

IBM Customer Engineering

SERVICE INDEX

83

Sorter

Machine Serial

FORWARD

IBM 083 SERVICE INDEX

The 083 Service Index was prepared from an analysis of 5000 IR's by grouping the failing parts within the reported symptom. The causes for particular failures are listed according to frequency of failure, and ease of checking.

The Index was designed primarily for use on the Standard Numeric 083. The conditions for the diagnostic charts are; Sort Select switch set on 'N', all digit suppress switches normal, and sorting cards with only one punch per column, (12 through 9).

Service hints have been included to provide additional information which will aid the Customer Engineer in correcting machine failures. They contain such information as:

1. Trouble analysis techniques.
2. Methods of detecting a failure.
3. Methods of correcting a failure.
4. Methods of increasing failure frequency.
5. Temporary additional test circuits for aid in locating a failure.

Special Features have been covered as thoroughly as possible, but due to the low percentage of machines with special features installed and the infrequency of failures experienced on them, some conditions may not be found in the Index which might be experienced in the field. In such cases, the Special Feature information in the machine itself must be used to locate the failure.

HOW TO USE A SERVICE INDEX

1. Determine symptom. (Observe machine in operation. Get as much information as possible from the operator.)
2. Locate symptom in the Index.
3. Follow the diagnostic chart on the symptom page.
4. Be sure to check the Service Hints for aid in unusual or infrequent failures.
5. Always use the diagnostic charts starting at the top and proceeding toward the bottom. Never attempt to go toward the top of the page.

The following symbols are used throughout the Index.

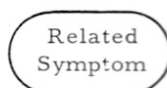
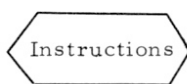
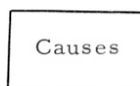


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GENERAL INFORMATION

MISSORTING means punched cards selected into the wrong stacker pocket.

REJECTING means punched cards going into the Reject stacker pocket.

Missorting due to crooked feeding, brush tracking, or multi-punched columns, can show up as "EDIT STOPS" with the EDIT STOP SWITCH on.

Troubles may occur on machines with special features installed due to the added wiring and components. Some features are covered in the Service Index and many useful hints can be found on the appropriate pages. Try to make machine fail on normal numeric sorting, and use the appropriate symptom page in the service index. If failures occur, only while special features are in use, the appropriate wiring diagrams and reference information must be used for trouble analysis.

GENERAL SERVICE HINTS

S. H. #1. Failures can often be made more frequent by varying the voltages in the circuit. This can be done most easily by moving the wires on the Power Supply Terminal Strip, which will vary the output voltages from the transformer, thereby varying all the voltages in the machine.

S.H. #2. A cable clamp is now available for installation on the cable to the key unit. This will prevent breakage of wires when the key unit is removed for access to the motor area. (CEM 082-104)

S.H. #3. Loose set screws on the CB cams can cause a variety of intermittent and solid failures by operating the CB's extraneously. Be sure that these set screws are tight.

S.H. #4. Lace deck of about 200 cards with punches 9 through 12, columns 10 and 70. Put 2 punch in column 40. Check sort brush timing at both ends of card. Run cards. Laced columns should appear as straight lines. Wavering lines indicate crooked feeding, possibly missorting and rejecting. Watch Sort Control relays. These should pick and drop every cycle, testing coding CB's, tubes, and relays dynamically. Intermittent failures to pick relays can be spotted easily this way.

S.H. #5. If failures occur with Sort Selection switch at setting, other than "N": check operation on "N" setting first. If failures occur, turn to appropriate page of index. If no failures occur, turn Sort Selection switch to failing position and analyze. The only change caused by turning this switch is to alter the routing of the CB-13 impulse to various sort magnets. Probable causes for trouble here:

1. Faulty Sort Selection switch contacts.
2. Faulty points on relay 10, 11, or 12, which might not be used when switch is set at "N".

GENERAL FEED SERVICE HINTS

S. H. #6. In the 083 Sorter, a large percentage of failures can be attributed to the sort brush, index head (column indicator), and the feed. Following is a list of items in these areas which can be quickly checked in the case of intermittent failures or in the course of a machine inspection.

Sort Brush:

1. Timing. (Use gauge on machine. Turn Sort/Test switch to Test, brush just starts to read 9 hole and edit bulb lights at zero degrees.)
2. Tracking: (Check sort brush holder thumb screw and hopper side plates. Check for excessive lateral movement caused by excessive opening in brush holder extensions. Form, if necessary, to reduce gap.)
3. Check for wear, inadequate tension, and bent strands.

Throat:

1. Adjustment. (.0095" to .010" clearance to roller.)
2. Nicked throat knife. (Stone smooth)
3. Binding throat rollers.
4. Throat roller touching first lower feed roll shaft. (Shift support bar to give .010" clearance between roller and shaft. Re-adjust throat knife)

Index Head Assembly: (Column Indicator)

1. Pressure springs at ends of screw shaft broken.
2. End play in Index Head assembly.
3. End play in brush holder assembly.
4. Dirt buildup on common contact bar assembly.
5. Contact plunger on brush holder not making proper contact, or binding.
6. Warped Column Index Shaft.

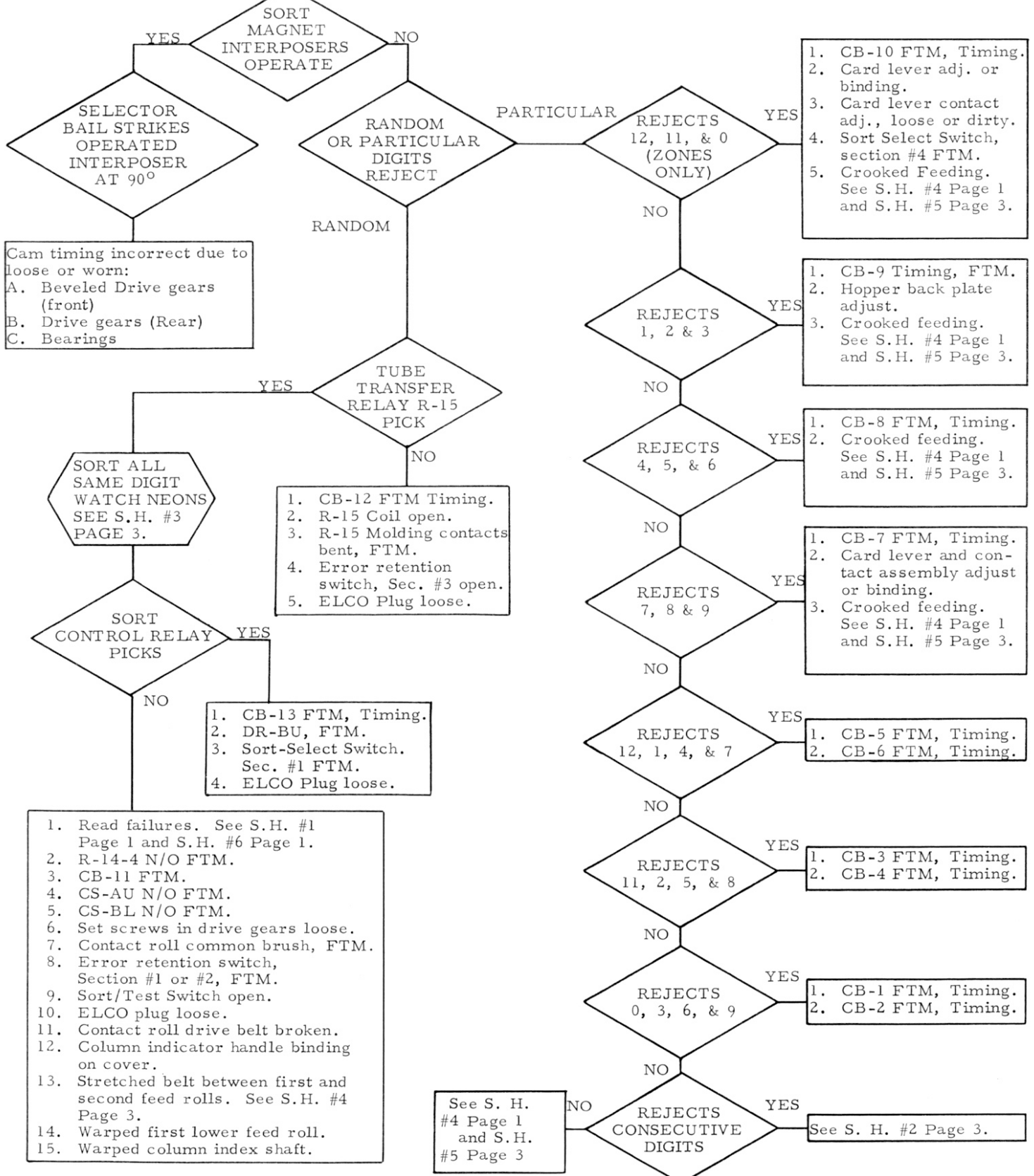
Feed Knives:

1. Loose.
2. Failing to travel .015" to .020" behind the face of the hopper posts.
3. Timing incorrect. (Card must enter first feed rolls at 216°. Reference: Timing chart on W.D. and/or CEM #082-11)
4. Cam followers must have a .002" to .005" clearance over the entire cam periphery. Cam follower rollers should be able to be turned by light finger pressure. However, greater than .005" clearance, will cause excessive wear. Check clearance by inserting a .002" feeler gauge between cam and cam follower roller. Turn machine by hand. Feeler gauge must be snug over the entire cam periphery.

