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OS

IBM Systems Reference Library

IBM System/360 Operating System:

Storage Estimates

This publication is intended for three types of users: system planners, system programmers, and problem programmers. It contains instructions, formulas, and tables that can be used to estimate the main and auxiliary storage requirements for any machine configuration, control program, and control program option of the IBM System/360 Operating System. Main storage requirements are divided into two categories: fixed main storage and dynamic main storage. Fixed main storage contains the resident portions of the control program and the optional services and load modules that can be made resident to improve the performance of the operating system. Dynamic main storage is the area where program processing is done.

Each type of user can use this publication differently.

- System planners can use this publication to plan the storage requirements of a new system, including the effects of options and different machine configurations on the total storage requirement.

- System programmers can use this publication to determine the amount of main and auxiliary storage that has to be allocated during system generation and to determine the amount of storage available to the problem programmer.

- Problem programmers can use the dynamic storage sections to estimate the requirements of their jobs.

The information for TSO, TCAM, Model 195, Model 165, the 2880 channel, and Extended Channel Support is for planning purposes only.

Twelfth Edition (January, 1971)

This is a major revision of, and obsoletes, C28-6551-11. A summary of major changes appears on page 5. This edition contains information on the components in release 20. 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 20 of IBM System/360 Operating System, and to all subsequent releases until otherwise indicated in new editions or Technical Newsletters. Changes are continually made to the information herein; before using this publication in connection with the operation of IBM systems, consult the latest IBM System/360 SRL Newsletter, Order No. GN20-0360, for the editions that are applicable and current.

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Preface

The purpose of this publication is to enable users to estimate the main and auxiliary storage requirements for any machine configuration, control program, and control program option of the IBM System/360 Operating System.

This publication is divided into seven sections. The introduction explains how to calculate a total storage requirement and briefly describes the different control programs and how they use main storage.

Each of the next three sections describes how to estimate fixed and dynamic main storage requirements for one of the control programs (PCP, MFT, or MVT and M65MP) and the associated control program options selected during system generation. In these sections, the descriptive material is in the beginning of the section and the tables are grouped together at the back. A prerequisite for this section is the publication IBM System/360 Operating System: System Generation, GC28-6554.

Section 5 contains dynamic main storage requirements for the following IBM-supplied service programs: TESTRAN, the loader, the 1130/360 data transmission program, system environment recording, the overlay supervisor, and graphic programming support.

Section 6 describes how to estimate the dynamic main storage requirements for data access methods.

Section 7 describes the auxiliary storage required for the IBM-supplied control programs and processing programs. In addition it describes the requirements for the work space that these programs use.

The appendixes contains a list of load modules that can be made resident when the system is initialized.

How to Use This Publication

Page 7 contains a general table of contents with tab markers to each of the descriptive and table sections. Follow the tabs to quickly locate sections you are interested in.

The following notation conventions are used in this publications:

1. A number that appears in parentheses after a column heading or a table entry indicates the number of a note found at the bottom of the table. For example, 132 (2) refers the reader to note 2 for more information on the entry 132.
2. A bullet (•) is used both to itemize when used in text or a table, and to indicate multiplication when used in a formula.
3. Asterisk (*) is used to indicate an estimate that has not been verified.

Prerequisite and Related Publications

The reader should be familiar with the following publications:

IBM System/360 Operating System:

Concepts and Facilities, GC28-6535

For a better understanding of the facilities of the IBM System/360 Operating System, it is suggested that the reader also be familiar with the following additional publications:

IBM System/360 Operating System:

System Programmer's Guide, GC28-6550

Supervisor and Data Management Services, GC28-6646

Supervisor and Data Management Macro Instructions, GC28-6647

Operator's Reference, GC28-6691

Job Control Language Reference, GC28-6704

Summary of Major Changes--Release 20

Item	Description	Areas Affected
TSO (Time Sharing Option)	A new control program option is available in MVT. This publication describes its fixed, dynamic, and auxiliary storage requirements.	100,108,120-123,127, 145-152,230,231,235, 237-241,247,254-256, 279, Appendix B
Telecommunications Access Method (TCAM)	The dynamic and auxiliary storage requirements of a new access method are describes in this publication.	73,126,212-224,231, 235,237-241,247,248, 251-253,278,279,288, 293,295,302
Model 155	The fixed and auxiliary storage requirements for the Model 155 are described in this publication.	55,56,73,77,104,105, 126,129,237-241
Model 165	The fixed and auxiliary storage requirements for the Model 165 are described in this publication.	55,56,73,77,104,105, 126,129,237-241
ASCII	The sizes of several OPEN/CLOSE modules have increased because of ASCII.	280,281,297
Service Aids	New dynamic and auxiliary storage requirements for Service Aids.	37,83,135,247
Extended Channel Support	This publication describes the fixed main storage requirements for extended channel support.	78,130
2880 Channel	This publication describes the fixed main storage requirements for the 2880 channel.	73,75,77,126,128,129
Model 195	The auxiliary and fixed storage requirements for the Model 195 have changed.	129,239,241
Reader/Interpreter	The formula for calculating the region size of the reader/interpreter has changed.	109
Background Reader	The storage requirements of the background reader are described in this publication.	110
OLTEP	The fixed and dynamic storage requirements for OLTEP have changed.	20,35,57,75,80,81,105, 128,132,133,239,241

GENERAL CONTENTS

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Introduction—Contents

Introduction

The IBM System/360 Operating System (the operating system) is a set of control program and processing modules that you can combine in a variety of ways during system generation. The storage requirements of each installation are different and must be estimated separately.

Storage Requirements

The storage required by your installation depends on: your machine configuration, the control program that your system runs under, and the control program and programming options that you select. Any operating system, however, uses two types of storage: main storage and auxiliary storage. For your operating system, the total storage requirement is the sum of its main and auxiliary storage requirements.

MAIN STORAGE REQUIREMENT

The total main storage needed for your operating system is the sum of its fixed and dynamic storage requirements.

- Fixed main storage requirement is main storage used by the resident portions of the control program, including the optional modules and services that you make resident.

- Dynamic main storage requirement is main storage used during program processing by nonresident system functions, processing programs, and problem programs.

AUXILIARY STORAGE REQUIREMENT

Your operating system requires input/output devices for system residence and for work space used by the control program and the processing programs. The minimum device requirement is: a direct access device for system residence, an operator's console, a system input device, and a system output device. The total auxiliary storage requirement is the total of the auxiliary storage allocated for system residence and the work space required by control and processing programs.

Operating System Configurations

The amount of main and auxiliary storage required by an installation depends on the particular operating system configuration you select during system generation. The operating system has four configurations: the primary control program (PCP), multiprogramming with a fixed number of tasks (MFT), multiprogramming with a variable number of tasks (MVT), and Model 65 Multiprocessor (M65MP).

Each configuration offers the facilities of primary data management[1] and contains a supervisor that provides for:

- Overlapping of central processing unit operations and input/output channel activity.
- Supervision and processing of interruptions.
- Error checking and standard input/output error recovery procedures.
- Satisfaction of requests for supervisor services.

The following text briefly summarizes the characteristics of each configuration. The rest of this section discusses how storage is organized in each configuration.

PCP CONFIGURATION

The PCP configuration permits stacked job processing of one input stream in sequential order and controls the performance of only one task at a time. The job scheduler is not resident, but is brought into main storage between job steps to read and interpret control statements for the next step, allocate input/output devices, and issue volume mounting messages to the operator.

MFT CONFIGURATION

The primary characteristic of the MFT configuration is that the dynamic area is divided into two or more discrete areas called partitions. Each partition can service as many as three job queues, with priority of the queues based on the order in which they were initially specified (at SYSGEN, system initialization, or during operation); i.e., if a partition is assigned to service work in job classes A,B, and C, A jobs are scheduled into that partition first, and C jobs are scheduled only when there are no A or B jobs. Additionally, several partitions may be assigned to service the same job class queues to keep the partitions busy.

The MFT job scheduler reads input job streams and enqueues jobs on one of fifteen available input job queues, corresponding to the CLASS parameter on the JOB statement. Position on a queue is determined by the PRTY parameter on the JOB statement; jobs of equal priority are enqueued first-in first-out (FIFO). Jobs are dequeued from the input queues and initiated according to their place on the queue.

The MFT configuration controls the concurrent operation of more than one task. Each task represents a step of a separate job; up to fifteen problem program tasks can be performed concurrently. Multitask operation is achieved by using the wait time of one task to perform processing for another task of lower priority. The dispatching priority of a task is determined by the partition in which the task resides. The partition with the highest main storage address has highest priority; each lower partition has a correspondingly lower priority. When an event occurs for which a task is waiting and if the currently active task has a lower priority, processing of the lower priority task is suspended, and processing of the higher priority task resumes.

In a MFT system that has subtasking, up to 249 tasks can be performed concurrently: the task that becomes active is the highest priority task that is ready.

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[1]Primary data management includes the queued sequential, basic sequential, and basic partitioned access methods (QSAM, BSAM, and BPAM).

MVT CONFIGURATION

The MVT configuration reads one or more input streams and schedules the jobs according to priority. Each job initiated operates in an area of storage called a region and up to 15 independent jobs can be performed concurrently. The job steps within a single job are performed in sequential order since one step may depend on the successful completion of another. However, within a job step, any number of tasks can be initiated. These tasks are performed concurrently, both with one another and with tasks initiated by other jobs, as well as with system tasks initiated by the control program.

Some of the system tasks in concurrent operation with the tasks initiated by a job step are those tasks performed by the job scheduler routines (the reader/interpreter, the initiator/terminator, and the output writer). All these tasks can be in operation concurrently and each system task also operates in a region.

However, the initiator/terminator operates alternately in the region of the last job step initiated and the region of the next step to be initiated. When a job step terminates, its region is freed and a new region is obtained. The new region occupies the highest contiguous area large enough for either the minimum job initiation requirement or the next job step, whichever is larger.

M65MP CONFIGURATION

The Model 65 Multiprocessor (M65MP) configuration consists of two interconnected Model 65 CPUs. When the system is operating in the "multisystem" mode, main storage is shared by both CPUs and the services of a single control program are used. M65MP is a version of MVT and is completely dependent upon a functional MVT system. Most configurations, functions, and options available with MVT are also available with M65MP; the exceptions are Main Storage Hierarchy Support, support for Shared DASD, and 2816 Switching Unit Support for more than one console per CPU.

PCP—Contents

Illustrations

Figures

PCP—Fixed and Dynamic Main Storage Requirements

The total amount of main storage required, for PCP, is the sum of its fixed and dynamic storage requirements.

- <u>Fixed main storage</u> is the main storage used by the resident portion of the control program.

- <u>Dynamic main storage</u> is main storage used during program execution by nonresident system functions, processing programs, and problem programs.

The total amount of fixed main storage that your system requires is determined by four factors:

1. The basic fixed storage requirement - for PCP this is the storage required by the nucleus.

2. The optional fixed storage requirement - this amount depends on the control program options you select during system generation.

3. The recovery management storage requirement - this amount depends on the recovery management facilities you select during system generation.

4. The input/output supervisor (IOS) storage requirement this amount depends on the nature of the input/output devices you select during system generation.

The sum of the storage required by these four factors is the fixed storage size necessary for your system.

The maximum dynamic storage requirement, for PCP, is either the size of the scheduler or the maximum job step requirement, whichever is larger. Figure 1 shows how main storage is organized for a system running under PCP.

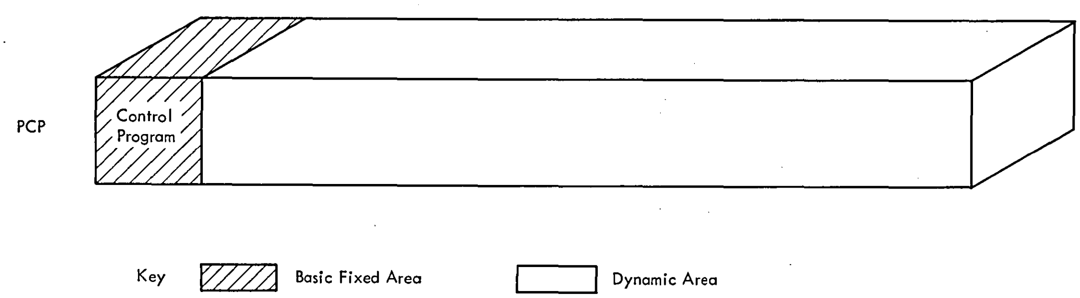

Figure 1. Main Storage for a System Running under PCP

Basic Fixed Requirement

The basic fixed requirement, for PCP, is the amount of storage required by the nucleus.

BASIC PCP = 14,112

Note: If the link library or the SVC library contains multiple extents, the basic fixed requirement must be increased 16 bytes for each additional extent. If the link library consists of more than one volume, the basic fixed requirement must be increased 16 bytes for each additional volume and 16 bytes for each extent on each additional volume.

Optional Fixed Requirement

You can add control program options that: (1) change the organization and size of fixed main storage by making certain modules and tables resident, and (2) increase the size of fixed main storage by adding extra services to your system.

Five control program options change the organization of storage and cause the fixed area to be increased. Although these options decrease the dynamic area, they improve the performance of the operating system. The following options are involved:

- Resident type 3 and 4 supervisor call (SVC) routine option -- allows reenterable modules of type 3 and 4 SVC routines to be resident.
- Resident job queue (JOBQE) option -- allows all or a portion of the job queue for the scheduler to be resident.
- Resident reenterable load module (RENT) option -- allows access method modules to be resident.
- Resident link library directory (BLDTAB) option -- allows all or a portion of the directory for the link library to be resident.
- Resident error recovery procedure (ERP) option -- allows selected error recovery procedures to be resident.

Figure 2 shows how main storage is organized when you specify all of these options.

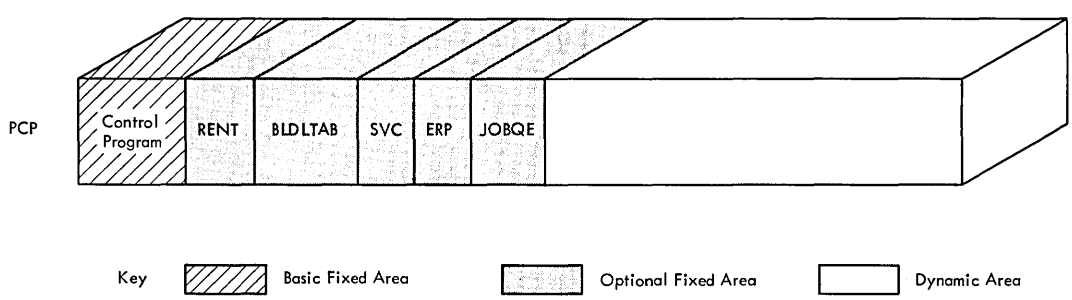

Figure 2. Effect of Control Program Options on the Organization of Main Storage for a System Running Under PCP

During system generation, you can add control program options that tailor the system to your installation's needs. These options require additional fixed storage and are specified by the following macro instructions:

- CTRLPROG -- specifies the operating system configuration.
- DATAMGT -- specifies the optional access methods.
- GRAPHICS -- specifies the graphics programming services.
- SCHEDULR -- specifies job scheduler options.
- SUPRVSOR -- specifies task supervisor options.
- SVCTABLE -- specifies supervisor call (SVC) routines.
- TESTRAN -- specifies the test translator.

Table 1a
: contains the fixed storage requirements for the options specified in the CTRLPROG, DATAMGT, GRAPHICS, SVCTABLE, and TESTRAN macro instructions.

Table 2a
: contains the fixed storage requirements for the options specified in the SCHEDULR macro instruction.

Table 3a
: contains the fixed storage requirements for the options specified in the SUPRVSOR macro instruction.

When you estimate the optional fixed storage requirements, <u>include</u> the storage required by:

1. Resident job queue records.
2. Resident user added SVC routines.
3. Resident BLDLTAB entries.
4. Resident type 3 and 4 SVC routines.
5. Resident error recovery procedures.

Recovery Management Requirement

The operating system requires storage in order to perform recovery management. The recovery management procedures consist of recording system environment data at the time of a machine malfunction and providing an analysis of this data to determine whether recovery is feasible. The data is arranged in a usable format and written on the SYS1.LOGREC data set.

There are two recovery management facilities available for PCP:

<u>System Environment Recording Option 0 (SER0)</u>: SER0 is an independent function that determines the type of malfunction and, if possible, writes the error on SYS1.LOGREC. It does not use any operating system facilities to collect and record data. SER0 consists of a resident module and a nonresident module. The nonresident module is loaded into the dynamic area without regard to what was previously there. After SER0 completes its operation, no further operations are allowed and the system goes into a wait state.

System Environement Recording Option 1 (SER1): SER1 is a completely resident function that uses operating system facilities to collect and record data. SER1 resides on the SYS1.LINKLIB and is attached to the nucleus at IPL/NIP time. When SER1 completes recording the data associated with the malfunction, it attempts to determine (1) the effect and extent of the damage caused by the malfunction, and (2) whether the failure affected only a specific task. If the failure has not damaged the supervisor and the malfunction can be related to a specific task, the task is terminated. If the supervisor is damaged or if the malfunction cannot be related to a specific task, all operations are terminated and the system goes into a wait state.

You specify the desired recovery management facility during system generation in the SUPRVSOR macro instruction. If you do not specify recovery management, the system assigns a default value of SER0 or SER1 depending on the size of main storage.

Table 4a.
: contains the storage requirements for recovery management for models 40, 50, 65, and 75.

Input/Output Supervisor Requirement

The operating system requires storage for the input/output supervisor (IOS). Part of the storage required for IOS is included in the basic fixed storage requirement. The total amount of storage required by IOS depends on the I/O configuration selected during system generation.

Table 5a
: contains the fixed storage requirements for the I/O channel configuration.

Table 6a
: contains the fixed storage requirements for the type of I/O devices specified.

Table 7a
: contains the fixed storage requirements that depend on the type of IBM-supplied processing programs selected.

Example 1 – Estimating a Fixed Storage Requirement for PCP

Example 1 shows how the fixed storage requirement was estimated for a PCP configuration. For convenience, assume that the reenterable load modules made resident are the modules in standard list IEAIGG00. (This list is given in Appendix A.)

System/360 Configuration:
- Model 40 with 64K bytes of storage and storage protection
- SERO
- Ordered Seek Queueing with 10 I/O requests queued on the channels
- Multiplexor channel with:
  - One 2540 card reader punch
  - One printer
  - One console
- One selector channel with:
  - Two IBM 2311 Disk Storage Drives without record overflow

Control Program Options
- BDAM
- Resident reenterable load modules
- Storage Protection

```
BASIC fixed requirement for PCP.............................. 14,112 Bytes

OPTIONAL fixed requirements from Table 1a:
  • BDAM  ......................................... 192 Bytes

OPTIONAL fixed requirements from Table 3a:
  • Resident reenterable load modules 150 + 30(24).. 720 Bytes
  • Storage Protection.............................. 442 Bytes
  • Standard list IEAIGG00....................... 7,224  Bytes
                                                              8,386  Bytes

RECOVERY management requirements from Table 4a:
  • SERO................................................... 254 Bytes

IOS channel requirements from Table 5a:
  • Multiplexor channel.............................. 60 Bytes
  • One selector channel............................. 50 Bytes
  • One channel path with direct access devices...... 32 Bytes
  • Ordered Seek Queueing........................... 262 Bytes
  • 10 I/O requests................................. 120 Bytes
                                                                524 Bytes

IOS I/O device requirements from Table 6a:
  • Four unit record devices 4(56).................. 224 Bytes
  • Direct access capability......................... Included
  • Two IBM 2311 Disks without record
    overflow 2(142)................................. 284 Bytes
  • Resident error routine (Basic Support)......... 1368 Bytes
                                                              1,896 Bytes

FIXED MAIN STORAGE REQUIREMENT FOR EXAMPLE 1............. 25,364  Bytes
```

Dynamic Storage Requirements for PCP

When you use PCP, the maximum dynamic storage requirement is either the size of the scheduler or the maximum job step requirement whichever is larger. A job step may use a program written by your installation or an IBM-supplied program. The amount of storage required for a job step depends on:

- The storage required for job initiation.
- The storage required for the load module.
- The storage required for any IBM-supplied program that the job step uses.
- The storage required for supervisor services requested by the job step and for the checkpoint/restart work area if checkpoint/restart is specified.
- The storage required for the data management access methods used by the job step.

JOB INITIATION REQUIREMENTS

Dynamic storage is required for job initiation, but is available for use by the job step after it is initiated. If the minimum requirement for job initiation is greater than the amount requested for the job step, the job initation requirement is used for the job step.

The minimum storage required to initiate a job is determined by the size of the scheduler and whether you specify certain options during system generation in the SCHEDULR macro. The PCP scheduler has three design levels available: 18K, 44K, and 100K. The storage required by the scheduler increases if one or more of the following options are specified: automatic volume recognition, user-written accounting routines, and Sysout job separators.

Design Level: The design levels of the PCP scheduler specify the amount of storage required for execution of the scheduler. This storage requirement depends on the I/O device specifications made during system generation and on the maximum number of DD statements to be processed in any one job step. The maximum allowed for each condition depends on the scheduler used. If these maximums are exceeded, the amount of storage required by the scheduler increases.

You can use the following formulas to determine the initiation requirements of the 18K and 44K/100K scheduler, respectively. If the result of the formula is less than the design level, then the scheduler operates within its design level; if the result exceeds the design level, then the scheduler requires that amount of storage to operate.

18K scheduler requirement = 18,432 + [(E•N) - 3000] + 250(D-20)
44K/100K scheduler requirement = DESIGN + [(E•N) - 4800] + 250(D-25)

Where:

E = the sum of:
- a. the number of UNITNAME macro instructions, and
- b. the number of <u>different</u> unit types specified by the UNIT parameter of all IODEVICE macro instructions.

N = is determined by K, where K is the sum of:
- a. the number of IODEVICE macro instructions,
- b. the number of IODEVICE macro instructions that specify UNIT=2314, multiplied by one less than the number of units specified in the IODEVICE statement.
- c. the number of IODEVICE macro instructions that specify UNIT=2321, multiplied by ten.
- d. the number of alternate channel paths specified, and
- e. the number of 2314 IODEVICE macro instructions that specify alternate channel paths, multiplied by one less than the number of units specified in the IODEVICE statement.
- f. the sum of all undefined unit addresses on channel 0 up to the first defined unit address for the first defined control unit, and
- g. the sum of the undefined unit addresses, associated with each control unit, that would appear between the unit addresses defined. This applies to all channels.

K is used to determine the value of N as follows:

K	N
0 - 80	32
81 - 110	36
111 - 140	40
141 - 170	44
171 - 200	48
201 - 248	52
249 - 278	56
279 - 308	60
309 - 338	64
339 - 368	68
369 - 398	72
399 - 428	76
429 - 458	80
459 - 488	84
489 - 518	88
519 - 548	92
549 - 578	96
579 - 608	100
609 - 638	104
639 - 668	108
669 - 698	112
699 - 728	116
729 - 768	120

D = the maximum number of DD statements to be processed in any one job step. If the maximum number of DD statements is less than 20 for the 18K scheduler, assume (D-20)=0. If the maximum number of DD statements is less than 25 for the 44K/100K scheduler, assume (D-25)=0.

AUTOMATIC VOLUME RECOGNITION: The size of the scheduler increases when automatic volume recognition is selected. (Automatic volume recognition allows the operator to mount labeled tapes on any available device before the volume is needed.) The amount of additional storage depends on the scheduler selected:

- With the 18K scheduler, add 5,800 bytes.
- With the 44K or 100K scheduler, add 4,000 bytes.

ACCOUNTING ROUTINES: The size of the scheduler also increases when you supply an accounting routine. (See the publication IBM System/360 Operating System: System Programmer's Guide for information on sypplying an accounting routine.) The amount of additional storage is equal to 2,600 bytes, plus the size of the accounting routine, plus the additional storage required by the accounting routine (e.g., OPEN, GETMAIN).

SYSOUT JOB SEPARATORS: Finally, the size of the scheduler increases when SYSOUT job separators are used. The amount of additional storage depends on whether the IBM-supplied routines are used:

- With IBM-supplied SYSOUT job separators, add 4,000 bytes.
- With user-supplied SYSOUT job separators, add their requirement.

IBM-Supplied Program Requirements

IBM-supplied programs require dynamic storage in which to operate. Tables 8a through 15a contain the minimum dynamic storage requirements for these programs.

Table 8a
: contains the storage requirements for each processor. These estimates include the requirements for the access methods used by the processor. If the access method modules are resident, the requirement can be reduced by the sum of the resident modules.

Table 9a
: contains the storage requirements for utility programs. These estimates do not include the requirements of the access methods used by the utility program. The sizes of the access method routines used must be added to the minimum requirements if the routines are not resident.

Table 10a
: contains the storage requirements for the IEHDASDR system utility program.

Table 11a
: contains the storage requirements for the IEHDASDR buffer/workarea size.

Table 12a
contains the storage requirements for the IEBDG data set utility program.

Table 13a
contains the storage requirements for IBM-supplied utility programs when the SYSUTILS macro instruction is specified. These estimates do not include the requirements of the access methods used by the utility program. The sizes of the access method routines used must be added to the minimum requirements if the routines are not resident.

In addition, dynamic storage is also required by graphic programming support, the overlay supervisors, the system environment recording functions, TESTRAN, the 1130/360 Data Transmission program, and the Loader. Section 4 contains the dynamic storage requirements for these programs.

Supervisor Services Requirements

Dynamic storage is used by the control program both while supervisor services are performed and after control is returned to the program that requires them. In PCP, the storage required for supervisor services is obtained from the dynamic area.

Table 14a
contains the dynamic storage requirements for the supervisor services that perform the opening and/or closing of a data set and the handling of end-of-volume conditions.

Table 15a
contains the dynamic storage requirement for the rest of the supervisor services and also gives the duration of the storage requirement.

Access Method Requirements

Section 5 contains the storage requirements for access methods used by the job steps.

Tables

Table 1a. Fixed Storage Requirements for Control Program Options Specified in the CTRLPROG, DATAMGT, GRAPHICS, SVCTABLE, and TESTRAN Macro Instructions for PCP

Macro Instruction	Control Program Options	Storage Requirement (in bytes)
CTRLPROG	• Main Storage Hierachy Support • PCI Fetch	1,742 2,612
DATAMGT	• BDAM and/or ISAM (basic requirement) • ISAM (additional)	192 72
GRAPHICS	• Graphic Programming Services (1)	558
SVCTABLE	• User Added SVC Routines • Each Resident SVC Routine (2) Each Transient SVC Routine	24 4 2
TESTRAN	• Test Translator	68

Notes:
1. For each 2250, Model 1, with 4K buffer, add 32 bytes. For each 2250, model 1, with 8K buffer, add 48 bytes.
2. The size of the SVC routine(s) must be added to the fixed storage requirement.

Table 2a. Fixed Storage Requirement for Control Program Options Specified in the SCHEDULR Macro Instruction for PCP

Macro Instruction	Control Program Option	Storage Requirement (in bytes)
SCHEDULR	• Alternate Console	196 (1)
	• Composite Console (per console)	96
	• Resident Job Queue	562
	Each Resident Record	176

<u>Note</u>:
1. If you select the interval timer, suotract 50 bytes.

Table 3a. Fixed Storage Requirements for Control Program Options Specified in the SUPRVSOR Macro Instruction for PCP

Macro Instruction	Control Program Option	Storage Requirement (in bytes)
SUPRVSOR	• IDENTIFY Facility	
	Module Resident	608
	Module Nonresident	118
	• Multiple WAIT	204
	• Resident ATTACH	640
	• Resident BLDLTAB	284
	Each Resident Directory Entry	40 (1)
	• Resident EXTRACT	92
	• Resident Reenterable Load Module (Resident Access Method Option)	150
	Each Resident Module	24 (2,3)
	• Resident SPIE	98
	• Resident Type 3 and 4 SVC Routines	120 (4,8)
	Each Resident Module	40 (2,5)
	• Residents Error Recovery Procedure	100
	Each Resident Module	24 (2)
	• ENQ/DEQ	1,440
	• Storage Protection	442 (6)
	• Timing Facilities	
	Time	236
	Interval Timing	1,994 (9)
	• Trace	246
	Each Entry in Trace Table	16
	• Transient SVC Table	102
	Each User SVC Routine Added	4
	• Validity Check	240 (6)
	• Verify DASD Vol. SERIAL No.	Included (7)

Notes:

1. If you use the standard list IEABLD00, storage is required for nine entries. The standard list is given in the IBM System/360 Operating System: System Programmer's Guide.
2. When you select this option, you must add the sum of all resident modules to the fixed storage requirement. Appendix A contains the names and sizes of the modules that may be resident.
3. If you use the standard list IEAIGG00, 30 modules are loaded with a storage requirement of approximately 7,224 bytes. Appendix A indicates the modules that are in the standard list.
4. When you select this option, you must also select the transient SVC table option and add the required storage.
5. If you use the standard list IEARSV00, 29 modules are loaded with a storage requirement of approximately 29,696 bytes. Appendix A indicates the modules that are in the standard list.
6. If you select storage protection, the validity check option is included as a standard feature; the storage requirement for protection includes the storage required by validity check.
7. The NODAV option cancels verification checking. If you select this option, the size of fixed main storage for IOS resident code is decreased by 132 bytes.
8. If you select the resident access method option, subtract 46 bytes.
9. If you select BDAM or ISAM, subtract 58 bytes.

Table 4a. Fixed Storage Requirements for Recovery Management for PCP

Description	Storage Requirement (in bytes)
SER0 on Models 40, 50, 65, 75	254
SER1 on Model 40	3168
SER1 on Model 50	3432
SER1 on Model 65	3320
SER1 on Model 75	3288

Table 5a. Fixed Storage Requirements for IOS that Depend on the Channel Configuration for PCP

Description	Storage Requirement (in bytes)
Multiplexor or high speed multiplexor channel	60
• Priority queuing	6
• Alternate selector channel	4
Each associated logical channel	6
Selector Channel	
• Each channel (1)	50
• Second channel path on each channel	50
• Each additional channel path on each channel	32
• With priority queuing, each channel path on each channel requires additinal storage	6
• First channel path with direct access devices on each channel (2)	32
• Each additional path with direct access on each channel	12
• Each channel switch (3)	18
Queuing capability	
• FIFO - first in, first out	0
• Ordered Seek Queuing	262
Each queued I/O request (4)	12

Notes:

1. If the number of devices exceeds 240, add 12 bytes for each logical channel.
2. If you select shared DASD, add 8 bytes.
3. IOS routines do not provide for switching devices onto a multiplexor channel.
4. The maximum number of I/O request that can be queued, pending satisfaction by the channels, is specified by your installation at system generation time in the MAXIO parameter of the CTRLPROG macro instruction.

Table 6a. Fixed Storage Requirements for IOS That Depend on the Type of I/O Devices Selected for PCP

Description	Storage Requirement (in bytes) (1)
Unit record capability	0
• Any graphic devices	34
• Each unit record device (1)	56
• Each 1403 printer with UCS feature	64
• Each optical character reader	54
• Each 2495 tape cartridge reader	78
• Each magnetic character reader	48
Graphics capability	206
Magnetic tape capability	102
• Any read/write tape adapter units	38
• Each magnetic tape drive	104 (3)
Telecommunications capability	52
• Each telecommunications line group	18
• Each telecommunications line	58
Direct access capability (2)	Included
• Any drum storage devices	36
• Each 2302, 2303, and 2311 without record overflow	142
• Each 2302, 2303 and 2311 with record overflow	182
• Each 2301	182
• Each address for a 2314	182
• Each 2321 without record overflow	290
• Each 2321 with record overflow	1328
• Resident error routine	
Basic support (only 2311 devices)	1368
Any number of 2314 devices	28
Any number of 2301 devices	20
Any number of 2302 devices	70
Any number of 2303 devices	12
Any number of 2321 devices	16
with record overflow	248
with CCH	88
with DDR	30
with SYSRES DDR	16

Notes:

1. The following rules apply:
   - A console is considered a unit record device.
   - A 2540 card reader-punch counts as two unit record devices.
   - A card reader and printer used as a composite console are counted as two non-console devices.
2. If you specify shared DASD, add 590 bytes.
3. If you select ESV, add 22 bytes + 24 bytes for each tape drive. If you select EVA, add 22 bytes + 16 bytes for each tape drive. If you select EVA and ESV, add 22 bytes plus 24 bytes for each tape drive.

Table 7a. Fixed Storage Requirements for IOS That Depend on the Type of IBM-Supplied Processing Program Selected

Description	Storage Requirement (in bytes)
OLTEP	28 (1)

Note:
1. If your channel configuration includes 2880 channels, add an additional 16 bytes.

Table 8a. Minimum Dynamic Storage Requirement for IBM-Supplied Processing Programs for PCP

Processing Program	Access Method Used	Storage Requirement (in bytes)
ALGOL	BSAM,QSAM	45,056
Assembler E	BSAM,BPAM	16,360
Assembler F	QSAM,BPAM, and BSAM	49,152
COBOL E	BSAM,BPAM	17,504
COBOL F	BSAM,BPAM	81,920
American National Standard COBOL	BSAM,BPAM	81,920
GSP for COBOL F	GAM	35,318 (7)
FORTRAN IV E	BSAM	15,360 (1,2)
FORTRAN IV G	QSAM	81,920 (3)
FORTRAN IV H	QSAM	155,648 (4)
GSP for FORTRAN IV	GAM	35,318 (7)
Linkage Editor E (15K)	BSAM,BPAM	15,500
Linkage Editor E (18K)	BSAM,BPAM	18,432
Linkage Editor F (44K)	BSAM,BPAM	45,056
Linkage Editor F (88K)	BSAM,BPAM	90,112
Linkage Editor F (128K)	BSAM,BPAM	131,072
OLTEP	BSAM,BPAM	28,000
PL/I F	SAM,BPAM	45,056
GSP for PL/I F	GAM	35,318 (7)
RPG E	BSAM	15,360
Sort/merge	QSAM	16,000 (5)
TESTRAN editor	BSAM	18,432 (6)

Notes:

1. This estimate includes enough work space to process approximately 170 cards. More storage may be required by larger source programs.
2. If the PRFRM option is used, the minimum storage requirement is 19,456 bytes. If blocked input or output are also used, the minimum storage requirement is increased by the value of the expression (2 (BLKSIZE)) for each data set that contains blocked records.
3. This estimate includes sufficient work space to process approximately 400 cards. More storage may be required by larger source programs.
4. This estimate includes sufficient work space to process approximately 200-300 cards with a blocking factor of five for the SYSPRINT and SYSLIN data sets. More storage may be required by larger source programs. Add 18,432 bytes for each additional 100 cards.
5. This estimate is for sort/merge with no linkage editor or direct access devices; if a linkage editor is used, the minimum dynamic requirement is the requirement for the linkage editor selected.
6. The TESTRAN editor requires an overlay supervisor. The storage required by the overlay supervisor specified for the system during system generation must be added to the TESTRAN editor requirement.
7. This estimate assume that the modules are loaded with the LOAD macro instruction. Appendix A contains a list of the modules and their dynamic storage requirements.

Table 9a. Minimum Dynamic Storage Requirement for IBM-Supplied Utility Programs and Service Aids for PCP (Part 1 of 3)

Utility Program	Storage Requirement (in bytes) (1)
• System utilities:	
IEHATLAS	9,740 + R + 16(T)
IEHDASDR	(2)
IEHINITT	12,483
IEHLIST	17,800
IEHMOVE	15,360
IEHPROGM	12,758
IFCEREPO	20,480
(Models 40, 50, 65, 75)	
• Data Set utilities:	
IEBCOMPR	14,813 + 2B + 2L + E
IEBCOPY	27K + M + N + P
IEBTCRIN	10,230 + A + R + E
IEBDG	(4)
IEBEDIT	10,936
IEBGENER	12,164 + 4B + 2L + E + F
IEBISAM	5,000 + R
IEBPTPCH	15,691 + 4B + + E + F
IEBUPDAT	8,722 + 2B
IEBUPDTE	16,546 + 4B + 2L + E
• Service Aids	
IMASPZAP	16K
IMAPTFLS	6K
IMAPTFLE	46K
IMBMDMAP	36K
IMDPRDMP	42K

Table 9a. Minimum Dynamic Storage Requirement for IBM-Supplied Utility Program and Service Aids for PCP (Part 2 of 3)

Where: A = 2 times the BUFL on SYSUT1.

B = the largest blocksize in the job step, rounded to the next highest multiple of 2K. If the format specified for the data set is VS and LRECL is less than 32K, use R instead of B in the formula.

R = the maximum logical record length, rounded to the next highest multiple of 2K.

L = 2,048 if user header and trailer labels are to be processed; otherwise, L=0.

E = the sum of the sizes of all the user exit routines. Round the size of each routine to the next highest multiple of 2K and then add.

F = 2,048 for each group of MAX parameters that are less than or equal to 200 bytes.

M = 1K minimum and is the sum of:

1. the maximum number of input data sets referenced in any COPY step multiplied by 10,

2. the maximum number of membernames, including newnames, multiplied by 10 - this number is added only when SELECT or EXCLUDE is used.

3. the maximum number of newnames referenced in any COPY step multiplied by 4; add 4 bytes to this number.

4. the maximum number of input members referenced in the largest input data set specified in any COPY step multiplied by 10 - this number should be added when EXCLUDE or "Full Copy" is used and 80 bytes should be added to the total.

N = the sum of:

1. the number of directory blocks allocated to the largest output directory used in the job step multiplied by 276,

2. the maximum number of input members to be copied from any one input data set referenced in the job step multiplied by 74.

* The storage required for N is only necessary for optimal performance.

P = 2K minimum and is twice the maximum input or output blocksize. If you are performing a compress-in-place operation, B = the maximum track capacity of the device being used. If you allow the minimum 2K for P, the maximum input or output blocksize can be only 700 bytes.

T = maximum number of records per track.

Table 9a. Minimum Dynamic Storage Requirement for IBM-Supplied Utility Program and Service Aids for PCP (Part 3 of 3)

<u>Notes</u>:

1. If you are planning to specify the SYSUTILS macro instruction during system generation, use Table 12a to determine what size to specify.
2. To determine the minimum dynamic storage requirements for the IEHDASDR system utility program, use Tables 9a and 10a.
3. When using the compress facility, the minimum dynamic storage requirement is 28,000 + T, for PCP.
   Where: T = the maximum track capacity of the device being used + $\frac{\text{maximum track capacity} \bullet 6}{100}$ + 1,000.
4. To determine the minimum dynamic storage requirements for the IEBDG data set utility program, use Table 11a.

Table 10a. Minimum Dynamic Storage Requirements for IEHDASDR System Utility Program for PCP

Function	Storage Requirement (in bytes) (1)
ANALYZE/FORMAT (2)	15,700 + (N•B) + N(344) + M(280)
ANALYZE (2,3)	16,148 + (N•B) + N(344)
DUMP (4)	17,800 + (N•B) + N(360) + M(280)
GETALT	10,728
LABEL	10,982
RESTORE	12,680 + X + N(344) + M(280)

Where: B = a buffer/workarea size determined by the function performed and the device type being used. Table 11a contains the computed size, rounded to the next highest multiple of 2K.

M = the number of copies to be made.

N = the number of operations to be performed, with a minimum of 1 and a maximum of 6. If enough storage is provided, multiple operations will be performed concurrently. (For information on performing multiple functions concurrently, refer to the publication IBM System/360 Operating System: Utilities, GC28-6586.)

X = buffer/workarea size required to perform one or more RESTORE operations, and is computed as 2B • (N-1) + B. The computed size provides enough storage to perform multiple RESTORE operations concurrently.

Notes:

1. If the QSAM access method is not resident, add 2,000 bytes to the minimum requirement.
2. If the IPL text is required and is supplied via the input stream, add 3,640 bytes.
3. Use this formula only when ANALYZE is to be performed on an IBM 2321 Data Cell.
4. If a permanent data check or missing address marker is encountered during a dump to SYSOUT, an additional 1000 bytes is required to recover and print the defective track.

Table 11a. IEHDASDR Buffer/Workarea Size for PCP

Function	Device Type					
	IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage	IBM 2321 Data Cell
ANALYZE/ FORMAT	22,528	6,144	6,144	6,144	8,192	4,096
DUMP	26,623	8,192	8,192	6,144	10,240	6,144
RESTORE	24,576	8,192	6,144	6,144	10,240	4,096

Table 12a. Minimum Dynamic Storage Requirements for IEBDG Data Set Utility Program for PCP

```
IEBDG = 12,000 + A + B + C + D + E + F + G(272)

Where:  A = 520 • (H/8)
         Where: H = the number of FD statements.  If H is less than
                    or equal to 8, then A=520.  The value for A must
                    be a multiple of 520.

        B = 512 • (I/18)
         Where:  I = the number of CREATE statements.  If I is less
                     than or equal to 18, then B=512.  The value for
                     B must be a multiple of 512.

        C = the sum of all field lengths on all FD statements.  Each
            length must be rounded to the next highest multiple of
            8.  Use one of the following to calculate the value to
            be used for a particular FD statement, if any of the
            conditions apply:
            • If ripple action and format of AN, AL, or CO are
              specified on an FD statement, use the following
              formula to calculate the field length:
               L = FL + FR
               Where:  L = the value to be used for this FD
                           statement when determining the value for
                           C.
                      FL = the length of the defined field specified
                           on the FD statement.
                      FR = 36 for AN, 26 for AL, or 63 for CO.  (If
                           FL is larger than FR, then L=FL.)

            • If ripple or wave action and PICTURE are specified,
              the value to be used for this FD statement is:
                     2 • picture length

            • If roll action and PICTURE are specified, the value to
              be used for this FD statement is:
                     3 • picture length

        D = S + (6•N)
         Where:  S = the sum of all picture lengths on all CREATE
                     statements.  Each length must be rounded to the
                     next highest multiple of 8.
                N = the number of pictures.

        E = U + 72(N/8)
         Where:  U = the dynamic storage requirements for all user
                     exit routines.
                 N = the number of user exit routines.

            • The value for E must be a multiple of 8.

        F = the logical record length of the output data set.  If
           RECFM=U, then F=blocksize.  The value for F must be a
           multiple of 8.

        G = the number of user-specified input and output data sets.
           The value for G must be a multiple of 8.
```

Table 13a. Minimum Dynamic Storage Requirement for IBM-Supplied Utility Programs When the SYSUTILS Macro Instruction is Specified for PCP

Utility Program	Storage Requirement (in bytes) (1)
• System utilities:	
IEHDASDR	N/A (2)
IEHINITT	N/A (2)
IEHLIST	31,000
IEHMOVE	21,504 + B (3)
IEHPROGM	23,000
IFCEREPO	N/A (2)
• Data set utilities:	
IEBCOMPR	23,551 + 2B + 2L + E
IEBCOPY	(See Table 8a.)
IEBTCRIN	N/A (2)
IEBDG	N/A (2)
IEBEDIT	N/A (2)
IEBGENER	23,551 + 4B + 2L + E + F
IEBISAM	N/A (2)
IEBPTPCH	23,551 + 4B + E + F
IEBUPDAT	23,551 + 2B
IEBUPDTE	23,551 + 4B + 2L + E

Where: B = the largest blocksize in the job step, rounded to the next highest multiple of 2K. If the format specified for the data set is VS and LRECL is less than 32K, then B = the maximum logical record length, rounded to the next highest multiple of 2K.
L = 2,048 if user header and trailer labels are to be processed; otherwise, L=0.
E = the sum of the sizes of all the user exit routines. Round the size of each routine to the next highest multiple of 2K and then add.
F = 2,048 for each group of MAX parameters that are less than or equal to 200 bytes.

Notes:
1. If you specify a size smaller than 23,000 in the SYSUTILS macro instruction, all of the utility programs operate in the storage shown in Table 8a. If the size you specify is larger than the minimum storage requirement for a particular utility program, that program will be taken out of overlay structure. In order for all of the affected programs to be taken out of overlay structure, the largest minimum storage requirement must be specified.
2. This utility program is not affected by the size specified in the SYSUTILS macro instruction. It operates in the storage shown in Table 8a.
3. The IEHMOVE utility program is not in overlay structure. If the size you specify is equal to or greater than 21,534, successive loading of IEHMOVE modules takes place at execution time.

Table 14a. Dynamic Storage Requirement for OPEN/CLOSE/EOV for PCP

Supervisor Service	Storage Requirement (in bytes)
OPEN	
• With security protection	960 + 496 (N-1)
• Without security protection	800 + 496 (N-1)
Add to one of above entries, if relevant:	
• Each Format 3 data set control block for BSAM or QSAM	144
• Each additional Format 1 data set control block for BPAM (concatenated data sets only)	176
• Each Format 3 data set control block for BPAM (concatenated data sets only)	144
• Each additional Format 1 data set control block for ISAM and/or BDAM	104
• Each Format 3 data set control block for ISAM and/or BDAM	144
• Each ISAM data set	144
• Each 1403 printer with UCS feature	272
CLOSE	
• With RLSE	1,200 + 472 (N-1)
• Without RLSE	800 + 472 (N-1)
• With EOV (QSAM only, with or without RLSE)	1,480 + 472 (N-1)
• With EOV and EXTEND (QSAM only, with or without RLSE)	1,656 + 472 (N-1)
EOV	
• With EXTEND	1,000
• Without EXTEND	800
• With security protection	848
Where: N = the total number of data sets that are opened (or closed) at the same time; i.e., with the same OPEN (or CLOSE) macro instruction.	

When user label processing is specified (i.e., LABEL=(,SUL) is coded on the DD statement), an additional 168 bytes of dynamic storage are required.

Table 15a. Dynamic Storage Requirement for Supervisor Services in PCP

Supervisor Service	Storage Requirement (in bytes)	Duration of Requirement
ABEND •Normal & Abnormal Termination All data sets not closed •Abnormal Termination Dump Requested	240 700 4800	Temporary Temporary Temporary
ATTACH •Load module on link or job library •Load module in main storage	656 248 216	Temporary Released when task is terminated Released when task is terminated
BLDL	496	Temporary
DEQ	100 (2)	Temporary
Execution of job step	156 + (16 + 4D)E + (12 + 4G)F (see note 1)	Released when job step is terminated
FIND	496	Temporary
IDENTIFY	40	Released when load module is released
LINK, LOAD, XCTL •Load module on link or job library •Load module in main storage	656 32 0	Temporary Released when load module is released
RESERVE	34 + R (3)	Temporary
SETPRT	736	Temporary
SPIE	48	Released when task is terminated
STIMER (with exit routine)	72	Released when exit routine completes
STOW	1,738	Temporary

Where: R = the length of the rname used to represent the serially reusable resource (1 to 255 bytes)

Notes:
1. The variables in this formula are:
   D = the average number of devices in each DD statement.
   E = the number of DD statement.
   F = the number of device pools.
   G = the average number of devices in each device pool.
2. This storage is required only when the shared DASD option has been selected and a DEQ macro instruction is issued to release a device that has been reserved.
3. This storage is required only in systems with PCP when the shared DASD option has been selected.

Add 1024 bytes to the dynamic storage requirements obtained from Tables 13a and 14a. This additional storage is used by the system to process supervisor services and interrupts that occur during processing. If you do not provide this storage, the job step may terminate due to insufficient storage.

MFT—Contents

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MFT—Fixed and Dynamic Main Storage Requirements

The total amount of main storage required, for MFT, is the sum of its fixed and dynamic storage requirements.

- Fixed main storage is the main storage used by the resident portion of the control program.
- Dynamic main storage is main storage used during program execution by nonresident system functions, processing programs, and problem programs.

The total amount of fixed main storage that your system requires is determined by four factors:

1. The basic fixed storage requirement - for MFT this is the storage required by the nucleus, the system queue area, and the operator communication areas.
2. The optional fixed storage requirement - this amount depends on the control program options you select during system generation.
3. The recovery management storage requirement - this amount depends on the recovery management facilities you select during system generation.
4. The input/output supervisor (IOS) storage requirement this amount depends on the nature of the input/output devices you select during system generation.

The sum of storage required by these four factors is the fixed storage size necessary for your system.

Dynamic storage requirements, for MFT, depend on the storage required by the jobs or job steps to be run concurrently in the system and the number of readers and/or writers that you establish in the system. Figure 3 shows how main storage is organized for a system running under MFT.

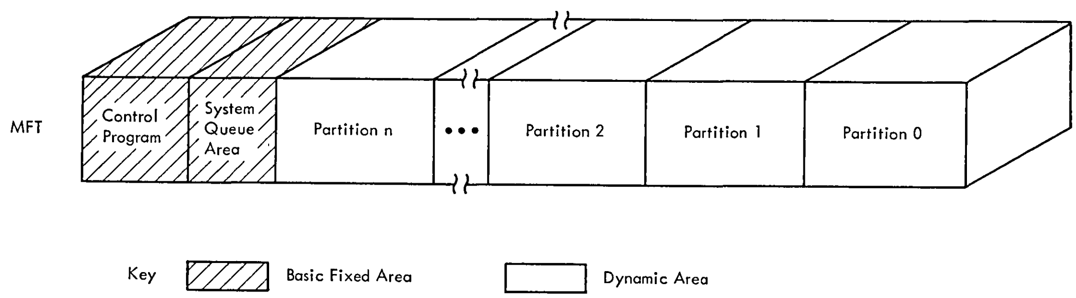

Figure 3. Main Storage for a System Running Under MFT

Basic Fixed Requirement

The basic fixed requirement for MFT is the amount of storage required by the nucleus, the system queue area, and the operator communication areas. The nucleus requirement depends on the number of partitions that you generate. The system queue area requirement depends on: the number of partitions that you generate, if you select MFT with subtasking, if you select SMF, and if you select remote job entry. The operator communication areas, which allow interaction between the control program and the operator, involve two types of areas: (1) buffers, used to transmit information to the operator and write-to-log buffers, and (2) reply queue elements, used to transmit information to the control program. (The user specifies the number of buffers and reply queue elements in the SCHEDULR macro instruction during system generation.)

```
        BASIC MFT = NUCLEUS + SQA + OPERATOR
                  = [24,096+XP] + (see formula for SQA)
                    + [(144•B)+(24•E)] + 132(J) + 16(S)
-------------------------------------------------------------------------
Where:  X = the size of the control blocks for each task
            X = 304 bytes if the central processing unit has
                floating-point registers
            X = 272 bytes if these registers are not present

        P = the number of partitions generated and must be greater
            than or equal to two

        B = the number of write-to-operator buffers and the number of
            write-to-log buffers

        E = the number of reply queue elements

        J = the number of partitions if job step timing is selected:
            otherwise 0.

        S = the number of partitions if SMF is selected:  otherwise 0.
            If you select SMF, you must also select job step timing.
```

Note: If the link library or the SVC library contains multiple extents, the basic fixed requirement must be increased 16 bytes per additional extent. If the link library consists of more than one volume, the basic fixed requirement must be increased 1 byte per additional volume and 16 bytes per extent on each additional volume.

SQA for MFT:

```
SQA = A + B + 184C + (224 + 56D) P + 32M + 96R + 48W + (528+92T)

Where:  A = 192 if MCS is not in the system.
        A = 216 if MCS is in the system.

        B = the size of the tables required for the active consoles:

            B = 144 for each active 1052 console
            B = 248 for each active composite console

        C = the number of active or pending commands.

        D = the number of nontemporary DSNAMEs in a job.
            (26-character DSNAMEs are assumed.  If longer DSNAMEs are
            used, increase the value 56 by one for each extra
            character used.  For example, if 42-character DSNAMEs are
            used, use the value 72 instead of the value 56.)

        P = the number of partitions.

        M = the number of consoles if MCS is in the system, or 0 if
            MCS is not in the system.

        R = the maximum number of RJE central commands that may be
            queued for processing at one time, or 0 if RJE is not in
            the system.

        T = number of CRJE line groups.

        W = the number of direct system output writers started.
```

ADDITIONAL SYSTEM QUEUE AREA FOR MFT WITH SUBTASKING

If you select MFT with subtasking during system generation, additional storage is required in the system queue area. The additional storage can be estimated by the following formula:

Additional SQA = S(208 + T + F)

Where: S = number of concurrently active subtasks. The maximum value for S = 255-(number of system tasks + the number of partitions).

T = 112 if the interval timer is selected: otherwise 0.

F = 32 if there are floating point registers: otherwise 0.

ADDITIONAL SYSTEM QUEUE AREA FOR SYSTEM MANAGEMENT FACILITIES (SMF)

If SMF is selected additional space is required in the system queue area. The size of the area required for SMF can be estimated by the following formula:

SMF Area = Timing Control Table Size (TCTSIZE) + SMF Control Table Size
+ SMF I/O Buffer Size

TCTSIZE: One TCT is created for each active job (no. of TCT's = no. of active initiators); if OPT = 2 is selected, the size of the TCT can be estimated by the following formula:

TCT = 100 + 12(maximum no. of DDs per step) + 8(no. of devices in
each DD statement)

If OPT = 1 is selected, the size of the TCT = 88 bytes with hierarchy 1 storage, or 72 bytes without hierarchy1 storage.

SMF Control Table: The size of the SMF control table = 124 bytes.

SMF I/O Buffer: The SMF I/O buffer requires space in the system queue area. The minimum buffer size is 400 bytes which is twice the size of the largest record that can be written on the SMF data set. The maximum buffer size is 64K bytes.

Optional Fixed Requirement

You can add control program options that: (1) change the organization and size of fixed main storage by making certain modules and tables resident, and (2) increase the size of fixed main storage by adding extra services to your system.

