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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
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**FILE**ID**RM3UPSIDX                                        E 15
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RRRRRRRR    MM      MM    333333    UU      UU  PPPPPPPP      SSSSSSSS    IIIIII    DDDDDDDD    XX      XX
RRRRRRRR    MM      MM    333333    UU      UU  PPPPPPPP      SSSSSSSS    IIIIII    DDDDDDDD    XX      XX
RR      RR  MMMM  MMMM  33      33  UU      UU  PP      PP  SS              II      DD      DD  XX      XX
RR      RR  MMMM  MMMM  33      33  UU      UU  PP      PP  SS              II      DD      DD  XX      XX
RR      RR  MM  MM  MM          33  UU      UU  PP      PP  SS              II      DD      DD    XX  XX
RR      RR  MM  MM  MM          33  UU      UU  PP      PP  SS              II      DD      DD    XX  XX
RRRRRRRR    MM      MM        33    UU      UU  PPPPPPPP      SSSSSS          II      DD      DD      XX
RRRRRRRR    MM      MM        33    UU      UU  PPPPPPPP      SSSSSS          II      DD      DD      XX
RR  RR      MM      MM          33  UU      UU  PP                  SS      II      DD      DD    XX  XX
RR  RR      MM      MM          33  UU      UU  PP                  SS      II      DD      DD    XX  XX
RR    RR    MM      MM  33      33  UU      UU  PP                  SS      II      DD      DD  XX      XX      ....
RR    RR    MM      MM  33      33  UU      UU  PP                  SS      II      DD      DD  XX      XX      ....
RR      RR  MM      MM    333333    UUUUUUUUUU  PP          SSSSSSSS      IIIIII    DDDDDDDD    XX      XX      ....
RR      RR  MM      MM    333333    UUUUUUUUUU  PP          SSSSSSSS      IIIIII    DDDDDDDD    XX      XX      ....

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
```

```
0 MODULE RM3UPSIDX (LANGUAGE (BLISS32) ,
0                   IDENT = 'V04-000'
0                   ) =
1 BEGIN
1 !
1 !****************************************************************************
1 !*                                                                          *
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1 !*                                                                          *
1 !****************************************************************************
1
1 !++
1 !
1 ! FACILITY:     RMS32 index sequential file organization
1 !
1 ! ABSTRACT:
1 !                insert SIDR data record, all index updates
1 !
1 !
1 ! ENVIRONMENT:
1 !
1 !               VAX/VMS operating system
1 !
1 !--
1
1 !
1 ! AUTHOR:                       Christian Saether
1 !
1 ! CREATION DATE:                20-JUL-78  13:58
1 !
1 ! MODIFIED BY:
1 !
1 !       V03-009 DGB0072         Donald G. Blair         24-Jul-1984
1 !               During a root bucket split, the buckets are carefully
1 !               written to disk in a certain order so as to minimize
1 !               the possiblity of file corruption.  I needed to fix
1 !               the error path so that buckets not yet written out
1 !               to disk at the time of an error are marked as invalid
1 !               so they aren't written out later to corrupt the file.
```

```
1 !
1 !     V03-008 MCN0003         Maria del C. Nasr       15-Mar-1983
1 !             More linkages reorganization
1 !
1 !     V03-007 MCN0002         Maria del C. Nasr       01-Mar-1983
1 !             Reorganize linkages
1 !
1 !     V03-006 TMK0004         Todd M. Katz            01-Feb-1983
1 !             Add support for Recovery Unit Journalling and RMS ROLLBACK
1 !             Recovery. When an attempt is made to insert a duplicate SIDR
1 !             into an index for a key of reference that does not allow
1 !             duplicates, before returning a duplicate key error determine
1 !             whether or not the last element in this SIDR array is marked
1 !             RU_DELETEd. It is only necessary to test the last SIDR array
1 !             element, because any SIDR array for a key of reference that
1 !             does not allow duplicates that is deleted within a Recovery Unit
1 !             is in effect "locked" by the stream doing the deletion for the
1 !             life of the Recovery Unit.
1 !
1 !             If the last SIDR element in the array is not marked RU_DELETE
1 !             then a duplicate key error is returned as before. Likewise, if
1 !             the last SIDR element is marked RU_DELETE but an attempt to
1 !             lock the corresponding primary data record fails because some
1 !             other process has it locked, then RMS concludes that the
1 !             Recovery Unit in which the element was deleted has not
1 !             concluded, and returns the duplicate key error.
1 !
1 !             However, if the last SIDR element in the array is marked
1 !             RU_DELETE and RMS is able to lock the SIDR, then RMS can
1 !             conclude that either it is the current stream that did the
1 !             delete within a Recovery Unit (in which case it already has the
1 !             entire SIDR array "locked"), or the Recovery Unit in which the
1 !             element was deleted (by some other process) has successfully
1 !             terminated. In either case RMS may proceed to insert the new
1 !             SIDR. In the latter case RMS reclaims the entire SIDR before
1 !             inserting the new SIDR, and of course, in the former case no
1 !             space reclamation is possible.
1 !
1 !     V03-005 TMK0003         Todd M. Katz            19-Sep-1981
1 !             Whenever key compression is enabled and a SIDR bucket is to be
1 !             updated, or index compression is enabled and an index bucket is
1 !             to be updated, the key of the new record (found in keybuffer 2)
1 !             is right-shifted two bytes to make room for the two key
1 !             compression overhead bytes, and those bytes are filled in. It
1 !             is also possible that a multi-bucket split occurring at the
1 !             primary data level will require the insertion of two new index
1 !             records into the level one index. The key of the second record
1 !             will be found in keybuffer 3, and it too should be shifted two
1 !             bytes and the key compression overhead bytes filled in
1 !             appropriately. This was not being done, and why everything
1 !             worked up to this point I don't know!
1 !
1 !     V03-004 TMK0002         Todd M. Katz            09-Sep-1981
1 !             The symbol IRB$B_SRCHFLAGS is now a word in size. Change all
1 !             references to it.
1 !
1 !             Add support for prologue SIDRs. This requires only a few minor
```

```
1 !                     modifications to take into account the different structure of
1 !                     of prologue 3 SIDRs from prologue 1 and 2 SIDRs, and that their
1 !                     keys maybe compressed.
1 !
1 !             V03-003 KBT0237         Keith B. Thompson       23-Aug-1982
1 !                     Reorganize psects
1 !
1 !             V03-002 TMK0001         Todd M. Katz            02-Jul-1981
1 !                     Implement the RMS cluster solution for next record positioning.
1 !                     Since there is no longer a NRP list to update, do not bother
1 !                     to update it. In addition, since RMS will never squish out
1 !                     prologue 2 SIDR entries, never call the routine RM$RECVR_SPC
1 !                     (delete it) to reclaim SIDR space. Deleted entries will remain
1 !                     deleted for prologue 1 and 2.
1 !
1 !             V03-001 MCN0001         Maria del C. Nasr       25-Mar-1981
1 !                     Use macro to calculate key buffer address.
1 !
1 !             V018    TMK0001         Todd M. Katz    11-Feb-1982
1 !                     After an index bucket has been split, as part of the
1 !                     preparation for updating the index level immediatly above
1 !                     the current level, clear IRAB[IRB$L_VBN_MID]. There is a
1 !                     possibility that because a new index record must be inserted
1 !                     in the next level's index bucket, that index bucket may
1 !                     split. If the point of insertion of the new high key value
1 !                     resulting from the just split index bucket will be at the
1 !                     split point of the index bucket immediately above it, and
1 !                     if IRAB[IRB$L_VBN_MID] is not zero (which it won't be if a
1 !                     multibucket split occurred at the data level), the bucket
1 !                     at the next level may be incorrectly handled as a two-pass
1 !                     multibucket split instead of as a two-pass non-multibucket
1 !                     split. This will result in the corruption of the new index
1 !                     bucket. It will contain two identical keys with different
1 !                     VBN pointers, the low order key will have the same VBN
1 !                     pointer as the new high order key of the old bucket, and a
1 !                     pointer will be overwritten resulting in an inability to
1 !                     randomly access all records below it.
1 !
1 !             V017    CDS0001         C Saether       30-Aug-1981
1 !                     Reset CURBDB after release with keep lock, as
1 !                     it has changed and become the lock blb.
1 !
1 !             V016    PSK0003         P S Knibbe      09-Aug-1981
1 !                     Add support for splitting index buckets.
1 !
1 !             V015    PSK0002         P S Knibbe      29-Jul-1981
1 !                     Remove support for growing prologue three
1 !                     compressed indexes.
1 !
1 !             V014    PSK0001         P S Knibbe      14-Jun-1981
1 !                     Add support to RM$INS_IF_FIT for prologue three
1 !                     files.
1 !                     Add support to RM$INSS_OR_IDX for UKEY_ONLY
1 !
1 !             V013    CDS0081         C D Saether     26-Feb-1981     22:00
1 !                     Check for errors on split_em.
1 !
```

