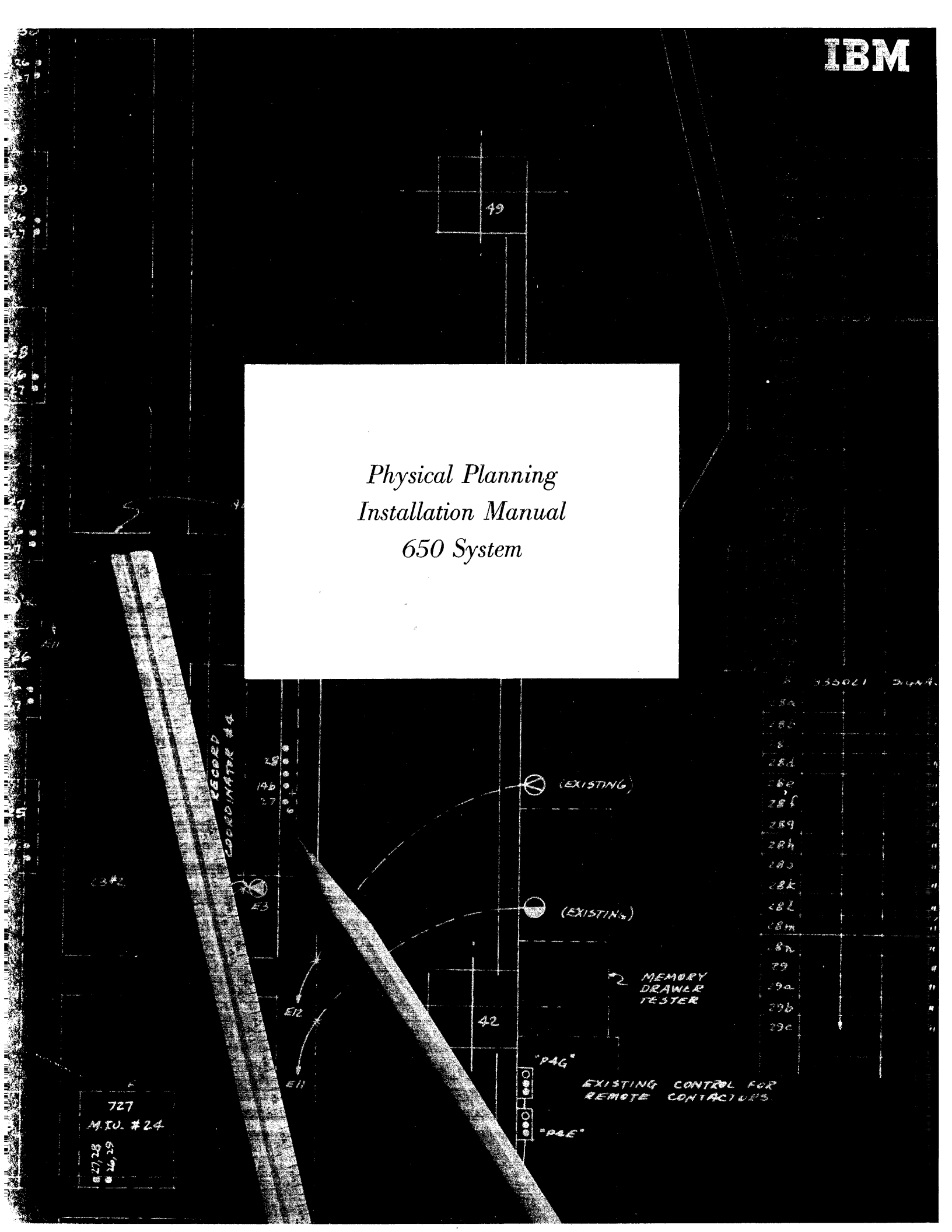
IBM

Physical Planning Installation Manual 650 System



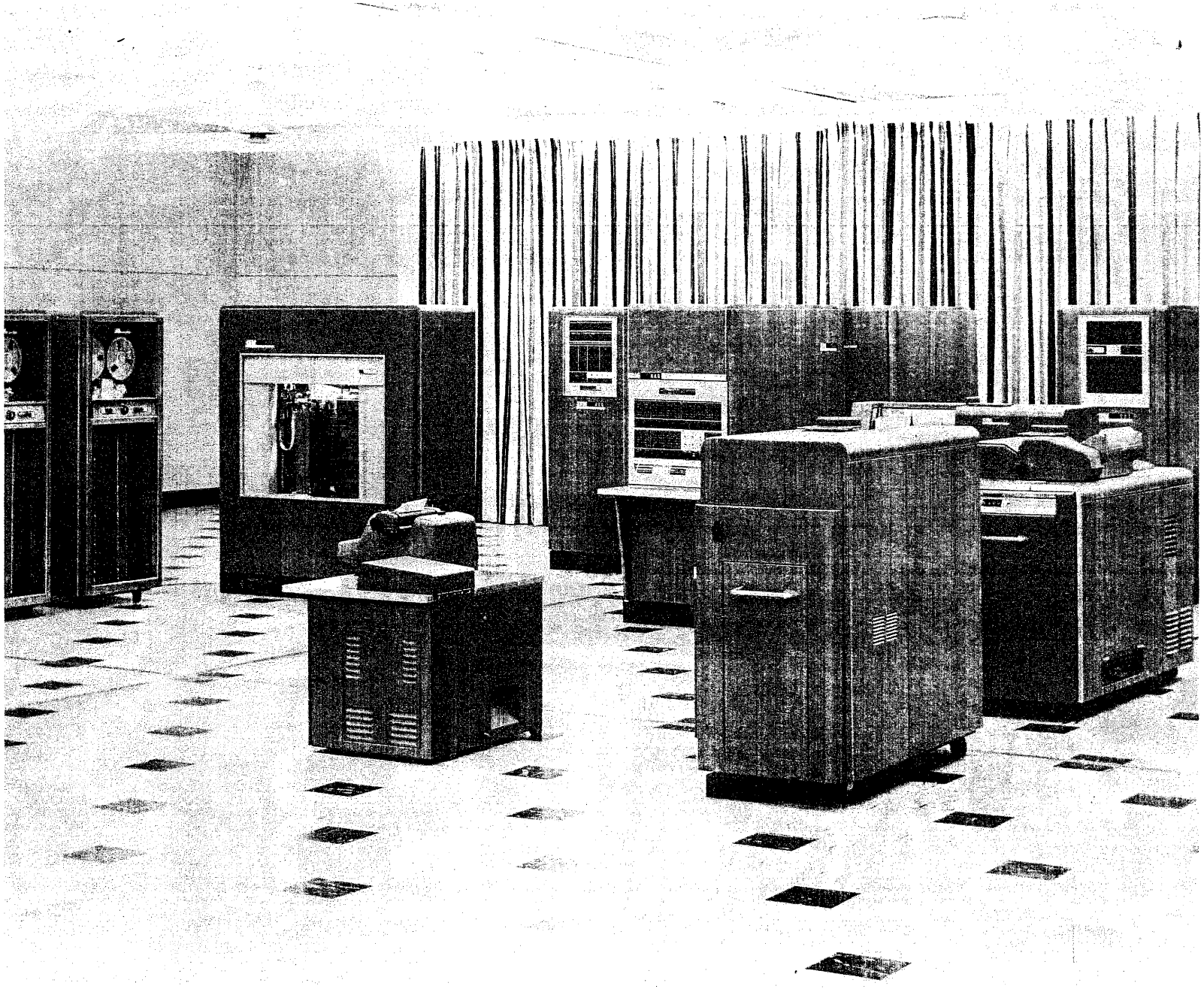
PHYSICAL PLANNING INSTALLATION MANUAL

650 SYSTEM

This manual contains the information necessary for planning the installation of a 650 System. It should be carefully studied well in advance of planning a 650 installation.

In addition to the technical information needed for preinstallation planning, there are recommendations and suggestions that will help to make a convenient and effective installation.

INTERNATIONAL BUSINESS MACHINES CORPORATION
SALES ENGINEERING DEPARTMENT
OCTOBER 1, 1957



650 SYSTEM

CONTENTS

INTRODUCTION

Successful installation of a 650 System requires considerable planning. Physical installation planning should start at least twelve months before a 650 System with magnetic tapes and/or disk storage is scheduled for delivery. Six months of advance planning is usually adequate for a 650 System with punched card input-output and storage unit.

This physical planning manual should be carefully studied and consideration given to the following items and their requirements:

1. Sufficient and suitable floor space
2. Floor loading
3. Power source
4. Air conditioning
5. Temperature and humidity controls
6. Customer Engineering service area
7. Tape storage
8. Unit arrangement for efficient customer operation

GENERAL DESCRIPTION

A 650 Data Processing System is made up of a combination of several units connected by cables.

A 650 Basic System must have:

650 Console Unit	1 only
655 Power Unit	1 only

These units may be installed:

407 Accounting Machine	
533 Card Read Punch	
537 Card Read Punch	
653 Storage Unit	1 only

A 650 System with magnetic tapes and/or disk storage must have:

650 Console Unit	1 only
652 Control Unit	1 only
653 Storage Unit	1 only
655 Power Unit	1 only
727 Magnetic Tape Unit	1 to 6
and/or	
355 Disk Storage	1 to 4

These units may be installed:

407 Accounting Machine
533 Card Read Punch
537 Card Read Punch
838 Inquiry Station

The 650 Console Unit has a control console and contains the magnetic drum and the logical and arithmetic circuits.

The 652 Control Unit has an indicating panel and contains the power supply and control circuits for the 727 and/or the 355 and 838 units.

The 653 Storage Unit has an indicating panel and may contain immediate access storage, index registers and automatic floating-decimal arithmetic. This unit with immediate access storage is a necessary component of a tape system, and/or disk storage system.

The 655 Power Unit contains the power supplies for the 650, 533's and 537's in addition to input-output translating circuits.

The 727 Magnetic Tape Units contain the tape feeding mechanism and the reading and writing mechanisms.

The 355 Disk Storage provides a large capacity storage of data with random access. The unit contains the disks, access arms and control mechanism. There are side windows in the 355 units for viewing the mechanisms, but it is unnecessary for the operator to see these windows from the 650 Console unit.

The 407 Accounting Machine is an input-output unit. It has components for reading data from cards, storage of data, transmitting data to the 650, printing data stored from cards or received from the 650.

The 533 Card Read Punch is a card input-output unit. It has two independently operated feeds, one for reading data from cards to the 650 and one for punching data into cards from the 650.

The 537 Card Read Punch is a card input-output unit. It has one card feed, where data can be read from cards to the 650 and data punched into cards from the 650.

The 838 Inquiry Station is a modified IBM Electric Typewriter, stand, and appropriate control circuits, that permit the operator to obtain a record from the disk storage or insert limited data into the disk storage.

Access to the various units by customer personnel will vary with the type of application. However, only occasional reference to the 652, 653 and 355 is required.

SPACE AND LAYOUT REQUIREMENTS

Space and layout requirements will differ for each 650 System installation. The following are general rules for guidance:

Space

The floor area required will be determined by the number of units in the system, length to width ratio of the room, location and size of columns and provision for future expansion.

A typical 650 Basic System requires 250 to 600 square feet of floor area.

A typical 650 System with magnetic tapes and/or disk storage requires 1000 to 1800 square feet of floor area, including tape storage and Customer Engineering service area. The Customer Engineering service area may be 50 or 150 square feet as described later in the manual.

Layout of Machine Units

When laying out the machine room area for specific unit locations, consideration must be given to the size of the various units, the clearances required for opening of gates, the lengths of connecting cables and location of units for efficient operation. To make a layout, it is necessary to have an accurate drawing of the proposed 650 area scaled at 3/8 inch equals 1 foot. Plastic templates of the various units may be obtained from IBM. The templates are to the scale 3/8 inch equals 1 foot and show the allowable minimum working clearances.

For a 650 Basic System the customer and salesman should make a 3/8 inch scale layout of the machines. Cables required to connect the machines will be sent by the factory. Unless otherwise specified to the factory, 17 foot cables will be supplied with the first punched card input-output unit, 22 foot cables with the second and 31 foot cables with the third.

For a 650 System with magnetic tapes and/or disk storage, a 3/8 inch scale layout should be made by the customer and salesman, with the advice and assistance of the Physical Planning Engineer. Each IBM branch office is responsible for ordering the correct external cables. The cable order should be made up at the branch office and forwarded by the Branch Manager to the Physical Planning Engineer for formal approval and processing.

On pages 42 to 47 are several possible layouts. Other arrangements may be made by using the connecting cable lengths, unit dimensions, and clearances shown on pages 32, 33 and 35.

FLOOR CONSTRUCTION

The machine room floor must support the total weight of all the components as well as the localized weight at each machine caster. The floor must be capable of carrying a load of approximately 100 pounds per square foot.

The various units of a 650 System with magnetic tape and/or disk storage are connected by a large number of cables. With this system it is recommended that cables be laid beneath the machine floor.

The most common method of preparing a floor for a 650 System is to construct a raised floor over the building floor. A properly designed raised floor distributes the entire machine load more evenly over the building floor and structural members, materially reducing the necessary pounds per square foot rating required of the building floor, and can provide a means of having connecting cables under the floor.

The raised floor can be constructed of wood, concrete, steel, or aluminum, depending on the customer's desires, budget, local building codes and fire insurance requirements.

The covering used will depend upon such factors as mobility of machine units, appearance and cost. Among the better types are rubber tile, vinyl tile, grease-resistant asphalt tile and finished hardwood floor. The type of floor covering used should not dust or chip and should lend itself to ease of cleaning.

There are two basic types of raised floor construction in general use, "Raceway Floors" and "Free Access Floors." These two types of floors are illustrated on pages 40 and 41.

A raceway floor has raceways or troughs 14 inches to 16 inches wide and 6 inches to 8 inches deep built into the raised floor. The raceways are normally run parallel to the walls of the room and carry the connecting cables. Sometimes, they are also used to carry the 208 or 230 volt power supply cables and connections. Raceways should be covered with removable covers, so the cables are accessible and may be easily laid in the raceway. Raceways may also be provided in existing floors.

A free access floor is so designed that cables may run in any direction under the machine floor without being restricted to definite paths. The floor panels should be removable. This type of floor allows for more flexibility in machine layout with the fixed lengths of cables supplied with the 650 System. In addition, changes in machine location can be made with a minimum amount of construction work, even where raceways are required beneath the free access floor.

If cables are left on top of the floor, the cables must be covered by a ramp to prevent damage to the cables from traffic over them. The ramp is provided by the customer. Figure 1, page 39, illustrates the design and dimensions of such a ramp.

AREA CLEANLINESS

The operation of 650 tape installations has shown that dirt and dust can be major sources of trouble if not properly controlled.

The following will acquaint you with facts concerning building materials and room maintenance:

A. Materials

1. Asphalt tile is not as satisfactory for 650 installations as vinyl or rubber tile, because it is more brittle and there is a greater tendency to chip at the edges and to crack.

2. "Marbleized" tile patterns have been found to be difficult to keep clean because dirt cannot be distinguished from the pattern.

