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IBM 2671 Paper Tape Reader
IBM 2822 Paper Tape Reader Control
Component Description

This publication gives sufficient information to understand the IBM 2671 Paper Tape Reader and IBM 2822 Paper Tape Reader Control and the associated special features. The main purpose of the publication, however, is to assist programmers and operators to operate the machine when it is used as an I/O unit to the IBM System/360 Model 25, 30, 40, 44, 50, or 67, or to System/370. The relevance of the controls and indicators for such a configuration are given, together with points of specific interest to the following:

- **Programmers: Operational characteristics, including stop conditions, addressing, recovery procedures, and System/360 commands.**

- **Operators: Tape loading, unloading, rewinding, and repair procedures.**

- **System Analysts: Tape specifications.**

The sections for programmers presuppose a knowledge of System/360 and System/370 operation and of paper tape readers, but no such knowledge is required in understanding the sections for operators.

Associated Publications

Physical Characteristics of the 2671 Paper Tape Reader and 2822 Paper Tape Reader Control and of System/360 operation are given in the following publications:

1. *IBM System/360 Installation Manual – Physical Planning,* Order No. GC22-6820.
2. *IBM System/360 Installation Manual – Physical Planning, IBM World Trade 50-Hertz Requirements,* Order No. GC19-0001.

Preface

This publication is written for customer programmers and operators using the IBM 2671 Paper Tape Reader and IBM 2822 Paper Tape Control as an I/O unit to an IBM System/360 Model 25, 30, 40, 44, 50, or 67, or to an IBM System/370. Programmers should be familiar with the System/360, but operators require no previous experience of System/360 or the machine operation to use this publication; descriptions in this publication assume that the 2671/2822 is attached to System/370 via a single multiplexer channel, in which case operation is identical to System/360 operation.

The publication describes in general terms the operation of the 2671/2822 and associated features in "Introduction", and gives the relevance of the controls and indicators with System/360 operation in "2671 Controls and Lamps".

Programmers should read "Operational Characteristics", in which data handling details are given. Operators should follow the instructions given in "Paper Tape Splicing", "Cleaning by Operator", and "Tape Loading, Unloading, and Rewinding".

Because there are five possible configurations of the 2671, the loading instructions have been divided into basic logical steps, each step being given on a separate tabulated page. This layout allows operators to select and collate the instructions particular to their machine configuration.

For details of the tape that can be read by the 2671/2822 see "Paper Tape Specifications".

Contents

Illustrations

Frontispiece. IBM 2671 Paper Tape Reader and IBM 2822 Paper Tape Reader Control   [01769]

The IBM 2671 Paper Tape Reader (see Frontispiece) reads 5-, 6-, 7-, and 8-track punched chad paper tapes at speeds between 500 and 1,000 characters per second. The characters read are buffered one at a time by the IBM 2822 Paper Tape Reader Control and transmitted to an IBM System/360 over one of the System/360 multiplexer or selector channels.

The 2671/2822 may be connected to any of the following models of System/360: 25, 30, 40, 44, 50, or 67.

The 2671 is controlled by the 2822, which receives all its commands via one of the System/360 channels from the System/360 (Figure 1).

The 2671/2822 can equally be attached to System/370 through a simple multiplexer channel. The operation in this instance is identical to the operation with System/360. Therefore, references made throughout this publication to System/360 also mean System/370.

All paper tape codes, except System/360 code, require translation before the characters of the code take on meaning. Translation is done by means of a look-up table held in the System/360 program. The characters transmitted are held by the System/360 in their original code and are only translated when the tape or record is ended.

BASIC 2671 PAPER TAPE READER

The basic 2671 (Figure 2) can read strips of punched paper tape, whose lengths may range from 9 inches (in.) (23 centimeters [cm]) to 20 feet (ft) (6,1 meters [m]). These lengths include a 6-inch (15,2 cm) long leader and a 3-inch (7,6 cm) long trailer. Tapes that have completely blank sections (without feed holes also) cannot be read.

The basic 2671 comprises:
1. Read head.
2. Reader drive.
3. Reader brake.
4. End-of-tape sensor.

Read Head

The paper tape is constrained by tape guides to pass between a light source and ten photocells (eight reading
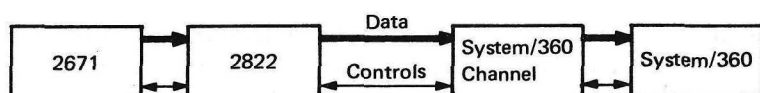

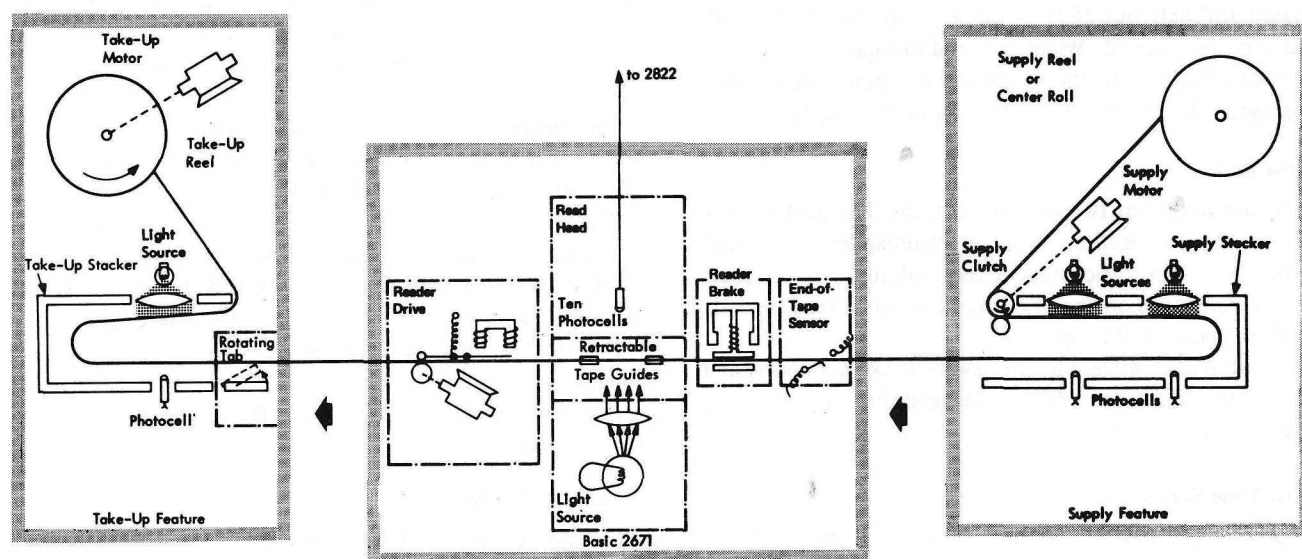Figure 1. Connection to System/360   [08269]

Figure 2. Basic 2671 and Special Features   [01770A]

photocells, feed hole photocell, and light source control photocell). The tape guides may be retracted by the operator to insert paper tape into the read head. A tape-width selector allows the tape guides to be correctly set for 5-, 6-, 7-, and 8-track paper tapes. A reading photocell is positioned at each track of the paper tape. The tracks are numbered from 1 through 8, working from bottom to top of the read head.

If a hole is punched in a track of the paper tape, sufficient light passes through the hole to operate the track photocell. If no hole is punched, insufficient light passes through the paper to operate the photocell.

The outputs of all eight reading photocells pass to the 2822.

Feed Hole Photocell

The feed hole photocell detects the feed holes in the tape. The photocell output is used to control the feeding of tape into the supply stacker (if the supply feature is equipped), and to stop the reader drive if no feed holes are detected in a section of tape.

Light Source Control Photocell

This photocell is used to control the intensity of the light source. The photocell is positioned between tracks so that variations in the light passing through the paper are detected (due to changes in paper thickness, for example). The output of the photocell is used to control the light source supply, so that the difference in light intensity between hole and no-hole conditions may be held constant.

Reader Drive

The reader drive motor operates continuously after power-on. The reader drive clutch is controlled from the 2822, and when the clutch engages the idler roller, the paper tape is drawn through the 2671 at a maximum speed of 1,000 characters per second. When the end-of-tape sensor operates, a signal is sent to the reader drive clutch control logic to disengage the clutch, independently of the 2822.

Reader Brake

The reader brake has two braking surfaces. The braking surfaces are forced together by an electromagnet, controlled by the 2822. The efficiency of the braking action is such that the tape stops on the next character to be read, regardless of the speed of the tape.
Note: The reader drive and the reader brake are controlled so that when the reader drive is engaged the reader brake is released, and vice versa.

End-of-Tape Sensor

The paper tape passes over the feeler of a microswitch, which is the end-of-tape sensor. As soon as there is no tape in the sensor, the microswitch operates. The microswitch contacts are wired to the reader drive clutch so that the clutch is disengaged when the microswitch operates.

Specification of Tape Basket

To avoid tape from being spilled onto the floor if the take-up feature is not fitted, the customer is advised to have made a basket of the following dimensions:

Height: 39 in. (99 cm)
Length: 20 in. (51 cm)
Width : 24 in. (61 cm)

The basket should be made of wood or cardboard, but not of metal. Metal baskets cause electrostatic discharges which can interfere with the operation of the 2671/2822, and also other units nearby.

Tape baskets are not available from IBM.

SPECIAL FEATURES FOR 2671

In order to read reels of punched paper tape and to reel the tape after reading, the following special features can be supplied:
1. Supply (reel-feeding) feature.
2. Center-roll feature.
3. Take-up feature.
   The supply feature is a prerequisite for the center-roll feature.

Supply Feature

The supply feature (see Figure 2) feeds punched paper from a reel into the supply stacker. The tape is drawn out of the stacker by the reader drive. The tape is reeled off to keep the stacker full at all times; the supply motor is controlled by photocells located in the stacker.

The reel may be wound clockwise or counterclockwise, but is always reeled off the outside of the spool. The tape reel always needs to be rewound before it is used again.

The maximum supply speed into the stacker is 500 characters per second.

The inside of the diameter of the reel may be 4-1/2 in. (12 cm) or 2 in. (5 cm); the feature has both types of hub. The outside diameter of the hub must not exceed 10.5 in. (27 cm).

If the reel is to be wound onto the take-up feature, then:
1. Total type length must not exceed 1,000 ft (305m).
2. Tape leader must be at least 20 in. (51 cm) long.

For strip feeding, the leader must be at least 6 in. (15 cm) long.

For all types of use, the tape trailer must be at least 3 in. (8 cm) long.

Center-Roll Feature

The supply feature is a prerequisite for the center-roll feature.

The tape is pulled from the inside of the spool by means

of a special center-roll feeding device. The tape is fed into the stacker as for the supply feature. The reel may be either wound clockwise or counterclockwise.

Center-roll feeding removes the necessity for rewinding the reel of tape at the end of a read operation if the take-up feature is fitted.

Reels with inside diameters of from 2-3/4 in. to 4-1/2 in. (7 cm to 11,4 cm) can be used. The length of tape must not exceed 1,000 ft (305m); this gives, for example, an outside diameter of 10-1/2 in. (27 cm) to a reel with the maximum inside diameter.

Take-Up Feature

The take-up reel (see Figure 2) winds in tape from the take-up stacker at a speed of 500 characters per second. As soon as tape is fed into the take-up stacker by the reader drive, the presence of the tape is sensed by a photocell, which switches on the take-up motor. When the take-up stacker empties, the take-up motor stops.

2822 PAPER TAPE READER CONTROL

The 2822 contains logic that matches the 2671 to the System/360 channel. The more important parts of the logic are shown on Figure 3.

Buffer and Data Register

The outputs of the photocells in the read head are fed to a buffer. The buffer holds the character just read on the tape, and a data register holds the previous character waiting to be transmitted to the System/360; the System/360 must accept the data from the data register within 0.8 milliseconds. When the data register is emptied, it is reloaded from the buffer, which is then free to accept another

character from tape. If the character in the data register is not accepted within the 0.8 millisecond period, the 2671 stops immediately on the character not yet read. Such a stoppage is called *channel contention*.

Delete Character Detection

The delete character detection logic recognizes characters having every available track punched, including the feed hole. The delete character resets the buffer, which is left empty to receive the next valid character at the read head.

Channel Interface

The 2822 converts channel commands from System/360 into controls for the 2671. The 2822 also transmits data characters, status bytes, and sense bytes to System/360. The interface presented is the standard I/O System/360 channel interface.

Isolation Feature

The isolation feature is installed on all machines of engineering change level 351 649, and can be fitted as a special feature to all machines below this engineering change level.

The isolation feature allows the IBM customer engineer to switch on and off the 2671 readily, without disturbing the operation of the rest of the System/360.

