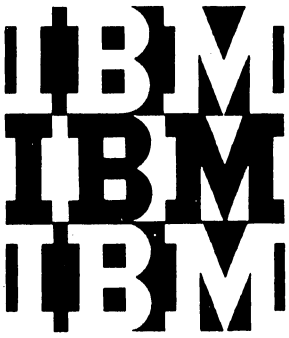

File No. S360-36
Order No. GY30-2005-4

Program Logic

IBM System/360 Operating System

Remote Job Entry

Program Logic Manual

Program Number 360S-RC-536

This Program Logic Manual describes the internal logic of the Remote Job Entry (RJE) under the MFT or MVT options of the IBM System/360 Operating System. This publication is intended for use by personnel involved in program maintenance and by system programmers who are altering the system design. Program logic information is not necessary for the use and operation of the program; therefore, distribution of this publication is limited to persons with program maintenance or modification responsibilities.

PREFACE

This Program Logic Manual (PLM) is a detailed guide to the internal structure of Remote Job Entry. It supplements the program listings by providing descriptive text and flowcharts; program structure at the machine instruction level is not discussed.

This PLM is divided into three main sections.

- System Overview: This section gives a general discussion of the relationships among RJE modules.
- Physical Organization: This section describes the organization of RJE as produced by system generation.
- Logical Organization: This section describes in detail the functions performed by RJE. It includes descriptions of RJE routines, followed by flowcharts of these routines. The flowcharts are arranged alphabetically, by chart ID, for easy reference.

Detailed illustrations and descriptions concerning control blocks used by RJE, and tables created by RJE are presented in appendixes.

Prerequisite and Related Literature

The following IBM System/360 publications provide information helpful in the effective use of this manual:

IBM System/360 Operating System: Remote Job Entry, GC30-2006.

IBM System/360 Operating System: MVT Job Management, Program Logic Manual, GY28-6660.

Fifth Edition (June 1970)

This is a major revision of, and obsoletes, Y30-2005-2 and TNLs Y30-2523 and Y30-2535. The IHKABXMT, IHKABLRD, and IHKCHLRD routines have been rewritten to add the reverse interrupt (RVI) line control character facility to the routines. The IHKCHNIP, IHKXJBGN, and IHKCDRMV routines have been expanded to include the OS system management facilities (SMF) feature in RJE. Additional bytes have been added to the RJE line control block (LCB) and to the terminal directory. The common work area, named LWKWORK, used by both the IHKABLWR and IHKABORT routines has been added to assist RJE users. All flowcharts have been changed to conform with the revised flowchart standards. Changes to the text, and small changes to illustrations, are indicated by a vertical line to the left of the change; changed or added illustrations are denoted by the symbol • to the left of the caption.

This edition applies to Release 19 of IBM System/360 Operating System and to all subsequent releases until otherwise indicated in new editions or Technical Newsletters. Changes are continually being made to the specifications herein; before using this publication in connection with the operation of IBM systems, consult the latest IBM System/360 SRL Newsletter, GN20-0360, for the editions that are applicable and current.

Specifications contained herein are subject to change from time to time. Any such change will be reported in subsequent revisions or Technical Newsletters.

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The Remote Job Entry (RJE) facility of the IBM System/360 Operating System provides users with the ability to introduce jobs into a central input stream from remote locations via communications lines. Any element entered into the job stream at the central location (except central commands) may also be entered at a remote work station.

RJE collects jobs from remote work stations. When each complete job has been collected, it is passed to the operating system job scheduler where it is interpreted, enqueued on an input job queue, initiated, executed, terminated, and enqueued on the RJE output queue. RJE then dequeues the output and returns it to the work station.

RJE operation provides multiple access to the central system since more than one work station can be in communication with the central system, which may be processing its own local input stream at the same time. Thus, RJE permits machine centralization and extension of large scale data processing capabilities to remote sites that might not otherwise be able to justify the same computing facility locally.

The number of supported work stations is dependent upon the central system. The limiting factors that determine the number of supported work stations are main storage capacity, central processing unit speed, direct access storage capacity, and the operating system environment. The operating environment may be either multiprogramming with a variable number of tasks (MVT) or multiprogramming with a fixed number of tasks (MFT).

SYSTEM OVERVIEW

This section gives a general description of the internal operation of the RJE system. Figure 1A illustrates the control and data flow in an MFT environment; Figure 1B illustrates the control and data flow in an MVT environment. The same functions are performed by RJE in both environments. The system-dependent differences in the RJE system are not what functions are performed, but how those functions are performed. For example, the OS reader/interpreter (R/I) is used as a subroutine in the MFT system, while in the MVT RJE system it is attached as a daughter task using the ATTACH macro instruction.

RJE operation is initiated by the central operator with a START command referring to an RJE procedure. As a result, a command scheduling control block (CSCB) is built, and the RJE load module (IHKRJBGN) is loaded into main storage by the system task control (STC) routine. When system initiation of the started RJE task is complete, the STC routine gives control to the RJE task with the address of the start parameter list (SPL) in register 1.

STARTUP OF THE RJE SYSTEM

The RJE routine interfacing with the STC routine is IHKRJBGN (not to be confused with the RJE load module of the same name). When IHKRJBGN receives control, it executes an ENQ macro instruction on the RJE resource. If the resource is currently in use, the request to start RJE operation is denied (to protect RJE from being started twice). Otherwise, the RJE system proceeds with initialization.

RJE INITIALIZATION

Initialization of the RJE system involves:

1. Validating the parameter specified on the START command;
2. Reading the RJE control tables from direct access storage devices (DASD) into main storage;
3. Updating these control tables according to the parameter on the START command;
4. Building the necessary parameter lists to interface with the R/I;
5. Placing the communications ECB address, passed in the SPL, in the dispatcher ECB list for the RJE central command subtask;
6. Freeing the START command input buffer and specifying the maximum number of RJE commands to be queued;
7. Loading the operating system modules used by RJE.

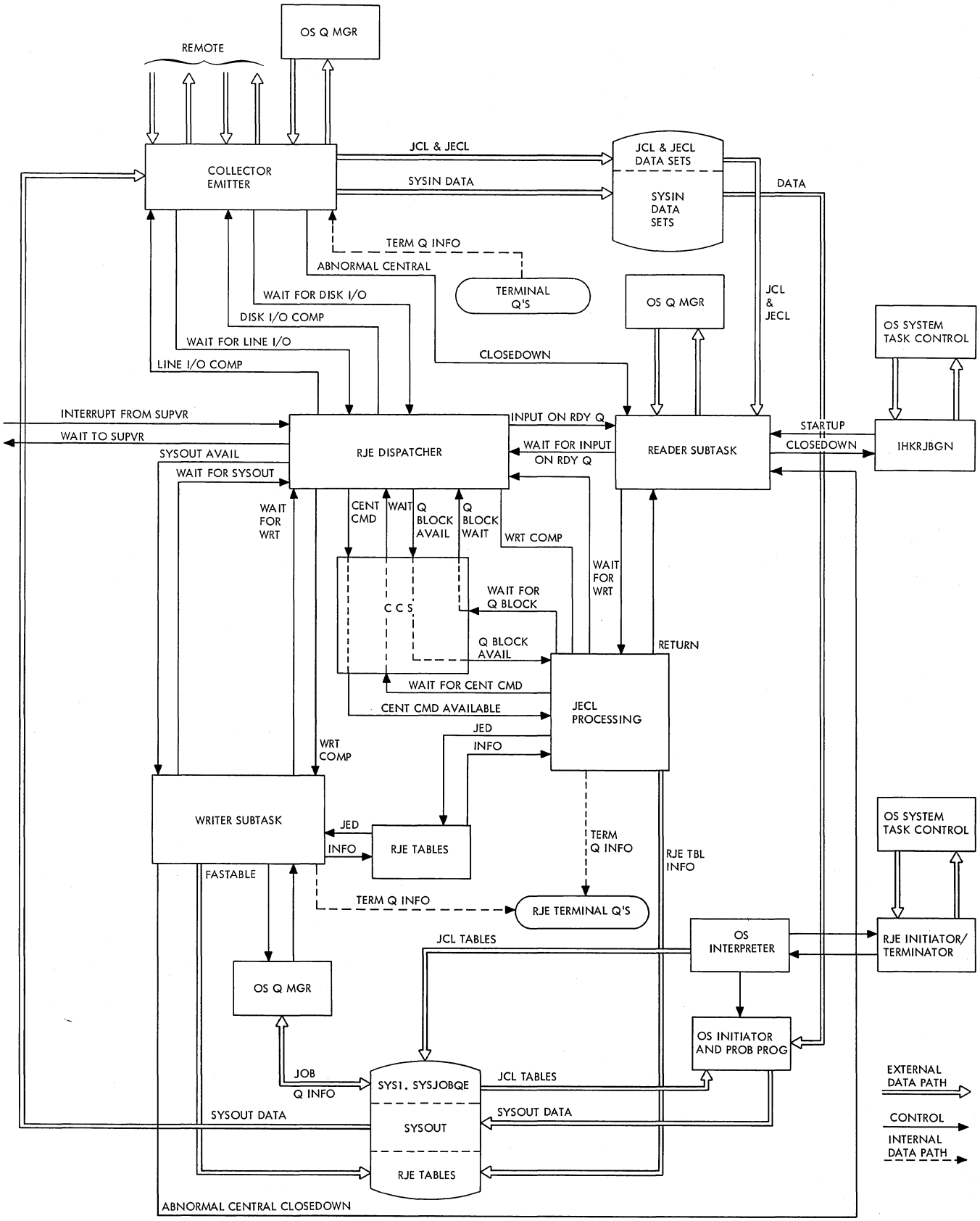


Figure 1A. System Overview for MFT

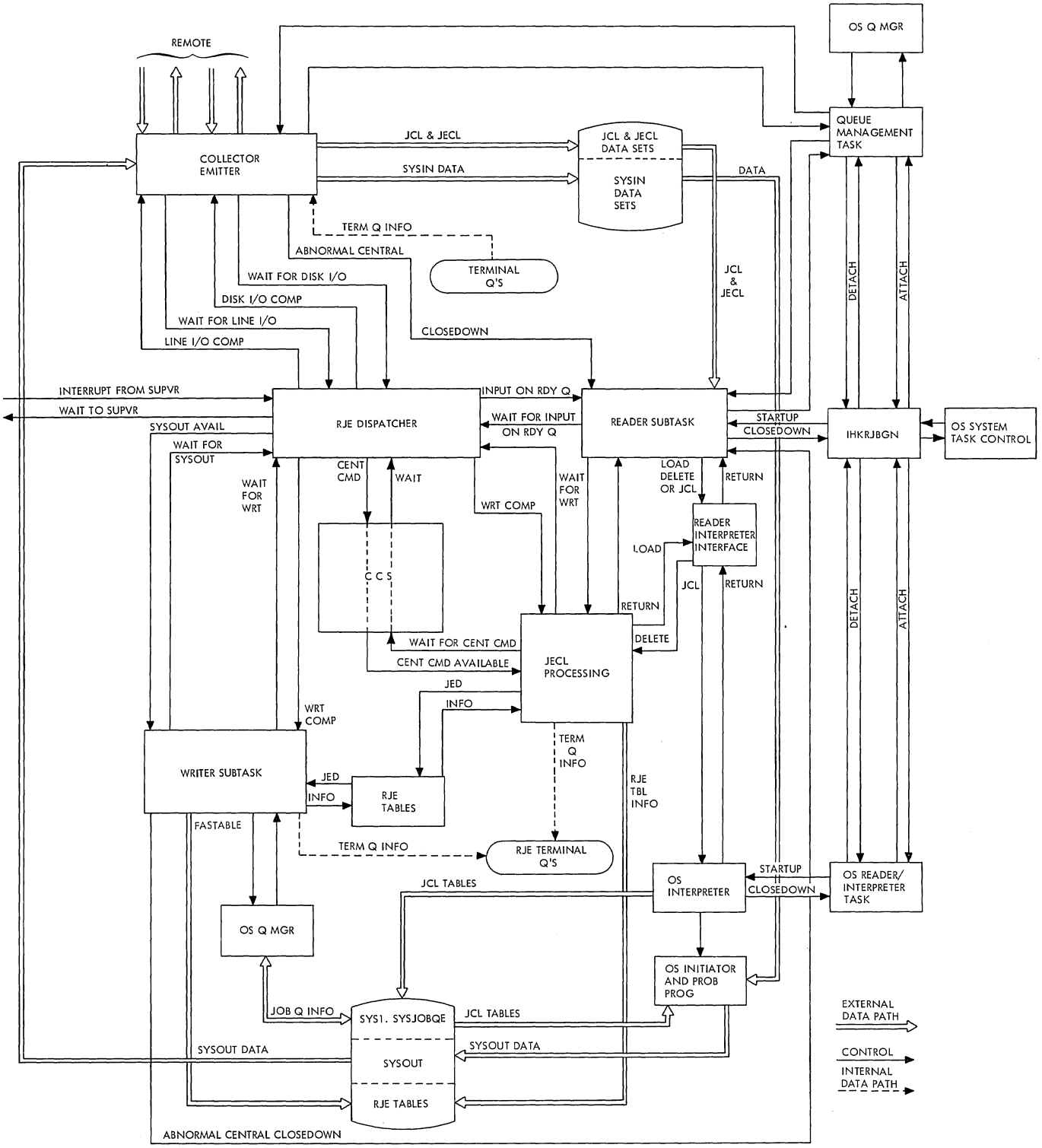


Figure 1B. System Overview for MVT

When the general initialization process is complete, control returns to IHKRJBGN. If initialization was not successful, the error encountered is displayed for the central operator, and RJE proceeds with termination. Otherwise, RJE is ready to begin normal operation. In MVT this involves attaching the two daughter tasks, the operating system queue manager and the operating system reader/interpreter. In MFT the queue manager and R/I are used as subroutines. In either the MFT or MVT environment RJE subtask operation begins when IHKCHRDR receives control as a result of a modified GET macro instruction via the R/I in-core access method.

RJE SUBTASK OPERATION

RJE subtask operation is controlled by the RJE dispatcher (IHKCHDSP). Control of the subtasks is maintained with the subtask control block (STCB) and the ECB list. An STCB and an entry in the dispatcher ECB list is constructed for each RJE subtask for the following functions during the assembly of the RJE system:

1. RJE input queue reader.
2. RJE writer (SYSOUT interface).
3. Central command routine.
4. One subtask for each supported communications line.

Operation begins when the reader subtask receives control as a result of a modified GET macro instruction via the R/I in-core access method. On its initial entry, IHKCHRDR tries to dequeue an entry from the RJE input queue (queue 39 of the SYS1.SYSJOBQE). When the queue is empty, the reader subtask initiation processing is complete. Control is passed to the dispatcher to wait for work on the input queue with the QMGR ECB address in register 1. The dispatcher places the ECB address in the ECB list entry for the reader subtask. The dispatcher in turn, scans the remaining ECBs looking for a posted ECB.

Initially the ECB list entry for each subtask contains a pointer to a posted ECB for all except the central command and reader subtasks. This allows the writer and each line subtask to execute their initiation requirements prior to normal operation.

On initial entry the writer subtask tries to dequeue job output from the RJE SYSOUT queue (assigned by the installation at RJE assembly). When it finds the queue empty, the writer subtask startup is complete. Control is passed to the dispatcher while the subtask waits for work to be placed on the output queue, with the writer QMGR ECB address in register 1. This ECB address is placed in the ECB list entry for the writer subtask.

Initiation requirements for each of the line subtasks involve opening the communications line and placing line information in the line control block (LCB). This function is performed by the line scheduler (IHKABLST). When the reader and writer subtasks have completed initiation requirements, a READ Initial macro instruction is executed for each line by IHKABLST. After the operation is initiated, the line scheduler gives control to the dispatcher, passing as a parameter the address of the ECB for the line. This ECB is placed in the dispatcher ECB list entry for the line subtask. When a READ Initial has been executed by all the line subtasks and there are no posted ECBs in the ECB list, the dispatcher executes a WAITR macro instruction, which gives control to the supervisor.

When input becomes available from a communications line, the READ Initial operation is completed and the ECB for the event being waited for -- the completion of the I/O operation -- is posted. Control passes from the operating system I/O supervisor to the access method (BTAM), which posts the line subtask ECB in the dispatcher ECB list. Control is then given to the dispatcher, which scans the ECB list for the posted ECB. When the posted ECB is found, the dispatcher gives control to the subtask waiting for the event completion, in this case completion of communications line I/O by a line subtask.

Each line subtask is serviced by a group of reentrant RJE modules collectively called the collector/emitter. Collector/emitter functions include line scheduling, reading from the line, and writing to the line. The collector routine's function is to collect JECL, JCL, and SYSIN data from each line and to place it in appropriate data sets. If the input is coming from a work station that has the compress/expand option, the data records are unpacked before any processing occurs. All JECL and JCL are placed in a queue entry and enqueued on the RJE input queue (queue number 39). SYSIN data is written to a temporary data set allocated by the collector according to the line SYSIN DD statement in the procedure currently being processed. Each DD * and DD DATA statement in the input stream is modified to describe the SYSIN data set created to contain the SYSIN data, and is placed in the queue entry with the JCL for the job. When the reader/interpreter eventually processes this job, the input data set appears to be no different from an operating system data set with the disposition of (OLD, DELETE). That is, once the data set is collected,

it is not processed until the job, of which it is a part, is processed.

The collector enqueues entries on the RJE input queue when an EOT is received or when the start of a new job is detected (JED or JOB card received). This procedure insures that each queue entry does not include more than one job. When an entry is placed on the input queue, the operating system queue manager posts the reader subtask QMGR ECB, which was chained to the queue by the initial dequeue request issued when the reader subtask was started. When the dispatcher reaches the ECB posted for the reader subtask in its ECB scan, it passes control to the subtask to process the JCL/JECL queue entry.

The reader handles the logical records (i.e., JCL and JECL) from the queue entry using the OS queue manager facilities. All JCL statements are passed to the R/I for normal translation. Before the translated JCL is transcribed to the input class of the SYS1.SYSJOBQE for the job being processed, the interpreter gives control to the RJE edit module (IHKCEDIT). MSGCLASS and SYSOUT class parameters are replaced with the assigned RJE SYSOUT class. This results in all remote job output being placed on the RJE SYSOUT queue. The SYSOUT parameters are changed only for those output data sets to be returned to the work station.

The reader passes all JECL statements to the JECL processing routines. Depending on the statement being processed, these routines either make entries into or retrieve information from the RJE tables, and enqueue messages and job output on the work station queues.

After the JCL/JECL queue entry is completely interpreted, RJE input processing of the job is complete and the queue entry is deleted. From this point, the remotely submitted job is initiated, executed, and terminated, as with any other job, by the operating system. RJE has no further awareness of the job (except that it was submitted) until job termination puts the job output on the assigned RJE SYSOUT queue.

When output is enqueued on the RJE SYSOUT queue, the OS queue manager posts the writer subtask QMGR ECB, which was chained to the queue on the initial dequeue request issued when the writer subtask was started. The dispatcher then gives control to the writer subtask when it reaches the ECB posted for the writer subtask in the ECB list scan. The writer searches the Fastable for the jobname. If the name is found, the job is marked complete. If the job is not found or is marked for deletion in the Fastable entry, the system message blocks (SMBs) and all SYSOUT data sets are scratched. If the job is found and is not to be deleted, the Fastable entry is checked for job output disposition. If immediate return of output has been requested, the output is placed on the work station output queue. If deferred output has been requested, job status is maintained in the Fastable. The output is available when requested by the OUTPUT command. In addition, if notification of job completion was requested, a notify message is built for the job and placed on the output queue.

Transmission of output to the work station -- both message and job output -- is controlled by the line scheduler. Prior to scheduling input operations on a line, the line scheduler checks the output queue for available output. If output is available, control is passed to the emitter. If the output is to be sent to a work station that has the compress/expand option, the output records are packed before being transmitted. When all available output has been transmitted, the emitter returns control to the line scheduler, which schedules another input operation. When the input operation is completed (EOT received), the queue is again checked for output. If a READ Initial operation (a line prepare operation) is outstanding when output becomes available, a RESETPL macro instruction is executed to terminate the operation. This allows the line scheduler to execute an output operation on the line when no input activity is present.

The central command subtask receives control from the dispatcher whenever the communications ECB is posted. This ECB is posted when the RJE subtask SVC 34 (IGC1503D) is loaded and is given control to process a central RJE command. The RJE subtask SVC 34 scans the CSCBs looking for the one built for RJE. If the RJE CSCB is not found, the command is rejected. If the CSCB is found, the command is placed in the RJE central command queue, and the communications ECB is posted. When the dispatcher comes to the posted ECB, the subtask is given control to process the command. Portions of the RJE reader subtask are used to process commands entered by the central operator. As with remote commands, this processing involves manipulating status information in RJE tables or generating output based upon information in the tables.

A number of control paths in Figures 1A and 1B have not been mentioned. All paths representing I/O waits and I/O completions reflect the fact that, as a subtask is forced to wait, it returns to the dispatcher to allow another RJE subtask to operate.

If no RJE subtask has the resource it requires, control passes via the WAITR macro to the operating system supervisor allowing another task within the system to assume control. The control paths labelled "wait for Q block" and "block available" reflect the fact that RJE queue space may temporarily become unavailable causing a subtask to wait.

RJE CLOSEDOWN

Closedown of the RJE task is initiated by the central operator with the STOP command. When the central command subtask receives a STOP command, the subtask module (IHKCASTP) is linked by the central command router. This module oversees the closedown of the work station in conjunction with the line scheduler. As a result, all active work stations receive notification of the central closedown and are detached from the central system. Closedown status is maintained in the RJE tables, and control is returned to the central command router. Control is then passed to the reader subtask at IHKCHASE, which causes return to the reader/interpreter end-of-data address (EODAD). As a result, the RJE module IHKRJBGN, which interfaces with the STC routine, resumes control. IHKRJBGN links to IHKCHUCK to initiate final closedown requirements such as deleting loaded programs, closing the communication line and the direct access data sets, unchaining QMGR ECBs, and freeing dynamically acquired storage space. When control returns to IHKRJBGN, a DEQ macro is executed freeing the RJE resource, and control is returned to the STC routine for termination of the RJE task by the operating system.

SYSTEM GENERATION

The RJE facility of the operating system is included when RJE is specified at system generation time (OPTIONS=RJE coded as a parameter in the SCHEDULR macro instruction). The resident RJE modules are copied from the SYS1.RC536 to the SYS1.TELCMLIB; the nonresident RJE modules are copied from the SYS1.RC536 and SYS1.CI505 to the SYS1.LINKLIB. These modules are then available for later linkage editing of the central RJE program.

The RJE feature of the operating system provides the user with four macros, located on SYS1.MACLIB, that allow him to design and assemble the system to his particular needs. The macros are:

- RJELINE
- RJETERM
- RJEUSER
- RJETABL

The RJELINE macro defines the communications network supported by the RJE system.

- Each RJELINE macro generates the following control blocks:
  1. One BTAM DCB and DECB used for reading from and writing to the line.
  2. One BSAM DECB used for writing the SYSIN data to disk and reading the SYSOUT data from disk.
  3. A Line Control Block (LCB).
  4. A Subtask Control Block (STCB).
  5. Queue Entry Blocks (QEB).
  6. Dispatcher ECB list.
  7. One entry in the line table.
  8. IHKQMNGR ECB list.
- Each RJETERM macro generates one entry in the terminal directory.
- The RJEUSER macro generates the user directory.
- The RJETABL macro generates the Fastable, specifies the SYSOUT class information required for RJE operation, and specifies the linkage to the desired user exits (if any) provided by the central system.

When an operating system has been generated with RJE capabilities, the user codes and assembles these macros reflecting his requirements. The object module (named IHKAARJE) is placed in a temporary data set created by the user. The user-exit routines (if any) are then assembled and the object module(s) placed in this same data set. IHKAARJE and the user exits are then linkage edited to SYS1.TELCMLIB as separate modules.

A linkage edit of all preassembled modules -- the modules distributed on SYS1.RC536 and the modules just created -- is now done. This creates the RJE load module (IHKRJBGN) that is placed on SYS1.LINKLIB.

A linkage edit of the initialize routine (IHKCDINI) and the RJE macro module (IHKAARJE) is then performed. This creates the initialize program, IHKINTAB.

This program, along with the program IHKCDBMI, is run to initialize the seven data sets required by RJE. RJE is now ready for operation.

At system generation time, the RJE system generation macro instructions differentiate between the MFT and MVT system-dependent modules by having system-dependent versions of RJE modules (in order to take advantage of the attach facility for MVT) listed under different names in the generation library SYS1.RC536. The macro instructions allow the proper version to be taken by its routine name from this library and to be linkage edited to SYS1.TELCMLIB under the primary RJE module name. The following table lists the system-dependent RJE modules and their system-dependent names as they appear on SYS1.RC536.

RJE Module Name	MFT Version Name	MVT Version Name
IHKABLWR	IHKCHLWR	IHKABLWR
IHKABLRD	IHKCHLRD	IHKABLRD
IHKABALC	IHKCHALC	IHKABALC
IHKRJBGN	IHKCHBGN	IHKXJBGN
IHKCHRDR	IHKCHRDR	IHKXHRDR
IHKCEDIT	IHKCEDIT	IHKXEDIT
IHKCAINT	IHKCAINT	IHKXAINT

RJE USE OF MULTIPLE TASKS IN MVT

Under MVT, RJE operates as three separate tasks (RJE, the OS queue management, and the OS reader/interpreter interface). The RJE task is initiated (attached) by the master scheduler when a START command referring to an RJE procedure is entered by the operator at the central location. Control is passed to the RJE task at module IHKXJBGN as described in the Initiation of RJE section. The remaining two tasks are service task modules of the RJE task and are attached by IHKXJBGN.

Each ATTACH macro instruction specifies that the task cannot be rolled out, nor can it cause another task to be rolled out. Each ATTACH is issued with the GIVEJPQ=NO parameter, which allows both the attaching task (RJE) and the attached task to use subpool 252, thus making space available with a zero storage protection key. Each ATTACH macro instruction also specifies an event control block (ECB) to be posted by the control program when the attached task has terminated. The ECB insures that the attached task has completed before RJE detaches the task, and RJE returns to the operating system reader/interpreter at RJE closedown.

The two attached tasks serve the main RJE task by removing those operating system functions used by RJE that have high execution time (for example, I/O for which the wait for completion is not within the RJE dispatcher) and frequent use. Since most of the time required by the operating system R/I routine is spent waiting, this time can now be used by other tasks allowing RJE to service the lines faster.

Communication between the tasks is accomplished by a series of ECBs. Each of the attached tasks has an ECBLIST, a list of ECBs controlled by the RJE task (note the two service tasks do not interface with each other, only with the RJE task). There is one ECB in the ECBLIST for each RJE subtask that uses the RJE task. For each ECB in the ECBLIST there exists another ECB that is posted by the attached task when the request of the RJE task has been serviced. The RJE task passes parameters between the tasks by posting bits in the subtask ECBs. For specific codes see the module descriptions for IHKBBRII and IHKQMNGR.

The two load modules that are attached are IHKBBNIT and IHKQMNGR. IHKQMNGR provides an interface to the OS queue manager modules to perform the functions of ASSIGN/START, WRITE and ASSIGN, WRITE and ENQUEUE, WRITE, READ, DELETE, and DEQUEUE entries on SYS1.SYSJOBQE. The OS queue management task is used by the RJE collector/emitter (C/E) subtasks and the RJE reader subtask. Since the collector/emitter uses this task, it is given the same priority as the RJE task. The RJE modules that use the OS queue management task are:

IHKABLRD
IHKABLWR
IHKXHRDR
IHKABALC.

IHKABLWR performs only READ and WRITE operations through IHKQMNGR, while the other modules execute all their queue management functions through IHKQMNGR.

The OS reader/interpreter task (R/I) provides two services for the RJE reader and the RJE command interpreter; namely, it loads and deletes nonresident RJE modules used by IHKXHRDR and IHKXAINT and provides all interfaces to the reader/interpreter and JCL processing. Since the R/I task is used by the RJE reader subtask and the RJE central command subtask, the priority assigned to the task is one less than that of the RJE task. The modules that make up the R/I task are:

IHKBBNIT
OS reader/interpreter modules
IHKBBRII
IHKXEDIT.

Though all these modules exist locally in the R/I task, IHKBBRII and IHKXEDIT are members of the IHKRJBGN load module. The addresses of these modules are passed to the R/I task when it is attached.

The OS reader/interpreter function is performed in the R/I task. The R/I is used as a subroutine by RJE and is invoked in the following manner. IHKXJBGN attaches IHKBBNIT, which then links to IEFVH1 with

register 1 containing the address of the interpreter entrance list (NEL). The NEL was built by IHKCHNIP and passed to IHKBBNIT when it was attached. IEFVH1 builds some operating system scheduler tables and passes control to IEFVH2. IEFVH2 pseudo-opens a DCB to get input and stores the address of IHKBBRII in location DCBREAD of the DCB. The address of IHKBBRII was passed to the R/I as the address of the in-core access method (one of the exit list entries in the NEL). IEFVH2 then branches to IEFVHA, the "statement getter" of the operating system interpreter. Control passes to IHKBBRII when the R/I issues a GET macro instruction. IHKBBRII then posts the RJE reader ECB (on the first pass this signals to IHKXJBGN that the RJE task has been attached and that the R/I can now accept work). IHKBBRII then waits for the RJE reader or for the command interpreter to post its ECB list with a request. If the request is to pass IEFVHA a record, IHKBBRII returns to IEFVHA with the address of the record in register 1. When IHKBBRII gains control again (IEFVHA has issued another GET), it posts the RJE reader to indicate that the last record was processed and continues processing as described above.

INITIATION OF RJE

The RJE task is initiated when a START command referring to an RJE procedure is entered by the central operator. It is recognized by the command scheduling routine (SVC 34), which posts the master scheduler ECB. The master scheduler determines that a new task is to be started and passes control to the system task control routine via an ATTACH macro instruction. The system task control routine obtains a region, checks the operand of the command and builds an internal input stream from the parameters in the command operand. The interpreter, used as a closed subroutine, reads the input stream (which calls a cataloged procedure), and creates the appropriate job description tables. The I/O device allocation routine assigns the devices requested by the DD cards in the cataloged procedure for RJE, and control is passed to RJE at IHKRJBGN.

INITIALIZATION OF RJE

Initialization of the RJE task at RJE system startup is performed by two routines:

- IHKCHBGN (MFT); IHKXJBGN (MVT)
- IHKCHNIP

This section contains a description of these routines.

RJBGN ROUTINE (CHART BN, BP)

Routine Name: IHKCHBGN -- RJE starter module - MFT (Chart BN)

Entry Point: IHKRJBGN is the only entry point and is used at system startup time. It is also designated (by use of the linkage editor ENTRY statement) as the entry point of the RJE load module. Upon entry at the IHKRJBGN entry point, register 1 contains the address of a start parameter list (SPL) consisting of the following.

First fullword - Pointer to the address vector table (AVT).

Second fullword - Operation indicator specifying 0 to indicate normal closedown.

On exiting from RJBGN one of the following events occurs:

1. Normal closedown message is sent if RJE terminated normally and the R/I return code is zero.
2. START RJE is rejected if RJE is already an active task in the system.
3. Abnormal central closedown message is sent if the reader/interpreter returns a nonzero return code or if RJE encountered an irrecoverable error.

Function: This routine is given control by the system task control (STC) routine at RJE system startup. An ENQ macro instruction is issued to insure that only one RJE task is active in the system. If the ENQ instruction indicates that another RJE task is active, the current starting request is rejected, a message is sent to inform the central operator, and a return is made to the STC routine. If no other RJE tasks are active, control is passed to the RJE initialization routine, IHKCHNIP. If initialization is not successful, the RJE resource is freed with a DEQ macro instruction and a return is made to the STC routine.

A successful return from initialization indicates that the RJE tables were rolled in, that the necessary OS routines were loaded, that the syntax of the START command was correct, and that the control blocks necessary for using the reader/interpreter as a subroutine were constructed. At this time, control is passed to IEFVH1, which, in turn, gives control to RJE processing routines by means of a modified GET macro issued by the reader/interpreter via its in-core access method.

IHKCHBGN receives control back from IEFVH1 when either the RJE processing routines return to the reader/interpreter end-of-data address (EODAD) or when the reader/interpreter has encountered an error that prevents further processing. If return is not a result of EODAD, the reader/interpreter returns a nonzero return code.

External Routines:

IHKCHNIP -- For RJE initialization
IEFVH1 -- For reader/interpreter to use as a subroutine.
IHKCBLDM -- To build messages to display to the central operator.

IHKCHUCK -- For RJE closedown and final closedown processing.

Exits:

Normal -- Return to system task control (STC) with a zero return code.
Error -- None.

Tables/Work Areas: Standard 18-word save area.

Attributes: Serially reusable.

Routine Name: IHKXJBGN -- MVT (Chart BP)

Entry Points:

IHKEODAD is the entry point used when a subtask abend condition occurs. When a subtask abends, the operation indicator is set to a positive value to notify the IHKCHUCK routine that there is no space left to be freed before closedown is completed.

IHKRJBGN is the entry point used at system startup time. IHKRJBGN is entered by the statement:

START (procname)

where procname is the name of a cataloged procedure in SYS1.PROCLIB containing a // EXEC PGM=IHKRJBGN statement and its associated JCL.

Function: This routine is given control by IEFVACTL (the operating system L-shaped routine) at RJE system startup. RJBGN issues an ENQ macro instruction to insure that only one RJE task is active. It builds the parameter list needed by the IHKCHNIP routine (nonresident initialization routine). IHKXJBGN attaches the IHKQMNGR and IHKBBNIT routines. It then branches and links to the RJE reader (IHKXHRDR). When the reader returns to close down, XJBGN links to the IHKCHUCK routine for final closedown processing. When IHKCHUCK returns, a DEQ macro instruction (to release RJE) is issued, an 'RJE CLOSEDOWN' message is sent to central, and control is returned to IEFVACTL (the L-shaped routine).

Upon entry to this routine, register 1 points to an SPL (start parameter list) consisting of the following.

First fullword -- Pointer to the address vector table (AVT).

Second fullword -- Operation indicator specifying:

0 - Normal closedown;
\+ - Subtask abend condition.

External Routines:

IHKCHNIP -- To initialize RJE.
IHKCBLDM -- To get messages for the central console.
IHKXHRDR -- To startup RJE.
IHKCHUCK -- To perform final RJE closedown processing.
IHKBBNIT -- To attach the OS reader/interpreter.
IHKQMNGR -- To attach the OS queue manager routines.

Exits:

Normal -- Return to IEFVACTL (L-shaped routine).
Error -- None.

Tables/Work Areas: None.

Attributes: Serially reusable.

CLEAN UP ROUTINE (CHART EF)

Routine Name: IHKCHUCK -- ECB unchain and clean-up module -- MFT and MVT.

Entry Points: IHKCHUCK is the only entry point for this routine. Standard subroutine linkage prevails, and register 1 contains the address of a parameter list. Error messages are displayed to the central operator as required and include:

1. IHK060I ABNORMAL CENTRAL CLOSEDOWN.
2. IHK063I DISK ERROR QMGR RJE ABORTED.
3. IHK063I DISK ERROR IN CLOSEDOWN.

Function: IHKCHUCK performs the necessary RJE closedown functions, which include:

1. Freeing dynamically allocated main storage;
2. Unchaining RJE reader and writer subtask QMGR ECBs;
3. Closing telecommunications lines used by RJE;
4. Deleting loaded modules;
5. Closing opened RJE data sets;
6. Checking for abnormal central closedown;
7. Displaying messages for errors encountered in RJE.

The following discussion contains sections numbered to indicate which actions are applicable when one of the following two conditions occurs.

1. When RJE performs normal closedown procedures, sections I, II, and III are applicable.

2. When a subtask abend condition occurs, sections II and III are applicable.

I. A total of 144 bytes of main storage are used by RJE. This storage area is obtained by IHKCHNIP in one block of 144 bytes to meet the requirements for the reader/interpreter, which is used as a subroutine. These requirements include the option list, exit list, and reader/interpreter ECB, each of which has an address in the interpreter entrance list (NEL). This storage area is freed separately in IHKCHUCK since portions of it may have been relocated by the reader/interpreter. All areas are freed when the NEL address is obtained from the RJE communications region. The NEL area is freed last.

II. After all the reader/interpreter parameter areas are freed, IEFQMUNC is loaded to prepare to unchain the reader and writer subtasks QMGR ECBs. The addresses of these ECBs are also obtained from the RJE communications region. A preliminary check is made to see if the ECB was chained. If no ECB was chained for the reader, RJE encountered an error in starting. As a result, the unchaining of QMGR ECBs and the closing of communication lines are ignored.

III. Chained QMGR ECBs mean that the communication lines were opened. Communication line DCB addresses are obtained from the line table, the address of which can be found in the RJE communications region. Telecommunication lines are closed one at a time until they are all closed. Close instructions issued for lines in the line table that are not referred to in the started RJE procedure are treated as 'No-Ops' (no operations) by the operating system.

Nonresident modules loaded during initialization are deleted, including the unchain module IHKCHUCK. These modules include:

1. IEFSD447
2. IEFQMSSS
3. IEFQMDQ2
4. IEFQDELE
5. IEFQMUNC.

The DCBs for the seven RJE data sets are closed. These seven data sets include:

1. The Fastable.
2. The JED table.
3. The user directory.
4. The terminal directory.
5. The broadcast and message slot directory.
6. The pending message data set.
7. The broadcast message data set.

IHKCHUCK checks the closedown status in the RJE communication switch to determine whether the RJE subtasks encountered an error requiring abnormal closedown, or closed down as a result of operator action. A message handling facility is provided for the error conditions detected that require operator awareness.

External Routines:

IHKCBLDM -- To build error messages for the central operator.
IHKCDCMR -- To close RJE data sets.
IEFQMUNC -- To unchain the RJE reader and writer subtasks QMGR ECBs.

Exits:

Normal -- Return to the IHKRJBGN entry point with return code of zero.
Error -- Return to the IHKRJBGN entry point with return code of four.

Tables/Work Areas: Standard 18-word save area.

Attributes: Serially reusable and nonresident.

RJE INITIALIZATION ROUTINE (CHARTS BL,BM)

Routine Name: IHKCHNIP

Entry Point: IHKCHNIP

Function: RJENIP uses the rollin routine, IHKCDRIN, to bring the RJE system control tables into main storage. It then checks the parameter on the START command. If invalid, the command is rejected (an error return code returned to IHKRJBGN in register 15). If FORM was specified, the RJE coldstart procedure is executed (IHKCBCLD). If NFMT was specified, the RJE warmstart procedure (IHKCFWMS) is executed. If NONE was specified and rollin (IHKCDRIN) indicates that the RJE warmstart procedure is needed (RJE did not close down), a message is sent to the central operator and the startup request is rejected. If NONE is valid, an IOB (input/output block) is built for each job marked complete in the Fastable, and the IOB pointer in the JED table is updated to point to the new IOB.

A request to start RJE is denied if one of the following conditions occurs:

1. An invalid parameter is found on the START command.
2. A restart (NONE parameter on START command) occurs after an abnormal

closedown.
3. An I/O error occurs during rollin of tables.
4. RJE data sets can not be opened.
5. An I/O error occurs during writing of JED tables (NONE only).

Regardless of whether the parameter on the START command was FORM, NFMT, or NONE, the following functions are performed:

1. The terminal directory entries are reinitialized. This includes turning on the dequeue-nothing bit in TDIRSTAT to insure that, in a warmstart situation, all warmstart-associated operations are completed before any output is sent to the remote work station. Reinitialization also includes setting to zero:

   a. TDIRSECB -- Stop acknowledge ECB.

   b. TDIRFQEB -- First terminal queue entry block.

   c. TDIRLQEB -- Last terminal queue entry block.

   d. TDIRLMEL -- Last message queue entry block.

   e. TDIRFAST -- Address of last queue entry block dequeued by line analysis write.

   f. TDIRSWCH -- All switches except hardware and RJSTART switches.

   g. TDIRTTR -- TTR0 of the first block to be sent upon receipt of a CONTINUE (HERE).

   h. TDIRLCB -- Address of line control block.

2. The address of the communication ECB is placed in the dispatcher ECB list.

3. The option list is built as follows:

   a. List length X'0040', bytes 0-1.

   b. Option switches X'01' (enqueue selected) or X'81' (if SMF is present in RJE), byte 2.

   c. System code X'01' (for MFT or MVT), byte 3.

   d. Interpreter number H'0', used for generation of unique data set names, bytes 6-7.

   e. The next 34 bytes are taken from the PARM field of the // EXEC statement for RJE in SYS1.PROCLIB. If the parameters are not specified on the EXEC card, a default value (in parentheses) is filled in.

   (1) Parameter options -- This one-byte field specifies whether account numbers or programmer names are required on JOB statements: If bit 2 (the third bit) is on, account numbers are required; if bit 3 is on, programmer names are required. Default is all bits off (X'0').

   (2) Default priority -- PP - (C'00').

   (3) Default time limit -- TTT - (C'999').

   (4) Default SYSOUT primary quantity -- 000 - (C'030').

   (5) Default SYSOUT secondary quantity -- MMM - (C'010').

   (6) Interpreting priority -- III - (C'249').

   (7) Default region size -- CCC - (C'050').

   (8) Command authorization -- R - (C'3') specifies disposition of commands read from this input stream:

   C'0' -- Execute the command.
   C'1' -- Display the command, and execute it.
   C'2' -- Display the command, but do not execute it until advised by operator.
   C'3' -- Ignore the command.

   (9) Label Processing -- L - (C'2')

   C'0' -- Bypassed label processing (BLP) will be treated as no label.
   C'1' -- BLP will be treated as bypass label.
   C'2' -- Operator will be requested to indicate whether BLP is to be treated as no label or bypass label.

   (10) Default SYSOUT device name -- ssssssss - (C'SYSDA').

   (11) Command authorization for MCS - four hexadecimal numbers from 0000 to E000 indicating which operator command groups

are to be executed if read from this input stream. This parameter is valid only for systems with the multiple console support (MCS) option (X'E000').

(12) Default MSGLEVEL value - specifies the MSGLEVEL value if no value is specified on the JOB statement. Unless there is a MSGLEVEL=entry in the JOB statement, job control statements and allocation/termination messages are recorded in the system output data set according to the value of this parameter (X'00').

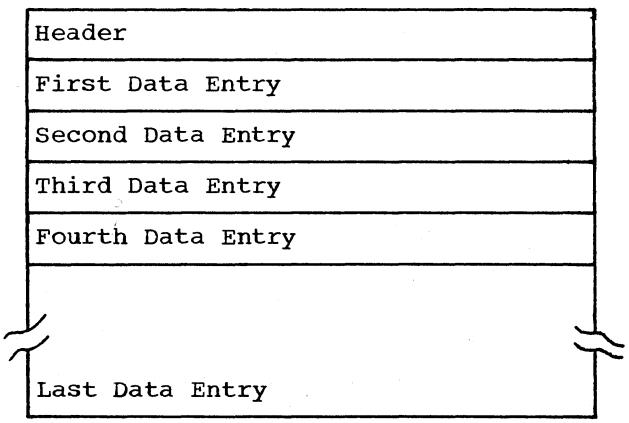
f. The next four bytes are blank -- X'40'.
g. Starting jobname -- 2F'0'.
h. Cataloged procedure name -- 2F'0'.

4. The ECB passed to R/I is zeroed. If the ECB is posted, R/I will return after processing current job (not used by RJE).

5. Four exit list entries are built (each is a doubleword). The four entries provide the operating system with information necessary for it to interface with the RJE reader, interface with the RJE JCL edit routine, interface with SMF if it is in the system, and return to IHKRJBGN when RJE closes down. The exit list for RJE is built as follows:

This list consists of a doubleword header followed by a list of data entries, both of which are eight bytes long.

Exit List for RJE



Header

Byte	Value
0-1	H'28' length of exit list including header.
2-7	Reserved.

Data Entries

The data entry format is:

Exit Definition 1	Exit Identifier 1	Linkage Information 6

For RJE the data entries are as follows:

Data entry format:

Byte	Use
0	Exit definition: Bits 0-1 Definition type: 00 Default. 01 Address. Bits 2-7 Reserved.
1	Exit Identifier: Bit 0 One for accounting routine entry. Bit 1 One for input access method entry. Bit 2 One for return routine. Bits 3-7 Reserved.
2-7	Linkage Information: Default - set to zero Address definition - three-byte, right-justified address padded with zeros.

First data entry:

Byte	Value
0	X'01' indicates address constant linkage.
1	X'80' for JCL edit routine.
2-3	H'00'.
4-7	A (address of RJE JCL routine).

Second Data Entry:

Byte	Value
0	X'01' indicates address constant linkage information.
1	X'40' for input access method entry.
2-7	the three-byte address of RJE reader, right-justified and padded with zeros.

Third Data Entry:

Byte	Value
0	X'00' indicates return by branching on register 14.
1	X'20' return routine.
2-7	6X'00'.

Fourth Data Entry:

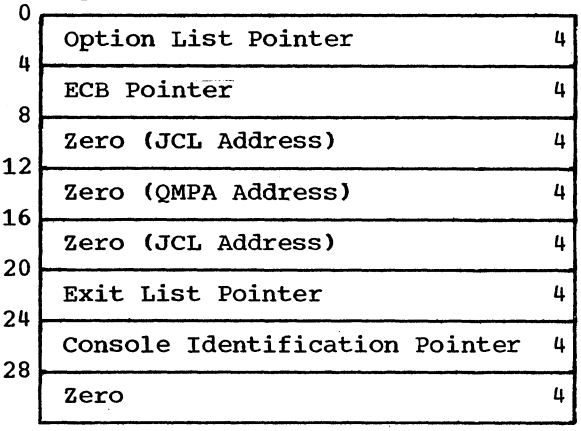
Byte	Value
0	X'80' indicates EBCDIC name.
1	X'07' for SMF exit routine.
2-7	C'IEFUJV'

6. The start parameter list (SPL) is checked and manipulated as follows:

   a. START command is checked for valid parameter.
   b. The command input buffer is validated for central queuing, and the address of the central command control record is placed in the buffer.
   c. The address of the communication ECB is placed in the RJE dispatcher ECB list for the central command subtask that is posted by SVC 34 when an RJE central command is processed.

7. The addresses of the option list, exit list, and ECB are put in the eight-word interpreter entrance list (NEL): the rest of the NEL is zeroed. The presence of an address in the sixth word indicates to the operating system interpreter that user exits are desired.

Interpreter Entrance List (NEL)



Bytes:

0-3	Pointer to the option list built by IHKCHNIP.
4-7	A pointer to the RJE reader ECB (2 words).
8-11	Zero -- Not used by RJE.
12-15	Zero -- Not used by RJE.
16-19	Zero -- Not used by RJE.
20-23	Pointer to exit list built by IHKCHNIP, used for accounting routine entry (JCL Edit), input access method entry point, and return routine (default).
24-27	Pointer to the console identifier for the multiple console support (MCS) feature of the operating system.
28-31	Zero -- Not used by RJE.

8. RJENIP places the address of the NEL in the AVT (IHKZZNEL).

Upon entry to IHKCHNIP, register 1 contains the address of a two-word parameter list as follows:

First fullword -- Address of the RJE communications region (IHKCACOM).

Second fullword -- Address of the operating system in-core access method entry point for the R/I (IHKCHRDR for MFT and IHKBBRII for MVT).

On leaving this routine, RJE tables and directories, the SPL, and the RJE communications regions are updated. The interpreter parameter list is built, and the address of this R/I list is returned in register 1. Error messages are also written to the operator as required.

The command input buffer is freed and the maximum number of RJE commands to be queued is specified by an SVC 34.

External Routines:

IHKCDRIN -- Rollin -- Brings in RJE system control tables.
IHKCFWMS -- Warmstart RJE.
IHKCBCLD -- Coldstart RJE.
IHKCBLDM -- Construct error messages for central operator.

Tables/Work Areas: Standard 18-word save area, JED table on restart condition (NONE), terminal directory, 144-byte GETMAIN area to build NEL, option list, exit list, and the ECB for the R/I.

Exits:

Normal -- Returns to the IHKRJBGN entry point with zero as return code.
Error -- Returns to the IHKRJBGN entry point with four as return code.

Attributes: Serially reusable and nonresident.

OS QUEUE MANAGER INTERFACE ROUTINE
(CHART UZ)

Routine Name: IHKQMNGR -- OS queue manager interface - MVT.

Entry Point: IHKQMNGR

The initial calling sequence for this routine is as follows:

```
LA        1,PARMLIST
ATTACH    EP=IHKQMNGR
```

where PARMLIST contains:

Address of ECB to be posted for IHKRJBGN, and
Address of ECBLIST for IHKQMNGR.

The calling sequence when the queue manager function is needed is as follows:

```
LA      0,PARMLIST
LA      1,QMECB
POST    (1),(0)
```

where PARMLIST contains:

Address of queue manager parameter area (QMPA), and
Address of ECB to be posted when the queue manager function is complete.

QMECB is an ECB in the ECBLIST of IHKQMNGR.

When the queue manager function is finished, the return code from the queue manager is in the three low-order bytes of the ECB of the RJE subtask, and the ECB is posted.

Function: This routine provides an interface with the operating system queue manager enabling an RJE subtask to wait in the dispatcher while the I/O operations for the queue manager are taking place. This routine is attached by IHKRJBGN and issues a wait on the QMNGR ECB list. When an RJE subtask needs a queue manager function, it posts an ECB in the ECB list of IHKQMNGR that gives IHKQMNGR control. IHKQMNGR loads the OS queue manager and when control returns, it deletes the queue manager and posts the ECB of the RJE subtask. IHKQMNGR issues a wait again. At closedown, IHKRJBGN posts an ECB for IHKQMNGR and passes a special parameter to tell IHKQMNGR to return to the operating system.

External Routines:

WAIT -- To wait on ECBLIST.
IEFQMSSS -- ASSIGN/START - To initialize a queue entry and assign initial TTRs (relative track and record number) for writing.
-- WRITE and ASSIGN - To write a record on SYS1.SYSJOBQE and assign the next TTR.
-- READ - To read a record from SYS1.SYSJOBQE.
-- WRITE and ENQUEUE - To write last record and enqueue the queue entry.
-- WRITE - To write a record on SYS1.SYSJOBQE.
IEFQDELE -- DELETE - To delete a queue entry.
IEFQMDQ2 -- DEQUEUE - To dequeue a queue entry.

Exits:

Normal -- Returns to the operating system.
Error -- Not applicable.

Tables/Work Areas: None.

Attributes: Attached as a separate task.

Notes: The operation of this subroutine depends upon an internal representation of the external character set that is equivalent to the one used at assembly time. The coding has been arranged so that redefinition of character constants, by reassembly, will result in a correct module for the new definition.

OS INTERPRETER ENTRANCE LIST INTERFACE ROUTINE (CHART YB)

Routine Name: IHKBBNIT -- NEL interface task - MVT

Entry Point: IHKBBNIT

Function: This routine links to IEFVH1 (reader/interpreter) after having been attached by IHKRJBGN. When a STOP RJE command is received, IHKBBNIT checks for an abnormal return from the R/I and, if found, sets bit 5 in the RCS (RJE closedown status). Regardless of the return, it then posts the ECB for the RJE reader with a posting code of 1 to indicate that the R/I is no longer available.

On entry to this routine, register 1 contains a pointer to a three-word parameter list defined as follows:

First fullword -- Address of the RJE address vector table (AVT).
Second fullword -- Not used.
Third fullword -- Address of the RJE reader ECB.

At closedown this routine sets the closedown indicator for IHKRJBGN and the RJE reader routines.

External Routines:

IEFVH1 -- Operating system reader/ interpreter initialization.
POST -- Posting of RJE reader ECB.

Exits:

Normal -- Return to the operating system.
Error -- None.

Attributes: Serially reusable.

OS READER/INTERPRETER INTERFACE ROUTINE (CHART YC)

Routine Name: IHKBBRII -- OS R/I Interface - MVT

Entry Point: IHKBBRII

Function: This routine is a logical member of the attached OS R/I task that exists physically in the RJE load module. The address of IHKBBRII (RII) is passed to the R/I by IHKRJBGN when the R/I task is attached. RII gains control when the R/I issues a modified GET macro instruction for a record. RII acts as an interface between the RJE reader and the OS reader/ interpreter, and loads and deletes nonresident modules for the RJE reader and command interpreter.

When RII gets control, it posts the ECB for the RJE reader to indicate that the R/I has issued a GET macro for a record. It then waits for the RJE reader or for the command interpreter ECB list to be posted.

When one of the ECBs is posted, RII determines which routine posted the ECB, turns off the post bit, determines which ECB to post when this request is satisfied, and prepares for a load or delete operation. RII then determines the request type and performs one of the following operations:

1. Sends record to R/I -- the address of the record is placed in the R/I save area, and control is returned to R/I.

2. Loads -- module determined by RII is loaded, ECB of this module is posted (the code is the entry point of the module), and a WAIT macro instruction is issued for the next request.

3. Deletes -- module determined by RII is deleted, ECB of requester is posted, and a WAIT macro instruction is issued for the next request.

4. Sends EODAD -- EODAD is moved into the R/I save area and control is returned to the R/I.

On entry to this routine a fullword parameter is introduced by the calling sequence for RJE modules as follows:

```
LA      0,PARM
LA      1,RIECB
POST    (1),(0)
```

The high-order byte of the parameter is the operation code, which can denote one of the following:

X'00' -- Record for R/I.
X'04' -- Load.
X'08' -- Delete.
X'0C' -- EODAD.

The three low-order bytes are used as follows:

Operation Code	Low-order Bytes
0	Address of record.
4	Second byte is the last character of the name for SHOWS (otherwise, not used); the two low-order bytes are the offset to the module name.
8	Same as for operation code 4.
12	(Not used.)

After a requested function has been performed, the requester is posted. If the request is LOAD, the posted code is the address of the entry point of the loaded routine. If the request is an EODAD, the reader is posted by IHKBBNIT with a code of 1. For the other requests the post code is zero.

External Routines:

WAIT -- To wait on ECBLIST.
POST -- To inform requester of request completion.
LOAD -- To load nonresident module.
DELETE -- To delete nonresident module.

Exits:

Normal -- IHKBBRII returns to R/I.
Error -- None.

Tables/Work Areas: An 84-byte table of module names, and 8-byte ECB list, and 16 bytes of associated ECBs are maintained.

Attributes: Serially reusable.

COLDSTART ROUTINE (CHART BO)

Routine Name: IHKCBCLD

Entry Point: IHKCBCLD

Function: This routine is linked to by IHKCHNIP if FORM was specified on the START command. The RJE coldstart frees all of the Fastable entries by inserting a blank (hex 40) in the first byte of the FASTNAME field of each entry and then writing each entry to disk. The Fastable now reflects no jobs in the system.

External Routines: BSAM -- standard use is made of the OPEN, WRITE, CHECK, and CLOSE macros.

Tables/Work Areas: None.

Exits:

Normal -- Returns to IHKCHNIP.
Error -- SYNAD -- If the WRITE is no good the task is abnormally terminated.

Attributes: Serially reusable and nonresident.

WARMSTART ROUTINE (CHART FI)

Routine Name: IHKCFWMS

Entry Point: IHKCFWMS

Function: After a system failure this routine is linked to by IHKCHNIP to reinitialize the Fastable if NFMT was specified on the START command. The active entries will accurately reflect the jobs, submitted by remote users, that are present in the system.

1. If the job entry is marked incomplete, it represents an entry on the OS input queue, or OS hold queue, or a job on the RJE output queue that was not dequeued before malfunction. No action occurs when the entry is marked incomplete.

2. If the job entry is marked complete, it represents a job that was processed by the RJE routine prior to system failure (i.e., it was dequeued by RJE from the RJE output queue). The bits set previously by the JOBEND and SYSDEQ routines to indicate actions performed, are reset to indicate that they must be performed again when normal operations resume. If bit 1 of the Fastable FASTDSB is on, bit 0 of the FASTDSBE is turned on. Likewise, if bit 2 of the FASTDSB is on, bit 1 of the FASTDSBE is turned on. Then all bits of the FASTDSB are turned off. Bits 1 and 2 of the FASTDSB indicate job that is enqueued for delivery to source and alternate respectively. Bits 0 and 1 of the FASTDSBE indicate any bypassed output that is for source and alternate respectively.

External Routines: None.

Tables/Work Areas: Fastable.

Exits:

Normal -- Returns to IHKCHNIP.
Error -- None.

Attributes: Serially reusable and nonresident.

STOP RJE ROUTINE (CHART AP)

Routine Name: IHKCASTP

Entry Point: IHKCASTP

Function: This routine gains control from IHKBBCCR when a STOP RJE command is entered at the central console. It then synchronizes the closing down of the various subtasks of the RJE system. Specifically the following actions are taken:

1. The RJE STOP bit in the table region (bit 0 of IHKCDRCS) is set to initiate closedown procedures by the SYSDEQ (IHKCHSDQ) routine and the collector/emitter (C/E).

2. A RESETPL macro is issued for each communications line to disrupt any looping-polling operations performed by the line scheduler.

3. The dispatcher is then entered to wait in turn for the STOP ACK ECBs for SYSDEQ and for each active terminal to be posted. At this time the C/E can get control; when it recognizes that the STOP RJE bit is on, it generates an RJENDC for each active terminal. After each RJENDC is processed, the RJEND routine (IHKCARJN) posts an ECB in the C/E. When the line scheduler recognizes that this ECB is posted, it goes to the line analysis write routine to write the closedown message to the terminal and close down the line.

The STOP ACK ECB in the TDIR entry is then posted for RJE STOP. SYSDEQ posts its own STOP ACK ECB (IHKCBSAE) when it gets control.

4. The FASTCNT is incremented for each entry in the Fastable.

5. All data sets are closed by IHKCDCMR.

6. A normal closedown is indicated by putting X'FF' in the second byte of the last Fastable entry.

On entry to IHKCASTP, register 1 contains the address of a four word parameter list of the following format:

1. Pointer to the address vector table (AVT).

2. Pointer to the first LCB.

3. Pointer to halfword containing the number of LCBs.

4. Pointer to halfword containing the length of an LCB.

When all closedown procedures have been completed, IHKCASTP exits to a special entry point in the RJE reader (IHKCHASE), causing the OS reader/interpreter to terminate by returning IHKCASTP to the EODAD exit.

External Routines:

IHKCHDSP -- RJE dispatcher.
IHKCDFMR -- Fastable manager -- Writes Fastable entries to disk.
IHKCDCMR -- Close manager -- Closes RJE disk data sets.
IHKCCQMG -- Queue manager -- Issues the RESETPL macro.

Tables/Work Areas: None.

Exits:

Normal -- Exits to RJE reader at IHKCHASE.
Error -- None.

Attributes: Serially reusable.

COLLECTOR/EMITTER

The collector/emitter has the capability of handling as many lines as the system can support. Four modules make up the collector/emitter: dispatcher, line scheduler, line analysis read (LRD), and line analysis write (LWR). Each of these modules has reentrant attributes that allow the collector/emitter to service each line individually; specifically, the three generalized modules become specific modules for each line. Four elements, each on a line basis, provide this function:

1. Save area for registers for each line.
2. Disk buffering.
3. Subtask control block (STCB).
4. Line control block (LCB).

The collector/emitter controls the record format for a work station that is equipped with the compress/expand feature. The collector unpacks all input from such a work station before it is processed. The emitter packs all output to such a work station immediately before it is transmitted. The rest of the system is unaware that there has been any change in record format during line transmission.

The function, save registers and restore, is supplied by the RJE dispatcher saving the registers in the save area for each line and restoring them upon returning control to the calling module when the subtask ECB is posted. The registers contain address pointers to the three elements (STCB, LCB, ECB) that help make each module specific.

Each line has an event control block (ECB) represented in the ECB list. Associated with each ECB is an STCB. The STCB contains a pointer to the save area that contains the registers for that line. The dispatcher determines which ECB was posted and the STCB associated with that ECB. Loading the save area pointer in register 13 allows the rest of the registers to be loaded with pointers to the line information. Returning via standard linkage conventions, control is passed to the module that had entered the dispatcher for a wait. The registers for that module now contain pointer information necessary to make the module specific. (See Figure 2).

DISPATCHER (CHART HA)

Routine Name: IHKCHDSP

Entry Point: IHKAADSP

Function: The dispatcher is the controller within RJE. It passes control to different programming components based upon availability of and requirements for various resources.

RJE is one task of the operating system and is represented in the system by one TCB. The dispatcher within the RJE system controls each RJE subtask. The term subtask is used here in something other than

strict OS terminology. The RJE subtask is a sequence of instructions receiving control only from the RJE dispatcher and yielding control only to the RJE dispatcher. One RJE subtask can never seize control from another RJE subtask.

More than one subtask (with one ECB list entry for each subtask) may wait in the dispatcher. Associated with each ECB entry in the list is a subtask control block (STCB). The STCBs for the lines are chained together and have priority over the STCBs for the reader, writer, and central command subtasks. Each STCB has a pointer to the ECB list entry it represents. When the dispatcher relinquishes program control to a subtask, it keeps a pointer to that STCB. When program control is passed back to the dispatcher, it stores the new ECB pointer (which was passed in register 1), in the ECB list; places a pointer to the ECB list entry in the STCB; and stores the save area pointer in the STCB. This dynamic association is possible because the subtask to which the dispatcher relinquishes program control is the one that must return control. In this way, the dispatcher draws the association between the STCBs and the ECBs.

Multiple waiting is controlled by the OS supervisor. Completion of an event causes an ECB for that event to be posted. ECBs are posted by either the I/O supervisor or an RJE subtask, or by the operating system through its interfaces. Once an ECB is posted, control falls through the multiple wait to the next sequential instruction. The dispatcher checks the STCBs. Finding an ECB posted, the dispatcher restores register 13 with the pointer to a save area from the entry in the STCB. It restores the registers and returns program control via standard linkage.

Following is a list of some of the events for which various RJE components must wait:

1. Collector waits for I/O from each line to finish.
2. Emitter waits for I/O to each line to finish.
3. Reader waits for information to be available in RJE input queue.
4. Output routines wait for more main storage queue space to become available if it is all being used.
5. Writer waits for output to be put on SYSOUT queues.
6. Central command processor waits for a command to become available from the OS command scheduler.
7. Service routines wait for disk I/O to complete.

If an OS subtask of RJE abends at any time, this routine issues the IHK068I RJE SUBTASK ABENDED message. Control is then passed to the IHKXJBGN routine for abnormal closedown procedures to be initiated.

External Routines: None.

Tables/Work Areas: Subtask control blocks (STCB).

Exits:

Normal -- OS supervisor to wait for completion of an event.
Error -- IHKXJBGN to handle subtask abend condition.

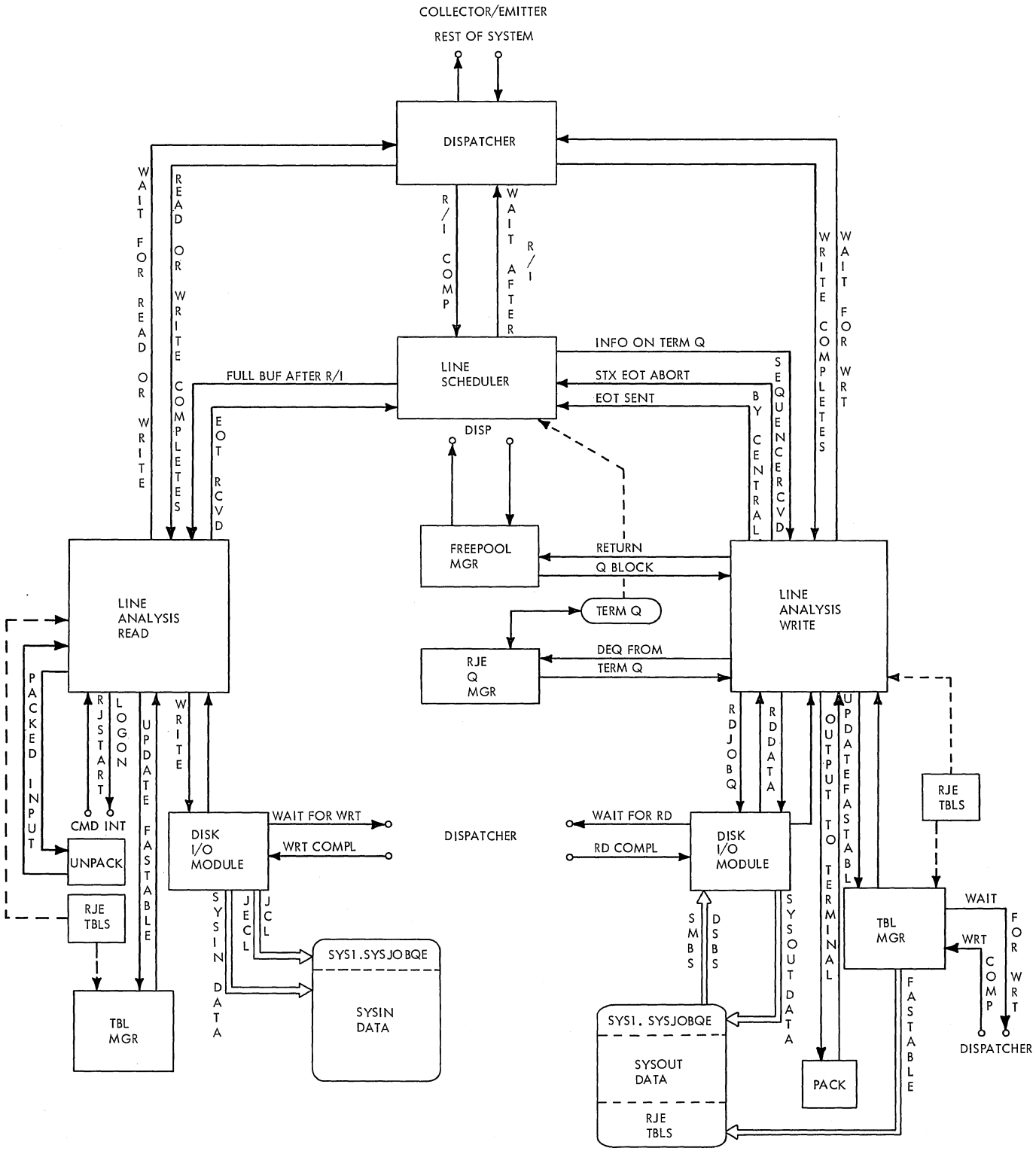


Figure 2. Collector/Emitter

LINE SCHEDULER (CHARTS TA-TF)

Routine Name: IHKABLST

Entry Points:

IHKABLSD -- The dispatcher gives control to the line scheduler at this entry point when the RJE task is started. It is used to open the lines and set the line-type flag in the LCB.

IHKABLST -- This entry point is a branch table. The specific entry in the branch table is determined by the return code in register 15. The following codes determine the function needed by the returning routine:

0 Normal return. Line scheduler performs its normal functions.

4 Branch to IHKABREQ -- Line analysis write returns to this point when the line scheduler calls it to send output and it is unable to do so.

8 Branch to IHKABEOT -- This internal subroutine performs a READ ENQ operation on a switched line until an ENQ is received (indicating the remote terminal wishes to send to the central installation) or output becomes available for the remote terminal.

12 The line scheduler exits to the line analysis write routine because the line analysis read routine has run out of space on disk for the input.

16 The line scheduler exits to the RJENDF internal subroutine. This code is used to supply an exit through the line scheduler from the line analysis write routine to the line analysis read routine to build an RJENDF command.

20 The line scheduler exits to the dispatcher to wait for the line analysis read routine to get more queue space. This situation occurs when the line scheduler requests line analysis read to enqueue an internal RJENDF or RJENDC command.

24 This return code (for switched line only) indicates a normal return from line analysis read.

28 Branch to the LSTABORT internal routine to send an EOT to an IBM 2780 work station on a switched line, because an RJSTART or LOGON command is required.

32 Branch to the LSTOPEN internal routine to disable and then enable again IBM World Trade 3977 data sets to provide resynchronization of the data sets.

Function: The basic functions of the line scheduler are:

- Checks for queued output on each terminal queue;
- Checks the terminal directory entry (TDE) to determine if the remote work station is inactive and to determine the disposition of output;
- Performs a READ Initial on each line;
- Checks the STOP RJE switch;
- Checks the RJE system warmstart switch;
- Opens the line DCBs.

Program control is initially passed to the line scheduler by the RJE dispatcher. First the line scheduler determines from the unit control block (UCB) the type of line, i.e., switched (dial), leased, or multidrop, and sets the first byte of the line control block as follows:

X'FF' - Indicates a switched line.
X'FE' - Indicates a leased line.
X'FD' - Indicates a multidrop line.

This byte is used by the LWR and LRD routines to determine the type of line on which they are working.

The line scheduler then checks the STOP RJE and warmstart switch. If the STOP RJE switch is on, the line scheduler causes LRD to generate an RJENDC for every active terminal; causes LWR to write the closedown message to every active terminal; and then posts all the terminals' ECBs. If the warmstart switch is on, the line scheduler causes LRD to generate an RJENDF for every active terminal, thereby forcing a restart condition for all active terminals.

The terminal directory entry (TDE) in the LCB is then checked for zero. If it is zero, indicating a switched line with no connection, the line scheduler does a READ Initial. The READ Initial issues an enable command (allows a terminal to dial the central computer) that remains pending.

If the TDE is not zero, the line scheduler determines whether the line is switched or nonswitched (leased or multidrop). On a switched or leased line, the line scheduler takes the address entry of the TDE in the LCB and checks it for output. If there is output, control is passed to the line analysis write routine. If there is no output, a READ Initial is issued.

On a multidrop line, the line scheduler checks all the terminals on that line for output. If there is output for one of the terminals, a pointer to the associated TDE is placed in the LCB and control is passed

to the line analysis write routine. If there is no output, a READ Initial is put on the line.

The enable command (switched line) or the prepare command (nonswitched) put on the line by the READ Initial remains pending until one of the two following events occurs.

1. A RESETPL -- Every time something is enqueued for a line, the RJE queue manager does a RESETPL. If there is no activity on the line, the operation will be halted, in which case, the line scheduler can once again check for output.

2. A positive response to the operation -- This means the terminal wants to send something. On a positive response, the line scheduler passes control to the line analysis read routine to process the input being sent by the work station.

External Routines:

IHKCHDSP -- Dispatcher -- Contains multiple wait.
IHKABLRD -- Line analysis read -- Processes data link control characters and writes to disk.
IHKABLWR -- Line analysis write -- Writes output to remote work stations.

Tables/Work Areas: Line control block.

Exits:

Normal -- To dispatcher to wait for an I/O operation to complete, and to the line analysis read and line analysis write routines.
Error -- To internal subroutine to build an RJENDF.

Attributes: Reentrant.

LINE ANALYSIS READ

Line analysis read is composed of three routines:

IHKABLRD (LRD) and IHKCHLRD -- This is the main routine that reads the input, checks it, and writes it to a data set on a direct access device.

IHKABALC (ALC) and IHKCHALC -- This routine allocates disk space for SYSIN data sets, modifies the DD * or DD DATA card to point to the new data set, and opens the data set.

IHKABXMT (XMT) -- This routine transmits an error message to the remote terminal and sometimes to the central operator.

Line Analysis Read (LRD) Routine (Charts UA-UJ)

Routine Name: IHKCHLRD - MFT

Entry Points:

IHKABLRD -- This is the usual entry point and is entered for processing of input. At entrance to this routine, register 1 contains a pointer to a one-word parameter list that contains a pointer to the LCB. Register 13 contains a pointer to the line save area.

IHKABCON -- This entry point is in the constant area of this routine. IHKABALC uses it as the base address of a DSECT of the ABCON constant area.
IHKABXCN -- This entry point is in the constant area of this routine. IHKABXMT uses it as the base address of a DSECT in the ABXCN constant area.
IHKABRET -- This entry point is entered to write a JECL entry to the job queue and return to the IHKABLST routine.

Function: The basic functions of this routine are:

- Reading the input data using BTAM;
- Recognizing the data link control characters on the input record;
- Sequence checking the JECL commands-RJSTART, CONTINUE, LOGON, LOGOFF, and RJEND;
- Checking for the invalid JECL commands-RJENDC and RJENDF;
- Writing the JECL and JCL records on SYS1.SYSJOBQE using the OS queue manager;
- Starting a new queue entry for JECL and JCL when a JED card, or a JOB card not preceded by a JED card, is found;
- Checking for the DCB parameter on the SYSIN DD card;
- Passing the block size to IHKABALC if the block size is specified in the DCB parameter;
- Writing SYSIN data on a sequential disk data set that was just allocated.
- Counting SYSIN records (The total count for each SYSIN data set is placed into a SPACE parameter on the third SYSIN statement generated by RJE).

LRD uses various forms of the BTAM READ macro instruction to read input from the line. Each READ macro puts 80-character

card images and the data link control characters in the BTAM buffer. LRD moves only the card images to disk. The READ Initial is done by the line scheduler prior to calling this routine, which issues the READ Continue commands.

The card images are processed as follows:

- LRD verifies that the first card is RJSTART and that the second card is either LOGON or CONTINUE. If the first two cards are out of sequence, an error message is sent to the terminal and no more input is accepted until the proper cards are received.
- The JECL and JCL cards are written on SYS1.SYSJOBQE (two 80-character records per 176-byte block), formatted as follows:

4	80	80	4	1	7
TTR0	Card Image	Card Image	TDIR Pointer	Card Ind.	Not Used

Bytes

0-3 -- TTR0 -- relative track and record number (TTR) of next record.

4-163 -- Card images (two 8-character records).

164-167 -- TDIR pointer -- relative displacement of the TDE for the terminal that submitted the cards.

168 -- Number of cards indicator -- indicates number of cards in the record:

X'00' 2 cards
X'50' 1 card
X'10' 0 cards

169-175 -- (Not used).

A new queue entry is started each time a JED card, or a JOB card not preceded by a JED card, is found. Hence a queue entry may contain:

- JECL statements.
- JED and JCL statements.
- JCL statements.
- JCL and JECL statements.

When a DD * or DD DATA card is encountered, it is checked for a DCB parameter. If the BUFNO subparameter is specified, it is ignored. If the BLKSIZE subparameter is specified, the block size is passed to the routine with the IHKABALC entry point and a data set is allocated. The cards following the DD * or DD DATA card to the /* are put on the SYSIN data set: one to five 80-character records per block depending on the blocking factor. If a JECL or JCL card is encountered after the DD * card, the SYSIN data set is closed, and the JECL or JCL card is put on SYS1.SYSJOBQE. When all statements for one job have been received and put on the disk data sets, the queue entry is enqueued for the reader. Whenever the SYSIN data set is closed, the third SYSIN DD statement is created to include the SMF count and is placed on SYS1.SYSJOBQE.

If the remote CPU indicates that it is sending input in discontinue mode, line analysis read issues a READ Initial on a multipoint or leased line, or a WRITE Reset and READ Continue on a switched line instead of issuing a READ Continue. Line analysis read remains in the discontinue mode of reading until the remote CPU indicates it is resuming normal transmission. This feature allows commands to be entered through the printer-keyboard.

While any BTAM or BSAM I/O operation is taking place, control is given to the dispatcher so that processing on another line or subtask may be done. The dispatcher returns control to this routine when the I/O operation is completed.

External Routines:

IHKCHDSP -- Dispatcher -- To allow processing of other lines or subtasks while waiting for I/O to complete.
IHKABALC -- To allocate SYSIN data sets.
IHKABXMT -- To transmit an error message.
IHKCAVER -- Command interpreter -- To check the syntax and validity of an RJSTART or LOGON card.
IHKCBLDM -- Build message -- To get a pointer to an error message.
IHKCCSCN -- Scan -- To find the start of fields on JECL and JCL cards.
IHKCDFMR -- Fastable manager -- To write updated Fastable entry on disk.
IHKCDSCH -- Fastable search -- To search Fastable for available entry or duplicate jobname.
IHKCHUPK -- To unpack compressed records.
IEFQMSSS -- To read logical records from RJE queue.
IEFQDELE -- To delete entry from RJE queue.
BSAM -- To write the SYSIN data sets on disk.
BTAM -- To read input from the line.

Exits:

Normal -- Return is made to the line scheduler with a return code in register 15 as follows:

0 - Return for nonswitched line, or after RJENDC or RJENDF.
8 - Error message was sent on switched line; line scheduler must send EOT.
12 - Line scheduler should call IHKABLWR because an out-of-space condition occurred.
20 - RJENDC or RJENDF was not queued because SYS1.SYSJOBQE is temporarily out of space.
24 - Normal return for switched line.
28 - Return to send EOT to an IBM 2780 terminal on a switched line, because RJSTART or LOGON is required.
32 - Return to resynchronize IBM World Trade 3977 data sets.

Error -- The line error recovery procedures are those supplied by the OS BTAM Binary Synchronous Communications System (BSCS). If an error occurs on the line, it is retried by BTAM six times. If the error is not recoverable, BTAM posts a return code (41). If line analysis read finds this return code, it executes the following procedure. If there is a user-exit routine, it is called with a pointer to the line DECB in register 1. Then in the terminal directory entry, the enqueue jobs and the enqueue messages bits are turned off, the dequeue nothing bit is turned on, and the RJSTART and LOGON switches are turned off. An RJENDF card with the line error message is generated and put on the JECL and JCL queue entry. The queue entry is enqueued for the reader, and return is made to the line scheduler.

IHKABXMT is called if any of the following errors occurs:

1. RJSTART or LOGON is missing or invalid;
2. RJENDF or RJENDC is submitted from the terminal;
3. A JOB card is missing; or the jobname is missing, too long, or duplicate;
4. The Fastable is full;
5. The central installation is out of space for SYSIN, or out of space on SYS1.SYSJOBQE;
6. The SYSIN data set is too long;
7. A disk I/O error occurs;
8. A SYSIN DD statement is invalid.
9. An RJENDF or RJENDC statement is to be generated by RJE.

An error message is sent to the terminal, and for cases 4, 5, and 7 a message is also sent to the central operator. If the write to the terminal is unsuccessful, an RJENDF card with the error message is generated, if possible, and put on the JECL and JCL queue entry. The queue entry is enqueued for the reader, and return is made to the line scheduler. Abnormal central closedown is initiated when an irrecoverable error is encountered.

Tables/Work Areas: Each line has a line control block (LCB), subtask control block (STCB), 452-byte disk buffer, 18-word register save area, a DECB and DCB for line I/O, and a DECB and DCB for disk I/O associated with the line. While the line is sending input, a BTAM buffer is also used.

Attributes: Reentrant.

Notes: The operation of this subroutine depends upon an internal representation of the external character set that is equivalent to the one used at assembly time. The coding has been arranged so that redefinition of character constants, by reassembly, will result in a correct routine for the new definition. The two code exceptions in the resulting routine are:

1. The code that verifies that the JOB name begins with an alphabetic character.
2. The code that inserts the number of SYSIN records into the third SYSIN statement image.

LRD Routine (for MVT)

Routine Name: IHKABLRD -- MVT

Entry Points: Same as for the IHKCHLRD routine for MFT.

Function: Same as for the IHKCHLRD routine for MFT.

External Routines:

IHKCHDSP
IHKABXMT
IHKCAVER
IHKCBLDM
IHKCCSCN
IHKCDFMR
IHKCDSCH
IHKCHUPK
BSAM
BTAM
: Same as for the IHKCHLRD routine for MFT.

IHKABALC -- to allocate SYSIN data sets.
IHKQMNGR -- to interface with IEFQMSSS and IEFQDELE.

Exits: Same as for the IHKCHLRD routine for MFT.

Tables/Work Areas: Same as for the IHKCHLRD routine for MFT.

Attributes: Reentrant.

Notes: Same as for the IHKCHLRD routine for MFT.

Allocate (ALC) Routine (Charts UL,UM)

Routine Name: IHKCHALC -- MFT

Entry Point:

IHKABALC -- This entry point is used by IHKCHLRD to allocate a SYSIN data set. Register 1 points to a one-word parameter list that contains the address of the LCB.

Function: The basic functions of this routine are:

- Allocating a data set for SYSIN data.
- Modifying the DD * or DD DATA card to point to the new data set.
- Overriding the block size in the JFCB if block size was specified on the SYSIN DD statement.
- Opening the data set.

A sequential data set is allocated for the SYSIN data using the DADSM ALLOCATE routine (SVC 32). The DD * or DD DATA card is changed to the following cards:

Name	Operation	Operand
//ddname	DD	UNIT=23xx,DISP=(OLD,DELETE),VOLUME=SER=xxxxxx,
//		DSNAME=SYSyyddd.T123456.R0007.jobname.Sxxxxxxx,
//		SPACE=(80,(nnnnnn))

The date, jobname, and sequence number are placed in the DSNAME each time. There is a DD card, for each line in the RJE procedure, that specifies the volume, unit, primary and secondary allocation, and the blocking factor for SYSIN data. This routine obtains this information from system control tables. The nnnnnn, which must be ≤ 32,767, is the count of the SYSIN records for SMF.

External Routines:

IEFQMSSS -- To read logical records on the RJE queue.
IGC0003B -- DADSM allocate -- To allocate space for each SYSIN data set.
OPENJ -- To open a SYSIN data set.

Tables/Work Areas: LCB, 452-byte disk buffer, register save area, BSAM DCB, BTAM buffer, and constant area of IHKABLRD are used. LCBPARM1 in the LCB contains the JECL/JCL buffer index. LCBPARM2 in the LCB contains a pointer to the DD * or DD DATA card in the BTAM buffer. LCBPARM3 in the LCB contains the block size specified in the DCB parameter of the SYSIN DD statement.

Exits:

Normal -- Return is made to the IHKABLRD entry point with a return code of zero in register 15.
Error -- Return is made to the IHKABLRD entry point with a return code in register 15 to indicate the error condition as follows:

4 - There is an I/O error in writing a record on SYS1.SYSJOBQE.
8 - There is no space available on disk for the SYSIN data set.
12 - There is an I/O error in allocating the SYSIN data set.

LRD calls IHKABXMT to send the appropriate error message.

Attributes: Reentrant.

Notes: The operation of this subroutine depends on an internal representation of the external character set that is equivalent to the one used at assembly time. The

coding has been arranged so that definition of character constants, by reassembly, will give a correct module for the new definition.

ALC Routine (for MVT)

Routine Name: IHKABALC -- MVT

Entry Point:

IHKABALC -- This entry point is used by IHKABLRD to allocate a SYSIN data set. Register 1 points to a one-word parameter list that contains the address of the LCB.

Function: Same as for the IHKCHALC routine for MFT.

External Routines:

IHKQMNGR -- To interface with IEFQMSSS.
IGC00033 -- Same as for the IHKCHALC rou-
OPENJ tine for MFT.

Tables/Work Areas: Same as for the IHKCHALC routine for MFT.

Exits: Same as for the IHKCHALC routine for MFT.

Attributes: Reentrant.

XMT ROUTINE (CHARTS UK,UN-UQ)

Routine Name: IHKABXMT

Entry Points:

IHKABXMT -- This entry point is entered to transmit the error message.
IHKABRJF -- This entry point is entered to generate an RJENDF or RJENDC statement. Line analysis read assigns a queue entry, generates the statement, and queues it for the reader. On entry, register 1 contains a pointer to the LCB. Register 13 contains a pointer to the line save area. LCBPARM1 in the LCB contains a code to indicate one of the following:

00	for RJENDC.
13	for RJENDF with line error message.
19	for RJENDF with abnormal closedown message.
65	for RJENDF with disk error JED message.
255	for RJENDF with no message.

Function: This routine transmits an error message to the line and sometimes to the central operator.

When invalid input is detected, this routine transmits a reverse interrupt (RVI) line control character to end the transmission of data from a remote work station. Data is read from the line until an EOT indication is received from the remote work station. After the EOT indication is transmitted, an error message is sent to the central system as nontransparent text.

The following types of messages are sent to the central operator regardless of the kind of terminal:

1. Maximum number of jobs exceeded
2. Out of space -- SYSIN or SYS1.SYSJOBQE
3. Disk I/O error -- SYSIN or SYS1.SYSJOBQE

Upon entry to this routine, LCBPARM1 in the LCB must contain an input code as follows:

code 0 - Invalid JOB name
4 - Duplicate JOB name
8 - No JOB card
12 - SYSIN limit exceeded
16 - Maximum jobs exceeded
20 - Out of space - SYSIN
24 - Out of space - SYS1.SYSJOBQE
28 - I/O error on assign/start
32 - I/O error on queue manager not assign/start
36 - I/O error on allocation or writing SYSIN
40 - Invalid TERMID
44 - Invalid RJSTART or LOGON
48 - Invalid operation - RJENDF or RJENDC
52 - RJSTART or LOGON required
56 - Undefined keyword SYSIN DD
60 - Invalid keyword value SYSIN DD DCB
64 - RJENDF line error
68 - RJENDF finishing
72 - WRITE disconnect.

LCBPARM2 in the LCB must contain a pointer to a card or a message.

LCBPARM3 in the LCB must contain the address of the end of a BTAM buffer.

External Routines:

IHKCHDSP -- Dispatcher - To allow processing of other lines while waiting for I/O to complete.
IHKCBLDM -- Build Message - To get a pointer to an error message.
IHKCDSCH -- Fastable Search - To search Fastable for entry for current job.
BTAM -- To read input from the line and

to write an error message to the line.

Tables/Work Areas: Each line has a Line Control Block (LCB), Subtask Control Block (STCB), 452-byte output buffer, 18-word register save area, a DECB and DCB for line I/O, a DECB and DCB for disk I/O, and a BTAM buffer associated with it. The Fastable, the terminal directory, and the constant region in IHKABLRD are used.

Exits:

Normal -- Return is made to the IHKABLRD entry point with a return code in register 15 as follows:

0 - Enqueue queue entry, RELBUF, return to IHKABLST.
4 - RELBUF, return to IHKABLST.

Error -- Return is made to the IHKABLRD entry point with a return code in register 15 as follows:

8 - Generate RJENDF with error message that could not be sent.
12 - Generate RJENDF with line error message.
16 - Return to discontinue input.
20 - Return to Read ENQ routine to wait three minutes for corrected input.

Attributes: Reentrant.

LINE ANALYSIS WRITE

The line analysis write routine is composed of three subroutines:

- IHKABLWR (MVT) or IHKCHLWR (MFT) (LWR), which gets a logical record to be sent to the remote station. It may be an RJE message, a line from an OS SMB (JCL, allocation-deallocation messages), or a single logical record from a SYSOUT data set.
- IHKABORT (LWT), which blocks logical records in the BTAM buffer and transmits the completed block to the remote work station.
- IHKABRER (RER), which determines if a SYSOUT data set may be opened, and if so opens it.

LWR Routine (Charts SA-SK)

Routine Name: IHKABLWR -- MVT
IHKCHLWR -- MFT

Entry Points:

IHKABLWR -- entered to process QEBs enqueued on a terminal queue.

Function: When output is detected on a terminal queue by the line scheduler, it calls LWR to process the output. From the TDE for the terminal, LWR obtains a pointer to the first of a chain of QEBs, each of which defines data to be transmitted. Each of the QEBs is dequeued, processed, then returned to the RJE Freepool.

The message QEB either contains the RJE message text within itself or indicates the location of a message stored on disk.

If the message text is within the QEB, LWR calls LWT and passes LWT a pointer to the message text which LWT transmits to the remote printer-keyboard. If the message text is on a disk data set, LWR using IHKCDMDQ reads the text into main storage and calls LWT to transmit the message.

Processing of JOB QEB: The JOB QEB contains a pointer to a Fastable entry. From the Fastable entry LWR obtains a pointer to the JED table entry on disk. The JED table manager is called to read this entry into main storage. The JED entry contains a queue manager parameter area (QMPA). This has a pointer to the first of a chain of DSBs and SMBs that define a SYSOUT data set or system messages respectively (see Figure 3).

DSBs and SMBs are formatted as 176-byte records and reside on SYS1.SYSJOBQE. Each contains a one-byte indicator in the fifteenth byte position as follows:

X'FF' - Indicates a DSB.
X'FE' - Indicates a compressed SMB (usually contains JCL).
Nonzero - Indicates a normal SMB (usually contains allocation-deallocation messages).
X'00' - DSB for a data set that has been deleted.

If the RJE system contains the system management facilities (SMF) option of the operating system, a type-6 output writer record is written when a change of form, class, or job is made.

SMB Processing: When LWR detects an SMB in the chain, it determines if it is a compressed or normal SMB. Normal SMBs cause LWR to pass to LWT a pointer to the text to be transmitted. Compressed SMB text is decompressed before being passed to LWT. The SMB text is transmitted as fixed blocked data to a remote CPU, or fixed unblocked data to a remote 2780.

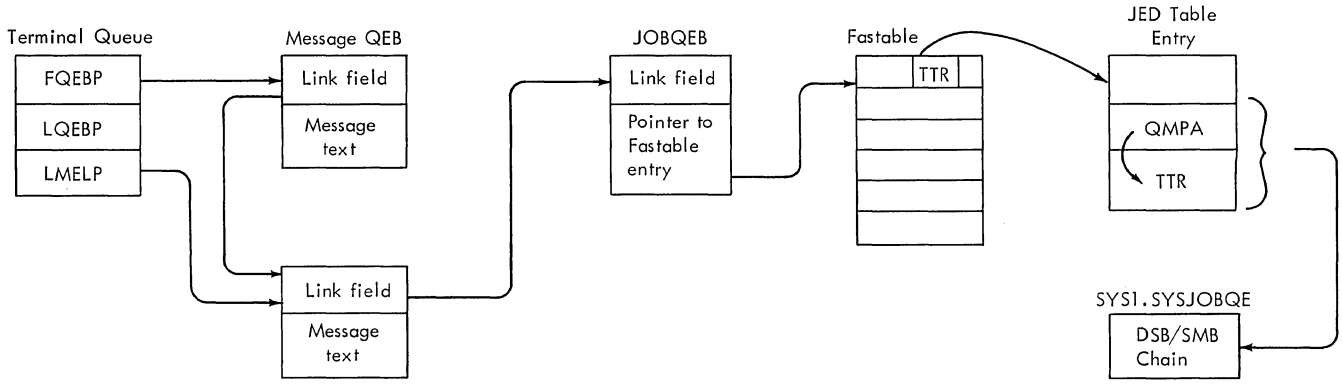


Figure 3. Queue for Processing a JOB

DSB Processing: The DSB contains an entry of a TIOT created by the operating system for a remotely submitted job. It is used by LWR to create a new TIOT referred to by the OPEN, CHECK, and CLOSE routines to provide access to the SYSOUT data set. BSAM is used to read a block of SYSOUT data. LWR deblocks the data and passes LWT one logical record at a time, along with sufficient identifying information, so that LWT can generate a header to describe the data set to the remote station. Once transmitted, the data set is scratched. After the complete chain of DSBs/SMBs associated with one job has been processed, the chain is deleted.

A TTR pointer to the current block being transmitted is saved for LWR by LWT. This permits resumption of processing from that point after a discontinue-continue sequence. The discontinuation may be originated by the remote operator, be caused by equipment failure, or by the recognition of a request for a change of forms in the printer. Resumption of output begins when a CONTINUE or RJSTART command is received.

During any I/O operation, LWR branches to the dispatcher to wait.

External Routines:

IHKCHDSP -- RJE dispatcher.
IHKABLWT -- Transmits data to terminals.
IHKABRER -- Nonresident subroutine used only by LWR. It reads the DSCB of the SYSOUT data set from the VTOC to determine if there is a DSCB and if so, if the data set was ever written on. If not, the data set is scratched without ever being opened.
IHKCDRMV -- Scratches SYSOUT data sets.
IEFQDELE -- Returns the chain of DSBs/SMBs to queue manager disk free space for reuse.
IEFQMSSS -- Reads DSB or SMB into main storage (MFT only).
IHKQMNGR -- Uses IEFQMSSS to read a DSB or SMB into main storage (MVT only).
IHKCDMDQ -- Reads an RJE delayed message text or a broadcast message text from disk into main storage.
IHKCGTD2 -- Scratches a job and all its SYSOUT data sets.
BSAM -- Reads SYSOUT data sets.
BTAM -- Writes EOT to line.
SMFWTM -- Writes a record to the SMF data set (SVC 83).

Tables/Work Areas: This routine issues four GETMAIN requests:

1. Main storage for 636-byte work area, named LWKWORK, to contain a parameter list for subroutines, message building work area, space to hold main storage copies of the JED table DSBs/SMBs, headers defining characteristics of the SYSOUT data set, and an SMF work area. The transmission routine, IHKABORT, also uses several words for its temporary storage needs.

2. Main storage for a new TIOT entry that is usually 48 bytes and is built using the information from the DSB. This is then used by the OPEN, CHECK, and CLOSE routines to provide BSAM access to the SYSOUT data set.

3. Main storage for BSAM input buffer, whose size is the same as the DCBBLKSI of the SYSOUT data set.

4. Main storage to create a type-6 output writer SMF record.

Other tables used are the RJE system control tables: Fastable, JED table, terminal directory, line control block (LCB).

Exits:

Normal -- IHKABLWR exits to the line scheduler branch table, IHKABLST. Register 15 is set as follows:

0 - Indicates that the terminal queue is empty (nonswitched line).

4 - Indicates that IHKABLWR discontinued, either by recognizing a request to discontinue submitted at the remote station, or a request to change forms on the printer (nonswitched line).

8 - Indicates that IHKABLWR stopped transmission to a switched line.

Error -- IHKABLWR exits to the line scheduler branch table, IHKABLST, and register 15 is set as follows:

16 - Indicates that IHKABLWR discontinued because of line failure, and requested generation of an RJENDF card. LCBPARM1 contains the offset of the appropriate error message.

Attributes: Reentrant.

Notes: The operation of this subroutine depends upon an internal representation of the external character set that is equivalent to the one used at assembly time. The coding has been arranged so that redefinition of the character constants, by reassembly, will result in a correct subroutine for the new definitions.

LWT Routine (Charts VA-VG)

Routine Name: IHKABORT

Entry Point: IHKABLWT

Function: Generates a header if necessary, blocks logical records in the BTAM buffer, and transmits the header and blocks of data to the remote terminal. This routine also sends component selection, or vertical forms control selection, or vertical forms control sequence to the 2780 remote station.

Remote CPU Support:

When this routine is called by IHKABLWR or IHKCHLWR, the length of the logical record is loaded into register 7 from LCBPARM1 in the LCB. A check is then made to see if a request was made to empty the buffer (R7=0), to transmit data (R7=data length), or to send a special heading to the remote work station to indicate to the central installation that an RJEND statement has been submitted (R7=negative value). If R7=0, another check is made to see if anything is in the buffer. If anything is there, it is transmitted; if not, control goes back to the LWR routines. If R7= negative value, SOH 5 ETX is sent only to a remote CPU, not to a 2780.

When a request is made to transmit data, a header is generated and transmitted if this is the first data of a new data set. The data that is transmitted, when there is not enough room for another record, is blocked into a BTAM buffer.

The length of data that is to be moved into the buffer at one time is determined as follows:

- If the record size (LWKRECSZ in LWR work area) is zero it means that the logical records may vary in length. In this case the device size is used as the logical record size (called "buffer bumper") for the block being created in the BTAM buffer. However, if the record size is not zero (logical record length of fixed length records), the device size is compared with the record size, and the smaller of the two is used as the buffer bumper.

- The buffer bumper is then compared with the input record length (as indicated in register 7). If the buffer bumper is smaller, its length is used to move the truncated record to the buffer; but if the input record length is smaller, it is used to move the record (padded to the size of the buffer bumper) to the buffer.

RJE messages are sent in fixed unblocked format ,and user-exit information is sent as specified in the record format in the header.

There are two types of headers that transmit control information to a CPU, a data header and a closedown header. The data header describes RJE output that is sent to the work station after a header is received. Data headers are transmitted in nontransparent text mode and have the following format:

SOH	Device Type	Control Character	Record Format	Record Size	ETX

where:

SOH is the data link start of header character.
Device type indicators:

C'1' - for output destined for the work station printer
C'2' - for output destined for the work station punch
C'3' - for RJE message output for either the work station printer-keyboard, if available, or the printer
C'4' - for output specified to be processed by a user-exit routine at the work station.

Control character indicators:

C'1' - machine code carriage control characters in output
C'2' - ASA carriage control characters in output
C'3' - carriage control characters are not part of output.

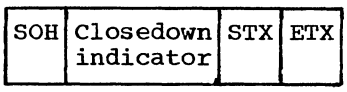
Record Format indicators:

C'1' - fixed unblocked output
C'2' - fixed blocked output
C'3' - variable unblocked output
C'4' - variable blocked output
C'5' - undefined output.

Record size - contains the logical record length (in decimal value) of the RJE output that follows.

ETX is the data link control text ending character.

The closedown header is transmitted to CPUs when the central operator enters a STOP command for the RJE task. The header that tells the CPU that RJE activity is being terminated at the central system has the following format:



where:

SOH is the data link control start of header character;
Closedown indicator is C'5' to tell the CPU that the central operator has initiated central closedown;
STX is the data link control text starting character;
ETX is the data link control text ending character.

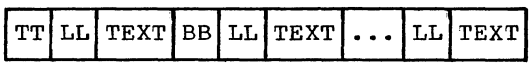
All RJE output (either message output or job output) to CPU work stations is sent in the transparent mode of communication. The maximum length for output transmissions is 404 bytes, which includes a maximum of 400 bytes of text and four data link control characters. Message output is sent as fixed/unblocked data and has a record length of 60 bytes. Job output may consist of punch, printer, or user exit data. Punch and printer output processing varies according to record format, to the availability of the compress/expand work station facility, and to the length of the output record being processed. User exit output processing varies according to the length of the data record being processed.

Punch and Printer Output:

Punch and printer output is processed in the following manner. The output record length is checked to see if it is within the maximum allowable size for the specified device. Maximum punched output is 80 bytes and maximum printer output is determined by the number of bytes contained in the TDIRPRNT field of the work station's terminal directory entry. If the output data contains carriage control characters, the record length is calculated as the device size plus one. If the record length exceeds the allowable size, the data is truncated to the maximum amount for the device. A record is truncated to the allowable size regardless of whether or not the work station has the compress/expand facility.

Next, the output data record format is processed. This processing is dependent on the availability of the compress/expand feature at the work station. If the work station does not have this capability, all punch and printer output is transmitted as fixed blocked records. Variable and undefined data records are padded with blanks to equal the maximum device size. Blocked records use the maximum length and are transmitted to the work station when the output buffer can not hold another record. The blocking factor used for fixed length records is that of the logical record, provided it is not greater than the allowable device size.

The job output processing that is dependent on the availability of the compress/expand facility at the work station involves removing trailing and imbedded blanks in the punch and printer output. Each compressed output record has the following format.



where:

TT is the total length of the compressed record (including the TT byte);
LL is the length of the following text (not including the LL byte);

BB is the number of blanks suppressed before the next text area of the record.

Note: There is no BB byte count at the end of the compressed record to indicate the total number of trailing blanks suppressed in the record.

Output data records are always compressed in the BTAM buffer. If the buffer can not hold the maximum length record, the buffer is emptied by sending the data to the work station using a write operation. The record is then compressed into the empty buffer and the TTR (relative track and record address) is saved for discontinue processing.

User Exit Output:

User exit output is transmitted in blocks of data in which the block length of the records transmitted is determined by the LRECL field in the DCB for the user's data set.

2770 or 2780 Support:

LCBPARM1 is checked just as for a CPU; however, there should never be a negative value in LCBPARM1 to indicate RJEND state. In transparent mode, one logical record is transmitted to a 2770 or a 2780 at a time. In nontransparent mode, more than one record is transmitted at a time. The length of each record is equal to the printer line size or, in the case of a punch, is 80 characters.

RJE output operations to the 2770 or 2780 are in both transparent and nontransparent mode of Binary Synchronous Communications (BSC). Only punch output is sent in transparent mode. All other output (message, user exit, and printer output) is sent in nontransparent text mode. This output is edited before it is transmitted, and if any data link control characters are found in output that is to be printed, these characters are replaced with blanks.

On a leased or switched line a component selection sequence is sent to select the printer or the punch. However, on a multipoint line the component selection sequence is not used. A terminal is addressed instead. This must be done before any vertical forms control sequences are sent to the printer and before going to the punch.

If a carriage control character is used at the beginning of a record, it must be changed to 2770 or 2780 code. If ASA code is specified, the vertical forms control sequence is sent before the data.

If machine code is specified, the vertical forms control sequence is sent after the data, spacing one less than is specified since the 2770 or 2780 printer then prints spaces.

Conversion of Carriage Control Characters:

Machine code and ASA carriage control characters are translated, by IHKABORT, into the 2780 escape sequence(s) that provides the equivalent carriage operation on the 2780 printer. Write and suppress space operations for both the 2770 and 2780 and channel skips of 9 through 12 for the 2780 only (that are not provided as carriage control functions with the 2780 escape sequence) default to write and space one (machine code) operations or to space one and write (ASA) operations.

For data sets not containing carriage control characters, the records are preceded with an escape sequence to skip to channel one, and the output is single spaced on the printer.

Stacker select carriage control characters for the 2770 or 2780 card punch output are ignored.

Blocking of Output:

Card punch output is transmitted in fixed unblocked 80-character records. Printed output is formatted into blocks that contain up to seven records for each transmission, provided the work station has the multiple records transmission (MRT) feature. If the work station does not have MRT, transmissions will not contain more than two records. With MRT installed, a maximum of seven records may be sent in each transmission, if the line buffer can hold them.

BTAM Error Procedures:

Irrecoverable line errors are processed by invoking RJENDF procedures. EOT responses to write operations invoke discontinue processing. When a contention situation occurs while users are bidding for the line, internal discontinue procedures are invoked.

External Routines:

IHKABLWR -- Line Analysis Write - To allow processing of another record, to RJENDF, or to discontinue.
IHKCHDSP -- Dispatcher -- to wait for I/O to complete.
IHKCHPCK -- To compress output records for transmission to CPU work

stations.
BTAM -- To write messages and data to the line.

Exits:

Normal -- Return to the IHKABLWR entry point (to the IHKABLWR routine for MVT or to the IHKCHLWR routine for MFT) with a zero return code in register 15.
Error -- Return to the IHKABLWR entry point with a four return code in register 15 and LCBPARM1 containing one of the following values.

LCBPARM1 Positive - Line failure
LCBPARM1 Negative - Discontinue processing
LCBPARM1 Zero - Contention

Tables/Work Areas: Line control block, Terminal directory entry, IHKTRTAB, line DECB, work area for IHKABLWR and IHKABORT modules, and BTAM output buffer.

