C 13

```
RRRRRRRRRRRR     MMM         MMM     SSSSSSSSSSSS
RRRRRRRRRRRR     MMM         MMM     SSSSSSSSSSSS
RRRRRRRRRRRR     MMM         MMM     SSSSSSSSSSSS
RRR         RRR  MMMMMM   MMMMMM  SSS
RRR         RRR  MMMMMM   MMMMMM  SSS
RRR         RRR  MMMMMM   MMMMMM  SSS
RRR         RRR  MMM   MMM   MMM  SSS
RRR         RRR  MMM   MMM   MMM  SSS
RRR         RRR  MMM   MMM   MMM  SSS
RRRRRRRRRRRR     MMM         MMM     SSSSSSSSS
RRRRRRRRRRRR     MMM         MMM     SSSSSSSSS
RRRRRRRRRRRR     MMM         MMM     SSSSSSSSS
RRR   RRR        MMM         MMM              SSS
RRR   RRR        MMM         MMM              SSS
RRR   RRR        MMM         MMM              SSS
RRR      RRR     MMM         MMM              SSS
RRR      RRR     MMM         MMM              SSS
RRR      RRR     MMM         MMM              SSS
RRR         RRR  MMM         MMM  SSSSSSSSSSSS
RRR         RRR  MMM         MMM  SSSSSSSSSSSS
RRR         RRR  MMM         MMM  SSSSSSSSSSSS
```

```
**FILE**ID**RM3SRCHKY                                        F  5                                                          RM
                                                                                                                           VO
```

```
RRRRRRRR    MM      MM    333333      SSSSSSSS  RRRRRRRR      CCCCCCCC  HH      HH  KK      KK  YY      YY
RRRRRRRR    MM      MM    333333      SSSSSSSS  RRRRRRRR      CCCCCCCC  HH      HH  KK      KK  YY      YY
RR      RR  MMMM  MMMM  33      33  SS          RR      RR  CC          HH      HH  KK      KK  YY      YY
RR      RR  MMMM  MMMM  33      33  SS          RR      RR  CC          HH      HH  KK      KK  YY      YY
RR      RR  MM  MM  MM          33  SS          RR      RR  CC          HH      HH  KK    KK      YY  YY
RR      RR  MM  MM  MM          33  SS          RR      RR  CC          HH      HH  KK    KK      YY  YY
RRRRRRRR    MM      MM        33      SSSSSS    RRRRRRRR    CC          HHHHHHHHHH  KKKKKK          YY
RRRRRRRR    MM      MM        33      SSSSSS    RRRRRRRR    CC          HHHHHHHHHH  KKKKKK          YY
RR  RR      MM      MM          33          SS  RR  RR      CC          HH      HH  KK    KK        YY
RR  RR      MM      MM          33          SS  RR  RR      CC          HH      HH  KK    KK        YY
RR    RR    MM      MM  33      33          SS  RR    RR    CC          HH      HH  KK      KK      YY          ....
RR    RR    MM      MM  33      33          SS  RR    RR    CC          HH      HH  KK      KK      YY          ....
RR      RR  MM      MM    333333    SSSSSSSS    RR      RR    CCCCCCCC  HH      HH  KK      KK      YY          ....
RR      RR  MM      MM    333333    SSSSSSSS    RR      RR    CCCCCCCC  HH      HH  KK      KK      YY          ....


LL            IIIIII      SSSSSSSS
LL            IIIIII      SSSSSSSS
LL              II      SS
LL              II      SS
LL              II      SS
LL              II      SS
LL              II        SSSSSS
LL              II        SSSSSS
LL              II              SS
LL              II              SS
LL              II              SS
LL              II              SS
LLLLLLLLLL    IIIIII    SSSSSSSS
LLLLLLLLLL    IIIIII    SSSSSSSS
```

```
MODULE RM3SRCHKY (LANGUAGE (BLISS32) ,
                IDENT = 'V04-000'
                ) =
BEGIN
!
!****************************************************************************
!*                                                                          *
!*  COPYRIGHT (c) 1978, 1980, 1982, 1984 BY                                 *
!*  DIGITAL EQUIPMENT CORPORATION, MAYNARD, MASSACHUSETTS.                  *
!*  ALL RIGHTS RESERVED.                                                    *
!*                                                                          *
!*  THIS SOFTWARE IS FURNISHED UNDER A LICENSE AND MAY BE USED AND COPIED   *
!*  ONLY IN  ACCORDANCE WITH  THE  TERMS  OF  SUCH  LICENSE  AND WITH THE   *
!*  INCLUSION OF THE ABOVE COPYRIGHT NOTICE. THIS SOFTWARE OR  ANY  OTHER   *
!*  COPIES THEREOF MAY NOT BE PROVIDED OR OTHERWISE MADE AVAILABLE TO ANY   *
!*  OTHER PERSON.  NO TITLE TO AND OWNERSHIP OF  THE  SOFTWARE IS  HEREBY   *
!*  TRANSFERRED.                                                            *
!*                                                                          *
!*  THE INFORMATION IN THIS SOFTWARE IS  SUBJECT TO CHANGE WITHOUT NOTICE   *
!*  AND  SHOULD  NOT  BE  CONSTRUED AS  A COMMITMENT BY DIGITAL EQUIPMENT   *
!*  CORPORATION.                                                            *
!*                                                                          *
!*  DIGITAL ASSUMES NO RESPONSIBILITY FOR THE USE  OR  RELIABILITY OF ITS   *
!*  SOFTWARE ON EQUIPMENT WHICH IS NOT SUPPLIED BY DIGITAL.                 *
!*                                                                          *
!*                                                                          *
!****************************************************************************

!++
!
! FACILITY:     RMS32 INDEX SEQUENTIAL FILE ORGANIZATION
!
! ABSTRACT:
!                This module starts at current bucket and searchs to stop level
!
!
! ENVIRONMENT:
!
!               VAX/VMS OPERATING SYSTEM
!
!--

!
! AUTHOR:        D. H. Gillespie     CREATION DATE:            18-APR-78  9:39
!
! MODIFIED BY:
!
!       V03-011 TMK0004         Todd M. Katz            03-Apr-1983
!               Add support for RU record space reclamation. This involves
!               modifications to RM$SEARCH_TREE as follows. Whenever RMS
!               has write access to a file that is marked RU Journallable,
!               and is currently positioning to a primary data bucket but
!               not for modification, then RMS wants to set the CSH$V_LOCK
!               flag so that the bucket will be EXclusively locked in case RU
!               record reclamation takes place on the bucket. In addition, RMS
!               wants to EXclusively lock all SIDR buckets whenever it has
!               write access to the file.
```

```
1 !
1 !        V03-010 MCN0005         Maria del C. Nasr       15-Mar-1983
1 !                More linkages reorganization
1 !
1 !        V03-009 MCN0004         Maria del C. Nasr       28-Feb-1983
1 !                Reorganize linkages
1 !
1 !        V03-008 TMK0003         Todd M. Katz            03-Feb-1983
1 !                Add support for Recovery Unit Journalling and RU ROLLBACK
1 !                Recovery of ISAM files. Make a change to SEARCH_V2. Do not set
1 !                the bit IRB$V_DUPS_SEEN if the current primary data record is
1 !                either marked RU_DELETE or DELETED. Previously just a check for
1 !                DELETED was being made.
1 !
1 !        V03-007 TMK0002         Todd M. Katz            09-Sep-1982
1 !                The field IRB$B_SRCHFLAGS has been changed to a word in size.
1 !                Fix all references to it.
1 !
1 !                Add support for prologue 3 SIDRs. This includes the removal of
1 !                misleading comment statements.
1 !
1 !                In the local routine SEARCH_V2, when a search key is found to
1 !                be equal to a key of a record, set the IRAB bit IRB$V_DUP_KEY.
1 !
1 !
1 !        V03-006 KBT0297         Keith B. Thompson       24-Aug-1982
1 !                Reorganize psects
1 !
1 !        V03-005 MCN0003         Maria del C. Nasr       29-Jun-1982
1 !                Allow keys of different data types other than string
1 !                in prologue 3 files.  Change all CH$COMPARE calls to
1 !                RM$COMPARE_KEY to compare keys taking into consideration
1 !                the different data types.
1 !
1 !        V03-004 TMK0001         Todd M. Katz            25-May-1982
1 !                Eliminate unneccesary linkage declaration for RM$RECORD_KEY.
1 !
1 !        V03-003 MCN0002         Maria del C. Nasr       25-Mar-1982
1 !                Use macro to calculate key buffer address.
1 !
1 !        V03-002 CDS0008         C Saether               23-Mar-1982
1 !                Restore BKT_ADDR when BDB is restored when leaving
1 !                block that confirms down pointer from level 1.
1 !                This was causing the check for level 0 to fail and
1 !                not lock the next bucket when positioning horizontally
1 !                at level 0.
1 !
1 !        V03-001 CDS0007         C Saether               3-Mar-1982
1 !                Fix bug where horizontal reads at the stoplevel were
1 !                not locking the bucket on positions for insert or
1 !                delete.  This was working correctly for position for
1 !                insert at level 0 only (which is the normal place
1 !                where horizontal reads would take place).
1 !                The changes in RM$CACHE and RM$RELEASE have made them
1 !                sensitive to this error.
1 !
1 !        V02-039 CDS0006         C Saether               20-Jan-1982
```

```
1 !             Set VBN_LEFT for scan forward when not locking.
1 !             Clear IRB$L_REC_COUNT before calling RM$SRCH_BY_KEY
1 !             in the horizontal scan logic.
1 !             Once data level horizontal scan has started, do not
1 !             drop back into outer loop anymore.
1 !
1 !     V02-038 CDS0005         C Saether               14-Jan-1982
1 !             Put back logic to check index down pointer after
1 !             positioning to level on insert.  It's really necessary.
1 !
1 !     V02-037 CDS0004         C Saether               31-Dec-1981
1 !             Fix error path botched in V02-036.
1 !             Put back retry on rlk error going down tree inadvertently
1 !             removed by V02-036.
1 !
1 !     V02-036 CDS0003         C Saether               29-Dec-1981
1 !             Remove logic to check down pointer before going
1 !             across on position for insert.
1 !             Modify horizontal scan at data level on position for
1 !             insert to release bucket prior to going ahead.  This
1 !             eliminates need for special algorithms to avoid deadlock
1 !             with rrv updating by other streams.  Previous algorithm
1 !             could get into infinite loop with another process.
1 !
1 !     V02-035 PSK0009         P Knibbe                07-Oct-1981
1 !             Make sure all calls to RM$RECORD_VBN check for
1 !             prologue version.
1 !
1 !     V02-034 CDS0002         C Saether               29-Sep-1981
1 !             Make check for exclusive lock before setting abovelckd.
1 !
1 !     V02-033 CDS0001         C Saether               20-Aug-1981
1 !             Remove references to BDB$L_OWN.
1 !
1 !     V02-032 PSK0008         Paulina S. Knibbe       08-Aug-1981
1 !             Remove all references to SPLCTX
1 !
1 !     V02-031 PSK0007         Paulina S. Knibbe       30-Jul-1981
1 !             Remove support for truncated index keys.
1 !
1 !     V02-030 PSK0006         Paulina S. Knibbe       12-Jun-1981
1 !             1) Make RM$V3_VBN a global routine
1 !             2) Save LST_NCMP when bouncing back and forth between
1 !                two buckets.
1 !             3) Add logic to support horizontal processing in V3
1 !                compresses indexes.
1 !             4) Add RM$CHK_HORIZ
1 !             5) Change calls to COMP_ASCII to be CH$COMPARE
1 !
1 !     V02-029 PSK0005         Paulina S. Knibbe       28-May-1981
1 !             Fix problem on GT search. Make lock-above optimization
1 !             work for prologue three files.
1 !
1 !     V02-028 PSK0004         Paulina S. Knibbe       03-May-1981
1 !             Add support for compressed keys in index, SIDR and data
1 !             buckets.
1 !
```

```
1 !        V02-027 PSK0003          Paulina S. Knibbe       30-Apr-1981
1 !                Fix problem when key goes past range in bucket
1 !
1 !        V02-026 MCN0001          Maria del C. Nasr       23-Apr-1981
1 !                Add support for non-compressed keys at the primary data
1 !                level of prologue 3 files.
1 !
1 !        V02-025 PSK0002          Paulina S. Knibbe       30-Mar-1981
1 !                Add support for random searching of PLG3 buckets with
1 !                fixed length keys.
1 !
1 !        V02-024 PSK0001          Paulina S. Knibbe       19-Mar-1981
1 !                Change index bucket VBN processing to handle VBN lists
1 !                at end of bucket
1 !
1 !        V02-023 REFORMAT         Keith B. Thompson       23-Jul-1980
1 !
1 ! REVISION HISTORY:
1 !
1 !        Christian Saether,       27-JUL-78  10:48
1 !        X0002 - SRCH_BY_KEY changed to store last record address for
1 !                ADD_TO_ARRAY
1 !
1 !        Christian Saether,       9-AUG-78  11:55
1 !        X0003 - never return RNF on POSINSERT
1 !
1 !        Wendy Koenig,   11-AUG-78  14:10
1 !        X0004 - only lock the root if it is the lock-above or stoplevel level
1 !
1 !        Christian Saether,       14-AUG-78  10:21
1 !        X0005 - add code to disable RNF on position for insert
1 !
1 !        Christian Saether,       24-AUG-78  9:39
1 !        X0006 - Add POSDELETE to SEARCH_TREE
1 !
1 !        Christian Saether,       24-AUG-78  19:41
1 !        X0007 - Correct logic error horizontal positioning on insert across
1 !                empty buckets
1 !
1 !        Christian Saether,       26-SEP-78  15:57
1 !        X0008 - never do lock_above on position for delete
1 !
1 !        D. H. Gillespie,         6-OCT-78  17:34
1 !        X0009 - fix bug when positioning for insert and entire file is empty
1 !                from where search started and end
1 !
1 !        Christian Saether,       9-OCT-78  12:10
1 !        X0010 - reverse usage of EMPT_SEEN and EMPTY_BKT so EMPTY_BKT is not
1 !                clobbered while searching index levels
1 !
1 !        Wendy Koenig,   24-OCT-78  14:03
1 !        X0011 - make changes caused by sharing conventions
1 !
1 !        Christian Saether,       27-OCT-78  15:09
1 !        X0012 - do not set DUPS_SEEN if the record is deleted on position for
1 !                insert
1 !
```

```
  1 !       Christian Saether,      12-DEC-78  20:17
  1 !       X0013 - set ADUP_SEEN always when passing dupes - this has been taken
  1 !               out 12/18/78
  1 !
  1 !       Christian Saether,      15-DEC-78  11:17
  1 !       X0014 - mask split_bits in csearch_tree before calling search_tree
  1 !
  1 !       Christian Saether,      9-JAN-79  12:08
  1 !       X0015 - on lock error going horizontal, reread bucket with lock to
  1 !               force stall
  1 !
  1 !       Christian Saether,      15-JAN-79  18:22
  1 !       X0016 - modify lockabove logic to avoid deadlocks
  1 !
  1 !       Christian Saether,      20-JAN-79  20:18
  1 !       X0017 - confirm level 1 down pointer before going across level 0
  1 !
  1 !       Wendy Koenig,   23-JAN-79  14:21
  1 !       X0018 - zero MIDX_TMP1
  1 !
  1 !       Christian Saether,      24-JAN-79  11:25
  1 !       X0019 - set up bkt_addr after releasing empty bucket when going across
  1 !               at data level
  1 !
  1 !       Christian Saether,      26-JAN-79  9:49
  1 !       X0020 - only clear splits bits when coming around from data level,
  1 !               take out going across at data level kluge
  1 !
  1 !       Christian Saether,      6-FEB-79  17:42
  1 !       X0021 - do not look at owner of bdb to make lockabove decision
  1 !
  1 !       Christian Saether,      14-FEB-79  14:05
  1 !       X0022 - always go across data level primary key dupes
  1 !
  1 !*****
  1
  1 LIBRARY 'RMSLIB:RMS';
  1
  1 REQUIRE 'RMSSRC:RMSIDXDEF';
  1
  1 ! define default psects for code
  1 !
  1 PSECT
  1     CODE = RM$RMS3(PSECT_ATTR),
  1     PLIT = RM$RMS3(PSECT_ATTR);
  1
  1 !
  1
  1 MACRO
M 1     L_HIGH_KEY =
  1         RL$HIGH_KEY = JSB()%;
  1
  1
  1 ! Linkages
  1 !
