S229 - 4002 - 3

IBM

Rochester
Field
Support

088
Customer
Engineering
Service
Information
Manual

SIM

General Systems Division

INTRODUCTION

The 088 Service Information Manual merges information from the Field Technical Support Centers, Service Index, Field Support Machine Files and Parts Catalog Corrections.

Service Hint oriented, this manual provides the Customer Engineer with the ability to identify the problem and quickly find the appropriate Service Hint.

Additional material is provided in the form of CEMs and Diagnostic Techniques.

Rochester Field Support compiled this manual. It is not intended to replace Maintenance Manuals or other machine documentation.

Fourth Edition (May 1975)

HOW TO USE THIS MANUAL

1. Determine the symptom or failing feature.

   A. Question the operator.

   B. Observe the machine in operation.

2. Use the Table of Contents or the Index to locate the symptom. The Service Hints and Diagnostic Techniques are not necessarily written as stand alone fixes, but as a guide to help isolate and fix a problem.

TABLE OF CONTENTS

SERVICE HINT 1 - MACHINE FUNCTIONS

Card Selection is the operation by which a particular card may be selected from a file of cards. The type of card to be selected may be an X card, an NX card, the first card of a group, the last card of a group, a single card group, a zero card, a card with a particular number, or a card out of sequence.

Checking Sequence is an operation by which the collator checks a file of cards to determine whether or not they are in order. As the cards are fed through the machine, each card is compared with the one ahead; if it is out of sequence, the machine stops and the control stop light comes on.

Merging is the operation by which the collator combines two files of cards, already in sequence, into a single file. The cards in one file are compared with those in the other, and feeding from the two files is thereby controlled so that the combined file is in numerical sequence.

Merging with Selection is the operation by which cards in one file that do not have corresponding cards in the other file are selected as the two files are merged. Cards can be selected from either or both files and, when the operation is completed, there may be three groups of cards - one merged file and two groups of selected cards.

Matching is the operation by which the collator compares two files of cards to determine that there is a card or group of cards in one file to match each card or group of cards in the other file. Unmatched cards in either or both files are selected. When the operation is completed, there may be four groups of cards - two groups that match and two groups of selected cards.

BASIC SET UP WIRED TO MERGE (SEQ CHECKING ON - CARDS IN ALL STATIONS)				
COMPARE OUTPUT	PRI SEQUENCE OUTPUT	SEC SEQUENCE OUTPUT	COMP INLK RELAY	ACTION RESULTING
LOW PRI	EQUAL OR HIGH	EQUAL OR HIGH	DOWN	PRI FEED
LOW SEC	EQUAL OR HIGH	EQUAL OR HIGH	DOWN	SEC FEED
* EQUAL	EQUAL	HIGH	DOWN	PRI FEED
EQUAL	HIGH	HIGH	DOWN	PRI FEED SEC FEED
EQUAL	HIGH	EQUAL	DOWN	PRI FEED SEC FEED PICK INLK RLY
EQUAL (FORCED BY) (INLK RELAY)	EQUAL OR HIGH	EQUAL	UP	SEC FEED HOLD INLK RLY
EQUAL (FORCED BY (INLK RELAY)	EQUAL OR HIGH	HIGH	UP	SEC FEED DROP INLK RLY
* BASIC SET UP WIRED TO MATCH (MERGE RULES APPLY EXCEPT FOR FOLLOWING)				
EQUAL	EQUAL	EQUAL	DOWN	PRI FEED SEC FEED

SERVICE HINT 2 - DIAGNOSTIC CONTROL PANELS

S.H. 2-1 - QUICK TEST USING CUSTOMER'S CONTROL PANEL

1. A test of tubes, SMS cards and associated relays of those positions which are wired on the control panel can be made as follows. This test may save service time by use of the customer control panel without alteration and without test cards.

   A. Use customer or test control panel which is causing failure with no cards in the machine.

   B. While depressing the start key, transfer both the primary and secondary clutch trip switches (CE aid panel) for a single clutch cycle.

   C. Result will be an A-B-D code set up in all wired compare positions; plus, an equal ("Hi" and "Lo" setup) reading into all wired sequence positions.

   D. A defective tube, SMS card or relay may be determined by observing the CE diagnostic aid panel lights for each position.

2. This test can be expanded by:

   A. Shorting out the Primary and Secondary card levers.

   B. Depressing the runout key.

Result: All codes should be set up in wired positions. It should be noted that although this is a faster test procedure, it is not as complete as the Quick Test Control Panel outlined in S.H. 2-2.

S.H. 2-2 - QUICK TFST CONTROL PANEL

Wire a control panel to stop the machine with any condition other than equal compare output and equal primary and secondary sequence outputs. Sequence and compare entries are to be wired to columns commonly used by the customer. DPBC is OFF(Fig. 1). Cards punched with a 2 and a 9 in even-numbered columns and a 5 and a 7 in odd-numbered columns will pick all code and sequence relays. A failure of any code or sequence relay to pick will result in an unequal output. A

short between the brushes or in brush circuitry will result in an unequal sequence output. Running blank cards with the same control panel will test for erroneous picking of code or sequence relays. Running blank cards with DPBC wired ON will check all BC circuits and/or lights.

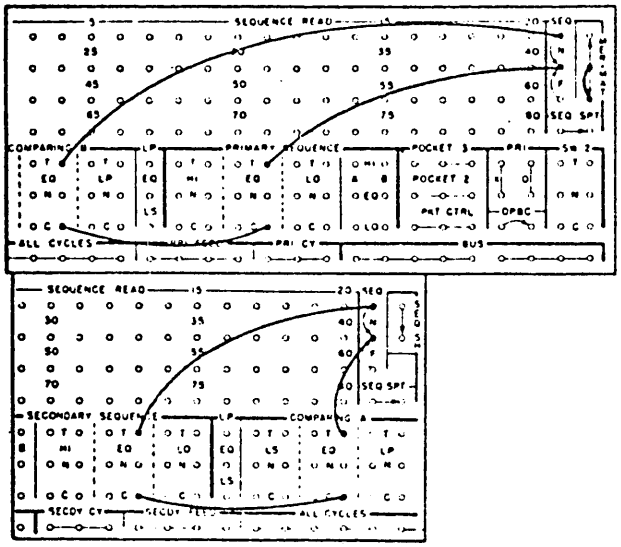


Figure 1

S.H. 2-3 - CLUTCH CHECK CONTROL PANEL (ALTERNATING FEED TEST)

Wire the control panel as follows. Running blank cards in both feeds with this control panel wiring should aid in analyzing clutch troubles of any nature.

1. Jackplug secondary sequence OFF.
2. Jackplug primary sequence OFF.
3. Pick selector one from PRI CY hub.
4. Jackplug first and second picks of selector one together.
5. Wire from transfer hubs of selector one to secondary feed.
6. Wire from normal hubs of selector one to primary feed.
7. Wire from common hubs of selector one to all cycles.
8. Wire from secondary exit to selector assignment entry of selector one.

CAUTION: See S.H. 11-4.

SERVICE HINT 3 - PRIMARY OR SECONDARY CONTROL STOP LIGHT

If both lights are on, see S.H. 4.

Note: To feed one card at a time and keep the answer lights on, use the portable start key. See S.H. 35-1.

Low sequence answer? (To determine sequence answer, see S.H. 35-6.)
Y N
|
Control panel "Sequence On" jackplugged?
Y N
|
Did selected condition cause stop?
Y N
|
- If primary control stop, trouble is between test hub #4 and pick of R36, or in hold circuit of R36.
- If secondary control stop trouble is between test hub #4 and pick of R38, or in hold circuit of R38. For intermittent secondary control stops, see S.H. 15.

- Analyze selective circuit.

- If primary control stop, trouble is between test hub #4 and pick of R36, or in hold circuit of R36.
- If secondary control stop, trouble is between test hub #4 and pick of R38, or in hold circuit of R38. For intermittent secondary control stops also see S.H. 15.

- Examine card for sequence error.
1. Lift cards from hopper that has control stop light on.
2. Do not press reset.
3. Press runout button, cards will go into stacker 1 or 5.

Card in Error?
Y N
|
- False sequence answer. See S.H. 35-6, How to determine position causing error. Note: Check control panel for position wired.
- See Read Failures, S.H. 9.
- Check relays and relay points associated with the failing position.

- Legitimate stop.

SERVICE HINT 4 - BOTH PRIMARY AND SECONDARY CONTROL STOP LIGHTS

If either primary or secondary control stop light only, see S.H. 3.

Note: To feed one card at a time and keep the answer lights on, use the portable start key. See S.H. 35-1.

Both low primary and low secondary sequence answer?

Y

Correct sequence and compare answer?

Y

Missing sequence answer?

Y

Missing compare answer?

Y

More than one sequence answer?

Y

More than one compare answer?

Y

- Shorted point in compare answer relay network.
- Defective compare answer tube or associated circuitry.
- If split compare, see S.H. 14-1.

N

- Shorted point in sequence answer relay network.
- Defective sequence answer tube or associated circuitry.
- If split compare, see S.H. 14-1.

N

- Check compare answer relay network in, or preceding, the col. of decision.
- Answer point cleaning circuit, see S.H. 14-2.
- Faulty relay transfer, see S.H. 29-4.
- Read failure, see S.H. 9.

N

- Trouble is probably in the sequence answer relay network in, or preceding, the col. of decision.
- Answer point cleaning circuit, see S.H. 14-2.
- Faulty relay transfer, see S.H. 29-4.
- Read failure, see S.H. 9.

N

- Check test hub 4 for CR 46 impulse. If no impulse, check test hubs 3, 2, 1 respectively.
- Check CR 37 hold circuit to R36 and R38.

N

- Examine cards for sequence error.
  1. Empty both hoppers.
  2. Do not press reset.
  3. Press runout, cards will go to stackers 1 and 5.

Cards in error?

Y

- False low sequence answer.
- See Read Failure, S.H. 9.

N

- Legitimate stop.

SERVICE HINT 5 - PRIMARY OR SECONDARY CHECK LIGHTS

DPBC?

Y

- Failure to feed from hopper?
  - Y
    - Card Jam?
      - Y
        - Stop was caused by
        - Circuit #1, see S.H. 6-1.
        - Circuit #2, see S.H. 6-2.
        - Circuit #3, see S.H. 6-3.
        - Mechanical clutch problem, see S.H. 34.
      - N
        - Legitimate stop.
  - N
    - Check hopper adj.
    - See Feed Failures, S.H. 8.

N

Blank col. indicate lamp off?

Y

- Check indicated col. on diagnostic panel to determine if any code relays are picked up.
  - Y
    - Is indicated col. blank in card?
      - Y
        - Check brush, see S.H. 9.
        - Impulse C.B.'s
        - Tube and relay circuit, see S.H. 31.
        - DPBC failures, see S.H. 19.
      - N
        - Legitimate stop.
  - N
    - Shorted code relay #4 N/C point in DPBC test circuit.

N

Double punch in card?

Y

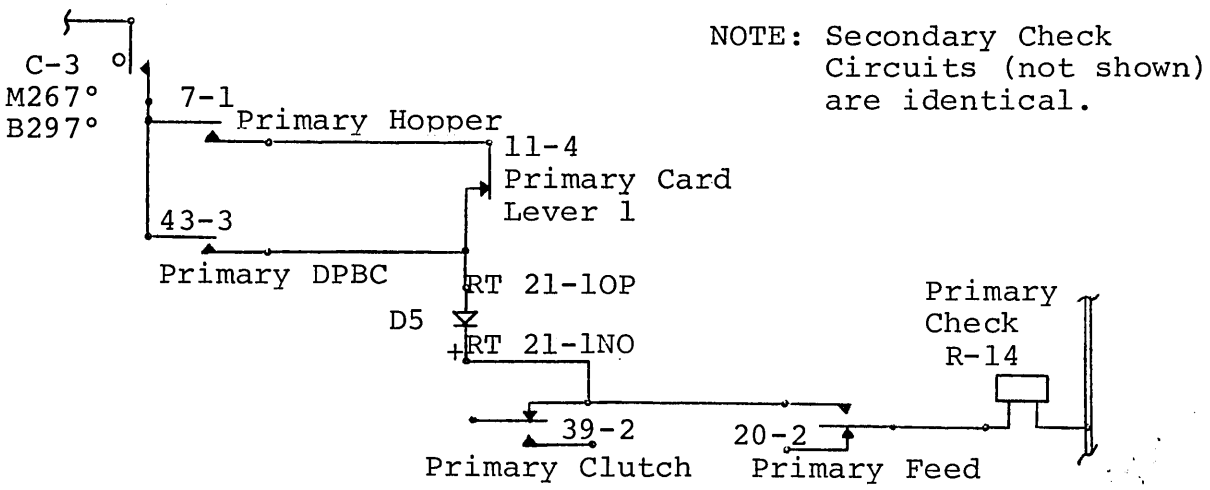
- False DPBC.
  - Read failure, see S.H. 9.
  - Shorted code relay #4 N/O point in DPBC test circuit.
  - False DPBC, see S.H. 19-2.

N

- Legitimate stop.

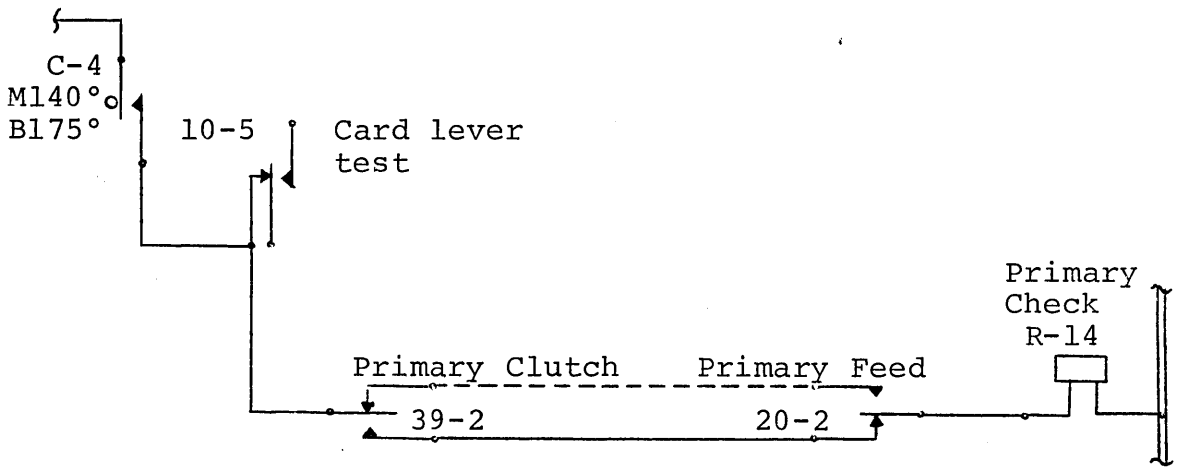
SERVICE HINT 6 - CHECK LIGHT CIRCUITS

S.H. 6-1 - Detects failure to feed from hopper.

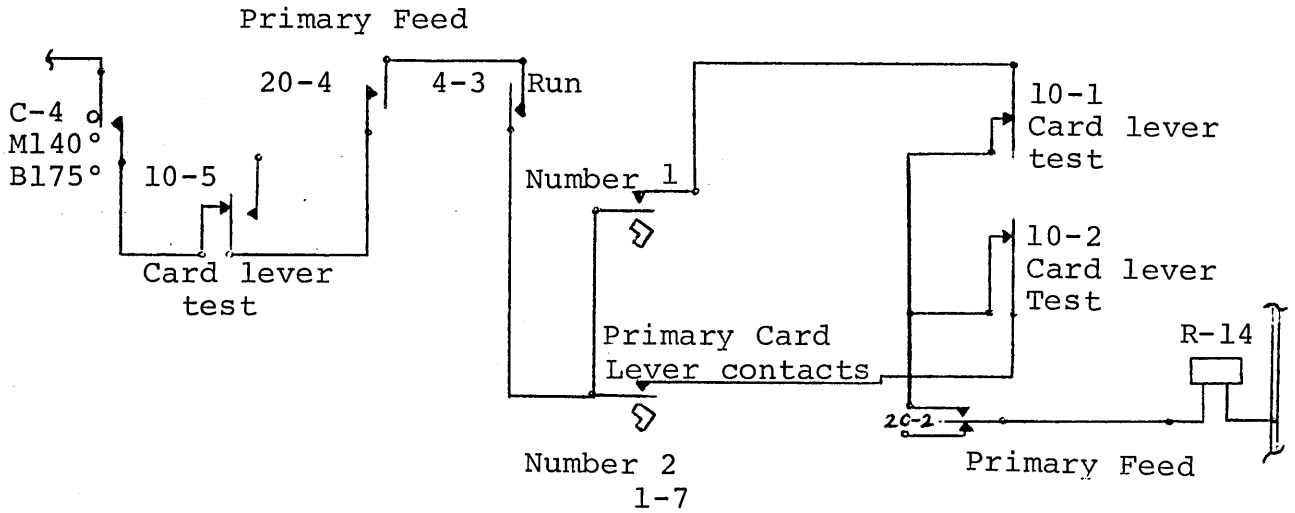


NOTE: Secondary Check Circuits (not shown) are identical.

S.H. 6-2 - _____Detects Clutch failure to unlatch.
- ----------Detects Clutch failure to latch up.



S.H. 6-3 - Detects jam at either Card lever 1 or Card lever 2.



SERVICE HINT 7 - MACHINE STOPS, NO CONTROL OR CHECK LIGHTS

Run-in failure?

Y — Run cards out of machine using manual clutch trip switches and try run-in again. If run-in now fails, take "yes" leg for run-in failure.

Did cards feed in?

Y — See "yes" leg for run-in failure.

N — Both feeds fail to feed?

Y — Primary feed fails?

Y — Secondary feed fails?

Y — Check for CR43 impulse between All Cycles hub and test hub 12.

N — Check for CR43 impulse between All Cycles hub and test hub 10.

N — Check for CR43 impulse between test hub 8 and All Cycles hub.

N — Check for CR43 impulse at test hubs 7 and 8.

SERVICE HINT 8 - FEED FAILURES

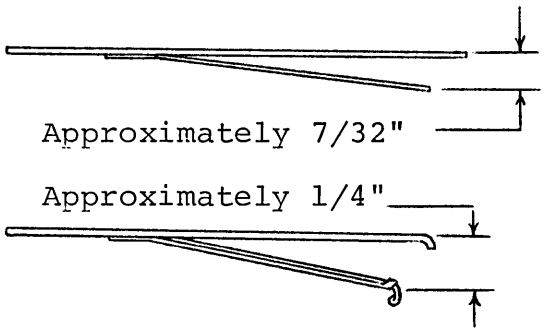
S.H. 8-1 - File feed clutch adj. - too many or too few cards in hopper.

S.H. 8-2 - File feed side joggler - not pushing cards to rear hopper plate.

S.H. 8-3 - File feed rear joggler tie bar loose - feed knives will not travel behind 12 edge of card.

S.H. 8-4 - CARD WEIGHT ADJUSTMENTS

Misfeeding may occur when feeding the last few cards in the primary hopper because of card weight adjustment. The dimensions for adjusting the card weight springs are as follows:



S.H. 8-5 - Did machine take a clutch cycle? If not, check out associated clutch circuitry. Relay dust bugs, CB's, etc.

S.H. 8-6 - Check throat opening, roller, binding feed knives, hopper side plates, hopper back posts, feed knife travel behind card, and condition of cards (worn, warped, too long/short).

S.H. 8-7 - If card did not advance correctly, check card lever tension, jam bar clearance, feed roll tension.

S.H. 8-8 - Motor runs but no feed, check R4 (run relay) and associated circuitry, or primary/secondary clutch relay failed to pick.

SERVICE HINT 9 - READ FAILURES

S.H. 9-1 - Use 2 group brushes.

1. Brush Block Asm. P/N 610275
2. Individual Brush P/N 609798

S.H. 9-2 - Check brush tracking.

1. In primary, make sure side joggler is adj. correctly.
2. In secondary, check distance between hopper side plates.

S.H. 9-3 - Check for loose, bent, broken or worn brushes.

S.H. 9-4 - Check for broken or bent control panel jacks or wires.

S.H. 9-5 - If isolated to one position, check associated circuitry.

1. Tubes, relays, etc. See S.H. 31-1.
2. Swap control panel wires; move failing brush to another compare/sequence position, and wire the failing compare/sequence position to another brush.

S.H. 9-6 - Highly intermittent read errors can be caused by corrosion on ends of dummy fuse on front side of SMS gate.

S.H. 9-7 - CHECK FOR WORN PULLEYS BELTS, CLUTCH PARTS

The following procedures have been helpful in diagnosing damaged cards or jams, intermittent errors and card jamming caused by loose or damaged timing belts.

1. Run cards into the machine. After the machine has stopped, mark a pencil line on the shear plate along the front edge of the card near the merge pocket. Run the machine a few cycles at a time. In this way, significant variations between the edge of the cards and the pencil line can be seen if the machine contains these defective parts. Check at various feed stations to help narrow down specific station failing. Do not overlook loose feed clutch drive arm studs causing variations in brush-to-card timing and variations in clutched CB impulses.

2. Run blank cards using clutch trip switch and brush display switch on CE panel. This will check for variation between cards. Any variation in excess of 5° indicates worn pulleys, belts or clutch malfunction.

S.H. 9-8 - Check impulse CBs. See S.H. 30.

S.H. 9- 9 - INTERMITTENT ERRORS

A critical timing condition can exist in the hold circuit of R-39 and R-41 on transistor 088s. The counter E.M.F. from the paralleled relay coils can prevent either relay from dropping by 300 degrees. This can cause a variety of intermittent machine errors. Later production machines have an 820 ohm resistor wired in series with the hold coil of each of these relays.

All machines should be checked to insure that these resistors are installed. (Two required per machine. Four required if machine has additional clutch relays 39A and 41A.)

MACHINES AFFECTED: All TX 088s prior to H suffix serial on WD.

P/N	E/C	NAME
602309	807508	Resistor, 820 ohm 2 watt

S.H. 9-10 - BRUSH CABLE STRAIN RELIEF

Machines which require frequent brush removal may experience broken and shorted individual brush wires.

Future production machines will have a clamp assembly installed on all brush block frames.

These parts are available in B/M 635184 for installation on field machines that have this problem and exposure. One B/M is required for each brush block.

MACHINES AFFECTED: All 088s prior to M-4 suffix

B/M	E/C	NAME
635184	807262	Clamp Asm. Brush Cable (1 B/M required per brush block)

INSTALLATION TIME: Man Hrs .1 per B/M

S.H. 9-11 - Check for low voltage. See S.H. 33-3.

S.H. 9-12 - If card count is wired, see S.H. 23-4.

SERVICE HINT 10 - MATCH - MERGE FAILURES

S.H. 10-1 - Primary card lever #2 fail to make.

1. This failure will not cause a primary check light.
2. This failure can be detected by quick test panel. See S.H. 2-2.

S.H. 10-2 - Check brushes - worn, bent, loose, tracking, and timing.

S.H. 10-3 - Check for bent or broken control panel jacks or wires.

S.H. 10-4 - Check impulse C.B.'s. See S.H. 30.

S.H. 10-5 - Check code relays and C.B.'s. See S.H. 2-1.

S.H. 10-6 - Check for low voltage, see S.H. 33-3.

S.H. 10-7 - METHOD FOR DETECTING TIMING VARIATIONS IN FEED WHICH CAUSE READ PROBLEMS

By using blank cards, the brush timing can be observed between cards for excess variation by using clutch trip switch and brush display switch on CE aid panel. Any variation in excess of 5° indicates improper belt tension, loose or worn pulleys, or clutch malfunction. Further diagnosis is necessary to determine the exact cause of timing variations.

Timing variations may also be observed by drawing a line on the lower card guide at the leading edge of the card and observing the point at which the card stops. Variations can be detected by the distance between the leading edge of the card and the line.

S.H. 10-8 - INTERMITTENT ERRORS

A critical timing condition can exist in the hold circuit of R-39 and R-41 on transistor 088s. The counter E.M.F. from the paralleled relay coils can prevent either relay from dropping by 300 degrees. This can cause a variety of intermittent machine errors. Later production machines have an 820 ohm resistor wired in series with the hold coil of each of these relays.

All machines should be checked to insure that these resistors are installed. (Two required per machine. Four required if machine has additional clutch relays 39A and 41A.)

MACHINES AFFECTED: All TX 088s prior to H suffix serial on W.D.

P/N	E/C	NAME
602309	807508	Resistor, 820 ohm, 2 watt

S.H. 10- 9 - If tube machine, see S.H. 31-2.

S.H. 10-10 - If card count is wired, see S.H. 23-4.

S.H. 10-11 - HIGH SEQUENCE INSTEAD OF EQUAL SEQUENCE ANSWER

1. Run a group of equal cards through each feed with the control panel wired to stop on high primary, or high secondary sequence. This is to determine which feed is failing.
2. If the machine produces a high primary sequence, while checking the primary feed, check for the position failing by using the dial switch.
3. After determining the position failing, check:
   A. Primary brush.
   B. Control-panel wiring.
   C. Tube circuit from primary hub.
   D. Odd-number relay in sequence storage.

S.H. 10-12 - WRONG COMPARE ANSWER

1. Run a group of equal cards (same control number in both primary and secondary) through each feed simultaneously with the control panel wired to stop the machine on low secondary and low primary.
2. If the machine produces a low secondary or low primary during the run, the column of decision lights indicates the first column containing an error. Turn dial switches to indicate column to find code storage.
3. Check card to see what coding should have been.
4. Check other columns with the dial switches to see whether this code was dropped in all positions.
   A. If code was dropped in all positions, check code C.B. involved.
   B. If code was dropped in this column only, check tube, relay, and brush positions involved. See S.H. 9 and S.H. 31-2.

SERVICE HINT 11 - SEQUENCE FAILURES

S.H. 11-1 - Check brushes to determine failing position. To determine failing position, see S.H. 35-6.

1. Loose, worn, bent, tracking, and timing.
2. Swap control panel wires; move failing brush to another sequence position, and wire the failing sequence position to another brush.

S.H. 11-2 - Check for bent or broken control panel jacks or wires.

S.H. 11-3 - Check tubes - See S.H. 31.

S.H. 11-4 - PASSING LOW PRIMARY SEQUENCE ERRORS

It is possible to pass low primary sequence errors when all of the following conditions exist:

1. Blank cards are run through the secondary.
2. Blank cards are run out of secondary. (leaves R-35 up)
3. Machine not turned off.
4. Clutch trip switches not operated.
5. Punched cards run through primary.
6. Secondary blank col. sequence check not installed. (B/M 605153)

Note: If you run blanks through the secondary, trip the clutch switches before returning machine to customer.

S.H. 11-5 - PASSING SEQUENCE ERRORS WHEN USING SEQUENCE SHIFT

Failure to detect sequence error.

If the customer is using sequence shift and has control panel wired with "Secondary Sequence ON" and "Primary Sequence ON", the first error will be detected in the secondary portion and will result in a "Secondary Control Stop" light. This is normal and correct operation. However, subsequent errors in the secondary portion will go undetected because of the following:

1. R38 (Sec 40B) drops due to low secondary sequence (now used in primary feed) when 46-4 N/C point is transferred.
2. R28 (Sec 10B) is picked by reset key and held through latched secondary cam S7, which cannot be opened until a secondary feed occurs. Since only primary feed is being used, S7 will not open and R28 remains held.
3. R28-4 N/O (Sec 40B) point provides a continual pick for R38 from this point on and renders the 46-4 N/C point ineffective, thereby failing to detect subsequent errors in secondary circuit.

A suggested correction is to advise customers using sequence shift to wire as follows:

1. "Secondary Sequence OFF".

2. "Primary Sequence ON" through the normally closed points of a low secondary sequence answer relay. This allows only "Primary Control Stop" indications and will allow complete detection of errors in the secondary portion of sequence checking.

3. Another suggested method is shown on Page 26, Figure 23, of Reference Manual, Form A24-1013-4.

SERVICE HINT 12 - FAIL TO START

S.H. 12- 1 - Secondary "C" cam idler gear may wear and have excessive wink. This causes failure to feed, control stops, noisy operation, and other problems associated with C.B. timing.

S.H. 12- 2 - Check fuses.

S.H. 12- 3 - Stacker full switches.

S.H. 12- 4 - File feed gate switch.

S.H. 12- 5 - Jam switch.

S.H. 12- 6 - Check voltage. See S.H. 33-3.

S.H. 12- 7 - Cover interlock switch.

S.H. 12- 8 - Contactors K1, K2.

S.H. 12- 9 - Delay relays DR1, DR2, DR3.

S.H. 12-10 - Motor runs but no feed. Check R4 (Run Relay) and associated circuitry or primary/secondary clutch relay failed to pick.

SERVICE HINT 13 - FAIL TO STOP

S.H. 13-1 - Secondary "C" cam idler gear may wear and have excessive wink. This causes failure to feed, control stops, noisy operation, and other problems associated with C.B. timing.

S.H. 13-2 - Diode D10 being faulty may cause a failure to stop.

SERVICE HINT 14 - FALSE ANSWER - CONTROL STOPS

S.H. 14-1 - FALSE ANSWER, TRANSISTOR 088 WITH SPLIT COMPARE

A condition exists on a few 088s equipped with split unit device where double answers develop causing a control stop. This condition is caused by cable capacitance in the split feature cabling.

The indication is an extra answer relay being up in addition to correct answer. Code relays are set up correctly. Pulse which fires answer transistor will usually not show on the timer. This condition can be corrected by installing B/M 605842 (see CEM #26 which released this B/M for answer point clearing).

The capacitors in this B/M will provide sufficient damping to prevent the capacitive coupling between cables and prevent double answer set-up.

MACHINES AFFECTED: All TX (Serial numbers after 15,000) with split compare

B/M	NAME
605842	Answer Point Cleaning Circuit

INSTALLATION TIME: Man Hrs 1.0

S.H. 14-2 - CONTROL STOP LIGHTS, FAILURE TO DEVELOP ANSWER

Loss of the C-44 impulse, caused by dirt in the code relay answer points, can be greatly reduced by a circuit change to the answer network.

The change provides a high current spike of short duration through the answer network each time C-44 closes. The cleaning current is generated by a resistor-capacitor combination connected to each answer hub line.

B/M 605810 - Answer Relay Point Cleaning Circuit.

MACHINES AFFECTED: IBM 088s wired to W/D 602700* or A.