Attributes: Resident and reentrant.

PACK/UNPACK ROUTINE (CHART YD)

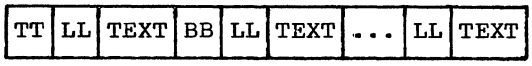
Routine Name: IHKCHPUP

Entry Points:

IHKCHPCK -- Entry into IHKCHPUP to pack a record. On entry, register 1 points to a parameter list that contains the following:
First fullword - address of the length of the input record
Second fullword - address of the input record
Third fullword - address of the output record (buffer).

IHKCHUPK -- Entry into IHKCHPUP to unpack a record. On entry, register 1 points to a parameter list that contains the following:
First fullword - address of the input record
Second fullword - address of the output record (buffer).

Function: This routine packs or unpacks records. The format of the packed record is as follows:



where:

TT is a byte containing the total length of the compressed record (including the TT byte itself);
LL is a byte containing the length of the following text (not including the LL byte);
BB is a byte containing the number of blanks between text fields on the input record.

Note: There is no BB byte count at the end of the compressed record to indicate the number of trailing blanks suppressed in the record.

The input for this routine is the parameter list contained in register 1. The output for this routine is a packed or unpacked record.

External Routines: Not applicable.

Tables/Work Areas: None.

Exits:

Normal -- Return is made to the calling routine.
Error -- Not applicable.

Attributes: Reusable.

Note: The operation of this subroutine depends on an internal representation of the external character set that is equivalent to the one used at assembly time. The coding has been arranged so that redefinition of character constants, by reassembly, will result in a correct module for the new definition.

OPENER FOR SYSOUT DATA SET ROUTINE (CHART SL)

Routine Name: IHKABRER

Entry Point: IHKABRER - Entered by IHKABLWR with register 1 pointing to a parameter list that contains the following:

Word 1 - pointer to a six-character string of volume serial numbers.
Word 2 - pointer to SYSOUT DCB.

Function: This routine determines if a SYSOUT data set should be opened. When output becomes available on a terminal queue, IHKABLWR is called to send it to a remote work station. IHKABLWR links to IHKABRER to determine if the SYSOUT data sets can be opened, and if so, opens them.

When IHKABRER gains control it reads into main storage the job file control block (JFCB) and changes the BUFNO field to zero. Using the DSNAME of the JFCB, IHKABRER tries to read the corresponding data set control block (DSCB) from the volume table of contents (VTOC). If no

DSCB is available, IHKABRER does not try to open the data set. If the DSCB is available, it is read into main storage and the TTR of the last block written is checked for zero. If it is zero, this indicates that the data set was not written on, and IHKABRER does not try to open it. If it is not zero IHKABRER issues the OPEN macro (TYPE=J) to open the SYSOUT data set. Control is then returned to IHKABLWR.

External Routines:

SVC 64 -- RDJFCB macro reads JFCB into main storage.
SVC 27 -- OBTAIN macro reads DSCB into main storage.
SVC 22 -- OPEN macro, TYPE=J, opens SYSOUT data set.

Tables/Work Areas:

JFCB in main storage -- Contains DSNAME.
DSCB in main storage -- Contains TTR pointer.

Exits:

Normal -- Returns to IHKABLWR with SYSOUT data set opened.
Error -- Returns to IHKABLWR with the SYSOUT data set unopened.

Attributes: Reusable, nonresident.

DATA SET SCRATCH ROUTINE (CHART WA)

Routine Name: IHKCDRMV

Entry Point: IHKCDRMV

Function: This routine is called by IHKABLWR and by IHKCGDLT to scratch output data sets. A scratch list is built for all volumes (maximum of five) occupied by the data set, and the SCRATCH macro is issued to scratch the data set. The UCB use count field is decremented and, if it equals zero, the data management count is set to zero and the allocation bit is turned off. IHKCDRMV expects a parameter list that contains the following:

Word 1 - Address of queue manager parameter area (QMPA).
Word 2 - Address of data set block (DSB).

External Routines: None.

Tables/Work Areas: None.

Exits:

Normal -- Register 15 contains zero. The data set has been scratched successfully.
Error -- Register 15 contains a nonzero value. The scratch was unsuccessful.

RJE PROCESSING OF INPUT

The RJE reader subtask (see Figure 4), using the language processing routines, processes the remotely submitted input similar to the way the OS reader/interpreter processes locally submitted input. The essential difference is that the remotely submitted input contains Job Entry Control Language (JECL) as well as Job Control Language (JCL). The RJE reader extracts each JECL statement and passes it to the subroutine designed to process it.

JECL is divided into two categories:

- Job Entry Definition (JED) statements,
- Remote work station commands.

The JED statements are passed to the JED processor and the remote commands are passed to the command interpreter, which checks the syntax of the commands and calls the appropriate command processor.

JCL is passed to the OS interpreter, which translates each JCL statement into internal text and passes control to the RJE JCL edit routine. This routine changes the device class on each DD SYSOUT statement to a unique RJE SYSOUT class and saves the original class in an internal table. After examining each JCL statement, and making changes if necessary, JCL edit gives control to the appropriate OS JCL processing routine. The original class is reassigned at job completion by the RJE writer.

RJE READER (CHARTS EQ-EV, EX)

Routine Name: IHKCHRDR - MFT

Entry Points:

IHKCHRDR -- The entry point for this routine used by the reader/interpreter for an in-core access method provided by the operating system.
IHKCHASE -- The entry point used by the RJE subtasks when subtask closedown is complete or when an error that necessitates abnormal RJE closedown is encountered. Entry at IHKCHASE results in return to the R/I end-of-data address (EODAD).
IHKCELST -- The entry point for the central data set work area used by IHKCEDIT and IHKCHJPR.

IHKCEJDT -- The entry point for the main storage copy of the JED table for the job used by IHKCHJPR to insert the notify information and used by IHKCEDIT to insert SYSOUT class information.

IHKCEJBN -- The entry point to access the name of the job currently being processed by the RJE reader subtask.

Function: The RJE reader module gains control from the R/I via the OS in-core access method. Although the RJE reader initially gains control from the R/I, it is the R/I that is used as the subroutine. Once processing has begun, by the R/I issuing a modified GET macro via its in-core access method, it is the RJE reader that controls the status of the processing until termination by reaching the EODAD. Once in control, the primary function of the RJE reader is dequeuing and reading logical records from the RJE queue (queue number 39) of the SYS1.SYSJOBQE. These records consist of the JCL in job entries and work station commands that has been collected from the work stations and placed on the queue by the IHKCHLRD routine, part of the collector/emitter. These entries on the queue may be one of the following formats:

1. One or more work station commands.
2. The JCL of a job entry preceded by a JED statement, if present.
3. The JCL of a job entry preceded by a JED statement, if present, followed by one or more work station commands.

If a queue entry contains both a job for processing and work station commands, the commands will always follow the job in the queue entry. Processing of queue entry input is as follows:

1. The JCL in a queue entry is passed to the R/I for interpreting and processing.
2. When all JCL in a queue entry has been passed to the R/I (this condition being indicated by JECL on the queue or no more data in the queue entry), a // null is passed to the R/I to force enqueuing of the job on the desired OS input queue.
3. JED statements are passed to the JED processor (IHKCHJPR) where the RJE job handling options are interpreted and processed.
4. Work station commands are passed to the command interpreter for translation, and for routing to the proper processing modules.
5. Jobs partially collected in a queue entry, as indicated by JCL immediately followed by an internal RJEND command (RJENDF), are cancelled in the operating system and deleted in RJE.
6. Jobs are acknowledged when they are enqueued on the OS input queue.
7. JCL in a queue entry is flushed if a job is marked as enqueued on the OS input queue but is not deleted from the RJE input queue (warmstart condition).
8. Users are notified of missing central data sets.
9. The JOBCARD user exit is passed for examination and modification to the JOB card (and continuations).
10. The JOBACK user exit is passed for examination and modification to the RJE job acknowledgment message and is allowed to add a 59-character message of its own that is sent following the RJE acknowledgment message.
11. The Fastable entry and JED table for the job are updated on their respective direct access data sets.
12. Abnormal closedown procedures are initiated when the QMGR returns with an I/O error indication on a dequeue or delete request.
13. Errors incurred while reading logical records from a queue entry result in both the entry and the job being deleted.

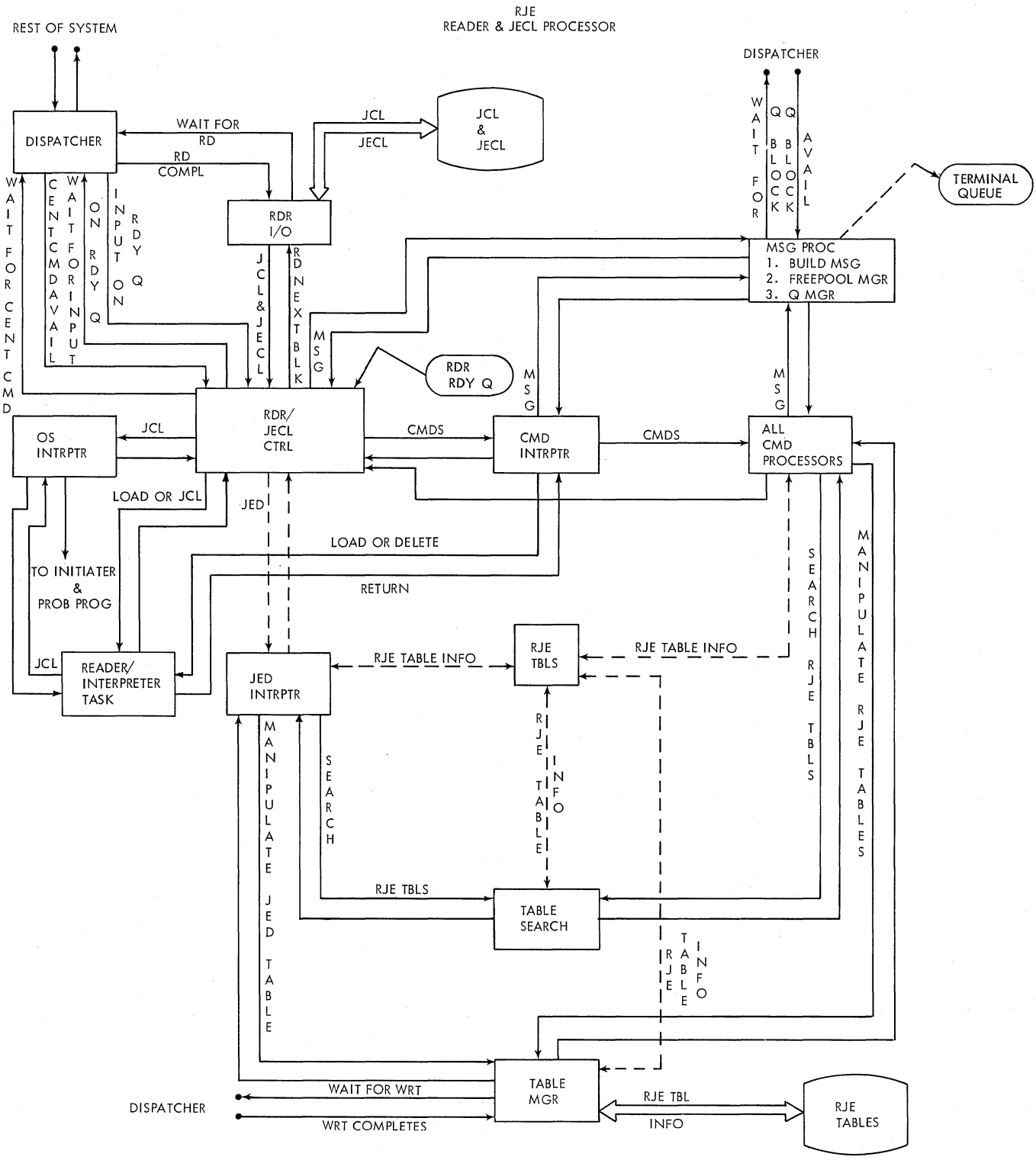


Figure 4. RJE Reader and JECL Processor

Upon R/I entry into IHKCHRDR, register 1 contains the address of the R/I in-core access method DCB. Input from the RJE queue of the SYS1.SYSJOBQE consists of 176-byte records of the following format:

TTR0	DATA ENTRY	DATA ENTRY	RELATIVE TDIR ENTRY OFFSET	NUMBER OF DATA ENTRIES

Description:

Byte	Use
0-3	TTR0 is the TTR of the next logical record in the queue entry. This field is zero if this is the last record in the queue entry.
4-83	A data entry consists of 80-character card images of JCL or JECL collected from the communications lines.
84-163	A second 80-character card image.
164-167	Relative terminal directory entry offset from the starting address of the terminal directory for the work station from which the data is collected.
168	The number of data entries in a logical record: X'00' -- two data entries in a logical record. X'50' -- one data entry in a logical record. X'10' -- no data entries in a logical record (the TTR0 field is also zero in this case).
169-175	(Not used.)

On leaving the RJE reader routine, the updated JED table for the job is written to the direct access data set and the user, and RJE job accepted messages are returned to the user submitting the job. Error messages indicating the three following error conditions may be sent to the user.

1. Data sets are specified in the JED central parameter, but not specified in the JCL for the job (message IHK153I).
2. Error incurred while reading a logical record from the queue entry (message IHK163I DISK ERROR QMGR jobname).
3. Error incurred while writing the updated JED table to the direct access data set (message IHK163I DISK ERROR JED jobname).

External Routines:

IHKCDJMR -- To write updated JED table to the direct access data set.
IHKCDFMR -- To write updated Fastable entry to direct access data set.
IHKCHDSP -- To wait for work on RJE input queue.
IHKCBLDM -- To construct RJE messages and enqueue them on the work station input queue.
IHKCDSCH -- To search Fastable for jobname.
IHKCFSTB -- To find position of job on input queue for job accepted messages.
IHKCHJPR -- To process JED statements found in the input stream.
IHKCAINT -- To process work station commands found in the input stream.
IEFQMSSS -- To read logical records from a queue entry.
IEFQMDQ2 -- To dequeue an entry from the RJE queue.
IEFQDELE -- To delete an entry on the RJE queue.
IEFSD447 -- To mark an entry on the RJE queue that is also enqueued on an OS input queue but not deleted from the RJE queue.

Tables/Work Areas: Standard 18-word save area, JED table, QMGR parameter area, central data set work area, 176-byte buffer for logical queue records.

Exits:

Normal -- Return to R/I end-of-data address.
Error -- Return to R/I end-of-data address with indicator set in the RJE communication switch.
User -- Job card user-exit routine: The entry point of this user exit is provided in the third word of IHKCDSOC (user exit and SYSOUT information table). The user exit is passed the address of the JOB card and each continuation card in register 1. The user exit is passed 80-character records, one per entry, until the JOB statement has been processed. A // null statement is passed if continuation is expected but is not present in the input stream. The jobname may not be changed by the user exit routine. Register 14 contains the return address, and register 13 the address of a standard 18-word save area. Registers must be saved on entry and restored on return.

Job acknowledgment user exit -- The entry point of this exit is provided in the fourth word of IHKCDSOC (user exit and SYSOUT table). The user exit is passed the address of the RJE JOB ACCEPTED message text beginning with the jobname field (31 characters of text are contained in this message). Register 14 contains the return address, and register 13 the address of a standard 18-word save area. Registers must be saved upon entry and restored before return. The user exit has the option of sending a 59-character message of its own. If this option is taken, register 1 must contain the address of the 59-character buffer containing the message. If this option is not exercised, the contents of register 1 must be zero on return.

Attributes: Not reusable.

Notes: Comments are keyed to personnel familiar with the OS Assembler Language, which depends upon an internal representation of the external character set that is equivalent to the one used at assembly time. The coding has been arranged so that redefinition of character constants, by reassembly, will result in a correct module for new definitions.

Routine Name: IHKXHRDR -- MVT

Entry Points:

IHKCHRDR -- The entry point for this routine used by IHKRJBGN. All others are the same as described in the IHKCHRDR routine for MFT.

Function: The RJE reader module gains control from IHKRJBGN. Once in control, the primary function of the RJE reader is dequeuing and reading logical records from the RJE queue (queue number 39) of the SYS1.SYSJOBQE. The remaining description of the functions of this module is the same as that for the IHKCHRDR routine for MFT.

External Routines:

IHKCDJMR
IHKCDFMR
IHKCHDSP
IHKCBLDM
IHKCDSCH
IHKCFSTB
IHKCHJPR
IHKCAINT

} Same as for the IHKCHRDR routine for MFT.

IHKQMNGR -- To read logical records from a queue entry, to dequeue and/or delete an entry from the RJE queue, and to mark an entry on the RJE queue that is also enqueued on an OS input queue but not deleted from the RJE queue.

IHKBBRII -- To pass records to the reader/interpreter, to pass an EODAD to the R/I, and to load and delete nonresident modules. The interface is accomplished by posting the ECB of IHKBBRII and then issuing a WAIT until the request is serviced.

Tables/Work Areas: Same as for the IHKCHRDR routine for MFT.

Exits:

Normal -- Return to IHKRJBGN.
Error -- Return to IHKRJBGN with indicator set in the RJE communication switch.
User -- See the user exit description for the IHKCHRDR routine for MFT.

Attributes: Not reusable.

Notes: Same as for the IHKCHRDR routine for MFT.

JED PROCESSOR (CHARTS EA-EE)

Routine name: IHKCHJPR

Entry point: IHKCHJPR

Function: This routine processes the JED and JOB statements. When the RJE reader finds a JED card in the input stream, it causes the JED processor to handle the card.

The JED processor creates a dummy Fastable entry as follows:

- It builds the Fastable job information byte (FASTJIB) by modifying the system defaults with parameters contained in the JED, and any JED continuation, cards.
- The user identification for the source is inserted in the FASTUSE field of the Fastable.
- If an alternate is specified in the OUTPUT parameter, his ID is placed in the FASTALT field of the Fastable. The FASTDSB, FASTDSBE, and FASTCNT fields are set to zero.

A dummy, main storage JED table for reference by IHKCEDIT and IHKCHRDR and located in the RJE reader, is initialized to blanks (first 25 bytes) and binary zeroes (remaining bytes).

If notify message text is given in the NOTIFY parameter, it is moved into the first 25 bytes of the dummy JED table.

If a CENTRAL parameter is found, the CENTRAL subparameters are moved to IHKCELST, the central parameter work area located in IHKCHRDR, for reference by IHKCEDIT and IHKCHRDR. Each entry of IHKCELST is 18 bytes long, left-adjusted, and padded with blanks. The low-order byte is a flag set by IHKCEDIT and checked by IHKCHRDR. IHKCELST is blank if no CENTRAL parameter is found.

At entrance to IHKCHJPR register 1 contains the address of a five-word parameter list aligned on a word boundary and containing the following:

First fullword -- Not used.
Second fullword -- Starting address of the JED, JED continuation, or JOB card to be processed.
Zero, if the JED processor is to give the error message ILLEGAL CONTINUATION. This situation will occur when IHKCHRDR discovers that the JED statement is followed by some JECL statement instead of a JOB statement.
Third fullword -- Contains the address of the entry in the terminal directory for the terminal from which this job is being entered.
Fourth fullword -- The address of the RJE address vector table (AVT).
Fifth fullword -- The address of the main storage JED table located in IHKCHRDR.

If no errors are detected in processing the JED and JOB statements, the Fastable, dummy JED table, and IHKCELST are the output from this routine.

If an error is found in the JED or JED continuation cards, a message is sent to the originating terminal. If possible, IHKCHJPR will continue scanning the JED statement for other errors, sending an error message for each. When IHKCHJPR can scan no further, or has reached the end of the JED statement, the JED processor reinitializes itself for the next job and passes a return code of four to IHKCHRDR.

Tables/Work Areas: None.

External Routines:

IHKCCSCN -- Scans parameters and operation codes in the input cards.
IHKCBLDM -- Enqueues error messages on the appropriate terminal queue.
IHKCDSCH -- Is used to locate the reserved Fastable entry.
IHKCAMSN -- Scans the notify message text for length and possible errors.
IHKCCSUD -- Scans the user directory to determine the validity of the user identification of the alternate.

Exits:

Normal -- Register 15 has a return code of zero.
Error -- Register 15 has a return code of four. An error was found in the JED statement, or the reserved Fastable entry was not found.

Attributes: Serially reusable, nonresident

JCL EDIT ROUTINE (CHARTS DA-DC)

Routine Name: IHKCEDIT - MFT
IHKXEDIT - MVT

Entry Point: IHKCEDIT

Function: Changes the SYSOUT class and MSGCLASS classname from that specified in the JCL entered with a remote job to the RJE SYSOUT class that is defined by the RJETABL macro. The change of SYSOUT class is not made for any data set that is directed to the central installation and that is specified in the CENTRAL parameter of the JED statement.

The JCL edit routine receives control from the OS interpreter, after IEFVFA (the OS JCL scan routine) has accumulated and converted one complete JCL statement (includes continuations and overrides) to internal text.

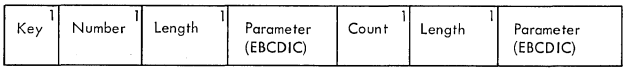
At entry to IHKCEDIT, register 14 contains the address of the JCL statement processor to which IHKCEDIT will relinquish control; register 13 contains a pointer to a save area; , and register 1 contains a pointer to the following three-word parameter list:

Word 1 - Text buffer pointer.
Word 2 - QMPA pointer.
Word 3 - Queue manager entry pointer.

The text buffer pointer points to the first text buffer for a statement. The actual text begins in the second word of the buffer. The first word is binary zero unless the internal text for this statement is continued in another buffer (this is not the usual case). If the text is continued, the first word contains the three-byte, right-adjusted TTR of the next buffer, and an identifier of X'0B'. The format of the internal text buffer appears below.

The QMPA and queue manager entry pointer are provided in case the internal text is continued. The continuation buffer resides on queue manager space on disk. It may be read into main storage and rewritten to disk using the queue manager routines.

Format of the Internal Text Buffer



where:

Key
is the one-byte binary code that represents a keyword.

The keyword codes used by IHKCEDIT are:

JOBK	EQU	X'65'	JOB
EXECK	EQU	X'54'	EXEC
DDK	EQU	X'3D'	DD
MSGCLAJK	EQU	X'63'	MSGCLASS
SYSOUTK	EQU	X'1A'	SYSOUT

Number
is a one-byte binary number that specifies the number of positional parameters in the entry.

Length
is a one-byte number that specifies the length of the parameter that follows it.

(The high-order bit of the Key, Number, and Length fields is always off.)

Parameter
contains the positional parameter.

Count
is a one-byte binary number that specified the number of subparameters in the entry. Its high-order bit is always on (which differentiates between count and other fields).

The SYSOUT and MSGCLASS are changed by the JCL edit routine in the following ways. The SYSOUT classes specified in the RJETABL macro are:

SYSPRT = SYSOUT class for printer

SYSPCH = SYSOUT class for punch

SYSUSER = SYSOUT class for a user-written routine

SYSRJE = RJE SYSOUT class.

For a JOB statement, IHKCEDIT searches for the keyword MSGCLASS=. When found, the classname is stored in the first byte of JEDTSOUT area in the dummy JED table entry, and the RJE SYSOUT class (defined in the keyword SYSRJE= in the RJETABL macro) is substituted in the text buffer.

If the MSGCLASS information does not completely fit into the internal text buffer, or into the continuation buffer, if one is provided, IHKCEDIT requests an additional buffer by invoking the OS queue manager assign routine (IEFQMSSS) and writes the MSGCLASS information to the disk buffer by means of the queue manager write routine (IEFQMSSS). The new disk buffer is chained to the preceding one by inserting the appropriate TTR in the first word of the preceding buffer.

If the keyword MSGCLASS= is not found, it is added to the internal text buffer with the RJE SYSOUT class specified as the classname. The SYSPRT classname is stored in JEDTSOUT. For an EXEC statement, the stepname is stored and used for searching the central parameter list.

For a DD statement, JCL edit stores the ddname and searches for the keyword SYSOUT= . If not found, the statement is ignored. When found, IHKCELST, the central parameter list built by the JED processor, is searched using as a search argument the current stepname.ddname. If a match is found or CENTRAL=ALL was specified on the JED card, the data set is to be directed to the central installation; the SYSOUT class is not changed by IHKCEDIT unless the RJE SYSOUT class is specified. In this case the SYSPRT class is substituted in the DD statement. This entry in the central parameter list is flagged as used.

If no match is found and the SYSOUT class is one defined by the RJETABL macro, the classname is stored in the next available slot of JEDTSOUT, and the RJE SYSOUT class is substituted in the DD statement. If the SYSOUT class is not one defined by the RJETABL macro, the SYSPRT classname is stored in JEDTSOUT and the RJE SYSOUT class is substituted. If progname is present, it is ignored.

No more than 24 SYSOUT classes may be stored in JEDTSOUT. For each keyword SYSOUT= , found after JEDTSOUT is full, the

RJE SYSOUT class is substituted. When the job is complete, the data set is routed to the remote printer.

After processing each JCL statement, IHKCEDIT returns via register 14 to the appropriate JCL statement processor (IEFVJA or IEFVEA or IEFVDA).

External Routines:

IHKCHDSP -- To perform dummy wait (MFT only).
None -- For MVT.

Tables/Work Areas: A 98-byte dummy JED table entry built by the JED processor is written to the disk data set that contains the JED table by the RJE reader at the end of a job.

Exits:

Normal -- Returns via register 14.
Error -- None.

Attributes: Serially reusable.

COMMAND PROCESSING ROUTINES

The RJE task processes two types of commands:

- Central commands
- Remote work station commands

The syntax of both types of commands is checked by the command interpreter routine. If a valid command is found, it is passed to the appropriate command processing routine. If an invalid command is found, an error code is returned to the calling routine by the command interpreter, and a diagnostic message is sent to the central installation (as a result of a central command) or to the terminal that submitted the command.

COMMAND INTERPRETER (CHARTS AA-AH, AJ, AL-AO)

Routine Name: IHKCAINT - MFT

Entry Points:

IHKCAINT -- Used by the RJE reader and the central command routine to check the syntax of the JECL.
IHKCAVER -- Used by the collector/emitter to verify RJSTART and LOGON commands. The high-order bit of register 1 is on at entry.
IHKCACOM -- RJE communications region -- It consists of a list of addresses used by RJE routines.

Function: Given an 80-byte card image of an RJE command, this routine scans the operand for syntax errors. If an error is found, a diagnostic message is enqueued to be sent to the originator of the command. If no errors are found, the contents of the operand field are condensed and put into fixed locations of a 15-byte extension of the 80-byte card image, and the proper command processor is given control.

There is one exception to this procedure. In the case of a CONTINUE command, there is no command processor; the command interpreter indicates which option was found in the operand field by setting bits 9 and 10 of TDIRSWCH. (The bit configurations are 01-BEGIN, 10-NO, 11-no operand.) A RESETPL macro is issued and the RJSTART processor is given control to re-enqueue any messages or jobs that were dequeued during discontinue mode.

RJSTART and LOGON require special consideration because they must be scanned when they reach the collector/emitter as well as when they reach the reader. Since the command interpreter can cause a wait in the dispatcher if there are no available QEBs, a second entry point allows the command interpreter to verify RJSTART and LOGON for the collector/emitter at any time, even while processing a command for the reader or central command routine. When one of these two routines is verified for the C/E, the command processor is not given control. The command interpreter checks the RJE tables for valid userids, termids, and protection keys, and prevents a user from trying to log on at two terminals at once. If the C/E does not provide the terminal directory entry address with the RJSTART command, this address is found and returned in the third word of the C/E parameter list. If either command is found to be invalid, the error message is built and the address of it is returned in the C/E parameter list. The error message does not use a QEB and is not enqueued. The C/E writes it to the terminal directly from the build message routine buffer.

At entrance to this routine register 1 points to a parameter list that contains the following:

- The first byte contains one of the following command codes to locate the proper interpreting and processing routines:

0 - undefined operation
4 - LOGON
8 - RJSTART
12 - DELETE
16 - LOGOFF
20 - BRDCSTR
24 - OUTPUT
28 - STATUS
32 - RJEND
36 - CENOUT
40 - BRDCST
44 - USERID
48 - SHOW
52 - MSG
56 - MSGR
60 - ALERT
64 - CONTINUE
68 - RJENDF
72 - RJENDC

- The next three bytes contain the address of the first character of the operation field (verb) for the command being processed.
- The second fullword contains the address of the first character of the 80-byte card image.
- The third fullword contains the address of the terminal directory entry for the terminal from which the command was submitted. In the case of a central command, this word is a binary zero. (In the case of an error on RJSTART or LOGON, this word will contain the address of the text of the error message when the parameter list is returned to the C/E.)

External Routines:

IHKCCSCN -- Scan -- Scans operand for blank, nonblank, or comma.

Register 1 contains the address of the following parameter list:

First halfword -- Maximum scan length.
Second halfword -- Number of sensitive characters.
Second fullword -- Starting address of scan.
Third fullword -- Stopping address of scan.
The following bytes -- String of sensitive characters.

IHKCBLDM -- Build messages.

1. Enqueues error messages, or
2. Returns the address of the message text to be written by the C/E.

Register 1 contains the address of the following parameter list:

First fullword -- Terminal directory entry address.
Next halfword -- Message offset.
Next byte -- Length indicator.
Next eight bytes -- Command name.
Next eight bytes -- Sequence number.

IHKCAMSN -- Message scan -- Scans message text field for errors and resolves double quotes.

Register 1 contains the address of the following parameter list:

First fullword -- Address of the leading quote.
Second fullword -- Stopping address (end of card).
Third fullword -- Maximum allowable message length.

IHKCCSUD -- Search UDIR -- Checks for a valid LOGON command.
IHKCBSTD -- Search TDIR -- Checks for a valid RJSTART command.
IHKCCQMG -- Queue manager -- issues RESETPL macro for continue command
IHKCBLGN -- LOGON
IHKCBRJS -- RJSTART
IHKCGDLT -- DELETE
IHKCBLGF -- LOGOFF
IHKCFBDR -- BRDCSTR
IHKCFOUT -- OUTPUT
IHKCFSTA -- STATUS
IHKCARJN -- RJEND
IHKCHCNT -- CENOUT
IHKCDBDC -- BRDCST
IHKCBUID -- USERID
IHKCASHO -- SHOW
IHKCFMSG -- MSG and MSGR
IHKCGALT -- ALERT

The preceding command processing routines are called with register 1 pointing to IHKCACOM. The high-order bit indicates which routine called the command interpreter (0-collector/emitter, 1-reader).

Tables/Work Areas: There are two identical work areas of 56 words each. One is used for each entry point: IHKCAINT or IHKCAVER. They include switches, parameter lists, buffers for card image, and save areas.

Exits:

Normal -- Register 15 contains 0.
Error -- Register 15 contains 4 if an error was found by either the interpreter or the processor.

Attributes: IHKCAINT and IHKCAVER are independently, serially reusable.

Notes: The operation of this routine depends upon an internal representation of the external character set that is equivalent to the one used at assembly time. The coding has been arranged so that redefinition of character constants, by reassembly, will result in a correct routine for the new definitions.

Routine Name: IHKXAINT - MVT

Entry Points: See the IHKCAINT routine for MFT.

Function: Same as for the IHKCAINT routine for MFT.

External Routines:

IHKBBRII -- Loads and deletes nonresident command processors. The interface to IHKBBRII is accomplished by posting the ECB in the IHKCAINT routine. The posting code is a pointer to a one-word parameter, the high-order byte of which indicates LOAD (4) or DELETE (8). The low-order byte is an index used by IHKBBRII to locate the proper routine name. After posting the ECB, the command interpreter waits in the dispatcher for the posting of the ECB in IHKCAINT. Control is returned from IHKBBRII when this ECB is posted.

See the IHKCAINT routine for MFT for the other external routines.

Tables/Work Areas: Same as for the IHKCAINT routine for MFT.

Exits: Same as for the IHKCAINT routine for MFT.

Attributes: Same as for the IHKCAINT routine for MFT.

Notes: Same as for the IHKCAINT routine for MFT.

CENTRAL COMMAND ROUTINES

This section contains a description of the routines used to schedule and process the following central commands:

MSG
BRDCST
SHOW
CENOUT
USERID

CENTRAL COMMAND SCHEDULING ROUTINE (CHART AZ)

Routine Name: IGC1503D

Entry Point: IGC1503D

Function: When an RJE central command is entered through the central console or card reader, it is recognized, and SVC 34 gives control to IGC1503D. This routine builds a command input buffer which is chained to the RJE command queue. It checks the existence of an RJE task by testing the CSCB for RJE. If RJE is not found, the next CSCB in the chain is tested. If all of the CSCBs are tested and none contains RJE, an error message is written to the central operator.

At entry IGC1503D expects the following parameter list, the address of which is in register 2:

A 40-byte extended save area where bytes

0-3 -- Contain the address of XCTL name (routine used to write error messages to the console).
4-7 -- Contain zero.
8-15 -- Contain the characters: IGC1503D.
16 -- Contains an error code.
17-19 -- Contain the address of the input buffer. (The first two bytes contain the total length of the buffer; the second two bytes are unused; and the remainder of the buffer contains the total input text, including the command verb.)
20 -- Contains one of the following verb codes:

120 -- MSG
124 -- CENOUT
128 -- BRDCST
132 -- USERID
136 -- SHOW.

21-23 -- Contains the address of the operand field of a command (the first nonblank character following the verb). The pointer is zero if there are no parameters for the verb.
24-31 -- Contains the verb (left-adjusted and padded with blanks).
32-39 -- (Not used.)

On exit from this routine, the output consists of a command input buffer which may be created by using the IEZCIB macro instruction.

External Routines: IGC0503D -- Message module -- Used to send error messages to the console.

Tables/Work Areas: CIB queue, CIBs.

Exits:

Normal -- Return via register 14.
Error -- IGC0503D is entered via an XCTL macro instruction and control is not returned. Register 2 contains the address of the extended save area. An error code in byte 16 requests a particular prepared error message, and bytes 24-31 of the extended save area are inserted in the variable portion of the message.

Attributes: Reentrant.

Notes: The module may not exceed 952 bytes in length. If more than 952 bytes are required, then a second load via an XCTL macro instruction must be performed.

The module cannot enter a wait state for any reason because an interlocking situation may arise.

Registers need not be saved upon entry, except register 14 that contains the return address.

CENTRAL COMMAND SUBTASK ROUTINE (CHART YA)

Routine Name: IHKCRIME

Entry Point: IHKBBCCR

Function: Provides an interface between the command modules of SVC 34 and the RJE command interpreter. This routine removes the command input buffer from the command queue and uses its information to construct a command buffer that is acceptable to the command interpreter for RJE processing. Upon return from the command interpreter, IHKCRIME frees the command input buffer and waits for the next command.

This routine receives control from the RJE dispatcher when SVC 34 enqueues a command on the RJE command queue and posts the ECB in the RJE command scheduling control block.

Upon entry, this routine contains a command input buffer, which may be created by using the IEZCIB macro instruction.

On exit, the following buffer is passed to the command interpreter:

Byte 0 Verb Code
36 - CENOUT
40 - BRDCST
44 - USERID
48 - SHOW
52 - MSG

1-3 Address of Verb.
4-7 Address of start of buffer.
8-11 Binary zero.
12-93 Card image of command.

External Routines:

IHKCAINT -- Command interpreter, to scan command and call proper processor.

Tables/Work Areas: 92 byte area for the command.

Exits:

Normal -- Return to dispatcher to wait for another command.
Error -- None.

Attributes: Reusable.

MSG COMMAND PROCESSOR (CHART FC)

Routine Name: IHKCFMSG

Entry Point: IHKCFMSG

Function: Handles messages from the central operator or a remote work station to a user, a terminal, or to the central operator. The central command has the option of deleting messages for a particular terminal from a message-pending direct access data set.

When the command is received from the command interpreter, IHKCFMSG checks whether the terminal or user is able to receive. The terminal can receive if it is active. The user can receive if he is logged on at a terminal that can itself receive. If a message can be sent, an extended message is built and parameters are passed to IHKCBLDM (build message) to enqueue the message for a terminal. If a message is to be held, IHKCDMEQ is called to enqueue the message for the message-pending data set.

Messages are not enqueued for the user if the user cannot be found and no terminal is specified. Messages are not enqueued for the terminal if the data set is full.

For a deletion, messages for the terminal specified are removed from the disk data set; and a message is returned to the central operator concerning the status of his command.

In all cases a message is returned to the sender with the sequence number from a remote command and the status of the message.

External Routines:

IHKCBSTD -- Search terminal directory for terminal specified.
IHKCCSUD -- Search user directory for user specified.
IHKCDMDE -- Delete messages from disk data set for a terminal.
IHKCBLDM -- Send command card messages and status messages.
IHKCDMEQ -- Add message for a terminal to disk data set.

Tables/Work Areas: None.

Exits:

Normal -- Register 15 contains zero.
Error -- Nonzero value is in register 15 if a disk error occurred.

Attributes: Serially reusable, nonresident.

BRDCST COMMAND PROCESSOR (CHART JD)

Routine Name: IHKCDBDC

Entry Point: IHKCDBDC

Function: Allows the central operator to prepare and modify a disk data set containing a series of messages that will be printed at any remote work station when requested.

At initial system startup two disk data sets are created for use by the BRDCST processing routines. The data sets are:

- A slot directory data set;
- A message text data set.

The slot directory is a sequential data set that logically consists of 100 slots with four bytes per slot. Each slot is associated with one record of the message data set and is formatted as follows:

Bytes

0-2 -- TTR -- relative track and record number of a record in the message data set.

3 -- FLAG
X'00' indicates an active slot.
X'FF' indicates an inactive slot.

The message data set is sequential and consists of 250 logical records with 60 bytes per record. The first 100 records are used to hold BRDCST message text; the remaining 150 records are used to hold the text of messages that could not be sent to a terminal.

The BRDCST processor, using the BRDCST service routines, modifies the slot directory and message data sets. It performs the following modifications upon request:

- Packs all active texts into the low-numbered slots; the inactive, into the high-numbered slots.
- Inserts text into a specified slot, pushing up all consecutive active texts to make room.
- Marks all texts inactive to logically delete all BRDCST messages.
- Writes text to the message data set.

External Routines:

IHKCDBIN -- Rolls in BRDCST slot directory.
IHKCDBOT -- If changes have been made to the slot directory, it rolls out to disk the new modified version.
IHKCDBPK -- Performs the pack function.
IHKCDBIS -- Performs the insert function.
IHKCDBSH -- Searches BRDCST slot directory in main storage for an inactive entry.
IHKCDBTX -- Writes the text of a new message to disk, and marks the slot in the directory active.

Tables/Work Areas: None.

Exits:

Normal -- The requested function has been performed. All I/O operations are complete. Register 15=0.
Error -- An error message is typed on the central typewriter:

IHK0151 MSG CANNOT BE ADDED BRDCST
The return code in register 15=4.

Several situations produce the above error condition:

1. Any insert request into any other slot where all higher numbered slots are active.

2. A request to put text into the lowest numbered available slot when all 100 slots are already active.

A disk error message may be typed at the central console and at the remote terminal, if an error was detected while processing the BRDCST or BRDCSTR command. The error may have occurred before the message was added to the data set.

Attributes: Serially reusable.

SHOW COMMAND PROCESSORS

This section contains a description of the routines used to process the following options on the SHOW command:

- JOBS
- TERMS
- USERS
- DEFER
- BRDCST
- MSGS
- LERB
- ACTIVE.

SHOW ACTIVE AND SHOW TERMS PROCESSOR (CHARTS AT, AU)

Routine Name: IHKCHATS - MFT and MVT

Entry Points: IHKCASHA and IHKCASHT are common entry points for this routine.

IHKCASHA -- This is the entry point used by the IHKCAINT routine when it receives a SHOW ACTIVE command.
IHKCASHT -- This is the entry point used by the IHKCAINT routine when it receives a SHOW TERMS or a SHOW TERMS, termid command.

The calling sequence for IHKCHATS is as follows:

```
LOAD    EP=IHKCASHA or IHKCASHT
LR      15,0
L       1,RJE communications region
        address
BALR    14,15
DELETE EP=IHKCASHA or IHKCASHT
```

Function: This routine responds to the central commands that retrieve information relating to the work stations in the RJE system, and are entered by the central operator. He can request:

1. A list of all work stations in the RJE system.

   ---SHOW TERMS---

2. A list of the active work stations in the RJE system.

   ---SHOW ACTIVE---

3. The state of a particular work station in the RJE system.

   ---SHOW TERMS,termid---

The response to these requests contains the name of the work station and an indication showing whether or not the work station is active. If the work station is active, the EBCDIC unitname for the communications line on which it is attached is displayed. In addition, if there is a user logged on at the work station, his userid is displayed as part of the response.

Input for this routine is obtained from the first two addresses pointed to by the parameter list in register 1, which contains the RJE communication region address. The first word of the parameter list is not used. The second word points to a 95-byte RJE command record with the following format.

80-byte command image	15-byte condensation

Description:

Byte	Use
0-79	Command image -- 80-byte image of the command that was received and interpreted by the command interpreter (IHKCAINT) routine.
80-94	Command condensation
80	Command type -- contains C'H' to indicate SHOW.
81	Operand type -- contains: C'A' for SHOW ACTIVE. C'T' for SHOW TERMS or SHOW TERMS,termid.
82-89	Request type -- contains: binary zero for major request - SHOW ACTIVE or SHOW TERMS. EBCDIC termid for specific request - SHOW TERMS,termid.
90-94	(Not used.)

The output for the IHKCHATS routine is a printer-keyboard display of the RJE system. Processing continues until all work stations that are able to satisfy the request made on the routine have been checked. The output messages have the following format:

IHK027I termid I

for inactive work station.

IHK027I termid A unitname

for active work station.

IHK027I termid P unitname userid

for processing work station.

In addition, for a SHOW ACTIVE request the message

IHK027I NO ACTIVE WORK STATIONS

is displayed if there are no work stations active when the request is made.

The message

IHK027I NO ACTIVE WORK STATIONS

is displayed if there are no entries in the terminal directory. Should the operator submit a SHOW TERMS,termid command with an invalid termid, the message

IHK042I INVALID TERMID SHOW

is displayed.

External Routines:

IHKCBLDM -- To construct and display messages for the central operator.
IHKCBSTD -- To search the terminal directory for the termid on a specific request.

Exits:

Normal -- Return to calling routine with zero as return code.
Error -- Not applicable.

Tables/Work Areas: Standard 18-word save area, 24-byte message text buffer.

Attributes: Serially reusable and nonresident.

JOB INFORMATION REQUEST ROUTINE (CHARTS BY, BZ)

Routine Name: IHKCHJIR -- MFT and MVT

Entry Points: IHKCASHD and IHKCASHJ are common entry points for this routine.

IHKCASHD -- This is the entry point used by the IHKCAINT routine on receipt of a SHOW DEFER or a SHOW DEFER,userid command.

IHKCASHJ -- This is the entry point used by the IHKCAINT routine on receipt of a SHOW JOBS or a SHOW JOBS, jobname command.

Standard subroutine linkage conventions prevail in this module, and the calling sequence for either entry point is as follows:

```
LOAD    EP=IHKCASHD or IHKCASHJ
LR      15,0
L       1,RJE communications region
        address
BALR    14,15
DELETE  EP=IHKCASHD or IHKCASHJ
```

Function: This routine responds to central commands that retrieve information relating to jobs in the RJE system, and are entered by the central operator. He can request:

1. A list of all RJE jobs currently residing in the central system.

   ---SHOW JOBS---

2. A list of all deferred jobs currently residing in the central system.

   ---SHOW DEFER---

3. A list of all deferred jobs that are currently residing in the central system for a particular user.

   ---SHOW DEFER,userid---

4. The status of a particular job currently residing in the central system.

   ---SHOW JOBS,jobname---

The responses to these requests include the jobname and source userid--the alternate userid is included if applicable. In addition, the disposition of the output (immediate or deferred) is displayed along with job completion status (complete or incomplete). If the output is deferred, the number of normal central closedowns occurring while the job was in the central system is included. All job status information is retrieved from the Fastable entry assigned to the job.

On entry to this routine, register 1 contains the address of the second word of the RJE communications region, which contains the address of a 95-byte RJE command input record with format as follows:

80-byte command image	15-byte condensation

Description:

Byte	Use
0-79	Command image -- 80-byte image of the command that was received and interpreted by IHKCAINT.
80-94	Command condensation -
80	Command type -- contains C'H' to indicate SHOW.
81	Operand type -- contains: C'J' for SHOW JOBS(,jobname) C'D' for SHOW DEFER(,userid).
82-89	Request type -- contains: binary zero for major request - SHOW JOBS or SHOW DEFER. jobname for SHOW JOBS, jobname userid for SHOW DEFER, userid.
90-94	(Not used.)

The output of this routine is a printer-keyboard display of the requested status of the jobs in the RJE system. Output operations continue until all jobs that satisfy the request have been displayed. The output messages have the following format:

IHK028I jjjjjjjj uuu N/A COMP I

for complete jobs with immediate output.

IHK028I jjjjjjjj uuu N/A INCP I

for incomplete jobs with immediate output.

IHK028I jjjjjjjj uuu N/A COMP or INCP D nnn

for jobs with deferred output and no alternate user.

IHK028I jjjjjjjj uuu aaa COMP or INCP D nnn

for jobs with deferred output and an alternate user.

where:

jjjjjjjj
is the jobname.

uuu
is the source user's userid.

aaa
is the alternate user's userid.

nnn
is the number of normal closedowns since the job was received.

If the operator requests a display of jobs that were specified as deferred output, but there are no longer such jobs in the central system, the following message is displayed.

IHK028I NO DEFERRED JOB OUTPUT.

If the operator requests a deferred job output display for a particular user under the above condition, the following message is displayed.

IHK028I NO DEFERRED JOB OUTPUT uuu

If a display of all jobs was requested, and there are no jobs currently in RJE, the following message is displayed.

IHK004I NO JOB(S) IN SYSTEM SHOW

If a display of a particular job was requested but the job could not be found, the following message is displayed.

IHK004I NO JOB(S) IN SYSTEM SHOW jjjjjjjj

If the operator specifies an invalid userid when entering SHOW DEFER,userid, the following message is displayed.

IHK040I INVALID USERID SHOW

External Routines:

IHKCBLDM -- To construct and display messages for the central operator.
IHKCDSCH -- To search the Fastable for jobname on SHOW JOBS,jobname commands.
IHKCCSUD -- To search the user directory for the userid on SHOW DEFER, userid commands.

Exits:

Normal -- Return to calling routine with zero return code.
Error -- Not applicable.

Tables/Work Areas: Standard 18-word save area, 28-byte message text buffer, Fastable (READ operation only), user directory (READ

operation only).

Attributes: Serially reusable and nonresident.

SHOW MSGS PROCESSOR (CHART AW)

Routine Name: IHKCASHM

Entry Point: IHKCASHM

Function: When IHKCASHM receives control from IHKCASHO, it loads the message dequeue routine (IHKCDMDQ), which reads into main storage a message from the message-pending data set. The build message (IHKCBLDM) routine is then called to write the message to the central console. This process is continued until all messages have been displayed on the central console. If a termid is specified, then only those messages pending for that terminal are displayed.

External Routines:

IHKCBLDM -- Build message
IHKCDMDQ -- Message dequeue
IHKCBSTD -- Search TDIR

Tables/Work Areas: None.

Exits:

Normal -- Register 15 contains 0.
Error -- Register 15 contains 4 -- a specified termid is not in the TDIR.

Attributes: Serially reusable.

SHOW USERS(,USERID) PROCESSOR ROUTINE (CHARTS AU, AV)

Routine Name: IHKCHSUP - MFT and MVT

Entry Points: IHKCASHU is the only entry point for this routine, and it is used by the IHKCAINT routine when a SHOW USERS or a SHOW USERS,userid command is received. Standard subroutine linkage conventions prevail, and the calling sequence is as follows.

```
LOAD    EP=IHKCASHU
LR      15,0
L       1,RJE communications region
        address
BALR    14,15
DELETE EP=IHKCASHU
```

Function: The IHKCHSUP routine responds to the central commands that retrieve information relating to the users of the RJE system, and are entered by the central operator. He can request:

1. A list of all users in the RJE system and their status.

   ---SHOW USERS---

2. The status of a particular user in the RJE system.

   ---SHOW USERS,userid---

The response to these requests contains the identification of the user and his protection key, with an indication of whether the user is logged on. The termid of the work station where the user is or was last logged on is also displayed. If the user is currently logged on, the unitname for the communications line on which his work station is attached is displayed. The message has the following format.

IHK001I userid key STATUS termid unitname

At entry to this routine the input for the module is found at the address contained in the second word of the RJE communications region, the address of which is in register 1. This input address points to a 95-byte RJE command input record with the following format.

80-byte command image	15-byte condensation

Description:

Byte	Use
0-79	Command image - 80-byte image of the command that was received and interpreted by the command interpreter routine (IHKCAINT).
80-94	Command condensation -
	80 Command type - contains C'H' to indicate SHOW.
	81 Operand type - contains C'U' to indicate USERS or USERS,userid.
	82-84 Request type - contains:

binary zero for major request -
SHOW USERS.
EBCDIC userid for specific request -
SHOW USERS,userid.

85-94 (Not used.)

The output for IHKCHSUP is a printer-keyboard display of the status of the RJE users. Processing continues until all entries in the user directory have been checked to see which could satisfy the request made on the routine. Output messages have the following format:

IHK001I userid key OFF

When the user is logged off never having logged on.

IHK001I userid key OFF termid

When the user is logged off but was previously logged on.

IHK001I userid key ON termid unitname

When user is currently logged on.

IHK001I NO USERS IN DIRECTORY

When there are no users in the user directory.

In the event the operator submits a SHOW USERS,userid command with an invalid userid, the following message is displayed.

IHK040I INVALID USERID SHOW

External Routines:

IHKCBLDM -- To construct and display messages for the central operator.
IHKCBSTD -- To search the terminal directory for the termid to see if user is currently logged on.
IHKCCSUD -- To search the user directory for the userid on a specific request.

Exits:

Normal -- Return to calling routine with zero return code.
Error -- Not applicable.

Tables/Work Areas: Standard 18-word save area, 21-byte message text buffer, terminal directory, user directory, line control block, data control block for the line, data event control block for the line, data extent block for the line, and unit control block for the line.

Attributes: Serially reusable and nonresident.

SHOW BRDCST PROCESSOR (CHART AW)

Routine Name: IHKCASHB

Entry Point: IHKCASHB

Function: The SHOW BRDCST command requests that all active BRDCST messages be displayed on the central console. The messages are retrieved from the message-text data set by the message dequeue routine (IHKCDMDQ) and are passed to the build message routine to display on the central console.

External Routines:

IHKCBLDM -- Build and display message.
IHKCDMDQ -- Dequeue message from message queue.

Tables/Work Areas: None.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable.

SHOW LERB PROCESSOR (CHART AX)

Routine Name: IHKCASHL

Entry Point: IHKCASHL

Function: This routine displays the current value of each line error counter (data check, nontext time-out, and intervention required) and of the transmissions counter on the central console. If a linename is specified, the values for that line are displayed; otherwise, the values for all lines are displayed. A BTAM routine is used to write the values to the console.

External Routines:

IHKCBLDM -- Build message.
IECTLERP -- BTAM line error print routine.

Tables/Work Areas: Line table.

Exits:

Normal -- Register 15 contains 0.
Error -- Register 15 contains 4 if a specified linename cannot be found in the line table.

Attributes: Serially reusable.

CENOUT COMMAND PROCESSOR (CHARTS GG, GH)

Routine Name: IHKCHCNT

Entry Point: IHKCHCNT

Function: Allows the user to have his output processed by the central system output writers. IHKCHCNT is linked to by IHKCASHO to process the CENOUT central command. It dequeues the output for the specified job from the RJE output queue and enqueues it on the central SYSOUT queues as specified by the SYSOUT classes in the JED table (see discussion of JCL edit routine that changes SYSOUT classes). The output can then be processed by the central system output writers. After the output has been enqueued on the central queues, this routine issues a message to the central operator indicating which SYSOUT classes were used. CENOUT then turns off the discontinued output bit in the terminal directory in case the processed job had been partially transmitted by the RJE writer. This stops the writer from trying to continue an already processed, partially transmitted, job. Finally, the Fastable entry for this job is cleared.

The following cases are exceptions to the above procedure:

- If the specified job is not in the system, a JOB NOT IN SYSTEM message is returned to the central operator.
- If the specified job is not complete, a JOB NOT COMPLETE message is sent to the operator.
- If the output is presently enqueued for a terminal, (i.e., someone has already requested the output), a JOB NOT IN SYSTEM message is returned to indicate that the output cannot be delivered to central.

External Routines:

IHKCBLDM -- Builds system messages.
IHKCBSTD -- Searches terminal directory.
IHKCCSUD -- Searches user directory.
IHKCDJMR -- Fastable manager.
IHKCDSCH -- Searches Fastable for jobname.
IHKCHDSP -- Dummy waits in dispatcher.
IEFQMSSS -- OS queue manager.
IEFQDELE -- OS queue delete.

Tables/Work Areas:

A 98-byte work area is used to receive the JED table entry. Four 176-byte buffers are used for reading and writing SMBs/DSBs with OS queue manager. Three 52-byte QMPAs are used to interface with the OS queue manager.

Exits:

Normal -- Returns to calling routine with a zero return code.
Error -- None.

Attributes: Serially reusable, nonresident.

USERID COMMAND PROCESSOR (CHART BH)

Routine Name: IHKCBUID

Entry Point: IHKCBUID

Function: Adds or deletes a user to or from the user directory.

When a user is to be added, the userid and protection key are inserted into an empty entry, and an ADDED TO USER DIRECTORY message is printed on the central console. If the user directory is full, a USER DIRECTORY FULL message is returned.

When a user is to be deleted from the directory, all fields of the entry are filled with blanks (X'40') except for the TTR pointer. The status byte is then cleared to binary zero, and a DELETED FROM USER DIRECTORY message is printed on the central console. If the command has a userid that is found in the user directory, but the protection key in the directory does not match the protection key on the command, an INVALID PROTECTION KEY message is returned.

Once an entry is modified, it is written to disk.

External Routines:

IHKCCSUD -- Searches user directory.
IHKCDUMR -- Writes updated entry to disk.
IHKCBLDM -- Writes system messages to the central operator.

Tables/Work Areas: User directory.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable and nonresident.

Notes: The operation of the central command processing routines depends upon an internal representation of the external character set that is equivalent to the one used at assembly time. The coding has been arranged so that redefinition of character constants, by reassembly, will result in a correct module for the new definitions.

REMOTE WORK STATION COMMAND PROCESSING ROUTINES

This section contains a description of the routines used to process commands submitted by the remote work stations.

RJSTART PROCESSOR (CHARTS BF, BG)

Routine Name: IHKCBRJS

Entry Point: IHKCBRJS

Function: Allows a terminal to be logically connected to the RJE system. When the RJSTART processor is called by the command interpreter, it performs the following operations:

- It sets the enqueue jobs, enqueue messages, continue here, and RJSTART bits in the terminal directory. The posting bit of the stop acknowledge ECB is turned off as are all status bits (except the delayed message bit) not set by RJSTART.
- If requested, broadcast messages are enqueued on the terminal queue for the terminal submitting the RJSTART card.
- If the notify pending RJSTART or bypassed output bits are on in the terminal directory entry, a search of the user directory is made for users who last logged on at this terminal (termid in user directory entry matches termid in terminal directory entry). When a user is found, the notify pending terminal startup bit is inspected. If it is on, the Fastable is searched for jobs that have the notify source pending RJSTART bit on and that specify the indicated user as the source. For every job found, the source notification bit is turned on and the notify source pending RJSTART bit is turned off in the Fastable; and depending on the job termination, either an ABEND NOTIFY or a NOTIFY message is enqueued.

When all the notifications for a user have been found and enqueued, the notify pending terminal startup bit in the user directory is turned off, and the bypassed output bit in the user directory entry is checked.

If the bypassed output bit is on, the Fastable is searched for the bypassed jobs. When jobs are found, they are enqueued, and depending on the destination, either the bypassed output source or bypassed output alternate bits are turned off in the Fastable. When all bypassed jobs have been found for this user, the bypassed output bit in the user directory is turned off. If the bypassed output bit was not on or if all jobs have been found for one user, the search proceeds to the next user who last logged on at the terminal submitting the RJSTART card.

When the end of the user directory is reached, the notify pending RJSTART and bypassed output bits in the terminal directory are turned off.

- Terminal directory entry is written to disk.
- The undelivered messages, if present, are enqueued.
- An RJSTART ACCEPTED message is enqueued. IHKCBRJS is also entered on a CONTINUE command for the enqueuing of delayed messages and bypassed output only.

External Routines:

IHKCFBDR -- Enqueue broadcast messages.
IHKCCSGN -- Search for jobs that have notify pending RJSTART and undelivered immediate output bits on.
IHKCFQOP -- Enqueue undelivered immediate output.
IHKCBLDM -- Enqueue system messages.
IHKCDTMR -- Write updated terminal directory entries to disk.
IHKCDJMR -- Read JED table entries for notify messages.

Tables/Work Areas: Fastable, user directory, terminal directory.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable, nonresident.

LOGON PROCESSOR (CHART BB)

Routine Name: IHKCBLGN

Entry Point: IHKCBLGN

Function: Logs a user on the RJE system by the following procedure:

- The userid is entered in the current LOGON portion of the terminal directory entry for the user's present terminal.
- The termid is entered in the user directory entry for this user.

- A LOGON ACCEPTED message is transmitted to the remote work station.
- The user is notified of any pending deferred output, and the notify pending LOGON and the notify pending terminal startup bits in the user directory entry are turned off. Depending on the type of notification (source or alternate), the source notification or the alternate notification bit is turned on and the notify source pending RJSTART or the notify alternate pending LOGON bit is turned off in the Fastable only.
- The user is sent any bypassed output. If the user has any bypassed output, he is sent this at the next RJSTART command from his terminal. However, if he has changed terminals before another RJSTART is received from his old terminal, the output is sent when he logs on at the new terminal and the bypassed output bit is turned off in the user directory. Depending on the destination of the output (source or alternate), the bypassed output source or the bypassed output alternate bit in the Fastable is turned off.

External Routines:

IHKCCSUD -- Search user directory.
IHKCCSGN -- Search Fastable for undelivered output.
IHKCBLDM -- Build and enqueue system messages.
IHKCDUMR -- Write updated user directory entry to disk.
IHKCBSTD -- Search terminal directory.

Tables/Work Areas: Fastable, user directory, terminal directory.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable, nonresident.

LOGOFF PROCESSOR (CHART AL)

Routine Name: IHKCBLGF

Entry Point: IHKCBLGF

Function: Logs a user off the RJE system. When the LOGOFF routine is called by the command interpreter, register 1 contains a pointer to the terminal directory entry for the terminal from which this command came. The LOGOFF routine zeros the userid field (bytes 9-11) in this TDIR entry.

External Routines:

IHKCBLDM -- Builds and enqueues LOGOFF ACCEPTED message.

Tables/Work Areas: Terminal directory.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable, nonresident.

ALERT PROCESSOR (CHARTS GA-GD)

Routine Name: IHKCGALT

Entry Point: IHKCGALT

Function: This routine processes the ALERT command. The following alert requests are acted upon by this routine:

1. Alert for a specific job (specific ALERT). This form of the ALERT command is a request to be alerted when a specific job is complete (for which the submitter is a valid recipient). Using the jobname as a search argument, a search is made of the Fastable. If the job is not found, a JOB NOT IN SYSTEM response is given. If the job is complete, the user receives either an INVALID RECEIVER message, if he is not a valid recipient of the output, or an alert message with any user-notify information appended. If the user is a valid recipient and the job is incomplete, the user receives a JOB NOT COMPLETE message, and either the specific alert source bit in FASTJIB (Fastable job information byte) is set if the submitter originated the job; or the specific alert alternate bit in FASTJIB is set if the alert submitter is the designated alternate. The proper alert response can then be initiated at job completion when these bits are checked.
2. User requests to be alerted when any job submitted by him is completed (minor ALERT).
   a. If any completed jobs submitted by this user (whose output has not previously been delivered to him, and for which he has not previously received a notify message) reside in the system, the immediate response is an alert message (for each job) with any user-notify information appended.
   b. In order to keep this request pending in the system, the minor

alert bit in USERSTAT (user directory user status) is set for this user. Whenever any job originated by this user is completed, this bit is checked and, if it is on, the appropriate alert message is issued at this time.

c. If there are no complete jobs originated by the submitter (same conditions as (a) above) residing in the system, the submitter receives a NO OUTPUT message to indicate that the ALERT command was processed and the alert remains pending as above.

3. User requests to be alerted when any job completes for which he is a valid recipient of its output (major ALERT).

   a. If any completed jobs, for which the submitter is a valid recipient of its output (output that has not been delivered to him previously, and for which he has not been notified or alerted previously), reside in the system the immediate response is an alert message (for each job) with any user-notify information appended.

   b. The alert is kept pending in the system by setting the major alert bit in UDIRSTAT (user directory user status) for this user.

   c. If no complete jobs, for which the submitter is a valid recipient of its output, reside in the system, the NO OUTPUT message is returned and the ALERT remains pending in the system as in (b) above.

4. User requests to cancel any pending alerts issued by him (ALERT cancel).

   a. The major alert and minor alert bits in the user directory are turned off for this user.
   b. All specific alert requests for jobs with output for this user are cancelled. If the submitter originated the job, the alert source bit in FASTJIB (Fastable job information byte) is turned off. If the submitter is the designated alternate, the alert alternate bit in FASTJIB is turned off.

   c. An ALERTS CANCELLED message is issued for each ALERT cancel command processed.

If any changes have been made in bit settings in the Fastable, the new table is written to disk.

External Routines:

IHKCDSCH -- Searches Fastable for a particular jobname.
IHKCDJMR -- Reads user-notify information from disk to main storage.
IHKCBLDM -- Builds system messages.
IHKCCSGN -- Searches Fastable for undelivered output.
IHKCCSUD -- Searches user directory for user entry.

Tables/Work Areas: A 50-byte work area is used to receive the entry from the JED table, which contains the user notify information.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable, nonresident.

STATUS PROCESSOR (CHARTS FG, FH)

Routine Name: IHKCFSTA

Entry Points:

IHKCFSTA -- Entered to process requests for status of all jobs submitted by a user.
IHKCFSTB -- Entered to process requests for status of one particular job.

Function: This routine returns to the submitter (provided he is a valid receiver) the status of a specific job or the status of all jobs submitted by him. The status returned is one of the following:

- Scheduled for execution
- Executing
- Abnormally completed
- Normally completed

When a request for the status of a particular job is received and the jobname is not found in the Fastable, a NO JOB(S) IN SYSTEM message is returned to the user. If the jobname cannot be read on the SYS1.SYSJOBQE, a disk error message replaces the status. The central operator receives a disk error message.

External Routines:

IHKCCSGN -- Searches Fastable.
IHKCBLDM -- Builds and enqueues status messages.
IHKCDSCH -- Searches Fastable for a given

jobname.
IEFLOCDQ -- OS queue search routine.
IEFALTRA -- Enables access to OS queue manager areas on direct access.

Tables/Work Areas: Fastable.

Exits:

Normal -- Returns to the calling routine.
Error -- None.

Attributes: Serially reusable, nonresident.

DELETE PROCESSORS (CHARTS GE, GF)

The processing of the DELETE command requires the use of two modules, IHKCGDLT and IHKCGDT2.

Routine Name: IHKCGDLT

Entry Point: IHKCGDLT

Function: This routine processes the DELETE command. The following forms of the command are acted upon:

A. Delete a specific job. This is a request to delete from the RJE system all references to the specified job (other than named data sets). This is accomplished as follows:

   The Fastable is searched for the job using IHKCDSCH.

   1. If the job is not found, a JOB NOT IN SYSTEM message is sent to the user.
   2. If the submitter of the command did not originate the job, an INVALID RECEIVER message is returned.
   3. If the command is valid, control is passed to IHKCGDT2 to remove the job from the RJE system.
   4. Upon receiving control from IHKCGDT2, the following action occurs:
      a. If the return code is a zero, a JOB DELETED message is returned.
      b. If the return code is a nonzero value, a JOB NOT IN SYSTEM message is returned indicating the job output was already enqueued for delivery and could not be deleted.

B. Delete all jobs originated by the DELETE command submitter. This is a request to remove from the RJE system all references to all jobs originated by the command submitter (except named data sets). The following actions are taken.

   Using IHKCCSGN, the Fastable is searched for jobs submitted by the command submitter.

   1. If no job is found, a JOB NOT IN SYSTEM message is returned.
   2. If a job is found, control is passed to IHKCGDT2 to remove it from the system.
   3. When control is returned, the return code is checked and either:
      a. A JOB DELETED message is returned if the code is zero, or
      b. A JOB NOT IN SYSTEM message for this job is sent if the code is a nonzero value.
   4. Steps 2 and 3 above are repeated until all jobs have been processed.

External Routines:

IHKCGDT2 -- Deletes the job from the RJE system.
IHKCBLDM -- Builds system messages.
IHKCCSGN -- Searches Fastable for jobs by a given user.
IHKCDSCH -- Searches Fastable for a specific job.

Tables/Work Areas: Fastable.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable, nonresident.

Routine Name: IHKCGDT2

Entry Point: IHKCGDT2

Function: This routine removes from the RJE system all references to a given job (except named data sets that remain under control of the operating system). This is done in the following manner:

A. If the job is not complete, the MGCR (OS CANCEL macro) is issued and the job deletion bit in the Fastable is set (bit 3 of FASTJIB).

B. If the job is complete, several tests are made.

   1. If the job has immediate output, it is not removed from the system (since it has already been enqueued for delivery).

   2. If the job has deferred output and the output has already been enqueued for delivery, the job is not removed.

   3. If the job has deferred output, not already enqueued, three routines are called to remove it from the system.

      a. The OS queue manager read routine is called to read in the DSBs (data set blocks) for the job.

      b. The data set scratch routine (IHKCDRMV) is called to scratch the associated data sets.

      c. The OS queue manager delete routine is called to delete the OS queue space.

C. If the job is removed by either A or B above, the last action taken is to place a character blank into the first byte of the FASTNAME field to remove the job from the Fastable.

External Routines:

IHKCDJMR -- Reads in JED table from disk.
IHKCDFMR -- Writes updated Fastable to disk.
IHKCDRMV -- Scratches given data sets.
IEFQDELE -- Deletes OS queue space.
IEFQMRAW -- Reads in DSBs/SMBs from disk.

Tables/Work Areas: A 98-byte work area is used to receive the JED table information. A 19-byte buffer is used to build the OS CANCEL command. A 176-byte buffer is used to receive the DSBs/SMBs read in by OS queue manager.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable, nonresident.

OUTPUT PROCESSOR (CHARTS FA, FB)

Routine Name: IHKCFOUT

Entry Points:

IHKCFOUT -- Entered by the command interpreter to process the OUTPUT command.
IHKCFQOP -- Entered by JOBEND routine to enqueue immediate output.

Function: Processes the OUTPUT command by enqueuing deferred output on a terminal queue.

This routine processes output requests submitted by a user in the output command. The following types of requests are handled:

1. Request for output from a specific job -- indicated by a jobname as the operand of the OUTPUT command.

2. Request for output from any job submitted by a particular user -- indicated by a userid as the operand of the OUTPUT command.

3. Request for output from any job in the system for which the command originator is a valid recipient -- indicated by an * as the operand of the OUTPUT command.

4. Request for output from any job submitted by the command originator -- indicated by no operand on the OUTPUT command.

If output is to be sent to the command originator, the output is enqueued, and the output enqueued for source or the output enqueued for alternate bit is set in the Fastable. If no output is to be sent, a message is returned to the requester giving the reason.

External Routines:

IHKCCSGN -- Search Fastable for valid jobs for specified recipient.
IHKCCPLM -- Get QEB for enqueueing request.
IHKCCQMG -- Enqueue request for output.
IHKCDSCH -- Search Fastable for particular jobname.
IHKCBLDM -- Enqueue message for terminal.
IHKCDFMR -- Write entry from Fastable onto disk.

Tables/Work Areas: Fastable.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable, nonresident.

MSGR PROCESSOR (CHART FC)

The same routine is used to process the central command and the remote MSGR command. It is discussed in the section on the Central Command Processing Routines.

BRDCSTR PROCESSOR (CHART FD)

Routine Name: IHKCFBDR

Entry Point: IHKCFBDR

Function: This routine processes a request for broadcast messages or delayed messages by enqueuing a dummy message QEB (queue entry block) on the requesting terminal's queue. This message QEB contains no message, but the link field contains an indicator in the high-order byte: X'84' for delayed messages, and X'88' for broadcast messages. This indicator is recognized by the line write routine, which gets the broadcast or delayed messages from the broadcast message data set.

External Routines:

IHKCCPLM -- Freepool manager.
IHKCCQMG -- Queue manager.

Tables/Work Areas: None.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable, nonresident.

RJEND PROCESSOR (CHARTS AR, AS)

Routine Name: IHKCHIRP

Entry Point: IHKCARJN

Function: This routine processes RJEND commands submitted by terminals and RJEND commands generated by the collector/emitter in the case of a terminal failure or a STOP RJE command.

When called by the command interpreter the following action is taken:

A. RJEND

1. Break terminal queue after last message.
2. Enqueue RJEND ACCEPTED message for the terminal and for the central system.
3. Turn off enqueue messages bit (bit 3 of TDIRSTAT).
4. Log off any user who may still be logged on at this terminal (set TDIRUSID to zero).
5. Process any jobs that were removed from the terminal queue:
   a. Turn on bypassed output bit (bit 0 of TDIRSTAT);
   b. Turn off enqueued bits in Fastable (bits 1 and 2 of FASTDSB);
   c. Turn on bypassed output bit in Fastable for source or alternate (bit 0 or 1 of FASTDSBE);
   d. Turn on bypassed output bit for the user receiving job output (bit 0 of UDIRSTAT).
6. Cancel alerts for all users who were last logged on at the terminal.
7. Cancel specific alerts on all jobs for which these users were valid receivers.

B. RJENDF (terminal failure)

1. Break terminal queue after last message.
2. Turn off enqueue messages bit (bit 3 of TDIRSTAT).
3. Log off any user who may still be logged on at this terminal (set TDIRUSID to zero).
4. Process any jobs that were removed from the terminal queue:
   a. Turn on bypassed output bit (bit 0 of TDIRSTAT);
   b. Turn off enqueued bits in Fastable (bits 1 and 2 of FASTDSB);
   c. Turn on bypassed output bit in Fastable for source or alternate (bit 0 or 1 of FASTDSBE);
   d. Turn on bypassed output bit for the user receiving the job output (bit 0 of UDIRSTAT).
5. Check for a message from the collector/emitter on the 95-byte extended card image. If there is one, put it on the disk data set.

6. Remove any messages from the terminal queue and put on disk data set.

C. RJENDC (STOP RJE)

1. Break terminal queue after last message.

2. Generate and enqueue status report for the terminal.

3. Enqueue closedown message for the terminal.

4. Turn off enqueue messages bit (bit 3 of TDIRSTAT).

5. Log off any user who may still be logged on at this terminal (set TDIRUSID to zero).

6. Process any jobs that were removed from the terminal queue:

   a. Turn on bypassed output bit for terminal (bit 0 of TDIRSTAT);

   b. Turn off enqueued bits in Fastable (bits 1 and 2 of FASTAB);

   c. Turn on bypassed output bit in Fastable for source or alternate (bit 0 or 1 of FASTDSBE);

   d. Turn on bypassed output bit for user receiving job output (bit 0 of UDIRSTAT).

7. Check TDIRFAST to see if there is any discontinued output to dequeue. If so, process as in 6.

8. Cancel alerts for all users who were last logged on at the terminal being closed down.

9. Cancel specific alerts on all jobs for which these users were valid receivers.

10. Post an ECB for the collector/emitter indicating the completion of closedown procedures for this terminal.

External Routines:

IHKCBLDM -- Build message -- Send proper message to terminal or central operator.
IHKCFSTA -- STATUS processor -- Generate and enqueue status report for terminal at time of STOP RJE.
IHKCCPLM -- Freepool manager -- Return QEB to Freepool.
IHKCCSUD -- UDIR search -- Search UDIR for a user receiving a particular dequeued job.
IHKCCSGN -- General Fastable search -- Search Fastable for all jobs for which a particular user was a valid receiver.
IHKCDFMR -- Table managers -- Write updated TDIR, UDIR, or Fastable entries on disk.
IHKCDMEQ -- Message enqueue -- Write dequeued messages on disk in case of a terminal failure.

Tables/Work Areas: Fastable, user directory, terminal directory, Freepool.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable, nonresident.

SERVICE ROUTINES USED BY CENTRAL AND REMOTE COMMAND PROCESSING ROUTINES

SEARCH BRDCST AND MSG SLOT DIRECTORIES ROUTINE (CHART JG)

Routine Name: IHKCDBSH

Entry Points:

IHKCDBSH -- Entered to search broadcast slot directory.
IHKCDMSH -- Entered to search message slot directory.

Function: This routine searches the broadcast or message slot directory for the first inactive entry, beginning at some specified point. An inactive entry in the BRDCST directory is indicated by an X'FF' in the fourth byte; in the message directory by an X'FF' in the fourth byte. If found, the address of the inactive entry is returned to the calling routine.

At entrance to this routine register 1 points to a parameter list containing the following:
Word 1 - The address of the main storage slot directory rolled in by IHKCDBIN.
Word 2 - The address of the particular slot within the directory at which to begin the search.

External Routines: None.

Tables/Work Areas: Main storage slot directories.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable and nonresident.

ROLLIN-ROLLOUT BRDCST AND MSG SLOT DIRECTORIES (CHART JK)

Routine Name: IHKCDBIN

Entry Points:

IHKCDBIN -- Entered to roll in either directory.
IHKCDBOT -- Not a true entry point. Its address is passed to the calling routine by IHKCDBIN and is used to roll out the slot directory when processing is complete.

Function: Maintains disk copies of the two slot directories. The slot directory is a list of TTR pointers to the records on disk containing the message texts. To maintain this directory over periods when RJE is not in operation, it is necessary to keep a disk copy of the main storage table up-to-date.

There are two directories, one for BRDCST, another for MSG, kept on distinct disk data sets. This rollin-rollout routine is designed to service either.

At the beginning of servicing either a BRDCST or MSG command, IHKCDBIN rolls into main storage the appropriate slot directory for reference by the various processing modules. After processing is completed, IHKCDBOT rolls out the modified slot directory back to disk. If the directory is not changed, rollout is not done. The entire routine is locked when entered and unlocked by IHKCDBOT.

At entrance to IHKCDBIN register 1 points to a parameter list containing the following:

Bytes:

0-3 -- Address of list of resident DCBs.

4 -- A code indicating which slot directory to roll in:
X'00' -- request BRDCST slot directory.
X'80' -- request MSG slot directory.

5-7 -- Address of RJE dispatcher.

At entrance to IHKCDBOT the parameter value passed in register 1 indicates that the directory is to be copied back onto disk and the routine is to be unlocked, or indicates the unlocking only.

The parameters to the rollin routine are preserved for later use by the rollout routine also.

External Routines:

BSAM -- Standard use is made of the OPEN, CLOSE, READ, WRITE, and CHECK macro instructions.
IHKCHDSP -- RJE dispatcher.

Tables/Work Areas: The 900-byte main storage slot directory (MSG or BRDCST) is within this routine. It is available for use by the other associated routines.

Exits:

Normal -- Return to calling routine.
Error -- None.

Attributes: Serially reusable and nonresident.

XDAP DRIVER FOR BRDCST-MSG DATA SET (CHART JH)

Routine Name: IHKCDBTX

Entry Points:

IHKCDBTX -- Entered to read a 60-byte logical record.
IHKCDBTW -- Entered to write a 60-byte logical record.

Function: Maintains BRDCST-MSG data set, which contains the text of broadcast messages and the text of messages that could not be sent to terminals. This routine services a request to either read or write a 60-byte record (one message text) from or to the BRDCST-MSG disk data set. The access method used is XDAP and the required TTR pointers are kept in the slot directories.

At entrance to this routine register 1 points to a parameter list containing the following:

Word 1 - Address of list of resident DCBs.
Word 2 - Address of RJE dispatcher.
Word 3 - Address of the slot containing the TTR pointer to the record to be read or written.
Word 4 - Address of a 60-byte I/O area.

External Routines:

IHKCHDSP -- RJE dispatcher.

Tables/Work Areas: None.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Reusable and nonresident.

Note: The data set remains open until a STOP command is received.

INSERT BRDCST TEXT ROUTINE (CHART JE)

Routine Name: IHKCDBIS

Entry Point: IHKCDBIS

Function: Adds a message text to one of the first 100 records in the broadcast-message data set.

When called by the central BRDCST processor, IHKCDBDC, this routine inserts a new message into a particular one of the 100 message slots of the BRDCST-MSG data set. The original contents of this slot and all higher-numbered, consecutive, active slots are pushed up to make room. This requires that there be an inactive slot at a higher number. If none exists, IHKCDBIS returns a code of 4 in register 15, and the slot directory and the BRDCST-MSG data sets remain unchanged.

At entrance to this routine, register 1 points to a parameter list containing the following:

Word 1 - Address of list of resident DCBs.
Word 2 - Address of RJE dispatcher.
Word 3 - Address of slot in BRDCST slot directory to receive new text.
Word 4 - Address of a 60-byte area containing the new text.
Word 5 - Address of the first slot of the broadcast slot directory.

External Routines:

IHKCDBSH -- Search broadcast main storage slot directory for the first inactive slot, above the one specified, to receive the new message text.
IHKCDBTX -- (Alias IHKCDBTW) -- Write broadcast message text to disk.

Tables/Work Areas: Main storage copies of the slot directories.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Reusable and nonresident.

PACK ACTIVE BROADCAST MESSAGES ROUTINE (CHART JF)

Routine Name: IHKCDBPK

Entry Point: IHKCDBPK

Function: This routine rearranges the contents of the broadcast main storage slot directory so that the active entries will be packed together into the low-numbered slots and the inactive entries will be packed into the high-numbered slots. The sequential order of the active slots is not changed.

At entry to this routine register 1 points to the broadcast main storage slot directory.

External Routines: IHKCDBSH -- Search broadcast main storage slot directory for an inactive slot.

Tables/Work Areas: Main storage copy of broadcast slot directory.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Reusable and nonresident.

MESSAGE ENQUEUE ROUTINE (CHART JL)

Routine Name: IHKCDMEQ

Entry Point: IHKCDMEQ

Function: This routine copies the 60-byte text of a message (it may be off-line), which temporarily cannot be sent to a terminal, onto the broadcast-message data set (only the last 150 logical records are available for these messages) where it is held for future delivery.

An inactive slot in the message slot directory is modified to indicate that this entry is now active, and to contain the offset of the TDE for this terminal.

An inactive slot in the message slot directory is modified as follows:

- Byte 0 is set to X'00' to indicate that this entry is now active.

- The offset from the terminal directory (TDIR) of the terminal directory entry (TDE) for this terminal is entered in bytes 1-5.

At entrance to this routine register 1 points to a parameter list containing the following:

Word 1 - Address of DCBs for message slot directory and delayed message data sets.
Word 2 - Address of RJE dispatcher.
Word 3 - Address of TDE for terminal to receive message.
Word 4 - Address of TDIR.
Word 5 - Address of TDIR table manager.
Word 6 - Address of 60-byte I/O area of text to be written to disk.

External Routines:

IHKCDTMR -- Entry point IHKCDTMR is used to record updated TDIR entry on disk.
IHKCDBIN -- Rolls in message slot directory.
IHKCDBOT -- Rolls out modified slot directory.
IHKCDMSH -- Entry point IHKCDMSH is used to search message slot directory for inactive slot.
IHKCDBTX -- Entry point IHKCDBTW used to write message text to broadcast-message data set.
IHKCHDSP -- Dummy pass through dispatcher.

Tables/Work Areas: In-core copy of message slot directory and terminal directory.

Exits:

Normal -- Returns to calling routine with zero return code, indicating text is on disk.
Error -- A return code indicates the result of an error as follows:

4 -- the disk data set to contain the new message text is already full; message is not recorded as requested.
Not 0 or 4 -- This number is an offset for the appropriate disk error message passed by IHKCDBIN, IHKCDBOT, or IHKCDBTW.

Attributes: Reusable and nonresident.

Notes: The first byte of the fourth word of the calling routine save area contains X'FF' to indicate the completion of this routine.

Proper functioning of this subroutine is dependent upon internal representation of the external character set that is equivalent to the one used at assembly time. If the character constants are redefined, a reassembly without any coding changes still results in a correct subroutine for the new definitions.

This routine uses the lock function, which permits only one user at a time to use IHKCDMEQ. A calling routine that finds the door locked waits in the dispatcher.

BROADCAST AND MESSAGE DATA SET DEQUEUER (CHART FE)

Routine Name: IHKCDMDQ

Entry Point: IHKCDMDQ

Function: IHKCDMDQ obtains a message from the broadcast-message data set. This routine reads into a calling routine area a 60-byte text of either a delayed message for a particular terminal or a broadcast message. This delayed message, read in on a previous call, (last 150 logical records) may be marked inactive (or deleted).

The following requests are serviced by this routine:

1. A request for one message text pending startup of a specific terminal.
2. A request for one message text pending startup of a specific terminal and for deletion of the message (slot is marked inactive).
3. A request for one active broadcast message.

Input is in the form of the following parameter list:

Word 1 - Address of list of resident DCBs (IHKCDCBS).

Word 2 - Address of dispatcher high-order byte:

off indicates broadcast request.
on indicates delayed message request.

Word 3 - Relative address in slot directory for starting point of search. A zero displacement will start search at the beginning of the slot directory. If the option of deleting a message is requested, the slot marked inactive is the

one just before the slot indicated by this parameter. If this value is zero, no slot is marked inactive.

Word 4 - Address of 60-byte I/O area in which message is to be placed.

Word 5 - (Used only for delayed message request) A 3-byte displacement of TDIR entry, right-justified, high-order byte:
X'00' return message and delete.
X'80' return message only.

External Routines:

IHKCDBIN -- Rolls in the designated slot directory.
IHKCDBTX -- Read specified text into I/O area.
IHKCHDSP -- Dummy waits in dispatcher.

Tables/Work Areas: Main storage copies of slot directories, 60-byte I/O area provided by calling routine, all DCBs are resident within IHKCDTMR.

Exits:

Normal -- Returns to calling routine with the following return codes:

0 - Message is in I/O area and register 1 points to the next message slot.
4 - No message available. If requested, the previous message is deleted.

Error -- A return code of something other than 0 or 4 indicates the offset address for an appropriate disk error message from IHKCDBIN or from IHKCDBTX.

Attributes: Reentrant (uses locked door function of dispatcher) and nonresident.

MESSAGE DELETE ROUTINE (CHART JJ)

Routine Name: IHKCDMDE

Entry Point: IHKCDMDE

Function: This routine searches the message slot directory for all active slots associated with a particular terminal, when one is found, it is marked inactive to logically delete the message text associated with this slot. If none are found, no action is taken by this routine.

At entrance to this routine register 1 points to a parameter list containing the following:

Word 1 - Address of RJE dispatcher.
Word 2 - Address of TDIR entry of terminal whose messages are to be deleted.
Word 3 - Address of TDIR.
Word 4 - Address of IHKCDTMR (an entry point in IHKCDFMR).

External Routines:

IHKCDBIN -- Rolls in message slot directory.
IHKCDFMR -- Writes updated TDIR entry to disk.

Tables/Work Areas: Terminal directory, in-core copy of message slot directory.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Reusable and nonresident.

SERVICE ROUTINES

RJE contains within its structure many resources that are commonly shared by many routines. These resources are:

- Freepool management
- Queue management
- Table management
- System message management
- Searches
- Scans

This section contains a description of each of these resources.

FREEPOOL MANAGER (CHART CF)

Routine Name: IHKCCPLM

Entry Point: IHKCCPLM

Function: Maintains the RJE Freepool.

The Freepool manager supplies queue entry blocks (QEBs) to the various modules that build queue entries for the RJE input and output streams. The QEBs are maintained in the RJE Freepool, a buffer pool consisting of two subpools:

- Subpool 1 contains the QEBs used for enqueuing RJE system messages.
- Subpool 2 contains the QEBs used for enqueuing job output on the terminal queues.

Each subpool is maintained through the use of a 6-byte pool control list (PCL). The format of the PCL is:

Bytes 0-3 -- Pointer to first QEB in the subpool.

Bytes 4-5 -- Number of QEBs in the subpool.

Each PCL is continually updated by the Freepool manager.

Note: The size of the Freepool is a function of the number of lines supported. Each RJELINE macro generates four message QEBs and ten job QEBs unless respecified by the user in the RJELINE macro instruction at RJE system assembly time. The QEBs are chained together during assembly of the system generation macros.

The Freepool manager may be used by three different subtasks simultaneously:

- Once to retrieve a message block,
- Once to retrieve a job block,
- Once to return either a job or message block.

If, when servicing a request to retrieve a block, the Freepool manager finds a subpool empty, it checks bit 5 of TDIRSTAT, bit 8 of TDIRSWCH for each entry in the terminal directory, and bit 0 of IHKCDRCS. If any bit is on (indicating a terminal failure or discontinue or closedown), the freepool manager gives control to the overload safety routine, IHKCAOSR, which clears the terminal queue, if it is not empty. When control is returned, the message and job QEBs freed are added to their respective subpools. If RJE is in the closedown situation, a dummy QEB is enqueued for the cleared terminal.

If no terminal directory entry satisfies one of the three conditions, the Freepool manager goes to the dispatcher to wait. This is possible since the Freepool manager may still be entered with a request to return blocks. When such a request is received, the Freepool manager services the request and then posts the Freepool manager ECB. When the dispatcher ECB scan reaches the Freepool manager ECB, control is returned to the Freepool manager, which services the retrieval request. The ECB in the Freepool manager can also be posted by the collector/emitter when any one of the conditions is set. This provision gives the Freepool manager control to clear the queues if it went to the dispatcher, without freeing any QEBs, before one of the conditions arose.

At entrance to this routine, register 1 points to a two-word parameter list. The first word specifies which subpool:

- Binary zero for subpool 1
- Any nonzero number for subpool 2.

The second fullword specifies what is to be done:

- Binary zero if a block is to be retrieved
- Address of the QEB if a block is to be returned.

External Routines:

IHKCAOSR -- Overload safety routine.
IHKCHDSP -- RJE dispatcher.

Tables/Work Areas: Freepool, terminal directory (read only).

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable.

QUEUE MANAGER ROUTINE (CHART CD)

Routine Name: IHKCCQMG

Entry Point: IHKCCQMG

Function: Enqueues or dequeues QEBs on or from a specified terminal queue and/or issues a RESETPL macro to interrupt any polling operations being performed by the collector/emitter.

RJE has one terminal queue for each terminal that the system supports. These queues are maintained through the use of QCLs (queue control lists -- bytes 16-27 of each TDIR entry). Each QCL is composed of three fields of four bytes each. These fields contain the following information about the queues:

- First queue entry pointer (FQEBP) -- contains the address of the first QEB in the queue.
- Last queue entry pointer (LQEBP) -- contains the address of the last QEB in the queue.
- Last message element pointer (LMELP) -- contains the address of the QEB representing the last RJE system message in the queue.

The RJE queue manager enqueues or dequeues QEBs on or from the terminal queues by updating the pointers in the QCL. The order of servicing a queue is first-in-first-out (FIFO) within each output class. The system message class has priority over the class of job output. A typical queue entry is shown in Figure 5.

In addition to the normal job and message QEBs, the queue may contain two types of dummy QEBs. These are used to indicate to the line analysis write routine that the broadcast messages and/or the delayed messages are to be sent to a terminal. These dummy QEBs differ from the normal message QEBs in two ways:

- The high-order byte contains a X'84' if delayed messages are to be sent, or a X'88' if broadcast messages are to be sent.
- The 60-byte message field does not contain a message.

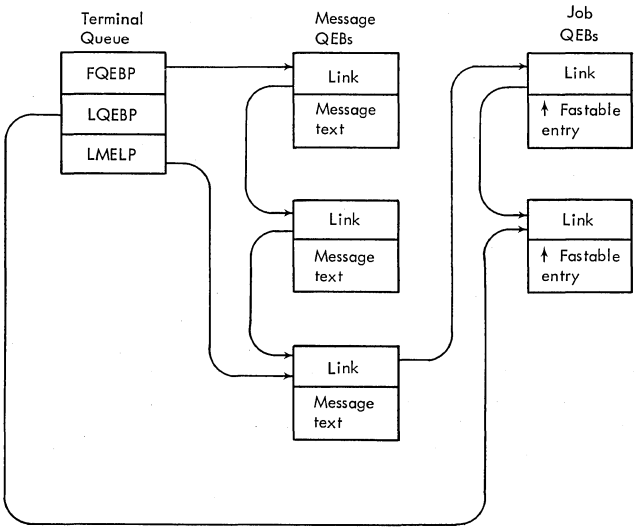


Figure 5. Typical Terminal Queue

When any QEB is enqueued for an active terminal, a RESETPL macro is issued to interrupt any polling operations being performed by the collector/emitter.

At entrance to this routine register 1 points to a parameter list consisting of two fullwords. Word one contains the address of the terminal directory entry of the terminal under consideration. Word two indicates whether to enqueue or dequeue. If a dequeue request is to be serviced this word is a binary zero. If an enqueue request is to be serviced, this word contains the address of the QEB to be enqueued. If only the RESETPL macro is to be issued, the first byte of the second word contains a X'FF'. If a STOP RJE command has been entered and a RESETPL macro instruction is to be issued for the lines, word one contains a zero and word two contains the address of the DECB for the line that is to be reset.

External Routines: None.

Tables/Work Areas: Terminal directory (read only), Freepool.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable.

TABLE MANAGER ROUTINES (CHART JA)

The RJE task has four system control tables:

Fastable
JED table
User directory (UDIR)
Terminal directory (TDIR)

Three of these, the Fastable, the UDIR, and the TDIR exist in their entirety (are maintained) in main storage and also in three separate disk data sets. The fourth, the JED table, is maintained only in a disk data set. These data sets are created by the utility program IHKINTAB, and maintained by the table manager and by the rollin and rollout routines.

The table managers are a collection of routines, in one module, which service all I/O requests involving the four disk data sets containing the RJE system control tables. The access method used is XDAP.

Routine Name: IHKCDFMR

Entry Points:

IHKCDOMR -- Must be called before any of the other managers are used. It opens the four disk data sets used by the table managers and, in addition, opens the three disk data sets used by the broadcast-message processors (see section on Command Processing). This routine is called by IHKCDRIN (rollin routine) to prepare the disk tables at RJE system startup.

IHKCDFMR -- Writes to the disk data set (DDNAME=IHKFSTDD) one record from one entry of the main storage Fastable.

IHKCDUMR -- Writes to the disk data set (DDNAME=IHKUDRDD) one record from one entry of the main storage user directory.

IHKCDTMR -- Writes to the disk data set (DDNAME=IHKTDRDD) one record from one entry of the main

storage terminal directory.

IHKCDJMR -- Services both read and write requests between the disk data set containing the JED table (DDNAME=IHKJEDD) and a calling routine work area in main storage.

IHKCDCMR -- Closes the seven disk data sets used by the table managers and the broadcast-message routines. Once this call is made no further reference can be made to any of these seven data sets. This routine is called by IHKCSTAP (stop routine) to finalize the disk tables at RJE system closedown.

IHKCDCBS -- A list of three addresses of the three DCBs used by the broadcast-message routines.

The table manager contains the four DCBs needed for its operations. These DCBs remain open while RJE is an active task and are closed when the task is terminated. This routine also contains three other DCBs that are not used by the table manager (other than being opened and closed along with the four actually used by this routine). These other three DCBs are provided for the broadcast-message processors, which are nonresident I/O handlers.

External Routines: None

Tables/Work Areas: Fastable, JED table, user directory, terminal directory.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Reentrant.

THE ROLLIN ROUTINE (CHART JI)

Routine Name: IHKCDRIN

Entry Point: IHKCDRIN

Function: At system startup IHKCDRIN is used to restore the main storage copies of the Fastable, the TDIR, and UDIR to their status prior to the last closedown. The second byte of the last entry of the Fastable is checked to determine if the previous closedown was normal (by STOP command) or abnormal (RJE abended). The type of closedown is indicated to the calling routine by a return code in register 15:

0 - Normal closedown.
4 - Abnormal.

The byte is then zeroed and the entry is written to the Fastable.

External Routines:

IHKCDFMR -- Fastable manager - writes the last record of the Fastable to the disk data set.

IHKCDOMR -- Opens the disk data sets.

BSAM -- Standard use is made of the OPEN, CLOSE, READ, and CHECK macros.

Tables/Work Areas: None.

Exits:

Normal -- Register 15 contains a zero return code to indicate that the tables were brought into main storage by IHKCDROT, the rollout routine, as a result of a normal RJE closedown. X'FF' is in the high-order byte of the fourth word of the calling routine save area.

Error -- Register 15 contains a return code of either four or eight to indicate one of the following conditions:

4 - indicates that an error that prevented sucessful rollin of the RJE data sets was encountered. Either a data set could not be opened or an irrecoverable I/O error occurred while reading the data sets into main storage.

8 - indicates that the tables were brought into main storage by other than the IHKCDROT routine as the result of an abnormal RJE closedown. X'FF' is in the high-order byte of the fourth word of the calling routine save area.

Attributes: Reusable and nonresident.

BUILD MESSAGE ROUTINE (CHART BD)

Routine Name: IHKCRUMB

Entry Point: IHKCBLDM

Function: This routine builds RJE system messages by combining message parameters, passed to it from the calling routine(s), with "canned" message texts obtained from the system message data set (IHKCHOFS).

On entry to this routine, register 1 contains the address of an input parameter list, which is in the following form.

Bytes	Contents
0-3	Address of the terminal directory

entry for the terminal to which the message is to be sent.

4-5	The message offset.
6	Message length indicator.
7-End	Message parameters.

The value passed in the terminal identifier field (word 1) of the input parameter list indicates message disposition as follows:

1. If the terminal identifier field is zero, the message is built and enqueued to the central operator by issuing an SVC 35 (WTO).

2. If the high-order bit of the terminal identifier is one, the message is built but not enqueued. The address of the 60-byte message is returned to the calling routine in register 1.

3. If a terminal directory entry address is specified in the terminal identifier, the message is built into a queue entry block furnished by the manager of the RJE Freepool (IHKCCPLM). The message QEB is passed to the RJE queue manager (IHKCCQMG) for enqueuing on the proper terminal queue, if the enqueue messages bit in the terminal directory is on. Otherwise the message is put on the message-pending data set.

External Routines:

IHKCCPLM -- Retrieves or returns terminal queue entry blocks to the Freepool.
IHKCCQMG -- Enqueues these blocks on proper terminal queues.
IHKCHOFS -- Contains the "canned" message text portion of the messages. This routine is not executable.
IHKCDMEQ -- Enqueues a message on the message-pending data set.

Tables/Work Areas: IHKCHOFS is a table containing a series of pointers to and text of system messages.

Exits:

Normal -- Returns to calling routine. Register 1 may contain the address of a 60-byte message if so indicated in the terminal identifier field.
Error -- None.

Attributes: Serially reusable and reentrant. There is a locked door on the routine that allows only one user to use the routine at a time. The one exception is for the user who requests the return of a message. He may enter the routine at any time.

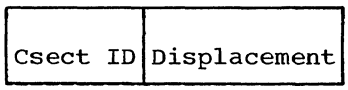
RJE MESSAGE DATA SET

Routine Name: IHKCHOFS

Entry Points:

IHKCHOFS -- Contains the table of resident and nonresident RJE messages.
IHKCHUMO -- Contains the resident RJE messages.

Function: This module contains two control sections, IHKCHOFS and IHKCHUMO. IHKCHOFS is a table containing the locations of any RJE message, whether it is resident or nonresident. The format of each table entry is as follows:



where:

Csect ID is a byte containing either X'FF', if the message is resident, or the last character of the control section name, if the message is nonresident. All message control section names begin with the letters IHKCHUM.

Displacement is a byte containing the hexadecimal displacement of the address of the message in the location within its own control section.

External Routines: Nineteen nonresident message text control sections that are not executable. The addresses of the messages (labels beginning with the letter O) precede the messages themselves (labels beginning with the letter M).

Exits: Not applicable.

Attributes: Resident and not executable.

SEARCH ROUTINES

There are four routines that search the RJE internal tables:

General search routine.
Job search routine.
Search terminal directory routine.
Search user directory routine.

A brief description of each of these routines follows.

General Search Routine (Chart CB)

Routine Name: IHKCCSGN

Entry Point: IHKCCSGN

Function: Performs serial search of the Fastable (IHKCDFTB) for the first job meeting conditions specified by an input parameter list.

At entrance to this routine register 1 points to a parameter list containing the following:

1. Start location - the first fullword contains the address of an entry in the Fastable at which the search is to start. If this word is a binary zero, the search begins at the first entry in the Fastable.

2. Source Prefix - the next three bytes contain the prefix of the user who submitted the job being searched for by this routine. If the source prefix contains a binary zero, a search is made for a job for which the destination prefix is indicated by a valid receiver, regardless of by whom the job was submitted.

3. Destination Prefix - the next three bytes contain the prefix of a user who is a valid receiver of the job for which a search is being made. This prefix may be identical to the originator prefix, provided the originator prefix is not zero, except in those cases specified below.

4. The last byte contains a character designating the job status option -- state of completion -- chosen by the calling routine:

   C - Search for the first job for which the destination prefix is a valid receiver of job output. The job may be in any stage of completion or delivery.

   O - Search for the first completed job for which the destination prefix is a valid receiver, but which is not already enqueued for delivery. Such a job will be referred to as a type N job.

   A - Search for the first type N job for which the destination prefix is not already notified or alerted.

T - Search for the first type N job for which the notify-pending RJSTART bit is set to 1, and for which the source has not been notified. In this case the source and destination prefixes must be identical.

L - Search for the first type N job for which one of the notify-pending LOGON or notify-pending RJSTART bits is set and the destination prefix has not been notified. In this case the source prefix must contain a binary zero.

I - Search for the first type N job for which the bypassed output bit for the destination prefix is set to 1.

External Routines: None.

Tables/Work Areas: Fastable.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable.

Job Search Routine (Chart JB)

Routine Name: IHKCDSCH

Entry Point: IHKCDSCH

Function: The job search routine searches the Fastable for a given jobname. When a matching jobname is found, a pointer to the first byte of the Fastable entry that contains the jobname is returned in register 1. If a matching jobname is not found, a pointer to an available entry in the Fastable (indicated by a X'40' in the first byte) is returned. If a matching jobname is not found and the Fastable is full, register 1 remains unchanged and register 15 contains an 8.

At entrance to this routine register 1 contains a pointer to an eight-byte jobname. If the jobname is less than eight characters, it is left-justified and padded with blanks (X'40').

External Routines: None.

Tables/Work Areas: Fastable.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable.

Search Terminal Directory Routine (Chart BC)

Routine Name: IHKCBSTD

Entry Point: IHKCBSTD

Function: Performs serial search of terminal directory for a specified terminal name. If the terminal name is found a pointer to the TDE is returned in register 1. If it is not found, register 1 remains unchanged.

External Routines: None.

Tables/Work Areas: Terminal directory.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable.

Search User Directory Routine (Chart CA)

Routine Name: IHKCCSUD

Entry Point: IHKCCSUD

Function: Searches user directory for a specified user prefix. If it is found, a pointer to the associated user directory entry is returned in register 1. If it is not found register 1 contains zero.

External Routines: None.

Tables/Work Areas: User directory.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable.

SCAN ROUTINE (CHART CC)

Routine Name: IHKCCSCN

Entry Point: IHKCCSCN

Function: Scans for the first character of a given character string or for the first nonblank character.

The scan routine is used by the command interpreter to locate the text in each JECL record, and by the RJE reader to locate the verb on JCL and JECL records.

At entrance to this routine register 1 points to a variable length parameter list. The contents of the parameter list are defined as follows:

First halfword -- contains the number of characters to which scan is sensitive. If this number is a binary zero, Scan searches for the first nonblank character.

Second fullword -- contains the starting address for the scan.

Third fullword -- contains the address of a stopping point for the scan. The remaining part of the parameter list is a variable length character string $C_1,C_2,C_3,C_j...C_n$ containing the characters to which the scan is sensitive. The maximum length of this character string is 12.

External Routines: None.

Tables/Work Areas: None.

Exits:

Normal -- Register 15 contains one of the following indicators:

- 0 - If no sensitive character or nonblank was found.
- 4 - If a find was made on a request to scan for the first nonblank character.
- 4j - If a hit was made on the j-th character of the character string $C_1C_2...C_j...C_n$.

Register 1 in all cases of a find contains the address of the character found. It remains unchanged if no character was found.

Error -- None.

Attributes: Serially reusable.

MESSAGE SCAN ROUTINE (CHART AY)

Routine Name: IHKCAMSN

Entry Point: IHKCAMSN

Function: Scans a given message for quote marks, resolves imbedded double quotes (i.e., changes them to single quotes), and checks for a maximum allowable message length. The end of a text field is recognized by a single quote followed by a blank, comma, or right parenthesis.

External Routines: IHKCCSCN.

Tables/Work Areas: None.

Exits:

Normal -- Returns to calling routine with zero in register 15.

Error -- Register 15 contains one of the following return codes:

- 4 - Embedded quote is not double - scan terminated.
- 8 - Trailing quote is missing.
- 12 - Message exceeds maximum allowable length.

Attributes: Serially reusable.

OVERLOAD SAFETY ROUTINE (CHART AQ)

Routine Name: IHKCHOSE

Entry Point: IHKCAOSR

Function: This routine clears a terminal queue in the case in which the Freepool manager senses that a Freepool resource has been depleted, and that a terminal failure or discontinue or closedown has occurred.

For each job removed from the queue, the terminal directory entry and the user directory entry are marked as having bypassed output. Also the enqueued bit is set off, and the bypassed bit set on, in the Fastable entry. All table entries are written to disk and the job queue entry block (QEB) is returned to the Freepool. For each message removed, the message is written to the disk delayed message data set and the message queue entry block is returned to the Freepool.