  1
  1 LINKAGE
```

```
;  286          0350  1       L_CACHE,
;  287          0351  1       L_COMPARE_KEY,
;  288          0352  1       L_HIGH_KEY,
;  289          0353  1       L_PRESERVE1,
;  290          0354  1       L_RABREG_4567,
;  291          0355  1       L_RABREG_457,
;  292          0356  1       L_RABREG_567,
;  293          0357  1       L_RABREG_67,
;  294          0358  1       L_RABREG_7,
;  295          0359  1       L_REC_OVHD;
;  296          0360  1
;  297          0361  1 !
;  298          0362  1 ! Forward Routines
;  299          0363  1 !
;  300          0364  1
;  301          0365  1 FORWARD ROUTINE
;  302          0366  1       RM$V3_VBN               : RL$RABREG_567;
;  303          0367  1
;  304          0368  1 !
;  305          0369  1 ! External Routines
;  306          0370  1 !
;  307          0371  1
;  308          0372  1 EXTERNAL ROUTINE
;  309          0373  1       RM$CACHE                : RL$CACHE ADDRESSING_MODE( GENERAL ),
;  310          0374  1       RM$CNTRL_ADDR           : RL$RABREG_567,
;  311          0375  1       RM$COMPARE_KEY          : RL$COMPARE_KEY,
;  312          0376  1       RM$GETBKT               : RL$RABREG_457,
;  313          0377  1       RM$KEY_DESC             : RL$RABREG_7,
;  314          0378  1       RM$REC_OVHD             : RL$REC_OVHD,
;  315          0379  1       RM$RECORD_VBN           : RL$PRESERVE1,
;  316          0380  1       RM$RLSBKT               : RL$PRESERVE1,
;  317          0381  1       RM$SRCH_CMPR            : RL$RABREG_567;
;  318          0382  1
;  319          0383  1 LITERAL
;  320          0384  1       LS = -1,
;  321          0385  1       GT = 1,
;  322          0386  1       EQ = 0;
```

```
1 ROUTINE SEARCH_FIX (GOAL) : RL$RABREG_567 =
1
1 !++
1 !
1 ! SEARCH_FIX
1 !
1 !       This routine searches a PLG3 fixed length key index bucket from
1 !       the current record address to the end of the bucket for an index
1 !       record equal or greater than the input search key.
1 !
1 ! CALLING SEQUENCE:
1 !       SEARCH_FIX
1 !
1 ! INPUT PARAMETERS:
1 !
1 !       GOAL - 0 - be satisfied with an equal match
1 !            - 1 - position past an equal match (search for GT match)
1 !
1 ! IMPLICIT INPUTS:
1 !       REC_ADDR                - address of record in bucket to begin search on
1 !       BKT_ADDR                - address of current bucket
1 !       IDX_DFN                 - address of index descriptor for current key of reference
1 !       IRAB                    - address of internal RAB
1 !       IRAB[IRB$V_SRCHGT]      - if set, search for index record gt search key
1 !       IRAB[IRB$V_POSINSERT]   - if set, search for position to insert record
1 !       IRAB[KEY_BUFFER_2]      - address of search key
1 !       IRAB[IRB$B_KEYSZ]       - size of key to compare
1 !
1 ! OUTPUT PARAMETERS:
1 !       NONE
1 !
1 ! IMPLICIT OUTPUTS:
1 !       REC_ADDR         - if EQ, address of index record equal to search key
1 !                        - if GT, at end of record data in bucket
1 !                        - if LS, address of index record greater than search key
1 !       IRAB [IRB$L_REC_COUNT]  - Numbe- of the record who address is in REC_ADDR
1 !       [DUPS_SEEN]      - Set if goal is gt and we found an eq match
1 !
1 ! ROUTINE VALUE:
1 !       R0               -  0, search key = index record
1 !                        - -1, search key < index record
1 !                        - +1, search key > index record
1 !
1 ! SIDE EFFECTS:
1 !
1 !--
2 BEGIN
2
2 EXTERNAL REGISTER
2     R_IRAB_STR,
2     R_IFAB_STR,
2     R_IDX_DFN_STR,
2     R_BKT_ADDR_STR,
2     R_REC_ADDR_STR;
2
2 LOCAL
2     STATUS,              ! place to hold results of compare
```

```
2     RSTART,                 ! address of first record in range
2     REND,                   ! address of last record in range
2     EOB;                    ! address past last record in bucket
2
2 EOB = .BKT_ADDR + .BKT_ADDR [BKT$W_FREESPACE];
2 RSTART = .REC_ADDR;
2 REND = .EOB;
2
2 ! Do a binary search of fixed length index records
2 !
2
2 WHILE 1 DO
3     BEGIN
3     LOCAL
3         SIZE;               ! Number of characters in range
3
3     BUILTIN
3         AP;
3
3     SIZE = .REND - .RSTART;
3     REC_ADDR = (.RSTART + (.SIZE^-1) / .IDX_DFN[IDX$B_KEYSZ] * .IDX_DFN[IDX$B_KEYSZ]);
3     AP = 3;                 ! Contiguous compare
3     STATUS = RM$COMPARE_KEY (.REC_ADDR, KEYBUF_ADDR(2), .IRAB [IRB$B_KEYSZ]);
3
3     CASE .STATUS FROM LS TO GT OF
3         SET
3         [LS]:   ! Search key is < record in bucket
3                 ! prepare to search low half of bucket
3                 !
4                 BEGIN
4                 REND = .REC_ADDR;
4
4                 IF .REND EQL .RSTART
4                 THEN
4
4                     ! Only one record left and we just compared it
4                     !
4                     EXITLOOP;
3                 END;
3
3         [EQ]:   ! Search key = record in bucket
3                 !
3                 !       GENERIC SEARCH          GOAL IS EQ MATCH
3                 !           yes                     yes             search previous
3                 !           yes                     no              search next
3                 !           no                      yes             return
3                 !           no                      no              search next
3                 !
4                 BEGIN
4
4                 IF .GOAL EQL EQ
4                 THEN
4                     IF .IRAB [IRB$B_KEYSZ] EQL .IDX_DFN [IDX$B_KEYSZ]
4                     THEN
4                         EXITLOOP
4                     ELSE
4
```

```
4                   ! generic equal match. we must postion to the previous
4                   ! record in order to find first equal match
4                   !
5                   BEGIN
5
5                   IF (.REND - .RSTART) EQL .IDX_DFN [IDX$B_KEYSZ]
5                   THEN
5                       EXITLOOP;
5
6                   IF (.REND - .RSTART) EQL (.IDX_DFN [IDX$B_KEYSZ]^1)
5                   THEN
5                       REND = .REC_ADDR
5                   ELSE
5                       REND = .REC_ADDR + .IDX_DFN [IDX$B_KEYSZ];
5                   END
5
4           ELSE
4
4               ! Search past the equal match
4               !
5               BEGIN
5
5               ! If there is another record in the bucket, compare it
5               !
5               REC_ADDR = .REC_ADDR + .IDX_DFN[IDX$B_KEYSZ];
5
5               IF .REC_ADDR EQL .EOB
5               THEN
5                   STATUS = GT
5               ELSE
5                   STATUS = LS;
5
5               EXITLOOP;
5               END
3           END;
3
3   [GT]:   ! Search key is > record in bucket
3           !
4           BEGIN
4           REC_ADDR = .REC_ADDR + .IDX_DFN[IDX$B_KEYSZ];
4
4           IF (.REND - .RSTART) LEQ (.IDX_DFN[IDX$B_KEYSZ])^1
4           THEN
4
4               ! We just compared the last record in the range
4               ! If this is the last record in the bucket, return
4               ! with a GT status.
4               !
4
4               IF .REND EQL .EOB
4               THEN
4                   EXITLOOP
4               ELSE
4                   ! We are not at the end of bucket so we know that
4                   ! we must have done an earlier compare against the
4                   ! low record of the next range and got an LS result.
4                   ! Return that record.
```

```
0558 4                         !
0559 5                         BEGIN
0560 5                         STATUS = LS;
0561 5                         EXITLOOP;
0562 4                         END;
0563 4
0564 4                 ! Prepare to search high half of bucket
0565 4                 !
0566 4                 RSTART = .REC_ADDR;
0567 3                 END;
0568 3            TES;
0569 2     END;
0570 2
0571 2 ! We now have a record of some sort.
0572 2 ! Compute the record count so that we can later pick up the VBN portion
0573 2 ! of the record from the end of the bucket
0574 2 !
0575 2 IRAB[IRB$L_REC_COUNT] = (.REC_ADDR-.BKT_ADDR-BKT$C_OVERHDSZ)/.IDX_DFN[IDX$B_KEYSZ];
0576 2
0577 2 RETURN .STATUS;
0578 1 END;


                                                   .TITLE  RM3SRCHKY
                                                   .IDENT  \V04-000\

                                                   .EXTRN  RM$CACHE, RM$CNTRL_ADDR
                                                   .EXTRN  RM$COMPARE_KEY, RM$GETBKT
                                                   .EXTRN  RM$KEY_DESC, RM$REC_OVHD
                                                   .EXTRN  RM$RECORD_VBN, RM$R[SBKT
                                                   .EXTRN  RM$SRCH_CMPR

                                                   .PSECT  RM$RMS3,NOWRT,  GBL,  PIC,2

                     091C    8F   BB 00000 SEARCH_FIX:
                                                   PUSHR   #^M<R2,R3,R4,R8,R11>                    ; 0387
            50         04    A5   3C 00004         MOVZWL  4(BKT_ADDR), R0                         ; 0448
                           6045   9F 00008         PUSHAB  (R0)[BKT_ADDR]                          ;
            58               56   D0 0000B         MOVL    REC_ADDR, RSTART                        ; 0449
            52               6E   D0 0000E         MOVL    EOB, REND                               ; 0450
   54       52               58   C3 00011 1$:     SUBL3   RSTART, REND, R4                        ; 0463
            50               54   D0 00015         MOVL    R4, SIZE                                ;
   50       50         FF    8F   78 00018         ASHL    #-1, SIZE, R0                           ; 0464
            51         20    A7   9A 0001D         MOVZBL  32(IDX_DFN), R1                         ;
            50               51   C6 00021         DIVL2   R1, R0                                  ;
            53         20    A7   9A 00024         MOVZBL  32(IDX_DFN), R3                         ;
            50               53   C4 00028         MULL2   R3, R0                                  ;
   56       50               58   C1 0002B         ADDL3   RSTART, R0, REC_ADDR                    ;
            5C               03   D0 0002F         MOVL    #3, AP                                  ; 0465
            53       00B4    CA   3C 00032         MOVZWL  180(IFAB), R3                           ; 0466
            53         60    A9   C0 00037         ADDL2   96(IRAB), R3                            ;
            50       00A6    C9   9A 0003B         MOVZBL  166(IRAB), R0                           ;
            51               56   D0 00040         MOVL    REC_ADDR, R1                            ;
                          0000G   30 00043         BSBW    RM$COMPARE_KEY                          ;
            5B               50   D0 00046         MOVL    R0, STATUS                              ;
   02 FFFFFFFF  8F           5B   CF 00049         CASEL   STATUS, #-1, #2                         ; 0468
 0051         0010         0006      00051 2$:     .WORD   3$-2$,-                                 ;
```

```
                                                                         4$-2$,-                         ;
                                                                         8$-2$                           ;
                                   52          56 D0 00057 3$:   MOVL    REC_ADDR, REND                  ; 0474
                                   58          52 D1 0005A       CMPL    REND, RSTART                    ; 0476
                                               B2 12 0005D       BNEQ    1$                              ;
                                               64 11 0005F       BRB     11$                             ; 0481
                                           1C  AE D5 00061 4$:   TSTL    GOAL                            ; 0494
                                               2B 12 00064       BNEQ    7$                              ;
                              20   A7    00A6  C9 91 00066       CMPB    166(IRAB), 32(IDX_DFN)          ; 0496
                                               57 13 0006C       BEQL    11$                             ;
        54       20   A7                   08  00 ED 0006E       CMPZV   #0, #8, 32(IDX_DFN), R4         ; 0506
                                               4F 13 00074       BEQL    11$                             ;
                                   50      20  A7 9A 00076       MOVZBL  32(IDX_DFN), R0                 ; 0510
                      50           50          01 78 0007A       ASHL    #1, R0, R0                      ;
                                   50          54 D1 0007E       CMPL    R4, R0                          ;
                                               05 12 00081       BNEQ    6$                              ;
                                   52          56 D0 00083       MOVL    REC_ADDR, REND                  ; 0512
                                               89 11 00086 5$:   BRB     1$                              ;
                                   52      20  A7 9A 00088 6$:   MOVZBL  32(IDX_DFN), REND               ; 0514
                                   52          56 C0 0008C       ADDL2   REC_ADDR, REND                  ;
                                               80 11 0008F       BRB     1$                              ; 0496
                                   50      20  A7 9A 00091 7$:   MOVZBL  32(IDX_DFN), R0                 ; 0525
                                   56          50 C0 00095       ADDL2   R0, REC_ADDR                    ;
                                   6E          56 D1 00098       CMPL    REC_ADDR, EOB                   ; 0527
                                               1E 12 0009B       BNEQ    9$                              ;
                                   5B          01 D0 0009D       MOVL    #1, STATUS                      ; 0529
                                               23 11 000A0       BRB     11$                             ;
                                   50      20  A7 9A 000A2 8$:   MOVZBL  32(IDX_DFN), R0                 ; 0540
                                   56          50 C0 000A6       ADDL2   R0, REC_ADDR                    ;
                                   50      20  A7 9A 000A9       MOVZBL  32(IDX_DFN), R0                 ; 0542
                      50           50          01 78 000AD       ASHL    #1, R0, R0                      ;
                                   50          54 D1 000B1       CMPL    R4, R0                          ;
                                               0A 14 000B4       BGTR    10$                             ;
                                   6E          52 D1 000B6       CMPL    REND, EOB                       ; 0550
                                               0A 13 000B9       BEQL    11$                             ;
                                   5B          01 CE 000BB 9$:   MNEGL   #1, STATUS                      ; 0560
                                               05 11 000BE       BRB     11$                             ; 0559
                                   58          56 D0 000C0 10$:  MOVL    REC_ADDR, RSTART                ; 0566
                                               C1 11 000C3       BRB     5$                              ; 0455
                      50           56          55 C3 000C5 11$:  SUBL3   BKT_ADDR, REC_ADDR, R0          ; 0575
                                   50          0E C2 000C9       SUBL2   #14, R0                         ;
                                   51      20  A7 9A 000CC       MOVZBL  32(IDX_DFN), R1                 ;
               0094   C9           50          51 C7 000D0       DIVL3   R1, R0, 148(IRAB)               ;
                                   50          5B D0 000D6       MOVL    STATUS, R0                      ; 0577
                                   5E          04 C0 000D9       ADDL2   #4, SP                          ; 0578
                                         091C  8F BA 000DC       POPR    #^M<R2,R3,R4,R8,R11>            ;
                                                  05 000E0       RSB                                     ;

; Routine Size:  225 bytes,    Routine Base:  RM$RMS3 + 0000


;  516          0579  1
```

```
1 ROUTINE SEARCH_V2 (GOAL) : RL$RABREG_567 =
1 !+++
1 !
1 ! SEARCH_V2
1 !
1 !       This routine searches a prologue two bucket or a prologue 3 data level
1 !       bucket (primary or SIDR) with non-compressed keys for a record whose
1 !       value is equal or greater than the search key.
1 !
1 ! INPUT PARAMETER
1 !
1 !       GOAL    - 0, return if you find an equal or greater than match
1 !               - 1, return only with a greater than match
1 !
1 ! IMPLICIT INPUTS:
1 !       REC_ADDR                - address of record in bucket to begin search on
1 !       BKT_ADDR                - address of current bucket
1 !       IDX_DFN                 - address of index descriptor for current key of reference
1 !       IRAB                    - address of internal RAB
1 !       IRAB[IRB$V_SRCHGT]      - if set, search for index/data record gt search key
1 !       IRAB[IRB$V_POSINSERT]   - if set, search for position to insert record
1 !       IRAB[KEY_BUFFER_2]      - address of search key
1 !       IRAB[IRB$B_KEYSZ]       - size of key to compare
1 !       IFAB[IFB$B_PLG_VER]     - prologue version number
1 !
1 ! OUTPUT PARAMETERS:
1 !       NONE
1 !
