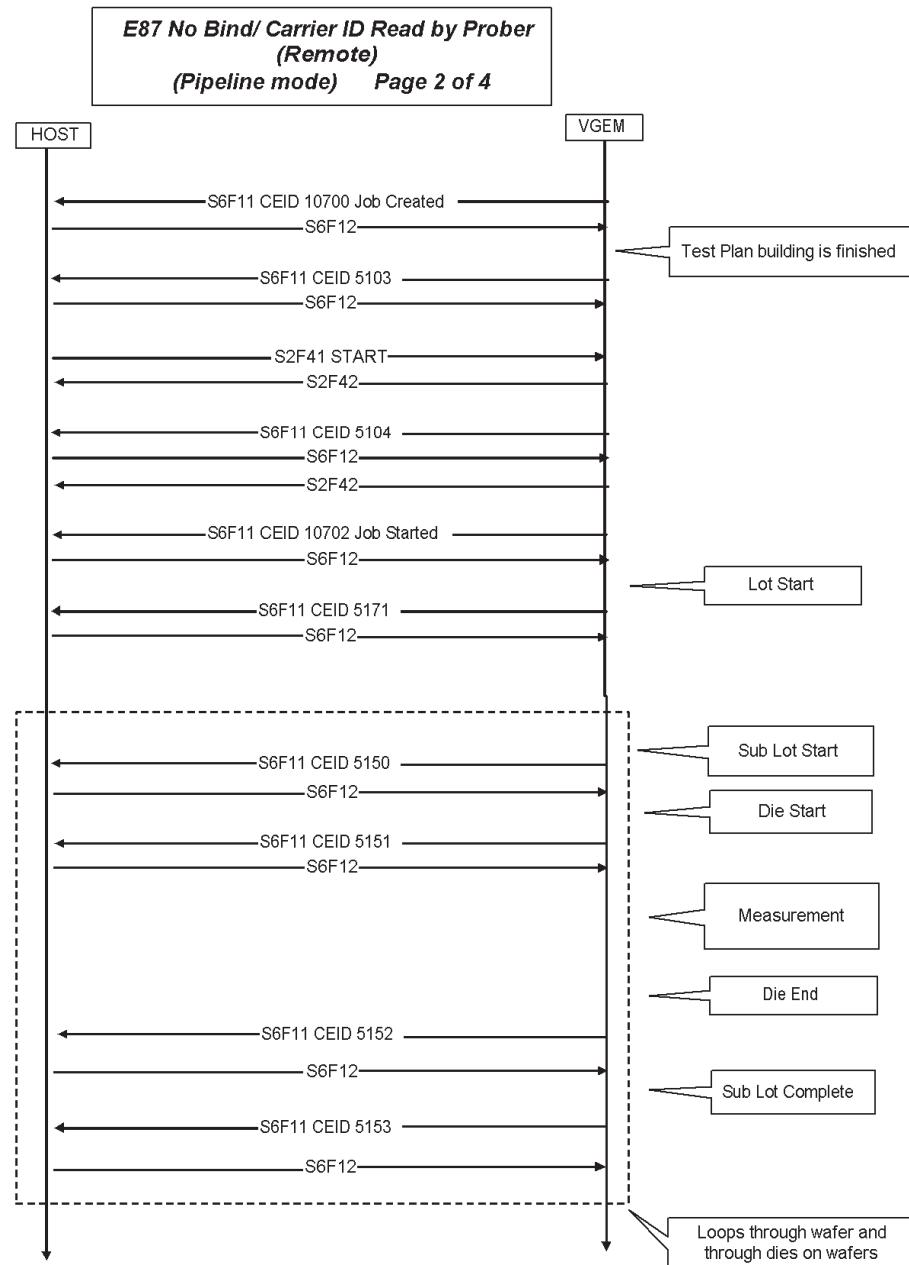
Section No.	Title	Description
15.1.1 vers. 2.x	E87 No Bind/Carrier ID Read by Prober – Remote, Pipeline	Typical test scenario with the VGEM remote mode and the prober pipeline mode. Before starting the test, prober reads the carrier ID, and host checks it. Also the prober reads the slot map, and the host checks it. The retest operation is available.  Port State Transitions: STANDBY, SETTINGUP, READY, STARTING, LOTSTART, SUBLOTSTART, testing SUBLOTCOMPLETE, PENDINGCOMPLETE, STARTING, LOTSTART, SUBLOTSTART, testing, SUBLOTCOMPLETE, PENDINGCOMPLETE, LOTCOMPLETE, RELEASING, RELEASED, STANDBY.
15.1.2 vers. 2.x	E87 No Bind/Carrier ID Read by Prober – Remote, Random Access	Typical test scenario with the VGEM remote mode and the prober random access mode. Before starting the test, prober reads the carrier ID, and host checks it. Also the prober reads the slot map, and the host checks it. The retest operation is available.  Port State Transitions: STANDBY, SETTINGUP, READY, STARTING, LOTSTART, SUBLOTSTART, testing SUBLOTCOMPLETE, PENDINGCOMPLETE, STARTING, LOTSTART, SUBLOTSTART, testing, SUBLOTCOMPLETE, PENDINGCOMPLETE, LOTCOMPLETE, RELEASING, RELEASED, STANDBY.
15.1.3 vers. 2.x	E87 No Bind/Carrier ID Read by Prober Remote, Pipeline, Cascading Operation	Typical test scenario with the VGEM remote mode and the prober pipeline mode. Before starting the test, prober reads the carrier ID, and host checks it. Also the prober reads the slot map, and the host checks it. The cascading operation is available. The cascading operation is for the two port carrier handling.  Port State Transitions: STANDBY, SETTINGUP, READY, STARTING, LOTSTART, SUBLOTSTART, testing SUBLOTCOMPLETE, PENDINGCOMPLETE, LOTCOMPLETE, RELEASING, RELEASED, STANDBY.

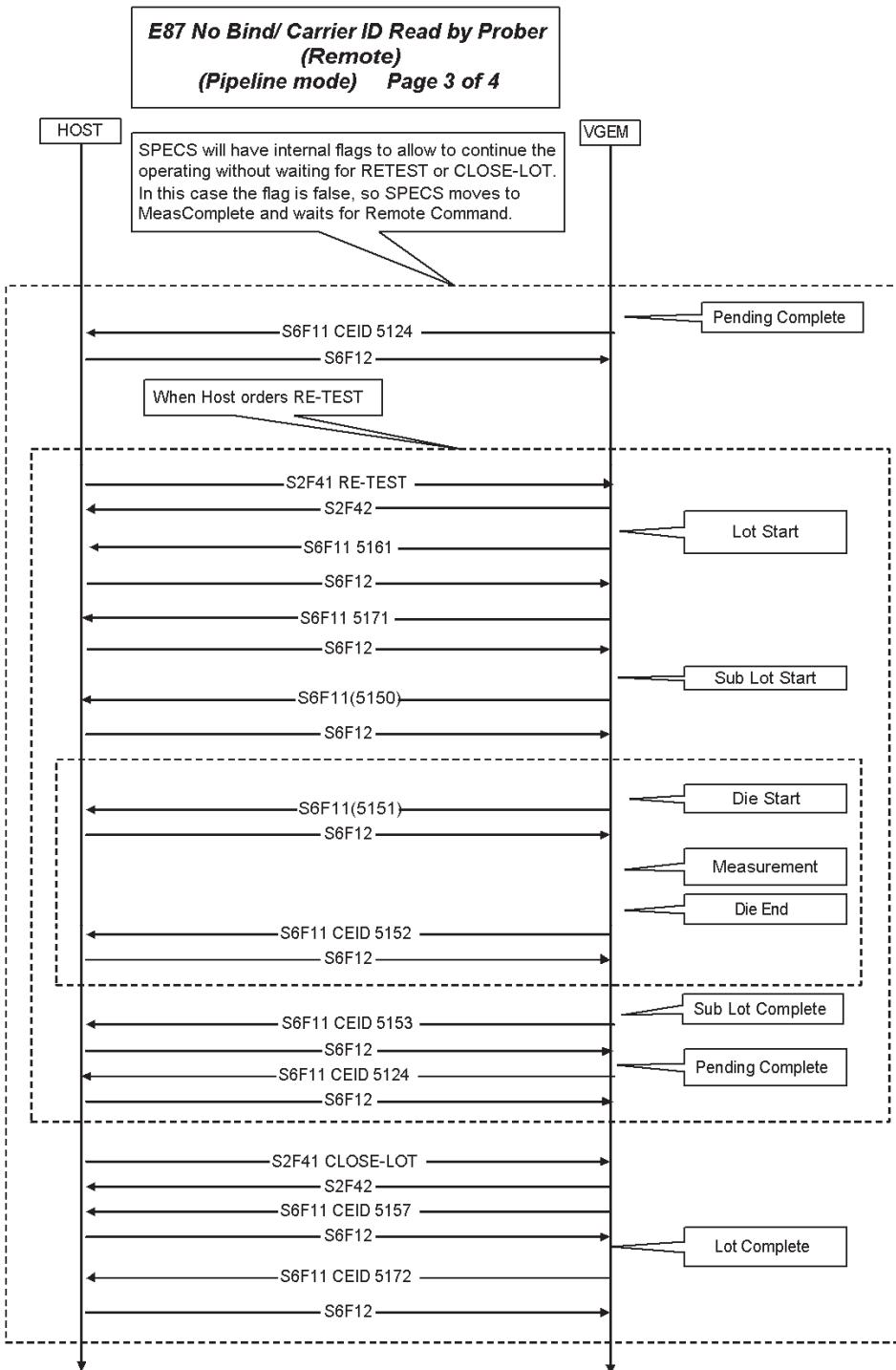
Section No.	Title	Description
15.1.4 vers. 2.x	Manual Access Normal Run – Local, On-line	Typical test scenario with the VGEM local mode and the prober pipeline mode. Before starting the test, prober reads the carrier ID, and operator checks it. Also the prober reads the slot map, and the operator checks it. Port State Transitions: STANDBY, SETTINGUP, READY, STARTING, LOTSTART, SUBLOTSTART, testing SUBLOTCOMPLETE, PENDINGCOMPLETE, LOTCOMPLETE, RELEASING, RELEASED, STANDBY.
15.1.5 vers. 2.x	Alarm Scenarios	Notifies a prober alarm. The SPECS or prober detects the prober alarm, and notifies it to the host via the VGEM. After clearing the prober alarm, the test must be resumed or aborted.
15.1.6 vers. 2.x	PP-SELECT Exception	Notifies the PP-SELECT parsing error, the tester recipe error, or the prober recipe error. The SPECS or prober detects an error, and notifies it to the host via the VGEM.
15.1.7 vers. 2.x	Cancel Measurement	Scenario to cancel the test. Port State Transitions: READY, STANDBY.
15.1.8 vers. 2.x	Carrier ID Host Verification Failure	Scenario to release the carrier from the prober because of the incorrect carrier ID. Prober reads the carrier ID, and sends it to the host via the VGEM. Then the host checks it, and sends the carrier release command to the prober because of the incorrect carrier ID. And the prober releases the carrier.
15.1.9 vers. 2.x	Slot Map Host Verification Failure	Scenario to release the carrier from the prober because of the incorrect slot map. Prober reads the carrier ID, and sends it to the host via the VGEM. Then the host checks it, and sends the ProceedWithCarrier command to the prober. Next, the prober reads the slot map, and sends it to the host. Then the host checks it, and sends the carrier release command to the prober because of the incorrect slot map. And the prober releases the carrier.
15.1.10 vers. 2.x	E87 Bind Scenarios	Notifies a prober status (Carrier ID verification OK/NG or Slot Map verification OK/NG). Prober detects a status, and notifies it to the host via the VGEM. This scenario is only for the prober in the BIND operation.
15.1.11 vers. 2.x	CarrierReCreate	Scenario that allows a repeated introduction of the same carrier on the load port.
15.1.12 vers. 2.x	E90 Substrate Tracking Scenarios	Typical Substrate Tracking Scenarios.
15.1.13 vers. 2.x	Abort Process	Scenario to abort the test. Port State Transitions: EXECUTING, STANDBY.

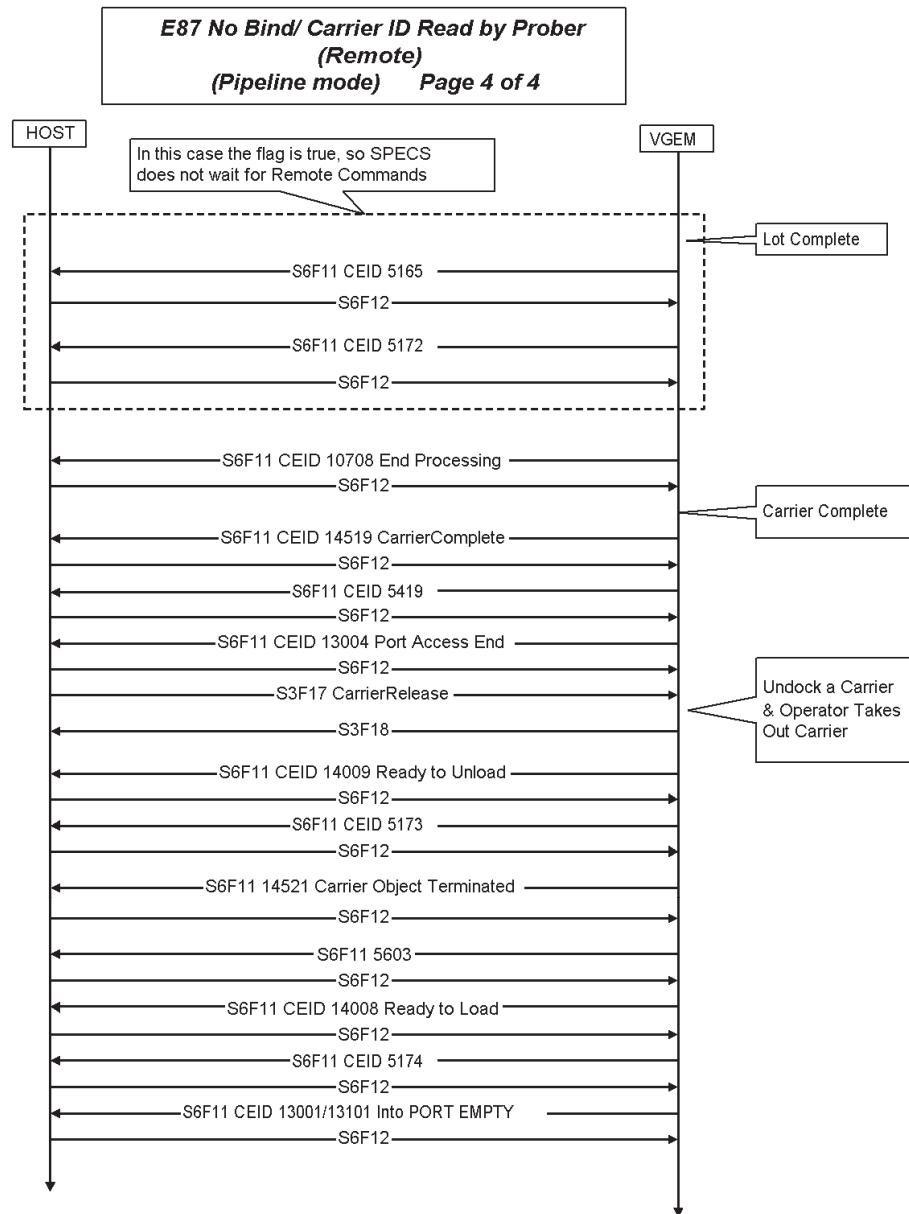
Section No.	Title	Description
15.1.14 vers. 3.x	Normal Sequence	E87/ BIND Carrier ID and SlotmapVerification by Equipment E40/E94 Normal Sequence
15.1.15 vers. 3.x	Abort Scenarios	E40/E94 Abort Scenarios - Control Job - Process Job
15.1.16 vers. 3.x	Pause Scenarios	E40/E94 Pause/Resume Scenarios - Control Job - Process Job
15.1.17 vers. 3.x	PPBadCompile Scenario	E40/E94 Process Job setup failure. All jobs are self aborted on the port where the failure occurred.
15.1.18 vers. 3.x	Adaptive Test (E40/E94) <i>host driven</i> While Processing a Wafer	This scenario allows for changing the test flow without unloading and reloading the current wafer
15.1.19 vers. 3.x	Adaptive Test (E40/E94) <i>host driven</i> Between Wafers	This scenario allows for changing the test flow between wafers. The parameters tuned in the current recipe will be effective at the start of the next wafer.
15.1.20 vers. 3.x	Adaptive Test (E40/E94) <i>host driven</i> Between Process Jobs	This scenario shows how a control job is paused before executing the next process job. This allows the host to tune a process job in the queue.
15.1.21 vers. 3.x	Adaptive Test (E40/E94) <i>tester driven</i> VGEM controls PJ Execution	This scenario shows an adaptive test scenario using the Control Rule. VGEM selects the next PJ based on the Execution Level & ExecuteAttribute attributes.
15.1.22 vers. 3.x	Adaptive Test (E40/E94) <i>tester driven</i> VGEM controls PJ Execution; LOT termination sequence	This scenario is a special case of scenario 15.1.21 that shows how the LOT completes if there are no more process jobs to execute.
15.1.23 vers. 3.x	E40/E94 CJ Abort - Alarm Paused	This is a Control Job Abort scenario with the equipment in Alarm Paused state.
15.1.24 vers. 3.x	E40/E94 CJ Abort - Paused	This is a Control Job Abort scenario with the equipment in Paused state.
15.1.25 vers. 3.x	E40/E94 PJ Abort - Alarm Paused	This is a Process Job Abort scenario with the equipment in Alarm Paused state.
15.1.26 vers. 3.x	E40/E94 PJ Abort - Paused	This is a Process Job Abort scenario with the equipment in Paused state.

## 15.1.1. E87 No Bind/Carrier ID Read by Prober – Remote, Pipeline

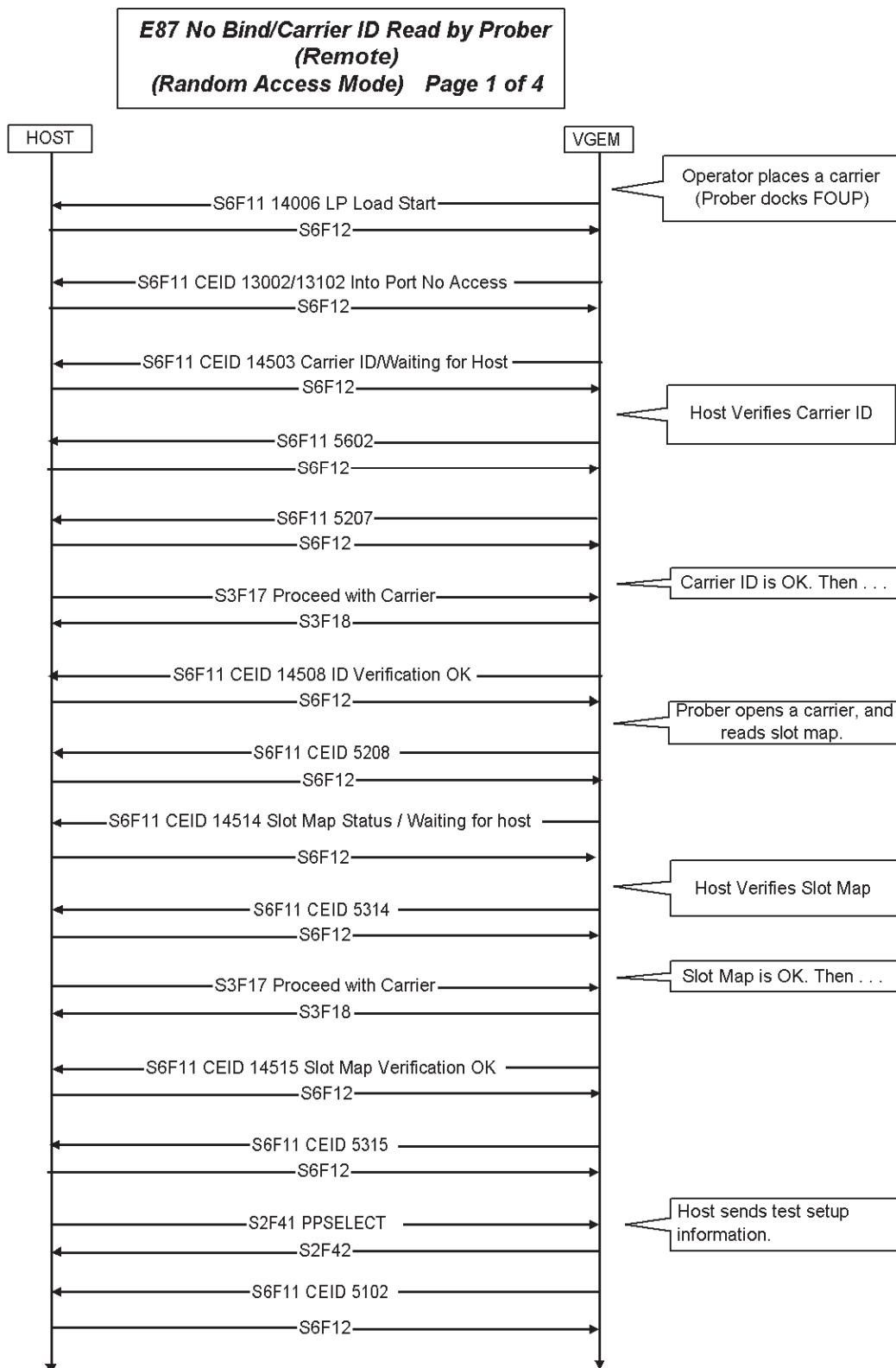


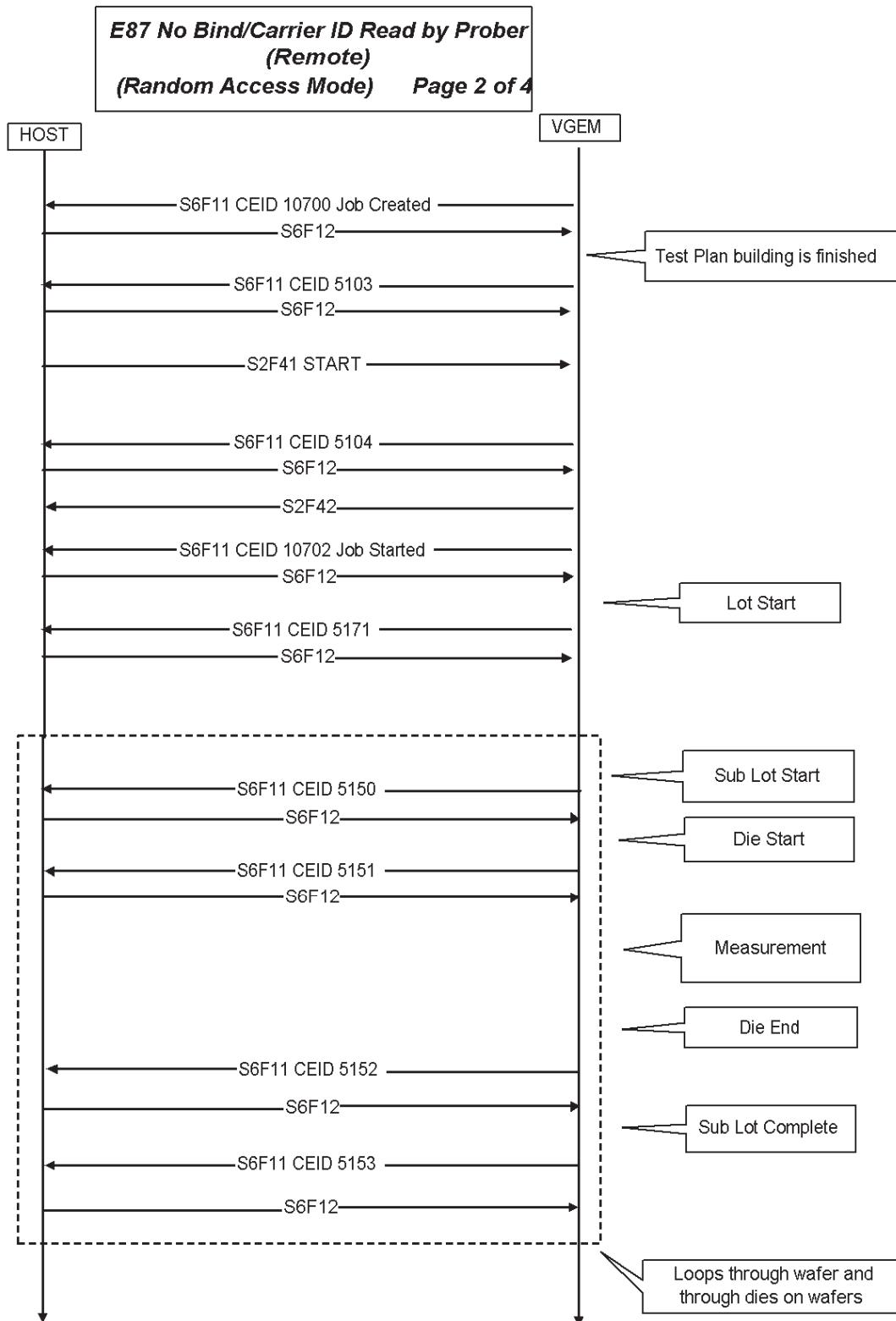


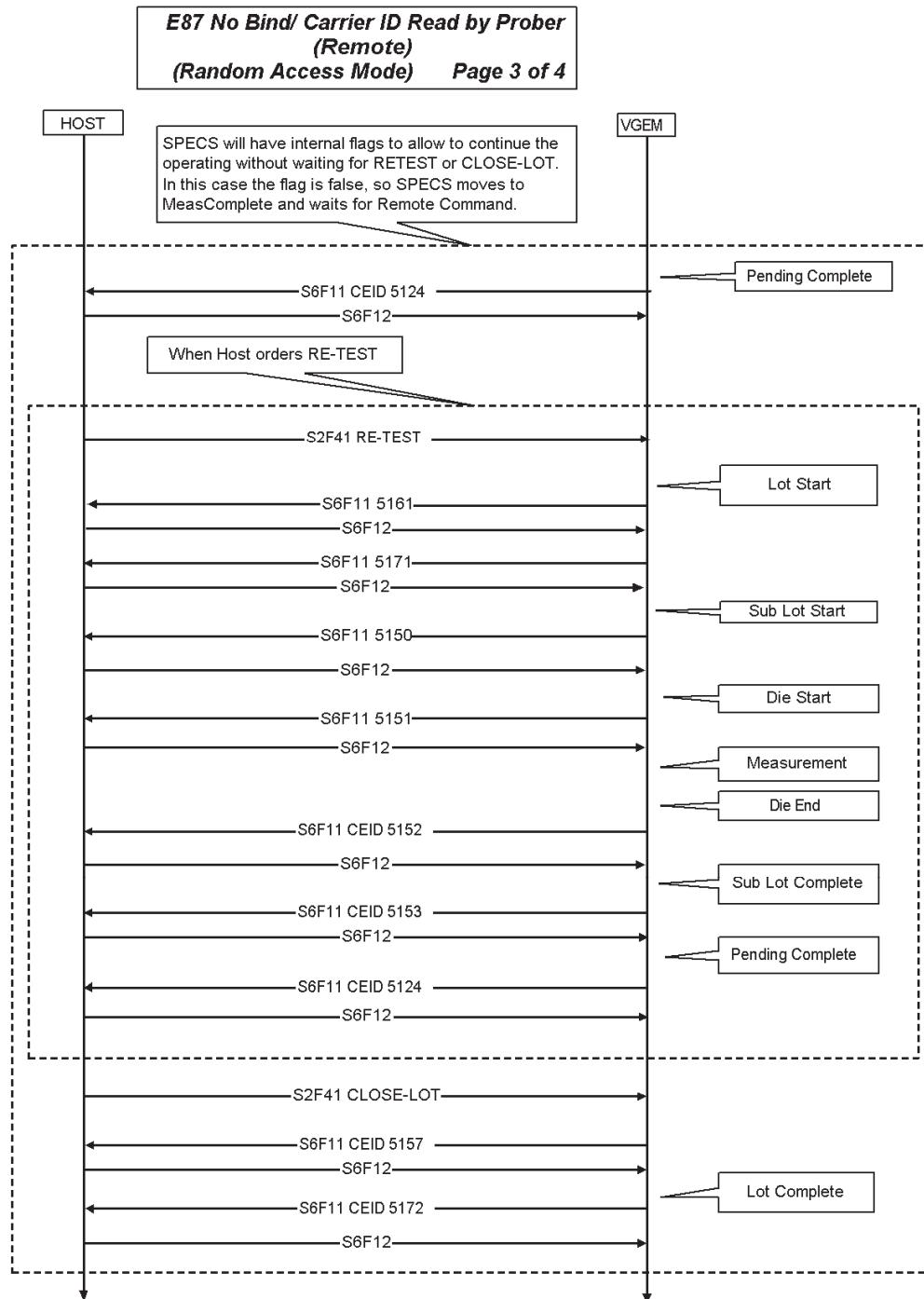


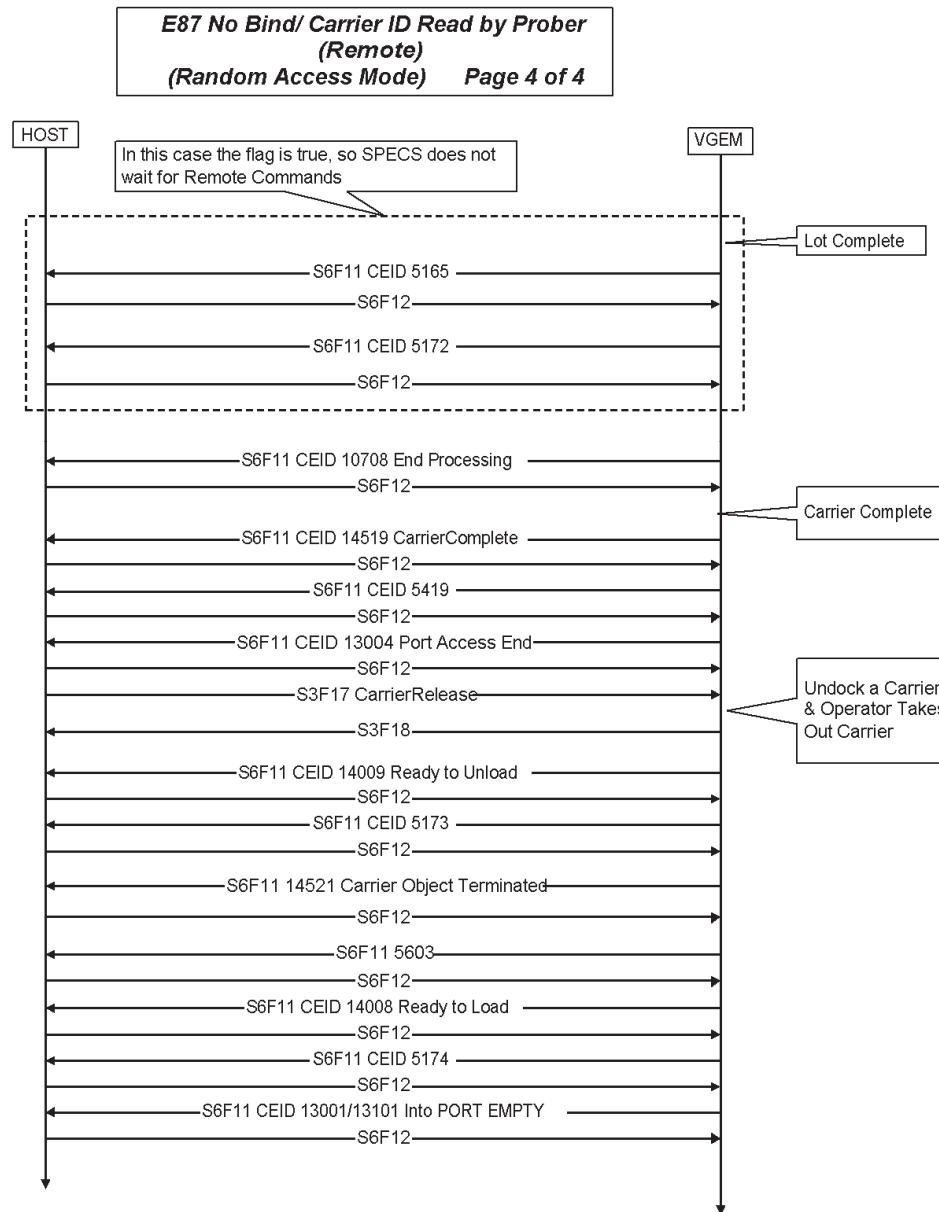


## 15.1.2. E87 No Bind/Carrier ID Read by Prober – Remote, Random Access

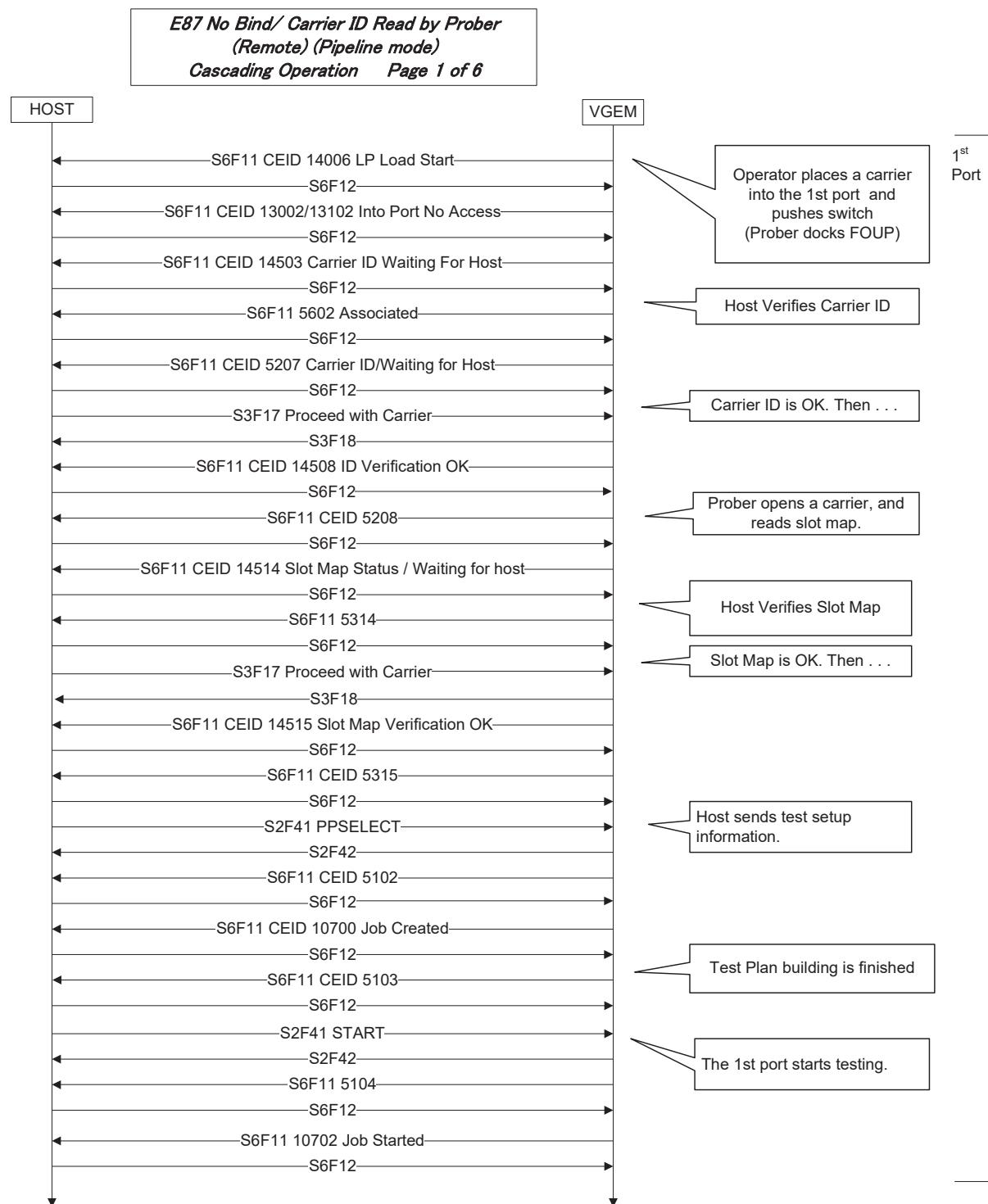


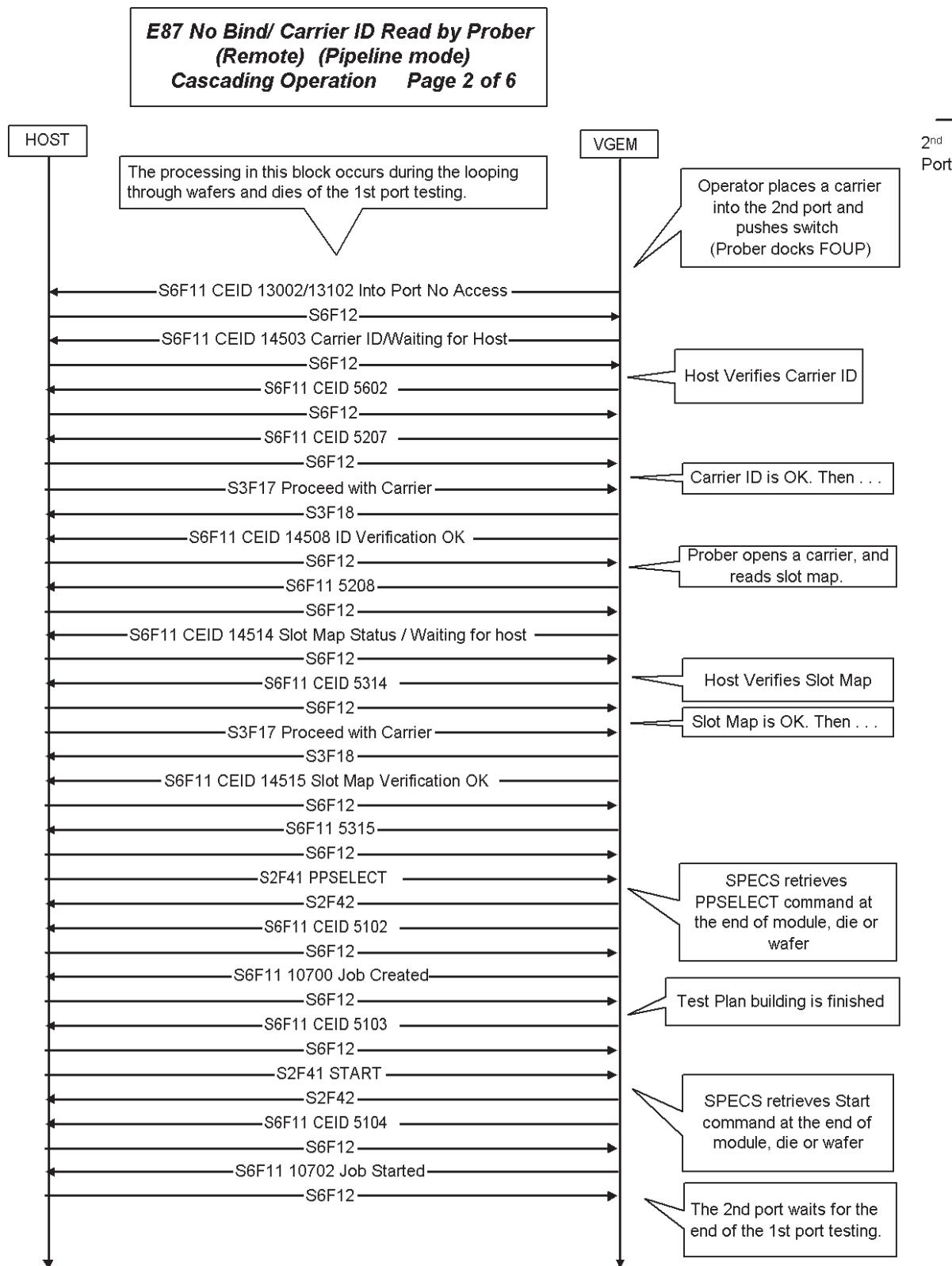


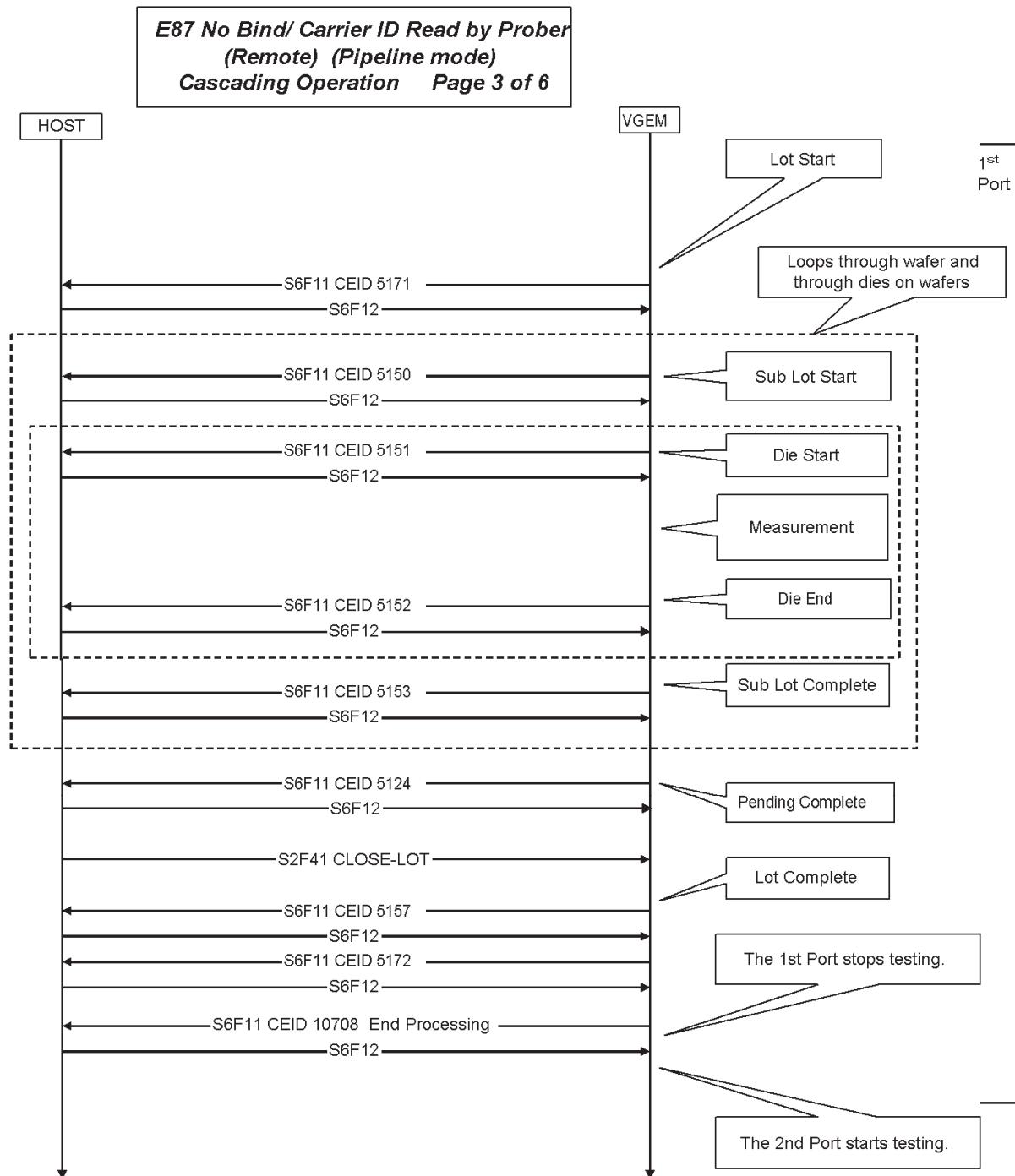


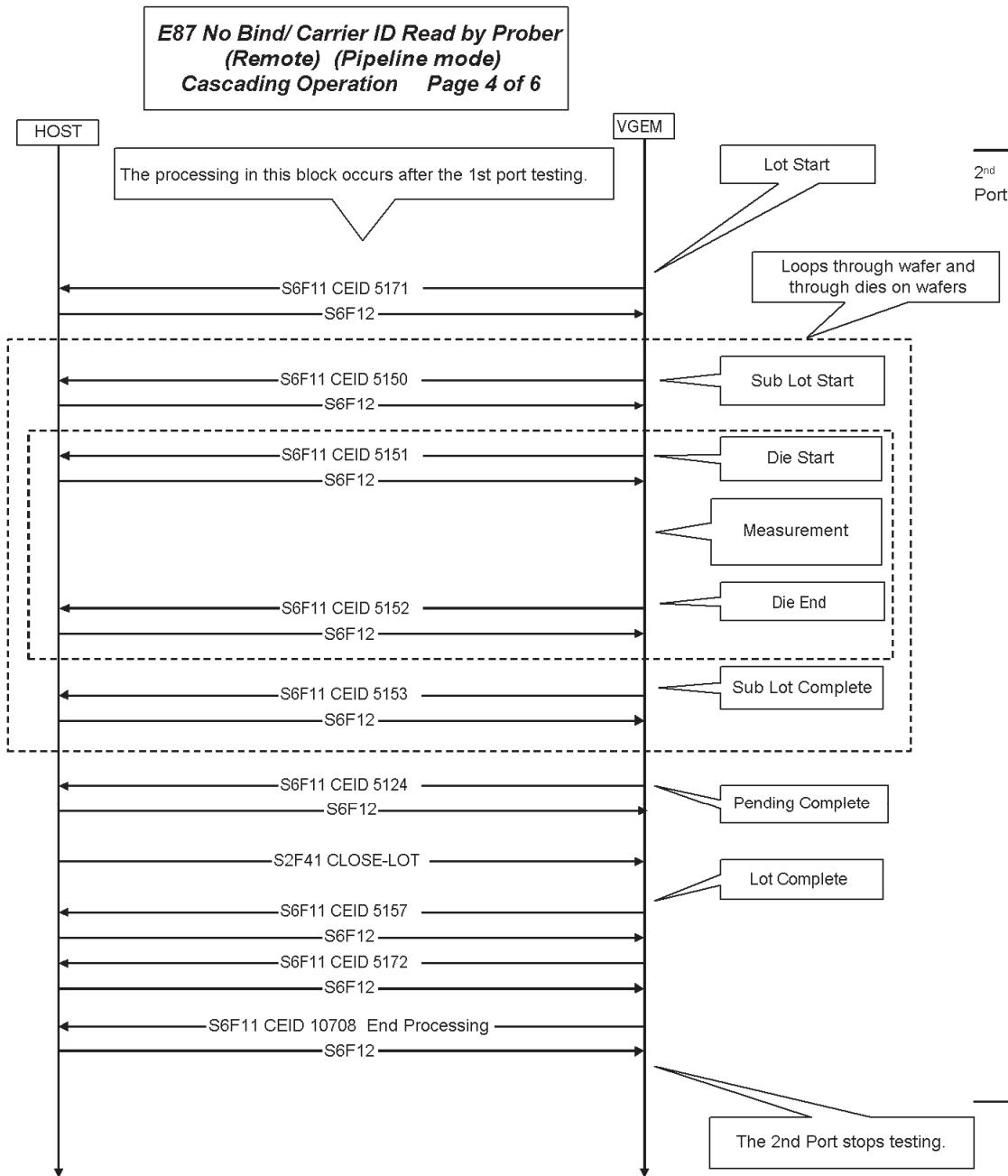


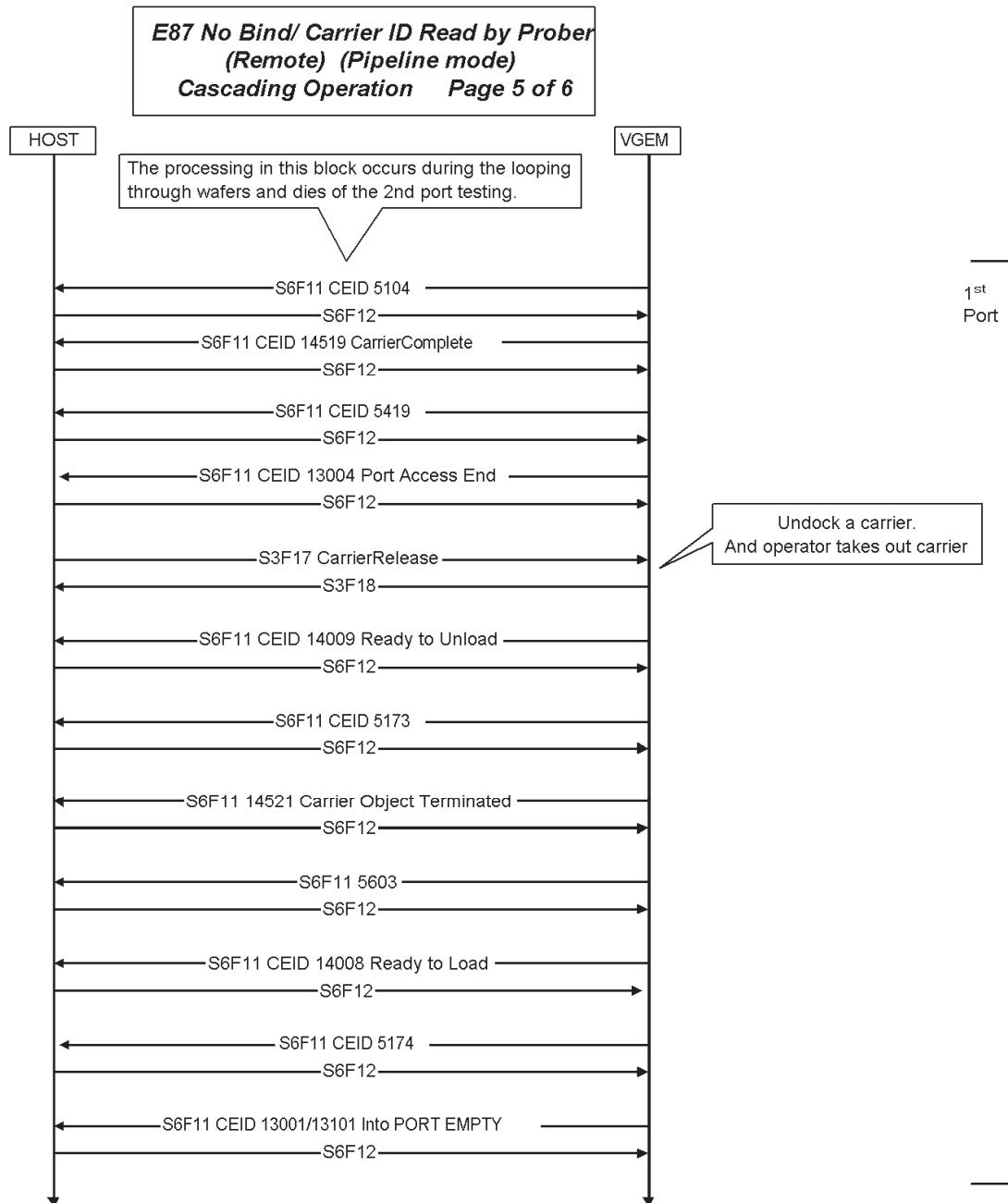
## 15.1.3. E87 No Bind/Carrier ID Read by Prober – Remote, Pipeline, Cascading Operation



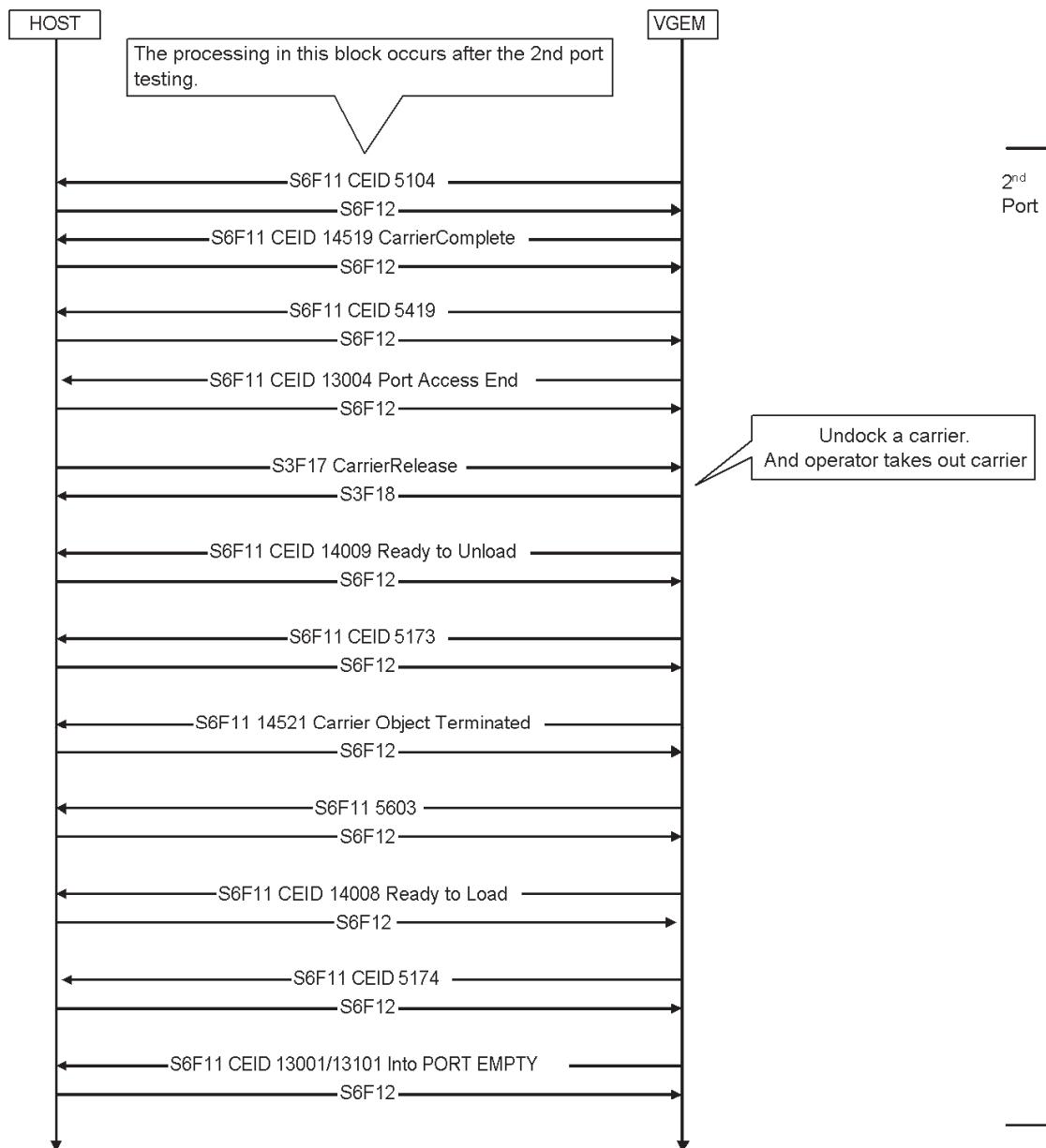




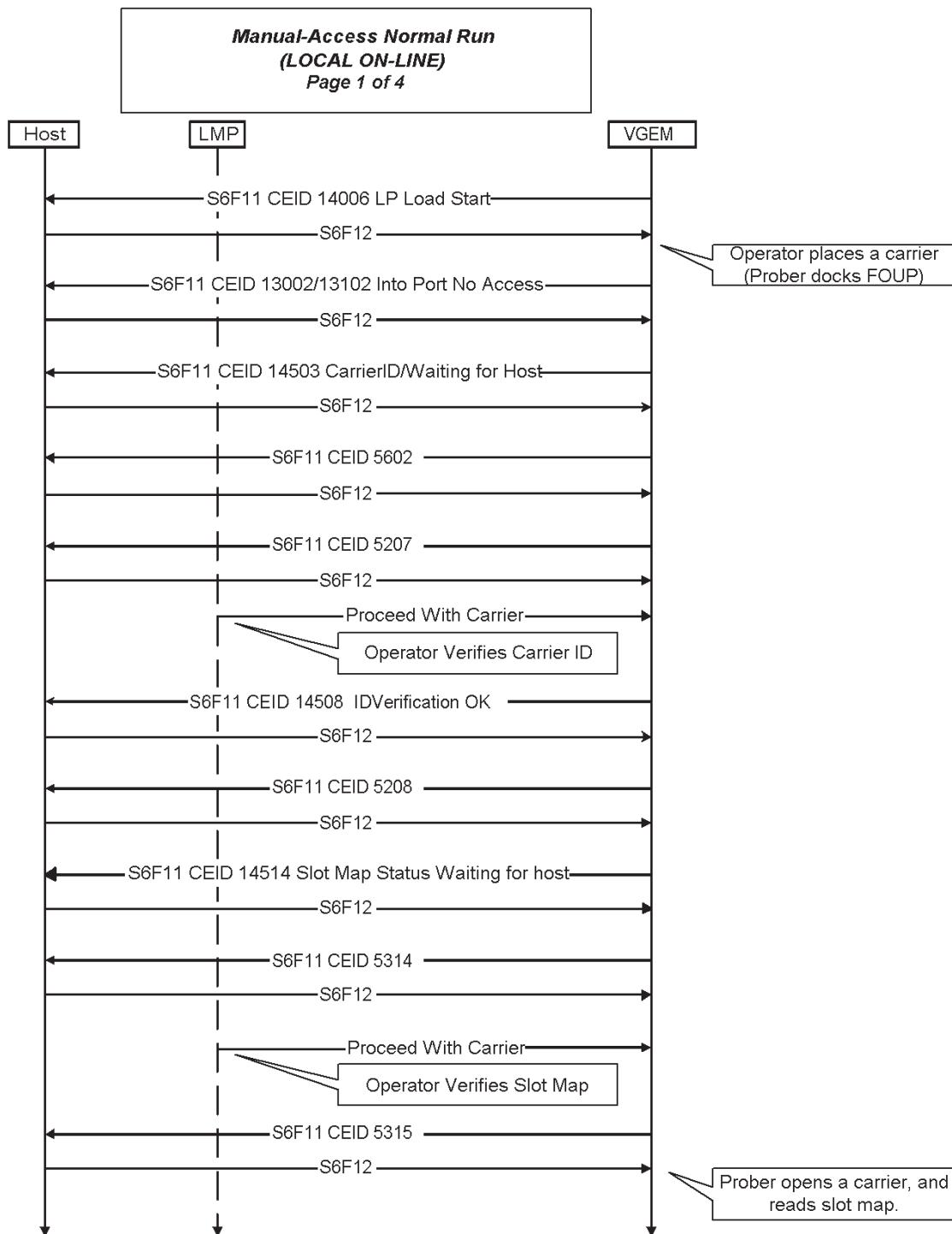


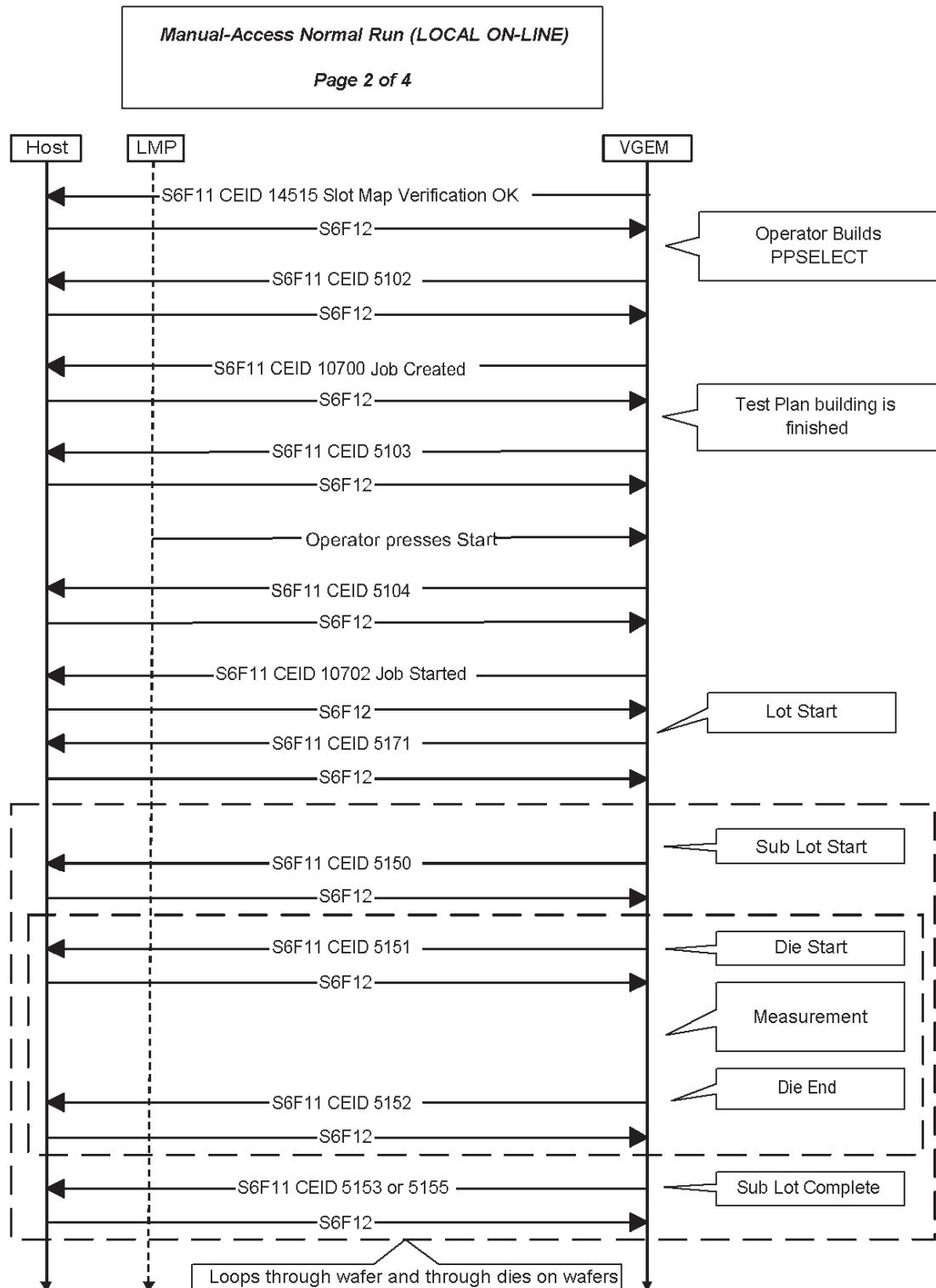


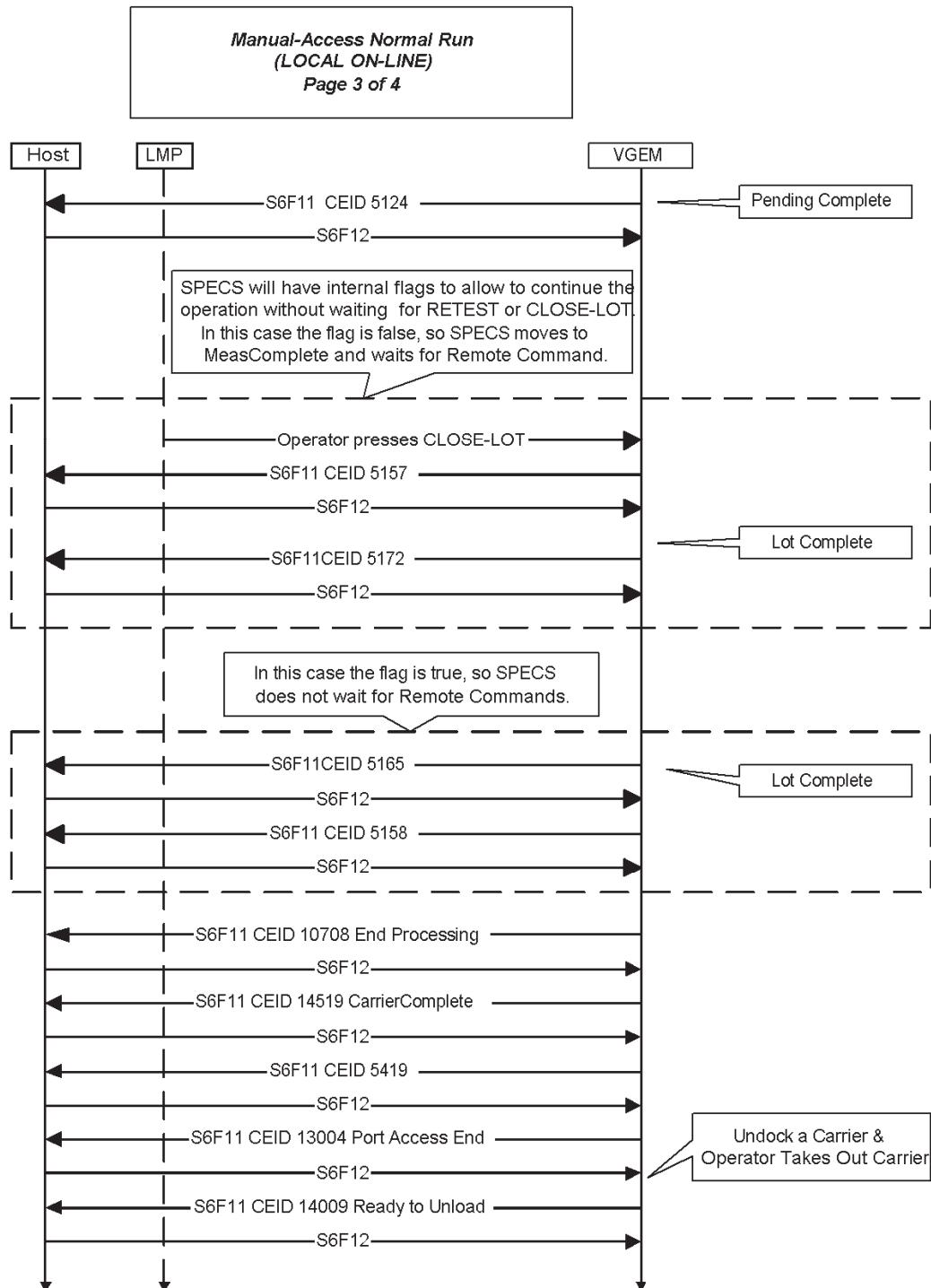
**E87 No Bind/ Carrier ID Read by Prober  
(Remote) (Pipeline mode)  
Cascading Operation Page 6 of 6**

