



IBM 7090/7094/7094 II Data Processing Systems Installation Manual—Physical Planning

This manual contains information necessary for planning the physical installation of an IBM 7090/7094/7094 II Data Processing System.

In addition to technical information needed for physical installation planning, it contains recommendations and suggestions to be used as a guide only in planning an efficient and pleasant installation. The customer should make arrangements as he deems necessary for professional consultants' services in planning his installation. It is important that local and national code requirements be adhered to by the customer.

The requirements of the system are subject to modification by engineering developments.

Third Edition

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Requests for copies of IBM publications should be made to your IBM representative or to the IBM branch office serving your locality.

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IBM 7090/7094/7094 II DATA PROCESSING SYSTEMS

PREINSTALLATION PLANNING

The successful installation of a large data processing system requires long range planning and continuous supervision to see that the plans are followed. The customer assumes the responsibility of providing suitable space for the IBM System which he orders. IBM Installation Planning Representatives are available, at the regional offices, for consultation in planning physical requirements of the installation.

The customer will, in many cases, establish a preinstallation consulting and service group which includes IBM representatives, accounting firms, engineering consultants, and other outside consultants. This group will consult with and advise the customer's data processing manager (or executive committee) on the course of action, objectives, and progress of the installation. The manager (or executive committee) will be in charge of the over-all operation and will coordinate the physical planning with the procedures and general planning. By the time the actual order for the system is closed, considerable preliminary methods and procedures planning will have been completed because such planning often forms the basis for the detailed machine order. The customer's planning and programming staff, which also reports to the data processing manager, will prepare a list of the actual components to be used in the installation. This list should include not only the system's components, but also other equipment or furniture, such as tape storage cabinets, work tables, chairs, and desks.

The customer must decide on a suitable location for the 7090/7094 area. Suitable facilities for installation may exist in some customers' offices; in others, minor or major changes to existing space will provide a suitable location. In other instances, the customer may desire a complete new building. The operation should follow a planned schedule so that the machine room will be ready to receive the system when it is delivered.

SCHEDULE

Because each data processing machine installation is unique, it is not possible to provide herein a detailed schedule. The following suggested schedule should be adhered to as closely as possible, however:

Twelve months before machine delivery:

1. Determine the machine components desired and review the order.
2. Read this Physical Planning Installation Manual.
3. Determine the prospective location of the system. Make a preliminary layout of the proposed installation.
4. Request a visit by the IBM Installation Planning Representative to discuss with customer personnel (including the planning staff and consulting group) installation, power, and air conditioning requirements. At this meeting, the proposed room layout will be discussed. Floor construction and the placement of raceways and power receptacles will also be discussed.
5. Advise IBM of security or other restrictions, and advise of any unusual housing requirements as a result of these restrictions.

6. Study local delivery quotations on power and air conditioning equipment to determine when this equipment must be ordered.

Six months before machine delivery, the air conditioning equipment should be reviewed.

Four months before machine delivery, the final layout should be made and approved by the customer and IBM Branch Manager, and CE Manager so that all cables can be ordered. The cable order should be made up at the IBM branch office from the final layout and forwarded by the Branch Manager as specified in the DP Orders and Movements section of the IBM Branch Office Manual. When the customer and the branch office require assistance, the Installation Planning Representative should be contacted. THIS IS A CRITICAL POINT IN THE SCHEDULE. After these cables are ordered, no changes should be made in the layout that will affect cable lengths.

One month before machine delivery, a survey must be made by local IBM representatives to determine specific requirements for moving the machine components from the delivery platform to the machine room. This information should be forwarded directly to the IBM Traffic Department at Poughkeepsie.

Two weeks before system delivery:

1. Cables will be delivered to the machine room to be set in place by the customer under the supervision of the IBM Customer Engineers. It is IBM's responsibility to connect the interconnecting cables to any IBM components.
2. Customer Engineering furniture and equipment will be delivered.

Components not shipped with the system will have their cables shipped with the individually delivered units.

One week before machine delivery, ALL AIR CONDITIONING EQUIPMENT SHOULD BE INSTALLED, TESTED, AND READY FOR OPERATION. Electrical facilities, lighting, floor ramps, painting, plastering, and decorating should also be completed at this time.

Every effort should be made to balance the air conditioning system as soon as possible after the machine has been delivered.

SYSTEMS COMPONENTS

A 7090 Data Processing System may consist of a combination of the following components connected by cables:

Name	Machine	Model
Card Reader	711	2
Printer	716	1
Card Punch	721	1
Magnetic Tape Unit	729	II, IV, V, VI
Disk Storage	1301	1-2
Input-Output Synchronizer	1414	6
Instruction Processing Unit	7108	1
Arithmetic Sequence Unit	7109	1
Console Control Unit	7151	1
Core Storage	7302	1
Drum Storage	7320	
Hypertape Drive	7340	1
Multiplexor	7606	1

<u>Name</u>	<u>Machine</u>	<u>Model</u>
Data Channel (Tape and Card)	7607	1, 3
Data Channel (Tape)	7607	2, 4
Power Converter	7608	1
Data Channel Console	7617	
Power Control	7618	
File Control Unit	7631	II, III, IV
Hypertape Control Unit	7640	
Data Channel	7909	

A 7094 Data Processing System may consist of a combination of the following components connected by cable:

<u>Name</u>	<u>Machine</u>	<u>Model</u>
Card Reader	711	2
Printer	716	1
Card Punch	721	1
Magnetic Tape Unit	729	II, IV, V, VI
Disk Storage	1301	1, 2
Input-Output Synchronizer	1414	6
Arithmetic Sequence Unit	7109	1
Instruction Processing Unit	7110	1
Console Control Unit	7151	2
Core Storage	7302	1
Drum Storage	7320	1
Hypertape Drive	7340	1
Multiplexor	7606	1
Data Channel (Tape and Card)	7607	1, 3
Data Channel (Tape)	7607	2, 4
Power Converter	7608	1
Data Channel Console	7617	
Power Control	7618	
File Control Unit	7631	II, III, IV
Hypertape Control Unit	7640	
Data Channel	7909	

A 7094 II Data Processing System may consist of a combination of the following components connected by cable:

<u>Name</u>	<u>Machine</u>	<u>Model</u>
Card Reader	711	2
Printer	716	1
Card Punch	721	1
Magnetic Tape Unit	729	II, IV, V, VI
Disk Storage	1301	1, 2
Input-Output Synchronizer	1414	6
Arithmetic Sequence Unit	7109	1
Instruction Processing Unit	7111	1
Console Control Unit	7151	2
Core Storage	7302	3
Drum Storage	7320	1
Hypertape Drive	7340	1
Multiplexor	7606	2
Data Channel (Tape and Card)	7607	1, 3
Data Channel (Tape)	7607	2, 4
Power Converter	7608	1

<u>Name</u>	<u>Machine</u>	<u>Model</u>
Data Channel Console	7617	1
Power Console	7618	1
File Control Unit	7631	2, 3, 4
Hypertape Control Unit	7640	1
Data Channel	7909	1

UNIT DESCRIPTION - 7090/7094/7094 II SYSTEMS

- 711 - Card Reader provides punched card input to the 7090/7094/7094 II System. Cards are read in at a maximum of 250 cards per minute. This unit can be used only on a 7607 Data Channel Model 1 or 3 to which a 716 Printer is also attached.
- 716 - Printer provides printed output for the 7090/7094/7094 II System. The maximum speed is 150 lines per minute. This unit supplies power for a 711 Card Reader and/or a 721 Card Punch. The 716 can be used only on a 7607 Data Channel Model 1 or 3.
- 721 - Card Punch provides punched card output for the 7090/7094/7094 II System. Cards are punched at a maximum rate of 100 cards per minute. This unit can be used only on a 7607 Data Channel Model 1 or 3 to which a 716 Printer is also attached.
- 729 II, IV, V, VI - The 729 II, IV, V, VI Magnetic Tape Unit provides large capacity input-output for storage of data or programs in the 7090/7094/7094 II Systems. A dual-density feature enables the 729 II to read or write at either 15,000 or 41,667 characters per second under stored program control. Under the same conditions, the 729 IV can read or write at either 22,500 or 62,500 characters per second. The 729 V operates at 15,000, 41,667 or 60,000 and the 729 VI operates at 22,500, 62,500 or 90,000 characters per second.
- 1301 - Disk Storage Unit provides access to randomly stored data. (See Installation Manual - Physical Planning, IBM Input-Output Components, 7000 Series and 1410 Data Processing Systems, Form C22-6681.)
- 1414-6 - Input-Output Synchronizer contains control and synchronizing circuitry for Paper Tape and telegraph input-output units. (See Form C22-6681.)
- 7108 - Instruction Processing Unit contains the stored program control circuits for a 7090 System.
- 7109 - Arithmetic Sequence Unit contains the control circuits to provide proper sequencing of arithmetic and logical operations for the 7090 System, and also for the 7094/7094 II System when it is equipped with the 7094 feature.
- 7110 - Instruction Processing Unit contains the stored program control circuits for a 7094 System.

- 7111 - Instruction Processing Unit contains the stored program control circuits for a 7094 II System.
- 7151 - Console Control Unit provides centralized control of the 7090/7094/7094 II System. It contains indicator switches, keys, and register displays. Channel indicators are provided and the register displays have been grouped for the operator's convenience. Information in a storage location or register can be displayed and/or changed by manual insertions through the entry keys and switches. Model 1 is for the 7090 System and Model 2 is used on the 7094/7094 II System.
- 7302 - Core Storage has a capacity of 32,768 36-bit words. The access time for the extraction or storing of a 36-bit word is 2.18 microseconds on the 7090, 2.0 microseconds on the 7094 for the Model 1, and 1.4 microseconds on the 7094 II for the Model 3.
- 7320 - Drum Storage provides rapid random access auxiliary drum storage. (See Form C22-6681.)
- 7340 - Hypertape Drive is a cartridge loaded high-speed magnetic tape unit. (See Form C22-6681.)
- 7606 - Multiplexor provides the only access to the 7302 Core Storage; it accomplishes all the data and address switching necessary to transmit data to or from core storage and also provides control switching for core storage. Eight data channel tape units may be attached to the 7606 Multiplexor. Only one 7606 is used with a 7094/7094 or 7094 II System.
- 7607 - Data Channel Model 2 contains control circuits, registers, and counters to provide simultaneous and independent transfer of information between input and output units and core storage via the 7606 Multiplexor. The 7607 can handle up to ten 729 II or 729 IV Magnetic Tape Units, or any combination of these units, with no address restriction. The 7607 Model 2 accommodates ten magnetic tape units only.
- The 7607 Data Channel Model 1 performs the above functions plus controlling motion and data transmission to and from a 716 Printer, 721 Card Punch and 711 Card Reader.
- The 7607 Data Channel Model 3 performs the same function as Model 1; however, it is required when 729 II, IV, V, and VI Magnetic Tape Units are used.
- The 7607 Data Channel Model 4 performs the same function as the Model 2; however, it is required when 729 II, IV, V, and VI Magnetic Tape Units are used.
- 7608 - Power Converter converts incoming 60-cycle power to 400-cycle. It houses a motor-generator and a circuit breaker for protection of the motor-generator.

- 7617 - Data Channel Console contains entry keys, switches, indicators, and register displays. Information in the data register, word counter, address counter, and location counter of the 7607 can be displayed and/or altered by manual insertions through the entry keys and switches of the 7617.
- 7618 - Power Control distributes 60-cycle and 400-cycle power to units in the 7090-7094 Systems. This unit contains power switching, regulating equipment, the starter for the motor-generator, and the exciter.
- 7631 - File Control Unit contains control and synchronizing circuitry for Disk File units. (See Form C22-6681.)
- 7640 - Hypertape Control Unit contains control and data synchronizing circuitry for Hypertape Drives. (See Form C22-6681.)
- 7909 - Data Channel Unit contains control and synchronizer circuitry for additional input-output units.

NOTE: The 7090, 7094 or 7094 II may be direct-coupled to the 7040/7044 Data Processing System. (See Form C22-6681.)

BUILDING REQUIREMENTS

An Installation Planning Representative is available to assist in selecting a suitable area. If the installation of the system requires a new building design, or if the existing space is to be altered radically, a suggested machine layout should be made prior to any building planning.

In selecting a location for the computer installation, consideration should be given to the following:

1. Availability and location of proper and adequate power.
2. Space to house air conditioning equipment, (compressor and air handling location, placement of cooling tower or evaporative condenser).
3. Ceiling height, outside wall area and glass area, since these factors will affect the ease of air conditioning the area.
4. Work flow to other areas such as accounting department, etc.
5. Floor loading capacity.
6. Proper safety and fire prevention procedures.

FLOOR CONSTRUCTION

The weight of each unit is listed in the Specification Summary section. A structural engineer should be consulted to insure that the floor in an installation is capable of supporting the system layout. Factors to be considered in determining floor loading are:

1. If more than three machines are placed side by side, no allowance can be taken for side clearance at the ends of the machines.
2. Regardless of the actual service clearances required, clearances used in floor loading computations cannot be more than 30 inches in any one direction from the machine.
3. Twenty pounds for each square foot of service area used in calculation must be applied as live-load in floor loading computations.
4. Ten pounds for each square foot of total area used in calculation must be applied as false floor load in floor loading computations. For machines or systems not requiring false floors, there is no need to apply the ten pound factor.
5. Cable weight must be considered as part of the machine weight.
6. Most office building floors rated at fifty pounds per square foot have an additional allowance of twenty to twenty-five pounds per square foot for partitions. The local building department should be contacted about using this partition allowance when determining floor loading capacity.

A raised floor will accomplish the following major objectives:

1. Allows future layout change with minimum reconstruction cost.
2. Conceals interconnecting cables and power receptacles.
3. Provides personnel safety.
4. Permits space between the two floors to house air supply ducts or act as an air plenum, if desired.

A raised floor can be constructed of steel, aluminum, or fire-resistant wood. The free-access type floor, which rests on pedestals, is preferred over the raceway type whenever permitted by local building codes. The two general floor types are shown in Figure 1.

When selecting a raised floor covering, consideration should be given to such factors as the frequency of moving machine units, minimum cracking or dusting of the tile, appearance and cost. Experience has shown that a material such as vinyl tile is most applicable due to its resilience and its resistance to cracking and dusting.

If a raised floor utilizing metal panels is used, steps must be taken to insure that no metal is exposed to the walking surface.

The three-foot floor area in front of the 7607, 7606, 7108/7110, and 7109 sections must be level within 1/16 inch per foot. The floor over the length of the largest number of units placed side by side must be level within 1 inch.

SPACE AND LAYOUT REQUIREMENTS

Although space and layout requirements differ for each system, a few general rules can be given.

Space

The floor area required for the system will be determined by the specific components desired, length-to-width ratio of the room, location of columns, provision for future expansion, and so on. To determine the exact area required for a specific group of components, a machine layout should be made, using the room under consideration.

Space should be provided for daily tape storage within the machine room. Space may also be needed for printer forms stands, storage cabinets, card files, work tables, and desks, as well as IBM punched card equipment such as punches, sorters, or transceivers.

The integration of the computer work area with that of other accounting areas and with storage areas should be considered. The work flow from punched card equipment to and from the system should be considered when aisles and intermediate storage locations are planned. Items such as permanent master document files, card files, and magnetic tape files require different types of storage areas, which should be carefully located to minimize both the amount of space necessary and the travel time between areas.

At the option of IBM, a substantial amount of test equipment may be assigned to the installation to maintain the equipment in the machine room. Some machines may be moved to the test area, depending upon the type of work to be done. These areas should be, whenever possible, on the same floor level. If they are not, ramps should be provided for moving test equipment and machine components.

The Customer Engineering test area for a single installation should contain at least 300 square feet of space that is air conditioned to the same specifications as the machine room. The air conditioning should be sized to include the heat load of at least one magnetic tape unit.