```
1 !       V012    REFORMAT          D M Walp       24-JUL-1980
1 !
1 !       V011    CDS0080           C D Saethe.    27-FEB-1980
1 !               Don't mark buffers invalid on errors.
1 !
1 !       V010    CDS0072           C D Saether    15-JAN-1980     14:50
1 !               Don't zero or update nrp list unless splitting. (also
1 !               corrects bug calling nrp routines with uninitialized value).
1 !
1 ! REVISION HISTORY:
1 !
1 !   Wendy Koenig,        12-OCT-78  14:51
1 !   X0002 - CHANGE NRP STUFF
1 !
1 !   Wendy Koenig,        24-OCT-78  14:03
1 !   X0003 - MAKE CHANGES CAUSED BY SHARING CONVENTIONS
1 !
1 !   Christian Saether,  12-DEC-78  20:40
1 !   X0004 - handle case where SIDR pointer being added to deleted record
1 !
1 !   Christian Saether,  14-DEC-78  17:39
1 !   X0005 - recvr_spc forces record to be deleted unless positioned for insert
1 !           on it
1 !
1 !   Wendy Koenig,        25-JAN-79  11:26
1 !   X0006 - GET RID OF SETTING VALID
1 !
1 !   Christian Saether,  1-july-79  11:30
1 !   X0007 - set irb$v_dup when dupes seen on alternate
1 !
1 !   Christian Saether,  26-NOV-79  12:10
1 !   0008 - don't force write thru if links don't change
1 !
1 !   Ron Schaefer,        11-JAN-80  16:50
1 !   0009 - clear deleted-sidr flag on each call to RM$SQUISH_SIDR
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 ! linkages
1 !
1 LINKAGE
1     L_PRESERVE1,
1     L_QUERY_AND_LOCK,
1     L_RABREG_4567,
1     L_RABREG_567,
1     L_RABREG_67,
1     L_RABREG_7,
;  229          0293  1       L_RELEASE,
;  230          0294  1       L_SIDR_FIRST,
;  231          0295  1
;  232          0296  1       ! Local Linkage.
;  233          0297  1       !
;  234          0298  1       RL$INS_IF_FIT = JSB ()
;  235          0299  1                   : GLOBAL (R_BKT_ADDR, R_RAB, R_IRAB, R_IFAB, R_REC_ADDR,
;  236          0300  1                           R_IDX_DFN);
;  237          0301  1
;  238          0302  1 ! Forward Routines.
;  239          0303  1 !
;  240          0304  1 FORWARD ROUTINE
;  241          0305  1       RM$INS_IF_FIT           : RL$INS_IF_FIT;
;  242          0306  1
;  243          0307  1
;  244          0308  1 ! External Routines.
;  245          0309  1 !
;  246          0310  1 EXTERNAL ROUTINE
;  247          0311  1       RM$ALLOC_BKT            : RL$RABREG_7,
;  248          0312  1       RM$CSEARCH_TREE         : RL$RABREG_67,
;  249          0313  1       RM$EXT_ARRY_RFA         : RL$RABREG_67,
;  250          0314  1       RM$GETNXT_ARRAY         : RL$RABREG_67,
;  251          0315  1       RM$INS_REC              : RL$RABREG_67,
;  252          0316  1       RM$MOVE                 : RL$PRESERVE1,
;  253          0317  1       RM$NEW_ROOT             : RL$RABREG_4567,
;  254          0318  1       RM$QUERY_PROC           : RL$QUERY_AND_LOCK ADDRESSING_MODE(GENERAL),
;  255          0319  1       RM$RECORD_SIZE          : RL$RABREG_567,
;  256          0320  1       RM$RLNERR               : RL$RELEASE ADDRESSING_MODE(LONG_RELATIVE),
;  257          0321  1       RM$RLSBKT               : RL$PRESERVE1,
;  258          0322  1       RM$SIDR_FIRST           : RL$SIDR_FIRST,
;  259          0323  1       RM$SQUISH_SIDR          : RL$RABREG_567,
;  260          0324  1       RM$SPLIT_EM             : RL$RABREG_67,
;  261          0325  1       RM$UPD_PCG              : RL$RABREG_7;
```

```
1 %SBTTL 'RMS$INSS_OR_IDX'
1 GLOBAL ROUTINE RMS$INSS_OR_IDX : RL$RABREG_567 =
1
1 !++
1 !
1 ! FUNCTIONAL DESCRIPTION:
1 !       Call from level 0 to insert SIDR record and perform all neccessary
1 !       index updates, or from level 1 on primary key to update index
1 !
1 ! CALLING SEQUENCE:
1 !       RMS$INSS_OR_IDX()
1 !
1 ! INPUT PARAMETERS:
1 !       NONE
1 !
1 ! IMPLICIT INPUTS:
1 !               IRAB -                  pointer to internal RAB
1 !                    [ LOCK_BDB ] -     BDB of bucket to access if at level 1 on primary
1 !                                       key and LOCKABOVE used on position for insert
1 !                                       otherwise 0
1 !                    [ CURBDB ] -       locked BDB of level 0 if primary key. This is
1 !                                       released after successfully positioning at current
1 !                                       level 1.  For SIDR insert this is zero on entry
1 !                                       causing search down alternate index from root.
1 !                    [ STOPLEVEL ] -    1 for index update primary key, 0 for SIDR insert
1 !                    [ SPL_BITS ] -     status flags from primary data level split, 0 for
1 !                                       SIDR insert
1 !                    BIG_SPLIT -        more than two bucket split
1 !                    [ VBN_LEFT ] -     VBN of left hand bucket for primary key index
1 !                                       update
1 !                    [ VBN_RIGHT ] -    VBN of right bkt prim key if present
1 !                    [ VBN_MID ] -      middle bkt VBN in 3-4 bkt prim key split case
1 !                    [ SRCHFLAGS ] -    search flags for CSEARCH_TREE
1 !                    POSINSERT -        set to cause position for insert
1 !                    IDX_DFN -          pointer to index descriptor for key of reference
1 !                    [ DUPKEYS ] -      duplicate keys are allowed if set other fields as
1 !                                       used by routines called by this routine
1 !
1 ! OUTPUT PARAMETERS:
1 !       NONE
1 !
1 ! IMPLICIT OUTPUTS:
1 !       NONE
1 !
1 ! ROUTINE VALUE:
1 !       SUC - success
1 !       any error codes from allocation or get bucket routines
1 !
1 ! SIDE EFFECTS:
1 !       NONE
1 !
1 !--
1
2       BEGIN
2
2       LITERAL
2           TRUE = 1,
;   320         0383  2             FALSE = 0;
;   321         0384  2
;   322         0385  2         EXTERNAL REGISTER
;   323         0386  2             COMMON_RAB_STR,
;   324         0387  2             R_REC_ADDR_STR,
;   325         0388  2             R_IDX_DFN_STR,
;   326         0389  2             R_BKT_ADDR_STR;
;   327         0390  2
;   328         0391  2         GLOBAL REGISTER
;   329         0392  2             R_BDB_STR;
;   330         0393  2
;   331         0394  2         LOCAL
;   332         0395  2             ERRSTATUS,
;   333         0396  2             KILL_CUR;           ! Used only for error path -- true if we are to
;   334         0397  2                                 ! throw away the updated contents of IRB$L_CURBDB;
;   335         0398  2                                 ! false if we should write it to disk.
;   336         0399  2
;   337         0400  2         MACRO
;   338         0401  2
;   339       M 0402  2             EXONERR (CALL) =
;   340       M 0403  2             BEGIN
;   341       M 0404  2             IF NOT (ERRSTATUS = (CALL))
;   342       M 0405  2             THEN EXITLOOP
;   343         0406  2             END %,
;   344         0407  2
;   345         0408  2             ! This macro is used to handle errors after we have dirtied the
;   346         0409  2             ! bucket being split but before we have written it to disk.  In
;   347         0410  2             ! such cases, we want to throw away the dirty buffer.
;   348         0411  2             !
;   349       M 0412  2             EXONERR_KILL_CUR (CALL) =
;   350       M 0413  2             BEGIN
;   351       M 0414  2             IF NOT (ERRSTATUS = (CALL))
;   352       M 0415  2             THEN
;   353       M 0416  2                 (KILL_CUR = TRUE;
;   354       M 0417  2                 EXITLOOP)
;   355         0418  2             END %;
;   356         0419  2
;   357         0420  2         ! This routine is constructed as one while loop which is left via a return
;   358         0421  2         ! when no further index updates are neccessary
;   359         0422  2         !
;   360         0423  2
;   361         0424  2         WHILE 1
;   362         0425  2         DO
;   363         0426  3             BEGIN
;   364         0427  3
;   365         0428  3             ! By default, we save the curbdb contents on an error.
;   366         0429  3             KILL_CUR = FALSE;
;   367         0430  3
;   368         0431  3             ! if LOCK_BDB is nonzero then it was not released on the way down the
;   369         0432  3             ! tree and no further action is needed otherwise we must force a search
;   370         0433  3             ! from the root
;   371         0434  3             !
;   372         0435  3
;   373         0436  3             IF (BDB = .IRAB[IRB$L_LOCK_BDB]) NEQ 0
;   374         0437  3             THEN
;   375         0438  4                 BEGIN
;   376         0439  4
;  377           0440  4             ! Swap current and lock bdb's and set up REC_ADDR.
;  378           0441  4             !
;  379           0442  4             REC_ADDR = .BDB[BDB$L_ADDR] + BKT$C_OVERHDSZ;
;  380           0443  4             IRAB[IRB$L_LOCK_BDB] = .IRAB[IRB$L_CURBDB];
;  381           0444  4             IRAB[IRB$L_CURBDB] = .BDB;
;  382           0445  4             END
;  383           0446  3         ELSE
;  384           0447  3
;  385           0448  3             ! Current bdb becomes lock bdb to be released later and curbdb is
;  386           0449  3             ! zeroed to force search from root.
;  387           0450  3             !
;  388           0451  4             BEGIN
;  389           0452  4             IRAB[IRB$L_LOCK_BDB] = .IRAB[IRB$L_CURBDB];
;  390           0453  4             IRAB[IRB$L_CURBDB] = 0;
;  391           0454  3             END;
;  392           0455  3
;  393           0456  3         EXONERR(RM$CSEARCH_TREE());
;  394           0457  3
;  395           0458  3         BKT_ADDR = .BBLOCK[.IRAB[IRB$L_CURBDB], BDB$L_ADDR];
;  396           0459  3
;  397           0460  3         ! REC_ADDR is now pointing to the position of insert of the new record.
;  398           0461  3         ! If this is a prologue three bucket with compressed key records, then
;  399           0462  3         ! then shift the contents of keybuffer 2 down two bytes so that
;  400           0463  3         ! all key buffers look alike.
;  401           0464  3         !
;  402           0465  5         IF ((.BKT_ADDR[BKT$B_LEVEL] EQLU 0
;  403           0466  5                          AND
;  404           0467  5                         .IDX_DFN[IDX$V_KEY_COMPR])
;  405           0468  4              OR
;  406           0469  5             (.BKT_ADDR[BKT$B_LEVEL] NEQU 0
;  407           0470  5                          AND
;  408           0471  4                         .IDX_DFN[IDX$V_IDX_COMPR]))
;  409           0472  3         THEN
;  410           0473  4             BEGIN
;  411           0474  4
;  412           0475  4             MACRO
;  413           0476  4                 KEYLEN          = 0,0,8,0 %,
;  414           0477  4                 FRNT_CMPR       = 1,0,8,0 %;
;  415           0478  4
;  416           0479  4             LOCAL
;  417           0480  4                 BUFF : REF BBLOCK;
;  418           0481  4
;  419           0482  4             BUFF = KEYBUF_ADDR(2);
;  420           0483  4             RM$MOVE (.IRAB[IRB$B_KEYSZ], .BUFF, .BUFF+2);
;  421           0484  4             BUFF [KEYLEN] = .IRAB [IRB$B_KEYSZ];
;  422           0485  4             BUFF [FRNT_CMPR] = 0;
;  423           0486  4
;  424           0487  4             ! If the level 1 index is to be updated with two index records
;  425           0488  4             ! because a multi-bucket split has taken place at the primary data
;  426           0489  4             ! record, then the key of the second index record (in keybuffer 3)
;  427           0490  4             ! should also be shifted down two bytes and the size and front
;  428           0491  4             ! compression count filled in so that all keybuffers continue to
;  429           0492  4             ! look alike.
;  430           0493  4             !
;  431           0494  4             IF .IRAB[IRB$V_BIG_SPLIT]
;  432           0495  4             THEN
;  433           0496  5                 BEGIN
```

