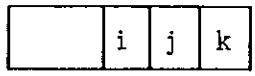
TAG AND DIRECTORY OPERATIONS

The tag and directory operations provide for the manipulation of the storage control portion of the Bus and Lining Module.

All tag and directory instructions are in the short format:



The i-, j-, and k-fields always refer to X-registers. Whenever a pair of X registers is specified, the value of the i-, j-, or k-field (as appropriate) is assumed to be even. If it is not, the low order bit of the field is forced to 0, exception bit RS is set, and the operation proceeds. The 48-bit quantity $X^{0,1}$ is defined as 48 0's.

Tag and Directory instructions (except ITUMA) may be executed only when the MPM is in the supervisory mode; if one is encountered in the problem mode, exception bit PV is set and the instruction execution is suppressed so that no X-registers or tag or directory entires are changed.

A complete description of these instructions is included in the section "Bus and Lining Module".

Invalidate Tag and Update MS per Alternate Key

ITUMA

eal ← X^j + X^k

eak ← alternate key

If the line containing the ea is present in HSS, its copy in MS is set equal to the HSS copy, and the tag corresponding to the line is made invalid. Otherwise no change takes place.

Exceptions: none

Invalidate Tag and Update MS

ITUM

The MS copy of each line in HSS is made equal to the HSS value. All tags are made invalid.

Exception	Exception bit
problem mode	PV

Directory Enter DEN

The contents of register pair $X^{k,k+1}$ specify a directory entry. A directory search is performed (using increasing counts appropriate to the page size) to locate an invalid entry. Then the contents of X^k and X^{k+1} replace that invalid entry.

The physical directory address (PDA) of the invalid entry and the count used to locate it are returned to register X^i in bit positions 0,1,...,11 and 12,13,...,17 respectively; bits 18,19,..., 23 are set to 0's.

If no invalid entry can be located, no directory entry is made; a count of 32 and a PDA of 0 are returned to X^i.

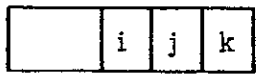
Exception	Exception bit
in problem mode	PV
k odd	RS

Directory Enter per Physical DENP

Bit 0,1,...,11 of X^k specify a PDA. The contents of register pair $X^{i,i+1}$ replace the directory entry at location PDA. No check is made that this is a legitimate PDA for this directory entry.

Exception	Exception bit
in problem mode	PV
i odd	RS

Directory Swap DSW



Bits 19,20,...,46 of register pair $X^{k,k+1}$ specify a virtual page address. A directory search is performed to locate the entry corresponding to this virtual address. The entry is returned to the register pair $X^{i,i+1}$. Then the contents of $X^{j,j+1}$ replace the contents of the entry just located. No check is made that this location is a legitimate PDA for the directory entry specified by $X^{j,j+1}$.

If the entry cannot be located, $X^{i,i+1}$ are set to 0's, and no new directory entry is made.

Exception	Exception bit
in problem mode	PV
i,j, or k odd	RS

Directory Move and Invalidate DM

Bits 0,1,...,11 of register X^k specify one PDA (pda_1); bits 12,13,...,23 specify a second PDA (pda_2).

The directory entry at location pda_2 replaces the directory entry at location pda_1, and the entry at pda_2 is replaced by the invalid pattern (forty-eight 0's are stored).

The move and invalidation are interlocked so that no intervening accesses to location pda_1 are permitted.

No check is made that the directory entry in pda_2 can be legitimately located in pda_1.

Exception	Exception bit
in problem mode	PV

Directory Examine DEX

Bits 19,20,...,46 of register pair $X^{k,k+1}$ specify a virtual address. The directory entry corresponding to this virtual page address replaces the contents of registers $X^{i,i+1}$.

If no entry can be located, $X^{i,i+1}$ are set to 0's.

Exception	Exception bit
in problem mode	PV
i or k odd	RS

Directory Examine per Physical DEXP

Bits 0,1,...,11 of X^k specify a PDA. The directory entry at location PDA replaces the contents of register pair $X^{i,i+1}$.

Exception	Exception bit
in problem mode	PV
i odd	RS

Directory Search for Smaller DSS

Bits 19,20,...,46,47 of register pair $X^{k,k+1}$ specify a virtual page address and page size. A directory search is performed to find either an invalid entry or an entry specifying a page size smaller than the page size of the search argument. Upon locating either type of entry, the PDA and the ID-PS field of the entry is returned to register pair $X^{i,i+1}$ in bit positions 0,1,...,11 and 18,19,...,47 respectively.

If an invalid entry was found, bits $X^{k}_{12,13}$ are set to 0,0. If a smaller page entry was found, bits $X^{i}_{12,13}$ are set to 0,1. If the search was unable to locate either type entry, bits $X^{i}_{12,13}$ are set to 1,0. In all cases bits $X^{i}_{14,15,16,17}$ are set to 0's.

Exception	Exception bit
in problem mode	PV
i or k odd	RS

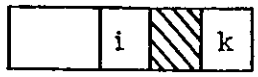
Directory Search for Invalid DSI

Bits 19,20,...,46 of register pair $X^{k,k+1}$ specify a virtual page address. A directory search is performed to find an invalid entry. The PDA of the invalid entry and the count used to locate it are returned to register X^{i} in bit positions 0,1,...,11 and 12,13,...,17 respectively; bits 18, 19,...,23 are set to 0's.

If no invalid entry can be located, the count returned is 32 and the PDA is 0.

Exception	Exception bit
in problem mode	PV
k odd	RS

Directory Search per Count DSC



Bits 19,20,...,46 of the register pair $X^{k,k+1}$ specify a virtual page address. Also bits $X^{k}_{13,14,...,17}$ specify a count. The hash function H (va, cnt) specifies a PDA. This PDA and the ID-PS field of the directory entry at location PDA are returned to register pair $X^{i,i+1}$ in bit positions 0,1,...,11 and 18,19,...,47 respectively; bits 12,13,...,17 are set to 0's.

Exception	Exception bit
in problem mode	PV
i or k odd	RS