Four control program options change the organization of storage and cause the fixed area to be increased. Although these options decrease the dynamic area, they improve the performance of the operating system. The following options are involved:

- Resident type 3 and 4 supervisor call (SVC) routine option -- allows reenterable modules of type 3 and 4 SVC routines to be resident.
- Resident reenterable load module (RENT) option -- allows access method modules and reenterable load modules to be resident.
- Resident link library directory (BLDLTAB) option -- allows all or a portion of the directory for the link library to be resident.
- Resident error recovery procedure (ERP) option -- allows selected error recovery procedures to be resident.

Figure 4 shows how main storage is organized when you specify all of these options.

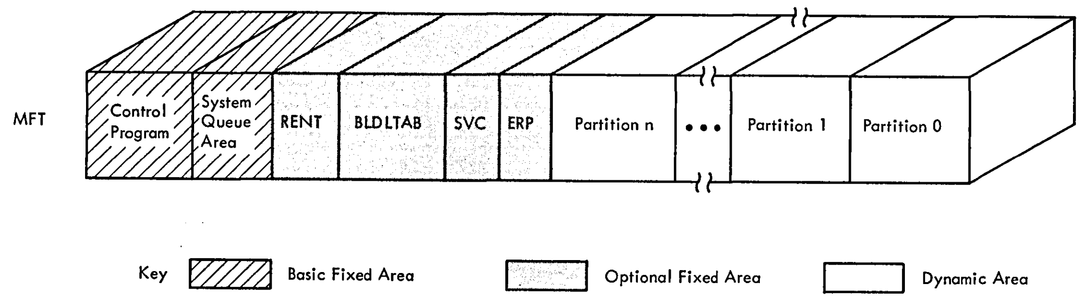

Figure 4. Effect of Control Program Options on the Organization of Main Storage for a System Running Under MFT

During system generation, you can add control program options that tailor the system to your installations needs. These options require additional fixed storage and are specified by the following macro instructions:

- CTRLPROG -- specifies the operating system configuration.
- DATAMGT -- specifies the optional access methods.
- GRAPHICS -- specifies the graphics programming services.
- SCHEDULR -- specifies job scheduler options.
- SECONSLE -- specifies secondary consoles for MCS.
- SUPRVSOR -- specifies task supervisor options.
- SCVTABLE -- specifies supervisor call (SVC) routines.
- TESTRAN -- specifies the test translator.
- CENPROCS -- specifies central processing unit.

Table 1b
: contains the fixed storage requirements for the options specified in the CTRLPROG, DATAMGT, GRAPHICS, SVCTABLE, CENPROCS, and TESTRAN macro instructions.

Table 2b
: contains the fixed storage requirements for the options specified in the SCHEDULR and SECONSLE macro instructions.

Table 3b
: contains the fixed storage requirements for the options specified in the SUPRVSOR macro instruction.

When you estimate the optional fixed storage requirements, include the storage required by:

1. Resident user-added SVC routines.
2. Resident BLDLTAB entries.
3. Resident reenterable load modules.
4. Resident type 3 and 4 SVC routines.
5. Resident error recovery procedures.
6. The round-up factor for MFT necessary to make the sum of items 1, 2, 3, 4, and 5 a multiple of 1K when the storage protection option is not included in the system, or a multiple of 2K when the storage protection option is included.

Recovery Management Requirement

The operating system requires storage in order to perform recovery management. The recovery management procedures consist of recording system environment data at the time of a machine malfunction and providing an analysis of this data to determine whether recovery is feasible. The data is arranged in a usuable format and written on the SYS1.LOGREC data set.

There are six recovery management facilities available for MFT.

- System Environment Recording (SER0): SER0 is an independent function that determines the type of malfunction and, if possible, write the error on SYS1.LOGREC. It does not use any operating system facilities to collect and record data. SER0 consists of a resident module and a nonresident module. The nonresident module is loaded into the dynamic area without regard to what was previously there. After SER0 completes its operation, no further operations are allowed and the system goes into a wait state.

- System Environment Recording (SER1): SER1 is a completely resident function that uses operating system facilities to collect and record data. SER1 resides on the SYS1.LINKLIB and is attached to the nucleus at IPL/NIP time. When SER1 completes recording the data associated with the malfunction, it attempts to determine (1) the effect and extent of the damage caused by the malfunction, and (2) whether the failure affected only a specific task. If the failure has not damaged the supervisor, and if the malfunction can be related to a specific task, the task is terminated. If the supervisor is damaged or if the malfunction cannot be related to a specific task, all operations are terminated and the system goes into a wait state.

- Machine Check Handler (MCH): MCH records the data associated with a machine check error and attempts a recovery by retrying the failing instruction. If retry is not possible, MCH attempts to determine the task affected by the failure and to terminate the associated job step. MCH also includes the facility of refreshing areas of main storage if the associated load module has the refreshable attribute. The system is placed in a wait state only when the effects of the failure cannot be definitely determined, when non-refreshable program damage has occurred in the supervisor, or when a non-recoverable machine failure exists.

- Channel Check Handler (CCH): CCH intercepts channel check conditions, performs an analysis of the environment, and facilitates recovery from channel check conditions by allowing for the scheduling of device dependent error recovery procedures by the input/output supervisor, which will determine whether the failing channel operation can be retried. CCH also constructs a channel error inboard record entry to be written onto SYS1.LOGREC by the outboard recorder routine (OBR) of the I/O supervisor. If CCH is not present in the system, one of the other recovery management facilities receives control and writes an error record for the channel failure. In this case, the error causes system termination.

- Alternate Path Retry (APR): APR allows an I/O operation that developed an error on one channel to be retried on another channel. The alternate channel must be one that has been assigned to the device performing the I/O. APR also provides the capability to logically connect a channel path to a device online or offline by use of the VARY command. APR is optional for MFT.

* Dynamic Device Reconfiguration (DDR): DDR allows a demountable volume to be moved from one device to another and repositioned, if necessary, without abnormally terminating the affected job or reperforming IPL. A request to move a volume can be initiated by the operator, or by the system after a permanent I/O error on a demountable SYRES or non-SYRES volume. DDR is optional for MFT.

The desired recovery management facility is specified at system generation in the SUPRVSOR macro instruction. If you do not specify recovery management, the systems assigns a default of either SER0 or SER1 depending on the size of main storage. If you don't specify MCH and CCH for the Models 85, 155, and 165, they are automatically included during system generation.

Table 4b
contains the storage requirements for the recovery management facilities available on each model.

Input/Output Supervisor Requirement

The operating system requires storage for the input/output supervisor (IOS). Part of the storage required for IOS is included in the basic fixed storage requirement. The total amount of storage required by IOS depends on the I/O configuration selected during system generation.

Table 5b
: contains the fixed storage requirements for the I/O channel configuration.

Table 6b
: contains the fixed storage requirements for the type of I/O devices specified.

Table 7b
: Contains the storage requirements that depend on the type of IBM-supplied processing program selected.

Example 2 – Estimating a Fixed Storage Requirement for MFT

Example 2 shows how the fixed storage requirement was estimated for a MFT configuration with two partitions: the high priority partition is to contain a telecommunications application and the low priority partition is to process batched jobs. Five WTO buffers and five reply queue elements are used. The system does not have Multiple Console Support, or SMF. The standard list IEAIGG00 is resident.

System/360 Configuration
- Model 50 with 128K bytes of storage and storage protection
- SER1
- FIFO queuing, with 30 I/O requests queued on the channels
- Multiplexor channel with:
  - One 2540 card reader punch
  - One printer
  - One 1052 console
  - Two telecommunications line groups with four lines each
- One selector channel with:
  - Four IBM 2311 Disk Storage Drives with record overflow
- A second selector channel with:
  - Four magnetic tape drives

Control Program Options:
- BTAM
- Interval timer
- Storage protection
- Resident reenterable modules

BASIC fixed requirement for MFT 24,704+1600+5(144)+5(24)).. 27,214 Bytes

OPTIONAL fixed requirement from Table 1b and 2b:
- BTAM (186 + 72)................................ 258 Bytes
- Alternate console................................ 70 Bytes

OPTIONAL fixed requirement from Table 3b:
- Storage protection............................ 460 Bytes
- Interval timing 1,978 + 2(112)............... 2,202 Bytes
- Standard list IEAIGG00........................... 7,224

10,214 Bytes

RECOVERY management requirement from Table 4b:
- SER1.. 3,432 Bytes

IOS channel requirement from Table 5b:
- Multiplexor channel............................ 60 Bytes
- Two selector channels 2(50)..................... 100 Bytes
- One channel path with direct access devices..... 32 Bytes
- 30 I/O requests 30(12)......................... 360 Bytes

552 Bytes

IOS I/O device requirement from Table 6b:

- Four unit record devices 4(56).................. 224 Bytes
- Magnetic tape capability........................ 102 Bytes
- Four magnetic tape drives 4(104)................ 416 Bytes
- Telecommunications capability.................... 62 Bytes
- Two line groups 2(20)............................ 40 Bytes
- Eight lines 8(58)............................... 464 Bytes
- Direct access capability...................... Included
- Four IBM 2311 Disks with record
  overflow 4(182)................................. 728 Bytes
- Resident error routine...................... 1,696 Bytes

3,732 Bytes

Round up factor to make requirement a multiple of 2K........ 1,520 Bytes

FIXED MAIN STORAGE REQUIREMENT FOR EXAMPLE 2................ 47,104 Bytes

Dynamic Storage Requirements in MFT

Several factors determine the dynamic storage requirements for MFT. The primary consideration is the number of jobs (or job steps) to be run concurrently and the storage required by them. During system generation, the maximum number of partitions should be established, along with their size and job class(es). The number, size, and job class(es) of partitions may be modified during system generation or during operation. There is one restriction on estimating the dynamic storage requirement: there must be one partition large enough to initiate a job and it must not contain an unending job, such as telecommunications or graphics.

The size of the partitions is affected by:

- The storage necessary to initiate the job step.
- The storage required for the load module.
- The storage required for an IBM-supplied program that the job step may use.
- The storage required for supervisor services requested by the job step and for the Checkpoint Restart work area if Checkpoint Restart is specified.
- The storage required for the data management access methods used by the job step.

Once you have established the maximum number of problem program partitions, along with their size and job class(es), you should decide how many reader and/or writers to establish in the system. Reader/interpreters and output writers operate as separate tasks and require their own partitions if they are to be resident in the system.

READER/INTERPRETER PARTITION REQUIREMENT

The size of a partition required for a reader/interpreter depends on the size of the scheduler chosen during system generation, and the size and number of input, output, and procedure buffers. (Records from the procedure library are read into a procedure buffer when a job step in the input stream invokes a cataloged procedure.)

The input and output buffer sizes (BUFL) and buffer numbers (BUFNO) are specified in the reader cataloged procedure invoked when a reader is started. The publication IBM System/360 Operating System: System Programmer's Guide includes the reader cataloged procedure supplied by IBM. The size of a procedure buffer is the blocksize specified for the procedure library. The number of procedure buffers used by the reader/interpreter is always one. If input, output, or procedure buffer sizes or buffer numbers are changed, the partition size must be adjusted accordingly. The following formula can be used to estimate the partition size for the reader/interpreter.

```
PARTITION = SCHEDULER + IB + PB + OB
-----------------------------------------------------------------------
Where:  SCHEDULER = either 30,720 or 45,056, and is the size of the
                    scheduler selected during system generation.

        IB = the storage required by the input buffers; it is
             calculated as follows:

             IB = AB + AC

             Where: A = the number of input buffers
                    B = the size of an input buffer
                    C = the size of the input/output block (IOB)

        PB = the storage required by the procedure buffers; it is
             calculated as follows:

             PB = AB + AC

             Where: A = the number of procedure buffers
                    B = the size of a procedure buffer
                    C = the size of the input/output block (IOB)

        OB = the storage required by the output buffers; it is
             calculated as follows:

             OB = AB + AC

             Where: A = the number of output buffers
                    B = the size of an output buffer
                    C = the size of the input/output block (IOB)
```

- IB+PB=0 if unblocked single buffering is used for both.
- OB=0 if unblocked single or double buffering is used.
- For a description of the IOB, refer to the publication IBM System/360 Operating System: System Control Blocks, GC28-6628.
- The partition size must be rounded to the next highest multiple of 1K, unless the storage protection feature is included in the system. When the storage protection feature is included, the partition size must be rounded to the next highest multiple of 2K.

OUTPUT WRITER PARTITION REQUIREMENT

The size of a partition required for an output writer depends on the size of the data set writer used, and the size and number of output buffers, and the size of the input buffers. The output buffer size (BUFL) and the buffer number (BUFNO) are specified in the cataloged procedure used when a writer is started. The input buffer sizes are specified for the SYSOUT data set in the problem program. The output writer partition contains two input buffers of this size. The publication IBM System/360 Operating: System Programmer's Guide contains the cataloged procedure supplied by IBM. If the buffer size or the buffer number in the procedure is overridden, the partition size must be adjusted accordingly.

If the standard (10K) data set writer is used, the partition requirement for the writer is:

PARTITION = 10,240 + IB + OB

Where: IB = the storage required by the input buffers.

IB = 2E + 2F

Where: E = the size of the input buffer
F = the size of the input/output block (IOB)

OB = the storage required by the output buffers.

OB = AB + AC

Where: A = the number of output buffers
B = the size of the output buffer
C = the size of the input/output block (IOB)

*Round the sum of OB and IB to the next highest multiple of 1K, or 2K if the storage protection option is in the system.

- For a description of the IOB, refer to the publication IBM System/360 Operating System: System Control Blocks, GC28-6628.

- If the output writer uses command chaining with machine code control character output, more than three buffers, and a unit record output device, then PARTITION = 11,264 + IB + OB.

- If variable spanned record are being used on input or output then the formula is 12,288 + IB + OB. In this case nothing extra need be added for command chaining.

- The partition size must be rounded to the next highest multiple of 1K, unless the storage protection feature is included in the system. When the storage protection feature is included, the partition size must be rounded to the next highest multiple of 2K.

- Adjust the partition size if a nonstandard data set writer is used. (For information on providing a nonstandard data set writer, see the publication IBM System/360 Operating System: System Programmer's Guide.)

- If the log is being used, the size of the output buffer must be equal to or greater than the number on the "BLKSIZE=" parameter of the log data set.

REMOTE JOB ENTRY PARTITION REQUIREMENT

Remote job entry (RJE) operates as a system task, much like a combined reader/interpreter and output writer. RJE accepts jobs submitted by remote users, passes them to the initiator/terminator for scheduling and execution, and returns the output to the remote user. The partition required for RJE can be estimated by the following formula:

$$PARTITION = 46{,}596 + 408A + 1516B + 76C + 24D + 18E + F + 48G + 16H + (13+10I)J + (13+9I)K + L + M + N + O + P + Q + R + [(624+S_1) + (624+S_2) + \ldots + (624+S_n)] + 64U + 8V$$

Where:
- A = the number of line groups
- B = the number of lines
- C = the number of terminals
- D = the number of jobs
- E = the number of users
- F = 0 if compress/expand is not selected and if compress/expand is selected, F = 832
- G = the number of completed jobs that can be in the central RJE system
- H = the number of dial lines
- I = the maximum number of terminals connected on a multipoint line
- J = the number of multipoint lines for 2780s
- K = the number of multipoint lines for 1130s
- L = 30720 if the 30K scheduler is used or L = 45056 if the 44K scheduler is used.
- M = 1,112.
- N = 6000.
- O = 0 if BTAM is resident. If BTAM is not resident, O = 5,000.
- P = the size of the JOBACK user exit option, including dynamic work areas. If the JOBACK user exit option is not selected, P=0.
- Q = the size of the JOBCARD user exit option, including dynamic work areas. If the JOBCARD user exit option is not selected, Q=0.
- R = the size of the COMMERR user exit option, including dynamic work areas. If the COMMERR user exit option is not selected, R=0.
- S_1 to S_n = the blocksizes of the SYSOUT data sets for each line simultaneously sending output
- U = the total number of MSG QEB's specified in the RJELINE macros. It will equal 4 if the default is used.
- V = the total number of JOB QEB's specified in the RJELINE macros. It will equal 10 if the default is used.

- The partition size must be rounded to the next highest multiple of 1K, unless the storage protection feature is included in the system. When the storage protection feature is included, the partition size must be rounded to the next highest multiple of 2K.

CONVERSATIONAL REMOTE JOB ENTRY (CRJE) PARTITION REQUIREMENT

CRJE allows remote access to the operating system from conversational terminals. The terminal user may prepare and update programs and data, submit them for processing, and receive the output at the terminal. CRJE jobs are processed concurrently with jobs submitted normally. CRJE operates in dynamic storage. The partition size necessary to run CRJE can be calculated by the following formula:

```
PARTITION = 53,558 + AA' + 388B + 992C + (552 + D')D + 104E
            + (1376 + F) + 48G + 32H + 32J + 16K + L + M + N + O + P
            + Q + S + 768T + U + V

Where:  A  = number of line groups.
        A' = 52 if device I/O modules are resident
           = 332 if the device is a 1050 and the I/O modules are not
             resident
           = 300 if the device is a 2740 with checking and the I/O
             modules are not resident.
           = 212 if the device is a 2741 and the I/O modules are not
             resident.
        B  = number of lines.
        C  = number of active users.
        D  = number of users receiving job output at one time.
        D' = blocksize of sysout data set.
        E  = number of START RDRs pending.
        F  = maximum blocksize of an OS data set to be EDITed.
        G  = number of completed jobs submitted by CRJE.
        H  = number of active users projected to be in synax checker
             mode at one time.
        J  = number of active users projected to be using EXEC command
             at same time.
        K  = number of active users projected to be using TABSET at
             the same time.
```

(Continued)

```
L  = syntax checker requirements

     FORTRAN = 16384
               19456 + 192
               21504
     Where:  16384 bytes are required if the E level syntax
             table, only, is to be resident.

             19456 bytes are required if the G and H level
             syntax table is to be resident

             21504 bytes are required if both the E level and
             the G and H level syntax checkers are to be
             resident
     PL/I =    17408
               21504 + 300(PLINO)
               28672
     Where:  17408 bytes are required for the resident
             restricted checker

             21504 bytes are required for full checking with
             partial dynamic structure

             28672 bytes are required for full checking with
             resident structure

             PLINO is the maximum number of PL/I statement
             lines allowed under CRJE.

             Note:  If both checkers are selected, include
                    (300 PLINO).

M  = 0 if BTAM is fully resident or 6000 if BTAM is not
     resident.
N  = size of user LOGON exit routine if included in CRJE.
O  = size of user LOGOFF exit routine if it is included in
     CRJE.
P  = size of user JOBCARD exit routine if it is included in
     CRJE.
Q  = size of user specified command processors included in
     CRJE.
R  = 0 if BTAM On-line Test is not included.
   = 2128 if BTAM On-line Test is included.
S  = 5760.
T  = number of BTAM transmission codes used.
V  = 952 if one or more 1050s on a leased line with Timeout
     Suppression feature are supported.
   = 0 if no 1050s with Timeout Suppression are supported.
```

JOB INITIATION

In MFT, the minimum amount of storage required to initiate a job depends on the size of the scheduler and the amount of storage required by an accounting routine, if one is supplied. (The storage requirement for initiation is not affected when the automatic volume recognition option is selected.) The storage required to initiate a job can be specified, during system generation, in the MINPART parameter of the SCHEDULR macro instruction. The following formulas can be used to calculate MINPART:

MINPART = 30K/44K scheduler requirement + amount of storage required by accounting routine or

or

MINPART = 30K/44K Scheduler requirement + amount of storage required for reader/interpreter

whichever is larger.

If MINPART is not specified, the scheduler design level is used as the default value.

The MFT scheduler has two design levels: 30K and 44K. The design levels of the MFT scheduler specify the amount of storage required for execution of the scheduler. This storage requirement depends on the I/O device specifications made during system generation and on the maximum number of DD statements to be processed in any one job step. The maximum allowed for each condition depends on the scheduler used. If these maximums are exceeded, the size of the scheduler increases.

The following formulas can be used to determine the initiation requirements of the 30K and 44K schedulers. If the result of the formula is less than the design level, then the scheduler operates within its design level; if the result exceeds the design level, then the scheduler requires that amount of storage to operate.

30K scheduler requirement = 30,720 + [(E•N) - 3000] + 250(D-20)

44K scheduler requirement = 45,056 + [(E•N) - 3200] + 250(D-25)

Where:

E = the sum of:

a. the number of UNITNAME macro instructions, and
b. the number of <u>different</u> unit types specified by the UNIT parameter of all IODEVICE macro instructions.

N = is determined by K, where K is the sum of:

a. the number of IODEVICE macro instructions,
b. the number of IODEVICE macro instructions that specify UNIT=2314, multiplied by one less than the number of units specified in the IODEVICE statement.
c. the number of IODEVICE macro instructions that specify UNIT=2321, multiplied by ten,
d. the number of alternate channel paths specified,
e. the number of 2314 IODEVICE macro instructions that specify alternate channel paths, multiplied by one less than the number of units specified in the IODEVICE statement.
f. the sum of all undefined unit addresses on channel 0 up to the first defined unit address for the first defined control unit and,
g. the sum of the undefined unit addresses, associated with each control unit, which would appear between the addresses defined. This applies to all channels.

K is used to determine the value of N as follows:

K	N
0 - 80	32
81 - 110	36
111 - 140	40
141 - 170	44
171 - 200	48
201 - 248	52
249 - 278	56
279 - 308	60
309 - 338	64
339 - 368	68
369 - 398	72
399 - 428	76
429 - 458	80
459 - 488	84
489 - 518	88
519 - 548	92
549 - 578	96
579 - 608	100
609 - 638	104
639 - 668	108
669 - 698	112
699 - 728	116
729 - 768	120

Note: If the value of either of the expressions [(E•N) - 3000] or [(E•N) - 3200] is less than 0, assume 0.

D = the maximum number of DD statements to be processed in any one job step. If the maximum number of DD statements is less than 20 for the 30K scheduler, assume (D-20)=0. If the maximum number of DD statements is less than 25 for the 44K scheduler, assume (D-25)=0.

The storage required to initiate a job increases beyond the computed size of the scheduler if an accounting routine is supplied. The amount of additional storage is equal to 2,750 bytes, plus the size of the accounting routine, plus the additional storage required by the routine (e.g., OPEN, GETMAIN).

With MFT, there must be at least one partition large enough for the operation of initiating a job. This partition must not contain an unending job. If the size required to initiate a job is used as the partition size, this is also the maximum amount of dynamic storage that is available to the job.

IBM-Supplied Program Requirements

IBM-supplied programs require dynamic storage in which to operate. Tables 8b through 15b contain the minimum dynamic storage requirements for these programs.

Table 8b
: contains the storage requirements for each processor. These estimates include the requirements for the access methods used by the processor. If the access method modules are resident, the requirement can be reduced by the sum of the resident modules.

Table 9b
contains the storage requirements for utility programs. These estimates do not include the requirements of the access methods used by the utility program. The sizes of the access method routines used must be added to the minimum requirements if the routines are not resident.

Table 10b
contains the storage requirements for the IEHDASDR system utility program.

Table 11b
contains the storage requirements for the IEHDASDR buffer/workarea size.

Table 12b
contains the storage requirements for the IEBDG data set utility program.

Table 13b
contains the storage requirements for IBM-supplied utility programs when the SYSUTILS macro instruction is specified. These estimates do not include the requirements of the access methods used by the utility program. The sizes of the access method routines used must be added to the minimum requirements if the routines are not resident.

In addition, dynamic storage is also required by graphic programming support, the overlay supervisors, the system environment recording functions, TESTRAN, the 1130\360 Data Transmission program, and the Loader. Section 4 contains the dynamic storage requirements for these programs.

Supervisor Services Requirements

Dynamic storage is used by the control program both while supervisor services are performed and after control is returned to the program that requires them. In MFT, the storage required for supervisor services is obtained from within the partition.

Table 14b
contains the dynamic storage for the supervisor services that perform the opening and/or closing of a data set and the handling of end-of-volume conditions.

Table 15b
contains the dynamic storage requirement for the rest of the supervisor services and also gives the duration of the storage requirement.

Access Method Requirements

Section 5 contains the storage requirements for access methods used by the job steps.

MFT—Tables

Table 1b. Fixed Storage Requirements for Control Program Options Specified in the CTRLPROG, DATAMGT, GRAPHICS, SVCTABLE, CENPROCS, and TESTRAN Macro Instructions for MFT

Macro Instruction	Control Program Option	Storage Requirement (in bytes)
CENPROCS	• Scientific or Universal Instruction Set	98
	• Model 85	1264 (3)
	• Models 155,165	336 (4)
CTRLPROG	• Main Storage Hierachy Support	1,756
	• PCI Fetch	3,472
	• Time Slicing	432
DATAMGT	• BDAM and/or BTAM and/or ISAM basic requirement	186
	• BTAM (additional)	72
	• ISAM (additional)	64
	• QTAM	600
	• TCAM	600
GRAPHICS	• Graphic Programming Services (1)	652
SVCTABLE	• User Added SVC Routines	24
	Each Resident SVC Routine (2)	4
	Each Transient SVC Routine	2
TESTRAN	• Test Translator	40

Notes:
1. For each 2250, model 1, with 4K buffer, add 32 bytes. For each 2250, model 1, with 8K buffer, add 48 bytes.
2. The size of the SVC routine(s) must be added to the fixed storage requirement.
3. Add 96 bytes if there are 2880 channels present.
4. Add 128 bytes if there are 2880 channels present.

Table 2b. Fixed Storage Requirements for Control Program Options Specified in the SCHEDULR and SECONSLE Macro Instructions for MFT

Macro Instruction	Control Program Option	Storage Requirement (in bytes)
SCHEDULR	• Alternate Console	70 (3)
	• Composite Console	
	(per console)	32
	• LOG (4)	3036
	• Multiple Console Support	1700
	Master Console	
	Composite Console	416
	Not a Composite Console	208
	Alternate Console	
	Composite Console	416
	Not a Composite Console	208
	Each 2250 used as a Master or Alternate Console	5,096
	Each 2740 used as a Master or Alternate Console	216 (1)
	Each Model 85 Operator's Console with CRT Display used as a Master or Alternate Console in MCS	3880
	Each 2260 used as a Master or Alternate Console	1696
	• SMF	6000
	• ESV	(5)
SECONSLE	• Each Composite Console (2)	416
	• Each Console that is not a Composite Console (2)	208
	• Each 2250 used as a Secondary Console	5096
	• Each 2740 used as a Secondary Console	216 (1)
	• Each Model 85 Operator's Console with CRT Display used as a Secondary Console in MCS	3880
	• Each 2260 used as a Master or Alternate Console	1696

Note:
1. If the BTAM modules IGG019M0, IGG019MA, and IGG019MB are not resident in the RAM area, add 6224 bytes when you specify a 2740 for the first time. Each additional 2740 requires only 216 bytes. In addition, for the first 2740 specified, there is a basic storage requirement of 2280 bytes if RAM has been specified, or 2182 bytes if RAM has not been specified.
2. The first console specified under SECONSLE does not require additional storage.
3. If you select the interval time, subtract 50 bytes.
4. The log is included unless NOLOG is specified during system generation.
5. If you specify ESV=SMF and you did not include SMF, add 6000 bytes.

Table 3b. Fixed Storage Requirements for Control Program Options Specified in the SUPRVSOR Macro Instruction for MFT (Part 1 of 2)

Macro Instruction	Control Program Option	Storage Requirement (in bytes)
SUPRVSOR	• IDENTIFY Facility	
	Module Nonresident	118
	Module resident	608
	• Multiple WAIT	Included
	• Resident ATTACH (without subtasking)	610
	• Resident ATTACH (with subtasking)	840 (10)
	• Resident BLDLTAB	284
	Each Resident Directory Entry	40 (1)
	• Resident EXTRACT (without subtasking)	92
	• Resident EXTRACT (with subtasking)	432
	• Resident Reenterable Load Module	380
	Each Resident Access Method Module	24 (3)
	Each Resident Module	40 (2)
	• Resident SPIE	98
	• Resident Type 3 and 4 SVC Routines	128 (4,9)
	Each Resident Module	40 (2,5)
	• Resident error recovery procedure	100
	Each resident module	24 (2)
	• Storage Protection	460 (6)
	• Job Step Timing	420
	• Timing Facilities	
	Time	236
	Interval Timing	(7)
	• Trace	416
	Each Entry in Trace Table	16
	• Transient SVC Table	102
	Each User SVC Routine Added	4
	• Subtasking	2884 (11)
	• Validity Check	244 (5)
	• Verify DASD Vol. Serial No.	Included (8)
	• On-line-test (ONLNTEST)	514 (12)
	• Patch facility	200

Table 3b. Fixed Storage Requirements for Control Program Options Specified in the SUPRVSOR Macro Instruction for MFT (Part 2 of 2)

Notes:

1. If you use the standard list IEABLD00, storage is required for nine entries. The standard list is given in the IBM System/360 Operating System: System Programmer's Guide.
2. When you select this option, add the sum of all resident modules to the fixed storage requirement.
3. If you use the standard list IEAIGG00, 30 modules are loaded with a storage requirement of approximately 7,224 bytes. Appendix A indicates the modules that are in the standard list.
4. If this option is selected, the transient SVC table option must also be selected and the required storage added.
5. If you use the standard list, IEARSV00, 29 modules are loaded with a storage requirement of approximately 29,696 bytes. Appendix A indicates the modules that are in the standard list.
6. When you select storage protection, the validity check option is included as a standard feature; the storage requirement for storage protection includes the storage required by validity check.
7. The amount of storage required by the interval timing option depends on the number of partitions generated. Use the formula:
   AMOUNT = 1978 + 112P
   P is the number of partitions.
   If BDAM or ISAM is selected, subtract 66 bytes.
   If you supply a user accounting routine, job step CPU timing is automatically provided as part of the interval timing option. For this situation use the formula:
   AMOUNT = 1978 + 112P + 290
   P is the number of partitions.
8. The NODAV option cancels verification checking. If you use this option the size of fixed main storage required for IOS resident code is decreased by 132 bytes.
9. If you select the resident reenterable load module option, subtract 46 bytes.
10. Add 32 bytes if the interval timing function is included.
    Add 12 bytes if there are floating point registers.
    Add 136 bytes if you include time slicing.
11. Add 172 bytes if you include time slicing.
    Add 52 bytes if the job step timing function is included.
    Add 30 bytes if there are floating point registers.
    Add 62 bytes if the resident reenterable load module option is selected.
    Add 24 bytes for shared DASD support.
    Add 90 bytes if you select the validity check option. (If you select main storage hierarchy support along with the validity check option, the storage requirement for both is 116 bytes.)
12. If you test more than two devices within a single test definition, add 32 bytes for each additional device up to a maximum of 14. If your system has 2880 channels, add 72 bytes.

Table 4b. Fixed Storage Requirements for Recovery Management for MFT

Description	Storage Requirement (in bytes)	
	Without MCS	With MCS
SER0 on Models 40, 50, 65, 75	254	254
SER1 on Model 40	3168	3448
SER1 on Model 50	3432	3702
SER1 on Model 65, 67-1 in 65 mode	3320	3700
SER1 on Model 75	3288	3568
CCH on Models 65, 67-1 in 65 Mode, 75, 85,	2100(1)	2100(1)
91/95, 155, 165	4000	4000
MCH on Model 85	8000	8000
MCH on Model 65 only	6144	6544
MCH on Model 155	5,408	5,408
MCH on Model 165	6,760	6,760
APR on Models 40, 50, 65, 67-1 in 65 mode, 75, 85	420	420
DDR on Models 40, 50, 65, 67-1 in 65 mode, 75, 85	2450	2450
DDR with DDR SYSRES on Models 40, 50, 65, 67-1 in 65 mode, 75, 85	3950	4070

Notes:
1. Add: 970 + 72A if your system has 2860 channels.
870 + 72A if your system has 2870 channels.
1036 if your system has 2880 channels.
62 if your system has the Model 155 (integrated) channel.
Where: A = the size of a record area for the 2860/2870 channels.

Table 5b. Fixed Storage Requirements for IOS That Depend on the Channel Configuration for MFT

Description	Storage Requirement (in bytes)
Multiplexor or high speed multiplexor channel	60
• Priority queuing	6
• Alternate selector channel	4
• Each associated logical channel	6
Selector Channel	
• Each channel (1)	50
• Second channel path on each channel	50
• Each additional channel path on each channel	32
• With priority queuing, each channel path on each channel requires additional storage	6
• First channel path with direct access devices on each channel (2)	32
• Each additional path with direct access on each channel	12
• Each channel switch (3)	18
Queuing capability	
• FIFO - first in, first out	0
• Ordered Seek Queuing	262
• Priority	104
Each queued I/O request (4)	12
One or more channels with an address greater than 6	32

Notes:
1. If the number of devices exceeds 240, add 12 bytes for each logical channel.
2. If you select shared DASD, add 8 bytes.
3. IOS routines do not provide for switching devices onto a multiplexor channel.
4. The maximum number of I/O requests that can be queued, pending satisfaction by the channels, is specified by your installation at system generation time in the MAXIO parameter of the CTRLPROG macro instruction.

Table 6b. Fixed Storage Requirements for IOS That Depend on the Type of I/O Devices Selected for MFT

Description	Storage Requirement (in bytes)
Unit record capability	0
• Any graphic devices	34
• Each unit record device (1)	56
• Each 1403 printer with UCS feature	64
• Each optical character reader	54
• Each 2495 tape cartridge reader	78
• Each magnetic character reader	48
Graphics capability	206
Magnetic tape capability	102
• Any read/write tape adapter units	38
• Each magnetic tape drive	104(3)
Telecommunications capability	62
• Each telecommunications line group	20
• Each telecommunications line	58
Direct access capability (2)	Included
• Any drum storage devices	36
• Each 2302, 2303, and 2311 without record overflow	142
• Each 2302, 2303, and 2311 with record overflow	182
• Each 2301	182
• Each address for a 2314	182
• Each 2321 without record overflow	290
• Each 2321 with record overflow	330
• Resident error routine	
Basic support (only 2311 devices)	1368
Any number of 2314 devices	28
Any number of 2301 devices	20
Any number of 2302 devices	70
Any number of 2303 devices	12
Any number of 2321 devices	16
with record overflow	248
with CCH	88
with DDR	30
with SYSRES DDR	16

Notes:

1. The following rules apply:
   - A console is considered a unit record device.
   - A 2540 card reader-punch counts as two unit record devices.
   - A card reader and printer used as a composite console are counted as two nonconsole devices.
2. If shared DASD is specified, add 1,283 bytes.
3. If you select EVA, add 22 bytes + 16 bytes for each tape drive. If you select ESV, add 22 bytes + 24 bytes for each tape drive. If you select ESV and EVA, add 22 bytes + 24 bytes for each tape drive.

Table 7b. Fixed Storage Requirements for IOS That Depend on the Type of IBM-Supplied Processing Program Selected for MFT.

Description	Storage Requirement (in bytes)
OLTEP	28(1)

Note:
1. If your channel configuration includes 2880 channels, add an additional 16 bytes.

Table 8b. Minimum Dynamic Storage Requirement for IBM-Supplied Processing Programs for MFT (Part 1 of 2)

Processing Program	Access Method Used	Storage Requirement (in bytes)
ALGOL	BSAM,QSAM	45,056
Assembler E Assembler F	BSAM,BPAM QSAM,BPAM,BSAM	16,360 49,152
COBOL E COBOL F American National Standard COBOL GSD for COBOL F	BSAM,BPAM BSAM,BPAM BSAM,BPAM GAM	17,504 81,920 81,920 35,318 (7)
FORTRAN IV E FORTRAN IV G FORTRAN IV H GSP FOR FORTRAN IV	BSAM QSAM QSAM GAM	15,360 (1,2) 81,920 (3) 155,648 (4) 35,318 (7)
GJP	BSAM,GAM,BPAM	70,000 (8)
Linkage Editor E (15K) Linkage Editor F (18K) Linkage Editor F (44K) Linkage Editor F (88K) Linkage Editor F (128K)	BSAM,BPAM BSAM,BPAM BSAM,BPAM BSAM,BPAM BSAM,BPAM	15,500 18,744 45,056 90,112 131,072
OLTEP	BSAM,BPAM	28,000
PL/1 F GSP for PL/1 F	SAM,BPAM GAM	45,056 35,318 (7)
RPG E	BSAM	15,360
SGJP	BSAM,BTAM,BPAM	70,000 (8)
Sort/merge	QSAM	16,000 (5)
TESTRAN editor	BSAM	18,432 (6)

Table 8b. Minimum Dynamic Storage Requirement for IBM-Supplied Processing Programs for MFT (Part 2 of 2)

Notes:

1. This estimate includes enough work space to process approximately 170 cards. More storage may be required by larger source programs.
2. If the PRFRM option is used, then the minimum main storage requirement is 19,456 bytes. If blocked input or output are also used, then the minimum main storage requirement is increased by the value of the expression [2+(BLKSIZE)] for each data set that contains blocked records.
3. This estimate includes sufficient work space to process approximately 400 cards. More storage may be required by larger source programs.
4. This estimate includes sufficient work space to process approximately 200-300 cards with a blocking factor of five for the SYSPRINT and SYSLIN data sets. More storage may be required by larger source programs; add 18,432 for each additional 100 cards.
5. This estimate is for sort/merge with no linkage editor or direct access devices; if a linkage editor is used, the minimum dynamic requirement is the requirement for the linkage editor selected. In addition, conditions such as physical record length greater than 400 bytes, large numbers of intermediate storage data sets, or extracted control fields require additional main storage.
6. The TESTRAN editor requires an overlay supervisor. The storage required by the overlay supervisor specified for the system during system generation must be added to the TESTRAN editor requirement.
7. This estimate assumes that the modules are loaded with the LOAD macro instruction. Appendix A contains a list of the modules and their dynamic storage requirements.
8. This estimate includes a constant storage requirement of 10,000 bytes and one active partition or region of 60,000 bytes actually performing job control operations (GJP or SGJP). There is no 60,000 byte requirement during execution of a problem program initiated by GJP or SGJP at the display terminal. The 60,000 byte requirement is the minimum size partition that may be specified with a scheduler requirement of 48,000 bytes; larger values are permissible.

Table 9b. Minimum Dynamic Storage Requirement for IBM-Supplied Utility Programs and Service Aids for MFT (Part 1 of 3)

Utility Program	Storage Requirement (in bytes) (1)
• System utilities:	
IEHATLAS	9,740 + R + 16(T)
IEHDASDR	(2)
IEHINITT	12,483
IEHLIST	17,800
IEHMOVE	15,360
IEHPROGM	12,758
IFCEREPO (Models 40, 50, 65, 75)	20,480
IFCEREPO Model 165	28,672
• Data set utilities:	
IEBCOMPR	14,813 + 2B + 2L + E
IEBCOPY	27K + M + N + P
IEBTCRIN	10,230 + A + R + E
IEBDG	(7)
IEBEDIT	10,936
IEBGENER	12,164 + 4B + 2L + E + F
IEBISAM	5,000 + R
IEBPTPCH	15,691 + 4B + E + F
IEBUPDAT	8,722 + 2B
IEBUPDTE	16,546 + 4B + 2L + E
• Service Aids	
IMASPZAP	16K
IMAPTFLS	6K
IMAPTFLE	46K
IMBMDMAP	36K
IMDPRDMP	42K

Table 9b. Minimum Dynamic Storage Requirement for IBM-Supplied Utility Programs and Service Aids for MFT (Part 2 of 3)

Where: A = 2 times the BUFL on SYSUT1

B = the largest blocksize in the job step, rounded to the next highest multiple of 2K. If the format specified for the data set is VS and LRECL is less than 32K, use R instead of B in the formula.

R = the maximum logical record length, rounded to the next highest multiple of 2K.

L = 2,048 if user header and trailer labels are to be processed; otherwise, L=0.

E = the sum of:

1. Each user exit routine rounded to the next highest multiple of 2K and
2. The storage made available to the user exit routines, by the utility, rounded to the next highest multiple of 2K.

F = 2,048 for each group of MAX parameters that are less than or equal to 200 bytes.

M = 1K minimum and is the sum of:

1. the maximum number of input data sets referenced in any COPY step multiplied by 10,

2. the maximum number of membernames, including newnames, multiplied by 10 - this number is added only when SELECT or EXCLUDE is used,

3. the maximum number of newnames referenced in any COPY step multiplied by 4, add 4 bytes to this number

4. the maximum number of input members referenced in the largest input data set specified in any COPY step multiplied by 10 - this number should be added when EXCLUDE or "Full Copy" is used and 80 bytes should be added to the total.

N = the sum of:

1. the number of directory blocks allocated to the largest output directory used in the job step multiplied by 276,

2. the maximum number of input members to be copied from any one input data set referenced in the job step multiplied by 74.

* The storage required for N is only necessary for optimal performance.

P = 2K minimum and is twice the maximum input or output blocksize. If you are performing a compress-in-place operation, B = the maximum track capacity of the device being used. If you allow the minimum 2K for P, the maximum input or output blocksize can be only 700 bytes. This number should be rounded up to the next multiple of 1K or 2K if the storage protection option is specified.

T = maximum number of records per track.

Table 9b. Minimum Dynamic Storage Requirement for IBM-Supplied Utility Programs and Service Aids for MFT (Part 3 of 3)

Notes: 1. If you are planning to specify the SYSUTILS macro instruction during system generation, use Table 13b to determine what size to specify. 2. To determine the minimum dynamic storage requirements for the IEHDASDR system utility program, use Tables 10b and 11b. 3. When using the compress facility, the minimum dynamic storage requirement is 28,000 + T. Where: T = the maximum track capacity of the device being used + $\frac{\text{maximum track capacity} \bullet 6}{100}$ + 1,000. 4. To determine the minimum dynamic storage requirements for the IEBDG data set utility program, use Table 12b.

Table 10b. Minimum Dynamic Storage Requirements for IEHDASDR System Utility Program for MFT

Function	Storage Requirement (in bytes) (1)
ANALYZE/FORMAT(3)	15,700 + (N•B) + N(344) + M(280)
ANALYZE(3,4)	16,140 + (N•B) + N(344)
DUMP (5)	17,800 + (N•B) + N(360) + M(280)
GETALT	10,728
LABEL	10,982
RESTORE	12,680 + X + N(344) + M(280)

Where: B = a buffer/workarea size determined by the function performed and the device type being used. Table 11b contains the computed size, rounded to the next highest multiple of 2K.

M = the number of copies to be made.

N = the number of operations to be performed, with a minimum of 1 and a maximum of 6. If enough storage is provided, multiple operations will be performed concurrently. (For information on performing multiple functions concurrently, refer to the publication <u>IBM System/360 Operating System: Utilities</u>, GC28-6586.)

X = a buffer/workarea size required to perform one or more RESTORE operations, and is computed as 2B • (N-1) + B. The computed size provides enough storage to perform multiple RESTORE operations concurrently.

<u>Notes</u>:
1. If the QSAM access method is not resident, add 2,000 bytes to the minimum requirement.
2. The minimum dynamic storage requirement for job steps performing multiple functions is the region size of the function that has the largest region size requirement.
3. If the IPL text is required and is supplied via the input stream, add 3,640 bytes.
4. Use this formula only when ANALYZE is to be performed on an IBM 2321 Data Cell.
5. If a permanent data check or missing address marker is encountered during a dump to SYSOUT, an additional 1000 bytes is required to recover and print the defective track.

Table 11b. IEHDASDR Buffer/Workarea Size for MFT

Function	Device Type					
	IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage	IBM 2321 Data Cell
ANALYZE/ FORMAT	22,528	6,144	6,144	6,144	8,192	4,096
DUMP	26,624	8,192	8,192	6,144	10,240	6,144
RESTORE	24,576	8,192	6,144	6,144	10,240	4,096

Table 12b. Minimum Dynamic Storage Requirements for IEBDG Data Set Utility Program for MFT

IEBDG = 12,000 + A + B + C + D + E + F + G(176)

Where: A = 520 • (H/8)

Where: H = the number of FD statements. If H is less than or equal to 8, then A=520. The value for A must be a multiple of 520.

B = 512 • (I/18)

Where: I = the number of CREATE statements. If I is less than or equal to 18, then B=512. The value for B must be a multiple of 512.

C = the sum of all field lengths on all FD statements. Each length must be rounded to the next highest multiple of 8. Use one of the following to calculate the value to be used for a particular FD statement, if any of the conditions apply:

- If ripple action and a format of AN, AL, or CO are specified on an FD statement, use the following formula to calculate the field length:

  L = FL + FR

  Where: L = the value to be used for this FD statement when determining the value for C.

  FL = the length of the defined field specified on the FD statement.

  FR = 36 for AN, 26 for AL, or 63 for CO. (If FL is larger than FR, then L=FL.)

- If ripple or wave action and PICTURE are specified, the value to be used for this FD statement is:

  2 • picture length

- If roll action and PICTURE are specified, the value to be used for this FD statement is:

  3 • picture length

D = S + (6•N)

Where: S = the sum of all picture lengths on all CREATE statements. Each length must be rounded to the next highest multiple of 8.

N = the number of pictures.

E = U + 72(N/8)

Where: U = the dynamic storage requirements for all user exit routines.

N = the number of user exit routines.

- The value for E must be a multiple of 8.

F = the logical record length of the output data set. If RECFM=U, then F=blocksize. The value for F must be a multiple of 8.

G = the number of user-specified input and output data sets. The value for G must be a multiple of 8.

Table 13b. Minimum Dynamic Storage Requirement for IBM-Supplied Utility Programs When the SYSUTILS Macro Instruction is Specified for MFT

Utility Program	Storage Requirement (in bytes) (1)
• System utilities:	
IEHDASDR	N/A (2)
IEHINITT	N/A (2)
IEHLIST	31,000
IEHMOVE	21,504 + B (3)
IEHPROGM	23,000
IFCEREPO	N/A (2)
• Data set utilitiies:	
IEBCOMPR	23,551 + 2B + 2L + E
IEBCOPY	(See Table 8b.)
IEBTCRIN	N/A (2)
IEBDG	N/A (2)
IEBEDIT	N/A (2)
IEBGENER	23,551 + 4B + 2L + E + F
IEBISAM	N/A (2)
IEBPTPCH	23,551 + 4B + E + F
IEBUPDAT	23,551 + 2B
IEBUPDTE	23,551 + 4B + 2L + E

Where: B = the largest blocksize in the job step, rounded to the next highest multiple of 2K. If the format specified for the data set is VS and LRECL is less than 32K, then B = the maximum logical record length, rounded to the next highest multiple of 2K.

L = 2,048 if user header and trailer labels are to be processed; otherwise, L=0.

E = the sum of:

1. Each user exit routine rounded to the next highest multiple of 2K and
2. The storage made available to the user exit routine by the utility, rounded to the next highest multiple of 2K.

F = 2,048 for each group of MAX parameters that are less than or equal to 200 bytes.

Notes:

1. If you specify a size smaller than 20,479 in the SYSUTILS macro instruction, all of the utility programs operate in the storage shown in Table 9. If the size you specify is larger than the minimum storage requirement for a particular utility program, that program will be taken out of overlay structure. In order for all of the affected programs to be taken out of overlay structure, the largest minimum storage requirement must be specified.
2. This utility program is not affected by the size specified in the SYSUTILS macro instruction. It operates in the storage shown in Table 9.
3. The IEHMOVE utility program is not in overlay structure. If the size you specify is equal to or greater than 21,534, successive loading of IEHMOVE modules takes place at execution time.
4. When using the compress facility, the minimum dynamic storage requirement is 23,551 + T. Where: T = the maximum track capacity of the device being used + $\frac{\text{maximum track capacity} \cdot 6}{}$ + 1,000.

Table 14b. Dynamic Storage Requirement for OPEN/CLOSE/EOV for MFT

Supervisor Service	Storage Requirement (in bytes)
OPEN	
• With security protection	960 + 496 (N-1)
• Without security protection	800 + 496 (N-1)
Add to one of above entries, if relevant:	
• Each Format 3 data set control block for BSAM or QSAM	144
• Each additional Format 1 data set control block for BPAM (concatenated data sets only)	176
• Each Format 3 data set control block for BPAM (concatenated data sets only)	144
• Each additional Format 1 data set control block for ISAM and/or BDAM	104
• Each Format 3 data set control block for ISAM and/or BDAM	144
• Each ISAM data set	144
• Each 1403 printer with UCS feature	272
CLOSE	
• With RLSE	1,200 + 472 (N-1)
• Without RLSE	800 + 472 (N-1)
• With EOV (QSAM only, with or without RLSE)	1,480 + 472 (N-1)
• With EOV and EXTEND (QSAM only, with or without RLSE)	1,656 + 472 (N-1)
EOV	
• With EXTEND	1,000
• Without EXTEND	800
• With security protection	848
Where: N = the total number of data sets that are opened (or closed) at the same time; i.e., with the same OPEN (or CLOSE) macro instruction.	

When user label processing is specified (i.e., LABEL=(,SUL) is coded on the DD statement), an additional 168 bytes of dynamic storage are required.

Note: An additional 1024 bytes of dynamic storage should be added to the totals obtained from tables 14b. and 15b. This additional storage is used by the system to process supervisor services and interrupts that may occur during execution. If this storage is not provided, the job step may terminate due to insufficient storage.

Table 15b. Dynamic Storage Requirement for Supervisor Services for MFT (Part 1 of 2)

Supervisor Service	Storage Requirement (in bytes)	Duration of Requirement
ABEND •Normal & Abnormal Termination All data sets not closed •Abnormal Termination Dump Requested Outstanding Enqueues (MFT with subtasking)	240 700 4800 100	Temporary Temporary Temporary Temporary
ATTACH •Load module on link or job library •Load module in main storage •Load Module in RENT area	656 248 216 256	Temporary Released when task is terminated Released when task is terminated Released when task is terminated
BLDL	496	Temporary
DEQ	100 (2)	Temporary
Execution of job step	156 + (16 + 4D)E + (12 + 4G)F (see note 1)	Released when job step is terminated
FIND	496	Temporary
IDENTIFY	40	Released when load module is released
LINK, LOAD, XCTL •Load module on link or job library •Load module in main storage •Load Module in RENT area	656 32 0 40	Temporary Released when load module is released Released when load module is released
RESERVE	34 * R	Temporary
SETPRT	736	Temporary
SPIE	48	Released when task is terminated
STIMER (with exit routine)	72	Released when exit routine completes
STOW	1,738	Temporary
Where: R = the length of the rname used to represent the serially reusable resource (1 to 255 bytes)		

Table 15b. Dynamic Storage Requirement for Supervisor Services for MFT (Part 2 of 2)

<u>Notes</u>: 1. The variables in this formula are: D = the average number of devices in each DD statement. E = the number of DD statement. F = the number of device pools. G = the average number of devices in each device pool. 2. This storage is required only when the shared DASD option has been selected and a DEQ macro instruction is issued to release a device that has been reserved.

MVT and M65MP—Contents

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MVT and M65MP—Fixed and Main Storage Requirements

The total amount of main storage required, for MVT or M65MP, is the sum of the fixed and dynamic storage requirements.

- Fixed main storage is the main storage used by the resident portion of the control program.

- Dynamic main storage is main storage used during program execution by nonresident system functions, processing programs, and problem programs.

The total amount of fixed main storage that your system requires is determined by four factors:

1. The basic fixed storage requirement -- for MVT this is the amount of storage required by the nucleus, the master scheduler region, the modules always loaded into the link pack area, and the system-queue area; for M65MP this is the storage required by the prefixed storage area 1, the nucleus, the master scheduler region, the modules always loaded into the link pack area, the prefixed storage region 2, and the system queue area.

2. The optional fixed requirement -- this amount depends on the control program options you select during system generation. Since M65MP is an version of MVT and is completely dependent on a functional MVT system, all configurations, functions, and options available with MVT are also available with M65MP. (The exceptions are: Main Storage Hierachy Support, 2816 Switching Unit Support for more than one console per CPU, support for Shared DASD.)

3. The recovery management requirement -- this amount depends on the recovery management facilities you select during system generation.

4. The input/output supervisor (IOS) storage requirement -- this amount depends on the nature of the input/output devices you select during system generation.

The sum of the storage required by these four factors is the fixed storage size necessary for your system.

The maximum dynamic storage requirement, for MVT or M65MP, is dependent on the number and sizes of the regions that you establish for the job scheduler routines and operator commands. Figures 5 and 6 show how main storage is organized for systems running under MVT and M65MP respectively.