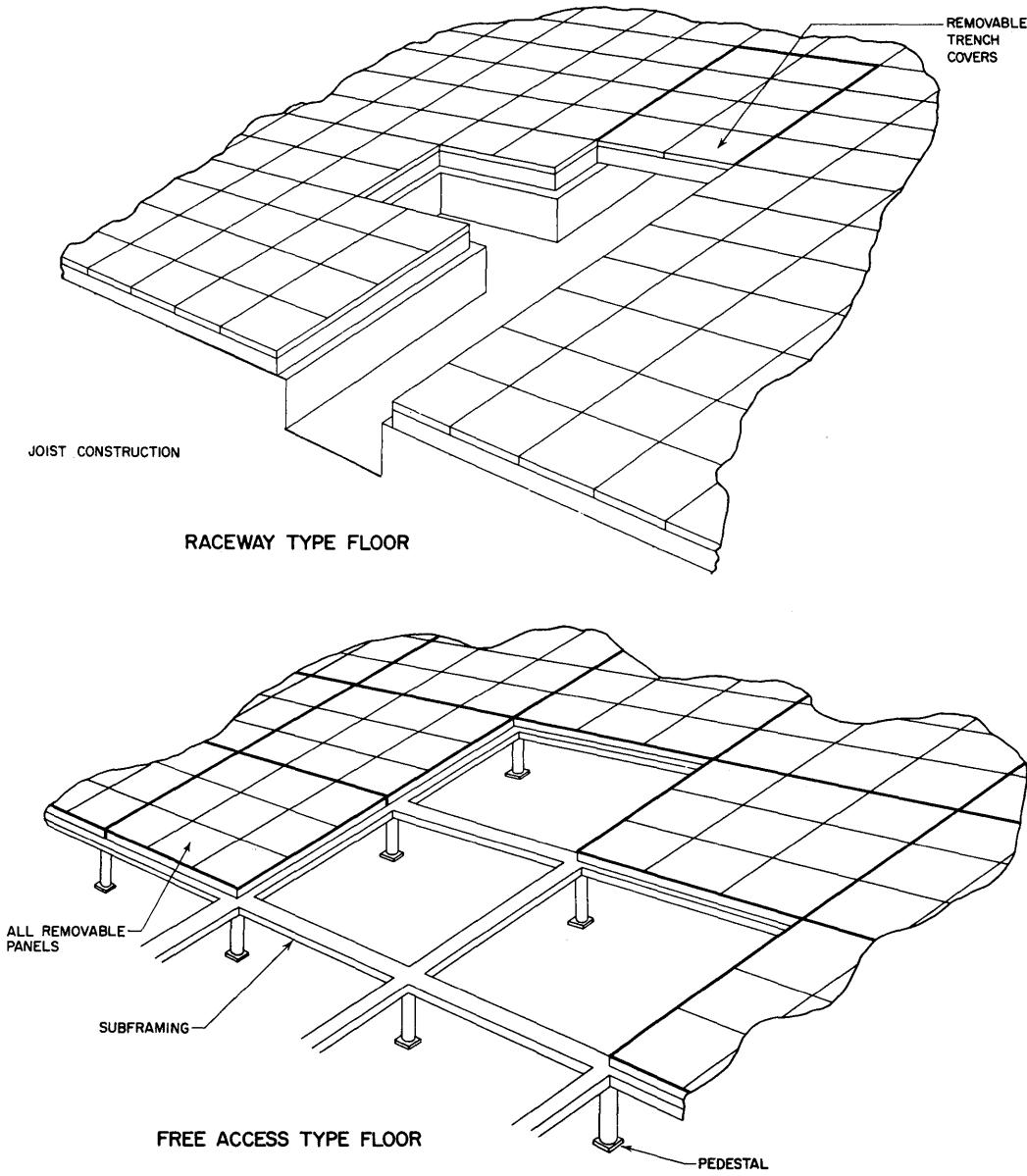


Figure 1. Types of Raised Flooring

ACOUSTICAL TREATMENT

Acoustical treatment is recommended for a more comfortable operation of the system. For best results an acoustical consultant should be approached. However, the following is presented as general information.

At least 100 square feet of bulk-storage space should be provided within reasonable distance of the machine room. This space is for the storage of bulky items such as filters, equipment transformers, and so on, and does not require air conditioning.

LAYOUT OF MACHINE COMPONENTS

Operational requirements should determine the specific location of components in the machine room. However, because the separate components are connected by cables of restricted length, and because of space limitations and the necessity of maintaining clearances between machines for servicing, work space, and aisles, the customer may need to prepare and analyze several tentative layouts before deciding on the final one.

Because each customer has a different room size, a different column spacing, a different combination of machine components, and a different procedure for using auxiliary input-output units, each installation should be considered individually to reach the best arrangement. The layout shown in Figure 2 is typical, not standard.

The customer should prepare a layout of the computer system with the advice of the salesman and Installation Planning Representative. This layout must be final and approved by the customer before the ordering of the system cables. It is the responsibility of each IBM Branch Office to be certain that cables are ordered on schedule. Installation Planning Representatives are available for assistance in cable ordering.

To make a layout, it is necessary to have an accurate drawing of the proposed area scaled at 1/4 inch to the foot. Plastic templates, supplied by IBM, show the clearances required to allow working room for the Customer Engineer and his equipment. They also show the swinging radii of the component gates and machine covers and caster and cable hole locations. These templates are used to properly position the machine equipment on the area drawing. In some cases, clearances shown on the templates may be overlapped as long as the larger clearance is maintained. The gate swing of an auxiliary unit must not interfere with the gate swing of its corresponding control unit.

Machine components must be located so that the length of connecting cables will not exceed maximum limits. These limits are different for each type of machine. Charts showing the limits may be found in the cable section of this manual.

The following points should be considered when planning the system layout:

1. The fronts of the magnetic tape units should be visible from the operator's console.
2. The card reader, printer, and card punch should be located near the console.
3. Adequate working area is required around the console and magnetic tape units.
4. The 7617 Data Channel Console should be located about 5 feet to 8 feet in front of the data channel it services. Where possible, this unit should be located in front of the data channel and, at the same time, close to the operator's console.
5. The machine area should be planned so that expansion is possible. New machines or additional equipment can then be added to the existing layout without radical revisions.
6. When three or more data channels are used in a system, it is recommended that they be divided between the two legs available from the multiplexor.

7. Where at all possible, it is strongly recommended that no unit be placed adjacent to the exposed side of the 7302 Core Storage.
8. The 7302 Core Storage is shipped in a cradle. This cradle should be removed at the unit location unless space limitations prevent this action. If space is limited, the cradle is removed at the shipping platform. The shipping cradle weighs about 850 pounds and is 43 inches wide and 84 inches long. The cradle will add 7 inches to the height of the 7302 Core Storage.

TYPICAL 7090/7094/7094 II LAYOUT

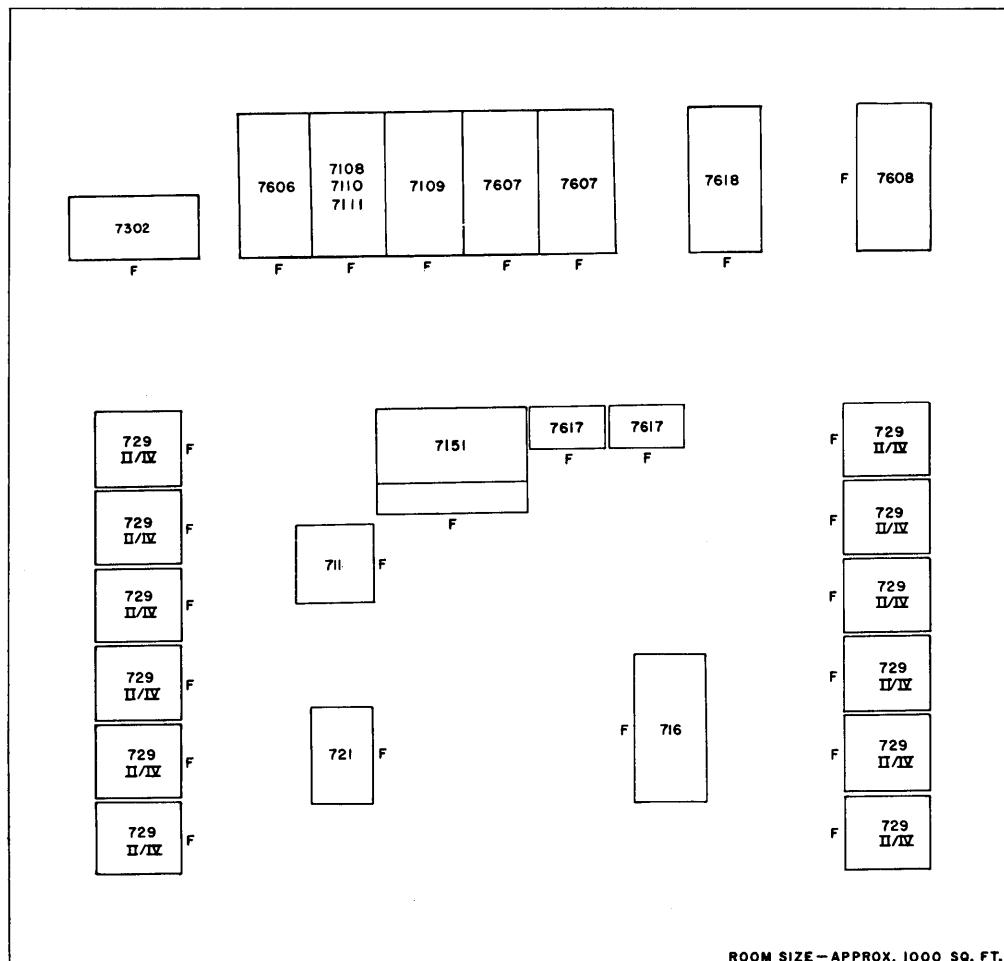


Figure 2. Typical 7090/7094/7094 II System Layout

The final layout must be reviewed to insure that cable limitations have not been violated and that proper clearances have been maintained. The required copies of this layout must accompany the cable order.

After cables have been ordered, any change in the final layout that affects cable lengths must be accompanied by an RPQ.

The IBM CE branch manager will provide a scaled layout of the Customer Engineering equipment that will be installed in the CE room to assist the customer in locating receptacles, lights, and so on.

The following lists show the size and approximate quantity of CE equipment to be considered in arriving at an adequate space arrangement for the CE Room.

TYPICAL 7090/7094/7094 II SYSTEMS TEST EQUIPMENT

<u>Quantity</u>	<u>Description</u>	<u>Approximate Dimensions (Inches)</u>
2	Oscilloscope	13 x 24 x 17
2	Dolly-Oscilloscope	20 x 26 x 36
2	AC Voltmeter	
3	Multimeter-Simpson #260	7 x 9 x 4
2	DC Voltmeter	
1	Tape Drive Tester	6 x 9 x 14

TYPICAL 7090/7094/7094 II SYSTEMS OFFICE AND LABORATORY EQUIPMENT

1	IBM Parts Cabinet	48 x 24 x 87
2	Shelf Cabinets (Parts)	36 x 18 x 72
1	Work Bench and Lamp	72 x 30 x 35
1	System Diagram Book Rack	13 x 31 x 40
1	Bookcase	36 x 12 x 27
2	File Cabinets	18 x 28 x 60
1	Desk (single) with Chair and Lamp	45 x 34 x 29
1	Drafting Chair	
2	Wiring Stools	
1	Card File, Four-Drawer Model	9 x 17 x 24
1	Table and Four Chairs	30 x 60
1	Stock Control Tub File	
1	Power Lift	29 x 54 x 70

ACOUSTICAL TREATMENT

Acoustical treatment is recommended for a more comfortable operation of the system. For best results, an acoustical consultant should be engaged. The following is presented as general information.

The principal noise sources in the system are the mechanical units, such as card machines, printers, and blowers. The floor construction should be of a nature that retards vibration to other areas. The wall should be constructed to prevent the transmission of noise to the adjacent area. It is important that these walls be constructed from the floor to the base ceiling and properly sealed. The doors must also have a good seal. The wall surfaces should be made soft to prevent reverberations (the importance of this feature diminishes with the increased size of a room). The greatest sound reduction will be obtained by properly treating the ceiling. Best results can be expected from a dropped porous ceiling. If overhead duct work exists, it may be possible that the noise generated in the machine room will be transmitted to other rooms unless proper precautions are taken.

LIGHTING

A minimum average illumination of 40-foot candles measured 30 inches above the floor should be maintained in the general machine room area.

Direct sunlight should be avoided, because lower levels of illumination are needed to observe the console and signal lamps. The lights for general illumination should be sectionally controlled by switches so that a portion of the lighting can be turned off as desired.

VIBRATION

It may be necessary to install machines in an area that is subject to minor vibrations. The machine can withstand a sustained vibration of up to 0.25G.

G's of acceleration may be computed from vibration readings of amplitude and frequency by the formula:

$$G = 0.103 AF^2$$

where A is the displacement in inches from the mean, and
F is the frequency in cycles per second.

The machines can withstand intermittent vibrations somewhat greater than 0.25G if the frequency is below 25 cycles per second. If the anticipated building vibration is greater than 0.25G, the customer should have the vibration measured, and the results should be forwarded to the Installation Planning Representative for review.

TAPE STORAGE

Storage facilities for frequent or infrequent usage of magnetic tape should be maintained within the following limits:

Heavy Duty Tape

Relative humidity--20 to 80%
Temperature--50 to 90°F

Mylar* Tape-Long Term Storage

Relative humidity--20 to 80%
Temperature--50 to 90° F

Tape exposed to atmospheric conditions outside the above limits will require reconditioning before it is used. This is accomplished by permitting the tape to remain in the correct operating environment for a length of time equal to the storage time (up to maximum reconditioning period of 24 hours).

The tape should be stored in a dust-proof container in a vertical position and should never come in contact with magnetic material at any time. Magnetic fields of greater than 50 oersteds intensity can cause loss of information or introduction of noise.

When shipping magnetic tape, each reel should be sealed in a plastic bag and packed individually in stiff cardboard shipping boxes. These may be obtained from IBM.

*Trademark of E.I. duPont de Nemours & Co. (Inc.)

AIR CONDITIONING

The recommended design condition for the installation of these computer systems is 75 degrees F and 50% relative humidity. In areas where it is not feasible to maintain 50% R.H., a design condition of 40-45% should be used.

The components of the system are internally cooled by air circulated by blowers in most units. The air intake varies slightly from one unit to another but, in general, is through the bottom and also through louvers along the bottom edge. One-inch dust filters are included at each air input. Warm air exhausts from the top of each unit.

To determine the air-conditioning capacity necessary for an installation, the following factors must be taken into consideration:

Machine heat dissipation, personnel, latent load, fresh air introduction, infiltration of heat through outer walls, ceiling, floors, door openings partitions, glass wall area, and possible reheat.

A separate air-conditioning system is recommended for a data processing installation. Because of the amount of heat dissipated while the system is in operation, it is necessary for the air-conditioning system to maintain a cooling cycle year-round.

TEMPERATURE AND HUMIDITY REQUIREMENTS (MYLAR TAPE)

1. Machine power ON: Operational Period
Temperature: 50 - 80°F
Relative Humidity: 20 - 80%
Max. Wet Bulb Temp: 78°F
2. Machine power OFF: 50 - 110°F
Temperature: 0 - 80%
Max. Wet Bulb Temp: 80°F

The area must be at the conditions for the operational period before machine power is turned on.

TEMPERATURE AND HUMIDITY CONDITIONS

Under all conditions of operation, the computer input air and room air should not exceed 80°F. This is a maximum operating temperature and should not be considered a design condition.

When conditioned air is supplied to the base of any unit by means of an underfloor duct or plenum chamber, the relative humidity in the duct should not be greater than 80%. This specification is an absolute maximum. Air temperature in this duct should be kept above room dew-point temperature to prevent condensation within or on the machines. When it is necessary to add moisture to the system for control of low relative humidity, one of the following methods should be used:

1. Steam grid or jets
2. Steam cup
3. Water atomizers.

Note: In localities where the outside temperature drops below freezing, condensation will form on single glazed window panes. Also, if outside temperatures are considerably below freezing, the outside walls of the building should be waterproofed or vapor sealed on the inside or, in time, structural damage will occur in outside walls.

AIR FILTRATION

A high efficiency filter rated according to the following specifications should be installed to filter all air supplied to the data processing room.