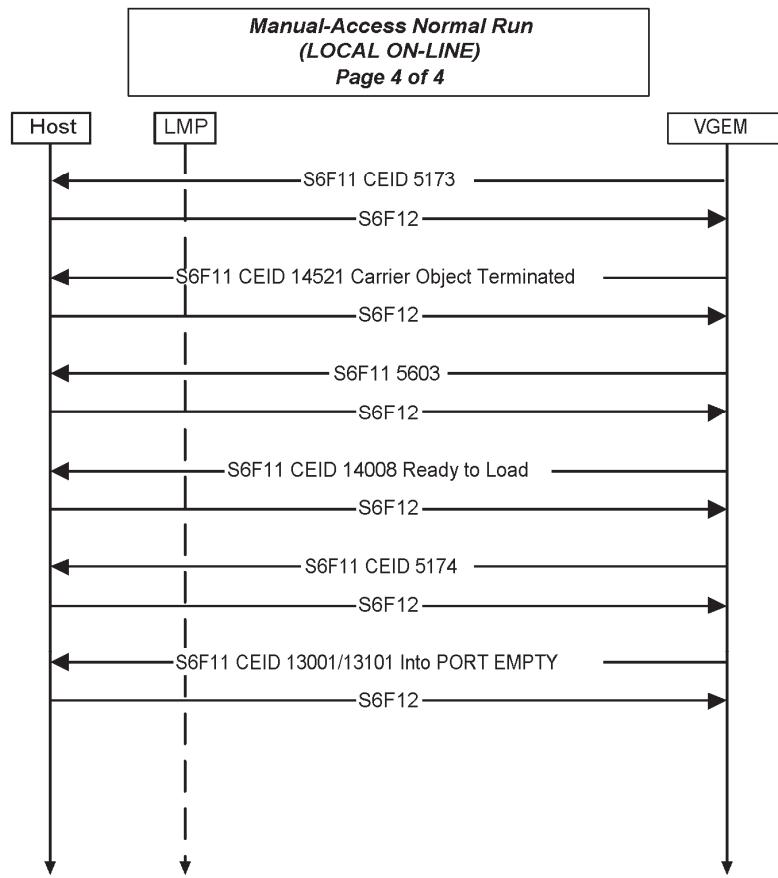


## 15.1.4. Manual Access Normal Run – Local, On-line

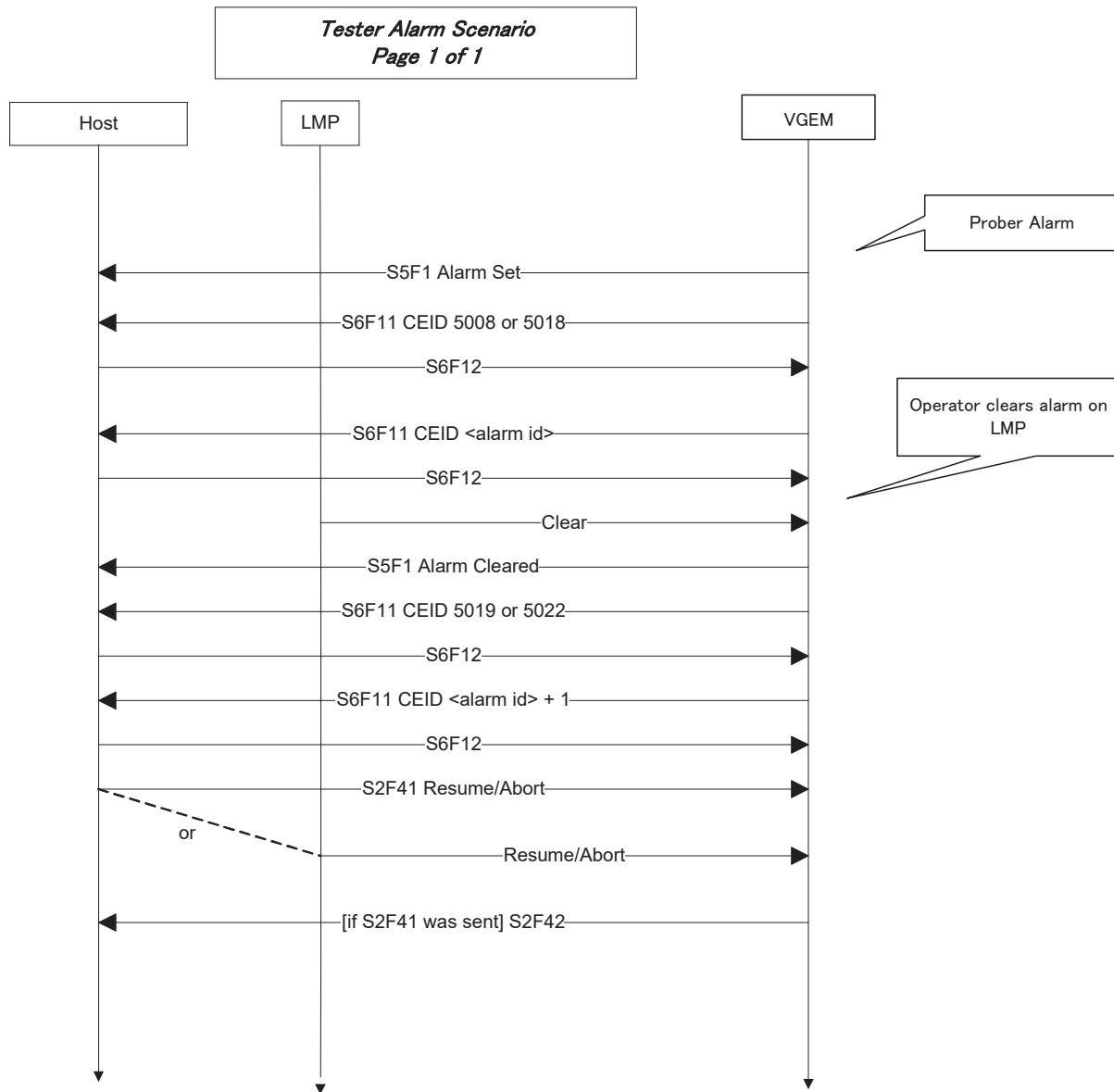


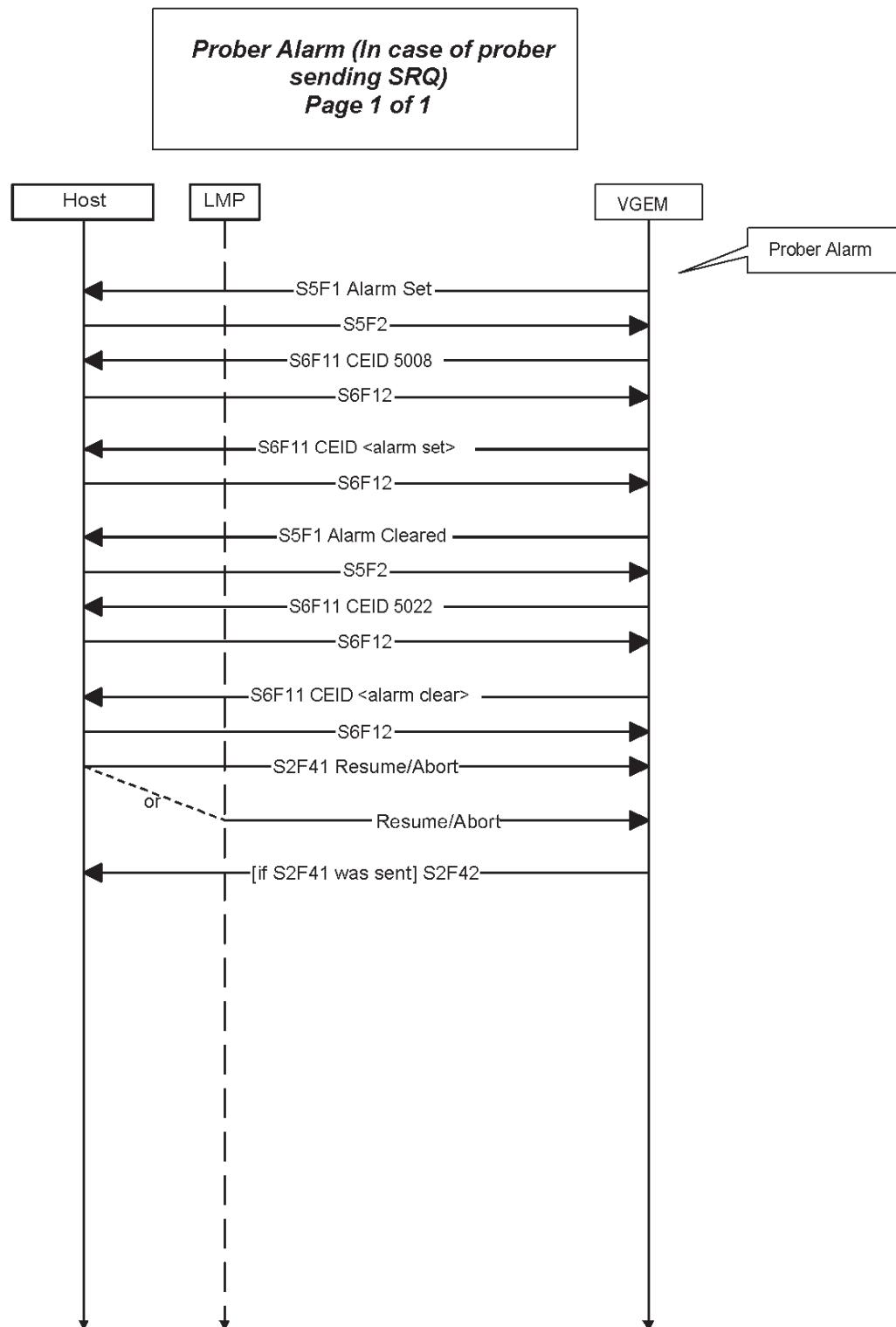


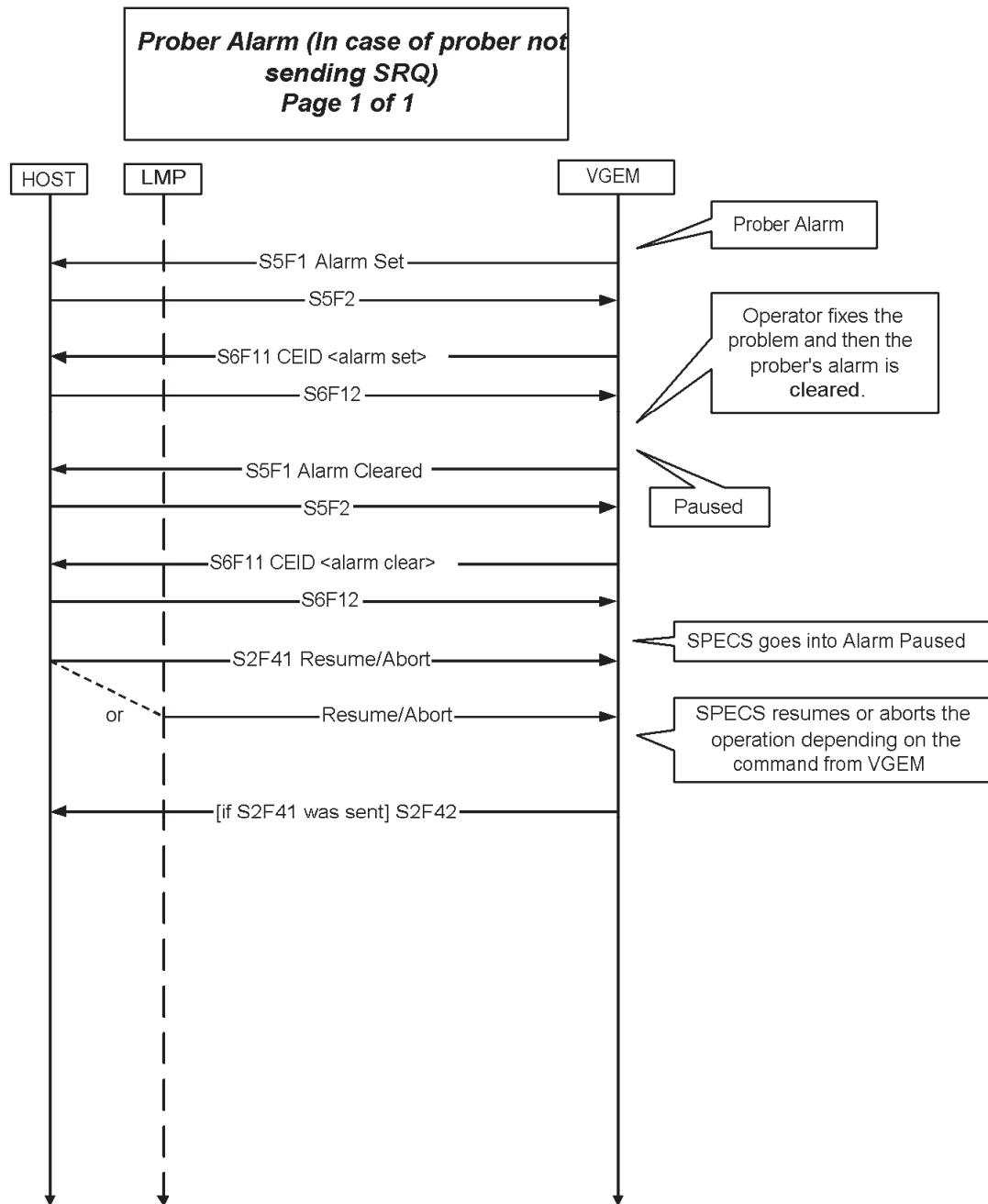




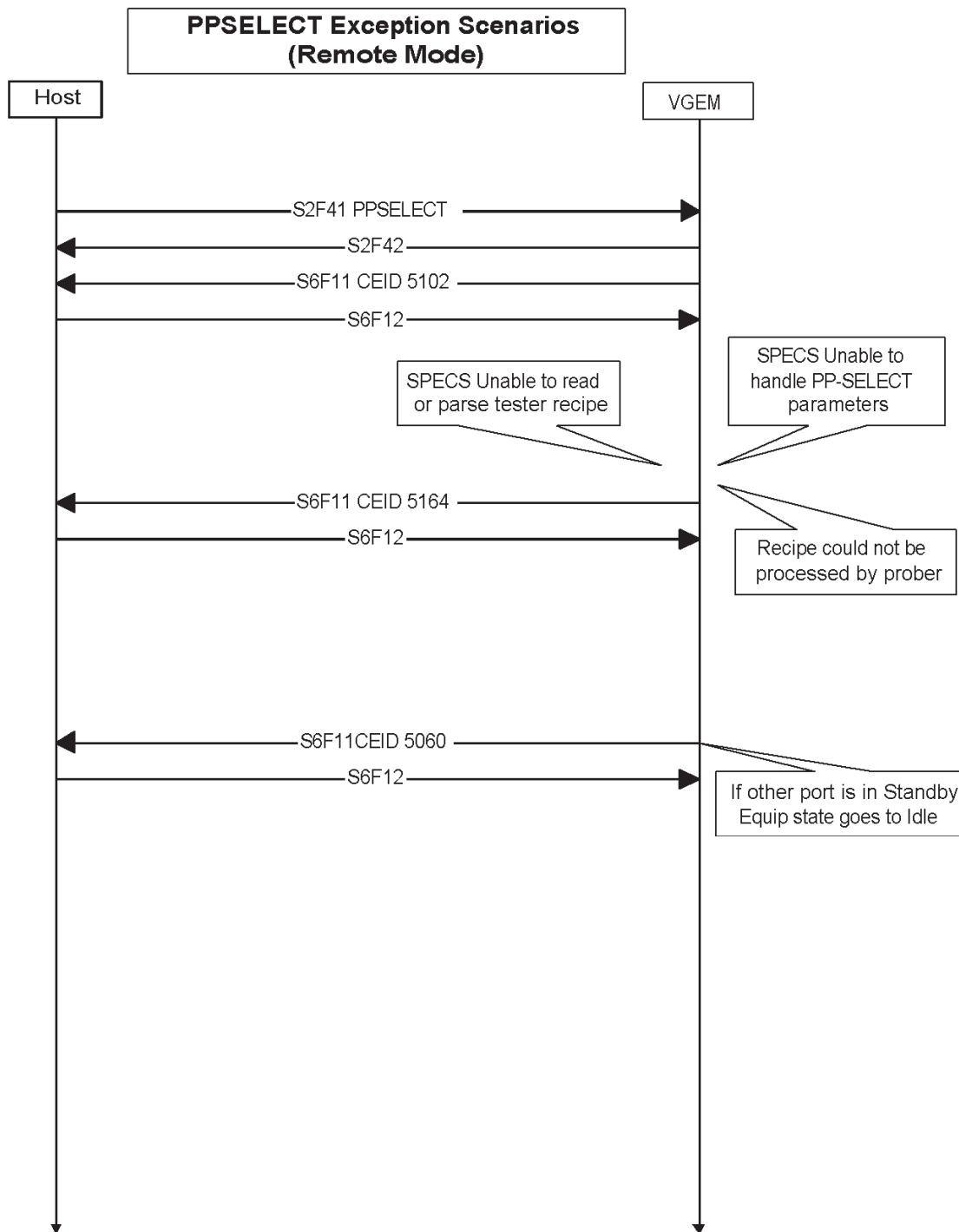
## 15.1.5. Alarm Scenarios



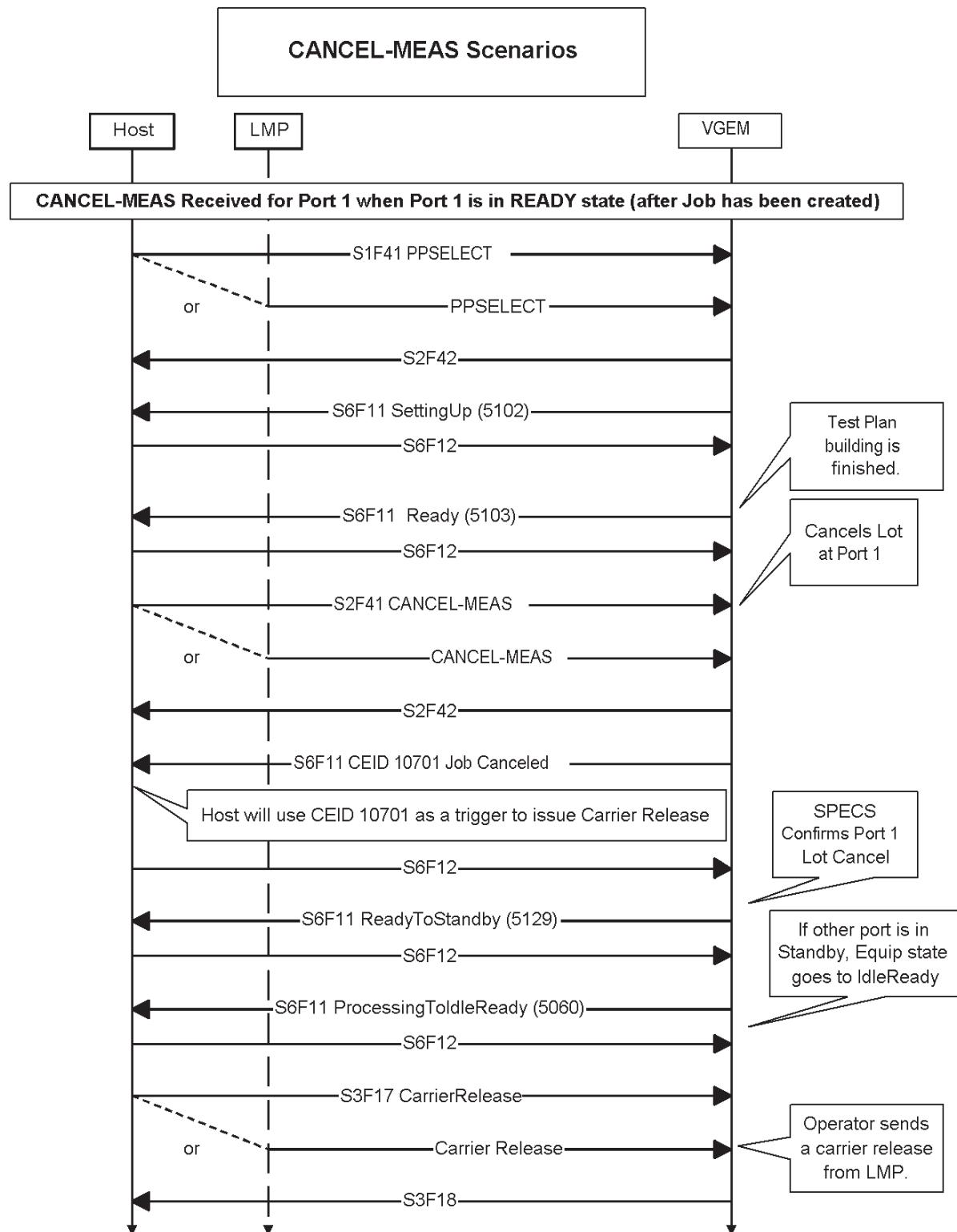




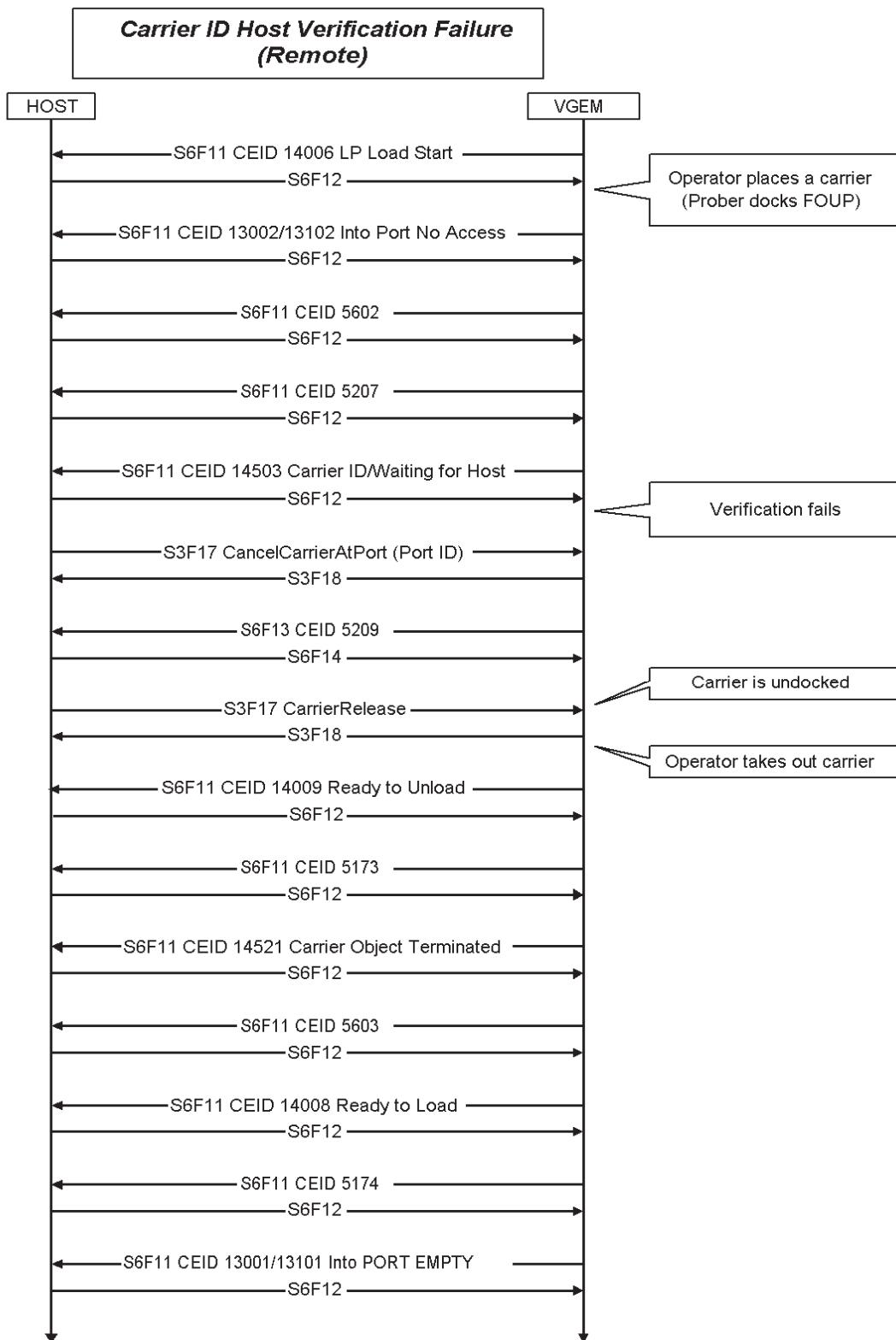
### 15.1.6. PP-Select Exception



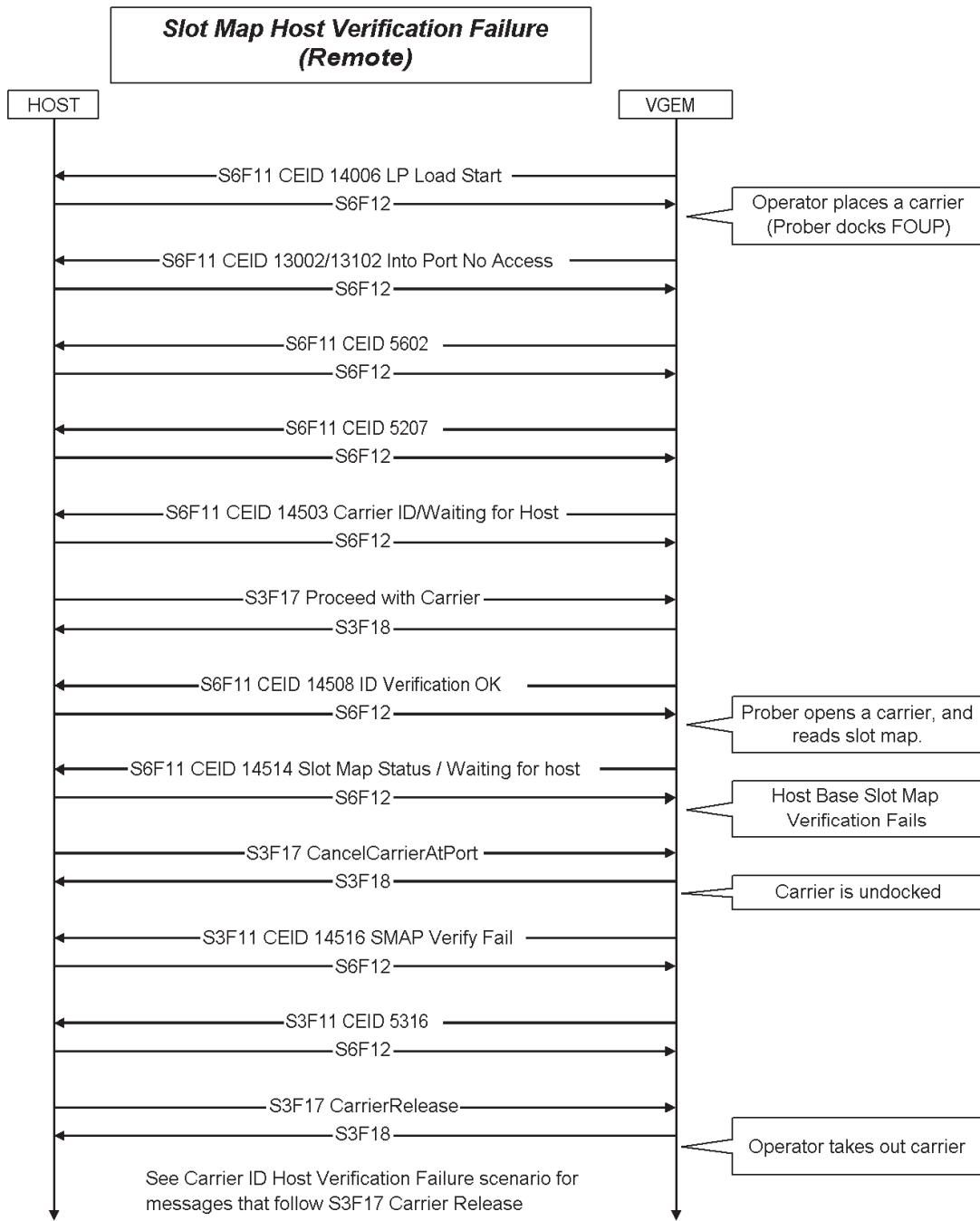
## 15.1.7. Cancel Measurement

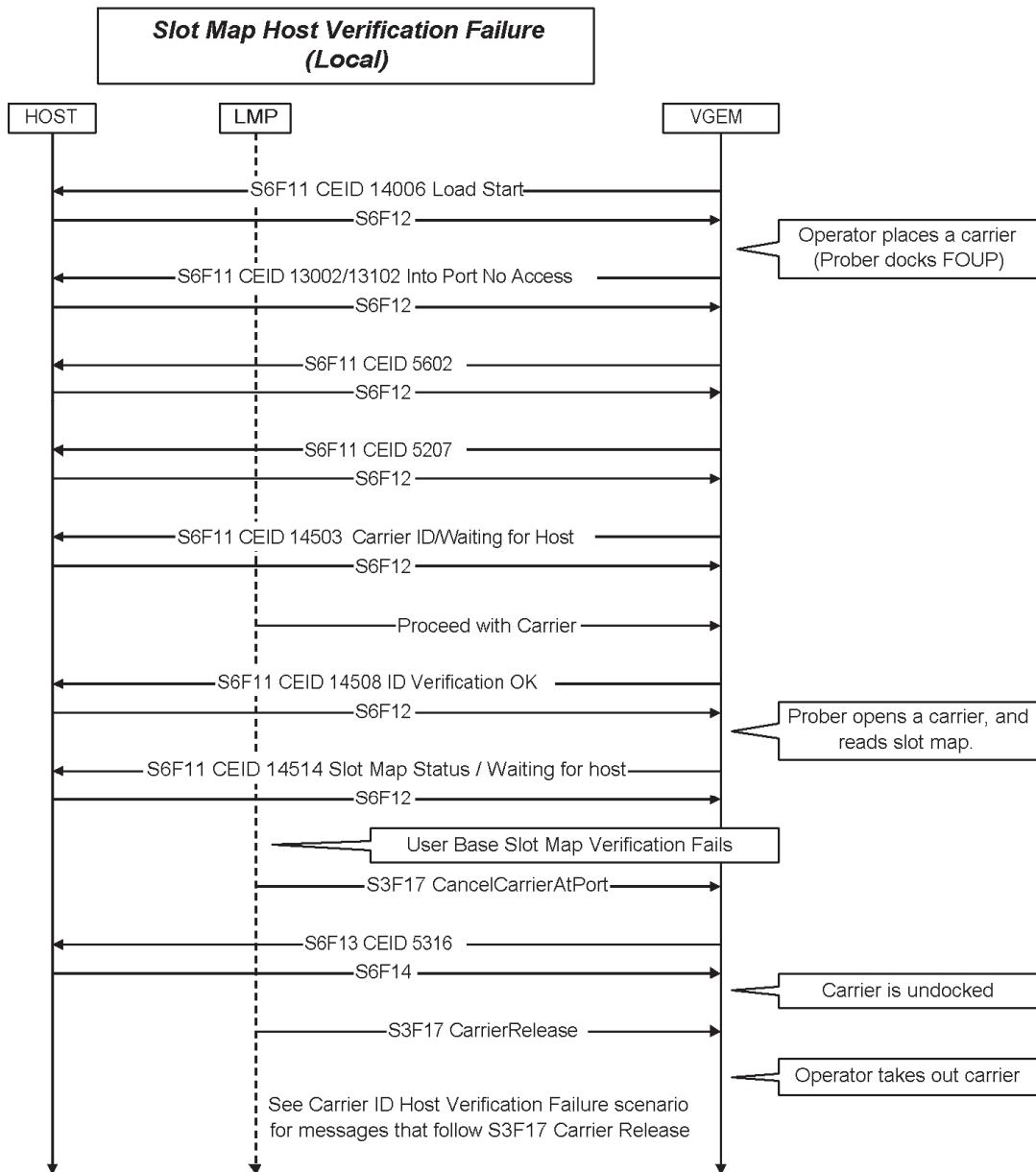


### 15.1.8. Carrier ID Verification Failure

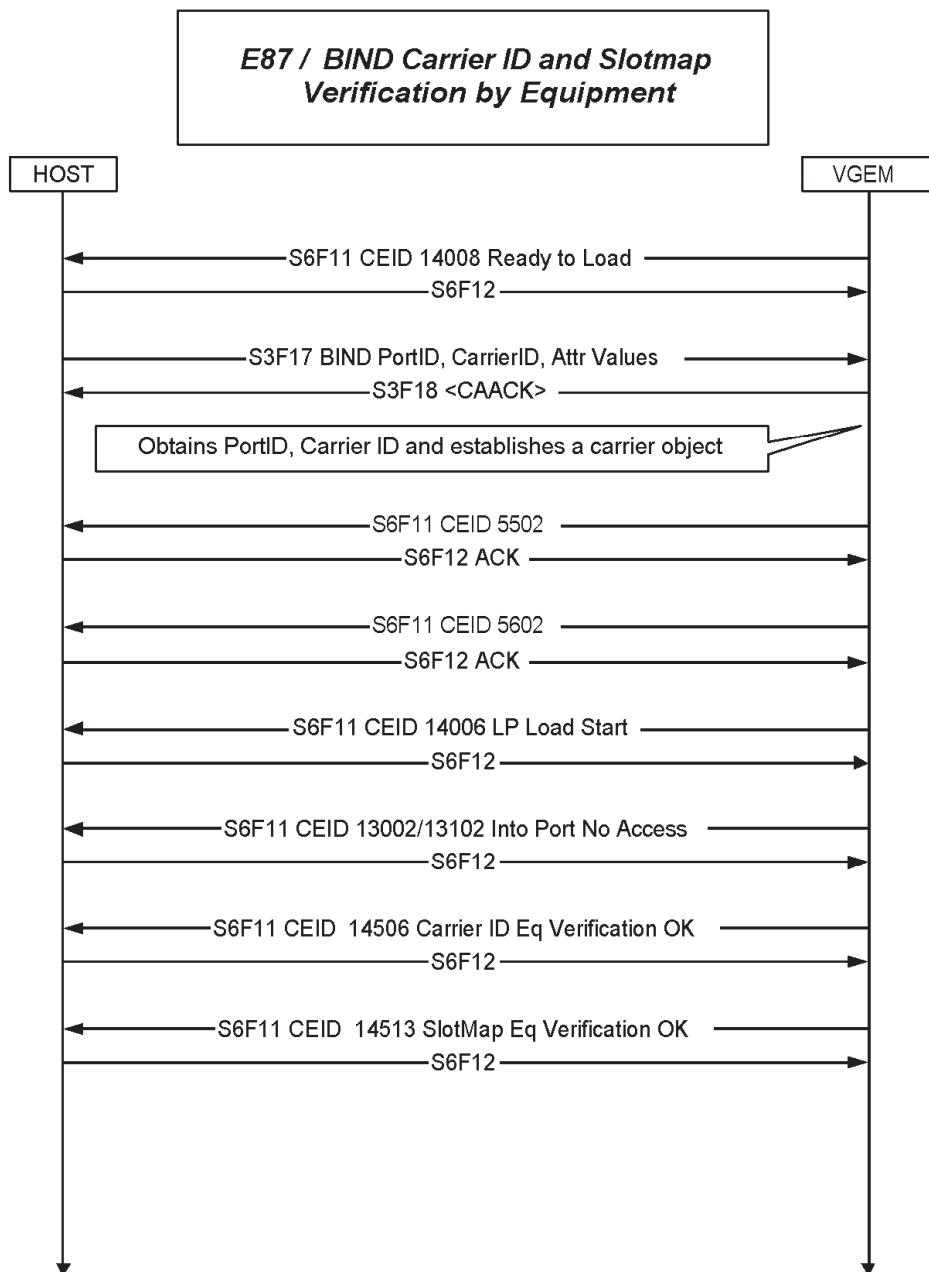


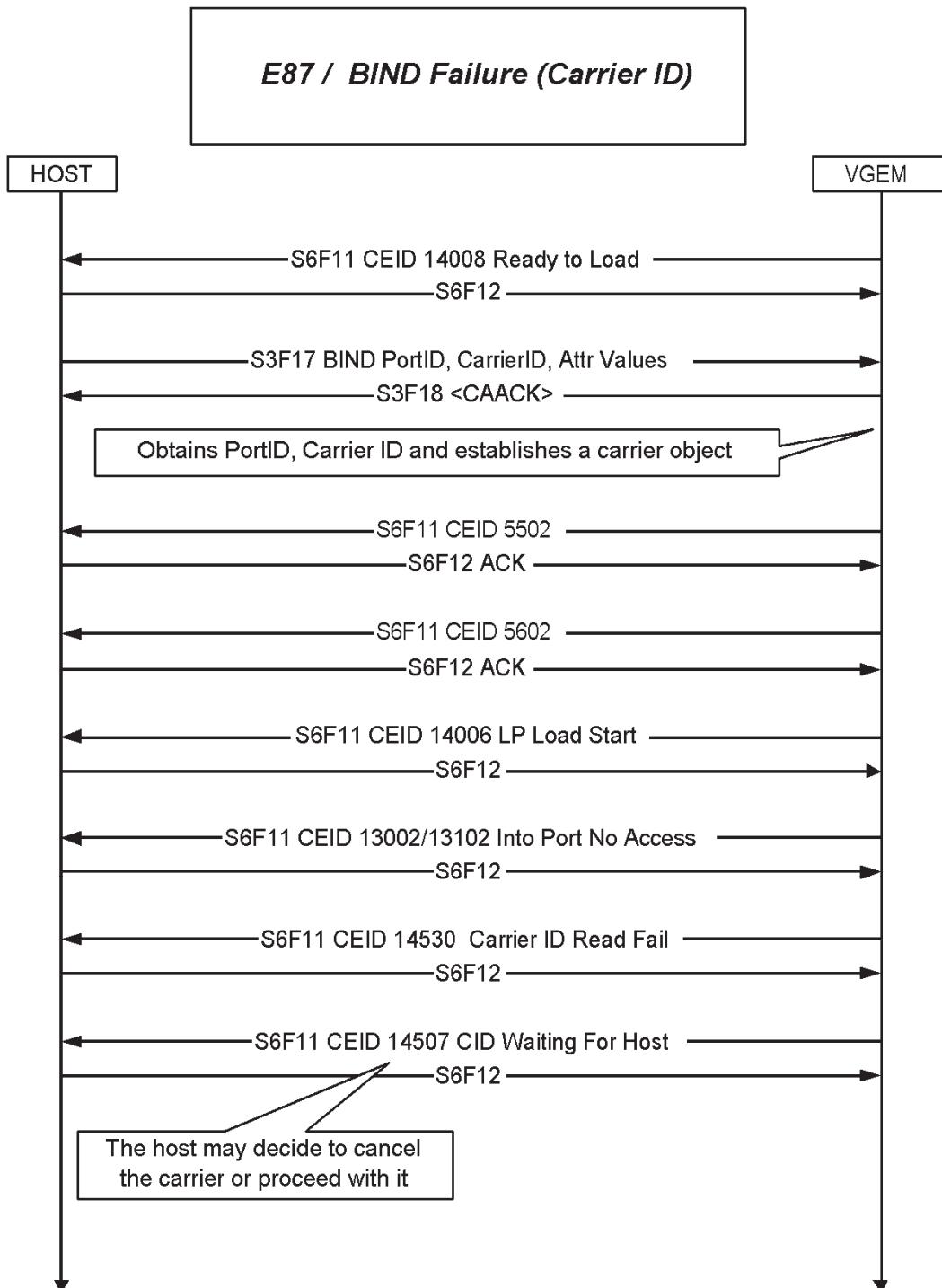
### 15.1.9. Slot Map Host Verification Failure