External Routines:

IHKCDTMR -- Table manager - Update TDIR entry.
IHKCCSUD -- Search UDIR - Search UDIR for user receiving a particular dequeued job.
IHKCDUMR -- Table manager - Update UDIR entry.
IHKCDFMR -- Table manager - Update Fastable entry.
IHKCCPLM -- Freepool manager - Return QEB to Freepool.
IHKCDMEQ -- Message enqueue - Write dequeued message on disk.

Tables/Work Areas: Terminal directory, user directory, Fastable.

Exits:

Normal -- Returns to calling routine.
Error -- None.

Attributes: Serially reusable.

INITIALIZE DISK FOR TABLE MANAGERS (CHART JC)

Routine Name: IHKCDINI

Entry Points: IHKCDINI

Function: Formats the space on disk allocated to each of the four data sets that will contain the system control tables, and writes the main storage tables to the appropriate disk data set.

This routine is run as a separate utility program. It is linkage edited with the RJE macro module, IHKAARJE, that contains the system control tables and is renamed IHKINTAB.

When IHKINTAB gets control, it loads all four DCBs with logical record size, and block size, and opens them. Using the length and number of bytes-per-entry constants defined in IHKAARJE to write blanks in each record in each table. IHKINTAB then closes the DCBs, sets them to note mode, and opens them. Each data set is rewritten noting the TTRs of each record in the corresponding entry in the main storage table. (Exception: JED table - the TTRs for this table are placed in the corresponding entry of the Fastable). IHKINTAB then issues a CLOSE macro (TYPE=T) to reset each data set to the beginning of the data set. The main storage tables with the TTRs are now written to disk and the DCBs are closed. The data sets are now ready for use.

External Routines: BSAM.

Tables/Work Areas: Fastable, terminal directory, user directory.

Exits:

Normal -- Returns to calling routine.
Error -- Abends with a system abend code of:
12 - Indicates a DCB failed to open.
13 - Indicates a write operation error.

Attributes: Reusable.

INITIALIZE DISK FOR BROADCAST AND MESSAGE PROCESSORS (CHART FF)

Routine Name: IHKCDBMI

Entry Point: IHKCDBMI

Function: Formats data sets required by the broadcast and message processors, which refer to a disk data set (DDNAME=IHKTXTDD) by means of BDAM. IHKCDBMI formats the space on disk allocated to this data set by writing a dummy record for each message. The TTR pointer for each record is placed in the corresponding entry in the main storage slot directory. The slot directories are then written to disk data sets created to contain them.

External Routines: BSAM.

Tables/Work Areas: The two slot directories are built into a 1150-byte constant area.

Exits:

Normal -- Returns to calling routine.
Error -- An abend code is placed in register 15:

12 - Indicates failure to open a DCB.
13 - Indicates a write error.

Attributes: Reusable.

RJE PROCESSING OF OUTPUT

The RJE writer (see Figure 6) gains control when a remotely submitted job is completed and is enqueued on the RJE SYSOUT queue by the OS queue manager.

The OS queue manager signals the RJE writer that a job is finished by posting the RJE writer ECB in the dispatcher. The SYSOUT dequeue routine builds a work area and interfaces with the OS queue manager (IEFQMDQ2) to dequeue the job from the SYSOUT queue. After the job has been dequeued, a portion of the work area is written to the JED table.

Program control is then passed to the JOBEND routine, which obtains the jobname from the work area. The jobname is used to search the Fastable for the entry for that job. JOBEND then marks the job as complete in the Fastable. Checking the entry for this job in the Fastable, JOBEND determines the disposition of the job; that is, immediate, deferred, or delete.

If output is immediate, JOBEND sets a return code of zero so that SYSDEQ may enqueue the job on the terminal directory queue designated in the Fastable.

Deferred output causes JOBEND to check the notify source bit in the Fastable. If the user wants to be notified, JOBEND interfaces with the build message routine, gets a message built, and enqueues it on the terminal queue. If the user did not request to be notified, the job output remains in the system until the user submits an OUTPUT command for that job.

If the output is to be deleted because the source has been removed from the user directory, JOBEND sets a return code of eight so that SYSDEQ can then remove the job from the JED table, and the output data set can be removed by the OS scratch routine.

After setting the proper return code (default is four), JOBEND passes program control back to the SYSDEQ routine that processes the job. It requests another job to be dequeued from the SYSOUT queue. If there is another job, the process is repeated. If the queue is empty, the writer subtask returns to the dispatcher to wait.

RJE WRITER

The RJE writer is composed of two routines:

SYSDEQ
JOBEND

SYSDEQ Routine (Charts BJ and BK)

Routine Name: IHKCHSDQ

Entry Point: IHKCHSDQ is the only entry point. On entry to this routine, IHKCHSDQ receives the queue control record (QCR) of the completed job on the RJE SYSOUT class queue. On exiting from CHSDQ one of the following events occurs:

1. JED table entries are updated for completed RJE jobs.

2. The job is deleted and a JED table I/O error message is sent to the appropriate recipients.

Function: This routine provides the SYSOUT interface with the OS queue manager and initiates RJE processing of jobs executed in the operating system. The specific functions of the SYSOUT dequeuer and its interfaces with the operating system are as follows:

1. At system startup the ECB for the writer subtask is posted as complete by the initializing routines. An exclusive entry to the OS queue manager by the SYSOUT dequeue routine is necessary, in order to furnish the operating system with the address of this ECB, regardless of whether or not output is available. Finally, the completion bit of the STOP Acknowledged ECB for IHKCHSDQ is set to zero to prevent rollout of this routine before it is completed.

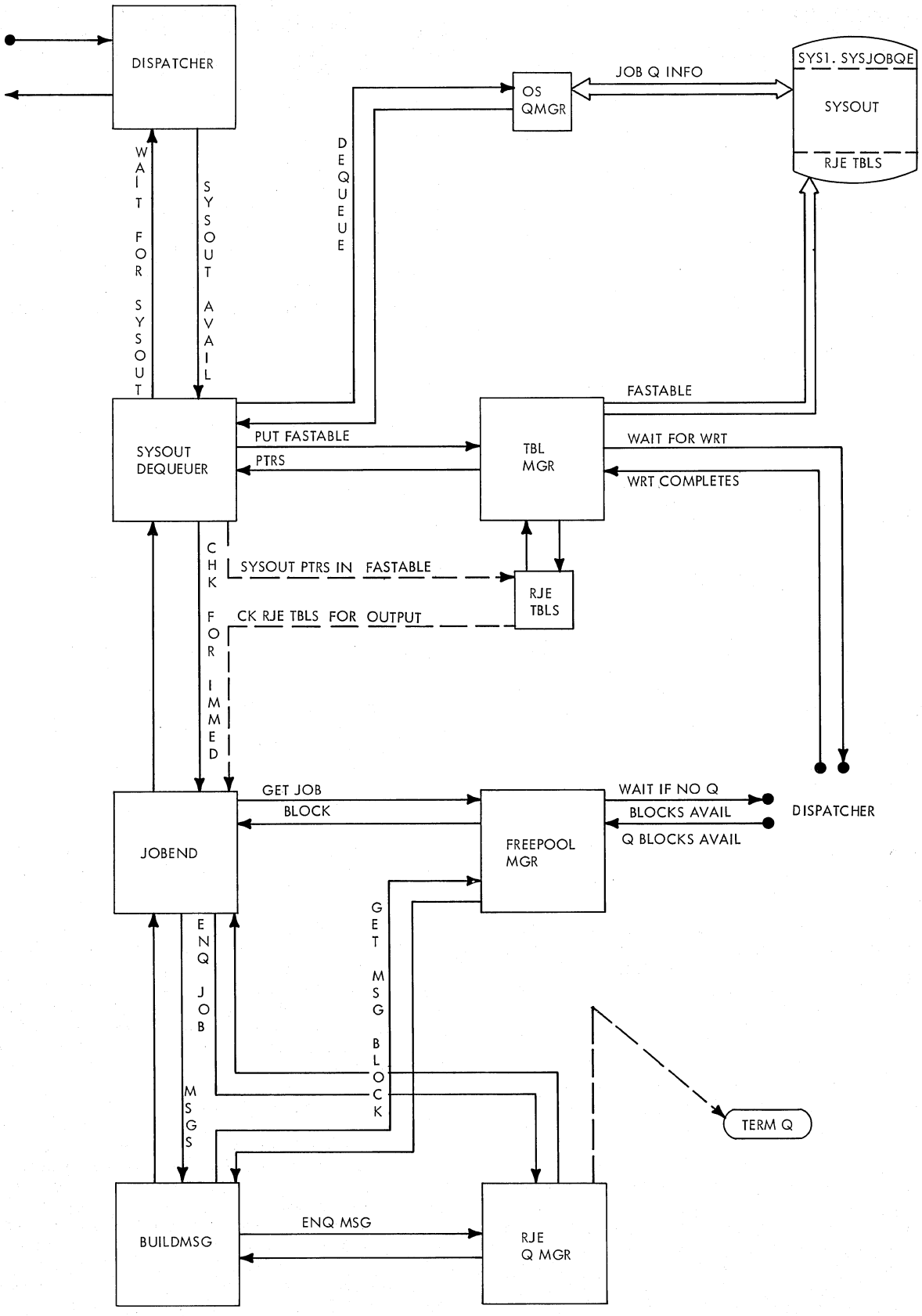


Figure 6. RJE Writer

2. The stop bit in the RJE communications switch is tested to determine whether a stop RJE situation is pending in the system (that is, whether the operator entered a STOP RJE command). If the stop bit is set on, the SYSDEQ busy bit in the RJE communications switch is set off; the SYSDEQ STOP Acknowledge ECB is posted, and control is returned to the dispatcher waiting for a dummy unposted ECB.

3. If a STOP RJE command is not pending, the OS queue manager parameters are built, and a dequeue request is made to determine if there is any work on the RJE SYSOUT queue. The parameters are as follows:

   a. Queue manager parameter area (QMPA) is cleared to zero.

   b. Chain SMB/DSB (system message block or data set block) to QMPAE (queue manager parameter area extension).

   c. Chain QMPAE to QMPA.

   d. Place class code in QMPA.

   e. Place SYSDEQ QMGR ECB address in QMPA (must be zero).

   f. Set dequeue code in QMPA.

   The calling sequence to the OS queue manager dequeue module is as follows:

```
LA    1,queue manager parameter area

L     15,IEFQMDQ2 Entry point
      address from AVT

BALR 14,15.
```

   The OS queue manager returns a code of zero, four, or twelve in register 15 to indicate the status of the request:

```
 0 -- Work is currently on queue
 4 -- No work on queue
12 -- I/O error while reading or writ-
      ing from SYS1.SYSJOBQE.
```

4. If the QMGR return is zero, SYSDEQ sets the SYSDEQ busy bit on in the RJE communications switch and searches the Fastable for the jobname. If the job is not found or the job found is marked as complete, the job is deleted in RJE and in the operating system. A message is sent to the central operator informing him of the deletion.

   The JED table for the job is read into main storage and is updated with the QCR (queue control record) for the dequeued job, and then is written back to disk. If writing the JED table to disk incurs an I/O error, the job is deleted in the operating system and in RJE, and an error message is returned to the user submitting the job. If the JED update is successful, the user and work station are verified. If either the user or the work station is not found in its respective directory, the job is deleted in the operating system and in RJE, and the central operator is notified of the deletion.

   If the user and the work station are validated, the job delete bit is checked in the Fastable. If the bit is on, control is passed to IHKCGDT2 to delete the job in RJE and in the operating system. This job deletion condition occurs when a job is deleted from the input queue or when a job is deleted during execution.

   If the job is not to be deleted, control is passed to IHKCHNDJ to handle special processing of complete jobs; such as, notifying and alerting source and alternate recipients of job completion. The return code of IHKCHNDJ is checked for immediate or deferred output. A nonzero return code indicates deferred output and completion of SYSDEQ processing of the job. A zero return code indicates immediate output, and IHKCFQOP is given control to place the output on the associated work station output queue.

   After the dequeued job processing is complete, and after checking for a pending STOP RJE condition, a dequeue request for another job is made.

5. If the return code from the OS queue manager is four, no entries were found in the RJE SYSOUT class queue. The SYSDEQ busy bit is set off in the RJE communications switch, and control is passed to the dispatcher while SYSDEQ waits for work on the RJE SYSOUT class queue. SYSDEQ will regain control when work becomes available on the queue because the OS QMGR will post the ECB for which SYSDEQ is waiting in the dispatcher. If the SYSDEQ busy bit is off in the RJE communications switch when a STOP command is entered by the central operator, IHKCASTP will also post the SYSDEQ QMGR ECB as complete in order to accomplish normal RJE subtask closedown.

6. If the return code from the OS queue manager is twelve, an I/O error occurred. SYSDEQ sets the QMGR I/O error indicator in the RJE communications switch and initiates an RJE abnormal closedown by returning to the RJE reader module subtask exit that returns to the reader/interpreter end-of-data address.

7. Dummy waits are made after QMGR processing, and the completion status of each loaded program is processed with a posted ECB in the RJE dispatcher to insure ample time to process the communications lines.

External Routines:

IEFQMDQ2 -- To dequeue jobs from SYSOUT queue.
IHKCDSCH -- To search Fastable for dequeued job.
IHKCDJMR -- To read and write JED table to and from disk.
IHKCHNDJ -- For RJE processing of completed jobs.
IHKCHDSP -- Dispatcher for dummy waits.
IHKCGDT2 -- To delete jobs.
IHKCBLDM -- To send error messages.
IHKCCSUD -- To search user directory for user submitting the job.
IHKCBSTD -- To search terminal directory for the work station where user is or was last logged on.
IHKCFQOP -- To queue immediate job output on work station output queue.

Exits:

Normal -- Return to dispatcher to wait for work on the RJE SYSOUT queue.
Error -- Initiate abnormal RJE central closedown.

Tables/Work Areas: A 36-byte queue manager parameter area, an eight-byte queue manager parameter extension, and a 180-byte QCR input area are needed to interface with IEFQMDQ2.

Attributes: Not reusable.

JOBEND Routine (Charts EK and EL)

Routine Name: IHKCHNDJ

Entry Point: IHKCHNDJ

Function: This routine performs the following functions:

1. Marks the job as complete. Bit 0 of the Fastable delivery status byte (FASTDSB) is set to 1.

2. Handles delivery of immediate output.

   a. If the source has been removed from the user directory, this job is flagged for deletion by the delete routine.

   b. If jobs may be enqueued for the source terminal (bit 2 of the terminal directory status byte is on), the output of this job is flagged to be enqueued for delivery to the source by IHKCFQOP.

   c. If jobs may not be enqueued, bit 0 (bypassed output) of the user directory status byte, bit 0 (bypassed output) of the terminal directory status byte, and bit 0 (bypassed output source) of the Fastable delivery status byte extention (FASTDSBE) are set to 1.

   d. If the source work station is attached by a switched line, a message is written to the central operator requesting that he inform the source that there is output available when he submits an RJSTART command at his terminal. The central operator will call the remote terminal.

3. Handles notify requests for deferred output.

   a. If the notify source bit and the enqueue messages bit (bit 3 of TDIRSTAT) are on, the notify message is enqueued. If messages may not be enqueued because bit 4 of UDIRSTAT, bit 1 of TDIRSTAT, and bit 6 of FASTDSB (notify pending RJSTART bits) are set to 1, bit 3 of UDIRSTAT (notify pending LOGON) is also set to 1. The source will be notified when he logs on at another terminal or at RJSTART at his present terminal, whichever occurs first.

      If messages may not be enqueued and the source work station is attached by a switched line, a message is sent to the central operator requesting him to call the source terminal and inform it that a notify message is pending.

   b. If notify alternate is specified, and the alternate is logged on at his terminal, the notify message is sent. If the alternate is not logged on, bit 3 (notify pending LOGON) of the UDIRSTAT byte and bit 7 (notify alternate pending LOGON) are set to 1. The alternate user subsequently is notified at his next LOGON.

4. Handles specific alert requests.

   a. If the specific alert source bit (bit 5 of FASTJIB) is on, and messages may be enqueued for the source, he will be notified at job completion.

   b. If the specific alert alternate bit (bit 6 of FASTJIB) is on and messages may be enqueued for the alternate, he will be notified at job completion.

5. Handles general alert requests for source and alternate.
   Bits 1 and 2 of the status byte of the user directory entry for the source are checked. If set, the action taken is identical to that of the specific alert requests (see 4a). Bit 2 of the UDIRSTAT byte of the alternate's user directory entry is checked. If set, the action taken is the same as that for a specific alert for the alternate.

6. If the source was notified due to a notify or alert request, bit 4 of FASTDSB is turned on. For the alternate, bit 5 of FASTDSB is turned on. These bit settings indicate the appropriate action has been taken.

7. If the alternate has been removed from the user directory, notify and alert alternate requests will be ignored.

8. Checks the job delete bit (bit 3 of FASTJIB) for an attempt to cancel this job. If set, JOBEND sets a return code for IHKCHSDQ to delete the job. JOBEND then sends the JOB DELETED message to the remote work station. This signifies that all references to the job have been removed from the system.

Standard subroutine linkage conventions prevail at entry for this routine. Register 1 must contain the address of the following four-word parameter list aligned on a fullword boundary:

First word -- Address of JED table entry point.
Second word -- Address of terminal directory entry point.
Third word -- Address of Fastable entry point.
Fourth word -- Address of address vector table entry point.

External Routines:

IHKCCSUD -- Search user directory.
IHKCBSTD -- Search terminal directory.
IHKCBLDM -- Send messages to the central operator and to work stations.

Tables/Work Areas: User directory, Fastable, terminal directory, JED table, address vector table.

Exits:

Normal -- Returns to calling routine with one of the following return codes:

0 - job output should be queued.
4 - job output should not be queued.

Error -- None.

Attributes: Serially reusable, nonresident.

LOCKED DOOR FUNCTION IN RJE

One of the significant properties of RJE is that resources become available at uncontrolled intervals as far as the subtask is concerned. When a resource becomes available, the dispatcher gives program control to a subtask that may be waiting for a resource. When a subtask must wait for more of the same resource or for an additional resource, it branches to the dispatcher.

The RJE writer is an example of a subtask. The writer subtask normally waits for three resources or event completions:

1. Enqueued SYSOUT.
2. Completion of I/O by table manager.
3. Queue blocks for Freepool manager.

Because the writer must wait for three different resources, special care must be taken to assure that dependencies between the various modules of the subtask are properly resolved.

Consider the following example. Many RJE modules are used in more than one subtask. The RJE queue manager, for example, is used in the RJE writer subtask and in the RJE reader subtask. The queue manager, however, requires no special handling because while it is being used by one RJE subtask, it will not be used by another; that is, control can never be seized from one RJE subtask by another RJE subtask. An RJE subtask yields control by branching to the multiple wait in the dispatcher. An RJE subtask receives control only from the multiple wait in the dispatcher.

The Freepool manager is another module used by more than one subtask. (This module, however, does require special handling to keep problems from occurring.)

For example, the Freepool manager is entered by the RJE writer in order to get a message block to enqueue. If no blocks are available, control branches to the dispatcher to wait. At this point, it is possible that the reader subtask will be entered to process an input statement. This statement may require a message to be generated. The Freepool manager cannot be entered at this time. Because the Freepool manager has a wait in it, it is necessarily not reentrant; that is, the Freepool manager must yield control to the dispatcher before its processing is complete. If it were reentered at this time, the ECB would be placed in the position in the ECB list reserved for the reader subtask. The ECB is already in the list for the writer subtask. If the Freepool manager ECB were also placed into the ECB list for the reader, the ECB list would point to two identical ECBs -- the supervisor does not allow this.

In order to eliminate this problem, a subtask wishing to use the Freepool manager must be queued. That is, only one subtask may use the Freepool manager module at a time. If subtask 2 desires use of the Freepool manager when subtask 1 is not yet finished with it (this only happens if subtask 1 is waiting for more queue blocks to become available), it must wait in line until subtask 1 has finished with the module.

This waiting in line is accomplished in the following manner.

Subtask A calls upon Routine B for a service, and Routine B is already servicing a request for Subtask C. Routine B, which senses it cannot be entered by checking its busy bit, places Subtask A in a wait state by storing the registers of Subtask A, zeroing register 14, and exiting to the dispatcher. The dispatcher upon being entered, checks register 14 for zero. If it is zero, it flags the STCB of Subtask A to indicate that this subtask is waiting for a reusable module. The dispatcher then changes the Subtask A ECB pointer in the ECB list to point to a dummy ECB. This ECB is never posted as complete. The dispatcher then enters a wait state. When control falls through the multiple wait, it scans the STCBs until it finds an ECB posted or a specially flagged STCB. Finding a posted ECB, the dispatcher returns control to the subtask represented by the STCB. In this case, it is possible that the STCB belongs to Subtask C. Routine B now finishes the Subtask C request, and the Routine B busy bit is reset. Subtask C eventually returns to the dispatcher and the multiple wait. Once again as control falls through the wait, the dispatcher scans the STCBs. It then encounters the flagged STCB and passes control to Subtask A at Routine B with a restoration of the registers for Subtask A. Being idle, Routine B can service the Subtask A request.

Thus the "locked door" function allows a reusable module to place a task in the wait state until the reusable module is able to be entered again.

This appendix contains a description of the control blocks used by the RJE task. The following blocks are included:

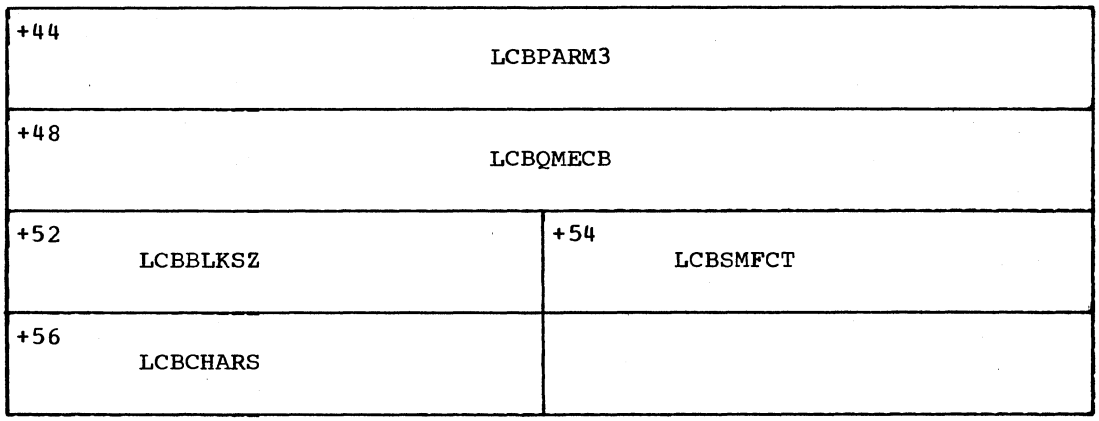
Line control block
Subtask control block

Line Control Block (LCB): Located in control section, IHKCDTBL, is generated by RJELINE system generation macro.

The LCB contains a list of pointers used by the line scheduler, line analysis read, and line analysis write routines.

+0 LCBTYPLN	+1 LCBDDECB
+4 LCBLDECB	
+8 LCBNSWFL	+9 LCBBUFER
+12 LCBTDIR	
+16 LCBTABNM	+17 LCBDFTRM
+20 LCBDDNAM	
+28 LCBWORKA	
+32 LCBFLAG	+33 LCBCTMTB
+36 LCBPARM1	
+40 LCBPARM2	

Figure 7. Line Control Block (Part 1 of 2)



The length of each LCB is 58 bytes

Figure 7. Line Control Block (Part 2 of 2)

Definition of names

Byte 0 - LCBTYPLN (1 byte) - Indicates the type of line with which an LCB is associated. It is set as follows:

X'FF' - switched line
X'FE' - point-to-point line
X'FD' - multipoint line
Set by LST at initialization.
Checked by LRD, LST, LWR, LWT, XMT.

Byte 1 - LCBDDECB (3 Bytes) - Contains the address of the disk DECB for a line. The disk DECB is used for writing SYSIN data and for reading SYSOUT data. The ECB is also passed to IHKQMNGR to be posted when the queue manager function is complete.
Set by RJELINE macro.
Checked by ALC, LRD, LST, LWR, XMT.

Byte 4 - LCBLDECB (4 bytes)
The first byte, LCBFLG, contains switches that are used for RJE World Trade Support.

Bit 0 - Not used.

Bit 1 - IBM 3977 data set (is/is not) present on the line.
'0' - is not
'1' - is
Set by RJELINE macro.
Checked by XMT.

Bit 2 - A switched world trade modem (is/is not) present.
'0' - is not
'1' - is
Set by RJELINE macro.
Checked by XMT.

Bit 3-7 - Not used.

The remaining three bytes contain the address of the line DECB for a line. The line DECB is used for reading from or writing to the line.

Set by RJELINE macro.
Checked by LRD, LST, LWR, LWT, XMT.

Byte 8 - LCBNSWFL (1 byte) - Contains switches that are used for one transmission only. The byte is zeroed (turned off) by LRD and by LWT upon entry.

Bit 0 - This (is/is not) the first text on page.
'0' - is
'1' - is not
Set by LWT.
Checked by LWT.
Turned off by LRD, LWT.

Bit 0 - There (are/are no) cards to be enqueued.
'0' - are no
'1' - are
Set by LRD.
Checked by LRD.
Turned off by LRD, LWT.

Bit 1 - There (was/was not) an error encountered in the input.
'0' - was not
'1' - was
Set by XMT.
Checked by LRD.
Turned off by LRD, LWT, XMT.

Bit 2 - Stop RJE (is/is not) being processed.
'0' - is not
'1' - is
Set by LRD
Checked by LRD.
Turned off by LRD, LWT.

Bit 3 - RJENDF (has/has not) been generated.
'0' - has not
'1' - has
Set by LRD.
Checked by LRD.
Turned off by LRD, LWT.

Bit 4 - RJSTART or LOGON required error (was/was not) encountered on an IBM 2780 on a switched line.
'0' - was not
'1' - was
Set by XMT.
Checked by LRD.
Turned off by LRD, LWT, XMT.

Bit 5 - Flush to EOT switch - XMT (should/should not) flush to EOT to send message to a 2780.
'0' - should not
'1' - should
Set by XMT.
Checked by XMT.
Turned off by LRD, LWT, XMT.

Bit 6 - XMT (should/should not) return to LRD to release the BTAM buffer, but not to enqueue the queue entry.
'0' - should not
'1' - should
Set by XMT.

Checked by XMT.
Turned off by LRD, LWT, XMT.

Bit 7 - ABEND switch - XMT (should/should not) ABEND after sending message.
'0' - should not
'1' - should
Set by XMT.
Checked by XMT.
Turned off by LRD, LWT, XMT.

Byte 9 - LCBBUFER (3 bytes) - Contains the address of a 452-byte output buffer area. The use of this area depends upon the activity on the line at any particular time. A description of the uses of this area follows. The decimal numbers refer to the bytes in the output buffer area.

0 - 47	Queue manager parameter area - used by ALC and LRD.
0 - 9	GETMAIN MF=E form - used by LWR.
48 - 447	400-byte disk output buffer for SYSIN - used by LRD.
48 - 449	402-byte line output buffer - used by LWT.
44 - 219	176-byte record of JECL and JCL for SYS1.SYSJOBQE - used by ALC and LRD.

The fields within the record are:

44 - 47	TTR0 of next record
48 - 127	first card
128 - 207	second card
208 - 211	relative terminal directory pointer
212	card indicator X'00' - two cards in record X'50' - one card in record X'10' - no cards in record
213 - 219	(Not used.)

224 - 235	Three-word save area for ALC
236 - 243	Two-word EXLST entry for DCB for SYSIN - used by ALC.
244 - 419	JFCB - used by ALC to allocate SYSIN data set.
373 - 443	Data link control characters, header, and 60-byte error message (total of 71 bytes) - used by XMT.
448 - 449	Number of characters in JOB name of JOB being read - used by ALC and LRD.

Set by RJELINE macro.
Checked by ALC, LRD, LWR, LWT, XMT.

Byte 12 - LCBTDIR (4 bytes) - Contains the address of the terminal directory entry for the terminal currently active on this line.
Set by LRD, LST.
Checked by ALC, LRD, LST, LWR, LWT, XMT.
Turned off by LST after a terminal on a switched line has been disconnected.

Byte 16 - LCBTABNM (1 byte) - Contains the number of entries in the terminal table. The terminal has one entry for each terminal on a multipoint line.
Set by RJELINE macro.
Checked by LST.

Byte 17 - LCBDFTRM (3 bytes) - Contains the address of the define terminal list for polling all the terminals on the line.

Set by RJELINE macro.
Checked by LRD, LST.

Byte 20 - LCBDDNAM (8 bytes) - Contains the eight-character DDNAME of the SYSIN DD card for this line.
Set by RJELINE macro.
Checked by LRD, XMT.

Byte 28 - LCBWORKA (4 bytes) - For LRD, it is the address of the BTAM input buffer. If LRD is entered at IHKABRJF, it is zero. For LWR and LWT, it is the address of the work area obtained by GETMAIN.
Set by LRD, LWR.
Checked by LRD, LWR, LWT, XMT.

Byte 32 - LCBFLAG (1 byte) - Contains flags that are used by LST to indicate what it is doing in the RJENDC process. These bits are set and checked only by LST.

Bit 0 - If on, it indicates that LST has gone to the dispatcher to wait for RJEND routine to process RJENDC.
Bit 1 - If on, it indicates that LST has gone to LRD to build RJENDC.
Bit 2 - If on, it indicates that LST has gone to LWR to send RJENDC message.
Bits 3-7 - (Not used.)

Byte 33 - LCBCTMTB (3 bytes) - Contains the address of the terminal table. Each entry in the table is six bytes long. The first entry has the address of the current entry in the first four bytes and a switch in the last two bytes. The rest of the entries contain one (for 1130) or two (for 2780) polling characters in the first two bytes and the address of the terminal directory entry in the last four bytes. There is one entry in this table for each terminal on a multipoint line. This table is used only by LST.

If LST is reading input, it uses this table to find the terminal directory pointer, which corresponds to the polling characters for the terminal that submitted input. This terminal directory pointer is passed to LRD in LCBTDIR.

If LST is checking to see if output is available for any terminal on the line, it uses the terminal directory pointers in the table. When LST reaches the end of the terminal table entries, it sets the flag bytes in the first entry to X'8000'. If it reaches the end of the table again and the bit is still set, LST realizes there is no output available for any terminal on this line.

Set by RJELINE macro.
Checked by LST.

Byte 36 - LCBPARM1 (4 bytes) - Used to pass parameters to other routines.
Checked by ALC, LRD, LST, LWR, LWT, XMT.
Set by ALC, LRD, LWR, LWT, XMT.

Byte 40 - LCBPARM2 (4 bytes) - Used to pass parameters to other routines.
Set by ALC, LRD, LWR, XMT.
Checked by LRD, LWR, LWT, XMT.

Byte 44 - LCBPARM3 (4 bytes) - Used to pass parameters to other routines.

Set by LRD, LWR, XMT.
Checked by LRD, LWR, XMT.

Byte 48 - LCBQMECB (4 bytes) - Contains an ECB in the ECBLIST of IHKQMNGR. This ECB is posted when an OS queue manager function is needed. When it is posted, the POST macro puts X'40' in the high-order byte and the address of the parameter list in the low-order three bytes. The parameter list is actually LCBPARM1 and LCBPARM2.
Set by ALC, LRD, LWR, IHKQMNGR.
Checked by IHKQMNGR.

Byte 52 - LCBBLKSZ (2 bytes) - Contains the block size for the SYSIN data set that is specified in the SYSIN DD statement in the RJE procedure.
Set by ALC.
Checked by ALC.

Byte 54 - LCBSMFCT (2 bytes) - Contains the SMF record count of the SYSIN data set that is specified in the SYSIN DD statement in the RJE procedure.
Set by LRD.
Checked by LRD.

Byte 56 - LCBCHARS (2 bytes) - Contains the number of characters in the jobname of the job currently being processed on the line.
Set by LRD.
Checked by LRD.

+0 Current Entry		+4 Flag Bytes
+6 Polling Chars.	+8 TDIR Pointer	
+12 Polling Chars.	+14 TDIR Pointer	
. . .	. . .	
+6n Polling Chars.	+6n+2 TDIR Pointer	

Where n is the number of terminals on this multipoint line

Figure 8. Terminal Table

Subtask Control Block: Located in control section, IHKCSTCB in module IHKAARJE. It is generated by the RJELINE system generation macro.

There is one subtask control block for each RJE subtask and for each communications line. It is used by the RJE dispatcher to determine to which subtask to relinquish control.

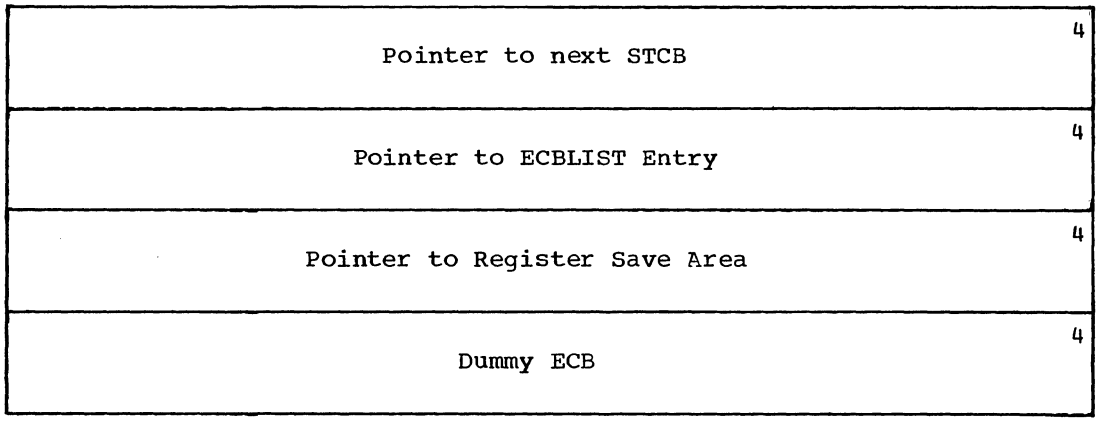


Figure 9. Subtask Control Block

Byte

0-3 - Pointer to next STCB in chain.

4-7 - Pointer to an ECBLIST entry for the subtask associated with this STCB.

8-11 - Pointer to the register save area for the subtask associated with this STCB.

12-15 - A dummy ECB that is initially posted. This allows each subtask to gain control at system startup for initiation.

APPENDIX B: RJE CONTROL TABLES

There are five tables for the RJE system.

Table Name	Main Storage Code Name	Disk DDNAME
Fastable	IHKCDFTB	IHKFSTDD
JED table	(Disk only)	IHKJEDDD
User directory	IHKCDUDR	IHKUDRDD
Terminal directory	IHKCDTDR	IHKTDRDD
Line Table	IHKCDLNT	(Main Storage only)

Each table is composed of a sequential series of logical records, called entries. The contents of a table are defined by describing just one entry of the table.

With each type of table is associated a DSECT, which is a map of the contents of the entry. A description of the contents of any one table is really a description of the DSECT.

FASTABLE

The Fastable is a directory of all the active jobs within the RJE system. Each job is described in one entry of the Fastable. Additional information is stored on disk in the JED table at a location indicated by a pointer within each entry. Since all entries are identical in format, the DSECT below is the map of any one active entry.

+0 FASTNAME		
+8 FASTJIB	+9 FASTJEDT	
+12 FASTDSB	+13 FASTDSBE	+14 FASTTTR
+16 FASTTTR (Cont'd)	+17 FASTALT	
+20 FASTCNT	+21 FASTUSE	

Total length is 24 bytes

Figure 10. Map of One Entry in Fastable

Definitions of Names

1. FASTNAME - 8 Bytes

   The name of the job from the user's job card. It identifies the job within the RJE system. If the first byte of the FASTNAME field is X'40', the entry is inactive and is available to receive a new jobname. If the first byte of the FASTNAME field is X'00', the entry should not be used. The corresponding JED entry is not correct.

   Set to X'40' by the line analysis write routine after a job is sent.
   Set to X'00' by IHKCDJMR.

2. FASTJIB - 1 Byte
   Each bit reflects either a parameter option or a condition of status of this job.

   Bit Definitions -
   Bit 0 - Immediate output.
   '1' - Immediate output is requested.
   '0' - Output is to be deferred.
   Set by JED processor.
   Checked by JOBEND.
   Reset for each new job by the JED statement.

   Bit 1 - Notify source.
   '1' - Inform source of job completion.
   '0' - Do not inform source of job completion.
   Set by JED processor.
   Checked by JOBEND.
   Reset for each new job by the JED statement.

   Bit 2 - Notify alternate.
   '1' - Inform alternate receiver of job completion.
   '0' - Do not inform alternate receiver of job completion.
   Set by JED interpreter.
   Checked by JOBEND.
   Reset for each new job by the JED statement.

   Bit 3 - Job Delete Bit - An attempt to cancel this job in the operating system was made by the reader or delete command processor.
   '1' - JOBEND deletes the job and sends the job deleted message.
   '0' - No attempt was made to cancel the job.
   Set by RJE reader and delete command processor.
   Checked by JOBEND.
   Reset for each new job by the JED statement.

   Bit 4 - JED Table notify information.
   '1' - There is information to be added to a notify message.
   '0' - There is no information to be added.
   Set by JED processor.
   Checked by JOBEND, ALERT, LOGON, RJSTART.
   Turned off by IHKABLWR when a job is discontinued.

   Bit 5 - Specific alert source.
   '1' - Requested by source.
   '0' - Not requested.
   Set by ALERT routine.
   Checked by JOBEND.

Turned off by the ALERT routine on an ALERT cancel command or by the RJEND routine if RJE closes down or if an RJEND command is submitted by a terminal where the source was last logged on.

Bit 6 - Specific alert alternate.
'1' - Requested by alternate.
'0' - Not requested.
Set by ALERT routine.
Checked by JOBEND.
Turned off by ALERT routine on an ALERT cancel command or by the RJEND routine if RJE closes down or if an RJEND command is submitted by a terminal where the alternate user was last logged on.

Bit 7 - CENTRAL parameter on JED card.
'1' - At least one output has been specified by the CENTRAL parameter.
'0' - There is no CENTRAL parameter specified.
Set by JED processor.
Checked by JOBEND.
Reset for each new job by the JED statement.

3. FASTJEDT - 3 Bytes
It identifies the location (on disk) of the JED table entry that contains additional information about this job.
It is changed by table manager when the JED entry cannot be written because of a disk error.

4. FASTDSB - 1 Byte
Each bit reflects a condition of this job.

Bit definitions

Bit 0 - Completion status of the job.
'1' - Job completed execution.
'0' - Job not completed.
Set by JOBEND.
Checked by the output routine, the STATUS routine, and the SHOW JOBS processor.
Turned off by the warmstart routine.

Bit 1 - Status of job delivery to source.
'1' - Enqueued for delivery to source.
'0' - Not yet enqueued for delivery.
Set by the output routine and by the LOGON and RJSTART routines via a call to output for delivery of bypassed output.
Checked by the output routine.
Turned off by the RJEND routine or the overload safety routine when purging job output from a terminal queue.
Turned off by the warmstart routine.

Bit 2 - Status of job delivery to alternate.
'1' - Enqueued for delivery to alternate.
'0' - Not yet enqueued for delivery.
Set by output.
Checked by output.
Turned off by the RJEND routine or the overload safety routine if a terminal queue is purged of job output.
Turned off by warmstart.

Bit 3 - Type of job termination.
'1' - The job terminated abnormally in the operating system.

'0' - The job either has completed normally, or has not completed execution (see bit 0).
Set by SYSDEQ.
Checked by JOBEND, RESTART, LOGON, ALERT, STATUS.
Turned off by warmstart.

Bit 4 - Source notification.
'1' - Originator has been notified or alerted that this job is complete.
'0' - Originator has not been notified nor alerted (he may not desire to be).
Set by JOBEND when notify message has been enqueued.
Set by LOGON and RJSTART if a notify message is sent for this job.
Checked by LOGON and RJSTART via IHKCCSGN if job has notify pending RJSTART bit on, and is for a specified user (LOGON) or terminal (RJSTART).
Turned off by warmstart.

Bit 5 - Alternate notification.
'1' - This alternate destination has been notified or alerted that this job is complete.
'0' - This alternate destination has not been notified or alerted (he may not desire to be).
Set by JOBEND when notify message has been enqueued.
Set by LOGON if an alternate notification message is enqueued for this job.
Checked by LOGON via IHKCCSGN if notify alternate pending LOGON bit is on.
Turned off by warmstart.

Bit 6 - Notify source pending RJSTART.
'1' - A requested notify or alert directed to this originator was attempted but not successful because terminal was not on-line.
'0' - Null.
Set by JOBEND when an attempt was made to notify alternate but terminal was down or alternate was not logged on.
Checked by LOGON via IHKCCSGN if notify pending LOGON bit in the user directory is on.
Turned off by warmstart.
Turned off by LOGON if alternate (FASTALT) corresponds to user logging on.

Bit 7 - Notify alternate pending LOGON.
'1' - A requested notify or alert directed to this alternate destination was attempted but not successful because the user was not logged on.
'0' - Null.
Set by JOBEND when an attempt was made to notify alternate but terminal was down or alternate not logged on.
Checked by LOGON via IHKCCSGN if notify pending LOGON bit in the user directory is on.
Turned off by warmstart.
Turned off by LOGON if the user logging on is the alternate (FASTALT).

5. FASTDSBE -- 1 byte

Bit definitions --

Bit 0 - Bypassed output source.
'1' - Output from this job was once logically available for transmission to the source, but was passed over

because the terminal was not available. This bit could be set as a consequence of purging the queue at RJEND, terminal failure, discontinue, or because an immediate output job completed after the terminal sent an RJEND command.

'0' - Output from this job has not logically become available for transmission to the source.

Set by warmstart when status of job delivery to source bit is on.
Set by RJEND or the overload safety routine when purging the terminal queue.
Set by JOBEND for an immediate output job completing after RJEND of the source terminal.
Checked by RJSTART or a servant routine of RJSTART.
Checked by LOGON.
Turned off by LOGON when reenqueuing this output.

Bit 1 - Bypassed output alternate.

'1' - Output of this job was logically available for transmission to the alternate, but was passed over because the queue on which it resided was purged.

'0' - Output from this job has never become logically available to the alternate.

Set by warmstart when status of job delivery to alternate bit is on.
Set by RJEND or the overload safety routine when purging the terminal queue.
Checked by RJSTART, or its servant routines.
Checked by LOGON.
Turned off by RJSTART when re-enqueuing.
Turned off by LOGON when re-enqueuing.

Bits 2-7 - (Not used.)

6. FASTTTR - 3 bytes
It is the relative track and record (TTR) address of this entry on the disk data set. It is set by the initialize utility program, IHKINTAB, and should never be changed. It is used by the table manager routine.

7. FASTALT - 3 bytes
User identification of the alternate receiver. If there is no alternate receiver, this field is a binary zero.
Filled in by JED processor.

8. FASTCNT - 1 byte
Count of RJE closedowns since creation of deferred output.
Incremented by the stop routine.
Checked by the SHOW DEFER routine.

9. FASTUSE - 3 bytes
User identification of the source (userid).
Filled in by JED processor.

JED TABLE

The JED table is a logical extension of the Fastable. However, in order to conserve main storage space (at the expense of execution time), the JED table is on disk rather than in main storage.

Each job has its own entry in the JED table, which can be found by means of a pointer in the job entry in the Fastable.

+0	JEDTNMSG
+25	JEDTSOUT
+50	JEDTQMPA
+86	JEDTQMPE
+94	JEDTTTR0

The length of each entry is 98 bytes

Figure 11. Map of One Entry in JED Table

Definition of names

1. JEDTNMSG -- 25 bytes
   Contains the text of the notify message input on JED card.
   This will be output along with notification of ready output.
   Unused characters are blanks.
   Set by JED processor.
   Read by ALERT, SYSDEQ, RJSTART, LOGON.

2. JEDTSOUT -- 25 bytes
   The first byte is the MSGCLASS assigned by the user. Each byte from 2-25 contains the SYSOUT device class as specified by the programmer on the JCL DD statement. These are listed in order of appearance within the JCL deck. If more than 24 SYSOUT statements appear within any one job, the default option assumed is the SYSOUT class for the printer.
   Set by JCL edit.
   Read by line analysis write.

3. JEDTQMPA -- 36 bytes
   The OS queue manager parameter area (JEDTQMPA) contains information necessary for the C/E to transmit the output from this job.
   Set by SYSDEQ.
   Modified by line analysis write.

4. JEDTQMPE -- 8 bytes
   The OS external queue manager parameter area is an extension of the JEDTQMPA.
   Set by SYSDEQ.
   Modified by line analysis write.

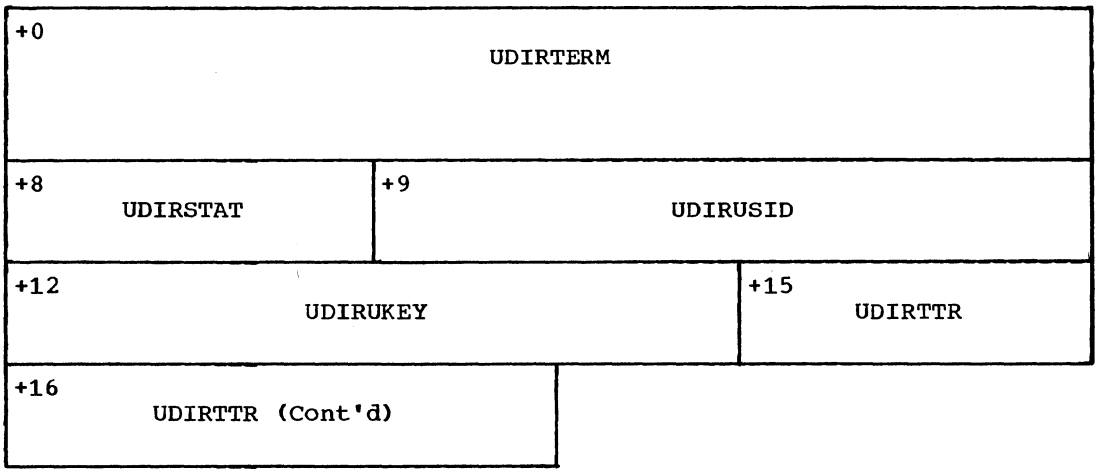
5. JEDTTTR0 -- 4 bytes
   Contains the first four bytes of an SMB/DSB for the next job.
   Set by SYSDEQ and line analysis write.

USER DIRECTORY

The purpose of the user directory is to keep a list of authorized users of the RJE system. A potential user must have his identification and an associated three-character code (key) stored within this directory prior to his logging on the system. The user identification and key submitted at LOGON time must agree with the corresponding entries in the user directory.

Other purposes of the directory are to maintain a description of user status within the RJE system and to identify the most recent terminal associated with the user.

The directory consists of a series of entries, one for each user. A map of one entry follows.



Total length is 18 bytes

Figure 12. Map of One Entry in User Directory

Definition of names

1. UDIRTERM -- 8 bytes
   Terminal name of the last terminal at which this user was logged on.
   Set by LOGON.
   Checked by SHOW USERS.
   Checked by command interpreter to determine validity of LOGON.

2. UDIRSTAT -- 1 byte
   Each bit describes a condition or status of the user.

   Bit definitions -
   Bit 0 - Bypassed output.

   '1' - An attempt to deliver output to this user was not successful because the terminal was in the inactive state, or because the queue was purged.
   '0' - No such condition exists.
   Set by RJEND or the overload safety routine if a queue that contains output for this user is purged.
   Set by JOBEND if immediate output for this user is bypassed because of a previous RJEND.
   Checked by RJSTART or its servant routines.
   Checked by LOGON when a user changes terminals.

Turned off by RJSTART or LOGON or the servant routines called by them.

Bit 1 - Minor alert.

'1' - Alert this user when any job submitted by him has finished.
'0' - Do not alert.
Set by ALERT.
Checked by JOBEND.
Turned off by the ALERT routine upon receiving the ALERT cancel command from this user.
Turned off by RJEND and RJENDC, not RJENDF.

Bit 2 - Major alert.

'1' - Alert this user when any job, whose output is to be sent to him, is completed.
'0' - Do not alert.
Set by ALERT.
Checked by JOBEND.
Turned off by the ALERT routine upon receiving the ALERT cancel command from this user.
Turned off by the RJEND routine when an RJEND or RJENDC command is received.

Bit 3 - Notify pending LOGON.

'1' - Notify a user of the completion of one or more jobs for which he is a deferred recipient.
'0' - No NOTIFY commands pending.
Set by JOBEND when an attempt was made to notify source. This bit is set so that the user will be notified if he changes terminals and logs on before the notify message is sent to his original terminal.
Set by JOBEND when an attempt was made to notify alternate, but terminal was down or alternate was not logged on.
Checked by LOGON.
Turned off by LOGON after all notify messages for a user have been sent.

Bit 4 - Notify pending terminal startup.

'1' - An attempt to notify or alert this user failed because his terminal was not on-line.
'0' - No such condition exists.
Set by JOBEND when an attempt was made to notify source.
Checked by RJSTART if notify pending RJSTART bit is on in the terminal directory entry.
Turned off by RJSTART if user was last logged on at the terminal submitting RJSTART.
Turned off by LOGON after all notify messages for this user have been enqueued.

Bit 5 - (Not used.)

Bit 6 - (Not used.)

Bit 7 - (Not used.)

3. UDIRUSID -- 3 bytes
Three-character identification of an authorized user. If first byte is X'40', entry is inactive.

4. UDIRUKEY -- 3 bytes
   Three-character user key must agree with the three-character key submitted by a potential user at LOGON time. This is to prevent an unauthorized user from submitting jobs.

5. UDIRTTR -- 3 bytes
   Relative track and record number (TTR) of this entry on the disk data set. It is set by the initialize utility program, IHKINTAB, and should never be changed. It is used by the table manager routine.

TERMINAL DIRECTORY

The purpose of the TDIR is to maintain a list of potential remote terminals supported by the RJE system.

Other information about the terminal is recorded here. The identification of the user who is currently logged on, as well as information concerning the status of the device, is also kept in this directory. It consists of a series of entries, one for each terminal.

Each entry of the terminal directory is expected to be on a word boundary. Each entry is a multiple of four bytes in length. A map of one entry follows.

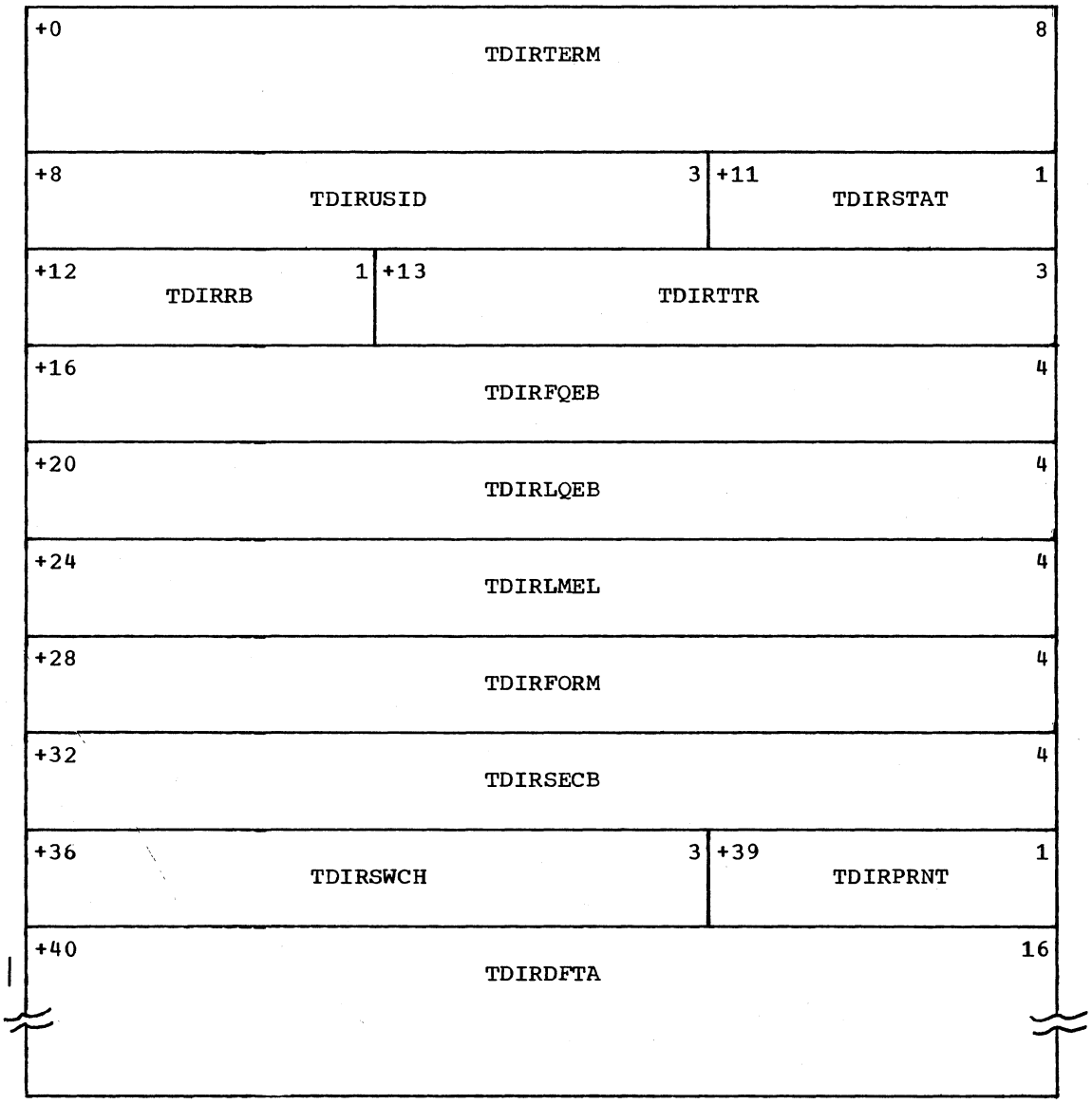
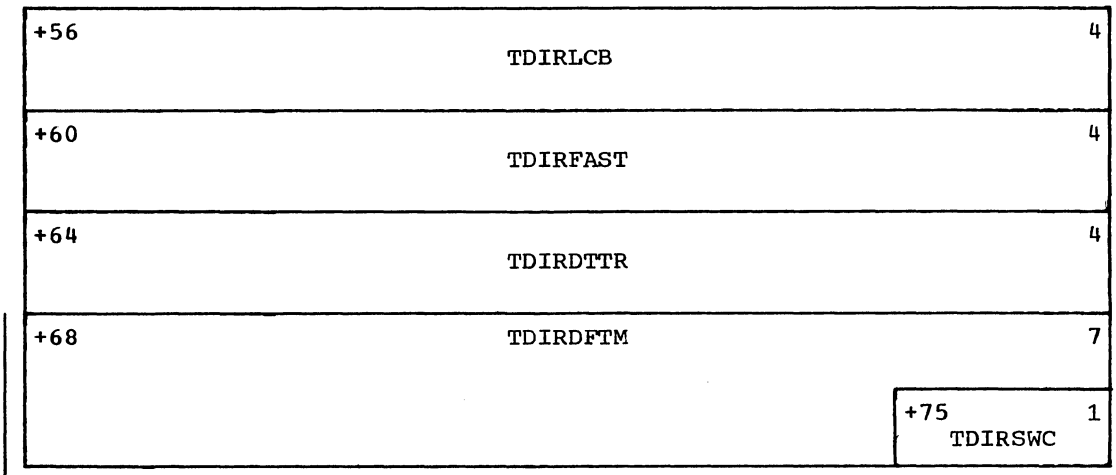


Figure 13. Map of One Entry in Terminal Directory (Part 1 of 2)



Total length of one entry is 76 bytes

Figure 13. Map of One Entry in Terminal Directory (Part 2 of 2)

1. TDIRTERM -- 8 bytes
   Eight-character identification of the terminal that is authorized as a work station of the RJE system.

2. TDIRUSID -- 3 bytes
   Userid of the user currently logged on. This field is zero if no user is logged on.
   Set by LOGON.
   Reset by RJEND or LOGOFF.
   Checked by SHOW USERS.
   Checked by command interpreter to determine validity of LOGON.

3. TDIRSTAT -- 1 byte

   Bit 0 - Bypassed output.
   '1' - Output for some user of this terminal was logically available but was not sent due to the occurrence of RJEND or clearing of queues by the overload safety routine prior to job transmission.
   '0' - No such situation exists.
   Set by RJEND or overload safety routine when purging a terminal queue of job output.
   Set by JOBEND when an immediate output job completes after the source terminal has submitted an RJEND command.
   Checked by RJSTART to determine if any bypassed output is available for reenqueuing.
   Turned off by RJSTART.

   Bit 1 - Notify pending RJSTART.
   '1' - A notify message for some user of this terminal was attempted but terminal was not on-line.
   '0' - No such notify condition exits.
   Set by JOBEND.
   Turned off by RJSTART.

   Bit 2 - Enqueue jobs.
   '1' - Job output may be enqueued on the queue for this terminal.
   '0' - Job output may not be enqueued.
   Set by RJSTART routine for RJSTART and CONTINUE.
   Checked by JOBEND when desiring to enqueue immediate output.

Checked by output when responding to the OUTPUT command.
Turned off by line scheduler when it senses that the stop ECB of the stop subtask is posted. This ECB is checked prior to issuing each READ Initial on a line.
Turned off by the line analysis read routine when a mechanical failure of a terminal is detected.
Turned off by the line analysis read routine when an RJEND is received.
Turned off by the line analysis write routine when a discontinue indication is received.
Turned off by RJEND or the overload safety routine before clearing jobs from a terminal queue.

Bit 3 - Enqueue Messages.
'1' - Messages may be enqueued for this terminal.
'0' - Messages may not be enqueued.
Set by RJSTART routine for RJSTART and CONTINUE.
Checked by message processor routine.
Checked by SHOW TERMS routine to determine whether the terminal is in active or inactive state.
Checked by the line analysis write routine to determine if a terminal is active.
Checked by JOBEND and SYSDEQ prior to generating any messages to be enqueued. If set, the messages are not generated until the next RJSTART is received from the terminal.
Checked by IHKCBLDM before enqueuing a message. If set, the message is put on the delayed message data set.
Turned off by RJEND routine after enqueueing the RJEND acknowledgment for this terminal.
Turned off by the RJEND routine after enqueueing a notification that RJE is closing down.
Turned off by RJEND routine upon receiving the RJENDF statement for processing.
Turned off by the line analysis read routine when a mechanical failure of a terminal is detected.

Bit 4 - Dequeue messages only.
'1' - Only messages may be dequeued by line analysis write.
Note: The line analysis write dequeues a message before writing it.
'0' - Anything on the queue may be dequeued by the line analysis write.
Set by line analysis read when an RJEND is received from the terminal.
Set by line scheduler when the stop ECB is posted.
Checked by line analysis write before each dequeue operation.
Checked by the pool manager routine to determine if RJEND has been received.
Turned off by RJSTART.

Bit 5 - Dequeue nothing.
'1' - No output is to be dequeued by line analysis write when this bit is set. A mechanical failure has disabled communications with this terminal.
'0' - Any available output may be dequeued for transmission.
Set by line analysis read upon sensing that communications with an active terminal are disabled.
Checked by line scheduler prior to calling line analysis write.
Checked by the pool manager routine to determine if there has been a line failure.
Turned off by RJSTART.

Bit 6 - RJETXT delayed message indicator.
'1' - Messages are on the delayed data set.
'0' - No messages are on the delayed data set.
Set by IHKCDMEQ when a delayed message for the terminal is enqueued.
Checked by RJSTART, which creates a dummy QEB with X'84' as first byte.
Turned off by line analysis write when every delayed message for the terminal has been deleted.
Turned off by IHKCDMDE.

Bit 7 - (Reserved.)

4. TDIRRB -- 1 byte

Bit 0 - EXLST switch.
'1' - Line analysis read has taken on EXLST exit before the SYNAD exit.
'0' - Line analysis read has not taken on EXLST exit before

Bits 1-3 - Not used.
Bit 4 - Compress/Expand switch
'1' - Compress/expand feature is present at the work station.
'0' - Compress/expand feature is not present.
Set by RJELINE at RJE assembly time.
Checked by the line analysis read routines and the output routing and transmitting routine (LWT).

Bit 5 - Multiple record transmission (MRT) switch
'1' - MRT feature is present at the work station.
'0' - MRT feature is not present.
Set by RJETERM at RJE assembly time.
Checked by the LWT routine.

Bit 6 - Status of compress/expand
'1' - Next record to be received is packed.
'0' - Next record to be received is unpacked.
Set by the line analysis read routines.
Checked by the line analysis read routines.
Turned off by RJEND.

Bit 7 - (Not used.)

5. TDIRTTR -- 3 bytes
It is the relative track and record number (TTR) of this entry on the disk data set. It is set by the initialize utility program, IHKINTAB, and should never be changed. It is used by the table manager routine.

The next 12 bytes represent the queue control list for the terminal queue of this terminal. These 12 bytes are cleared to zero by IHKCHNIP in a warmstart situation.
Checked by queue manager.

6. TDIRFQEB -- 4 bytes
It has the address of the first terminal queue entry block, if any are enqueued. It not, the three low-order bytes of this word are binary zero. The first QEB points to a message, if there are any messages.
Checked by the line scheduler and the line analysis write routines.
Turned off by IHKCHNIP.

7. TDIRLQEB -- 4 bytes
It has the address of the last terminal queue entry block if any

are enqueued. If not, its contents are meaningless.
Turned off by IHKCHNIP.

8. TDIRLMEL -- 4 bytes
It has the address of the last queue entry block representing a message element or message segment, if any are enqueued; otherwise its contents are meaningless. The last message QEB points to a job if there are any jobs.
Turned off by IHKCHNIP.

9. TDIRFORM -- 4 bytes
It contains the previous form number specified in the SYSOUT keyword parameter. It is initialized to the contents of the form number field in the DSB set when no form number is specified in the SYSOUT keyword.
Initialized to X'40' by RJETERM macro.
Set by the line analysis write routine.
Checked by the line analysis write routine.

10. TDIRSECB -- 4 bytes
The STOP ACK ECB is used by the stop subtask to wait for the completion of the closedown procedure executed for this terminal when the STOP RJE command is received from the console. This ECB is posted as complete by the collector/emitter (C/E) after the stop routine sets the RJE stop bit (bit 0 of IHKCDRCS), provided that the terminal has already submitted an RJEND statement and the RJEND procedure is complete. If this is not the case, an RJENDC is generated for the terminal and is placed in the input stream. The RJENDC routine posts an ECB in the C/E when the RJEND process is complete. The C/E then sends the closedown message to the terminal, closes down the line, and posts the STOP ACK ECB.

Bit Definitions

Bit 0 - Wait bit.

Bit 1 - Completion bit.

Bit 2-31 - Not available to RJE programs.

Turned off by IHKCHNIP.

11. TDIRSWCH -- 3 bytes

Bit Definitions

Bit 0 - DD DATA switch -- line analysis read (is/is not) currently processing SYSIN DATA following a DD DATA card.
'1' - Is
'0' - Is not
Set by the line analysis read routine.
Checked by the line analysis read routine.
Turned off by IHKCHNIP and the line analysis read routine.

Bit 1 -- DD * switch -- line analysis read (is/is not) currently processing SYSIN data following a DD * card.
'1' - Is
'0' - Is not
Set by the line analysis read routine.
Checked by the line analysis read routine.
Turned off by IHKCHNIP and the line analysis read routine.

Bit 2 - End of SYSIN switch.
'1' - Line analysis read should close SYSIN data set.

'0' - Line analysis read should not close SYSIN data set.
Set by the line analysis read routine.
Checked by the line analysis read routine.
Turned off by IHKCHNIP and the line analysis read routine.

Bit 3 - RJSTART switch -- line analysis read (has/has not) received an RJSTART card.
'1' - Has
'0' - Has not
Set by the line analysis read routine.
Checked by the line analysis read routine.
Checked by the line analysis write routine just before sending SOH 5 to a terminal that has submitted an RJEND.
Checked by IHKCASTP before doing RESETPL.
Turned off by the line analysis read routine.

Bit 4 - LOGON switch -- line analysis read (has/has not) received a LOGON card.
'1' - Has
'0' - Has not
Set by the line analysis read routine.
Checked by the line analysis read routine.
Turned off by IHKCHNIP and the line analysis read routine.

Bit 5 - (Reserved.)

Bit 6 - Job switch -- line analysis write (is/is not) currently sending a job data set to the terminal.
'1' - Is
'0' - Is not
Set by the line analysis write routine.
Checked by the line analysis write routine.
Turned off by IHKCHNIP and the line analysis write routine.

Bit 7 - RJENDF switch -- line analysis read (cannot/can) put an RJENDF card on a queue entry.
'1' - Cannot
'0' - Can
Set by line analysis read.
Checked by line analysis read.
Turned off by IHKCHNIP and the line analysis read routine.

Bit 8 - Discontinue switch -- line analysis write (has/has not) received an indication to discontinue job output.
'1' - Has
'0' - Has not
Set by line analysis write.
Checked by the line analysis write routine, the pool manager routine, and RJEND.
Turned off by IHKCHNIP and the line analysis write routine.

Bits 9-10 - Continue switches.
'00' - A CONTINUE command has not been received.
'01' A CONTINUE BEGIN command has been received.
'10' - A CONTINUE NO command has been received.
'11' - A CONTINUE (no operand) command has been received.
Set by command interpreter and RJSTART.
Set by the line analysis write routine after contention discontinue.
Checked by line analysis write, line scheduler, pool manager, RJEND.
Turned off by line analysis write.
Turned off by IHKCHNIP.

Bit 11 - Write to line.
'0' - WRITE Initial.

'1' - WRITE Continue.
Set by line analysis write.
Set by the line analysis read routine when sending an out-of-space error message.
Checked by line analysis write.
Turned off by line analysis write.
Turned off by IHKCHNIP.

Bit 12 - Line analysis write (is/is not) currently transmitting delayed messages from the message-pending data set.
'1' - Is
'0' - Is not
Set by line analysis write.
Checked by line analysis write.
Turned off by line analysis write.
Turned off by IHKCHNIP.

Bit 13 - Discontinue input switch -- line analysis read (has/has not) received an indication to retain the current data set because input is temporarily discontinued.
'1' - Has
'0' - Has not
Set by the line analysis read routine.
Checked by the line analysis read routine.
Turned off by by IHKCHNIP and the line analysis read routine.

Bit 14 - Disable switch -- collector/emitter (has/has not) disabled the switched line.
'1' - Has
'0' - Has not
Set by line analysis read.
Set by line analysis write.
Checked by line scheduler.
Turned off by IHKCHNIP.

Bit 15 - JED switch -- line analysis read (has/has not) received a JED card before a JOB card.
'1' - Has
'0' - Has not
Set by the line analysis read routine.
Checked by the line analysis read routine.
Turned off by IHKCHNIP and the line analysis read routine.

Bit 16 - The remote work station is attached by a (switched/nonswitched) line.
'1' - Switched line
'0' - Nonswitched line
Set by the line analysis read routine.
Checked by JOBEND.

Bit 17 - Machine type:
'0' - 2780
'1' - CPU
Set by the RJETERM macro.
Checked by the line analysis read routine (LRD, XMT) and the line analysis write routine (LWR, LWT).

Bit 18 - Is punch device available at the remote station?
'0' - Yes
'1' - No
Set by the RJETERM macro.
Checked by the line analysis write routine.

Bit 19 - JCL switch -- line analysis read (has/has not) received a JCL card.
'1' - Has
'0' - Has not
Set by the line analysis read routine.
Checked by the line analysis read routine.
Turned off by IHKCHNIP and the line analysis read routine.

Bit 20 - A new header (is/is not) required.
'0' - Is
'1' - Is not
Used by line analysis write only.

Bit 21 - Blocked output buffer status -- Output buffer to BTAM (is/is not) empty.
'0' - Is
'1' - Is not
Used by line analysis write only.

Bit 22 - Contention discontinued.
'1' - Transmission of output temporarily discontinued during line contention.
'0' - Null
Set by line analysis write.
Checked by line analysis write and line scheduler.
Turned off by line analysis write.

Bit 23 - Branch to LWR switch -- after an error, line analysis read (should/should not) direct line scheduler to branch to line analysis write.
'1' - Should
'0' - Should not
Set by line analysis read.
Checked by line analysis read.
Turned off by line analysis read.

12. TDIRPRNT -- 1 byte
Contains the number of characters per print-line on the remote terminal printer.
Set by RJETERM macro.
Checked by line analysis write (LWT).

13. TDIRDFTA -- 16 bytes
Multipoint line - Contains a polling list used by the line analysis read routine and the line scheduler routine for polling just this terminal.
Point-to-point line or switched line - This field is zero.

14. TDIRLCB -- 4 bytes
Contains the address of the line control block (LCB) for the line by which this terminal is connected.
Set by line analysis read.
Checked by line analysis read and RJE queue manager.
Turned off by IHKCHNIP.

15. TDIRFAST -- 4 bytes
Contains the address of the Fastable entry of the job that has been discontinued.
Turned off by IHKCHNIP.
Set by the line analysis write routine at discontinue time.
Checked by the line analysis write routine at continue time.
Turned off by the line analysis write routine when dequeueing a new QEB.

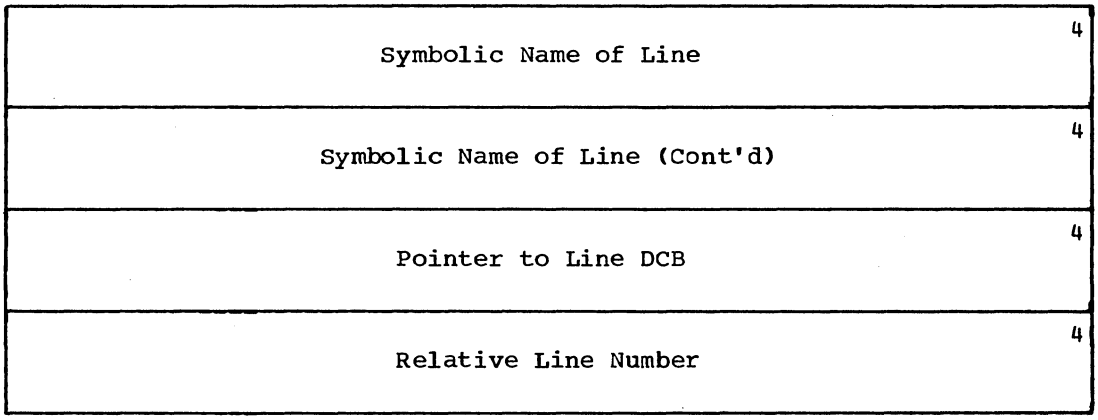
16. TDIRDTTR -- 4 bytes
    Contains the TTR0 of the first block to be sent upon receipt of a CONTINUE (no operand) command.
    Set by line analysis write (LWT) each time a block is sent.
    Checked by line analysis write (LWR) at continue time.
    Turned off by line analysis write (LWR) when dequeueing a new QEB.

17. TDIRDFTM -- 7 bytes
    Multipoint line - Contains the BTAM-defined terminal list used by the line analysis write routine for addressing.
    Point-to-point line or switched line - This field is zero.

18. TDIRSWC -- 1 byte
    Contains a check for the IBM 2770 Data Communication System.
    Bit 0-4 - Not used.
    Bit 5 - WACK (Was/was not) previously received.
        '0' - was not
        '1' - was
        Set by line analysis write (LWR).
        Checked by line analysis write (LWR).
        Reset by line analysis write (LWR).
    Bit 6 - The attached IBM 2770 work station (does/does not) have the expanded buffer feature.
        '0' - does not
        '1' - does
        Set by RJELINE macro.
        Checked by line analysis write routine.
    Bit 7 - The attached remote work station (is/is not) an IBM 2770.
        '0' - is not
        '1' - is
        Set by RJELINE macro
        Checked by line analysis write routine.

LINE TABLE

Used by the SHOW command processor when the user has specified in the SHOW command that he wants the line error print procedure. The information in the line table is established at RJELINE macro generation.



Each entry is 16 bytes

Figure 14. Map of One Entry in Line Table

APPENDIX C: LWKWORK WORK AREA

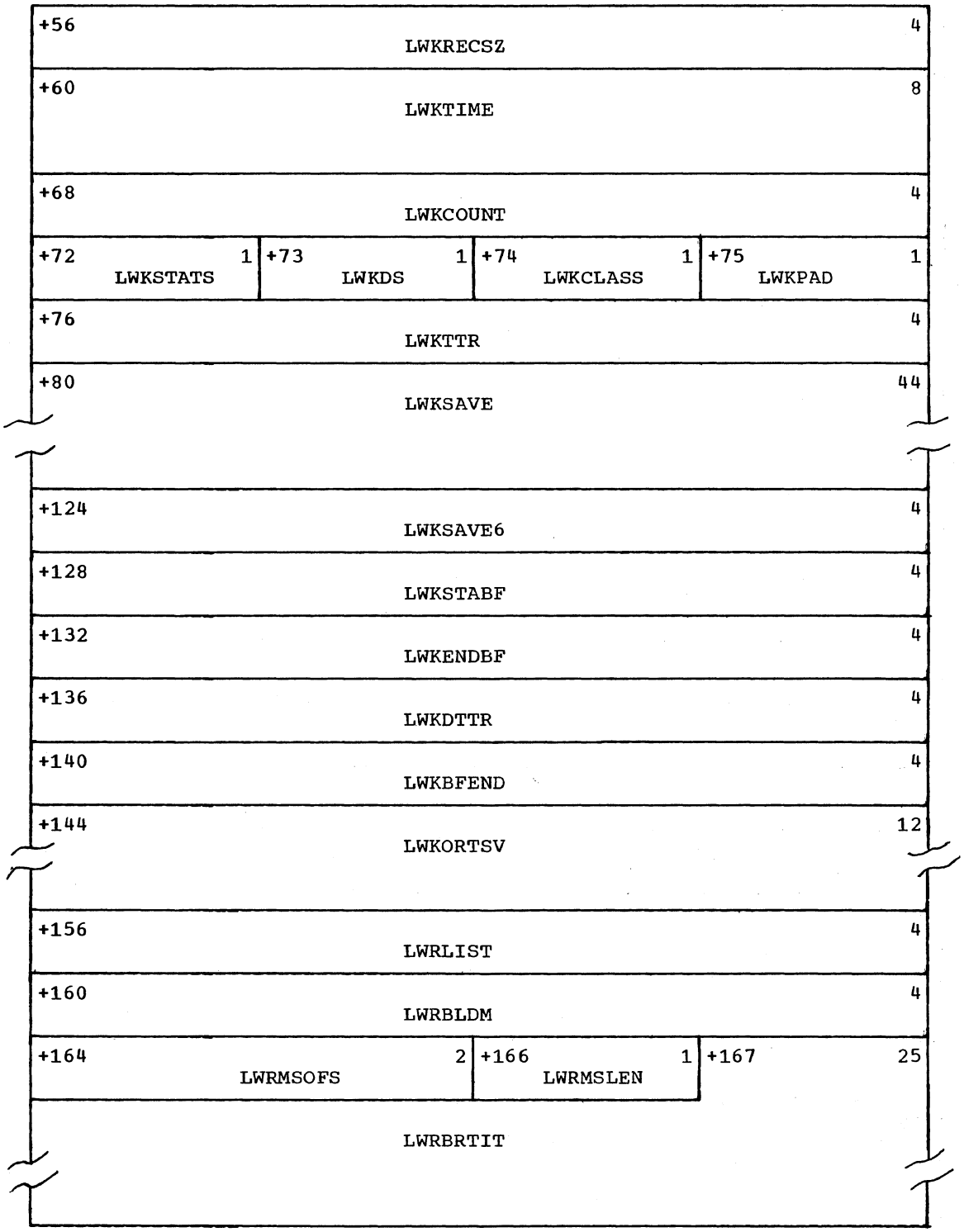
The following work area, named LWKWORK, is used by both the IHKABLWR and IHKABORT routines. The space for the work area is allocated by the IHKABLWR routine when the line scheduler, IHKABLST, calls IHKABLWR to process output for a particular remote work station. The space is freed when IHKABLWR returns control to IHKABLST.

If it is necessary to modify the work area format, any changes in the DSECT should be made simultaneously to both routines. If the number of bytes in the work area must be changed, make corresponding changes to the DSECT of both IHKABLWR and IHKABORT routines and change, in IHKABLWR, the value labeled LWRSIZE.

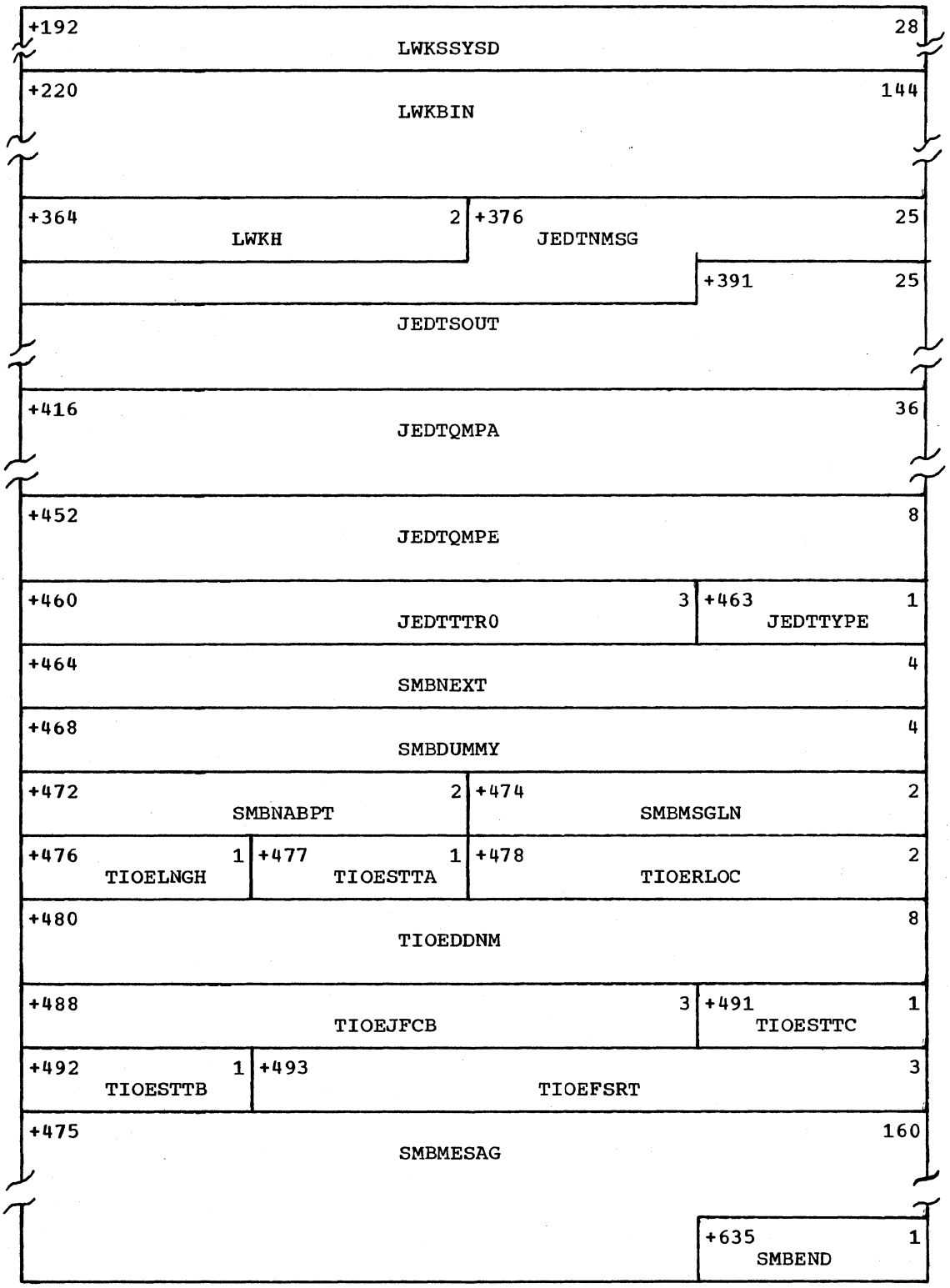
LWKWORK

+0 LWKADFST 4			
+4 LWKADJED 4			
+8 LWKADDSB 4			
+12 LWKADQMP 4			
+16 LWKADCBS 4			
+20 LWKADISP 4			
+24 LWKMDQK 4			
+28 LWKMDQIO 4			
+32 LWKMDQTD 4			
+36 LWKTIOTO 4			
+40 LWKTIOTN 4			
+44 LWKTIOTL 4			
+48 LWKADTCB 4			
+52 LWKSYSCT 1	+53 LWKID 1	+54 LWKCNTRL 1	+55 LWKRECFM 1

● Figure 15. LWKWORK work area (Part 1 of 3)



● Figure 15. LWKWORK work area (Part 2 of 3)



● Figure 15. LWKWORK Work Area (Part 3 of 3)

The fields of LWKWORK compose parameter lists as follows.

Parameter list for the JED Table manager routine, IHKCDJMR:

1. LWKADFST -- 4 bytes
   Contains the address of a Fastable entry.

2. LWKADJED -- 4 bytes
   Contains the address of the JED entry that is in main storage.

Parameter list for the data set scratch routine, IHKCDRMV:

3. LWKADDSB -- 4 bytes
   Contains the address of the DSB that points to the data set to be scratched.

4. LWKADQMP -- 4 bytes
   Contains the address of the queue manager parameter area.

Parameter list for the message disk dequeue routine, IHKCDMDQ:

5. LWKADCBS -- 4 bytes

   Contains the address of the resident DCBs (address of IHKCDCBS).

6. LWKADISP -- 4 bytes

   Contains the address of the RJE dispatcher, IHKCHDSP. First bit indicates whether MSG or BRDCST request has been received from IHKCDMDQ as follows:

   X'80' - MSG.
   X'00' - BRDCST.

7. LWKMDQK -- 4 bytes
   Contains a control value for IHKCDMDQ.

8. LWKMDQIO -- 4 bytes
   Contains the address of a 60-byte input/output area.

9. LWKMDQTD -- 4 bytes
   Contains the address of a terminal directory entry. The first bit indicates whether text is to be deleted or not as follows:

   C'1' - do not delete text.
   C'0' - delete text.

10. LWKTIOTO -- 4 bytes
    Contains the address of the old task I/O table (TIOT).

11. LWKTIOTN -- 4 bytes
    Contains the address of the new TIOT in an area allocated by a GETMAIN request.

12. LWKTIOTL -- 4 bytes
    Contains the number of bytes in the TIOT GETMAIN area.

13. LWKADTCB -- 4 bytes
    Contains the address of a task control block (TCB).

14. LWKSYSCT -- 1 byte
    Contains the counter for 24 SYSOUT classes.

15. LWKID -- 1 byte
    Contains the identification of the output destination device as follows:

    C'1' - printer.
    C'2' - punch.
    C'3' - keyboard.
    C'4' - user exit routine.

16. LWKCNTRL -- 1 byte
    Contains an indication of the control characters being used as follows:

    C'1' - Machine code.
    C'2' - ASA code.
    C'3' - No control characters.

17. LWKRECFM -- 1 byte
    Indicates the record format as follows:

    C'1' - fixed unblocked.
    C'2' - fixed blocked.
    C'3' - variable unblocked.
    C'4' - variable blocked.
    C'5' - undefined.

18. LWKRECSZ -- 4 bytes
    Contains the logical record length of fixed blocked records. If the records are not fixed, these bytes contain zero.

19. LWKTIME -- 8 bytes
    Contains the time and date of RJE operation.

20. LWKCOUNT -- 4 bytes
    Contains the SYSOUT count.

21. LWKSTATS -- 1 byte
    Contains error status information. X'04' indicates an error condition.

22. LWKDS -- 1 byte
    Contains the data set count.

23. LWKCLASS -- 1 byte
Contains the SYSOUT class.

24. LWKPAD -- 1 byte
This byte is not used, but is required for padding.

25. LWKTTR -- 4 bytes
Contains the relative track and record address (TTR) of the last block of SYSOUT data read.

26. LWKSAVE -- 44 bytes
Contains the save area used by IHKABORT.

27. LWKSAVE6 -- 4 bytes
Contains the contents of register 6 during SMB (system message block) processing.

28. LWKSTABF -- 4 bytes
Contains the address of the SYSOUT buffer.

29. LWKENDBF -- 4 bytes
Contains the address of the first byte beyond the SYSOUT buffer.

30. LWKDTTR -- 4 bytes
Contains the TTR location indicating where reading of records is to begin.

31. LWKBFEND -- 4 bytes
Contains the buffer end address for IHKABORT.

32. LWKORTSV -- 12 bytes
Contains the buffer management information for IHKABORT.

33. LWRLIST -- 4 bytes
Contains the address of the job file control block (JFCB) in the IHKABRER routine.

Parameter list for IHKCRUMB routine.

34. LWRBLDM -- 4 bytes
Contains an indication that the message is not to be enqueued, shown as follows:

X'80000000'.

35. LWRMSOFS -- 2 bytes
Contains the offset for the message address.

36. LWRMSLEN -- 1 byte
Contains the number of bytes to be added to the message.

37. LWRBRTIT -- 25 bytes
Contains the characters to be added to the message.

38. LWKSSYSD -- 28 bytes
Contains the save area for system management facilities (SMF) information.

39. LWKBIN -- 144 bytes
Contains the system message block (SMB) work area. The JED table, including its queue manager parameter area, is read into this work area, as is also the DSB or SMB information fields, which overlap the JED table by 4 bytes.

40. LWKH -- 2 bytes
These bytes are not used, but are needed to put the QMPA on a word boundary. The JED table must begin on a half word, not a full word.

41. JEDTNMSG -- 25 bytes
Contains temporary storage space.

42. JEDTSOUT -- 25 bytes
Contains the original SYSOUT classes.

43. JEDTQMPA -- 36 bytes
Contains the queue manager parameter area (QMPA) made up of the following:

LWRQMNAM - 8 bytes, containing the job name.
LWRQMPOP - 1 byte, containing the functional code parameter.
LWRQMFLT - 2 bytes, containing the first logical track assigned to the job.
LWRQMTST - 1 byte, containing the number of records used in the logical track.
LWRQMTLN - 2 bytes, containing the relative address of the next logical track.
LWRQMNOT - 1 byte, containing the number of logical tracks assigned to the job.
LWRQMTPY - 1 byte, containing the job type.
LWRQMSTA - 1 byte, containing the job status, indicated as follows:

C'0' - ready.
C'1' - cancel.
C'2' - priority change.
C'3' - not used.
C'4' - job enqueued.

LWRQMPRI - 1 byte, containing job priority.
LWRQMLNK - 2 bytes, containing the

relative address of the next queue entry.

LWRQMTID - 4 bytes, containing queue entry identification.

LWRQMWTQ - 4 bytes, containing the count and address for track stacking.

LWRQMELA - 4 bytes, containing the address of user's ECB/IOB.

LWRQMPCL - 4 bytes, containing the address of an external parameter indicating either of the following:

- number of records to be assigned.
- number of records to be read or written.

44. JEDTQMPE -- 8 bytes
Contains the external queue manager parameter area made up of the following:

LWRQMPCA - 4 bytes, containing a buffer address.

LWRQMPEX - 4 bytes, containing the TTR for a read operation.

45. JEDTTTR0 -- 3 bytes
Contains the TTR of this DSB or SMB. This field is also labeled SMBDSKAD when a DSB or SMB overlaps the JED table.

46. JEDTTYPE -- 1 byte
Contains the JED table ID. This byte is also labeled SMBIDENT when a DSB or SMB overlaps the JED table.

47. SMBNEXT 4 bytes
Contains the TTR of the next DSB or SMB.

48. SMBDUMMY -- 4 bytes
Contains the TTR of allocated dummy SMB. If this is not the last SMB for the step, this field is zero.

49. SMBNABPT -- 2 bytes
Contains relative pointer to next available byte.

50. SMBMSGLN -- 2 bytes
Contains the length of a message or a zero if there are no more messages in the block. If each bit equals 1, a data set follows.

X'FF' indicates an active DSB.
X'00' indicates a scratched DSB.

51. TIOELNGH -- 1 byte
Contains the length of a DD entry.

52. TIOESTTA -- 1 byte
Contains status A.

53. TIOERLOC -- 2 bytes
Contains the location of the DD entry pool.

54. TIOEDDNM -- 8 bytes
Contains the ddname of the DD entry.

55. TIOEJFCB -- 3 bytes
Contains the TTR of a JFCB.

56. TIOESTTC -- 1 byte
Contains the status C.

57. TIOESTTB -- 1 byte
Contains status B (repeated).

58. TIOEFSRT -- 3 bytes
Contains the address that points to a unit control block (UCB) (repeated).

59. SMBMESAG -- 160 bytes
Contains a variable length message that overlaps the DSB information beginning with the second byte of the SMBMSGLN field.