B/M 605842 - Answer Relay Point Cleaning Circuit.

MACHINES AFFECTED: IBM 088s wired to W/D 602700B or W/D 603000 all suffixes.

SERVICE HINT 15 - SECONDARY CONTROL STOPS

S.H. 15-1 - INTERMITTENT SECONDARY CONTROL STOPS - THYRATRON TRANSISTOR MACHINES

Highly intermittent control stops may be caused by a shorted diode in the sequence relay hold circuit (Section 32, W/D 603000). The purpose of the diode is to stop circulating current due to the induced voltage between the hold coils of sequence relays. If a diode is shorted, the induced current will cause slow drop-out of the relay during read time, particularly with an "8-9" combination. This results in control stops due to a momentary double sequence answer. A quick check for shorted diodes in each individual sequence hold circuit can be made by the following procedure:

1. Turn main line switch OFF.
2. Make certain all rotary switches on the diagnostic aid panel are OFF.
3. Turn dynamic timer ON.
4. Connect the timer CONT to R372 hold coil B side.
5. Connect the lead from the timer COMMON hub to R372-1 O/P. Make certain that this polarity is correct. Erroneous timer indications will result if the timer leads are reversed.
6. Remove relay 210 to isolate the hold circuit.
7. Using a small screwdriver, manually pick each sequence relay. Caution: Do not dislocate the relay armature.
8. The timer light will remain OFF if the diode is not shorted. If timer light glows, replace the diode for that position and recheck. Note: When a short or ground in a circuit has caused a fuse to blow, it is important to check the circuit for shorted diodes. If a fuse blows, it is possible that enough current has been drawn to damage the diode in the circuit.

S.H. 15-2 -

Intermittent false equal secondary sequence answers may result due to the high resistance of the 560 ohm resistor in the secondary sequence circuits (W.D. Sections 29, 31). The 560 ohm resistor (P/N 603088) has been changed to a 470 ohm resistor (P/N 2123791) in all cross-over circuits in the secondary sequence positions.

If the above problem is experienced, the 560 ohm resistor should be replaced by the 470 ohm (P/N 2123791) resistor in the positions causing the failure.

SERVICE HINT 16 - STACKER SELECT FAILURES

S.H. 16-1 - Check stacker select magnet - travel, and/or dirt between yoke and armature.

S.H. 16-2 - Check C.B. and associated relay points and control panel wiring.

S.H. 16-3 - FALSE SELECTION

False selection of part of an equal (matching primary card) group of secondary cards.

With a board wired to merge equals and select unequals, a failure to read any position at the secondary sequence station while feeding an equal group of secondary cards will cause the following:

1. A false high secondary sequence output.
2. High secondary sequence causes the drop out of the interlock relay.
3. Drop out of the interlock relay will result in a low secondary compare output instead of a forced equal compare output.
4. A low secondary compare output will result in the false selection of the remaining cards in the matched secondary group.

Note: The quick test board in S.H. 2-2 will locate this failure.

SERVICE HINT 17 - JAMMING

S.H. 17-1 - MERGE POCKET JAMMING

Merge pocket jamming caused by primary and secondary card interference may be corrected by installing:

1. B/M 605877 Merge Pocket Speed Change - Changes the transport feed roll pulleys to change the relationship between primary and secondary card as they enter pocket 3 to minimize card to card interference.

   Note: When installing B/M 605877 on 51-80 (Standard Feature only) machines, interference may be encountered with the 51 column arrestor tape. On all 51-80 (Standard Feature) machines order and install a new CB Cam, P/N 608606, in location C60 (SCC-2) of the lower primary CB unit in place of the present cam, P/N 602120. Adjust the new cam, P/N 608606, to make at 45 and break at 265.

2. B/M 635281 Merge Pocket Jamming Change - Includes (a) New ledge hardware (b) New style deflector springs and brackets (c) New merge pocket jam detection device (d) Ledge 603723 is obsoleted and should be discarded (e) B/M 635281 cannot be used on 51-80 machines. Pre Req B/M 605877

MACHINES AFFECTED: 088s prior to A5 S/N suffix

S.H. 17-2 - ALIGNMENT AND TENSION

Alignment - Pressure rolls must be directly below center line of feed roll (see Figure 1) to insure proper angle of card entry into pocket. This alignment may be checked with alignment tool P/N 603886 or insert a .010 feeler gauge between rolls (free to move up or down) and adjust to make gauge parallel with card line.

Note: If pressure rolls are moved to an extreme, either forward or to the rear of center, card jamming may be experienced due to card interference at either the feed roll station or the shear plate.

Tension - Should be within 1 1/2 to 2 1/2 pounds pull. (Measure with strip of card and push pull scale P/N 9900012 pulled through rolls.) It is important that tension does not vary more than 1/4 pound between front and rear.

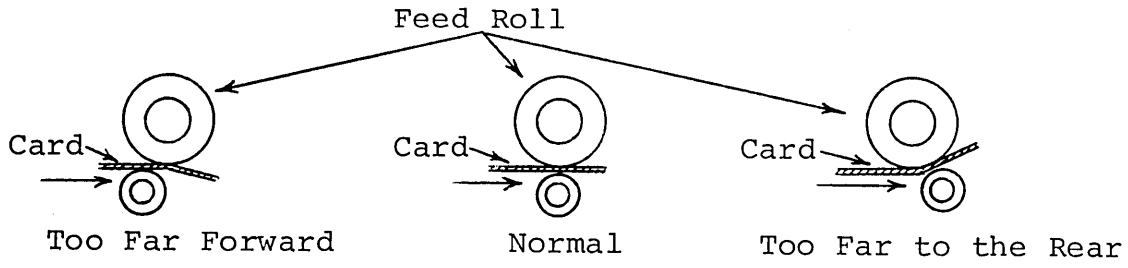


Figure 1

S.H. 17-3 - MISCELLANEOUS HINTS, JAMMING

1. Form the radial card guide plates to match the profile slide and install to be squared with the sides of the stacker.

2. There should be .003" to .005" clearance between the center lower card guide and the spring deflector attached to pocket 2 and 4 select magnets.

3. Check chute blade adjustments.

   A. Position chute blade for 1/32" clearance to the center lower card guide as in Figure 2.

   B. Chute blade tension should be such that 3/4 pound or 300 to 350 grams tension will just hold the armature attracted to the selector magnet which operates both chute blades. 3/8 pound or 150-200 grams tension should just hold the armature attracted on the select magnet which operates one chute blade. This tension measurement should be taken with the measuring tool held just underneath the armature backstop bracket. Push-pull scale (P/N 9900012) makes an ideal tool for taking above measurement in pounds. Adjust by shifting magnet armature assembly horizontally.

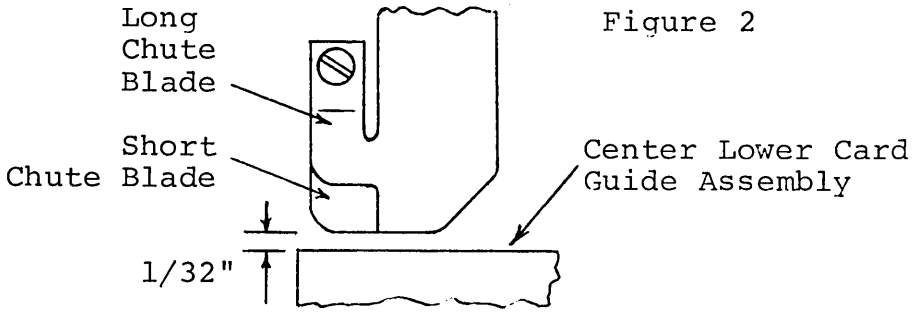


Figure 2

C. The adjustment of pocket 2 and 4 select magnet armature stop has been changed to .040 ± .003 air gap. Adjustment of the merge pocket select magnet armature stop will remain .035 ± .003 air gap. Air gap to be measured between stop and armature when in fully attracted position.

4. Round off the jam tape hanger to remove any possible burrs. This may be done by removing the shear plate to get at the hanger.

5. Adjust the merge pocket jam tape lever upward to a point where the card just touches as cards are feeding into the merge pocket.

6. Raise aligning card lever so the card will fall off sooner.

7. Jams may be caused by sharp corners on contact roll card guide, P/N 602247, or bouncing of card guide holding screws, P/N 52522, due to loose locknut, P/N 602229. See Parts Catalog 088 Figure 10, or see Figure 3, Reference 29, 38, 39-61, 62, 64.

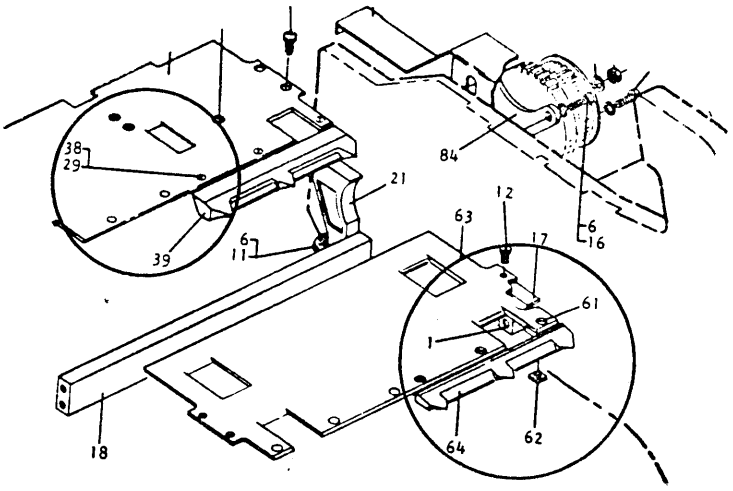


Figure 3

S.H. 17-4 - METHOD FOR DETECTING TIMING VARIATIONS IN FEED

The following is a method for detecting timing variations in feed which cause cardmarking or jamming.

By using blank cards, the brush timing can be observed between cards for excess variation by using clutch trip switch and brush display switch on CE aid panel. Any variation in excess of 5° indicates improper belt tension, loose or worn pulleys, or clutch malfunction. Further diagnosis is necessary to determine the exact cause of timing variations.

Timing variations may also be observed by drawing a line on the lower card guide at the leading edge of the card and observing the point at which the card stops. Variations can be detected by the distance between the leading edge of the card and the line.

S.H. 17-5 - CARD NICKING AND JAMMING

1. Jam tape support clips must be perfectly smooth with no trace of a square edge in the slot. With the jam bar assembly moved toward the left or right end, the clips can be stoned smooth. See Figure 4.
2. Pocket deflectors - clearance between spring steel deflectors (attached to the pocket 2 and pocket 4 selector magnets) and the card guide plates should be from .003" to .005". Less than .003" clearance can cause skewing and card jamming.

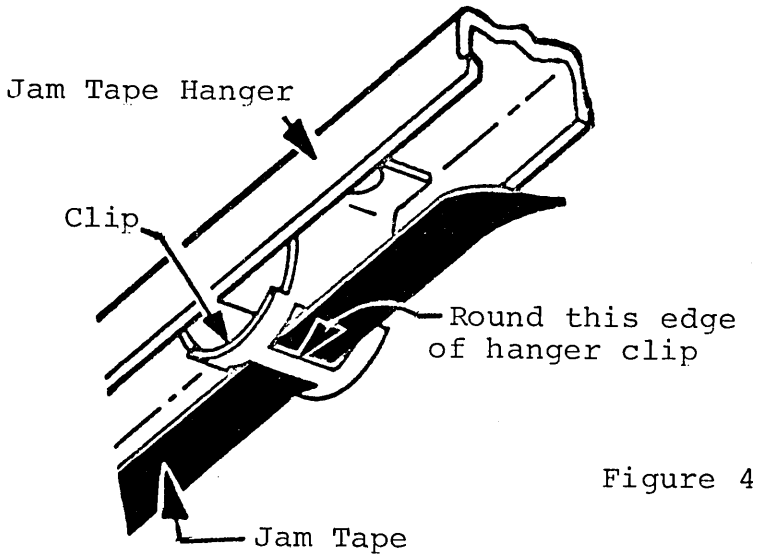


Figure 4

S.H. 17-6 - MALFORMED RADIAL CARD GUIDES

Malformed radial card guides can be a cause of card jamming. See FEMM for adjustment.

SERVICE HINT 18 - STACKER IMPROVEMENTS

S.H. 18-1 - 51-80 STACKING IMPROVEMENT

B/M 635319 has been released to improve stacking in 51-80 (secondary only) machines. The B/M includes new card pushers and mounting hardware.

MACHINES AFFECTED - All 088s with secondary only 51-80

B/M	E/C	NAME
635319	808467B	51-80 Stacker Improvement

INSTALLATION TIME: Man Hrs .6

PREREQUISITES:	TYPE	B/M	CEM
	A	605269	088-14

S.H. 18-2 - CARD TIPPING OVER IN POCKET

Form radial card guide plates to match the profile, see FEMM, and install it squared with stacker side plates. Raise the aligning card lever so the card will fall off sooner.

S.H. 18-3 - IMPROVED STACKER SLIDE

A new style cast aluminum stacker slide is available to replace the present black bakelite stacker slide on IBM 088s prior to K1 suffix. The new style slide will not warp and bind, thus eliminating stacking problems and breakage due to these conditions.

Individual new style stacker slides cannot be installed as direct replacement for the former slide. The appropriate bill of material provides the necessary parts for one complete machine (5 stacker slides) and must be used for initial installation of the new style slides.

It is recommended that a quantity of B/M 605268 and/or 605269 be ordered for updating all affected machines in your office.

B/M 605268 - Improved Stacker Slide. (Standard Stackers).

B/M 605269 - Improved Stacker Slides (51-80 Column).

MACHINES AFFECTED: Prior to approximately IBM 088-K1 suffix (Standard Stackers); Prior to approximately IBM 088-P1 suffix (51-80 Column).

INSTALLATION TIME: 2.5 Hrs (B/M 605268); 3.0 Hrs (B/M 605269).

S.H. 18-4 - RPQ 51-80 FEATURE IMPROVEMENTS (SLANT STACKER 51-80 ON BOTH PRIMARY AND SECONDARY FEEDS)

B/M 691388 - Pressure Rolls - This B/M includes redesigned pressure rolls for the 6 transport stations. This change will reduce card skewing in the transport and improve card stacking.

B/M 691389 - RPQ 51-80 Improvements - This B/M includes a number of improvements which are individually explained below.

1. Flipper Springs - An improved flipper spring design released 2 springs for each of the 5 pocket stations instead of the present single spring design. This improvement provides increased control over card stability as it enters the stacker pocket and also eliminates card marking exposure.

2. Chute Blade - The improved chute blades afford a stronger, more stable design which will reduce misselecting and jamming caused by former chute blade flutter and bounce. This basic design improvement is similar to the one now used on 188 collators; however, the new blade is smaller and lighter.

3. Shear Plates - The redesigned shear plates are released to reduce exposure to card interference as cards enter the stacker.

4. 84 Sorter Type Stacker Card Pushers - The 84 pushers will improve stacking by moving the stacked deck of cards further forward, providing more clearance for cards falling into the stacker.

5. Card Guide (Select Magnet) - New guides are released to eliminate jamming and interference of cards at the select magnet assembly for cards which tend to rise at the corner as they pass under the magnet.

B/M 605877 - Transport Speed Change - This change has proven very successful in eliminating merge pocket jamming caused by card "floating" and card score interference. The transport roll (feed rolls on each side of the merge pocket) speed is changed to allow the primary card to fully enter the pocket before the secondary

card begins to enter, therefore, eliminating card-to-card interference while merging, which has been the major cause of jamming. See CEM 34. B/M 605877 contains a ledge which is for standard machines only. This ledge cannot be used on 51-80 machines.

Although the B/Ms can be installed separately, it is recommended that both B/Ms 691388 and 691389 be installed at the same time. B/M 691388 is a prerequisite for B/M 691389; B/Ms are not sectional and should be planned for complete installation once started. Some customer machine time can be saved by preassembling flipper spring assemblies (step 2 and 3 of B/M 691389) before taking machine from customer.

MACHINES AFFECTED: All 088s prior to approximately J3 suffix with 51-80 RPQ feature 698186.

B/M	E/C	NAME
691388	891878	Pressure Roll Redesign
691389	891878	51-80 RPQ Improvements
605877	804399	Transport Speed Change

INSTALLATION TIME: Man Hrs 2.0 - B/M 691388
9.0 - B/M 691389 *
1.0 - B/M 605877

* Subtract .5 Hr if flipper springs are preassembled

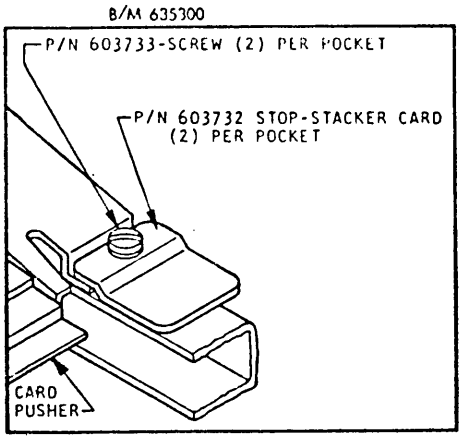
PREREQUISITES - RPQ Feature #698186 (Prerequisite not required for B/M 605877)

S.H. 18-5 - CARDS VERTICALLY "CLIMBING OUT" OF RADIAL STACKER

A new stacker card stop, P/N 603732, is released to prevent cards from following the card pusher on its return stroke in the radial stacker.

The stop eliminates the problem of cards vertically "climbing out" of the stacker pocket. It also helps reduce noise caused by excessive oscillation of the stacker slides.

Two stops, P/N 603732, are installed in each stacker pocket (10 per machine) as indicated in the illustration. A longer screw, P/N 603733, is released for attaching stops.



Note: Stop P/N 603732, cannot be used in stacker pockets processing 51 column cards due to stacker slide interference.

MACHINES AFFECTED: All 088s prior to A4 suffix.

B/M	E/C	NAME	
635300	805484	B/M Stacker Stop	1 required per machine

INSTALLATION TIME: Man Hrs .2 per stacker pocket

SERVICE HINT 19 - DPBC

S.H. 19-1 - FAILURE TO DETECT DOUBLE PUNCH

If P6 or S6 fails to make, intermittent failure to detect a double punch will result. An arc suppression circuit is available to reduce arcing and burning of P6 and S6.

B/M 605091 - Primary and Secondary 6-Cam Arc Suppression Circuit.

MACHINES AFFECTED: Prior to IBM 088-11935 J0

INSTALLATION TIME: 1.0 to 1.5 Hrs

S.H. 19-2 - ERRONEOUS DOUBLE PUNCH INDICATIONS

If trouble is experienced with erroneous double punch indications caused by the reading of Xs, change the timing of P6 cam as follows:

From M349°, B179° To M345° ± 5°, B175° ± 1°

This will allow a greater safety factor against reading Xs by dropping the blank column test relays earlier.

S.H. 19-3 - FUNCTIONAL CORRECTION

All IBM 088s will fail to detect blank columns on the first card cycle following a stop. A B/M is available to correct the circuitry to allow blank column checking on all machine cycles. IBM 088s wired to W/D 603000E have this improved circuitry included (Approximately M2 suffix).

B/M 605340 - Blank column detection circuit correction

MACHINES AFFECTED: All tube machines (serials prior to 15000).

INSTALLATION TIME: 1.0 Hrs

S.H. 19-4 - FALSE DPBC LIGHTS

False DPBC lights can be caused by code relays which pick on the short end of the pick specification time in conjunction with primary and secondary brush impulse CBs that are long in duration. Time brush impulse CBs toward the low tolerance. Tube machines - shortest impulse equals 4°. Transistor machines - shortest impulse equals 3°. Code cams should be timed for a break of at least 4° between adjacent code impulses to prevent extra codes. If brush impulse CBs are timed to the low end of the tolerance, be sure that code cams are made for the complete duration of the brush impulse CBs.

SERVICE HINT 20 - TOP SLIDING COVER ASSEMBLY REPLACEMENT

B/M 605887 is released to afford field replacement of an improved top sliding cover assembly. The improved top cover assembly will provide better top cover latching and interlock switch operation.

The old level top cover assembly may be identified by its spring loaded cover handpull design, compared to the new level which has a recessed plastic handpull design.

The B/M includes the following parts:
- P/N 603191 - Top Cover Assembly
- P/N 603124 - Top Front Casting
- P/N 30037 - Screw (two)
- P/N 609551 - Stud (two)
- P/N 609602 - Hand Pull

MACHINES AFFECTED: All 088s

B/M	E/C	NAME
605887	805489	Top Sliding Cover Assembly

INSTALLATION TIME: Man Hrs 2.0

SERVICE HINT 21 - SAFETY

SAFETY

S.H. 21-1 - FILE FEED JOGGLER SPRING BREAKAGE

Breakage of joggler spring P/N 602147 and possible personal injury, is being corrected by installation of B/M 635239.

B/M 635239 includes an improved spring plus a new stud assembly which utilizes a C Clip to contain the spring if it should break.

MACHINES AFFECTED: All 088s prior to K4 suffix

B/M	E/C	NAME
635239	807524	Joggler Spring and Stud Asm.

INSTALLATION TIME: Man Hrs 0.3

SAFETY

S.H. 21-2 - RELAY GATE SHIPPING COVER

An extremely urgent fire hazard may exist on 088s. In an effort to shield PM relays from dust, some relay gate shipping covers have been left installed.

An investigation has been made in the Rochester Plant. The results are as follows, using a full capacity IBM 088.

1. At room temperature of 75°F, the temperature at the hottest relay is 175°F, using the present individual relay covers.

2. When the relay gate is only partially covered (less coverage than the shipping cover) the temperature increases to 220°F.

3. The plastic shipping cover has a melting point of 200°F.

With a plastic shipping cover installed, and a machine up to operating temperature, a spark from a cigarette, lighter, relay point arc, etc., can cause immediate ignition of the shipping cover.

It is recommended that an immediate check be made on all IBM 088s to verify that shipping covers have been removed from the relay gate.

SAFETY

S.H. 21-3 - 1. SEALING PLATE

2. DYNAMIC TIMER SWITCH TERMINALS

1. Sealing Plate P/N 602580 - Some cases have been found where the sealing plate, which is the U channel piece running between the upper and lower frame at the rear of the machine, has sharp edges. All machines must be checked and all sharp edges removed with a file. All stock has been reworked on machines manufactured after January, 1963 (A3 suffix).

2. Dynamic Timer Switch Terminals - Some early IBM 088s shipped prior to August, 1960 (K0 suffix) did not have the dynamic timer switch terminals covered. Affected machines should have these terminals taped on the next service call.

SERVICE HINT 22 - SPECIAL FEATURE DETERMINATION

S.H. 22-1 - SPECIAL FEATURES W/Ds

When servicing the machines with Special Features, lost time is sometimes encountered because it is not readily evident that a Special Feature is installed on the machine. To prevent lost time and confusion, the Special Feature wiring diagrams and instructions for the thyratron transistor IBM 088 are printed on loose-leaf yellow sheets for insertion in the main wiring diagram book.

The following is a description of the IBM 088 Special Feature diagram identification method, and suggested procedure for placing the Special Feature diagram pages in the main wiring diagram book.

1. Special Feature wiring diagrams, and the main wiring diagram, have an index page showing the sections, names of sections, part number and change level of each section with the diagram. It is recommended that the Special Feature Index be placed behind the main wiring diagram index.

   The number on the upper left and lower right corner of the index page is the part number of the complete feature diagram.

   The yellow feature pages have a section number and/or letter in the upper right corner.

2. Special Feature sections with a number alone indicates a section that should be inserted in place of the corresponding standard section of the main wiring diagram.

3. A Special Feature section having a number with a letter following indicates an added section which is to be placed behind its corresponding numbered section.

4. A Special Feature section having a letter only indicates an added section. The letter is used because this feature page does not affect any particular standard wiring diagram page. It is recommended that the added section be placed behind its Feature Index page. This will assist in locating any additional wiring information while servicing the feature.

5. Upon completion of field installation of a feature, it is recommended that these yellow feature sheets be placed in the appropriate place in the wiring diagram book. Retain the standard sections in the back of the book for future reference. This will provide a complete book of diagrams and instructions to fit each individual machine, and will highlight the presence of a change to the standard wiring.

6. Whenever one or more yellow pages are lost or worn and require replacement, the complete Special Feature diagram should be ordered. Order replacement feature diagrams from the MES Order Department at the plant of manufacture, stating machine serial number, index number and suffix level desired. The main wiring diagram may also be ordered by the above procedure.

S.H. 22-2 - CONTROL PANELS

The plant controls the location of control panel hubs for special features. Depending on each individual machine, these could be located in different places on the control panel. When a machine with special features is ordered, or a special feature is ordered, do not prewire panels for this feature unless you are sure of where it will be located. MES Order Dept. can supply advance information on these locations.

Do not change control panel locations. An RPQ is needed for control panel arrangements other than those furnished by the Plant. When locations are changed without benefit of an RPQ, confusion can result. The machine could be replaced with another - result - the new machine and the customer's control panels are not compatible.

SERVICE HINT 23 - CARD COUNT DEVICE

S.H. 23-1 - COUNT DEVICE - UNWANTED RESET ON STOP CONDITION

When the count device and eject clutch are used simultaneously, an erroneous counter reset will result because card levers 2 and 3 will drop when the card is ejected.

B/M 691541 adds a latch relay to prevent this condition.

MACHINES AFFECTED: All TX 088s with both the eject clutch and count device features.

B/M	E/C	NAME
691541	892150	Make count device and eject clutch compatible.

INSTALLATION TIME: Man Hrs 2.0

SPECIAL TOOLS: Crimping tool for #20 wire terminals.

S.H. 23-2 - FAILURE TO ZERO SUPPRESS WITH SEQUENCE SHIFT

Machines with "Zero Suppress Sequence" feature wired to W/D 690636* will suppress digits 9,8,7 instead of 12,11,0 in the secondary portion of the sequence unit when "sequence shift" is used.

This condition can result in undetected errors which are difficult to analyze. B/M 690799 corrects this by using the primary zero filter cams to control "zero suppression" in the secondary portion of the sequence unit when "sequence shift" is used.

B/M 690799 - Change W/D 690636* to 690636A

MACHINES AFFECTED: Machines wired to W/D 602700* and A with B/M 690636*

INSTALLATION TIME: 1.0 Hr

S.H. 23-3 - CARD COUNT DEVICE

Machines with auxiliary card counter will count over by 1 when wired to count only "matched" or "equal" cards (count impulse wired through the equal compare selector). The equal reading set up on run-in causes the counter to advance 1 prior to reading the card at the primary or secondary brushes. Install one of the following Bills of Material to correct this condition:

1. B/M 690971 - change W/D 690272* to A

2. B/M 690972 - change W/D 690747* to A

MACHINES AFFECTED:

Item 1 - 088s with auxiliary card counter wired to W/D 690272*. (Machines prior to 088-15000)

Item 2 - 088s with auxiliary card counter wired to W/D 690747*. (Machines between 088-15000 and 088-16311)

INSTALLATION TIME: 2.0 Hrs

S.H. 23-4 - EXTRA "C" CODES - THYRATRON TRANSISTOR

If selectors or compare positions are plugged to the count device, noise generated by the UT and TT coils can cause extra "C" codes.

Bills of Material are available to suppress this noise, and to change existing selenium diodes to silicon diodes to prevent circuit leakage.

B/M 622035 - Update 1,2 position count device.

B/M 691195 - Update 3,4 position count device.

MACHINES AFFECTED: Thyratron Transistor 088s (088s after 15000 serial) prior to E2 suffix with count device installed.

INSTALLATION TIME: Approx. 2.0 Hrs each B/M

SPECIAL TOOLS: Crimping tool P/N 450898

SERVICE HINT - 24 - MARK SENSE

S.H. 24-1 - MARK SENSE - ZENER DIODE POLARITY

Zener Diode P/N 369129 polarity may vary and must be identified by the symbol marked on the case, ie, bolt end may be either cathode or anode.

Some of these Zener Diodes may have been installed backwards causing reading problems and transistor failures due to loss of the +30 volts.

These diodes are located in the 30 volt Mark Sense Desense block on bottom of SMS gate, and are shown in Section D of Desense Feature Print.

Check the +30 volt level to see if it is between 26 to 34 volts no load tolerance. Reverse diode (if backward) or replace diode to obtain correct voltage.

MACHINES AFFECTED: TX 088s with Mark Sense Desense
B/Ms 603800-603813-603814

S.H. 24-2 - DIODES - MARK SENSE, DESENSITIZED TRANSISTOR MACHINES

The diodes in the inputs of the desensitized selectors are physically located on the pin side of the SMS gate. They are in the input jumper assembly (P/N 603603). The diodes are covered with insulating sleeves and/or tape.

S.H. 24-3 - MARK SENSE INTERFERENCE

The errors attributable to mark sensing on the back of the card can be corrected by installation of a Sales Bill of Material. Contact Regional Sales Engineering if you have this problem.

S.H. 24-4 - MARK SENSE DESENSE DEVICE - THYRATRON TRANSISTOR MACHINE

Make sure the desense bias voltage is present on the SMS gate at all times on mark desensitized machines. This voltage is to prevent exceeding the base to emitter reverse voltage specification.

S.H. 24-5 - SERVICE AIDS

DP Detection of MS Desense TX machines using selectors

The entry of DP BC switch is not desensitized. If wiring similar to Figure 63 in Operators Manual A24-1013-2 is used, a false DP light will occur due to the +30 volts present at the read brushes during the interval between cards when brushes are on the bare contact roll.

Solution:

1. Pick a selector with the selected brush pulse shown wired to DP BC jackplug.

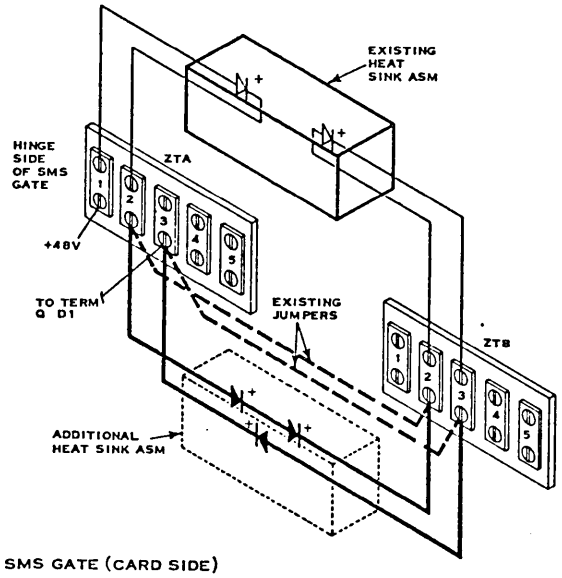
2. Assign selector to proper feed.