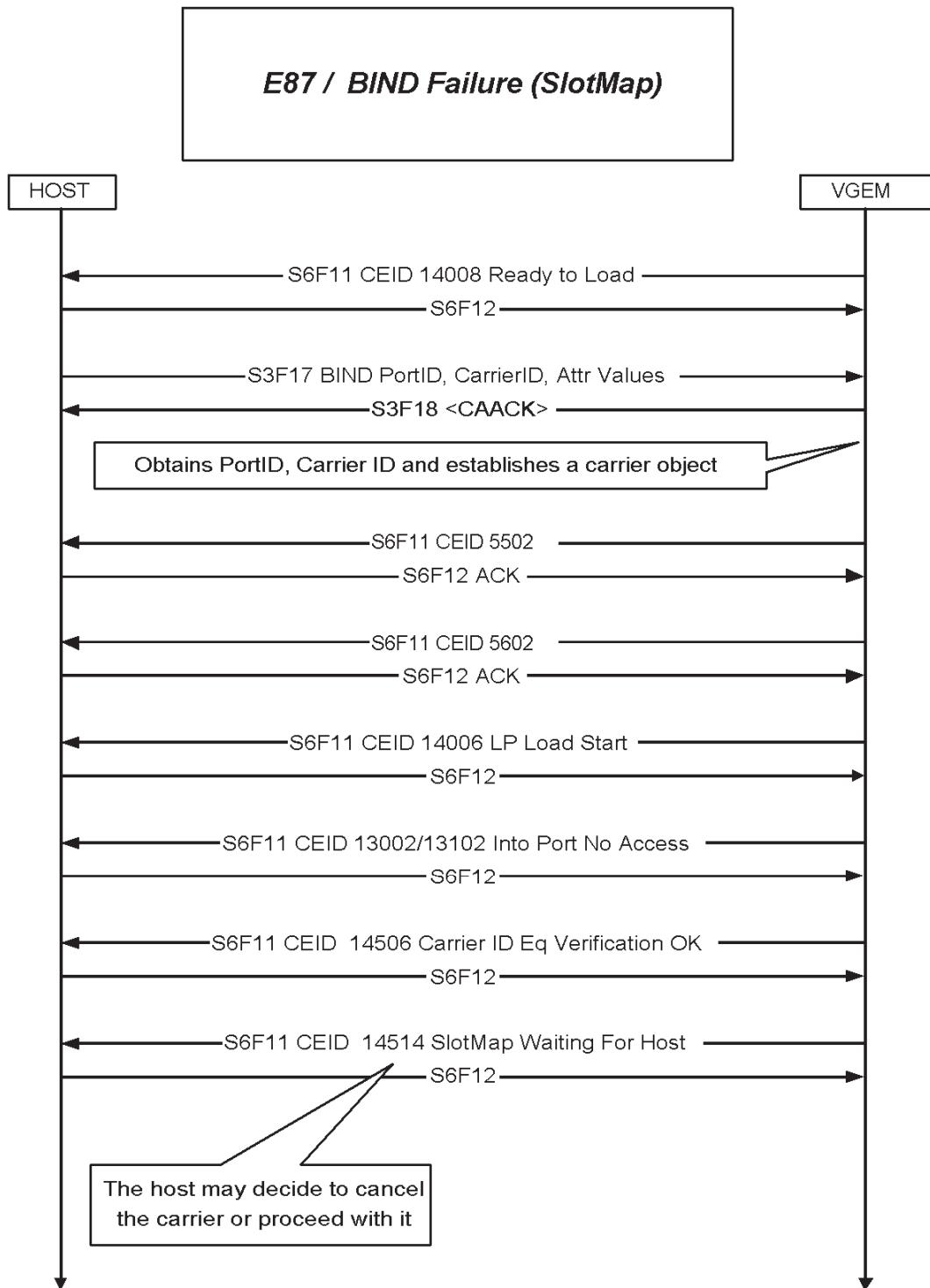




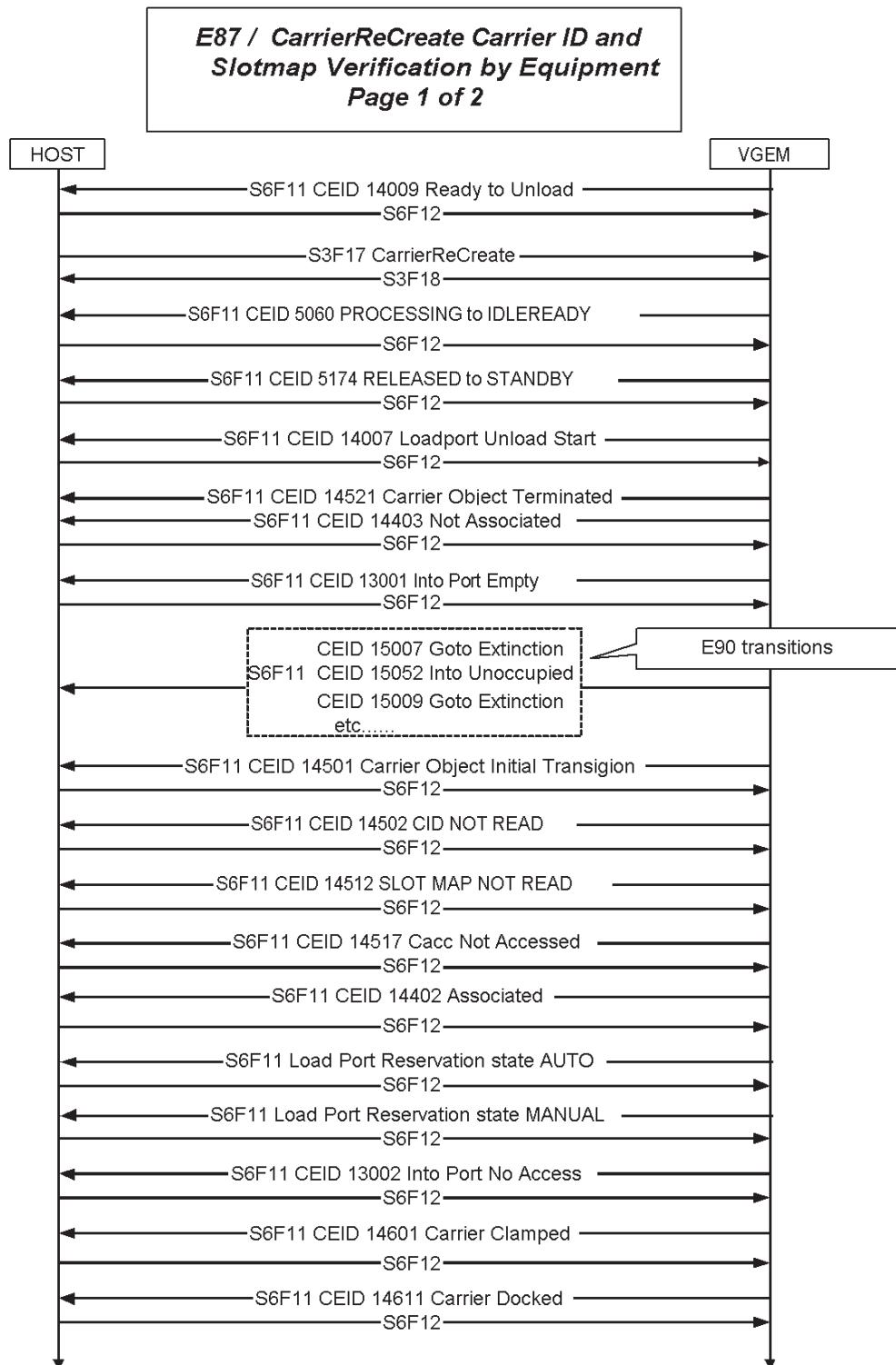
## 15.1.10. E87 Bind Scenarios

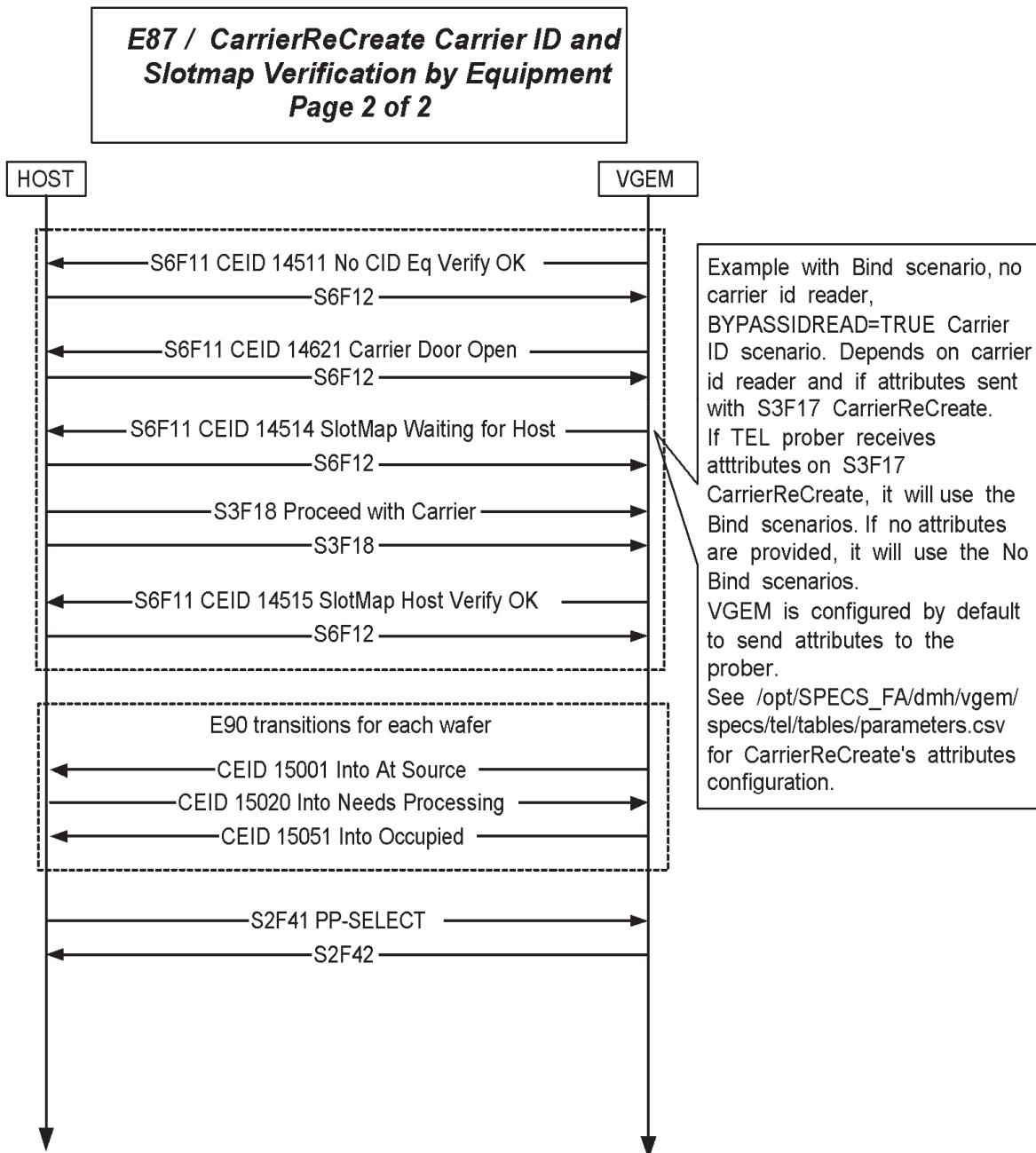




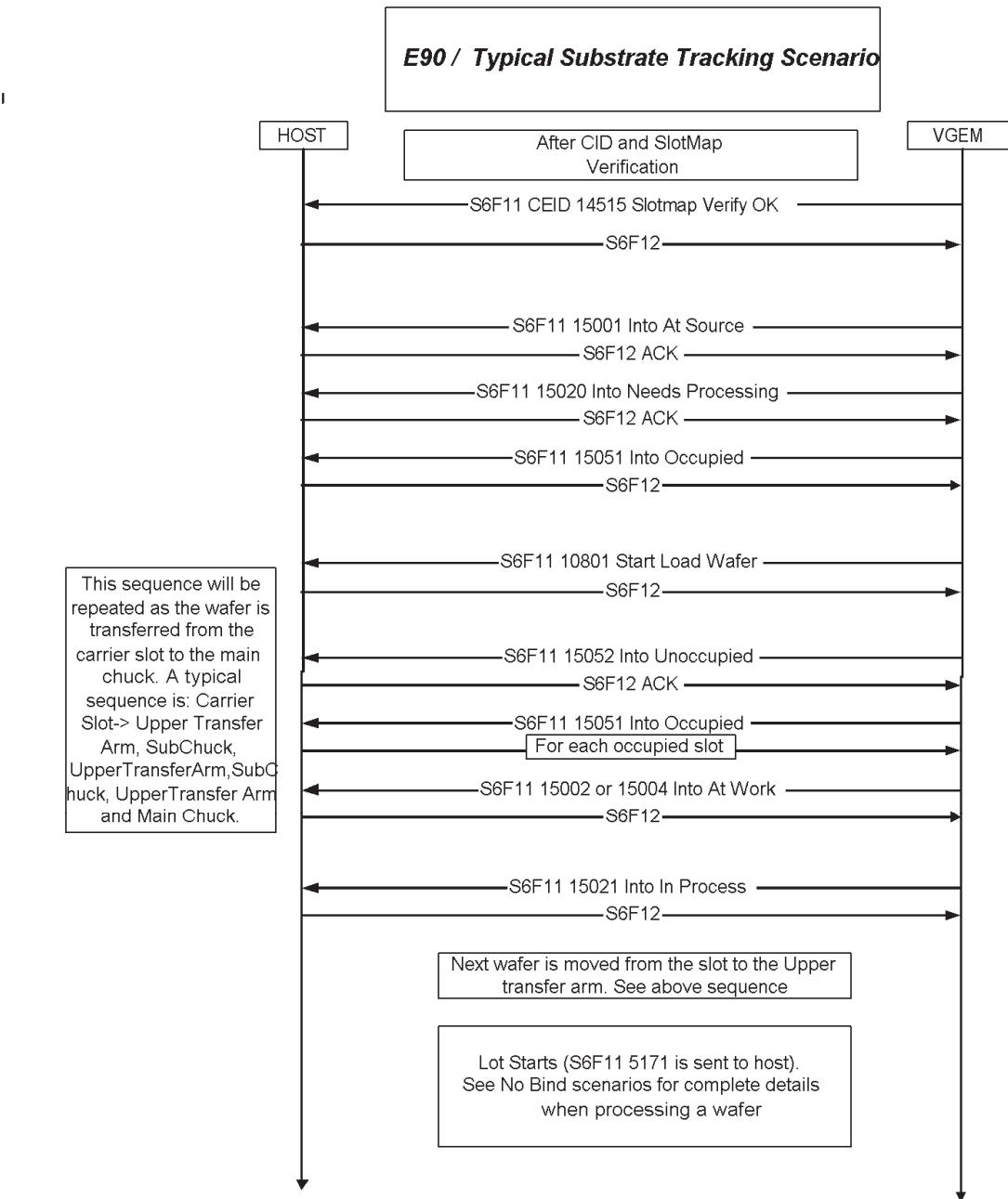


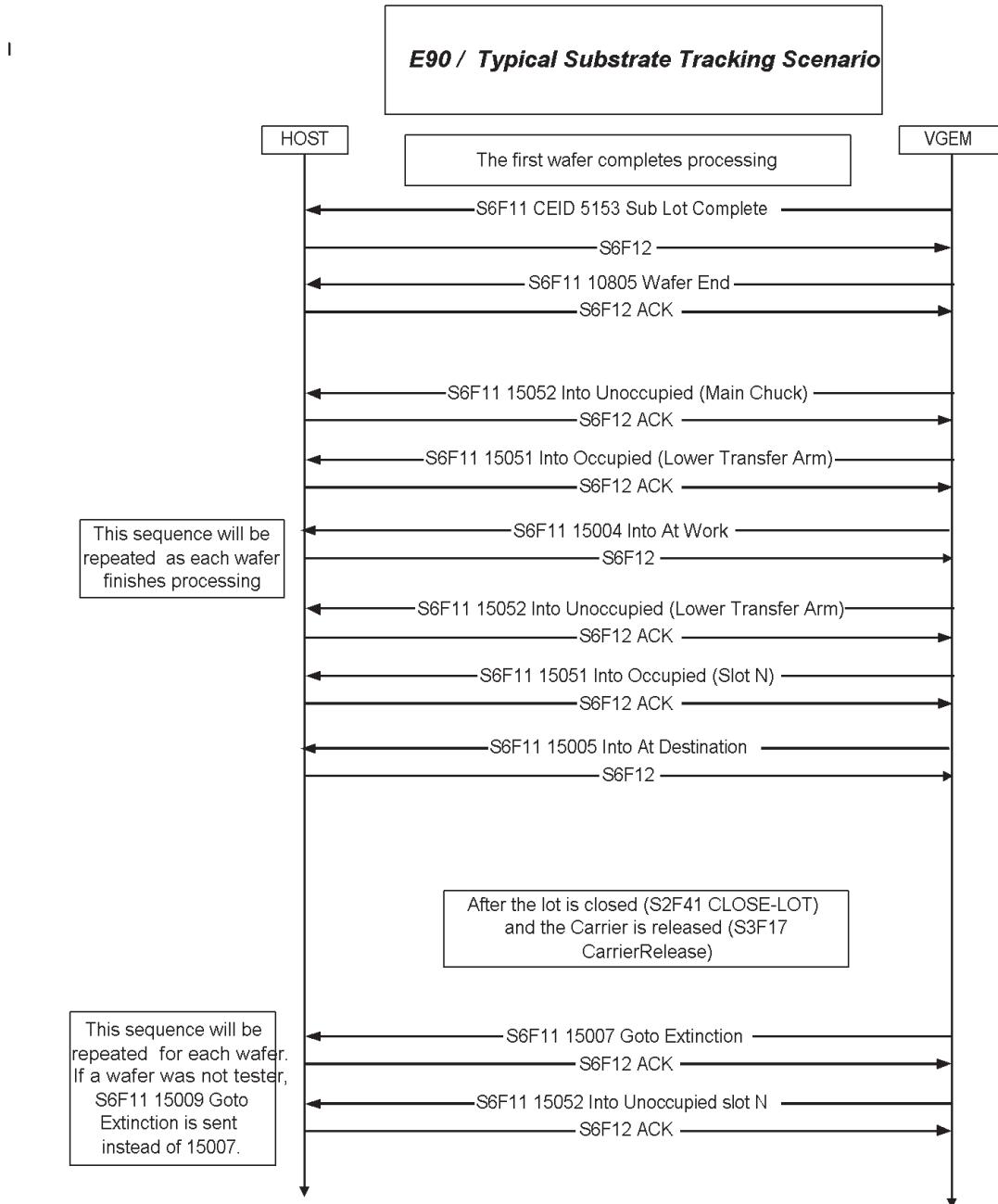
### 15.1.11. Carrier ReCreate Scenarios



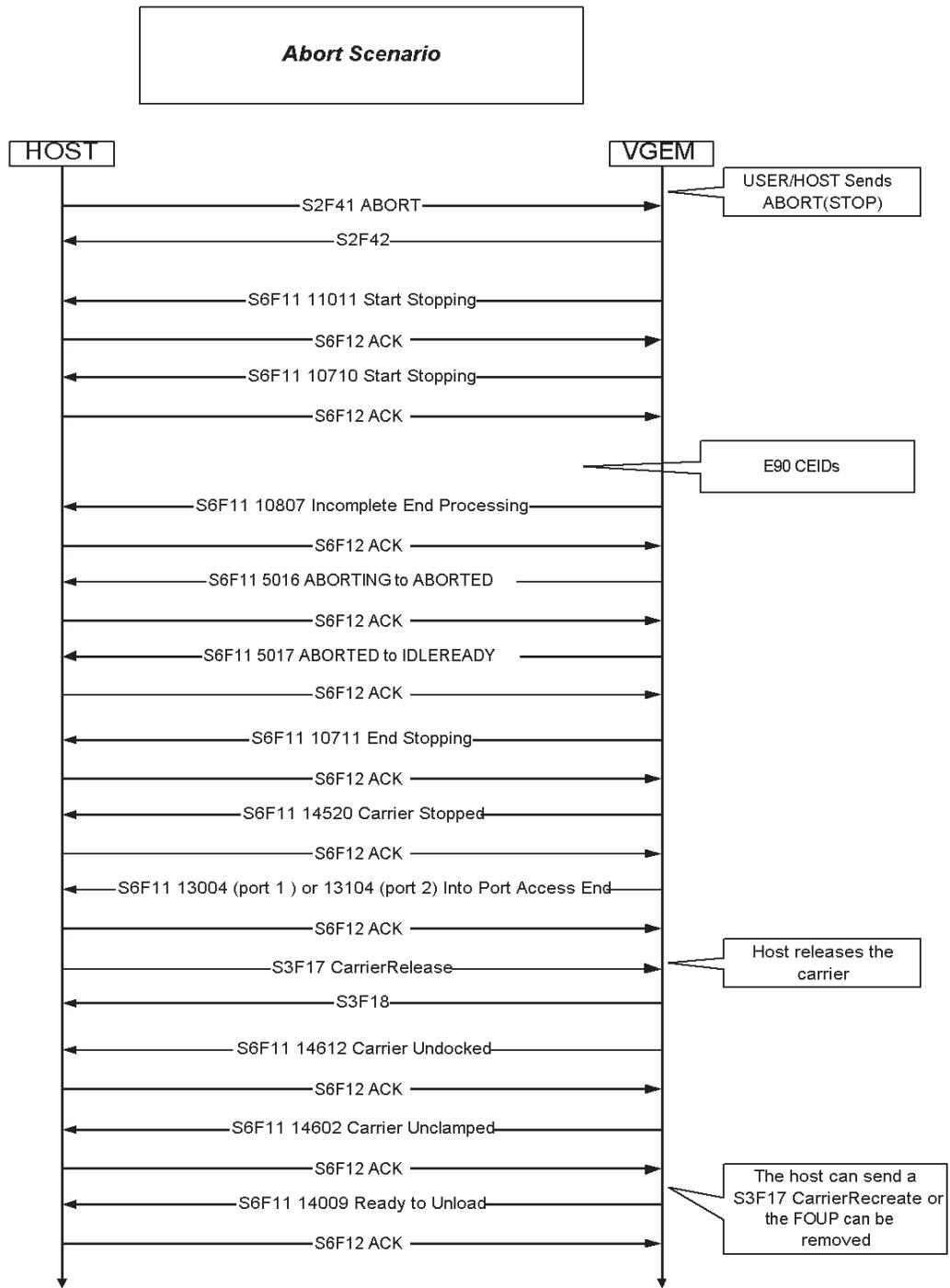


### 15.1.12. E90 Substrate Tracking Scenarios



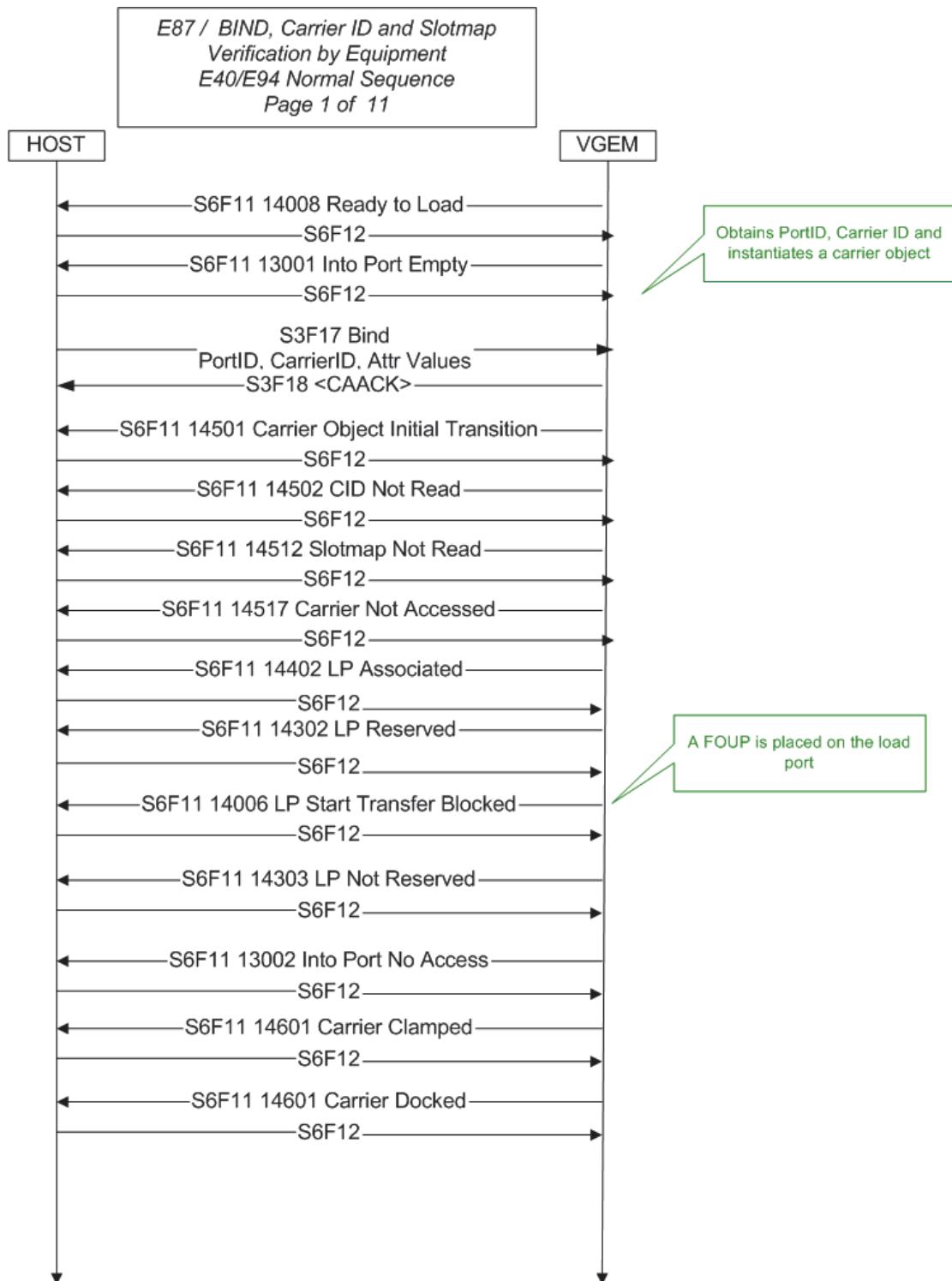


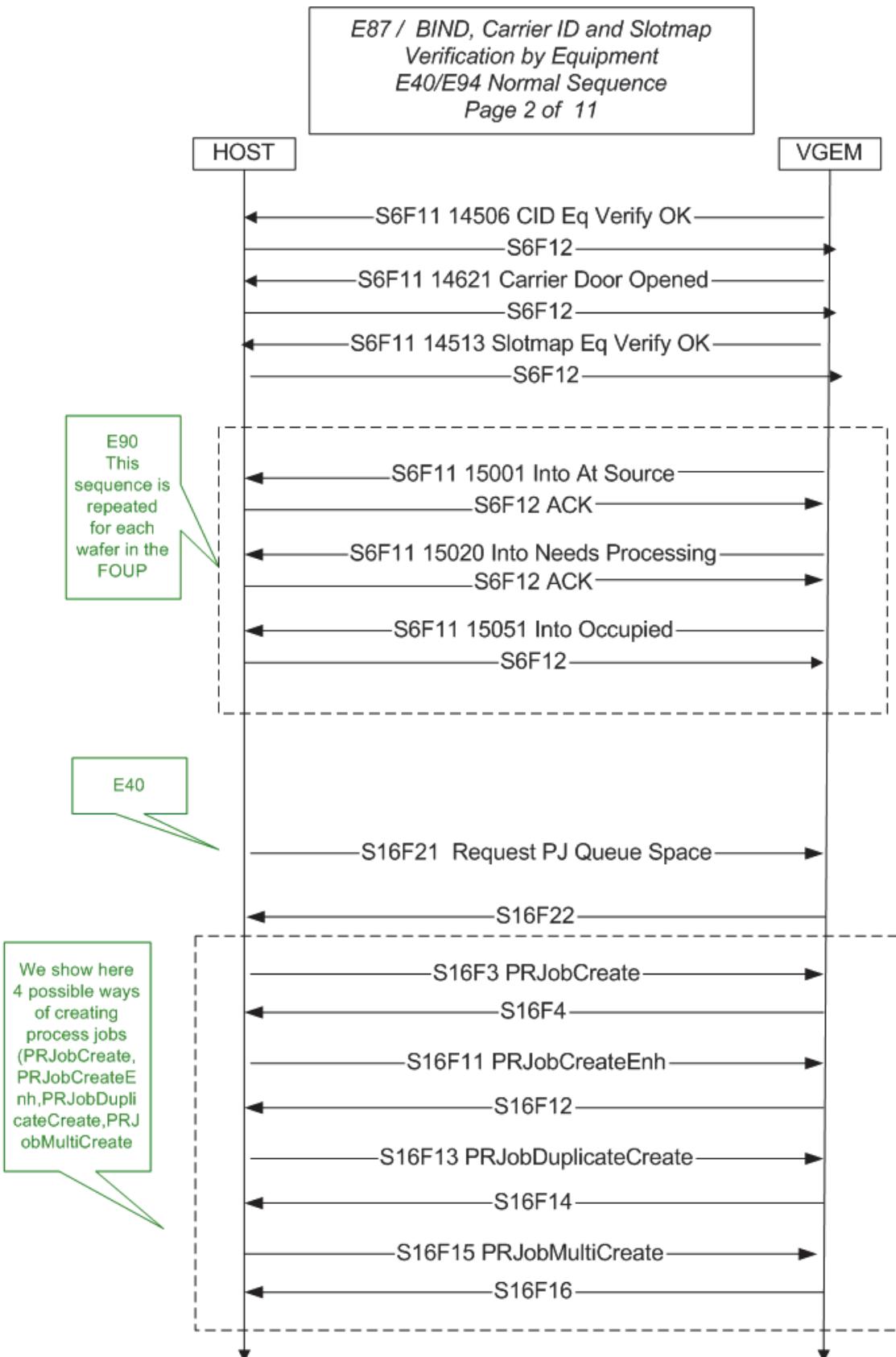
### 15.1.13. Abort Process

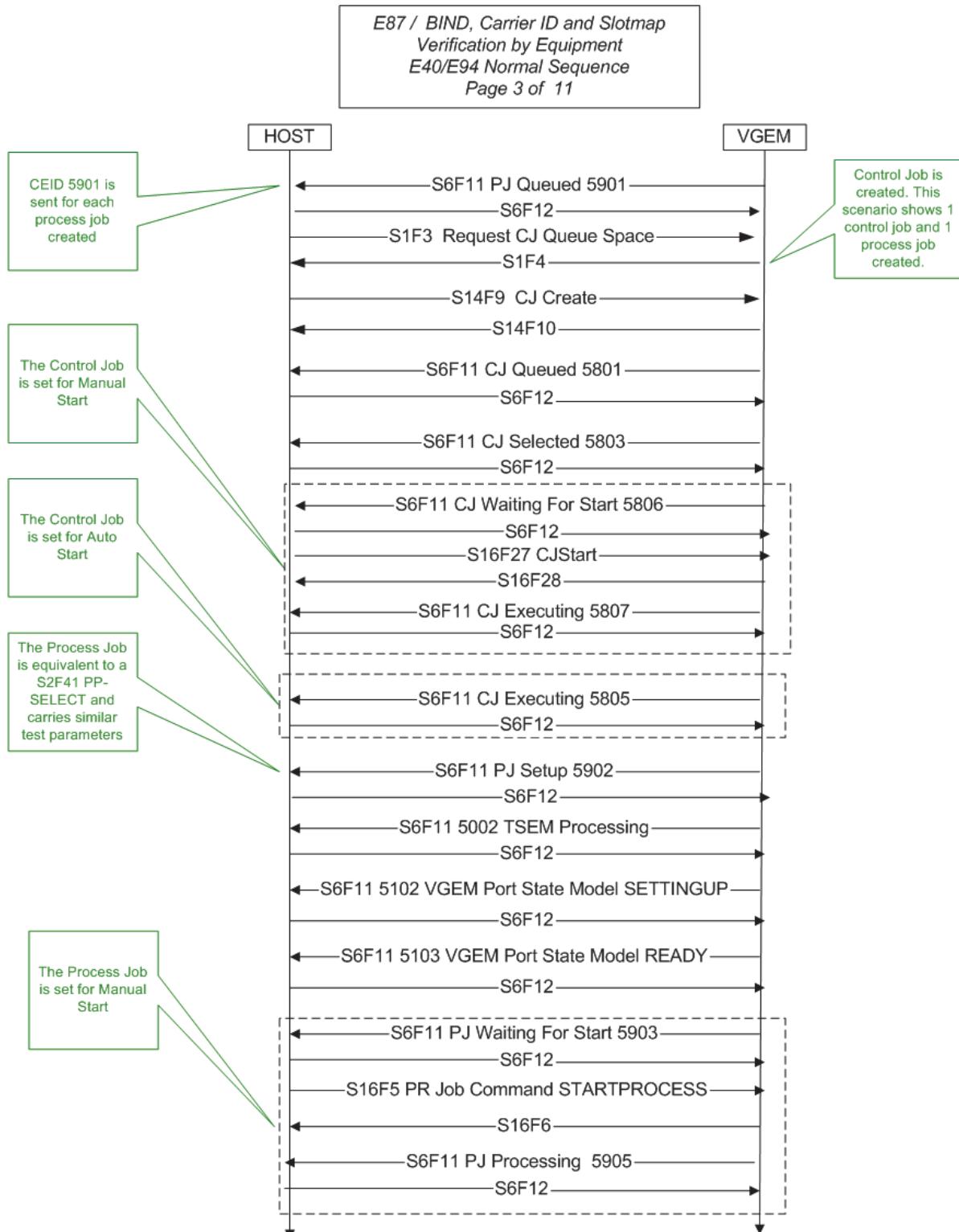


### 15.1.14. Normal Sequence

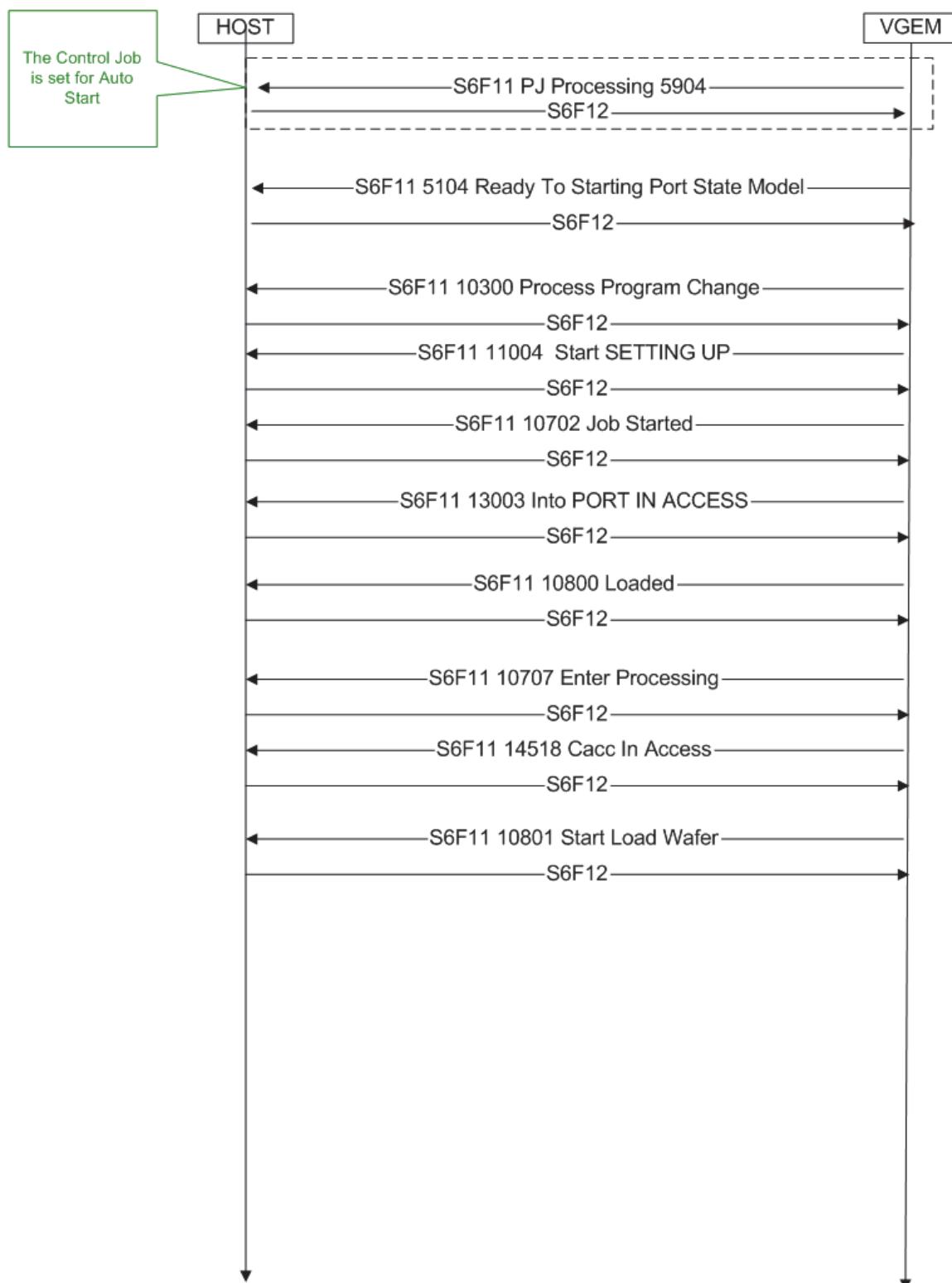
The following scenario supports process state model (SEMI E40-0701 or before), however, the latest process state model (SEMI E40-0705E or later) shows a little different scenario as shown in the pages 9 and 10 of 11. You can replace those pages shown later with the series of pages.



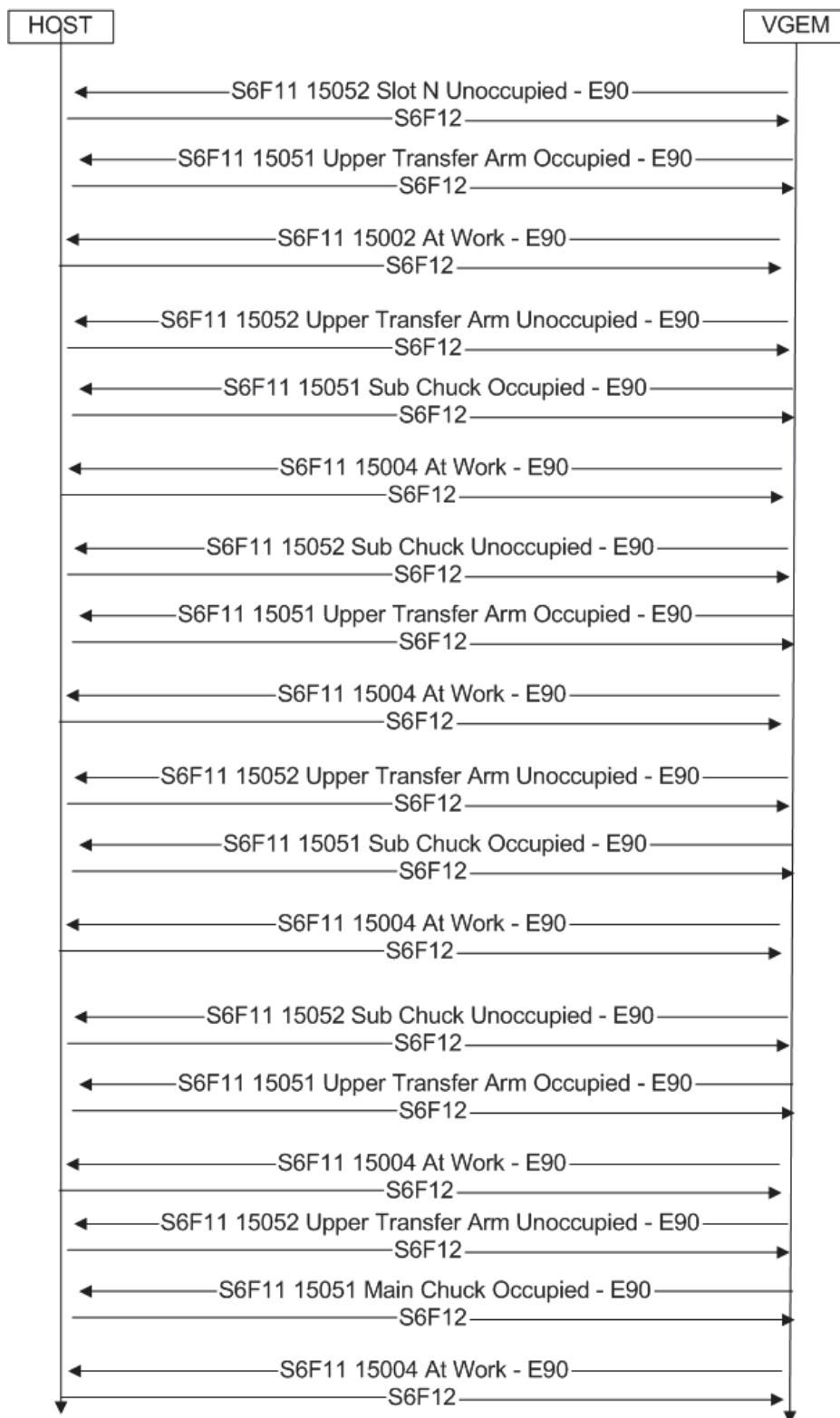




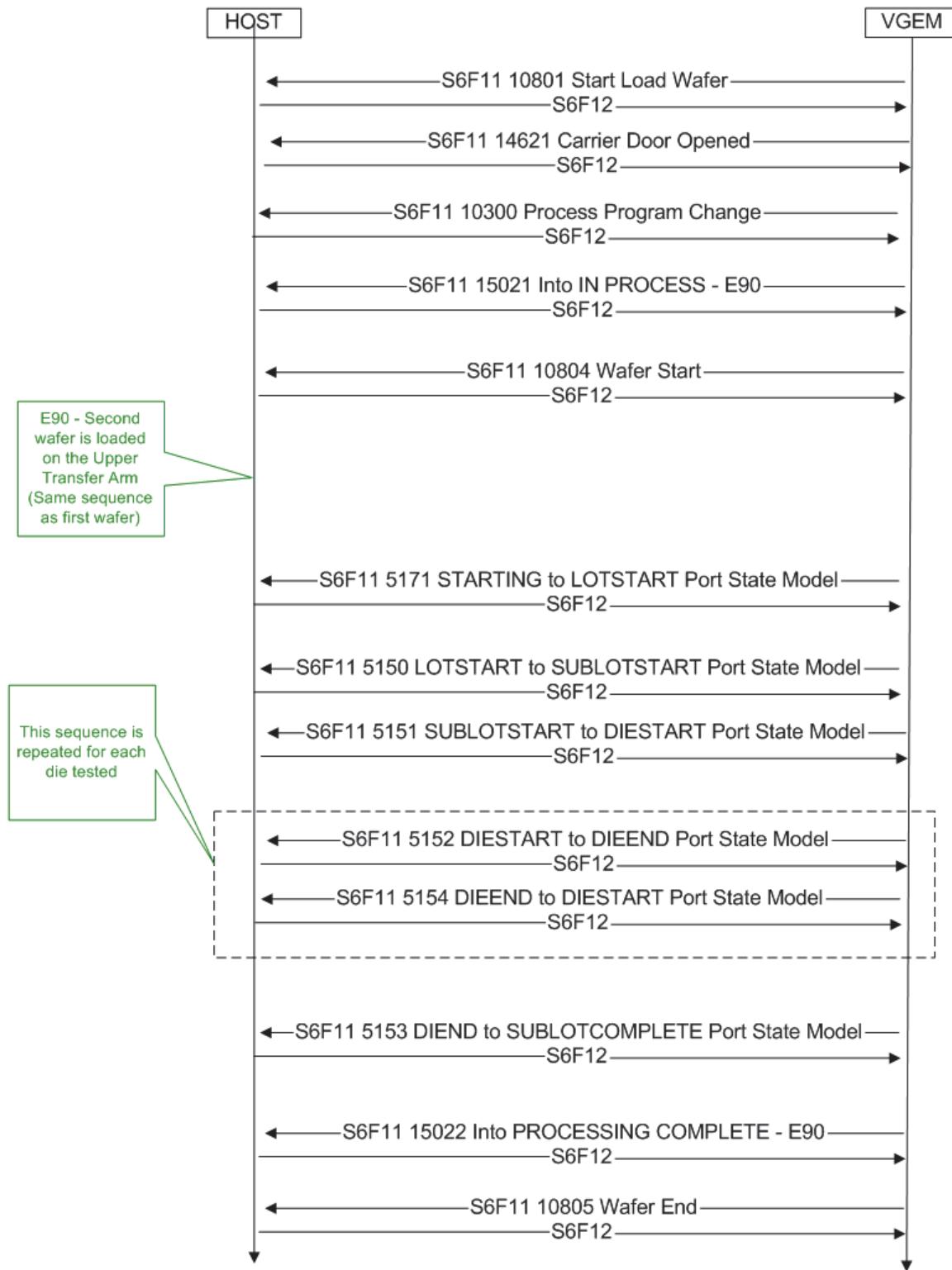
*E87 / BIND, Carrier ID and Slotmap  
Verification by Equipment  
E40/E94 Normal Sequence  
Page 4 of 11*



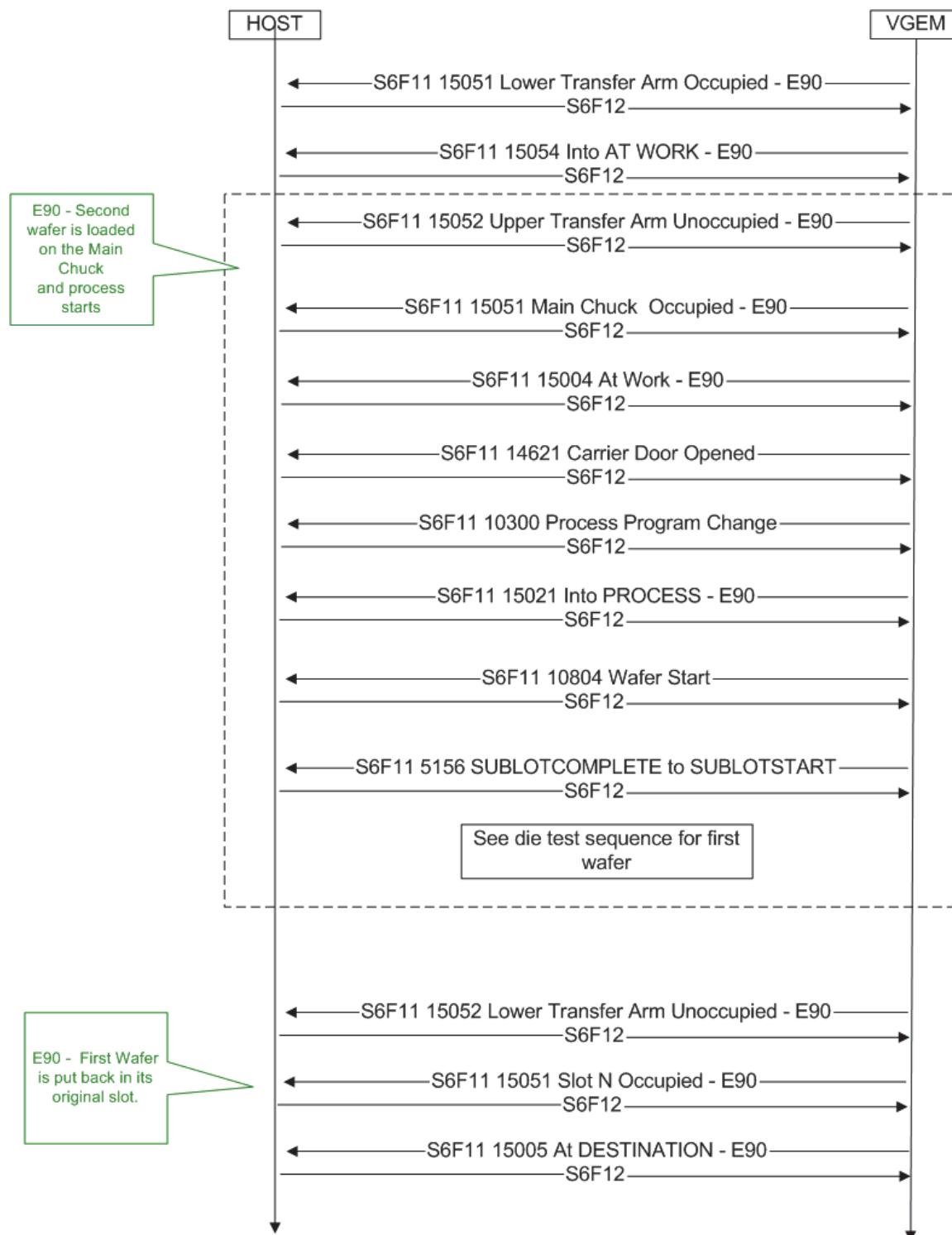
*E87 / BIND, Carrier ID and Slotmap  
Verification by Equipment  
E40/E94 Normal Sequence  
Page 5 of 11*



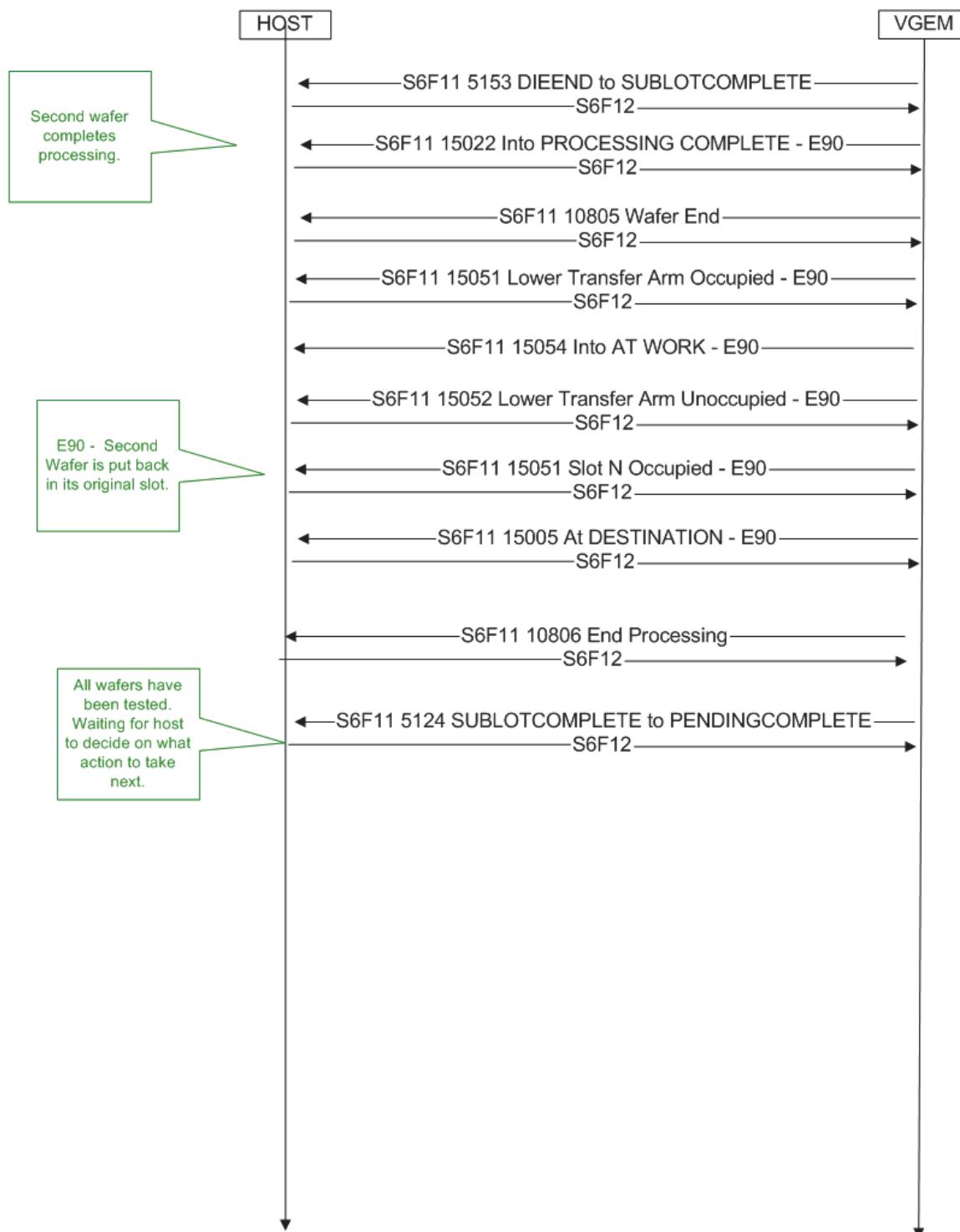
*E87 / BIND, Carrier ID and Slotmap  
Verification by Equipment  
E40/E94 Normal Sequence  
Page 6 of 11*



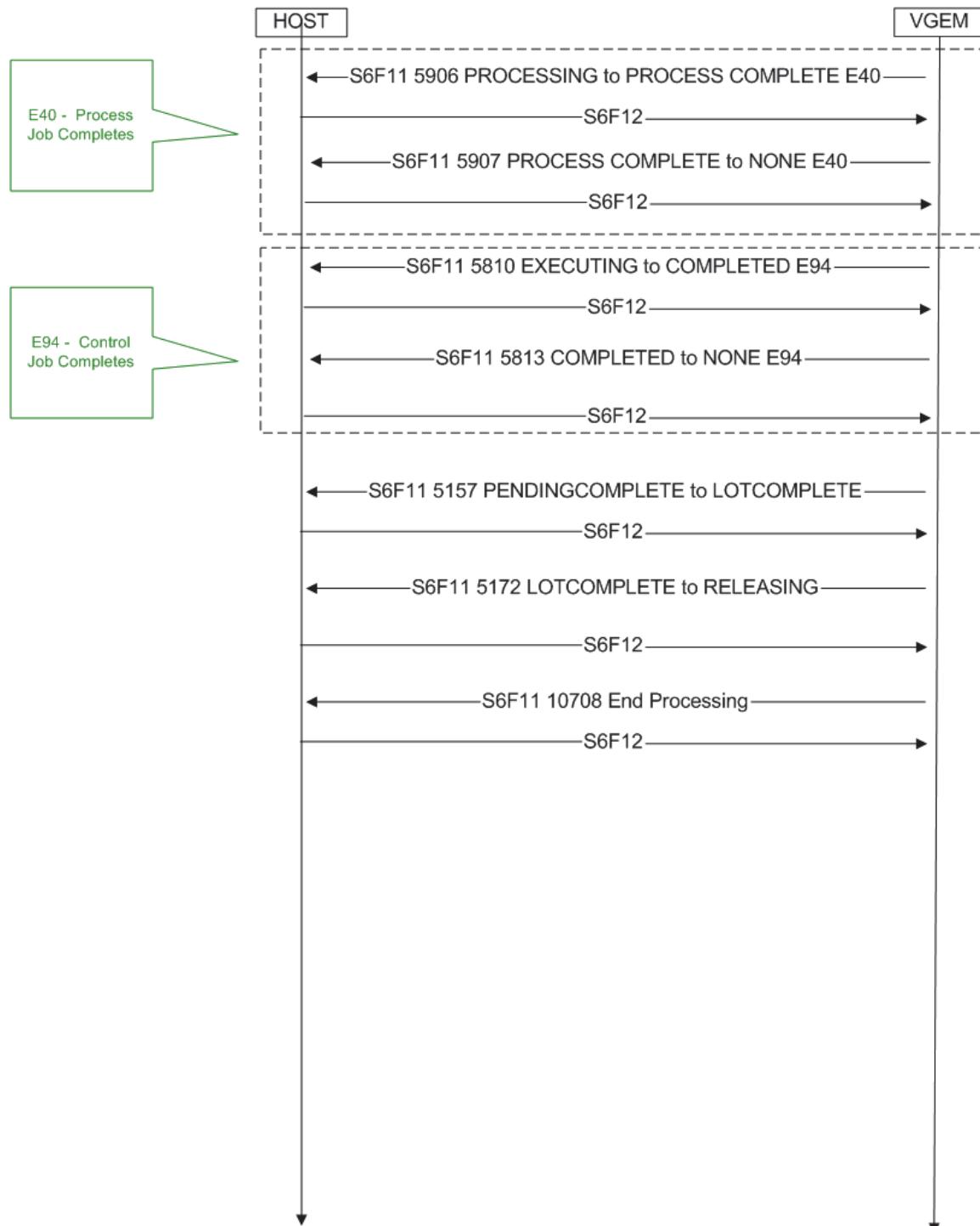
*E87 / BIND, Carrier ID and Slotmap  
 Verification by Equipment  
 E40/E94 Normal Sequence  
 Page 7 of 11*

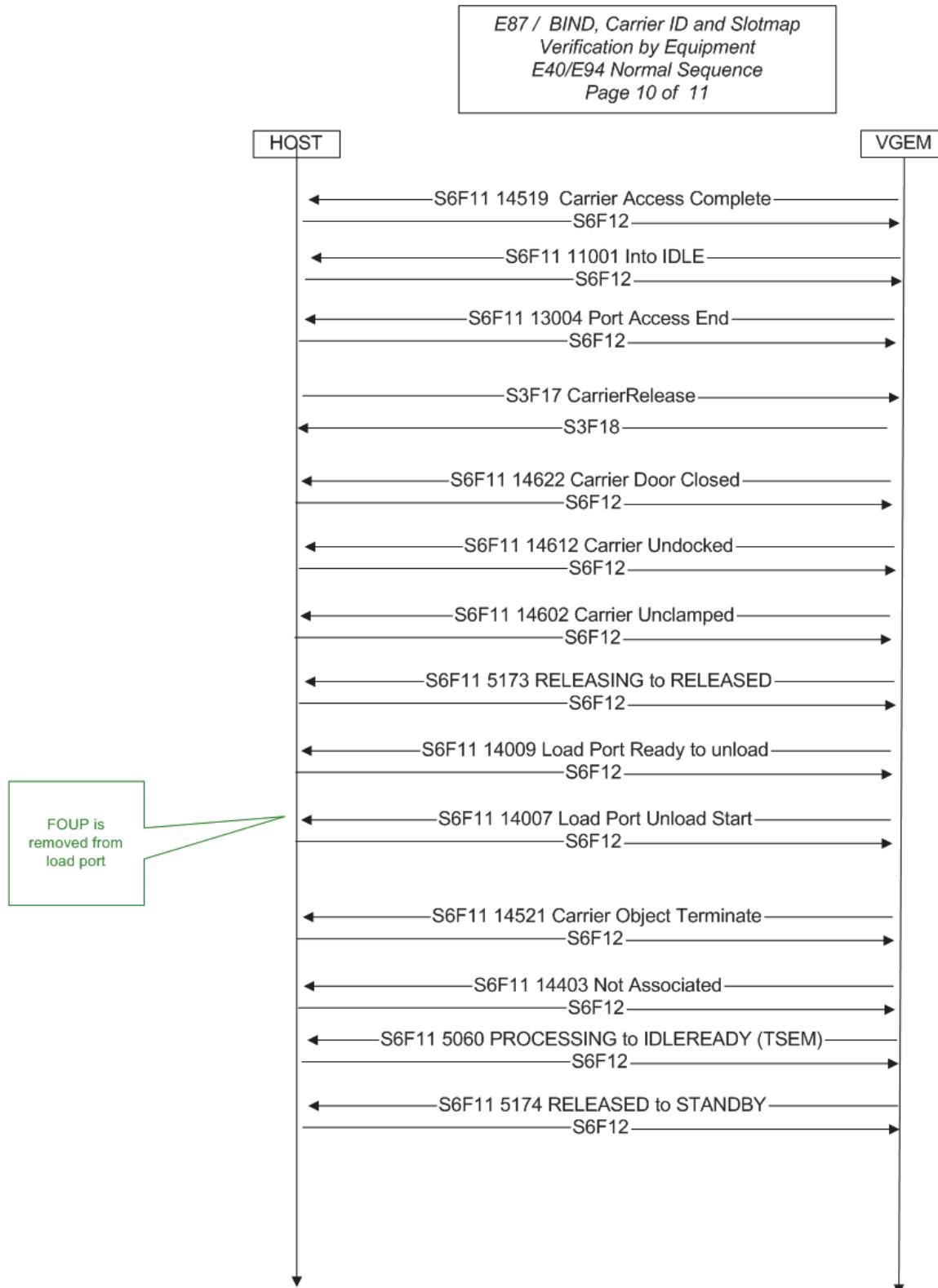


*E87 / BIND, Carrier ID and Slotmap  
Verification by Equipment  
E40/E94 Normal Sequence  
Page 8 of 11*

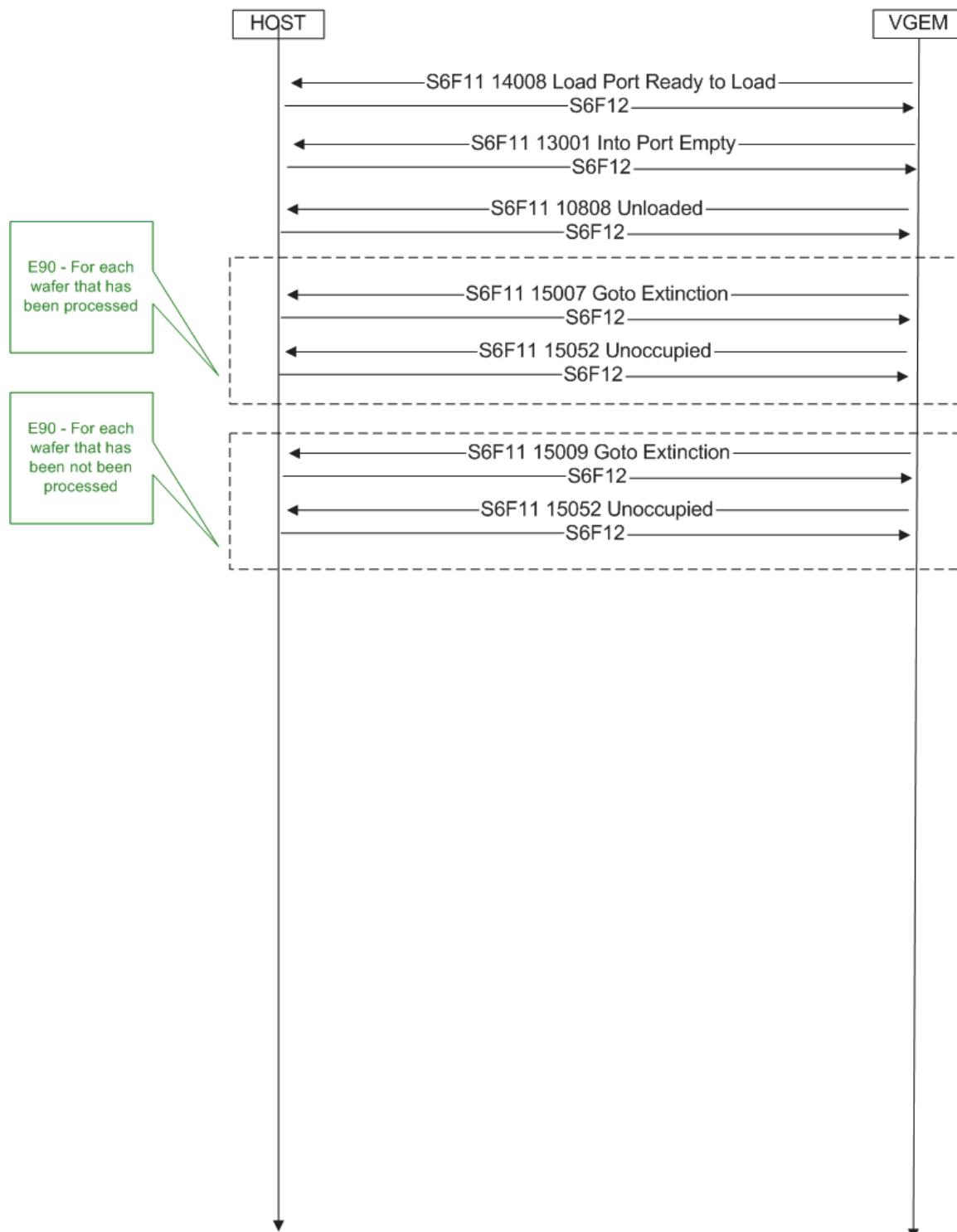


*E87 / BIND, Carrier ID and Slotmap  
 Verification by Equipment  
 E40/E94 Normal Sequence  
 Page 9 of 11*

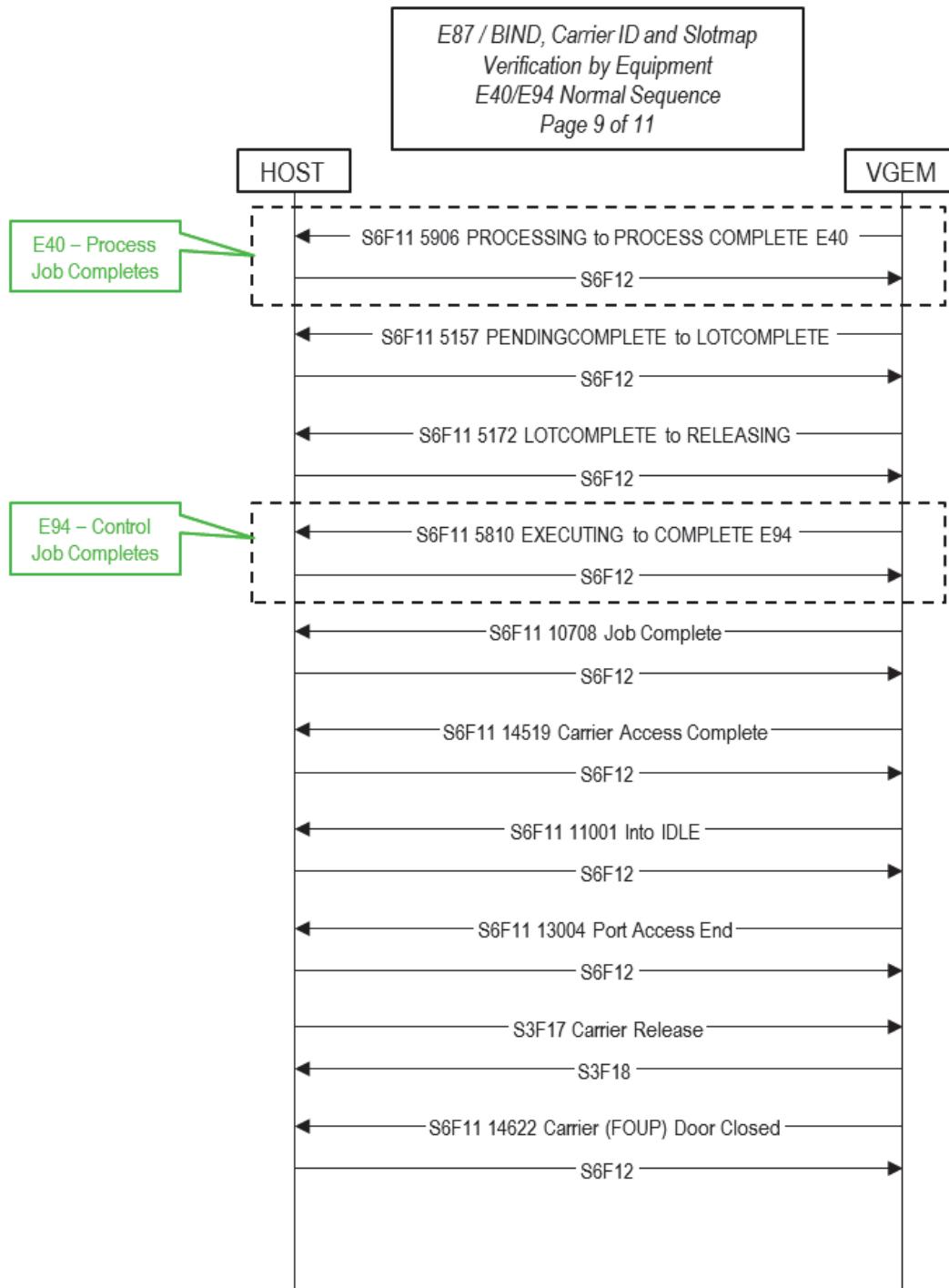




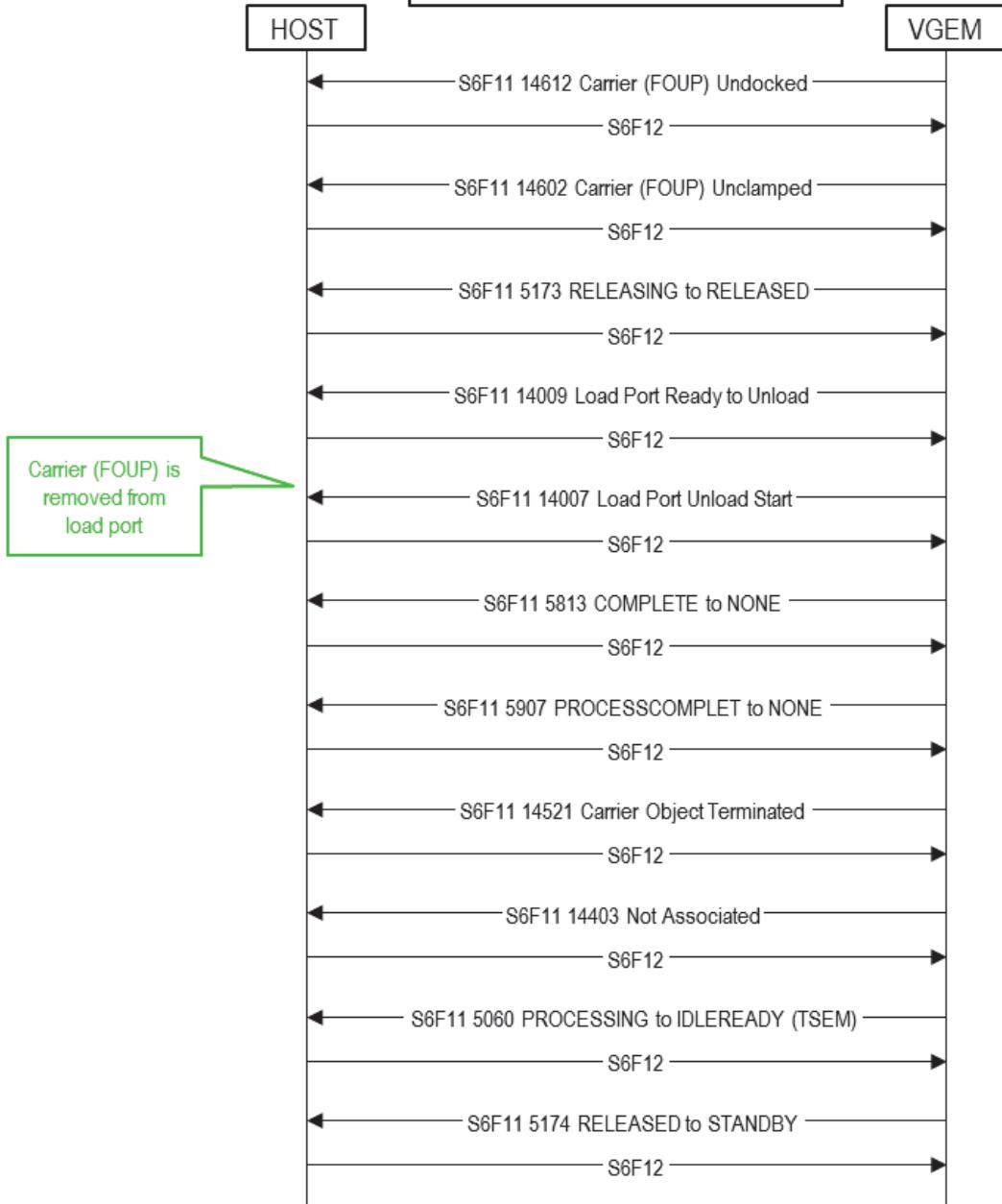
*E87 / BIND, Carrier ID and Slotmap  
 Verification by Equipment  
 E40/E94 Normal Sequence  
 Page 11 of 11*



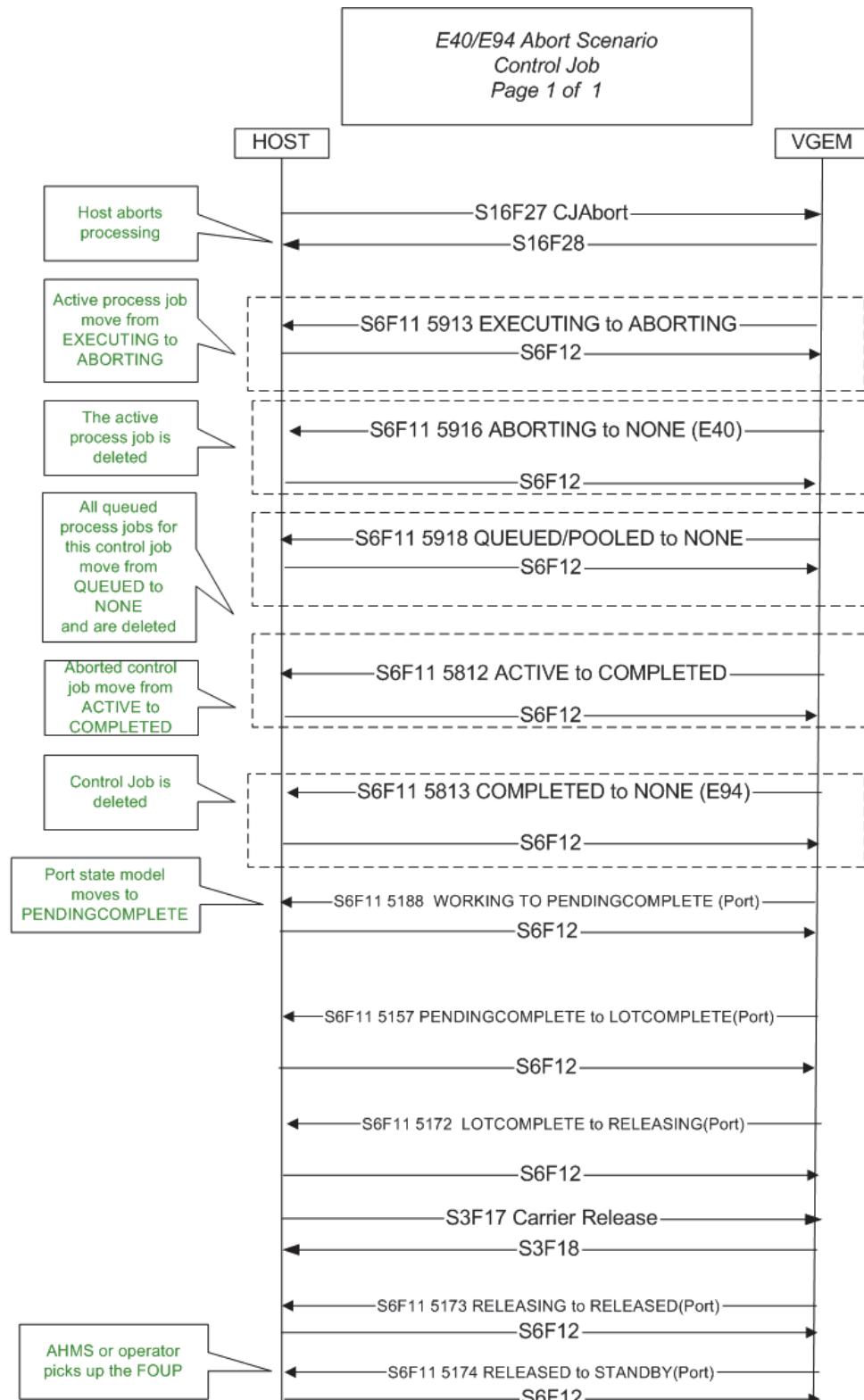
The following two pages are replaced with the pages 9 and 10 shown previously to support the latest process job state model (SEMI E40-0705E or later). Different points are the timing on transiting the state to XXXXX\_TO\_NONE. To make them be effective, the key “VGEM JobDeleteEvent” must be set to “CarrierTerminated” in the /opt/SPECS\_FA/dmh/vgem/default.ini file.