The feature is built into the power control circuits and the standard I/O channel interface of the 2822. The circuitry, which prevents disturbance to the rest of the system when switching on and switching off the 2671, is called the degate logic. The degate logic can be made operative by a degate switch, located in the 2822. The degate logic controls the power-on and power-off sequences, ensuring that all 2671 operations have ceased before switch-off
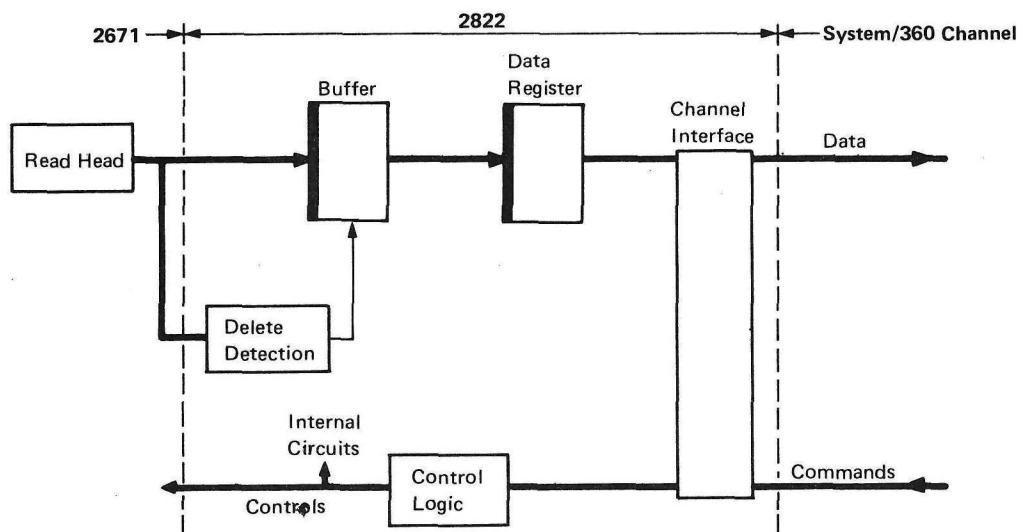
Figure 3. 2822 Block Schematic   [08270]

and that no 2671 operation can take place during switch-on.

When the degate switch is set off, interlocks are provided to stop the power being turned on and off locally. The power-on-and-reset pushbutton, however, retains the reader reset function, even when the power-on function is inhibited. The power-off-if-in-local pushbutton loses its function completely.

The positions of the switches, pushbuttons and lamps on the console of the 2671 are shown in Figure 4.

2671 CONSOLE SWITCHES

All switches are active when pushed up.

End-of-Record Switches

The end-of-record (EOR) character, when read, means that the record that has just been read is finished.

Any character left spare in the tape code may be used as the EOR character. The code of the selected EOR character must be set up on the end-of-record switches, so that the 2671 can be stopped when the EOR character is read. The up-positions of the end-of-record switches, by track, correspond to ones and the down-positions correspond to zeros in the tape code.

Delete Switch

The delete character is that character having all available tracks punched, including the feed hole. When the delete switch is pushed up, all delete characters read are automatically suppressed in the 2822 and are not transmitted to System/360.

When the delete switch is pushed down, the delete character is transmitted to System/360, just like all other characters.

If reading on a track is suppressed for any reason (this is not applicable to track 8), the delete character is not recognized as such and is transmitted to System/360, even when the delete switch is on.

Track Suppress Switch

When the track-suppress switch is pushed up, reading on a track (from 1 to 7) chosen by the customer is suppressed. The bit of the code corresponding to the suppressed track is made zero. The tape code parity is automatically adjusted in the 2822.

When a character consists of only a one punched in the suppressed track, a blank character is transmitted to System/360. The customer chooses which track is to be
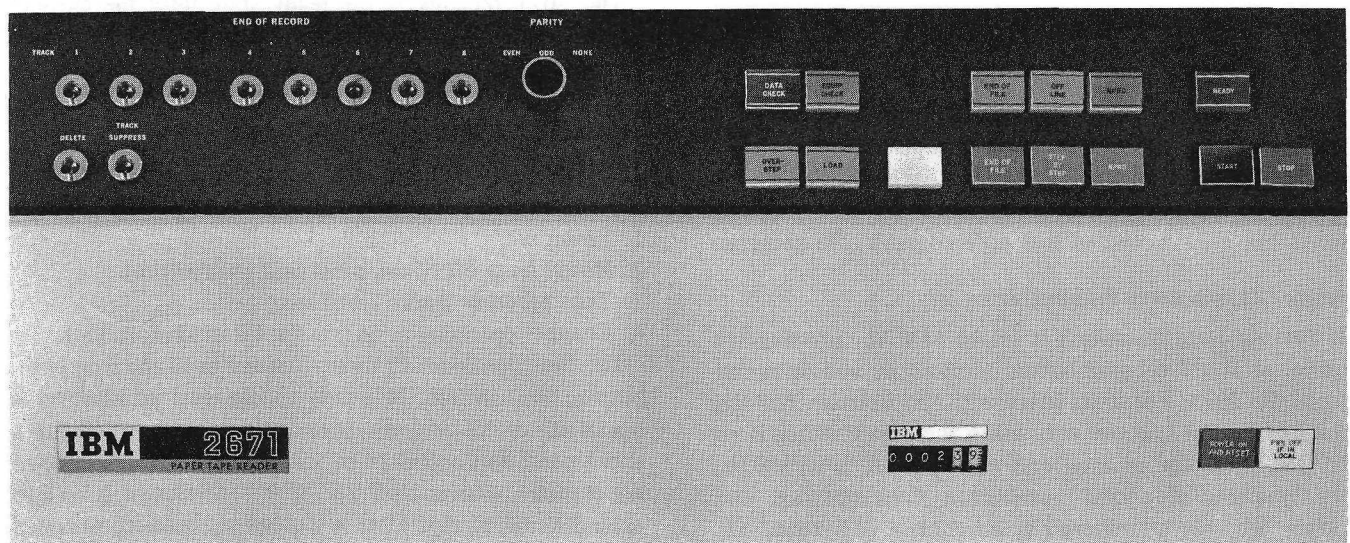
Figure 4. 2671 Paper Tape Reader: Console   [01771]

suppressed and additional logic is wired in by an IBM customer engineer.

While reading 8-track tape when the track-suppress switch is on, it is possible to read the shifted binary-coded decimal (BCD) code while still maintaining odd parity checking, and to consider seven-hole punched characters (track 1 to 7) as delete characters. If track 8 is punched, then it is necessary to wire this track for suppression.

Parity Switch

The setting of the three-position parity switch permits a choice of parity checking within the 2671/2822. When set to NONE, no parity checking takes place. When set to EVEN, even-parity checking circuitry is active for all tracks of the tape being used. When set to ODD, odd-parity checking circuitry is active for all tracks of the tape being used. Regardless of the setting of the switch, all tracks are transmitted to the System/360 with odd parity. When the width of the tape is such that a track does not exist, a 0-bit is transmitted for that track position.

Delete characters are not parity checked when the delete switch is on.

2671 CONSOLE PUSHBUTTONS

Power-On-and-Reset Pushbutton

If the remote/local switch (located on the CE panel) is set to LOCAL, pressing the power-on-and-reset pushbutton supplies ac and dc power to the 2671.

For units fitted with the isolation feature, the pushbutton is active only when the degate switch (located inside the unit) is set to ON. With the remote/local switch set to REMOTE, the pushbutton is inoperative and power is supplied under the control of System/360, but the pushbutton still retains its reset function. The change from local to remote powering, and vice versa, can only be made by the IBM customer engineer.

For units not fitted with the isolation feature, the power-on-and-reset pushbutton must not be used when the 2671 is in local mode to avoid channel disturbances (unless the System/360 is in a wait condition).

Pressing the pushbutton (even when the power is on) resets the 2671, provided that no command is in progress.

Power-Off-if-in-Local Pushbutton

If the remote/local switch is set to LOCAL, pressing the power-off-if-in-local pushbutton removes ac and dc power from the 2671. For units fitted with the isolation feature, the pushbutton is active only when the degate switch is set to ON. When the remote/local switch is set to REMOTE, the power-off-if-in-local pushbutton does nothing, and power can only be removed under control of System/360. The change from local to remote powering, and vice versa, can only be made by the IBM customer engineer.

Provided that the 2671 is in local mode and the isolation feature is fitted, the pushbutton may be used in powering procedures, as described on a label attached to the unit.

It is advisable to turn the power off when the following conditions are satisfied:
1. Unit not last on the channel.
2. Remote/local switch set to LOCAL.
3. No immediate use of 2671 expected.

Start Pushbutton

Provided all other ready conditions are satisfied, pressing the start pushbutton puts the 2671 in a ready condition, turns on the ready lamp, and signals the System/360 that a paper tape read operation can be initiated.

Stop Pushbutton

In a nonprocess runout (NPRO) operation, pressing the stop pushbutton stops the tape immediately and turns off the NPRO lamp.

If the 2671 is ready, but not reading, pressing the stop pushbutton turns off the ready lamp immediately.

In a read operation, the ready lamp turns off only after the read operation is completed, regardless of the status of the 2671 at the completion of the read operation.

End-of-File Pushbutton

When several rolls or strips of tape belonging to the same file have to be read, the end-of-file pushbutton must be kept in the OFF position until the last roll or strip of tape is inserted in the 2671. Then the pushbutton is pressed and the end-of-file lamp turns on; the 2822 is conditioned to signal to the channel that the last tape of a file has been read.

The 2671 remains in the ready state until the channel issues a new command, when the status unit exception is sent and the 2671 becomes not ready.

NPRO (Nonprocess Runout) Pushbutton

The NPRO pushbutton, when operated, feeds tape without processing, if the following conditions are satisfied:
1. Power on.
2. Ready lamp off (if on, press stop pushbutton).
3. Tape properly loaded (load lamp off).
4. Channel operating or unit in the CE mode (off-line).

The tape continues to move forward until the stop pushbutton, load switch, or power-on-and-reset pushbutton is operated, or an end-of-tape condition is detected, or a check condition occurs (tape jam in the 2671 or in one of the stackers, or overstep). The NPRO pushbutton is used to rewind a roll of tape after it has been processed, provided that the roll of tape was previously moved from the take-up feature to the supply feature.

Step-by-Step Pushbutton

Each time the step-by-step pushbutton is pressed, the tape advances one character position provided the following conditions are satisfied:

1. Power is on.
2. Ready lamp is off (if on, press stop pushbutton).
3. Tape properly loaded (load lamp off).
4. Unit under system control (channel operating) or in CE mode.

The step-by-step pushbutton is used primarily to position the first character of a predetermined record in front of the read head.

2671 CONSOLE LAMPS

Power-On-and-Reset Lamp

This lamp, which is incorporated in the power-on-and-reset pushbutton, indicates that ac and dc power are supplied to the 2671.

Ready Lamp

If the 2671 is on-line, the ready lamp indicates that the 2671 is reading tape or waiting for instructions from the System/360. The lamp turns on when the following conditions are satisfied:

1. Power is on.
2. Tape is properly loaded.
3. Overstep lamp is off.
4. Start pushbutton is pressed.

The lamp turns off when one of the following conditions occurs:

1. The operator has pressed the stop pushbutton and the read operation has been completed.
2. The operator has retracted the tape guides by pressing the load switch.
3. The operator has pressed the power-on-and-reset pushbutton while no command is being executed.
4. No tape is under the read head and the end-of-file lamp is off.
5. An overstep has occurred on tape stop. Such a situation may occur on a tape stop that is due either to an end-of-read operation or to channel contention when a read operation is in process.

End-of-File Lamp

The end-of-file lamp indicates that the end-of-file pushbutton has been pressed. The lamp turns off when the System/360 is informed that the last tape of the file has been read (unit-exception status byte, or when the stop pushbutton is pressed.

Equipment Check Lamp

The equipment check lamp indicates that a timeout condition has occurred. Each time a character is read, a time interval is initiated. If the following character punched in the tape is not read before the end of the time allowed (approximately 0.8 seconds), a timeout condition occurs, and the equipment check lamp turns on. The 2671 stops, and the ready lamp stays on. Any of the following conditions can cause a timeout condition:

1. *The tape jammed.* Free the tape and splice the damaged portions. Position the tape either at the beginning of the record, at the beginning of the tape, or at the beginning of the next record and read the tape again. (The actual procedure depends on the requirements of the particular job in the program.)
2. *A length of tape was not punched.* At the maximum speed of the 2671, about 5 ft (1,52m) of unpunched tape can be read before an equipment check occurs. The program normally ignores an equipment check of this kind and the 2671 continues to read without operator intervention.
3. *An unusual intervention.*
4. *Failure of the photocell reading system.*
5. *Failure of the tape drive motor.*

The equipment check lamp is turned off when a new operation is initiated, or when system reset is performed.

Data Check Lamp

The data check lamp indicates that a parity error has been detected. The erroneous character is transmitted to the System/360. The 2671 stops, and the ready lamp remains on. The erroneous character remains in the data register. The data check lamp is turned off when a new read operation is initiated, or when system reset is performed.

NPRO Lamp

The NPRO lamp indicates that the NPRO pushbutton has been pressed. The lamp turns off when the stop or power-on-and-reset pushbutton or reload switch is pressed, an end-of-tape is detected, or an overstep or a check condition occurs.

Overstep Lamp

The overstep lamp indicates that a character has been lost on a tape stop. This condition turns off the ready lamp. The power-on-and-reset pushbutton turns off the overstep lamp. Because of inertia in the lamp control feedback system, switching on and off may occasionally turn on the overstep lamp. In such cases, use the power-on-and-reset pushbutton to clear the error.

Load Lamp

The load lamp indicates that the tape guides are retracted. (The right-hand top key is still depressed.)

Off-Line Lamp

The off-line lamp indicates that the 2671 is in the CE mode.

HOURS COUNTER

Elapsed time in hours and minutes is indicated on the counter located on the 2671 console. The counter operates:
1. From the first read command until a run-out condition (end of tape) has been detected.
2. During a tape rewind operation, provided the 2671 is not off-line and the System/360 is not in the CE test mode.

2671 READER PLATE SWITCHES

The switches located on the reader plate (Figure 5) are of the mechanical type.