3. Carpeting may be used but a lint free and static free material should be used. This also applies to drapes used for soundproofing or decorative purposes.

4. Ceiling and wall material finishes should not "dust" or flake.

B. Cleaning

1. Waxing, when necessary, should be kept to a minimum. Some waxes tend to flake and this can seriously jeopardize the operating efficiency of the installations from a dust standpoint. The method of application of wax should be such that wax is applied only on intended surfaces.

2. Cleaning should be done with a damp mop, never dry or wet. Under no circumstances can sweeping be tolerated.

3. Vacuuming has been found effective, if an external vacuum or an adequate sealed or filtered container, (i.e. water-type tank), is used.

4. It is recommended that smoking be permitted only in the immediate vicinity of the console. Under no circumstances should smoking be permitted while handling tape, when attending tape drives or in the tape storage area. Tobacco ashes on the tape can cause errors.

5. Material should not be placed on top of machines. In addition to restricting the air flow, foreign material may fall into the machines. Tape reels and machine covers, similarly, should not be laid on the floor or on the machines.

6. When vacuuming under machines, it is recommended that a nonconductor type of nozzle be used to minimize the possibility of an electrical accident.

7. Before installing the machine, it is imperative that all exposable underfloor areas including cable raceways be thoroughly cleaned. It is also absolutely necessary that the regular cleaning schedule include periodic cleaning of these areas.

8. It is not possible to recommend a cleaning schedule. Since each installation will differ, experience will have to dictate, but a schedule should be planned which will include cleaning the entire installation at least once a day.

AIR CONDITIONING REQUIREMENTS

A. Basic System

The air in the machine room must be maintained within the following limits:

1. Temperature between 50° and 90°F.
2. Relative Humidity between 0 and 80%.

B. Tape System

The air in the machine room must be maintained within the following limits:

Acetate Tape
1. Temperature between 65° and 80° F.
2. Relative humidity between 40 and 60%.

Mylar* Tape
1. Temperature between 50° and 90° F.
2. Relative humidity between 20 and 80%.

C. Disk Storage System

The air in the machine room must be maintained within the following limits:

1. Temperature between 50° and 90° F.
2. Relative humidity between 0 and 80%.

D. Tape and Disk Storage System

The air in the machine room must be maintained within the limits specified for the type of tape to be used.

E. Air Filtration

Normal air filtration is adequate for most installations. Air filters should have an efficiency rating of 20% by the National Bureau of Standards Discoloration Test Method.

Special air filtration is necessary in only those installations which will be subject to corrosive gases, salt air or unusual dirt or dust conditions.

* Trademark

The above limitations of Mylar tape and air filtration are applicable to 650 installations which include tape and/or disk storage only, and in no way apply to the 700 series equipment which may be used as peripheral equipment in the 650 installation. This peripheral equipment includes the Tape Data Selector, Tape-to-Card, Tape-to-Printer and Card-to-Tape systems, all of which require the temperature, humidity and air filtration specifications as outlined in the appropriate physical planning manual.

If the 650 is subjected to temperature below 50° F. for any extended time, it will be necessary to provide an appropriate warm-up period before starting the machine, to prevent damage to the magnetic drum.

During nonoperational periods, when machine power is "OFF," the room air temperature may be as high as 110° F. However, the room temperature must be brought below the maximum temperature specified for the system before the 650 System is started.

Heat dissipation data is located on pages 30 and 31.

TAPE STORAGE

Short Term Storage

When tape is stored for short periods of time, the surrounding atmosphere should be controlled with the following limits:

Acetate Tape
1. Relative humidity 40 - 60%
2. Temperature 65 - 80° F.

Mylar Tape
1. Relative humidity 20 - 80%
2. Temperature 50 - 90° F.

If the tape must be removed from this conditioned atmosphere, it should be hermetically sealed in a plastic bag.

If the container is not hermetically sealed, the tape should not be used until it has been returned to the conditioned area for a length of time equal to the time it was removed. Tapes removed from the conditioned area for periods exceeding twenty-four hours will require only twenty-four hours of conditioning.

Long Term Storage

A. The reels should have proper mechanical support as provided by the dustproof containers.

B. The reel and container should be enclosed in a hermetically sealed moistureproof plastic bag.

C. Storage should be in an area where the temperature range is between 40° and 120° F.

D. The tape should not be subjected to strong magnetic fields, or be in contact with magnetic materials. Either of these can cause loss of information or the introduction of noise.

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.

The record of temperature and humidity can be used:

A. To assure the customer that his air conditioning installation is continuously performing its job properly. Installation errors and loss of efficiency due to malfunction of some part of the system can be quickly detected.

B. 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.

C. To determine if the air environment in the machine area meets the requirements for the machine.

Experience gained from machines already installed has proved that the purchase and installation costs of the recording instruments are a wise investment for the customer. The instruments warn of approaching air conditioning trouble so that corrective measures may be taken to prevent machine shutdown and its associated effects.

The instruments should be of a direct-reading, electric-drive type with a 7 day recording chart. The instruments should be so located that they will indicate the conditions of the air entering the machines.

A visual or audible signal device should be incorporated into the instrument installation. Its purpose is to provide a visual or audible indication that the temperature or humidity conditions in the 650 area are nearing the maximum limitations stated in this manual. Action can then be taken by the customer's personnel to correct the situation and avoid interruption of machine operation.

CUSTOMER ENGINEERING AREA

For a 650 Basic System space is required for only a cabinet 32" x 22" x 38" which Customer Engineering may elect to furnish for storage of parts and test equipment.

For a 650 System with magnetic tape and/or disk storage, a suitable area for use by the Customer Engineers maintaining the installation should be provided by the customer. If this area is located within the machine room, a minimum of 50 square feet consisting of 10 feet of wall space approximately 5 feet deep, should be provided. Depending upon individual circumstances, Customer Engineering may elect to furnish this area with any or all of the following equipment, as shown in Figure A: desk, chair, parts cabinet, tape drive tester.

The area should be equipped with one 208-230 volt ± 8%, 60 cycle, three-phase, 20 ampere outlet and a minimum of one 110 volt, 60 cycle, single-phase, 15 ampere outlet.

If it is impractical to provide this area within the main machine room, a separate service room on the same floor level (to provide ease of machine movements between the two areas), comprising a minimum of 150 square feet of space, is required. This room should be fully air-conditioned and provide the electrical requirements indicated above. In this area, Customer Engineering may elect to provide any of the equipment considered for the area shown in Figure A and any of the following additional items as shown in Figure B: workbench, file cabinet, additional chair, coat rack.

CUSTOMER ENGINEERING AREA DIAGRAMS

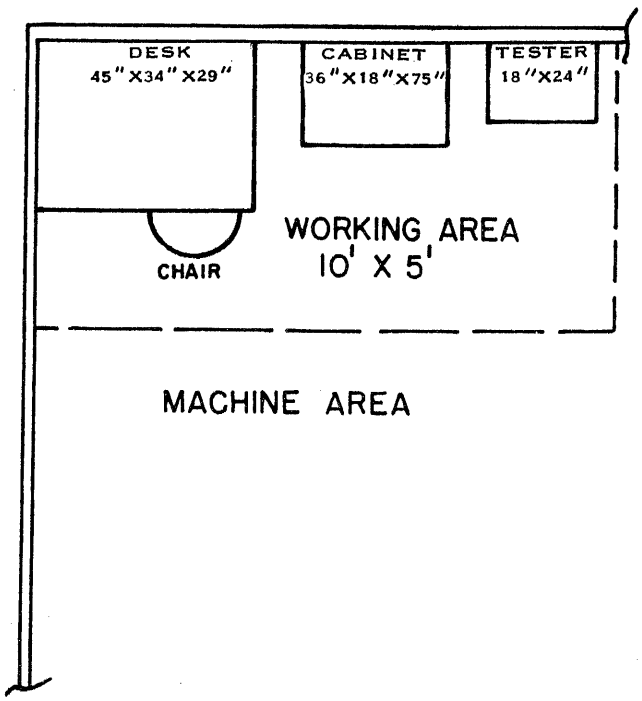


FIGURE A

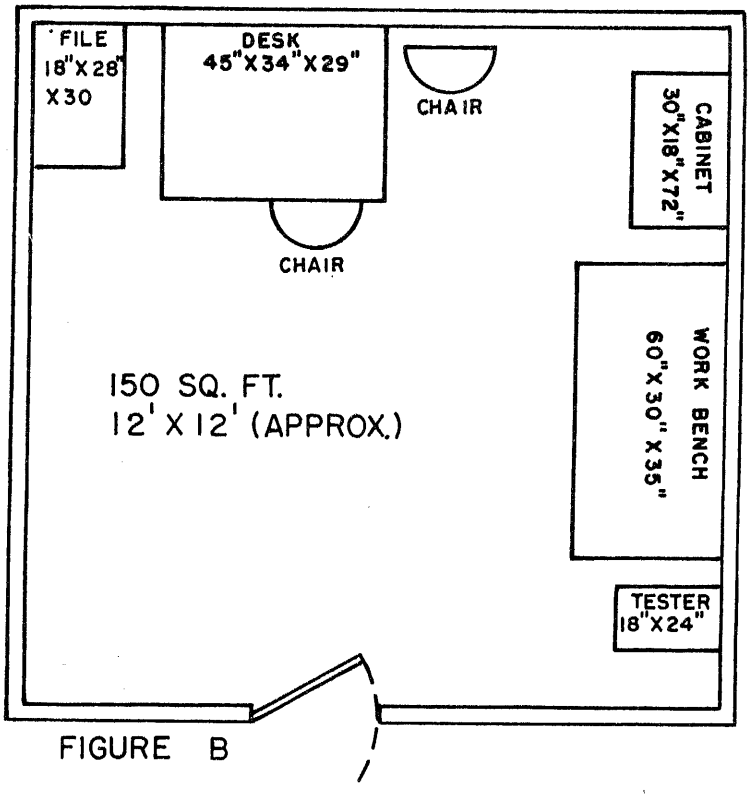


FIGURE B

CONNECTING CABLES

There are two types of cables used for connecting units in a 650 System.

1. Signal Cables
2. Power Cables

The signal cables have summary punch type connectors and are supplied in fixed lengths measured from connector to connector, as shown on page 35.

The power cables have cannon type connectors and are supplied in lengths corresponding to the length of signal cable ordered.

Listed below are the fixed lengths of signal cables that will be supplied.

CABLE CHART

Signal Cables	Cable Lengths in Feet Length #1	Length #2	Length #3	Length #4	Diameter in inches	Bending Radius in inches	Number of signal cables	Notes
650-655	7				1 5/8	7	2	1
650-653	20				1 1/8	7	2	
652-355	9	12	16	20	1 5/16	7	1	2
652-653	20				1 1/8	7	1	
655-407	17	22	31	40	1 5/8	7	2	3
655-533	17	22	31	40	1 5/8	7	2	3
655-537	17	22	31	40	1 5/8	7	2	3
652-727	8	13	16		1 1/8	7	1	4
727-727	8	13	16		1 1/8	7	1	5
652-838	15	22	33	50	1 5/16	7	1	6
838-838	15	22	33	50	1 5/16	7	1	7

The actual cable length required is equal to the distance between units plus either item "A" or both items "A" and "B":

A. The length of cable between the floor and the receptacle in each unit shown in the schematic on page 35.

B. Two times the depth of the cable raceway where raceways are used or two times the depth of the false floor where free access floors are used.

Notes

1. This is the horizontal distance between the 650 and 655 and applies to both cables. This is not a connector to connector length. When checking cable length on the machine layout, two times the trench depth must be subtracted from the 7 foot length; rise and fall into machine are automatically adjusted.

2. These cable lengths will be supplied in any combination to connect four 355 units to the 652. The maximum total length of these cables must not exceed 56 feet.

3. Any one of these four cable lengths will be supplied, choice of cable lengths will be determined by the planned layout.

4. Any one of these three cable lengths will be supplied to connect the 652 to the first 727; choice of cable length will be determined by planned layout.

   There are two signal cable receptacles on the 652. Up to four 727's can be connected to one receptacle.

5. These cable lengths will be supplied in any combination, for connecting one 727 to the next 727, in a connected group of 727's, that does not exceed 45 feet of cable between the 652 and the last 727 of a group. The choice of cable lengths will be determined by the planned layout.

6. Any one of these four cable lengths will be supplied to connect the 652 to the first 838; choice of cable length will be determined by the planned layout.

7. These cable lengths will be supplied for connecting one 838 to the next 838. The choice of cable lengths will be determined by the planned layout.

POWER DISTRIBUTION

If a new power service is being installed for the 650 System, it is suggested that the service be large enough to handle any future expansion of the system.

For single-phase power the service should be three wire. The third wire is for grounding and must not carry current from any source.

For three-phase power the service should be four wire. The fourth wire is for grounding only and must not carry current from any source.

Typical wiring diagrams are illustrated on pages 36 and 37.

Suitable protective devices should be installed on the line. Typical examples are as follows:

A. Three-pole safety switch-fuse combination equipped with superlag fuses.

B. Circuit breaker with a Heinemann curve 1 trip or equivalent.

If circuit breakers are used, their contacts should be rated so that a high current fault will not cause contact welding. If these protective devices are located outside of the machine room, it is desirable that a remote means of operation be provided in the machine area. This is a safety precaution so all 650 power may be cut off quickly.

Lightning Protection

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

A. the utility company installs lightning protectors on the primary,

B. primary power is supplied by an overhead power service,

C. 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 and two of either model is required for three-phase.

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.

POWER CORDS, PLUG CONNECTORS AND RECEPTACLES

The following units have power input cords and plug connectors. These power cords are shown on the schematic, page 35. The length, diameter and minimum bending radius is shown below.

Power Cord	Length in Feet	Diameter in Inches	Minimum Bending Radius in Inches
355 to power receptacle	14	5/8	1 1/2
407 to power receptacle	8 3/4	5/8	1 1/4
652 to power receptacle	14	1 3/4	7
653 to power receptacle	14	1 3/4	7
655 to power receptacle	14	1 3/4	7
838 to power receptacle	6	3/8	1 1/2

The power cords will be supplied with a three prong plug connector for single-phase, and a four prong plug connector for three-phase. The receptacles must be supplied by the customer.

The power service, plug connector and receptacle chart on page 26 lists the receptacles to be used for the various units.

Phase Rotation of Receptacles

The three-phase power receptacles must be wired for correct phase rotation. (See page 36.)

A. The Green wire should be connected to the ground connection.

B. Looking at the face of the receptacle, the conductors should be Red, White, Black and Green in a counterclockwise direction.