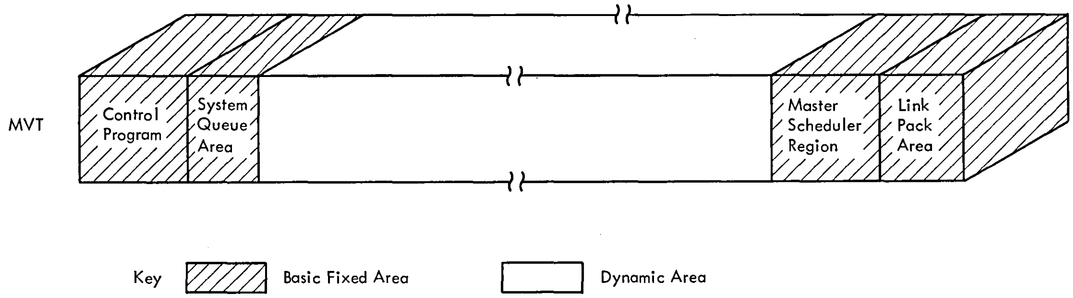

Figure 5. Main Storage for a System Running Under MVT

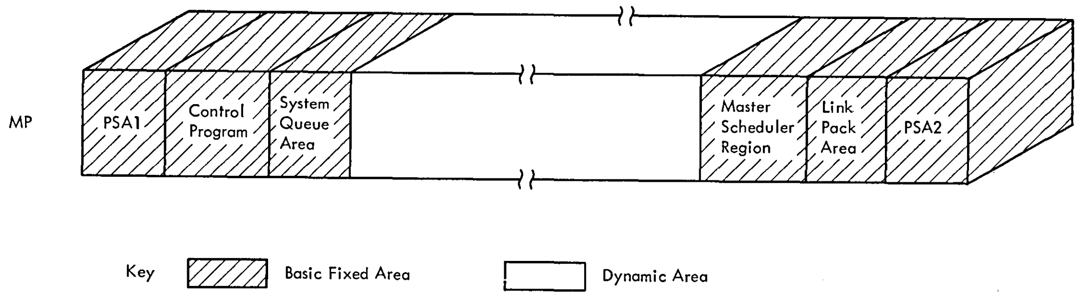

Figure 6. Main Storage for a System Running Under M65MP

Basic Fixed Requirement

WITH MVT

The basic fixed requirement for MVT is the amount of storage required by the nucleus, the master scheduler region, the modules always loaded into the link pack area with MVT, and the system queue area.

BASIC MVT				
NUCLEUS	=	43,576 (1,2)		
MSR	=	12,288		
LPA	=	6,144	= 63,488	+ SQA (4)
ROUND-UP	=	1,480 (3)		

Notes:
1. If the link library or the SVC library contains multiple extents, the basic fixed requirement must be increased 16 bytes per additional extent. If the link library consists of more than one volume, the basic fixed requirement must be increased 1 byte per additional volume and 16 bytes per extent on each additional volume.
2. Add the total of all user-written routines for the system management facilities (SMF).
3. The basic fixed requirement must be a multiple of 2K.
4. A discussion of the requirement for the system queue area follows.

WITH M65MP

The basic fixed requirement for M65MP is the amount of storage required by the prefixed storage area 1, the nucleus, the master scheduler region, the modules always loaded into the link pack area with MVT, the prefixed storage area 2, and the system queue area.

BASIC M65MP				
PSA1	=	3,379		
NUCLEUS	=	47,262 (1,2)		
MSR	=	18,432		
LPA	=	6,144	= 79,872	+ SQA (4)
PAS2	=	4,096		
ROUND-UP	=	775 (3)		

Notes:
1. This requirement includes the MVT nucleus and additional storage required for M65MP.
2. If the link library or the SVC library contains multiple extents, the basic fixed requirement must be increased 16 bytes per additional extent. If the link library consists of more than one volume, the basic fixed requirement must be increased 1 byte per additional volume and 16 bytes per extent on each additional volume.
3. The basic fixed requirement must be a multiple of 2K.
4. A discussion of the requirement for the system queue area follows.

SYSTEM QUEUE AREA

With MVT, the basic fixed requirement also includes storage required by the system queue area (SQA), which the control program uses for control blocks and work queues. The user specifies the initial size of the system queue area in the CTRLPROG macro instruction during system generation, but the operator may increase the size when the system is initialized. (The size of the SQA may never by decreased below the value set during system generation.) If more storage is required by the SQA and there is free storage contiguous to the area, the SQA will expand upward in 2K blocks.

The number and size of control blocks and work queues within the SQA vary depending on what functions are being performed at the same time. This causes the storage required by the SQA to fluctuate. The following formula can be used to calculate the maximum SQA needed for a specific environment (i.e., a specific number of readers, writers, initiators, etc.). This maximum would only be required when all of the functions need their maximum requirements at the same time. To determine what size you should specify for the SQA, do one of the following: (1) specify the maximum to ensure that there is always enough available storage in the SQA; (2) use 20K as a guideline (most users with 4 initiators and without remote job entry do not require more than 20K); or (3) examine the formula to see what affects the size of the SQA, and, depending on the environment and the functions being performed, estimate how large the SQA should be.

$$SQA = 4472 + (148 \bullet B) + (24 \bullet O) + (48 \bullet P) + (960 \bullet C) + (500 \bullet D) + (2808 \bullet I) + W + J + R$$

Where: B = the number of write-to-operator buffers plus the number of write-to-log buffers selected during system generation.
O = the number of reply queue elements selected during system generation.
P = the number of modules and SVC routines resident in the link pack area, excluding the required link pack area modules.
C = the number of operator commands requiring separate regions that may operate concurrently.
D = the number of direct system output writers started.
I = the number of reader/interpreters operating concurrently.
W = 2,920 for one output writer plus 2,240 bytes for each additional output writer operating concurrently.
J = the sum of the amount of space required in SQA by the job steps operating concurrently. Because the SQA requirement of a job step depends on the functions and processors used by the step, and because the job steps that are running concurrently change continually, the amount of SQA space required should be estimated based on the following three values:

1. The minimum workable value for the SQA requirement of a job step is 3,000 bytes per initiator. This value provides enough space for a job step that meets the following requirements:
   a. Consists of a single load module.
   b. Does not multitask.
   c. Uses from three to seven data sets.
   d. Has from one to three data sets open at the same time.
   e. Does not abnormally terminate.

2. A workable value for the SQA requirement of a very large job step is 5,000 bytes per initiator. This value provides sufficient space for the execution either of any IBM-supplied processor or of a job step that meets the following requirements:
   a. Does not multitask.
   b. Has up to five load modules in its region at one time (excluding access method modules).
   c. Uses up to twelve data sets.
   d. Has up to twelve data sets open at the same time.
   e. Has up to seven unique data set names of 44 characters each.
   f. Does not abnormally terminate.
3. If a job step abnormally terminates, 2,000 bytes of additional storage are required in the SQA. Therefore, you will want to take this into consideration when determining the estimated value for J.

R = the round-up factor required to make the system queue area a multiple of 2K.

SYSTEM QUEUE AREA FOR REMOTE JOB ENTRY

When you select remote job entry (RJE), additional space is required in the system queue area. The amount of additional storage required can be estimated with the following formula:

SQA for RJE = 3,568 + 92A + 100B + 80C + 144D + 48E + 96F

Where: A = the number of line groups

B = the number of lines

C = the number of nonresident RJE modules that are active at one time (assume one or two)

D = the number of access method modules that are active at one time (assume four for BTAM, and one or two for BSAM or BDAM)

E = the number of completed remote jobs residing in the central system (the maximum value for E is the number of remote jobs the system will support)

F = number of queued RJE central commands specified on the RJETABL macro.

SYSTEM QUEUE AREA FOR CONVERSATIONAL REMOTE JOB ENTRY

When you select conversational remote job entry (CRJE), additional space is required in the system queue area. The additional storage required can be estimated by the following formula:

SQA for CRJE = 2984 + 92A + 40(B + 4) + 144C + 96D

Where: A = number of line groups.

B = the size of the CRJE transient area specified in the PARM field in the EXEC statement of the CRJE procedure.

C = number of access method modules active at one time (assume four for BTAM; two for BSAM).

D = number of queued CRJE commands specified on the CRJETABL macro.

SYSTEM QUEUE AREA FOR THE TIME SHARING OPTION (TSO)

If you specify the time sharing option (TSO), additional space is required in the system queue area. The additional storage can be estimated by the following formula:

SQA for TSO = 4000 + 220A + B + 70C + (DxE) + F(64 + 30G + 16D + (GxH))

Where: A = the number of active foreground regions.
B = 70 if a data set is provided for TSO Dump; otherwise B = 0.
C = the number of swap data sets.
D = the average number of data sets requested by more than one user.
E = the average length of the data set names that are requested by more than one user.
F = the number of logged-on users.
G = the average number of data sets requested by only one user.
H = the average length of the fully qualified name of data sets requested by one user only.

SYSTEM QUEUE AREA FOR SMF

SMF requires space in the system queue area. The size of the area required for SMF can be estimated by the following formula:

SMF Area = Timing Control Table Size (TCTSIZE) + SMF Control Table Size + SMF I/O Buffer Size

TCTSIZE: One TCT is created for each active job (No. of TCT's = No. of active initiators); if OPT=2 is selected, its size can be estimated by the following formula:

TCTSIZE = 100 + 12(No. of DD statements) + 8(No. of devices)

If OPT=1 is selected, the size of the TCT=88 bytes with hierachy 1 storage, or 72 bytes without hierachy 1 storage.

SMF Control Table: The size of the SMF Control Table = 124 bytes.

SMF I/O Buffer: The SMF I/O Buffer requires space in the SQA. The minimum buffer size is 400 bytes which is twice the size of the largest record that can be written on the SMF data set. The maximum buffer size is 64K bytes. If you want the I/O, involved in writing from the buffer to the SMF data set, to occur at the rate of once per job, specify a buffer size that is twice the size of the records produced during the job. For example: a job that produced 929 bytes of information would require a buffer size of approximately 2000 bytes. (For further information on SMF, see the publication IBM System/360 Operating System: System Programmer's Guide.)

Optional Fixed Requirement

You can add control program options that: (1) change the organization and size of fixed main storage by making certain modules and tables resident, and (2) increase the size of fixed main storage by adding extra services to your system.

Four control program options change the organization of storage and can cause the fixed area to be increased. Although these options decrease the dynamic area, they improve the performance of the operating system. The following options are involved:

- Resident reenterable load module (RENT) option -- allows access method modules to be resident.
- Resident link library directory (BLDTAB) option -- allows all or a portion of the directory for the link library to be resident.
- Resident type 3 and 4 supervisor call (SVC) routine option -- allows reenterable modules of type 3 and 4 SVC routines to be resident.
- Resident error recovery procedure (ERP) option -- this option allows selected error recovery procedures to be resident.

Figures 7 and 8 show how main storage is organized when you specify all of these options.

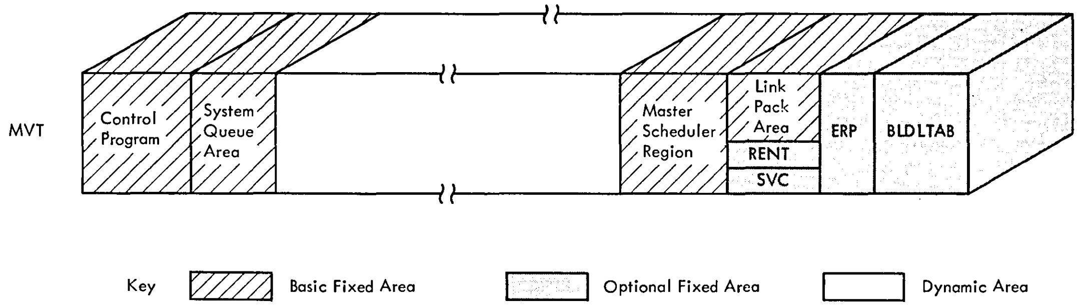

Figure 7. Effect of Control Program Options on the Organization of Main Storage for a System Running Under MVT

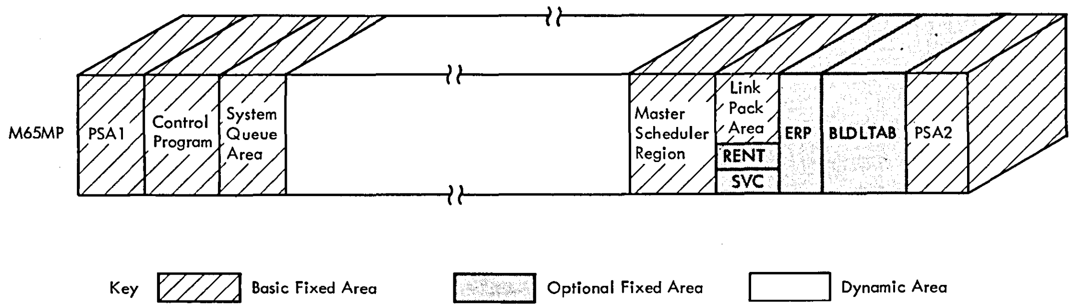

Figure 8. Effect of Control Program Options on the Organization of Main Storage for. a System Running Under M65MP

During system generation, you can add control program options that tailor the system to your installations needs. These options require additional fixed storage and are specified by the following macro instructions:

- CENPROCS -- specifies the central processing unit.
- CTRLPROG -- specifies the operating system configuration.
- DATAMGT -- specifies the optional access methods.
- GRAPHICS -- specifies the graphics programming services.
- SCHEDULR -- specifies job scheduler options.
- SECONSLE -- specifies secondary consoles in MCS.
- SUPRVSOR -- specifies task supervisor options.
- SVCTABLE -- specifies supervisor call (SVC) routines.
- TESTRAN -- specifies the test translator.

Table 1c
: contains the fixed storage requirements for the options specified in the CENPROCS, CTRLPROG, DATAMGT, GRAPHICS, SVCTABLE, and TESTRAN macro instructions.

Table 2c
: contains the fixed storage requirements for the options specified in the SCHEDULR and SECONSLE macro instructions.

Table 3c
: contains the fixed storage requirements for the options specified in the SUPRVSOR macro instruction.

When you estimate the optional fixed storage requirements, include the storage required by:

1. Resident user-added SVC routines.
2. Resident BLDLTAB entries.
3. Resident reenterable load modules.
4. Resident type 3 and 4 SVC routine modules.
5. Error recovery procedures.
6. The round-up factor for MVT necessary to make the sum of items 1, 2, 3, 4, and 5 a multiple of 2K.

Recovery Management Requirement

The operating system requires storage in order to perform recovery management. The recovery management procedures consists of recording system environment data at the time of a machine malfunction and providing an analysis of this data to determine whether recovery is feasible. The data is arranged in a usable format and written on the SYS1.LOGREC data set.

There are six recovery management facilities available:

- System Environment Recording (SER0): SER0 is an independent function that determines the type of malfunction and, if possible, writes the error on SYS1.LOGREC. It does not use any operating system facilities to collect and record data. SER0 consists of a resident module and a nonresident module. The nonresident module is loaded into the dynamic area without regard to what was previously there. After SER0 completes its operation, no further operations are allowed and the system goes into a wait state.

- System Environment Recording (SER1): SER1 is a completely resident function that uses operating system facilities to collect and record data. SER1 resides on the SYS1.LINKLIB and is attached to the nucleus at IPL/NIP time. When SER1 completes recording the data associated with the malfunction, it attempts to determine (1) the effect and extent of the damage caused by the malfunction, and (2) whether the failure affected only a specific task. If the failure has not damaged the supervisor, and if the malfunction can be related to a specific task, the task is terminated. If the supervisor is damaged of if the malfunction cannot be related to a specific task, all operations are terminated and the system goes into a wait state.

- Machine Check Handler (MCH): MCH records the data associated with a machine check error and attempts a recovery by retrying the failing instruction. If retry is not possible, MCH attempts to determine the task affected by the failure and to terminate the associated job step. MCH also includes the facility of refreshing areas of main storage if the associated load module has the refreshable attribute. The system is placed in a wait state only when the effects of the failure cannot be definitely determined, when non-refreshable program damage has occurred in the supervisor, or when a non-recoverable machine failure exists.

- Channel Check Handler (CCH): CCH intercepts channel check conditions, performs an analysis of the environment, and facilitiates recovery from channel check conditions by allowing for the scheduling of device dependent error recovery procedures by the input/output supervisor, which will determine whether the failing channel operation can be retried. CCH also constructs a channel error inboard record entry to be written onto SYS1.LOGREC by the outboard recorder routine (OBR) of the I/O supervisor. If CCH is not present in the system, one of the other recovery management facilities receives control and writes an error record for the channel failure. In this case, the error causes system termination.

- Alternate Path Retry (APR): APR allows an I/O operation that developed an error on one channel to be retried on another channel. The alternate channel must be one that has been assigned to the device performing the I/O. APR also provides the capability to logically connect a channel path to a device online or offline by use of the VARY command. APR is optional for MVT and is included in M65MP.

- Dynamic Device Reconfiguration (DDR): DDR allows a demountable volume to be moved from one device to another and repositioned, if necessary, without abnormally terminating the affected job or reperforming IPL. A request to move a volume can be initiated by the operator, or by the system, after a permanent I/O error for demountable SYRES or non-SYSRES volumes. DDR is optional for MVT and is included in M65MP.

The desired recovery management facility is specified at system generation in the SUPRVSOR macro instruction. If you do not specify recovery management, the systems assigns a default of either SER0 or SER1 (except for M65MP) depending on the size of main storage. If you don't specify CCH and MCH for the Models 85, 155, and 165, they are automatically included during system generation. CCH is autimatically included for the Model 195.

Table 4c
: contains the storage requirements for the recovery management facilities available on each model.

Input/Output Supervisor Requirement

In addition to the basic and optional fixed requirement, the operating system also requires storage for the input/output supervisor (IOS). Part of the storage required for IOS is included in the basic fixed storage requirement. The total amount of storage required by IOS depends on the I/O configuration selected during system generation.

Table 5c
: contains the fixed storage requirements for the I/O channel configuration.

Table 6c
: contains the fixed storage requirements for the type of I/O devices specified.

Table 7c
: contains the fixed storage requirements for the type of IBM-supplied processing program selected.

Example 3 – Estimating a Fixed Storage Requirement for MVT

Example 3 shows how the fixed storage requirement was estimated for an MVT configuration. The scheduler uses one reader/interpreter and three output writers. Multiple console support or SMF is not in the system.

System/360 Configuration:
- Model 65 with 512K bytes of storage with storage protection
- SER1
- Priority queueing, with 40 I/O requests queued on the channels
- One multiplexor channel with:
  - One 2540 card reader punch
  - One console
  - Three printers
- One selector channel with:
  - Four IBM 2311 Disk Storage Drives with record overflow
  - Six magnetic tapes
- A second selector channel with:
  - Four IBM 2311 Disk Storage Drives with record overflow
  - One IBM 2301 Drum Storage Drive
- A channel switch is used to attach four additional magnetic tapes to the two selector channels

Control Program Options:
- Four additional transient areas
- Job step timing
- Resident reenterable load modules

```
BASIC fixed requirement for MVT 63,488  + 20,480........... 83,968 Bytes

OPTIONAL fixed requirement from Table 1c:
  • Two additional pairs of
    transient area 2(2,990)...................... 5,980 Bytes

OPTIONAL fixed requirement from Table 3c:
  • Job step timing............................... 144 Bytes
  • Standard list IEAIGG00.......................... 7,224
                                                            7,368 Bytes

RECOVERY management requirement from Table 4c:
  • SER1.............................................. 3,288 Bytes

IOS channel requirement from Table 5c:
  • Multiplexor channel............................ 60 Bytes
  • Priority queueing on the channel................. 6 Bytes
  • Two selector channels 2(50).................... 100 Bytes
  • One additional channel path
    on each channel 2(50).......................... 100 Bytes
  • Two channel paths on each channel with
    priority queueing on the channels 2(2)(6)....... 24 Bytes
  • One channel path with direct access
    devices on each channel 2(32)................... 64 Bytes
  • One channel switch............................. 18 Bytes
  • Priority queuing............................... 104 Bytes
  • 40 I/O requests 40(16)......................... 640 Bytes

                                                            1,116 Bytes
```

IOS I/O device requirements from Table 6c:

- Six unit record devices 6(42) .... 252 Bytes
- Magnetic tape capability .... 102 Bytes
- Twelve magnetic tape drives 12(104) .... 1,248 Bytes
- Direct access capability .... Included
- One IBM 2301 Drum (36 + 182) .... 218 Bytes
- Eight IBM 2311 Disks with record overflow 8 (182) .... 1,456 Bytes
- Resident error routine .... 1,696 Bytes

4,958 Bytes

Round up factor to make recovery management, OPTIONAL and IOS a multiple of 2K.................................. 1,966 Bytes

FIXED MAIN STORAGE REQUIREMENT FOR EXAMPLE 3............. 108,644 Bytes

Dynamic Storage Requirement in MVT

Several factors must be considered when you estimate the dynamic storage requirements. Because the job scheduler routines and operator commands require separate regions in the dynamic area, the number and sizes of these regions in use at any one time affects the amount of dynamic storage available for allocation to job steps. In addition, when remote job entry or conversational remote job entry is selected during system generation, another region is required.

The size of a region for a job step is affected by the following factors:

- The storage necessary to initiate the job step.
- The storage required for the load module.
- The storage required for an IBM-supplied program that the job step may use.
- The storage required for supervisor services requested by the job step and for the Checkpoint Restart work area if Checkpoint Restart is specified.
- The storage required for the data management access methods used by the job step.

If you select TSO (Time Sharing Option), storage in the dynamic area is required for the following:

- The time sharing control region.
- Each user foreground region, which includes the minimum storage required to run the largest of: the user's program or any of the TSO language processors, command processors, service routines, or utility programs.
- The TSO trace writer and the TSO trace data set processor which run in a separate region.
- The data management access methods used by TSO.

See the section called 'Time Sharing Region Requirement' for a detailed description of TSO requirements.

READER/INTERPRETER REGION REQUIREMENT

The reader/interpreter cataloged procedure, the automatic SYSIN batching (ASB) reader, and the background reader cataloged procedure are available to read and interpret the input stream. The region reader is started. The publication IBM System/360 Operating System: System Programmer's Guide contains the cataloged procedures supplied by IBM.

1. The reader cataloged procedure is invoked by a START RDR command. Each reader requires one region that remains in use until the input stream is exhausted; then the region is automatically freed for use by other tasks. The region required for a reader depends on whether any modules of the reader/interpreter are in the link pack area, and the size and number of input, output, and procedure buffers. (Records from the procedure library are read into a procedure buffer when a job step in the input stream invokes a cataloged procedure.

The input and output buffer sizes (BUFL) and buffer numbers (BUFNO) are specified in the reader procedure invoked when a reader is started. The size of a procedure is the blocksize specified for the procedure library. The number of procedure buffers used by the reader/interpreter is always one. If input, output, or procedure buffer sizes or buffer numbers are changed, the region size must be adjusted accordingly. The following formula can be used to estimate the region size for each reader.

$$REGION = 48K + IB_1 + IB_2 + OB$$

Where: $IB_1 = AB + AC$

Where: A = the number of input stream buffers
B = the size of input stream buffers
C = the size of the input/output blocks (IOB)

$IB_2 = AB + AC$

Where: A = the number of procedure buffers
B = the size of procedure buffers
C = the size of the input/output blocks (IOB)

$OB = AB + AC$

Where: A = the number of output buffers
B = the size of output buffers
C = the size of the input/output block (IOB)

- $IB_1 + IB_2$ must be rounded up to the next highest multiple of 2K except when unblocked single buffering is used for both, in which case: $IB_1+IB_2=0$.
- If either IB_1 or IB_2 does not have unblocked single buffering, then: if $(IB_2+(2K-2IB_2))$ is greater than IB_1, $IB_1 + IB_2$ should be rounded up to the next highest multiple of 2K. If $(IB_2+(2K-2IB_2))$ is less than IB_1, both IB_1 and IB_2 should be rounded up to the next highest multiple of 2K.
- OB must be rounded up to the next highest multiple of 2K except when unblocked single or double buffering is used, in which case: OB=0.
- Subtract the size of the Reader modules that are in the link pack area.
- For a description of the IOB, refer to the publication <u>IBM System/360 Operating System: System Control Blocks</u>, GC28-6628.

2. The ASB reader cataloged procedure is invoked by a START RDRA command. The ASB reader copies system input data onto a direct access volume and writes the job control language statements onto the job queue data set (SYS1.SYSJOBQE). Each ASB reader requires one region that remains in use until the input stream is exhausted; then the storage is freed for use by other tasks. A region is not required for the interpretation of job control language statements until a user-specified number of jobs (a batch) have been accumulated. When a batch has been accumulated, a region is dynamically acquired and the interpreter is invoked.

The minimum region size required by the ASB reader cataloged procedure is 16K. This value includes the storage required for the following:

- 10 input buffers consisting of 80-character records plus the QSAM control block requirements (approximately 1,400 bytes). If either the number of input buffers or the blocksize is increased, without a corresponding decrease of the other, then the region size for the ASB reader must be increased accordingly.

* Single buffering of the procedure library with a blocksize of up to 3200.

* Single buffering of the input stream data with a blocksize of up to 3200.

If the modules used by BSAM and QSAM are not resident, the region size required by the ASB reader must be increased by the size of these modules and then rounded to the next highest multiple of 2K.

Reader/Interpreter Region Requirement using ASB Reader

The size of the region required for the interpreter subroutine used by the ASB reader depends on the size of the procedure buffer and the number of job queue records resident during interpretation of the JCL. The size of the procedure buffer is the blocksize specified for the procedure library. If the blocksize is changed, the region size must be adjusted accordingly. The following formula can be used to estimate the region required for the interpreter.

REGION = 54K + PB + 184 + 250N + n(8 + 176N)
Where: PB = size of the procedure buffer N = number of 176 byte job queue records per logical track n = number of job queue tracks, in core, during interpretation of the JCL • PB = 0 if unblocked records are used. • The standard RDRA procedure uses the following values: PB = 3200 N = 12 n = 4 • The region size must be rounded to the next highest multiple of 2K.

This region is required only when a batch has been accumulated. Once the batch is interpreted, this region is freed for use by the other tasks.

3. The background reader cataloged procedure is invoked by a START BRDR command. It interprets jobs that were entered on the SUBMIT command and places them on the job queue data set. Each background reader requires one region with a size equal to:

   REGION = 10K + size required for Reader/Interpreter.

OUTPUT WRITER REGION REQUIREMENT

The operator may start and stop output writers as the backlog of work in the output classes changes. One writer can process several classes, and several writers can process the same class. Each output writer requires one region which is retained until the operator stops the writer. The region required for an output writer depends on the size of the input and output buffers and whether the output writer modules are in the link pack area.

The input buffer sizes are specified for the SYSOUT data set in the problem program. The SYSOUT writer region contains two input buffers of this size.

The output buffer size (BUFL) and the buffer number (BUFNO) are specified in the cataloged procedure used when a writer is started. The publication IBM System/360 Operating System: System Programmers's Guide contains the cataloged procedure supplied by IBM. If the buffer specifications in the procedure are overridden, the region size must be adjusted accordingly.

The following formula can be used to estimate the region required by the output writer:

REGION = 12,288 + IB + OB

Where: IB = the storage required by the input buffers, rounded to the next highest multiple of 2K. The storage required is calculated as follows:
IB = 2E + 2F

Where: E = the size of the input buffer
F = the size of the input/output block (IOB)

OB = the storage required by the output buffers, rounded to the next highest multiple of 2K. The storage required is calculated as follows:
OB = AB + AC

Where: A = the number of output buffers
B = the size of the output buffer
C = the size of the input/output block (IOB)

- For a description of the IOB, refer to the publication IBM System/360 Operating System: System Control Blocks, GC28-6628.
- If the output writer uses command chaining with machine code control character output, more than three buffers, and a unit record output device, then REGION = 13,312 + IB + OB
- If variable spanned record are being used on input or output then the formula is 14,336 + IB + OB. In this case nothing extra need be added for command chaining.
- Subtract 2K if the output writer modules are in the link pack area.
- If the log is being used, the input/output buffer size must be equal to or greater than the size specified on the "BLKSIZE=" parameter of the log data set.

The preceding formula assumes that the standard output writer is used. If the user provides a nonstandard data set writer that is not in the link pack area, the size of the region must be adjusted accordingly. (For information on providing a nonstandard data set writer, see the publication IBM System/360 Operating System: System Programmer's Guide.)

OPERATOR COMMAND REGION REQUIREMENTS

The operator can control the number of reader/interpreter, output writers, and initiator/terminators in operation by using a START command. This command requires a separate region only until the task is initiated, then the region is exchanged for a region equal to the size required by the initiated task.

In addition, certain other operator commands require separate regions that are freed once the requested function has been performed. The following is a list of operator commands that require separate regions.

Command	Region Requirement (in bytes)
CANCEL 'jobname'	6,144
DISPLAY 'jobname'	6,144
HOLD 'jobname'	6,144
HOLDQ	6,144
MOUNT 'devicename'	MINPART
RELEASE 'jobname'	6,144
RELEASE Q	6,144
RESET 'jobname'	6,144
START	MINPART
SEND	12K
DISPLAY USERS	6K

Where: MINPART is the minimum requirement for job initiation with MVT; see the section "Job Initiation Requirements."

- The CANCEL command does not require a separate region when the job to be canceled is executing; the job's region is used.

REMOTE JOB ENTRY REGION REQUIREMENT

Remote job entry (RJE) operates as a system task, much like a combined reader/interpreter and output writer. RJE accepts jobs submitted by remote users, passes them to the initiator/terminator for scheduling and execution, and returns the output to the remote user. The region required for RJE can be estimated by the following formula:

$$REGION = 46{,}596 + 408A + 1{,}516B + 76C + 24D + 18E + 16G + (13+10H)I + (13+9H)J + K + L + M + N + O + P + Q + [(624+R_1) + (624+R_2) + \ldots + (624+R_n)] + 64U + 8V$$

Where:
- A = the number of line groups
- B = the number of lines
- C = the number of terminals
- D = the number of jobs
- E = the number of users
- G = the number of dial lines
- H = the maximum number of terminals connected on a multipoint line
- I = the number of multipoint lines for 2780s
- J = the number of multipoint lines for 1130s
- K = 8,192 if module IEFVHA is in the link pack area. If module IEFVHA is not in the link pack area, K=40,960.
- L = 0 if compress/expand is not selected. If compress/expand is selected, L = 832.
- M = 0 if BTAM is resident. If BTAM is not resident, M=5,000.
- O = the size of the JOBACK user exit option, including dynamic work areas. If the JOBACK user exit option is not selected, O=0.
- P = the size of the JOBCARD user exit option, including dynamic work areas. If the JOBCARD user exit option is not selected, P=0.
- Q = the size of the COMMERR user exit option, including dynamic work areas. If the COMMERR user exit option is not selected, Q=0.
- R_1 to R_n = the blocksizes of the SYSOUT data sets for each line simultaneously sending output
- U = the total number of MSG QEB's specified in the RJELINE macros. It will equal 4 if the default is used.
- V = the total number of JOB QEB's specified in the RJELINE macros. It will equal 10 if the default is used.

- The sum of R_1 to R_n must be raised to the next highest multiple of 2K; then the total region size must be raised to the next highest multiple of 2K.

CONVERSATIONAL REMOTE JOB ENTRY (CRJE) REGION REQUIREMENT

CRJE allows remote access to the operating system from conversational terminals. The terminal user may prepare and update programs and data, submit them for processing, and receive the output at the terminal. CRJE jobs are processed concurrently with jobs submitted normally.

CRJE operates in dynamic storage. The region size necessary to run CRJE can be calculated by the following formula:

```
REGION = 53,558 + AA' + 388B + 922C + (552 + D')D + 104E + (1376 + F)+
          32H + 32J +16K + L + M + N + O + P + Q + R + S + 768T + U + V

Where:  A  = number of line groups.
        A' = 52 if device I/O modules are resident.
           = 332 if the device is a 1050 and the I/O modules are not
             resident.
           = 300 if the device is a 2740 with checking and the I/O
             modules are not resident.
           = 212 if the device is a 2741 and the I/O modules are not
             resident.
        B  = number of lines.
        C  = number of active users.
        D  = number of users receiving job output at one time.
        D' = blocksize of SYSOUT data set.
        E  = number of START RDR's pending.
        F  = maximum blocksize of an OS data set to be EDITed.
        H  = number of active users projected to be in syntax checker
             mode at one time.
        J  = number of active users projected to be using EXEC command
             at same time.
        K  = number of active users projected to be using TABSET at
             the same time.
```

(Continued)

(Continued)

```
L  = syntax checker requirements.
     FORTRAN = 16384
               19456 + 192
               21504
     Where:  16384 bytes are required if the E level syntax
             table, only, is to be resident.

             19456 bytes are required if the G and H level
             syntax table is to be resident.

             21504 bytes are required if both the E level, and
             the G and H level syntax checkers are to be
             resident.

     PL/I = 17408
            21504 + 300 (PLINO)
            28672

     Where:  17408 bytes are required for the resident
             restricted checker.

             21504 bytes are required for checking with
             partial dynamic structure.

             28672 bytes are required for checking with fully
             dynamic structure.

             PLINO is the maximum number of PL/I statement
             lines allowed under CRJE.

             Note:  If both checkers are selected, include
                    (300 PLINO).

M  = 0 if BTAM is fully resident or 6000 if BTAM is not
     resident.
N  = size of user LOGON exit routine if included in CRJE.
O = size of user LOGOFF exit routine if it is included in
     CRJE.
P  = size of user JOBCARD exit routine if it is included in
     CRJE.
Q  = size of user specified command processors included in
     CRJE.
R  = 0 if BTAM On-line Test is not included.
   = 2128 if BTAM On-line Test is included.
S  = 0 if the modules IEFQMSSS, IEFQMDQ2, and IEFQDELE are
     resident.
   = 5760 if the above modules are not resident.
T  = number of BTAM transmission codes used.
U  = 0 if the RAM list of modules is resident
   = 1800 if the RAM list of modules is not resident
V  = 952 if one or more 1050's on a leased line with Timeout
     Suppression feature are supported.
   = 0 if no 1050's with Timeout Suppression are supported.
```

JOB STEP INITIATION

When MVT is used, the region required to initiate a job step is specified during system generation in the MINPART parameter of the SCHEDULR macro instruction. The amount specified for MINPART must be large enough for operation of the initiator/terminator and must include the storage used by the initiator/terminator to maintain portions of the job queue in main storage.

The size of the scheduler does not increase when automatic volume recognition or SMF is selected.

The size required for the initiator/terminator is approximately 52K (the default value assumed if MINPART is not specified) plus the storage required by an accounting routine, or user-written routines to supplement SMF if they are supplied.

Note: MINPART is the minimum region required by any job step unless module IEFSD061 of the initiator/terminator is resident in the link pack area. If the module is resident, the minimum region for a job step may be greater than or equal to MINPART minus 40K. The minimum region size will be calculated by the system.

The following formula can be used to determine the size of the initiator/terminator region for a specific installation.

MINPART = (45,056 + V + D) + P + INITQBF - IEFSD062

Where: Each term should be a multiple of 2K. The values for V and D are required; the values for INITQBF and IEFSD062 are optional.

V = the amount required for the I/O device specifications made during system generation. The 52K default value includes enough storage to handle approximately 150 I/O device specifications; to calculate the exact amount for a particular installation, use the formula:

V = DMT + DNT (See notes 1 and 2.)

Where: DMT = 4 + 12(A + B + 1) ([K/32]*)4 + 4
DNT = 4 + 12(A + B)

A = the number of UNITNAME macro instructions.

B = the number of different unit types specified by the UNIT parameter of all IODEVICE macro instructions.

K = The sum of:

a. the sum of all IODEVICE macro instructions, each multiplied by the number of units specified within it,
b. the number of IODEVICE macro instructions that specify UNIT=2314, multiplied by one less than the number of units specified in the IODEVICE statement,
c. the number of IODEVICE macro instructions that specify UNIT = 2321, multiplied by 10,
d. the number of alternate channel paths specified,
e. the sum of all IODEVICE macro instructions that specify alternate channel paths, each multiplied by the number of units specified within it.
f. the sum of all undefined unit addresses on channel 0 up to the first defined unit address for the first defined control unit,
g. the sum of the undefined unit addresses, associated with each control unit, that would appear between the unit addresses defined. This applies to all channels.

Notes:

1. If the formula for V yields a number of bytes equal to or greater than 2048, MINPART must be increased by 2K.

2. DMT and DNT represent the storage requirements for the device mask table (DEVMASKT) and the device name table (DEVNAMET). To improve system performance and reduce the dynamic storage required by the initiator/terminator, it is recommended that you place these tables in the MVT link pack area.

* - quotient rounded to whole number

D = the amount required for the DD statements in the job step. The 52K default value includes enough storage (6,144 bytes) to handle approximately 18 DD statements per job step. Each additional DD statement requires 250 bytes of main storage. Note: Each member of a generation data group requested in a job step should be considered a separate DD statement.

P = the BLKSIZE specified in the procedure library DCB. Round this value up to the next highest multiple of 2K. If the procedure library is not blocked (i.e., BLKSIZE = 80), P=0.

INITQBF = is optional and is the amount used by the initiator/terminator to maintain portions of SYS1.SYSJOBQE in main storage, rounded up to the nearest multiple of 2K*. This value, when divided by 1024, yields the number of buffers to be specified in the INITQBF parameter of the SCHEDULR macro instruction during system generation. The value is calculated as follows:

INITQBF = 88 + 37•N + L(8 + 176•N)

Where: N = the number of 176-byte records to be included in a logical track of SYS1.SYSJOBQE. (This is the value specified in the JOBQFMT parameter of the SCHEDULR macro instruction during system generation although the values of N and INITQBF are established when the system is generated, they may be varied when the system is initialized.)

L = the number of logical tracks to be maintained in storage.

*A method used to handle the data brought in from SYS1.SYSJOBQE is called track stacking.

IEFSD062 = 8,192 and is the amount required by module IEFSD062. This amount can be subtracted if the module is in the link pack area. The 52K default value includes this amount.

The storage required to initiate a job increase beyond the computed size of the initiator/terminator if an accounting routine is supplied. The amount of additional storage is equal to 2,750 bytes, plus the size of the accounting routine, plus the additional storage required by the routine (e.g., OPEN, GETMAIN).

IBM-Supplied Program Requirements

IBM-supplied programs require dynamic storage in which to operate. Tables 8c through 13c contain the minimum dynamic storage requirements for these programs.

Table 8c
: contains the storage requirements for each processor. These estimates include the requirements for the access methods used by the processor. If the access method modules are resident, the requirement can be reduced by the sum of the resident modules.

Table 9c
: contains the storage requirements for utility programs. These estimates do not include the requirements of the access methods used by the utility program. The sizes of the access method routines used must be added to the minimum requirements if the routines are not resident.

Table 10c
: contains the storage requirements for the IEHDASDR system utility program.

Table 11c
: contains the storage requirements for the IEHDASDR buffer/work area size.

Table 12c
: contains the storage requirements for the IEBDG data set utility program.

Table 13c
: contains the storage requirements for IBM-supplied utility programs when the SYSUTILS macro instruction is specified. These estimates do not include the requirements of the access methods used by the utility program. The sizes of the access method routines used must be added to the minimum requirements if the routines are not resident.

In addition, dynamic storage is also required by graphic programming support, the overlay supervisors, the system environment recording functions, TESTRAN, the 1130/360 Data Transmission program, and the loader. Section 4 contains the dynamic storage requirements for these programs.

Supervisor Services Requirements

Dynamic storage is used by the control program both while supervisor services are performed and after control is returned to the program that requires them. In MVT, the storage required for supervisor services is obtained from subpools within the region.

Table 14c
: contains the dynamic storage for the supervisor services that perform the opening and/or closing of a data set and the handling of end-of-volume conditions.

Table 15c
: contains the dynamic storage requirement for the rest of the supervisor services and also gives the duration of the storage requirement.

Access Method Requirements

Section 5 contains the storage requirements for access methods used by the job steps.

Time Sharing Region Requirement

The time sharing option (TSO) allows you to develop, test, and execute programs, at remote terminals, in a time sharing environment. Storage is required in the dynamic area for the time sharing control region and each foreground region. The time sharing control region provides the storage for: the time sharing control task, the region control task, several resident SVC routines, the time sharing extension to the link pack area, and various control blocks. The foreground region is the area where the user's program is executed. It provides storage for the user's program, language processors, and the TSO command processors.

TIME SHARING CONTROL REGION - STORAGE REQUIRMENT

The storage required for the time sharing control region can be estimated by the following formula:

REGION = 30,550 + A + B + C + D + E

Where: A = the storage required by the time sharing control task and is equal to:

352 + 72R + 48U + 4M(U + R + 1) + RD1

B = the storage required to swap control and is equal to:

1296 + 36R for each 2301 or 2303 drum storage device
1764 + 36R for each 2311 disk storage device +RD2
3168 + 36R for each 2314 disk storage device

C = the storage required for the time sharing driver and is equal to:

44 + 32R + 36(RxQ) + 28U

*Note: If RD1, RD2, or RD3 is greater than C, then C =0.

D = the storage required for terminal handling and is equal to:

88 + 60U + (PxN) + RD3

*E = the size of the time sharing link pack area rounded up to the next highest multiple of 2K.

M = the number of MAP entries.

N = the number of allocated terminal buffers.

P = the size of a terminal buffer.

Q = the average number of queues per region.

R = the maximum number of active time sharing regions.

U = the maximum number of time sharing users.

RD1, RD2, and RD3 are the factors required to round-up A, B, and D to the next highest multiple of 2K.

*Use Tables 16c-20c and Appendix B to determine the size of the component that you can put in the link pack area.

FOREGROUND REGION - STORAGE REQUIREMENT

The storage requirement for each user's foreground region is the larger of L or T and can be estimated by the following formulas:

L = 11.5K + LSQA + A + B + C
Where: A = the larger of of 52K or MINPART where MINPART can be calculated by the formula given in a preceding section of this publication. B = the larger of .5K or the number of bytes of MAIL and NOTICES waiting for the user when he logs on. C = 2K if you use track stacking; 0 otherwise. LSQA = the local system queue area; all TSO commands will run if LSQA = 8K.

T = A + (B + B1 + B2 - B3) + LSQA
Where: A = 20K if the TSO command system is operating in the foreground region: otherwise A = 0. The TSO command system (TMP) can be made resident in the time sharing link pack area; in this case the storage requirement =10K. The module names and sizes of the TMP are listed in Appendix B. B = the storage requirement of the largest command processor, or TSO utility program to be run in the foreground region. B1 = the storage requirement of the largest non-resident TSO service routine or subcommand that will be used with the command processors. B2 = the storage requirement of the largest language processor or user program that will run under the RUN subcommand of the EDIT command processor, or the storage requirements of the largest user's program that will be run under the TEST command processor. B3 = 14K if the user's program is going to be run using the RUN subcommand of EDIT: otherwise B3 = 0. LSQA = the size of the local system queue area in the foreground region; all TSO command processors will run if LSQA = 8K.

TSO - COMMAND PROCESSORS, SERVICE ROUTINES, LANGUAGE PROCESSORS, AND UTILITY PROGRAMS

Dynamic main storage is required in the user's foreground region for the TSO command processors, service routines, and any language processor that will be used with the command processors.

Table 16c.
: contains the dynamic main storage requirements for the TSO command processors.

Table 17c.
: contains the dynamic main storage requirements for the TSO service routines.

Table 18c.
contains the dynamic main storage requirements for the language processors that will be used with TSO.

Table 19c.
contains the dynamic main storage requirements for the TSO utility programs.

TSO - Trace Writer and Trace Data Set Processor

The TSO trace writer and trace data set processor require a separate region to run in.

Table 20c.
contains the dynamic storage requirements for the trace writer and trace data set processor.

TSO - Access Methods

Section 5 contains the storage required for the access methods used by TSO.

Tables

Table 1c. Fixed Storage Requirements for Control Program Options in the CENPROCS, CTLPROG, DATAMGT, GRAPHICS, SVCTABLE, and TESTRAN Macro Instructions for MVT

Macro Instruction	Control Program Option	Storage Requirement (in bytes)
CENPROCS	• Model 91 • Model 85 • Model 195 • Models 155, 165	1264 (5) 1264 (6) 2328 336 (5)
CTLPROG	• Each Additional Pair of Transient Areas • Main Storage Hierachy Support • PCI Fetch • Rollout/Rollin • Time-Slicing	2,990 1120 Included 6,160 (1) 974 (2)
DATAMGT	• BDAM • BTAM • ISAM • QTAM • TCAM	Included 60 64 568 600
GRAPHICS	• Graphic Programming Services	642
SVCTABLE	• User Added SVC Routines Each Resident SVC Routine (3) Each Transient SVC Routine	24 4 4
TESTRAN	• Test Translator	40 (4)

Notes:
1. If you supply routines to modify the operation of this option, the storage required by these routines must be added to the fixed storage requirement. If you select hierachy support, add 36 bytes.
2. Increase the storage requirement by 16 bytes for each time-slice group that is specified. If job step timing is selected, add 14 bytes.
3. The size of the SVC routine(s) must also be added to the fixed storage requirement.
4. If you use TESTRAN for the Model 91, the storage requirement is 62 bytes. If the MODE=TRACE operand is also specified, the storage requirement is 68 bytes.
5. Add 128 bytes if there are 2880 channels present.
6. Add 96 bytes if there are 2880 channels present.

Table 2c. Fixed Storage Requirements for Control Program Options Specified in the SCHEDULR and SECONSLE Macro Instructions for MVT

Macro Instruction	Control Program Option	Storage Requirement (in bytes)
SCHEDULR	• Alternate Console	120
	• Composite Console	32
	(per console)	32 (1)
	• Multiple Console Support	2,550
	Master Console	
	Composite Console	128
	Not a Composite Console	64
	Alternate Console	
	Composite Console	128
	Not a Composite Console	64
	Each 2250 used as a Master or Alternate Console	5,096
	Each 2740 used as a Master or Alternate Console	216 (2,4)
	Each Model 85 Operator's Console with CRT Display used as a Master or Alternate Console in MCS	3,880
	Each 2260 used as a Master or Alternate Console	1696
	• SMF	1,470
	• ESV	(5)
	• Time sharing (TSO)	3686
SECONSLE	• Each Composite Console (3)	128
	• Each Console that is not a Composite Console (3)	64
	• Each 2250 used as a Secondary Console	5,096
	• Each 2260 used as a Secondary Console	1696
	• Each 2740 used as a Secondary Console	216 (2,4)
	• Each Model 85 Operator's Console with CRT Display used as a Secondary Console	3,880

<u>Notes</u>:
1. If both the primary and alternate consoles are composite consoles, this amount is 64 bytes.
2. If the BTAM modules IGG019M0, IGG019MA, and IGG019MB are not resident in the RAM area, add 6,224 bytes when you specify a 2,740 for the first time. Each additional 2740 requires only 216 bytes.
3. The first console specified under SECONSLE does not require additional storage.
4. For the first 2740 specified, add 1,840 bytes.
5. If you specify ESV=SMF and do not include SMF, add 1,470 bytes.

Table 3c. Fixed Storage Requirements for Control Program Options Specified in the SUPRVSOR Macro Instruction for MVT

Macro Instruction	Control Program Option	Storage Requirement (in bytes)
SUPRVSOR	• Decimal Simulation (Model 91 only)	3,520
	• IDENTIFY Facility	
	Module resident	Included
	• Multiple WAIT	Included
	• Resident ATTACH	Included
	• Resident BLDLTAB	284
	Each Resident Directory Entry	56 (1,7)
	• Resident EXTRACT	Included
	• Resident Reenterable Load Module (Resident Access Method Option)	Included
	Each Resident Module	24 (2,3)
	• Resident SPIE	Included
	• Resident Type 3 and 4 SVC Routines	Included (4)
	Each Resident Module	40 (2,5,8)
	• Resident error recovery procedure	100
	Each resident module	24(2)
	• Storage Protection	Included
	• Timing Facilities	
	• Job Step Timing	144
	Time	Included
	Interval Timing	Included
	• Trace	508
	Each Entry in Trace Table	32
	• Transient SVC Table	Included
	Each User SVC Routine Added	Included
	• Validity Check	Included
	• Verify DASD Vol. Serial No.	Included (6)
	• On-line-test (ONLNTEST)	300
	• Patch facility	516 (9)

<u>Notes</u>:
1. If you use the standard list IEABLD00, storage is required for nine entries. The standard list is given in the <u>IBM System/360 Operating System: System Programmer's Guide</u>.
2. When you select this option, add the sum of all resident modules to the fixed storage requirement. Appendix A contains the names and sizes of the modules that may be resident.
3. If you use the standard list IEAIGG00, 30 modules are loaded with a storage requirement of approximately 7,224 bytes. Appendix A indicates the modules that are in the standard list.
4. If this option is selected, the transient SVC table option must also be selected and the required storage added.
5. If you use the standard list, IEARSV00, 29 modules are loaded with a storage requirement of approximately 29,696 bytes. Appendix A indicates the modules that are in the standard list.
6. The NODAV option cancels verification checking. If you use this option the size of fixed main storage required for IOS resident code is decreased by 132 bytes.
7. This requirement is in the link pack area.
8. This requirement is in the system queue area.
9. If you test more than two devices within a single test definition, add 32 bytes for each additional device up to a maximum of 14. If your system has 2880 channels, add 72 bytes.

Table 4c. Fixed Storage Requirements for Recovery Management for MVT

Description	Storage Requirement (in bytes)	
	Without MCS	With MCS
SER0 on Models 40, 50, 65, 75	254	254
SER1 on Model 40	3,152	3,432
SER1 on Model 50	3,400	3,680
SER1 on Model 65, 67-1 in 65 mode	3,288	3,568
SER1 on Model 75	3,256	3,536
SER1 on Model 91/95	6,224	6,504
SER1 on Model 195	8184	8532
CCH on Models 65, 75, 85, 91, 95, 155, 165, 195	2,100(3)	2,100(3(
MCH on Model 85	8,000	8,000
MCH on Model 65 only (1)	6,144	6,544
MCH on Model 155	5,120	5,120
MCH on Model 165	6,144	6,144
APR on Models 40, 50, 65, 75, 85,91/95, 195	420(2)	420(3)
DDR on Models 40, 50, 65, 75, 85, 91/951 195	1,950	1,950
DDR with DDR SYSRES on Models 40, 50, 65, 75, 85,91/95, 195	3,450	3,570

Notes:
1. For M65MP; with MCS add 400 bytes.
2. For M65MP, add 150 bytes.
3. Add: 1042 if your system has 2860 channels.
942 if your system has 2870 channels.
1036 if your system has 2880 channels.
62 if your system has the Model 155 (integrated) channel.

Table 5c. Fixed Storage Requirements for IOS That Depend on the Channel Configuration for MVT

Description	Storage Requirement (in bytes)
Multiplexor or high speed multiplexor channel (5)	60
• Priority queueing	6
• Alternate selector channel	4
Each associated logical channel	6
Selector Channel	
• Each channel (1,6)	50
• Second channel path on each channel	50
• Each additional channel path on each channel	32
• With priority queuing, each channel path on each channel requires additional storage	6
• First channel path with direct access devices on each channel (2)	32
• Each additional path with direct access on each channel	12
• Each channel switch (3)	18
Queuing capability	
• FIFO - first in, first out	0
• Ordered Seek Queuing	262
• Priority	104
Each queued I/O request (4)	12
One or more channels with an address greater than 6	32

Notes:
1. If the number of devices exceeds 240, add 12 bytes for each logical channel.
2. If you select shared DASD, add 8 bytes.
3. IOS routines do not provide for switching devices onto a multiplexor channel.
4. The maximum number of I/O request that can be queued, pending satisfaction by the channels, is specified by your installation at system generation time in the MAXIO parameter of the CTLPROG macro instruction.
5. With M65MP increase the storage requirements for a multiplexor channel by 8 bytes.
6. With M65MP increase the storage requirement for each channel by 4 bytes.

Table 6c. Fixed Storage Requirements for IOS That Depend on the Type of I/O Devices Selected for MVT

Description	Storage Requirement (in bytes) (1)
Unit record capability	0
• Any graphic devices	20
• Each unit record device (2)	42
• Each 1403 printer with UCS feature	50
• Each optical character reader	54
• Each 2495 tape cartridge reader	78
• Each magnetic character reader	48
Graphics capability	476
• Each graphic device	112
• Each 2250, Model 1, with 4K buffer	46
• Each 2250, Model 1, with 8K buffer	62
• Each 2840, with 8K buffer	86
• Each 2840, with 16K buffer	118
• Each 2840, with 32K buffer	182
Magnetic tape capability	102
• Any read/write tape adapter units	38
• Each magnetic tape drive	104 (4)
Telecommunications capability	62
• Each telecommunications line group	20
• Each telecommunications line	58
Direct access capability (3)	Included
• Any drum storage devices	36
• Each 2302, 2303, and 2311 without record overflow	142
• Each 2302, 2303 and 2311 with record overflow	182
• Each 2301	182
• Each address for a 2314	182
• Each 2321 without record overflow	290
• Each 2321 with record overflow	330
• Resident error routines	
Basic support (only 2311 devices)	1368
Any number of 2314 devices	28
Any number of 2301 devices	20
Any number of 2302 devices	70
Any number of 2303 devices	12
Any number of 2321 devices	16
with record overflow	248
with CCH	88
with DDR	30
with SYSRES DDR	16

Notes:
1. With M65MP, increase the storage requirement for each type of I/O device specified by 4 bytes.
2. The following rules apply:
   - A console is considered a unit record device.
   - A 2540 card reader-punch counts as two unit record devices.
   - A card reader and printer used as a composite console are counted as two non-console devices.
3. If shared DASD is specified, add 1,397 bytes.
4. If you select ESV, add 22 bytes + 24 bytes for each tape drive. If you select EVA, add 22 bytes + 16 bytes for each tape drive. If you select ESV and EVA, and 22 bytes + 24 bytes for each tape drive.

Table 7c. Fixed Storage Requirements for IOS That Depend on the Type of IBM-Supplied Processing Program Selected

Description	Storage Requirement (in bytes)
OLTEP	28 (1)
Note: 1. If your channel configuration includes 2880 channels, add an additional 16 bytes.	