Load Switch

The load switch is a two-position switch consisting of right-hand and left-hand top keys.

Pressing the right-hand top key (load key) turns on the load switch and retracts the tape guides for tape loading or unloading. Pressing the left-hand top key turns off the load switch and positions the tape guides for tape reading. When on, the load switch:
1. Resets the buffer.
2. Clears the data register.
3. Stops the tape immediately when it is running (NPRO lamp or ready lamp goes out).
4. Turns off the overstep lamp.

Supply Switch

The supply switch is used only with the supply feature.

This switch is set when the supply clutch lever is perpendicular to the supply stacker and is set off when the supply clutch lever is in line with the supply stacker.

When on, the switch allows the supply clutch to feed the tape from the reel under the control of the supply stacker photocells. When off, the switch prevents the supply clutch from engaging.

CAUTION
When the supply feature is used, it is compulsory to set the supply clutch lever perpendicular to the supply stacker. Forgetting this step will result in the tape being pulled directly by the reader clutch and the tape may suffer damage.

Rotating Tab

The rotating tab is only supplied with the take-up feature. The rotating tab operates a microswitch (called the take-up switch), housed in the take-up stacker guide. When the tab is pressed against the stacker guide, the take-up motor is turned off by the take-up switch, and the tab deflects the tape forward (see Figure 17).

When the rotating tab is in line with the take-up stacker, the take-up motor is free to operate under the control of the take-up stacker photocells.
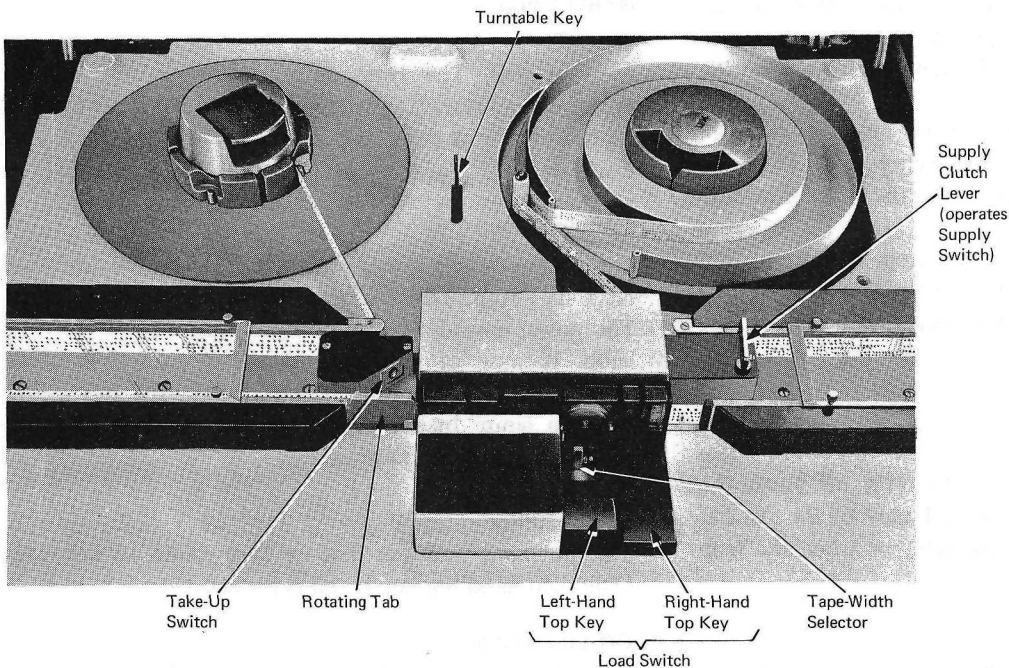
Figure 5. 2671 Paper Tape Reader: Reader Plate   [08311]

Tape-Width Selector

The three positions of the tape-width selector correspond to the three positions of the tape-width lever, which can adjust the tape guides to the three different widths of tape to be read.

The setting of the selector is internally detected to control the transfer of data to the buffer, as follows:

Tape-Width Lever Setting	Tape Width	Transferred Tracks
8	1 inch	1 to 8
6, 7	7/8 inch	1 to 6, 7
5	11/16 inch	1 to 5

Turntable Key

The turntable key is spring loaded.

Pulling the key forward unlocks the two-sided rotatable supply turntable to allow selection of the supply feature or the center-roll feature. The key automatically springs back into position to lock the turntable at the selected feature.

INTERFACE

The 2671 is connected to the System/360 I/O multiplexer or selector channel through the 2822. The 2822-to-channel connection is called the I/O interface. The interface consists of a set of wires over which the data and control signals are sent. A summary of the lines in the interface is as follows:

Buses (18 Lines)

Bus Out (9)	Channel → I/O Unit(s)
Bus In (9)	Channel ← I/O Unit(s)

Tags (6 Lines)

Address Out	Channel → I/O Unit(s)
Command Out	Channel → I/O Unit(s)
Service Out	Channel → I/O Unit(s)
Address In	Channel ← I/O Unit(s)
Status In	Channel ← I/O Unit(s)
Service In	Channel ← I/O Unit(s)

Selection Controls (7 Lines)

Select Out	Channel → I/O Unit(s)
Select In	Channel ← I/O Unit(s)
Hold Out	Channel → I/O Unit(s)
Request In	Channel ← I/O Unit(s)
Operational Out	Channel → I/O Unit(s)
Operational In	Channel ← I/O Unit(s)
Suppress Out	Channel → I/O Unit(s)

Metering Controls (3 Lines)

Metering Out	Channel → I/O Unit(s)
Metering In	Channel ← I/O Unit(s)
Clock Out	Channel → I/O Unit(s)

The select-out line is bypassed when the power-off-if-in-local pushbutton on the 2671 is pressed. When the power-on-and-reset pushbutton is pressed, the logic of the 2671/2822 is reset, and the select-out bypass is released.

When operating at full speed (1,000 characters per second + 25 per cent variation), the 'request in' line is activated every 0.8 milliseconds. So that 2671 may operate continuously, a data character must be accepted by the channel within 0.8 milliseconds after the 'request in' line is activated.

Interface Timing

The following chart specifies minimum and maximum response times for all interface signal sequences. The functions of these signals are those defined by the standard interface for System/360.

Initial Selection Sequence	*Response Times (microseconds)*
'Operational in' up response to 'select out' up	1.9 to 4.2
'Address in' up response to 'address out' down	1.4 to 3.3
'Address in' down response to 'command out' up	4.4 to 8.8
'Status in' up response to 'command out' down	3.0 to 6.6
'Status in' down response to 'service out' up	2.4 to 5.2

Data Transfer Sequence	*Response Times (microseconds)*
'Operational in' up response to 'select out' up	1.7 to 3.8
'Address in' up response to 'select out' up	3.1 to 6.8
'Address in' down response to 'command out' up	0.6 to 2.5
'Service in' up response to 'command out' down	3.3 to 7.1
'Service in' down response to 'service out' up	2.7 to 5.5

ADDRESSING

The 2671 is addressed by sending eight bits of address plus a parity bit over the nine bus-out lines. The 2671 is equipped with an address card which is adjusted to agree with the address set up by the program. This card can be adjusted only by an IBM customer engineer. Any one of 256 bit combinations is valid as an address for the 2671.

COMMANDS

The 2671 can accept all the System/360 I/O commands with the exception of read backward and write, which are treated as invalid commands. The valid commands for the 2671 are:

Bit Positions	P	0	1	2	3	4	5	6	7
Read	0	0	0	0	0	0	0	1	0
Read Modified	1	0	0	0	0	0	1	1	0
Sense	0	0	0	0	0	0	1	0	0
Test I/O	1	0	0	0	0	0	0	0	0
Control	1	0	0	0	0	0	0	1	1

Only the read and read modified commands will initiate a read operation in the 2671/2822.

With the 'read' command (bit 5 = 0), the read operation ends only if the count in the channel control word reaches zero.

With 'read modified' commands (bit 5 = 1), the read operation can be ended if:

1. EOR character detected.
2. Count in the channel control word reaches zero.

The sense command gates back the sense bytes of the 2671/2822 to the System/360.

The test I/O instruction is given by the System/360 program to check the availability of the 2671/2822, if it has not been accessed for some time.

STATUS BYTES

The status byte informs the System/360 of the current status of the 2671/2822:

Bit	Condition
0	Not used
1	Not used
2	Not used
3	Busy
4	Channel End
5	Device End
6	Unit Check
7	Unit Exception

All bits of the status byte are reset when the byte is accepted by System/360, with the exception of bits 3 and 6 if the 2671/2822 is not ready (ready lamp off). Bit 6 is set on if any of bits 0 through 2 of the sense byte are on.

Examples of Status Bytes

Busy

A busy status byte is returned to a new command when the 2671 is still executing the previous command and before any end status (including channel end) is generated in the 2822.

Channel End

A channel end status byte indicates that transmission of data characters over the interface for a given command has been completed.

Device End

The device end indicates that the 2671 has been restored from any one of the not-ready conditions to a ready condition.

Unit Check

The unit-check status byte is sent to the system to reject a command. A sense command can be issued by the system to interrogate the 2671 as to why the command was rejected. Note that a sense command is accepted with a blank status even when the unit generates unit check because of a not-ready situation.

Sense Bit 0 (Command Reject): Invalid command.

Sense Bit 1 (Intervention Required): The 2671/2822 is unable to perform a read operation.

Sense Bit 2 (Bus-Out Check): Incorrect parity of a valid or invalid command.

Unit Exception

The unit-exception status byte is issued by the 2671 to reject the first command following the end of the last tape of a file (end-of-file lamp on). The status of the 2671 becomes not-ready after issuing this status byte.

Busy and Device End

If the device-end interrupt, generated by the not-ready-to-ready transition, is stacked, any subsequent valid command (except test I/O) is rejected. Busy and device-end is returned to the channel.

Busy and Channel End and Device End

The busy and channel-end and device-end status byte rejects any command, except test I/O, when such a command is issued after channel-end and device-end was generated in the 2822 and before the status byte is accepted by the channel.

Busy and Channel End and Device End and Unit Check

The busy and channel-end and device-end and unit-check status byte rejects any command, except test I/O, when such a command is issued after channel-end and device-end and unit-check was generated in the 2822 and before the status byte is accepted by the channel.

Channel End and Device End

The channel-end and device-end status byte is transmitted to the System/360 each time a tape read operation has been properly performed. If the modifier bit is not present in the read command byte, the read operation is completed upon receiving a stop signal from the system (character count equals zero). If the read command byte contains the modifier bit, the read operation is normally stopped when an EOR character is detected by the 2671. (The EOR character is not transmitted to the system.) The channel-end and device-end status byte can also be generated by an end-of-tape at the read head.

Channel-end and device-end is returned:

1. *To a halt I/O* when halt I/O occurs after initial selection and before channel-end is presented.
2. *To a control no-operation (NOP)* when no status information is pending.
3. *To a test I/O* issued after a channel-end and device-end status was generated and before it is accepted by the channel.

As soon as the channel-end and device-end status byte is accepted by the system, the 2671 becomes not-ready (sense

bit 1, intervention required, turns on) if one of the following conditions is satisfied:

1. An end-of-tape is detected (EOF pushbutton not operated).
2. An overstep occurs on a normal tape stop, except on channel contention and supply stacker stops.
3. The stop pushbutton is operated during the tape read operation.

Channel End and Device End and Unit Check

The channel-end and the device-end and unit-check status byte, when issued, indicates that an unusual condition has occurred in the 2671 to prevent further data characters being read properly. Operator intervention may be required, dependent upon the sense bit that set unit check.

By issuing a sense command, the System/360 program determines the exact condition that caused the channel-end and device-end and unit-check status byte issued by the 2671, as follows:

Sense Bit 1 (Intervention Required): Indicates that the 2671 became not-ready before the normal completion of a read operation (for example, overstep on a tape stop because of the channel contention, a supply stacker stop, or the load switch pressed).

Sense Bit 3 (Equipment Check): Indicates that a timeout has occurred since the last data character was read. A timeout condition is caused by a 2671 (unit) failure or by detection of a length of blank tape. The 2671 remains in a ready status. The System/360 program can initiate a new read command or request operator intervention.

Sense Bit 4 (Data Check): Indicates that incorrect parity has been detected on a data character. However, this data character is transmitted to the system I/O channel, and the 2671 remains in a ready status. The System/360 program can either initiate a new read command or request operator intervention.

Channel-end and device-end and unit-check is also returned to a test I/O command issued after the status byte was generated and before the status byte is accepted by the channel.

SENSE BYTES

When a sense command is received by the 2671, one byte of sense information is transmitted to the system I/O channel. The following bit assignment is used in the sense byte:

Bit	Condition
0	Command Reject
1	Intervention Required
2	Bus Out Check
3	Equipment Check
4	Data Check
5	Not used
6	Not used
7	Not used

These conditions are reset at the beginning of the next read command with the exception of 'intervention required', which is reset by pressing the start pushbutton after all requirements for a ready condition are satisfied.

Examples of Sense Bytes

Command Reject

The command reject condition is detected when a read backward or a write command is received at the 2671, or when valid commands have invalid modifier bits. A parity error on the command prevents the command reject condition from being detected, and instead a bus-out check condition occurs.

