

IBM

Customer Engineering
Reference Manual

353 Disk Storage

354 Disk Control

IBM Machine Record

MACH TYPE	SERIAL NUMBER	VOLTAGE	AC <input type="checkbox"/>	DC <input type="checkbox"/>	CYCLES	DATE INSTALLED
353						
354						

SYSTEM DIAGRAMS EC LEVEL	PLANT INSTALLED SPECIAL FEATURES			
	DESCRIPTION	QTY	DESCRIPTION	QTY

FIELD INSTALLED SPECIAL FEATURES						
CEM NO.	DIAGRAM OR B/M NO.	DESCRIPTION OF FEATURE	INSTALLED		REMOVED	
			MAN NO.	DATE	MAN NO.	DATE

Issued to: _____

Branch Office: _____

Department: _____

Address: _____

If this manual is misplaced, it should
be returned to the above address.

IBM **Customer Engineering Reference Manual**
353 Disk Storage
354 Disk Control

This edition, Form 227-5583-1, incorporates major changes and additions to Form R27-5583-0. The latter form is made obsolete by these changes.

Section 2 of this manual contains reference material that is specifically intended for the 353 Disk Storage and the 354 Disk Control. Most of the service checks, adjustments, and removal and replacement procedures for the 353 Disk Storage are the same as those for the 1301 Disk Storage. The procedures that are the same are not included here, but are found in the 1301 Disk Storage Customer Engineering Reference Manual (Form 227-5581).

INSTALLATION INSTRUCTIONS 5

Section 1. SCHEDULED MAINTENANCE
This section describes scheduled maintenance objectives and procedures. The accepted inspection routine is given in detail 1.1

Section 2. SERVICING PROCEDURES
This section includes adjustments, removals, replacements, waveforms, levels, and performance tests of machine areas and functional units 2.1

Section 3. SERVICE AIDS
This section contains specific trouble symptoms and cures, scope aids, lubrication charts, and servicing hints. 3.1

Section 4. LOCATIONS
This section gives locations of all major components and functional units. 4.1

Section 5. SPECIAL TOOLS AND SUPPLIES
This section lists and describes the tools and supplies that are specifically designed for this machine or are necessary for proper servicing of this machine 5.1

SAFETY

Personal safety cannot be overemphasized. To ensure your own safety, make it an every day practice to follow safety precautions at all times. Become familiar with and use the safety practices outlined in IBM pocket-size cards, Forms 124-0002 and MO4-8401, issued to all Customer Engineers.

Exercise caution when working around moving parts of the machine. Parts of the body or clothing near the machine can cause accidents if the machine starts unexpectedly. These accidents can be prevented.

Potential difference within the power contactor gate is -48 v DC to +208 v AC. Potential difference within the electronic gates, printed cards, and display back panel is -48 v DC to +30 v DC. Do not remove or replace circuit cards when DC power is on.

Do not short out or bypass any safety feature. One such feature is the access cover door safety switch. Do not allow the access to run with this door open by manually energizing this cover safety switch. Also note that although the actuator is electronically interlocked with this door open, if for any reason the solenoid DC power goes off the actuator will attempt to move under hydraulic pressure.

Access Mechanism

Because of the random and sometimes unpredictable motion of the access mechanism, it should be serviced with caution. Shields and guards have been provided which can be of assistance only when firmly in place.

Care should be taken to remove the access assembly according to outlined procedures. Two men must be available to handle this unit since it weighs approximately 60 pounds and the mounting screws are accessible only from the rear of the supporting strut.

Power Supplies

When a DC failure is sensed, a DC off sequence is initiated but power remains on at the gate blowers, convenience outlets, and disk drive motor. Do not depend on this feature as safety protection.

Always use fuse pullers to remove or insert fuses. Replace plastic protective covers over fuses immediately after replacing fuse.

The power supplies are heavy and should be

removed with care. Remove line cord from power receptacle and wait at least 15 seconds after power is turned off before attempting any repair or adjustment within any power supply.

High Voltages

High voltage lines and connections exist in many areas within the machine. Such voltages are found on transformers, terminals, convenience outlets, and the like. Contactor relays utilize high voltages at their points. Check these contactor relays with the power on only if absolutely necessary, and use extreme caution.

Power On States

Before the file is brought up to running condition from the power sequence panel, it may exist in one of several states of power on. In all cases, the following assumptions are made:

1. The file is plugged into the wall.
2. The wall plug is at the specified potential.

Mainline (70 amp C. B.) switch OFF.

1. 208-230 volts AC is present at:
 - a. input and output of mainline filter
 - b. input to the mainline switch

Mainline switch and CB-2 (30 amp C. B.) ON.

1. 208-230 v AC is present at:
 - a. input and output of mainline filter
 - b. input and output of mainline switch
 - c. input and output of CB-2
 - d. input to K-2, K-3, K-4
 - e. T1
2. 110 v AC is present at:
 - a. convenience outlet
 - b. TB204, TB203
 - c. T1
3. 24 v AC is present at:
 - a. T1
 - b. TB204
 - c. power sequence panel

When working in these areas, remove the input power cord or turn off AC power at customer's wall switch.

1. Remove packing material as specified in unpacking instructions. Do not install drawers.
2. Inspect machine for shipping damage, especially in the power contactor box, hydraulic power supply, and SMS gates.

WARNING: Applying power to a machine with loose or damaged connections in these areas can cause damage to the machine and its surrounding area.

3. Connect all power cables from mechanical frame to electronic frame before securing them. Level electronic frame with mechanical frame.
4. Swing out the receiver (see * Receiver Swing Out, Section 2).
5. Clean the disks (see * Disk Cleaning, Section 2).
6. As the drawers are installed (see * Drawer Replacement, Section 2), inspect the drawer and clean heads. These units are adjusted at the plant so they will be interchangeable with each other.
7. Swing receiver into the array (see * Receiver Swing-In, Section 2). Check for binds in loading mechanism.
8. Manually load and unload heads to ensure correct alignment.

WARNING: Never load or unload the heads when they are out of the array.

9. Push access fully into disk array against inner crash stop.
10. Check that the carriage-way wipers are not

dry and that the way is not dirty.

11. Replace actuator shield.
12. Before applying power, check that the voltage at outlet agrees with the amount shown on the nameplate.
13. Start disk drive motor and check disk rotation as indicated by arrow on filter frame. Turn on electronic DC, gate blowers, solenoid DC, and hydraulic power supply.

WARNING: Do not load the heads.

14. Reinspect drawer profiles.
15. Allow the disk array to run (purge) for 1-1/2 hours before loading the heads.
16. Load heads for 30 minutes.
17. Unload heads and turn machine off. Check rundown time of disk array and compare it to the run-down time recorded on the decal in the power sequence gate. Run-down time at installation should not be shorter than recorded time minus four minutes.
18. After the disks have come to a complete stop, remove the access cover and again inspect and clean heads and disks.
19. Manually load and unload heads to ensure correct alignment.
20. Replace actuator shield.
21. Purge system for 15 minutes before loading heads.
22. Reinspect the heads and disks again at the end of the first, second and third week of operation. After that time refer to the Scheduled Maintenance Routine Chart in Section 1 for correct inspection frequency.