3. Wire from blank column test (top row of hubs) through selector to DP BC jackplug entry.

S.H. 24-6 - MARK SENSE DESENSE FEATURE IMPROVEMENT

Most customer applications do not require the full amount of circuit desensitizing provided by this feature. Reduced machine efficiency results and is aggravated by the added resistance of aged components.

A Bill of Material is available to add to selection circuit. This circuit provides the Customer Engineer with various taps to select a desense bias voltage to suit individual machine requirements. Either one, two or all three of the diodes shown below may be connected to reduce the present bias by approximately 1 volt increments.



SMS GATE (CARD SIDE)

This change effectively reduces the effect of the desense feature in the interest of improved overall machine operation.

New production and reconditioned machines will have these diodes mounted. However, the circuit will NOT be connected when the machine is shipped from the plant. If future machine performance warrants the installation

of these diodes, bias voltage selection must be tested thoroughly on customer applications using mark sense cards. Thereafter, if an objectionable number of marks are read, it will be necessary to remove one, two, or all three of the diodes installed on this change.

MACHINES AFFECTED: All 088s prior to approx. S5 suffix with any of the following mark desensitizing features installed: 603800, 603813, and 603814.

B/M	E/C	NAME
635981	810470	Mark Sense Bias Selection

INSTALLATION TIME: Man Hrs 0.5

SERVICE HINT 25 - CONTROL PANEL WIRING

Digit Selector Control Panel Wiring Primary and Secondary "DI" Hubs

Some customer applications may require wiring both the primary and secondary "DI" digit impulse hubs to the "C" common hubs of the digit selector.

Back circuits can result from this particular control panel wiring. B/Ms are available to correct this condition.

1. B/M 622026 - Change W/D 690280* to 690280A - (tube machines)
2. B/M 622027 - Change W/D 690822* or A to 690822B (thyratron transistor machines)

MACHINES AFFECTED:
1. Tube 088s prior to B2 suffix with digit selector device (W/D 690280*) installed
2. Thyratron-transistor 088s prior to B2 suffix with digit selector device (W/D 690822*, A) installed

INSTALLATION TIME: 0.5 Hr

SERVICE HINT 26 - CONTROL PANEL MECHANICS

S.H. 26-1 - CONTROL PANEL LINK AND/OR DASHPOT REMOVAL

The dashpot P/N 123113 and/or link P/N 123115 can be removed without disassembling the closure mechanism by the following method:

1. Dashpot

   A. Remove 2 springs P/N 123132 - remove lower clip P/N 139766
   B. Turn Stud P/N 237521 out with 7/16 wrench
   C. Partially open control panel and pry dashpot out with large screwdriver.

2. Link 123115 Removal

   A. Remove Clip P/N 219743
   B. Partially open control panel and remove link

   Note: Links (left and right) are interchangeable.

S.H. 26-2 - CONTROL PANEL ALIGNMENT

A control panel that is not aligned properly may cause damaged or shorted contacts and/or failure of contacts to make. To correct control panel alignment, proceed as follows:

1. Remove control panel door from frame.

2. Remove control panel and insert panel gauge assembly P/N 450323, into control panel retainer. Insert alignment bar, P/N 450323, into control panel retainer. Insert alignment bar, P/N 450307, into slots and make certain that all stationary contacts are flush with the top surface.

3. Adjust roller adjusting screw, P/N 75717 for the best over-all condition and form individual contacts if out of alignment with the majority of contacts.

4. As the mechanism is closed, check for 1/8" rise of control panel. If amount of rise is improper, adjust two eccentric studs, P/N 186881 at top of mechanism to obtain the 1/8" travel.

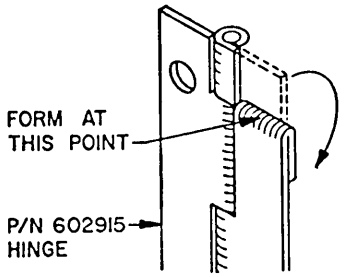
SERVICE HINT 27 - DAMAGE TO MAIN LINE CORD OR CABLES

S.H. 27-1 - DAMAGE TO MAIN LINE CORD

Main line cord damage can be caused by the strain relief clamp not being installed. This clamp is located under the base near the location of the main line cord opening in the base. The clamp should be installed on all machines to prevent damage to the wire terminals.

S.H. 27-2 - CABLE CHAFING AND GROUNDING EXPOSURE - RC PANEL HINGE

A cable chafing and grounding exposure exists on all TX 088s (serials over 15000) prior to P3 suffix. The exposure exists on the RC panel hinge at the upper end. To correct this exposure, form the top of the hinge as indicated in the figure below.



SERVICE HINT 28 - TRANSISTOR DIODE BURNOUT

S.H. 28-1 - BURNOUT OF TRANSISTORS AND DIODES

Collapse of count device relay coils produces a high voltage spike of approximately +200V to -300V at the count device "Reset" hubs on the control panel. "Reset" may be parallel wired to a selector or compare entry position (Figure 75 Page 76 of the Operator Reference Manual, Form #A24-1013-2). The voltage spike may cause burnout of transistors and diodes in the selector or compare entry positions.

B/M 691070 provides diodes and instructions to clamp the high voltage spike to ground and eliminate transistor and diode burnout.

Rochester MES Order Department has automatically shipped a sufficient quantity of B/M 691070 to each Branch Office having machines affected. Production machines after August 15, 1961, have this correction installed.

B/M 691070 - Update Count Device to "B" suffix.

MACHINES AFFECTED: Thyratron Transistor 088s prior to approx. L1 suffix with count device (B/M 690748* or A) installed.

INSTALLATION TIME: 2.0 Hrs

S.H. 28-2 - SMS CARD BURNOUT - THYRATRON - TRANSISTOR

Maintenance Reduction

Severe transistor and diode damage on thyratron transistor machines (serials after 15000) is caused by high voltage spikes emitted by the "ALL CYCLES" and "PRIMARY, SECONDARY CYCLES" hubs. The selector SMS cards are most affected. A B/M is available to provide clamping diodes in the affected circuits. 088s wired to W/D 603000E have this improved circuitry included (approximately M2 suffix).

B/M 605337 - SMS card burnout correction - Blank column detection circuit correction

MACHINES AFFECTED: Thyratron-transistor machines (serial after 15000) wired to W/D 603000* through D.

INSTALLATION TIME: 1.6 Hrs

S.H. 28-3 - DIODE 4 AND 8 FAILURES

Early tube machines with added card lever and clutch relay capacity installed (W/D 690284*) are exposed to D-4 and D-8 diode failures. These diodes are in the pick circuits to R39, R39A and R41, R41A.

If failures are experienced, install IN 1218 diode, P/N 603793, in positions D-4, D-8, in place of IN 448, P/N 694614.

The note on W/D 690284* should be changed to read "HD diode asm. P/N 603793".

MACHINES AFFECTED: 088s wired to 602700*. Prior to approx. M0 suffix, with add card lever and clutch relay capacity installed. W/D 690284*.

SERVICE HINT 29 - PERMISSIVE MAKE RELAYS

S.H. 29-1 - This is a method to effectively clean PM relays:

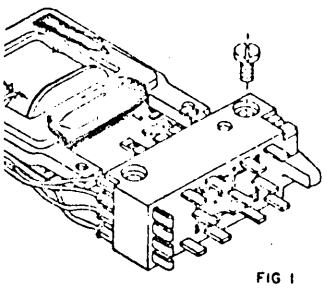


FIG 1

STEP 1 - Remove the two relay yoke mounting screws and separate the contact molding asm. from the yoke asm. This will expose the contact wires and common contacts. Use care to prevent breakage of coil wires from relay contact molding.

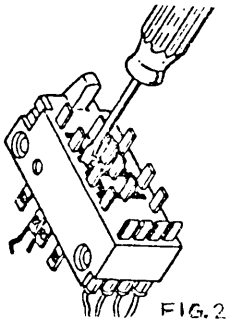


FIG. 2

STEP 2 - Using a screwdriver, press the contacts free of the locating hole and remove them from the molding.

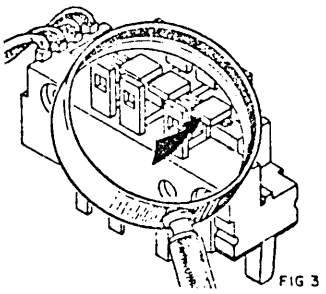


FIG 3

STEP 3 - Inspect the common contact point for dust or corrosion. If necessary, lightly burnish the point with the metal burnishing tool. Do not attempt to clean the common contact if it is pitted or burned as this will result in increased air gap and loss of contact tension.

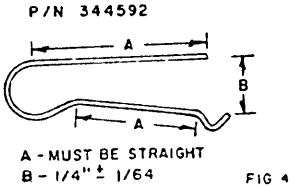


FIG 4

STEP 4 - Check new contacts for correct configuration before installing.

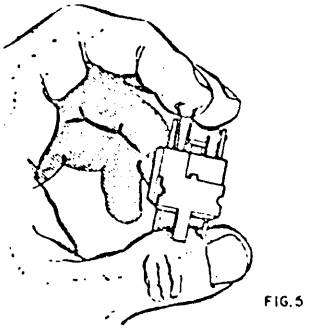


FIG. 5

STEP 5 - Install new contact wires one at a time to avoid twisting.

STEP 6 - Reassemble yoke to contact molding asm. The armature must be centered on the contact wires with equal dimensions at (A) between the end contacts and the ears of the molded armature actuator. Be certain that the yoke is held tight against the mounting pads (B). Do not overtighten screws so the molding becomes cracked or damaged.

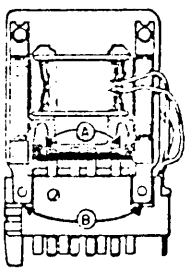


FIG 6

STEP 7 - Visually check all wires to see that none are crossed or misplaced from the locating hole. Check armature for freedom and proper seating of pivot springs.

S.H. 29-2 - PM RELAY - MOLDED ARMATURE ACTUATOR CRACKS AND FAILS TO HOLD

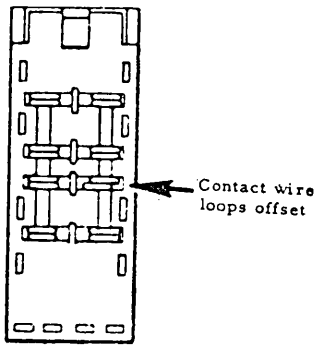
The black actuator may crack in the center section that is in contact with the armature. This condition has been tested in the Electrical Laboratory. The plastic actuator is molded through three holes in the armature. No failures can be attributed to cracks in the molding as long as the cracks are in the center portion between the two outside armature mold holes.

Machine troubles that appear to be caused by failure to hold may actually be caused by failure to get a solid pick shot. If the relay doesn't seal on the pick shot, the armature will not seal with the hold coil energized. Do not overlook dirt between the armature and core or relay frame. Don't discount the possibility of fluctuating input line voltage caused by excessive number of machines on one line or poor voltage regulation of the customer's supply line.

S.H. 29-3 - PM RELAY POINT FAILURES

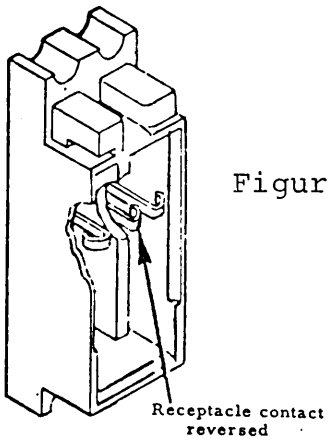
Although the code relays may operate correctly, the wire contacts can be twisted and one N/C wire may remain made while the N/O contacts make, and vice versa.

This condition is difficult to see even though the machine failure has been localized. The contact wire loops will be offset from each other when the wires are crossed. See Figure 1.



PM Relay connector side

Figure 1



PM Relay moulding contact side

Figure 2

Cases have been found where an extremely intermittent failure was traced to the relay molding receptacle. The exposure is very limited; however, it is well to be aware of a possible reversal of the receptacle contacts in the molding. A reduced contact tension will result. See Figure 2.

S.H. 29-4 - FAILURE OF CONTACTS TO MAKE - PM RELAY

The failure of relay contacts to fully make on the normally open side may possibly be caused by incorrect power supply voltages. Refer to the no load DC voltage settings on the decal near the non-regulated power supply for correct adjustments. If the voltage is low, ie, below the correct setting, permissive make relays will not seal properly. Also see S.H. 33-3.

SERVICE HINT 30 - CIRCUIT BREAKERS

S.H. 30-1 - TIMING

CB timing is critical. In instances of intermittent failures, and you can identify the failing circuits, be sure that all associated CBs are accurately timed.

S.H. 30-2 - CB CAM TIMING

When accurate individual CB timing cannot be obtained, consider the following:

1. Failing cam has one or more worn lobes.
2. CB worn at roller or roller arm pivot, resulting in lost travel.
3. CB points worn or burned.
4. Loose contact piles.
5. High circuit resistance when closed.

S.H. 30-3 - ROLLER CBs

Incorrect roller spring adjustment can cause intermittent impulse failures such as ragged start, stop or duration breakup.

Adjust roller CBs as follows, with CB removed from machine. The roller type of plunger circuit breaker is designed to operate at higher speeds than the standard plunger type. A curved flat spring is fastened to the roller arm. This spring operates the contact plunger which, in turn, operates the lower contact strap.

1. A force of 100 to 150 grams should be required to move the operating point to just touch the stationary point. Measure from the end of the operating strap.

2. The contact air gap should be .027" to .032" when the plunger is resting against the frame. See Figure 1, next page.

3. When measured at the roller, 475 to 550 grams should be required to close the contacts with .020" to .030" overtravel. See Figure 2, next page.

4. With the circuit breaker assembly attached to the mounting bar by the holding screw, turn in or out on the adjusting screw to obtain a contact air gap of .017" to .022" on the cam's low dwell. See Figure 3, next page.

5. Use the adjusting screw to set the impulse duration.

6. Rotate the cam to set accurate make and break times. Be sure to check all lobes.

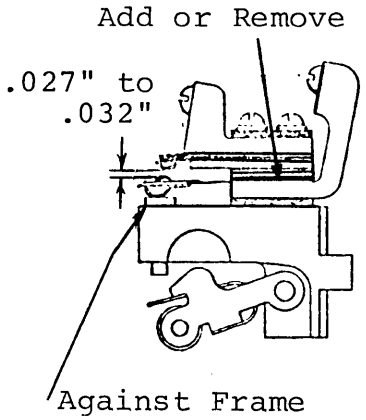


Figure 1

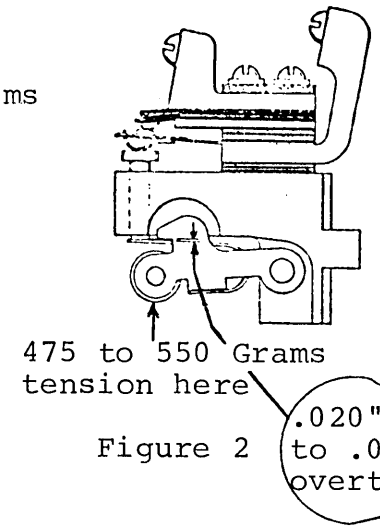


Figure 2

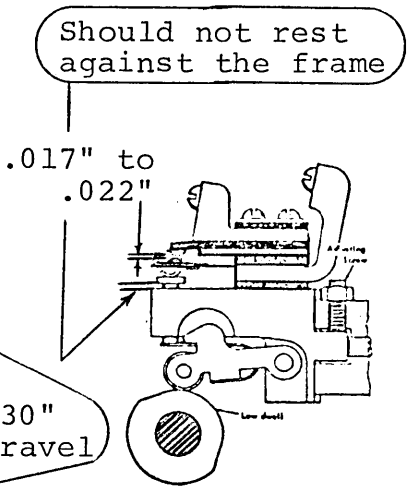


Figure 3

S.H. 30-4 - VARIATIONS IN CB DURATION

1. For maximum reliability of brush impulse cams, P2, through P5 and S2 through S5, the specified contact air gap (.015"-.018") should be maintained. Insufficient contact clearance (less than .015") has resulted in extraneous readings and associated blank column error indications because of contact bounce. Excessive clearance (more than .018") causes loss of duration as well as reduced contact pressure. When contact stack screws are tightened, it may be necessary to adjust for proper timing by rotation of the cams rather than compensating by contact clearance adjustments. The air gap for P6 through P9 and S6 through S9 should be changed from .015"-.018" to .018"-.022" on all "*" through "A" suffix wiring diagram timing charts.

2. Tighten loose CB contact stack holding screws. Note: Check timing.

3. Remove all grease from cams, and under no circumstances, lubricate plungers. Note: Do not use solvent to clean cams.

4. If items 1, 2, and 3 have been checked and proper timing and duration cannot be obtained, replace the CB.

5. Ventilation of the underside of primary and secondary CB covers will reduce the build-up of black substance on CB points.

S.H. 30-5 - IMPULSE CBs

False DPBC lights can be caused by code relays which pick on the short end of the pick specification time in conjunction with primary and secondary brush impulse CBs that are long in duration. Time brush impulse CBs toward the low tolerance. Tube machines - shortest impulse equals 4°. Transistor machines - shortest impulse equals 3°. Code cams should be timed for a break of at least 4° between adjacent code impulses to prevent extra codes. If brush impulse CBs are timed to the low end of the tolerance, be sure that code cams are made for the complete duration of the brush impulse CBs.

S.H. 30-6 - P-6 TIMING CHANGE - 088 WITH ALPHA DEVICE

On machines with alpha collating device, the cam for P-6 is changed to provide increased duration. The P/N of P-6 with alpha device is P/N 602125. All machines have correct cam but timing change is not noted on W.D. The following W.D. changes should be made:

Sec. 11 P-6 M325°, B215°
Sec. 66B-M325°, B215° Cam P/N 602125
Sec. 67B and 68B P-6 M325°, B215°

S.H. 30-7 - SERVICE CHECK FOR CORRODED OR PITTED CONTACTS ON CB'S

To check for pitted or corroded contacts on CB's, take a strip of card stock and insert it between the contacts. Holding the contacts closed, pull the card from between the contacts and check for a drag or tear in the card. If the card hangs up or tears, replace the CB or burnish the contacts.

SERVICE HINT 31 - TUBES

S.H. 31-1 - SUSPECTED TUBE FAILURE

Switch unit. (To be sure of selecting proper units to switch, refer to wiring side view of tube panel, Section 49 and 50 or Wiring Diagram.)

1. If trouble disappears in both positions:

   A. Check tube and RC panel edge connectors for cracks between common connections.
   B. Check for poor crimp connections at edge connectors.

2. If trouble follows unit, switch tubes to determine whether tube or unit is at fault.

3. If trouble stays in original position:

   A. Switch relays.
   B. Check RC network edge connectors.
   C. Switch capacitors and resistors.

   Note: If relay still fails to pick, be sure brush circuit is functioning properly.

S.H. 31-2 - INTERMITTENT TUBE TROUBLE

A high resistance connection at the filament cable terminals on the power supply or at the tube gate bus bars will produce failures as a result of low filament voltage. The trouble may appear or disappear when the tube gate is opened.

Failure to remain in conduction, causing match or merge failures:

The 5696 tube may cut off after sustained periods of conduction. The length of conducting time required to cause this failure may vary over a very wide range. If intermittent mismerging or mismatching is encountered, it may be caused by a tube cutting off and changing the answer. For example: If a "low primary" reading is set up and a group of primary cards are fed, a secondary code relay tube may cut off, changing the answer to an erroneous "low secondary". The primary feed would then stop and the secondary feed start resulting in a mismerge or mismatch. To check for this failure, use the "9-2" cards outlined in Service Hint 2-2. Stop the machine for approximately two minutes with all the code relay tubes fired. If the answer changes when the machine is stopped, use the dial switches to locate failing tubes.

SERVICE HINT 32 - MECHANICAL TIMINGS

S.H. 32-1 - TIMING SEQUENCE

Note: For CR drive mechanism, see S.H. 35-3, for broken belt, see S.H. 32-4.

No major timings should be changed until the following sequence is checked:

1. Secondary clutch engages at 310°. See S.H. 32-2. It is changed by moving dynamic timer index.

2. Primary clutch engages at 310°. See S.H. 32-2. It is changed by slipping drive gear on primary drive shaft.

3. Picker knife timing is 70° ± 1 (pilot holes in picker knife cam shaft line up at approximately 303°. It is changed by slipping picker knife drive pulley on shaft.

4. CR cams are changed by idler gears.

S.H. 32-2 - CLUTCH ENGAGEMENT TIMING

A good method to visually check the timing of clutches is to notice the time at which the detent (A) drops behind the tooth on the clutch drive wheel (B). This may be checked as follows: (See drawing below, Fig. 1)

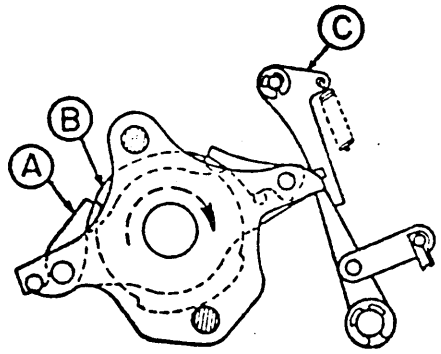


Figure 1

1. Be sure clutch is latched and the keeper (C) is behind drive arm.

2. Trip clutch armature.

3. Turn hand wheel while watching detent (A). Secondary and primary detent may be observed by removing end covers on respective feed and looking over CR CB units.

4. Crank slowly approaching 300-310° and observe exact time at which detent (A) drops behind tooth (B) on the clutch drive wheel. This action can be seen every second cycle. Caution: Be certain before checking that the Keeper (C) is behind the drive arm as indicated in Step 1, or erroneous timing reading will result. After checking timing of one tooth, mark it with a pencil and repeat procedure to make certain timing tolerances are correct on both sides of clutch drive wheel.

S.H. 32-3 - DRIVE MECHANISM TIMING VARIATIONS

Timing variations in clutch CBs and read brush impulses should be held to a maximum of 3°. Oscillation should occur only immediately following feed clutch engagement. Observe brush impulse CBs while operating clutch switch on the CE panel. Observe primary nine digit and secondary twelve digit timing for any variation which may be caused by the following:

1. Loose motor drive belts.
2. Loose clutch feed roll belts.
3. Loose screws and the clutch pulley assembly P/N 602013).
4. Secondary feed, idler gear (P/N 602078) may be worn.

Note: See S.H. 9-7 - How to Check for Worn Belts, Pulleys, Clutch Parts.

S.H. 32-4 - CLUTCH TIMING

1. If all timing is lost, the general timing sequence is:

   A. Time index to secondary clutch.
   B. Time secondary feed knives to index.
   C. Primary clutch to index.
   D. Primary feed knives to index.

2. Clutches are to latch at 310° ± 1°. Latch time is determined by the time the keeper (Figure 1 C) falls behind the drive arm. With clutch engaged, turn the clutch over until the drive arm is near the keeper. While putting finger pressure on the clutch-driven pulley, in direction of rotation, continue to rotate clutch until keeper snaps behind drive arm. This is to occur at 310° ± 1°.

3. Only four belts on the IBM 088 will affect basic machine timing: the two motor drive belts; primary and secondary clutch driven belts.

4. If either motor drive belt breaks or comes off, the only timing lost is the primary feed end. This can be regained by aligning the primary feed knife cam shaft with the aligning tool at 303°. Note: Primary clutch must be engaged. Check primary-clutch time, impulse CBs, and brush timings; correct if necessary. Be sure sequence-brush heel-strands are on scribed line.

   WARNING: Remove the tool before cranking machine.

5. If the secondary clutch drive belt breaks, engage secondary clutch; crank index to 303°; rotate feed knife camshaft to align holes in feed knife cam and side frames; replace belt. WARNING: Remove tool before cranking machine. Check secondary impulse CBs and secondary brush timings; correct if necessary. (One tooth on picker knife pulley is approximately 7°.)

6. The procedure on the primary clutch drive belt is the same as on the secondary except that the primary clutch is engaged instead of the secondary clutch.

SERVICE HINT 33 - POWER SUPPLIES

Caution: Power supply is not isolated from frame. Frame is "0" volts.

S.H. 33-1 - FAULTY "K" CONTACTOR

1. Check for binding armature by manually depressing the armature and watching for full closure of the N/C contacts. Form ears at end of the restoring bail for free operation of the restoring bail.

2. Check the contact mounting screws for snugness. Caution: Do not over-tighten.

S.H. 33-2 - POWER SUPPLY RELAY CHATTERING - BLOWING FUSES

Proper power supply relay adjustment is essential to apply and remove thyratron bias and plate voltages in the proper sequence. The momentary presence of plate voltages without grid bias can cause an excessive number of thyratrons to fire simultaneously, overloading fuses 16, 17 or 19.

Clutch thyratrons thus fired can cause premature primary or secondary feed cycles with associated checks lights. These conditions may occur if:

1. Power supply relays chatter when the main line switch is turned on. To correct, adjust relay DR2 so that its armature, when fully attracted, touches both halves of the split core as well as the lower relay yoke extension. Chattering may also occur if the thermal points of DR3 are dirty or adjusted for excessive delay. A delay of 30 seconds is correct.

2. Power supply sequencing is such that the -70 volt supply is cut off prior to the +70 volt supply when the top sliding cover is opened. To correct, adjust DR1-AL N/C points for greater stationary strap rise and less point air gap than the BU and BL points on DR1.

In addition, fuses 16, 17 and 19 should be changed to the values indicated on the chart on the following page.

Fuse No.	10 Pos. Part No.	Collator Rating
16	335010	1 amp.
17	335010	1 amp.
19	333952	2 amp.

Fuse No.	16 Pos. Part No.	Collator Rating
16	333952	2 amp.
17	333952	2 amp.
19	333952	2 amp.

Fuse No.	22 Pos. Part No.	Collator Rating
16	253675	3 amp.
17	253675	3 amp.
19	333952	2 amp.

B/M 605093 provides necessary circuit changes to prevent relay chattering and insure proper power supply sequencing. Improper power supply sequencing may cause premature primary or secondary feed cycles and the associated check lights. Machines wired to wiring diagram 602700A and later have this improvement installed.

B/M 605093 - Power Supply Sequencing

MACHINES AFFECTED: Machines wired to Wiring Diagram 602700*. (Prior to approx. 088-11010 D0).

INSTALLATION TIME: 8.0 Hrs

S.H. 33-3 - POWER SUPPLY TOLERANCES

Input voltage (115V, 208V, and 230V, single phase, AC) tolerances for tube or transistor machines are $\pm$ 10%.

Transistor 088 output voltage tolerances are:

Supply	Tolerance
+ 48V	$\pm$ 10%
- 12V	$\pm$ 12%
- 70V	$\pm$ 10%

Tube 088 with nonregulated supplies; output voltages under no-load conditions are:

Supply	Voltage (no load)
+ 48V	+ 52 $\pm$ 1V
+ 70V	+ 80 $\pm$ 2V
- 70V	- 80 $\pm$ 2V

The voltage difference between adjacent taps on the transformer is approximately 0.7V.

Tube 088 with regulated supplies; output voltage tolerances under no-load conditions are:

Supply	Tolerance
+ 48V	± 2%
+ 70V	± 1%
- 70V	± 1%

There is approximately a two-volt difference between adjacent taps on the transformer.

Tube 088 regulated filament supply (for all tube 088s) should be set at 6.5vac measured between terminals 34 and 49 at the filament supply output. This voltage may differ from that at the CE Panel 6.3V test hub. Adjust at the taps on the buck-boost transformer. Voltage difference between adjacent taps is 0.1V.

S.H. 33-4 - POWER SUPPLY CONTACTS

Shrinkage of plastic contact holders can warp the metal frame of the contactor causing the restoring bail to bind.

1. Turn off machine and remove main line power cord before checking contactors.

2. Check for binding armature by manually depressing the armature and watching for full closure of the contacts. Form ears (Figure 1) at the end of the restoring bail for free operation. Check the operating contact mounting screws for snugness. Fig. 2.

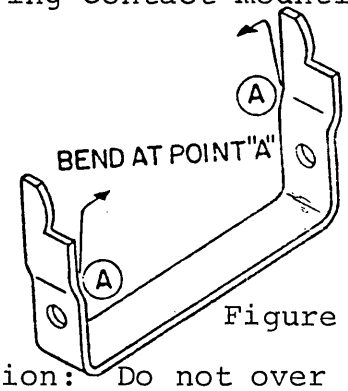


Figure 1

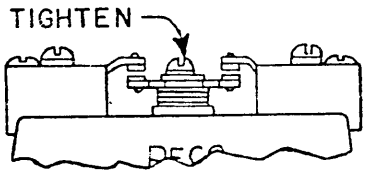


Figure 2

Caution: Do not over tighten, Fig. 2. Failure of the K contact will result in no ready light.

S.H. 33-5 - "GHOST" LIGHTS - ANSWER NEONS

"Ghost" lights refer to false, dim, erratic firing of answer neons due to firing below specified voltages. Field B/M 605962 is released to eliminate "Ghost" lights by reducing answer neon voltages from -70V to -55V.

The B/M adds a voltage divider network to the -70V supply of the answer neons. This change advances 088 W/D 603000 from "E" to "F" suffix.

MACHINES AFFECTED: All TX 088s prior to K3 suffix.

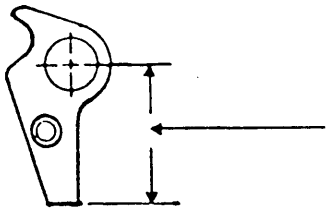
B/M	E/C	NAME
605962	805087	Answer Neon Voltage Change

INSTALLATION TIME: 0.7 Man Hrs

SERVICE HINT 34 - FEED CLUTCH PARTS

S.H. 34-1 - CLUTCH DETENTS

Excessive wear of clutch ratchet and associated parts causing erratic feeding can be corrected temporarily, and clutch life extended by installation of 1402 oversize detents. Select the detent which will best compensate for wear experienced.