REJECTING RANDOM OR PARTICULAR DIGITS

SET SORT-SELECT SWITCH ON 'N' AND CHECK SORT BRUSH FOR TRACKING, TIMING, LOOSENESS, AND WEAR
SEE S.H. #1 PAGE 1 AND S.H. #6 PAGE 1.

FOR INTERMITTENT REJECTING SEE
S.H. #1 PAGE 3 AND S.H. #3 PAGE 4.



SERVICE HINTS FOR REJECTING RANDOM DIGITS

S.H. #1. Temporary Reject Detection Circuit

Insert jumper wire from Relay, 12-4 N/C to Error Relay 16 1 coil. Turn Edit Stop switch off. Run cards and sort on column containing numeric punches, and no blanks or zones.

If the sort control relay fails to pick, Relay 16 will pick and card will reject with Edit Light on. This will normally indicate a read failure. However, any failure to pick or hold Storage Relays will give this indication. If the card rejects, but the Edit Light does not light, it is an indication that the card read properly and Storage Relay did pick. This indicates that a Storage Relay point failed to make or that a mechanical failure occurred.

Failures can often be made more frequent by varying the voltages in the circuit. This can be done most easily by moving the wires on the Power Supply Terminal Strip, which will vary the input voltage to the transformer, thereby varying all the voltages in the machine.

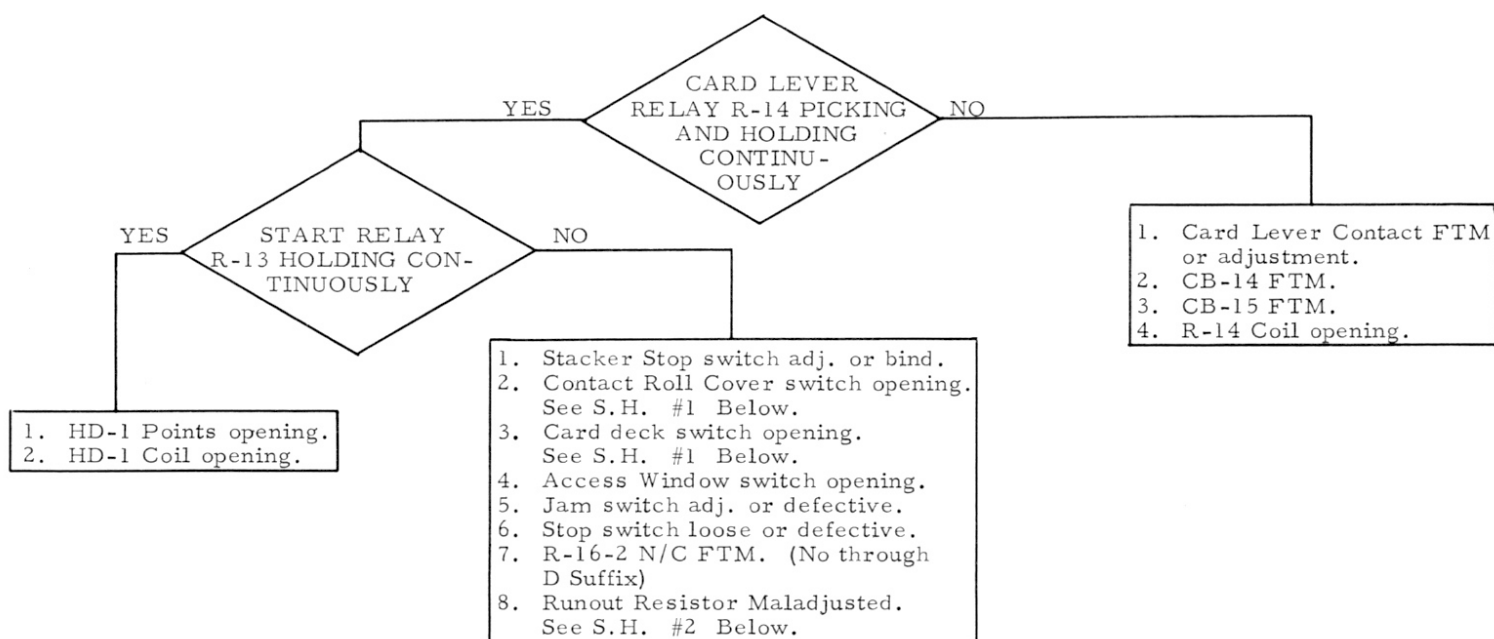
S.H. #2. If #2 N/C points or #4 N/C points of Sort Control relays fail to make, rejecting of lower digits will result. For example: If R-4-2 N/C or R-4-4 N/C fail to make, 3, 2, 1, 0 will reject. If #3 N/C points of sort control relays fail to make, rejecting of higher digits will result. For example: If R-5-3 N/C fails to make, 9, 8, 7, 6 will reject.

S.H. #3. Machines with Printed Circuit chassis have neon lights which glow for the duration of tube conduction. Watching these lights can help detect tube failures. Insure that the 105 volt supply is available to operate neon lights correctly.

S.H. #4. Intermittent rejecting can be caused by a stretched cog belt between first and second feed rolls. This is a result of broken wires inside the belt. A new style timing belt is available with nylon tension members rather than steel. It is identified by white strips visible on the edges of the belt.

S.H. #5. Intermittent rejecting can be caused by flat areas or nicks worn into first upper cork feed rolls because of jams at the first feed roll position. If this occurs, both the first upper and first lower shafts should be replaced by the former style gear driven steel feed roll shafts. For additional information and part numbers, see CEM-082-16.

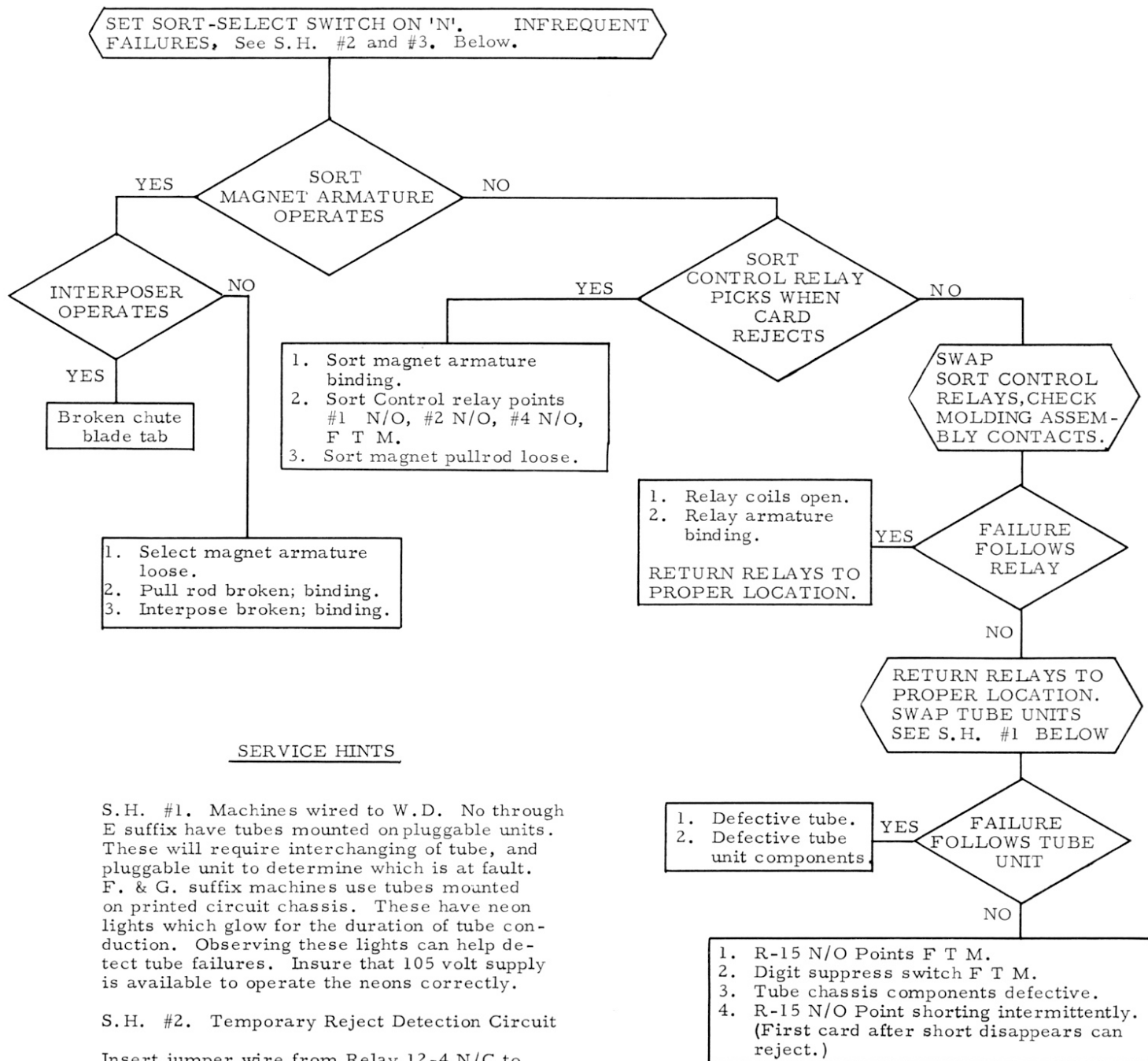
STOPPING



S.H. #1. Loose or maladjusted card deck or contact roll cover can cause stopping when cards are being jogged. Their respective switches may be properly adjusted, but the cover may cause them to open.