* Refer to 1301 CE Reference Manual

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APPROACH TO SCHEDULED MAINTENANCE

The prime objective of any maintenance activity is to provide maximum machine availability to the customer. Every scheduled maintenance operation should assist in realizing this objective. Unless a scheduled maintenance operation decreases machine downtime, it is unnecessary.

With the exception of the gimbal torques, do not adjust or disassemble a unit that is working properly, even if tolerances vary from those specified.

Absolute cleanliness is essential to proper operation and maintenance of this machine. A Hoover 86 vacuum or one of comparable efficiency should be used to ensure cleanliness of machine components and surrounding areas.

Visual Inspection

Visual inspection is the first step in every scheduled maintenance operation. Always look for corrosion, dirt, wear, cracks, binds, burned contacts, and loose connections and hardware. Alertness in noticing these items may save machine downtime later.

SCHEDULED MAINTENANCE PROCEDURES

Specific items of scheduled maintenance are scheduled on punched cards processed in the Central Processing unit for the branch office. Details of scheduled maintenance operations are listed in the "Scheduled Maintenance Routine Chart." During normal scheduled maintenance, perform only those operations listed on

the chart for that maintenance period. Details on adjustments, service checks, and removal and replacement are given in the pages listed in the index column of the chart (Figure 1-1). Observe all safety practices.

Solid-State Circuits

Diagnostic programs are the basic tools used in scheduled maintenance of solid-state circuits. These are effective in locating potential and intermittent troubles. These items are also excellent troubleshooting tools. When using them for scheduled maintenance, use them only as directed on the scheduled maintenance chart. Diagnostic programs are available through the system to which the machine is attached.

Do not adjust pulses unless the condition of the machine warrants it.

Mechanical Units

Three basic scheduled maintenance steps that are performed on every machine are cleaning, lubrication, and inspection. Remember, do not do more than recommended scheduled maintenance on equipment that is operating satisfactorily.

ELECTRONIC SCHEDULED MAINTENANCE ROUTINE

Motion Oscillator Check -- 05.16.01.1

Check the output of the motion oscillator (pin A of TDS- at 01A2E08) and adjust if necessary. This adjustment

must be made only when the actuator is stationary.

1. If the actuator is cold, the oscillator should be on low range (-12 volts not being applied to 01A2E08C). The time for one cycle is between 6.1 to 6.8 milliseconds.
2. With the actuator at normal operating temperature and -12 volts to 01A2E08C, adjust the oscillator to $4.125 \pm .100$ milliseconds. If it is necessary to check and adjust this before temperature of oil reaches normal, it will be necessary to clip -12 volts to 01A2E08C, by-passing the thermal switch. Be sure to remove this jumper.

Access Time Check -- 06.03.01.1

Access time is the interval from the instant that a change in the track portion of the locate register is detected until the end operation trigger is set. Sync on the desired change in the track portion of the locate register and check the time from the change to the following set of the end operation trigger. The oil temperature must be normal and the oscillator must be at $4.125 \pm .100$ ms.

1. Set the address of any cylinder, 1 through 15, into the access register. Set and reset the register. Maximum access time should be 84 milliseconds.
2. Set the address of any cylinder, 16 through 63, into the access register. Set and reset the

register. Maximum access time should be 153 milliseconds.

3. Set the address of any cylinder, 64 through 255, into the access register. Set and reset the register. Maximum access time should be 223 milliseconds.

Head Motion Check -- 04.52.01.1 or 04.53.01.1

"Head motion" is an indication that the access has not slowed enough to allow the detent to be inserted safely.

1. Adjust the detent safety integrator (TED- 6B09 or 6D09) so a single pulse at the input (pin D) causes a +N pulse out (pin A) of at least 7 milliseconds duration.
2. Set address 50 in the access register. Set and reset the register and observe 01A4H15A with an oscilloscope. If the signal looks like Figure 1-2, the integrator pulse is too narrow and should be increased so the picture appears as Figure 1-3.
3. Set and reset different addresses in the access register, detent safety must resemble Figure 1-3 on any address change greater than 50 cylinders.
4. Address changes from 10 to 49 should also resemble Figure 1-3, but the shorter strokes may begin to resemble Figure 1-2. Address changes of less than 10 cylinders will be very erratic about indicating not detent safety condition.

CODE	UNIT	FREQ. WEEKS	LUBRICATE -- CLEAN	OBSERVE	PAGE
8	Electronic Circuits	4		Perform Electronic Routine	1.1
9	Actuator		Do not use any solvent on any actuator moving parts. Wipe actuator way clean with a clean lint-free tissue, dampened with IBM #6. Leave a light film of oil on ways. Put 5-6 drops of IBM #6 on the wipers. Do not saturate wipers.	After oiling and cleaning actuator way, check gib adjustment. Check wipers for wear - replace if worn, or if excessively blackened. Check that aluminum wiper holders do not touch housing ways. Check output shaft seal for leaks. If felt wiper of shaft seal appears saturated, the seal is leaking and should be replaced. Check felt oil retainers. Replace when over saturated with oil.	
9	Hydraulic Power Supply		Add oil to reservoir as required.	Check system pressure 550 ± 10 PSI. Check pressure differential across mechanical filter. Record pressure drop on decal inside power sequence gate. Replace filter if pressure drop is 35 PSI or greater or if it has decreased more than 5 PSI since last reading. Do not clean. Return filter to San Jose. Check oil temp- $120^\circ \pm 3^\circ\text{F}$. Check cooling system pressure 50 ± 10 PSI.	
0	Blowers & Filters	8	Lubricate the three blower bearings with IBM #6	Check SMS gate filters. If dirty, clean by flushing with hot water. Shake and let drip dry. Check power supply blower filter.	
1	Data & Clock Head & Arm Assembly		Remove any accumulated dirt from arm assembly. If required, clean heads with lint free tissues, isopropyl alcohol, and head cleaning paddle. Absolute Cleanliness is Essential.	Check all heads for smooth surface finish. Check head for freedom in cone pivots - - pitch and roll 30 grams maximum. Pitch 10 grams and roll 3grams minimum. Use gram gage P/N 2108473.	
0	Disk Array Filter	26		The disk array filter will normally last 3 years on single shift operation. However, adverse environmental conditions can cause it to become heavily clogged. Replace this filter if it has over 1/4" of dirt accumulation or at the end of 3 years. Mark installation date on new filter.	
9	Base			Check line cards for safe condition and grounding. Check run-down time and compare it with run-down time recorded on decal on power sequence gate door. Replace motor if run-down time is less than 60% of original run-down time.	
1	Head Load Linkage	52	Oil head load linkage with IBM #6. Oil sparingly. These links are not high speed and are seldom operated. Lubricate rack assembly and gear rack block assembly sparingly with IBM#6.		
9	Compressed Air System		Open shut-off valve on air-pipe air line to drain any accumulated moisture from the tank.	Check that system pressure is between 42 and 44 PSI with heads loaded. Compressor should turn on no more often than once every 30 minutes. If frequency increases, check air system for leaks. Compressor should pump up system fully and turn off within 45 seconds.	
9	Hydraulic Power Supply		Replace magnetic filter. Do not clean. Return filter to San Jose.		