Table 8c. Minimum Dynamic Storage Requirement for IBM-Supplied Processing Programs for MVT (Part 1 of 2)

Processing Program	Access Method Used	Storage Requirement (in bytes)
ALGOL	BSAM,QSAM	48K
Assembler F	QSAM,BPAM, and BSAM	50K
COBOL E COBOL F American National Standard COBOL GSP for COBOL F	BSAM,BPAM BSAM,BPAM BSAM,BPAM GAM	22K 86K 86K 71K (6,7)
FORTRAN IV E FORTRAN IV G FORTRAN IV H GSP for FORTRAN IV	BSAM QSAM QSAM GAM	42K (1,2) 100K (3) 160K (4) 71K (6,7)
GJP	BSAM,GAM,BPAM	72K (8)
Linkage Editor E (15K) Linkage Editor E (18K) Linkage Editor F (44K) Linkage Editor F (88K) Linkage Editor F (128K)	BSAM,BPAM BSAM,BPAM BSAM,BPAM BSAM,BPAM BSAM,BPAM	24K 26K 54K 96K 136K
OLTEP	BSAM,BPAM	30K
PL/I F GSP for PL/I F	SAM,BPAM GAM	50K 71K (6,7)
RPG E	BSAM	18K
SGJP	BSAM,BTAM,BPAM	72K (8)
Sort/merge	QSAM	18K (5)
TESTRAN editor	BSAM	50K

Table 8c. Minimum Dynamic Storage Requirement for IBM-Supplied Processing Programs for MVT (Part 2 of 2)

<u>Notes</u>:

1. This estimate includes enough work space to process approximately 170 cards. More storage may be required by larger source programs.
2. If the PRFRM option is used, then the minimum main storage requirement is 19,456 bytes. If blocked input or output is also used, then the minimum main storage requirement is increased by the value of the expression [2*(BLKSIZE)] for each data set that contains blocked records.
3. This estimate includes sufficient work space to process approximately 400 cards. More storage may be required by larger source programs.
4. This estimate includes sufficient work space to process approximately 200-300 cards with a blocking factor of five for the SYSPRINT and SYSLIN data sets. More storage may be required by larger source programs; add 18,432 for each additional 100 cards.
5. This estimate is for sort/merge with no linkage editor or direct access devices; if a linkage editor is used, the minimum dynamic requirement is the requirement for the linkage editor selected. In addition, conditions such as physical record length greater than 400 bytes, large numbers of intermediate storage data sets, or extracted control fields require additional main storage.
6. This estimate assumes that the modules are loaded with the LOAD macro instruction. Appendix A contains a list of the modules and their dynamic storage requirements.
7. The region size required for MVT includes storage for one graphic device with four graphic data sets. To determine the storage necessary for additional graphic devices and graphic data sets, see Appendix A.
8. This estimate includes a constant storage requirement of 12,000 bytes and one active partition or region of 60,000 bytes actually performing job control operations (GJP or SGJP). There is no 60,000 byte requirement during execution of a problem program initiated by GJP or SGJP at the display terminal. The 60,000 byte requirement is the minimum size region that may be specified with a reader/interpreter size requirement of 48,000 bytes.

Table 9c. Minimum Dynamic Storage Requirement for IBM-Supplied Utility Programs and Service Aids for MVT (Part 1 of 3)

Utility Programm	Storage Requirements (in bytes)) (1)
• System utilities:	
IEHATLAS	14K + R + 16(T)
IEHDASDR	(2)
IEHINITT	14K
IEHLIST	18K
IEHMOVE	16K + B
IEHPROGM	12K
IFCEREPO (Models 40, 50, 65, 75, 91, 165, 195)	28K
• Data set utilities	
IEBCOMPR	18K + 2B + 2L + E
IEBCOPY	27K + M + N + P
IEBTCRIN	12K + A + R + E
IEBDG	(4)
IEBEDIT	14K
IEBGENER	14K + 4B + 2L + E + F
IEBISAM	8K + R
IEBPTPCH	16K + 4B + E + F
IEBUPDAT	12K + 2B
IEBUPDTE	22K + 4B + 2L + E
• Service Aids	
IMASPZAP	15K
IMAPTFLS	6K
IMAPTFLE	46K
IMBMDMAP	36K
IMDPRDMP	42K

Table 9c. Minimum Dynamic Storage Requirement for IBM-Supplied Utility Programs and Service Aids for MVT (Part 2 of 3)

Where:

A = 2 times the BUFL on SYSUT1

B = the largest blocksize in the job step, rounded to the next highest multiple of 2K. If the format specified for the data set is VS and LRECL is less than 32K, use R instead of B in the formula.

R = The maximum logical record length, rounded to the next highest multiple of 1K.

L = 2,048 if user header and trailer labels are to be processed; otherwise, L=0.

E = The sum of the sizes of all the user exit routines. Round the size of each routine to the next highest multiple of 2K and then add.

F = 2,048 for each group of MAX parameters that are less than or equal to 200 bytes.

M = 1K minimum and is the sum of:

1. the maximum number of input data sets referenced in any COPY step multiplied by 10,
2. the maximum number of membernames, including newnames, multiplied by 10 - this number is added only when SELECT or EXCLUDE is used,
3. the maximum number of newnames referenced in any COPY step multiplied by 4, add 4 to the number,
4. the maximum number of input members referenced in the largest input data set specified in any COPY step multiplied by 10 - this number should be added when EXCLUDE or "Full Copy" is used and 80 bytes should be added to the total.

N = the sum of:

1. the number of directory blocks allocated to the largest output directory used in the job step multiplied by 276,
2. the maximum number of input members to be copied from any one input data set referenced in the job step multiplied by 10.

* The storage required for N is only necessary for optimal performance.

P = 2K minimum and is twice the maximum input or output blocksize rounded up to the next multiple of 2K. If you are performing a compress-in-place operation, B = the maximum track capacity of the device being used rounded up to the next multiple of 2K. If you allow the minimum 2K for P, the maximum input or output blocksize can be only 700 bytes.

T = maximum number of records per track.

Table 9c. Minimum Dynamic Storage Requirements for IBM-Supplied Utility Programs and Service Aids for MVT (Part 3 of 3)

<u>Notes</u>:

1. If you are planning to specify the SYSUTILS macro instruction during system generation, use Table 12c to determine what size to specify.
2. To determine the minimum dynamic storage requirements for the IEHDASDR system utility program, use Tables 9c and 10c.
3. When using the compress facility, the minimum dynamic storage requirement is 28K + T for MVT.
   Where: T = the maximum track capacity of the device being used + $\frac{\text{maximum track capacity} \bullet 6}{100}$ + 1,000.
4. To determine the minimum dynamic storage requirements for the IEBDG data set utility program, use Table 11c.

Table 10c. Minimum Dynamic Storage Requirements for IEHDASDR System Utility Program for MVT

Function	Storage Requirement (in bytes) (1)
ANALYZE/FORMAT(3)	20K + (N•B)
ANALYZE(3,4)	20K + (N•B)
DUMP(5)	20K + (N•B)
GETALT	12K
LABEL	12K
RESTORE	16K + X

Where: B = a buffer/workarea size determined by the function performed and the device type being used. Table 10c contains the computed size, rounded to the next highest multiple of 2K.

M = the number of copies to be made.

N = the number of operations to be performed, with a minimum of 1 and a maximum of 6. If enough storage is provided, multiple operations will be performed concurrently. For information on performing multiple functions concurrently, refer to the publication IBM System/360 Operating System: Utilities, GC28-6586.

X = a buffer/workarea size required to perform one or more RESTORE operations, and is computed as 2B • (N-1) + B. The computed size provides enough storage to perform multiple RESTORE operations concurrently.

Notes:
1. If the QSAM access method is not resident, add 2,000 bytes to the minimum requirement.
2. The minimum dynamic storage requirement for job steps performing multiple functions is the region size of the function that has the largest region size requirement.
3. If the IPL test is required and is supplied via the input stream, add 3,640 bytes.
4. Use this formula only when ANALYZE is to be performed on an IBM 2321 Data Cell.
5. If a permanent data check or missing address marker is encountered during a dump to SYSOUT, an additional 1000 bytes is required to recover and print the defective track.

Table 11c. IEHDASDR Buffer/Workarea Size

Function	Device Type					
	IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage	IBM 2321 Data Cell
ANALYZE/ FORMAT	22,528	6,144	6,144	6,144	8,192	4,096
DUMP	26,624	8,192	8,192	6,144	10,240	6,144
RESTORE	24,576	8,192	6,144	6,144	10,240	4,096

Table 12c. Minimum Dynamic Storage Requirements for IEBDG Data Set Utility Program for MVT

IEBDG = 12,000 + A + B + C + D + E + F + G(280)
Where: A = 520 • (H/8) Where: H = the number of FD statements. If H is less than or equal to 8, then A=520. The value for A must be a multiple of 520. B = 512 • (I/18) Where: I = the number of CREATE statements. If I is less than or equal to 18, then B=512. The value for B must be a multiple of 512. C = the sum of all field lengths on all FD statements. Each length must be rounded to the next highest multiple of 8. Use one of the following to calculate the value to be used for a particular FD statement, if any of the conditions apply: • If ripple action and a format of AN, AL, or CO are specified on an FD statement, use the following formula to calculate the field length: L = FL + FR Where: L = the value to be used for this FD statement when determining the value for C. FL = the length of the defined field specified on the FD statement. FR = 36 for AN, 26 for AL, or 63 for CO. (If FL is larger than FR, then L=FL.) • If ripple or wave action and PICTURE are specified, the value to be used for this FD statement is: 2 • picture length • If roll action and PICTURE are specified, the value to be used for this FD statement is: 3 • picture length D = S + (6•N) Where: S = the sum of all picture lengths on all CREATE statements. Each length must be rounded to the next highest multiple of 8. N = the number of pictures. E = U + 72(N/8) Where: U = the dynamic storage requirements for all user exit routines. N = the number of user exit routines. • The value for E must be a multiple of 8. F = the logical record length of the output and input data set. If RECFM=U, then F=blocksize. The value for F must be a multiple of 8. G = the number of user-specified input and output data sets. The value for G must be a multiple of 8. • For MVT, add a round-up factor to make the dynamic storage requirement for IEBDG a multiple of 2K.

Table 13c. Minimum Dynamic Storage Requirement for IBM-Supplied Utility Programs When the SYSUTILS Macro Instruction is Specified for MVT

Utility Program	Storage Requirement (in bytes) (1)
• System utilities:	
IEHDASDR	N/A (2)
IEHINITT	N/A (2)
IEHLIST	32K
IEHMOVE	22K + B (3)
IEHPROGM	24K
IFCEREPO	N/A (2)
• Data set utilities:	
IEBCOMPR	24K + 2B + 2L + E
IEBCOPY	(See Table 8c.)
IEBTCRIN	N/A (2)
IEBDG	N/A (2)
IEBEDIT	N/A (2)
IEBGENER	24K + 4B + 2L + E + F
IEBISAM	N/A (2)
IEBPTPCH	24K + 4B + E
IEBUPDAT	24K + 2B
IEBUPDTE	24K + 4B + 2L + E

Where: B = the largest blocksize in the job step, rounded to the next highest multiple of 2K. If the format specified for the data set is VS and LRECL is less than 32K, then B = the maximum logical record length, rounded to the next highest multiple of 2K.

L = 2,048 if user header and trailer labels are to be processed; otherwise, L=0.

E = the sum of the sizes of all the user exit routines. Round the size of each routine to the next highest multiple of 2K and then add.

F = 2,048 for each group of MAX parameters that are less than or equal to 200 bytes.

<u>Notes</u>:

1. If you specify a size smaller than 23,000 in the SYSUTILS macro instruction, all of the utility programs operate in the storage shown in Table 8c. If the size you specify is larger than the minimum storage requirement for a particular utility program, that program will be taken out of overlay structure. In order for all of the affected programs to be taken out of overlay structure, the largest minimum storage requirement must be specified.
2. This utility program is not affected by the size specified in the SYSUTILS macro instruction. It operates in the storage shown in Table 8c.
3. The IEHMOVE utility program is not in overlay structure. If the size you specify is equal to or greater than 21,534, successive loading of IEHMOVE modules takes place at execution time.

Table 14c. Dynamic Storage Requirement for OPEN/CLOSE/EOV for MVT

Supervisor Service	Storage Requirement (in bytes)
OPEN	
•With security protection	960 + 496 (N-1)
•Without security protection	800 + 496 (N-1)
Add to one of above entries, if relevant:	
•Each Format 3 data set control block for BSAM or QSAM	144
•Each additional Format 1 data set control block for BPAM (concatenated data sets only)	176
•Each Format 3 data set control block for BPAM (concatenated data sets only)	144
•Each additional Format 1 data set control block for ISAM and/or BDAM	104
•Each Format 3 data set control block for ISAM and/or BDAM	144
•Each ISAM data set	144
•Each 1403 printer with UCS feature	272
CLOSE	
•With RLSE	1,200 + 472 (N-1)
•Without RLSE	800 + 472 (N-1)
•With EOV (QSAM only, with or without RLSE)	1,480 + 472 (N-1)
•With EOV and EXTEND (QSAM only, with or without RLSE)	1,656 + 472 (N-1)
EOV	
•With EXTEND	1,000
•Without EXTEND	800
•With security protection	848
Where: N = the total number of data sets that are opened (or closed) at the same time; i.e., with the same OPEN (or CLOSE) macro instruction.	

When user label processing is specified (i.e., LABEL=(,SUL) is coded on the DD statement), an additional 168 bytes of dynamic storage are required.

Table 15c. Dynamic Storage Requirement for Supervisor Services in MVT (Part 1 of 2)

Supervisor Service	Storage Requirement (in bytes)	Sub-pool	Duration of Requirement
ABEND	968	252	Temporary
ATTACH •With ETXR •Without ETXR	 144 (1) 72 (1)	 0 0	 Released when task is terminated Released when task is terminated
BLDL	456	252	Temporary
BUILD	1,536 + 104	252 252	Temporary Released when storage is needed to satisfy a GETMAIN
CALL (overlay)	1,440	252	Temporary
CATLG	1,072	252	Temporary
DEQ	100 (7)	0	Temporary
FIND	456	252	Temporary
INDEX	1,072	252	Temporary
GETPOOL	1,536 + 176 + buffers (2)	252 252 0	Temporary Released after buffers are obtained if storage is needed to satisfy a GETMAIN request Released by FREEPOOL
LINK,LOAD,XCTL •Module in overlay mode •Module uses TESTRAN (5)	1,536 + module (3) + 1,536 + 992 (4) + 672 + 120 + 8 per CSECT + 640 + 216 + 1,536 + 1,072 (6)	252 251 or 252 252 252 252 252 252 0 252 252	Temporary Released according to attributes Temporary Released when job step is terminated Released when task is terminated Released by TEST OPEN Temporary Released when task is terminated Temporary Released when task is terminated

Table 15c. Dynamic Storage Requirement for Supervisor Services in MVT (Part 2 of 2)

Supervisor Service	Storage Requirement (in bytes)	Sub-pool	Duration of Requirement
LOCATE	496	252	Temporary
SEGLD	1,560	252	Temporary
SEGWT (if no SEGLD)	1,560	252	Temporary
SETPRT	736	252	Temporary
SPIE (if first for task)	32	0	Released when task is terminated
STIMER (with exit routine)	72	0	Released when exit routine completes
STOW	1,592	252	Temporary
UNCATLG	1,072	252	Temporary

Notes:
1. The appropriate LINK requirements must also be added.
2. The buffer requirement is equal to the length of a buffer multiplied by the number of buffers and rounded up to the next highest multiple of eight.
3. If the module is in storage and is reusable, this amount is not needed. The remainder of the requirements for LINK, LOAD, and XCTL are added if the conditions apply.
4. This amount is for the asynchronous overlay supervisor module and is required only if the module is not already in storage.
5. If a module is in overlay mode and uses TESTRAN, the 1536 bytes obtained for overlay are freed before any storage is requested for TESTRAN. This storage may then be used for TESTRAN.
6. This amount is for BSAM modules and is required only if the modules are not already in storage.
7. This storage is required only when the shared DASD option has been selected and a DEQ macro instruction is issued to release a device that has been reserved.

Table 16c. Dynamic Storage Requirements for the TSO Command Processors (Part 1 of 4)

Command	Dynamic Storage Requirement (in bytes)
EDIT	14K + A + B + C + D + F + IO
OUTPUT	3K + B1 + BSIZE + D + 44N + IO + PRINT1
TEST	8.1K + B2 + D + E + PRINT2 + 24Q + IO + R + S + T + U
LISTBC	1K + B3 + D + IO
SEND	2K + B4 + D + IO
ACCOUNT	1.5K + B5 + E + Subcommand Requirement Where: the subcommand requirement is the additional storage required for ACCOUNT when subcommands are processing and is equal to: For ADD 2K + B6 + D1 + IO For LIST 2K + B7 + D1 + IO For DELETE 2K + B8 + D1 + IO For CHANGE 2K + B9 + D1 + IO
OPERATOR	1K + B10 + E + IO + H
WHEN	B11
SUBMIT	5K + B17 + D + IO
CANCEL/STATUS	2K + B13
HELP	BSIZEHELP - B14 + D + IO
RUN	1K + B15 + D + IO
CALL	1K + B16 + D + IO
FREE	1K + B17 + D + IO
ALLOCATE	1K + B18 + D + IO
EXEC	27K + D + IO
LINK	B19
LOADGO	11K + B20 + LD + D2 + IO
LOGON/LOGOFF	2K + B21 + D + IO
PROFILE	2K + B22 + D + IO
TERMINAL	2K + B23 + D + IO
TIME	2K + B24 + D + IO

Table 16c. Dynamic Storage Requirements for the TSO Command Processors (Part 2 of 4)

Where:	A =	the additional dynamic storage required to run the commands HELP, RUN, MERGE, and FORMAT under EDIT.
	B =	13.5K maximum, or the size of EDIT modules from Appendix B that are not resident in the time sharing link pack area.
	C =	6.5K maximum, or the maximum size of any one of the EDIT subcommands from Appendix B that are not resident in the time sharing link pack area.
	D =	12K maximum, or the maximum size of any one of the service routines: PARSE, DAIR, and SCAN that are not resident in the time sharing link pack area. Table 17c. contains the dynamic storage requirements for the TSO service routines.
	BSIZE =	the blocksize of the largest data set retrieved by OUTPUT and the combined size of the non-resident BSAM read modules.
	BSIZEHELP =	the blocksize of the HELP data set.
	D1 =	12K maximum if the subcommand is using the PARSE service routine and PARSE is not resident in the time sharing link pack area. If PARSE is resident, D1 = 2K + the size of a user entry in the user attribute data set.
	D2 =	20K maximum if the PARSE and SCAN service routine are not in the time sharing link pack area. If either or both of these routines are in the link pack area, subtract their size from 20K.
	E =	1.5K maximum, or the size of the TSO service routine SCAN, if SCAN is not resident in the time sharing link pack area.
	F =	10K if the RENUM subcommand is run under EDIT.
	IO =	6.5K maximum, or the size of the I/O service routines GETLINE/PUTLINE that are not resident in the time sharing LPA.
	H =	the additional dynamic storage required to run the HELP command.
	LD =	16K maximum, or the size of the Loader modules (from Appendix A) that are not resident in the link pack area.
	N =	the number of jobs in the job list.
	PRINT2 =	THE STORAGE REQUIRED FOR QSAM access methods + the storage required for buffers (the default blocksize is equal to 1629), + 148 bytes for a DCB + 50 bytes for each print data set used.

Table 16c. Dynamic Storage Requirements for the TSO Command Processors (Part 3 of 4)

PRINT1 = the largest block size of a PRINT data set written in by OUTPUT + the size of the non-resident QSAM PUT modules.

Q = each symbol created with an EQUATE command.

R = 48 bytes for each active breakpoint.

S = 900 bytes + 6.4K if module IKJEGSYM is not in the time sharing link pack area.

T = 36 bytes for each module in storage that was link edited with the TEST attribute and 36 bytes for each module that was run under TEST

U = 16 bytes for each symbolic address used with a test subcommand.

B1 = 12K maximum, or the size of the OUTPUT modules from Appendix B that are not resident in the time sharing link pack area.

B2 = 20K maximum, or the size of the TEST modules from Appendix B that are not resident in the time sharing link pack area.

B3 = 3K maximum, or the size of the LISTBC modules from Appendix B that are not resident in the time sharing link pack area.

B4 = 8K maximum, or the size of the SEND modules from Appendix B that are not resident in the time sharing link pack area.

B5 = 6K maximum, or the size of the ACCOUNT modules from Appendix B that are not resident in the time sharing link pack area.

B6 = 20K maximum, or the size of the ADD modules from Appendix B that are not resident in the time sharing link pack area.

B7 = 12K maximum, or the size of the LIST modules from Appendix B that are not resident in the time sharing link pack area.

B8 = 9K maximum, or the size of the DELETE modules from Appendix B that are not resident in the time sharing link pack area.

B9 = 22K maximum, or the size of the CHANGE modules from Appendix B that are not resident in the time sharing link pack area.

B10 = 6K maximum, or the size of the OPERATOR modules from Appendix B that are not resident in the time sharing link pack area.

B11 = 3K maximum, or the size of the WHEN modules from Appendix B that are not resident in the time sharing link pack area.

B12 = 15K maximum, or the size of the SUBMIT modules from Appendix B that are not resident in the time sharing link pack area.

B13 = 15K maximum, or the size of the CANCEL/STATUS modules from Appendix B that are not resident in the time sharing link pack area.

B14 = 12K maximum, or the size of the HELP modules from Appendix B that are not resident in the time sharing link pack area.

B16 = 5K maximum, or the size of the RUN modules from Appendix B that are not resident in the time sharing link pack area.

Table 16c. Dynamic Storage Requirements for the TSO Command Processors (Part 4 of 4)

B16 =	3.2K maximum, or the size of the CALL modules from Appendix B that are not resident in the time sharing link pack area.
B17 =	2K maximum, or the size of the FREE modules from Appendix B that are not resident in the time sharing link pack area.
B18 =	6K maximum, or the size of the ALLOCATE modules from Appendix B that are not resident in the time sharing link pack area.
B19 =	the size required for program IEWL (i.e., the size required for the 44K, 88K, or 128K Linkage Editor.)
B20 =	12K maximum, or the size of the LINK/LOADGO modules from Appendix B that are not in the time sharing link pack area.
B21 =	184 bytes maximum, or 0 if module IKJEFL00 is resident in the time sharing link pack area.
B22 =	2K maximum, or the size of the PROFILE modules from Appendix B that are not resident in the time sharing link pack area.
B23 =	2.5K maximum, or the size of the TERMINAL modules from Appendix B that are not resident in the time sharing link pack area.
B24 =	736 bytes, or 0 if module IKJEFT25 is in the time sharing link pack area.

Table 17c. Dynamic Storage Requirements for TSO Service Routines

Service Routine(1)	Dynamic Storage Requirement in bytes
PARSE	12K
SCAN	1.5K
GETLINE/PUTLINE	6.5K
DAIR	9K
DEFAULT	4K
CIR	1K

Notes:
1. The TSO service routines can be made resident in the time sharing link pack area. See Appendix B for a list of the module names and sizes.

Table 18c. Minimum Dynamic Storage Requirements for Language Processors That Can be Used With TSO

Processing Program	Access Method Used	Storage Requirement (in bytes)
ALGOL	BSAM,QSAM	48K
Assembler F	QSAM,BPAM, and BSAM	50K
COBOL E	BSAM,BPAM	22K
COBOL F	BSAM,BPAM	86K
American National Standard COBOL	BSAM,BPAM	86K
FORTRAN IV E	BSAM	42K (1,2)
FORTRAN IV G	QSAM	100K (3)
FORTRAN IV H	QSAM	160K (4)
FORTRAN Syntax Checker	GAM	21K
Linkage Editor E (15K)	BSAM,BPAM	24K
Linkage Editor E (18K)	BSAM,BPAM	26K
Linkage Editor F (44K)	BSAM,BPAM	54K
Linkage Editor F (88K)	BSAM,BPAM	96K
Linkage Editor F (128K)	BSAM,BPAM	136K
PL/I F	SAM,BPAM	50K
PL/1 Syntax Checker (16K)	N/A	17K
PL/1 Syntax Checker (20K)	NA	21K
PL/1 Syntax Checker (27K)	NA	28K

Notes:
1. This estimate includes enough work space to process approximately 170 cards. More storage may be required by larger source programs.
2. If the PRFRM option is used, then the minimum main storage requirement is 19,456 bytes. If blocked input or output are also used, then the minimum main storage requirement is increased by the value of the expression [2*(BLKSIZE)] for each data set that contains blocked records.
3. This estimate includes sufficient work space to process approximately 400 cards. More storage may be required by larger source programs.
4. This estimate includes sufficient work space to process approximately 200-300 cards with a blocking factor of five for the SYSPRINT and SYSLIN data sets. More storage may be required by larger source programs; add 18,432 for each additional 100 cards.

Table 19c. Dynamic Storage Requirements for the TSO Utility Programs

Utility	Dynamic Storage Requirements (in bytes)
LISTDS	7K + A + DF + IO + P + 2048(N) + 2048(Q) + D
LISTALC	7K + A1 + IO + P + 2048(N) + 2048(Q)
LISTCAT	8K + A2 + IO + P + 280(R) + 2048(N) + 2048(Q) + D + CIR
PROTECT	2K + A3 + P + IO + DF
DELETE	3K + A4 + D + IO + CIR + P + DF
RENAME	4K + A5 + D + CIR + IO + P + DF

Where: A = 8K maximum, or the size of the LISTDS modules from Appendix B that are not resident in the time sharing link pack area.

A1 = 6K maximum, or the size of the LISTALC modules from Appendix B that are not resident in the time sharing link pack area.

A2 = 8K maximum, or the size of the LISTCAT modules from Appendix B that are not resident in the time sharing link pack area.

A3 = 5K maximum, or the size of the PROTECT module from Appendix B if it is not resident in the time sharing link pack area.

A4 = 6K maximum, or the size of the DELETE module from Appendix B, if it is not resident in the time sharing link pack area.

A5 = 7K maximum, or the size of the RENAME module from Appendix B, if it is not resident in the time sharing link pack area.

CIR = the size of the catalog information service routine from table 17c.; if this routine is resident in the time sharing link pack area, CIR = 0.

D = the size of the DAIR service routine from Table 17c; if this routine is resident in the time sharing link pack area, D = 0.

DF = the size of the DEFAULT service routine from Table 17c; if this routine is resident in the time sharing link pack area, DF = 0.

IO = the size of the GETLINE/PUTLINE service routines from Table 17c; if these routines are resident in the time sharing link pack area, IO = 0.

R = the number of levels of data set name qualifiers minus four.

Q = 1 for each set of 127 aliases in excess of the first 5.

P = the size of the PARSE service routine from Table 17c; If PARSE is resident in the time sharing link pack area, P = 0.

N = 1 for each set of 184 data set names processed in excess of the first 184 data set names processed.

Table 20c. Minimum Dynamic Storage Requirements for the TSO Trace Writer and the TSO Trace Data Set Processor

Function	Storage Requirement (in bytes)
TSO Trace Writer	8K + N(BLKSIZE + 36) + (NxI) + Y
TSO Trace Writer with Chained Scheduling	8K + N(BLKSIZE + 36) + I1 + N(I2) + Y
TSO Trace Data Set Processor	10K + A(B + C) + D(E + F) + Y

Where: N = the maximum number of buffers to be used for trace data. If NCP is specified, N=NCP.

BLKSIZE = the maximum size of the trace data buffers.

I = the size of the IOB for each buffer.

A = the number of buffers for the input data set.

B = the size of the input data set buffers.

C = the size of the IOB for each input data set buffer.

D = the number of buffers for the output data set.

E = the size of the output data set buffers.

F = the size of the IOB for each output data set buffer.

I1 = the size of the IOB.

I2 = the size of the ICB for each buffer.

Y = the access method requirement. For the trace writer, Y=0 if all BSAM modules are resident: otherwise [Y = 2K]. For the trace data set processor, Y=0 if all QSAM modules are resident: otherwise Y=2K.

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GRAPHIC PROGRAMMING SUPPORT REQUIREMENT

The graphic programming support routines require dynamic storage. These routines are problem oriented routines (PORs) for the IBM 2250 Display Unit. Only one copy of a routine is required in main storage, regardless of how often the routine is used. With MVT, these routines may be placed in the link pack area. Table 1 contains the dynamic storage requirement for the problem oriented routines.

Table 1. Minimum Dynamic Storage Requirement for Problem Oriented Routines for the IBM 2250 Display Unit

Problem Oriented Routine	Storage Requirement (in bytes)
GARC - Circular Arc	2,408
GCGRID - Cartesian Grid	1,368
GCPRNT - Graphic Character Print	1,160
GLABEL - Grid Labeling	1,968
GPGRID - Polar Grid	4,040
GPGVRD - Polar Grid with Vectors	3,548
GSDPLT - Graphic Data Plotting	4,096
GSPLOT - Scale and Plot	3,352
GSTOR - Store Graphic Orders	248
GSVPLT - Scale and Plot with Vectors	2,808
GVARC - Circular Arc with Vectors	2,896
PENTRK - Light Pen Tracking	1,000
Note: If the off-screen, off-grid option is used with problem oriented routines, add 800 bytes for the GOFFSAG module.	

OVERLAY SUPERVISOR REQUIREMENT

If a load module used in a job step is in overlay mode, the amount of storage required by the job step is increased by the size of an overlay supervisor module. Three overlay supervisor modules are furnished with the system:

- Basic module (synchronous overlay without check)
- Advanced module (synchronous overlay with check)
- Asynchronous module

The basic module does not test whether a request for overlay is valid; the other two do. Neither the basic nor advanced modules permit overlay through the SEGLD macro instruction; the asynchronous module does. (The SEGLD macro instruction, however, can be used because it is ignored without causing an error when either the basic or advanced module is used.)

The basic or advanced module may be used with PCP and/or MFT; the asynchronous module may be used only with MVT. Table 2 contains the dynamic storage requirement for each module.

Table 2. Dynamic Storage Required by the Overlay Supervisor Modules

Overlay Supervisor	Storage Requirement (in bytes)
Basic module	436
Advanced module	512
Asynchronous module (MVT only)	992

An overlay supervisor operates through the use of tables. The linkage editor generates these tables and incorporates them in the overlay program. Because the tables are part of the overlay program, their size must be considered in planning the availability of main storage for processing programs.

Two kinds of tables are created in overlay load modules by the linkage editor:

- A segment table (SEGTAB)
- Entry tables (ENTABs)

The segment table is a control section at the beginning of the root segment of the overlay program. Each segment of an overlay program, including the root segment, may contain one entry table. An ENTAB contains an entry for each symbol referred to by a V-type address constant except when:

- The symbol is defined in a segment in the path of the segment containing the address constant, or

- An ENTAB entry for the symbol exists in a segment in the path of the segment containing the address constant.

In addition to the main storage allocated to the SEGTABs and ENTABs, main storage for a NOTE list is required to execute a program in overlay. Table 3 contains these storage requirements.

Table 3. Dynamic Main Storage for Overlay Supervisor Tables and Lists

Description	Storage Requirement (in bytes)
Segment Table (SEGTAB)	4N + 24
Each entry table (ENTAB)	12(M+1)
NOTE list	4N + 8
Where: N = the number of segments in program. M = the number of entries in ENTAB.	

TESTRAN REQUIREMENT

When TESTRAN is used, the amount of dynamic storage used by the assembler language program is increased considerably. The additional storage is required for the TESTRAN interpreter and for inline code generated by the assembler for each TESTRAN macro instruction.

The requirement for the TESTRAN interpreter may be one of two amounts depending on whether the TRACE macro instruction is used. The TEST OPEN macro instruction also requires space during execution. These storage requirements are shown in Tables 4. Table 5 is used to estimate the storage requirement for the inline code supplied when a TESTRAN macro instruction is expanded by the assembler program.

Table 4. Dynamic Main Storage Requirement for TESTRAN During Execution

Description	Storage Requirement (in bytes)
Primary main storage requirement: • No TRACE • TRACE	 3,600 4,100
TEST OPEN	40 + 9D + 9E + 9F
Where: D = the number of TEST AT macro instructions. E = the number of counters defined. F = the number of flags defined.	

Table 5. Dynamic Main Storage Requirement for TESTRAN Inline Code Supplied by Assembler Program

TESTRAN Macro Instruction	Storage Requirement (in bytes)
DUMP DATA	12 + 2M + Y
DUMP CHANGES	12 + 2M + Y
DUMP MAP	3 + 2M
DUMP PANEL	5 + 2M + X
DUMP COMMENT	4 + 2M + C
DUMP TABLE	5 + 2M
TRACE FLOW	12 + 2M + C
TRACE CALL	12 + 2M + C
TRACE REFER	12 + 2M + C + Y
TRACE STOP	4 + 2M + 3T
SET COUNTER	9
SET FLAG	9
SET VARIABLE	10 + 2M
GO BACK	3 + P
GO IN	6
GO OUT	3
GO TO	6
TEST OPEN	26 + 4L + 2M + Z
TEST WHEN	15 + 2M
TEST ON	27
TEST CLOSE	3
TEST AT	7 + 3A
TEST DEFINE	3 + W
Where: A = the number of test points. C = the number of characters in the comment operand. L = the number of additional TESTRAN control section names listed in OPTEST. M = the number of key word modifiers. P = three additional bytes if the GO BACK is to return to a specified problem program address. T = the number of trace operations stopped. W = the number of counters or flag names in operand. X = the number of registers to be dumped. Y = the number of characters in the NAME and CSECT subfields. Z = the number of characters in control section name given to the macro instruction.	

1130/360 DATA TRANSMISSION PROGRAM

The 1130/360 Data Transmission program allows the FORTRAN programmer to transmit data between an IBM 1130 Disk Monitor System and an IBM System/360 Operating System. This program can be used in any configuration with binary synchronous communication.

Table 6 contains the formula to be used to determine the minimum dynamic storage requirement for the 1130/360 Data Transmission program.

Table 6. Minimum Dynamic Storage Requirement for 1130/360 Data Transmission Program

S = 1,048 + A + B + C + D + buffers
Where: A = is the maximum dynamic storage required to execute the user's program, rounded up to the next highest multiple of 2K. B = is the sum of the sizes of the conversion routines required by the user's application. The storage required by each conversion routine is: • Converts extended precision numbers = 1,136 • Converts standard precision numbers = 1,144 • Converts integer numbers or some alphameric data = 1,288 C = 952 • N Where: N = is the number of 1130 Disk Monitor Systems to be supported simultaneously by the user's application program. D = is the dynamic storage required by the following modules: • IKDGTIRB, IKRDWRT, IKDGTCLT, IKDGTNIT, IKDGTEND • Required BTAM modules If any of these modules are made resident, decrease the value for D accordingly. buffers = is the sum of the largest input record plus the largest output record plus 32.

DYNAMIC STORAGE REQUIREMENTS FOR THE FLOATING POINT EXTENDED PRECISION SIMULATOR

If you use the floating point precision simulator, additional storage is required in the dynamic area. The additional storage required is either:

3300 bytes if you hardware does not have the extended precision feature,

<u>or</u>

1450 bytes if your hardware has the extended precision feature.

DYNAMIC STORAGE REQUIREMENTS FOR THE LOADER

The amount of dynamic main storage required for the loader depends on the following:

- The size of the loader modules and whether or not they are resident in fixed main storage.
- Data Management Access Methods that are used by the loader.
- The size of the tables and buffers used by the loader.
- The size of the program being loaded.
- The control program (PCP, MFT, or MVT).

The maximum amount of dynamic main storage that the loader can obtain for its own tables and buffers, and the loaded program is specified by the SIZE parameter. Figure 9 shows how storage is allocated for the loader in a system with the loader modules resident (A) and in a system where the loader modules are not resident (B).

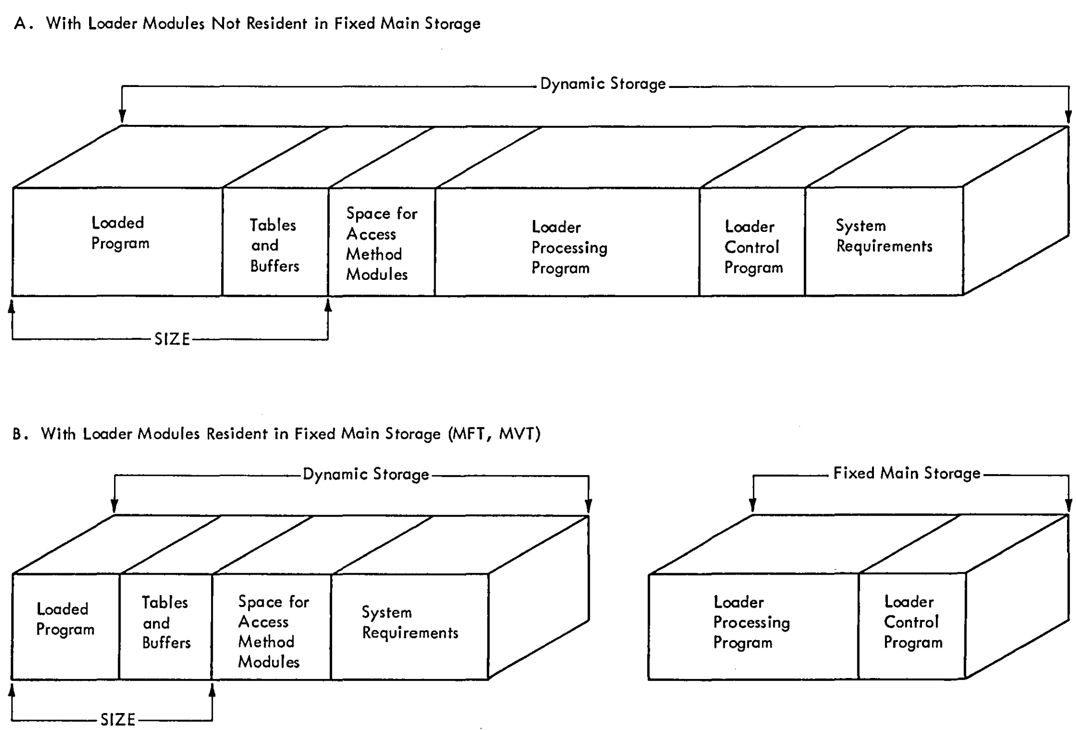

Figure 9. Dynamic Main Storage Required by Loader

The loader will always reserve 4000 bytes of dynamic storage for the access method modules even if they are resident. The amount of storage required by the loader for its tables and buffers is variable and depends on the program being loaded and the processor used: 2K is the minimum required, but PL/1 requires a minimum of 8K and FORTRAN requires a minimum of 3K. Table 6 shows the storage requirements for the loader.

Table 7. Dynamic Storage Requirements for the Loader

Control Program	Storage Required (in bytes)					
	Loader Modules		Access Method Modules	Tables and buffers	System Requirements	Loaded Program
	Control	Processing				
PCP	440	13,350	4000	3000 (1)	1600	Variable
MFT	440 (2)	13,350 (2)	4000	3000 (1)	1600	Variable
MVT	2000 (2)	14,000 (2)	4000	3000 (1)	4000	Variable

Notes:

1. 2000 bytes is the minimum size required. The general formula for calculating the storage for the table and buffer area is:

$$S=20a+8b+4x132(c+1)\ \overset{SYSPRINT}{+BUFNO}\left(\frac{SYSPRINT}{BLKSIZE+24}\right)\overset{SYSLIN}{+BUFNO}\left(\frac{SYSLIN}{BLKSIZE+24}\right)+1506$$

Where: S = storage required (in bytes)
a = number of external symbols
b = number of external relocation dictionary entries that refer to control sections that have not been processed by the Loader
c = [I/32] where I= number of external symbols in any one input module

2. These modules may be resident in fixed main storage.

Estimating the SIZE Value in MVT

The maximum amount of main storage that is available to the loader's tables and buffers, and the loaded program is specified by the SIZE parameter. In MVT, the formula for determining the actual SIZE value used by the Loader is:

SIZE = Region size-22K

For example: if a REGION of 100K is specified and a SIZE of 100K is specified, the loader will obtain 78K for the tables, buffers, and loaded program.

Access Methods—Contents

Illustrations

Tables

PCP, MFT, MVT and M65MP—Data Access Method Requirements

When a data control block is opened, a set of access method modules, tailored to the characteristics of the associated data set, is brought into main storage. An access method module may be used with two or more data sets if the data set characteristics that apply to the module are identical.

If the resident reenterable load module is selected, any or all of the modules may be made resident. (If the Checkpoint/Restart facilities are to be utilized by an installation, all BSAM and BPAM modules must be made resident.) If an MFT system has the system log facility, all BSAM modules must be resident. The amount of dynamic storage required by the program is reduced by the sum of all resident modules used by the program. Appendix A contains a list of all reenterable access method modules.

In addition to the modules, control blocks are created according to the characteristics of the data set and the type of device. With PCP and MFT all of the control blocks estimates must be included in the dynamic storage requirement. With MVT, certain control blocks are placed in the system queue area rather than in the partition or region. These control blocks are so indicated and should not be added to the dynamic requirement.

Sequential Access Methods (BSAM and QSAM)

The dynamic main storage requirement for retrieving or storing a data set with the basic sequential or queued sequential access method (BSAM or QSAM) is estimated from the following formula:

$S = A_1 + A_2 + B_1 + B_2 + B_3 + B_4$ + buffers + record area
Where: A_1 = size of the data control block (DCB) and, for BSAM, the data event control blocks (DECBs). A_2 = size of input/output blocks (IOBs), data extent blocks (DEBs) for PCP and MFT only, and channel programs. (Assume one extent in each DEB.) B_1 = size of sharable, directly entered routines for macro instructions. B_2 = size of sharable, indirectly entered routines for macro instructions. B_3 = size of sharable interruption handling routines. B_4 = size of sharable error recovery routines for QSAM. buffers = storage required for the input and output buffers and equals 8+(4•BUFNO)+(BUFNO•BLKSIZE) record area = storage required for the assembly and segmenting of a spanned record and equals: for QSAM = 32 + LRECL when the DCB specifies: BFTEK = A, RECFM = VS or VBS, and locate mode. for BSAM = 12 plus the smaller of the track capacity or blocksize when the DCB specifies: BFTEK = R, RECFM = VS, and MACRF = WL.
<u>Note</u>: For dummy data sets, $S = A_1 + B_1$, where B_1 = 104 bytes.

Estimates A_2, B_1, B_2, B_3, and B_4 represent storage that remains allocated only while the data control block is open (unless it is used concurrently with another data control block). Estimate A_1 includes storage that normally remains allocated for the duration of a job step.

Use Tables 8 through 17 to calculate estimates A_1, A_2 and B_1 through B_4 for each data set to be retrieved or stored with BSAM or QSAM. Add together the entries in each table that correspond to the attributes of the data set.

Select one entry from Table 8 for each data set stored or retrieved with BSAM.

Table 8. Estimate A_1 for BSAM

I/O Device Type	Storage Requirement (in bytes)
Card reader, card punch, printer or TSO terminal	72 + 20n
Paper tape	80 + 20n
Optical character readers (1285/1287/1288)	88 + 20n
1419 Magnetic character reader	88 + 20n
1275 Optical reader sorter	88 + 20n
Magnetic tape or direct access storage	88 + 20n
Direct access storage (Create BDAM spanned record format)	88 + 24n
Where: n = the number of data event control blocks, i.e., the number of channel programs (when the data control block is open for UPDAT, $n \geq 2$).	

Select one entry from Table 9 for each data set stored or retrieved with QSAM.

Table 9. Estimate A_1 for QSAM

I/O Device Type	Storage Requirement (in bytes)
Unit record, or TSO terminal	80
Magnetic tape	96
Direct access storage	96
Optical character readers (1285/1287/1288)	96

Select one entry from Table 10 for each data set stored or retrieved with either BSAM or QSAM. If BSAM is used to create a direct data set for use with BDAM, use Table 11. For MVT, subtract 96 bytes from each entry selected from either Table 10 or Table 11.

Table 10. Estimate A_2 for BSAM and QSAM (Part 1 of 2)

I/O Device Type	Data Control Block Open for	Storage Requirement (in bytes): Normal Scheduling	Storage Requirement (in bytes): Chained Scheduling
Printer or punch	OUTPUT	56n + 96	56n + 144
Card reader	INPUT	96 + n(48 + relevant options)	48n + 144
Magnetic tape	INPUT OUTPUT RDBACK	96 + n(48 + relevant options)	48n + 144
Magnetic tape	INOUT OUTIN	56n + 96	64n + 144
Card read-punch	INOUT	64n + 96	N/A
Optical Character Readers	INPUT (BSAM)	160	N/A
	INPUT (QSAM)	96+n(48+16r)	N/A
Magnetic ink character reader and optical reader sorter (1419/1275)	INPUT (BSAM)	608+28n	N/A
Direct access storage	UPDAT (BSAM)	112 + (120 + relevant options) See Note	N/A
	UPDAT (QSAM)	112 + n(128 + relevant options)	
	INOUT OUTIN	112 + n(128 + relevant options) See Note	192 + n(122 + relevant options)
	INPUT OUTPUT	112 + n(88 + relevant options) See Note	INPUT 192 + n(64)
	INPUT (OFFSET READ)	112 + n(112)	OUTPUT 192 + (64 + relevant options)
TSO terminal	Any	120	0

Table 10. Estimate A_2 for BSAM and QSAM (Part 2 of 2)

Where relevant, include in the above storage requirement: (record overflow and exchange buffering are mutually exclusive)	
Option	Storage Requirement (in bytes)
Record overflow (normal scheduling, not UPDAT)	48(t - 1)
Write validity check	24 (32 if record overflow but not UPDAT)
Exchange buffering (normal scheduling)	8B - 8
User Totaling	4

Where: n = the number of channel programs (number of buffers for QSAM) for chained scheduling, n≥2.
r = number of lines read (BUFL/LRECL).
t = the number of tracks that a record may occupy.
B = the blocking factor for blocked, fixed-length records (B = 1 when a unit record device is specified).

Note: If record overflow is used and the data control block is opened for UPDAT, INPUT, INOUT, or OUTIN, then add 96 bytes.

Select one entry from Table 11 for each direct data set created with BSAM.

Table 11. Estimate A_2 for BSAM When Creating a Direct Data Set

Option	Record Format	Storage Requirement (in bytes)
Without record overflow	F	120+128n
	U or V	120+160n
With record overflow	F, U, or V	192+56t+(48+24t)n
Write validity check without record overflow	F	120+176n
	U or V	120+184n
Write validity check with record overflow	F, U, or V	192+72t+(80+24t)n
Where: n = the number of channel programs. t = the number of tracks that a record may occupy.		

Select one or more entries from Table 12 for each data set stored or retrieved with BSAM. Because these entries represent storage for sharable routines, no entry should be added more than once when estimate B_1 is calculated for multiple data control blocks open at the same time.

Table 12. Estimate B_1 for BSAM (Part 1 of 2)

Macro Instruction	I/O Device Type	Data Control Block Open for	Storage Requirement (in bytes)	
			Normal Scheduling	Chained Scheduling
READ/WRITE	Unit record, magnetic tape, or direct access	INPUT OUTPUT INOUT RDBACK OUTIN	408	408
	Direct access	UPDAT	320	N/A
	TSO terminal	Any	492	N/A
READ	Paper tape	INPUT (trans-late)	572	N/A
	Optical Reader Magnetic Reader (1419/1275)	INPUT INPUT	136 176	N/A N/A
	TSO terminal	Any	316	N/A
READ (offset READ of a spanned direct data set)	Direct access	INPUT	104	N/A
CHECK	Unit record, magnetic tape, or direct access	INPUT OUTPUT INOUT RDBACK OUTIN	120	120
	Direct access	UPDAT	144	N/A
	Paper tape	INPUT	288	N/A
	Optical Reader Magnetic Reader (1419/1275)	INPUT INPUT	818 414	N/A N/A
	TSO terminal	Any	70	N/A
CHECK (creating a direct data set)	Direct access	OUTPUT	192	N/A
CHECK (creating a direct data set with VS format)	Direct access	OUTPUT	387	N/A

(Part 1 of 2)

Table 12. Estimate B_1 for BSAM (Part 2 of 2)

Macro Instruction	I/O Device Type	Data Control Block Open for	Storage Requirement (in bytes) Normal	Chained
CNTRL	Magnetic tape	Any	440	N/A
	Card reader	INPUT	176	N/A
	Printer	OUTPUT	192	N/A
	Optical Reader Magnetic Reader (1419/1275	INPUT INPUT	864 440	N/A N/A
	TSO terminal	Any	2	N/A
NOTE/POINT	Magnetic tape	INPUT OUTPUT INOUT RDBACK OUTIN	344	296
	Direct access with no record overflow	INPUT OUTPUT INOUT OUTIN	280	352
	Direct access with no record overflow	UPDAT	352	N/A
	Direct access with record overflow	Any	352	N/A
	TSO terminal	Any	6	N/A
WRITE (creating a direct data set with F format)	Direct access	OUTPUT	592	N/A
WRITE (creating a direct data set with U or V format)	Direct access	OUTPUT	776	N/A
WRITE (creating a direct data set with record overflow)	Direct access	OUTPUT	1056	N/A
WRITE (creating a direct data set with VS format. BFTEK VS format. BFTEK =R must be specified)	Direct access	OUTPUT	1914	N/A
	TSO terminal	OUTPUT	166	N/A
DSPLY	Optical Reader	INPUT	472	N/A
RESCN	Optical Reader	INPUT	592	N/A
Appendage	Magnetic Reader (1419/1275)	INPUT	3620	N/A

For each data set stored or retrieved with QSAM, select one item either from Table 13 if simple buffering is used or from Table 14 if exchange buffering is used. Because these entries represent storage for sharable routines, no entry should be added more than once when estimate B_1 is calculated for multiple data control blocks open at the same time.

Table 13. Estimate B_1 for QSAM (Simple Buffering) (Part 1 of 2)

Macro Instruction	Mode	Record Format	Storage Requirement (in bytes)
GET	Locate	F or U	144
		V	136
		V spanned	184
		V spanned (logical record interface)	634
	Move	F or U	264
		V	240
		V spanned	392
	Data	V spanned	384
GET (reading backwards for magnetic tape)	Locate	F or U	152
	Move	F or U	256
GET (with CNTRL for card reader)	Move	F or U	344
		V	336
GET (with PUTX function)	Data control block open for UPDAT	F, U, or V	400
		V spanned (logical record interface)	1920
GET (paper tape translate)	Move	F or V	800
GET (TSO terminal)	Any	Any	392

Table 13. Estimate B_1 for QSAM (Simple Buffering) (Part 2 of 2)

PUT (if CNTRL for printer is desired, add 192)	Locate	F or U	168
		V	216
		V spanned	232
		V spanned record interface)	
PUT (includes PUTX function; if CNTRL for printer is desired, add 192)	Move	F or U	264
		V	296
		V spanned	498
	Data	V spanned	484
PUT (TSO terminal)	Any	Any	212
GET (for Optical Readers)	Locate	F	312
		V or U	408
	Move	F	376
		V or U	456
PUT/GET (TSO terminal)	Any	Any	520
CNTRL (for Optical Readers)	N/A	N/A	864
RDLINE(for Optical Readers)	N/A	N/A	232

Note: Each GET macro instruction includes the corresponding RELSE macro instruction; each PUT macro instruction includes the corresponding TRUNC macro instruction.

Table 14. Estimate B_1 for QSAM (Exchange Buffering)

Macro Instruction	Mode	Record Format	Storage Requirement (in bytes)
GET	Locate	F, U, or V	128
		F blocked	120
	Substitute	F or U	104
		F blocked	160
PUT (includes PUTX function; if CNTRL for printer is desired, add 192)	Move	F, U, or V	376
		F blocked	336
	Substitute	F or U	376
		F blocked	336

Note: Each GET macro instruction includes the corresponding RELSE macro instruction; each PUT macro instruction includes the corresponding TRUNC macro instruction.

Select one or more entries from Table 15 for each data set stored or retrieved with either BSAM or QSAM. Because these entries represent storage for sharable routines, no entry should be added more than once when estimate B_2 is calculated for multiple data control blocks open at the same time.

Table 15. Estimate B_2 for BSAM and QSAM (1)

I/O Device Type	Data Control Block Open for	Storage Requirement (in bytes)	
		Normal Scheduling	Chained Scheduling
Card punch or printer (with hardware control character or no control character)	OUTPUT	152	216
Card punch or printer (with ASA control character)	OUTPUT	256	344
Card reader	INPUT		
Magnetic tape	INPUT,OUTPUT,INOUT, OUTIN,RDBACK	96	240
Magnetic Readers (1419/1275)	INPUT	346	N/A
Optical Readers	INPUT	254	N/A
Direct access	INPUT (record format not standard F), INOUT, OUTIN, UPDAT		(N/A for UPDAT)
Direct access	UPDAT (with: record format = VS or VBS and a logical record interface of BFTEK=R, or BUILDRCD macro is issued	1919	N/A
Direct access without record overflow	OUTPUT, OUTIN, INOUT, INPUT, UPDAT (record format Standard F)	544	680
Direct access with record overflow	OUTPUT, OUTIN, INOUT, INPUT	824	N/A

Where relevant, add to the above requirements:

Option	Storage Requirement (in bytes)
User Totaling	220 + (n+1)•length of user's totaling area rounded to 1/2 word. Where: n = number of channel programs (number of buffers for QSAM); for chained scheduling $n \geq 2$.