S.H. #2. Adjust the run out time for one-half to one second after the last 9 card drops into the 9 pocket. The Run-Out Resistor is located directly behind the power supply terminal strip.

REJECTING ONE DIGIT



SERVICE HINTS

S.H. #1. Machines wired to W.D. No through E suffix have tubes mounted on pluggable units. These will require interchanging of tube, and pluggable unit to determine which is at fault. F. & G. suffix machines use tubes mounted on printed circuit chassis. These have neon lights which glow for the duration of tube conduction. Observing these lights can help detect tube failures. Insure that 105 volt supply is available to operate the neons correctly.

S.H. #2. Temporary Reject Detection Circuit

Insert jumper wire from Relay 12-4 N/C to Error Relay 16 P1 coil. Turn Edit Stop switch off. Run cards and sort on column containing numeric punches and no blanks or zones.

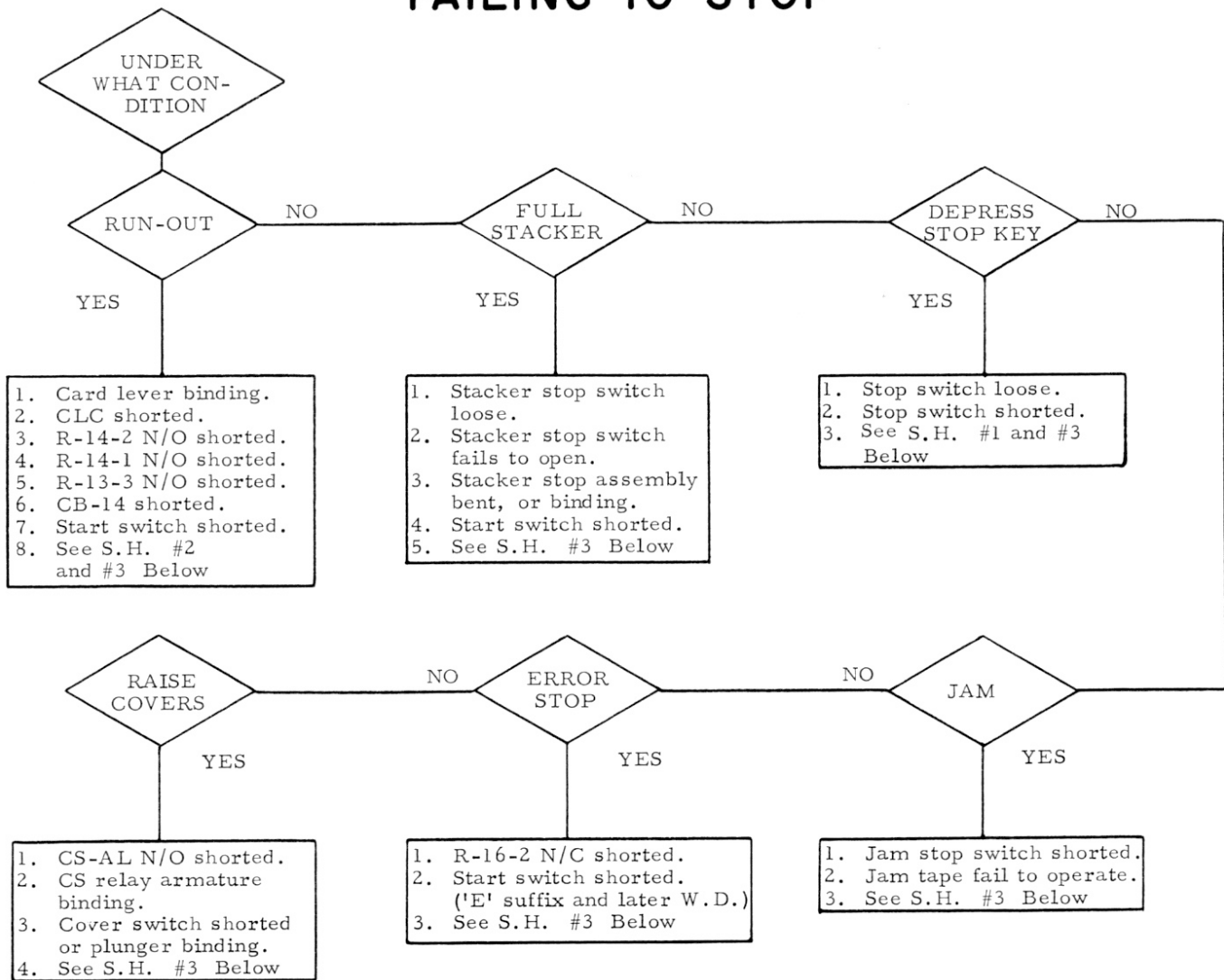
If the sort control relay fails to pick, Relay 16 will pick and card will reject with Edit Light on. This will normally indicate a read failure. However, any failure to pick or hold Storage Relays will give this indication. If the card rejects, but the Edit Light does not light it is an indication that the card read properly and Storage Relay did pick. This indicates that a Storage Relay point failed to make or that a mechanical failure occurred.

Failures can often be made more frequent by varying the voltages in the circuit. This can be done most easily by moving the wires on the Power Supply Terminal Strip, which will vary the input voltage to the transformer, thereby varying all the voltages in the machine.

S. H. #3. Intermittent Rejecting-Known Causes:

1. Card lever timing adjustments.
2. Sort brush tension.
3. Sort brush wear.
4. Crooked feeding resulting from worn cork feed rolls. See S.H. #5 Page 3
5. Hopper back plate fingers too far above card line.
6. Throat roller rubbing on first lower feed roll. Shift support bar to give .010" clearance between roller and feed roll. Re-adjust throat knife.
7. Stretched belt between first and second feed rolls, resulting from broken wires inside belt. (A new style timing belt is available with nylon tension members rather than steel. It is identified by white strips visible on the edges of the belt.)
8. Failures in the Power Supply.

FAILING TO STOP



SERVICE HINTS

S.H. #1. Stopping, but restarting when the stop key is released can be caused by a shorted start switch or, if cards are in the machine, by shorted R-13-1 N/O points.

S.H. #2. If machine fails to stop immediately upon running out, adjust Run-Out resistor directly behind Power Supply Terminal Strip. Adjust to stop machine one half to one second after the last nine punched card is in the stacker.

S.H. #3. A. The following causes apply to all "Fail to Stop" conditions:

1. R-13-2 N/O shorted.
2. R-13 armature binding.
3. HD-1 points shorted.
4. HD-1 armature binding.

B. The following will cause machine to coast to a stop instead of stopping immediately:

1. R-13-2 N/C fail to make.
2. HD-2 points fail to make.
3. HD-2 coil open.

MISSORTING MACHINES WITH ERROR RETENTION

SET SORT SELECT SWITCH ON "N"
CHECK SORT BRUSH FOR TRACKING, TIMING, LOOSE-
NESS AND WEAR. FOR INFREQUENT FAILURES SEE
S.H. #1, #4, AND #6 PAGE 1

TURN EDIT STOP SWITCH ON

FALSE EDIT LIGHTS

CHECK SORT
BRUSH FOR
TRACKING, TIM-
ING, LOOSENESS
WEAR, ETC.

TURN ON ERROR RETENTION SWITCH
SEE S.H. #1 PAGE 7
IF NO ERROR RETENTION SEE PAGE 8

RUN AGAIN. WHEN MACHINE STOPS WITH
EDIT LIGHT ON. SEE WHICH SORT CON-
TROL RELAYS REMAIN ENERGIZED.

TWO OR MORE
S.C. RELAYS
UP

Shorted Sort Control
Relay #2 or #3 points
See S.H. #3 Page 7.

ONE OF THESE RELAYS SHOULD BE UP.
EXAMINE THE FIRST CARD REJECTED TO
DETERMINE WHICH ONE. OTHER IS ERROR.
SWAP THIS RELAY WITH ANOTHER. CHECK
MOLDING ASSEMBLY CONTACTS.

FAILURE
FOLLOW
RELAY

YES

1. Sort control relay
points (#1 points)
shorted.
2. Relay armature
binding.

RETURN RELAYS TO
PROPER LOCATION

NO

RETURN RELAYS TO
PROPER LOCATION
SWAP TUBE IN
ERRONEOUS POSITION
WITH ANOTHER.

FAILURE
FOLLOW
TUBE

YES

Defective or
weak tube

NO

CHECK EDIT
LIGHT BULB
FOR OPEN

ALL MISSORTED
CARDS GO INTO
ONE POCKET

NO

YES

1. Chute blades sticking together.
2. Various select magnet arma-
tures dirty or binding.
3. Interposer pull rods dirty
or binding.
4. Feed knife timing.
5. Run out resistor adj.
See S.H. #6 Page 7.
6. Selector pin striking chute
blade tab too close to next
higher tab.
7. See S.H. #5 and #7 Page 7.

1. Sort control relay points.
(#4 N/O) shorted.
2. Binding select magnet arma-
ture.
3. Bent interposer pull rods.
4. Broken interposer pawl spring.
5. Interposer fails to restore
from previous card cycle.

NO

1. CB-11 shorted.
2. Coding CB shorted.
3. Coding CB timing.
4. Burned bias resistor
See S.H. #4 Page 7.
5. Digit suppress switches
shorted.
6. Tube chassis com-
ponents.
7. Recheck sort brush
for tracking and timing.

SERVICE HINTS

Missorting On Machines With Error Retention

S.H. #1. Error Retention switch on allows the two or more Sort Control Relays which set up the Edit Stop condition to remain energized. The CE can then determine what conditions are causing these results. The error card and all following cards will be rejected. Due to the fact that the Sort Control relays, in picking, extinguish the tube immediately, any neon lights that might be on now are from cards following the error cards, hence cannot be used here for analysis.