```
5               BUFF = KEYBUF_ADDR(3);
5               RM$MOVE (.IRAB[IRB$B_KEYSZ], .BUFF, .BUFF+2);
5               BUFF [KEYLEN] = .IRAB [IRB$B_KEYSZ];
5               BUFF [FRNT_CMPR] = 0;
4               END;
3           END;
3
3       ! If RMS is positioning to insert a SIDR and a duplicate was encountered
3       ! during positioning then investigate further as to whether this does
3       ! or doesn't represent an error.
3       !
3       IF .IRAB[IRB$B_STOPLEVEL] EQL 0
3       THEN
4           BEGIN
4
4           IF .IRAB[IRB$V_DUPS_SEEN]
4           THEN
4
4               ! If duplicates were seen and this key of reference does not
4               ! allow duplicate keys then this will represent an error unless
4               ! all the elements in the array were deleted within a Recovery
4               ! Unit that has since terminated successfully or by the current
4               ! stream whose process is still within a Recovery Unit.
4               !
4               IF NOT .IDX_DFN[IDX$V_DUPKEYS]
4               THEN
5                   BEGIN
5
5                   LOCAL
5                       BEG_OF_SIDR,
5                       END_OF_SIDR,
5                       LAST_SIDR : REF BBLOCK;
5
5                   ! Position to the last element in the current SIDR array.
5                   ! It is only necessary to determine the status of this
5                   ! element in order to determine whether or not the
5                   ! insertion of this duplicate represents an error or not.
5                   !
5                   END_OF_SIDR = .REC_ADDR;
5                   REC_ADDR    = .IRAB[IRB$L_LST_REC];
5                   BEG_OF_SIDR = .REC_ADDR;
5                   REC_ADDR    = RM$SIDR_FIRST (0);
5
5                   DO
6                       BEGIN
6                       LAST_SIDR = .REC_ADDR;
6                       RM$GETNXT_ARRAY();
6                       END
5                   UNTIL .REC_ADDR GEQA .END_OF_SIDR;
5
5                   ! If the last element in the current SIDR array was deleted
5                   ! within a Recovery Unit, then RMS may still be able to
5                   ! insert this new element provided it would be able to
5                   ! lock the primary data record the SIDR element points to.
5                   ! Being able to lock the record will indicate either that
5                   ! the Recovery Unit in which the SIDR element was deleted
5                   ! has successfully terminated, or that it was the current
```

```
;  491       0554  5                  ! stream that deleted the element within a Recovery Unit
;  492       0555  5                  ! (which may still be active). In either case, RMS may
;  493       0556  5                  ! consider the element to be deleted, and as all elements
;  494       0557  5                  ! in the array would then be deleted, RMS can proceed to
;  495       0558  5                  ! insert the new element.
;  496       0559  5                  !
;  497       0560  5                  IF .LAST_SIDR[IRC$V_RU_DELETE]
;  498       0561  5                  THEN
;  499       0562  6                      BEGIN
;  500       0563  6
;  501       0564  6                      LOCAL
;  502       0565  6                          ID,
;  503       0566  6                          TEMP_STATUS,
;  504       0567  6                          VBN;
;  505       0568  6
;  506       0569  6                      ! Extract the RFA out of the SIDR and determine without
;  507       0570  6                      ! waiting the lock status of the corresponding primary
;  508       0571  6                      ! data record.
;  509       0572  6                      !
;  510       0573  6                      REC_ADDR = .LAST_SIDR;
;  511       0574  6                      RM$EXT_ARRY_RFA (VBN, ID);
;  512       0575  6                      IRAB[IRB$V_NO_Q_WAIT] = 1;
;  513       0576  6
;  514       0577  6                      ! If RMS is able to lock the corresponding primary data
;  515       0578  6                      ! record, then it may treat the SIDR array element as
;  516       0579  6                      ! being deleted and proceed to insert the new element.
;  517       0580  6                      !
;  518       0581  7                      IF (TEMP_STATUS = RM$QUERY_PROC (.VBN, .ID))
;  519       0582  6                      THEN
;  520       0583  6
;  521       0584  6                          ! If the last element was deleted within another
;  522       0585  6                          ! process's Recovery Unit, or if the current
;  523       0586  6                          ! process is not in a Recovery Unit, then RMS may
;  524       0587  6                          ! perform some space reclamation before inserting
;  525       0588  6                          ! the new element. Space reclamation will consist
;  526       0589  6                          ! of deleting the entire SIDR array.
;  527       0590  6                          !
;  528       0591  7                          IF   .TEMP_STATUS<0,16> EQLU RMSSUC()
;  529       0592  6                               OR
;  530       0593  6                              NOT .IFAB[IFB$V_RUP]
;  531       0594  6                          THEN
;  532       0595  7                              BEGIN
;  533       0596  7                              RM$SQUISH_SIDR (0, .BEG_OF_SIDR);
;  534       0597  7                              IRAB[IPB$V_DUPS_SEEN] = 0;
;  535       0598  7                              IRAB[IRB$V_DUP_KEY] = 0;
;  536       0599  7                              END
;  537       0600  7
;  538       0601  7                          ! Otherwise, RMS can not perform any space
;  539       0602  7                          ! reclamation, and instead positions to the
;  540       0603  7                          ! insertion point of the new element.
;  541       0604  7                          !
;  542       0605  6                          ELSE
;  543       0606  6                              RM$GETNXT_ARRAY()
;  544       0607  6
;  545       0608  6                      ! If RMS is not able to lock the primary data record
;  546       0609  6                      ! that the last SIDR element points to then RMS can not
;  547       0610  6                      ! consider all the elements in the SIDR array to be
```