Select one or more entries from Table 16 for each data set stored or retrieved with either BSAM or QSAM. An entry must be selected if all attributes listed for that entry apply to the data set, no matter how many entries apply. Because these entries represent storage for sharable routines, no entry should be added more than once when estimate B_3 is calculated for multiple data control blocks open at the same time.

Table 16. Estimate B_3 for BSAM and QSAM

Scheduling	I/O Device Type	Data Control Block Open for	Record Format	Storage Requirement
Chained	Any	INPUT, OUTPUT, INOUT, OUTIN	Any	1428
	Direct access	INPUT, INOUT, OUTIN	Any	256
Normal	Any except paper tape	INPUT, INOUT, OUTIN, UPDAT	Blocked F including standard	144
		INPUT, INOUT, OUTIN, UPDAT	V	136
	Direct access with record overflow	INPUT, INOUT, OUTIN, UPDAT	Any	600
	Direct access	UPDAT (QSAM only)	Any	248
	Direct access	UPDAT (BSAM only)	Any	152
	Direct access	INPUT, INOUT, OUTIN	Any (except standard F)	152
	Printer	OUTPUT	Any	96
	Direct access	UPDAT	Any	240
	Card reader or magnetic tape (only for input stream when MVT is not specified)	INPUT,RDBACK	Any	80
	Paper tape	INPUT	F or U	56
	Paper tape	INPUT	Translate tables for ASCII or Burroughs	512
			Translate tables for IBM, teletype, NCR, or Friden	768
	Direct access (creating a direct data set)	OUTPUT	VS (BFTEK=R)	104
	Direct access (offset READ of direct data set)	INPUT	VS (BFTEK=R)	335

Select one entry from Table 17 for each data set stored or retrieved with QSAM. (Estimate B does not apply to BSAM.) Because these entries represent storage for sharable routines, no entry should be added more than once when estimate B is calculated for multiple data control blocks open at the same time.

Table 17. Estimate B for QSAM

Data Control Block Open For	Storage Requirement (in bytes)
INPUT	152
OUTPUT	152
UPDAT	640
UPDAT (logical record interface spanned records)	933

Checkpoint/Restart Facility

When the installation plans to use the checkpoint/restart facility, six basic resident modules (see Table 18) are loaded into the fixed main storage area at NIP time. These modules allow checkpoint records to be written on magnetic tape or a direct access device. (The six modules names are already part of the standard RAM list, IEAIGG00.)

If chained scheduling or track overflow will be used to write checkpoint records, the user must obtain the optional modules indicated in Table 18 for the featurs and add them to his system.

Table 18. Resident Modules for the Checkpoint/Restart Facility

Always resident	
These modules are always used for tape and direct access --	IGG019BA* IGG019BB* IGG019CC*
In addition, if direct access is used these modules are used	IGG019CD* IGG019CH* IGG019BC
Optional modules that can be added	
IF track overflow is used add these modules	IGG019C1 IGG019C2 IGG019C3
IF chained scheduling is used -- 1-add these modules for tape and direct access --	IGG019CU IGG019CW
2-And, if direct access is used add these modules --	IGG019CV IGG019CZ
*See "Notes About the Location of the Modules."	

For example, if the user decided to use direct access only for the checkpoint data set, using chained scheduling, he would need all the modules except for the three required for track overflow.

The user obtains the optional modules by:

1. Adding the additional names for the modules he will require to the standard list IEAIGG00, which is a member of SYS1.PARMLIB.

2. Building a separate list that contains the names of the modules he requires and add it to SYS1.PARMLIB. Then use the operator communication option at NIP time to get the additional modules loaded as part of the nucleus. The operator communication option is specified in the SUPRVSOR system generation macro instruction.

See the chapter "Using the Resident BLDL Table, Access Method, SVC Routine, and Job Queue Options, the Link Pack Area, and the Link Library List" in the System Programmer's Guide for detail information about modifying the standard RAM list.

Notes About the Location of the Modules

PCP and MFT Systems -- The parameter RESIDNT with ACSMETH as one of the subparameters must be specified in the system generation macro instruction SUPRVSOR. The six basic resident modules are access method modules and will be in the RENT area in fixed main storage. (See Figure 2.) Any optional modules chosen will also be in the RENT area and increase its size, provided the correct procedure is followed to obtain them.

*MVT and M65MP Systems -- The parameter RESIDNT with RENTCODE as one of the subparameters must be specified in the system generation macro instruction SUPRVSOR. The first five of the basic resident modules (with the asterisks) are always loaded into the link pack area. The sixth basic resident module will be loaded into the RENT area of fixed main storage (see Figure 7). Its name is part of the standard RAM list.

Any optional modules chosen will also be in the RENT area and increase its size, provided the correct procedure is followed to obtain them.

BSAM Example

Fixed-length blocked records are read from one tape and written on another. The CHECK macro instruction and normal scheduling are used.

$$S = A_1 + A_2 + B_1 + B_2 + B_3 + \text{buffers}$$

A_1, DCB and DECB:	
INPUT from tape, 88 + 20(2)	128
OUTPUT to tape, 88 + 20(2)	128
A_2, Channel programs, DEB, and IOB:	
INPUT from tape, normal scheduling, 96+2(48)	192
OUTPUT to tape, normal scheduling, 96+2(48)	192
B_1, Sharable directly entered routines:	
READ/WRITE	408
CHECK	120
B_2, Sharable indirectly entered routines:	
Magnetic tape	96
B_3, Sharable interruption routine:	
Normal scheduling, fixed-length blocked records	144
Total	1,408 bytes + buffers

QSAM Example

Fixed-length blocked records are read from magnetic tape and written to another tape. Move mode and normal scheduling are used.

$$S = A_1 + A_2 + B_1 + B_2 + B_3 + B_4 + \text{buffers}$$

A_1, Control blocks:	
INPUT from tape	96
OUTPUT to tape	96
A_2, Channel programs, DEB, and IOB:	
INPUT from tape, normal scheduling, 96+2(48)	192
OUTPUT to tape, normal scheduling, 96+2(48)	192
B_1, Sharable directly entered routines:	
GET, move mode, simple buffering	264
PUT, move mode, simple buffering	264
B_2, Sharable indirectly entered routines:	
Magnetic tape	96
B_3, Sharable interruption routines:	
Normal scheduling, fixed-length blocked records	144
B_4, Sharable error routines:	
INPUT	152
OUTPUT	152
Total	1,648 bytes + buffers

Basic Partitioned Access Method (BPAM)

The dynamic main storage requirement for retrieving or storing a data set with the basic partitioned access method (BPAM) is estimated from the following formula. All estimates for BPAM are calculated from the tables used for BSAM.

$S = A_1 + A_2 + B_1 + B_2 + B_3 + \text{buffers}$
Where: A_1 = size of data control block (see Table 9). A_2 = size of input/output blocks (IOBs), data extent blocks (DEBs) for PCP and MFT only, and channel programs (see Table 11). B_1 = size of sharable, directly entered routines for macro instructions (see Table 13 and include NOTE and POINT macro instructions). B_2 = size of sharable, indirectly entered routines for macro instructions (see Table 16). B_3 = size of sharable interruption handling routines (see Table 17). buffers = size of input and output buffers.

Estimates A_2, B_1, B_2, and B_3 include storage that remains allocated only while the data control block is open (unless it is used concurrently with another data control block). Estimate A_1 includes storage that normally remains allocated for the duration of a job step.

Because BPAM uses the same sharable routines as BSAM, storage requirements for sharable routines should not be duplicated when estimates B_1, B_2, and B_3 are calculated for multiple data control blocks open at the same time.

BPAM Example

One member with fixed-length blocked records (not Standard F) is read. Two buffers and the CHECK, NOTE, and POINT macro instructions are used.

$S = A_1 + A_2 + B_1 + B_2 + B_3$ + buffers

A_1, Control blocks:	
Direct access, INPUT, 88 + 20(2)	128
A_2, Channel programs, 112 + 88(2)	288
B_1, Sharable directly entered routines:	
READ/WRITE, INPUT	408
CHECK	120
NOTE/POINT	280
B_2, Sharable indirectly entered routines:	
INPUT	96
B_3, Sharable interruption routines:	
Normal scheduling, fixed-length blocked records	144
Normal scheduling, any record format except standard F	152
Total	1,616 bytes + buffers

Basic Direct Access Method (BDAM)

The dynamic main storage requirement for retrieving or storing a data set with BDAM is estimated from the following formula:

$S = A_1 + A_2 + B_1 + B_2 + B_3 + B_4$ + Segment area for VRE
Where: A_1 = size of the data control block (DCB), data event control blocks (DECBs), data extent block (DEB) for PCP and MFT only, and interruption request blocks (IRB) for PCP and MFT only.
A_2 = size of input/output blocks (IOBs), and channel programs.
B_1 = size of sharable routines for addressing method.
B_2 = size of sharable routines for macro instructions.
B_3 = size of sharable routines for options.
B_4 = 3378 for VRE, 1536 otherwise
Segment area = the smaller of the track capacity or the maximum record size.

Select entries from Table 19 for each data set stored or retrieved with BDAM.

Table 19. Estimate A_1 for BDAM

Control Block	Storage Requirement (in bytes)
Data control block	88
Data extent block for PCP and MFT only	112
Each data event control block	28, 36 for VRE
Interruption request block for PCP and MFT only	96

Select one entry from Table 20 for each read or write operation.

Table 20. Estimate A_2 for BDAM

Macro Instruction and Type Field	Storage Requirement (in bytes): Without Extended Search or Write Validity Check Options non-VRE	VRE	Additional Bytes With Write Validity Option non-VRE	VRE	Additional Bytes With Extended Search Option non-VRE	VRE
READ I	112	120(3)	N/A	N/A	N/A	N/A
READ K	112	120(4)	N/A	N/A	64	96
WRITE I	112	128	24	40	N/A	N/A
WRITE K	112	128	24	24	64	88
WRITE A (record format F)	144	N/A	24	N/A	80	N/A
WRITE A (record format U or V)	168	272	32	48	0	0

Notes:
1. If the dynamic buffering option is included, add 16 bytes for each data control block and include the total size (in bytes) of all buffer areas.
2. If the read exclusive option is used, add 80 bytes for each data control block.
3. If "next address" is requested, add 32 bytes.
4. If "next address" is requested, add 40 bytes.

Select one entry from Table 21 for each data set stored or retrieved with BDAM. Because these entries represent storage for sharable routines, no entry should be added more than once when estimate B_1 is calculated for multiple data control blocks open at the same time.

Table 21. Estimate B_1 for BDAM

Addressing Method	Storage Requirement (in bytes): Without Feedback Option	With Feedback Option
Relative record	312	520
Relative record with record overflow	632	848
Relative track	296	296
Actual	0	0

Select one or more entries from Table 22 for each data set stored or retrieved with BDAM. Because these entries represent storage for sharable routines, no entry should be added more than once when estimate B_2 is calculated for multiple data control blocks open at the same time.

Table 22. Estimate B_2 for BDAM

Type Field of Macro Instruction	Storage Requirement (in bytes) Without Extended Search Option non-VRE	VRE	With Extended Search Option non-VRE	VRE
I	200	648(1)	N/A	N/A
K	160	684(1)	360	936
A (Record format F)	288	N/A	504	N/A
A (Record format U or V)	652	1432	1,792	2496

Note:
1. This number should be used only once if types I and K are being used.

Select one or more entries from Table 23 for each data set stored or retrieved with BDAM. Because these entries represent storage for sharable routines, no entry should be added more than once when estimate B_3 is calculated for multiple data control blocks open at the same time.

Table 23. Estimate B_3 for BDAM

Option	Storage Requirement (in bytes)
Write validity check	242
Dynamic buffering	512
Read exclusive	936
Extended search	248
CHECK macro instruction	264

Note: Add 264 bytes once to the total estimate if one or more of the following apply:

- Type field of macro instruction is A and record format is U or V.
- Dynamic buffering.
- Read exclusive.

BDAM Example

Read with one channel program and write with another channel program using relative track addressing, validity checking, and key type operations. The extended search, feedback, and dynamic buffering options are not used.

$S = 1,536 + A_1 + A_2 + B_1 + B_2 + B_3$

Constant	1,536	
A_1, Control blocks:		
Data control block	88	
Data extent block	112	
Two data event control blocks, 28 (2)	56	
Interruption request block	96	
A_2, Channel programs:		
READ K without extended search option	112	
WRITE K with validity check option	136	
B_1, Addressing method:		
Relative track without feedback option	296	
B_2, Macro instructions:		
Type K without extended search option	160	
B_3, Options:		
Write validity check	160	
Total		2,752 bytes

Basic Indexed Sequential Access Method (BISAM)

The dynamic main storage requirement for retrieving or storing a data set with the basic indexed sequential access method (BISAM) is estimated by adding together the buffer area requirements, a coding space estimate, a channel program space estimate, and a control block space estimate. The buffer area requirement for BISAM is determined as follows:

For fixed length records: Area = N(BLKSIZE + 16) + B

For variable length records: Area = N(BLKSIZE + J) + B

Where: N = number of buffers

B = size of BCB (20 for alignment on a fullword boundary and 24 for alignment on a doubleword boundary).

J = 16 if the buffers are aligned on a doubleword boundary and 12 if the buffers are aligned on a fullword boundary.

If new logical records are not written in a data set (i.e., if WRITE KN is not used), refer to Tables 25 and 26. If WRITE KN is used, refer to Tables 27 and 28. In both cases, use Table 29. When both WRITE KN and any combination of READ K, READ KU, or WRITE K is used, use the total of Tables 26 and 29 for the channel program space estimates.

Without WRITE KN

Select one or more entries from Table 24 for each data set stored or retrieved using BISAM without WRITE KN. Because these entries represent storage for sharable routines, no entry should be added more than once when coding space is calculated for multiple data control blocks open at the same time.

Table 24. Coding Space Estimate for BISAM Without WRITE KN

Macro Instruction and Type Field	Record Format	Write Validity Checking	Levels of Indexing Searched on Device	Storage Requirements (in bytes)
READ K, READ KU, or WRITE K (3)(4)	Fixed	No	None (1)	3,418
	Fixed	No	One or more (2)	3,608
	Fixed	Yes	None (1)	3,684
	Fixed	Yes	One or more (2)	3,874
	Variable			4,056

Notes:
1. Assume only one level of indexing, which is in main storage.
2. Assume one or more levels of indexing, of which the highest level may be in main storage if there are two or more levels.
3. If dynamic buffering is used, add 664 bytes.
4. If CHECK macro is used to test for completion of READ or WRITE, add 112 bytes.

Select one entry from Table 25 for each data set stored or retrieved using BISAM without WRITE KN.

Table 25. Channel Program Space Estimate for BISAM Without WRITE KN

Levels of Indexing Searched on Device	Storage Requirement (in bytes)
None	360M
One	360M + 88
Two or more	360M + 192
Where: M = the value in the NCP field of the data control block.	
Note: For write validity check, add 104M bytes to the above requirement.	

With WRITE KN

Select one or more entries from Table 26 for each data set stored or retrieved using BISAM with WRITE KN. Because these entries represent storage for sharable routines, no entry should be added more than once when the coding space estimate is calculated for multiple data control blocks open at the same time.

Table 26. Coding Space Estimate for BISAM With WRITE KN

Record Format and Blocking	User Work Area	Write Validity Check	Storage Requirement (in bytes): WRITE KN Used Alone	Storage Requirement (in bytes): WRITE KN With READ K, READ KU, or WRITE K
Fixed Length Unblocked	No	No	6,895	10,111
		Yes	7,223	10,587
	Yes	No	6,813	10,029
		Yes	7,255	10,619
Fixed Length Blocked	No	No	7,397	10,613
		Yes	7,709	11,073
	Yes	No	7,835	11,051
		Yes	8,481	11,845
Variable Length	Yes	N/A	9,260	13,484

Note: These estimates assume that no levels of indexing are searched on the device. For WRITE KN used with READ K and WRITE K, the following apply:

- Add 288 bytes if one or more index levels are searched on device and the record format is fixed length.
- Add 664 bytes if dynamic buffering is used.
- Add 112 bytes if the CHECK macro is used to test for completion of WRITE KN or READ and WRITE K.

Select entries from Table 27 for each data set stored or retrieved using BISAM with WRITE KN.

Table 27. Channel Program Space Estimate for BISAM With WRITE KN

Channel Program Use	Storage Requirement (in bytes)	
	Without Write Validity Check	With Write Validity Check
Basic channel program	736	928
Add to the above entry, if relevant:		
Levels of indexing searched on device		
• One	88	88
• Two or more	192	192
Fixed-length unblocked records		
• With user work area	64 + 24N	104 + 32N
• Without user work area	128	176
Fixed-length blocked records		
• With user work area	48 + 40N	88 + 48N
• Without user work area	56	80
Where: N = the number of physical records that fit on one track.		

Select entries from Table 28 for each data set stored or retrieved with BISAM.

Table 28. Control Block Space Estimate for BISAM

Control Block	Storage Requirement (in bytes)
Data control block	236
Data event control block	26
Input/output block	56
Data extent block for PCP and MFT only	84+16E+2M=about 112
Buffer control block for dynamic buffering	24
Interruption request block for PCP and MFT only	96
Work area (any BISAM DCB)	56
Work area for WRITE KN (if not supplied by user):	
• Unblocked records	10 + L + R
• Blocked records	L + R + B
Where: E = the number of extents. M = the number of modules. L = the key length. R = the record length (LRECL). B = the block size.	

BISAM Example

Read with two channel programs simultaneously and update fixed length unblocked records. One level of indexing is searched on the device. The write validity check option is not used.

Sharable routines:		
READ K/WRITE K....................................	3,608	(See Note)
Two channel programs, 336(2) + 64....................	736	
Control blocks:		
Two data event control blocks, 26(2)................	52	
Two input/output blocks, 56(2).....................	112	
Data control block.................................	236	
Data extent block..................................	112	
Interruption request block.........................	96	
Work area..	48	
Total		5,000 bytes

Note: If the record format is variable length unblocked, add 448 bytes.

Queued Indexed Sequential Access Method (QISAM)

To retrieve or store a data set with the queued indexed sequential access method, dynamic main storage is required for the following:

- The buffer area
- Coding space
- Channel program space
- Control block space

Buffer Area Requirement

The buffer area requirement for QISAM is determined by one of the following formulas:

For creating a data set:	Area = N(BLKSIZE + 8) + 8
For scanning a data set with fixed length blocked records:	Area = N(BLKSIZE + 16) + 8
For scanning a data set with variable length blocked records:	Area = N(BLKSIZE + H) + 8
For scanning a data set with fixed length unblocked records or variable length unblocked records when both key and data are to be read:	Area = N(BLKSIZE + G) + 8
For scanning a data set with fixed length unblocked records when only data is to be read:	Area = N(LRECL + 16) + 8

Where: N = number of buffers
G = smallest multiple of 8 equal to or greater than KEYLEN + 10
H = 16 if buffers are aligned on a doubleword boundary, or 12 if buffers are aligned on a fullword boundary

Data Set Creation

To determine the coding space required, select an entry from Table 29 for each data set created with QISAM. Because these entries represent storage for sharable routines, no entry should be added more than once when the coding space estimate is calculated for multiple data control blocks open at the same time.

Table 29. QISAM Coding Space Estimate for Data Set Creation

Record Format	Write Validity Checking	Storage Requirement (in bytes)
Fixed Length	Yes	6,232
	No	5,772
Variable Length	Yes	6,464
	No	5,974

Select one entry from Table 30 for each data set created with QISAM.

Table 30. QISAM Channel Program Space Estimate for Data Set Creation

Description	Storage Requirement (in bytes)
Unblocked records and relative key position zero	664 + 8N
All other cases	664 + 24N
Where: N = the number of buffers used.	
Notes: 1. For write validity check, add 96 bytes to the above requirement. 2. Add 216 bytes to the above requirement if the last track of the track index also contains data (i.e., if it is a shared track).	

Select entries from Table 32 for each data set created with QISAM.

Table 31. QISAM Control Block Space Estimate for Data Set Creation

Control Block	Storage Requirement (in bytes)
One data control block	236
Data extent block for PCP and MFT only	84 + 16E + 2M = about 112
Work area	784 + 4N + 2L
Where: E = the number of extents. M = the number of modules. N = the number of buffers. L = the key length.	

Data Set Scanning

Select entries from Table 32 for each data set referred to in the scan mode of QISAM. Because these entries represent storage for sharable routines, no entry should be added more than once when the coding space estimate is calculated for multiple data control blocks open at the same time.

Table 32. QISAM Coding Space Estimate for Data Set Scanning

Description	Storage Requirement (in bytes)	
	Variable Length Format	Fixed Length Format
Reading a Data Set	4,488	4,292
Reading and updating a data set • Without write validity check • With write validity check	 4,864 5,316	 4,634 5,120
Note: The starting point for sequential reference may be expressed as I, B, or K. There are additional storage requirements if the starting point for sequential reference if expressed as either I or K: • If it is I, add 656 bytes. • If it is K, add 1,866 bytes.		

Select one or more entries from Table 33 for each data set referred to in the scan mode of QISAM.

Table 33. QISAM Channel Program Space Estimate for Data Set Scanning

Description	Storage Requirement (in bytes)
Primary requirement	56 + 56N
Add to the above entry, if relevant:	
Setting limits by I	96
Setting limits by K	344
Where: N = the number of buffers used.	

Select entries from Table 34 for each data set referred to in the scan mode of QISAM.

Table 34. QISAM Control Block Space Estimate for Data Set Scanning

Control Block	Storage Requirement (in bytes)
Work area	312
One data control block	236
Data extent block for PCP and MFT only	84+16E+2M = about 112
Interruption request block for PCP and MFT only	96
Where: E = the number of extents M = the number of modules	
Note: Add 10 bytes if the record format is variable length.	

QISAM Example

A data set is created with two channel programs, two buffers, and fixed-length records with a key length of 12 bytes. The write validity check option is not used.

Sharable routines:
  Primary requirement.............................. 5,772 (1)
Channel programs:
  Fixed-length records, 664 + 24(2)................. 712
Control blocks:
  Data control block................................ 236
  Data extent block................................. 112
  Work area, 784 + 4(2) + 12(2)..................... 816
                                    Total   7,648 bytes

Note:
1. Add 202 bytes if the record format is variable length.

Basic Telecommunications Access Method (BTAM)

The basic telecommunications access method (BTAM) may be used only if MFT or MVT is selected. The dynamic main storage requirement for retrieving or storing a data set with the basic telecommunications access method (BTAM) is estimated by adding together a coding space estimate, a control information space estimate, a control block space estimate by line group, a control block space estimate by line, and a channel program space estimate by line.

The coding space estimate (Table 35) includes the BTAM code required to support the READ, WRITE, REQBUF, and RELBUF macro instructions, and dynamic buffer allocation. This code is sharable across line groups and is not duplicated for multiple data control blocks open at the same time.

Table 35. BTAM Coding Space Estimate

Description	Storage Requirement (in bytes)
Primary requirement:	
• without buffer management	7,184
• with buffer pool support (REQBUF and RELBUF)	7,624
• with dynamic buffering	8,728
Optional requirement:	
• online test	2,520
additional if ONLTST macro is used	464
• line error print (LERPRT)	374
• line open (LOPEN)	396
• translate (TRNSLATE)	158
• change entry for Auto Poll (CHGNTRY)	352
• World Trade Telegraph Terminals	1,108
• change entry for Expanded ID verification (CHGNTRY)	38

Select the appropriate entry from Table 36 for each type of terminal to be supported under BTAM.

Table 36. BTAM Control Information Space Estimate by Device Type (Part 1 of 2)

Terminal Device Type	Storage Requirement (in bytes)
IBM 1030 Data Collection System	248
IBM 1030 Data Communications System with Auto Poll	248
IBM 1050 Data Communications System	248
IBM 1050 Data Communications System on a switched network	344
IBM 1050 Data Communications System with Auto Poll	232
IBM 1060 Data Communications System	216
IBM 1060 Data Communications System with Auto Poll	224
IBM 2260 Display Unit attached as a remote terminal with a 2701 Data Adapter Unit	328
IBM 2740 Communications Terminal	144
IBM 2740 Communications Terminal with checking	248
IBM 2740 Communications Terminal with checking and OIU (IBM 2760 Optical Image Unit)	296
IBM 2740 Communications Terminal with station control	168
IBM 2740 Communications Terminal with station control and checking	240
IBM 2740 Communications Terminal on a switched network	200
IBM 2740 Communications Terminal with checking on a switched network	304
IBM 2740 Communications Terminal with transmit control on a switched network	216
IBM 2740 Communications Terminal with checking and OIU (IBM 2760 Optical Image Unit) on a switched network	376
IBM 2740 Communications Terminal with transmit control and checking on a switched network	304
IBM 2740 Communications Terminal with station control, checking and Auto Poll	240
IBM 2740 Communications Terminal with station control and Auto Poll	160
IBM 2741 Communications Terminal	128

Table 36. BTAM Control Information Space Estimate by Device Type (Part 2 of 2)

Terminal Device Type	Storage Requirement (in bytes)
IBM 2741 Communications Terminal on a switched network	160
IBM BSC Terminal on a nonswitched, point-to-point network	296
IBM BSC Terminal on a switched network	432
IBM BSC Terminal on a nonswitched multipoint network	328
AT&T Model 33/35 TWX stations	200
AT&T 83B3 Selective Calling Stations	168
Western Union Plan 115A Outstations	160
World Trade Telegraph Terminals	176

The control blocks in Table 37 are used for each line group.

Table 37. BTAM Control Block Space for Each Line Group

Control Block	Storage Requirement (in bytes)
Data control block	
• with binary synchronous communication	100
• without binary synchronous communication	52

The control blocks in Table 38 are used for each line; select and total the appropriate entries.

Table 38. BTAM Control Block Space for Each Line

Control Block	Storage Requirement (in bytes)
Data event control block	
• with binary synchronous communication	48
• without binary synchronous communication	40
Input/output block	64
Line error block (LERB macro instruction)	20

Select entries from Table 39 for each line according to its device type.

Table 39. BTAM Channel Program Space Estimate by Device Type per Line

Terminal Device Type	Storage Requirement (in bytes)
IBM 1030 Data Collection System	64
IBM 1030 Data Collection System (P)	88
IBM 1050 Data Communications System	64
IBM 1050 Data Communications System (P)	80
IBM 1050 Data Communications System (AD)	88
IBM 1060 Data Communications System	56
IBM 1060 Data Communications System (P)	80
IBM 2740 Communications Terminal	40
IBM 2740 Communications Terminal (C)	48
IBM 2740 Communications Terminal (CO)	64
IBM 2740 Communications Terminal (A)	48
IBM 2740 Communications Terminal (D)	56
IBM 2740 Communications Terminal (AC)	48
IBM 2740 Communications Terminal (DC)	64
IBM 2740 Communications Terminal (DCO)	64
IBM 2740 Communications Terminal (ADT)	64
IBM 2740 Communications Terminal (ADTC)	64
IBM 2740 Communications Terminal (S)	56
IBM 2740 Communications Terminal (SP)	88
IBM 2740 Communications Terminal (SC)	64
IBM 2740 Communications Terminal (SCP)	88
IBM 2741 Communications Terminal	48
IBM 2741 Communications Terminal (A)	48
IBM BSC Terminal on a nonswitched point-to-point network	72
IBM BSC Terminal on a switched network	80
IBM BSC Terminal on a nonswitched multipoint network	88
IBM 2260 Display Unit (R)	64
AT&T 83B3 Selective Calling Stations	48
AT&T Model 33/35 Teletypewriter Exchange Terminal using the eight-bit Data Interchange Code (A)	56
AT&T Model 33/35 Teletypewriter Exchange Terminal using the eight-bit Data Interchange Code (D)	56
Western Union Plan 115A Outstations	40
World Trade Telegraph Terminals	40

Where: A = Automatic answering
C = Checking
D = Dialing (automatic calling)
P = Auto Poll
R = Remote attachment with an IBM 2701 Type III Adapter
S = Station control
T = Transmit control
O = IBM 2760 Optical Image Unit

Table 40 contains the storage requirement for code translation tables (AMSTRTAB) per device type.

Table 40. Storage Requirement for Code Translation Tables for BTAM

Description	Storage Requirement (in bytes)
Input Translation (transmission code to EBCDIC)	256
Output Translation (EBCDIC to transmission code)	256

BTAM Example

This example shows how to estimate the dynamic storage required by a telecommunications application with Auto Poll and buffer pool support but without dynamic buffering and binary synchronous communication.

Assume an MFT configuration of:

One line with three IBM 1050 Data Communications System Terminals
One line with two IBM 1050 Data Communications System Terminals

Basic system information

One line group
Start-stop error recovery procedures
Translation
One DECB per line

```
BTAM coding space estimate (7,624 + 158 + 352)..... 8,134
Control information space by device type............. 232
Control block space estimate for one line group....... 52
Control block space estimate for two lines 104(2).... 208
Channel program space for two lines 80(2)............ 160
Translation tables for input and output 256(2)....... 512
                                           Total              9,298 bytes
```

Queued Telecommunications Access Method (QTAM)

The queued telecommunications access method (QTAM) may be used only if MFT or MVT is selected. The dynamic main storage requirement for QTAM is estimated from formulas and tables for message control and message processing.

Message Control

Storage required for message control is estimated from the following formula:

S = A + L + C + P + B
Where: A = the size of message control modules and subroutines. L = the size of line procedure specification (LPS) routines and linkages to them. C = the size of control blocks and information. P = the size of channel programs and related areas. B = the size of input/output buffer times the number of buffers. To this figure must be added 16 times the number of buffers plus 24m. m = the number specified in the third operand of the BUFFER macro instruction that is the number of channel command words QTAM must generate to send the idle characters specified by the PAUSE macro instruction.

Estimates A, L, C, and P are obtained from Tables 41 through 44.

Table 41. Estimate A for QTAM Message Control

Module or Subroutines	Storage Requirement (in bytes)
Primary requirement:	
• Implementation module	8,360
• BTAM module	1,056
Optional requirements:	
• Operator control	3,610
• Checkpoint/restart	1,232
• World Trade Telegraph Terminals	1,248

Select entries from Table 42 according to the Line Procedure Specification (LPS) macro instructions used. Almost all of these macro instructions create inline linkages to modules. These modules also make linkages to second level routines that are used by the modules. These second level routines only need to be included once. The storage requirement is equal to the size of the sharable module and needed second level routine plus the size of the generated linkage. If a macro instruction is used more than once (in either the same or a different LPS), estimate L is increased only by the additional linkages. A few macro instructions produce inline functional code instead of linkages. Each communications line group requires one LPS. Line groups with the same message handling characteristics can use the same LPS.

Table 42. Estimate L for QTAM Message Control (Part 1 of 3)

LPS Macro Instruction	Storage Requirement (in bytes)		
	Inline Linkage or Code	Sharable Modules	Second Level Routine
BREAKOFF	8	216	
CANCELM	8	104	
COUNTER	12		
DATESTMP	8	88	80 IECKEXPD
DIRECT	10	0	104 IECKLKUP

(Part 1 of 3)

Table 42. Estimate L for QTAM Message Control (Part 2 of 3)

LPS Macro Instruction	Storage Requirement (in bytes)		
	Inline Linkage or Code	Sharable Modules	Second Level Routine
ENDRCV	12	0 (3)	
ENDRCV (WTTA)	18	152	
ENDSEND	8	0 (3)	
EOA	22	96	96 IECKSCAN 64 IECKSKPS(5) 40 IECKROUT(5) 24 IECKTYPE(5) 104 IECKLKUP
EOB	6	184	
EOBLC	6	400	
ERRMSG	28	304 + error message	104 IECKLKUP
INTERCPT	12	152	
LOGSEG	14	QSAM (1)	
LPSTART	20	1320	
MODE(C)	14	64 + MODE(U)	96 IECKSCAN
MODE(U) INITIATE MODE(U) PRIORITY MODE(U) CONVERSE	10 10 10	16 24 296	96 IECKSCAN
MSGTYPE(C)	14	56	96 IECKSCAN
MSGTYPE(U)	0	0	
OPCTL	50	3610	104 IECKLKUP 1176 IECKLNCH 96 IECKSCAN
PAUSE	13 + no. of idle characters	272	
POLLIMIT	14	128	
POSTRCV	6	0 (3)	
POSTSEND	8	0 (3)	
RCVHDR	8		
RCVSEG	0	0 (4)	
REROUTE	18	44	104 IECKLKUP
ROUTE	8	40	104 IECKLKUP 96 IECKSCAN

(Part 2 of 3)

Table 42. Estimate L for QTAM Message Control (Part 3 of 3)

LPS Macro Instruction	Storage Requirement (in bytes)		
	Inline Linkage or Code	Sharable Modules	Second Level Routine
SENDHDR	16		
SENDSEG	0	0 (4)	
SEQIN	8	128	96 IECKSCAN
SEQOUT	8	112	80 IECKEXPD
SKIP (S)	8 + no. to be skipped	64	96 IECKSCAN
SKIP (CT)	8	40	96 IECKSCAN
SOURCE	8	176	96 IECKSCAN
TIMESTMP	8	144	80 IECKEXPD
TRANS	10	56 + 256T	
WRU	0	0	

Where: C = character operand specified (conditional).

U = character operand null (unconditional).

N = the number of characters in destination code.

S = skip to and include designated character configuration.

CT = skip designated count of nonblank characters.

T = the number of translation tables. Translation tables are: RCVEITA2, RCVET1, RCVET2, RCVEZSC3, RCVE1030, RCVE1050, RCVE1060, RCVE2260, RCVE2740, RCVF2740, RCVF1050, SENDITA2, SENDT1, SENDT2, SENDT3, SENDZSC3, SEND1030, SEND1050, SEND1060, SEND2260, SEND2740.

Notes:

1. QSAM is used with PUT (move mode). The user may specify any device or record format.
2. For operands other than CONVERSE, INITIATE, or PRIORITY, the storage requirement is the user program plus 36 plus IECKSCAN for a C character operand or 10 for a U character operand.
3. These delimiters cause linkages to QTAM routines included in Table 46.
4. This macro instruction identifies the entry point for the RCVSEG and SENDSEG sections of LPS.
5. If the macro instruction MSGTYPE, ROUTE, or SKIP(S) is used in the program, the storage estimate for IECKTYPE, IECKROUT, or IECKSKPS, respectively, should not be added to the requirement for EOA.

Select all applicable entries from Table 43.

Table 43. Estimate C for QTAM Message Control (Part 1 of 2)

Control Blocks and Information	Storage Requirement (in bytes)
Terminal table	
•TERMTBL macro instruction	12
•OPTION macro instruction	the number of bytes specified
•TERM macro instruction	10 + I + D + (U see note 3) Where: (I + U + D) ≤ 243
•DLIST macro instruction	9 + I + 2(N see note 3)+ (134 see note 1) Where (I + 2N) ≤ 243
•PROCESS macro instruction	9 + (Y see note 3)
Polling list (POLL macro instruction)	
•without Auto Poll	For nonswitched- 4 + 2(N see note 2) For switched IBM terminal- 5 (see note 2) For TWX and WTTA - 3 + (I see note 2)
•with Auto Poll	8 + KN, where For IBM 1030, K=2 For all others, K=3
ENDREADY macro instruction	32
BUFFER macro instruction	8
Data Control Block and Data Extent Block	
•For the checkpoint data set	32 + 93
•For each communication line group	32 + 4L + 72 + 4C
•For each WTTA communication line group	36 + 4L + 72 + 4C
•For each direct access device	32 + 76
Line Control Block	112 for each communication line
Message Control Block for process and destination queues	32X

(Part 1 of 2)

Table 43. Estimate C for QTAM Message Control (Part 2 of 2)

Where: N = the number of terminals.

I = the number of bytes in terminal ID.

U = the number of bytes in optional area.

D = the number of bytes in device address area which contains:

- For nonswitched-- address and polling characters.
- For IBM switched terminal-- 1 byte of the number of dial digits + as many bytes as dial digits + addressing characters.
- For TWX -- 1 byte of the number of dial characters + as many bytes as dial digits + 1 byte of the number of ID characters + two times as many bytes as the number of ID characters.
- For WTTA -- 1 byte of the number of ID characters + two times as many bytes as the number of ID characters.

X = the number of lines or terminals (depending on queuing techniques) and the number of process queues.

Y = the number of bytes in name of the process entry in the terminal table (1-8).

L = the number of polling lists in the CPOLL keyword parameter.

C = the number of communication lines in the data set.

Notes:
1. If the macro instruction is used more than once, the 134 should be included only once.
2. Add the number of bytes necessary for alignment on a halfword boundary.
3. Add the number of bytes necessary for alignment on a fullword boundary.

Select one entry from Table 44 for each terminal device type used.

Table 44. Estimate P for QTAM Message Control

Terminal Device Type	Storage Requirement (in bytes)
IBM 1030 Data Collection System	312 + 56N
IBM 1030 Data Collection System with Auto Poll	224 + 96N
IBM 1050 Data Communications System	224 + 56N
IBM 1050 Data Communications System with Auto Poll	200 + 96N
IBM 1050 Data Communications System on a switched network	336 + 80N
IBM 1060 Data Communications System	208 + 48N
IBM 1060 Data Communications System with Auto Poll	192 + 96N
IBM 2260-2848 Display Complex attached as a remote terminal on a switched network	304 + 80N
IBM 2740 Communications Terminal	
Type I: Basic nonswitched network	128 + 80N
Type II: Basic switched network	200 + 80N
Type III: Basic nonswitched network	
with station control	168 + 80N
with station control and Auto Poll	144 + 96N
Type IV: Basic nonswitched network	
with station control and checking	248 + 80N
with station control, checking and Auto Poll	224 + 96N
Type V: Basic switched network with transmit control and checking	304 + 80N
Type VI: Basic nonswitched network with checking	208 + 80N
Type VII: Basic switched network with checking	272 + 80N
Type VIII: Basic switched network with transmit control	200 + 80N
AT&T Model 33/35 TWX Stations	200 + 48N
AT&T 83B3 Selective Calling Stations	173 + 48N
Western Union Plan 115A Outstations	168 + 40N
World Trade Telegrpah Terminals	152 + 64N
Where: N = the number of communication lines	

Message Processing

Storage required for message processing is estimated from the following formula:

S = C + M
Where: C = the size of control blocks. M = the size of macro instruction routines and inline code.

Estimates C and M are calculated from Tables 45 and 46.

Table 45. Estimate C for QTAM Message Processing

Message Processing Data Control and Extent Blocks	Storage Requirement (in bytes)
Main storage process queues	(44 + 140)N
Main storage destination queues	(44 + 140)M
Where: N = the number of MS process queues. M = the number of MS destination queues.	

Select entries from Table 46 for each macro instruction used. Almost all of these macro instructions create inline linkages to modules. Their storage requirements are equal to the size of the module plus the size of the generated linkages plus the work area. If the macro instruction is used more than once, the estimate is increased only by the additional linkage.

Table 46. Estimate M for QTAM Message Processing

	Storage Requirement (in bytes)		
Macro Instruction	Work Area (1)	Inline Code	Sharable Module
GET Segment	Variable (2)	14	336
GET Message	Variable (2)	14	408
GET Record	Variable (2)	14	432
PUT Segment	Variable (2)	14	592
PUT Message	Variable (2)	14	564
PUT Record	Variable (2)	14	640
RETRIEVE Destination	(buffer size)-8	12	136
RETRIEVE Sequence number	(buffer size)-8	28	416
COPYQ	32	22	96
COPYP	Up to 255	24	96 + 112 IECKDCBL (4)
COPYT	Up to 252	22	120
CHNGP	Up to 255	24	144 + 112 IECKDCBL (4)
CHNGT	Up to 252	22	240
RELEASEM	None	18	264
STOPLN	None	30	1176 IECKLNCH (3) + 112 IECKDCBL (4)
STARTLN	None	14	1176 IECKLNCH (3) + 112 IECKDCBL (4)
CLOSEMC	None	6	288 + 1176 IECKLNCH (3)
CKREQ	None	120	

Notes:
1. The same work area can be used more than once.
2. Use the length specified in the SOWA subfield of the macro instruction.
3. When combinations of STOPLN, STARTLN, and CLOSEMC are used, the requirement for IECKLNCH is included only once.
4. The requirement for IECKDCBL is to be added only when the terminal name is given as an operand in the macro instruction.

QTAM Example

This example contains the coding used and the storage required for the following telecommunications application.

Assume a telecommunications configuration of:

- One line with two IBM 1050 Data Communications System terminals (BOST,PHIL)
- One line with a IBM 1050 Data Communications System terminal (WASH)
- One line with two Western Union Plan Outstations (NYCX,CHIX)
- One direct access device

Basic system information:

- Two line groups
- Two line procedure specification routines
- No logging
- One main-storage process queue
- One main-storage destination queue
- Three buffers per line for the IBM 1050 terminal
- Two buffers per line for Western Union Plan 115A Outstation
- Two buffers for the message processing program
- Ninety-two bytes per buffer

Note: An ampersand (&) indicates that the sharable module or second line routine for this macro instruction is already included in the storage requirement. An ampersand also indicates that a work area is being reused.

Message Control Requirement = A + L + C + P + B
A: Message control modules and subroutines................. 9,416 bytes
L: LPS routines and linkages

Name	Macro	Operand	Inline Code	Sharable Modules
LPS1	LPSTART	10,TERM=(1050)	20	1320
	RCVSEG		0	
	TRANS	RCVF1050	10	312
	RCVHDR		8	
OPERCTL	OPCTL	CTLMSG=QQQ,TERM=WASH, ALTERM=BOST,INTRCPT=YES	50	4986
	ROUTE	4	8	40&
	EOA	C'.'	22	184&
	MODE	CONVERSE,C'C'	10	296&
	MODE	PRIORITY,C'P'	10	24&
	MODE	INITIATE,C'I'	10	16&
	MSGTYPE	C'S'	14	56&
	SOURCE	4	8	176&
	SEQIN	3	8	128&
	ENDRCV		12	
	EOBLC		6	424
	ERRMSG	X'8000',SOURCE, =C'.DESTINATION ERROR'	28	322&
	POLLIMIT	=X'1'	14	128
	POSTRCV		6	
	SENDHDR		16	
	SEQOUT	4	8	192
	TIMESTMP	6	8	144&
	SENDSEG		0	
	PAUSE	X'15',13X'5E'	26	272
	TRANS	SEND1050	10	256&
	ENDSEND		8	
	EOBLC		6	&
	POSTSEND		8	
		Totals	334	9,276

Total for LPS1.......... 9,290 bytes

Name	Macro	Operand	Inline Code	Sharable Modules
LPS2	LPSTART	10,TERM=(1050)	20	&
	RCVSEG		0	
	TRANS	RCVET1	10	256&
	BREAKOFF	200	8	216
	RCVHDR		8	
	ROUTE	4	8	&
	EOA	C'.'	22	&
	MODE	CONVERSE,C'C'	10	&
	MODE	PRIORITY,C'P'	10	&
	MODE	INITIATE,C'I'	10	&
	ENDRCV		12	
	ERRMSG	X'8000',SOURCE, =C'.DESTINATION ERROR'	28	&
	POSTRCV		6	
	SENDHDR		16	
	SEQOUT		8	&
	SENDSEG		0	&
	PAUSE	X'15',2X'1F'	15	&
	TRANS	SENDT1	10	256&
	POSTSEND		8	
		Totals	209	728

Total for LPS2............ 937 bytes

Total L.......................... 10,547 bytes

C: Control Blocks and Information

Name	Macro	Operand	Requirement
DISK	DCB	DSORG=CQ,MACRF=(G,P), DDNAME=SYSQUEUE	
DCB1	DCB	DSORG=CX,MACRF=(G,P), CPOLL=(POLL1,POLL2),CPRI=E, BUFRQ=3,ACLOC=13,CLPS=LPS1, DDNAME=LINES	
DCB2	DCB	DSORG=CX,MACRF=(G,P),CPRI=E, CPOLL=POLL3,BUFRQ=2,ACLOC=13, CLPS=LPS2,DDNAME=TLINE	

Message Queue control blocks 32(4).......... 128

Data control block and data extent block
- Line group one:32 + 4(2) + 72 + 4(2)..... 120
- Line group two:32 + 4(1) + 72 + 4(1)..... 112
- Direct access device:32 + 76............. 108

Line control block 3(112).................. 336
Total 804

Name	Macro	Operand	
	OPEN	(DISK,DCB1,(INOUT), DCB2,(INOUT))	In transient area
	ENDREADY		32
	CLOSE	(DISK,DCB1,DCB2)	In transient area
POLL1	POLL	(BOST,PHIL)	8
POLL2	POLL	(WASH)	6
POLL3	POLL	(NYX,CHIX)	8
	BUFFER	10,092,6	8
	TERMTBL	ALLP	12
PROC	PROCESS		16
BOST	TERM	L,DCB1,1,62026215	21
PHIL	TERM	L,DCB1,1,64026415	21
WASH	TERM	L,DCB1,2,62026215	21
CHIX	TERM	L,DCB2,1,13131307	21
NYCX	TERM	L,DCB2,1,18131807	21
ALLP	DLIST	(PROC,BOST,PHIL,WASH, CHIX,NYCX)....................	160
		Total	355

Total C............................ 1,159 bytes

P: Channel program area 224 + 56(2) + 168 + 40.............. 544 bytes

B: Buffer areas 10(92) + 16(10) + 24(6).................... 1,224 bytes

Total dynamic requirement for Message Control............ 22,890 bytes

Message Processing Requirement = C + M

C: Control Blocks

Name	Macro	Operand	Requirement
DCBI	DCB	DSORG=MQ,MACRF=G,DDNAME=INPUT, BUFRQ=2,SOWA=74,RECFM=S, EODAD=EOD,TRMAD=LOCIN, SYNAD=ERROR	
DCBO	DCB	DSORG=MQ,MACRF=P,DDNAME=OUTPUT, RECFM=S,TRMAD=LOCOUT	

Data control block and data extent block

Main storage process queue: 44 + 140	184
Main storage destination queue: 44 + 140	184

Total C.............................. 368 bytes

M: Macro instruction Routines and Inline Linkages

Name	Macro	Operand	Work Area	Inline Code	Sharable Modules
	OPEN	(DCBI,(INPUT), DCBO,(OUTPUT))		In transient area	
BEGIN	GET	DCBI,AREA	74	14	336

Processing:
If a close down
branch to STOP
If not, branch to TEST

Name	Macro	Operand	Work Area	Inline Code	Sharable Modules
STOP	CLOSEMC			6	1464
	CLOSE	(DCBI,DCBO)		In transient area	

Processing:
Return to control program

TEST

Processing:
If a control message,
branch to CHANGE
If not, branch to WRITE

Name	Macro	Operand	Work Area	Inline Code	Sharable Modules
CHANGE	COPYT	NYCX,WORKAREA	20	22	120
	CHNGT	NYCX,WORKAREA	&	22	240
WRITE	PUT	DCBO,AREA	&	14	592
		Totals	94	78	2,560

Total M........................... 2,732 bytes

Total dynamic requirement for Message Processing.......... 3,100 bytes

Graphic Access Method (GAM)

The dynamic main storage requirement for the I/O and attention-handling operations of the graphic support routines are estimated from the following formula. No dynamic storage is required for buffer management facilities because these are SVC routines and, as such, are executed in the SVC transient area.

$S = A_1 + A_2 + B_1 + B_2$
Where: A_1 = size of the data control block(DCB), data extent block (DEB) for PCP only, input/output block(IOB), and unit control block(UCB). A_2 = size of macro instructions. B_1 = size of sharable I/O routines. B_2 = size of sharable interruption handling routines.

Select one entry from Table 47 for each type of device used.

Table 47. Estimate A_1 for Graphic Support

I/O Device Type	Storage Requirement (in bytes)
2250	4X + 52Y + 72Z + 74W
2260	4X + 52Y + 72Z + 74W
Where: X = the number of unit control blocks. Y = the number of data control blocks. Z = the number of input/output blocks. W = the number of data extent blocks for PCP only.	

Select one or more entries from Table 48 for each macro instruction used.

Table 48. Estimate A_2 for Graphic Support

I/O Device Type	Storage Requirement (in bytes)
2250	70M + 60A + 36B + 4D
2260	70M + 60A
Where: M = number of input/output macro instructions used. A = number of attention handling macro instructions used. B = number of buffer management macro instructions used. D = number of order and data-generation macro instructions used.	

Select one entry from Table 49 for the particular device type used. Include this estimate only once if both devices are used.

Table 49. Estimate B_1 for Graphic Support

I/O Device Type	Storage Requirement (in bytes)
2250	1,775
2260	1,775

Select one entry from Table 50 for the particular device type used. Include this estimate only once if both devices are used.

Table 50. Estimate B_2 for Graphic Support

I/O Device Type	Storage Requirement (in bytes)
2250	1,875
2260	1,875

<u>2250 Example</u>

An installation employs four 2250 Display Units, Model 3, attached to a 2840 Display Control. In the program being considered, the buffer management and attention handling facilities are being used with a single display unit. The program includes three input/output, two buffer management, and four attention handling macro instructions.

$$S = A_1 + A_2 + B_1 + B_2$$

A_1, control blocks (4 UCBs, 1 DCB, 3 IOBs, 1 DEB)....	358	
A_2, macro instructions 70(3) + 60(4) + 36(2).........	522	
B_1, sharable I/O routines........................	1,775	
B_2, sharable attention handling routines...........	<u>1,875</u>	
Total		4,530 bytes

<u>2260 Example</u>

An installation employs eight 2260 Display Stations attached to a single 2848 Display Control. In the program being considered, four 2260 Display Stations are associated with each of two DCBs. Attention handling is used. The program includes two input/output and eight attention handling macro instructions.

$$S = A_1 + A_2 + B_1 + B_2$$

A_1, control blocks (8 UCBs, 2 DCBs, 2 IOBs, 2 DEBs)..	428	
A_2, macro instructions 70(2) + 60(8)..................	620	
B_1, sharable I/O routines........................	1,775	
B_2, sharable attention handling routines...........	<u>1,875</u>	
Total		4,698 bytes

Telecommunications Access Method (TCAM)

The telecommunications access method (TCAM) can be used if you select MFT or MVT. If you select the TSO option of MVT, you must use TCAM. You can estimate the dynamic storage requirement for TCAM by using the following tables and formulas for the message control program requirements and the message processing program requirements.

Message Control Program Requirements

The dynamic main storage requirement for the message control program is:

S = M + L + C + P +(A+B)(K+12) + 0 + TS
Where: M = the size of the message handler macro expansions. L = the size of the message control modules. C = the size of the control blocks and information. P = the size of the channel programs, translation tables, and special character tables. A = the value of the MSUNITS operand on the INTRO macro. B = the value of the LNUNITS operand on the INTRO macro. K = the value of the KEYLEN operand on the INTRO macro. O = the size of selected TCAM options. TS = 0 if the TSO option is not selected: otherwise TS = 16,510 + Y. Where: Y = the size of selected TSO macros from Table 56.

Use Tables 51 through 56 to calculate the storage requirements for M,L,C,P,A,B,K,O, and Y.

Table 51. Estimate M for TCAM Message Control Program (Part 1 of 4)

Macro Instruction	Storage Requirements in bytes	
	First use of macro	Each subsequent use of macro
CANCELMG (1)	12	8
CHECKPT (1)	8	4
CODE		
with tablename operand, in INHDR group	60	52
with tablename operand, not in INHDR group	22	18
with no operand, in INHDR group	56	48
with no operand, not in INHDR group	18	14
COUNTER (1)	18	14
CUTOFF	18	14
DATETIME (1)	38	30
ERRORMSG (1,2)	28+c	20+c
with 'EXIT' operand	32+c	24+c
ERRSET (1)	16	16
FORWARD (1)	26+c	22+c
with 'EXIT' operand	30+c	26+c
with 'DEST=PUT' operand	20	20
HOLD (1)	12	8
with 'INTVL' operand	16	12
INBUF	0	0
with 'PATH' operand	28	28
INEND	2	2
with no 'INMSG' macro or with 'INMSG' macro that uses 'PATH' operand	22	22
INHDR	12	12
with 'PATH' operand	44	40
INITIATE (1)	16	16
with characters operand	52+c	52+c
INMSG	8	8
with 'PATH' operand	36	36
LOCK (1)	16	12
with characters operand	44+c	40+c
LOCOPT (1)	14	14

(continued)

Table 51. Estimate M for TCAM Message Control Program (Part 2 of 4)

Macro Instruction	Storage Requirements in bytes: First use of macro	Storage Requirements in bytes: Each subsequent use of macro
LOG (1)		
in INHDR, INBUF, OUTHDR, or	18	14
OUTBUF in INMSG or OUTMSG	12	8
MSGEDIT (1,3)	28	14
with characters operand	34+c	20+c
in outgoing group	32	14
in outgoing group with characters operand	38+c	20+c
MSGFORM (1,4)	32	12
with 'BLOCK' or 'SUBBLCK' operand	34	14
with 'BLOCK' and 'SUBBLCK' operands	36	16
MSGGEN	13+c	9+c
with the fieldname operand	16	12
with the 'CODE' operand	17+c	13+c
with fieldname and 'CODE' operands	20	16
MSGLIMIT (1)		
with integer operand	20	16
with opfield operand	46	42
MSGTYPE (1)	4	4
with characters operand	36+c	36+c
ORIGIN (1)	56	52
OUTBUF	0	0
with 'PATH' operand	28	28
OUTEND	2	2
with no 'OUTMSG' macro or with 'OUTMSG' macro that uses 'PATH' operand	12	12

(continued)

Table 51. Estimate M for TCAM Message Control Program (Part 3 of 4)

Macro Instruction	Storage Requirements in bytes: First use of macro	Storage Requirements in bytes: Each subsequent use of macro
OUTHDR	12	12
with 'PATH' operand	40	40
OUTMSG	10	10
with 'PATH' operand	36	36
PATH (1)	24	24
with characters operand	60+c	60+c
PRIORITY (1)	40	40
with characters operand	56+c	56+c
REDIRECT (1,5)	12	8
with mask operand	16	12
SCREEN	16	12
with characters operand	52+c	48+c
SEQUENCE (1)		
in INHDR group	36	32
in OUTHDR group	20	12

(continued)

Table 51 Estimate M for TCAM Message Control Program (Part 4 of 4)

Macro Instruction	Storage Requirements in bytes: First use of macro	Storage Requirements in bytes: Each subsequent use of macro
SETEOF (1)	8	8
with characters operand	44+c	44+c
SETSCAN (1)	14	14
with characters operand	23+c	19+c
STARTMH	38	18
UNLOCK (1)	16	12
with characters operand	44+c	40+c

Where: c = the number of characters coded in the character string operand of the macro.

