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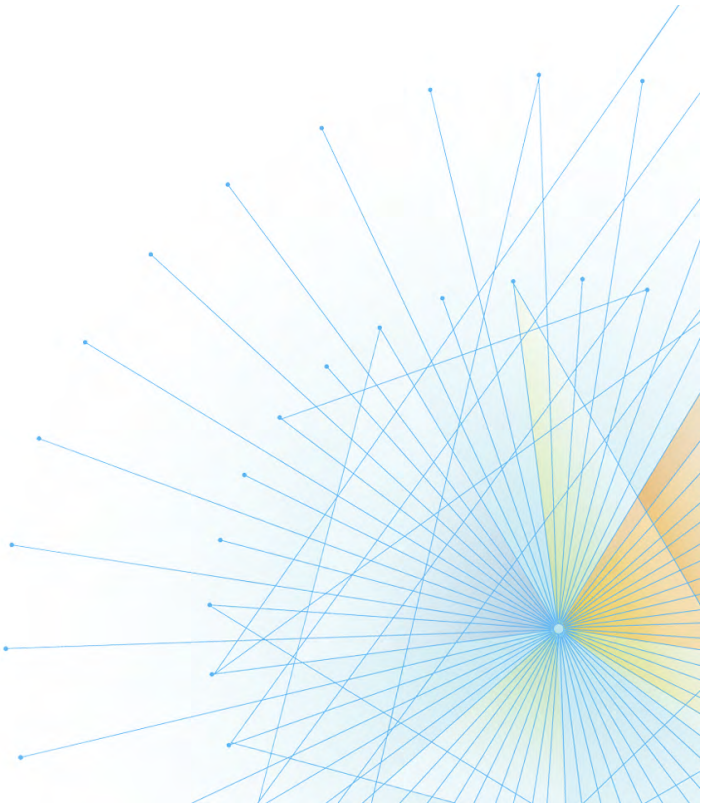
# ISPW
# Interfaces Guide

## Release 18.02



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# Contents

# Introduction

This manual documents the various interfaces available in ISPW, and contains the following chapters:

- "External Call Interface"
- "Standalone Load Modules"
- "DB2 Programs, Plans, and Packages"
- "DB2 Generated DECLARE Statements"
- "Managing Native Stored Procedures and Triggers in ISPW"
- "QMF Interface"
- "Natural Interface"
- "ISPW Web Interface".

## Related Publications

- *ISPW Release Notes:* Overview of release features and any new ISPW information.
- *ISPW Installation and Configuration Guide*: Gives step-by-step instructions for the system programmer to configure, customize, and maintain ISPW. Refer to it when installing ISPW according to the *Compuware Installer Mainframe Products SMP/E Installation Guide*.
- *ISPW Deploy Reference*: Introduces ISPW users to the new ISPW Deploy product. It gives details of the concepts and facilities from both an end-user and technical perspective.
- *ISPW Messages and Codes*: Documents the messages and codes for ISPW, including started task errors, abend codes, return codes, allocation errors, and ISPW CM errors.
- *ISPW Planning Guide*: Provides information for use in the early stages of an ISPW implementation. It contains only what is necessary for planning and initial installation.
- *ISPW Remote Server Guide*: Describes ISPW remote servers, Controlled Tasks run on platforms separate from the main ISPW Administration Server.
- *ISPW Technical Reference*: Provides detailed information on ISPW's structure, terms and concepts, maintenance functions, processing, security, and other technical content.
- *ISPW User Guide*: Provides an overview for Applications and other Information Systems staff to use ISPW effectively.
- *ISPW Upgrade Guide, Release 4.4 to 17.02*: Describes the major differences between ISPW 4.4 and ISPW 17.02 and serves as a guide for the upgrade process between these versions.
- *ISPW Web Interface Installation and Configuration Guide*: Provides instructions on how to install the ISPW Web Interface. ISPW Web is an Internet-based application designed to be used on workstations or smartphones. The ISPW Web Interface uses a Web browser that enables you to remotely approve or reject ISPW actions as well as deploy software to both mainframe and distributed environments.

### Online Documentation

The ISPW product installation package does not include the product documentation. Access the ISPW documentation from the Compuware Support Center website at **https://go.compuware.com** in the following electronic formats:

- Release Notes in HTML format
- Product manuals in PDF format
- Product manuals in HTML format.

The product documentation is available for viewing or downloading:

- View PDF files with the free Adobe Reader, available at **http://www.adobe.com**.
- View HTML files with any standard web browser.

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# External Call Interface

The ISPW External Call Interface (ECI) is an alternate interface to the User Interface that can be used to perform a subset of ISPW functions. The ECI can be called either by an API (programmatically) or via JCL. The ECI is an z/OS Interface to ISPW.

## When to Use the ECI

The ECI is intended for those situations in which processing occurs outside of ISPW that needs to be reflected in the ISPW repository. This processing might be a result of external events or could be a set of mass operations which have been done outside the user interface.

**Example 1**

When a component has been implemented into another environment, the status of the Task can be updated to reflect this by an ECI call.

**Example 2**

When migrating application systems into ISPW, the ECI can be used to populate the repository with information about the components.

### Limitations

The ECI only affects ISPW's logical meta-data repository. For functions concerning components, it does not provide any consistency checking with the actual component itself. It is the user's responsibility to ensure that the information provided in the ECI calls is correct.

## Using the ECI via the API

### Calling the ECI

Calls to ISPW functions are provided though the WZZECI interface module.

This is an LE-compliant routine that can be called (either statically or dynamically) from any other LE program.

All calls to WZZECI must include a common data structure in which an OBJECT and METHOD identify the type of call. Other parameters may be required, depending upon the type of call.

All ECI sessions must begin with a call to initialize the ISPW environment and end with a call to clean up the session. Between these two calls, any number of other calls may be made.

### Processing Considerations

After successful initialization of the ISPW environment, multiple ECI functions can be performed. Each ECI function is considered to be separate and, if successful, is committed in the repository.

## Security

All ECI calls pass through authorization checking by the ISPW Server. It is recommended that security rules and associated SAF profiles be defined to protect usage of the ECI. Authority checking is done against the UserID making the ECI calls.

## Handling Errors

Calls made to the ECI which are not successful result in non-zero return codes. Error messages are returned to help determine what the error is.

# Using the ECI via JCL

ECI calls via JCL are made though the WZZECIJ program.

Figure 1 shows an example of initiating a Task operation and defining a Task to be added to the Set.

**Figure 1** Task Operation - Initiate and Task Operation - Specify Tasks JCL for WZZECIJ

```
//WZZECIJ  JOB MSGCLASS=X,CLASS=A,NOTIFY=JohnDoe
//STEP1    EXEC  PGM=WZZRCJOB,PARM='Default/WZZECIJ'
//STEPLIB DD DSN=ISPW.CONFIG.AUTHLOAD,DISP=SHR
//*****************************************************************
//* STEP 1:  PERFORM TASK OP IN BATCH VIA ECI
//*****************************************************************
//WORKIN   DD *
$DEFINE_TSB
  APPLID=TST
  STRMNAME=TEST
  OP=X
  LVL=HLD1
$DEFINE_TSBT
  APPLID=TST
  MTYPE=COB
  MNAME=TESTCOB
```

The format of the input via JCL is the `$DEFINE_datagroup` followed by a line for each keyword and its corresponding value. Valid `$DEFINE_datagroup` values are specified alongside the descriptions of the functions on the following pages. Each `$DEFINE_datagroup` statement delimits any previous call. The indentation of the keywords is for clarity purposes only.

The valid keywords for each call are documented in the following descriptions of each function call. They can be specified in any order. Values that are text with embedded spaces must be enclosed by single quotes.

## Limitations

The JCL Interface does not support all ECI calls. The description for each function specifies whether the JCL Interface is valid for that function. Some calls return values (for example, Assignment Add returns details about the Assignment just added). The JCL Interface cannot do anything with these values.

## Connecting to the ISPW Environment

Initiation of WZZECI creates an ISPW Environment automatically using the information specified in the server connection definition file. A DD name WZZRCJOB points to this file. The format of the WZZRCJOB runtime configuration file is the same for both batch and TSO users.

## Security

All ECI calls pass through authorization checking by the ISPW Server just like a normal ISPW user. Authority checking is done against the UserID of the batch Job.

## Handling Errors

Calls made to the ECI which are not successful result in non-zero return codes. Error messages are displayed in the output to help determine what the error is.

## Additional DD Statements

Two additional DD statements, WZZSETID and WZZOUT, can be added to the JCL stream.

### WZZSETID

When this statement is added to the JCL and you are performing task operations, the Set ID is written to the destination. For more information, see Task Operation on page 23. A simple form of this DD statement is:

```
//WZZSETID DD SYSOUT=*
```

### WZZOUT

When this statement is added to the JCL, program execution information is written to this destination. This may be useful in resolving issues with the execution of the operation. If this statement is not in the JCL, the program execution information is written to a dynamically allocated SYSOUT DD statement. A simple form of this DD statement is:

```
//WZZOUT DD SYSOUT=*
```

# ECI Functions and Calls

## Functions

Usage of the ECI is described in terms of ***functions***. Each function is considered to be a “unit of work”. Some functions relate to a single ECI call, while others may consist of multiple calls.

## Calls

ECI Calls are distinguished by the Object and Method specified with the call.

# Function and Call Mappings

Table 1 summarizes the Functions currently supported with their associated Objects and Methods. The **JCL Call** column indicates whether the function can be called via the JCL Interface program WZZECIJ.

**Table 1** Supported Functions

| Function | Object | Method | Description | JCL Call |
|---|---|---|---|---|
| Initialize Environment | ENV | INIT | Initialize the ISPW environment | No |
| Terminate Environment | ENV | TERM | Cleanup the ISPW environment | No |
| Assignment Add | ASGNMENT | ADD | Add an Assignment | Yes |
| Release Add | RELEASE | ADD | Add a Release | Yes |
| Task Load | TASK | LOAD | First call in loading of a single Task | Yes |
| | TASK | LOADPART | Calls to load individual parts of a Component for a Task (for example, load, DBRM, etc.) | Yes |
| | TASK | LOADEND | Delimit the loading of a single Task | Yes |
| Task Status Update | TASK | STATUPDT | Update the status of a Task (for example, the result of a generate) | No |
| Task Operation | TASK | BATOP | First call in processing Task operations in a Set | Yes |
| | TASK | BATOPTSK | Call for each Task to have operation performed | Yes |
| | TASK | BATOPEND | Delimit the list of Tasks and Lock the set for execution. | Yes |
| Set Approve | SET | APRVMOD | Approve/Deny Set | Yes |
| Set Execute | SET | EXECUTE | Release Set for Execution | Yes |
| Component Transport Control | TRNSPCTL | AUTHREQ | Manage the operation of Component Transport Servers. | No |

# Initialize Environment

## Purpose

This call initializes an ISPW environment. It must be successfully made before any of the other ECI functions can be called. The JCL Interface makes this call implicitly, which is why an explicit JCL call of this type is not available.

## API Parameter List

### ECIR

The ECIR Data Structure must have the values in Table 2 set.

**Table 2** ECIR Data Structure Values for Initialize

| Parameter | Value |
|---|---|
| CONNECTION DEFINITION | DDNAME of the ISPW Connection Definition file |
| OBJECT | ENV |
| METHOD | INIT |

## ISPW Connection Definition

The connection definition is a sequential file or PDS member containing the necessary information to connect to an ISPW server. This dataset must be allocated to the DDNAME specified in the ECIR.

The specification is made by keyword parameters starting in column 1 in the following format:

```
CMID = cccc
SRID = ssss
```

where the parameters and defaults in Table 3 apply.

**Table 3** Connection Definition Parameter Defaults

| Parameter | Default | Description |
|---|---|---|
| cccc | ISPW | ISPW Communications MVS Subsystem ID |
| ssss | ISPW | ISPW Server ID |

## ECIR Data Structure

The same data area must be passed on each call as ISPW uses this as an anchor to maintain the ISPW environment. When a non-zero return code is returned from WZZECI, error information is passed back in the ECIR. The ECIR layout is described in Table 4.

**Table 4** ECIR Layout

| Position | Length | Type | Field | Description |
|---|---|---|---|---|
| 1 | 4 | CHAR | EYECATCHER | Used to identify the ECIR control block. Must have a value of **ECIR**. |
| 5 | 4 | BINARY | ENVIRONMENT HANDLE | Used by ISPW to maintain environment.<br><br>The ENV INIT call populates this field and it is used by all subsequent ECI calls as a means of identifying the session. This should ***not*** be initialized between calls. |
| 9 | 8 | CHAR | CONNECTION DEFINITION | Specifies the ISPW Connection Definition Name.<br><br>Must be set on ENV INIT request to DDNAME containing connection definition |
| 17 | 8 | CHAR | OBJECT | Specifies the request Object name |
| 25 | 8 | CHAR | METHOD | Specifies the request Method name |
| 33 | 4 | BINARY | RETURN CODE | ISPW request return code. |
| 37 | 4 | BINARY | REASON CODE | ISPW request reason code. |
| 41 | 8 | CHAR | ERROR ID | Error ID as defined in the Error Messages |
| 49 | 8 | CHAR | ERROR CODE | ISPW Diagnostic Code |
| 57 | 72 | CHAR | SHORT ERROR MSG | Short error message |
| 129 | 255 | CHAR | LONG ERROR MSG | Long error message |
| 384 | 32 | CHAR | RESERVED | |

## Return Codes

For each ECI request, the return codes in Table 5 are possible.

**Table 5** ECI Request Return Codes

| Return Code | Description |
|---|---|
| 0 | Successful |
| 4 | Invalid ECIR |
| 8 | ISPW Server Function error (See error message) |
| 12 | ECI Usage Error (See Reason Codes) |
| 16 | Error in Environment Initialization |

**Table 5** ECI Request Return Codes ***(Continued)***

| Return Code | Description |
|---|---|
| 20 | Internal ISPW Communications Error |

### Possible Reason Codes

For non-zero Return codes, a Reason code (see Table 6) is supplied which provides more information on the cause of the error.

**Table 6** ECI Request Reason Codes

| Reason Code | Description |
|---|---|
| 1 | ECI Initialization not done |
| 2 | Bad OBJECT or METHOD |
| 3 | Bad Field Map (Internal Error) |

## Terminate Environment

### Purpose

This call cleans up and terminates an ISPW environment. It should be made after all other calls for the session have been done. The JCL Interface makes this call implicitly, which is why an explicit JCL call of this type is not available.

### API Parameter List

#### ECIR

The ECIR Data Structure must have the values in Table 7 set.

**Table 7** ECIR Data Structure Values for Terminate

| Parameter | Value |
|---|---|
| OBJECT | ENV |
| METHOD | TERM |

## Add Assignment

### Purpose

This call adds an Assignment in ISPW.

### API Parameter List

#### ECIR, ASA

The ECIR Data Structure must have the values in Table 8 set.

**Table 8** ECIR Data Structure Values for Add Assignment

| Parameter | Value |
|---|---|
| OBJECT | ASGNMENT |
| METHOD | ADD |

### JCL Invocation

```
$DEFINE_ASA
```

## ASA Data Structure

The ASA data area contains details required to add the Assignment. The ASA layout is described in Table 9.

**Table 9** ASA Layout

| Position | Length | Type | Description | JCL Keywords | API | JCL |
|---|---|---|---|---|---|---|
| 1 | 4 | CHAR | Default Application for Tasks added to this Assignment | APPLID | Mandatory | Mandatory |
| 5 | 50 | CHAR | Description for Assignment | DESC | Optional | Optional |
| 55 | 4 | CHAR | Default signout level for Tasks added to this assignment | DFLTLVL | Optional | Optional |
| 59 | 8 | CHAR | Work Reference ID – text field for customer use | REFNO | Optional | Optional |
| 67 | 8 | CHAR | UserID of the Assignment Owner Defaults to UserID of caller | OWNER | Optional | Optional |
| 75 | 10 | CHAR | Default Release ID associated to Tasks added to this Assignment | IMPLNO | Optional | Optional |
| 85 | 4 | CHAR | Assignment Prefix – not required if a specific Assignment is specified | ASGNPRF | See note below. | |
| 89 | 8 | CHAR | Stream Name | STRMNAME | Mandatory | Mandatory |
| 97 | 10 | CHAR | Assignment Number – returned if Prefix is specified, otherwise must be specified | PROJNO | See note below. | |
| 107 | 10 | CHAR | Return Value – Creation Date | | Optional | NA |
| 117 | 8 | CHAR | Return Value – Creation Time | | Optional | NA |

You must specify either Assignment Number or Assignment Prefix.

# Add Release

## Purpose

This call adds a Release in ISPW.

## API Parameter List

### ECIR, RLA

The ECIR Data Structure must have the values in Table 10 set.

**Table 10** ECIR Data Structure Values for Add Release

| Parameter | Value |
|---|---|
| OBJECT | RELEASE |
| METHOD | ADD |

## JCL Invocation

```
$DEFINE_RLA
```

### RLA Data Structure

The RLA data area contains details required to add the Release. The RLA layout is described in Table 11.

**Table 11** RLA Layout

| Position | Length | Type | Description | JCL Keyword | API | JCL |
|---|---|---|---|---|---|---|
| 1 | 10 | CHAR | Release ID – returned if release prefix is used, otherwise must be specified. | RLSEID | See note below. | |
| 11 | 50 | CHAR | Description for Assignment | DESC | Optional | Optional |
| 61 | 4 | CHAR | Owning Application for Release | APPLID | Mandatory | Mandatory |
| 65 | 8 | CHAR | Work Reference ID – text field for customer use | REFNO | Optional | Optional |
| 73 | 8 | CHAR | UserID of the Assignment Owner Defaults to UserID of caller | OWNER | Optional | Optional |
| 81 | 8 | CHAR | Stream Name | STRMNAME | Mandatory | Mandatory |
| 89 | 10 | CHAR | Implementation Date – informational only | IMPLDATE | Optional | Optional |
| 99 | 8 | CHAR | Implementation Time – informational only | IMPLTIME | Optional | Optional |
| 107 | 4 | CHAR | Release Prefix – must be specified if Release ID is not | RLSEPRF | See note below. | |

You must specify either Release ID or Release Prefix.

## Task Load

### Purpose

The Task load process is used to populate the ISPW repository with Tasks and Components. Tasks can be loaded at any level (even production). It is the responsibility of the caller to make sure that Task information loaded reflects the actual location and status of the physical components.

### Description

The Task load process consists of one TASK LOAD call, zero or more TASK LOADPART calls, and one TASK LOADEND call. The information for the Task is not committed to the repository until a successful TASK LOADEND call is made.

### Version Sequence Issues

Loading Tasks through the ECI has consequences for versioning, in that these tasks are inherently not based upon any existing versions in the repository.

ECI loaded tasks are considered to be ***mutable*** (for example, ISPW cannot guarantee the integrity of the task with relation to other tasks), and so the strict versioning sequence rules do not apply.

## Task Load – Initiate

### Purpose

This call initiates the loading of a Task into ISPW. It can be made to add a Task and its associated Component information to any level, including Production.

## API Parameter List

### ECIR, TSI

The ECIR Data Structure must have the values in Table 12 set.

**Table 12** ECIR Data Structure Values for Task Load – Initiate

| Parameter | Value |
|---|---|
| OBJECT | TASK |
| METHOD | LOAD |

## JCL Invocation

```
$DEFINE_TSI
```

## TSI Data Structure

The TSI data area contains details required to add the Task. The TSI layout is described in Table 13.