Phase 1 - Red; Phase 2 - White; Phase 3 - Black

POWER SERVICE, PLUG CONNECTOR AND RECEPTACLE CHART

(All receptacles are for use with 208V or 230V Service except as noted)

Units	Service Size			Plug Connector			Receptacle	
	Phase	Amp	Wires	Manufacturer	Part #	IBM Part #	Manufacturer	Part #
355	3	30	4	Hubbell	21426	473214	Hubbell	20403 or 20414
407	1	15	3	Pass and Seymour	5664	256342	Pass and Seymour	5661
407	3	20	4	Pass and Seymour	9951	256344	Pass and Seymour	7250
652	3	100	4	Russell and Stoll	7338	335384	Russell and Stoll	7334
653	1	100	3	Russell and Stoll	7337	440599	Russell and Stoll	7333
653	3	60	4	Hubbell	7302	335382	Hubbell	7301
**655	1	100	3	Crouse Hinds	APJ 10377 NB	252689	Crouse Hinds	Area 10355
**655	3	60	4	Hubbell	7302	335382	Hubbell	7301
***655	3	100	4	Russell and Stoll	7338	335384	Russell and Stoll	7334
838	1	15	3	Pass and Seymour	5664	256342	Pass and Seymour	5661
838 (115V)	1	15	3	Pass and Seymour	5267	256341	Pass and Seymour	5261
Tape Drive Tester	3	20	4	Pass and Seymour	9951	256344	****Pass and Seymour	7250

** For use with one punched card input-output unit.

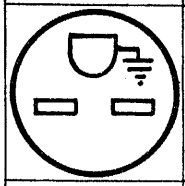
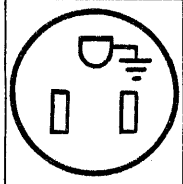
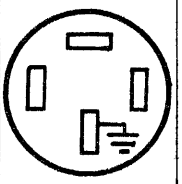
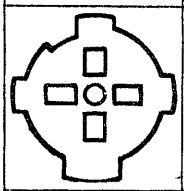
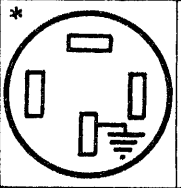
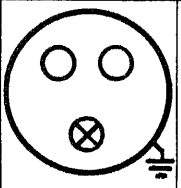
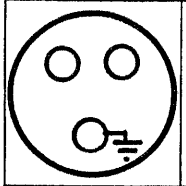
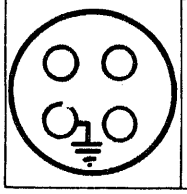
*** For use with one, two or three punched card input-output units.

**** The customer should supply at least one suitably protected receptacle adjacent to the 727 tape units if two or more 727's are installed.

The tape drive testers use 208 or 230 volts three-phase power.

The above type receptacles or their equivalent must be supplied and installed by the customer.

RECEPTACLE AND PLUG CHART

RECEPTACLE				PLUG	
Schematic	Mfg. No.	Amp.	Phase	IBM Part No.	Mfg. No.
	P&S 5661	15 (230 V)	1	256342	P&S 5664
	P&S 5261	15 (115 V)	1	256341	P&S 5267
	P&S 7250	20	3	256344	P&S 9951
	Hubbell #20403 or 20414	30	3	473214	Hubbell # 21426
* 	Hub. 7301	60	3	335382	Hub. 7302
	C. H. Area 10355	100	1	252689	C. H. APJ 10377 NB
	R&S 7333	100	1	440599	R&S 7337
	R&S 7334	100	3	335384	R&S 7338

Notes:

* Ground must be horizontally to the right or the left if receptacle is placed in raceways.

Hub - Hubbell
R&S - Russell and Stoll
P&S - Pass and Seymour
C.H. - Crouse Hinds

POWER REQUIREMENTS

It is recommended that the power source be 208 volts or 230 volts, three-phase, 60 cycles per second; however, certain units can be operated from a single-phase, 208 volt or 230 volt source of power.

Complete breakdown of KVA and current by unit and features is shown in KVA and Current Requirements Chart found on page 29.

Permissible Variations for 650 Basic System

Voltage - Source voltage may have a total variation of ± 10% of the rated voltage, including transient and steady state.

Frequency - The line frequency must be 60 cycles per second, ± 1/2 cycle per second.

Permissible Variations for 650 System with Magnetic Tape and/or Disk Storage

Voltage - Source voltage may have a total variation of ± 8% of the rated voltage, including transient and steady state.

Frequency - The line frequency must be 60 cycles per second, ± 1/2 cycle per second.

K.V.A. AND CURRENT REQUIREMENTS

Units		K.V.A.	AMPERES Single Phase 115V	Single Phase 208V	Single Phase 230V	Three Phase 208V	Three Phase 230V
355	Disk Storage	4.60	-	-	-	12.8	11.6
407	Accounting Machine	1.80	-	8.80	7.80	8.80	7.80
533	Card Read Punch	**					
537	Card Read Punch	**					
650	Console	**					
652	Control Unit:						
M.A1	Tape	5.20	-	-	-	14.4	13.0
M.B1	Disk Storage Control (D.S.C.)	5.23	-	-	-	14.5	13.1
M.B2	D.S.C. and 1 Inquiry Control	5.87	-	-	-	16.3	14.8
M.B3	D.S.C. and 2 Inquiry Controls	6.37	-	-	-	17.7	16.0
M.C1	Tape, D.S.C.	*7.42	-	-	-	20.6	18.7
M.C2	Tape, D.S.C. and 1 Inquiry Control	*8.07	-	-	-	22.4	20.3
M.C3	Tape, D.S.C. and 2 Inquiry Controls	*8.58	-	-	-	23.8	21.5
653	Storage Unit:						
M.A2	Automatic Floating Decimal (A.F.D.)	5.50	-	26.5	23.9	15.2	13.8
M.A3	Index Registers (I.R.)	6.20	-	29.8	27.0	17.1	15.5
M.A4	I.R. and A.F.D.	9.30	-	44.7	40.4	25.8	23.4
M.B1	Immediate Access Storage (I.A.S.)	7.50	-	36.1	32.6	20.8	18.8
M.B2	I.A.S. and A.F.D.	10.7	-	51.5	46.5	29.6	26.8
M.B3	I.R. and I.A.S.	11.5	-	55.3	50.0	31.8	28.8
M.B4	I.A.S. , I.R. and A.F.D.	14.4	-	69.3	62.6	40.0	36.3
M.C1	I.A.S. and Tape	8.90	-	42.8	38.7	24.8	22.5
M.C2	I.A.S., A.F.D. and Tape	12.1	-	58.2	52.6	33.6	30.4
M.C3	I.A.S., I.R. and Tape	12.0	-	57.7	52.2	33.2	30.0
M.C4	I.A.S., I.R., A.F.D. and Tape	15.5	-	74.5	67.4	43.0	38.9
655	Power Unit:						
M.1	1 card input-output	17.7	-	84.9	76.8		
		19.0	-	-	-	52.6	50.0
M.2	2 card input-output	21.5	-	-	-	59.8	54.0
M.3	3 card input-output	25.6	-	-	-	71.2	64.4
727	Magnetic Tape Unit	2.20	-	-	-	6.0	6.0
838	Inquiry Station	0.23	2.0	-	1.0	-	-

*Indicated Calculated Values, these may change

**The K.V.A. for these units is included in the K.V.A. listed for the 655.

The M. of M.A1, M.A2 etc. denotes Model Numbers.

HEAT DISSIPATION

The following chart lists the heat dissipation, internal fan capacities, size of forced air outlets and the maximum allowable temperature rise per unit.

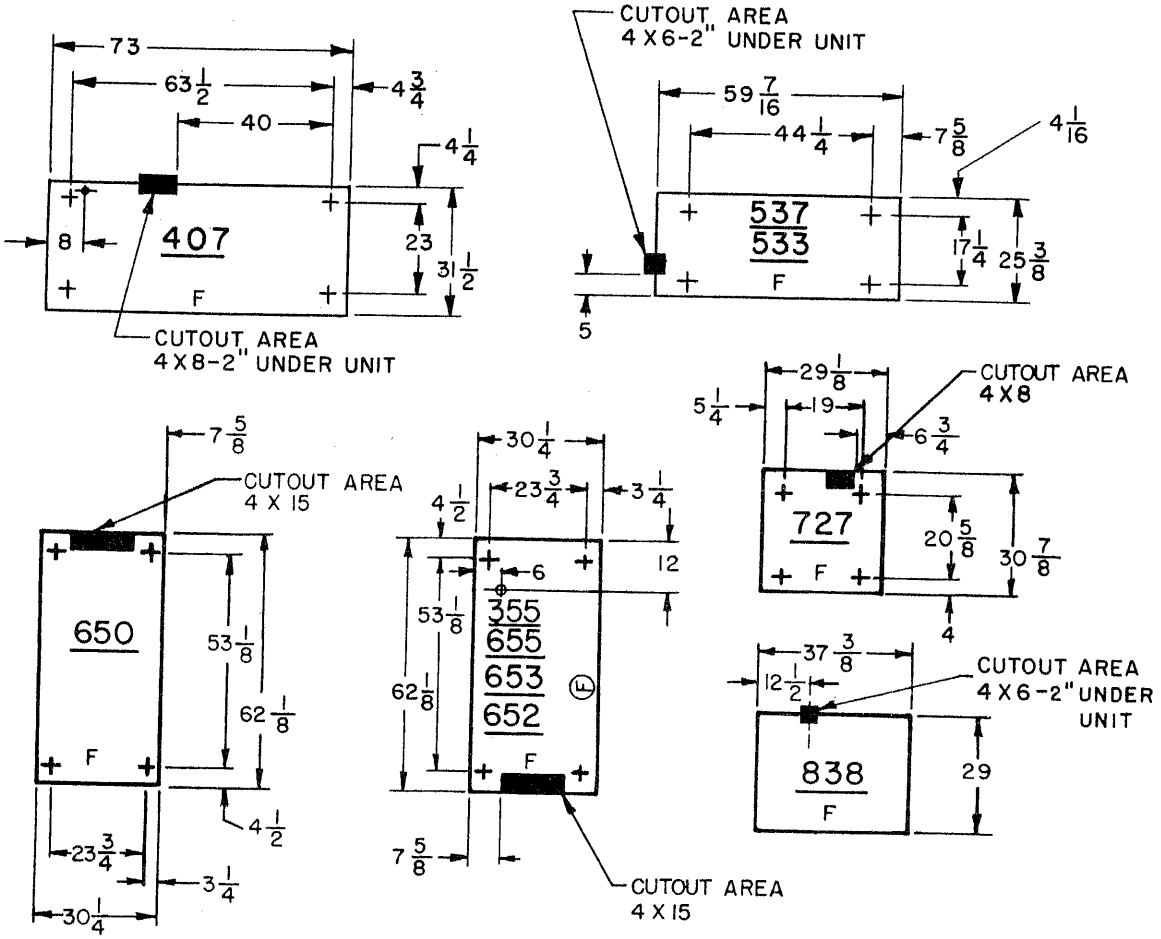
Units	Heat Dissipation including radiant heat (BTU's per hr.)	Radiant Heat (BTU's per hr.)	Air Moved through units by blowers (C F M)	Maximum Allowable temperature rise per unit in degrees F.	Size of forced air outlets in inches
355	12, 700	1, 900	300	30°	25 3/4 x 55 1/4
407	7, 500	7, 500	none	-	none
533	1, 500	1, 500	none	-	none
537	2, 500	2, 500	none	-	none
650	32, 800-33, 800*	2, 000-2, 200	900-1, 150	35°	25 3/4 x 55 1/4
652	15, 200-25, 754*	2, 000-2, 548	400-800	35°	25 3/4 x 55 1/4
653	12, 340-32, 800*	800-2, 000	350-950	35°	25 3/4 x 55 1/4
655	14, 000-24, 000*	1, 500-1, 800	600-950	25°	25 3/4 x 55 1/4
727	4, 100	-	220	40°	12 x 12
838	650	650	-	-	none

*Note: Following chart lists the breakdown of B. T. U.'s and C. F. M. by feature for these units. Cool air enters through air filters in the bottom of the 650, 652, 653 and 655 and from the lower rear of the 727. It is circulated around the electronic components by forced air blowers, then exhausted through the forced air outlets in the top of the units.

BREAKDOWN OF C.F.M. AND B.T.U. BY FEATURE

Feature	C.F.M. Through Units				B.T.U.'s Per Hr. Total				B.T.U.'s Per Hr. Radiant			
	650	652	653	655	650	652	653	655	650	652	653	655
One card Input unit		no e	no e	600		no e	no e	14,000		no e	no e	
Two card Input units		f	f		32,800	f	f	17,500		f	f	1,500
One card Input unit & Alpha	900	f	f			f	f	17,500	2,000	f	f	
Two card Input units & Alpha		e	e	950		e	e	21,500		e	e	
Three card Input units		c	c			c	c	21,000		c	c	1,800
Three card Input units & Alpha	1,150	t	t		33,800	t	t	24,000	2,200	t	t	
Index Registers I.R.	no	no		no	no	no	12,340	no	no	no	800	no
Immediate Access Storage I.A.S.	e	e	350	e	e	e	16,380	e	e	e	1,000	e
Automatic Floating Decimal A.F.D.	f	f		f	f	f	13,100	f	f	f	800	f
I.R. & I.A.S.	f	f		f	f	f	22,600	f	f	f	1,600	f
I.R. & A.F.D.	e	e	650	e	e	e	19,000	e	e	e	1,400	e
I.A.S. & A.F.D.	c	c		c	c	c	24,100	c	c	c	1,600	c
I.A.S., I.R. & A.F.D.	t	t	950	t	t	t	29,200	t	t	t	1,800	t
I.A.S. & Tape			650				20,320				1,800	
I.A.S., I.R. & Tape		400				15,200	26,200			2,000	1,900	
I.A.S., A.F.D. & Tape			950				27,000				1,900	
I.A.S., I.R., A.F.D. & Tape							32,800				2,000	
Disk Storage Control D.S.C.		400				15,360				2,160		
D.S.C. & Inquiry Sta. (1) I.S.		450				17,392				2,160		
D.S.C. & I.S. (2)		770				19,426				2,160		
Tape & D.S.C.		700				21,688				2,548		
Tape, D.S.C. & I.S. (1)		750				23,721				2,300		
Tape, D.S.C. & I.S. (2)		800				25,754				2,050		