Mechanical and electrostatic air cleaners operate on entirely different principles. Therefore, it is necessary to specify a different efficiency rating for each type.

Mechanical Air Filter. This type must be rated at a minimum of 20% efficient by the Bureau of Standards discoloration test using atmospheric dust. This rating applies to a clean filter and must be maintained throughout the life of the filter.

Electrostatic Plate Type Filter. This type must be rated at a minimum of 85% to 90% efficient by the Bureau of Standards discoloration test using atmospheric dust. Electrostatic air cleaners are designed to operate at 85% to 90% efficiency at a given face velocity. As the face velocity through an electrostatic filter is increased, its efficiency decreases. Therefore, an electrostatic filter operated at increased face velocity or below 85% efficiency would allow a greater number of particles charged by the ionizing wires to pass through the plate section and enter the room. This would increase what is known as space charge. As the space charge increases, a greater voltage differential occurs between the positively charged particles and the negative surfaces in the room. This causes dust to accumulate rapidly on all surfaces, defeating the purpose of a high-efficiency filter.

Special air filtration is necessary only where installations are exposed to corrosive gases, salt air, or unusual dirt or dust conditions.

AIR DISTRIBUTION AND TYPES OF SYSTEMS

Even though the heat loads of the computer system are considerably reduced from previous systems, the heat load is concentrated in a relatively small area. For this reason, careful consideration should be given to the method of air distribution to eliminate areas of excessive air motion.

Several different types of air-conditioning systems can be designed to satisfy the temperature and humidity requirements. The following are brief descriptions of the most common types of systems in use. In no case should these descriptions be considered complete, and the use of an experienced air conditioning design engineer is strongly recommended. All local building codes should be checked, including the electrical code, as some localities will not permit the use of the raised floor as an air conditioning plenum as described.

SINGLE DUCT - OVERHEAD SYSTEM

In this system, the entire heat load of the room--including the heat generated by the computer system--is absorbed by the air supplied to the machine room. The air is generally supplied from either an overhead duct and diffuser system or by a ceiling plenum.

The return air to the air-conditioning unit is taken from either ceiling return registers located above the heat producing units, or a fixed pattern of returns both in the ceiling or on the walls around the periphery of the room.

The temperature control system would consist of temperature and humidity controls placed in a representative location within the machine room. A temperature and humidity recorder (discussed in detail later) would be mounted adjacent to the controls to monitor the room conditions.

TWO DUCT - TWO-AIR-CONDITIONING-UNIT SYSTEM

One air-handling unit with separate controls supplies conditioned and filtered air to the air inlets on the machines. This air may be supplied to the machines through ducts laid beneath the raised floor or fed to a floor plenum chamber with holes through the floor under the machines. Each machine is supplied with a quantity of air equal to its internal fan capacity. This air absorbs the heat generated by the machine and is discharged from the top of the units into the room. Relative humidity of the air supplied to the units should be maintained below 80% and temperatures should be controlled to prevent condensation on or within the units. To insure a controlled relative humidity, it is necessary to provide for a reheat system to operate with the cooling unit. This unit is basically a sensible cooling operation.

The second air-handling unit supplies air directly to the room through a separate duct system and should be large enough to absorb the remaining heat load in the area. It should be capable of maintaining room temperature and relative humidity as specified in this manual and give complete year-round air conditioning, ventilation, and heating.

TWO DUCT - SINGLE-AIR-CONDITIONING-UNIT SYSTEM

This system is similar to the preceding system except on one respect: this system uses only one air-handling unit to supply both air circuits. The air is filtered and the temperature and humidity are regulated before the air is delivered to the room and the individual units through separate ducts.

A split coil with reheat and/or face and bypass dampers can be used to regulate the air to be supplied directly to the individual unit. Relative humidity of this air should be maintained below 80% and temperature should be controlled to prevent condensation on or within the units.

The temperature control system for the air being supplied to the overhead system would be the same as for a single-duct overhead system. In addition, a control system would have to be installed in the discharge duct to regulate the air supply to the underfloor system. The controls would operate either the separate cooling and reheat coils or the face and bypass dampers to maintain the required conditions. A remote reading temperature and humidity recorder should be installed with the sensing elements in the discharge air to the underfloor system to monitor the air entering the machine units.

UNDERFLOOR SYSTEM

In this system the space between the regular building floor and the raised floor is used as a supply plenum. All air is discharged into the room through floor registers around the perimeter of the area. The air is returned to the air-conditioning unit by means of ceiling registers located directly above the machine units.

A higher return temperature can be utilized in this system without affecting the design conditions of the over-all room. The design of this system takes into consideration a heat-transfer factor through the metal floor. This affords a certain amount of reheat to control the relative humidity of air before it enters the room.

The temperature control system would consist of the same controls as described for the single-duct-overhead system. In addition, the system must have control of air temperature in the underfloor supply system to prevent an uncomfortably cold floor. Air entering the machine through cable holes must be within stated specifications.

The air-conditioning system should use predominantly recirculated air with a set minimum for introduction of fresh air for personnel. This minimum fresh air introduction enables the machine area to be pressurized so that air leakage is always outward. This helps prevent dust entry from adjacent areas.

The air-conditioning load should not be supplied from the same transformer that supplies the computer system.

TEMPERATURE AND HUMIDITY RECORDING INSTRUMENTS

It is recommended that all customers install temperature and humidity recording instruments. Recording instruments are necessary to provide a continuous record of temperature and humidity conditions in the machine area. Also, if the air conditioning

requirements are not met, a record is available to indicate the extent and duration of the undesirable condition and to indicate whether a drying-out period is required. This may, in some cases, save machine downtime.

The record of temperature and humidity can be used:

1. To assure the customer that his air-conditioning installation is continuously performing its job properly. Installation errors and loss of efficiency because of malfunction of some part of the air-conditioning system can be quickly detected.
2. To determine if a mandatory drying-out period is necessary when humidity limitations are exceeded. The drying-out may be necessary if the excess humidity occurs either during periods of actual machine operation or during periods when the machine is shut down and unattended. The extent and duration of the excess humidity is used to determine the duration of the drying-out period.
3. To determine if the environment in the area meets the requirements for the system.

A visual or audible signal device should be incorporated into the instrument to provide a visual or audible indication that the temperature or humidity conditions in the computer area are nearing the maximum limitations stated in this manual. Action can then be taken by customer personnel to correct the situation.

Direct reading instruments with a 7-day electric-drive chart should be used for all installations to monitor the ambient room conditions. The recorder should be located at a representative location within the room and adjacent to the control devices.

POWER REQUIREMENTS

The computer system operates on a 208-volt, 3-phase, 5-wire, 60-cycle supply. The five wires consist of three phase wires, one neutral wire and one equipment ground wire. The equipment ground wire from all the units can be tied into one main grounding wire at the main distribution panel. This wire shall be carried directly back to the transformer or building ground (Figure 3). Conduit is not a satisfactory means of grounding.

The power distributed within the computer system is both 60 cycle and 400 cycle. The 400-cycle power is produced by the 7608 Power Converter and distributed to the console, data channels, multiplexor, CPU, and core storage units through the 7618 Power Control. The 7608 houses a motor-generator rated at 50 HP and 30 KW.

The line-to-line voltage tolerances must be maintained within 208 volts plus or minus 8% steady state or transient. The line frequency must be maintained at 60 cycles plus or minus 1/2 cycle per second.

A separate feeder connected to the main building distribution panel will usually provide a suitable supply. However, in cases where the building power fluctuates in excess of plus or minus 8%, a separate transformer or motor-alternator may be necessary. If a transformer is used, it should be fed from the highest primary source readily available. The feeder for the computer system should feed no other loads. If there is any question about the suitability of the power service, the customer should consult the IBM Installation Planning Representative.

The power feeder for the computer system should be protected by a main line circuit breaker. (See Safety and Fire Precautions section for further details.) The individual branch circuits on the distribution panel should be protected by suitable three-phase circuit breakers, properly derated according to manufacturer specifications. The distribution panel should be located in an unobstructed, well-lighted area in the computer room.

Branch circuits should terminate under the raised floor as close as possible to the machine they supply. The branch circuits can be run in conduit, greenfield, or flexible cable, depending on local codes and fire regulations.

Suitable convenience outlets should be installed in the computer room and CE room for use by maintenance personnel, customer engineers, and so on.

One receptacle for every five magnetic tape units should be located adjacent to the tape units, and one should be located in the engineering area. These receptacles should accept a Pass and Seymour 9951, 208-volt, 3-phase, 4-wire, 20-ampere connector.

As a safety precaution, a remote power-off device that will remove all power in the computer system should be provided in the machine room.

PHASE ROTATION

The three-phase power receptacles for use with the computer system must be wired for correct phase rotation. Looking at the face of the receptacle, and running counter-clockwise, the sequencing will be phase one, phase two, and phase three.

LIGHTNING PROTECTION

It is recommended that the customer install lightning protection on his secondary power source when:

The utility company installs lightning protectors on the primary source.

Primary power is supplied by an overhead power service.

The area is subject to electrical storms or equivalent type power surges.

A recommended type of service protector to be installed is the G. E. Pellet-Type Model 9LA15A1 or Model 9LA15A4, or its equivalent.

One of either model is required for single-phase lines and two of either model are required for three phase lines.

The determination as to whether lightning protection is desirable, the selection of the service protector needed, and its proper installation are to be made by the customer.

SPECIAL CONSIDERATIONS

Should it, at any time, become necessary to install the 400-cycle power distribution cables in conduit, the conduit used must be non-magnetic.

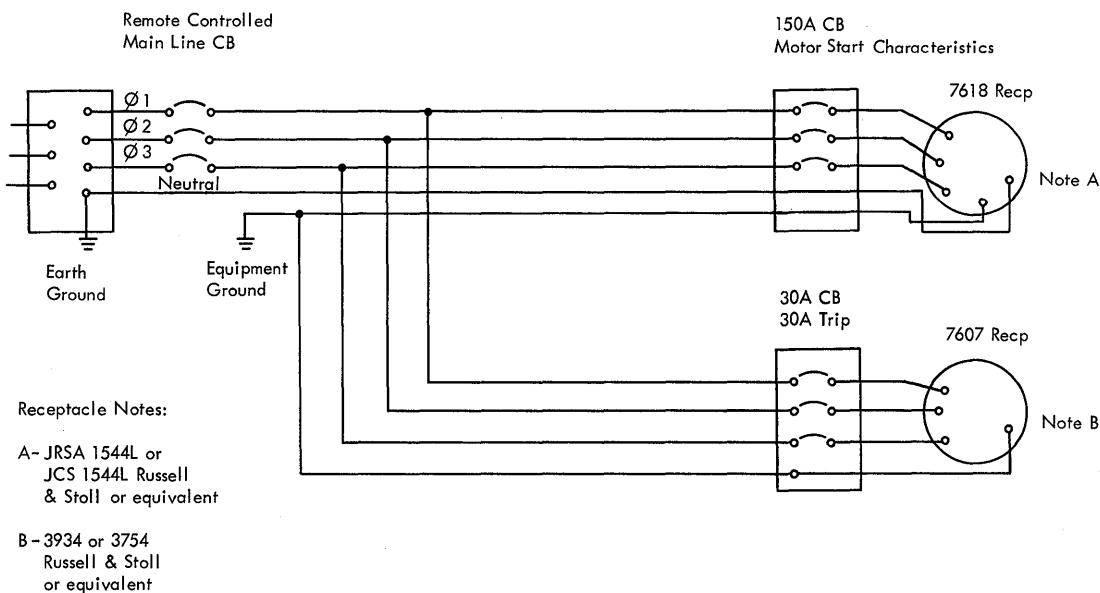


Figure 3. Typical Power System

SPECIFICATION SUMMARY

<u>Machine</u>	<u>Name</u>	<u>KVA</u>	<u>BTU/hr</u>	<u>CFM</u>	<u>Plugs*</u>
711	Card Reader	**	2,600	--	--
716	Printer	5.4	7,150	--	--
721	Card Punch	**	3,070	--	--
729 II/IV/V/VI	Magnetic Tape Unit	1.62	3,900	.500	--
7151	Console Control Unit	0.71	1,570	--	--
7302 Series 11,000	Core Storage	8.03	19,400	1,100	--
7302 Series 12,000	Core Storage	5.83	15,420	1,860	--
7302 Mod 3	Core Storage	7.70	23,400	2,780	--
7108	Instruction Processor	1.59	3,620	400	--
7109	Arithmetic Processor	1.59	3,620	400	--
7110	Instruction Processor	1.82	4,410	500	--
7111	Instruction Processor	1.7	4,600	600	--
7606	Multiplexor	0.73	1,550	400	--
7607	Data Channel	1.53	3,590	500	B
7608#	Power Converter	8.69	19,800	1,100	--
7617	Data Channel Console	--	--	--	--
7618	Power Control	0.20	500	--	C
7909	See I/O Components Manual - Physical Planning, Form C22-6681				

<u>Machine</u>	<u>Weight (lb.)</u>	<u>Dimensions (inches)</u>			<u>Service Clearances (inches)</u>			
		<u>L</u>	<u>W</u>	<u>H</u>	<u>F</u>	<u>R</u>	<u>R.S.</u>	<u>L.S.</u>
711	560	32	30	32	30	24	24	24
716	1,910	59	30	47	42	36	24	30
721	670	40	26	50	36	36	24	24
729 II/IV/V/VI	1,200	34	29	69	30	30	2	2
7151	650+	60	41	44+	36	30	30	30
7302 Series 11,000	2,450	56	30	69	96	42	--	36
7302 Series 12,000	1,500	80	36	70	36	36	30	18
7302 Mod 3	2,200	113	36	70	36	36	30	30
7108	2,225	56	30	69	60	42	0	0
7109	2,225	56	30	69	60	42	&	&
7110	2,335	56	30	69	60	42	0	0
7111	2,335	56	30	69	60	42	0	0
7606	1,500	56	30	69	60	42	--	--
7607	2,290	56	30	69	60	42	&	&
7608	1,680	61	29	58	36	--	--	--
7617	110	30	17	30	24	30	--	--
7618	1,150	56	30	69	30	30	30	30
7909	See I/O Components Manual - Physical Planning, Form C22-6681							

Air conditioning for personnel may be computed on the basis of 500 BTU/hr per person. One ton of air conditioning equals 12,000 BTU/hr.

* Supplied by IBM: B - Russell & Stoll 3760

C - Russell & Stoll JPS - 1544L

** Power for the 711 Card Reader and the 721 Card Punch is supplied through the 716 Printer.

The 7608 Power Converter houses a motor-generator rated at 50 hp and 30 kw. The 19,800 BTU/hr listed for this unit represents the heat dissipation of the 7608 for the system load.

The console width can be reduced to approximately 30" for shipping.

& This figure is 0" if another unit is adjacent to it on the particular side in question or 36" if this unit is the last of a group or standing alone.

+ Model 2 49 inches high and 700 pounds.

CABLES

External interconnecting cables are supplied by IBM. They are custom-made according to lengths required for each installation. Cables are measured and ordered in accordance with the approved layout. The key number or key number group and part number, along with the cable length, must be submitted for each cable or group in the computer system.

All external cables are measured from the base of one unit to the base of the unit to which it connects. When computing cable lengths required between units, measure from center points of cable hole locations and add twice the depth of the false floor, if any. All cable lengths should be as short as possible and under no circumstances may maximum cable lengths be exceeded.

CABLES SUPPLIED

1. Cables necessary to connect standard announced input-output control units to the main processing system.
2. The cables listed below for connecting standard announced components such as punches, readers, printers, storage units, and tape units to the input-output control units or processor.
 - a. One tape signal cable for each tape unit plus one tape signal cable for each tape channel in excess of one in the installation. This cable is to be used for the interchange of tape units between tape channels and/or systems.
 - b. One signal cable (or set of signal cables) for each punch, printer, reader, or other input-output device.
 - c. One signal cable (or set of signal cables) and air hose where required for each storage unit.
 - d. One signal cable for each inquiry station.
 - e. One tape signal cable with each control unit for punch, printer, reader; or tape data selector; or other control unit for auxiliary operation.
 - f. Power cables will be supplied to power each unit as required by the system installation manual.
3. The cable required for new or additional equipment will be supplied in accordance with the above. If components of a system must be moved to permit addition of a new component or system into an existing installation, those cables necessary to permit the move will be replaced at no charge. An explanation of why the cables are required must accompany the cable order. All replaced cables must be returned to the plant.
4. Any cables requested for reasons other than the above (such as a layout revision after installation at the customer's request or cables for special equipment) will be considered only on an RPQ basis.
5. After cables have been ordered, any changes in an approved layout that would affect cable lengths must be accompanied by an RPQ giving complete reasons for the requested change.