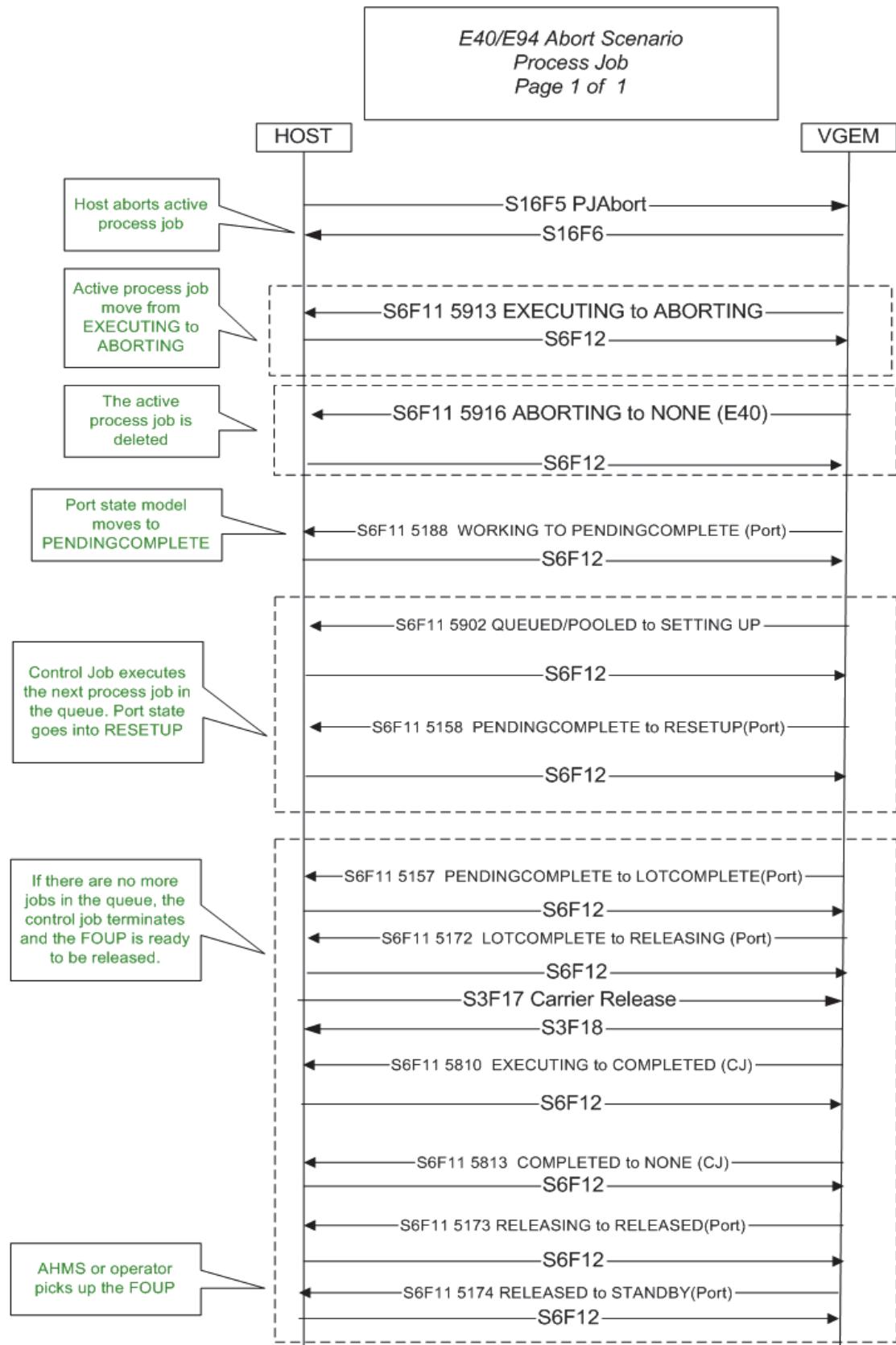


*E87 / BIND, Carrier ID and Slotmap  
 Verification by Equipment  
 E40/E94 Normal Sequence  
 Page 10 of 11*

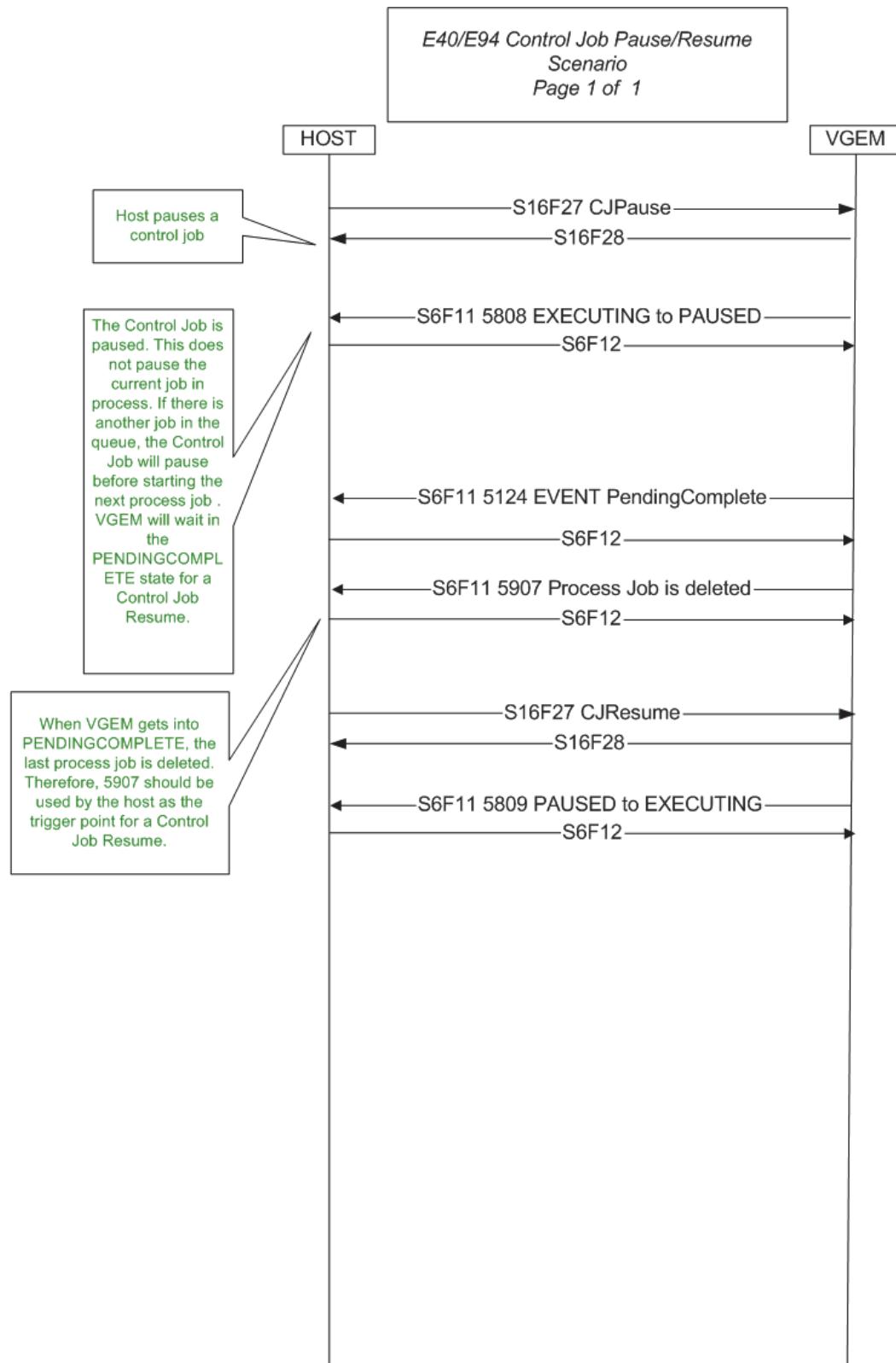


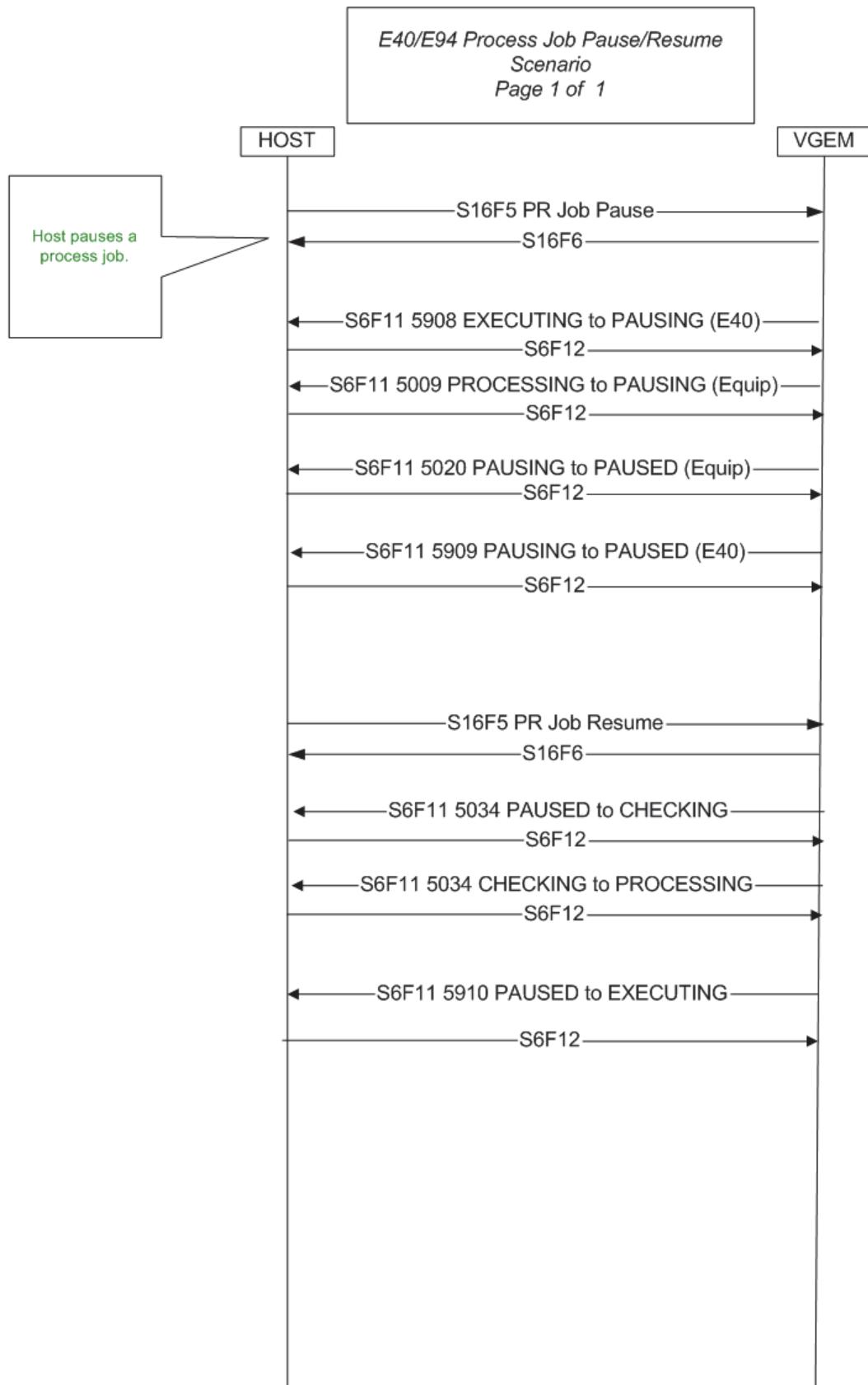
### 15.1.15. Abort Scenarios



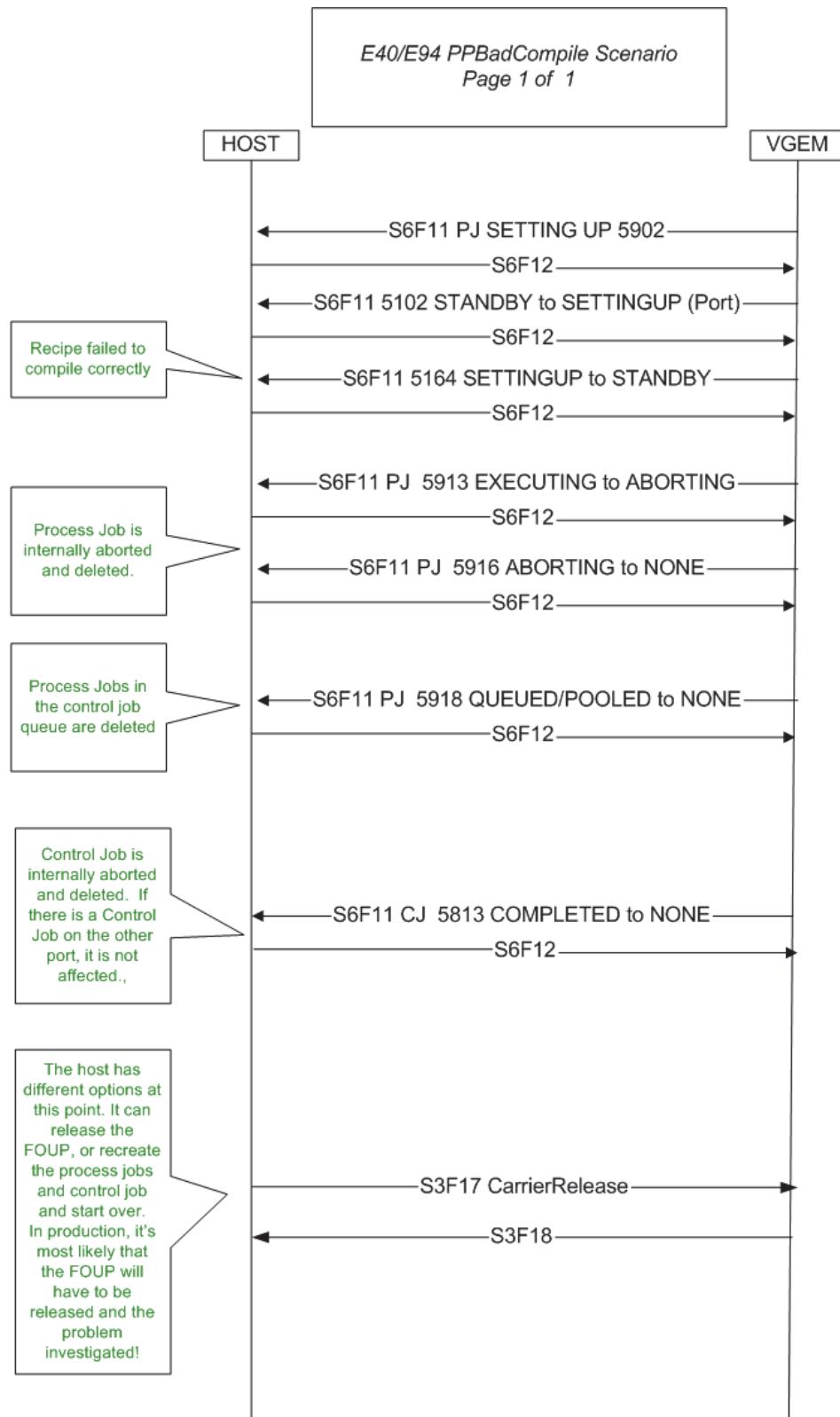


### 15.1.16. Pause Scenarios

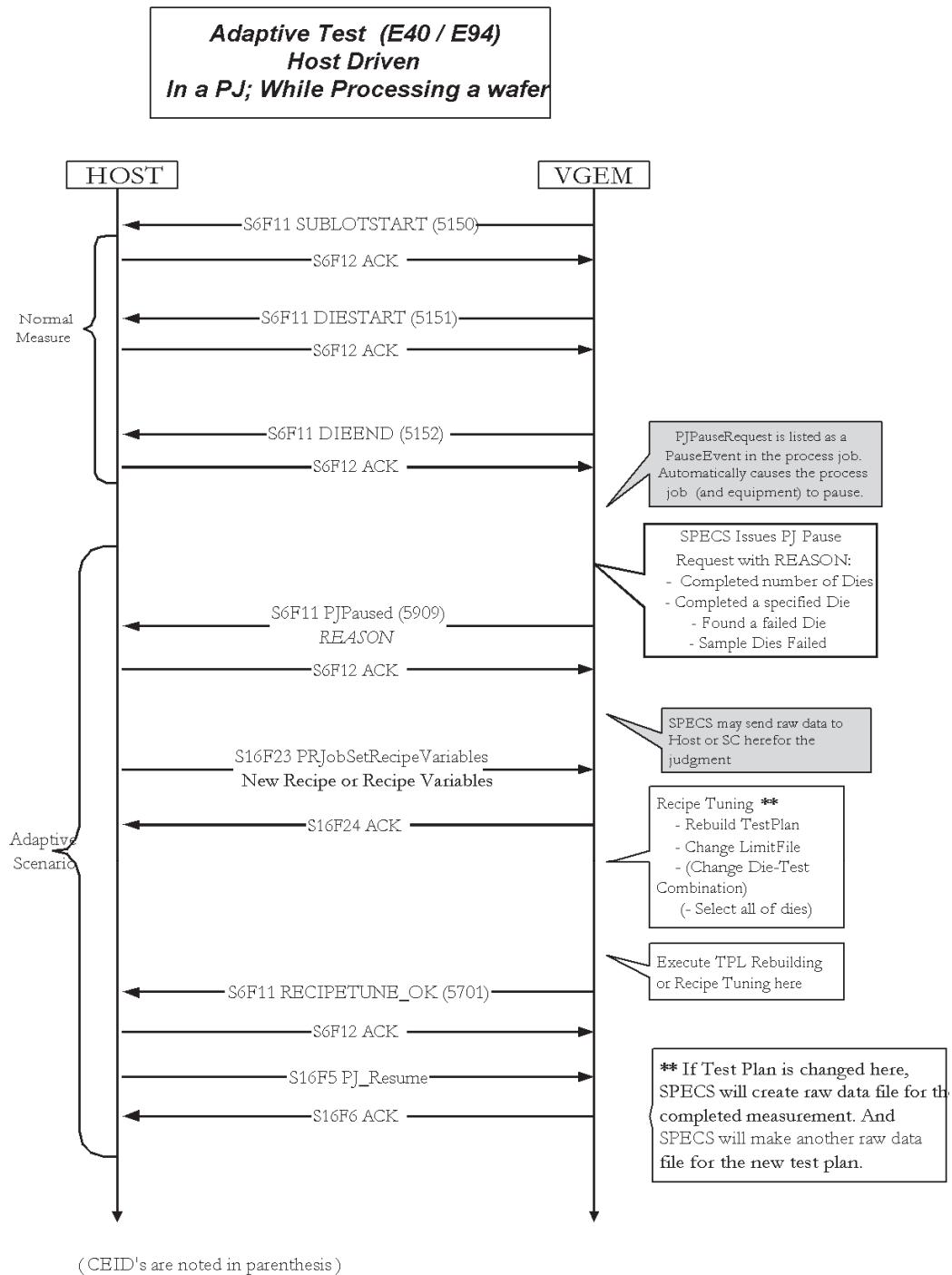




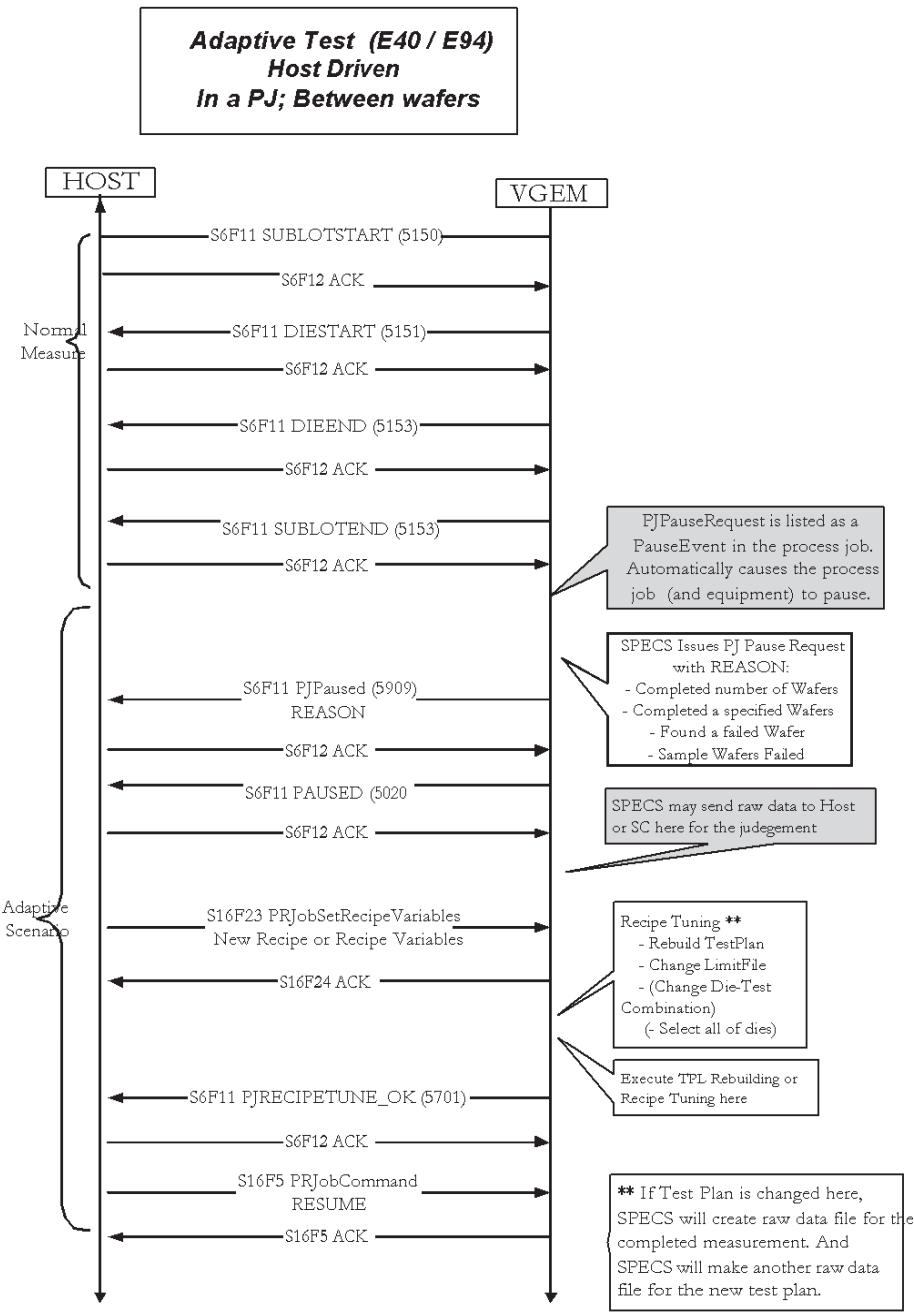
### 15.1.17. PPBadCompile Scenario



### 15.1.18. Adaptive Testing While Processing a Wafer

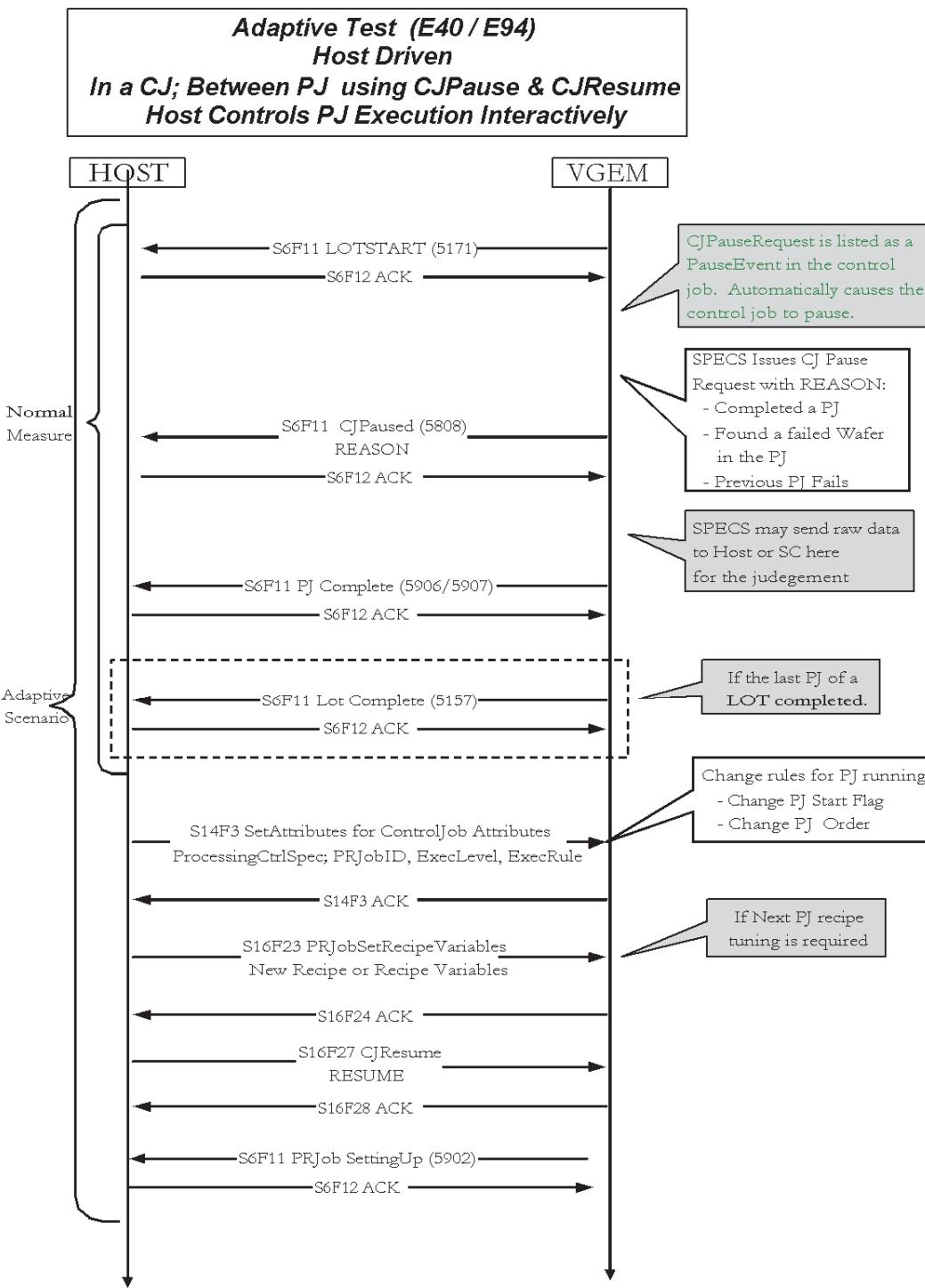


### 15.1.19. Adaptive Testing Between Wafers



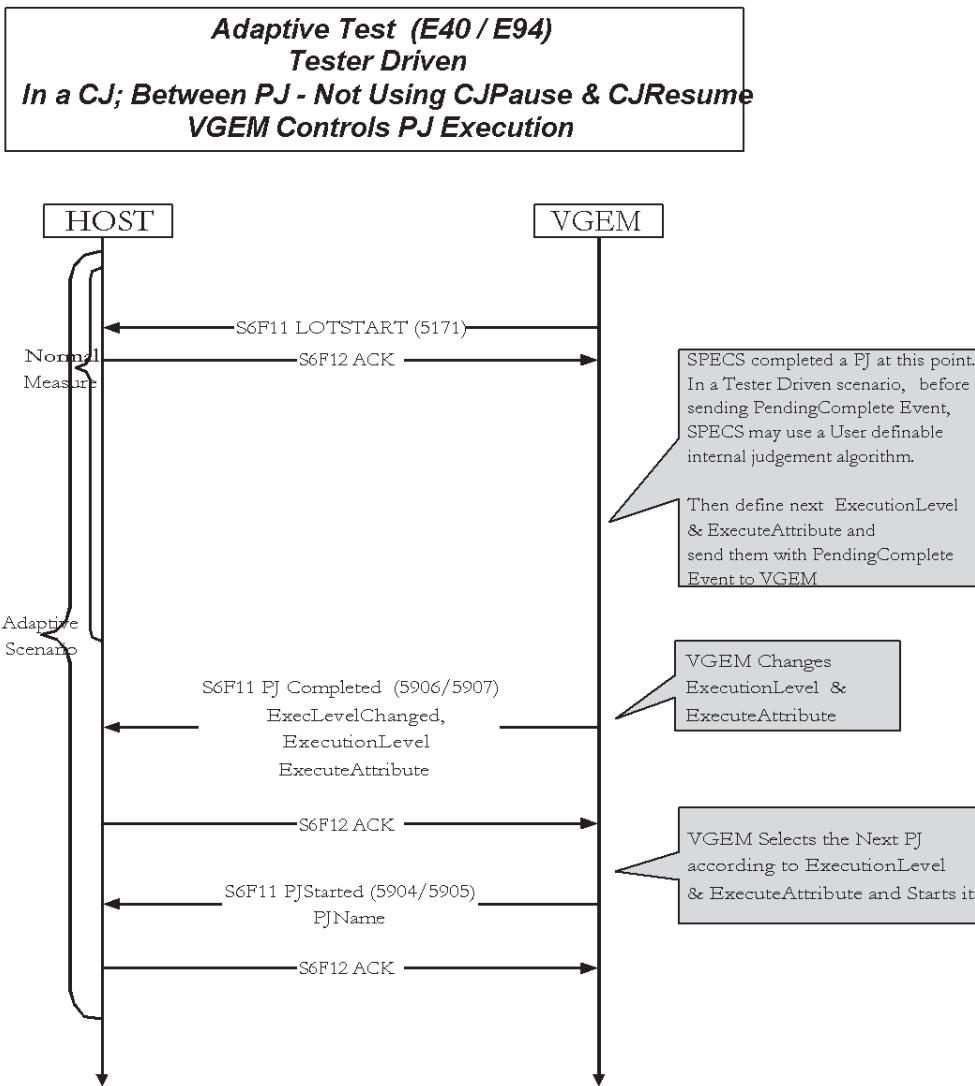
(CEID's are noted in parenthesis )

## 15.1.20. Adaptive Testing Between Process Jobs



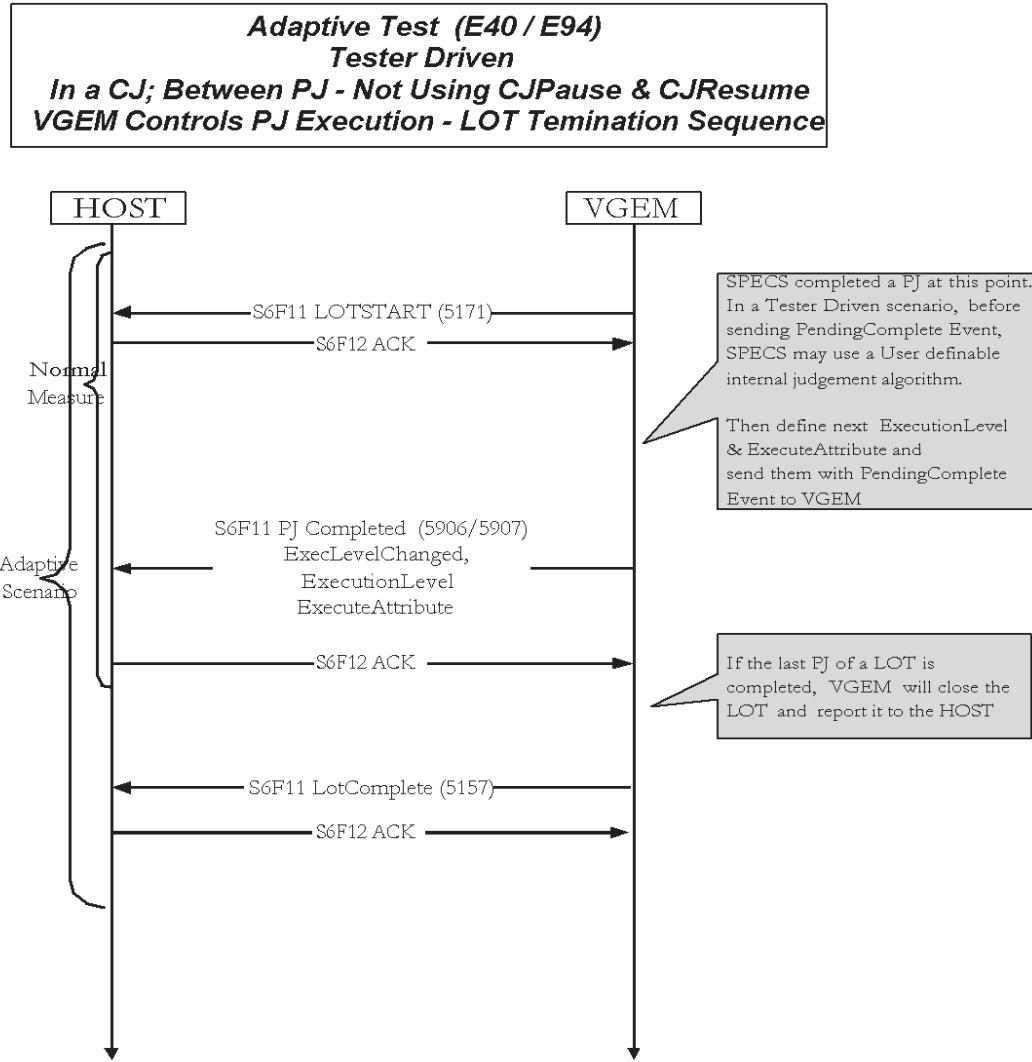
( CEID's are noted in parenthesis )

### 15.1.21. Adaptive Testing – VGEM Controls Process Job Execution



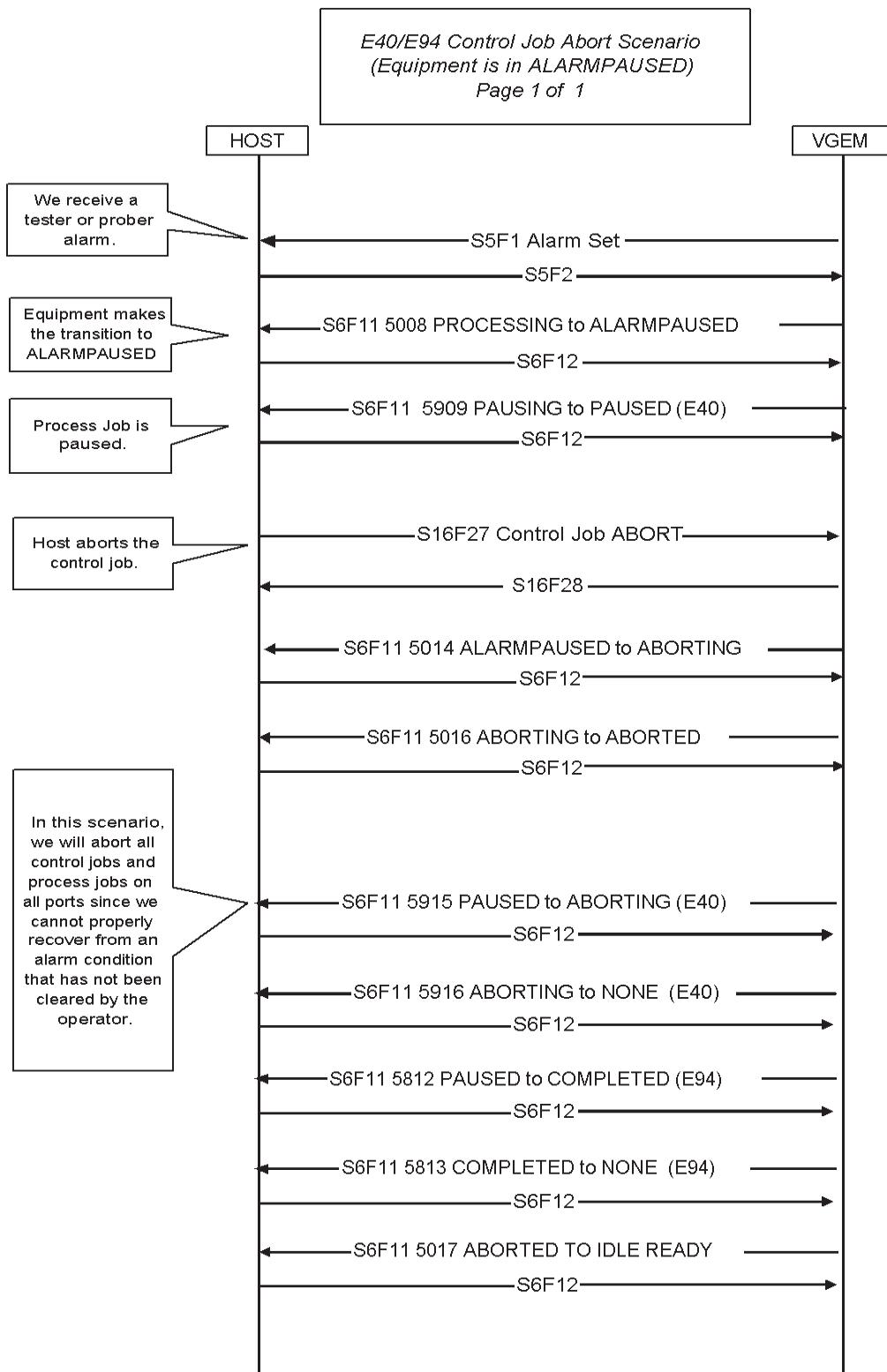
( CEID's are noted in parenthesis )

### 15.1.22. Adaptive Testing – VGEM Controls Process Job Execution LOT Termination Sequence

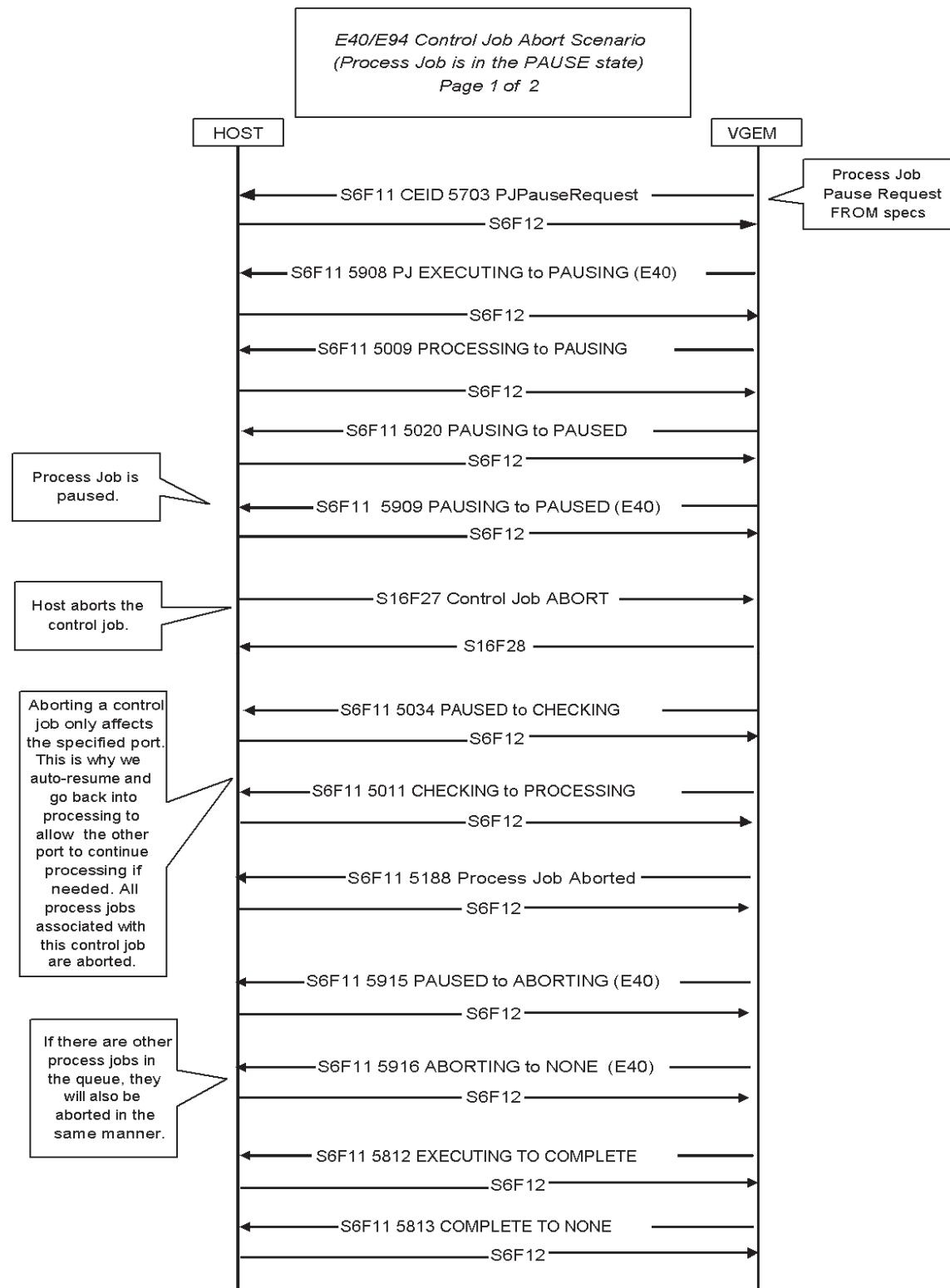


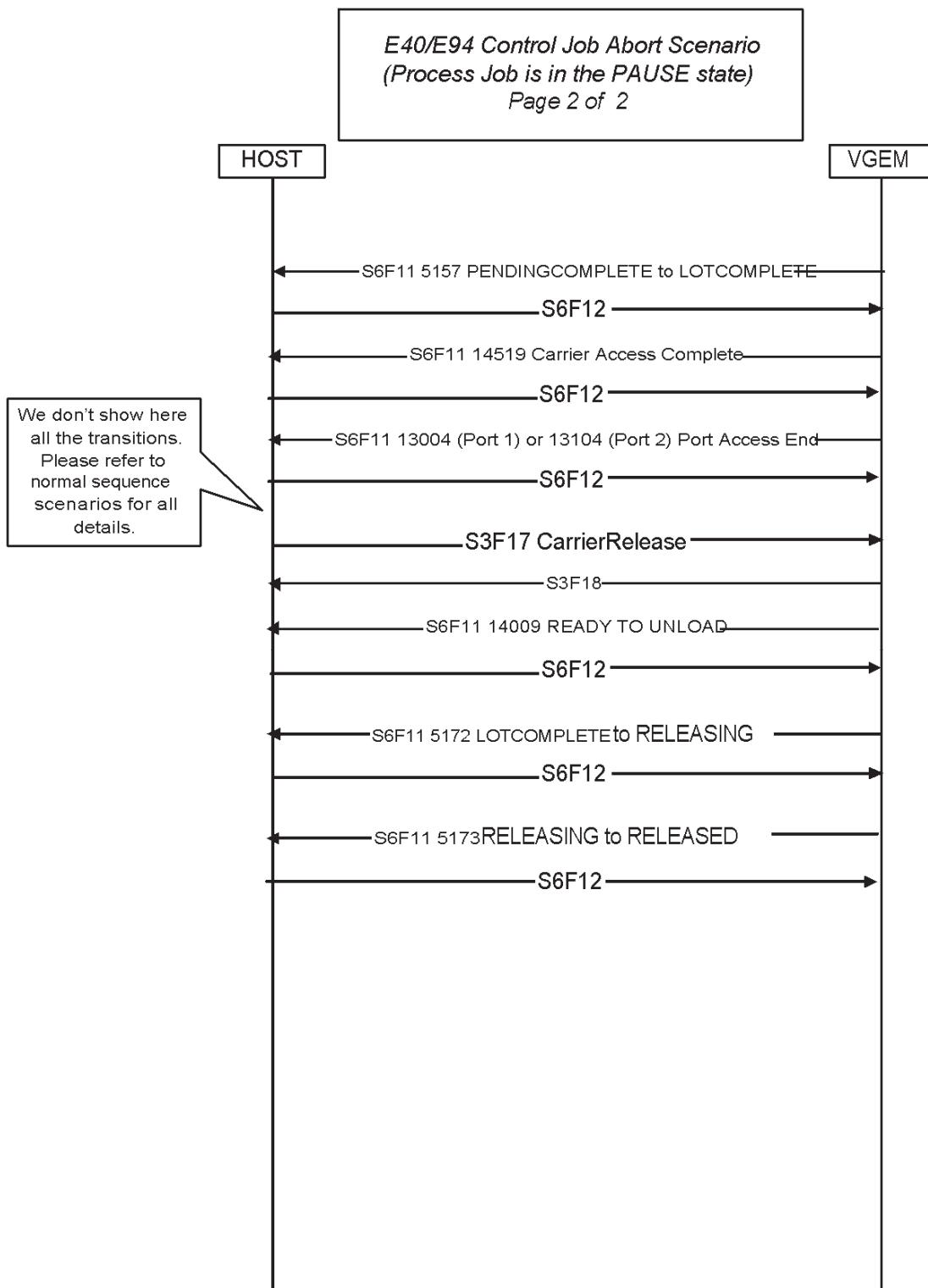
( CEID's are noted in parenthesis )

### 15.1.23. E40/E94 CJ Abort Alarm Paused

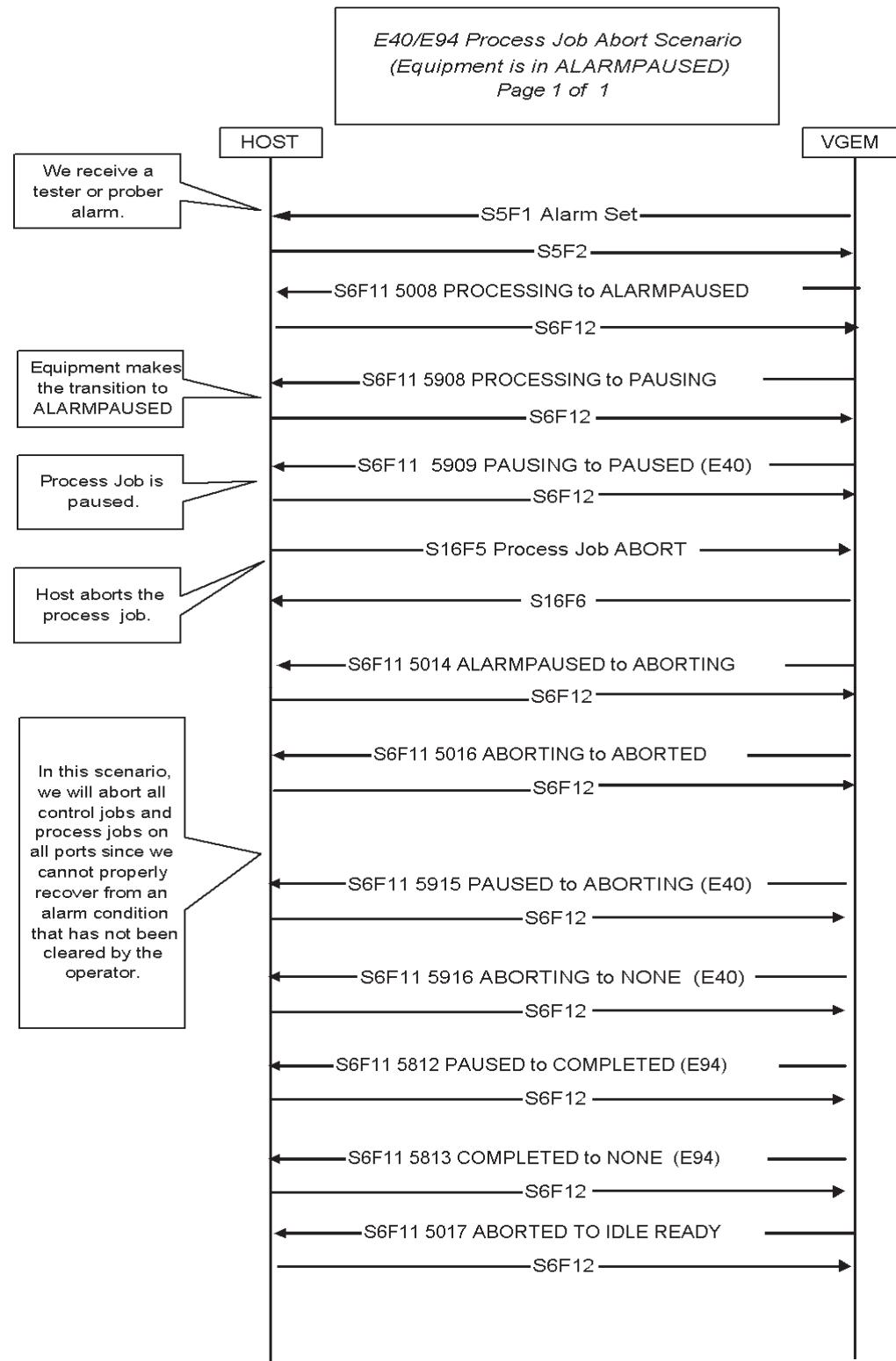


## 15.1.24. E40/E94 CJ Aboart Paused

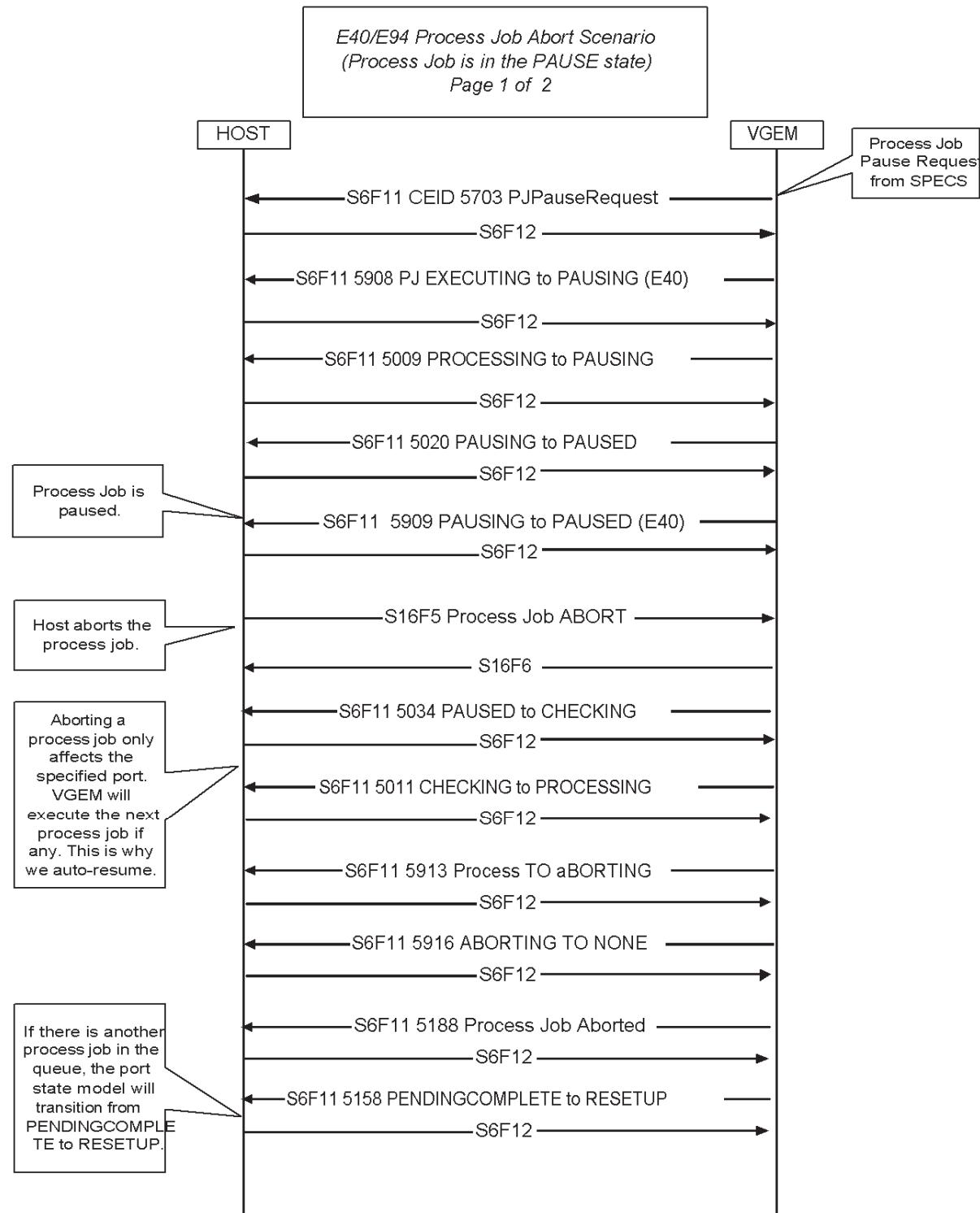


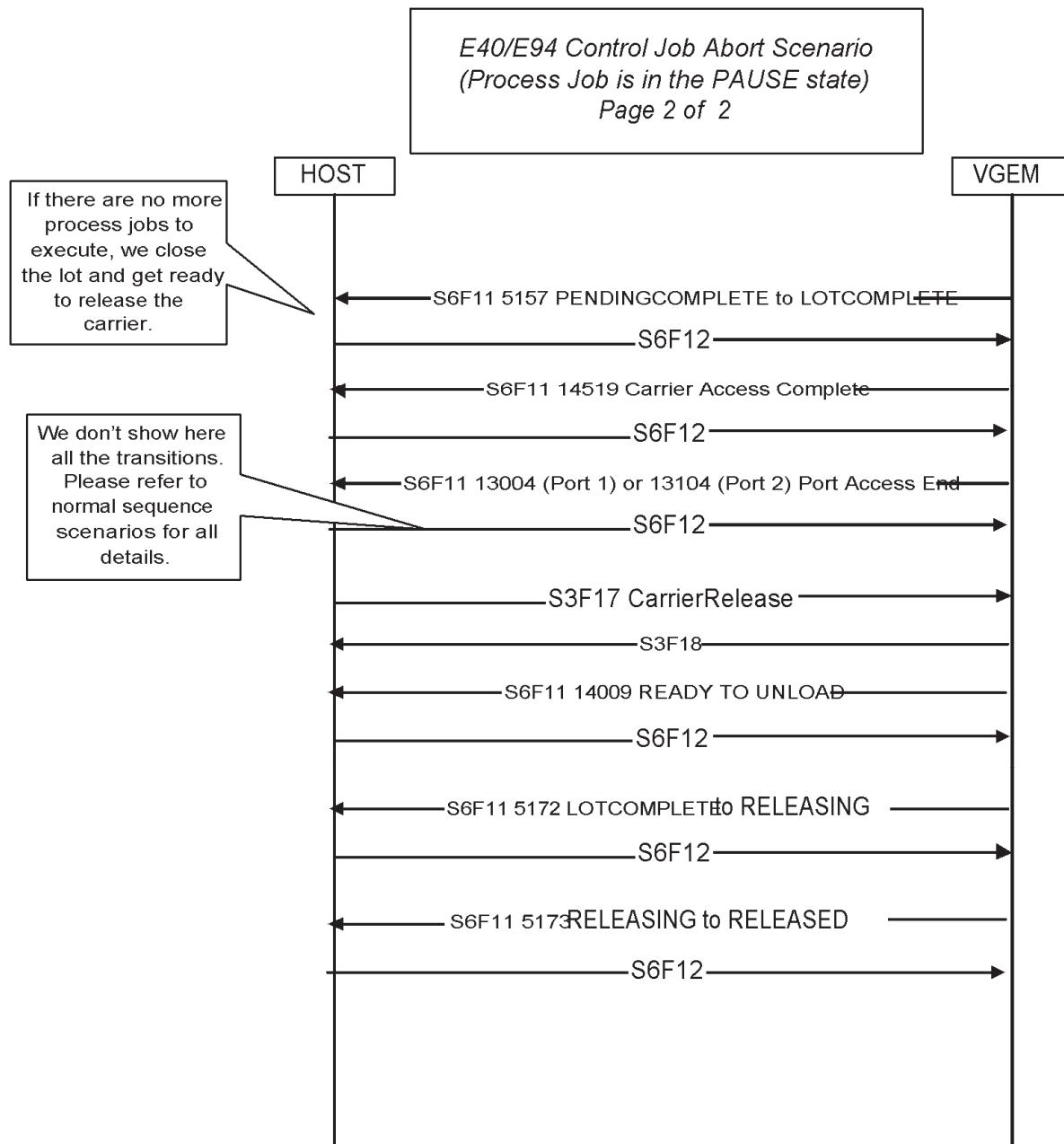


## 15.1.25. E40/E94 PJ Aboart Alarm Paused



## 15.1.26. E40/E94 PJ Aboart Paused





## 15.2. Standard GEM Capabilities and Scenarios

VGEM supports most of the GEM equipment capabilities and scenarios found in SEMI E-30. The following scenarios detail each of these.

### 15.2.1. Establish Communications

The Establish Communications capability provides a means of formally establishing communications following system initialization or any loss of communications between communicating partners, and thus of notifying the communication partner that a period of non-communication has occurred.

#### 15.2.1.1. Host Initiated Connect:

Host	Equipment	Description
		Communication state is ENABLED
S1,F13		Host sends an Establish Communications Request
	S1,F14	Reply COMMACK = Accept and Communications state = COMMUNICATING

#### 15.2.1.2. Equipment Initiated Connect:

Host	Equipment	Description
		Communications state = NOT COMMUNICATING [LOOP] [LOOP] - SEND
	S1,F13	Equipment sends an Establish Communications Request
S1,F14		Host replies with an Establish Communications Acknowledge. [IF] S1,F14 is received without timeouts [THEN] exit_loop-SEND [ELSE] Delay for interval in Establish Communications Timeout [ENDIF] [END-LOOP] -SEND [IF] COMMACK = Accept [THEN] Communications state = COMMUNICATING exit_loop- [ELSE] Rest timer for delay and delay for interval specified in EstablishCommunicationsTimeout [ENDIF] [END_LOOP]

### 15.2.1.3. Simultaneous Attempts to Establish Communications

The equipment receives an S1,F14 from the host before sending S1,F14:

Host	Equipment	Description
		Communications state = NOT COMMUNICATING
	S1,F13	Equipment sends an Establish Communications Request
S1,F13		Host sends an Establish Communications Request.
S1,F14		Host sends reply COMMACK = Accept, Communications are established and Communications state = COMMUNICATING
	S1,F14	Reply COMMACK = Accept

Where the equipment sends S1,F14 to the host before receiving S1,F14:

Host	Equipment	Description
		Communications state = NOT COMMUNICATING
	S1,F13	Equipment sends an Establish Communications Request
S1,F13		Host sends an Establish Communications Request.
	S1,F14	Equipment sends COMMACK = Accept, Communications are established and Communications state = COMMUNICATING
S1,F14		Host send reply COMMACK = Accept

### 15.2.2. Data Collection

Data collection allows the host to monitor equipment activity via event reporting and query of selected status or other variable data.

#### 15.2.2.1. Event Data Collection:

A collection event occurs on the equipment:

Host	Equipment	Description
	S6,F5	If Event Report is Multi-block then the equipment sends Multi-block inquire.
S6,F6		The host grants permission to send the multi-block event report.
	S6,F11	Equipment sends Event Report.
S6,F12		Host acknowledges the report.

The host requests Event Report:

Host	Equipment	Description
S6,F15		The host requests an event report.
	S6,F16	The equipment sends an event report.

### 15.2.2.2. Dynamic Event Report Configurations

This capability allows the host to dynamically modify the equipment event reporting setup.

Collection Event Reporting Set-up:

Host	Equipment	Description
S2,F39		If the Define Report is multi-block then the host sends a multi-block inquiry.
	S2,F40	The equipment grants the Multi-block.
S2,F33		The host sends report definitions.
	S2,F34	The equipment acknowledges with a DRACK = 0.
S2,F39		If the Link Event Report is multi-block, the host sends Multi-Block inquire.
	S2,F40	The equipment grants the multi-block.
S2,F35		The host links reports to the desired collection events.
	S2,F36	The equipment acknowledges. If LRACK = 0, the event linkages are acceptable.
S2,F37		Host enables specific collection events.
	S2,F38	The equipment acknowledges. If ERACK = 0, the equipment will generate the specified reports when the appropriate collection events happen.

### 15.2.2.3. Status Data Collection

This capability allows the host to query the equipment for selected status information and is useful in initialization and synchronization.

Host Requests Status Report:

Host	Equipment	Description
S1,F3		The host requests report of selected status variable values.
	S1,F4	The equipment responds with the requested status variable data.

Request Equipment Status Variable Name list:

Host	Equipment	Description
S1,F11		The host requests that the equipment identify the specified status variables.
	S1,F12	The equipment responds with the requested status variable descriptions.

### 15.2.2.4. Variable Data Collection

This capability allows the host to query for the equipment data variables and is useful during initialization and synchronization.

The host requests report:

Host	Equipment	Description
S6,F19		The host requests variables contained in report RPTID.

Host	Equipment	Description
	S6,F20	The equipment responds with a list of variable data for the given RPTID.

### 15.2.3. On-line Identification

In order to be GEM compliant, the equipment must accept the S1,F1 from the host at any time while it is ONLINE and COMMUNICATING, and respond with S1,F2.

Host Initiated:

Host	Equipment	Description
S1,F1		Equipment control state is ONLINE. The host sends an "Are you there?"
	S1,F2	The equipment replies with MDLN and SOFTREV.

### 15.2.4. Alarm Management

This capability provides for host notification and management of alarm conditions on the equipment.

Enable/Disable Alarms

Host	Equipment	Description
S5,F3		The host requests the specified alarm be Enabled or Disabled.
	S5,F4	The equipment acknowledges.

Upload Alarm Information:

Host	Equipment	Description
S5,F5		The host requests the specified alarm data and text.
	S5,F6	The equipment sends the requested data and text.

Only known prober alarms are reported on the S5,F6. The TEL prober does not support the S5,F5 request for all alarm information or the S5,F7 request for valid alarms. Information concerning a specific alarm may be successfully reported. VGEM may have information about prober alarms if they happen to have been set prior to the S5,F5 request.

Send Alarm Report:

Host	Equipment	Description
	S5,F1	The equipment detects an alarm. An alarm report is sent (if enabled).
S5,F2		The host acknowledges the alarm report.
	S6,F11	The equipment sends an event report (if enabled).
S6,F12		The host acknowledges the event report.

### 15.2.5. Remote Control

This capability provides the host with a level of control over equipment operations.

Host Command Send

Host	Equipment	Description
S2,F41		The host sends the command.
	S2,F42	The equipment acknowledges the command with (HCACK = 0 or 4).
	S6,F11	The equipment sends an event report for the state change or other collection event occurrence.
S6,F12		The host acknowledges the event report.

### 15.2.6. Equipment Constants

This capability provides a method for the host to read and to change the value of selected equipment constants on the equipment.

Host	Equipment	Description
S2,F15		The host sends equipment constants
	S2,F16	The equipment acknowledges. EAC=0

Host Equipment Constants Request:

Host	Equipment	Description
S2,F13		The host requests the value of equipment constants.
	S2,F14	The equipment sends the requested constant data.

Host Equipment Constant Namelist Request:

Host	Equipment	Description
S2,F29		The host requests constant Namelist.
	S2,F30	The equipment sends the requested constant data.

### 15.2.7. Equipment Terminal Services

This capability allows the host to display information on the Local Management Panel (LMP) or the operator of the equipment to send information to the host.

The Host sends information to Equipment's Display Device:

Host	Equipment	Description
S10,F3		The host sends textual information to the equipment for display to the operator on the LMP.
	S10,F4	The equipment acknowledges the request to display text. The operator acknowledges the message.
	S6,F11	The equipment sends S10 ACK event.

Host	Equipment	Description
S6,F12		The host acknowledges.

The Host sends second message before the operator acknowledges first message:

Host	Equipment	Description
S10,F3		The host sends textual information to the equipment for display to the operator on the LMP.
	S10,F4	The equipment acknowledges the request to display text. The operator acknowledges the message.
S10,F3		The host sends textual information to equipment for display to the operator, overwriting the first message sent since it is still unrecognized.
	S6,F11	The equipment sends S10 ACK event.
S6,F12		The host acknowledges.

Operator sends message to the host:

Host	Equipment	Description
	S10,F1	The operator sends textual information via LMP.
S10,F2		The host acknowledges receipt of the operator-initiated message.

The Host sends multi-block text message to the equipment:

Host	Equipment	Description
S10,F5		The host sends multiple blocks of textual information to the equipment for display to the operator on the LMP.
	S10,F6	The equipment acknowledges the request to display text. The operator acknowledges the message.
	S6,F11	The equipment sends S10 ACK event.
S6,F12		The host acknowledges.

### 15.2.8. Error Messages

This capability provides the host with information describing the reason for a particular message or communication fault detected by the equipment.

Unrecognized Device ID:

Host	Equipment	Description
Sx,Fy		The equipment detects an unrecognized device ID within the message from the host.
	S9,F1	The equipment reports to the host that an "unrecognized device ID" was detected in the received message.

Unrecognized Stream Type:

Host	Equipment	Description
Sx,Fy		The equipment detects an unrecognized stream type within the message from the host.
	S9,F3	The equipment reports to the host that an "unrecognized stream type" was detected in the received message.

Unrecognized Function Type:

Host	Equipment	Description
Sx,Fy		The equipment detects an unrecognized function type within the message from the host.
	S9,F5	The equipment reports to the host that an "unrecognized function type" was detected in the received message.

Illegal Data Format:

Host	Equipment	Description
Sx,Fy		The equipment detects illegal data format within the message from the host.
	S9,F7	The equipment reports to the host that an "illegal data format" was detected in the received message.

Transaction Timer Timeout:

Host	Equipment	Description
Sx,Fy		The equipment does not receive an expected reply message from the host and a transaction timer timeout occurs.
	S9,F9	The equipment reports to the host that a transaction timer timeout occurred.

Data too long:

Host	Equipment	Description
Sx,Fy		The equipment detects that the message from the host contains more data than it can handle.
	S9,F11	The equipment reports to the host that "data too long" was detected in the message it received.

### 15.2.9. Clock

This capability enables host management of time-related activities and occurrences associated with the equipment and across multiple piece of equipment.

VGEM resolves internal time references to the level of one second. Centisecond values are assigned properly for the current time, but other time values for the equipment are returned at .00. In an instance of unresolvable simultaneous events, the centisecond value is rounded up.

Host Sets Date and Time:

Host	Equipment	Description
S2,F31		The host instructs the equipment to set the time.
	S2,F32	The equipment sets its internal time reference to the value of TIME received from the host and acknowledged completion.

Host Requests Date and Time:

Host	Equipment	Description
S2,F17		The host requests the equipment time.
	S2,F18	The equipment returns its internal time reference value to the host.

### 15.2.10. Spooling

This capability allows the equipment to queue messages intended for the host during times of communication failure and to deliver those messages when communications are restored.

Define the set of messages to be spooled:

Host	Equipment	Description
S2,F43		The host defines messages to be spooled in case of communications failure.
	S2,F44	The equipment acknowledges the setup.

Define the Maximum Number of Messages to Send in Response to S6,F23:

Host	Equipment	Description
S2,F15		The host sends a value for the equipment constant MaxSpoolTransmit.
	S2,F16	The equipment acknowledges the equipment constant change.

Request or Delete Spooled Data:

Host	Equipment	Description
S1,F3		The host requests data that included spool-related status variables.
	S1,F4	The equipment sends status data.
S6,F23		The host request or delete spooled data. If RSDC = 0, spool data is requested. If RSDC =1, the spool data is discarded.
	S6,F11	The equipment sends Spooling Deactivated event report.
S6,F12		The host acknowledges the event report.

### 15.2.11. Control

These capabilities allow for the configuration and manipulation of the control state model.

Host Accepts ON-LINE:

Host	Equipment	Description
	S1,F1	Operator switches to ON-LINE when the EQUIPMENT OFF-LINE state is

Host	Equipment	Description
		active. The equipment requests ON-LINE.
S1,F2		The host grants ON-LINE.
	S6,F11	The equipment sends "Control State LOCAL" event report.
S6,F12		The host acknowledges the event report.

Operator Sets OFF-LINE:

Host	Equipment	Description
	S6,F11	The operator switches to OFF-LINE when the equipment ON-LINE state is active. The equipment requests OFF-LINE.
S6,F12		The host acknowledges the event report.

Operator Sets REMOTE:

Host	Equipment	Description
	S6,F11	The operator switches to REMOTE when the equipment ON-LINE/LOCAL state is active. The equipment sends "ControlStateREMOTE" event report
S6,F12		The host acknowledges the event report.

Operator Sets LOCAL:

Host	Equipment	Description
	S6,F11	The operator switches to LOCAL when the equipment ON-LINE/REMOTE state is active. The equipment sends "ControlStateLOCAL" event report.
S6,F12		The host acknowledges the event report.

Host Sets OFF-LINE:

Host	Equipment	Description
S1,F15		The host requests OFF-LINE.
	S1,F0	If the equipment is OFF-LINE, it does not process requests and the scenario stops here.
	S1,F16	The equipment acknowledges the request and transitions to OFF-LINE, HOST OFF-LINE state.
	S6,F11	Equipment off-line event is sent.
S6,F12		The host acknowledges the event.

Host Sets ON-LINE:

Host	Equipment	Description
S1,F17		The host requests ON-LINE.
	S1,F18	If the equipment is OFF-LINE, HOST OFF-LINE it acknowledges (ONLACK = 0) and goes ON-LINE.

Host	Equipment	Description
	S1,F18	IF ONLACK = 2, the equipment is already ON-LINE. If ONLACK = 1, the equipment is OFF-LINE, but not in HOST OFF-LINE (i.e., the OFF-LINE button is set.) In either case, the equipment denies the request and the scenario ends here.
	S6,F11	ControlState LOCAL (or REMOTE) event is sent.
S6,F12		The host acknowledges the event.

## Chapter 16. SECS-II Messages

SECS II defines the communications passed between the host and equipment in the form of messages. These messages are grouped by activity into Streams. Functions are defined within Streams for each specific activity.

### 16.1. Stream Messages Support

SECS II Stream Message	Description	* Supported
Stream 1	Equipment Status	Yes
Stream 2	Equipment Control and Diagnostics	Yes
Stream 3	Material Status	Yes
Stream 4	Material Control	No
Stream 5	Exception (Alarm) Reporting	Yes
Stream 6	Data Collection	Yes
Stream 7	Process Program Load	Yes
Stream 9	System Errors	Yes
Stream 10	Terminal Services	Yes
Stream 11	Host File Services - No longer included in the SEMI E5 Standard	No
Stream 12	Wafer Mapping	No
Stream 13	Data Set Transfers	No
Stream 14	Object Services	Yes
Stream 15	Recipe Management	No
Stream 16	Processing Management	Yes
Stream 17	Equipment Control and Diagnostics	No
Stream 18	Subsystem Control and Data	No

\* Not all functions in the stream may be supported.