**Table 13** TSI Layout

| Position | Length | Type | Description | JCL Keyword | API | JCL |
|---|---|---|---|---|---|---|
| 1 | 4 | CHAR | ISPW Application ID | APPLID | Mandatory | Mandatory |
| 5 | 8 | CHAR | Stream Name | STRMNAME | Mandatory | Mandatory |
| 13 | 4 | CHAR | ISPW Component Type (must be a valid Component Type for the specified Application) | MTYPE | Mandatory | Mandatory |
| 17 | 4 | CHAR | Reserved – set to null or spaces | MCLAS | NA | NA |
| 21 | 64 | CHAR | Component Name | MNAME | Mandatory | Mandatory |
| 85 | 8 | CHAR | Component Short Name (otherwise spaces). If this is spaces, ISPW will automatically generate the short name, which will be the same as the Component Name for Component Names that are 8 characters or less.<br>For Component Names longer than 8 characters, ISPW will generate a unique name. | SHRTNAME | Optional | Optional |
| 93 | 10 | CHAR | Owning Assignment ID (must be a valid Assignment number) | PROJNO | Mandatory | Mandatory |
| 103 | 10 | CHAR | Associated Release ID (must be either a valid Release ID or spaces) | RLSEID | Optional | Optional |
| 113 | 1 | CHAR | Action Code.<br>space – normal ISPW processing<br>**D** – Component to be deleted<br>**C** – Component source in production | ACTION | Optional | Optional |
| 114 | 4 | CHAR | Level the Component is at (must be a valid Level for the specified Application) | CLVL | Mandatory | Mandatory |
| 118 | 4 | CHAR | Level the Component logically started. Defines the "Path" the Component moves to production (must be a valid starting level for the specified Application) | SLVL | Mandatory | Mandatory |
| 122 | 4 | CHAR | Target environment for generated objects | TENV | Optional | Optional |
| 126 | 2 | CHAR | ISPW Operation code. If spaces, ISPW will use **TL**. | LASTOP | Optional | Optional |
| 128 | 10 | CHAR | Date of last ISPW operation – YYYY-MM-DD. If spaces, ISPW will use the current date. | LASTDATE | Optional | Optional |

**Table 13** TSI Layout ***(Continued)***

| Position | Length | Type | Description | JCL Keyword | API | JCL |
|---|---|---|---|---|---|---|
| 138 | 8 | CHAR | Time of last ISPW operation – HH:MM:SS. If spaces, ISPW will use the current time. | LASTTIME | Optional | Optional |
| 146 | 8 | CHAR | UserID identifying who did last operation. If spaces, ISPW will use the ECI caller UserID. | USERID | Optional | Optional |
| 154 | 8 | CHAR | User-specified external version number | EXTVER | Optional | Optional |
| 162 | 50 | CHAR | For new components in ISPW, this will become the component description. (For example, if doing a TASK LOAD for an already existing component, this field has no effect.) | CMPNDESC | Optional | Optional |
| 212 | 50 | CHAR | Text field describing reason for Task | CHNGDESC | Optional | Optional |
| 262 | 8 | CHAR | UserID identifying who did the checkout. If spaces, ISPW will use the ECI caller UserID. | COPYUSER | Optional | Optional |
| 270 | 10 | CHAR | Checkout Date – YYYY-MM-DD. If spaces, ISPW will use the current date. | COPYDATE | Optional | Optional |
| 280 | 8 | CHAR | Checkout Time – HH:MM:SS. If spaces, ISPW will use the current time. | COPYTIME | Optional | Optional |
| 288 | 1 | CHAR | Indicates whether the Task being loaded is to be marked as successfully generated or not:<br>**C** – successfully generated<br>**R** – a generate is required<br>blank – not relevant | GENSTAT | Optional | Optional |
| 289 | 1 | CHAR | Indicates whether the Task being loaded is to be marked as successfully implemented or not:<br>**C** – successfully implemented<br>**R** – implementation is required<br>blank – not relevant | IMPLSTAT | Optional | Optional |
| 290 | 1 | CHAR | Indicates whether any Tasks superseded by the one being loaded are to be cleaned up automatically:<br>**Y** – cleanup superseded Task automatically<br>**N** or space – will not clean up the superseded Task | CUIND | Optional | Optional |
| 291 | 6 | CHAR | Return value containing the internal ISPW Task ID | TASKID | Optional | NA |
| 297 | 6 | CHAR | Return value containing the internal ISPW Component ID | CMPNID | Optional | NA |
| 303 | 6 | CHAR | Must be set to null (x'00'). This input field will be exploited in a future ISPW release. | OCMPNID | Optional | NA |
| 309 | 246 | CHAR | Must be spaces. This input field will be exploited in a future ISPW release. | CRELPATH | Optional | Optional |
| 555 | 24 | CHAR | Must be spaces. This input field will be exploited in a future ISPW release. | VSTORKEY | Optional | Optional |
| 579 | 1 | CHAR | Default is **L** for original Task Load functionality where no incremental relationship is assumed with the Task that was there before. The new **V** option protects version integrity by checking version numbers and assumes there is a relationship with the Task that was there before. | TASKORIG | Optional | Optional |

# Task Load – Load Parts

## Purpose

This (optional) call is only used in conjunction with a TASK LOAD. It is used to define the individual parts associated with a component (for example, DBRM, load module, listing, etc.). Each Part must be

defined in accordance with the Associations defined in ISPW for the specific Component Type and Application the Part is associated with. Zero to many calls of this type follow a TASK LOAD.

### API Parameter List

#### ECIR, TSIP

The ECIR Data Structure must have the values in Table 14 set.

**Table 14** ECIR Data Structure Values for Task Load – Load Parts

| Parameter | Value |
|---|---|
| OBJECT | TASK |
| METHOD | LOADPART |

### JCL Invocation

```
$DEFINE_TSIP
```

### TSIP Data Structure

The TSIP data area contains details required to add the Parts associated with a Component. The TSIP layout is described in Table 15.

**Table 15** TSIP Layout

| Position | Length | Type | Description | JCL Keyword | API | JCL |
|---|---|---|---|---|---|---|
| 1 | 4 | CHAR | Target Environment, as indicated in the ISPW Associations, to correctly identify where this Part is stored | TENV | Optional | Optional |
| 5 | 4 | CHAR | Set value as specified in the ISPW Associations which relates to this Part (for example, GMT1) | ASSCSET | Mandatory | Mandatory |
| 9 | 1 | CHAR | Sequence value as specified in the ISPW Associations which relates to this Part (for example, 2) | ASSCSEQ | Mandatory | Mandatory |
| 10 | 64 | CHAR | Name of the Part | PARTNAME | Mandatory | Mandatory |

## Task Load – Delimit the Loading for a Task

### Purpose

This call is only used in conjunction with a TASK LOAD (and any associated TASK LOADPART calls). It is used to delimit the loading of a Task and contains the User Extension Data. Every TASK LOAD call must be completed by a TASK LOADEND call.

### API Parameter List

#### ECIR, TSIE

The ECIR Data Structure must have the values in Table 16 set.

**Table 16** ECIR Data Structure Values for Task Load – Delimit the Loading for a Task

| Parameter | Value |
|---|---|
| OBJECT | TASK |
| METHOD | LOADEND |

### JCL Invocation

```
$DEFINE_TSIE
```

Only the $DEFINE_TSIE is required. No additional parameters are necessary, unless User Extension Data is to be updated for this module.

### TSIE Data Structure

The TSIE data area contains user data associated with a Task and is used to delimit the sequence of calls for a single Task. The TSIE layout is described in Table 17.

**Table 17** TSIE Layout

| Position | Length | Type | Description | JCL Keyword | API | JCL |
|---|---|---|---|---|---|---|
| 1 | 254 | CHAR | User extension data | VPS01U | Optional | Optional |
| 255 | 254 | CHAR | User extension data | VPS02U | Optional | Optional |
| 509 | 254 | CHAR | User extension data | VPS03U | Optional | Optional |
| 763 | 254 | CHAR | User extension data | VPS04U | Optional | Optional |

## Task Status Update

### Purpose

The TASK STATUPDT call performs a Task status update.

### API Parameter List

#### ECIR, TSUS

The ECIR Data Structure must have the values in Table 18 set.

**Table 18** ECIR Data Structure Values for Task Status Update

| Parameter | Value |
|---|---|
| OBJECT | TASK |
| METHOD | STATUPDT |

### TSUS Data Structure

The TSUS data area contains details required to perform the status update. The TSUS layout is described in Table 19.

**Table 19** TSUS Layout

| Position | Length | Type | Description |
|---|---|---|---|
| 1 | 6 | BINARY | ISPW TASK IDENTIFIER |
| 7 | 8 | BINARY | ISPW PROCESS TOKEN |
| 15 | 2 | CHAR | OPERATION CODE of operation in progress |
| 17 | 1 | CHAR | **Y** to specify that operation processing is completed |
| 18 | 1 | CHAR | **Y** to specify that operation completed successfully |
| 19 | 1 | CHAR | Usually **B** to indicate message from background process |
| 20 | 16 | CHAR | Text of message to be set on Task |
| 36 | 25 | CHAR | |

# Task Operation

## Purpose

The Task Operation process is used to perform an ISPW operation against one or more ISPW Tasks. A Set is created, the Tasks are put into the Set, and the Set is locked for execution.

## Description

The Task Operation process consists of one TASK BATOP call (to create the Set), one or more TASK BATOPTSK calls (to put Tasks into the Set), and one TASK BATOPEND call. Once the BATOPEND call is made, the Set is locked for execution.

## Handling Error Situations

This set of calls creates a Set and then attempts to put each Task into it for the requested Operation. This can lead to various errors and warnings (for example, overlay messages). A flag on the TASK BATOP is used to determine what ISPW will do in these situations (for example, continue, stop, or completely roll back the creation of the Set).

# Task Operation – Initiate

## Purpose

This call initiates the Task Operation process. Its input contains fields that specify the type of operation, level at which the operation is to be performed, and the date/time that the operations will be executed. This corresponds to the Set definition.

## API Parameter List

### ECIR, TSB

The ECIR Data Structure must have the values in Table 20 set.

**Table 20** ECIR Data Structure Values for Task Operation – Initiate

| Parameter | Value |
|---|---|
| OBJECT | TASK |
| METHOD | BATOP |

## JCL Invocation

```
$DEFINE_TSB
```

## TSB Data Structure

The TSB data area contains details about the Set that will be created. The TSB layout is described in Table 21.

**Table 21** TSB Layout

| Position | Length | Type | Description | JCL Keyword | API | JCL |
|---|---|---|---|---|---|---|
| 1 | 4 | CHAR | Application ID | APPLID | Mandatory | Mandatory |
| 5 | 8 | CHAR | Stream Name | STRMNAME | Mandatory | Mandatory |
| 13 | 2 | CHAR | Operation (for example, **P** for Promote) | OP | Mandatory | Mandatory |
| 15 | 4 | CHAR | Level at which the operation is to be performed | LVL | Mandatory | Mandatory |
| 19 | 8 | CHAR | Set Owner. When using the ECI, this is always set to the userID of the ECI caller. Other values coded here are ignored. | OWNER | Optional | Optional |

**Table 21** TSB Layout ***(Continued)***

| Position | Length | Type | Description | JCL Keyword | API | JCL |
|---|---|---|---|---|---|---|
| 27 | 50 | CHAR | Set Description. If not specified, will be set to **BATCH REQUEST FOR TASK OP *op***. | DESC | Optional | Optional |
| 77 | 10 | CHAR | Set Start Date. If not specified, will be set to current date. | STRTDATE | Optional | Optional |
| 87 | 8 | CHAR | Set Start Time. If not specified, will be set to current time. | STRTTIME | Optional | Optional |
| 95 | 10 | CHAR | Deploy Implementation start date | DIMPDATE | Optional | Optional |
| 105 | 8 | CHAR | Deploy Implementation start time | DIMPTIME | Optional | Optional |
| 113 | 10 | CHAR | Deploy Activation start date | DACTDATE | Optional | Optional |
| 123 | 8 | CHAR | Deploy Activation start time | DACTTIME | Optional | Optional |
| 131 | 4 | CHAR | Set Prefix. If not specified, will be set to **S**. | CNPRF | Optional | Optional |
| 135 | 10 | CHAR | Release ID | RLSEID | Optional | Optional |
| 145 | 1 | CHAR | Set Change Type. If not specified, will be set to **S**. | CHNGTYPE | Optional | Optional |
| 146 | 1 | CHAR | Set Execution Status:<br>**I** – Immediate processing (default)<br>**H** – Held | EXECSTAT | Optional | Optional |
| 147 | 10 | CHAR | Set ID – Returned value | SETID | Optional | NA |
| 157 | 4 | INT | BASEID – Returned Value | BASEID | Optional | NA |
| 161 | 1 | CHAR | ABORTFLG – What to do with an error:<br>**Y** – Abort option: Stops adding any further Tasks to the Set and leaves any previously added Tasks in the Set. The user will then have to manually remove the Tasks from the Set before re-running the operation.<br>**C** – Cleanup option: Stops adding any further Tasks to the Set, removes any previously added Tasks from the Set, and deletes the Set.<br>**N** – Continue option (default): Continues adding Tasks to the Set, ignoring any Tasks that fail to be added to the Set, and then executes the Set. | ABORTFLG | Optional | Optional |
| 162 | 1 | CHAR | VCTLFLG – Version Control Flag:<br>**W** – Warning option: The version control check warning is heeded, and the Promote is failed.<br>**N** – Continue option (default): The version control check warning is ignored, and the Promote continues even though the Setproc replacement prompt has a value of N (No). | VCTLFLG | Optional | Optional |

# Task Operation – Specify Tasks

## Purpose

This call is only used in conjunction with a TASK BATOP call. It is used to specify individual Tasks to be put into the Set. One to many calls of this type follow a TASK BATOP call.

## API Parameter List

### ECIR, TSBT

The ECIR Data Structure must have the values in Table 22 set.

**Table 22** ECIR Data Structure Values for Task Operation – Specify Task

| Parameter | Value |
|---|---|
| OBJECT | TASK |
| METHOD | BATOPTSK |

## JCL Invocation

```
$DEFINE_TSBT
```

## TSBT Data Structure

The TSBT data area contains the key fields needed to identify a Task. The TSBT layout is described in Table 23.

**Table 23** TSBT Layout

| Position | Length | Type | Description | JCL Keyword | API | JCL |
|---|---|---|---|---|---|---|
| 1 | 4 | CHAR | Application ID of the Task | APPLID | Mandatory | Mandatory |
| 5 | 4 | CHAR | Component Type of the Task | MTYPE | Mandatory | Mandatory |
| 9 | 4 | CHAR | Component Class of the Task (default is **NULL**) | MCLAS | Mandatory | Mandatory |
| 13 | 64 | CHAR | Name of the Component | MNAME | Mandatory | Mandatory |
| 77 | 246 | CHAR | Relative Path of the Component (default is **NULL**, and this only applies to distributed components) | CRELPATH | Optional | Optional |
| 323 | 10 | CHAR | Set ID | SETID | Mandatory | NA* |

* For the JCL interface, the Set ID is preserved from the TSB datagroup and does not need to be specified on this call. When using the API, the Set ID is required.

# Task Operation – Delimit the Task Operations

## Purpose

This call is only used in conjunction with a TASK LOAD (and any associated TASK LOADPART calls). It is used to delimit the loading of a Task and contains the User Extension Data. Every TASK LOAD call must be completed by a TASK LOADEND call.

## API Parameter List

### ECIR, TSBE

The ECIR Data Structure must have the values in Table 24 set.

**Table 24** ECIR Data Structure Values for Task Operation – Delimit the Task Operations

| Parameter | Value |
|---|---|
| OBJECT | TASK |
| METHOD | BATOPEND |

## JCL Invocation

```
$DEFINE_TSBE
```

### TSBE Data Structure

The TSBE data area contains the Set ID. The TSBE layout is described in Table 25.

**Table 25** TSBE Layout

| Position | Length | Type | Description | JCL Keyword | API | JCL |
|---|---|---|---|---|---|---|
| 1 | 10 | CHAR | Set ID of the Set that was returned from the TASK BATOP call. | SETID | Mandatory | NA* |

* For the JCL interface, the Set ID is preserved from the TSB datagroup and does not need to be specified on this call. When using the API, the Set ID is required.

## Container Operation

### Purpose

The Container Operation is used to perform operations against multiple tasks at the same level in a container. The valid operations are fallback (FB), generate (G), promote (P), implement (I), and regress (X).

### Description

The Container Operation consists of a Task Set Process call, one Set Create call, and one Add Assignment call. The Add Assignment is used only with the fallback operation.

The data structures used in the container operations are described below. The Add Assignment data structure is defined in the Add Assignment section of this guide.

## Task Set Process

### Purpose

This call initiates the Container Operation. It identifies the container, container type, the task level, and the operation to be performed.

### JCL Invocation

```
$DEFINE_TSST
```

### TSST Data Structure

The TSST data area contains information on the container to be operated on. The TSST layout is described in Table 26.

**Table 26** TSST Data Structure

| Type | Length | Description | JCL Keyword | JCL |
|---|---|---|---|---|
| CHAR | 10 | Container ID | CNTRID | Mandatory |
| CHAR | 1 | Container Type – one of A, R, or S | CNTYPE | Mandatory |
| CHAR | 4 | Valid component level | CLVL | Mandatory |
| CHAR | 8 | User ID performing the operation | NEWUSER | Optional |
| CHAR | 2 | Operation to be performed | NEWOPT | Mandatory |
| CHAR | 1 | Change type – one of S, I, or E | CHNGTYPE | Optional |
| CHAR | 1 | Execution status – one of I or H | EXECSTAT | Optional |
| CHAR | 4 | Component type | WTMTYPE | Optional |
| CHAR | 255 | Deploy Environment list | DPENVLST | Optional |

**Table 26** TSST Data Structure *(Continued)*

| Type | Length | Description | JCL Keyword | JCL |
|---|---|---|---|---|
| CHAR | 8 | System name | SYSTNAME | Optional |
| CHAR | 1 | Do not deploy tasks if set to N | AUTODPLY | Optional |
| CHAR | 1 | Override version control warnings | OVRDEVER | Optional |
| CHAR | 4 | Component class | WTMCLAS | Optional |
| CHAR | 64 | Component name | WTMNAME | Optional |

# End Task Set Process

## Purpose

This call terminates the Container Operation. There are no fields on this call. You must use this call if you have multiple operations in a single job. This call is not required if there is only a single Container operation in the job.

## JCL Invocation

```
$DEFINE_TSSE
```

# Set Create

## Purpose

This call creates a Set.

## JCL Invocation

```
$DEFINE_STC
```

## STC Data Structure

The STC data structure contains information used to create a Set. The STC layout is described in Table 27.

**Table 27** STC Data Structure

| Type | Length | Description | JCL Keyword | JCL |
|---|---|---|---|---|
| CHAR | 10 | Set ID | SETID | Optional |
| CHAR | 4 | Container prefix | CNPRF | Optional |
| CHAR | 4 | Application ID | APPLID | Mandatory |
| CHAR | 8 | Stream name | STRMNAME | Mandatory |
| CHAR | 50 | Description | DESC | Optional |
| CHAR | 8 | Owner | OWNER | Optional |
| CHAR | 10 | Release ID | RLSEID | Optional |
| CHAR | 10 | Set Start date | IMPLDATE | Optional |
| CHAR | 8 | Set Start time | IMPLTIME | Optional |
| CHAR | 10 | Deploy Implementation date | DIMPDATE | Optional |
| CHAR | 8 | Deploy Implementation time | DIMPTIME | Optional |
| CHAR | 10 | Deploy Activation Date | ACTVDATE | Optional |
| CHAR | 8 | Deploy Activation Time | ACTVTIME | Optional |
| CHAR | 2 | Operation | OP | Mandatory |

**Table 27** STC Data Structure ***(Continued)***

| Type | Length | Description | JCL Keyword | JCL |
|---|---|---|---|---|
| CHAR | 4 | Level | LVL | Mandatory |
| CHAR | 1 | Change type | CHNGTYPE | Optional |
| CHAR | 1 | Execution status – one of I or H | EXECSTAT | Mandatory |
| CHAR | 1 | Implementation flag | IMPLFLAG | Optional |
| CHAR | 8 | System name | SYSTNAME | Optional |
| CHAR | 1 | Build option – one of S, L, F, or N | BUILDOPT | Optional |
| CHAR | 255 | Deploy Environment list | DPENVLST | Optional |

### Example

In this example, all tasks at the STG1 level that can be generated in container PLAY001563 will be generated. A new assignment is added at the DEV1 level . The program execution information is written to WZZOUT. The runtime configuration value PROD is just an example. You must specify your own value. The STEPLIB DD is only required if the runtime configuration authorized LOADLIB, default name ISPW.AUTHLINK, is not in the LINKLIST.

```
//STEP001  EXEC  PGM=WZZRCJOB,PARM='PROD/WZZECIJ'
//STEPLIB  DD DISP=SHR,DSN=ISPW.AUTHLINK
//WZZOUT   DD SYSOUT=*
//WORKIN   DD    *
$DEFINE_TSST
  CNTRID=PLAY001563
  CNTYPE=A
  CLVL=STG1
  NEWPOPT="G "
$DEFINE_STC
  APPLID=PLAY
  STRMNAME=PLAY
  EXECSTAT=I
  CNPRF=S
  DESC='CONTAINER API GENERATED'
  OP=G
  LVL=STG1
$DEFINE_TSSE
$DEFINE_ASA
  APPLID=PLAY
  STRMNAME=PLAY
  DESC="ADD ASSIGNMENT 001"
  DFLTLVL=DEV1
  ASGNPRF=PLAY
//
```

## Set Approvals

### Purpose

This call is used to Approve or Deny a Set. The userID associated with the ECI calling Task or Job is used by ISPW for the security check.

## API Parameter List

### ECIR, STR

The ECIR Data Structure must have the values in Table 28 set.

**Table 28** ECIR Data Structure Values for Set Approvals

| Parameter | Value |
|---|---|
| OBJECT | SET |
| METHOD | APPRVMOD |

## JCL Invocation

```
$DEFINE_STR
```

## STR Data Structure

The STR data area contains the fields necessary for the approval of a Set. The STR layout is described in Table 29.

**Table 29** STR Layout

| Position | Length | Type | Description | JCL Keyword | API | JCL |
|---|---|---|---|---|---|---|
| 1 | 10 | CHAR | Set ID | SETID | Mandatory | Mandatory |
| 11 | 10 | CHAR | Approver | APPROVER | Mandatory | Mandatory |
| 21 | 1 | CHAR | Sequence | SEQ | Mandatory | Mandatory |
| 22 | 1 | CHAR | Approval Indicator:<br>**A** – Approve<br>D – Deny<br>**P** – Pending (reset) | APRVCODE | Mandatory | Mandatory |

# Set Execute

## Purpose

This call is used to release a Set for execution. It is valid only where the Execution Status of the Set is HELD. The userID associated with the ECI calling Task or Job is used by ISPW for the security check.

## API Parameter List

### ECIR, STR

The ECIR Data Structure must have the values in Table 30 set.

**Table 30** ECIR Data Structure Values for Task Operation – Set Execute

| Parameter | Value |
|---|---|
| OBJECT | SET |
| METHOD | EXECUTE |

## JCL Invocation

```
$DEFINE_STM
```

### STM Data Structure

The STM data area contains the fields necessary for the release of a Set. The STM layout is described in Table 31.

**Table 31** STM Layout

| Position | Length | Type | Description | JCL Keyword | API | JCL |
|---|---|---|---|---|---|---|
| 1 | 10 | CHAR | Set ID | SETID | Mandatory | Mandatory |
| 11 | 1 | CHAR | Execute Code | EXECSTAT | Mandatory | Mandatory |

## Component Transport Control

### Purpose

The TRNSPCTL AUTHREQ is used to send an operational request to a Component Transport Server. The requests can be used to initiate the following functions:

- Put the Component Transport Server into a hold state. When the server is in a hold state, all new requests will be queued and any warehouse datasets will be closed and de-allocated. This can be used to allow backups of warehouse datasets.
- Release the server from a hold state.
- Start the warehouse housekeeping function. If you are not running this function periodically by coding HKINTERVAL=0 in the Component Transport parameters, you can trigger the housekeeping through this call.