1 ! IMPLICIT OUTPUTS:
1 !       REC_ADDR        - if EQ, address of index/record equal to search key
1 !                       - if GT, at end of record data in bucket
1 !                       - if LS, address of index/record greater than search key
1 !        [ DUPS_SEEN ]  - set if duplicates seen when SRCHGT set
1 !        [ DUP_KEY ]    - set if a duplicate key is seen when SRCHGT is set
1 !       IRB$L_LST_NCMP  - Address of last record in bucket if search key > data record
1 !
1 !
1 ! ROUTINE VALUE:
1 !       R0              - 0, search key = index/data record
1 !                       - -1, search key < index/data record
1 !                       - 1,  search key > index/data record
1 !
1 ! SIDE EFFECTS:
1 !       RRV are skipped
1 !       AP is clobbered
1 !
1 !--
2 BEGIN
2
2 EXTERNAL REGISTER
2     R_IRAB_STR,
2     R_IFAB_STR,
2     R_IDX_DFN_STR,
2     R_BKT_ADDR_STR,
2     R_REC_ADDR_STR;
2
2 BUILTIN
```

```
    AP;

LOCAL
    OVHD,
    TOTAL_SIZE,
    STATUS,
    EOB;

EOB = .BKT_ADDR + .BKT_ADDR [BKT$W_FREESPACE];

WHILE .REC_ADDR LSSA .EOB
DO
    BEGIN

    AP = 3;  ! Initialize for a contiguous compare

    BEGIN

    LOCAL
        REC_SIZE;

    ! Search for the 1st record whose key is greater than or
    ! equal to the search key
    !

    IF (REC_SIZE = .BKT_ADDR [BKT$B_LEVEL]) EQL 0
    THEN

        ! We have a data record, check if it is an RRV
        !
        BEGIN

        IF .BKT_ADDR[BKT$B_INDEXNO] EQLU 0
            AND
           .REC_ADDR [IRC$V_RRV]
        THEN
            RETURN GT;

        ! Nope. Do the setup for compare
        !

        IF .IDX_DFN [IDX$B_KEYREF] NEQ 0
        THEN

            ! We have a SIDR data record, set REC_SIZE to -1 as flag
            !
            REC_SIZE = .REC_SIZE - 1

        ELSE

            ! We have a primary data record, set AP to 2 as flag
            !
            AP = .AP - 1;
        END;

    ! Now get the number of bytes of overhead for this record
    !
```

```
4     OVHD = RM$REC_OVHD(.REC_SIZE; REC_SIZE);
4     TOTAL_SIZE = .OVHD + .REC_SIZE;
3     END; ! of block defining rec_size
3
3     ! Do the comparison (finally).  But first set AP to contiguous compare
3     ! again, since the primary key is extracted at the front of the record.
3     !
3
3     IF .IFAB[IFB$B_PLG_VER] EQLU PLG$C_VER_3
3     THEN
3         AP = 3;
3
3     STATUS = RM$COMPARE_KEY (.OVHD + .REC_ADDR,
3                                 KEYBUF_ADDR(2),
3                                 .IRAB [IRB$B_KEYSZ]);
3
3     IF .STATUS LSS 0
3     THEN
3         RETURN .STATUS;
3
3     IF .STATUS EQL 0
3     THEN
3         IF .GOAL EQL 0
3         THEN
3             RETURN EQ
3         ELSE
3             ! We have an equal match but were looking for a GT match.
3             ! Go get the next record and continue comparison (this will
3             ! position past all duplicates).
3             !
4             BEGIN
4             IRAB[IRB$V_DUP_KEY] = 1;
4             IRAB [IRB$L_LST_REC] = .REC_ADDR;
4
5             IF  (.BKT_ADDR[BKT$B_LEVEL] EQLU 0
5                          AND
5                         .BKT_ADDR[BKT$B_INDEXNO] NEQU 0)
4                   OR
5                  NOT (.REC_ADDR[IRC$V_DELETED]
5                        OR
5                       .REC_ADDR[IRC$V_RU_DELETE])
4             THEN
4                 IRAB [IRB$V_DUPS_SEEN] = 1;
3             END;
3
3     REC_ADDR = .REC_ADDR + .TOTAL_SIZE;
2     END;
2
2 ! We have a GT match. Save the address of the last record in
2 ! the bucket (we are positioned past it now).
2 !
2 IRAB [IRB$L_LST_NCMP] = .REC_ADDR - .TOTAL_SIZE;
2
2 RETURN GT
1 END;
```

```
                                                091C     8F BB 00000 SEARCH_V2:
                                                                             PUSHR    #^M<R2,R3,R4,R8,R11>                      ; 0580
                                         5B       04     A5 3C 00004         MOVZWL   4(BKT_ADDR), EOB                          ; 0645
                                         5B              55 C0 00008         ADDL2    BKT_ADDR, EOB                             ;
                                         5B              56 D1 0000B 1$:     CMPL     REC_ADDR, EOB                             ; 0647
                                                         7B 1E 0000E         BGEQU    10$                                       ;
                                         5C              03 D0 00010         MOVL     #3, AP                                    ; 0651
                                         51       0C     A5 9A 00013         MOVZBL   12(BKT_ADDR), REC_SIZE                    ; 0662
                                                         14 12 00017         BNEQ     4$                                        ;
                                                  01     A5 95 00019         TSTB     1(BKT_ADDR)                               ; 0669
                                                         04 12 0001C         BNEQ     2$                                        ;
                           6F            66              03 E0 0001E         BBS      #3, (REC_ADDR), 11$                       ; 0671
                                                  21     A7 95 00022 2$:     TSTB     33(IDX_DFN)                               ; 0678
                                                         04 13 00025         BEQL     3$                                        ;
                                                         51 D7 00027         DECL     REC_SIZE                                  ; 0683
                                                         02 11 00029         BRB      4$                                        ;
                                                         5C D7 0002B 3$:     DECL     AP                                        ; 0689
                                                      0000G 30 0002D 4$:     BSBW     RM$REC_OVHD                               ; 0694
                                         52              50 D0 00030         MOVL     R0, OVHD                                  ;
                           58            52              51 C1 00033         ADDL3    REC_SIZE, OVHD, TOTAL_SIZE                ; 0695
                                         03     00B7     CA 91 00037         CMPB     183(IFAB), #3                             ; 0702
                                                         03 12 0003C         BNEQ     5$                                        ;
                                         5C              03 D0 0003E         MOVL     #3, AP                                    ; 0704
                                         53     00B4     CA 3C 00041 5$:     MOVZWL   180(IFAB), R3                             ; 0707
                                         53       60     A9 C0 00046         ADDL2    96(IRAB), R3                              ;
                           51            52              56 C1 0004A         ADDL3    REC_ADDR, OVHD, R1                        ; 0706
                                         50     00A6     C9 9A 0004E         MOVZBL   166(IRAB), R0                             ;
                                                      0000G 30 00053         BSBW     RM$COMPARE_KEY                            ;
                                         54              50 D0 00056         MOVL     R0, STATUS                                ;
                                                         05 18 00059         BGEQ     6$                                        ; 0710
                                         50              54 D0 0005B         MOVL     STATUS, R0                                ; 0712
                                                         38 11 0005E         BRB      13$                                       ;
                                                         24 12 00060 6$:     BNEQ     9$                                        ; 0714
                                                  18     AE D5 00062         TSTL     GOAL                                      ; 0716
                                                         2F 13 00065         BEQL     12$                                       ;
                                    43   A9              01 88 00067         BISB2    #1, 67(IRAB)                              ; 0725
                                    4C   A9              56 D0 0006B         MOVL     REC_ADDR, 76(IRAB)                        ; 0726
                                                  0C     A5 95 0006F         TSTB     12(BKT_ADDR)                              ; 0728
                                                         05 12 00072         BNEQ     7$                                        ;
                                                  01     A5 95 00074         TSTB     1(BKT_ADDR)                               ; 0730
                                                         08 12 00077         BNEQ     8$                                        ;
                           09            66              02 E0 00079 7$:     BBS      #2, (REC_ADDR), 9$                        ; 0732
                           05            66              05 E0 0007D         BBS      #5, (REC_ADDR), 9$                        ; 0734
                                    44   A9       80     8F 88 00081 8$:     BISB2    #128, 68(IRAB)                            ; 0736
                                         56              58 C0 00086 9$:     ADDL2    TOTAL_SIZE, REC_ADDR                      ; 0739
                                                         80 11 00089         BRB      1$                                        ; 0647
                     0098  C9            56              58 C3 0008B 10$:    SUBL3    TOTAL_SIZE, REC_ADDR, 152(IRAB)           ; 0745
                                         50              01 D0 00091 11$:    MOVL     #1, R0                                    ; 0747
                                                         02 11 00094         BRB      13$                                       ;
                                                         50 D4 00096 12$:    CLRL     R0                                        ; 0748
                                                091C     8F BA 00098 13$:    POPR     #^M<R2,R3,R4,R8,R11>                      ;
                                                            05 0009C         RSB                                                ;

; Routine Size:  157 bytes,    Routine Base:  RM$RMS3 + 00E1
```

```
1 GLOBAL ROUTINE RM$SRCH_BY_KEY : RL$RABREG_567 =
1 !++
1 !
1 !     RM$SRCH_BY_KEY
1 !
1 !         This routine searches a bucket from the current record address
1 !         for an index/data record equal or greater than the input search key
1 !
1 ! CALLING SEQUENCE:
1 !         RM$SRCH_BY_KEY()
1 !
1 ! INPUT PARAMETERS:
1 !         NONE
1 !
1 ! IMPLICIT INPUTS:
1 !         REC_ADDR                - address of record in bucket to begin search on
1 !         BKT_ADDR                - address of current bucket
1 !         IDX_DFN                 - address of index descriptor for current key of reference
1 !         IRAB                    - address of internal RAB
1 !         IRAB[IRB$V_SRCHGT]      - if set, search for index/data record gt search key
1 !         IRAB[IRB$V_POSINSERT]   - if set, search for position to insert record
1 !         IRAB[KEY_BUFFER_2]      - address of search key
1 !         IRAB[IRB$B_KEYSZ]       - size of key to compare
1 !
1 ! OUTPUT PARAMETERS:
1 !         NONE
1 !
1 ! IMPLICIT OUTPUTS:
1 !         REC_ADDR        - if EQ, address of index/record equal to search key
1 !                         - if GT, at end of record data in bucket
1 !                         - if LS, address of index/record greater than search key
1 !         IRAB [ EMPT_SEEN ] - set if no data records encountered
1 !              [ DUPS_SEEN ] - set if duplicates seen when SRCHGT set
1 !              [ DUP_KEY ]   - set if duplicate key seen when SRCHGT is set
1 !
1 ! ROUTINE VALUE:
1 !         R0              - 0, search key = index/data record
1 !                         - -1, search key < index/data record
1 !                         - 1,  search key > index/data record
1 !
1 ! SIDE EFFECTS:
1 !         RRV are skipped
1 !         AP is clobbered
1 !
1 !--
1
2     BEGIN
2
2     EXTERNAL REGISTER
2         COMMON_RAB_STR,
2         R_BKT_ADDR_STR,
2         R_REC_ADDR_STR,
2         R_IDX_DFN_STR;
2
2     LOCAL
2         BKTYP,                  ! Type of bucket we are searching
2         GOAL,                   ! Flag to say 'search past dups'
```

```
;  745      0806  2          STATUS;                     ! Result of a given compare
;  746      0807  2
;  747      0808  2
;  748      0809  2      ! If the record we are about to look at is an RRV, then we have an
;  749      0810  2      ! empty bucket.
;  750      0811  2      !
;  751      0812  2      IF   .BKT_ADDR[BKT$B_LEVEL] EQL 0
;  752      0813  2            AND
;  753      0814  2          .BKT_ADDR[BKT$B_INDEXNO] EQLU 0
;  754      0815  2      THEN
;  755      0816  3          BEGIN
;  756      0817  3          LOCAL
;  757      0818  3              CNTRL: REF BBLOCK;  ! Control byte for 1st record
;  758      0819  3
;  759      0820  3          CNTRL = RM$CNTRL_ADDR(0);
;  760      0821  3
;  761      0822  3          IF .CNTRL [IRC$V_RRV]
;  762      0823  3          THEN
;  763      0824  4              BEGIN
;  764      0825  4              IRAB [IRB$V_EMPT_SEEN] = 1;
;  765      0826  4              RETURN GT
;  766      0827  3              END;
;  767      0828  2          END;
;  768      0829  2
;  769      0830  2      ! Should we be satisfied with an equal match or continue searching
;  770      0831  2      ! for a greater than match ?
;  771      0832  2      !
;  772      0833  2      GOAL = EQ;
;  773      0834  2
;  774      0835  2      IF .IRAB [IRB$V_SRCHGT]
;  775      0836  3          OR (.IRAB [IRB$V_POSINSERT] AND .BKT_ADDR [BKT$B_LEVEL] EQL 0)
;  776      0837  2      THEN
;  777      0838  2          GOAL = GT;
;  778      0839  2
;  779      0840  2      ! Now actually search the !!!!@@## bucket
;  780      0841  2      ! First find out what kind of bucket it is
;  781      0842  2      !
;  782      0843  2
;  783      0844  2      IF .BKT_ADDR [BKT$B_LEVEL] EQL 0
;  784      0845  2      THEN
;  785      0846  2          BKTYP = .IDX_DFN [IDX$B_DATBKTYP]
;  786      0847  2      ELSE
;  787      0848  2          BKTYP = .IDX_DFN [IDX$B_IDXBKTYP];
;  788      0849  2
;  789      0850  2      CASE .BKTYP FROM IDX$C_V2_BKT TO IDX$C_NCMPNCMP OF
;  790      0851  2          SET
;  791      0852  2          [IDX$C_V2_BKT]: ! Prologue two index bucket.
;  792      0853  2                          !
;  793      0854  2                          STATUS = SEARCH_V2 (.GOAL);
;  794      0855  2
;  795      0856  2          [IDX$C_CMPIDX]: ! Prologue three compressed index bucket.
;  796      0857  2                          !
;  797      0858  2                          STATUS = RM$SRCH_CMPR (.GOAL);
;  798      0859  2
;  799      0860  2          [IDX$C_NCMPIDX]: ! Prologue three noncompressed index bucket.
;  800      0861  2                          !
;  801      0862  2                          STATUS = SEARCH_FIX (.GOAL);
;  802          0863  2
;  803          0864  2          [IDX$C_CMPCMP]: ! Prologue three primary data bucket.
;  804          0865  2                          ! Primary key is compressed, data is compressed.
;  805          0866  2                          !
;  806          0867  2                          ! Prologue 3 compressed SIDR bucket.
;  807          0868  2                          !
;  808          0869  2                          STATUS = RM$SRCH_CMPR (.GOAL);
;  809          0870  2
;  810          0871  2          [IDX$C_CMPNCMP]: ! Prologue three primary data bucket.
;  811          0872  2                          ! Primary key is compressed, data is NOT compressed
;  812          0873  2                          !
;  813          0874  2                          STATUS = RM$SRCH_CMPR (.GOAL);
;  814          0875  2
;  815          0876  2          [IDX$C_NCMPCMP]: ! Prologue three data bucket.
;  816          0877  2                          ! Primary key is NOT compressed, data is compressed
;  817          0878  2                          !
;  818          0879  2                          ! Prologue 3 noncompressed SIDR bucket.
;  819          0880  2                          !
;  820          0881  2                          STATUS = SEARCH_V2 (.GOAL);
;  821          0882  2
;  822          0883  2          [IDX$C_NCMPNCMP]: ! Prologue three data bucket.
;  823          0884  2                          ! Primary key is NOT compressed, data is NOT compressed
;  824          0885  2                          !