## 16.2. Stream Message Detail Abbreviations

Following conventions used in the E5-1000, the following abbreviations are used in the stream message details:

Sn,Fn - denotes Stream and Function Number	Function Name	S or M - denotes Single or Multi-block; H,E - indicates direction between Host and Equipment; Reply, Reply, or blank - denotes reply option
	Description	Short description of the function
	Structure	Detailed structure, including lists and define items.; L,n - denotes a list and the length; Tags - denoted an item in the structure data and implies that the item has a header.
	Exception	Exceptions to the general rules or structure of the function.

## 16.3. Stream 1 - Equipment Status

Stream 1 Functions provide a means for exchanging information about the status of the equipment.

### 16.3.1. Message Summary

For Host Initiated Messages:

Primary Message	Description	Response Message	Description
S1,F0	Abort Transaction		
S1,F1	Are You There Request	S1,F2	On Line
S1,F3	Selected Equipment Status Request	S1,F4	Selected Equipment Status Data
S1,F13	Establish Communications Request	S1,F14	Connect Request Acknowledge
S1,F15	Request OFF-LINE	S1,F16	OFF-LINE Acknowledge
S1,F17	Request ON-LINE	S1,F18	ON-LINE Acknowledge
S1,F19	Get Attribute	S1,F20	Attribute Data

For Equipment Initiated Messages:

Primary Message	Description	Response Message	Description
S1,F0	Abort Transaction		
S1,F1	Are You There Request	S1,F2	On Line
S1,F11	Status Variable Namelist Reply	S1,F12	Status Variable Namelist Acknowledge
S1,F13	Establish Communications Request	S1,F14	Connect Request Acknowledge

### 16.3.2. Message Details

<i>S1,F0</i>	<i>Abort Transaction</i>	S,H↔E
Description	Used in lieu of an expected reply to abort a transaction. Function 0 is defined in every stream and has the same meaning in every stream.	
Structure	Header only	
<i>S1,F1</i>	<i>Are You There Request</i>	S,H↔E, reply
Description	Establishes if the equipment is on-line. A function 0 response to this message means the communication is inoperative. In the equipment, a function 0 is equivalent to a timeout on the receive timer after issuing S1,F1 to the host.	
Structure	Header only	
<i>S1,F2</i>	<i>On Line Data</i>	S,H↔E
Description	Data signifying that the equipment is alive.	
Structure	L, 2 1. <MDLN> 2. <SOFTREV>	
Exception	The host sends a zero-length list to the equipment.	
<i>S1,F3</i>	<i>Selected Equipment Status Request</i>	S,H→E, reply
Description	A request to the equipment to report selected values of its status.	
Structure	L, n 1. <SVID <sub>1</sub> > . . . n. <SVID <sub>n</sub> >	
Exception	A zero-length list means report all SVIDs.	
<i>S1,F4</i>	<i>Selected Equipment Status Data</i>	M,H←E
Description	The equipment reports the value of each SVID requested in the order requested. The host remembers the names of values requested.	
Structure	L, n 1. <SV <sub>1</sub> > . . n. <SV <sub>n</sub> >	
Exception	A zero-length list item for SV <sub>i</sub> means that SVID <sub>i</sub> does not exist.	

S1,F11	<i>Status Variable Namelist Request</i>	S,H→E, reply
Description	A request to the equipment to identify certain status variables.	
Structure	L,n 1. <SVID <sub>1</sub> > . . . n. <SVID <sub>n</sub> >	
Exception	A zero-length means report all SVIDs.	
S1,F12	<i>Status Variable Namelist Reply</i>	M,H←E
Description	The equipment reports to the host the name and units of the requested SVs.	
Structure	L,n 1. L,3 1. <SVID <sub>1</sub> > 2. <SVNAME <sub>1</sub> > 3. <UNITS <sub>1</sub> > 2. L,3 . . . n. L,3 1. <SVID <sub>n</sub> > 2. <SVNAME <sub>n</sub> > 3. <UNITS <sub>n</sub> >	
Exception	Zero-length ASCII items for both SVNAME <sub>i</sub> and UNITS <sub>i</sub> indicates that the SVID does not exist.	
S1,F13	<i>Establish Communications Request</i>	S,H↔E, reply
Description	The purpose of this message is to provide a formal means of initializing communications at a logical application level both on power-up and following a break in communications. It should be the following any period where host and Equipment SECS applications are unable to communicate. An attempt to send an Establish Communications Request (S1,F13) should be repeated at programmable intervals until an Establish Communications Acknowledge (S1,F14) is received within the transaction timeout period with an acknowledgement code accepting the establishment.	
Structure	L,2 1. <MDLN> 2. <SOFTREV>	
Exception	The host sends a zero-length list to the equipment.	

S1,F14	<i>Establish Communications Request Acknowledge</i>	S,H↔E
Description	Accept or deny Establish Communications Request (S1,F13). MDLN and SOFTREV are on-line data and are valid only if COMMACK = 0.	
Structure	L,2 1. <COMMACK> 2. L,2 1. <MDLN> 2. <SOFTREV>	
Exception	The host sends a zero-length list for item 2 to the equipment.	
SECS	0: Accepted. Message Error 1: Denied. Try again. Codes 2 – 63: Reserved.	
S1,F15	<i>Request OFF-LINE</i>	S,H→E, reply
Description	The host requests that the equipment transition to the OFF-LINE state.	
Structure	Header only	
S1,F16	<i>OFF-LINE Acknowledge</i>	S,H←E
Description	Acknowledge or error	
Structure	<OFLACK>	
SECS	0: OFF-LINE Accepted. Message Error 1 – 63: Reserved. Codes	
S1,F17	<i>Request ON-LINE</i>	S,H→E, reply
Description	The host request that the equipment transition to the ON-LINE state.	
Structure	Header only	
S1,F18	<i>ON-LINE Acknowledge</i>	S,H←E
Description	Acknowledge or error.	
Structure	<ONLACK>	
SECS	0: ON-LINE Accepted. Message Error 1: ON-LINE Not allowed. Codes 2: Equipment already on-line. 3 – 63: Reserved.	

<i>S1,F19</i>	<i>Get Attribute</i>	S,H↔E, reply
Description	Request for attribute data relating to the specified object or entity within the equipment.	
Structure	<pre>L, 3   1. &lt;OBJTYPE&gt;   2. L,m      [m=number of objects for which                  attributes requested]     1.&lt;OBJID<sub>1</sub>&gt;     .     .     m.&lt;OBJID<sub>m</sub>&gt;   3. L,n      [n=number of attributes requested                  for each object]     1.&lt;ATTRID<sub>1</sub>&gt;     .     .     n.&lt;ATTRID<sub>n</sub>&gt;</pre>	
Exception	A zero-length list (m=0) is a request for attributes of all objects of the specified type. A zero-length list (n=0) is a request for all attributes of the object(s) to be returned in a predefined order.	

<i>S1,F20</i>	<i>Attribute Data</i>	<i>S,H←E</i>
Description	This message is used to transfer the requested set of object attributes. The order of requested objects and attributes is retained from the primary message.	
Structure	<pre> L,2   1. L,m      [m=number of objects for                  which data is sent]     1. L,n      [n=number of attributes                  returned for OBJID<sub>1</sub>]       1.&lt;ATTRDATA<sub>1</sub>&gt;       .       .       n.&lt;ATTRDATA<sub>n</sub>&gt;       .       .       m. L,n      [n=number of attributes                  returned for OBJID<sub>m</sub>]         1.&lt;ATTRDATA<sub>1</sub>&gt;         .         .         n.&lt;ATTRDATA<sub>n</sub>&gt;   2. L,p      [p=number of errors                  reported]     1. L,2       1.&lt;ERRCODE<sub>1</sub>&gt;       2.&lt;ERRTEXT<sub>1</sub>&gt;       .       .       p. L,2         1.&lt;ERRCODE<sub>p</sub>&gt;         2 &lt;ERRTEXT<sub>p</sub>&gt; </pre>	
Exception	If m=0, it indicates that the specified OBJTYPE is unknown. If any n=0, it indicates that the corresponding object was not found. If any ATTRDATA item is reported as a zero-length item, it indicates that the specified attribute does not exist. If no errors were found, p=0.	

## 16.4. Stream 2 - Equipment Control and Diagnostics

Stream 2 Functions provide information about the control of equipment from the host. All aspects of remote control and equipment diagnostics are covered unless specifically referenced in later Streams (Streams 4, 8, 10 and 13).

### 16.4.1. Message Summary

For Host Initiated Messages:

Primary Message	Description	Response Message	Description
S2,F0	Abort Transaction		
S2,F13	Equipment Constant Request	S2,F14	Equipment Constant Data
S2,F15	New Equipment Constant Send	S2,F16	New Equipment Constant Acknowledge
S2,F17	Date and Time Request	S2,F18	Date and Time Data
S2,F21	Remote Command Send	S2,F22	Remote Command Acknowledge
S2,F29	Equipment Constant Namelist Request	S2,F30	Equipment Constant Namelist Reply
S2,F31	Date and Time Set Request	S2,F32	Date and Time Set Acknowledge
S2,F33	Define Report	S2,F34	Define Report Acknowledge
S2,F35	Link Event Report	S2,F36	Link Event Report Acknowledge
S2,F37	Enable/Disable Event Report	S2,F38	Enable/Disable Report Acknowledge
S2,F39	Multi-Block Inquire	S2,F40	Multi-Block Grant
S2,F41	Host Command Send	S2,F42	Host Command Acknowledge
S2,F43	Reset Spooling Streams and Functions	S2,F44	Reset Spooling Acknowledge
S2,F49	Enhanced Remote Command	S2,F50	Enhanced Remote Command Acknowledge

For Equipment Initiated Messages:

Primary Message	Description	Response Message	Description
S2,F0	Abort Transaction		
S2,F17	Date and Time Request	S2,F18	Date and Time Data
S2,F25	Loopback Diagnostic Request	S2,F26	Loopback Diagnostic Data

### 16.4.2. Message Details

S2,F0	<i>Abort Transaction</i>	S,H↔E
	Description	As with S1,F0, this is used in lieu of an expected reply to abort a transaction.
	Structure	Header Only
S2,F13	<i>Equipment Constant Request</i>	S,H→E, reply
	Description	Constants such as for calibration, servo gain, alarm limits, data collection mode, and other values that are changed infrequently can be obtained using this message.
	Structure	L,n 1. <ECID <sub>1</sub> > · · · n. <ECID <sub>n</sub> >
	Exception	A zero-length list means report all ECV's according to a predefined order.
S2,F14	<i>Equipment Constant Data</i>	M,H←E
	Description	Data Response to S2,F13 in the order requested.
	Structure	L,n 1. <ECV <sub>1</sub> > 2. <ECV <sub>2</sub> > · · · n. <ECV <sub>n</sub> >
	Exception	A zero-length list item for ECV <sub>i</sub> means that a ECID <sub>i</sub> does not exist.
S2,F15	<i>New Equipment Constant Send</i>	S,H→E, reply
	Description	Change one or more equipment constants.
	Structure	L,n 1. L,2 1. <ECID <sub>1</sub> > 2. <ECV <sub>1</sub> > 2. L,2 · · · n. L,2 1. <ECID <sub>n</sub> > 2. <ECV <sub>n</sub> >

S2,F16	<i>New Equipment Constant Acknowledge</i>	M,H←E
Description	Acknowledge or error. If EAC contains a non-zero error code, the equipment should not change any of the ECIDs specified in S2F15.	
Structure	<EAC>	
SECS	0: Acknowledge.	
Message Error 1:	Denied. At least one constant does not exist.	
Codes	2: Denies. Busy. 3: Denied. At least one constant out of range. >3: Other equipment-specific error 4-63: Reserved	
S2,F17	<i>Data and Time Request (DTR)</i>	S,H↔E, reply
Description	Useful to check equipment time base or for equipment to synchronize with the host time base.	
Structure	Header only	
S2,F18	<i>Date and Time Data (DTD)</i>	M,H↔E
Description	Actual time data.	
Structure	<TIME>  12-byte format: YYMMDDhhmmss 16-type format: YYYYMMDDhhmmsscc E148 format: YYYY-MM-DDThh:mm:ss.sTZD	
Exception	A zero-length item means no time exists.	
S2,F21	<i>Remote Command Send</i>	S,H→E, [reply]
Description	Similar to pressing buttons on the front panel or causes some equipment activity to commence or to cease.	
Structure	<RCMD>	
S2,F22	<i>Remote Command Acknowledge</i>	S,H←E
Description	Acknowledge or error.	
Structure	<CMDA>	
SECS	0: Completed or done.	
Message Error 1:	Command does not exist.	
Codes	2: Cannot perform now. >2: Other equipment-specific error. 3-63: Reserved.	
S2,F25	<i>Loopback Diagnostic Request</i>	S,H→E
Description	A diagnostic message for checkout of protocol and communication circuits. The binary string sent is echoed back.	
Structure	<ABS>	

S2,F26	<i>Loopback Diagnostic Data</i>	S,H←E
	Description	The echoed binary string.
	Structure	<ABS>
S2,F29	<i>Equipment Constant Namelist Request</i>	S,H→E, reply
	Description	This function allows the host to retrieve basic information about what equipment constants are available in the equipment.
	Structure	L,n 1. <ECID <sub>1</sub> > . . n. <ECID <sub>n</sub> >
	Exception	A zero-length list means send information for all ECIDs.
S2,F30	<i>Equipment Constant Namelist</i>	M,H←E
	Description	Data response.
	Structure	L,n (number of equipment constants) 1. L,6 1. <ECID <sub>1</sub> > 2. <ECNAME <sub>1</sub> > 3. <ECMIN <sub>1</sub> > 4. <ECMAX <sub>1</sub> > 5. <ECDEF <sub>1</sub> > 6. <UNITS <sub>1</sub> > 2. L,6 . . n. L,6 1. <ECID <sub>n</sub> > 2. <ECNAME <sub>n</sub> > 3. <ECMIN <sub>n</sub> > 4. <ECMAX <sub>n</sub> > 5. <ECDEF <sub>n</sub> > 6. <UNITS <sub>n</sub> >
	Exception	Zero-length ASCII items for ECNAME <sub>i</sub> , ECMIN <sub>i</sub> , ECMAX <sub>i</sub> , and UNITS <sub>i</sub> indicates that ECID does not exist.
S2,F31	<i>Date and Time Set Request</i>	S,H→E, reply
	Description	Useful to synchronize the equipment time with the host time base.
	Structure	<TIME>
S2,F32	<i>Date and Time Set Acknowledge</i>	S,H←E
	Description	Acknowledge the receipt of time and date.
	Structure	<TIACK>
	SECS	0: OK.
	Message Error 1:	Error, not done.
	Codes	2-63: Reserved.

S2,F33	<i>Define Report</i>	M,H→E, reply
Description	The purpose of this message is for the host to define a group of reports for the equipment. The type of report to be transmitted is defined by a Boolean “Equipment Constant.” An “Equipment Constant Value” of “False” means that an “Event Report” (S6,F11) will be sent, and a value of “True” means that an “Annotated Event Report” (S6,F13) will be sent. If S2,F33 is Multi-block, it must be preceded but the S2,F39/S2,F40 Inquire/Grant transaction.	
Structure	<pre> I,2   1. &lt;DATAID&gt;   2. L,a          # reports     1. L,2        report 1       1. &lt;RPTID<sub>1</sub>&gt;       2. L,b        # VIDs this report         1. &lt;VID<sub>1</sub>&gt;         .         .         b. &lt;VID<sub>b</sub>&gt;        .       .       a. L,2        report a         1. &lt;RPTID<sub>a</sub>&gt;         2. L,c        # VIDs this report           1. &lt;VID<sub>1</sub>&gt;           .           .           c. &lt;VID<sub>c</sub>&gt; </pre>	
Exception	A list of zero-length following <DATAID> deletes all report definitions and associated links. Refer to S2, F35 (Link Event/Report). A list of zero-length following <RPTID> deletes report type RPTID. All CEID links to this RPTID are also deleted.	

S2,F34	<i>Define Report Acknowledge</i>	S,H←E
Description	Acknowledge or error. If an error condition is detected the entire message is rejected (i.e., partial changes are not allowed).	
Structure	<DRACK>	
SECS	0: Accepted.	
Message Error 1:	Denied. Insufficient space.	
Codes	2: Denied. Invalid format.	
	3: Denied. At least one PRTID already defined.	
	4: Denied. At least one VID does not exist.	
	> 4: Other errors.	
	5 – 63: Reserved.	

S2,F35	<i>Link Event Report</i>	M,H→E, reply
Description	The purpose of this message is for the host to link n reports to an event (CEID). These linked event reports will default to 'disabled' upon linking. That is, the occurrence of an event would not cause the report to be sent until enabled. See S2,F37 for enabling reports. If S2,F35 is Multi-block, it must be preceded by the S2,F39/S2,F40 Inquire/Grant transaction.	
Structure	<pre> L,2   1. &lt;DATAID&gt;   2. L,a                      # events     1. L,2                     event 1       1. &lt;CEID<sub>1</sub>&gt;       2. L,b         1. &lt;RPTID<sub>1</sub>&gt;         .         .         b. &lt;RPTID<sub>b</sub>&gt;         .         .       a. L,2                     event a         1. &lt;CEID<sub>a</sub>&gt;      # RPTIDs this event         2. L,c           1. &lt;RPTID<sub>1</sub>&gt;           .           .         c. &lt;VID<sub>c</sub>&gt;       .     .   . .</pre>	
Exception	A list of zero-length following CEID deletes all report links to that event.	

S2,F36	<i>Link Event Report Acknowledge</i>	S,H←E
Description	Acknowledge or error. If an error condition is detected, the entire message is rejected (i.e., partial changes are not allowed).	
Structure	<LRACK>	
SECS	0: Accepted.	
Message Error 1:	Denied. Insufficient space.	
Codes	2: Denied. Invalid format.	
	3: Denied. At least one CEID link already defined.	
	4: Denied. At least one CEID does not exist.	
	5: Denied. At least one RPTID does not exist.	
	>6: Other errors.	
	6 – 63: Reserved.	

S2,F37	<i>Enable/Disable Event Report</i>	S,H→E, reply
Description	The purpose of thi smessage is for the host to enable or disable reporting for a group of events (CEIDs).	
Structure	$\text{I}, 2$ <ul style="list-style-type: none"> <li>1. &lt;CEED&gt;                   enable/disable</li> <li>2. <math>\text{I}, n</math>                   # CEIDs           <ul style="list-style-type: none"> <li>1. &lt;CEID<sub>1</sub>&gt;</li> <li>.</li> <li>.</li> <li>n. &lt;CEID<sub>n</sub>&gt;</li> </ul> </li> </ul>	
Exception	A list of zero length following CEED means all CEIDs	
S2,F38	<i>Enable/Disable Event Report Acknowledge</i>	S,H←E
Description	Acknowledge or error. If an error conditions is detected the entire message is rejected, i.e., partial changes are not allowed.	
Structure	<ERACK>	
SECS	0:           Accepted	
Message Error 1:	Denied. At least one CEID does not exist.	
Codes	<ul style="list-style-type: none"> <li>&gt; 1:       Other errors</li> <li>2 – 63:    Reserved</li> </ul>	
S2,F39	<i>Mulit-Block Inquire</i>	S,H→E, reply
Description	If a S2,F23, S2,F33, S2,F35, S2,F45, or S2,F49 message is more than one block, this transaction must precede the messages.	
Structure	$\text{I}, 2$ <ul style="list-style-type: none"> <li>1. &lt;DATAID&gt;</li> <li>2. &lt;DATALENGTH&gt;</li> </ul>	
S2,F40	<i>Multi-block Grant</i>	S,H←E
Description	Grant permission to send multi-block message.	
Structure	<GRANT>	
SECS	0:       Permission granted.	
Message Error 1:	Busy, try again.	
Codes	<ul style="list-style-type: none"> <li>2:       No space available.</li> <li>3:       Duplicate DATAID.</li> <li>&gt; 3:     Equipment-specific error code.</li> <li>4 – 63:   Reserved</li> </ul>	

**S2,F41 Host Command Send** S,H→E, reply

Description The Host requests the Equipment perform the specified remote command with the associated parameters.

Structure L,2

- 1. <RCMD>
- 2. L,n # of parameters
  - 1. L,2
    - 1. <CPNAME<sub>1</sub>> parameter 1 name
    - 2. <CPVAL<sub>1</sub>> parameter 1 value
    - .
    - .
  - n. L,2
    - 1. <CPNAME<sub>n</sub>> parameter n name
    - 2. <CPVAL<sub>n</sub>> parameter n value

**S2,F42 Host Command Acknowledge** S,H←E

Description Acknowledge Host command or error.. If command is not accepted due to one or more invalid parameters (i.e., HCACK=3), then a list of invalid parameters will be returned containing the parameter name and reason for being invalid.

Structure L,2

- 1. <HCACK>
- 2. L,n # of parameters
  - 1. L,2
    - 1. <CPNAME<sub>1</sub>> parameter 1 name
    - 2. <CPACK<sub>1</sub>> parameter 1 value
    - .
    - .
  - n. L,2
    - 1. <CPNAME<sub>n</sub>> parameter n name
    - 2. <CPACK<sub>n</sub>> parameter n value

Exception If there are no invalid parameters, then a list of zero length will be sent for item 2.

SECS 0: Acknowledge, command has been performed.

Message Error 1: Command does not exist.

Codes 2: Cannot perform now.

3: At least one parameter is invalid.

4: Acknowledge, command will be performed with completion signal later by an event.

5: Rejected, already in desired condition.

6: No such object exists.

7 – 63: Reserved.

S2,F43	<i>Reset Spooling Streams and Functions</i>	S,H→E, reply
Description	This message allows the host to select specific streams and functions to be spooled whenever spooling is active.	
Structure	<pre>L,m   1. L,2     1. &lt;STRID<sub>1</sub>&gt;     2. L,n       1. &lt;FCNID<sub>1</sub>&gt;       .       .       n. &lt;FCNID<sub>n</sub>&gt;        .       .    m. L,2     1. &lt;STRID<sub>m</sub>&gt;     2. L,n       1. &lt;FCNID<sub>1</sub>&gt;       .       .       n. &lt;FCNID<sub>n</sub>&gt;</pre>	
Exception	<p>1. A zero-length list, m=0, turns off spooling for all stream and functions.</p> <p>2. A zero-length list, n=0, turns on spooling for all functions for the associated stream.</p>	

S2,F44	<i>Reset Spooling Acknowledge</i>	M,H←E
Description	Acknowledge or error.	
Structure	L,2	
	1. <RSPACK>	(accept or reject)
	2. L,m	(m = number of streams with errors)
	1. L,3	
	1. <STRID <sub>1</sub> >	
	2. <STRACK <sub>1</sub> >	(error in stream)
	3. L,n	(n = number of function in error)
	1. <FCNID <sub>1</sub> >	
	.	
	.	
	n. <FCNID <sub>n</sub> >	
	.	
	m. L,3	
	1. <STRID <sub>m</sub> >	
	2. <STRACK <sub>m</sub> >	(error in stream)
	3. L,n	(n = number of function in error)
	1. <FCID <sub>1</sub> >	
	.	
	.	
	n. <FCNID <sub>n</sub> >	
Exception	1. If RSPACK=0, a zero-length list, m=0, is given, indicating no streams or functions in error. 2. A zero-length list, n=0, indicates no functions in error for specified streams.	
SECS	0:	Acknowledge, spooling setup accepted.
Message	1:	Spooling setup rejected.
Error Codes	2-63:	Reserved.

S2,F49	<i>Enhanced Remote Command</i>	S,H→E, reply
Description	The host requests an object to perform the specified remote command with its associated parameters. If multi-block, it shall be preceded by the S2,F39/F40 Multi-Block Inquire/Grant transaction.	
Structure	<pre>L,4   1. &lt;DATAID&gt;   2. &lt;OBJSPEC&gt;   3. &lt;RCMD&gt;   4. L,m          # of parameter groups     1. L,2       1. &lt;CPNAME<sub>1</sub>&gt;   command parameter 1 name       2. &lt;CPVAL<sub>1</sub>&gt;   command-enhanced parameter       1 value       .       .       m. L,2         1. &lt;CPNAME<sub>m</sub>&gt;   command parameter m name         2. &lt;CPVAL<sub>m</sub>&gt;   command-enhanced         parameter m value</pre>	
S2,F50	<i>Enhanced Remote Command Acknowledge</i>	S,H←E
Description	The equipment acknowledge Enhanced Remote Command or reports any error(s). If the command is not accepted due to one or more invalid parameters (i.e., HCACK=3), then a list of invalid parameters will be returned containing the parameter name and reason for being invalid.	
Structure	<pre>L,2   1. &lt;HCACK&gt;   2. L,n          # of parameter groups     1. L,2       1. &lt;CPNAME<sub>1</sub>&gt;       2. &lt;CPACK<sub>1</sub>&gt;       .       .       n. L,2         1. &lt;CPNAME<sub>n</sub>&gt;         2. &lt;CPACK<sub>n</sub>&gt;</pre>	
Exception	If there are no invalid parameters, then a list of zero length will be sent for item 2.	
SECS	0: Acknowledge.	
Message Error 1:	Command does not exist.	
Codes	2: Cannot perform now. 3: At least one parameter is invalid. 4: Acknowledge; command will be performed with completion signal later by an event. 5: Rejected, already in desired condition. 6: No such object exists. 7 – 63: Reserved.	

## 16.5. Stream 3 - Materials Status

The material status functions are used for carrier action requests and responses.

### 16.5.1. Message Summary

For Host Initiated Messages:

Primary Message	Description	Response Message	Description
S3,F15	Materials Multi-Block Inquire	S3,F16	Materials Multi-Block Grant
S3,F17	Carrier Action Request	S3,F18	Carrier Action Acknowledge
S3,F25	Port Action	S3,F26	Reserve At Port Cancel Reservation At Port
S3,F27	Access Mode	S3,F28	Sets port access mode to MANUAL or AUTO
S3,F29	Carrier Tag Read Request	S3,F30	Carrier Tag Read Data
S3,F31	Carrier Tag Write Data Request	S3,F32	Carrier Tag Write Data Acknowledge

No Equipment Initiated Messages

### 16.5.2. Message Details

S3,F15    *Materials Multi-Block Inquire*

S,H→E, reply

Description    This message requests permission to send a multi-block message based upon a maximum of length of the total message. It must be sent prior to sending any multi-block primary message in Stream 3.

Structure    I, 2

- 1. <DATAID>
- 2. <DATALENGTH>

S3,F16    *Materials Multi-Block Grant*

S,H←E

Description    This message grants or denies permission to send a multi-block primary message in Stream 3.

Structure    <GRANT>

SECS    0:    Permission granted.

Message Error 1:    Busy, try again.

Codes    2:    No space available.

3:    Duplicate DATAID.

> 3:    Equipment-specific error code.

4 – 63:    Reserved

S3,F17	<i>Carrier Action Request</i>	M,H→E, reply
Description	This message requests an action to be performed for a specified carrier. If multi-block, this message must be preceded by the S3,F11/F12 transaction.	
Structure	L,5 1. <DATAID> 2. <CARRIERACTION> 3. <CARRIERID> 4. <PTN> 5. L,n n = number of carrier attributes 1. L,2 1. <CATTRID <sub>1</sub> > 2. <CATTRDATA <sub>1</sub> > . . n. L,2 1. <CATTRID <sub>n</sub> > 2. <CATTRID <sub>n</sub> >	
Exception	If n = 0, then no carrier attributes are included. If CARRIERID is not a zero-length item, then PTN may be omitted (a zero-length item).	
S3,F18	<i>Carrier Action Acknowledge</i>	S,H←E
Description	This message acknowledges the carrier action request.	
Structure	L,2 1. <CAACK> 2. L,n 1. L,2 1. <ERRCODE <sub>1</sub> > 2. <ERRTEXT <sub>1</sub> > . . n. L,2 1. <ERRCODE <sub>n</sub> > 2. <ERRTEXT <sub>n</sub> >	
Exception	If n = 0, no errors exist.	
SECS	0:	Acknowledge, command has been performed.
Message Error 1:		Invalid command.
Codes	2:	Cannot perform now.
	3:	Invalid data or argument.
	4:	Acknowledge, command will be performed with completion signal later by an event.
	5:	Rejected. Invalid state.
	6:	Command performed with errors.
	7 – 63:	Reserved.

S3,F25	<i>Port Action Request</i>	S,H→E, reply
Description	This message requests an action to be performed for a port.	
Structure	L, 3 1. <PORTACTION> 2. <PTN> 3. L, 0	
	where PORTACTION is "ReserveAtPort" or "CancelReservationAtPort".	
S3,F26	<i>Port Action Acknowledge</i>	S,H←E
Description	This message acknowledges the port action request.	
Structure	L, 2 1. <CAACK> 2. L, n 1. L, 2 1. <ERRCODE <sub>1</sub> > 2. <ERRTEXT <sub>1</sub> > . . n. L, 2 1. <ERRCODE <sub>n</sub> > 2. <ERRTEXT <sub>n</sub> >	
Exception	If n=0, no errors exist.	
SECS	0: Acknowledge, command has been performed.	
Message Error 1:	Invalid command.	
Codes	2: Cannot perform now. 3: Invalid data or argument. 4: Acknowledge, command will be performed with completion signal later by an event. 5: Rejected. Invalid state. 6: Command performed with errors. 7 – 63: Reserved.	

S3,F27	<i>Change Access</i>	S,H→E,reply
Description	The host requests the equipment to change the Access Mode for the specified Load Ports. ACCESSMODE specifies the desired Access Mode. PTN specifies a desired Load Port Number.	
Structure	L,2 1. <ACCESSMODE> 2. L,n 1. <PTN <sub>1</sub> > . . n. <PTN <sub>n</sub> >	
Exception	If n=0, then the command applies to all Load Ports on the equipment. If any specified port is already in the specified Access Mode, then the equipment shall accept the command, and toggle all Load Ports to the specified mode. If the equipment is unable to change one or more of the specified port(s) to the specified Access Mode, then the equipment shall accept the command (with appropriate response acknowledgement) and shall change only the Access Mode of those port(s) allowed by the equipment, supplying the host with an indication that not all ports were successfully changed.	
S3,F28	<i>Change Access Acknowledge</i>	S,H←E
Description	This message acknowledges the Change Access message.	
Structure	L,2 1. <CAACK> 2. L,n 1. L,3 1. <PTN <sub>1</sub> > 2. <ERRCODE <sub>1</sub> > 3. <ERRTEXT <sub>1</sub> > . . n. L,3 1. <PTN <sub>n</sub> > 2. <ERRCODE <sub>n</sub> > 3. <ERRTEXT <sub>n</sub> >	
Exception	If the command is successful, CAACK=0, and n=0. If the command was successful for some ports, CAACK = 6 and n > 0.	
SECS	0: Acknowledge, command has been performed.	
Message Error 1:	Invalid command.	
Codes	2: Cannot perform now. 3: Invalid data or argument. 4: Acknowledge, command will be performed with completion signal later by an event. 5: Rejected. Invalid state. 6: Command performed with errors. 7 – 63: Reserved.	

S3,F29	<i>Carrier Tag Read Request</i>	S,H→E
Description	This message is used by the host to request the equipment to read data from the carrier tag of a carrier.	
Structure	L, 4 1. <LOCID> 2. <CARRIERSPEC> 3. <DATASEG> 4. <DATALENGTH>	
Exception	Either LOCID and CARRIERSPEC can omitted (zero length item), but not both. If DATASEG and DATALENGTH are both omitted (are zero length items) then all data is requested. If DATALENGTH only omitted, then al data within the indicated section is requested.	
S3,F30	<i>Carrier Tag Read Data</i>	S,H←E
Description	This message is used to return requested information from the carrier tag of the carrier indicated in the request and to acknowledge the results of the request.	
Structure	L, 2 1. <DATA> 2. L, 2 1. <CAACK> 2. L, s 1. L, 2 1. <ERRCODE <sub>1</sub> > 2. <ERRTEXT <sub>1</sub> > . . s. L, 2 1. <ERRCODE <sub>s</sub> > 2. <ERRTEXT <sub>s</sub> >	
Exception	If the carrier identifier or the carrier location originally specified is unknown, then DATA is zero length. If CAACK is non-zero, then DATA is zero length.	

S3,F31	<i>Carrier Tag Write Data Request</i>	S,H→E
Description	The host requests the equipment to write data to a carrier tag. The carrier must be indicated either by its location identifier or its carrier identifier, or both. DATASEG may be used to indicate a specific section of data to be written or overwritten. DATALENGTH may be used to indicate the length of the data to be written.	
Structure	L,5 1. <LOCID> 2. <CARRIERSPEC> 3. <DATASEG> 4. <DATALENGTH> 5. <DATA>	
Exception	Either LOCID and CARRIERSPEC can be omitted (zero length item), but not both. If DATASEG and DATALENGTH are both omitted (are zero length items) then all data is to be overwritten. If only DATALENGTH is omitted, then all data within the indicated section is to be written.	
S3,F32	<i>Carrier Tag Write Data Acknowledge</i>	S,H←E
Description	This message acknowledges the success or failure of writing data to the carrier tag requested.	
Structure	L,2 1. <CAACK> 2. L,s 1. L,2 1. <ERRCODE <sub>1</sub> > 2. <ERRTEXT <sub>1</sub> > . . s. L,2 1. <ERRCODE <sub>s</sub> > 2. <ERRTEXT <sub>s</sub> >	
Exception	S = 0 if and only if there are no errors.	

## 16.6. Stream 5 - Exception Handling

Stream 5 messages pertain to binary and analog exception handling. These exceptions are classified in two categories: errors and alarms. Messages cover basic alarm messaging and extended capabilities for Exception Handling.

Alarms mention while using messages F1-F8 may be categorized according to the ALCD field as:

- Personal safety
- Equipment safety
- Parameter control warning
- Parameter control error
- Irrecoverable error
- Equipment status warning
- Attention flags
- Data integrity

### 16.6.1. Message Summary

For Host Initiated Messages:

Primary Message	Description	Response Message	Description
S5,F0	Abort Transaction		
S5,F1	Alarm Report Send	S5,F2	Alarm Report Acknowledge
S5,F3	Enable/Disable Alarm Send	S5,F4	Enable/Disable Alarm Acknowledge
S5,F5	List Alarm Request	S5,F6	List Alarm Data
S5,F7	List Enable Alarm Request	S5,F8	List Enable Alarm Data

For Equipment Initiated Messages:

Primary Message	Description	Response Message	Description
S5,F0	Abort Transaction		
S5,F1	Alarm Report Send	S5,F2	Alarm Report Acknowledge

### 16.6.2. Message Details

S5,F0	<i>Abort Transaction</i>	S,H↔E
	Description	As with S1,F0, this is used in lieu of an expected reply to abort a transaction.
	Structure	Header Only
S5,F1	<i>Alarm Report Send</i>	S,H←E, [reply]
	Description	This message reports a change in or presence of an alarm condition. One message will be issued when the alarm is set and one message will be issued when the alarm is cleared. The ALCD (Alarm code byte) flag is sent as part of this message. Irrecoverable errors and attention flags may not have a corresponding clear message.
	Structure	<ul style="list-style-type: none"> <li>I,3</li> <li>1. &lt;ALCD&gt;</li> <li>2. &lt;ALID&gt;</li> <li>3. &lt;ALTX&gt;</li> </ul> <p>Where:</p> <ul style="list-style-type: none"> <li>ALCD - Alarm Code Byte</li> <li>bit 8 = 1 means alarm set</li> <li>bit 8 = 0 means alarm cleared</li> <li>bit 7-1 is alarm category</li> <li>0 = not used</li> <li>1 = Personal safety</li> <li>2 = Equipment safety</li> <li>3 = Parameter control warning</li> <li>4 = Parameter control error</li> <li>5 = Irrecoverable error</li> <li>6 = Equipment status warning</li> <li>7 = Attention flags</li> <li>8 = Data integrity</li> <li>&gt;8 = other categories</li> <li>9-63 reserved</li> </ul> <p>Note: Bits 1-7 are not set in this implementation.</p>
S5,F2	<i>Alarm Report Acknowledge</i>	S,H→E
	Description	Acknowledge or error.
	Structure	<ACKC5>
	SECS	0: Accepted.
	Message Error > 0:	Error, not accepted.
	Codes	1 – 63: Reserved.

S5,F3	<i>Enable/Disable Alarm Send</i>	S,H→E, [reply]
Description	This message will change the state of the enable bit in the equipment. The enable bit determines if the alarm will be sent to the host. Alarms which are not controllable in this was are unaffected by this message.	
Structure	L,2 1. <ALED> 2. <ALID>	
Exception	A zero-length item for ALID means all alarms.	
S5,F4	<i>Enable/Disable Alarm Acknowledge</i>	S,H←E
Description	Acknowledge or error.	
Structure	<ACKC5>	
SECS	0: Accepted.	
Message Error > 0:	Error, not accepted.	
Codes	1 – 63: Reserved.	
S5,F5	<i>List Alarms Request</i>	S,H→E, reply
Description	This message requests the equipment to send binary and analog alarm information to the host.	
Structure	<ALID <sub>1</sub> , . . . , ALID <sub>n</sub> >	
Exception	A zero-length item means send all possible alarms regardless of the state of ALED.	
S5,F6	<i>List Alarm Data</i>	M,H←E
Description	This message contains the alarm data known to the equipment. There are "m" alarms in the list. The ALCD flag is sent as part of this message.	
Structure	L,m 1. L,3 1. <ALCD <sub>1</sub> > 2. <ALID <sub>1</sub> > 3. <ALTX <sub>1</sub> > 2. L,3 . . . m. L,3 1. <ALCD <sub>m</sub> > 2. <ALID <sub>m</sub> > 3. <ALTX <sub>m</sub> >	
Exception	If m = 0, no response can be made. A zero-length item returned for ALCD <sub>i</sub> or ALTX <sub>i</sub> means that value does not exist.	

S5,F7	<i>List Enabled Alarm Request</i>	S,H→E, reply
	Description	List alarms that are enabled.
	Structure	Header only
S5,F8	<i>List Enabled Alarm Data</i>	M,H←E
	Description	This message is similar to S5,F6 except that it lists only alarms that are enabled.
	Structure	Same as S5,F6

## 16.7. Stream 6 - Data Collection

This stream is intended to cover the needs of in-process measurements and equipment monitoring.

### 16.7.1. Message Summary

For Host Initiated Messages:

Primary Message	Description	Response Message	Description
S6,F0	Abort Transaction		
S6,F15	Event Report Request	S6,F16	Event Report Data
S6,F17	Annotated Event Report Request	S6,F18	Annotated Event Report Data
S6,F19	Individual Report Request	S6,F20	Individual Report Data
S6,F21	Annotated Individual Report Request	S6,F22	Annotated Individual Report Data
S6,F23	Request Spooled Data	S6,F24	Request Spooled Data Acknowledgement Send

For Equipment Initiated Messages:

Primary Message	Description	Response Message	Description
S6,F0	Abort Transaction		
S6,F5	Multi-block Data Send Inquire	S6,F6	Multi-block Grant
S6,F11	Event Report Send	S6,F12	Event Report Acknowledge
S6,F13	Annotated Event Report Send	S6,F14	Annotated Event Report Acknowledge

### 16.7.2. Message Details

S6,F0	<i>Abort Transaction</i>	S,H↔E
	Description	As with S1,F0, this is used in lieu of an expected reply to abort a transaction.
	Structure	Header Only
S6,F5	<i>Multi-block Data Send Inquire</i>	S,H←E, reply
	Description	If the discrete data report S6,F11, F13 can involve more than one block, this transaction must precede the transmission.
	Structure	I, 2 <ul style="list-style-type: none"> <li>1. &lt;DATAID&gt;</li> <li>2. &lt;DATALENGTH&gt;</li> </ul>
S6,F6	<i>Multi-block Grant</i>	S,H→E
	Description	Grant permission to send
	Structure	<GRANT6>
	SECS	0: Permission granted.
	Message Error 1:	Busy, try again.
	Codes	2: Not interested. >2: Other errors. 3 – 63: Reserved.

S6,F11	<i>Event Report Send</i>	M,H←E, reply
Description	The purpose of this message is for the equipment to send a defined, linked, and enabled group of reports to the host upon the occurrence of an event (CEID). If S6,F11 is Multi-block, it must be preceded by the S6,F5/S6.F6 Inquire/Grant transaction.	
Structure	<pre> L,3   1. &lt;DATAID&gt;   2. &lt;CEID&gt;   3. L,a     1. L,2       1. &lt;RPTID<sub>1</sub>&gt;       2. L,b         1. &lt;V<sub>1</sub>&gt;         .         .         b. &lt;V<sub>b</sub>&gt;         .         .       a. L,2           report a         1. &lt;RPTID<sub>a</sub>&gt;         2. L,c           #Vs this report           1. &lt;V<sub>1</sub>&gt;           .           .         c. &lt;V<sub>c</sub>&gt; </pre>	
Exception	If there are no reports linked to the event a 'null' report is assumed. A zero-length list for # of reports means there are no reports linked to the given CEID.	
S6,F12	<i>Event Report Acknowledge</i>	S,H→E
Description	Acknowledge or error.	
Structure	<ACKC6>	
SECS	0: Accepted.	
Message Error >0:	Error, not accepted.	
Codes	1 – 63: Reserved.	

S6,F13	<i>Annotated Event Report Send</i>	M,H←E, reply
Description	This message is the same as S6,F11 with the exception that VID's are sent with the data. If S6,F13 is Multi-block, it must be preceded by the S6,F5/S6,F6 Inquire/Grant transaction.	
Structure	<pre> L,3   1. &lt;DATAID&gt;   2. &lt;CEID&gt;   3. L,a     1. L,2       1. &lt;RPTID<sub>1</sub>&gt;       2. L,b         1. L,2           1. &lt;VID<sub>1</sub>&gt;           2. &lt;V<sub>1</sub>&gt;         .         .         b. L,2           1. &lt;VID<sub>b</sub>&gt;           2. &lt;V<sub>b</sub>&gt;         .         .         a. L,2           1. &lt;RPTID<sub>a</sub>&gt;           2. L,c             1. L,2               1. &lt;VID<sub>1</sub>&gt;               2. &lt;V<sub>1</sub>&gt;             .             .             c. L,2               1. &lt;VID<sub>c</sub>&gt;               2. &lt;V<sub>c</sub>&gt; </pre>	
Exception	IF there are no reports linked to the event a 'null' report is assumed. A zero-length list for # of reports means there are no reports linked to the given CEID.	

S6,F14	<i>Annotated Event Report Acknowledge</i>	S,H→E
Description	Acknowledge or error.	
Structure	<ACKC6>	
SECS	0: Accepted.	
Message Error >0:	Error, not accepted.	
Codes	1 – 63: Reserved.	

S6,F15	<i>Event Report Request</i>	S,H→E, reply
Description	The purpose of this message is for the host to demand a given report group from the equipment.	
Structure	<CEID>	

S6,F16	<i>Event Report Data</i>	M,H←E
Description	Equipment sends reports linked to given CEID to host.	
Structure	Identical to structure of S6,F11.	
Exception	A zero-length item means there are no reports linked to the given CEID.	
S6,F17	<i>Annotated Event Report Request</i>	S,H→E, reply
Description	Same as S6,F15, but requests annotated reports.	
Structure	<CEID>	
S6,F18	<i>Annotated Event Report Data</i>	M,H←E
Description	Equipment sends annotated reports linked to given CEID	
Structure	Same as S6,F13	
Exception	A zero-length item means there are no reports linked to the given CEID.	
S6,F19	<i>Individual Report Request</i>	S,H→E, reply
Description	The purpose of this message is for the host to request a defined report from the equipment.	
Structure	<RPTID>	
S6,F20	<i>Individual Report Data</i>	M,H←E
Description	Equipment sends variable data defined for the given RPTID to the host.	
Structure	L, n # of variable data items 1. <V <sub>1</sub> > . . n. <V <sub>n</sub> >	
Exception	A zero-length list means RPTID is not defined.	
S6,F21	<i>Annotated Individual Report Request</i>	S,H→E, reply
Description	The purpose of this message is for the host to request an annotated defined report from the equipment.	
Structure	<RPTID>	

S6,F22	<i>Annotated Individual Report Data</i>	M,H←E
Description	Equipment sends annotated variable data defined for the given RPTID to the host.	
Structure	<pre>L,n   1. L,2     1. &lt;VID<sub>1</sub>&gt;     2. &lt;V<sub>1</sub>&gt;     .     .   n. L,2     1. &lt;VID<sub>n</sub>&gt;     2. &lt;V<sub>n</sub>&gt;</pre>	
Exception	A zero-length list for # of variable data items means RPTID is not defined.	
S6,F23	<i>Request Spooled Data</i>	S,H→E, reply
Description	The purpose of this message is for the host to request transmission or deletion of the messages currently spooled by the equipment.	
Structure	<pre>&lt;RSDC&gt; Where: RSDC - Request Spool Data Code 0 = Transmit Spooled Message 1 = Purge Spooled Messages 2-63 Reserved</pre>	
S6,F24	<i>Request Spooled Data Acknowledgement Send</i>	S,H←E
Description	The purpose of this message is to acknowledge the receipt of the Request Spooled Data (S6,F23) and to respond with an appropriate acknowledge data.	
Structure	<pre>&lt;RSDA&gt; Where: RSDA - Request Spool Data Acknowledge 0 = OK 1 = Denied, busy try later 2 = Denied, spooled data does not exist 3-63 Reserved</pre>	

## 16.8. Stream 7 – Process Program Management

The functions in this stream are used to manage and transfer process programs. Process programs are the equipment-specific descriptions that determine the procedure to be conducted on the material by a single piece of equipment. Methods are provided to transfer programs as well as establish the link between the process program and the material to be processed with that program.

### 16.8.1. Message Summary

For Host Initiated Messages:

Primary Message	Description	Response Message	Description
S7,F1	Process Program Load Inquire	S7,F2	Process Program Load Grant
S7,F3	Process Program Send	S7,F4	Process Program Acknowledge
S7,F5	Process Program Request	S7,F6	Process Program Data
S7,F17	Delete Process Program Send	S7,F18	Delete Process Program Acknowledge
S7,F19	Current EPPD Request	S7,F20	Current EPPD Data

No Equipment Initiated Messages

### 16.8.2. Message Details

S7,F1	<i>Process Program Load Inquire</i>	S,H↔E, reply
Description	This message is used to initiate the transfer of a process program or to select from stored programs. The message may be used to initiate the transfer of an unformatted process program (S7,F3/S7,F4)	
Structure	I, 2 1. <PPID> 2. <LENGTH>	

S7,F2	<i>Process Program Acknowledge</i>	S,H↔E
Description	This message is used to initiate the transfer of a process program or to select from stored programs. The message may be used to initiate the transfer of an unformatted process program (S7,F3/S7,F4)	
Structure	<PPGNT>	
SECS	0: OK	
Message Error 1:	Already have	
Codes	2: No space	
	3: Invalid PPID	
	4: Busy, try later	
	5: Will not accept	
	>5: Other error	
	6 – 63: Reserved	
S7,F3	<i>Process Program Send</i>	M,H↔E, reply
Description	The program is sent. If S7,F3 is multi-block, it must be preceded by the S7,F1/S7,F2 Inquire/Grant transaction.	
Structure	I, 2 1. <PPID> 2. <PPBODY>	
S7,F4	<i>Process Program Acknowledge</i>	S,H↔E
Description	Acknowledge or error.	
Structure	<ACKC7>	
SECS	0: Accepted.	
Message Error 1:	Permission not granted.	
Codes	2: Length error.	
	3: Matrix overflow.	
	4: PPID not found.	
	5: Mode unsupported.	
	6: Command will be performed with completion signaled later.	
	>6 : Other error	
	7 – 63: Reserved	
S7,F5	<i>Process Program Request</i>	S,H↔E, reply
Description	This message is sent to request the transfer of a process program.	
Structure	<PPID>	

S7,F6	<i>Process Program Data</i>	M,H↔E
Description	This message is used to transfer a process program.	
Structure	I,2 1. <PPID> 2. <PPBODY>	
Exception	A zero-length list means request denied.	
S7,F17	<i>Delete Process Program Send</i>	S,H→E, reply
Description	This message is used by the host to request the equipment to delete process programs from equipment storage.	
Structure	I,n (number of process programs to be deleted) 1. <PPID <sub>1</sub> > · · n. <PPID <sub>n</sub> >	
Exception	If n = 0, then delete all.	
S7,F18	<i>Delete Process Program Send Acknowledge</i>	S,H←E
Description	Acknowledge or error.	
Structure	<ACKC7>	
SECS	0: Accepted.	
Message Error 1:	Permission not granted.	
Codes	2: Length error. 3: Matrix overflow. 4: PPID not found. 5: Mode unsupported. 6: Command will be performed with completion signaled later. >6 : Other error 7 – 63: Reserved	
S7,F19	<i>Current EPPD Request</i>	S,H→E, reply
Description	This message is used to request the transmission of the current equipment process program directory (EPPD). This is a list of all the PPIDs of the process programs stored in the equipment.	
Structure	Header Only	
S7,F20	<i>Current EPPD Data</i>	M,H←E
Description	This message is used to transmit the current EPPD.	
Structure	I,n (number of process programs in the directory) 1. <PPID <sub>1</sub> > · · n. <PPID <sub>n</sub> >	

## 16.9. Stream 9 - Systems Errors

Stream 9 provides a method of informing the host that a message block has been received which cannot be handled or that a timeout on a transaction (receive) timer has occurred. The messages indicate either a Message Fault or a Communications Fault has occurred but do not indicate a Communications Failure has occurred.

### 16.9.1. Message Summary

For Host Initiated Messages:

Primary Message	Description
S9,F0	Abort Transaction

For Equipment Initiated Messages:

Primary Message	Description
S9,F0	Abort Transaction
S9,F1	Unrecognized Device ID
S9,F3	Unrecognized Stream Type
S9,F5	Unrecognized Function Type
S9,F7	Illegal Data
S9,F9	Transaction Timer Time-out
S9,F11	Data too long
S9,F13	Conversation Time-out

### 16.9.1. Message Details

S9,F0	<i>Abort Transaction</i>	S,H↔E
	Description	As with S1,F0, this is used in lieu of an expected reply to abort a transaction.
	Structure	Header Only
S9,F1	<i>Unrecognized Device ID</i>	S,H←E
	Description	The device ID in the message block header did not correspond to any known device ID in the node detecting the error.
	Structure	<MHEAD>
S9,F3	<i>Unrecognized Stream Type</i>	S,H←E
	Description	The equipment does not recognize the stream type in the message block header.
	Structure	<MHEAD>

S9,F5	<i>Unrecognized Function Type</i>	S,H←E
	Description	This message indicates that the receiver does not recognize the function in the message ID.
	Structure	<MHEAD>
S9,F7	<i>Illegal Data</i>	S,H←E
	Description	This message indicates that the stream and function were recognized, but the associated data format could not be interpreted.
	Structure	<MHEAD>
S9,F9	<i>Transaction Timer Timeout</i>	S,H←E
	Description	This message indicates that a transaction (receive) timer has timed out and that the corresponding transaction has been aborted. It is up to the host to respond to this error in an appropriate manner to keep the system operational.
	Structure	<MHEAD>
S9,F11	<i>Data Too Long</i>	S,H←E
	Description	This message to the host indicates that the equipment has been sent more data than it can handle.
	Structure	<MHEAD>
S9,F13	<i>Conversation Timeout</i>	S,H←E
	Description	Data were expected but none were received within a reasonable length of time. Resources have been cleared.
	Structure	I,2 1. <MEXP> 2. <EDID>

## 16.10. Stream 10 - Terminal Services

The function of this stream is to pass textual messages between operator terminals attached to processing and/or testing equipment and the host. The equipment makes no attempt to interpret the text of the message, but merely passes it from terminal keyboard to the host or from the host to the display of the terminal. Management of human response times to information displayed on terminals is the responsibility of the host.

### 16.10.1. Message Summary

For Host Initiated Messages:

Primary Message	Description	Response Message	Description
S10,F0	Abort Transaction		
S10,F3	Terminal Display, Single	S10,F4	Terminal Display, Single Acknowledge
S10,F5	Terminal Display, Multi-block	S10,F6	Terminal Display, Multi-block Acknowledge

For Equipment Initiated Messages:

Primary Message	Description	Response Message	Description
S10,F0	Abort Transaction		
S10,F1	Terminal Request	S10,F2	Terminal Request Acknowledge

### 16.10.2. Message Details

**S10,F0 Abort Transaction** S,H↔E

Description As with S1,F0, this is used in lieu of an expected reply to abort a transaction.

Structure Header Only

**S10,F1 Terminal Request** S,H←E, [reply]

Description A terminal text message to the host.

Structure L,2

1. <TID>

2. <TEXT>

<i>S10,F2</i>	<i>Terminal Request Acknowledge</i>	S,H→E
Description	Acknowledge or error.	
Structure	<ACKC10>	
SECS	0: Accepted for display.	
Message Error 1:	Message will not be displayed.	
Codes	2: Termianl not available.	
	3 – 63: Reserved	
<i>S10,F3</i>	<i>Terminal Display, Single</i>	S,H→E, [reply]
Description	Data to be displayed.	
Structure	L, 2	
	1. <TID>	
	2. <TEXT>	
<i>S10,F4</i>	<i>Terminal Display, Single Acknowledge</i>	S,H←E
Description	Acknowledge or error.	
Structure	<ACKC10>	
SECS	0: Accepted for display.	
Message Error 1:	Message will not be displayed.	
Codes	2: Termianl not available.	
	3 – 63: Reserved.	
<i>S10,F5</i>	<i>Terminal Display, Multi-block</i>	S,H→E, [reply]
Description	Data to be displayed on the equipment's terminal.	
Structure	L, 2	
	1. <TID>	
	2. L, n	
	1. <TEXT <sub>1</sub> >	
	.	
	.	
	n. <TEXT <sub>n</sub> >	
<i>S10,F6</i>	<i>Terminal Display, Multi-block Acknowledge</i>	S,H←E
Description	Acknowledge or error.	
Structure	<ACKC10>	
SECS	0: Accepted for display.	
Message Error 1:	Message will not be displayed.	
Codes	2: Termianl not available.	
	3 – 63: Reserved.	

## 16.11. Stream 14 - Object Services

### 16.11.1. Message Summary

For Host Initiated Messages:

Primary Message	Description	Response Message	Description
S14,F1	GetAttr Request	S14,F2	GetArre Data
S14,F3	SetAttr Request	S14,F4	SetAttr Data
S14,F9	Create Object Request	S14,F10	Create Object Acknowledge

No Equipment Initiated Messages

### 16.11.2. Message Details

S14,F1	<i>GetAttr Request</i>	S,H↔E, reply
Description	This message is used to request a set of specified attributes for one or more objects. It consists of an "object specifier" for the owner of the target objects (the objects of interest), the target object type, a list of identifiers of the target objects, a filter (a list of qualifying relationships) that limits the target objects of interest to those that meet all of the qualifications in the filter, and the specific attributes whose values are requested.	
Structure	<pre> I,5   1. &lt;OBJSPEC&gt;   2. &lt;OBJTYPE&gt;   3. L,i                                i = identifiers of the object  instances requested         1. &lt;OBJID<sub>1</sub>&gt;         .         .         i. &lt;OBJID<sub>i</sub>&gt;         4. L,q                                q = # object qualifiers to match           1. L,3             1. &lt;ATTRID<sub>1</sub>&gt;             2. &lt;ATTRDATA<sub>1</sub>&gt;             3. &lt;ATTRRELN<sub>1</sub>&gt;           .           .           q. L,3             1. &lt;ATTRID<sub>q</sub>&gt;             2. &lt;ATTRDATA<sub>q</sub>&gt;             3. &lt;ATTRRELN<sub>q</sub>&gt;           5. L,a                                a = # attributes requested             1. &lt;ATTRID<sub>1</sub>&gt;             .             .             a. &lt;ATTRID<sub>a</sub>&gt; </pre>	
Exception	If OBJSPEC is a zero-length item, no object specifier is provided. If i = 0, only the filter is to be applied. If q = 0, no filter is specified. If both l and q = 0, information for all instances of the objects are requested. If a = 0, all attributes are requested.	

S14,F2	<i>GetAttr Data</i>	S,H↔E
Description	This message is used to transfer the set of requested attributes for the specified object(s). The order of attributes is retained from the primary message.	
Structure	<pre> L,2   1. L,n          n = number of objects     1. L,2       1. &lt;OBJID<sub>1</sub>&gt;       2. L,a        a = number of attributes         1. L,2           1. &lt;ATTRID<sub>1</sub>&gt;           2. &lt;ATTRDATA<sub>1</sub>&gt;         .         .         a. L,2           1. &lt;ATTRID<sub>a</sub>&gt;           2. &lt;ATTRDATA<sub>a</sub>&gt;         .         .       n. L,2         1. &lt;OBJID<sub>n</sub>&gt;         2. L,b        b = number of attributes           1. L,2             1. &lt;ATTRID<sub>1</sub>&gt;             2. &lt;ATTRDATA<sub>1</sub>&gt;           .           .           b. L,2             1. &lt;ATTRID<sub>b</sub>&gt;             2. &lt;ATTRDATA<sub>b</sub>&gt;         2. L,2           1. &lt;OBJACK&gt;           2. L,p        p = number of errors reported             1. L,2               1. &lt;ERRCODE<sub>1</sub>&gt;               2. &lt;ERRTEXT<sub>1</sub>&gt;             .             .             p. L,2               1. &lt;ERRCODE<sub>p</sub>&gt;               2. &lt;ERRTEXT<sub>p</sub>&gt; </pre>	
Exception	If OBJSPEC is a zero-length item, no object specifier is provided. If n = 0, no objects matched the specified filter. If p = 0, no error were detected.	

```

SECS      OBJACK :
Message Error  0  = Successful completion of requested data
Codes        1  = Error
              >1 Reserved

ERRCODE -- Code identifying an error.

0  = No error
1  = Unknown object in Object Specifier
2  = Unknown target object type
3  = Unknown object instance
4  = Unknown attribute name
5  = Read-only attribute - access denied
(the following values are new in 1996)
6  = Unknown object type
7  = Invalid attribute value
8  = Syntax error
9  = Verification error
10 = Validation error
11 = Object identifier in use
12 = Parameters improperly specified
13 = Insufficient parameters specified
14 = Unsupported option requested
15 = Busy
16 = Not available for processing
17 = Command not valid for current state
18 = No material altered
19 = Materially partially processed
20 = All material processed
21 = Recipe specification-related error
22 = Failed during processing
23 = Failed while not processing
24 = Failed due to lack of material
25 = Job aborted
26 = Job stopped
27 = Job cancelled
28 = Cannot change selected recipe
29 = Unknown event
30 = Duplicate report ID
31 = Unknown data report
32 = Data report not linked
33 = Unknown trace report
34 = Duplicate trace ID
35 = Too many data reports
36 = Sample period out of range
37 = Group size too large
38 = Recovery action currently invalid
39 = Busy with another recovery currently unable to
perform the recovery
40 = No active recovery action
41 = Exception recovery failed
42 = Exception recovery aborted

```

```
43 = Invalid table element
44 = Unknown table element
45 = Cannot delete predefined
46 = Invalid token
(the following value is new in September 1997)
47 = Invalid parameter
0-63 Reserved
```

S14,F3	<i>SetAttr Request</i>	S,H↔E, reply
Description	This message is used to request that a given set of attributes be assigned specified values for all objects of the specified type and exactly matching the specified attribute requirements.	
Structure	L,4	
	1. <OBJSPEC>	
	2. <OBJTYPE>	
	3. L,i	i = number of object instances requested
	1. <OBJID <sub>1</sub> >	
	.	
	.	
	i. <OBJID <sub>i</sub> >	
	4. L,n	n = # attribute settings
	1. L,2	
	1. <ATTRID <sub>1</sub> >	
	2. <ATTRDATA <sub>1</sub> >	
	.	
	.	
	n. L,2	
	1. <ATTRID <sub>n</sub> >	
	2. <ATTRDATA <sub>n</sub> >	
Exception	If OBJSPEC is a zero-length item, no object specifier is provided.	

S14,F4	<i>SetAttr Data</i>	S,H↔E
Description	This message is used to acknowledge that the attributes for the specified objects have been set as requested or to indicate an error for each attribute value that was not set as requested. The order of attributes is retained from the primary message.	
Structure	<pre> L,2   1. L,i                               i = number of objects requested   1. L,2     1. &lt;OBJID<sub>1</sub>&gt;     2. L,n                               n = number of attributes set.       1. L,2         1. &lt;ATTRID<sub>1</sub>&gt;         2. &lt;ATTRDATA<sub>1</sub>&gt;       .       .       n. L,2         1. &lt;ATTRID<sub>n</sub>&gt;         2. &lt;ATTRDATA<sub>n</sub>&gt;       .       .     i. L,2       1. &lt;OBJID<sub>i</sub>&gt;       2. L,n         1. L,2           1. &lt;ATTRID<sub>1</sub>&gt;           2. &lt;ATTRDATA<sub>1</sub>&gt;         .         .       n. L,2         1. &lt;ATTRID<sub>n</sub>&gt;         2. &lt;ATTRDATA<sub>n</sub>&gt;     2. L,2       1. &lt;OBJACK&gt;       2. L,p                               p = number of errors reported         1. L,2           1. &lt;ERRCODE<sub>1</sub>&gt;           2. &lt;ERRTEXT<sub>1</sub>&gt;         .         .       p. L,2         1. &lt;ERRCODE<sub>p</sub>&gt;         2. &lt;ERRTEXT<sub>p</sub>&gt; </pre>	
Exception	If n = 0 for any object, the object was not found. If p = 0, no errors were detected.	
SECS	OBJACK :	
Message Error	0 = Successful completion of requested data	
Codes	1 = Error >1 Reserved	
	ERRCODE -- Code identifying an error.	