```
6                                       ! deleted. In this case RMS can not insert this new
6                                       ! new element, but instead returns a duplicate key
6                                       ! error. If RMS were to insert the SIDR and the
6                                       ! Recovery Unit failed, then after Recovery Unit
6                                       ! ROLLBACK this SIDR array would have two non-deleted
6                                       ! elements even though this key of reference does not
6                                       ! allow duplicates.
6                                       !
6                                       ELSE
6                                           ERRSTATUS = RMSERR(DUP);
6                                       END
6
6                                   ! If the last element in the current SIDR array was not
6                                   ! deleted within a Recovery Unit, then RMS can not insert
6                                   ! this new element and instead must return a duplicate key
6                                   ! error.
6                                   !
5                                   ELSE
5                                       ERRSTATUS = RMSERR(DUP);
5
6                                   IF .ERRSTATUS<0,16> EQLU RMSERR(DUP)
5                                   THEN
5                                       EXITLOOP;
5                                   END
5
5                               ! As this key of reference allows duplicate keys, and a
5                               ! duplicate was seen, save that information so that the proper
5                               ! success status may eventually be returned.
5                               !
4                               ELSE
4                                   IRAB[IRB$V_DUP] = 1;
4
4                           END
4
4                       ! If this wasn't position to level 0 then release lock on level
4                       ! below after positioning to point of insert above.
4                       !
3                       ELSE
3                           RELEASE(IRAB[IRB$L_LOCK_BDB]);
3
3                       BDB = .IRAB[IRB$L_CURBDB];
3                       BDB[BDB$V_DRT] = T;
3
3                       ! Now try to put the record into the existing bucket - success if it
3                       ! fits.
3                       !
3                       IF RM$INS_IF_FIT()
3                       THEN
4                           BEGIN
4
4                           ! Record fits without splitting so release lock bdb (there is
4                           ! one only at level 0 when lock above was used on positioning)
4                           ! write thru bucket and return.
4                           !
4                           LOCAL
4                               FLAGS;
4
```

```
;  605      0668  4               FLAGS = 0;
;  606      0669  4
;  607      0670  4               IF (BDB = .IRAB[IRB$L_LOCK_BDB]) NEQ 0
;  608      0671  4               THEN
;  609      0672  5                   BEGIN
;  610      0673  5                   IRAB[IRB$L_LOCK_BDB] = 0;
;  611      0674  5                   RM$RLSBKT(0);
;  612      0675  4                   END;
;  613      0676  4
;  614      0677  4               BDB = .IRAB[IRB$L_CURBDB];
;  615      0678  4               IRAB[IRB$L_CURBDB] = 0;
;  616      0679  4               RETURN RM$RLSBKT(.FLAGS);
;  617      0680  4
;  618      0681  3               END;
;  619      0682  3
;  620      0683  3           ! Allocate a new bucket to split into.
;  621      0684  3
;  622      0685  3           EXONERR(RM$ALLOC_BKT());
;  623      0686  3
;  624      0687  3           ! If LOCKABOVE was used and we are doing a SIDR data level split there
;  625      0688  3           ! are now 3 buffers in use.
;  626      0689  3           !
;  627      0690  3           BDB = .IRAB[IRB$L_NXTBDB];
;  628      0691  3
;  629      0692  3           ! Split the bucket !!!
;  630      0693  3           !
;  631      0694  4           IF NOT (ERRSTATUS = RM$SPLIT_EM())
;  632      0695  3           THEN
;  633      0696  4               BEGIN
;  634      0697  4               BDB [BDB$V_VAL] = 0;
;  635      0698  4               IRAB [IRB$L_NXTBDB] = 0;
;  636      0699  4               RM$RLSBKT(0);
;  637      0700  4               BBLOCK [.IRAB[IRB$L_CURBDB], BDB$V_VAL] = 0;
;  638      0701  4               EXITLOOP
;  639      0702  3               END;
;  640      0703  3
;  641      0704  3           ! Now save the VBN of the new bucket for next level update.
;  642      0705  3           !
;  643      0706  3           IRAB[IRB$L_VBN_RIGHT] = .BDB[BDB$L_VBN];
;  644      0707  3           BDB[BDB$V_DRT] = 1;
;  645      0708  3           IRAB[IRB$L_NXTBDB] = 0;
;  646      0709  3
;  647      0710  3           ! We must clear VBN_MID for the next level update as a precaution.
;  648      0711  3           ! If the current index bucket split was for a multibucket data level
;  649      0712  3           ! split, the update at the next level could be done incorrectly if
;  650      0713  3           ! that index bucket split and the point of insertion of the new key
;  651      0714  3           ! was at the split point, and if this VBN cell is not zero.
;  652      0715  3           !
;  653      0716  3           IRAB[IRB$L_VBN_MID] = 0;
;  654      0717  3
;  655      0718  3           ! Write the new bucket.
;  656      0719  3           !
;  657      0720  3           EXONERR_KILL_CUR(RM$RLSBKT(RLS$M_WRT_THRU));
;  658      0721  3
;  659      0722  3           ! If this was a continuation bucket then no index update is neccessary
;  660      0723  3           ! so release lock bdb if any and write out current bdb.
;  661      0724  3           !
```

```
3    IF .IRAB[IRB$V_CONT_BKT]
3    THEN
4        BEGIN
4
4        LOCAL
4            FLAGS;
4
4        FLAGS = RLS$M_WRT_THRU;
4
4        IF (BDB = .IRAB[IRB$L_LOCK_BDB]) NEQ 0
4        THEN
5            (IRAB[IRB$L_LOCK_BDB] = 0;
4            RM$RLSBKT(0T));
4
4        BDB = .IRAB[IRB$L_CURBDB];
4        IRAB[IRB$L_CURBDB] = 0;
4        RETURN RM$RLSBKT(.FLAGS);
4
3        END;
3
3    ! Set up BDB and BKT_ADDR for new root code if taken or releasing
3    ! CURBDB if not and VBN_LEFT for next pass, i.e., the index update or
3    ! new root generation.
3    !
3    BDB = .IRAB[IRB$L_CURBDB];
3    BKT_ADDR = .BDB[BDB$L_ADDR];
3    IRAB[IRB$L_VBN_LEFT] = .BDB[BDB$L_VBN];
3
3    IF .BKT_ADDR[BKT$V_ROOTBKT]
3        AND
3        .BKT_ADDR[BKT$B_LEVEL] EQL .IDX_DFN[IDX$B_ROOTLEV]
3    THEN
3
3        ! This is a root bucket which split so link in new bucket make new
3        ! root, make non root out of old bucket.
3        !
4        BEGIN
4        BKT_ADDR[BKT$V_ROOTBKT] = 0;
4        EXONERR_KILL_CUR(RM$ALLOC_BKT());
4
4        ! Restore next bucket link of original bucket that got clobbered
4        ! when we linked in a bucket for the new root.
4        !
4        BKT_ADDR[BKT$L_NXTBKT] = .IRAB[IRB$L_VBN_RIGHT];
4
4        ! Set up BDB and BKT_ADDR for NEW_ROOT.
4        !
4        BDB = .IRAB[IRB$L_NXTBDB];
4        BKT_ADDR = .BDB[BDB$L_ADDR];
4        RM$NEW_ROOT();
4
4        ! Write out and release new root.
4        !
4        BDB[BDB$V_DRT] = 1;
4        IRAB[IRB$[_NXTBDB] = 0;
4        EXONERR_KI[L_CUR(RM$RLSBKT(RLS$M_WRT_THRU));
4
```

```
;  719        0782  4                  ! Update all relevant prologue information.
;  720        0783  4                  !
;  721        0784  4                  EXONERR_KILL_CUR(RM$UPD_PLG());
;  722        0785  4
;  723        0786  4                  ! Now write out original root bucket.
;  724        0787  4                  !
;  725        0788  4                  BDB = .IRAB[IRB$L_CURBDB];
;  726        0789  4                  IRAB[IRB$L_CURBDB] = 0;
;  727        0790  4                  RETURN (RM$RLSBKT(RLS$M_WRT_THRU));
;  728        0791  4
;  729        0792  3                  END;
;  730        0793  3
;  731        0794  3              ! Write out current BDB keeping lock on it until positioned to level
;  732        0795  3              ! above on index update.
;  733        0796  3              !
;  734      P 0797  3              EXONERR(RM$RLSBKT(RLS$M_WRT_THRU
;  735      P 0798  3                      OR
;  736        0799  3                      RLS$M_KEEP_LOCK));
;  737        0800  3              IRAB[IRB$L_CURBDB] = .BDB;
;  738        0801  3
;  739        0802  3              IRAB[IRB$B_STOPLEVEL] = .IRAB[IRB$B_STOPLEVEL] + 1;
;  740        0803  3              IRAB[IRB$W_SRCHFLAGS] = IRB$M_POSINSERT;
;  741        0804  3              IRAB[IRB$B_SPL_BITS] = 0;
;  742        0805  2              END;     ! end of WHILE loop
;  743        0806  2
;  744        0807  2          ! This is the error code to release LOCK_BDB and CURBDB if they
;  745        0808  2          ! are non-zero. This code is only executed on errors.
;  746        0809  2          !
;  747        0810  2          IF (BDB = .IRAB[IRB$L_LOCK_BDB]) NEQ 0
;  748        0811  2          THEN
;  749        0812  3              (IRAB[IRB$L_LOCK_BDB] = 0;
;  750        0813  2              RM$RLSBKT(0));
;  751        0814  2
;  752        0815  2          ! If .kill_cur is true, we call release-no-error to pitch the
;  753        0816  2          ! dirty contents of the curbdb buffer, else we call release-bucket
;  754        0817  2          ! to release the buffer but save the contents.
;  755        0818  2          !
;  756        0819  2          IF (BDB = .IRAB[IRB$L_CURBDB]) NEQ 0
;  757        0820  2          THEN
;  758        0821  3              BEGIN
;  759        0822  3              IRAB[IRB$L_CURBDB] = 0;
;  760        0823  3              IF .KILL_CUR THEN
;  761        0824  3                  RM$RLNERR(0)
;  762        0825  3              ELSE
;  763        0826  3                  RM$RLSBKT(0);
;  764        0827  2              END;
;  765        0828  2
;  766        0829  2          RETURN .ERRSTATUS;
;  767        0830  2
;  768        0831  1          END;