60. SMBEND -- 1 byte
This byte indicates the end of the LWKWORK area.

APPENDIX D: RJE ACRONYMS

AVT - RJE Address Vector Table

BLP - Bypassed Label Processing
BSAM - Basic Sequential Access Method
BSC - Binary Synchronous Communications
BTAM - Basic Telecommunications Access Method

CCB - Command Control Block
CCCB - Central Command Control Block
CCW - Channel Command Word
C/E - RJE Collector/Emitter
CIB - Command Input Buffer
CPU - Central Processing Unit
CSCB - Command Scheduling Control Block

DASD - Direct Access Storage Device
DCB - Data Control Block
DEB - Data Extent Block
DECB - Data Event Control Block
DSB - Data Set Block
DSCB - Data Set Control Block

ECB - Event Control Block
EOB - End of Block
EOD - End of Data
EODAD - End-of-Data Address
EOF - End of File
EOT - End of Transmission

ID - Identification
I/O - Input/Output
IOB - I/O Block

JCL - Job Control Language
JECL - Job Entry Control Language
JED - Job Entry Definition
JFCB - Job File Control Block

LCB - Line Control Block
LERB - Line Error Block
LRD - Line Read Routine
LUB - Logical Unit Block
LWR - Line Write Routine

MCS - Multiple Console Support option of the System/360 Operating System
MFT - Multiprogramming with a Fixed Number of Tasks
MVT - Multiprogramming with a Variable Number of Tasks

NEL - Interpreter Entrance List

OS - IBM System/360 Operating System

PCL - Pool Control List
PUB - Physical Unit Block

QCL - Queue Control List
QCR - Queue Control Record
QEB - Queue Entry Block
QMGR - OS Queue Manager
QMNGR - RJE Queue Manager Routine
QMPA - Queue Manager Parameter Area
QMPAE - Queue Manager Parameter Area Extension

RCS - RJE Closedown Status
R/I - OS Reader/Interpreter
RII - RJE Reader/Interpreter Interface
RJE - Remote Job Entry
RVI - Reverse Interrupt Control Character

SMB - System Message Block
SMF - System Management Facilities feature of the IBM System/360 Operating System
SPL - Start Parameter List
STC - System Task Control Routine
STCB - Subtask Control Block
SYSDQ - SYSOUT Class Dequeue Routine

TCB - Task Control Block
TCU - Transmission Control Unit
TDE - Terminal Directory Entry
TDIR - Terminal Directory
Termid - Terminal Identification
TIOT - Task I/O Table
TTR - Relative Track and Record Number

UCB - Unit Control Block
UDIR - User Directory
Userid - User Identification

VTOC - Volume Table of Contents

XDAP - Execute Direct Access Program

• Chart AA. IHKCAINT -- Command Interpreter (Main Routine) - MFT

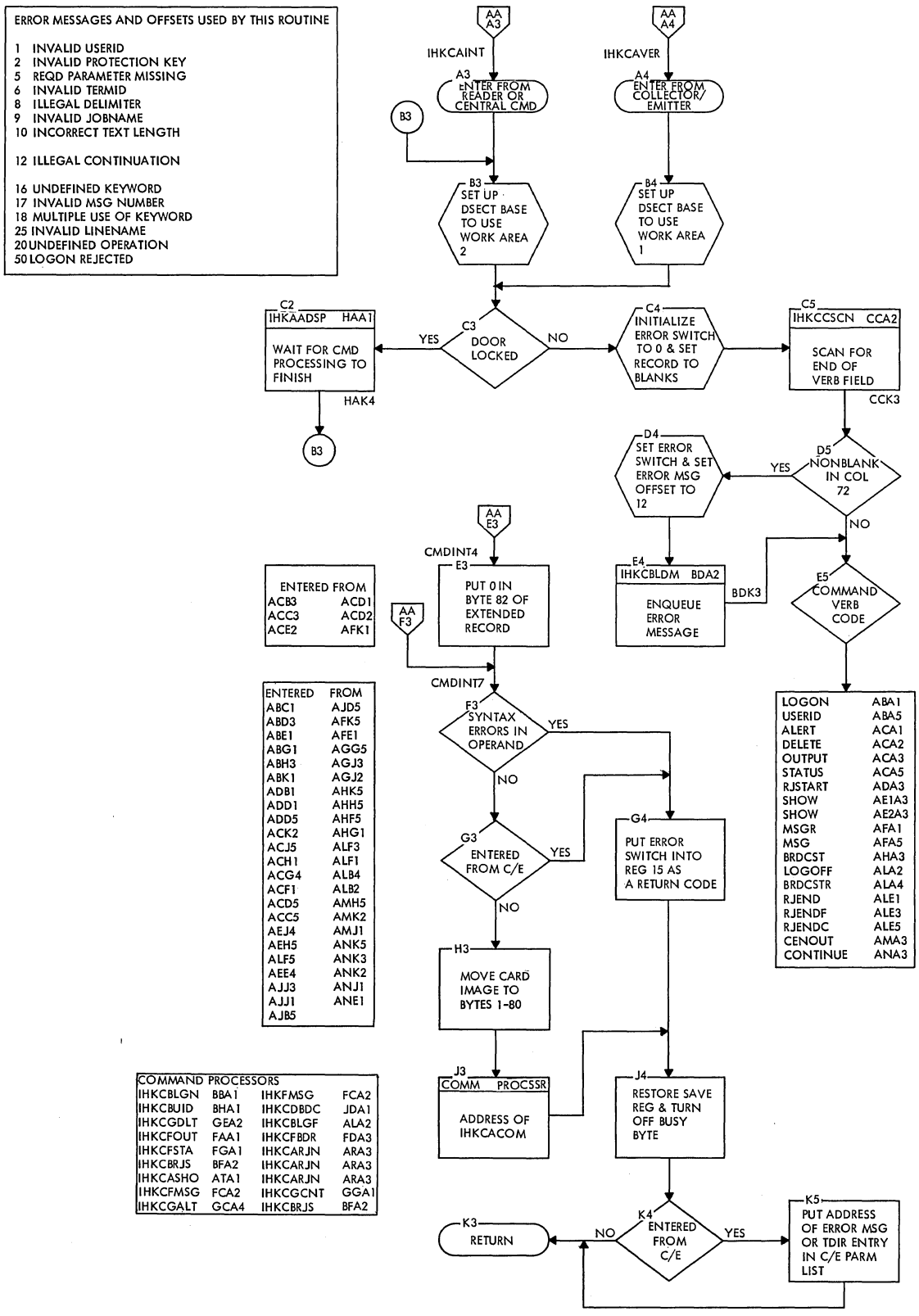


Chart AB. IHKCAINT -- LOGON/USERID Interpreter

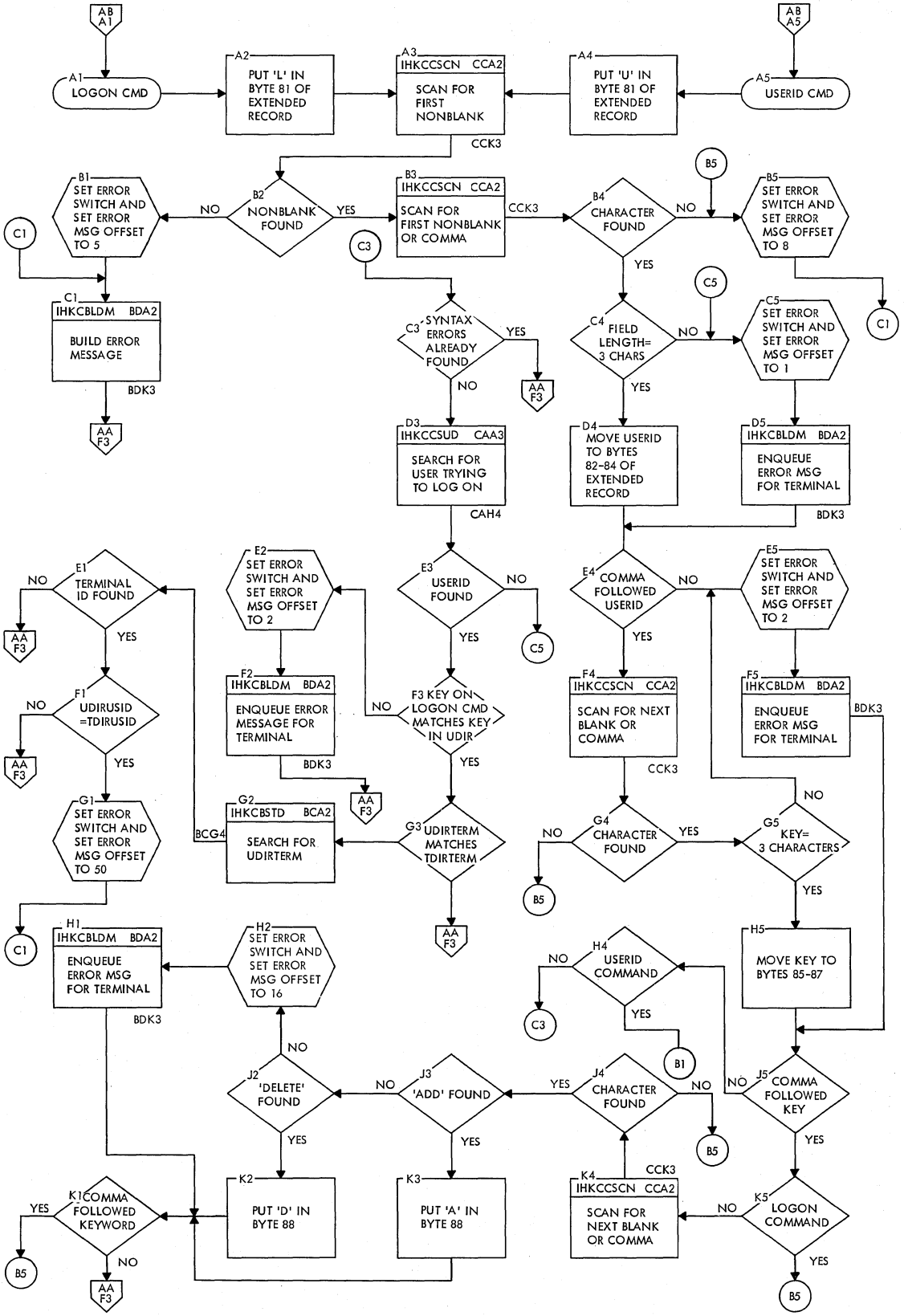


Chart AC. IHKCAINT and IHKXAINT -- DELETE/OUTPUT/STATUS/ALERT Interpreter

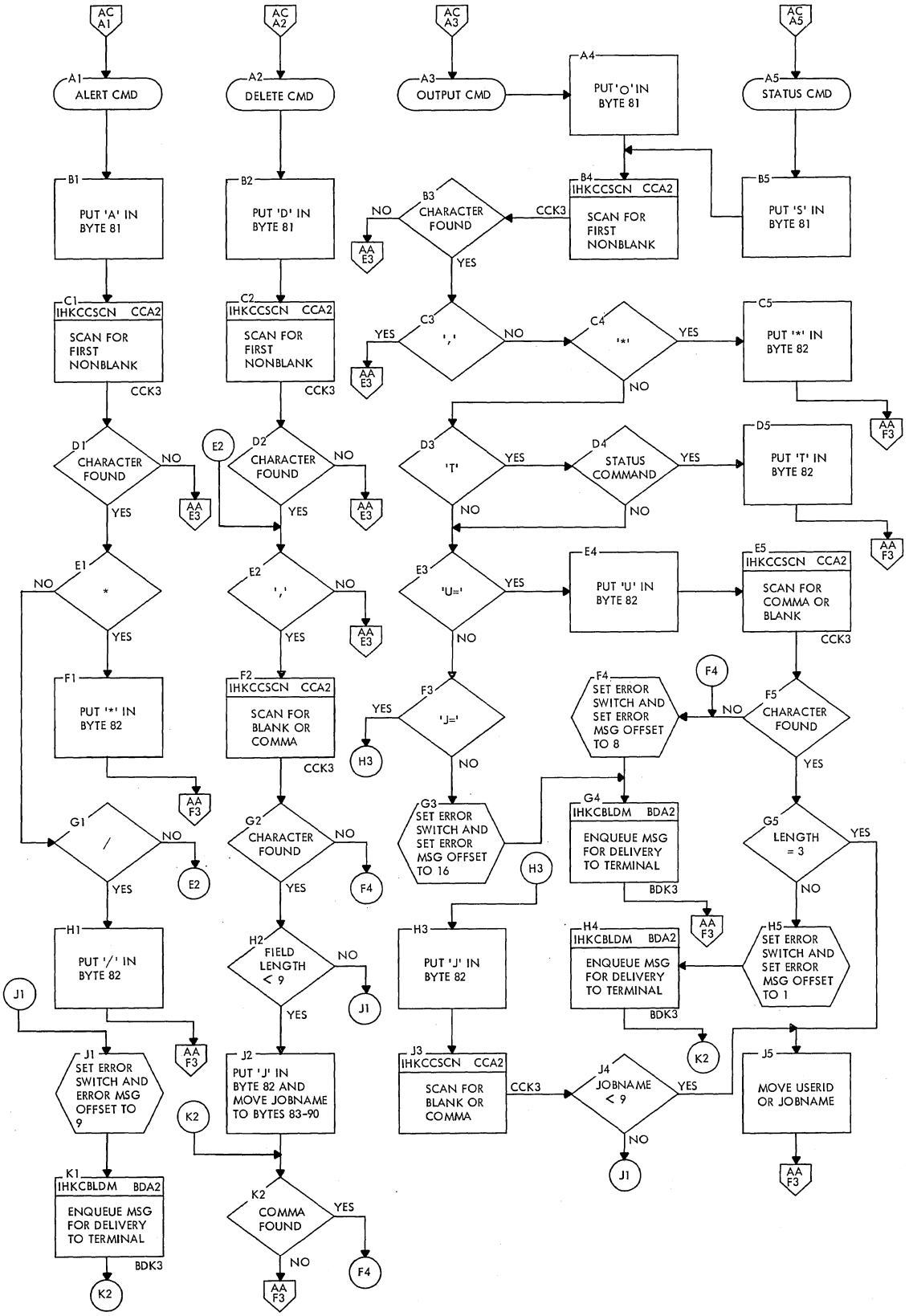


Chart AD. IHKCAINT and IHKXAINT -- RJSTART Interpreter

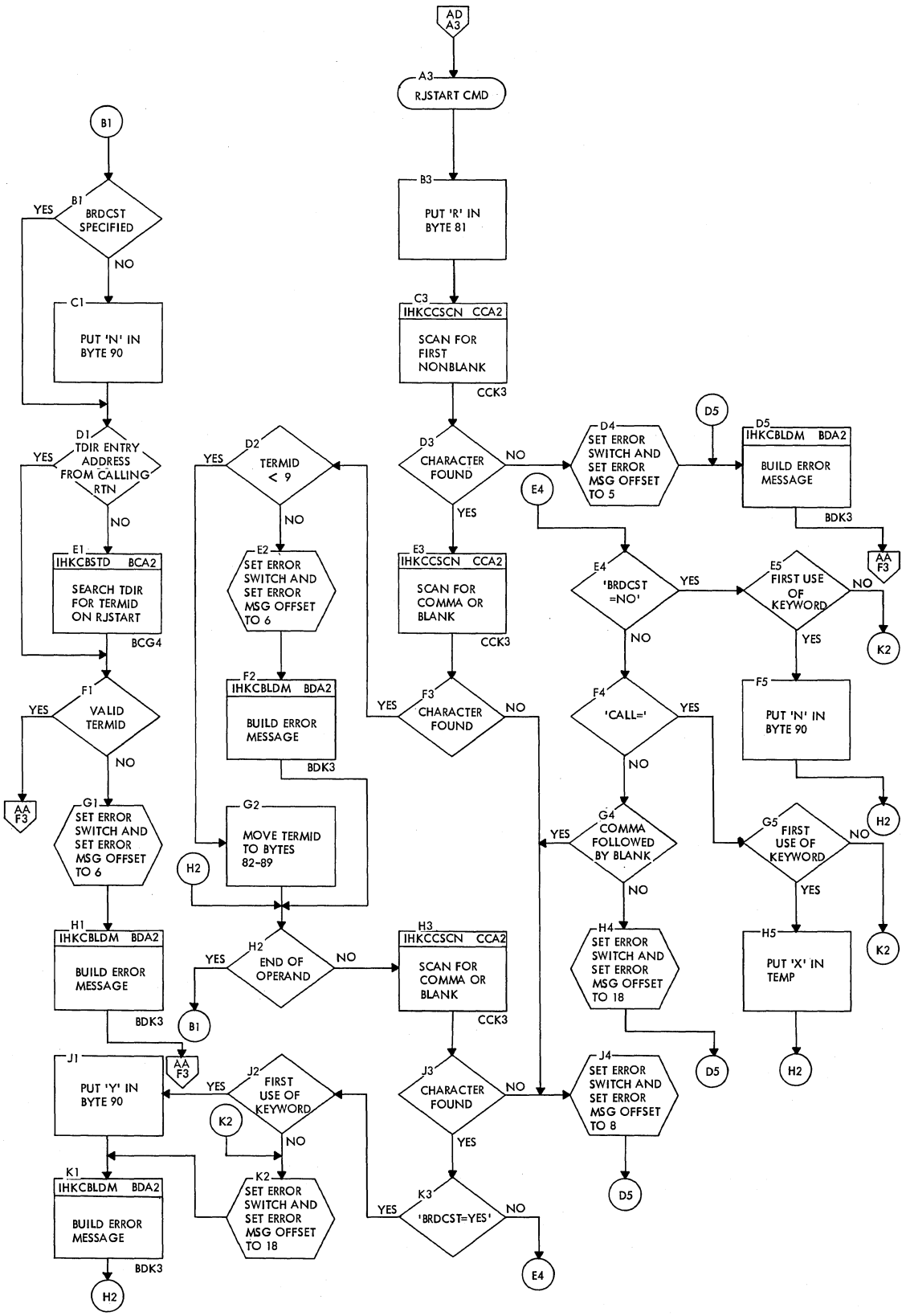


Chart AE1. IHKCAINT -- SHOW Interpreter - MFT

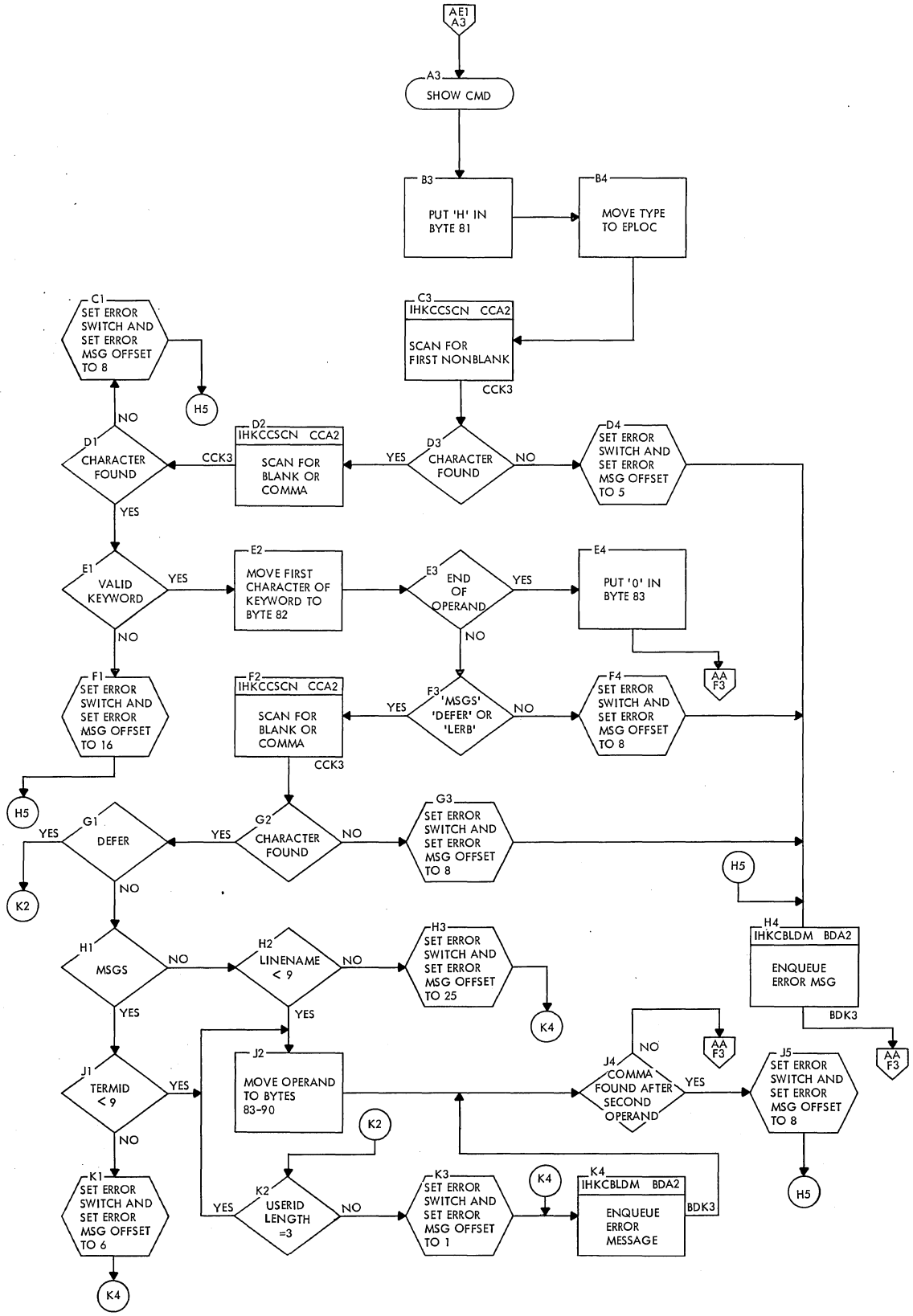


Chart AE2. IHKXAINT -- SHOW Interpreter - MVT

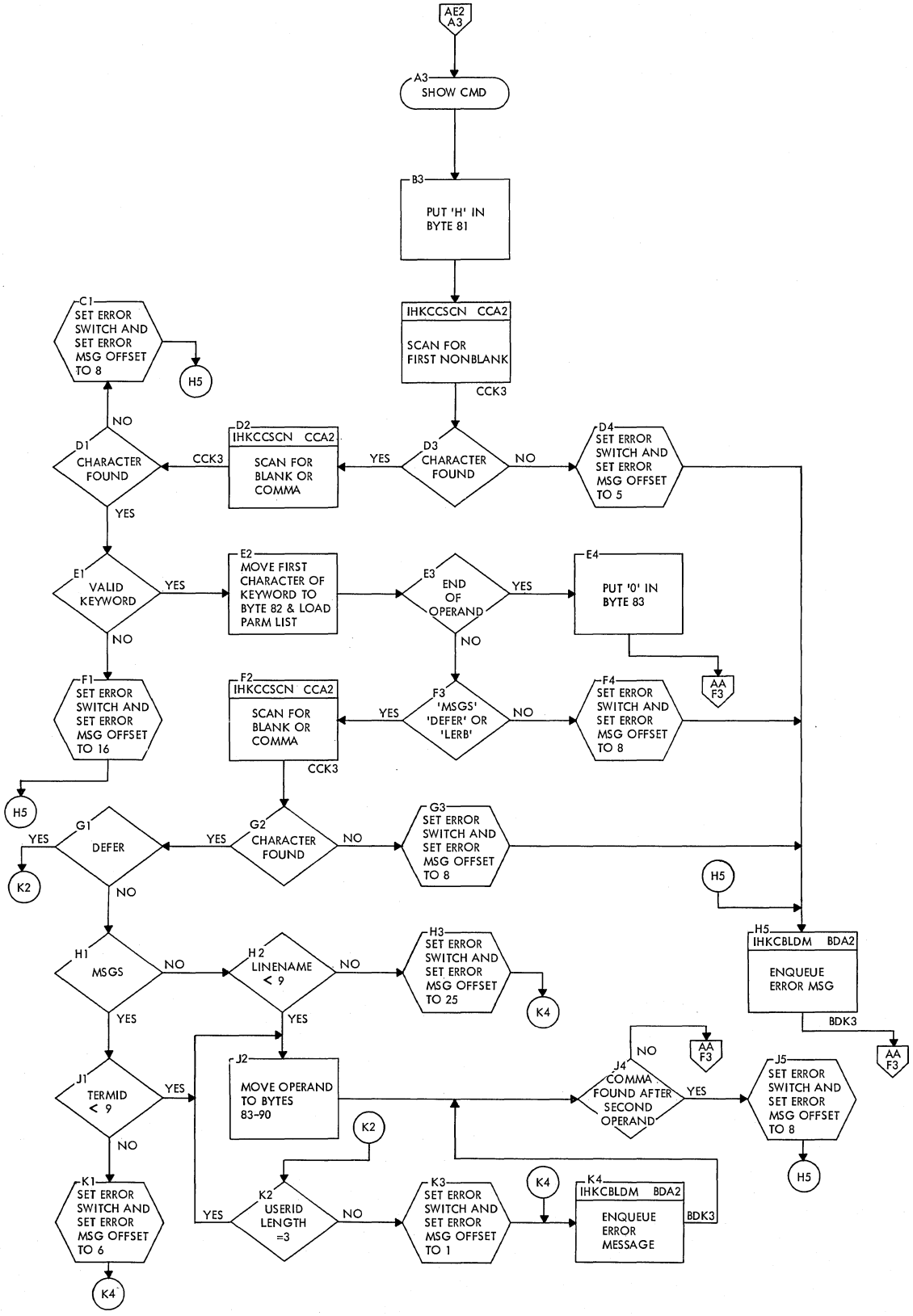
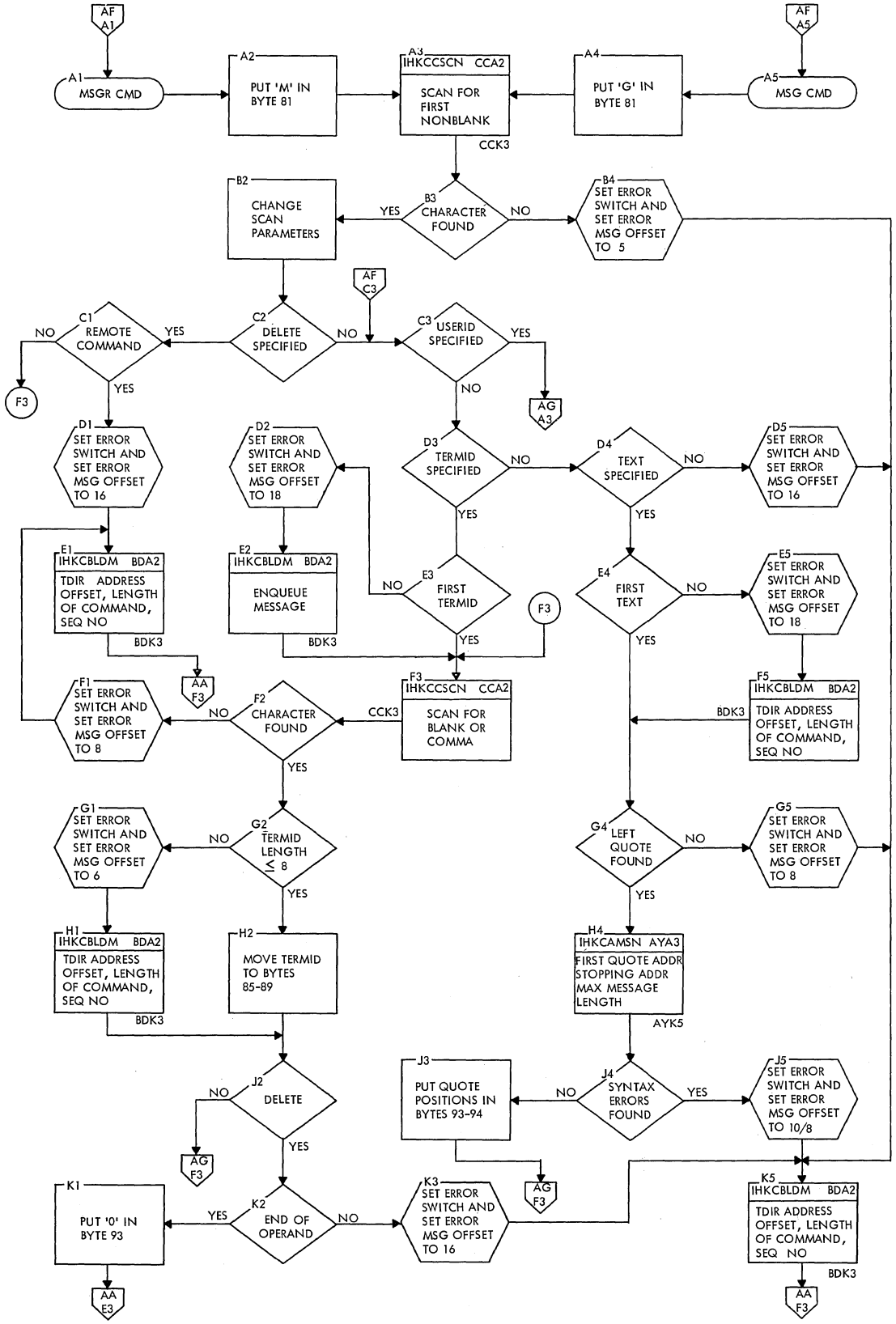


Chart AF. IHKCAINT and IHKXAINT -- MSGR/MSG Interpreter



● Chart AG. IHKCAINT and IHKXAINT -- MSGR/MSG Interpreter

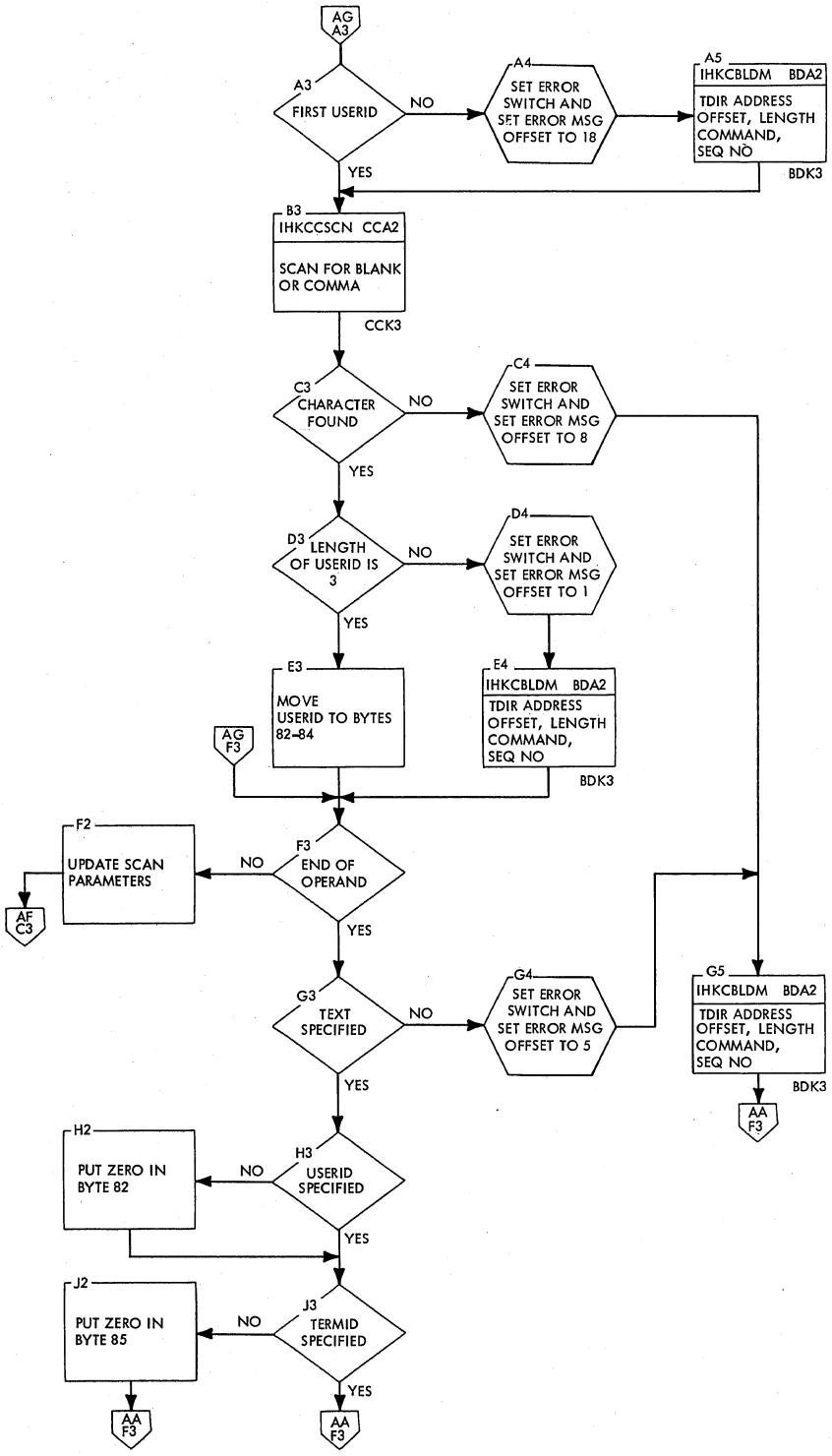


Chart AH. IHKCAINT and IHKXAINT -- BRDCST Interpreter

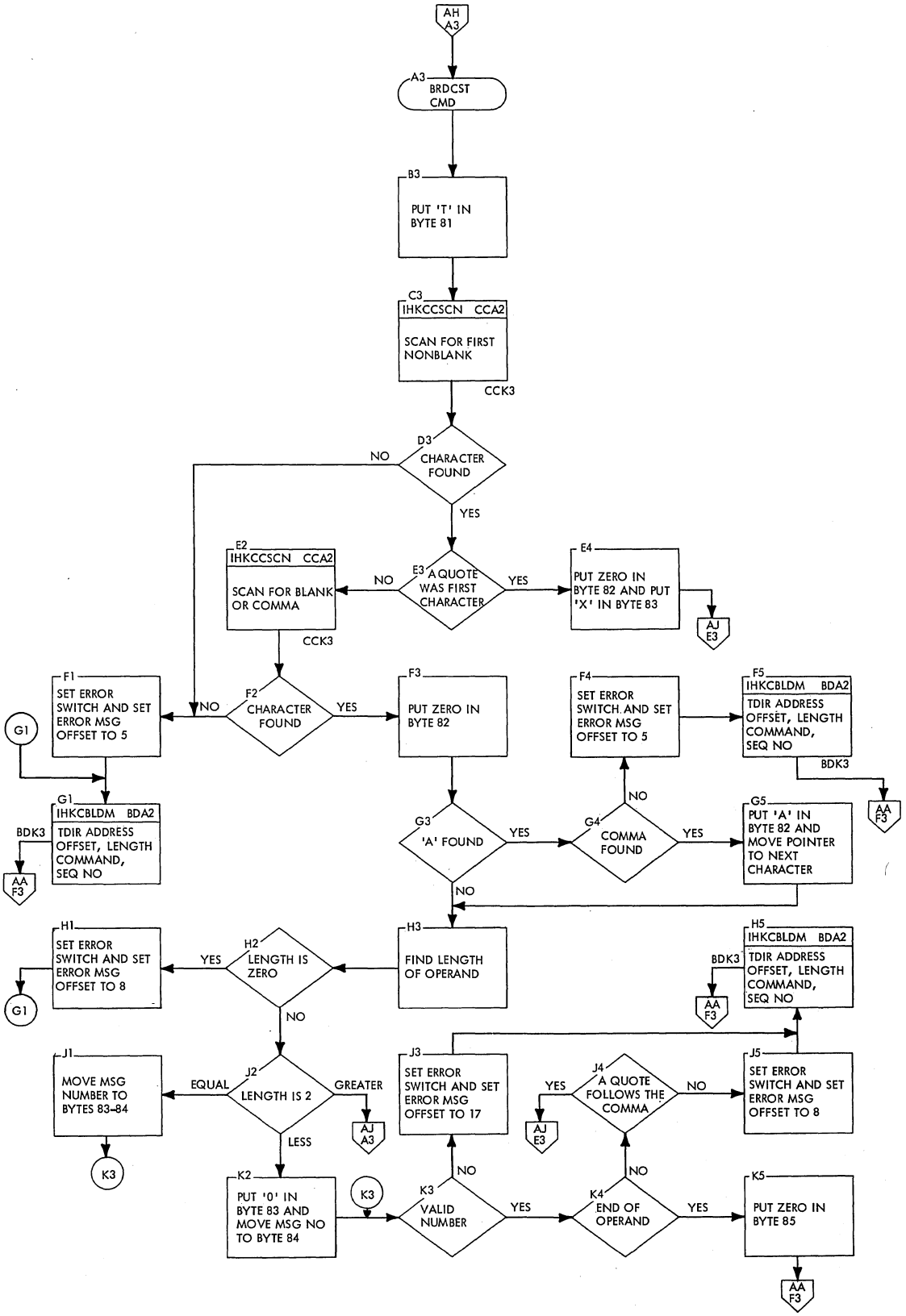


Chart AJ. IHKCAINT and IHKXAINT -- BRDCST Interpreter

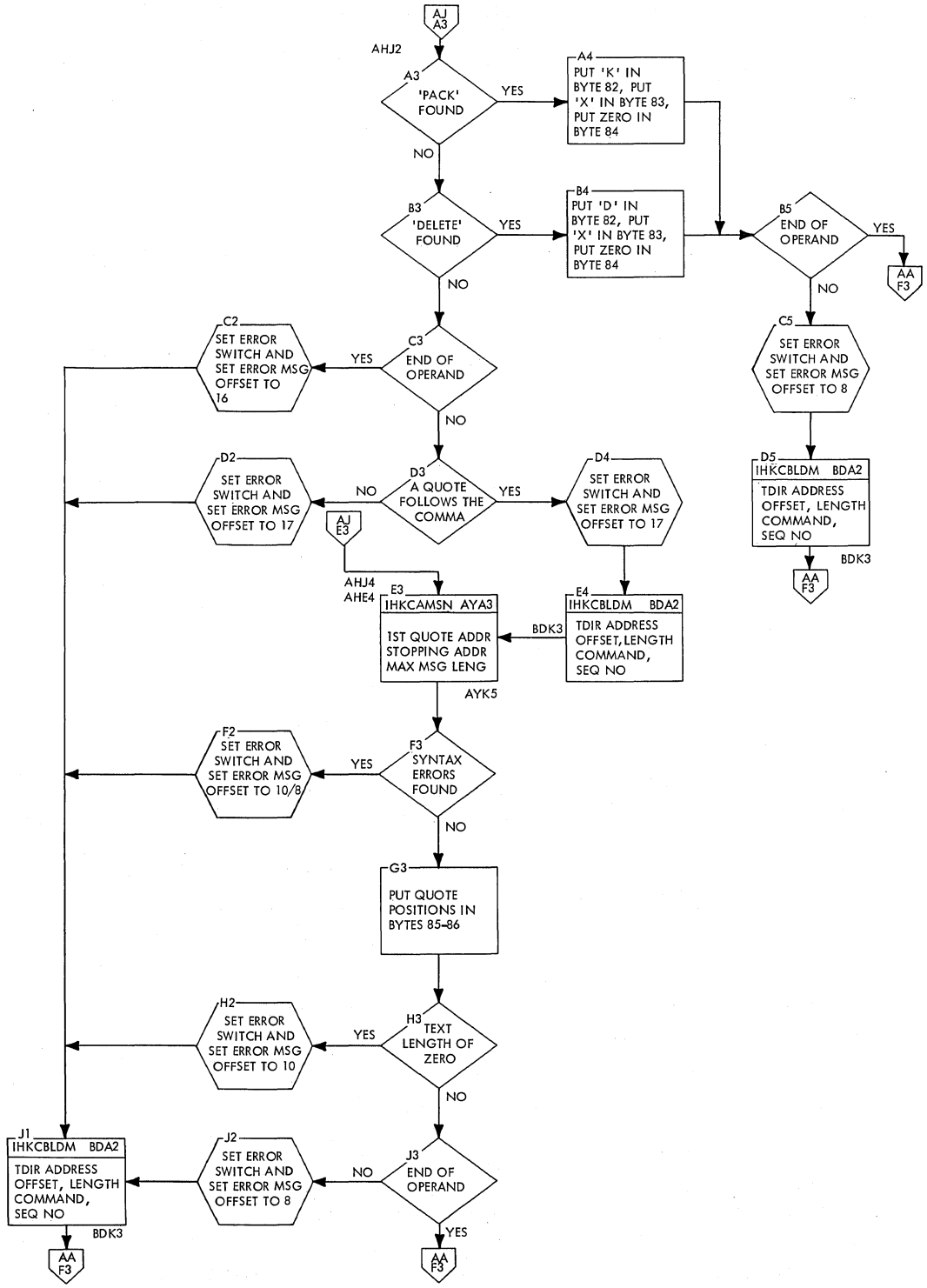


Chart AL. IHKCAINT and IHKXAINT -- LOGOFF/BRDCSTR/RJEND Interpreter

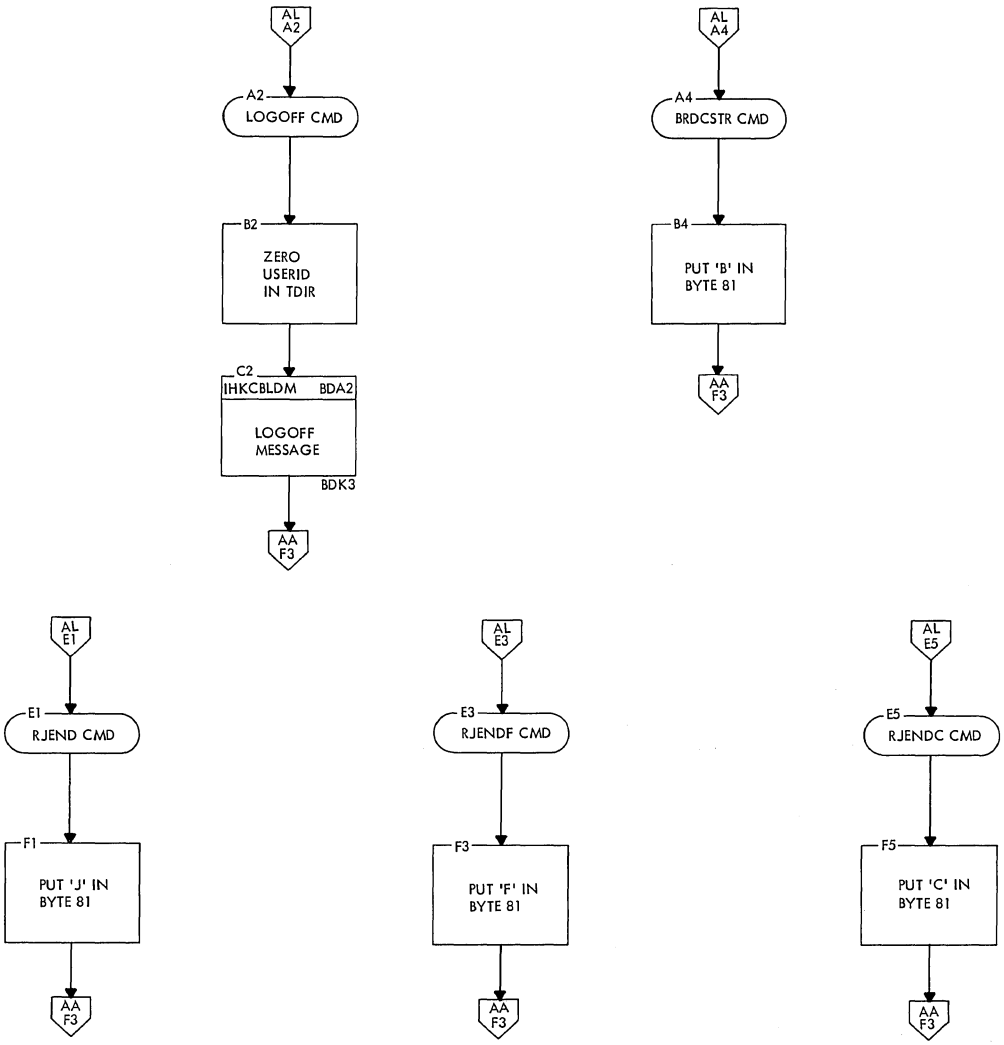


Chart AM. IHKCAINT and IHKXAINT -- CENOUT Interpreter

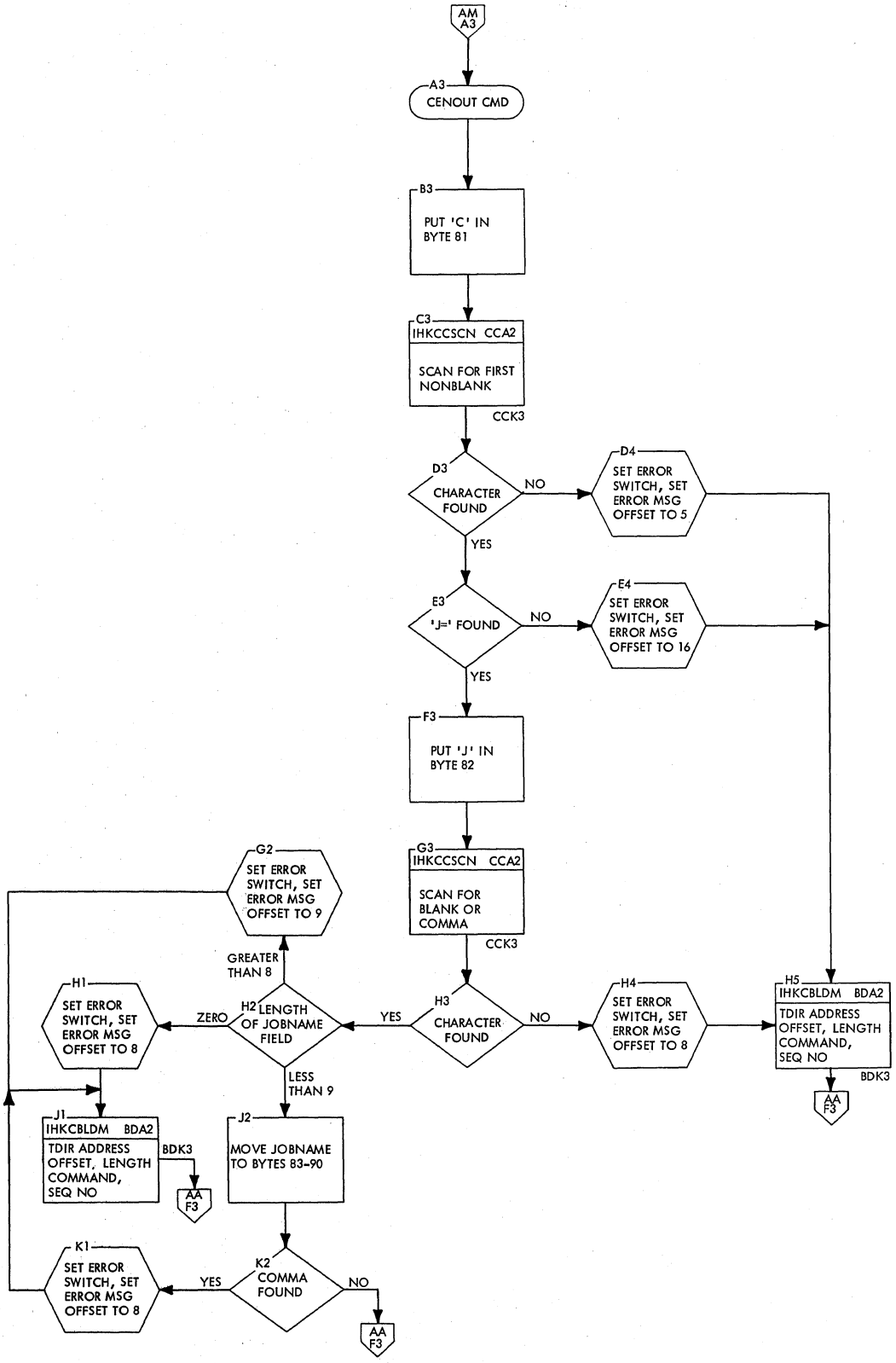
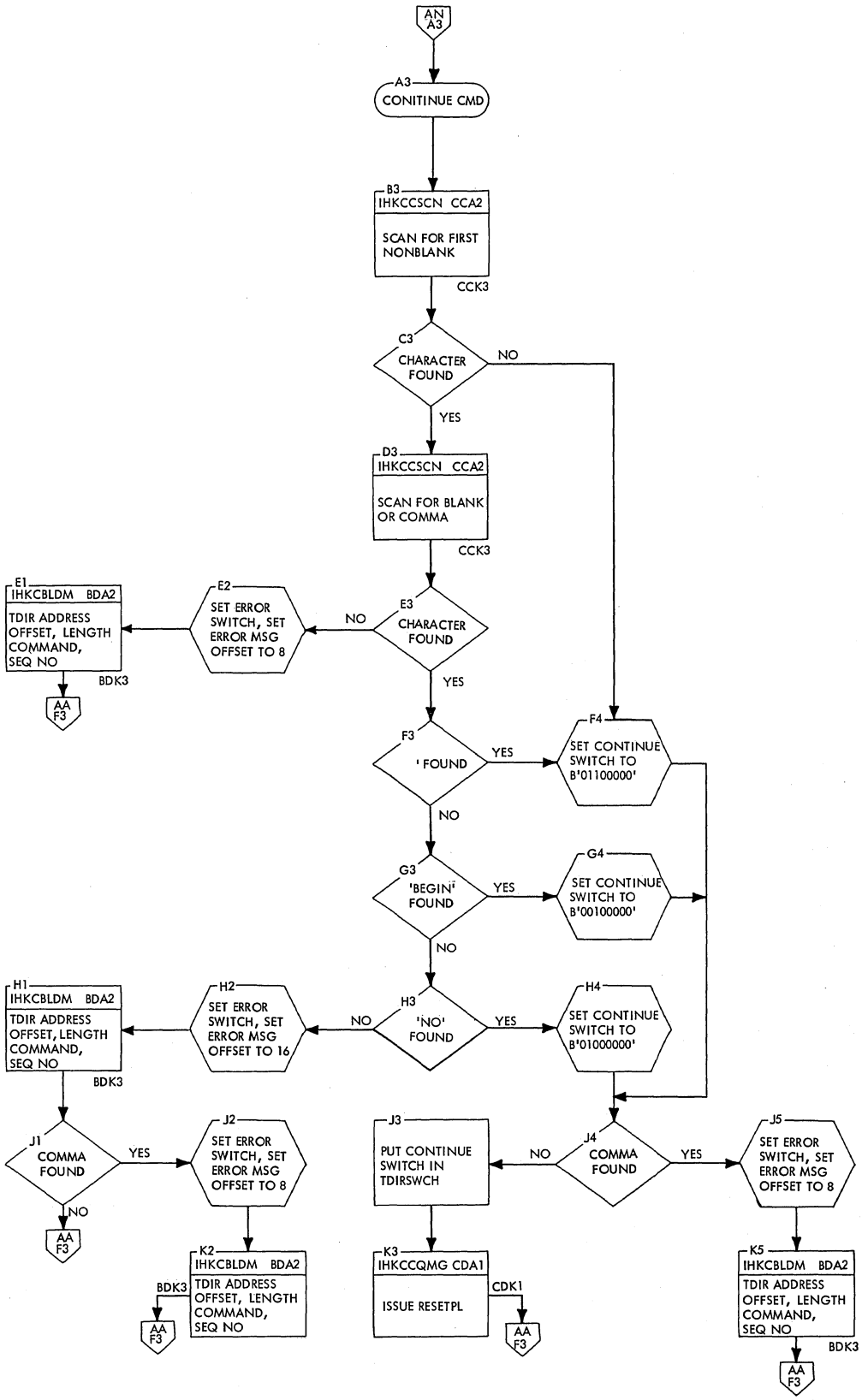
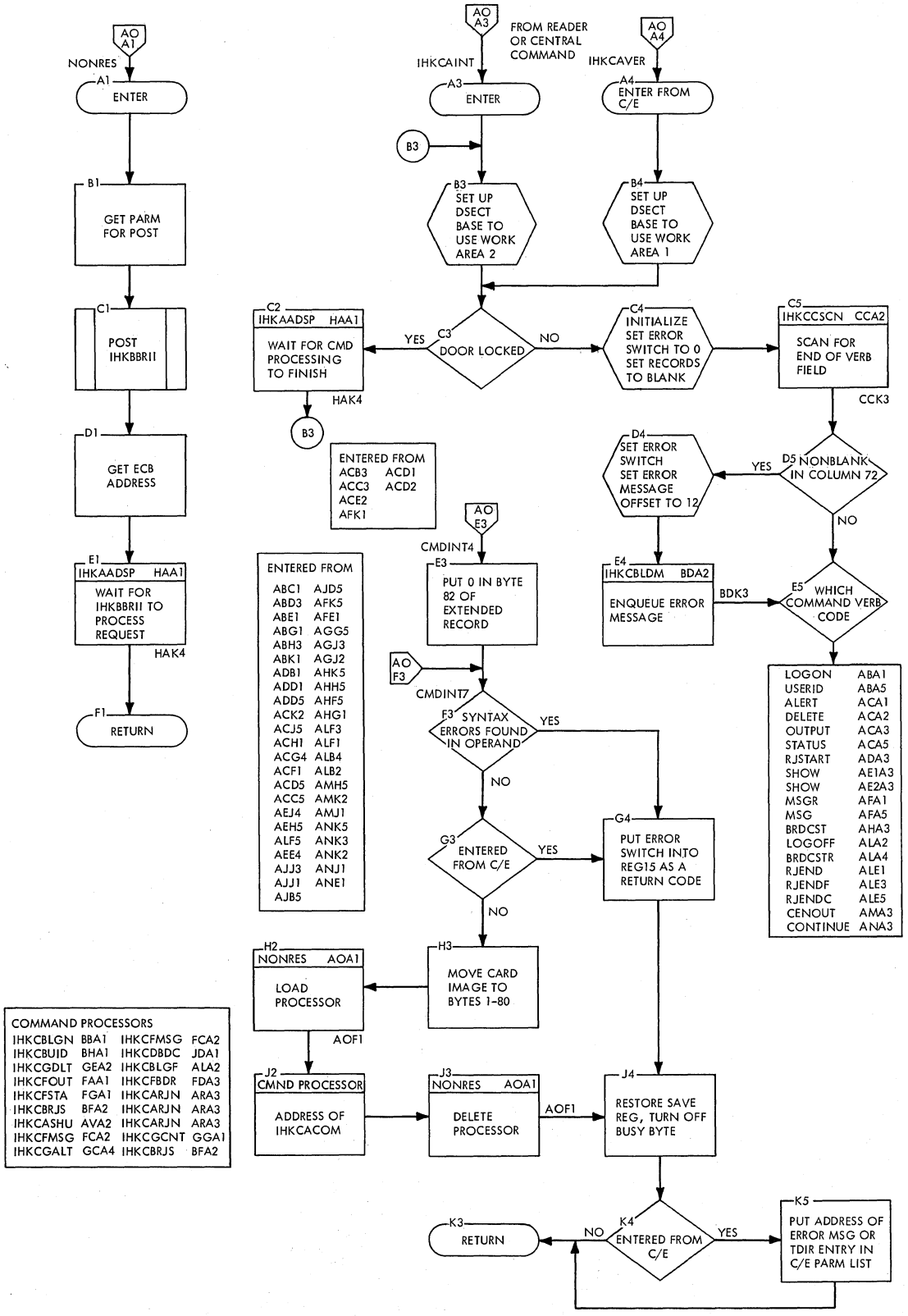


Chart AN. IHKCAINT and IHKXAINT -- CONTINUE Interpreter/Processor



● Chart AO. IHKXAINT -- Command Interpreter (Main Routine) - MVT



● Chart AP. IHKCASTP -- STOP RJE Command Processor

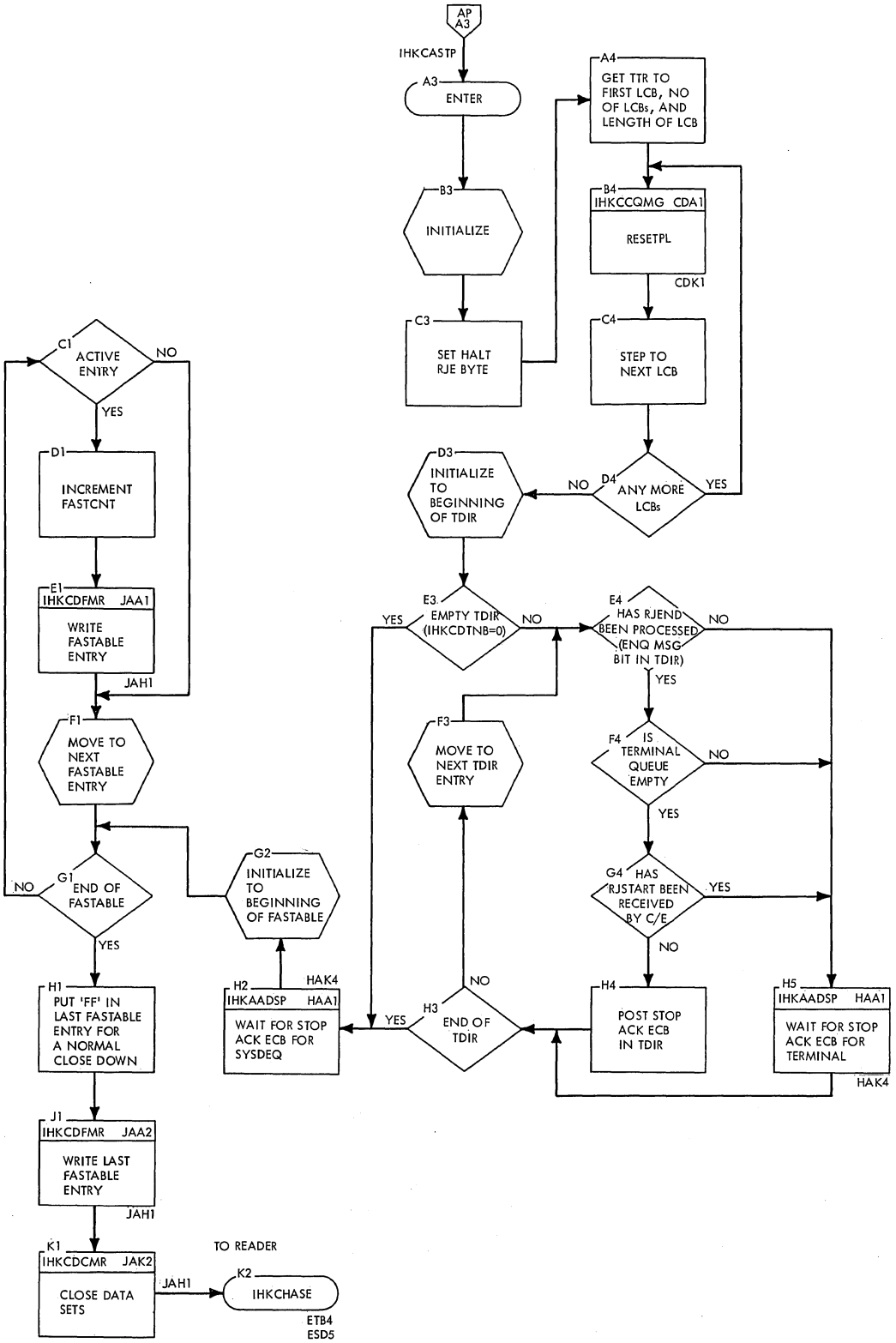


Chart AQ. IHKCHOSE -- Overload Safety Routine

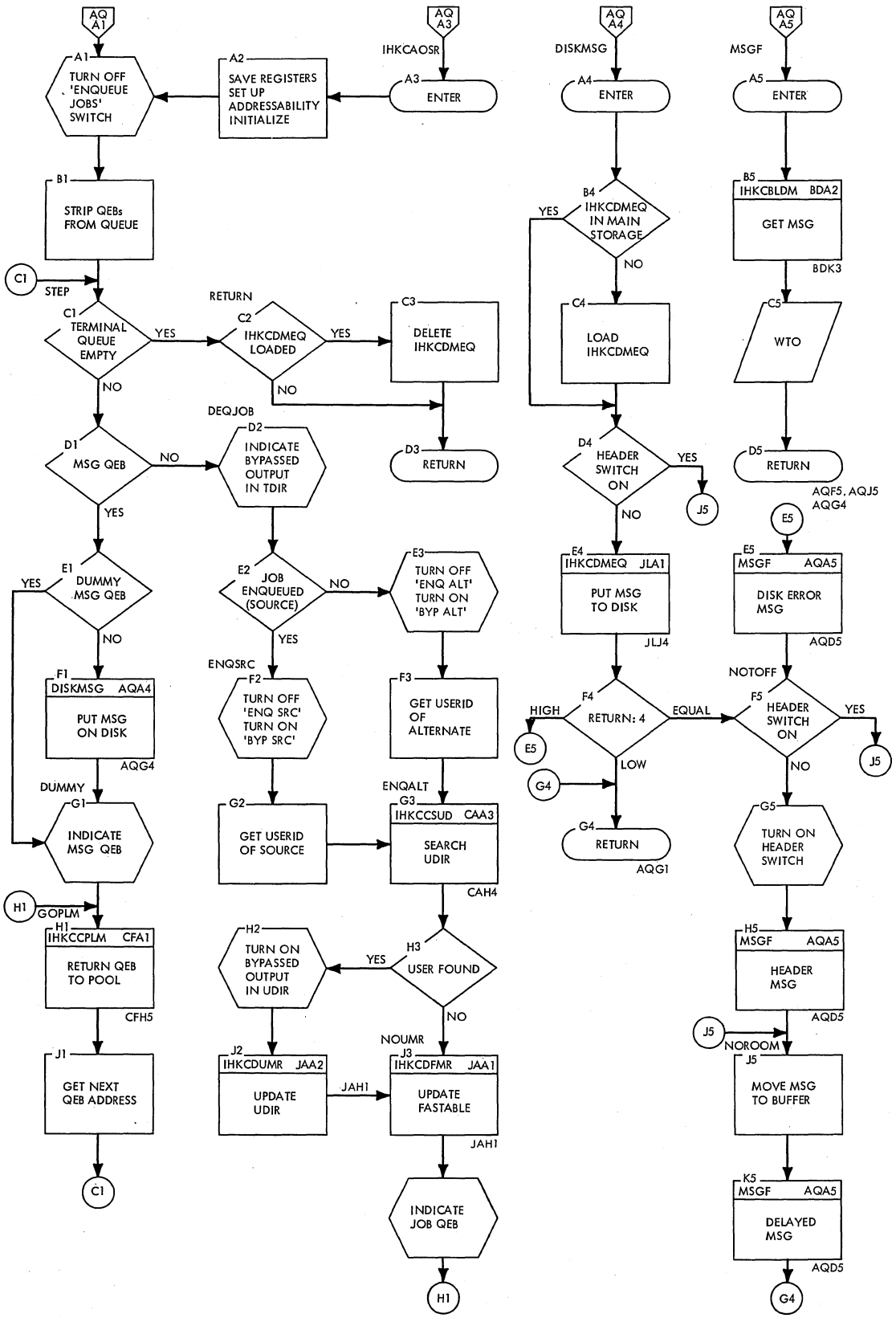


Chart AR. IHKCHIRP -- RJEND Processor

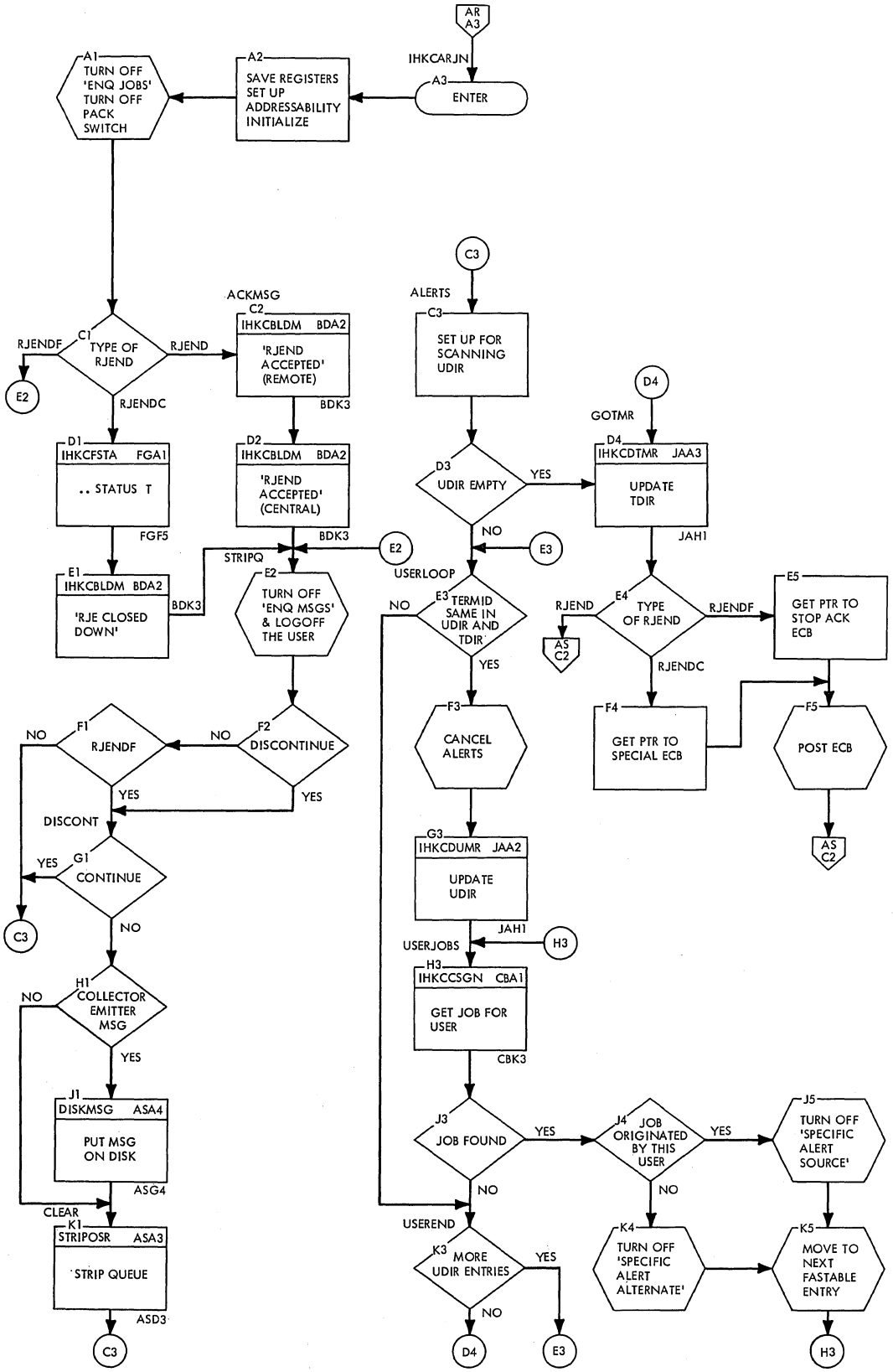
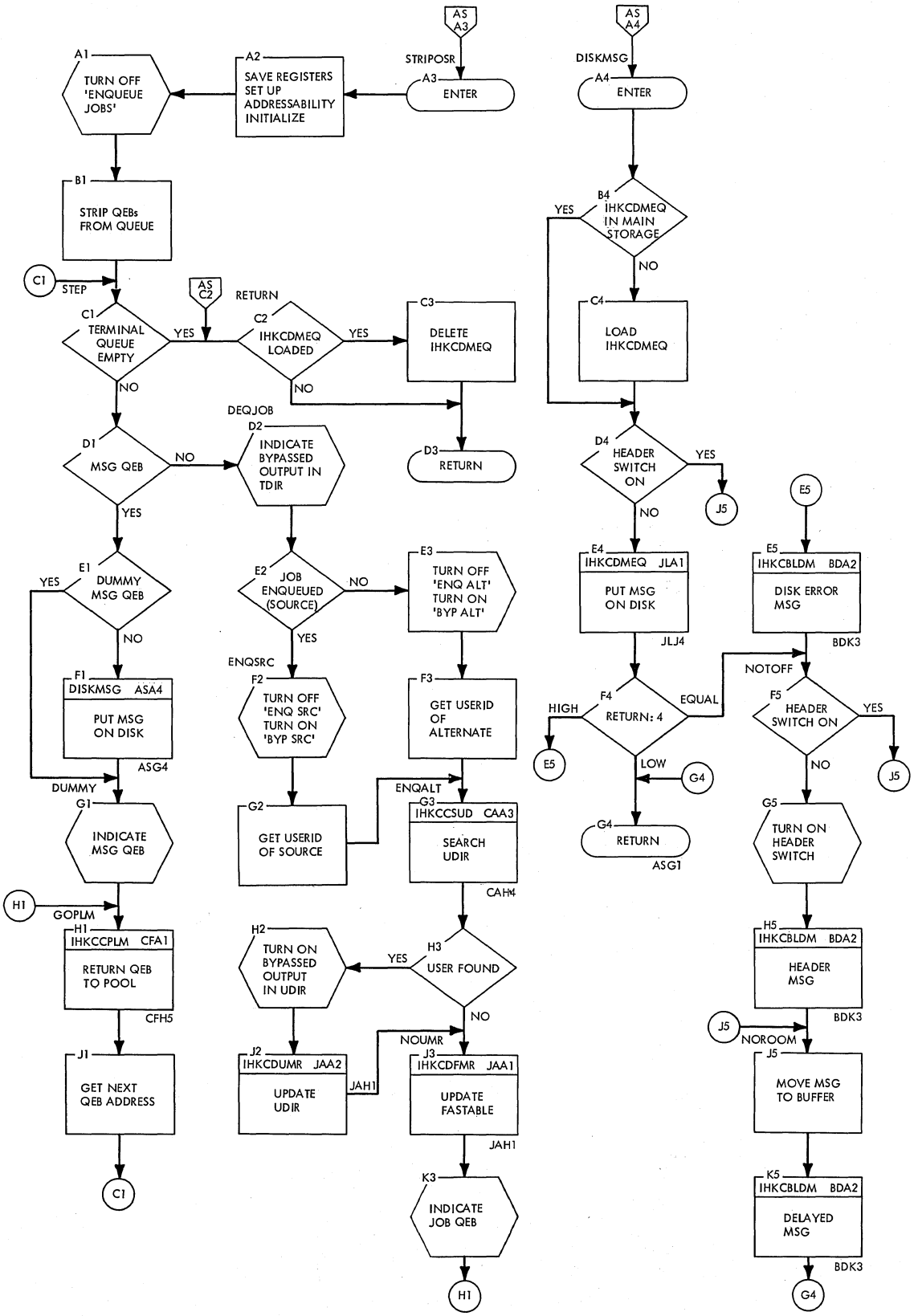


Chart AS. IHKCHIRP -- RJEND Processor (Continued)



● Chart AT. IHKCHATS -- SHOW ACTIVE and SHOW TERMS Processor

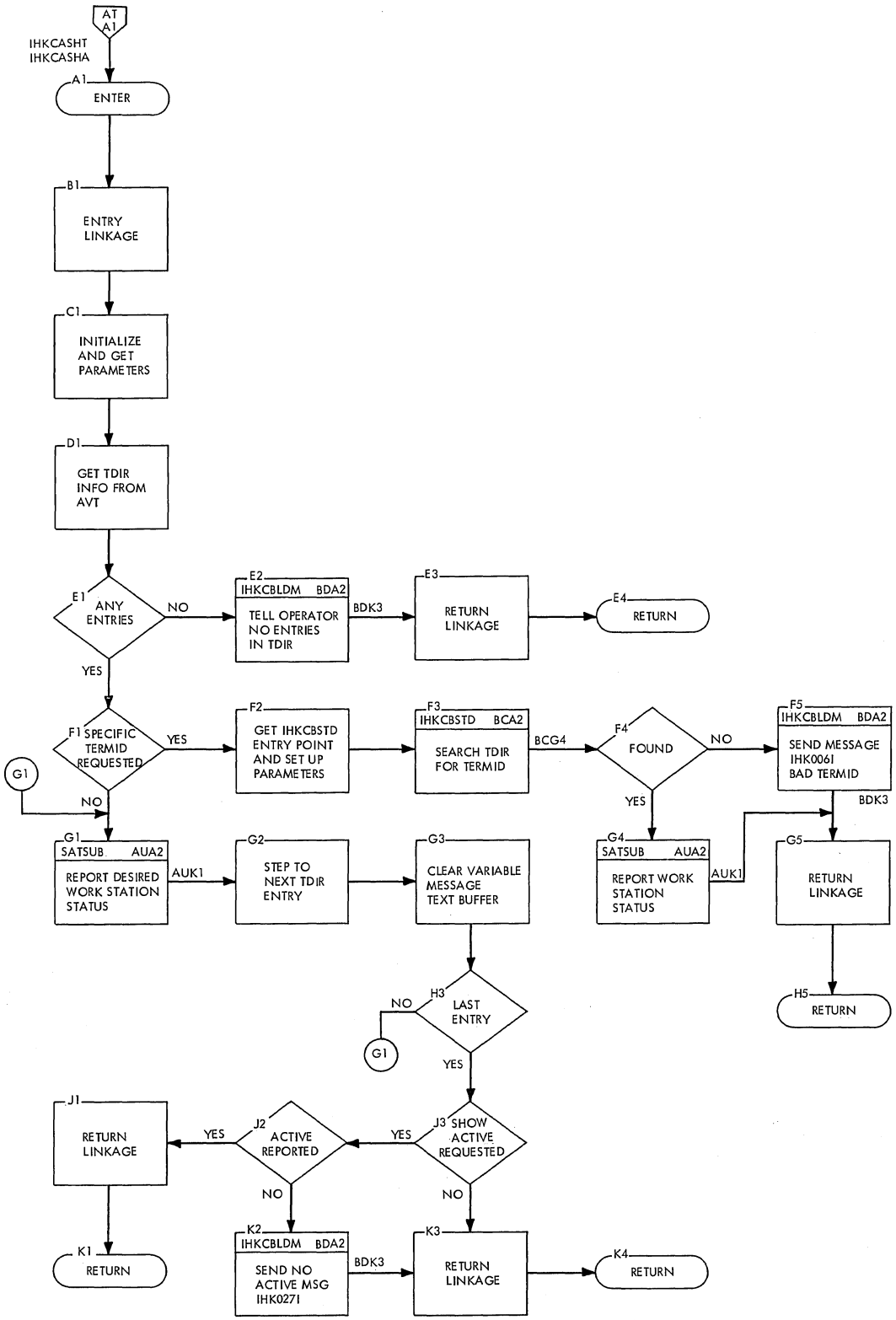


Chart AU. SATSUB and SUPSUB -- SHOW ACTIVE, SHOW TERMS, SHOW USERS Subroutines

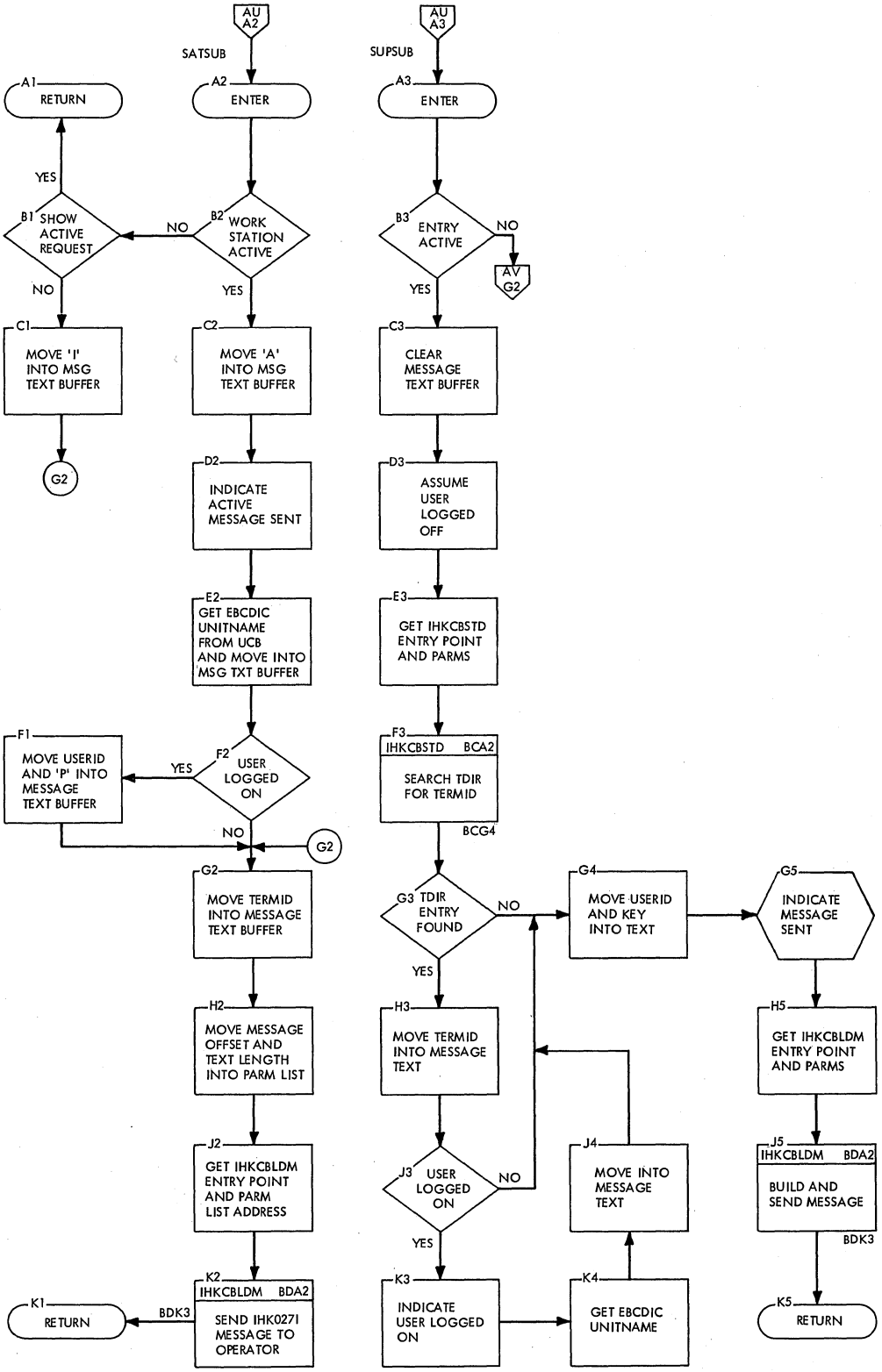


Chart AV. IHKCHSUP -- SHOW USERS Processor

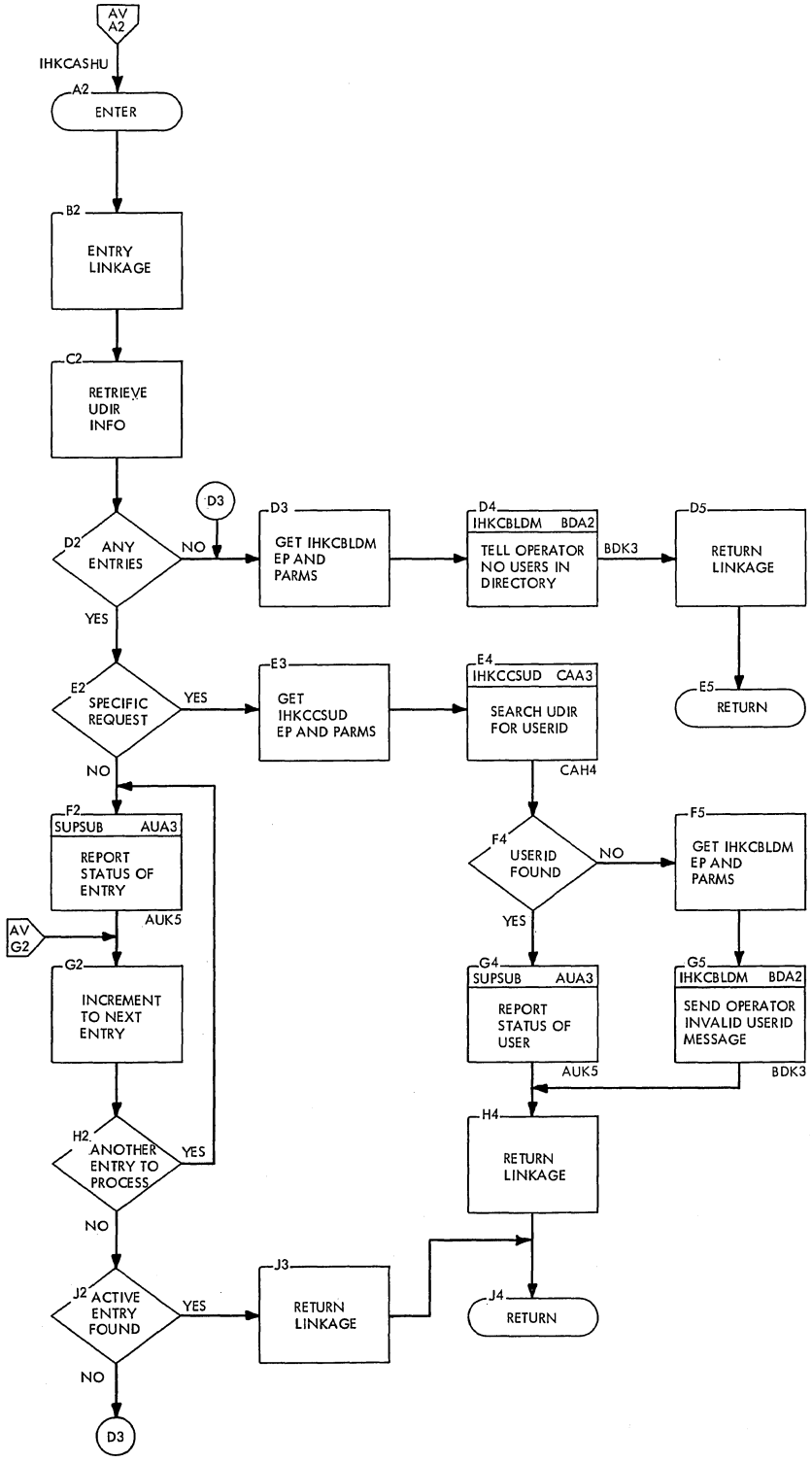


Chart AW. IHKCASHB -- SHOW BRDCST and IHKCASHM -- SHOW MSGS

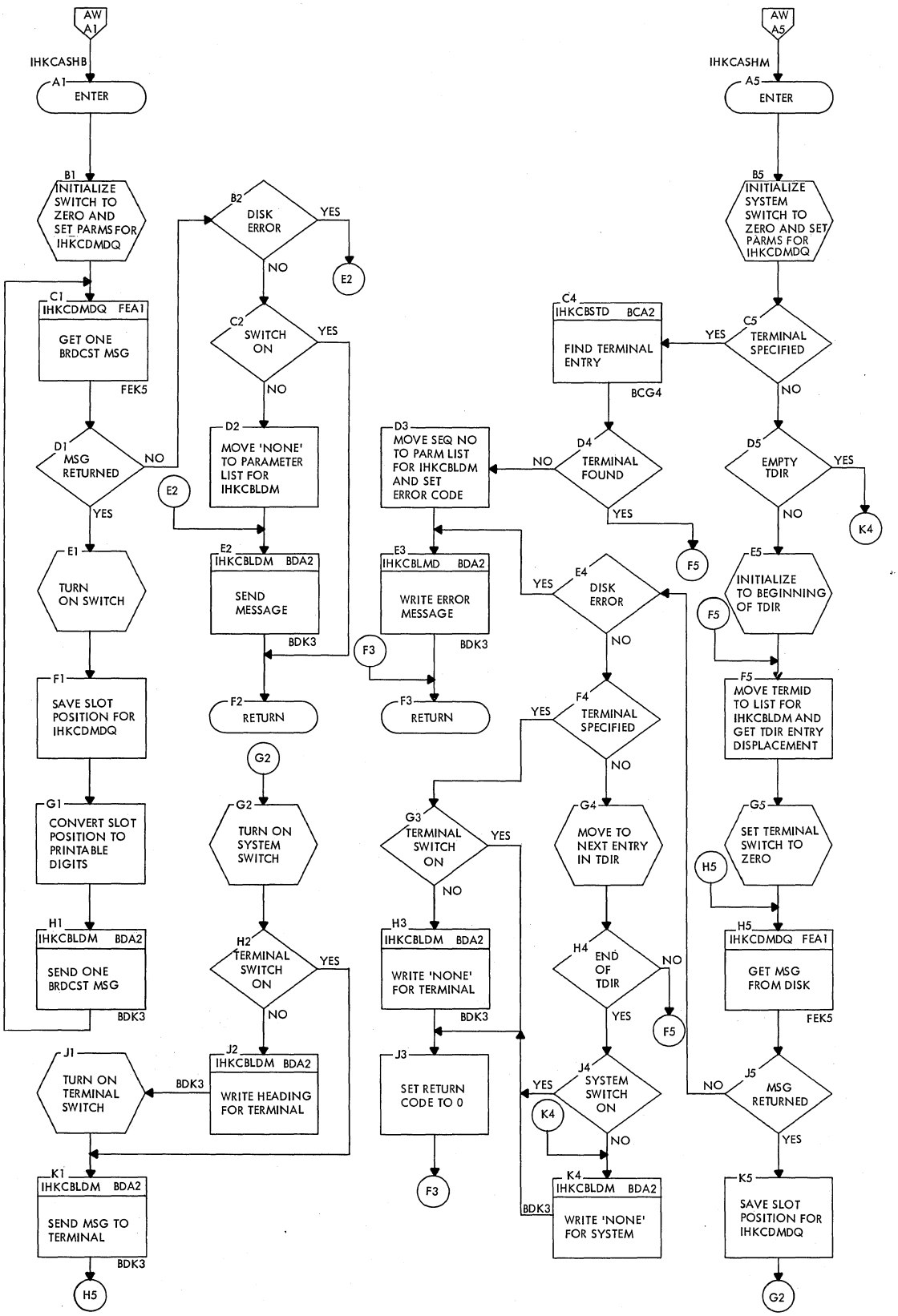


Chart AX. IHKCASHL -- SHOW LERB Processor

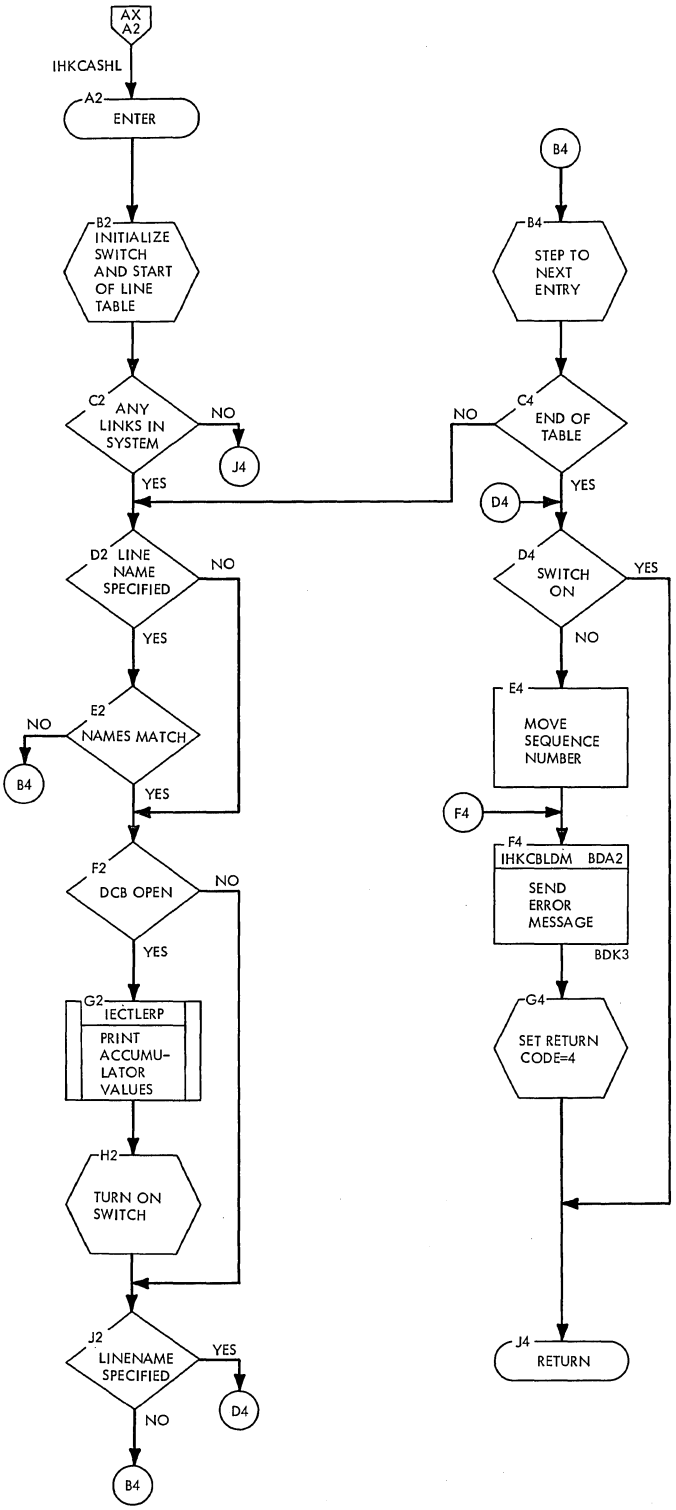
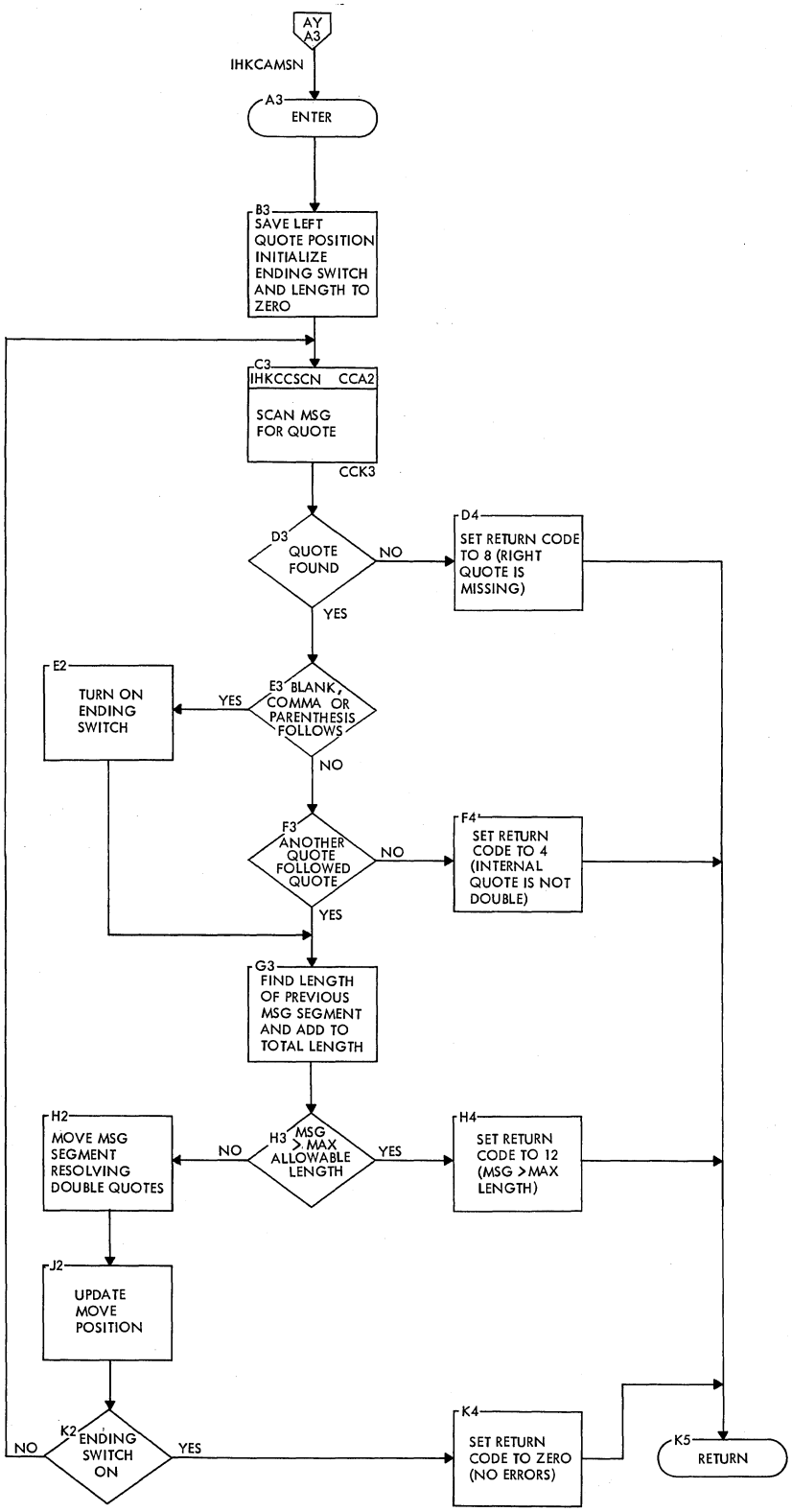


Chart AY. IHKCAMSN -- Message Scan Routine



• Chart AZ. IGC1503D -- Central Command Scheduler

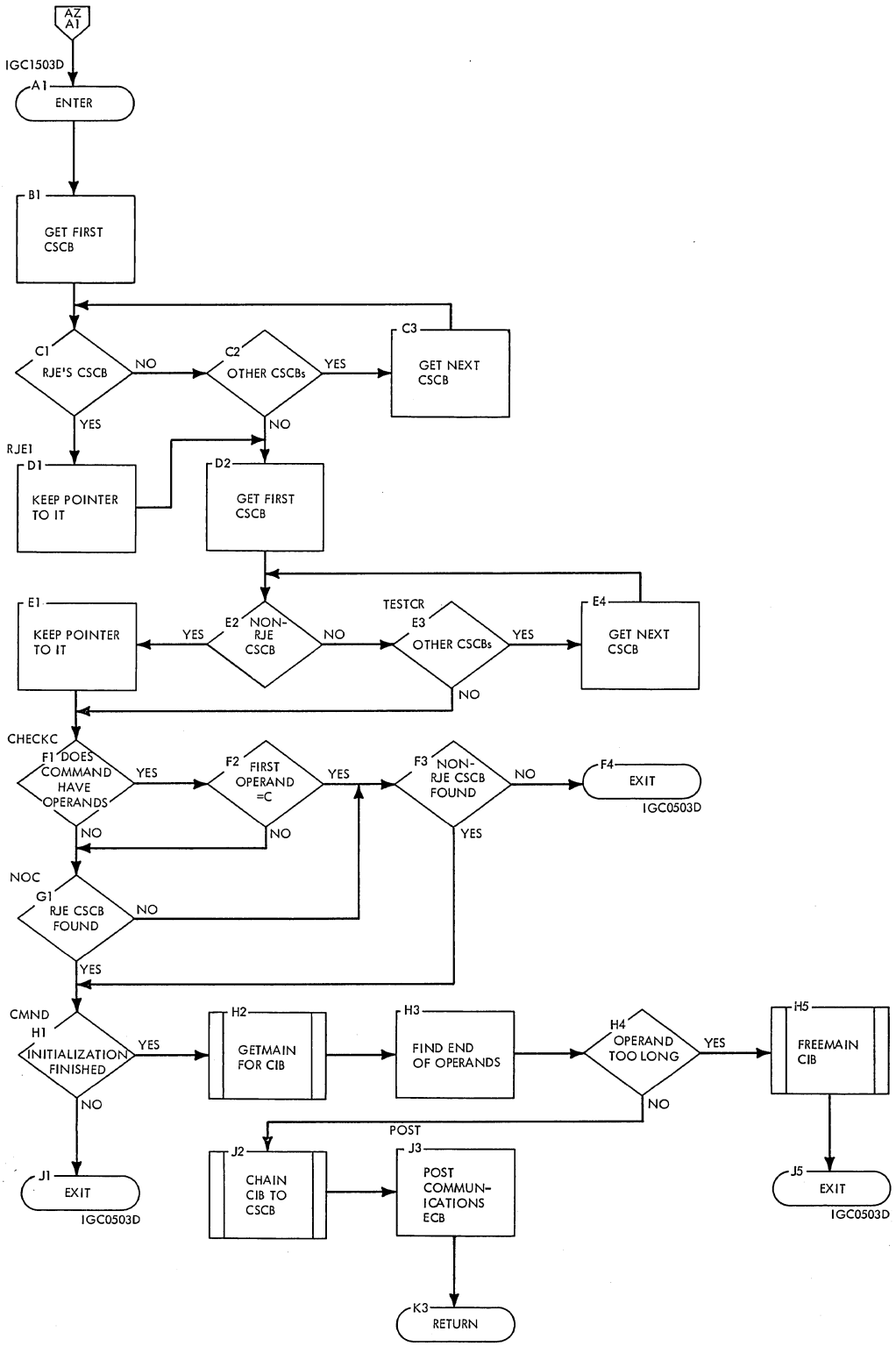


CHART AZ. CENTRAL COMMAND SCHEDULER

• Chart BB. IHKCBLGN -- LOGON Processor

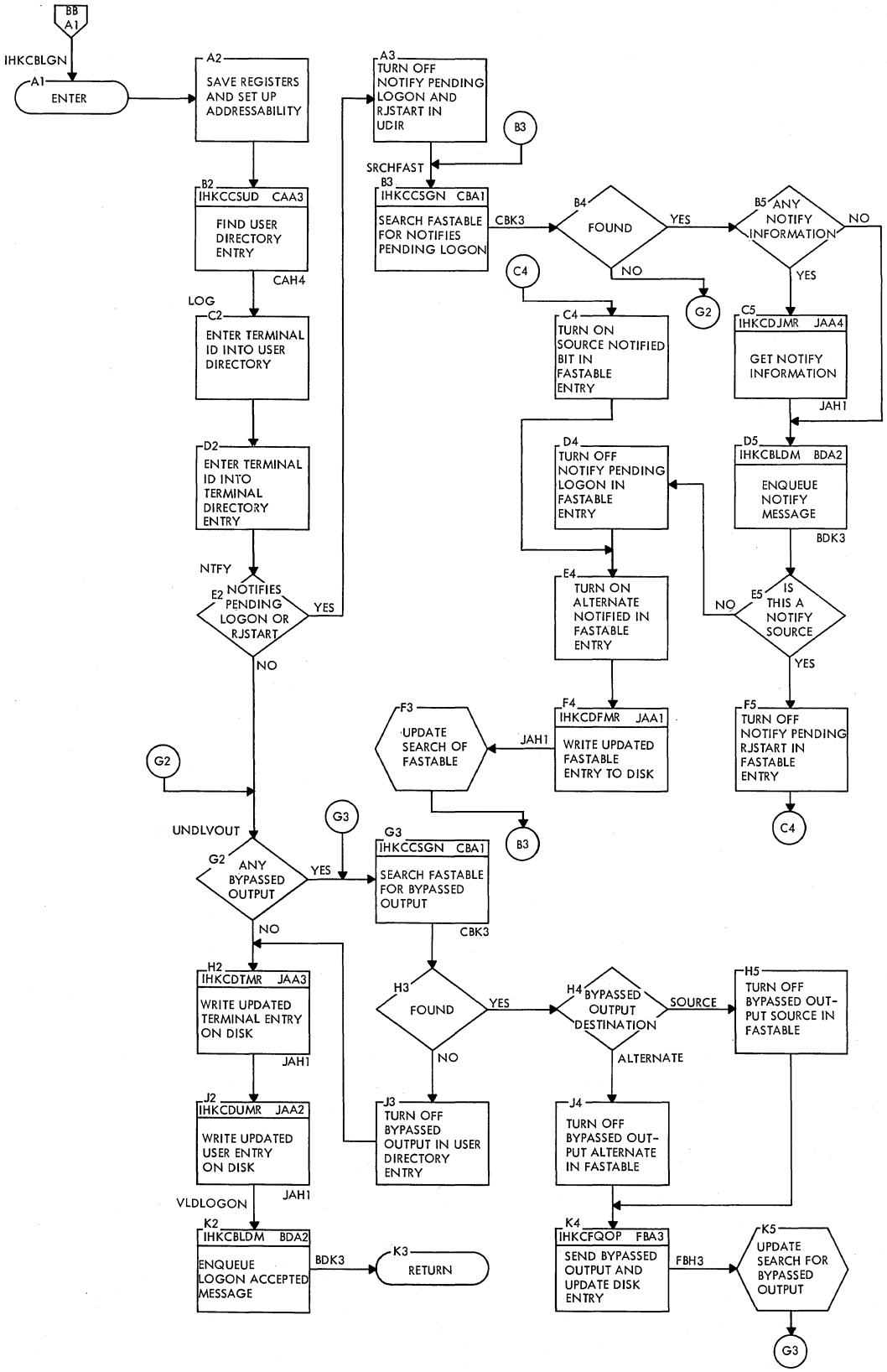


Chart BC. IHKCBSTD -- Search Terminal Directory Routine

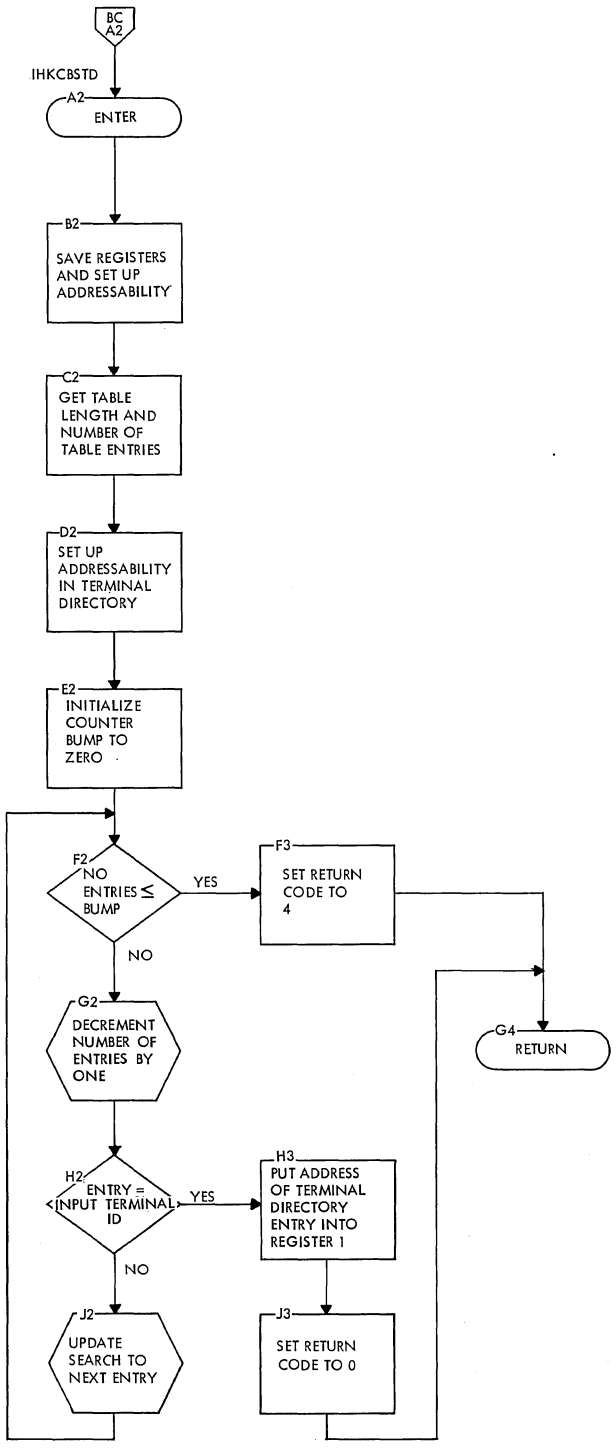


Chart BD. IHKCRUMB -- Build Message

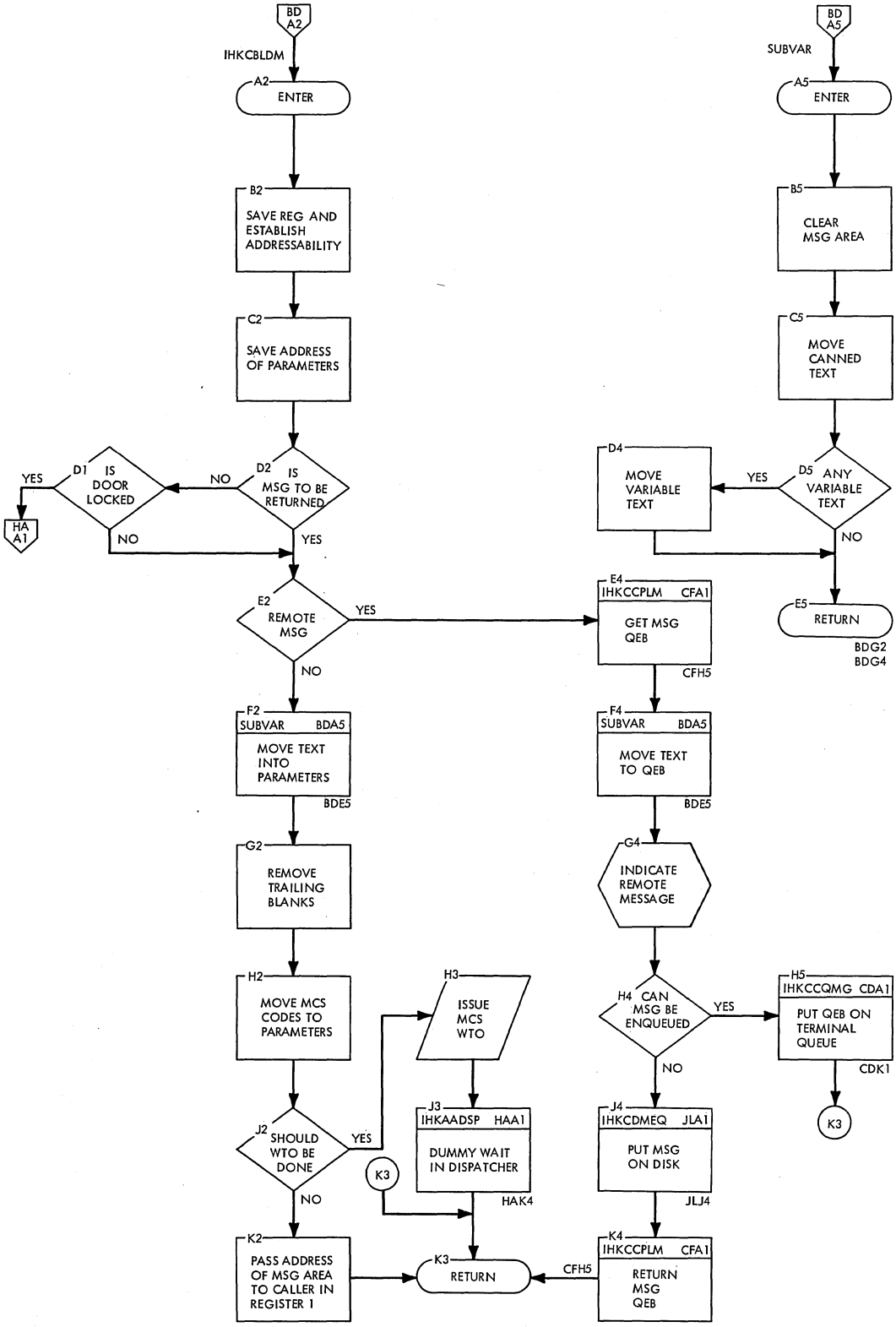


Chart BF. IHKCBRJS -- RJSTART Processor

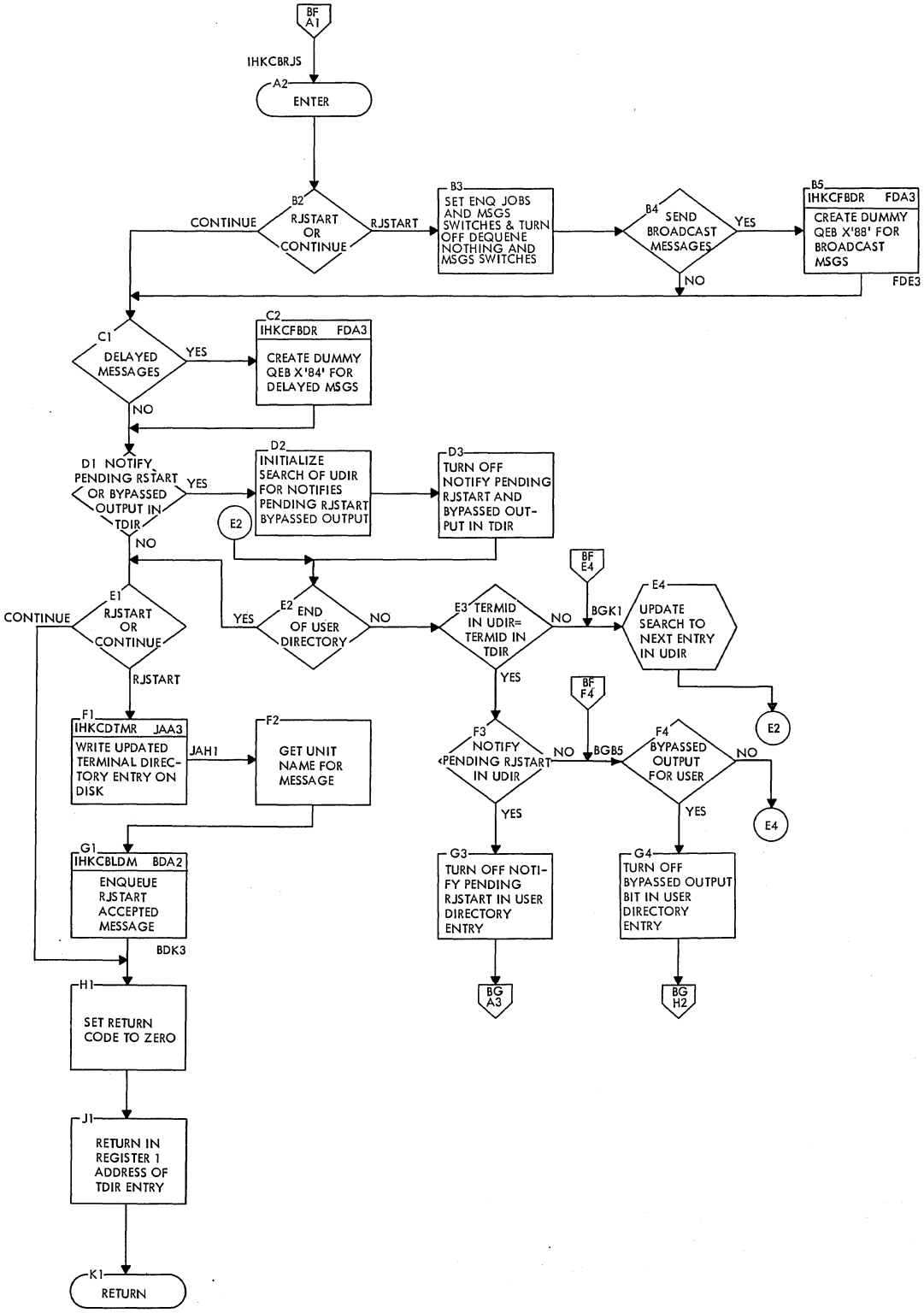


Chart BG. IHKCBRJS -- RJSTART Processor

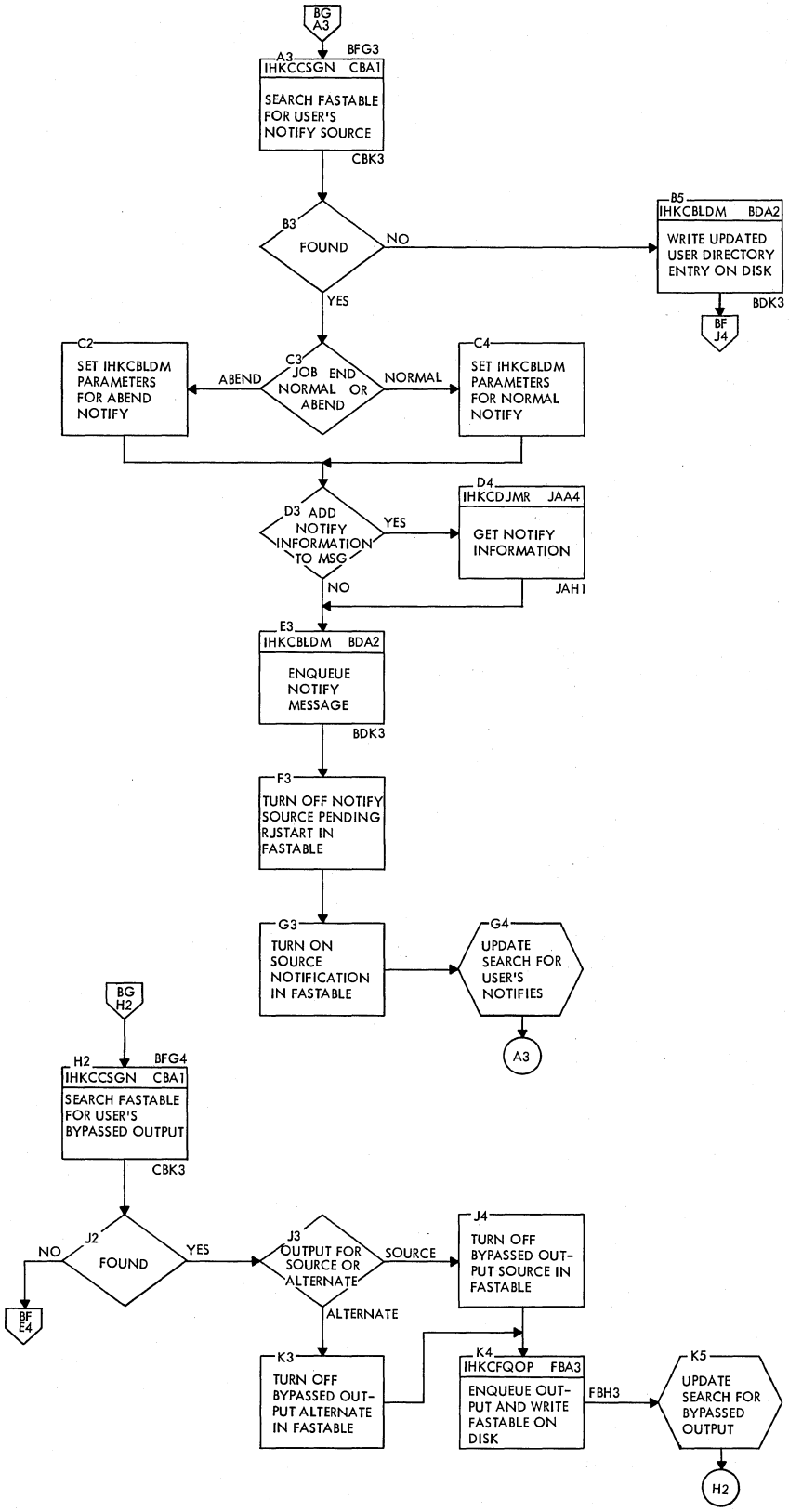


Chart BH. IHKCBUID -- USERID Processor

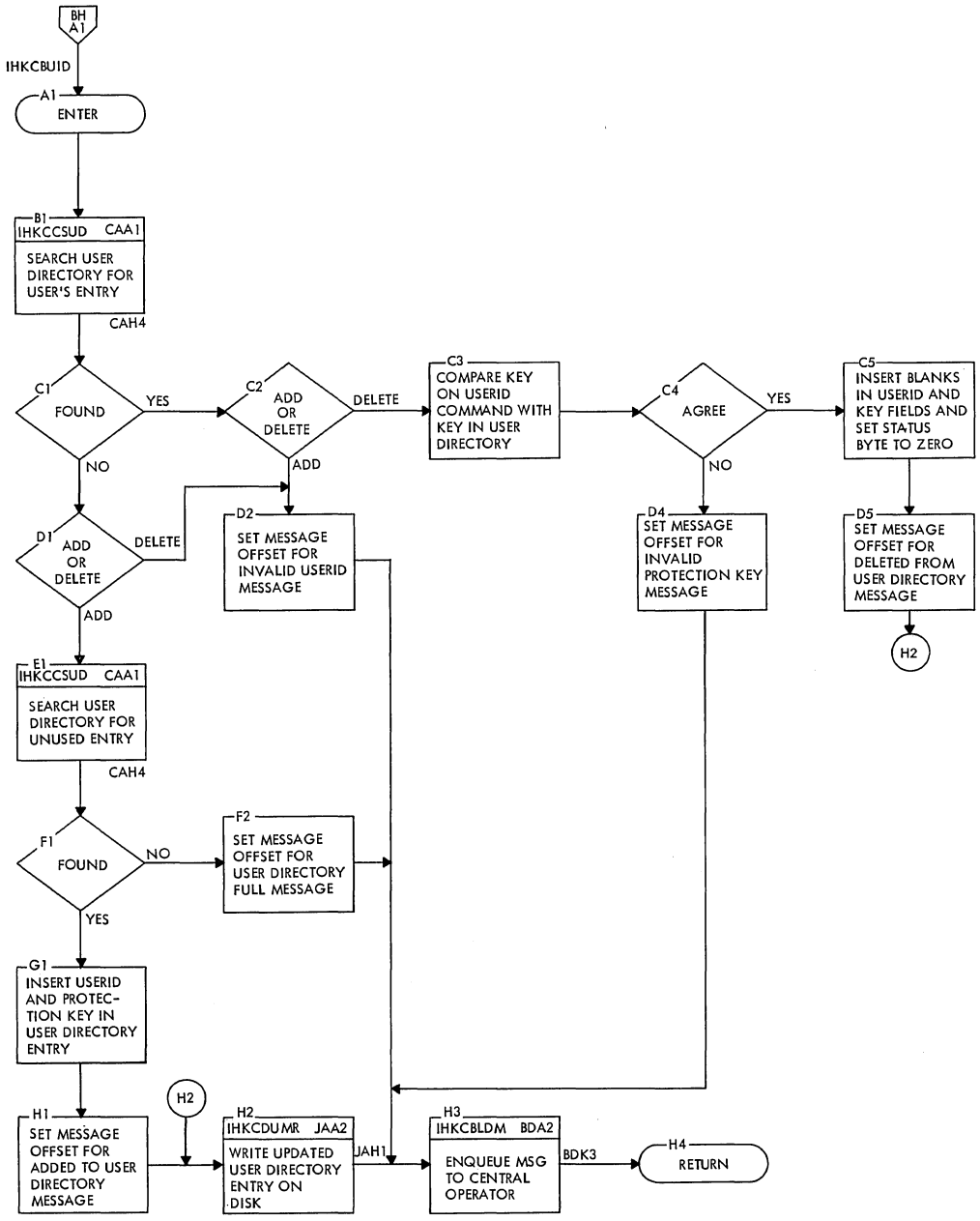
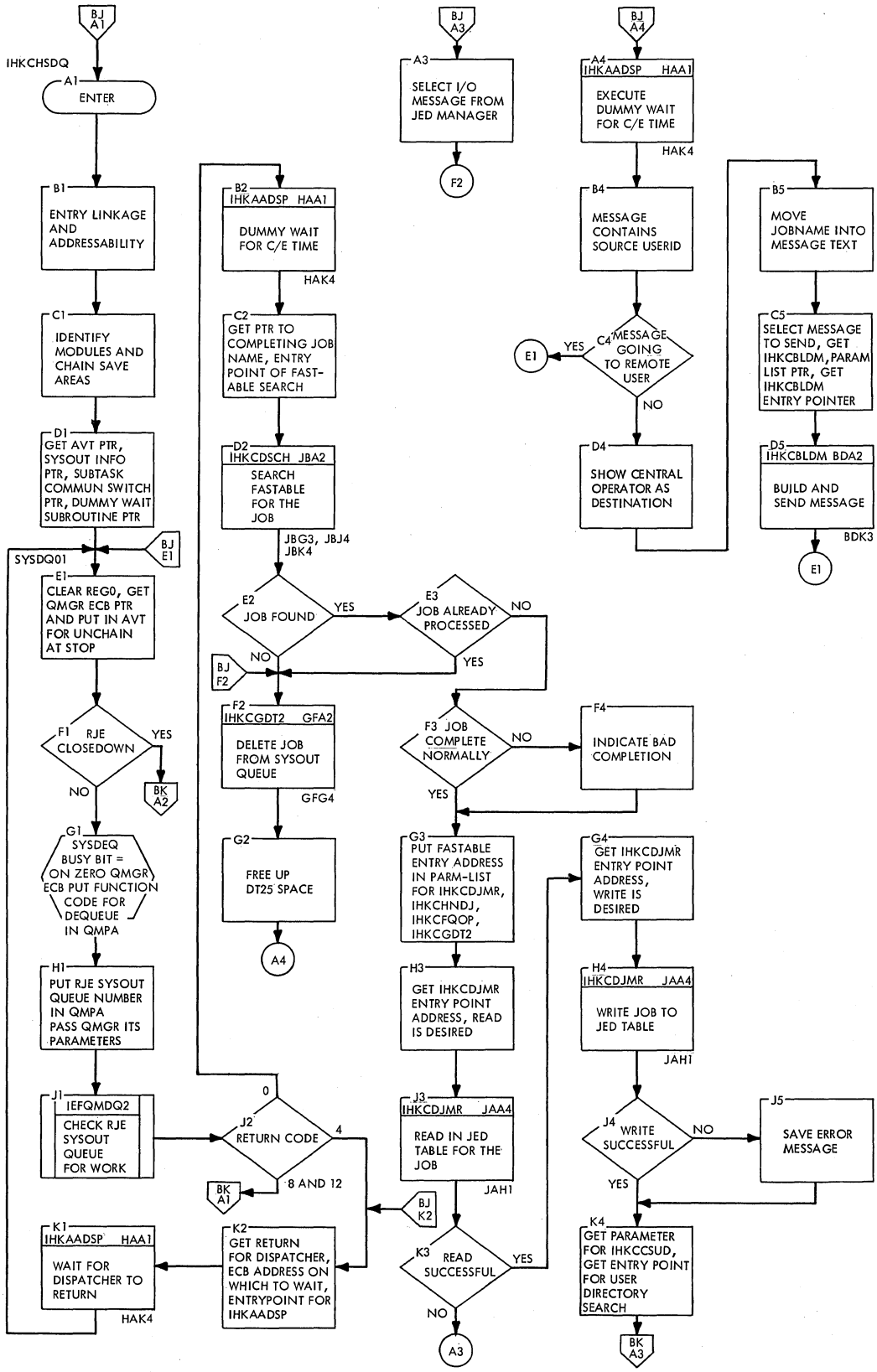
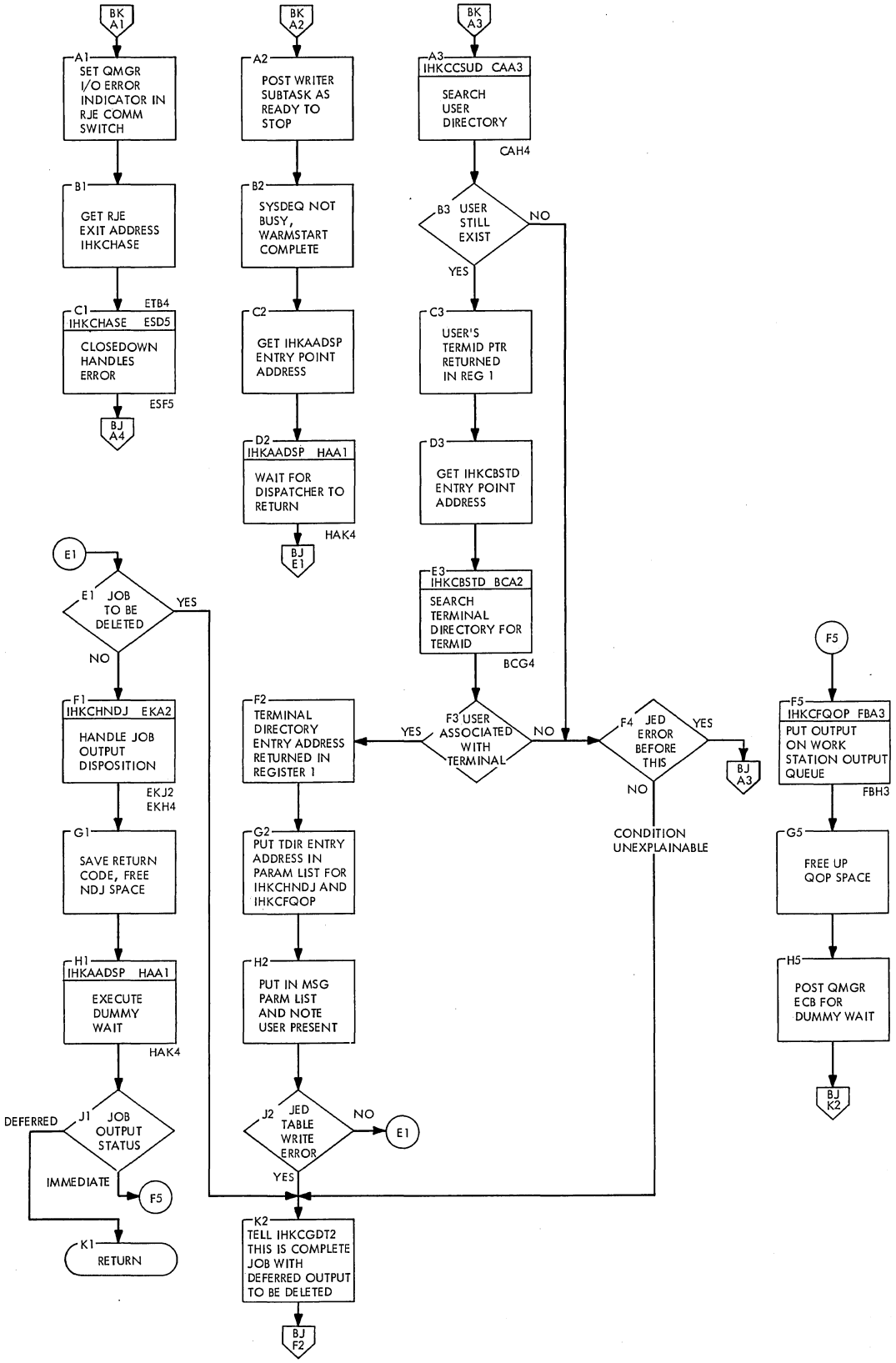