Figure 1-1. Scheduled Maintenance Routine Chart



Figure 1-2. Short Stroke

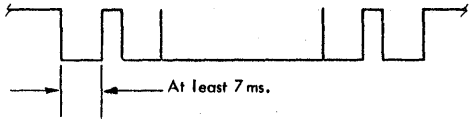


Figure 1-3. Long Stroke

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* Refer to 1301 CE Reference Manual

DISK ARRAY

INDEX HEADS

Service Check

The +N early index out of ANZZ 6B18 B and G should be a minimum of 25 microseconds (Figure 2-1).

If the output resembles Figure 2-2, check inputs for a minimum negative shift of 1.3 volts. If less, the transducer air gap must be adjusted.

DISKS

Removal and Replacement

The removal and replacement procedure for this unit is the same as that for the 1301 with the following exception:

If the data from the disks does not have to be retrieved after reassembly, it is not necessary to scribe the data disks. However, the sector, index, and address disks should be scribed to allow realignment during reassembly.

CLOCK HEAD

The service procedures for the 353 are the same as those for the 1301 with the following exceptions:

The clock frequency of the 353 is $270 \text{ kc} \pm 1\%$.

The 353 clock can be rewritten using the CE clock write box:

1. Disconnect normal clock circuits and connect clock write box as noted on page 03.01.01.0 of the system diagrams.
2. Erase the old track by depressing the Erase key for at least one disk revolution.
3. Depress the Write key for at least one disk revolution.

HYDRAULIC ACTUATOR

Service Check

The service check for this unit is the same as that for the 1301 with the following exception:

Replace the step of the service check that says "Set Access Inop," with "Set CE test switch on CE panel to CE position."

Removal and Replacement

The removal and replacement procedure for this unit is the same as that for the 1301 with the following exception:

When measuring the resistance of the detent detector coil, refer to system diagrams page 04.52.01.1.

LIMIT SWITCHES

Inner Limit Switch

Service Check

The service check for this unit is the same as that for the 1301 with the following exception:

The inner limit switch must be made when the carriage is at cylinder 256, and not made when the carriage is at cylinder 255.

Adjustment

The adjustment procedure for this unit is the same as that for the 1301 with the following exception:

Adjust the eccentric adjusting screw until the switch is made at cylinder 256 and not made at cylinder 255.

ACCESS TIME

Service Check

Access time is the interval from the instant that a change in the track portion of the locate register is detected until the end of the operation trigger is set. Sync on the desired change in the track portion of the locate register and check the time from the change to the following set of the end operation trigger. The oil temperature must be normal and the oscillator at $4.125 \pm .100 \text{ ms}$.

1. Set the address of any cylinder, 1 through 15, into the access register. Set and reset the register. Maximum access time should be 84 milliseconds.
2. Set the address of any cylinder, 16 through 63, into the access register. Set and reset the register. Maximum access time should be 153 milliseconds.
3. Set the address of any cylinder, 64 through 255, into the access register. Set and reset the register. Maximum access time should be 223 milliseconds.

POWER SUPPLIES

DC SUPPLIES

There is a 750 watt supply in the 353 and a 2000 watt supply in the 354; these supplies are standard 400-cycle 7030 system supplies and are serviced in a like manner.

ELECTRONIC COMPONENTS

READ CIRCUITS

WARNING: Do not put scope probes, leads or jumpers of any kind on the lines coming directly from the data heads. The heads can be damaged and/or data destroyed by possible potential differences.

The peak-to-peak signal at the input to the pre-amplifier (ANG-) should not be less than 15 millivolts, or more than 70 millivolts for any 300 microsecond period. Waveforms showing input and output signals for special circuit cards are in system diagrams manual.

Read Amplifier Calibration

Three potentiometers have been used in the read amplifiers and bit detectors to facilitate setting the regulated signal output and the bit detection threshold. The following calibration procedure is recommended:

1. Deselect the heads by depressing GENERAL RESET on the Disk Synchronizer, and balance the DC level appearing at pins H and G of the Overdriven and Limiter Amplifier (AMX-) to within 0.1 volt of each other by means of the potentiometer on the card.
2. Set the machine to a continuous read condition on the track and sector. Cylinders around 132 should be used because the amplitude difference between single bit and all bit patterns at that location will be slight.
3. Use a 1-to-1 or a X10 compensated probe with a wide band (2 mc or greater) preamplifier. Sync on index; use an expanded scale of about 50 microseconds per cm, and observe an AGC burst on pins A and F of the second Linear Amplifier (ANF-) (Figure 2-3).
4. Adjust the voltage level that appears at these pins for a value of from 6 v to 6.25 v by means of the potentiometer on the AGC Detector (AUE-).
5. If this voltage level cannot be obtained, the AGC Detector (AUE-), the Variable Gain

Amplifier (ANE-), and the subsequent two linear amplifiers (ANF-) should be checked.

NOTE: On some machines, the card code for the AGC Detector may be listed as ANH-; AUE- is the later designation.

6. Referring to Figure 2-4, observe the waveform that appears at pin A of the OR- AND (ANW-) and by means of the potentiometer on this card adjust the clipping level to 50%.

NOTE: This is easily accomplished by maintaining E2 (Figure 2-4) at a constant vertical deflection of one cm (by means of the oscilloscope variable voltage control), and by adjusting the potentiometer on the OR- AND (ANW-) to obtain a vertical oscilloscope deflection of two cm for E1 (Figure 2-4).

It is very important that the base line of reference used for measuring the clipping level be after the recovery time as shown. Any overshoot is to be disregarded in the measurement of the 50% level.

DISK SURFACE REQUIREMENTS

The 353 disks are mechanically and electronically perfect.

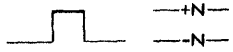


Figure 2-1. Correct Index Pulse

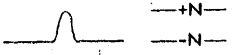


Figure 2-2. Incorrect Index Pulse

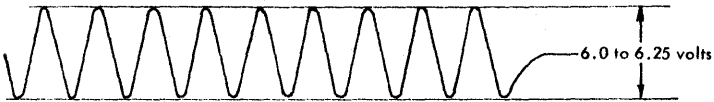


Figure 2-3. Voltage Output of Second Linear Amplifier

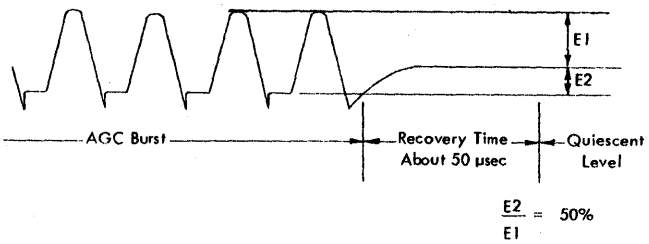


Figure 2-4. Read Amplifier Clipping Level

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TROUBLESHOOTING HINTS

WARNING: Voltage is present on both sides of most circuit cards. Metal caps of transistors are often a part of the circuit. Avoid pulling or replacing cards when power is on since a resultant short could damage transistors or other circuit components.