0 = No error  
1 = Unknown object in Object Specifier  
2 = Unknown target object type  
3 = Unknown object instance  
4 = Unknown attribute name  
5 = Read-only attribute - access denied  
(the following values are new in 1996)  
6 = Unknown object type  
7 = Invalid attribute value  
8 = Syntax error  
9 = Verification error  
10 = Validation error  
11 = Object identifier in use  
12 = Parameters improperly specified  
13 = Insufficient parameters specified  
14 = Unsupported option requested  
15 = Busy  
16 = Not available for processing  
17 = Command not valid for current state  
18 = No material altered  
19 = Materially partially processed  
20 = All material processed  
21 = Recipe specification-related error  
22 = Failed during processing  
23 = Failed while not processing  
24 = Failed due to lack of material  
25 = Job aborted  
26 = Job stopped  
27 = Job cancelled  
28 = Cannot change selected recipe  
29 = Unknown event  
30 = Duplicate report ID  
31 = Unknown data report  
32 = Data report not linked  
33 = Unknown trace report  
34 = Duplicate trace ID  
35 = Too many data reports  
36 = Sample period out of range  
37 = Group size too large  
38 = Recovery action currently invalid  
39 = Busy with another recovery currently unable to  
perform the recovery  
40 = No active recovery action  
41 = Exception recovery failed  
42 = Exception recovery aborted  
43 = Invalid table element  
44 = Unknown table element  
45 = Cannot delete predefined  
46 = Invalid token  
(the following value is new in September 1997)

47 = Invalid parameter  
0-63 Reserved

S14,F9	<i>Create Object Request</i>	S,H↔E, reply
Description	This message is used to request VGEM to create a control job object. "ControlJob" is currently the only object type supported.	
Structure	<pre>L,3   1. &lt;OBJSPEC&gt;   2. &lt;OBJTYPE&gt;   3. L,a                                a = # of attributes requested     1. L,2       1. &lt;ATTRID<sub>1</sub>&gt;       2. &lt;ATTRDATA<sub>1</sub>&gt;     .     .     a. L,2       1. &lt;ATTRID<sub>a</sub>&gt;       2. &lt;ATTRDATA<sub>a</sub>&gt;     a. (same format as 1.)</pre>	
Exception	If OBJSPEC is a null-length item, no object specifier is provided. If a = 0, no specific attribute settings are requested for the new object.	
S14,F10	<i>Create Object Acknowledge</i>	S,H↔E, reply
Description	This message is used to acknowledge the success or failure of creating the new object specified ("ControlJob").	
Structure	<pre>L,3   1. &lt;OBJSPEC&gt;   2. L,b                                b = number of attributes returned     1. L,2       1. &lt;ATTRID<sub>1</sub>&gt;       2. &lt;ATTRDATA<sub>1</sub>&gt;     .     .     b. L,2       1. &lt;ATTRID<sub>b</sub>&gt;       2. &lt;ATTRDATA<sub>b</sub>&gt;   3. L,2     1. &lt;OBJACK&gt;     2. L,p                                p = number of errors reported       1. L,2         1. &lt;ERRCODE<sub>1</sub>&gt;         2. &lt;ERRTEXT<sub>1</sub>&gt;       .       .       p. L,2         1. &lt;ERRCODE<sub>p</sub>&gt;         2. &lt;ERRTEXT<sub>p</sub>&gt;</pre>	
Exception	If OBJSPEC is a null-length item, no object was created. If b = 0, no attribute of the new object are returned. If p = 0, no errors were detected.	

## 16.12. Stream 16 - Process Management

### 16.12.1. Message Summary

For Host Initiated Messages:

Primary Message	Description	Response Message	Description
S16,F1	Multi-block Process Job Data Inquire	S16,F2	Multi-block Process Job Data Grant.
S16,F3	Process Job Create Request	S16,F4	Process Job Create Acknowledge
S16,F5	Process Job Command Request	S16,F6	Process Job Command Acknowledge
S16,F11	PRJobCreateEnh	S16,F12	PRJobCreateEnh Acknowledge
S16,F13	PRJobDuplicateCreate	S16,F14	PRJobDuplicateCreate Acknowledge
S16,F15	PRJobMultiCreate	S16,F16	PRJobDuplicateCreate Acknowledge
S16,F17	PRJobDequeue	S16,F18	PRJobDequeue Acknowledge
S16,F19	PRGetAllJobs	S16,F20	PRGetAllJobs Send
S16,F21	PRGetSpace	S16,F22	PRGetSpace Send
S16,F23	PRJobSetRecipeVariable	S16,F24	PRJobSetRecipe Variable Acknowledge
S16,F25	PRJobSetStartMethod	S16,F26	PRJobSetStartMethod Acknowledge
S16,F27	Control Job Command Request	S16,F28	Control Job Command Acknowledge
S16,F29	PRSetMtrlOrder	S16,F30	PRSetMtrlOrder Acknowledge

No Equipment Initiated Messages

### 16.12.2. Message Details

- S16,F1 Multi-block Process Job Data Inquire**      S,H↔E, reply
- Description If any of processing management messages are larger than 1 block, then this transaction must precede that message.
- Structure I,2  
1. <DATAID>  
2. <DATALENGTH>

S16,F2	<i>Multi-block Process Job Data Grant</i>	S,H↔E, reply
Description	Message to indicate if permission is granted to transmit a multi-block job data message	
Structure	<GRANT>	
SECS	0: Permission granted.	
Message Error 1:	Busy, try again.	
Codes	2: No space available.	
	3: Duplicate DATAID.	
	> 3: Equipment-specific error code.	
	4 – 63: Reserved	
S16,F3	<i>Process Job Create Request</i>	S,H↔E, reply
Description	This message creates a process job. VGEM automatically assigns a process job ID.	
Structure	L,5 <ul style="list-style-type: none"> <li>1. &lt;DATAID&gt;</li> <li>2. &lt;MF&gt; # &lt;MF&gt; = 0x0d (qty in carriers)</li> <li>3. L,n <ul style="list-style-type: none"> <li>1. &lt;MID<sub>1</sub>&gt;</li> <li>.</li> <li>.</li> <li>n. &lt;MID<sub>n</sub>&gt;</li> </ul> </li> <li>4. L,3 <ul style="list-style-type: none"> <li>1. &lt;PRRECIPEMETHOD&gt;</li> <li>2. &lt;RCPSPEC&gt;</li> <li>3. L,m (m = {c, 2}) <ul style="list-style-type: none"> <li>1. L,2 <ul style="list-style-type: none"> <li>1. &lt;RCPPARN<sub>1</sub>&gt;</li> <li>2. &lt;RCPPARVAL<sub>1</sub>&gt;</li> </ul> </li> <li>.</li> <li>.</li> <li>m. L,2 <ul style="list-style-type: none"> <li>1. &lt;RCPPARN<sub>m</sub>&gt;</li> <li>2. &lt;RCPPARVAL<sub>m</sub>&gt;</li> </ul> </li> </ul> </li> </ul> </li> <li>5. &lt;PRPROCESSSTART&gt;</li> </ul>	
Exception	For the m length list m = 0 may be allowed value depending on the value of PRRECIPEMETHOD.	

S16,F4	<i>Acknowledge or report error in the creation of a process job</i>	S,H↔E, reply
Description	Acknowledge or report error in the creation of a process job.	
Structure	<pre>L,2   1. &lt;PRJOBID&gt;   2. L,2     1. &lt;ACKA&gt;     2. L,n       1. L,2         1. &lt;ERRCODE<sub>1</sub>&gt;         2. &lt;ERRTEXT<sub>1</sub>&gt;       .       .       n. L,2         1. &lt;ERRCODE<sub>m</sub>&gt;         2. &lt;ERRTEXT<sub>m</sub>&gt;</pre>	
Exception	This list may be zero length, generally the case when ACKA indicates success. When ACKA indicates a create failure, the equipment may supply one or more ERRCODEs.	
SECS	ACKA: TRUE is successful, else FALSE.	
Message Error Codes		
S16,F5	<i>Process Job Command Request</i>	S,H→E, reply
Description	Send a job control command to a processing job.	
Structure	<pre>L,4   1. &lt;DATAID&gt;   2. &lt;PRJOBID&gt;   3. &lt;PRCMDNAME&gt;   4. L,n     1. L,2       1. &lt;CPNAME<sub>1</sub>&gt;       2. &lt;CPVAL<sub>1</sub>&gt;     .     .     n. L,2       1. &lt;CPNAME<sub>n</sub>&gt;       2. &lt;CPVAL<sub>n</sub>&gt;</pre>	
Exception	The CPNAME, CPVAL pairs are command parameter identifiers and values; n = 0 is valid for some commands (PRCMDNAME).	

## Chapter 16. SECS-II Messages

S16,F6    *Process Job Command Acknowledge*                                S,H←E

Description    The processing service sends its confirmation for receipt of a processing request.

Structure    L,2  
                1. <PRJOBID>  
                2. L,n    (n = {0,n})  
                        1. L,2  
                                1. <ACKA>  
                                2. L,n     (n = {0,n})  
  1. <ERRCODE<sub>1</sub>>  
  2. <ERRTEXT<sub>1</sub>>  
  .  
  .  
                        n. L,2  
  1. <ERRCODE<sub>n</sub>>  
  2. <ERRTEXT<sub>n</sub>>

Exception    This list n may be zero length.

SECS           ACKA: TRUE is successful, else FALSE.

Message Error  
Codes

S16,F11 *PRJobCreateEnh* S,H→E, reply

Description Request equipment to create a process job with the given PRJOBID.

Structure L,7

1. <DATAID>
2. <PRJOBID>
3. <MF> MF = 13, carrier
4. L,n n = # of carriers
1. L,2
  1. <CARRIERID<sub>1</sub>>
  2. L,j j = # of slots
    1. <SLOTID<sub>1</sub>>
    2. <SLOTID<sub>2</sub>>
    - .
    - j. <SLOTID<sub>j</sub>>
  - .
  - n. L,2
    - 1.<CARRIERID<sub>n</sub>>
    2. L,j j = # of slots
      1. <SLOTID<sub>1</sub>>
      2. <SLOTID<sub>2</sub>>
      - .
      - j. <SLOTID<sub>j</sub>>
5. L,3
  1. <PRRECIPEMETHOD>
  2. <RCPSPEC>
  3. L,m m = # recipe parametrs
    1. L,2
      1. <RCPPARN<sub>1</sub>>
      2. <RCPPARVAL<sub>1</sub>>
    - .
    - m. L,2
      1. <RCPPARN<sub>m</sub>>
      2. <RCPPARVAL<sub>m</sub>>
6. <PRPROCESSSTART>
7. <PRPAUSEEVENT>

S16,F12	<i>PRJobCreateEnh Acknowledge</i>	S,H↔E, reply
Description	This message acknowledges the request and reports any errors in the creation of a process job.	
Structure	<pre>L,2   1. &lt;PRJOBID&gt;   2. L,2     1. &lt;ACKA&gt;     2. L,n       1. L,2         1. &lt;ERRCODE<sub>1</sub>&gt;         2. &lt;ERRTEXT<sub>1</sub>&gt;         .         .       n. L,2         1. &lt;ERRCODE<sub>n</sub>&gt;         2. &lt;ERRTEXT<sub>n</sub>&gt;</pre>	
SECS	ACKA: TRUE is successful, else FALSE.	
Message Error Codes		

S16,F13 *PRJobDuplicateCreate* S,H↔E, reply

Description This message creates multiple process jobs. The same recipe and value of PRProcessStart are applied to each process job.

Structure L,5

1. <DATAID>
2. L,p (p=nbr of process jobs)
  1. L,3
    1. <PRJOBID>
    2. <MF> MF = 13, carrier
    3. L,n
      1. L,2
        - 1.<CARRIERID<sub>1</sub>>
        2. L,j j=nbr of slots
          1. <SLOTID<sub>1</sub>>
          - .
          - j. <SLOTID<sub>j</sub>>
        - .
        - n. L,2
          - 1.<CARRIERID<sub>n</sub>>
          2. L,j j=nbr of slots
            1. <SLOTID<sub>1</sub>>
            - .
            - j. <SLOTID<sub>j</sub>>
        - .
        - .
        - p. (same format as 1.)
      3. L,3
        1. <PRRECIPEMETHOD>
        2. <RCPSPEC>
        3. L,m
          1. L,2
            1. <RCPPARN<sub>1</sub>>
            2. <RCPPARVAL<sub>1</sub>>
          - .
          - m. L,2
            1. <RCPPARN<sub>m</sub>>
            2. <RCPPARVAL<sub>m</sub>>
      4. <PRPROCESSSTART>
      5. <PRPAUSEEVENT>

S16,F14    *PRJobDuplicateCreate Acknowledge*                          S,H↔E, reply

Description    This message creates a process job. VGEM automatically assigns a process job id.

Structure    L,2  
              1. L,m  
                  1. <PRJOBID<sub>1</sub>>  
                  .  
                  .  
                  m. <PRJOBID<sub>m</sub>>  
              2. L,2  
                  1. <ACKA>  
                  2. L,n  
                    1. L,2  
                      1. <ERRCODE<sub>1</sub>>  
                      2. <ERRTEXT<sub>1</sub>>  
                    .  
                    .  
                    n. L,2  
                      1. <ERRCODE<sub>n</sub>>  
                      2. <ERRTEXT<sub>n</sub>>

SECS           ACKA: TRUE is successful, else FALSE.  
Message Error  
Codes

S16,F15 *PRJobMultiCreate* S,H↔E, reply

Description This message creates multiple unique process jobs

Structure L,2

1. <DATAID>
2. L,p p = # of process jobs
  1. L,6
    1. <PRJOBID<sub>1</sub>>
    2. <MF<sub>1</sub>>
    3. L,n
      1. L,2
        - 1.<CARRIERID<sub>1</sub>>
        2. L,j j=# of slots
          1. <SLOTID<sub>1</sub>>
          - .
          - j. <SLOTID<sub>j</sub>>
        - .
      - n. L,2
        - 1.<CARRIERID<sub>n</sub>>
        2. L,j j=# of slots
          1. <SLOTID<sub>1</sub>>
          - .
          - j. <SLOTID<sub>j</sub>>
    4. L,3
      1. <PRRECIPEMETHOD<sub>1</sub>>
      2. <RCPSPEC<sub>1</sub>>
      3. L,m m = n of recipe
        1. L,2
          1. <RCPPARN<sub>1</sub>>
          2. <RCPPARVAL<sub>1</sub>>
          - .
          - .
        - m. L,2
          1. <RCPPARN<sub>m</sub>>
          2. <RCPPARVAL<sub>m</sub>>
      5. <PRPROCESSSTART<sub>1</sub>>
      6. <PRPAUSEEVENT<sub>1</sub>>
      - .
      - .
      - p. (same format as 1.)

S16,F16 *PRJobDuplicateCreate Acknowledge* S,H↔E, reply

Description This message acknowledges the request and reports any errors in the creation of a process job.

Structure L,m

- 1. L,m
  - 1. <PRJOBID<sub>1</sub>>
  - .
  - .
  - m. <PRJOBID<sub>m</sub>>
- 2. L,2
  - 1. <ACKA>
  - 2. L,n
    - 1. L,2
      - 1. <ERRCODE<sub>1</sub>>
      - 2. <ERRTEXT<sub>1</sub>>
    - .
    - .
    - n. L,2
      - 1. <ERRCODE<sub>n</sub>>
      - 2. <ERRTEXT<sub>n</sub>>

SECS ACKA: TRUE is successful, else FALSE.

Message Error

Codes

S16,F17 *PRJobDequeue* S,H↔E, reply

Description This message removes process jobs from the equipment for jobs that not begun processing

Structure L,m

- 1. <PRJOBID<sub>1</sub>>
- .
- .
- m. <PRJOBID<sub>m</sub>>

Exception If m = 0 , dequeue all jobs.

S16,F18	<i>PRJobDequeue Acknowledge</i>	S,H↔E, reply
Description	This message acknowledges the request to de-queue and report any errors.	
Structure	<pre>L,2   1. L,m     1. &lt;PRJOBID<sub>1</sub>&gt;     .     .     m. &lt;PRJOBID<sub>m</sub>&gt;   2. L,2     1. &lt;ACKA&gt;     2. L,n       1. L,2         1. &lt;ERRCODE<sub>1</sub>&gt;         2. &lt;ERRTEXT<sub>1</sub>&gt;       .       .       n. L,2         1. &lt;ERRCODE<sub>n</sub>&gt;         2. &lt;ERRTEXT<sub>n</sub>&gt;</pre>	
S16,F19	<i>PRGetAllJobs</i>	S,H↔E, reply
Description	This message requests VGEM to return a list of all process jobs which have not completed.	
Structure	Header only.	
S16,F20	<i>PRGetAllJobs Send</i>	S,H↔E, reply
Description	This message creates a process job. VGEM automatically assigns a process job ID.	
Structure	<pre>L,m   1. L,2     1. &lt;PRJOBID<sub>1</sub>&gt;     2. &lt;PRSTATE<sub>1</sub>&gt;   .   .   m. L,2     1. &lt;PRJOBID<sub>m</sub>&gt;     2. &lt;PRSTATE<sub>m</sub>&gt;</pre>	
Exception	If m = 0, then no process jobs are running or waiting to run.	
S16,F21	<i>PRGetSpace</i>	S,H↔E, reply
Description	This message requests VGEM to return the number of process jobs it has space to create.	
Structure	Header only.	

S16,F22	<i>PRGetSpace Send</i>	S,H↔E, reply
Description	This message is used to return to the host the number of process jobs which can be created.	
Structure	<PRJOBSPACE>	
S16,F23	<i>PRJobSetRecipeVariable</i>	S,H↔E, reply
Description	This message sets the value of recipe variable parameters for a specific process job.	
Structure	L,2 1. <PRJOBID> 2. L,m                                    m = # recipe variables 1. L,2 2. <RCPPARVAL <sub>1</sub> > . . m. L,2 1. <RCPPARNM <sub>m</sub> > 2. <RCPPARVAL <sub>m</sub> >	
S16,F24	<i>PRJobSetRecipe Variable Acknowledge</i>	S,H↔E, reply
Description	This message returns the status of the request to set recipe variables.	
Structure	L,2 1. <ACKA> 2. L,n 1. L,2 2. <ERRCODE <sub>1</sub> > 2. <ERRTEXT <sub>1</sub> > . . n. L,2 1. <ERRCODE <sub>n</sub> > 2. <ERRTEXT <sub>n</sub> >	
Exception	If n = 0, no errors exist.	
S16,F25	<i>PRJobSetStartMethod</i>	S,H↔E, reply
Description	This message is used to request VGEM to change the start method (USERSTART or AUTO) for one or more process jobs.	
Structure	L,2 1. L,m                                    m = # of jobs 1. <PRJOBID <sub>1</sub> > . . m. <PRJOBID <sub>m</sub> > 2. <PRPROCESSSTART>	

- S16,F26 *PRJobSetStartMethod Acknowledge* S,H↔E, reply
- Description This message acknowledges the request to set job start method and returns any errors.
- Structure L,2
- 1. L,m m = # of jobs
    - 1. <PRJOBID<sub>1</sub>>
    - .
    - .
    - m. <PRJOBID<sub>m</sub>>
  - 2. L,2
    - 1. <ACKA>
    - 2. L,n
      - 1. L,2
        - 1. <ERRCODE<sub>1</sub>>
        - 2. <ERRTEXT<sub>1</sub>>
        - .
        - .
      - n. L,2
        - 1. <ERRCODE<sub>n</sub>>
        - 2. <ERRTEXT<sub>n</sub>>
- S16,F27 *Control Job Command Request* S,H↔E, reply
- Description This message sends a control job command to a specific control job.
- Structure L,3
- 1. <CTLJOBID>
  - 2. <CTLJOBCMD>
  - 3. L,2
    - 1. <CPNAME>
    - 2. <CPVAL>
- Exception “3. L,2 is L,0” for commands that do not need parameters.
- S16,F28 *Control Job Command Acknowledge* S,H↔E, reply
- Description This message indicates success or failure of command request to a control job.
- Structure L,2
- 1. <ACKA>
  - 2. L,2
    - 1. <ERRCODE>
    - 2. <ERRTEXT>
- SECS ACKA: TRUE is successful, else FALSE.
- Message Error Codes

S16,F29	<i>PRSetMtrlOrder</i>	S,H↔E, reply
Description	This message requests VGEM to use a specific order in which materials are processed. The only supported order is LIST.	
Structure	<PRMTRLORDER>	
S16,F30	<i>PRSetMtrlOrder Acknowledge</i>	S,H↔E, reply
Description	This message acknowledges the request for change to the material order processing. The only supported order is LIST.	
Structure	<ACKA>	
SECS	ACKA: TRUE is successful, else FALSE.	
Message Error Codes		

# Chapter 17. Event Reports

## 17.1. Default Reports

The SECS II standard calls for a means to define reports and associate them with collection events. This is done via the S2F33, S2F35, and S2F37 messages. VGEM supports each of these messages and maintains the report definitions.

VGEM provides a number of default reports, which will typically be overwritten when communications with the host is initiated, and the host defines custom reports. TSEM requires that the system have a set of default reports. This is helpful for the case where the host has not been configured or the host is being simulated, a set of default reports exists. The default reports are tailored for VGEM and not the same as the default reports specified in the TSEM.

Listed below are the set of default reports and their variables for each tester platform. Details on each variable can be found in Chapter 19.

Default Report Summary:

spname	RPTID	VIDs	Description
GEMPORT	6000	1300 1400 1450 1360 2860 2340 2270 2500 2520 2700	
GEMPORT	6001	1300 1400 1510 1200 2860 1190 1450 1330 1360 2500 2520 2700	Setup
GEMPORT	6002	1560 1300 1400 1510 1200 2860 1580 1190 1450 1360 2500 2520 2700	Lot Complete
GEMPORT	6003	1360 1300 1560 1400 2340 2270 1310 2500 2520 2700	SubLot Complete
GEMPORT	6004	1360 1300 1560 1400 2860 2500 2520 2700	Process
GEMPORT	6005	1360 1400 2860 2500 2520 2700	Lot/SubLot
GEMPORT	6006	1360 1400 2210 2860 2220	Diagnostics
GEMPORT	6007	1360 1300 1395 1560 1400 2340 2270 1310 2500 2520 2700	PP-BADCOMPILE
GEMPORT	6101	83729 83730	portid carrierid
GEMPORT	6102	1370 1020	portid carrierid
GEMPORT	6103	1370 83730 83740	portid carrierid slotmap
GEMPROBER	1	0x00012002 (=73730)	Prober Default Report CarrierID
GEMPROBER	2	0x0001200c (=73740)	Prober Default Report SlotMap
GEMPROBER	3	0x00012001 (=73729)	Prober Default Report PortID
GEMPROBER	4	108	Prober Default Report JobID

## Chapter 17. Event Reports

spname	CEID	RPTID	spname	CEID	RPTID
GEMPORT	13004	6101	GEMPROBER	4008	3
GEMPORT	14503	6101	GEMPROBER	4009	3
GEMPORT	14507	6101	GEMPROBER	4503	1
GEMPORT	14510	6101	GEMPROBER	4503	3
GEMPORT	14513	6103	GEMPROBER	4504	1
GEMPORT	14514	6103	GEMPROBER	4504	3
GEMPORT	14515	6103	GEMPROBER	4506	1
GEMPORT	14516	6103	GEMPROBER	4506	3
GEMPORT	14530	6101	GEMPROBER	4507	1
GEMPORT	5063	6005	GEMPROBER	4507	3
GEMPORT	5102	6003	GEMPROBER	4508	1
GEMPORT	5103	6102	GEMPROBER	4508	3
GEMPORT	5104	6003	GEMPROBER	4509	1
GEMPORT	5106	6003	GEMPROBER	4509	3
GEMPORT	5107	6003	GEMPROBER	4510	1
GEMPORT	5124	6102	GEMPROBER	4510	3
GEMPORT	5129	6003	GEMPROBER	4511	1
GEMPORT	5150	6003	GEMPROBER	4511	3
GEMPORT	5151	6003	GEMPROBER	4513	1
GEMPORT	5152	6003	GEMPROBER	4513	2
GEMPORT	5153	6002	GEMPROBER	4513	3
GEMPORT	5153	6003	GEMPROBER	4514	1
GEMPORT	5153	6004	GEMPROBER	4514	2
GEMPORT	5154	6003	GEMPROBER	4514	3
GEMPORT	5155	6002	GEMPROBER	4515	1
GEMPORT	5155	6003	GEMPROBER	4515	3
GEMPORT	5155	6004	GEMPROBER	4516	1
GEMPORT	5156	6003	GEMPROBER	4516	3
GEMPORT	5157	6001	GEMPROBER	4518	1
GEMPORT	5157	6003	GEMPROBER	4518	3
GEMPORT	5161	6001	GEMPROBER	4519	1
GEMPORT	5161	6003	GEMPROBER	4519	3
GEMPORT	5164	6003	GEMPROBER	4520	1
GEMPORT	5165	6001	GEMPROBER	4520	3
GEMPORT	5165	6003	GEMPROBER	4521	1
GEMPORT	5165	6004	GEMPROBER	4521	3
GEMPORT	5171	6003	GEMPROBER	4530	1
GEMPORT	5175	6102	GEMPROBER	4530	3
			GEMPROBER	700	4
			GEMPROBER	701	4
			GEMPROBER	702	4
			GEMPROBER	708	4
			GEMPROBER	711	4

## Chapter 18. Collection Events

Collection Events are described as an event or set of related events occurring on the tester that warrant notification of the host. There is a collection event defined for every transition depicted on the equipment and port state transition diagrams.

The Collection Event ID's (CEID's) for the equipment state transitions are composed by adding 5000 to the transition number (e.g. Transition 1 from INIT to IDLEREADY is represented as CEID 5001). CEID's for port state transitions are composed by adding 5100 to the transition number. The control and spooling transition CEIDs are designated by the 4000 series included in the table. Process Job transition CEIDs are designated by 5900 series, Control Job transition CEIDs by 5800 series and tester alarms by the 7000 series.

Event reports received from the prober will be forwarded to the host with a CEID value that is 10000 higher than the CEID value sent by the prober.

Collection Events sent from the prober will be passed on to the host if those events are not disabled by the host. The VGEM will add 10000 to the prober's collection event ID to ensure the collection event is unique and does not duplicate a tester CEID. The following table lists the known prober collection events, the CEID that the VGEM will send to the host and the description of that event.

The prober is responsible for maintaining the Load Port Transfer and Access Mode state models. In each case, collection events related to the state model will be passed through to the host if they are enabled. Requests for the current state will be forwarded to the prober. These requests may come in the form of S1,F3 messages from the host or arise from the need to present a report to the host (via a Stream 6 function) that contains the variable holding the current state.

## 18.1. VGEM and Prober Events Mappings

The following table lists prober collection events that have a special interest to the VGEM. See the prober's documentation for a full listing of their collection events.

Table 18-1. VGEM/Prober CEID Mapping

VGEM	Prober	Description	VGEM	Prober	Description
10700	700	JobCreated	15001	5001	E90 - No state to AT SOURCE
10701	701	JobCancel	15002	5002	E90 - AT SOURCE to AT WORK
10702	702	JobStarted	15003	5003	E90 - AT WORK to AT SOURCE
10708	708	JobComplete	15004	5004	E90 - AT WORK to AT WORK
10711	711	EndStopping	15005	5005	E90 - AT WORK to AT DESTINATION
13004	3004	Port1AccessEnd	15006	5006	E90 - AT DESTINATION to AT WORK
13104	3104	Port2AccessEnd	15007	5007	E90 - AT DESTINATION to Extinction
14008	4008	ReadyToLoad	15008	5008	E90 - AT DESTINATION to AT SOURCE
14009	4009	ReadyToUnload	15009	5009	E90 - SUBSTRATE to Extinction
14503	4503	CarrierIDHostVerifyWait	15020	5020	E90 - No state to NEEDS PROCESSING
14504	4504	CarrierIDVerifyOK	15021	5021	E90 - NEEDS PROCESSING to IN PROCESS
14506	4506	CarrierIDEqVerifyOK	15022	5022	E90 - IN PROCESS to PROCESSING COMPLETE
14507	4507	CarrierIDHostVerifyWait	15023	5023	E90 - IN PROCESS to NEEDS PROCESSING
14508	4508	CarrierIDVerificationOK	15024	5024	E90 - IN PROCESS to IN PROCESS
14509	4509	CarrierIDVerificationFail	15025	5025	E90 - NEEDS PROCESSING to PROCESSING COMPLETE
14510	4510	NoCarrierIDHostVerifyWait	15051	5051	E90 - Into OCCUPIED state
14511	4511	CarrierIDEqVerifyOK	15052	5052	E90 - Into UNOCCUPIED state
14513	4513	SlotEqVerifyOK			
14514	4514	SlotMapWaitingForHost			
14515	4515	SlotMapVerifyOK			
14516	4516	SlotMapVerifyFail			
14518	4518	CarrierAccessInAccess			
14519	4519	CarrierAccessComplete			
14520	4520	CarrierAccessStopped			
14521	4521	CarrierObjectTerminated			
14530	4530	CarrierIDReadFailure			
14531	4531	CarrierIDRead_NoCarrierObject			

## 18.2. Collection Events Sorted by CEID

Table 18-2. Events Sorted by CEID

CEID	name	description
4000	Control State OFF-LINE	The Control State has become OFF-LINE.
4001	Control State LOCAL	The Control State has become LOCAL.
4002	Control State REMOTE	The Control State has become REMOTE.
4015	Operator Command Issued	The Operator has issued a command.
4020	Operator Equipment Constant Change	The Operator has changed an Equipment Constant.
4080	Spooling Activated	Spooling has been activated.
4081	Spooling Deactivated	Spooling has been deactivated.
4083	Spool Transmit Failure	There has been a failure while attempting to transmit spooled data.
4100	Terminal Services Operator Display Acknowledge	The operator has acknowledged a Terminal Services Display.
5000	WORKSTATIONREADY_TO_INIT	Initialization of the tester has begun.
5001	INIT_TO_IDLEREADY	All tester initialization is complete with no alarms or error conditions.
5002	IDLEREADY_TO_PROCESSING	The tester has received a PP-SELECT command.
5006	PROCESSING_TO_STOPPING	The tester has received a STOP command.
5007	PROCESSING_TO_ABORTING	An abort command has been received.
5008	PROCESSING_TO_ALARMPAUSED	An alarm has been reported by the prober or tester that requires feedback.
5009	PROCESSING_TO_PAUSING	The tester has received a PAUSE command.
5011	CHECKING_TO_PROCESSING	The tester has reported that processing has been resumed.
5012	STOPPING_TO_IDLEREADY	The tester cleanup is complete.
5013	PAUSE_TO_STOPPING	The tester has received a STOP command from the host via S2F41 STOP.
5014	PAUSE_TO_ABORTING	The tester has received an ABORT command.
5015	STOPPING_TO_ABORTING	The tester has received an ABORT command. Time spent in the ABORTING state is extremely brief before transitioning thru the ABORTED state to the IDLEREADY state.
5016	ABORTING_TO_ABORTED	The tester has reported that processing has been aborted. ABORTED is always a pass-through state. Time spent in the ABORTED state is extremely brief before transitioning to the IDLEREADY state.
5017	ABORTED_TO_IDLEREADY	Used as a pass-through transition between ABORTING and IDLEREADY.
5018	IDLE_TO_IDLEWITHALARMS	An alarm has been set by the tester or prober.
5019	IDLEWITHALARMS_TO_IDLE	All alarms have been cleared and no testing is in process.
5020	PAUSING_TO_PAUSED	The tester has reported that it has successfully paused its processing.
5021	PROCESSPAUSE_TO_ALARMPAUSED	An alarm has been set by the prober or tester.
5022	ALARMPAUSED_TO_PAUSED	All alarms have been cleared and the equipment has returned to its PAUSED state.
5033	CHECKING_TO_PAUSED	The tester has returned to the paused state.
5034	PAUSED_TO_CHECKING	A RESUME command was received from the host via S2F41 RESUME.
5035	IDLE_TO_WORKSTATIONREADY	The tester executive has stopped.
5036	ABORTED_TO_WORKSTATIONREADY	The operator has aborted the tester executive.
5037	IDLEWITHALARMS_TO_WORKSTATIONREADY	An ABORT has been received from the host via S2F41 ABORT. The tester will re-initialize while the host and VGEM continue running and communicating.

CEID	name	description
5060	PROCESSING_TO_IDLEREADY	Processing has completed on both ports.
5062	IDLEREADY_TO_IDLENOTREADY	The tester has reported that it is in a state that allows continuity and diagnostic tests.
5063	IDLENOTREADY_TO_IDLEREADY	Tester has completed continuity or diagnostic testing and has returned to normal processing state.
5102	STANDBY_TO_SETTINGUP	The host or operator has executed a PP-SELECT command.
5103	SETTINGUP_TO_READY	All PP-SELECT activity has completed and the tester is ready to receive a START command.
5104	READY_TO_STARTING	The host or operator has executed a START command.
5106	STOPPORTSTATE_TO_STANDBY	The tester has received an abort command.
5107	ABORTPORTSTATE_TO_STANDBY	The tester has received a stop command.
5124	SUBLOTCOMPLETE_TO_PENDINGCOMPLETE	The processing of the current lot has completed normally. The lot may be retested or closed.
5129	READY_TO_STANDBY	Processing of the lot has been cancelled.
5150	LOTSTART_TO_SUBLOTSTART	A subplot is a wafer. The tester has started operations to test a wafer.
5151	SUBLOTSTART_TO_DIESTART	Testing of the first die on the current subplot has begun.
5152	DIESTART_TO_DIEEND	Testing of a die on the current subplot has completed.
5153	DIEEND_TO_SUBLOTCOMPLETE	Testing of all dies on the current subplot has completed.
5154	DIEEND_TO_DIESTART	Testing of a subsequent die on the current subplot has begun.
5155	SUBLOTSTART_TO_SUBLOTCOMPLETE	Processing of the current wafer has been completed.
5156	SUBLOTCOMPLETE_TO_SUBLOTSTART	The next wafer in the FOUP is being started.
5157	PENDINGCOMPLETE_TO_LOTCOMPLETE	The tester has reported the completion of the lot.
5158	PENDINGCOMPLETE_TO_RESETUP	The host or LMP executed a new PP-SELECT command.
5161	PENDINGCOMPLETE_TO_SUBLOTSTART	The host or operator has requested the RETEST of the lot.
5164	SETTINGUP_TO_STANDBY	The tester cannot compile the recipe for this wafer test.
5165	SUBLOTCOMPLETE_TO_LOTCOMPLETE	The tester has completed processing of the current lot. LOTCOMPLETE is a pass thru state in this case.
5171	STARTING_TO_LOTSTART	The tester has reported that processing of the lot has started.
5172	LOTCOMPLETE_TO_RELEASEING	The tester has reported the completion of processing of the lot.
5173	RELEASEING_TO_RELEASED	The prober has reported the completion of processing on the port.
5174	RELEASED_TO_STANDBY	The prober has reported the clearing of the port.
5175	RESETUP_TO_REREADY	The tester has validated the new PP-SELECT.
5176	RESETUP_TO_PENDINGCLOSE	The tester has rejected the new PP-SELECT.
5177	READY_TO_PENDINGCLOSE	The tester has reported the cancellation of the new run.
5178	PENDINGCLOSE_TO_RESETUP	The host or LMP has executed a PP-SELECT command.
5179	STARTING_TO_READY	The tester has reported the inability of the prober to handle the recipe.
5181	REREADY_TO_STARTING	The host or operator has requested the START of the lot.
5182	RESETUP_TO_PENDINGCLOSE	The tester has completed a request from the host to abort a Process Job.
5183	REREADY_TO_PENDINGCLOSE	The tester has completed a request from the host to abort a Process Job.
5184	SETTINGUP_TO_STANDBY	The tester has completed a request from the host to abort a Process Job.
5185	READY_TO_STANDBY	The tester has completed a request from the host to abort a Process Job.
5186	STARTING_TO_SUBLOTSTART	The tester has started operations to test a wafer after a new process job started.
5187	LOTCOMPLETE_TO_RESETUP	The tester has received a PP-SELECT command in the lot complete state.

CEID	name	description
5188	WORKING_TO_PENDINGCOMPLETE	The tester has completed a request from the host to abort a Process Job.
5190	STARTING_TO_STANDBY	The tester has received a PJAbort while waiting to begin testing.
5206	IDNOTREAD_TO_IDVERIFICATIONOK	The prober has reported its verification of a Carrier ID.
5207	IDNOTREAD_TO_IDWAITINGFORHOST	The prober has reported a new Carrier ID for host verification.
5208	IDWAITINGFORHOST_TO_IDVERIFICATIONOK	The prober has reported the verification of a Carrier ID.
5209	IDWAITINGFORHOST_TO_IDVERIFICATIONFAIL	The prober has reported the failure to verify a Carrier ID.
5221	CARRIEROBJECT_TO_NOCARRIEROBJECT	The prober has reported the deletion of a Carrier object.
5313	SLOTMAPNOTREAD_TO_SLOTMAPVERIFICATIONOK	The prober has reported its verification of a Slot Map.
5314	SLOTMAPNOTREAD_TO_SLOTMAPWAITINGFORHOST	The prober has reported a new Slot Map for host verification.
5315	SLOTMAPWAITINGFORHOST_TO_SLOTMAPVERIFICATIONOK	The prober has reported the verification of a Slot Map.
5316	SLOTMAPWAITINGFORHOST_TO_SLOTMAPVERIFICATIONFAIL	The prober has reported the failure to verify a Slot Map.
5418	NOTACCESSED_TO_INACCESS	The prober has reported the accessing of a Carrier.
5419	INACCESS_TO_CARRIERCOMPLETE	The prober has reported the completing of a Carrier.
5420	INACCESS_TO_CARRIERSTOPPED	The prober has reported the stopping of a Carrier.
5502	NOTRESERVED_TO_RESERVED	The prober has reported the reservation of a Port to a Carrier.
5503	RESERVED_TO_NOTRESERVED	The prober has reported the unreservation of a Port from its Carrier.
5602	NOTASSOCIATED_TO_ASSOCIATED	The prober has reported the association of a Port to a Carrier.
5603	ASSOCIATED_TO_NOTASSOCIATED	The prober has reported the disassociation of a Port from a Carrier.
5701	RECIPE_TUNED_OK	Recipe tuning on a process job succeeded.
5702	RECIPE_TUNED_FAILED	Recipe tuning on a process job failed.
5703	PJPAUSEREQUEST	SPECS has requested a process job pause.
5704	CJPAUSEREQUEST	SPECS has requested a control job pause.
5901	NONE_TO_QUEUED/POOLED	A process job was created.
5902	QUEUED/POOLED_TO_SETTINGUP	A process job is in set up state.
5903	SETTINGUP_TO_WAITINGFORSTART	A process job is awaiting a start command.
5904	SETTINGUP_TO_PROCESSING	A process job is in process.
5905	WAITINGFORSTART_TO_PROCESSING	A process job is in process.
5906	PROCESSING_TO_PROCESSCOMPLETE	A process job has completed.
5907	PROCESSCOMPLETE_TO_NONE	A process job has been deleted.
5908	EXECUTING_TO_PAUSING	A process job is pausing.
5909	PAUSING_TO_PAUSED	A process job has paused.
5910	PAUSED_TO_EXECUTING	A process job has resumed.
5911	EXECUTING_TO_STOPPING	A process job is stopping.
5912	PAUSE_TO_STOPPING	A process job is stopping.
5913	EXECUTING_TO_ABORTING	A process job is aborting.
5914	STOPPING_TO_ABORTING	A process job is aborting.
5915	PAUSE_TO_ABORTING	A process job is aborting.
5916	ABORTING_TO_NONE	A process job has been deleted.
5917	STOPPING_TO_NONE	A process job has been deleted.

CEID	name	description
5918	QUEUED/POOLED_TO_NONE	A process job has been deleted.
5801	NONE_TO_QUEUED	A control job was created.
5802	QUEUED_TO_NONE	A control job is canceled aborted or stopped from QUEUED state.
5803	QUEUED_TO_SELECTED	A control job is selected for processing.
5804	SELECTED_TO_QUEUED	A control job is deselected.
5805	SELECTED_TO_EXECUTING	A control job is in process - autostart.
5806	SELECTED_TO_WAITINGFORSTART	A control job is awaiting a start command.
5807	WAITINGFORSTART_TO_EXECUTING	A control job has been started.
5808	EXECUTING_TO_PAUSED	A control job is paused.
5809	PAUSED_TO_EXECUTING	A control job has resumed.
5810	EXECUTING_TO_COMPELTED	A control job has completed normally.
5811	ACTIVE_TO_COMPLETED	An active control job is stopped.
5812	ACTIVE_TO_ABORTED	An active control job is aborted.
5813	COMPLETED_TO_NONE	A control job is deleted.
7000	Alarm Set: CustomAlarm	The Alarm: CustomAlarm has been set.
7001	Alarm Clr: CustomAlarm	The Alarm: CustomAlarm has been cleared.
7002	Alarm Set: EquipNotResponding	The Alarm: EquipNotResponding has been set.
7003	Alarm Clr: EquipNotResponding	The Alarm: EquipNotResponding has been cleared.
7006	Alarm Set: HWInitError	The Alarm: HWInitError has been set.
7007	Alarm Clr: HWInitError	The Alarm: HWInitError has been cleared.
7008	Alarm Set: OCRIDError	The Alarm: OCRIDError has been set.
7009	Alarm Clr: OCRIDError	The Alarm: OCRIDError has been cleared.
7012	Alarm Set: ProberSetup	The Alarm: ProberSetup has been set.
7013	Alarm Clr: ProberSetup	The Alarm: ProberSetup has been cleared.
7016	Alarm Set: WaferHandling	The Alarm: WaferHandling has been set.
7017	Alarm Clr: WaferHandling	The Alarm: WaferHandling has been cleared.
7020	Alarm Set: UnexpectedMaterial	The Alarm: UnexpectedMaterial has been set.
7021	Alarm Clr: UnexpectedMaterial	The Alarm: UnexpectedMaterial has been cleared.

## Chapter 19. Variable Listings

VGEM maintains GEM, TSEM, E40 and E94 variables. These variables fall into three categories: Status Variables, Data Variables and Equipment Constants. These variables are maintained in an in-memory database. Each variable has a variable ID.

### 19.1. Status Variables

Table 19-1. Status Variables

varID	value TSN	Variable Name	Description
870	U4	SpoolCountActual	The number of messages currently in the spool queue.
871	U4	SpoolCountTotal	The total number of messages that have been spooled -- including those that have been discarded.
872	A	SpoolFullTime	The clock time at which the spooler last became full.
873	A	SpoolStartTime	The clock time at which spooling last became active.
877	A	SpoolStreamFns	The list of SnFm message types that are spooled. Set by S2F43
2000	L	AlarmsEnabled	The list of alarms that have been enabled for reporting.
2010	L	AlarmsSet	The list of alarms that are ON (in an unsafe state on the equipment).
2020	U4	AlarmsState	The value of the latest alarm transition Collection Event ID.
2030	L	BaseConfig	Base tester configuration listing all physical heads and sites.
2040	L	CalDate	Date of last successful calibration.
2050	L	CalFixtureID	ID of calibration fixture in current configuration.
2060	L	CallInterval	Time limit between calibrations.
2070	L	CalStatus	Status of last calibration (1=OK).
2080	A	CarrierID1	Identifier of the FOUP on port 1.
2090	A	CarrierID2	Identifier of the FOUP on port 2.
2095	L	CJStateList	List of the current state of all Control Jobs.
2096	U4	CJ_QueueAvailableSpace	List of the available space in the ControlJob queue.
2097	L	CJ_QueuedCJobs	List of the Control Jobs present in the queued state.
2098	A	CJ_ObjID1	The Object ID attribute for the current Control Job on port 1.
2099	L	CJ_CurrentPRJob1	The Current Process Job attribute for the current Control Job on port 1.
2101	A	CJ_DataCollectionPlan1	The Data Collection Plan attribute for the current Control Job on port 1.
2102	L	CJ_CarrierInputSpec1	The Carrier Input Spec attribute for the current Control Job on port 1.
2103	L	CJ_MtrlOutSpec1	The Material Out Spec attribute for the current Control Job on port 1.
2104	L	CJ_MtrlOutbyStatus1	The Material Out by attribute for the current Control Job on port 1.
2105	L	CJ_PauseEvent1	The Pause Event attribute for the current Control Job on port 1.
2106	L	CJ_ProcessingCtrlSpec1	The Processing Control attribute for the current Control Job on port 1.
2107	A	CJ_ProcessOrderMgmt1	The Process Order Management attribute for the current Control Job on port 1.
2108	TF	CJ_StartMethod1	The Start Method attribute for the current Control Job on port 1.
2109	A	CJ_State1	The State attribute for the current Control Job on port 1.
2111	A	CJ_ObjID2	The Object ID attribute for the current Control Job on port 2.
2112	L	CJ_CurrentPRJob2	The Current Process Job attribute for the current Control Job on port 2.

## Chapter 19. Variable Listings

varID	value TSN	Variable Name	Description
2113	A	CJ_DataCollectionPlan2	The Data Collection Plan attribute for the current Control Job on port 2.
2114	L	CJ_CarrierInputSpec2	The Carrier Input Spec attribute for the current Control Job on port 2.
2115	L	CJ_MtrlOutSpec2	The Material Out Spec attribute for the current Control Job on port 2.
2116	L	CJ_MtrlOutbyStatus2	The Material Out by attribute for the current Control Job on port 2.
2117	L	CJ_PauseEvent2	The Pause Event attribute for the current Control Job on port 2.
2118	L	CJ_ProcessingCtrlSpec2	The Processing Control attribute for the current Control Job on port 2.
2119	A	CJ_ProcessOrderMgmt2	The Process Order Management attribute for the current Control Job on port 2.
2121	TF	CJ_StartMethod2	The Start Method attribute for the current Control Job on port 2.
2122	A	CJ_State2	The State attribute for the current Control Job on port 2.
2123	L	CJ_PRJobStatusList1	List of the current state of all Process Jobs attribute for the current Control Job on port 1.
2124	L	CJ_PRJobStatusList2	List of the current state of all Process Jobs attribute for the current Control Job on port 2.
2125	A	ExecuteAttribute1	Attribute for handling StartFlag EQ LE GE
2126	A	ExecuteAttribute2	Attribute for handling StartFlag EQ LE GE
2127	A	ExecutionLevel1	Used to control execution of Process Jobs on Port 1 based on StartFlag
2128	A	ExecutionLevel2	Used to control execution of Process Jobs on Port 2 based on StartFlag
2130	A	IWCondition1	The pause condition for in-a-wafer.
2131	A	IWCondition2	The pause condition for in-a-wafer.
2132	A	IWNumOfDies1	Number of Die designated when IWCondition is NDIE and THLD.
2133	A	IWNumOfDies2	Number of Die designated when IWCondition is NDIE and THLD.
2134	A	IWDieLabel1	Die Label designated when IWCondition is CDIE.
2135	A	IWDieLabel2	Die Label designated when IWCondition is CDIE.
2136	A	IWJudgeRule1	Judgement rule designated when IWCondition is THLD .
2137	A	IWJudgeRule2	Judgement rule designated when IWCondition is THLD .
2138	A	IWJudgeTLevel1	Threshold for Judgement rule designated when IWCondition is THLD .
2139	A	IWJudgeTLevel2	Threshold for Judgement rule designated when IWCondition is THLD .
2141	A	BWCondition1	The pause condition for between-wafers.
2142	A	BWCondition2	The pause condition for between-wafers.
2143	A	BWNumOfWafs1	Number of wafers designated when BWCondition is NWAF and THLW.
2144	A	BWNumOfWafs2	Number of wafers designated when BWCondition is NWAF and THLW.
2145	A	BWafID1	Wafer ID designated when BWCondition is CWAF.
2146	A	BWafID2	Wafer ID designated when BWCondition is CWAF.
2147	A	BWJudgeRule1	Judgement rule designated when BWCondition is THLW.
2148	A	BWJudgeRule2	Judgement rule designated when BWCondition is THLW.
2149	A	BWJudgeTLevel1	Threshold for Judgement rule designated when BWCondition is THLW.
2151	A	BWJudgeTLevel2	Threshold for Judgement rule designated when BWCondition is THLW.
2152	A	PJECondition1	The pause condition for end-of-PJ.
2153	A	PJECondition2	The pause condition for end-of-PJ.
2154	A	PJEJudgeRule1	Judgement rule designated when PJECondition is PFLT.
2155	A	PJEJudgeRule2	Judgement rule designated when PJECondition is PFLT.

varID	value TSN	Variable Name	Description
2156	A	PJEJudgeTLevel1	Threshold for Judgement rule designated when PJECondition is PFLT.
2157	A	PJEJudgeTLevel2	Threshold for Judgement rule designated when PJECondition is PFLT.
2158	A	AdaptiveMethod1	SPECSs behavior for adaptive test.
2159	A	AdaptiveMethod2	SPECSs behavior for adaptive test.
2161	A	RecipeFName1	Recipe file name.
2162	A	RecipeFName2	Recipe file name.
2163	A	TestCondFName1	Test condition file name.
2164	A	TestCondFName2	Test condition file name.
2165	A	CondLevel1	Test condition level.
2166	A	CondLevel2	Test condition level.
2167	A	WaferAbort1	Abort wafer flag.
2168	A	WaferAbort2	Abort wafer flag.
2169	A	MeasLibName1	Measurement library name.
2171	A	MeasLibName2	Measurement library name.
2172	A	DeviceLibName1	Device library name.
2173	A	DeviceLibName2	Device library name.
2174	A	MeasLibNames1	The list of measurement libraries for current test on port 1.
2175	A	MeasLibNames2	The list of measurement libraries for current test on port 2.
2176	A	TcoFNames1	The list of test plan constant files for current test on port 1.
2177	A	TcoFNames2	The list of test plan constant files for current test on port 2.
2100	A	CLOCK	The value of the equipment hardware clock. The format is YYYYMMDDhhmmss.
2071	U2	CompatibilityMode	Compatibility with non E40 E94 job control installations.
2110	A	ConfigInfo	Configuration information.
2120	U4	ConfigInfoType	Configuration information source (0=Auto 1=Manual/File.)
2140	U1	ControlState	The value of the current control state. 0 = Offline; 1 = Online
2150	A	CurrentOCRState	Current OCR state.
2160	A	Datalog	Datalog used.
2170	A	DatalogConfig1	Data log configuration for port 1.
2180	A	DatalogConfig2	Data log configuration for port 2.
2190	L	DiagDate	Date of last diagnostic execution.
2200	L	DiagFixtureID	ID of diagnostic fixture in current configuration. (Not used in SPECS-FA)
2210	L	DiagFixtureList	List of current diagnostic calibration and test boards in current configuration. (Not used in SPECS-FA)
2220	L	DiagStatus	Status of last diagnostic (1=OK 0=Failure.)
2230	A	DieSpecFileName1	The list of die specification file names for the current test on port 1.
2240	A	DieSpecFileName2	The list of die specification file names for the current test on port 2.
2250	A	DieTestSpecNames1	The list of pairs of die file names and test file names for the current test on port 1.
2260	A	DieTestSpecNames2	The list of pairs of die file names and test file names for the current test on port 2.
2270	L	DockingStatus	Whether the handler is currently docked. 0 = Yes 1 = No. (Not used in SPECS-FA)

## Chapter 19. Variable Listings

varID	value TSN	Variable Name	Description
2280	A	DPRCRevision	The revision of the DPRC software. (Not used in SPECS-FA)
2290	A	EquipName	The external name of the equipment.
2300	A	EquipSerialID	The serial number identifier of the equipment.
2310	L	EventDescriptions	The list of events (CEIDs and descriptions defined for the equipment).
2320	L	EventsEnabled	The list of events that have been enabled for reporting.
2330	A	FileType	File type.
2340	U4	HandlerComStatus	The status of the communications link between handler/s (0=Disabled; 1=1-way enabled; 2=2-way enabled; 3=Not communicating). (Not used in SPECS-FA)
2350	L	HeadConfig	Number of sites currently configured per head. (Not used in SPECS-FA)
2360	A	LightPoleStatus	Color/status (i.e. Red/flash.)
2370	A	LimitFileName1	The name of the limit file associated with the testing on port 1.
2380	A	LimitFileName2	The name of the limit file associated with the testing on port 2.
2390	A	LoadBoard	The type of Loadboard currently on the tester. (Not used in SPECS-FA)
2400	A	LotID1	The identification of the lot currently under test on port 1.
2410	A	LotID2	The identification of the lot currently under test on port 2.
2420	A	MDLN	Equipment model type.
2430	A	OCRMode	OCR reading mode on prober.
2440	A	OperatorID1	The identifier of the operator who is responsible for the lot on port 1.
2450	A	OperatorID2	The identifier of the operator who is responsible for the lot on port 2.
2460	A	PCMRevision	The revision of PCM software. (Not used in SPECS-FA)
2465	L	PJStateList	List of the current state of all Process Jobs.
2466	A	PJ_ObjID1	The Object ID attribute for the current Process Job on port 1.
2467	L	PJ_PauseEvent1	The Pause Event IDs attribute for the current Process Job on port 1.
2468	A	PJ_PRJobState1	The State attribute for the current Process Job on port 1.
2469	L	PJ_PRMtlNameList1	The Material Name List attribute for the current Process Job on port 1.
2471	B	PJ_PRMtlType1	The Material Type attribute for the current Process Job on port 1.
2472	TF	PJ_PRProcessStart1	The Process Start attribute for the current Process Job on port 1.
2473	U1	PJ_PRRRecipeMethod1	The Recipe Method attribute for the current Process Job on port 1.
2474	A	PJ_RecID1	The Recipe ID attribute for the current Process Job on port 1.
2475	L	PJ_RecVariableList1	The list of variables supporting a recipe method for the current Process Job on port 1.
2476	A	PJ_ObjID2	The Object ID attribute for the current Process Job on port 2.
2477	L	PJ_PauseEvent2	The Pause Event IDs attribute for the current Process Job on port 2.
2478	A	PJ_PRJobState2	The State attribute for the current Process Job on port 2.
2479	L	PJ_PRMtlNameList2	The Material Name List attribute for the current Process Job on port 2.
2481	B	PJ_PRMtlType2	The Material Type attribute for the current Process Job on port 2.
2482	TF	PJ_PRProcessStart2	The Process Start attribute for the current Process Job on port 2.
2483	U1	PJ_PRRRecipeMethod2	The Recipe Method attribute for the current Process Job on port 2.
2484	A	PJ_RecID2	The Recipe ID attribute for the current Process Job on port 2.
2485	L	PJ_RecVariableList2	The list of variables supporting a recipe method for the current Process Job on port 2.

varID	value TSN	Variable Name	Description
2486	U4	PJ_AvailableSpace	number of process jobs that the host can create
2487	U4	TSClock_AvailableSpace	Number of TS-Clock object that the host can create
2470	U4	PortState	The enumeration of the most-recently reported port state.
2480	A	PortStateName	The string value of the most-recently reported port state.
2490	U4	PortState1	The enumeration of the current state of port 1.
2500	A	PortStateName1	The string value of the current state of port 1.
2502	A	PortAssociationStateName1	The string value of the current association state of port 1.
2503	A	PortAssociationStateName2	The string value of the current association state of port 2.
2504	A	PortReservationStateName1	The string value of the current reservation state of port 1.
2505	A	PortReservationStateName2	The string value of the current reservation state of port 2.
2510	U4	PortState2	The enumeration of the current state of port 2.
2520	A	PortStateName2	The string value of the current state of port 2.
2530	A	PPExecName1	The name of the current working process program on port 1.
2540	A	PPExecName2	The name of the current working process program on port 2.
2550	U4	PreviousPortState	The enumeration of the state preceding the most-recently reported port state.
2560	A	PreviousPortStateName	The string value of the state preceding the most-recently reported port state.
2570	U4	PreviousPortState1	The enumeration of the immediately previous state of port 1.
2580	A	PreviousPortStateName1	The string value of the immediately previous state of port 1.
2590	U4	PreviousPortState2	The enumeration of the immediately previous state of port 2.
2600	A	PreviousPortStateName2	The string value of the immediately previous state of port 2.
2610	U1	PreviousProcessState	The enumeration of the immediately previous process state of the equipment.
2620	A	PreviousProcessStateName	The string value of the immediately previous process state of the equipment.
2625	A	ProbeCardFound	Probe card on system.
2630	A	ProberRecipeFileName1	The prober recipe for the lot on port 1.
2640	A	ProberRecipeFileName2	The prober recipe for the lot on port 2.
2650	A	ProbeSpecFileName1	The name of the probe specification file name for the lot on port 1.
2660	A	ProbeSpecFileName2	The name of the probe specification file name for the lot on port 2.
2670	A	ProcessName1	The name of the process for the lot on port 1.
2680	A	ProcessName2	The name of the process for the lot on port 2.
2690	U1	ProcessState	The enumeration of the current processing state of the equipment.
2700	A	ProcessStateName	The string value of the current processing state name of the equipment.
2710	A	ProductID1	The ID of the product for which tester is currently configured for the lot on port 1.
2720	A	ProductID2	The ID of the product for which tester is currently configured for the lot on port 2.
2725	A	RecipePath	The directory path where tester recipes will be uploaded to/downloaded from.
2726	A	RecipeFile	The directory path where the master tester recipe file is located

## Chapter 19. Variable Listings

varID	value TSN	Variable Name	Description
2730	A	RequestedOCRState	The new OCR state requested by the host or from the panel.
2740	A	RequiredProbeCardType1	The type of probe card required to perform the current test on port 1.
2750	A	RequiredProbeCardType2	The type of probe card required to perform the current test on port 2.
2760	A	SOFTREV	The equipments software revision number.
2770	A	SortType	Sort Type.
2780	A	StationID	Station ID.
2790	A	SubLotID1	The subplot currently being processed on port 1.
2800	A	SubLotID2	The subplot currently being processed on port 2.
2805	A	TestBoardID	List by head of the IDs of current test boards or probe cards.
2810	L	TestBoardIDList	List of lds in current test board configuration. Usually the same value as TestBoardID.
2820	L	TestBoardSiteID	X and Y coordinates of the head sites within testboard or probe card.
2830	L	TesterID	Tester ID.
2840	A	TestFileDependentParameters1	Last set of test file dependent parameters received for port 1.
2850	A	TestFileDependentParameters2	Last set of test file dependent parameters received for port 2.
2860	L	TestHeadID	The ID of each test head.
2870	L	TestHeadStatus	List of test head/status pairs (Status: 0=disabled 1=enabled 2=not available.) (Not used in SPECS-FA)
2880	A	TestPlanName1	The name of the test plan associated with the test on port 1.
2890	A	TestPlanName2	The name of the test plan associated with the test on port 2.
2900	A	TestSpecFileName1	The name of the test specification file name associated with the test on port 1.
2910	A	TestSpecFileName2	The name of the test specification file name associated with the test on port 2.
2915	L	VirtualID	ID of each virtual configuration. (Not used in SPECS-FA)
2920	A	VOSRevision	The revision of VOS firmware.
2930	A	WaferList1	The list of wafer ids to be tested in the lot on port 1.
2940	A	WaferList2	The list of wafer ids to be tested in the lot on port 2.
2943	A	WaferSlotMap1	The list of slots containing wafers in the foup on port 1.
2946	A	WaferSlotMap2	The list of slots containing wafers in the foup on port 2.
2950	U4	WaferSlotUnderTest1	The wafer slot currently being tested on port 1.
2960	U4	WaferSlotUnderTest2	The wafer slot currently being tested on port 2.
2965	U1	SubstIDReadState	VGEM internal use only status.
2970	A	WaferSpecFileName1	The name of the wafer specification file for the lot on port 1.
2975	L	SubstIDConfirmationResult1	Substrate ID Confirmation Result on port 1.
2980	A	WaferSpecFileName2	The name of the wafer specification file for the lot on port 2.
2985	L	SubstIDConfirmationResult2	Substrate ID Confirmation Result on port 2.
2990	A	WfFileRevision	The revision of Wf File.
10001	A	ModelName	Same as data item MDLN.
10002	A	SoftRevision	Same as data item SOFTREV.
10003	A	OperatorName	Name of user. Space 16-byte under log-out state.
10004	U2	OperatorLevel	1 = General operator 2 = Process engineer 3 = Equipment engineer 4 = Service engineer 5 = Super user

varID	value TSN	Variable Name	Description
10005	L	AlarmsEnabled	L n 1.<ALID1> : n.<ALIDn> n : Number of ALIDs to be reported
10006	L	AlarmsSet	L n 1.<ALID1> : n.<ALIDn> n : Number of ALIDs to be reported
10007	A	CLOCK	YYYYMMDDhhmmsscc
10008	B	ControlState	L n 1.<PortState 1> : n.<PortState n> n : Number of ports of the equipment
10009	L	EventsEnabled	L n 1.<CEID1> : n.<CEIDn> n : Number of CEID to be reported
10010	L	PPExecName	L n 1.<PPID1> : n.<PPIDn> n : Number of PPID to be reported Currently n=1
10011	U2	SpoolCountActual	The number of messages in storage
10012	U2	SpoolCountTotal	The number of messages in storage
10013	A	SpoolFullTime	Same as Status variable CLOCK.
10014	A	SpoolStartTime	Same as Status variable CLOCK.
10015	L	JobAll	L n 1.L 2 1.<ProberJobID> 2.<ProberJobState> : n.L 2 1.<ProberJobID> 2.<ProberJobState> n : Number of jobs that the equipment currently holds.
10016	U2	ChargeableState	0=Undefined 1=CHARGE DISABLED 2=CHARGE ENABLED
10017	U1	ProcessState	0=Undefined 1=INIT 2=IDLE 3=IDLE with ALARMS 4=MAINTENANCE 5=SETTING UP 6=EXECUTING 7=PAUSING 8=PAUSED 9=CHECKING 10=PAUSED SETTING UP 11=ALARM PAUSED 12=STOPPING 13=ABORTING
10018	U1	PreviousProcess	0=Undefined 1=INIT 2=IDLE 3=IDLE with ALARMS 4=MAINTENANCE 5=SETTING UP 6=EXECUTING 7=PAUSING 8=PAUSED 9=CHECKING 10=PAUSED SETTING UP 11=ALARM PAUSED 12=STOPPING 13=ABORTING
10020	L	PortStateList	L n 1.<PortState 1> : n.<PortState n> n : Number of ports of the equipment
10022	B	PreviousControl	L n 1.<PortState 1> : n.<PortState n> n : Number of ports of the equipment
10023	U2	SpoolState	0=Spool Inactive 1=Spool Active
10024	U2	SpoolUnloadSub	0=Spool Inactive 1=Spool Active
10025	U2	SpoolLoadSub	5=Spool Not Full 6=Spool Full
11020	U2	Port1State	0=Undefined 1=PORT DISABLED 2=PORT EMPTY 3=PORT NO ACCESS 4=PORT IN ACCESS 5=PORT ACCESS END
11021	U2	Port2State	0=Undefined 1=PORT DISABLED 2=PORT EMPTY 3=PORT NO ACCESS 4=PORT IN ACCESS 5=PORT ACCESS END
11022	L	CassetteMap1	L[n] 1.<WaferPresence1> : : n.<WaferPresencen> (Note) n : 0 13 25 26 n = 0 is the data until the cassette map is completed. n = 13 25 26 corresponds to cassette slot numbers. <WaferPresence>: Refer to the data item Wafer Presence.
11023	L	CassetteMap2	L[n] 1.<WaferPresence1> : : n.<WaferPresencen> (Note) n : 0 13 25 26 n = 0 is the data until the cassette map is completed. n = 13 25 26 corresponds to cassette slot numbers. <WaferPresence>: Refer to the data item Wafer Presence.
11100	U2	AlarmState	0=Undefined 1=NO ALARM 2=ALARM
11500	A	ChuckTempSetPoint	-100.0 ~ 200.0
11501	A	ChuckTempActual	-100.0 ~ 200.0
11510	A	CardName	Trace Not an object Name of the probe card currently installed on the equipment.
11511	A	CardId	ID of the probe card currently installed on the equipment.