Cable orders should be placed with the IBM Manufacturing Plant for the system ordered. Improperly placed orders will not be honored by the receiving plant.

External interconnecting cables should be installed under the false floor. Where a false floor is not used, these cables should be protected from damage. They should also be protected in a way that will not present a safety hazard to operating personnel.

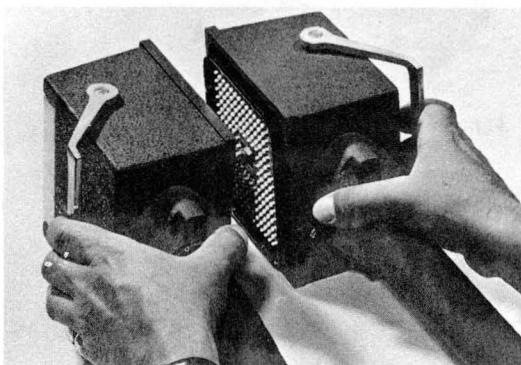
200-POSITION MULTIPLE CONNECTOR

The 200-position multiple connector permits two properly oriented connectors to be joined together without use of a junction box. This feature is especially useful when a tape unit is taken out of line; the signal is made continuous to remaining adjacent tape units by latching their connectors together.

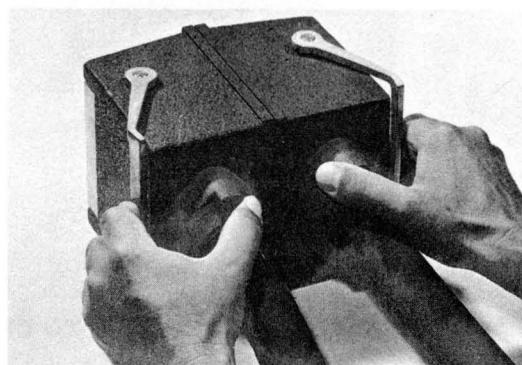
It is important however, that these connectors be joined correctly to minimize possible damage to their keeper plates. Figure 4 illustrates this procedure. The unlatching must be done in the reverse order.

POWER AND SIGNAL CONNECTORS

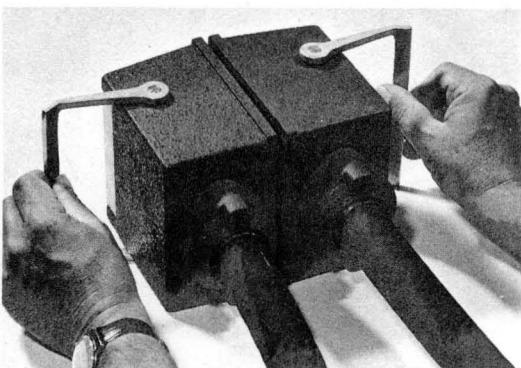
Figures 5 through 14 are representative cable connectors used in the 7090 System. Dimensions given are maximum over-all measurements and may be used in calculations concerning subfloor clearances.



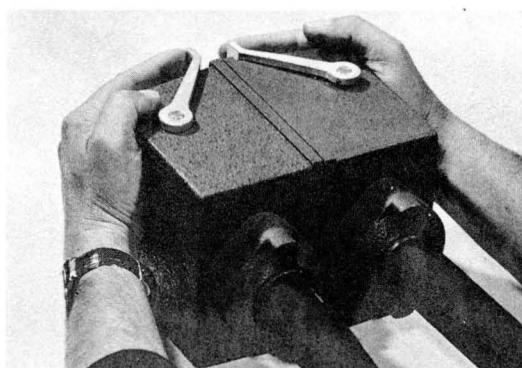
ALIGN CONNECTORS



DEPRESS HANDLES AND
JOIN CONNECTORS



RAISE HANDLES SIMULTANEOUSLY



CONNECTORS LATCHED

Figure 4. Correct Latching of 200-Position Multiple Connector

POWER CONNECTORS BETWEEN MACHINES



Figure 5. 3-5/8" High, 4-1/2" Deep,
2-1/16" Wide

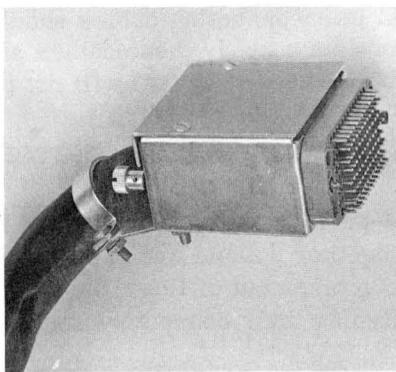


Figure 6. 2-1/2" High, 4" Deep,
2-3/4" Wide

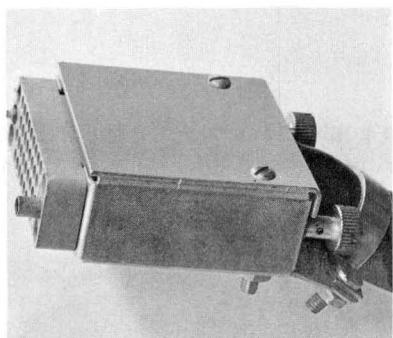


Figure 7. 2-1/2" High, 4" Deep,
2-3/4" Wide

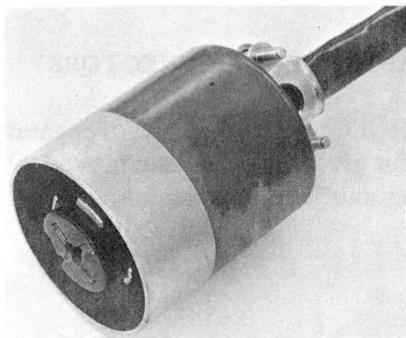


Figure 8. O.D. 2-1/3", 3-1/2" Long

POWER CONNECTORS TO CUSTOMER SERVICE



Figure 9. 3Ø, 30Amp, 4 Wire;
O.D. 2-1/4", 4-1/2" Long

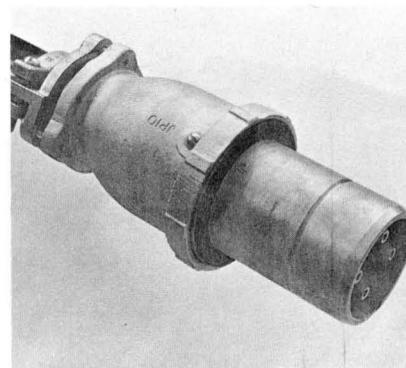


Figure 10. O.D. 4-1/8", 10-1/2" Long

SIGNAL CONNECTORS

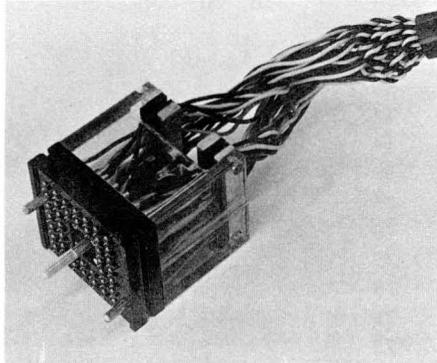


Figure 11. 2" High, 2-1/2" Deep,
2-3/8" Wide

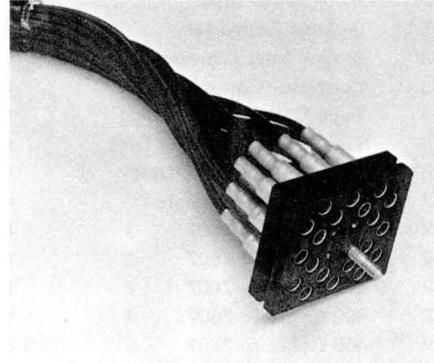


Figure 12. 2" High, 2-13/16" Deep,
2-3/8" Wide

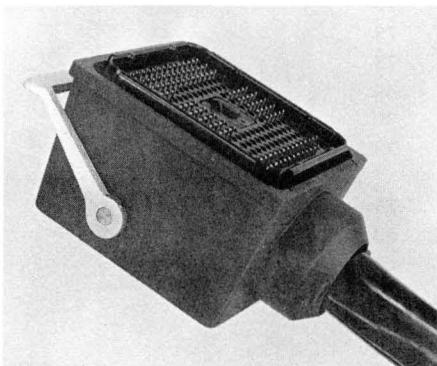


Figure 13. 7-11/16" High, 3-1/2" Deep,
5-15/16" Wide

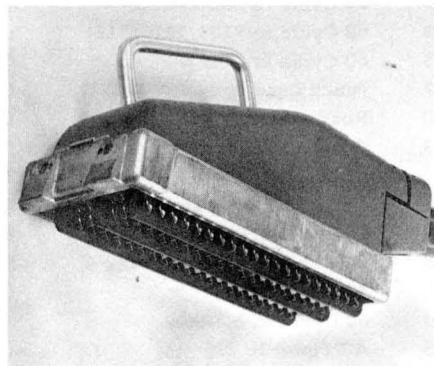
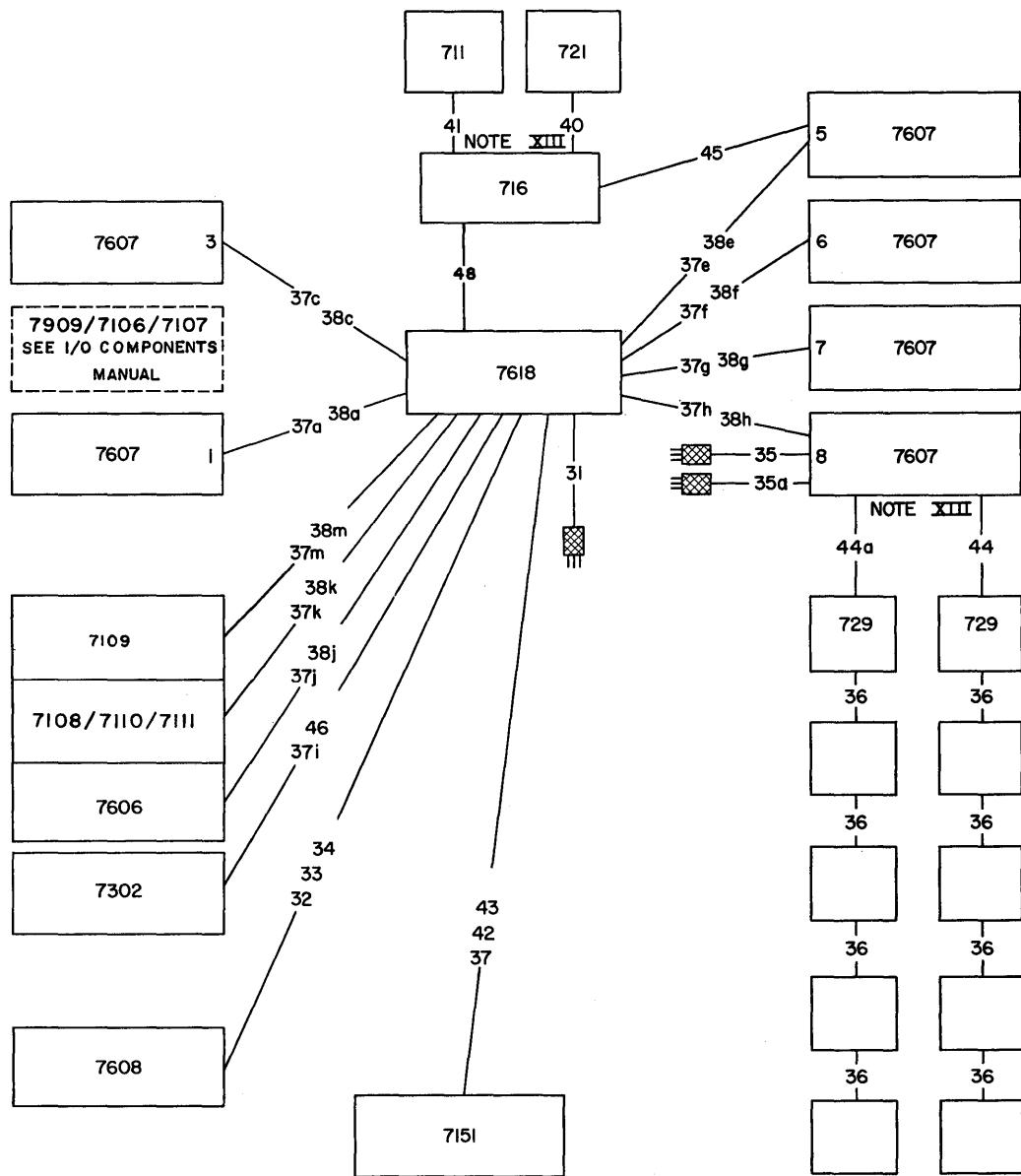


Figure 14. 8-1/4" High, 4-1/2" Deep,
3" Wide

7090/7094/7094 II POWER CABLES

<u>Key No.*</u>	<u>Part No.</u>	<u>Description</u>	<u>Diam. Inches</u>	<u>Maximum Length (ft)</u>	<u>Notes</u>
31	532969	AC - Power Input	1.80	14	III, VII
32	532967	Input to Converter	1.70	50	
33	532970	Output from Converter	1.50	50	
34	532542	Converter Control	0.97	50	
35	532953	Tape Unit Input (1st Leg)	0.50	14	I, VII
35a	532953	Tape Unit Input (2nd Leg)	0.50	14	I, VII
36	535098	Tape Unit to Tape Unit	0.85	50	I
37	532542	400 Cycle to Console	0.70	75	
37a	532542	400 Cycle to 7607 1	0.70	75	
37b	532542	400 Cycle to 7607 2	0.70	75	
37c	532542	400 Cycle to 7607 3	0.70	75	
37d	532542	400 Cycle to 7607 4	0.70	75	
37e	532542	400 Cycle to 7607 5	0.70	75	
37f	532542	400 Cycle to 7607 6	0.70	75	
37g	532542	400 Cycle to 7607 7	0.70	75	
37h	532542	400 Cycle to 7607 8	0.70	75	
37i	532542	400 Cycle to Memory	0.70	75	
37k	532542	400 Cycle to 7108/7110/7111	0.70	75	
37m	532542	400 Cycle to 7109	0.70	75	
38a	532973	60 Cycle to 7607 1	0.80	75	
38b	532973	60 Cycle to 7607 2	0.80	75	
38c	532973	60 Cycle to 7607 3	0.80	75	
38d	532973	60 Cycle to 7607 4	0.80	75	
38e	532973	60 Cycle to 7607 5	0.80	75	
38f	532973	60 Cycle to 7607 6	0.80	75	
38g	532973	60 Cycle to 7607 7	0.80	75	
38h	532973	60 Cycle to 7607 8	0.80	75	
38j	532973	60 Cycle to Multiplexor	0.80	75	
38k	532973	60 Cycle to 7108/7110/7111	0.80	75	
38m	532973	60 Cycle to 7109	0.80	75	
40	320187	Punch Input	0.70	44	
41	513320	Reader Input	0.70	30	
42	532553	Console Marginal Check Control	1.25	75	
43	532554	Console Control and 60 Cycle	1.20	75	
44	532536	7607 to 1st Tape Unit Leg	0.85	60	I, IX
44a	532536	7607 to 2nd Tape Unit Leg	0.85	60	I, IX
45	532535	7607 to Printer	0.50	35	I
46	532554	60 Cycle to Memory	1.20	75	
48	535575	AC Power to 716	0.70	75	