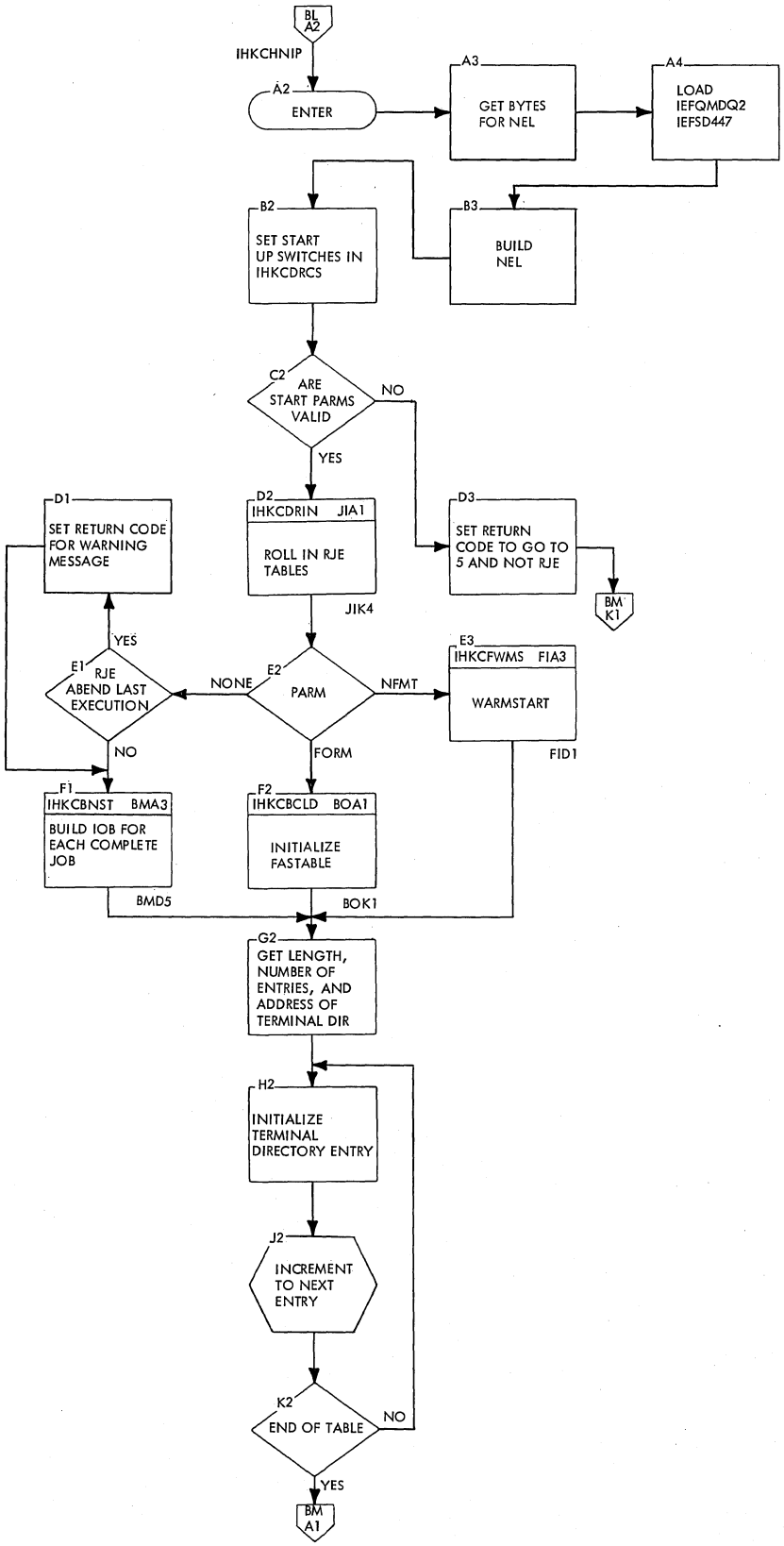
Chart BJ. IHKCHSDQ -- SYSDEQ Routine



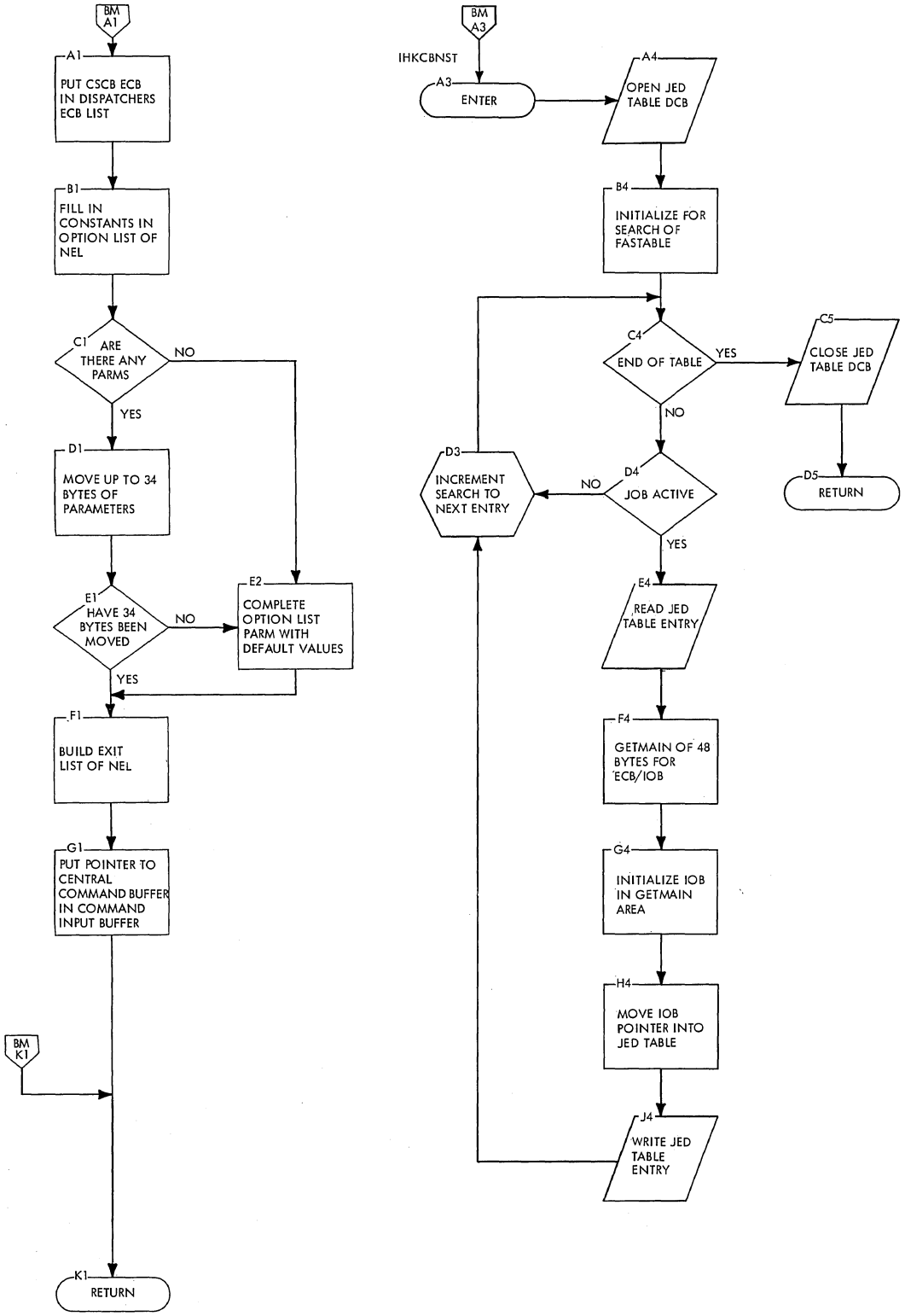
• Chart BK. IHKCHSDQ -- SYSDEQ Routine



• Chart BL. IHKCHNIP -- RJE Initialization Routine



• Chart BM. IHKCHNIP -- RJE Initialization Routine



• Chart BN. IHKCHBGN -- RJBGN Routine - MFT

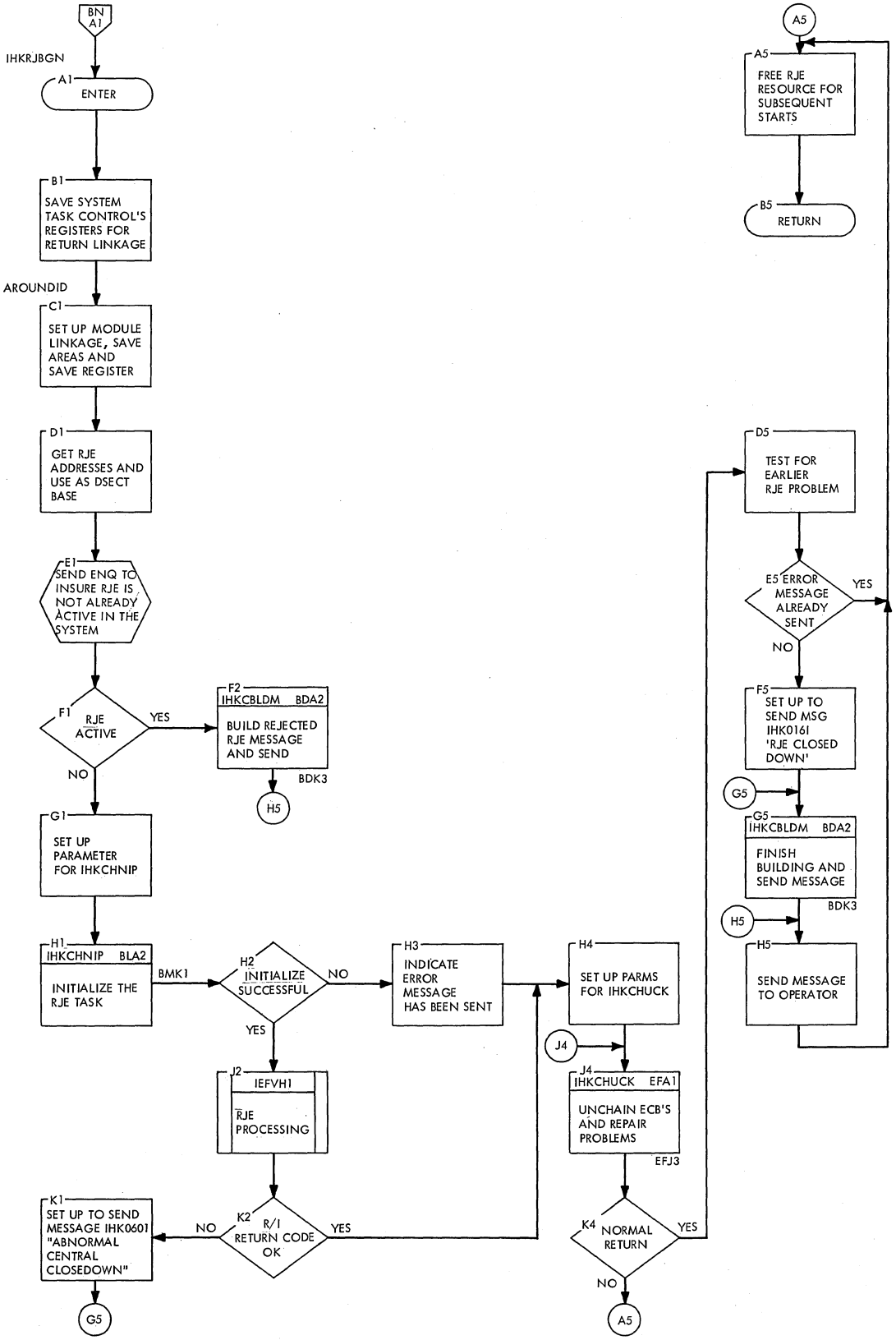
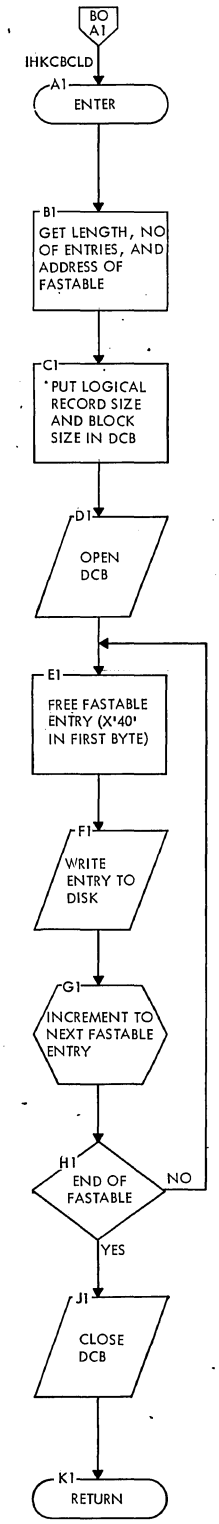


Chart BO. IHKCBCLD -- Coldstart Routine



• Chart BP. IHKXJBGN -- RJBGN Routine - MVT

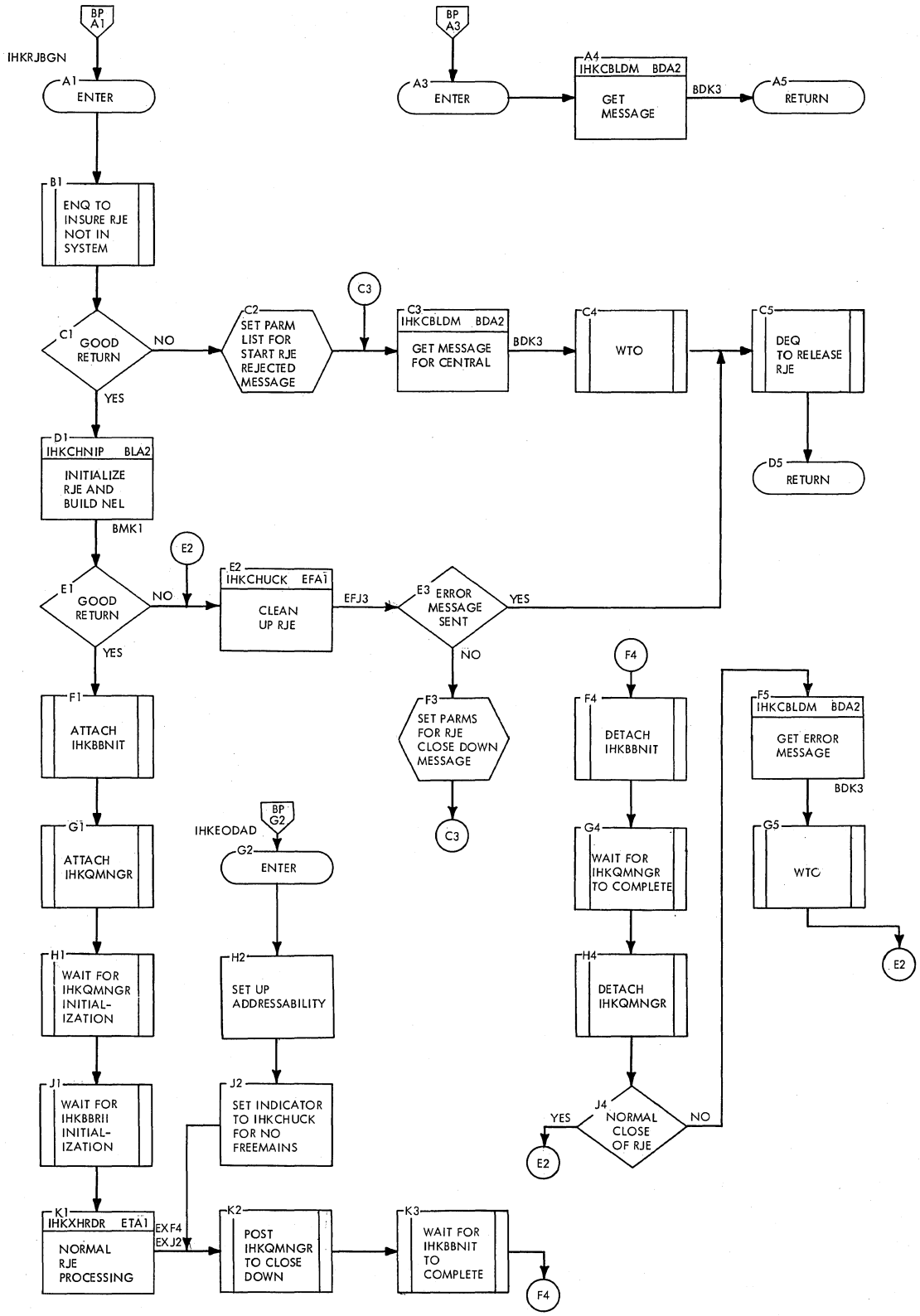


Chart BY. IHKCHJIR -- SHOW DEFER and SHOW JOBS Processor

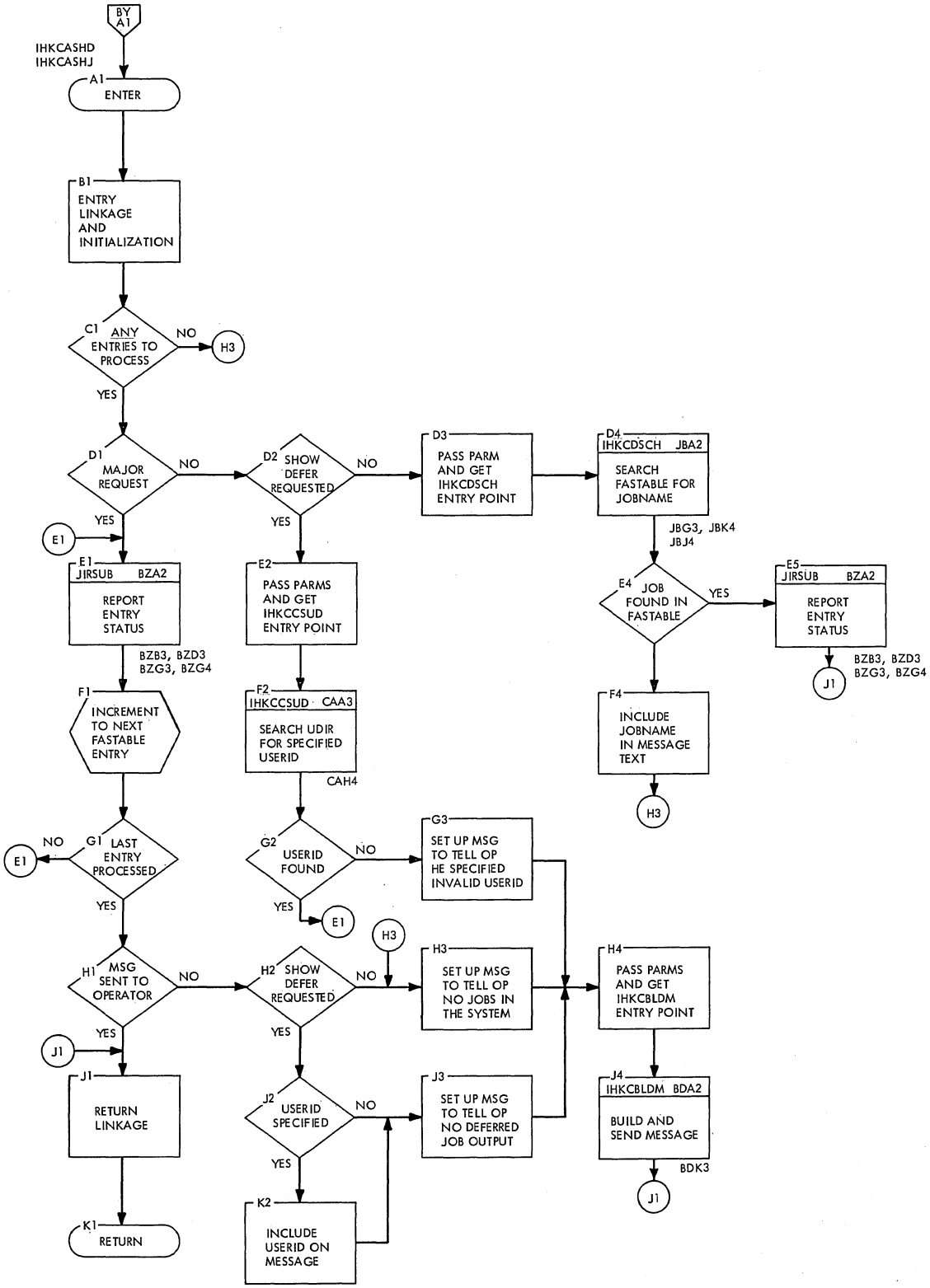
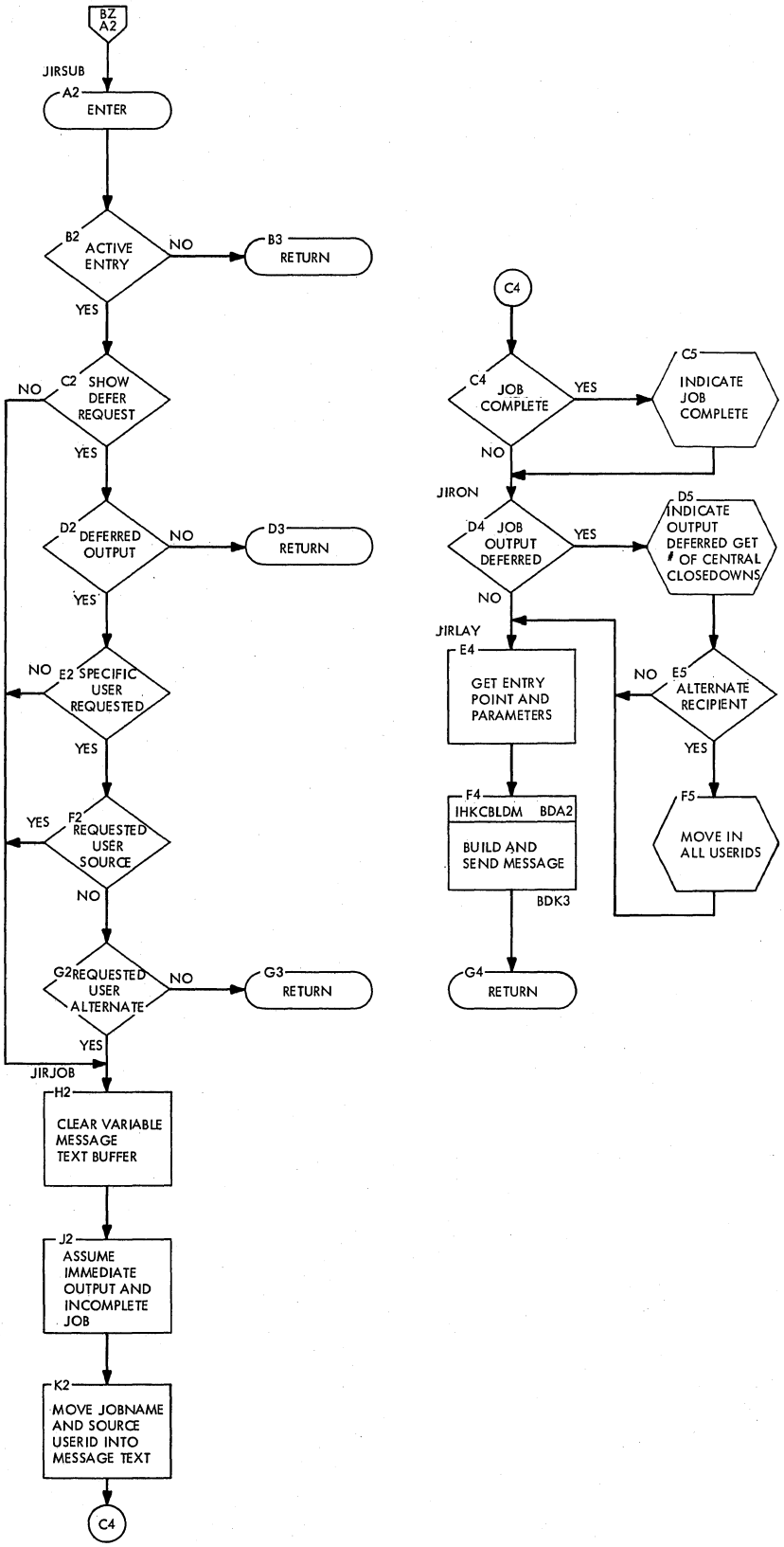


Chart BZ. JIRSUB -- SHOW DEFER and SHOW JOBS Subroutine



● Chart CA. IHKCCSUD -- Search User Directory

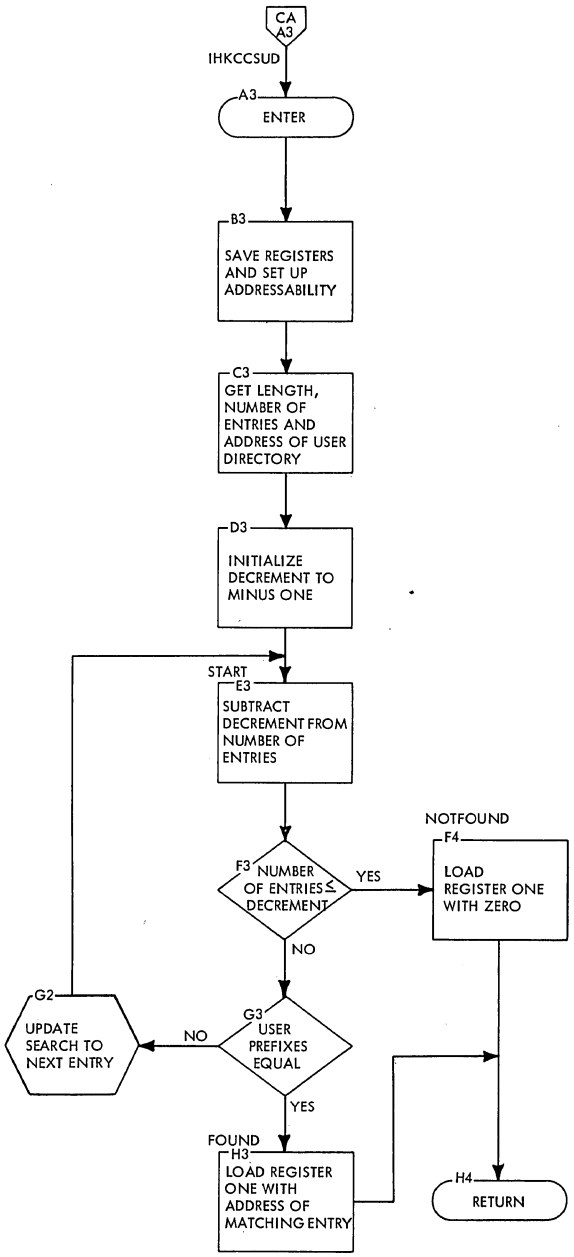


Chart CB. IHKCCSGN -- General Search of Fastable

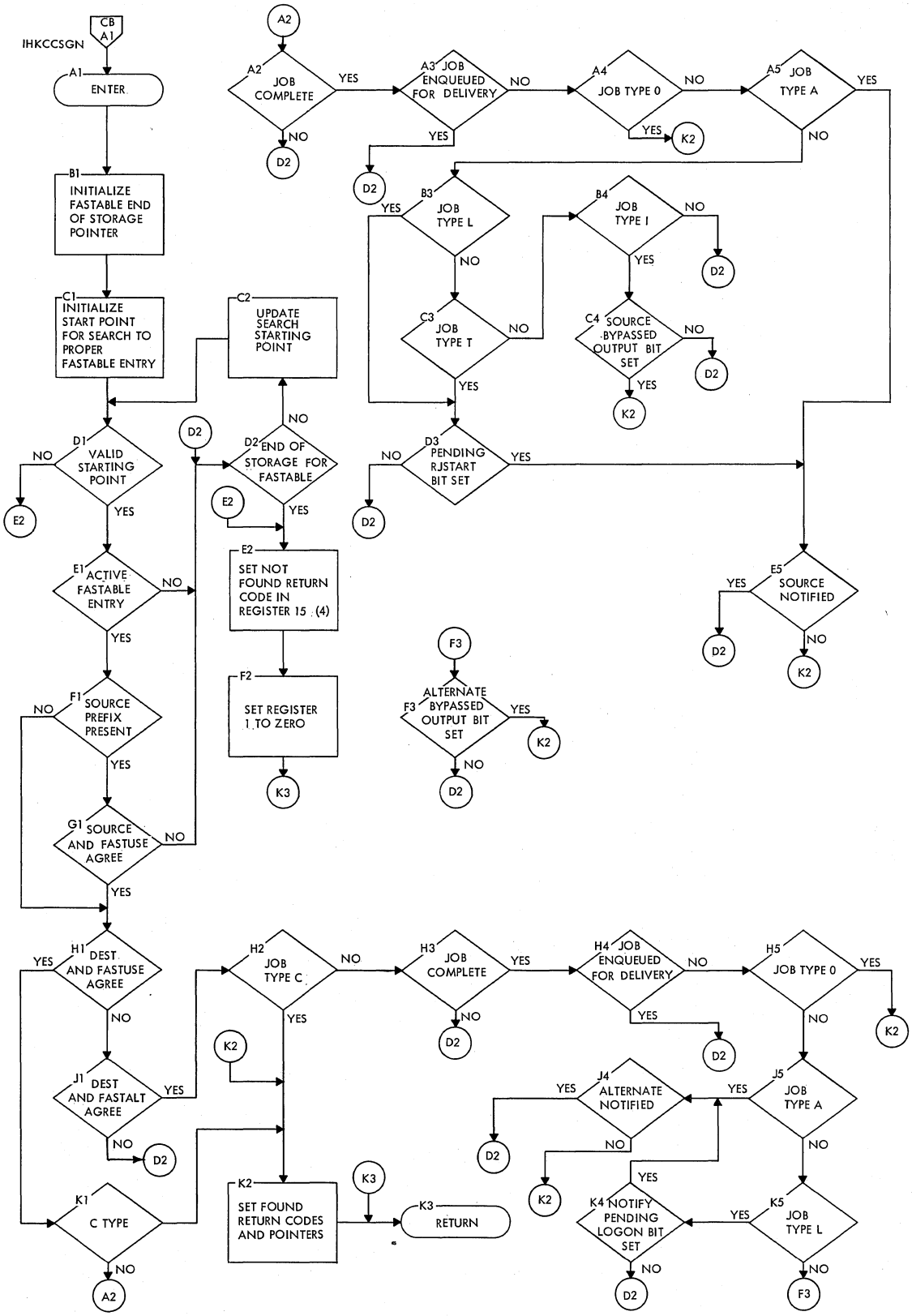
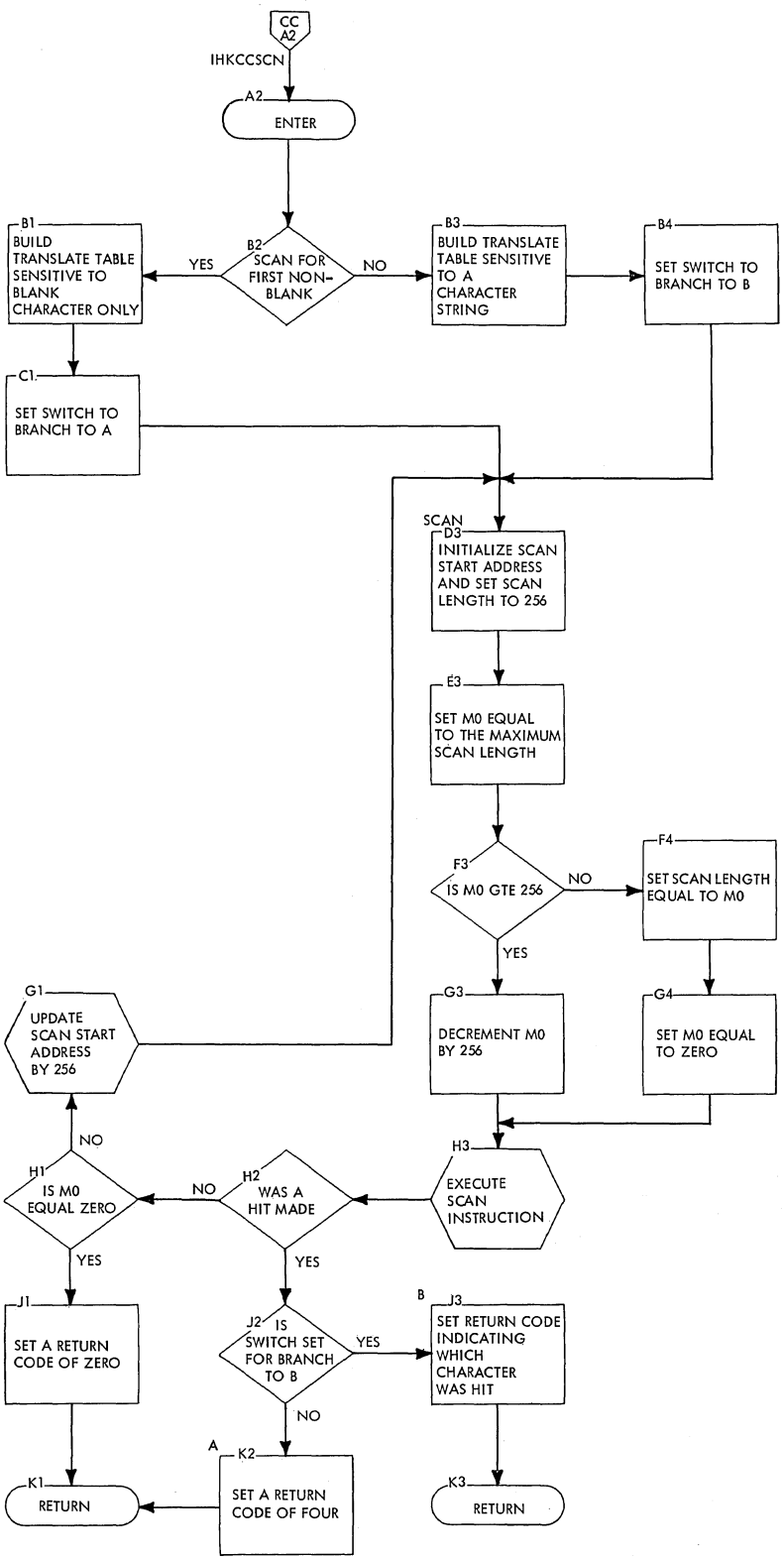
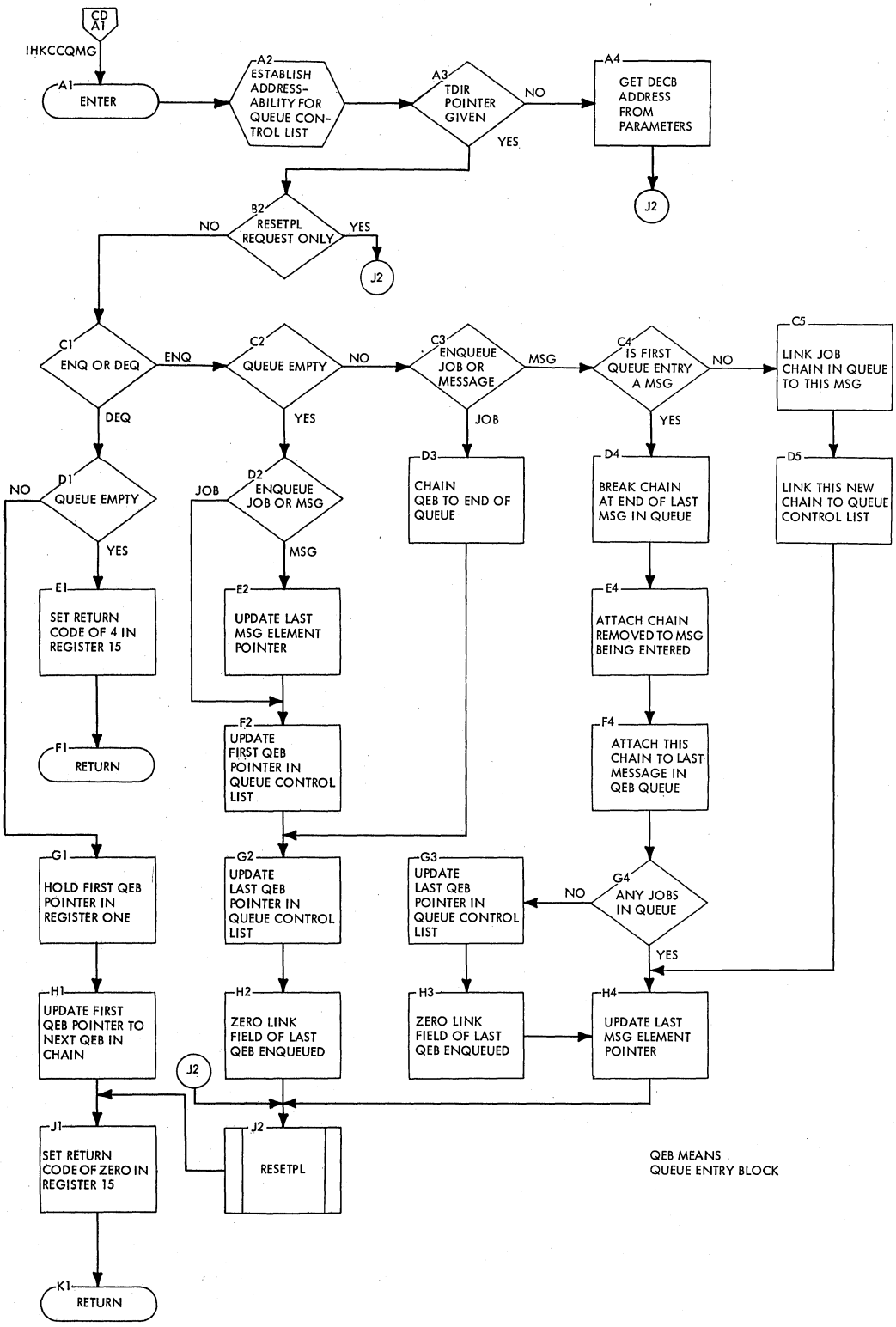


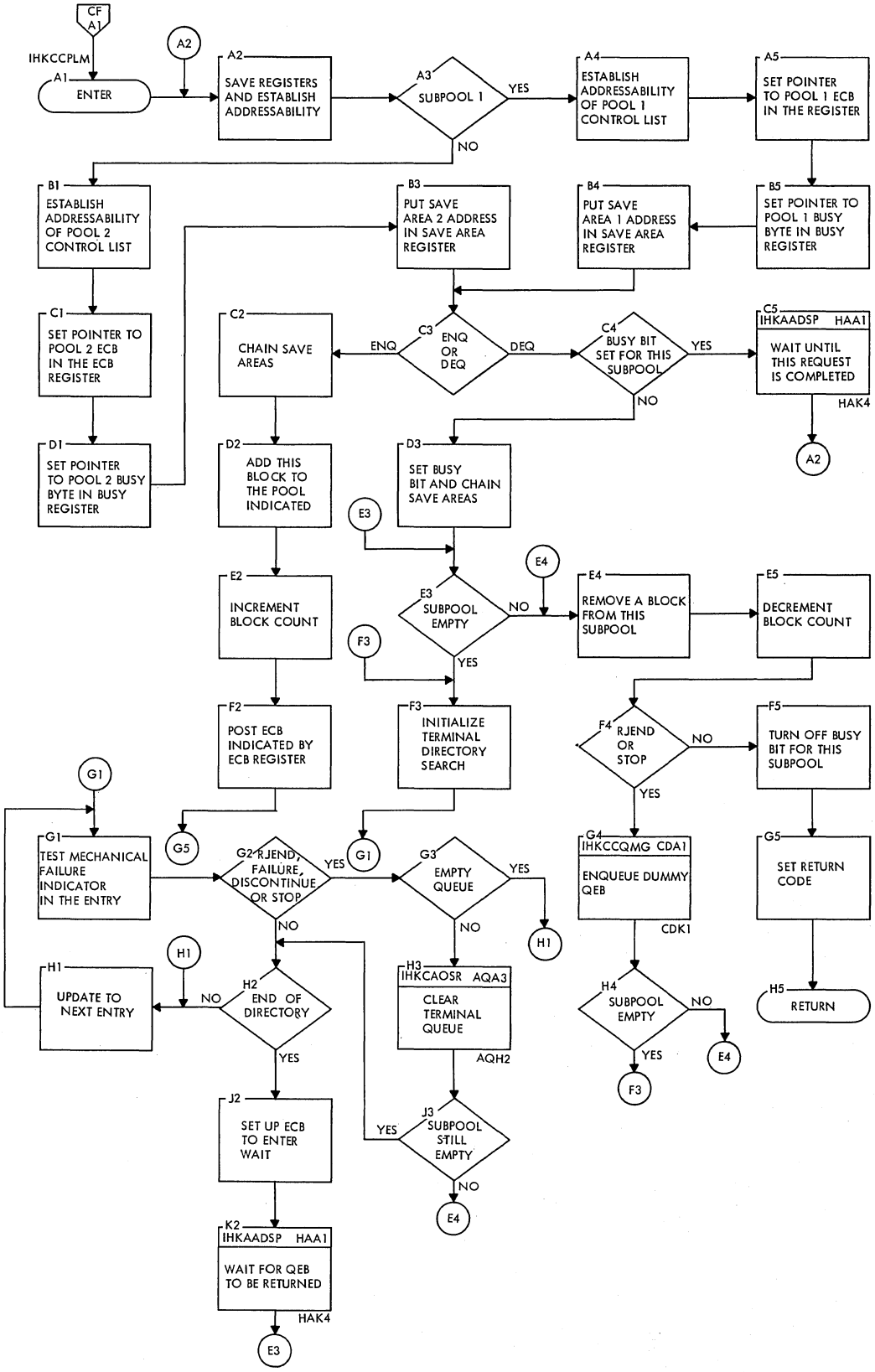
Chart CC. IHKCCSCN -- Scan Routine



• Chart CD. IHKCCQMG -- RJE Queue Manager



• Chart CF. IHKCCPLM -- Freepool Manager



• Chart DA. IHKCEDIT and IHKXEDIT -- JCL Edit Routine

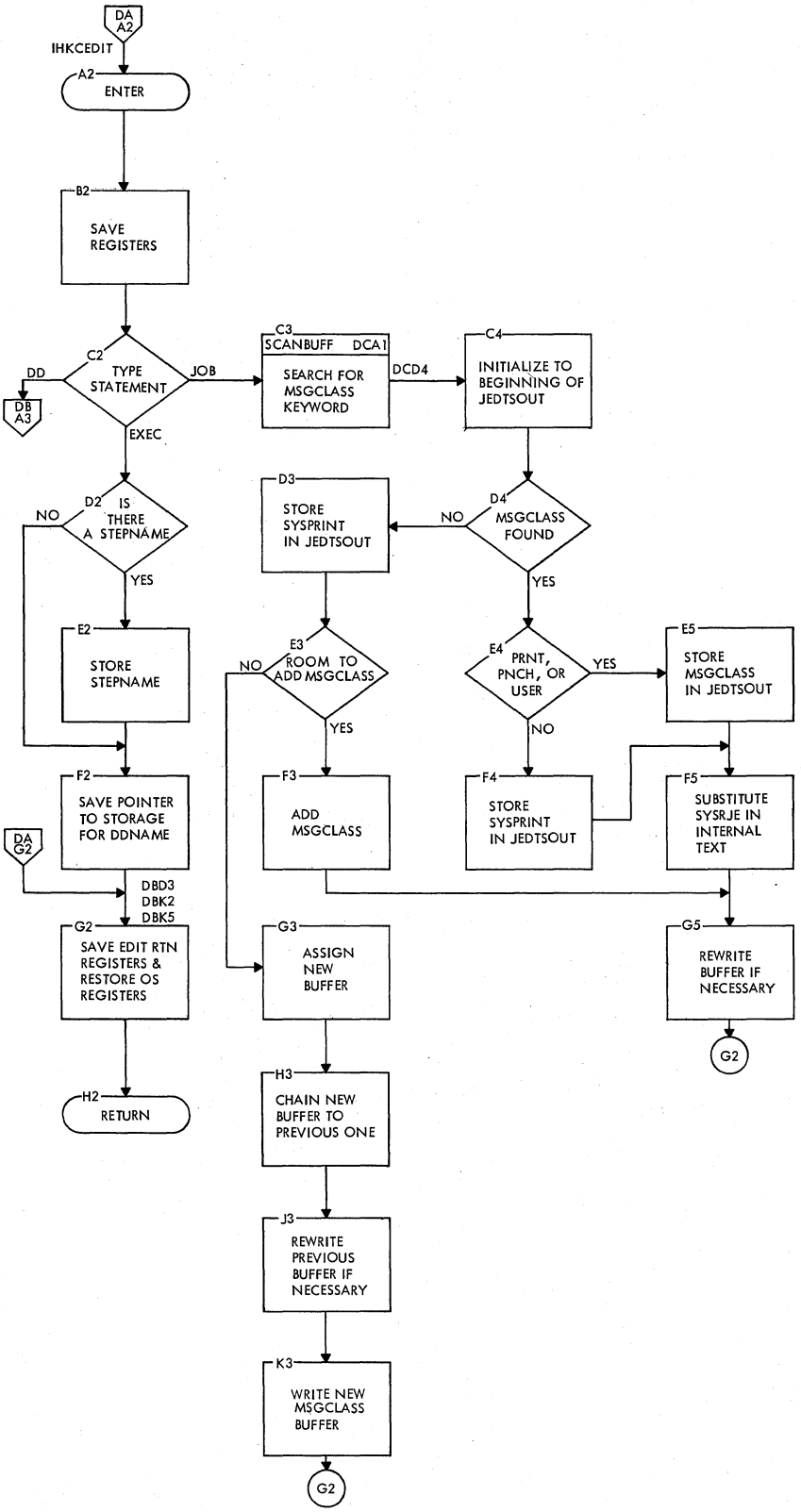


Chart DB. IHKCEDIT and IHKXEDIT -- JCL Edit Routine

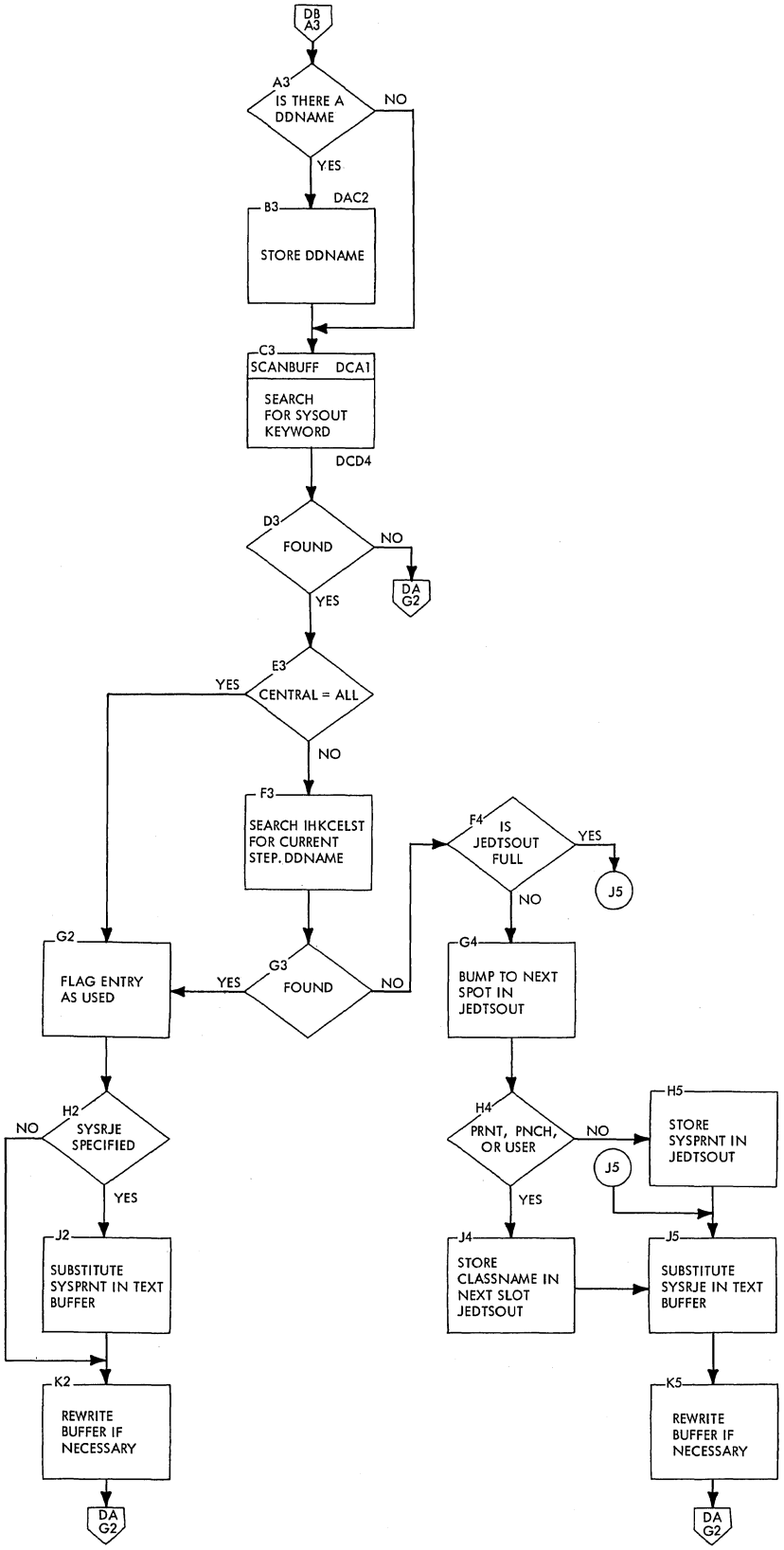


Chart DC. IHKCEDIT and IHKXEDIT -- JCL Edit Routine

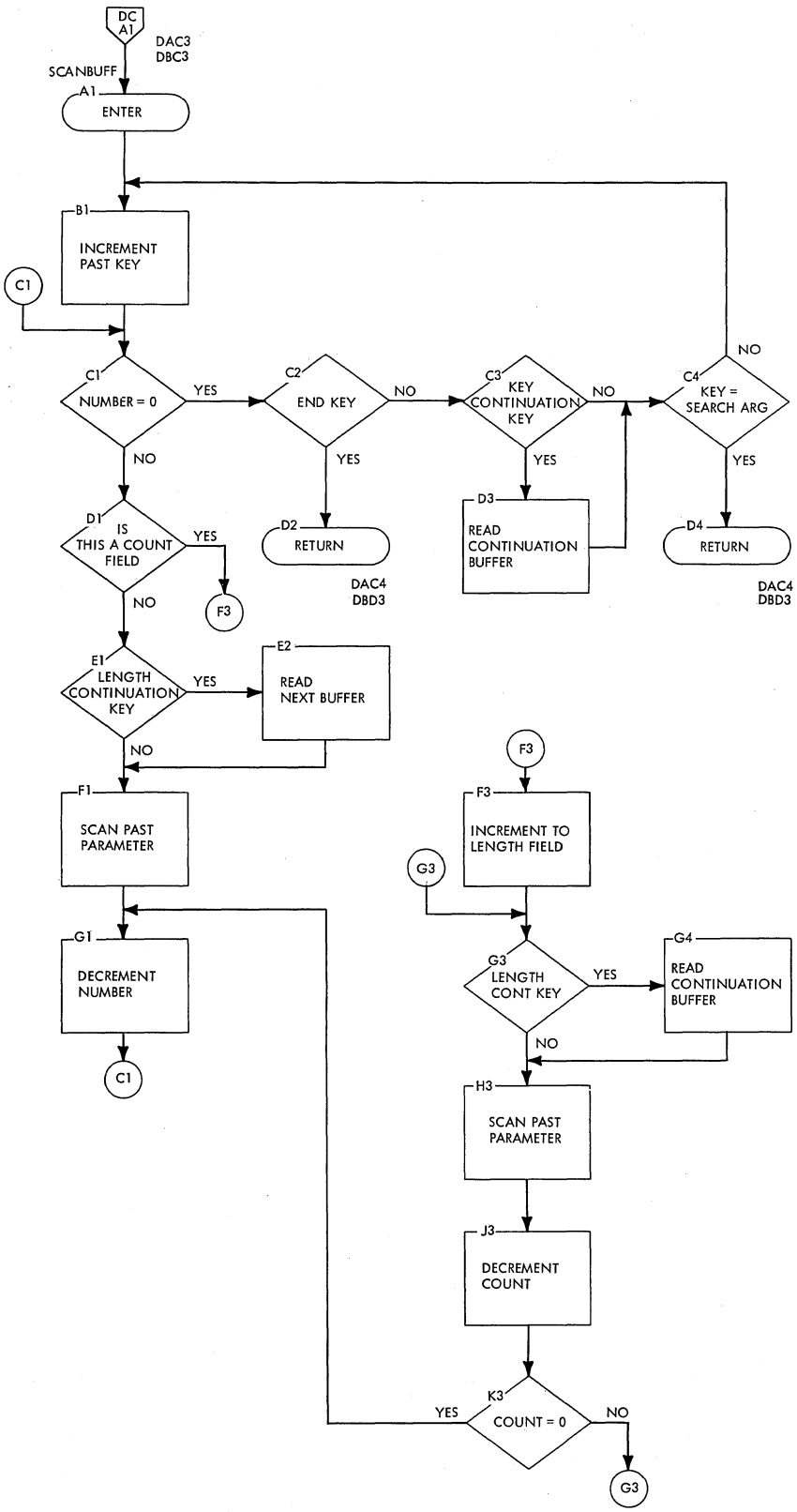


Chart EA. IHKCHJPR -- JED Processor

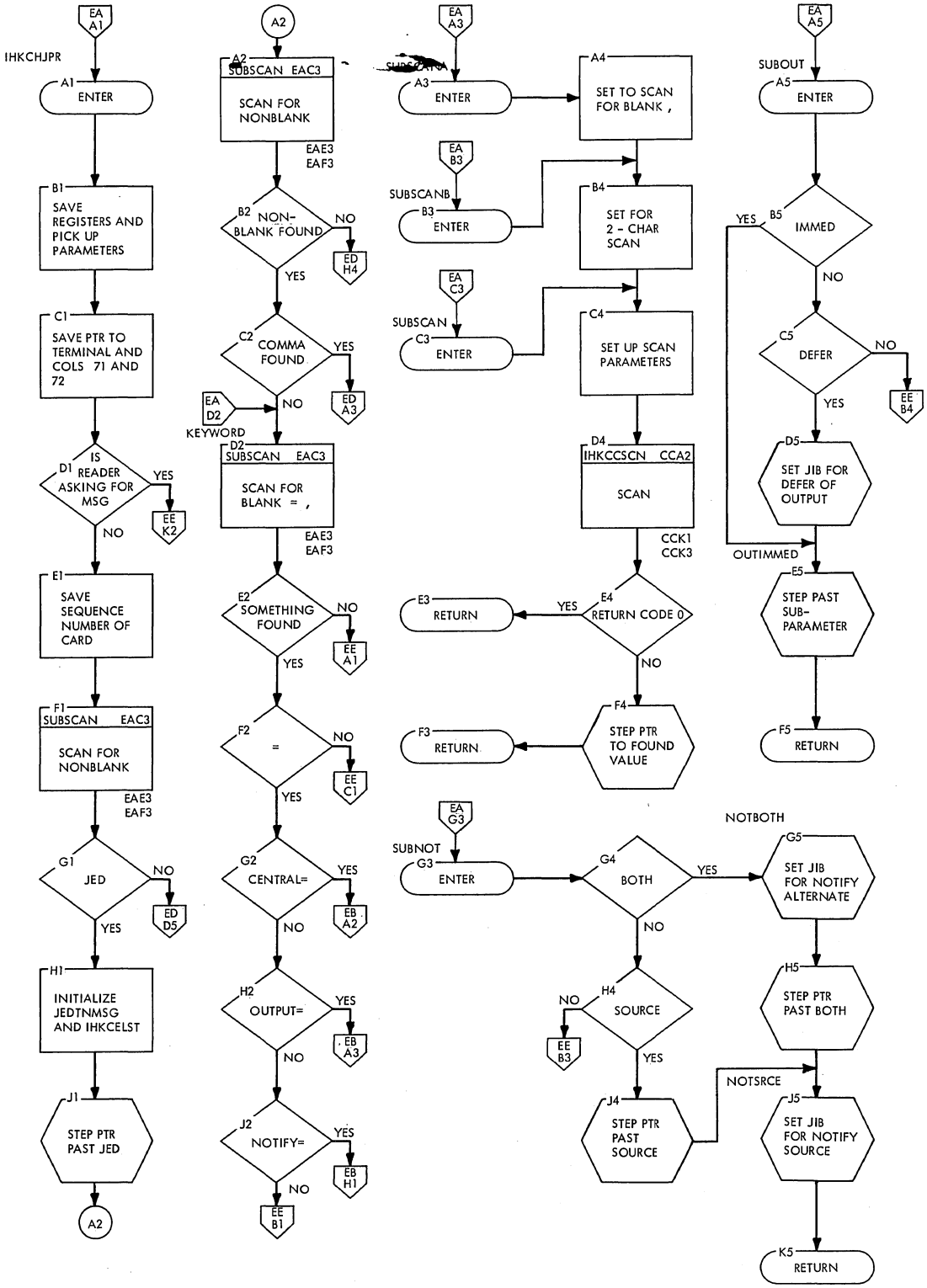
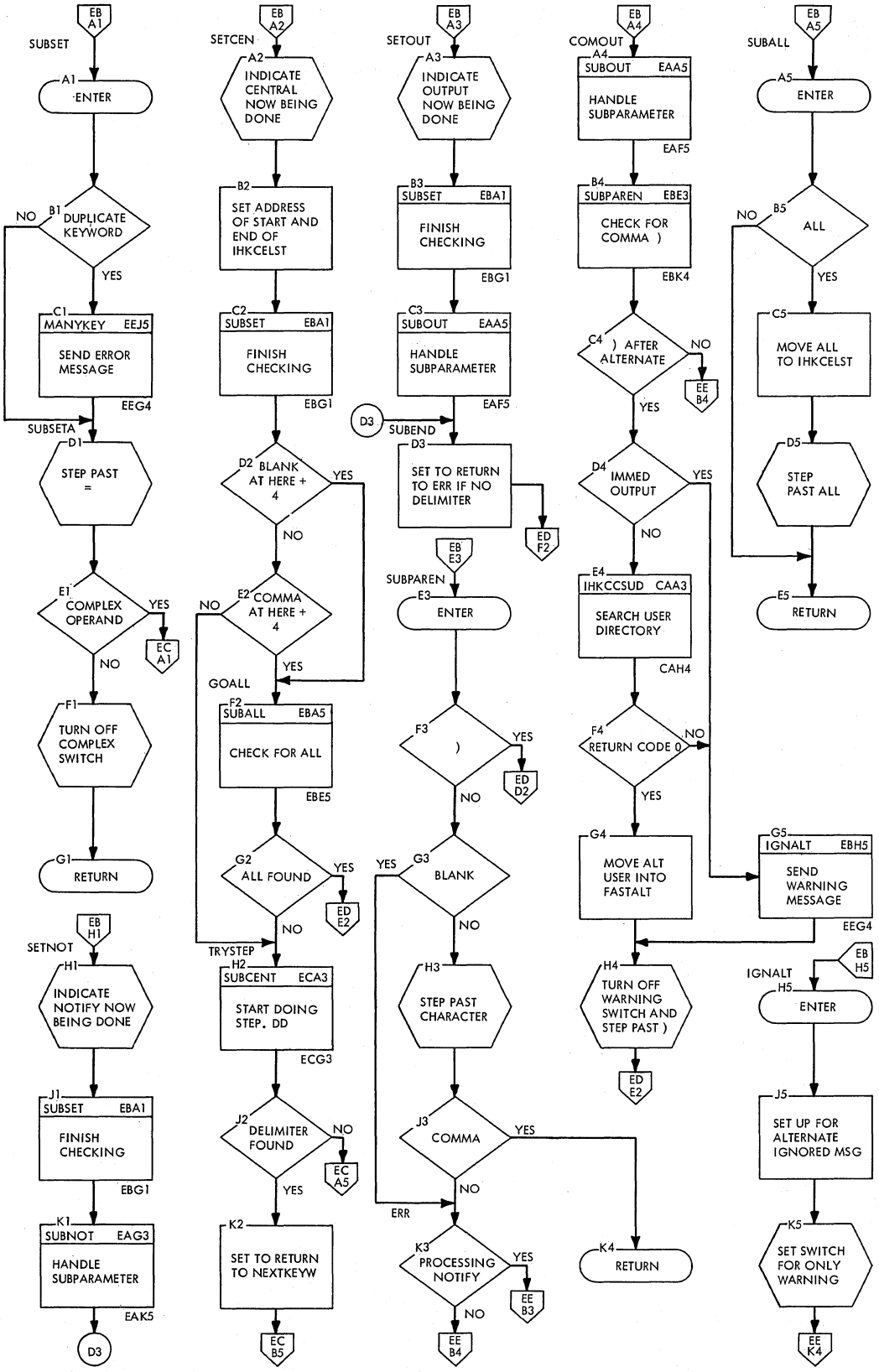
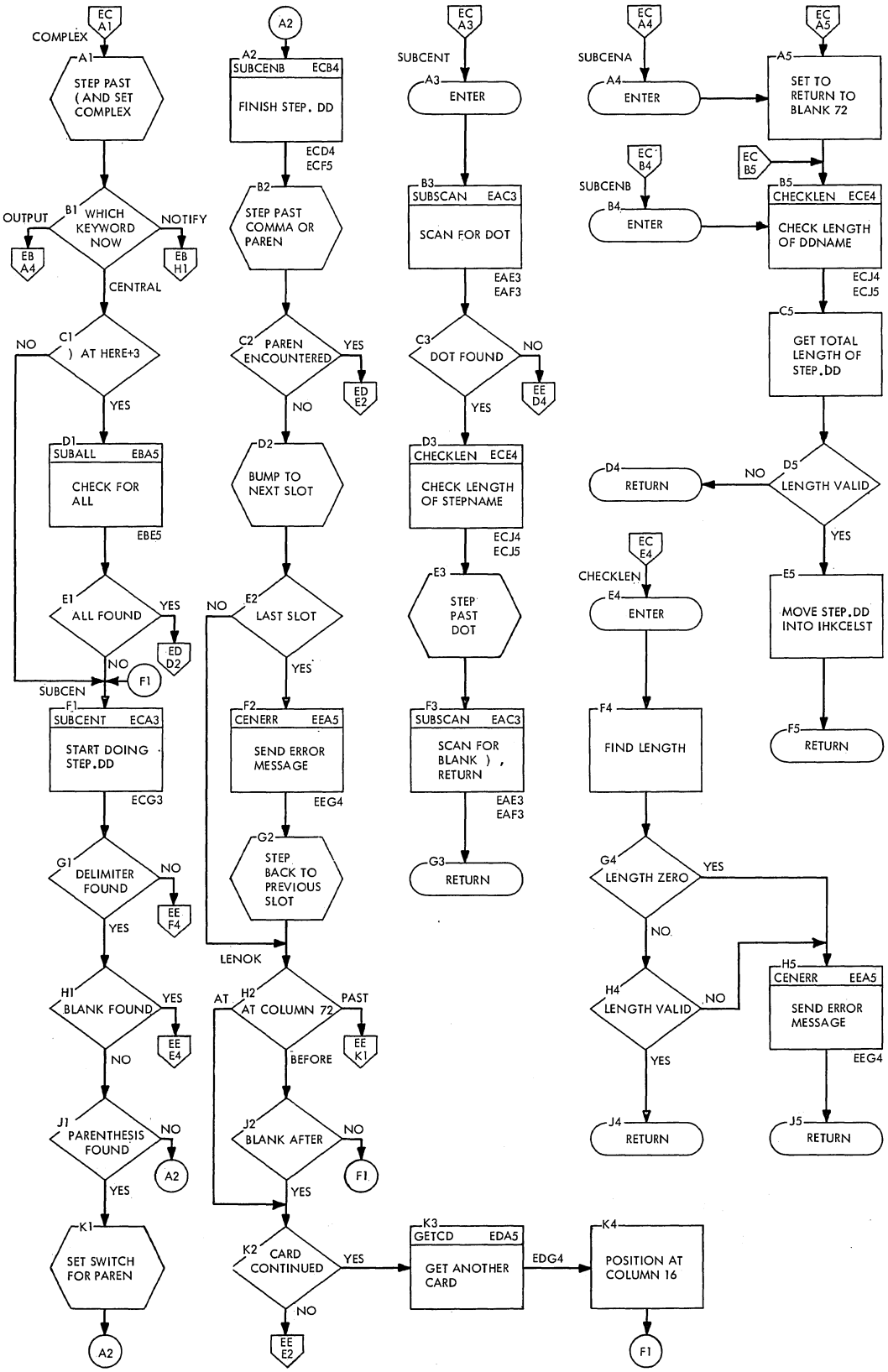


Chart EB. IHKCHJPR -- JED Processor



• Chart EC. IHKCHJPR -- JED Processor



• Chart ED. IHKCHJPR -- JED Processor

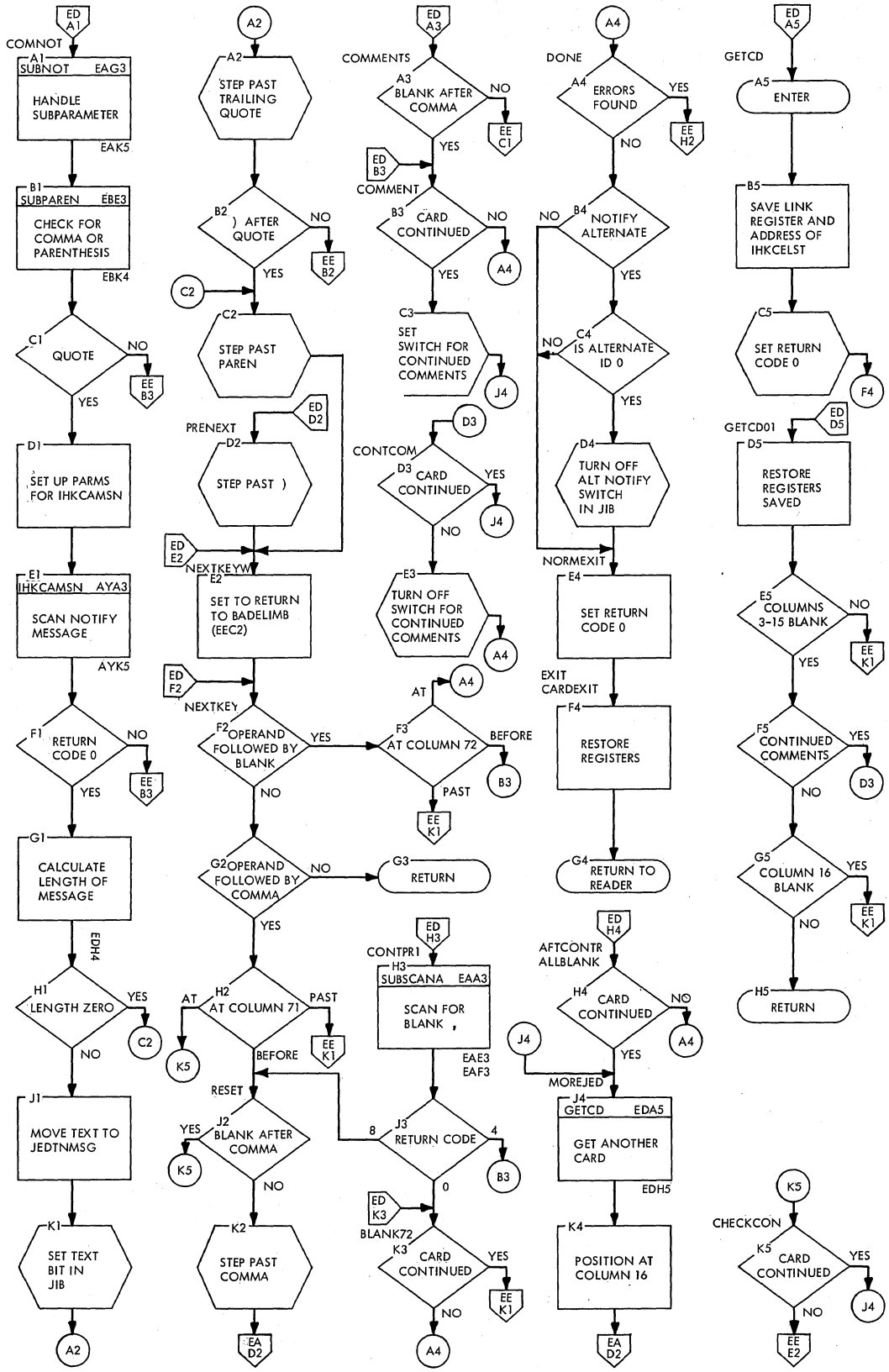
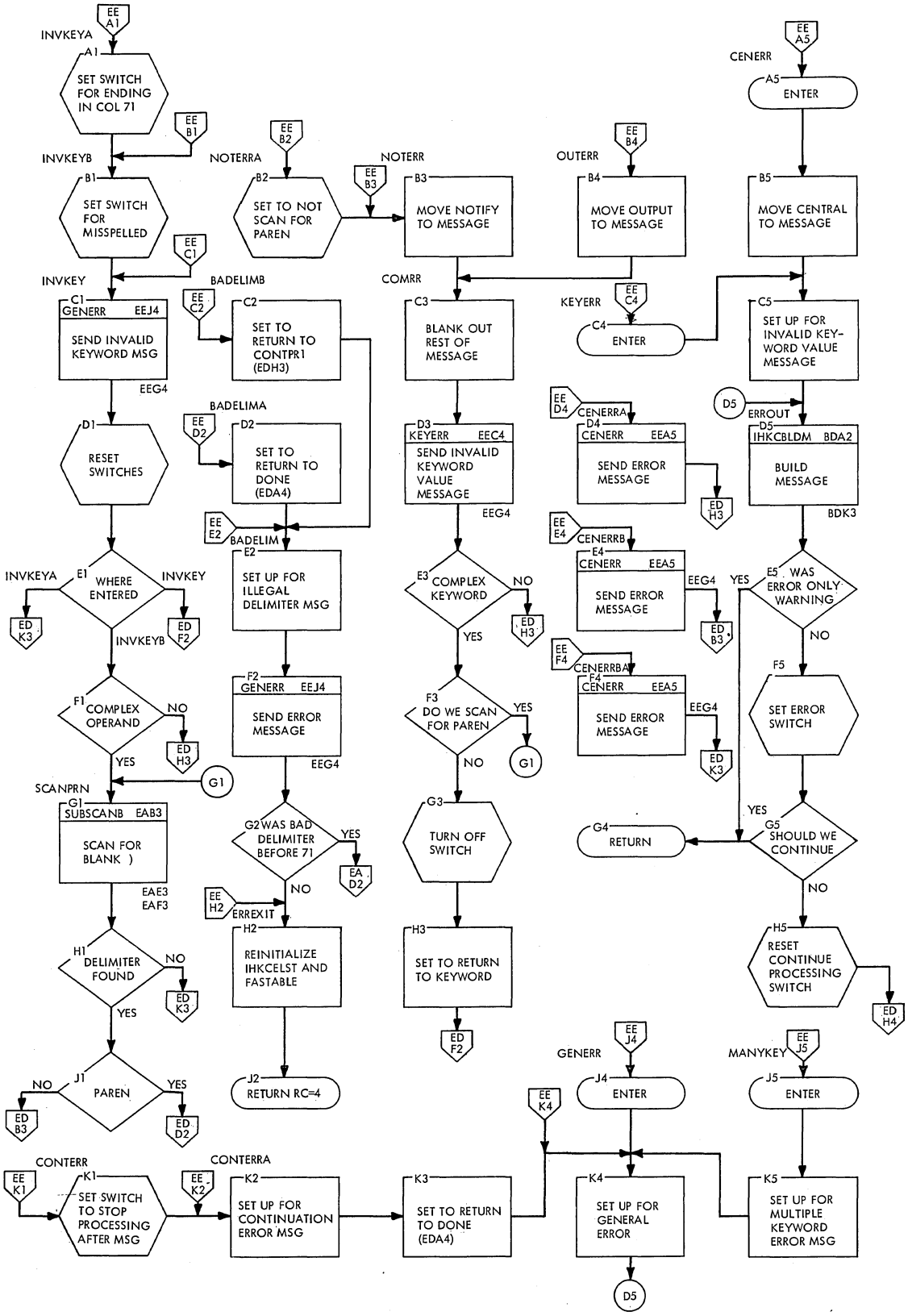


Chart EE: IHKCHJPR -- JED Processor



• Chart EF. IHKCHUCK -- Cleanup Routine

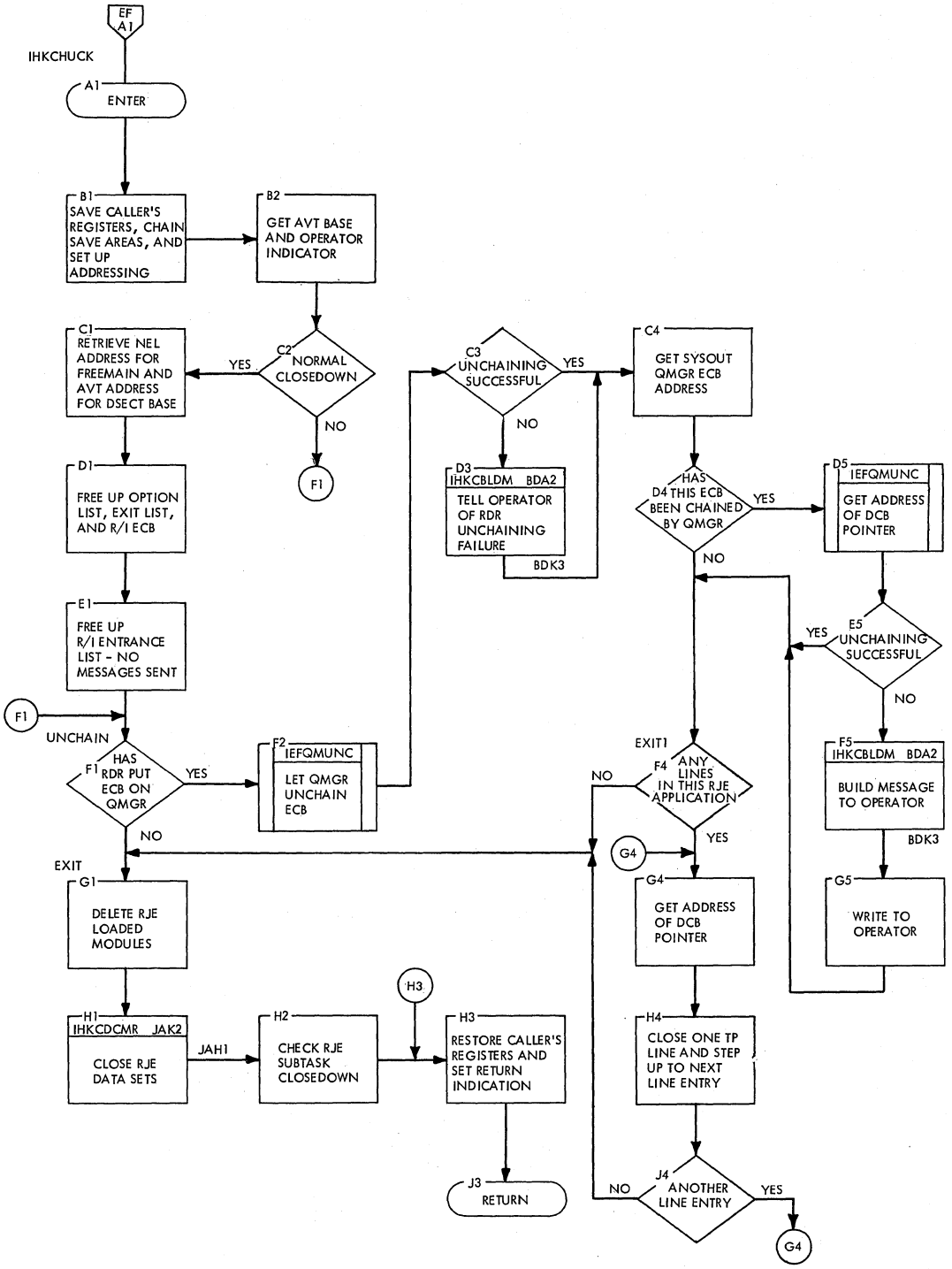


Chart EK. IHKCHNDJ -- JOBEND Routine

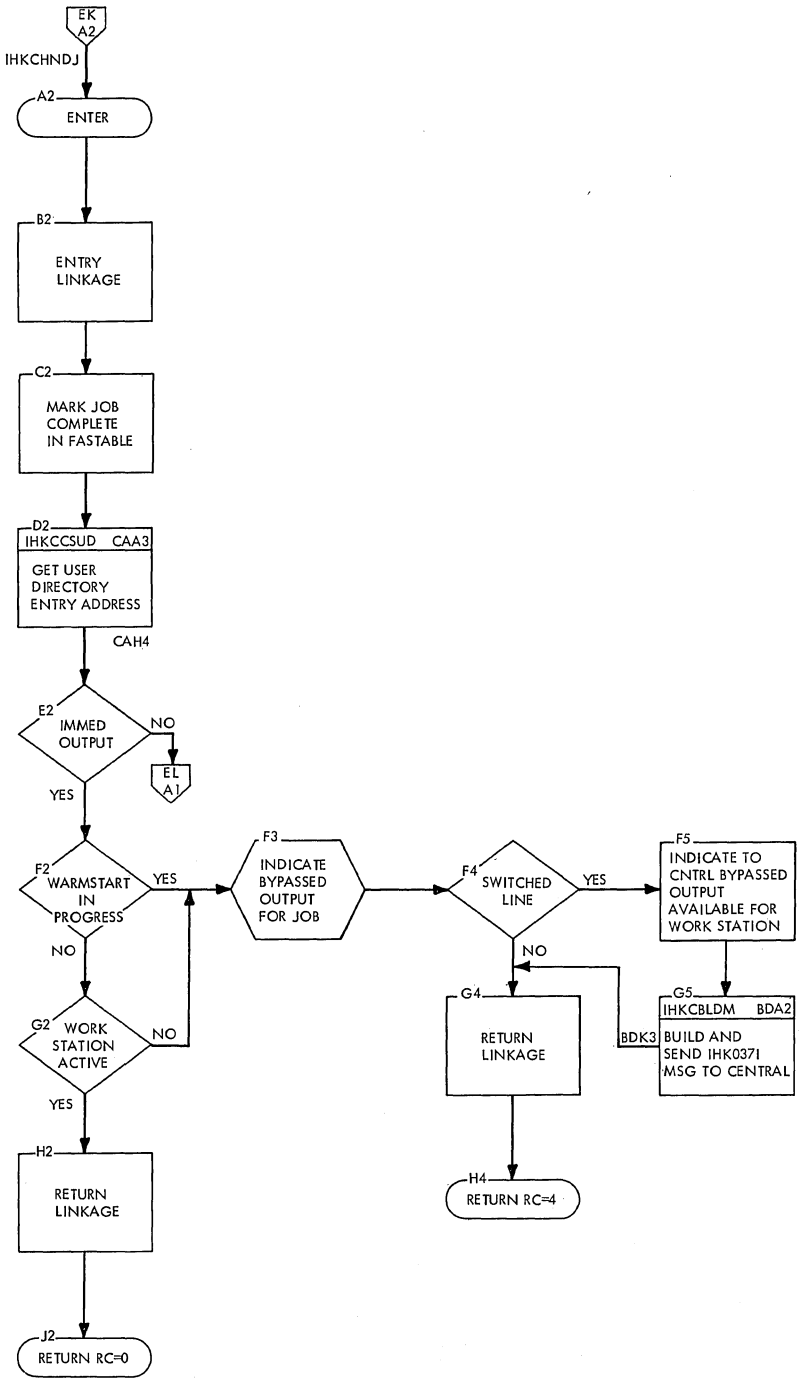
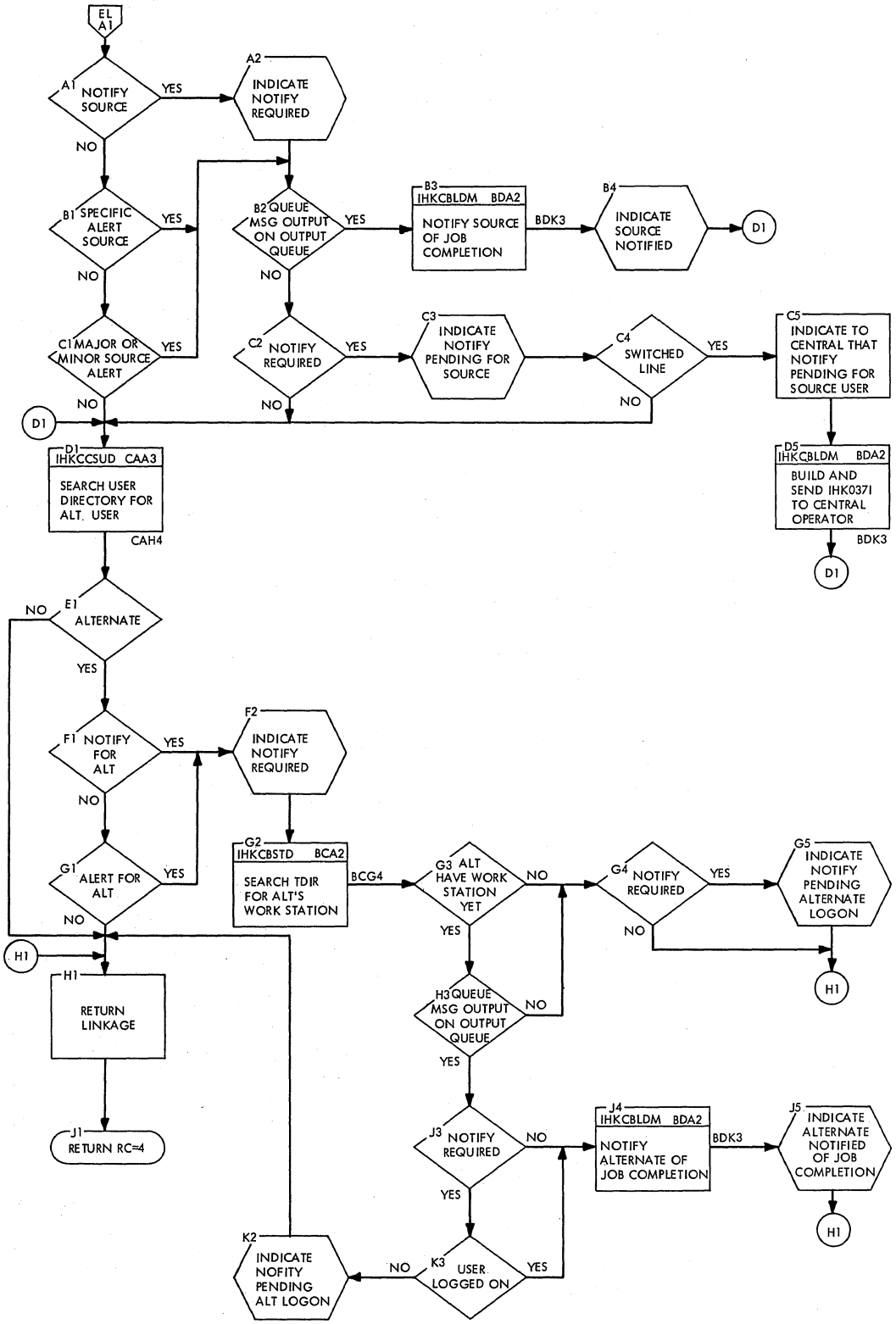


Chart EL. IHKCHNDJ -- JOBEND Routine



• Chart EQ. IHKCHRDR -- RJE Reader - MFT

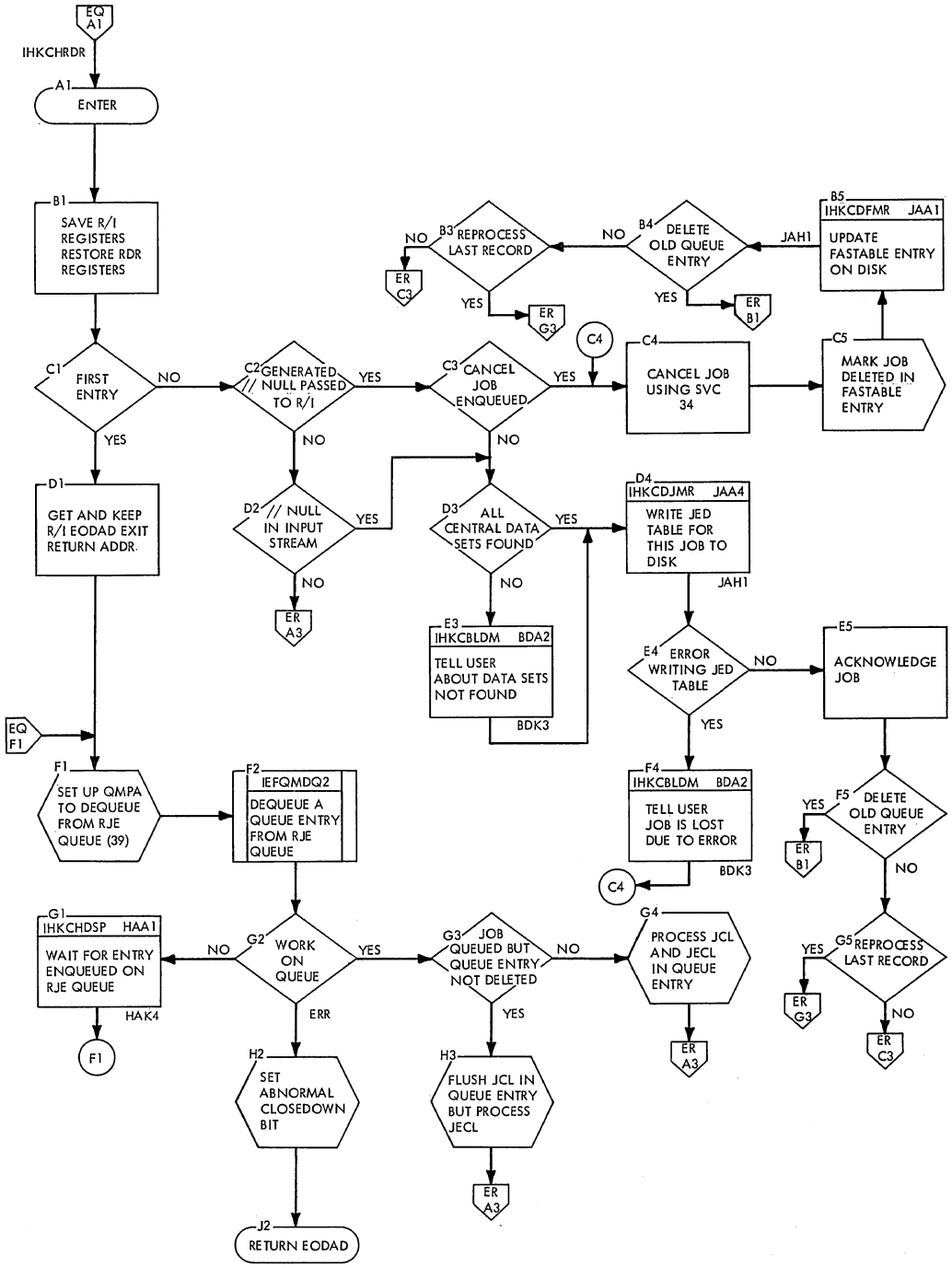


Chart ER. IHKCHRDR -- RJE Reader - MFT

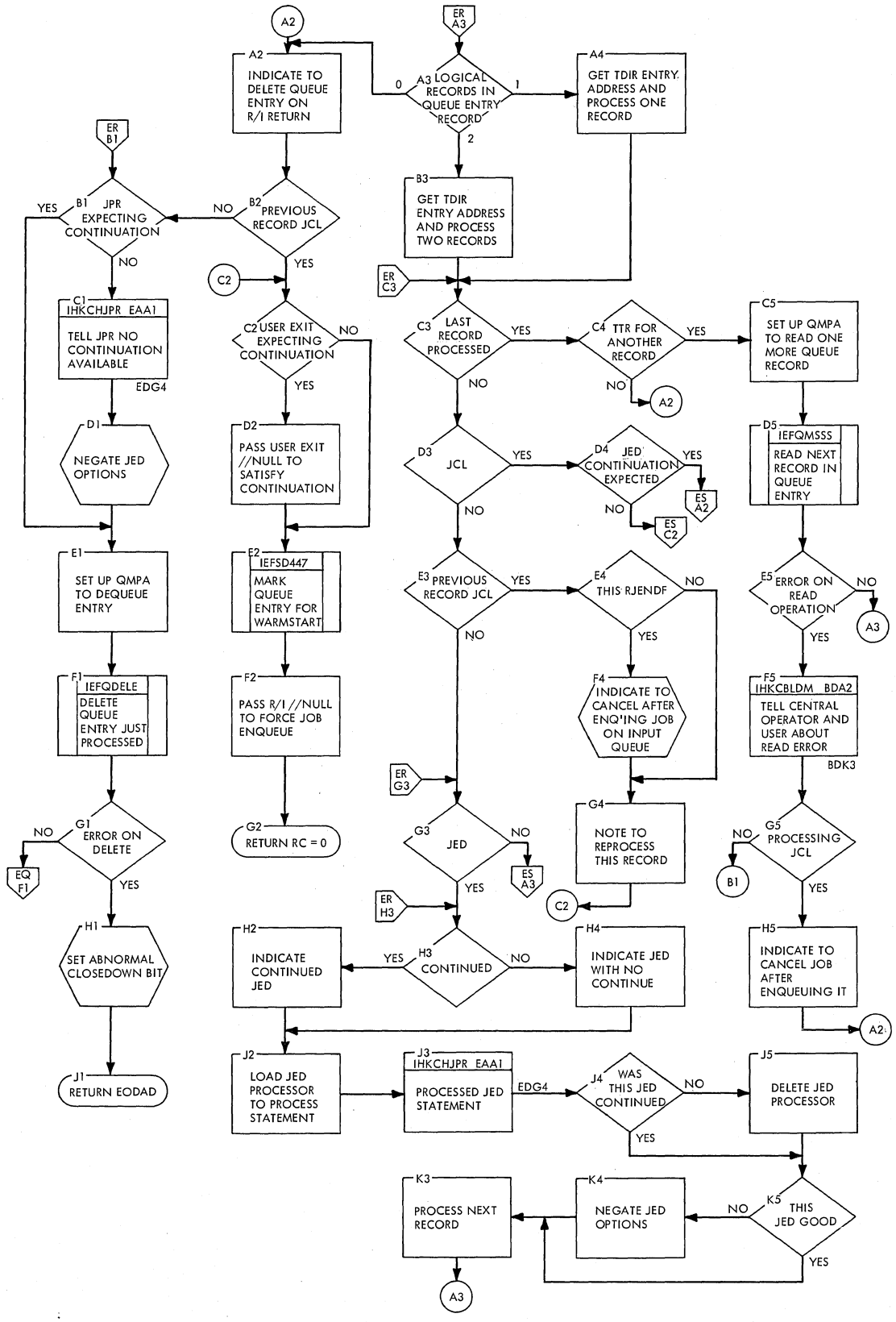
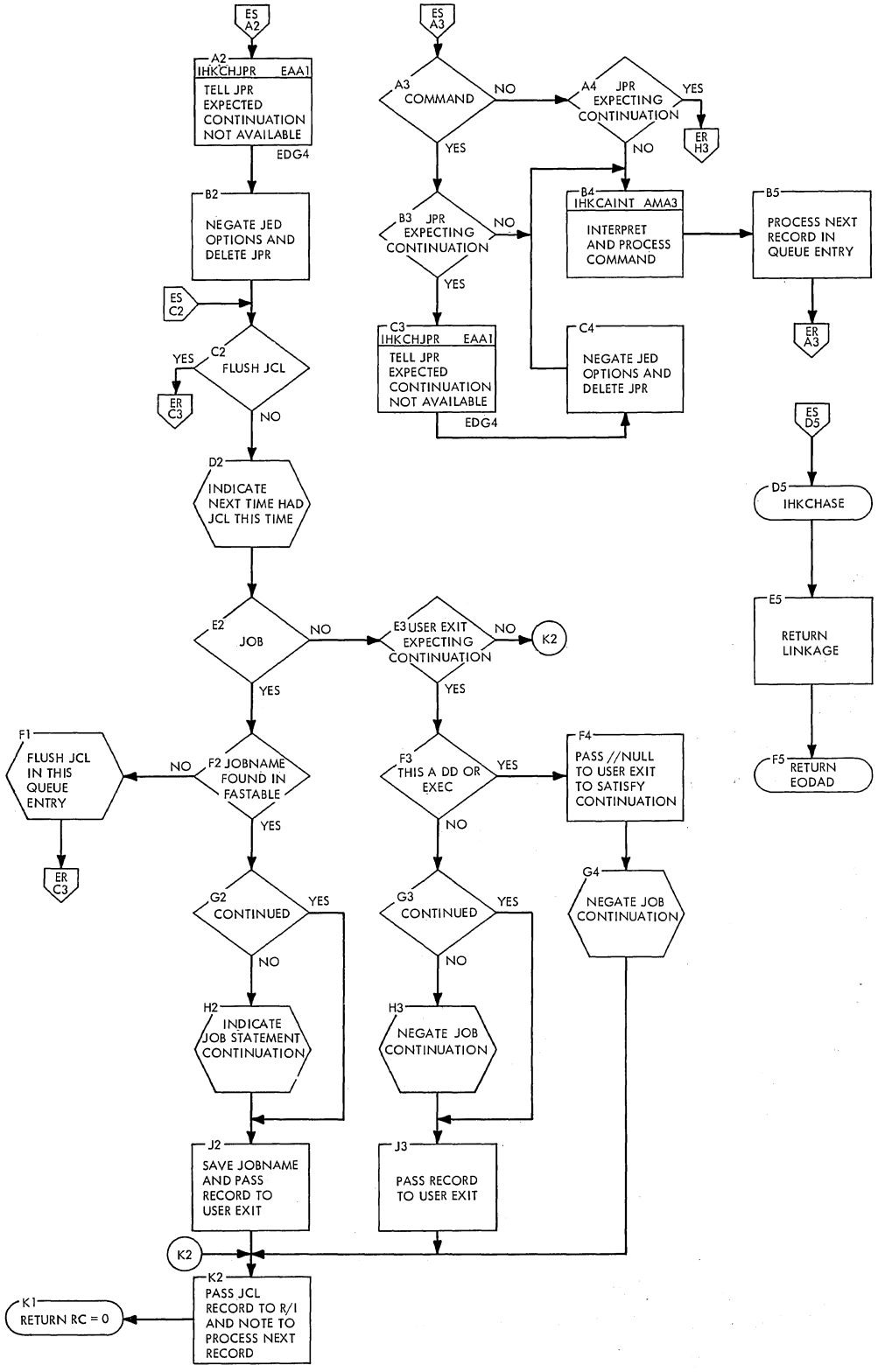
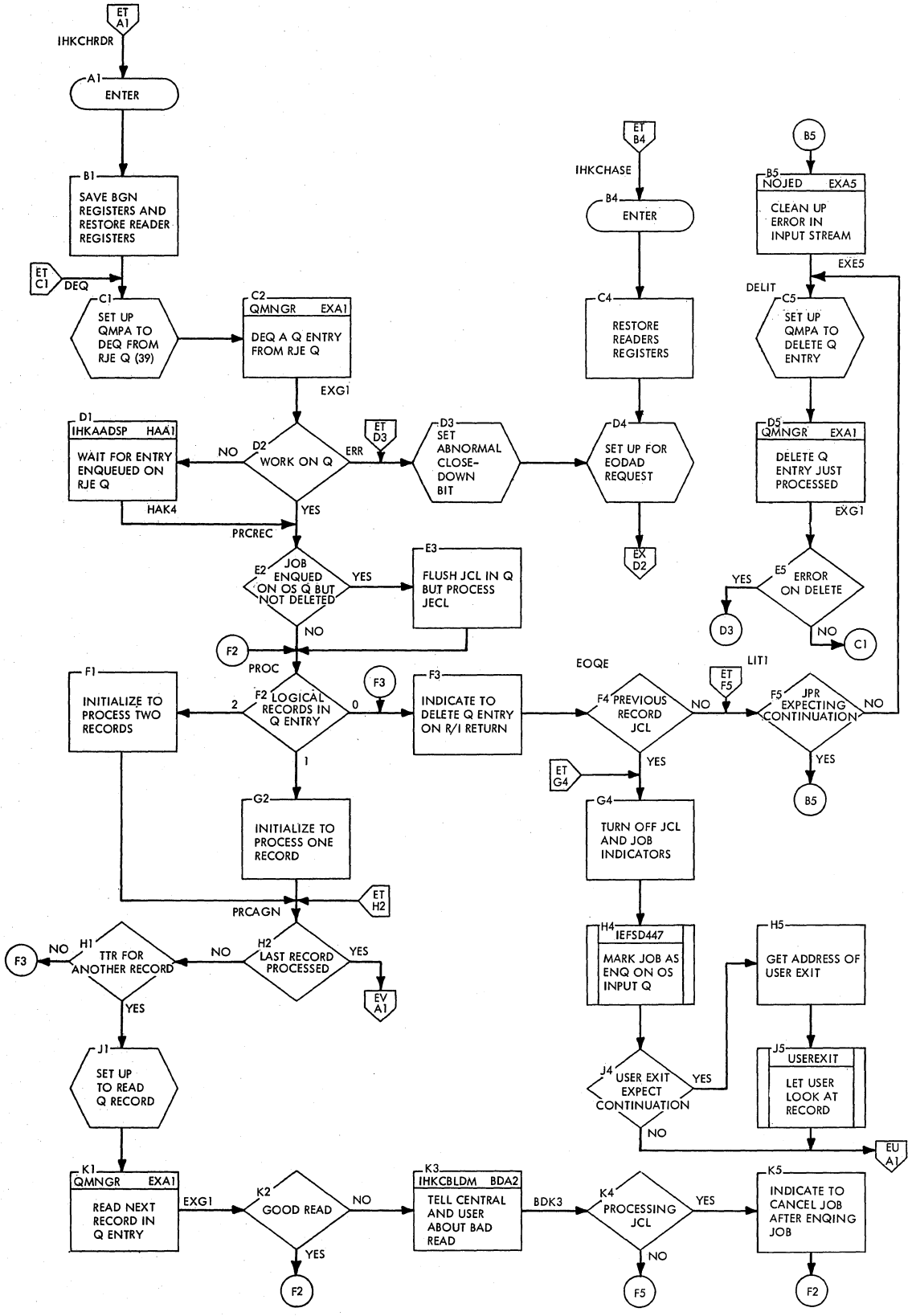