Notes:

1. May not be used in a TSO message control program.
2. If the REDIRECT macro is coded before ERRORMSG, 4 bytes can be subtracted from this value.
3. If the MSGFORM macro is coded before MSGEDIT, 8 bytes can be subtracted from this value; if MSGEDIT is in an outgoing group, 4 additional bytes can be subtracted.
4. If the MSGEDIT macro is coded before MSGFORM, 8 bytes can be subtracted from this value; if the MSGEDIT, DATETIME, ERRORMSG, or SEQUENCE macros were coded in an outgoing group before MSGFORM, 4 more bytes can be subtracted from this value.
5. If the ERRORMSG macro is coded before REDIRECT, 4 bytes can be subtracted from this value.

Select entries from the following table. Each entry should be included only once regardless of the number of times the associated option is used in the Message Control Program. More than one entry may be included for one macro depending upon the operands coded. One entry may also encompass more than one mace. If more than one entry applies to a particular macro whose size is being determined, add the storage requirement for each applicable entry to determine the total number of bytes required for the macro.

Table 52. Estimate L for TCAM Message Control Program (Part 1 of 2)

Option	Storage Requirement (in bytes)
Non-optional modules	8855
CANCELMG macro coded	145
Checkpt macro coded	85
CODE macro coded in any group	310
coded only in INHDR group (additional)	130
COUNTER macro coded	105
CUTOFF macro coded	520
DATETIME macro coded	235
DATETIME, ERRORMSG, MSGEDIT, or MSGFORM macros for any group or SEQUENCE macro for outgoing group only	380
ERRORMSG macro coded	420
ERRORMSG or REDIRECT macro coded	290
FORWARD macro coded with any operands	165
coded without DEST=PUT (additional)	525
coded with EOA specified (additional)	505
HOLD macro coded	1635
LOCK macro coded	150
LOG macro coded in either INHDR, INBUF, OUTHDR, or OUTBUF groups	220
coded in either INMSG or OUTMSG (additional)	690
MSGEDIT or MSGFORM macros coded with any operands	300
MSGEDIT macro coded for any insert operation	1340
coded for remove operation using an offset (additional)	655
coded for insert operation using an offset (additional)	255
coded for insert operation using a count (additional)	350
(also see DATETIME entry above and SETSCAN entry below)	
MSGFORM macro coded	1560
(also see MSGEDIT and DATETIME entries above)	
MSGGEN macro coded	230
MSGLIMIT macro coded	190
ORIGIN macro coded	145
SCREEN macro coded	220
SEQUENCE macro coded in an incoming group	160
coded in an outgoing group	140
(also see DATETIME entry above)	
SETSCAN, FORWARD, or MSGEDIT macro coded with a character string	435
SETSCAN macro coded with POINT=BACK	175
SETSCAN macro coded with an integer	0
STARTMH macro coded with any operands	875
coded with STOP=YES, or CONT=YES	1785
TLIST macro coded for distribution list	185
TLIST macro coded for cascade list	185
TRANLIST macro coded	445
UNLOCK macro coded	40

(continued)

Table 52. Estimate L for TCAM Message Control Program (Part 2 of 2)

Option	Storage Requirement (in bytes)
Any macro coded with the name of an option field (i.e., COUNTER, LOCOPT, PATH, STARTMH, FORWARD, REDIRECT ERRMSG, MSGEDIT, or MSGLIMIT,TRANSLIST)	160
Operands on the INTRO macro	
DTRACE=0 (Default)	475
DTRACE=0	575
FEATURE=(,,TIMER) (Default)	980
FEATURE=(,,NOTIMER)	15
INTVL=0	665
LINETYP=BOTH	11140
LINETYP=BISC	9025
LINETYP=MINI	4415
LINETYP=STEP and ENVIRON=MIXED or TSO	6900
LINETYP=STSP and ENVIRON=TCAM	5550
MSUNITS≠0 and DISK=YES (Default)	10410
MSUNIT≠0 and DISK=NO	6080
MSUNIT=0 and DISK=YES	7060
PRIMARY=SYSCON	580
TREXIT=0 and TRACE=0	530
Opened data control blocks with following options	
Message Queues data set	
CPB=1 on INTRO macro	720
CPB=1 on INTRO macro	1480
OPTCD=R on DCB or MSUNITS=0 on INTRO	3510
Line Group data set	
PCI=(N,N) on DCB macro	835
Dial lines	540
Leased lines	450
2260 local lines	650
FEATURE=(82741) on INTRO macro	1180
FEATURE=(NODIAL,NO2741) on INTRO macro	760
FEATURE=(DIAL,NO2741) on INTRO macro	1055
BFDELAY=0 on TERMINAL macro	1840

Table 53. Estimate C for TCAM Message Control Program (Part 1 of 2)

Control Blocks and Information	Storage Estimates (in bytes)
Address Vector Table INTRO macro, DISK=NO DISK=YES ENVIRON=TSO	 1152 1278 1128
READY macro	44
Termname TABLE TTABLE macro	$82+N(3+C)$
Terminal Table TERMINAL macro TLIST macro PROCESS macro LOGTYPE macro	 $20+O_n+D_n+(68+28P_n)$* $6+2T_n$ $20+O_n+68+28P_n$ 115
Station Control Block (generated as a result of OPEN macro)	$(84+4R)(S+U)$
Process Control Block PCB macro	 88
Line Control Block non-switched lines switched lines (generated as a result of OPEN macro)	 144 for each opened nonswitched line 152 for each opened switched line
Data Control Blocks Message Queues Data Set Checkpoint Data Set Line Group Data Set	 44 44 $40+4I$
Invitation Lists INVLIST macro	 $9+3E+EA$
Option Table OPTION macro	 $10+FX$
Disk Input/Output Blocks (generated as a result of OPEN macro)	52 for each extent of an opened message queues data set
Disk Channel Program Blocks (generated as a result of OPEN macro)	$B(77+K)$

Table 53. Estimate C for TCAM Message Control Program (Part 2 of 2)

Control Blocks and Information	Storage Estimates (in bytes)
WHERE: N = the number of entries defined by TERMINAL, PROCESS, TLIST or LOGTYPE macros C = the number of characters in the longest entry name (as specified in the TTABLE macro) O = the number of option fields used for a terminal table entry D = the length of device dependent data specified on the TERMINAL macro: BUFSIZE, ADDR, BFDELAY, BLOCK, SUBBLCK, or TRANSP operands P = the number of priority levels (LEVEL operand) specified on TERMINAL or PROCESS macros T = the number of entries specified for a TLIST macro R = the value of the USEREG operand on the INTRO macro S = the number of TERMINAL macros specifying BFDELAY I = the number of invitation lists specified on the INVLI operand of the DCB macro E = the number of entries defined for the INVLIST macro A = the length of the addressing characters defined for each entry in the INVLIST macro F = the number of TERMINAL or PROCESS macros which define data for the option field X = the number of bytes defined by the OPTION macro (include the bytes necessary for the requested alignment) B = the value of the CPB operand on the INTRO macro K = the value of the KEYLEN operand on the INTRO macro U = the number of lines whose TERMINAL macros do not specify BFDELAY *NOTE: If outgoing messages are queued by line, (68+28P) should be included for only one terminal on the line.	

Add 520 bytes for each different translation table specified for line group DCBs. Select one of the following entries from Table 54 for each terminal device type associated with an opened DCB.

Table 54. Estimate P for TCAM Message Control Program

Terminal Device Type	Storage Requirements (in bytes)
IBM 1030 Data Collection System	80 + 56n
IBM 1030 Data Collection System with Auto Poll	80 + 88n
IBM 1050 Data Communication System	80 + 56n
IBM 1050 Data Communication System with Auto Poll	80 + 88n
IBM 1050 Data Communication System on a switched network	80 + 80n
IBM 1060 Data Communication System	80 + 56n
IBM 1060 Data Communication System with AUTO Poll	80 + 88n
IBM 2260 Display Complex attached as a remote terminal on a switched network	80 + 56n
IBM 2260 Display Complex attached with a local configuration	80 + 40n
IBM 2265	80 + 56n
IBM 2740 Communication Terminal	
Type I: Basic nonswitched network	80 + 80n
Type II: Basic switched network	80 + 56n
Type III: Basic switched network with transmit control	40 + 72n
Type IV: Basic nonswitched network with Auto Poll	80 + 88n
IBM 2741 Communication Terminal	80 + 48n
IBM 2741 Communication Terminal or 5041 line on a switched network	80 + 64n
IBM 2760 Communication Terminal on a switched network	80 + 56n
IBM 2760 Communication Terminal on a nonswitched network	80 + 80n
IBM 2770 Communication Terminal	80 + 80n
IBM 2770 Communication Terminal with Auto Poll	80 + 88n
IBM 2780 Communication Terminal	80 + 80n
IBM 2780 Communication Terminal with Auto Poll	80 + 88n
IBM 7770 Audio Response Unit	80 + 32n
AT&T Model 33/35 TWX Stations	80 + 64n
AT&T 83B3 Selective Calling Stations or Western Union Plan 115A Outstations	80 + 56n
World Trade Telegraph Terminals	80 + 48n
Where: n = the number of opened communication lines	

Table 55. Estimate O for Message Control Program

Name of Function	Selected Option	Storage Requirement (in bytes)
Subtask Trace Table	DTRACE=a on INTRO macro	16(a+1)
Interrupt Trace Table	TRACE=t and TREXIT=exit on INTRO macro	32(t+1)
Cross Reference Table	CROSSRF=c on INTRO macro	16(c+1)
Checkpoint/Restart	OPEN executed for check-point DCB	
IEDQNF Executor		354
IGG019RA-Appendage		100
Work area		296+3E+6(C+3) Where: E=value of CPRCDS operand on INTRO macro c=value of CKREQS operand on INTRO macro
Disk I/O Buffers (for Checkpoint/ Restart		300n Where: n=1. If n is greater than 1, efficiency may be increased by overlapping I/O and processing.
Transient area		850
On Line Test	OLTEST=X on INTRO macro	1024X
Trap Facility	COMWRTE=m on INTRO macro	
IEDQFW-Executor		1530
Trace routine		1044
Application Program Processing	TCAM DCB opened in a Message Processing Program	
Work area		(396+4R)Q Where: R=value of USEREG operand on INTRO macro Q=number of Opens
IEDQEU-Open/Close Subtask		1140
One or more schedulers:		
IEDQEC-Put Scheduler	DCB(s) for output	1500
IEDQEW-Get Scheduler	DCB(s) for input	2200
IEDQEZ-Get Scheduler	DCB(s) for input	24
IEDQE7-Retrieve Scheduler	QTAM Compatable DCB(s)	860

Table 56. Estimate Y for TSO Macro Instructions

Macro Instruction	Storage Requirement (in bytes)
ATTEN	18
CARRIAGE	8
TSINPUT	64
LOGON	20
SIMATTN	20
HANGUP	12
TRANLIST	4+4T+L
Where: T = the number of translation tables specified; L = the total size of all specified control character strings	

Message Processing Program

Storage required for a message processing program can be estimated from the following formula:

S=810+A+W+T+408F

Where: A = the size of the access method modules

W = the size of the work area specified by the 'BLKSIZE' operand of the DCB macro

T = the size of the TCAM macro expansions

F = 0, if SYNADAF is not executed

F = 1, if SYNADAF is executed

Estimates A and T are obtained from Tables 57 and 58.

Table 57. Estimate A for TCAM Message Processing Program

Option	Storage Requirements (in bytes)
SAM DCB opened for input	3000
QTAM DCB opened for input	2150
SAM DCB opened for output	1010
QTAM DCB opened for output	500
BSAM DCB opened	340
POINT MACRO is used	345
TCOPY MACRO	530
QCOPY MACRO	330
TCHNG MACRO	645
ICOPY MACRO	280

Include the size of the macros in Table 58, once for each time the macro is coded.

Table 58. Estimate T for TCAM Message Processing Program

Macro Instruction	Storage Estimate (in bytes)
CHECK	14
CKREQ	22
GET	14
ICHNG	58
ICOPY	42
MCPCLOSE with password	78
without password	68
MRELEASE with password	78
without password	68
POINT	16
PUT	14
QCOPY	30
QSTART	0
READ	34
RETRIEVE	24
TCHNG with password	62
without password	48
TCOPY	34
WRITE	34

Checkpoint/Restart Work Area Requirement

When using the Checkpoint/Restart facilities, the user must provide a Checkpoint/Restart work area in his program. This work area is required only when a checkpoint is taken, and at all other times may be used for other purposes. The size of the work area can be computed using the following formula:

```
S = 1,108 + T + 48(N-2) + D + E

Where:  T = the size of the TIOT when a checkpoint is taken.  The size
            is computed as:
            T = 28 + 20A + 4B

            Where:  A = the total number of data sets defined in the
                        job step, including JOBLIB, if one is present
                    B = the sum of devices allocated to each data set,
                        not including the first device

        N = the number of data sets that were open when the checkpoint
            was taken.  The value for N must be at least 2 and must
            include the checkpoint data set, even if this data set was
            not open.

             240 for PCP (for 2 RBs)
        D =  344 for MFT (for 3 RBs)
             0 for MVT/M65MP

        E =  0 if the user opens the checkpoint data set.
                                   or
             the sum of the lengths of the IOBs created by the open
             routines, if the checkpoint/restart facility opens the
             checkpoint data set -- plus (for PCP and MFT) the size of
             the DEB.

• Increase the size of the work area by 384 bytes if all of the
  following conditions apply:  (1) the user adds to a direct access
  output data set after a checkpoint is taken, (2) a new extent is
  required, and (3) a restart is then attempted.
```

Auxiliary Storage—Contents

Tables

Estimating the Auxiliary Storage Requirement

Every operating system configuration uses auxiliary storage on direct access devices for system residence and for work space. The total auxiliary storage requirement is the sum of its system residence and work space requirements plus the auxiliary storage required for input stream(s) and system output data. This section contains tables and formulas to be used in estimating the direct access auxiliary storage requirements.

System Residence

The total amount of auxiliary storage required for system residence is determined by the libraries and data sets to be used by the system, and on the direct access devices selected. The system residence requirements may be split between several volumes, one of which is the system residence volume. The following libraries and data sets are required for every operating system and must be on the system residence volume:

- SYSCTLG (System Catalog) -- The system catalog contains pointers to all cataloged data sets.
- SYS1.NUCLEUS (Nucleus library) -- This library contains the resident portion (nucleus) of the control program and consists of modules selected and link edited during system generation.
- SYS1.SVCLIB (SVC library) -- The members of the SVC library are the nonresident SVC routines, the data management access methods, the system's standard error recovery routines, and the modules for MCH on the model 65, M65MP, or Model 85 when this level of recovery management is selected.
- SYS1.LOGREC -- This data set is used by recovery management to record statistical data about machine errors.

The following data sets are required and must be on a direct access volume, not necessarily the system residence volume:

- SYS1.LINKLIB (Link library) -- The members of the link library are programs and routines that can be referred to by XCTL, ATTACH, LINK, or LOAD macro instructions, or by EXEC statements. Nonresident operating system programs, e.g., the COBOL compiler, are contained in this library.
- SYS1.SYSJOBQE -- This data set is used as a work area by the job scheduler.
- SYS1.PARMLIB -- This data set contains the resident access methods list, the resident BLDLTAB list, and the resident SVC parameter list, which are used by the nucleus initialization program (NIP) the PRESRES list, which is used by the master scheduler, and the SMFDEFLT list, that is used by the SMF routines.
- SYS1.PROCLIB (Procedure library) -- The members of the procedure library include those cataloged procedures used to perform certain system functions, e.g., compile-link edit-go.

The following libraries and data sets are optional and, if selected, must be on a direct access volume, not necessarily the system residence volume:

- SYS1.MACLIB (Macro library) -- The members of the macro library include the macro definitions for the system macro instructions.
- SYS1.SORTLIB (Sort library) -- The members of the sort library are the load modules from which a sort/merge program is produced at execution time.
- SYS1.ALGLIB (ALGOL library) -- The members of the ALGOL library are load modules (ALGOL subroutines).
- SYS1.ASRLIB (Recovery management library for MCH) -- When MCH is selected, this library contains all refreshable nucleus modules.
- SYS1.COBLIB (COBOL library) -- The members of the COBOL library are load modules (COBOL subroutines).
- SYS1.FORTLIB (FORTRAN library) -- The members of the FORTRAN library are load modules (FORTRAN subprograms).
- SYS1.PL1LIB (PL/I library) -- The members of the PL/I library are load modules (PL/I subprograms).
- SYS1.ROLLOUT (The rollout data set) -- This data set must be large enough to contain the entire dynamic area.
- SYS1.TELCMLIB (Telecommunications library) -- The members of the telecommunications library are load modules (telecommunications subroutines).
- SYS1.SYSVLOGX and SYS1.SYSVLOGY (System log data sets) -- These data sets are used to record write-to-log (WTL) messages before they are printed on the system output unit.
- Data set for Checkpoint/Restart for telecommunications -- This data set contains all the information necessary to restart the telecommunications system.
- SYS1.ACCT (accounting data set) -- This data set contains accounting information that the user wishes to keep.

The following data sets are optional.

- SYS1.MAN (SMF Data Set) -- The SMF data set may reside on tape or on direct access. If the SMF data set resides on tape only a primary data set (SYS1.MANX) is required. If it resides on direct access, a primary data set (SYS1.MANX) and an alternate data set (SYS1.MANY) are required. Whatever volume is selected becomes PRESRES.
- SYS1.DUMP -- This data set may reside on tape or direct access. It is used to contain a core image dump written by the ABEND routines, if a system failure occurs.

The following data sets are required if TSO (Time Sharing Option) is selected.

- SYS1.SWAP -- This data set contains TSO user regions that have been swapped out of main storage. It must be on a direct access device.
- SYS1.BRODCAST -- This data set contains two types of TSO messages: MAIL and NOTICES. It must be on a direct access device.

* SYS1.UADS -- This data set contains a list of the terminal users who are authorized to use TSO along with information about each of ther terminal users. It must be on a direct access device.

* SYS1.HELP -- This data set is required if the TSO HELP command is going to be used. It contains information regarding the SYNTAX, OPERANDS, AND FUNCTIONS OF A TSO command. It must be on a direct access device.

* SYS1.CMDLIB -- This data set contains TSO command processors, service routines, and utilities. It must be on a direct access device.

The following data sets are required if TCAM is selected during system generation.

* TCAM Message Queues Data Set.

* TCAM Checkpoint Data Set.

The System Catalog (SYSCTLG)

The number of tracks required on the system residence volume for the system catalog is estimated from the following formula:

$$\text{Number of tracks} = \left(\frac{\text{Number of blocks required}}{\text{Number of blocks on each track}}\right) + 1$$

The number of blocks required is calculated as follows:

$$\text{Number of blocks} = L + 1.17X_\ell + K\left(\frac{D_\ell - 3X_\ell}{6} + 1\right) + N + \frac{V_n}{20} + \frac{A + C}{14} + 1$$

Where: L = the number of index levels.

X_ℓ = the number of indexes defined at level ℓ. (Each index level should be evaluated separately and the result added to the total requirement.)

D_ℓ = the number of data sets cataloged at level ℓ. (Each index level should be evaluated separately and the result added to the total requirement.)

K = 0 if ($D_\ell - 3X_\ell$) is negative; otherwise, K=1.

N = the number of data sets that occupy six or more volumes.

V_n = the number of volumes occupied by the nth data set that resides on six or more volumes. (Each data set should be evaluated separately and the result added to the total requirement.)

A = the number of high level aliases.

C = the number of pointers to the control volume (CVOL).

Note: Round off all fractions to next lower integers before calculating totals.

The number of blocks on each track is as follows:

- IBM 2301 Drum Storage - 45
- IBM 2302 Disk Storage - 14
- IBM 2303 Drum Storage - 12
- IBM 2311 Disk Storage - 10
- IBM 2314 Disk Storage - 17

The Nucleus Library (SYS1.NUCLEUS)

The number of tracks required on the system residence volume for the nucleus is estimated from the following formula:

$$\text{Number of tracks} = \frac{S}{1024 \bullet T} + \frac{12}{T}$$

Where: S = the size of the nucleus in bytes and is equal to the fixed storage requirement, excluding the storage required by items which may be altered when the system is initialized. These items include:

- resident BLDLTAB list
- resident reenterable load modules
- resident type 3 and 4 SVC routines
- resident error procedures
- resident job queue in PCP
- system queue area in MVT

T = a device parameter, defined as follows:

- IBM 2301 Drum Storage, T = 11
- IBM 2303 Drum Storage, T = 2.2
- IBM 2311 Disk Storage, T = 2
- IBM 2314 Disk Storage, T = 4

Note 1: The number of tracks also depends on the number of modules in the nucleus and the number of entry points in each module.

Note 2: When allocating space for SYS1.NUCLEUS, you must indicate in the SPACE parameter the number of 256-byte records to be allocated for a directory. In most cases, one 256-byte record is sufficient. (See the description of the SPACE parameter of the DD statement in the publication IBM System/360 Operating System: Job Control Language.)

The SVC Library (SYS1.SVCLIB)

The amount of auxiliary storage required by the SVC Library depends on the components in the system being measured. The actual amount of storage is the sum of all applicable entries from Table 59 plus the number of tracks required for directory records.

Table 59. Auxiliary Storage Requirements for the SVC Library

Description	No. of Directory Records (1)	Number of Tracks Required			
		IBM 2301 Drum Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage
•Primary data management/other control program functions					
for PCP(2)	67	26	108	141	70
for MFT(2,7)	81	34	137	178	90
for MVT(5)	80	32	133	172	86
for M65MP(3)	82	32	132	172	86
•BDAM	7	3	10	11	6
•BISAM/QISAM	22	14	57	72	38
•BTAM	15	6	21	29	14
•Chkpt/Restart	3	1	4	5	3
•GAM	3	3	8	11	6
•GJP(4)	1	1	1	1	1
•MCH	3	3	11	13	7
•MCS(6)	2	1	3	3	2
•OLTEP	1	1	2	2	1
•QTAM	12	4	16	20	11
•SGJP(4)	1	1	1	1	1
•TESTRAN	1	1	1	1	1
•TCAM	15	7	29	36	19
•TSO	12	5	17	20	10

Notes:

1. Number of 256-byte records to be allocated for a directory when a new partitioned data set is being defined. (See the description of the SPACE parameter of the DD statement in the publication _IBM System/360 Operating System: Job Control Language Reference_.) The number of directory records that can be contained on a track is as follows:
   - •IBM 2301 Drum Storage - 45
   - •IBM 2303 Drum Storage - 12
   - •IBM 2311 Disk Storage - 10
   - •IBM 2314 Disk Storage - 17
2. These estimates include the storage required by the following SVC routines: ATTACH (SVC 42); EXTRACT (SVC 40); IDENTIFY (SVC 41); and SPIE (SVC 14). If any of these routines are made resident at system generation, the storage requirement for the SVC Library is decreased by the size of the SVC routine.
3. These estimates include the tracks required for MCH.
4. If both GJP and SGJP are used, add only the storage requirement for one of these components.
5. If SMF is specified during system generation, add the following: one directory record, one track for a 2301 or 2314, two tracks for a 2311 or 2303.
6. If a 2740 is specified as a console in MCS and there is no BTAM support, add the following: 1 directory entry, 1 track for a 2301, 4 tracks for a 2303, 5 tracks for a 2311, or 3 tracks for a 2314.
7. If subtasking is included, add: 5 directory entries, 2 tracks on a 2311 or 2303 and 1 track on a 2314 or 2301.

The Machine Error Recording Data Set (SYS1.LOGREC)

The user must not allocate space for this data set; however, the amount of space used must be known in order to estimate the total storage requirement of the operating system.

The number of tracks required on the system residence volume for the SYS1.LOGREC data set is estimated from the following formula:

Number of tracks = $R + \frac{D}{S}$

Where: D = the number of uniquely addressable I/O devices in the system.

R,S = device parameters defined in Table 60.

Note: Round off fractions to the next higher integer.

Table 60. Device Parameters for SYS1.LOGREC

Device Parameters	IBM 2301 Drum Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage
R				
•without MCH				
(Models 30,40,50,65,75)	4	16	21	11
(model 91)	6	N/A	32	18
(model 195)	7	31	36	21
•with MCH				
(model 65)	7	28	33	20
(models 85,155)	6	24	33	18
S	89	25	28	33

The Parameter Library (SYS1.PARMLIB)

Table 61 gives the number of tracks required on the system residence volume for the parameter library.

Table 61. Auxiliary Storage Requirements for the Parameter Library

Device Type	Number of Tracks
IBM 2301 Drum	1
IBM 2303 Drum	2
IBM 2311 Disk	2
IBM 2314 Disk	1

Note: The number of directory records is 1. (When allocating space for SYS1.PARMLIB, the number of 256-byte directory records to be allocated for a directory must be indicated in the SPACE parameter. See the description of the SPACE parameter of the DD statement in the publication IBM System/360 Operating System: Job Control Language Reference.)

The Link Library (SYS1.LINKLIB)

The amount of auxiliary storage required by the link library depends on two factors: (1) the components in the system being generated and (2) whether LBMAINT=E or LBMAINT=F is specified in the GENERATE macro instruction during system generation. Table 62 gives the auxiliary storage requirements for the link library with a specification of LBMAINT=E. Table 63 gives the auxiliary storage requirements for the link library with a specification of LBMAINT=F. The actual amount of storage required for this library is the sum of all applicable entries from Table 62 or Table 63 plus the number of tracks required for directory records.

Table 62. Auxiliary Storage Requirements for Link Library, LBMAINT=E (Part 1 of 2)

Description	No. of Directory Records (1)	Number of Tracks Required IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage
•Control program modules for job						
for PCP with 18K scheduler	32	52	194	212	270	143
for PCP with 44K scheduler	28	50	190	206	262	138
for PCP with 100K scheduler	25	48	179	195	248	130
for MFT with 30K scheduler	49	69	254	282	354	188
for MFT with 44K scheduler	49	65	248	273	345	183
for MVT (11)	49	71	263	290	366	193
for M65MP (2)	49	71	263	290	366	193
Accounting data set writer (10)	1	1	1	1	1	1
•ALGOL	5	6	27	27	38	17
•Assembler E	5	9	31	33	42	23
• Assembler F	3	8	29	32	40	22
• American National Standard COBOL	3	24	88	94	123	61
• COBOL E	9	18	70	74	96	50
• COBOL F	2	17	64	69	90	46
• CRJE	3	1	4	4	5	3
•EREP/SER0/SER1 (3)						
EREP, Model Independent (without CCH/MCH)	2	4	12	12	17	8
Model 40 EREP	1	2	5	6	7	4
SER0	1	1	2	2	2	1
SER1	1	1	1	1	2	1
Model 50 EREP	1	2	5	6	7	4
SER0	1	1	2	2	2	1
SER1	1	1	1	1	2	1
Model 65 EREP	2	2	7	9	11	6
SER0	1	1	2	2	2	1
SER1	1	1	1	1	2	1
Model 75 EREP	2	2	6	7	8	5
SER0	1	1	2	2	2	1
SER1	1	1	1	1	4	1
with CCH and MCH on Model 85	16	4	16	16	21	12
Model 91 EREP	3	3	12	13	16	9
SER1	1	1	1	N/A	3	2
•EREP without SER						
with CCH on Models 65,75,91, 155,165,	3	4	14	14	18	11
with MCH on Model 65,85	3	4	14	14	19	11
with MCH on Models 165,155	1	1	3	3	3	2
with CCH/MCH on Model 65,85	3	4	15	15	19	12
• EREP Model Independent (with CCH)	2	3	9	9	11	6
Model 195 EREP	3	4	14	14	21	11
SER1	1	1	3	3	3	2

Table 62. Auxiliary Storage Requirement for Link Library, LBMAINT=E (Part 2 of 2)

•FORTRAN IV E	4	6	22	24	32	16
•FORTRAN IV G	1	5	18	19	24	13
• FORTRAN IV H	1	28	112	119	156	80
• FORTRAN Syntax Checker	2	2	6	6	7	4
•GJP and SGJP	9	10	33	37	46	25
•Graphics						
GSP	13					
PROs (3)	6	3	10	10	14	8
PORs (3)	7					
• GJP (9)	7	3	29	29	12	26
•Linkage editor E - 15K	1	3	10	10	13	7
•Linkage editor E - 18K	1	3	9	10	13	7
•Linkage editor F - 44K	1	4	14	14	19	10
•Linkage editor F - 88K	1	4	14	14	19	10
•Linkage editor F - 128K	1	4	13	14	18	9
•Loader	1	2	4	5	5	3
•OLTEP	6	5	17	20	24	13
•OL/I F (5)	51	69	258	295	361	196
PL/I Syntax Checker						
16K Version	1	2	7	8	10	9
20K Version	1	3	8	9	10	6
27K Version	1	3	12	13	16	9
•1130/360 Data Transmission (6)	1	1	2	2	3	2
•1130/360 Data transmission (7)	5	1	4	4	5	3
•RJE	11	4	12	14	16	10
• RPG E	4	10	36	40	50	27
• Service Aids	4	5	17	20	25	13
•SGJP (9)	7	7	26	28	38	19
•Sort/merge	1	5	17	17	22	12
•TESTRAN editor	7	4	11	13	15	8
• TCAM	19	12	46	47	58	30
•TESTRAN interpreter	4	2	6	7	9	5
• TSO	6	8	24	27	30	16

Notes:

1. The number of 256-byte records to be allocated for a directory when a new partitioned data set is being defined. (See the description of the SPACE parameter of the DD statement in the publication IBM System/360 Operating System: Job Control Language.) The number of directory records that can be contained on a track is as follows:
   - IBM 2301 Drum Storage - 45
   - IBM 2302 Disk Storage - 14
   - IBM 2303 Drum Storage - 12
   - IBM 2311 Disk Storage - 10
   - IBM 2314 Disk Storage - 17
2. These estimates include the tracks required for EREP without SER on the Model 65.
3. If system error recovery is to support more than one CPU, the total link library storage requirement is the sum of the value for model independent EREP plus the values for EREP and SER0 or SER1 for each CPU to be supported.
4. ATTINQ storage requirement of 675 bytes has been included in the requirements for the PORs.
5. These estimates include the PL/I F compiler, macro processor, and library modules that are invoked dynamically. If you select the shared library feature, see Table 85 for the storage requirements.
6. Use this estimate if user callable modules have been generated into SYS1.FORTLIB.
7. Use this estimate if all 1130/360 Data Transmission modules are generated into the link library.
8. Add the auxiliary storage requirement for an accounting routine, if one is supplied.
9. When both GJP and SGJP are used, see the entry "GJP and SGJP" in this table.
10. This auxiliary storage requirement must be added only when accounting routine inclusion is specified in the SCHEDULR macro instruction during system generation.
11. If SMF is specified during system generation add the following: one directory record, one track for a 2301, three tracks for a 2303, three tracks for a 2311, or 2 tracks for a 2314.

Table 63. Auxiliary Storage Requirements for Link Library, LBMAINT=F(1) (Part 1 of 2)

Description	No. of Directory Records (2)	Number of Tracks Required				
		IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage
•Control program modules for job management and utilities (9)						
for PCP with 18K scheduler	32	45	205	212	287	139
for PCP with 44K scheduler	28	44	201	205	281	137
for PCP with 100K scheduler	25	42	192	200	269	129
for MFT with 30K scheduler	49	69	254	282	354	188
for MFT with 44K scheduler	47	68	244	262	334	184
for MVT (12)	49	63	276	289	386	189
for M65MP (3)	49	63	215	290	389	189
•Accounting data set writer (11)	1	1	1	1	1	1
•ALGOL	4	6	23	24	32	17
•Assembler F	2	8	36	36	46	22
•Assembler E	5	8	36	40	45	23
American National Standard COBOL	3	23	87	93	124	64
•COBOL E	9	18	70	73	96	50
•COBOL F	2	16	64	69	90	46
•CRJE	3	1	3	3	6	3
•EREP/SER0/SER1 (4)						
EREP,Model Independent (without CCH/MCH)				2 4	12 12	15 8
Model 40 EREP	1	3	5	5	5	4
SER0	1	1	1	1	1	1
SER1	1	1	1	1	1	1
Model 50 EREP	1	2	6	6	7	4
SER0	1	1	1	1	1	1
SER1	1	1	1	1	1	1
Model 65 EREP	2	4	9	9	12	7
SER0	1	1	1	1	1	1
SER1	1	1	1	1	1	1
Model 75 EREP	2	2	6	7	8	5
SER0	1	1	1	1	1	1
SER1	1	1	1	1	1	1
Model 91 EREP	3	4	13	13	16	9
SER1	1	1	N/A	N/A	2	1
•EREP without SER						
with CCH on Models 65,75,91, 155,165	3	4	14	14	18	11
with MCH on Model 65	3	4	14	14	19	11
with MCH on Models 165,155	1	1	3	3	3	2
with CCH/MCH on Model 65	3	4	15	15	19	12
with CCH and MCH on Model 85	16	4	16	16	21	12
EREP Model Independent						
(with CCH)	2	3	9	9	11	6
Model 195EREP	3	4	14	14	21	11
SER1	1	1	3	3	3	2
•FORTRAN IV E	4	6	22	24	31	16
•FORTRAN IV G	2	4	23	23	26	13
•FORTRAN IV H	1	26	125	128	163	80
•FORTRAN Syntax Checker	2	2	6	6	7	4
•GJP (10)	7	7	25	26	33	18
•GJP and SGJP	9	9	34	37	48	24
•Graphics						
GSP	13	8	19	22	27	14
PORs (5)	6	3	10	10	14	8
•Linkage Editor E - 15K	1	3	10	11	14	7
•Linkage Editor E - 18K	1	3	9	10	14	7
•Linkage Editor F - 44K	1	4	14	14	18	9
•Linkage Editor F - 88K	1	4	13	14	17	10

Table 63. Auxiliary Storage Requirements for Link Library, LBMAINT=F (Part 2 of 2)

Description	No. of Directory Records (2)	Number of Tracks Required: IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage
•Linkage Editor F - 88K	1	4	14	15	28	10
•Linkage Editor F - 128K	1	4	14	14	20	10
•Loader	1	1	5	5	7	3
•OLTEP	6	5	17	19	23	12
•PL/I F	51	69	259	295	361	196
•PL/I Syntax Checker						
16K Version	1	2	7	8	10	9
20K Version	1	3	8	9	10	6
27K Version	1	3	12	13	16	9
•1130/360 Data Transmission (7)	1	1	2	2	3	2
•1130/360 Data Transmission (8)	5	1	4	4	5	3
•RJE	11	4	12	14	16	9
•Service Aids	4	5	17	20	25	13
•RPG E	4	9	41	42	60	31
•SGJP (10)	7	7	26	28	37	21
•Sort/Merge	1	4	16	17	25	13
•TCAM	19	12	40	47	58	30
•TESTRAN editor	7	4	11	13	15	8
•TESTRAN interpreter	4	2	6	7	9	5
•TSO	6	8	24	27	30	16

Notes:

1. These estimates were computed using the 44K level F linkage editor; value$_2$ of the SIZE option was 6K.
2. The number of 256-byte records to be allocated for a directory when a new partitioned data set is being defined. (See the description of the SPACE parameter of the DD statement in the publication IBM System/360 Operating System: Job Control Language.) The number of directory records that can be contained on a track is as follows:

   - IBM 2301 Drum Storage - 45
   - IBM 2302 Disk Storage - 14
   - IBM 2303 Drum Storage - 12
   - IBM 2311 Disk Storage - 10
   - IBM 2314 Disk Stoage - 17
3. These estimates include the tracks required for EREP without SER on the Model 65.
4. If system error recovery is to support more than one CPU, the total link library storage requirement is the sum of the value for model independent EREP plus the values for EREP and SER0 or SER1 for each CPU to be supported.
5. ATTINQ storage requirement of 675 bytes has been included in the requirements for the PORs.
6. These estimates include the PL/1 F compiler, macro processor, and library modules that are invoked dynamically. If you select the shared library feature, see Table 85 for the storage requirements.
7. Use this estimate if user callable modules have been generated into SYS1.FORTLIB.
8. Use this estimate if all 1130/360 Data Transmission modules are generated into the link library.
9. Add the auxiliary storage requirement for an accounting routine, if one is supplied.
10. When both GJP and SGJP are used, see the entry "GJP and SGJP" in this table.
11. This auxiliary storage requirement must be added only when accounting routine inclusion is specified in the SCHEDULR macro instruction during system generation.
12. If SMF is specified during system generation, add the following: one directory record, one track for a 2301, three thracks for a 2303, three tracks for a 2311, or two tracks for a 2314.

Work Space for the PCP Scheduler (SYS1.SYSJOBQE)

The number of tracks required for work space for the PCP scheduler is estimated from the following formula:

$$\text{Number of tracks} = \frac{57 + \frac{B}{3} + 2C + \frac{E}{28} + \frac{F}{176} + 3G + \frac{H - 5}{15} + \frac{J}{2}}{K}$$

Where: B = the largest number of passed data sets in any one job.
C = the number of steps in the largest job.
E = the number of volume serials for all job steps that use existing data sets or specific volumes. (Each job step should be evaluated separately and the result added to the total requirement.)
F = the number of characters in data set names, including qualifiers, for all job steps that use the VOLUME=REF=dsname DD statement parameter. (Each job step should be evaluated separately and the result added to the total requirement.)
G = the largest number of DD statements in any one job.
H = the number of volume serial numbers for all data sets (if $H \leq 5, \frac{H-5}{15} = 0$). (Each data set should be evaluated separately and the result added to the total requirement.)
J = the number of JOB statements when all messages are not to be written on the system output device; or the total number of job control statements when all messages are to be written as system output.
K = the number of 176-byte records on each track for one of the following direct access devices:

- IBM 2301 Drum Storage, K=66
- IBM 2302 Disk Storage, K=20
- IBM 2303 Drum Storage, K=17
- IBM 2311 Disk Storage, K=15
- IBM 2314 Disk Storage, K=25

Note 1: This requirement must include calculations for all cataloged procedures to be executed.

Note 2: Round off all fractions to the next higher integer.

Work Space for the MFT or MVT Schedulers (SYS1.SYSJOBQE)

The following formula can be used to estimate the space required for the job queue data set for the MFT or MVT scheduler:

$$\text{Number of tracks} = \frac{\left[\Sigma_i(Q_i \cdot \bar{I}_i) + \Sigma_i(R_i \cdot \bar{O}_i) + T(\frac{IWA}{176}) + L + Z + S(NI + 1)\right](N + 1) + QCR}{K}$$

Where: Q_i = the maximum number of jobs that will be queued at any one time on the input queue for class i.

$\bar{I}_j$ = the average size (in logical tracks) of a job in the input queue for class i.

R_i = the maximum number of jobs that will be queued at any one time on the output queue for class i.

$\bar{O}_i$ = the average size (in logical tracks) of a job in the output queue for class i.

T = the number of transient readers required. For MVT, T = 0.

IWA = size of the interpreter work area saved for each transient reader. For MFT, IWA = 2048; for MVT, IWA = 0.

N = the number of records per logical track.

K = the number of 176-byte records on each physical track for one of the following direct access devices:

- IBM 2311 Disk Storage, K = 15
- IBM 2301 Drum Storage, K = 66
- IBM 2303 Drum Storage, K = 17
- IBM 2314 Disk Storage, K = 25

L = the number of logical tracks required when the automatic SYSIN batching (ASB) reader is used; it is calculated as follows:

$$L = J \bullet (\frac{X}{3} - Y) + 2$$

Where: J = the number of jobs in an ASB reader batch
X = the average number of job control language statements per job
Y = the number of records per logical track

- The minimum value for the expression $(\frac{X}{3} - Y)$ is 1.
- For MFT, L =0; for MVT when the ASB reader is not used, L = 0.

Z = the size (in logical tracks) of the records reserved for termination.

S = the size (in logical tracks) of the records reserved for initiators, plus 1 logical track for overflow.

NI = the maximum number of initiators that will be active.

QCR = the number of tracks required for 76 queue control records (36 bytes each) on the direct access direct.

Note: A 2301, 2303, or 2311 may be completely allocated for the job queue; however, the 2314 is restricted to a maximum of 1,250 tracks.

The average size of a job in the input and output queues can be computed by using the following two formulas. The following rules apply:

- These requirements must include calculations for all cataloged procedures to be executed.
- All fractions must be rounded to the next highest integer.

The following formula can be used to estimate the size (in logical tracks) of a job in the input queue for class $\underline{i}$:

$$I_i = \frac{1 + \frac{2B}{3} + 2C + \frac{E}{28} + \frac{F}{176} + G + G_I + \frac{H - 5}{15} + \frac{2D + L}{118}}{N}$$

Where: B = the number of passed data sets in the job.
C = the number of steps in the job.
E = the number of volume serial numbers for all job steps that use existing data sets or specific volumes. Each job step should be evaluated separately and the result added to the total.
F = the number of characters in data set names, including qualifiers, for all job steps that use the VOLUME=REF=dsname DD statement parameter. Each job step should be evaluated separately and the result added to the total.
G = the number of DD statements in the job.
G = G - the number of system output DD statements of class $\underline{i}$ in the job (G).
H = the number of volume serial numbers for all data sets (if $H \leq 5, \frac{H-5}{15}=0$). (Each data set should be evaluated separately and the result added to the total requirement.)
D = the number of non-temporary data set names in the job.
L = the total length of the non-temporary data set names.
N = the number of records per logical track.

The following formula can be used to estimate the size (in logical tracks) of a job in output queue $\underline{i}$. (There are 36 output queues, one for each system output device class.)

$$O_i = \frac{\frac{J}{2} + 2G_i + \frac{H_i - 5}{15} + A}{N}$$

Where: J = 0 if MSGCLASS≠$\underline{i}$ for the job, or
2 if MSGLEVEL=0 for the job, or
the number of job control language records for the job if MSGLEVEL≠0.
G_i = the number of system output DD statements of class $\underline{i}$ in a job.
H_i = the number of volume serial numbers for all system output data sets of class $\underline{i}$ in the job. (Each data set should be evaluated separately and the result added to the total.)
A = 0 if MSGCLASS≠$\underline{i}$, or
the number of DD statements (G) in the job if MSGCLASS=$\underline{i}$.
N = the number of records per logical track.

The Procedure Library (SYS1.PROCLIB)

IBM supplies cataloged procedures to perform many routine operations. The storage required by these procedures depends on the device on which the library resides and on whether the procedure library is unblocked or blocked. Table 57 gives the auxiliary storage requirements for the IBM-supplied cataloged procedures. These track requirements reflect the storage needed when the procedure library is unblocked. If the user supplies additional cataloged procedures for the library, the additional storage requirements must be added. If the user blocks the procedure library, the auxiliary storage requirements must be adjusted accordingly.

Table 64. Auxiliary Storage Requirements for the Procedure Library

Device Type	Number of Tracks
IBM 2301 Drum	9
IBM 2302 Disk	24
IBM 2303 Drum	32
IBM 2311 Disk	33
IBM 2314 Disk	21
IBM 2321 Data Cell	91
Note: The number of directory records is 5. (When allocating space for SYS1.PROCLIB, the number of 256-byte directory records to be allocated for a directory must be indicated in the SPACE parameter. See the description of the SPACE parameter of the DD statement in the publication IBM System/360 Operating System: Job Control Language Reference.)	

System Log Data Sets for MVT and MFT (SYS1.SYSVLOGX and SYS1.SYSVLOGY)

The number of tracks required for the system log data sets can be estimated from the following formula:

Number of tracks = N/K

Where: N = the maximum number of variable length records (record lengths can vary from 5 bytes to 148 bytes) to be written in the data set before a full data set condition is reached.

K = the number of variable length records on each track for any one of the following direct access devices: IBM 2301 Drum, IBM 2302 Drum, IBM 2303 Drum, IBM 2311 Disk, and the IBM 2314 Disk.

The Macro Library (SYS1.MACLIB)

The amount of auxiliary storage required by the macro library depends on two factors: (1) whether the library is blocked or unblocked, and (2) the components in the system being measured. Table 65 gives the auxiliary storage requirements for the blocked and unblocked macro library. The actual amount of storage required by the library is the sum of all applicable entries from Table 58 plus the number of tracks required for directory records.

Table 65. Auxiliary Storage Requirements for the Macro Library

Description	No. of Directory Records (1)	Number of Tracks Required					
		IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage	IBM 2321 Data Cell
Blocked (2)							
•Basic macro instructions (3)	9	68	354	354	370	193	648
•BTAM	2	13	65	66	70	37	119
•Graphics	7	21	106	109	117	60	209
•OCR	1	3	16	16	16	9	29
•QTAM	5	12	60	68	74	36	125
•TESTRAN	1	12	64	64	64	34	112
•TCAM							
•TSO	1	12	60	60	60	32	108
• IMDSADMP-Service Aids (4)	1	5	25	25	24	13	42
Unblocked							
•Basic macro instruction (3)	9	156	428	573	596	374	1247
•BTAM	2	29	79	103	109	69	228
•Graphics	7	47	128	172	178	112	375
•OCR	1	7	19	25	26	17	55
•QTAM	5	26	72	95	99	63	210
•TESTRAN	1	28	76	102	106	67	221
•TCAM							
•TSO	1	29	80	100	100	68	230
•IMDSADMP-Service Aids (4)	1	11	30	41	42	27	88

Notes:

1. The number of 256-byte records to be allocated for a directory when a new partitioned data set is being defined. (See the description of the SPACE parameter of the DD statement in the publication IBM System/360 Operating System: Job Control Language.) The number of directory records that can be contained on a track is as follows:

   - IBM 2301 Drum Storage - 45
   - IBM 2302 Disk Storage - 14
   - IBM 2303 Drum Storage - 12
   - IBM 2311 Disk Storage - 10
   - IBM 2314 Disk Storage - 17
   - IBM 2321 Data Cell - 5

2. The blocking factor for all devices except the IBM 2311 and the IBM 2321 is equal to 3360 bytes per block; the blocking factor for the IBM 2311 is equal to 3600 bytes per block; and the blocking factor for the IBM 2321 is equal to 2000 bytes per block.

3. These are the macro instruction used by the control program, primary data management, BDAM, BISAM/QISAM, and RJE.

4. This storage is required if the service aids option is not excluded on the CTRLPROG macro instruction during system generation.

The Subroutine Libraries

Many components of the operating system have subroutine libraries. The auxiliary storage required by these libraries is given in Table 66. The size of any subroutine library is the sum of all applicable entries for the library plus the number of tracks required for directory records.

Table 66. Auxiliary Storage Requirements for the Subroutine Libraries (Part 1 of 2)

Description	No. of Directory Records (1)	Number of Tracks Required					
		IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage	IBM 2321 Data Cell
•SYS1.ALGLIB	14	3	9	10	12	7	25
•SYS1.ASRLIB	1	1	N/A	4	4	3	N/A
•SYS1.COBLIB							
COBOL E (3)	18	3	6	8	9	6	19
COBOL F (3,6)	8	2	5	7	8	5	15
American National Standard COBOL(3)	12	3	8	10	11	7	22
•SYS1.FORTLIB (2,4)							
FORTRAN IV E	17	4	12	14	17	10	36
FORTRAN IV G or H (5) with error message facility	28	6	20	23	26	15	56
FORTRAN IV G or H (5) without error message facility	26	6	18	22	25	15	56
1130/360 Data Transmission	4	1	2	2	2	2	4
•Graphic Subroutine Package (GSP) (6)	1	1	1	1	1	1	2
•SYS1.PL1LIB							
With complex function (7)	83	18	57	68	79	46	160
Without complex functions (6)	69	15	47	56	65	37	132
•SYS1.SORTLIB	36	14	42	51	60	34	124
•SYS1.TELCMLIB							
for BTAM	1	1	1	1	1	1	2
for QTAM	11	3	9	11	12	7	25
for RJE	4	3	9	10	13	7	27
for TCAM	20	6	20	20	28	15	56
for CRJE	6	5	16	18	22	12	51

Table 66. Auxiliary Storage Requirements for the Subroutine Libraries (Part 2 of 2)

Notes:

1. Number of 256-byte records to be allocated for a directory when a new partitioned data set is being defined. (See the description of the SPACE parameter of the DD statement in the publication IBM System/360 Operating System: Job Control Language.) The number of directory records that can be contained on a track is as follows:
   - IBM 2301 Drum Storage - 45
   - IBM 2302 Disk Storage - 14
   - IBM 2303 Drum Storage - 12
   - IBM 2311 Disk Storage - 10
   - IBM 2314 Disk Storage - 17
   - IBM 2321 Data Cell - 5
2. These estimates are with a specification of LBMAINT=E.
3. The requirement of the combined COBOL libraries is equal to the sum of the requirements of the individual libraries.
4. If two FORTRAN IV compilers are desired (i.e., E and G or H) in the same system, the larger library (G or H) should be requested during system generation.
5. The libraries with the error message facility are identical and the libraries without the error message facility are identical; therefore, if both compilers with identical libraries are present, space is required for only one library.
6. The Graphic Programming Services for FORTRAN IV may be used with the E, G, and/or H compiler. Add the storage requirement for GSP to the storage requirement for the FORTRAN IV library selected.
7. If GSP=INCLUDE is specified at system generation increase the track requirement by 1.

The Rollout Data Set (SYS1.ROLLOUT)

The rollout data set, used only with MVT and M65MP, must be large enough to contain the dynamic main storage area. This area is the maximum amount of storage that could be rolled out at any one time. The space allocated for this data set must be contiguous and the block size is 1024.

The Data Set for Checkpoint/Restart

The checkpoint data set may be on any direct access device or any magnetic tape drive supported by BSAM and BPAM. The size of the checkpoint data set is determined by the user. The following information can be used as a guideline in determining the size of this data set.

Table 67 contains the size and number of records written when a checkpoint is taken. The number of tracks or the amount of tape occupied by the checkpoint data set can be determined by applying the number of records and their sizes against either the track capacities of the direct access device or the recording density and type for the magnetic tape device.

Table 67. Auxiliary Storage Requirement for the Data Set for Checkpoint/Restart

Description	Size (in bytes)	Number of Records Required	
		With PCP or MFT	With MVT
CHR (checkpoint header record)	400	1	1
DSDR (data set descriptor record)	400	N/2 (1)	N/2 (1)
CIR (core image record)	B	A/B	A/B
SUR (supervisor record)	200	1	C/170

Where:
- N = the number of data sets defined in the job step
- A = the amount of storage required by the user-written program
- B = the blocksize of the checkpoint data set. If specified by the user, the blocksize must be equal to or greater than 600; if the default is to be used, the blocksize is equal to 32,760 for magnetic tape or track capacity for the direct access device used.
- C = the amount of storage required in the system queue area by the user-written program.

Note:
1. Add one record for the first generation data set and a second record for each additional 4 generation data sets. Also, add one record for each data set that requires 6 to 20 volumes and one record for each additional 15 volumes. That is, if the data set requires 35 volumes, add 2 records; if 50 volumes are required, add 3 records, and so on.

The Accounting Data Set (SYS1.ACCT)

This data set can be used with any configuration. The user determines how much space is to be allocated to the data set and what accounting information is to be stored in the data set.

The SMF Data Set (SYS1.MAN)

This data set can reside on tape or on direct access. If it resides on direct access, a primary data set (SYS1.MANX) and an alternate data set (SYS1.MANY) are required. The size of the data set depends on the length of the records written onto it. For example, the size required for the data set would be 48,473 bytes, if you had a total of 12 jobs per hour for four hours with each job having:

- 4 DD statements per job step plus,
- 2 items of accounting information with 5 bytes per item plus,
- 3 steps per job.

(For a detailed explanation of how this number was calculated see the publication, IBM System/360 Operating System: System Programmers Guide.)