* See Figure 15



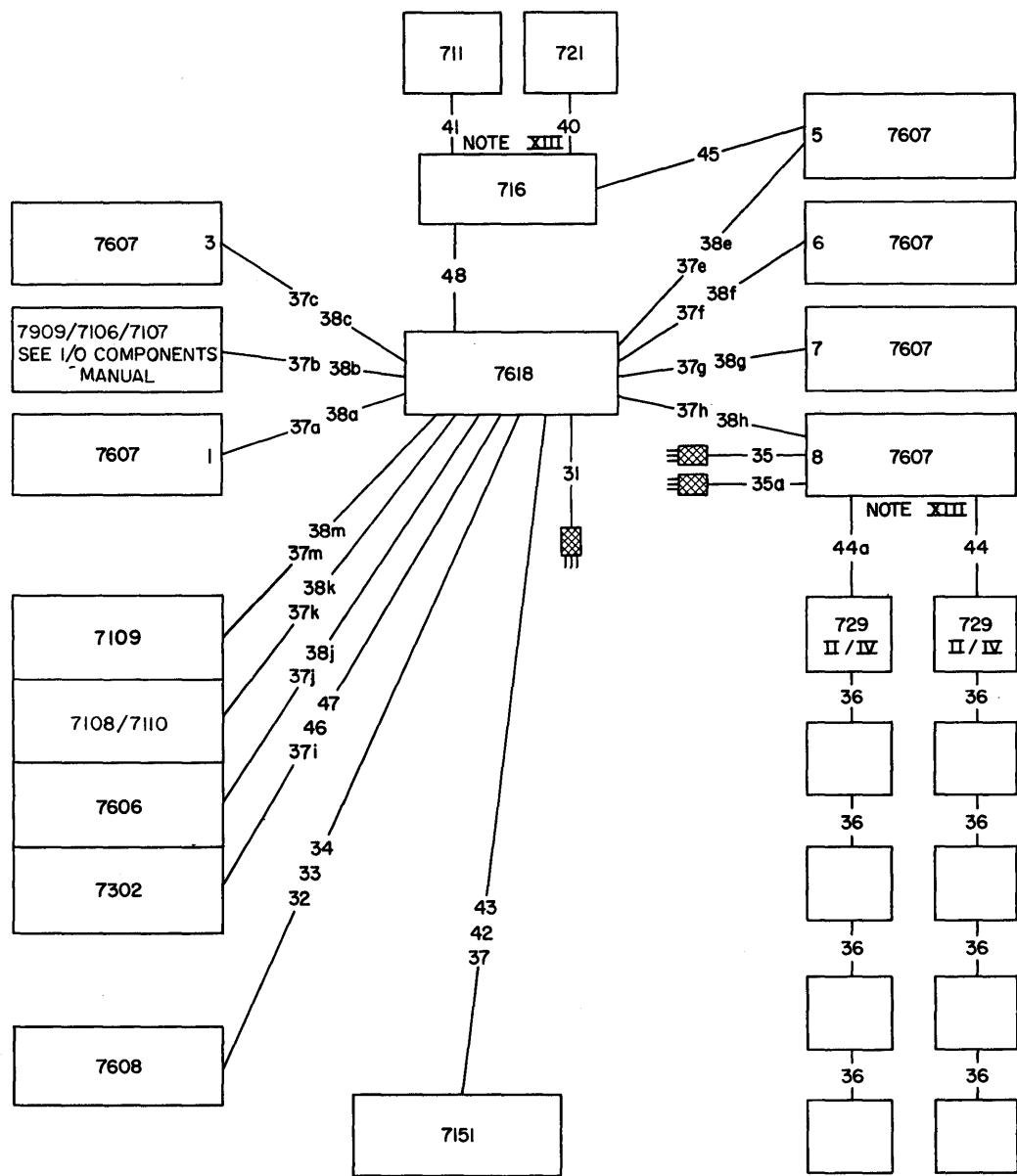
Cable notes are on pages 40 and 41.

Figure 15. Power Cabling Schematic for 7090/7094 with 7302 Series 12,000 and for 7094 II with 7302-3

POWER CABLES FOR 7090/7094 WITH 7302 SERIES 11,000

<u>Key No.*</u>	<u>Part No.</u>	<u>Description</u>	<u>Diam. Inches</u>	<u>Max. Length (ft)</u>	<u>Notes</u>
31	532969	AC - Power Input	1.80	14	III, VII
32	532967	Input to Converter	1.70	50	
33	532970	Output from Converter	1.50	50	
34	532542	Converter Control	0.97	50	
35	532953	Tape Unit Input (1st Leg)	0.50	14	I, VII
35a	532953	Tape Unit Input (2nd Leg)	0.50	14	I, VII
36	535098	Tape Unit to Tape Unit	0.85	50	I
37	532542	400 Cycle to Console	0.70	75	
37a	532542	400 Cycle to Data Channel	1	0.70	75
37b	532542	400 Cycle to Data Channel	2	0.70	75
37c	532542	400 Cycle to Data Channel	3	0.70	75
37d	532542	400 Cycle to Data Channel	4	0.70	75
37e	532542	400 Cycle to Data Channel	5	0.70	75
37f	532542	400 Cycle to Data Channel	6	0.70	75
37g	532542	400 Cycle to Data Channel	7	0.70	75
37h	532542	400 Cycle to Data Channel	8	0.70	75
37i	532542	400 Cycle to Memory		0.70	75
37k	532542	400 Cycle to 7108/7110		0.70	75
37m	532542	400 Cycle to 7109		0.70	75
38a	532973	60 Cycle to Data Channel	1	0.80	75
38b	532973	60 Cycle to Data Channel	2	0.80	75
38c	532973	60 Cycle to Data Channel	3	0.80	75
38d	532973	60 Cycle to Data Channel	4	0.80	75
38e	532973	60 Cycle to Data Channel	5	0.80	75
38f	532973	60 Cycle to Data Channel	6	0.80	75
38g	532973	60 Cycle to Data Channel	7	0.80	75
38h	532973	60 Cycle to Data Channel	8	0.80	75
38j	532973	60 Cycle to Multiplexor		0.80	75
38k	532973	60 Cycle to 7108/7110		0.80	75
38m	532973	60 Cycle to 7109		0.80	75
39	535575	Printer AC Input	0.70	14	II, VII
40	320187	Punch Input	0.70	44	
41	513320	Reader Input	0.70	30	
42	532553	Console Marginal Check Control	1.25	75	
43	532554	Console Control and 60 Cycle	1.20	75	
44	532536	Data Channel to 1st Tape Unit Leg	0.85	60	I, IX
44a	532536	Data Channel to 2nd Tape Unit Leg	0.85	60	I, IX
45	532535	Data Channel to Printer	0.50	35	I
46	532554	60 Cycle to Memory	1.20	75	
47	532537	Memory Heater Input	0.60	75	
48	535575	AC Power to 716	0.70	75	

* See Figure 16.



Cable Notes are on pages 40 and 41.

Figure 16. Power Cabling Schematic for 7090/7094 with 7302 Series 11,000

SIGNAL CABLES FOR 7090/7094 WITH 7302 SERIES 12,000 AND FOR
7094 II WITH 7302-3

<u>Key No.</u>	<u>Part No.</u>	<u>Description</u>	<u>Diam. Inches</u>	<u>Maximum Length (ft)</u>	<u>Notes</u>
1	533724	Printer - Card Punch	1.10	20	
2	532120	Printer - 7607	1.10	35	
3	532120	Printer - 7607	1.10	35	
4	533717	Printer - Card Reader	1.10	30	
**5-5b	587323	7151 Console - 7109	0.83	65	
**6-6g	587323	7151 Console - 7108/7110	0.83	65	
**6h-6j	587323	7151 Console - 7110/7111	0.83	65	
7	587323	7151 Console - Multiplexor	0.83	65	
**8-8d	587323	Data Channel Console - 7607	0.83	50	
**9-9e	587323	Data Channel Console - 7607	0.83	50	
10	587314	Multiplexor - 7607 1	0.93	100	
10a	587314	Multiplexor - 7607 2	0.93	100	
10b	587314	Multiplexor - 7607 3	0.93	100	
10c	587314	Multiplexor - 7607 4	0.93	100	
10d	587314	Multiplexor - 7607 5	0.93	100	
10e	587314	Multiplexor - 7607 6	0.93	100	
10f	587314	Multiplexor - 7607 7	0.93	100	
10g	587314	Multiplexor - 7607 8	0.93	100	
**11-11b	587314	Multiplexor - 7607 1	0.93	100	V
**12-12c	587314	Multiplexor - 7607 1	0.93	100	V
**13-13b	587314	Multiplexor - 7607 1	0.93	100	V
**13a	531641	Multiplexor - 7607 1	0.93	100	XV
**14-14f	587314	7607 - 7607	0.93	100	V
**15-15a	587314	7607 - 7607	0.93	100	V
**15b	531641	7607 - 7607	0.93	100	V
**16-16b	587314	Multiplexor - 7607 5	0.93	100	V
**17-17c	587314	Multiplexor - 7607 5	0.93	100	V
**18-18b	587314	Multiplexor - 7607 5	0.93	100	V
**18a	531641	Multiplexor - 7607 5	0.93	100	XV
19	535099	Tape Unit - Tape Unit	1.45	60	IV
20	532121	7607 - Tape Unit	1.45	60	IV, IX
21	532121	7607 - Tape Unit	1.45	60	IV, IX
22	352464	Tape Unit - Tape Unit (Special)	1.45		XIV
**23-23g	587314	Multiplexor - 7302	0.93	18	
**23b-23g	587314	Multiplexor - 7302-3	0.93	18	XVI
**24-24a	587314	7302-3 - 7111	0.93	21	XVI

* See Figure 17.

** This specifies a multiple group of cables.

Example: Key No. 5-5b represents cables 5, 5a, and 5b.

When submitting a cable order, the three cables can be ordered by calling out the Key No. group 5-5b.

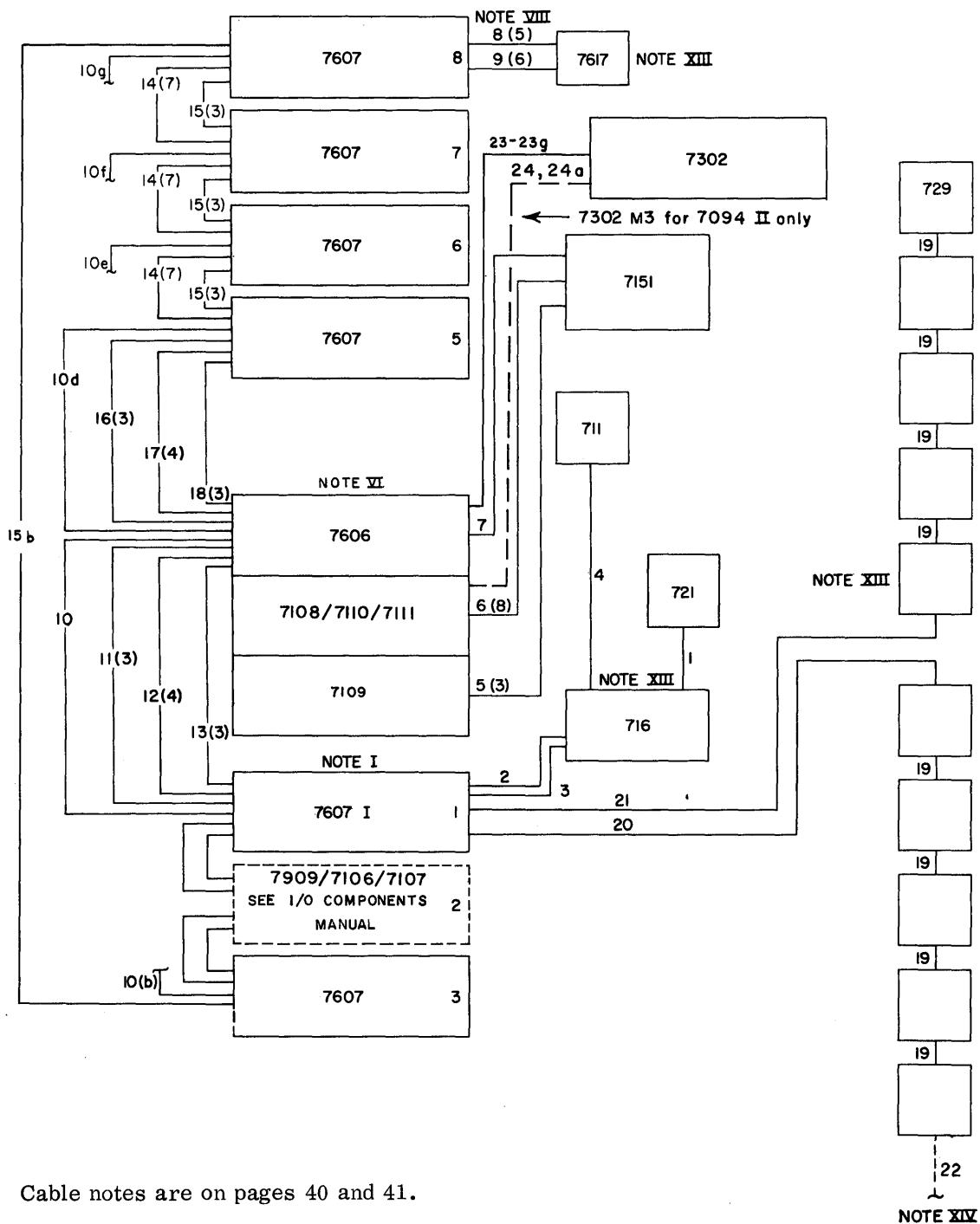


Figure 17. Signal Cabling Schematic for 7090/7094 with 7302 Series 12,000 and for 7094 II with 7302-3

SIGNAL CABLES FOR 7090/7094 WITH 7302 SERIES 11,000

<u>Key No.*</u>	<u>Part No.</u>	<u>Description</u>	<u>Diam. Inches</u>	<u>Max. Length(ft)</u>	<u>Notes</u>
1	533724	Printer - Card Punch	1.10	20	
2	532120	Printer - Data Channel	1.10	35	
3	532120	Printer - Data Channel	1.10	35	
4	533717	Printer--Card Reader	1.10	30	
**5 - 5b	587323	7151 Console - 7109	0.83	65	
**6 - 6g	587323	7151 Console - 7108/7110	0.83	65	
**6h - 6j	587323	7151 Console - 7110	0.83	65	
7	587323	7151 Console - Multiplier	0.83	65	
**8 - 8d	587323	Data Channel Console - Data Channel	0.83	50	
**9 - 9e	587323	Data Channel Console - Data Channel	0.83	50	
10	587314	Multiplexor - Data Channel 1	0.93	100	
10a	587314	Multiplexor - Data Channel 2	0.93	100	
10b	587314	Multiplexor - Data Channel 3	0.93	100	
10c	587314	Multiplexor - Data Channel 4	0.93	100	
10d	587314	Multiplexor - Data Channel 5	0.93	100	
10e	587314	Multiplexor - Data Channel 6	0.93	100	
10f	587314	Multiplexor - Data Channel 7	0.93	100	
10g	587314	Multiplexor - Data Channel 8	0.93	100	
**11 - 11b	587314	Multiplexor - Data Channel 1	0.93	100	V
**12 - 12c	587314	Multiplexor - Data Channel 1	0.93	100	V
**13 - 13b	587314	Multiplexor - Data Channel 1	0.93	100	V
**14 - 14f	587314	Data Channel - Data Channel	0.93	100	V
**15 - 15b	587314	Data Channel - Data Channel	0.93	100	V
**16 - 16b	587314	Multiplexor - Data Channel 5	0.93	100	V
**17 - 17c	587314	Multiplexor - Data Channel 5	0.93	100	V
**18 - 18b	587314	Multiplexor - Data Channel 5	0.93	100	V
19	535099	Tape Unit - Tape Unit	1.45	60	IV
20	532121	Data Channel - Tape Unit	1.45	60	IV, IX
21	532121	Data Channel - Tape Unit	1.45	60	IV, IX
22	352464	Tape Unit - Tape Unit (Special)	1.45		XIV

* See Figure 18.

** This specifies a multiple group of cables.

Example: Key No. 5-5b represents cables 5, 5a, and 5b.

When submitting a cable order, the three cables can be ordered by calling out the Key No. group 5-5b.