### API Parameter List

#### ECIR, CTQ

The ECIR Data Structure must have the values in Table 32 set.

**Table 32** ECIR Data Structure Values for Component Transport Control

| Parameter | Value |
|---|---|
| OBJECT | TRNSPCTL |
| METHOD | AUTHREQ |

### CTQ Data Structure

The CTQ data area contains details required to perform the Component Transport function. The CTQ layout is described in Table 33.

**Table 33** CTQ Layout

| Position | Length | Type | Field | Description |
|---|---|---|---|---|
| 1 | 4 | CHAR | CTREQTYP | Request Type. Valid values are:<br>**HOLD** – hold the server<br>**RELE** – release the server<br>**CWHK** – start warehouse housekeeping |
| 5 | 2 | BINARY | CTQCOMPT | Not used |
| 7 | 8 | CHAR | SCTSRVNM | Name of the Component Transport Server |
| 15 | 4 | CHAR | SWLBTYPE | Not used |
| 19 | 254 | CHAR | SWLBNAME | Not used |
| 273 | 24 | CHAR | SSTORKEY | Not used |
| 297 | 8 | CHAR | TCTSRVNM | Not used |

**Table 33** CTQ Layout ***(Continued)***

| Position | Length | Type | Field | Description |
|---|---|---|---|---|
| 305 | 4 | CHAR | TWLBTYPE | Not used |
| 309 | 254 | CHAR | TWLBNAME | Not used |
| 563 | 24 | CHAR | TSTORKEY | Not used |
| 587 | 24 | CHAR | VSTORKEY | Not used |
| 611 | 8 | CHAR | ERRID | If the return code is not zero, this contains the ID of the error. |
| 619 | 8 | CHAR | ERRCODE | If the return code is not zero, this contains the error code. |
| 627 | 72 | CHAR | ERRSTXT | If the return code is not zero, this contains a short error message. |
| 699 | 255 | CHAR | ERRLTXT | If the return code is not zero, this contains the long error message. |

# Manually Defining a Component Reference

Through the ECI, you can manually add both Internal and External Component References to Tasks. To do so, you will need to create JCL to define and add these References to ISPW. You can add one or more References to a Task or multiple Tasks at once.

## Definition Structure

The basic structure required consists of a job card, the initialization JCL, and the definition for the Reference(s) to add to their specific Task(s).

### Initialization JCL

The initialization JCL that must be provided for all jobs is as follows. Modify the DSNs according to your site's naming conventions.

```
//WZZPPB EXEC PGM=WZZPPB,REGION=0M
//STEPLIB  DD DISP=SHR,DSN=ISPW.TEST.MPWM170.SPWMLOAD
//WZZRCJOB DD DISP=SHR,DSN=ISPW.TEST.SITE.PROD.PARMS(WZZRCJOB)
//SYSPRINT DD SYSOUT=*
//WORKOUT  DD SYSOUT=*
//WORKIN   DD *
```

### Defining References Structure

The structure for defining the References is as follows. See Table 34 on page 33 for the variables and their associated parameters.

- The first part of the definition must be the CRUX, used to define to which Task the Reference should be added. It is defined as follows and must start with `$DEFINE_CRUX`:

```
$DEFINE_CRUX
  APPL=TSTI
  STREAM=BASIC
  TYPE=CLST
  NAME=TREXX00
  LEVEL=PROD
  DELREF=1
  DELEXT=1
```

- After the CRUX, Internal References (CRE) and External References (CRX) are defined to add References to the Task defined in the CRUX above. The format for these is as follows, and each one must start with `$DEFINE_CRE` or `$DEFINE_CRX` respectively:

```
$DEFINE_CRE
  REFCAT=PGM
  REFNAME=WZZTEST1
  IMPTYPE=MANUAL
  SOURCE=1
  RELSHP=W
  INHERIT=Y
$DEFINE_CRX
  EXTNTYPE=M
  EXTNNAME=PANEL_WZZTEST1_LONG
```

Once the desired number of CRE and CRX References have been added, another CRUX can be defined to add References to other Tasks.

## Sample JCL

The following JCL demonstrates how to add multiple References to multiple Tasks in a single job. It is provided as member WZZPPB in your SAMPLIB.

```
//CRUXSAMP JOB (),'ADD IMPACTS',
//  CLASS=A,MSGCLASS=A,NOTIFY=PAUL
//WZZPPB EXEC PGM=WZZPPB,REGION=0M
//STEPLIB  DD DISP=SHR,DSN=#BASEHLQ.#BASELOAD
//WZZRCJOB DD DISP=SHR,DSN=#SITEHLQ.#SITELEVP.#SITEPARM(WZZRCJOB )
//SYSPRINT DD SYSOUT=*
//WORKOUT  DD SYSOUT=*
//WORKIN   DD *
$DEFINE_CRUX
  APPL=TSTI
  STREAM=BASIC
  TYPE=CLST
  NAME=TREXX00
  LEVEL=PROD
  DELREF=1
  DELEXT=1
$DEFINE_CRE
  REFCAT=PGM
  REFNAME=WZZTEST1
  IMPTYPE=MANUAL
  SOURCE=1
  RELSHP=W
  INHERIT=Y
$DEFINE_CRX
  EXTNTYPE=M
  EXTNNAME=PANEL_WZZTEST1_LONG
$DEFINE_CRE
  REFCAT=PGM
  REFNAME=WZZTEST2
  IMPTYPE=MANUAL
  SOURCE=1
  RELSHP=D
  INHERIT=Y
$DEFINE_CRE
  REFCAT=PGM
  REFNAME=WZZTEST3
  IMPTYPE=MANUAL
  SOURCE=1
  RELSHP=S
  INHERIT=Y
$DEFINE_CRE
  REFCAT=PGM
  REFNAME=WZZTEST4
  IMPTYPE=MANUAL
  SOURCE=1
  RELSHP=W
  INHERIT=N
$DEFINE_CRUX
```

```
  APPL=TSTI
  STREAM=BASIC
  TYPE=CLST
  NAME=TIMPACTS
  LEVEL=PROD
  DELREF=1
  DELEXT=1
$DEFINE_CRE
  REFCAT=PGM
  REFNAME=WZZTEST1
  IMPTYPE=MANUAL
  SOURCE=1
  RELSHP=W
  INHERIT=Y
$DEFINE_CRE
  REFCAT=PGM
  REFNAME=WZZTEST2
  IMPTYPE=MANUAL
  SOURCE=1
  RELSHP=D
  INHERIT=Y
$DEFINE_CRX
  EXTNTYPE=M
  EXTNNAME=PANEL_WZZTEST2_LONG
$DEFINE_CRE
  REFCAT=PGM
  REFNAME=WZZTEST3
  IMPTYPE=MANUAL
  SOURCE=1
  RELSHP=S
  INHERIT=Y
$DEFINE_CRE
  REFCAT=PGM
  REFNAME=WZZTEST4
  IMPTYPE=MANUAL
  SOURCE=1
  RELSHP=W
  INHERIT=N
```

## Command Parameter Definitions

Table 34 lists the command parameter definitions for the ECI.

**Table 34** Command Parameter Definitions

| Command | Variable | Description | Parameters |
|---|---|---|---|
| CRUX | APPL | Name of the Application the Task is in. | 4 Chars max |
| | STREAM | Name of the Stream the Task is in. | 4 Chars max |
| | TYPE | Type of the Task (for example, COB, ASM, etc.). | 4 Chars max |
| | NAME | Name of the Task. | 8 Chars max |
| | LEVEL | Level the Task is currently at. | 4 Chars max |
| | DELREF | What Source Reference Number should ISPW delete below? | 1 Int (0 - 9, 0 means none) |
| | DELEXT | Should External References be deleted? | 1 Int (0 or 1) |

**Table 34** Command Parameter Definitions ***(Continued)***

| Command | Variable | Description | Parameters |
|---|---|---|---|
| CRE | REFCAT | Category of the Reference to be added. | 4 Chars max |
| | REFNAME | Name of the Reference to be added.<br>**Note:** This module must already exist within ISPW. | 64 Chars max |
| | IMPTYPE | Impact Type of the Reference to be added. | 8 Chars max |
| | SOURCE | Source number to be assigned to this Reference (used as the DELREF value in CRUX). | 1 Int (0 - 9, 5 is displayed as “PARSER”) |
| | RELSHP | Type of relationship this Reference has with its associated Task. | 1 Char max |
| | INHERIT | Should this Reference be inherited by future versions of this Task? | 1 Char (Y or N) |
| CRX | EXTNTYPE | Type of the External Reference to be added. | 1 Char Max |
| | EXTNNAME | Name of the External Reference to be added. | 64 Chars Max |

## Adding a Reference

To add a Reference, start with a $DEFINE_CRUX to specify the target Task. Then define the Internal References (CRE) and External References (CRX) as necessary.

> References are specific to a Task. That means that to add the same Reference to three Tasks, you will need to define three $DEFINE_CRUX with a $DEFINE_CRE under each.

Start with the Task, and then describe the References. For instance, the example below shows an Internal Reference to the Program WZZTEST1 and an External Reference to PANEL_WZZTEST1_LONG being added to the Task TREXX00.

```
$DEFINE_CRUX
  APPL=TSTI
  STREAM=BASIC
  TYPE=CLST
  NAME=TREXX00
  LEVEL=PROD
  DELREF=1
  DELEXT=1
$DEFINE_CRE
  REFCAT=PGM
  REFNAME=WZZTEST1
  IMPTYPE=MANUAL
  SOURCE=1
  RELSHP=W
  INHERIT=Y
$DEFINE_CRX
  EXTNTYPE=M
  EXTNNAME=PANEL_WZZTEST1_LONG
```

## Deleting a Reference

You can delete a Reference by setting the DELREF Flag (for Internal References) or the DELEXT Flag (for External References) in the definition of the CRUX. The delete can be by itself, or more References can be added/deleted afterwards by including additional CRUX, CRE, and CRX definitions.

The sample below causes ISPW to delete any Internal References to the Task=TREXX00 of Type=CLST in Application=TSTI and Stream=BASIC that have a SOURCE number below or equal to 2. It also causes ISPW to delete any External References to the same Task.

```
$DEFINE_CRUX
  APPL=TSTI
  STREAM=BASIC
  TYPE=CLST
  NAME=TREXX00
  LEVEL=PROD
  DELREF=2
  DELEXT=1
```

# Standalone Load Modules

The term *standalone load modules* refers to load modules that must be managed without any source. They are not generated; they are simply migrated to production. An example would be the production components supplied by vendors.

## Environment Assumptions

It is assumed:

- DCB information is the same between the TEST, HOLD, and PROD level datasets.
- No link option is provided.

## Production Cycle Processing

The following are the ISPW production cycle processes for standalone load modules.

### Add Task

Standalone load modules, by definition, are not “created”. They are copied. Therefore, they must exist at the time the Add function takes place. The Extended Add function is used to specify the load dataset from which the module is to be copied. This load library name is stored in the &ALTLIB variable and is used in the copy step of the TEST level generate job as the “copy from” dataset. If a backup library has been specified for the Associated load module component in M.AD, it is permissible to specify ACTION = H when adding a load-only task to an assignment. &ALTLIB will be set to the backup load library.

### Checkout

An empty source module is created and used for checkout control. The TEST Generate copies the load module from the library specified on the Add Task to the TEST level load library. The Generate for a HOLD level copies the load module from the previous level load library to the HOLD level load library.

### Select

Load modules cannot be edited with the regular ISPF editor. A message identifying the dataset type as invalid will appear if this option is used.

### Browse

The load module itself is browsed using the ISPF browse facility. This option can be used at any time.

### Generate

The TEST Generate copies the load module from the library specified on the Add Task to the TEST level load library. The Generate for a HOLD level copies the load module from the previous level load library to the HOLD level load library.

### Promote

The empty source module and load module is promoted to HOLD.

### Regress

The empty source is copied back to the previous level. The load module is deleted, unless it has been defined to be retained in M.AD.

The load module is ***not*** copied back to the previous level load library. If required or desired, other options can be "disallowed" by using the WZTLCS# panel as a pre-exit.

# Initialization

## M.CT Values

The values listed in Table 35 should be used for the M.CT entry.

**Table 35** M.CT Values

| Field | Value |
|---|---|
| Description | **Load-only modules (Load copied-no source)** |
| Technology | **LC** |
| Cycle Flag | **Y** |
| Generate Flag | **Y** |
| Generate Skeleton | Skeleton name for component type. |
| Generate Job | Name of the batch job to perform the demanded generate. |
| Generate Table | Name of the table to be used in the demanded job. |
| Test Gen. Panel | Test panel name for component type. |
| Hold Gen. Panel | Hold panel name for component type. |
| Prod Move Job | Currently not used. |
| Model | **DUMMY** |

## M.EX Values

The values listed in Table 36 should be used for the M.EX entry.

**Table 36** M.EX Values

| Operation | Field | Value |
|---|---|---|
| B | Exit Key | LC |
| | Description | (LOAD CONTROL): LOAD MODULES |
| | Pre-op | ISPEXEC DISPLAY PANEL(WZTLCB#) |
| | Post-op | ISPEXEC DISPLAY PANEL(WZTLCB#) |

**Table 36** M.EX Values ***(Continued)***

| Operation | Field | Value |
|---|---|---|
| C | Exit Key | LC |
| | Description | (LOAD CONTROL): LOAD MODULES |
| | Pre-op | ISPEXEC DISPLAY PANEL(WZTLCC#) |
| | Post-op | ISPEXEC DISPLAY PANEL(WZTLCC#) |
| G | Exit Key | LC |
| | Description | (LOAD CONTROL): LOAD MODULES |
| | Pre-op | ISPEXEC DISPLAY PANEL(WZTLCG#) |
| R | Exit Key | LC |
| | Description | (LOAD CONTROL): LOAD MODULES |
| | Pre-op | ISPEXEC DISPLAY PANEL(WZTLCR#) |
| S | Exit Key | LC |
| | Description | (LOAD CONTROL): LOAD MODULES |
| | Pre-op | ISPEXEC DISPLAY PANEL(WZTLCS#) |

# M.AD Values

Follow the procedure in Table 37 to set up the M.AD entries.

**Table 37** M.AD Values

| Step | Action |
|---|---|
| 1 | Add a component Type to an application in M.AD for the load libraries and define the load library names in the Names section. Example Names entries are shown in Figure 2 on page 39. |
| 2 | Add a component Type to an application in M.AD for the source libraries required for load-only processing. Example Name entries are shown in Figure 3 on page 40. |
| 3 | Add a Generate association for the LCTL component Type to indicate that a LOAD will be generated and to point to the component type of the (LOAD) libraries to be used. An example entry is shown in Figure 4 on page 40. |
| 4 | The flags in M.AD for the test level should be set up so that associations are moved to the HOLD level. However, at least the test level generate needs to be done so module has been copied. An example entry is shown in Figure 5 on page 40. |

## Names Entries for LOAD

Example M.AD Names entries are shown in Figure 2 for application component type LOAD.

**Figure 2** M.AD Names Entries for LOAD

```
WZZMADD D/N       BLM LIBRARY NAMES TABLE (PROD)                BROWSE MODE
Command ===>                                                 Scroll ===> CSR

List Commands: L Locate Entry, U Update Mode

                    Lib    Library
Type Clas  Lev      Type   Name

LOAD       FIXH     PDS    BLM.FIXH.LOADLIB
LOAD       FIXT     PDS    BLM.FIXT.LOADLIB
LOAD       HOLD     PDS    BLM.HOLD.LOADLIB
LOAD       PROD     PDS    BLM.PROD.LOADLIB
LOAD       TEST     PDS    BLM.TEST.LOADLIB
****************************** Bottom of data ******************************
```

## Name Entries for LCTL

Example M.AD Names entries are shown in Figure 3 for application component type LCTL.

**Figure 3** M.AD Names Entries for LCTL

```
WZZMADD D/N       BLM LIBRARY NAMES TABLE (PROD)                BROWSE MODE
Command ===>                                                 Scroll ===> CSR

List Commands: L Locate Entry, U Update Mode

                    Lib   Library
Type Clas  Lev      Type  Name

LCTL       FIXH     PDS   BLM.FIXH.CHKOUT.EMPTYSRC
LCTL       FIXT     PDS   BLM.FIXT.CHKOUT.EMPTYSRC
LCTL       HOLD     PDS   BLM.HOLD.CHKOUT.EMPTYSRC
LCTL       PROD     PDS   BLM.PROD.CHKOUT.EMPTYSRC
LCTL       TEST     PDS   BLM.TEST.CHKOUT.EMPTYSRC
****************************** Bottom of data ********************************
```

## Association Entry for LCTL

An example M.AD Associations entry is shown in Figure 4 for application component type LCTL.

**Figure 4** M.AD Associations Entry for LCTL

```
WZZMADA D/A       BLM  ASSOCIATIONS TABLE (PROD)                 UPDATE MODE
Command ===>                                                 Scroll ===> CSR

List Commands: A Add Entry, L Locate Entry, B Browse Mode
Line Commands: D Delete

                              Target              Assoc  Assoc  Assoc
    Type   Clas   Association   Env.   Set  Seq.   Appl   Type   Clas

    LCTL              G               LOAD  1     BLM    LOAD
****************************** Bottom of data ********************************
```

## Flag Entries for LCTL

An example M.AD Flags screen is shown in Figure 5 for application component type LCTL.

**Figure 5** M.AD Flags Screen for LCTL

```
WZZMADF D/F       SAMP CONTROL FLAGS TABLE (PROD)               BROWSE MODE
Command ===>                                                 Scroll ===> CSR

List Commands: L Locate Entry, U Update Mode

                  Promote  Version   Generate   Implement    Pack Keep
Type Clas  Lev    Method   Control   Opt  Chk   Opt  Chk     Src  Memb

LCTL       FIXH     A         N
LCTL       FIXT     A                 R    Y
LCTL       HOLD     A         N
LCTL       PROD               N
LCTL       TEST     A                 R    Y
```

These flag settings will force a successful Generate to be done at the TEST levels, and then on the promotes, the LOAD will be moved up with the component. The Version Control flags are set to **N** in

this case, because it represents the situation where the component versions are not checked out based upon another version, but instead delivered from an external source.

# Site-specific Components

## Generate Skeleton Requirements

The generate skeleton WZTLCG# is supplied in the ISPW base SAMPLIB dataset as a sample.

# Maintenance Issues

## Pre-Exit and Post-Exit Panels

The pre-exit and post-exit panels use `.RESP=ENTER` or `.RESP=END` in the `)INIT` section, so they are normally processed without being displayed.

The recommended approach for pre-exits and post-exits is to use the `&TECHNOL` value (`LC`) as the Exit Key, rather than the `&MEMBTYPE` value. Then, the value for `&MEMBTYPE` can be whatever is desired.

## Load Library Blocksize

The IEBCOPY program will not copy to a smaller blocksize for RECFM=U, so ideally the TEST/HOLD/PROD load libraries must be set up with identical blocksizes, which would be equal to or greater than that for any load library which would be specified as &ALTLIB. If this is not possible, the COPYMOD control statement, with the appropriate parameters coded, may be used in an IEBCOPY step to “reblock” to a smaller blocksize for the output library.

## IEBCOPY

The IEBCOPY program does not issue any MVS enqueue to attempt to ensure exclusive use for update of the dataset into which it is copying. Therefore, there might be instances when a Generate job would fail (ABEND S213-30) if it attempted to update a load library simultaneously with another job. “Replacement” programs are available (for example, PDSFAST) which can avoid this problem; alternatively, Compuware can supply an Assembler program which runs in a TSO environment (foreground or background/batch) and issues an appropriate enqueue and dequeue around a call of IEBCOPY.

If update activity on the TEST and HOLD load datasets is reasonably low, this problem may not be encountered frequently enough to be of real concern.

## Linkage Editor

The only change required is to substitute link-edit JCL for the IEBCOPY in the Generate skeleton used. The advantage would be that the linkage editor uses the appropriate enqueue for its output dataset. A possible disadvantage might be that a user might need to specify correct link-edit parameters if they differed from those that were coded as the default in the skeleton.

## Load Module Aliases

Although the example skeleton provided is not sufficient to properly handle load modules with aliases, this capability could be added without great difficulty.

# DB2 Programs, Plans, and Packages

Often changes to programs that call DB2 (DB2 programs) have accompanying data definition language (DDL) changes. The coordination of both of these changes is difficult, but very important. This chapter focuses only on DB2 programs, plans, and packages.

ISPW always performs a BIND on plans and packages—never a REBIND. **No REBIND option exists in ISPW.**

## General Information

### Intended Audience

You should have basic knowledge of DB2, including knowledge of database request modules (DBRMs), timestamps, plans, and packages.

### DB2 Interface Overview

Processes are provided to construct and execute plan and package binds. The bind process can be driven by a Generate of a plan or a DB2 program, or can be requested independently.

### Plan Bind Process

A plan bind may be required because of a change in a plan's attributes or because of a DBRM (DB2 program) update. Therefore, ISPW provides for initiating a bind by generating the plan task itself or indirectly by the generate/compile of the DB2 program task that uses the DBRM/plan Component Reference to determine which plans to bind.

### Package Bind Process

A package bind is normally only required when the DBRM (DB2 program) is updated. Therefore, ISPW treats package attributes as an extension of generate parameters, and the package bind is incorporated as a step in the program generate processing. If a site continues to reference DBRMs directly in plan definitions, the DBRM to plan Component Reference repository can be utilized to automatically bind all plans affected by the DBRM change.

### DB2 Interface Data Repository

There are several ISPW Repository objects to support the plan/package. The tables and entries required for the DB2 interface are described below and include:

- Plan Component Table
- Generate Parameters Table (`<appl>CMPL`)
- Application Definition (M.AD) Plan Implementation entries
- Application Definition (M.AD) Levels entries
- External Reference Table (M.ER)
- DBRM to Plan Component Reference Tables.