CASTER LOCATION AND WEIGHT DISTRIBUTION

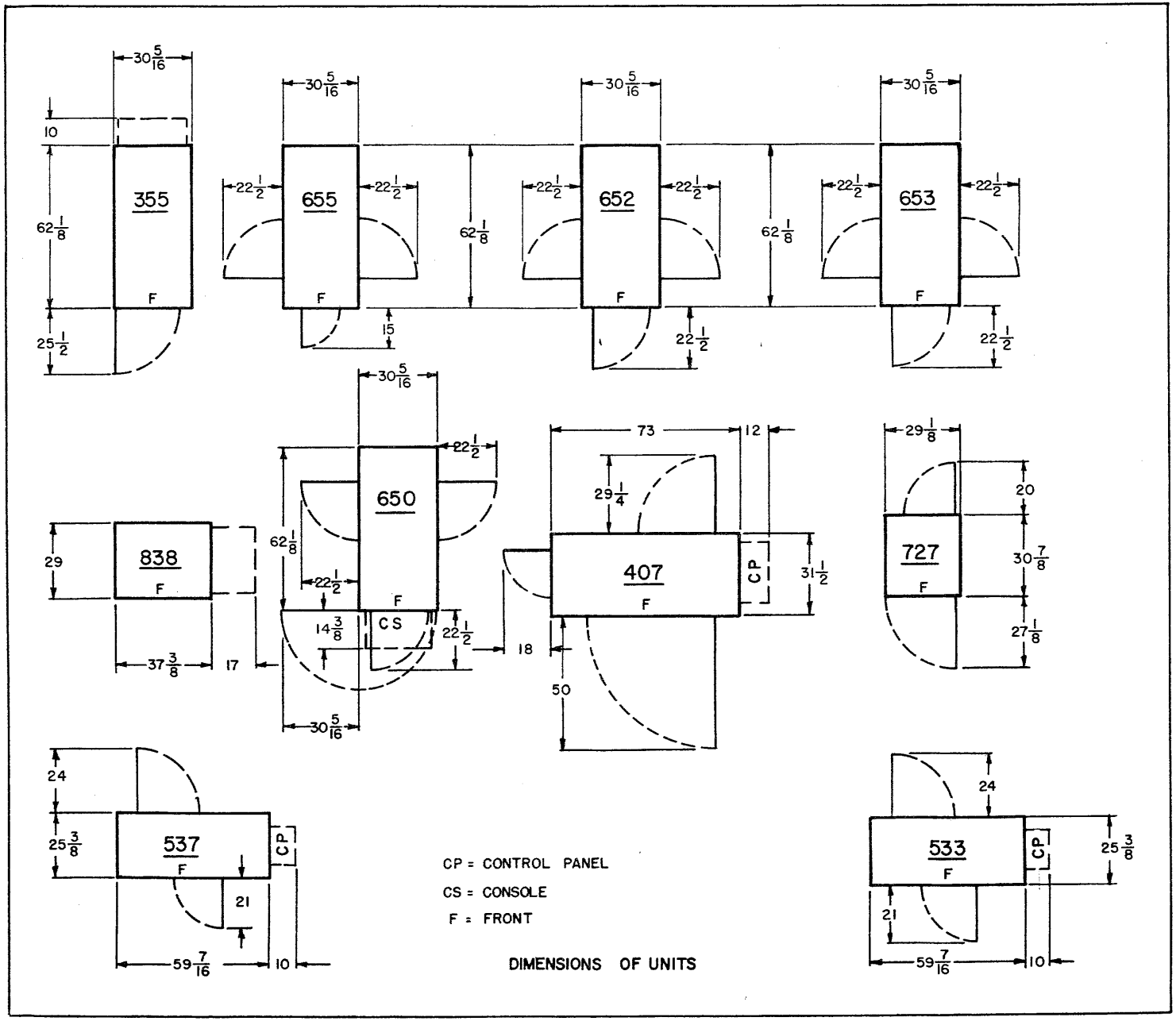


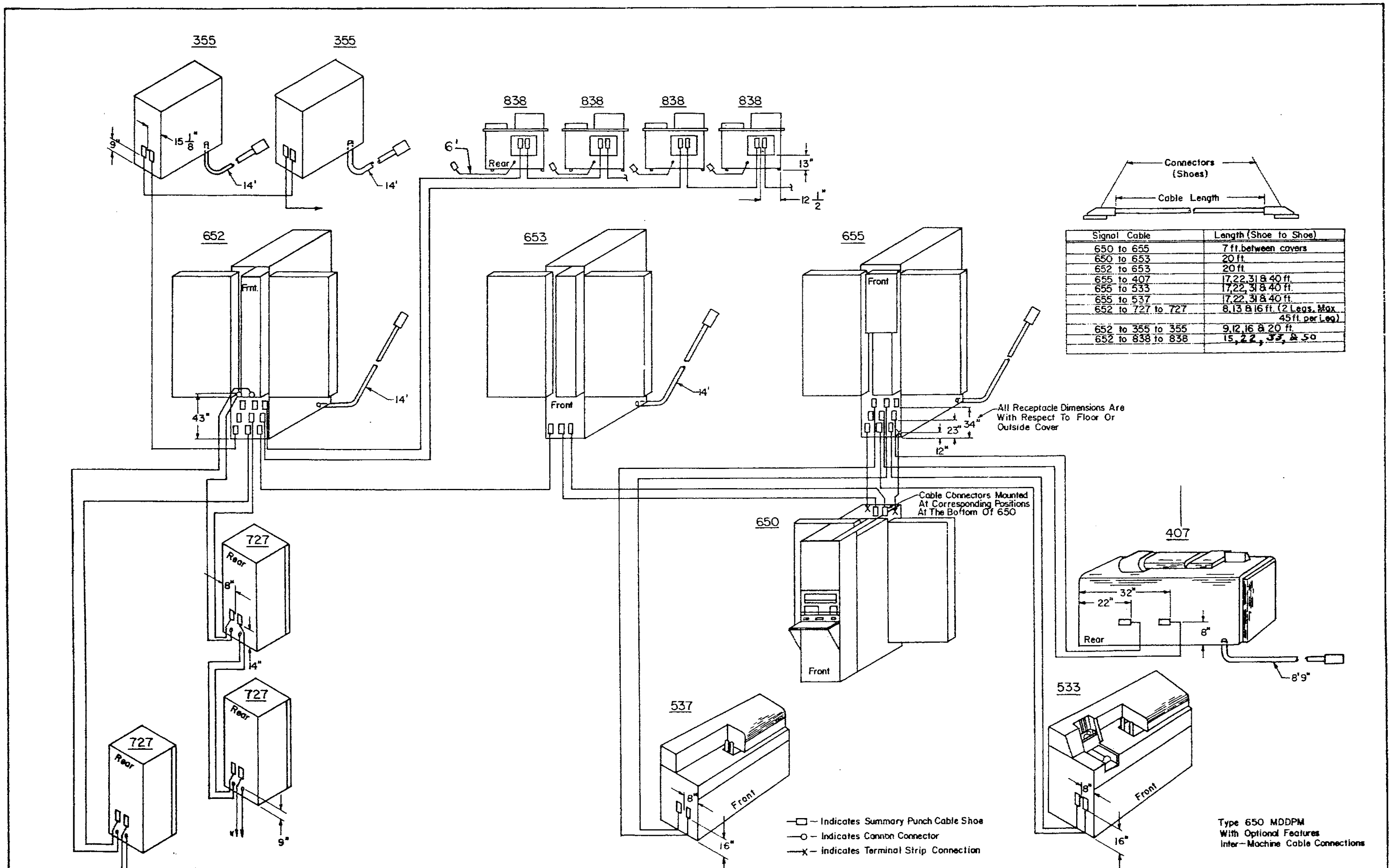
NOTES

■ – INDICATES LOCATION OF FLOOR CUTOUTS FOR CABLES
+ – INDICATES CENTER LINE LOCATION FOR CASTER PIVOTS
⊕ – INDICATES LOCATION OF POWER CORD EXIT FROM UNITS
F – INDICATES FRONT OF MACHINE
Ⓕ – INDICATES FRONT OF 355 MACHINE ONLY

	WEIGHT DISTRIBUTION IN POUNDS			UNIT DIMENSIONS IN INCHES		
UNIT	RIGHT END	LEFT END	TOTAL WEIGHT	LENGTH	WIDTH	HEIGHT
355	1075	1015	2090	62 1/8	30 1/4	71
407	1318	1307	2625	73	31 1/2	51
533	630	665	1295	59 7/16	25 3/8	49 1/8
537	670	560	1230	59 7/16	25 3/8	50 3/4
	FRONT	REAR				
650	1053	943	1996	62 1/8 *	30 1/4	71
652	965	1270	2235	62 1/8	30 1/4	71
653	1059	1813	2872	62 1/8	30 1/4	71
655	1481	1491	2972	62 1/8	30 1/4	71
727			950	30 7/8	29 1/8	69
838			240	37 3/8	29	37

* DESK UNDER OPERATORS CONSOLE INCREASES LENGTH TO 76 1/2" OVERALL

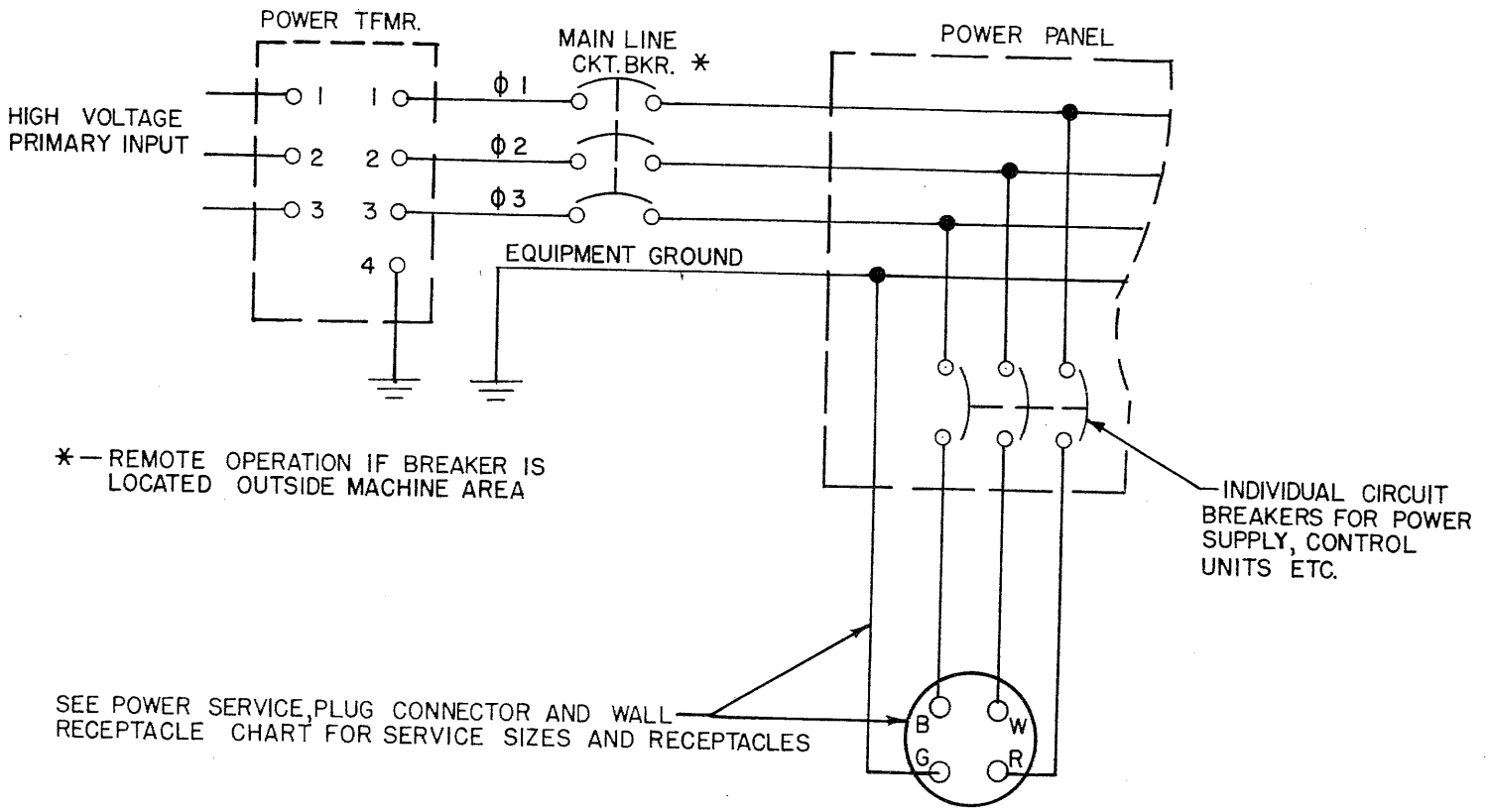

355
655
652
653
650
838
407
727
537
533
F
CS
CP
10
62 1/8
25 1/2
30 5/16
22 1/2
15
29
37 3/8
17
14 3/8
73
12
29 1/4
31 1/2
18
50
29 1/8
20
30 7/8
27 1/8
24
25 3/8
21
59 7/16
CP = CONTROL PANEL
CS = CONSOLE
F = FRONT
DIMENSIONS OF UNITS



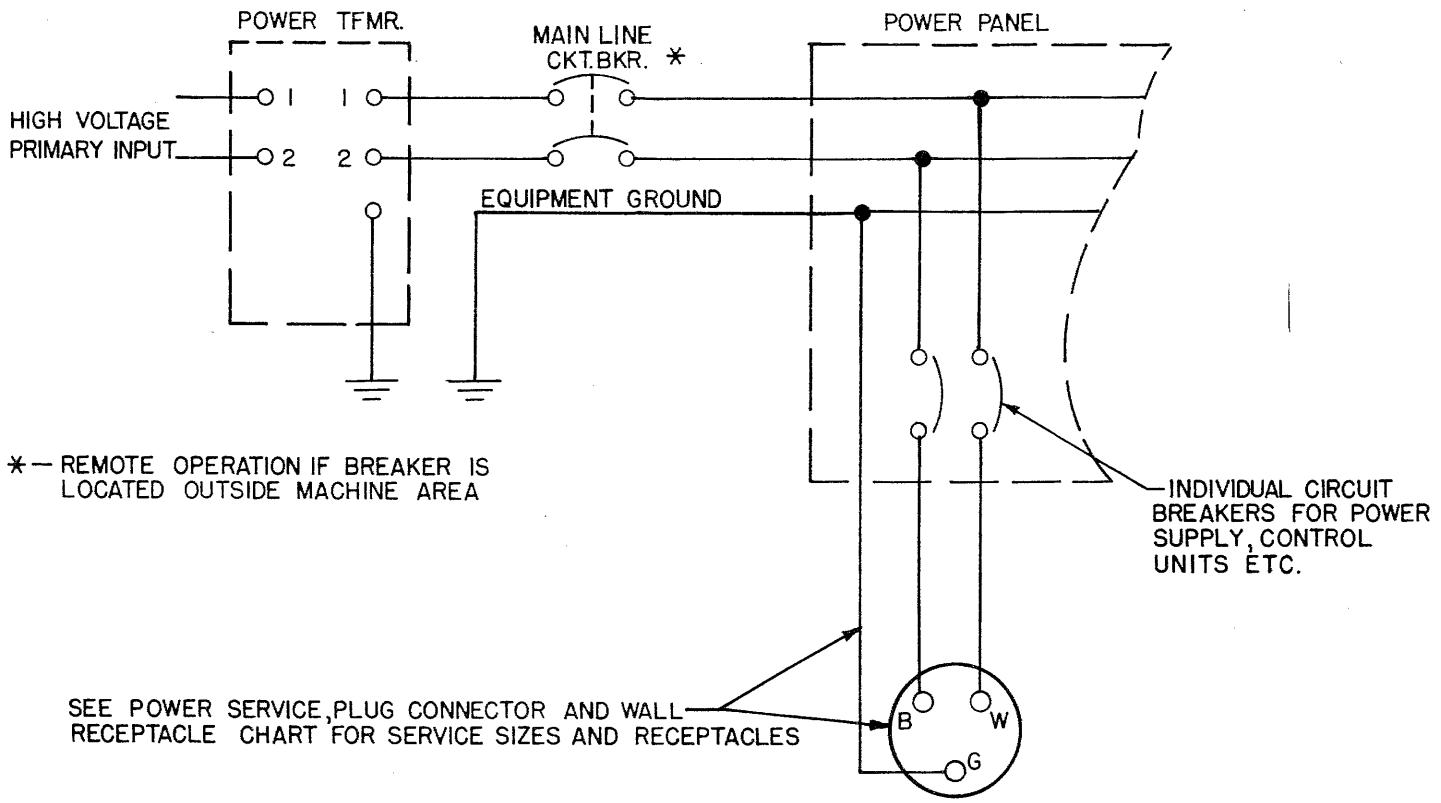
Signal Cable	Length (Shoe to Shoe)
650 to 655	7 ft. between covers
650 to 653	20 ft.
652 to 653	20 ft.
655 to 407	17,22,31 & 40 ft.
655 to 533	17,22,31 & 40 ft.
655 to 537	17,22,31 & 40 ft.
652 to 727 to 727	8,13 & 16 ft. (2 Legs, Max 45 ft. per Leg)
652 to 355 to 355	9,12,16 & 20 ft.
652 to 838 to 838	15, 22, 33, & 50