## Chapter 19. Variable Listings

varID	value TSN	Variable Name	Description
11512	U4	ContactAct	The accumulated number of times of contacts by the probe card currently installed on the equipment.
11513	U4	ContactLimit	Limit value to the accumulated number of times of contacts by probe card.
11520	A	CurrentProcessProgramId	Specified a process program that uses <ProberJobID> previously specified. The PPID will be a combination of Structure class Class and recipe name while inserting [slash (/)] between each two of them such as Structure class / Class name / Recipe name.
11521	A	PreviousProcessProgramId	Specified a process program that uses <ProberJobID> previously specified. The PPID will be a combination of Structure class Class and recipe name while inserting [slash (/)] between each two of them such as Structure class / Class name / Recipe name.
11530	U4	TotalProcessedWafer	Addition counter value of processed wafer in the equipment.
11531	U8	TotalProcessedDie	Addition counter value of processed die in the equipment.
75553	U1	LP1AccessMode	Desired access mode of Load Port 1. 0=Manual. 1=Auto
75554	A	LP1CarrierID	ID number of a carrier of Load Port 1
75555	A	LP1LocationID	Location ID of Load Port 1
75556	U1	LP1AssociationState	Association State of Load Port 1. 0=Not Associated. 1=Associated.
75557	U1	LP1PortID	ID of Load Port 1
75558	L	LP1PortStateInfo	PortAssociationState combined with the PortTransferState for Load Port 1.
75559	U1	LP1PortTransferState	0=OUT OF SERVICE 1=TRANSFER BLOCKED 2=READY TO LOAD 3=READY TO UNLOAD
75560	U1	LP1LoadPortReservationState	1=NOT RESERVED 2=RESERVED
75563	L	LP1SlotMap	List of Slot Status of Load Port 1 as provided by the host until a successful slot map read or as read by the equipment.
75585	U1	LP2AccessMode	Desired access mode of Load Port 2. 0=Manual. 1=Auto
75586	A	LP2CarrierID	ID number of a carrier of Load Port 2
75587	A	LP2LocationID	Location ID of Load Port 2
75588	U1	LP2AssociationState	Association State of Load Port 2. 0=Not Associated. 1=Associated.
75589	U1	LP2PortID	ID of Load Port 2
75590	L	LP2PortStateInfo	PortAssociationState combined with the PortTransferState for Load Port 2.
75591	U1	LP2PortTransferState	0=OUT OF SERVICE 1=TRANSFER BLOCKED 2=READY TO LOAD 3=READY TO UNLOAD
75592	U1	LP2LoadPortReservationState	1=NOT RESERVED 2=RESERVED
75595	L	LP2SlotMap	List of Slot Status of Load Port 2 as provided by the host until a successful slot map read or as read by the equipment.
75617	L	CarrierLocationMatrix	Matrix of carrier locations.
75618	L	PortAssociationStateList	List of all PortAssociationStates.
75619	L	PortList	List of all PortIDs.
75620	L	PortStateInfoList	List of all PortStateInfo.
75621	L	PortTransferStateList	List of all PortTransferState.
5100	A	ToHostCEID	CEID to send to host

## 19.2. Data Variables

Table 19-2. Data Variables

varID	value TSN	Variable Name	Description
1000	A	AlarmDetails	Details of the alarm in AlarmID as passed up from the equipment.
1010	U4	AlarmID	The ALID of the alarm most recently sent to the host.
1020	A	CarrierID	Identification of the most-recently handled FOUP.
1022	A	CJPauseReason	The reason a control job pause request was issued by equipment to vgem.
1030	L	ClassCnt	List of counts for all the classes defined for the equipment (e.g.GOOD BAD).(Not used in SPECS-FA)
1040	L	ClassID	List of bin classes on equipment. (Not used in SPECS-FA)
1050	L	ClassName	Name tag for high-level class information. (Not used in SPECS-FA)
1060	A	CurrentDieFileName	The location and name of the current/last die test result file written to disk.
1070	A	CurrentWaferResultFile	The location and name of the current/last wafer test result file written to disk.
1080	A	DatalogConfig	The file location to which processing data is written.
1090	L	DeviceUnitID	Unit serial number of the device under test.
1100	A	DieEndTime	YYYYMMDDhhmmss. The time the most-recent die test ended. 0 if no die in the current lot has completed and when no lot is in process.
1110	U4	DiePositionXUnderTest	The X position on the die of the most-recently reported test.
1120	U4	DiePositionYUnderTest	The Y position on the die of the most-recently reported test.
1130	A	DieStartTime	YYYYMMDDhhmmss. The time the most-recent die test started. 0 if no die in the current lot has been started and when no lot is in process.
1140	A	DieSpecFileName	The list of die specification file names for the current test.
1150	A	DieTestSpecNames	The list of pairs of die file names and test file names for the current test.
1160	U4	ECIDChangeName	The last equipment constant ECID
1170	A	EventText	A text description of the Collection Event most recently sent to the host.
1180	L	EventLimit	The LIMITID(s) of the limit reached by LimitVariable(s).
1182	A	ExecuteAttribute	Attribute for handling StartFlag EQ LE GE
1184	A	ExecutionLevel	Used to control execution of Process Jobs based on StartFlag
1190	L	ExecutionCnt	Number of test executives since last reset for the current PPID and current lot at this test-site.
1200	L	HardBinCnt	List of hard bins defined for the current test and the number of devices each contains.
1210	L	HardBinID	List of test-site hard bin numbers for the current test.
1220	L	HardBinName	List of Test-site hard bin names. Same as 1200 unless hard bins have names as well as numbers.
1223	A	JobState1	The current job state of port 1.
1224	A	JobState2	The current job state of port 2.
1230	U4	LastDiePositionXTested	The X position tested immediately before the current test.
1240	U4	LastDiePositionYTested	The Y position tested immediately before the current test.
1250	A	LastWaferIDTested	The wafer id tested immediately before the current test.
1260	U4	LastWaferSlotTested	The wafer slot tested immediately before the current test.
1270	A	LimitFileName	The limit file name for the last port reported.

## Chapter 19. Variable Listings

varID	value TSN	Variable Name	Description
1280	U4	LimitVariable	The VID of the variable whose value most recently changed monitoring zones.
1290	A	LotEndTime	YYYYMMDDhhmmss. The time the most-recent lot ended. 0 if no lot has been started and while a lot is in process.
1300	A	LotID	The identification of the lot currently under test.
1310	A	LotProcessingTime	hh:mm:ss The time since the start of the current lot in seconds. 0 if no lot is in process.
1320	A	LotStartTime	YYYYMMDDhhmmss. The time the lot was started. 0 if no lot is in process.
1330	L	LotUnitOutput	Hard bin output for a specific site by lot.
1340	A	PendingCompleteTime	YYYYMMDDhhmmss. The time the lot reached PENDINGCOMPLETE state. 0 if no lot has been started and while a lot is in process.
1350	U4	OperatorCommand	The last remote command issued from the Panel since the control_mode became REMOTE.
1352	A	PJPauseReason	The reason a pause request was issued by equipment to vgem.
1353	A	PJPauseValue	The parameter value that caused a pause request issued by equipment to vgem.
1360	A	OperatorID	The identifier of the most-recently reported Operator.
1370	U1	PortID	The port associated with the most recent port activity. 1 or 2.
1380	A	PPChangeName	The Process Program ID affected by the creation
1390	U1	PPChangeStatus	The action taken on PPChangeName 1=create 2=edit 3=deleted.
1395	A	PPBadCompileCode	Error code returned on a PPBadCompile event
1396	A	PPError	Error code returned on a PPBadCompile event
1400	A	PPEexecName	The name of the current working process program.
1410	A	ProbeCardTypeFound	Description of probe card type.
1420	A	ProberRecipeFileName	The name of the Prober Recipe in use for the active lot.
1430	A	ProbeSpecFileName	The name of the probe specification file in use for the active lot.
1440	A	ProcessName	The name of the process in use for the active lot.
1450	A	ProductID	The ID of the product for which the tester is currently configured.
1460	A	RequiredProbeCardType	The type of probe card required to perform the current test.
1470	U1	ResultOfLastDie	Pass (1) or Fail (0).
1480	U1	ResultOfLastSubLot	Pass (1) or Fail (0).
1490	L	RetestWafers	List of wafers to be retested.
1500	L	SiteContacts	List of number of contacts for each site on each head.
1510	L	SoftBinCnt	List of soft bins defined for the current test and the number of devices each contains.
1520	L	SoftBinID	List of test-site soft bin numbers. Not relevant if soft bins are not enumerated.
1530	L	SoftBinName	List of test-site soft bin names.
1540	A	StartTestPortID	Start test source (e.g.hand keyboard host.)
1550	A	SubLotEndTime	YYYYMMDDhhmmss. The time the subplot ended. 0 if no lot is in process or no subplot has completed.
1560	A	SubLotID	The subplot currently being processed.
1570	A	SubLotStartTime	YYYYMMDDhhmmss. The time the subplot started. 0 if no lot is in process or no subplot has been started.

varID	value TSN	Variable Name	Description
1580	U4	SubLotUnitOutput	The bin output for each site by subplot.
1600	L	TestBoardSiteContacts	Number of contacts since last reset for each site on each head.
1610	L	TestBoardSiteInserts	Insertion count on a test board site. Specific to socket type sites.
1620	L	TestBoardSiteStatus	Availability of each site on each Test board (1=enabled 0=disabled). Related to remote commands DISABLE-SITE and ENABLE-SITE.
1630	L	TestBoardStatus	Test board availability (1=enabled)
1640	A	TestFileDependentParameters	Last set of test file dependent parameters received.
1650	A	TestPlanName	The name of the test plan associated with the current test.
1660	A	TestSpecFileName	The name of the test specification file for the current test.
1670	B	TransitionType	The direction of limits zone transition. (0=low to high; 1=high to low.
1680	A	ValueOfLastDie	String containing various result values for the die.
1690	A	ValueOfLastSubLot	String containing various result values for the subplot.
1700	L	VirtualConfig	Current virtual configuration listing all virtual Ids. Not applicable for current testers.
1710	A	WaferList	The list of wafer ids being tested in the current lot.
1715	A	WaferSlotMap	The list of slots containing wafers in the foup for the current lot.
1720	U4	WaferSlotUnderTest	The wafer slot currently being tested.
1730	A	WaferSpecFileName	The name of the wafer specification file for the current test.
1740	A	CJ_ObjID	The Object ID attribute for the current Control Job.
1741	L	CJ_CurrentPRJob	The Current Process Job attribute for the current Control Job.
1742	A	CJ_DataCollectionPlan	The Data Collection Plan attribute for the current Control Job.
1743	L	CJ_CarrierInputSpec	The Carrier Input Spec attribute for the current Control Job.
1744	L	CJ_MtrlOutSpec	The Material Out Spec attribute for the current Control Job.
1745	L	CJ_MtrlOutbyStatus	The Material Out by attribute for the current Control Job.
1746	L	CJ_PauseEvent	The Pause Event attribute for the current Control Job.
1747	L	CJ_ProcessingCtrlSpec	The Processing Control attribute for the current Control Job.
1748	U1	CJ_ProcessOrderMgmt	The Process Order Management attribute for the current Control Job.
1749	TF	CJ_StartMethod	The Start Method attribute for the current Control Job.
1750	U1	CJ_State	The State attribute for the current Control Job.
1751	A	PJ_ObjID	The Object ID attribute for the current Process Job.
1752	L	PJ_PauseEvent	The Pause Event IDs attribute for the current Process Job.
1753	U1	PJ_PRJobState	The State attribute for the current Process Job.
1754	L	PJ_PRMtlNameList	The Material Name List attribute for the current Process Job.
1755	B	PJ_PRMtlType	The Material Type attribute for the current Process Job.
1756	TF	PJ_PRProcessStart	The Process Start attribute for the current Process Job.
1757	U1	PJ_PRRecipeMethod	The Recipe Method attribute for the current Process Job.
1758	A	PJ_RecID	The Recipe ID attribute for the current Process Job.
1759	L	PJ_RecVariableList	The list of variables supporting a recipe method for the current Process Job.
1760	L	CJ_PRJobStatusList	List of the current state of all Process Jobs attribute for the current Control Job.
1770	A	lWCondition	The pause condition for in-a-wafer.

## Chapter 19. Variable Listings

varID	value TSN	Variable Name	Description
1771	A	IWNumOfDies	Number of Die designated when IWCondition is NDIE and THLD.
1772	A	IWDieLabel	Die Label designated when IWCondition is CDIE.
1773	A	IWJudgeRule	Judgement rule designated when IWCondition is THLD .
1774	A	IWJudgeTLevel	Threshold for Judgement rule designated when IWCondition is THLD.
1775	A	BWCondition	The pause condition for between-wafers.
1776	A	BWNumOfWafs	Number of wafers designated when BWCondition is NWAF and THLW.
1777	A	BWafID	Wafer ID designated when BWCondition is CWAF.
1778	A	BWJudgeRule	Judgement rule designated when BWCondition is THLW.
1779	A	BWJudgeTLevel	Threshold for Judgement rule designated when BWCondition is THLW.
1780	A	PJECondition	The pause condition for end-of-PJ.
1781	A	PJEJudgeRule	Judgement rule designated when PJECondition is PFLT.
1782	A	PJEJudgeTLevel	Threshold for Judgement rule designated when PJECondition is PFLT.
1783	A	AdaptiveMethod	SPECSs behavior for adaptive test.
1784	A	RecipeFName	Recipe file name.
1785	A	TestCondFName	Test condition file name.
1786	A	CondLevel	Test condition level.
1787	A	WaferAbort	Abort wafer flag.
1788	A	MeasLibName	Measurement library name.
1789	A	DeviceLibName	Device library name.
1790	A	MeasLibNames	The list of measurement libraries.
1791	A	TcoFNNames	The list of test plan constant files.
10100	U4	AlarmID	Alarm identification ID
10101	U4	ECChangeID	Equipment constant ID
10102	L	EventLimit	L n 1.<LIMITID1> : n.<LIMITIDn> n = Number of LIMITIDs that have caused a zone transition.
10103	U4	LimitVariable	Variable ID
10104	U2	OperatorCommand	0:JOB_CREATE (Not executable at present) 1:PP-SELECT (Not executable at present) 2:JOB_CANCEL (Not executable at present) 3:START (Not executable at present) 4:PAUSE 5:RESUME 6:STOP 7:ABORT 8:ONLINE-LOCAL 9:ONLINE-REMOTE
10105	A	PPChangeName	Fixed to the same as data item PPID. If PPID is smaller than 46 bytes specify the PPID with front-aligned and spaced added to its end to fill shortage.
10106	U1	PPChangeStatus	1 = Create; 2 = Edit; 3 = Delete
10107	B	TransitionType	1 = Lower to Upper; 2 = Upper to Lower
10108	A	EventJobID	Process job identifier. Character string that can be printed. Duplication of ProberJobID process of process JOBS simultaneously existing in the equipment is prohibited.
10109	U2	EventJobState	0 Undefined; 1 JOB CREATED; 2 JOB SET UP; 5 JOB PROCESSING; 6 JOB STOPPING; 7 JOB ABORTING
10110	L	EventJobTime	L 2 1.<CLOCK 1> 2.<CLOCK 2> <CLOCK 1> Starting time <CLOCK 2> Completion time Note: If the time is not fixed delete spaces.

varID	value TSN	Variable Name	Description
10111	L	EventJobRcp	L n 1.<PPID1> : n.<PPIDn> n = Number of PP IDs to be used by a same job.
10112	A	EventWaferJobID	Process job identifier. Character string that can be printed. Duplication of ProberJobID process of process JOBs simultaneously existing in the equipment is prohibited.
10114	U2	EventWaferState	0 Undefined; 1 UNPROCESSED; 2 IN PROCESS; 3 PROCESSED
10115	A	EventWaferProcID	Process ID assigned to the job.
10116	B	EventWaferLoc	Cassette station (port) number
10117	A	EventWaferProdID	Product name assigned to the job. (Process name)
10118	A	EventWaferSlotNo	Slot number in which wafer is stored. Format is 01 to 26.
10119	A	EventWaferWaferNo	Number allocated to identify wafers.
10120	A	EventWaferWaferID	ID allocated to identify wafer. However because a maximum of 25 bytes are valid in the equipment data after the 26th byte is ignored.
10121	A	EventWaferIDType	Specifies which of the following data to use as the wafer identifier. SLOTNO or WAFERNO or WAFERID
10122	A	EventWaferWaferSize	Wafer diameter. Units : [mm]
10123	A	EventWaferFlat	Flat orientation shape of wafer FLAT or NOTCH
10124	A	EventWaferFlatAngle	Flat orientation angle of wafer
10125	U2	EventWaferRow	Die matrix size in rows
10126	U2	EventWaferColumn	Die matrix size of wafer in line direction
10127	A	EventWaferDieSizeX	X direction die size
10128	A	EventWaferDieSizeY	Y direction die size
10129	A	EventWaferRefCoordX	X coordinate of reference die
10130	A	EventWaferRefCoordY	Y coordinate of reference die
10131	A	EventWaferRefPosX	X coordinate of reference die
10132	A	EventWaferRefPosY	Y coordinate of reference die
10133	B	EventWaferBinList	BIN Value List that determines PASS/FAIL of die.
10134	B	EventWaferDataResult	BIN test results
10140	B	EventWaferEndLoc	Cassette station (port) number
10141	A	EventWaferEndSlotNo	Slot number in which wafer is stored. Format is 01 to 26.
10142	A	EventWaferEndWaferID	ID allocated to identify wafer. However because a maximum of 25 bytes are valid in the equipment data after the 26th byte is ignored.
10150	B	WaferMovedCurrentPosition	Wafer position in the equipment. 0 = Unknown 1 = Carrier on Port 1 2 = Carrier on Port 2 6 = Upper transfer arm 7 = Lower transfer arm 8 = Sub chuck 9 = Main chuck
10151	B	WaferMovedPreviousPosition	Wafer position in the equipment. 0 = Unknown 1 = Carrier on Port 1 2 = Carrier on Port 2 6 = Upper transfer arm 7 = Lower transfer arm 8 = Sub chuck 9 = Main chuck
10152	A	WaferMovedWaferId	ID allocated to identify wafer. However because a maximum of 25 bytes are valid in the equipment data after the 26th byte is ignored.
10160	I2	EventDieCoodX	X coordinate of the die which has state conversion.
10161	I2	EventDieCoodY	Y coordinate of the die which has state conversion.
10162	A	EventDieWaferId	ID allocated to identify wafer. However because a maximum of 25 bytes are valid in the equipment data after the 26th byte is ignored.
10172	TF	AlarmCode	bit 8 = 1 Alarm set. bit 8 = 0 Alarm cleared.

## Chapter 19. Variable Listings

varID	value TSN	Variable Name	Description
10173	U2	TraceID	Trace request ID
10174	A	EventName	Character string which represents an event that has taken place.
10175	L	TransferredFileName	L n 1.<FileName 1> : 2.<FileName n> n : Number of transferred files.
10209	A	PreviousOperatorName	Name of user. Space 16-byte under log-out state.
10211	U2	PreviousOperatorLevel	1 = General operator 2 = Process engineer 3 = Equipment engineer 4 = Service engineer 5 = Super user
10212	U2	PreviousPortState	0 = Undefined 1 = PORT DISABLED 2 = PORT EMPTY 3 = PORT NO ACCESS 4 = PORT IN ACCESS 5 = PORT ACCESS END
10221	L	EventSlotNo	L n 1.L 2 1.<SLOTNO1> 2.<WAFERID1> : n.L 2 1.<SLOTNOn> 2.<WAFERIDn> n : Number of wafers whose state changed simultaneously.
10223	B	EventJobLoc	Cassette station (port) number
10224	A	EventJobProdId	Product name assigned to the job. (Process name)
10225	A	EventJobNoOfWafer	The number of wafers stored in a cassette.
10226	U1	EventJobTestType	Specification of detail process type in case of re-measurement. It is rendered valid when marking is selected in TEST_TYPE.
10227	U1	EventJobTestTypeA	1: Inspects all chips 2: Only inspects paths. 3: Only inspects failed chips. 4: Only inspects specified bins. data item WAFERID. Specification of detail process type in case of re-measurement. It is rendered valid when re-measurement is selected in TEST_TYPE.
10228	U1	EventJobTestTypeB	1: Only marks failed chips. 2: Only marks specified bins. Specification of detail process type in case of re-measurement. It is rendered valid when marking is selected in TEST_TYPE.
10229	L	EventJobTestBin	Bin that is an object of marking process. It is rendered valid when the bin specification is selected in TEST-TYPE_A or TEST-TYPE_B.
10230	TF	EventJobSlotOrd	Specifies a removal sequence of wafers to be followed when taking them out of a cassette.
10231	L	EventJobSlotInfo	Specifies a wafer ID and whether or not the wafer is an object to be processed.
10300	L	ResultData	Wafer-by-wafer processing result.
83729	U1	PortID	ID of a Load Port
83730	A	CarrierID	ID of the Carrier
83731	U1	AccessMode	Desired Access mode of Load Port
83732	A	LocationID	Location ID of Load Port.
83733	L	PortStateInfo	PortAssociationState combined with the PortTransferState
83734	U1	PortAssociationState	Association State of Load Port. 0=Not associated. 1=Associated.
83737	L	PortList	List of Load Ports
83738	U1	PortTransferState	List of PPIDs that exist in the current execution area. 0=Out of Service. 1=Transfer Blocked. 2=Ready to Load 3=Ready to Unload.
83740	L	SlotMap	List of slot status of Load Port as provided by the host until a successful slot map read then as read by the equipment.
83741	U1	CarrierAccessingStatus	Current accessing state of the carrier by the equipment. 0=Not Accessed. 1=In access. 2=Carrier Complete. 3=Carrier Stopped
83742	U1	CarrierIDStatus	Current substate of the CarrierID Status state model. 0=ID not read. 1=Waiting for Host. 2=Verification OK. 3=Verification Failed.
83743	U1	Reason	Reason for Transition 14. SLOTMAPNOTREAD to WAITINGFORHOST in CARRIER SLOT MAP STATE MODEL. 0=Verification needed. 1=verification by equipment unsuccessful. 2=read fail. 3=improper substate position.

varID	value TSN	Variable Name	Description
83744	U1	SlotMapStatus	Current Substate of the Slot Map Status event. 0=Slot Map Not Read. 1=Waiting For Host. 2=Slot Map Verificaiton OK. 3=Slot Map Verification Failed.
202513	A	LotID	LotID relevant to the event. Conforms to JobID
202514	A	SubstDestination	Destination Substrate Location
202515	L	SubstHistory	History of locations visited
202516	A	SubstID	Substrate ID relevant to the event
202517	A	SubstLocID	Substrate Location ID relevant to the event
202518	U1	SubstLocState	Substrate location state relevant to the event
202520	U1	SubstProcState	SUBSTRATE PROCESSING state relevant to the event
202522	A	SubstSource	Source Substrate Location relevant to the event
202523	U1	SubstState	SUBSTRATE TRANSPORT state relevant to the event
202524	U1	SubstType	Substrate type relevant to the event
202525	U1	SubstUsage	Substrate Usage relevant to the event

## 19.3. Equipment Constants

Table 19-3. Equipment Constants

varID	valueT SN	varname	description	varvalue	units	ECCMIN	ECCMAX	ECCDEF
874	U4	MaxSpoolTransmit	Max number of spooled msgs per S6F23 reply; 0 = no limit	0		0	32000	0
875	U4	SpoolMax	Max number of messages that can be spooled at one time.	10000		0	100000	10000
876	TF	OverWriteSpool	True = buffer the spooler circularly; False = stop buffering when spooler is full	0		0	1	0
3000	TF	AnnotateEventReports	Determines whether the equipment uses S6F11 or S6F13 for event reporting (1=S6F13 0=S6F11).	1		0	1	1
3010	U2	DateTimeRequestPeriod	Determines the frequency of the heartbeat message (S1F1 in seconds. 0=never).	0	s	0	32767	0
3020	TF	EstablishCommStream	Determines whether S1F1 or S1F13 will be used for establishing communications. 1=S1F13; 0=S1F1.	1		0	1	1
3030	U2	EstablishCommunicationsTimeout	Contains the time in seconds to wait when attempting to establish communications with the host.	30	s	10	32767	
3040	A	HSMSCConnectMode	Whether to establish the TCP/IP socket session when opening the hsmcs session. ACTIVE (communicate with existing session or PASSIVE (create new session.	PASSIVE			PASSIVE	
3050	A	IPAddressPort	If HSMSCConnectMode is PASSIVE the port on which the TCP/IP socket session will be established. If HSMSCConnectMode is ACTIVE the host and port to connect to in the format hostname:portnumber.	5555				

## Chapter 19. Variable Listings

varID	valueT SN	varname	description	varvalue	units	ECMIN	ECMAX	ECDEF
3060	TF	SpoolWhenNoComm	Whether to turn on spooling when there is no host communication. 1=turn on spooling; 0=no spooling.	0	0	0	0	0
3070	A	T3	Reply timeout.	45	s	1	120	45
3080	A	T5	Connect separation timeout.	10	s	1	240	10
3090	A	T6	Control transaction timeout.	5	s	1	240	5
3100	A	T7	NOT SELECTED timeout.	10	s	1	240	10
3110	A	T8	Network inter-character timeout.	5	s	1	120	5
3120	U4	TestSiteInterval	ID of each virtual configuration. Like sampling report every nth part.	0				
3130	U1	TimeFormat	0=YYMMDDhhmmss 1=YYYYMMDDhhmmsscc 2= YYYY-MM-DDThh:mm:ss.sTZD in S2F18/S2F31/S6F1.	1		0		
3140	U1	RecipeOwner	1=tester 2=prober	2		1		
3145	A:20	RecipeDirMask	Mask used to filter directory results.	ALL				
10080	U2	EstablishCommunicationTimeout	Interval in seconds	30	s	1	300	
10081	U4	MaxSpoolTransmit	Number of messages that are to be resent at a time. All messages will be resent at a time by selecting 0 (zero).	10		0	70	
10082	TF	OverWriteSpool	TRUE = Overwrite FALSE = Not overwrite	1		0	1	
10083	U4	JobMax	Max. number of jobs	2		1	2	
10084	U2	InitCommState	1=Enabled 2=Disabled	1		1	2	
10085	U2	InitControlState	1=Online 2=Offline	1		1	2	
10086	U2	OnlineSubState	4=ON-LINE / LOCAL 5=ON-LINE / REMOTE	5		4	5	
10087	U2	OfflineSubState	1=OFF-LINE / EQUIPMENT OFF-LINE 2=OFF-LINE / ATTEMPT ON-LINE 3=OFF-LINE / HOST OFF-LINE	1		1	3	
10088	U2	OnlineFailed	1=OFF-LINE / EQUIPMENT OFF-LINE 3=OFF-LINE / HOST OFF-LINE	1		1	3	
10400	TF	ConfigSpool	TRUE=Spooling is performed. FALSE=Spooling is not performed.	0		0	1	
10401	U1	StopUnit	0 : Die unit;1 : Wafer unit;2 : Cassette unit;3 : Lot unit	0		0	3	
10402	TF	AlarmAtSpoolActive	TRUE: Occurs. FALSE: Does not occur.	1		0	1	
10403	U1	BinType	0 = X Y BIN...X Y BIN; 1 = X1 Y1 N1 BIN BIN...Xn Yn Nn BIN BIN BIN; 2 = BIN BIN...BIN	0		0	2	

## Chapter 20. Implementation Details

VGEM is installed with default settings that define certain basic values for the system. These may be altered depending on your particular installation. The following values are set in the default.ini file. The values are cascading, so that values set here take precedence over values found in the code. Contact your Keysight representative to make changes to these defaults.

### 20.1. Tester and Prober Types

Table 20-1. Tester and Prober Type Specification

Parameter	Default Setting	Description
VGEM testerType	specs	Identifies the tester type, and thus the directory for running the appropriate tables within VGEM.
VGEM proberType	tel	Identifies the prober type, and thus the directory for running the appropriate tables within VGEM.

### 20.2. E-4 SECS-I Protocol Parameters

Table 20-2. E-4 SECS-I Protocol Parameters

Parameter	Default Setting	Description
VGEM BAUD	9600	Sets serial line speed. Range 300 – 9600.
VGEM DEVID	0	Identifier assigned to the equipment. Range 0 – 32767.
VGEM T1	500	Receive inter-character timeout in the block transfer protocol. Range 0.1 – 10 sec.
VGEM T2	10000	Protocol timeout in the block transfer protocol. Range 0.2 – 25 sec.
VGEM T3	45	Reply timeout in the message protocol. Range 1 – 120 sec.
VGEM T4	45	Inter-block timeout in the message protocol. Range 1 – 120 sec.
VGEM RTY	3	The retry limit or the maximum number of times the block transfer protocol will attempt to retry sending a block before declaring a failed send. Range 0 – 31.

### 20.3. E-30 GEM State Initialization Parameters

Table 20-3. E-30 GEM State Initialization Parameters

Parameter	Default Setting	Description
VGEM InitCommState	ENABLED	Initial Communications State is set to ENABLED.
VGEM InitOnlineState	REMOTE	Initial Online State is set to REMOTE.
VGEM InitControlState	Attempt ON-LINE	Initial Control State is set to Attempt ON-LINE.
VGEM OnlineFailState	Host OFF-LINE	Initial OnlineFail State is set to Host OFF-LINE.

### 20.4. E-37 HSMS Protocol Parameters

Table 20-4. E-37 HSMS Protocol Parameters

Parameter	Default Setting	Description
VGEM T5	10	Connect separation timeout. Range 1 – 240 sec.
VGEM T6	5	Control transaction timeout. Range 1 – 240 sec.
VGEM T7	10	NOT SELECTED timeout. Range 1 – 240 sec.
VGEM T8	5	Network Intercharacter timeout. Range 1-120 sec.
VGEM IPAddressPort	5557	If HSMSConnectMode is PASSIVE, the port on which the TCP/IP socket session will be established. If HSMSConnectMode is ACTIVE, the host and port to connect to in the format 'hostname:portnumber.'
VGEM HSMSConnectMode	PASSIVE	Whether to establish the TCP/IP socket session when opening the HSMS session. 'ACTIVE' (communicate with existing session) or 'PASSIVE' (create new session).
VGEM UseLinkTest	0	Set if the VGEM executes the SECS LinkTest or not. 1 means execute. Note that this is effective only when the HSMSConnectionMode is ACTIVE.
VGEM LinkTestInterval	180	Set the interval time of HSMS LinkTest in seconds.

### 20.5. User-Interface Parameters

Table 20-5. User-Interface Parameters

Parameter	Default Setting	Description
VGEM show_tracewin	0	Indicates if the trace window for this VGEM session will be displayed. The trace window contains all messages sent from and received by the VGEM.
VGEM show_datatables	0	Indicates if the data tables associated with this VGEM session will be displayed. These tables contain all the data maintained during the VGEM session.

## 20.6. Miscellaneous

Table 20-6. Miscellaneous

Parameter	Default Setting	Description
VGEM CompatibilityMode	0	0 = E40/94 mode 1= VGEM 2.x mode (support for S2F41 Remote Commands)
VGEM AnnotateEventReports	1	0 = E30 - S6F11 event report style 1= E30 - S6F13 event report style
VGEM eqmbx	GEMMBX	The name of the equipment mailbox. Do not edit this value.
VGEM txt_LMP_title	“SPECS-FA LMP: “	Window title of Local Management Panel (LMP).
VGEM EquipName	4070FA-00	The external name of the equipment.
VGEM logfile	testersecsgem.log	Log file. This can be anything the user chooses.
VGEM logdirectory	/var/tmp	Directory name where the log file above is stored.
VGEM Debug	0	Creates SECS/GEM log files in /var/tmp/gemport.log and /var/tmp/gemprober.log. Also writes state models changes to /var/tmp/testersecsgem.log.
VGEM LogFilesTimeStamp	0	0 = Creates SECS/GEM log files in /var/tmp/gemport.log and /var/tmp/gemprober.log at startup and overwrites existing file. This option is used when Debug is set 1. 1= create a gemport file with named gemport_{datetime}.log and a gemprober file named gemprober_{datetime}.log under /var/tmp. This avoids overwriting previous log files since it creates a unique name.

## 20.7. MDLN and SOFTREV Values

Table 20-7. MDLN and SOFTREV Values

Parameter	Default Setting	Description
VGEM MDLN	4070FA	MDLN is obtained from the tester via the InitComplete event. This parameter is the value to send prior to receiving the event.
VGEM SOFTREV	3.61	SOFTREV is obtained from the tester via the InitComplete event. This parameter is the value to send prior to receiving the event.

## 20.8. Recipe Path

Table 20-8. Recipe Path

Parameter	Default Setting	Description
VGEM Recipepath	/tmp/tester_recipe	Provides the path to the recipe.
VGEM RecipeFile	/opt/SPECS/usr/tpl/FA_recipe2.rec	Path to the master recipe file.

## 20.9. Prober Interactions

Table 20-9.

Parameter	Default Setting	Description
VGEM ShowProberErrors	1	Determines whether an error from the prober during initialization should display an error message and kill the VGEM.
VGEM ShowBlankCarrier	0	Determines whether the LMP should prompt for a CarrierID when the value is BLANK.

## Appendix A. VGEM Production Settings

This section provides VGEM recommended settings in a production environment:

`vgem/defaults.ini`

**VGEM Debug** 0

Turns off debugging. This setting, when set to 1, logs additional debug information such as state transitions to the file specified by VGEM logfile `/var/tmp/testersecsgem.log`.

**VGEM show\_tracewin** 0

User-Interface Parameters. ‘show\_tracewin’ controls 2 windows that display the host SECS trace and the prober SECS trace.

**VGEM show\_datatables** 0

This setting controls the SQL database user interface.

**VGEM Persistence** 0

This flag enables/disables the database persistence:

1= constants, reports, are saved to disk.

0= table changes like constants, reports etc. are not saved to disk.

If set to 1, the end-user would have to make the .csv files writeable in production.

**VGEM AnnotateEventReports** 0

Users usually prefer S6F11 (=0) because of less data length. Users use S6F13 (=1) when they need more readable information in the data.

<b>VGEM InitCommState</b>	"ENABLED"
<b>VGEM OnlineFailState</b>	"Host OFF-LINE"
<b>VGEM UseLinkTest</b>	0

E-30 GEM State Initialization Parameters.

<b>VGEM BAUD</b>	9600
<b>VGEM DEVID</b>	0
<b>VGEM T1</b>	500
<b>VGEM T2</b>	10000
<b>VGEM T3</b>	45
<b>VGEM T4</b>	45
<b>VGEM RTY</b>	3

E-4 SECS-I Protocol Parameters

<b>VGEM T5</b>	10
<b>VGEM T6</b>	5
<b>VGEM T7</b>	10
<b>VGEM T8</b>	5

E-37 HSMS Protocol Parameters

## Appendix A. VGEM Production Settings

VGEM IPAddressPort	5557
VGEM HSMSConnectMode	PASSIVE

VGEM defaults for host to VGEM HSMS connection

## Appendix B. Prober Reports

spname	RPTID	VIDs	description
GEMPORT	6000	1300 1400 1450 1360 2860 2340 2270 2500 2520 2700	
GEMPORT	6001	1300 1400 1510 1200 2860 1190 1450 1330 1360 2500 2520 2700	Setup
GEMPORT	6002	1560 1300 1400 1510 1200 2860 1580 1190 1450 1360 2500 2520 2700	Lot Complete
GEMPORT	6003	1360 1300 1560 1400 2340 2270 1310 2500 2520 2700	SubLot Complete
GEMPORT	6004	1360 1300 1560 1400 2860 2500 2520 2700	Process
GEMPORT	6005	1360 1400 2860 2500 2520 2700	Lot/SubLot
GEMPORT	6006	1360 1400 2210 2860 2220	Diagnostics
GEMPORT	6101	83729 83730	portid carrierid
GEMPORT	6102	1370 1020	portid carrierid
GEMPORT	6103	1370 83730 83740	portid carrierid slotmap
GEMPROBER	1	0x00012002	Prober Default Report CarrierID
GEMPROBER	2	0x0001200c	Prober Default Report SlotMap
GEMPROBER	3	0x00012001	Prober Default Report PortID
GEMPROBER	4	108	Prober Default Report JobID

spname	CEID	RPTID
GEMPORT	13004	6101
GEMPORT	14503	6101
GEMPORT	14507	6101
GEMPORT	14510	6101
GEMPORT	14513	6103
GEMPORT	14514	6103
GEMPORT	14515	6103
GEMPORT	14516	6103
GEMPORT	14530	6101
GEMPORT	5063	6005
GEMPORT	5102	6003
GEMPORT	5103	6102
GEMPORT	5104	6003
GEMPORT	5106	6003

spname	CEID	RPTID
GEMPROBER	4008	3
GEMPROBER	4009	3
GEMPROBER	4503	1
GEMPROBER	4503	3
GEMPROBER	4504	1
GEMPROBER	4504	3
GEMPROBER	4506	1
GEMPROBER	4506	3
GEMPROBER	4507	1
GEMPROBER	4507	3
GEMPROBER	4508	1
GEMPROBER	4508	3
GEMPROBER	4509	1
GEMPROBER	4509	3

## Appendix B. Prober Reports

GEMPORT	5107	6003
GEMPORT	5124	6102
GEMPORT	5129	6003
GEMPORT	5150	6003
GEMPORT	5151	6003
GEMPORT	5152	6003
GEMPORT	5153	6002
GEMPORT	5153	6003
GEMPORT	5153	6004
GEMPORT	5154	6003
GEMPORT	5155	6002
GEMPORT	5155	6003
GEMPORT	5155	6004
GEMPORT	5156	6003
GEMPORT	5157	6001
GEMPORT	5157	6003
GEMPORT	5157	6004
GEMPORT	5161	6001
GEMPORT	5161	6003
GEMPORT	5164	6003
GEMPORT	5165	6001
GEMPORT	5165	6003
GEMPORT	5165	6004
GEMPORT	5171	6003
GEMPORT	5175	6102

GEMPROBER	4510	1
GEMPROBER	4510	3
GEMPROBER	4511	1
GEMPROBER	4511	3
GEMPROBER	4513	1
GEMPROBER	4513	2
GEMPROBER	4513	3
GEMPROBER	4514	1
GEMPROBER	4514	2
GEMPROBER	4514	3
GEMPROBER	4515	1
GEMPROBER	4515	3
GEMPROBER	4516	1
GEMPROBER	4516	3
GEMPROBER	4518	1
GEMPROBER	4518	3
GEMPROBER	4519	1
GEMPROBER	4519	3
GEMPROBER	4520	1
GEMPROBER	4520	3
GEMPROBER	4521	1
GEMPROBER	4521	3
GEMPROBER	4530	1
GEMPROBER	4530	3
GEMPROBER	700	4
GEMPROBER	701	4
GEMPROBER	702	4
GEMPROBER	708	4
GEMPROBER	711	4

## Appendix C. Prober Constants

*varID* = VGEM's variable = *eqvarID* + 10000

*eqvarID* = prober's variable

*varID* is the value the host must use when interacting with VGEM.

varID	eqvarID	varname	description	Value TSN	varvalue	units	ECMIN	ECMAX	ECDEF
10080	80	EstablishCommunicationTimeout	Interval in seconds	U2	30	s	1	300	
10081	81	MaxSpoolTransmit	Number of messages that are to be re-sent at a time. All messages will be re-sent at a time by selecting 0 (zero).	U4	10		0	70	
10082	82	OverWriteSpool	TRUE = Overwrite FALSE = Not overwrite	TF	1		0	1	
10083	83	JobMax	Max. number of jobs	U4	2		1	2	
10084	84	InitCommState	1=Enabled 2=Disabled	U2	1		1	2	
10085	85	InitControlState	1=Online 2=Offline	U2	1		1	2	
10086	86	OnlineSubState	4=ON-LINE / LOCAL 5=ON-LINE / REMOTE	U2	4		4	5	
10087	87	OfflineSubState	1=OFF-LINE / EQUIPMENT OFF-LINE 2=OFF-LINE / ATTEMPT ON-LINE 3=OFF-LINE / HOST OFF-LINE	U2	1		1	3	
10088	88	OnlineFailed	1=OFF-LINE / EQUIPMENT OFF-LINE 3=OFF-LINE / HOST OFF-LINE	U2	1		1	3	
10400	400	ConfigSpool	TRUE=Spooling is performed. FALSE=Spooling is not performed.	TF	1		0	1	
10401	401	StopUnit	0 : Die unit;1 : Wafer unit;2 : Cassette unit;3 : Lot unit	U1	0		0	3	
10402	402	AlarmAtSpoolActive	TRUE : Occurs. FALSE : Does not occur.	TF	1		0	1	
10403	403	BinType	0 = X Y BIN...X Y BIN; 1 = X1 Y1 N1 BIN BIN...Xn Yn Nn BIN BIN BIN; 2 = BIN BIN...BIN	U1	0		0	2	
149265	139265	BypassReadID1	Bypass CarrierID for Load Port 1. FALSE=Not bypass. True=Bypass.	TF	1		0	1	
149266	139266	BypassReadID2	Bypass Carr						

## Appendix C. Prober Constants

## Appendix D. Prober Status Variables

*varID* = VGEM's variable = *eqvarID* + 10000

*eqvarID* = prober's variable

*varID* is the value the host must use when interacting with VGEM.

varID	eqvarID	varname	description	valueTSN
10001	1	ModelName	Same as data item MDLN.	A:6
10002	2	SoftRevision	Same as data item SOFTREV.	A:6
10003	3	OperatorName	Name of user. Space 16-byte under log-out state.	A:16
10004	4	OperatorLevel	1 = General operator, 2 = Process engineer, 3 = Equipment engineer, 4 = Service engineer, 5 = Super user	U2
10005	5	AlarmsEnabled	L, n 1.<ALID1> : n.<ALIDn> n: Number of ALIDs to be reported	L
10006	6	AlarmsSet	L, n 1.<ALID1> : n.<ALIDn> n: Number of ALIDs to be reported	L
10007	7	CLOCK	YYYYMMDDhhmmsscc	A:16
10008	8	ControlState	L, n 1.<PortState 1> : n.<PortState n> n: Number of ports of the equipment	B
10009	9	EventsEnabled	L, n 1.<CEID1> : n.<CEIDn> n: Number of CEID to be reported	L
10010	10	PPExecName	L, n 1.<PPID1> : n.<PPIDn> n: Number of PPID to be reported. Currently n=1.	L
10011	11	SpoolCountActual	The number of messages in storage	U2

## Appendix D. Prober Status Variables

varID	eqvarID	varname	description	valueTSN
10012	12	SpoolCountTotal	The number of messages in storage	U2
10013	13	SpoolFullTime	Same as Status variable CLOCK.	A:16
10014	14	SpoolStartTime	Same as Status variable CLOCK.	A:16
10015	15	JobAll	<p>L, n</p> <p>1..L, 2</p> <p>1..&lt;ProberJobID&gt;</p> <p>2..&lt;ProberJobState&gt;</p> <p>:</p> <p>n..L, 2</p> <p>1..&lt;ProberJobID&gt;</p> <p>2..&lt;ProberJobState&gt;</p> <p>n: Number of jobs that the equipment currently holds.</p>	L
10016	16	ChargeableState	0=Undefined, 1=CHARGE DISABLED, 2=CHARGE ENABLED	U2
10017	17	ProcessState	0=Undefined, 1=INIT, 2=IDLE, 3=IDLE with ALARMS, 4=MAINTENANCE, 5=SETTING UP 6=EXECUTING, 7=PAUSING, 8=PAUSED, 9=CHECKING, 10=PAUSED SETTING UP, 11=ALARM PAUSED, 12=STOPPING, 13=ABORTING	U1
10018	18	PreviousProcess	0=Undefined, 1=INIT, 2=IDLE, 3=IDLE with ALARMS, 4=MAINTENANCE, 5=SETTING UP, 6=EXECUTING, 7=PAUSING, 8=PAUSED, 9=CHECKING, 10=PAUSED SETTING UP, 11=ALARM PAUSED, 12=STOPPING, 13=ABORTING	U1
10020	20	PortStateList	<p>L, n</p> <p>1..&lt;PortState 1&gt;</p> <p>:</p> <p>n..&lt;PortState n&gt;</p> <p>n: Number of ports of the equipment</p>	L
10022	22	PreviousControl	<p>L, n</p> <p>1..&lt;PortState 1&gt;</p> <p>:</p> <p>n..&lt;PortState n&gt;</p> <p>n: Number of ports of the equipment</p>	B
10023	23	SpoolState	0=Spool Inactive, 1=Spool Active	U2
10024	24	SpoolUnloadSub	0=Spool Inactive, 1=Spool Active	U2
10025	25	SpoolLoadSub	5=Spool Not Full, 6=Spool Full	U2

varID	eqvarID	varname	description	valueTSN
11020	1020	Port1State	0=Undefined, 1=PORT DISABLED, 2=PORT EMPTY, 3=PORT NO ACCESS 4=PORT IN ACCESS, 5=PORT ACCESS END	U2
11021	1021	Port2State	0=Undefined, 1=PORT DISABLED, 2=PORT EMPTY, 3=PORT NO ACCESS, 4=PORT IN ACCESS, 5=PORT ACCESS END	U2
11022	1022	CassetteMap1	L, n 1.<WaferPresence1> : n.<WaferPresence> (Note) n: 0 13 25 26 n = 0 is the data until the cassette map is completed. n = 13, 25, 26 corresponds to cassette slot numbers. <WaferPresence>: Refer to the data item Wafer Presence.	L
11023	1023	CassetteMap2	L, n 1.<WaferPresence1> : n.<WaferPresence> (Note) n: 0 13 25 26 n = 0 is the data until the cassette map is completed. n = 13, 25, 26 corresponds to cassette slot numbers. <WaferPresence>: Refer to the data item Wafer Presence.	L
11100	1100	AlarmState	0=Undefined, 1=NO ALARM, 2=ALARM	U2
11500	1500	ChuckTempSetPoint	-100.0 to 200.0	A:6
11501	1501	ChuckTempActual	-100.0 to 200.0	A:6
11510	1510	CardName	Trace Not an object Name of the probe card currently installed on the equipment.	A:20
11511	1511	CardId	ID of the probe card currently installed on the equipment.	A:20
11512	1512	ContactAct	The accumulated number of times of contacts by the probe card currently installed on the equipment.	U4
11513	1513	ContactLimit	Limit value to the accumulated number of times of contacts by probe card.	U4

## Appendix D. Prober Status Variables

varID	eqvarID	varname	description	valueTSN
11520	1520	CurrentProcessProgramId	Specified a process program that uses <ProberJobID> previously specified. The PPID will be a combination of Structure class Class and recipe name while inserting [slash (/)] between each two of them such as Structure class / Class name / Recipe name.	A:46
11521	1521	PreviousProcessProgramId	Specified a process program that uses <ProberJobID> previously specified. The PPID will be a combination of Structure class Class and recipe name while inserting [slash (/)] between each two of them such as Structure class / Class name / Recipe name.	A:46
11530	1530	TotalProcessedWafer	Addition counter value of processed wafer in the equipment.	U4
11531	1531	TotalProcessedDie	Addition counter value of processed die in the equipment.	U8
75553	65553	LP1AccessMode	Desired access mode of Load Port 1. 0=Manual, 1=Auto	U1
75554	65554	LP1CarrierID	ID number of a carrier of Load Port 1	A
75555	65555	LP1LocationID	Location ID of Load Port 1	A
75556	65556	LP1AssociationState	Association State of Load Port 1. 0=Not Associated, 1=Associated.	U1
75557	65557	LP1PortID	ID of Load Port 1	U1
75558	65558	LP1PortStateInfo	PortAssociationState combined with the PortTransferState for Load Port 1.	L
75559	65559	LP1PortTransferState	List of PPIDs that exist in the current execution area	U1
75563	65563	LP1SlotMap	List of Slot Status of Load Port 1 as provided by the host until a successful slot map read or as read by the equipment.	L
75585	65585	LP2AccessMode	Desired access mode of Load Port 2. 0=Manual, 1=Auto	U1
75586	65586	LP2CarrierID	ID number of a carrier of Load Port 2	A
75587	65587	LP2LocationID	Location ID of Load Port 2	A

<b>varID</b>	<b>eqvarID</b>	<b>varname</b>	<b>description</b>	<b>valueTSN</b>
75588	65588	LP2AssociationState	Association State of Load Port 2. 0=Not Associated, 1=Associated.	U1
75589	65589	LP2PortID	ID of Load Port 2	U1
75590	65590	LP2PortStateInfo	PortAssociationState combined with the PortTransferState for Load Port 2.	L
75591	65591	LP2PortTransferState	List of PPIDs that exist in the current execution area	U1
75595	65595	LP2SlotMap	List of Slot Status of Load Port 2 as provided by the host until a successful slot map read or as read by the equipment.	L
75617	65617	CarrierLocationMatrix	Matrix of carrier locations.	L
75618	65618	PortAssociationStateList	List of all PortAssociationStates.	L
75619	65619	PortList	List of all PortIDs.	L
75620	65620	PortStateInfoList	List of all PortStateInfo.	L
75621	65621	PortTransferStateList	List of all PortTransferState.	L

## Appendix D. Prober Status Variables

## Appendix E. Prober Data Variables

*varID* = VGEM's variable = *eqvarID* + 10000

*eqvarID* = prober's variable

*varID* is the value the host must use when interacting with VGEM.

varID	eqvarID	varname	description	Value TSN	units
10172	172	AlarmCode	bit 8 = 1: Alarm set. bit 8 = 0: Alarm cleared.	TF	
10100	100	AlarmID	Alarm identification ID	U4	
10101	101	ECChangeld	Equipment constant ID	U4	
10160	160	EventDieCoodX	X coordinate of the die which has state conversion.	I2	
10161	161	EventDieCoodY	Y coordinate of the die which has state conversion.	I2	
10162	162	EventDieWaferId	ID allocated to identify wafer. However, because a maximum of 25 bytes are valid in the equipment data after the 26th byte is ignored.	A28	
10108	108	EventJobID	Process job identifier. Character string that can be printed. Duplication of ProberJobID process of process JOBS simultaneously existing in the equipment is prohibited.	A30	
10223	223	EventJobLoc	Cassette station (port) number	B	
10225	225	EventJobNoOfWafer	The number of wafers stored in a cassette.	A2	
10224	224	EventJobProdId	Product name assigned to the job. (Process name)	A20	
10111	111	EventJobRcp	L, n 1.<PPID1> : n.<PPIDn> n = Number of PP IDs to be used by a same job.	L	
10231	231	EventJobSlotInfo	Specifies a wafer ID and whether or not the wafer is an object to be processed.	L	
10230	230	EventJobSlotOrd	Specifies a removal sequence of wafers to be followed when taking them out of a cassette.	TF	
10109	109	EventJobState	0 = Undefined, 1 = JOB CREATED, 2 = JOB SET UP, 5 = JOB PROCESSING, 6 = JOB STOPPING, 7 = JOB ABORTING	U2	

## Appendix E. Prober Data Variables

varID	eqvarID	varname	description	Value TSN	units
10229	229	EventJobTestBin	Bin that is an object of marking process. It is rendered valid when the bin specification is selected in TEST-TYPE_A or TEST-TYPE_B.	L	
10226	226	EventJobTestType	Specification of detail process type in case of re-measurement. It is rendered valid when marking is selected in TEST_TYPE.	U1	
10227	227	EventJobTestTypeA	1: Inspects all chips, 2: Only inspects paths, 3: Only inspects failed chips, 4: Only inspects specified bins. data item WAFERID. Specification of detail process type in case of re-measurement. It is rendered valid when re-measurement is selected in TEST_TYPE.	U1	
10228	228	EventJobTestTypeB	1: Only marks failed chips. 2: Only marks specified bins. Specification of detail process type in case of re-measurement. It is rendered valid when marking is selected in TEST_TYPE.	U1	
10110	110	EventJobTime	L, 2 1.<CLOCK 1> 2.<CLOCK 2> <CLOCK 1> Starting time <CLOCK 2> Completion time Note: If the time is not fixed, delete spaces.	L	
10102	102	EventLimit	L, n 1.<LIMITID1> : n.<LIMITIDn> n = Number of LIMITIDs that have caused a zone transition.	L	
10174	174	EventName	Character string which represents an event that has taken place.	A32	
10221	221	EventSlotNo	L, n 1.L, 2 1.<SLOTNO1> 2.<WAFERID1> : n.L, 2 1.<SLOTNOn> 2.<WAFERIDn> n : Number of wafers whose state changed simultaneously.	L	
10133	133	EventWaferBinList	BIN Value List that determines PASS/FAIL of die.	B	

varID	eqvarID	varname	description	Value TSN	units
10126	126	EventWaferColumn	Die matrix size of wafer in line direction	U2	
10134	134	EventWaferDataResult	BIN test results	B	
10127	127	EventWaferDieSizeX	X direction die size	A6	µm
10128	128	EventWaferDieSizeY	Y direction die size	A6	µm
10140	140	EventWaferEndLoc	Cassette station (port) number	B	
10141	141	EventWaferEndSlotNo	Slot number in which wafer is stored. Format is 01 to 26.	A2	
10142	142	EventWaferEndWaferID	ID allocated to identify wafer. However, because a maximum of 25 bytes are valid in the equipment data after the 26th byte is ignored.	A28	
10123	123	EventWaferFlat	Flat orientation shape of wafer FLAT or NOTCH	A5	
10124	124	EventWaferFlatAngle	Flat orientation angle of wafer	A3	°
10121	121	EventWaferIDType	Specifies which of the following data to use as the wafer identifier. SLOTNO or WAFERNO or WAFERID	A8	
10112	112	EventWaferJobID	Process job identifier. Character string that can be printed. Duplication of ProberJobID process of process JOBS simultaneously existing in the equipment is prohibited.	A30	
10116	116	EventWaferLoc	Cassette station (port) number	B	
10115	115	EventWaferProcID	Process ID assigned to the job.	A20	
10117	117	EventWaferProdID	Product name assigned to the job. (Process name)	A20	
10129	129	EventWaferRefCoordX	X coordinate of reference die	A4	
10130	130	EventWaferRefCoordY	Y coordinate of reference die	A4	
10131	131	EventWaferRefPosX	X coordinate of reference die	A4	
10132	132	EventWaferRefPosY	Y coordinate of reference die	A4	
10125	125	EventWaferRow	Die matrix size in rows	U2	
10118	118	EventWaferSlotNo	Slot number in which wafer is stored. Format is 01 to 26.	A2	
10114	114	EventWaferState	0: Undefined, 1: UNPROCESSED, 2: IN PROCESS, 3: PROCESSED	U2	
10120	120	EventWaferWaferID	ID allocated to identify wafer. However, because a maximum of 25 bytes are valid in the equipment data after the 26th byte is ignored.	A28	
10119	119	EventWaferWaferNo	Number allocated to identify wafers.	A2	
10122	122	EventWaferWaferSize	Wafer diameter. Units: [mm]	A3	mm

## Appendix E. Prober Data Variables

varID	eqvarID	varname	description	Value TSN	units
10103	103	LimitVariable	Variable ID	U4	
10104	104	OperatorCommand	0: JOB_CREATE (Not executable at present), 1: PP-SELECT (Not executable at present), 2: JOB_CANCEL (Not executable at present), 3: START (Not executable at present), 4: PAUSE, 5: RESUME, 6: STOP, 7: ABORT, 8: ONLINE-LOCAL, 9: ONLINE-REMOTE	U2	
10105	105	PPChangeName	Fixed to the same as data item PPID. If PPID is smaller than 46 bytes specify the PPID with front-aligned and spaced added to its end to fill shortage.	A46	
10106	106	PPChangeStatus	1 = Create, 2 = Edit, 3 = Delete	U1	
10211	211	PreviousOperatorLevel	1 = General operator, 2 = Process engineer, 3 = Equipment engineer, 4 = Service engineer, 5 = Super user	U2	
10209	209	PreviousOperatorName	Name of user. Space 16-byte under log-out state.	A16	
10212	212	PreviousPortState	0 = Undefined, 1 = PORT DISABLED, 2 = PORT EMPTY, 3 = PORT NO ACCESS, 4 = PORT IN ACCESS, 5 = PORT ACCESS END	U2	
10300	300	ResultData	Wafer-by-wafer processing result.	L	
10173	173	TraceID	Trace request ID	U2	
10175	175	TransferredFileName	$L, n$ $1.<\text{FileName } 1>$ $:$ $2.<\text{FileName } n>$ <i>n</i> : Number of transferred files.	L	
10107	107	TransitionType	1 = Lower to Upper, 2 = Upper to Lower	B	
10150	150	WaferMovedCurrentPosition	Wafer position in the equipment. 0 = Unknown, 1 = Carrier on Port 1, 2 = Carrier on Port 2, 6 = Upper transfer arm, 7 = Lower transfer arm, 8 = Sub chuck, 9 = Main chuck	B	
10151	151	WaferMovedPreviousPosition	Wafer position in the equipment. 0 = Unknown, 1 = Carrier on Port 1, 2 = Carrier on Port 2, 6 = Upper transfer arm, 7 = Lower transfer arm, 8 = Sub chuck, 9 = Main chuck	B	
10152	152	WaferMovedWaferId	ID allocated to identify wafer. However, because a maximum of 25 bytes are valid in the equipment data after the 26th byte is ignored.	A28	

varID	eqvarID	varname	description	Value TSN	units
83729	73729	PortID	ID of a Load Port	U1	
83730	73730	CarrierID	ID of the Carrier	A	
83731	73731	AccessMode	Desired Access mode of Load Port	U1	
83732	73732	LocationID	Location ID of Load Port.	A	
83733	73733	PortStateInfo	PortAssociationState combined with the PortTransferState	L	
83734	73734	PortAssociationState	Association State of Load Port. 0=Not associated. 1=Associated.	U1	
83737	73737	PortList	List of Load Ports	L	
83738	73738	PortTransferState	List of PPIDs that exist in the current execution area. 0=Out of Service. 1=Transfer Blocked. 2=Ready to Load 3=Ready to Unload.	U1	
83740	73740	SlotMap	List of slot status of Load Port as provided by the host until a successful slot map read then as read by the equipment.	L	
83741	73741	CarrierAccessingStatus	Current accessing state of the carrier by the equipment. 0=Not Accessed. 1=In access. 2=Carrier Complete. 3=Carrier Stopped	U1	
83742	73742	CarrierIDStatus	Current substate of the CarrierID Status state model. 0=ID not read. 1=Waiting for Host. 2=Verification OK. 3=Verification Failed.	U1	
83743	73743	Reason	Reason for Transition 14. SLOTMAPNOTREAD to WAITINGFORHOST in CARRIER SLOT MAP STATE MODEL. 0=Verification needed. 1=verification by equipment unsuccessful. 2=read fail. 3=improper substate position.	U1	
83744	73744	SlotMapStatus	Current Substate of the Slot Map Status event. 0=Slot Map Not Read. 1=Waiting For Host. 2=Slot Map Verification OK. 3=Slot Map Verification Failed.	U1	

## Appendix E. Prober Data Variables

## Appendix F. Prober Alarms

*varID* = VGEM's variable = *eqvarID* + 10000

*eqvarID* = prober's variable

*varID* is the value the host must use when interacting with VGEM.

ALID	eqALID	ALTX
16787217	16777217	STAGE MOTOR SPEED SETTING ERROR
16787218	16777218	STAGE MOTOR ERROR
16787219	16777219	STAGE MOTOR ERROR
16787220	16777220	XYZ AXES MOTOR ERROR
16787221	16777221	XYZT AXES MOTOR ERROR
16787222	16777222	STAGE INITIALIZATION ERROR
16787226	16777226	X AXIS SERVO PACK ERROR
16787227	16777227	X AXIS INITIAL PROCESSING ERROR
16787228	16777228	X AXIS DRIVE PULSE DOES NOT MATCH
16787229	16777229	X AXIS TIME OUT ERROR
16787230	16777230	X AXIS MOTOR DRIVER ERROR
16787231	16777231	X MOTOR ENCODER ERROR
16787232	16777232	X AXIS SERVO MOTOR COMMUNICATION ERROR
16787233	16777233	X AXIS ENCODER ABSOLUTE POSITION ERROR
16787246	16777246	Y AXIS SERVO PACK ERROR
16787247	16777247	Y AXIS INITIAL PROCESSING ERROR
16787248	16777248	Y AXIS DRIVER PULSE DOES NOT MATCH
16787249	16777249	Y AXIS TIME OUT ERROR
16787250	16777250	Y AXIS MOTOR DRIVER ERROR
16787251	16777251	Y MOTOR ENCODER ERROR
16787252	16777252	Y AXIS SERVO MOTOR COMMUNICATION ERROR
16787253	16777253	Y AXIS ENCODER ABSOLUTE POSITION ERROR
16787266	16777266	Z AXIS MOTOR DRIVER ENCODER ERROR
16787267	16777267	Z AXIS INITIAL PROCESSING ERROR
16787268	16777268	Z AXIS DRIVE PULSE DOES NOT MATCH
16787269	16777269	Z AXIS TIME OUT ERROR
16787270	16777270	Z AXIS MOTOR DRIVER ERROR
16787271	16777271	Z AXIS ENCODER ABSOLUTE POSITION ERROR
16787272	16777272	Z AXIS ENCODER ABSOLUTE POSITION ERROR
16787273	16777273	Z AXIS INITIAL SENSOR ERROR
16787274	16777274	Z AXIS INITIAL SENSOR LOGIC NON-CONFORMITY ERROR
16787275	16777275	Z AXIS INTERLOCK ERROR
16787286	16777286	q AXIS MOTOR ENCODER ERROR
16787287	16777287	q AXIS INITIAL PROCESSING ERROR

## Appendix F. Prober Alarms

16787288	16777288	q AXIS DRIVE PULSE DOES NOT MATCH
16787289	16777289	q AXIS TIME OUT ERROR
16787290	16777290	q AXIS MOTOR DRIVER ERROR
16787291	16777291	3 PIN UP SENSOR ERROR
16787316	16777316	NEEDLE POLISHER DOWN SENSOR ERROR (DOES NOT TURN ON)
16787317	16777317	UPPER/LOWER CAMERA POSITIONING TARGET SENSOR ERROR (BOTH SENSORS)
16787318	16777318	UPPER/LOWER CAMERA POSITIONING TARGET DOWN SENSOR ERROR
16787319	16777319	BRIDGE LOCK SENSOR ERROR
16787320	16777320	BRIDGE LIMIT SENSOR ERROR
16787321	16777321	VACUUM SENSOR ERROR (NOT COMPLETELY OFF)
16787322	16777322	VACUUM SENSOR ERROR (NOT COMPLETELY ON)
16787323	16777323	VACUUM SENSOR ERROR (DOES NOT TURN OFF)
16787324	16777324	PROBE POLISHER DOWN SENSOR ERROR (DOES NOT TURN OFF)
16787325	16777325	UPPER/LOWER CAMERA POSITIONING TARGET UP SENSOR ERROR
16787336	16777336	BRIDGE ESCAPE LIMIT SENSOR ERROR
16787337	16777337	BRIDGE CENTER LIMIT SENSOR ERROR
16787338	16777338	BRIDGE LOCK DOWN SENSOR ERROR
16787339	16777339	RING DOWN EXECUTION ERROR
16787340	16777340	RING UP EXECUTION ERROR
16787341	16777341	TEST HEAD OPEN ERROR
16787342	16777342	RING OPEN WAS DETECTED
16787343	16777343	CANNOT EXECUTE RING OPEN
16787344	16777344	CANNOT EXECUTE RING CLOSE
16787345	16777345	THE POLISHER VACUUM SENSOR TURNED OFF PART WAY
16787346	16777346	THE POLISHER VACUUM SENSOR WONT TURN ON
16787347	16777347	THE POLISHER VACUUM SENSOR WONT TURN OFF
16787348	16777348	CANNOT TURN ON THE AIR BEARING VACUUM SENSOR
16787349	16777349	CANNOT TURN OFF THE AIR BEARING VACUUM SENSOR
16787350	16777350	THE WAPP LOCK SENSOR IS NOT TURNED ON
16787351	16777351	THE WAPP LOCK SENSOR IS NOT TURNED OFF
16787416	16777416	IMAGE RECOGNITION DEVICE (MAGIC) COMMUNICATION ERROR
16787417	16777417	A PARAMETER ERROR OCCURRED WITH THE IP BOARD
16787816	16777816	UNDEFINED PARAMETER RECEIVED
16787817	16777817	HEAD PLATE IS OPEN
16787818	16777818	SOLENOID DRIVE ESCAPE OPERATION NOT POSSIBLE
16787819	16777819	MARKER ARM Z POSITION ERROR
16787820	16777820	MARKER ARM HOME POSITION ERROR
16787821	16777821	MARKER ARM LOCK ERROR
16787822	16777822	MARKER ARM REVOLUTION ERROR (LOAD)
16787823	16777823	MARKER ARM REVOLUTION ERROR (UNLOAD)
16787824	16777824	CANNOT RELEASE THE MECHANISM RELATED TO THE INKER ARM.