                                                               .TITLE  RM3UPSIDX
                                                               .IDENT  \V04-000\

                                                               .EXTRN  RM$ALLOC_BKT, RM$CSEARCH_TREE
                                                               .EXTRN  RM$EXT_ARRY_RFA
```

```
                                                  .EXTRN  RM$GETNXT_ARRAY
                                                  .EXTRN  RM$INS_REC, RM$MOVE
                                                  .EXTRN  RM$NEW_ROOT, RM$QUERY_PROC
                                                  .EXTRN  RM$RECORD_SIZE, RM$RLNERR
                                                  .EXTRN  RM$RLSBKT, RM$SIDR_FIRST
                                                  .EXTRN  RM$SQUISH_SIDR, RM$SPLIT_EM
                                                  .EXTRN  RM$UPD_PLG

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

                               1C BB 00000 RM$INSS_OR_IDX::
                                                  PUSHR   #^M<R2,R3,R4>                        ; 0327
               5E              18 C2 00002        SUBL2   #24, SP                              ;
          08   AE        20    A9 9E 00005        MOVAB   32(R9), 8(SP)                        ; 0443
                               6E D4 0000A 1$:    CLRL    KILL_CUR                             ; 0429
               50      0084    C9 9E 0000C        MOVAB   132(IRAB), R0                        ; 0436
               54              60 D0 00011        MOVL    (R0), BDB                            ;
                               0F 13 00014        BEQL    2$                                   ;
  56      18   A4              0E C1 00016        ADDL3   #14, 24(BDB), REC_ADDR               ; 0442
               60        08    BE D0 0001B        MOVL    @8(SP), (R0)                         ; 0443
          08   BE              54 D0 0001F        MOVL    BDB, @8(SP)                          ; 0444
                               07 11 00023        BRB     3$                                   ; 0436
               60        08    BE D0 00025 2$:    MOVL    @8(SP), (R0)                         ; 0452
                         08    BE D4 00029        CLRL    @8(SP)                               ; 0453
                            0000G 30 0002C 3$:    BSBW    RM$CSEARCH_TREE                      ; 0456
          04   AE              50 D0 0002F        MOVL    R0, ERRSTATUS                        ;
               03        04    AE E8 00033        BLBS    ERRSTATUS, 4$                        ;
                             022E 31 00037        BRW     29$                                  ;
               50        20    A9 D0 0003A 4$:    MOVL    32(IRAB), R0                         ; 0458
               55        18    A0 D0 0003E        MOVL    24(R0), BKT_ADDR                     ;
                         0C    A5 95 00042        TSTB    12(BKT_ADDR)                         ; 0465
                               07 12 00045        BNEQ    5$                                   ;
  07      1C   A7              06 E0 00047        BBS     #6, 28(IDX_DFN), 6$                  ; 0467
                               47 13 0004C        BEQL    7$                                   ; 0469
  42      1C   A7              03 E1 0004E 5$:    BBC     #3, 28(IDX_DFN), 7$                  ; 0471
               51      00B4    CA 3C 00053 6$:    MOVZWL  180(IFAB), BUFF                      ; 0482
               51        60    A9 C0 00058        ADDL2   96(IRAB), BUFF                       ;
                         02    A1 9F 0005C        PUSHAB  2(BUFF)                              ; 0483
                               51 DD 0005F        PUSHL   BUFF                                 ;
               7E      00A6    C9 9A 00061        MOVZBL  166(IRAB), -(SP)                     ;
                            0000G 30 00066        BSBW    RM$MOVE                              ;
               5E              0C C0 00069        ADDL2   #12, SP                              ;
               61      00A6    C9 9B 0006C        MOVZBW  166(IRAB), (BUFF)                    ; 0484
  1F      44   A9              02 E1 00071        BBC     #2, 68(IRAB), 7$                     ; 0494
               50      00B4    CA 3C 00076        MOVZWL  180(IFAB), R0                        ; 0497
               51        60  B940 3E 0007B        MOVAW   @96(IRAB)[R0], BUFF                  ;
                         02    A1 9F 00080        PUSHAB  2(BUFF)                              ; 0498
                               51 DD 00083        PUSHL   BUFF                                 ;
               7E      00A6    C9 9A 00085        MOVZBL  166(IRAB), -(SP)                     ;
                            0000G 30 0008A        BSBW    RM$MOVE                              ;
               5E              0C C0 0008D        ADDL2   #12, SP                              ;
               61      00A6    C9 9B 00090        MOVZBW  166(IRAB), (BUFF)                    ; 0499
                         41    A9 95 00095 7$:    TSTB    65(IRAB)                             ; 0508
                               03 13 00098        BEQL    8$                                   ;
                             008E 31 0009A        BRW     16$                                  ;
                         44    A9 95 0009D 8$:    TSTB    68(IRAB)                             ; 0512
                               03 19 000A0        BLSS    9$                                   ;
                               0097 31 000A2          BRW      17$                              :
                7C         1C    A7 E8 000A5 9$:      BLBS     28(IDX_DFN), 15$                 : 0521
                53               56 D0 000A9          MOVL     REC_ADDR, END_OF_SIDR            : 0535
                56         4C    A9 D0 000AC          MOVL     76(IRAB), REC_ADDR               : 0536
          0C    AE               56 D0 000B0          MOVL     REC_ADDR, BEG_OF_SIDR            : 0537
                                 7E D4 000B4          CLRL     -(SP)                            : 0538
                              0000G 30 000B6          BSBW     RM$SIDR_FIRST                    :
                5E               04 C0 000B9          ADDL2    #4, SP                           :
                56               50 D0 000BC          MOVL     R0, REC_ADDR                     :
                52               56 D0 000BF 10$:     MOVL     REC_ADDR, LAST_SIDR              : 0542
                              0000G 30 000C2          BSBW     RM$GETNXT_ARRAY                  : 0543
                53               56 D1 000C5          CMPL     REC_ADDR, END_OF_SIDR            : 0545
                                 F5 1F 000C8          BLSSU    10$                              :
47              62               05 E1 000CA          BBC      #5, (LAST_SIDR), 13$             : 0560
                56               52 D0 000CE          MOVL     LAST_SIDR, REC_ADDR              : 0573
                           10    AE 9F 000D1          PUSHAB   ID                               : 0574
                           18    AE 9F 000D4          PUSHAB   VBN                              :
                              0000G 30 000D7          BSBW     RM$EXT_ARRY_RFA                  :
                5E               08 C0 000DA          ADDL2    #8, SP                           :
          07    A9               01 88 000DD          BISB2    #1, 7(IRAB)                      : 0575
                52         10    AE D0 000E1          MOVL     ID, R2                           : 0581
                51         14    AE D0 000E5          MOVL     VBN, R1                          :
                    00000000G    00 16 000E9          JSB      RM$QUERY_PROC                    :
                23               50 E9 000EF          BLBC     TEMP_STATUS, 13$                 :
                01               50 B1 000F2          CMPW     TEMP_STATUS, #1                  : 0591
                                 06 13 000F5          BEQL     11$                              :
13      00A2    CA               02 E0 000F7          BBS      #2, 162(IFAB), 12$               : 0593
                           0C    AE DD 000FD 11$:     PUSHL    BEG_OF_SIDR                      : 0596
                                 7E D4 00100          CLRL     -(SP)                            :
                              0000G 30 00102          BSBW     RM$SQUISH_SIDR                   :
                5E               08 C0 00105          ADDL2    #8, SP                           :
          43    A9       8001    8F AA 00108          BICW2    #32769, 67(IRAB)                 : 0597
                                 0B 11 0010E          BRB      14$                              : 0591
                              0000G 30 00110 12$:     BSBW     RM$GETNXT_ARRAY                  : 0606
                                 06 11 00113          BRB      14$                              : 0591
          04    AE       84EC    8F 3C 00115 13$:     MOVZWL   #34028, ERRSTATUS                : 0629
        84EC    8F         04    AE B1 0011B 14$:     CMPW     ERRSTATUS, #34028                : 0631
                                 19 12 00121          BNEQ     17$                              :
                                 61 11 00123          BRB      19$                              : 0633
          05    A9               10 88 00125 15$:     BISB2    #16, 5(IRAB)                     : 0641
                                 11 11 00129          BRB      17$                              : 0521
                54       0084    C9 D0 0012B 16$:     MOVL     132(IRAB), BDB                   : 0649
                         0084    C9 D4 00130          CLRL     132(IRAB)                        :
                                 7E D4 00134          CLRL     -(SP)                            :
                              0000G 30 00136          BSBW     RM$RLSBKT                        :
                5E               04 C0 00139          ADDL2    #4, SP                           :
                54         20    A9 D0 0013C 17$:     MOVL     32(IRAB), BDB                    : 0651
          0A    A4               02 88 00140          BISB2    #2, 10(BDB)                      : 0652
                              0000V 30 00144          BSBW     RM$INS_IF_FIT                    : 0657
                0B               50 E9 001 7          BLBC     R0, 18$                          :
                                 51 D4 0014A          CLRL     FLAGS                            : 0668
                54       0084    C9 D0 0014C          MOVL     132(IRAB), BDB                   : 0670
                                 66 12 00151          BNEQ     21$                              :
                                 70 11 00153          BRB      22$                              : 0677
                              0000G 30 00155 18$:     BSBW     RM$ALLOC_BKT                     : 0685
          04    AE               50 D0 00158          MOVL     R0, ERRSTATUS                    :
                26         04    AE E9 0015C          BLBC     ERRSTATUS, 19$                   :
```