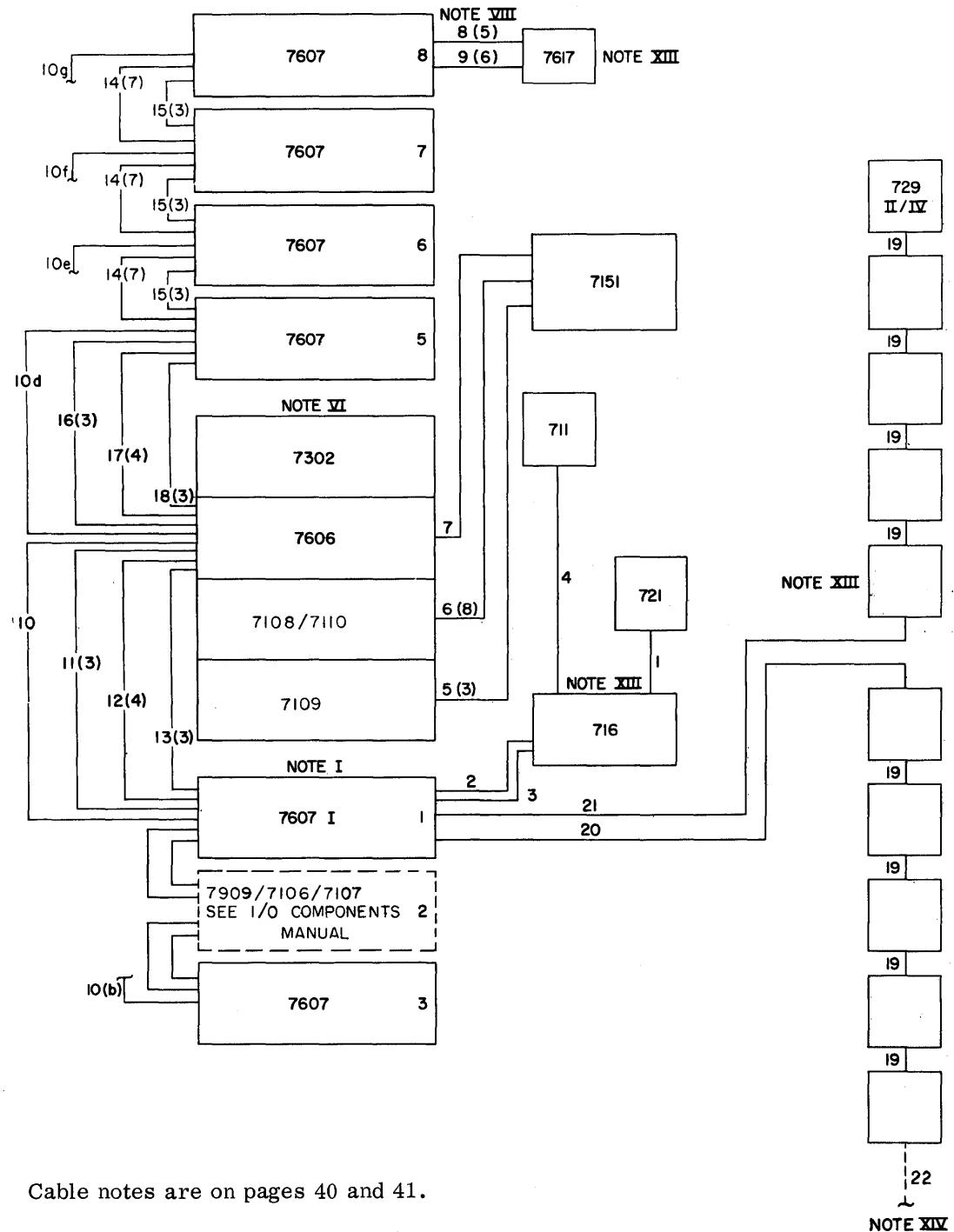


Figure 18. Signal Cabling Schematic for 7090/7094 with 7302 Series 11,000

CABLE NOTES

- I. Each 7607 Data Channel can have two legs of 729 II, IV, V, or VI Magnetic Tape Units attached with a maximum of five intermixed tape units per leg. The 7607 Model 1 or 3 can also have printer, card punch, and card reader attached; the 7607 Model 2 or 4 can only accommodate ten intermixed tape units. The 7607 will possess one 30-ampere plug for each tape unit leg. The maximum combined power cable length between the 7607 Data Channel and the furthest tape unit in that group is 60 feet. This is the combined total of cable key numbers 36 and 44 or 44a (Figure 15).
- III. The 7618 Power Control houses the motor-generator controls and distribution power cables to the 7151, 7302, 7606, 716, 7108/7110, 7109, 7909, and 7607's. It receives 208-volt, 60-cycle, 3-phase power from the customer's source. The 7608 Power Converter is an acoustically treated unit that houses the motor-generator. It receives 60-cycle, 208-volt, 3-phase power and returns 400-cycle, 208-volt, 3-phase power. The 7618 takes this 400-cycle power and distributes it to all units mentioned. The 7618 also distributes 60-cycle power for the convenience outlets and cooling fans of these units.
- IV. A maximum of five magnetic tape units may be connected in one signal group (not required to be in the same power group). Two tape groups are available in each 7607 Data Channel. Maximum allowed signal cabling from the data channel to the furthest tape unit in that signal group is 60 feet. This includes the combined cable lengths of cable key numbers 19 and 20 and 21 (Figure 17).
- V. The 7606 Multiplexor can have two legs of signal cable groups to feed 7607 or 7909 Data Channels. A maximum of four data channel units may be connected in one signal group. Maximum allowed signal cabling from the multiplexor to the data channel is 100 feet per signal leg. In addition, 140 feet of priority cable (key 15b) is available to connect the ends of the signal legs of a two channel system. This results in a total of 340 feet of cable for a two channel system. For every channel in excess of two, reduce the total allowable cable by 40 feet. For maximum system efficiency, channels should be numbered in descending character rate order and cabled in numeric sequence. (See Figure 19.)
- VI. The 7108 (or 7110), 7109 and 7606 Multiplexor units must be placed against one another. All interconnecting cables between these units will be considered internal.

<u>Machine</u>	<u>Plug</u>	<u>Receptacle</u>	<u>Size</u>	<u>Phase</u>
7607	R & S - 3760	R & S - 3934 or R & S - 3754	30A, 250v	3
7618	R & S - JPS1544L	R & S - JRSA - 1544L or R & S - JCS - 1544L	150A, 250v	3

- VIII. The number in parentheses represents the number of cables.
- IX. If only one tape unit leg is required, either power cable 44a or 44 (Figure 15) can be ordered. The same is true for signal cable numbers 20 and 21 (Figure 17).
- XIII. Tape units, card machines, and 7617 Data Channel Consoles are shown for only one 7607 Data Channel. Each data channel has its own data channel console, its complement of tape units, and/or card machines. Card machines can be attached to a 7607 Model 1 or 3 only.
- XIV. This cable is provided when it is desired to interconnect tape units between channels and/or systems. This cable differs from the normal tape signal cable in that the same type of connector face is required at each end. One such cable is supplied for every tape channel in excess of one. Care should be taken to prevent exceeding the maximum number of tape units or cable limitations of any channel or of the system.
- XV. One cable, either 13a or 18a, may be ordered, but not both depending on routing of priority cable discussed in Note V.
- XVI. Cable key numbers 23 and 23a are not required for a 7302-3. Cable key numbers 23b through 23g are the same for the 7302-3 as key numbers 23b through 23g for a 7302 Series 12,000. Key numbers 24 and 24a are required only for a 7302-3.

7909 DATA CHANNEL CABLING

Increased priority requirements of the 7909 Data Channel and its attachable units have made necessary the revision of the cabling scheme for the data channels to increase the flexibility of the system.

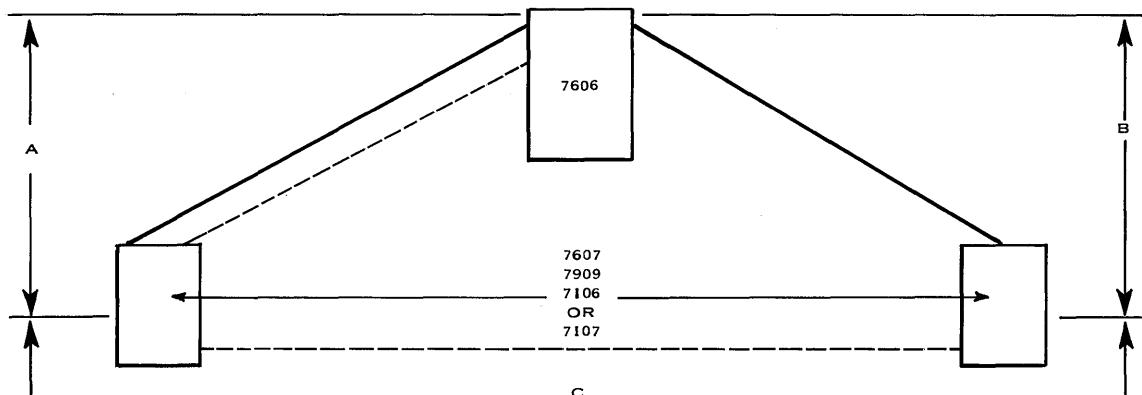
The new method of cabling provides more cable than was previously available in most cases and eliminates some of the problems which arise as a result of cable limitations.

When a 7909 is installed, the following rules should be followed to make the operation of the system as efficient as possible.

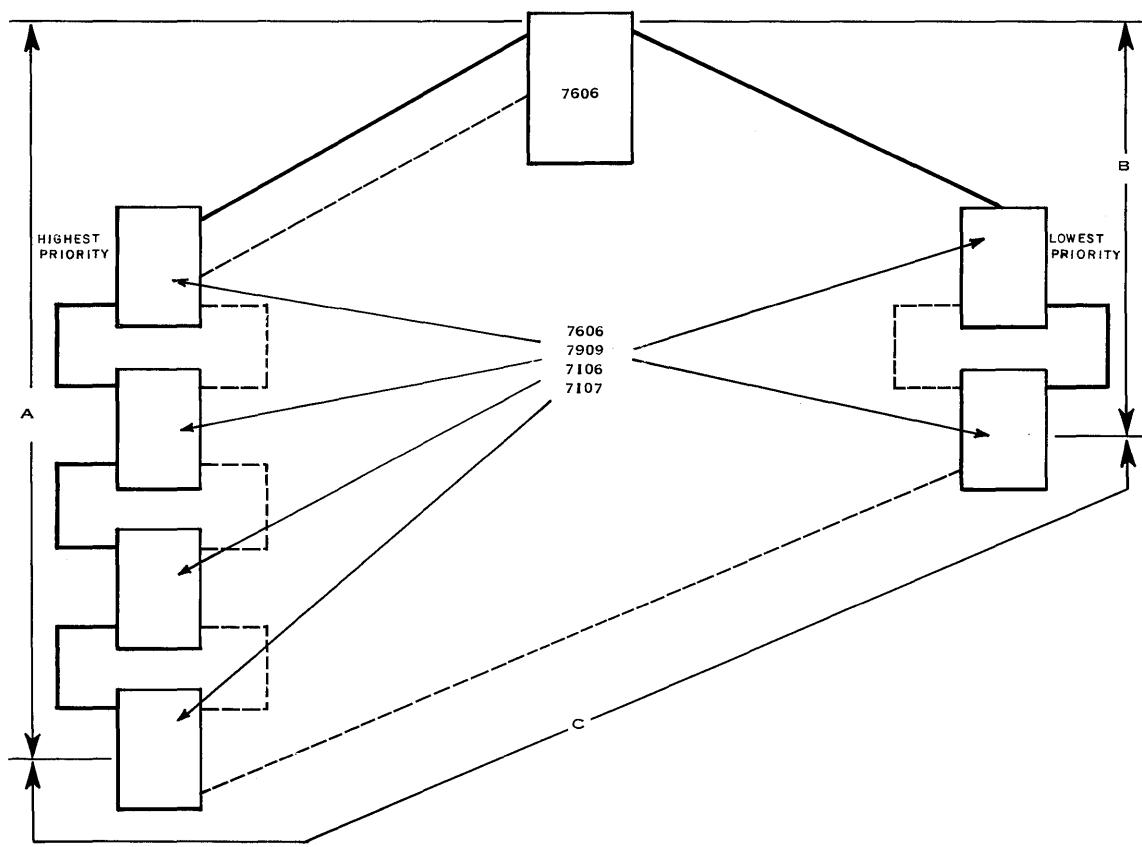
1. Number the data channels in descending character-rate order.
2. Cable channels in numeric sequence according to the following cable limits.

Note: Items 1 and 2 apply to the priority cable (P/N 531641) only. Signal cables are routed out of the multiplexor to each signal leg as before. The limits are:

- a. For a two-channel system--100 ft. per signal leg maximum (200 ft. total), and 140 ft. to connect signal legs together. (340 ft. total.)
- b. For each additional channel reduce the total cable allowed (340 ft.) by 40 ft. For example, a six channel system with 4 channels on one signal leg and two on the other results in 180 ft. of total cable. This could be apportioned 100 ft. on leg 1, 40 ft. on leg 2, and 40 ft. to connect legs, or in any other combination totaling 180 ft., provided that no individual signal leg is longer than 100 ft., and that the priority cable connecting signal legs does not exceed 140 ft. The priority cable is to follow the same route as the signal cables between channels and is to be the same length.



2-Channel System



6-Channel System

FOR BOTH SYSTEMS ————— SIGNAL CABLE

----- PRIORITY CABLE

$$\text{TOTAL CABLE ALLOWABLE} = A + B + C = 340 - 40 [N-2]$$

WHERE N = NO. OF CHANNELS B \leq 100 FT.

A \leq 100 FT.

C \leq 140 FT.

Figure 19. Data Channel Cabling -- 7090/7094/7094 II Systems

7090/7094 TO 7094 II CONVERSION

If a 7090 or 7094 is installed, it is possible to convert to a 7094 II in the field. The following is the required data and the suggested procedure for such a conversion.

The following units will require modification or replacement as noted:

7090 System Units

7108 replaced with a 7111 unit
7109 field-modified
7151 field-modified to a 7151-2
7302 replaced with a 7302-3
7606 field-modified to a 7606-2
7607 field-modified (all units)

7094 System Units

7109 field-modified
7110 replaced with a 7111
7151 field-modified
7302 replaced with 7302-3
7606 field-modified to 7606-2

Procedure for Conversion

1. Make a system layout including the 7302-3. The physical specifications will be found in the 7090/94/94 II Specifications Summary. When converting from a 7090 or 7094 with a 7302 Series 11,000 to a 7094 II, it may be necessary to rearrange some of the units to permit the installation of the larger 7302-3.
2. Cables with key numbers 23b through 23g, 24, and 24a must be ordered for the 7302-3 when converting from a 7090 or 7094 with 7302 Series 11,000 to a 7094 II. Key numbers 37i and 46 may have to be ordered if the presently installed cables are too short. Key number 47 is not required for the 7302-3. If the 7090 or 7094 has a 7302 Series 12,000 installed, key numbers 23b through 23g can be reused, and 23 and 23a can be substituted for 24 and 24a, provided they are long enough.
3. Cables with key numbers 6h and 6j must be ordered when converting from a 7090 to a 7094 II.

The cable order for the above cables, plus an MES for any cables required for rearrangement of the system units to permit the conversion, should be in the factory 90 days prior to shipment of conversion units. A copy of the new system layout is to accompany the cable order.

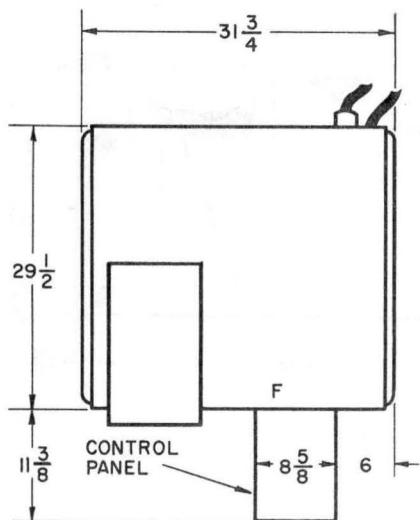
MACHINE DRAWINGS

The drawings on following pages are not to scale. The features, as dimensioned, are in their correct locations.