16787825	16777825	AIR PRESSURE DECREASE DETECTED
16787826	16777826	VACUUM AIR PRESSURE DECREASE DETECTED
16787827	16777827	SACC INITIALIZE ERROR
16787828	16777828	MARKER ARM INITIALIZE ERROR
16787829	16777829	SACC LOCK ERROR
16787830	16777830	SACC Z DOWN ERROR
16787831	16777831	SACC UNLOAD ERROR
16787832	16777832	INKER ARM SENSOR ERROR
16787833	16777833	SACC COVER OPEN ERROR
16787836	16777836	SOFTWARE INTERLOCK OCCURRED
16787837	16777837	SOFTWARE INTERLOCK OCCURRED
16787838	16777838	SOFTWARE INTERLOCK OCCURRED
16787839	16777839	SOFTWARE INTERLOCK OCCURRED
16787840	16777840	SOFTWARE INTERLOCK OCCURRED
16787841	16777841	SOFTWARE INTERLOCK OCCURRED
16787842	16777842	SOFTWARE INTERLOCK OCCURRED
16787843	16777843	A SOFTWARE INTERLOCK OCCURRED
16787844	16777844	SOFTWARE INTERLOCK OCCURRED
16787845	16777845	SOFTWARE INTERLOCK OCCURRED
16787846	16777846	SOFTWARE INTERLOCK OCCURRED
16787847	16777847	SOFTWARE INTERLOCK OCCURRED
16787848	16777848	SOFTWARE INTERLOCK OCCURRED
16787849	16777849	SOFTWARE INTERLOCK OCCURRED
16787850	16777850	SOFTWARE INTERLOCK OCCURRED
16787851	16777851	SOFTWARE INTERLOCK OCCURRED
16787852	16777852	SOFTWARE INTERLOCK OCCURRED
16787853	16777853	SOFTWARE INTERLOCK OCCURRED
16787854	16777854	SOFTWARE INTERLOCK OCCURRED
16787855	16777855	SOFTWARE INTERLOCK OCCURRED
16787866	16777866	OPTION SETTING ERROR
16787867	16777867	AUTO HF ERROR STATUS DETECTED
16787876	16777876	VACUUM AIR MAIN PRESSURE ERROR
16787877	16777877	AIR MAIN PRESSURE ERROR
16787916	16777916	MARKER DRIVER DEFECT
16787917	16777917	MARKER DRIVER DEFECT
16787918	16777918	MARKER DRIVER DEFECT
16787919	16777919	MARKER DRIVER DEFECT
16787920	16777920	MARKER DRIVER DEFECT
16787921	16777921	MARKER DRIVER DEFECT
16787922	16777922	MARKER DRIVER DEFECT
16787923	16777923	MARKER MOVEMENT TIME OUT ERROR

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16787946	16777946	PROBE CAMERA ILLUMINATION SETTING ERROR
16788016	16778016	STAGE TIMER ERROR
16788026	16778026	BRIDGE DRIVE ERROR
16788027	16778027	BRIDGE DRIVE ERROR
16788028	16778028	TARGET DRIVE ERROR
16788029	16778029	TARGET DRIVE ERROR
16788030	16778030	INKER ARM DRIVE ERROR
16788031	16778031	INKER ARM DRIVE ERROR
16788032	16778032	BRIDGE DRIVE ERROR
16788066	16778066	SURFACE MAP ERROR
16788067	16778067	WAFER MACRO-ALIGNMENT FAILURE
16788068	16778068	CANNOT MOVE TO PROBE ALIGNMENT POSITION
16788069	16778069	TARGET MARK COULD NOT BE RECOGNIZED BY THE PROBE CAMERA
16788070	16778070	THE BRIDGE CAMERA COULD NOT FOCUS ON THE TARGET
16788071	16778071	THE BRIDGE CAMERA COULD NOT RECOGNIZE THE TARGET
16788073	16778073	CARD Z DIFFERENCE ERROR
16788074	16778074	TARGET HOLE CHECK ERROR
16788075	16778075	CONTACT HEIGHT EXCEEDED THE PROBE WAFER OBSTRUCTION LIMIT
16788076	16778076	PERPENDICULAR CUMULATIVE COEFFICIENT VALUE IS INCORRECT
16788116	16778116	FILE OPEN ERROR
16788117	16778117	FILE CLOSE ERROR
16788118	16778118	FILE WRITE ERROR
16788119	16778119	FILE READ ERROR
16788120	16778120	FILE NAME SETTING MISTAKE
16788121	16778121	FILE SEARCH ERROR
16788122	16778122	FILE OPERATION ERROR
16788123	16778123	WAFER PATTERN DATA DOWNLOAD ERROR
16788124	16778124	PROBER PATTERN DATA DOWNLOAD ERROR
16788136	16778136	COMMUNICATION MESSAGE ERROR
16788137	16778137	TASK OPERATION ERROR
16788138	16778138	CONFIRMED AN ERROR WITH THE MOTOR CONTROLLER BOARD
16788139	16778139	INTERRUPT SETUP ERROR
16788140	16778140	TASK RESTART ERROR
16788141	16778141	IP RESET ERROR
16788142	16778142	IP UNIT DOWN
16788143	16778143	A STAGE MOTOR INITIALIZATION ERROR OCCURRED (SETUP)
16788144	16778144	A STAGE MOTOR INITIALIZATION ERROR OCCURRED (SETUP)
16788145	16778145	AN INTERRUPT PROCESSING ERROR OCCURRED
16788146	16778146	AN UNDEFINED ERROR CODE OCCURRED
16788147	16778147	A STAGE DRIVE ERROR OCCURRED
16788166	16778166	A MESSAGE COMMUNICATION ERROR OCCURRED

16788167	16778167	Z CONTACT DRIVE/Z UP NOT POSSIBLE BECAUSE 3 PIN IS PROTRUDING
16788168	16778168	THE STAGE IS NOT INITIALIZED. INITIALIZE IT
16789217	16779217	UNDEFINED LOADER ERROR
16789221	16779221	A WAFER SIZE VALUE OTHER THAN 200 mm OR 300 mm HAS BEEN SET
16789226	16779226	UPPER ARM MOTOR DRIVER BOARD DEFECTIVE
16789236	16779236	UPPER ARM MOTOR DRIVER BOARD DEFECT
16789237	16779237	UPPER ARM MOTOR DRIVER BOARD DEFECT
16789238	16779238	LOADER Z NOT ON TABLE POSITION (ARM DRIVE)
16789239	16779239	UPPER ARM ENCODER DEFECT (CHECK THE WAFER)
16789240	16779240	WAFER TABLE DOOR IS OPEN (ARM DRIVE)
16789241	16779241	UPPER ARM DOWN LIMIT CHECK ERROR
16789242	16779242	UPPER ARM UP LIMIT CHECK ERROR
16789243	16779243	LOAD PORT 1 DOOR IS OPEN (ARM DRIVE)
16789244	16779244	LOAD PORT 2 DOOR IS OPEN (ARM DRIVE)
16789245	16779245	LOWER ARM MOTOR DRIVER BOARD DEFECT
16789246	16779246	LOWER ARM MOTOR DRIVER BOARD DEFECT
16789247	16779247	LOWER ARM MOTOR DRIVER BOARD DEFECT
16789249	16779249	LOWER ARM ENCODER DEFECT(CHECK THE WAFER)
16789251	16779251	LOWER ARM DOWN LIMIT CHECK ERROR
16789252	16779252	LOWER ARM UP LIMIT CHECK ERROR
16789253	16779253	LOADER q MOTOR DRIVER BOARD DEFECT(ORG DRIVER DATA)
16789254	16779254	LOADER q MOTOR DRIVER BOARD DEFECT
16789255	16779255	LOADER q MOTOR DRIVER BOARD IS DEFECTIVE (AT INITIALIZATION)
16789256	16779256	LOADER q ENCODER DEFECT(CHECK THE WAFER)
16789257	16779257	LOADER q DOWN LIMIT CHECK ERROR
16789258	16779258	LOADER q UP LIMIT CHECK ERROR
16789259	16779259	UPPER ARM IS NOT AT HOME POSITION (LOADER q DRIVE)
16789260	16779260	LOWER ARM IS NOT AT HOME POSITION (LOADER q DRIVE)
16789261	16779261	LOAD PORT 1 DOOR IS OPEN (LOADER q DRIVE)
16789262	16779262	LOAD PORT 2 DOOR IS OPEN (LOADER q DRIVE)
16789263	16779263	WAFER TABLE DOOR IS OPEN (LOADER q DRIVE)
16789265	16779265	SUBCHUCK q MOTOR DRIVER BOARD DEFECT
16789266	16779266	SUBCHUCK q MOTOR DRIVER BOARD DEFECT
16789267	16779267	SUBCHUCK q MOTOR DRIVER BOARD DEFECT
16789269	16779269	SUBCHUCK q ENCODER DEFECT (CHECK THE WAFER)
16789270	16779270	SUBCHUCK q DOWN LIMIT CHECK ERROR
16789271	16779271	SUBCHUCK q UP LIMIT CHECK ERROR
16789272	16779272	NO WAFER SHOULD BE ON SUBCHUCK
16789273	16779273	WAFER SHOULD BE ON SUBCHUCK
16789274	16779274	SUBCHUCK IS AT ITS LOWEST POINT BUT THERE IS A WAFER PRESENT(CANNOT
16789275	16779275	LOADER Z MOTOR DRIVER BOARD DEFECT

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16789276	16779276	LOADER Z MOTOR DRIVER BOARD DEFECT
16789277	16779277	LOADER Z MOTOR DRIVER BOARD DEFECT
16789279	16779279	LOADER Z ENCODER DEFECT (CHECK THE WAFER)
16789280	16779280	LOADER Z SOFTWARE INTERLOCK ERROR
16789281	16779281	LOADER Z DOWN LIMIT CHECK ERROR
16789282	16779282	LOADER Z UP LIMIT CHECK ERROR
16789283	16779283	NO TRAY ON WAFER TABLE IN LOADER Z
16789284	16779284	LOADER Z HAS BEEN TRANSFERRED TO HOME POSITION
16789285	16779285	A DOOR IS OPEN OR THE DRIVER BOARD IS DEFECTIVE (LOADER Z DRIVE)
16789286	16779286	LOAD PORT 1 DOOR IS OPEN (LOADER Z)
16789287	16779287	LOAD PORT 2 DOOR IS OPEN (LOADER Z)
16789288	16779288	WAFER TABLE DOOR IS OPEN (LOADER Z)
16789289	16779289	LOADER Z WAFER TABLE BASE
16789290	16779290	LOADER Z UPPER ARM POSITION
16789291	16779291	LOADER Z LOWER ARM POSITION
16789292	16779292	LOADER Z LOADER q POSITION
16789293	16779293	LOADER Z SLIDE POSITION
16789295	16779295	UPPER ARM NOT AT HOME POSITION
16789296	16779296	LOWER ARM NOT AT HOME POSITION
16789298	16779298	SLIDE MOTOR DRIVER BOARD DEFECT
16789299	16779299	SLIDE MOTOR DRIVER BOARD DEFECT
16789300	16779300	SLIDE MOTOR DRIVER BOARD DEFECT (AT INITIALIZATION)
16789302	16779302	SLIDE MOTOR DRIVER ENCODER DEFECT
16789304	16779304	SLIDE DOWN LIMIT CHECK ERROR
16789305	16779305	SLIDE UP LIMIT CHECK ERROR
16789306	16779306	THE LOADER Z IS NOT IN ITS HOME POSITION SO THE SLIDER CANNOT COME TO THE
16789307	16779307	THE SLIDER IS NOT IN THE UNLOADING POSITION
16789308	16779308	SLIDE DRIVE IS NOT POSSIBLE BECAUSE THE DOOR IS CLOSED
16789309	16779309	YOU CANNOT USE THE SLIDE SWITCH DURING LOADER DIAGNOSTICS
16789310	16779310	YOU CANNOT ACCESS THE CASSETTE BECAUSE LOADER INDIVIDUAL OPERATION
16789311	16779311	SLIDE DRIVE NOT POSSIBLE BECAUSE WAFER TABLE DOOR IS OPEN
16789326	16779326	ARM VACUUM ON ERROR
16789327	16779327	ARM VACUUM OFF ERROR
16789336	16779336	SUBCHUCK VACUUM ON ERROR
16789337	16779337	SUBCHUCK VACUUM OFF ERROR
16789346	16779346	SUBCHUCK Z DOWN ERROR
16789347	16779347	SUBCHUCK Z UP ERROR
16789348	16779348	SUBCHUCK Z MIDDLE ERROR
16789349	16779349	SUBCHUCK LOW SOLENOID POSITION SENSOR DEFECT
16789350	16779350	SUBCHUCK UP SOLENOID POSITION SENSOR DEFECT
16789356	16779356	LOADER Z DOWN ERROR

16789357	16779357	LOADER Z UP ERROR
16789359	16779359	LOADER Z LOCK PIN UNLOCK ERROR
16789360	16779360	LOADER Z LOCK PIN LOCK ERROR
16789361	16779361	LOADER Z POSITION ILLEGAL
16789362	16779362	UPPER ARM IS NOT AT ITS HOME POSITION (LOADER Z DRIVE)
16789363	16779363	LOWER ARM IS NOT AT ITS HOME POSITION (LOADER Z DRIVE)
16789364	16779364	LOADER q IS NOT AT ITS HOME POSITION(LOADER q DRIVE)
16789365	16779365	LOAD PORT 1 DOOR IS OPEN (LOADER Z DRIVE)
16789366	16779366	LOAD PORT 2 DOOR IS OPEN (LOADER Z DRIVE)
16789367	16779367	WAFER TABLE DOOR IS OPEN (LOADER Z DRIVE)
16789368	16779368	LOADER Z POSITION SENSOR DEFECT
16789376	16779376	CANNOT OPEN SHUTTER (ARM DRIVE)
16789377	16779377	CANNOT CLOSE SHUTTER (ARM DRIVE)
16789378	16779378	THE SHUTTER CANT OPEN BECAUSE THE BRIDGE ISNT AT THE HOME
16789379	16779379	SHUTTER OPEN CLOSE SENSOR DEFECT
16789380	16779380	BOTH ARMS ARE NOT INTERRUPTING THE ORIGIN SENSORS
16789386	16779386	NO WAFER IS ON WAFER TABLE
16789387	16779387	WAFER I S ON WAFER TABLE
16789389	16779389	THE WAFER IS NOT RETURNED TO THE WAFER TABLE
16789391	16779391	NO RETURN FOR WAFER ON WAFER TABLE
16789392	16779392	WAFER TABLE LOADING FAILURE
16789393	16779393	WAFER TABLE UNLOADING FAILURE
16789396	16779396	NO WAFER IS ON BUFFER TABLE
16789397	16779397	WAFER IS ON BUFFER TABLE
16789399	16779399	BUFFER TABLE LOADING ERROR
16789400	16779400	BUFFER TABLE UNLOADING ERROR
16789401	16779401	CANNOT MOVE WAFER AS THERE IS NO WAFER ON MAIN CHUCK
16789419	16779419	PREALIGN SENSOR DATA ERROR
16789421	16779421	PREALIGNMENT DATA ILLEGAL
16789426	16779426	THE SLIDER IS NOT AT ITS HOME POSITION PRESS THE CONFIRM BUTTON TO
16789431	16779431	THE SLIDE IS NOT INITIALIZED. PRESS OK AND MOVE TO THE UNLOAD POSITION
16789436	16779436	THE SLIDER IS NOT AT ITS DRAW-OUT POSITION PRESS THE CONFIRM BUTTON TO
16789516	16779516	ARM NUMBER ERROR
16789517	16779517	THERE SHOULD BE NO WAFER ON ARM
16789518	16779518	WAFER SHOULD BE ON ARM
16789520	16779520	BECAUSE THERE IS A JIG ON THE ARM IT CANNOT MOVE TO THE HOME POSITION
16789568	16779568	THERE SHOULD BE NO WAFER ON CASSETTE SLOT
16789569	16779569	WAFER SHOULD BE ON CASSETTE SLOT
16789576	16779576	ARM ROBOT POSITION ILLEGAL
16789586	16779586	MOTOR PROTECT
16789587	16779587	UPPER ARM ORIGIN SENSOR DEFECTIVE

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16789588	16779588	LOWER ARM ORIGIN SENSOR DEFECTIVE
16789590	16779590	LOADER q ORIGIN SENSOR DEFECTIVE
16789591	16779591	LOADER Z ORIGIN SENSOR DEFECTIVE
16789592	16779592	SLIDER ORIGIN SENSOR DEFECTIVE
16789596	16779596	SYSTEM MEMORY ALLOCATION ERROR
16789597	16779597	SYSTEM CLOCK ERROR
16789599	16779599	POWER TRIPPED (FUSE BLOWN)
16789617	16779617	PREALIGNMENT CONVERTED DATA ERROR
16789618	16779618	PREALIGNMENT CONVERTED DATA ERROR
16789620	16779620	PREALIGNMENT ECCENTRICITY CALCULATION ILLEGAL
16789626	16779626	PREALIGNMENT INPUT WAFER SIZE ERROR
16789627	16779627	PREALIGNMENT SPECIAL FLAT ORIENTATION ERROR
16789636	16779636	PREALIGNMENT WAFER ECCENTRICITY SIZE ERROR
16789637	16779637	PREALIGNMENT FLAT ORIENTATION OR NOTCH NOT FOUND
16789638	16779638	PREALIGNMENT FLAT ORIENTATION OVER 90°
16789641	16779641	PREALIGNMENT FLAT ORIENTATION OR NOTCH COUNT ERROR
16789646	16779646	POSITION WAFER FO ON WT IN SAME DIRECTION AS ONE ON MC
16789766	16779766	UNABLE TO CLEAR LOADER MOTOR ALARM
16789768	16779768	UNABLE TO MAGNETIZATION LOADER MOTOR
16789770	16779770	UNABLE TO RELEASE LOADER MOTOR BRAKE
16789816	16779816	INITIAL PROCESSING ERROR
16789826	16779826	UNABLE TO READ HARD DISK MACHINE DATA
16789828	16779828	UNABLE TO READ CASSETTE DATA ON HARD DISK
16789830	16779830	UNABLE TO READ HARD DISK MOTOR DATA
16789831	16779831	UNABLE TO WRITE MACHINE DATA TO HARD DISK
16789832	16779832	UNABLE TO WRITE MOTOR DATA TO HARD DISK
16789833	16779833	UNABLE TO WRITE CASSETTE DATA TO HARD DISK
16789836	16779836	UNABLE TO DELETE TASK FOR LOADER INTERRUPT PROCESS
16789838	16779838	UNABLE TO DELETE LOADER INITIAL TASK
16789840	16779840	UNABLE TO LOAD FUNCTION TASK DELETE
16789843	16779843	CANNOT DELETE LOADER SLIDE TASK
16789848	16779848	UNABLE TO DELETE MESSAGE q FOR LOADER INITIAL TASK
16789850	16779850	UNABLE TO DELETE MESSAGE q FOR LOADER FUNCTION TASK
16789852	16779852	UNABLE TO DELETE MESSAGE q FOR LOADER DIAGNOSTIC TASK
16789853	16779853	CANNOT DELETE MESSAGE q FOR LOADER SLIDE TASK
16789916	16779916	UNEXPECTED MESSAGE RECEIVED
16789917	16779917	UNDEFINED ERROR MESSAGE
16789918	16779918	FORMAT ERROR MESSAGE RECEIVED
16789926	16779926	ORIGIN POSITION TRANSFER NOT COMPLETED
16789927	16779927	ARMS NOT INTERRUPTING ORIGIN SENSORS
16789928	16779928	THE INDEX IS TOO LARGE

16789936	16779936	UNLOAD ALARM STOP WAFER
16789966	16779966	UNLOAD ALARM STOP WAFER
16789967	16779967	WAFER TAKE-OUT COMPLETE
16789986	16779986	WAFER REARRANGING COMPLETED
16789987	16779987	WAFER REARRANGING DATA DEFECT
16790017	16780017	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 1 OF CASSETTE 1
16790018	16780018	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 2 OF CASSETTE 1
16790019	16780019	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 3 OF CASSETTE 1
16790020	16780020	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 4 OF CASSETTE 1
16790021	16780021	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 5 OF CASSETTE 1
16790022	16780022	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 6 OF CASSETTE 1
16790023	16780023	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 7 OF CASSETTE 1
16790024	16780024	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 8 OF CASSETTE 1
16790025	16780025	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 9 OF CASSETTE 1
16790026	16780026	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 10 OF CASSETTE 1
16790027	16780027	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 11 OF CASSETTE 1
16790028	16780028	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 12 OF CASSETTE 1
16790029	16780029	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 13 OF CASSETTE 1
16790030	16780030	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 14 OF CASSETTE 1
16790031	16780031	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 15 OF CASSETTE 1
16790032	16780032	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 16 OF CASSETTE 1
16790033	16780033	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 17 OF CASSETTE 1
16790034	16780034	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 18 OF CASSETTE 1
16790035	16780035	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 19 OF CASSETTE 1
16790036	16780036	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 20 OF CASSETTE 1
16790037	16780037	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 21 OF CASSETTE 1
16790038	16780038	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 22 OF CASSETTE 1
16790039	16780039	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 23 OF CASSETTE 1
16790040	16780040	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 24 OF CASSETTE 1
16790041	16780041	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 25 OF CASSETTE 1
16790042	16780042	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 26 OF CASSETTE 1
16790043	16780043	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 27 OF CASSETTE 1
16790044	16780044	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 28 OF CASSETTE 1
16790045	16780045	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 29 OF CASSETTE 1
16790046	16780046	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 30 OF CASSETTE 1
16790047	16780047	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 31 OF CASSETTE 1
16790117	16780117	THERE IS A WAFER IN SLOT 1 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790118	16780118	THERE IS A WAFER IN SLOT 2 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790119	16780119	THERE IS A WAFER IN SLOT 3 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790120	16780120	THERE IS A WAFER IN SLOT 4 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790121	16780121	THERE IS A WAFER IN SLOT 5 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED

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16790122	16780122	THERE IS A WAFER IN SLOT 6 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790123	16780123	THERE IS A WAFER IN SLOT 7 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790124	16780124	THERE IS A WAFER IN SLOT 8 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790125	16780125	THERE IS A WAFER IN SLOT 9 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790126	16780126	THERE IS A WAFER IN SLOT 10 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790127	16780127	THERE IS A WAFER IN SLOT 11 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790128	16780128	THERE IS A WAFER IN SLOT 12 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790129	16780129	THERE IS A WAFER IN SLOT 13 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790130	16780130	THERE IS A WAFER IN SLOT 14 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790131	16780131	THERE IS A WAFER IN SLOT 15 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790132	16780132	THERE IS A WAFER IN SLOT 16 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790133	16780133	THERE IS A WAFER IN SLOT 17 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790134	16780134	THERE IS A WAFER IN SLOT 18 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790135	16780135	THERE IS A WAFER IN SLOT 19 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790136	16780136	THERE IS A WAFER IN SLOT 20 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790137	16780137	THERE IS A WAFER IN SLOT 21 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790138	16780138	THERE IS A WAFER IN SLOT 22 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790139	16780139	THERE IS A WAFER IN SLOT 23 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790140	16780140	THERE IS A WAFER IN SLOT 24 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790141	16780141	THERE IS A WAFER IN SLOT 25 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790142	16780142	THERE IS A WAFER IN SLOT 26 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790143	16780143	THERE IS A WAFER IN SLOT 27 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790144	16780144	THERE IS A WAFER IN SLOT 28 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790145	16780145	THERE IS A WAFER IN SLOT 29 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790146	16780146	THERE IS A WAFER IN SLOT 30 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790147	16780147	THERE IS A WAFER IN SLOT 31 OF CASSETTE 1 SO WAFER CANNOT BE UNLOADED
16790166	16780166	THERE IS NO NUMBER 1 CARRIER
16790167	16780167	THERE IS NO NUMBER 2 CARRIER
16790168	16780168	THERE ARE NO CARRIERS
16790171	16780171	NO. 1 CASSETTE HAS NOT BEEN CLAMPED
16790172	16780172	NO. 2 CASSETTE HAS NOT BEEN CLAMPED
16790173	16780173	CANNOT RELEASE CASSETTE 1
16790174	16780174	CANNOT RELEASE CASSETTE 2
16790175	16780175	LOAD PORT 1 WILL NOT GO FLAT
16790176	16780176	LOAD PORT 2 WILL NOT GO FLAT
16790177	16780177	LOAD PORT 1 WILL NOT TILT
16790178	16780178	CASSETTE 2 WILL NOT TILT
16790186	16780186	A WAFER IS PROTRUDING FROM CASSETTE 1
16790187	16780187	A WAFER IS PROTRUDING FROM CASSETTE 2
16790196	16780196	SMIF COMMUNICATION ERROR
16790206	16780206	MOVEMENT OF THE LOADER Z FAILED

16790207	16780207	THERE IS NO EMPTY SLOT
16790208	16780208	THE LOADER Z IS NOT AT THE HOME POSITION
16790210	16780210	ADJUSTMENT WAS NOT COMPLETED.
16790217	16780217	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 1 OF CASSETTE 2
16790218	16780218	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 2 OF CASSETTE 2
16790219	16780219	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 3 OF CASSETTE 2
16790220	16780220	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 4 OF CASSETTE 2
16790221	16780221	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 5 OF CASSETTE 2
16790222	16780222	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 6 OF CASSETTE 2
16790223	16780223	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 7 OF CASSETTE 2
16790224	16780224	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 8 OF CASSETTE 2
16790225	16780225	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 9 OF CASSETTE 2
16790226	16780226	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 10 OF CASSETTE 2
16790227	16780227	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 11 OF CASSETTE 2
16790228	16780228	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 12 OF CASSETTE 2
16790229	16780229	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 13 OF CASSETTE 2
16790230	16780230	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 14 OF CASSETTE 2
16790231	16780231	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 15 OF CASSETTE 2
16790232	16780232	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 16 OF CASSETTE 2
16790233	16780233	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 17 OF CASSETTE 2
16790234	16780234	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 18 OF CASSETTE 2
16790235	16780235	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 19 OF CASSETTE 2
16790236	16780236	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 20 OF CASSETTE 2
16790237	16780237	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 21 OF CASSETTE 2
16790238	16780238	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 22 OF CASSETTE 2
16790239	16780239	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 23 OF CASSETTE 2
16790240	16780240	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 24 OF CASSETTE 2
16790241	16780241	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 25 OF CASSETTE 2
16790242	16780242	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 26 OF CASSETTE 2
16790243	16780243	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 27 OF CASSETTE 2
16790244	16780244	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 28 OF CASSETTE 2
16790245	16780245	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 29 OF CASSETTE 2
16790246	16780246	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 30 OF CASSETTE 2
16790247	16780247	CANNOT TAKE OUT WAFER BECAUSE THERE ISNT ONE IN SLOT 31 OF CASSETTE 2
16790317	16780317	THERE IS A WAFER IN SLOT 1 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790318	16780318	THERE IS A WAFER IN SLOT 2 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790319	16780319	THERE IS A WAFER IN SLOT 3 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790320	16780320	THERE IS A WAFER IN SLOT 4 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790321	16780321	THERE IS A WAFER IN SLOT 5 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790322	16780322	THERE IS A WAFER IN SLOT 6 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790323	16780323	THERE IS A WAFER IN SLOT 7 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED

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16790324	16780324	THERE IS A WAFER IN SLOT 8 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790325	16780325	THERE IS A WAFER IN SLOT 9 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790326	16780326	THERE IS A WAFER IN SLOT 10 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790327	16780327	THERE IS A WAFER IN SLOT 11 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790328	16780328	THERE IS A WAFER IN SLOT 12 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790329	16780329	THERE IS A WAFER IN SLOT 13 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790330	16780330	THERE IS A WAFER IN SLOT 14 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790331	16780331	THERE IS A WAFER IN SLOT 15 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790332	16780332	THERE IS A WAFER IN SLOT 16 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790333	16780333	THERE IS A WAFER IN SLOT 17 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790334	16780334	THERE IS A WAFER IN SLOT 18 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790335	16780335	THERE IS A WAFER IN SLOT 19 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790336	16780336	THERE IS A WAFER IN SLOT 20 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790337	16780337	THERE IS A WAFER IN SLOT 21 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790338	16780338	THERE IS A WAFER IN SLOT 22 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790339	16780339	THERE IS A WAFER IN SLOT 23 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790340	16780340	THERE IS A WAFER IN SLOT 24 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790341	16780341	THERE IS A WAFER IN SLOT 25 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790342	16780342	THERE IS A WAFER IN SLOT 26 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790343	16780343	THERE IS A WAFER IN SLOT 27 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790344	16780344	THERE IS A WAFER IN SLOT 28 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790345	16780345	THERE IS A WAFER IN SLOT 29 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790346	16780346	THERE IS A WAFER IN SLOT 30 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790347	16780347	THERE IS A WAFER IN SLOT 31 OF CASSETTE 2 SO WAFER CANNOT BE UNLOADED
16790416	16780416	THERE WAS A MAPPING SENSOR ERROR OR THERE ARE NO WAFERS
16790417	16780417	CANNOT READ WAFER POSITION
16790418	16780418	CANNOT READ PIANO WIRE POSITION
16790419	16780419	NO WAFERS IN CASSETTE
16790420	16780420	DID NOT READ WAFER MAP
16790421	16780421	CANNOT DETECT MAPPING SENSOR POSITION
16790422	16780422	MAPPING SENSOR INTERRUPT ERROR
16790466	16780466	CASSETTE 1 IS FOR REJECTS. LEAVE IT EMPTY
16790467	16780467	CASSETTE 2 IS FOR REJECTS. LEAVE IT EMPTY
16790476	16780476	WAFER THICKNESS ERROR
16790517	16780517	THE POSITION OF THE 1ST WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790518	16780518	THE POSITION OF THE 2ND WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790519	16780519	THE POSITION OF THE 3RD WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790520	16780520	THE POSITION OF THE 4TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790521	16780521	THE POSITION OF THE 5TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790522	16780522	THE POSITION OF THE 6TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790523	16780523	THE POSITION OF THE 7TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT

16790524	16780524	THE POSITION OF THE 8TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790525	16780525	THE POSITION OF THE 9TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790526	16780526	THE POSITION OF THE 10TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790527	16780527	THE POSITION OF THE 11TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790528	16780528	THE POSITION OF THE 12TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790529	16780529	THE POSITION OF THE 13TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790530	16780530	THE POSITION OF THE 14TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790531	16780531	THE POSITION OF THE 15TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790532	16780532	THE POSITION OF THE 16TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790533	16780533	THE POSITION OF THE 17TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790534	16780534	THE POSITION OF THE 18TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790535	16780535	THE POSITION OF THE 19TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790536	16780536	THE POSITION OF THE 20TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790537	16780537	THE POSITION OF THE 21ST WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790538	16780538	THE POSITION OF THE 22ND WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790539	16780539	THE POSITION OF THE 23RD WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790540	16780540	THE POSITION OF THE 24TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790541	16780541	THE POSITION OF THE 25TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790542	16780542	THE POSITION OF THE 26TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790543	16780543	THE POSITION OF THE 27TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790544	16780544	THE POSITION OF THE 28TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790545	16780545	THE POSITION OF THE 29TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790546	16780546	THE POSITION OF THE 30TH WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790547	16780547	THE POSITION OF THE 31ST WAFER FROM THE BOTTOM IS INCORRECT. CANNOT
16790616	16780616	THE WAFER IS SLANTED
16790617	16780617	THE WAFER IN SLOT 1 IS SLANTED
16790618	16780618	THE WAFER IN SLOT 2 IS SLANTED
16790619	16780619	THE WAFER IN SLOT 3 IS SLANTED
16790620	16780620	THE WAFER IN SLOT 4 IS SLANTED
16790621	16780621	THE WAFER IN SLOT 5 IS SLANTED
16790622	16780622	THE WAFER IN SLOT 6 IS SLANTED
16790623	16780623	THE WAFER IN SLOT 7 IS SLANTED
16790624	16780624	THE WAFER IN SLOT 8 IS SLANTED
16790625	16780625	THE WAFER IN SLOT 9 IS SLANTED
16790626	16780626	THE WAFER IN SLOT 10 IS SLANTED
16790627	16780627	THE WAFER IN SLOT 11 IS SLANTED
16790628	16780628	THE WAFER IN SLOT 12 IS SLANTED
16790629	16780629	THE WAFER IN SLOT 13 IS SLANTED
16790630	16780630	THE WAFER IN SLOT 14 IS SLANTED
16790631	16780631	THE WAFER IN SLOT 15 IS SLANTED
16790632	16780632	THE WAFER IN SLOT 16 IS SLANTED

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16790633	16780633	THE WAFER IN SLOT 17 IS SLANTED
16790634	16780634	THE WAFER IN SLOT 18 IS SLANTED
16790635	16780635	THE WAFER IN SLOT 19 IS SLANTED
16790636	16780636	THE WAFER IN SLOT 20 IS SLANTED
16790637	16780637	THE WAFER IN SLOT 21 IS SLANTED
16790638	16780638	THE WAFER IN SLOT 22 IS SLANTED
16790639	16780639	THE WAFER IN SLOT 23 IS SLANTED
16790640	16780640	THE WAFER IN SLOT 24 IS SLANTED
16790641	16780641	THE WAFER IN SLOT 25 IS SLANTED
16790642	16780642	THE WAFER IN SLOT 26 IS SLANTED
16790643	16780643	THE WAFER IN SLOT 27 IS SLANTED
16790644	16780644	THE WAFER IN SLOT 28 IS SLANTED
16790645	16780645	THE WAFER IN SLOT 29 IS SLANTED
16790646	16780646	THE WAFER IN SLOT 30 IS SLANTED
16790647	16780647	THE WAFER IN SLOT 31 IS SLANTED
16790717	16780717	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 1
16790718	16780718	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 2
16790719	16780719	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 3
16790720	16780720	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 4
16790721	16780721	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 5
16790722	16780722	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 6
16790723	16780723	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 7
16790724	16780724	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 8
16790725	16780725	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 9
16790726	16780726	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 10
16790727	16780727	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 11
16790728	16780728	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 12
16790729	16780729	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 13
16790730	16780730	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 14
16790731	16780731	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 15
16790732	16780732	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 16
16790733	16780733	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 17
16790734	16780734	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 18
16790735	16780735	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 19
16790736	16780736	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 20
16790737	16780737	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 21
16790738	16780738	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 22
16790739	16780739	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 23
16790740	16780740	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 24
16790741	16780741	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 25
16790742	16780742	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 26

16790743	16780743	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 27
16790744	16780744	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 28
16790745	16780745	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 29
16790746	16780746	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 30
16790747	16780747	COULD NOT CALCULATE LOAD ACCESS POSITION FOR WAFER IN SLOT 31
16790817	16780817	COULD NOT CALCULATE LOAD POSITION WHEN CREATING MAP
16790917	16780917	COULD NOT CALCULATE UNLOAD ACCESS POSITION WHEN CREATING MAP
16791017	16781017	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 1
16791018	16781018	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 2
16791019	16781019	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 3
16791020	16781020	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 4
16791021	16781021	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 5
16791022	16781022	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 6
16791023	16781023	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 7
16791024	16781024	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 8
16791025	16781025	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 9
16791026	16781026	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 10
16791027	16781027	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 11
16791028	16781028	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 12
16791029	16781029	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 13
16791030	16781030	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 14
16791031	16781031	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 15
16791032	16781032	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 16
16791033	16781033	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 17
16791034	16781034	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 18
16791035	16781035	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 19
16791036	16781036	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 20
16791037	16781037	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 21
16791038	16781038	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 22
16791039	16781039	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 23
16791040	16781040	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 24
16791041	16781041	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 25
16791042	16781042	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 26
16791043	16781043	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 27
16791044	16781044	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 28
16791045	16781045	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 29
16791046	16781046	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 30
16791047	16781047	COULD NOT CALCULATE WAFER UNLOAD POSITION FOR WAFER IN SLOT 31
16791057	16781057	THE WAFER IN SLOT 1 CANNOT BE TAKEN OUT
16791058	16781058	THE WAFER IN SLOT 2 CANNOT BE TAKEN OUT
16791059	16781059	THE WAFER IN SLOT 3 CANNOT BE TAKEN OUT

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16791060	16781060	THE WAFER IN SLOT 4 CANNOT BE TAKEN OUT
16791061	16781061	THE WAFER IN SLOT 5 CANNOT BE TAKEN OUT
16791062	16781062	THE WAFER IN SLOT 6 CANNOT BE TAKEN OUT
16791063	16781063	THE WAFER IN SLOT 7 CANNOT BE TAKEN OUT
16791064	16781064	THE WAFER IN SLOT 8 CANNOT BE TAKEN OUT
16791065	16781065	THE WAFER IN SLOT 9 CANNOT BE TAKEN OUT
16791066	16781066	THE WAFER IN SLOT 10 CANNOT BE TAKEN OUT
16791067	16781067	THE WAFER IN SLOT 11 CANNOT BE TAKEN OUT
16791068	16781068	THE WAFER IN SLOT 12 CANNOT BE TAKEN OUT
16791069	16781069	THE WAFER IN SLOT 13 CANNOT BE TAKEN OUT
16791070	16781070	THE WAFER IN SLOT 14 CANNOT BE TAKEN OUT
16791071	16781071	THE WAFER IN SLOT 15 CANNOT BE TAKEN OUT
16791072	16781072	THE WAFER IN SLOT 16 CANNOT BE TAKEN OUT
16791073	16781073	THE WAFER IN SLOT 17 CANNOT BE TAKEN OUT
16791074	16781074	THE WAFER IN SLOT 18 CANNOT BE TAKEN OUT
16791075	16781075	THE WAFER IN SLOT 19 CANNOT BE TAKEN OUT
16791076	16781076	THE WAFER IN SLOT 20 CANNOT BE TAKEN OUT
16791077	16781077	THE WAFER IN SLOT 21 CANNOT BE TAKEN OUT
16791078	16781078	THE WAFER IN SLOT 22 CANNOT BE TAKEN OUT
16791079	16781079	THE WAFER IN SLOT 23 CANNOT BE TAKEN OUT
16791080	16781080	THE WAFER IN SLOT 24 CANNOT BE TAKEN OUT
16791081	16781081	THE WAFER IN SLOT 25 CANNOT BE TAKEN OUT
16791082	16781082	THE WAFER IN SLOT 26 CANNOT BE TAKEN OUT
16791083	16781083	THE WAFER IN SLOT 27 CANNOT BE TAKEN OUT
16791084	16781084	THE WAFER IN SLOT 28 CANNOT BE TAKEN OUT
16791085	16781085	THE WAFER IN SLOT 29 CANNOT BE TAKEN OUT
16791086	16781086	THE WAFER IN SLOT 30 CANNOT BE TAKEN OUT
16791087	16781087	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 1 WAFER IS BEING TRANSFERRED
16791088	16781088	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 2 WAFER IS BEING TRANSFERRED
16791089	16781089	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 3 WAFER IS BEING TRANSFERRED
16791090	16781090	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 4 WAFER IS BEING TRANSFERRED
16791091	16781091	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 5 WAFER IS BEING TRANSFERRED
16791092	16781092	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 6 WAFER IS BEING TRANSFERRED
16791093	16781093	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 7 WAFER IS BEING TRANSFERRED
16791094	16781094	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 8 WAFER IS BEING TRANSFERRED
16791095	16781095	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 9 WAFER IS BEING TRANSFERRED
16791096	16781096	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 10 WAFER IS BEING
16791097	16781097	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 11 WAFER IS BEING
16791098	16781098	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 12 WAFER IS BEING
16791099	16781099	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 13 WAFER IS BEING
16791100	16781100	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 14 WAFER IS BEING

16791101	16781101	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 15 WAFER IS BEING
16791102	16781102	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 16 WAFER IS BEING
16791103	16781103	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 17 WAFER IS BEING
16791104	16781104	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 18 WAFER IS BEING
16791105	16781105	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 19 WAFER IS BEING
16791106	16781106	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 20 WAFER IS BEING
16791107	16781107	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 21 WAFER IS BEING
16791108	16781108	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 22 WAFER IS BEING
16791109	16781109	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 23 WAFER IS BEING
16791110	16781110	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 24 WAFER IS BEING
16791111	16781111	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 25 WAFER IS BEING
16791112	16781112	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 26 WAFER IS BEING
16791113	16781113	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 27 WAFER IS BEING
16791114	16781114	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 28 WAFER IS BEING
16791115	16781115	THE WAFER CANNOT BE INSERTED BECAUSE SLOT 29 WAFER IS BEING
16791163	16781163	WAFER TABLE IS PULLED OUT OF THE LOADER Z
16791164	16781164	NO TRAY ON WAFER TABLE IN LOADER Z
16791267	16781267	PRINTER INITIALIZE ERROR
16791268	16781268	SIO BOARD INITIAL ERROR
16791269	16781269	GPIB BOARD INITIAL ERROR
16791270	16781270	TESTER-IF BOARD INITIAL ERROR
16791271	16781271	BIN/XY-IF BOARD INITIAL ERROR
16791272	16781272	HOT CHUCK INITIAL ERROR
16791273	16781273	KLA IP BOOT ERROR
16791274	16781274	GPIB COMMUNICATIONS TIME OUT
16791275	16781275	TTL TESTER TIME OUT
16791276	16781276	GPIB HARDWARE ERROR
16791279	16781279	HEAD PLATE INTERLOCK SETTING ERROR
16791280	16781280	BAR CODE READER INITIALIZE ERROR
16791281	16781281	OCR TASK CREATION ERROR
16791282	16781282	HOT&COLD INITIALIZE ERROR
16791283	16781283	HOT&COLD TASK CREATE ERROR
16791284	16781284	HOT&COLD MODE ERROR
16791285	16781285	OPERATING RATE INITIALIZE ERROR
16791286	16781286	GPIB TASK INITIALIZATION ERROR
16791287	16781287	RDP TASK INITIALIZATION ERROR
16791288	16781288	AIR COOLING INITIALIZE ERROR
16791289	16781289	AIR COOLING TASK CREATE ERROR
16791290	16781290	TEMP CONTROL SYSTEM INITIALIZE ERROR
16791291	16781291	TEMP CONTROL SYSTEM TASK CREATE ERROR
16791293	16781293	RS232 ENHANCE TESTER CABLE IS NOT CONNECTED

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16791294	16781294	RS232 ENHANCE TASK CREATION ERROR
16791296	16781296	HOT AIR INITIAL ERROR
16791300	16781300	ZIF CONNECT OPEN ERROR
16791301	16781301	TOP PLATE LOCK LOCK ERROR
16791302	16781302	TOP PLATE LOCK UNLOCK ERROR
16791304	16781304	SACC CLAMP METHOD SETTING ERROR
16791305	16781305	TOP PLATE LOCK AIR DOWN
16791306	16781306	ZIF CONNECTION ERROR
16791307	16781307	RECEIVED ALARM SIGNAL FROM UPS
16791308	16781308	RECEIVED POWER DOWN SIGNAL FROM UPS
16791309	16781309	UPS INSPECTION SYSTEM CREATION ERROR
16791310	16781310	UPS INSPECTION SYSTEM OPTION SETTING ERROR
16791417	16781417	TRANSMISSION DATA FCS ERROR ON THE CONTROLLER SIDE
16791418	16781418	TRANSMISSION DATA FORMAT ERROR ON THE CONTROLLER SIDE
16791419	16781419	NUMERICAL DATA ERROR ON THE CONTROLLER SIDE
16791420	16781420	THE CONTROLLER RECEIVED AN UNDEFINED COMMAND
16791421	16781421	CONTROLLER STATUS SENSOR ERROR
16791422	16781422	CONTROLLER STATUS A/D ERROR
16791423	16781423	PREHEATER ERROR
16791424	16781424	CONTROLLER STATUS UPPER LIMIT ERROR
16791425	16781425	SETTING DATA NG
16791427	16781427	CONTROLLER TRANSMISSION ERROR
16791428	16781428	CONTROLLER RECEPTION ERROR
16791429	16781429	CONTROLLER INITIAL STATUS READ-OUT ERROR
16791430	16781430	THE TEMPERATURE OF THE TEST VALUE READOUT OF UNITS 1 & 2 ARE +-3 DEGREES
16791432	16781432	NFB ERROR
16791433	16781433	CHUCK OVERHEAT
16791435	16781435	I/O ADDRESS IS NOT CONNECTED TO THE VME BUS
16791436	16781436	THE CONNECTOR IS REMOVED OR NOT CONNECTED
16791437	16781437	THERE IS NO RESPONSE FROM THE TEMPERATURE CONTROLLER
16791439	16781439	THE TEMPERATURE SETTING WAS NOT REACHED
16791440	16781440	TEMPERATURE CONTROLLER 1 SENSOR ERROR
16791441	16781441	TEMPERATURE CONTROLLER 2 SENSOR ERROR
16791442	16781442	TEMPERATURE CONTROLLER 1 A/D CONVERTER ERROR
16791443	16781443	TEMPERATURE CONTROLLER 2 A/D CONVERTER ERROR
16791444	16781444	THE DEHUMIDIFICATION TIME OUT OCCURRED
16791566	16781566	LOST THE CARD
16791716	16781716	CHUCK TEMPERATURE SENSOR ERROR
16791717	16781717	CHUCK ABNORMAL TEMPERATURE
16791718	16781718	HOT&COLD SYSTEM ERROR
16791720	16781720	CONDENSATION MAY HAVE FORMED ON THE STAGE

16791721	16781721	HOT&COLD CONTROL DEFECT
16791722	16781722	SHUTTER SENSOR ERROR
16791723	16781723	EXCESSIVE LOAD ON THE DEHUMIDIFIER BLOWER MOTOR
16791724	16781724	DEHUMIDIFIER DRAIN TANK IS FULL
16791725	16781725	DEHUMIDIFIER AIR VOLUME DECREASE
16791726	16781726	DEHUMIDIFIER TEMPERATURE ERROR
16791727	16781727	DEHUMIDIFIER POWER SUPPLY ERROR
16791728	16781728	CONDENSATION MAY HAVE FORMED ON THE STAGE
16791729	16781729	CONDENSATION MAY HAVE FORMED ON THE STAGE
16791730	16781730	INSUFFICIENT REFRIGERANT
16791731	16781731	REFRIGERANT FULL
16791732	16781732	THE REFRIGERANT TEMPERATURE ROSE
16791733	16781733	GENERATOR WATER LEAK
16791734	16781734	HOT&COLD CONTROL DEFECT
16791735	16781735	CHUCK TOP HEATER DISCONNECTION
16791736	16781736	CONDENSATION MAY HAVE FORMED ON THE STAGE
16791737	16781737	CONDENSATION MAY HAVE FORMED ON THE STAGE
16791739	16781739	TEMPERATURE CONTROL DEFECT
16791740	16781740	HOT&COLD OPERATION ENDED IN ERROR
16791741	16781741	AUTO TUNING PROCESSING TIME OUT
16791742	16781742	CONDENSATION MAY HAVE FORMED ON THE STAGE
16791743	16781743	CHILLER MALFUNCTION WAS DETECTED
16791816	16781816	CHUCK TEMPERATURE SENSOR ERROR
16791817	16781817	CHUCK ABNORMAL TEMPERATURE
16791818	16781818	TEMP CONTROL SYSTEM ERROR
16791820	16781820	CONDENSATION MAY HAVE FORMED ON THE STAGE
16791821	16781821	TEMP CONTROL DEFECT
16791822	16781822	SHUTTER SENSOR ERROR
16791823	16781823	EXCESSIVE LOAD ON THE DEHUMIDIFIER BLOWER MOTOR
16791824	16781824	DEHUMIDIFIER DRAIN TANK IS FULL
16791825	16781825	DEHUMIDIFIER AIR VOLUME DECREASE
16791826	16781826	DEHUMIDIFIER TEMPERATURE ERROR
16791827	16781827	DEHUMIDIFIER POWER SUPPLY ERROR
16791828	16781828	CONDENSATION MAY HAVE FORMED ON THE STAGE
16791829	16781829	CONDENSATION MAY HAVE FORMED ON THE STAGE
16791830	16781830	INSUFFICIENT REFRIGERANT
16791831	16781831	REFRIGERANT FULL
16791832	16781832	THE REFRIGERANT TEMPERATURE ROSE
16791833	16781833	GENERATOR WATER LEAK
16791834	16781834	TEMPERATURE CONTROL DEFECT
16791835	16781835	CHUCK TOP HEATER DISCONNECTION

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16791836	16781836	CONDENSATION MAY HAVE FORMED ON THE STAGE
16791837	16781837	CONDENSATION MAY HAVE FORMED ON THE STAGE
16791839	16781839	TEMPERATURE CONTROL DEFECT
16791840	16781840	TEMP CONTROL OPERATION ENDED IN ERROR
16791841	16781841	AUTO TUNING PROCESSING TIME OUT
16791842	16781842	COOLING AIR PRESSURE FALLING
16791886	16781886	COULD NOT CONNECT WITH OBSERVATION UNIT
16791887	16781887	OBSERVATION UNIT DEFROST MODE TIME OUT
16791888	16781888	OBSERVATION UNIT DETECTED AN ERROR
16791889	16781889	UNIT OBSERVATION FROST POINT ERROR
16791890	16781890	UNIT OBSERVATION TEMPERATURE GAP ERROR
16791891	16781891	UNIT OBSERVATION AIR FLOW AMOUNT ERROR
16791892	16781892	UNIT OBSERVATION DEFROSTING
16791906	16781906	HOT AIR SYSTEM ABNORMALITY
16791907	16781907	HOT AIR HEATER CUT-OUT
16791908	16781908	HOT AIR AIR CURRENT DROPPED
16791909	16781909	HOT AIR AIR TIME OUT
16792016	16782016	THE CARD COULD FALL
16792017	16782017	CARD DROP PREVENTION MONITOR TASK CANNOT BE STARTED
16792018	16782018	CANNOT FIND THE CARD DROP PREVENTION CONTROL BOARD
16792430	16782430	CARD CONTACT LIMIT HAS BEEN REACHED
16792431	16782431	PROBE MARK INSPECTION JUDGMENT ERROR
16792444	16782444	INPUT THE NUMBER OF THE WAFER THAT COULD NOT BE RECOGNIZED
16792717	16782717	WAFER CONTROL MAP DATA NOT SET
16792718	16782718	WAFER CONTROL MAP DATA ERROR
16792719	16782719	WAFER CONTROL MAP DATA & PROBER CHIP SIZE ARE DIFFERENT
16792720	16782720	WAFER CONTROL MAP DATA & PROBER WAFER SIZE ARE DIFFERENT
16792721	16782721	WAFER CNTRL MAP DATA&PROBER FLAT ORIENTATION POSITIONS DIFF
16792722	16782722	THERE WAS A FREE PROBE AREA SETTING FILE ERROR OR THERE IS NO FILE
16792723	16782723	THERE WAS A SKIP AREA SETTING FILE ERROR OR THERE IS NO FILE
16792724	16782724	CANNOT SAVE MAP DATA TO THE HARD DISK
16792725	16782725	CANT READ MAP DATA FROM HARD DISK
16792816	16782816	THE MARKER POSITION DATA IS NOT REGISTERED
16792817	16782817	MULTI PARAMETER SETTING ERROR
16792818	16782818	LOT NAME HAS NOT BEEN INPUT
16792819	16782819	CANNOT PERFORM SIMULTANEOUS MARKING
16792820	16782820	CANNOT PERFORM AFTER MARKING
16792821	16782821	MULTI TESTING IS NOT POSSIBLE
16792822	16782822	ERROR WITH THE WAFER PARAMETER SETTINGS
16793116	16783116	ERROR OCCURRED WITH TESTER I/F BOARD
16793117	16783117	BOTH TESTER I/F PASS AND FAIL SIGNAL ARE ON

16793118	16783118	HV-TTL COMMUNICATION TASK ERROR
16793119	16783119	HV-TTL COMMUNICATION PORT INITIALIZE ERROR
16793120	16783120	COMMUNICATIONS CANT CONNECT TO G/C
16793121	16783121	G/C IS OFF-LINE
16793122	16783122	A TIME OUT ERROR OCCURRED IN COMMUNICATIONS WITH THE G/C
16793123	16783123	AN ERROR OCCURRED WHILE TRANSFERRING FILE WITH THE G/C
16793124	16783124	COMMUNICATIONS WITH THE G/C WERE CUT
16793125	16783125	COMMUNICATIONS CANT CONNECT TO GCS
16793126	16783126	GCS IS OFF-LINE
16793127	16783127	A TIME OUT ERROR OCCURRED IN COMMUNICATIONS WITH THE GCS
16793128	16783128	AN ERROR OCCURRED WHILE TRANSFERRING FILE WITH THE GCS
16793129	16783129	COMMUNICATIONS WITH THE GCS WERE CUT
16793130	16783130	W/S IS OFF-LINE
16793131	16783131	TIME OUT ERROR OCCURRED DURING COMMUNICATION WITH W/S
16793132	16783132	COMMUNICATION WITH W/S HAS BEEN CUT
16793133	16783133	ERROR OCCURRED WITH TRANSFER AND RECEIPT OF FILES WITH W/S
16793218	16783218	THERE IS NO FD MEDIA
16793221	16783221	NOT ENOUGH SYSTEM MEMORY
16793322	16783322	A WAFER SIZE VALUE OTHER THAN 200 mm OR 300 mm HAS BEEN SET
16793326	16783326	WAFER TABLE BASE IS NOT SET (ARM DRIVE)
16793327	16783327	OPENER IS NOT AT OPEN POSITION (ARM DRIVE)
16793336	16783336	MAPPING ARM IS NOT AT HOME POSITION (LOADER q DRIVE)
16793346	16783346	LOADER Z ORIGIN SENSOR DEFECTIVE
16793356	16783356	CANNOT DELETE FOUP_OPENER TASK
16793357	16783357	CANNOT DELETE LOADER ARM STOP TASK
16793358	16783358	CANNOT DELETE LOADER SENSOR STATUS TASK
16793366	16783366	FOUP_OPENER TIME OUT ERROR (FOR COMMUNICATION)
16793367	16783367	FOUP_OPENER TIME OUT ERROR (NO RESPONSE)
16793368	16783368	FOUP_OPENER ILLEGAL COMMAND
16793369	16783369	FOUP_OPENER COMMAND CANNOT BE EXECUTED
16793370	16783370	FOUP_OPENER AIR PRESSURE ERROR
16793371	16783371	FOUP_OPENER EMERGENCY FUNCTION ACTIVATED
16793372	16783372	FOUP_OPENER WAFER IS PROTRUDING FROM CASSETTE
16793373	16783373	FOUP_OPENER I/O PORT NOT INITIALIZED
16793374	16783374	FOUP_OPENER INITIALIZATION NOT COMPLETED
16793375	16783375	FOUP_OPENER VACUUM ERROR
16793376	16783376	FOUP_OPENER 24 V MISSING ERROR
16793381	16783381	FOUP_OPENER OPENER UP ERROR
16793382	16783382	FOUP_OPENER OPENER DOWN ERROR
16793383	16783383	FOUP_OPENER OPENER UP / DOWN SENSOR ERROR
16793384	16783384	FOUP_OPENER OPENER CLOSE ERROR

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16793385	16783385	FOUP_OPENER OPENER OPEN ERROR
16793386	16783386	FOUP_OPENER OPENER OPEN / CLOSE SENSOR ERROR
16793387	16783387	FOUP_OPENER OPENER LOCK ERROR
16793388	16783388	FOUP_OPENER OPENER UNLOCK ERROR
16793389	16783389	FOUP_OPENER OPENER LOCK / UNLOCK SENSOR ERROR
16793390	16783390	FOUP_OPENER OPENER VACUUM-CHUCK ERROR
16793391	16783391	FOUP_OPENER OPENER NOT READY FOR ACTION
16793392	16783392	FOUP_OPENER OPENER COULD NOT MOVE
16793396	16783396	FOUP_OPENER LOADPORT UNDOCK ERROR
16793397	16783397	FOUP_OPENER LOADPORT DOCK ERROR
16793398	16783398	FOUP_OPENER LOADPORT DOCK / UNDOCK SENSOR ERROR
16793399	16783399	FOUP_OPENER LOADPORT SAFTY FRAME SENSOR ERROR
16793400	16783400	FOUP_OPENER RATCH OPEN ERROR
16793401	16783401	FOUP_OPENER RATCH CLOSE ERROR
16793402	16783402	FOUP_OPENER RATCH OPEN/CLOSE SENSOR ERROR
16793403	16783403	FOUP_OPENER LOADPORT COULD NOT MOVE
16793404	16783404	FOUP_OPENER LOADPORT NOT READY FOR ACTION
16793406	16783406	FOUP_OPENER THERE IS NO CASSETTE AT LOADPOAT
16793407	16783407	FOUP_OPENER THE DOOR OF CASSETTE IS UNLOCKED
16793408	16783408	FOUP_OPENER CANNOT OPEN CASSETTE
16793409	16783409	FOUP_OPENER THERE IS NO BODY OF THE CASSETTE
16793410	16783410	UPPER ARM IS NOT AT HOME POSITION (FOUP_OPENER DRIVE)
16793411	16783411	LOWER ARM IS NOT AT HOME POSITION (FOUP_OPENER DRIVE)
16793412	16783412	MAPPING ARM IS NOT AT HOME POSITION (FOUP_OPENER DRIVE)
16793416	16783416	LOADER Z MOTOR DRIVER BOARD DEFECT
16793417	16783417	LOADER Z MOTOR DRIVER BOARD DEFECT
16793418	16783418	LOADER Z MOTOR DRIVER BOARD DEFECT
16793419	16783419	WAFER TABLE BASE IS NOT SET (LOADER Z DRIVE)
16793420	16783420	LOADER Z ENCODER DEFECT(CHECK THE WAFER)
16793421	16783421	WAFER TABLE DOOR IS OPEN (LOADER Z DRIVE)
16793422	16783422	LOADER Z DOWN LIMIT CHECK ERROR
16793423	16783423	LOADER Z UP LIMIT CHECK ERROR
16793424	16783424	LOADER Z HAS BEEN TRANSFERRED TO HOME POSITION
16793425	16783425	UPPER ARM IS NOT AT HOME POSITION (LOADER Z DRIVE)
16793426	16783426	LOWER ARM IS NOT AT HOME POSITION (LOADER Z DRIVE)
16793427	16783427	LOADER q IS NOT AT HOME POSITION (LOADER Z DRIVE)
16793428	16783428	MAPPING ARM IS NOT AT HOME POSITION (LOADER Z DRIVE)
16793436	16783436	MAPPING ARM IS NOT AT HOME POSITION (MAPPING ARM DRIVE)
16793437	16783437	MAPPING ARM IS NOT AT REACH POSITION (MAPPING ARM DRIVE)
16793438	16783438	MAPPING ARM POSITION ILLEGAL
16793439	16783439	LOADER q IS NOT AT HOME POSITION (MAPPING ARM DRIVE)

16793440	16783440	OPENER IS NOT AT OPEN POSITION (MAPPING ARM DRIVE)
16793441	16783441	MAPPING ARM POSITION IS OUT OF MAPPING AREA
16793456	16783456	THE WAFER PROTRUDING STOP BAR IS NOT AT HOME POSITION
16793457	16783457	THE WAFER PROTRUDING STOP BAR IS NOT AT ON POSITION
16793458	16783458	THE WAFER TABLE DOOR LOCK IS NOT AT CLOSE POSITION
16793459	16783459	THE WAFER TABLE DOOR LOCK IS NOT AT OPEN POSITION
16793476	16783476	COMMAND ERROR WHEN COMMUNICATING WITH THE LOADER CONTROLLER
16793477	16783477	SYSTEM ERROR WHEN COMMUNICATING WITH THE LOADER CONTROLLER
16793478	16783478	UPPER ARM MOTOR COULD NOT DETECT THE END OF MOTOR DRIVE
16793479	16783479	LOWER ARM MOTOR COULD NOT DETECT THE END OF MOTOR DRIVE
16793480	16783480	SUBCHUCK MOTOR COULD NOT DETECT THE END OF MOTOR DRIVE
16793481	16783481	LOADER q MOTOR COULD NOT DETECT THE END OF MOTOR DRIVE
16793482	16783482	LOADER Z MOTOR COULD NOT DETECT THE END OF MOTOR DRIVE
16793483	16783483	LOADER X MOTOR COULD NOT DETECT THE END OF MOTOR DRIVE
16793507	16783507	SH COMMUNICATION RS PORT INITIALIZATION FAILED
16793508	16783508	FAILD TO CLOSE THE SH COMMUNICATION RS PORT
16793509	16783509	SH COMMUNICATION TIME OUT
16797215	16787215	STOPPER

## Appendix F. Prober Alarms

## Appendix G. Prober Settings

This section provides TEL P-12XL prober settings for using with VGEM:

### GPIB Parameter Settings

GPIB parameters can be set on Main Menu/Diag/Adjust/Hard option page.

Terminator	CRLF
Update coordinate on I/J drive	No
Z position after movement	Down
Off wafer drive	Yes
"Z" command SRQ	43H
Initial wafer SRQ	4A+46(H)
Output SRQ on command error	Yes
Alignment error unload/reject	With u,U
Output SRQ48 at carrier end	Yes
Output SRQ 4E at lot end	No
Issue SRQ 69 or SRQ 48 when lot finished	48H
Display end of lot message	No/Yes *1

\*1: Depends on User Environment for Wafer Carrier Handling

No: for Automatic

Yes: for Operator Assistance

### Operator Parameter Settings

Operator parameters can be set on Main Menu/SETUP/Operation Parameter/GPIB page.

GPIB	Use
Stop at Reference die	No
Receive Parameters	No
Random Wafer Testing	No
GPIB Timer	0 sec
Contract check	No
Cassete Map Transport	Yes
Use LotEnd command (UD007)	Yes

## Network Parameters Settings

Network parameters can be set on Main Menu/Diag/GEM/Communication Parameters page.

Connect Mode	ACTIVE
Host Port Number	5556
Session ID	0000
Cassete Map transfer	Yes
Connect retry	ENABLE
Duplicate Block Detection	DISABLE
Multi-Block Data Send Inquire	DISABLE
W-BIT (S5)	ENABLE
W-BIT (S6)	ENABLE

## Edit Alarms Settings

Edit Alarms can be set on Main Menu/Diag/GEM page

Msg	AlarmRpt	ALL NO
	Detect	ALL NO
	Clear	ALL NO
	Recog	ALL NO
Ast	AlarmRpt	ALL NO
	Detect	ALL NO
	Clear	ALL NO
	Recog	ALL NO
Err	AlarmRpt	ALL YES
	Detect	ALL YES
	Clear	ALL YES
	Recog	ALL YES

## Equipment Constants Settings

Equipment Constants can be set on Main Menu/Diag/GEM page

ECID	EC Name	EC Value
83	Job Max	1 (for Single Load Port) 2 (for Dual Load Port)
139265	BypassReadID1	TRUE (for Load Port #1)
139266	BypassReadID2	TRUE (for Load Port #2)



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