;  825          0886  2                          STATUS = SEARCH_V2 (.GOAL);
;  826          0887  2          TES;
;  827          0888  2
;  828          0889  2       RETURN .STATUS
;  829          0890  1       END;





                              0C    A5   95 00000 RM$SRCH_BY_KEY::
                                                                TSTB     12(BKT_ADDR)                          ; 0812
                                    19   12 00003               BNEQ     1$                                    ;
                              01    A5   95 00005               TSTB     1(BKT_ADDR)                           ; 0814
                                    14   12 00008               BNEQ     1$                                    ;
                                    7E   D4 0000A               CLRL     -(SP)                                 ; 0820
                                 0000G   30 0000C               BSBW     RM$CNTRL_ADDR                         ;
                   5E               04   C0 0000F               ADDL2    #4, SP                                ;
   08              60               03   E1 00012               BBC      #3, (CNTRL), 1$                       ; 0822
           44      A9               02   88 00016               BISB2    #2, 68(IRAB)                          ; 0825
                   50               01   D0 0001A               MOVL     #1, R0                                ; 0826
                                         05 0001D               RSB                                            ;
                                    51   D4 0001E 1$:           CLRL     GOAL                                  ; 0833
   09      42      A9               01   E0 00020               BBS      #1, 66(IRAB), 2$                      ; 0835
                   08         42    A9   E9 00025               BLBC     66(IRAB), 3$                          ; 0836
                              0C    A5   95 00029               TSTB     12(BKT_ADDR)                          ;
                                    03   12 0002C               BNEQ     3$                                    ;
                   51               01   D0 0002E 2$:           MOVL     #1, GOAL                              ; 0838
                              0C    A5   95 00031 3$:           TSTB     12(BKT_ADDR)                          ; 0844
                                    06   12 00034               BNEQ     4$                                    ;
                   50         29    A7   9A 00036               MOVZBL   41(IDX_DFN), BKTYP                    ; 0846
                                    04   11 0003A               BRB      5$                                    ;
                   50         28    A7   9A 0003C 4$:           MOVZBL   40(IDX_DFN), BKTYP                    ; 0848
   06              00               50   CF 00040 5$:           CASEL    BKTYP, #0, #6                         ; 0850
```

```
      0010          0017          0010          001E    00044 6$:     .WORD   9$-6$,-                            ;
                    001E          001E          0010    0004C                 7$-6$,-                            ;
                                                                              8$-6$,-                            ;
                                                                              7$-6$,-                            ;
                                                                              7$-6$,-                            ;
                                                                              9$-6$,-                            ;
                                                                              9$-6$                              ;
                                                  0E  11 00052        BRB     9$                                 ; 0854
                                                  51  DD 00054 7$:    PUSHL   GOAL                               ; 0858
                                               0000G  30 00056        BSBW    RM$SRCH_CMPR                       ;
                                                  0C  11 00059        BRB     10$                                ;
                                                  51  DD 0005B 8$:    PUSHL   GOAL                               ; 0862
                                                FE22  30 0005D        BSBW    SEARCH_FIX                         ;
                                                  05  11 00060        BRB     10$                                ;
                                                  51  DD 00062 9$:    PUSHL   GOAL                               ; 0886
                                                FEFC  30 00064        BSBW    SEARCH_V2                          ;
                                  5E              04  C0 00067 10$:   ADDL2   #4, SP                             ;
                                                      05 0006A        RSB                                        ; 0890

; Routine Size:  107 bytes,    Routine Base:  RM$RMS3 + 017E

;  830          0891  1
```

```
1 ROUTINE RM$SEARCH_TREE : RL$RABREG_4567 =
1
1 !++
1 !
1 ! FUNCTIONAL DESCRIPTION:
1 !
1 !       This routine searches from the current record in the current bucket
1 !       to the stop level requested for a data record /index equal to or
1 !       greater than the search key.
1 !       NOTE: this ıoutine should never be called by an outside routine
1 !               RM$CSEARCH_TREE should be used in its place
1 !
1 ! CALLING SEQUENCE:
1 !       RM$SEARCH_TREE()
1 !
1 ! INPUT PARAMETERS:
1 !       NONE
1 !
1 ! IMPLICIT INPUTS:
1 !       BKT_ADDR                - address of current bucket
1 !       REC_ADDR                - address of record in bucket to start search at
1 !       IDX_DFN                 - address of index descriptor for current key of reference
1 !       IRAB                    - address of internal RAB
1 !       IRAB[KEYBUF2]           - address of search key
1 !       IRAB[IRB$B_KYSZ]        - size of key to compare(not equal to key size if generic search)
1 !       IRAB[IRB$B_STOPLEVEL]   - level to stop search at
1 !       IRAB[IRB$W_SRCHFLAGS]
1 !       IRAB[IRB$V_POSINSERT]   - if set, this is a position for insert
1 !       IRAB[IRB$V_POSDELETE]   - if set, this is position for delete
1 !       IRAB[IRB$V_SRCHGT]      - if set, this is a GT approximate search
1 !       IRAB[IRB$V_SRCHGE]      - if set, this is a GE approximate search
1 !       IRAB[IRB$V_FIRST_TIM]   - if set, this is the first seq. positioning
1 !                               - after a $connect or $rewind
1 !       IFAB[IFB$B_EXTRABUF]    - used to decide whether to try lockabove
1 !                               performance optimization coming down tree
1 !       IFAB[IFB$V_RU]          - if set, file is RU Journallable
1 !       IFAB[IFB$V_WRTACC]      - if set, file is write accessed
1 !
1 ! OUTPUT PARAMETERS:
1 !       NONE
1 !
1 ! IMPLICIT OUTPUTS:
1 !       REC_ADDR                - address of index/data record which terminated search
1 !       IRAB[IRB$L_CURBDB]      - address of current BDB
1 !       BDB                     - address of current BDB
1 !       IRAB[IRB$L_LOCK_BDB]    - address of level above current if locked
1 !       IRAB[IRB$V_ABOVELCKD]   - set when level above data level locked
1 !       IRAB[IRB$V_DUPS_SEEN]   - set if non-deleted duplicate key encountered
1 !                                       at data level on position for insert
1 !       IRAB[IRB$V_DUP_KEY]     - set if duplicate key encountered at data level
1 !                                       on position for insert
1 !       IRAB [IP3$L_REC_COUNT]  - Set to the number of the record we found in
1 !                                 a prologue three bucket
1 !
1 ! ROUTINE VALUE:
1 !       RMS$_RNF                - record not found
1 !       RMS$_SUC                - record found, in approximate search key
```

```
1 !                                  may not equal record/index key
1 !       RMS$_RLK                 - on an horizontal search at level zero for position
1 !                                  for insert, a lock error was encountered
1 !       miscellaneous I/O errors
1 !
1 ! SIDE EFFECTS:
1 !       IRAB [ EMPT_SEEN ]         - may be clobbered at any level
1 !            [ EMPTY_BKT ]         - may be clobbered at data level
1 !
1 !--
1
2     BEGIN
2
2     LABEL
2         BLK,
2         BLK1,
2         BLK2,
2         BLK3,
2         BLK4,
2         BLK5,
2         BLK6;
2
2     BUILTIN
2         AP,
2         TESTBITSC;
2
2     LOCAL
2         VBN;
2
2     EXTERNAL REGISTER
2         COMMON_RAB_STR,
2         COMMON_IO_STR,
2         R_REC_ADDR_STR,
2         R_IDX_DFN_STR;
2
2     VBN = 0;
2
2     DO
2 BLK2 :
3         BEGIN
3
3         LOCAL
3             ST;
3
3         ST = 0;
3
3         ! if this is the 1st time, just get the 1st down pointer w/o searching
3         !
3
3         IF NOT .IRAB[IRB$V_FIRST_TIM]
3         THEN
3             ST = RM$SRCH_BY_KEY()
3         ELSE
3             IRAB [IRB$L_LST_NCMP] = .BKT_ADDR + BKT$C_OVERHDSZ;
3
3         ! If the status is GT then no record in this bucket terminated the
3         ! search. Therefore search horizontally for termination record.
```

```
3               ! Also search horiz when skipping over dups on position for insert
3               !
3               !
3
3               IF .ST GTR 0
3               THEN
4                   BEGIN
4
4                   LOCAL
4                       SIZE;
4
4                   IF .BKT_ADDR[BKT$V_LASTBKT]
4                   THEN
4
4                       IF .IRAB[IRB$V_POSINSERT]
4                       THEN
5                           RETURN RMSSUC(SUC)
4                       ELSE
4                           RETURN RMSERR(RNF);
4
4                   BDB = .IRAB[IRB$L_CURBDB];
4                   SIZE = .BDB[BDB$W_NUMB];
4
4                   IF .VBN EQL 0
4                   THEN
4                       VBN = .BKT_ADDR[BKT$L_NXTBKT];
4
5                   IF (.IRAB[IRB$V_POSINSERT] AND .BKT_ADDR[BKT$B_LEVEL] EQLU 0)
4                   THEN
5 BLK3 :                BEGIN
5
5                       ! Check if we can insert the new key into the left
5                       !  hand bucket (the one we've got) or if we have to
5                       !  go get the right hand bucket in order to make the
5                       !  decision.
5                       !
5                       ! NEXT_DOWN will be equal to -1 if none was saved,
5                       ! causing this test to fail.  Once this test has been
5                       ! made once, NEXT_DOWN is set to zero, again causing
5                       !  failure on this test.
5                       !
5
5                       IF .VBN EQLU .IRAB [IRB$L_NEXT_DOWN]
5                       THEN
5                           ! Horizontal pointer = down pointer
5                           !
5
6                           IF  NOT (.IDX_DFN [IDX$V_DUPKEYS] AND .IDX_DFN [IDX$B_KEYREF] EQL 0)
5                           THEN
5                               ! Not a primary data bucket with possible duplicates
5                               !
5                               RETURN RMSSUC(SUC);
5
5                       ! If the file is being shared in any way, and the bucket
5                       ! in the level above was not locked coming down the tree,
5                       ! we must re-access the level above to confirm that in
5                       ! fact a split has not occurred and the level above index
```

```
! bucket doesn't have a new key value in the pointer to
! the bucket we are in.  If this is not done, the horizontal
! positioning logic that follows may cause the record to
! be inserted such that it is not accessible by random access.
! The following pictures illustrate.  Assume 1 record per
! bucket at the data level.
!
!   ----
!  : 9  '  level 1     Index looks like this when coming
!   ----               down tree looking to insert an "8".
!    v
!
!  :-9--:  data level
!
!   db 1
!
!  :5-9-:       However, by the time that db 1 is actually
!   ----        accessed, it has split and the index updated.
!  /    \       Yet, because the key value "8" is less than the
! ---  ---      lowest key value in db 2, the position for
!: 5 :: 9 :     insert would be in db 1.  Rescanning the level
! ---  ---      1 bucket for key "8" will now find the correct
!db 1  db 2     down pointer to db 2.
!

! If the down pointer from level 1 can not have changed,
! either because the file is not shared or it is still
! locked, or it has already been checked once, then the
! check does not have to be made.
!

IF .IFAB [IFB$V_NORECLK]
    OR .IRAB [IRB$V_ABOVELCKD]
THEN
    BEGIN
    IF .IRAB [IRB$L_NEXT_DOWN] NEQ 0
    THEN
        BEGIN
        IRAB [IRB$L_VBN_RIGHT] = 0;
        IRAB [IRB$L_NEXT_DOWN] = 0;
        IRAB [IRB$L_VBN_LEFT] = .BDB [BDB$L_VBN];
        END;

    LEAVE BLK3;
    END
ELSE

    ! If NEXT_DOWN is zero, we've already been through
    ! here once, so don't check again.
    !

    IF .IRAB [IRB$L_NEXT_DOWN] EQL 0
    THEN
        LEAVE BLK3;

! The VBN of the level 1 bucket has been saved in the
! VBN_RIGHT field.  Reaccess the bucket.  Release the
! level 0 bucket and exit on errors.
!

ST = CACHE (.IRAB [IRB$L_VBN_RIGHT],
            .IDX_DFN [IDX$B_IDXBKTSZ]*512);
IF NOT .ST
THEN
    BEGIN
    BDB = .IRAB [IRB$L_CURBDB];
    RM$RLSBKT(0);
    IRAB [IRB$L_CURBDB] = 0;
    RETURN .ST;
    END;

! Rescan the level 1 bucket just accessed.  If the
! key value is no longer in the bucket at all, then
! release both level 1 and level 0 buckets and come
! down the tree from the top (returning RLK to CSEARCH_TREE
! does that).
!

REC_ADDR = .BKT_ADDR + BKT$C_OVERHDSZ;
IRAB [IRB$L_REC_COUNT] = 0;
IF RM$SRCH_BY_KEY() GTR 0
THEN
    BEGIN
    ST = RMSERR(RLK);
    RM$RLSBKT(0);
    BDB = .IRAB [IRB$L_CURBDB];
    RM$RLSBKT(0);
    IRAB [IRB$L_CURBDB] = 0;
    RETURN .ST;
    END;

! At this point we've a down pointer in the same level
! 1 bucket.  Check the pointer itself to see if it still
! points to the level 0 bucket we found before.
!

BEGIN

LOCAL
    LEV0_BDB    : REF BBLOCK,
    LEV1_VBN;

LEV0_BDB = .IRAB [IRB$L_CURBDB];
AP = 1;

IF .IFAB [IFB$B_PLG_VER] LSSU PLG$C_VER_3
THEN
    LEV1_VBN - RM$RECORD_VBN()
ELSE
    LEV1_VBN = RM$V3_VBN();

IF .LEV1_VBN NEQ  .LEV0_BDB [BDB$L_VBN]
THEN
```

```
6
6            ! The pointer from the level 1 bucket is not the same,
6            ! but it is in the same level 1 bucket.  Simply release
6            ! the level 0 bucket we have accessed, and go around the
6            ! loop again so that this all happens again.
6            !
7            BEGIN
7            IRAB [IRB$B_SPL_BITS] = 0;
7            IRAB [IRB$L_CURBDB] = .BDB;
7            BDB = .LEV0_BDB;
7            RM$RLSBKT(0);
7            BDB = .IRAB [IRB$L_CURBDB];
7            BKT_ADDR = .BDB [BDB$L_ADDR];
7            REC_ADDR = .BKT_ADDR + BKT$C_OVERHDSZ;
7            LEAVE BLK2;
6            END;
6
6        ! Ok, everything is cool.  The down pointer is still the
6        ! same.  Release the level 1 bucket and prepare to follow
6        ! the horizontal links at the data level for primary key.
6        !
6
6        RM$RLSBKT(0);
6        BDB = .LEV0_BDB;
6        BKT_ADDR = .BDB [BDB$L_ADDR];
5        END;               ! of block defining LEV* locals.
5
5        IRAB [IRB$L_VBN_RIGHT] = 0;
5        IRAB [IRB$L_NEXT_DOWN] = 0;
5        IRAB [IRB$L_VBN_LEFT] = .BDB [BDB$L_VBN];
5
4        END;
4
4    ! Under the following circumstances, the bucket to be read must
4    ! be locked:
4    !
4    ! 1. If this is the stoplevel on any positioning for modification.
4    ! 2. If this is a SIDR bucket and the file is write accessed.
4    ! 3. If this is a primary data bucket, the file is write accessed
4    !    and marked RU Journallable.
4    !
6    IF ((.IRAB[IRB$W_SRCHFLAGS]
6                          AND
5                          (IRB$M_POSINSERT + IRB$M_POSDELETE)) NEQ 0
5                  AND
5                 .IRAB[IRB$B_STOPLEVEL] EQL .BKT_ADDR[BKT$B_LEVEL])
4         OR
6       ((.IRAB[IRB$W_SRCHFLAGS]
6                          AND
5                          (IRB$M_POSINSERT + IRB$M_POSDELETE)) EQLU 0
5                  AND
5                 .IFAB[IFB$V_WRTACC]
5                  AND
5                 .BKT_ADDR[BKT$B_LEVEL] EQLU 0
5                  AND
6                 (.IFAB[IFB$V_RU]
6                          OR
5                       .IDX_DFN[IDX$B_KEYREF] GTRU 0))
4   THEN
4       IRAB [IRB$B_CACHEFLGS] = CSH$M_LOCK;
4
4   ! Release current bucket before reading the next one.
4   !
4
4   RM$RLSBKT(0);
4   IRAB [IRB$L_CURBDB] = 0;
4
4   ! Read in the next bucket in the horizontal chain.
4   !
4
5   IF NOT (ST = RM$GETBKT(.VBN, .SIZE))
4   THEN
5       BEGIN
5
5       ! If the level above was locked, release it.
5       !
5
5       IF TESTBITSC(IRAB[IRB$V_ABOVELCKD])
5       THEN
5           RELEASE(IRAB[IRB$L_LOCK_BDB]);
5
5       RETURN .ST;
4       END;
4
4   VBN = .BKT_ADDR[BKT$L_NXTBKT];
4   IRAB[IRB$L_CURBDB] = .BDB;
4
5   IF (.IRAB[IRB$V_POSINSERT] AND .BKT_ADDR[BKT$B_LEVEL] EQLU 0)
4   THEN
4
4       ! This is a position for insert at level 0.
4       !
4       ! At this point we have just read in the next bucket in the
4       ! horizontal chain.  The position for insert in the bucket
4       ! just released was at the end of that bucket.
4       !
4       ! Basically, if the record is lower than any record in
4       ! the next bucket, it should be inserted at the end of
4       ! the previous bucket.