DETENT CHART

PART NO.	DIM.	CODE NO.
602017	.656	0
609737	.658	1
609738	.660	2
609739	.662	3
609740	.664	4
609741	.666	5
609742	.668	6
609743	.670	7

S.H. 34-2 - CLUTCH DUST COVER

A cover has been released to reduce clutch problems due to dust.

B/M 635306 includes covers for both feed clutches.

MACHINES AFFECTED: All 088s

B/M	E/C	NAME
635306	808461	Dust Cover

INSTALLATION TIME: Man Hrs 0.4

Type A, Code 01, IBM Distribution Center

S.H. 34-3 - REDESIGNED FEED CLUTCH

A B/M is available for installing an improved primary and secondary feed clutch when trouble is experienced with present clutch. Design improvements have been made to the drive arm and latch assembly providing a stronger drive arm and more positive latching.

The B/M includes sufficient parts to convert one clutch. The magnet and yoke assemblies are not included. Old style clutch parts are being obsoleted and will no longer be available after present stock is depleted.

Sufficient quantities of conversion B/M should be on hand in B/O stock to cover normal clutch maintenance requirements.

MACHINES AFFECTED: 088s prior to approx. No. 18415.

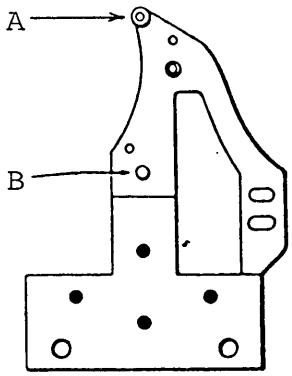
B/M	E/C	NAME
605861	804325	Redesigned Feed Clutch

2 B/Ms required per machine if both feeds require conversion.

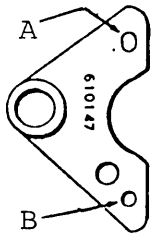
Part No.	Name
603729	Redesigned Clutch Asm.

S.H. 34-4 - CLUTCH LATCHING ASSEMBLY ADJUSTING TOOL

Adjusting tool P/N 610147 is included in all 088s after serial number 18415. This tool is also included in the conversion B/M 605861. See CEM 38.



Clutch Latching Asm.



Adjusting Tool
P/N 610147

The tool P/N 610147 is used to locate the clutch latching assembly with respect to the clutch. The clutch keeper and latch must be removed and the tool slipped over the clutch ratchet shaft. Hole "A" will slip over the keeper pivot and hole "B" over the latch pivot stud. At this time the locating block for the latching assembly can be adjusted against the latching assembly. Snug the latching assembly holding screws.

The only further adjustment of the latching assembly is the lateral adjustment to obtain .008 to .012 unlatching clearance. See Referance Manual, Clutch Adjustment.

S.H. 35 - MISCELLANEOUS

S.H. 35-1 - Diagnostic Techniques
S.H. 35-2 - Clutch, Cycle Prediction
S.H. 35-3 - CR Mechanism
S.H. 35-4 - Dynamic Timer
S.H. 35-5 - CE Aid Panel
S.H. 35-6 - Diagnostic Panel
S.H. 35-7 - Control Key and Light Panel
S.H. 35-8 - Drive Motor Map
S.H. 35-9 - Changing Motor Rotation

S.H. 35-1 - DIAGNOSTIC TECHNIQUES

Utilize dynamic timer for card lever bounce, erratic CBs, etc. See write up for using dynamic timer, S.H. 35-4.

Use portable start key (plugs into diagnostic panel). Each depression of key will feed one card and keep answer relays picked. Holding key in will not feed more cards. It must be released and pressed again for another card to feed. See S.H. 35-2 for predicting clutch cycles.

Intermittent control stop lights can be narrowed down by jumpering CE panel test hubs. Their location in the W.D. can be found in the miscellaneous section near the back of your machine W.D.

On highly intermittent problems, check voltages; also, check belts pulleys and clutches per S.H. 10-7.

When in doubt about how a circuit works, do not overlook "Purpose of Relays and Relay Points", near the back of the FEMM.

Make test decks by reproducing customer's decks; then most malfunctions will be analyzed with the customer's control panel.

1. Make test decks with doubles for each feed and singles for each feed.

2. Rewire control panel to keep test decks separated.

3. Testing in this manner uses the same brushes, relays and control panel wiring as the customer did when problem occurred.

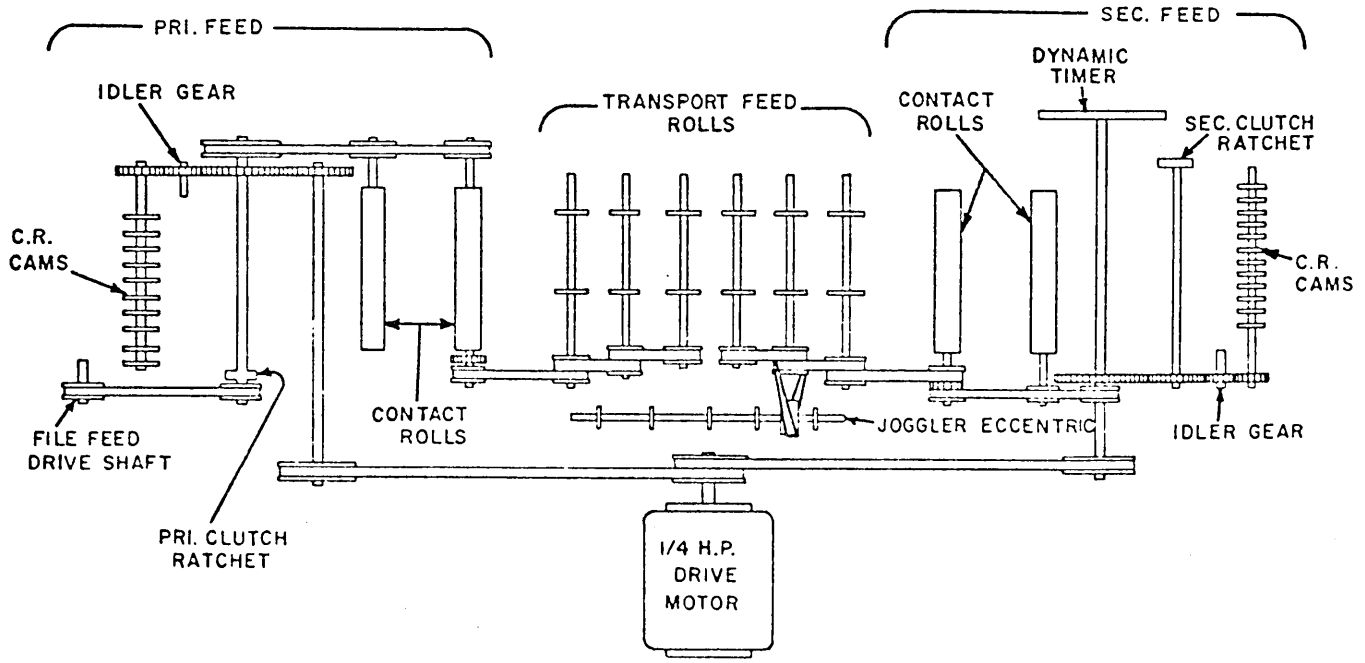
S.H. 35-2 - CLUTCH CYCLE PREDICTION

This can be especially helpful when using the portable start key. See Page 8-2.

BASIC SET UP WIRED TO MERGE (SEQ CHECKING ON - CARDS IN ALL STATIONS)				
COMPARE OUTPUT	PRI SEQUENCE OUTPUT	SEC SEQUENCE OUTPUT	COMP INLK RELAY	ACTION RESULTING
LOW PRI	EQUAL OR HIGH	EQUAL OR HIGH	DOWN	PRI FEED
LOW SEC	EQUAL OR HIGH	EQUAL OR HIGH	DOWN	SEC FEED
* EQUAL	EQUAL	HIGH	DOWN	PRI FEED
EQUAL	HIGH	HIGH	DOWN	PRI FEED SEC FEED
EQUAL	HIGH	EQUAL	DOWN	PRI FEED SEC FEED PICK INLK RLY
EQUAL (FORCED BY) (INLK RELAY)	EQUAL OR HIGH	EQUAL	UP	SEC FEED HOLD INLK RLY
EQUAL (FORCED BY (INLK RELAY)	EQUAL OR HIGH	HIGH	UP	SEC FEED DROP INLK RLY
* BASIC SET UP WIRED TO MATCH (MERGE RULES APPLY EXCEPT FOR FOLLOWING)				
EQUAL	EQUAL	EQUAL	DOWN	PRI FEED SEC FEED

The compare interlock relay forces an equal compare when there are multiple secondaries to feed behind the last primary card of that group when merging or matching with selection of unmatched cards.

S.H. 35-3 - CONTINOUS RUNNING DRIVE MECHANISM



S.H. 35-4 - DYNAMIC TIMER

Use of the Dynamic Timer

The dynamic timer can be used in one of two possible ways in each bulb circuit. When it is desired to measure an active machine impulse, such as that used to pick up a relay, the timer should be plugged to a coil and the result observed with the leads connected across the coil in question. When it is desired to measure the duration of a contact, the timer can be plugged to CONT and the leads placed so that they will be shorted out through the contact to be tested.

When the timer is used on contact, care should be taken that the points tested are sufficiently isolated so that no back circuit can occur to give a false indication. Capacitors across such points should be disconnected before testing. Keep in mind, however, that the capacitor might be at fault and might be the cause of the failure.

The revolving neon bulbs are lighted for the length of the contact, or impulse duration measured across the respective leads, and appears as a bright streak on the face of the dial. The streak begins where the impulse starts and ends where it stops. Bouncing of a contact point may be clearly observed by breaks in the streak on the dial. Correct polarity must be observed to obtain a light on COIL operation. It is especially important to use the dynamic timer in checking and adjusting cam timings; cam contacts break later under running conditions than when the machine is turned by hand.

The voltages mentioned in the text are theoretical voltages and will vary with individual power supplies and different supply voltages.

There are two identical sets of jacks. Consequently, any two of the three tests can be performed simultaneously. Therefore, it is possible to compare the timing between any two relays or coils by noting when the neon bulb glows.

When the dynamic timer is used, the lamp on the indicator dial will be illuminated when:

1. Thirty-five volts or more DC is applied between COIL-HI-V and COM with the COIL-HI-V lead on the negative side of the circuit and COM on the positive side of the circuit. This is the high voltage connection.

2. Five volts or more DC is applied between COIL-LO-V and COM with the COIL-LO-V lead on the negative side of the circuit. This is the low voltage connection.

3. The CONT and COM hubs are shorted together through a cam or relay point when no voltages are present. This is called contact connection.

The actual hold time of a relay can be determined in some cases by:

1. Connecting one timer light (coil connection) across the pick coil of the relay, and;

2. Connecting the other timer light (contact connection) across an unused N/O point of the relay. By observing the timer index, it is possible to see the actual time that the relay contacts are transferred in relationship to the pick time. Thus, the relay hold time is established.

Note: Before changing any timings, check the dynamic timer index to see that it agrees with the mechanical timings. See below.

Streaks on Dynamic Timer Index

To eliminate visible tails or streaks that may appear on the end of CB impulses when displayed on the dynamic timer, replace 12AU7 tube with 5751 tube, P/N 98878. When normal replacement of the 12AU7 on the IBM 088 dynamic timer power pack is required, a 5751 tube should be used.

MACHINES AFFFCTED: Prior to IBM 088-10500 A0.

Timing Sequence

No major timings should be changed until the following sequence is checked:

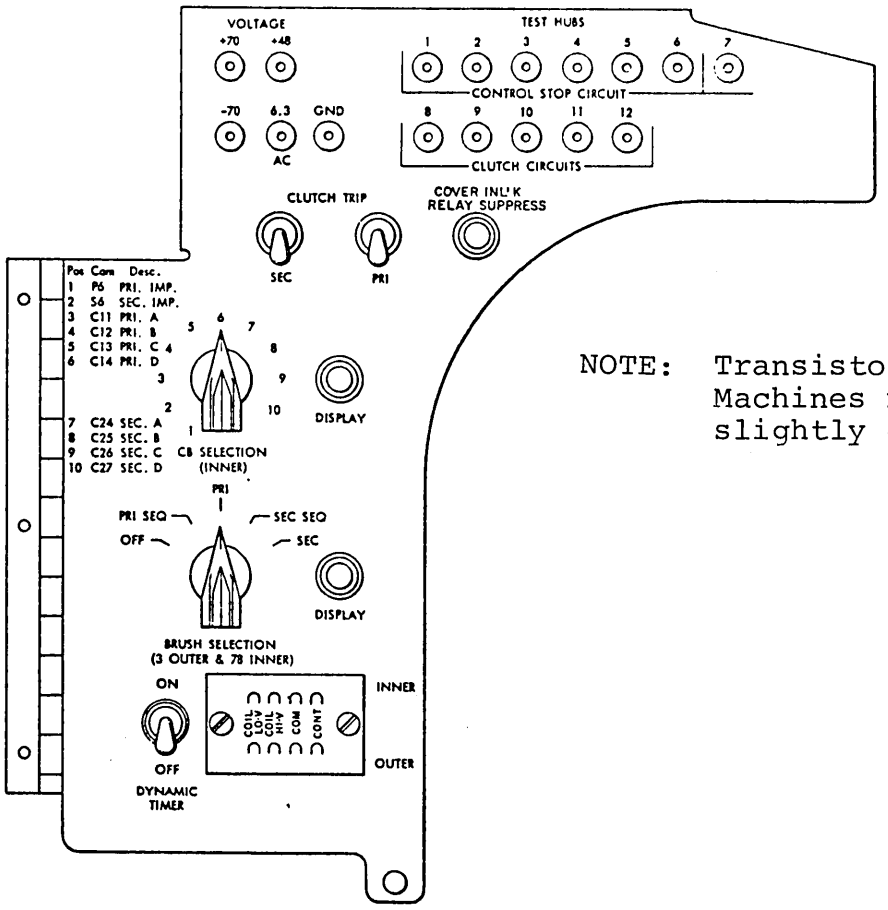
1. Secondary clutch engages at 310°. See S.H. 32-2. It is changed by moving dynamic timer index.

2. Primary clutch engages at 310°. See S.H. 32-2. It is changed by slipping drive gear on primary drive shaft.

3. Picker knife timing is 70° $\pm$ 1 (pilot holes in picker knife cam shaft line up at approximately 303°. It is changed by slipping picker knife drive pulley on shaft.

4. CR cams are changed by idler gears.

S.H. 35-5 - CE AID PANEL



NOTE: Transistorized Machines may be slightly different.

The IBM 088 Collator has two service panels, as well as the front control key and light panel, for the use of the customer engineer. The two service panels are the CE aid panel, located on the secondary feed end, and the diagnostic panel, located just above the transport rolls.

Dynamic Timer

The built-in dynamic timer is under control of a switch located to the left of the timer terminals on the CE aid panel. The timer switch, not in series with the main-line switch, activates the timer after the usual warm-up period. Timer must be turned off when not in use as the power to it is not under control of the main-line switch. CAUTION: Remove all timer leads before using the display switches.

CB Dynamic Checking

A dial switch is provided to facilitate dynamically checking certain critical CBs without having to externally connect the dynamic timer. With the dial set on the CB to be checked, the CB timing is indicated by the inner light of the dynamic timer when the display switch is pressed.

Brush Dynamic Checking

Dynamic checking of all four sets of brushes can be accomplished without connecting any leads to the dynamic timer or the brushes. To check brush timing set the brush selection switch to the set of brushes to be checked; run cards, punched in columns 3 and 78, through the feed involved; press the display switch. Check the timing of brush 3 by the outer light and brush 78 by the inner light. Note: The brush selection switch must be turned off after checking in order for the machine to function properly.

Test Points (Hubs)

Test hubs for checking circuits and voltages are provided. Voltages are tested between the GROUND hub and the voltage hub being tested. GROUND is zero volts on this machine.

Test hubs 1 through 6 are test points in the control stop circuits, while test hubs 7 through 12 are test points in the clutch control circuits. Test points 13 through 16 are located on the front of the primary feed below the primary brush assembly. Test points 17 through 22 are similarly located on the secondary feed.

Clutch Tripping Circuits

Electrical tripping of feed clutches is provided by two switches on the CE aid panel.

S.H. 35-6 - DIAGNOSTIC PANEL

Compare Selector Switches

The diagnostic panel above the transport mechanism contains dial switches and indicating lights that enable the customer engineer to read digit values in any position of the compare units and high, equal or low readings in any position of the sequence units. Columns of decision and results of the compare unit are also indicated.

The portable start key jack with automatic single cycling is located on this panel.

Compare Storage Indication

These lights show the code relays that are energized for the position selected by the setting of the primary and secondary compare dial switches. There can be one or two lights on; however, there should never be less than one, or more than two.

Equal Compare Lights (Columr of Decision)

These lights turn on from left to right for an equal condition until a low secondary to a low primary condition exists. The first light

that is off is the column of decision. On a ten-position machine, lights A1 through A5, and B1 through B5, are used.

Sequence Selector Switches

To check the condition of any desired position of the sequence unit, set the proper sequence selector switch to that position. The sequence storage indication lights will then show whether the column was high, low, or equal. The digit representation is not stored.

The sequence A switch checks both the primary and secondary position, corresponding to the setting, at the same time. In the same way, the B switch checks the primary and secondary position simultaneously.

Card Lever Check Light (W/Ds 602700B and 603000)

This light is energized as a result of a card feed failure, a malfunctioning card lever, or a DPBC error. If this light comes on, the primary or secondary check light will be lit to indicate which feed detected the error.

Note: To observe diagnostic panel lights, the top cover must be open and the cover interlock switch must be latched in the CE test position.

Procedure for Checking Answer Lights

To observe answer lights under error conditions, depress start key only (do not depress reset key).

1. Compare answer lights

   A. Both A and B compare lights will indicate answer if split is not wired.

   B. When compare split is wired, answer lights A and B function independently to indicate respective A and B compare answers.

2. Sequence Answer Lights

   A. Sequence answer lights indicate output from A and B as one unit when split is not wired.

   B. When sequence unit is split, answer lights indicate B unit output only.

Procedure for Checking Compare Errors

1. Check equal compare lights for column of decision. First light off is the column of decision.

2. Turn compare A or B switch to column of decision indicated by equal compare lights. Code lights will indicate information read into this column.

3. Compare punching in this column of cards to information indicated by code lights. If they do not agree, check the following:

   A. Condition of brush in affected position.

   B. Suspected tube failure. See S.H. 31-1.

Note: On the runout, A, B and D code relays will pick and A,B and D code lights will be on.

Procedure for Checking for Sequence Error

1. Check primary or secondary equal sequence lights for column of decision.

   A. The first light that is off indicates the group which contains the column of decision. To locate the actual column turn the primary or secondary A or B switch to the positions within the affected group. (The first other than equal position is the column of decision.

   B. Equal is both High and Low lights on.

2. Compare punching in this column of cards to information indicated by code lights.

   A. Primary sequence:

      1. High indicates that sequence brushes read before primary brushes.
      2. Low indicates that primary brushes read before sequence brushes.

   B. Secondary sequence:

      1. High indicates that secondary brushes read before sequence brushes.
      2. Low indicates that sequence brushes read before secondary brushes.

S.H. 35-7 - CONTROL KEY AND LIGHT PANEL

The front control key and light panel contains the keys and lights for normal machine operation. When used in conjunction with the service panels, a complete diagnosis of machine malfunction may be obtained.

Ready Light

This light comes on when power sequencing is complete. The circuit is through the DR4 BL n/o, fuse relay n/c point, jam contact n/c, pocket stop n/c, joggler contact n/c, stop key n/c, run relay n/c (or primary feed n/o, secondary feed n/o, or C16), and start relay n/c. This light turns off when the start relay picks. It is off when the machine is running.

Note: This does not apply exactly to all machine W.D.'s but is a good guide for all machines.

Transport Light

This light turns on if the jam contact transfers, and turns off when the jam contact is restored.

Fuse Light

This light turns on if any of the +48 or +70 volt signal fuses blow.

Double-Punch and Blank-Column Detection

This light turns on if either R43, primary DPBC, or R45, secondary DPBC, are picked. The relays as well as the DPBC light hold through the reset key. The primary or secondary check light comes on to indicate which feed has the error.

Blank-Column Lights

These lights are located on either side of the signal light unit and come on and stay on if a blank column is detected. The light will flash on a double punch as the second hole is sensed but the light does not stay on.

Primary Check Light

This light is actually controlled by four circuits:

1. C4 monitors the primary clutch and primary feed relay points. If either one is up and the other is down, the light turns on.
2. C4 monitors the card levers, which should not be made at this time. If any are made, the check light turns on.
3. C3 monitors the primary hopper relay and primary card lever number 1 relay. Both should be up. If the hopper relay is up and the card lever number 1 relay is down, the check light turns on.
4. C3 monitors the DPBC relay to turn on the primary check light whenever the primary DPBC relay picks.

Secondary Check Light

Same as primary check light but for secondary feed.

Primary Control Stop Light

This light turns on whenever the test interlock relay (R62) picks and the primary control stop relay (R36) is down. The light remains on until the reset key is depressed. The test interlock relay (R62) picks if either the primary control stop relay (R36) or the secondary control stop relay (R38) fails to pick.

Failure of the primary control stop relay to pick can be caused by:

1. Low primary sequence answer (basic must be wired on and no compare interlock).

2. No sequence and/or compare answer, or a point on one of these answer relays failing to make.

3. More than one sequence and/or compare answer.

Secondary Control Stop Light

Same as primary control stop light but for secondary feed.

Runout Key

The machine stops after the last card is fed from either hopper. If the machine is to be run out, depress the runout key until the feed whose hopper is empty takes one cycle. Thereafter, the machine operates automatically until the opposite hopper empties, at which time the machine will stop again.

The runout key is also used in conjunction with error conditions. For example, if there is a secondary sequence error, it is usually necessary to visually check the card responsible. Remove the cards in the secondary hopper, depress the runout key, and the three cards in the secondary feed are deposited in the stacker nearest that feed. The secondary control stop light remains on. Depress the reset key, and the secondary control stop light goes out. The cards are returned in proper order to the secondary hopper, and the start key is depressed. The secondary feed will now take three cycles and the machine will then continue the normal operations.

S.H. 35-8 - DRIVE MOTOR MAP

Does the motor fail to start with no hum?

Y

- Blown fuse.
- H.D. relay.
- Main line switch.
- Motor plug.
- Motor cord wires.
- Open winding.

N

Does the motor fail to start with hum?

Y

- Start switch FTM.
- Defective capacitor.
- Start winding open.
- Motor or driven device jammed.

N

Does the motor sound noisy?

Y

- Loose pulley.
- Worn bearings.
- Bent shaft.
- Run winding shorted.

N

Does the motor run slow and/or overheat?

Y

- Start switch FTM.*
- Bearing worn or gummy.
- Excessive belt tension or load.
- Misalignment with driven device.
- Low line voltage.

N

The motor starts slowly with no torque.

- Check low line voltage.
- Grounded winding.
- Shorted winding.
- Defective capacitor.

* Quick Check - Remove belt, manually spin pulley, energize motor. If motor runs, the trouble is probably in the start circuit.

S.H. 35-9 - CHANGING MOTOR ROTATION

To change the rotation of a capacitor or split phase motor, use the following procedure:

1. Make certain that power to the motor has been disconnected.

2. Remove the cover over the motor terminal. Two screws hold the cover in place.

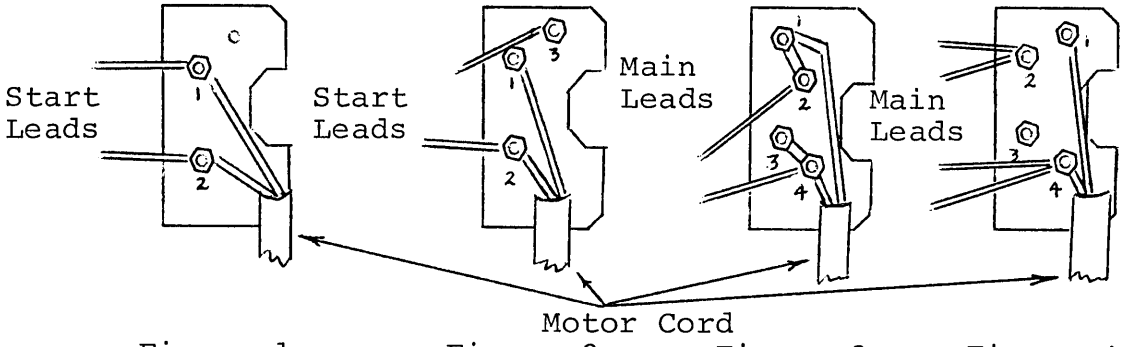


Figure 1 Figure 2 Figure 3 Figure 4

3. Normally there are two leads coming from inside the motor and fastened to the terminal posts (Figure 1 or 2). These two leads are usually from the start winding. The leads from the run winding are usually soldered to the back side of the terminal board (Figure 3).

   The two leads from the start winding should be reversed from their original connection. A motor wired as in Figure 1 requires the leads to terminals 1 and 2 to be reversed. A motor wired as in Figure 2 requires the leads on terminals 2 and 3 to be reversed.

4. Replace any wires previously removed, replace cover and momentarily turn power on to the motor. Observe rotation and, if correct, proceed to install motor on machine. Motors used on 3-phase power lines do not have a start winding, capacitor, or centrifugal switch mechanism. To change rotation on a motor of this type reverse any two of the three wires in the terminal box on motor.

   To change the direction of rotation of a dual voltage type motor, leads are reversed in a manner similar to the single voltage types. Motors of this type will generally have terminal boards wired as shown in Figure 3 or Figure 4. The procedure for changing rotation is generally given on a drawing fastened to the end bell. The start winding leads must be <u>positively identified</u> before making any changes, or damage to the motor may result when power is applied. The drawing that shows the procedure for changing rotation also shows the proper connections for the various voltage applications.

SECTION 2

DOCUMENTATION

A. CUSTOMER ENGINEERING PUBLICATIONS

CE Manual of Instruction	S225-6533
CE Reference Manual	S225-6494
CE Service Information Manual	S229-4002
Parts Catalog	S121-0501
Parts Catalog Supplement for S121-0501	S121-0525
Operator's Guide Reference Card	G229-4011

B. PROGRAMMED INSTRUCTION

Base Mechanics Study	SR25-4596
Circuits Study Guide	SR25-4597

C. SHIPPING GROUP CONTENTS - 80 COLUMN

Part Name	P/N	Qty.
Lockwasher, Clamp	009092	2
Screw, Clamp	120211	2
Test lead, red	206046	1
Test lead, black	206047	1
Power Cord Clamp	315838	1
Card Weight Asm.	602334	2
Maintenance Package	603510	1
Upper Magazine Asm.	603781	1
Clutch Location Plate	610147	1
Label Bill of Material	641456	1

D. SHIPPING GROUP CONTENTS - 51 COLUMN

Part Name	P/N	Qty.
Lockwasher, Clamp	009092	2
Screw, Clamp	120211	2
Screw, Hanger Mounting Bracket	186759	2
Test lead, red	206046	1
Test lead, black	206047	1
Power Cord Clamp	315838	1
Card Weight Asm.	603453	1
Card Weight Asm.	603484	2
Maintenance Package	603510	1
Operator Instructions 51-80 Column Feature	603551	1
Upper Magazine Asm.	603781	2
Clutch Location Plate	610147	1
File Feed Guide Asm.	614315	2
Label Bill of Material	641456	1

E. MAINTENANCE PACKAGE

Part Name	P/N	Qty.
Wiring Diagram	603000	1
Shipping Group Instructions, 51-80 Column	605164	1
CE Binder	222836	1
Report Packet Asm.	600705	1
Test Deck and Carton	602573	1
Diagnostic Binder Tab	603582	1

F. HOW TO ORDER MISSING WIRING DIAGRAMS

Missing wiring diagrams (basic, supplemental, feature RPQ) can be obtained by the following procedure.

Have the Branch Office order diagrams by description from form number, or Part Number, if known, from MLC Department 624, Rochester. Supply the following information:

1. Type of Machine
2. Serial Number of Machine
3. Customer Number
4. Status
5. Mailing Address

Status 1 machines; use form number Z120-1679, Wiring Diagram/ Logic Page Request. Status 2 or 3 machines; use form number Z170-6173, "DP Supply Order".

G. DOCUMENTATION - RPQ FEATURES

Parts catalogs are not generally created for low inventory RPQ's. Therefore, it is essential that B/M parts listings and reference drawings be retained in the machine. Delay in RPQ parts procurement can be avoided by insuring B/M paperwork is available in your machine. Missing or lost B/M paperwork should be ordered from the MES Department of the Plant controlling the machine type affected. Requests for B/M paperwork must include machine serial number and feature description to insure the appropriate material is received.

H. RETURNING MACHINES TO PLANTS

Each Branch Office is responsible for all damages which are attributed to improper packing.

Note: It is the responsibility of the Branch Office to order packaging material. Refer to Branch Office Manual, Transportation Section 070-264, dated November, 1970, or later, for additional information.

Order on DP Supply Order from plant of control.

The Branch Office Manual section also refers to a packing group reference listing form ZZ20-1897-34. This listing includes all machine types and the Bill of Material number for all shipping groups.

It is also the GSD CE's responsibility to see that each machine discontinued and shipped out is complete - no assemblies or parts missing, etc.

SECTION 3

PHYSICAL CHARACTERISTICS, INSTALLATION AND SAFETY INFORMATION

A. PHYSICAL CHARACTERISTICS

1. Dimensions and clearances
2. Electrical requirements and heat dissipation
3. Power receptacle requirements - 60 HZ

B. PHYSICAL PLANNING

1. Floor Planning
2. Templates
3. Electrical requirements

    a. Plugs, cords, and receptacles
    b. Power Specifications
    c. Grounding

The unit record Data Processing Planning and Installation Manual (Form Number GC-24-1037) contains the following information that may be of interest. To conserve space, this information has not been reproduced in this publication.