Solenoid Driver No. 2 (TDR-) must never have -48 v on it alone. If this card is removed from the gate there is a possibility of this condition occurring. Solenoid DC and electronic DC must be turned off prior to removing this card.

Intermittent problems can sometimes be aggravated by vibration. Tapping the edge of the cards with the plastic end of a screw driver in the area suspected should be sufficient. Caution is required since too violent a vibration can cause adjacent card components to short.

It may become necessary or desirable to jumper in signals or voltages to specific inputs or outputs to check certain functions. If this is done, be careful that the logic blocks are not overloaded because erroneous indications will result. More important is the use of voltages that can damage or destroy the transistors. For the majority of logic block cases, a properly placed ground will create the effect desired. All other cases must be treated individually based on knowledge of the circuits involved.

Special circuit card diagrams are shown in the system diagrams. Also shown are input and output waveforms for most of these cards.

Clamping

Clamping to Noncurrent State

A limiting resistor is not needed when clamping to the noncurrent state. +N is the noncurrent N line; clamp to +6 volts. -P is the noncurrent P line; clamp to -12 volts.

Clamping to Current State

A limiting resistor (5K to 7K, 1/2 watt) is necessary when clamping to the current state. -N is the current N line; clamp to -6 volts. +P is the current P line; clamp to ground.

Actuator Switching

The electrical connectors on the hydraulic actuators are interchangeable. Change these if you have determined that an actuator is failing. If the actuator is at fault, the mechanism will still fail even though the controls are switched.

Read Malfunctions

WARNING: Do not put scope probes, leads, or jumpers of any kind on the lines coming directly

from the data or format heads. The heads can be damaged and/or data destroyed by possible potential differences.

1. Failure of the read amplifier to reject line noise can be caused if the receiver is not electrically isolated from frame ground.
2. Read failures can be caused by a noncalibrated read amplifier or a too long, or too short, single-shot pulse.
3. Read failures can be caused if heads are not fully loaded. This condition will cause decreased output from all heads of a module. For this condition to occur, the heads loaded microswitch would also have to be in incorrect adjustment.

Read/Write Failures

1. Failure of the clock read circuit will cause read and write failures. Check that the clock line drive is gating and passing clock signals properly.
2. Incorrect adjustment or loosening of the carriage yoke assembly can cause read or write failures.
3. The input voltage must remain within $\pm 10\%$. This tolerance includes any variable combination of steady state and/or short duration transients.

Access Malfunctions

1. Failure to go to the correct cylinder can be caused by a blown fuse.
2. Access failure can be caused by a partially opened access door or by failure of the interlock.
3. Failure of the motion oscillator to switch to slow speed can cause the access to be set inop when the hydraulic oil is cold.
4. Excessive access time can be caused by failure of the oscillator to switch to high speed.

SERVICE CHECKS

Access Cover Safe Switch

When the access cover door is opened or removed, this switch will open and cause:

1. The access to be set INOP.
2. The access register set pulse to be blocked (from system).
3. Rezero to be held off.
4. Access Register to be held reset.

CAUTION: If solenoid DC is dropped for any reason, the actuator may attempt to move under hydraulic pressure. Service this unit with caution.

DC Voltages

1. The 48 v relay supply must be a minimum of 44.6 v and a maximum of 50.4 v.
2. The DC supply voltages must be within $\pm 2\%$ rated output voltage at the laminar bus on the gates.

STANDARD MODULAR SYSTEM MAINTENANCE

All normal maintenance of standard modular system components is found in Form 223-6900, Standard Modular System. Included in this form are:

Wrapped-Wire Connections
Crimped Connections
Soldered Connections
Wiring Rules
SMS Service Tools
SMS Card Maintenance
Measurements
Ventilating Systems

CE SERVICE AIDS

HYDRAULIC MANUAL SELECTOR VALVE

The hydraulic selector valve is used to check cooler system (CS), upstream (USP), and system pressures (SP). The selector valve can also be used to circulate (CIR) oil through the system. The selector valve should be in HP (home position) when the system is being used.

POWER SEQUENCE CONTROLS

The power sequence control panel (Figure 3-1) provides the facilities for starting and stopping the file during normal operations and ensures proper operation of file components. The sequence control may

be either automatic or manual. The manual control of power sequence has been provided for CE manual start and component check. The automatic control of power sequence is under control of a 4-minute timing device. Normally, initiation of START on the first file is under manual control. Subsequent files, in remote control, are started on receipt of a timed pulse during the sequencing of a preceding file. When the file is ready for normal operation, a "Power Sequence Complete" signal is sent from file to file. When this line is completed by the last file, the line indicates that the file sequence is complete for all files in remote control.

Indicator lights are provided as servicing aids for the Customer Engineer. They indicate both normal and abnormal conditions as long as the line 70-amp breaker is closed.

Power Sequence Panel

All power sequence functions are controlled by, and monitored at, this panel. The red lights indicate unsatisfactory conditions; the white lights indicate satisfactory conditions. Normal sequence is indicated by the small arrow heads next to the lights.

Auto Control Switch

This switch selects the originating point of the start or stop sequence signal. A remote signal normally originates at a previous file. A local signal originates with the start or stop switch on the power sequence panel.

Sequence Control Switch

Auto or manual sequence is selected by this switch. Auto sequence puts all functions under control of the sequence timer. Manual sequence allows the CE to select the time and sequence for most functions.

Damage to the heads or disks can result if the heads are loaded before the disks are at operating speed. To prevent this damage, the head load circuit is always directed through the timer 180-second contact. The disks and the timer, therefore, must run for 180 seconds before the heads can be loaded. In a stop sequence, the heads must be unloaded before the disk array is stopped.

System Function Lights

The remote start and remote stop lights have no significance on the 353. The start next file light indicates the delivery of a signal to the subsequent file.

Access Inop Lights

If any access is set INOP, manually or automatically, the associated inop relay picks, turning on the respective inop light.

Access Inop Switches

Manual operation of any of these switches causes an inop relay to be picked or tripped. Accesses that have been set inop by any method can be reset only by tripping the inop relays with these switches.

Auto Start Stop Controls

Auto local start and auto local stop are initiated with the start or stop switches. The start lock-up light comes on with the pick of R10 during an auto start sequence. The timer light is tied in parallel with the timer motor and is on whenever there is power to the timer motor. The cycle start light comes on with the pick of R111 at 15 seconds after the start of an auto power sequence start. During a manual sequence start, the cycle start light does not come on until the disk drive auxiliary (R32) picks. The stop lock-up light comes on when R47 picks during any stop sequence.