4       !
4       ! Field usage is as follows:
4       !  IRAB[ VBN_LEFT ] - the leftmost, non-empty bucket in
4       !       which the position for insert was at the end of
4       !       the bucket.
4       !
4       !  IRAB[ VBN_RIGHT ] - the rightmost bucket in which the
4       !       position for insert was at the beginning of the
4       !       bucket, i.e., less than all existing values in
4       !       that bucket, or an empty bucket.  This is used
4       !       to determine if VBN_LEFT may be used after backing
4       !       up.
4       !
4       ! Because the buckets are released prior to accessing the
4       ! next bucket, it is possible for splits to occur prior to
```

```
4	! backing up, if that is necessary.  The following assumptions
4	! are made:
4	! 1) The position for insert can never be to the left of
4	! the initial VBN_LEFT.
4	! 2) The position for insert can never be in or to the right
4	! of a bucket in which the position for insert was at the
4	! beginning of that bucket.
4	! 3) If the NXTBKT link from a VBN_LEFT matches a previously
4	! accessed VBN_RIGHT, the correct position for insert is at
4	! the end of VBN_LEFT.
4	! 4) Empty buckets are skipped over until a non-empty bucket
4	! is encountered.
4
4	! Note that an EMPT_SEEN bucket also returns greater than (GT)
4	! status.  VBN_LEFT and VBN_RIGHT are initialized to zero
4	! in the CSEARCH_TREE routine when positioning for insert and
4	! the stoplevel is 0.
4	!
4
4	WHILE 1 DO
4
5	BEGIN
5
5	REC_ADDR = .BKT_ADDR + BKT$C_OVERHDSZ;
5	IRAB [IRB$L_REC_COUNT] = 0;
5
5	ST = RM$SRCH_BY_KEY();
5
5	IF (VBN=.BKT_ADDR[BKT$L_NXTBKT]) EQL .IRAB[IRB$L_VBN_RIGHT]
5	THEN
6	    BEGIN
6	    IRAB [IRB$L_VBN_LE.T] = 0;
6	    IRAB [IRB$L_VBN_RIGHT] = 0;
7	    RETURN RMSSUC(SUC)
5	    END;
5
5	IF .ST LSS 0
5	    AND
6	    .REC_ADDR EQLA (.BKT_ADDR + BKT$C_OVERHDSZ)
5	    OR
6	    (.BKT_ADDR[BKT$V_LASTBKT] AND .IRAB[IRB$V_EMPT_SEEN])
5	THEN
6	    BEGIN
6
6	    IF .IRAB [IRB$L_VBN_RIGHT] EQL 0
6	    THEN
6	        IRAB [IRB$L_VBN_RIGHT] = .BDB [BDB$L_VBN];
6
6	    VBN = .IRAB [IRB$L_VBN_LEFT];
6	    END
6
5	ELSE
6	    BEGIN
6
6	    IF .ST LEQ 0 OR .BKT_ADDR[BKT$V_LASTBKT]
6	    THEN
7	        BEGIN
```

```
; 1288        1348  7                                  IRAB [IRB$L_VBN_LEFT] = 0;
; 1289        1349  7                                  IRAB [IRB$L_VBN_RIGHT] = 0;
; 1290        1350  7                                  RETURN RM$SUC(SUC);
; 1291        1351  6                                  END;
; 1292        1352  6
; 1293        1353  6                              IF .IRAB [IRB$V_EMPT_SEEN]
; 1294        1354  6                              THEN
; 1295        1355  7                                  BEGIN
; 1296        1356  7                                  IF .IRAB [IRB$L_VBN_RIGHT] EQL 0
; 1297        1357  7                                  THEN
; 1298        1358  7                                      IRAB [IRB$L_VBN_RIGHT] = .BDB [BDB$L_VBN];
; 1299        1359  7                                  END
; 1300        1360  6                              ELSE
; 1301        1361  7                                  BEGIN
; 1302        1362  7                                  IRAB [IRB$L_VBN_RIGHT] = 0;
; 1303        1363  7                                  IRAB [IRB$L_VBN_LEFT] = .BDB [BDB$L_VBN];
; 1304        1364  6                                  END;
; 1305        1365  5                              END;
; 1306        1366  5
; 1307        1367  5                          RM$RLSBKT(0);
; 1308        1368  5                          IRAB [IRB$L_CURBDB] = 0;
; 1309        1369  5                          IRAB [IRB$B_CACHEFLGS] = CSH$M_LOCK;
; 1310        1370  5
; 1311        1371  6                          IF NOT (ST=RM$GETBKT(.VBN,.SIZE))
; 1312        1372  5                          THEN
; 1313        1373  6                              BEGIN
; 1314        1374  6                              IF TESTBITSC (IRAB[IRB$V_ABOVELCKD])
; 1315        1375  6                              THEN
; 1316        1376  6                                  RELEASE(IRAB[IRB$L_LOCK_BDB]);
; 1317        1377  6                              RETURN .ST
; 1318        1378  5                              END;
; 1319        1379  5
; 1320        1380  5                          IRAB [IRB$L_CURBDB] = .BDB;
; 1321        1381  5
; 1322        1382  4                          END;    ! of position for insert level 0 WHILE loop.
; 1323        1383  4                      END         ! of greater than status from srch_by_key.
; 1324        1384  3                  ELSE
; 1325        1385  3
; 1326        1386  3                      ! status was less than or equal meaning we have a down pointer if
; 1327        1387  3                      ! at an index level or may or may not have the data record
; 1328        1388  3                      ! depending upon whether an exact match was desired or not
; 1329        1389  3                      !
; 1330        1390  4                      BEGIN
; 1331        1391  4
; 1332        1392  4                      LOCAL
; 1333        1393  4                          SIZE;
; 1334        1394  4
; 1335        1395  4                      IF .BKT_ADDR[BKT$B_LEVEL] EQLU .IRAB[IRB$B_STOPLEVEL]
; 1336        1396  4                      THEN
; 1337        1397  5                          BEGIN
; 1338        1398  5
; 1339        1399  5                          IF .ST EQL 0
; 1340        1400  5                          THEN
; 1341        1401  6                              RETURN RM$SUC(SUC)
; 1342        1402  5                          ELSE
; 1343        1403  5
; 1344        1404  5                              IF .IRAB[IRB$V_POSINSERT]
```

```
5             OR
5             .IRAB[IRB$V_SRCHGT]
5             OR
5             .IRAB[IRB$V_SRCHGE]
5           THEN
6             RETURN RMSSUC(SUC)
5           ELSE
5             RETURN RMSERR(RNF);
5
4         END;
4
4       ! Get the down pointer from the index record positioned at.
4       !
4
4       IF .IFAB[IFB$B_PLG_VER] LSSU PLG$C_VER_3
4       THEN
5         BEGIN
5         AP = 1;
5         VBN = RM$RF'ORD_VBN();
5         END
4       ELSE        ! Version 3 index bucket
5         BEGIN
5         VBN = RM$V3_VBN();
4         END;
4
4       IF .VBN EQLU 0
4       THEN
4         RETURN (RMSERR(TRE));
4
4       ! Check if about to read data level and switch to data level
4       ! transfer size.
4       !
4       IF .BKT_ADDR[BKT$B_LEVEL] EQLU 1
4       THEN
4         SIZE = .IDX_DFN[IDX$B_DATBKTSZ]
4       ELSE
4         SIZE = .IDX_DFN[IDX$B_IDXBKTSZ];
4
4       SIZE = .SIZE*512;
4
4       ! now check to see if the next level to read needs to be locked
4       !
4       !
4       BDB = .IRAB[IRB$L_CURBDB];          ! get curbdb into bdb
4
4       IF .IRAB[IRB$V_POSINSERT]
4         OR
4         .IRAB[IRB$V_POSDELETE]
4       THEN
4
4         ! lock the stop level if either position for insert or delete
4         !
4         !
4 BLK4 :
5         BEGIN
5
5         LOCAL
```

```
; 1402          1462  5                     STOPLEVCHK  : BYTE;
; 1403          1463  5
; 1404          1464  5                 STOPLEVCHK = .IRAB[IRB$B_STOPLEVEL];
; 1405          1465  5                 STOPLEVCHK = .STOPLEVCHK + 1;
; 1406          1466  5
; 1407          1467  5                 IF .BKT_ADDR[BKT$B_LEVEL] EQL .STOPLEVCHK
; 1408          1468  5                 THEN
; 1409          1469  5 BLK5 :
; 1410          1470  6                     BEGIN
; 1411          1471  6
; 1412          1472  6                     LOCAL
; 1413          1473  6                         REC_SIZE;
; 1414          1474  6
; 1415          1475  6                     ! if the stoplevel not zero, just lock it
; 1416          1476  6                     !
; 1417          1477  6
; 1418          1478  6                     IF .IRAB[IRB$B_STOPLEVEL] NEQ 0
; 1419          1479  6                         OR
; 1420          1480  6                         .IRAB[IRB$V_POSDELETE]
; 1421          1481  6                     THEN
; 1422          1482  7                         BEGIN
; 1423          1483  7                         IRAB[IRB$B_CACHEFLGS] = CSH$M_LOCK;
; 1424          1484  7                         LEAVE BLK5;
; 1425          1485  7
; 1426          1486  6                         END;
; 1427          1487  6
; 1428          1488  6                     ! try to save the next down pointer if it's in this bucket
; 1429          1489  6                     ! to avoid possible i/o at the data level
; 1430          1490  6                     !
; 1431          1491  7 BLK6 :              BEGIN
; 1432          1492  7
; 1433          1493  7                     IRAB [IRB$L_NEXT_DOWN] = -1;
; 1434          1494  7
; 1435          1495  7                     ! See if we're already at the end of the bucket.
; 1436          1496  7                     !
; 1437          1497  7                     CASE .IDX_DFN [IDX$B_IDXBKTYP] FROM IDX$C_V2_BKT TO IDX$C_NCMPIDX OF
; 1438          1498  7                     SET
; 1439          1499  8                     [IDX$C_V2_BKT]: BEGIN
; 1440          1500  8                                 REC_ADDR = .REC_ADDR + RM$REC_OVHD(1; REC_SIZE);
; 1441          1501  8                                 REC_ADDR = .REC_ADDR + .REC_SIZE;
; 1442          1502  7                                 END;
; 1443          1503  7
; 1444          1504  8                     [IDX$C_CMPIDX]: BEGIN
; 1445          1505  8                                 REC_ADDR = .REC_ADDR + .(.REC_ADDR)<0,8> + 2;
; 1446          1506  7                                 END;
; 1447          1507  7
; 1448          1508  8                     [IDX$C_NCMPIDX]:BEGIN
; 1449          1509  8                                 REC_ADDR = .REC_ADDR + .IDX_DFN [IDX$B_KEYSZ];
; 1450          1510  7                                 END;
; 1451          1511  7                     TES;
; 1452          1512  7
; 1453          1513  7                     IF .REC_ADDR GEQA .BKT_ADDR + .BKT_ADDR[BKT$W_FREESPACE]
; 1454          1514  7                     THEN
; 1455          1515  7                         LEAVE BLK6;
; 1456          1516  7
; 1457          1517  7                     IF .IDX_DFN [IDX$B_IDXBKTYP] EQL IDX$C_V2_BKT
; 1458          1518  7                     THEN
```

```
8              BEGIN
8              AP = 1;
8              IRAB [IRB$L_NEXT_DOWN] = RM$RECORD_VBN();
8              END
7          ELSE
8              BEGIN
8              IRAB [IRB$L_REC_COUNT] = .IRAB [IRB$L_REC_COUNT] + 1;
8              IRAB [IRB$L_NEXT_DOWN] = RM$V3_VBN();
7              END;
7
6          END;  ! of BLK6
6
6          ! if we have extrabufs and this bucket is locked then
6          ! we did lockabove optimization so set
6          ! abovelckd to note that and save the bdb in lock_bdb.
6          ! Also, if the blb_ptr is zero and there are extrabufs
6          ! then the file is exclusively accessed therefore the
6          ! optimization may also be made.
6          !
6
6          IF  .IRAB[IRB$B_BCNT] GTRU 2
6          THEN
6              IF .BDB[BDB$L_BLB_PTR] EQL 0
6              THEN
7                  BEGIN
7                  IRAB[IRB$V_ABOVELCKD] = 1;
7                  IRAB[IRB$B_CACHEFLGS] = CSH$M_LOCK OR CSH$M_NOWAIT;
7                  IRAB[IRB$L_LOCK_BDB] = .BDB;
7                  IRAB[IRB$L_CURBDB] = 0;
7                  LEAVE BLK4;
7
7                  END
6              ELSE
6                  IF .BBLOCK[.BDB[BDB$L_BLB_PTR], BLB$V_LOCK]
6                  THEN
7                      BEGIN
7                      IRAB[IRB$V_ABOVELCKD] = 1;
7                      IRAB[IRB$B_CACHEFLGS] = CSH$M_LOCK OR CSH$M_NOWAIT;
7                      IRAB[IRB$L_LOCK_BDB] = .BDB;
7                      IRAB[IRB$L_CURBDB] = 0;
7                      LEAVE BLK4;
7
6                      END;
6
6          ! We are not keeping the level above locked on the
6          ! way down.  Remember the vbn of this level 1 bucket we
6          ! just passed through because it may have to be
6          ! checked when we get to level 0.
6          !
6
6          IRAB [IRB$L_VBN_RIGHT] = .BDB [BDB$L_VBN];
6          IRAB[IRB$B_CACHEFLGS] = CSH$M_LOCK;
6
6          END
5      ELSE
5
5          ! if position for insert and we have the extra buffers and
```

```
5                   ! we are going all the way to level zero, then we will try
5                   ! the performance optimization of keeping the level above
5                   ! the data level locked to avoid going back to the root in
5                   ! the event of a split.
5                   !
5
5                   IF .IRAB[IRB$V_POSINSERT]
5                       AND
5                       .IRAB[IRB$B_STOPLEVEL] EQL 0
5                       AND
5                       .IRAB[IRB$B_BCNT] GTR 2
5                   THEN
6                       BEGIN
6                       STOPLEVCHK = .STOPLEVCHK + 1;
6
6                       IF .BKT_ADDR[BKT$B_LEVEL] EQL .STOPLEVCHK
6                       THEN
6                           BBLOCK[IRAB[IRB$B_CACHEFLGS], CSH$V_LOCK] = 1;
6
5                       END;
5
5               ! release the current bucket before going down
5               !
5               RM$RLSBKT(0);
5               IRAB[IRB$L_CURBDB] = 0;
5               END                                 ! of BLK4
5
5           ! This is not a position for modification. Release the level above
5           ! bucket, and if the next bucket to be obtained is a data bucket,
5           ! the file is write accessed, and either the file is RU Journallable
5           ! or the data bucket to be obtained is a SIDR bucket, then make
5           ! sure the next bucket is locked.
5           !
4           ELSE
5               BEGIN
5
5               ! Determine whether the next bucket to be obtained will have to
5               ! be locked.
5               !
5               IF .IFAB[IFB$V_WRTACC]
5                   AND
5                  .BKT_ADDR[BKT$B_LEVEL] EQLU 1
5                   AND
6                  (.IFAB[IFB$V_RU]
6                        OR
6                       .IDX_DFN[IDX$B_KEYREF] GTRU 0)
5               THEN
5                   IRAB[IRB$B_CACHEFLGS] = CSH$M_LOCK;
5
5               ! Release the current bucket.
5               !
5               RM$RLSBKT(0);
5               IRAB[IRB$L_CURBDB] = 0;
4               END;
4
4           WHILE 1 DO
5               BEGIN
```

```
; 1573          1633  5             ST = RM$GETBKT(.VBN, .SIZE);
; 1574          1634  5
; 1575          1635  5             ! if successful drop out of here
; 1576          1636  5             !
; 1577          1637  5
; 1578          1638  5             IF .ST
; 1579          1639  5             THEN
; 1580          1640  5                 EXITLOOP;
; 1581          1641  5
; 1582          1642  5             ! if abovelckd then release it to
; 1583          1643  5             ! avoid deadlock.  Save the VBN of the level 1
; 1584          1644  5             ! bucket as it will need to be rechecked when level 0
; 1585          1645  5             ! is reached.
; 1586          1646  5             !