```
             54      3C     A9 D0 00160        MOVL    60(IRAB), BDB                 ; 0690
                         0000G 30 00164        BSBW    RM$SPLIT_EM                   ; 0694
        04   AE             50 D0 00167        MOVL    R0, ERRSTATUS                 ;
             1A      04     AE E8 0016B        BLBS    ERRSTATUS, 20$                ;
        0A   A4             01 8A 0016F        BICB2   #1, 10(BDB)                   ; 0697
                     3C     A9 D4 00173        CLRL    60(IRAB)                      ; 0698
                            7E D4 00176        CLRL    -(SP)                         ; 0699
                         0000G 30 00178        BSBW    RM$RLSBKT                     ;
             5E             04 C0 0017B        ADDL2   #4, SP                        ;
             50      20     A9 D0 0017E        MOVL    32(IRAB), R0                  ; 0700
        0A   A0             01 8A 00182        BICB2   #1, 10(R0)                    ;
                          00DF 31 00186 19$:   BRW     29$                           ; 0696
      008C   C9      1C     A4 D0 00189 20$:   MOVL    28(BDB), 140(IRAB)            ; 0706
        0A   A4             02 88 0018F        BISB2   #2, 10(BDB)                   ; 0707
                     3C     A9 D4 00193        CLRL    60(IRAB)                      ; 0708
                   0090     C9 D4 00196        CLRL    144(IRAB)                     ; 0716
                            02 DD 0019A        PUSHL   #2                            ; 0720
                         0000G 30 0019C        BSBW    RM$RLSBKT                     ;
             5E             04 C0 0019F        ADDL2   #4, SP                        ;
        04   AE             50 D0 001A2        MOVL    R0, ERRSTATUS                 ;
             73      04     AE E9 001A6        BLBC    ERRSTATUS, 24$                ;
21      44   A9             04 E1 001AA        BBC     #4, 68(IRAB), 23$             ; 0725
             51             02 D0 001AF        MOVL    #2, FLAGS                     ; 0732
             54    0084     C9 D0 001B2        MOVL    132(IRAB), BDB                ; 0734
                            0C 13 001B7        BEQL    22$                           ;
                   0084     C9 D4 001B9 21$:   CLRL    132(IRAB)                     ; 0736
                            7E D4 001BD        CLRL    -(SP)                         ; 0737
                         0000G 30 001BF        BSBW    RM$RLSBKT                     ;
             5E             04 C0 001C2        ADDL2   #4, SP                        ;
             54      20     A9 D0 001C5 22$:   MOVL    32(IRAB), BDB                 ; 0739
                     20     A9 D4 001C9        CLRL    32(IRAB)                      ; 0740
                            51 DD 001CC        PUSHL   FLAGS                         ; 0741
                            6A 11 001CE        BRB     27$                           ;
             54      20     A9 D0 001D0 23$:   MOVL    32(IRAB), BDB                 ; 0749
             55      18     A4 D0 001D4        MOVL    24(BDB), BKT_ADDR             ; 0750
      0088   C9      1C     A4 D0 001D8        MOVL    28(BDB), 136(IRAB)            ; 0751
5F      0D   A5             01 E1 001DE        BBC     #1, 13(BKT_ADDR), 28$         ; 0753
        15   A7      0C     A5 91 001E3        CMPB    12(BKT_ADDR), 21(IDX_DFN)     ; 0755
                            58 12 001E8        BNEQ    28$                           ;
        0D   A5             02 8A 001EA        BICB2   #2, 13(BKT_ADDR)              ; 0762
                         0000G 30 001EE        BSBW    RM$ALLOC_BKT                  ; 0763
        04   AE             50 D0 001F1        MOVL    R0, ERRSTATUS                 ;
             33      04     AE E9 001F5        BLBC    ERRSTATUS, 25$                ;
        08   A5    008C     C9 D0 001F9        MOVL    140(IRAB), 8(BKT_ADDR)        ; 0768
             54      3C     A9 D0 001FF        MOVL    60(IRAB), BDB                 ; 0772
             55      18     A4 D0 00203        MOVL    24(BDB), BKT_ADDR             ; 0773
                         0000G 30 00207        BSBW    RM$NEW_ROOT                   ; 0774
        0A   A4             02 88 0020A        BISB2   #2, 10(BDB)                   ; 0778
                     3C     A9 D4 0020E        CLRL    60(IRAB)                      ; 0779
                            02 DD 00211        PUSHL   #2                            ; 0780
                         0000G 30 00213        BSBW    RM$RLSBKT                     ;
             5E             04 C0 00216        ADDL2   #4, SP                        ;
        04   AE             50 D0 00219        MOVL    R0, ERRSTATUS                 ;
             0B      04     AE E9 0021D 24$:   BLBC    ERRSTATUS, 25$                ;
                         0000G 30 00221        BSBW    RM$UPD_PLG                    ; 0784
        04   AE             50 D0 00224        MOVL    R0, ERRSTATUS                 ;
             05      04     AE E8 00228        BLBS    ERRSTATUS, 26$                ;
```

```
    6E               01 D0 0022C 25$:   MOVL    #1, KILL_CUR              ;
                     37 11 0022F        BRB     29$                       ;
    54         20    A9 D0 00231 26$:   MOVL    32(IRAB), BDB             ; 0788
               20    A9 D4 00235        CLRL    32(IRAB)                  ; 0789
                     02 DD 00238        PUSHL   #2                        ; 0790
                  0000G 30 0023A 27$:   BSBW    RM$RLSBKT                 ;
    5E               04 C0 0023D        ADDL2   #4, SP                    ;
                     5B 11 00240        BRB     33$                       ;
                     06 DD 00242 28$:   PUSHL   #6                        ; 0799
                  0000G 30 00244        BSBW    RM$RLSBKT                 ;
    5E               04 C0 00247        ADDL2   #4, SP                    ;
04  AE               50 D0 0024A        MOVL    R0, ERRSTATUS             ;
    16         04    AE E9 0024E        BLBC    ERRSTATUS, 29$            ;
08  AE         20    A9 9E 00252        MOVAB   32(R9), 8(SP)             ; 0800
08  BE               54 D0 00257        MOVL    BDB, @8(SP)               ;
               41    A9 96 0025B        INCB    65(IRAB)                  ; 0802
42  A9               01 B0 0025E        MOVW    #1, 66(IRAB)              ; 0803
               44    A9 94 00262        CLRB    68(IRAB)                  ; 0804
                   FDA2 31 00265        BRW     1$                        ; 0424
    54       0084    C9 D0 00268 29$:   MOVL    132(IRAB), BDB            ; 0810
                     0C 13 0026D        BEQL    30$                       ;
             0084    C9 D4 0026F        CLRL    132(IRAB)                 ; 0812
                     7E D4 00273        CLRL    -(SP)                     ; 0813
                  0000G 30 00275        BSBW    RM$RLSBKT                 ;
    5E               04 C0 00278        ADDL2   #4, SP                    ;
    54         20    A9 D0 0027B 30$:   MOVL    32(IRAB), BDB             ; 0819
                     18 13 0027F        BEQL    32$                       ;
               20    A9 D4 00281        CLRL    32(IRAB)                  ; 0822
    0A               6E E9 00284        BLBC    KILL_CUR, 31$             ; 0823
                     53 D4 00287        CLRL    R3                        ; 0824
        00000000G    EF 16 00289        JSB     RM$RLNERR                 ;
                     08 11 0028F        BRB     32$                       ;
                     7E D4 00291 31$:   CLRL    -(SP)                     ; 0826
                  0000G 30 00293        BSBW    RM$RLSBKT                 ;
    5E               04 C0 00296        ADDL2   #4, SP                    ;
    50         04    AE D0 00299 32$:   MOVL    ERRSTATUS, R0             ; 0829
    5E               18 C0 0029D 33$:   ADDL2   #24, SP                   ; 0831
                     1C BA 002A0        POPR    #^M<R2,R3,R4>             ;
                        05 002A2        RSB                               ;