Standard Numeric 083's wired to W/D 336001 F and G suffix, with 978 Card Counters attached, may have a wiring error which prevents Error Retention from functioning. Check the following and refer to CEM-082-62.

1. The taped wire must be re-installed from A-2 to switch S-3 Common.
2. Remove lead from R-51-AL O/P to A-2.
3. Install jumper from R-51-AL O/P to R-16-5 O/P.

S.H. #2. With Edit switch on, error card rejects. With Edit Stop switch on, error card rejects and the machine stops, regardless of setting of Edit switch. Error card is any card which causes two or more Sort Control relays to pick.

S.H. #3. In this case, edit lights were false. Shorted points might not cause failures if customer does not use Edit or Edit Stop switches. In analyzing this missorting failure, false edit lights have appeared. Continue analysis of missorting failure.

S.H. #4. CEM 082-41, Burning Resistors. "A 15K, 2W Resistor, P/N 317098, is available to replace overloaded bias resistors which are susceptible to burning. All four 15K, 1/2W resistors must be replaced as soon as possible." Applies to all 083's between approximately HY and B1 suffix machines wired to F & G suffix W/D's.

S.H. #5. Intermittent missorting may be caused by flat areas or nicks worn into the first upper cork feed rolls because of jams at the first feed roll position. If this occurs, both the first upper and lower shafts should be replaced by the former style gear driven steel feed roll shafts. For further information and part numbers, refer to CEM-082-16.

S.H. #6. A maladjusted run out resistor will allow cards to remain in the transport at the end of a run. Quite often these cards are overlooked by the operator. When the next column is sorted, these cards stack and appear to have missorted. This condition will always show up as a "missorting" of the first few cards in the pocket.

S.H. #7. Intermittent missorting can be caused by a stretched cog belt between first and second feed rolls. This is a result of broken wires inside belt. A new style timing belt is available with nylon tension members rather than steel. It is identified by white strips visible on the edges of the belt.

DRIVE MOTOR SERVICE HINTS

S.H. #1. Drive Motor Fails To Start. The drive motor will vibrate & usually blow Fuse #3, but will not start if:

- A. The internal start switch (centrifugal switch) or the external start switch (start relay) is open.
- B. The start capacitor is open or shorted.
- C. Either the start winding or the run winding is open or shorted.

S.H. #2. Internal Start Switch Check; (Centrifugal Switch)
Main line switch off. Meter on "R" scale. Meter leads on HD-2 points. Meter must read zero ohms continuously. If resistance is indicated, the switch is open. If switch trouble is suspected, check the contact points first, then the switch operating collar. The slightest wear or bind in the collar can cause malfunctioning of the switch.

S.H. #3. External Start Switch Check; (Start Relay.)
Main line switch off. Meter on "R" scale. Meter leads on start relay terminals 3 and 4. If there is no deflection, start relay coil is open. If trouble with the switch is suspected, it can be removed from the machine for cleaning of the points and inspection of the coil

S.H. #4. Start Capacitor Check; (Machines with Centrifugal Switch.)
Disconnect start capacitor. Using highest resistance scale of meter, check for momentary meter deflection. Reverse meter leads and check again. Both readings should be the same. Continuous deflection or no deflection indicates a defective capacitor.

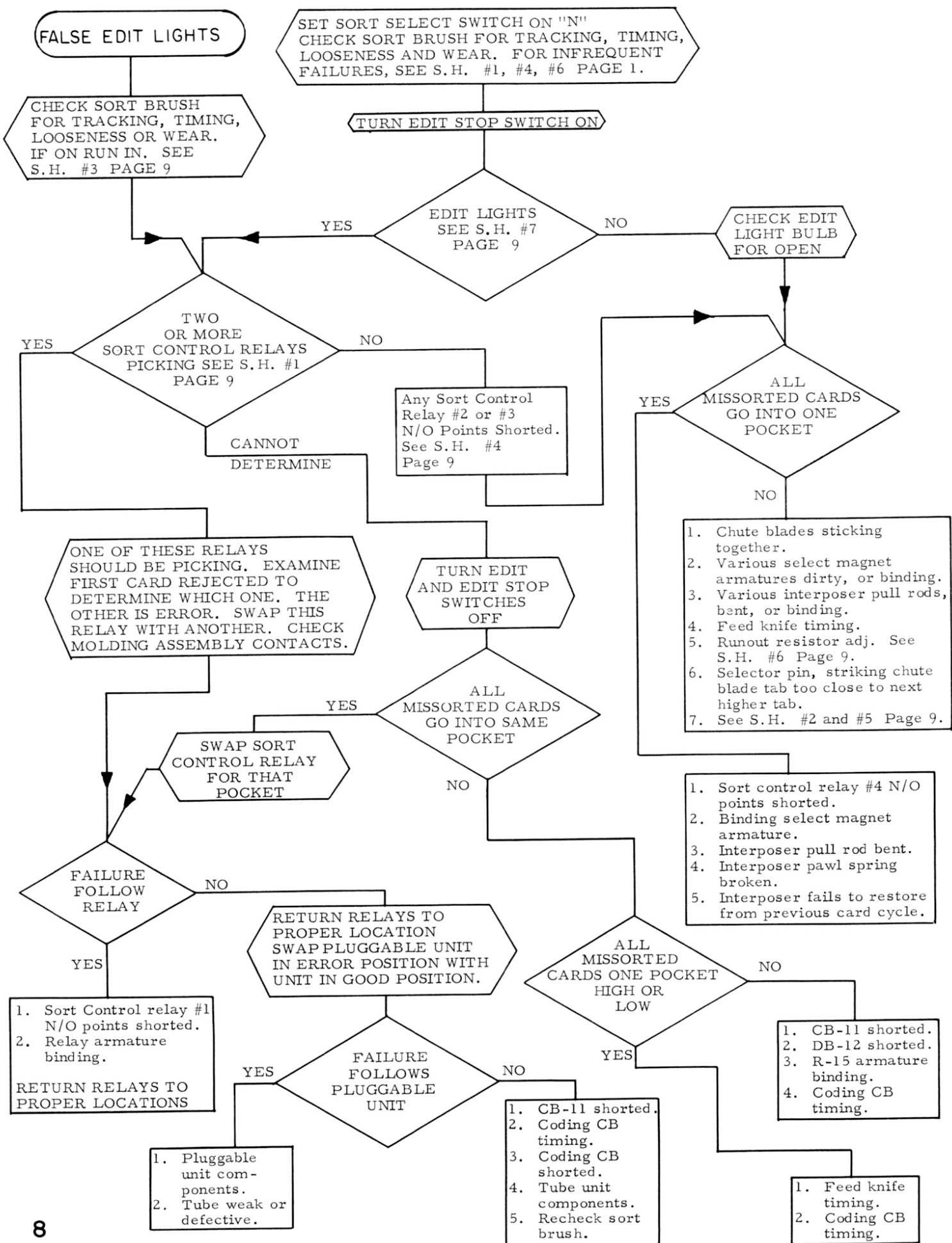
S.H. #5. Start Capacitor Check; (Machines with external start switch.)
Main line switch off. Meter on highest resistance scale. Connect one meter lead to terminal 2 of start relay. Place the other lead first on one terminal of the start capacitor, then on the other terminal. One should show a direct short, (Zero resistance), the other should give a momentary deflection. If both show a short, the capacitor is shorted. Should the results be one short and one open, the capacitor is open.

S.H. #6. IF NEITHER THE START SWITCH NOR THE START CAPACITOR ARE FOUND TO BE DEFECTIVE, THEN THE TROUBLE IS EITHER IN THE BEARINGS OR IN THE MOTOR WINDINGS. In this case, the motor will have to be replaced or rebuilt, whichever is appropriate.

NOTE: IT IS ADVISED THAT THE AREA AROUND THE DRIVE MOTOR BE KEPT AS FREE FROM CARD DUST AS POSSIBLE TO AVOID THE POSSIBILITY OF A FLASH FIRE IN THE CENTRIFUGAL SWITCH AREA.

MISSORTING

MACHINES WITHOUT ERROR RETENTION



SERVICE HINTS

Missorting On Machines Without Error Retention

S.H. #1. A temporary error retention circuit may be installed to aid in locating the cause of infrequent sorting failures. This circuit allows the Sort Control relays which picked to remain energized when an Edit Stop condition occurs.

1. Add jumper from R-16-4, N/O to R-9-P-1 B side.
2. Add jumper from R-16-4, N/C to CS-AU, N/O.
3. Add jumper from R-16-4, O/P to CS-AU, O/P.
4. Insulate the CS-AU point.

S.H. #2. Intermittent missorting can be caused by a stretched cog belt between first and second feed rolls. This is a result of broken wires inside belt. A new style timing belt is available with nylon tension members rather than steel. It is identified by white strips visible on the edges of the belt.

S.H. #3. A false Edit condition can occur on running after digit suppress keys have been used on the previous sort. This occurs on machines wired to NO through E suffix W/D's. When digit suppress keys are depressed, tubes for suppressed digits can still conduct, but they are not extinguished, as the extinguishing impulse must come through the suppress switch, now open. After the suppress keys have been released, tubes which are conducting will pick their respective Sort Control relays as soon as Tube Transfer relay R-15 picks when machine is started again.