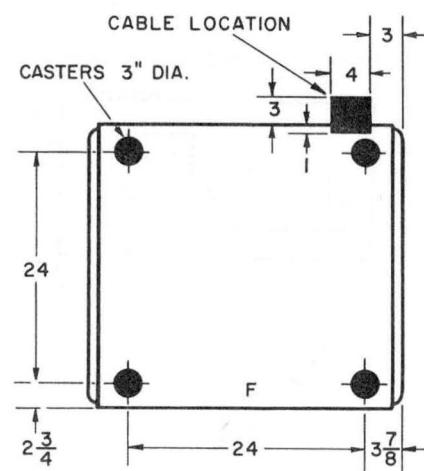
The cable floor openings, shown by the darkened areas, are the recommended sizes for a pedestal-type floor construction, where it is often necessary to insert the connector ends of the cable up through the floor. Where a raceway type of construction is used, the floor opening may be decreased, because the opening must be large enough to accommodate only the cables themselves. Air intake locations shown on some drawings are the recommended areas from which an air intake hole can be cut in the floor. The size of the opening is determined by the amount of air required. Note: All dimensions are in inches.

711 CARD READER

Top View



Plan View



Notes

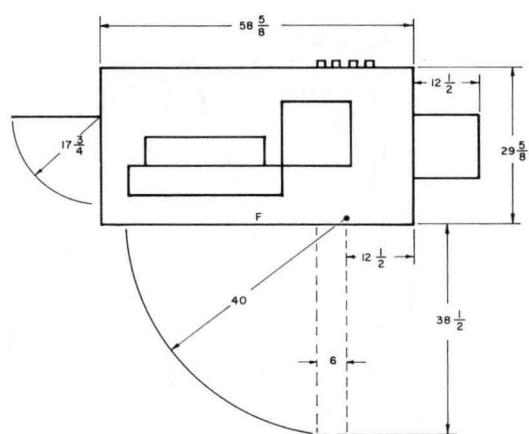
Height: 31-5/8 inches

Service Clearances:

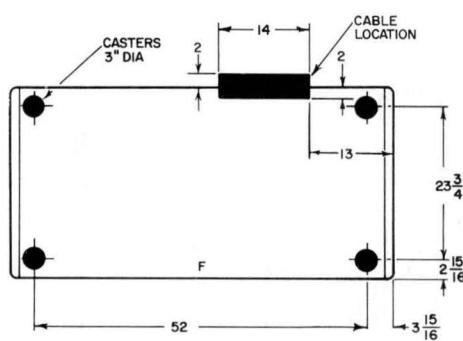
Front	30 inches
Rear	24 inches
Left Side	24 inches
Right Side	24 inches

716 PRINTER

Top View



Plan View



Notes

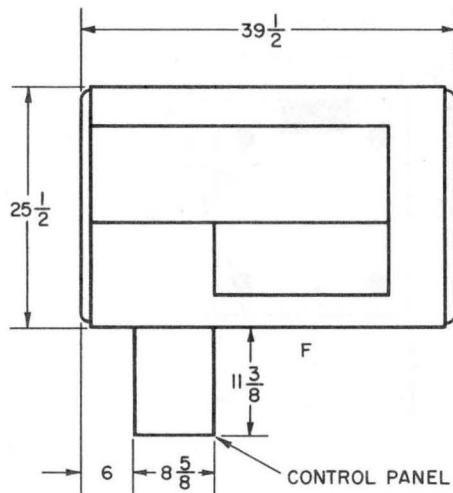
Height: 47 inches

Service Clearances:

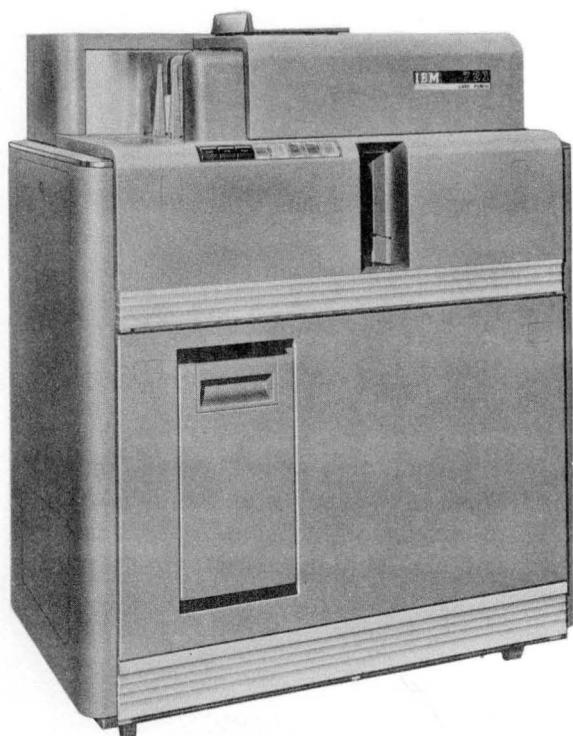
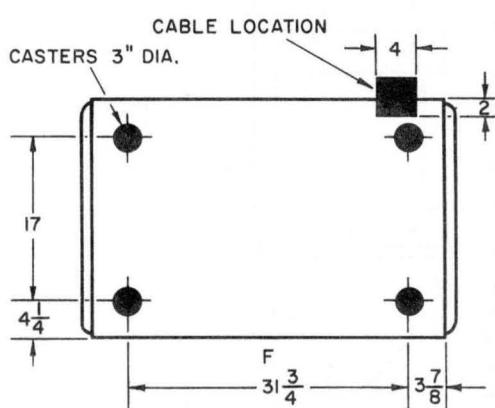
Front	42 inches
Rear	36 inches
Left Side	30 inches
Right Side	24 inches

721 CARD PUNCH

Top View



Plan View



Notes

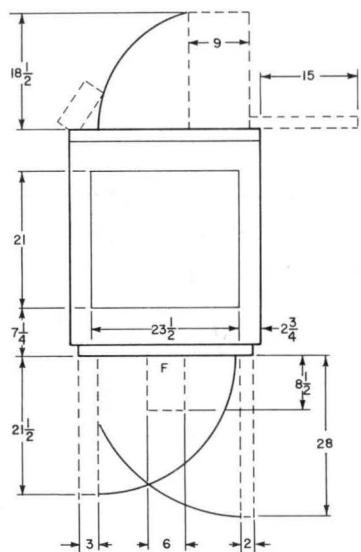
Height: 49-5/8 inches

Service Clearances:

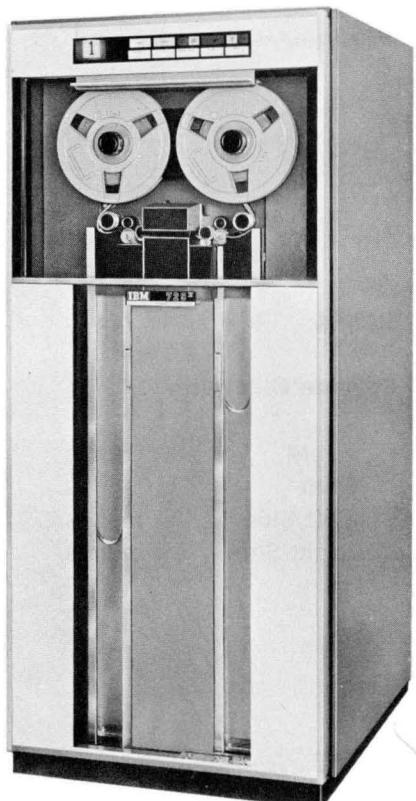
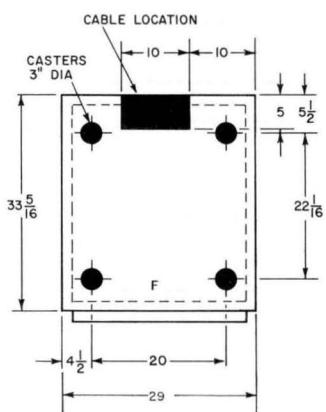
Front	36 inches
Rear	36 inches
Left Side	24 inches
Right Side	24 inches

729 II, IV, V, VI MAGNETIC TAPE UNIT

Top View



Plan View



Notes

Height: 69 inches

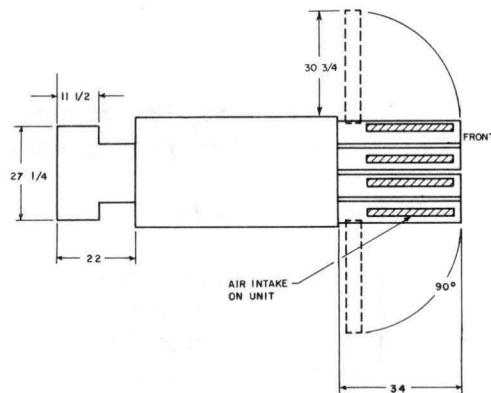
Service Clearances:

Front	30 inches
Rear	30 inches
Sides	*

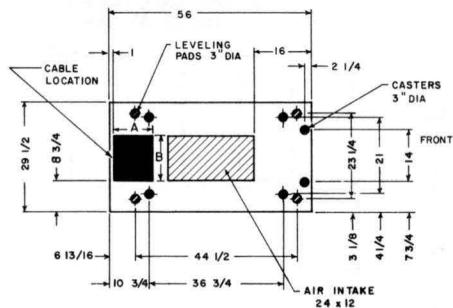
* Minimum clearance between tape units of two inches on the sides, otherwise 30 inches between a tape unit and any other unit.

7108, 7110, 7111 INSTRUCTION PROCESSING UNIT
 7109 ARITHMETIC SEQUENCE UNIT
 7606 MULTIPLEXOR
 7607 DATA CHANNEL

Top View



Plan View



Notes

Height: 69 inches

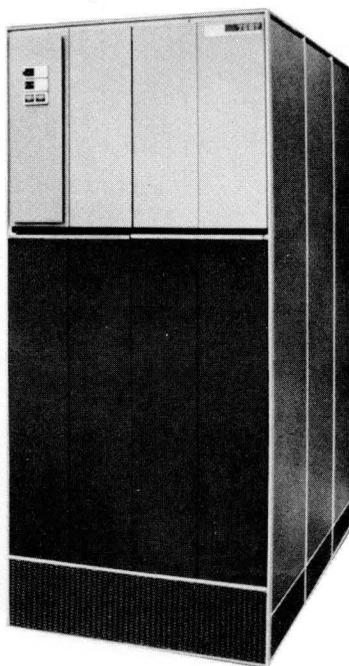
Service Clearances:

Front	60 inches
Rear	42 inches
Sides	*

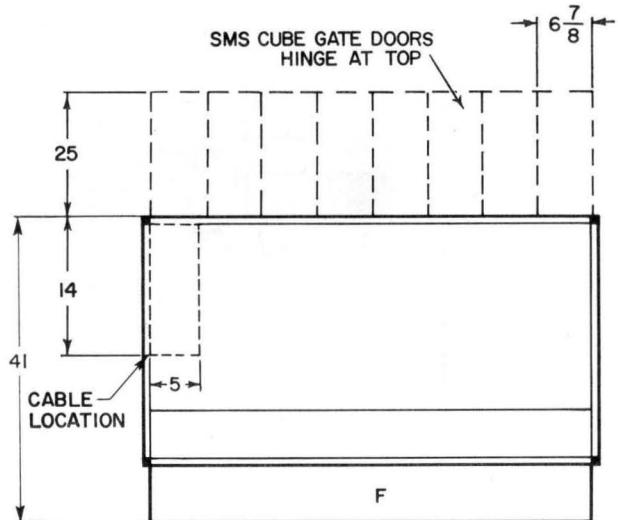
*No service clearance is required unless unit is last one in a row; then 36 inches are required on the exposed side.

Cable Holes in Inches

	A	B
7108	8	12
7109	8	12
7110	8	12
7111	8	12
7606	12	12
7607	12	12



7151 CONSOLE CONTROL UNIT



Notes

Height: 44 inches (7090 System)
49 inches (7094 System)

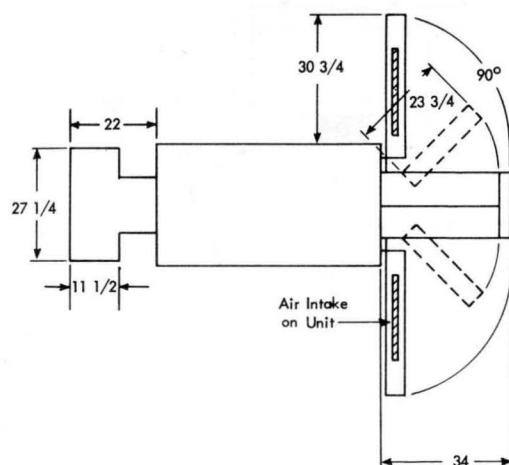
Service Clearances:

Front	36 inches
Rear	30 inches
Left Side	30 inches
Right Side	30 inches

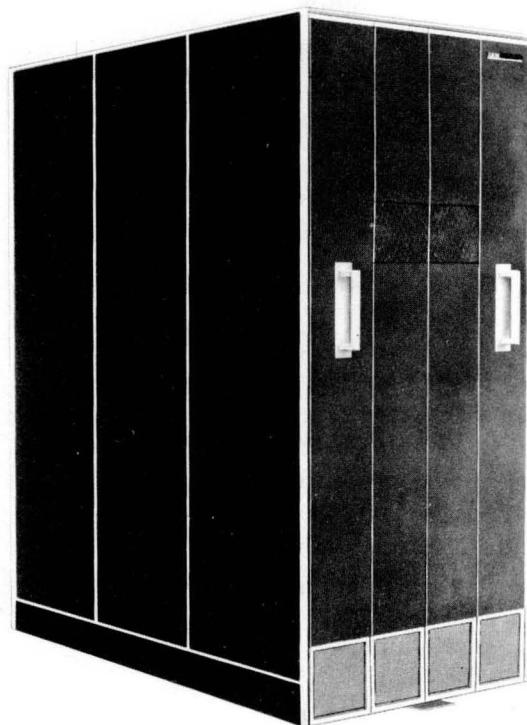
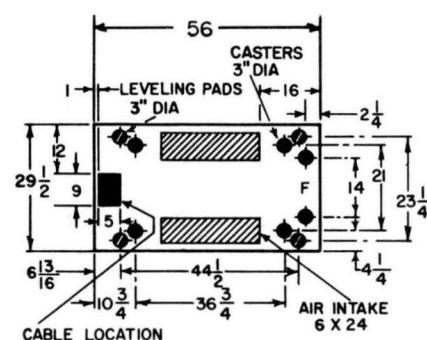


7302 CORE STORAGE SERIES 11,000

Top View



Plan View



Notes

Height: 69 inches

Service Clearances:

Front 96 inches*

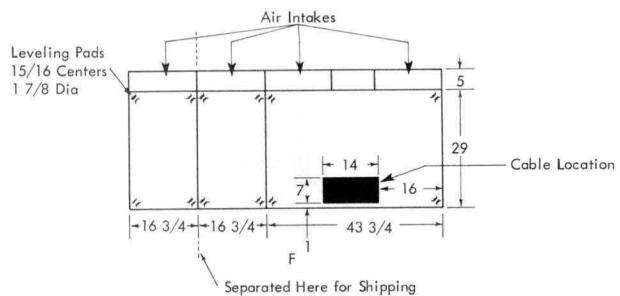
Rear 42 inches

L. Side 36 inches

* The 96-inch clearance is required to permit the use of the power lift for removal of the core array from the oil tank. It may be decreased to 60 inches with readily removable units.