Intervention Required

The intervention-required condition means that the 2671 is not ready. (This is best described by stating the conditions for ready.) The 2671 is ready when:

1. Power is on.
2. Tape is properly loaded.
3. Overstep lamp is off.
4. Start pushbutton is pressed.

The 2671 becomes not-ready immediately when:

1. The stop pushbutton is pressed while no read operation is in progress.
2. The load switch is pressed.
3. The power-on-and-reset pushbutton is pressed.

The 2671 becomes not-ready at the end of a read operation when:

1. There is an overstep condition on a normal or abnormal tape stop. The overstep condition is reset by pressing the load switch or the power-on-and-reset pushbutton.
2. The end of tape is detected at the read head (EOF lamp being off).
3. The stop pushbutton has been operated during the read operation, and a normal or abnormal completion has occurred.

As soon as the 2671 is restored from any one of the not-ready conditions to the ready condition, a device-end interrupt is generated to inform the program of this transition.

Bus-Out Check

Bus-out check is set when a parity error has been detected for a command issued by the System/360.

Equipment Check

The equipment-check sense bit indicates that a timeout has occurred in the 2671 since the last data character was read. This timeout could be caused by:

1. A failure of the photocells or the light projection system.
2. A tape drive motor failure.
3. An unusual tape creeping condition.
4. A length of blank tape.
5. Tape jamming in the stackers.

Data Check

In a data check, the parity of the data, except recognized EOR characters and delete characters, can be checked if the parity switch is set to the odd or even position. Regardless of the tape code used, the data sent from the 2822 to the channel has odd parity.

TAPE CODE TRANSLATION

The 2671 is capable of reading any tape code that can be punched in 5-, 6-, 7-, or 8-track tape. (Feed holes alone are ignored.) This is possible because the translation of the code punched in the tape is done by System/360. The eight tracks of the 2671 are connected to the system I/O channel by bus-in lines as follows:
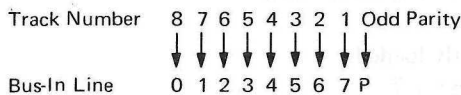
```
Track Number    8 7 6 5 4 3 2 1 Odd Parity
                ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓
Bus-In Line     0 1 2 3 4 5 6 7 P
```

When the width of the tape is such that a track does not exist, a 0-bit is transmitted for that track position.

The eight bus-in lines connect to the eight bits of a core-storage byte in the System/360 as follows:

```
Bus-In Lines    0 1 2 3 4 5 6 7
                ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓
Core Storage    0 1 2 3 4 5 6 7
```
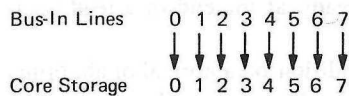
A hole punched in a track of paper tape is represented as a 1-bit in its respective position of core storage. A blank in a track of paper tape is represented as a 0-bit in its respective position of core storage.

The translate instruction in the System/360 may be used to convert the tape code to the desired internal code. The translate instruction operates by adding the binary value represented by the tape code to the starting address of a table. The sum of these two numbers is the address of a position in the table that contains the desired internal extended binary-coded-decimal interchange code (EBCDIC) or United States of America standard code for information interchange (USASCII) code for the character. The internal code is automatically taken from the table to replace the tape code in the read-in area.

Special Tape Code Characters

End-of-Record Character

The EOR character is chosen by the customer from among the spare codes of the tape code. The end-of-record switches on the 2671 console allow the customer to generate the coding of the chosen EOR character.

The state of the end-of-record switches is continuously compared with each character read by the 2671.

If the 2671 is operating under the control of modified read commands, the 2671 stops at each EOR character. None of the EOR characters is transmitted to the channel.

If the 2671 is operating under the control of unmodified read commands, the 2671 stops only when the channel control word count reaches zero. EOR characters up to this point are transmitted to the channel and are counted as data characters.

The one condition, however, where an EOR character is transmitted to System/360 under a modified read command is as follows:

> System/360 program changes from an unmodified read command to a modified read command, and the first character of the new record is an EOR character.

The EOR character is not parity checked.

If the EOR character is used to indicate the ends of a series of fixed-length records, it is advisable to issue successive modified read commands, rather than unmodified read commands that are followed by one modified read command. This enables the translation program to take place at the end of each record, rather than at the end of the complete tape.

Delete Character

The delete character is that character having all possible tracks punched. The delete character has this format for all 5-, 6-, 7-, and 8-track codes.

If a mistake in the punching of a character is made, the bad character is erased by punching all remaining tracks.

The delete character is automatically suppressed in the 2671 provided that the delete switch has been pushed up.

The 2671 does not stop, and the character count in the channel is unaffected. The delete character is not parity checked.

NORMAL STOP CONDITIONS

Character Count Equals Zero or EOR Character

After a 2671 operation has been completed, the stop signal comes either from the system (when the character count equals zero) or from the detection of an EOR character. The ready lamp remains on. No operator intervention is required except when the stop pushbutton was previously operated. If the stop pushbutton was operated during the read operation, the ready lamp turns off, and the start pushbutton must be operated to resume the read operation.

Character Count Equals Zero

When the 2671 is stopped by the System/360 because the character count equals zero, the third character of the next record is located at the reading head, the second character in the buffer, and the first character in the data register. The first character is ready to be transferred when a new read operation is initiated by the System/360.

End-of-Record (EOR) Detection

For a read command with modifier, the characters are read until the EOR character is detected, or until the channel signals the 2671 to stop. The EOR character is not transferred to the system but remains in the data register. The data register is cleared when a new read command is issued, thus erasing the EOR character.

For a read command without modifier, the EOR characters do nothing and furthermore are counted into the channel control word counter as data characters.

Programming Note: An EOR character is sent to the channel by a read command with modifier if:

The reading mode for the same tape changes from 'read without modifier' to 'read with modifier', and the first character read by the 'read with modifier' is an EOR character.

Supply Stacker Stop

When the supply feature is used, the tape in the read head is stopped whenever the supply stacker is empty. The reader drive operates again as soon as the supply system has refilled the stacker.

End-of-Tape Condition

If an end-of-tape condition is detected at the read head and the EOF lamp is off, the ready lamp turns off. A new tape must be loaded and the start key pressed to resume the tape operation.

Channel Contention

A character can remain stored in the data register (see Figure 3) for at least 0.8 milliseconds before the tape stops owing to a System/360 channel contention. The 2671 stops to avoid losing a character and restarts when the System/360 channel is again available. The maximum speed of the tape reader (1,000 characters per second) can only be maintained if the System/360 channel is available to handle the characters at this rate.

No operator intervention is required.

Data Check

When the 2671 stops after detecting a data-check condition, the incorrect character remains in the data register after being transmitted to System/360. The next character after the incorrect character is in the buffer and the second character after the incorrect character is at the read head.

The four different ways to restart the reading operation after a data check condition are as follows:

1. The System/360 can decide not to consider the incorrect character as wrong and send another read command. No operator intervention is necessary.
2. When the data-check lamp remains on, the operator can press the stop and start pushbuttons successively without disturbing the tape. The System/360 is thus warned by means of an interrupt that a reading operation can be initiated; the incorrect character is considered as wrong, but is not read again.
3. When the data-check lamp remains on, the operator can press the load key and backspace the tape manually two character positions. After the start pushbutton is pressed, a read operation is initiated by the System/360, and the character is read again.
4. When the data-check lamp remains on, the operator can reposition the tape at the beginning of the record, at the beginning of the tape, or at the beginning of the next record. Pressing the power-on-and-reset pushbutton makes the 2671 ready again.

Note: Which procedure is followed depends on the requirements of the particular job in the program.

Operator Intervention

Power-On-and-Reset Pushbutton

Depressing the power-on-and-reset pushbutton while the 2671 is reading causes a general reset. The 2671 stops, all lamps turn off (except power-on), and the unit-check status is generated.

Load Switch

Retracting the tape guides by pressing the load switch while a read operation is in process causes a reset condition. The 2671 stops and generates channel-end and device-end and unit-check. The ready lamp turns off, and the buffer and data register are cleared.

Without Operator Intervention

The 2671 stops during a read operation when abnormal conditions occur internally or in the system.

By the System

The 2671 stops when the emergency switch (located on the System/360) is operated. All power, both ac and dc, is removed from the 2671.

When a halt I/O is initiated by the System/360, the 2671 stops on the second character following the last character sent to the System/360 (in the same way as for a channel contention). The 2671 remains ready and a channel-end and device-end status byte is generated.

When a selective or general reset is initiated by the System/360, the 2671 stops immediately and all functions of the 2822 are reset except the buffer and the data register. No status byte is generated and the 2671 remains ready.

By the 2671

If the 2671 stops with the ready and equipment-check lamps on, a timeout has occurred because the last character was transferred to the system.

If the 2671 stops with the ready and data-check lamps on, a parity error has occurred.

Overstep

Overstep is that condition where a character on a tape overshoots the read head slightly, owing to the maladjustment of the brake or the drive clutch; it will always require intervention by the IBM customer engineer.

Each time an overstep condition occurs, the overstep lamp lights and the ready lamp is off, regardless of the state of the other lamps.

Note: Owing to the thermal inertia in the lamp control feedback circuit, the overstep lamp may light when the load switch is set on and then off. In this case, operate the power-on-and-reset pushbutton to clear the error.

ERROR RECOVERY PROCEDURES

The following fault conditions require operator intervention. If simultaneous fault conditions occur, assign error-recovery priority in the following order:
1. Equipment check.
2. Intervention required.
3. Data check.

Equipment Check

If a tape jam has occurred, it is necessary to free the tape and splice the damaged areas. After repair, the tape may be positioned at the beginning of the tape, of the record, or of the next record. The 2671 must be reset, then made ready, so that reading may continue.

Intervention Required

An intervention-required error is caused by any of the following conditions:
1. If the 2671 is not ready or the power-on-and-reset pushbutton has been pressed during reading.
2. If the load switch has been pressed during reading.
3. If the tape has broken.

It is necessary to reposition the tape (after repair if necessary). The tape may be positioned at the beginning of the tape, of the record, or of the next record (as required). The 2671 must be reset, then made ready, so that reading may continue.

Data Check

If a data-check error occurs, any of the following operations may be undertaken:
1. The tape may be backspaced two characters.
2. The tape may be repositioned at the beginning of the record.
3. The tape may be repositioned at the beginning of the tape.
4. The error may be ignored completely.

For each of these operations, the 2671 must be reset, then made ready, so that reading may continue.

Operator Intervention

Power-On and Reset Pushbutton

Depressing the power-on-and-reset pushbutton while the 2671 is reading causes a general reset. The 2671 stops, all lamps turn off (except power-on), and the unit-check status is generated.

Load Switch

Releasing the tape guides by pressing the load switch while a read operation is in process causes a reset condition. The 2671 stops and generates channel-end and device-end and unit-check. The ready lamp turns off, and the buffer and data register are cleared.

Without Operator Intervention

The 2671 stops during a read operation when abnormal conditions occur internally or in the system.

By the System

The 2671 stops when the emergency switch (located on the System/360) is operated. All power, both ac and dc, is removed from the 2671.

When a halt I/O is initiated by the System/360, the 2671 stops on the record character following the last character sent to the System/360 (in the same way as for a channel operation). The 2671 remains ready and a channel-end and device-end status byte is generated.

When a selective or general reset is initiated by the System/360, the 2671 stops immediately and all functions of the 2822 are reset except the buffer and the data register. No status byte is generated and the 2671 remains ready.

By the 2671

If the 2671 stops with the ready and equipment-check lamps on, a timeout has occurred because the last character was transferred to the system.

If the 2671 stops with the ready and data-check lamps on, a parity error has occurred.

Overrun

Overrun is that condition where a character on a tape overshoots the read head slightly, owing to the maladjustment of the brake or the drive clutch. It will always require intervention by the IBM customer engineer.

Each time an overrun condition occurs, the overrun lamp lights and the ready lamp is off, regardless of the state of the other lamps.

Note: Owing to the thermal inertia in the lamp control feedback circuit, the overstep lamp may light when the load switch is set on and then off. In this case, operate the power-on-and-reset pushbutton to clear the error.

ERROR RECOVERY PROCEDURES

The following fault conditions require operator intervention. If simultaneous fault conditions occur, assign error-recovery priority in the following order:
1. Equipment check.
2. Intervention required.
3. Data check.

Equipment Check

If a tape jam has occurred, it is necessary to free the tape and splice the damaged areas. After repair, the tape may be positioned at the beginning of the tape, of the record, or of the next record. The 2671 must be reset, then made ready, so that reading may continue.

Intervention Required

An intervention-required error is caused by any of the following conditions:
1. If the 2671 is not ready or the power-on-and-reset pushbutton has been pressed during reading.
2. If the load switch has been pressed during reading.
3. If the tape has broken.

It is necessary to reposition the tape (after repair if necessary). The tape may be positioned at the beginning of the tape, of the record, or of the next record (as required). The 2671 must be reset, then made ready, so that reading may continue.

Data Check

If a data-check error occurs, any of the following operations may be undertaken:
1. The tape may be backspaced two characters.
2. The tape may be repositioned at the beginning of the record.
3. The tape may be repositioned at the beginning of the tape.
4. The error may be ignored completely.

For each of these operations, the 2671 must be reset, then made ready, so that reading may continue.

PAPER TAPE DETAILS

The 2671 is designed to operate with either IBM 190216 (1-1/16-inch width, 5-track) or IBM 304469 (1-inch width, 8-track) paper tape. Other paper tape of equivalent paper stock may be used.

The tape must be uniformly thick and opaque to enable the photocells to register the contrast correctly between hole and no-hole conditions.