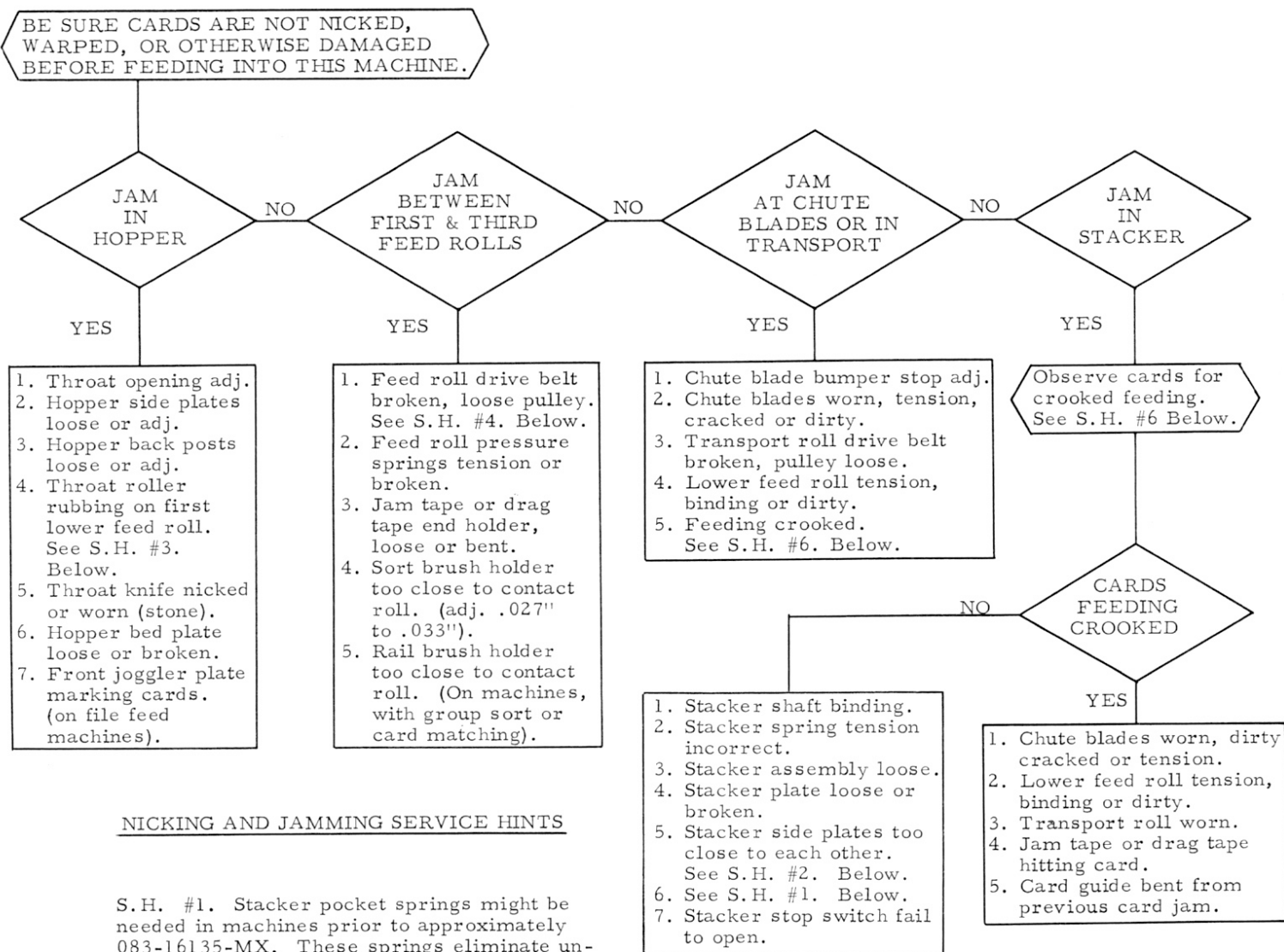
S.H. #4. In this case, edit lights were false. Shorted points might not cause failures if customer does not use Edit or Edit Stop switches. In analyzing this missorting failure, false edit lights have appeared. Continue analysis of missorting failure.

S.H. #5. Intermittent missorting may be caused by flat areas or nicks worn into the first upper cork feed rolls because of jams at the first feed roll position. If this occurs, both the first upper and lower shafts should be replaced by the former style gear driven steel feed roll shafts. For further information and part numbers, refer to CEM-082-16.

S.H. #6. A maladjusted run out resistor will allow cards to remain in the transport at the end of a run. Quite often these cards are overlooked by the operator. When the next column is sorted, these cards stack and appear to have missorted. This condition will always show up as a "missorting" of the first few cards in the pocket.

S.H. #7. With Edit switch on, error card rejects. With Edit Stop switch on, error card rejects and the machine stops, regardless of setting of Edit switch. Error card is any card which causes two or more Sort Control relays to pick.

JAMMING



NICKING AND JAMMING SERVICE HINTS

S.H. #1. Stacker pocket springs might be needed in machines prior to approximately 083-16135-MX. These springs eliminate uneven stacking and possibly nicking and jamming. See CEM-083-3.

S.H. #2. Stacker side plates are not perpendicular to their mounting base. Instead, the bottoms of the plates are moved .015" to .020" to the left to insure good card stacking. The side plates can be adjusted individually to obtain this measurement but they MUST be adjusted in sequence because each side plate effects the pocket to the left. Start with the maladjusted pocket and work toward the left end of the machine.

S.H. #3. Intermittent throat jamming may be caused by the throat roller touching the first lower feed roll. If so, the Hopper Base Support Bar which mounts the roller block should be shifted to allow .010" clearance between the roller and the feed roll. The throat knife must now be readjusted.

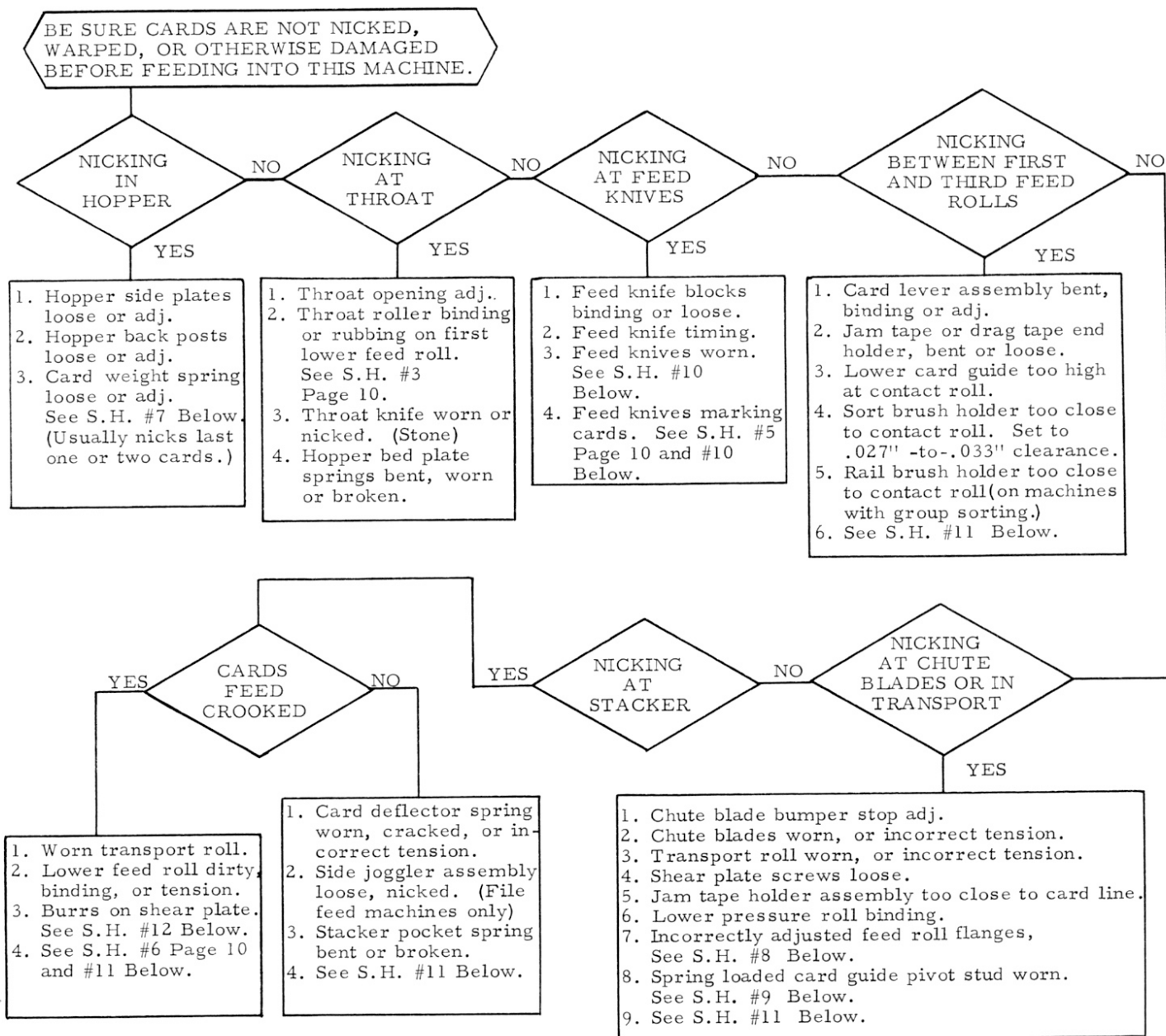
S.H. #4. If transport drive belts, P/N 336258, break repeatedly, Drive pulleys, P/N 336176 should be checked to insure they have 19 teeth. A limited number of machines may have been shipped with 20 tooth pulleys installed throughout the drive. These must be replaced since they cause excessive strain on the belts.