; Routine Size:  675 bytes,    Routine Base:  RM$RMS3 + 0000
```

```
1 %SBTTL 'RM$INS_IF_FIT'
1 GLOBAL ROUTINE RM$INS_IF_FIT : RL$INS_IF_FIT =
1
1 !++
1 !
1 ! FUNCTIONAL DESCRIPTION:
1 !
1 !       This routine inserts a SIDR or index record into the bucket
1 !       at the position pointed to by REC_ADDR and returns success if
1 !       it fits else returns 0 to indicate a split is neccessary.
1 !
1 ! CALLING SEQUENCE:
1 !       RM$INS_IF_FIT()
1 !
1 ! INPUT PARAMETERS
1 !       NONE
1 !
1 ! IMPLICIT INPUTS:
1 !       RAB [ LOA ] -           if set use fill sizes to determine bucket size
1 !       IRAB [ DUPS_SEEN ] - set if duplicates seen meaning only continuation
1 !                               record is neccessary
1 !       BKT_ADDR -              points to beginning of bucket
1 !       IDX_DFN -               pointer to index descriptor
1 !       [ DATFILL ] -           fill size for data buckets when fill percents used
1 !       [ IDXFILL ] -           "     "     index   "       "         "       "
1 !       [ DATBKTSZ ] -          size of data bkts in VBN's
1 !       [ IDXBKTSZ ] -          "    "  index "    "
1 !
1 ! OUTPUT PARAMETERS:
1 !       NONE
1 !
1 ! IMPLICIT OUTPUTS:
1 !       NONE
1 !
1 ! ROUTINE VALUE:
1 !       NONE
1 !
1 ! SIDE EFFECTS:
1 !       NONE
1 !
1 !--
1
2    BEGIN
2
2    EXTERNAL REGISTER
2       R_BKT_ADDR_STR,
2       R_RAB_STR,
2       R_IRAB_STR,
2       R_IFAB_STR,
2       R_REC_ADDR_STR,
2       R_IDX_DFN_STR;
2
2    GLOBAL REGISTER
2       R_IMPURE;
2
2    LOCAL
2       REC_SZ;
```

```
;  827      0889  2
;  828      0890  2      ! this block is defined to limit scope of BKT_ROOM
;  829      0891  2      !
;  830      0892  3      BEGIN
;  831      0893  3
;  832      0894  3      LOCAL
;  833      0895  3          END_BKT,
;  834      0896  3          BKT_ROOM        : SIGNED;
;  835      0897  3
;  836      0898  3      ! set up bucket size used to determine split based on whether this is
;  837      0899  3      ! data or index level and whether fill percentages are used
;  838      0900  3      !
;  839      0901  3      IF .BKT_ADDR[BKT$B_LEVEL] EQL 0
;  840      0902  3      THEN
;  841      0903  4          BEGIN
;  842      0904  4          END_BKT = .BKT_ADDR + .IDX_DFN[IDX$B_DATBKTSZ]*512;
;  843      0905  4
;  844      0906  4          IF .RAB[RAB$V_LOA]
;  845      0907  4          THEN
;  846      0908  4              BKT_ROOM = .IDX_DFN[IDX$W_DATFILL]
;  847      0909  4          ELSE
;  848      0910  4              BKT_ROOM = .IDX_DFN[IDX$B_DATBKTSZ]*512;
;  849      0911  4          END
;  850      0912  3      ELSE
;  851      0913  4          BEGIN
;  852      0914  4          END_BKT = .BKT_ADDR + .IDX_DFN[IDX$B_IDXBKTSZ]*512;
;  853      0915  4
;  854      0916  4          IF .RAB[RAB$V_LOA]
;  855      0917  4          THEN
;  856      0918  4              BKT_ROOM = .IDX_DFN[IDX$W_IDXFILL]
;  857      0919  4          ELSE
;  858      0920  4              BKT_ROOM = .IDX_DFN[IDX$B_IDXBKTSZ]*512;
;  859      0921  3          END;
;  860      0922  3
;  861      0923  3      ! Set up record size.
;  862      0924  3      !
;  863      0925  3      REC_SZ = RM$RECORD_SIZE();
;  864      0926  3
;  865      0927  3      ! Establish amount of room left in bucket with new record minus 1 byte for
;  866      0928  3      ! check byte at end of bucket
;  867      0929  3      !
;  868      0930  4      IF  (.IFAB [IFB$B_PLG_VER] GEQU PLG$C_VER_3)
;  869      0931  3           AND
;  870      0932  4          (.BKT_ADDR[BKT$B_LEVEL] GTRU 0)
;  871      0933  3      THEN
;  872      0934  4          BEGIN
;  873      0935  4
;  874      0936  4          LOCAL
;  875      0937  4              VBN_FREE;
;  876      0938  4
;  877      0939  4          VBN_FREE = .END_BKT - BKT$C_ENDOVHD;
;  878      0940  4          BKT_ROOM = .(.VBN_FREE)<0,16> - .BKT_ADDR [BKT$W_FREESPACE];
;  879      0941  4          BKT_ROOM = .BKT_ROOM - .REC_SZ<0,16> - .REC_SZ <16,16>;
;  880      0942  4          END
;  881      0943  3      ELSE
;  882      0944  3          BKT_ROOM = .BKT_ROOM - .REC_SZ - .BKT_ADDR[BKT$W_FREESPACE] - 1;
;  883      0945  3
;  884          0946  3     IF .BKT_ROOM LSS 0
;  885          0947  3     THEN
;  886          0948  3         RETURN 0;
;  887          0949  3
;  888          0950  3     IRAB[IRB$W_POS_INS] = .REC_ADDR - .BKT_ADDR; ! set up for INS_REC
;  889          0951  2     END; ! of block defining BKT_ROOM
;  890          0952  2     RETURN RM$INS_REC(.BKT_ADDR, .REC_SZ);
;  891          0953  2
;  892          0954  1     END;



                                              080C   8F  BB 00000 RM$INS_IF_FIT::
                                                                          PUSHR   #^M<R2,R3,R11>                              ; 0833
                                                0C   A5  95 00004         TSTB    12(BKT_ADDR)                                ; 0901
                                                     17  12 00007         BNEQ    1$                                          ;
                                       50       17   A7  9A 00009         MOVZBL  23(IDX_DFN), R0                             ; 0904
                         50            50            09  78 0000D         ASHL    #9, R0, R0                                  ;
                         53            55            50  C1 00011         ADDL3   R0, BKT_ADDR, END_BKT                       ;
                         1D       05   A8            05  E1 00015         BBC     #5, 5(RAB), 2$                              ; 0906
                                       52       26   A7  3C 0001A         MOVZWL  38(IDX_DFN), BKT_ROOM                       ; 0908
                                                     1A  11 0001E         BRB     3$                                          ;
                                       50       16   A7  9A 00020 1$:     MOVZBL  22(IDX_DFN), R0                             ; 0914
                         50            50            09  78 00024         ASHL    #9, R0, R0                                  ;
                         53            55            50  C1 00028         ADDL3   R0, BKT_ADDR, END_BKT                       ;
                         06       05   A8            05  E1 0002C         BBC     #5, 5(RAB), 2$                              ; 0916
                                       52       24   A7  3C 00031         MOVZWL  36(IDX_DFN), BKT_ROOM                       ; 0918
                                                     03  11 00035         BRB     3$                                          ;
                                       52            50  D0 00037 2$:     MOVL    R0, BKT_ROOM                                ; 0920
                                                   0000G 30 0003A 3$:     BSBW    RM$RECORD_SIZE                              ; 0925
                                       03     00B7   CA  91 0003D         CMPB    183(IFAB), #3                               ; 0930
                                                     25  1F 00042         BLSSU   4$                                          ;
                                                0C   A5  95 00044         TSTB    12(BKT_ADDR)                                ; 0932
                                                     20  13 00047         BEQL    4$                                          ;
                                       51       FC   A3  9E 00049         MOVAB   -4(R3), VBN_FREE                            ; 0939
                                       52            61  3C 0004D         MOVZWL  (VBN_FREE), BKT_ROOM                        ; 0940
                                       53       04   A5  3C 00050         MOVZWL  4(BKT_ADDR), R3                             ;
                                       52            53  C2 00054         SUBL2   R3, BKT_ROOM                                ;
                                       51            50  3C 00057         MOVZWL  REC_SZ, R1                                  ; 0941
                         51            52            51  C3 0005A         SUBL3   R1, BKT_ROOM, R1                            ;
           52            50            10            10  EF 0005E         EXTZV   #16, #16, REC_SZ, BKT_ROOM                  ;
                         52            51            52  C3 00063         SUBL3   BKT_ROOM, R1, BKT_ROOM                      ;
                                                     0F  11 00067         BRB     5$                                          ; 0930
                         51            52            50  C3 00069 4$:     SUBL3   REC_SZ, BKT_ROOM, R1                        ; 0944
                                       53       04   A5  3C 0006D         MOVZWL  4(BKT_ADDR), R3                             ;
                                       51            53  C2 00071         SUBL2   R3, R1                                      ;
                                       52       FF   A1  9E 00074         MOVAB   -1(R1), BKT_ROOM                            ;
                                                     11  19 00078 5$:     BLSS    6$                                          ; 0946
                    48   A9            56            55  A3 0007A         SUBW3   BKT_ADDR, REC_ADDR, 72(IRAB)                ; 0950
                                                     50  DD 0007F         PUSHL   REC_SZ                                      ; 0952
                                                     55  DD 00081         PUSHL   BKT_ADDR                                    ;
                                                   0000G 30 00083         BSBW    RM$INS_REC                                  ;
                                       5E            08  C0 00086         ADDL2   #8, SP                                      ;
                                                     02  11 00089         BRB     7$                                          ;
                                                     50  D4 0008B 6$:     CLRL    R0                                          ; 0954
```