Disk Drive

The disk drive on and off switches are for manual control of the disk drive motor. The disk drive can be manually started only if the heads are unloaded and the timer is at the beginning of a cycle. The disk drive light is in parallel with the disk drive contactor (K2). If a disk-drive-motor-overload switch or over-temperature switch opens, R39 picks and turns on the motor overload light. A disk drive overload or over-temperature condition causes a stop sequence to occur.

Electronic DC

The electronic DC on and off switches are for manual control of the electronic DC power. If electronic DC is applied and all access swingout interlocks are closed (access in operating position), R44 picks to turn on the electronic DC present light. An over-temperature condition in an electronic gate causes R48 to drop. R48 picks R36 which turns on the electronic air temperature light.

Solenoid DC

The solenoid DC on and off switches are for manual control of solenoid DC power. The solenoid DC present light is turned on when R8 is picked by K301. Solenoid DC can come on only when electronic DC is present. The loss of electronic DC drops solenoid DC. This protects the solenoid driver cards from damage caused by having 48 volts without proper biasing voltages.

Oil Pump

The oil pump on and off switches are for manual control of the hydraulic power supply motor. A pressure switch in the hydraulic system picks R7 when operating pressure has been reached. R7 turns on the pressure normal light. Opening an overload in the oil pump drops R2 which in turn picks R40 which turns on the motor overload light. When the temperature of the oil exceeds 130°, R49 drops to pick R38 which turns on the high oil temperature light.

Head Load

The head load switch is for manual loading of the heads. The switch is effective only after the timer has run 180 seconds. This time must be allowed so pressure will build up in the array and remove particles of dirt. The head unload switch is for manual unloading of the heads. In any stop sequence, the heads must be unloaded before the disk array can be stopped.

Before the heads can be loaded, at least one access must be retracted and air pressure must be normal (above 30 psi). The accesses retracted light is picked by R4. R4 is picked by all the access retracted switches or inop relay points in series. The air pressure normal switch closes to pick R46 which turns on the pressure normal light. The head load light is turned on by R125. R125 also picks the clock head solenoid and the head load air solenoid control (K202). The heads unloaded light is turned on by the pick of R43. R43 will pick only if all the heads, including the clock head, are unloaded. The head load check switch is for manual control of the head check operation. Depression of this switch in manual control will pick the head load check relay (R45). This relay, in series with the head loaded switches on each access and the clock head, will pick R5 if all heads, including the clock head, are loaded. R5 turns on the heads loaded light.

File Ready

The file ready light is turned on by the file ready relay (R64) if all of the following conditions are present:

1. Not stop sequence delay
2. Heads loaded
3. Electronic DC present
4. Oil pressure normal
5. Solenoid DC present
6. Solenoid power supply control

Manual Reset

The following conditions can be reset only by depressing the manual reset switch:

1. Disk drive overload
2. Electronic air overtemperature
3. Oil overtemperature
4. Oil pump overload
5. DC failure indication
6. Air pressure normal (after disk drive on)



Figure 3-1. CE Power Sequence Panel

SECTION 4. LOCATIONS

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Electronic Frame	4. 2	Power Contactor Box - Covered	4. 5
Hydraulic Power Supply	4. 3	Power Sequence Gate	4. 6

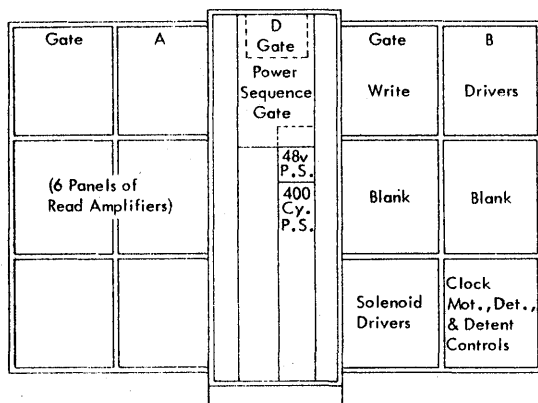
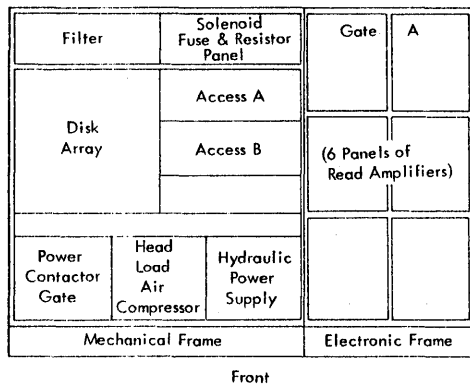