Chart ES. IHKCHRDR -- RJE Reader - MFT



• Chart ET. IHKXHRDR -- RJE Reader - MVT



• Chart EU. IHKXHRDR -- RJE Reader - MVT

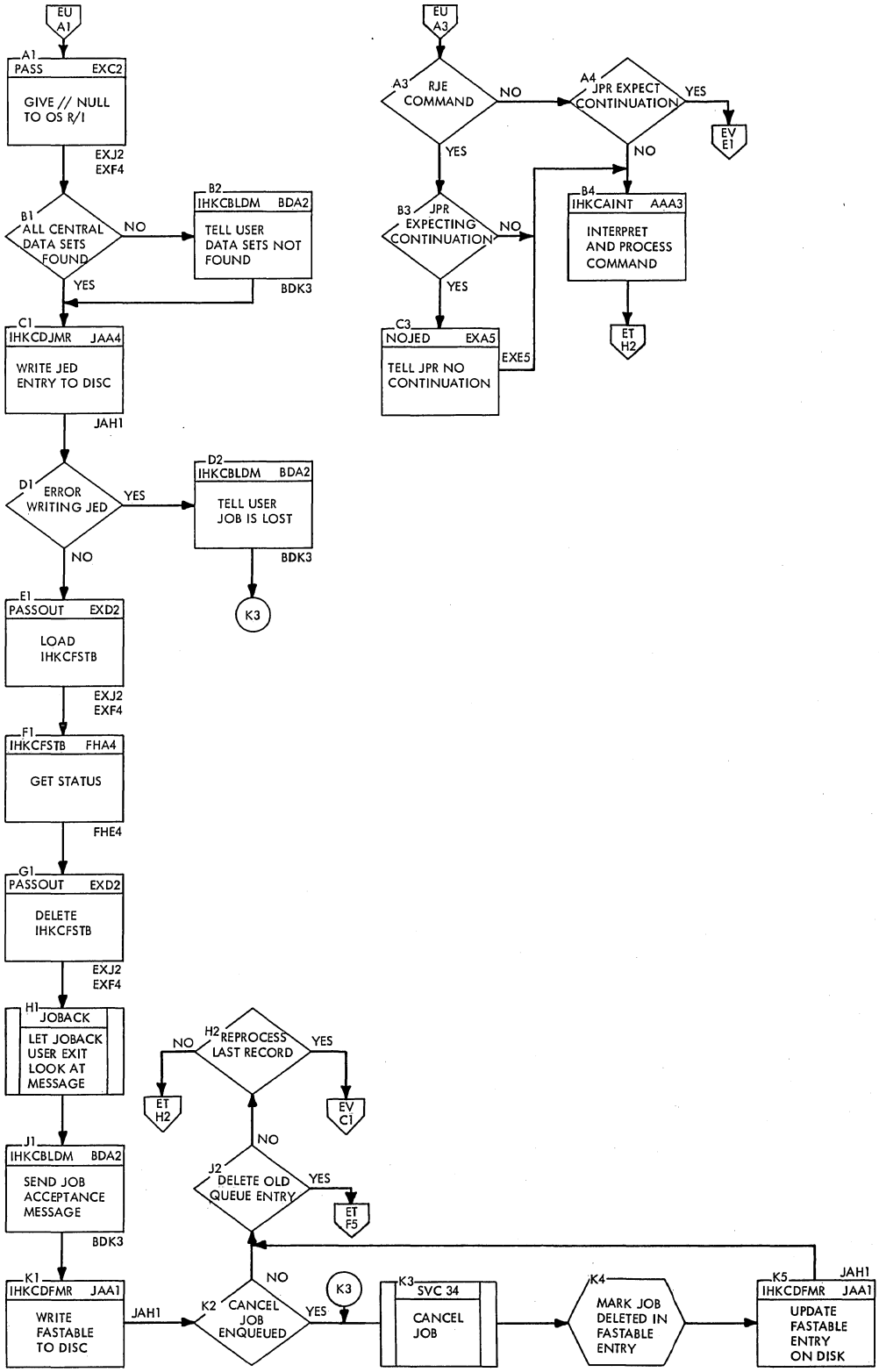


Chart EV. IHKXHRDR -- RJE Reader - MVT

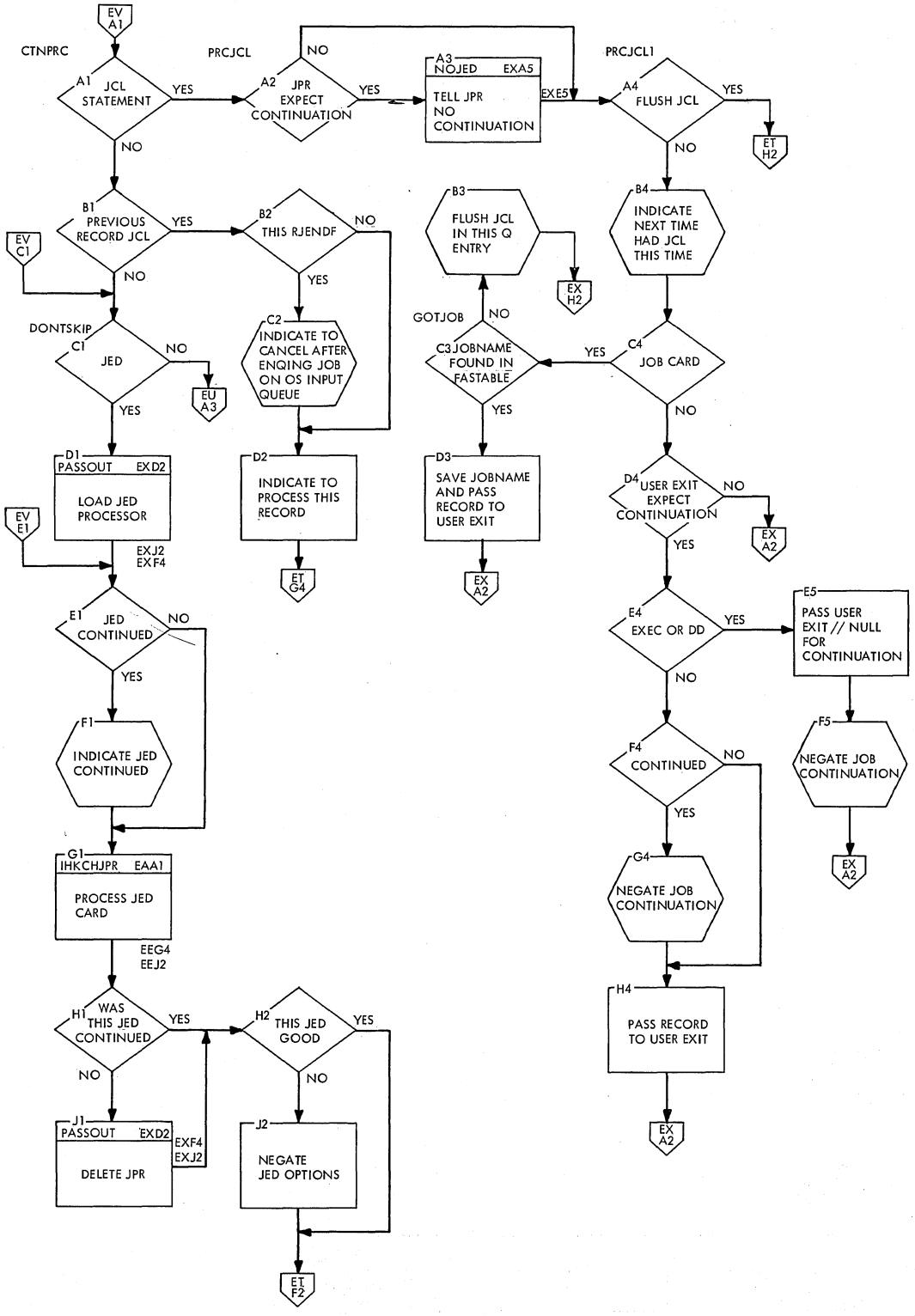


Chart EX. IHKXHRDR -- RJE Reader - MVT

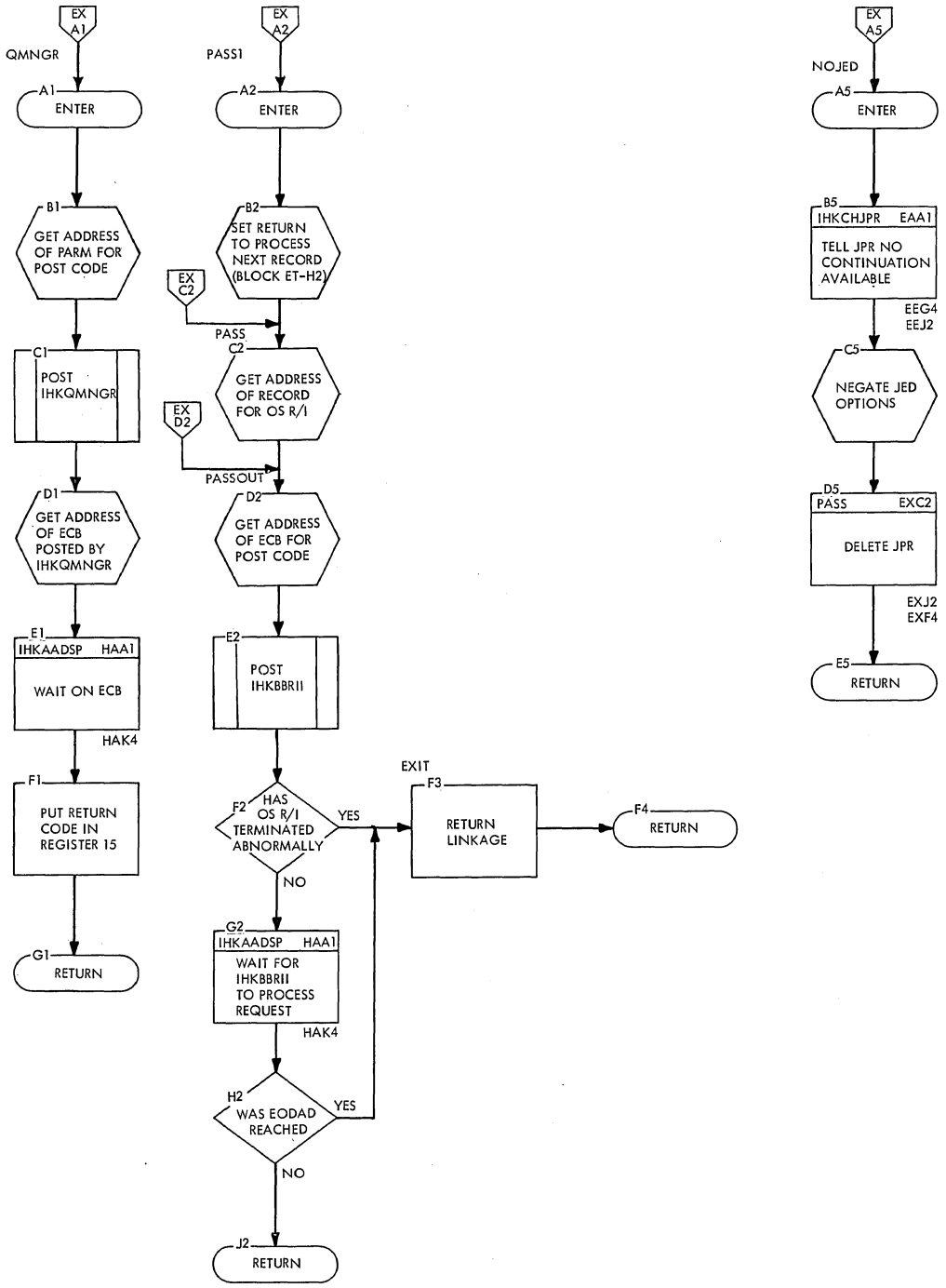


Chart FA. IHKCFOUT -- Output Command Processor

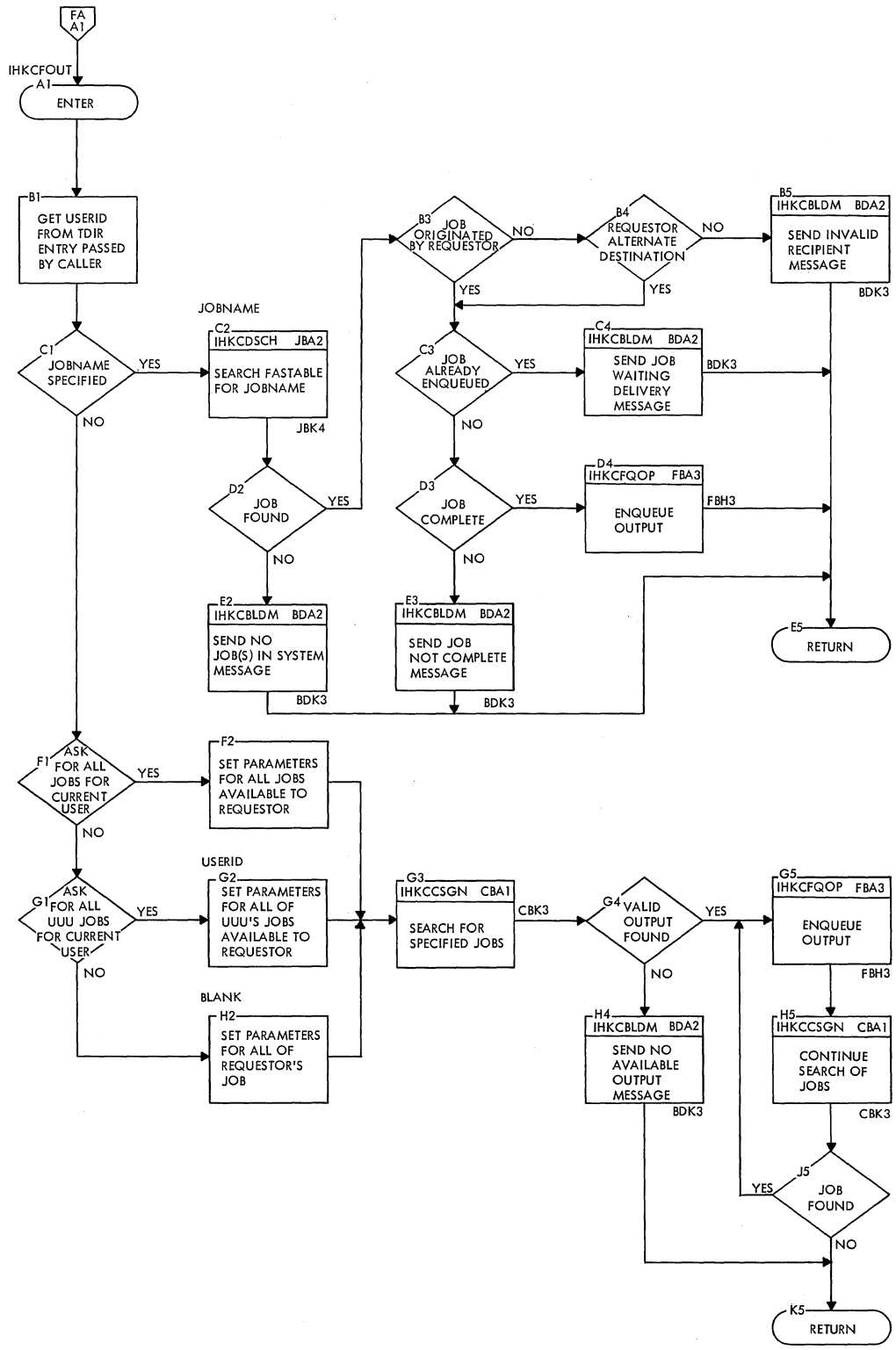


Chart FB. IHKCFOUT -- Enqueue Output for Delivery

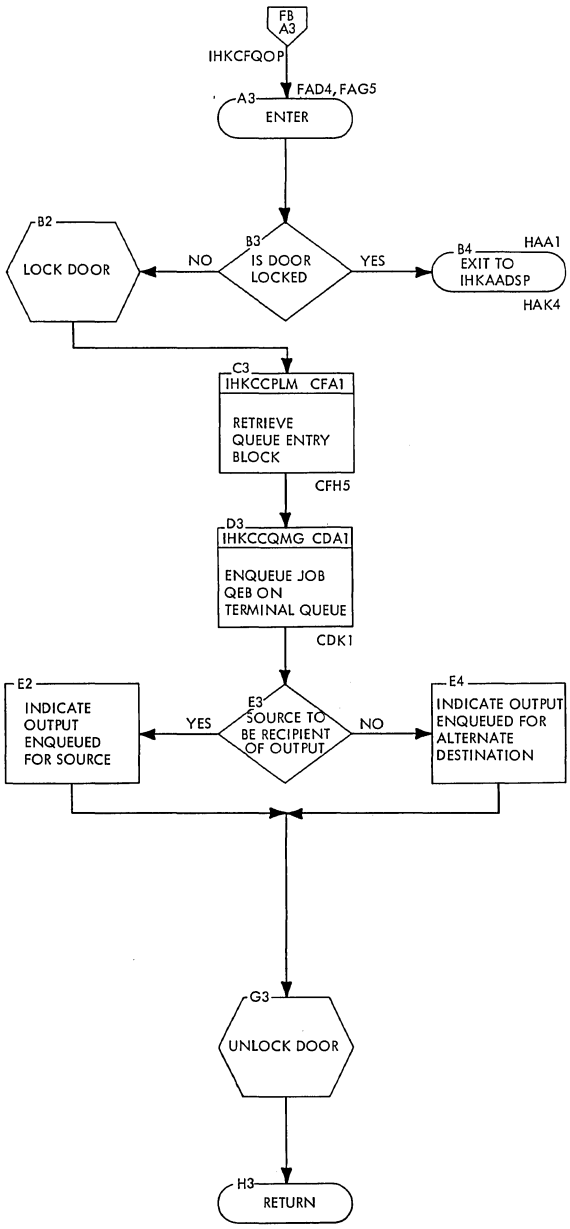


Chart FC. IHKCFMSG -- Message Command Processor

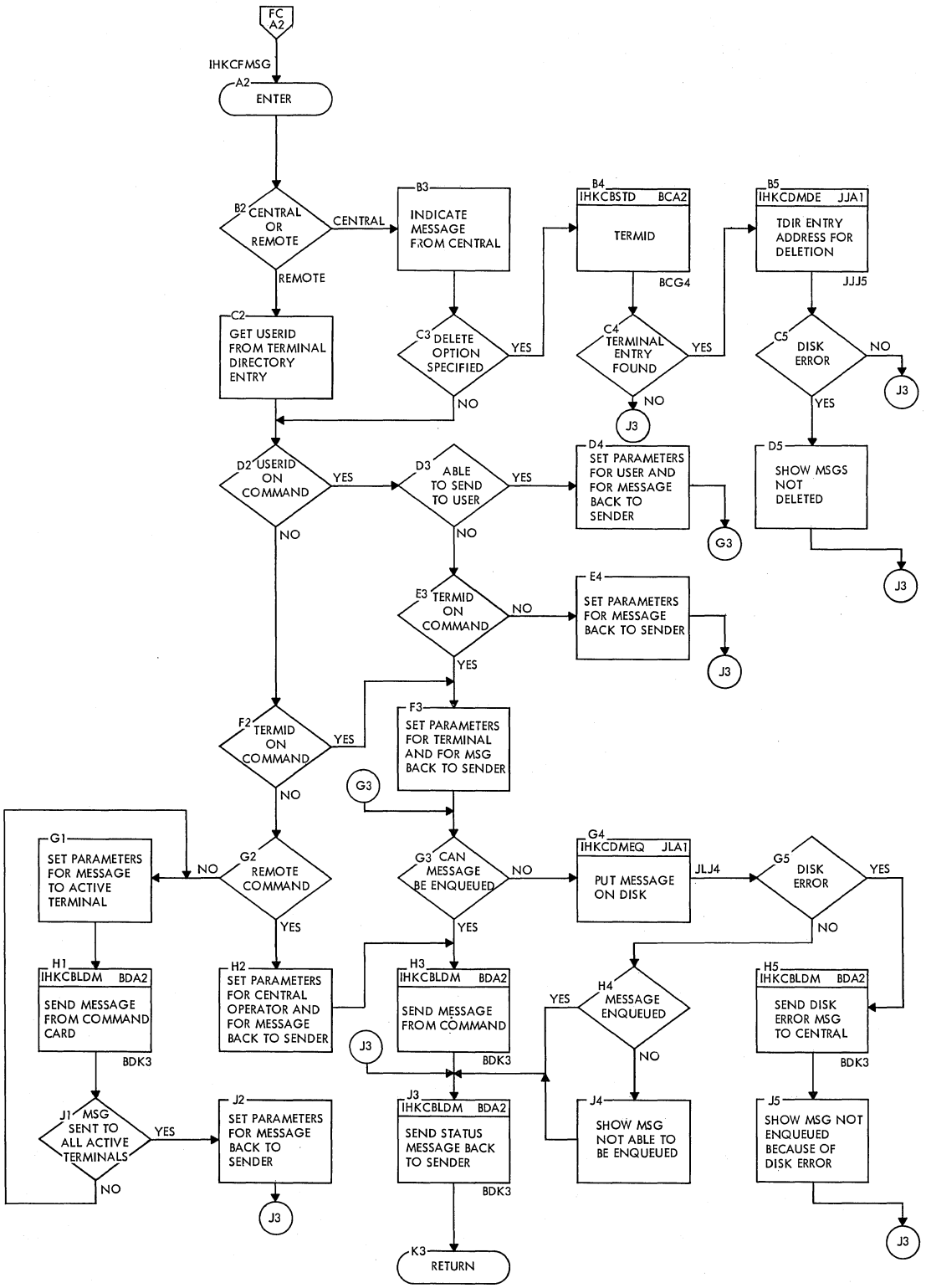
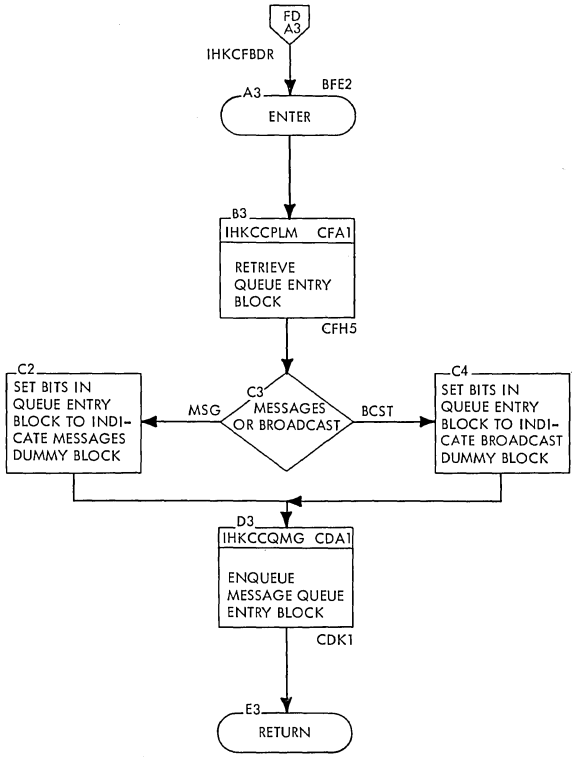


Chart FD. IHKCFBDR -- Message Dequeue Request Processor



• Chart FE. IHKCDMDQ -- Dequeue and Delete BRDCST or MSG

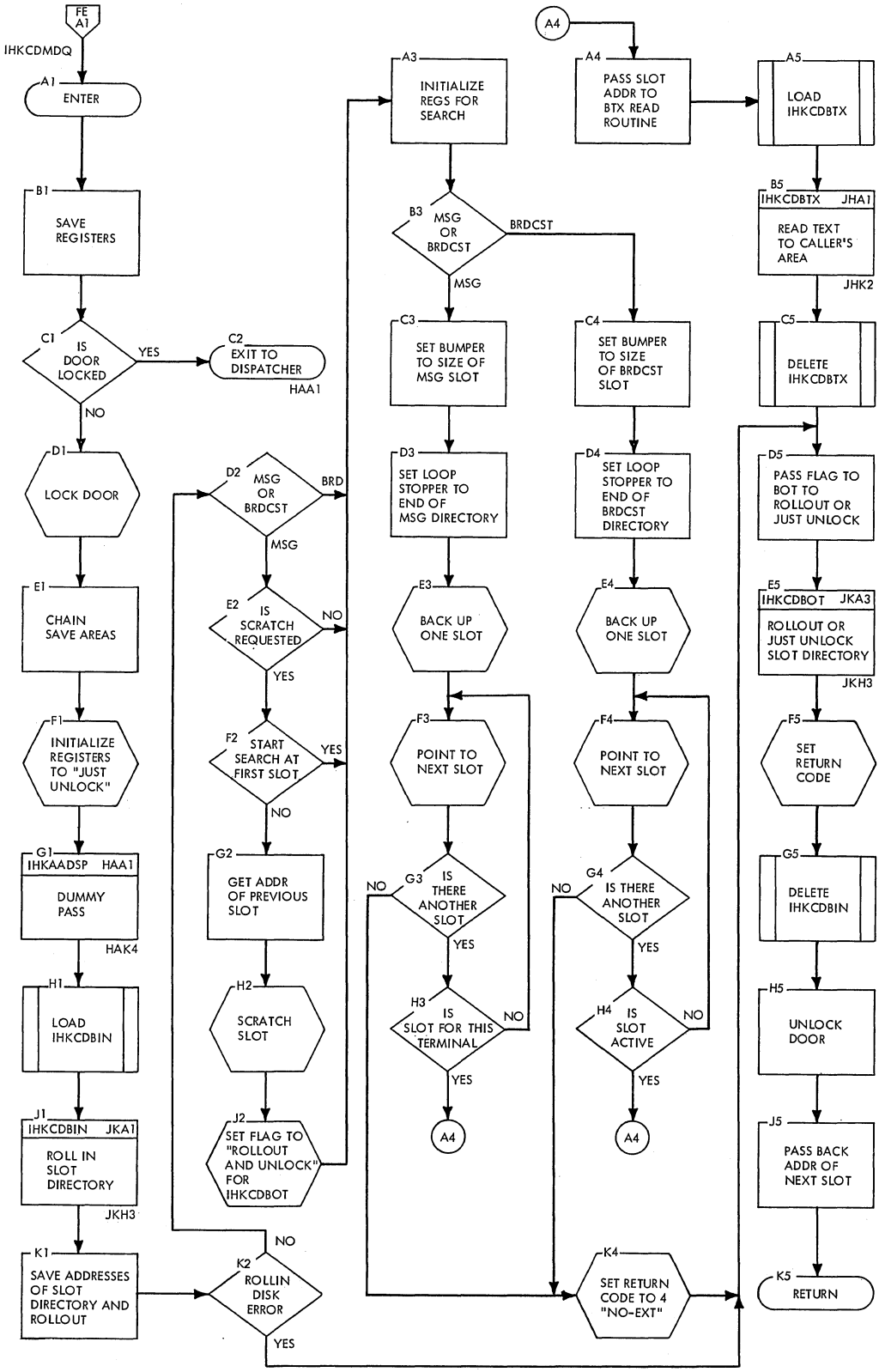


Chart FF. IHKCDBMI -- Initialize BRDCST and MSG data sets

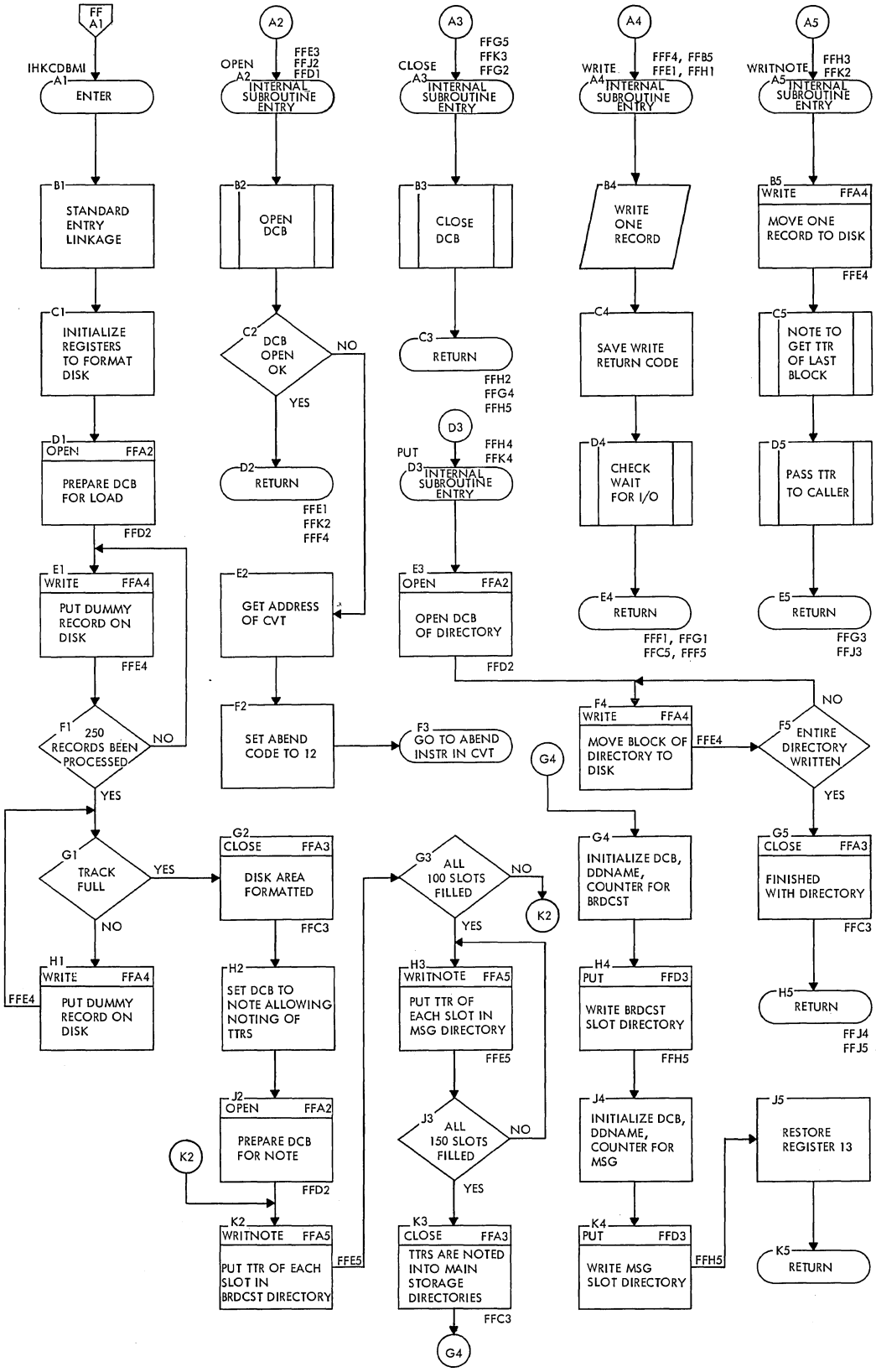


Chart FG. IHKCFSTA -- STATUS Command Processor

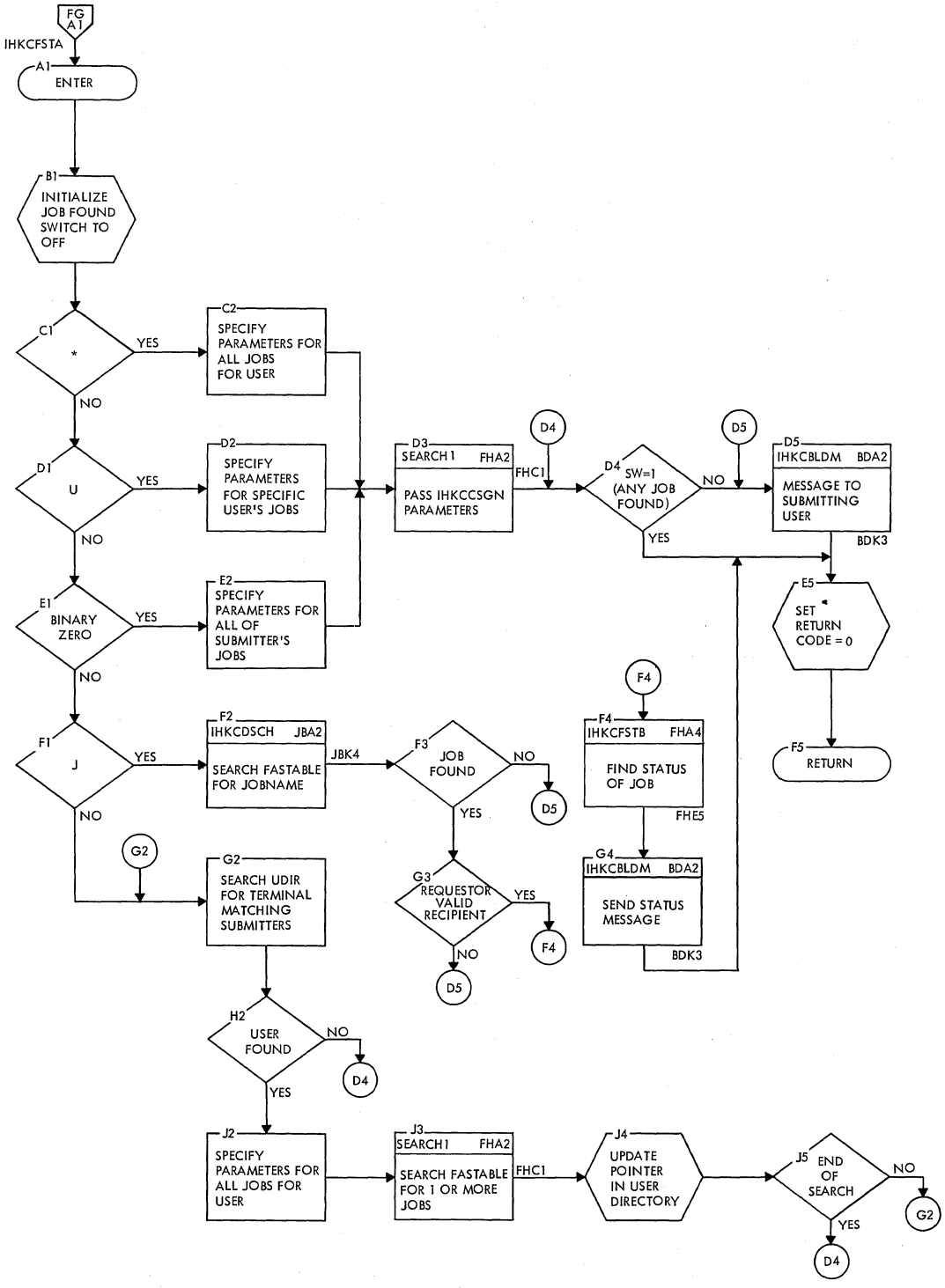


Chart FH. IHKCFSTA -- STATUS Subroutines

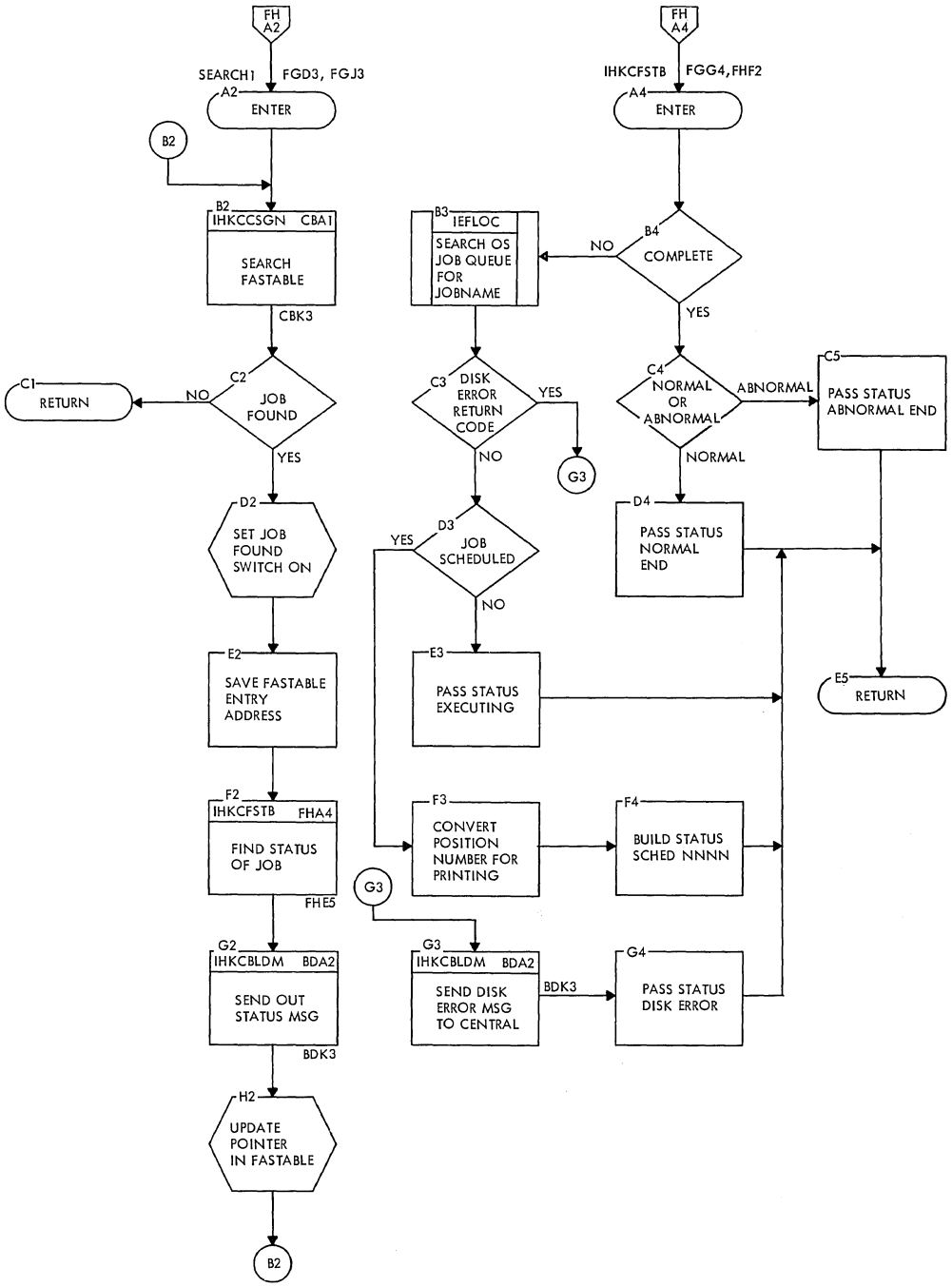


Chart FI. IHKCFWMS -- RJE Warmstart Routine

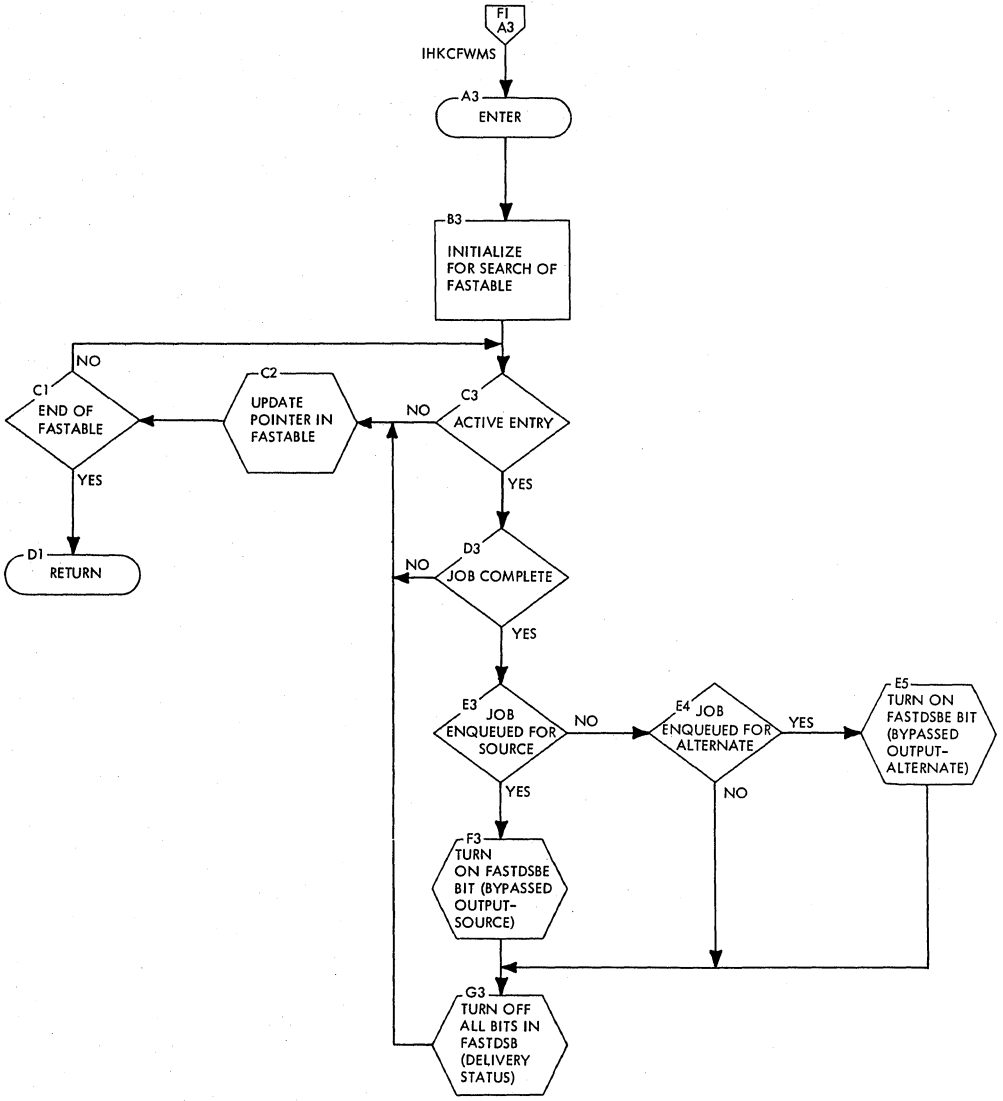


Chart GA. IHKCGALT -- ALERT Command Processor

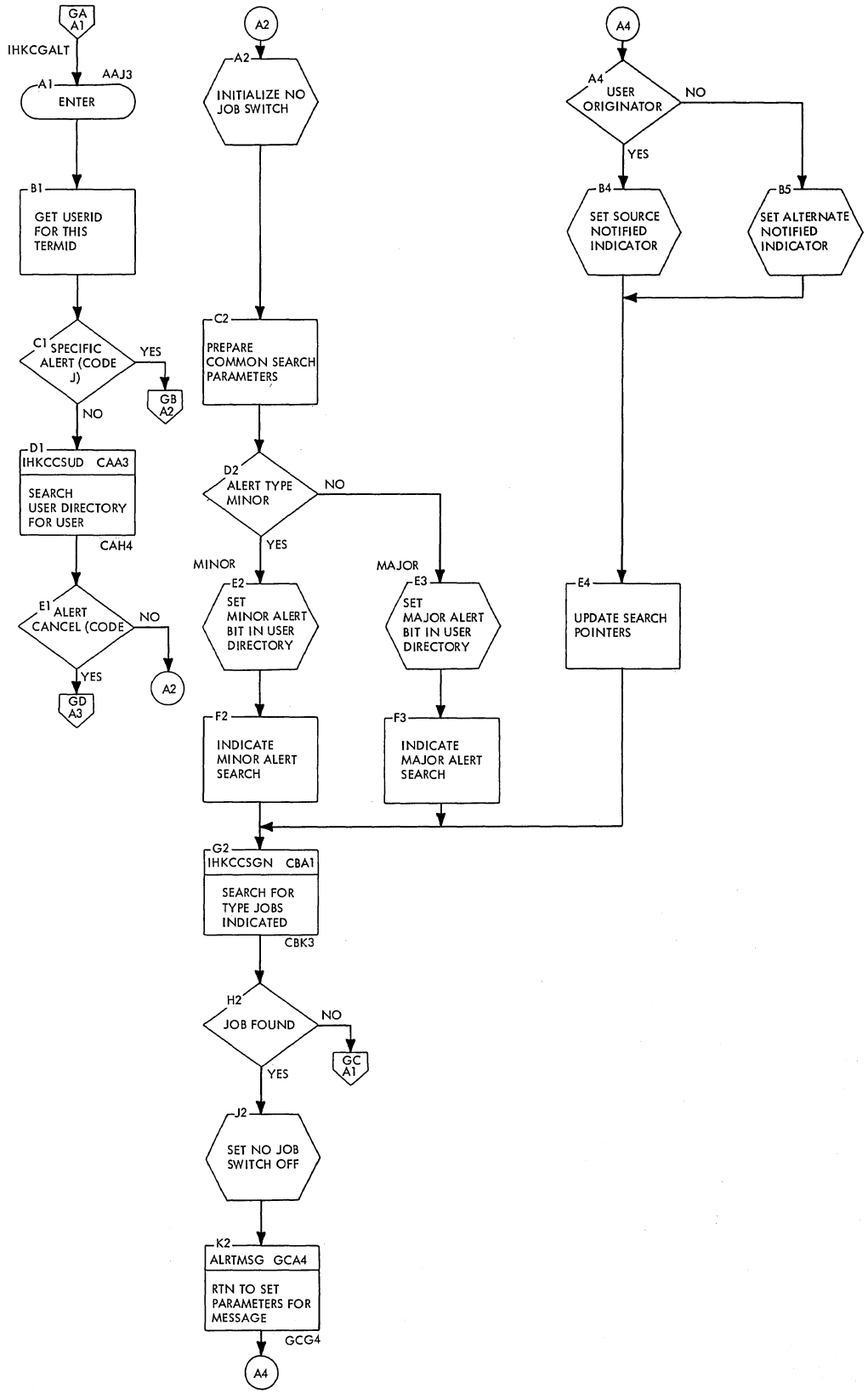


Chart GB. IHKCGALT -- ALERT Command Processor

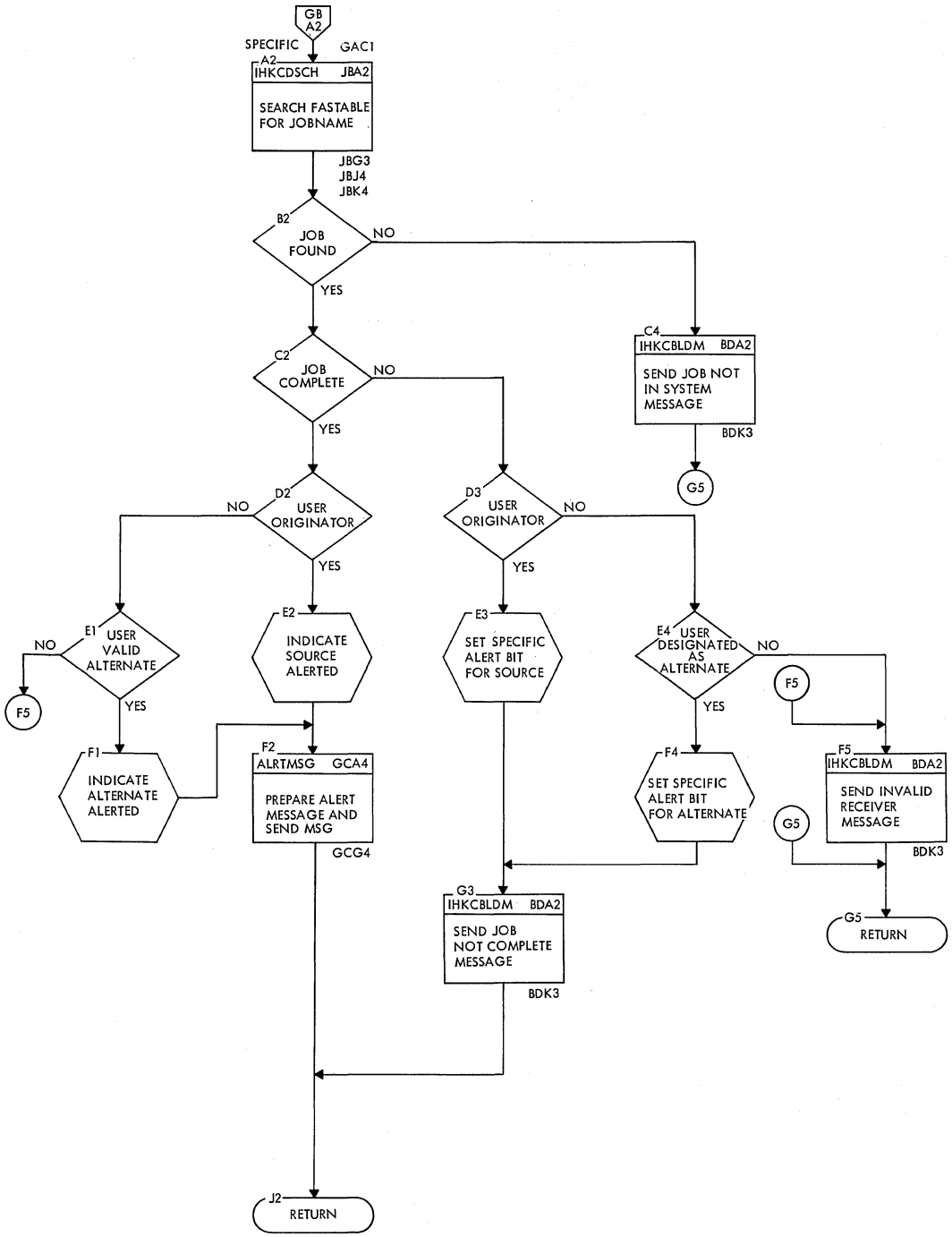


Chart GC. IHKCGALT -- ALERT Command Processor

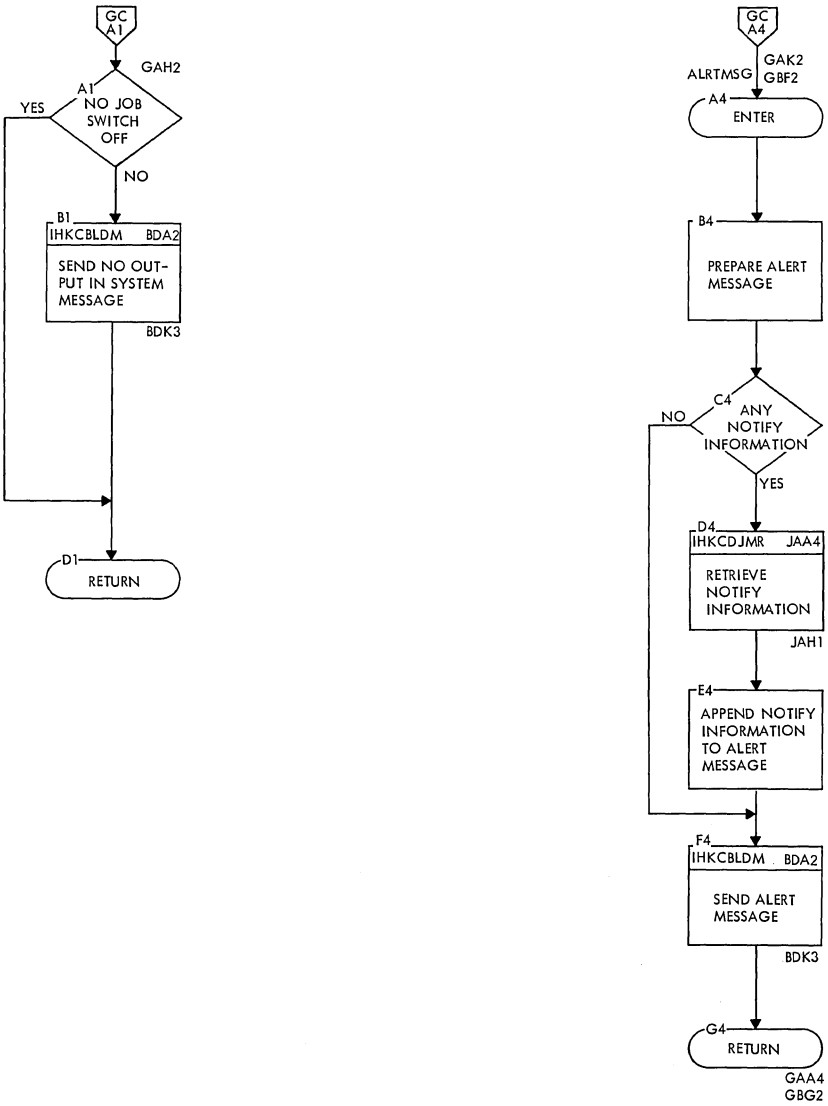
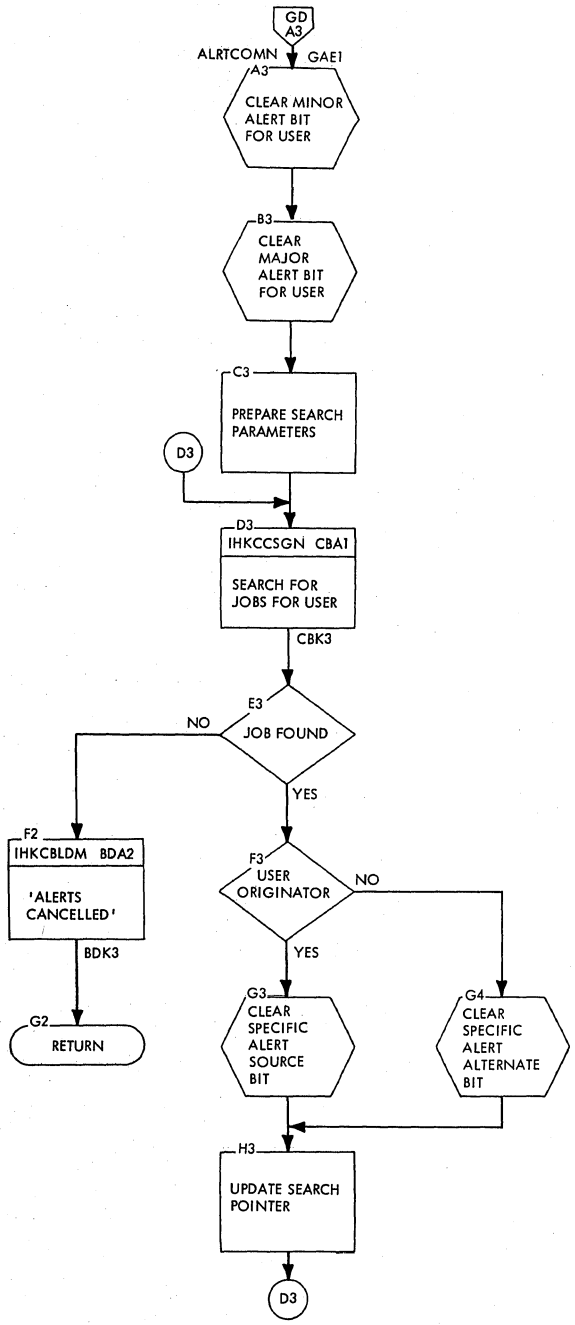


Chart GD. IHKCGALT -- ALERT Command Processor



• Chart GE. IHKCGDLT -- DELETE Command Processor

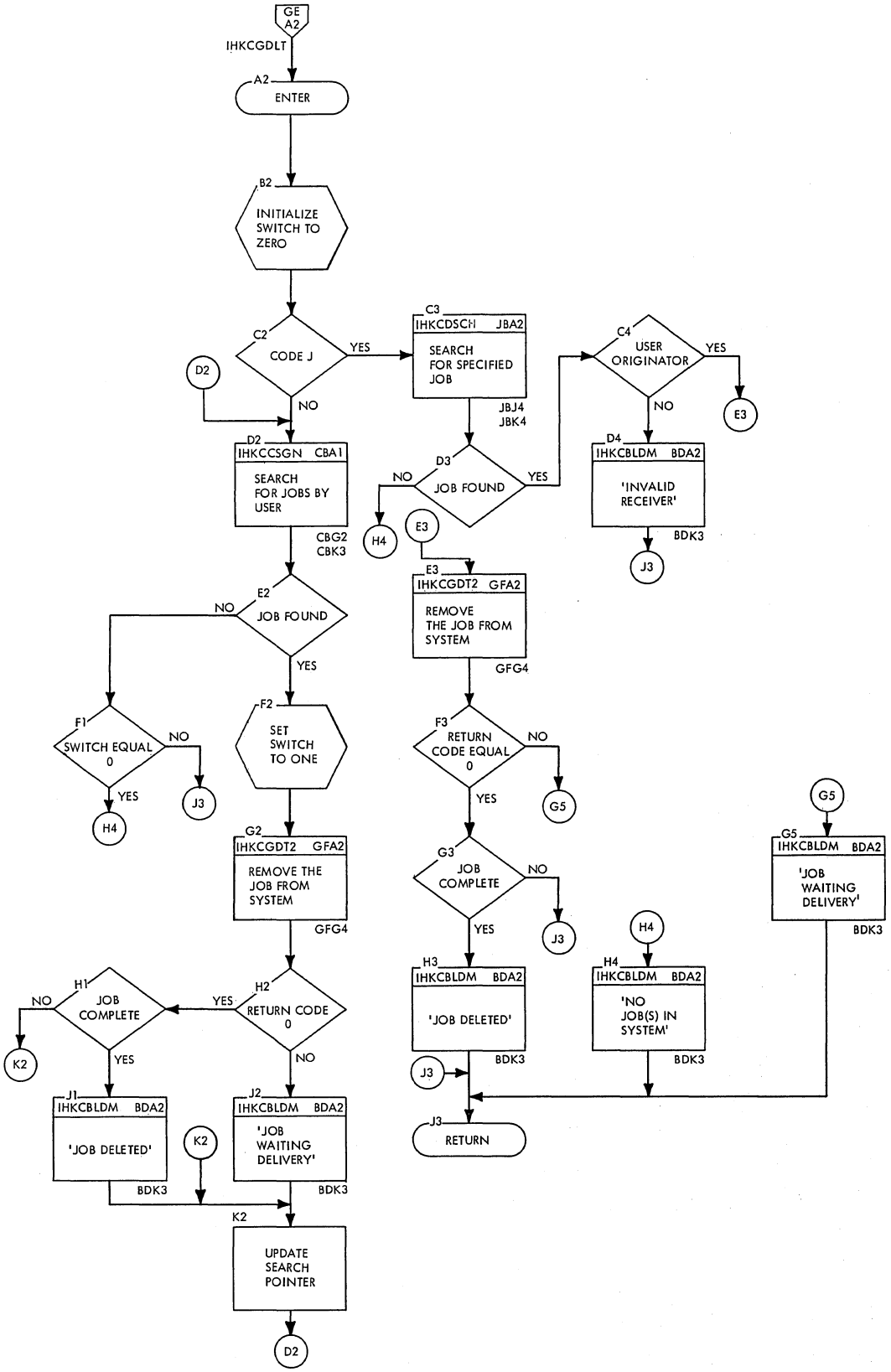


Chart GF. IHKCGDT2 -- DELETE Two

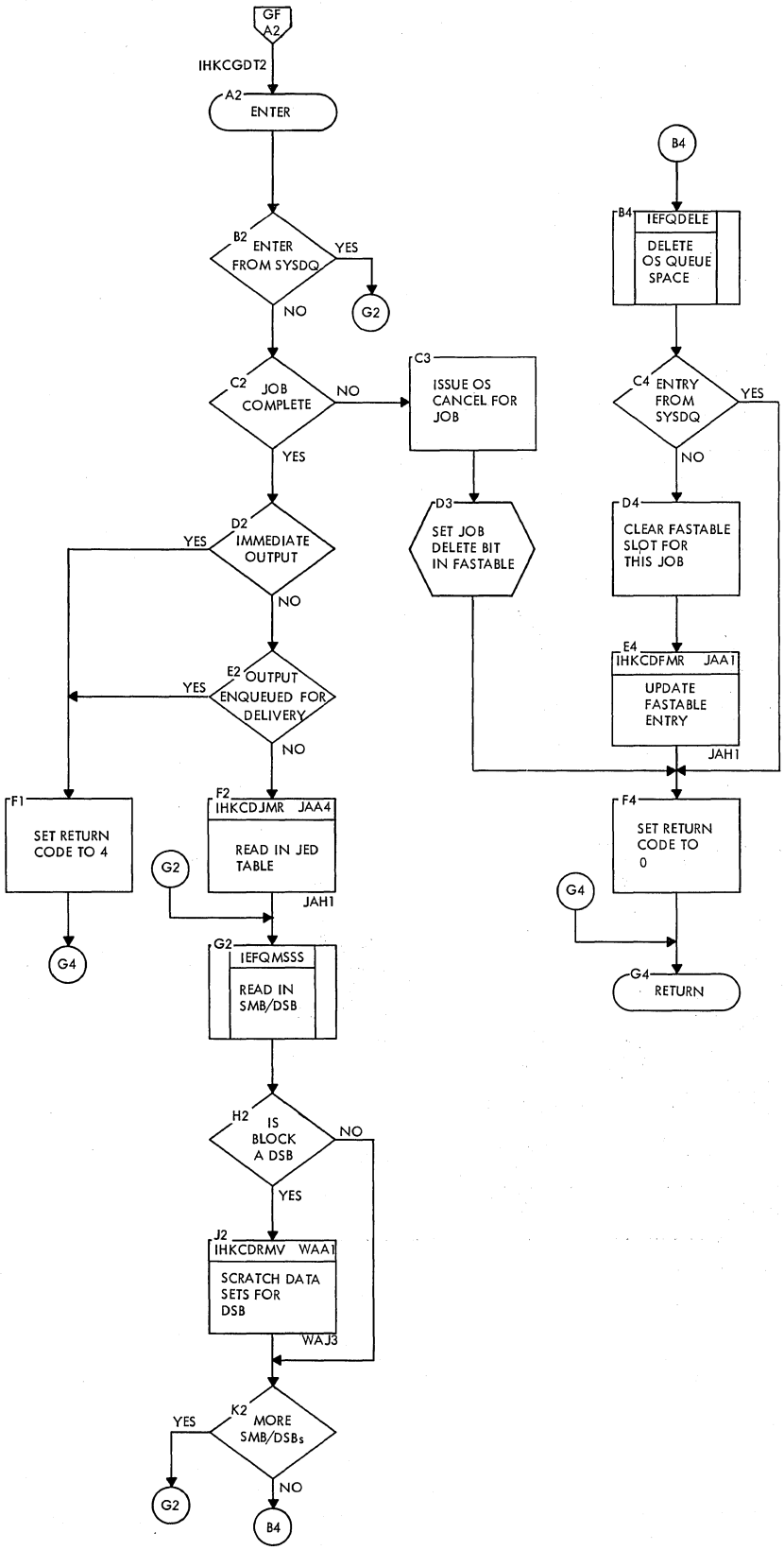


Chart GG. IHKCHCNT -- CENOUT Central Command Processor

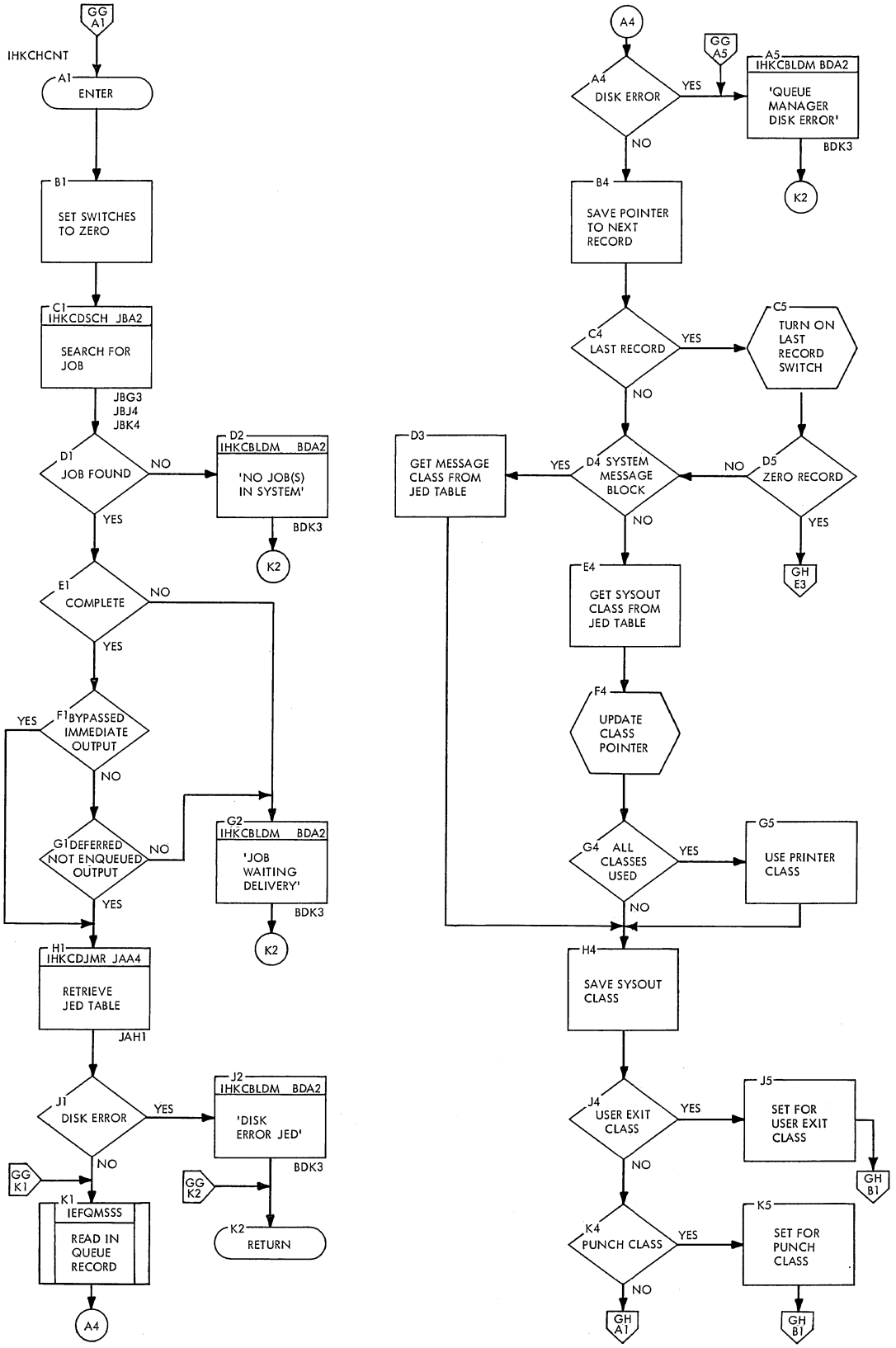
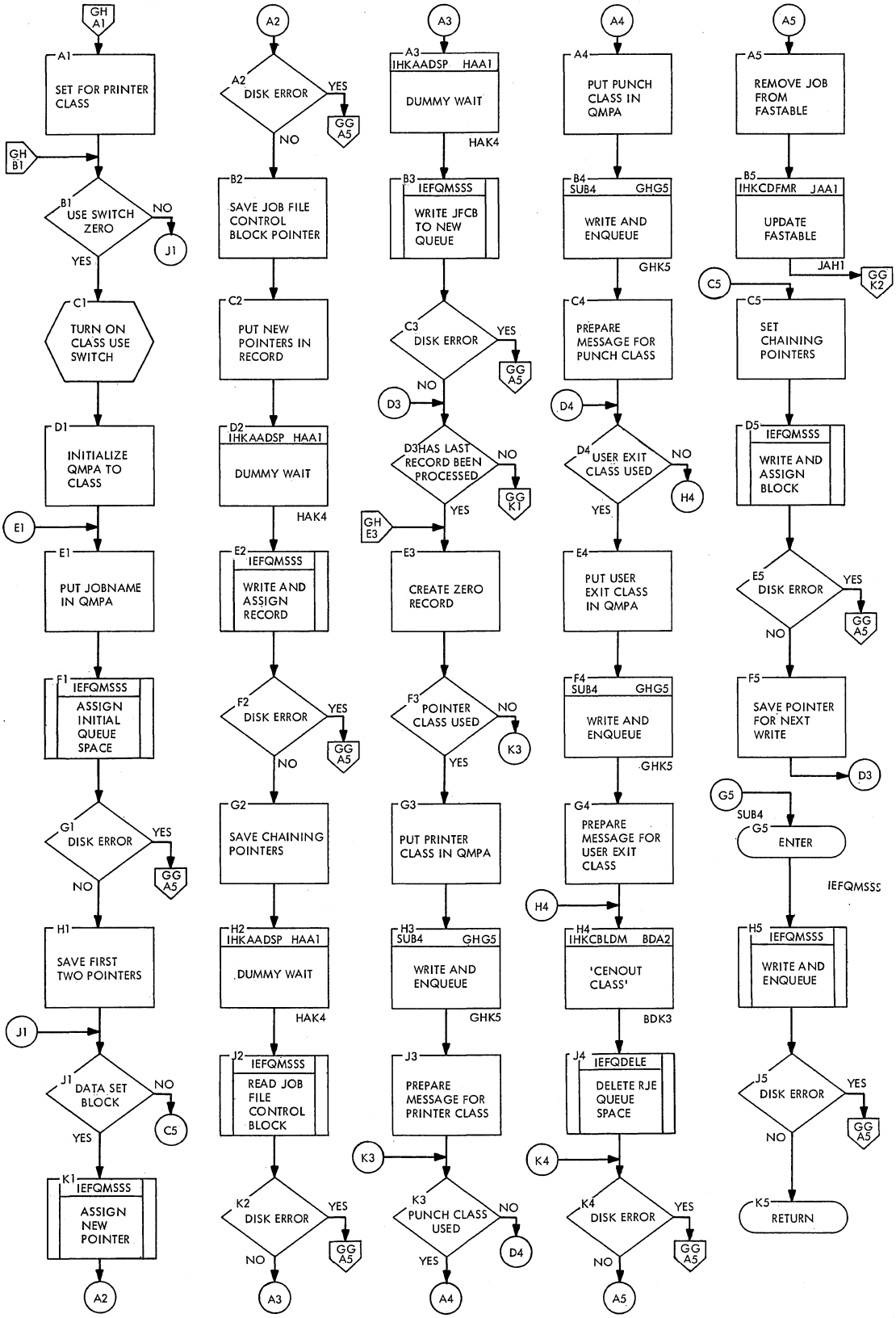