Environment Information

1. Temperature and Humidity
2. Pollution
3. Lighting, Carpets, Noise
4. Card Paper Storage

Safety & Fire Information

1. Locations
2. Safety Considerations
3. General Precautions
4. Personnel Training
5. Type of Fire Prevention Equipment
6. Air Conditioning Systems
7. Electrical Systems

A. PHYSICAL CHARACTERISTICS

1. DIMENSIONS AND CLEARANCES (inches)

TYPE	MACHINE NAME	WIDTH	DEPTH	HEIGHT	WEIGHT
088	COLLATOR	58	28	58	1095

SERVICE CLEARANCE (inches)

TYPE	RIGHT	LEFT	FRONT	REAR
088	30	24	42	24

2. ELECTRICAL REQUIREMENTS AND HEAT DISSIPATION

	AC AMPS (60HZ)			DC AMPS		BTU/HR	
TYPE	115V	208V	230V	115V	230V	AC	DC
088	14.2	7.9	7.1	---	---	4450	--
	9.5*	5.3*	4.8*	---	---	2650*	--

	PLUG TYPE		POWER CORD		IBM
TYPE	115V	208/230V	ft	(cm)	PART NUMBER
088	A,B	E,H	8	(244)	624069

3. ATTACHMENT CORD PLUGS

	PLUG END VIEW	PLUG RATING	ADDITIONAL INFORMATION	IBM PART NO.
A		15 AMP, 125 VOLT	LARGE DIA. CORD	256341
B		15 AMP, 125 VOLT	LARGE DIA. CORD	624037
E		15 AMP, 250 VOLT	LARGE DIA. CORD	256342
H		15 AMP, 250 VOLT	LARGE DIA. CORD	624036

* FOR MACHINES WITH SERIAL NUMBERS ABOVE 15000

B. PHYSICAL PLANNING

1. Floor Planning

Efficient operation and servicing of data processing equipment depends primarily on convenient access to the equipment by both operating and service personnel. A properly oriented work-flow pattern should be a major objective. Equipment should be arranged to allow adequate space for servicing.

2. Physical Planning Templates

IBM provides templates of its data processing equipment, scale: 1/4 inch = 1 foot (1 mm = 50 mm).

The templates provided for unit record equipment are:

	FORM NUMBER
Accounting Machines	GX24-6512
Calculators	GX24-6513
Card Proving Machines, Card Punches, Verifiers, Tape Punches	GX24-6514
Collators, Sorters, Interpreters-	GX24-6515
High Speed Punches, Statistical Machines	GX24-6516
Miscellaneous Paper, Document Machines	GX24-6517
IBM 834/836	GX24-6539
IBM 1255, 5486, 5496	GX21-9098

3. Electrical Requirements

a. PLUGS, CORDS, AND RECEPTACLES

Power to unit record machines is usually provided through a separate power cord connected to each machine. For certain small machines, power is provided from an adjacent IBM machine. The customer provides a matching power receptacle for each plug.

In some cases the customer may choose between a non-locking or locking plug. Plugs are matched to the machine current and voltage specifications and may not be changed except within the customer's available choices.

In no case may a line cord and/or plug be changed to one of a lesser rating unless authorized by engineering.

b. POWER SPECIFICATIONS

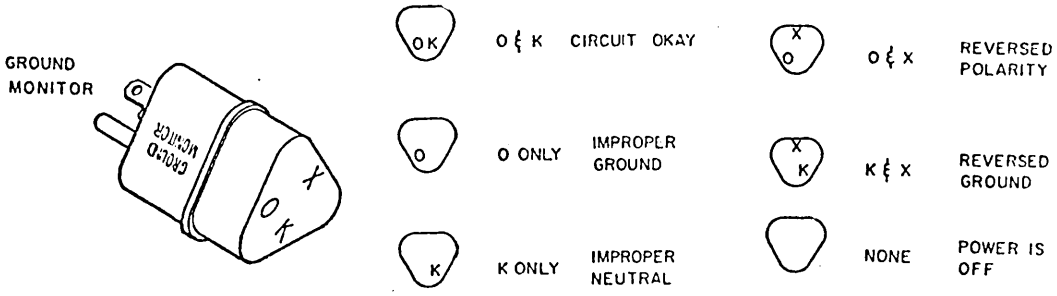
For all unit record machines, these electrical specifications apply:

Voltage tolerance: ± 10%
Frequency: 60 hertz ± 1/2 hertz

c. GROUNDING

Power cords for all unit record machines have an equipment ground wire. For safety, power service to each machine must include an insulated equipment grounding wire (green or green with yellow trace.) All such ground wires can be connected to a main ground wire (not system neutral) at a branch circuit or distribution panel. (This is a non current-carrying ground, not a neutral.) This wire shall be carried directly back to the service ground or to a suitable building ground. All machines must be connected to this ground. IBM recommends that conduit not be used as the only grounding means, because discontinuities can occur at points where sections of conduit are joined.

The Ground Monitor IBM P/N 9900453 is an OPD tool which is now available for field use.



It is intended for use on building wall outlets having 115 Volt 3 wire receptacles and detects whether or not proper ground and ac polarity are available at the receptacle. This tool simply plugs into 3 wire receptacle and lights on the ground monitor will indicate the above conditions. The Ground Monitor will indicate an "Improper Ground" when used on IBM system convenience outlets having isolation transformers, because of the intentional omission of grounded transformer windings to provide additional safety for IBM personnel.

SECTION 4

CUSTOMER ENGINEERING MEMORANDUM

For convenience and ease of updating this section in the future, the entire 088 CEM list is reprinted here. All cancelled CEM's appear in the appropriate service hints in section one of this Manual.

THIS IS A MAJOR REVISION .REPLACES THE EXISTING 088 IN YOUR FILE.

1 FAILURE TO DETECT DOUBLE PUNCH — IBM 88

If P6 or S6 fails to make, intermittent failure to detect a double punch will result. An arc suppression circuit is available to reduce arcing and burning of P6 and S6.

B/M 605091 - Primary and Secondary 6-Cam Arc Suppression Circuit

MACHINES AFFECTED - Prior to IBM 88-11935 J0

INSTALLATION TIME - 1.0 to 1.5 Hrs.

IBM USE ONLY

TYPE A, PR Card Code 01, Mechanicsburg.

9/9/60

2 FILE FEED SIDE JOGGLER BREAKAGE — IBM 88

If trouble is experienced with breakage of the file feed side joggler, an improved style may be installed. B/M 605151 provides a spring steel side joggler and new style side plate. The new style side joggler (P/N 603200) can not be used with the old style side plate due to the additional length of the new style side joggler.

Mechanicsburg stock will be of the new style and will require B/M 605151 for initial replacement of a broken side joggler. Subsequent replacement of the side joggler will require only P/N 603200.

B/M 605151 - Card Side Joggler Assembly

MACHINES AFFECTED - Prior to approximately 88-11355 E0.

INSTALLATION TIME - 1.5 Hrs.

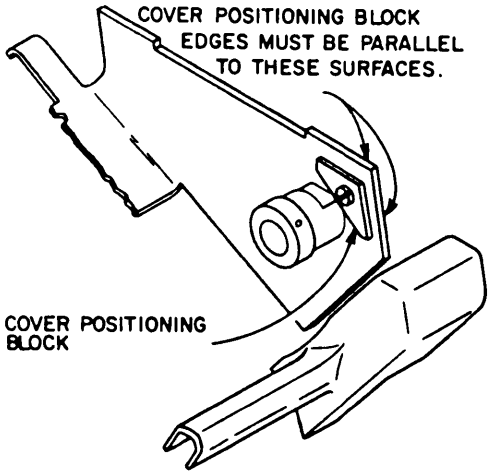
IBM USE ONLY

TYPE A, PR Card Code 01, Mechanicsburg.

11/18/60

3 LOOSE FEED ROLL COVERS, FILE FEED — IBM 88

Two positioning blocks are available to provide more rigid support of the file feed lower magazine feed roll cover. Loosening of cover screws allows the cover to shift and bind against the feed rolls.



B/M 605071 - Cover Positioning Block

MACHINES AFFECTED - Prior to approximately IBM 88-10408 SZ

INSTALLATION TIME - 1.0 Hr.

IBM USE ONLY

TYPE A, PR Card Code 01, Mechanicsburg.

11/18/60

4 P-6 TIMING CHANGE, ALPHA DEVICE — IBM 88 WITH ALPHA DEVICE

On machines equipped with an alphabetic collating device, the cam for P-6 is changed to provide increased duration. The part number of the P-6 cam with alpha device installed is P/N 602125. All machines have the correct cam installed but this change is not noted on the main wiring diagram in machines shipped prior to August 9, 1960.

To avoid confusic ... it is suggested that the main wiring diagram on mach ... lowing timing and part number

C A N C E L L E D

Section II, A & B - "M325°, B215°" (Below P-6).
Section 66B - "M325°, B215°," Cam P/N 602125 Opposite P-6.
Section 67B & 68B - Show P-6 timing as M325°, B215°.

MACHINES AFFECTED - Prior to K0 Suffix with alpha device

197/06-11-71

11/18/60

5 ERRONEOUS DOUBLE PUNCH INDICATIONS (P-6) 88

If trouble is experienced with erroneous double punch indications caused by the reading of X's, change the timing of P6 Cam as follows:

From M349°, B179° To M345° ± 5°, B175° ± 1°

This will allow a g ... ; the blank column test relays

C A N C E L L E D

This change is Inc... as part ... 10-30 Arc Suppression, as announced in CEM 88 and is installed on all machines after October 1, 1960 Mark changes on the machine wiring diagram.

MACHINES AFFECTED - Wire to W/D 602700* and A.

12/2/60

197/06-11-71

6 SCOPE TEST PROCEDURE — IBM 88

An oscilloscope testing procedure has been developed to check tubes, relays, capacitors and resistors in the compare and sequence circuits for marginal operation. By installing a test resistor and running a prepunched card deck, oscilloscope patterns of individual tube current waveshape may be observed.

Service Hint #24, IBM 88 Service Index, contains scope patterns and detailed information concerning this test. The test is to be applied as a Preventive Maintenance routine at a 52-week frequency.

A dummy fuse is supplied to shunt the test resistor for normal operation and should be replaced upon completion of the test. The one-amp fuse #27 protects this circuit in the event that the dummy fuse is left out and normal operation is attempted.

B/M 605161 - Oscilloscope Diagnostic Test Resistor

MACHINES AFFECTED - Prior to approximately 88-11670 H0

INSTALLATION TIME - 2.5 Hrs.

IBM USE ONLY

TYPE A, MES Code 01 Rochester.

2/3/61

197/06-11-71

7 FAILURE TO ZERO SUPPRESS WITH SEQUENCE SHIFT — IBM 88

Machines with "Zero Suppress Sequence" feature wired to W/D 690636* will suppress digits 9-8-7 instead of 12-11-0 in the secondary portion of the sequence unit when "sequence shift" is used.

This condition can result in undetected errors which are difficult to analyze. B/M 690799 corrects this by using the primary zero filter cams to control "zero suppression" in the secondary portion of the sequence unit when "sequence shift" is used.

B/M 690799 - Change W/D 690636* to 690636A.

MACHINES AFFECTED - Machines wired to W/D 602700* and A with B/M 690636*.

INSTALLATION TIME - 1.0 Hr.

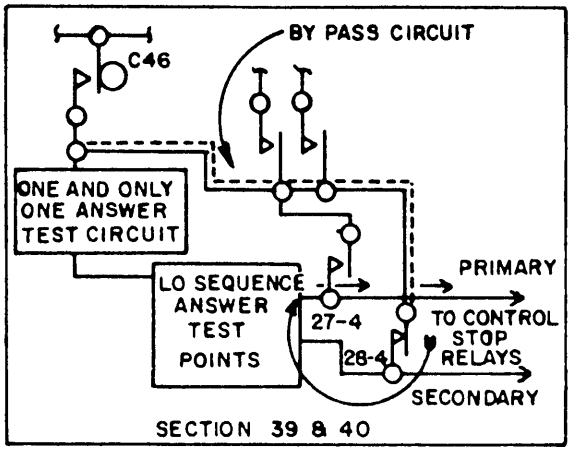
IBM USE ONLY

TYPE A, MES Code 01, Rochester.

3/17/61
197/06-11-71

8 FAILURE TO DETECT "ONE AND ONLY ONE ANSWER" — IBM 88

A back circuit exists which will bypass the "one and only one answer" circuit in machines wired to W/D 602700* and A. This condition causes various machine malfunctions such as failure to merge, match, select or control stop. The back circuit is shown in the following sketch.



B/M 605189 relocates diodes D6 and D7 to eliminate this back circuit. This correction should be installed as soon as possible on all machines affected.

B/M 605189 - Diode relocation

MACHINES AFFECTED - All IBM 88's wired to W/D 602700* through A. (Prior to approximately 88-12588).

INSTALLATION TIME - 1 Hr.

IBM USE ONLY

TYPE E, MES Code 01, Rochester.

3/24/61
197/06-11-71

9 POWER SUPPLY RELAY CHATTERING - BLOWING FUSES — IBM 88

Proper power supply relay adjustment is essential to apply and remove thyratron bias and plate voltages in the proper sequence. The momentary presence of plate voltages without grid bias can cause an excessive number of thyratrons to fire simultaneously, overloading fuses 16, 17, or 19.

Clutch thyratrons thus fired can cause premature primary or secondary feed cycles with associated checks lights. These conditions may occur if:

1. Power supply relays chatter when the main line switch is turned on. To correct, adjust relay DR2 so that its armature, when fully attracted, touches both halves of the split core as well as the lower relay yoke extension. Chattering may also occur if the thermal points of DR3 are dirty or adjusted for excessive delay. A delay of 30 seconds is correct.

2. Power supply sequencing is such that the -70 volt supply is cut off prior to the +70 volt supply when the top sliding cover is opened. To correct, adjust DR1-AL N/C points for greater stationary strap rise and less point air gap than the BU and BL points on DR1.

In addition, fuses 16, 17 and 19 should be changed to the values indicated on the chart below:

Fuse No.	10 Pos. Part No.	Collator Rating
16	335010	1 amp.
17	335010	1 amp.
19	333952	2 amp.

Fuse No.	16 Pos. Part No.	Collator Rating
16	333952	2 amp.
17	333952	2 amp.
19	333952	2 amp.

Fuse No.	22 Pos. Part No.	Collator Rating
16	253675	3 amp.
17	253675	3 amp.
19	333952	2 amp.

B/M 605093 provides necessary circuit changes to prevent relay chattering and insure proper power supply sequencing. Improper power supply sequencing may cause premature primary or secondary feed cycles and the associated check lights. Machines wired to wiring diagram 602700A and later have this improvement installed.

B/M 605093 - Power Supply Sequencing.

MACHINES AFFECTED - Machines wired to Wiring Diagram 602700*. (Prior to approximately 88-11010 D0).

INSTALLATION TIME - 8.0 Hrs.

IBM USE ONLY

TYPE A, MES Code 01, Rochester.

6/2/61
197/06-11-71

10 CARD COUNT ERRORS — IBM 88

Machines with auxiliary card counter will count over by 1 when wired to count only "matched" or "equal" cards (count impulse wired through the equal compare selector). The equal reading set up on run-in causes the counter to advance 1 prior to reading the card at the primary or secondary brushes. Install one of the following Bills of Material to correct this condition:

1. B/M 690971 - Change W/D 690272* to A.
2. B/M 690972 - Change W/D 690747* to A.

MACHINES AFFECTED -

Item 1 - 88's with auxiliary card counter wired to W/D 690272*. (Machines prior to 88-15000).

Item 2 - 88's with auxiliary card counter wired to W/D 690747*. (Machines between 88-15000 and 88-16311).

INSTALLATION TIME - 2.0 Hrs.

IBM USE ONLY

TYPE A, MES Code 01, Rochester.

6/16/61
197/06-11-71

11 ERRONEOUS SELECTOR PICK - THYRATRON TRANSISTOR — IBM 88

Thyratron Transistor IBM 88's prior to W/D 603000C have a backcircuit which could result in erroneous picking of selectors.

The 100 mfd capacitors in the Primary and Secondary clutch circuit (Section 12, W/D 603000 A or B) will discharge back through the card lever relay points to either "Primary and Secondary feed" hubs or "All Cycles" hubs (Section 11) depending upon the status of BASIC relay 32. This pulse is approximately 15V and will appear between 325° and 75°. If a selector pickup is wired to any of these hubs, it may pick erroneously. Install one of the following Bills of Material to correct this condition:

1. B/M 605225 - Change W/D 603000 A to C.

2. B/M 605226 - Change W/D 603000 B to C.

3. B/M 605073 - Change W/D 603000 A or B to C if features 690746 (added card lever and clutch relays) and/or 690851 (primary eject clutch) are installed.

MACHINES AFFECTED - Thyratron Transistor IBM 88's wired to W/D 603000 A or B (approximately 88-15001L0 - 15361A1)

INSTALLATION TIME - .5 Hr.

IBM USE ONLY

TYPE E, MES Code 01, Rochester.

8/25/61
197/06-11-71

12 LOOSE CONTACT ROLL DRIVE BELT — IBM 88

B/M 605015 provides adjustable idler pulley assemblies to maintain correct Primary and Secondary contact roll drive belt tension. This will prevent premature wear of pulleys and belts due to loose belts. Production machines after approximately November 1, 1961 will have these idler pulleys installed.

B/M 605015 - Contact Roll Belt Idlers (one B/M required per machine).

MACHINES AFFECTED - IBM 88's prior to approximately P1 suffix (November production).

INSTALLATION TIME - 1.5 Hrs. per machine.

IBM USE ONLY

TYPE A, PR Card Code 01, Mechanicsburg.

9/22/61
197/06-11-71

13 BURNOUT OF TRANSISTORS AND DIODES — IBM 88 WITH COUNT DEVICE

Collapse of count device relay coils produces a high voltage spike of approximately +200V to -300V at the count device "Reset" hubs on the control panel. "Reset" may be parallel wired to a selector or compare entry position (Fig. 75, Page 76 of the Operator Reference Manual, Form #A24-1013-2). The voltage spike may cause burnout of transistors and diodes in the selector or compare entry positions.

B/M 691070 provides diodes and instructions to clamp the high voltage spike to ground and eliminate transistor and diode burnout.

Rochester MES Order Department has automatically shipped a sufficient quantity of B/M 691070 to each branch office having machines affected. Production machines after August 15, 1961 have this correction installed.

B/M 691070 - Update Count Device to "B" suffix.

MACHINES AFFECTED - Thyratron Transistor 88's prior to approximately L1 suffix with count device (B/M 690748* or A) installed.

INSTALLATION TIME - 2.0 Hrs.

IBM USE ONLY

TYPE E, MES Code 01, Rochester.

197/06-11-71
10/13/61

14 IMPROVED STACKER SLIDE — IBM 88

A new style cast aluminum stacker slide is available to replace the present black bakelite stacker slide on IBM 88's prior to K1 suffix. The new style slide will not warp and bind, thus eliminating stacking problems and breakage due to these conditions.

Individual new style stacker slides cannot be installed as direct replacement for the former slide. The appropriate bill of material provides the necessary parts for one complete machine (5 stacker slides) and must be used for initial installation of the new style slides.

It is recommended that a quantity of B/M 605268 and/or 605269 be ordered for updating all affected machines in your office.

B/M 605268 - Improved Stacker Slide. (Standard Stackers).

B/M 605269 - Improved Stacker Slides (51-80 Column).

MACHINES AFFECTED - Prior to approximately IBM 88-K1 suffix (Standard Stackers); Prior to approximately IBM 88-P1 suffix (51-80 Column).

INSTALLATION TIME - 2.5 Hrs. (B/M 605268); 3.0 Hrs. (B/M 605269).

IBM USE ONLY

TYPE A, PR Card Code 01, Mechanicsburg.

10/27/61
197/06-11-71

15 FUNCTIONAL IMPROVEMENTS OF 51-80 COLUMN DEVICE — IBM 88

Machines equipped with the 51-80 column device (secondary) should be updated to prevent the following:

1. Hang-up of the last primary 80 column card on the arrestor tapes if this card is unmatched.

2. Incorrect selection of unmatched cards on runout.

3. Machine idling after a primary or secondary control stop.

B/M 605364 - Tube machines (prior to 15000 serial) update 51-80 column device to "B" suffix W/D.

B/M 605321 - Thyratron-transistor machines (15000 serial and above, prior to A2 suffix) update 51-80 device to "A" suffix W/D.

MACHINES AFFECTED - All IBM 88's equipped with 51-80 column device (secondary) prior to A2 suffix.

INSTALLATION TIME - 1.5 Hrs.

IBM USE ONLY

TYPE E, MES Code 01, Rochester.

197/06-11-71
1/5/62

16 DIGIT SELECTOR CONTROL PANEL WIRING - PRIMARY AND SECONDARY "DI" HUBS — IBM 88

Some customer applications may require wiring both the primary and secondary "DI" digit impulse hubs to the "C" common hubs of the digit selector.

Back circuits can result from this particular control panel wiring. B/M's are available to correct this condition.

1. B/M 622026 - Change W/D 690280* to 690280A - (tube machines).

2. B/M 622027 - Change W/D 690822* or A to 690822B (thyratron transistor machines).

MACHINES AFFECTED - 1. Tube 88's prior to B2 suffix with digit selector device (W/D 690280*) installed; 2. Thyratron-transistor 88's prior to B2 suffix with digit selector device (W/D 690822*, A) installed.

INSTALLATION TIME - .5 Hr.

IBM USE ONLY

TYPE A, MES Code 01, Rochester.

197/06-11-71
1/19/62

17 DIODE 4 AND 8 FAILURES - TUBE MACHINES WITH ADDED CARD LEVER AND CLUTCH RELAY CAPACITY INSTALLED — IBM 88

Early tube machines with added card lever and clutch relay capacity installed (W/D 690284*) are exposed to D-4 and D-8 diode failures. These diodes are in the pick circuits to R-39, 39A and R-41, 41A.

If failures are experienced, install IN 1218 diode, P/N 603793 in positions D-4, D-8 in place of IN 448, P/N 694614.

The note on W/[illegible] ity) should be changed to rea

CANCELLED

P/N 603793 - IN 1218 Diode.

MACHINES AFFECTED - IBM 88's wired to 602700*. A (prior to approximately M0 suffix) with added card lever and clutch relay capacity (W/D 690284*) installed.

INSTALLATION TIME - 0.3 Hr.

IBM USE ONLY

TYPE A, PR Card Code 01, Mechanicsburg.

197/06-11-71
2/16/62

18 SCOPE TEST RESISTOR BURNOUT — IBM 88

The size of the scope test resistor fuse (#27 on machines prior to 88-15000 or #8 on machines after 88-15000) has been changed from 1 amp to a .6 amp fuse. The purpose of this fuse is to prevent burnout of the scope test resistor if the dummy fuse is left out and normal machine operation is attempted.

If the dummy fuse is not replaced after scope testing, highly intermittent machine malfunctions will occur due to the voltage drop across the scope test resistor.

The new fuse h

CANCELLED

test resistor and should be t the next service call or insp

P/N 111263 - Fuse .6 amp.

MACHINES AFFECTED - IBM 88's prior to C2 suffix.

INSTALLATION TIME - .1 Hr.

IBM USE ONLY

TYPE E, PR Card Code 01, Mechanicsburg.

197/06-11-71
3/23/62

19 EXTRA "C" CODES - THYRATRON TRANSISTOR — IBM 88 WITH COUNT DEVICE INSTALLED

If selectors or compare positions are plugged to the count device, noise generated by the UT and TT coils can cause extra "C" codes.

Bills of material are available to suppress this noise, and to change existing selenium diodes to silicon diodes to prevent circuit leakage.

B/M 622035 - Update 1, 2 Position Count Device.

B/M 691195 - Update 3, 4 Position Count Device.

MACHINES AFFECTED - Thyratron Transistor IBM 88's (88's after 15000 serial) prior to E2 suffix with count device installed.

INSTALLATION TIME - Approximately 2.0 Hrs. each B/M.

Special tool required - Crimping tool P/N 450898.

IBM USE ONLY

TYPE A, MES Code 01, Rochester.

5/4/62

197/06-11-71

20 READ FAILURES — IBM 88

Current production IBM 88's have improved lower feed rolls installed. The improved Hypalon feed roll can be identified by its even textured appearance as compared with the former blue-grey neoprene roll with bits of cork imbedded throughout.

Previously used cork-neoprene feed rolls are subject to compression and wear, which results in underfeeding. When cork-neoprene lower rolls are to be replaced by Hypalon rolls, all lower rolls in the machine should be replaced. If cards are fed from Hypalon into cork-neoprene rolls, accelerated feed roll wear will be experienced because of the difference in roll diameters. If, because of expediency, only one feed is changed to Hypalon rolls, merge pocket jamming may occur due to incorrect primary and secondary card overlap. If this happens, it will be necessary to change the other feed to Hypalon rolls.

When worn cork-neoprene lower rolls are changed to the improved Hypalon, it will be necessary to retime the brushes. The brush timing procedure has been improved to locate the brushes for the best operating position on the contact roll. The sequence brushes should be used as the reference timing, instead of the 70° throat timing. This timing procedure should also be used for feeds which still have all cork-neoprene rolls and supersedes the timing procedure found in the CE Reference Manuals.

Timing Procedure

1. Set sequence and compare brush heel strands to scribed line.

2. By slipping the picker knife cam shaft drive pulley, adjust card timing to obtain sequence brush timing. Reclamp the pulley hub.

3. Check the compare brush make timing. This timing should be within 2° of the normal timing tolerance. If it is not, look for an incorrect feeding condition such as insufficient feed roll tension, etc. between the sequence and compare read stations. Obtain compare brush timing by moving compare brush block.

4. Check cl

CANCELLED

if necessary.

Existing stock of the cork-neoprene lower rolls can be used to replace worn or damaged individual rolls in situations where time does not permit changing all lower rolls. It is strongly recommended, however, that a planned schedule be set up to gradually change over all lower feed rolls since the cork-neoprene rolls are being discontinued.

Standard Feed

Cork-Neoprene (discontinued)		Hypalon
P/N 602260	1st, 4th lower feed roll, shaft	P/N 603870
P/N 602881	1st, 4th lower feed roll assembly	P/N 603872
P/N 602261	2nd, 3rd lower feed roll, shaft	P/N 603871
P/N 602882	2nd, 3rd lower feed roll assembly	P/N 603873

51-80 Column Feed

P/N 603310	1st, 4th lower feed roll, shaft	P/N 603875
P/N 603465	1st, 4th lower feed roll assembly	P/N 603876
P/N 603309	2nd, 3rd lower feed roll, shaft	P/N 603874
P/N 603467	2nd, 3rd lower feed roll assembly	P/N 603877

There is no change to the upper feed rolls.

Caution: IBM 88 Hypalon feed rolls are not interchangeable with those used in 1402 machines. IBM 1402 feed rolls are identified with a color stripe on the shaft.

MACHINES AFFECTED - All IBM 88's prior to approximately C2 suffix.

INSTALLATION TIME - Approximately 2 Hrs., all lower rolls, one feed.

IBM USE ONLY

TYPE A, PR Card Code 01, Mechanicsburg.

5/11/62

21 IMPROVED FEED COVER MOUNTING — IBM 88

Improved feed cover mountings are available to reduce the service time required for removal and installation of the covers.

B/M 605284 provides new feed cover mounting hanger assemblies for all four feed covers. New covers are designed to "snap-on."

B/M 605284 - Feed Cover Mounting Hanger Assembly.

21 continued

MACHINES AFFECTED - All IBM 88's prior to H2 suffix.

INSTALLATION TIME - 1.7 Hrs.

Special tool required - Glyptal P/N 289318.

IBM USE ONLY

TYPE A, PR Card Code 01, Mechanicsburg. 197/06-11-71 5/11/62

SAFETY

22 SAFETY - RELAY GATE SHIPPING COVER IBM 88

An extremely urgent fire hazard may exist on IBM 88's. In an effort to shield PM relays from dust, some relay gate shipping covers have been left installed.

An investigation has been made in the Rochester Plant. The results are as follows, using a full capacity IBM 88:

1. At room temperature of 75°F, the temperature at the hottest relay is 175°F, using the present individual relay covers.

2. When the relay gate is only partially covered (less coverage than the shipping cover) the temperature increases to 220°F.

3. The plastic shipping cover has a melting point of 200°F.

With a plastic shipping cover installed, and a machine up to operating temperature, a spark from a cigarette, lighter, relay point arc, etc., can cause immediate ignition of the shipping cover.

It is recommended that an immediate check be made on all IBM 88's to verify that shipping covers have been removed from the relay gate.

7/13/62

23 ERRONEOUS MERGE - MATCH SELECTION IBM 88

If Basic Setup is wired through a toggle switch, the Match relay may hold through the Merge Circuit, when the toggle switch is moved from Match to Merge.

A circuit improvement (B/M 691041) is available to correct wiring in the "Merge-Match Basic Setup" circuits if toggle switches are installed. B/M 691041 adds a N/C R34 point between R32 pick and the control panel hub.

Factory-installed toggle switches and Field B/Ms shipped after August, 1961, (K1 suffix machines) have this improvement included.

B/M 691041 - Update toggle switch.

MACHINES AFFECTED - All IBM 88's prior to approximately K1 suffix with toggle switches installed, wired to W/D 602700 B or W/D 603000* through C (Main machine wiring diagrams).

INSTALLATION TIME - .2 Hr.

IBM USE ONLY

TYPE A, MES Code 01, Rochester.

197/06-11-71 11/30/62

24 1. SMS CARD BURNOUT - THYRATRON - TRANSISTOR IBM 88

2. FAILURE TO DETECT BLANK COLUMNS IBM 88

Maintenance Reduction

Severe transistor and diode damage on thyratron transistor machines (serials after 15000) is caused by high voltage spikes emitted by the "ALL CYCLES" and "PRIMARY, SECONDARY CYCLES" hubs. The selector SMS cards are most affected. A B/M is available to provide clamping diodes in the affected circuits. IBM 88's wired to W/D 603000E have this improved circuitry included (approximately M2 suffix).

Functional Correction

All IBM 88's will fail to detect blank columns on the first card cycle following a stop. A B/M is available to correct the circuitry to allow blank column checking on all machine cycles. IBM 88's wired to W/D 603000E have this improved circuitry included (Approximately M2 suffix).

B/M 605337 - SMS card burnout correction - Blank column detection circuit correction.

MACHINES AFFECTED - Thyratron-transistor machines (serials after 15000) wired to W/D 603000* through D.

INSTALLATION TIME - 1.6 Hrs.

B/M 605340 - Blank column detection circuit correction.

MACHINES AFFECTED - All tube machines (serials prior to 15000).

INSTALLATION TIME - 1.0 Hr.