SCHEMATIC DIAGRAM FOR 650 SYSTEM

POWER SYSTEM FOR 650 SYSTEM—THREE PHASE



POWER SYSTEM FOR 650 SYSTEM–SINGLE PHASE



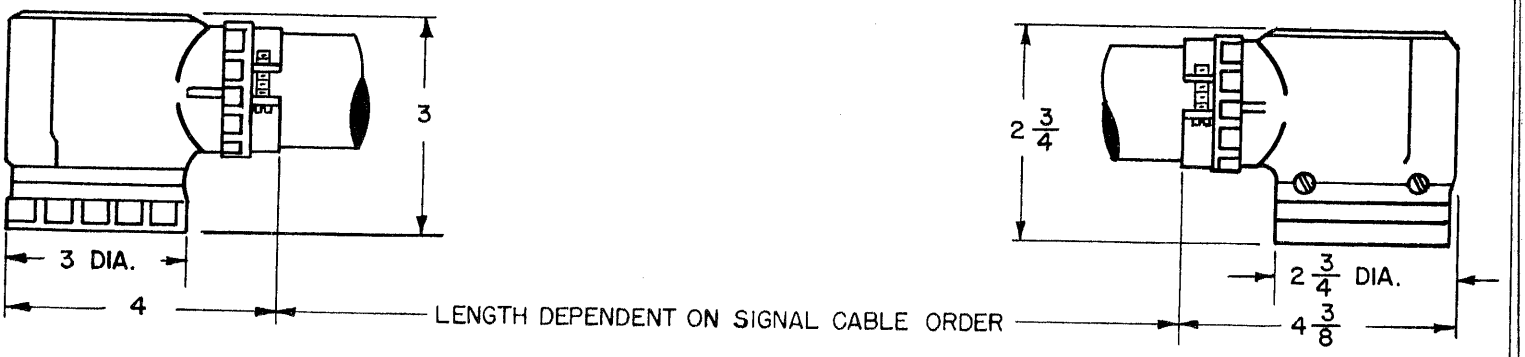
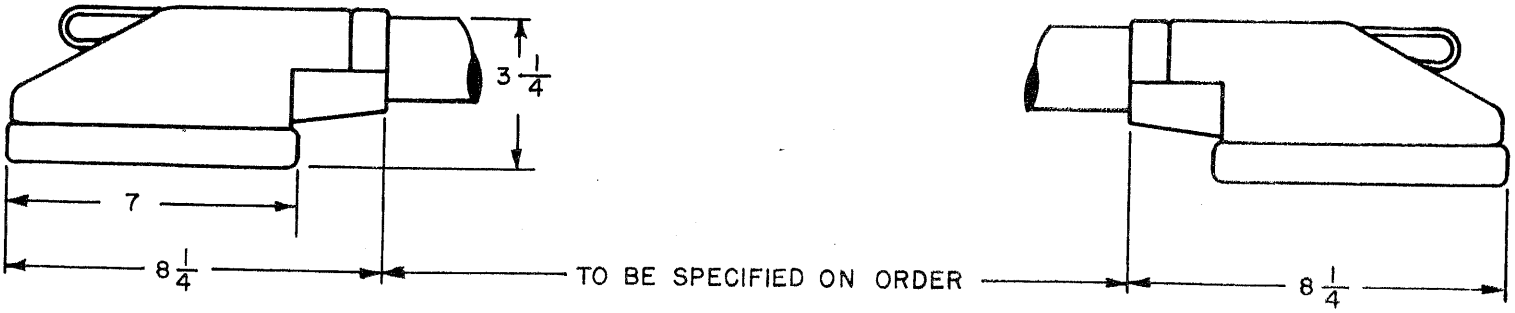


Figure "A"

CANNON CONNECTOR

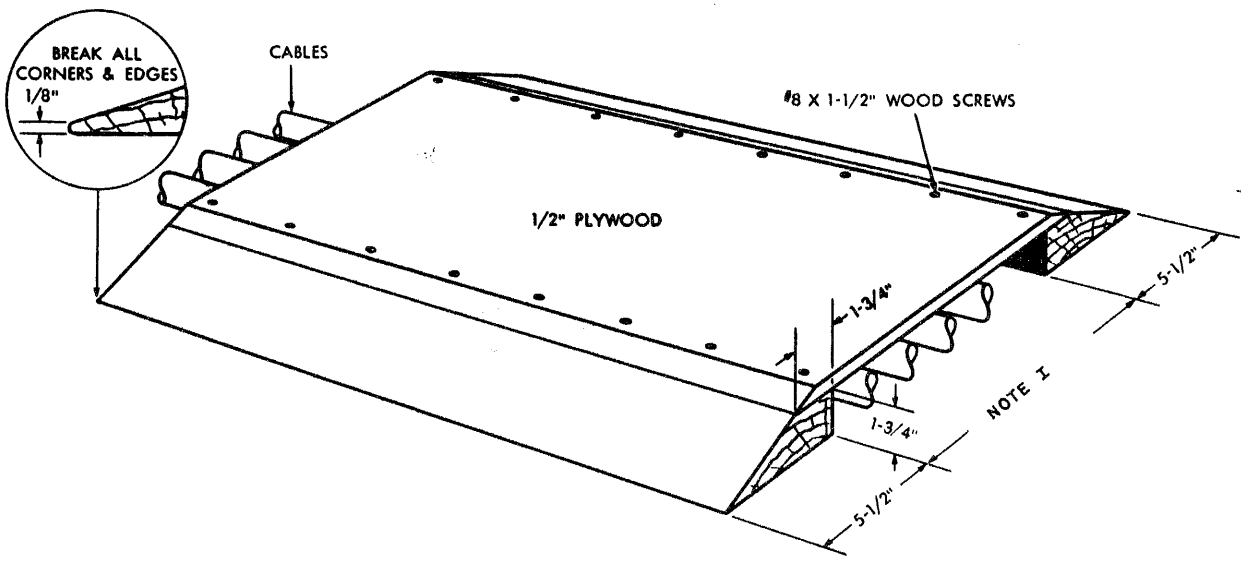


NOTE :

S.P. CONNECTOR 3" WIDE

Figure "B"