Figure 4-1. Component Orientation 353

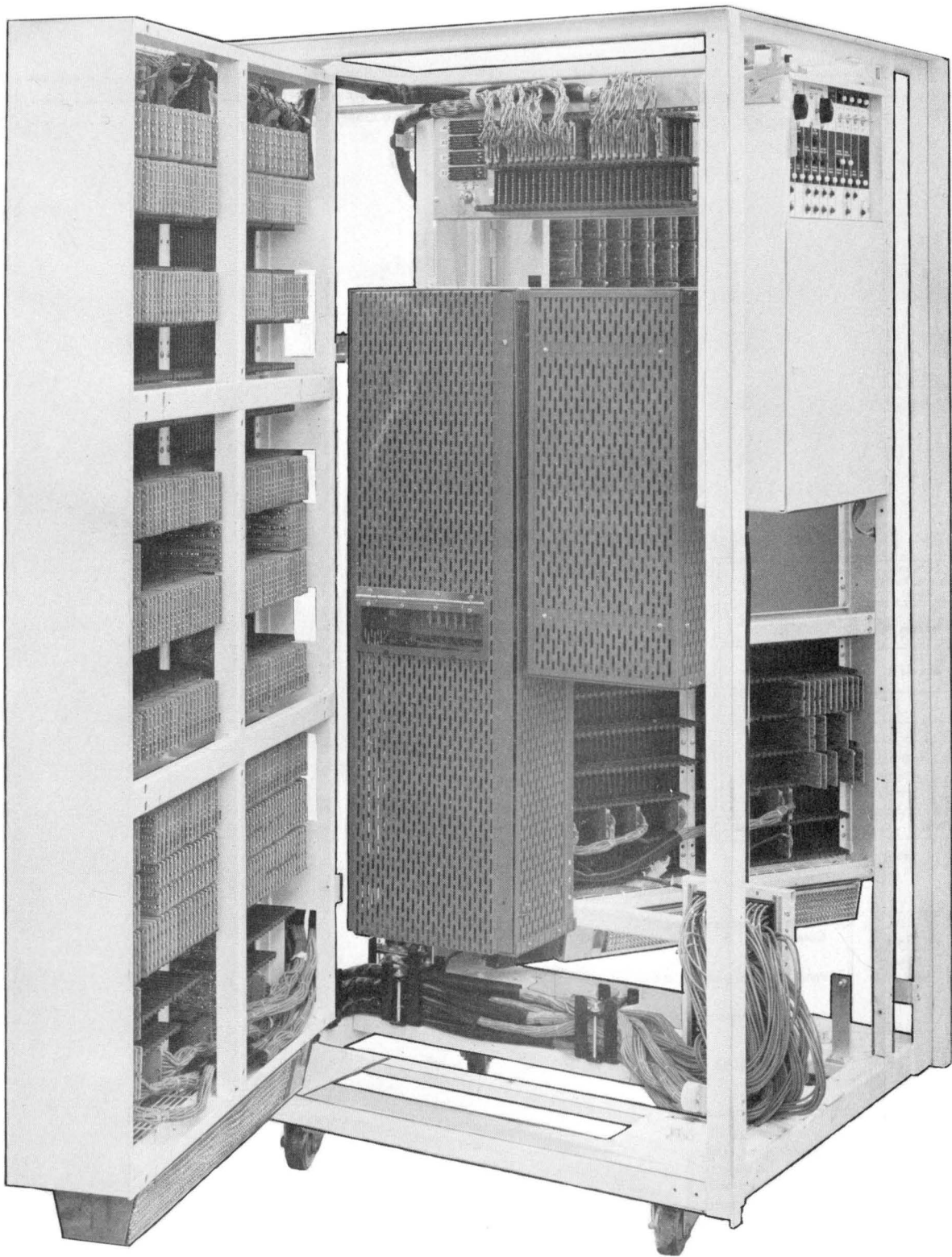


Figure 4-2. Electronic Frame

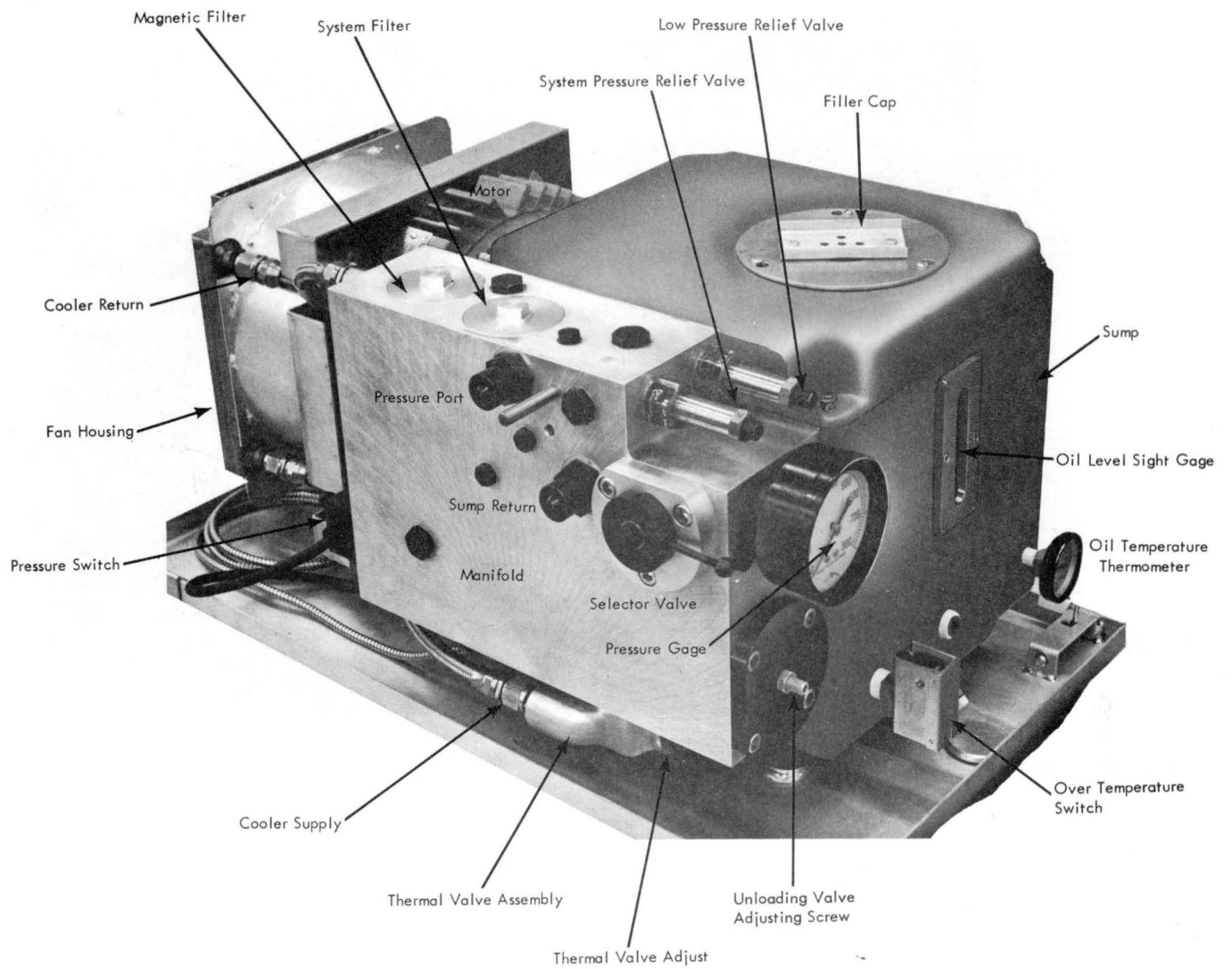


Figure 4-3. Hydraulic Power Supply