The Core Image Dump Data Set (SYS1.DUMP)

This data set can reside on tape or direct access. If it resides on direct access, the number of tracks allocated for the data set must be large enough to contain all of main storage. Use the following chart to determine the number of tracks required:

STORAGE SIZE / DEVICE	128K	256K	512K
IBM 2301 Drum Storage	9	15	28
IBM 2302 Disk Storage	29	55	108
IBM 2303 Drum Storage	30	56	110
IBM 2311 Disk Storage	39	75	145
IBM 2314 Disk Storage	20	38	75

The TCAM Message Queues Data Set

If you use TCAM, you can queue messages on two secondary storage devices: the IBM 2311 Disk Storage Drive and the IBM 2314 Direct Access Storage Facility. The number of records that can be written per track on each of these devices can be estimated by the following formulas:

Number of records per 2311 track = 1/(.00035 KEYLEN)

Number of records per 2314 track = 1/(.00070 KEYLEN)

Where: KEYLEN = the value specified on the KEYLEN operand of the INTRO macro instruction.

The message queues data set must begin on a cylinder boundary and it can have multiple extents on multiple volumes. The data section of each record will be 6 bytes long and the key section (message) will be the length specified on the KEYLEN operand. Tables 68 and 69 contain examples of the number of records per track for each of the two devices.

Table 68. 2311 Track Capacity for TCAM Disk Message Queues Data Set

Records per track	10	10	11	11	12	12	13	13	14	14	15	15	16
Value of KEYLEN	255	239	238	212	211	189	188	169	168	153	152	138	137
Records per track	16	17	17	18	18	19	19	20	20	21	21	22	22
Value of KEYLEN	125	124	114	113	103	102	94	93	85	84	77	76	71
Records per track	23	23	24	24	25	25	26	26	27	27	28	28	29
Value of KEYLEN	70	64	63	58	57	53	52	48	47	43	42	39	38

Table 69. 2314 Track Capacity for TCAM Disk Message Queues Data Set

Records per track	17	17	18	18	19	19	20	20	21	21
Value of KEYLEN	255	247	248	226	227	208	209	193	192	178
Records per track	23	24	24	25	25	26	26	27	27	28
Value of KEYLEN	164	163	151	150	135	134	128	127	117	116
Records per track	30	30	31	31	32	32	33	33	34	34
Value of KEYLEN	99	91	90	84	83	76	75	70	69	63
Records per track	36	37	37	38	38	39	39	40	40	41
Value of KEYLEN	52	51	46	45	41	40	36	35	32	31

The TCAM Checkpoint Data Set

For the IBM 2311 Disk Storage Drive the size in bytes of the Checkpoint Data Set is given by the formula

S=(61+1.05L)+1.26AL +N(61+1.05L)+(M+3)(61+1.05L)

For the IBM 2314 Direct Access Storage Facility the size in bytes of the Checkpoint Data Set is given by the formula

S=(101+1.05L)+1.39AL +N(101+1.05L)+(M+3)(101+1.05L)

In these formulas,

L = the length of a control record=30+3A

L = the length of an environment record=22+B+C+4D+5E+ ($21F_1+21F_2+\ldots+21F$)+($G(H_1+H_2+\ldots+H_1)$)

L = the length of an incident record=12+K

L = the length of a checkpoint request record=17+21F+J

where

A is the value coded in the CPRCDS-" operand of the INTRO macro.

B is the total number of bytes of data located in all option fields assigned to stations, lines, or application programs.

C is equal to the sum of the number of single entries in the Terminal Table plus the number of group entries in the Terminal Table.

D is equal to the number of single, group and process entries in the Terminal Table whose destination queues are maintained on disk.

E is equal to the number of destination queues maintained on disk for single, group, and process entries in the Terminal Table.

F is equal to the number of priority levels specified for each destination (assume one priority level for each destination queue defined by a PROCESS macro, and one for each destination queue defined by a TERMINAL macro having no "LEVEL=" operand).

G is equal to 1 if "I" is specified in the "STARTUP=" operand of the INTRO macro; otherwise, G is equal to 0.

H is equal to the length of an Invitation List (a formula for determining this length is given in the discussion of the LCOPY macro).

I is equal to the number of lines having Invitation Lists (not counting output-only lines).

J is the length, in bytes, of the maximum number of option fields assigned to any one entry in the Terminal Table.

K is equal to J if J is greater than 32; otherwise K is equal to 32.

M is equal to the value coded for the "CKREQS=" operand of the INTRO macro.

N is equal to the number of incident checkpoint records desired (N should be between 1 and 255).

If L is less than 300 bytes, it is rounded up to 300 bytes.

Space Requirements for TSO Swap Data Set

The total swap data set space required is the sum, for each TSO user region of (R/A1)*(U + 2) * A2

where
R   is the size of the region
A1 is the size of a swap allocation unit in bytes (see below)
A2 is the size a swap allocation unit in tracks (see below)
U   is the expected upper bound on the number of users normally logged on in the region.

Since a variation of the number of users logged on to a region is to be expected, it might be advantageous to provide overflow space on some lower speed device unless the time sharing parameters are so structured that the expected upper bound will not be exceeded.

SWAP Device	Swap Allocation Unit Sizes Allocatin Unit(A2)	Sizes(A1)
2301	1 track	18K
2303	4 tracks	18K
2311	10 tracks	32K
2314	10 tracks	64K

Space Requirements for TSO User Attribute Data Set

Directory (blocks) = N * A/4
Space (tracks)=N * A/S

Where
N = the number of TSO users authorized to use the system.
A = the average number of member blcoks per user.
S = the number of blocks on a track and is equal to:

R/B

where
R = the number of bytes of data on a track.
B= 24C + 12 CD + 12 CDE + 88X + 24Y + 44

where

C   is the number of passwords the user has
D   is the average number of account numbers per password
E   is the average number of procedure names per account
X   is the number of account numbers unique to this user
Y   is the number of procedure names unique to this user

Space Requirements for TSO Broadcast Data Set

Space (track) = (1 + M + B + M/26 + U/12) /K

where

M is the maximum number of messages sent to non logged on users as "mail"

B is the maximum number of "notices" placed in the data set by the operator

U is the maximum number of users authorized to use the TSO system

K is the number of 130 byte keyed records on a track

2301	2302	2303	2311	2314
64	22	17	16	25

The Command Library (SYS1.CMDLIB)

The amount of axiliary storage required by the command library is the sum of the track requirements from Table 70 plus the amount of space required for directory records.

Table 70. Auxiliary Storage Requirements for SYS1.CMDLIB

No. of Directory Records (1)	Number of Tracks Required				
	IBM 2301 Drum Storage	IBM 2302 Drum Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage
21	25	90	100	127	67

Note:

1. Number of 256-byte directory records to be allocated for a directory when new partitioned data set is being defined. (See the description of the SPACE parameter in the publication IBM System/360 Operating System: Job Control Language Reference) The number of directory records that can be contained on a track is as follows:

- IBM 2301 Drum Storage - 45
- IBM 2302 Drum Storage - 14
- IBM 2303 Drum Storage - 12
- IBM 2311 Disk Storage - 10
- IBM 2314 Disk Storage - 17

The Help Library (SYS1.HELP)

The amount of auxiliary storage required by the help library is the sum of the track requirements from Table 71 plus the amount of space required for directory records.

Table 71. Auxiliary Storage Requirements for SYS1.HELP

No. of Directory Records	Number of Tracks Required				
	IBM 2301 Drum Storage	IBM 2302 Drum Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage
3	21	56	75	78	49

Note:

1. Number of 256-byte directory records to be allocated for a directory when a new partitioned data set is being defined. (See the description of the SPACE parameter in the publication IBM System/360 Operating System: Job Control Language Reference) The number of directory records that can be contained on a track is as follows:

   - IBM 2301 Drum Storage - 45
   - IBM 2302 Drum Storage - 14
   - IBM 2303 Drum Storage - 12
   - IBM 2311 Disk Storage - 10
   - IBM 2314 Disk Storage - 17

Work Space Requirements

Work space requirements for IBM-supplied programs depend on either the number of source cards or the amount of main storage available to the program, or both. These estimates are for typical source programs and vary considerably, according to the type and combination of statements in the program being processed. The following list shows where to find the work space requirements for those IBM-supplied programs that need work space:

- ALGOL work space requirements are in Table 75.
- Assembler E work space requirements are in Table 76.
- Assembler F work space requirements are in Table 78.
- COBOL E work space requirements are in Table 80.
- COBOL F work space requirements are in Table 82.
- American National Standard COBOL work space requirements are in Table 81.
- FORTRAN IV E work space requirements are in Table 84.
- FORTRAN IV H work space requirements are in Table 79.
- GJP work space requirements are in Table 87.
- Linkage editor E work space requirements are in Table 73.
- Linkage editor F work space requirements are in Table 74.
- PL/I F work space requirements are in Table 86.
- PL/I F shared library storage requirements are in Table 85.
- RJE work space requirements are in Table 77.
- RPG E work space requirements are in Table 83.
- SGJP work space requirements are in Table 87.
- TESTRAN work space requirements are in Table 72.

Table 72. Work Space for TESTRAN Macro Instructions

Device	Number of Tracks Required				
	1K-Byte Program	5K-Byte Program	10K-Byte Program	25K-Byte Program	50K-Byte Program
IBM 2301 Drum Storage	1*	1*	2*	4*	6*
IBM 2302 Disk Storage	2*	5*	8*	14*	24*
IBM 2303 Drum Storage	2*	4*	8*	16*	24*
IBM 2311 Disk Storage	2	7	11	20	36
IBM 2314 Disk Storage	2*	5*	9*	15*	29*
IBM 2321 Data Cell	5*	15*	26*	47*	86*

Note: These estimates are based on the following assumptions:
- Ten percent of the program is dumped three times.
- Two percent of a program byte count is attributed to TESTRAN macro instructions. (See Table 58 for storage estimates for TESTRAN macro instructions.)

Table 73. Work Space for the Linkage Editor E

Device	Number of Tracks Required			
	15K E Level Linkage Editor Operating in		18K E Level Linkage Editor Operating in	
	15K	18K	18K	20K
IBM 2301 Drum Storage	4*	12*	4*	7*
IBM 2302 Disk Storage	16*	48*	16*	28*
IBM 2303 Drum Storage	16*	48*	16*	28*
IBM 2311 Disk Storage	26	70	26	42
IBM 2314 Disk Storage	13*	35*	13*	21*
IBM 2321 Data Cell	58*	167*	58*	100*

Note: These estimates assume the maximum size programs are processed by the linkage editor.

Table 74. Work Space for Linkage Editor F (SYSUT1)

Size of Program	Number of Tracks Required					
	IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage	IBM 2321 Data Cell
10K	2	14	4	5	3	11
50K	8	18	18	22	14	55
100K	16	35	35	44	27	110

Note: These estimates assume that the record length used is the largest record size supported for the device. The record lengths used are as follows:

- IBM 2301, record length is 18K
- IBM 2302, record length is 4K
- IBM 2303, record length is 4K
- IBM 2311, record length is 3K
- IBM 2314, record length is 6K
- IBM 2321, record length is 1K

In general, the amount of work space for a program can be estimated by the following formula:

$$\text{Number of tracks} = \frac{\text{size of program}}{\text{record length}} + .10 \text{ of size}$$

Table 75. Work Space for ALGOL

Data Set	Number of Source Cards	Number of Tracks Required					
		IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage	IBM 2321 Data Cell
SYSUT1	150 500 1000	1 1 2	2 4 8	2 4 8	2 5 10	1 3 5	5 15 30
SYSUT2	150 500 1000	1 1 2	2 4 8	2 4 8	2 5 10	1 3 5	5 15 30
SYSUT3	150 500 1000	1 1 1	1 2 4	1 2 4	1 3 5	1 1 2	2 5 10

Note: The primary quantity specified in the SPACE parameter of the DD statements for SYSUT1, SYSUT2, and SYSUT3 must be large enough to contain the entire data set. The use of a secondary quantity for any of these data sets will increase the need for main storage by 40 percent.

Table 76. Work Space for Assembler E

Data Set	Number of Source Cards	Number of Tracks Required: IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage	IBM 2321 Data Cell
SYSUT1	150	2	7	8	10	5	N/A
	500	6	20	22	28	14	N/A
	1000	11	38	42	54	27	N/A
SYSUT2	150	2	7	8	10	5	N/A
	500	6	21	24	30	15	N/A
	1000	12	40	44	56	28	N/A
SYSUT3	150	6	23	25	32	16	N/A
	500	7	24	27	34	17	N/A
	1000	8	27	30	38	19	N/A

Note: These estimates are based on the assumption that no macro instructions are used in the source program. The storage required for SYSUT3 increases when macro instructions are used and is approximately equal to the storage required for SYSUT1 for a 1000 card program.

Table 77. Work Space for Remote Job Entry

Data Set	IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage
	Allow ONE TRACK on each device for EACH MULTIPLE of:				
SYS1.IHKBRDSL	(1)	(1)	(1)	(1)	(1)
SYS1.IHKFSTB	130 Jobs	57 Jobs	37 Jobs	42 Jobs	58 Jobs
SYS1.IHKJEDTB	88 Jobs	30 Jobs	24 Jobs	22 Jobs	36 Jobs
SYS1.IHKMSGSL	(1)	(1)	(1)	(1)	(1)
SYS1.IHKTDRTB	101 Terminals	37 Terminals	28 Terminals	27 Terminals	43 Terminals
SYS1.IHKTXTTB	3 (2)	7 (2)	9 (2)	9 (2)	6 (2)
SYS1.IHKUDRTB	135 Users	62 Users	38 Users	46 Users	62 Users

Notes:
1. Allow one track for this data set in any RJE installation.
2. Allow this many tracks for this data set in any RJE installation.

Table 78. Work Space for Assembler F

Data Set	Number of Source Cards	Assembler F Operating In	Number of Tracks Required: IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage	IBM 2321 Data Cell
SYSUT1	150	44K	2	6	6	8	5	14
		100K	2	8	8	8	8	15
		200K	2	8	8	8	8	15
	500	44K	4	15	15	20	11	35
		100K	5	19	19	20	19	37
		200K	5	19	19	20	19	37
	1000	44K	7	29	29	38	29	67
		100K	9	34	34	37	34	68
		200K	9	34	34	37	34	68
SYSUT2	150	44K	2	6	6	7	6	13
		100K	2	7	7	7	7	13
		200K	2	7	7	7	7	13
	500	44K	4	14	14	18	14	32
		100K	5	17	17	18	17	33
		200K	5	17	17	18	17	33
	1000	44K	7	26	26	34	26	60
		100K	8	30	30	33	30	60
		200K	8	30	30	33	30	60
SYSUT3	150	44K	1	3	3	3	3	6
		100K	1	3	3	3	3	6
		200K	1	3	3	3	3	6
	500	44K	1	4	4	5	4	9
		100K	2	5	5	5	5	10
		200K	2	5	5	5	5	10
	1000	44K	2	6	6	8	6	14
		100K	2	8	8	8	8	15
		200K	2	8	8	8	8	15

Note: These estimates are based on the assumption that no macro instructions are used in the source program. The storage required for SYSUT3 increases when macro instructions are used and is approximately equal to the storage required for SYSUT1 for a 1000 card program.

Table 79. Work Space for FORTRAN IV H

Data Set	Number of Source Cards	Number of Tracks Required: IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage	IBM 2321 Data Cell
SYSUT1 (EDIT option)	150	2	5	8	8	5	14
	500	7	15	20	20	16	35
	1000	10	28	40	40	32	70
SYSUT2 (XREF option)	150	1	1	1	1	1	N/A
	500	1	2	4	4	2	N/A
	1000	1	4	8	8	4	N/A

Table 80. Work Space for COBOL E

Data Set	Number of Source Cards	Number of Tracks Required					
		IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage	IBM 2321 Data Cell
SYSUT1	150	1	2	3	3	2	6
	500	2	8	9	11	6	20
	1000	4	16	18	23	12	42
SYSUT2	150	1	5	6	7	3	13
	500	4	16	17	23	12	42
	1000	9	33	35	45	24	82
SYSUT3	150	2	5	7	7	4	13
	500	5	17	18	23	12	42
	1000	9	33	35	46	24	84

Table 81. Work Space for American National Standard COBOL

Data Set	Number of Source Cards	Number of Tracks Required					
		2301	2302	2303	2311	2314	2321
SYSUT1	1003	4	14	16	20	9	35
	2075	5	17	19	24	12	42
SYSUT2	1003	5	16	18	22	8	39
	2075	6	20	22	28	12	49
SYSUT3	1003	3	10	11	13	6	26
	2075	4	14	16	20	9	35
SYSUT4	1003	1	4	4	5	3	9
	2075	3	9	10	12	6	21

Note: These estimates are for American National Standard COBOL operating in 81K bytes of core storage, with a buffer size of 2768 bytes. The XREF option was specified.

Table 82. Work Space for COBOL F

Data Set	Number of Source Cards	Number of Tracks Required					
		IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage	IBM 2321 Data Cell
SYSUT1	1860	4	12	13	13	10	26
	2700	6	18	20	20	14	40
SYSUT2	1860	3	12	13	13	9	26
	2700	5	14	15	15	11	30
SYSUT3	1860	3	12	12	12	9	24
	2700	6	18	21	21	16	42
SYSUT4	1860	2	4	4	4	2	8
	2700	5	14	5	5	11	30

Note: These estimates are for COBOL F operating in 81K bytes of storage, with a buffer size of 2762 bytes.

Table 83. Work Space for RPG E

Data Set	Number of Source Cards	Number of Tracks Required					
		IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage	IBM 2321 Data Cell
SYSUT1	150	1	3	4	3	3	7
	500	2	8	10	10	7	21
	1000	4	16	20	20	13	42
SYSUT2	150	1	3	4	3	3	4
	500	2	8	10	10	7	12
	1000	4	16	20	20	13	24
SYSUT3	150	1	2	3	3	2	5
	500	2	7	9	8	7	16
	1000	4	13	18	15	13	32

Table 84. Work Space for FORTRAN IV E

Data Set	Number of Source Cards	Size Option (3)	Block Size	Number of Tracks Required (1) IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage	IBM 2321 Data Cell
SYSUT1 and SYSUT2 (2) with the SPACE Option (3)	150	15K	104	1*	2*	3*	3	2*	6*
		44K	1704	1*	2*	2*	2	2*	4*
		86K	1704	1*	2*	2*	2	2*	4*
		200K	1704	1*	2*	2*	2	2*	4*
	500	15K	104	3*	7*	9*	10	6*	20*
		44K	1704	2*	6*	6*	6	4*	12*
		86K	1704	2*	6*	6*	6	4*	12*
		200K	1704	2*	6*	6*	6	4*	12*
	1000	15K	104	5*	14*	17*	19	11*	39*
		44K	1704	3*	12*	12*	12	8*	24*
		86K	1704	3*	12*	12*	12	8*	24*
		200K	1704	3*	12*	12*	12	8*	24*
SYSUT1 and SYSUT2 (2) with the PRFRM Option (3)	150	19K	96	1*	3*	3*	3	2*	6*
		48K	1696	1*	2*	2*	2	1*	3*
		90K	1696	1*	1*	2*	1	1*	2*
		204K	1696	0*	0*	0*	0	0*	0*
	500	19K	96	3*	7*	9*	10	6*	19*
		48K	1696	1*	6*	6*	6	4*	11*
		90K	1696	1*	5*	5*	5	4*	10*
		204K	1696	0*	0*	0*	0	0*	0*
	1000	19K	96	5*	14*	18*	19	12*	38*
		48K	1696	3*	12*	12*	12	8*	23*
		90K	1696	2*	11*	11*	11	8*	22*
		204K	1696	0*	0*	0*	0	0*	0*

Notes:
1. These estimates assume that 40 bytes of intermediate text are generated for each source card image on each utility data set.
2. If the ADJUST compiler option is specified, the estimates for SYSUT2 are twice those given for SPACE compile, regardless of whether SPACE or PRFRM is specified.
3. For detailed information on the compiler options, see the publication IBM System/360 Operating System: FORTRAN IV E Programmer's Guide, GC28-6503.

Table 85. Storage Requirements for Options Specified in the PL1LIB Macro for the Shared Library Feature (Part 1 of 2)

PARAMETER	Sub-parameter		Sub-parameter		Sub-parameter		Sub-parameter	
If MODES=	TASK	The storage requirement is	NOTK	The storage requirement is	REAL	The storage requirement is	CMPX	The storage requirement is
And ARRAY=	N.A		N.A		BASIC	2000 bytes	BASIC	2500 bytes
	N.A		N.A		LEAF	2500 bytes	LEAF	3200 bytes
CONVS=	N.A		N.A		BASIC	3900 bytes	BASIC	4400 bytes
	*BIT	2700 bytes	*BIT	2700 bytes	*BIT	2700 bytes	*BIT	2700 bytes
	*CHAR	3900 bytes	*CHAR	3900 bytes	*CHAR	3900 bytes	*CHAR	3900 bytes
	*EDIT	4300 bytes	*EDIT	4300 bytes	*EDIT	4300 bytes	*EDIT	4300 bytes
	*OPT1	5000 bytes	*OPT1	5000 bytes	*OPT1	5000 bytes	*OPT1	5000 bytes
	*PICT	7900 bytes	*PICT	7900 bytes	*PICT	7900 bytes	*PICT	7900 bytes
	*STERL	4400 bytes	*STERL	4400 bytes	*STERL	4400 bytes	*STERL	4400 bytes
MATHS=	N.A		N.A		BASIC	1800 bytes	BASIC	4300 bytes
	N.A		N.A		LONG	2700 bytes	LONG	5500 bytes
	N.A		N.A		SHORT	3800 bytes	SHORT	4800 bytes
RECIO=	BASIC	2400 bytes	BASIC	1700 bytes	N.A		N.A	
	WAIT	1300 bytes	WAIT	1100 bytes	N.A		N.A	
STORG=	*ERR	1300 bytes	*ERR	1300 bytes	*ERR	1300 bytes	*ERR	1300 bytes
	*LISTP	2700 bytes	*LISTP	2700 bytes	*LISTP	2700 bytes	*LISTP	2700 bytes
STRGS=	*BIT	3200 bytes	*BIT	3200 bytes	*BIT	3200 bytes	*BIT	3200 bytes
	*CHAR	1800 bytes	*CHAR	1800 bytes	*CHAR	1800 bytes	*CHAR	1800 bytes
	*STR	2700 bytes	*STR	2700 bytes	*STR	2700 bytes	*STR	2700 bytes
STRIO=	DATA	5300 BYTES	DATA	5300 bytes	N.A		N.A	
	EDIT	3200 bytes	EDIT	3100 bytes	N.A		N.A	
	LIST	5300 bytes	LIST	5200 bytes	N.A		N.A	

Table 85. Storage Requirements for Options Specified in the PL1LIB Macro for the Shared Library Feature (Part 2 of 2)

- To use this table; locate your subparameters, in the proper column, and add the storage requirements.
- Subparameters marked with an * can be specified for any MODES= condition and should be added only once.
- If you specify a combination of subparameters, add the storage requirements individually.
- Storage is required, on SYS1.LINKLIB, for the modules selected with this option. Convert the storage required into tracks by using the following conversion factors:

Device	Conversion factor
IBM 2301 Drum Storage Device	6×10^{-5} tracks/byte
IBM 2302 Disk Storage Device	26×10^{-5} tracks/byte
IBM 2303 Drum Storage Device	30×10^{-5} tracks/byte
IBM 2311 Disk Storage Device	35×10^{-5} tracks/byte
IBM 2314 Disk Storage Device	70×10^{-5} tracks/byte

EXAMPLE: If the PL1LIB macro shared library feature is specified as

```
MODES=(TASK,REAL),CONVS=(BASIC,BIT,CHAR),STRGS=BIT
```

```
the storage requirement is  7100   (basic requirement)
                           +3900
                           +2700
                           +3900
                           +3200
                           20,800 bytes   20,800 bytes (35x10-5 tracks/bytes) = 8
                         Tracks on a 2311
```

Table 86. Work Space for PL/I F

Data Set	Number of Source Cards	PL/I F Operating In	Number of Tracks Required					
			IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage	IBM 2321 Data Cell
SYSUT1 without the EXTDIC option	150	44K	4	6	6	8	4	22*
		100K	0	0	0	0	0	0*
		200K	0	0	0	0	0	0*
	500	44K	14	23	23	31	16	92*
		100K	9	9	9	18	9	27*
		200K	0	0	0	0	0	0*
	1000	44K	28	48	48	64	32	192*
		100K	34	33	33	68	34	102*
		200K	9	12	12	15	6	27*
SYSUT1 with the EXTDIC option	150	44K	4	6	6	8	4	24
		100K	0	0	0	0	0	0
		200K	0	0	0	0	0	0
	500	44K	14	23	23	31	16	99
		100K	11	9	9	22	11	33
		200K	0	0	0	0	0	0
	1000	44K	28	112	112	64	32	202
		100K	37	150	150	74	37	111
		200K	12	52	52	20	9	28
SYSUT3 with or without the EXTDIC option	150	44K	5	12*	17*	17	10*	25*
		100K	3	4*	12*	14	7*	20*
		200K	3	4*	12*	14	7*	20*
	500	44K	13	35*	50*	49	29*	84*
		100K	9	29*	36*	38	23*	67*
		200K	9	29*	36*	38	23*	67*
	1000	44K	26	33*	100*	97	58*	168*
		100K	18	25*	72*	76	45*	134*
		200K	18	25*	72*	76	45*	134*

Note: These estimates are based on the assumptions that the input is 80-character records and that there is no increase for the macro processor.

Table 86 contains suggested work space requirements for each of the four or five data sets that are required for each display unit using GJP or SGJP. The notes included in the table describe how many records each data set can contain, using the suggested work space requirements. If any of these data sets must contain more records, increase the track requirements accordingly.

Table 87. Work Space for GJP or SGJP

Data Set	Number of Tracks Required				
	IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage
SYS1.DIAnnn (1)					
primary	1	4	4	5	3
secondary	1	4	4	5	3
SYS1.JCLnnn (2)					
primary	1	4	4	5	3
secondary	1	4	4	5	3
SYS1.EXTnnn (3)					
primary	1	4	4	5	3
secondary	1	4	4	5	3
SYS1.EXTnnnA (4)					
primary	1	4	4	5	3
secondary	1	4	4	5	3
SYS1.DISnnn (5)					
primary	10	40	40	50	30
secondary	2	8	8	10	6

Where: nnn = the address of the display unit to be used

Notes:

1. The diary data set contains a history of all operations performed during a session. Each record contains 120 bytes; each operation frame can result in 1 to 4 records. The suggested primary track requirement can contain up to 95 diary records.
2. The JCL data set contains generated JCL records for a single job. Each record contains 80 bytes; each operation frame associated with job definition can result in 1 to 4 records. The suggested primary track requirement can contain up to 125 JCL records. The JCL data set can also contain system message block (SMB) records, which are placed in the data set after a foreground job is completed. Each record contains 176 bytes; each generated JCL record (other than system input data) will result in an average of 3 to 4 SMB records. The suggested primary track halve this requirement) requirement can contain up to 75 SMB records.
3. The extract data set contains the information entered on an operation frame for the current job. Each record contains 372 bytes; each operation frame results in 1 record. The suggested primary track requirement can contain up to 40 records.
4. The alternate extract data set has the same format as the extract data set.
5. The display data set contains Sysout records for a data set from a user's job. Each record contains 3300 bytes and holds 25 Sysout records. The suggested primary track requirement can contain up to 1250 Sysout records (GJP only).

Appendix A—Contents

Appendix A: Reentrant Load Modules, Type 3 and 4 SVC Routines and Error Recovery Procedures

This appendix lists the modules and SVC routines that may be resident in the fixed area of storage. The name and size of each module and routine is given, along with the library in which it is located. This list is divided into five sections:

- Those modules that are always loaded into the link pack area with MVT.
- Those reenterable load modules from the link library that may be resident in the link pack area with MVT.
- Those access method modules that may be resident with any configuration.
- Those type 3 and 4 SVC routine modules that may be resident with any configuration.
- Error recovery procedures that may be resident with any configuration.

Modules Always Loaded Into the Link Pack Area With MVT

The following list contains those job scheduler modules from the link library that are always loaded into the link pack area when an MVT system is initialized:

Module Name	Function	Size
IEFSD102	MVT Initiator, Replace Region Interface	136
IEFSD105	MVT Initiator, Wait for Work in the Input Queue	96
IEFSD263	MVT Initiator, ATTACH	538
IEFQINTZ	MVT Queue Management, Get Region for Queue	88
IEFDSOLD	Wait for a STOP or MODIFY DSO command	88
IEEPRTN	Free Region for START and MOUNT	44
IEEPALTR	Queue Alter, Get Region	100
IEEPPRES	Get Region for PRESRES Routine	104
IEEPRWI2	Get Region for Write-log	120
IEFVME	ASB GET/FREE Interpretation Region	288
IEETRWI2	GET Region for START and MOUNT	120
*IEEVGPSD	Display User/Send-Get Region	198

*Included if TSO is selected during system generation.

The following list contains the BSAM and QSAM modules from the SVC library that are always loaded into the MVT link pack area.

Module Name	Function	Size
IGG019AA	Simple GET Locate Fixed	152
IGG019AB	Simple GET Locate variable	128
IGG019AI	Simple PUT Locate fixed	128
IGG019AK	Simple PUT Move Fixed	216
IGG019AJ	Simple PUT Locate Variable	256
IGG019AQ	GET Error Routine	336
IGG019AR	PUT Error Routine	192
IGG019BA	READ/WRITE All Devices	392
IGG019BB	CHECK All Devices	296
IGG019CC	Schedules I/O for tape, DA-IN, CDRDR, PTRDR	472
IGG019CD	SK F STD - Fit on Track ?	528
IGG019CE	PRNTR - PCH, End of block	136
IGG019CF	PRNTR - PCH, ASA Char to Command Code	256
IGG019CH	CK for multiple extent in DEB (Appendage)	112
IGG019CI	Length CK for F Blocked Records (Appendage)	272
IGG019CJ	Read Length CK for V Tape Records (Appendage)	248
IGG019CL	PRNTR Test Channel 9,12 (Appendage)	64

Note: Some of these modules are part of the standard RAM list. The space required for these modules should be subtracted from the area required for the standard list.

MODULES THAT MAY BE RESIDENT IN THE LINK PACK AREA IN MVT

The following list contains reenterable load modules from the link library (except where noted) that may be loaded into the link pack area with MVT.

Initiator/Terminator Modules

IEFSD061	Step Termination	41,108
IEFSD104	Alias for IEFSD061	
IEFSD065	Alias for IEFSD061	
IEFW42SD	Alias for IEFSD061	
IEFV4221	Alias for IEFSD061	
IEFSD062	Step Start	7,840
IEFSD62A	Alias for IEFSD062	
DEVNAMET	Device Name Table	Variable (see page 118)
DEVMASKT	Device Mask Table	Variable (see page 118)

Reader/Interpreter Modules

IEFVHA	Reader Control Routine	35064
IEFQDELE	Queue Manager Delete Routine	535
IEFQMDQ2	Queue Manager Dequeue Routine	1098
IEFQMSSS	Queue Manager	4472
IEVINA	Reader In-Stream Procedure Processor	7186

ASB Reader Modules

IEFVMA	Initialization	1496
IEFVMB	Input Stream processor	6550
IEFVMC	Command Processor	496
IEFVMD	Termination	2016
IEFVMF	Interpreter Control	9160

Restart Reader Modules

IEFRSTRT	Issues SVC 52	8
IEFVRR1	Dequeue by Jobname Interface	2008

IEFVRR2	Table Merge Routine	2976
IEFVRR3	Reinterpretation Delete/Enqueue Routine	2696
IEFVRRC	Reinterpretation Control Routine	1126
IEFRCLN1	Linkage Reinterpretation	100
IEFRCLN2	Linkage Reinterpretation	100

Loader Modules

IEWLDRGO	Loader Control/Interface	440
IEWLOADR	Loader Processing	13,350

Output Writer Modules

IEFSD070	Data Set Writer Attach	416
IEFSD078	Writer Control	400
IEFSD080	Writer Control	6320
IEFSD085	SYSOUT Data Set Control	4296
IEFSD086	SYSOUT Message Handler	2720
IEFSD087	SYSOUT Data Set Writer	3072
IEFSD094		3488
IEFQMNQ2		1096
IEFSDXXX	Variable Spanned Records	1232
IEFSDXYZ	Command Changing of Writer Output	552
IEFSDPCA		1992

TESTRAN Modules

IEGOPEN2	TEST OPEN Phase 2	648
IEGOPEN3	TEST OPEN Phase 3	1064
IEGTTROT	TESTRAN Router	1616
IEGTTRNA	DUMP DATA, CHANGES Routine	864
IEGTTRNB	DUMP COMMENT Routine	248
IEGTTRNC	DUMP PANEL Routine	344
IEGTTRND	GO TO/IN/OUT Routine	384
IEGTTRNE	TEST ON Routine	552
IEGTTRNF	DUMP TABLE Routine	632
IEGTTRNG	TEST WHEN Routine	1536
IEGTTRNH	TEST CLOSE Routine	736
IEGTTRNJ	GO BACK Routine	1416
IEGTTRNK	DUMP MAP Routine	1112
IEGTTRNL	TRACE FLOW/CALL/REFER Routine	968
IEGTTRNM	TRACE STOP Routine	776
IEGTTRNN	SET COUNTER Routine	488
IEGTTRNO	Overlay Routine	1472
IEGTTRNP	SET FLAG Routine	368
IEGTTRNR	SET VARIABLE Routine	456
IEGTTRNX	Overlay 2 Routine	272
IEGTTRNZ	Trace Interrupt Routine	992

Graphics Cancel Key Option Modules

IFFCAN01	Cancel Key Option - Routine 1	1904
IFFCAN02	Cancel Key Option - Routine 2	1280
IFFCAN03	Cancel Key Option - Routine 3	40

SMF Module

IFASMFDP	Dump Program For SMF Data Set on Direct Access	710

Graphics Modules (Problem Oriented Routines)

IFFANA	Express Attention Handling	376
ANLZ	Alias for IFFANA	
IFFPAAST	Store Graphic Orders	256

GSTOR	Alias for IFFPAAST	
IFFPBAPR	Graphic Character Print	1216
GCPRNT	Alias for IFFPBAPR	
IFFPCAAR	Circular Arc	2512
GARC	Alias for IFFPCAAR	
IFFPDAPL	Scale and Plot	3504
GSPLOT	Alias for IFFPDAPL	
IFFPEAGR	Cartesian Grid	1432
GCGRID	Alias for IFFPEAGR	
IFFPFAVA	Circular Arc With Vectors	3024
GVARC	Alias for IFFPFAVA	
IFFPGAVP	Scale and Plot with Vectors	2944
GSVPLT	Alias for IFFPGAVP	
IFFPHALA	Grid Labeling	1848
GLABEL	Alias for IFFPHALA	
IFFPIAPG	Polar Grid	4224
GPGRID	Alias for IFFPIAPG	
IFFPJAPV	Polar Grid with Vectors	3704
GPGVRD	Alias for IFFPJAPV	
IFFPKADG	Graphic Data Plotting	4264
GSDPLT	Alias for IFFPKADG	
IFFPLARE	Light Pen Tracking	1048
PENTRK	Alias for IFFPLARE	
IFFPPASG	Off-screen/off-grid option	816
GOFFSAG	Alias for IEFPPASG	

Graphics Modules (FORTRAN IV, COBOL F, and PL/1 F Graphic Subroutine Package)

Note: Control section names appear in parentheses after the function; alias names are so indicated.

IFFAAA02	Terminate Graphic Subroutine Package (TMGSP)	208
IFFAAA03	Initialize Graphic Device (INDEV)	1552
IFFAAA04	Terminate Graphic Device (TMDEV)	456
IFFAAA05	Initialize Graphic Data Set (INGDS) Note: For each graphic data set initialized by this call, add 2•(graphic-data-output-area-length+100). Also, for each graphic data set that has one or more keyed or correlated elements or sequences, add 550•(no. of elements / 40). If this division results in a remainder, add an additional 550 bytes.	1080
IFFAAA06	Terminate Graphic Data Set (TMGDS)	488
IFFACA00	Create Attention Level (CRATL)	800
IFFACA01	End Attention Levels (ENATL)	784
IFFACA02	Enable Attention Sources (ENATN)	920
IFFACA03	Disable Attention Sources (DSATN)	696
IFFACA04	Modify Position of Attention Level (MPATL)	1176
IFFACA05	Modify Light Pen or End-Order-Sequence Attention Information (MLPEO)	560
IFFACA06	Set Light Pen Attentions (SLPAT)	304
IFFACA07	Modify Status of Programmed Function Indicator Lights (MLITS)	872
IFFACA08	Request Attention Information (RQATN)	3080
IFFACA13	Sound Audible Alarm (SALRM)	176
IFFACA50	Specify Link-Load Status (SPEC)	264
IFFADA01	Read Data (GSPRD)	1852
IFFADA02	Remove Cursor (RCURS)	832
IFFADA03	Insert Cursor (ICURS)	1084
IFFAEA01	Set Data Mode (SDATM)	720

IFFAEA02	Set Graphic Mode (SGRAM)	184
IFFAEA03	Set Data Limits (SDATL)	224
IFFAEA04	Set Graphic Data Set Limits (SGDSL)	1008
IFFAEA06	Set Scissoring Option (SSCIS)	176
IFFAEA07	Set Character Mode (SCHAM)	160
IFFAFA01	Plot Lines/Plot Points (PLINE/PPNT)	2072
IFFAFA16	Alias for IFFAF01	
IFFAFA02	Plot Line Segment(s) (PSGMT)	2728
IFFAFA03	Plot Text (PTEXT)	2504
IFFAFA04	Set Beam at Absolute Position/Move Beam to Position (STPOS/MVPOS)	1576
IFFAFA17	Alias for IFFAFA04	
IFFAFA05	Begin a Sequence of Elements/Begin a Buffer Subroutine (BGSEQ/BGSUB)	704
IFFAFA18	Alias for IFFAFA05	
IFFAFA06	End a Sequence of Elements (ENSEQ)	336
IFFAFA07	End a Buffer Subroutine (ENSUB)	656
IFFAFA08	Link to a Buffer Subroutine (LKSUB)	1056
IFFAFA09	Place in Include Status/Place in Omit Status (INCL/OMIT)	848
IFFAFA10	Alias for IFFAFA09	
IFFAFA11	Execute (EXEC)	848
IFFAFA12	Reset a Graphic Data Set (RESET)	1672
IFFAFA13	Indicate Beam Position (IDPOS)	560
IFFAFA14	Force a Set Mode Order (FSMOD)	112
IFFAFA15	Set End-Order-Sequence Order (STEOS)	1176
IFFAFA19	Order Graphic Data Sets (ORGDS)	720
IFFAGA01	Locate Position of Light Pen (LOCPN)	904
IFFAGA02	Begin Light Pen Tracking (BGTRK)	968
IFFAGA03	Read Current Location of Tracking Symbol (RDTRK)	400
IFFAGA04	End Light Pen Tracking (ENTRK)	200
IFFAGA05	Define Strokes (DFSTR)	592
IFFAGA06	Plot Strokes (PLSTR)	2904
IFFAGA07	Generate Graphic Orders (ORGEN)	2712
IFFAGA08	Convert Coordinates (CNVRT)	920
IFFAHA01	Flow Control Management	1520
IFFAHA02	Buffer Management	1224
IFFAHA03	Key Table Management	528
IFFAHA04	Data Generator	1424
IFFAHA05	Data Store	2464
IFFAHA06	Scaling	608
IFFAHA15	Alias for IFFAHA06	
IFFAHA07	Scissoring	1672
IFFAHA09	Cancel Key	240
IFFAHA11	Director, Part 2	280
IFFAHA13	Update1/Update2	1120
IFFAHA14	Alias for IFFAHA13	
IFFAJA01	Test Return Code (ITRC)	320
IFFAJA02	Test Integer Beam Position/Test Real Beam Position (ITBP/ITRP)	552
IFFAJA03	Alias for IFFAJA02	
IFFAJA04	Test Status (ITST)	328

1130/360 Data Transmission Modules

IKDGTCLT	Return Status of Communication Line to User	376
IKDGTEND	Logically Disconnect Communication Support	848
IKDGTIRB	Determine BTAM Procedure to be Requested	2432
IKDGTNIT	Establish Initial Communication Contact	912
IKDRDWRT	Request BTAM Procedure	1128

PL/I F Library Modules

IHECLSA	Close files (this module is required only for the execution of programs compiled and link edited under PL/I Versions 1, 2, 3).	1096
IHECLTA	Close files	1368
IHECLTB	Alias for IHECLTA	
IHECTTA	Multitasking close files	1800
IHECTTB	Alias for IHECTTA	
IHEERDA	Data Processing error messages	720
IHEEREA	I/O error messages	1704
IHEERIA	Error messages	896
IHEERNA	Error messages (this module is only required for the execution of programs compiled and link edited under PL/I Versions 1 and 2).	4504
IHEEROA	Error messages	856
IHEERPA	Error messages	1272
IHEERSA	SNAP	936
IHEERSB	Alias for IHEERSA	
IHEERTA	Multitasking error messages	712
IHEESMA	To print SNAP and system action messages	1776
IHEESMB	Alias for IHEESMA	
IHEESSA	To print SNAP and system action messages	2152
IHEESSB	Alias for IHEESSA	
IHEITBA	BSAM interface	3784
IHEITCA	BSAM interface	2640
IHEITDA	QISAM interface	2280
IHEITEA	BISAM interface	1760
IHEITFA	BDAM interface	1856
IHEITGA	QSAM interface	1168
IHEITHA	BISAM interface	2616
IHEITJA	BDAM interface	2656
IHEITKA	QSAM Interface Spanned Input	736
IHEITLA	QSAM Interface Spanned Output	536
IHEOPNA	Open files	984
IHEOPOA	Open files	1992
IHEOPPA	Open files	2008
IHEOPQA	Open files	1424
IHEOPZA	Open files	992
IHETEXA	Task ABEND message	1464
IHETOMA	Write to operator	512
IHETOMB	Alias for IHETOMA	
IHETOMC	Alias for IHETOMA	
IHETOMD	Alias for IHETOMA	
IHETOME	Alias for IHETOMA	
IHEZZAA	ABDUMP	1424
IHEZZBA	ABDUMP	1872
IHEZZCA	ABDUMP	3256
IHEZZFA	ABDUMP	1760

TCAM Modules	Function	Size
IEDQCF	DATOPFLD or OPTFIELD command	2270
IEDQCG	RLNSTATN command	500
IEDQCH	STSTATUS command	760
IEDQCI	LNSTATUS command	1060
IEDQCJ	QSTATUS command	670
IEDQCK	INTRCEPT command	470
IEDQCL	ACTVATED command	1100
IEDQCM	DPRIOPCL or DSECOPCL command	515
IEDQCN	CPRIOPCL	500
IEDQCO	ACCEPTNG, NOACCEPT, NOENTRNG, NOTRAFIC, or ENTERING command	500
IEDQCP	GOTRACE or NOTRACE command	850
IEDQCQ	SUSPXMIT command	1150
IEDQCR	RESMXMIT	340
IEDQCS	ACCEPTNG or ENTERING command	250
IEDQCT	NOENTRNG or NOTRAFIC command	250

IEDQCU	YESXMIT command	1700
IEDQCV	SYSINTVL, SYSCLOSE, or NOXMIT command	1230
IEDQCW	AUTOSTOP or AUTOSTART command	780
IEDQCX	ERRECORD command	800
IEDQCZ	INTERVAL or POLLDLAY command	910
IEDQC0	SYSCLOSE command	800
IEDQC1	POLLDLAY command	1000
IEDQC2	OLT command	430
IEDQC3	STATDISP command	650
IEDQC4	STATMDFY command	920
IEDQEC	PUT Scheduler	1328
IEDQEW	GET Scheduler	1600
IEDQEZ	GET Scheduler	24
IEDQNG	Checkpoint (CHECKPT macro)	230
IEDQNH	Checkpoint (TCHNG macro)	220
IEDQNJ	Checkpoint (Operator Control)	250
IEDQNK	Checkpoint (Environment)	850
IEDQNM	Checkpoint (CKREQ macro)	330
IEDQNO	Checkpoint	220
IEDQNP	Checkpoint	610
IEDQNQ	Checkpoint	700
IEDQNR	Checkpoint	250
IEDQNS	Checkpoint	150
IEDQNX	Operator Awareness Message Router	580

TSO-TCAM Modules

IEDAYO	TSOUTPUT	2332
IEDAYI	TSINPUT	1780
IEDAYL	LOGON	1020
IEDAYH	HANGUP	660
IEDAYA	ATTENTION	560

Fortran Syntax Checker Modules

IPDSNEXC	Checking and Error Message Setup	9984
IPDTEE	Description of FORTRAN E	2304
IPDAGH	Description of FORTRAN G/H	5632

PL/I SYNTAX CHECKER MODULES

IKM001	Syntax Checker Module of 20K Version	17,408
IKM21	Transient load Modules for 20K Version	4096
IKM22	Transient Load Modules for 20K Version	
IKM23	Transient Load Modules for 20K Version	
IKM002	Syntax Checker Module of 27K Version	28,672
IKM003	Syntax Checker Module of 16K Version	17,408

Miscellaneous Modules

IEWSZOVR	Asynchronous Overlay Supervisor	992
IECBBFB1	Build Buffers	96
IECQBFG1	Get Pool	224
IGG019P8	End of Extent Appendage Routine	296
IGG019P9	Abnormal End of Extent Appendage Routine	88
IEAXDS00	Decimal Stimulation Routine for Model 91	3236
IEEUNIT1	Unit Status Syntax Check	1990
IEEUNIT2	Unit Status UCB Scan	920
IEEUNIT3	Unit Status Data Cell Scan and Exit	1250
IEEUNIT4	Unit Status UCB Search and Writer	1300

Access Method Modules

The following list contains the access method modules that may be made resident in any configuration when the resident reenterable load module option is selected. All of these modules are on the SVC library. Those module names followed by -SL are the modules loaded when the IBM-supplied standard list IEAIGG00 is used.

SEQUENTIAL ACCESS METHOD MODULES

Modules Common to BSAM and QSAM

Module	Function	Size
IGG019AX	User Totaling Save Routine	120
IGG019CA-SL	Stacker Select Card Reader	144
IGG019CB-SL	Space or Skip - QSAM, BSAM	168
IGG019CC-SL	Schedules I/O for Tape, DA-IN,CDRDR,PTRDR	472
IGG019CD-SL	SK F Std - Fit on TRK?	568
IGG019CE-SL	PRNTR-PCH, End of Block (SAM)	144
IGG019CF-SL	PRNTR-PCH, ASA Char to Command Code	280
IGG019CG	Update QSAM/BSAM SII Appendage	256
IGG019CH-SL	CK for multiple extent in DEB (Appendage)	128
IGG019CI-SL	Length CK for F Blocked Records (Appendage)	272
IGG019CJ-SL	Read Length CK for V Tape Records (Appendage)	264
IGG019CK-SL	Checks Delimiter Characters (Appendage)	96
IGG019CL-SL	PRNTR Test Chan 9, 12 (Appendage)	72
IGG019CM	Translate table TELE TYPE	848
IGG019CN	Translate table ASCII	568
IGG019CO	Translate table BURROUGHS	568
IGG019CP	Translate table FRIDEN	848
IGG019CQ	Translate table IBM PTTC/8	848
IGG019CR	Translate table NCR	848
IGG019CS	WLR Appendage P. T. Rdr.	32
IGG019CT	BSAM End-of-Block Routine	56
IGG019AW	Update QSAM EOE Appendage	224
IGG019CU	C.E, AB.E. PCI (Input/OUTPUT) Appendage	1352
IGG019CV	EOB DA Output, PCI	752
IGG019CW	EOB Tape In/Out DA Input PCI	536
IGG019CX	EOB Printer/Punch PCI	208
IGG019CY	EOB ASA Char. Printer/PUNCH PCI	328
IGG019CZ	APPND End of Extent PCI	224
IGG019C1	TRK OV ASYNCH ERR. RTN	392
IGG019C2	EOB TRK OV.	968
IGG019C3	TRK OV ABNE APPENDAGE	152
IGG019BM	Update BSAM EOE Appendage	128
IGG019UA	Universal Character Set Image AN	272
IGG019UB	Universal Character Set Image HN	272
IGG019UC	Universal Character Set Image PCAN	272
IGG019UD	Universal Character Set Image PCHN	272
IGG019UE	Universal Character Set Image PN	272
IGG019UF	Universal Character Set Image QN	272
IGG019UG	Universal Character Set Image RN	272
IGG019UH	Universal Character Set Image SN	272
IGG019UI	Universal Character Set Image TN	272
IGG019UJ	Universal Character Set Image XN	272
IGG019UK	Universal Character Set Image YN	272
IGG019UL	Universal Character Set Image QNC	272
IGG019TC	Schedules I/O for Tape - User Totaling Facility	148
IGG019TD	SK F Std - Fit on Tape? - User Totaling Facility	620
IGG019TV	EOB DA Output, PCI - User Totaling Facility	804
IGG019TW	EOB Tape Input/Output PCI - User Totaling Facility	276
IGG019T2	EOB TRK OV - User Totaling Facility	1020

BSAM Modules

Module	Function	Size
IGG019BA-SL	READ/WRITE all devices	392
IGG019BB-SL	CHECK all devices	296
IGG019BC-SL	NOTE/POINT Disk	256
IGG019BD-SL	NOTE/POINT Tape	312
IGG019BE-SL	Control Tape	416
IGG019BF	Read Translate	552
IGG019BG	Paper Tape Check	264
IGG019BH	Update BSAM R/W	312
IGG019BI	Update BSAM Check	120
IGG019BK	NOTE/POINT Rt. D.A. PCI/T.O./UPDATE	328
IGG019BL	NOTE/POINT Rt. Tape PCI	272

QSAM Modules (Simple Buffering)

Module	Function	Size
IGG019AA-SL	Simple GET Locate Fixed	152
IGG019AB-SL	Simple GET Locate Variable	128
IGG019AC-SL	Simple GET Move Fixed	280
IGG019AD-SL	Simple GET Move Variable	216
IGG019AE	Update QSAM GET	392
IGG019AF	Update QSAM Synch.	712
IGG019AG-SL	GET Move Fixed with CNTRL	152
IGG019AH	GET Move Variable with CNTRL	152
IGG019AI-SL	Simple PUT Locate Fixed	144
IGG019AJ-SL	Simple PUT Locate Variable	280
IGG019AK-SL	Simple PUT Move Fixed	232
IGG019AL-SL	Simple PUT Move Variable	368
IGG019AM-SL	Simple Backward Locate Fixed	144
IGG019AN-SL	Simple Backward Move Fixed	232
IGG019AQ-SL	GET Error Routine	336
IGG019AR-SL	PUT Error Routine	192
IGG019AT	GET Translate	792
IGG019AV-SL	Simple PUT Locate Dummy	88
IGG019BN	Update/Locate Var Length Rcd Exten	1987
IGG019BO	Get/Loc Var Length Rcd Exten	622
IGG019BP	Put/Loc Var Length Rcd Exten	968
IGG019BQ	Update GET Var Spanned	925
IGG019FB	Simple GET Locate Variable Spanned	208
IGG019FD	Simple GET Move Variable Spanned	432
IGG019FF	Simple GET Data Variable Spanned	440
IGG019FG	Simple PUT Data Variable Spanned	584
IGG019FJ	Simple PUT Locate Variable Spanned	256
IGG019FL	Simple PUT Move Variable Spanned	568

QSAM Modules (Exchange Buffering)

Module	Function	Size
IGG019EA	EXC. LOC. GET BLKD	96
IGG019EB	EXC. LOC. GET UNBLKD	104
IGG019EC	EXC. SUBS GET UNBLKD	80
IGG019ED	EXC. SUBS GET BLKD	136
IGG019EE	EXC. PUT, PUTX UNBLKD	352
IGG019EF	EXC. PUT, PUTX BLKD	312

BSAM/QSAM Optical Reader Modules (1285/1287/1288)

IGG019VA	GET Locate Mode, Fixed Records - QSAM	312
IGG019VB	GET Locate Mode, Variable Records - QSAM	408
IGG019VC	GET Move Mode, Fixed Records - QSAM	376
IGG019VD	GET Move Mode, Variable Records - QSAM	456
IGG019VE	SYNCH Module - QSAM	880
IGG019VF	READ Module - BSAM	136
IGG019VG	CHECK Module - BSAM	818
IGG019VH	CNTRL Module - BSAM/QSAM	864
IGG019VI	RDLNE Module - QSAM	232
IGG019VJ	DSPLY Module - BSAM	472
IGG019VK	RESCN Module - BSAM	592
IGG0197A	OPEN Stage II (OCR) - BSAM/QSAM	1024
IGG0197B	OPEN Stage III (OCR) - BSAM/QSAM	1024

BSAM 1419/1275 Modules

IGG019V1	READ	174
IGG019V2	EOB	336
IGG019V3	CHECK	416
IGG019V4	CONTROL	440
IGG019V5	Appendages	3504
IGG0197C	OPEN Stage II	1024
IGG0197D	OPEN Stage III	1024
IGG00201D	CLOSE Module	1024

BSAM/QSAM TSO Interface Modules

IGG01QTX	CHECK	70
IGG019TY	NOTE/POINT	6
IGG019TZ	CONTROL	12
IGG019T3	GET	392
IGG019T4	PUT	212
IGG019T5	READ/WRITE	492
IGG019T6	GET/PUT	520
IGG019T7	READ	312
IGG019T8	WRITE	166
IGG0196S	TSO Open Executor	1024

BASIC DIRECT ACCESS METHOD MODULES

Note: The BDAM modules followed by an asterisk must all be loaded into the link pack area if any one of them is to be made resident.