7302 CORE STORAGE SERIES 12,000

Plan View



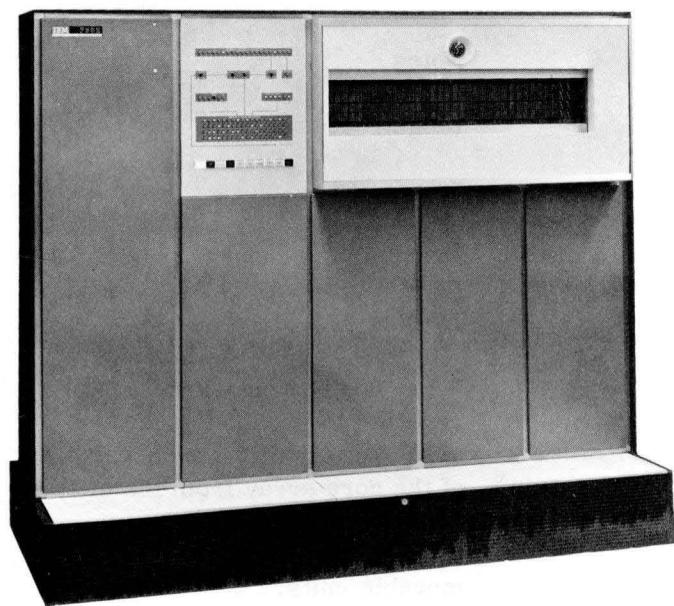
Notes

Height: 70 inches

Service Clearances:

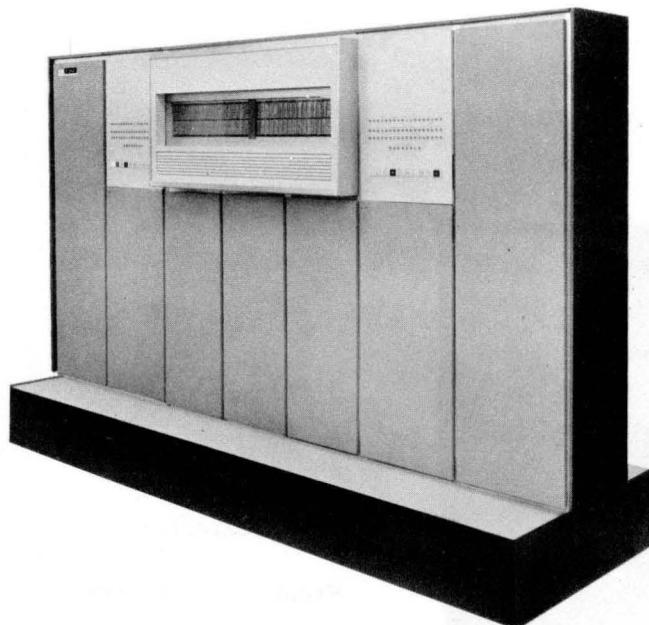
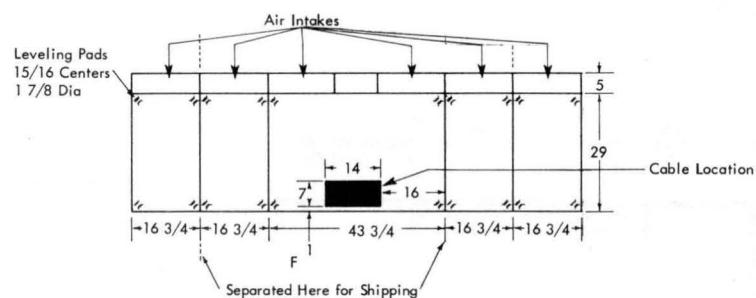
Front	36 inches
Rear	36 inches
Left Side	18 inches
Right Side	30 inches

The plan view does not include covers. One inch must be added all around to include them. The air intakes receive room air from the rear. Casters are mounted opposite the leveling pads at the four corners of each separated section for shipping; these casters are removed when the units are in position.



7302 CORE STORAGE MODEL 3

Plan View



Notes

Height: 70"

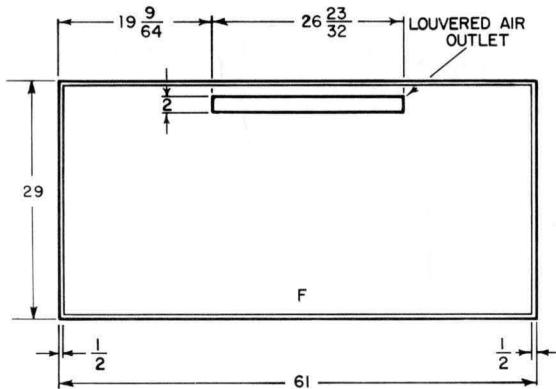
Service Clearance:

Front	Rear	RS	LS
36"	36"	30"	30"

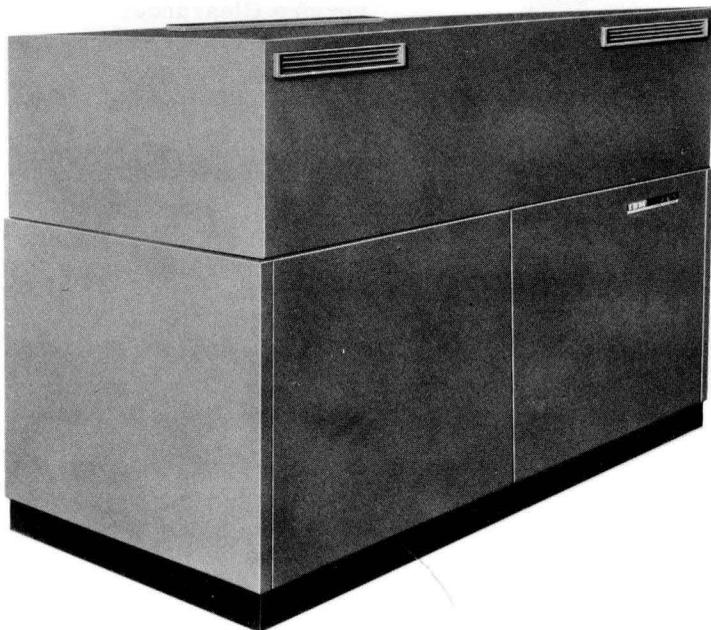
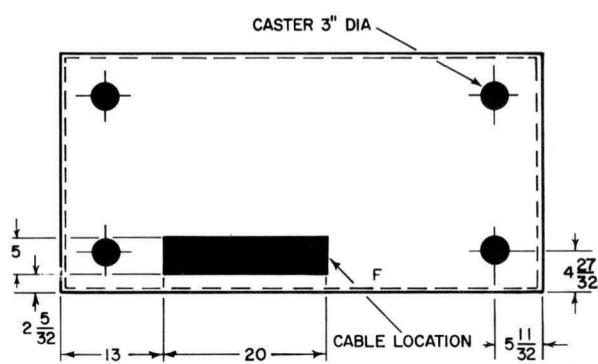
Plan view does not include covers. One inch must be added all around to include them.

7608 POWER CONVERTER

Top View



Plan View



Notes

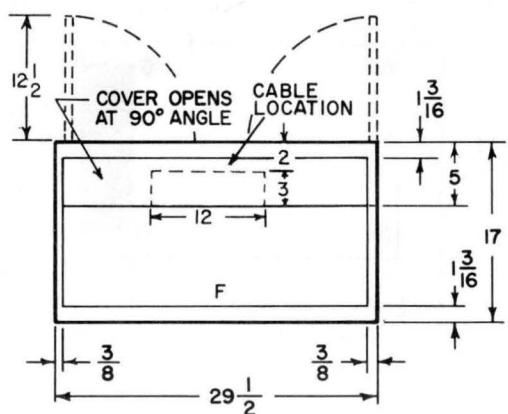
Height: 58 inches

Service Clearance:

Front 36 inches

7617 DATA CHANNEL CONSOLE

Top View



Notes

Height: 30 inches

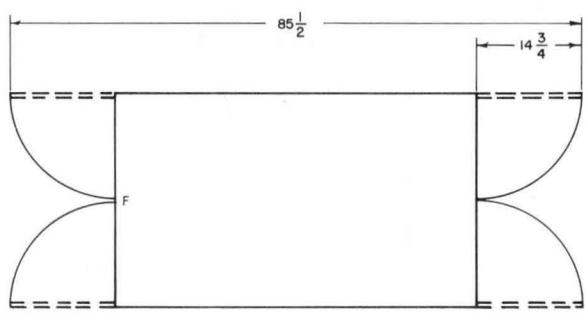
Service Clearances:

Front	24 inches
Rear	30 inches

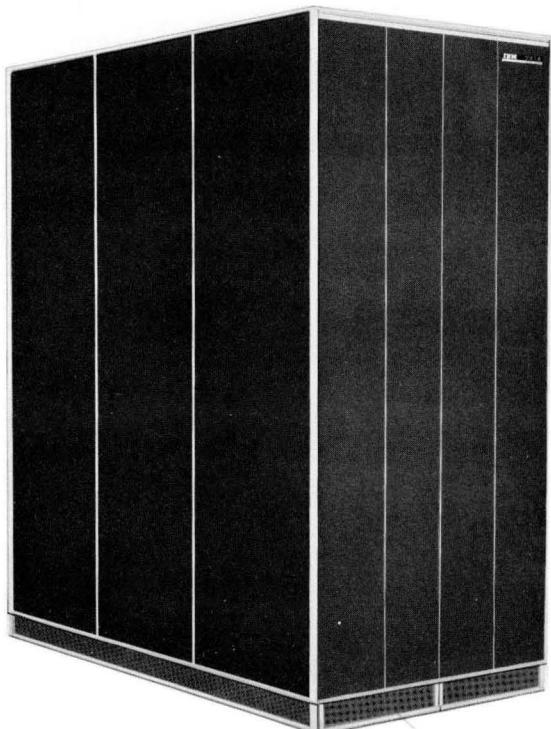
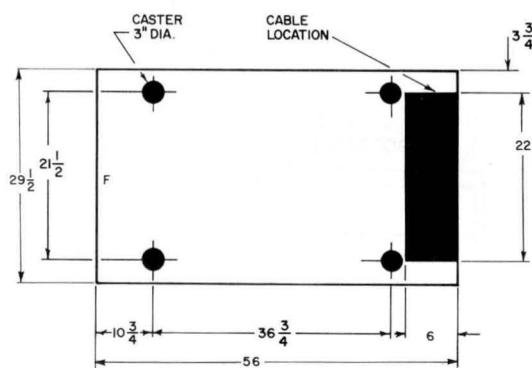


7618 POWER CONTROL

Top View



Plan View



Notes

Height: 69 inches

Service Clearances:

Front	30 inches
Rear	30 inches
Left Side	30 inches
Right Side	30 inches

SAFETY AND FIRE PRECAUTIONS

Safety is a vital factor in planning for a large computer installation. This consideration is reflected in the choice of a computer location, building materials used, fire prevention equipment, air conditioning and electrical systems, and personnel training.

Locating a Computer Area

1. The computer area should be in a noncombustible or fire-resistant building or room.
2. The computer room should not be located above, below, or adjacent to areas where inflammable or explosive materials or gases are stored, manufactured, or processed. If the customer must locate near such an area, he should take precautions to safeguard the area.

Structural Safety

1. Walls enclosing a computer area should be of noncombustible materials wherever possible. These walls should extend from floor to ceiling. If walls are made of combustible material, they should be protected as prescribed by code.
2. If a computer area has one or more outside walls adjacent to a building that is susceptible to fire:
 - a. Installation of shatterproof windows in the computer room would improve the safety of personnel and equipment from flying debris and water damage.
 - b. Sprinklers could be installed externally over the windows to protect them with a blanket of water in case of fire in the adjacent area.
3. Where a false (or hung) ceiling is to be added it should be of noncombustible or fire-resistant material. All ducts and insulating materials should be noncombustible and nondusting. If combustible materials are used in the space between the regular ceiling and the false ceiling, proper protection should be provided.
4. A raised floor, installed over the regular floor, should be constructed of non-combustible or fire-retardant materials. If the regular floor is of combustible material, it should be properly protected from the ceiling below, preferably by water sprinklers.
(Note: Before the computer is installed, the space between the raised and regular floors should be cleared of debris. Also, this space should be periodically checked after installation, to keep it free of accumulated dust and possible debris.)
5. The roof or floor above the computer and tape storage areas should be a watertight slab. If practical, the walls of the room should be sealed to the slab in such a manner as to prevent water entering from above.

Type of Fire Prevention Equipment in a Computer Area

1. Portable carbon dioxide fire extinguishers of suitable size (15 pounds) and number should be provided in the machine room. This is the recommended nonwetting agent for electrical equipment (Class C Hazard). Extinguishers should be overhead, marked, and readily accessible to individuals in the immediate area. Local codes govern the frequency of inspecting the cylinders, which is done by weighing for dissipation of contents.
2. Where portable carbon dioxide cylinders are used as the primary extinguishing agent, it is advisable to locate a standpipe or hose unit within effective range of the computer area as a secondary extinguishing agent for a Class A Hazard.
3. In some cases, local building codes and ordinances, or insurance regulations, require automatic water sprinklers. One of the following should be used, if it conforms to such codes and ordinances:
 - a. Pre-action sprinkler system. High temperatures actuate heat-sensitive devices, which open a control valve. This valve, located outside the room, admits water into the sprinkler piping before the sprinkler heads operate. This type of system minimizes the possibility of accidental discharge of water due to failure or mechanical breakage of the automatic sprinkler heads.
 - b. Higher temperature sprinkler heads. Replace the sprinkler heads with high-rated ones (preferably in the intermediate range of 175° F rating).
4. A fire detection system should be installed to protect the computer and tape storage areas. This detection system should actuate an alarm and shut down the air conditioning system.

Data Storage

1. Any data stored in the computer room--whether in the form of magnetic tape, paper tape, cards, or paper forms--should be in enclosed metal cabinets or fire-resistant containers.
2. For security purposes or for maintaining duplicates of master records, a separate storage room should be used. This room should be of fire-resistant material and contain the same type of fire prevention equipment as described in "Type of Fire Prevention Equipment in a Computer Area."

Supporting Facilities

Air Conditioning Systems

1. In most installations, the computer area is controlled by a completely separate air conditioning system. In these cases, an emergency power-off switch should be placed in a convenient location, preferably near the operating console or next to the main exit door. Fusible-link dampers should be located at fire walls and at places as prescribed by local code.

2. Where the regular building air conditioning system is used, with supplemental units in the computer area, the supplemental units would then be handled as stated previously. The regular building air conditioning system should have an alarm in the regular building maintenance area to alert the maintenance personnel of an emergency. Air ducts serving other areas but passing through the computer room should contain fusible-link dampers at each wall of the computer room.

3. The air filters used as part of the air conditioning system should contain non-combustible material.

Electric Systems

1. The main line breaker for the computer equipment should be pushbutton operated. This pushbutton control should be in a convenient location, preferably near the operating console or next to the main exit door. A light should be installed to indicate when power is on.

2. Some local codes require a special battery operated lighting unit that will automatically illuminate an area in case of power or lighting circuit failure. These units are wired to and controlled by the lighting circuit. Even when not required by code it is recommended that such lights be installed.

3. Protection against lightning surges can be obtained by installing lightning arresters on the secondary power source, especially when:

- a. The utility company installs lightning protectors on the primary power source.
- b. Primary power is supplied by an overhead power service.

4. If power receptacles are located under the false floor which could be susceptible to excessive water, waterproof connectors should be used. Proper drainage will guard against flooding or trapping water under the false floor in the computer room. This is important in certain new buildings where the regular floor is depressed and the raised surface is on the level of the adjacent areas.

Preplanning to Continue Operation in an Emergency

1. The continued operation of a customer's computer is dependent on information stored on cards, tape, disks, drums, and so on. Also, there must be equipment available to process the information. Arrangements should be made for emergency use of other equipment, transportation of personnel, data, and supplies to temporary location. Duplicate or master records should be maintained from which the necessary information can be taken to resume operation. These records should be stored in a remote area.

2. Where continuity of operation is essential, a stand-by power source should be installed.

General Precautions and Personnel Training

1. The computer room, air conditioning equipment room, and data storage room should be monitored during non-operating hours.
2. Steampipes and waterpipes running above the false ceiling should be inspected to guard against possible damage due to accidental breakage, leakage, or condensation.
3. Emergency exit doors should be located in the computer area. The number of doors depends on the size and location of the area.
4. Personnel should be trained in emergency measures such as:
 - a. Proper method and sequencing of shutting off all electrical power.
 - b. Shutting off air conditioning system.
 - c. Handling fire extinguishers in the approved manner.
 - d. Properly operating a small-diameter fire hose.
 - e. Evacuating records.
 - f. Evacuating personnel.
 - g. Calling fire company.
 - h. Administering of first aid.

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