IBM USE ONLY

TYPE E, MES Code 01, Rochester.

197/06-11-71 11/30/62

25 RUNOUT MIS-SELECTION ON ZERO BALANCE OPERATION IBM 88

The zero balance selection operation described in the Reference Manual (page 38) requires that zero balance cards be selected. On some tube IBM 88's and thyratron-transistor IBM 88's prior to W/D 603000E, the last card may mis-select if zero balance selection is being done in the secondary feed. A circuit change is available to correct this function.

B/M 605341 - Zero balance selection correction on runout.

MACHINES AFFECTED -

1. Tube type IBM 88's (serials prior to 15000) wired to W/D 602700* or A with B/M 605153* through B (secondary blank column sequence check) installed.

2. Tube type IBM 88's wired to W/D 602700B.

B/M 605342 - Zero balance selection correction on runout.

MACHINES AFFECTED - All thyratron-transistor IBM 88's prior to approximately 88-17885M2, 88-50116M2.

INSTALLATION TIME - .8 Hr.

IBM USE ONLY

TYPE A, MES Code 01, Rochester.

197/06-11-71 1/11/63

26 CONTROL STOP LIGHTS, FAILURE TO DEVELOP ANSWER IBM 88

Loss of the C-44 impulse, caused by dirt in the code relay answer points, can be greatly reduced by a circuit change to the answer network.

The change provides a high current spike of short duration through the answer network each time C-44 closes. The cleaning current is generated by a resistor-capacitor combination connected to each answer hub line.

B/M 605810 - Answer Relay Point Cleaning Circuit.

MACHINES AFFECTED - IBM 88's wired to W/D 602700* or A (prior to approximately 88-12568M0).

B/M 605842 - Answer Relay Point Cleaning Circuit.

MACHINES AFFECTED - IBM 88's wired to W/D 602700B or W/D 603000 all suffixes (after approximately 88-12568M0).

26 continued

INSTALLATION TIME - 1.0 Hrs.

IBM USE ONLY

TYPE A, MES Code 01, Rochester.

1/11/63

SAFETY

27 1. SEALING PLATE — IBM 88
2. DYNAMIC TIMER SWITCH TERMINALS

1. Sealing Plate (P/N 602580)

Some cases have been found where the sealing plate, which is the U channel piece running between the upper and lower frame at the rear of the machine, has sharp edges. All machines must be checked and all sharp edges removed with a file. All stock has been reworked on machines manufactured after January, 1963 (A3 Suffix).

2. Dynamic Timer Switch Terminals

Some early IBM 88's shipped prior to August, 1960 (KO Suffix) did not have the dynamic timer switch terminals covered. Affected machines should have these terminals taped on the next service call.

IBM USE ONLY

TYPE E, Service Code 33.

2/13/63

28 SERVICE INFORMATION — IBM 88

1 Quick Test

A test of tubes or SMS cards and associated relays of those positions which are wired on the control panel can be made as follows. This test may save service time by use of the customer control panel without alteration and without test cards.

a) Use customer or test control panel which is causing failure with no cards in the machine.

b) While depressing the start key, transfer both the primary and secondary clutch trip switches (CE aid panel) for a single clutch cycle.

c) Result will be an A-B-D code set up in all wired compare positions. Plus, an equal ("Hi" and "Lo" setup) reading into all wired sequence positions.

d) A defective tube, SMS card or relay may be determined by observing the CE diagnostic aid panel lights for each position.

It should be noted that although this is a faster test procedure, it is not as complete as the "Quick Test" outlined on page 24 of the CE Reference Manual (Form No. 225-6494-2).

2 PM Relay - ...ld

CANCELLED

The black a... ...ntact with the armature. This condition has been tested in the Electrical Laboratory. The plastic actuator is molded through three holes in the armature. No failures can be attributed to cracks in the molding as long as the cracks are in the center portion between the two outside armature mold holes.

Machine troubles that appear to be caused by failure to hold may actually be caused by failure to get a solid pick shot. If the relay doesn't seal on the pick shot, the armature will not seal with the hold coil energized. Do not overlook dirt between the armature and core or relay frame. Don't discount the possibility of fluctuating input line voltage caused by excessive number of machines on one line or poor voltage regulation of the customers' supply line.

3 Mark-Sense Interference

The errors attributable to mark-sensing on the back of the card can be corrected by installation of a Sales Bill of Material. Contact Regional Sales Engineering if you have this problem.

4 Passing Low Primary Sequence Errors

On tape machines wired to 602700* through A, it is possible to pass low primary sequence errors if all these conditions exist:

a) Blank cards are run through secondary feed.

b) Blank cards run out of secondary feed (leaves R-35 up).

c) Machine not turned off.

d) Clutch trip switches not operated.

e) Punched cards processed through primary feed.

f) Secondary Blank Column Sequence Check (B/M 605153 not installed).

On machines affected: If you have occasion to run blanks through the secondary feed (checking stacking for example), trip the clutch switches before returning the machine to the customer.

5 Check for Worn Pulleys, Belts, Clutch Parts

The follo... ...ged cards or jams, intermitte... ...ged timing belts:

CANCELLED

Run cards into the machine. After the machine has stopped, mark a pencil line on the shear plate along the front edge of the card near the merge pocket. Run the machine a few cycles at a time. In this way, significant variations between the edge of the cards and the pencil line can be seen if the machine contains these defective parts. Check at various feed stations to help narrow down specific station failing. Do not overlook loose feed clutch drive arm studs causing variations in brush-to-card timing, and variations in clutched CB impulses.

6 Improved Brush Tracking Adjusting Screw, P/N 610148

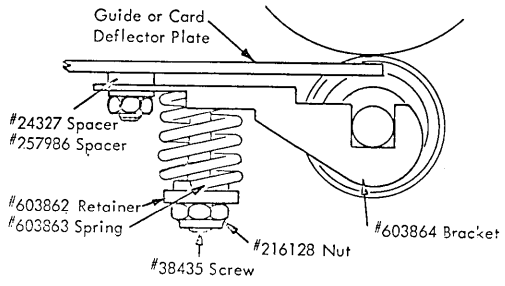
The improved brush tracking screw is now available to facilitate brush tracking from inside the brush station. The new nyloc set screw, P/N 610148, is rounded at the wrench socket end to eliminate a binding exposure. Set screw adjustment from the inside of the brush station eliminates extensive removal of covers and pulleys. CAUTION - Use on serial numbers 17220 and above only.

6/28/63
5/1/64

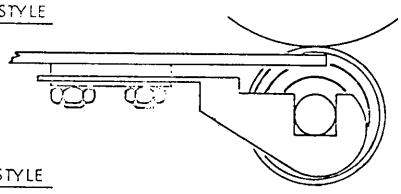
29 IMPROVED TRANSPORT TENSION ROLL ASSEMBLY — IBM 8

Maintenance Reduction - B/M 605849 has been released to afford a new transport pressure roll assembly design. The new design allows for improved pressure roll tension adjustment.

The B/M includes assembly parts, alignment tools, and instructions for installing the redesigned pressure rolls at pockets 1, 2, 4, and 5. The new pressure roll design cannot be installed on shear plates above pockets processing 51 column cards because of card interference.



NEW STYLE



OLD STYLE

B/M 605849 - Improved Transport Tension Roll Assembly (Pockets 1, 2, 4, and 5)
MACHINES AFFECTED - All 088's prior to H3 suffix
INSTALLATION TIME - 3.0 Hours (45 minutes for each pocket)

IBM USE ONLY

TYPE A, MES Code 01, Rochester.

6/28/63
197/06-11-71

30 "GHOST" LIGHTS - ANSWER NEONS 088

"Ghost" lights refer to false, dim, erratic firing of answer neons due to firing below specified voltages. Field B/M 605962 is released to eliminate "Ghost" lights by reducing answer neon voltages from -70V to -55V.

The B/M adds a voltage divider network to the -70V supply of the answer neons. This change advances 088 W/D 603000 from "E" to "F" suffix.

MACHINES AFFECTED - All TX 88s prior to K3 suffix.

B/M	E/C	NAME
605962	805087	Answer Neon Voltage Change

INSTALLATION TIME - .7 Man hours

IBM USE ONLY

TYPE A, MES Code 01, Rochester.

Serial Number Required

5/1/64
197/06-11-71

31 TOP SLIDING COVER ASSEMBLY REPLACEMENT IBM 088

B/M 605887 is released to afford field replacement of an improved top sliding cover assembly. The improved top cover assembly will afford better top cover latching and interlock switch operation.

The old level top cover assembly may be identified by its spring loaded cover hand-pull design, compared to the new level which was a recessed plastic hand-pull design.

The B/M includes the following parts: P/N 603191 - Top Cover Assembly
P/N 603124 - Top Front Casting
P/N 30037 - Screw (two)
P/N 609551 - Stud (two)
P/N 609602 - Hand Pull

MACHINES AFFECTED - All 088's

B/M	E/C	NAME
605887	805489	Top Sliding Cover Assembly

INSTALLATION TIME - Man hrs 2.0

IBM USE ONLY

TYPE A, MES Code 01, Rochester.

Serial Number Required

197/06-11-71
10/18/63

32 SERVICE INFORMATION IBM 088

1. Columns 3 and 78 are internally wired to the dynamic timer display for the purpose of checking brush timing at both ends of the card.

In many cases the customers' cards may not be punched in columns 3 and 78. It may be desirable to use the customers' cards for testing brush timing to save time.

In order to use the test circuit with customer cards which are not punched in columns 3 and 78, the columns which are punched may be control panel wired to brushes 3 and 78 to facilitate use of the internally wired test circuit.

It should be noted that slight variation in brush display may be due to variation in card punching from one card to the next.

2. Regulated Transistor Power Supply Voltage Tolerances (Tyratron transistor 088)

a) Input / C A N C E L L E D Volts ± 10%
Volts ± 10%
230 Volts ± 10%

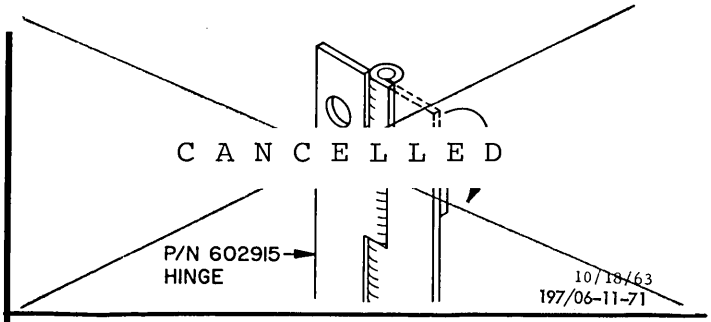
b) The + 48, -12 and -70 Volt DC levels are provided by a common, center tapped, secondary winding of the ferro-resonant regulator.

c) All DC plus (+) and minus (-) voltages utilize a common ground terminal (logic Sec. 1 post 21) on the output terminal block.

d) DC supply output voltage level requirements: +48 Volts ± 10%
-12 Volts ± 12%
-70 Volts ± 10%

3. Cable Chafing and Grounding Exposure - RC Panel Hinge

A cable chafing and grounding exposure exists on all TX 088s (serials over 15000) prior to P3 suffix. The exposure exists on the RC panel hinge at the upper end. To correct this exposure, form the top of the hinge as indicated in the figure below.



33 INTERMITTENT FALSE EQUAL SECONDARY SEQUENCE ANSWERS - BRUSH NOISE IBM 088

Intermittent false equal secondary sequence answers may result due to the high resistance of the 560 OHM resistor in the secondary sequence circuits (logic sections 29 and 31) when reading successive digits.

The 560 OHM resistor (P/N 603088) has been changed to a 470 OHM resistor (P/N 2123791) in all cross-over circuits in the secondary sequence positions.

The lower resistance in the cross-over circuit reduces the sensitivity of the "flip-flop" circuit to read-brush noise when the 8MFD capacitor (in the pick circuit) goes to the upper limits of its tolerance.

If the above problem is experienced, the 560 OHM resistor (P/N 603088) should be replaced by the causing failure
(It should not b C A N C E L L E D

This change advances 088 W/D 603000 from "F" to "G" suffix.

MACHINES AFFECTED - All 088's (serials over 15000) prior to K3 suffix.

P/N	NAME
2123791	Resistor 470 OHM

INSTALLATION TIME - .2 hr per position

IBM USE ONLY

TYPE A, PR Card, Code 01, Mechanicsburg

Records - Note resistor P/N and value change in logic diagrams.

10/18/63

34 MERGE POCKET JAMMING IBM 088

Merge pocket jamming caused by primary and secondary card interference may be corrected by installing:

1 B/M 605877 Merge Pocket Speed Change - Changes the transport feed roll pulleys to change the relationship between primary and secondary card as they enter pocket 3 to minimize card-to-card interference.

NOTE: When installing B/M 605877 on 51-80 (Standard Feature only) machines, interference may be encountered with the 51 column arrestor tape. On all 51-80 (Standard Feature) machines order and install a new CB Cam, P/N 608606, in location C60 (SCC-2) of the lower primary CB unit in place of the present cam, P/N 602120. Adjust the new cam, P/N 608606, to make at 45 and break at 265.

2 B/M 635281 Merge Pocket Jamming Change - Includes (a) New ledge hardware (b) New style deflector springs and brackets (c) New merge pocket jam detection device (d) Ledge 603723 is obsoleted and should be discarded (e) B/M 635281 cannot be used on 51-80 machines.

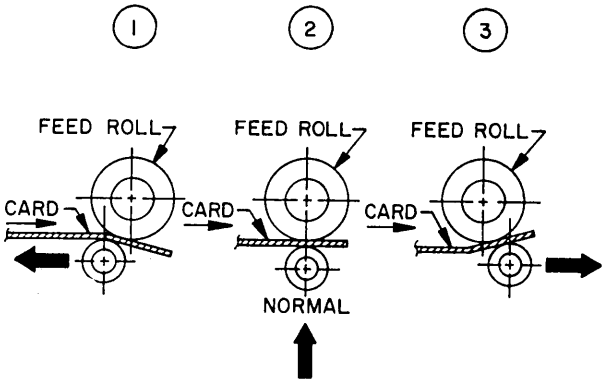
Pressure roll adjustments are critical and the following conditions should be noted:

A ALIGNMENT - Pressure rolls must be directly below center line of feed roll (Fig. below) to insure proper angle of card entry into pocket. This alignment may be checked with alignment Tool P/N 603886 or insert a .010 feeler gauge between rolls (free to move up or down) and adjust to make gauge parallel with card line.

NOTE: If pressure rolls are moved to an extreme, either forward or to the rear of center, card jamming may be experienced due to card interference at either the feed roll station or the shear plate.

34 continued

B TENSION - Should be within 1 1/2 to 2 1/2 pounds pull. (Measure with strip of card and push pull scale P/N 9900012 pulled through rolls.) It is important that tension does not vary more than 1/4 pound between front and rear.



MACHINES AFFECTED -

1 All 088's prior to A5 S/N Suffix

B/M	E/C	NAME	INST TIME
605877	807837	Merge Pocket Speed Change	.6 hrs

In addition for - Standard Feature 51-80 order

P/N	NAME	INST TIME
608606	CB Cam	.7 hrs

2 All 088's (Except 51-80)

B/M	E/C	NAME	INST TIME
635281	807837B	Merge Pocket Jamming Change	.8 hrs

NOTE: B/M 605877 is a prerequisite for B/M 635281.

SPECIAL TOOLS - #36 Drill, P/N 3989, and #6-32 Tap, P/N 4008.

TYPE A, PR Card, Code 01, IBM Distribution Center.

RECORDS - Retain B/M instruction for parts ordering and future reference.

Advise Your Service B/O Of Your Territory Requirements. No MSIR Control.

1/29/65
197/06-11-71

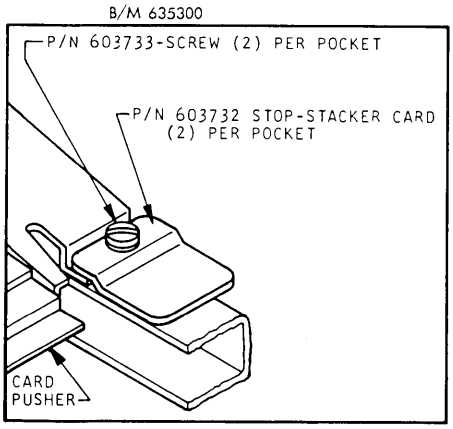
35 CARDS VERTICALLY "CLIMBING OUT" OF RADIAL STACKER — IBM 088

A new stacker card stop, P/N 603732, is released to prevent cards from following the card pusher on its return stroke in the radial stacker.

The stop eliminates problem of cards vertically "climbing out" of the stacker pocket. It also helps reduce noise caused by excessive oscillation of the stacker slides.

Two stops, P/N 603732, are installed in each stacker pocket (10 per machine) as indicated in the illustration. A longer screw, P/N 603733, is released for attaching stops.

B/M 635300



NOTE: Stop, P/N 603732, cannot be used in stacker pockets processing 51 column cards due to stacker slide interference.

MACHINES AFFECTED - All 088s prior to A4 suffix.

B/M	E/C	NAME
635300	805484	B/M Stacker Stop 1 required per machine

INSTALLATION TIME - Man hrs .2 (Per Stacker Pocket)

IBM USE ONLY

TYPE A, PR Card, Code 01, Mechanicsburg.

RECORDS - Note new P/Ns in Parts Catalog

ADVISE YOUR SERVICE B/O OF YOUR TERRITORY REQUIREMENTS. NO MSIR CONTROL.

1/10/64
197/06-11-71

36 FALSE ANSWER, TRANSISTOR 088 WITH SPLIT COMPARE FEATURE — IBM 088

A condition exists on a few 088's equipped with split unit device where double answers develop causing a control stop. This condition is caused by cable capacitance in the split feature cabling.

The indication is an extra answer relay being up in addition to correct answer. Code relays are set up correctly. Pulse which fires answer transistor will usually not show on the timer. This condition can be corrected by installing B/M 605842 (see CEM #26 which released this B/M for answer point clearing).

The capacitors in this B/M will provide sufficient damping to prevent the capacitive coupling between cables and prevent double answer set-up.

MACHINES AFFECTED - All TX (Serial numbers after 15,000) with split compare

B/M	NAME
605842	Answer Point Cleaning Circuit

INSTALLATION TIME - Man hrs 1.0

IBM USE ONLY

TYPE A, MES, Code 01, Rochester.

ADVISE YOUR SERVICE B/O OF YOUR TERRITORY REQUIREMENTS 197/06-11-71

Serial Number Required 5/1/64

37 RPQ 51-80 FEATURE IMPROVEMENTS (SLANT STACKER 51-80 ON BOTH PRIMARY AND SECONDARY FEEDS) — IBM 088

B/M 691388 - Pressure Rolls - This B/M includes redesigned pressure rolls for the 6 transport stations. This change will reduce card skewing in the transport and improve card stacking.

B/M 691389 - RPQ 51-80 Improvements - This B/M includes a number of improvements which are individually explained below.

37 continued

1 Flipper Springs - An improved flipper spring design released 2 springs for each of the 5 pocket stations instead of the present single spring design. This improvement affords increased control over card stability as it enters the stacker pocket and also eliminates card marking exposure.

2 Chute Blade - The improved chute blades afford a stronger, more stable design which will reduce mis-selecting and jamming caused by former chute blade flutter and bounce. This basic design improvement is similar to the one now used on 188 collators; however, the new blade is smaller and lighter.

3 Shear Plates - The redesigned shear plates are released to reduce exposure to card interference as cards enter the stacker.

4 84 Sorter Type Stacker Card Pushers - The 84 pushers will improve stacking by moving the stacked deck of cards further forward, affording more clearance for cards falling into the stacker.

5 Card Guide (Select Magnet) - New guides are released to eliminate jamming and interference of cards at the select magnet assembly for cards which tend to rise at the corner as they pass under the magnet.

B/M 605877 - Transport Speed Change - This change has proven very successful in eliminating merge pocket jamming caused by card "floating" and card score interference. The transport roll (feed rolls on each side of the merge pocket) speed is changed to allow the primary card to fully enter the pocket before the secondary card begins to enter, therefore, eliminating card-to-card interference while merging, which has been the major cause of jamming. See 088 CEM #34. B/M 605877 contains a ledge which is for standard machines only. This ledge cannot be used on 51-80 machines.

Although the B/Ms can be installed separately, it is recommended that both B/Ms 691388 and 691389 be installed at the same time. B/M 691388 is a prerequisite for B/M 691389; B/Ms are not sectional and should be planned for complete installation once started. Some customer machine time can be saved by pre-assembling flipper spring assemblies (step 2 and 3 of B/M 691389) before taking machine from customer.

MACHINES AFFECTED - All 088s prior to approximately J3 suffix with 51-80 RPQ feature #698186

B/M	E/C	NAME
691388	891878	Pressure Roll Redesign
691389	891878	51-80 RPQ Improvements
605877	804399	Transport Speed Change

INSTALLATION TIME - Man hrs 2.0 - B/M 691388
9.0 - B/M 691389 *
1.0 - B/M 605877
*Subtract .5 hr if flipper springs are pre-assembled

PREREQUISITES - RPQ feature #698186 (Prerequisite not required for B/M 605877)

IBM USE ONLY

TYPE A, MES, Code 01, Rochester - For B/Ms 691388 and 691389. TYPE A, PR Card, Code 01,

RECORDS - Retain B/M paperwork for ordering future parts 197/06-11-71

Serial Number Required (Also indicate "RPQ feature #698186") 5/1/64

38 REDESIGNED FEED CLUTCH IBM 088

A B/M is available for installing an improved primary and secondary feed clutch when trouble is experienced with present clutch. Design improvements have been made to the drive arm and latch assembly providing a stronger drive arm and more positive latching.

The B/M includes sufficient parts to convert one clutch. The magnet and yoke assemblies are not included. Old style clutch parts are being obsoleted and will no longer be available after present stock is depleted.

Sufficient quantities of conversion B/M should be on hand in B/O stock to cover normal clutch maintenance requirements.

MACHINES AFFECTED - 088s prior to approximately #18415

B/M	E/C	NAME
605861	804325	Redesigned Feed Clutch

2 B/Ms Required Per Machine if Both Feeds Require Conversion

INSTALLATION TIME - Man hrs 2.0 per feed

IBM USE ONLY

TYPE A, PR Card, Code 01, Mechanicsburg

RECORDS - New P/N listing and clutch illustration is included in B/M 605861

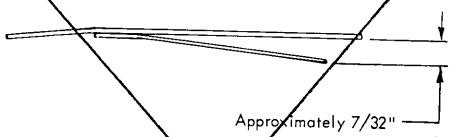
ADVISE YOUR SERVICE B/O OF YOUR TERRITORY REQUIREMENTS 5/1/64

39 SERVICE AIDS AND INFORMATION IBM 088

A CARD WEIGHT ADJUSTMENTS

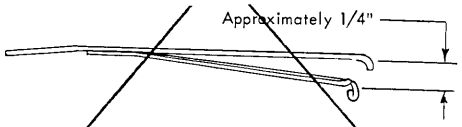
Misfeeding may occur when feeding the last few cards in the primary hopper because of card weight adjustment. The dimensions for adjusting the card weight springs are as follows:

End Springs (2)



C A N C E L L E D

Center Spring



B READ BRUSHES

Only 2 group brushes with pre-hardened wire should be used in 088s - These newest level brushes provide a significant increase in life. Also the strand breakage exposure is minimized. The following part numbers are for 2 group pre-hardened brushes:

Brush Block Asm - P/N 610275
Individual Brush - P/N 609798

6/26/64
197/06-11-71

40 COUNT DEVICE - UNWANTED RESET ON STOP CONDITION IBM 088

When the count device and eject clutch are used simultaneously, an erroneous counter reset will result because card lever 2 and 3 will drop when the card is ejected.

B/M 691541 adds a latch relay to prevent this condition.

MACHINES AFFECTED - All TX 088's with both the eject clutch and count device features.

B/M	E/C	Name
691541	892150	Make count device and eject clutch compatible.

INSTALLATION TIME - Man hrs 2.0

SPECIAL TOOLS - Crimping tool for #20 wire terminals.

IBM USE ONLY

TYPE E, MES, Code 01, Rochester.

Will Be Shipped Automatically. 8/28/64
197/06-11-71

SAFETY

41 SAFETY - FILE FEED JOGGLER SPRING BREAKAGE

Breakage of joggler spring P/N 602147 and possible personnel injury, is being corrected by installation of B/M 635239.

B/M 635239 includes an improved spring plus a new stud assembly which utilizes a C Clip to contain the spring if it should break.

On Machines with dual file feeds, indicate a B/M quantity of 2 on MSIR card.

MACHINES AFFECTED - ALL 088s prior to K4 Suffix

B/M	E/C	NAME
635239	807524	Joggler Spring and Stud Asm

INSTALLATION TIME - Man Hrs .3

IBM USE ONLY

TYPE E, PR Card, Code 33, Mechanicsburg

You will receive MSIR Cards for Survey, Ordering and Installation Control.

8/28/64

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42 BRUSH CABLE STRAIN RELIEF IBM 088

Machines which require frequent brush removal may experience broken and shorted individual brush wires.

Future production machines will have a clamp assembly installed on all brush block frames.

These parts are available in B/M 635184 for installation on field machines that have this problem and exposure. One B/M is required for each brush block.

MACHINES AFFECTED - All 088s prior to M-4 Suffix

B/M	E/C	NAME
635184	807262	Clamp Asm Brush Cable (1 B/M required per brush block)

INSTALLATION TIME - Man Hrs .1 per B/M

IBM USE ONLY

TYPE A, PR Card, Code 01, Mechanicsburg.

ADVISE YOUR SERVICE B/O OF YOUR TERRITORY REQUIREMENTS. NO MSIR CONTROL

197/06-11-71
9/11/64

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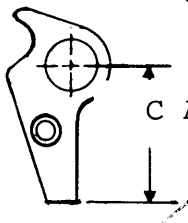
43 SERVICE AIDS AND INFORMATION IBM 088

I CLUTCH DETENTS

Excessive wear of clutch ratchet and associated parts causing erratic feeding can be corrected temporarily, and clutch life extended by installation of 1402 oversize detents. Select the detent which will best compensate for wear experienced.



DETENT CHART

PART NO.	DIM.	CODE NO.
CANCELLED		0
		1
		2
609739	.662	3
609740	.664	4
609741	.666	5
609742	.668	6
609743	.670	7

II COG BELT PULLEYS

Highly intermittent and difficult to analyze timing problems can be caused by cracked or loose cog belt pulleys slipping at a point where the plastic pulley meets the metal collar. When replacing cog belts or before attempting to correct a timing condition, check to insure the pulley is not defective.

III CONTROL PANEL LINK AND/OR DASH POT REMOVAL

The dash pot P/N 123113 and or link P/N 123115 can be removed without disassembling the closure mechanism by the following method:

1 Dash Pot -
- (a) Remove 2 springs P/N 123132 - Remove lower clip #139766
- (b) Turn Stud #237521 out with 7/16 wrench
- (c) Partially open control panel and pry dash pot out with large

CANCELLED

2 Li
- (a) Remove clip P/N 219743
- (b) Partially open control panel and remove link

NOTE: Links (left and right) are interchangeable.

FOR YOUR SERVICE INFORMATION

10/23/64

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44 MARK SENSE - ZENER DIODE POLARITY IBM 088

Zener Diode P/N 369129 polarity may vary and must be identified by the symbol marked on the case, i.e. bolt end may be either Cathode or Anode.

Some of these Zener Diodes may have been installed backwards causing reading problems and transistor failures due to loss of the +30 volts.

These diodes CANCELLED k on bottom of SMS gate, a

Check the + 30 volt level to see if it is between 26 to 34 volts no load tolerance. Reverse diode (if backward) or replace diode to obtain correct voltage.

MACHINES AFFECTED - T. X. 088's with Mark Sense DeSense
B/M's 603800-603813-603814

For Your Service Information

11/6/64

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45 51-80 STACKING IMPROVEMENT IBM 088

B/M 635319 has been released to improve stacking in 51-80 (Secondary Only) Machines. The B/M includes new card pushers and mounting hardware.

MACHINES AFFECTED - All 088's with Secondary Only 51-80

B/M	E/C	NAME
635319	808467B	51-80 Stacker Improvement

INSTALLATION TIME - Man hrs .6

PREREQUISITES -

TYPE	B/M	CEM
A	605269	088-14

IBM USE ONLY

TYPE A, PR Card, Code 01, IBM Distribution Center

Advise Your Service B/O Of Your Territory Requirements. No MSIR Control.

197/06-11-71
2/12/65

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46 CLUTCH DUST COVER IBM 088

A cover has been released to reduce clutch problems due to dust.

B/M 635306 includes covers for both feed clutches.

MACHINES AFFECTED - All 088's

B/M	E/C	NAME
635306	808461	Dust Cover

46 continued

INSTALLATION TIME - Man hrs .4

IBM USE ONLY

TYPE A, PR Card, Code 01, IBM Distribution Center

Advise Your Service B/O Of Your Territory Requirements. No MSIR Control.

2/12/65
197/06-11-71

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47 SERVICE AIDS IBM 088

A DP Detection on MS Desense TX Machines using selectors

The entry of DP BC switch is not desensitized. If wiring similar to Figure 63 in Operators Manual A24-1013-2 is used, a false DP light will occur due to the +30 volts present at the read brushes during the interval between cards when the brushes are on the bare contact roll.

Solution:

1. Pick a selector with the selected brush pulse shown wired to DP BC Jack Plug.
2. Assign selector to proper feed.
3. Wire from blank column test (top row of hubs) through selector to DP BC Jack Plug entry.

B Alternating Feed Test

The following wiring can be used to alternate feed cycles i.e. primary cycle, secondary cycle, primary cycle, etc. This procedure is helpful in diagnosing clutch troubles, worn feed rolls, weak or stretched belts, etc.

Wire

CANCELLED

4. Primary feed from N/C of selector.
4. Secondary feed from transferred of selector.
5. Secondary exit to selector assignment entry.
6. Primary and secondary sequence wired off.

C Quick Test for Missing Codes

CEM 088 #28 item 1, outlines a quick test which will detect missing A, B, & D codes. This test can be expanded by:

1. Shorting out the primary and secondary card lever.
2. Depress the runout key.

Result: All codes should be set up in wired positions.