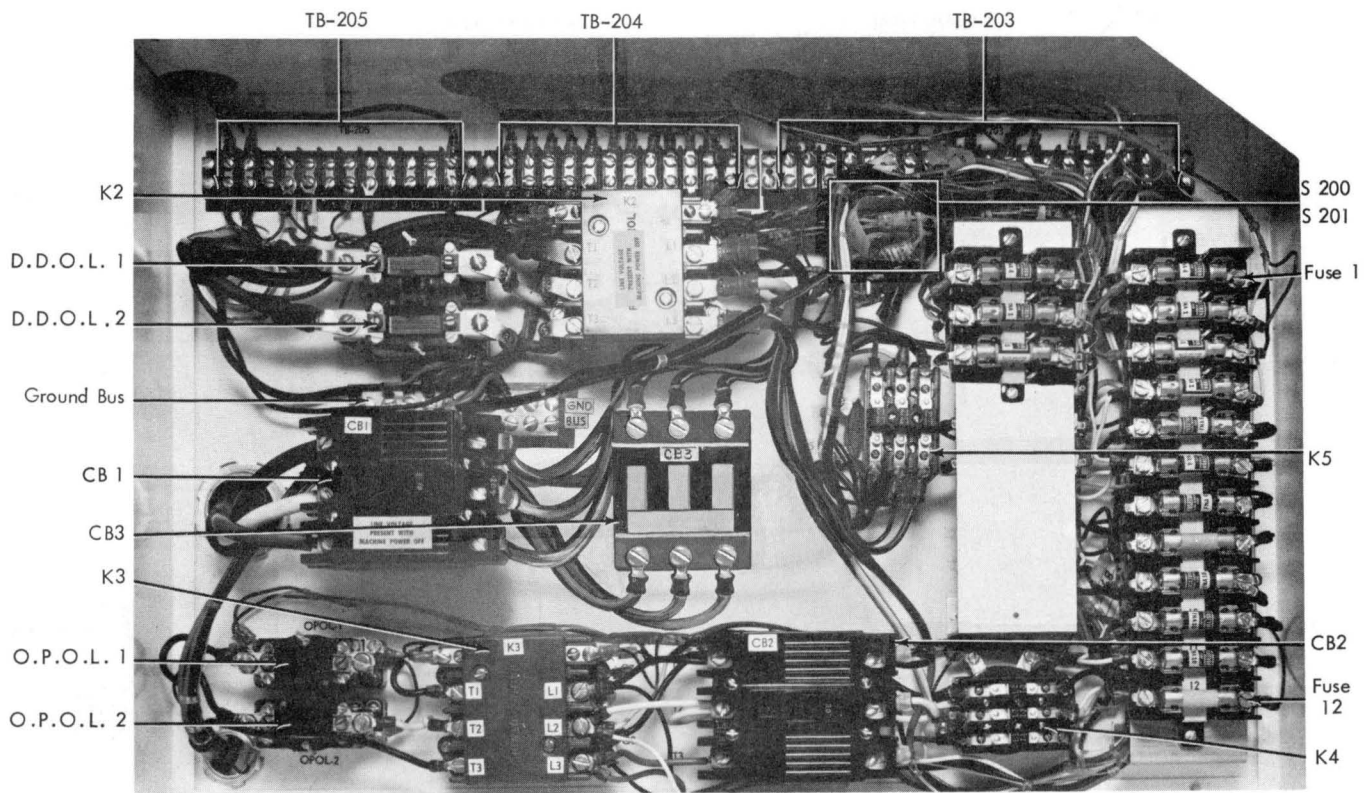


Figure 4-4. Power Contactor Box

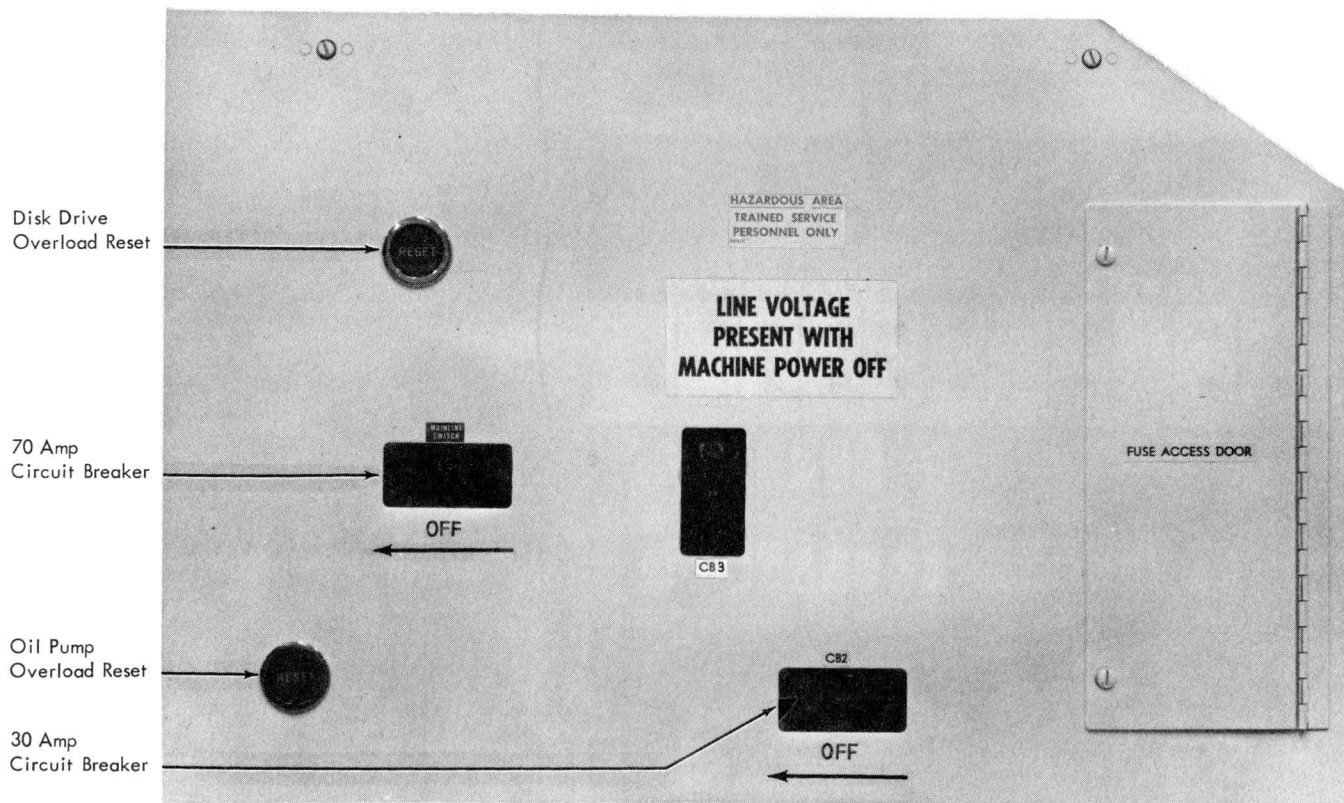
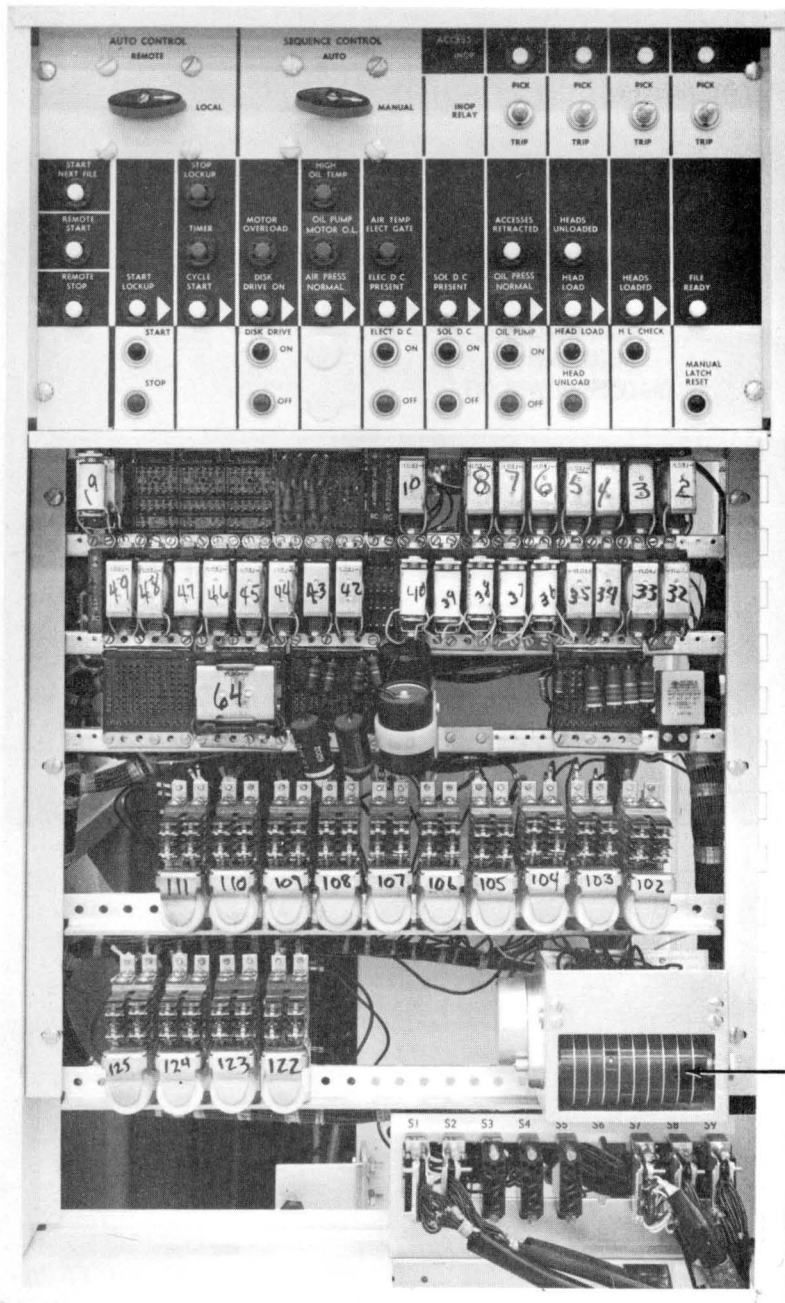