```
                                                  080C    8F  BA 0008D 7$:      POPR     #^M<R2,R3,R11>                  ;
                                                              05 00091          RSB                                     ;

; Routine Size:  146 bytes,    Routine Base:  RM$RMS3 + 02A3


;  893          0955  1
;  894          0956  1 END
;  895          0957  1
;  896          0958  0 ELUDOM




;                                           PSECT SUMMARY
;
;       Name                        Bytes                           Attributes
;
;  RM$RMS3                              821  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         80         2        154          00:00.4



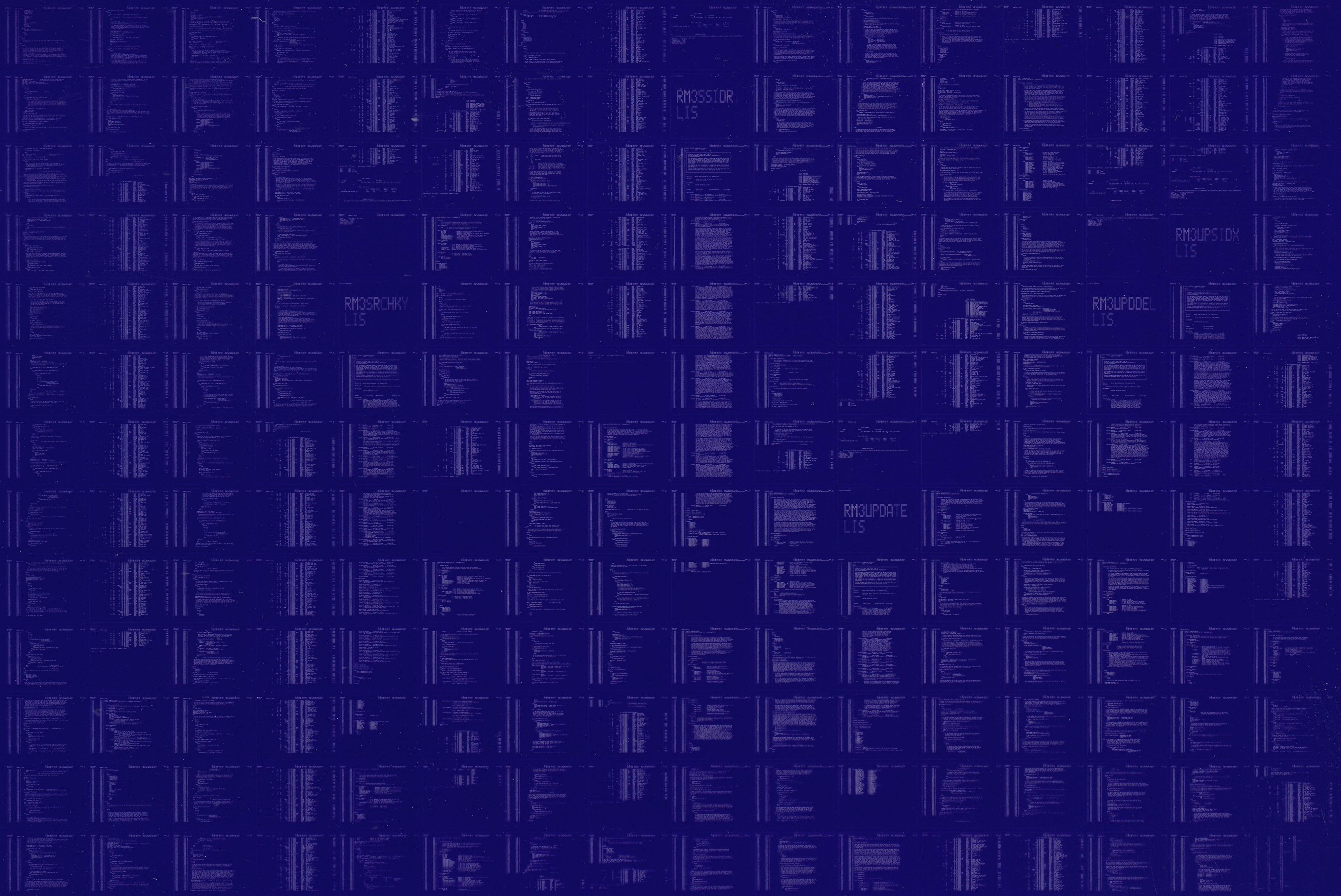

;                                           COMMAND QUALIFIERS

;       BLISS/CHECK=(FIELD,INITIAL,OPTIMIZE)/LIS=LIS$:RM3UPSIDX/OBJ=OBJ$:RM3UPSIDX MSRC$:RM3UPSIDX/UPDATE=(ENH$:RM3UPSIDX)

; Size:           821 code + 0 data bytes
; Run Time:          00:21.6
; Elapsed Time:      01:00.1
; Lines/CPU Min:       2656
; Lexemes/CPU-Min: 15848
; Memory Used:  263 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

0329 AH-BT13A-SE
VAX/VMS V4.0

DIGITAL EQUIPMENT CORPORATION
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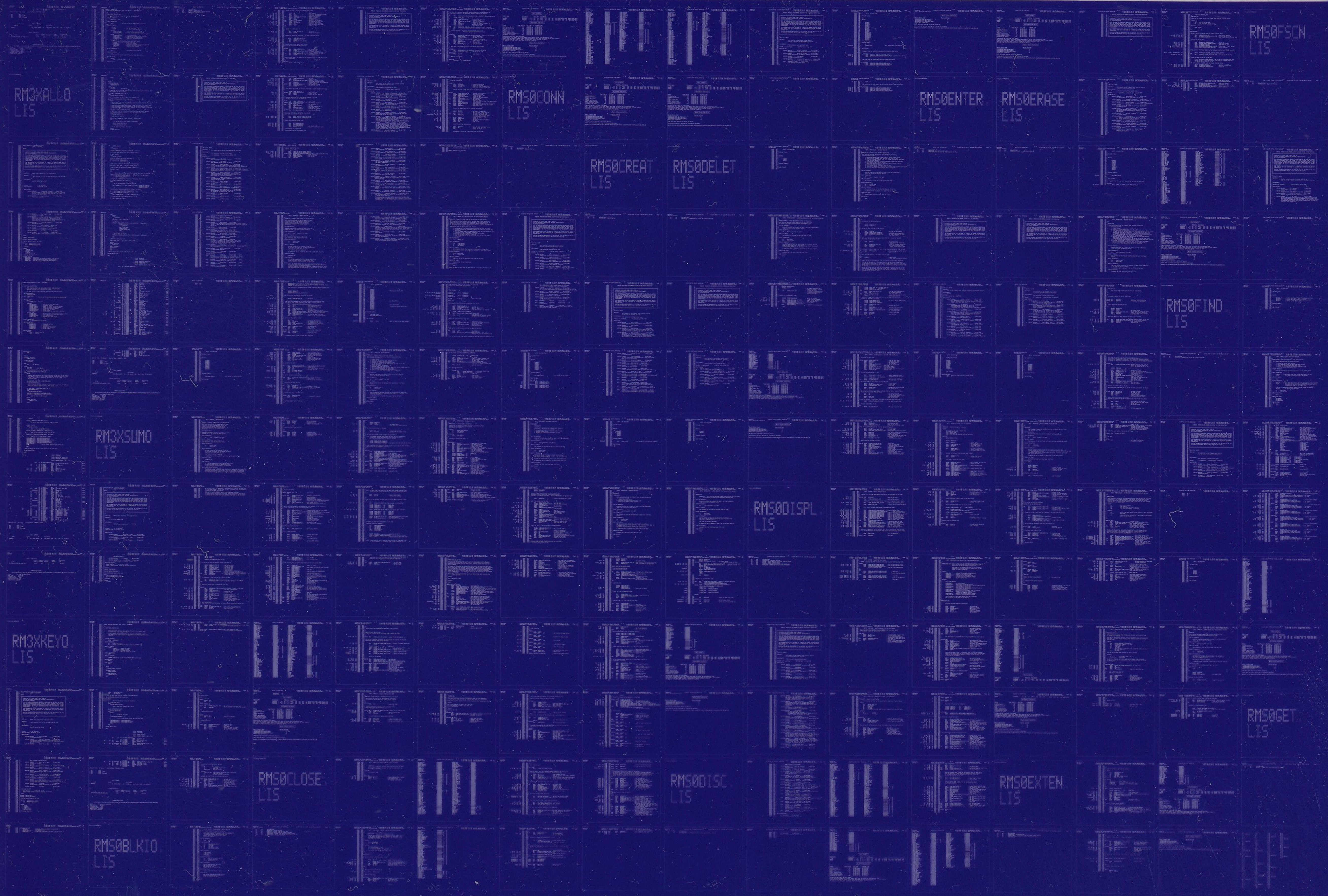

RMS0FSCN
LIS

RM3XALLO
LIS

RMS0CONN
LIS

RMS0ENTER
LIS

RMS0ERASE
LIS

RMS0CREAT
LIS

RMS0DELET
LIS

RMS0FIND
LIS

RM3XSUMO
LIS

RMS0DISPL
LIS

RM3XKEYO
LIS

RMS0GET
LIS

RMS0CLOSE
LIS

RMS0DISC
LIS

RMS0EXTEN
LIS

RMS0BLKIO
LIS