Chart GH. IHKCHCNT -- CENOUT Central Command Processor



• Chart HA. IHKCHDSP -- Dispatcher

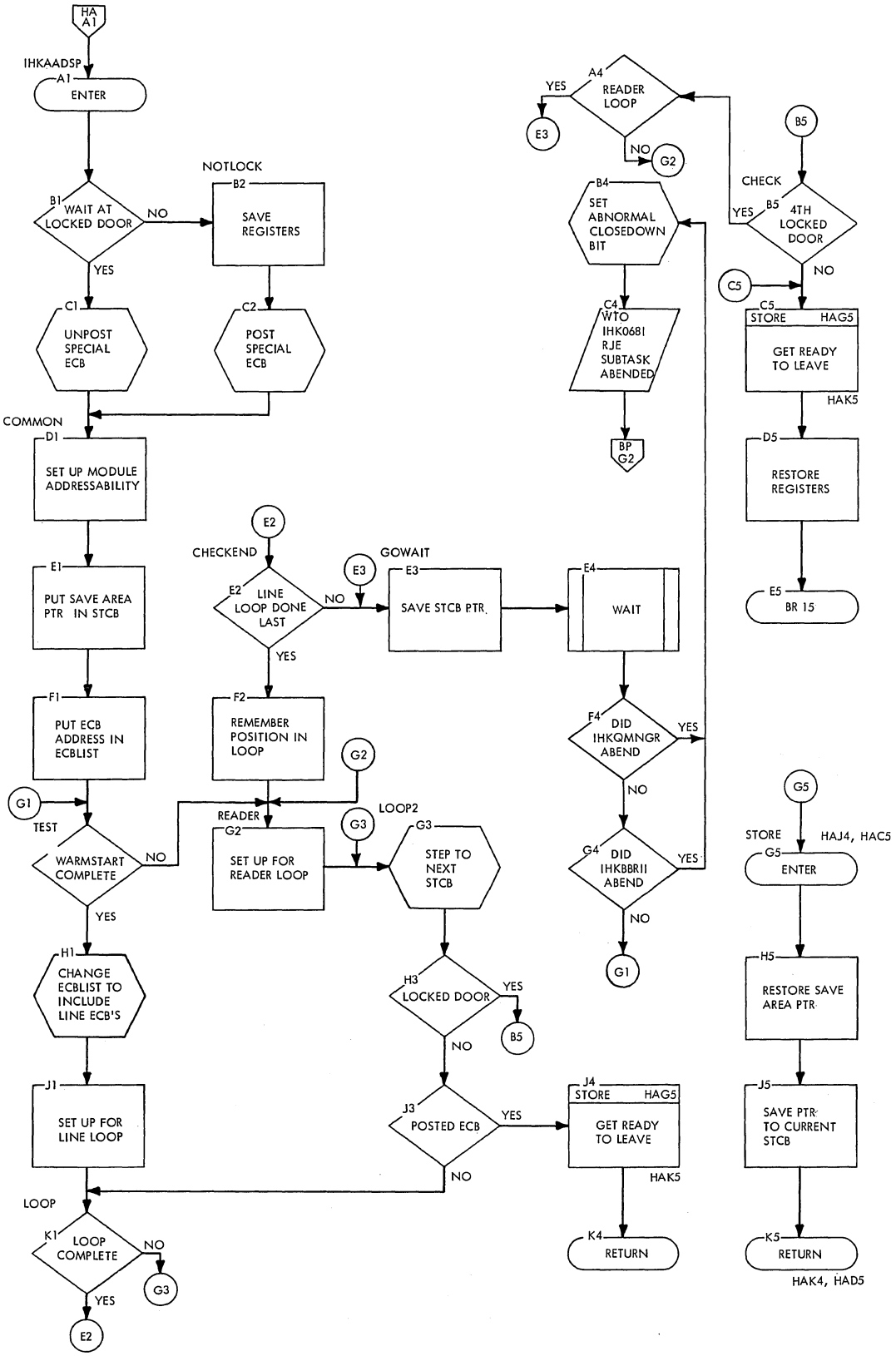


Chart JA. IHKCDFMR -- Table Managers

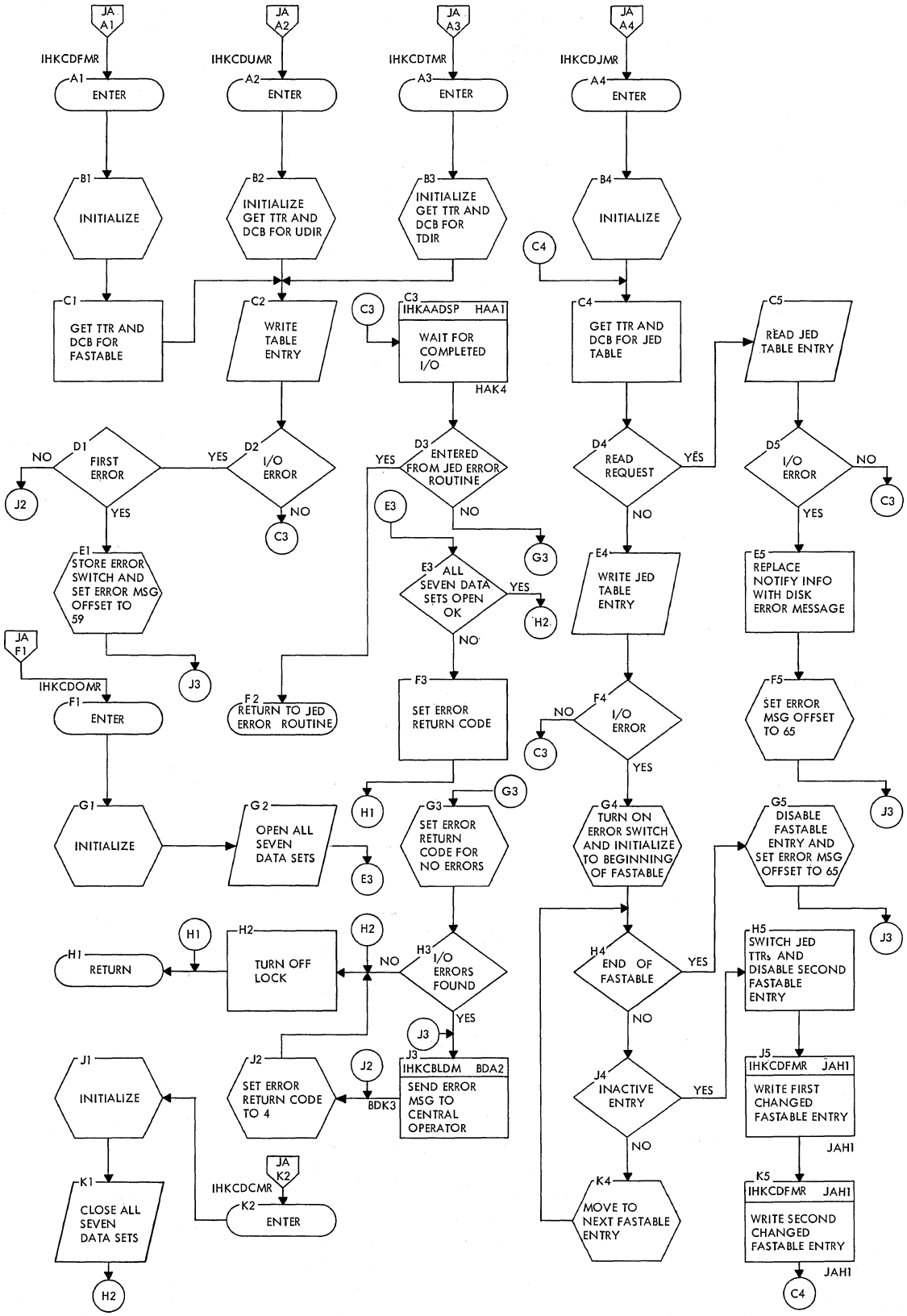


Chart JB. IHKCDSCH -- Job Search Routine

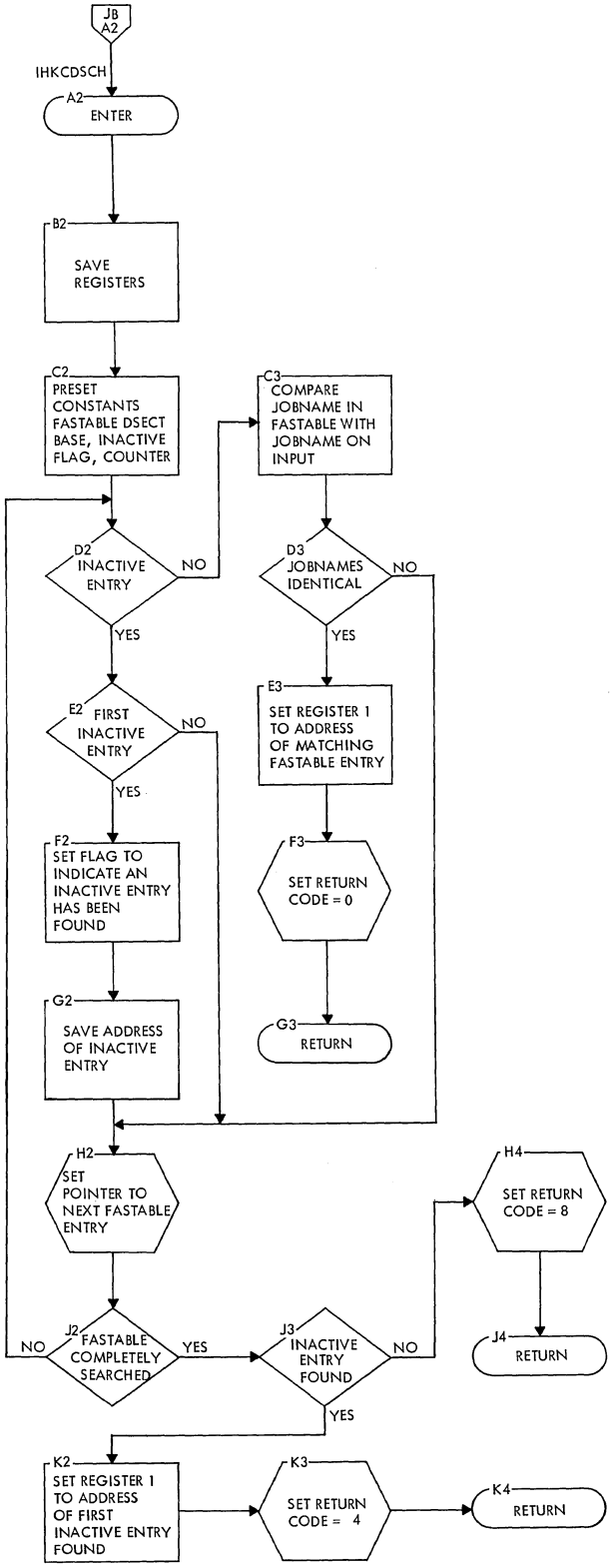


Chart JC. IHKCDINI -- Initialize Disk for Table Managers

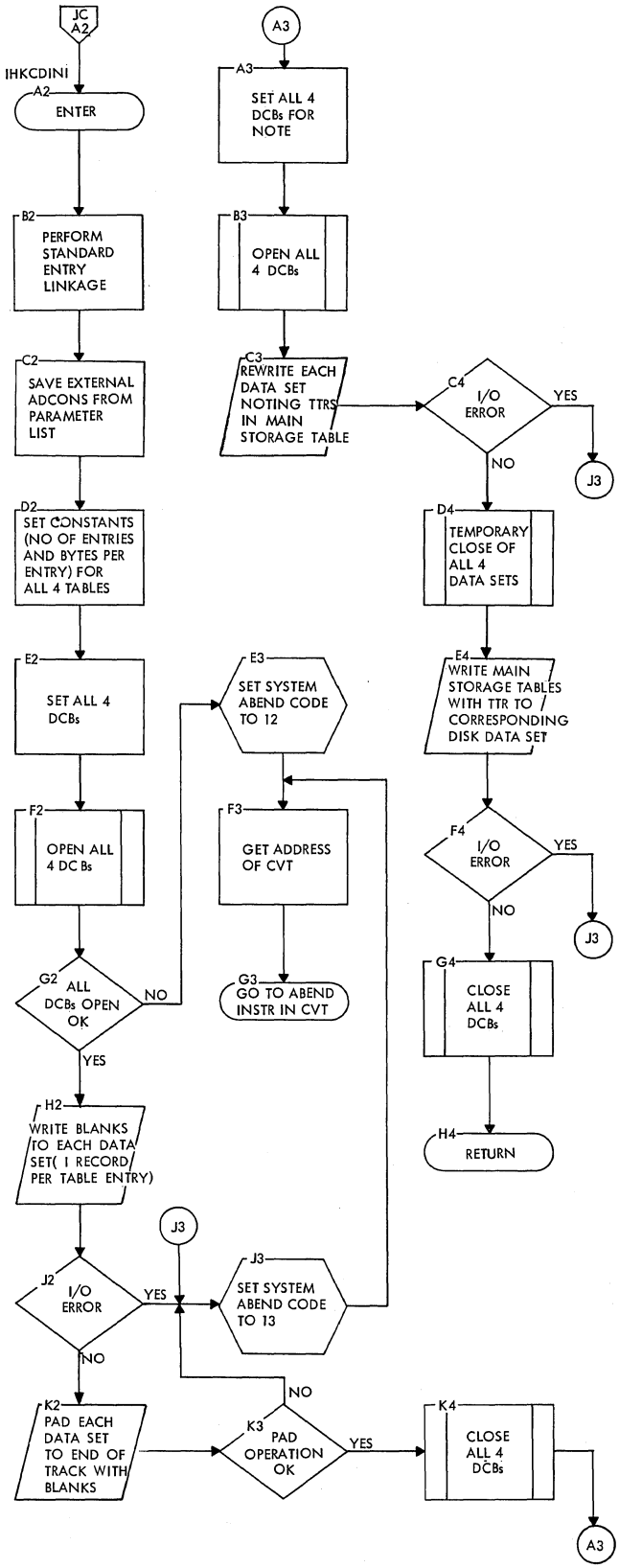


Chart JD. IHKCDBDC -- Central BRDCST Processor

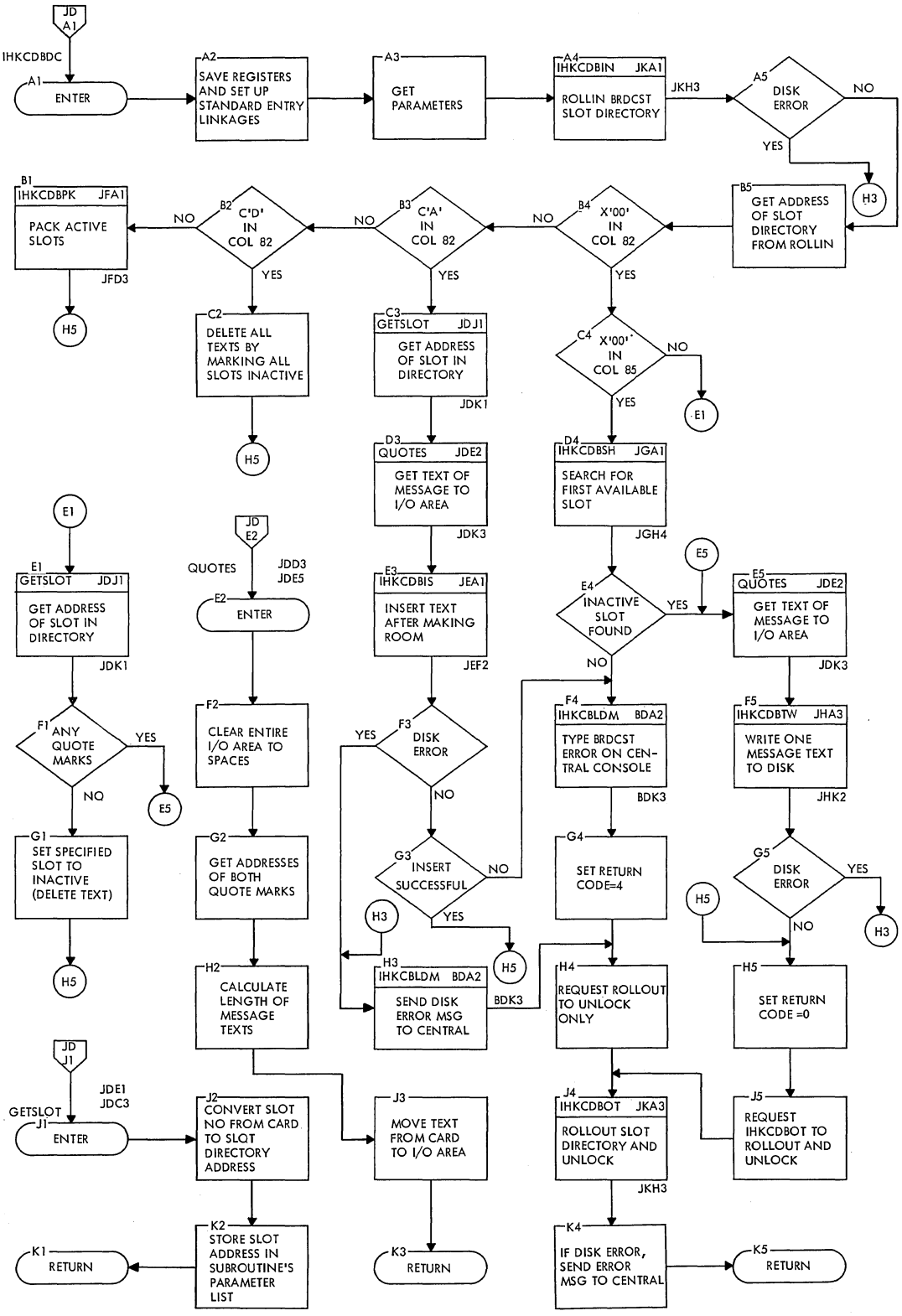


Chart JE. IHKCDBIS -- BRDCST Insert Routine

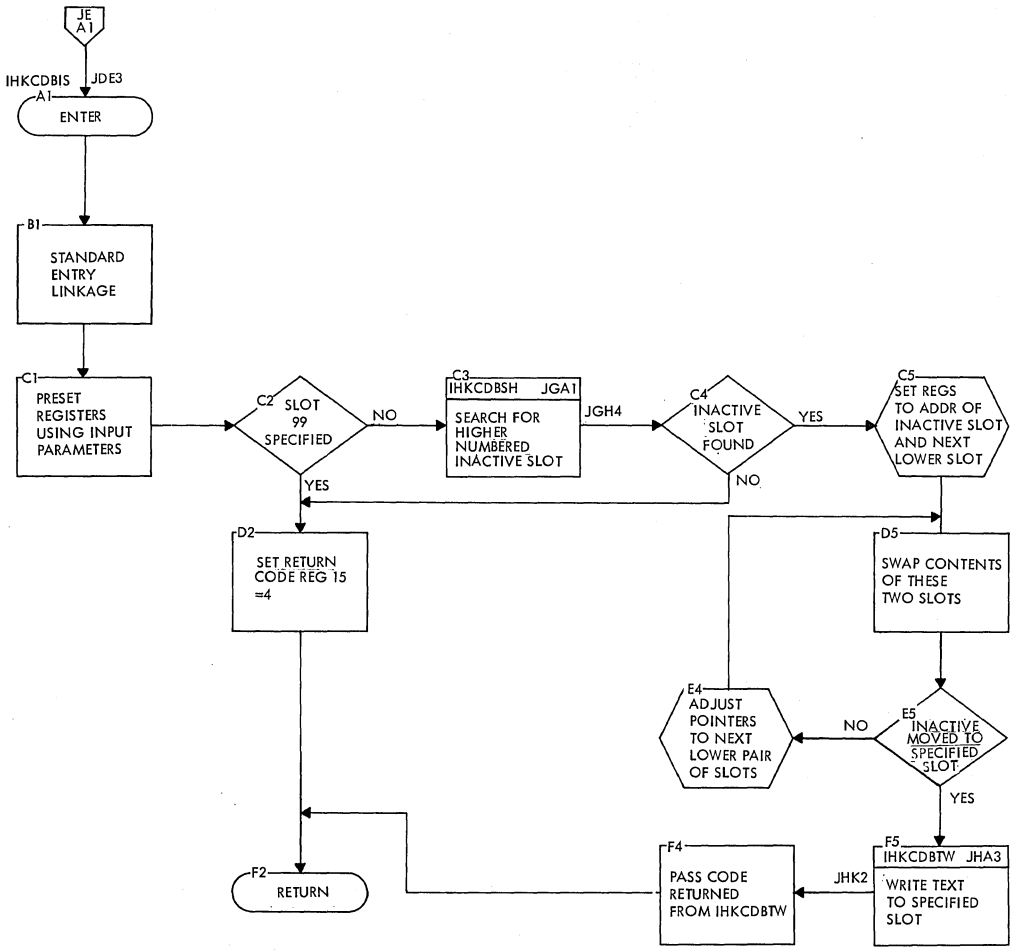


Chart JF. IHKCDBPK -- Pack Active BRDCST Directory Slots

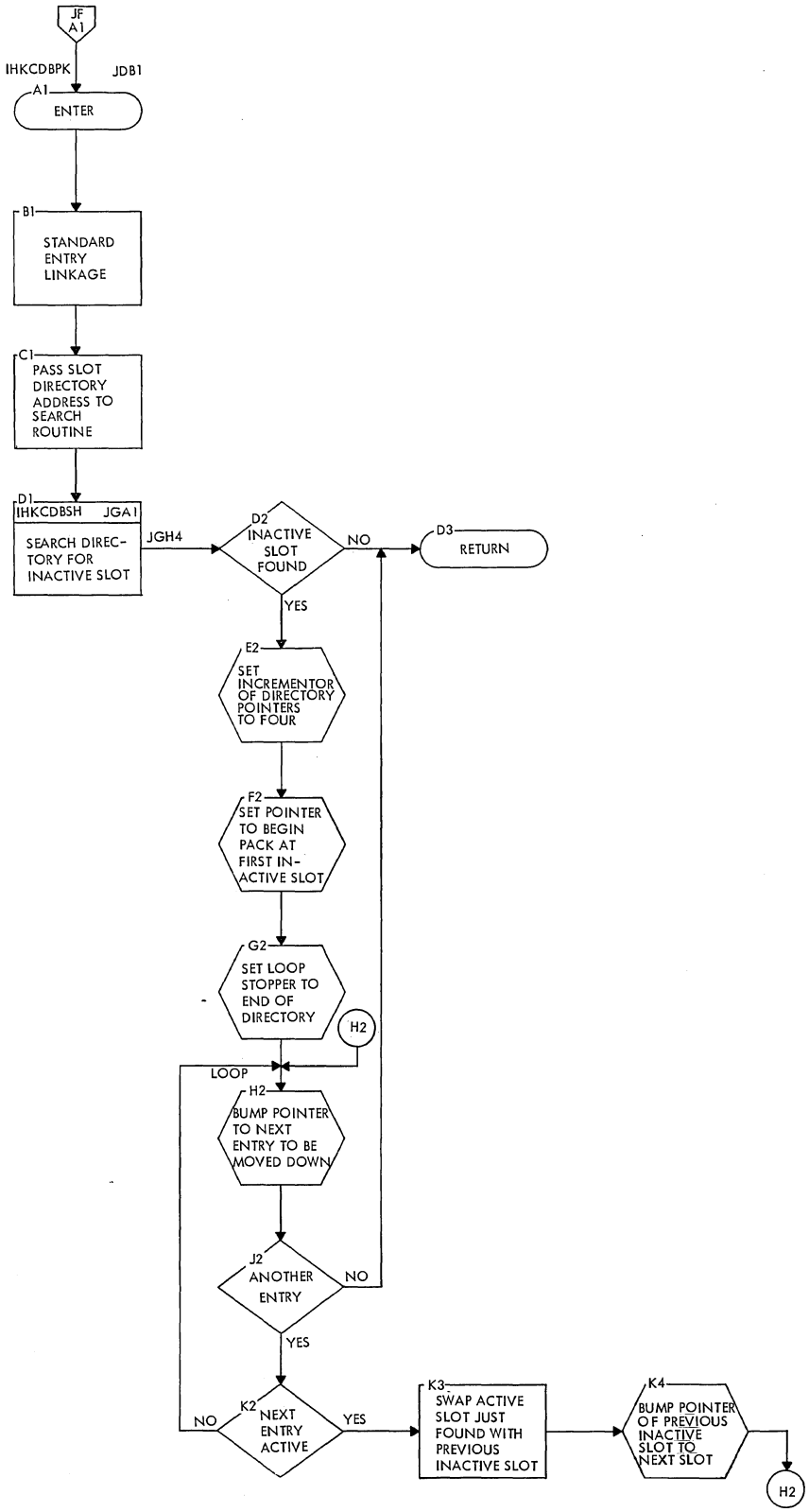


Chart JG. IHKCDBSH -- Search BRDCST-MSG Slot directories

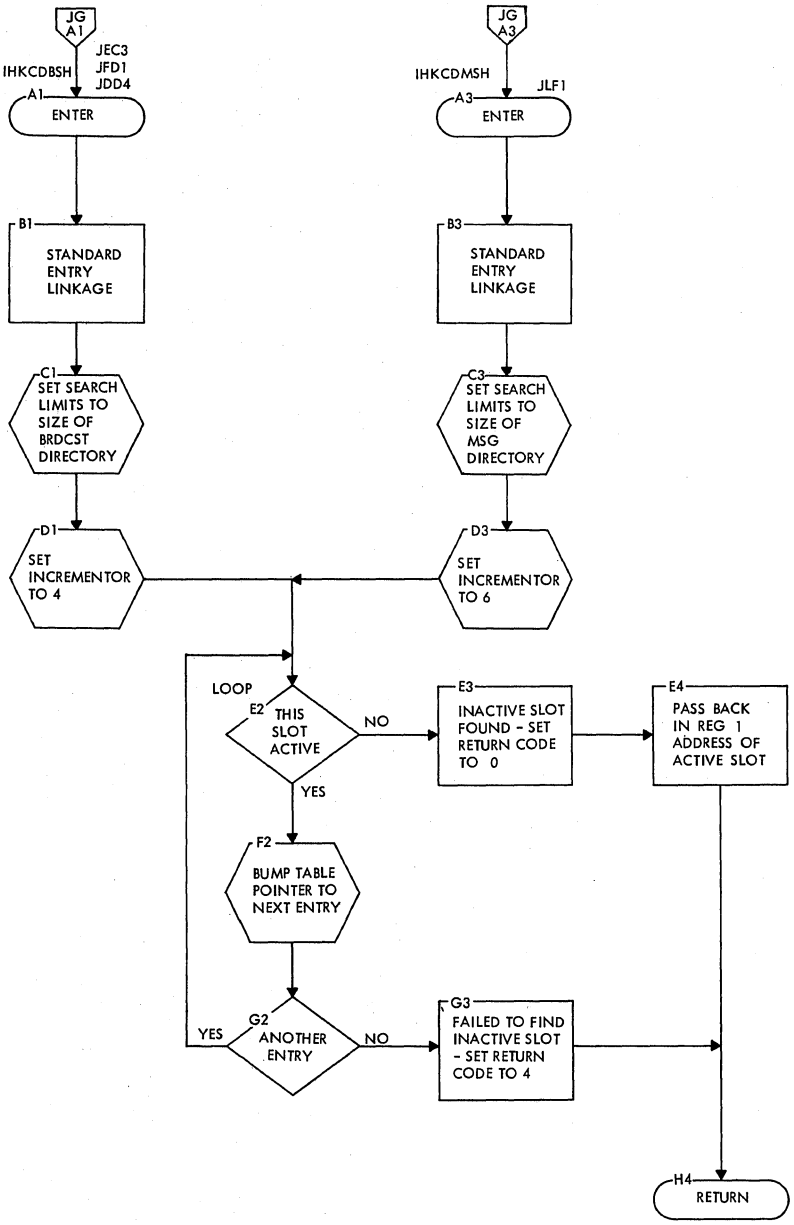


Chart JH. IHKCDBTX -- XDAP Driver for RJETXT

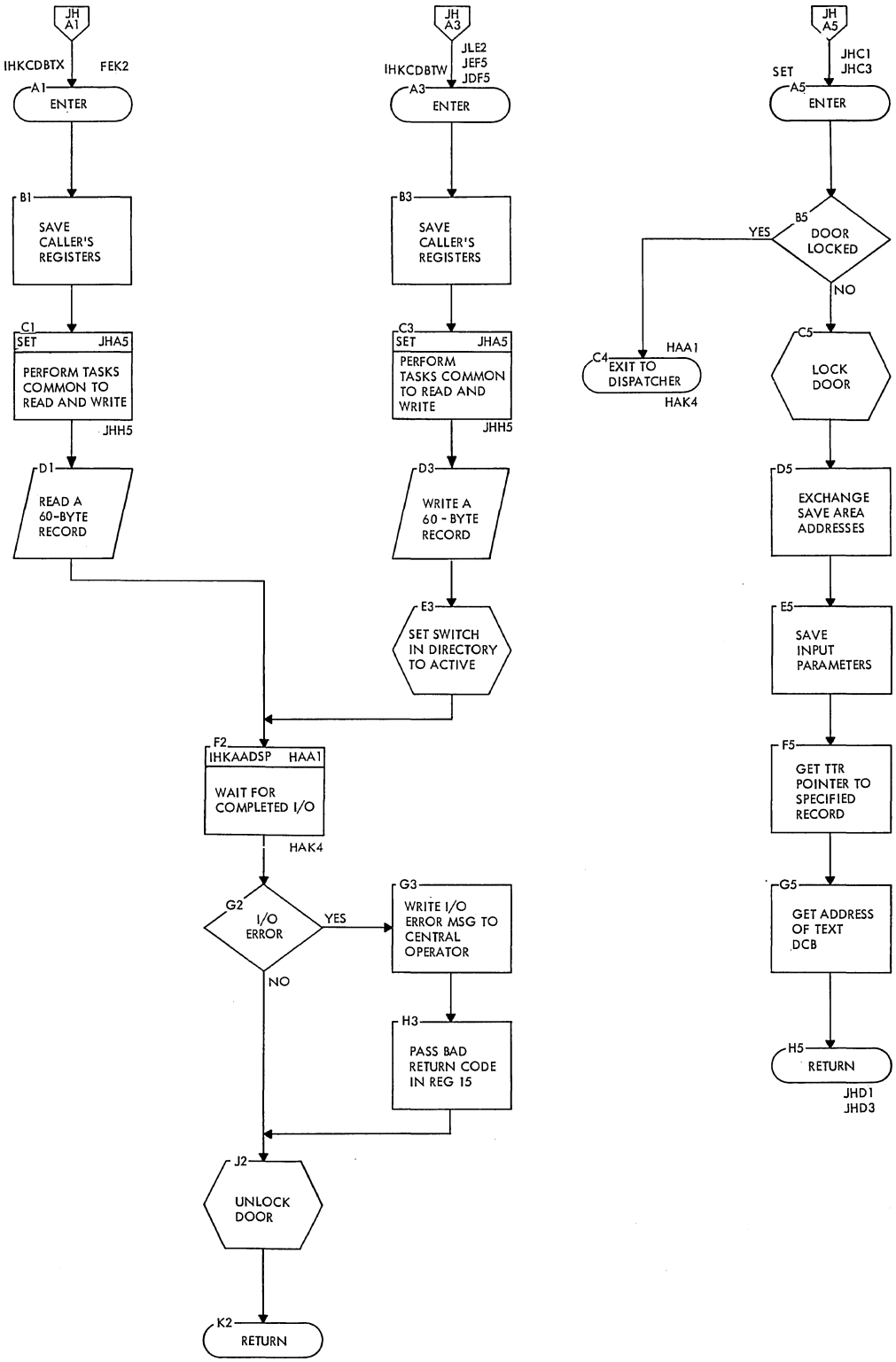


Chart JI. IHKCDRIN -- Rollin Routine

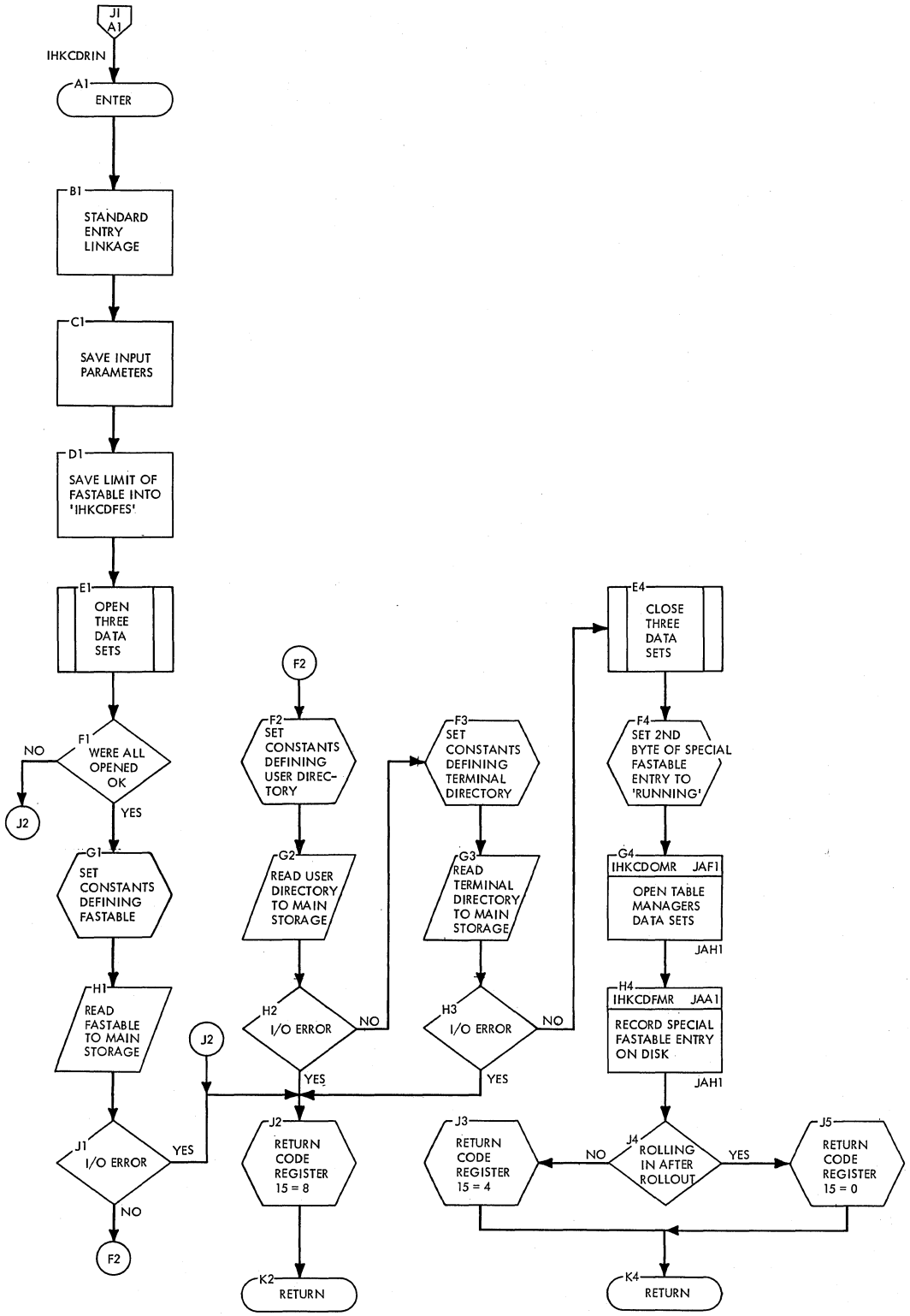


Chart JJ. IHKCDMDE -- Message Delete Routine

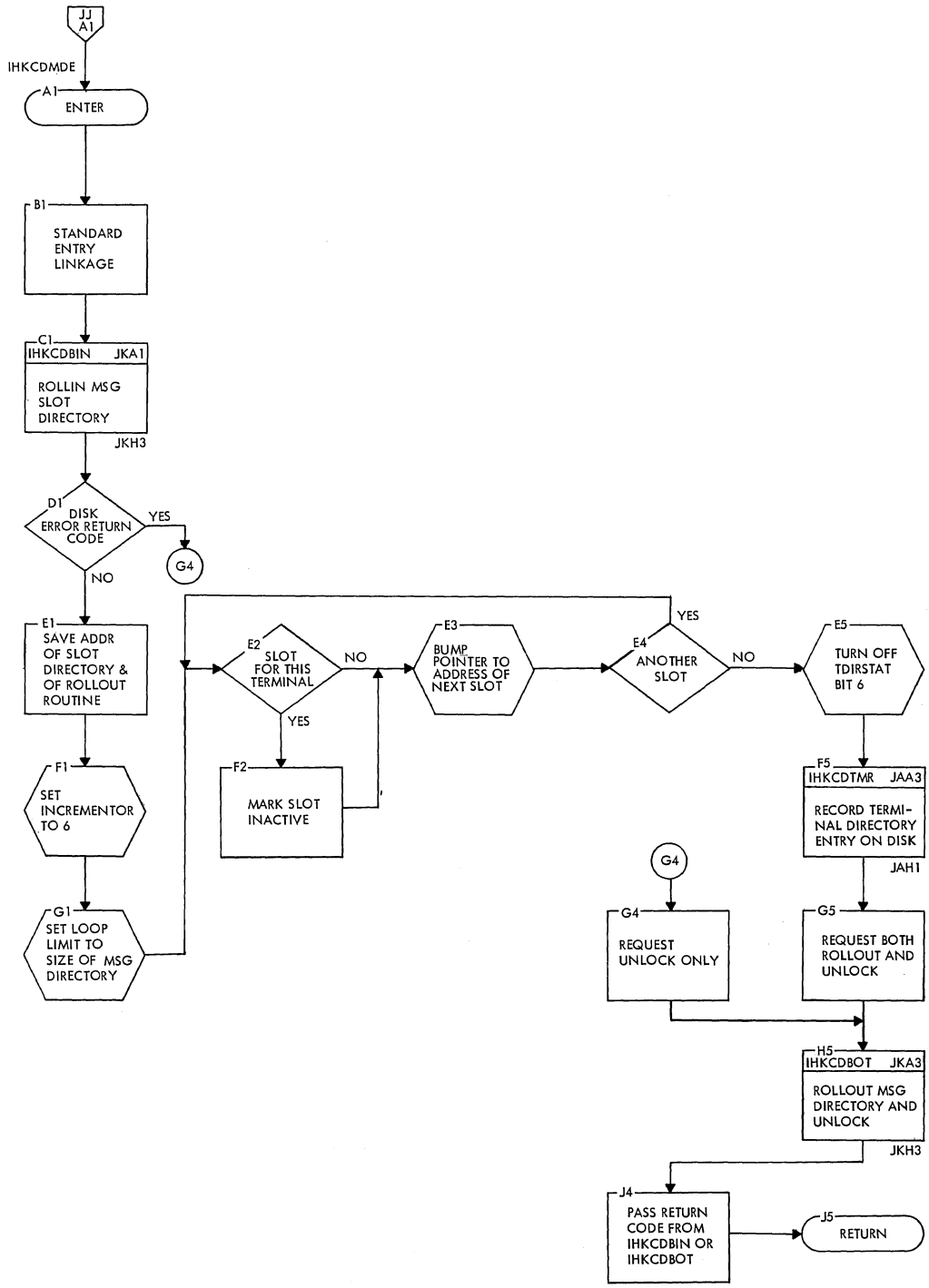
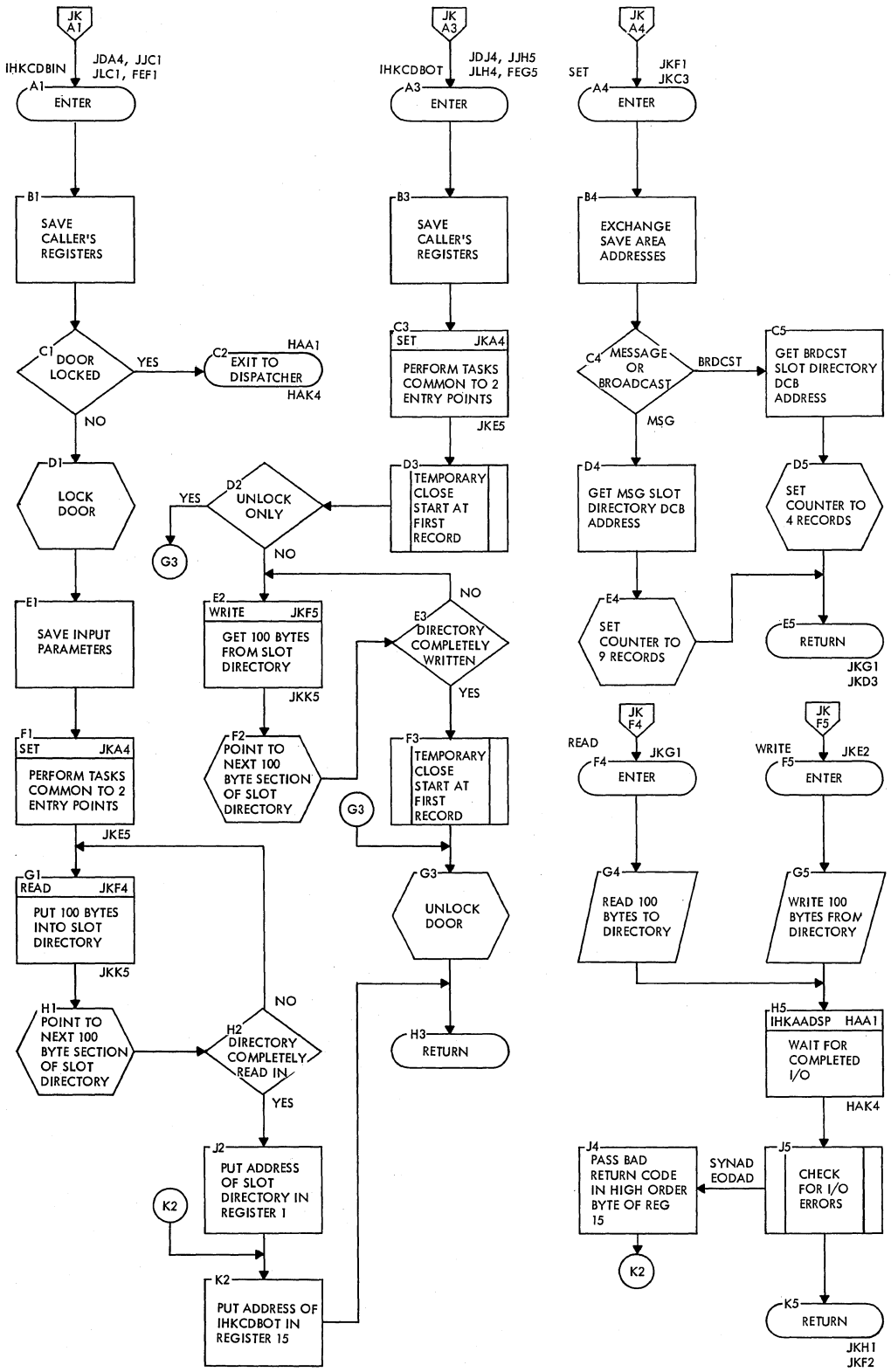
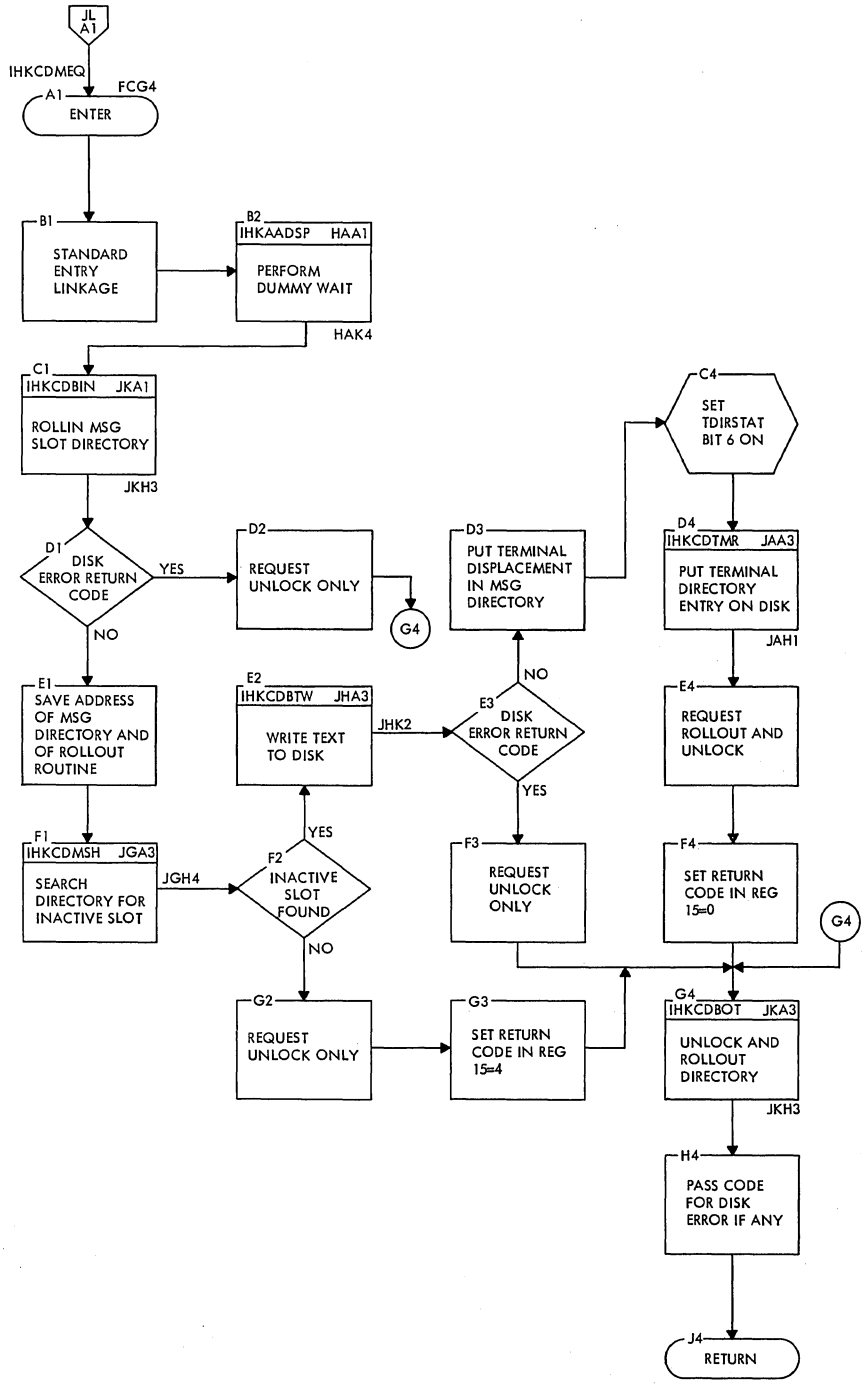


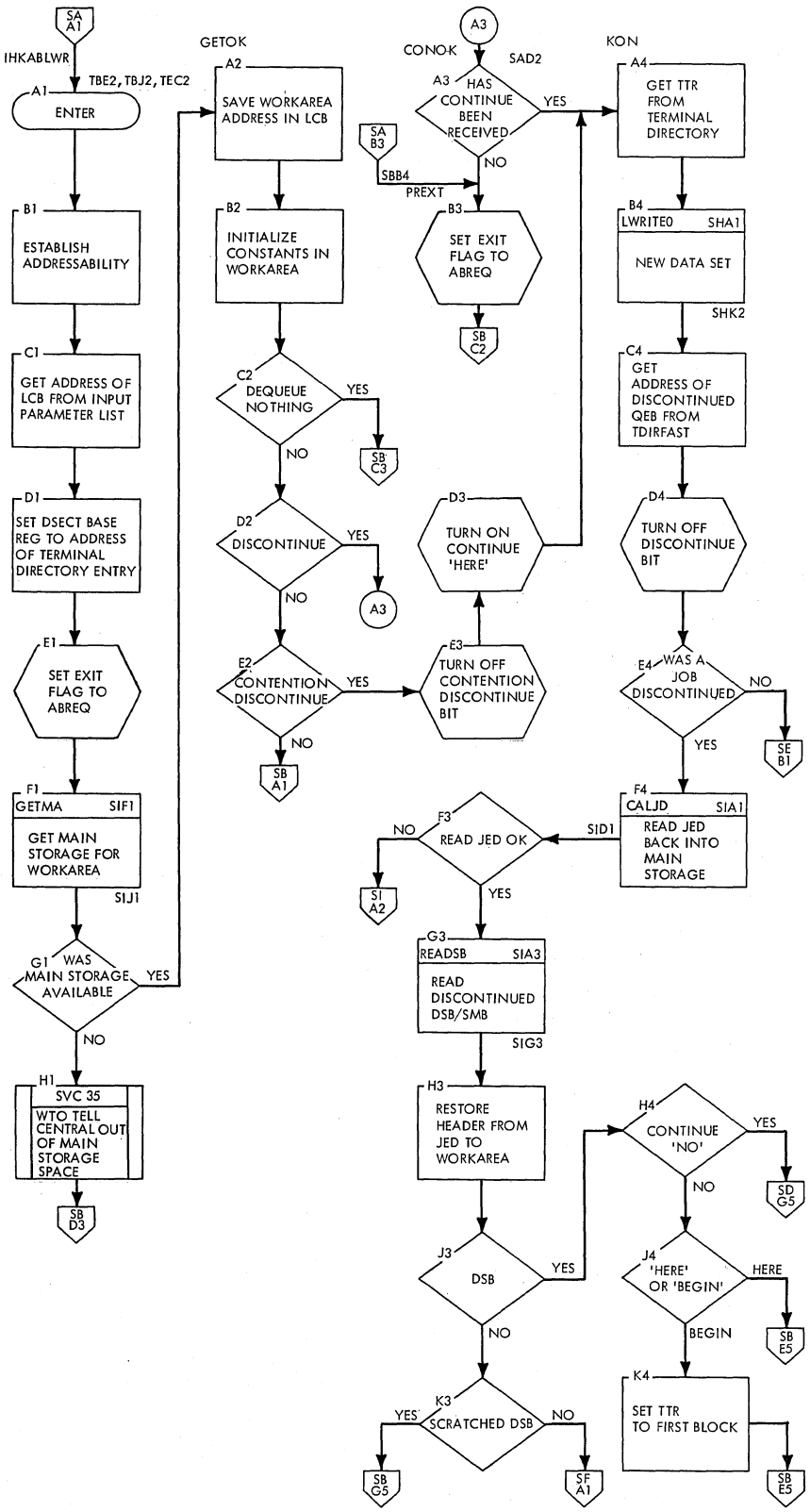
Chart JK. IHKCDBIN -- Rollin/Rollout Slot Directories



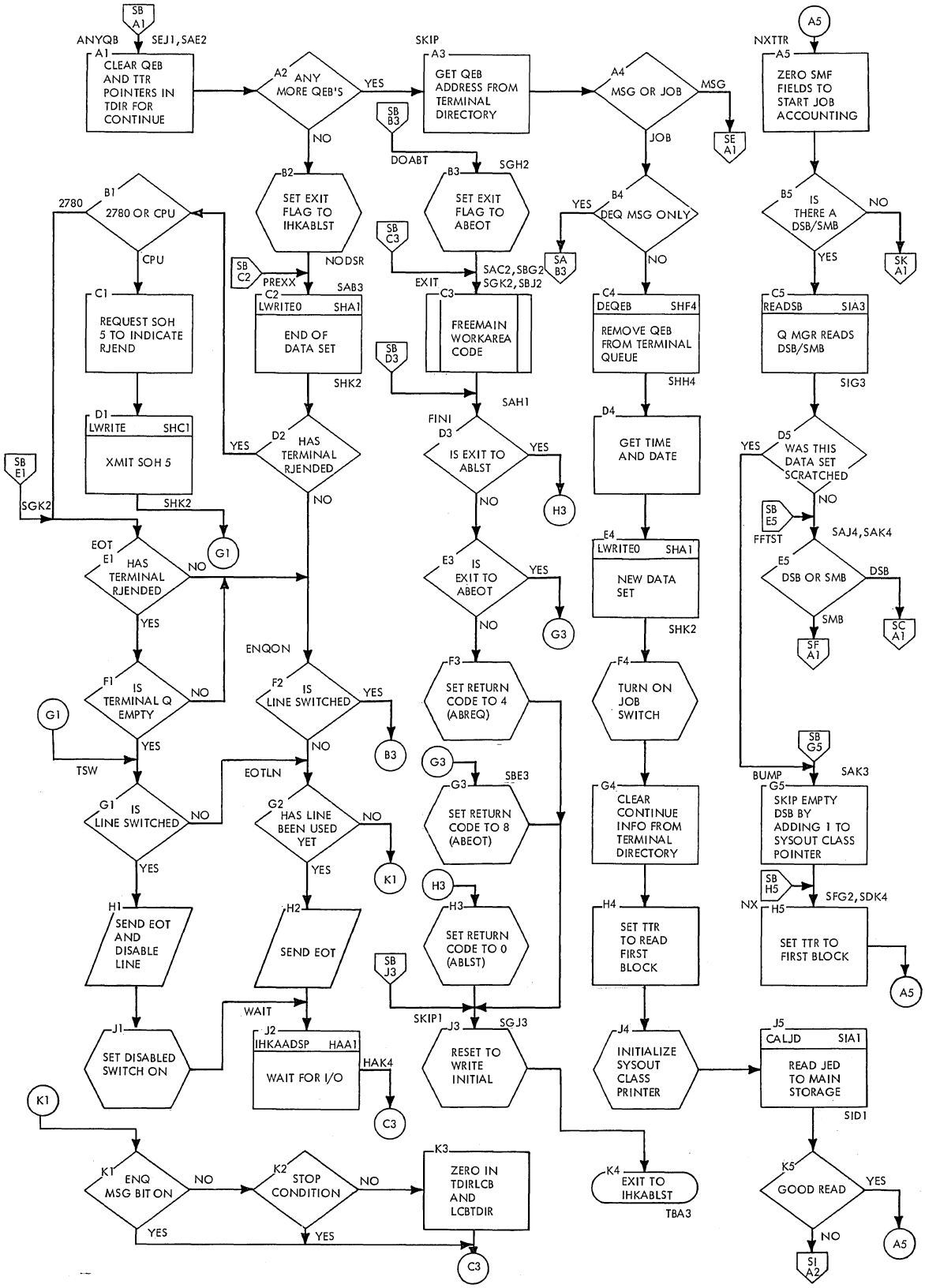
- Chart JL. IHKCDMEQ -- Enqueue Delayed Messages



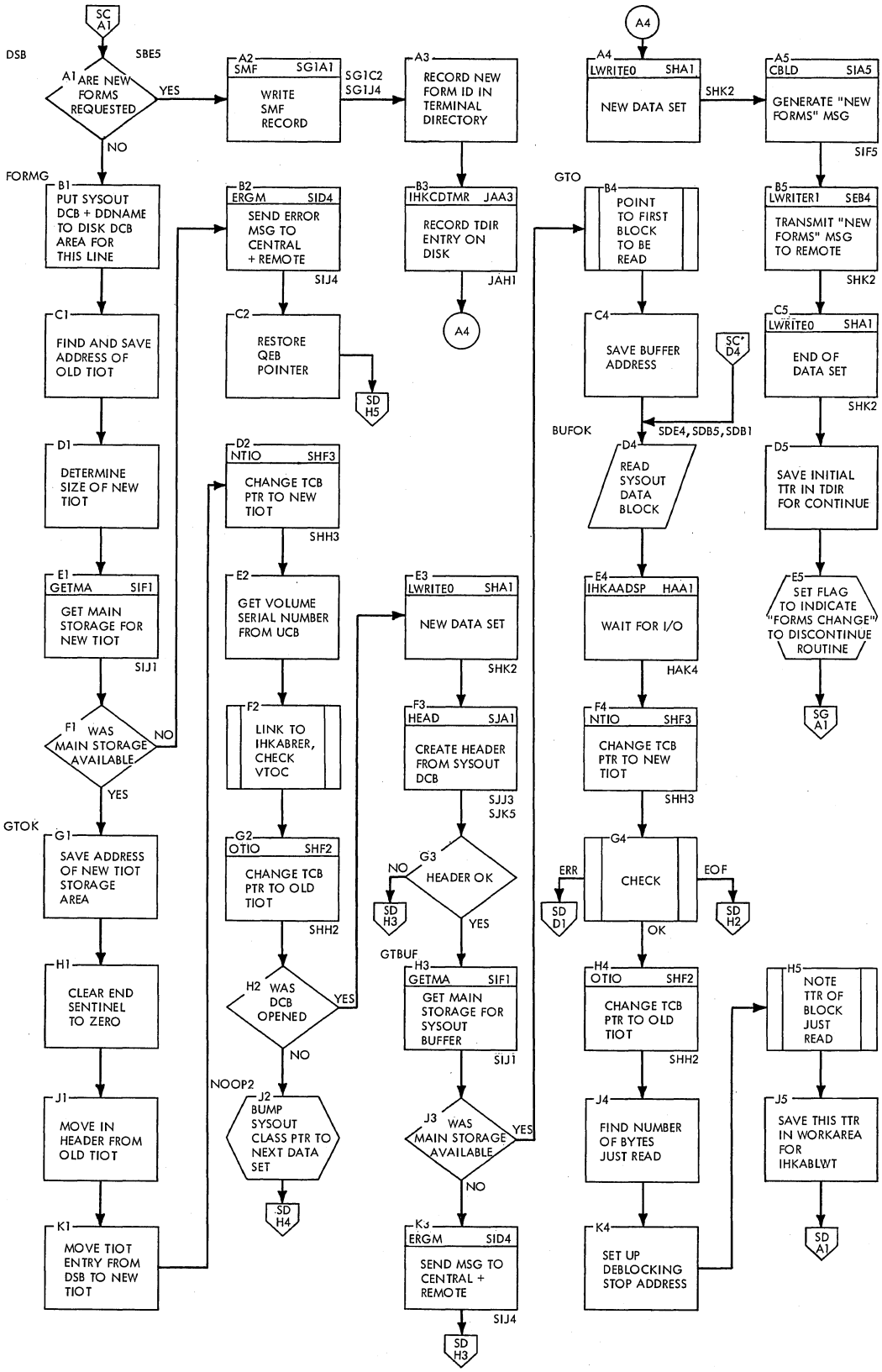
• Chart SA. IHKABLWR and IHKCHLWR -- (Entry Continue) Line Analysis Write (LWR Routine)



- Chart SB. IHKABLWR and IHKCHLWR -- QEB Processor, Transmit EOT and EXIT



• Chart SC. IHKABLWR and IHKCHLWR -- DSB Processor



• Chart SD. IHKABLWR and IHKCHLWR -- Deblocking

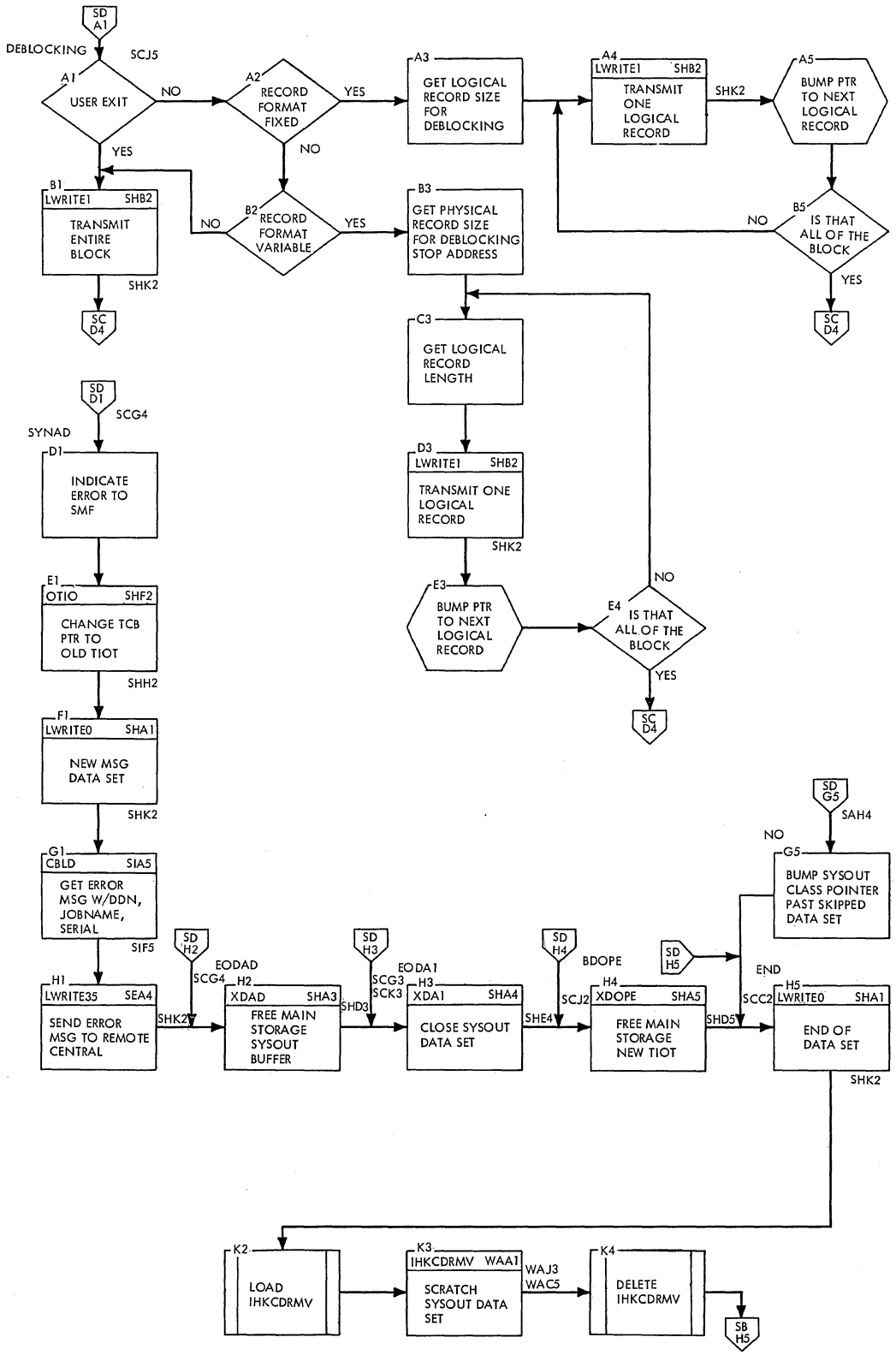
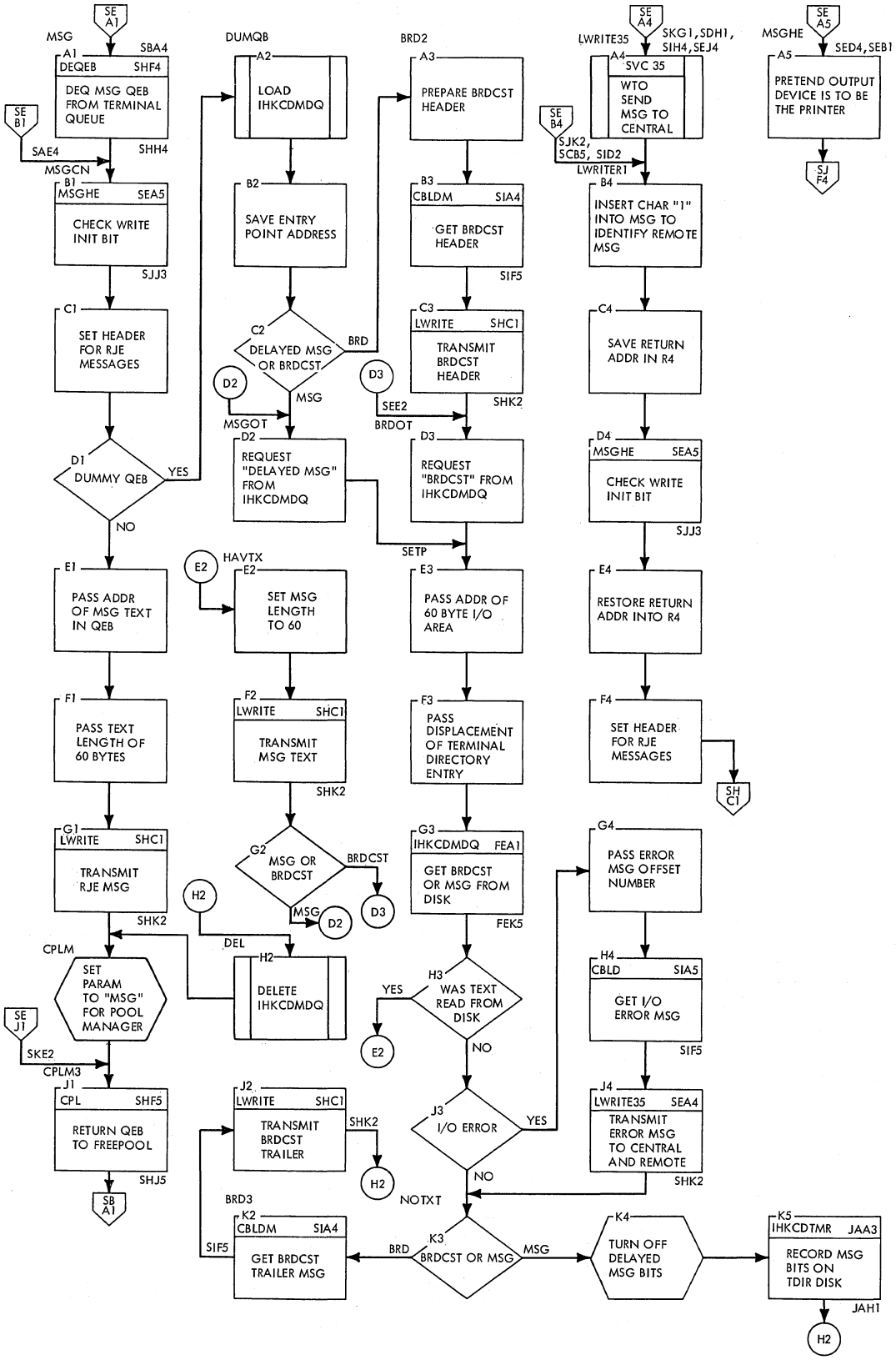
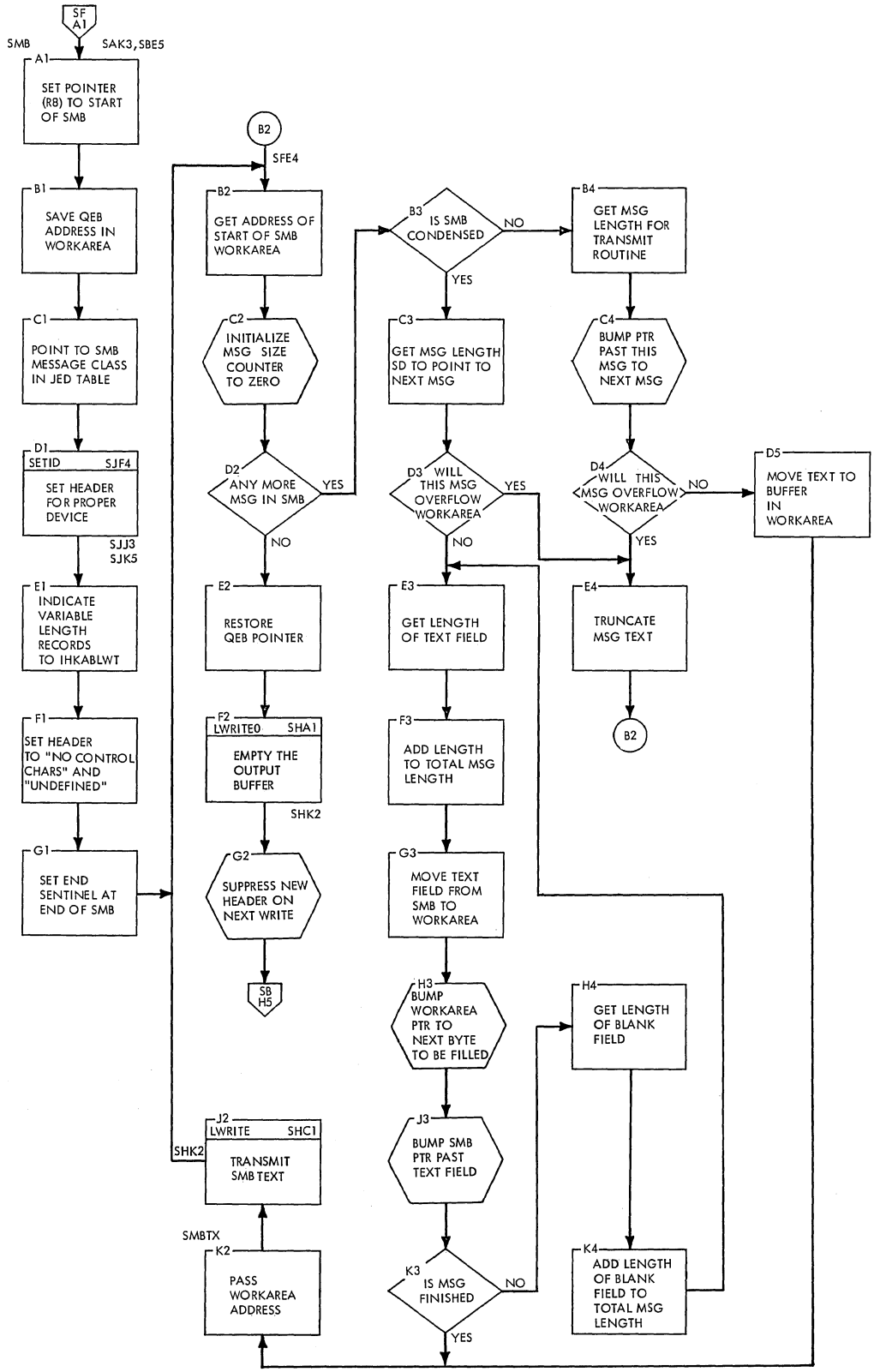


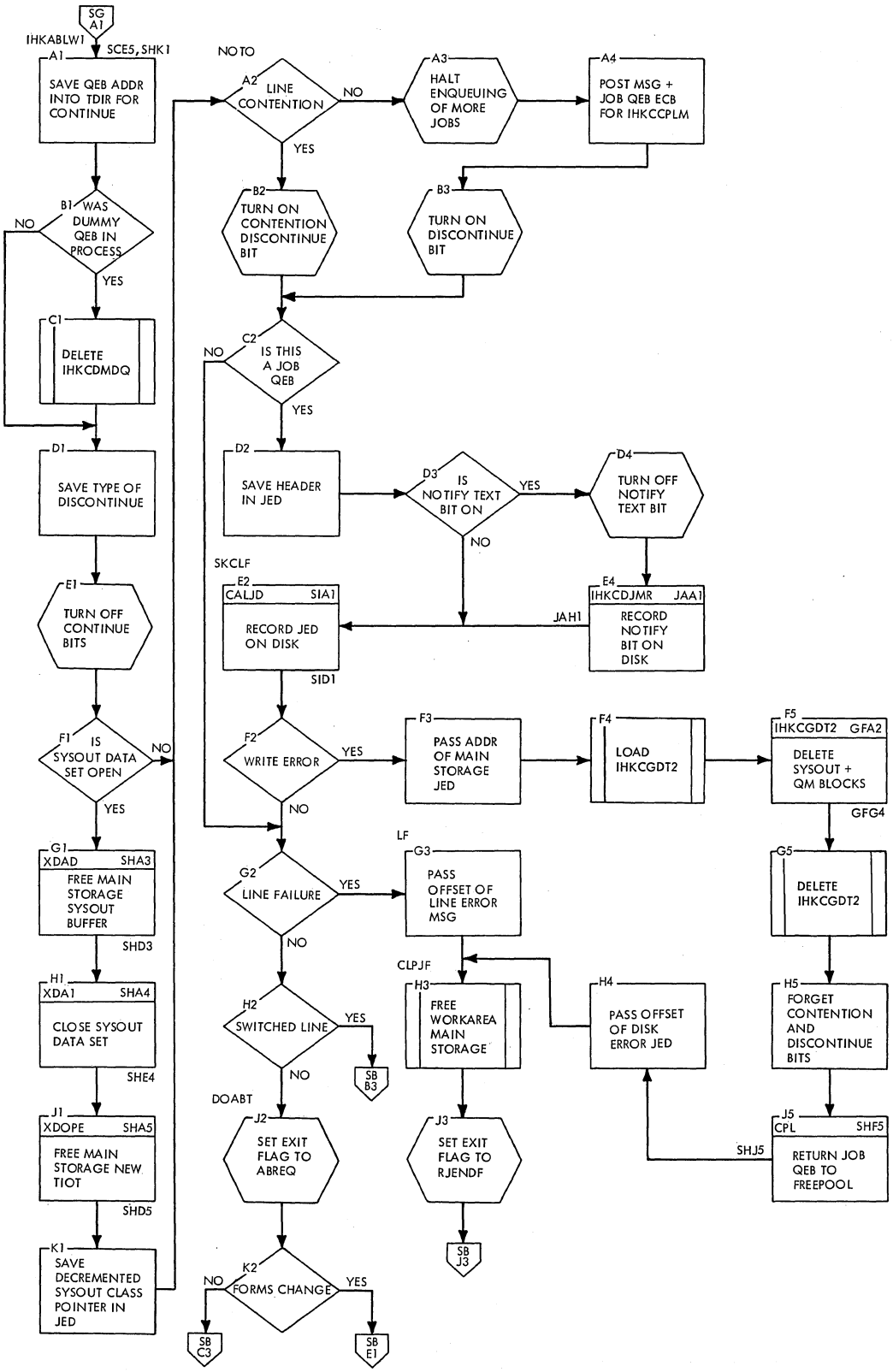
Chart SE. IHKABLWR and IHKCHLWR -- Broadcast, Delayed Messages, RJE Messages



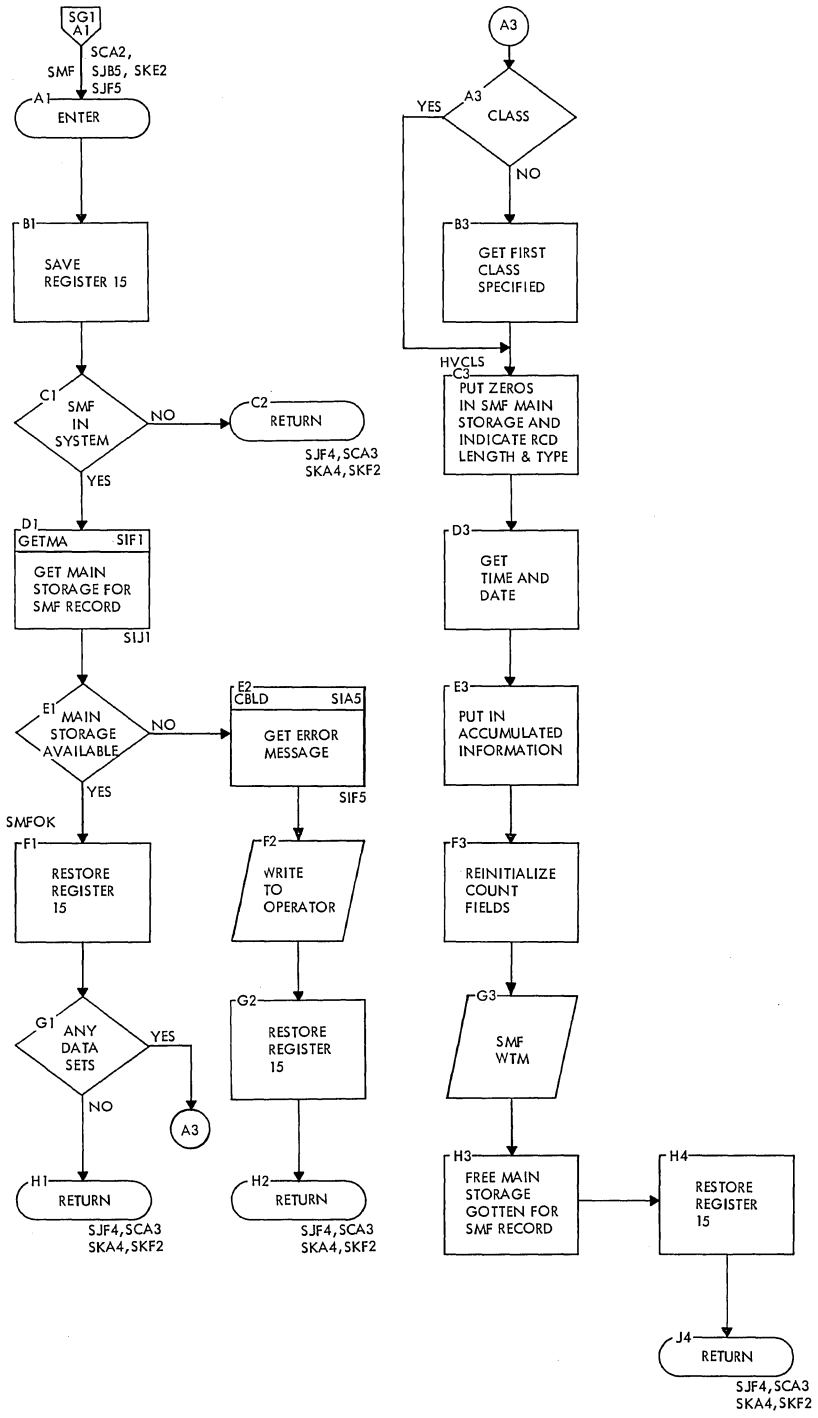
• Chart SF. IHKABLWR and IHKCHLWR -- SMB Processor



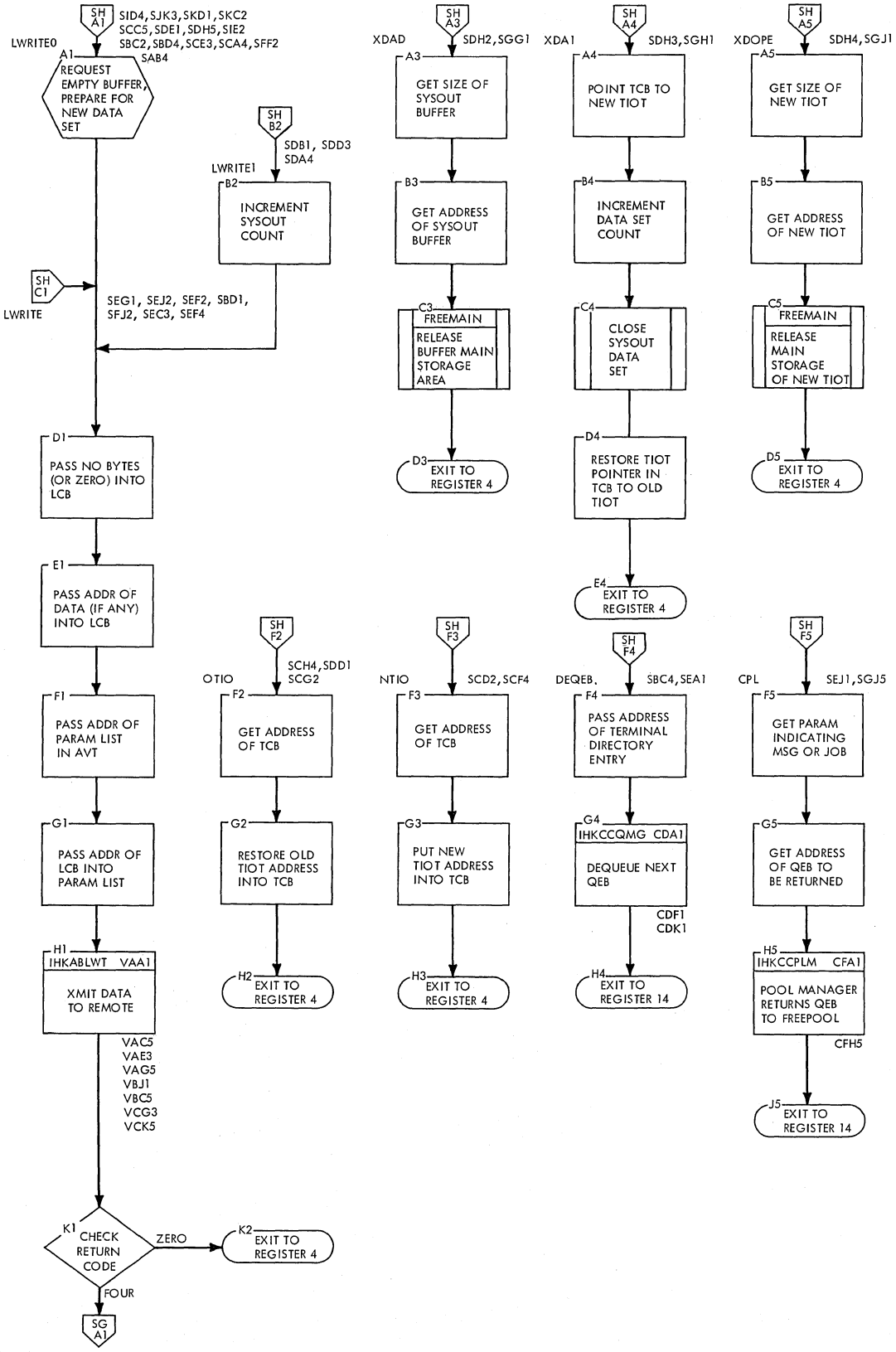
- Chart SG. IHKABLWR and IHKCHLWR -- Discontinue, RJENDF Exit



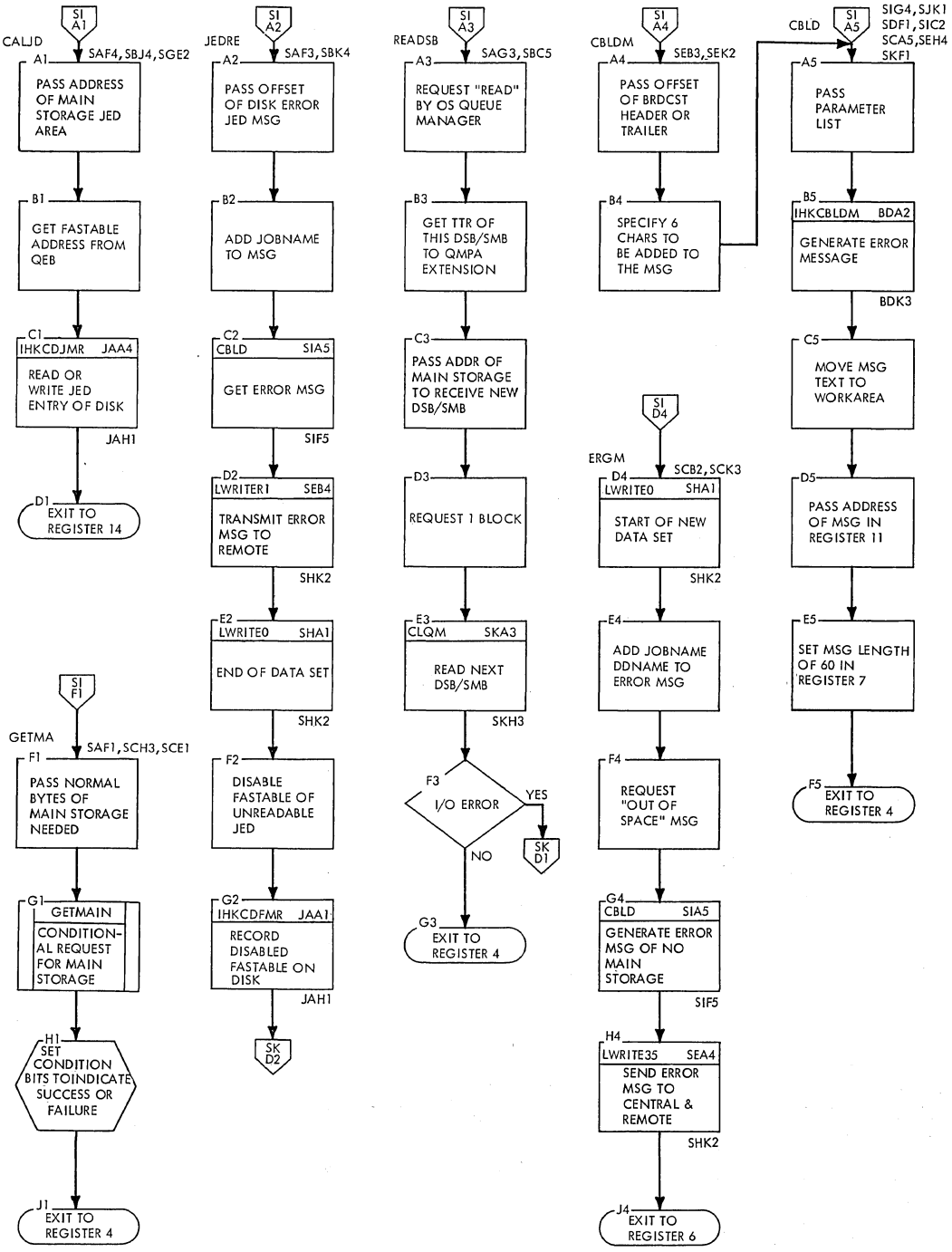
- Chart SG1. IHKABLWR and IHKCHLWR -- SMF Subroutine



• Chart SH. IHKABLWR and IHKCHLWR -- Call Transmit, Other Subroutines



- Chart SI. IHKABLWR and IHKCHLWR -- Subroutines



- Chart SJ. IHKABLWR and IHKCHLWR -- DCB Interpreter

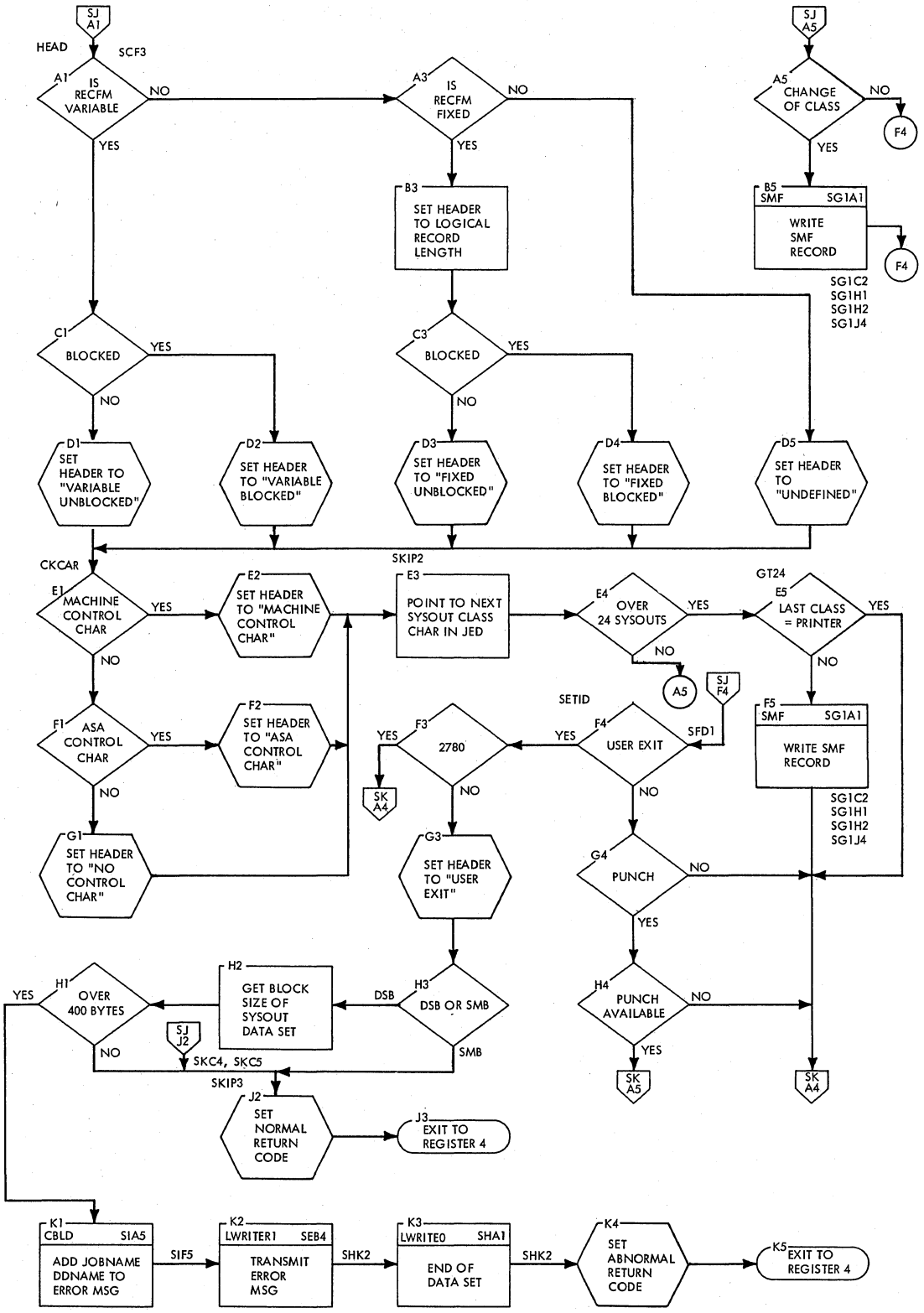
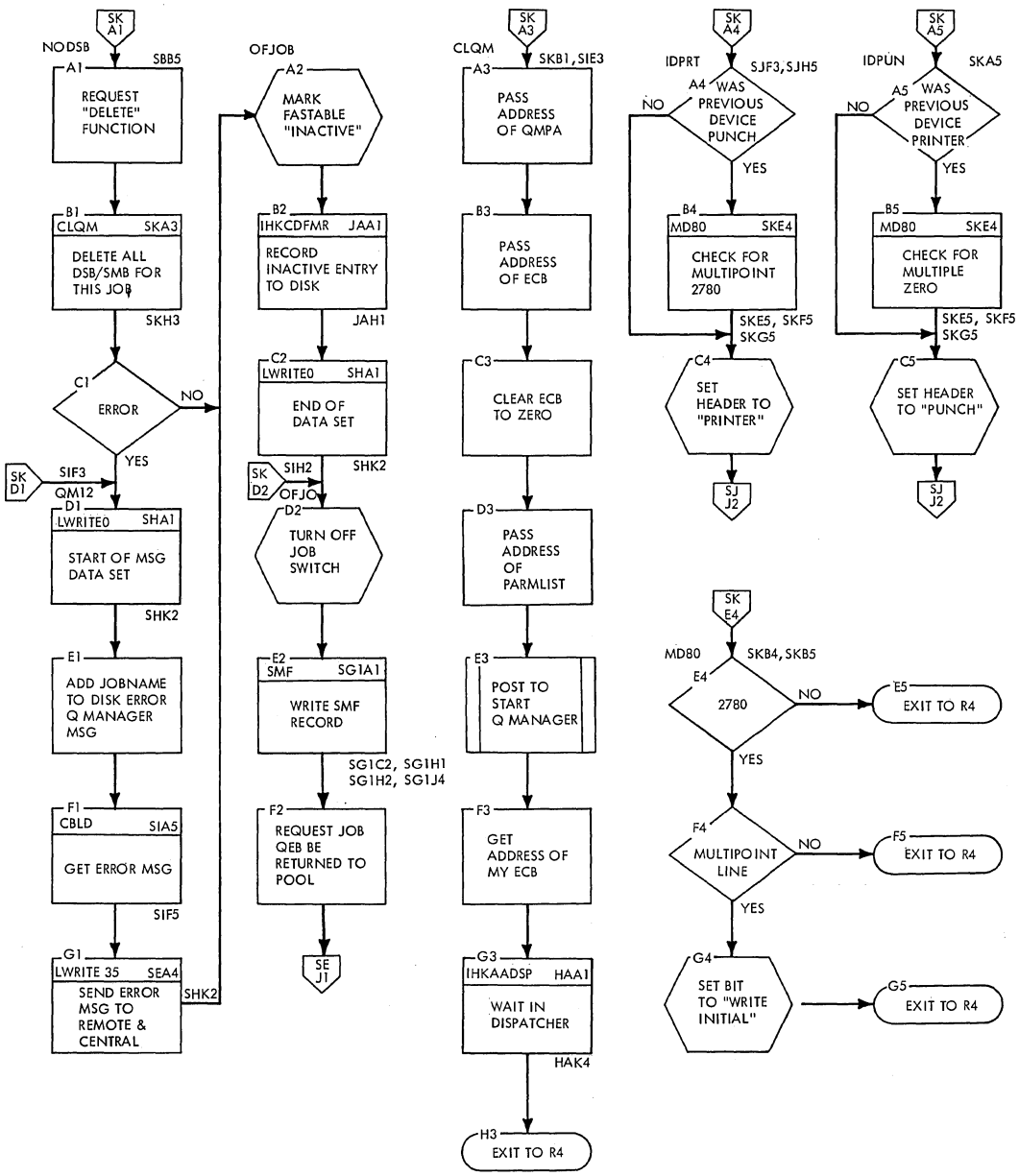
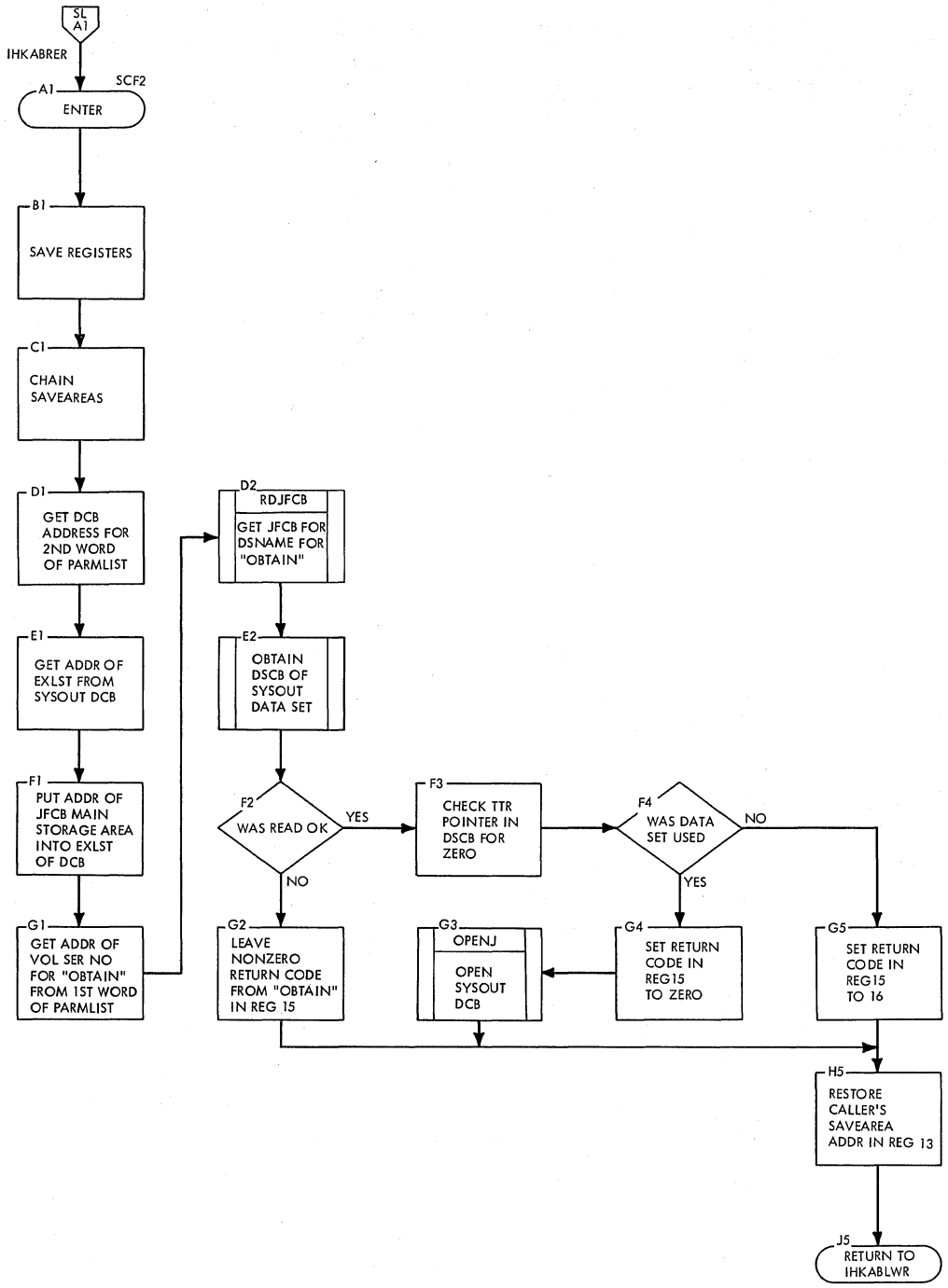


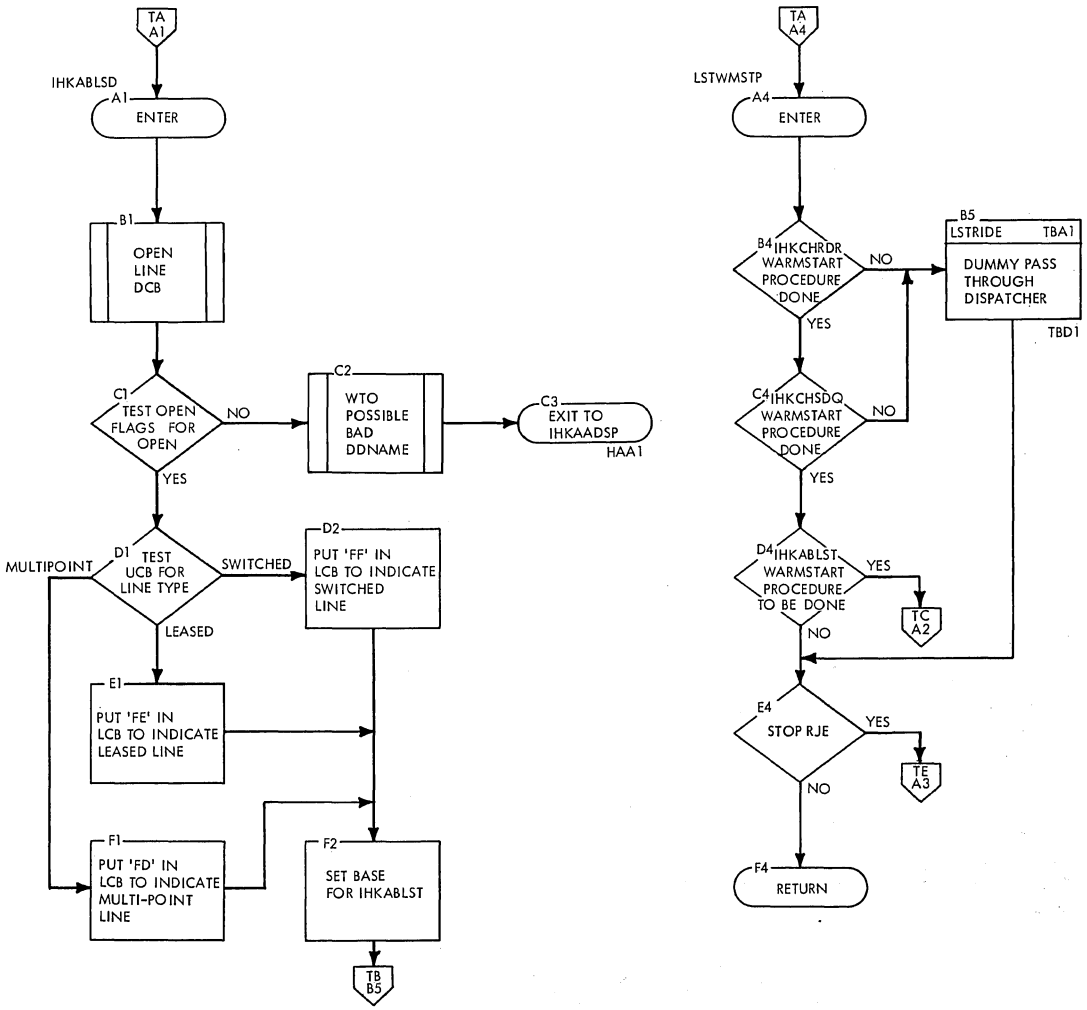
Chart SK. IHKABLWR and IHKCHLWR -- Call Queue Manager Delete



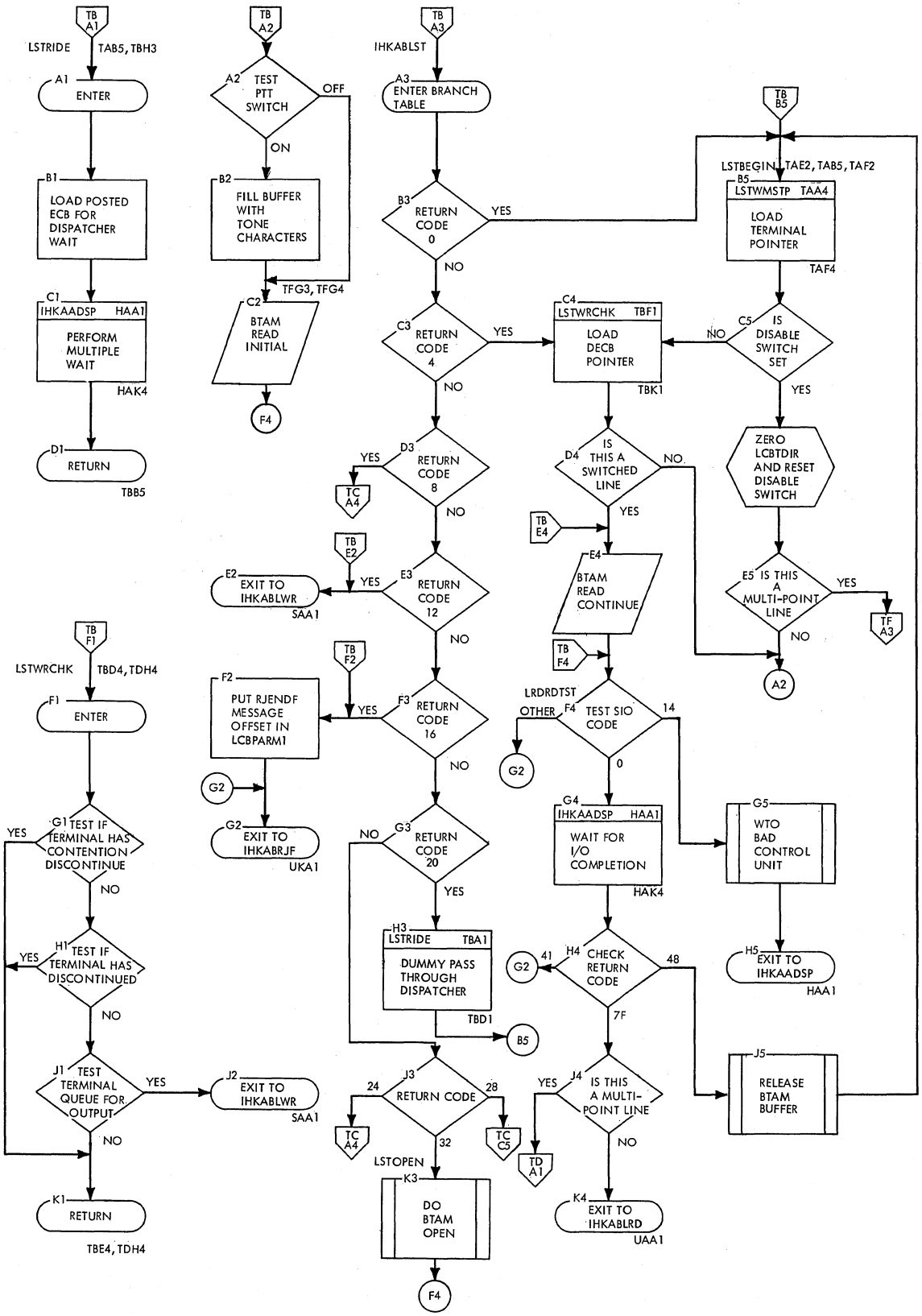
- Chart SL. IHKABRER -- Opens SYSOUT Data Set If Not Empty



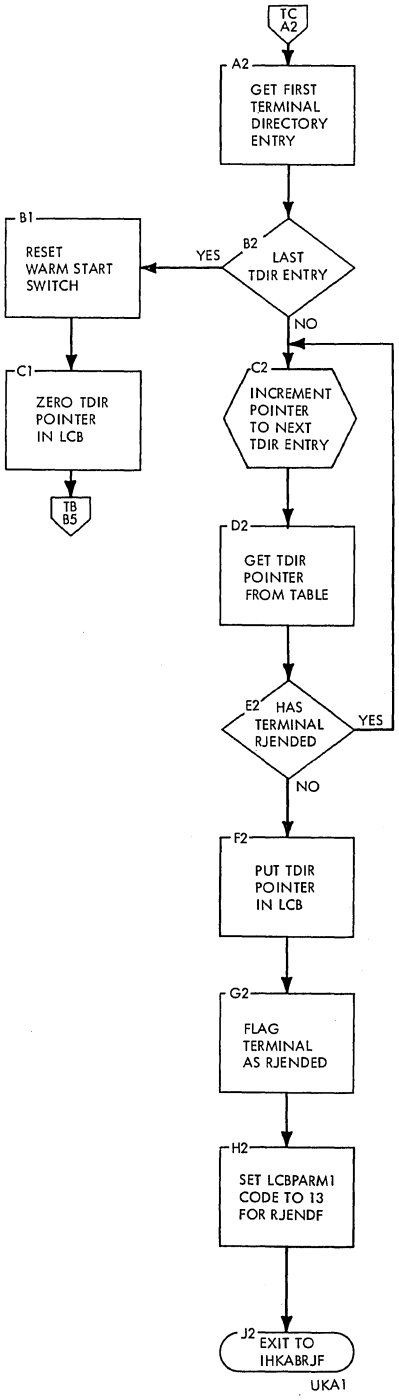
- **Chart TA. IHKABLST -- Line Scheduler**

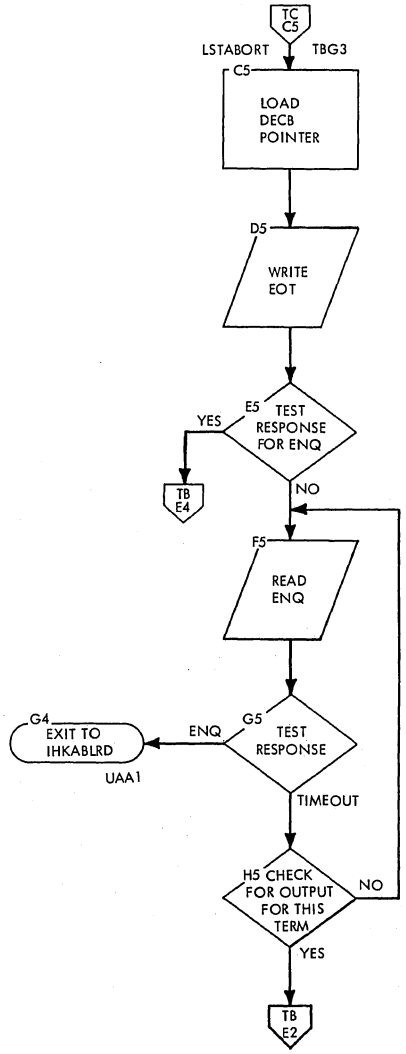


• Chart TB. IHKABLST -- Line Scheduler

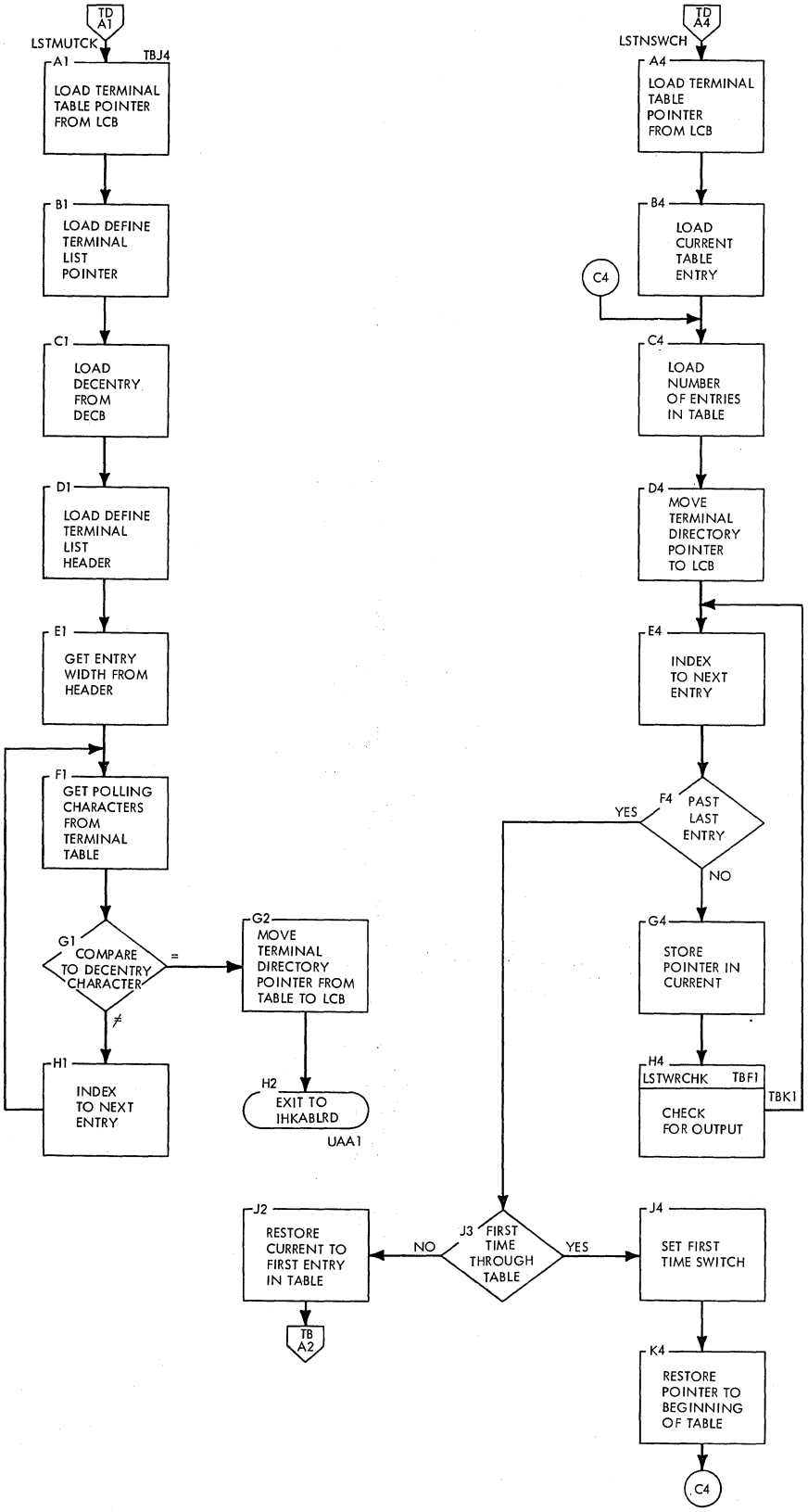


- **Chart TC. IHKABLST -- Line Scheduler**

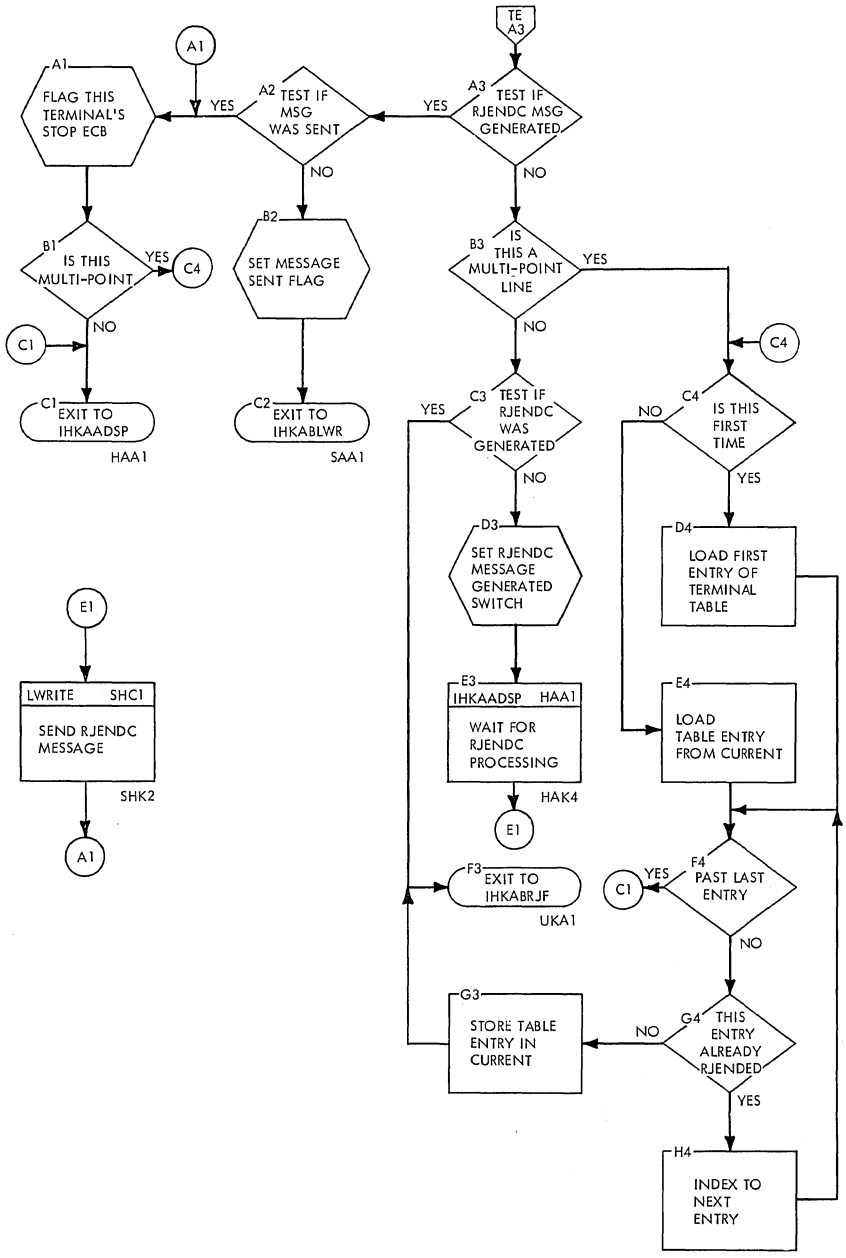




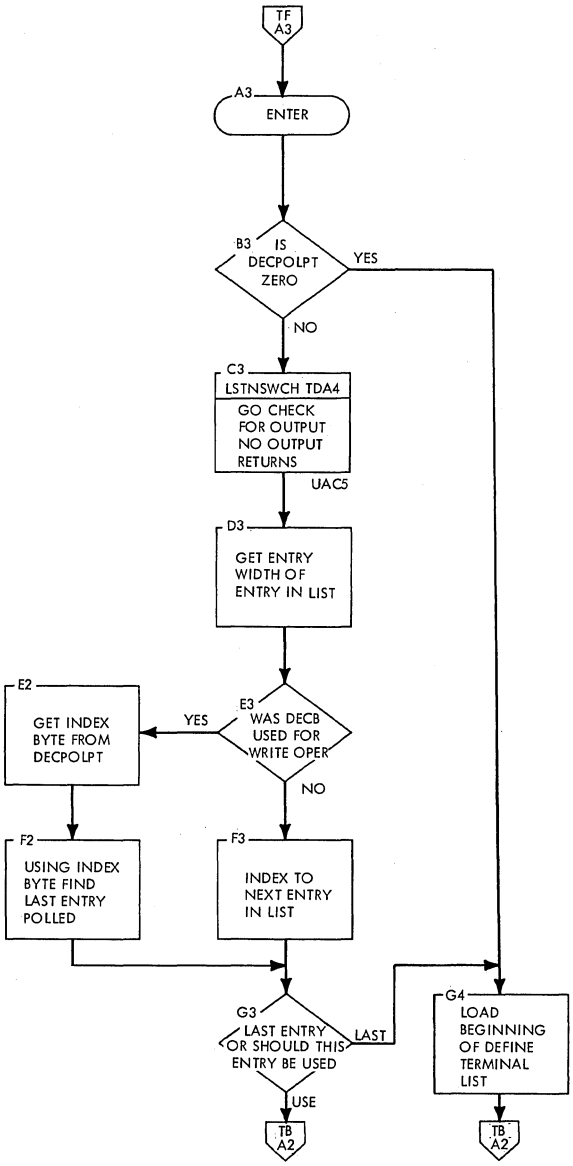
• Chart TD. IHKABLST -- Line Scheduler



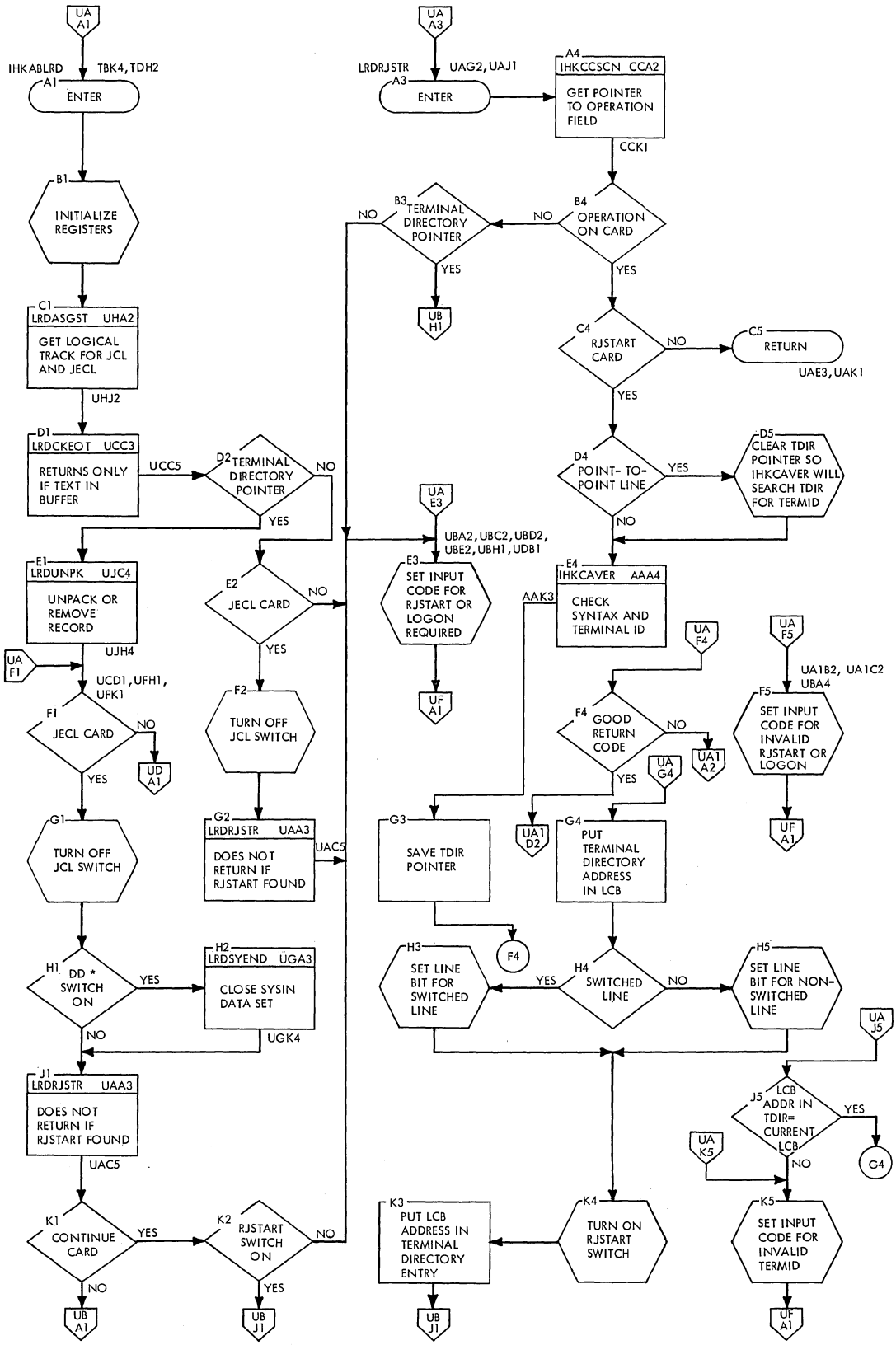
- **Chart TE. IHKABLST -- Line Scheduler**



- Chart TF. IHKABLST -- Line Scheduler



- Chart UA. IHKABLRD and IHKCHLRD -- Line Analysis Read



- Chart UA1. IHKABLRD and IHKCHLRD -- Line Analysis Read

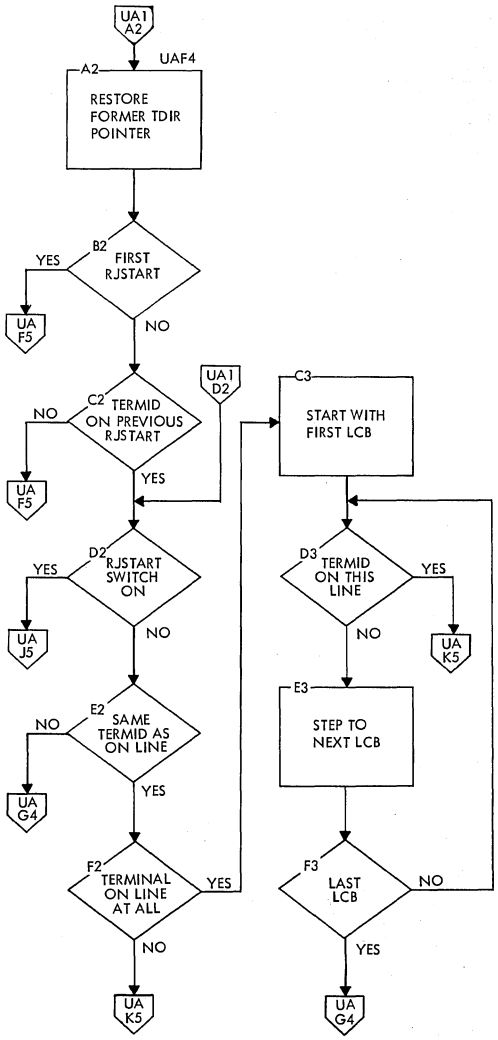
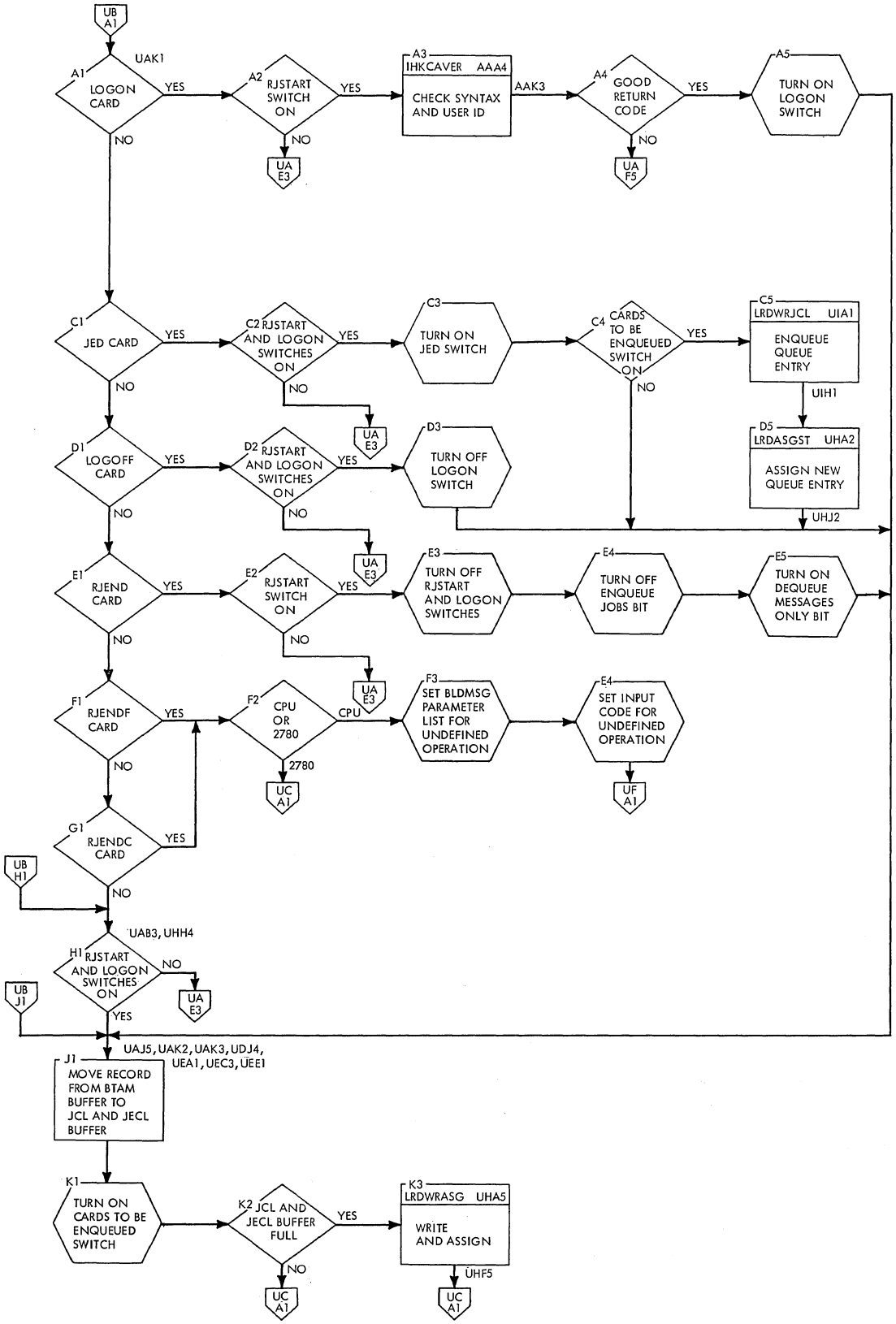
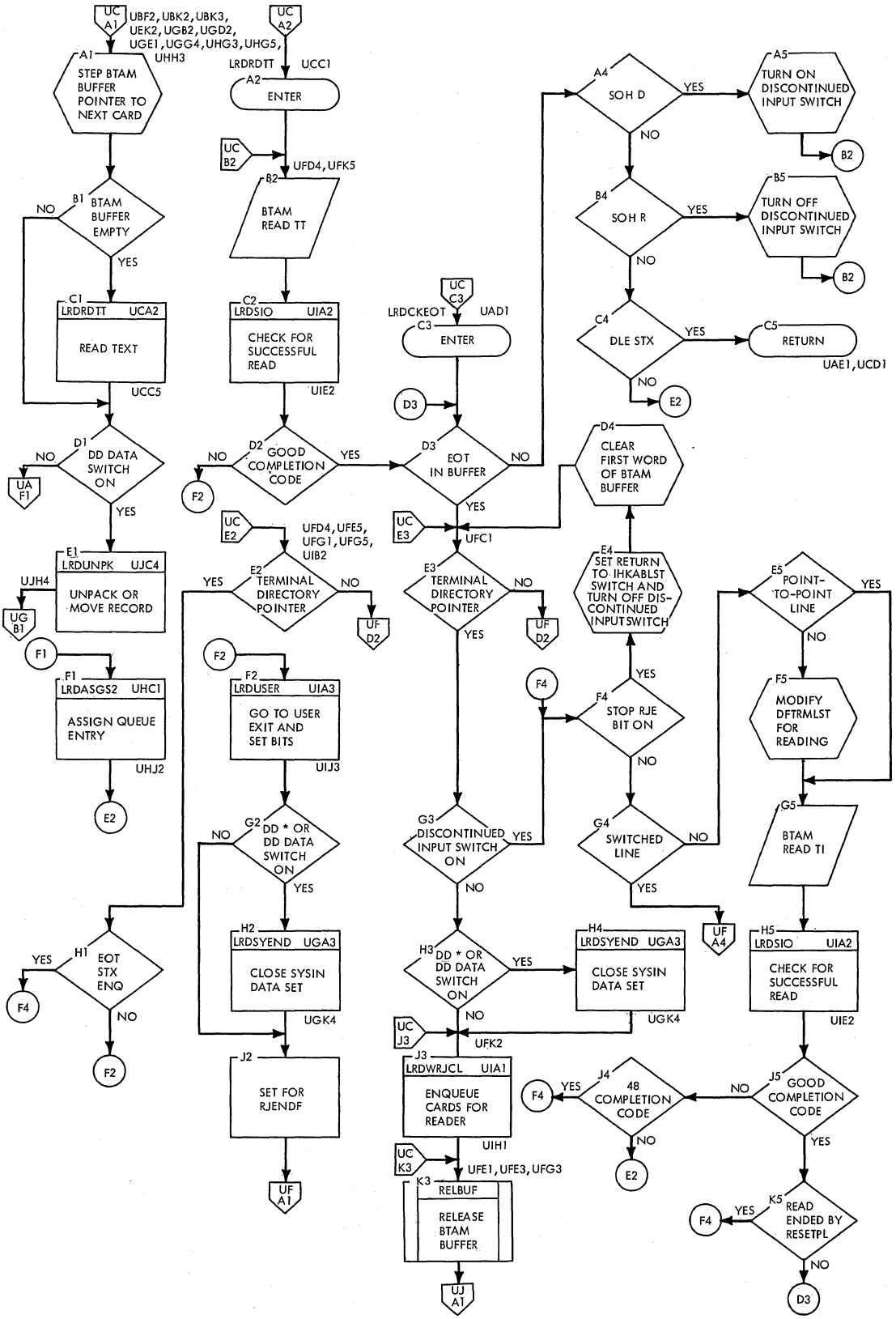