## Plan Component Table

The plan component table is an ISPF table containing the bind attributes for an individual plan task (for example, the bind statement parameters). This library is defined in M.AD as the source library for the Plan components. In the bind process, the plan parameter table associated with the Task is used to build the bind statement executed.

## Generate Parameters Table

This is an ISPF table maintained for each application containing information by Component Name and Type. It is used to control the generate processing of that component. A set of variables is stored on this table which indicate:

- whether a component uses DB2,
- whether a bind should be processed as part of the program generate,
- whether the component employs a DB2 package, and
- the variables for package attributes which may be used to override general specifications stored in the M.AD Plan Implementation entries for the package bind.

## M.AD Plan Implementation entries

This is a part of M.AD containing information by application, level, and implementation "rule" to simplify the plan/package definition process while giving control and flexibility to the bind process. It supports situations where different databases or package collections need to be targeted at different levels and helps manage the mapping of attributes such as plan name, owner, qualifier, and other plan/package parameters which may vary in different levels or implementations of an application. For more information, see "AD (P) - Plans" in the chapter entitled "Maintenance Functions" in the *ISPW Technical Reference*.

## M.AD Levels entries

This is a part of M.AD containing information by application and level that contains a number of DB2-related variables applicable to the level, such as:

- the DB2 subsystem used,
- the plan Component Reference table name,
- DBRM libraries, and
- the "rule" to be used in implementing plans and packages.

For more information, see "AD (S,L) - Levels" in the chapter entitled "Maintenance Functions" in the *ISPW Technical Reference*.

## External Reference Table

This table defines installation-dependent variables and datasets to ISPW. For each DB2 subsystem, the DB2 load library name is defined here.

## DBRM to Plan Component Reference Tables

Packages are viewed as the solution to the problems of DBRMs that are referenced in multiple plans. However, unless a site is utilizing packages exclusively, a mechanism is needed to identify and bind all plans that are directly referencing an updated DBRM. Therefore, ISPW continues to provide support for automating the bind of these plans using the DBRM to plan Component Reference repository. An ISPF table is maintained at each level to contain this impact information. As plan

component types are processed through the update cycle, the DBRMs required by a plan are extracted and related to the plan/application.

The CLIST WZU2TC# is provided to create empty Component Reference tables. Parameters to the CLIST are:

- `<table>` = table name,
- `<lib>` = R for PROD level, W for other levels.

Example: `EXEC %WZU2TC# DEVPLAN W.`

# Environment Assumptions

- A plan or package is bound to only one subsystem for any level.
- All subsystems that may be accessed via bind processing of any bind job (either generate or promote) must be available on the same OS/390 system image that the bind job is executing on. If propagating binds, this will include those subsystems associated with any lower levels to be bound.

# Production Cycle Processing

## DB2 Program Tasks

A DB2 program task follows the standard processing outlined for generated type tasks. The additional processing required for DB2 generation is handled in the input parameters specified on the panels and the steps defined in the skeletons for the generate. Additional pre-exit processing occurs on "P-Style" promotes to bind the package and to bind those plans using the DBRM as indicated in the DBRM/plan component reference repository. This is accomplished by setting up the M.EX entry for each program Component Type using DB2 as specified above.

Currently, for "P-Style" promotes, the HOLD DBRM is copied to the next level in the pre-exit before bind processing is performed. If some bind should fail, a non-zero return code will be returned from the pre-exit, standard processing will not be done, and the DBRM at the target level will be out of sync with the target level source/load until the problem is resolved.

## Plan Tasks

A Plan task follows the standard processing outlined for generated type tasks with the exceptions listed in the following sections and additional processing controlled by M.EX entries.

### Browse

In the pre-exit, the table of bind parameters is displayed. Regular browse processing is bypassed.

### Checkout

In the regular processing, the plan is not actually copied, but the bind attribute table that identifies how the plan is bound is copied from production to TEST. If this is a new plan, the model is copied. In the post-exit, the plan Component Reference information for the module is updated in the TEST level with the PROD level information (or deleted when ACTION=D).

### Select

In the pre-exit, the plan attribute table is updated using ISPF table services. The final step in the pre-exit updates the TEST level plan Component Reference information using the updated plan attribute table.

### Promote

In the post-exit, the HOLD level plan Component Reference information for the module is updated (or deleted for ACTION=D).

In the pre-exit, the plan is bound at the target level using the plan attribute table of the current level. If the bind fails, a non-zero return code will be returned from the pre-exit and standard processing will not be done. Normal promote processing updates the target level plan attribute table. In the post-exit, the Component Reference information is updated using the plan attribute table (or deleted for ACTION=D).

### Regress

In regular processing, the source is moved to the previous level and—depending on the setting of the Retain flag for the library Names—load and GMT modules are deleted. If the load is deleted, plan/package binds may need to be done for the levels affected. In the pre-exit, the previous level plan Component Reference table is restored with the information in the plan attribute table regressed.

# Initialization

## Defining the DB2 Environment

The key to installing the ISPW DB2 interface is defining the environment. Are the “rules” for implementing plans and packages defined at a high level (for the whole site) or a low level (for an application)? Ultimately, for each application and level, the following need to be identified:

- the subsystem,
- the DBRM libraries used,
- the owner and qualifier values,
- any plan and package naming conventions used, and
- any other plan/package bind parameters that may be required.

This environment information is stored in ISPW’s central data repository and is described below.

## M.CT Values

Two categories of Component Types are used to support DB2:

- Program Component Types, and
- Plan Component Types.

It is not necessary to set up specific Types for DB2 programs versus non-DB2 programs, because use of DB2 can be indicated on the generate panel. The refer-only Component Type of DBRM is required for the DBRM generated for DB2 programs.

### M.CT Values for Program Types

The values in Table 38 show a sample M.CT entry for a DB2 program.

**Table 38** M.CT values for Program Types

| Field | Value |
|---|---|
| Description | **DB2 Cobol program** |
| Cycle Flat | **Y** |
| Generate Flag | **Y** |
| Generate Skeleton | Skeleton name for component type. |
| Generate Job | Name of the batch job to perform the demanded generate. |

**Table 38** M.CT values for Program Types ***(Continued)***

| Field | Value |
|---|---|
| Generate Table | Name of the table to be used in the demanded job. |
| Test Gen. Panel | Test panel name for component type. |
| Hold Gen. Panel | Hold panel name for component type. |
| Prod Move Job | Currently not used. |

### M.CT Values for Plan Types

The values in Table 39 show a sample M.CT entry for a DB2 plan.

**Table 39** M.CT values for Plan Types

| Field | Value |
|---|---|
| Description | **DB2 Plan bind attributes table** |
| Cycle Flag | **Y** |
| ISPW Typed | **PLAN** |
| Generate Flag | **Y** |
| Generate Skeleton | Skeleton name for component type. |
| Generate Job | Name of the batch job to perform the demanded generate. |
| Generate Table | Name of the table to be used in the demanded job. |
| Test Gen. Panel | Test panel name for component type. |
| Hold Gen. Panel | Hold panel name for component type. |
| Prod Move Job | Currently not used. |
| Model | $PLAN from the ISPW SAMPLIB (a model is required). |

### M.CT Values for DBRM Types

The fields and values in Table 40 show a sample M.CT entry for a DBRM.

**Table 40** M.CT values for DBRM Types

| Field | Value |
|---|---|
| Description | **DB2 Database Request Module** |
| Cycle Flag | **Y** |
| Prod Move Job | Currently not used. |
| Execution Env. | **REFR** |

## M.EX Values

### M.EX Values for Program Exits

The values in Table 41 should be used for the M.EX entry for programs.

**Table 41** M.EX values for Program Exits

| Op | Field | Value |
|---|---|---|
| P | Exit Key | The component type |
| | Description | **DB2 Bind of plans/packages** |
| | Pre-op | ISPEXEC SELECT CMD(%WZU2PP#P &DEBUG) |

## M.EX Values for Plan Exits

### If Using Packages and Collections

The values in Table 42 should be used for the M.EX entries if using packages and collections.

**Table 42** M.EX values for Plan Exits

| Op | Field | Value |
|---|---|---|
| B | Exit Key | PLAN |
| | Description | DB2 exit to browse plan attribute table |
| | Pre-op | ISPEXEC SELECT CMD(%WZU2PB# &DEBUG) |
| S | Exit Key | PLAN |
| | Description | DB2 exit to update plan attribute table |
| | Pre-op | ISPEXEC SELECT CMD(%WZU2PS# &DEBUG) |

### If Using DBRMs Directly with Plans

The values in Table 43 should be used for the M.EX entries if using DBRMs directly with plans.

**Table 43** M.EX values for Plan Exits

| Op | Field | Value |
|---|---|---|
| C | Exit Key | PLAN |
| | Description | DB2 exit to update XREF table info |
| | Post-op | ISPEXEC SELECT CMD(%WZU2PC# &DEBUG) |
| D | Exit Key | PLAN |
| | Description | DB2 exit to restore XREF table info |
| | Pre-op | ISPEXEC SELECT CMD(%WZU2PD# &DEBUG) |
| P | Exit Key | PLAN |
| | Description | DB2 exit to bind plan/update XREF table info |
| | Pre-op | ISPEXEC SELECT CMD(%WZU2PP#O &DEBUG) |
| | Post-op | ISPEXEC SELECT CMD(%WZU2PP# &DEBUG) |
| R | Exit Key | PLAN |
| | Description | DB2 exit to update XREF table info |
| | Post-op | ISPEXEC SELECT CMD(%WZU2PC# &DEBUG) |
| X | Exit Key | PLAN |
| | Description | DB2 exit to restore XREF table info |
| | Pre-op | ISPEXEC SELECT CMD(%WZU2PX# &DEBUG) |

# M.AD Levels

For detailed descriptions of the fields shown in Figure 6, see “AD (S,L) - Levels” in the chapter entitled “Maintenance Functions” in the *ISPW Technical Reference*.

**Figure 6** M.AD/L (Levels)

```
ISPW M.AD/L       BROWSE BLM  LEVEL DETAIL (PROD)
Command ===>

Level  (KEY) ==> TEST     (TEST HOLD PROD, etc)
 Next Level  ==> HOLD
 Impl Exit?  ==>          (Y - Yes)

 Set Scheduling Information:
   Set Class      ==>    Job Name ==>         Queue Name ==>
   Failure Notify ==>

 DB2 Information:
   Impl Name/Rule ==> APPL     Name or Rule to determine Plan Implementation
   DB2 Subsys     ==> DB2T     Sub-system applicable for this Level
   DBRM Libs      ==> CORE.TEST.DBRMLIB

   XREF Name      ==> TEST$PLN
   XREF Lib       ==> W        R - Read only, W - Read/Write

Press END to return
```

## M.AD Plan Implementation

The specifications shown in Figure 7 drive the bind statement generation of plans and packages. There may be more than one implementation at a given level. For detailed field descriptions, see “AD (P) - Plans” in the chapter entitled “Maintenance Functions” in the *ISPW Technical Reference*.

**Figure 7** Modify BLM Plan Implementation Detail (Prod)

```
WZZMADP1 /P       MODIFY BLM PLAN IMPLEMENTATION DETAIL (PROD)
Command ===>

Enter required details:

 Level  (KEY) ==> TEST     (TEST HOLD PROD, etc)
 Impl   (KEY) ==> BLM      (Implementation name)
 Do BINDs?    ==> N  (Y/N) N=No bind processing for PLANs or PACKAGEs
 Owner        ==> BLMDEV          Qualifier    ==>
 Subsystem    ==> DB2T            Explain      ==> Y         (Y/N)

 Logical  Collection IDs ===> BLMCOLL
 Physical Collection IDs ===> BLMD

Plan Bind Details :
 Name Prefix  ==> D       Name Suffix ==>
 Other Parms  ==>

Package Bind Details :
 Collection   ==> BLMD
 Other Parms  ==>

Press ENTER to complete the change or END to terminate
```

## M.AD Associations

The associations values for a DB2 program Type might be defined as shown in Figure 8.

**Figure 8** BLM Associations Table (PROD)

```
WZZMADA D/A       BLM ASSOCIATIONS TABLE (PROD)                  UPDATE MODE
Command  ===>                                                 Scroll ===> CSR

List Commands: A Add Entry, L Locate Entry, B Browse Mode
Line Commands: D Delete

                                Target                Assoc  Assoc  Assoc
    Type   Clas   Association    Env.   Set  Seq.     Appl   Type   Clas

    COB                C                LKED  1      BLM    LKED
    COB                G                GMT1  1      BLM    DBRM
    COB                G                LOAD         BLM    LOAD
    COB                I                DCL   1      BLM    DCLG
    COB                I                MAC   1      BLM    COPY
    COB                I                SYS   1      BLM    LOAD
    COB                I                SYS   2      BLM    LODS
    COB                R                             BLM    LKED
```

## M.ER Values

As shown in Figure 9, for each DB2 subsystem, an M.ER entry is required to describe the DB2 load library. The Type Code must be of the format: `DB2<subsystemid>`.

**Figure 9** M.ER — Browse External Reference Detail (PROD)

```
ISPW M.ER          BROWSE EXTERNAL REFERENCE DETAIL (PROD)
Command ===>


  Type Code (KEY) ==> DB2DB2T            View Code (KEY) ==>

  Description     ==> DB2 LOAD LIBRARY FOR SUBSYSTEM: DB2T

  Variable/Dsname ==> SYS1.DB2T.DB2.LOADLIB
  (Fully qualified if data set name, no quotes)

Press END to return
```

## Example Generate Panel

An example generate panel is shown in Figure 10, with the flags indicating whether the program uses DB2.

**Figure 10** Example Generate Panel

```
ISPW P/S/G  ------------ Generate Options -----------------------------------
COMMAND ===>

 Type ==> C            Name(s) for Generated Type(s):
 Name ==> WZZRPCR      Src1 ==> WZZRPCR   Src2 ==> WZZRPCR   Src3 ==> WZZRPCR
 Load ==> WZZRPCR      Lod1 ==> WZZRPCR   Lod2 ==>           Lod3 ==>
 Program (Y/N) ==> N           SQL used?   ==> Y  Package used?     ==> Y
 Do Binds?     ==> Y  (Y/N/B)  Bind Plans? ==> N  Prod DB2 Subsytem ==>
 Target Env.      ==>          (Blank or MSP)
 Add'l Gen. Opts  ==>
 Add'l Link Opts  ==>



 SAVE changes to above Options? ==> Y  (Y/N)                Edit JCL?   ==>
 Include TEST: Copylib? ==> Y  Linklib? ==> Y    (Y/N)      Panel Lock? ==> N
 DISPLAY/CHANGE DB2 Package Bind Parameters? ==> N  (Y/N)
 JOBCARD Information:
 ==> //&LOADNAME  JOB  (,),'ISPW',CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1),
 ==> //        NOTIFY=KARYNS
 ==> //*
 ==> //*
     ----|----1----|----2----|----3----|----4----|----5----|----6----|----7--
 Press ENTER to Submit Generate or  END to terminate
```

## Example Bind Options Panel

If the **DISPLAY/CHANGE DB2 Package Bind Parameters** field has been set to **Y**, then the panel WZXGENP shown in Figure 11 is displayed.

**Figure 11** DB2 Package Bind Option Screen

```
ISPW P/S/G --------------  DB2 PACKAGE BIND OPTIONS   ------------------------
COMMAND ===>


 Collection   ==>

 Owner        ==>
 Qualifier    ==>

 Explain      ==> N         (Y/N)
 Validate     ==>
 Release      ==>
 Isolation    ==>
 Flag         ==>
 Currentdata  ==> N         (Y/N)
 Degree       ==>

 Press ENTER to Submit Generate or  END to terminate
```

# Site-specific Components

## Introduction

Each site must build customized generate panels and skeletons according to their requirements and guidelines. For reference purposes, sample components are supplied in the ISPW installation SAMPLIB dataset.

## DB2 Program Processing

SAMPLIB components which may be reviewed to aid in the setup of DB2 program processing include those listed in Table 44.

**Table 44** DB2 Program Processing SAMPLIB

| Type | Name | Description |
|---|---|---|
| Panel | WZUGD | TEST level generate example |
| Panel | WZUGH | HOLD level generate example |
| Skeleton | WZUG | Generalized mainline “driver” skeleton |
| Skeleton | WZU@JOB | Jobcard |
| Skeleton | WZU@MTYP | Sets parameters by Component Type |
| Skeleton | WZU@DB2 | DB2 pre-compile step |
| Skeleton | WZU@COB | COBOL compile step |
| Skeleton | WZU@LKED | Link-edit step |
| Skeleton | WZU@DBRM | Copy of temp DBRM to PDS |
| Skeleton | WZU@DB2B | DB2 Bind processing |
| Skeleton | WZU@INPR | Reset task “in process” status |

## DB2 Plan Processing

SAMPLIB components which may be reviewed to aid in the set up of DB2 plan processing include those listed in Table 45.

**Table 45** DB2 Plan Processing SAMPLIB

| Type | Name | Description |
|---|---|---|
| Panel | WZUGD2 | TEST level generate example |
| Panel | WZUGH2 | HOLD level generate example |
| Skeleton | WZUGBIND | Mainline skeleton |
| Skeleton | WZU@JOB | Jobcard |
| Skeleton | WZU@DB2B | DB2 Bind processing |
| Skeleton | WZU@INPR | Reset task “in process” status |

## Jobcard Changes for Binds

If DB2 jobs must run under special job classes, be sure the analysts know to specify this class on their jobcard when requesting DB2 services. If the site generates jobcards for the analysts, check for the ISPWTYPE=PLAN and check for DB2 program Component Types (if program generates have a bind step) to set the proper job class values.

## Plan Attributes ISPF Table Model

A model is required for every new Plan task. It is required because a Plan task is an ISPF table and is processed using ISPF table services. Plan Component Types must specify a model in M.CT, which may be overridden in M.AD for specific applications if they require a different model. A model Plan attributes ISPF table is supplied in member $PLAN found in the ISPW installation SAMPLIB dataset. Copy this model to the site models dataset and reference this dataset member in M.CT for all Plan Component Types.

The model provided is very simple. A site may wish to add additional parameter/value rows into the site Plan model. If so, use ISPF table services to update the model.

# Other Issues

## DB2 Security

The binding of packages and plans requires that certain DB2 privileges are granted. At the TEST level where individual users need to bind plans and packages, it might be necessary to give them these privileges for each of the Test "DB2 Owners" they are concerned with. At the HOLD levels, DB2 Binds are either performed by the Set Processor ID or the Demanded Batch job ID (depending upon how the generate was submitted). These IDs should be regarded as secure, and therefore it is safe to grant more system-wide privileges to them (for example, BINDAGENT). At the PROD level, only the Set Processor ID requires these privileges.

## Minimizing Timestamp Errors with Bind Propagation

The ability to "propagate" binds has been incorporated into the DB2 interface.

For example, suppose a site concatenates load libraries for execution (TEST/HOLD/PROD) and deletes the load and DBRM modules as a task is promoted through the cycle. Then execution of a DB2 program will fail at the TEST level after that task has been promoted to HOLD until the plan and/or package is bound on the TEST subsystem using the DBRM in the HOLD level library.

This out-of-sync situation can be minimized by using the propagation feature to execute additional binds for lower levels in a bind request. This is achieved by passing the appropriate values for the following propagation parameters to the bind routine WZU2P#B.

### PROPAGATE

Controls whether propagation is performed.

- PROPAGATE (N) – No propagation (default)
- PROPAGATE (Y) – Propagation is done.

### PROPCNTL

Controls the scope of the propagation by promotion path determined by the start level indicated.

- PROPCNTL (0) – Propagate down the current path (default)
- PROPCNTL (1) – Propagate down the "other" paths
- PROPCNTL (ALL) – Propagate down all paths.

### PROPEXCL....CONTINUE HERE

Controls binding of the level used to determine the scope of the propagation.

- PROPEXCL (N) – Bind the current level (default).
- PROPEXCL (Y) – Exclude the current level from bind processing.

Since the load and DBRM are copied from the final HOLD level to the PROD level, propagation is not normally required because the timestamp values are identical. If propagation was done for the HOLD bind, the lower levels in the path were also bound using that DBRM. If propagation is required to process levels in other paths or other scenarios, it is strongly recommended that this be handled in a post-promote process. Then only the failure of a bind for the PROD level will stop the move of a task.

## Startup Issues

For sites already using DB2 and implementing ISPW's DB2 component management, it is advisable to construct a load process that reads the DB2 catalogs to build both the individual plan bind parameter tables and the DBRM/plan impact Component Reference repository. The impact information must also identify each plan to an ISPW application. Otherwise, every plan must be moved through the circuit to production. Sites just starting to use DB2 are not greatly affected.

# DB2 Package Version Management

ISPW's DB2 Package Version Management is configurable by Application and Level. This allows users to flexibly manage the DB2 Package Versions in the DB2 catalog.

It is assumed that the reader has a basic knowledge of DB2. This includes knowledge of database request modules (DBRMs), timestamps, plans, and packages.

## ISPW Services

Some local configuration is required to enable this option. If it is preferred to perform this work externally, ISPW Services can be arranged.

## Background

DB2 has a feature that allows multiple versions of a DB2 Package to exist. It is easy to create Package Versions because all it requires is an option on the DB2 Pre-compile. The challenge, however, is in having a process that FREEs old, unused versions at the appropriate time.

ISPW's Package Version Management:

- Tracks the Package Versions created within ISPW
- Provides a Housekeeping mechanism for inactive versions to be freed automatically.

## Overview

ISPW provides a version ID to the DB2 pre-compiler/in-line compiler that allows an easy correlation between the program version managed by ISPW and the DB2 packages created for that version.

DB2 Packages will become eligible for clean-up (with a DB2 FREE PACKAGE command) when their program versions are deleted in ISPW or become "Historical". The Package Version Housekeeping Job can be configured in each ISPW environment with rules that specify when versions are to be freed.