D Eject Clutch - Check Circuit Improvement

At present the primary eject clutch circuitry checks only for a failure to take a cycle. A minor wiring change will allow a check for an extra clutch cycle also. Add a jumper wire from Eject - 2 N/O to R-EJ CL - 2 N/C.

IBM USE ONLY

For Your Service Information. 197/06-11-71 2/12/65

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48 SECONDARY SEQUENCE FAILURES - TUBE 088's IBM 088

1. Failure to Read Equal Secondary Sequence

Trouble may be experienced with failure to read equal's on machine with secondary blank column sequence checking device, B/M 605153. This is due to oscillation between tubes and one tube may drop out. This is most critical with the 4° minimum CB duration. Also the new "A" suffix 5696 tubes can aggravate the condition.

This condition can be corrected by one or more of the following applied as necessary in the order listed.

A. Install B/M 635490 which changes the .47 MFD cross over capacitors to .22 MFD. The resistor remains unchanged at 330 ohms.

B. Lengthen impulse CB duration to 5°.

NOTE: If false double punch lights occur with longer duration, install a disk type .01 MFD (200 volts Min.) capacitor (.005 MFD for selector inputs) between grid and ground in parallel with existing cap in each DP pluggable unit. If selectors are used for DP selection, a .005 MFD cap must be installed in each selector input. (Obtain parts locally as required.)

C. Adj +70 volt supply to highest setting within tolerance.

SERVICE HINT: A false high sequence can go undetected. If symptoms point to an intermittent false high, swap the upper and lower tubes. Error then should be low secondary sequence, machine will then stop and the failing position can be easily found.

2. False Equal Secondary Sequence

On some machines, installation of B/M 605188 has caused a false equal secondary sequence answer due to insufficient cross over with the .1 MFD cap and 560 ohm resistor resulting in a failure to extinguish a tube when going to a higher digit. Correction of this problem is to install B/M 635490. (Same as Item 1.)

MACHINES AFFECTED - Tube 088's (S/Ns prior to 15,000) with B/M 605153 or wired to B suffix main W/D

B/M	E/C	NAME
635490	808763	Secondary Sequence Modification

INSTALLATION TIME - Man hrs 1.5 for 16 pos machines.
(.3 hrs for each additional secondary sequence position)

IBM USE ONLY

TYPE A, MES Code 01, Rochester

Advise Your Service B/O Of Your Territory Requirements. No MSIR Control.

197/06-11-71

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49 EXCESSIVE CONTACT ROLL WEAR IBM 088

When it becomes necessary to replace bronze type contact rolls on the 088, it is recommended that they be replaced with the carbon graphite type. The carbon graphite roll has superior wearing qualities and is a direct replacement for the old style roll. Field tests indicate an improved roll life of at least 100%. The improved roll will also reduce brush wear.

088s equipped with mark sense desensitizing cannot use the carbon graphite roll because of the slightly higher resistance of the new style roll.

MACHINES A CANCELLED t those with mark I.

P/N	NAME
603547	1st and 2nd contact roll assembly (Replacement for P/N 602885)

IBM USE ONLY

TYPE A, PR Card, Code 01, IBM Distribution Center

For Your Service Information

6/4/65

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50 INTERMITTENT ERRORS IBM 088

This CEM obsoletes 088 CEM 103.

A critical timing condition can exist in the hold circuit of R-39 and R-41 on transistor 088s. The counter E M F from the paralleled relay coils can prevent either relay from dropping I CANCELLED tent machine errors. Later p in series with the hold coil o. each of these relays.

All machines should be checked to insure that these resistors are installed. (Two required per machine. Four required if machine has additional clutch relays 39A and 41A).

50 continued

MACHINES AFFECTED - All TX 088s prior to H suffix serial

P/N	E/C	NAME
602309	807508	Resistor, 820 OHM 2 watt

INSTALLATION TIME - Man hrs 0.2

CANCELLED

TYPE E, Code 01, IBM Distribution Center

RECORDS - Note resistor Part Number and values in Logic Diagrams

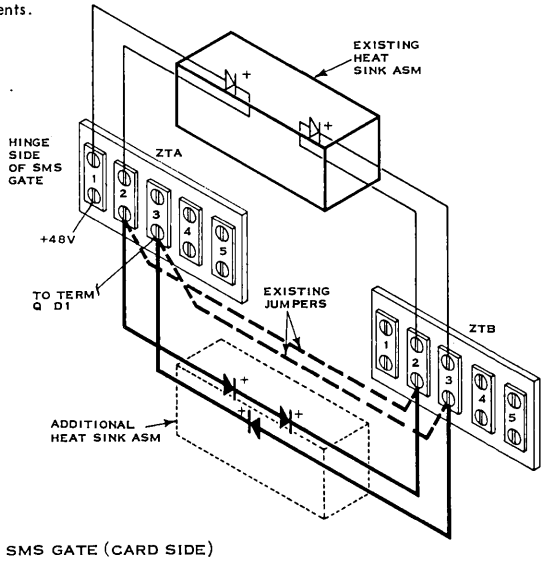
Advise Your Service B/O Of Your Territory Requirements. No MSIR Control.

197/06-11-71
11/12/65

51 MARK SENSE DESENSE FEATURE IMPROVEMENT IBM 088

Most customer applications do not require the full amount of circuit desensitizing provided by this feature. Reduced machine efficiency results and is aggravated by the added resistance of aged components.

A Bill of Material is available to add a selection circuit. This circuit provides the Customer Engineer with various taps to select a desense bias voltage to suit individual machine requirements. Either one, two, or all three of the diodes shown below may be connected to reduce the present bias by approximately 1 volt increments.



SMS GATE (CARD SIDE)

This change effectively reduces the effect of the desense feature in the interest of improved overall machine operation.

New production and reconditioned machines will have these diodes mounted. However, the circuit will NOT be connected when the machine is shipped from the plant. If future machine performance warrants the installation of these diodes, bias voltage selection must be tested thoroughly on customer applications using mark sense cards. Thereafter, if an objectionable number of marks are read, it will be necessary to remove one, two, or all three of the diodes installed on this change.

MACHINES AFFECTED - All 088s prior to approximately S5 suffix with any of the following mark desensitizing features installed: 603800, 603813, and 603814.

B/M	E/C	NAME
635981	810470	Mark Sense Bias Selection

INSTALLATION TIME - Man hrs 0.5

IBM USE ONLY

TYPE A, MES, Code 01, Rochester.

Advise Your Service B/O Of Your Territory Requirements. No MSIR Control.

Serial Number Required.

197/06-11-71
3/18/66

52 SERVICE INFORMATION IBM 088

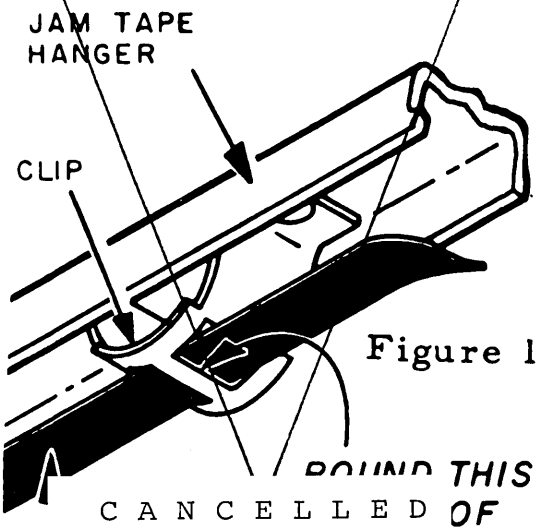
I Card Nicking and Jamming.

A Jam tape support clips must be perfectly smooth with no trace of a square edge in the slot. With the jam bar assembly moved toward the left or right end, the clips can be stoned smooth. See Figure 1.

B Pocket deflectors - clearance between spring steel deflectors (attached to the pocket 2 and pocket 4 selector magnets) and the card guide plates should be from .003" to .005". Less than .003" clearance can cause skewing and card jamming.

II Damage to Main Line Cord.

Main line cord damage can be caused by the strain relief clamp not being installed. This clamp is located under the base near the location of the main line cord opening in the base. The clamp should be installed on all machines to prevent damage to the wire terminals.



III Diodes - Mark Sense, Desensitized Transistor Machines.

The diodes in the inputs of the desensitized selectors are physically located on the pin side of the SMS gate. They are in the input jumper assembly (P/N 603603). The diodes are covered with insulating sleeves and/or tape.

IV File Feed Delay - Tube Machines.

If the file feed delay is too short, connect the pick and hold coils in series on R2.

V CBs.

A Do not lubricate nylon cams or CB plungers. CB rollers and pivots should be lubricated with #9 oil.

B False DPBC lights can be caused by code relays which pick on the short end of the pick specification time in conjunction with primary and secondary brush impulse CBs that are long in duration. Time brush impulse CBs toward the low tolerance. Tube machines - shortest impulse equals 4 °. Transistor machines - shortest impulse equals 3°. Code cams should be timed for a break of at least 4° between adjacent code impulses to prevent extra codes. If brush impulse CBs are timed to the low end of the tolerance, be sure that code cams are made for the complete duration of the brush impulse CBs.

VI Drive Mechanism Timing Variations.

Timing variations in clutch CBs and read brush impulses should be held to a maximum of 3°. Oscillation should occur only immediately following feed clutch engagement. Observe brush impulse CBs while operating clutch switch on the CE panel. Observe primary nine digit and secondary twelve digit timing for any variation which may be caused by the following:

A Loose motor drive belts.

B Loose clutch feed roll belts.

C Loose screws and the clutch pulley assembly (P/N 602013).

52 continued

D Secondary feed, idler gear (P/N 602078) may be worn.

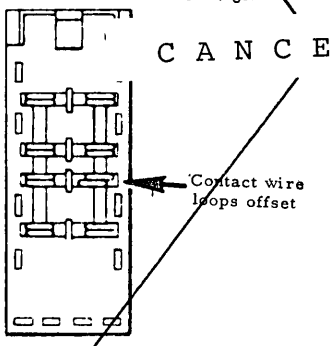
VII Mark Sense Desense Device - Thyratron Transistor Machine.

Make sure the desense bias voltage is present on the SMS gate at all times on mark desensitized machines. This voltage is to prevent exceeding the base to emitter reverse voltage specification.

VIII PM Relay Point Failures.

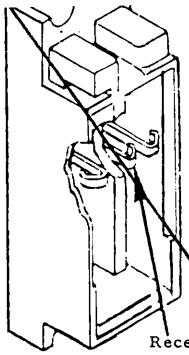
Although the code relays may operate correctly, the wire contacts can be twisted and one N/C wire may remain made while the N/O contacts make, and vice versa.

This condition is difficult to see even though the machine failure has been localized. The contact wire loops will be off set from each other when the wires are crossed. See Figure 2.



PM Relay connector side

Figure 2



PM Relay moulding contact side

Figure 3

IX PM Relay Failures.

Cases have been found where an extremely intermittent failure was traced to the relay moulding receptacle. The exposure is very limited, however, it is well to be aware of a possible reversal of the receptacle contacts in the moulding. A reduced contact tension will result. See Figure 3.

X Scope Testing.

Due to variations in timing between the card and the CRCB used to sync the scope, the pattern will move laterally on the scope face. Also, changing from one digit to the next causes the pattern to move laterally. If X5 amplification is being used, the trace will disappear. Continual horizontal alignment is necessary. You may prefer to sync on a digit from the card to establish a steady trace throughout the test. Scope test deck P/N 603044 has been altered on test decks punched in the plant. Test decks in the field can be gang-punched in this manner if desired.

All "0" cards have "11" in column 40 and "1" in column 50; "1" cards have "0" in column 40 and "4" in column 50.

For secondary feed test, connect sync lead to column 40 read brush. For primary feed test, connect sync lead to column 50 read brush.

When running the scope test, you may want to examine particular positions for a much longer length of time than the test affords.

All cards have "0" punched in column 60; "1" punched in column 61; "3" punched in column 62; "6" punched in column 63.

After an initial run is made, making notes of marginal positions, questionable positions may require a closer examination on a certain code. These positions can be wired to the column containing the required digit. Internal scope sync can be used. The machine can be stopped, a component changed and rechecked without regard to number of cards passed or having to make up special decks.

XI Quick Test Panel.

The "9-2" test deck can be supplemented by a 7-5 and 8-4 deck. The additional decks may show up marginal timings undetected by the 9-2 test.

XII Intermittent Tube Trouble - IBM 088

A A high resistance connection at the filament cable terminals on the power supply or at the tube gate bus bars will produce failures as a result of low filament voltage. The trouble may appear or disappear when the tube gate is opened.

B Failure to Remain In Conduction.

The 5696 tube may cut off after sustained periods of conduction. The length of conducting time required to cause this failure may vary over a wide range. If intermittent mismerging or mismatching is encountered, it may be caused by a tube cutting off and changing the answer. For example: If a "low primary" reading is set up and a group of primary cards are fed, a secondary code relay tube may cut off, changing the answer to an erroneous "low secondary". The primary feed would then stop and the secondary feed start resulting in a mismerge or mismatch. To check for this failure, use the "9-2" cards outlined in Service Hint 1, IBM 88 Service Index. Stop the machine for approximately two minutes with all the code relay tubes fired. If the answer changes when the machine is stopped, use the dial switches to locate failing tubes.

XIII Special Features W/Ds - IBM 088.

When servicing the machines with Special Features, lost time is sometimes encountered because it is not readily evident that a Special Feature is installed on the machine. To prevent lost time and confusion, the Special Feature wiring diagrams and instructions for the thyratron transistor IBM 088 are printed on loose-leaf yellow sheets for insertion in the main wiring diagram book.

The following is a description of the IBM 088 Special Feature diagram identification method, and suggested procedure for placing the Special Feature diagram pages in the main wiring diagram book.

A Speci[illegible] gram, have an index [illegible] number, and chang[illegible] mmended that the Special Feature index be placed behind the main wiring diagram index.

The number on the upper left and lower right corner of the index page is the part number of the complete feature diagram.

The yellow feature pages have a section number and/or letter in the upper right corner.

B Special Feature sections with a number alone indicates a section that should be inserted in place of the corresponding standard section of the main wiring diagram.

C A Special Feature section having a number with a letter following indicates an added section which is to be placed behind its corresponding numbered section.

D A Special Feature section having a letter only indicates an added section. The letter is used because this feature page does not affect any particular standard wiring diagram page. It is recommended that the added section be placed behind its Feature Index page. This will assist in locating any additional wiring information while servicing the feature.

E Upon completion of field installation of a feature, it is recommended that these yellow feature sheets be placed in the appropriate place in the wiring diagram book. Retain the standard sections in the back of the book for future reference. This will provide a complete book of diagrams and instructions to fit each individual machine, and will highlight the presence of a change to the standard wiring.

F Whenever one or more yellow pages are lost or worn and require replacement, the complete Special Feature diagram should be ordered. Order replacement feature diagrams from the MES Order Department at the plant of manufacture, stating machine serial number, index number and suffix level desired. The main wiring diagram may also be ordered by the above procedure.

XIV Failure to Detect Sequence Error - IBM 088.

If the customer is using sequence shift and has control panel wired with "Secondary Sequence ON" and "Primary Sequence ON", the first error will be detected in the secondary portion and will result in a "Secondary Control Stop" light. This is normal and correct operation. However, subsequent errors in the secondary portion will go undetected because of the following:

A R38 (Sec 40B) drops due to low secondary sequence (now used in primary feed) when 46-4 N/C point is transferred.

B R28 (Sec 10B) is picked by reset key and held through latched secondary cam S7, which cannot be opened until a secondary feed occurs. Since only primary feed is being used, S7 will not open and R28 remains held.

C R28-4 N/O (Sec 40B) point provides a continual pick for R38 from this point on and renders the 46-4 N/C point ineffective, thereby failing to detect subsequent errors in secondary circuit.

A suggested correction is to advise customers using sequence shift to wire as follows:

A "Secondary Sequence OFF".

B "Primary Sequence ON" through the normally closed points of a low secondary sequence answer relay. This allows only "Primary Control Stop" indications and will allow complete detection of errors in the secondary portion of sequence checking.

C Another suggested method is shown on Page 26, Figure 23, of Reference Manual, Form A24-1013-3.

XV Intermittent Secondary Control Stops - Thyratron/Transistor Machines.

Highly intermittent control stops may be caused by a shorted diode in the sequence relay hold circuit (Section 32, W/D 603000). The purpose of the diode is to stop circulating current due to the induced voltage between the hold coils of sequence relays. If a diode is shorted, the induced current will cause slow drop-out of the relay during read time, particularly with an "8-9" combination. This results in control stops due to a momentary double sequence answer. A c[illegible]quence hold circuit can b[illegible]

CANCELLED

A Turn main line switch "OFF".

B Make certain ALL rotary switches on the diagnostic aid panel are "OFF".

C Turn dynamic timer "ON".

D Connect the timer "CONT" to R372 hold coil "B" side.

E Connect the lead from the timer "COMMON" hub to R372-1 O/P. Make certain that this polarity is correct. Erroneous timer indications will result if the timer leads are reversed.

F Remove relay 210 to isolate the hold circuit.

G Using a small screwdriver, manually pick each sequence relay. Caution: Do Not dislocate the relay armature.

H The timer light will remain "OFF" if the diode is not shorted. If timer light glows, replace the diode at that position and recheck. Note: When a short or ground in a circuit has caused a fuse to blow, it is important to check the circuit for shorted diodes. If a fuse blows, it is possible that enough current has been drawn to damage the diode in the circuit.

XVI Power Supply Contacts.

Shrinkage of plastic contact holders can warp the metal frame of the contactor causing the restoring bail to bind.

A Turn off machine and remove main line power cord before checking contactors.

B Check for binding armature by manually depressing the armature and watching for full closure of the contacts. Form ears (Figure 4) at the end of the restoring bail for free operation. Check the operating contact mounting screws for snugness.

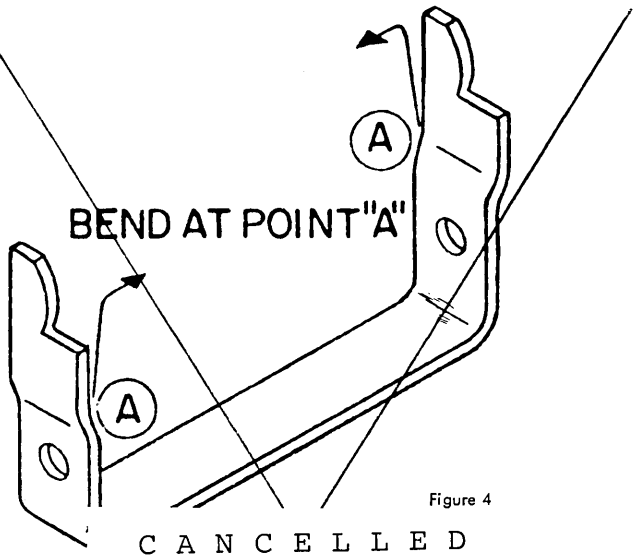


Figure 4

CANCELLED

CAUTION: Do not over-tighten. (Figure 5). Failure of the K contact will result in no ready light.

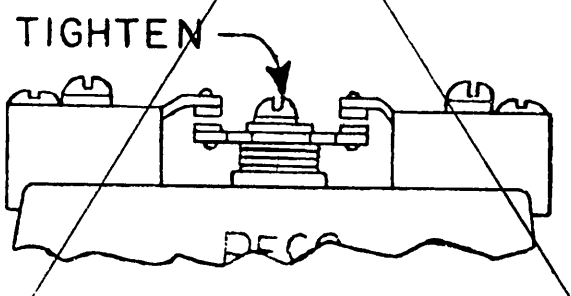


Figure 5

IBM USE ONLY

FOR YOUR SERVICE INFORMATION 73/06-24-66

EC #52 ENDS THE SMALL TEXT SIZE FORMAT .
EC # 53 IS ON SHEET 8.

53 51/80 STACKER IMPROVEMENT IBM 088

The 51/80 Stacker device B/M 698345 using outboard mounted magnets can mis-select occasionally due to lost motion in the select magnet linkage.
FBM 692412 provides an additional bearing which reduces lost motion in this linkage.

Machines affected - All 088's with 51/80 stacker B/M 698345.

B/M	E/C	NAME
692412	893403	Chute Blade Bearing Addition

Installation Time - Man Hours 2.0

IBM USE ONLY

TYPE A, Code 01, MES, Rochester.

Advise your Service Branch Office of your Territory

Requirements. No MSIR Control. 197/06-11-71 186/01-08-71

SECTION 5

PARTS INFORMATION

A. 088 Most Used Parts

B. P/N Additions and Corrections to Parts Catalog S121-0501-5

C. How to Order Obsolete Parts

D. Parts Ordering - RPQ Features

E. Aperture Card Feature

F. 51 Column Stacker Area

A. 088 MOST USED PARTS

Description	Part No.
Brush Asm., 2 Group	609798
Brush Asm., 3 Group	610208
Brush Block, 2 Group	610275
Brush Block, 3 Group	610211
Clutch-Feed	603729
Contact Roll	603547
Contact Wires for P.M. Relay	344592
Dust Cover (P.M. Relay)	602955
Joggler Adjusting Screw	327871
Knife Block	603850
Lamp, Incand-10V	219293
Lamp, Neon Indicator	603680
Lamp, Operator Panel	608346
Motor	602346
Pulley, Timing	602483
Relay P.M. 6 Pos. Tube Machine	344620
Relay, P.M. 6 pos.	311715
Relay, P.M. 4 pos. Tube Machine	344601
Relay, P.M. 6 pos.	311714
Relay, P.M. 4 pos.	311713
Relay, P.M. 4 pos.	311712
SMS Card	371888
Spring, Hopper Bed Plate	609780
Spring, Throat Guide File Feed	603704
Switch, Runout	253267
Weight, Card	602334

B. 088 P/N ADDITIONS AND CORRECTIONS CAT. 121-0501-F

Note: N/S = not shown

Fig.	Item	P/N	Description
4	27	603955	Spring (new style joggler file feed)
10	104	602004	Clip (cover retaining sec.)
10	111	603268	Clip (cover retaining pri.)
13	28	366145	Pulley - up trans. roll
15	46	603919	Spring (clutch drive dog)
17	32	602810	Shaft upper pri. only 13 inches
17	56	602095	Shaft lower pri. only 10 inches
19	54	603255	Cap. 8 MFD 100V (RC network)
19	C4	222355	Selenium Valve Unit
20	110	333587	Switch
5	97	603704	Guide Throat (new style spring)
N/S	N/S	697898	Ledge Asm. (removable 51 col.)
32	N/S	603549	Screw (for top of Radial Guide Asm.)
N/S	N/S	696475	Stacker Joggler Linkage Asm. (RPQ Col. 51-80)

C. HOW TO ORDER OBSOLETE PARTS

Mechanicsburg occasionally cancels a standard parts order because the ordered part is obsolete (Code 10).

The following steps outline the action required to resolve such situations:

1. Determine if you ordered the correct part number. If there was an error made by anyone, simply reorder using the correct part number.

2. Determine if in your own opinion, a substitute part can be used.

3. If you determine that you do in fact need the obsolete part, your Field Manager or Branch Manager must contact the RSP Order Department Mechanicsburg by phone, wire or letter for assistance.

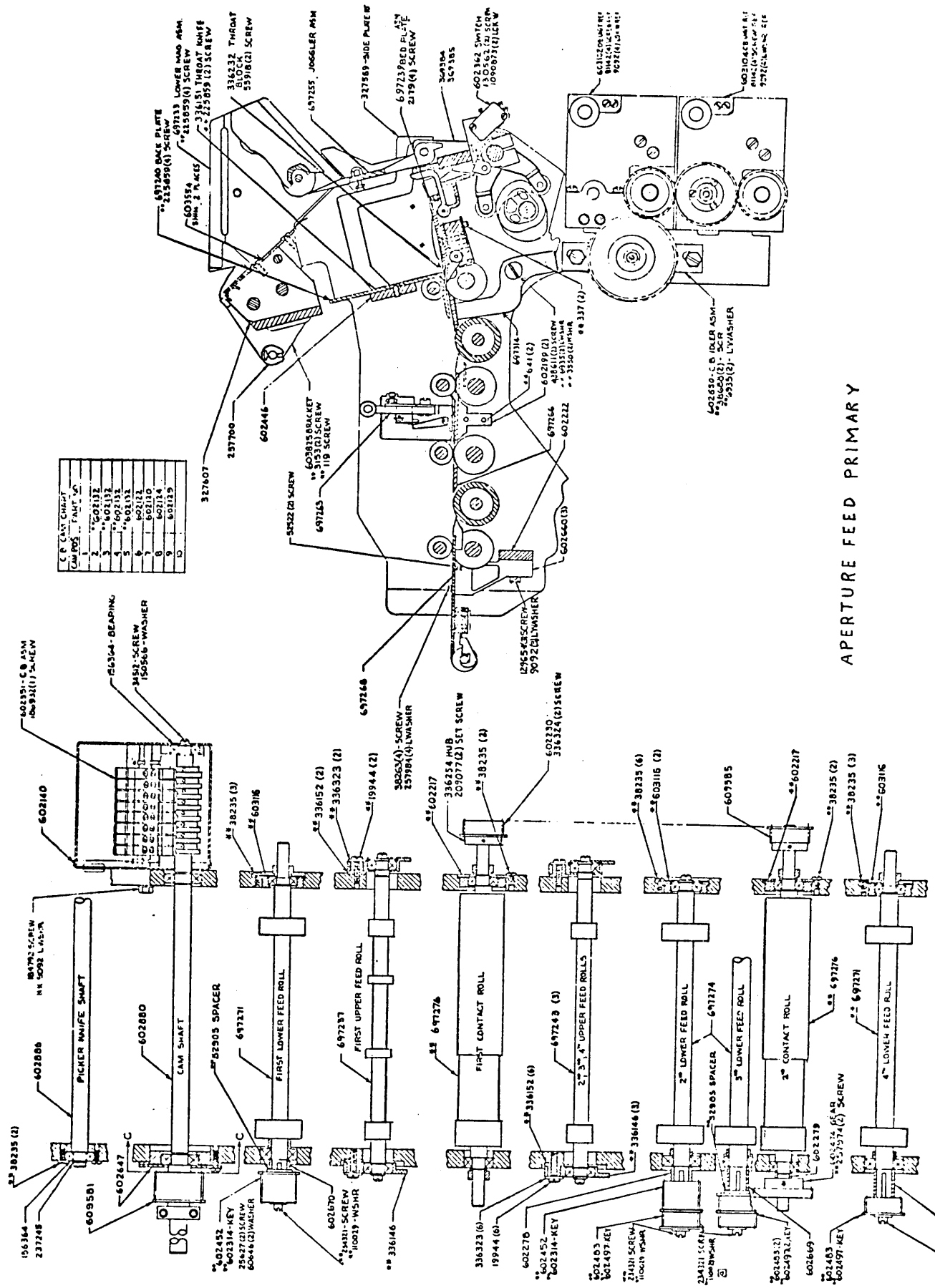
   Management must inform Mechanicsburg of the fact that although the ordered part is obsolete, it is required for machine repair.

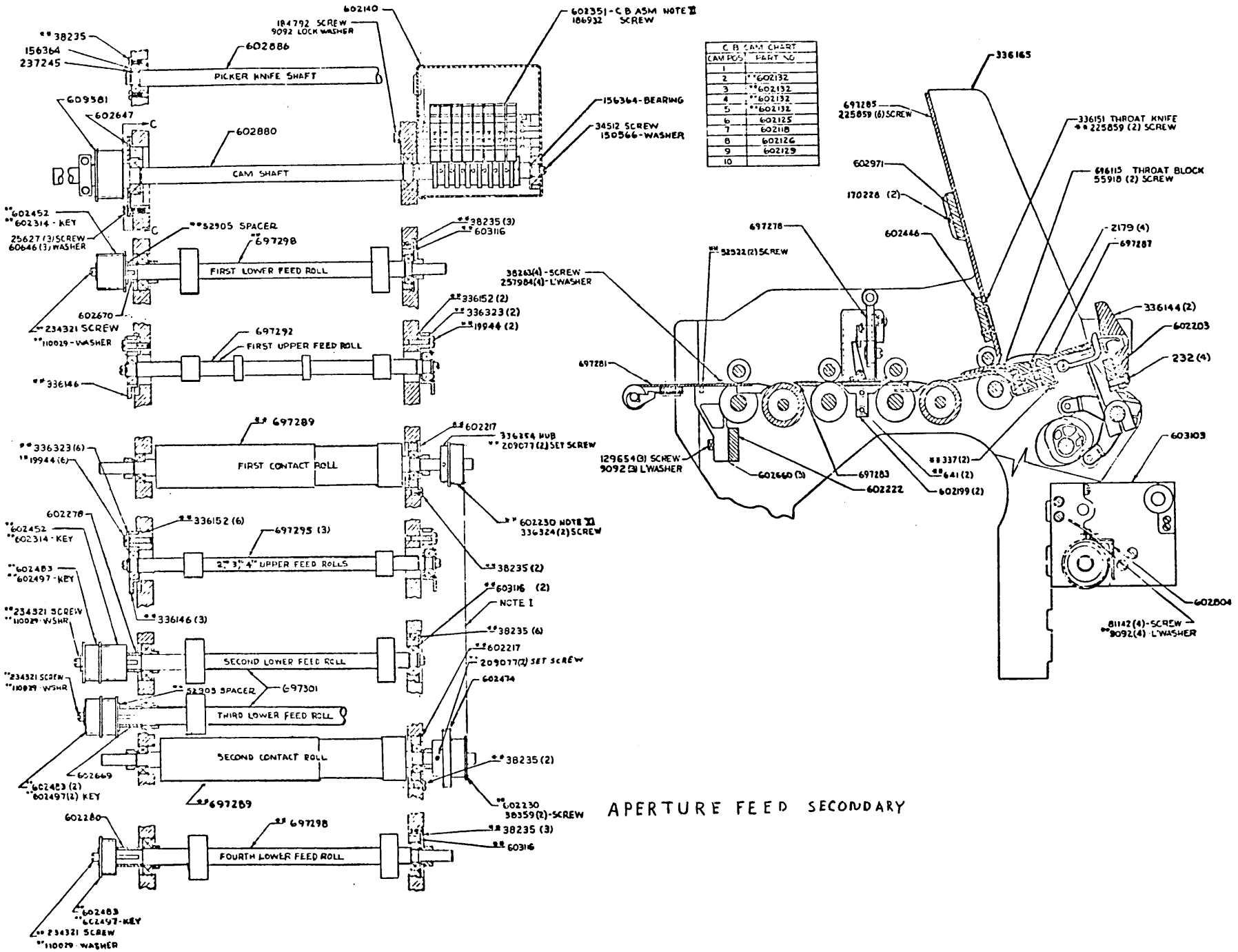
D. PARTS ORDERING - RPQ FEATURES

Parts catalogs are not generally created for low inventory RPQ's. Therefore, it is essential that B/M parts listings and reference drawings be retained in the machine. Delay in RPQ parts procurement can be avoided by insuring B/M paperwork is available in your machine.