; 1587          1647  5
; 1588          1648  5             IF TESTBITSC(IRAB[IRB$V_ABOVELCKD])
; 1589          1649  5             THEN
; 1590          1650  6                 BEGIN
; 1591          1651  6                 BDB = .IRAB[IRB$L_LOCK_BDB];
; 1592          1652  6                 IRAB [IRB$L_VBN_RIGHT] = .BDB [BDB$L_VBN];
; 1593          1653  6                 IRAB[IRB$L_LOCK_BDB] = 0;
; 1594          1654  6                 RM$RLSBKT(0);
; 1595          1655  5                 END;
; 1596          1656  5
; 1597          1657  6             IF .ST<0,16> NEQ RMSERR(RLK)
; 1598          1658  5             THEN RETURN .ST;
; 1599          1659  5
; 1600          1660  5             IRAB [IRB$B_CACHEFLGS] = CSH$M_LOCK;
; 1601          1661  4             END;
; 1602          1662  4
; 1603          1663  4         IRAB[IRB$L_CURBDB] = .BDB;
; 1604          1664  4         VBN = 0;
; 1605          1665  3         END;                                    ! end else block
; 1606          1666  3
; 1607          1667  3     REC_ADDR = .BKT_ADDR + BKT$C_OVERHDSZ;
; 1608          1668  3     IRAB [IRB$L_REC_COUNT] = 0;
; 1609          1669  3     END
; 1610          1670  2 UNTIL 0                                         ! end until loop
; 1611          1671  1 END;



                                            0C  BB 000C0 RM$SEARCH_TREE:
                                                               PUSHR   #^M<R2,R3>                              ; 0892
                              5E            0C  C2 00002       SUBL2   #12, SP                                 ;
                                     04     AE  D4 00005       CLRL    VBN                                     ; 0984
                                            6E  D4 00008 1$:   CLRL    ST                                      ; 0993
                  07       42     A9        06  E0 0000A       BBS     #6, 66(IRAB), 2$                        ; 0998
                                            84  10 0000F       BSBB    RM$SRCH_BY_KEY                          ; 1000
                              6E            50  D0 00011       MOVL    R0, ST                                  ;
                                            06  11 00014       BRB     3$                                      ;
                       0098       C9     0E A5  9E 00016 2$:   MOVAB   14(R5), 152(IRAB)                       ; 1002
                                            6E  D5 0001C 3$:   TSTL    ST                                      ; 1010
                                            03  14 0001E       BGTR    4$                                      ;
                                          0201  31 00020       BRW     39$                                     ;
```

```
               07        0D    A5 E9 00023 4$:    BLBC    13(BKT_ADDR), 5$                ; 1017
               31        42    A9 E8 00027        BLBS    66(IRAB), 9$                    ; 1020
                             0214 31 0002B        BRW     41$                             ;
               54        20    A9 D0 0002E 5$:    MOVL    32(IRAB), BDB                   ; 1026
         08    AE        14    A4 3C 00032        MOVZWL  20(BDB), SIZE                   ; 1027
                         04    AE D5 00037        TSTL    VBN                             ; 1029
                               05 12 0003A        BNEQ    6$                              ;
         04    AE        08    A5 D0 0003C        MOVL    8(BKT_ADDR), VBN                ; 1031
               03        42    A9 E8 00041 6$:    BLBS    66(IRAB), 8$                    ; 1033
                             00D0 31 00045 7$:    BRW     20$                             ;
                         0C    A5 95 00048 8$:    TSTB    12(BKT_ADDR)                    ;
                               F8 12 0004B        BNEQ    7$                              ;
               50      0090    C9 D0 0004D        MOVL    144(IRAB), R0                   ; 1048
               50        04    AE D1 00052        CMPL    VBN, R0                         ;
                               0C 12 00056        BNEQ    11$                             ;
               03        1C    A7 E8 00058        BLBS    28(IDX_DFN), 10$                ; 1053
                             01DE 31 0005C 9$:    BRW     40$                             ;
                         21    A7 95 0005F 10$:   TSTB    33(IDX_DFN)                     ;
                               F8 12 00062        BNEQ    9$                              ;
05       06    AA              03 E0 00064 11$:   BBS     #3, 6(IFAB), 12$                ; 1094
07       06    A9              05 E1 00069        BBC     #5, 6(IRAB), 13$                ; 1095
                               50 D5 0006E 12$:   TSTL    R0                              ; 1098
                               D3 13 00070        BEQL    7$                              ;
                             0099 31 00072        BRW     19$                             ; 1101
                               50 D5 00075 13$:   TSTL    R0                              ; 1114
                               CC 13 00077        BEQL    7$                              ;
               52        16    A7 9A 00079        MOVZBL  22(IDX_DFN), R2                 ; 1125
52             52              09 78 0007D        ASHL    #9, R2, R2                      ;
                               53 D4 00081        CLRL    R3                              ;
               51      008C    C9 D0 00083        MOVL    140(IRAB), R1                   ;
                  00000000G    00 16 00088        JSB     RM$CACHE                        ;
               6E              50 D0 0008E        MOVL    R0, ST                          ;
               1C              6E E9 00091        BLBC    ST, 14$                         ; 1126
               56        0E    A5 9E 00094        MOVAB   14(R5), REC_ADDR                ; 1142
                       0094    C9 D4 00098        CLRL    148(IRAB)                       ; 1143
                             FEF6 30 0009C        BSBW    RM$SRCH_BY_KEY                  ; 1144
                               50 D5 0009F        TSTL    R0                              ;
                               1F 15 000A1        BLEQ    15$                             ;
               6E      82AA    8F 3C 000A3        MOVZWL  #33450, ST                      ; 1147
                               7E D4 000A8        CLRL    -(SP)                           ; 1148
                            0000G 30 000AA        BSBW    RM$RLSBKT                       ;
               5E              04 C0 000AD        ADDL2   #4, SP                          ;
               54        20    A9 D0 000B0 14$:   MOVL    32(IRAB), BDB                   ; 1149
                               7E D4 000B4        CLRL    -(SP)                           ; 1150
                            0000G 30 000B6        BSBW    RM$RLSBKT                       ;
               5E              04 C0 000B9        ADDL2   #4, SP                          ;
                         20    A9 D4 000BC        CLRL    32(IRAB)                        ; 1151
                             02D6 31 000BF        BRW     69$                             ; 1152
               52        20    A9 D0 000C2 15$:   MOVL    32(IRAB), LEV0_BDB              ; 1166
               5C              01 D0 000C6        MOVL    #1, AP                          ; 1167
               03      00B7    CA 91 000C9        CMPB    183(IFAB), #3                   ; 1169
                               05 1E 000CE        BGEQU   16$                             ;
                            0000G 30 000D0        BSBW    RM$RECORD_VBN                   ; 1171
                               03 11 000D3        BRB     17$                             ;
                            0000V 30 000D5 16$:   BSBW    RM$V3_VBN                       ; 1173
         1C    A2              50 D1 000D8 17$:   CMPL    LEV1_VBN, 28(LEV0_BDB)          ; 1175
                               21 13 000DC        BEQL    18$                             ;
```

```
                           44    A9  94 000DE         CLRB    68(IRAB)                             ; 1184
           20  A9                54  D0 000E1         MOVL    BDB, 32(IRAB)                        ; 1185
               54                52  D0 000E5         MOVL    LEV0_BDB, BDB                        ; 1186
                                 7E  D4 000E8         CLRL    -(SP)                                ; 1187
                              0000G  30 000EA         BSBW    RM$RLSBKT                            ;
               5E                04  C0 000ED         ADDL2   #4, SP                               ;
               54          20    A9  D0 000F0         MOVL    32(IRAB), BDB                        ; 1188
               55          18    A4  D0 000F4         MOVL    24(BDB), BKT_ADDR                    ; 1189
               56          0E    A5  9E 000F8         MOVAB   14(R5), REC_ADDR                     ; 1190
                               FF09  31 000FC         BRW     1$                                   ; 1191
                                 7E  D4 000FF 18$:    CLRL    -(SP)                                ; 1199
                              0000G  30 00101         BSBW    RM$RLSBKT                            ;
               5E                04  C0 00104         ADDL2   #4, SP                               ;
               54                52  D0 00107         MOVL    LEV0_BDB, BDB                        ; 1200
               55          18    A4  D0 0010A         MOVL    24(BDB), BKT_ADDR                    ; 1201
                         008C    C9  7C 0010E 19$:    CLRQ    140(IRAB)                            ; 1204
         0088  C9          1C    A4  D0 00112         MOVL    28(BDB), 136(IRAB)                   ; 1206
               05          42    A9  93 00118 20$:    BITB    66(IRAB), #5                         ; 1220
                                 07  13 0011C         BEQL    21$                                  ;
           0C  A5          41    A9  91 0011E         CMPB    65(IRAB), 12(BKT_ADDR)               ; 1222
                                 1A  13 00123         BEQL    22$                                  ;
               05          42    A9  93 00125 21$:    BITB    66(IRAB), #5                         ; 1226
                                 18  12 00129         BNEQ    23$                                  ;
               14          06    AA  E9 0012B         BLBC    6(IFAB), 23$                         ; 1228
                           0C    A5  95 0012F         TSTB    12(BKT_ADDR)                         ; 1230
                                 0F  12 00132         BNEQ    23$                                  ;
05       00A0  CA                01  E0 00134         BBS     #1, 160(IFAB), 22$                   ; 1232
                           21    A7  95 0013A         TSTB    33(IDX_DFN)                          ; 1234
                                 04  13 0013D         BEQL    23$                                  ;
           40  A9                01  90 0013F 22$:    MOVB    #1, 64(IRAB)                         ; 1236
                                 7E  D4 00143 23$:    CLRL    -(SP)                                ; 1241
                              0000G  30 00145         BSBW    RM$RLSBKT                            ;
               5E                04  C0 00148         ADDL2   #4, SP                               ;
                           20    A9  D4 0014B         CLRL    32(IRAB)                             ; 1242
                           08    AE  DD 0014E         PUSHL   SIZE                                 ; 1247
                           08    AE  DD 00151         PUSHL   VBN                                  ;
                              0000G  30 00154         BSBW    RM$GETBKT                            ;
               5E                08  C0 00157         ADDL2   #8, SP                               ;
               6E                50  D0 0015A         MOVL    R0, ST                               ;
               03                6E  E8 0015D         BLBS    ST, 24$                              ;
                               00A1  31 00160         BRW     36$                                  ;
           04  AE          08    A5  D0 00163 24$:    MOVL    8(BKT_ADDR), VBN                     ; 1261
           20  A9                54  D0 00168         MOVL    BDB, 32(IRAB)                        ; 1262
               03          42    A9  E8 0016C         BLBS    66(IRAB), 26$                        ; 1264
                               0237  31 00170 25$:    BRW     72$                                  ;
                           0C    A5  95 00173 26$:    TSTB    12(BKT_ADDR)                         ;
                                 F8  12 00176         BNEQ    25$                                  ;
               56          0E    A5  9E 00178 27$:    MOVAB   14(R5), REC_ADDR                     ; 1314
                         0094    C9  D4 0017C         CLRL    148(IRAB)                            ; 1315
                               FE12  30 00180         BSBW    RM$SRCH_BY_KEY                       ; 1317
               6E                50  D0 00183         MOVL    R0, ST                               ;
           04  AE          08    A5  D0 00186         MOVL    8(BKT_ADDR), VBN                     ; 1319
               50        008C    C9  9E 0018B         MOVAB   140(IRAB), R0                        ;
               60          04    AE  D1 00190         CMPL    VBN, (R0)                            ;
                                 2E  13 00194         BEQL    32$                                  ;
                                 6E  D5 00196         TSTL    ST                                   ; 1327
                                 09  18 00198         BGEQ    28$                                  ;
```

```
                51        0E     A5 9E 0019A         MOVAB   14(R5), R1                      ; 1329
                51               56 D1 0019E         CMPL    REC_ADDR, R1                    ;
                                 09 13 001A1         BEQL    29$                             ;
                15        0D     A5 E9 001A3 28$:    BLBC    13(BKT_ADDR), 31$               ; 1331
10        44    A9               01 E1 001A7         BBC     #1, 68(IRAB), 31$               ;
                                 60 D5 001AC 29$:    TSTL    (R0)                            ; 1335
                                 04 12 001AE         BNEQ    30$                             ;
                60        1C     A4 D0 001B0         MOVL    28(BDB), (R0)                   ; 1337
          04    AE      0088     C9 D0 001B4 30$:    MOVL    136(IRAB), VBN                  ; 1339
                                 27 11 001BA         BRB     35$                             ; 1327
                                 6E D5 001BC 31$:    TSTL    ST                              ; 1345
                                 04 15 001BE         BLEQ    32$                             ;
                08        0D     A5 E9 001C0         BLBC    13(BKT_ADDR), 33$               ;
                        0088     C9 D4 001C4 32$:    CLRL    136(IRAB)                       ; 1348
                                 60 D4 001C8         CLRL    (R0)                            ; 1349
                                 71 11 001CA         BRB     40$                             ; 1350
0A        44    A9               01 E1 001CC 33$:    BBC     #1, 68(IRAB), 34$               ; 1353
                                 60 D5 001D1         TSTL    (R0)                            ; 1356
                                 0E 12 001D3         BNEQ    35$                             ;
                60        1C     A4 D0 001D5         MOVL    28(BDB), (R0)                   ; 1358
                                 08 11 001D9         BRB     35$                             ; 1353
                                 60 D4 001DB 34$:    CLRL    (R0)                            ; 1362
        0088    C9        1C     A4 D0 001DD         MOVL    28(BDB), 136(IRAB)              ; 1363
                                 7E D4 001E3 35$:    CLPL    -(SP)                           ; 1367
                              0000G 30 001E5         BSBW    RM$RLSBKT                       ;
                5E               04 C0 001E8         ADDL2   #4, SP                          ;
                          20     A9 D4 001EB         CLRL    32(IRAB)                        ; 1368
          40    A9               01 90 001EE         MOVB    #1, 64(IRAB)                    ; 1369
                          08     AE DD 001F2         PUSHL   SIZE                            ; 1371
                          08     AE DD 001F5         PUSHL   VBN                             ;
                              0000G 30 001F8         BSBW    RM$GETBKT                       ;
                5E               08 C0 001FB         ADDL2   #8, SP                          ;
                6E               50 D0 001FE         MOVL    R0, ST                          ;
                19               6E E8 00201         BLBS    ST, 38$                         ;
11        04    A9               15 E5 00204 36$:    BBCC    #21, 4(IRAB), 37$               ; 1374
                54      0084     C9 D0 00209         MOVL    132(IRAB), BDB                  ; 1376
                        0084     C9 D4 0020E         CLRL    132(IRAB)                       ;
                                 7E D4 00212         CLRL    -(SP)                           ;
                              0000G 30 00214         BSBW    RM$RLSBKT                       ;
                5E               04 C0 00217         ADDL2   #4, SP                          ;