SUMMARY PUNCH CONNECTOR

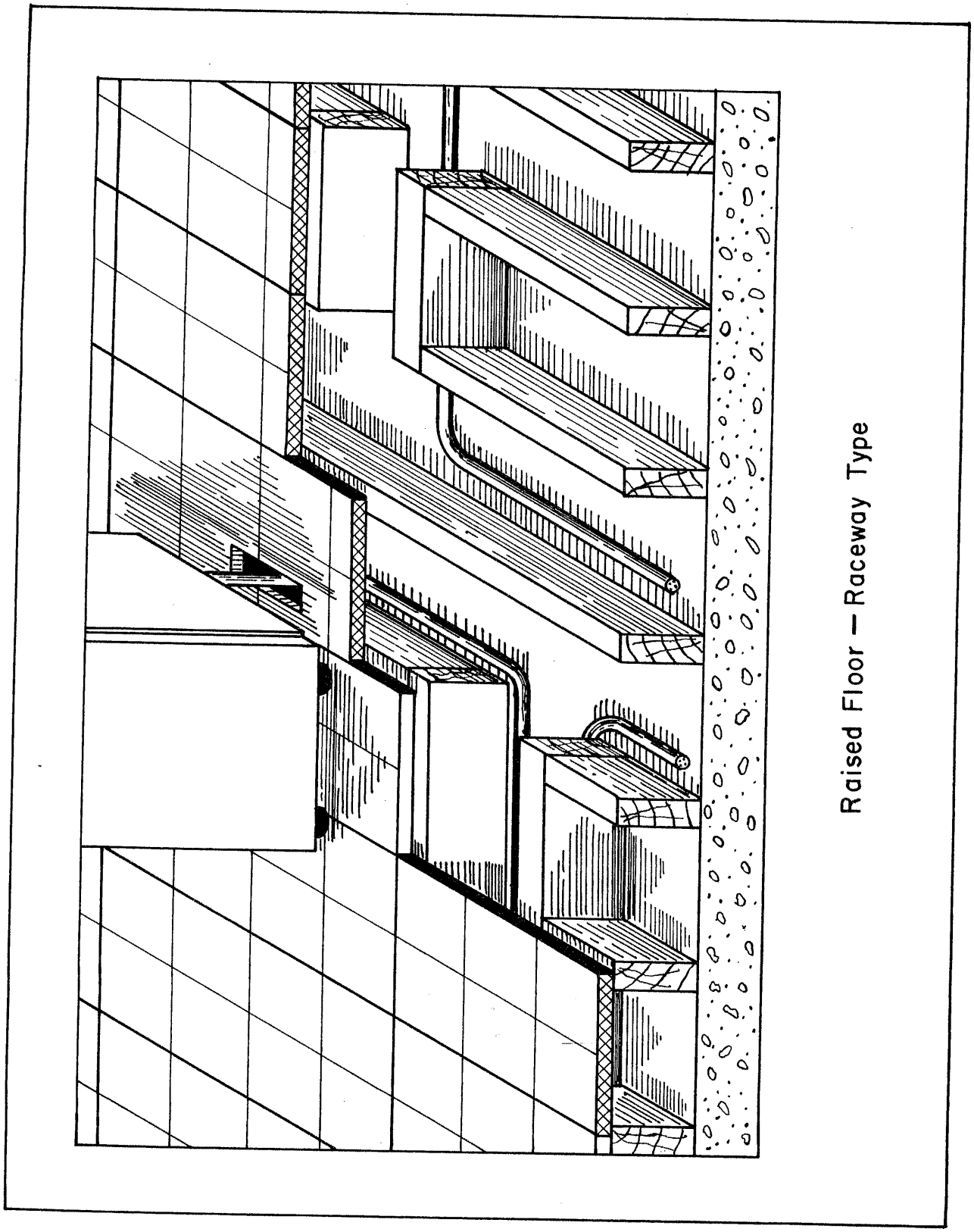


NOTES

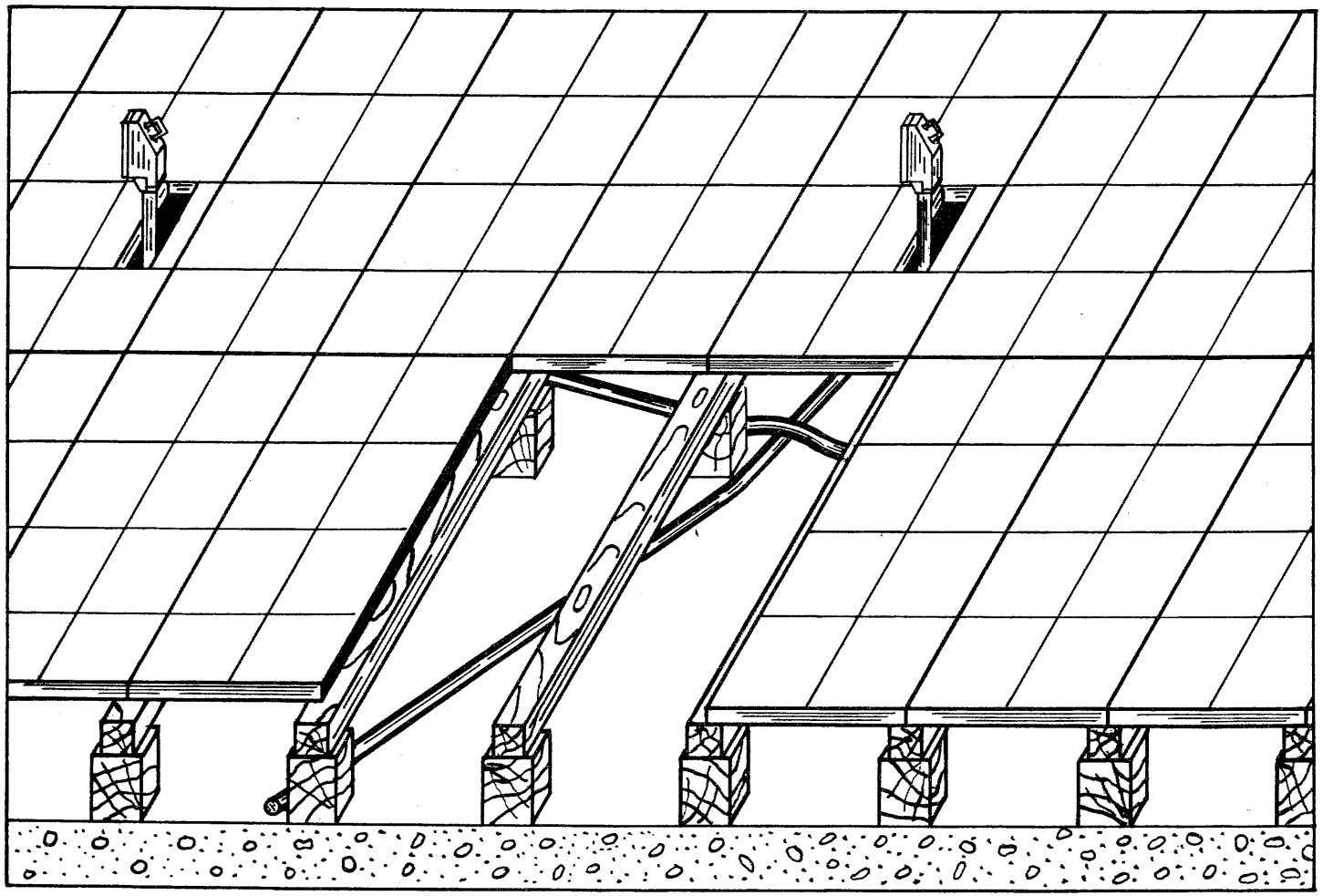
I DIMENSION VARIABLE (10"—15") DEPENDING ON NUMBER OF CABLES TO BE COVERED

II SIDE RAILS MAY BE MADE FROM 2" X 6" STOCK — CHOICE OF WOOD OPTIONAL

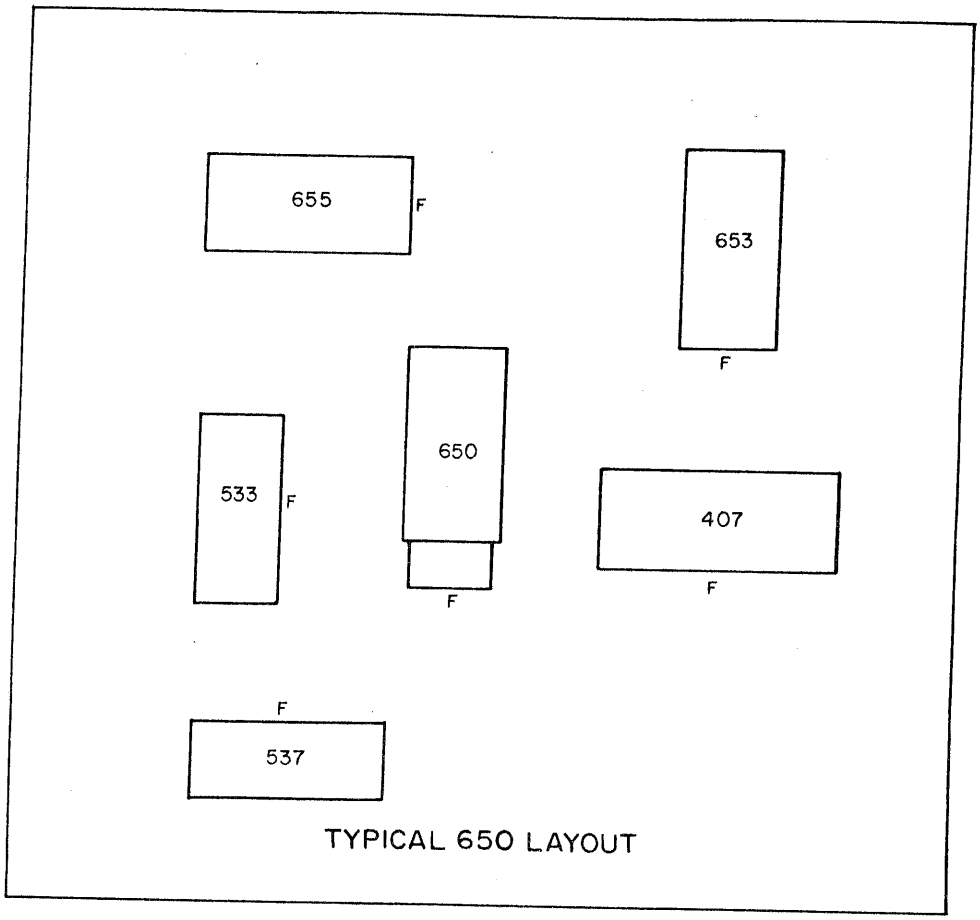
Figure 1



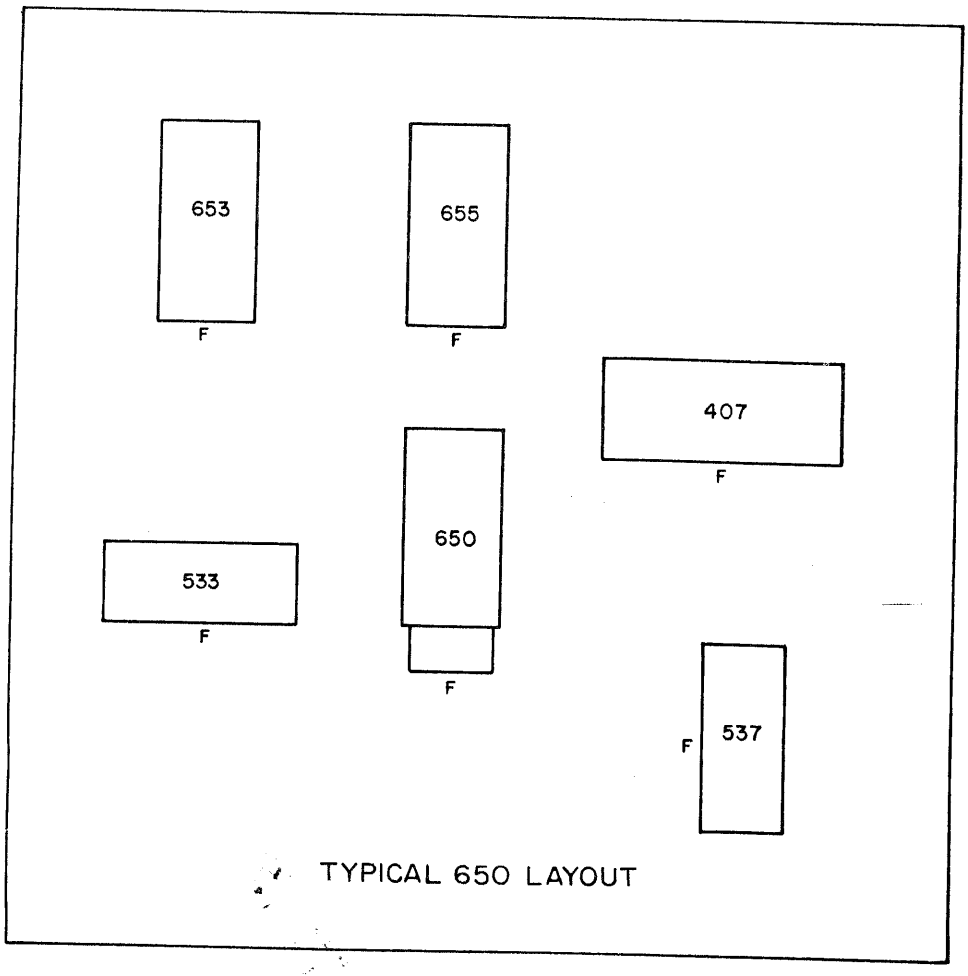
Raised Floor — Raceway Type



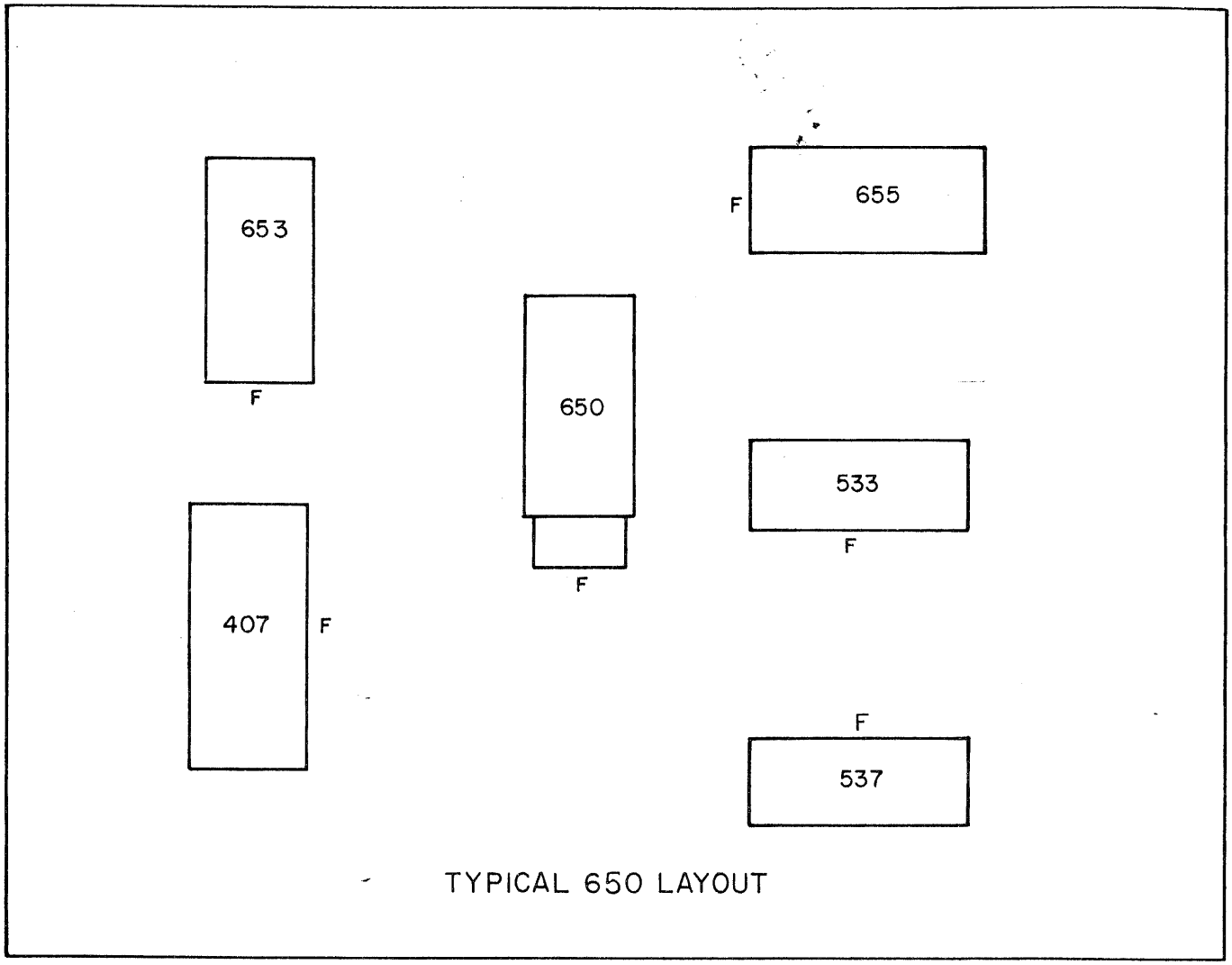
Raised Floor – Pedestal Or Free Access Type