S.H. #5. Feeding failures may be a result of feed knife marking of cards. It may be necessary to reverse the feed cams on the shaft. The timing hole in the cam should be toward the rear of the machine. This change may be needed on machines prior to 083-24098-EZ.

S.H. #6. Two methods to determine card skew and crooked feeding:

- Check sort brush timing at both ends of card. If feeding is straight here, then lace deck of about 200 cards with punches 9 through 12 in columns 10 and 70. When run, laced card columns should appear as straight lines. Wavering lines indicate crooked feeding.
- Start machine feeding cards, holding a marking ink bottle or soft lead pencil against right end of Jam Bar, and touch moving cards with a minimum amount of pressure to obtain a line on the back of all cards. Remove cards from the stackers and measure the distance between the line and the rear of the card at the 9 edge. The distance at the 12 edge must be the same, minus 1/32 or plus 1/16 inch. A greater variance than this indicates excessive skew which can cause nicks and jams. By doing this at different parts of transport, point causing crooked feeding can be determined.

NICKING



NICKING AND JAMMING SERVICE HINTS (CONT.)

S.H. #7. A loose card weight spring assembly, loose screws, or a maladjusted spring can cause nicking of the last card or two in the hopper. With the card weight out of the hopper, the spring should be adjusted so that the distance between the end sections (Which rest on the feed knives) and the bottom of the weight itself is $5/32"$ plus $1/32$ or minus $1/16"$. Should the spring assembly mounting screw holes be stripped, replace the card weight with P/N 336675 which has been redesigned to include a threaded metal insert, which is used to attach the spring assembly.

S.H. #8. Fourth & fifth upper feed rolls on some machines with large lower idler rolls may have improperly adjusted steel flanges. If flange is too close to idler roll, it may cause creasing of card. If necessary, loosen set screws and shift flange.

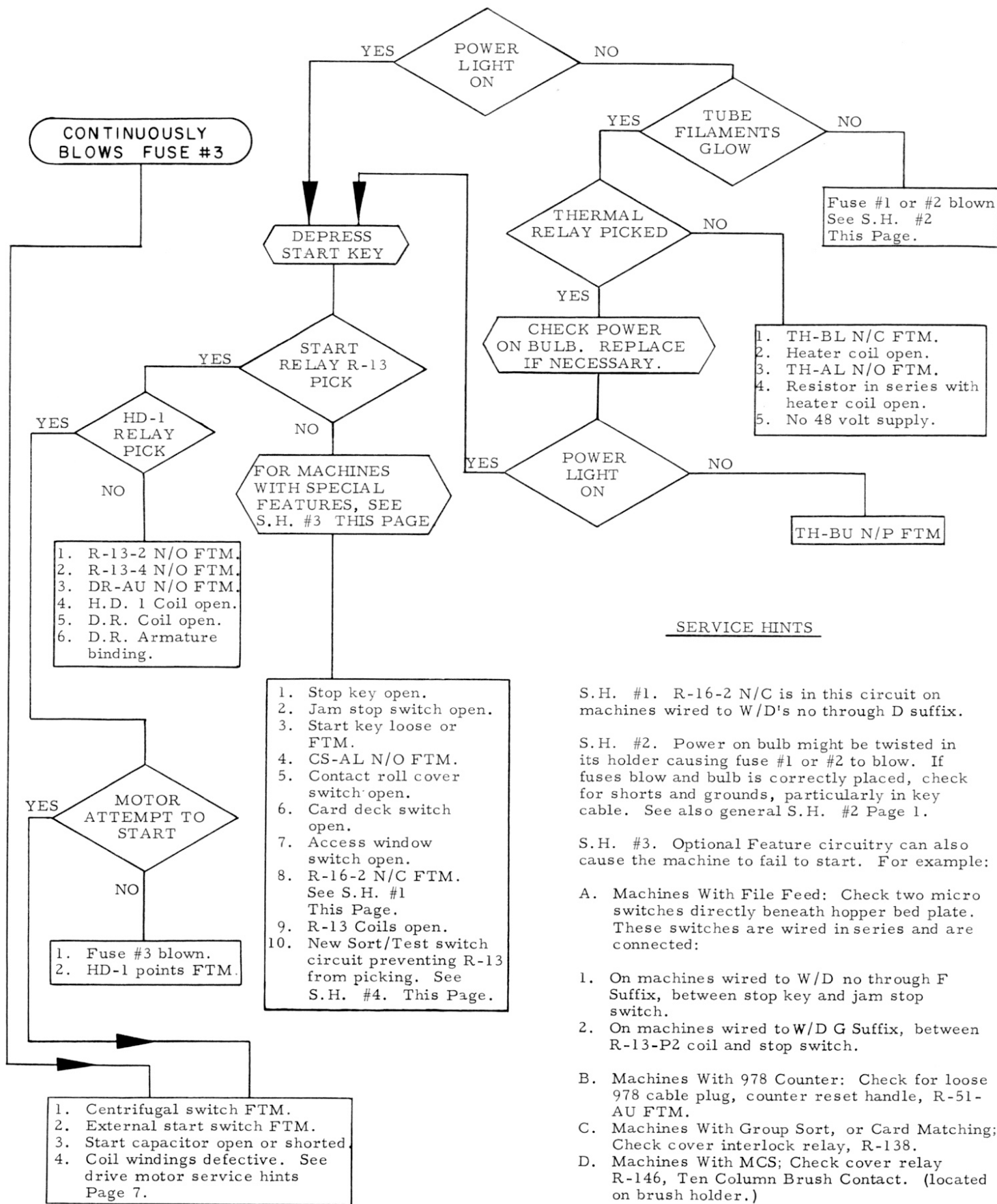
S.H. #9. Nicking can sometimes be caused by slight grooves in lower card guide. Groove is result of lateral movement of spring loaded front guide, when its pivot stud has worn. When replacing, always use flipper P/N 223797 which contains a bronze pivot insert.

S.H. #10. Production 083's now incorporate IBM-108 Feed Knife. P/N 223082. It may be identified by a notch filed into the feed knife block. This knife has slightly higher projection. Either style may be used in field machines, however, the same style must be used in both positions. If one of each is used, nicking on 12 edge of card may be experienced.

S.H. #11. If nicking occurs, mark machine components which align with the nick with wax crayon. Feed cards. When cards nick, they will leave marks on crayoned area which will help to locate exact spot where nicking occurs.

S.H. #12. A small number of machines prior to P1 Suffix may contain small burrs on stacker shear plates. This can cause nicking around column 40 on the 9 edge of the cards. Stone these burrs. (CEM 082-80, Item 1)

FAILING TO START



SERVICE HINTS

S.H. #1. R-16-2 N/C is in this circuit on machines wired to W/D's no through D suffix.

S.H. #2. Power on bulb might be twisted in its holder causing fuse #1 or #2 to blow. If fuses blow and bulb is correctly placed, check for shorts and grounds, particularly in key cable. See also general S.H. #2 Page 1.

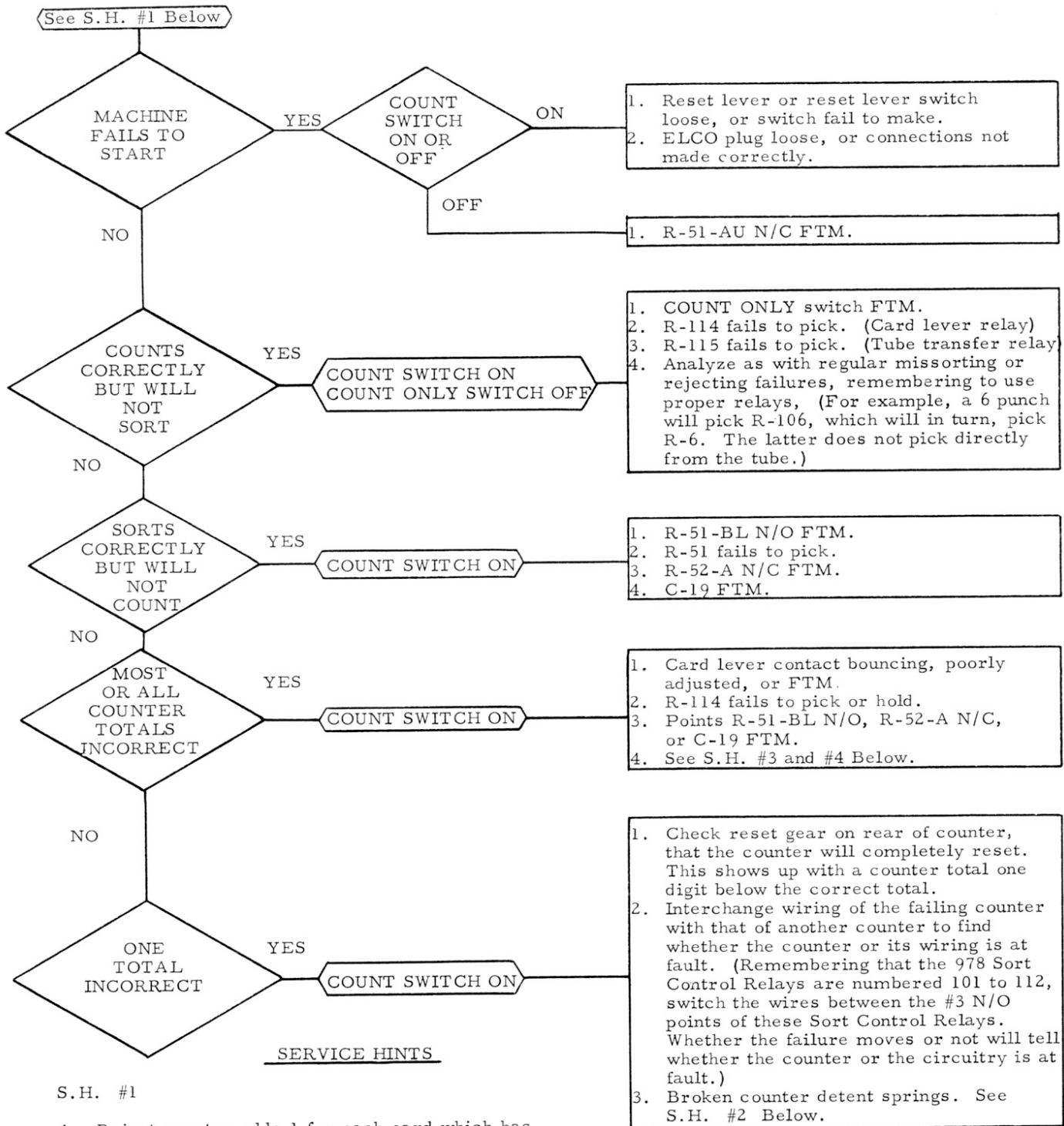
S.H. #3. Optional Feature circuitry can also cause the machine to fail to start. For example:

A. Machines With File Feed: Check two micro switches directly beneath hopper bed plate. These switches are wired in series and are connected:

1. On machines wired to W/D no through F Suffix, between stop key and jam stop switch.
 2. On machines wired to W/D G Suffix, between R-13-P2 coil and stop switch.
- B. Machines With 978 Counter: Check for loose 978 cable plug, counter reset handle, R-51-AU FTM.
- C. Machines With Group Sort, or Card Matching; Check cover interlock relay, R-138.
- D. Machines With MCS; Check cover relay R-146, Ten Column Brush Contact. (located on brush holder.)

S.H. #4. Machines starting with K2 suffix incorporate a circuit change which prevents the machine from starting if the Sort/Test switch is set at Test.

978 COUNTER FAILURES



S.H. #1

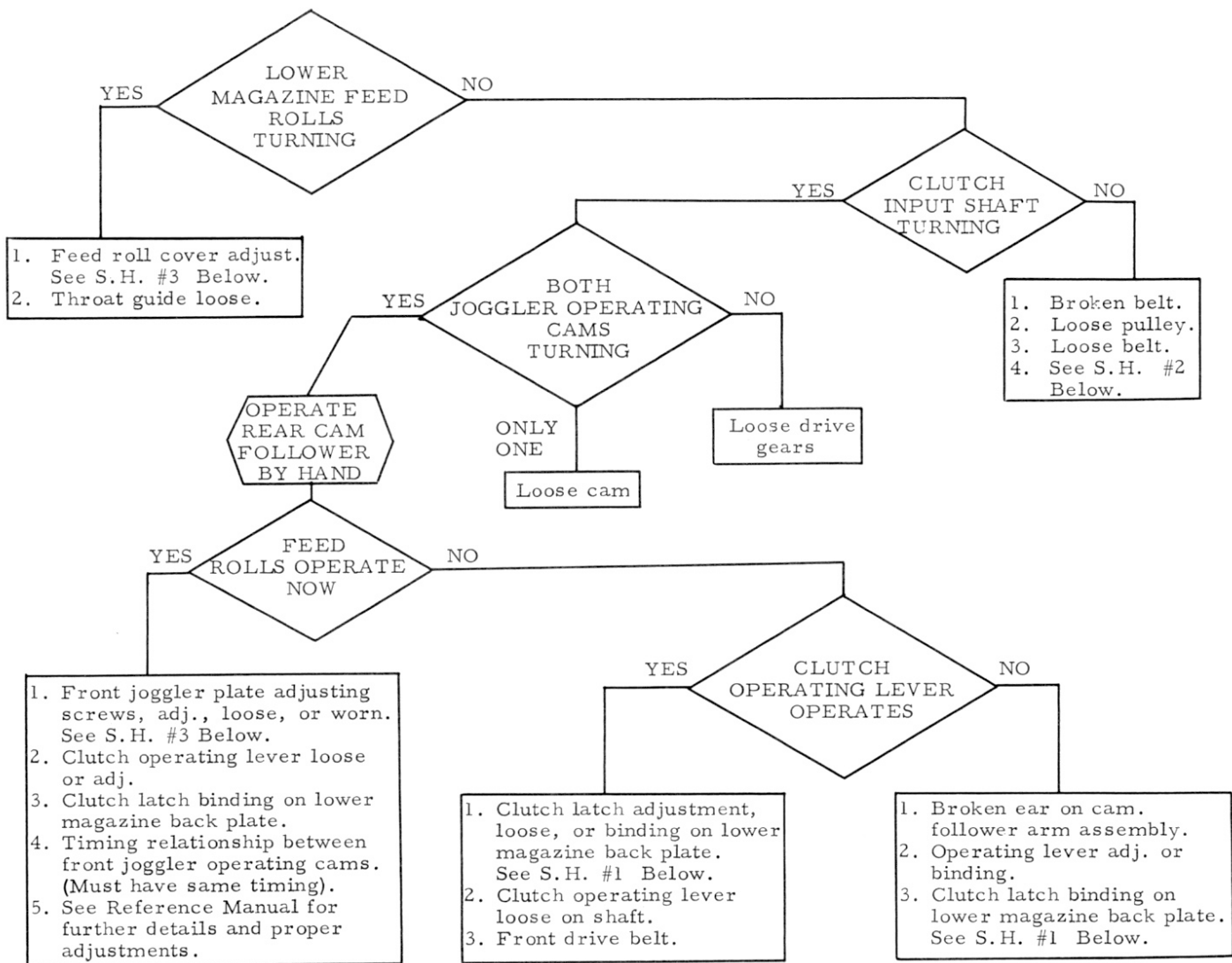
- Reject counter adds 1 for each card which has not had at least one punch read.
- Subtotal counter adds 1 for each card that passes through the machine.
- Counters 1 through 12 add all card punches read. If a counter adds extra numbers, it is quite possible two punches are being read from one card, possibly from an adjacent column. Check sort brush tracking.

S.H. #2. Incorrect totals can be caused by broken Detent Springs on Counter. These are the flat blue-steel springs which hold the counter shaft in a detented position. Detent spring P/N 144076 should be installed when breakage is experienced. Older counters contain only one detent spring while newer ones contain two. When breakage is experienced, two springs must be installed in both style counters.

S.H. #3. In cases where incorrect counting is experienced after a machine stop or upon rapid alternate depression of the start and stop keys, a Bill of Material is available which incorporates a potentiometer to adjust the delay relay drop-out time. This may be needed for machines prior to 083-15880-LX, and prior to 086-11008-CY which have the 978 installed.

S.H. #4. A possible wiring error on machines prior to C1 suffix wired to W/D 336001 G can cause breakage of Counter Reset Detents. This wiring error can cause the Reset Switch to be ineffective and can allow the counters to be reset while voltage is applied to counter magnets. To correct this condition, remove jumper from R-14-P2 coil common to DR coil common. Indicate wiring change on machine W/D.

FILE FEED FAILING TO FEED



SERVICE HINTS

S.H. #1. Newer models of the 083 have the clutch latch undercut, and do not experience this trouble. On older models, when this binding is experienced, remove, shim, and replace the lower magazine back plate in position so there will be a slight clearance between the latch and the back plate.

S.H. #2. If a drive belt is slightly loose, trouble might appear only when the file feed tray is full of cards. Replace the front drive belt.

S.H. #3. CEM 082-25 announces improved parts for file feed:

- A. Jogger adjusting screws.
- B. Lower magazine feed roll cover.