## Internal Package Tracking

When Package Version Management is enabled for a level, any DB2 Bind performed as part of the ISPW process will be tracked in an internal ISPW repository table. Details of the Bind are matched to the ISPW Task that is the source of the DBRM being bound.

## Housekeeping Process

A Housekeeping Process, which can be run periodically, makes a call to ISPW and returns the details of any DB2 Packages that can be freed for that subsystem.

## Configuration

### Update Skeletons

The SAMP members WZU@DB2, WZU@DB2B, and WZU@BLD would have been customized in the SITE Application.

### M.ER

Define M.ER Variables DB2PKG, DB2PKVDK, and DB2PKVIK. Refresh the server.

## M.AD(L)

Once the interface is turned on, specification of the pre-compile version format must be done in M.AD(L) as shown in Figure 12.

**Figure 12** Specifying Pre-compile Version Format in M.AD(L)

```
ISPW M.AD/L            MODIFY APPLICATION F42M STREAM F42M LEVEL (QA)
COMMAND ===>
Enter required details:

 Level  (KEY) ==> QA     Promote Analysis  ==>    (Y - Yes)
 Next Level   ==> PRD    Impact Approvals  ==>    (Y - Yes)
                         Impl Exit?        ==> D  (D - Deploy, Y - External)

 Warehouse for Sources  : Name ==> ISPWPROD   Policy ==> KEEP3INASSIGN
              Gen Types: Name ==> ISPWPROD   Policy ==> KEEP3INASSIGN

 Set Scheduling Information:
   Set Class      ==> A  Job Name ==>            Queue Name ==>
   Failure Notify ==>

 DB2 Information:
   Impl Name/Rule ==>          Name or Rule to determine Plan Implementation
   DB2 Subsys     ==> DSN1     Sub-system applicable for this Level
   DBRM Libs      ==> ISPW.F42M.QA.DBRM

   PKG Mgmt       ==> *         (* to enable)     Version ID ==> B (B - Build)
Press ENTER to complete the change or END to terminate
Note: You can add a new entry by overtyping the Key with a new unique value
```

Table 46 lists valid values for the Package Management fields and their meanings.

**Table 46** Package Management Values and Descriptions

| Field | Description |
|---|---|
| PKG Mgmt | Blank – no management for this level<br>* – Package Management enabled for this level |
| Version ID | **B** – Build ID<br>**T** – Task ID<br># – Version ID only |

## Housekeeping Job

The SAMP member WZU@PKGH contains JCL to call the routine WZU@DB2F to free the DB2 Packages. This needs to be customized and made available for use. A copy of this JOB can be made which calls WZU@DB2V instead of WZU@DB2F. This copy will be useful in testing whether the interface is set up and working correctly.

## Pre-compile Process

A new ISPW program is used instead of the standard DB2-supplied program for the pre-compile process (in skel WZU@DB2). This new program provides a variable containing an ISPW Generated Version that is suitable for the DB2 Pre-compile step. The format of the version ID is dependent upon what was specified in M.AD(L). This generated version ID is stored against the ISPW Task so that it can be used to determine if any subsequent DB2 Packages can be freed. The pre-compile skeleton requires changes to support the passing of the ISPW-generated version ID. Because of JCL and input parameter constraints, a new ISPW program wraps around the DB2 Pre-compiler.

## Bind Process

An enhancement to ISPW's Bind process calls new ISPW messages to record and retrieve information about the Bind being performed. As a result of this, ISPW has all the information it needs to know what Binds have been performed against which Tasks in any DB2 subsystem.

### BINDHIST ADD

If Package Version Management is enabled, a call is made in the Bind processing logic after a successful Bind to register the Package Version.

### BINDHIST STATUPD

In a Fallback (FB) Operation, it is necessary to update the Status of the Package in the Repository Table to indicate that it is active again (and update the previous one to Inactive). If Package Version Management is enabled, this is done with a call in the normal Package Bind process. The code will check to see if a corresponding Package exists and, if so, will call the function to update its status.

## Housekeeping Process

A batch Housekeeping process (Figure 13) is supplied that issues DB2 FREE PACKAGE for any Package Versions that are identified as not being in use and able to be freed. This housekeeping job needs to be defined for each individual DB2 subsystem and scheduled to run periodically.

**Figure 13** Housekeeping Process

```
//WZDB2PKG JOB ,,CLASS=A,MSGCLASS=H,MSGLEVEL=(1,1),
//    NOTIFY=CRAIG
//* REUSE THE RX HARNESS TO INVOKE THE DB2 PKG FREE PROCESS
//* PARM1 = DB2 SUBSYSTEM
//* PARM2 = INACTIVE KEEP DAYS
//* PARM3 = DELETE KEEP DAYS
//WZZRX    EXEC PGM=IKJEFT01,REGION=0M,TIME=1440,DYNAMNBR=99,
//  PARM='%WZURX##I DSN1 9 2 WZU@DB2F ISPF'
//SYSPROC  DD DISP=SHR,DSN=ISPW.F42.SITE.PROD.CLIST
//         DD DISP=SHR,DSN=ISPW.W42.PRD.CLIST
..
..
```

### Housekeeping Job Input Parms

The Input Parms for the Housekeeping job are listed in Table 47.

**Table 47** Housekeeping Job Input Parms

| Field | Description |
|---|---|
| PARM1 | DB2 Subsystem – Specify the DB2 Subsystem in which housekeeping is to occur. |
| PARM2 | Inactive Keep Days – The number of days after which an Inactive ISPW Task's Package will be freed. |
| PARM3 | Delete Keep Days – The number of days after which a Deleted ISPW Task's Package will be freed. |

The value specified for PARM2 needs to be carefully considered in the context of the organization's requirement for fallback. It should be complementary with the period of time that Superseded Backup tasks are kept in the warehouse and can be fallen back to. Check the relevant Warehouse Policy for this Application Level to confirm. If a Package Version is Freed and its Inactive Task is still backed up in the Warehouse, a subsequent Fallback operation will need to perform a Bind, rather than reinstate that Package Version, because it is no longer in the DB2 catalog.

The value specified for PARM3 can be set to a relatively small number of days, because the corresponding load and dbrm does not exist in ISPW after the associated Task has been deleted.

# Processing Details

This section explains what occurs during normal processing when Package Version Management is enabled.

## DB2 Table for Bind Details

ISPW DB2 Table (WZT_PKG_BIND_HIST) is used to store the details of successful Binds and then used in conjunction with the status of associated Tasks to determine what Packages might be available for FREE. To understand the process, it is worth looking at this table in detail, because when implementing this feature and testing it, it will be necessary to inspect the contents of the table to make sure it has been set up correctly.

An example row with all of the columns is shown in Figure 14.

**Figure 14** WZT_PKG_BIND_HIST DB2 Table Row Example

```
TABLE WZZF420.WZT_PKG_BIND_HIST                                  Format SNG
                                    Top Line is 1    of 27    in Row 1
Key    Column           Data
 U     DB2_SSID         DSN1
 U     PKG_COLLID       F42MDEV
 U     PKG_NAME         TEST99
 U     PKG_VERS_ID      B#7DDBDCC8CDCC7DDBE4439592
 U     BASE_ID                    1
       PKG_BIND_PARMS    OWNER(ISPWDEV) CURRENTDATA(NO) ISOLATION(CS).......
                        ..................................................
                        ..................................................
                        ..................................................
                        ........
       APPL_ID          F42M
       STREAM_NAME      F42M
       LVL              DEV1
       IMPL_RULE
  N    TASK_ID          '..H..
       TASK_LVL         DEV1
       BUILD_ID         '.U.nk
       SEC_TASK_ID
       DP_ENV
       SUB_ENV
       SYST_NAME
       CREATED_TSTAMP   2013-11-28-11.03.44.828984
       WS1
 U     CURR_ISPW_BIND   Y
       STATUS           H
       STATUS_TSTAMP    2013-11-28-11.49.49.323218
       FREE_TSTAMP      2013-11-28-11.49.49.323218
***  End of record  ***
```

The columns in WZT_PKG_BIND_HIST are described in Table 48.

**Table 48** WZT_PKG_BIND_HIST DB2 Table Column Descriptions

| Column | Description |
|---|---|
| DB2_SSID | DB2 Subsystem ID related to the Bind |
| PKG_LOC | Location ID for the Bind. Must not be blank. Default is the current Location. |
| PKG_COLLID | Collection ID for the Bind |

**Table 48** WZT_PKG_BIND_HIST DB2 Table Column Descriptions ***(Continued)***

| Column | Description |
|---|---|
| PKG_NAME | Package Name for the Bind |
| PKG_VERS_ID | ISPW-defined version ID that was used during the Pre-Compile |
| BASE_ID | Internal ISPW Use |
| PKG_BIND_PARMS | Package Bind Parameters supplied to the Bind Process |
| APPL_ID | Foreign key for the M.AD(P) entry used for the Bind |
| STREAM_NAME | |
| LVL | |
| IMPL_RULE | |
| TASK_ID | Internal ISPW Task_ID identifying the Task for which the Bind was performed |
| TASK_LVL | ISPW Level the Task was at when the Bind was performed |
| BUILD_ID | Internal ISPW Use |
| SEC_TASK_ID | Internal ISPW Use |
| DP_ENV | Deploy Information if Bind performed in deploy processing |
| SUB_ENV | |
| SYST_NAME | |
| CREATED_TSTAMP | Timestamp when the Bind Row was added. (Should correspond to just after Bind Timestamp in Catalog.) |
| WS1 | Internal ISPW Use |
| CURR_ISPW_BIND | Indicates whether this Bind is the deemed to be the current bind for the Task (value **Y**). A subsequent Bind will result in a new row, and this row will be marked **N**. |
| STATUS | Values can be:<br>• Space – active<br>• **I** – Inactive<br>• **D** – Deleted<br>• **H** – Historical |
| STATUS_TSTAMP | Timestamp of the most recent status change |
| FREE_TSTAMP | Timestamp when the FREE was performed |

## Bind Processing

After a successful bind, the new BINDHIST ADD call is made to ISPW to register the Bind in the DB2 Table. After it is successful, a row will have been added to the DB2 Table, which will relate the DB2 Package to the ISPW Task for which the Package was bound. These status values determine whether the DB2 Package is a candidate for a FREE when the housekeeping job executes. The status values for a new row will be as listed in Table 49.

**Table 49** DB2 Row Status Values

| Column | Description |
|---|---|
| CURR_ISPW_BIND | **Y** |
| STATUS | <space> |
| CREATED_TSTAMP | Current date and time |
| STATUS_TSTAMP | Current date and time |
| FREE_TSTAMP | null |

As the ISPW Task is promoted, generated, regressed, or deleted within ISPW, the status of the DB2 Package may change, depending upon whether the Task is re-generated, made historical, or another bind performed. The DB2 Table will be updated to reflect that status as described in Table 50.

**Table 50** Result of DB2 Table Update

| Action | Outcome |
|---|---|
| Another Bind Performed | The PKG_VERS_ID has not changed. A new row is added, and the previously current row for the same PKG_VERS_ID will have the CURR_ISPW_BIND flag set to **N**, the STATUS set to **H**, and the STATUS_TSTAMP set. |
| Generate followed by Bind | A new PKG_VERS_ID will be generated, and so a new Row for the new Version will be added. |
| Any P, X, or D operation where a Task is made Inactive or Deleted | If a Task with a corresponding row in the Bind History Table becomes inactive, then the row in the Bind History table will be set to **I**. This reflects the fact that the associated DBRM/LOAD is stored in ISPW and available in a fallback scenario.<br><br>If a Task with a corresponding row in the Bind History Table is deleted or becomes inactive with Superseded Gone status, then the row in the Bind History table will be set to **D**. This reflects the fact that the associated DBRM/LOAD is deleted from ISPW. |
| A FREE is performed by ISPW Housekeeping | The Package Version rows that are FREEd will be updated to a status of **H** and will now be there for the audit history. |

## Fallback Processing

One of the advantages of keeping Package Versions is that during a Fallback Operation, if a Package exists that corresponds to the new Load Module being replaced, then the Program will work against that matching Package.

If a Fallback does occur, then the previous Package needs to be updated to reflect the fact it is now active, and no new Bind is required.

## FREE Processing

The Housekeeping Job is the only method by which a FREE PACKAGE is executed.

It is periodically run per DB2 Subsystem (perhaps from the scheduler) and will execute a FREE PACKAGE for any Package meeting the specified criteria.

Packages with a STATUS value of **I** or **D** may be freed. The criteria by which a Package is FREEd is determined according to the parameters listed in Table 51.

**Table 51** FREE Processing

| Input Parm | Description |
|---|---|
| Inactive Keep Days | If the status of a Package is **I** and the status timestamp indicates it has been in this status for at least the same number of days as the specified input Parameter, then the Package is freed. |
| Delete Keep Days | If the status of a Package is **D** and the status timestamp indicates it has been in this status for at least the same number of days as the specified input Parameter, then the Package is freed. |

# Testing the Setup

Correct Installation of the Package Versioning functionality should be thoroughly tested to make sure that after it is implemented no Packages are FREEd when they should not be.

## Build a Test Plan

A Test plan should be created to test the various scenarios within the organization. This should include all of the ISPW operations which would affect a Task and its generated DBRM/LOAD.

## Compare Against DB2 Catalog

The ISPW DB2 Package Version Table needs to accurately represent what Packages are in the DB2 Catalog. It is recommended that during the testing process comparisons be made between the two.

## Ensure Housekeeping Frees Correctly

A key part of the testing is to ensure that the Housekeeping process will not FREE any Packages that it should not.

# DB2 Generated DECLARE Statements

DCLGENs are source modules generated from the DB2 catalog for a DB2 table or view. DCLGEN processing differs from the typical Generated Type processing because it is the source itself that is generated directly into the primary source dataset.

## Environment Assumptions

- By default, the same implementation name/rule specified for an application level that is controlling plan/package processing, is also used for DCLGEN processing to retrieve DB2 control information from the M.AD Plan Implementation entries. Information used includes:

  a. DB2 subsystem
  b. Owner/qualifier value – used to set CURRENT SQLID value to qualify the unqualified table/view names. If for a TEST level no owner or qualifier values are specified, the qualifier used will default to the submitter's userID.

  If a different implementation name/rule applies, then it must be passed to routine WZTDCLG# specifically using parameter IMPL().

- The userID submitting a Generate job must have authority to update the source dataset (either TEST or HOLD) directly as the DCLGEN is generated directly into the source dataset member. The ISPW program normally used for updating HOLD source datasets is not employed here.

## Production Cycle Processing

### Promote

A pre-exit is executed to empty the source module before it is promoted to the HOLD level. This prevents program generates at this HOLD level from using the DCLGEN before the Generate for the DCLGEN has executed. Otherwise, the DCLGEN may contain declarations that do no properly reflect the table/view structure at this level.

## Initialization

### M.CT Values

The values in Table 52 should be used for the M.CT entry.

**Table 52** M.CT Values for DCLGENs

| Field | Value |
|---|---|
| Description | DB2 DCLGEN Modules |
| Cycle Flag | **Y** |
| Generate Flag | **Y** |
| Generate Skeleton | Skeleton name for component type |
| Generate Job | Name of the batch job to perform the demanded generate |

**Table 52** M.CT Values for DCLGENs *(Continued)*

| Field | Value |
|---|---|
| Generate Table | Name of the table to be used in the demanded job |
| Test Gen. Panel | Test panel name for component type |
| Hold Gen. Panel | Hold panel name for component type |
| Prod Move Job | Currently not used |
| Model | **DUMMY** (not applicable to DCLGENs) |

## M.ER Values

For each DB2 subsystem, an M.ER entry is required to describe the DB2 runtime library. As shown in Figure 15, the Type Code must be of the format: `DB2<subsystemid>`.

This runtime library holds the program used to set the CURRENT SQLID value for the Generate job execution. Default name values for the program (DSNTIAD) and plan (DSNTIAD) are set in routine WZTDCLG#. Site names may differ. If so, these values may be overridden.

**Figure 15** M.ER — Browse External Reference Detail (PROD)

```
ISPW M.ER          BROWSE EXTERNAL REFERENCE DETAIL (PROD)
Command ===>


  Type Code (KEY) ==> DB2DB2T            View Code (KEY) ==>

  Description     ==> DB2 LOAD LIBRARY FOR SUBSYSTEM: DB2T

  Variable/Dsname ==> SYS1.DB2T.DB2.RUNLIB.LOAD
  (Fully qualified if data set name, no quotes)

Press END to return
```

## M.EX Values

The values in Table 53 should be used for the M.EX entry.

**Table 53** M.EX Values for DCLGENs

| Op | Field | Value |
|---|---|---|
| P | Exit Key | The component type |
| | Description | “Erase DCLGEN source before copy to next level” |
| | Pre-op | ISPEXEC SELECT CMD(%WZTDCLR# &DEBUG) |

# Site-specific Components

## Sample Components

Each site must customize generate panels and skeletons according to their requirements and guidelines. For reference purposes, sample DCLGEN components are supplied in the ISPW

installation SAMPLIB dataset that may be reviewed to aid in the setup of DB2 DCLGEN processing. These include the samples listed in Table 54.

**Table 54** SAMPLIB Components for Setup of DCLGEN Processing

| Type | Name | Description |
|---|---|---|
| Panel | WZTDCLGD | TEST level generate example |
| Panel | WZTDCLGH | HOLD level generate example |
| Skeleton | WZTDCLG# | Mainline DCLGEN generate skeleton |
| Skeleton | WZU@JOB | Jobcard |
| Skeleton | WZU@INPR | Reset task “in process” status |

## Jobcard Changes for DCLGENs

If DB2 jobs must run under special job classes, be sure the analysts know to specify this class on their jobcard when requesting DB2 services. If a site generates jobcards for the analysts, check for the DCLGEN Component Types to set the proper job class values.

# Managing Native Stored Procedures and Triggers in ISPW

Perform the tasks in this milestone to enable management of DB2 native stored procedures and triggers in ISPW.

Roles involved:
ISPW Installer
DB2 DBA

## Overview

Stored procedures and triggers are DB2 DDL statements. These statements can be managed in ISPW by creating Objects using the ISPW Deploy procedure. The method used depends on the size:

- For normal-sized stored procedures, objects are created by calling DSNTEP2 from the Deploy procedure.
- For SQL statements that exceed the size limitation of 2,097,152 bytes, a version of CLST WZU2P#PP can be used. It removes the white spaces in the SQL statement to make it smaller. Then it calls DSNREXX to execute the Create of the stored procedure.

This milestone provides sample instructions for both methods.

The process includes the following steps:

1. Edit the SQL for Environment-specific variables.
2. Run a drop of the Object. (Should be in the code from developer.)
3. Create the Object.
4. Grant the Object.

Define deploy types for stored procedures and triggers with the Deploy Category of **DB2**. Make sure that Deploy Category is used in CLST WZU@ACI#, the main Deploy exit. Also make sure that WZU@ACI# calls CLST WZU2P#B in the same way as a DB2 bind in the activation of the Deploy. The logic is implemented in CLST WZU2P#PP. In the examples shown, the Deploy Type **SPDF** is used for stored procedures, and **SPTR** is used for triggers.

## Step 1. Customize CLST WZU2P#PP

In CLST WZU2P#PP, edit the DB2_Bind Processing section adding code similar to that shown in Figure 16. The lower part of the figure performs the actual application of the settings defined in the upper part. Edit the sample code's Environment-specific information as required.

This process can also be performed by using Adaption Cards in the Implementation of the Deploy.

**Figure 16** Sample Additional WZU2P#PP Code in DB2_Bind Processing Section

```
/* DB2 SP Modification, Edit Source to adapt Subsystem specifics */
If membtype = 'SPDF' | membtype = 'SPTR' Then Do
  say "Using Inputlib: " dbrmlib
  spdflib = strip(dbrmlib,,"'")
  Address TSO
  "ALLOC F(SPDFIN) DA('"spdflib"("pgmname")') SHR REUS"
  "execio * diskr SPDFIN (stem spdfin. finis)"
  xssid = strip(ssid,b)
  xssid = substr(xssid,4)
  toprmin = xssid
  select
       when toprmin = 'D' then do
            tssid =  'DBSD'
            tgen  =  'DB2DGEN'
            tcos  =  'DB2DCOS'
            tcom  =  'DB2DCOM'
            tpay  =  'DB2DPAY'
            tdba  =  'DB2DDBA'
            tsg   = 'SGDBX'
            tsyn1 = 'DEV'
            tsyn2 = 'DEV.'
            tfsg  = 'SGDBP'
            end
       when toprmin = 'P' then do
            tssid =  'DBSP'
            tgen  =  'DB2PGEN'
            tcos  =  'DB2PCOS'
            tcom  =  'DB2PCOM'
            tpay  =  'DB2PPAY'
            tdba  =  'DB2PDBA'
            tsg   = 'SGDBP'
            tsyn1 = 'PROD'
            tsyn2 = 'PROD.'
            tfsg  = 'SGDBP'
            end
       otherwise do
            /* nada */
                end
    end
    fssid = 'DBSP'
    fgen  = 'DB2PGEN'
    fcos  = 'DB2PCOS'
    fcom  = 'DB2PCOM'
fpay  = 'DB2PPAY'
fdba  = 'DB2PDBA'
fsg   = 'SGDBP'
fsyn1 = 'PROD'
fsyn2 = 'PROD.'
fsg2  = 'SYSDEFLT'
Do k = 1 TO spdfin.0
  If ssid <> 'DBSP' Then Do
    wrkline = spdfin.k
    pos_ssid=INDEX(wrkline,fssid)
    if pos_ssid >0 then wrkline=OVERLAY(tssid,wrkline,pos_ssid)
    pos_gen=INDEX(wrkline,fgen)
    if pos_gen >0 then wrkline=OVERLAY(tgen,wrkline,pos_gen)
    pos_cos=INDEX(wrkline,fcos)
    if pos_cos >0 then wrkline=OVERLAY(tcos,wrkline,pos_cos)
    pos_com=INDEX(wrkline,fcom)
    if pos_com >0 then wrkline=OVERLAY(tcom,wrkline,pos_com)
    pos_pay=INDEX(wrkline,fpay)
    if pos_pay >0 then wrkline=OVERLAY(tpay,wrkline,pos_pay)
    pos_dba=INDEX(wrkline,fdba)
    if pos_dba >0 then wrkline=OVERLAY(tdba,wrkline,pos_dba)
    pos_sg =INDEX(wrkline,fsg)
    if pos_sg  >0 then wrkline=OVERLAY(tsg,wrkline,pos_sg)
    pos_sg2=INDEX(wrkline,fsg2)
    if pos_sg2 >0 then wrkline=OVERLAY(tsg2,wrkline,pos_sg2)
    spdfin.k = wrkline
    End
  End
```

# Step 2. Use Echo Mode to Verify DB2 Handling

DB2 handling—such as that for binds and stored procedures—is controlled by a Plan entry on the Modify Application Stream Plan Implementation screen (M.AD/P) for each level in the development lifecycle. To avoid affecting the runtime environment, you can choose to ***not*** run the actual bind or

create during setup and testing. The M.AD/P screen includes a **Do BINDs?** field that can be set to Y (Yes), N (No), or E (Echo). When E is specified, ISPW echoes the commands to the log without executing them. The commands are written in the format and order in which they would have been processed. You can then visually verify that the commands are appearing correctly in the log before changing the **Do BINDs?** field to Y.