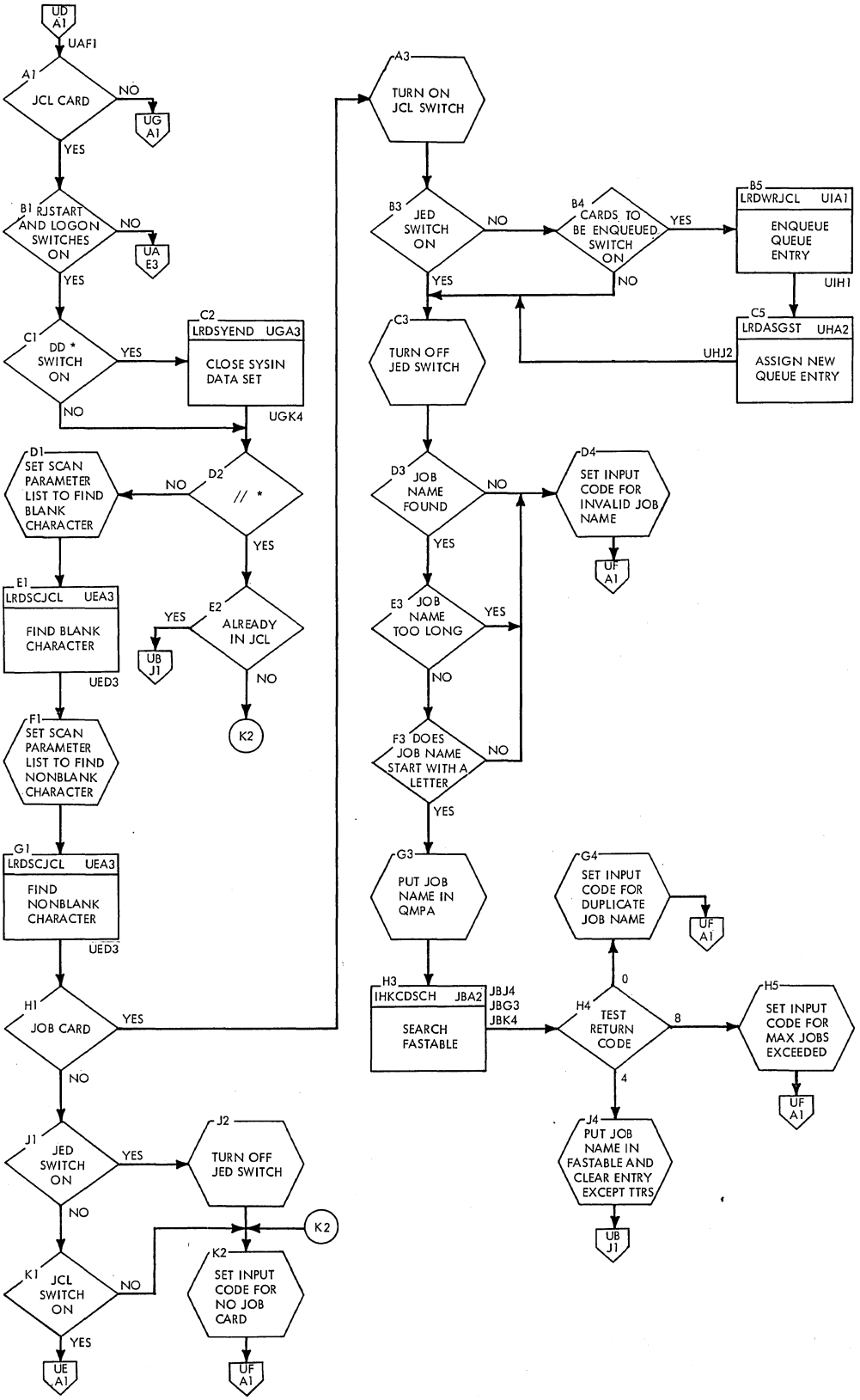
Chart UB. IHKABLRD and IHKCHLRD -- Line Analysis Read



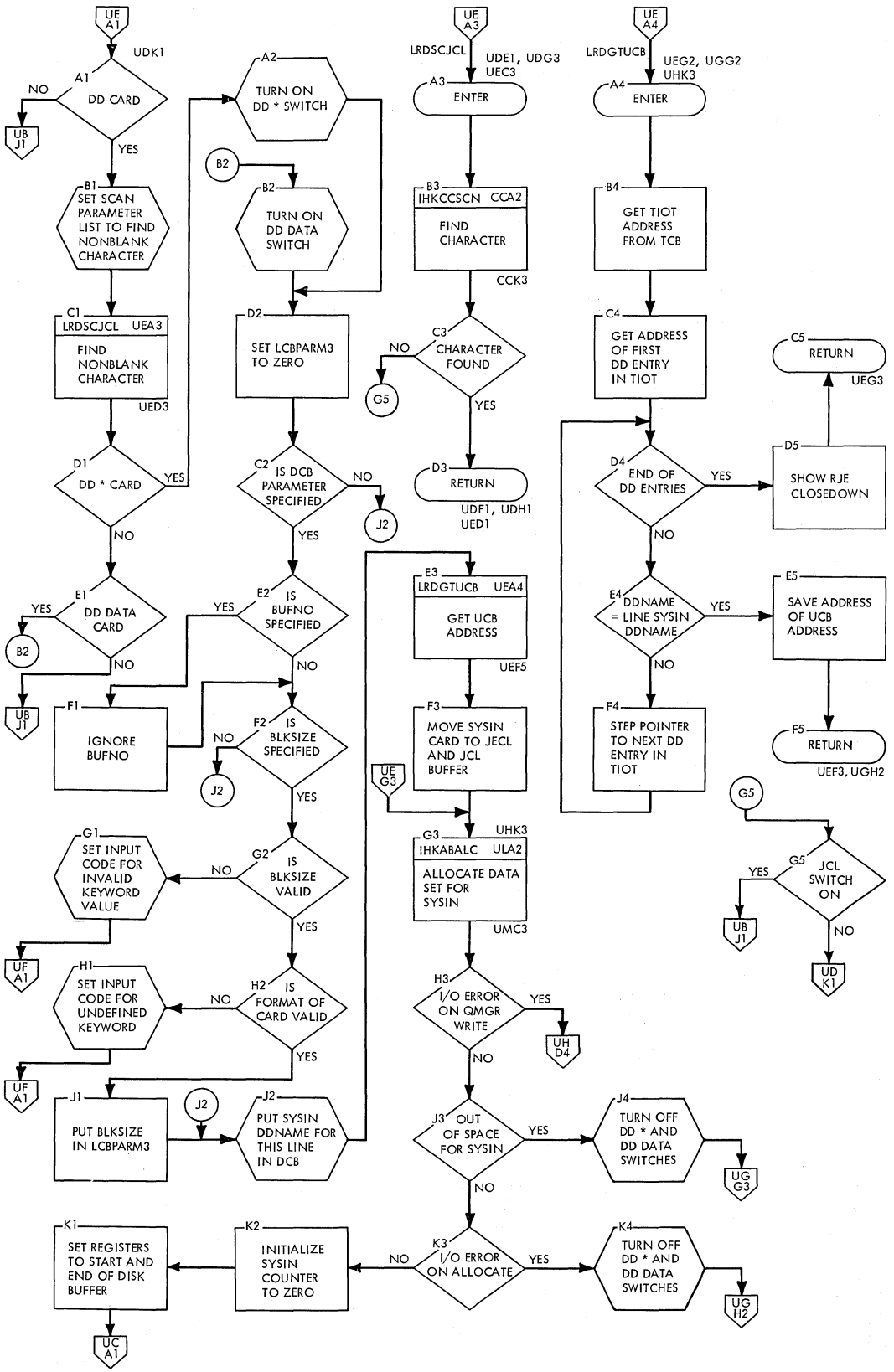
- Chart UC. IHKABLRD and IHKCHLRD -- Line Analysis Read



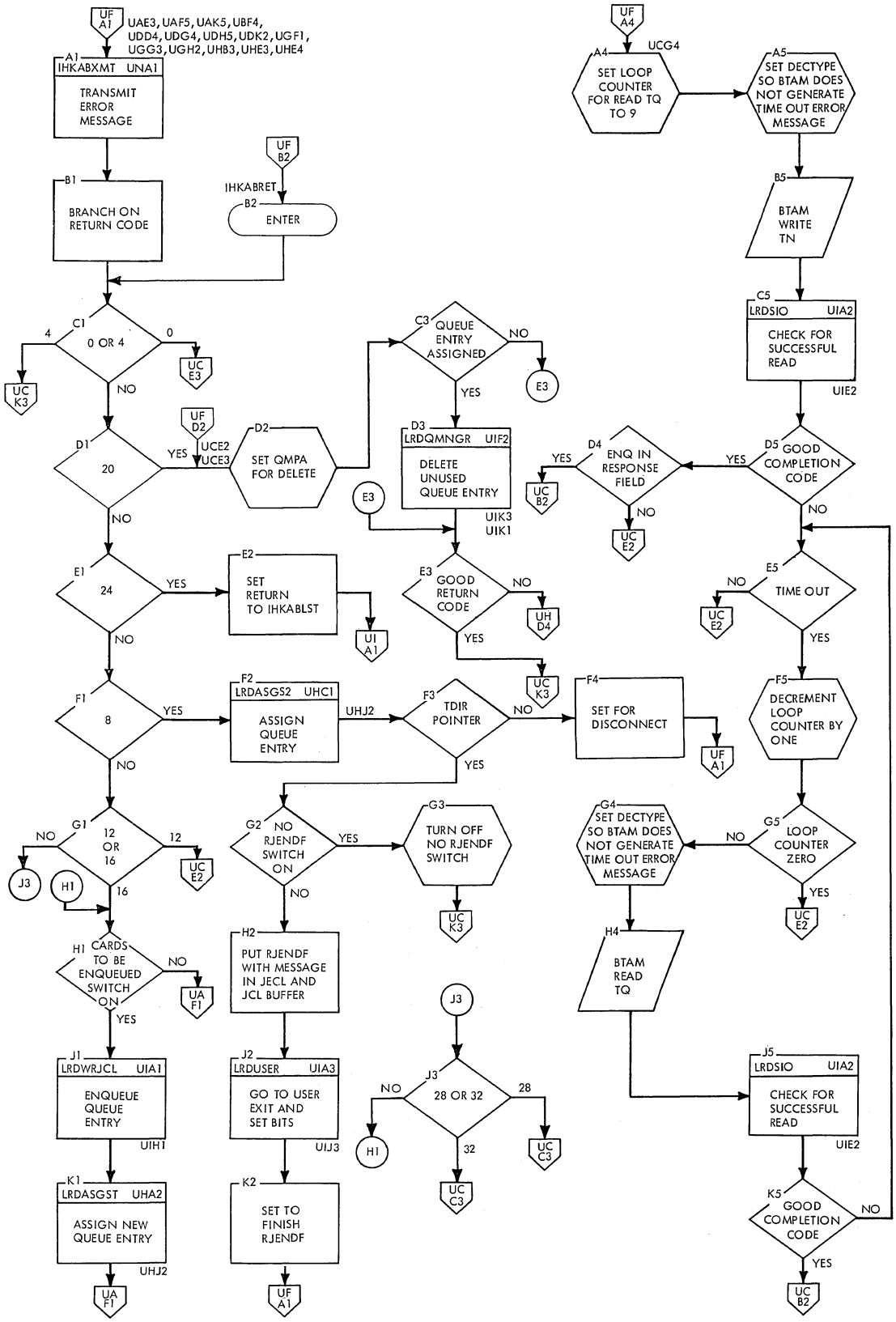
- Chart UD. IHKABLRD and IHKCHLRD -- Line Analysis Read



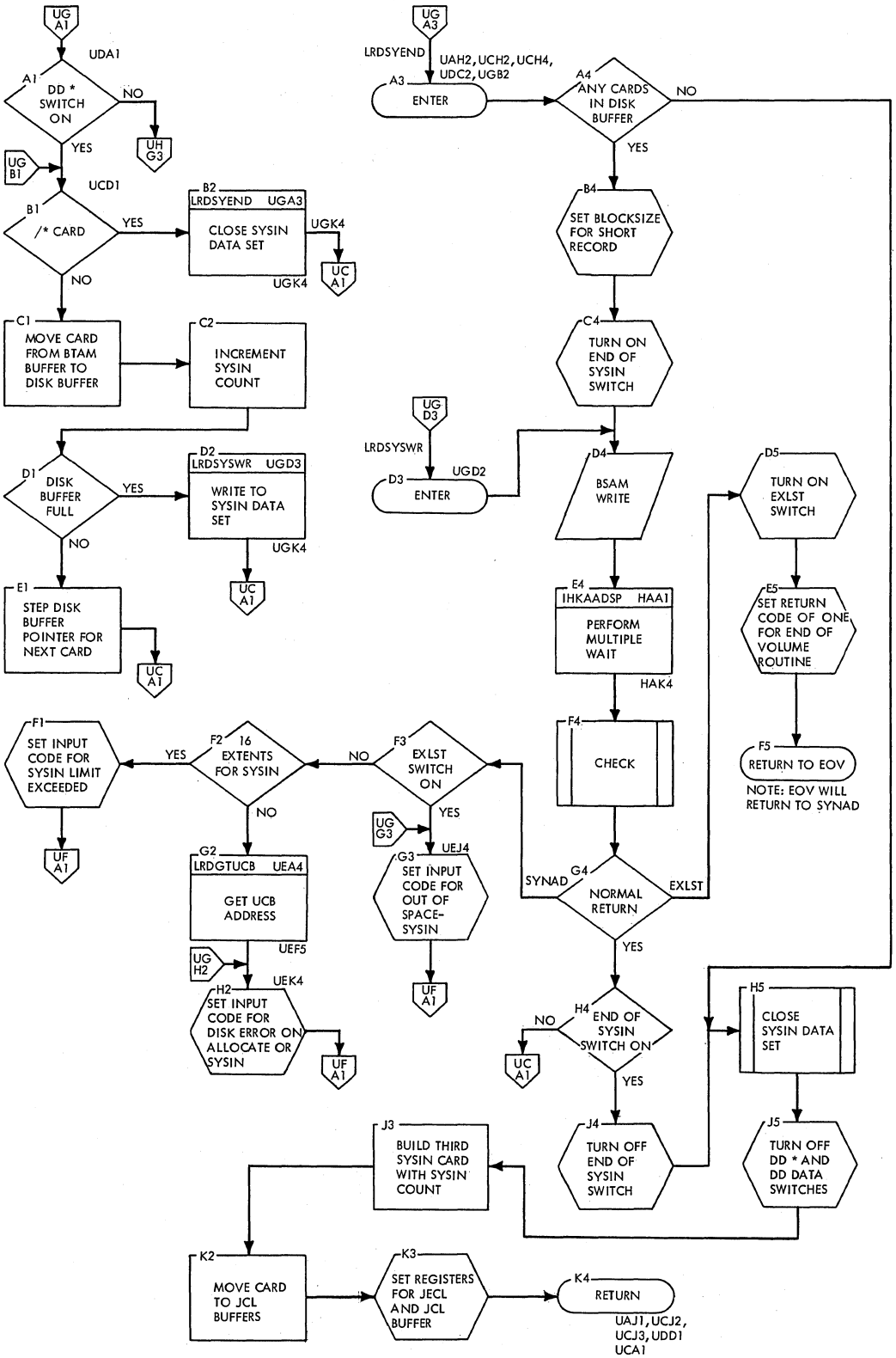
- Chart UE. IHKABLRD and IHKCHLRD -- Line Analysis Read



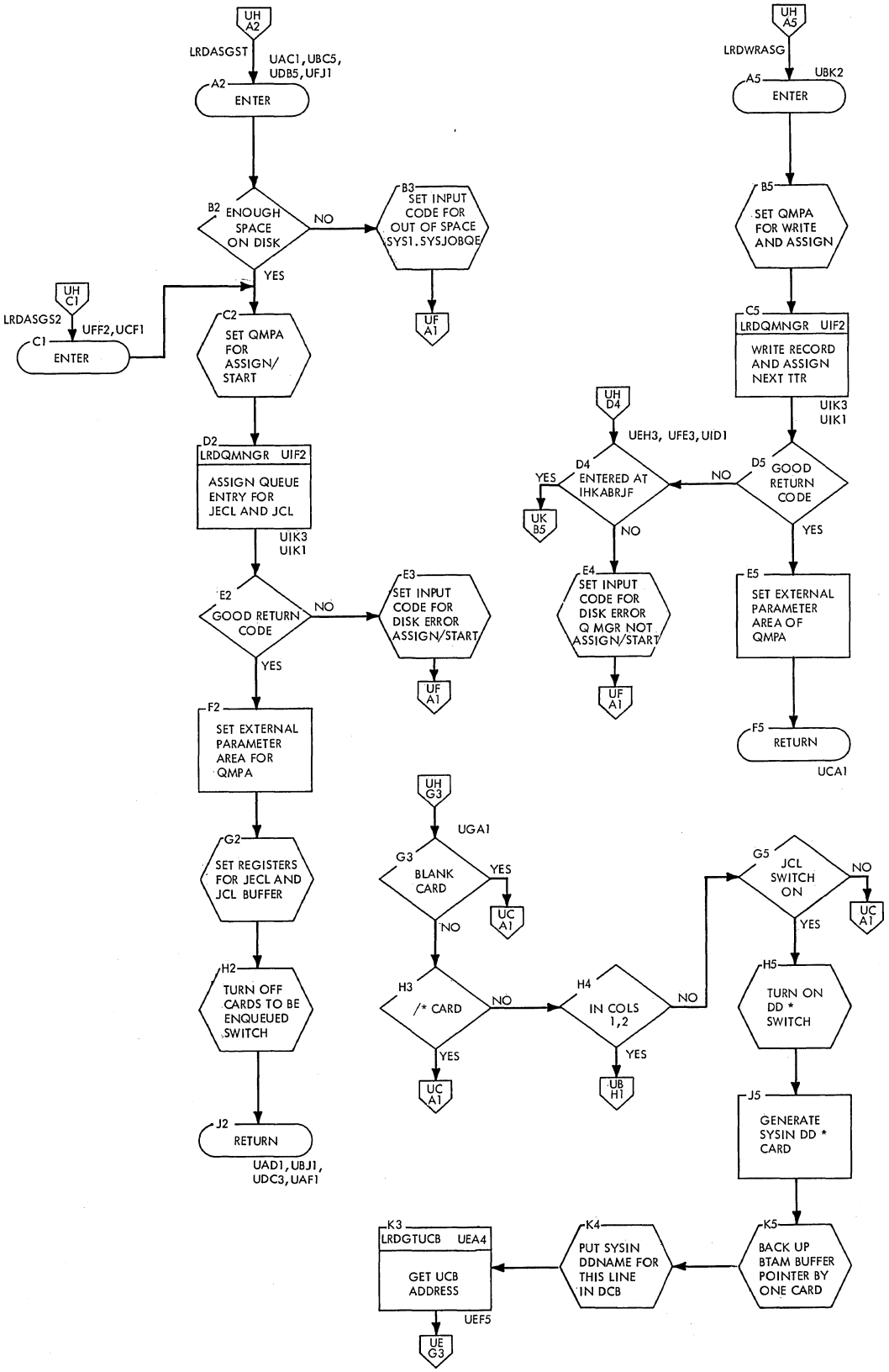
- Chart UF. IHKABLRD and IHKCHLRD -- Line Analysis Read



- Chart UG. IHKABLRD and IHKCHLRD -- Line Analysis Read



• Chart UH. IHKABLRD and IHKCHLRD -- Line Analysis Read



- Chart UI. IHKABLRD and IHKCHLRD -- Line Analysis Read

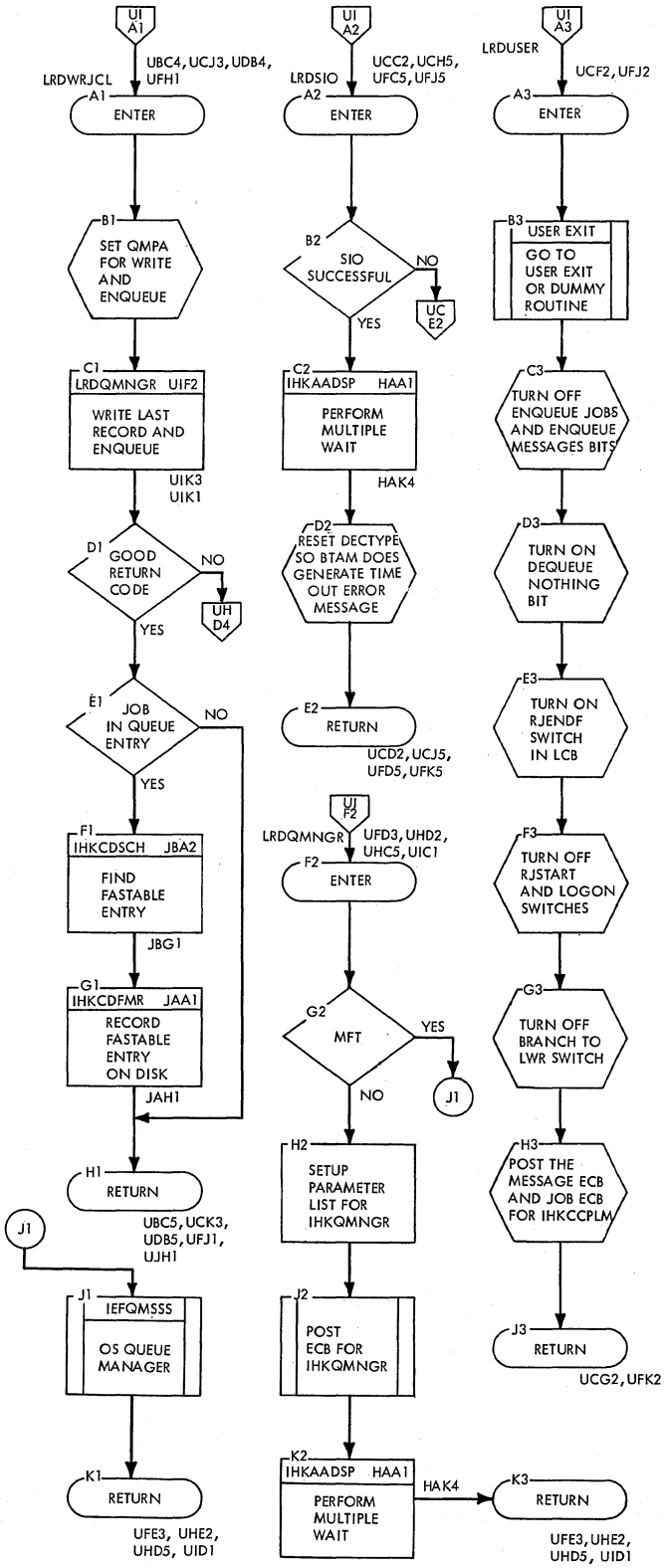
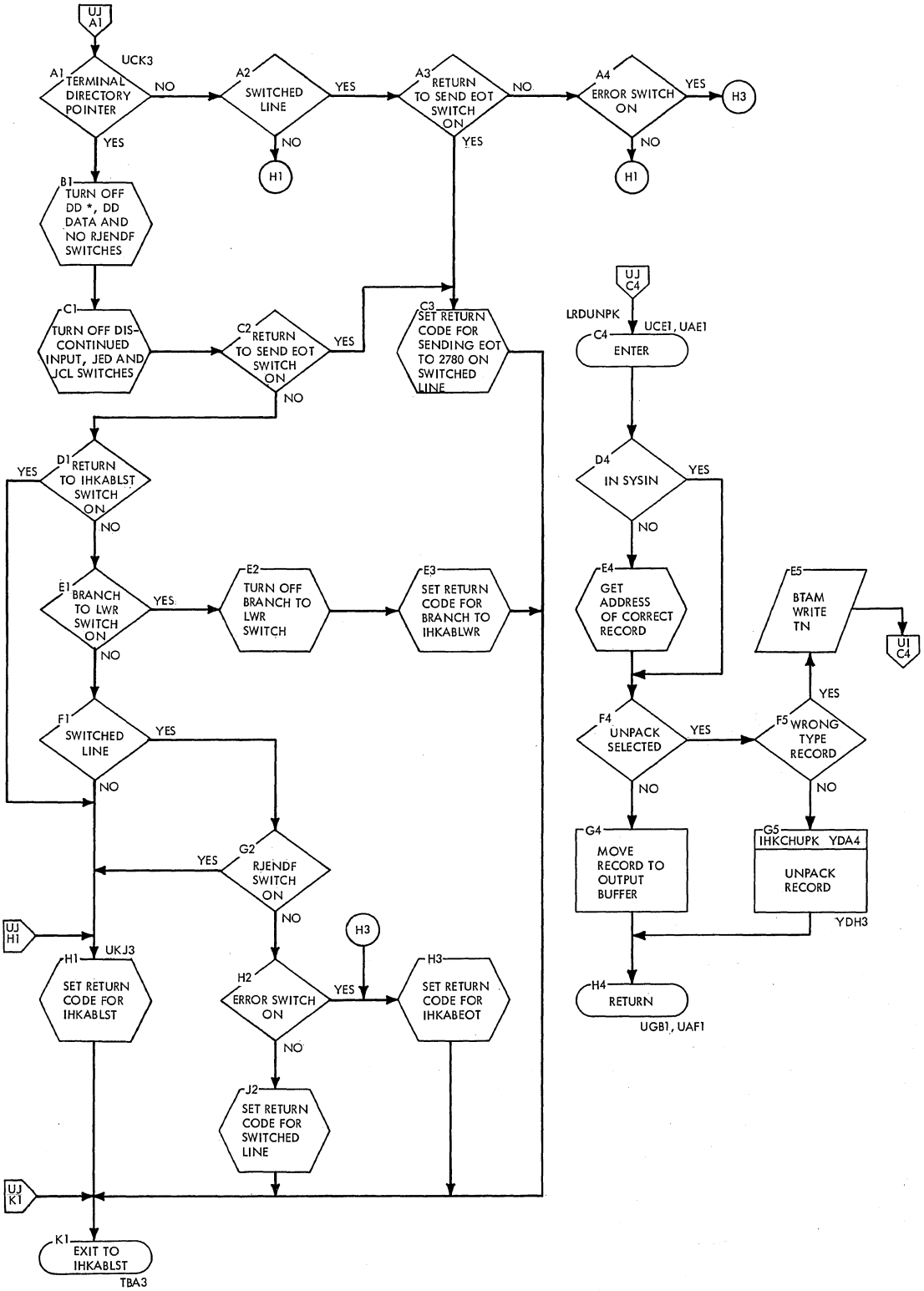
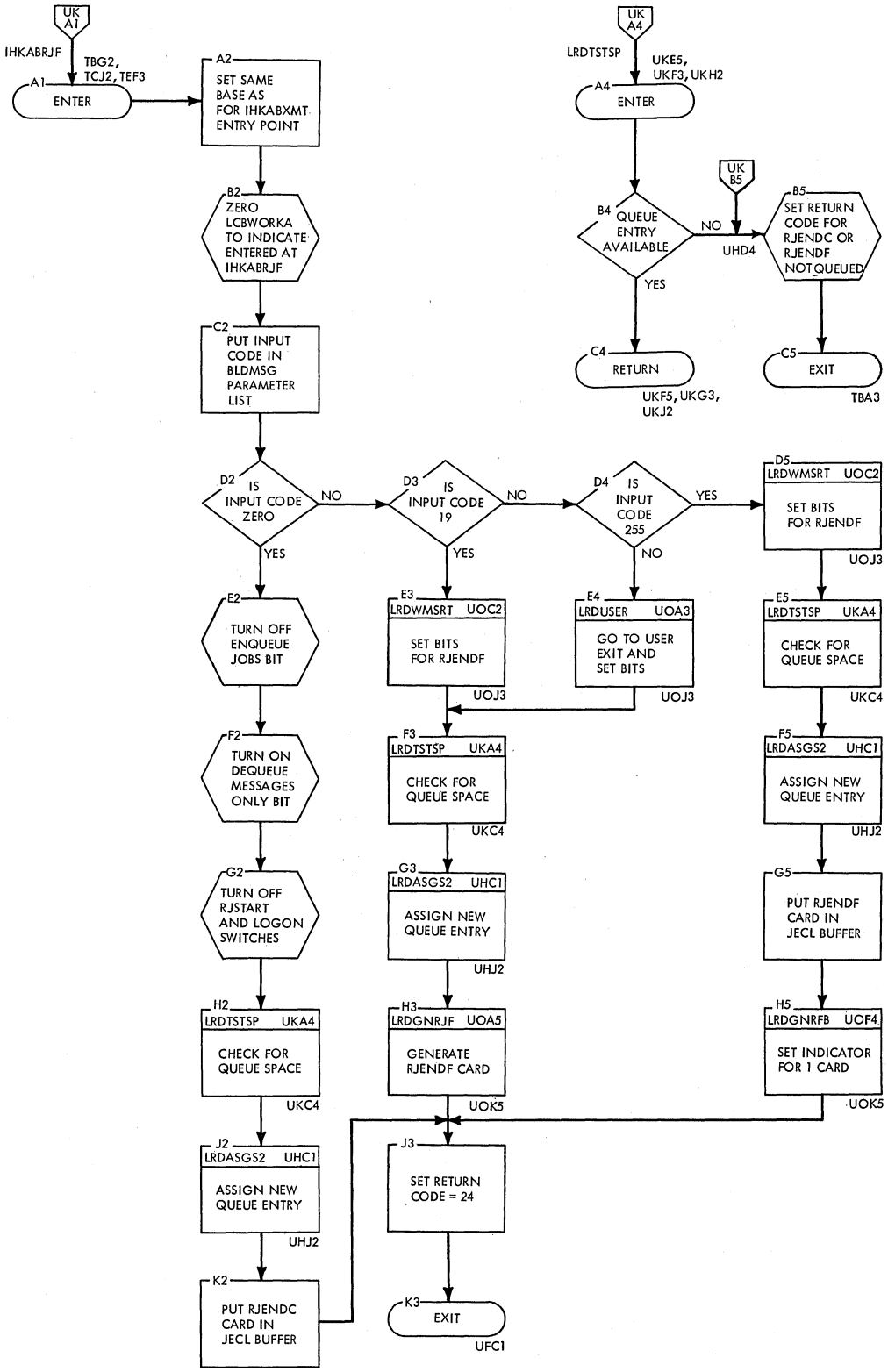


Chart UJ. IHKABLRD and IHKCHLRD -- Line Analysis Read



- Chart UK. IHKABXMT -- Error Message Transmitter



- Chart UL. IHKABALC and IHKCHALC -- SYSIN Allocation Routine

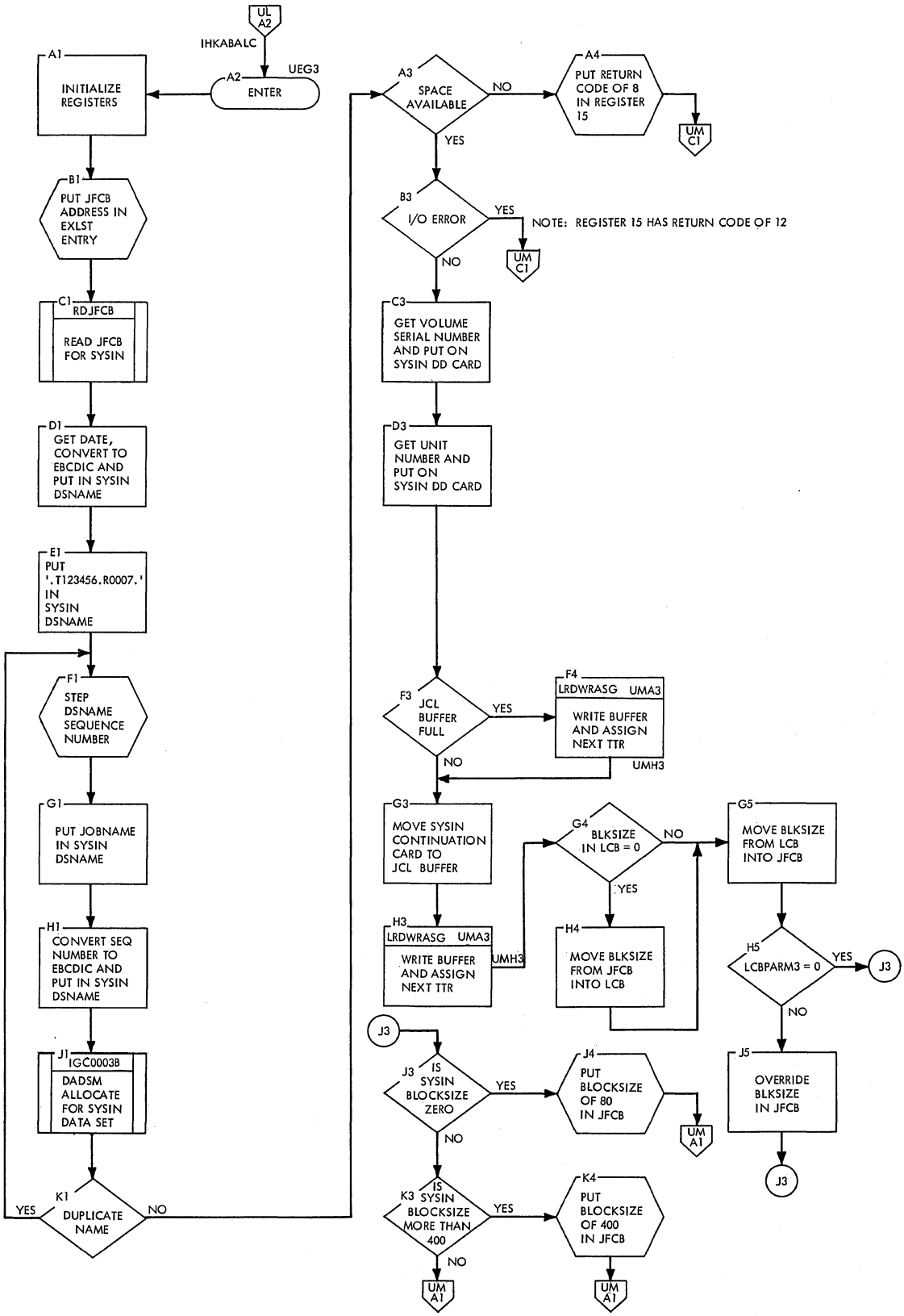
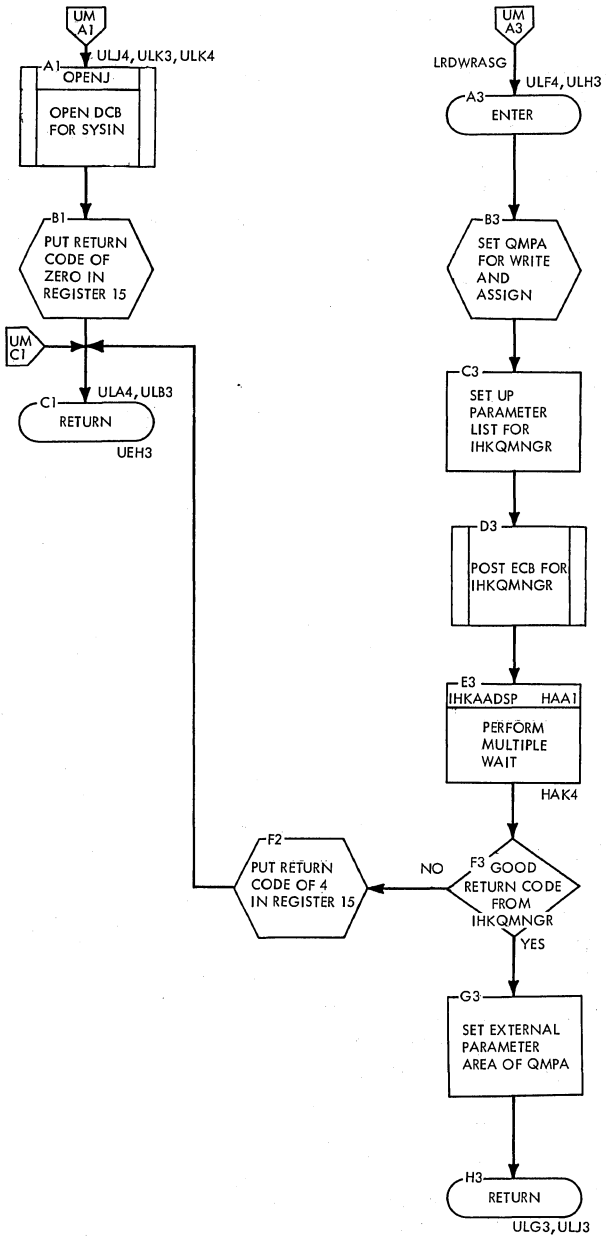
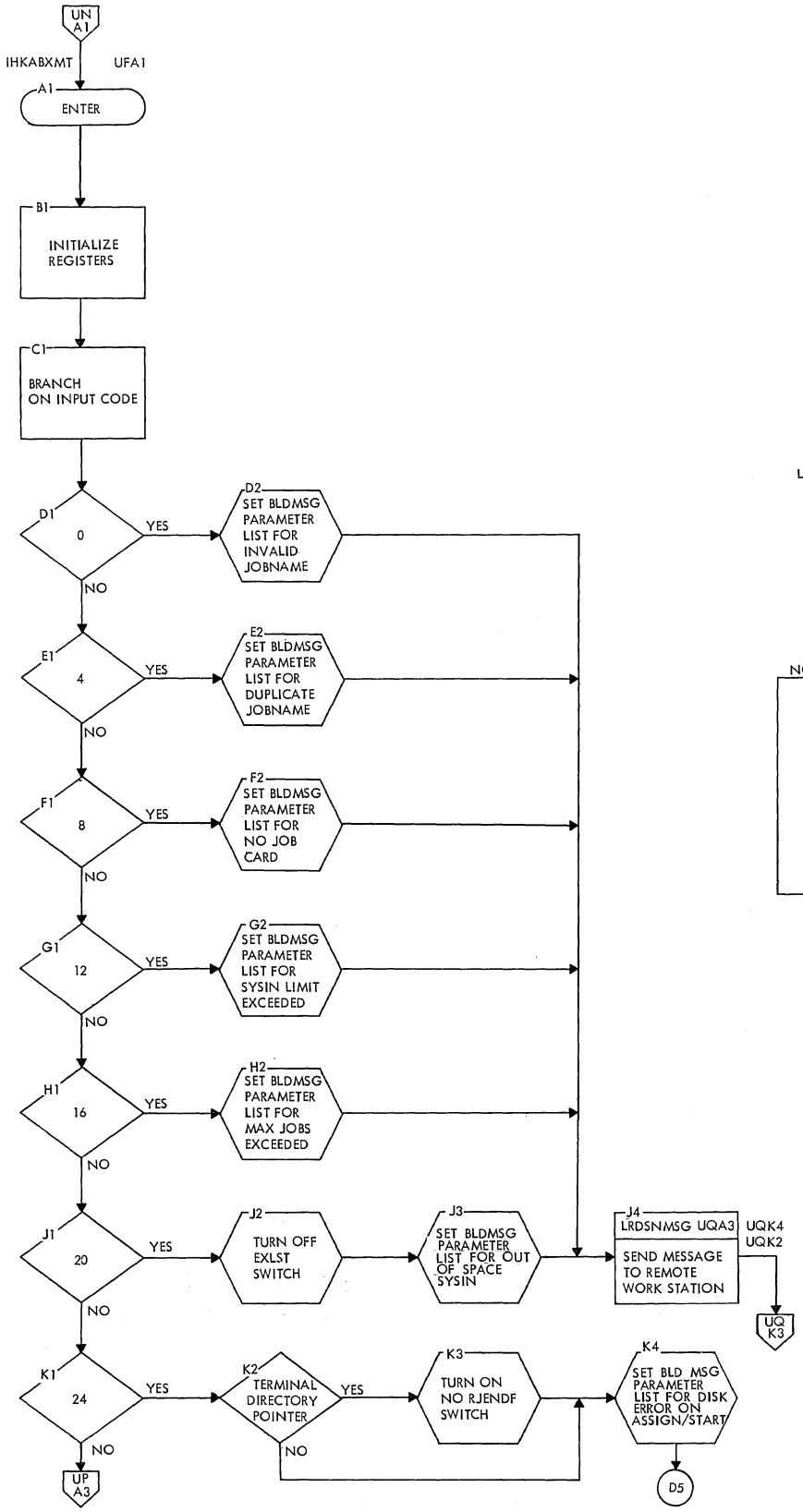


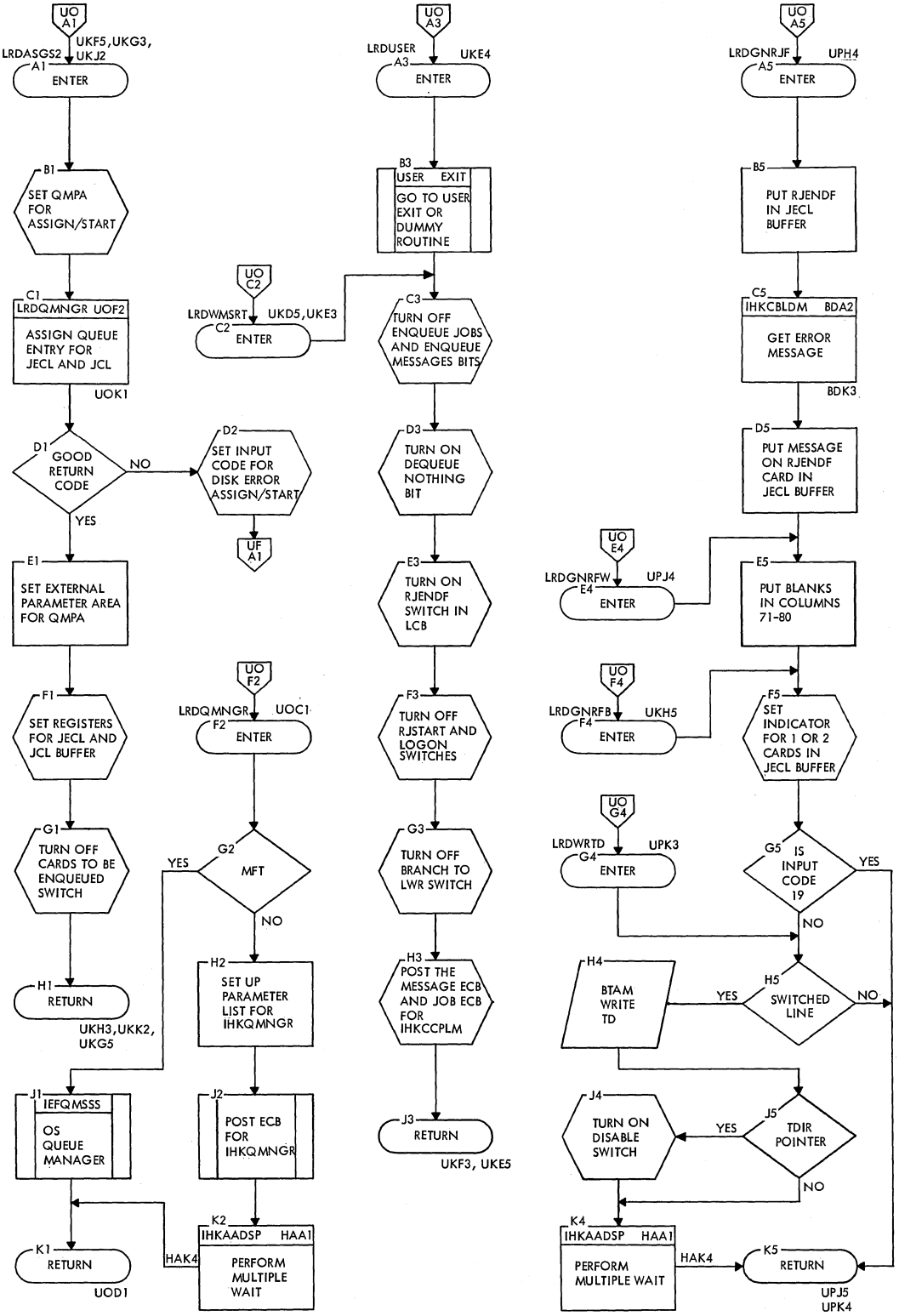
Chart UM. IHKABALC and IHKCHALC -- SYSIN Allocation Routine



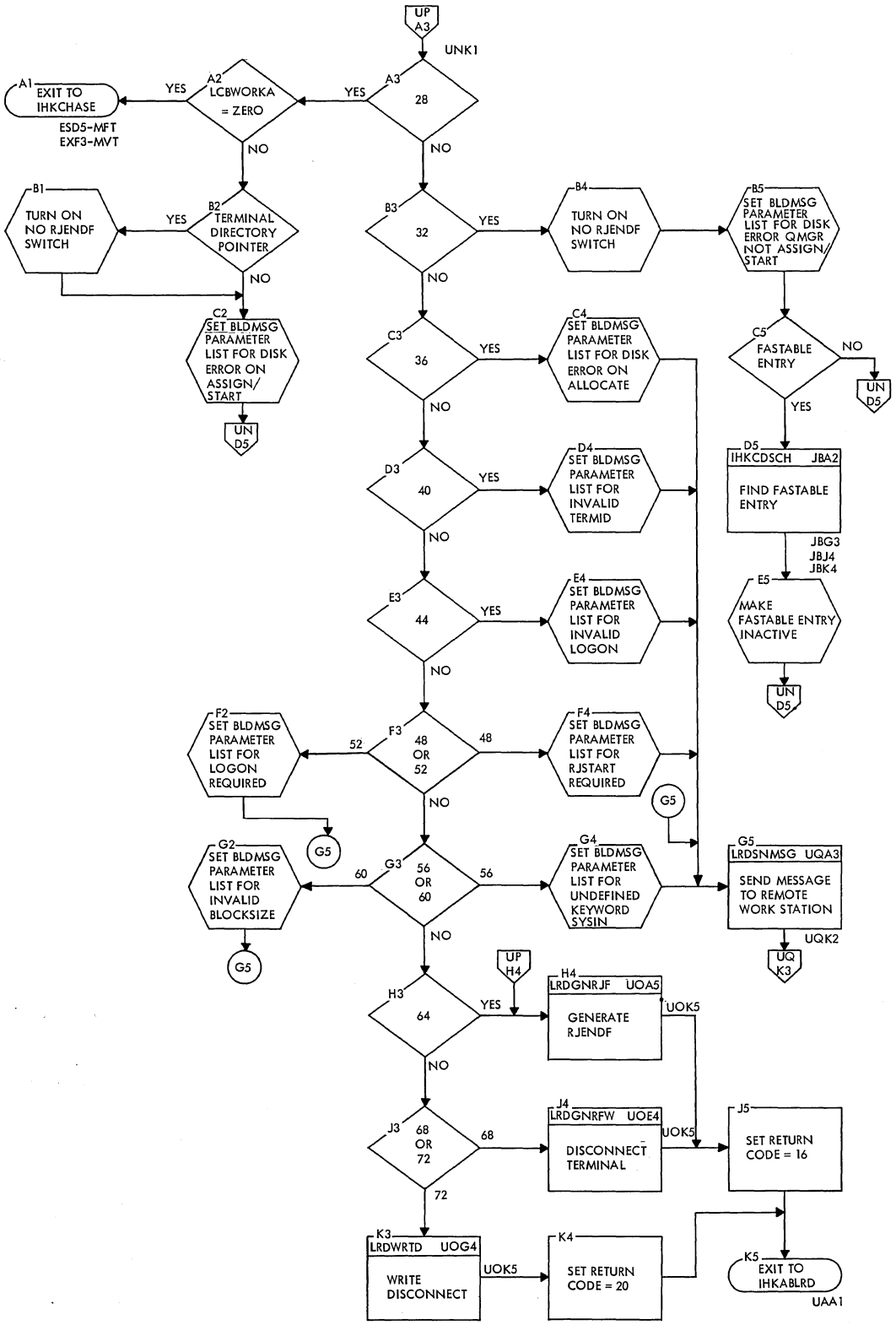
• Chart UN. IHKABXMT -- Error Message Transmitter



- Chart UO. IHKABXMT -- Error Message Transmitter



- Chart UP. IHKABXMT -- Error Message Transmitter



• Chart UQ. IHKABXMT -- Error Message Transmitter

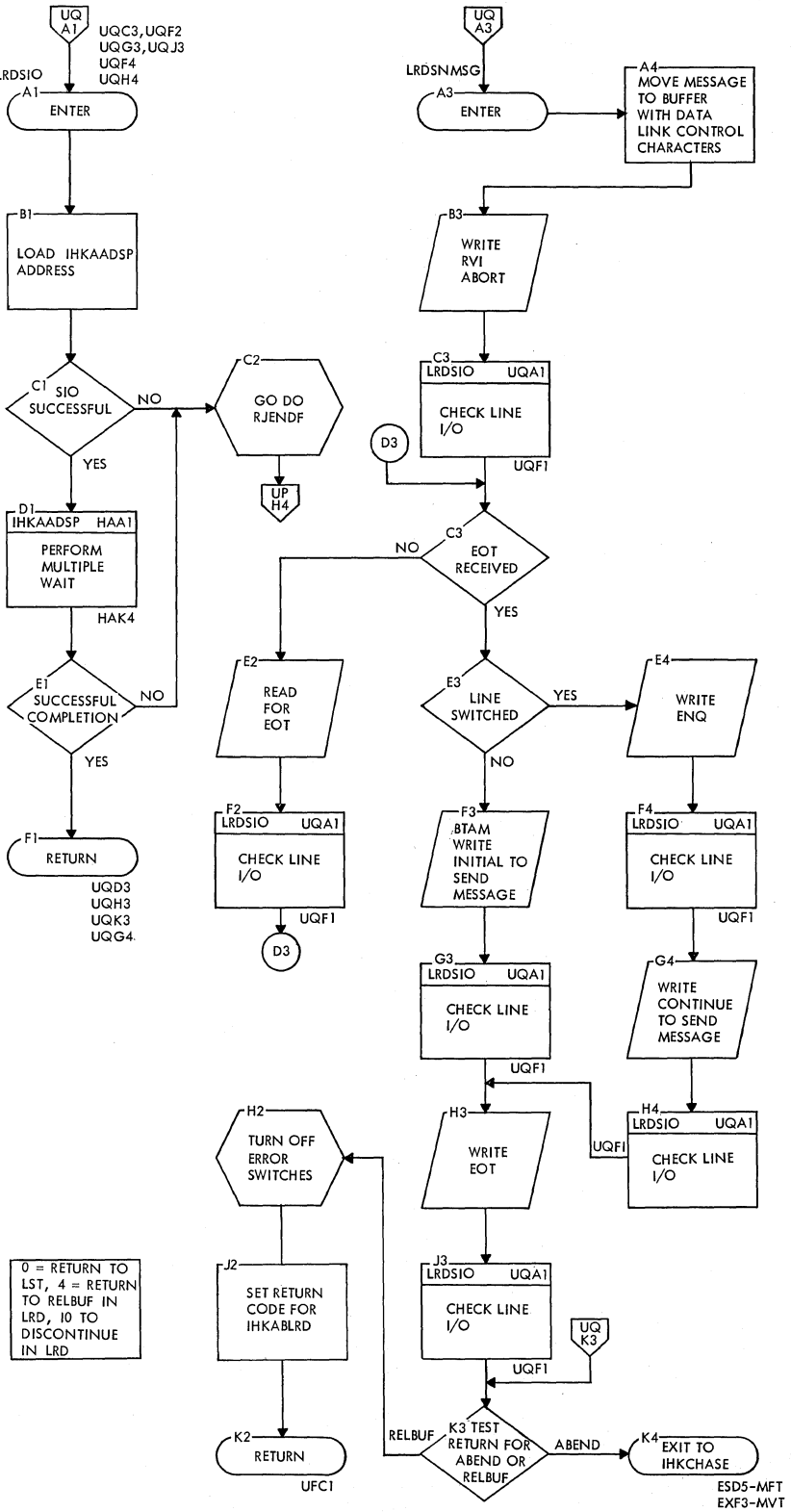


Chart UZ. IHKQMNGR Interface With OS Queue Manager

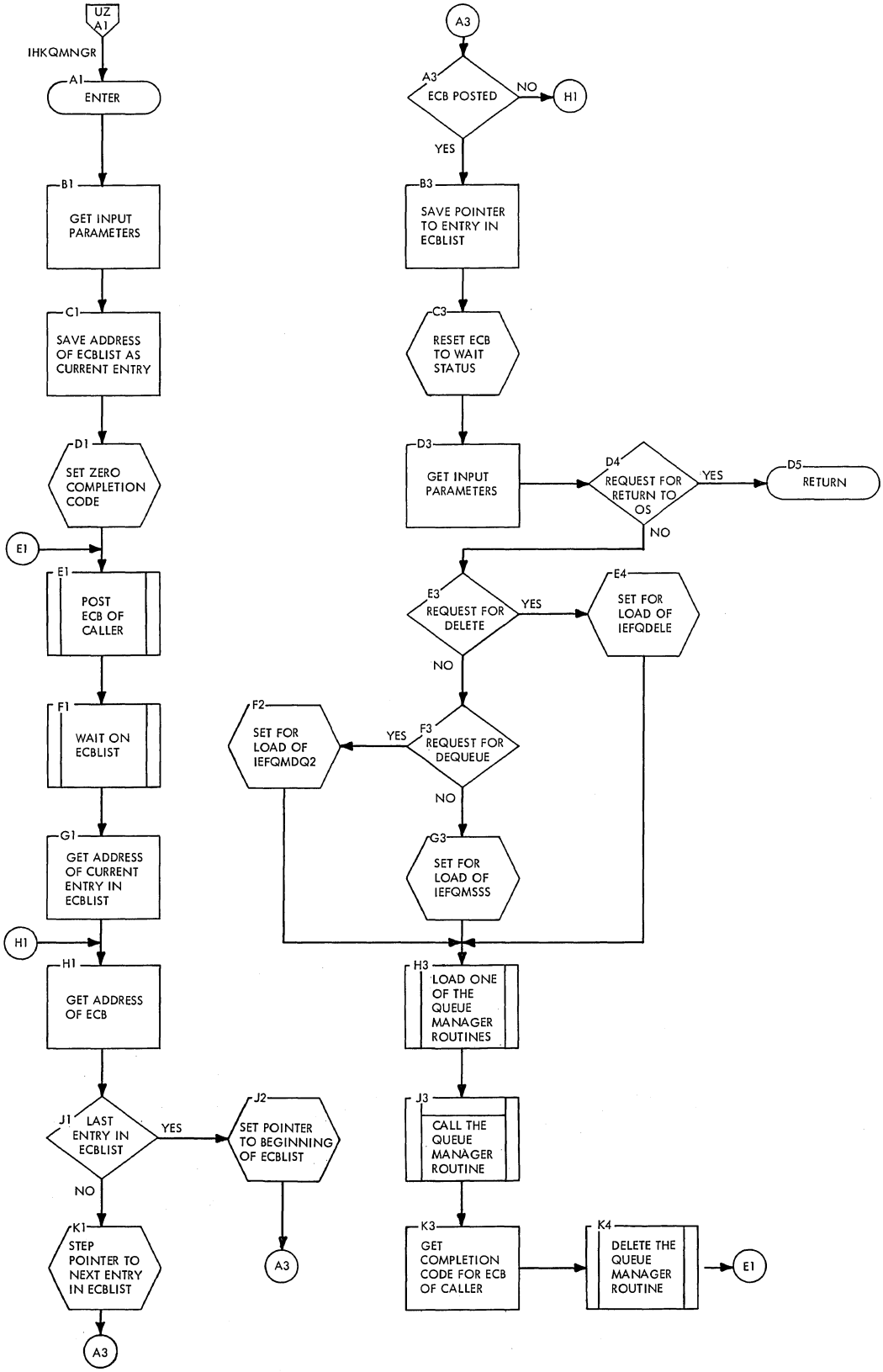


Chart VA. IHKABORT -- Control

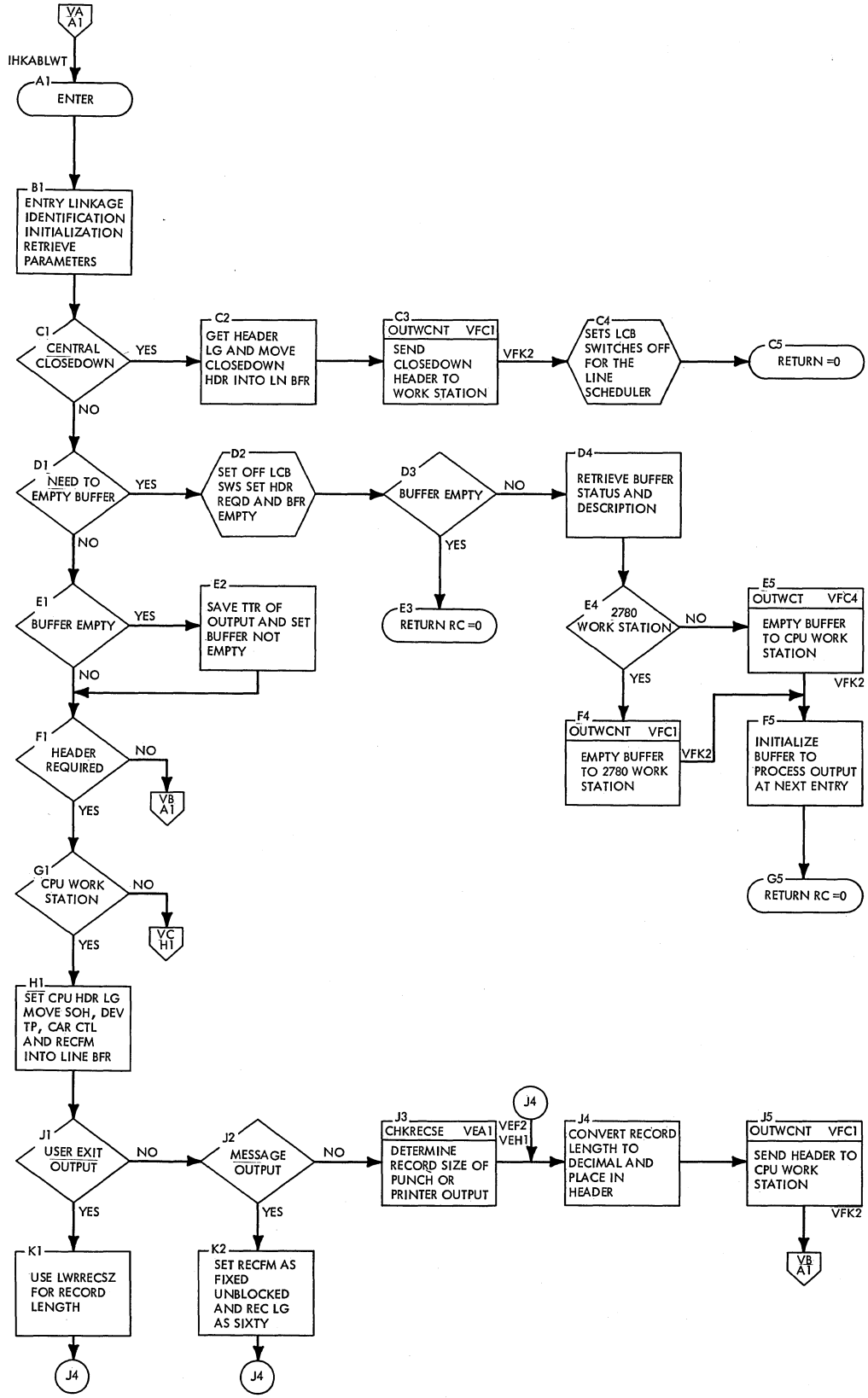


Chart VB. IHKABORT -- CPU Output Processing

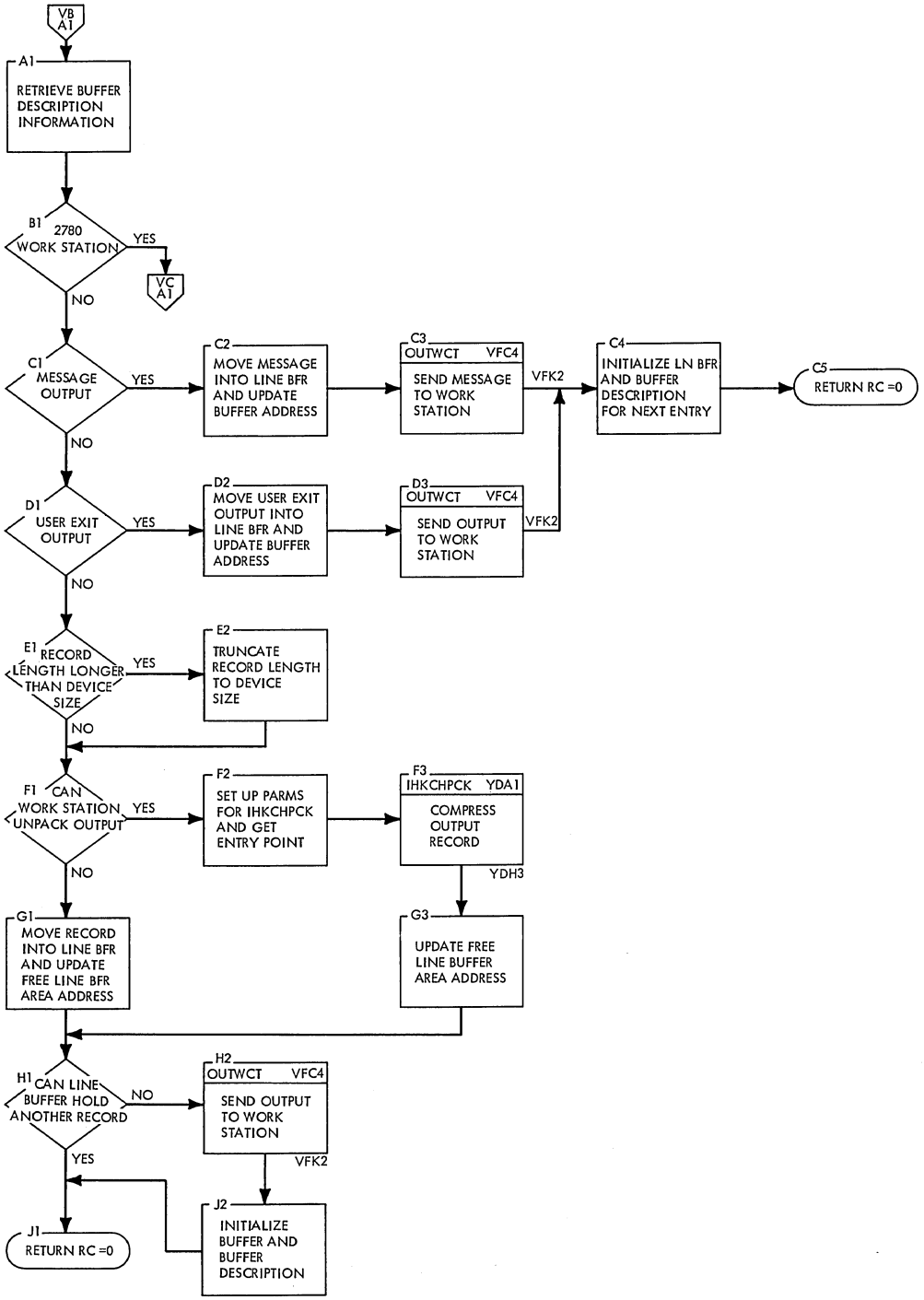


Chart VC. IHKABORT -- 2780 Output Processing

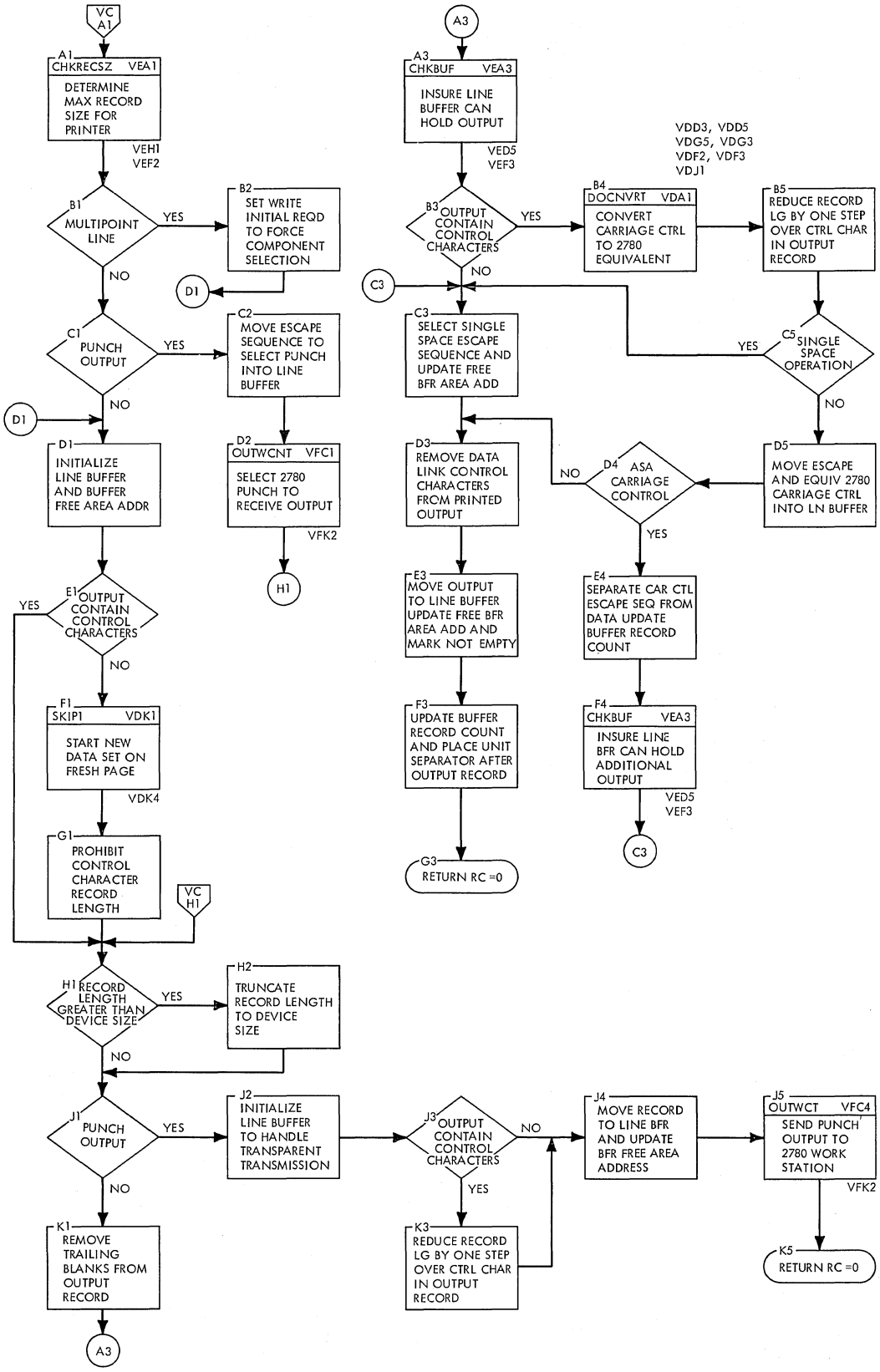


Chart VD. IHKABORT -- 2780 Control Character Conversion Routine

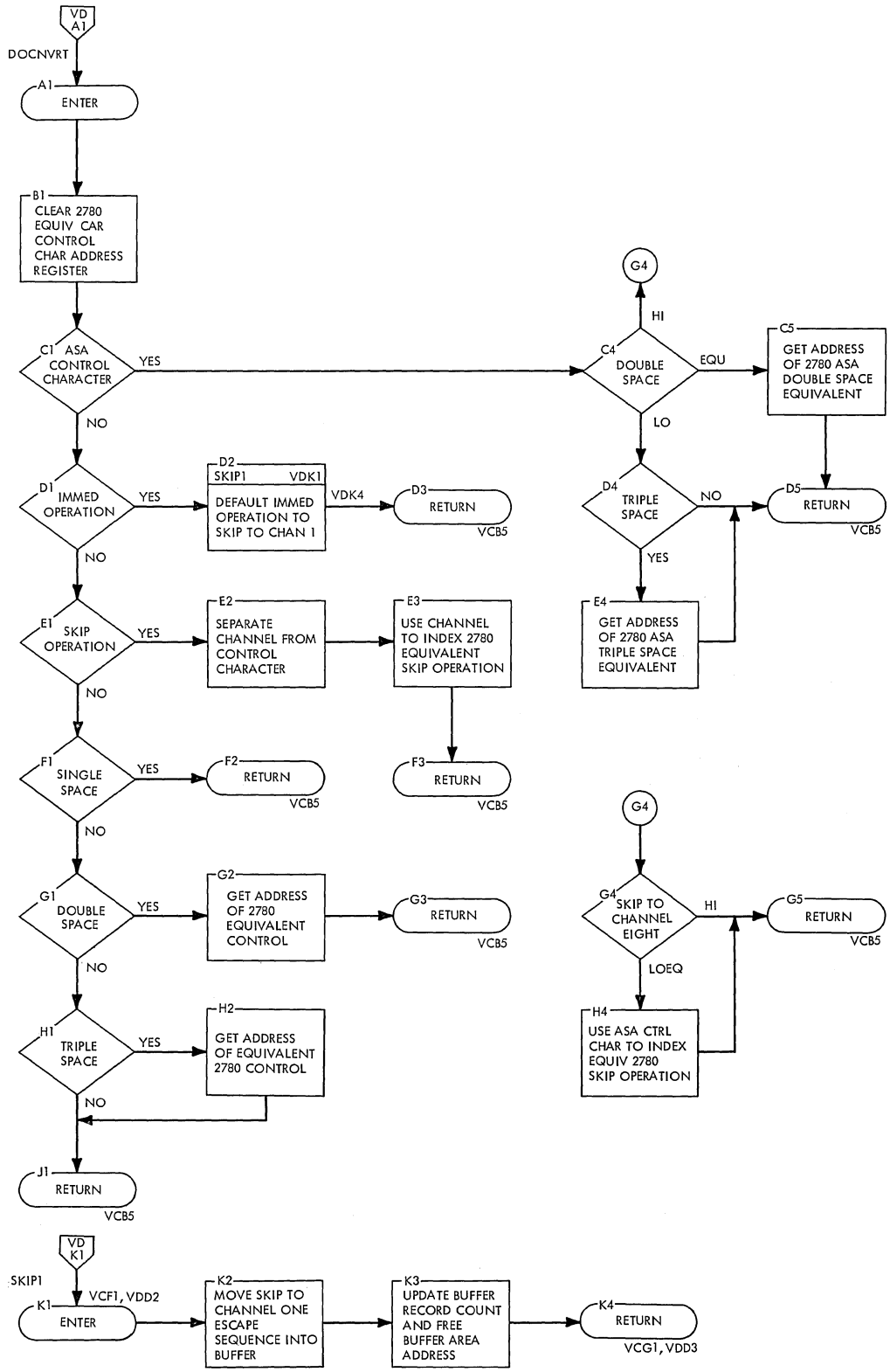


Chart VE. IHKABORT -- Common Checking

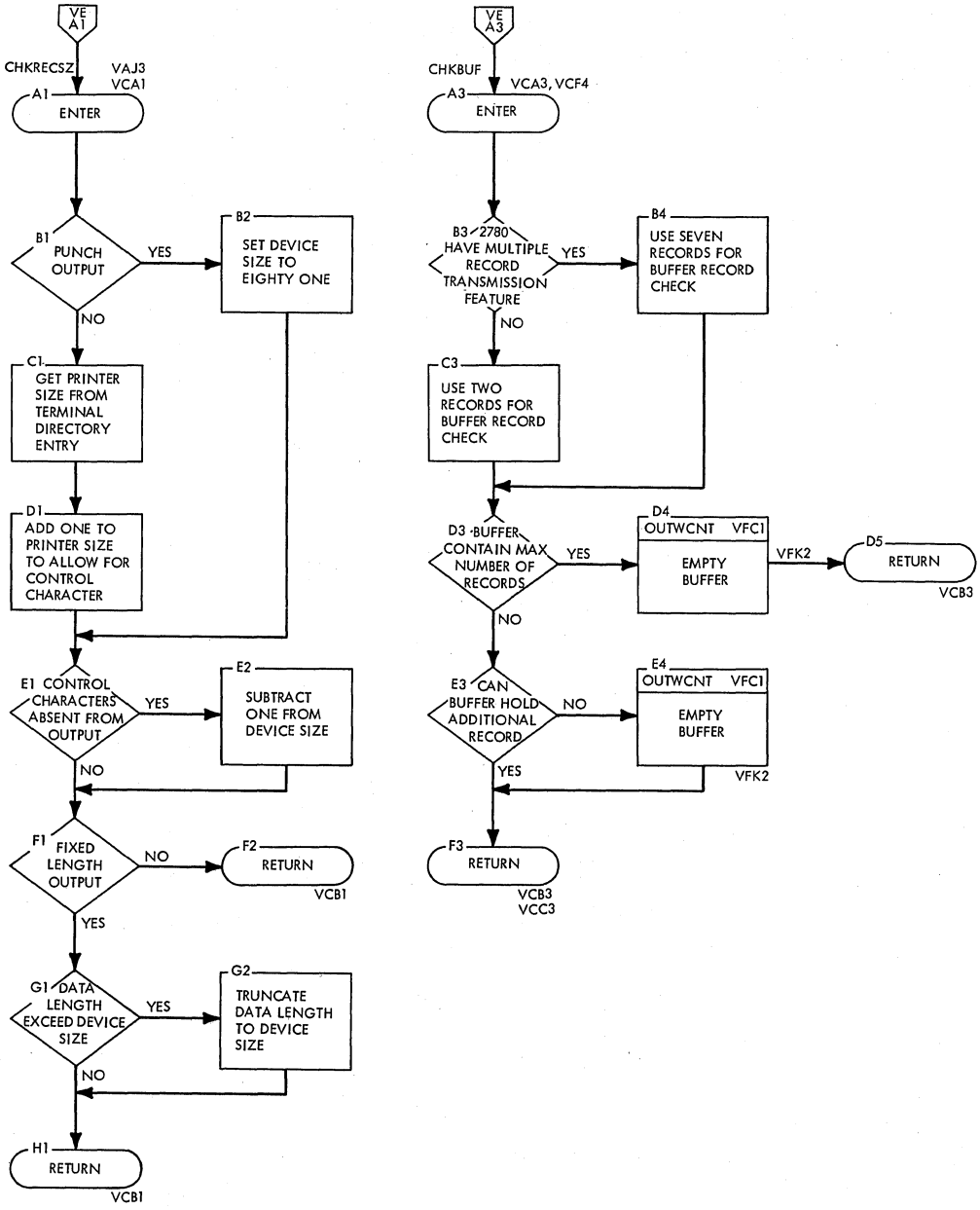


Chart VF. IHKABORT -- BTAM Write Routines

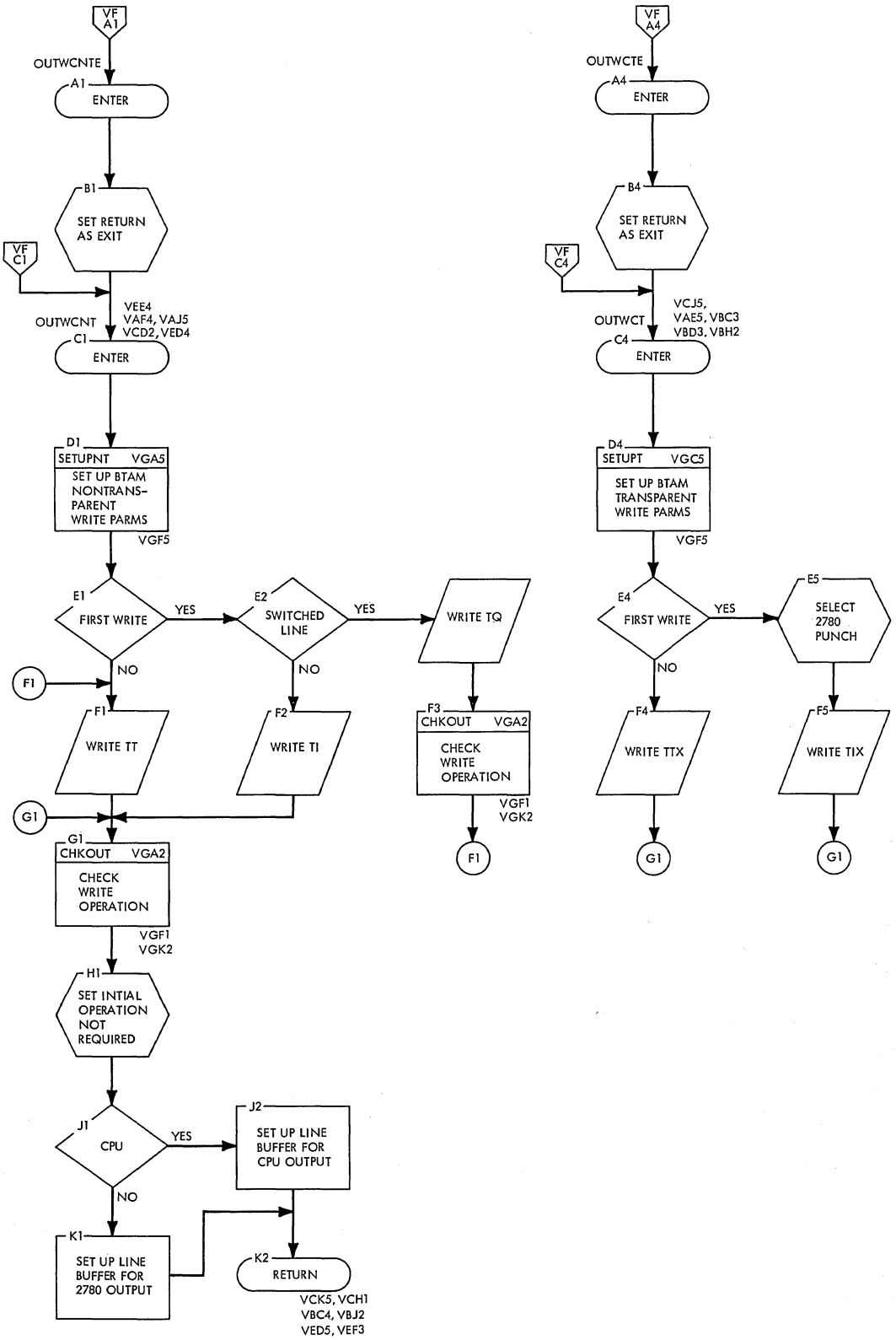


Chart VG. IHKABORT -- I/O Checking

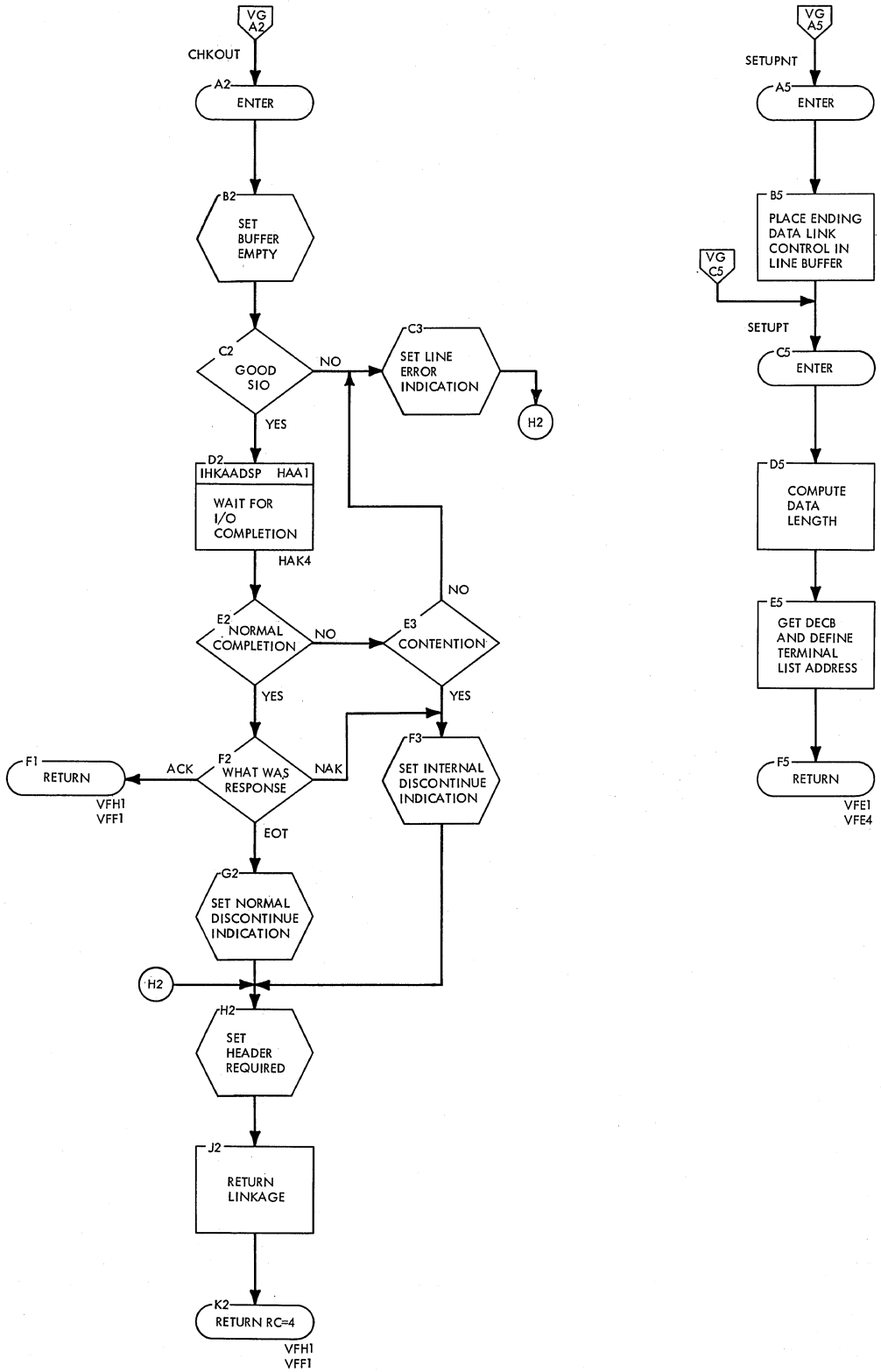


Chart WA. IHKCDRMV -- Data Set Scratch Routine

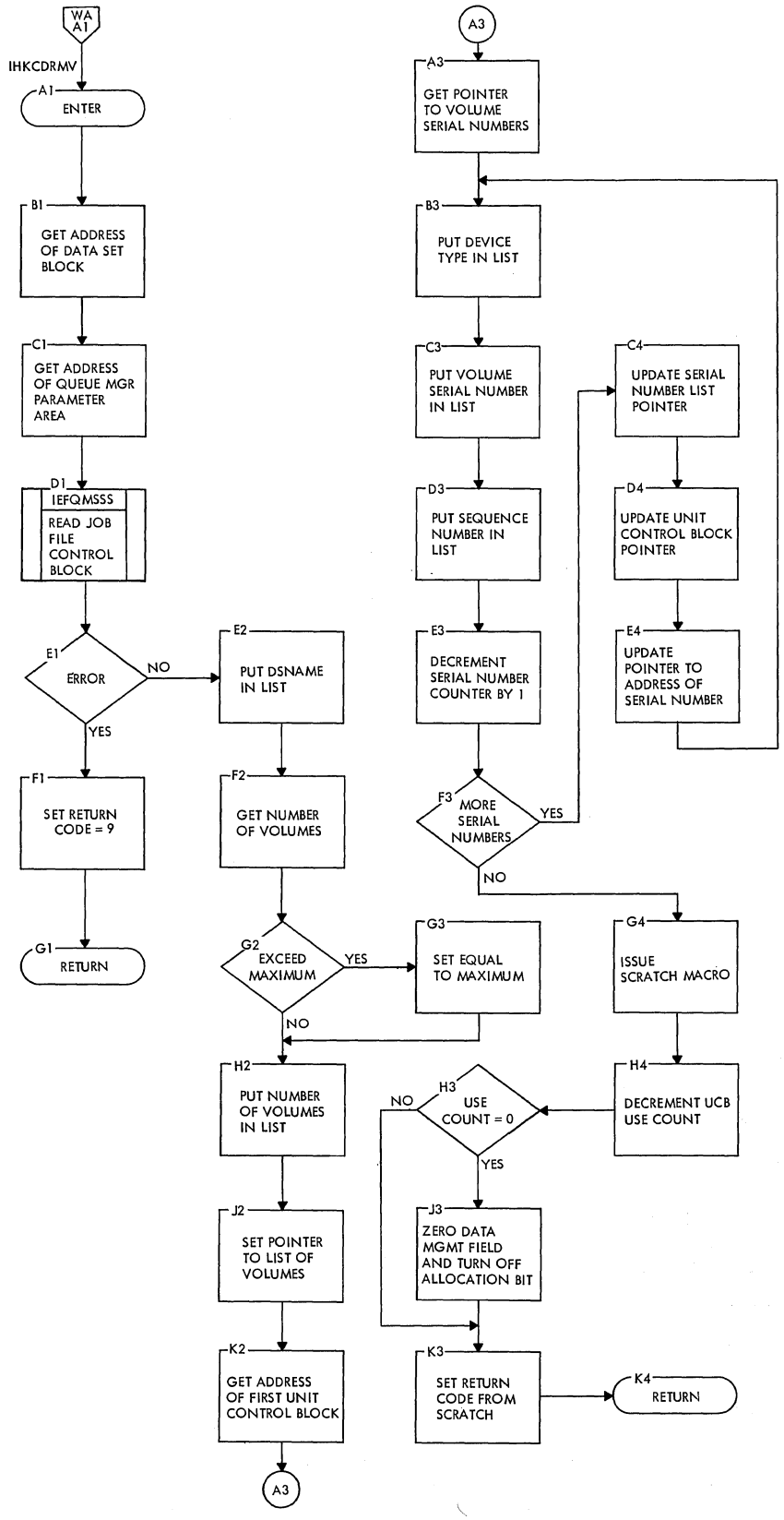


Chart YA. IHKCRIME -- Central Command Subtask Routine

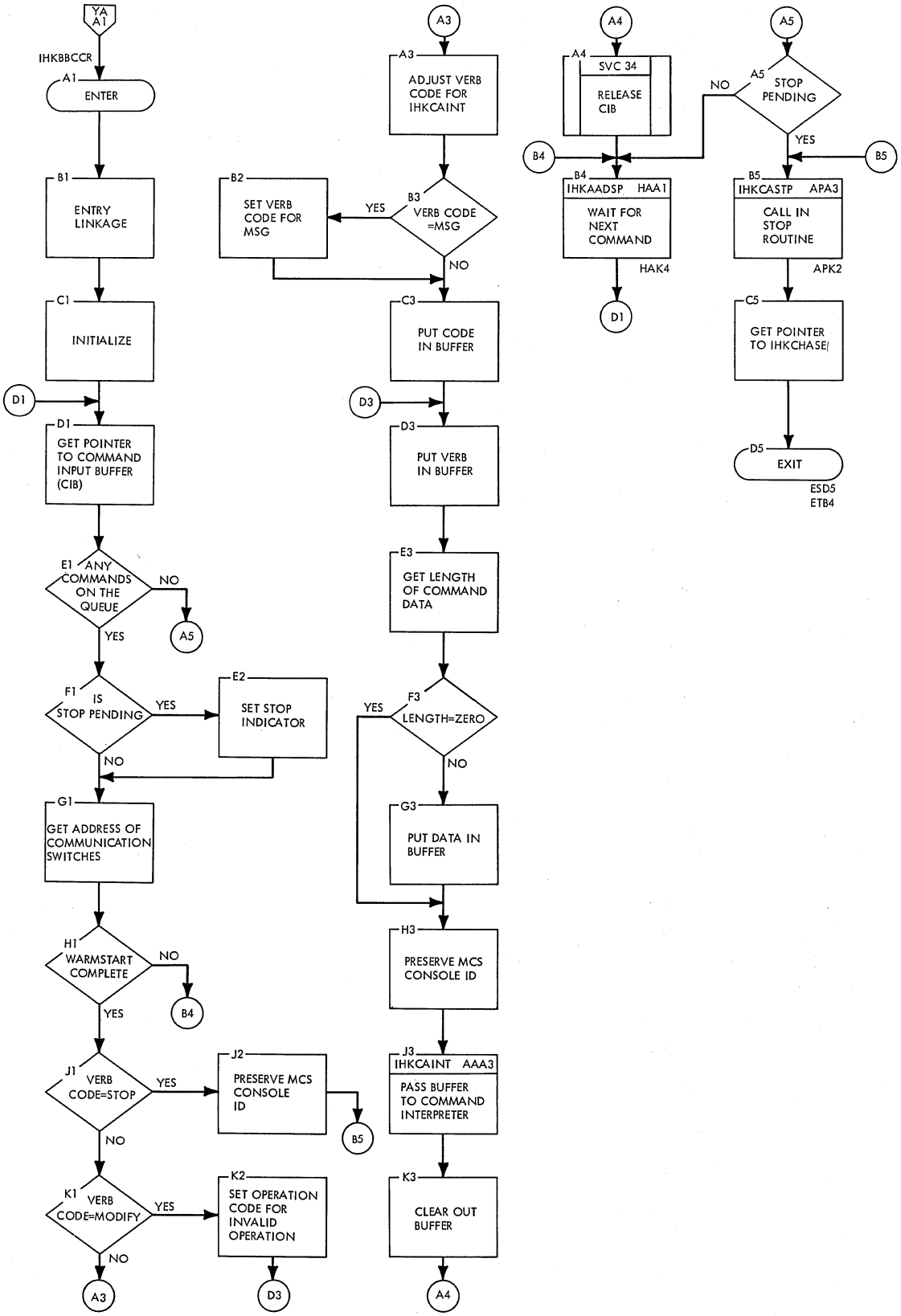


Chart YB. IHKBBNIT -- NEL Interface Routine

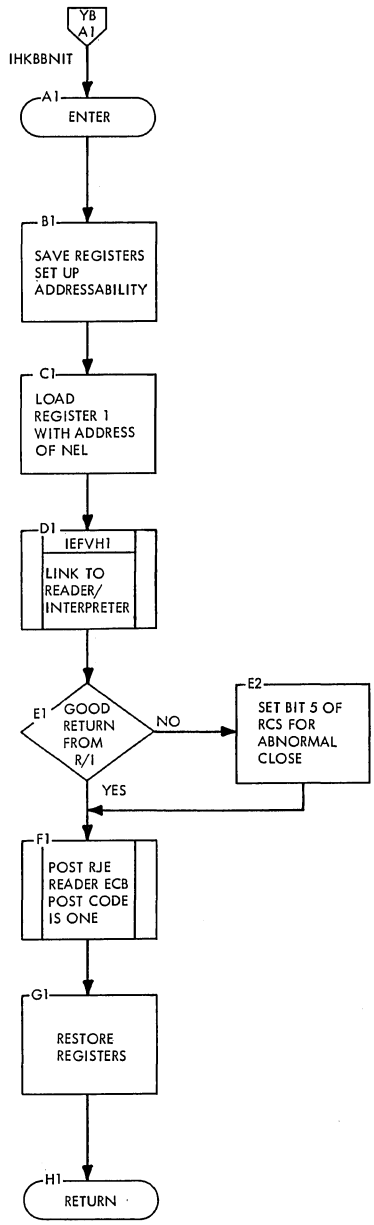


Chart YC. IHKBBRIT -- OS Reader/Interpreter Interface Routine

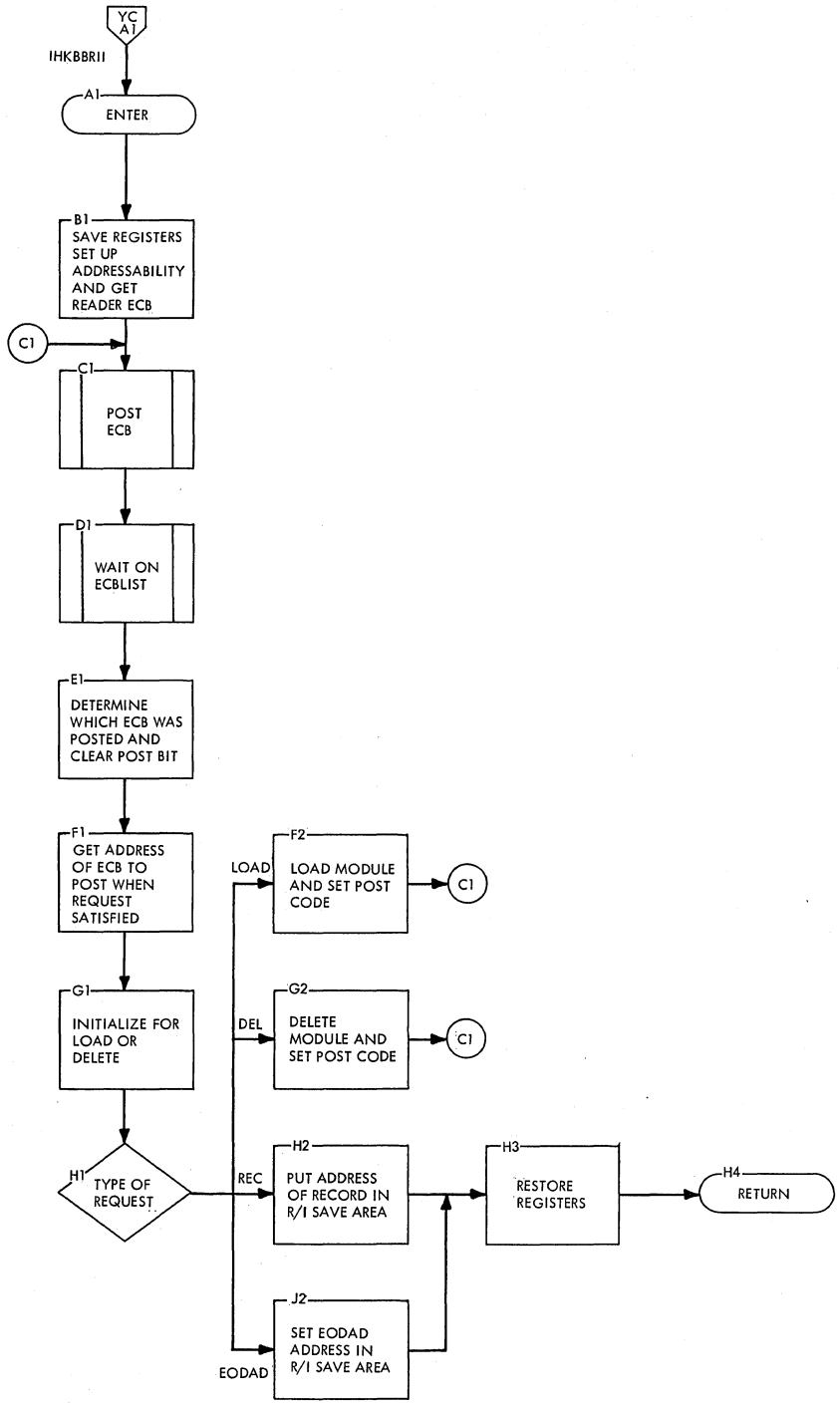
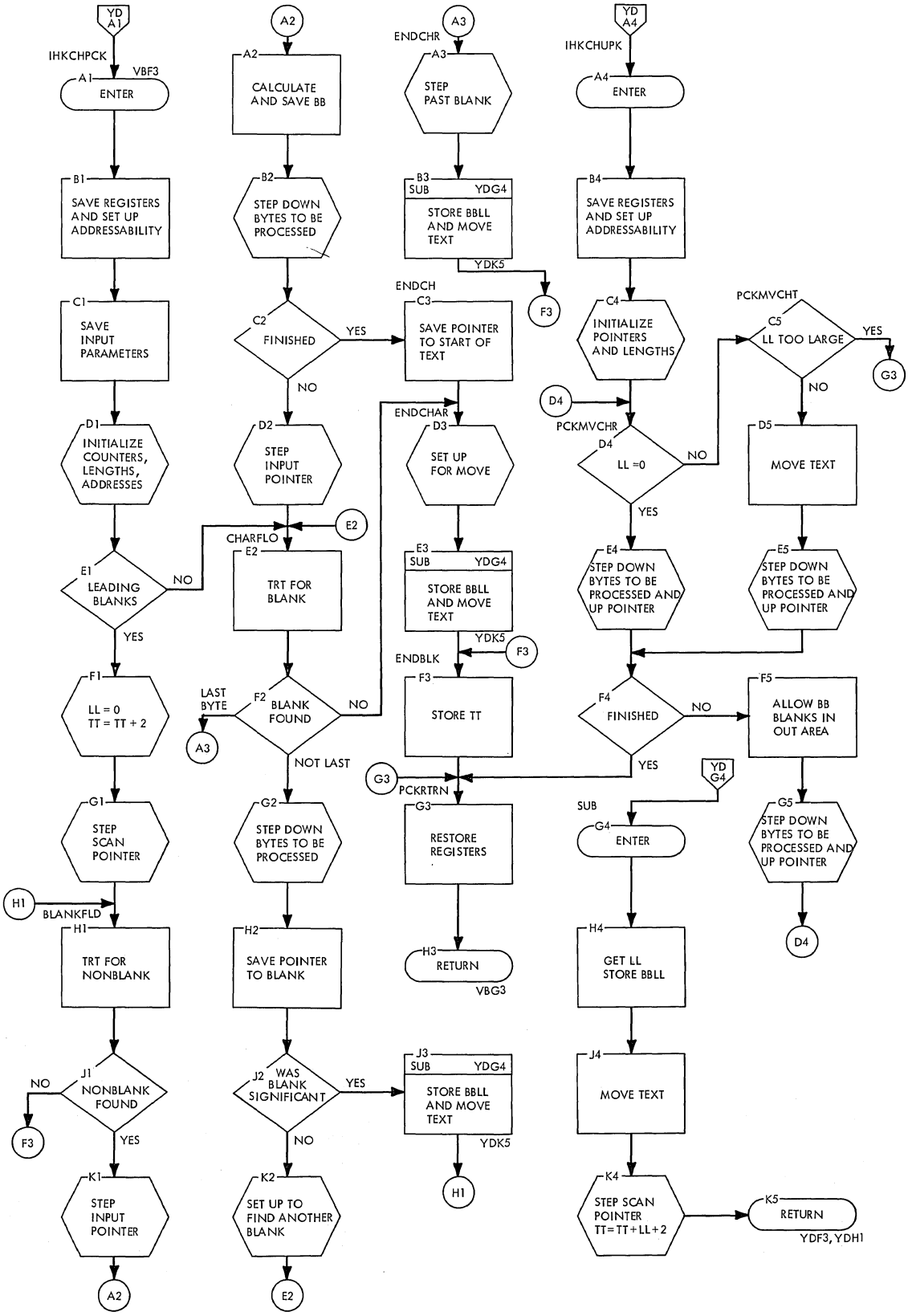


Chart YD. IHKCHPUP -- PACK/UNPACK



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