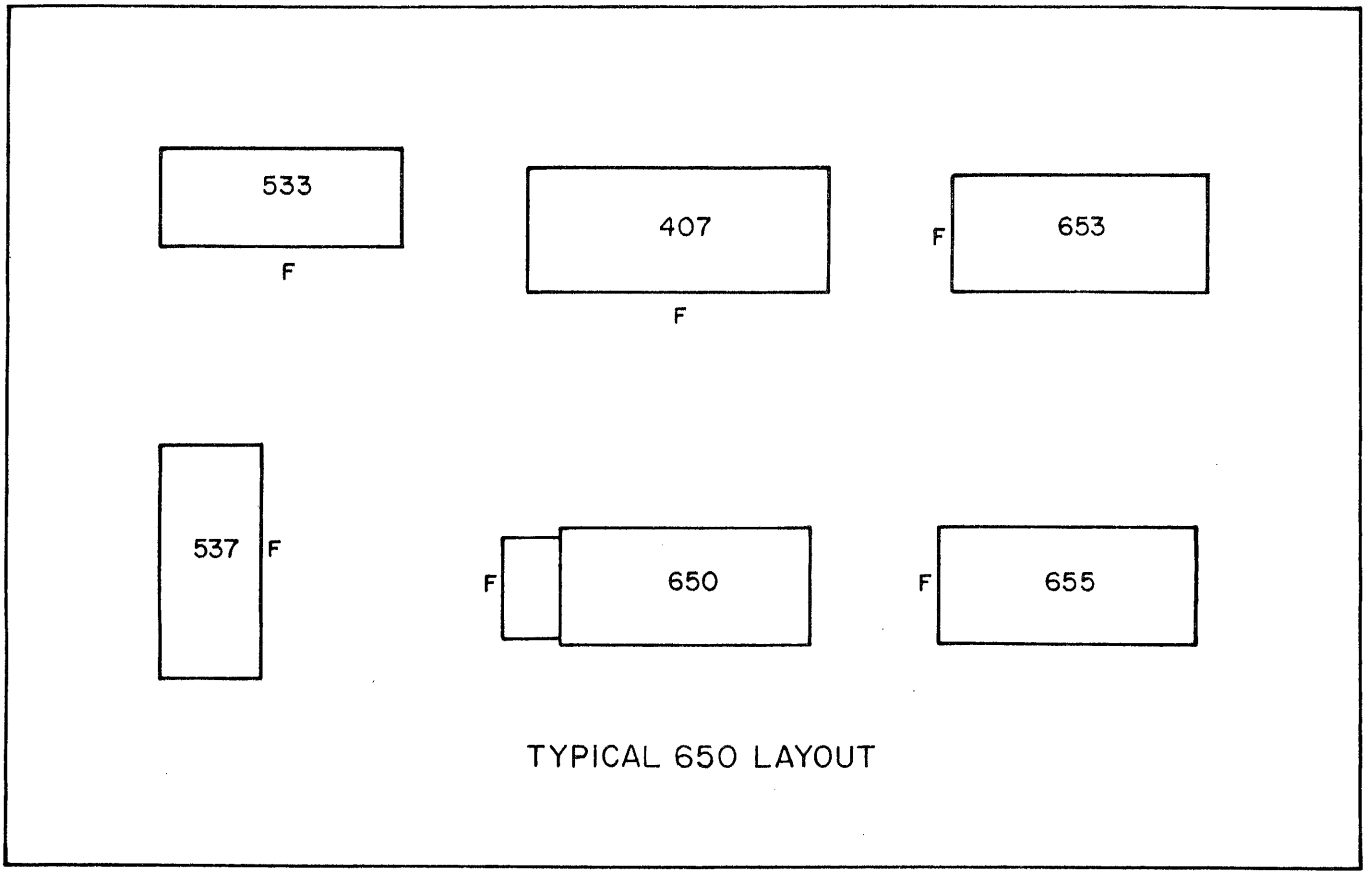
TYPICAL 650 LAYOUT



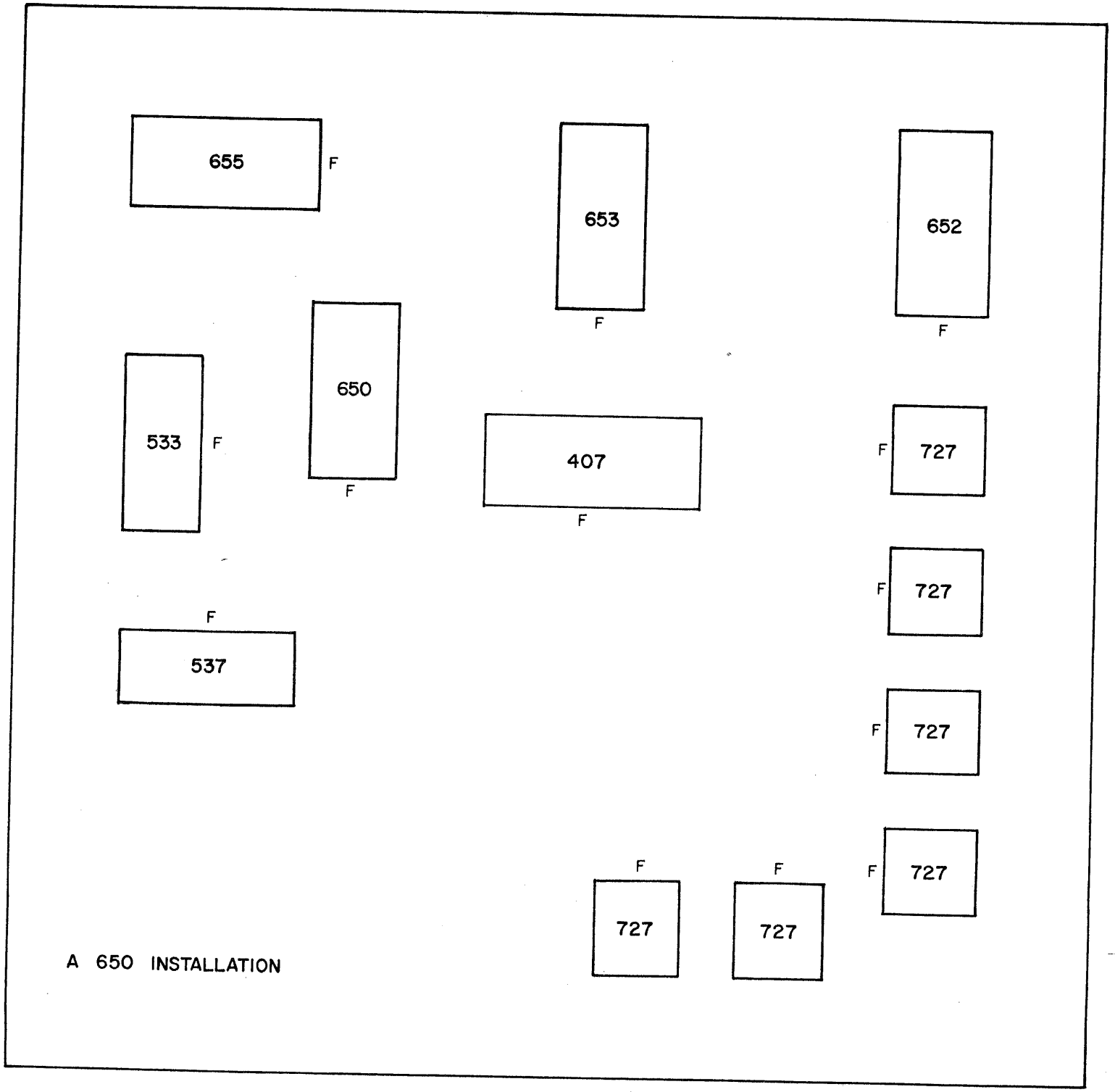
TYPICAL 650 LAYOUT

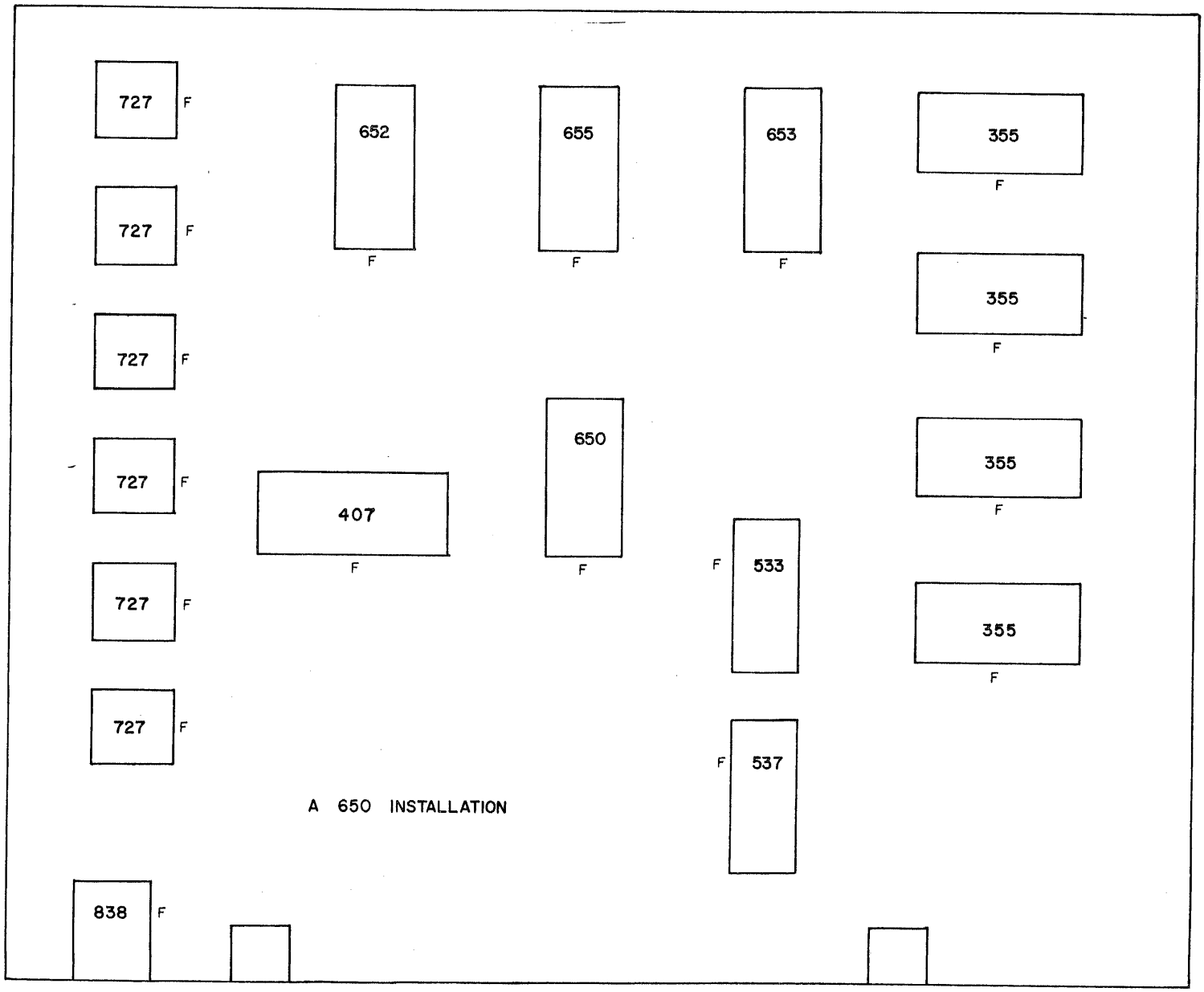


TYPICAL 650 LAYOUT

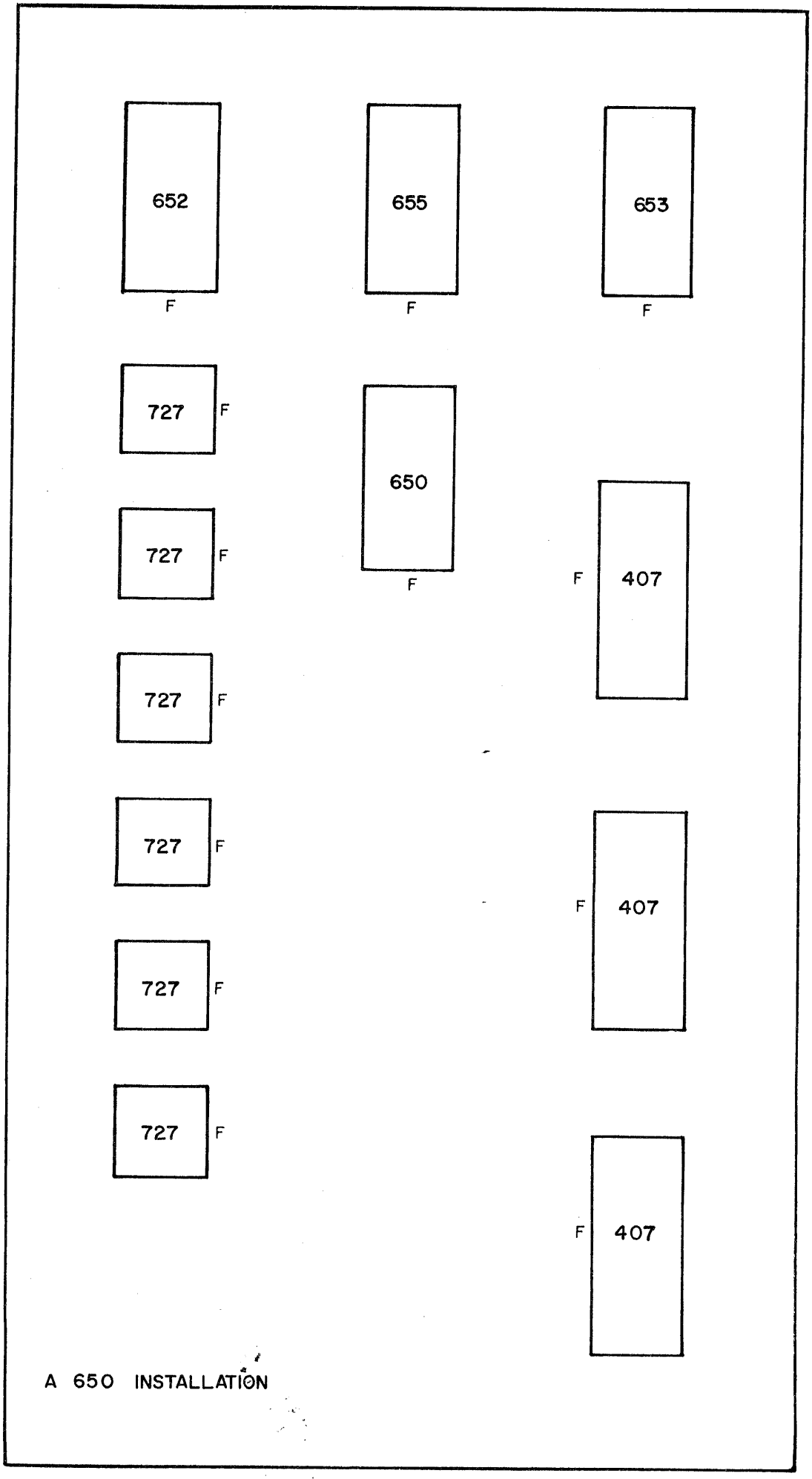


TYPICAL 650 LAYOUT

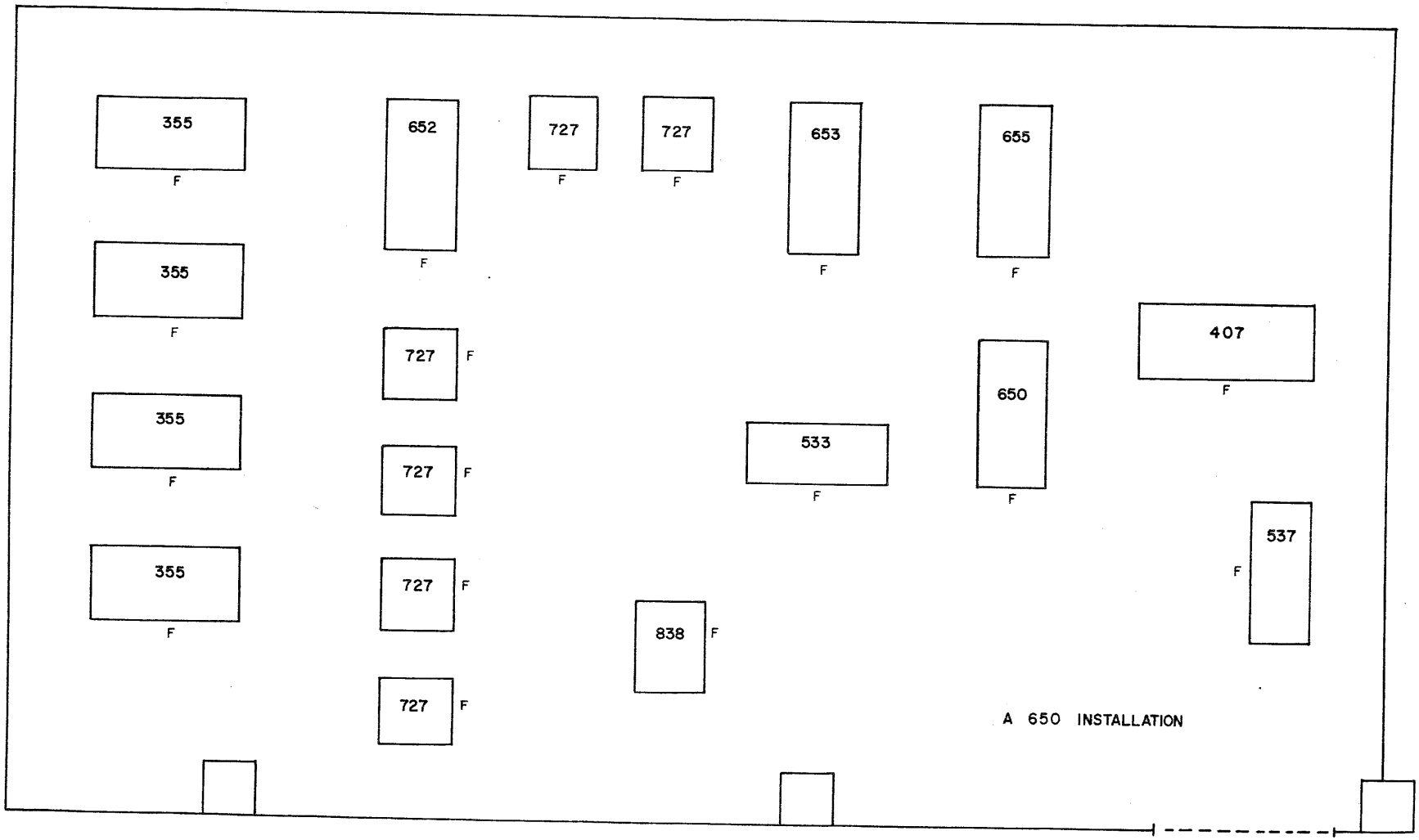

655
F
653
F
652
F
650
F
533
F
407
F
F
727
F
727
F
537
F
727
F
727
F
727
A 650 INSTALLATION



A 650 INSTALLATION



A 650 INSTALLATION


355
F
355
F
355
F
355
F
652
F
727
F
727
F
727
F
727
F
727
F
727
F
838
F
533
F
653
F
655
F
650
F
407
F
537
F
A 650 INSTALLATION

EXHAUST HOODS

Conditions may exist in some installations where exhaust vent hoods for the 355, 650, 652, 653 and 655 would offer an advantage. For these installations IBM has designed two different vent hood arrangements. The hoods and duct system become a part of the customer's air conditioning system and are not furnished by IBM.