FILE FEED JAMMING

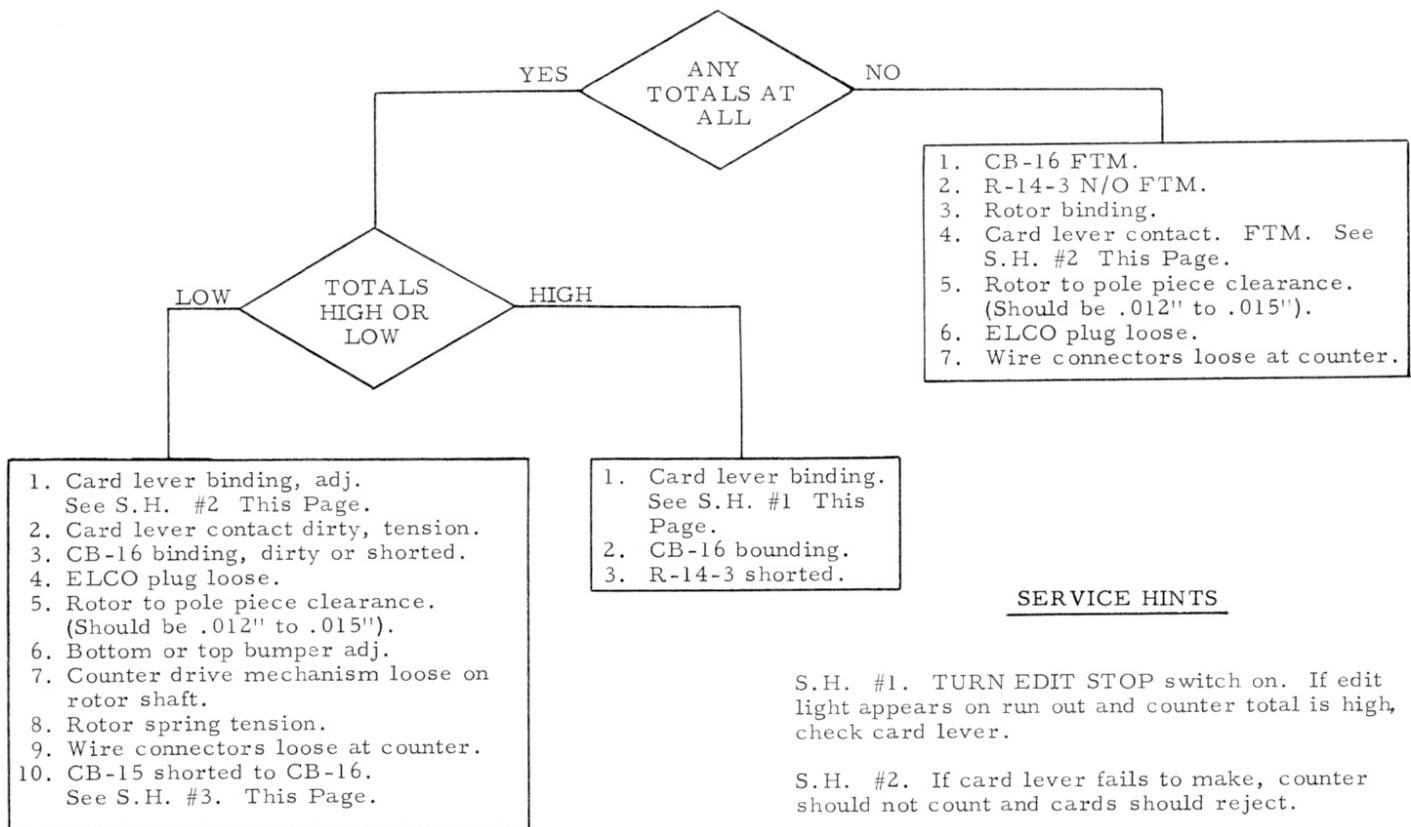
Most File Feed Jamming is a result of the File Feed failing to stop feeding cards from the lower magazine into the hopper. This is usually a result of

1. Clutch failures caused by a broken, worn, or binding latch.
2. A maladjusted clutch operating lever.
3. Front jogger plate cam follower assembly binding on its pivot.
4. Front jogger plate out of adj. (causes nicks and jams)

File Feed jams are also sometimes the result of

1. Broken throat guides.
2. Incorrectly adjusted side jogger.
3. Loose front jogger plate.
4. Hopper side plates adjusted incorrectly.

AUXILIARY CARD COUNTER FAILURES *



SERVICE HINTS

S.H. #1. TURN EDIT STOP switch on. If edit light appears on run out and counter total is high, check card lever.

S.H. #2. If card lever fails to make, counter should not count and cards should reject.

S.H. #3. A short between CB-15 and CB-16 can be caused by burrs on the CB's and can result in shorting 48 volts to the counter after CB-16 breaks, thereby undercounting.

SORT SUPPRESS *

FUNCTION: This circuit permits separating a deck of cards into two decks on the basis of specific punches, while maintaining the sequence of cards in each deck. With Sort Suppress switch on, any cards that would normally sort will go to the 12 pocket while any others will reject. Blanks can be separated from punched cards, or by use of Digit Suppress keys, specific digits can be separated from others by rejecting them.

CIRCUIT DESCRIPTION: When Sort Suppress switch is depressed, the common connection is removed from all sort magnets except 12 and through relay "S" points all sorting impulses go to the 12 magnet.

ALPHABETIC SORTER *

FUNCTION: With this feature, the sorting patterns for Sort Selection switch settings A-1, A-2, and A-N are permanently changed. To sort a column alphabetically, all the cards are fed through once, and some of them a second time. Ten letters, including all the vowels, are sorted on the first pass. It is not necessary to remove the sorted cards from the 0 to 9 pockets until the remaining cards are sorted on the second pass.

CIRCUIT DESCRIPTION: There is a special group of 5 relays, R-17 through R-21, one or more of which are picked with each setting of the Sort Selection Switch. With this switch set at N & Z, sort patterns are normal. With the A-1, A-2, and A-N settings, tubes conduct and Sort Control Relays pick normally. However, by means of the Sort Control relay points and the points of relays 17 through 21, the CB-13 impulse is directed to the proper sort magnets in order to obtain the proper sorting pattern. (See SORTING PATTERN CHART in final sections of the machine W/D.)

*Additional information is available in CE Manual, Form #225-6694-2, Operator's Manual, Form #A-24-1034-0, and Catalog Form #124-7102-2.

GROUP SORT*

FUNCTIONS: Permits a group of cards to be sorted according to a punch in the master card of that group. The Master card is identified by a corner cut at the leading edge, front or rear, or a 9 punch in column 1 or 80. The last card of the group can be a Trailer card, identified by a corner cut at the trailing edge, front or rear. Detail cards are those without Master card or Trailer card identification, with the exception of the last Detail card which may be used, with a corner cut, as the Trailer card.

Digit punched in the Master card is read by the sort brush and selected and stacked accordingly. All following Detail cards, regardless of their punching will follow the Master card into the same pocket until a new Master card or a Trailer card is read.

CIRCUIT DESCRIPTION: When Master card feeds, rail brush reads the corner cut, or 9 punch, picks Master tube which, in turn, picks Setup relay. Setup relay points allow digit tubes to pick from the sort brush, allows Tube transfer relay to pick, and thereby allows the proper Sort control relays to pick. Master tube is extinguished, as is the Sort tube. Setup relay drops providing a hold circuit for the Sort Control relay until the Master, or Trailer tube conducts.

NOTE: Timing of the Rail Brush, and CB's #21 and #22 is very critical.

To check Rail Brush timing, feed a square cut card in by hand with Sort Brush and Rail Brush both in place. Card should insulate both brushes from contact roll at the same time. Rail brush MUST be completely insulated from contact roll by 353°, or false corner-cut readings will result.

CARD MATCH*

FUNCTION: Permits separation of group of cards into two files: Masters with Details, and Masters without Details. Detail cards are identified by a corner cut, front or rear, or a 9 punch in column 1 or 80. Master cards are identified by a significant punch in an assigned column, or by a corner cut opposite to that of the Detail cards.

The first Detail card, read by the Rail Brush, sets up a sort-to-11 circuit, which, once picked remains energized. Cards will continue to sort into the 11 pocket until the first Master card is read. The first Master card will follow the Detail cards into the same pocket, and drop out the sort-to-11 circuit so that multiple Master cards will reject. However, if a Detail card follows a Master, the Detail card takes precedence and the sort-to-11 circuit is maintained. The cards must be arranged so that Details precede Masters.

CIRCUIT DESCRIPTION: Detail card picks Detail tube which picks Detail relay. Detail relay picks Card Match relay which holds and establishes the sort-to-11 circuit. Master card picks a sort control relay which sets up a circuit to pick the Master tube. Master tube picks Drop-out relay which drops the Card Match relay; breaking the sort-to-11 circuit. If a Detail card follows a Master, the Detail card takes precedence and the sort-to-11 circuit is maintained.

NOTE: Timing of the Rail Brush and CB #21 is very critical.

To check Rail Brush timing, feed a square cut card in by hand with Sort Brush and Rail Brush both in place. Card should insulate both brushes from contact roll at the same time. Rail Brush MUST be completely insulated from contact roll by 353°, or false corner-cut readings will result.

MULTIPLE COLUMN SELECTION -(MCS)*

FUNCTIONS: This circuit selects into the zero pocket all cards which compare with a predetermined alphabetic or numeric code. This code is wired from the emitter hubs on the control panel into the entry hubs. As each card feeds, it is read by the ten column brush assembly, and the result of the comparison determines whether the card is selected into the zero picket or is rejected.

NOTE:

- A. Comparing columns with two punches is possible because of the control panel entry filters. Comparing columns with 3 or more punches can cause back circuits.
- B. When MCS switch is turned on, time must be allowed for the MCS tubes to heat and the MCS thermal relay to pick.
- C. Ten column brushes must be timed to make 2° before standard CB's 1 through 6.

S.H. #1. In cases where incorrect selection is experienced after a machine stop or upon rapid alternate depression of the start and stop keys, a Bill of Material is available which incorporates a potentiometer to adjust the delay relay dropout time. This may be needed for machines prior to 083-15830-LX and prior to 086-11008-CY which have MCS installed.

NON COMPARE CONDITION: 1. An emitted impulse into an entry hub with no corresponding punch read from the card. 2. A punch read from the card with no corresponding entry impulse emitted. Both conditions will cause the Non-Compare tube to conduct, thereby picking R-163 and preventing CB-13 impulse from reaching the zero sort magnet. This tube keeps conducting until after the card has completely read.

COMPARE CONDITION: The coincidence of a read impulse with an emitted entry impulse will cause the Compare tube to conduct, preventing the Non-Compare tube from conducting and R-163 from picking for that digit only. (A single impulse at a later digit can cause the Non-Compare tube to conduct causing R-163 to pick at that time to give a Non-Compare condition.) If all punches in the card compare with all emitted entry impulses, R-163 does not pick for that card, CB-13 impulse is directed to zero sort magnet.

*Additional information is available in: CE Manual Form #225-6694-2; Operator's Manual Form #A-24-1034-0; Catalog Form #124-7102-2.

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