Missing or lost B/M paperwork should be ordered from the MES Department of the plant controlling the machine. Requests for B/M paperwork must include machine serial number and the feature description to insure appropriate material is received.

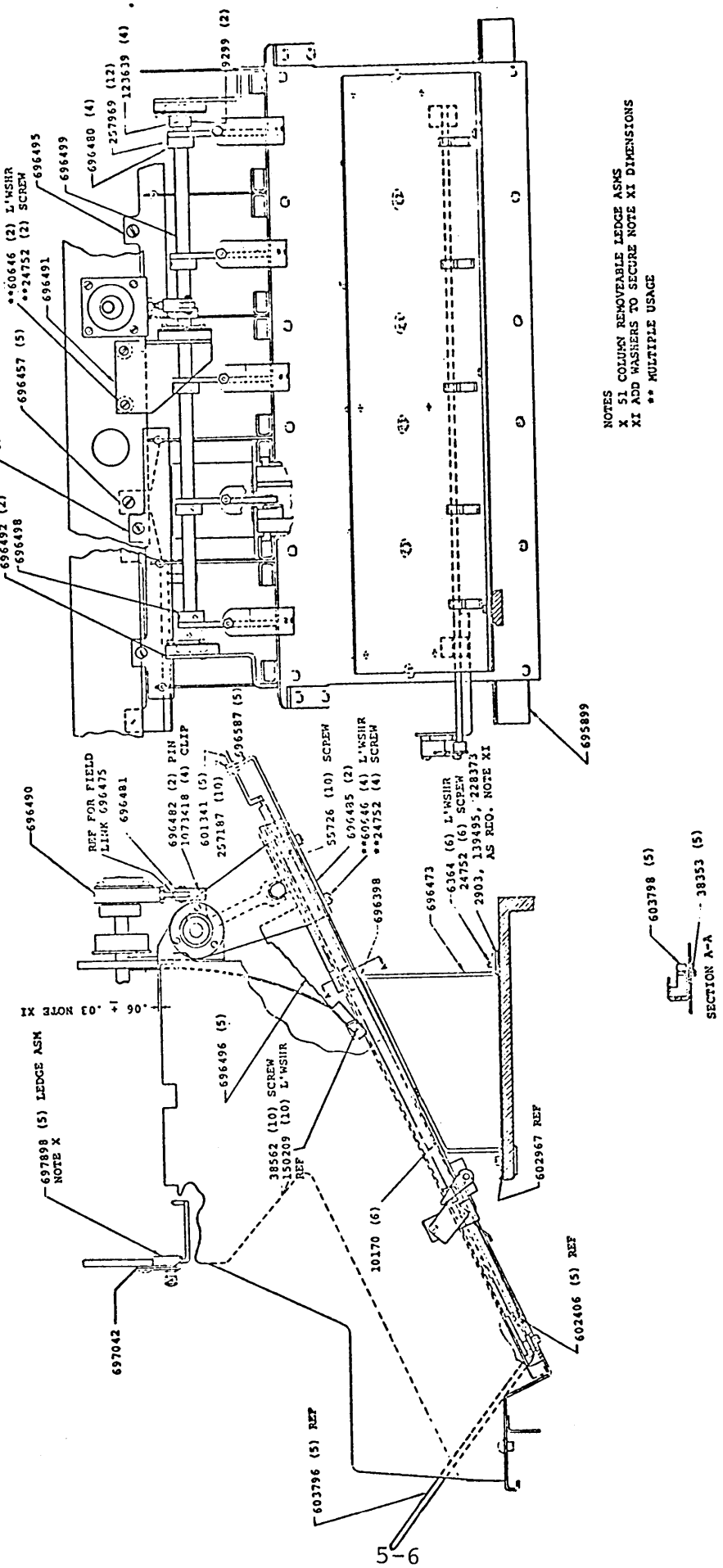
E. APERTURE CARD FEATURE





APERTURE FEED SECONDARY

F. 51 COLUMN STACKER AREA



*** 088 ***

B/M	DESCRIPTION	MACH W/D
603800	I-MARK DESENSITIZING, MOD 3 ONLY	603000*-G
603813	I-MARK DESENSITIZING, MOD 2 ONLY	603000*-G
603814	I-MARK DESENSITIZING, MOD 1 ONLY	603000*-H
605180	I-DESENSITIZING READ IN W/605153 FOR MACHS 602700*-A	602700*-B
605284	I-HANGER ASSM	603000-X
605284	I-HANGER ASSM	602700-X
622032	I-COUNT DEVICE 2 POS W/690284 OR 690794 & 690274 OR 691015	602700*-B
622037	R-COLL COUNT DEVICE 2 POS W/690270*-A	602700-X
622053	REIN-ALPHA COLL DEVICE 4, 8 OR 10 POS W/691055	603000*-H
622073	REIN-DIGIT SELECTOR 1 &/OR 2 W/690997*-A	603000-X
622078	REIN-ALPHA COLL DEVICE 4, 8 OR 10 POS W/690658	602700*-B
622081	REIN-RECODE SELS 6-10 &/OR 11-15 &/OR 16-20 W/690998	603000*-H
622091	REIN-COMPARING POS 11-16 &/OR 17-22 W/690977	603000*-H
622107	REIN-AUX CARD CTR 1 &/OR 2 W/690746	603000-X
622142	INA-MARK DESENSE W/603800, 603813, 603814	603000*-H
622152	INA-COLL POS 9 & 10, 5 TO 8 OR 5 TO 10 W/698234*-E	603000*-H
622152	INA-COLL POS 9 & 10, 5 TO 8 OR 5 TO 10 W/698233*-E	603000*-H
622153	CH-115V 60HZ 1PH TO 230V 50HZ 1PH W/603052	603000*-H
622582	CH-115V 50HZ 1PH TO 220V 50HZ 1PH W/603053	603000*-J
622622	CH-208/230V 50HZ 1PH TO 208/230V 60HZ 1PH W/603056	603000*-H
622691	REIN-MARK DESENSE, MOD 1 W/698228 & BRONZE CONT ROLLS	603000E
662582	THIS B/M PREREQ TO ALL VOLT B/MS FOR MACHS AFTER 9-1-71	
690271	I-RECODE SELECTORS 6-10 &/OR 11-15 &/OR 16-20	602700*-A
690272	I-AUX CD CTR 1 &/OR 2 W/690284 & 274 OR 698102 ON *-A MACH	602700*-B
690274	I-INNER RELAY GATE	602700*-B
690275	I-PLUG DPDT SWITCH 1 &/OR 2 W/O OPTIONAL COVERS	602700*-B
690276	I-CONTROL PANEL JUMP & FUSE 15 FOR OPT SPLITS	602700-X
690280	I-DIGIT SELECTOR NO 1 W/COLL COUNT DEVICE	602700*-B
690281	I-DIGIT SELECTOR NO 1 W/O COLL COUNT DEVICE	602700*-B
690282	I-DIGIT SELECTOR NO 2 W OR W/O COLL COUNT DEVICE	602700*-B
690284	I-ADDED CARD LEVER & CLUTCH REL PT CAP W/690274 OR 698102	602700*-A
690285	I-CONDENSER MTG PLATE	602700*-A
690286	I-SECONDARY FILE FD W/690725 JOGGLE PLATE	602700*-B
690286	I-SECONDARY FILE FD W/605284 HANGER ASSM	602700*-B
690287	I-CB UNIT LOWER SECONDARY	602700*-B
690287	I-CB UNIT LOWER SECONDARY	603000*-H
690288	CH-208/230V 60HZ 1PH TO 115V 60HZ 1PH	602700*-B
690288	CH-208/230V 60HZ 1PH TO 115V 60HZ 1PH	603000A-H
690292	CH-115V 60HZ 1PH TO 208V 60HZ 1PH W/690288, 603052, 602752	602700*-B

B/M	DESCRIPTION	MACH W/D
690292	CH-115V 60HZ 1PH TO 208V 60HZ 1PH W/690288, 603052, 602752	603000A-H
690292	CH-115V 60HZ 1PH TO 208V 60HZ 1PH W/602753, 602754	602700*-B
690292	CH-115V 60HZ 1PH TO 208V 60HZ 1PH W/602753, 602754	603000A-H
690293	CH-115V 60HZ 1PH TO 230V 60HZ 1PH W/603052, 602752, 690288	602700*-B
690293	CH-115V 60HZ 1PH TO 230V 60HZ 1PH W/603052, 602752, 690288	603000A-H
690294	CH-208V 60HZ 1PH TO 230V 60HZ 1PH	602700*-B
690294	CH-208V 60HZ 1PH TO 230V 60HZ 1PH	603000A-H
690295	CH-230V 60HZ 1PH TO 208V 60HZ 1PH	602700*-B
690295	CH-230V 60HZ 1PH TO 208V 60HZ 1PH	603000A-H
690474	INA-COMPARING POS 11-16 &/OR 17-22	602700*-B
690622	INA-COLL COUNT DEVICE 2 POS W/690270*-A	602700-X
690658	INA-ALPHA COLL DEVICE 4, 8 OR 10 POS W/698098	602700*-B
690691	INA-AUX CARD CTR 1 &/OR 2 W/690272 & 698086 OR 698087	602700-X
690698	R-DIGIT SEL 1 &/OR 2 W/690280* W OR W/O COLL COUNT DEV	602700-X
690725	I-JOGGLE PLATE W/690286 OR 690856 SEC FILE FEED	602700-X
690725	I-JOGGLE PLATE W/690286 OR 690856 SEC FILE FEED	603000-X
690734	INA-RECODE SEL 6-10 &/OR 11-15 &/OR 16-20 W/690271*-A	602700-X
690734	INA-RECODE SEL 6-10 &/OR 11-15 &/OR 16-20 W/690795*	602700-X
690746	I-ADDED CARD LEVER & CLUTCH REL PT CAP W/INNER RELAY GATE	603000*-H
690747	I-AUX CARD CTR 1 &/OR 2 W/ADDED CARD LEVER REL	603000*-H
690747	I-AUX CARD CTR 1 &/OR 2 W/CL REL RT 690746	603000*-H
690747	I-AUX CARD CTR 1 &/OR 2 W/INNER RELAY GATE 690749	603000*-H
690749	I-INNER RELAY GATE	603000*-H
690750	I-PLUG DPDT SWITCH 1 &/OR 2 W/O OPTIONAL COVERS	603000*-H
690751	I-RECODE SELS 6-10 &/OR 11-15 &/OR 16-20 W/690749 IN REL G	603000*-H
690752	I-MULTI SEL & SEQ SPLITS A2, A4, B2, B4, &/OR A5, A7, B5	603000*-H
690752	I-MULTI SEL & SEQ SPLITS B7 &/OR A8, A10, B8, B10	603000*-H
690776	R-PLUG DPDT SWITCH 1 &/OR 2 W/690275* OR 690750*-B	602700-X
690794	I-ADDED CARD LEVER & CLUTCH REL PT CAP W/690274 OR 698102	602700-B
690795	I-RECODE SELECTORS 6-10 &/OR 11-15 &/OR 16-20 W/690274	602700-B
690795	I-RECODE SELS 6-10 &/OR 11-15 &/OR 16-20 W/698102 INNER GA	602700-B
690796	I-MULTI SEL & SEQ SPLITS A2, A4, B2, B4, &/OR A5, A7, B5	602700-B
690796	I-MULTI SEL & SEQ SPLITS B7 &/OR A8, A10, B8, B10	602700-B
690822	I-DIGIT SELECTOR NO 1 &/OR 2 W OR W/O COLL COUNT DEVICE	603000*-H
690823	I-DIGIT SELECTOR NO 1 W/O COLL COUNT DEVICE	603000*-H
690824	I-DIGIT SELECTOR NO 2 W/690822*-B W OR W/O COLL COUNT DEV	603000*-H
690856	I-SECONDARY FILE FD W/690725 & 605284	603000*-H
690874	REIN-COMPARING POS 11-16 &/OR 17-22 W/690474	602700-X
690913	R-MULTI SEL & SEQ SPLITS A2, A4, B2, B4 &/OR A5, A7, B5	602700*-B

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B/M	DESCRIPTION	MACH W/D
690913	R-MULTI SEL & SEQ SPLITS B7 &/OR A8, A10 B8, B10	602700*-B
690946	I-MARK DESENSE ADDED SEL W/603800*-C	603000*-H
690955	R-SECONDARY FILE FD W/690286 OR 690856 OR 698101	602700-X
690955	R-SECONDARY FILE FD W/690286 OR 690856 OR 698101	603000-X
690956	REIN-COLL COUNT DEVICE 2 POS W/690622	602700-X
690976	INA-AUX CARD CTR 1 &/OR 2 W/690747	603000-X
690977	INA-COMPARING POS 11-16 &/OR 17-22	603000*-H
690997	INA-DIGIT SELECTOR 1 &/OR 2 W/690822*-B	603000-X
690998	INA-ADDL RECODE SELS 6-20 IN GRPS OF 5 W/690751, 698227	603000-X
690998	INA-ADDL RECODE SELS 6-20 IN GRPS OF 5 W/698226, 698228	603000-X
690999	R-MULTI SEL & SEQ SPLITS A2, A4, B2, B4 &/OR A5, A7, B5	603000-X
690999	R-MULTI SEL & SEQ SPLITS B7 &/OR A8, A10 B8, B10	603000-X
691015	I-INNER RELAY GATE, FOR MACHS PRIOR TO SN 12515	602700*-B
691055	INA-ALPHA COLL DEVICE 4, 8 OR 10 POS W/698232, 698233	603000*-H
691055	INA-ALPHA COLL DEVICE 4, 8 OR 10 POS W/698234, 698236	603000*-H
691055	INA-ALPHA COLL DEVICE 4, 8 OR 10 POS W/622053, 698262	603000*-H
691080	REIN-MULTI SEL & SEQ SPLITS A2, A4, B2, B4 &/OR A5, A7	602700*-B
691080	REIN-MULTI SEL & SEQ SPLITS B5, B7 &/OR A8, A10, B8, B10	602700*-B
691097	I-COUNT DEVICE 2 POS W/690287, 690746, 690749	603000*-H
691099	R-COLL COUNT DEVICE 2 POS W/690748*-B OR 691097*-A	603000-X
691104	I-COUNT DEVICE 2 POS W/690287, 690746 & 690749	603000*-H
698101	I-SECONDARY FILE FD CORR LIST FURNISH PROPER COVER GROUP	603000-E
5050878	CH-220V 50HZ TO 110V 50HZ W/5050569	
5050879	CH-115V 50HZ 1PH TO 208/230V 60HZ 1PH W/5050506	
5050880	CH-115V 60HZ 1PH TO 115V 50HZ 1PH W/5050494	
5050882	CH-208/230V 60HZ 1PH TO 220V 50HZ 1PH W/5050495	
5050886	CH-115V 50HZ 1PH TO 115V 60HZ 1PH W/5050506	
5050887	CH-208/230V 60HZ 1PH TO 115V 50 HZ 1PH W/5050495	
5050891	CH-220V 50HZ 1PH TO 115V 60HZ 1PH W/5050569 OR 5050507	

DESCRIPTION	B/M	MACH W/D
CH-115V 60HZ 1PH TO 208V 60HZ 1PH W/690288, 603052, 602752	690292	602700*-B
CH-115V 60HZ 1PH TO 208V 60HZ 1PH W/690288, 603052, 602752	690292	603000A-H
CH-115V 60HZ 1PH TO 208V 60HZ 1PH W/602753, 602754	690292	602700*-B
CH-115V 60HZ 1PH TO 208V 60HZ 1PH W/602753, 602754	690292	603000A-H
CH-115V 60HZ 1PH TO 230V 60HZ 1PH W/603052, 602752, 690288	690293	602700*-H
CH-115V 60HZ 1PH TO 230V 60HZ 1PH W/603052, 602752, 690288	690293	603000A-H
CH-115V 60HZ 1PH TO 230V 50HZ 1PH W/603052	622153	603000*-H
CH-115V 50HZ 1PH TO 220V 50HZ 1PH W/603053	622582	603000*-J
CH-115V 50HZ 1PH TO 208/230V 60HZ 1PH W/5050506	5050879	
CH-115V 60HZ 1PH TO 115V 50HZ 1PH W/5050494	5050880	
CH-115V 50HZ 1PH TO 115V 60HZ 1PH W/5050506	5050886	
CH-208/230V 60HZ 1PH TO 115V 60HZ 1PH	690288	602700*-B
CH-208/230V 60HZ 1PH TO 115V 60HZ 1PH	690288	603000A-H
CH-208/230V 60HZ 1PH TO 220V 50HZ 1PH W/5050495	5050882	
CH-208/230V 60HZ 1PH TO 115V 50 HZ 1PH W/5050495	5050887	
CH-208V 60HZ 1PH TO 230V 60HZ 1PH	690294	602700*-B
CH-208V 60HZ 1PH TO 230V 60HZ 1PH	690294	603000A-H
CH-208/230V 50HZ 1PH TO 208/230V 60HZ 1PH W/603056	622622	603000*-H
CH-220V 50HZ TO 110V 50HZ W/5050569	5050878	
CH-220V 50HZ 1PH TO 115V 60HZ 1PH W/5050569 OR 5050507	5050891	
CH-230V 60HZ 1PH TO 208V 60HZ 1PH	690295	602700*-B
CH-230V 60HZ 1PH TO 208V 60HZ 1PH	690295	603000A-H
I-ADDED CARD LEVER & CLUTCH REL PT CAP W/690274 OR 698102	690284	602700*-A
I-ADDED CARD LEVER & CLUTCH REL PT CAP W/690274 OR 698102	690794	602700-B
I-ADDED CARD LEVER & CLUTCH REL PT CAP W/INNER RELAY GATE	690746	603000*-H
I-AUX CARD CTR 1 &/OR 2 W/ADDED CARD LEVER REL	690747	603000*-H
I-AUX CARD CTR 1 &/OR 2 W/CL REL RT 690746	690747	603000*-H
I-AUX CARD CTR 1 &/OR 2 W/INNER RELAY GATE 690749	690747	603000*-H
I-AUX CD CTR 1 &/OR 2 W/690284 & 274 OR 698102 ON *-A MACH	690272	602700*-B
I-CB UNIT LOWER SECONDARY	690287	602700*-B
I-CB UNIT LOWER SECONDARY	690287	603000*-H
I-CONDENSER MTG PLATE	690285	602700*-A
I-CONTROL PANEL JUMP & FUSE 15 FOR OPT SPLITS	690276	602700-X
I-COUNT DEVICE 2 POS W/690287, 690746, 690749	691097	603000*-H
I-COUNT DEVICE 2 POS W/690287, 690746 & 690749	691104	603000*-H
I-COUNT DEVICE 2 POS W/690284 OR 690794 & 690274 OR 691015	622032	602700*-B
I-DESENSITIZING READ IN W/605153 FOR MACHS 602700*-A	605180	602700*-B
I-DIGIT SELECTOR NO 1 W/COLL COUNT DEVICE	690280	602700*-B
I-DIGIT SELECTOR NO 1 W/O COLL COUNT DEVICE	690281	602700*-B

DESCRIPTION	B/M	MACH W/D
I-DIGIT SELECTOR NO 2 W OR W/O COLL COUNT DEVICE	690282	602700*-B
I-DIGIT SELECTOR NO 1 &/OR 2 W OR W/O COLL COUNT DEVICE	690822	603000*-H
I-DIGIT SELECTOR NO 1 W/O COLL COUNT DEVICE	690823	603000*-H
I-DIGIT SELECTOR NO 2 W/690822*-B W OR W/O COLL COUNT DEV	690824	603000*-H
I-HANGER ASSM	605284	603000-X
I-HANGER ASSM	605284	602700-X
I-INNER RELAY GATE, FOR MACHS PRIOR TO SN 12515	691015	602700*-B
I-INNER RELAY GATE	690274	602700*-B
I-INNER RELAY GATE	690749	603000*-H
I-JOGGLE PLATE W/690286 OR 690856 SEC FILE FEED	690725	602700-X
I-JOGGLE PLATE W/690286 OR 690856 SEC FILE FEED	690725	603000-X
I-MARK DESENSITIZING, MOD 3 ONLY	603800	603000*-G
I-MARK DESENSITIZING, MOD 2 ONLY	603813	603000*-G
I-MARK DESENSITIZING, MOD 1 ONLY	603814	603000*-H
I-MARK DESENSE ADDED SEL W/603800*-C	690946	603000*-H
I-MULTI SEL & SEQ SPLITS A2, A4, B2, B4, &/OR A5, A7, B5	690796	602700-B
I-MULTI SEL & SEQ SPLITS B7 &/OR A8, A10, B8, B10	690796	602700-B
I-MULTI SEL & SEQ SPLITS A2, A4, B2, B4, &/OR A5, A7, B5	690752	603000*-H
I-MULTI SEL & SEQ SPLITS B7 &/OR A8, A10, B8, B10	690752	603000*-H
I-PLUG DPDT SWITCH 1 &/OR 2 W/O OPTIONAL COVERS	690275	602700*-B
I-PLUG DPDT SWITCH 1 &/OR 2 W/O OPTIONAL COVERS	690750	603000*-H
I-RECODE SELECTORS 6-10 &/OR 11-15 &/OR 16-20	690271	602700*-A
I-RECODE SELECTORS 6-10 &/OR 11-15 &/OR 16-20 W/690274	690795	602700-B
I-RECODE SELS 6-10 &/OR 11-15 &/OR 16-20 W/698102 INNER GA	690795	602700-B
I-RECODE SELS 6-10 &/OR 11-15 &/OR 16-20 W/690749 IN REL G	690751	603000*-H
I-SECONDARY FILE FD CORR LIST FURNISH PROPER COVER GROUP	698101	603000-E
I-SECONDARY FILE FD W/690725 JOGGLE PLATE	690286	602700*-B
I-SECONDARY FILE FD W/605284 HANGER ASSM	690286	602700*-B
I-SECONDARY FILE FD W/690725 & 605284	690856	603000*-H
INA-ADDL RECODE SELS 6-20 IN GRPS OF 5 W/690751, 698227	690998	603000-X
INA-ADDL RECODE SELS 6-20 IN GRPS OF 5 W/698226, 698228	690998	603000-X
INA-ALPHA COLL DEVICE 4, 8 OR 10 POS W/698232, 698233	691055	603000*-H
INA-ALPHA COLL DEVICE 4, 8 OR 10 POS W/698234, 698236	691055	603000*-H
INA-ALPHA COLL DEVICE 4, 8 OR 10 POS W/622053, 698262	691055	603000*-H
INA-ALPHA COLL DEVICE 4, 8 OR 10 POS W/698098	690658	602700*-B
INA-AUX CARD CTR 1 &/OR 2 W/690747	690976	603000-X
INA-AUX CARD CTR 1 &/OR 2 W/690272 & 698086 OR 698087	690691	602700-X
INA-COLL POS 9 & 10, 5 TO 8 OR 5 TO 10 W/698234*-E	622152	603000*-H
INA-COLL POS 9 & 10, 5 TO 8 OR 5 TO 10 W/698233*-E	622152	603000*-H

DESCRIPTION	B/M	MACH W/D
INA-COLL COUNT DEVICE 2 POS W/690270*-A	690622	602700-X
INA-COMPARING POS 11-16 &/OR 17-22	690474	602700*-B
INA-COMPARING POS 11-16 &/OR 17-22	690977	603000*-H
INA-DIGIT SELECTOR 1 &/OR 2 W/690822*-B	690997	603000-X
INA-MARK DESENSE W/603800, 603813, 603814	622142	603000*-H
INA-RECODE SEL 6-10 &/OR 11-15 &/OR 16-20 W/690271*-A	690734	602700-X
INA-RECODE SEL 6-10 &/OR 11-15 &/OR 16-20 W/690795*	690734	602700-X
REIN-ALPHA COLL DEVICE 4, 8 OR 10 POS W/691055	622053	603000*-H
REIN-ALPHA COLL DEVICE 4, 8 OR 10 POS W/690658	622078	602700*-B
REIN-AUX CARD CTR 1 &/OR 2 W/690746	622107	603000-X
REIN-COLL COUNT DEVICE 2 POS W/690622	690956	602700-X
REIN-COMPARING POS 11-16 &/OR 17-22 W/690474	690874	602700-X
REIN-COMPARING POS 11-16 &/OR 17-22 W/690977	622091	603000*-H
REIN-DIGIT SELECTOR 1 &/OR 2 W/690997*-A	622073	603000-X
REIN-MARK DESENSE, MOD 1 W/698228 & BRONZE CONT ROLLS	622691	603000E
REIN-MULTI SEL & SEQ SPLITS A2, A4, B2, B4 &/OR A5, A7	691080	602700*-B
REIN-MULTI SEL & SEQ SPLITS B5, B7 &/OR A8, A10, B8, B10	691080	602700*-B
REIN-RECODE SELS 6-10 &/OR 11-15 &/OR 16-20 W/690998	622081	603000*-H
R-COLL COUNT DEVICE 2 POS W/690748*-B OR 691097*-A	691099	603000-X
R-COLL COUNT DEVICE 2 POS W/690270*-A	622037	602700-X
R-DIGIT SEL 1 &/OR 2 W/690280* W OR W/O COLL COUNT DEV	690698	602700-X
R-MULTI SEL & SEQ SPLITS A2, A4, B2, B4 &/OR A5, A7, B5	690999	603000-X
R-MULTI SEL & SEQ SPLITS B7 &/OR A8, A10 B8, B10	690999	603000-X
R-MULTI SEL & SEQ SPLITS A2, A4, B2, B4 &/OR A5, A7, B5	690913	602700*-B
R-MULTI SEL & SEQ SPLITS B7 &/OR A8, A10 B8, B10	690913	602700*-B
R-PLUG DPDT SWITCH 1 &/OR 2 W/690275* OR 690750*-B	690776	602700-X
R-SECONDARY FILE FD W/690286 OR 690856 OR 698101	690955	602700-X
R-SECONDARY FILE FD W/690286 OR 690856 OR 698101	690955	603000-X
THIS B/M PREREQ TO ALL VOLT B/MS FOR MACHS AFTER 9-1-71	662582	

SECTION 7

P. M. ROUTINES

The recommended frequencies shown have been established through studies and tests and represent an average condition.

Individual application or usage may require modification of the frequency in order to achieve optimum preventive maintenance.

Code U R	Location/Operation	Frequency
0	Blowers/Filters	4 Mo.
1	Feeds	4 Mo.
3	CBs CR, Pri, Sec	4 Mo.
5	Drive	4 Mo.
8	Elect. Chassis/Line Cord	12 Mo.

CODE	UNIT	FREQ. MOS.	LUBRICATE/CLEAN	OBSERVE
1	Primary and Secondary Feeds	4	IBM 23 Gears, mechanical cams, and extension spring pivots. IBM 6: Ball-bearing hanger pivots, hopper contact and card lever pivots, picker knife stud.	Condition of belts Brushes for wear, damage, and alignment. Brush timing.
1	File Feed	4	IBM 23: Drive clutch spring (grease fitting). IBM 23: Gears, cams, upper magazine latch slot, drive clutch operating lever, side joggler leaf spring, joggler adjusting screw heads and spring ends. IBM 6: Upper magazine shaft pivots, drive clutch detent shaft pivot, joggler cam follower hubs, joggler pivots, drive belt idler pulley hub. Contact lever pivots.	Feed rolls for glaze. Condition of belts. Clutch overthrow.
1	Clutches	4	IBM 23: Reverse lock. IBM 23: Clutch grease fitting, gears, latch and keeper surfaces. IBM 9: Intermediate arm pivot. IBM 6: Keeper, latch and armature pivots, dog & detent pivots.	Check for loose drive dog pivot stud and excessive play between clutch pulley and clutch drive arm.

CODE	UNIT	FREQ. MOS.	LUBRICATE/CLEAN	OBSERVE
1	Transport & Stackers	4	IBM 23: Nylon cams and follower bearings. IBM 6: Jam bar contact operating lever pivot, selector magnet armature pivots.	Jam bar for binds and correct operation. Pusher and card support slide free of binds. Card restraining and retaining lever free and clean.
3	CB's-CR Primary-Secondary	4		Contact condition. Check for loose stack screws and proper air gap. Check timing of cams connected to CE aid panel.
7	Duo Relays	As Required	IBM 6: Armature pivots.	Dirt behind armature. Check stack screws. Contact rise.
0	Blowers Filters	4		Replace filter as necessary. Do not clean filters.
5	Motors	4	IBM 9: Motors	Condition of belts.
1	Machines equipped with 51 column device.	4	IBM 23: Upper ledge stud, 51 column radial guide detent spring and slide.	51 column select magnet assembly for wear.
8	Tubes, Relays and Auxiliary Electrical Components ——————— Line Cord	12	Check oscilloscope patterns against those in IBM 388 Service Index. Make certain that dummy fuse is removed before test and replaced after test. If not replaced, intermittent trouble will result.	

APPENDIX A

Metric Conversion

Feeler Gauge Conversion:

1.000"	=	25.4	mm	.010"	=	.2540	mm
.100"	=	2.54	mm	.0105"	=	.2667	mm
.010"	=	.254	mm	.011"	=	.2794	mm
.001"	=	.0254	mm	.012"	=	.3048	mm
.002"	=	.0508	mm	.014"	=	.3556	mm
.003"	=	.0762	mm	.015"	=	.3810	mm
.004"	=	.1016	mm	.018"	=	.4572	mm
.005"	=	.1270	mm	.020"	=	.5080	mm
.006"	=	.1524	mm	.021"	=	.5334	mm
.007"	=	.1778	mm	.023"	=	.5824	mm
.008"	=	.2413	mm	.025"	=	.6350	mm
.009"	=	.2286	mm	.030"	=	.7620	mm
.0095"	=	.2413	mm				

SECTION 8

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