Module	Function	Size
IGG019DA	WRITE FORMAT 'F', LOAD MODE	624
IGG019DB	WRITE FORMAT V, U, LOAD MODE	776
IGG019DC	CHECK ROUTINE, LOAD MODE	184
IGG019DD	WRITE FORMAT F, LOAD MODE, TRK. OV.	1064
IGG019KA*	FOUNDATION MODULE	1544
IGG019KC*	RELATIVE TRACK	272
IGG019KE*	RELATIVE BLOCK	296
IGG019KF*	CONVERT RELATIVE BLOCK	696
IGG019KG*	BLOCK FEEDBACK	184
IGG019KH*	CONVERT TO RELATIVE BLOCK	240
IGG019KI*	READ/WRITE by BLOCK KEY	152
IGG019KK*	READ/WRITE by BLOCK ID	176
IGG019KM*	WRITE ADD FORMAT U or V	592
IGG019KO*	WRITE ADD FORMAT F	224
IGG019KQ*	WRITE VERIFY	136
IGG019KS	START I/O APPENDAGE	64
IGG019KU	CHANNEL END APPENDAGE	136
IGG019KW*	KEY EXTENDED SEARCH	192
IGG019KY*	SELF FORMAT EXTENDED SEARCH	192
IGG019LA*	PRE-FORMAT EXTENDED SEARCH	192
IGG019LC	END OF EXTENT APPENDAGE	168
IGG019LE	DYNAMIC BUFFERING	504
IGG019LG	READ EXCLUSIVE	1032
IGG019LI	CHECK MODULE	240
IGG019KR	READ/WRITE for Spanned Records	648
IGG019KN	WRITE ADD for Spanned Records	1376
IGG019KJ	Foundation Module for Spanned Records	3368
IGG019KL	Dynamic Buffering for Spanned Records	536
IGG019BR	CREATE BDAM VAR SPANNED (WRITE)	1918
IGG019BS	CREATE BDAM VAR SPANNED (CHECK)	390
IGG019BT	CREATE BDAM VAR SPANNED CHAN. END APPENDAGE	174
IGG019BU	READ BDAM VAR SPANNED	300
IGG019BV	READ BDAM VAR SPANNED	354
IGG0199L	CREATE BDAM VAR SPANNED	1024
IGG019B0	BUILD BUFFER CNTRL BLOCK & BUFFER POOL	160

INDEXED SEQUENTIAL ACCESS METHOD MODULES

BISAM Modules

Module	Function	Size
IGG019G0	COMB, WRITE KN APPENDAGE FS	2288
IGG019G1	COMB, WRITE KN APPENDAGE FSWC	2408
IGG019G2	COMB, WRITE KN APPENDAGE FU	2200
IGG019G3	COMB, WRITE KN APPENDAGE FUWC	2432
IGG019G4	COMB, WRITE KN APPENDAGE BS	2848
IGG019G5	COMB, WRITE KN APPENDAGE BSWC	2936
IGG019G6	COMB, WRITE KN APPENDAGE BU	3304
IGG019G7	COMB, WRITE KN APPENDAGE BUWC	3752
IGG019G8	COMB, READ, WRITE K APPENDAGE (NO WC)	1304
IGG019G9	COMB, READ, WRITE K APPENDAGE (WC)	1568
IGG019GL	WKN, NO, WC	2424
IGG019GM	WKN, WC	2648
IGG019GN	COMB, NO, WC	3728
IGG019GO	COMB, WC	4104
IGG019GV	WRITE KN ASYNCHRONOUS (WC)	2072
IGG019GW	COMBINED ASYNCHRONOUS (WC)	3104
IGG019GX	READ, WRITE K ASYNCHRONOUS	992
IGG019GY	WRITE KN ASYNCHRONOUS (NO WC)	2064
IGG019GZ	COMBINED ASYNCHRONOUS (NO WC)	3112
IGG019H3	COMBINED PMT (VLR)	2180
IGG019H7	READ, WRITE K PMT (VLR)	1468
IGG019HP	CHANNEL PROGRAM WRITE KN (VLR)	1250
IGG019I9	READ, WRITE K APPENDAGE (VLR)	1686
IGG019IM	WRITE KN APPENDAGE (VLR)	2336
IGG019IN	WRITE KN APPENDAGE (VLR)	4068
IGG019IO	COMB, WRITE KN APPENDAGE (VLR)	3912
IGG019IX	READ, WRITE K ASYNCHRONOUS (VLR)	1100
IGG019IY	WRITE KN ASYNCHRONOUS (VLR)	3112
IGG019IZ	COMBINED ASYNCHRONOUS (VLR)	4278
IGG019J0	COMBINED PMT NLSD=0	1936
IGG019J3	COMBINED PMT NLSD≠0	2064
IGG019J6	READ, WRITE K PMT NLSD=0	1256
IGG019J7	READ, WRITE K PMT NLSD≠0	1464
IGG019JC	CHECK	112
IGG019JI	DYNAMIC BUFFER	732
IGG019JJ	CHANNEL PROGRAM NLSD=2+	216
IGG019JK	CHANNEL PROGRAM NLSD=1	96
IGG019JL	CHANNEL PROGRAM READ, WRITE K (NO WC)	392
IGG019JM	CHANNEL PROGRAM READ, WRITE K (WC)	512
IGG019JN	CHANNEL PROGRAM WRITE KN FS	952
IGG019JO	CHANNEL PROGRAM WRITE KN BS	872
IGG019JP	CHANNEL PROGRAM WRITE KN FSWC	1216
IGG019JQ	CHANNEL PROGRAM WRITE KN BSWC	1112
IGG019JR	CHANNEL PROGRAM WRITE KN FU	912
IGG019JS	CHANNEL PROGRAM WRITE KN BU	928
IGG019JT	CHANNEL PROGRAM WRITE KN FUWC	1176
IGG019JU	CHANNEL PROGRAM WRITE KN BUWC	1192
IGG019JV	READ, WRITE K NPMT	212
IGG019JW	WRITE KN NPMT	192
IGG019JX	WRITE KN PMT	648

QISAM Modules (Load Mode)

Module	Function	Size
IGG019GA	PUT (NO WC)	4408
IGG019GB	PUT (WC)	4496
IGG019GC	PUT APPENDAGE (NO WC)	1740
IGG019GD	PUT APPENDAGE (WC)	2124
IGG019GE	CHANNEL PROGRAMS (NO WC)	624
IGG019GF	CHANNEL PROGRAMS (WC)	736
IGG019IA	PUT (NO WC VLR)	4234
IGG019IB	PUT (WC VLR)	4340
IGG019IE	CHANNEL PROGRAMS (NO WC VLR)	568
IGG019IF	CHANNEL PROGRAMS (WC VLR)	664
IGG019I1	PUT W/O WRITE CHK-FULL TRACK INDEX WRITE	4096
IGG019I2	PUT W/O WRITE CHK-FULL TRACK INDEX WRITE	4096

QISAM Modules (Scan Mode)

IGG019HB	GET PUTX, RELSE, ESETL, SETL B	3888
IGG019HD	SETL K, SETL KC	1266
IGG019HF	SETL I	656
IGG019HG	GET APPENDAGE AND ASYNCHRONOUS	808
IGG019HH	PUTX APPENDAGE (NO WC)	376
IGG019HI	PUTX APPENDAGE (WC)	828
IGG019HJ	SETL I APPENDAGE	72
IGG019HK	SETL K, SETL KC APPENDAGE	600
IGG019HL	CHANNEL PROGRAMS	648
IGG019HN	GET, PUTX, RELSE, ESETL, SETL B (VLR)	3680

TELECOMMUNICATIONS MODULES

BTAM Modules

Module	Function	
IGG019MA	Read/Write Channel Program Generator	2632
IGG019MB	Channel End/Abnormal End Appendage	4552
IGG019MC	Program Controlled Interrupt Appendage	1104
IGG019MD	IBM 1050 Data Communications System on a non-switched network	248
IGG019ME	IBM 1050 Data Communications System on a non-switched network with Auto Poll	232
IGG019MF	IBM 1050 Data Communications System on a switched network	344
IGG019MI	IBM 1060 Data Communications System	216
IGG019MJ	IBM 1030 Data Collection System	248
IGG019MK	IBM 1030 Data Collection System with Auto Poll	248
IGG019ML	AT&T 83B3 Selective Calling Stations	168
IGG019MN	Western Union Plan 115A Outstations	160
IGG019MP	AT&T Model 33/35 Teletypwriter Exchange Terminal on a switched network (using eight bit Data Interchange Code)	200
IGG019MR	Online Test Control Module	2520
IGG019MS	Request/Release Buffer Routine	440
IGG019MT	IBM 2740 Communications Terminal	144
IGG019MU	IBM 2740 Communications Terminal on a switched network	200
IGG019MV	IBM 2740 Communications Terminal with transmit control and checking on a switched network	304
IGG019MW	IBM 2740 Communications Terminal with transmit control on a switched network	216
IGG019MX	IBM 2740 Communications Terminal with checking on a switched network	304
IGG019MY	IBM 2740 Communications Terminal with station control and checking	240
IGG019MZ	IBM 2740 Communications Terminal with station control	160
IGG019M0	IBM 2740 Communications Terminal with checking	248
IGG019M1	IBM 2740 Communications Terminal with station control, checking, and Auto Poll	240
IGG019M2	IBM 2740 Communications Terminal with station control and Auto Poll	160
IGG019M3	IBM 2260 Display Unit (attached as a remote terminal with a 2701 Data Adapter Unit)	328
IGG019M4	IBM 1060 Data Communications System with Auto Poll	224
IGG119M5	IBM BSC Terminal on a nonswitched point-to-point network	296
IGG419M6	IBM BSC Terminal on a switched network	432
IGG019PB	World Trade Telegraph Terminals	176
IGG019PC	IBM BSC Terminal on a nonswitched multipoint network	328
IGG019PD	WTTA Channel End Appendage	1008
IGG019PE	IBM 2741 Communications Terminal	128
IGG019PF	IBM 2741 Communications Terminal on a switched network	160
IGG019PK	2741 Break routine	78
IGG019PL	IBM 2740 Communications Terminal with checking and OIU (IBM 2760 Optical Image Unit)	296

IGG019PM	IBM 2760 Communications Terminal with checking and OIU (IBM 2760 Optical Image Unit) on a switched network	376
IGG019PN	IBM 1050 Non-switched Device I/O Module	224
IGG019PO	IBM 1050 Switched Device I/O Module	312
IGG019PP	IBM 2740X Checking	224
IGG019PQ	IBM 2740X Dial with Checking	272

QTAM Modules

Module	Function	Size
IGG019NJ	IBM 2740 Communications Terminal	104
IGG019NK	IBM 2740 Communications Terminal on a Switched network	176
IGG019NL	IBM 2740 Communications Terminal with transmit control and checking on a switched network	288
IGG019NM	IBM 2740 Communications Terminal with transmit control on a switched network	192
IGG019NN	IBM 2740 Communications Terminal with checking on a switched network	248
IGG019NO	IBM 2740 Communications Terminal with station control and checking	224
IGG019NP	IBM 2740 Communications Terminal with station control	144
IGG019NQ	IBM 2740 Communications Terminal with checking	192
IGG019NR	IBM 2260 Display Unit (remote)	280
IGG019NS	AT&T Model 33/35 Teletypewriter Exchange Terminal on a switched network (using 8-bit data Interchange Code)	192
IGG019NT	Western Union Plan 115A Outstations	144
IGG019NU	AT&T 83B3 Selective Calling Stations	152
IGG019NV	IBM 1030 Data Collection System	224
IGG019NW	IBM 1060 Data Communications System	192
IGG019NX	IBM 1050 Data Communications System on a switched network	312
IGG019NY	IBM 1050 Data Communications System on a non-switched network	200
IGG019NZ	Read/Write Channel Program Generator	1008
IGG019N1	IBM 1050 Data Communications System on a non-switched network with Auto Poll	216
IGG019N2	IBM 1060 Data Communications System with Auto Poll	200
IGG019N3	IBM 1030 Data Collection System with Auto Poll	224
IGG019N8	IBM 2740 Communications Terminal with station control, checking, and Auto Poll	224
IGG019N9	IBM 2740 Communications Terminal with station control and Auto Poll	144
IGG019QA	World Trade Telegraph Terminals	152
IGG019QB	WTTA Line End Appendage	1248

GRAPHICS ACCESS METHOD MODULES

Module	Function	Size
IGG019OA	Input/Output Control Routine	1616
IGG019OB	Channel End Appendage	376
IGG019OE	Attention Routing Routine	2296
IGG019OJ	Entry Interface Routine	200
IGG019OK	Attention Inquiry Routine	656

TELECOMMUNICATIONS ACCESS METHODS

TCAM Modules

Module	Function	Size
IGG019RA	Checkpoint Appendage	100
IGG019RB	Dispatcher without subtask trace	476
IGG019RC	Disk Message Queues Routine	1190
IGG019RD	Buffered Terminal Scheduler	1840
IGG019RG	GET/READ Routine	3054
IGG019RH	QTAM Compatable GET Routine	2160
IGG019RI	PUT/WRITE Routine	1012
IGG019RJ	QTAM Compatable PUT Routine	492
IGG019RL	CHECK Routine	340
IGG019RM	POINT Routine	346
IGG019RN	PCI Appendage	836
IGG019RO	Dispatcher with subtask trace	576
IGG019RP	Disk Reusability/Copy Routine	3512
IGG019RQ	Post Pending Routine	128
IGG019RR	Special Characters Table for	80
IGG019RS	Special Characters Table for 2260 remote	80
IGG019RT	Special Characters Table for 83B3, 115A	80
IGG019RU	Special Characters Table for TWX	80
IGG019RW	Special Characters Table for World Trade	80
IGG019R0	Line Appendage for all type lines	8100
IGG019R1	Dial Line Scheduler	540
IGG019R2	Disk Appendage	292
IGG019R3	Leased Line Scheduler	552
IGG019R4	Send Scheduler	1180
IGG019R5	Attention Handler for 2260 Local	256
IGG019R6	Start-up Message Routine	938
IGG019R7	EBCDIC Special Characters Table	80
IGG019R8	ASCI Special Characters Table	80
IGG019R9	6BIT Special Characters Table	80
IGG019Q0	I/O Interrupt Trace Routine	532
IGG019Q1	2260 Local Scheduler	652
IGG019Q2	Line Appendage for binary-synchronous devices	6850
IGG019Q3	Line Appendage for start/stop devices	4290
IGG019Q4	Line Appendage for 1050	2950

Type 3 and 4 SVC Routines

The following list contains those routines that may be resident when the resident type 3 and 4 SVC routine option is selected. All of these routines are on the SVC library. Those module names followed by -SL are the modules loaded when the IBM-supplied standard list IEARSV00 is used.

ABEND - SVC13 (PCP only)

IGC0001C	Normal termination processing	520
IGC0101C	ABEND processing	840
IGC0201C	ABEND processing	960
IGC0301C	ABEND processing	528
IGC0401C	ABEND processing	1024
IGC0501C	Normal termination processing	1024
IGC0601C	ABEND processing	936
IGC0A01C	ABEND processing	544
IGC0B01C	ABEND processing	728
IGC0C01C	ABEND processing	296
IGC0601C	ABEND processing	1024
IGC0701C	ABEND processing	256
IGC0501C	ABEND processing	512

ABEND - SVC13 (MFT only)

IGC0001C	Normal termination processing	1024
IGC0101C	ABEND processing	792
IGC0201C	ABEND processing	984
IGC0301C	ABEND processing	1024
IGC0401C	ABEND processing	560
IGC0501C	ABEND processing (without subtasking)	480
IGC0501C	ABEND processing (with subtasking)	1024
IGC0601C	ABEND processing	968
IGC0701C	ABEND processing	720
IGC0801C	ABEND processing	668
IGC0901C	ABEND processing	1024
IGC0A01C	ABEND processing	1024
IGC0B01C	ABEND processing (without MCS)	848
IGC0B01C	ABEND processing (with MCS)	960
IGC0C01C	ABEND processing (with subtasking)	600
IGC0D01C	ABEND processing (with subtasking)	704
IGC0E01C	ABEND processing (with subtasking)	1008

ABEND - SVC13 (MVT Only)

IGC0001C	ABEND Control Module	1024
IGC0101C	ABEND Processing	1024
IGC0201C	ABEND Processing	1024
IGC0301C	ABEND Processing	1024
IGC0401C	System Task Error Module	1024
IGC0A01C	ABEND Processing	1024

ABEND SVC13 (DAR - PCP, MFT, MVT)

IGC0801C	Writes core image dump (PCP,MFT)	1024
IGC0901C	Attempts to reinstate recursive ABENDs and failing permanently resident system tasks	1024
IGC0G01C	Attempts to reinstate failures in Rollout/Rollin and system error tasks (MVT)	1024
IGC0221C	Writes core image dump (MFT)	1024
IGC0321C	Attempts to reinstate recursive ABENDs and failing permanently resident system tasks (MFT)	1024

ABDUMP - SVC51 (PCP,MFT)

IGC0005A	ABDUMP Processing	960
IGC0105A	ABDUMP Processing	1024
IGC0205A	ABDUMP Processing	1024
IGC0305A	ABDUMP Processing	896
IGC0405A	ABDUMP Processing	680
IGC0505A	ABDUMP Processing	928
IGC0A05A	ABDUMP Processing	1024
IGC0B05A	ABDUMP Processing	632
IGC0C05A	ABDUMP Processing	1024
IGC0D05A	ABDUMP Processing	1024
IGC0E05A	ABDUMP Processing	1024
IGC0F05A	ABDUMP Processing	312

ABDUMP - SVC51 (MVT Only)

IGC0005A	ABDUMP Initialization	1024
IGC0105A	Dumps Control Blocks	1024
IGC0205A	Dumps Control Blocks	1024
IGC0305A	Dumps Main Storage Supervisor Elements	1024
IGC0405A	Dumps Control Blocks	1024
IGC0505A	Dumps Supervisor Provided Save Areas	1024
IGC0605A	Dumps Nucleus	1024
IGC0705A	Dumps Load Modules	1024
IGC0805A	Dumps Storage in Subpools 0-127	1024

ASCII - SVC67 (PCP, MFT, MVT)

IGC0010C	ASCII-EBCDIC/ASCII Translate	636

MGCR - SVC34 (MFT and MVT Only)

IGC0003D	Base Module	410
IGC1203D	Reply Processor	944
IGC0303D	Chain Manipulator	768
IGC0403D	Control Phase	972
IGC0503D	Error Phase	1024
IGC0603D	SET Command Processor	1024
IGC0703D	MODIFY/STOP Command Processor	992
IGC0803D	Command Processor	460
IGC0903D	Set Time of Day Processor	488
IGC1103D	VARY/UNLOAD/WRITE LOG Command Processor	1024
IGC1301D	TCAM Command Scheduler	352
IGC1403D	HALT END OF DAY Processor	112
IGC1503D	Command Scheduling	544
IGC3503D	Display Command Router Routine (MFT and MVT)	1024
IGC0006H	Statistics update -SVC68	1024
IGC4203D	Vary Unit Field Scan (MCS)	672
IGC4303D	VARY MSTCONS (MCS)	357
IGC4403D	Vary Keyword Scan (MCS)	917
IGC4503D	Periodic STOP Processor	752
IGC3703D	MVT CANCEL Processor	1024
IGG2103D	Error Message Writer	782
IGC4603D	VARY ONLINE/OFFLINE of Console (MCS)	820
IGC4703D	Process VARY HARDCPY Commands (MCS)	542
IGC4803D	Message for Status of Varied Console (MCS)	928
IGC4903D	Process VARY CONSOLE Command (MCS)	554
IGC1203D	Reply Processor Routine (MCS)	952
IGC1B03D	Reply Message Routine (MCS)	355
IGC3803D	Start Command Processing (MVT only)	376
IGC4103D	Hardcopy Message Module	736

IGC5503D	MCS/TSO Periodic Stop Command	440
IGC5803D	Display User/Send Router Routine	66
IGC1603D	Log/Writelog Processor	820
IGC2303D	SMF Processor	918
IGC3203D	VARY Router	378
IGC5403D	Command Translator	635
IGC5703D	VARY Hardcopy Processor	550
IGC5103D	STAE Exit Routine - First Load	739
IGC5203D	STAE Exit Routine - Second Load	358
IGC5303D	STAE Exit Routine - Message Module	604
IGC6503D	NS SET Command Handler	886
IGC5503D	MCS/TSO Periodic Stop Command Processor	440
IGC5803D	Display User/Send Router Module	66

Operator Communications - SVC72 (MFT and MVT Only)

IGC0007B	Router Module	328
IGC1I07B	Open Card Reader as Console	792
IGC2I07B	Open Printer as Console	832
IGC0I07B	Open 1052 Console	832
IGC1107B	Input From Card Reader Console	664
IGC2107B	Output to Printer Console	808
IGC0107B	Input/Output to 1052 Console	1024
IGCXL07B	Console Switch Handler	688
IGC3I07B	OPEN/CLOSE Routine (MCS)	985
IGCXL07B	Console Switch Routine (MCS)	300
IGCXM07B	Console Switch Routine (MCS)	880
IGCXN07B	Console Switch Routine (MCS)	734
IGCXV07B	Console Switch Routine (MCS)	728
IGC0007B	Link to Communications Task Routines (MCS)	266
IGC2107B	Unit Record Output Processor - BSAM (MCS)	409
IGC1107B	Unit Record Input Processor - BSAM (MCS)	265
IGC0107B	1052 Processor Module (MCS)	186
IGC0907B	Message Buffer Writer (MCS)	132
IGC5107B	Router Module	1016
IGC5207B	Sets WTO's	924
IGC5307B	Splits WTO's	776
IGC5407B	Handles CANCEL	1024
IGC5607B	Processes Deletion of Messages	888
IGC5707B	Handles DOM	696
IGC5807B	Handles Deletion of Messages	744
IGC5907B	Removes Messages	640
IGC5A07B	Evaluates K S parameters	1000
IGC5C07B	Handles Asynchronous Errors	760
IGC5D07B	Moves Screen Control Message	952
IGC5F07B	Handles Light Pen and Cursor Interrupts	680
IGC5E07B	MSG. Module 2	842
IGC5G07B	OPEN/CLOSE	1016
IGC5H07B	Model 85 I/O	936
IGC5J07B	ROLL Mode	976
IGC5K07B	TIMER - Interpreter	824
IGC5N07B	DCK 1	888
IGC5O07B	DCK 2	880
IGC5P07B	2250 - I/O 1	984
IGC5Q07B	2250 - I/O 2	560
IGC5R07B	2260 - I/O 3	968
IGC5S07B	DCK 3	824
IGC5T07B		710

Display Unit Status

IGC5L07B	Builds Suffix for Display Unit Commands	944
IGC5M07B	Writes Messages from Queue	1044
IGC5T07B	Clean Up and Issues Error Messages	832

TESTRAN

IGC0004I	TEST OPEN (SVC49)	1024
IGC0006A	TESTRAN Save Routine (SVC61)	664

Graphics

IGC0007A	Buffer Management (SVC71)	968
IGC0107A	Buffer Management (SVC71)	824
IGC0007C	SPAR (SVC73)	760
IGC0007D	DAR (SVC74)	608
IGC0007E	ATTNINQ (SVC75)	696

OPEN - SVC19

IGC0001I-SL	Initial Load - Load 1	1024
IGG0199X-SL	Initial Load Load 2	1024
IGG0190A	Tape Mount Verification	1024
IGG0190B	NSL Input	1024
IGG0190C	Unlabeled Tape Positioning	1024
IGG0190D	Labeled Tape Positioning	1024
IGG0190E	ABEND Processing	1024
IGG0190F	Input Tape Header Verification	1024
IGG0190G	Input Tape Header Label 2 and User Label Processing	1024
IGG0190H	Merge and DCB Exit	1024
IGG0190I	Direct Access DSCB Processing	1024
IGG0190J	BPAM Concatenation	1024
IGG0190K	Output Tape Header 2 Preparation	1024
IGG0190L-SL	Merge and Access Method Determination	1024
IGG0190M-SL	DCB Exit	1024
IGG0190N-SL	Final Module	1024
IGG0190P	Output Tape Volume Label Preparation	1024
IGG0190Q	Security	1024
IGG0190R	NSL or SL Volume Verification	1024
IGG0190S-SL	Final Load - Rewrite JFCB	1024
IGG0190T	Density Verification	1024
IGG0190U	Parallel Mounting - 2321	1024
IGG0190V	Parallel Mounting	1024
IGG0190W	OPEN Pre-Executor	1024
IGG0190X	Greater Than Five Volumes	1024
IGG0190Y	Tape Mount Verification	1024
IGG0190Z	Direct Access Mount Verification	1024
IGG0199A	Resolve VOLIDs of the Type XTRR00	1024
IGG0199M-SL	Merge	1024
IGG01995	Label Editor Routine	488
IGG0199R	Read Password	456
IGG0199C	Verifies Volume Labels	1024
IGG0199E	Merge and Access Method Determination	1024
IGG0199H	Reads DSCB for 2321	1024
IGG0199I	MOD Disposition for 2314/2311	1024
IGG0199J	MOD Disposition for 2321	1024
IGG0199P	Writes Header Label I	1024
IGG0199T	Destroys Old Label at Users Option	1024
IGG0199U	Creates a Label on a Tape	1024
IGG0199Y	BPAM Concatenation for 2321	1024
IGG0199Z	Reads DSCB	1024
IGG0199Q	Security	1024
IGG0199V	TSO Security	1024

OPEN Executors for TCAM

IGG01930	Disk Open	1024
IGG01931	Disk Open	1024
IGG01933	Open error handler	1024
IGG01934	Disk Open	1024
IGG01935	Line Open	1024
IGG01936	Line Open	1024
IGG01937	Line Open	1024
IGG01938	Line Open	1024
IGG01939	Line Open	1024
IGG01940	Line Open	1024
IGG01941	Checkpoint Open	1024
IGG01942	Checkpoint Open	1024
IGG01943	Checkpoint Open	1024
IGG01944	Checkpoint Open	1024
IGG01945	Checkpoint Open	1024
IGG01946	Message Processing Queues Open	1024
IGG01947	Message Processing Queues Open	1024
IGG01948	Line Open	1024
IGG01949	Checkpoint Open	1024

OPEN Executors for SAM

IGG0191A-SL	DEB Construction - Load 1	1024
IGG0196A-SL	DEB Construction - Load 2	1024
IGG0191B-SL	Main Executor - Load 1	1024
IGG0196B-SL	Main Executor - Load 2	1024
IGG0191C	Dummy Executor	1024
IGG0191D-SL	First Load Direct Access Executor	1024
IGG0191O-SL	Second Load-Direct Access Executor	1024
IGG0191E	Input Exchange Buffering Executor	1024
IGG0191F	Output Exchange Buffering Executor	1024
IGG0191G-SL	TAPE and Unit Record Executor	1024
IGG0191H	Record Overflow Executor	1024
IGG0191I	Buffer Construction Executor	1024
IGG0191J	Direct Access IN/OUT and OUT/IN	1024
IGG0191K	Direct Access Executor PCI	1024
IGG0191N	DEB construction for Direct Access Devices	1024
IGG0191P	Update Executor	1024
IGG0191Q	Tape/Unit Record Executor	1024
IGG0191R	TAPE, Disk IN/OUT Executor	1024
IGG0191S	Record Overflow Executor	1024
IGG0191T	UCS Load Determination	1024
IGG0191U	UCS Image Retrieval	1024
IGG0191V	UCS Load and Verification	1024
IGG01915	Load Executor for Variable Length Records	1024
IGG0191Y	Executor for User Totaling	1024
IGG01911-SL	IOB and Buffer Construction	1024
IGG01991	Load Executor for Variable Length Records	1024
IGG01916	Load Executor for Variable Length Records	1024
IGG01992	Load Executor for Variable Length Records	1024
IGG01910-SL	Load Executor	1024
IGG01917-SL	Load Executor	1024
IGG01912	Update Load Executor - Paper Tape	1024
IGG01918	Update Load Executor - Paper Tape	1024
IGG01913	Load Executor PCI/T.O	1024
IGG01919	Load Executor PCI/T.O	1024
IGG01914	Exchange Buffering Load Executor	1024
02401990	Exchange Buffering Load Executor	

OPEN Executors for BDAM

IGG0193A	Open Executor No. 1	1024
IGG0193C	Open Executor No. 2	1024
IGG0193E	Open Executor No. 3	1024
IGG0191L	Create BDAM Data Set	1024
IGG0191M	BSAM Load Mode, Record Overflow	1024
IGG0193F	Obtain/Format Buffer Area	1024

OPEN Executors for ISAM

IGG0192A	Build DEB	1024
IGG0192B	Buffers	1024
IGG01920	Validate fields in format 2 DSCB	1024

OPEN Executors for BISAM Only

IGG0192H	Move From DSCB, Get Work Area	1024
IGG0192I	Load PMT, CP1 or CP2	1024
IGG0192J	Load Appendage, Asynchronous	1024
IGG0192K	Load NPMT, Dynamic Buffering CP4-CP7	1024
IGG0192L	Load WRITE KN NPMT, Channel Programs	1024
IGG0192M	Set-up WRITE KN Channel Programs	1024
IGG0192N	Set-up WRITE KN Channel Programs	1024
IGG0192O	Set-up WRITE KN Channel Programs	1024
IGG0192P	Read HIGH-level Index	1024
IGG0192Q	Set-up WRITE KN Channel Programs	1024
IGG0192W	Move from DSCB to DCB work area (VLR)	1024
IGG0192X	Set-up WRITE KN Channel Programs (VLR)	1024
IGG0192Z	SET-UP WRITE KN Channel Programs (VLR)	1024
IGG01950	Validate Fields in Format 2 DSCB (VLR)	1024

OPEN Executors for QISAM Only

IGG0192D	Calculations	1024
IGG0192E	Calculations	1024
IGG0192F	Calculations	1024
IGG0192G	Calculations	1024
IGG0192R	Load, Set-up CP18 (No Write Validity Check)	1024
IGG0192S	Set-up, CP19, Pre-format	1024
IGG0192T	Set-up, CP20, CP21 (No Write Validity Check)	1024
IGG0192U	Load, Set-up CP18 (Write Validity Check)	1024
IGG0192V	Set-up CP20, CP21 (Write Validity Check)	1024
IGG01921	Set Up Load Mode Work Area	1024
IGG01923	Load (Scan Mode) (VLR)	1024
IGG01924	Set-up Channel Programs (VLR)	1024
IGG01928	Load (Scan Mode)	1024
IGG01929	Set-up Channel Programs	1024
IGG0195D	Resume Load Initialization	1024
IGG0195T	Full Track Index Write Initialization	1024
IGG0195U	Full track with Resume Load Initializaiton	1024
IGG0196D	Resume Load Initialization - Set Up CP 31	1024
IGG0195G	Resume Load Initialization	1024
IGG0196G	Resume Load Initialization	1024

OPEN Executors for Graphics

IGG0193Y	Open Executor - Load 1	1024
IGG0193Z	Open Executor - Load 2	1024
IGG0193L	Open Executor - Load 3	1024

OPEN Executors for BTAM

IGG0193M	Open Executor - Load 1	1024
IGG0193Q	Open Executor - Load 2	1024
IGG0193S	Open Executor - Load 3	1024
IGG0194N	Open Executor - Load 4	1024

OPEN Executors for QTAM

IGG0193N	Open Line Group - Load 1	1024
IGG0193O	Open Direct Access Message Queues-Load 1	1024
IGG0193P	Open Message-Process Queue	1024
IGG0193R	Open Line Group - Load 2	1024
IGG0193T	Open Line Group - Load 3	1024
IGG0193U	Open Direct Access Message Queue - Load 2	1024
IGG0193V	Open Checkpoint Data Set	1024
IGG0194A	Open Line Group - Load 4	1024

CLOSE - SVC20

IGC0002_-SL[1]	Initial Load	1024
IGG0200A-SL	Read JFCB and DSCB	1024
IGG0200B	Output Tape Trailer Label Preparation	1024
IGG0200C	Tape Positioning	1024
IGG0200D	Tape Positioning	1024
IGG0200F-SL	Direct Access Processing	1024
IGG0200G-SL	Delete Subroutine and Restore DCB	1024
IGG0200H-SL	CLOSE	
IGG0200W	Find First Volume of BDAM Data Set	1024
IGG0200X	Output Tape Trailer Label Preparation	1024
IGG0200Y-SL	Direct Access Processing	1024
IGG0200Z-SL	Where to Go Logic	1024
IGG0200I	Build and Record Type 14/15 SMF Records	1024
IGG0200J	Build and Record Type 14/15 SMF Records	1024
IGG0209Z-SL	XCTL to APPROPRIATE Module	1024

CLOSE-TCAM

IGG02030	Disk Close	1024
IGG02035	Line Close	1024
IGG02036	Checkpoint Close	1024
IGG02041	Checkpoint Close	1024
IGG02046	Message Processing Queues Open	1024
IGG02047	Message Processing Queues Close	1024

CLOSE Executors

IGG0201A	SAM - Close Executor for Non-Direct Access Devices	1024
IGG0201B	SAM	1024
IGG0201Z-SL	SAM/PAM - Close Executor for Direct Access Devices	1024
IGG0202I	QISAM - Flush Buffers, Indices	1024
IGG0202J	QISAM - Write EOF	1024
IGG0202K	QISAM - Calculate for Padding	1024
IGG0202L	QISAM - Pad Track Index	1024
IGG0202M	QISAM - Pad High-Level Indices	1024
IGG02029	ISAM	1024
IGG0202D	ISAM - Free Work Area	1024
IGG0202A	ISAM - Purge, Free Buffers	1024
IGG0203A	BDAM	1024
IGG0203M	BTAM	1024
IGG0203N	QTAM - Close Line Group	1024
IGG0203O	QTAM - Close Direct Access Message Queues	1024
IGG0203P	QTAM - Close Message-Process Queue	1024
IGG0203R	QTAM - Close General Closedown	1024
IGG0203Y	Graphics	1024
IGG0203X	Graphics	1024
IGG0201Y-SL	Release Work Areas and Buffers (D.A.)	1024

TCLOSE - SVC23

IGC0002C	Initial Load	1024
IGG0230C	Positioning and Disposition	1024
IGG0230D	Output Direct Access Processing	1024

ISAM Allocate Modules

IGG032I1	ISAM Allocate	1024
IGG032I2	ISAM Allocate	1024
IGG032I3	ISAM Allocate	1024
IGG032I4	ISAM Allocate	1024
IGG032I5	ISAM Allocate	1024
IGG032I6	ISAM Allocate	1024
IGG032I7	ISAM Allocate	776
IGG032I8	ISAM Allocate	744

End of Volume - SVC55

IGC0005E-SL	EOV Diagnostic	1024
IGG0550A	Tape Input Trailer Label Verification	1024
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IGG0325K	Direct Access Space Allocation Routines	1024
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IGG020D1	Direct Access Space Partial Release Routine	1024
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IGG03001	Direct Access Rename Routine	816
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IGG0CLC1	Second Load of LOCATE/INDEX/CATALOG	1024
IGG0CLC2	Set Pointer Entries, Volume Control	1024
IGG0CLC3	Block Point Entries and Volume	1024
IGG0CLC4	Control Blocks	1024
IGG0CLC5		1024
IGC0002H	Open Catalog Data Sets & Writes	1008
IGG0CLF2	Format Blocks in New Catalog Data Sets	808
IGG0290F	Direct Access Space Scratch Routines	635
IGG0CLC7	Fifth Load of Index/Catalog	660

Restart - SVC 52

IGG0005B	SMB Reader (used by MFT & MVT)	648
IGC0105B	Initialization	594
IGC0205B	Builds Channel Program/Positions Checkpoint Data Set	570
IGC0505B	Restores Problem Program Core and Rebuilds System Information (PCP and MFT)	1022
IGC0505B	Restores Problem Program Core and Rebuilds System Information - MVT	1024
IGC0603B	Rebuilds System Information (MFT)	288
IGC0605B	Rebuilds System Information - MVT	1008
IGC0705B	Rebuilds System Information - MVT	880
IGC0805B	Rebuilds Information - MVT Only System	980
IGC0905B	Rebuilds System Information - MVT	1024
IGC0G05B	JFCB Processor - Table Build	1024
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IGC0K05B	Mount/Verification Processor - Non-Direct Access	1024
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IGC0P05B	Positioning - Non-Direct Access	648
IGC0S05B	Repositioning in Parallel	1024
IGC0W05B	ISAM Data Set Processing	496
IGC0Q05B	SYSIN/SYSOUT Processor 2 - Direct Access	392
IGC0R05B	Positioning - Direct Access	1088
IGC0T05B	Access Method Processor/Restores I/O	584
IGC0V05B	Restart Exit Routine	464

[1]Punch a 12-0 multipunch. In EBCDIC, the 12-0 is a blank; in BCD, A ?.

STAE - SVC 60

IGC0006_[1]	Create or modify a STAE Environment	288
IGC0B01C	Schedule STAE Exit Routine 3 Test Retry Option (MVT)	1024
IGC0D01C	Data Set Closing (MVT)	1024
IGC0E01C	Schedule STAE Retry Routine (MVT)	1024
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IGC01111C	Schedule STAE Exit Routine and Test Retry Option (PCP,MFT)	864
IGC0211C	Data Set Closing (PCP,MFT)	640
IGC0311C	Schedule STAE Retry Routine (PCP,MFT)	584
IGC0411C	Data Set Closing for ISAM, BTAM and QTAM (PCP,MFT)	608

CHKPT - SVC 63

IGC0006C	Initialization	952
IGC0106C	Environment Checking	728
IGC0206C	Builds CHR	688
IGC0506C	Quiesces I/O	1024
IGC0A06C	Writes CHR on Checkpoint Data Set	352
IGC0D06C	Writes DSDRs on Checkpoint Data Set	1024
IGC0F06C	Writes CIRs and SUR on Checkpoint Data Set - PCP	800
IGC0F06C	Writes CIRs and SURs on Checkpoint Data Set - MVT	800
IGC0G06C	Writes CIRs and SURs on Checkpoint Data Set - MVT	1010
IGC0H06C	Writes CIRs and SURs on Checkpoint Data Set - MVT	1004
IGC0N06C	Restores I/O	1024
IGC0Q06C	Clean Up	832
IGC0S06C	Issues Console Message	512

BTAM - SVC 66

IGC0006F	Terminal Test Validation and Compare	720
IGC0106F	1030 Terminal Test	936
IGC0206F	1050 Terminal Test	912
IGC0306F	1060 Terminal Test	1024
IGC0406F	2740 Terminal Test	952
IGC0506F	2848/2260 Terminal Test	912
IGC0606F	2848/2260 Terminal Test	480
IGC0706F	BSC (USASCII/TRANSCODE) Test Module	784
IGC0806F	BSC (EBCDIC) Test Module	1012
IGC0906F	2741 Correspondence Code Terminal Test	858
IGC0A06F	2741 PTTC Code Terminal Test	858
IGC0B06F	2760 Terminal Test	396
IGC0D06F	BSC Test Control Module	712
IGC0C06F	2740C Online Test Module	914

SETPRT - SVC 81

IGC0008A	UCS Load Determination	1024
IGG08101	UCS Image Retrieval	1024
IGG08102	UCS Load and Verification	1024

TGET/TPUT - SVC 93

IGC0009C	First Load of TGET	1024
IGC09301	TPUT	1024
IGG09302	TPUT with TJID	1024
IGG09303	WAIT Remove Routine	1024

Terminal Status - SVC 94

IGC0009D	Initialization and TCLEARQ	1024
IGG09404	STBREAK	1024
IGG09405	STCOM	1024
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IGG0940D	STAUTOPT	1024
IGG0940E	RTAUTOPT	1024
IGG0940F	TSO ABEND	1024
IGG0190G	STCLEAR	1024

PROTECT - SVC 98

IGC0009H	First Load - Validity Checking	1024
IGC0109H	Second Load - List Processing	1024
IGC0209H	Third Load - Clean-up	1024

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[1]Punch a 12-0 multipunch. In EBCDIC, the 12-0 is a blank; in DCB, a ?.

IEHATLAS + ATLAS (SVC 86)

IGC0008F		1024

Miscellaneous SVC Routines

IGC0004H	Shared DASD Logical and Physical Reservation Control	608
IGC0005F	Shared DASD Logical Reservation Control	792
IGC0001F-SL	Purge (SVC 16)	1024
IGC0101F	Purge (SVC16 - Second Load - First of Two Possible)	948
IGC0201F	Purge (SVC16 - Second Load - Second of Two Possible)	948
IGC0001G	Restore	12
IGC0002A	BPAM Store Routine (SVC21)	1024
IGC0002B	OPEN-JFCB in Storage (SVC22)	1024
IGC0002E	D.A. Track Balance (SVC25)	712
IGC0002G	Obtain DSCB (SVC27)	864
IGC0003A	SAM FEOV Executor (SVC31)	1024
IGC0003E	WTO/WTOR (SVC35)	75
IGC0005C	RELEX (SVC53)	184
IGC0005G	FREEDBUF (SVC57)	72
IGC0006D	Read JFCB	1024
IGC0006I	Backspace (SVC69)	696
IGC0008C	SMF WTM (SVC83) Buffer Control	748
IGC0108C	SMF Data Set	1094
IGC0208C	SMF Data Set Verification	854
IGC0007H	Direct Access Space Availability (SVC 78)	1024
IGC0107H		1024
IGC0008G	SVC 87 - Delete Operator Messages (MCS)	220
IGC0004D	CHAP (SVC 44) MFT with Subtasking only	744
IGC0006B	DETACH (SVC 62) MFT with Subtasking only	424
*IGC0004[1]	EXTRACT (SVC 40) - PCP, MFT without subtasking	92
*IGC0004[1]	EXTRACT (SVC 40) - MFT with subtasking	432
*IGC0004B	ATTACH (SVC 42) - PCP,MFT without subtasking	610
*IGC0004B	ATTACH (SVC 42) - MFT with subtasking	1024
IGC0006G	SYNADAF (SVC 68) Initial Load	1024
IGC0106H	SYNAD Routine CSW Status and CCB Post Routine for SAM, DAM, and EXCP	1024
IGC0206H	SYNAD Routine for BISAM	1024
IGC0306H	SYNAD Routine for QISAM	1024
IGC0406H	SYNAD Routine for QISAM, BTAM, QTAM, and GAM	1024
IGC0506H	Formats Synad Message for EXCP	1024
IGC0606H	Formats Synad Message for Optical Character Readers	1024
IGC0009A	Volume Statistics Recording Routine	1024
IGC0706H	Synad Routine Unit Check Analysis	1024

* These modules can also be made permanently resident by specifying them in the SUPRVSOR macro during system generation.

[1]Punch a 12-0 multipunch. In EBCDIC, a 12-0 is a blank; in BCD a ?.

Error Recovery Procedures

The following list contains those procedures that may be resident when the resident error recovery procedure option is selected. All of these routines are on the SVC library.

Unit Record Device Error Routines

IGE0011B	1285 ERP	920
IGE0011C	1287 ERP	992
IGE0011D	1288 ERP	904

Error Routines Common to All Devices

IGE0025C	Write-to-Operator Load 1	925
IGE0125C	Write-to-Operator Load 2	338
IGE0225C	Write-to-Operator Load 3	1012
IGE0025D	Statistics Update	382
IGE0025E	I/O Purge	324
IGE0025E	Outboard Recorder (OBR)	720
IGE0125F	Outboard and Channel Check Recorder	936
IGE0525F	Statistical Data Recorder (SDR)	656

TCAM Routines

IGE0004G	Start-Stop Control Module	996
IGE0104G	Read/Write Unit Check Unit Exception	834
IGE0204G	Non-operational Control Unit	100
IGE0304G	Unit Check for Non-read, Non-write and Non-Poll CCWs	202
IGE0404G	Auto Poll and Read Response to Poll Unit Check and Unit Exception	308
IGE0504G	Error Post and CCW Return	584
IGE0604G	Unit Check and Unit Exception for Audio and 2260 Local Devices	268
IGE0804G	Start-Stop Channel Check	740
IGE0904G	Terminal Statistics Recording	172
IGE0004H	BSC Control Module	870
IGE0104H	BSC Equipment Check, Lost Data, Intervention Required, and Unit Exception	756
IGE0204H	BSC Data Check, Overrun and Command Reject	745
IGE0404H	BSC CCW Return Module	898
IGE0504H	BSC Error Post Module	468
IGE0804H	BSC Channel Check	534

Appendix B—Contents

Appendix B: Reentrant Load Modules That Can Be Made Resident in the Time Sharing Link Pack Area

This appendix lists the modules that may be resident in the time sharing link pack area. The name, size, and function of each module is given, along with the library in which it is located. This list is divided into two major sections:

- Those modules located on SYS1.LINKLIB that can be made resident in the time sharing link pack area.
- Those modules located on SYS1.CMDLIB that can be made resident in the time sharing link pack area.

It is recommended that modules marked with an * be placed in the time sharing link pack area. Modules marked with a ** must be placed in the time sharing link pack area.

Modules on SYS1.LINKLIB That Can Be Made Resident in the Time Sharing Link Pack Area

<u>TSO Command System Modules (TMP)</u>

IKJEFT01	TMP Initialization	1984
IKJEFT02	TMP Mainline	6732

<u>LOGON/LOGOFF Scheduler Modules</u>

IKJEFLE	Phase I Prompter	6264
IKJEFLGM	LOGON Messages	3344
IKJEFLE	System Initiated LOGOFF	384
IKJEFLB	Job Scheduling Task Router	1512
IKJEFLK	POST Invocation Iliniator Exit	264
IKJEFLG	LOGON Asynchronous	3000
IKJEFLC	Phase I Prompting Monitor	5184
IKJEFLL	LOGOFF Processor	3240
IKJEFLJ	Pre-invocation Initiator	2816
IKJEFLA	Initialization	1536
**IKJEFLS	STAE Exit and Retry	1504
IKJEFLI	LOGON Installation Exit Support	3858
IKJEFLPA	TOD and DATE Text Preparation	688

<u>Service Routine Modules</u>

*IKJPTGT	I/O Service routines (GETLINE/PUTLINE)	6640
IKJPUTL	Alias for IKJPTGT	
IKJGETL	Alias for IKJPTGT	
IKJSTCK	Alias for IKJPTGT	
IKJPARS	Parse Service Routine	11320
*IKJSCAN	Command Scan Service Routine	1536

<u>Command Processor Modules</u>

*IKJEFT25	TIME Command Processor	736

Modules on SYS1.CMDLIB That Can Be Made Resident in the Time Sharing Link Pack Area

Service Routine Modules

IKJEHDEF	Default Service Routine	4096
IKJDFLT	Alias for IKJEHDEF	
IKJEHCIR	Catalog Information Service Routine	732
IKJEFD00	Dynamic Allocation Interface Service Routine	9216

Command Processor Modules

IKJEFL00	LOGOFF	184
IKJEFT80	TERMINAL	2616
IKJEFT82	PROFILE	2040
IKJEFF60	OUTPUT	12400
IKJEFF67	OUTPUT - Message Processor	4096
IKJEFF61	OUTPUT - Queue Control	3072
IKJEFF65	OUTPUT - Default Class Table	32
IKJLINK	LINK - Initial Module	50
IKJLOADG	LOADGO - Initial Module	50
IKJLKL01	LINK/LOADGO Processing Module	11700
IKJLKL02	LINK/LOADGO Control Module	800
IKJEFA00	ACCOUNT	5800
IKJEFA10	ACCOUNT - ADD Subcommand Processor	20120
IKJEFA20	ACCOUNT-CHANGE Subcommand Processor	21400
IKJEFA30	ACCOUNT - DELETE Subcommand Processor	9320
IKJEFA40	ACCOUNT - LIST Subcommand Processor	12200
IKJEE100	OPERATOR	6120
IKJEES70	LISTBC	5120
IKJEES10	SEND	10240
IKJEES40	SEND/ACCOUNT Interface	7168
HELP	HELP	7168
IKJEFE11	WHEN	4096
IKJEFF50	CANCEL/STATUS	4096
IKJEFF53	CANCEL/STATUS	512
IKJEFF57	CANCEL	256
SUB	SUBMIT	4096
IKJEFF04	SUBMIT	8192
IKJEFF10	SUBMIT	124
IKJEFF16	SUBMIT	1024
IKJEFF02	SUBMIT	1536
EXEC	EXEC	15904
IKJEFE04	EXEC	5120
IKJEFR00	RUN	5048
IKJEFD20	CALL	3248
IKJEFDSO	ALLOCATE	5748

IKJEBEAA	EDIT - access method routines	4848
IKJEBEBO	EDIT - BOTTOM subcommand processor	208
IKJEBECG	EDIT - CHANGE subcommand processor, second load	3832
IKJEBECH	EDIT - CHANGE subcommand processor, first load	3400
IKJEBECI	EDIT - Command invoker service routine	3160
IKJEBECN	EDIT - CHANGE subcommand processor, third load	2464
IKJEBECO	EDIT - Initial copy service routine	1288
IKJEBEDA	EDIT - Data set allocation/unallocation service routine	1128
IKJEBEDE	EDIT - DELETE subcommand processor	1856
IKJEBEDO	EDIT - DOWN subcommand processor	880
IKJEBEEN	EDIT - END subcommand processor	1008
IKJEBEEX	EDIT - Access method termination routine	492
IKJEBEFA	EDIT - Final copy service routine	976
IKJEBEFI	EDIT - FIND subcommand processor	2264
IKJEBEFO	EDIT - FORMAT Subcommand processor	2256
IKJEBEHE	EDIT - HELP subcommand processor	112
IKJEBEIM	EDIT - INPUT subcommand processor, second load	3288
IKJEBEIN	EDIT - initialization routine	9688
IKJEBEIP	EDIT - INPUT subcommand processor, first load	1792
IKJEBEIS	EDIT - INSERT subcommand processor	1824
IKJEBELE	EDIT - Line edit service routine	2120
IKJEBELI	EDIT - Line number insert/replace/delete subcommand processor	1904
IKJEBELT	EDIT - LIST subcommand processor	1464
IKJEBEMA	EDIT - main control routine	3904
IKJEBEME	EDIT - MERGE subcommand processor	2112
IKJEBEMR	EDIT - Re-translate service routine	656
IKJEBEMS	EDIT - Message selection service routine	664
IKJEBEM1	EDIT - Message module, #1	1072
IKJEBEM2	EDIT - Message module, #2	1016
IKJEBEM3	EDIT - Message module, #3	816
IKJEBEM4	EDIT - Message module, #4	992
IKJEBEM5	EDIT - Message module, #5	928
IKJEBEM6	EDIT - Message module, #6	920
IKJEBEM7	EDIT - Message module, #7	640
IKJEBEPR	EDIT - PROFILE subcommand processor	1144
IKJEBEPS	EDIT - Processor table search routine	1840
IKJEBERE	EDIT - RENUM subcommand processor	2744
IKJEBERU	EDIT - RUN subcommand processor	2376
IKJEBESA	EDIT - SAVE subcommand processor	5432
IKJEBESC	EDIT - SCAN subcommand processor, first load	2160
IKJEBESN	EDIT - SCAN subcommand processor, second load	3616
IKJEBETA	EDIT - TABSET subcommand processor	1376
IKJEBETO	EDIT - TOP subcommand processor	360
IKJEBEUI	EDIT - Access method initialization routine	1552
IKJEBEUP	EDIT - UP subcommand processor	880
IKJEBEUT	EDIT - Access method interface routine	464
IKJEBEVE	EDIT - VERIFY subcommand processor	352
IKJEGINT	TEST - Initialization	8728
IKJEGMNL	TEST - Mainline Routines	19056
IKJEGSYM	TEST - Resolve Symbolic Addresses	5816
IKJEGPCH	TEST - Subcommand Initialization	2768
IKJEGASN	TEST - Subcommand Initialization	2760
IKJEGAT	TEST - AT Subcommand	4320
IKJEGATD	TEST - AT Subcommand	1016
IKJEGDCB	TEST - LISTDCB Subcommand	3848
IKJEGDEB	TEST - LISTDEB Subcommand	3644
IKJEGEQU	TEST - EQUATE and DROP Subcommands	3528
IKJEGGO	TEST - GO, RUN, and CALL Subcommands	2216
IKJEGLDF	TEST - LOAD, DELETE, GETMAIN, and FREEMAIN Subcommands	3926
IKJEGLST	TEST - LIST Subcommand Initialization	4144
IKJEGLAS	TEST - LIST Subcommand	3808
IKJEGMAP	TEST - LISTMAP Subcommand	1872

IKJEGOFF	TEST - OFF Subcommand	3672
IKJEGPSW	TEST - LISTPSW Subcommand	1800
IKJEGQFY	TEST - QUALIFY Subcommand	3056
IKJEGTCB	TEST - LISTTCB Subcommand	4072
IKJEGWHR	TEST - WHERE Subcommand	3040

Utility Routine Modules

IKJEHDS1	LISTDS Utility Routines	8192
LISTDS	Alias for IKJEHDS1	
IKJEHCT1	LISTCAT Utility Routines	8192
LISTCAT	Alias for IKJIHCT1	
IKJEHAL1	LISTALC Utility Rouines	6144
LISTALC	Alias for IKJIHAL1	
IKJEHPRO	PROTECT Utility Routines	5120
PROTECT	Alias for IKJEHPRO	
IKJEHDEL	DELETE Utility Routines	6144
DELETE	Alias for IKJEHDEL	
IKJEHREN	RENAME Utility Routines	7168
RENAME	Alias for IKJEHREN	

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