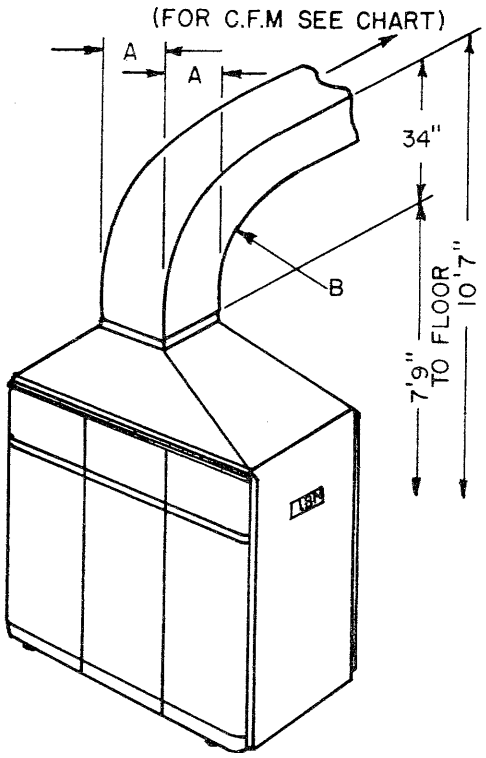
Figures 2 and 3 illustrate a machine supported system. When this system is used, the screens in the top of the machine units are removed and the hoods are fastened in their place. Additional exhaust-fan capacity must be provided in the duct system to overcome the air resistance of the hoods and duct system. Exhaust duct and fan should have sufficient capacity to prevent any back pressure at the top of any unit.

Figures 4 and 5 illustrate a ceiling-supported exhaust-hood system. The hoods for this system are of a different design and are suspended 4 inches above the top of the machine.

If exhaust hoods are used, the radiant portion of the total heat dissipated from the machine will not be removed. This heat load must be considered in designing the room cooling system.

The customer's air conditioning engineer or building superintendent should be consulted to determine if exhaust hoods should be used. He should also advise which system offers the most advantages for the customer.

MACHINE-SUPPORTED EXHAUST SYSTEM



TO VENT SHAFT OR EXHAUST SYSTEM
TOTAL MINIMUM CAPACITY – 3,700 TO 6,200 C.F.M

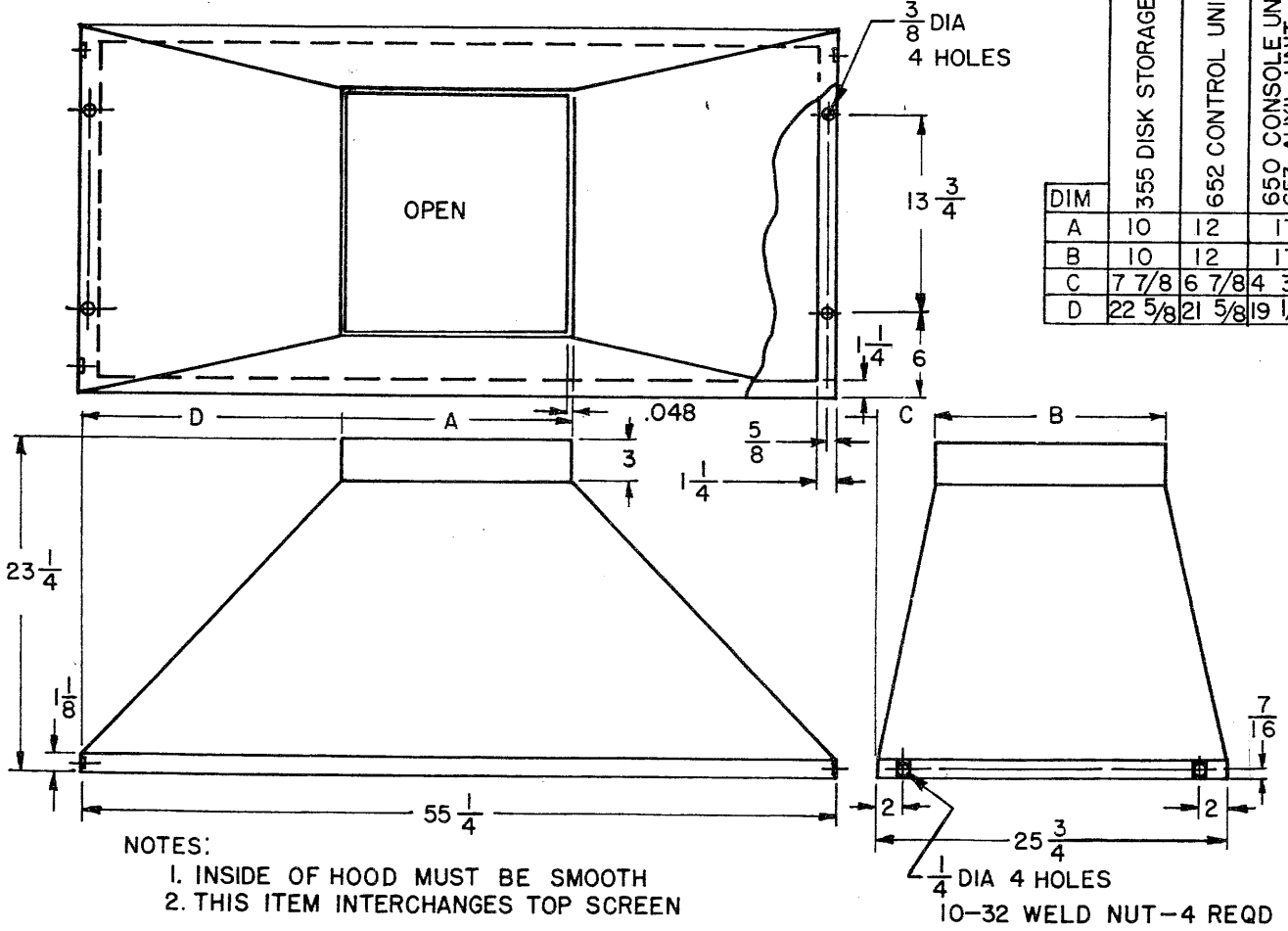
TOP SCREEN 253665 TO BE REMOVED
BEFORE HOOD INSTALLATION

UNITS	DIMENSIONS		CFM PER UNIT *
	A	B	
355	10"	24"	400
650	17"	17"	1,100 TO 1,500
652	12"	22"	800
653	17"	17"	700 TO 1,200
655	17"	17"	700 TO 1,100

* DETERMINED BY NUMBER OF FEATURES INCLUDED ON EACH UNIT. SEE TABLES ON PAGES 30 & 31

FIGURE 2

MACHINE SUPPORTED EXHAUST HOOD

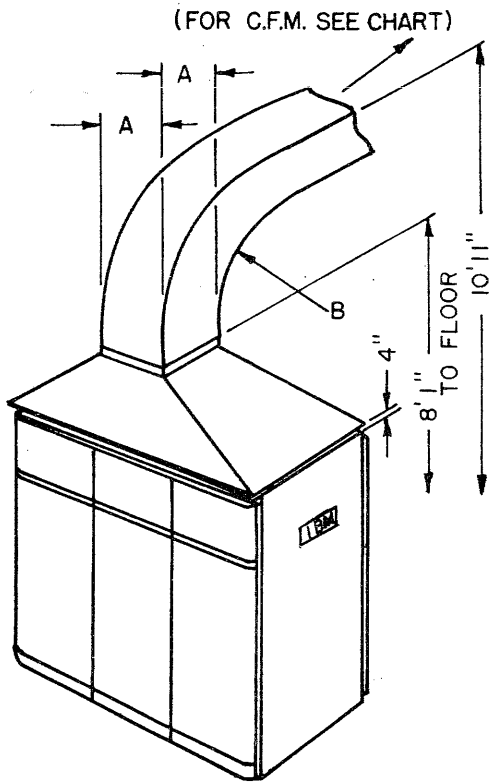


DIM	355 DISK STORAGE	652 CONTROL UNIT	650 CONSOLE UNIT 653 AUXIL.UNIT 655 POWER UNIT
A	10	12	17
B	10	12	17
C	7 7/8	6 7/8	4 3/8
D	22 5/8	21 5/8	19 1/8

NOTES:
1. INSIDE OF HOOD MUST BE SMOOTH
2. THIS ITEM INTERCHANGES TOP SCREEN

FIGURE 3

CEILING–SUSPENDED EXHAUST SYSTEM



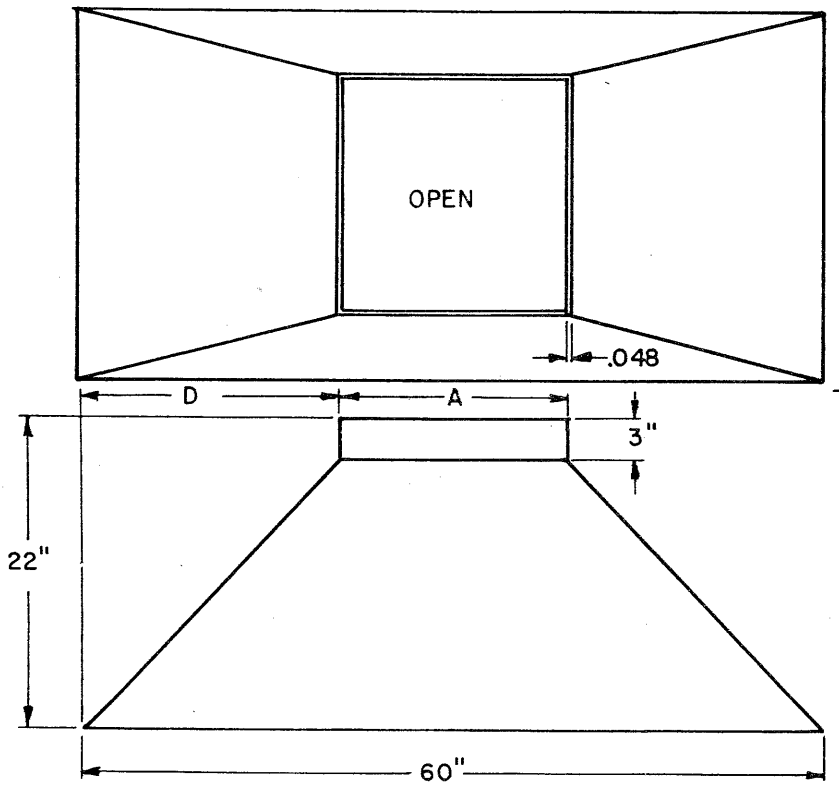
TO VENT SHAFT OR EXHAUST SYSTEM
TOTAL MINIMUM CAPACITY—3,700 TO 6,200 C.F.M.

UNITS	DIMENSIONS		CFM PER UNIT*
	A	B	
355	10"	24"	400
650	17"	17"	1,100 TO 1,500
652	12"	22"	800
653	17"	17"	700 TO 1,200
655	17"	17"	700 TO 1,100

* DETERMINED BY NUMBER OF FEATURES INCLUDED ON EACH UNIT. SEE TABLES ON PAGES 30 & 31

FIGURE 4

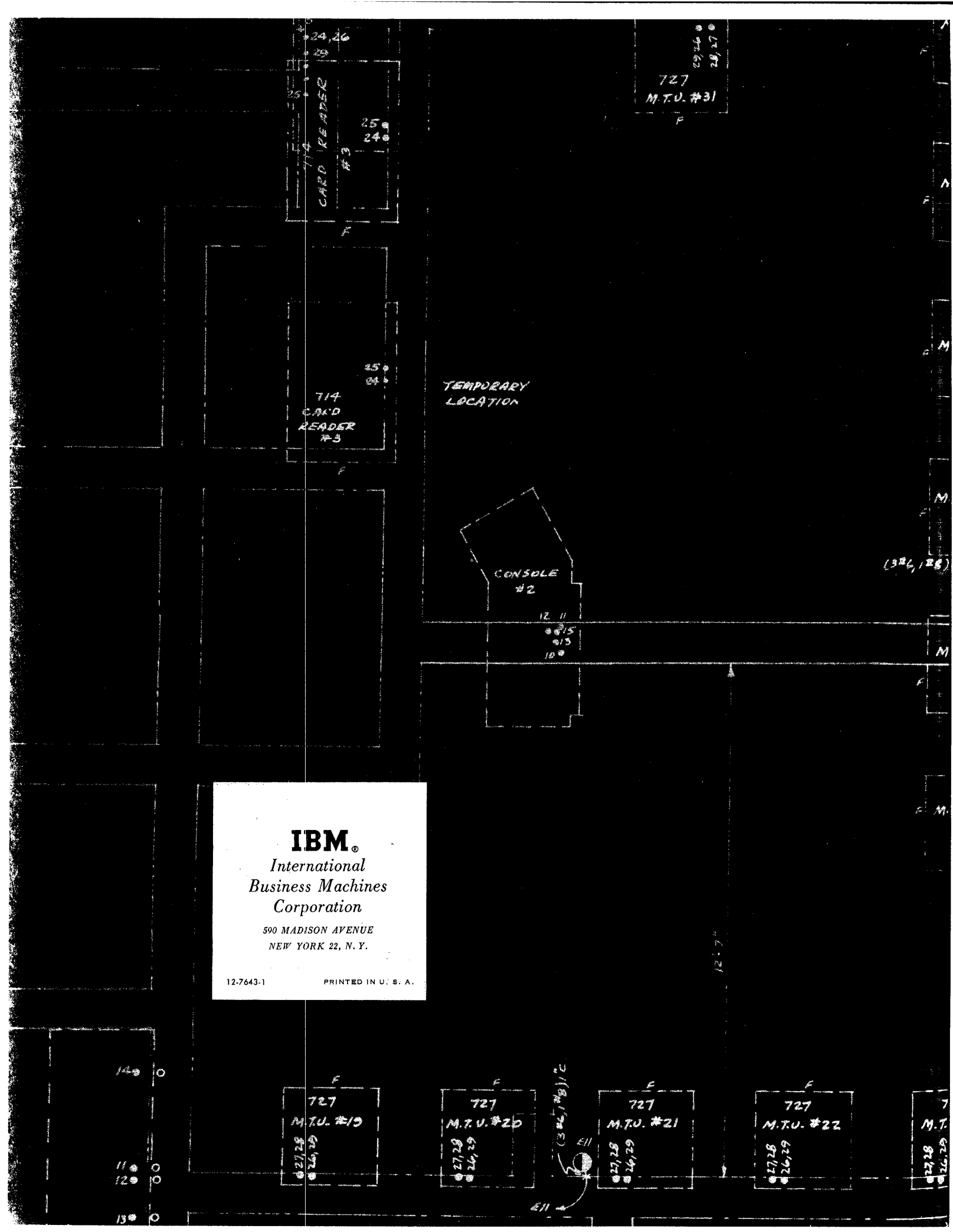
EXHAUST HOOD-CEILING SUSPENSION MOUNTING



DIM	355 DISK STORAGE	652 CONTROL UNIT	650 CONSOLE UNIT 653 AUXIL. UNIT 655 POWER UNIT
A	10	12	17
B	10	12	17
C	9	8	5 1/2
D	25	24	21 1/2

NOTES:
1. INSIDE TO BE SMOOTH

FIGURE 5



IBM®
International Business Machines Corporation
590 MADISON AVENUE
NEW YORK 22, N. Y.

12-7643-1 PRINTED IN U. S. A.