Dimensions

Chad paper tape, with the dimensions as given in Figure 6, is acceptable input to the 2671.

Feed Holes

The feed hole does not constitute part of the data character. The feed holes, however, are detected to control the supply of tape into the supply stacker (if supply feature fitted). The absence of feed holes causes the 2671 to stop.

Thickness Paper 0.004 ± 0.0003

Tape Movement

All dimensions are in inches
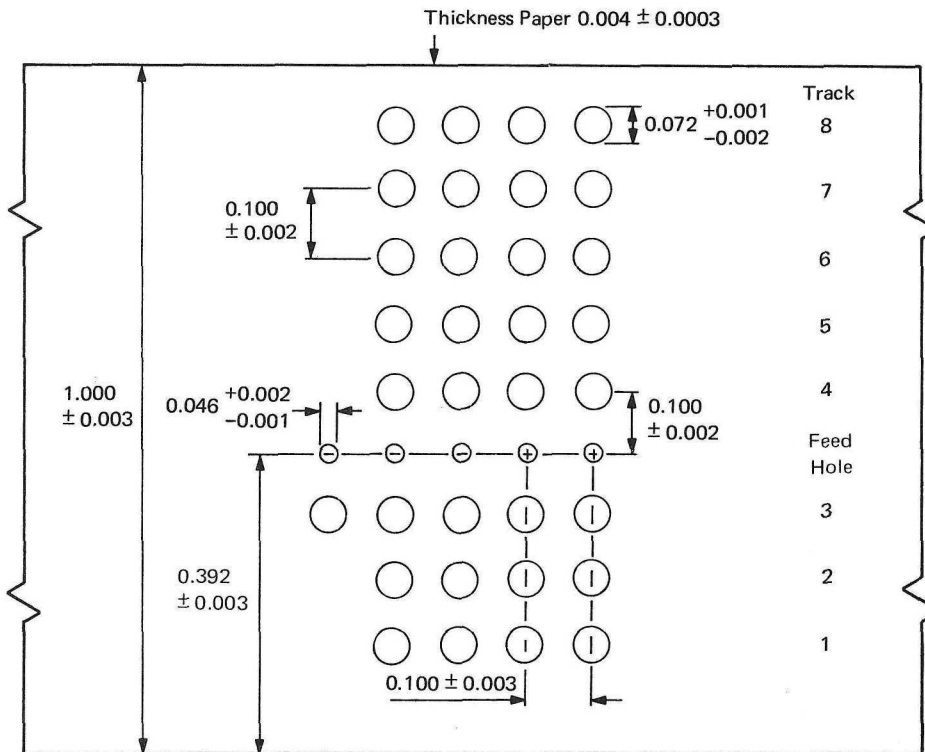
Notes:

1. Widths of Tape

    11/16 in. ± 0.003 in.
    7/8 in. ± 0.003 in.
    1 in. ± 0.003 in.

2. Feed Hole Punching

    Over a 6-inch length of the tape (60 characters) the distance between extreme feed hole centers should be:

    6 in. ± 0.009 in.

Figure 6. Tape Specifications   [08353]

Chad

The 2671 reads only chad tape (holes completely punched). (Chad is the name given to the circles of paper that are punched out of the tape.)

Paper Tape Handling

The 2671 can read the same piece of paper tape at least 30 times without significant damage to the tape. The loading time for a strip of tape, by a reasonably skilled operator, is about ten seconds. For a roll, the loading time is about 45 seconds.

Occasionally punched paper tape requires splicing. The ability of the 2671 to read spliced tape successfully depends upon the quality of the splice. The quality of the splice depends upon the type of splicing equipment, splicing material, adhesive, and, in some cases, the skill of the operator.

Paper tape splices are of two types: overlap splices and butt-joint splices.

Adhesive tape splices (Part 8 033 302) that are pre-punched with code holes and feed holes are available for tape splicing.

OVERLAP SPLICE

The overlap splice is made by overlapping the matching paper tape ends, by at least one punched tape column, and cementing the ends to hold them in place (Figure 7).

Some advantages of using the overlap splice are:
1. A large variety of overlap-splicing equipment is available.
2. The quality of the splices is not usually dependent upon the skill of the operator.

Some disadvantages of using the overlap splice are:
1. The splice cannot be made in the data area of the tape without the loss of data, parity conditions, and/or invalid characters.
2. Most adhesives require a relatively long time to dry.
3. The short life of the splice.

BUTT-JOINT SPLICE

The butt-joint splice (Figure 8) is made by butting two complementary tape ends together and holding them in position by a binding agent and an overlay material. The overlay material must be completely punched to allow proper reading of the tape if the splice is in a data portion of the tape. When overlays are placed on both sides of the tape, they must not face each other but must be offset by at least one character position.

Some advantages of using the butt-joint splice are:
1. The splice can be made in the data area of the tape without the loss of data.
2. The data portion of the tape can be repaired if torn or damaged.
3. The splice has relatively long life.

Some disadvantages of using the butt-joint splice are:
1. There is a limited choice of accurate tape-splicing equipment.
2. The quality of the splice is directly dependent upon the skill of the splice equipment operator.
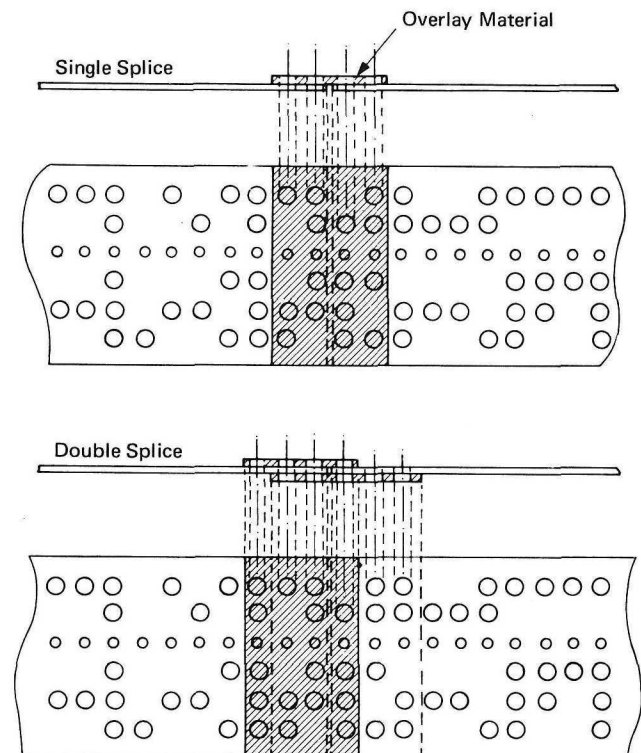
Figure 8. Butt-Joint Splice   [01777]

Figure 7. Overlap Splice   [01776A]

SPLICED TAPE SPECIFICATIONS

The dimensions of spliced tape must conform to the allowable tolerances as given in "Paper Tape Specifications". In addition, the spliced tape must conform to the following:

1. The total thickness of the splice must not exceed 0.010 in.
2. The width of the splice must match the width of the tape.
3. The splice must be approximately as strong as the IBM paper tape.
4. The splice must be flexible.
5. The splice must be clean and free of any substance that could create a hindrance in the tape feed area.
6. The distance between the closest parts of two consecutive splices must be larger than 4-1/3 in. (10 cm).

The operator should do the following cleaning tasks at least once a week (or more often, if necessary). All cleaning must be performed with the 2671 unloaded.

CLEANING SUPPLY AND TAKE-UP STACKERS

To clean the supply and take-up stackers (Figure 9):
1. Unscrew and remove the bolts holding the clear plastic covers in position; remove the covers.
2. Blow out all dust and chads.
3. Resecure the clear plastic covers.

CLEANING READ HEAD

To clean the read head:

CAUTION
Do not touch anything under the covers.

1. Lift off lamp cover.
2. Lift out plastic front guide.
3. Blow out all dust and chads.
4. Push front guide back into position.
5. Push back lamp cover.
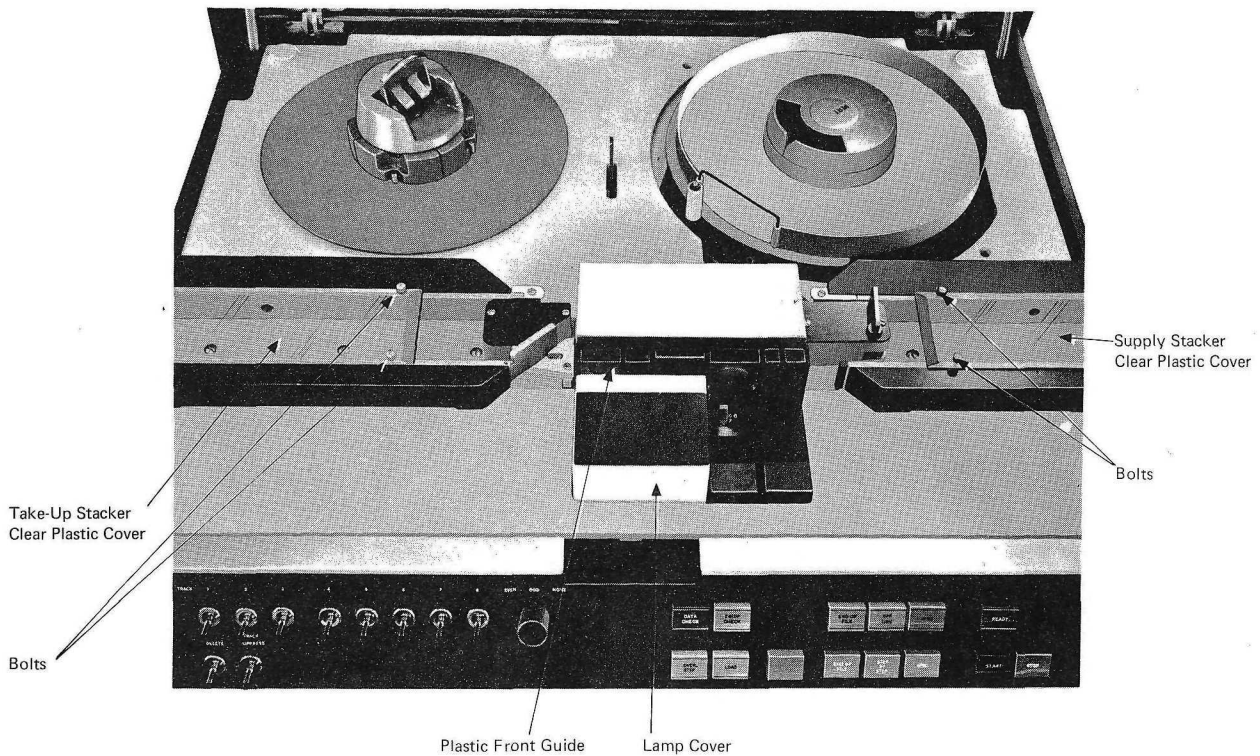
Figure 9. Tape Path Cleaning   [08312]

To ensure the good functioning of the 2671 and to protect chad paper tapes against damage, familiarize yourself completely with the instructions given in this section and obey them completely.

In particular, always load tape into the 2671 three-hole side down. For tape punched with six tracks, the three-hole down most side is identified as that side having the feed holes punched nearest the edge of the tape.

LOADING INSTRUCTIONS

Because the 2671 may be just the basic model or may incorporate one or more of the special features, the loading instructions have been identified as a series of basic steps (Figure 10). To determine which steps are to be followed for your type of machine, refer to Figure 11, where each configuration of the 2671 is given, together with the appropriate step numbers.