# Step 3. Create Objects by Calling DSNTEP2 from the Deploy Procedure

For normal-sized stored procedures, objects are created by calling DSNTEP2. Modify DSNTEP2 as shown in Figure 17.

**Figure 17** Sample DSNTEP2 Code to Create Objects

```
    Address TSO

  /* "ALLOC F(SYSIN) NEW REUSE DELETE ", */
    "ALLOC F(SYSIN) NEW DELETE ",
    " RECFM(F B) LRECL(80) BLKSIZE(6160)",
    " SPACE(1 1) TRACK"

    filerc = Listdsi("SYSPRINT" "file")
    If filerc = 0 Then
      "FREE F(SYSPRINT)"

 /* "ALLOC F(SYSPRINT) NEW REUSE DELETE ", */
    "ALLOC F(SYSPRINT) NEW REUSE DELETE ",
    " RECFM(F B) LRECL(133) BLKSIZE(0)",
    " SPACE(1 1) TRACK"

    "execio 0 diskw SYSIN (open"
    "execio * diskw SYSIN (stem spdfin. finis)"

    queue "RUN PROGRAM(DSNTEP2) PLAN(DSNTEP2),
       PARM('SQLTERM(#)') LIB('"$DSNRLIB"')"
    queue "END"
    Invoke_DB2 = "DSN SYSTEM("SSID")"
    "ISPEXEC SELECT CMD("Invoke_DB2") NEST"
    retc=rc
    "FREE F(SYSIN)"
    ecnt = 0
    e204 = 0
    "execio * diskr SYSPRINT (stem syspr. finis)"
    Do k = 1 TO syspr.0
      log = syspr.k
      if retc > 0 then do
        poserr=INDEX(log,'SQLCODE = -')
        if poserr > 0 then do
     /* Since we have DROP in the code, we need to allow one -204 if first time */
           if substr(log,poserr+11,3) = '204' then do
              e204 = e204 + 1
              end
           else do
              ecnt = ecnt + 1
              end
        end
      end
      say log
      If dplogrc = 0 Then
        rc=WZZUTI("SETLOG","WZU2P#PP","DD:WZZDPLOG",log)
      End
      if retc > 0 then do
         if ecnt = 0 then retc = 0
         end
      End
      End
   Else Do     /* Bind Process */
```

# Step 4. Customize WZU2P#PP for Large SQL Statements

The CLST WZU2P#PP can be used with SQL statements larger than 2,097,152 bytes to remove white space before calling DSNREXX to Create the stored procedure. Modify WZU2P#PP as shown in Figure 18.

**Figure 18** Sample WZU2P#PP Code for Large SQL Statements

```
/* CREATE ONE STATEMENT FOR ALL LINES TO SQLTERM               */
/* AND THEN EXECUTE IMMEDIATE ON THAT                         */
/*----------------------
 | enter db2 interfaces
 |-----------------------*/
   saverc = 0
   trace o
   'SUBCOM DSNREXX'
   if rc <> 0 then,

   IF RC THEN DO
      RC = RXSUBCOM('ADD','DSNREXX','DSNREXX')
      if rc <> 0 then,
         SAY 'RXSUBCOM ADD, RC='RC
   end

   ADDRESS DSNREXX
   if rc <> 0 then,
      SAY 'ADDRESS DSNREXX, RC='RC

   ADDRESS DSNREXX 'CONNECT' SSID
   if rc <> 0 then,
      SAY "ADDRESS DSNREXX CONNECT "SSID", RC="RC
   sqlterm = '#'
   sqlcmnt = '--'
   stmnt = ''
   do x = 1 to spdfin.0
     comnt = pos(sqlcmnt,left(spdfin.x,72))
     if comnt > 0 then do /* If comment on line, pick only before */
        stmnt = stmnt space(left(spdfin.x,comnt-1))
        end
     else do              /* else, just take whole line */
        stmnt = stmnt space(left(spdfin.x,72))
        end
     if pos(sqlterm,stmnt) > 0 then do
       stmnt = strip(stmnt,'L') /* If leading spaces, remove */
       stmnt = OVERLAY(' ',stmnt,pos(sqlterm,stmnt)) /* remove END*/
       stmnt = space(stmnt)   /* Squeeze a little bit more */
       RUNSTMT = 'EXECUTE IMMEDIATE :stmnt'
       ADDRESS DSNREXX "EXECSQL" RUNSTMT
       trace o
       log = ''
       say log
       If dplogrc = 0 Then ,
         rc=WZZUTI("SETLOG","WZU2P#PP","DD:WZZDPLOG",log)
       lstmnt = length(stmnt) /* original length for display */
       stmnt = stmnt||' '    /* add a space for fix process bolow */
       cut = LASTPOS(' ',stmnt,72)
       do while length(stmnt) > 72
         log = left(stmnt,cut)
         say log
         If dplogrc = 0 Then ,
           rc=WZZUTI("SETLOG","WZU2P#PP","DD:WZZDPLOG",log)
         stmnt = substr(stmnt,cut+1)
         cut = LASTPOS(' ',stmnt,72)
       end
       log = stmnt
       say log
       If dplogrc = 0 Then ,
         rc=WZZUTI("SETLOG","WZU2P#PP","DD:WZZDPLOG",log)
       log = ''
       say log
       If dplogrc = 0 Then ,
         rc=WZZUTI("SETLOG","WZU2P#PP","DD:WZZDPLOG",log)
       log='Length of statement:' lstmnt '(Limit 2097152)'
       say log
       If dplogrc = 0 Then ,
         rc=WZZUTI("SETLOG","WZU2P#PP","DD:WZZDPLOG",log)
       log = ''
       say log
       If dplogrc = 0 Then ,
         rc=WZZUTI("SETLOG","WZU2P#PP","DD:WZZDPLOG",log)
       call show_sqlca
       If sqlcode > 0 & saverc < 4 then saverc = 4
       If sqlcode < 0 then do
          if pos('DROP ',stmnt) > 0 & sqlcode = -204 then do
     /* Don't Fail on -204 when DROP */
            if saverc < 4 then saverc = 4
            end
          else do
            if saverc < 8 then saverc = 8
            end
       end
       stmnt = ''
     end
     retc = saverc
   end
```

# QMF Interface

In this discussion, we are assuming that you have some basic knowledge about QMF.

## QMF Interface Overview

Forms, Queries, and Procs are the only QMF objects managed by ISPW. Datasets (PDS/PDSE) are used by ISPW to maintain the QMF object source. The source is imported from these datasets into the appropriate QMF Environment and under the correct Owner as required. All the necessary Exits are provided to manage these QMF objects via standard ISPW Processing.

### How ISPW Interacts with QMF

ISPW makes use of the "REXX Callable Interface". This allows for QMF commands to be invoked from within a REXX exec. When ISPW first needs to communicate with QMF (for example, when selecting a task for edit), it will issue a call to QMF to initiate communication. QMF is then effectively running alongside ISPW, and ISPW can issue QMF commands (for example, EXPORT, SAVE, etc.) for immediate action.

QMF remains active until the user exits from the Assignment they are working in. Note that during the time that QMF is active, QMF cannot be started again in the user's TSO session (for example, in a split screen). This is a QMF constraint.

QMF tasks can be freely added to any assignment with other non-QMF tasks.

## Environment Assumptions

- QMF version 2.2 or higher.
- Each module is saved in QMF with CONFIRM=no and SHARE=yes parameters.
- The module is saved under the same name at each level, and this name is the Assignment Task name.
- At the TEST level, the owner is the same DB2 Owner as defined in the M.AD options for that application. The QMF interface will issue a SET CURRENT SQLID = db2owner at the TEST level.
- A batch job running under a production userID is used to save the modules to QMF in both the HOLD and PROD environments. This userID needs authority within DB2 to save the objects under the owner defined in M.AD.
- Modules within QMF are not erased as they are promoted up the levels.

### QMF Object Ownership

QMF objects have to be saved under an Owner ID in QMF. The Owner is specified in the Reference Data under M.AD (Plan Implementations). An entry with an Implementation of "QMF" can be defined in M.AD if the Owner of the QMF objects will be different from the Owner of the DB2 Plans and Packages.

It is normal that the ISPW User does not have any authority to save QMF objects under the Owners specified in the HOLD and PROD Environments (for example, all ISPW levels above the TEST level).

The QMF Interface provides a mechanism where either a batch job is submitted under a controlled userID to perform this operation or the Set Processor does this under its userID.

### Working at the TEST Level

The QMF Interface provides two ways of working at the TEST level:

- The user has authority to save QMF Objects under the Owner as specified in the Reference data. This is the default way of working. While the user is working on QMF objects within ISPW, a "SET CURRENT SQLID = testowner" is issued so that the objects are being saved under the relevant Owner.
- The user operates in QMF under their own userID, and the save is done under a controlled userID by the submission of a generate job. If the flag settings in M.AD specify for a TEST Generate to be done, the QMF interface will assume that the User will be working in QMF under their own ID.

## Production Cycle Processing

### C – Checkout

If this is a new module and a model exists, or if this module already exists in ISPW, the module (or model) is copied to the TEST PDS, imported into the "TEST" QMF and saved. If this is a new module and no model exists, a TEST PDS member is created, but nothing is saved in QMF.

### B – Browse

For Procs and Queries, ISPW will use standard PDS processing to browse the members in the PDS. Form information is difficult to understand and review in a PDS, so it is displayed in QMF and the User placed in the QMF Form manager. Regardless of the status of the module (that is, whether it is in HOLD, PROD, etc.), it will always be reviewed in the TEST QMF Form manager because TEST QMF is already active. This may involve an import if the Form is not already in the TEST environment, but it is not saved on exit.

### D – Delete

The Task is deleted along with the copy in the PDS. The user is given the option of having it deleted from the QMF TEST environment.

### S – Select (Default Editor)

The default editor for QMF objects can either be QMF itself or the ISPF editor. This is can be specified for each of the QMF types by defining entries in M.ER to indicate this.

Whichever editor is used, the source will be saved in both the source dataset and QMF itself.

When editing in QMF, whatever is currently in the QMF temporary storage area is what QMF saves. If you had selected a Proc and then edited another Proc before returning to the Assignment, the second Proc will be saved into the module in the Assignment. The same applies to Queries and Forms.

### ST – Select (Alternate Editor)

This operation will invoke either QMF or ISPF Edit, depending upon the entries in M.ER that specify the default editor. (This will invoke the non-default editor.)

Whichever editor is used, the source will be saved in both the source dataset and QMF itself.

When editing in QMF, whatever is currently in the QMF temporary storage area is what QMF saves. If you had selected a Proc and then edited another Proc before returning to the Assignment, the second Proc will be saved into the module in the Assignment. The same applies to Queries and Forms.

## P – Promote

The job that does the Promote must have authority to save the QMF object under the owner specified for the level to which the promotion is taking place.

Two methods of promotion are possible and depend upon the Flag settings in M.AD:

- Promote from within the User address space and demand a controlled job to do the import into the QMF Environment, or
- Create a Set to do the promote, in which case the Set Processor will perform the QMF Import under its own authority.

For each promotion level in the change cycle, a decision needs to be made as to which method of promotion is to be used. It is important that the flag settings in M.AD and Approval Rules in M.AR are set up correctly for the chosen method at each level. These settings are discussed in more detail later in this section.

Modules are ***not*** erased from the QMF Environment being promoted from.

## RE – Rename

The object in QMF is also renamed if the user has the authority to do so.

## EP – Export

If the module exists in QMF, it is exported to the TEST PDS.

When one module is selected for update, it is very convenient to make changes to related modules without returning to the Task List. Returning from QMF will only save the original module selected. The source in the TEST PDS is out of sync with QMF for all the other updated modules. To save these other updated modules, this option can be used to move the QMF source back into the PDS member.

## IP – Import

The option imports the TEST PDS member into QMF and saves it.

This would be useful if the TEST PDS member was edited directly out of ISPW.

## EX – Execute

Only Queries and Procs can be executed. ISPW will simply invoke an execution of the proc or query. QMF will prompt for any parameters before execution.

## Action “D” Processing

As the Task is promoted through the levels, the QMF object will be erased from the QMF Environments.

# Reference Data Entries

## M.CT Values

An ISPW Component Type is defined for each of the three QMF Object types. Sites may choose their own Component Type code for each of these, however the other attributes should be as shown in Table 55.

**Table 55** QMF Object Type Attributes

| Field | Value |
|---|---|
| Description | **QMF Queries** or **QMF Procs** or **QMF Forms** |
| Technology | **QM** |
| ISPW Type | QQRY for Queries; QPRC for Procs; QFRM for Forms |
| Cycle Flag | **Y** |
| Generate Flag | **Y** |
| Generate Skeleton | WZUQMG# (from the SAMPLIB dataset), modified for your site |
| Generate Job | Name of the batch jobname to be used to perform the demanded generate |
| Generate Table | Name of the table to be used in the demanded job |
| Test Gen. Panel | WZUQMGD (from the SAMPLIB dataset)<br><br>**Note:** This panel only needs to be defined if users need to submit a job at the TEST level to save the QMF Object under the Test level Owner. |
| Hold Gen. Panel | WZUQMGH (from the SAMPLIB dataset)<br><br>**Note:** This panel only needs to be defined if the settings in M.AD specify that a demanded job is required at the Hold Level to save the QMF Object under the Hold level Owner. Alternative processing can be defined where the Set Processor does this for all Hold Levels. |
| Prod Move Job | Currently not used |
| Execution Env. | spaces |

## M.EX Values

The values listed in Table 56 should be used for the M.EX entries.

**Table 56** M.EX Values for QMF

| Op | Field | Value |
|---|---|---|
| B | Exit Key | QM |
| | Description | Browse Form in QMF |
| | Pre-op | ISPEXEC SELECT CMD(%WZTQMB# &DEBUG) |
| C | Exit Key | QM |
| | Description | Import QMF Object into QMF Environment |
| | Post-op | ISPEXEC SELECT CMD(%WZTQMC# &DEBUG) |
| D | Exit Key | QM |
| | Description | Delete QMF Object from QMF |
| | Post-op | ISPEXEC SELECT CMD(%WZTQMD# &DEBUG) |

**Table 56** M.EX Values for QMF ***(Continued)***

| Op | Field | Value |
|---|---|---|
| EP | Exit Key | QM |
| | Description | Export QMF Object to the source dataset |
| | Pre-op | ISPEXEC SELECT CMD(%WZTQMEP &DEBUG) |
| EX | Exit Key | QM |
| | Description | Execute QMF Object |
| | Pre-op | ISPEXEC SELECT CMD(%WZTQMEX &DEBUG) |
| G | Exit Key | QM |
| | Description | Set QMF variables for Import |
| | Pre-op | ISPEXEC SELECT CMD(%WZTQMG# &DEBUG) |
| IP | Exit Key | QM |
| | Description | Import QMF Object from source dataset |
| | Pre-op | ISPEXEC SELECT CMD(%WZTQMIP &DEBUG) |
| P | Exit Key | QM |
| | Description | Import QMF Object to next level |
| | Pre-op | ISPEXEC SELECT CMD(%WZTQMP# &DEBUG) |
| S | Exit Key | QM |
| | Description | Invoke default editor for QMF |
| | Pre-op | ISPEXEC SELECT CMD(%WZTQMS# &DEBUG) |
| ST | Exit Key | QM |
| | Description | Invoke alternate editor for QMF |
| | Pre-op | ISPEXEC SELECT CMD(%WZTQMST &DEBUG) |
| X | Exit Key | QM |
| | Description | Import into previous QMF environment |
| | Post-op | ISPEXEC SELECT CMD(%WZTQMX# &DEBUG) |

## M.ER Values

The values listed in Table 57 should be used for the M.ER entries.

**Table 57** M.ER Values for QMF

| Key | Value |
|---|---|
| QMQUAL | This should contain the name of the Owner of the “SET CURRENT SQLID” Query. |
| QMEDITQ | If this entry is defined and has a value of “QMF”, the default editor invoked for QMF Queries with the ISPW “S” Operation will be QMF itself. Otherwise, the default editor will be ISPF Edit. ISPW Operation “ST” will invoke the non-default editor. |
| QMEDITF | Same as above, except for QMF Forms. |
| QMEDITP | Same as above, except for QMF Procs. |

## Example M.AD Flags

The M.AD (Flags) settings are crucial to the way that the QMF Interface works. Figure 19 shows an example of Flag settings in M.AD.

**Figure 19** Sample M.AD Flag Settings - QMF

```
ISPW M.AD/F       APPLICATION QMF STREAM QMF FLAGS                UPDATE MODE
Command  ===>                                                  Scroll ===> CSR

List Commands: L Locate Entry, B Browse Mode

                  Promote  Version   Generate   Implement   Pack  Keep
Type Clas  Lev    Method   Control   Opt  Chk   Opt  Chk    Src   Memb

QFRM       CONS
QFRM       HOLD     A                R    Y
QFRM       PROD
QFRM       TEST                      R    Y
QPRC       CONS
QPRC       HOLD     A                R    Y
QPRC       PROD
QPRC       TEST                      R    Y
QSQL       CONS
QSQL       HOLD     A                R    Y
QSQL       PROD
QSQL       TEST                      R    Y
****************************** Bottom of data ********************************
```

The above Flag settings would be specified for the following situation:

- Level Structure is TEST-CONS-HOLD-PROD
- The CONS level is a simple staging area and has no QMF Environment. The corresponding M.AD (Plan Imp) entry would not specify a DB2 Owner for the CONS level.
- Users have no authority to save the QMF Objects under the TEST Owner, which is why the Generate is required at TEST. (This does the import under the demanded job ID.)
- Promoting from CONS to HOLD can be done either in a Set or online using the “P” Operation. Either way, a job will be submitted to do the import into the QMF Environment.
- Promoting to PROD can only be done in a Set, so Approval Rules (M.AR) should also be specified to force this to happen.
- The Generates that do the imports must be successfully completed before promotion to the next level (Generate Chk set to “Y”).

## M.AD Plan Implementation Entries

The QMF Interface uses the values specified in M.AD (Plans) to determine the DB2 sub-system and QMF Object Owners for the levels in ISPW. If these values are different from the values used for DB2 Plan and Package bindings, QMF-specific entries can be defined using an Implementation of “QMF”.

Figure 20 shows the list of entries in M.AD (Plans) for an ISPW Application and Stream. Separate entries have been defined specifically for QMF definitions.

**Figure 20** Entries in M.AD for Application and Stream

```
ISPW M.AD/T       APPLICATION QMF STREAM QMF PLANS                Row 1 of 6
Command  ===>                                                  Scroll ===> CSR

List Commands: A Add Entry, L Locate Entry, B Browse Mode
Line Commands: S Select, D Delete

  Level  Implementation

  HOLD
  HOLD   QMF
  PROD
  PROD   QMF
  TEST
  TEST   QMF
****************************** Bottom of data ********************************
```

Figure 21 shows how the DB2 subsystem and QMF Owner are specified. The DB2 Plan/Package fields are superfluous.

**Figure 21** Specifying DB2 Subsystem and QMF Owner

```
ISPW M.AD/P        MODIFY APPLICATION QMF STREAM QMF PLAN IMPLEMENTATIO
Command ===>

Enter required details:

 Level  (KEY) ==> HOLD
 Impl   (KEY) ==> QMF      (Implementation name)
 Do BINDs?    ==>    (Y/N) N=No bind processing for PLANs or PACKAGEs
 Owner        ==> QMFHOLD          Qualifier    ==>
 Subsystem    ==> DSN1             Explain      ==>           (Y/N)

 Logical  Collection IDs ===>
 Physical Collection IDs ===>

Plan Bind Details :
 Name Prefix  ==>         Name Suffix  ==>
 Other Parms  ==>

Package Bind Details :
 Collection   ==>
 Other Parms  ==>

Press ENTER to complete the change or END to terminate
Note: You can add a new entry by overtyping the Keys with new unique values
```

# Site-specific Components and Install Notes

## Sample Components

A certain amount of customization is required for the QMF Interface to be installed properly. For reference purposes, sample and model components supplied in the ISPW installation SAMPLIB dataset may be reviewed to aid in the setup of QMF processing. These include the samples listed in Table 58.