                               017B 31 0021A 37$:    BRW     69$                             ; 1377
          20    A9               54 D0 0021D 38$:    MOVL    BDB, 32(IRAB)                   ; 1380
                               FF54 31 00221         BRW     27$                             ; 1310
          41    A9        0C     A5 91 00224 39$:    CMPB    12(BKT_ADDR), 65(IRAB)          ; 1395
                                 1E 12 00229         BNEQ    42$                             ;
                                 6E D5 0022B         TSTL    ST                              ; 1399
                                 0E 13 0022D         BEQL    40$                             ;
                0A        42     A9 E8 0022F         BLBS    66(IRAB), 40$                   ; 1404
05        42    A9               01 E0 00233         BBS     #1, 66(IRAB), 40$               ; 1406
05        42    A9               04 E1 00238         BBC     #4, 66(IRAB), 41$               ; 1408
                50               01 D0 0023D 40$:    MOVL    #1, R0                          ; 1410
                                 24 11 00240         BRB     45$                             ;
                50      82B2     8F 3C 00242 41$:    MOVZWL  #33458, R0                      ; 1412
                                 1D 11 00247         BRB     45$                             ; 1404
                03      00B7     CA 91 00249 42$:    CMPB    183(IFAB), #3                   ; 1419
                                 08 1E 0024E         BGEQU   43$                             ;
                5C               01 D0 00250         MOVL    #1, AP                          ; 1422
```

```
                            0000G 30 00253         BSBW     RM$RECORD_VBN                           ; 1423
                               03 11 00256         BRB      44$                                     ;
                            0000V 30 00258 43$:    BSBW     RM$V3_VBN                               ; 1427
           04   AE             50 D0 0025B 44$:    MOVL     R0, VBN                                 ;
                               08 12 0025F         BNEQ     46$                                     ; 1430
                50     86DC    8F 3C 00261         MOVZWL   #34524, R0                              ; 1432
                             014C 31 00266 45$:    BRW      73$                                     ;
                               51 D4 00269 46$:    CLRL     R1                                      ; 1437
                01       0C    A5 91 0026B         CMPB     12(BKT_ADDR), #1                        ;
                               08 12 0026F         BNEQ     47$                                     ;
                               51 D6 00271         INCL     R1                                      ;
                53       17    A7 9A 00273         MOVZBL   23(IDX_DFN), SIZE                       ; 1439
                               04 11 00277         BRB      48$                                     ;
                53       16    A7 9A 00279 47$:    MOVZBL   22(IDX_DFN), SIZE                       ; 1441
  53            53             09 78 0027D 48$:    ASHL     #9, SIZE, SIZE                          ; 1443
                54       20    A9 D0 00281         MOVL     32(IRAB), BDB                           ; 1448
                08       42    A9 E8 00285         BLBS     66(IRAB), 49$                           ; 1450
  03       42   A9             02 E0 00289         BBS      #2, 66(IRAB), 49$                       ; 1452
                             00B2 31 0028E         BRW      63$                                     ;
                50       41    A9 90 00291 49$:    MOVB     65(IRAB), STOPLEVCHK                    ; 1464
                               50 96 00295         INCB     STOPLEVCHK                              ; 1465
                50       0C    A5 91 00297         CMPB     12(BKT_ADDR), STOPLEVCHK                ; 1467
                               03 13 0029B         BEQL     50$                                     ;
                             0086 31 0029D         BRW      62$                                     ;
                         41    A9 95 002A0 50$:    TSTB     65(IRAB)                                ; 1478
                               7F 12 002A3         BNEQ     61$                                     ;
  7A       42   A9             02 E0 002A5         BBS      #2, 66(IRAB), 61$                       ; 1480
                52     0090    C9 9E 002AA         MOVAB    144(IRAB), R2                           ; 1493
                62             01 CE 002AF         MNEGL    #1, (R2)                                ;
  02            00       28    A7 8F 002B2         CASEB    40(IDX_DFN), #0, #2                     ; 1497
001E          0014           0006    002B7 51$:    .WORD    52$-51$,-                               ;
                                                            53$-51$,-                               ;
                                                            54$-51$                                 ;
                51             01 D0 002BD 52$:    MOVL     #1, R1                                  ; 1500
                            0000G 30 002C0         BSBW     RM$REC_OVHD                             ;
                56             50 C0 002C3         ADDL2    R0, REC_ADDR                            ;
                56             51 C0 002C6         ADDL2    REC_SIZE, REC_ADDR                      ; 1501
                               11 11 002C9         BRB      55$                                     ; 1497
                50             66 9A 002CB 53$:    MOVZBL   (REC_ADDR), R0                          ; 1505
                56       02  A046 9E 002CE         MOVAB    2(R0)[REC_ADDR], REC_ADDR               ;
                               07 11 002D3         BRB      55$                                     ; 1497
                50       20    A7 9A 002D5 54$:    MOVZBL   32(IDX_DFN), R0                         ; 1509
                56             50 C0 002D9         ADDL2    R0, REC_ADDR                            ;
                50       04    A5 3C 002DC 55$:    MOVZWL   4(BKT_ADDR), R0                         ; 1513
                50             55 C0 002E0         ADDL2    BKT_ADDR, R0                            ;
                50             56 D1 002E3         CMPL     REC_ADDR, R0                            ;
                               17 1E 002E6         BGEQU    58$                                     ;
                         28    A7 95 002E8         TSTB     40(IDX_DFN)                             ; 1517
                               08 12 002EB         BNEQ     56$                                     ;
                5C             01 D0 002ED         MOVL     #1, AP                                  ; 1520
                            0000G 30 002F0         BSBW     RM$RECORD_VBN                           ; 1521
                               07 11 002F3         BRB      57$                                     ;
                       0094    C9 D6 002F5 56$:    INCL     148(IRAB)                               ; 1525
                            0000V 30 002F9         BSBW     RM$V3_VBN                               ; 1526
                62             50 D0 002FC 57$:    MOVL     R0, (R2)                                ;
                02       54    A9 91 002FF 58$:    CMPB     84(IRAB), #2                            ; 1539
                               19 1B 00303         BLEQU    60$                                     ;
```

```
                        50        10    A4  D0 00305         MOVL    16(BDB), R0                              ; 1541
                                        04  13 00309         BEQL    59$                                      ;
                        0F        0A    A0  E9 0030B         BLBC    10(R0), 60$                              ; 1552
                  06    A9              20  88 0030F  59$:   BISB2   #32, 6(IRAB)                             ; 1555
                  40    A9              03  90 00313         MOVB    #3, 64(IRAB)                             ; 1556
                0084    C9              54  D0 00317         MOVL    BDB, 132(IRAB)                           ; 1557
                                        43  11 0031C         BRB     66$                                      ; 1558
                008C    C9        1C    A4  D0 0031E  60$:   MOVL    28(BDB), 140(IRAB)                       ; 1569
                                        2F  11 00324  61$:   BRB     64$                                      ; 1570
                        2F        42    A9  E9 00326  62$:   BLBC    66(IRAB), 65$                            ; 1582
                                  41    A9  95 0032A         TSTB    65(IRAB)                                 ; 1584
                                        2A  12 0032D         BNEQ    65$                                      ;
                        02        54    A9  91 0032F         CMPB    84(IRAB), #2                             ; 1586
                                        24  1B 00333         BLEQU   65$                                      ;
                                        50  96 00335         INCB    STOPLEVCHK                               ; 1589
                        50        0C    A5  91 00337         CMPB    12(BKT_ADDR), STOPLEVCHK                 ; 1591
                                        1C  12 C033B         BNEQ    65$                                      ;
                  40    A9              01  88 0033D         BISB2   #1, 64(IRAB)                             ; 1593
                                        16  11 00341         BRB     65$                                      ; 1599
                        12        06    AA  E9 00343  63$:   BLBC    6(IFAB), 65$                             ; 1615
                        0F              51  E9 00347         BLBC    R1, 65$                                  ; 1617
      05        00A0    CA              01  E0 0034A         BBS     #1, 160(IFAB), 64$                       ; 1619
                                  21    A7  95 00350         TSTB    33(IDX_DFN)                              ; 1621
                                        04  13 00353         BEQL    65$                                      ;
                  40    A9              01  90 00355  64$:   MOVB    #1, 64(IRAB)                             ; 1623
                                        7E  D4 00359  65$:   CLRL    -(SP)                                    ; 1627
                                     0000G  30 0035B         BSBW    RM$RLSBKT                                ;
                        5E              04  C0 0035E         ArDL2   #4, SP                                   ;
                                  20    A9  D4 00361  66$:   CLRL    32(IRAB)                                 ; 1628
                                        53  DD 00364  67$:   PUSHL   SIZE                                     ; 1633
                                  08    AE  DD 00366         PUSHL   VBN                                      ;
                                     0000G  30 00369         BSBW    RM$GETBKT                                ;
                        5E              08  C0 0036C         ADDL2   #8, SP                                   ;
                        6E              50  D0 0036F         MOVL    R0, ST                                   ;
                        2E              6E  E8 00372         BLBS    ST, 71$                                  ; 1638
      17          04    A9              15  E5 00375         BBCC    #21, 4(IRAB), 68$                        ; 1648
                        54      0084    C9  D0 0037A         MOVL    132(IRAB), BDB                           ; 1651
                008C    C9        1C    A4  D0 0037F         MOVL    28(BDB), 140(IRAB)                       ; 1652
                                0084    C9  D4 00385         CLRL    132(IRAB)                                ; 1653
                                        7E  D4 00389         CLRL    -(SP)                                    ; 1654
                                     0000G  30 0038B         BSBW    RM$RLSBKT                                ;
                        5E              04  C0 0038E         ADDL2   #4, SP                                   ;
                82AA    8F              6E  B1 00391  68$:   CMPW    ST, #33450                               ; 1657
                                        05  13 00396         BEQL    70$                                      ;
                        50              6E  D0 00398  69$:   MOVL    ST, R0                                   ; 1658
                                        18  11 0039B         BRB     73$                                      ;
                  40    A9              01  90 0039D  70$:   MOVB    #1, 64(IRAB)                             ; 1660
                                        C1  11 003A1         BRB     67$                                      ; 1631
                  20    A9              54  D0 003A3  71$:   MOVL    BDB, 32(IRAB)                            ; 1663
                                  04    AE  D4 003A7         CLRL    VBN                                      ; 1664
                        56        0E    A5  9E 003AA  72$:   MOVAB   14(R5), REC_ADDR                         ; 1667
                                0094    C9  D4 003AE         CLRL    148(IRAB)                                ; 1668
                                      FC53  31 003B2         BRW     1$                                       ; 0986
                        5E              0C  C0 003B5  73$:   ADDL2   #12, SP                                  ; 1671
                                        0C  BA 003B8         POPR    #^M<R2,R3>                               ;
                                        05  05 003BA         RSB                                              ;
```

```
; Routine Size:  955 bytes,    Routine Base:  RM$RMS3 + 01E9

; 1612          1672  1
```

```
1 GLOBAL ROUTINE RM$CSEARCH_TREE : RL$RABREG_67 =
1
1 !++
1 !
1 ! FUNCTIONAL DESCRIPTION:
1 !
1 !       This module controls the search through a tree.  If a start position
1 !       is given, the search continues from that point.  If no start position is
1 !       given, then the search begins at the root.  In the position for insert case,
1 !       when a bucket is found on a horizontal search, a record lock error is
1 !       returned from the search tree routine.  This controlling module then
1 !       restarts the search from the root to prevent deadlock.
1 !
1 ! CALLING SEQUENCE:
1 !       RM$CSEARCH_TREE()
1 !
1 ! INPUT PARAMETERS:
1 !       NONE
1 !
1 ! IMPLICIT INPUTS:
1 !       IRAB                    - address of internal RAB
1 !       IRAB[KEYBUFFER 2]       - address of search key
1 !       IRAB[IRB$B_KYSZ]        - size of key to compare(not equal to total key size if
1 !                                 generic search
1 !       IRAB[IRB$B_STOPLEVEL]   - level to stop search at
1 !       IRAB[IRB$W_SRCHFLAGS]   -
1 !       IRAB[IRB$V_POSINSERT]   - if set, this is a position for insert
1 !       IRAB[IRB$V_SRCHGT]      - if set, this is a GT approximate search
1 !       IRAB[IRB$V_SRCHGE]      - if set, this is a GE approximate search
1 !       IRAB[IRB$V_FIRST_TIM]   - if set, this is the 1ST sequential positioning
1 !                               - after a $connect or $rewind
1 !       IRAB[IRB$V_NORLS_RNF]   - if set, do not release on RNF error
1 !       IRAB[IRB$L_CURBDB]      - if zero, then start at root
1 !       IRAB[IRB$L_CURBDB]      - if non-zero, then
1 !       REC_ADDR                - address of record in bucket to start search at
1 !       IDX_DFN                 - address of current index descriptor
1 !
1 !
1 ! OUTPUT PARAMETERS:
1 !       NONE
1 !
1 ! IMPLICIT OUTPUTS:
1 !       REC_ADDR                - address of index/data record which terminated search
1 !       IRAB[IRB$L_CURBDB]      - address of current BDB
1 !       IRAB[IRB$L_LOCK_BDB]    - address of level above current if locked
1 !       IRAB[IRB$V_ABOVELCKD]   - set if level above data level locked
1 !       IRAB[IRB$V_NORLS_RNF]   - always cleared
1 !
1 ! ROUTINE VALUE:
1 !       RMS$_RNF                - record not found
1 !       RMS$_SUC                - record found, in approximate search key
1 !                                 may not equal record/index key
1 !       Miscellaneous I/O errors
1 !
1 ! SIDE EFFECTS:
1 !       if successful, bucket is accessed
1 !       if RNF and NORLS_RNF is set, then bucket is accessed
```

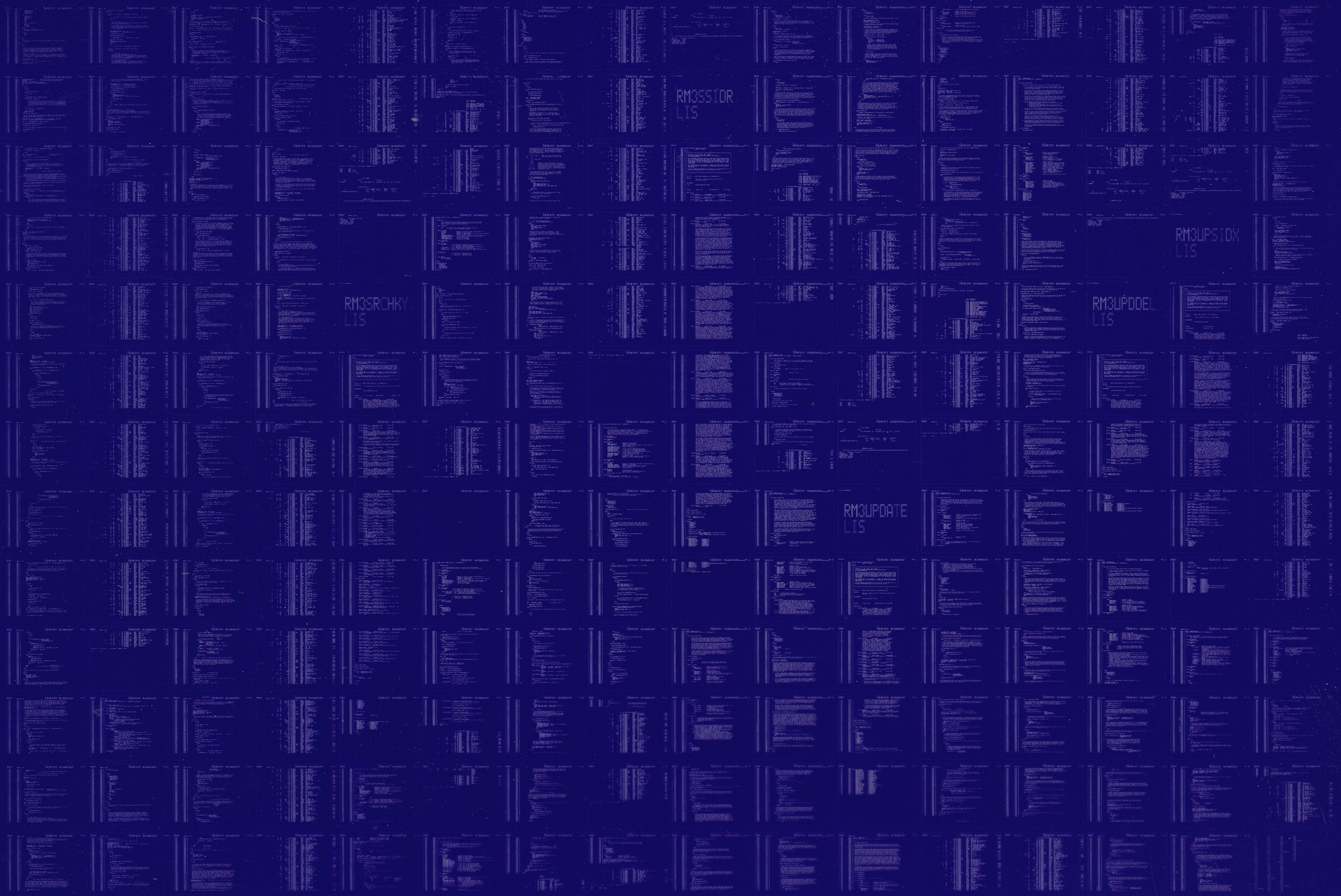
```
  1 !       bucket released on all other errors
  1 !       permanence is set in the root's bdb, if not pos-for-insert
  1 !               or there are extra buffers hanging around
  1 !
  1 !--
  1
  2     BEGIN
  2
  2     EXTERNAL REGISTER
  2         COMMON_RAB_STR,
  2         R_REC_ADDR_STR,
  2         R_IDX_DFN_STR;
  2
  2     GLOBAL REGISTER
  2         R_BDB_STR,
  2         R_BKT_ADDR_STR;
  2
  2     IRAB[IRB$V_ABOVELCKD] = 0;          ! make sure this is clear at the start
  2
  2     WHILE 1
  2     DO
  3         BEGIN
  3         BDB = .IRAB[IRB$L_CURBDB];
  3
  3         IF .BDB EQLU 0
  3         THEN
  3
  3             ! If no position given, start at root
  3             !
  4             BEGIN
  4
  4             ! If the index has not been initialized, read in the index des
  4             ! criptor again if it still has not been initialized, return error
  4             ! Once the index descriptors are shared, this code can come out
  4             ! since when the index is made, the in_core index descriptors will
  4             ! be updated.