The procedure for making the 2671 ready depends on whether the 2671 is set for remote or local operation.
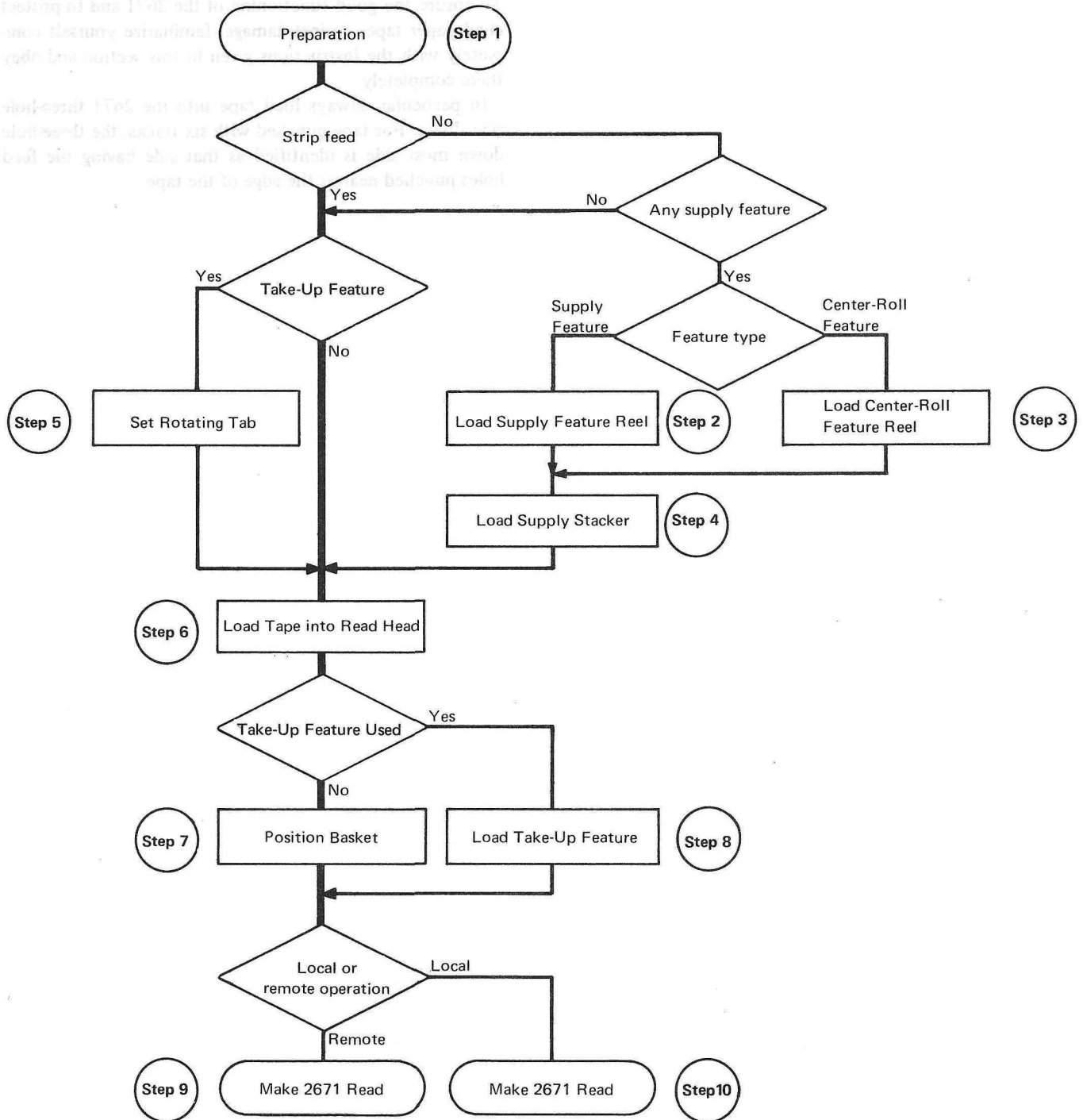
Figure 10. Tape Loading Flowchart   [08274]

CAUTION

1. The tape-width selector must always be correctly set; otherwise, the tape will be damaged by the retractable tape guides when you press the left-hand top key of the load switch.

2. The supply clutch lever must always be set perpendicular to the stacker at the end of the supply stacker loading step; otherwise, the tape will tear or break.

3. Do not push the rotating tab against the take-up stacker guide when there is tape in the read head; otherwise, the tape will tear.
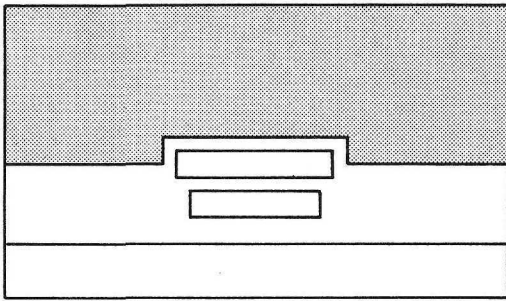
Basic 2671 Steps: 1, 6, 7, and 9 or 10*	**2671 with Supply Feature** Steps: 1, 2, 4, 6, 7, and 9 or 10*
2671 with Center-Roll Feature Steps: 1, 3, 4, 6, 7, and 9 or 10*	**2671 with Supply Feature and Take-Up Feature** Steps: 1, 2, 4, 6, 8, and 9 or 10*
2671 with Center-Roll Feature and Take-Up Feature Steps: 1, 3, 4, 6, 8, and 9 or 10*	**Strip Feeding** Strip feeding may take place on all 2671 configurations, except that if the take-up feature is fitted then the rotating tab on that feature must be considered. The steps for strip feeding in this instance are: 1, 5, 6, 7, and 9 or 10*
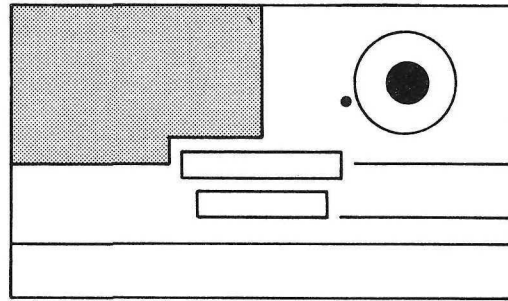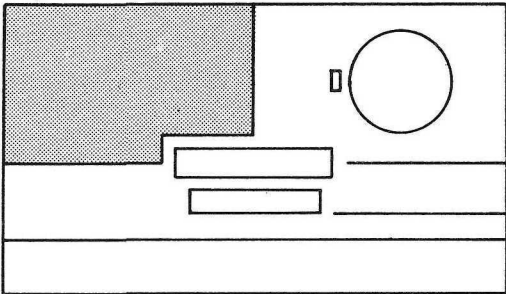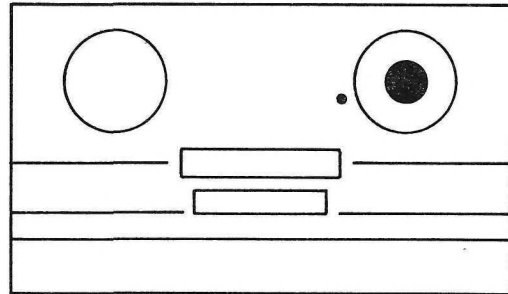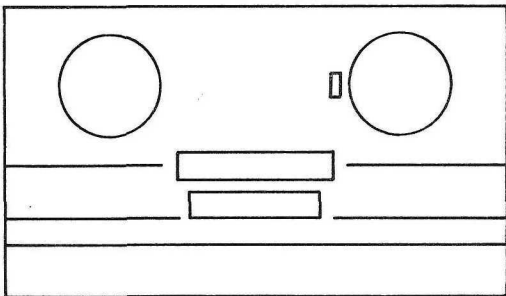
* Remote Operation: Step 9
  Local Operation: Step 10

Figure 11. Identification of the Tape Loading Steps   [08275]

Step 1: Preparing the 2671 for Loading

a. Depress the cover catch (Figure 12).

b. Operate the right-hand top key of the load switch to retract the tape guides.

c. Set the tape-width selector to the correct setting according to type of tape used:

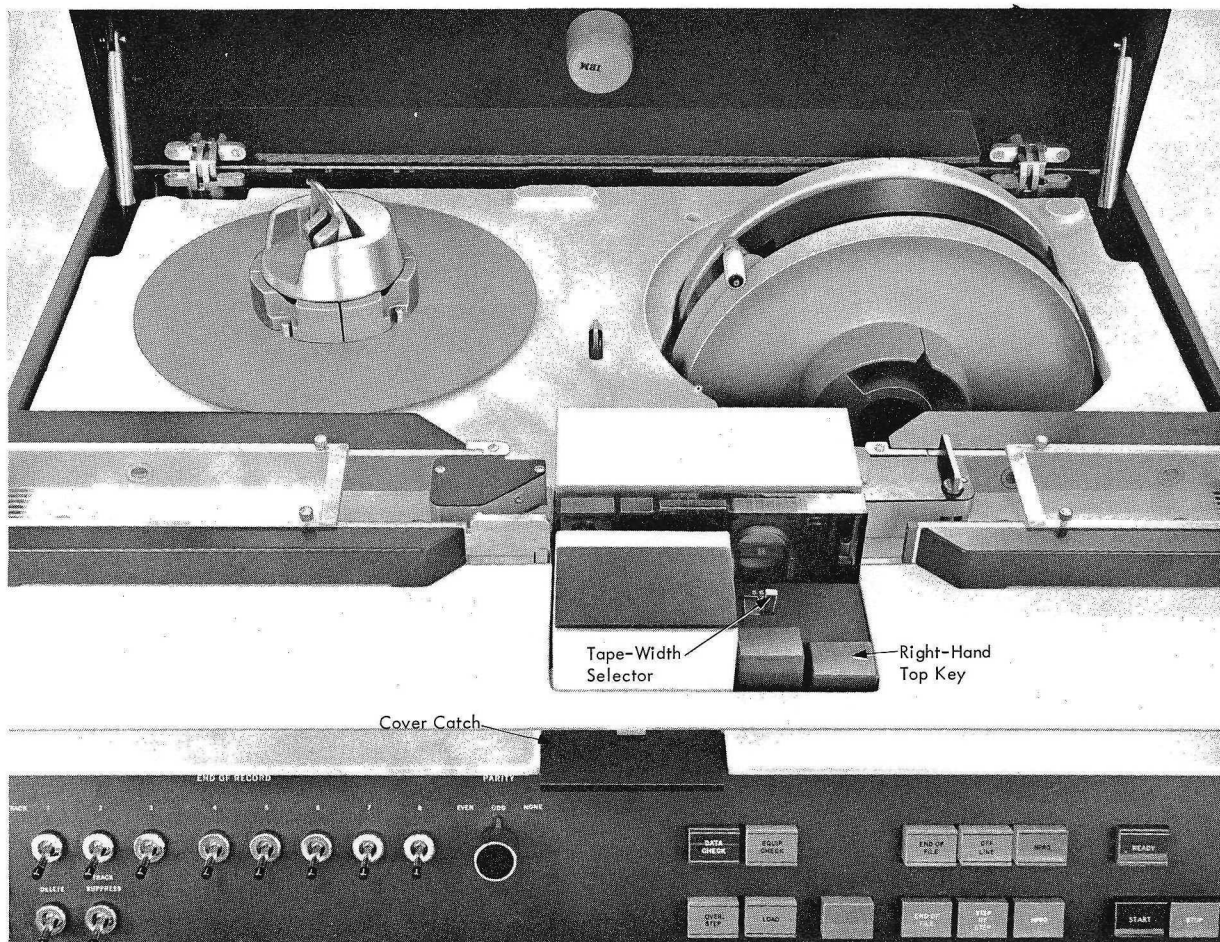| Tape Width Lever Setting	Tape Width
8	1 inch
6, 7	7/8 inch
5	11/16 inch

Figure 12. Step 1: Preparing the 2671 for Loading   [01778A]

Step 1: Preparing the 2671 for Loading

a. Depress the cover catch (Figure 12).

b. Operate the right-hand top key of the load switch to retract the tape guides.

c. Set the tape-width selector to the correct setting according to type of tape used.

Tape Width	Tape Width Selector Setting
1 inch	8
7/8 inch	6, 7
13/16 inch	5

Figure 12. Step 1: Preparing the 2671 for Loading   [0173A]

Right-hand Top Key

Tape-width Selector

Cover Catch

Step 2: Loading Reels onto Supply Feature

Note: Although the tape reels may have been wound in a clockwise or a counterclockwise direction, the instructions for loading onto the supply feature are the same.

a. If the center-roll feature is fitted and is showing uppermost, put the turntable key to release the turntable (Figure 13). Rotate the turntable so that the supply feature is uppermost. The turntable key will automatically re-engage to lock the turntable in position.

b. Two hubs are provided for the supply feature: 2-inch and 4-1/2-inch. Select the hub suitable for the tape reel to be loaded and push it over the shaft of the turntable. Push the hub not in use on the shaft attached to the inside of the top cover.

c. Place the tape reel over the hub, three-hole side down.

   i. 2-inch Hub: Hold the tape trailer against the hub and rotate the hub four or five times in the direction in which the tape reel is wound, to bind the tape firmly to the hub.

   ii. 4-1/2-inch Hub: Place the tape reel over the hub three-hole side down and engage the tape trailer in the hub slit.

d. Feed the tape leader through the gate of the turntable. Make sure that the clip over the gate is in position.

e. Feed the tape leader around the back of the supply tension roller, and pull off sufficient tape to load the rest of the 2671.
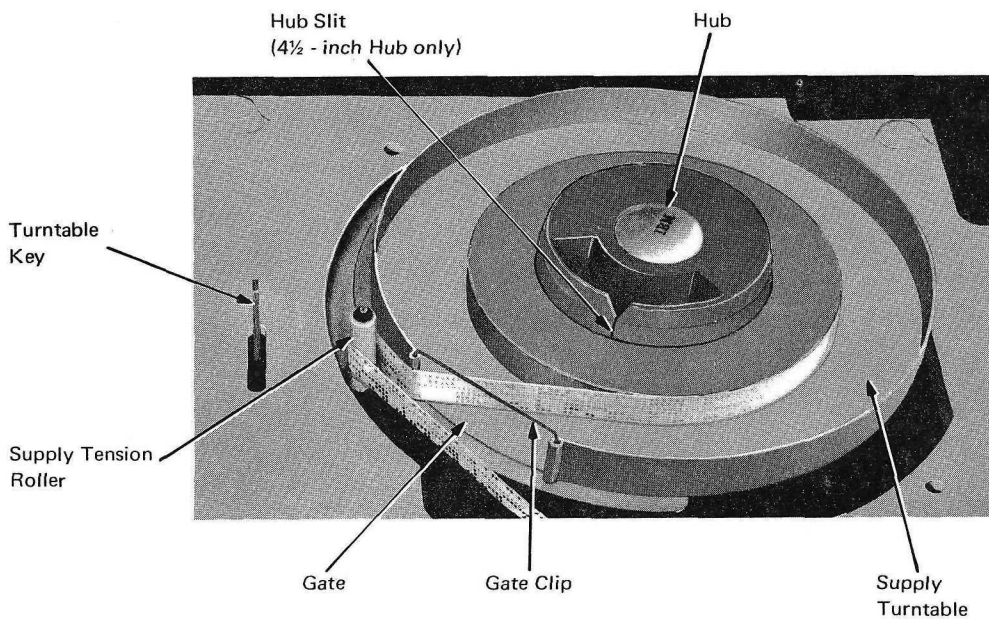
Figure 13. Step 2: Loading Reels onto Supply Feature (Clockwise-Wound Reel Shown) [08313]

Note: Although the tape reels may have been wound in a clockwise or a counterclockwise direction, the instructions for loading onto the supply feature are the same.

a. If the center-roll feature is fitted and is showing upper-most, put the turntable key to release the turntable (Figure 13). Rotate the turntable so that the supply feature is uppermost. The turntable key will automatically re-engage to lock the turntable in position.

b. Two hubs are provided for the supply feature: 2-inch and 4-1/2-inch. Select the hub suitable for the tape reel to be loaded and push it over the shaft of the turntable. Park the hub not in use on the shaft attached to the inside of the top cover.

c. Place the tape reel over the hub, three-hole side down.