**Table 58** SAMPLIB Components for Setup of QMF Processing

| Type | Name | Description |
|---|---|---|
| Panel | WZUQMGD | TEST level generate example |
| Panel | WZUQMGH | HOLD level generate example |
| Skeleton | WZUQMG# | Generalized mainline “driver” skeleton |

**Table 58** SAMPLIB Components for Setup of QMF Processing *(Continued)*

| Type | Name | Description |
|---|---|---|
| REXX | WZUQMAL | Allocate QMF datasets and start QMF |
| QMF Query | WZTQM#U | Query to be imported into QMF which does “SET CURRENT SQLID” |

## QMF Dataset Allocation and Startup

The WZUQMAL CLIST is used to invoke QMF alongside ISPW. This allocates the QMF environment for the user when the first QMF type module is accessed (where the action requires QMF) within an Assignment. If you already have a QMF start-up CLIST, you can modify WZUQMAL to call it instead. The CLIST has sections in it for allocating the QMF datasets, both for foreground processing and background processes.

Copy the WZUQMAL CLISTs to your site ISPW CLIST dataset. Modify it as described above to initiate the QMF environment for use within ISPW.

## Query for “SET CURRENT SQLID” Processing

A specific QMF Query accessible by all (SHARE=YES) is required to perform the “SET CURRENT SQLID =” processing. This should exist in all DB2 subsystems under the ownership of the userID specified in the M.ER entry for “QMQUAL”.

## Default Editor Settings

M.ER entries for QMEDITQ, QMEDITF, and QMEDITP need to be defined with a value of “QMF” if QMF is to be the editor of choice when the “S” operation is performed. It is normal for this to be set for QMF Forms (QMEDITF) because these cannot easily be edited in the ISPF editor. If the default editor for a specific object type is to be the ISPF editor, do not define the M.ER entry corresponding to that type. The “ST” operation will always invoke the alternative editor to what is invoked on an “S” operation.

## Requirements for Generate Processing

How the QMF Interface is implemented will determine whether or not Generates are required at the TEST and HOLD levels. The four situations listed in Table 59 determine what is required.

**Table 59** QMF Interface Implementation Situations

| Situation | Installation Considerations |
|---|---|
| Users have no authority to save QMF Objects under their own UserID | A TEST Generate must be set up to perform the QMF Import for the TEST Owner. The skeleton WZUQMG# and panel WZUQMGD need to be copied into the Site libraries and modified as required. The M.AD Flag settings should define for a Generate to be done at TEST. |
| Users have the authority to save QMF Objects at the TEST level under their own UserID | No Generate is required, so the M.AD Flag settings should not specify for a Generate to be done at TEST. |
| Promotion to a particular level can be done both Online and in a Set | If Users will be doing “online” promotes, a HOLD Generate must be set up to perform the QMF Import for the Owner at the level being promoted to. The skeleton WZUQMG# and panel WZUQMGH need to be copied into your Site libraries and modified as required. The M.AD Flag settings should define for a Generate to be done at each of the levels for which this is done. |

**Table 59** QMF Interface Implementation Situations ***(Continued)***

| Situation | Installation Considerations |
|---|---|
| Promotion to a particular level can only be done in a Set | This is the normal situation for a promotion to Production, but this can also be the rule for all HOLD levels if required. Be sure to have an Approval Rule specified in M.AR that forces all promotes through the Set Processor. For levels where this is specified, the M.AD Flag setting should indicate that no Generate is required and that the "Promote Method" specified for the level being promoted ***from*** must be set to "A". |

# Natural Interface

In this discussion, it is assumed that you have some basic knowledge of Natural.

## General Description

### Overview

ISPW manages most types of Natural objects including Programs, Maps, Local and Global data Areas, Copy Code, etc. Life-Cycle datasets (PDS/PDSE) are used by ISPW to maintain the Natural source external to Natural. The source is loaded from these external datasets into the appropriate Natural Environment application library as required using the SYSOBJ function. The Natural environment details associated with each level in the ISPW Life-Cycle are defined using ISPW Extension data which is applied to the M.AD Levels via the ISPW M.AD maintenance panels. All the necessary Exits are provided to manage the Natural objects via standard ISPW Processing.

ISPW would generally only maintain the source for the Natural objects in the external PDS/PDSE Life-Cycle datasets, however the recent implementation of SYSOBJ has resulted in the test environment compiled code also being saved alongside the source in these PDS/PDSE datasets.

### Interface

ISPW uses the standard Natural TSO and Batch interfaces to communicate with Natural. At some sites, the TSO interface uses the local %NAT function and the Batch interface uses local JCL procedures. Most processes initiated against a Natural component will start up Natural, process the prepared commands, and terminate the Natural session. The Edit process does not terminate Natural, but leaves the developer in Natural for editing of other components or for testing. The developer will end the Natural session manually. In either case, the termination of the Natural session brings the developer back to the ISPW screen that the Natural process was initiated from.

Natural tasks can be freely added to any assignment with other non-Natural tasks.

### Assumptions

- The module is saved under the same name at each level, and this name is the Assignment Task name.
- The module is loaded/unloaded to/from the Natural library defined in the extension data (M.AD) for the application/level that the module is currently at.
- In the TEST environment, all loads and unloads are performed using the developer's userID. The developer must have the correct access in Natural.
- A batch job and/or a started task, running under an ISPW userID, is used to load the modules at both the ISPW HOLD and PROD environments. This userID needs authority within Natural to log onto the Natural Library and save the object into that Natural Library.
- Modules within Natural are not normally erased as they are promoted up the levels, but this is managed using the Natural interface retain flag which is defined in the extension data. At some sites, modules are erased from the Natural libraries defined in the TEST environment, but they are

retained in all other Natural libraries. This is important because it ensures that the Natural libraries at levels such as PASS and PROD are identical except for changes in progress.

# Life-Cycle

## Terminology

The Life-Cycle used to manage the Natural components from development through to final production deployment consists of several levels of code for each ISPW Application. A typical sequence of levels would be SRSS > TEST > ENVT > PASS > PROD. The bottom level in the Life-Cycle path (for example SRSS) is the only level where program source changes can be made, and the top level (for example PROD) represents the final production code. The intermediate levels (for example TEST, ENVT, PASS) represent different phases of testing and control in the promotion path. In any application definition, there can be several bottom levels to support concurrent editing.

In ISPW terminology, the bottom levels are referred to collectively as the TEST environment. The intermediate levels are referred to collectively as the HOLD environment, and the final production level is referred to as the PROD environment.

## Definition

At each level in the Life-Cycle, ISPW provides a PDS library (RECFM=VB RECL=4624) where the Natural components are stored. The PDS library names are defined in the ISPW M.AD table. Also, at each level, ISPW provides extensions where details of the corresponding Natural library are defined. The Natural Libraries are kept synchronized with the ISPW PDS libraries as code is checked out and promoted using Natural SYSOBJ LOAD and UNLOAD functions.

## Extension Data

For any level in a Life-Cycle that is used by Natural components, there is a relationship between the Natural Library and the ISPW level. This relationship is defined as an extension to the ISPW application level table using extension class WNAEXTN. This extension class defines how to invoke Natural via batch or online methods and the parameters to use. As an example, the extensions for ISPW levels in application STBL are defined as listed in Table 60.

**Table 60** ISPW Levels in STBL

| | SRSS | TEST | ENVT | PASS | PROD |
|---|---|---|---|---|---|
| **WNADBID** | 2 | 2 | 3 | 3 | 5 |
| **WNAINVB** | NATBATT | NATBATT | NATBATE | NATBATE | NATBATP |
| **WNAINVO** | NAT SRST | NAT SRST | NAT SRSE | NAT SRSE | NAT SRSP |
| **WNALIB** | SRS-SS | OS-TBLM | OS-TBLM | OSPTBLM | OS-TBLM |
| **WNARTN** | N | Y | Y | Y | Y |
| **WNASMCPU** | | | | | ADAP0011 |
| **WNASPARM** | SRST | SRST | SRSE | SRSE | SRSP |
| **WNAXFER** | Y | Y | Y | Y | Y |

The extension variables that are defined for each level in the ISPW Life-Cycle are made available to the processing exits via the function WZNAMTLA. The variables are placed in the shared pool, and they can be retrieved with the ISPF VGET service using the name string WTNAVARS.

The online invocation method WNAINVO is used for Browse (B) and Select (S) operations. The batch invocation method WZNINVB is used for all other operations.

The online invocation method WNAINVO defines calls to the local REXX function NAT which is maintained in a CLIST library. The batch invocation method WNAINVB defines calls to local procedures which are maintained in a system procedure library. The ISPW Natural interface is using these local methods in order to execute the desired Natural functions at appropriate stages in the Life-Cycle under the direction of the ISPW processing exits.

## Working in the HOLD and PROD Environments

Natural objects are loaded into the Natural library specified in the ISPW Extension Data that is associated with an ISPW application/level definition. It is normal that ISPW users do not have any authority to load Natural objects into the Natural environments defined for the ISPW HOLD and PROD Environments (that is, all ISPW levels above the ISPW TEST environment). The Natural Interface provides a mechanism where a batch job is submitted under a controlled userID to perform the required operations using either Deploy or the Set Processor.

## Working in the TEST Environment

Natural objects are loaded and unloaded in the ISPW Test Environment using the authority of the developer's userID. Therefore, the developer's userID must have update authority in the corresponding Natural environment.

# Processing Exits

Standard ISPW processing copies objects between the ISPW PDS libraries that are defined to support the various levels in the Life-Cycle. When interfacing with Natural, ISPW must also ensure that the corresponding Natural Libraries are synchronized. This is achieved using ISPW processing exits that are invoked either before the standard ISPW operation (Pre-Exit), or after the standard ISPW operation (Post-Exit).

The exits are defined in the M.EX table under a technology key of NAT as shown in Table 61.

**Table 61** Processing Exits

| Operation | Description | Pre-Exit | Post-Exit |
|---|---|---|---|
| B | Browse | %WZTNAB# | |
| BK | Backup | %WZTNABK | |
| C | Checkout | | %WZTNAIP |
| D | Delete | %WZTNAD# | |
| EP | Export (Natural UNLOAD) | %WZTNAEP | |
| FB | Fallback | | %WZTNAP# |
| IP | Import (Natural LOAD) | %WZTNAIP | |
| R | Promote and Re-Generate (R-Style) | %WZTNAR# | %WZTNAP# |
| P | Promote all objects (A-Style) | | %WZTNAPB |
| RE | Rename | | %WZTNAIPR |
| RS | Restore | %WZTNARS | |
| S | Edit | %WZTNAS# | %WZTNAEP |
| X | Regress | | %WZTNAX# |

The post-exit %WZTNAPB is a local function which is used to drive special processing for fallback on promotes to level PASS. The pre-exits %WZTNABK and %WZTNARS are also special exits to handle Backup and Restore which support a custom local fallback process.

## B – Browse Operation

The user can invoke Browse on any member by selecting the Browse Operation from an Assignment Task List. For Natural components, ISPW launches Natural via a special Pre-Exit WZTNAB#, and the user is therefore able to view the component in the Natural Library that is pre-defined for the selected level.

The Browse Operation is routed to Natural via the local online function **%NAT** using a command like the following which is used to Logon to the SRS-SS library and browse member ISPWTES2

```
SRST ISPW LOGON SRS-SS;L ISPWTES2;FIN
```

## BK – Backup Operation

The BK operation is a local function which supports a tailored local fallback process for Natural objects. The intent is to provide a mechanism whereby the contents of a Natural library which is about to be overlaid can be backed up for eventual recovery using the RS command.

This function performs an Unload of the next level Natural library member to a sequential dataset with the name:

**S09128**.<*Member*>.<*Natlib*>.<*Date*>.<*Time*>

where

<*Member*> is the member name
<*Natlib*> is the Natural library name for the current level
<*Date*> is the date in the Julian date format YYDDD
<*Time*> is the time in the format HHMM.

For example, when requested at level PASS for member ISPWTES1 in application STBL, the production member is unloaded from the Natural library defined for level PROD and saved in a sequential dataset with a name such as:

```
S09128.ISPWTES1.OSPTBLM.D10215.T1930
```

The Natural library defined for the current level is included in the dataset name, but the contents are extracted from the next level. In the above example, OSPTBLM is the Natural library defined for level PASS in application STBL, but the contents will have been unloaded from the Natural library OS-TBLM which is defined for level PROD in application STBL.

For diagnostic purposes, the results of the Natural unload are copied to a dataset with the name:

**S09128**.<*Level*>.**NATUNLD**.<*Member*>

where

<*Level*> is the current level
<*Member*> is the member name.

## C – Checkout Operation

Standard Checkout processing copies the ISPW PDS member from the selected checkout level (for example, PROD) to the TEST environment PDS at the bottom level of the promotion path. Up to this

point, this is the same process used by ISPW to check out regular components, such as COBOL or JCL. When the regular processing has been completed, ISPW calls the post-exit WZTNAIP to import the component into the pre-defined Natural Library associated with the checkout level. The User is then able to edit the component in the Natural Library to make any required code changes.

If any errors are encountered during the Natural import phase, the results of the import can be viewed in a dataset with the name:

**S09128**.<*Level*>.**NATLOAD.CMPRINT**.<*Member*>

where

<*Level*> is the current ISPW checkout level
<*Member*> is the member name.

## D – Delete Operation

When the D operation is requested by a user, the Pre-Exit %WZTNAD# is called to remove the selected module from the Natural Library before regular ISPW processing removes the module from the ISPW PDS library. The D operation is only valid in the Test environment.

The Delete operation is also called during regular promote and regress operations to clean up the level being moved from (if the Natural retain flag is **N**). The Natural retain flag is **Y** for all levels except the first level, so modules are only removed from the Natural library after a Promote from the TEST environment.

If any errors are encountered during the Natural delete phase, the results of the delete can be viewed in a dataset with the name:

**S09128.ISPW**.<*Level*>.**NATDELT.CMPRINT**.<*Member*>

where

<*Level*> is the current ISPW level
<*Member*> is the member name.

## EP – Export Operation

The EP operation performs a Natural unload to extract a module from the Natural Library associated with a level and place it in the ISPW PDS. When the EP operation is requested by a user, the function %WZTNAEP is called to interface with Natural in order to execute the required SYSOBJ UUNLOAD command.

If any errors are encountered during the Natural export, the results can be viewed in a dataset with the name:

**S09128**.<*Level*>.**NATUNLD.CMPRINT**.<*Member*>

where

<*Level*> is the current ISPW checkout level
<*Member*> is the member name.

## FB – Fallback Operation

When the FB operation is requested, standard ISPW processing for Natural extracts the previous source version of the selected module from the ISPW Warehouse and populates the associated production ISPW PDS libraries.

For a production fallback, the standard ISPW implementation uses either Deploy or a Post-Exit to first load the source from the ISPW production PDS library into the Natural production library, then perform the equivalent of a compile (Catalog and Stow), and finally perform any required DB2 processing (Pre-compile, Bind, etc.). This is not ideal for two reasons: the resulting executable object could be different from the one that was previously created, and—in a fallback situation—the user wants to return to what previously existed rather than recreate what was there before. For regular 3-GL components, ISPW saves the generated objects (LOAD and DBRM) in the warehouse during a promote operation and recovers those objects automatically during the fallback operation.

The Fallback implementation uses both the Post-Exit and the Deploy methods to perform the Load, Catalog, and Stow, and it uses Deploy to perform a Bind if required. When the fallback operation has finished, a locally developed RS command can be used to restore the production library member from the backup that was taken when the component was originally promoted to the PASS level.

As currently defined, the Post-Exit %WZTNAP# is executed after the source has been retrieved from the ISPW Warehouse. This function is executed by the Set Processor (ISPWSX). If any errors are encountered during this Post-Exit phase, the results of the Natural operations can be viewed in a dataset with the name:

**S09128**.<*Level*>.**NATLOAD.CMPRINT**.<*Member*>

where

<*Level*> is the current ISPW level
<*Member*> is the member name.

When the Post-Exit has completed, ISPW initiates Deploy processing which starts an implement phase to perform the Load, Catalog, and Stow. When the implement phase has completed, an activation phase is started to generate the DBRM and perform any DB2 related processing (Pre-Compile and Bind).

See Deploy Processing on page 90 for more detailed Deploy information. If any errors are encountered during the Deploy phases, the results can be seen in the respective job outputs ISPWRXIJ (Implement) and ISPWRXAJ (Activate).

## IP – Import Operation

The IP operation performs a Natural load to copy a module from the ISPW PDS library to the associated Natural Library. When this operation is requested by a user, the function %WZTNAIP is called to interface with Natural in order to execute the required SYSOBJ LOAD command.

If any errors are encountered during the Natural import, the results can be viewed in a dataset with the name:

**S09128**.<*Level*>.**NATLOAD.CMPRINT**.<*Member*>

where

<*Level*> is the current ISPW checkout level
<*Member*> is the member name.

## R – Promote Operation (R-Style)

The R-Style promote method is used when the ISPW M.AD table defines a blank “Promote Method” under the flags for the source of the Promote. At some sites, this style of promote is defined for all Natural promotes to the first level in the HOLD environment. For example, in Application STBL, it would be used when promoting from level SRSS to level TEST.

When a Promote is requested, ISPW calls a special Pre-Exit WZTNAR# which runs before the standard PDS copy process, and it calls Post-Exit WZTNAP# when the standard copy processing has completed.

The ISPW M.AD tables are also defined such that a Generate is required at the first level in the HOLD environment. For example, after a Promote from level SRSS to level TEST in application STBL, a Generate will be forced.

The Pre-Exit WZTNAR# is responsible for updating the ISPW PDS library with the most current Natural Library member. This is achieved by calling the export function WZTNAEP for promotes from the TEST environment. For example, on a promote from level SRSS in application STBL, the export function would be used to extract the most current version from the Natural Library and place it in the PDS library defined for level SRSS. When the Pre-Exit has completed, regular ISPW processing manages the PDS copy from the TEST environment to the HOLD environment.

If any errors are encountered during the Natural export, the results can be viewed in a dataset with the name:

**S09128**.<*Level*>.**NATUNLD.CMPRINT**.<*Member*>

where

<*Level*> is the current ISPW checkout level
<*Member*> is the member name.

The R-Style Promote operation runs under the control of the Set Processor, so any problem analysis requires the Set details, which can be found via the Set Modify panel. To find out which Set was used for a particular component, the ISPF History can be viewed by entering **H** alongside a Task in a Task List. When the Set ID has been found, the Set Modify operation **M** can be entered alongside the Set Container via a Container List. From there, it is possible to view the Set Log, which will identify any errors and show the SX started Task Job ISPWSX that was used to manage the operations (Promote and Generate, as required).

The Promote Operation is also defined to run a Post-Exit, which is really not required because it does everything that the subsequent Generate does. The Post Exit has been tailored so it does not operate at the TEST level, so the Post-Exit is effectively redundant, and it could be removed from the M.EX table definition as an alternative to making local changes to the exit.

The ISPWSX started task job is archived to $AVRS (U.$.77) almost immediately upon completion. It would be helpful for diagnostic purposes if these jobs were to remain on SDSF for at least a few days, because they provide the programmers and technical support with better diagnostic features, such as the ability to edit and submit a failed job.

Upon completion of the promote operation, a Generate Job is created and Submitted by the Set Processor to load the source into the Natural Library and perform the Catalog and Stow as necessary. The generate job is also archived to $AVRS very soon after completion.

## P – Promote Operation (A-Style)

The A-Style promote method is used when the ISPW M.AD table defines a “Promote Method” with a value of **A** under the flags for the source of the Promote.

There are two types of Promote in ISPW, and these are termed the R-Style and the A-Style promote. The R-Style promote is used when a Re-Generate is required at the next level, and this style of promote is used when promoting to the first level in the HOLD environment. The A-Style promote is used when all components are to be copied and no generate is required at the target level, or when a Deploy process might be initiated. At some sites, the A-Style of promote is used when promoting to the higher levels in the Life-Cycle such as ENVT, PASS, and PROD, because Deploy is used. The Deploy process for Natural also performs a Generate.

This style of promote operation is defined in the M.EX table to use the Post-Exit %WZTNAPB and at the levels where the A-Style promote is used; Deploy functions are utilized to handle implementation and activation. See Deploy Processing on page 90 for more detailed Deploy information.

At some sites, the Post Exit is used to initiate a special backup function upon a Promote to level PASS. This backup function creates a backup of the production library using a batch job ISPWBK. A backup job is submitted for each Natural component to create a backup in a sequential dataset. See BK – Backup Operation on page 84 for more information.

## RE – Rename Operation

The RE operation is used to rename a component in the TEST environment when a source component has to be moved aside under a different name while another version is being worked on. To accomplish this, the source and object in the Natural Environment are deleted and the module is renamed in the PDS.

If the module is flagged to be retained at this level, the previous version is left in place in the Natural library, but some sites do not use the retain feature in the Test environment, so a local post-processing exit WZTNAIPR is used. This processing exit loads the Natural library from the PDS after a rename operation, so the module is never really deleted from the Natural library after the initial rename, and when a module is renamed back to the original name, the post exit loads the Natural library again to ensure that it matches the original PDS member.

## RS – Restore Operation

The RS operation is used to restore the selected module from a backup library, which is identified via an ISPF panel. This locally created command is used primarily after a Fallback to restore the production version of a component from a prior backup that was created with the BK operation or when the component was promoted to level PASS.

This operation generates and submits a batch job with the name ISPWRS to restore the component from the backup library and Load the component into the Natural library.

## S – Select for Edit Operation

The user can invoke Edit on any member by selecting the Edit Operation from an Assignment Task List. For Natural Components, ISPW launches Natural via a special Pre-Exit WZTNAS#. The user is therefore able to edit the component in the Natural Library that is pre-defined for the selected level. The Pre-Exit replaces the regular ISPW exit that drives the edit of the selected PDS member.