Figure 4-5. Power Contactor Box - Covered



CE Power Sequence Panel

Timer

Figure 4-6. Power Sequence Gate

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SHIPPING GROUP

This is a list of special tools and supplies that are sent with the machine from the plant. They should be kept with the machine.

353/354 Customer Engineering
 Reference Manual Form 227-5583
 1301 Customer Engineering
 Reference Manual Form 227-5581
 System Diagrams Manual
 353 Parts Catalog Form 127-0372
 354 Parts Catalog Form 127-0373
 Hydraulic Actuator Spanner Wrench . . P/N 2121394
 Seal Puller P/N 2121395
 Disk Cleaning Paddle P/N 2108010
 Head Cleaning Tool P/N 2108474
 Head Roll and Pitch Gram Gage . . . P/N 2108473
 Lint Free Tissue P/N 2123106
 Wrench - Hex Key 7/64 P/N 2108490
 Extraction Tool - Connector Pin . . . P N 2108398
 Insertion Tool - Taper Pin P/N 2108491
 Extraction Tool - Taper Pin P/N 2108493
 Air Filter P/N 2115348
 Wrench - Hex Key P/N 2108467
 Gage, Head Load P/N 2108577

TOOLS AVAILABLE WITH SYSTEM

The following is a list of tools available for systems which use the 353 Disk Storage Unit.

Tektronix 555 Oscilloscope and
 Accessories
 Tektronix Pre-Amp 53/54 CA P/N 460999
 Direct Coaxial Scope Probe (X1) . . . P/N 460852

OFFICE TOOLS AND SUPPLIES

The following is a list of tools and supplies normally located in the branch office. They can be obtained when needed.

Meter, Simpson P/N 450497
 Air Filter P/N 2115348
 Prefiltered Hydraulic Oil
 (in one gallon container) P/N 2115252
 Vacuum Cleaner -- Hoover Model 86
 10" Adjustable Wrench P/N 450177
 Isopropyl Alcohol P/N 2108601
 Wrapped-Wire Pistol Tool P/N 461012
 Torque Wrench and Accessory Kit
 (for shaft motor or actuator
 replacement) P/N 2108470
 Wrench Torque (5 to 150 in/lb). . . P/N 2108435
 Adapter - Actuator Torque P/N 2108436
 Socket - .500". P/N 2108464
 Socket - Universal P/N 2108466
 Socket - .375". P/N 2108478
 Roll - Torque Kit Tool P/N 2108481
 Socket - .125" Hex P/N 2108486
 Lint Free Tissue P/N 2123106
 Burndy Extractor Tool Rx 20-10 . . . P/N 461043
 Solder Iron Tip (SMS Pin Removal). . . P/N 451111
 Replacement Plunger P/N 451113
 Marginal Check Power Supply. . . . P/N 210860
 Wrapping Bit, Wire Size #24 P/N 461235
 Sleeve, Wire Size #24. P N 461015
 Hand Crimping Tool P/N 450898
 Wire Stripper P/N 450694
 Wire Gage P/N 461076
 #24 Gage Solid Tinned -- Copper
 Wire P/N 216226
 Markite Strip Assembly P/N 2108580

TOOLS FOR SMS SERVICING

The following is a list of tools and supplies that are not shipped with the machine but are recommended for each installation.

Hand Unwrap Tool P/N 451573
Card Extender--Cable
Isolation Tool P/N 451075
SMS Card Contact Lubricant P/N 451053
SMS Card Insertion --
Extraction Tool P/N 451030

TOOLS IN EMERGENCY PARTS CENTERS

The following is a list of tools available in all Emergency Parts Centers. They can be obtained when needed.

Disk Aligning Kit B/M 2108433

This kit contains special disk replacement tools. This kit does not contain replacement disks. Included in this kit is a special flashlight. However, due to the decay factor inherent in dry cell batteries they are not shipped with the light. Obtain two type AA pen light batteries locally.

Hoist for Shaft Motor Kit B/M 2108247

When replacing a shaft motor, the Hoist for Shaft Motor Kit (B/M 2108247), Disk Alignment Kit (B/M 2108433) and Shaft Motor and Instructions (B/M

2115248) must be ordered from the E. P. C. Special tools required for motor replacement will be shipped with the shaft motor.

Hydraulic Power Supply Replacement Kit

This kit contains a complete hydraulic power supply, including fluid with the equipment necessary to remove the used unit and install the new unit. The container for this unit serves the dual purpose of a shipping crate and a dolly platform to assist in the removal of the used unit and installation of the new unit.

APPLICABLE CUSTOMER ENGINEERING MANUALS

This is a list of CE manuals that contain information that is of value in servicing the IBM 353 Disk Storage.

Customer Engineering Manuals of Instruction

Tektronix Oscilloscopes *Form 223-6725
Transistor Component Circuits .Form 223-6889
Transistor Theory Illustrated. .Form 223-6794
Transistor Theory and
ApplicationForm 223-6783
IBM 353 Disk Storage *Form 227-5584

Customer Engineering Reference Manuals

Standard Modular System . . . *Form 223-6900

*Recommended for each installation

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International Business Machines Corporation
Data Processing Division
112 East Post Road, White Plains, New York