1. 2-inch Hub. Hold the tape reel against the hub and rotate the hub four or five times in the direction in which the tape reel is wound, to bind the tape firmly to the hub.

2. 4-1/2-inch Hub. Place the tape reel over the hub three-hole side down and engage the tape trailer in the hub slit.

d. Feed the tape leader through the gate of the turntable. Make sure that the clip over the gate is in position.

e. Feed the tape leader around the back of the supply tension roller, and pull off sufficient tape to load the rest of the 2671.

Step 3: Loading Reels onto Center-Roll Feature

a. If the center-roll feature is not showing uppermost, pull the turntable key to release the turntable (see Figure 13). Rotate the turntable so that the center-roll feature is uppermost. The turntable key will automatically re-engage to lock the turntable into position.

Notes:

1. With center-wound tape reels, the tape leader is on the inside of the reel and the tape trailer is on the outside of the tape reel.

2. Center-wound tape reels may have been wound clockwise or counterclockwise.

3. If the tape trailer feeds directly into the spring clip, the reel is clockwise-wound. If the tape trailer loops into the spring clip, the reel is counterclockwise-wound (Figure 14).

Clockwise-Wound Tape

Spring Clip

Trailer

Counterclockwise-Wound Tape

Spring Clip

Trailer
(looped back)
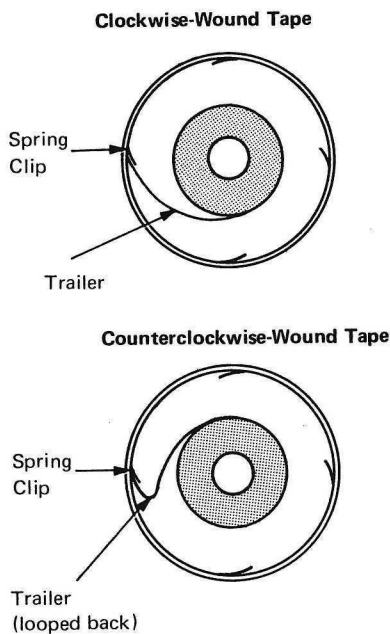
Figure 14. Center-Roll Feature: Identification of Clockwise-Wound and Counterclockwise-Wound Tape   [08276]

b. Place the tape reel three-hole side down over the rollers of the center-roll feature (Figure 15a).

i. *Clockwise-Wound Tape Reels:* Feed in the tape leader to the right of the trip roller (Figure 15b). Feed in the tape leader to the right, around the lower tapered guide. Feed the tape leader back under the clip on the upper tapered guide. Pull a sufficient length of tape off the tape reel to load the rest of the 2671.

ii. *Counterclockwise-Wound Tape Reels:* Feed the tape leader around the back of the fixed roller to the left

of the trip roller (Figure 15c). Feed the tape leader around the front of the trip roller. Feed the tape leader back under the clip on the upper tapered guide. Pull a sufficient length of the tape off the reel to load the rest of the 2671.

a. Center Roll

Clip

Fixed Roller

Trip Roller

Spring Clip

Tapered Guides

b. Center Roll: Clockwise-Wound Tape

c. Center Roll: Loading Counterclockwise-Wound Tape
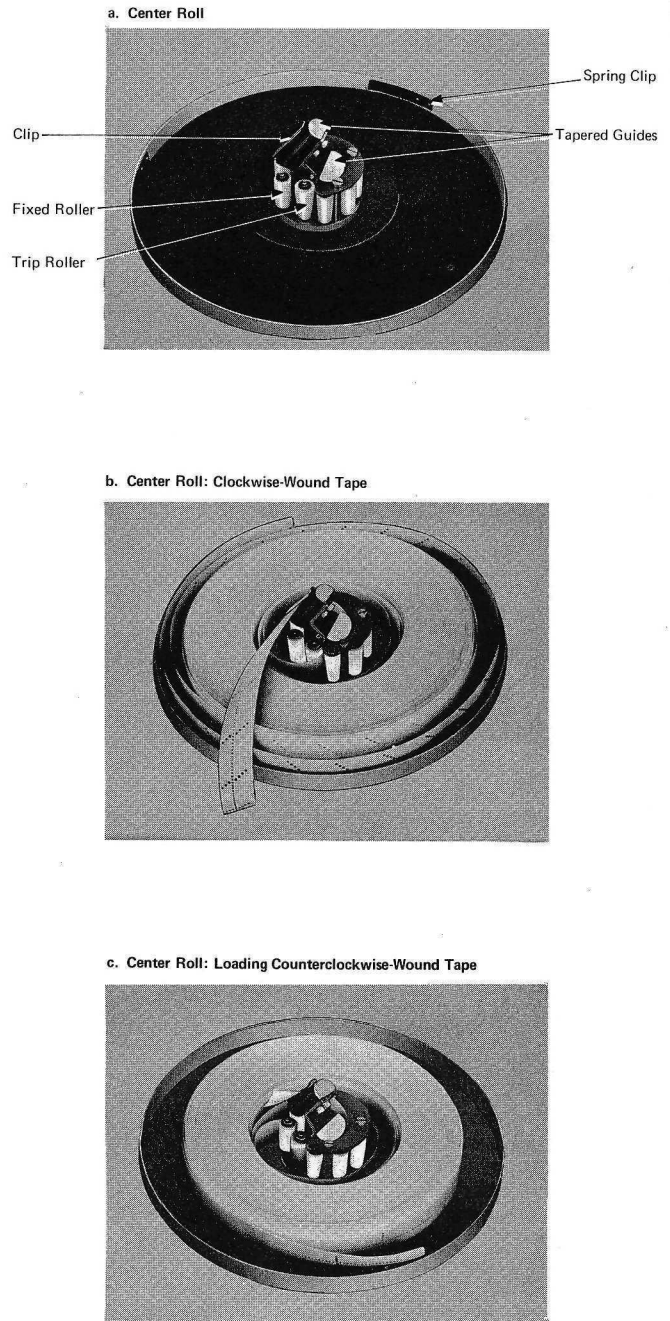
Figure 15. Step 3: Loading Reels onto Center-Roll Feature   [08314]

Step 4: Loading Supply Stacker

a. Turn the supply clutch lever (Figure 16) fully to the left.

b. Feed the tape leader into the supply stacker, between the supply stacker tape guide and rear sideplate of the supply stacker.

c. Wrap the tape around the supply stacker guide and pull the tape leader clear of the supply stacker.

CAUTION

Item d is mandatory. If this item is not done the tape will be broken or torn.

d. Turn the supply clutch lever so that the lever is perpendicular to the stacker walls.

Supply Clutch Lever

Supply Stacker Tape Guide

Supply Stacker

Tape Leader
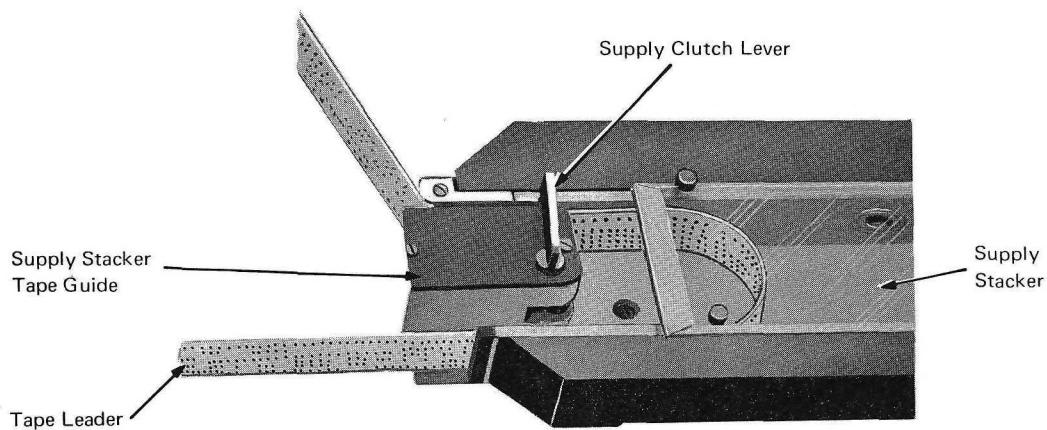
Figure 16. Step 4: Loading Supply Stacker   [08315]

a. Turn the supply clutch lever (Figure 16) fully to the left.

b. Feed the tape leader into the supply stacker, between the supply stacker tape guide and rear sideplate of the supply stacker.

c. Wrap the tape around the supply stacker guide and pull the tape leader clear of the supply stacker.

CAUTION

Item d is mandatory. If this item is not done the tape will be broken or torn.

d. Turn the supply clutch lever so that the lever is perpendicular to the stacker walls.

Supply Clutch Lever

Supply Stacker

Supply Stacker Tape Guide

Tape Leader

Figure 16. Step 6: Loading Supply Stacker [08212]

Step 5: Setting the Rotating Tab

Set the rotating tab against the take-up stacker guide (Figure 17) so that the tape is diverted to the front of the 2671.

Note: In this position the tab operates the take-up switch to prevent the take-up motor from running.
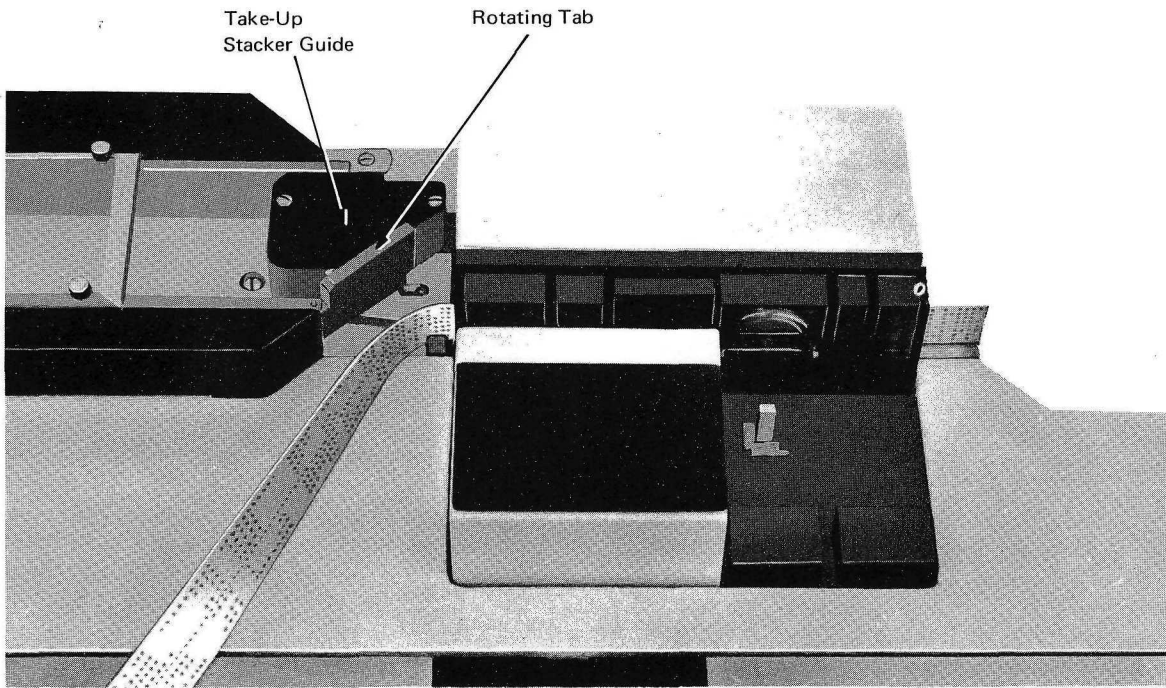
Figure 17. Step 5: Setting the Rotating Tab   [08316]

Step 6: Loading Tape into Read Head

a. With hands spaced apart to the width of the read head, insert the tape three-hole side down vertically into the read head (Figure 18).