The Edit request is routed to Natural via a locally developed online function %NAT using a command similar to the following, which is used to log onto the SRS-SS library and edit member ISPWTES2 inside the Natural environment:

```
SRST ISPW MAINMENU OFF;LOGON SRS-SS;E ISPWTES2;MAINMENU
```

When the user exits from Natural, the Post Exit WZTNAEP is called to export the updated source from the Natural Library and place it in the ISPW PDS.

If any errors are reported by the Post exit, the results of the export can be viewed in a dataset with the name:

**S09128**.<*Level*>.**NATUNLD.CMPRINT**.<*Member*>

where

<*Level*> is the current ISPW level at which the RS operation is selected
<*Member*> is the member name.

## X – Regress Operation

The Regress operation is used to move the selected module to the next lower level in the Life-Cycle and repair the current level with the Deployment of a previous version.

The Regress operation is defined to use a post exit WZTNAX#, which repairs the Natural Library at the level being regressed from. It restores a version from the next higher level in the Life-Cycle and then drives a generate (local code enhancement).

For levels where Deploy is used, an Action **I** task is also generated by ISPW to repair the Natural Library. The Deploy function WZTNADIP does this by implementing a version from the PASS level (if one exists) or the PROD level. This is coded on the assumption that Deploy is used at levels ENVT PASS and PROD.

A more generic solution could be implemented by using the standard Deploy copy process to copy from the appropriate Life-Cycle library (as determined by ISPW) to some intermediate staging area, which would then be used as the source for the repair using SYSOBJ LOAD.

The Regress Post Exit function WZTNAX# should be disabled for levels where Deploy is used, because it is performing equivalent functions and effectively doing the same thing twice.

## Generate Processing

The user can invoke Generate on any member by selecting the Generate Operation from an Assignment Task List. For Natural Components, ISPW launches Natural using the standard Generate Process Exit. The standard Generate Process Exit displays the generate panel and creates the generate JCL using the standard skeleton WZUG.

The JCL is created and submitted for background processing. Sample JCL which is created to generate a program in the TEST environment is shown in Figure 22.

**Figure 22** Sample JCL Created by User to Generate Program ISPWTES2 at Level SRSS

```
//NATLOAD  EXEC NATBATT,
//         COND=((4,LT)),
//         REGION=(3072K)
//CMWKF01  DD  DISP=SHR,DSN=D09128.STBLSRSS.NAT(ISPWTES2)
//CMSYNIN  DD *
LOGON SYSOBJH
SYSOBJH
LOADALL WITH NEWL SRS-SS WHERE REPL ALL
.
LOGON SRS-SS
XREF ON
CATALL ISPWTES2,,X,X,X,X,X,X,X,X,X,X,X,X,STOW CC
SYSBPM
D,SRS-SS,ISPWTES2
.
FIN
/*
```

Upon completion of the promote operation to the first HOLD environment level, a Generate Job is created and Submitted by the Set Processor to load the source into the Natural Library and perform the CATALL, STOW, and DBRM Bind as necessary.

**Figure 23** Sample JCL Created by ISPWSX to Generate Program ISPWTES2 at the TEST Level

```
//NATLOAD  EXEC NATBATT,
//         COND=((4,LT)),
//         REGION=(3072K)
//CMWKF01  DD  DISP=SHR,DSN=D09128.STBLTEST.NAT(ISPWTES2)
//CMSYNIN  DD *
LOGON SYSOBJH
SYSOBJH
LOADALL WITH NEWL OS-TBLM WHERE REPL ALL
.
LOGON OS-TBLM
XREF ON
CATALL ISPWTES2,,X,X,X,X,X,X,X,X,X,X,X,X,X,STOW CC
SYSBPM
D,OS-TBLM,ISPWTES2
.
FIN
/*
```

The Generate operations are enabled for the TEST environment and the first HOLD levels. For example, in application STBL, generate is enabled for levels SRSS and TEST.

# Deploy Processing

For the ENVT, PASS, and PROD levels, the ISPW Deploy feature is used to manage the implementation and activation of Natural objects in the target Natural Libraries. Deploy is invoked during Promote, Regress, and Fallback operations to manage the Natural Load, Catalog, and Stow during the implement phase and to manage the DB2 Bind during the activation phase. Deploy Implement processing is defined for the ENVT, PASS, and PROD levels, and Deploy Activate Processing is defined for the ENVT and PROD levels.

## Implement Phase

After a Promote to a level such as ENVT where ISPW Deploy is used, all Natural objects that are included in a “Promote Set” are merged together from their respective ISPW Life-Cycle PDS libraries to create a single temporary sequential file. This sequential file is then used as input to the SYSOBJ LOAD function to update the corresponding Natural Library using a single invocation of SYSOBJ. The “Load” function is followed by several “Catalog” functions which are performed in an order which is pre-determined by the Natural Component Type.

The ISPW Life-Cycle PDS library members maintain Natural objects in SYSOBJ UNLOAD format (one object per PDS member). The ISPW Deploy merge process mimics what happens when several Natural objects are unloaded at the same time to a sequential file and this is achieved by removing the header records from all objects except for the first object.

The temporary sequential file is created by the Deploy ISPWXDI started task which then creates and submits a batch job ISPWXDIJ to perform the SYSOBJ “Load” followed by the “Catalog” and “Clear Buffer Pool” functions as per the sample JCL shown in Figure 24.

**Figure 24** Sample Deploy Implement Job ISPWXDIJ for Two Natural Objects ISPWTES1 and ISPWTES2

```
//ISPWXDIJ JOB (09129,D00,0000,09128),'ISPWS4 DEP JOB',
//   MSGCLASS=7,CLASS=X,PRTY=9
/*JOBPARM N=1,F=0151,R=PROM,L=55,T=05
//* $ACFJ219 ACF2 ACTIVE MTLB
//* SKELETON WZTNAXJC SYSTEM = H120
//*LOGONID $ACFJ201 ACF2 CONTROL CARD SUCCESSFULLY SCANNED
/*SAMECPU ADAE0021
//NATEXEC EXEC NATBATE
//CMWKF01 DD DISP=SHR,DSN='S09128.ISPD.H120.D38706.P1.CMWKF01'
//CMSYNIN  DD *
LOGON SYSOBJH
SYSOBJH
LOADALL WITH NEWL OS-TBLM WHERE REPL ALL
.
LOGON OS-TBLM
CATALL ISPWTES1,,X,X,X,X,X,X,X,X,X,X,X,X,STOW CC
CATALL ISPWTES2,,X,X,X,X,X,X,X,X,X,X,X,X,STOW CC
SYSBPM
D,OS-TBLM,ISPWTES1
D,OS-TBLM,ISPWTES2
.
FIN
```

## Activate Phase

If a DBRM part is registered and the variable WZGSQL has the value Y, the ISPW Deploy Activation process is used to create a batch job which will generate the DBRM and perform any required DB2 Bind requests. The JCL is created by the started task ISPWXDA which submits the job ISPWXDAJ to perform the DBRM processing as per the sample job steps below.

**Figure 25** Sample Deploy Activate Job Steps Creating the DBRM for ISPWTES1 at the ENVT Level

```
//ISPWXDAJ JOB
//*********************************************************************
//*   SKEL WZUNAXGD - GENERATE DBRM SOURCE FOR ISPWTES1
//*********************************************************************
//GENDBRM EXEC NATBATP
//CMPRINT DD SYSOUT=*
//CMWKF01  DD DSN=&TMP1,UNIT=WORK,DCB=(DSORG=PS,RECFM=FB,
//          LRECL=80,BLKSIZE=3120),DISP=(,DELETE),SPACE=(TRK,(5,5))
//CMWKF02  DD DSN=&TMP2,UNIT=WORK,DCB=(DSORG=PS,RECFM=FB,
//          LRECL=80,BLKSIZE=3120),DISP=(,DELETE),SPACE=(TRK,(5,5))
//CMWKF03  DD DSN=&TMP3,UNIT=WORK,DCB=(DSORG=PS,RECFM=FB,
//          LRECL=80,BLKSIZE=3120),DISP=(,DELETE),SPACE=(TRK,(5,5))
//CMWKF04  DD DSN=&TMP4,UNIT=WORK,DCB=(DSORG=PS,RECFM=FB,
//          LRECL=80,BLKSIZE=3120),DISP=(,DELETE),SPACE=(TRK,(5,5))
//CMWKF05  DD DSN=&TMP5,UNIT=WORK,DCB=(DSORG=PS,RECFM=FB,
//          LRECL=80,BLKSIZE=3120),DISP=(,DELETE),SPACE=(TRK,(5,5))
//CMWKF06  DD DSN=&TMP6,UNIT=WORK,DCB=(DSORG=PS,RECFM=FB,
//          LRECL=80,BLKSIZE=3120),DISP=(,PASS),SPACE=(TRK,(5,5))
//CMSYNIN  DD *
LOGON SYSDB2
CMD CREATE DBRM ISPWTES1 USING INPUT DATA WITH XREF YES
OS-TBLM,ISPWTES1
.
FIN
//*********************************************************************
//*   SKEL WZUNAXDB - PRECOMPILE STEP FOR ISPWTES1
//*********************************************************************
//PC       EXEC PGM=DSNHPC,COND=EVEN,PARM='HOST(ASM),VERSION(AUTO)'
//DBRMLIB  DD DSN=D09358.DB2E.NATDBRM.OS-TBLM(ISPWTES1),
//            DISP=SHR
//STEPLIB  DD DSN=SYSDB2.DB2P.DSNEXIT,DISP=SHR
//         DD DSN=SYSDB2.DB2P.DSNLOAD,DISP=SHR
//SYSCIN   DD DSN=&DSNHOUT,DISP=(,PASS),UNIT=WORK,
//            SPACE=(800,(500,500))
//SYSIN    DD DSN=&TMP6,DISP=(OLD,DELETE)
//SYSPRINT DD SYSOUT=*
//SYSTERM  DD SYSOUT=*
//SYSUT1   DD SPACE=(800,(500,500),,,ROUND),UNIT=WORK
```

The activate Job that is created includes job steps to perform the DB2 Bind and Modify Static as per below along with various steps to report back the status to ISPW. If several DBRMs are processed for the same Natural Library in the same ISPW “Processing Set”, it is possible that a JCL error could result because the operating system maximum number of job steps could be exceeded.

**Figure 26** Sample Deploy Activate Job Steps to Bind the DBRM for ISPWTES1 at the ENVT Level

```
//ISPWXDAJ
//*********************************************************************
//*   SKEL WZU2BIND - BIND DB2 PACKAGE FOR ISPWTES1
//*********************************************************************
//BIND     EXEC PGM=IKJEFT01,DYNAMNBR=99
//STEPLIB  DD DISP=SHR,DSN=SYSDB2.DB2E.DSNLOAD
//SYSPRINT DD SYSOUT=*
//DBRMLIB  DD DISP=SHR,DSN=D09358.DB2E.NATDBRM.OS-TBLM
//         DD DISP=SHR,DSN=PASSINGI.SRSPROD.DBRMLIB
//         DD DISP=SHR,DSN=CHANGEI.DB2P.NATDBRM.OS-TBLM
//SYSTSPRT DD SYSOUT=*
//SYSLBC   DD DSN=SYS1.BRODCAST,DISP=SHR
//SYSTSIN  DD *
//SYSTSIN  DD *
 DSN SYSTEM(DB2E)
  BIND PACKAGE(OS_TBLM) -
  MEMBER(ISPWTES1) -
  QUAL(WBEPLAN) -
  OWNER(WBEPLAN) -
  RELEASE(DEALLOCATE) -
  CURRENTDATA(NO) -
  EXPLAIN(YES) -
  VALIDATE(BIND) -
  ISOLATION(CS)
 END
/*
//*********************************************************************
//*   SKEL WZUNAXMF - MODIFY STATIC FLAG FOR ISPWTES1
//*********************************************************************
//MODIFY  EXEC NATBATE
//CMWKF01  DD DSN=&DSNHOUT,DISP=(OLD,DELETE)
//CMWKF02  DD DSN=&TMP7,UNIT=WORK,DCB=(DSORG=PS,RECFM=FB,
//         LRECL=80,BLKSIZE=3120),DISP=(,DELETE),SPACE=(TRK,(5,5),RLSE)
//CMPRINT DD SYSOUT=*
//CMSYNIN  DD *
LOGON SYSDB2
CMD MODIFY XREF
SYSBPM
D,OS-TBLM,ISPWTES1
.
FIN
```

# Local Backup Restore Process

On a Promote to the PASS level a special backup job is spawned to create a backup of the current production object using the following JCL.

**Figure 27** Special Backup Job Created by Promote Post Exit on Promote to the PASS Level

```
//ISPWBK JOB (09129,D00,0000,09128),'ISPWSX BAKUP',
//   MSGCLASS=7,CLASS=D,NOTIFY=&SYSUID,PRTY=9
/*JOBPARM N=1,F=0151,R=PROM,L=55,T=05
//* $ACFJ219 ACF2 ACTIVE MTLB
/*ROUTE PRINT MTLB
/*SAMECPU ADAP0011
//*LOGONID $ACFJ201 ACF2 CONTROL CARD SUCCESSFULLY SCANNED
//****************** BEGIN SKEL WZU@NAUN ***************************
//NATBKUP  EXEC NATBATP,
//         REGION=(3072K)
//CMWKF01  DD DSN=S09128.ISPWTES2.OSPTBLM.D10215.T1933,
//            DISP=(,CATLG,DELETE),
//            UNIT=SMDA,SPACE=(CYL,(6,2),RLSE),
//            LABEL=RETPD=60
//CMPRINT  DD SYSOUT=*
SYSOBJH
UNLOAD ISPWTES2 LIB OS-TBLM SCKIND A OBJTYPE N WHERE XREF ON BATCHR
.
FIN
```

After a regular ISPW Fallback brings back an old version from the Warehouse, an additional manual restore process is initiated via the RS command to restore the Natural object from the backup that was created with a previous ISPWBK job.

**Figure 28** Special Restore Job Created When RS Command is Selected to Restore an Object After Fallback at PROD

```
 //ISPWRS JOB (09129,D00,0000,09128),'ISPWSX RESTORE',
//   MSGCLASS=T,CLASS=D,NOTIFY=&SYSUID,PRTY=9
/*JOBPARM N=1,F=0151,R=PROM,L=55,T=05
//* $ACFJ219 ACF2 ACTIVE MTLB
/*SAMECPU ADAP0011
//****************** BEGIN SKEL WZU@NARS ***************************
//NATREST  EXEC NATBATP
//CMWKF01  DD DSN=S09128.ISPWTES2.OSPTBLM.D10215.T1933,DISP=SHR
//CMPRINT  DD SYSOUT=*
//CMSYNIN  DD *
LOGON SYSOBJH
SYSOBJH
LOADALL WHERE REPLACE ALL
FIN
/*
```

# Processing Skeletons

ISPW provides several Natural processing skeletons listed in Table 62.

**Table 62** ISPW Natural Processing Skeletons

| Function | Skeleton | Natural Commands |
|---|---|---|
| C (Post) | WZTNAIP | Import to Natural Library from PDS<br><br>SYSOBJH<br>LOADALL WITH NEWL ~WNACLIB WHERE REPL ALL |
| BK | WZTNABK | Backup to sequential file<br><br>SYSOBJH<br>UNLOAD ~MEMBWORK LIB ~WNANLIB OBJTYPE N |

**Table 62** ISPW Natural Processing Skeletons ***(Continued)***

| Function | Skeleton | Natural Commands |
|---|---|---|
| RS | WZTNARS | Restore from sequential file<br><br>SYSOBJH<br>LOADALL WHERE REPLACE ALL |
| IP | WZTNAIP | Import to Natural Library from PDS<br><br>SYSOBJH<br>LOADALL WITH NEWL ~WNACLIB WHERE REPL ALL |
| EP | WZTNAEP | Export from Natural to PDS member<br><br>SYSOBJH<br>UNLOAD ~MEMBWORK LIB ~WNACLIB SCKIND A OBJTYPE N |
| Deploy | **Implement Phase** | |
| | WZTNAXIP | Import to Natural Library from PDS<br><br>SYSOBJH<br>LOADALL WITH NEWL ~WNACLIB WHERE REPL ALL |
| | WZTNADCA | Catalogue<br><br>LOGON ~WNACLIB<br>XREF ON<br>CATALL ~MEMBWORK,,X,X,X,X,X,X,X,X,X,X,X,X,X,STOW CC |
| | WZTNADCP | CLEAR Buffer Pool<br><br>SYSBPM<br>D,~WNACLIB,~MEMBWORK |
| | **Activate Phase** | |
| | WZUNAXGD | Build DBRM<br><br>LOGON SYSDB2<br>CREATE DBRM ~GMT1NAME USING INPUT DATA WITH XREF YES |
| | WZUNAXDB | Pre-Compile |
| | WZU2BIND | Bind |
| | WZUNAXMF | Modify Plan Static<br><br>LOGON SYSDB2<br>CMD MODIFY XREF |
| D | WZTNAD# | Delete from Natural library<br><br>LOGON ~WNACLIB<br>SYSMAIN DELETE ALL ~MEMBWORK IN ~WNACLIB |
| R (Pre) | WZTNAEP | Export from Natural to TEST Environment PDS<br><br>SYSOBJH<br>UNLOAD ~MEMBWORK LIB ~WNACLIB SCKIND A OBJTYPE N |

**Table 62** ISPW Natural Processing Skeletons ***(Continued)***

| Function | Skeleton | Natural Commands |
|---|---|---|
| R (Post) | WZTNAIP | LOAD from HOLD Environment PDS<br><br>SYSOBJH<br>LOADALL WITH NEWL ~WNACLIB WHERE REPL ALL |
| | WZTNACA | Catalogue<br><br>LOGON ~WNACLIB<br>XREF ON<br>CATALL ~MEMBWORK,,X,X,X,X,X,X,X,X,X,X,X,X,STOW CC |
| | WZTNACP | CLEAR Buffer Pool<br><br>SYSBPM<br>D,~WNACLIB,~MEMBWORK |
| P (Post) | WZU@JOBK<br>WZU@NAUN<br>WZTNABU | Backup PROD on promote to PASS<br><br>SYSOBJH<br>UNLOAD ~MEMBWORK LIB ~WNANLIB SCKIND A OBJTYPE N WHERE XREF ON BATCHR |
| G | WZU#NA## | Build basic JCL framework for Natural Library and include skeletons to: |
| | WZTNAIP | LOAD Natural Library from ISPW PDS<br><br>SYSOBJH<br>LOADALL WITH NEWL ~WNACLIB WHERE REPL ALL |
| | WZTNACA | Catalogue<br><br>LOGON ~WNACLIB<br>XREF ON<br>CATALL ~MEMBWORK,,X,X,X,X,X,X,X,X,X,X,X,X,STOW CC |
| | WZTNACP | CLEAR Buffer Pool<br><br>SYSBPM<br>D,~WNACLIB,~MEMBWORK |
| FB (Post) | WZTNAIP | LOAD from PROD Environment PDS<br><br>SYSOBJH<br>LOADALL WITH NEWL ~WNACLIB WHERE REPL ALL |
| | WZTNACA | Catalogue<br><br>LOGON ~WNACLIB<br>XREF ON<br>CATALL ~MEMBWORK,,X,X,X,X,X,X,X,X,X,X,X,X,STOW CC |
| | WZTNACP | Clear Buffer Pool<br><br>SYSBPM<br>D,~WNACLIB,~MEMBWORK |
| | **DB2 Objects** | |
| | WZTNAGD | Create DBRM<br><br>LOGON SYSDB2<br>CMD CREATE DBRM ~GMT1NAME USING INPUT DATA WITH XREF YES |
| | WZTNAMF | Modify Static Flag<br><br>LOGON SYSDB2<br>CMD MODIFY XREF |
| | WZTNACP | Clear Buffer Pool<br><br>SYSBPM<br>D,~WNACLIB,~MEMBWORK |

# Processing Order

When ISPW compiles Natural objects in the Deploy phase, the processing order is determined by the Component Type as indicated in Table 63. This is achieved by sorting all the items in a Deploy Package via a local code enhancement. But with ISPW 4.4 and above with the generate sequence code, this local code could be removed and all generate processing could be handled by the generate skeletons obviating the requirement for this additional Deploy processing.

**Table 63** Natural Processing Order

| Type | Description | Order |
|---|---|---|
| NATG | Natural Global Data Areas | 1 |
| NATA | Natural Parameter Area | 2 |
| NATC | Natural Copy Code | 3 |
| NATL | Natural Local Data Areas | 4 |
| NATM | Natural Map Components | 5 |
| NATH | Natural Help Routines | 6 |
| NATN | Natural Subprograms | 7 |
| NATS | Natural Subroutines | 8 |
| NATP | Natural Programs | 9 |

# ISPW Web Interface

ISPW provides an optional web-based interface that supports a set of REST APIs that can be used to request ISPW functions. The interface also supports callbacks to the REST APIs supported by other products, in order to notify them when requested functions complete or fail.

For a complete description of the ISPW Web Interface REST APIs, refer to the online Help for the Web Interface.

## Required Components

The Web Interface is an optional feature that makes use of components of:

- CES (Compuware Enterprise Services)
- CMSC (Compuware Mainframe Services Controller).

To configure the CMSC, refer to the *Enterprise Common Components Installation and Configuration Guide, MVS Version* for Release 17.02 and above.

To configure the CES, refer to the *Compuware Web Products Installation and Configuration Guide* for Release 17.02 and above.

## Enabling Web Interface API Support

Once you have the required releases of CES and CMSC installed, you can enable ISPW's Web Interface REST API support by adding `WEBAPI=Y` to the IWCM00 parameter member used by the ISPW/CM task. For more information, see the section entitled "Milestone 10: Install Base Software" in the *ISPW Installation and Configuration Guide*.

Before setting WEBAPI=Y, ensure that the ISPW CM task JCL includes the DD statements for ETPLIB, ETPLOG, WQPLIB, and WQPLOG. See the ISPWCM member in SAMPLIB for an example of these DD statements.