  4             !
  4
  4             IF .IDX_DFN[IDX$V_INITIDX]
  4             THEN
  5                 BEGIN
  5                 IRAB[IRB$V_NEW_IDX] = 1;
  5
P 5                 RETURN_ON_ERROR (RM$KEY_DESC(.IDX_DFN[IDX$B_KEYREF]),
P 5                     BEGIN
P 5                     (IRAB[IRB$V_NORLS_RNF] = 0)
  5                     END);
  5
  5                 IF .IDX_DFN[IDX$V_INITIDX]
  5                 THEN
  6                     (IRAB[IRB$V_NORLS_RNF] = 0;
  6
  6                     IF .IRAB[IRB$V_POSINSERT]
  6                     THEN
  7                         RETURN RMSERR(IDX)
  6                     ELSE
  5                         RETURN RMSERR(RNF));
  5
  4         END;
  4
  4     ! Read root and make sure it is still the root.  If not reread
  4     ! prologue to obtain root VBN.
  4     !
  4
  4     WHILE 1
  4     DO
  5         BEGIN
  5
  5         ! if pos for insert then -- if the root should turn out to be
  5         ! the stoplevel then lock it
  5         !
  5
  5         IF .IRAB[IRB$V_POSINSERT]
  5         THEN
  6             BEGIN
  6
  6             IF .IRAB[IRB$B_STOPLEVEL] EQL 0
  6             THEN
  7                 BEGIN
  7
  7                 IRAB [IRB$L_VBN_LEFT] = 0;
  7                 IRAB [IRB$L_VBN_RIGHT] = 0;
  7                 IRAB [IRB$L_NEXT_DOWN] = 0;
  7
  7                 ! If the root is at level 1, we want to save
  7                 ! it's VBN so that the down pointer from it can
  7                 ! be checked when level 0 is reached.
  7                 !
  7
  7                 IF .IDX_DFN [IDX$B_ROOTLEV] EQL 1
  7                 THEN
  7                     IRAB [IRB$L_VBN_RIGHT] = .IDX_DFN [IDX$L_ROOTVBN];
  7                 END
  6             ELSE
  6
  6                 IF .IDX_DFN[IDX$B_ROOTLEV] EQL .IRAB[IRB$B_STOPLEVEL]
  6                 THEN
  6                     IRAB[IRB$B_CACHEFLGS] = CSH$M_LOCK;
  6
  5             END;
  5
  5         ! try to get the root bucket
  5         !
  5
P 5         RETURN_ON_ERROR (RM$GETBKT(.IDX_DFN[IDX$L_ROOTVBN],
P 5                 .IDX_DFN[IDX$B_IDXBKTSZ]*512),
P 5             BEGIN
P 5             (IRAB[IRB$V_NORLS_RNF] = 0)
  5             END);
  5
  5         ! if it really is the root bucket, leave this loop
  5         !
  5
  5         IF .BBLOCK[.BDB[BDB$L_ADDR], BKT$V_ROOTBKT]
  5             THEN
  5                 EXITLOOP;
  5
  5             RM$RLSBKT(0);
  5             IRAB[IRB$V_NEW_IDX] = 1;
  5
P 5             RETURN_ON_ERROR (RM$KEY_DESC(.IDX_DFN[IDX$B_KEYREF]),
P 5                 BEGIN
P 5                 (IRAB[IRB$V_NORLS_RNF] = 0)
  5                 END);
  5
  4             END;
  4
  4         IRAB[IRB$L_CURBDB] = .BDB;
  4
  4         IF NOT .IRAB[IRB$V_POSINSERT]
  4             OR
  5             (.IDX_DFN[IDX$B_KEYREF] LSSU .IFAB[IFB$B_EXTRABUF])
  4         THEN
  4             BDB[BDB$V_PRM] = 1;
  4
  4         REC_ADDR = .BDB[BDB$L_ADDR] + BKT$C_OVERHDSZ;
  4         IRAB[IRB$L_REC_COUNT] = 0;
  4         END
  3     ELSE
  4         BEGIN
  4
  4         IF .IRAB[IRB$V_FIRST_TIM]
  4         THEN
  4             RETURN RMSERR (BUG);
  4
  4         BKT_ADDR = .BDB[BDB$L_ADDR]
  3         END;
  3
  4     BEGIN
  4
  4     LOCAL
  4         STS;
  4
  4     STS = RM$SEARCH_TREE();
  4
  5     IF .STS<0, 16> NEQU RMSERR(RLK)
  4     THEN
  5         BEGIN
  5
  6         IF .STS<0, 16> EQL RMSERR(RNF)
  5             AND
  5             NOT .IRAB[IRB$V_NORLS_RNF]
  5         THEN
  6             BEGIN
  6             IRAB[IRB$L_CURBDB] = 0;
  6             RM$RLSBKT(0)
  5             END;
  5
  5         IRAB[IRB$V_NORLS_RNF] = 0;
  5
  5         RETURN .STS
```

```
; 1842          1901 5              END
; 1843          1902 3          END;
; 1844          1903 3
; 1845          1904 3          IRAB[IRB$B_SPL_BITS] = 0;       ! clear dups_seen, empt_seen when
; 1846          1905 3                                          ! going around again from data level
; 1847          1906 3          END
; 1848          1907 3
; 1849          1908 1      END;                                ! end of routine RM$CSEARCH_TREE
```

```
                            30 BB 00000 RM$CSEARCH_TREE::
                                             PUSHR   #^M<R4,R5>                      ; 1673
        06    A9            20 8A 00002      BICB2   #32, 6(IRAB)                    ; 1747
              54     20     A9 D0 00006 1$:  MOVL    32(IRAB), BDB                   ; 1752
                            03 13 0000A      BEQL    2$                              ; 1754
                          00B3 31 0000C      BRW     12$
  2C    1C    A7            04 E1 0000F 2$:  BBC     #4, 28(IDX_DFN), 4$             ; 1768
        42    A9            08 88 00014      BISB2   #8, 66(IRAB)                    ; 1771
              7E     21     A7 9A 00018      MOVZBL  33(IDX_DFN), -(SP)              ; 1776
                         0000G 30 0001C      BSBW    RM$KEY_DESC                     ;
              5E            04 C0 0001F      ADDL2   #4, SP                          ;
              78            50 E9 00022      BLBC    STATUS, 7$                      ;
  16    1C    A7            04 E1 00025      BBC     #4, 28(IDX_DFN), 4$             ; 1778
        42    A9            20 8A 0002A      BICB2   #32, 66(IRAB)                   ; 1780
              07     42     A9 E9 0002E      BLBC    66(IRAB), 3$                    ; 1782
              50   855C     8F 3C 00032      MOVZWL  #34140, R0                      ; 1786
                            68 11 00037      BRB     8$                              ;
              50   82B2     8F 3C 00039 3$:  MOVZWL  #33458, R0                      ;
                            61 11 0003E      BRB     8$                              ;
              26     42     A9 E9 00040 4$:  BLBC    66(IRAB), 6$                    ; 1802
                     41     A9 95 00044      TSTB    65(IRAB)                        ; 1806
                            16 12 00047      BNEQ    5$                              ;
                   0088     C9 7C 00049      CLRQ    136(IRAB)                       ; 1810
                   0090     C9 D4 0004D      CLRL    144(IRAB)                       ; 1812
              01     15     A7 91 00051      CMPB    21(IDX_DFN), #1                 ; 1819
                            13 12 00055      BNEQ    6$                              ;
      008C    C9     18     A7 D0 00057      MOVL    24(IDX_DFN), 140(IRAB)          ; 1821
                            0B 11 0005D      BRB     6$                              ; 1806
        41    A9     15     A7 91 0005F 5$:  CMPB    21(IDX_DFN), 65(IRAB)           ; 1825
                            04 12 00064      BNEQ    6$                              ;
        40    A9            01 90 00066      MOVB    #1, 64(IRAB)                    ; 1827
              50     16     A7 9A 0006A 6$:  MOVZBL  22(IDX_DFN), R0                 ; 1838
  7E          50            09 78 0006E      ASHL    #9, R0, -(SP)                   ;
                     18     A7 DD 00072      PUSHL   24(IDX_DFN)                     ;
                         0000G 30 00075      BSBW    RM$GETBKT                       ;
              5E            08 C0 00078      ADDL2   #8, SP                          ;
              1F            50 E9 0007B      BLBC    STATUS, 7$                      ;
              50     18     A4 D0 0007E      MOVL    24(BDB), R0                     ; 1843
  1C    0D    A0            01 E0 00082      BBS     #1, 13(R0), 9$                  ;
                            7E D4 00087      CLRL    -(SP)                           ; 1847
                         0000G 30 00089      BSBW    RM$RLSBKT                       ;
        42    A9            08 88 0008C      BISB2   #8, 66(IRAB)                    ; 1848
              6E     21     A7 9A 00090      MOVZBL  33(IDX_DFN), (SP)               ; 1853
                         0000G 30 00094      BSBW    RM$KEY_DESC                     ;
              5E           04 C0 00097        ADDL2   #4, SP                          ;
              A3           50 E8 0009A        BLBS    STATUS, 4$                      ;
        42    A9           20 8A 0009D 7$:    BICB2   #32, 66(IRAB)                   ;
                           62 11 000A1 8$:    BRB     17$                             ;
        20    A9           54 D0 000A3 9$:    MOVL    BDB, 32(IRAB)                   ; 1857
              08     42    A9 E9 000A7        BLBC    66(IRAB), 10$                   ; 1859
      00B6    CA     21    A7 91 000AB        CMPB    33(IDX_DFN), 182(IFAB)          ; 1861
                           04 1E 000B1        BGEQU   11$                             ;
        0A    A4           08 88 000B3 10$:   BISB2   #8, 10(BDB)                     ; 1863
56      18    A4           0E C1 000B7 11$:   ADDL3   #14, 24(BDB), REC_ADDR          ; 1865
                   0094    C9 D4 000BC        CLRL    148(IRAB)                       ; 1866
                           10 11 000C0        BRB     14$                             ; 1754
07      42    A9           06 E1 000C2 12$:   BBC     #6, 66(IRAB), 13$               ; 1871
              50   8434    8F 3C 000C7        MOVZWL  #33844, R0                      ; 1873
                           37 11 000CC        BRB     17$                             ;
              55     18    A4 D0 000CE 13$:   MOVL    24(BDB), BKT_ADDR               ; 1875
                         FB70 30 000D2 14$:   BSBW    RM$SEARCH_TREE                  ; 1883
              51           50 D0 000D5        MOVL    R0, STS                         ;
      82AA    8F           51 B1 000D8        CMPW    STS, #33450                     ; 1885
                           20 13 000DD        BEQL    16$                             ;
      82B2    8F           51 B1 000DF        CMPW    STS, #33458                     ; 1889
                           10 12 000E4        BNEQ    15$                             ;
0B      42    A9           05 E0 000E6        BBS     #5, 66(IRAB), 15$               ; 1891
                     20    A9 D4 000EB        CLRL    32(IRAB)                        ; 1894
                           7E D4 000EE        CLRL    -(SP)                           ; 1895
                        0000G 30 000F0        BSBW    RM$RLSBKT                       ;
              5E           04 C0 000F3        ADDL2   #4, SP                          ;
        42    A9           20 8A 000F6 15$:   BICB2   #32, 66(IRAB)                   ; 1898
              50           51 D0 000FA        MOVL    STS, R0                         ; 1900
                           06 11 000FD        BRB     17$                             ;
                     44    A9 94 000FF 16$:   CLRB    68(IRAB)                        ; 1904
                         FF01 31 00102        BRW     1$                              ; 1749
                           30 BA 00105 17$:   POPR    #^M<R4,R5>                      ; 1908
                              05 00107        RSB                                     ;

; Routine Size:  264 bytes,    Routine Base:  RM$RMS3 + 05A4


; 1850         1909  1
; 1852          1910  1 GLOBAL ROUTINE RM$V3_VBN : RL$RABREG_567 =
; 1853          1911  1 !+++
; 1854          1912  1 !
; 1855          1913  1 ! RM$V3_VBN
; 1856          1914  1 !
; 1857          1915  1 !       This routine returns the VBN associated with record number
; 1858          1916  1 !       'rec_count'. It is only useful on Version 3.0 index buckets.
; 1859          1917  1 !
; 1860          1918  1 !---
; 1861          1919  2 BEGIN
; 1862          1920  2
; 1863          1921  2 EXTERNAL REGISTER
; 1864          1922  2     R_IRAB_STR,
; 1865          1923  2     R_IFAB_STR,
; 1866          1924  2     R_IDX_DFN_STR,
; 1867          1925  2     R_BKT_ADDR_STR,
; 1868          1926  2     R_REC_ADDR_STR;
; 1869          1927  2
; 1870          1928  2 LOCAL
; 1871          1929  2     VBN,                    ! temporary storage
; 1872          1930  2     FIRST_VBN,              ! addr of first VBN in bucket
; 1873          1931  2     VBN_SIZE;               ! size of VBNs in this index bucket
; 1874          1932  2
; 1875          1933  2 VBN_SIZE = (.BKT_ADDR[BKT$V_PTR_SZ]) + 2;
; 1876          1934  2 FIRST_VBN = .BKT_ADDR + (.IDX_DFN[IDX$B_IDXBKTSZ] * 512) - 4 - .VBN_SIZE;
; 1877          1935  2 VBN = .(.FIRST_VBN - (.VBN_SIZE * .IRAB[IRB$L_REC_COUNT]));
; 1878          1936  2 RETURN .VBN <0,.VBN_SIZE ^ 3>
; 1879          1937  1 END;



                                          52  DD 00000 RM$V3_VBN::
                                                             PUSHL   R2                                          ; 1910
       51      0D   A5          02        03  EF 00002       EXTZV   #3, #2, 13(BKT_ADDR), VBN_SIZE              ; 1933
                                51        02  C0 00008       ADDL2   #2, VBN_SIZE                                ;
                                50     16 A7  9A 0000B       MOVZBL  22(IDX_DFN), R0                             ; 1934
                    50          50        09  78 0000F       ASHL    #9, R0, R0                                  ;
                                50        55  C0 00013       ADDL2   BKT_ADDR, R0                                ;
                                50        51  C2 00016       SUBL2   VBN_SIZE, R0                                ;
                                50        04  C2 00019       SUBL2   #4, FIRST_VBN                               ;
                    52          51   0094 C9  C5 0001C       MULL3   148(IRAB), VBN_SIZE, R2                     ; 1935
                                50        52  C2 00022       SUBL2   R2, R0                                      ;
                                52        60  D0 00025       MOVL    (R0), VBN                                   ;
                                51        08  C4 00028       MULL2   #8, R1                                      ; 1936
       50           52          51        00  EF 0002B       EXTZV   #0, R1, VBN, R0                             ;
                                          04  BA 00030       POPR    #^M<R2>                                     ; 1937
                                              05 00032       RSB                                                 ;

; Routine Size:  51 bytes,    Routine Base:  RM$RMS3 + 06AC


; 1880          1938  1 END
; 1881          1939  0 ELUDOM
;                                  PSECT SUMMARY

;       Name                      Bytes                    Attributes

;  RM$RMS3                           1759  NOVEC,NOWRT,  RD ,  EXE,NOSHR,  GBL,  REL,  CON,  PIC,ALIGN(2)


;                            Library Statistics

;                                               -------- Symbols --------       Pages       Processing
;       File                                    Total    Loaded   Percent       Mapped      Time

;  _$255$DUA28:[RMS.OBJ]RMS.L32;1                3109       115         3        154          00:00.4



;                                   COMMAND QUALIFIERS

;       BLISS/CHECK=(FIELD,INITIAL,OPTIMIZE)/LIS=LIS$:RM3SRCHKY/OBJ=OBJ$:RM3SRCHKY MSRC$:RM3SRCHKY/UPDATE=(ENH$:RM3SRCHKY)

; Size:          1759 code + 0 data bytes
; Run Time:         00:44.8
; Elapsed Time:     01:23.0
; Lines/CPU Min:     2597
; Lexemes/CPU-Min: 16722
; Memory Used:  401 pages
; Compilation Complete
```

0328 AH-BT13A-SE
VAX/VMS V4.0

DIGITAL EQUIPMENT CORPORATION
CONFIDENTIAL AND PROPRIETARY


RM3SSIDR
LIS

RM3UPSIDX
LIS

RM3SRCHKY
LIS

RM3UPDDEL
LIS

RM3UPDATE
LIS