CAUTION
Unless the tape is fully into the read head, it will be changed by the tape guides during the next operation.

b. Make sure that the tape is seated on the bottom tape guides, then press the left-hand top key to reset the retractable tape guides.

c. Check that the retractable tape guides have cleared the top of the tape, then gently move the tape a little to check that the tape can move freely.
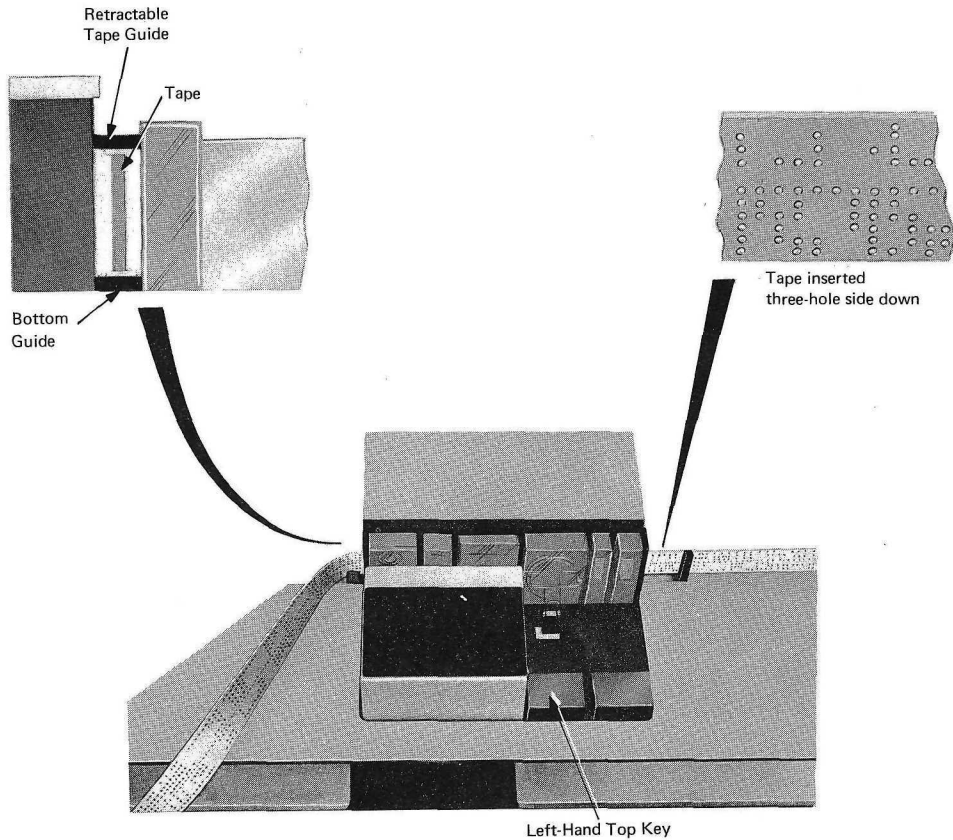
Figure 18. Step 6: Loading Tape into Read Head   [08317A]

Step 7: Positioning the Tape Basket

a. Position the tape basket (see "Specification of Tape Basket" in "Introduction") in front of the 2671 and directly below the end-of-record switches.

b. Guide the paper tape into the basket by hand.

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Step 8: Loading Tape onto Take-Up Feature

a. Set the rotating tab so that it is in line with the take-up stacker (Figure 19a).

b. While depressing the pressure pad at the back of the take-up stacker guide, place the tape around the left-hand side of the stacker guide, and insert it into the gap between the pressure pad and the stacker sideplate; ensure that there is sufficient tape through the stacker guide to reach the take-up reel.

c. Check that the tape is fully into the gap, then release the pressure pad.

d. Raise the tape latch handle on the top of the take-up reel to release the tape clamp (Figure 19b).

e. Thread about 1 in. (2,5 cm) of tape from the left to right behind one of the pins immediately in front of the tape clamp (Figure 19c).

f. Check that the tape is resting on the surface of the reel, then close the tape latch handle, to secure the tape with the tape clamp.

g. Slowly rotate the take-up reel clockwise to wind up all slack tape, including any slack in the take-up stacker.
Note: During read operation of the 2671, the tape will be drawn into the stackers with assistance of air suction through louvres at the closed end of the stackers.

a. Positioning Tape around Stacker Guide

Tape Pressure Pad
Stacker Guide
Rotating Tab

b. Releasing the Tape Clamp

Tape Latch Handle
Tape Clamp
Pin
Take-Up Reel

c. Tape Loaded onto Take-Up Reel

Tape positioned behind pin
Wind-Up Direction
All slack tape removed

Figure 19. Step 8: Loading Tape onto Take-Up Feature [08318]

8

Step 8: Loading Tape onto Take-Up Feature

a. Set the routing tab so that it is in line with the take-up stacker (Figure 19a).

b. While depressing the pressure pad at the back of the take-up stacker guide, place the tape around the left-hand side of the stacker guide, and insert it into the gap between the pressure pad and the stacker sideplate; ensure that there is sufficient tape through the stacker guide to reach the take-up reel.

c. Check that the tape is fully into the gap, then release the pressure pad.

d. Raise the latch handle on the top of the take-up reel to release the tape clamp (Figure 19b).

e. Thread about 1 in. (2.5 cm) of tape from the left to right behind one of the pins immediately in front of the tape clamp (Figure 19c).

f. Check that the tape is resting on the surface of the reel, then close the tape latch handle, to secure the tape with the tape clamp.

g. Slowly rotate the take-up reel clockwise to wind up all slack tape, including any slack in the take-up stacker.

Note: During read operation of the 3671, the tape will be drawn into the stacker with assistance of air suction through louvres at the closed end of the stackers.

b. Releasing the Tape Clamp

c. Tape Loaded onto Take-Up Reel

Figure 19. Step 8: Loading Tape onto Take-Up Feature

Step 9: Reading (Remote Powering)

a. Push the top cover shut, except when strip feeding.
b. Set up the EOR character (if any) on the end-of-record switches.
c. Set on the delete switch, if required.
d. Set on the track suppress switch, if required.
e. Set the parity switch to ODD, EVEN, or NONE, as required.
f. Press the end-of-file pushbutton if the record is the last (or the only one) of a series of records.
g. Press the start pushbutton (ready lamp should light).
  Notes:
  1. If the ready lamp does not light, refer to "Ready Lamp" in the "2671 Controls and Lamps" section for the possible causes.
  2. The 2671 will read the tape under the control of System/360.
  3. If possible, operate the 2671 with the top cover shut to keep out any room dust.

Step 10: Reading (Local Powering)

a. Push the top cover shut, except when strip feeding.
b. Press the power-on-and-reset pushbutton.
c. Set up the EOR character (if any) on the end-of-record switches.
d. Set on the delete switch, if required.
e. Set on the track suppress switch, if required.
f. Set the parity switch to ODD, EVEN or NONE, as required.
g. Press the end-of-file pushbutton, if this record is the last (or the only one) of a series of records.
h. Press the start pushbutton (ready lamp should light).
  Notes:
  1. If the ready lamp does not light, refer to "Ready Lamp" in the "2671 Controls and Lamps" section for the possible causes.
  2. The 2671 will read the tape under the control of System/360.
  3. If possible, operate the 2671 with the top cover shut to keep out any room dust.

9
——
10

Tape Loading, Unloading, and Rewinding 45

Step 9: Reading (Remote Powering)

a. Push the top cover shut, except when strip feeding.
b. Set up the EOR character (if any) on the end-of-record switches.
c. Set on the delete switch, if required.
d. Set on the track suppress switch, if required.
e. Set the parity switch to ODD, EVEN, or NONE, as required.
f. Press the end-of-file pushbutton if the record is the last (or the only one) of a series of records.
g. Press the start pushbutton (ready lamp should light).

Notes:

1. If the ready lamp does not light, refer to "Ready Lamp" in the "2671 Controls and Lamps" section for the possible causes.
2. The 2671 will read the tape under the control of System/360.
3. If possible, operate the 2671 with the top cover shut to keep out any room dust.

Step 10: Reading (Local Powering)

a. Push the top cover shut, except when strip feeding.
b. Press the power-on-and-reset pushbutton.
c. Set up the EOR character (if any) on the end-of-record switches.
d. Set on the delete switch, if required.
e. Set on the track suppress switch, if required.
f. Set the parity switch to ODD, EVEN or NONE, as required.
g. Press the end-of-file pushbutton, if this record is the last (or the only one) of a series of records.
h. Press the start pushbutton (ready lamp should light).

Notes:

1. If the ready lamp does not light, refer to "Ready Lamp" in the "2671 Controls and Lamps" section for the possible causes.
2. The 2671 will read the tape under the control of System/360.
3. If possible, operate the 2671 with the top cover shut to keep out any room dust.

UNLOADING INSTRUCTIONS

Unloading Read Head

1. Depress cover catch and raise the cover.
2. Press the NPRO pushbutton until the tape is clear of the read head.
3. Push top cover shut, except if take-up feature is in use.

Unloading the Take-Up Feature

1. Lift up the latch handle to release the tape reel.
2. Lift off the tape reel.
3. Push down latch handle.
4. Push top cover shut, except if reloading tape.

Power Off (If In Local Mode)

If the 2671 is operating in local mode (the local/remote switch in the 2822 is set to LOCAL) and if the 2671 is no longer required for use:

Press the power-off-in-local pushbutton; the lamp in the power-on-and-reset pushbutton will go out.

REWINDING INSTRUCTIONS

If the center-roll feature is fitted, there is no need to rewind tape reels.

If only the supply feature and the take-up feature are fitted, it is necessary to rewind every tape reel after use as follows:

1. Follow the "Unloading Instructions".
2. Follow steps 1, 2, 4, 6, and 8 of the "Loading Instructions".
3. Press the NPRO pushbutton until the tape is rewound on the take-up feature.

CAUTION

Do not attempt to rewind directly from the supply feature to the take-up feature without passing through the read head; otherwise, the tape can be broken or torn.

Unloading Read Head

1. Depress cover catch and raise the cover.
2. Press the NPRO pushbutton until the tape is clear of the read head.
3. Push top cover shut, except if take-up feature is in use.

Unloading the Take-Up Feature

1. Lift up the latch handle to release the tape reel.
2. Lift off the tape reel.
3. Push down latch handle.
4. Push top cover shut, except if reloading tape.

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1. Follow the "Unloading Instructions".
2. Follow steps 1, 2, 4, 6, and 6 of the "Loading Instructions".
3. Press the NPRO pushbutton until the tape is rewound on the take-up feature.

CAUTION

Do not attempt to rewind directly from the supply feature to the take-up feature without passing through the read head, otherwise, the tape can be broken or torn.

ABBREVIATIONS

ac	Alternating Current
BCD	Binary Coded Decimal
CE	Customer Engineer (IBM)
dc	Direct Current
EBCDIC	Extended Binary-Coded-Decimal Interchange Code
EOF	End of File
EOR	End of Record
EOT	End of Tape
I/O	Input/Output
NPRO	Nonprocess Runout
USASCII	United States of America Code for Information Interchange

GLOSSARY

Blank Character:

Feed Holes

Blank Tape:

Byte:

Data Register

Output

8 Bits + Parity Bit
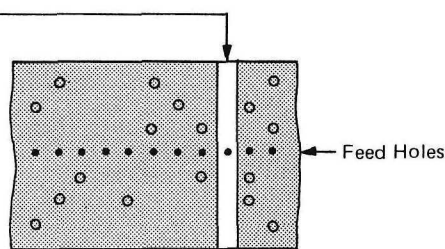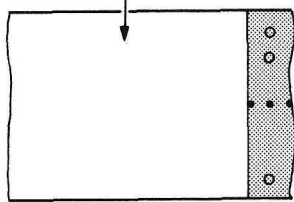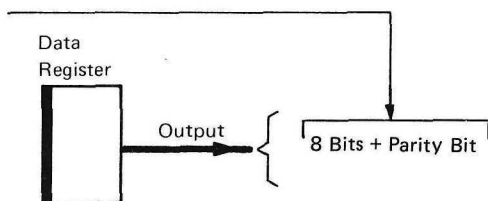
Chad:

Channel Contention: The channel is busy with another I/O unit at a time when the 2671/2822 requires to transmit data.

Check: A fault or a stop condition.

Degate: To close the gates at the standard I/O channel interface to data traffic.

Delete Character: All tracks punched (whether 5, 6, 7, or 8 in number); made during punching by adding the necessary additional holes to a wrongly-punched character.

EOR Character: A specific paper tape code that means that the end of a record is reached.

Null Character: Same as *Blank Character.*

Nonprocess Runout (NPRO): The feeding of tape through the 2671 without the tape being read (for example, as in rewinding).

Overstep: The condition caused by the tape not stopping with a character over the read head.

Track Suppression: The reading of holes punched in a particular track is ignored by the 2671/2822, and the track output is held to zero.

Tape Creep: The condition caused by the tape moving gradually when it should be stationary.

ABBREVIATIONS

ac	Alternating Current
BCD	Binary Coded Decimal
CE	Customer Engineer (IBM)
dc	Direct Current
EBCDIC	Extended Binary-Coded-Decimal Interchange Code
EOF	End of File
EOR	End of Record
EOT	End of Tape
I/O	Input/Output
NPRO	Nonprocess Runout
USASCII	United States of America Code for Information Interchange

GLOSSARY

Block Character.

Block Tape.

Channel Contention: The channel is busy with another I/O unit at a time when the 2671/2822 requires to transmit data.

Check: A halt or a stop condition.

Dequet: To close the gates at the standard I/O channel interface to data traffic.

Delete Character: All back is punched (whether 5, 6, 7, or 8 is number), made during punching by adding the necessary additional holes to a wrongly-punched character.

EOR Character: A specific paper tape code that marks that the end of a record is reached.

Null Character: Same as Blank Character.

Nonprocess Runout (NPRO): The feeding of tape through the 2671 without the tape being read (for example, as in rewinding).

Overtape: The condition caused by the tape not stopping with a character over the read head.

Track Suppression: The reading of holes punched in a particular track is ignored by the 2671/2822, and the track output is null to zero.

Tape Creep: The condition caused by the tape moving gradually when it should be stationary.

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